# *Annex No.12*
# *Cost Estimate*

THE STUDY ON
COUNTERMEASURES FOR SEDIMENTATION
IN
THE WONOGIRI MULTIPURPOSE DAM RESERVOIR
IN
THE REPUBLIC OF INDONESIA

# FINAL REPORT

# SUPPORTING REPORT III

# Annex No.12: Cost Estimate

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# CHAPTER 1 PRELIMINARY COST ESTIMATE FOR MASTER PLAN

## 1.1 Preface

This chapter is to support, on cost estimate, Part 1 [Master Plan] of the main report.

## 1.2 Conditions and Assumption for Cost Estimate

### 1.2.1 Price Level

(1) Price level

Price level is set at December 2005.

(2) Exchange rate

The following are exchange rates used for the cost estimate.

i) US$ 1.0= Y 119.63
ii) US$ 1.0= Rp. 10,035.3
(Y 1.0= Rp. 83.9)
where: US$: U.S. dollar;
Y: Japanese yen; and
Rp.: Indonesian rupiah

(3) Currency of cost estimate

Cost is estimated in U.S. dollar.

### 1.2.2 Cost Component

(1) Project cost

The following are project cost component.

i) Construction cost
ii) Government administration and engineering service cost
iii) Physical contingency
Note: Price contingency, and taxes and duties are excluded in the cost estimate.

(2) Construction cost

Construction cost is estimated as the aggregate of the following.

1) Cost for major works: to multiply the work quantities by their unit cost,
2) Cost for other works: 25 % or 50% (depending on the accuracy of quantification) of the major works, and
3) Cost for temporary works: 10 % of the major and other works

(3) Government administration and engineering service cost

Government administration and engineering service cost is estimated at 15 % and 5 % of the construction cost and the watershed conservation work cost, respectively.

(4) Physical contingency

Physical contingency is estimated at 20 % and 10 % of the total construction cost including the administration and engineering service cost, and the total watershed

conservation work cost including the administration and engineering service cost, respectively.

## 1.3 Unit Cost Analysis

### 1.3.1 Cost Analysis

Work rates are set for major work items, such as excavation ($m^3$), filling ($m^3$), concrete ($m^3$), reinforcing bar (ton), and steel gates (ton). The rates are set based on the cost data of the past 35 projects of power engineering and river improvement works in Indonesia.

The past cost data are updated to the price level based on the price indexes. The past cost data have i) foreign currency portion and local currency portion or ii) only local currency portion depending on the bidding type, i.e. ICB or LCB.

The foreign currency portion (F/C) is updated based on the price index computed in Table 1.3.1. The wholesale price indexes of Japan, U.S. and Singapore that are major exporters for Indonesia are used for the computation.

The local currency portion (L/C) is updated based on the price index computed in Table 1.3.2. The wholesale price index in Indonesia is used for the computation. The updated price of L/C is converted into US$ using the exchange rate of the price level.

Both F/C and L/C price indexes are listed with exchange rates of currencies in Table 1.3.3.

The past cost data are updated to the price level based on the price indexes as computed in Table 1.3.4 to Table 1.3.12 of the following.

A. Power engineering works
   - i) Estimated rates for civil works (Table 1.3.4)
   - ii) Estimated rates for metal works (Table 1.3.5)
   - v) Contracted rates for civil works (Table 1.3.6)
   - vi) Contracted rates for metal works (Table 1.3.7)

B. River improvement works
   - i) Contracted rates for civil, bridge and metal works (Table 1.3.8)

The updated costs are also shown in Figure 1.3.1.

Unit price of equipment is set based on the standard base price used in Japan. The equipment price is tabulated in Table 1.3.9.

The rates for the major works are set by simple average method of the past prices. The rates to be used in the cost estimate are listed in Table 1.3.10. Some major rates are listed below.

**Table 1.3.11 List of Major Work Rates**

| Works | Unit | Rate (US$) |
|---|---|---|
| 1. Civil works | | |
| 1) Excavation (open) | $m^3$ | 3 |
| 2) Excavation, tunnel | $m^3$ | 67 |
| 3) Backfill | $m^3$ | 4 |
| 4) Filling | $m^3$ | 6 |
| 5) Concrete, super-structure | $m^3$ | 113 |
| 6) Concrete, tunnel lining | $m^3$ | 127 |
| 7) Reinforcing bar | t | 813 |
| 8) Rock bolt, for tunnel | t | 22 |
| 9) Support, for tunnel | m | 1,820 |
| 2. Metal works | | |
| 1) Gate, roller gate/fixed wheel gate | t | 9,800 |
| 2) Gate, radial gate/tainter gate | t | 18,600 |
| 3) Screen | t | 4,750 |
| 4) Steel sheet pile | t | 1,200 |
| 3. Equipment (procurement) | | |
| 1) Bulldozer, 4t, swamp | nr. | 62,100 |
| 2) Crawler loader, 2.3 $m^3$ | nr. | 159,500 |
| 3) Dump truck, 10t | nr. | 98,800 |
| 4) Cutter-suction dredger, 600PS | nr. | 2,969,200 |

Source: JICA Study Team

1.3.2 Reference for Economic Analysis

Project cost and/or each of work rates have four resources/elements of the following.

i) labor,
ii) materials,
iii) equipment, and
iv) overhead and profit.

The proportion of the resources differs among work types, i.e.:

1) civil works;
2) metal works;
3) equipment supply; and
4) terrace improvement.

The proportion of the resources of each of the above work types is set in Table 1.3.12 for the economic analysis.

## 1.4 Cost for Alternative Works

Estimated cost for alternative works is tabulated below.

**Table 1.4.1 Estimated Work Cost**

| Alternatives | Amount (US$, thousand) |
|---|---|
| (1) Alternatives for reducing sediment deposition | |
| 1) Keduang sediment bypass | 82,940 |
| 2) Sediment sluicing by new gates | 35,630 |
| 3) Sediment storage reservoir with new gates in reservoir | 47,090 |
| 4) Sediment storage dam for sediment removal | 225,460 |
| 5) Dry excavation in reservoir | 287,990 |
| 6) Hydraulic dredging in reservoir | 44,567 |
| (2) Alternatives for securing function of intake | |
| 1) Modification of existing intake | 3,160 |
| 2) Relocation of intake | 8,800 |
| 3) Garbage trapping structure at existing intake | 3,670 |
| 4) Garbage trapping weir in Keduang River | 1,370 |
| 5) Siphon dredging | 2,880 |
| (3) Watershed conservation | |
| 1) Watershed conservation works | 42,558 |

Source: JICA Study Team
Note: Refer to Table 1.4.2 for the breakdown of Items (1) and (2) above, and Attachment 1 for Item (3) above.

For economic analysis, each of the above cost is sorted out to four amounts of work-types of the following.

1) Civil works;
2) Metal works;
3) Equipment supply; and
4) Terrace improvement

The cost sorting is computed in Table 1.4.3.

## 1.5 Operation and Maintenance Cost

Annual operation and maintenance cost is estimated in Table 1.5.1.

# CHAPTER 2 CONSTRUCTION PLAN FOR FEASIBILITY STUDY

## 2.1 Preface

This chapter is to support, on construction planning, Part 2 [Feasibility Study] of the main report.

## 2.2 Scope of Works

### 2.2.1 Scope of Works

The following are the scope of works proposed for the project.

**Table 2.2.1 Scope of Works**

| Item | Works |
|---|---|
| 1) Sediment storage reservoir | |
| (1) Spillway | <Shoot, concrete><br>- B= 15 m<br>- L= 720 m<br><Gate, steel><br>- Radial gate<br>- Two (2) leaves<br>- B= 7.5 m/unit<br>- H= 12.6 m/unit<br>- sill EL.= 127.0 m |
| (2) Closure dike | <Earthfill><br>- B= 10 m (crown)<br>- m= 1:3.0<br>- L= 650 m<br>- H= 8.3 m (max)<br>- crest EL.= 138.3 m |
| (3) Overflow dike | <Weir, concrete><br>- B= 10 m (crown)<br>- L= 250 m<br>- crest EL.= 136 m<br><Reservoir road><br>- B= 10 m<br>- crest EL.= 138.3 m |
| 2) Procurement of dredger | |
| (1) Procurement of dredger | <Procurement of equipment><br>- Cutter-suction dredger, 600PS<br>- Quantity= one (1) unit<br>- other ancillary equipment |
| 3) Watershed management in Keduang basin | |
| (1) Land preparation | <Terracing><br><Water way and masonry><br><Stabilization of lip and riser><br>- 9,872 ha in gross |
| (2) Side ditches | <Side ditch, masonry><br>- at housing yard of 1,388 ha (82 villages) |
| (3) Agro-forest and annual crop | <Material supply for perennial tree><br>- Seedling, compost and fertilizer<br><Material supply for annual crop><br>- Seed, compost and fertilizer<br><Planting><br>- for the area of Item (1) above |
| (4) Support program | <Material supply for annual crop><br>- Seed, compost and fertilize<br><Supporter dispatching><br>- 82 villages<br>- for soil and water conservation measures<br>- for agricultural promotion<br>- for community development |

Source: JICA Study Team

## 2.2.2 Implementation Agency

The Directorate of General of Water Resources (DGWR), Ministry of Public Works (Diredtorat Jenderal Sumber Daya Air, Departmen Pekrjaan Umum) would be the leading

implementation agency to be responsible for financing the project.

2.2.3 Financial Source

The Government of Indonesia will raise a fund applying to a loan for a foreign government or an international assistance agency. Cost of construction works, consulting services and their related contingencies would be financed under the foreign loan. Cost of land acquisition, compensation and resettlement, administrative expenses and taxes will be borne by the Government of Indonesia.

2.2.4 Consultant

A consultant will be selected as project consultant under the foreign loan.

The project consultant would perform:

i) design and supervision of the sediment storage reservoir works and the dredger procurement; and
ii) design and monitoring of the watershed conservation works.

2.2.5 Procurement Method

All project works would be executed on contract basis.

The sediment storage reservoir works and the dredger procurement would be performed by a contractor to be selected through international competitive bidding (ICB). The watershed conservation works would be performed by villagers' units and NGO.

The following are proposed procurement method to perform the project works.

**Table 2.2.2 Proposed Procurement Method**

| Works | Method | Client | Fund |
|---|---|---|---|
| 1) Sediment storage reservoir | One package of contract through ICB | DGWR | a foreign loan |
| 2) Procurement of dredger | | | |
| 3) Watershed management in Keduang basin | Direct contracts with villages' units, and Contract with NGO through LCB | DGWR, PBS and/or other local government | |

Source: JICA Study Team

## 2.3 Conditions and Assumption

2.3.1 Natural and Social Conditions

(1) Location, climate, and topography

1) Location

The construction works would be performed in the Wonogiri reservoir and in its upstream basin. The reservoir is located about 110 km southeast of Semarang, the provincial capital of the Central Java.

2) Climate

The Climate of Indonesia is tropical; hot, humid; more moderate in highlands. They say that the wet season is the period from November to May in and around the project area. The proposed development area has the rainfall of about 2,000 mm a

year. The following is an averaged precipitation acquired at an observatory near the Wonogiri dam.

**Table 2.3.1 Averaged Rainfall**

(Unit: mm)

| Jan. | Feb. | Mar. | Apr. | May | Jun. | Jul. | Aug. | Sep. | Oct. | Nov. | Dec. | Aver. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 332 | 343 | 281 | 187 | 92 | 57 | 36 | 19 | 27 | 76 | 202 | 246 | 1,897 |

Source: Waduk Krisak peng Skat 34 observatory, Wonogiri, Indonesia; based on daily precipitation data of 1980~2003, except 1985, 1990, 1991, 2001 and 2002 (19 years); sorted by JICA Study Team
The hatched months are called wet season.
Refer to Table 2.3.2, and Figure 2.3.1 for monthly precipitation.

3) Topography

The reservoir stores water through a year. The water level is controlled between 127 m (LWL, December) and 136 m (HWL, end April/ beginning May). A hard rock zone lies on the left bank of the dam body. The right bank of the dam body has a flat to very gentle gradient. Much of the land to be improved in upstream basin has rather steep gradient, such over 25 %, and most of the steep land has the gradient over 40 %.

(2) Seaport and access

When construction materials and equipment are imported, they will be loaded at the Semarang international seaport. The imported materials and equipment will be transported from Semarang to the site through Surakarta (about 155 km).

An asphalt-paved road is connected from Semarang to Surakarta (about 125 km) and Surakarta to the Wonogiri dam site (about 30 km).

(3) Workable days

Construction works would be performed from Monday to Saturday except National holidays. Such working days are deducted by work suspension days due to rainfall.

The work suspension days are estimated based on the daily precipitation (19 years, 1980-2003, except '85, '90, '91, '01 and '02) of the Waduk Krisak peng Skat 34 observatory that is located near the Wonogiri dam.

The following are the conditions to estimate the work suspension days.

**Table 2.3.3 Conditions for Work Suspension Days**

| Conditions item | Earthworks | Concrete/ rip-rap/ masonry | Dredging/ tunnel works |
|---|---|---|---|
| 1. Sundays and national holidays: | 1.0 | 1.0 | 1.0 |
| 2. Rainfall (p) | | | |
| 0mm < p < 5mm: | 0 | 0 | 0 |
| 5mm < p < 10mm: | 0.5 | 0 | 0 |
| 10mm < p < 20mm: | 1.0 | 0 | 0 |
| 20mm < p < 30mm: | 1.0 | 1.0 | 0 |
| 30mm < p < 50mm: | 2.0 | 1.0 | 1.0 |
| 50mm < p: | 3.0 | 1.0 | 1.0 |

Source: JICA Study Team
Note: - Overlapping days of Sunday/holiday with rainy day shall be deducted in counting work suspension days.
- Work suspension days of 1.5, 2.0 and 3.0 mean that the works will be suspended on the successive days.

The workable days are estimated on monthly basis through the following steps.

(i) Count Sundays and National holidays (Table 2.3.4).
(ii) Count rainy days (Table 2.3.5).
(iii) List the numbers of rainy days (Table 2.3.6).
(iv) Estimate work suspension days (Table 2.3.7).
(v) Estimate workable days (Table 2.3.8).

The following are the estimated workable days by type of works.

**Table 2.3.9 Estimated Workable Days**

| Works | J | F | M | A | M | J | J | A | S | O | N | D | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Earthworks | 10 | 8 | 13 | 17 | 20 | 23 | 24 | 25 | 24 | 23 | 16 | 16 | 219 |
| 2. Concrete/ riprap/ masonry works | 19 | 16 | 20 | 22 | 23 | 25 | 25 | 26 | 25 | 25 | 21 | 23 | 270 |
| 3. Dredging/ tunnel works | 21 | 19 | 22 | 23 | 23 | 25 | 26 | 26 | 25 | 25 | 22 | 24 | 281 |

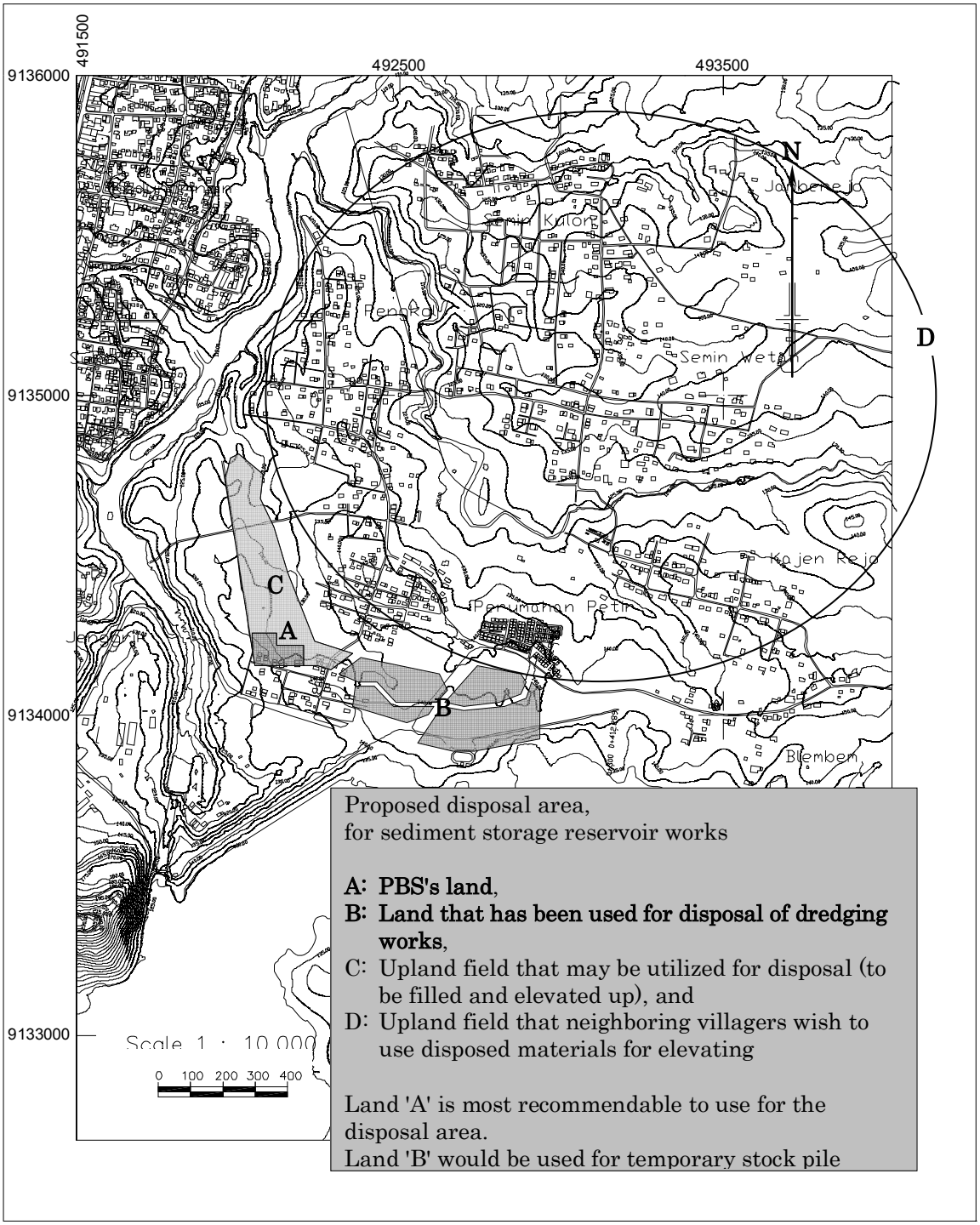
Source: JICA Study Team
Note: - The hatched months are called wet season.

(4) Disposal area

The excavation volume is more than the filling volume totally in the construction works of the sediment storage reservoir. The excavated materials would be diverted for the filling works as much as possible. The following is the earthmoving plan.

- Excavated material would be stocked at the land, located at the right bank of the dam body, that has been used for dredging disposal for the time being. Most of the excavated material at the proposed spillway would be stocked in this area and it would be diverted to the filling for the closure dike and the reservoir road.
- Finally surplus earth materials would be disposed in the PBS's land located at the downstream of the dam body.

Locations of these stock/ disposal areas are proposed as shown in Figure 2.3.2. The hauling distance would be about 1 km for stock/ disposal and for the successive filling.




Source: JICA Study Team

**Figure 2.3.2 Location of Proposed Disposal Area**

2.3.2 Availability of Construction Resources

(1) Labor

All labor would be employed in Indonesia for the works.

(2) Construction materials

Metal gates, stop logs and screens (roller/ fixed wheel gates and radial/ Tainter gates) would be designed in foreign countries and imported for the works. All other construction materials would be procured from the domestic market of Indonesia.

Ready-mixed concrete is available at the concrete plant factory that is located between Surakarta and Wonogiri.

(3) Construction equipment

Tunnel boring machines (if necessary) and work vessels would be temporary imported for the works. All other construction equipment would be procured from the domestic market of Indonesia.

## 2.4 Proposed Schedule

2.4.1 Construction Schedule

(1) Sediment storage reservoir works

1) Spillway

A spillway structure would be constructed at the right bank of the reservoir beside the dam body. A set of two radial gates would be installed at the spillway. Rather much excavation would be required. The excavated materials would be diverted to the proposed closure dike works.

Bulldozers and backhoes (hydraulic excavator) would be used for the excavation. Loaders and dump trucks would be used for hauling the excavated materials. Ready-mixed concrete would be purchased and be placed with concrete pump car. Truck crane would be used for installing spillway gates.

The spillway works would be a sequence of the following.

i) excavation for spillway (water way);
ii) concrete placing for spillway (water way);
iii) coffering for gate structure;
iv) excavation for gate structure;
v) concrete placing for gate structure;
vi) installation of gates;
vii) removal of coffer; and
viii) excavation for fore-bay.

2) Closure dike

A closure dike would be constructed between the dam site and a peninsula in the reservoir. The dike would be filled with the excavated materials at the proposed spillway site.

Dump trucks would transport the filling materials and bulldozer and vibratory compactor would spread and compact the dike.

The closure dike works would be a sequence of the following.

i) haling earth materials for filling; and
ii) filling for closure dike.

3) Overflow dike

A reservoir road would be constructed to access to the peninsula. An overflow dike would be constructed with concrete. The weir would have a lock having two gates at both sides of inner and outer reservoir.

Dump trucks would transport the filling materials and bulldozer and vibratory compactor would spread and compact the reservoir road. Ready-mixed concrete would be purchased and be placed with concrete pump car for the overflow dike. Truck crane would be used for installing slide gate.

The overflow dike works would be a sequence of the following.

i) filling for reservoir road;
ii) concrete placing for overflow dike; and
iii) installation of slide gate.

4) Sequence of works

The spillway structure would be constructed in the first year coffering in front of the proposed work site. The spillway will be constructed at first and be completed before the completion of the closure dike so that the Keduang River could be discharged downstream when the closure dike is completed. The closure dike would be constructed in the second year. The overflow dike would be constructed in the first, second and third years. The slide gate of the overflow dike would be installed before the closure dike is completed. These sequences of works are tabulated below.

**Table 2.4.1 Sequence of Works**

| Period | Works | Keduang River flow |
|---|---|---|
| 1st year | Spillway, and<br>Overflow dike | through existing intake |
| 2nd year (beginning half) | Closure dike, and<br>Overflow dike (including slide gate) | through existing intake or new spillway |
| (latter half) | Closure dike | through existing intake or new spillway |
| 3rd year | Overflow dike | through existing intake or new spillway |

Source: JICA Study Team

Works are scheduled based on the production rates of construction equipment and the work quantities. Production rates of construction equipment are computed in Table 2.4.2 for scheduling works. The site works would be commenced in the beginning of dry season. Overall work schedule for the sediment storage reservoir is shown in Figure 2.4.1.

(2) Watershed management in Keduang basin

1) Terracing

New construction or improvement of bench terrace would be performed at proposed

areas of the Keduang river basin, and the terraced fields would be planted on their lips and risers (land preparation). After the land preparation tree crops and annual crops would be planted (crop planting). All these works would be performed by manpower.

The land preparation works would be a sequence of:

i) top soil treatment (stripping);
ii) cutting and filling for terracing;
iii) bench surface improvement to form backward slope;
iv) excavation for trench (drainage ditch) at riser bottom;
v) filling for lip at riser top;
vi) improvement of drainage stream;
vii) masonry for drop structures;
viii) purchasing seedlings;
ix) planting at riser (BB or lamtoro gung);
x) planting at lip (elephant grass); and
xi) initial watering for the plants.

The terracing and other earth and masonry works would be performed in dry season. The planting works for the riser and lips would be performed in the beginning of the succeeding wet season. The terracing and planting would be performed area by area every year.

2) Side ditches

Side ditches would be constructed in the proposed housing yard area. The side ditches would be constructed with masonry. All these works would be performed by manpower.

3) Agro-forest and annual crop

The crop planting would be also commenced in the successive wet season after the land preparation (terracing) in the dry season.

The tree crops would be fertilized for the first three years of the planting. The annual crops would be fertilized for the first year of the planting. The fertilizing works for both tree and annual crops are to be performed under the initial investment of the project.

4) Support program

Many guidance experts would be dispatched to villages in the proposed area for group guidance, agricultural promotion, community development, monitoring and evaluation on the watershed conservation works to support villagers.

5) Annual work schedule

A sequence of terracing, planting riser and lips, and planting crops would be performed area by area. The sequence of works would be repeated next year depending on the area for development by tributary. The following is a sequence of construction schedule for the watershed conservation works.

**Table 2.4.3 Schedule for Watershed Conservation Works**

| Works | J | F | M | A | M | J | J | A | S | O | N | D |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Terracing | | | | | | * | * | * | * | * | | |
| Planting, riser & lip | | | | | | | | | | | * | * |
| Planting, crops | | | | | | | | | | * | * | * |
| - do - (2nd year) | * | * | | | | | | | | | | |

Source: JICA Study Team
Note: *: doing works
- The hatched months are called wet season.

(3) Procurement of dreder

1) Procurement of equipment

A cutter-suction dredger would be procured. The procurement would be completed for 14 months from the order, design, manufacturing, transportation and to the installation.

2) Periodic dredging

Dredging would be performed in front of the intake of the reservoir. The length of the discharge pipeline would be about one kilometer from around the intake to the new spillway forebay.

The following are estimation and proposed quantity for the annual dredging.

i) Working period : 6 months/year; wet season (discharging period, December to May, 22 days/month), 132 days/year
ii) Operation hour : 13 hours per day (2-shift)
iii) Dredging depth : 10 m (WL= 136m and sediment level= 127m, April~May)
iv) Type and class of dredger : Cutter-suction dredger, 600 PS (109 $m^3$/hr/unit x 13 hours/day= 1,417 $m^3$/day/unit); Refer to Table 2.4.4 for the production rate.
v) Estimated work quantity : 132 days/year x 1,417 $m^3$/day= 187,044 $m^3$/year

2.4.2 Project Implementation Schedule

Project implementation schedule is proposed as also shown in Figure 2.4.2.

## 2-5 Estimate of Construction Resources

2.5.1 Labor

Required labor for construction works is estimated in Table 2.5.1.

2.5.2 Construction Materials

Required construction materials are estimated in Table 2.5.2.

2.5.3 Construction Equipment

Required construction equipment is estimated in Table 2.5.3.

# CHAPTER 3 COST ESTIMATE FOR FEASIBILITY STUDY

## 3.1 Preface

This chapter is to support, on cost estimate, Part 2 [Feasibility Study] of the main report. The cost is estimated for the implementation of the urgent counter measures.

## 3.2 Conditions and Assumption

### 3.2.1 Price Level

(1) Price level

Price level is set at December 2006.

(2) Exchange rate

The following are exchange rates used for the cost estimate.

i) US$ 1.0= Y 118.92
ii) US$ 1.0= Rp. 9,050
(Y 1.0= Rp. 76.1)
where: US$: U.S. dollar;
Y: Japanese yen; and
Rp.: Indonesian rupiah

(3) Currency of cost estimate

Cost is estimated in U.S. dollar.

### 3.2.2 Cost Component

(1) Project cost

The project cost is composed of the following.

(i) Construction cost,
(ii) Consulting service cost,
(iii) Administrative expenses,
(iv) Land acquisition cost,
(v) Contingencies, and
(vi) Tax and duty

Note:
- Items (i) and (ii) are estimated excluding tax and duty.
- Items (iii) and (iv) are estimated including their related physical and price contingencies, and taxes.
- Item (v) is estimated as the physical and price contingencies for Items (i), (ii) and (v).
- Item (vi) is tax and duty to be rated relating to Items (i) and (ii).
- Items (i), (ii) and (v) will be financed under a loan to be raised by the Government of Indonesia (GOI).
- Items (iii), (iv) and (vi) will be borne by GOI.

(2) Construction cost

Construction cost is composed of:

i) cost for sediment storage reservoir works and dredger procurement; and
ii) cost for watershed conservation works.

i) Cost for sediment storage reservoir works and dredger procurement

The cost for sediment storage reservoir works and dredger procurement is estimated at the aggregate of the following.

a) Cost for temporary works: 10 % of the major and other works
b) Cost for major works: to multiply the work quantities by their unit cost,
c) Cost for other works: 25 % of the major works

ii) Cost for watershed conservation works

The cost for watershed conservation works is estimated multiply the quantities of works and material by their unit cost.

Village people would fully participate in the works with their contribution of the following.

**Table 3.2.1 People's Labor Contribution for Watershed Conservation Works**

| Item | a) Earth and stone moving works | b) Planting works, for lip & riser |
|---|---|---|
| 1. Labor contribution by villagers | 25 % | 50 % |
| 2. Labor wage rate by project | 75 % | 50 % |

Source: JICA Study Team
Item 2 is used for the project cost estimate.

(3) Consulting service cost

Consulting service cost is estimated at:

- 10 % of construction cost.

The consulting service cost is divided into two categories. One is for the design and supervision for the sediment storage reservoir works and dredger procurement, the other is for the design, preparation and monitoring for the watershed conservation works at the proportion of the following.

1) 75 % for sediment storage reservoir works, and
2) 25 % for watershed conservation works

The following is the computation for this proportion. The Watershed Conservation Expert, who solely works for the watershed conservation works, would have about 50 M/M of assignment in all foreign experts (about 220 M/M). He takes about 23 % in the M/M volume. As he deals with more subcontracts than other experts/ engineers for his task, the service rate for the watershed conservation works is set at 25 %. The service rate for the sediment storage reservoir works is set at 75 % accordingly.

(4) Administrative expenses

Administrative expenses are estimated at the aggregate of the following:

- 1.0 % of construction cost (base expenses), and
- its relating physical and price contingencies.

In the same manner as the consulting service cost, the administrative expenses are divided into two categories below.

1) 75 % for sediment storage reservoir works, and

2) 25 % for watershed conservation works

(5) Land acquisition cost

This cost item includes the cost for:

- land acquisition;
- compensation; and
- resettlement.

Compensation and resettlement cost would not be expensed. Land acquisition cost is estimated in case that a part of the proposed spillway structure might overlap with the existing public road.

The estimation is made multiplying the land area by the prevailing acquisition rate.

(6) Physical and price contingencies

1) Physical contingency

Physical contingency is estimated at 5 % or 20 % of the works depending on the type of works, scale of works, and the accuracy of survey, design and quantification.

2) Price contingency

Price contingency is estimated at the rates of the following.

- 1.2 % per annum for foreign currency portion (refer to Table 1.3.1), and
- 3.2 % per annum for local currency portion (refer to Table 1.3.2)

(7) Tax and duty

This item includes:

- value-added tax (VAT or PPN);
- customs duty; and
- all other taxes to be imposed in Indonesia.

The value-added tax (VAT) is estimated for the costs of the construction works and the consulting services. The tax rate of 10 % is applied for the computation.

## 3.3 Estimate of Project Cost

### 3.3.1 Construction Cost

(1) Price data

Price data on construction equipment and material are obtained through quotations from several construction companies in Indonesia. Major companies are selected so that the prices for a lot of items and quantities for equipment and material could be obtained. The following are the companies that the Study Team asked for the quotation.

- PT. Wijaya Karya
- PT. Waskita Karya
- PT. Trakindo Utama
- PT. Sac Nusantara

The quotations obtained from Wijaya Karya, Waskita Karya, and Trakindo Utama are shown in

Attachment 2.

The prices are compared in tables as below.

- Labor wage in Tables 3.3.1,
- Construction material price in Table 3.3.2, and
- Construction equipment rate (rental rate) in Table 3.3.3

Price lists are also obtained for heavy oil (banker) and ready-mixed concrete from the local suppliers of the following.

- Pertamina
- PT. Jaya Redymix
- PT. Bengawan Readymix

The price lists obtained from Pertamina, Jaya Redymix, and Bengawan Readymix are shown in Attachment 3.

(2) Prices used for estimation

The price data, that is not available through the quotations and the price lists obtained, is added from the 'Journal of Building Construction & Material Price, No. 25, July 2006. The prices used for cost estimate are tabulated below.

- Labor wage in Tables 3.3.4,
- Construction material price in Table 3.3.5, and
- Construction equipment rate (rental rate) in Table 3.3.6

(3) Unit cost for works

Unit costs for major works are estimated based on the labor wage, material price, and equipment rental rate. Estimated unit costs are tabulated below.

**Table 3.3.7 Estimated Unit Cost for Works**

| Work item | Unit | Unit cost ($) |
|---|---|---|
| 1. Steel sheet piling, Type U-III | ton | 1,326 |
| 2. Excavation, common | $m^3$ | 4 |
| 3. Excavation, forebay | $m^3$ | 4 |
| 4. Backfilling | $m^3$ | 2 |
| 5. Filling, for dike | $m^3$ | 3 |
| 6. Concrete | $m^3$ | 113 |
| 7. Rebar | ton | 982 |

Source: JICA Study Team
Note: - Price level: December 2006
- Refer to Table 3.3.8 for the breakdown of unit cost above.

(4) Construction cost

Construction cost is estimated in Table 3.3.9.

3.3.2 Consulting Service Cost

Consulting service cost is estimated in Table 3.3.10.

3.3.3 Land Acquisition Cost

Land acquisition cost is estimated in Table 3.3.11.

3.3.4 Administrative Expenses

Administrative expenses are estimated in Table 3.3.12.

3.3.5 Project Cost

Project cost is estimated in Table 3.3.13.

## 3.4 Estimate of Operation and Maintenance Cost

Operation and maintenance cost is estimated in Table 3.3.14.

# *Tables*

# Table 1.3.1 Foreign Currency Escalation (1/4)

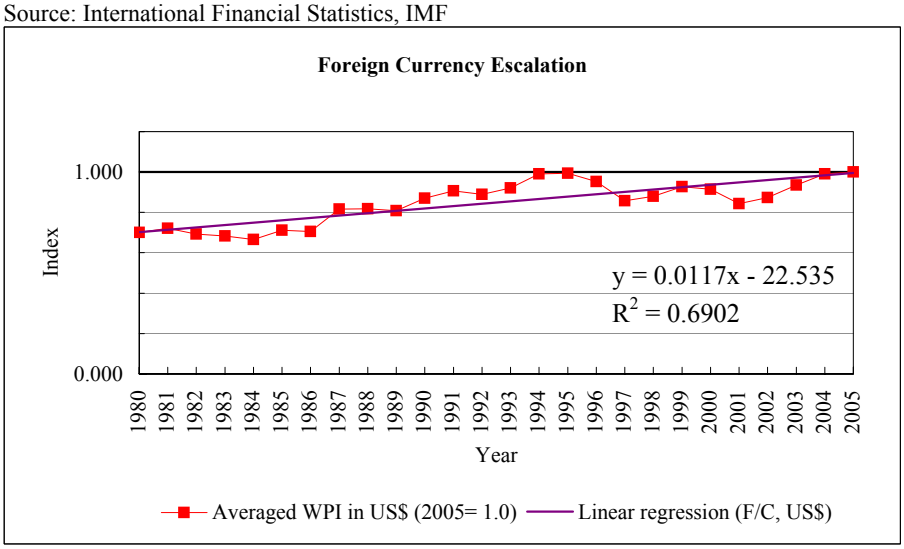
**Output**

Country: Japan, United States and Singapore

CU: Y, US$ and S$

| Year | *A* *(input)* US$ per SDR | *G* *(= Average($g_1$, $g_2$, $g_3$))* Averaged index, US$ per CU (2005= 1.0) | *H* *(= Average($h_1$, $h_2$, $h_3$))* Averaged index, WPI in CU (2005= 1.0) | *I* *(= Average($i_1$, $i_2$, $i_3$))* Averaged index, WPI in US$ (2005= 1.0) |
|---|---|---|---|---|
| 1980 | 1.2754 | 0.799 | 0.927 | **0.701** |
| 1981 | 1.1640 | 0.790 | 0.963 | **0.722** |
| 1982 | 1.1031 | 0.771 | 0.953 | **0.692** |
| 1983 | 1.0470 | 0.770 | 0.940 | **0.683** |
| 1984 | 0.9802 | 0.751 | 0.944 | **0.665** |
| 1985 | 1.0984 | 0.800 | 0.932 | **0.712** |
| 1986 | 1.2232 | 0.843 | 0.858 | **0.705** |
| 1987 | 1.4187 | 0.939 | 0.873 | **0.816** |
| 1988 | 1.3457 | 0.940 | 0.874 | **0.818** |
| 1989 | 1.3142 | 0.909 | 0.900 | **0.808** |
| 1990 | 1.4227 | 0.953 | 0.919 | **0.870** |
| 1991 | 1.4304 | 0.998 | 0.911 | **0.906** |
| 1992 | 1.3750 | 0.996 | 0.896 | **0.889** |
| 1993 | 1.3736 | 1.041 | 0.882 | **0.921** |
| 1994 | 1.4599 | 1.119 | 0.877 | **0.990** |
| 1995 | 1.4865 | 1.120 | 0.884 | **0.994** |
| 1996 | 1.4380 | 1.080 | 0.884 | **0.952** |
| 1997 | 1.3493 | 0.977 | 0.883 | **0.858** |
| 1998 | 1.4080 | 1.018 | 0.863 | **0.880** |
| 1999 | 1.3725 | 1.062 | 0.866 | **0.927** |
| 2000 | 1.3029 | 1.006 | 0.908 | **0.915** |
| 2001 | 1.2567 | 0.941 | 0.899 | **0.843** |
| 2002 | 1.3595 | 0.991 | 0.881 | **0.874** |
| 2003 | 1.4860 | 1.037 | 0.899 | **0.935** |
| 2004 | 1.5530 | 1.062 | 0.932 | **0.991** |
| 2005 | 1.4241 | 1.000 | 1.000 | **1.000** |

Source: International Financial Statistics, IMF




Escalation ratio is estimated at 1.2% per annum for F/C, (1.2%≈ 0.0117) based on a linear regression to the averaged plots of WPI in US$ among Japan, U.S. and Singapore that are major exporters for Indonesia.

# Table 1.3.1 Foreign Currency Escalation (2/4)

**Input 1**
Country: Japan
CU: Y

| Year | *A* *(input)* US$ per SDR | *a* *(input)* CU per SDR | *b* *(input)* WPI, (1990= 100) | *c* *(input)* WPI, (1995= 100) | *d* WPI, (1990= 100) | *e* *(= a/A)* CU per US$ | *f* *(= 1/e)* US$ per CU | $g_1$ *(= f/f2005)* Index, US$ per CU | $h_1$ *(= d/d2005)* Index, WPI in CU | $i_1$ *(= g x h)* Index, WPI in US$ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | (Y/SDR) | | | | (Y/US$) | (US$/Y) | | | |
| 1980 | 1.2754 | 258.91 | 104.7 | | 104.7 | 203.00 | 4.926E-03 | 0.589 | 1.149 | 0.677 |
| 1981 | 1.1640 | 255.95 | 106.1 | | 106.1 | 219.89 | 4.548E-03 | 0.544 | 1.165 | 0.634 |
| 1982 | 1.1031 | 259.23 | 106.6 | | 106.6 | 235.00 | 4.255E-03 | 0.509 | 1.170 | 0.596 |
| 1983 | 1.0470 | 243.10 | 106.0 | | 106.0 | 232.19 | 4.307E-03 | 0.515 | 1.164 | 0.599 |
| 1984 | 0.9802 | 246.13 | 106.1 | | 106.1 | 251.10 | 3.982E-03 | 0.476 | 1.165 | 0.555 |
| 1985 | 1.0984 | 220.23 | 105.3 | | 105.3 | 200.50 | 4.988E-03 | 0.597 | 1.156 | 0.690 |
| 1986 | 1.2232 | 194.61 | 100.3 | | 100.3 | 159.10 | 6.285E-03 | 0.752 | 1.101 | 0.828 |
| 1987 | 1.4187 | 175.20 | 97.2 | | 97.2 | 123.49 | 8.098E-03 | 0.969 | 1.067 | 1.034 |
| 1988 | 1.3457 | 169.36 | 96.6 | | 96.6 | 125.85 | 7.946E-03 | 0.951 | 1.060 | 1.008 |
| 1989 | 1.3142 | 188.52 | 98.5 | | 98.5 | 143.45 | 6.971E-03 | 0.834 | 1.081 | 0.902 |
| 1990 | 1.4227 | 191.21 | 100.0 | | 100.0 | 134.40 | 7.440E-03 | 0.890 | 1.098 | 0.977 |
| 1991 | 1.4304 | 179.09 | 101.0 | | 101.0 | 125.20 | 7.987E-03 | 0.956 | 1.109 | 1.059 |
| 1992 | 1.3750 | 171.53 | 100.1 | | 100.1 | 124.75 | 8.016E-03 | 0.959 | 1.099 | 1.054 |
| 1993 | 1.3736 | 153.63 | 98.6 | | 98.6 | 111.85 | 8.941E-03 | 1.070 | 1.082 | 1.158 |
| 1994 | 1.4599 | 145.61 | 96.8 | | 96.8 | 99.74 | 1.003E-02 | 1.199 | 1.063 | 1.274 |
| 1995 | 1.4865 | 152.86 | 96.1 | 100.0 | 96.1 | 102.83 | 9.725E-03 | 1.163 | 1.055 | 1.227 |
| 1996 | 1.4380 | 166.80 | | 98.4 | 94.6 | 116.00 | 8.621E-03 | 1.031 | 1.038 | 1.070 |
| 1997 | 1.3493 | 175.34 | | 99.0 | 95.1 | 129.95 | 7.695E-03 | 0.921 | 1.044 | 0.961 |
| 1998 | 1.4080 | 162.77 | | 97.5 | 93.7 | 115.60 | 8.651E-03 | 1.035 | 1.028 | 1.064 |
| 1999 | 1.3725 | 140.27 | | 96.0 | 92.3 | 102.20 | 9.785E-03 | 1.171 | 1.013 | 1.185 |
| 2000 | 1.3029 | 149.70 | | 96.1 | 92.4 | 114.90 | 8.703E-03 | 1.041 | 1.014 | 1.055 |
| 2001 | 1.2567 | 165.64 | | 93.9 | 90.2 | 131.81 | 7.587E-03 | 0.908 | 0.991 | 0.899 |
| 2002 | 1.3595 | 163.01 | | 92.0 | 88.4 | 119.90 | 8.340E-03 | 0.998 | 0.970 | 0.968 |
| 2003 | 1.4860 | 159.15 | | 91.3 | 87.7 | 107.10 | 9.337E-03 | 1.117 | 0.963 | 1.076 |
| 2004 | 1.5530 | 161.70 | | 92.2 | 88.6 | 104.12 | 9.604E-03 | 1.149 | 0.973 | 1.117 |
| 2005 | 1.4241 | 170.37 | | 94.8 | 91.1 | 119.63 | 8.359E-03 | 1.000 | 1.000 | 1.000 |

Source: International Financial Statistics, IMF
Base year: 2005
Remarks:
SDR: IMF's defining currency unit, determined using four currency units, i.e. Euro, Japanese yen, Pound sterling and U.S. dollar.
CU: Currency Unit
WPI: Wholesale Price Index
a: Exchange rate, CU per SDR
b: WPI (1990= 100)
c: WPI (1995= 100)
d: WPI (1990= 100)
e: Exchange rate, CU per US$
f: Exchange rate, US$ per CU
g: Averaged index of exchange rate, US$ per CU (2005= 1.0)
h: Averaged WPI in CU (2005= 1.0)
i: Averaged WPI in US$ (2005= 1.0)

# Table 1.3.1 Foreign Currency Escalation (3/4)

**Input 2**

Country: United States

CU: US$

| Year | *A* (input) US$ per SDR | *a* (= A) CU per SDR | *b* (input) WPI, (1990= 100) | *c* (input) WPI, (1995= 100) | *d* WPI, (1990= 100) | *e* (= a/A) CU per US$ | *f* (= 1/e) US$ per CU | $g_2$ (= f/f2005) Index, US$ per CU | $h_2$ (= d/d2005) Index, WPI in CU | $i_2$ (= g x h) Index, WPI in US$ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | (US$/SDR) | | | | (US$/US$) | (US$/US$) | | | |
| 1980 | 1.2754 | 1.2754 | 77.3 | | 77.3 | 1.0 | 1.000E+00 | 1.000 | 0.566 | 0.566 |
| 1981 | 1.1640 | 1.1640 | 84.3 | | 84.3 | 1.0 | 1.000E+00 | 1.000 | 0.618 | 0.618 |
| 1982 | 1.1031 | 1.1031 | 85.9 | | 85.9 | 1.0 | 1.000E+00 | 1.000 | 0.629 | 0.629 |
| 1983 | 1.0470 | 1.0470 | 87.0 | | 87.0 | 1.0 | 1.000E+00 | 1.000 | 0.637 | 0.637 |
| 1984 | 0.9802 | 0.9802 | 89.2 | | 89.2 | 1.0 | 1.000E+00 | 1.000 | 0.654 | 0.654 |
| 1985 | 1.0984 | 1.0984 | 88.7 | | 88.7 | 1.0 | 1.000E+00 | 1.000 | 0.650 | 0.650 |
| 1986 | 1.2232 | 1.2232 | 86.2 | | 86.2 | 1.0 | 1.000E+00 | 1.000 | 0.632 | 0.632 |
| 1987 | 1.4187 | 1.4187 | 88.4 | | 88.4 | 1.0 | 1.000E+00 | 1.000 | 0.648 | 0.648 |
| 1988 | 1.3457 | 1.3457 | 92.0 | | 92.0 | 1.0 | 1.000E+00 | 1.000 | 0.674 | 0.674 |
| 1989 | 1.3142 | 1.3142 | 96.6 | | 96.6 | 1.0 | 1.000E+00 | 1.000 | 0.708 | 0.708 |
| 1990 | 1.4227 | 1.4227 | 100.0 | | 100.0 | 1.0 | 1.000E+00 | 1.000 | 0.733 | 0.733 |
| 1991 | 1.4304 | 1.4304 | 100.2 | | 100.2 | 1.0 | 1.000E+00 | 1.000 | 0.734 | 0.734 |
| 1992 | 1.3750 | 1.3750 | 100.8 | | 100.8 | 1.0 | 1.000E+00 | 1.000 | 0.739 | 0.739 |
| 1993 | 1.3736 | 1.3736 | 102.3 | | 102.3 | 1.0 | 1.000E+00 | 1.000 | 0.750 | 0.750 |
| 1994 | 1.4599 | 1.4599 | 103.5 | | 103.5 | 1.0 | 1.000E+00 | 1.000 | 0.758 | 0.758 |
| 1995 | 1.4865 | 1.4865 | 107.3 | 100.0 | 107.3 | 1.0 | 1.000E+00 | 1.000 | 0.786 | 0.786 |
| 1996 | 1.4380 | 1.4380 | | 102.3 | 109.8 | 1.0 | 1.000E+00 | 1.000 | 0.804 | 0.804 |
| 1997 | 1.3493 | 1.3493 | | 102.3 | 109.8 | 1.0 | 1.000E+00 | 1.000 | 0.804 | 0.804 |
| 1998 | 1.4080 | 1.4080 | | 99.7 | 107.0 | 1.0 | 1.000E+00 | 1.000 | 0.784 | 0.784 |
| 1999 | 1.3725 | 1.3725 | | 100.6 | 107.9 | 1.0 | 1.000E+00 | 1.000 | 0.791 | 0.791 |
| 2000 | 1.3029 | 1.3029 | | 106.4 | 114.2 | 1.0 | 1.000E+00 | 1.000 | 0.836 | 0.836 |
| 2001 | 1.2567 | 1.2567 | | 107.6 | 115.5 | 1.0 | 1.000E+00 | 1.000 | 0.846 | 0.846 |
| 2002 | 1.3595 | 1.3595 | | 105.1 | 112.8 | 1.0 | 1.000E+00 | 1.000 | 0.826 | 0.826 |
| 2003 | 1.4860 | 1.4860 | | 110.8 | 118.9 | 1.0 | 1.000E+00 | 1.000 | 0.871 | 0.871 |
| 2004 | 1.5530 | 1.5530 | | 117.6 | 126.2 | 1.0 | 1.000E+00 | 1.000 | 0.925 | 0.925 |
| 2005 | 1.4241 | 1.4241 | | 127.2 | 136.5 | 1.0 | 1.000E+00 | 1.000 | 1.000 | 1.000 |

Source: International Financial Statistics, IMF

Base year: 2005

Remarks: SDR: IMF's defining currency unit, determined using four currency units, i.e. Euro, Japanese yen, Pound sterling and U.S. dollar.

CU: Currency Unit

WPI: Wholesale Price Index

a: Exchange rate, CU per SDR

b: WPI (1990= 100)

c: WPI (1995= 100)

d: WPI (1990= 100)

e: Exchange rate, CU per US$

f: Exchange rate, US$ per CU

g: Averaged index of exchange rate, US$ per CU (2005= 1.0)

h: Averaged WPI in CU (2005= 1.0)

i: Averaged WPI in US$ (2005= 1.0)

# Table 1.3.1 Foreign Currency Escalation (4/4)

**Input 3**
Country: Singapore
CU: S$

| Year | *A* *(input)* US$ per SDR | *a* *(input)* CU per SDR | *b* *(input)* WPI, (1990= 100) | *c* *(input)* WPI, (1995= 100) | *d* WPI, (1990= 100) | *e* *(= a/A)* CU per US$ | *f* *(= 1/e)* US$ per CU | $g_3$ *(= f/f2005)* Index, US$ per CU | $h_3$ *(= d/d2005)* Index, WPI in CU | $i_3$ *(= g x h)* Index, WPI in US$ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | (S$/SDR) | | | | (S$/US$) | (US$/S$) | | | |
| 1980 | 1.2754 | 2.6701 | 114.8 | | 114.8 | 2.0935 | 4.777E-01 | 0.808 | 1.065 | 0.861 |
| 1981 | 1.1640 | 2.3836 | 119.2 | | 119.2 | 2.0478 | 4.883E-01 | 0.826 | 1.106 | 0.914 |
| 1982 | 1.1031 | 2.3259 | 114.2 | | 114.2 | 2.1085 | 4.743E-01 | 0.803 | 1.059 | 0.850 |
| 1983 | 1.0470 | 2.2269 | 110.0 | | 110.0 | 2.1269 | 4.702E-01 | 0.796 | 1.020 | 0.812 |
| 1984 | 0.9802 | 2.1349 | 109.3 | | 109.3 | 2.1780 | 4.591E-01 | 0.777 | 1.014 | 0.788 |
| 1985 | 1.0984 | 2.3122 | 106.9 | | 106.9 | 2.1051 | 4.750E-01 | 0.804 | 0.992 | 0.797 |
| 1986 | 1.2232 | 2.6604 | 90.7 | | 90.7 | 2.1750 | 4.598E-01 | 0.778 | 0.841 | 0.655 |
| 1987 | 1.4187 | 2.8352 | 97.6 | | 97.6 | 1.9984 | 5.004E-01 | 0.847 | 0.905 | 0.767 |
| 1988 | 1.3457 | 2.6190 | 95.8 | | 95.8 | 1.9462 | 5.138E-01 | 0.869 | 0.889 | 0.773 |
| 1989 | 1.3142 | 2.4895 | 98.3 | | 98.3 | 1.8944 | 5.279E-01 | 0.893 | 0.912 | 0.814 |
| 1990 | 1.4227 | 2.4818 | 100.0 | | 100.0 | 1.7445 | 5.732E-01 | 0.970 | 0.928 | 0.900 |
| 1991 | 1.4304 | 2.3323 | 95.9 | | 95.9 | 1.6305 | 6.133E-01 | 1.038 | 0.889 | 0.923 |
| 1992 | 1.3750 | 2.2617 | 91.7 | | 91.7 | 1.6449 | 6.079E-01 | 1.029 | 0.851 | 0.875 |
| 1993 | 1.3736 | 2.2087 | 87.7 | | 87.7 | 1.6080 | 6.219E-01 | 1.052 | 0.813 | 0.856 |
| 1994 | 1.4599 | 2.1324 | 87.3 | | 87.3 | 1.4607 | 6.846E-01 | 1.158 | 0.810 | 0.938 |
| 1995 | 1.4865 | 2.1023 | 87.3 | 100.0 | 87.3 | 1.4143 | 7.071E-01 | 1.196 | 0.810 | 0.969 |
| 1996 | 1.4380 | 2.0129 | | 100.1 | 87.4 | 1.3998 | 7.144E-01 | 1.209 | 0.811 | 0.980 |
| 1997 | 1.3493 | 2.2607 | | 99.0 | 86.4 | 1.6755 | 5.968E-01 | 1.010 | 0.802 | 0.810 |
| 1998 | 1.4080 | 2.3380 | | 96.0 | 83.8 | 1.6605 | 6.022E-01 | 1.019 | 0.777 | 0.792 |
| 1999 | 1.3725 | 2.2866 | | 98.0 | 85.6 | 1.6660 | 6.002E-01 | 1.016 | 0.794 | 0.806 |
| 2000 | 1.3029 | 2.2560 | | 107.9 | 94.2 | 1.7315 | 5.775E-01 | 0.977 | 0.874 | 0.854 |
| 2001 | 1.2567 | 2.3262 | | 106.1 | 92.6 | 1.8510 | 5.402E-01 | 0.914 | 0.859 | 0.785 |
| 2002 | 1.3595 | 2.3608 | | 104.7 | 91.4 | 1.7365 | 5.759E-01 | 0.974 | 0.848 | 0.826 |
| 2003 | 1.4860 | 2.5273 | | 106.7 | 93.1 | 1.7007 | 5.880E-01 | 0.995 | 0.864 | 0.860 |
| 2004 | 1.5530 | 2.5373 | | 111.1 | 97.0 | 1.6338 | 6.121E-01 | 1.036 | 0.900 | 0.932 |
| 2005 | 1.4241 | 2.4099 | | 123.5 | 107.8 | 1.6922 | 5.909E-01 | 1.000 | 1.000 | 1.000 |

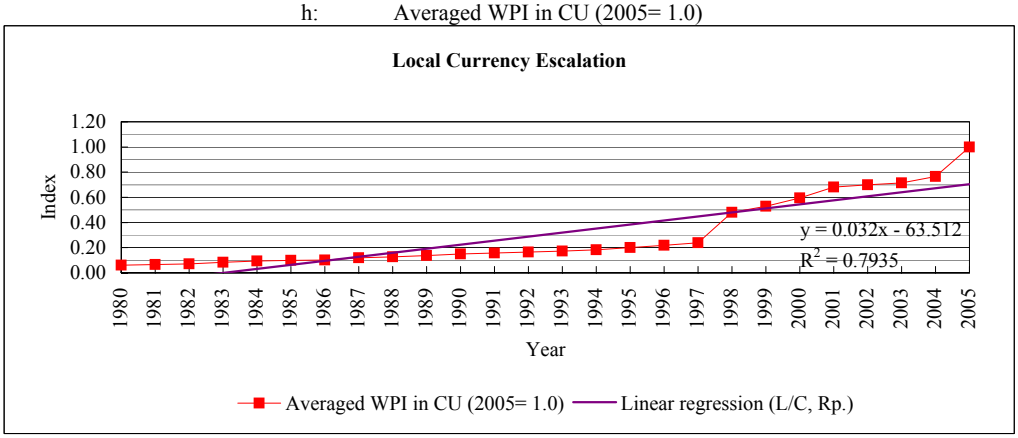
Source: International Financial Statistics, IMF
Base year: 2005
Remarks: SDR: IMF's defining currency unit, determined using four currency units, i.e. Euro, Japanese yen, Pound sterling and U.S. dollar.
CU: Currency Unit
WPI: Wholesale Price Index
a: Exchange rate, CU per SDR
b: WPI (1990= 100)
c: WPI (1995= 100)
d: WPI (1990= 100)
e: Exchange rate, CU per US$
f: Exchange rate, US$ per CU
g: Averaged index of exchange rate, US$ per CU (2005= 1.0)
h: Averaged WPI in CU (2005= 1.0)
i: Averaged WPI in US$ (2005= 1.0)

# Table 1.3.2 Local Currency Escalation

Country: Indonesia
CU: Rp.

| Year | *A* *(input)* US$ per SDR | *a* *(input)* CU per SDR | *b* *(input)* WPI, (1990= 100) | *c* *(input)* WPI, (1995= 100) | *d* WPI, (1990= 100) | *e* *(= a/A)* CU per US$ | *h* *(= d/d2005)* Index, WPI in CU |
|---|---|---|---|---|---|---|---|
| | | (Rp./SDR) | | | | (Rp./US$) | |
| 1980 | 1.2754 | 799.4 | 40.0 | | 40.0 | 626.8 | **0.060** |
| 1981 | 1.1640 | 749.6 | 44.3 | | 44.3 | 644.0 | **0.067** |
| 1982 | 1.1031 | 763.9 | 47.6 | | 47.6 | 692.5 | **0.072** |
| 1983 | 1.0470 | 1,040.7 | 56.1 | | 56.1 | 994.0 | **0.084** |
| 1984 | 0.9802 | 1,052.7 | 62.3 | | 62.3 | 1,074.0 | **0.094** |
| 1985 | 1.0984 | 1,235.7 | 65.4 | | 65.4 | 1,125.0 | **0.098** |
| 1986 | 1.2232 | 2,007.3 | 66.9 | | 66.9 | 1,641.0 | **0.101** |
| 1987 | 1.4187 | 2,340.8 | 79.7 | | 79.7 | 1,650.0 | **0.120** |
| 1988 | 1.3457 | 2,329.4 | 83.7 | | 83.7 | 1,731.0 | **0.126** |
| 1989 | 1.3142 | 2,361.5 | 90.8 | | 90.8 | 1,797.0 | **0.137** |
| 1990 | 1.4227 | 2,704.5 | 100.0 | | 100.0 | 1,901.0 | **0.150** |
| 1991 | 1.4304 | 2,849.4 | 105.1 | | 105.1 | 1,992.0 | **0.158** |
| 1992 | 1.3750 | 2,835.3 | 110.5 | | 110.5 | 2,062.0 | **0.166** |
| 1993 | 1.3736 | 2,898.2 | 114.7 | | 114.7 | 2,110.0 | **0.172** |
| 1994 | 1.4599 | 3,211.7 | 120.9 | | 120.9 | 2,200.0 | **0.182** |
| 1995 | 1.4865 | 3,430.8 | 134.6 | 100.0 | 134.6 | 2,308.0 | **0.202** |
| 1996 | 1.4380 | 3,426.7 | | 107.9 | 145.2 | 2,383.0 | **0.218** |
| 1997 | 1.3493 | 6,274.0 | | 117.5 | 158.2 | 4,650.0 | **0.238** |
| 1998 | 1.4080 | 11,299.4 | | 237.2 | 319.3 | 8,025.0 | **0.480** |
| 1999 | 1.3725 | 9,724.2 | | 262.0 | 352.7 | 7,085.0 | **0.530** |
| 2000 | 1.3029 | 12,501.4 | | 294.7 | 396.7 | 9,595.0 | **0.596** |
| 2001 | 1.2567 | 13,070.0 | | 336.4 | 452.8 | 10,400.3 | **0.681** |
| 2002 | 1.3595 | 12,154.1 | | 345.7 | 465.3 | 8,940.1 | **0.700** |
| 2003 | 1.4860 | 12,578.7 | | 353.1 | 475.3 | 8,464.8 | **0.715** |
| 2004 | 1.5530 | 12,427.5 | | 378.7 | 509.7 | 8,002.3 | **0.766** |
| 2005 | 1.4241 | 14,291.2 | | 494.1 | 665.1 | 10,035.3 | **1.000** |

Source: International Financial Statistics, IMF
Base year: 2005
Remarks: SDR: IMF's defining currency unit, determined using four currency units, i.e. Euro, Japanese yen, Pound sterling and U.S. dollar.
CU: Currency Unit
WPI: Wholesale Price Index
a: Exchange rate, CU per SDR
b: WPI (1990= 100)
c: WPI (1995= 100)
d: WPI (1990= 100)
e: Exchange rate, CU per US$
f: Exchange rate, US$ per CU
h: Averaged WPI in CU (2005= 1.0)




Escalation ratio is estimated at 3.2% per annum for L/C, (3.2%≈ 0.032)
based on a linear regression to the plots of WPI in Rp. in the domestic markect of Indonesia.

## Table 1.3.3 F/C and L/C Price Indexes

| Year | F/C | L/C | Exchange rate | |
|---|---|---|---|---|
| | (US$/US$) | (Rp./Rp.) | (Rp./US$) | (Y./US$) |
| 1980 | **0.701** | **0.060** | 626.8 | 203.00 |
| 1981 | **0.722** | **0.067** | 644.0 | 219.89 |
| 1982 | **0.692** | **0.072** | 692.5 | 235.00 |
| 1983 | **0.683** | **0.084** | 994.0 | 232.19 |
| 1984 | **0.665** | **0.094** | 1,074.0 | 251.10 |
| 1985 | **0.712** | **0.098** | 1,125.0 | 200.50 |
| 1986 | **0.705** | **0.101** | 1,641.0 | 159.10 |
| 1987 | **0.816** | **0.120** | 1,650.0 | 123.49 |
| 1988 | **0.818** | **0.126** | 1,731.0 | 125.85 |
| 1989 | **0.808** | **0.137** | 1,797.0 | 143.45 |
| 1990 | **0.870** | **0.150** | 1,901.0 | 134.40 |
| 1991 | **0.906** | **0.158** | 1,992.0 | 125.20 |
| 1992 | **0.889** | **0.166** | 2,062.0 | 124.75 |
| 1993 | **0.921** | **0.172** | 2,110.0 | 111.85 |
| 1994 | **0.990** | **0.182** | 2,200.0 | 99.74 |
| 1995 | **0.994** | **0.202** | 2,308.0 | 102.83 |
| 1996 | **0.952** | **0.218** | 2,383.0 | 116.00 |
| 1997 | **0.858** | **0.238** | 4,650.0 | 129.95 |
| 1998 | **0.880** | **0.480** | 8,025.0 | 115.60 |
| 1999 | **0.927** | **0.530** | 7,085.0 | 102.20 |
| 2000 | **0.915** | **0.596** | 9,595.0 | 114.90 |
| 2001 | **0.843** | **0.681** | 10,400.3 | 131.81 |
| 2002 | **0.874** | **0.700** | 8,940.1 | 119.90 |
| 2003 | **0.935** | **0.715** | 8,464.8 | 107.10 |
| 2004 | **0.991** | **0.766** | 8,002.3 | 104.12 |
| 2005 | **1.000** | **1.000** | 10,035.3 | 119.63 |

Remarks: Base year (index= 1.0);
2005 for F/C; 2005 for L/C.
F/C: Foreign currency portion
L/C: Local currency portion

## Table 1.3.4 Update of Estimated Rates for Civil Works (Power Engineering Projects) (1/4)

Price level: 2005
Exchange rate (Rp./US$): 10,035.3

| No. | Project | Stage | Year | Price data F/C (US$) | Price data L/C (Rp.) | Price index F/C (2005= 1.0) | Price index L/C (2005= 1.0) | Price updated (as of 2005) F/C (US$) | Price updated (as of 2005) L/C (Rp.) | Price updated (as of 2005) Equival. (US$) | Price updated (as of 2005) Total (US$) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **I.** | **Preparatory Works** | | | | | | | | | | |
| **I-1.** | **Access road (per km)** | | | | | | | | | | |
| 1. | PJT-H | FS | 1990 | 0.0 | 190,500,000 | 0.870 | 0.150 | 0.0 | 1,270,000,000 | 126,553.3 | 126,553.3 |
| 2. | PJT-N | FS | 1990 | 42,720.0 | 272,635,200 | 0.870 | 0.150 | 49,103.4 | 1,817,568,000 | 181,117.5 | 230,220.9 |
| 3. | PJT-D | FS | 1990 | 100,000.0 | 722,980,000 | 0.870 | 0.150 | 114,942.5 | 4,819,866,667 | 480,291.2 | 595,233.7 |
| 4. | PJT-B | FS | 1994 | 0.0 | 840,220,000 | 0.990 | 0.182 | 0.0 | 4,616,593,407 | 460,035.4 | 460,035.4 |
| 5. | PJT-AF | FS | 1994 | 129,000.0 | 688,800,000 | 0.990 | 0.182 | 130,303.0 | 3,784,615,385 | 377,130.3 | 507,433.3 |
| 6. | PJT-R | DD | 1996 | 0.0 | 314,807,220 | 0.952 | 0.218 | 0.0 | 1,444,069,817 | 143,899.0 | 143,899.0 |
| 7. | PJT-Q | DD | 1998 | 132,657.0 | 20,000 | 0.880 | 0.480 | 150,746.6 | 41,667 | 4.2 | 150,750.8 |
| | | | | | | **Average:** | | **63,585.1** | | **252,718.7** | **316,303.8** |
| **I-2.** | **Road improvement (per km)** | | | | | | | | | | |
| 1. | PJT-X | FS | 1988 | 31,000.0 | 5,400,000 | 0.818 | 0.126 | 37,897.3 | 42,857,143 | 4,270.6 | 42,167.9 |
| 2. | PJT-D | FS | 1994 | 50,000.0 | 63,567,945 | 0.990 | 0.182 | 50,505.1 | 349,274,423 | 34,804.6 | 85,309.7 |
| 3. | PJT-Q | DD | 1998 | 32,915.0 | 881,118 | 0.880 | 0.480 | 37,403.4 | 1,835,663 | 182.9 | 37,586.3 |
| | | | | | | **Average:** | | **41,935.3** | | **13,086.0** | **55,021.3** |
| **I-3.** | **Bridge (per m)** | | | | | | | | | | |
| 1. | PJT-V | FS | 1998 | 169.0 | 1,422,000 | 0.880 | 0.480 | 192.0 | 2,962,500 | 295.2 | 487.2 |
| 2. | PJT-G | FS | 1990 | 0.0 | 9,525,000 | 0.870 | 0.150 | 0.0 | 63,500,000 | 6,327.7 | 6,327.7 |
| 3. | PJT-Q | FS | 1990 | 754.0 | 3,321,000 | 0.870 | 0.150 | 866.7 | 22,140,000 | 2,206.2 | 3,072.9 |
| | | | | | | **Average:** | | **352.9** | | **2,943.0** | **3,295.9** |
| **I-4.** | **Base camp, workshop & other facilities (LS)** | | | | | | | | | | |
| 1. | PJT-H | FS | 1990 | 0.0 | 5,715,000,000 | 0.870 | 0.150 | 0.0 | 38,100,000,000 | 3,796,598.0 | 3,796,598.0 |
| 2. | PJT-N | FS | 1990 | 209,000.0 | 3,043,800,000 | 0.870 | 0.150 | 240,229.9 | 20,292,000,000 | 2,022,062.1 | 2,262,292.0 |
| 3. | PJT-T | FS | 1990 | 0.0 | 2,700,000,000 | 0.870 | 0.150 | 0.0 | 18,000,000,000 | 1,793,668.4 | 1,793,668.4 |
| 4. | PJT-Q | FS | 1990 | 209,000.0 | 3,043,800,000 | 0.870 | 0.150 | 240,229.9 | 20,292,000,000 | 2,022,062.1 | 2,262,292.0 |
| 5. | PJT-AF | FS | 1994 | 300,000.0 | 1,470,000,000 | 0.990 | 0.182 | 303,030.3 | 8,076,923,077 | 804,851.2 | 1,107,881.5 |
| 6. | PJT-B | FS | 1994 | 0.0 | 1,506,720,000 | 0.990 | 0.182 | 0.0 | 8,278,681,319 | 824,956.0 | 824,956.0 |
| | | | | | | **Average:** | | **130,581.7** | | **1,877,366.3** | **2,007,948.0** |
| | The adopted price data is varied with respect to project scale. | | | | | | | | | | |
| I-5. | Power supply and telecomunication system (LS) | | | | | | | | | | |
| | | | | | | Average: | | (Nil) | | (Nil) | (Nil) |
| **II.** | **Civil Works** | | | | | | | | | | |
| **II-1.** | **Excavation, common (per m3)** | | | | | | | | | | |
| 1. | PJT-AC | DD | 1992 | 2.5 | 2,009 | 0.889 | 0.166 | 2.8 | 12,099 | 1.2 | 4.0 |
| 2. | PJT-AG | DD | 1993 | 1.7 | 1,916 | 0.921 | 0.172 | 1.8 | 11,138 | 1.1 | 2.9 |
| 3. | PJT-S | DD | 1993 | 1.9 | 1,656 | 0.921 | 0.172 | 2.1 | 9,628 | 1.0 | 3.1 |
| 4. | PJT-E | DD | 1991 | 2.5 | 1,962 | 0.906 | 0.158 | 2.8 | 12,418 | 1.2 | 4.0 |
| 5. | PJT-K | FS | 1989 | 0.8 | 2,100 | 0.808 | 0.137 | 1.0 | 15,328 | 1.5 | 2.5 |
| 6. | PJT-B | FS | 1994 | 1.0 | 7,590 | 0.990 | 0.182 | 1.0 | 41,701 | 4.2 | 5.2 |
| 7. | PJT-AF | FS | 1994 | 1.0 | 8,400 | 0.990 | 0.182 | 1.0 | 46,154 | 4.6 | 5.6 |
| 8. | PJT-R | DD | 1996 | 2.0 | 1,451 | 0.952 | 0.218 | 2.1 | 6,655 | 0.7 | 2.8 |
| 9. | PJT-Q | DD | 1998 | 4.1 | 5,400 | 0.880 | 0.480 | 4.6 | 11,250 | 1.1 | 5.7 |
| | | | | | | **Average:** | | **2.1** | | **1.8** | **3.9** |
| **II-2.** | **Excavation, soft rock (per m3)** | | | | | | | | | | |
| 1. | PJT-AG | DD | 1993 | 2.5 | 2,204 | 0.921 | 0.172 | 2.7 | 12,815 | 1.3 | 4.0 |
| 2. | PJT-S | DD | 1993 | 3.4 | 3,002 | 0.921 | 0.172 | 3.7 | 17,451 | 1.7 | 5.4 |
| 3. | PJT-E | DD | 1991 | 3.7 | 2,862 | 0.906 | 0.158 | 4.1 | 18,114 | 1.8 | 5.9 |
| 4. | PJT-B | FS | 1994 | 1.7 | 8,665 | 0.990 | 0.182 | 1.7 | 47,607 | 4.7 | 6.4 |
| 5. | PJT-R | DD | 1996 | 4.1 | 2,902 | 0.952 | 0.218 | 4.3 | 13,310 | 1.3 | 5.6 |
| 6. | PJT-Q | DD | 1998 | 5.2 | 6,200 | 0.880 | 0.480 | 5.9 | 12,917 | 1.3 | 7.2 |
| | | | | | | **Average:** | | **3.7** | | **2.0** | **5.7** |

## Table 1.3.4 Update of Estimated Rates for Civil Works (Power Engineering Projects) (2/4)

Price level: 2005
Exchange rate (Rp./US$): 10,035.3

| No. | Project | Stage | Year | Price data F/C (US$) | Price data L/C (Rp.) | Price index F/C (2005= 1.0) | Price index L/C (2005= 1.0) | Price updated (as of 2005) F/C (US$) | Price updated (as of 2005) L/C (Rp.) | Equival. (US$) | Total (US$) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **II-3.** | **Excavation, hard rock (per m3)** | | | | | | | | | | |
| 1. | PJT-AC | DD | 1992 | 6.0 | 4,193 | 0.889 | 0.166 | 6.7 | 25,256 | 2.5 | 9.2 |
| 2. | PJT-AG | DD | 1993 | 6.1 | 4,347 | 0.921 | 0.172 | 6.6 | 25,271 | 2.5 | 9.1 |
| 3. | PJT-E | DD | 1991 | 5.6 | 4,050 | 0.906 | 0.158 | 6.2 | 25,633 | 2.6 | 8.8 |
| 4. | PJT-J | FS | 1989 | 2.6 | 3,938 | 0.808 | 0.137 | 3.2 | 28,741 | 2.9 | 6.1 |
| 5. | PJT-S | DD | 1993 | 9.2 | 6,872 | 0.921 | 0.172 | 10.0 | 39,956 | 4.0 | 14.0 |
| 6. | PJT-B | FS | 1994 | 4.6 | 12,836 | 0.990 | 0.182 | 4.7 | 70,525 | 7.0 | 11.7 |
| 7. | PJT-AF | FS | 1994 | 4.0 | 10,500 | 0.990 | 0.182 | 4.0 | 57,692 | 5.7 | 9.7 |
| 8. | PJT-R | DD | 1996 | 7.9 | 6,692 | 0.952 | 0.218 | 8.3 | 30,699 | 3.1 | 11.4 |
| 9. | PJT-Q | DD | 1998 | 5.0 | 21,800 | 0.880 | 0.480 | 5.7 | 45,417 | 4.5 | 10.2 |
| | | | | | | **Average:** | | **6.2** | | **3.9** | **10.1** |
| **II-4.** | **Excavation, tunnel (per m3)** | | | | | | | | | | |
| 1. | PJT-AG | DD | 1993 | 70.8 | 54,528 | 0.921 | 0.172 | 76.8 | 317,024 | 31.6 | 108.4 |
| 2. | PJT-S | DD | 1993 | 58.2 | 50,612 | 0.921 | 0.172 | 63.2 | 294,253 | 29.3 | 92.5 |
| 3. | PJT-AC | DD | 1992 | 41.0 | 35,003 | 0.889 | 0.166 | 46.1 | 210,858 | 21.0 | 67.1 |
| 4. | PJT-J | FS | 1989 | 32.8 | 47,250 | 0.808 | 0.137 | 40.6 | 344,891 | 34.4 | 75.0 |
| 5. | PJT-E | DD | 1991 | 51.9 | 39,042 | 0.906 | 0.158 | 57.3 | 247,101 | 24.6 | 81.9 |
| 6. | PJT-B | FS | 1994 | 34.5 | 32,594 | 0.990 | 0.182 | 34.8 | 179,088 | 17.8 | 52.6 |
| 7. | PJT-AF | FS | 1994 | 33.0 | 33,600 | 0.990 | 0.182 | 33.3 | 184,615 | 18.4 | 51.7 |
| 8. | PJT-R | DD | 1996 | 33.5 | 32,269 | 0.952 | 0.218 | 35.2 | 148,021 | 14.8 | 50.0 |
| 9. | PJT-Q | DD | 1998 | 39.3 | 309,000 | 0.880 | 0.480 | 44.6 | 643,750 | 64.1 | 108.7 |
| | | | | | | **Average:** | | **48.0** | | **28.4** | **76.4** |
| | The adopted price data is varied with respect to project scale. | | | | | | | | | | |
| **II-5.** | **Excavation, shaft (per m3)** | | | | | | | | | | |
| 1. | PJT-S | DD | 1993 | 50.2 | 41,069 | 0.921 | 0.172 | 54.5 | 238,772 | 23.8 | 78.3 |
| 2. | PJT-E | DD | 1991 | 59.5 | 52,128 | 0.906 | 0.158 | 65.7 | 329,924 | 32.9 | 98.6 |
| 3. | PJT-B | FS | 1994 | 38.4 | 37,088 | 0.990 | 0.182 | 38.8 | 203,777 | 20.3 | 59.1 |
| 4. | PJT-AF | FS | 1994 | 37.0 | 37,800 | 0.990 | 0.182 | 37.4 | 207,692 | 20.7 | 58.1 |
| 5. | PJT-R | DD | 1996 | 26.7 | 35,428 | 0.952 | 0.218 | 28.0 | 162,512 | 16.2 | 44.2 |
| | | | | | | **Average:** | | **44.9** | | **22.8** | **67.7** |
| | The adopted price data is varied with respect to project scale. | | | | | | | | | | |
| **II-6.** | **Excavation, inclined tunnel (per m3)** | | | | | | | | | | |
| 1. | PJT-S | DD | 1993 | 107.2 | 59,140 | 0.921 | 0.172 | 116.4 | 343,837 | 34.3 | 150.7 |
| 2. | PJT-E | DD | 1991 | 54.4 | 40,410 | 0.906 | 0.158 | 60.0 | 255,759 | 25.5 | 85.5 |
| 3. | PJT-B | FS | 1994 | 66.5 | 87,484 | 0.990 | 0.182 | 67.1 | 480,679 | 47.9 | 115.0 |
| 4. | PJT-AF | FS | 1994 | 63.0 | 88,200 | 0.990 | 0.182 | 63.6 | 484,615 | 48.3 | 111.9 |
| 5. | PJT-Q | DD | 1998 | 44.1 | 438,300 | 0.880 | 0.480 | 50.1 | 913,125 | 91.0 | 141.1 |
| | | | | | | **Average:** | | **71.4** | | **49.4** | **120.8** |
| | The adopted price data is varied with respect to project scale. | | | | | | | | | | |
| **II-7.** | **Backfill (per m3)** | | | | | | | | | | |
| 1. | PJT-S | DD | 1993 | 2.0 | 2,070 | 0.921 | 0.172 | 2.2 | 12,035 | 1.2 | 3.4 |
| 2. | PJT-AC | DD | 1992 | 1.5 | 1,307 | 0.889 | 0.166 | 1.7 | 7,870 | 0.8 | 2.5 |
| 3. | PJT-R | DD | 1996 | 3.9 | 1,440 | 0.952 | 0.218 | 4.1 | 6,604 | 0.7 | 4.8 |
| 4. | PJT-X | FS | 1988 | 3.1 | 2,206 | 0.818 | 0.126 | 3.8 | 17,508 | 1.7 | 5.5 |
| 5. | PJT-K | FS | 1989 | 1.6 | 4,200 | 0.808 | 0.137 | 2.0 | 30,657 | 3.1 | 5.1 |
| 6. | PJT-V | FS | 1998 | 2.2 | 3,420 | 0.880 | 0.480 | 2.5 | 7,125 | 0.7 | 3.2 |
| 7. | PJT-AF | FS | 1994 | 1.0 | 4,200 | 0.990 | 0.182 | 1.0 | 23,077 | 2.3 | 3.3 |
| 8. | PJT-B | FS | 1994 | 1.0 | 3,483 | 0.990 | 0.182 | 1.0 | 19,137 | 1.9 | 2.9 |
| 9. | PJT-D | FS | 1994 | 3.0 | 3,418 | 0.990 | 0.182 | 3.0 | 18,779 | 1.9 | 4.9 |
| 10. | PJT-Q | FS | 1990 | 0.8 | 5,580 | 0.870 | 0.150 | 0.9 | 37,200 | 3.7 | 4.6 |
| | | | | | | **Average:** | | **2.2** | | **1.8** | **4.0** |
| **II-8.** | **Filling, core (per m3)** | | | | | | | | | | |
| 1. | PJT-AG | DD | 1993 | 4.3 | 3,255 | 0.921 | 0.172 | 4.7 | 18,923 | 1.9 | 6.6 |
| 2. | PJT-N | FS | 1990 | 2.1 | 5,525 | 0.870 | 0.150 | 2.4 | 36,830 | 3.7 | 6.1 |
| 3. | PJT-Q | FS | 1990 | 3.2 | 4,500 | 0.870 | 0.150 | 3.7 | 30,000 | 3.0 | 6.7 |
| | | | | | | **Average:** | | **3.6** | | **2.9** | **6.5** |

## Table 1.3.4 Update of Estimated Rates for Civil Works (Power Engineering Projects) (3/4)

Price level: 2005
Exchange rate (Rp./US$): 10,035.3

| No. | Project | Stage | Year | Price data F/C (US$) | Price data L/C (Rp.) | Price index F/C (2005= 1.0) | Price index L/C (2005= 1.0) | Price updated (as of 2005) F/C (US$) | Price updated (as of 2005) L/C (Rp.) | Price updated (as of 2005) Equival. (US$) | Price updated (as of 2005) Total (US$) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **II-9.** | **Filling, filter (per m3)** | | | | | | | | | | |
| 1. | PJT-AG | DD | 1993 | 4.7 | 3,440 | 0.921 | 0.172 | 5.0 | 20,001 | 2.0 | 7.0 |
| 2. | PJT-H | FS | 1990 | 8.7 | 16,574 | 0.870 | 0.150 | 10.0 | 110,490 | 11.0 | 21.0 |
| 3. | PJT-N | FS | 1990 | 6.8 | 19,241 | 0.870 | 0.150 | 7.8 | 128,270 | 12.8 | 20.6 |
| 4. | PJT-Q | FS | 1990 | 11.7 | 14,040 | 0.870 | 0.150 | 13.4 | 93,600 | 9.3 | 22.7 |
| | | | | | | **Average:** | | **9.1** | | **8.8** | **17.9** |
| **II-10.** | **Filling, rockfill (per m3)** | | | | | | | | | | |
| 1. | PJT-AG | DD | 1993 | 7.3 | 5,377 | 0.921 | 0.172 | 8.0 | 31,259 | 3.1 | 11.1 |
| 2. | PJT-N | FS | 1990 | 2.0 | 8,763 | 0.870 | 0.150 | 2.3 | 58,420 | 5.8 | 8.1 |
| 3. | PJT-AC | DD | 1992 | 10.2 | 5,753 | 0.889 | 0.166 | 11.5 | 34,654 | 3.5 | 15.0 |
| 4. | PJT-AF | FS | 1994 | 3.0 | 8,400 | 0.990 | 0.182 | 3.0 | 46,154 | 4.6 | 7.6 |
| 5. | PJT-P | FS | 1990 | 5.3 | 4,140 | 0.870 | 0.150 | 6.1 | 27,600 | 2.8 | 8.9 |
| | | | | | | **Average:** | | **6.2** | | **4.0** | **10.2** |
| **II-11.** | **Rip rap (per m3)** | | | | | | | | | | |
| 1. | PJT-AG | DD | 1993 | 4.2 | 3,089 | 0.921 | 0.172 | 4.5 | 17,960 | 1.8 | 6.3 |
| 2. | PJT-M | FS | 1990 | 3.1 | 13,716 | 0.870 | 0.150 | 3.6 | 91,440 | 9.1 | 12.7 |
| 3. | PJT-Q | DD | 1998 | 6.9 | 5,475 | 0.880 | 0.480 | 7.8 | 11,405 | 1.1 | 8.9 |
| | | | | | | **Average:** | | **5.3** | | **4.0** | **9.3** |
| **II-12.** | **Concrete, mass (per m3)** | | | | | | | | | | |
| 1. | PJT-AG | DD | 1993 | 34.9 | 37,348 | 0.921 | 0.172 | 37.9 | 217,138 | 21.6 | 59.5 |
| 2. | PJT-S | DD | 1993 | 59.0 | 59,906 | 0.921 | 0.172 | 64.1 | 348,290 | 34.7 | 98.8 |
| 3. | PJT-E | DD | 1991 | 39.4 | 57,096 | 0.906 | 0.158 | 43.5 | 361,367 | 36.0 | 79.5 |
| 4. | PJT-AF | FS | 1994 | 60.0 | 92,400 | 0.990 | 0.182 | 60.6 | 507,692 | 50.6 | 111.2 |
| 5. | PJT-R | DD | 1996 | 47.1 | 78,086 | 0.952 | 0.218 | 49.5 | 358,192 | 35.7 | 85.2 |
| 6. | PJT-Q | DD | 1998 | 39.4 | 279,900 | 0.880 | 0.480 | 44.8 | 583,125 | 58.1 | 102.9 |
| | | | | | | **Average:** | | **50.1** | | **39.5** | **89.6** |
| **II-13.** | **Concrete, super-structure (per m3)** | | | | | | | | | | |
| 1. | PJT-AG | DD | 1993 | 43.6 | 44,805 | 0.921 | 0.172 | 47.3 | 260,494 | 26.0 | 73.3 |
| 2. | PJT-E | DD | 1991 | 41.6 | 59,022 | 0.906 | 0.158 | 45.9 | 373,557 | 37.2 | 83.1 |
| 3. | PJT-AC | DD | 1992 | 68.6 | 52,533 | 0.889 | 0.166 | 77.1 | 316,464 | 31.5 | 108.6 |
| 4. | PJT-K | FS | 1989 | 17.8 | 170,800 | 0.808 | 0.137 | 22.0 | 1,246,715 | 124.2 | 146.2 |
| 5. | PJT-B | FS | 1994 | 67.8 | 140,481 | 0.990 | 0.182 | 68.5 | 771,874 | 76.9 | 145.4 |
| 6. | PJT-AF | FS | 1994 | 65.0 | 140,700 | 0.990 | 0.182 | 65.7 | 773,077 | 77.0 | 142.7 |
| 7. | PJT-R | DD | 1996 | 44.3 | 107,710 | 0.952 | 0.218 | 46.5 | 494,083 | 49.2 | 95.7 |
| 8. | PJT-Q | DD | 1998 | 58.1 | 527,600 | 0.880 | 0.480 | 66.1 | 1,099,167 | 109.5 | 175.6 |
| | | | | | | **Average:** | | **54.9** | | **66.4** | **121.3** |
| **II-14.** | **Concrete, sub-structure (per m3)** | | | | | | | | | | |
| 1. | PJT-S | DD | 1993 | 70.6 | 76,217 | 0.921 | 0.172 | 76.7 | 443,124 | 44.2 | 120.9 |
| 2. | PJT-E | DD | 1991 | 41.6 | 59,022 | 0.906 | 0.158 | 45.9 | 373,557 | 37.2 | 83.1 |
| 3. | PJT-AG | DD | 1993 | 40.3 | 44,805 | 0.921 | 0.172 | 43.7 | 260,494 | 26.0 | 69.7 |
| 4. | PJT-AC | DD | 1992 | 68.6 | 52,533 | 0.889 | 0.166 | 77.1 | 316,464 | 31.5 | 108.6 |
| 5. | PJT-B | FS | 1994 | 67.8 | 140,481 | 0.990 | 0.182 | 68.5 | 771,874 | 76.9 | 145.4 |
| 6. | PJT-AF | FS | 1994 | 65.0 | 140,700 | 0.990 | 0.182 | 65.7 | 773,077 | 77.0 | 142.7 |
| 7. | PJT-R | DD | 1996 | 44.3 | 107,710 | 0.952 | 0.218 | 46.5 | 494,083 | 49.2 | 95.7 |
| 8. | PJT-Q | DD | 1998 | 54.5 | 349,600 | 0.880 | 0.480 | 61.9 | 728,333 | 72.6 | 134.5 |
| | | | | | | **Average:** | | **60.8** | | **51.8** | **112.6** |
| **II-15.** | **Lining, tunnel (per m3)** | | | | | | | | | | |
| 1. | PJT-AG | DD | 1993 | 34.9 | 37,348 | 0.921 | 0.172 | 37.9 | 217,138 | 21.6 | 59.5 |
| 2. | PJT-S | DD | 1993 | 70.6 | 76,217 | 0.921 | 0.172 | 76.7 | 443,124 | 44.2 | 120.9 |
| 3. | PJT-E | DD | 1991 | 61.9 | 70,884 | 0.906 | 0.158 | 68.3 | 448,633 | 44.7 | 113.0 |
| 4. | PJT-AC | DD | 1992 | 89.0 | 71,994 | 0.889 | 0.166 | 100.1 | 433,699 | 43.2 | 143.3 |
| 5. | PJT-B | FS | 1994 | 64.3 | 132,763 | 0.990 | 0.182 | 65.0 | 729,464 | 72.7 | 137.7 |
| 6. | PJT-AF | FS | 1994 | 71.0 | 132,300 | 0.990 | 0.182 | 71.7 | 726,923 | 72.4 | 144.1 |
| 7. | PJT-R | DD | 1996 | 41.4 | 108,108 | 0.952 | 0.218 | 43.5 | 495,908 | 49.4 | 92.9 |
| 8. | PJT-P | DD | 1998 | 92.4 | 803,800 | 0.880 | 0.480 | 105.0 | 1,674,583 | 166.9 | 271.9 |
| | | | | | | **Average:** | | **71.0** | | **64.4** | **135.4** |

## Table 1.3.4 Update of Estimated Rates for Civil Works (Power Engineering Projects) (4/4)

Price level: 2005
Exchange rate (Rp./US$): 10,035.3

| No. | Project | Stage | Year | Price data F/C | Price data L/C | Price index F/C | Price index L/C | Price updated (as of 2005) F/C | Price updated (as of 2005) L/C | Price updated (as of 2005) Equival. | Price updated (as of 2005) Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | (US$) | (Rp.) | (2005= 1.0) | | (US$) | (Rp.) | (US$) | (US$) |
| **II-16.** | **Lining, shaft (per m3)** | | | | | | | | | | |
| 1. | PJT-S | DD | 1993 | 70.6 | 76,217 | 0.921 | 0.172 | 76.7 | 443,124 | 44.2 | 120.9 |
| 2. | PJT-E | DD | 1991 | 61.9 | 70,884 | 0.906 | 0.158 | 68.3 | 448,633 | 44.7 | 113.0 |
| 3. | PJT-B | FS | 1994 | 67.3 | 144,975 | 0.990 | 0.182 | 68.0 | 796,563 | 79.4 | 147.4 |
| 4. | PJT-AF | FS | 1994 | 71.0 | 132,300 | 0.990 | 0.182 | 71.7 | 726,923 | 72.4 | 144.1 |
| 5. | PJT-Q | DD | 1998 | 101.7 | 706,000 | 0.880 | 0.480 | 115.6 | 1,470,833 | 146.6 | 262.2 |
| | | | | | | **Average:** | | **80.1** | | **77.5** | **157.6** |
| II-17. | Pile concrete (per m3) | | | | | | | | | | |
| | | | | | | Average: | | (Nil) | | (Nil) | (Nil) |
| **II-18.** | **Reinforcing bar (per ton)** | | | | | | | | | | |
| 1. | PJT-S | DD | 1993 | 501.0 | 627,210 | 0.921 | 0.172 | 544.0 | 3,646,570 | 363.4 | 907.4 |
| 2. | PJT-E | DD | 1991 | 446.0 | 579,600 | 0.906 | 0.158 | 492.3 | 3,668,354 | 365.5 | 857.8 |
| 3. | PJT-B | FS | 1994 | 239.0 | 1,474,900 | 0.990 | 0.182 | 241.4 | 8,103,846 | 807.5 | 1,048.9 |
| 4. | PJT-AF | FS | 1994 | 228.0 | 1,474,200 | 0.990 | 0.182 | 230.3 | 8,100,000 | 807.2 | 1,037.5 |
| 5. | PJT-R | DD | 1996 | 99.0 | 1,570,140 | 0.952 | 0.218 | 104.0 | 7,202,477 | 717.7 | 821.7 |
| 6. | PJT-Q | DD | 1998 | 101.0 | 5,260,000 | 0.880 | 0.480 | 114.8 | 10,958,333 | 1,092.0 | 1,206.8 |
| | | | | | | **Average:** | | **287.8** | | **692.2** | **980.0** |
| **II-19.** | **Curtain grouting (per m)** | | | | | | | | | | |
| 1. | PJT-AG | DD | 1993 | 12.9 | 16,047 | 0.921 | 0.172 | 14.0 | 93,299 | 9.3 | 23.3 |
| 2. | PJT-E | DD | 1991 | 30.9 | 18,846 | 0.906 | 0.158 | 34.1 | 119,278 | 11.9 | 46.0 |
| 3. | PJT-S | DD | 1993 | 47.9 | 51,833 | 0.921 | 0.172 | 52.0 | 301,353 | 30.0 | 82.0 |
| 4. | PJT-B | FS | 1994 | 104.4 | 171,162 | 0.990 | 0.182 | 105.5 | 940,448 | 93.7 | 199.2 |
| 5. | PJT-R | DD | 1996 | 14.3 | 40,529 | 0.952 | 0.218 | 15.0 | 185,912 | 18.5 | 33.5 |
| 6. | PJT-Q | DD | 1998 | 7.8 | 39,200 | 0.880 | 0.480 | 8.8 | 81,667 | 8.1 | 16.9 |
| | | | | | | **Average:** | | **38.2** | | **28.6** | **66.8** |
| **II-20.** | **Consolidation grouting (per m)** | | | | | | | | | | |
| 1. | PJT-S | DD | 1993 | 47.9 | 51,833 | 0.921 | 0.172 | 52.0 | 301,353 | 30.0 | 82.0 |
| 2. | PJT-AC | DD | 1992 | 9.6 | 5,031 | 0.889 | 0.166 | 10.8 | 30,307 | 3.0 | 13.8 |
| 3. | PJT-B | FS | 1994 | 69.8 | 114,488 | 0.990 | 0.182 | 70.5 | 629,052 | 62.7 | 133.2 |
| 4. | PJT-AF | FS | 1994 | 4.0 | 142,800 | 0.990 | 0.182 | 4.0 | 784,615 | 78.2 | 82.2 |
| 5. | PJT-R | DD | 1996 | 14.3 | 40,529 | 0.952 | 0.218 | 15.0 | 185,912 | 18.5 | 33.5 |
| 6. | PJT-Q | DD | 1998 | 10.7 | 85,300 | 0.880 | 0.480 | 12.1 | 177,708 | 17.7 | 29.8 |
| | | | | | | **Average:** | | **27.4** | | **35.0** | **62.4** |
| **II-21.** | **Rock bolt (per m)** | | | | | | | | | | |
| 1. | PJT-N | FS | 1990 | 20.5 | 2,667 | 0.870 | 0.150 | 23.6 | 17,780 | 1.8 | 25.4 |
| 2. | PJT-B | FS | 1994 | 13.1 | 45,430 | 0.990 | 0.182 | 13.3 | 249,613 | 24.9 | 38.2 |
| 3. | PJT-Q | DD | 1998 | 14.0 | 76,300 | 0.880 | 0.480 | 15.9 | 158,958 | 15.8 | 31.7 |
| | | | | | | **Average:** | | **17.6** | | **14.2** | **31.8** |
| **II-22.** | **Steel support, tunnel (per m)** | | | | | | | | | | |
| 1. | PJT-X | FS | 1988 | 1,280.0 | 1,149,894 | 0.818 | 0.126 | 1,564.8 | 9,126,143 | 909.4 | 2,474.2 |
| 2. | PJT-K | FS | 1989 | 630.0 | 1,697,500 | 0.808 | 0.137 | 779.7 | 12,390,511 | 1,234.7 | 2,014.4 |
| 3. | PJT-N | FS | 1990 | 151.0 | 2,596,515 | 0.870 | 0.150 | 173.6 | 17,310,100 | 1,724.9 | 1,898.5 |
| | | | | | | **Average:** | | **839.4** | | **1,289.7** | **2,129.1** |

Source: JICA Study Team

## Table 1.3.5 Update of Estimated Rates for Metal Works (Power Engineering Projects)

Price level: 2005
Exchange rate (Rp./US$): 10,035.3

| No. | Project | Stage | Year | Price data F/C | Price data L/C | Price index F/C | Price index L/C | Price updated (as of 2005) F/C | Price updated (as of 2005) L/C | Equival. | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | (US$) | (Rp.) | (2005= 1.0) | | (US$) | (Rp.) | (US$) | (US$) |
| **III.** | **Metal Works** | | | | | | | | | | |
| III-1. | Slide gate (per ton) | | | | | Average: | | (Nil) | | (Nil) | (Nil) |
| **III-2.** | **Fixed wheel gate/ Roller gate (per ton)** | | | | | | | | | | |
| 1. | PJT-Q | DD | 1998 | 5,950.0 | 25,500,000 | 0.880 | 0.480 | 6,761.4 | 53,125,000 | 5,293.8 | 12,055.2 |
| | | | | | | **Average:** | | **6,761.4** | | **5,293.8** | **12,055.2** |
| **III-3.** | **Tainter gate/ Radial gate (per ton)** | | | | | | | | | | |
| 1. | PJT-H | FS | 1990 | 6,327.0 | 13,392,150 | 0.870 | 0.150 | 7,272.4 | 89,281,000 | 8,896.7 | 16,169.1 |
| 2. | PJT-S | DD | 1993 | 10,309.0 | 2,370,150 | 0.921 | 0.172 | 11,193.3 | 13,779,942 | 1,373.1 | 12,566.4 |
| 3. | PJT-Q | DD | 1998 | 13,338.0 | 57,160,000 | 0.880 | 0.480 | 15,156.8 | 119,083,333 | 11,866.4 | 27,023.2 |
| | | | | | | **Average:** | | **11,207.5** | | **7,378.7** | **18,586.2** |
| **III-4.** | **Stoplog (per ton)** | | | | | | | | | | |
| 1. | PJT-H | FS | 1990 | 5,979.0 | 1,264,920 | 0.870 | 0.150 | 6,872.4 | 8,432,800 | 840.3 | 7,712.7 |
| 2. | PJT-B | FS | 1994 | 2,474.0 | 1,124,450 | 0.990 | 0.182 | 2,499.0 | 6,178,297 | 615.7 | 3,114.7 |
| 3. | PJT-Q | DD | 1998 | 4,857.0 | 14,570,000 | 0.880 | 0.480 | 5,519.3 | 30,354,167 | 3,024.7 | 8,544.0 |
| | | | | | | **Average:** | | **4,963.6** | | **1,493.6** | **6,457.2** |
| **III-5.** | **Trashrack (per ton)** | | | | | | | | | | |
| 1. | PJT-X | FS | 1988 | 4,250.0 | 1,229,796 | 0.818 | 0.126 | 5,195.6 | 9,760,286 | 972.6 | 6,168.2 |
| 2. | PJT-Q | DD | 1998 | 3,920.0 | 16,800,000 | 0.880 | 0.480 | 4,454.5 | 35,000,000 | 3,487.7 | 7,942.2 |
| | | | | | | **Average:** | | **4,825.1** | | **2,230.2** | **7,055.3** |
| III-6. | Trashracking system (per ton) | | | | | Average: | | (Nil) | | (Nil) | (Nil) |

Source: JICA Study Team

# Table 1.3.6 Update of Contracted Rates for Civil Works (Power Engineering Projects) (1/3)

Price level: 2005
Exchange rate (Rp./US$): 10,035.3

| No. | Project | Year | Price data F/C Currency | F/C Price | F/C Exch. rate (/US$) | F/C Equival. (US$) | L/C (Rp.) | Price index F/C (2005= 1.0) | Price index L/C (2005= 1.0) | Price updated (as of 2005) F/C (US$) | L/C (Rp.) | Equival. (US$) | Total (US$) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **I.** | **Preparatory Works** | | | | | | | | | | | | |
| **I-1.** | **Access road (per km)** | | | | | | | | | | | | |
| 1. | PJT-O | 1992 | Y | 1,402,360.0 | 124.8 | 11,236.9 | 43,574,740 | 0.889 | 0.166 | 12,639.9 | 262,498,434 | 26,157.5 | 38,797.4 |
| 2. | PJT-AG | 1994 | Y | 7,914,919.0 | 95.2 | 83,139.9 | 372,445,500 | 0.990 | 0.182 | 83,979.7 | 2,046,403,846 | 203,920.5 | 287,900.2 |
| 3. | PJT-C | 1995 | US$ | 125,291.0 | 1.0 | 125,291.0 | 188,383,986 | 0.994 | 0.202 | 126,047.3 | 932,593,990 | 92,931.4 | 218,978.7 |
| 4. | PJT-S | 1995 | US$ | 0.0 | 1.0 | 0.0 | 1,006,539,915 | 0.994 | 0.202 | 0.0 | 4,982,870,866 | 496,534.3 | 496,534.3 |
| 5. | PJT-F | 1992 | Y | 4,554,140.0 | 124.8 | 36,491.5 | 729,533,648 | 0.889 | 0.166 | 41,047.8 | 4,394,781,012 | 437,932.2 | 478,980.0 |
| | | | | | | | | **Average:** | | **52,742.9** | | **251,495.2** | **304,238.1** |
| **I-2.** | **Road improvement (per km)** | | | | | | | | | | | | |
| 1. | PJT-AG | 1994 | Y | 2,770,222.0 | 95.2 | 29,099.0 | 130,355,400 | 0.990 | 0.182 | 29,392.9 | 716,238,462 | 71,371.9 | 100,764.8 |
| 2. | PJT-C | 1995 | US$ | 41,585.0 | 1.0 | 41,585.0 | 62,257,629 | 0.994 | 0.202 | 41,836.0 | 308,206,084 | 30,712.2 | 72,548.2 |
| 3. | PJT-S | 1995 | Y | 1,593,949.0 | 83.1 | 19,181.1 | 352,289,735 | 0.994 | 0.202 | 19,296.9 | 1,744,008,589 | 173,787.4 | 193,084.3 |
| 4. | PJT-F | 1992 | Y | 1,593,949.0 | 124.8 | 12,772.0 | 255,336,362 | 0.889 | 0.166 | 14,366.7 | 1,538,170,855 | 153,276.0 | 167,642.7 |
| | | | | | | | | **Average:** | | **26,223.1** | | **107,286.9** | **133,510.0** |
| I-3. | Bridge (per m) | | | | | | | | | | | | |
| | | | | | | | | Average: | | (Nil) | | (Nil) | (Nil) |
| I-4. | Base camp, workshop & other facilities (LS) | | | | | | | | | | | | |
| | | | | | | | | Average: | | (Nil) | | (Nil) | (Nil) |
| **I-5.** | **Power supply and telecomunication system (LS)** | | | | | | | | | | | | |
| 1. | PJT-AA | 1991 | FF | 799,833.0 | 4.8 | 166,631.9 | 41,815,440 | 0.906 | 0.158 | 183,920.4 | 264,654,684 | 26,372.4 | 210,292.8 |
| 2. | PJT-AC | 1995 | FF | 342,898.0 | 5.1 | 67,234.9 | 112,221,928 | 0.994 | 0.202 | 67,640.7 | 555,554,099 | 55,360.0 | 123,000.7 |
| 3. | PJT-AG | 1994 | Y | 75,362,932.0 | 95.2 | 791,627.4 | 1,827,422,100 | 0.990 | 0.182 | 799,623.6 | 10,040,780,769 | 1,000,546.1 | 1,800,169.7 |
| 4. | PJT-C | 1995 | Y | 72,695,937.0 | 98.1 | 741,039.1 | 1,093,480,080 | 0.994 | 0.202 | 745,512.2 | 5,413,267,723 | 539,422.6 | 1,284,934.8 |
| 5. | PJT-S | 1995 | Y | 13,640,148.0 | 83.1 | 164,141.4 | 1,730,397,640 | 0.994 | 0.202 | 165,132.2 | 8,566,324,950 | 853,619.2 | 1,018,751.4 |
| 6. | PJT-E | 1995 | Y | 101,179,144.0 | 100.2 | 1,009,771.9 | 368,901,729 | 0.994 | 0.202 | 1,015,867.1 | 1,826,246,183 | 181,982.2 | 1,197,849.3 |
| | | | | | | | | **Average:** | | **496,282.7** | | **442,883.8** | **939,166.5** |
| **II.** | **Civil Works** | | | | | | | | | | | | |
| **II-1.** | **Excavation, common (per m3)** | | | | | | | | | | | | |
| 1. | PJT-AC | 1995 | FF | 7.0 | 5.1 | 1.4 | 2,285 | 0.994 | 0.202 | 1.4 | 11,310 | 1.1 | 2.5 |
| 2. | PJT-AG | 1994 | Y | 368.0 | 95.2 | 3.9 | 966 | 0.990 | 0.182 | 3.9 | 5,308 | 0.5 | 4.4 |
| 3. | PJT-S | 1995 | US$ | 0.0 | 1.0 | 0.0 | 983 | 0.994 | 0.202 | 0.0 | 4,868 | 0.5 | 0.5 |
| 4. | PJT-E | 1995 | Y | 22.0 | 100.2 | 0.2 | 2,251 | 0.994 | 0.202 | 0.2 | 11,145 | 1.1 | 1.3 |
| 5. | PJT-AA | 1991 | FF | 7.9 | 4.8 | 1.6 | 661 | 0.906 | 0.158 | 1.8 | 4,183 | 0.4 | 2.2 |
| 6. | PJT-O | 1992 | Y | 131.0 | 124.8 | 1.0 | 4,086 | 0.889 | 0.166 | 1.1 | 24,613 | 2.5 | 3.6 |
| 7. | PJT-C | 1995 | US$ | 1.2 | 1.0 | 1.2 | 1,730 | 0.994 | 0.202 | 1.2 | 8,565 | 0.9 | 2.1 |
| 8. | PJT-Y | 1994 | US$ | 0.9 | 1.0 | 0.9 | 757 | 0.990 | 0.182 | 0.9 | 4,160 | 0.4 | 1.3 |
| 9. | PJT-F | 1992 | Y | 122.0 | 124.8 | 1.0 | 1,431 | 0.889 | 0.166 | 1.1 | 8,621 | 0.9 | 2.0 |
| | | | | | | | | **Average:** | | **1.3** | | **0.9** | **2.2** |
| **II-2.** | **Excavation, soft rock (per m3)** | | | | | | | | | | | | |
| 1. | PJT-AG | 1994 | Y | 554.0 | 95.2 | 5.8 | 1,470 | 0.990 | 0.182 | 5.9 | 8,077 | 0.8 | 6.7 |
| 2. | PJT-S | 1995 | Y | 124.0 | 83.1 | 1.5 | 5,288 | 0.994 | 0.202 | 1.5 | 26,177 | 2.6 | 4.1 |
| 3. | PJT-E | 1995 | Y | 47.0 | 100.2 | 0.5 | 4,636 | 0.994 | 0.202 | 0.5 | 22,952 | 2.3 | 2.8 |
| 4. | PJT-F | 1992 | Y | 218.0 | 124.8 | 1.7 | 1,950 | 0.889 | 0.166 | 1.9 | 11,744 | 1.2 | 3.1 |
| | | | | | | | | **Average:** | | **2.5** | | **1.7** | **4.2** |
| **II-3.** | **Excavation, hard rock (per m3)** | | | | | | | | | | | | |
| 1. | PJT-AC | 1995 | FF | 24.4 | 5.1 | 4.8 | 8,007 | 0.994 | 0.202 | 4.8 | 39,639 | 3.9 | 8.7 |
| 2. | PJT-AG | 1994 | Y | 915.0 | 95.2 | 9.6 | 4,389 | 0.990 | 0.182 | 9.7 | 24,115 | 2.4 | 12.1 |
| 3. | PJT-E | 1995 | Y | 123.0 | 100.2 | 1.2 | 7,378 | 0.994 | 0.202 | 1.2 | 36,525 | 3.6 | 4.8 |
| 4. | PJT-AA | 1991 | FF | 53.2 | 4.8 | 11.1 | 4,763 | 0.906 | 0.158 | 12.3 | 30,144 | 3.0 | 15.3 |
| 5. | PJT-O | 1992 | Y | 518.0 | 124.8 | 4.2 | 9,603 | 0.889 | 0.166 | 4.7 | 57,847 | 5.8 | 10.5 |
| 6. | PJT-C | 1995 | US$ | 2.7 | 1.0 | 2.7 | 4,157 | 0.994 | 0.202 | 2.7 | 20,579 | 2.1 | 4.8 |
| 7. | PJT-Y | 1994 | US$ | 3.6 | 1.0 | 3.6 | 9,755 | 0.990 | 0.182 | 3.6 | 53,600 | 5.3 | 8.9 |
| 8. | PJT-F | 1992 | Y | 876.0 | 124.8 | 7.0 | 15,016 | 0.889 | 0.166 | 7.9 | 90,456 | 9.0 | 16.9 |
| | | | | | | | | **Average:** | | **5.9** | | **4.4** | **10.3** |
| **II-4.** | **Excavation, tunnel (per m3)** | | | | | | | | | | | | |
| 1. | PJT-AG | 1994 | Y | 9,494.0 | 95.2 | 99.7 | 22,659 | 0.990 | 0.182 | 100.7 | 124,500 | 12.4 | 113.1 |
| 2. | PJT-S | 1995 | Y | 1,703.0 | 83.1 | 20.5 | 43,197 | 0.994 | 0.202 | 20.6 | 213,849 | 21.3 | 41.9 |
| 3. | PJT-AC | 1995 | FF | 143.3 | 5.1 | 28.1 | 46,911 | 0.994 | 0.202 | 28.3 | 232,231 | 23.1 | 51.4 |
| 4. | PJT-AA | 1991 | FF | 181.2 | 4.8 | 37.7 | 29,432 | 0.906 | 0.158 | 41.6 | 186,279 | 18.6 | 60.2 |
| 5. | PJT-O | 1992 | Y | 2,362.0 | 124.8 | 18.9 | 23,001 | 0.889 | 0.166 | 21.3 | 138,558 | 13.8 | 35.1 |
| 6. | PJT-I | 1993 | Y | 2,648.0 | 111.7 | 23.7 | 45,304 | 0.921 | 0.172 | 25.7 | 263,395 | 26.2 | 51.9 |
| 7. | PJT-C | 1995 | US$ | 41.5 | 1.0 | 41.5 | 49,749 | 0.994 | 0.202 | 41.8 | 246,280 | 24.5 | 66.3 |
| 8. | PJT-E | 1995 | Y | 2,600.0 | 100.2 | 25.9 | 15,291 | 0.994 | 0.202 | 26.1 | 75,698 | 7.5 | 33.6 |
| 9. | PJT-Y | 1994 | US$ | 58.5 | 1.0 | 58.5 | 20,873 | 0.990 | 0.182 | 59.1 | 114,687 | 11.4 | 70.5 |
| | | | | | | | | **Average:** | | **40.6** | | **17.6** | **58.2** |
| **II-5.** | **Excavation, shaft (per m3)** | | | | | | | | | | | | |
| 1. | PJT-S | 1995 | Y | 568.0 | 83.1 | 6.8 | 61,508 | 0.994 | 0.202 | 6.8 | 304,494 | 30.3 | 37.1 |
| 2. | PJT-E | 1995 | Y | 2,298.0 | 100.2 | 22.9 | 11,747 | 0.994 | 0.202 | 23.0 | 58,153 | 5.8 | 28.8 |
| 3. | PJT-AA | 1991 | FF | 293.8 | 4.8 | 61.2 | 42,360 | 0.906 | 0.158 | 67.5 | 268,100 | 26.7 | 94.2 |
| 4. | PJT-AC | 1995 | FF | 77.4 | 5.1 | 15.2 | 25,330 | 0.994 | 0.202 | 15.3 | 125,394 | 12.5 | 27.8 |
| 5. | PJT-I | 1993 | Y | 3,668.0 | 111.7 | 32.8 | 9,298 | 0.921 | 0.172 | 35.6 | 54,058 | 5.4 | 41.0 |
| | | | | | | | | **Average:** | | **29.6** | | **16.1** | **45.7** |

# Table 1.3.6 Update of Contracted Rates for Civil Works (Power Engineering Projects) (2/3)

Price level: 2005
Exchange rate (Rp./US$): 10,035.3

| No. | Project | Year | Price data F/C Currency | Price data F/C Price | Price data F/C Exch. rate (/US$) | Price data F/C Equival. (US$) | Price data L/C (Rp.) | Price index F/C (2005= 1.0) | Price index L/C (2005= 1.0) | Price updated (as of 2005) F/C (US$) | Price updated (as of 2005) L/C (Rp.) | Price updated (as of 2005) Equival. (US$) | Price updated (as of 2005) Total (US$) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **II-6.** | **Excavation, inclined tunnel (per m3)** | | | | | | | | | | | | |
| 1. | PJT-S | 1995 | Y | 2,419.0 | 83.1 | 29.1 | 56,220 | 0.994 | 0.202 | 29.3 | 278,317 | 27.7 | 57.0 |
| 2. | PJT-E | 1995 | Y | 8,447.0 | 100.2 | 84.3 | 35,129 | 0.994 | 0.202 | 84.8 | 173,906 | 17.3 | 102.1 |
| 3. | PJT-AA | 1991 | FF | 295.8 | 4.8 | 61.6 | 50,447 | 0.906 | 0.158 | 68.0 | 319,284 | 31.8 | 99.8 |
| 4. | PJT-AC | 1995 | FF | 77.4 | 5.1 | 15.2 | 25,330 | 0.994 | 0.202 | 15.3 | 125,394 | 12.5 | 27.8 |
| 5. | PJT-I | 1993 | Y | 5,018.0 | 111.7 | 44.9 | 51,637 | 0.921 | 0.172 | 48.8 | 300,214 | 29.9 | 78.7 |
| 6. | PJT-C | 1995 | Y | 1,513.0 | 98.1 | 15.4 | 54,377 | 0.994 | 0.202 | 15.5 | 269,195 | 26.8 | 42.3 |
| | | | | | | | | **Average:** | | **43.6** | | **24.3** | **67.9** |
| **II-7.** | **Backfill (per m3)** | | | | | | | | | | | | |
| 1. | PJT-S | 1995 | Y | 21.0 | 83.1 | 0.3 | 983 | 0.994 | 0.202 | 0.3 | 4,868 | 0.5 | 0.8 |
| 2. | PJT-AC | 1995 | FF | 4.2 | 5.1 | 0.8 | 1,375 | 0.994 | 0.202 | 0.8 | 6,808 | 0.7 | 1.5 |
| 3. | PJT-O | 1992 | Y | 238.0 | 124.8 | 1.9 | 4,314 | 0.889 | 0.166 | 2.1 | 25,987 | 2.6 | 4.7 |
| 4. | PJT-I | 1993 | US$ | 0.0 | 1.0 | 0.0 | 36,451 | 0.921 | 0.172 | 0.0 | 211,923 | 21.1 | 21.1 |
| 5. | PJT-C | 1995 | US$ | 1.6 | 1.0 | 1.6 | 2,427 | 0.994 | 0.202 | 1.6 | 12,014 | 1.2 | 2.8 |
| 6. | PJT-E | 1995 | Y | 23.0 | 100.2 | 0.2 | 2,452 | 0.994 | 0.202 | 0.2 | 12,138 | 1.2 | 1.4 |
| 7. | PJT-Y | 1994 | US$ | 0.0 | 1.0 | 0.0 | 3,785 | 0.990 | 0.182 | 0.0 | 20,798 | 2.1 | 2.1 |
| 8. | PJT-F | 1992 | Y | 235.0 | 124.8 | 1.9 | 2,696 | 0.889 | 0.166 | 2.1 | 16,242 | 1.6 | 3.7 |
| | | | | | | | | **Average:** | | **0.9** | | **3.9** | **4.8** |
| **II-8.** | **Filling, core (per m3)** | | | | | | | | | | | | |
| 1. | PJT-AG | 1994 | Y | 709.0 | 95.2 | 7.4 | 3,003 | 0.990 | 0.182 | 7.5 | 16,500 | 1.6 | 9.1 |
| 2. | PJT-C | 1995 | US$ | 2.8 | 1.0 | 2.8 | 4,202 | 0.994 | 0.202 | 2.8 | 20,801 | 2.1 | 4.9 |
| 3. | PJT-S | 1995 | Y | 28.0 | 83.1 | 0.3 | 1,355 | 0.994 | 0.202 | 0.3 | 6,706 | 0.7 | 1.0 |
| 4. | PJT-F | 1992 | Y | 373.0 | 124.8 | 3.0 | 6,948 | 0.889 | 0.166 | 3.4 | 41,855 | 4.2 | 7.6 |
| | | | | | | | | **Average:** | | **3.5** | | **2.2** | **5.7** |
| **II-9.** | **Filling, filter (per m3)** | | | | | | | | | | | | |
| 1. | PJT-AG | 1994 | Y | 1,301.0 | 95.2 | 13.7 | 3,717 | 0.990 | 0.182 | 13.8 | 20,423 | 2.0 | 15.8 |
| 2. | PJT-C | 1995 | US$ | 4.2 | 1.0 | 4.2 | 6,269 | 0.994 | 0.202 | 4.2 | 31,035 | 3.1 | 7.3 |
| 3. | PJT-S | 1995 | Y | 13.0 | 83.1 | 0.2 | 7,123 | 0.994 | 0.202 | 0.2 | 35,263 | 3.5 | 3.7 |
| 4. | PJT-F | 1992 | Y | 276.0 | 124.8 | 2.2 | 5,081 | 0.889 | 0.166 | 2.5 | 30,610 | 3.1 | 5.6 |
| | | | | | | | | **Average:** | | **5.2** | | **2.9** | **8.1** |
| **II-10.** | **Filling, rockfill (per m3)** | | | | | | | | | | | | |
| 1. | PJT-AG | 1994 | Y | 568.0 | 95.2 | 6.0 | 3,717 | 0.990 | 0.182 | 6.1 | 20,423 | 2.0 | 8.1 |
| 2. | PJT-O | 1992 | Y | 18.0 | 124.8 | 0.1 | 560 | 0.889 | 0.166 | 0.1 | 3,373 | 0.3 | 0.4 |
| 3. | PJT-C | 1995 | US$ | 3.9 | 1.0 | 3.9 | 5,887 | 0.994 | 0.202 | 3.9 | 29,144 | 2.9 | 6.8 |
| 4. | PJT-S | 1995 | Y | 21.0 | 83.1 | 0.3 | 983 | 0.994 | 0.202 | 0.3 | 4,868 | 0.5 | 0.8 |
| 5. | PJT-F | 1992 | Y | 291.0 | 124.8 | 2.3 | 2,613 | 0.889 | 0.166 | 2.6 | 15,742 | 1.6 | 4.2 |
| | | | | | | | | **Average:** | | **2.6** | | **1.5** | **4.1** |
| **II-11.** | **Rip rap (per m3)** | | | | | | | | | | | | |
| 1. | PJT-AG | 1994 | Y | 1,301.0 | 95.2 | 13.7 | 3,717 | 0.990 | 0.182 | 13.8 | 20,423 | 2.0 | 15.8 |
| 2. | PJT-AA | 1991 | US$ | 0.0 | 1.0 | 0.0 | 59,350 | 0.906 | 0.158 | 0.0 | 375,635 | 37.4 | 37.4 |
| 3. | PJT-C | 1995 | US$ | 5.4 | 1.0 | 5.4 | 8,067 | 0.994 | 0.202 | 5.4 | 39,934 | 4.0 | 9.4 |
| 4. | PJT-F | 1992 | Y | 364.0 | 124.8 | 2.9 | 3,256 | 0.889 | 0.166 | 3.3 | 19,616 | 2.0 | 5.3 |
| | | | | | | | | **Average:** | | **5.6** | | **11.4** | **17.0** |
| **II-12.** | **Concrete, mass (per m3)** | | | | | | | | | | | | |
| 1. | PJT-AG | 1994 | Y | 3,929.0 | 95.2 | 41.3 | 172,641 | 0.990 | 0.182 | 41.7 | 948,577 | 94.5 | 136.2 |
| 2. | PJT-S | 1995 | Y | 856.0 | 83.1 | 10.3 | 169,840 | 0.994 | 0.202 | 10.4 | 840,792 | 83.8 | 94.2 |
| 3. | PJT-AA | 1991 | FF | 382.5 | 4.8 | 79.7 | 87,519 | 0.906 | 0.158 | 88.0 | 553,917 | 55.2 | 143.2 |
| 4. | PJT-O | 1992 | Y | 3,907.0 | 124.8 | 31.3 | 76,323 | 0.889 | 0.166 | 35.2 | 459,778 | 45.8 | 81.0 |
| 5. | PJT-AC | 1995 | FF | 184.4 | 5.1 | 36.2 | 60,352 | 0.994 | 0.202 | 36.4 | 298,771 | 29.8 | 66.2 |
| 6. | PJT-I | 1993 | Y | 975.0 | 111.7 | 8.7 | 172,702 | 0.921 | 0.172 | 9.4 | 1,004,080 | 100.1 | 109.5 |
| 7. | PJT-C | 1995 | US$ | 22.6 | 1.0 | 22.6 | 112,979 | 0.994 | 0.202 | 22.7 | 559,303 | 55.7 | 78.4 |
| 8. | PJT-E | 1995 | Y | 2,293.0 | 100.2 | 22.9 | 79,776 | 0.994 | 0.202 | 23.0 | 394,930 | 39.4 | 62.4 |
| 9. | PJT-Y | 1994 | US$ | 0.0 | 1.0 | 0.0 | 131,792 | 0.990 | 0.182 | 0.0 | 724,130 | 72.2 | 72.2 |
| 10. | PJT-F | 1992 | Y | 2,965.0 | 124.8 | 23.8 | 101,253 | 0.889 | 0.166 | 26.8 | 609,956 | 60.8 | 87.6 |
| | | | | | | | | **Average:** | | **29.4** | | **63.7** | **93.1** |
| **II-13.** | **Concrete, super-structure (per m3)** | | | | | | | | | | | | |
| 1. | PJT-AG | 1994 | Y | 4,001.0 | 95.2 | 42.0 | 182,028 | 0.990 | 0.182 | 42.4 | 1,000,154 | 99.7 | 142.1 |
| 2. | PJT-E | 1995 | Y | 4,663.0 | 100.2 | 46.5 | 134,230 | 0.994 | 0.202 | 46.8 | 664,507 | 66.2 | 113.0 |
| 3. | PJT-AC | 1995 | FF | 201.3 | 5.1 | 39.5 | 65,875 | 0.994 | 0.202 | 39.7 | 326,112 | 32.5 | 72.2 |
| 4. | PJT-AA | 1991 | FF | 412.0 | 4.8 | 85.8 | 91,757 | 0.906 | 0.158 | 94.7 | 580,739 | 57.9 | 152.6 |
| 5. | PJT-O | 1992 | Y | 5,996.0 | 124.8 | 48.0 | 136,677 | 0.889 | 0.166 | 54.0 | 823,353 | 82.0 | 136.0 |
| 6. | PJT-I | 1993 | Y | 1,433.0 | 111.7 | 12.8 | 179,543 | 0.921 | 0.172 | 13.9 | 1,043,854 | 104.0 | 117.9 |
| 7. | PJT-C | 1995 | US$ | 41.1 | 1.0 | 41.1 | 61,523 | 0.994 | 0.202 | 41.3 | 304,569 | 30.3 | 71.6 |
| 8. | PJT-S | 1995 | Y | 856.0 | 83.1 | 10.3 | 169,840 | 0.994 | 0.202 | 10.4 | 840,792 | 83.8 | 94.2 |
| 9. | PJT-Y | 1994 | US$ | 29.1 | 1.0 | 29.1 | 65,798 | 0.990 | 0.182 | 29.4 | 361,530 | 36.0 | 65.4 |
| 10. | PJT-F | 1992 | Y | 3,027.0 | 124.8 | 24.3 | 109,839 | 0.889 | 0.166 | 27.3 | 661,681 | 65.9 | 93.2 |
| | | | | | | | | **Average:** | | **40.0** | | **65.8** | **105.8** |
| **II-14.** | **Concrete, sub-structure (per m3)** | | | | | | | | | | | | |
| 1. | PJT-S | 1995 | Y | 1,592.0 | 83.1 | 19.2 | 100,444 | 0.994 | 0.202 | 19.3 | 497,250 | 49.6 | 68.9 |
| 2. | PJT-E | 1995 | Y | 2,458.0 | 100.2 | 24.5 | 89,762 | 0.994 | 0.202 | 24.6 | 444,365 | 44.3 | 68.9 |
| 3. | PJT-AA | 1991 | FF | 232.1 | 4.8 | 48.4 | 63,141 | 0.906 | 0.158 | 53.4 | 399,627 | 39.8 | 93.2 |
| 4. | PJT-O | 1992 | Y | 5,566.0 | 124.8 | 44.6 | 121,308 | 0.889 | 0.166 | 50.2 | 730,773 | 72.8 | 123.0 |
| 5. | PJT-AC | 1995 | FF | 443.3 | 5.1 | 86.9 | 145,102 | 0.994 | 0.202 | 87.4 | 718,325 | 71.6 | 159.0 |
| 6. | PJT-I | 1993 | Y | 461.0 | 111.7 | 4.1 | 165,564 | 0.921 | 0.172 | 4.5 | 962,582 | 95.9 | 100.4 |
| 7. | PJT-C | 1995 | US$ | 87.9 | 1.0 | 87.9 | 131,607 | 0.994 | 0.202 | 88.4 | 651,519 | 64.9 | 153.3 |
| | | | | | | | | **Average:** | | **46.8** | | **62.7** | **109.5** |

# Table 1.3.6 Update of Contracted Rates for Civil Works (Power Engineering Projects) (3/3)

Price level: 2005
Exchange rate (Rp./US$): 10,035.3

| No. | Project | Year | Price data | | | | | Price index | | Price updated (as of 2005) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | F/C | | | | L/C | F/C | L/C | F/C | L/C | Equival. | Total |
| | | | Currency | Price | Exch. rate | Equival. | | | | | | | |
| | | | | | (/US$) | (US$) | (Rp.) | (2005= 1.0) | | (US$) | (Rp.) | (US$) | (US$) |
| **II-15.** | **Lining, tunnel (per m3)** | | | | | | | | | | | | |
| 1. | PJT-AG | 1994 | Y | 5,005.0 | 95.2 | 52.6 | 249,018 | 0.990 | 0.182 | 53.1 | 1,368,231 | 136.3 | 189.4 |
| 2. | PJT-S | 1995 | Y | 1,115.0 | 83.1 | 13.4 | 114,625 | 0.994 | 0.202 | 13.5 | 567,451 | 56.5 | 70.0 |
| 3. | PJT-E | 1995 | Y | 4,944.0 | 100.2 | 49.3 | 101,620 | 0.994 | 0.202 | 49.6 | 503,070 | 50.1 | 99.7 |
| 4. | PJT-AC | 1995 | FF | 262.0 | 5.1 | 51.4 | 85,748 | 0.994 | 0.202 | 51.7 | 424,494 | 42.3 | 94.0 |
| 5. | PJT-AA | 1991 | FF | 388.1 | 4.8 | 80.9 | 68,312 | 0.906 | 0.158 | 89.3 | 432,355 | 43.1 | 132.4 |
| 6. | PJT-O | 1992 | Y | 6,669.0 | 124.8 | 53.4 | 89,244 | 0.889 | 0.166 | 60.1 | 537,616 | 53.6 | 113.7 |
| 7. | PJT-I | 1993 | Y | 2,189.0 | 111.7 | 19.6 | 150,314 | 0.921 | 0.172 | 21.3 | 873,921 | 87.1 | 108.4 |
| 8. | PJT-C | 1995 | Y | 4,055.0 | 98.1 | 41.3 | 238,901 | 0.994 | 0.202 | 41.5 | 1,182,678 | 117.9 | 159.4 |
| 9. | PJT-Y | 1994 | US$ | 41.7 | 1.0 | 41.7 | 102,526 | 0.990 | 0.182 | 42.1 | 563,331 | 56.1 | 98.2 |
| | | | | | | | | **Average:** | | **46.9** | | **71.4** | **118.3** |
| **II-16.** | **Lining, shaft (per m3)** | | | | | | | | | | | | |
| 1. | PJT-S | 1995 | Y | 808.0 | 83.1 | 9.7 | 156,402 | 0.994 | 0.202 | 9.8 | 774,269 | 77.2 | 87.0 |
| 2. | PJT-E | 1995 | Y | 12,186.0 | 100.2 | 121.6 | 332,032 | 0.994 | 0.202 | 122.3 | 1,643,722 | 163.8 | 286.1 |
| 3. | PJT-AA | 1991 | FF | 257.3 | 4.8 | 53.6 | 51,963 | 0.906 | 0.158 | 59.2 | 328,881 | 32.8 | 92.0 |
| 4. | PJT-AC | 1995 | FF | 369.8 | 5.1 | 72.5 | 121,014 | 0.994 | 0.202 | 72.9 | 599,080 | 59.7 | 132.6 |
| 5. | PJT-I | 1993 | Y | 3,844.0 | 111.7 | 34.4 | 122,378 | 0.921 | 0.172 | 37.4 | 711,500 | 70.9 | 108.3 |
| 6. | PJT-Y | 1994 | US$ | 41.7 | 1.0 | 41.7 | 102,526 | 0.990 | 0.182 | 42.1 | 563,331 | 56.1 | 98.2 |
| | | | | | | | | **Average:** | | **57.3** | | **76.8** | **134.1** |
| **II-17.** | **Pile concrete (per m3)** | | | | | | | | | | | | |
| 1. | PJT-S | 1995 | Y | 8,173.0 | 83.1 | 98.4 | 140,277 | 0.994 | 0.202 | 99.0 | 694,441 | 69.2 | 168.2 |
| | | | | | | | | **Average:** | | **99.0** | | **69.2** | **168.2** |
| **II-18.** | **Reinforcing bar (per ton)** | | | | | | | | | | | | |
| 1. | PJT-S | 1995 | US$ | 0.0 | 1.0 | 0.0 | 1,254,015 | 0.994 | 0.202 | 0.0 | 6,207,996 | 618.6 | 618.6 |
| 2. | PJT-E | 1995 | Y | 39,428.0 | 100.2 | 393.5 | 225,575 | 0.994 | 0.202 | 395.9 | 1,116,707 | 111.3 | 507.2 |
| 3. | PJT-AA | 1991 | FF | 1,861.5 | 4.8 | 387.8 | 992,762 | 0.906 | 0.158 | 428.0 | 6,283,303 | 626.1 | 1,054.1 |
| 4. | PJT-O | 1992 | Y | 37,581.0 | 124.8 | 301.1 | 833,727 | 0.889 | 0.166 | 338.7 | 5,022,453 | 500.5 | 839.2 |
| 5. | PJT-AC | 1995 | FF | 2,083.9 | 5.1 | 408.6 | 681,991 | 0.994 | 0.202 | 411.1 | 3,376,191 | 336.4 | 747.5 |
| 6. | PJT-I | 1993 | Y | 2,212.0 | 111.7 | 19.8 | 1,073,995 | 0.921 | 0.172 | 21.5 | 6,244,160 | 622.2 | 643.7 |
| 7. | PJT-AG | 1994 | Y | 8,043.0 | 95.2 | 84.5 | 1,106,973 | 0.990 | 0.182 | 85.4 | 6,082,269 | 606.1 | 691.5 |
| 8. | PJT-C | 1995 | US$ | 105.7 | 1.0 | 105.7 | 949,762 | 0.994 | 0.202 | 106.3 | 4,701,792 | 468.5 | 574.8 |
| 9. | PJT-Y | 1994 | US$ | 98.5 | 1.0 | 98.5 | 977,719 | 0.990 | 0.182 | 99.5 | 5,372,084 | 535.3 | 634.8 |
| | | | | | | | | **Average:** | | **209.6** | | **491.7** | **701.3** |
| **II-19.** | **Curtain grouting (per m)** | | | | | | | | | | | | |
| 1. | PJT-AG | 1994 | Y | 5,398.0 | 95.2 | 56.7 | 19,131 | 0.990 | 0.182 | 57.3 | 105,115 | 10.5 | 67.8 |
| 2. | PJT-E | 1995 | Y | 202.0 | 100.2 | 2.0 | 32,521 | 0.994 | 0.202 | 2.0 | 160,996 | 16.0 | 18.0 |
| 3. | PJT-AA | 1991 | FF | 317.6 | 4.8 | 66.2 | 172,355 | 0.906 | 0.158 | 73.1 | 1,090,855 | 108.7 | 181.8 |
| 4. | PJT-O | 1992 | Y | 4,238.0 | 124.8 | 34.0 | 132,155 | 0.889 | 0.166 | 38.2 | 796,116 | 79.3 | 117.5 |
| 5. | PJT-AC | 1995 | FF | 138.4 | 5.1 | 27.1 | 36,264 | 0.994 | 0.202 | 27.3 | 179,526 | 17.9 | 45.2 |
| 6. | PJT-C | 1995 | US$ | 17.9 | 1.0 | 17.9 | 26,492 | 0.994 | 0.202 | 18.0 | 131,149 | 13.1 | 31.1 |
| | | | | | | | | **Average:** | | **36.0** | | **40.9** | **76.9** |
| **II-20.** | **Consolidation grouting (per m)** | | | | | | | | | | | | |
| 1. | PJT-S | 1995 | Y | 11,692.0 | 83.1 | 140.7 | 293,183 | 0.994 | 0.202 | 141.5 | 1,451,402 | 144.6 | 286.1 |
| 2. | PJT-AC | 1995 | FF | 51.0 | 5.1 | 10.0 | 16,702 | 0.994 | 0.202 | 10.1 | 82,681 | 8.2 | 18.3 |
| 3. | PJT-AA | 1991 | FF | 35.2 | 4.8 | 7.3 | 76,691 | 0.906 | 0.158 | 8.1 | 485,385 | 48.4 | 56.5 |
| 4. | PJT-O | 1992 | Y | 4,454.0 | 124.8 | 35.7 | 74,913 | 0.889 | 0.166 | 40.2 | 451,282 | 45.0 | 85.2 |
| 5. | PJT-I | 1993 | Y | 5,330.0 | 111.7 | 47.7 | 263,373 | 0.921 | 0.172 | 51.8 | 1,531,240 | 152.6 | 204.4 |
| 6. | PJT-AG | 1994 | Y | 4,862.0 | 95.2 | 51.1 | 16,527 | 0.990 | 0.182 | 51.6 | 90,808 | 9.0 | 60.6 |
| 7. | PJT-C | 1995 | US$ | 17.9 | 1.0 | 17.9 | 26,852 | 0.994 | 0.202 | 18.0 | 132,929 | 13.2 | 31.2 |
| 8. | PJT-E | 1995 | Y | 3,299.0 | 100.2 | 32.9 | 42,908 | 0.994 | 0.202 | 33.1 | 212,417 | 21.2 | 54.3 |
| | | | | | | | | **Average:** | | **44.3** | | **55.3** | **99.6** |
| **II-21.** | **Rock bolt (per m)** | | | | | | | | | | | | |
| 1. | PJT-AA | 1991 | FF | 78.3 | 4.8 | 16.3 | 11,042 | 0.906 | 0.158 | 18.0 | 69,886 | 7.0 | 25.0 |
| 2. | PJT-O | 1992 | Y | 2,201.0 | 124.8 | 17.6 | 61,743 | 0.889 | 0.166 | 19.8 | 371,946 | 37.1 | 56.9 |
| 3. | PJT-AC | 1995 | FF | 44.0 | 5.1 | 8.6 | 14,328 | 0.994 | 0.202 | 8.7 | 70,932 | 7.1 | 15.8 |
| 4. | PJT-I | 1993 | Y | 101.0 | 111.7 | 0.9 | 4,003 | 0.921 | 0.172 | 1.0 | 23,273 | 2.3 | 3.3 |
| 5. | PJT-AG | 1994 | Y | 35.0 | 95.2 | 0.4 | 5,229 | 0.990 | 0.182 | 0.4 | 28,731 | 2.9 | 3.3 |
| 6. | PJT-C | 1995 | Y | 2,056.0 | 98.1 | 21.0 | 5,146 | 0.994 | 0.202 | 21.1 | 25,473 | 2.5 | 23.6 |
| 7. | PJT-S | 1995 | Y | 597.0 | 83.1 | 7.2 | 6,052 | 0.994 | 0.202 | 7.2 | 29,963 | 3.0 | 10.2 |
| 8. | PJT-E | 1995 | Y | 428.0 | 100.2 | 4.3 | 6,420 | 0.994 | 0.202 | 4.3 | 31,780 | 3.2 | 7.5 |
| 9. | PJT-Y | 1994 | US$ | 0.0 | 1.0 | 0.0 | 35,927 | 0.990 | 0.182 | 0.0 | 197,403 | 19.7 | 19.7 |
| | | | | | | | | **Average:** | | **8.9** | | **9.4** | **18.3** |
| **II-22.** | **Steel support, tunnel (per m)** | | | | | | | | | | | | |
| 1. | PJT-AA | 1991 | FF | 7,958.8 | 4.8 | 1,658.1 | 614,304 | 0.906 | 0.158 | 1,830.1 | 3,888,000 | 387.4 | 2,217.5 |
| 2. | PJT-O | 1992 | Y | 74,844.0 | 124.8 | 599.7 | 2,333,250 | 0.889 | 0.166 | 674.6 | 14,055,723 | 1,400.6 | 2,075.2 |
| 3. | PJT-I | 1993 | Y | 87,006.0 | 111.7 | 778.9 | 1,783,356 | 0.921 | 0.172 | 845.7 | 10,368,349 | 1,033.2 | 1,878.9 |
| 4. | PJT-C | 1995 | Y | 103,230.0 | 98.1 | 1,052.3 | 1,748,166 | 0.994 | 0.202 | 1,058.7 | 8,654,287 | 862.4 | 1,921.1 |
| 5. | PJT-S | 1995 | Y | 16,433.0 | 83.1 | 197.7 | 2,073,565 | 0.994 | 0.202 | 198.9 | 10,265,173 | 1,022.9 | 1,221.8 |
| 6. | PJT-E | 1995 | Y | 66,737.0 | 100.2 | 666.0 | 1,259,385 | 0.994 | 0.202 | 670.0 | 6,234,579 | 621.3 | 1,291.3 |
| 7. | PJT-Y | 1994 | US$ | 283.2 | 1.0 | 283.2 | 1,600,620 | 0.990 | 0.182 | 286.1 | 8,794,615 | 876.4 | 1,162.5 |
| | | | | | | | | **Average:** | | **794.9** | | **886.3** | **1,681.2** |

Source: JICA Study Team

## Table 1.3.7 Update of Contracted Rates for Metal Works (Power Engineering Projects)

Price level: 2005
Exchange rate (Rp./US$): 10,035.3

| No. | Project | Year | Price data | | | | | Price index | | Price updated (as of 2005) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | F/C | | | | L/C | F/C | L/C | F/C | L/C | Equival. | Total |
| | | | Currency | Price | Exch. rate | Equival. | | | | | | | |
| | | | | | (/US$) | (US$) | (Rp.) | (2005= 1.0) | | (US$) | (Rp.) | (US$) | (US$) |
| **III.** | **Metal Works** | | | | | | | | | | | | |
| **III-1.** | **Slide gate (per ton)** | | | | | | | | | | | | |
| 1. | PJT-E | 1995 | ATS | 27,776.0 | 10.1 | 2,761.0 | 1,626,027 | 0.994 | 0.202 | 2,777.7 | 8,049,639 | 802.1 | 3,579.8 |
| 2. | PJT-U | 1998 | YEN | 690,938.0 | 141.1 | 4,898.5 | 6,363,500 | 0.880 | 0.480 | 5,566.5 | 13,257,292 | 1,321.1 | 6,887.6 |
| 3. | PJT-O | 1993 | YEN | 622,222.0 | 100.0 | 6,222.2 | 4,926,000 | 0.921 | 0.172 | 6,755.9 | 28,639,535 | 2,853.9 | 9,609.8 |
| 4. | PJT-S | 1997 | ATS | 89,279.0 | 11.3 | 7,879.9 | 3,618,304 | 0.858 | 0.238 | 9,184.0 | 15,202,958 | 1,514.9 | 10,698.9 |
| 5. | PJT-AB | 1998 | US$ | 22,048.0 | 1.0 | 22,048.0 | 6,756,792 | 0.880 | 0.480 | 25,054.5 | 14,076,650 | 1,402.7 | 26,457.2 |
| 6. | PJT-Y | 1994 | YEN | 0.0 | 97.2 | 0.0 | 16,957,785 | 0.990 | 0.182 | 0.0 | 93,174,643 | 9,284.7 | 9,284.7 |
| 7. | PJT-AC | 1995 | DM | 5,111.0 | 1.6 | 3,297.4 | 20,965,971 | 0.994 | 0.202 | 3,317.3 | 103,791,936 | 10,342.7 | 13,660.0 |
| | | | | | | | | **Average:** | | **7,522.3** | | **3,931.7** | **11,454.0** |
| **III-2.** | **Fixed wheel gate/ Roller gate (per ton)** | | | | | | | | | | | | |
| 1. | PJT-U | 1998 | YEN | 837,399.0 | 141.1 | 5,936.9 | 6,978,400 | 0.880 | 0.480 | 6,746.5 | 14,538,333 | 1,448.7 | 8,195.2 |
| 2. | PJT-O | 1993 | YEN | 480,707.0 | 100.0 | 4,807.1 | 3,810,000 | 0.921 | 0.172 | 5,219.4 | 22,151,163 | 2,207.3 | 7,426.7 |
| 3. | PJT-S | 1997 | ATS | 70,698.0 | 11.3 | 6,239.9 | 3,689,344 | 0.858 | 0.238 | 7,272.6 | 15,501,445 | 1,544.7 | 8,817.3 |
| 4. | PJT-AB | 1998 | US$ | 8,769.0 | 1.0 | 8,769.0 | 5,252,384 | 0.880 | 0.480 | 9,964.8 | 10,942,467 | 1,090.4 | 11,055.2 |
| 5. | PJT-AA | 1994 | DM | 8,138.0 | 1.5 | 5,425.3 | 7,290,000 | 0.990 | 0.182 | 5,480.1 | 40,054,945 | 3,991.4 | 9,471.5 |
| 6. | PJT-Y | 1994 | YEN | 245,655.0 | 97.2 | 2,527.1 | 15,469,800 | 0.990 | 0.182 | 2,552.6 | 84,998,901 | 8,470.0 | 11,022.6 |
| 7. | PJT-AC | 1995 | DM | 9,645.0 | 1.6 | 6,222.6 | 8,146,476 | 0.994 | 0.202 | 6,260.2 | 40,329,089 | 4,018.7 | 10,278.9 |
| | | | | | | | | **Average:** | | **6,213.7** | | **3,253.0** | **9,466.7** |
| III-3. | Tainter gate/ Radial gate (per ton) | | | | | | | | | | | | |
| | | | | | | | | Average: | | (Nil) | | (Nil) | (Nil) |
| **III-4.** | **Stoplog (per ton)** | | | | | | | | | | | | |
| 1. | PJT-E | 1995 | ATS | 20,527.0 | 10.1 | 2,040.5 | 3,562,416 | 0.994 | 0.202 | 2,052.8 | 17,635,723 | 1,757.4 | 3,810.2 |
| 2. | PJT-U | 1998 | YEN | 529,067.0 | 141.1 | 3,750.9 | 6,492,200 | 0.880 | 0.480 | 4,262.4 | 13,525,417 | 1,347.8 | 5,610.2 |
| 3. | PJT-O | 1993 | YEN | 451,984.0 | 100.0 | 4,519.8 | 3,604,000 | 0.921 | 0.172 | 4,907.5 | 20,953,488 | 2,088.0 | 6,995.5 |
| 4. | PJT-S | 1997 | ATS | 53,727.0 | 11.3 | 4,742.0 | 3,748,544 | 0.858 | 0.238 | 5,526.8 | 15,750,185 | 1,569.5 | 7,096.3 |
| 5. | PJT-AB | 1998 | US$ | 4,403.0 | 1.0 | 4,403.0 | 4,652,360 | 0.880 | 0.480 | 5,003.4 | 9,692,417 | 965.8 | 5,969.2 |
| 6. | PJT-AA | 1994 | DM | 4,706.0 | 1.5 | 3,137.3 | 6,754,000 | 0.990 | 0.182 | 3,169.0 | 37,109,890 | 3,697.9 | 6,866.9 |
| 7. | PJT-Y | 1994 | YEN | 0.0 | 97.2 | 0.0 | 15,251,300 | 0.990 | 0.182 | 0.0 | 83,798,352 | 8,350.4 | 8,350.4 |
| | | | | | | | | **Average:** | | **3,560.3** | | **2,825.3** | **6,385.6** |
| **III-5.** | **Trashrack (per ton)** | | | | | | | | | | | | |
| 1. | PJT-E | 1995 | ATS | 15,239.0 | 10.1 | 1,514.8 | 5,357,118 | 0.994 | 0.202 | 1,523.9 | 26,520,386 | 2,642.7 | 4,166.6 |
| 2. | PJT-U | 1998 | YEN | 161,552.0 | 141.1 | 1,145.4 | 5,891,600 | 0.880 | 0.480 | 1,301.6 | 12,274,167 | 1,223.1 | 2,524.7 |
| 3. | PJT-O | 1993 | YEN | 243,426.0 | 100.0 | 2,434.3 | 1,946,000 | 0.921 | 0.172 | 2,643.1 | 11,313,953 | 1,127.4 | 3,770.5 |
| 4. | PJT-S | 1997 | ATS | 19,810.0 | 11.3 | 1,748.5 | 3,930,880 | 0.858 | 0.238 | 2,037.9 | 16,516,303 | 1,645.8 | 3,683.7 |
| 5. | PJT-AB | 1998 | US$ | 2,158.0 | 1.0 | 2,158.0 | 3,339,264 | 0.880 | 0.480 | 2,452.3 | 6,956,800 | 693.2 | 3,145.5 |
| 6. | PJT-AA | 1994 | DM | 5,296.0 | 1.5 | 3,530.7 | 29,704,000 | 0.990 | 0.182 | 3,566.4 | 163,208,791 | 16,263.5 | 19,829.9 |
| 7. | PJT-Y | 1994 | YEN | 0.0 | 97.2 | 0.0 | 5,672,260 | 0.990 | 0.182 | 0.0 | 31,166,264 | 3,105.7 | 3,105.7 |
| 8. | PJT-AC | 1995 | DM | 591.0 | 1.6 | 381.3 | 7,931,170 | 0.994 | 0.202 | 383.6 | 39,263,218 | 3,912.5 | 4,296.1 |
| | | | | | | | | **Average:** | | **1,738.6** | | **3,826.7** | **5,565.3** |
| **III-6.** | **Trashracking system (per ton)** | | | | | | | | | | | | |
| 1. | PJT-E | 1995 | ATS | 138,133.0 | 10.1 | 13,730.9 | 4,603,703 | 0.994 | 0.202 | 13,813.8 | 22,790,609 | 2,271.0 | 16,084.8 |
| 2. | PJT-U | 1998 | YEN | 848,474.0 | 141.1 | 6,015.4 | 1,987,700 | 0.880 | 0.480 | 6,835.7 | 4,141,042 | 412.6 | 7,248.3 |
| 3. | PJT-O | 1993 | YEN | 2,880,000.0 | 100.0 | 28,800.0 | 1,086,000 | 0.921 | 0.172 | 31,270.4 | 6,313,953 | 629.2 | 31,899.6 |
| 4. | PJT-S | 1997 | ATS | 165,000.0 | 11.3 | 14,563.1 | 1,839,936 | 0.858 | 0.238 | 16,973.3 | 7,730,824 | 770.4 | 17,743.7 |
| 5. | PJT-AB | 1998 | US$ | 27,241.0 | 1.0 | 27,241.0 | 6,348,080 | 0.880 | 0.480 | 30,955.7 | 13,225,167 | 1,317.9 | 32,273.6 |
| 6. | PJT-AA | 1994 | DM | 47,333.0 | 1.5 | 31,555.3 | 2,068,000 | 0.990 | 0.182 | 31,874.0 | 11,362,637 | 1,132.3 | 33,006.3 |
| 7. | PJT-Y | 1994 | YEN | 0.0 | 97.2 | 0.0 | 12,797,545 | 0.990 | 0.182 | 0.0 | 70,316,181 | 7,006.9 | 7,006.9 |
| 8. | PJT-AC | 1995 | DM | 18,308.0 | 1.6 | 11,811.6 | 28,703,805 | 0.994 | 0.202 | 11,882.9 | 142,098,045 | 14,159.8 | 26,042.7 |
| | | | | | | | | **Average:** | | **17,950.7** | | **3,462.5** | **21,413.2** |

Source: JICA Study Team

# Table 1.3.8 Update of Contracted Rates for Civil, Bridge and Metal Works (River Improvement Projects) (1/4)

Update computation — Price level: 2005; Exchange rate (Rp./US$): 10,035.3

| No. | Project | Year | Rate F/C (US$) | Rate L/C (Rp.) | Price index F/C (2005= 1.0) | Price index L/C (2005= 1.0) | Rate updated (as of 2005) F/C (US$) | Rate updated (as of 2005) L/C (Rp.) | Equival. (US$) | Total (US$) |
|---|---|---|---|---|---|---|---|---|---|---|
| **I.** | **Civil Works** | | | | | | | | | |
| **I-1.** | **Excavation, river/channel (per m3)** | | | | | | | | | |
| 1. | Ular (FC-1) | 1983 | 0.0 | 2,200 | 0.683 | 0.084 | 0.0 | 26,190 | 2.6 | 2.6 |
| 2. | Ular (FC-2) | 1985 | 0.0 | 1,800 | 0.712 | 0.098 | 0.0 | 18,367 | 1.8 | 1.8 |
| 3. | Ular (FC-3) | 1983 | 0.0 | 1,400 | 0.683 | 0.084 | 0.0 | 16,667 | 1.7 | 1.7 |
| 4. | Ular (FC-4) | 1985 | 0.0 | 1,200 | 0.712 | 0.098 | 0.0 | 12,245 | 1.2 | 1.2 |
| 5. | West Jakarta (P-1) | 1987 | 2.0 | 1,300 | 0.816 | 0.120 | 2.5 | 10,833 | 1.1 | 3.6 |
| 6. | West Jakarta (P-3) | 1989 | 0.0 | 10,900 | 0.808 | 0.137 | 0.0 | 79,562 | 7.9 | 7.9 |
| 7. | West Jakarta 2 (P-1) | 1988 | 2.0 | 1,800 | 0.818 | 0.126 | 2.4 | 14,286 | 1.4 | 3.8 |
| 8. | West Jakarta 2 (P-2) | 1990 | 1.0 | 900 | 0.870 | 0.150 | 1.1 | 6,000 | 0.6 | 1.7 |
| 9. | Madiun (P-1) | 1988 | 0.0 | 1,200 | 0.818 | 0.126 | 0.0 | 9,524 | 0.9 | 0.9 |
| 10. | Madiun (P-2) | 1989 | 0.0 | 700 | 0.808 | 0.137 | 0.0 | 5,109 | 0.5 | 0.5 |
| 11. | Madiun (P-3) | 1988 | 0.0 | 2,500 | 0.818 | 0.126 | 0.0 | 19,841 | 2.0 | 2.0 |
| 12. | Upper Solo (P-1) | 1988 | 0.0 | 1,100 | 0.818 | 0.126 | 0.0 | 8,730 | 0.9 | 0.9 |
| 13. | Upper Solo (P-2) | 1988 | 0.0 | 2,400 | 0.818 | 0.126 | 0.0 | 19,048 | 1.9 | 1.9 |
| 14. | Upper Solo (P-3) | 1990 | 0.0 | 1,900 | 0.870 | 0.150 | 0.0 | 12,667 | 1.3 | 1.3 |
| 15. | Upper Solo (P-4) | 1990 | 0.0 | 1,600 | 0.870 | 0.150 | 0.0 | 10,667 | 1.1 | 1.1 |
| 16. | Upper Solo (P-5) | 1990 | 0.0 | 4,300 | 0.870 | 0.150 | 0.0 | 28,667 | 2.9 | 2.9 |
| 17. | Upper Solo (P-5a) | 1990 | 0.0 | 6,800 | 0.870 | 0.150 | 0.0 | 45,333 | 4.5 | 4.5 |
| 18. | Upper Solo (P-1A) | 1991 | 0.0 | 2,700 | 0.906 | 0.158 | 0.0 | 17,089 | 1.7 | 1.7 |
| 19. | Lower Solo (P-F) | 1996 | 0.0 | 5,100 | 0.952 | 0.218 | 0.0 | 23,394 | 2.3 | 2.3 |
| 20. | Lower Solo (P-Is) | 1997 | 0.0 | 2,000 | 0.858 | 0.238 | 0.0 | 8,403 | 0.8 | 0.8 |
| | | | | | **Average:** | | **0.3** | | **2.0** | **2.3** |
| **I-2.** | **Dredging (per m3)** | | | | | | | | | |
| 1. | Ular (FC-1) | 1983 | 0.0 | 3,700 | 0.683 | 0.084 | 0.0 | 44,048 | 4.4 | 4.4 |
| 2. | Ular (FC-2) | 1985 | 0.0 | 5,500 | 0.712 | 0.098 | 0.0 | 56,122 | 5.6 | 5.6 |
| 3. | Ular (FC-3) | 1983 | 0.0 | 4,100 | 0.683 | 0.084 | 0.0 | 48,810 | 4.9 | 4.9 |
| 4. | Ular (FC-4) | 1985 | 0.0 | 3,500 | 0.712 | 0.098 | 0.0 | 35,714 | 3.6 | 3.6 |
| | | | | | **Average:** | | **0.0** | | **4.6** | **4.6** |
| **I-3.** | **Embankment (per m3)** | | | | | | | | | |
| 1. | Ular (FC-1) | 1983 | 0.0 | 2,200 | 0.683 | 0.084 | 0.0 | 26,190 | 2.6 | 2.6 |
| 2. | Ular (FC-2) | 1985 | 0.0 | 3,600 | 0.712 | 0.098 | 0.0 | 36,735 | 3.7 | 3.7 |
| 3. | Ular (FC-3) | 1983 | 0.0 | 2,200 | 0.683 | 0.084 | 0.0 | 26,190 | 2.6 | 2.6 |
| 4. | Ular (FC-4) | 1985 | 0.0 | 3,300 | 0.712 | 0.098 | 0.0 | 33,673 | 3.4 | 3.4 |
| 5. | West Jakarta 2 (P-1) | 1988 | 1.4 | 2,700 | 0.818 | 0.126 | 1.7 | 21,429 | 2.1 | 3.8 |
| 6. | West Jakarta 2 (P-2) | 1990 | 2.4 | 2,100 | 0.870 | 0.150 | 2.8 | 14,000 | 1.4 | 4.2 |
| 7. | Madiun (P-1) | 1988 | 0.0 | 1,700 | 0.818 | 0.126 | 0.0 | 13,492 | 1.3 | 1.3 |
| 8. | Madiun (P-2) | 1989 | 0.0 | 3,200 | 0.808 | 0.137 | 0.0 | 23,358 | 2.3 | 2.3 |
| 9. | Upper Solo (P-1) | 1988 | 0.0 | 2,400 | 0.818 | 0.126 | 0.0 | 19,048 | 1.9 | 1.9 |
| 10. | Upper Solo (P-2) | 1988 | 0.0 | 1,500 | 0.818 | 0.126 | 0.0 | 11,905 | 1.2 | 1.2 |
| 11. | Upper Solo (P-3) | 1990 | 0.0 | 1,900 | 0.870 | 0.150 | 0.0 | 12,667 | 1.3 | 1.3 |
| 12. | Upper Solo (P-4) | 1990 | 0.0 | 1,300 | 0.870 | 0.150 | 0.0 | 8,667 | 0.9 | 0.9 |
| 13. | Upper Solo (P-5a) | 1990 | 0.0 | 6,100 | 0.870 | 0.150 | 0.0 | 40,667 | 4.1 | 4.1 |
| 14. | Upper Solo (P-1A) | 1991 | 0.0 | 3,300 | 0.906 | 0.158 | 0.0 | 20,886 | 2.1 | 2.1 |
| 15. | Lower Solo (P-Is) | 1997 | 0.0 | 5,200 | 0.858 | 0.238 | 0.0 | 21,849 | 2.2 | 2.2 |
| | | | | | **Average:** | | **0.3** | | **2.2** | **2.5** |
| **I-4.** | **Concrete, weir (per m3)** | | | | | | | | | |
| 1. | Brantas-middle 2 | 1991 | 0.0 | 1,064,000 | 0.906 | 0.158 | 0.0 | 6,734,177 | 671.0 | 671.0 |
| 2. | Lower Solo (P-Bs) | 2000 | 0.0 | 727,600 | 0.915 | 0.596 | 0.0 | 1,220,805 | 121.7 | 121.7 |
| 3. | Lower Solo (P-Js) | 2001 | 0.0 | 927,400 | 0.843 | 0.681 | 0.0 | 1,361,821 | 135.7 | 135.7 |
| | | | | | **Average:** | | **0.0** | | **309.5** | **309.5** |
| **I-5.** | **Concrete, dam (mass) (per m3)** | | | | | | | | | |
| 1. | Wonorejo | | | | | | 10.0 | 89,608 | 8.9 | 18.9 |
| | | | | | **Average:** | | **10.0** | | **8.9** | **18.9** |
| | (Breakdown for Wonorejo) | | | | | | | | | |
| | Wonorejo (P-2) | 1994 | 9.7 | 8,100 | 0.990 | 0.182 | 9.8 | 44,505 | 4.4 | 14.2 |
| | Wonorejo (Lot-1) | 1999 | 0.0 | 6,400 | 0.927 | 0.530 | 0.0 | 12,075 | 1.2 | 1.2 |
| | Wonorejo (P-4) | 1996 | 0.2 | 7,200 | 0.952 | 0.218 | 0.2 | 33,028 | 3.3 | 3.5 |
| **I-6.** | **Syphon culvert (per m2 x m)** | | | | | | | | | |
| 1. | Brantas-middle 2 | 1991 | 0.0 | 781,900 | 0.906 | 0.158 | 0.0 | 4,948,734 | 493.1 | 493.1 |
| | | | | | **Average:** | | **0.0** | | **493.1** | **493.1** |
| **II.** | **Bridge Works** | | | | | | | | | |
| **II-1.** | **Bridge (per m)** | | | | | | | | | |
| 1. | West Jakarta (P-1, CBB) | 1987 | 5,286.7 | 3,867,600 | 0.816 | 0.120 | 6,478.8 | 32,230,000 | 3,211.7 | 9,690.5 |
| 2. | West Jakarta (P-1, MB) | 1987 | 5,917.2 | 4,401,100 | 0.816 | 0.120 | 7,251.5 | 36,675,833 | 3,654.7 | 10,906.2 |
| 3. | West Jakarta (P-1, TSB) | 1987 | 5,389.5 | 4,047,400 | 0.816 | 0.120 | 6,604.8 | 33,728,333 | 3,361.0 | 9,965.8 |
| 4. | West Jakarta (P-3, NB) | 1989 | 1,219.1 | 19,011,900 | 0.808 | 0.137 | 1,508.8 | 138,772,993 | 13,828.5 | 15,337.3 |
| 5. | West Jakarta 2 (P-1, GMB) | 1988 | 1,391.6 | 3,391,600 | 0.818 | 0.126 | 1,701.2 | 26,917,460 | 2,682.3 | 4,383.5 |
| 6. | West Jakarta 2 (P-1, PKB) | 1988 | 1,534.9 | 3,915,300 | 0.818 | 0.126 | 1,876.4 | 31,073,810 | 3,096.5 | 4,972.9 |
| 7. | West Jakarta 2 (P-1, SB) | 1988 | 2,383.7 | 5,653,400 | 0.818 | 0.126 | 2,914.1 | 44,868,254 | 4,471.0 | 7,385.1 |
| 8. | West Jakarta 2 (P-1, PB) | 1988 | 8,707.7 | 2,129,800 | 0.818 | 0.126 | 10,645.1 | 16,903,175 | 1,684.4 | 12,329.5 |
| 9. | West Jakarta 2 (P-2, TDMB) | 1990 | 4,207.2 | 3,613,500 | 0.870 | 0.150 | 4,835.9 | 24,090,000 | 2,400.5 | 7,236.4 |
| 10. | Madiun (P-1) | 1988 | 0.0 | 2,230,400 | 0.818 | 0.126 | 0.0 | 17,701,587 | 1,763.9 | 1,763.9 |
| | | | | | **Average:** | | **4,381.7** | | **4,015.5** | **8,397.2** |

## Table 1.3.8 Update of Contracted Rates for Civil, Bridge and Metal Works (River Improvement Projects) (2/4)

Price level: 2005

Update computation — Exchange rate (Rp./US$): 10,035.3

| No. | Project | Year | Rate F/C (US$) | Rate L/C (Rp.) | Price index F/C (2005= 1.0) | Price index L/C (2005= 1.0) | Rate updated (as of 2005) F/C (US$) | Rate updated (as of 2005) L/C (Rp.) | Equival. (US$) | Total (US$) |
|---|---|---|---|---|---|---|---|---|---|---|
| **II-2.** | **Bridge (per m2)** | | | | | | | | | |
| 1. | West Jakarta (P-1, CBB) | 1987 | 357.2 | 261,300 | 0.816 | 0.120 | 437.7 | 2,177,500 | 217.0 | 654.7 |
| 2. | West Jakarta (P-1, MB) | 1987 | 314.7 | 234,100 | 0.816 | 0.120 | 385.7 | 1,950,833 | 194.4 | 580.1 |
| 3. | West Jakarta (P-1, TSB) | 1987 | 549.9 | 413,000 | 0.816 | 0.120 | 673.9 | 3,441,667 | 343.0 | 1,016.9 |
| 4. | West Jakarta (P-3, NB) | 1989 | 128.3 | 2,001,300 | 0.808 | 0.137 | 158.8 | 14,608,029 | 1,455.7 | 1,614.5 |
| 5. | West Jakarta 2 (P-1, GMB) | 1988 | 139.2 | 339,200 | 0.818 | 0.126 | 170.2 | 2,692,063 | 268.3 | 438.5 |
| 6. | West Jakarta 2 (P-1, PKB) | 1988 | 153.5 | 391,500 | 0.818 | 0.126 | 187.7 | 3,107,143 | 309.6 | 497.3 |
| 7. | West Jakarta 2 (P-1, SB) | 1988 | 238.4 | 565,300 | 0.818 | 0.126 | 291.4 | 4,486,508 | 447.1 | 738.5 |
| 8. | West Jakarta 2 (P-1, PB) | 1988 | 1,404.5 | 343,500 | 0.818 | 0.126 | 1,717.0 | 2,726,190 | 271.7 | 1,988.7 |
| 9. | West Jakarta 2 (P-2, TDMB) | 1990 | 420.7 | 361,300 | 0.870 | 0.150 | 483.6 | 2,408,667 | 240.0 | 723.6 |
| 10. | Madiun (P-1) | 1988 | 0.0 | 371,700 | 0.818 | 0.126 | 0.0 | 2,950,000 | 294.0 | 294.0 |
| | | | | | **Average:** | | **450.6** | | **404.1** | **854.7** |
| **III.** | **Metal Works** | | | | | | | | | |
| **III-1.** | **Fixed wheel gate/ Roller gate (per m2)** | | | | | | | | | |
| 1. | Lower Solo (P-Js) | 2001 | 0.0 | 51,854,400 | 0.843 | 0.681 | 0.0 | 76,144,493 | 7,587.7 | 7,587.7 |
| | | | | | **Average:** | | **0.0** | | **7,587.7** | **7,587.7** |
| **III-2.** | **Tainter gate/ Radial gate (per m2)** | | | | | | | | | |
| 1. | Lower Solo (P-Bs) | 2000 | 0.0 | 42,806,300 | 0.915 | 0.596 | 0.0 | 71,822,651 | 7,157.0 | 7,157.0 |
| | | | | | **Average:** | | **0.0** | | **7,157.0** | **7,157.0** |
| **III-3.** | **Rubber gate, including hydro-mech. (per m2)** | | | | | | | | | |
| 1. | Brantas-middle 2 | 1991 | 5,574.8 | 1,133,400 | 0.906 | 0.158 | 6,153.2 | 7,173,418 | 714.8 | 6,868.0 |
| | | | | | **Average:** | | **6,153.2** | | **714.8** | **6,868.0** |
| **III-4.** | **Rubber dam, including civil works (per m2)** | | | | | | | | | |
| 1. | Brantas-middle 2 | 1991 | 5,574.8 | 18,697,300 | 0.906 | 0.158 | 6,153.2 | 118,337,342 | 11,792.1 | 17,945.3 |
| | | | | | **Average:** | | **6,153.2** | | **11,792.1** | **17,945.3** |
| **IV.** | **Equipment** | | | | | | | | | |
| **IV-1.** | **Pump station, including erection (per m3/s)** | | | | | | | | | |
| 1. | West Jakarta (P-2) | 1987 | 545,424.9 | 140,354,400 | 0.816 | 0.120 | 668,412.9 | 1,169,620,000 | 116,550.6 | 784,963.5 |
| | | | | | **Average:** | | **668,412.9** | | **116,550.6** | **784,963.5** |

## Table 1.3.8 Update of Contracted Rates for Civil, Bridge and Metal Works (River Improvement Projects) (3/4)

| No. | Project | Year | Work Q'ty | Unit | Contract price F/C Price | Exch. r. (/US$) | Equival. (US$) | L/C (Rp.) | Rate F/C (US$) | Rate L/C (Rp.) | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **I.** | **Civil Works** | | | | | | | | | | |
| **I-1.** | **Excavation, river/channel (per m3)** | | | | | | | | | | |
| 1. | Ular (FC-1) | 1983 | 482,307 | m3 | US$ 0 | 1.0 | 0 | 1,061,851,028 | 0.0 | 2,200 | |
| 2. | Ular (FC-2) | 1985 | 162,188 | m3 | US$ 0 | 1.0 | 0 | 290,155,600 | 0.0 | 1,800 | |
| 3. | Ular (FC-3) | 1983 | 214,200 | m3 | US$ 0 | 1.0 | 0 | 290,997,721 | 0.0 | 1,400 | |
| 4. | Ular (FC-4) | 1985 | 331,770 | m3 | US$ 0 | 1.0 | 0 | 391,751,680 | 0.0 | 1,200 | |
| 5. | West Jakarta (P-1) | 1987 | 37,905 | m3 | US$ 75,810 | 1.0 | 75,810 | 49,949,870 | 2.0 | 1,300 | |
| 6. | West Jakarta (P-3) | 1989 | 154,867 | m3 | Y 564,489 | 143.5 | 3,934 | 1,686,745,224 | 0.0 | 10,900 | |
| 7. | West Jakarta 2 (P-1) | 1988 | 168,103 | m3 | Y 42,862,889 | 125.9 | 340,452 | 310,879,491 | 2.0 | 1,800 | |
| 8. | West Jakarta 2 (P-2) | 1990 | 154,342 | m3 | Y 20,649,417 | 134.4 | 153,642 | 131,564,148 | 1.0 | 900 | |
| 9. | Madiun (P-1) | 1988 | 1,275,334 | m3 | US$ 0 | 1.0 | 0 | 1,567,707,780 | 0.0 | 1,200 | |
| 10. | Madiun (P-2) | 1989 | 1,007,000 | m3 | US$ 0 | 1.0 | 0 | 704,930,800 | 0.0 | 700 | |
| 11. | Madiun (P-3) | 1988 | 804,800 | m3 | US$ 0 | 1.0 | 0 | 2,027,731,180 | 0.0 | 2,500 | |
| 12. | Upper Solo (P-1) | 1988 | 1,400,060 | m3 | US$ 0 | 1.0 | 0 | 1,471,696,820 | 0.0 | 1,100 | |
| 13. | Upper Solo (P-2) | 1988 | 1,298,571 | m3 | US$ 0 | 1.0 | 0 | 3,146,636,314 | 0.0 | 2,400 | |
| 14. | Upper Solo (P-3) | 1990 | 1,732,076 | m3 | US$ 0 | 1.0 | 0 | 3,362,390,701 | 0.0 | 1,900 | |
| 15. | Upper Solo (P-4) | 1990 | 2,033,433 | m3 | US$ 0 | 1.0 | 0 | 3,304,941,174 | 0.0 | 1,600 | |
| 16. | Upper Solo (P-5) | 1990 | 1,113,881 | m3 | US$ 0 | 1.0 | 0 | 4,769,001,157 | 0.0 | 4,300 | |
| 17. | Upper Solo (P-5a) | 1990 | 78,998 | m3 | US$ 0 | 1.0 | 0 | 537,889,385 | 0.0 | 6,800 | |
| 18. | Upper Solo (P-1A) | 1991 | 394,116 | m3 | US$ 0 | 1.0 | 0 | 1,052,596,533 | 0.0 | 2,700 | |
| 19. | Lower Solo (P-F) | 1996 | 7,607,834 | m3 | US$ 0 | 1.0 | 0 | 38,694,455,000 | 0.0 | 5,100 | |
| 20. | Lower Solo (P-Is) | 1997 | 1,883,152 | m3 | US$ 0 | 1.0 | 0 | 3,780,141,000 | 0.0 | 2,000 | |
| **I-2.** | **Dredging (per m3)** | | | | | | | | | | |
| 1. | Ular (FC-1) | 1983 | 372,648 | m3 | US$ 0 | 1.0 | 0 | 1,364,264,328 | 0.0 | 3,700 | |
| 2. | Ular (FC-2) | 1985 | 80,784 | m3 | US$ 0 | 1.0 | 0 | 447,543,359 | 0.0 | 5,500 | |
| 3. | Ular (FC-3) | 1983 | 52,819 | m3 | US$ 0 | 1.0 | 0 | 215,924,072 | 0.0 | 4,100 | |
| 4. | Ular (FC-4) | 1985 | 99,000 | m3 | US$ 0 | 1.0 | 0 | 347,787,000 | 0.0 | 3,500 | |
| **I-3.** | **Embankment (per m3)** | | | | | | | | | | |
| 1. | Ular (FC-1) | 1983 | 422,542 | m3 | US$ 0 | 1.0 | 0 | 947,800,530 | 0.0 | 2,200 | |
| 2. | Ular (FC-2) | 1985 | 129,085 | m3 | US$ 0 | 1.0 | 0 | 461,927,656 | 0.0 | 3,600 | |
| 3. | Ular (FC-3) | 1983 | 136,540 | m3 | US$ 0 | 1.0 | 0 | 299,375,645 | 0.0 | 2,200 | |
| 4. | Ular (FC-4) | 1985 | 328,867 | m3 | US$ 0 | 1.0 | 0 | 1,085,799,761 | 0.0 | 3,300 | |
| 5. | West Jakarta 2 (P-1) | 1988 | 11,988 | m3 | Y 2,064,104 | 125.9 | 16,395 | 31,809,358 | 1.4 | 2,700 | |
| 6. | West Jakarta 2 (P-2) | 1990 | 16,181 | m3 | Y 5,244,129 | 134.4 | 39,019 | 34,217,827 | 2.4 | 2,100 | |
| 7. | Madiun (P-1) | 1988 | 809,585 | m3 | US$ 0 | 1.0 | 0 | 1,354,080,000 | 0.0 | 1,700 | |
| 8. | Madiun (P-2) | 1989 | 940,000 | m3 | US$ 0 | 1.0 | 0 | 2,993,915,100 | 0.0 | 3,200 | |
| 9. | Upper Solo (P-1) | 1988 | 958,687 | m3 | US$ 0 | 1.0 | 0 | 2,313,578,940 | 0.0 | 2,400 | |
| 10. | Upper Solo (P-2) | 1988 | 241,475 | m3 | US$ 0 | 1.0 | 0 | 369,121,967 | 0.0 | 1,500 | |
| 11. | Upper Solo (P-3) | 1990 | 551,805 | m3 | US$ 0 | 1.0 | 0 | 1,061,844,449 | 0.0 | 1,900 | |
| 12. | Upper Solo (P-4) | 1990 | 595,362 | m3 | US$ 0 | 1.0 | 0 | 770,999,245 | 0.0 | 1,300 | |
| 13. | Upper Solo (P-5a) | 1990 | 261,428 | m3 | US$ 0 | 1.0 | 0 | 1,596,804,368 | 0.0 | 6,100 | |
| 14. | Upper Solo (P-1A) | 1991 | 98,118 | m3 | US$ 0 | 1.0 | 0 | 324,097,997 | 0.0 | 3,300 | |
| 15. | Lower Solo (P-Is) | 1997 | 4,568,061 | m3 | US$ 0 | 1.0 | 0 | 23,918,585,000 | 0.0 | 5,200 | |
| **I-4.** | **Concrete, weir (per m3)** | | | | | | | | | | |
| 1. | Brantas-middle 2 | 1991 | 5,200 | m3 | US$ 0 | 1.0 | 0 | 5,532,633,046 | 0.0 | 1,064,000 | /*1 |
| 2. | Lower Solo (P-Bs) | 2000 | 43,277 | m3 | US$ 0 | 1.0 | 0 | 31,489,697,000 | 0.0 | 727,600 | |
| 3. | Lower Solo (P-Js) | 2001 | 3,177 | m3 | US$ 0 | 1.0 | 0 | 2,946,369,000 | 0.0 | 927,400 | |
| **I-5.** | **Concrete, dam (mass) (per m3)** | | | | | | | | | | |
| 1. | Wonorejo | | | | | | | | | | |
| | (Breakdown for Wonorejo) | | | | | | | | | | |
| | Wonorejo (P-2) | 1994 | 6,050,000 | m3 | Y 5,828,941,300 | 99.7 | 58,464,807 | 48,784,225,547 | 9.7 | 8,100 | |
| | Wonorejo (Lot-1) | 1999 | 6,050,000 | m3 | US$ 0 | 1.0 | 0 | 38,637,606,000 | 0.0 | 6,400 | |
| | Wonorejo (P-4) | 1996 | 6,050,000 | m3 | Y 159,669,779 | 116.0 | 1,376,464 | 43,833,903,013 | 0.2 | 7,200 | |
| **I-6.** | **Syphon culvert (per m2 x m)** | | | | | | | | | | |
| 1. | Brantas-middle 2 | 1991 | 4,002 | m2 | US$ 0 | 1.0 | 0 | 3,129,253,664 | 0.0 | 781,900 | /*2 |
| **II.** | **Bridge Works** | | | | | | | | | | |
| **II-1.** | **Bridge (per m)** | | | | | | | | | | **Width (m)** |
| 1. | West Jakarta (P-1, CBB) | 1987 | 17.1 | m | US$ 90,403 | 1.0 | 90,403 | 66,136,068 | 5,286.7 | 3,867,600 | 14.8 /*3 |
| 2. | West Jakarta (P-1, MB) | 1987 | 20.1 | m | US$ 118,935 | 1.0 | 118,935 | 88,463,067 | 5,917.2 | 4,401,100 | 18.8 /*4 |
| 3. | West Jakarta (P-1, TSB) | 1987 | 28.6 | m | US$ 154,139 | 1.0 | 154,139 | 115,755,285 | 5,389.5 | 4,047,400 | 9.8 /*5 |
| 4. | West Jakarta (P-3, NB) | 1989 | 16.6 | m | Y 2,904,045 | 143.5 | 20,237 | 315,597,897 | 1,219.1 | 19,011,900 | 9.5 /*6 |
| 5. | West Jakarta 2 (P-1, GMB) | 1988 | 40.2 | m | Y 7,043,010 | 125.9 | 55,941 | 136,344,051 | 1,391.6 | 3,391,600 | 10.0 /*7 |
| 6. | West Jakarta 2 (P-1, PKB) | 1988 | 50.0 | m | Y 9,662,261 | 125.9 | 76,746 | 195,765,728 | 1,534.9 | 3,915,300 | 10.0 /*8 |
| 7. | West Jakarta 2 (P-1, SB) | 1988 | 22.8 | m | Y 6,842,337 | 125.9 | 54,347 | 128,897,141 | 2,383.7 | 5,653,400 | 10.0 /*9 |
| 8. | West Jakarta 2 (P-1, PB) | 1988 | 37.1 | m | Y 40,672,727 | 125.9 | 323,056 | 79,015,467 | 8,707.7 | 2,129,800 | 6.2 /*10 |
| 9. | West Jakarta 2 (P-2, TDMB) | 1990 | 22.7 | m | Y 12,835,714 | 134.4 | 95,504 | 82,026,353 | 4,207.2 | 3,613,500 | 10.0 /*11 |
| 10. | Madiun (P-1) | 1988 | 488.0 | m | US$ 0 | 1.0 | 0 | 1,088,418,923 | 0.0 | 2,230,400 | 6.0 /*12 |

## Table 1.3.8 Update of Contracted Rates for Civil, Bridge and Metal Works (River Improvement Projects) (4/4)

| No. | Project | Year | Work Q'ty | Unit | Contract price F/C Price | Exch. r. (/US$) | Equival. (US$) | L/C (Rp.) | Rate F/C (US$) | Rate L/C (Rp.) | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **II-2.** | **Bridge (per m2)** | | | | | | | | | | |
| 1. | West Jakarta (P-1, CBB) | 1987 | 253.1 | m2 | US$ 90,403 | 1.0 | 90,403 | 66,136,068 | 357.2 | 261,300 | /*3 |
| 2. | West Jakarta (P-1, MB) | 1987 | 377.9 | m2 | US$ 118,935 | 1.0 | 118,935 | 88,463,067 | 314.7 | 234,100 | /*4 |
| 3. | West Jakarta (P-1, TSB) | 1987 | 280.3 | m2 | US$ 154,139 | 1.0 | 154,139 | 115,755,285 | 549.9 | 413,000 | /*5 |
| 4. | West Jakarta (P-3, NB) | 1989 | 157.7 | m2 | Y 2,904,045 | 143.5 | 20,237 | 315,597,897 | 128.3 | 2,001,300 | /*6 |
| 5. | West Jakarta 2 (P-1, GMB) | 1988 | 402.0 | m2 | Y 7,043,010 | 125.9 | 55,941 | 136,344,051 | 139.2 | 339,200 | /*7 |
| 6. | West Jakarta 2 (P-1, PKB) | 1988 | 500.0 | m2 | Y 9,662,261 | 125.9 | 76,746 | 195,765,728 | 153.5 | 391,500 | /*8 |
| 7. | West Jakarta 2 (P-1, SB) | 1988 | 228.0 | m2 | Y 6,842,337 | 125.9 | 54,347 | 128,897,141 | 238.4 | 565,300 | /*9 |
| 8. | West Jakarta 2 (P-1, PB) | 1988 | 230.0 | m2 | Y 40,672,727 | 125.9 | 323,056 | 79,015,467 | 1,404.5 | 343,500 | /*10 |
| 9. | West Jakarta 2 (P-2, TDMB) | 1990 | 227.0 | m2 | Y 12,835,714 | 134.4 | 95,504 | 82,026,353 | 420.7 | 361,300 | /*11 |
| 10. | Madiun (P-1) | 1988 | 2,928.0 | m2 | US$ 0 | 1.0 | 0 | 1,088,418,923 | 0.0 | 371,700 | /*12 |
| **III.** | **Metal Works** | | | | | | | | | | |
| **III-1.** | **Fixed wheel gate/ Roller gate (per m2)** | | | | | | | | | | |
| 1. | Lower Solo (P-Js) | 2001 | 63 | m2 | US$ 0 | 1.0 | 0 | 3,290,160,000 | 0.0 | 51,854,400 | /*13 |
| **III-2.** | **Tainter gate/ Radial gate (per m2)** | | | | | | | | | | |
| 1. | Lower Solo (P-Bs) | 2000 | 813 | m2 | US$ 0 | 1.0 | 0 | 34,801,543,000 | 0.0 | 42,806,300 | /*14 |
| **III-3.** | **Rubber gate, including hydro-mech. (p** | | | | | | | | | | |
| 1. | Brantas-middle 2 | 1991 | 315 | m2 | Y 219,859,210 | 125.2 | 1,756,064 | 357,014,320 | 5,574.8 | 1,133,400 | /*15 |
| **III-4.** | **Rubber dam, including civil works (pe** | | | | | | | | | | |
| 1. | Brantas-middle 2 | 1991 | 315 | m2 | Y 219,859,210 | 125.2 | 1,756,064 | 5,889,647,366 | 5,574.8 | 18,697,300 | /*16 |
| **IV.** | **Equipment** | | | | | | | | | | |
| **IV-1.** | **Pump station, including erection (per** | | | | | | | | | | |
| 1. | West Jakarta (P-2) | 1987 | 40 | m3/s | Y 2,707,870,791 | 123.5 | 21,926,079 | 5,642,245,219 | 545,424.9 | 140,354,400 | /*17 |

Source: JICA Study Team

Note:

- All data is contracted price.
- *1: for rubber dam, incl. other civil works
- *2: L= 230m, 2.9 x 3.0 x 2 conduits
- *3: PC bridge
- *4: PC bridge
- *5: PC bridge
- *6: PC bridge
- *7: PC bridge
- *8: PC bridge
- *9: PC bridge
- *10: Metal bridge
- *11: PC bridge
- *12: Metal bridge
- *13: 6m x 4.23m x 2, check + 3m x 4.23m x 1, discharge control
- *14: 15m x 7.1m x 7, check + 7.5m x 9m x 1, discharge control
- *15: 150m x 2.1m
- *16: 150m x 2.1m
- *17: 6.7m3/s x 6 units, incl. pump house, surge chamber, outlet/inlet, etc.

## Table 1.3.9 Unit Price of Equipment

Price level: Dec. 2005; US$ 1.0= Y 119.63

| No. | Equipment | Base price/*1 | Transportation cost/*2 | Total | Unit price |
|---|---|---|---|---|---|
| | | (Y, thousand) | (Y, thousand) | (Y, thousand) | (US$) |
| 1. | Bulldozer, 4t, swamp | 6,190 | 1,240 | 7,430 | 62,100 |
| 2. | Crawler loader, 2.3m3 | 15,900 | 3,180 | 19,080 | 159,500 |
| 3. | Dump truck, 10t | 9,850 | 1,970 | 11,820 | 98,800 |
| 4. | Cutter-suction dredger, 600PS | 296,000 | 59,200 | 355,200 | 2,969,200 |

Note: *1: Source: Kensetsu Kikai-tou Sonryou-hyou, Heisei 17 (Japan Construction Mechanization Association)
*2: 20% of base price

## Table 1.3.10 Rates for Works and Equipment

| No. | Item | Rate | | | Rate to be adopted |
|---|---|---|---|---|---|
| | | Engineer's estimate | Contract price | Average, weighted | |
| | | (US$) | (US$) | (US$) | (US$) |
| **A.** | **POWER ENGINEERING WORKS** | | | | |
| **I.** | **Preparatory Works** | | | | |
| I-1. | Access road (per km) | 316,303.8 | 304,238.1 | 311,276.4 | 311,000 |
| I-2. | Road improvement (per km) | 55,021.3 | 133,510.0 | 99,872.0 | 100,000 |
| I-3. | Bridge (per m) | 3,295.9 | (Nil) | 3,295.9 | 3,300 |
| I-4. | Base camp, workshop & other facilities (LS) | 2,007,948.0 | (Nil) | 2,007,948.0 | 2,000,000 |
| I-5. | Power supply and telecomunication system (LS) | (Nil) | 939,166.5 | 939,166.5 | 940,000 |
| **II.** | **Civil Works** | | | | |
| II-1. | Excavation, common (per m3) | 3.9 | 2.2 | 3.1 | 3 |
| II-2. | Excavation, soft rock (per m3) | 5.7 | 4.2 | 5.1 | 5 |
| II-3. | Excavation, hard rock (per m3) | 10.1 | 10.3 | 10.2 | 10 |
| II-4. | Excavation, tunnel (per m3) | 76.4 | 58.2 | 67.3 | 67 |
| II-5. | Excavation, shaft (per m3) | 67.7 | 45.7 | 56.7 | 57 |
| II-6. | Excavation, inclined tunnel (per m3) | 120.8 | 67.9 | 91.9 | 92 |
| II-7. | Backfill (per m3) | 4.0 | 4.8 | 4.4 | 4 |
| II-8. | Filling, core (per m3) | 6.5 | 5.7 | 6.0 | 6 |
| II-9. | Filling, filter (per m3) | 17.9 | 8.1 | 13.0 | 13 |
| II-10. | Filling, rockfill (per m3) | 10.2 | 4.1 | 7.2 | 7 |
| II-11. | Rip rap (per m3) | 9.3 | 17.0 | 13.7 | 14 |
| II-12. | Concrete, mass (per m3) | 89.6 | 93.1 | 91.8 | 92 |
| II-13. | Concrete, super-structure (per m3) | 121.3 | 105.8 | 112.7 | 113 |
| II-14. | Concrete, sub-structure (per m3) | 112.6 | 109.5 | 111.2 | 111 |
| II-15. | Lining, tunnel (per m3) | 135.4 | 118.3 | 126.3 | 127 |
| II-16. | Lining, shaft (per m3) | 157.6 | 134.1 | 144.8 | 145 |
| II-17. | Pile concrete (per m3) | (Nil) | 168.2 | 168.2 | 168 |
| II-18. | Reinforcing bar (per ton) | 980.0 | 701.3 | 812.8 | 813 |
| II-19. | Curtain grouting (per m) | 66.8 | 76.9 | 71.9 | 72 |
| II-20. | Consolidation grouting (per m) | 62.4 | 99.6 | 83.7 | 84 |
| II-21. | Rock bolt (per m) | 31.8 | 18.3 | 21.7 | 22 |
| II-22. | Steel support, tunnel (per m) | 2,129.1 | 1,681.2 | 1,815.6 | 1,820 |
| **III.** | **Metal Works** | | | | |
| III-1. | Slide gate (per ton) | (Nil) | 11,454.0 | 11,454.0 | 11,500 |
| III-2. | Fixed wheel gate/ Roller gate (per ton) | 12,055.2 | 9,466.7 | 9,790.3 | 9,800 |
| III-3. | Tainter gate/ Radial gate (per ton) | 18,586.2 | (Nil) | 18,586.2 | 18,600 |
| III-4. | Stoplog (per ton) | 6,457.2 | 6,385.6 | 6,407.1 | 6,410 |
| III-5. | Trashrack (per ton) | 7,055.3 | 5,565.3 | 5,863.3 | 5,860 |
| III-6. | Trashracking system (per ton) | (Nil) | 21,413.2 | 21,413.2 | 21,400 |
| **B.** | **RIVER IMPROVEMENT WORKS** | | | | |
| **I.** | **Civil Works** | | | | |
| I-1. | Excavation, river/channel (per m3) | - | 2.3 | 2.3 | 2 |
| I-2. | Dredging (per m3) | - | 4.6 | 4.6 | 5 |
| I-3. | Embankment (per m3) | - | 2.5 | 2.5 | 3 |
| I-4. | Concrete, weir (per m3) | - | 309.5 | 309.5 | 310 |
| I-5. | Concrete, dam (mass) (per m3) | - | 18.9 | 18.9 | 19 |
| I-6. | Syphon culvert (per m2 x m) | - | 493.1 | 493.1 | 490 |
| **II.** | **Bridge Works** | | | | |
| II-1. | Bridge (per m) | - | 8,397.2 | 8,397.2 | 8,400 |
| II-2. | Bridge (per m2) | - | 854.7 | 854.7 | 860 |
| **III.** | **Metal Works** | | | | |
| III-1. | Fixed wheel gate/ Roller gate (per m2) | - | 7,587.7 | 7,587.7 | 7,600 |
| III-2. | Tainter gate/ Radial gate (per m2) | - | 7,157.0 | 7,157.0 | 7,200 |
| III-3. | Rubber gate, including hydro-mech. (per m2) | - | 6,868.0 | 6,868.0 | 6,900 |
| III-4. | Rubber dam, including civil works (per m2) | - | 17,945.3 | 17,945.3 | 18,000 |
| **IV.** | **Equipment** | | | | |
| IV-1. | Pump station, including erection (per m3/s) | - | 784,963.5 | 784,963.5 | 780,000 |
| **C.** | **EQUIPMENT (FOR PROCUREMENT)** | | | | |
| **I.** | **Equipment for Dry Excavation** | | | | |
| I-1. | Bulldozer, 4t, swamp | - | - | - | 62,100 |
| I-2. | Crawler loader, 2.3m3 | - | - | - | 159,500 |
| I-3. | Dump truck, 10t | - | - | - | 98,800 |
| **II.** | **Equipment for Hydraulic Dredging** | | | | |
| II-1. | Cutter-suction dredger, 600PS | - | - | - | 2,969,200 |

Source: JICA Study Team

## Table 1.3.12 Cost Proportion in Resources

| No. | Item | Ratio | | Proportion | | Total |
|---|---|---|---|---|---|---|
| | | F/C | L/C | F/C | L/C | |
| **1.** | **Civil works** | | | | | |
| | 1) Labor | 0.00 | 1.00 | 0.0% | 5.0% | 5% |
| | 2) Materials | 0.05 | 0.95 | 1.3% | 23.8% | 25% |
| | 3) Equipment | 0.25 | 0.75 | 12.5% | 37.5% | 50% |
| | 4) Overhead & proft | 1.00 | 0.00 | 20.0% | 0.0% | 20% |
| | **Total** | | | **33.8%** | **66.3%** | **100%** |
| **2.** | **Metal works** | | | | | |
| | 1) Labor | 0.00 | 1.00 | 0.0% | 2.5% | 3% |
| | 2) Materials | 1.00 | 0.00 | 70.0% | 0.0% | 70% |
| | 3) Equipment | 0.00 | 1.00 | 0.0% | 7.5% | 8% |
| | 4) Overhead & proft | 1.00 | 0.00 | 20.0% | 0.0% | 20% |
| | **Total** | | | **90.0%** | **10.0%** | **100%** |
| **3.** | **Equipment** | | | | | |
| | 1) Labor | 0.00 | 0.00 | 0.0% | 0.0% | 0% |
| | 2) Materials | 0.95 | 0.05 | 85.5% | 4.5% | 90% |
| | 3) Equipment | 0.00 | 0.00 | 0.0% | 0.0% | 0% |
| | 4) Overhead & proft | 1.00 | 0.00 | 10.0% | 0.0% | 10% |
| | **Total** | | | **95.5%** | **4.5%** | **100%** |
| **4.** | **Terrace improvement** | | | | | |
| | 1) Labor | 0.00 | 1.00 | 0.0% | 90.0% | 90% |
| | 2) Materials | 0.00 | 1.00 | 0.0% | 5.0% | 5% |
| | 3) Equipment | 0.00 | 1.00 | 0.0% | 0.0% | 0% |
| | 4) Overhead & proft | 0.00 | 1.00 | 0.0% | 5.0% | 5% |
| | **Total** | | | **0.0%** | **100.0%** | **100%** |

Source: JICA Study Team

## Table 1.4.2 Estimate of Work Cost (1/4)

Price level: Dec. 2005; US$ 1.0= Y 119.63

| No. | Alternatives | Unit | Q'ty | Rate (US$) | Amount (US$, thousand) | equivalent (Y, million) |
|---|---|---|---|---|---|---|
| **(1) Alternatives for reducing sediment deposition** | | | | | | |
| **1) Keduang sediment bypass** | | | | | | |
| I. | Permanent works | | | | | |
| | [1] Tunnel works | | | | 33,850 | |
| | /1 Excavation, tunnel | m3 | 205,920 | 67 | 13,800 | |
| | /2 Rock bolt | m | 57,915 | 22 | 1,270 | |
| | /3 Support, tunnel | m | 6,435 | 1,820 | 11,710 | |
| | /4 Concrete, lining | m3 | 53,350 | 127 | 6,780 | |
| | /5 Gate, roller | t | 30 | 9,800 | 290 | |
| | [2] Open channel | | | | 6,670 | |
| | /1 Excavation | m3 | 41,000 | 3 | 120 | |
| | /2 Concrete | m3 | 58,000 | 113 | 6,550 | |
| | [3] Weir at Keduang | | | | 1,370 | |
| | /1 Excavation | m3 | 23,000 | 3 | 70 | |
| | /2 Concrete | m3 | 11,500 | 113 | 1,300 | |
| | [4] Sub-total, [1] to [3] | | | | 41,890 | |
| | [5] Other works (50%) | | | | 20,950 | |
| | [6] Sub-total, [4] to [5] | | | | 62,840 | |
| II. | Temporary works (10%) | | | | 6,280 | |
| III. | Sub-total, I.+II. | | | | 69,120 | |
| IV. | Physical contingency (20%) | | | | 13,820 | |
| **Total for 1) Keduang sediment bypass** | | | | | **82,940** | **9,920** |
| **2) Sediment sluicing by new gates** | | | | | | |
| I. | Permanent works | | | | | |
| | [1] Spillway | | | | 17,990 | |
| | /1 Excavation | m3 | 797,750 | 3 | 2,390 | |
| | /2 Backfill | m3 | 46,470 | 4 | 190 | |
| | /3 Concrete | m3 | 53,200 | 113 | 6,010 | |
| | /4 Reinforcing bar | t | 2,660 | 813 | 2,160 | |
| | /5 Gate, radial | t | 340 | 18,600 | 6,320 | |
| | /6 Excavation, fore-bay | m3 | 183,000 | 5 | 920 | |
| | [2] Sub-total, [1] to [1] | | | | 17,990 | |
| | [3] Other works (50%) | | | | 9,000 | |
| | [4] Sub-total, [2] to [3] | | | | 26,990 | |
| II. | Temporary works (10%) | | | | 2,700 | |
| III. | Sub-total, I.+II. | | | | 29,690 | |
| IV. | Physical contingency (20%) | | | | 5,940 | |
| **Total for 2) Sediment sluicing by new gates** | | | | | **35,630** | **4,260** |
| **3) Sediment storage reservoir with new gates in reservoir** | | | | | | |
| I. | Permanent works | | | | | |
| | [1] Spillway | | | | 17,990 | |
| | /1 Excavation | m3 | 797,750 | 3 | 2,390 | |
| | /2 Backfill | m3 | 46,470 | 4 | 190 | |
| | /3 Concrete | m3 | 53,200 | 113 | 6,010 | |
| | /4 Reinforcing bar | t | 2,660 | 813 | 2,160 | |
| | /5 Gate, radial | t | 340 | 18,600 | 6,320 | |
| | /6 Excavation, fore-bay | m3 | 183,000 | 5 | 920 | |
| | [2] Closure dike | | | | 5,790 | |
| | /1 Filling, for dike | m3 | 47,320 | 6 | 280 | |
| | /2 Steel sheet pile | t | 4,452 | 1,200 | 5,340 | |
| | /3 Concrete, capping | m3 | 3,300 | 13 | 40 | |
| | /4 Reinforcing bar | t | 165 | 813 | 130 | |
| | [3] Sub-total, [1] to [2] | | | | 23,780 | |
| | [4] Other works (50%) | | | | 11,890 | |
| | [5] Sub-total, [3] to [4] | | | | 35,670 | |
| II. | Temporary works (10%) | | | | 3,570 | |
| III. | Sub-total, I.+II. | | | | 39,240 | |
| IV. | Physical contingency (20%) | | | | 7,850 | |
| **Total for 3) Sediment storage reservoir with new gates in reservoir** | | | | | **47,090** | **5,630** |

## Table 1.4.2 Estimate of Work Cost (2/4)

Price level: Dec. 2005; US$ 1.0= Y 119.63

| No. | Alternatives | Unit | Q'ty | Rate | Amount | | equivalent |
|---|---|---|---|---|---|---|---|
| | | | | (US$) | (US$, thousand) | | (Y, million) |
| **4)** | **Sediment storage dam for sediment removal** | | | | | | |
| I. | Permanent works | | | | | | |
| [1] | Weir at Keduang | | | | | 113,870 | |
| /1 | Excavation | m3 | 1,909,000 | 3 | 5,730 | | |
| /2 | Concrete | m3 | 957,000 | 113 | 108,140 | | |
| [2] | Sub-total, [1] to [1] | | | | | 113,870 | |
| [3] | Other works (50%) | | | | | 56,940 | |
| [4] | Sub-total, [2] to [3] | | | | | 170,800 | |
| II. | Temporary works (10%) | | | | | 17,080 | |
| III. | Sub-total, I.+II. | | | | | 187,880 | |
| IV. | Physical contingency (20%) | | | | | 37,580 | |
| **Total for 4) Sediment storage dam for sediment removal** | | | | | | **225,460** | **26,970** |
| **5)** | **Dry excavation in reservoir** | | | | | | |
| I. | Equipment | | | | | | |
| [1] | Bulldozer, 4t, swamp | nr. | 2,960 | 62,100 | 183,820 | 183,820 | |
| [2] | Crawler loader, 2.3m3 | nr. | 11 | 159,500 | 1,750 | 1,750 | |
| [3] | Dump truck, 10t | nr. | 65 | 98,800 | 6,420 | 6,420 | |
| [4] | Sub-total, [1] to [3] | | | | | 191,990 | |
| [5] | Other equipment (25%) | | | | | 48,000 | |
| [6] | Sub-total, [4] to [5] | | | | | 239,990 | |
| II. | Physical contingency (20%) | | | | | 48,000 | |
| **Total for 5) Dry excavation in reservoir** | | | | | | **287,990** | **34,450** |
| **6)** | **Hydraulic dredging in reservoir** | | | | | | |
| I. | Equipment | | | | | | |
| [1] | Cutter-suction dredger, 600PS | nr. | 6 | 2,969,200 | 17,815 | 17,820 | |
| [2] | Sub-total, [1] to [1] | | | | | 17,820 | |
| [3] | Other equipment (25%) | | | | | 4,460 | |
| [4] | Sub-total, [2] to [3] | | | | | 22,280 | |
| II. | Physical contingency (20%) | | | | | 4,460 | |
| **Total for 6 units** | | | **6** | | | **26,740** | **3,200** |
| **Total for 10 units** | | | **10** | | | **44,567** | **5,330** |
| **Total for 1 unit** | | | **1** | | | **4,457** | **530** |
| **(2)** | **Alternatives for securing function of intake** | | | | | | |
| **1)** | **Modification of existing intake** | | | | | | |
| I. | Permanent works | | | | | | |
| [1] | Intake tower | | | | | 1,590 | |
| /1 | Concrete | m3 | 3,600 | 113 | 410 | | |
| /2 | Reinforcing bar | t | 180 | 813 | 150 | | |
| /3 | Gate, roller | t | 80 | 9,800 | 780 | | |
| /4 | Screen | t | 53 | 4,750 | 250 | | |
| [2] | Sub-total, [1] to [1] | | | | | 1,590 | |
| [3] | Other works (50%) | | | | | 800 | |
| [4] | Sub-total, [2] to [3] | | | | | 2,390 | |
| II. | Temporary works (10%) | | | | | 240 | |
| III. | Sub-total, I.+II. | | | | | 2,630 | |
| IV. | Physical contingency (20%) | | | | | 530 | |
| **Total for 1) Modification of existing intake** | | | | | | **3,160** | **380** |

## Table 1.4.2 Estimate of Work Cost (3/4)

Price level: Dec. 2005; US$ 1.0= Y 119.63

| No. | Alternatives | Unit | Q'ty | Rate | Amount | | equivalent |
|---|---|---|---|---|---|---|---|
| | | | | (US$) | (US$, thousand) | | (Y, million) |
| **2)** | **Relocation of intake** | | | | | | |
| I. | Permanent works | | | | | | |
| [1] | Tunnel works | | | | | 2,750 | |
| /1 | Excavation, tunnel | m3 | 9,760 | 67 | 650 | | |
| /2 | Support, tunnel | m | 574 | 1,820 | 1,040 | | |
| /3 | Concrete, lining | m3 | 8,375 | 127 | 1,060 | | |
| [2] | Intake tower | | | | | 1,690 | |
| /1 | Concrete | m3 | 5,800 | 113 | 660 | | |
| /2 | Reinforcing bar | t | 290 | 813 | 240 | | |
| /3 | Gate, roller | t | 60 | 9,800 | 590 | | |
| /4 | Screen | t | 42 | 4,750 | 200 | | |
| [3] | Sub-total, [1] to [2] | | | | | 4,440 | |
| [4] | Other works (50%) | | | | | 2,220 | |
| [5] | Sub-total, [3] to [4] | | | | | 6,660 | |
| II. | Temporary works (10%) | | | | | 670 | |
| III. | Sub-total, I.+II. | | | | | 7,330 | |
| IV. | Physical contingency (20%) | | | | | 1,470 | |
| **Total for 2) Relocation of intake** | | | | | | **8,800** | **1,050** |
| **3)** | **Garbage trapping structure at existing intake** | | | | | | |
| I. | Permanent works | | | 1,360 | | | |
| [1] | Intake tower | | | | | 1,850 | |
| /1 | Concrete, for front base | m3 | 2,175 | 113 | 250 | | |
| /2 | Concrete, for bridge | m3 | 730 | 113 | 80 | | |
| /3 | Reinforcing bar | t | 145 | 813 | 120 | | |
| /4 | Steel pile, D1,000, for bridge | t | 90 | 1,400 | 130 | | |
| /5 | Screen | t | 267 | 4,750 | 1,270 | | |
| [2] | Sub-total, [1] to [1] | | | | | 1,850 | |
| [3] | Other works (50%) | | | | | 930 | |
| [4] | Sub-total, [2] to [3] | | | | | 2,780 | |
| II. | Temporary works (10%) | | | | | 280 | |
| III. | Sub-total, I.+II. | | | | | 3,060 | |
| IV. | Physical contingency (20%) | | | | | 610 | |
| **Total for 3) Garbage trapping structure at existing intake** | | | | | | **3,670** | **440** |
| **4)** | **Garbage trapping weir in Keduang River** | | | | | | |
| I. | Permanent works | | | | | | |
| [1] | Weir at Keduang | | | | | 690 | |
| /1 | Excavation | m3 | 23,710 | 3 | 70 | | |
| /2 | Concrete | m3 | 4,140 | 113 | 470 | | |
| /3 | Steel trap | t | 32 | 4,750 | 150 | | |
| [2] | Sub-total, [1] to [1] | | | | | 690 | |
| [3] | Other works (50%) | | | | | 350 | |
| [4] | Sub-total, [2] to [3] | | | | | 1,040 | |
| II. | Temporary works (10%) | | | | | 100 | |
| III. | Sub-total, I.+II. | | | | | 1,140 | |
| IV. | Physical contingency (20%) | | | | | 230 | |
| **Total for 4) Garbage trapping weir in Keduang River** | | | | | | **1,370** | **160** |
| **5)** | **Siphon dredging** | | | | | | |
| I. | Equipment | | | | | | |
| [1] | Siphon type dredger | nr. | 1 | 1,917,000 | 1,920 | 1,920 | |
| [2] | Sub-total, [1] to [1] | | | | | 1,920 | |
| [3] | Other equipment (25%) | | | | | 480 | |
| [4] | Sub-total, [2] to [3] | | | | | 2,400 | |
| II. | Physical contingency (20%) | | | | | 480 | |
| **Total for 5) Siphon dredging** | | | | | | **2,880** | **340** |

## Table 1.4.2 Estimate of Work Cost (4/4)

Price level: Dec. 2005; US$ 1.0= Y 119.63

| No. | Alternatives | Unit | Q'ty | Rate | Amount | equivalent |
|---|---|---|---|---|---|---|
| | | | | (US$) | (US$, thousand) | (Y, million) |
| **(3)** | **Watershed conservation** | | | | | |
| **1)** | **Watershed conservation works** | | | | | |
| I. | Land preparation | | | | | |
| [1] | Terracing | | | | | |
| /1 | Cutting and filling | m3 | 22,224,000 | 0.69 | 15,335 | |
| [2] | Waterway and drop | | | | | |
| /1 | Stone material | m3 | 164,000 | 8.48 | 1,391 | |
| /2 | Excavation | m3 | 191,000 | 0.58 | 111 | |
| /3 | Masonry work | m3 | 149,000 | 10.64 | 1,585 | |
| [3] | Lip and rizer, planting | | | | | |
| /1 | Seedling, grass, for lip | nr. | 304,731,000 | 0.01 | 3,047 | |
| /2 | Seedling, shrub, for lip | nr. | 18,284,000 | 0.07 | 1,280 | |
| /3 | Seedling, grass, for riser | nr. | 432,330,000 | 0.0015 | 648 | |
| /4 | Planting work, for lip | m | 91,420,000 | 0.01 | 914 | |
| /5 | Planting work, for riser | m2 | 86,466,000 | 0.02 | 1,729 | |
| II. | Side ditches (housing yard) | | | | | |
| [1] | Side ditch | | | | | |
| /1 | Stone material | m3 | 37,000 | 8.48 | 314 | |
| /2 | Excavation | m3 | 53,000 | 0.58 | 31 | |
| /3 | Masonry work | m3 | 33,000 | 10.64 | 351 | |
| [2] | Hedge row | | | | | |
| /1 | Shrub, for hedge row | nr. | 8,346,000 | 0.07 | 584 | |
| /2 | Planting work | m2 | 1,043,000 | 0.02 | 21 | |
| III. | Agro-forestry and annual crop | | | | | |
| [1] | Agro-forestry and annual crop | L.S | | | 10,093 | |
| IV. | Support program | | | | | |
| [1] | Support program | L.S | | | 1,254 | |
| | Sub-total, I. to IV. | | | | 38,688 | |
| V. | Physical contingency (10%) | | | | 3,870 | |
| **Total for 1) Watershed conservation works** | | | | | **42,558** | **5,090** |

Source: JICA Study Team

## Table 1.4.3 Cost Breakdown by Work-type

| Code | Alternatives | Civil works | Metal works | Equipment | Terrace improvement | Total |
|---|---|---|---|---|---|---|
| | | (US$, tho.) | (US$, tho.) | (US$, tho.) | (US$, tho.) | (US$, tho.) |
| **100** | **Alternatives for reducing sediment deposition** | | | | | |
| 101 | Keduang sediment bypass | 82,370 | 570 | 0 | 0 | **82,940** |
| 102 | Sediment sluicing by new gates | 23,110 | 12,520 | 0 | 0 | **35,630** |
| 103 | Sediment storage reservoir with new gates in reservoir | 34,570 | 12,520 | 0 | 0 | **47,090** |
| 104 | Sediment storage dam for sediment removal | 225,460 | 0 | 0 | 0 | **225,460** |
| 105 | Dry excavation in reservoir | 0 | 0 | 287,990 | 0 | **287,990** |
| 106 | Hydraulic dredging in reservoir | 0 | 0 | 44,567 | 0 | **44,567** |
| **200** | **Alternatives for securing function of intake** | | | | | |
| 201 | Modification of existing intake | 1,110 | 2,050 | 0 | 0 | **3,160** |
| 202 | Relocation of intake | 7,230 | 1,570 | 0 | 0 | **8,800** |
| 203 | Garbage trapping structure at existing intake | 1,150 | 2,520 | 0 | 0 | **3,670** |
| 204 | Garbage trapping weir in Keduang River | 1,370 | 0 | 0 | 0 | **1,370** |
| 205 | Siphon dredging | 0 | 0 | 2,880 | 0 | **2,880** |
| **300** | **Watershed conservation** | | | | | |
| 301 | Watershed conservation works | 0 | 0 | 0 | 42,558 | **42,558** |

Source: JICA Study Team

# Table 1.5.1 Estimate of Operation and Maintenance Cost (1/3)

**[A] Base data**

| Code | Alternatives | Construc-tion cost | Breakdown | | | |
|---|---|---|---|---|---|---|
| | | | Earth-works | Concrete works | Metal works | Equipment |
| | | (US$, tho.) | (US$, tho.) | (US$, tho.) | (US$, tho.) | (US$, tho.) |
| **100** | **Alternatives for reducing sediment deposition** | | | | | |
| 101 | Keduang sediment bypass | 82,940 | 27,700 | 54,670 | 570 | - |
| 102 | Sediment sluicing by new gates | 35,630 | 6,930 | 16,180 | 12,520 | - |
| 103 | Sediment storage reservoir with new gates in reservoir | 47,090 | 7,490 | 16,510 | 23,090 | - |
| 104 | Sediment storage dam for sediment removal | 225,460 | 11,350 | 214,110 | - | - |
| 105 | Dry excavation in reservoir | 287,990 | - | - | - | 287,990 |
| 106 | Hydraulic dredging in reservoir | 44,567 | - | 17 | - | 44,550 |
| **200** | **Alternatives for securing function of intake** | | | | | |
| 201 | Modification of existing intake | 3,160 | - | 1,110 | 2,050 | - |
| 202 | Relocation of intake | 8,800 | 1,290 | 5,940 | 1,570 | - |
| 203 | Garbage trapping structure at existing intake | 3,670 | - | 890 | 2,780 | - |
| 204 | Garbage trapping weir in Keduang River | 1,370 | 140 | 930 | 300 | - |
| 205 | Siphon dredging | 2,880 | - | - | - | 2,880 |
| **300** | **Watershed conservation** | | | | | |
| 301 | Watershed conservation works | 42,558 | 42,558 | - | - | - |

**[B] Expected lifetime**

| Code | Alternatives | Earth-works | Concrete works | Metal works | Equipment | |
|---|---|---|---|---|---|---|
| | | (year) | (year) | (year) | (year) | |
| **100** | **Alternatives for reducing sediment deposition** | | | | | |
| 101 | Keduang sediment bypass | 20 | 50 | 25 | - | |
| 102 | Sediment sluicing by new gates | 20 | 50 | 25 | - | |
| 103 | Sediment storage reservoir with new gates in reservoir | 20 | 50 | 25 | - | |
| 104 | Sediment storage dam for sediment removal | 20 | 50 | 25 | - | |
| 105 | Dry excavation in reservoir | - | - | - | 17 | /*1 |
| 106 | Hydraulic dredging in reservoir | - | - | - | 27 | /*2 |
| **200** | **Alternatives for securing function of intake** | | | | | |
| 201 | Modification of existing intake | 20 | 50 | 25 | - | |
| 202 | Relocation of intake | 20 | 50 | 25 | - | |
| 203 | Garbage trapping structure at existing intake | 20 | 50 | 25 | - | |
| 204 | Garbage trapping weir in Keduang River | 20 | 50 | 25 | - | |
| 205 | Siphon dredging | - | - | - | 27 | /*3 |
| **300** | **Watershed conservation** | | | | | |
| 301 | Watershed conservation works | 20 | 50 | 25 | - | |

Note: *1: Value of 'Kensetsu Kikai-tou Sonryou-hyou, 2005' (Japan Construction Mechanization Association); 11 multiplied by 1.5.
*2: Value of 'Kensetsu Kikai-tou Sonryou-hyou, 2005' (Japan Construction Mechanization Association); 18 multiplied by 1.5.
*3: The same value as *2 is adopted.

**[C] Maintenance and repair rate through life**

| Code | Alternatives | Earth-works | Concrete works | Metal works | Equipment | |
|---|---|---|---|---|---|---|
| | | (%) | (%) | (%) | (%) | |
| **100** | **Alternatives for reducing sediment deposition** | | | | | |
| 101 | Keduang sediment bypass | 75 | 50 | 50 | - | |
| 102 | Sediment sluicing by new gates | 75 | 50 | 50 | - | |
| 103 | Sediment storage reservoir with new gates in reservoir | 75 | 50 | 50 | - | |
| 104 | Sediment storage dam for sediment removal | 75 | 50 | 50 | - | |
| 105 | Dry excavation in reservoir | - | - | - | 30 | /*1 |
| 106 | Hydraulic dredging in reservoir | - | - | - | 100 | /*2 |
| **200** | **Alternatives for securing function of intake** | | | | | |
| 201 | Modification of existing intake | 75 | 50 | 50 | - | |
| 202 | Relocation of intake | 75 | 50 | 50 | - | |
| 203 | Garbage trapping structure at existing intake | 75 | 50 | 50 | - | |
| 204 | Garbage trapping weir in Keduang River | 75 | 50 | 50 | - | |
| 205 | Siphon dredging | - | - | - | 100 | /*3 |
| **300** | **Watershed conservation** | | | | | |
| 301 | Watershed conservation works | 75 | 50 | 50 | - | |

Note: *1: Value of 'Kensetsu Kikai-tou Sonryou-hyou, 2005' (Japan Construction Mechanization Association); 40% multiplied by 0.75, considering the difference in labor wage.
*2: Value of 'Kensetsu Kikai-tou Sonryou-hyou, 2005' (Japan Construction Mechanization Association); 135% multiplied by 0.75.
*3: The same value as *2 is adopted.

**[D] Maintenance and repair rate cost (per annum)**

| Code | Alternatives | Mainte., total | Earth-works | Concrete works | Metal works | Equipment |
|---|---|---|---|---|---|---|
| | | (US$) | (US$, tho.) | (US$, tho.) | (US$, tho.) | (US$, tho.) |
| **100** | **Alternatives for reducing sediment deposition** | | | | | |
| 101 | Keduang sediment bypass | 1,597,000 | 1,039 | 547 | 11 | - |
| 102 | Sediment sluicing by new gates | 672,000 | 260 | 162 | 250 | - |
| 103 | Sediment storage reservoir with new gates in reservoir | 908,000 | 281 | 165 | 462 | - |
| 104 | Sediment storage dam for sediment removal | 2,567,000 | 426 | 2,141 | - | - |
| 105 | Dry excavation in reservoir | 5,082,000 | - | - | - | 5,082 |
| 106 | Hydraulic dredging in reservoir | 1,650,000 | - | - | - | 1,650 |
| **200** | **Alternatives for securing function of intake** | | | | | |
| 201 | Modification of existing intake | 52,000 | - | 11 | 41 | - |
| 202 | Relocation of intake | 138,000 | 48 | 59 | 31 | - |
| 203 | Garbage trapping structure at existing intake | 65,000 | - | 9 | 56 | - |
| 204 | Garbage trapping weir in Keduang River | 20,000 | 5 | 9 | 6 | - |
| 205 | Siphon dredging | 107,000 | - | - | - | 107 |
| **300** | **Watershed conservation** | | | | | |
| 301 | Watershed conservation works | 1,596,000 | 1,596 | - | - | - |

Note: - [D]= [A] x [C]/100 / [B]

# Table 1.5.1 Estimate of Operation and Maintenance Cost (2/3)

**[E] Operation cost (energy consumption, per annum)**

| Code | Equipment | Rated power (kW) | Fuel consump. (L/kW/hr) | Yearly ope. hr/*3 (hr) | Yearly consump. (L) | Operation cost/*1 (US$) | |
|---|---|---|---|---|---|---|---|
| **100** | **Alternatives for reducing sediment deposition** | | | | | | |
| 101 | Keduang sediment bypass | - | - | - | - | - | |
| 102 | Sediment sluicing by new gates | - | - | - | - | - | |
| 103 | Sediment storage reservoir with new gates in reservoir | - | - | - | - | - | |
| 104 | Sediment storage dam for sediment removal | | | | | | |
| | Bulldozer, 4t, swamp | 34 | 0.175 | 384,615 | 2,288,459 | 1,258,700 | /*2 |
| | Crawler loader, 2.3m3 | 151 | 0.175 | 14,286 | 377,508 | 207,600 | /*2 |
| | Dump truck, 10t (hauling= 15km) | 246 | 0.050 | 250,000 | 3,075,000 | 1,691,300 | /*2 |
| | | | | Sub-total for 104 | | 3,157,600 | |
| 105 | Dry excavation in reservoir | | | | | | |
| | Bulldozer, 4t, swamp | 34 | 0.175 | 769,231 | 4,576,924 | 2,517,300 | /*2 |
| | Crawler loader, 2.3m3 | 151 | 0.175 | 2,857 | 75,496 | 41,500 | /*2 |
| | Dump truck, 10t (hauling= 2km) | 246 | 0.050 | 16,667 | 205,004 | 112,800 | /*2 |
| | | | | Sub-total for 105 | | 2,671,600 | |
| 106 | Hydraulic dredging in reservoir | | | | | | |
| | (around intake) | | | | | | |
| | Cutter-suction dredger, 600PS | 441 | 0.381 | 9,174 | 1,541,425 | 610,400 | /*3 |
| | (upstream reservoir area) | | | | | | |
| | Cutter-suction dredger, 600PS | 441 | 0.381 | - | - | - | /*3 |
| | Booster pump | 441 | 0.381 | - | - | - | /*3 |
| | | | | Sub-total for 106 | | 610,400 | |
| **200** | **Alternatives for securing function of intake** | | | | | | |
| 201 | Modification of existing intake | - | - | - | - | - | |
| | Backhoe, 0.6m3 | 74 | 0.175 | 33 | 427 | 200 | /*2 |
| | Dump truck, 10t (hauling= 2km) | 246 | 0.050 | 83 | 1,021 | 600 | /*2 |
| | | | | Sub-total for 201 | | 800 | |
| 202 | Relocation of intake | - | - | - | - | - | |
| | Backhoe, 0.6m3 | 74 | 0.175 | 33 | 427 | 200 | /*2 |
| | Dump truck, 10t (hauling= 2km) | 246 | 0.050 | 83 | 1,021 | 600 | /*2 |
| | | | | Sub-total for 202 | | 800 | |
| 203 | Garbage trapping structure at existing intake | | | | | | |
| | Backhoe, 0.6m3 | 74 | 0.175 | 33 | 427 | 200 | /*2 |
| | Dump truck, 10t (hauling= 2km) | 246 | 0.050 | 83 | 1,021 | 600 | /*2 |
| | | | | Sub-total for 203 | | 800 | |
| 204 | Garbage trapping weir in Keduang River | | | | | | |
| | Backhoe, 0.6m3 | 74 | 0.175 | 33 | 427 | 200 | /*2 |
| | Dump truck, 10t (hauling= 2km) | 246 | 0.050 | 83 | 1,021 | 600 | /*2 |
| | | | | Sub-total for 204 | | 800 | |
| 205 | Siphon dredging | | | | | | |
| | Generator, 10kVA (for siphon pump and agitator) | 13 | 0.170 | 183 | 404 | 200 | /*2 |
| | | | | Sub-total for 205 | | 200 | |
| **300** | **Watershed conservation** | | | | | | |
| 301 | Watershed conservation works | - | - | - | - | - | |

Note:

*1: The rate of 10% is added to the amount for lubricant and others.

| Fuel | Price (Rp./L) | Exch. rate (Rp./US$) | Price (US$/L) |
|---|---|---|---|
| *2: Light oil (diesel) | 5,020 | 10,035 | 0.50 |
| *3: Heavy oil | 3,595 | 10,035 | 0.36 |

*4: computed below

| Code | Equipment | Hourly production | Yearly work q'ty | Yearly ope. hr |
|---|---|---|---|---|
| 101 | Keduang sediment bypass | | | |
| | Roller gate | negligible small | (Nil) | (Nil) |
| 102 | Sediment sluicing by new gates | | | |
| | Radial gate | negligible small | (Nil) | (Nil) |
| 103 | Sediment storage reservoir with new gates in reservoir | | | |
| | Radial gate | negligible small | (Nil) | (Nil) |
| 104 | Sediment storage dam for sediment removal | | | |
| | Bulldozer, 4t, swamp | 3 | 1,000,000 | 384,615 |
| | Crawler loader, 2.3m3 | 70 | 1,000,000 | 14,286 |
| | Dump truck, 10t (hauling= 15km) | 4 | 1,000,000 | 250,000 |
| 105 | Dry excavation in reservoir | | | |
| | Bulldozer, 4t, swamp | 3 | 2,000,000 | 769,231 |
| | Crawler loader, 2.3m3 | 70 | 200,000 | 2,857 |
| | Dump truck, 10t (hauling= 2km) | 12 | 200,000 | 16,667 |
| 106 | Hydraulic dredging in reservoir | | | |
| | (around intake) | | | |
| | Cutter-suction dredger, 600PS | 109 | 1,000,000 | 9,174 |
| | (upstream reservoir area) | | Discharge pipe L (m) | |
| | Cutter-suction dredger, 600PS | 70 | - 5,000 | - |
| | Booster pump | 70 | - | - |
| 201 | Modification of existing intake | | | |
| | Roller gate | negligible small | (Nil) | (Nil) |
| | Backhoe, 0.6m3 | 30 | 1,000 | 33 |
| | Dump truck, 10t (hauling= 2km) | 12 | 1,000 | 83 |
| 202 | Relocation of intake | | | |
| | Roller gate | negligible small | (Nil) | (Nil) |
| | Backhoe, 0.6m3 | 30 | 1,000 | 33 |
| | Dump truck, 10t (hauling= 2km) | 12 | 1,000 | 83 |
| 203 | Garbage trapping structure at existing intake | | | |
| | Backhoe, 0.6m3 | 30 | 1,000 | 33 |
| | Dump truck, 10t (hauling= 2km) | 12 | 1,000 | 83 |
| 204 | Garbage trapping weir in Keduang River | | | |
| | Backhoe, 0.6m3 | 30 | 1,000 | 33 |
| | Dump truck, 10t (hauling= 2km) | 12 | 1,000 | 83 |
| 205 | Siphon dredging | | | |
| | Generator, 10kVA (for siphon pump and agitator) | 546 | 100,000 | 183 |
| 301 | Watershed conservation works | | | |
| | (Nil) | (Nil) | (Nil) | (Nil) |

# Table 1.5.1 Estimate of Operation and Maintenance Cost (3/3)

**[F] Operation and maintenance cost (per annum)**

| Code | Alternatives | Operation cost | Maintenance cost | Total O&M cost | Yearly production | O&M cost per m3 | |
|---|---|---|---|---|---|---|---|
| | | (US$) | (US$) | (US$) | (m3) | (US$) | |
| **100** | **Alternatives for reducing sediment deposition** | | | | | | |
| 101 | Keduang sediment bypass | - | 1,597,000 | **1,597,000** | 692,000 | 2.3 | /*1 |
| 102 | Sediment sluicing by new gates | - | 672,000 | **672,000** | 557,670 | 1.2 | /*1 |
| 103 | Sediment storage reservoir with new gates in reservoir | - | 908,000 | **908,000** | 458,290 | 2.0 | /*1 |
| 104 | Sediment storage dam for sediment removal | 3,157,600 | 2,567,000 | **5,724,600** | 1,000,000 | 5.7 | /*1 |
| 105 | Dry excavation in reservoir | 2,671,600 | 5,082,000 | **7,753,600** | 2,000,000 | 3.9 | /*1 |
| 106 | Hydraulic dredging in reservoir | 610,400 | 1,650,000 | **2,260,400** | 1,000,000 | 2.3 | /*1 |
| **200** | **Alternatives for securing function of intake** | | | | | | |
| 201 | Modification of existing intake | 800 | 52,000 | **52,800** | 1,000 | 52.8 | /*2 |
| 202 | Relocation of intake | 800 | 138,000 | **138,800** | 1,000 | 138.8 | /*2 |
| 203 | Garbage trapping structure at existing intake | 800 | 65,000 | **65,800** | 1,000 | 65.8 | /*2 |
| 204 | Garbage trapping weir in Keduang River | 800 | 20,000 | **20,800** | 1,000 | 20.8 | /*2 |
| 205 | Siphon dredging | 200 | 107,000 | **107,200** | 100,000 | 1.1 | /*1 |
| **300** | **Watershed conservation** | | | | | | |
| 301 | Watershed conservation works | - | 1,596,000 | **1,596,000** | 1,410,000 | 1.1 | /*3 |

Note: - [F]= [D] + [E]
*1: for 'yearly production', Quantity of sediment to be evacuated
*2: for 'yearly production', Quantity of debris (garbage) to be evacuated
*3: for 'yearly production', Quantity of deductive sediment to be deposited (8,067,000t x 18.6% /1.064= 1,410,000m3)

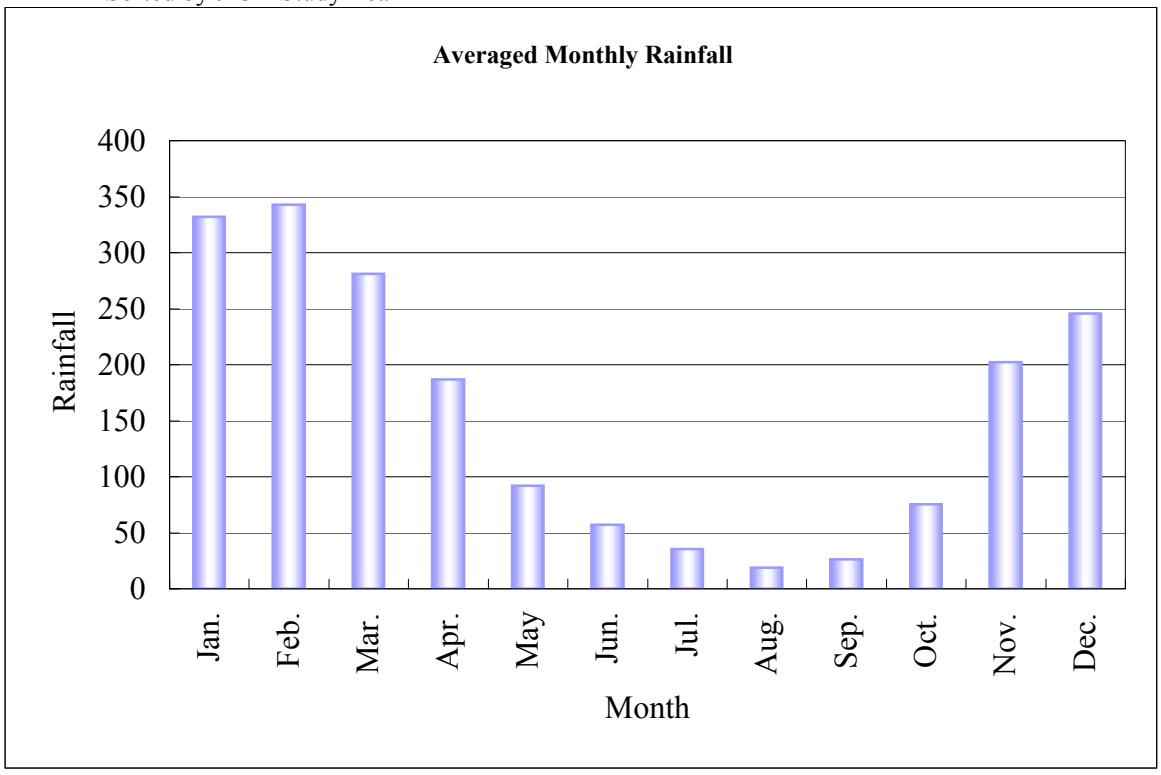
Source: JICA Study Team

## Table 2.3.2 Monthly Rainfall

Observatory: Waduk Krisak peng Skat 34, Wonogiri, Indonesia (Unit: mm)

| Year | Jan. | Feb. | Mar. | Apr. | May | Jun. | Jul. | Aug. | Sep. | Oct. | Nov. | Dec. | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1980 | 299 | 394 | 253 | 320 | 38 | 0 | 29 | 42 | 0 | 0 | 191 | 229 | 1,795 |
| 1981 | 354 | 260 | 391 | 171 | 105 | 65 | 63 | 25 | 45 | 206 | 180 | 156 | 2,021 |
| 1982 | 353 | 336 | 141 | 226 | 0 | 0 | 0 | 0 | 0 | 0 | 26 | 279 | 1,361 |
| 1983 | 319 | 195 | 276 | 117 | 254 | 25 | 0 | 0 | 0 | 155 | 218 | 195 | 1,754 |
| 1984 | 521 | 443 | 240 | 301 | 47 | 30 | 40 | 0 | 220 | 28 | 173 | 262 | 2,305 |
| 1986 | 381 | 220 | 290 | 102 | 50 | 94 | 1 | 0 | 72 | 44 | 304 | 102 | 1,660 |
| 1987 | 474 | 301 | 160 | 0 | 89 | 27 | 14 | 0 | 0 | 0 | 178 | 102 | 1,345 |
| 1988 | 235 | 330 | 315 | 160 | 303 | 105 | 0 | 0 | 7 | 71 | 369 | 413 | 2,308 |
| 1989 | 350 | 355 | 104 | 84 | 207 | 191 | 216 | 23 | 0 | 23 | 121 | 264 | 1,938 |
| 1992 | 452 | 470 | 315 | 271 | 79 | 125 | 0 | 181 | 81 | 198 | 245 | 206 | 2,623 |
| 1993 | 284 | 334 | 257 | 343 | 77 | 21 | 0 | 3 | 0 | 0 | 235 | 335 | 1,889 |
| 1994 | 352 | 289 | 519 | 125 | 0 | 0 | 2 | 0 | 0 | 10 | 203 | 214 | 1,714 |
| 1995 | 430 | 558 | 252 | 111 | 37 | 177 | 69 | 0 | 10 | 100 | 402 | 163 | 2,309 |
| 1996 | 404 | 243 | 331 | 76 | 12 | 18 | 0 | 63 | 0 | 147 | 216 | 272 | 1,782 |
| 1997 | 329 | 233 | 108 | 302 | 21 | 0 | 0 | 0 | 0 | 22 | 106 | 177 | 1,298 |
| 1998 | 88 | 286 | 361 | 258 | 138 | 160 | 243 | 19 | 69 | 219 | 45 | 277 | 2,163 |
| 1999 | 168 | 352 | 369 | 145 | 40 | 18 | 0 | 0 | 0 | 152 | 287 | 432 | 1,963 |
| 2000 | 197 | 371 | 368 | 381 | 149 | 15 | 0 | 0 | 0 | 0 | 217 | 269 | 1,967 |
| 2003 | 315 | 548 | 293 | 60 | 103 | 10 | 0 | 0 | 0 | 60 | 126 | 327 | 1,842 |
| Average | 332 | 343 | 281 | 187 | 92 | 57 | 36 | 19 | 27 | 76 | 202 | 246 | 1,897 |

Source: Daily precipitation data of 1980-2003, except 1985, 1990, 1991, 2001 and 2002 (data of 19 years) at Waduk Krisak peng Skat 34, Wonogiri, Indonesia
Sorted by JICA Study Team



## Table 2.3.4 Sundays and National Holidays in Indonesia

| Month | No. | Date | Name of holiday | Number of Sundays and National holidays | |
|---|---|---|---|---|---|
| January | 1. | 1 Sat. | - Tahun Baru | 1 | |
| | | 21 Fri. | - Idul Adha 1425 H | 1 | |
| | | | - Other Sundays | 5 | |
| | | | Sub-total for January | | 7 |
| February | 2. | 9 Wed. | - Tahun Baru Imlek 2556 | 1 | |
| | 3. | 10 Thu. | - Tahun Baru 1426 H | 1 | |
| | | | - Other Sundays | 4 | |
| | | | Sub-total for February | | 6 |
| March | 4. | 11 Fri. | - Hari Raya Nyepi | 1 | |
| | 5. | 25 Fri. | - Wafat Yesus Kristus | 1 | |
| | | | - Other Sundays | 4 | |
| | | | Sub-total for March | | 6 |
| April | 6. | 22 Fri. | - Maulid Nabi Muhammad S.A.W. | 1 | |
| | | | - Other Sundays | 4 | |
| | | | Sub-total for April | | 5 |
| May | 7. | 5 Thu. | - Kenaikan Yesus Kristus | 1 | |
| | 8. | 24 Tue. | - Hari Raya Waisak | 1 | |
| | | | - Other Sundays | 5 | |
| | | | Sub-total for May | | 7 |
| June | | | No National holiday | 0 | |
| | | | - Other Sundays | 4 | |
| | | | Sub-total for June | | 4 |
| July | | | No National holiday | 0 | |
| | | | - Other Sundays | 5 | |
| | | | Sub-total for July | | 5 |
| August | 9. | 17 Wed. | - Hari Kemerdekaan RI | 1 | |
| | | | - Other Sundays | 4 | |
| | | | Sub-total for August | | 5 |
| September | 10. | 2 Fri. | - Isa Mi raj Nabi Muhammad S.A.W. | 1 | |
| | | | - Other Sundays | 4 | |
| | | | Sub-total for September | | 5 |
| October | | | No National holiday | 0 | |
| | | | - Other Sundays | 5 | |
| | | | Sub-total for October | | 5 |
| November | 11. | 3 Thu. | - Idul Fitri 1 Syawai 1426 H | 1 | |
| | 12. | 4 Fri. | - Idul Fitri 1 Syawai 1426 H | 1 | |
| | | | - Other Sundays | 4 | |
| | | | Sub-total for November | | 6 |
| December | 13. | 25 (Sun.) | - Hari Raya Natal | 1 | |
| | | | - Other Sundays | 3 | |
| | | | Sub-total for December | | 4 |
| **Total** | | | | | **65** |

Note: - The above are based on a calender 2005.
Source: JICA Study Team

# Table 2.3.5 Rainy Days by Precipitation (1/5)

Observatory: Waduk Krisak peng Skat 34, Wonogiri, Indonesia (Unit: mm)

1980

| Date | Jan. | Feb. | Mar. | Apr. | May | Jun. | Jul. | Aug. | Sep. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 52 | 3 | 0 | 25 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | 7 | 0 | 0 | 30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3 | 5 | 20 | 30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 17 | 0 |
| 4 | 0 | 20 | 0 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 25 |
| 5 | 0 | 70 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 |
| 6 | 0 | 67 | 3 | 10 | 35 | 0 | 0 | 0 | 0 | 0 | 0 | 6 |
| 7 | 0 | 0 | 0 | 42 | 3 | 0 | 14 | 0 | 0 | 0 | 10 | 0 |
| 8 | 50 | 0 | 0 | 45 | 0 | 0 | 0 | 35 | 0 | 0 | 2 | 0 |
| 9 | 5 | 0 | 0 | 35 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10 | 28 | 40 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 0 |
| 11 | 0 | 6 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 |
| 12 | 0 | 21 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 13 | 26 | 3 | 0 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 57 |
| 14 | 0 | 9 | 10 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 27 | 0 |
| 15 | 0 | 13 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16 | 0 | 0 | 0 | 50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 17 | 0 | 0 | 70 | 3 | 0 | 0 | 0 | 7 | 0 | 0 | 15 | 0 |
| 18 | 0 | 10 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 19 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 20 | 0 |
| 21 | 35 | 15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22 | 0 | 55 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 |
| 23 | 5 | 0 | 0 | 10 | 0 | 0 | 15 | 0 | 0 | 0 | 0 | 22 |
| 24 | 7 | 16 | 40 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 15 | 17 |
| 25 | 0 | 10 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 |
| 26 | 28 | 0 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 15 | 0 |
| 27 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 20 | 0 |
| 28 | 8 | 16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 |
| 29 | 19 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 55 |
| 30 | 24 | | 65 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 22 | 0 |
| 31 | 0 | | 0 | | 0 | | 0 | 0 | | 0 | | 42 |
| Total | 299 | 394 | 253 | 320 | 38 | 0 | 29 | 42 | 0 | 0 | 191 | 229 |
| Total of year | | | | | | | | | | | | 1,795 |

**Precipitation** — **Numbers of days**

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0mm | 17 | 12 | 22 | 13 | 29 | 30 | 29 | 29 | 30 | 31 | 15 | 23 |
| 0<p<2mm | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2≦p<5mm | 0 | 2 | 1 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| 5≦p<10mm | 6 | 2 | 1 | 2 | 0 | 0 | 0 | 1 | 0 | 0 | 3 | 2 |
| 10≦p<20mm | 1 | 6 | 2 | 3 | 0 | 0 | 2 | 0 | 0 | 0 | 6 | 1 |
| 20≦p<30mm | 4 | 3 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 2 |
| 30≦p<50mm | 1 | 1 | 2 | 4 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| over50mm | 2 | 3 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| Total | 31 | 29 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 |

Note: Data: 1980~2003, except 1985, 1990, 1991, 2001 and 2002 (19 years)
Source: JICA Study Team

Observatory: Waduk Krisak peng Skat 34, Wonogiri, Indonesia (Unit: mm)

1981

| Date | Jan. | Feb. | Mar. | Apr. | May | Jun. | Jul. | Aug. | Sep. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 5 | 0 | 10 | 0 | 0 | 2 | 0 | 0 | 65 | 0 | 0 |
| 2 | 0 | 0 | 5 | 5 | 2 | 0 | 0 | 0 | 10 | 0 | 0 | 0 |
| 3 | 7 | 15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 4 | 0 | 47 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 15 |
| 5 | 10 | 22 | 75 | 0 | 5 | 0 | 0 | 0 | 0 | 58 | 10 | 10 |
| 6 | 5 | 15 | 32 | 0 | 22 | 0 | 5 | 0 | 0 | 10 | 0 | 0 |
| 7 | 0 | 0 | 20 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 |
| 8 | 27 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 |
| 9 | 0 | 0 | 47 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 17 |
| 10 | 5 | 25 | 71 | 0 | 7 | 0 | 10 | 0 | 0 | 0 | 0 | 37 |
| 11 | 0 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 22 | 25 | 0 |
| 12 | 0 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 0 |
| 13 | 15 | 0 | 3 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 |
| 14 | 36 | 0 | 0 | 0 | 25 | 0 | 10 | 0 | 0 | 0 | 5 | 0 |
| 15 | 3 | 0 | 25 | 0 | 0 | 0 | 25 | 0 | 0 | 0 | 0 | 0 |
| 16 | 0 | 37 | 0 | 17 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 |
| 17 | 30 | 0 | 0 | 50 | 22 | 0 | 0 | 0 | 0 | 0 | 33 | 0 |
| 18 | 0 | 0 | 7 | 5 | 22 | 0 | 3 | 0 | 0 | 0 | 0 | 0 |
| 19 | 30 | 13 | 20 | 17 | 0 | 19 | 0 | 0 | 0 | 0 | 0 | 0 |
| 20 | 15 | 0 | 15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 21 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 25 | 0 | 0 | 0 | 12 |
| 22 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23 | 17 | 7 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 10 | 0 |
| 24 | 0 | 17 | 0 | 0 | 0 | 18 | 0 | 0 | 0 | 40 | 15 | 0 |
| 25 | 0 | 0 | 0 | 33 | 0 | 0 | 0 | 0 | 10 | 11 | 0 | 0 |
| 26 | 9 | 0 | 3 | 17 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 25 |
| 27 | 15 | 0 | 15 | 0 | 0 | 18 | 0 | 0 | 0 | 0 | 0 | 0 |
| 28 | 50 | 57 | 12 | 10 | 0 | 0 | 0 | 0 | 25 | 0 | 10 | 0 |
| 29 | 0 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30 | 0 | | 25 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 60 | 21 |
| 31 | 75 | | 3 | | 0 | | 0 | 0 | | 0 | | 9 |
| Total | 354 | 260 | 391 | 171 | 105 | 65 | 63 | 25 | 45 | 206 | 180 | 156 |
| Total of year | | | | | | | | | | | | 2,021 |

**Precipitation** — **Numbers of days**

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0mm | 14 | 17 | 13 | 20 | 24 | 25 | 23 | 30 | 27 | 25 | 20 | 22 |
| 0<p<2mm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2≦p<5mm | 1 | 0 | 3 | 0 | 1 | 0 | 3 | 0 | 0 | 0 | 0 | 0 |
| 5≦p<10mm | 5 | 2 | 4 | 3 | 2 | 2 | 2 | 0 | 0 | 0 | 3 | 1 |
| 10≦p<20mm | 5 | 4 | 3 | 5 | 0 | 3 | 2 | 0 | 2 | 2 | 4 | 5 |
| 20≦p<30mm | 1 | 2 | 4 | 0 | 4 | 0 | 1 | 1 | 1 | 1 | 1 | 2 |
| 30≦p<50mm | 3 | 2 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 |
| over50mm | 2 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 0 |
| Total | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 |

Note: Data: 1980~2003, except 1985, 1990, 1991, 2001 and 2002 (19 years)
Source: JICA Study Team

Observatory: Waduk Krisak peng Skat 34, Wonogiri, Indonesia (Unit: mm)

1982

| Date | Jan. | Feb. | Mar. | Apr. | May | Jun. | Jul. | Aug. | Sep. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | 0 | 0 | 11 | 19 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 4 | 0 | 0 | 0 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 5 | 0 | 0 | 0 | 75 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 55 |
| 6 | 75 | 50 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7 | 20 | 31 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 50 |
| 8 | 0 | 33 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 9 | 40 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10 | 78 | 0 | 45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 12 | 18 | 0 | 0 | 32 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 13 | 22 | 50 | 40 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 14 | 7 | 9 | 0 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 15 | 0 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16 | 0 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 17 | 30 | 9 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 30 |
| 18 | 0 | 27 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 25 | 0 |
| 19 | 0 | 0 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 20 | 0 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 40 |
| 21 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 35 |
| 22 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23 | 25 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 |
| 24 | 0 | 0 | 0 | 34 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 25 | 10 | 30 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 35 |
| 26 | 0 | 65 | 6 | 25 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 17 |
| 27 | 3 | 0 | 5 | 15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| 28 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 |
| 29 | 0 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30 | 16 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| 31 | 0 | | 0 | | 0 | | 0 | 0 | | 0 | | 0 |
| Total | 353 | 336 | 141 | 226 | 0 | 0 | 0 | 0 | 0 | 0 | 26 | 279 |
| Total of year | | | | | | | | | | | | 1,361 |

**Precipitation** — **Numbers of days**

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0mm | 18 | 14 | 21 | 20 | 31 | 30 | 31 | 31 | 30 | 31 | 28 | 21 |
| 0<p<2mm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| 2≦p<5mm | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| 5≦p<10mm | 2 | 7 | 4 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10≦p<20mm | 3 | 0 | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| 20≦p<30mm | 3 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| 30≦p<50mm | 2 | 3 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 |
| over50mm | 2 | 3 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| Total | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 |

Note: Data: 1980~2003, except 1985, 1990, 1991, 2001 and 2002 (19 years)
Source: JICA Study Team

Observatory: Waduk Krisak peng Skat 34, Wonogiri, Indonesia (Unit: mm)

1983

| Date | Jan. | Feb. | Mar. | Apr. | May | Jun. | Jul. | Aug. | Sep. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 20 | 0 |
| 2 | 30 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3 | 0 | 3 | 0 | 18 | 10 | 0 | 0 | 0 | 0 | 0 | 5 | 0 |
| 4 | 22 | 15 | 0 | 2 | 15 | 0 | 0 | 0 | 0 | 0 | 12 | 0 |
| 5 | 10 | 0 | 0 | 12 | 0 | 0 | 0 | 0 | 0 | 5 | 70 | 0 |
| 6 | 20 | 7 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7 | 75 | 27 | 0 | 0 | 85 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 15 |
| 9 | 0 | 15 | 40 | 40 | 50 | 0 | 0 | 0 | 0 | 0 | 25 | 0 |
| 10 | 0 | 0 | 25 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 0 |
| 11 | 70 | 0 | 5 | 0 | 0 | 25 | 0 | 0 | 0 | 0 | 6 | 0 |
| 12 | 25 | 0 | 55 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 0 |
| 13 | 10 | 5 | 45 | 0 | 50 | 0 | 0 | 0 | 0 | 0 | 4 | 0 |
| 14 | 15 | 35 | 7 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 15 | 5 | 20 | 12 | 25 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16 | 0 | 0 | 0 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 17 | 0 | 0 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 18 | 0 | 0 | 0 | 0 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 19 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 |
| 20 | 25 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 12 | 0 |
| 21 | 0 | 0 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 |
| 22 | 12 | 0 | 0 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 5 | 20 |
| 23 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 6 | 20 |
| 24 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 55 | 5 | 25 |
| 25 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 40 |
| 26 | 0 | 0 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 45 | 6 | 10 |
| 27 | 0 | 13 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 0 |
| 28 | 0 | 50 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 20 | 0 | 0 |
| 29 | 0 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 0 | 65 |
| 30 | 0 | | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 15 | 2 | 0 |
| 31 | 0 | | 20 | | 0 | | 0 | 0 | | 0 | | 0 |
| Total | 319 | 195 | 276 | 117 | 254 | 25 | 0 | 0 | 0 | 155 | 218 | 195 |
| Total of year | | | | | | | | | | | | 1,754 |

**Precipitation** — **Numbers of days**

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0mm | 19 | 17 | 18 | 24 | 19 | 29 | 31 | 31 | 30 | 24 | 11 | 24 |
| 0<p<2mm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2≦p<5mm | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| 5≦p<10mm | 1 | 3 | 3 | 0 | 6 | 0 | 0 | 0 | 0 | 2 | 11 | 0 |
| 10≦p<20mm | 4 | 3 | 1 | 2 | 3 | 0 | 0 | 0 | 0 | 2 | 3 | 2 |
| 20≦p<30mm | 4 | 2 | 5 | 2 | 0 | 1 | 0 | 0 | 0 | 1 | 2 | 3 |
| 30≦p<50mm | 1 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 |
| over50mm | 2 | 1 | 1 | 0 | 3 | 0 | 0 | 0 | 0 | 1 | 1 | 1 |
| Total | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 |

Note: Data: 1980~2003, except 1985, 1990, 1991, 2001 and 2002 (19 years)
Source: JICA Study Team

# Table 2.3.5 Rainy Days by Precipitation (2/5)

Observatory: Waduk Krisak peng Skat 34, Wonogiri, Indonesia (Unit: mm)

| | 1984 | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date | Jan. | Feb. | Mar. | Apr. | May | Jun. | Jul. | Aug. | Sep. | Oct. | Nov. | Dec. |
| 1 | 10 | 40 | 25 | 0 | 0 | 0 | 40 | 0 | 0 | 0 | 0 | 0 |
| 2 | 20 | 30 | 45 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 17 |
| 3 | 5 | 25 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 10 |
| 4 | 15 | 25 | 7 | 0 | 0 | 0 | 0 | 0 | 48 | 0 | 0 | 10 |
| 5 | 99 | 85 | 5 | 15 | 0 | 0 | 0 | 0 | 4 | 0 | 25 | 0 |
| 6 | 2 | 0 | 5 | 22 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 25 |
| 7 | 10 | 75 | 10 | 5 | 0 | 0 | 0 | 0 | 20 | 0 | 0 | 15 |
| 8 | 0 | 0 | 15 | 0 | 0 | 0 | 0 | 0 | 9 | 0 | 0 | 5 |
| 9 | 5 | 0 | 10 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10 | 30 | 0 | 1 | 80 | 0 | 15 | 0 | 0 | 0 | 0 | 0 | 0 |
| 11 | 40 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 78 | 0 | 0 | 65 |
| 12 | 75 | 30 | 0 | 25 | 0 | 15 | 0 | 0 | 0 | 0 | 0 | 0 |
| 13 | 0 | 25 | 0 | 0 | 2 | 0 | 0 | 0 | 10 | 25 | 0 | 15 |
| 14 | 5 | 0 | 0 | 72 | 3 | 0 | 0 | 0 | 26 | 0 | 0 | 5 |
| 15 | 0 | 20 | 0 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 |
| 16 | 0 | 12 | 40 | 7 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 10 |
| 17 | 25 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 18 | 0 | 0 | 0 | 0 | 15 | 0 | 0 | 0 | 0 | 0 | 5 | 0 |
| 19 | 0 | 15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 20 | 0 |
| 20 | 0 | 0 | 0 | 0 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 21 | 0 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22 | 0 | 10 | 20 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 35 | 0 |
| 23 | 45 | 0 | 35 | 10 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 24 | 25 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 25 |
| 25 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 20 | 18 |
| 26 | 10 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 60 | 20 |
| 27 | 10 | 17 | 2 | 0 | 0 | 0 | 0 | 0 | 21 | 0 | 0 | 2 |
| 28 | 45 | 0 | 10 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 |
| 29 | 35 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| 30 | 0 | | 0 | 33 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 2 |
| 31 | 5 | | 0 | | 0 | | 0 | 0 | | 0 | | 0 |
| Total | 521 | 443 | 240 | 301 | 47 | 30 | 40 | 0 | 220 | 28 | 173 | 262 |
| Total of year | | | | | | | | | | | | 2,305 |
| **Precipitation** | **Numbers of days** | | | | | | | | | | | |
| 0mm | 10 | 13 | 15 | 16 | 24 | 28 | 30 | 31 | 20 | 29 | 22 | 13 |
| 0<p<2mm | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2≦p<5mm | 1 | 0 | 1 | 1 | 3 | 0 | 0 | 0 | 3 | 1 | 1 | 3 |
| 5≦p<10mm | 5 | 2 | 5 | 4 | 1 | 0 | 0 | 0 | 1 | 0 | 2 | 3 |
| 10≦p<20mm | 5 | 4 | 4 | 4 | 3 | 2 | 0 | 0 | 1 | 0 | 0 | 8 |
| 20≦p<30mm | 3 | 5 | 2 | 2 | 0 | 0 | 0 | 0 | 3 | 1 | 3 | 3 |
| 30≦p<50mm | 5 | 3 | 3 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 |
| over50mm | 2 | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 |
| Total | 31 | 29 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 |

Note: Data: 1980~2003, except 1985, 1990, 1991, 2001 and 2002 (19 years)
Source: JICA Study Team

Observatory: Waduk Krisak peng Skat 34, Wonogiri, Indonesia (Unit: mm)

| | 1986 | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date | Jan. | Feb. | Mar. | Apr. | May | Jun. | Jul. | Aug. | Sep. | Oct. | Nov. | Dec. |
| 1 | 0 | 0 | 30 | 40 | 0 | 0 | 0 | 0 | 0 | 0 | 15 | 0 |
| 2 | 5 | 0 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 |
| 3 | 65 | 0 | 60 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 9 | 0 |
| 4 | 5 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 5 | 0 | 5 | 2 | 2 | 0 | 10 | 0 | 0 | 0 | 0 | 80 | 0 |
| 6 | 20 | 5 | 2 | 5 | 0 | 2 | 0 | 0 | 0 | 0 | 45 | 0 |
| 7 | 5 | 5 | 25 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 8 | 0 | 2 | 15 | 0 | 0 | 0 | 0 | 0 | 0 | 30 | 15 | 0 |
| 9 | 20 | 15 | 10 | 0 | 45 | 0 | 0 | 0 | 0 | 0 | 10 | 0 |
| 10 | 10 | 10 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 45 | 0 |
| 11 | 25 | 25 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 10 | 0 |
| 12 | 8 | 35 | 0 | 25 | 0 | 0 | 0 | 0 | 0 | 35 | 0 | 0 |
| 13 | 5 | 5 | 5 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 15 | 0 | 0 | 25 | 0 | 0 | 42 | 0 | 0 | 0 | 0 | 0 | 5 |
| 16 | 10 | 25 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 17 | 0 | 0 | 5 | 5 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 18 | 3 | 35 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 19 | 5 | 17 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 65 | 0 |
| 20 | 5 | 5 | 2 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 0 |
| 21 | 30 | 10 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23 | 40 | 0 | 0 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 24 | 5 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 35 | 0 | 0 | 0 |
| 25 | 45 | 0 | 40 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 27 |
| 26 | 27 | 0 | 10 | 1 | 0 | 40 | 0 | 0 | 0 | 2 | 10 | 0 |
| 27 | 5 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 28 | 5 | 12 | 15 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 29 | 5 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 |
| 30 | 25 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 |
| 31 | 0 | | 0 | | 0 | | 0 | 0 | | 0 | | 55 |
| Total | 381 | 220 | 290 | 102 | 50 | 94 | 1 | 0 | 72 | 44 | 304 | 102 |
| Total of year | | | | | | | | | | | | 1,660 |
| **Precipitation** | **Numbers of days** | | | | | | | | | | | |
| 0mm | 7 | 10 | 11 | 20 | 29 | 26 | 30 | 31 | 26 | 27 | 20 | 26 |
| 0<p<2mm | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2≦p<5mm | 2 | 3 | 5 | 3 | 0 | 1 | 0 | 0 | 1 | 2 | 0 | 0 |
| 5≦p<10mm | 11 | 6 | 4 | 2 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 2 |
| 10≦p<20mm | 2 | 5 | 5 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 5 | 1 |
| 20≦p<30mm | 5 | 2 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 30≦p<50mm | 3 | 2 | 2 | 1 | 1 | 2 | 0 | 0 | 2 | 1 | 2 | 0 |
| over50mm | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 1 |
| Total | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 |

Note: Data: 1980~2003, except 1985, 1990, 1991, 2001 and 2002 (19 years)
Source: JICA Study Team

Observatory: Waduk Krisak peng Skat 34, Wonogiri, Indonesia (Unit: mm)

| | 1987 | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date | Jan. | Feb. | Mar. | Apr. | May | Jun. | Jul. | Aug. | Sep. | Oct. | Nov. | Dec. |
| 1 | 65 | 0 | 15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 |
| 2 | 0 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3 | 0 | 70 | 15 | 0 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 4 | 25 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 |
| 5 | 75 | 0 | 10 | 0 | 0 | 20 | 0 | 0 | 0 | 0 | 0 | 0 |
| 6 | 0 | 0 | 0 | 0 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7 | 25 | 0 | 0 | 0 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 8 | 0 | 0 | 0 | 0 | 15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 9 | 65 | 10 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10 | 5 | 46 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 11 | 5 | 40 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 12 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 13 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 14 | 20 | 0 | 5 | 0 | 17 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 15 | 5 | 0 | 0 | 0 | 27 | 0 | 0 | 0 | 0 | 0 | 0 | 5 |
| 16 | 2 | 0 | 0 | 0 | 0 | 0 | 12 | 0 | 0 | 0 | 0 | 0 |
| 17 | 2 | 5 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 18 | 0 | 5 | 25 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 19 | 20 | 5 | 35 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 20 | 0 | 50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 21 | 5 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 48 | 0 |
| 22 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 0 |
| 24 | 35 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 25 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 27 |
| 26 | 55 | 45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 87 | 0 |
| 27 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 28 | 28 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 32 | 0 |
| 29 | 0 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 |
| 30 | 20 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 |
| 31 | 0 | | 40 | | 0 | | 0 | 0 | | 0 | | 55 |
| Total | 474 | 301 | 160 | 0 | 89 | 27 | 14 | 0 | 0 | 0 | 178 | 102 |
| Total of year | | | | | | | | | | | | 1,345 |
| **Precipitation** | **Numbers of days** | | | | | | | | | | | |
| 0mm | 11 | 17 | 22 | 30 | 26 | 28 | 29 | 31 | 30 | 31 | 25 | 26 |
| 0<p<2mm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2≦p<5mm | 3 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 5≦p<10mm | 5 | 4 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 2 | 2 |
| 10≦p<20mm | 1 | 1 | 4 | 0 | 3 | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| 20≦p<30mm | 6 | 1 | 1 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| 30≦p<50mm | 1 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| over50mm | 4 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| Total | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 |

Note: Data: 1980~2003, except 1985, 1990, 1991, 2001 and 2002 (19 years)
Source: JICA Study Team

Observatory: Waduk Krisak peng Skat 34, Wonogiri, Indonesia (Unit: mm)

| | 1988 | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date | Jan. | Feb. | Mar. | Apr. | May | Jun. | Jul. | Aug. | Sep. | Oct. | Nov. | Dec. |
| 1 | 0 | 25 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | 0 | 4 | 95 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 | 0 |
| 3 | 0 | 0 | 0 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 4 | 0 | 40 | 0 | 0 | 15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 5 | 0 | 81 | 40 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 |
| 6 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 87 |
| 7 | 0 | 8 | 0 | 0 | 30 | 5 | 0 | 0 | 3 | 0 | 0 | 25 |
| 8 | 0 | 2 | 55 | 0 | 16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 9 | 0 | 2 | 14 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 |
| 10 | 6 | 23 | 6 | 0 | 0 | 41 | 0 | 0 | 0 | 0 | 0 | 47 |
| 11 | 24 | 47 | 0 | 0 | 63 | 35 | 0 | 0 | 0 | 0 | 0 | 0 |
| 12 | 0 | 29 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 19 | 55 |
| 13 | 25 | 7 | 0 | 0 | 16 | 0 | 0 | 0 | 0 | 0 | 37 | 15 |
| 14 | 4 | 0 | 10 | 0 | 42 | 0 | 0 | 0 | 0 | 0 | 56 | 5 |
| 15 | 12 | 35 | 0 | 0 | 3 | 24 | 0 | 0 | 0 | 0 | 46 | 20 |
| 16 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 7 |
| 17 | 0 | 0 | 10 | 37 | 0 | 0 | 0 | 0 | 0 | 7 | 48 | 0 |
| 18 | 1 | 0 | 0 | 21 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 |
| 19 | 0 | 0 | 0 | 47 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 30 |
| 20 | 8 | 0 | 16 | 30 | 0 | 0 | 0 | 0 | 0 | 8 | 0 | 0 |
| 21 | 30 | 0 | 17 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22 | 35 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23 | 0 | 0 | 0 | 0 | 88 | 0 | 0 | 0 | 0 | 0 | 72 | 23 |
| 24 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 45 |
| 25 | 8 | 7 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 44 | 20 |
| 26 | 7 | 0 | 16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 30 | 7 |
| 27 | 4 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 17 | 5 | 0 |
| 28 | 10 | 3 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12 |
| 29 | 16 | 0 | 0 | 15 | 30 | 0 | 0 | 0 | 0 | 23 | 0 | 0 |
| 30 | 18 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 |
| 31 | 2 | | 23 | | 0 | | 0 | 0 | | 10 | | 0 |
| Total | 235 | 330 | 315 | 160 | 303 | 105 | 0 | 0 | 7 | 71 | 369 | 413 |
| Total of year | | | | | | | | | | | | 2,308 |
| **Precipitation** | **Numbers of days** | | | | | | | | | | | |
| 0mm | 13 | 13 | 18 | 24 | 22 | 26 | 31 | 31 | 28 | 25 | 19 | 15 |
| 0<p<2mm | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2≦p<5mm | 3 | 5 | 1 | 0 | 1 | 0 | 0 | 0 | 2 | 0 | 1 | 0 |
| 5≦p<10mm | 4 | 3 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 3 | 2 | 4 |
| 10≦p<20mm | 6 | 1 | 6 | 2 | 3 | 0 | 0 | 0 | 0 | 2 | 1 | 3 |
| 20≦p<30mm | 2 | 3 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 4 |
| 30≦p<50mm | 2 | 3 | 1 | 3 | 3 | 2 | 0 | 0 | 0 | 0 | 5 | 3 |
| over50mm | 0 | 1 | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 2 | 2 |
| Total | 31 | 29 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 |

Note: Data: 1980~2003, except 1985, 1990, 1991, 2001 and 2002 (19 years)
Source: JICA Study Team

# Table 2.3.5 Rainy Days by Precipitation (3/5)

Observatory: Waduk Krisak peng Skat 34, Wonogiri, Indonesia (Unit: mm)

| Date | 1989 Jan. | Feb. | Mar. | Apr. | May | Jun. | Jul. | Aug. | Sep. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 16 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | 0 | 3 | 10 | 4 | 0 | 70 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3 | 0 | 9 | 0 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 4 | 32 | 5 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 25 | 0 |
| 5 | 21 | 0 | 0 | 0 | 0 | 13 | 0 | 0 | 0 | 0 | 0 | 0 |
| 6 | 63 | 18 | 4 | 0 | 2 | 4 | 0 | 5 | 0 | 0 | 53 | 0 |
| 7 | 10 | 19 | 3 | 17 | 0 | 0 | 0 | 18 | 0 | 0 | 0 | 0 |
| 8 | 11 | 7 | 0 | 9 | 23 | 0 | 0 | 0 | 0 | 0 | 12 | 0 |
| 9 | 0 | 0 | 3 | 0 | 0 | 0 | 50 | 0 | 0 | 0 | 0 | 0 |
| 10 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 |
| 11 | 9 | 7 | 8 | 6 | 2 | 15 | 0 | 0 | 0 | 0 | 19 | 60 |
| 12 | 9 | 15 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12 | 0 |
| 13 | 3 | 28 | 0 | 0 | 0 | 83 | 0 | 0 | 0 | 0 | 0 | 0 |
| 14 | 15 | 18 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 |
| 15 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 31 |
| 16 | 11 | 35 | 0 | 0 | 8 | 0 | 0 | 0 | 0 | 13 | 0 | 0 |
| 17 | 7 | 21 | 10 | 0 | 0 | 0 | 11 | 0 | 0 | 0 | 0 | 0 |
| 18 | 0 | 7 | 0 | 4 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 |
| 19 | 0 | 0 | 10 | 0 | 0 | 0 | 117 | 0 | 0 | 0 | 0 | 0 |
| 20 | 0 | 13 | 0 | 0 | 0 | 0 | 16 | 0 | 0 | 0 | 0 | 0 |
| 21 | 0 | 5 | 0 | 0 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22 | 18 | 0 | 0 | 0 | 49 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23 | 14 | 22 | 5 | 10 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 108 |
| 24 | 24 | 12 | 6 | 0 | 0 | 0 | 7 | 0 | 0 | 0 | 0 | 10 |
| 25 | 39 | 20 | 0 | 0 | 29 | 0 | 9 | 0 | 0 | 0 | 0 | 0 |
| 26 | 16 | 37 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 27 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 34 |
| 28 | 24 | 33 | 15 | 6 | 3 | 6 | 0 | 0 | 0 | 0 | 0 | 5 |
| 29 | 0 | | 0 | 7 | 71 | 0 | 0 | 0 | 0 | 10 | 0 | 0 |
| 30 | 0 | | 2 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 31 | 24 | | 5 | | 5 | | 0 | 0 | | 0 | | 7 |
| Total | 350 | 355 | 104 | 84 | 207 | 191 | 216 | 23 | 0 | 23 | 121 | 264 |
| Total of year | | | | | | | | | | | | 1,938 |
| **Precipitation** | **Numbers of days** | | | | | | | | | | | |
| 0mm | 13 | 6 | 15 | 19 | 20 | 24 | 23 | 29 | 30 | 29 | 25 | 23 |
| 0<p<2mm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2≦p<5mm | 1 | 1 | 6 | 2 | 4 | 1 | 2 | 0 | 0 | 0 | 0 | 0 |
| 5≦p<10mm | 3 | 7 | 5 | 6 | 2 | 1 | 2 | 1 | 0 | 0 | 0 | 3 |
| 10≦p<20mm | 7 | 7 | 5 | 3 | 1 | 2 | 2 | 1 | 0 | 2 | 3 | 1 |
| 20≦p<30mm | 4 | 4 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| 30≦p<50mm | 2 | 3 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| over50mm | 1 | 0 | 0 | 0 | 1 | 2 | 2 | 0 | 0 | 0 | 1 | 2 |
| Total | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 |

Note: Data: 1980~2003, except 1985, 1990, 1991, 2001 and 2002 (19 years)
Source: JICA Study Team

Observatory: Waduk Krisak peng Skat 34, Wonogiri, Indonesia (Unit: mm)

| Date | 1992 Jan. | Feb. | Mar. | Apr. | May | Jun. | Jul. | Aug. | Sep. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 9 | 0 | 0 | 7 | 0 | 0 | 0 | 0 | 12 | 0 | 30 | 5 |
| 2 | 10 | 10 | 0 | 11 | 49 | 40 | 0 | 0 | 6 | 0 | 0 | 47 |
| 3 | 9 | 16 | 30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 23 |
| 4 | 0 | 0 | 0 | 20 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 7 |
| 5 | 0 | 27 | 0 | 18 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 |
| 6 | 0 | 44 | 0 | 0 | 0 | 67 | 0 | 0 | 10 | 0 | 0 | 3 |
| 7 | 50 | 0 | 10 | 11 | 0 | 0 | 0 | 0 | 29 | 0 | 0 | 0 |
| 8 | 14 | 0 | 11 | 0 | 13 | 9 | 0 | 0 | 13 | 0 | 0 | 0 |
| 9 | 6 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 26 | 6 | 0 |
| 10 | 33 | 47 | 5 | 55 | 0 | 9 | 0 | 0 | 0 | 28 | 0 | 0 |
| 11 | 54 | 0 | 41 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 |
| 12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 20 | 0 |
| 13 | 78 | 17 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 14 | 69 | 67 | 18 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 15 |
| 15 | 27 | 0 | 21 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 |
| 16 | 0 | 14 | 8 | 32 | 0 | 0 | 0 | 0 | 0 | 19 | 8 | 92 |
| 17 | 0 | 11 | 21 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 77 | 0 |
| 18 | 18 | 72 | 10 | 34 | 0 | 0 | 0 | 0 | 0 | 0 | 14 | 0 |
| 19 | 13 | 0 | 23 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 |
| 20 | 0 | 0 | 34 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 21 | 0 | 15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23 | 35 | 60 | 18 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 55 | 0 |
| 24 | 3 | 0 | 22 | 4 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 |
| 25 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 35 | 7 | 0 | 9 | 2 |
| 26 | 0 | 0 | 0 | 8 | 3 | 0 | 0 | 53 | 0 | 56 | 2 | 0 |
| 27 | 19 | 0 | 0 | 69 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 28 | 0 | 26 | 0 | 0 | 0 | 0 | 0 | 10 | 0 | 3 | 6 | 0 |
| 29 | 5 | 30 | 35 | 0 | 0 | 0 | 0 | 26 | 0 | 50 | 8 | 0 |
| 30 | 0 | | 3 | 0 | 8 | 0 | 0 | 23 | 0 | 9 | 7 | 0 |
| 31 | 0 | | 0 | | 0 | | 0 | 34 | | 0 | | 0 |
| Total | 452 | 470 | 315 | 271 | 79 | 125 | 0 | 181 | 81 | 198 | 245 | 206 |
| Total of year | | | | | | | | | | | | 2,623 |
| **Precipitation** | **Numbers of days** | | | | | | | | | | | |
| 0mm | 14 | 14 | 14 | 18 | 26 | 26 | 31 | 25 | 23 | 22 | 17 | 21 |
| 0<p<2mm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2≦p<5mm | 1 | 0 | 1 | 2 | 1 | 0 | 0 | 0 | 1 | 2 | 2 | 2 |
| 5≦p<10mm | 4 | 0 | 3 | 2 | 2 | 2 | 0 | 0 | 2 | 2 | 6 | 4 |
| 10≦p<20mm | 5 | 7 | 5 | 3 | 1 | 0 | 0 | 1 | 3 | 1 | 1 | 1 |
| 20≦p<30mm | 1 | 2 | 4 | 1 | 0 | 0 | 0 | 2 | 1 | 2 | 1 | 1 |
| 30≦p<50mm | 2 | 3 | 4 | 2 | 1 | 1 | 0 | 2 | 0 | 0 | 1 | 1 |
| over50mm | 4 | 3 | 0 | 2 | 0 | 1 | 0 | 1 | 0 | 2 | 2 | 1 |
| Total | 31 | 29 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 |

Note: Data: 1980~2003, except 1985, 1990, 1991, 2001 and 2002 (19 years)
Source: JICA Study Team

Observatory: Waduk Krisak peng Skat 34, Wonogiri, Indonesia (Unit: mm)

| Date | 1993 Jan. | Feb. | Mar. | Apr. | May | Jun. | Jul. | Aug. | Sep. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | 4 | 5 | 0 | 56 | 63 | 0 | 0 | 0 | 0 | 0 | 0 | 50 |
| 3 | 3 | 11 | 0 | 48 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 |
| 4 | 0 | 20 | 0 | 36 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 5 | 0 | 21 | 0 | 0 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 6 | 27 | 6 | 0 | 49 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 30 |
| 7 | 13 | 77 | 0 | 23 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 |
| 8 | 0 | 0 | 0 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 9 | 12 | 14 | 0 | 42 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 46 |
| 10 | 0 | 2 | 22 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 |
| 11 | 0 | 0 | 64 | 0 | 0 | 10 | 0 | 0 | 0 | 0 | 0 | 22 |
| 12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 13 | 0 | 0 | 20 | 0 | 0 | 0 | 3 | 0 | 0 | 105 | 30 | |
| 14 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 10 | 55 | |
| 15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 0 | |
| 16 | 0 | 0 | 0 | 0 | 0 | 11 | 0 | 0 | 0 | 0 | 59 | 0 |
| 17 | 0 | 42 | 9 | 21 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 18 | 0 | 38 | 31 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 19 | 32 | 0 | 72 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 |
| 20 | 0 | 56 | 0 | 22 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 5 |
| 21 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22 | 34 | 2 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 17 |
| 23 | 32 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 20 |
| 24 | 30 | 23 | 0 | 26 | 0 | 0 | 0 | 0 | 0 | 0 | 20 | 0 |
| 25 | 15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 0 |
| 26 | 15 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 27 |
| 27 | 0 | 3 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 28 | 0 | 9 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 29 | 45 | | 15 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30 | 0 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 20 | 0 |
| 31 | 15 | | 0 | | 0 | | 0 | 0 | | 0 | | 0 |
| Total | 284 | 334 | 257 | 343 | 77 | 21 | 0 | 3 | 0 | 0 | 235 | 335 |
| Total of year | | | | | | | | | | | | 1,889 |
| **Precipitation** | **Numbers of days** | | | | | | | | | | | |
| 0mm | 17 | 12 | 20 | 18 | 28 | 28 | 31 | 30 | 30 | 31 | 22 | 17 |
| 0<p<2mm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2≦p<5mm | 2 | 3 | 1 | 2 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 |
| 5≦p<10mm | 1 | 4 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 |
| 10≦p<20mm | 5 | 2 | 1 | 1 | 1 | 2 | 0 | 0 | 0 | 0 | 2 | 2 |
| 20≦p<30mm | 1 | 3 | 2 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 3 |
| 30≦p<50mm | 5 | 2 | 1 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| over50mm | 0 | 2 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 2 |
| Total | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 |

Note: Data: 1980~2003, except 1985, 1990, 1991, 2001 and 2002 (19 years)
Source: JICA Study Team

Observatory: Waduk Krisak peng Skat 34, Wonogiri, Indonesia (Unit: mm)

| Date | 1994 Jan. | Feb. | Mar. | Apr. | May | Jun. | Jul. | Aug. | Sep. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 0 | 54 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 |
| 2 | 0 | 5 | 2 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3 | 0 | 0 | 24 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| 4 | 9 | 13 | 57 | 24 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 5 | 3 | 0 | 18 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 43 | 0 |
| 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 |
| 7 | 29 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 8 | 0 | 10 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 9 | 23 | 3 | 78 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| 10 | 42 | 4 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12 |
| 11 | 6 | 35 | 32 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 |
| 12 | 0 | 21 | 40 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 13 | 3 | 0 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 60 |
| 14 | 30 | 54 | 5 | 25 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 68 |
| 15 | 0 | 0 | 0 | 32 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16 | 45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 |
| 17 | 14 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 26 | 0 |
| 18 | 0 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 |
| 19 | 3 | 0 | 30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 0 |
| 20 | 42 | 0 | 35 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 30 | 0 |
| 21 | 23 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22 | 34 | 0 | 29 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23 | 10 | 8 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 24 | 0 | 37 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 25 | 5 | 9 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 55 | 0 |
| 26 | 0 | 30 | 30 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 27 | 6 | 25 | 4 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 28 | 4 | 3 | 16 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 29 | 0 | | 28 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 31 | 0 |
| 30 | 21 | | 7 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 4 | 15 |
| 31 | 0 | | 0 | | 0 | | 0 | 0 | | 0 | | 25 |
| Total | 352 | 289 | 519 | 125 | 0 | 0 | 2 | 0 | 0 | 10 | 203 | 214 |
| Total of year | | | | | | | | | | | | 1,714 |
| **Precipitation** | **Numbers of days** | | | | | | | | | | | |
| 0mm | 12 | 12 | 10 | 21 | 31 | 30 | 30 | 31 | 30 | 30 | 21 | 21 |
| 0<p<2mm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2≦p<5mm | 4 | 3 | 2 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 3 | 2 |
| 5≦p<10mm | 4 | 3 | 5 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| 10≦p<20mm | 2 | 3 | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 4 |
| 20≦p<30mm | 4 | 3 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| 30≦p<50mm | 5 | 3 | 5 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 |
| over50mm | 0 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 |
| Total | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 |

Note: Data: 1980~2003, except 1985, 1990, 1991, 2001 and 2002 (19 years)
Source: JICA Study Team

# Table 2.3.5 Rainy Days by Precipitation (4/5)

Observatory: Waduk Krisak peng Skat 34, Wonogiri, Indonesia (Unit: mm)

1995

| Date | Jan. | Feb. | Mar. | Apr. | May | Jun. | Jul. | Aug. | Sep. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 19 | 20 | 9 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| 2 | 10 | 30 | 30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3 | 30 | 41 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 |
| 4 | 24 | 4 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 5 | 2 | 0 | 5 | 0 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 29 |
| 6 | 46 | 46 | 0 | 50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7 | 18 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 0 | 19 |
| 8 | 0 | 24 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 | 8 |
| 9 | 0 | 0 | 0 | 0 | 6 | 34 | 64 | 0 | 0 | 0 | 0 | 0 |
| 10 | 10 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 5 |
| 11 | 0 | 32 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 28 | 0 |
| 12 | 0 | 20 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 |
| 13 | 14 | 49 | 30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 24 | 37 |
| 14 | 18 | 25 | 11 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 15 | 0 |
| 15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 14 |
| 16 | 0 | 17 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 36 | 0 |
| 17 | 19 | 0 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 34 | 0 | 0 |
| 18 | 15 | 0 | 29 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 21 | 0 |
| 19 | 30 | 16 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 48 | 0 |
| 20 | 57 | 40 | 5 | 9 | 0 | 47 | 0 | 0 | 0 | 0 | 0 | 0 |
| 21 | 40 | 17 | 0 | 0 | 0 | 59 | 0 | 0 | 0 | 0 | 67 | 0 |
| 22 | 23 | 0 | 3 | 0 | 20 | 0 | 0 | 0 | 0 | 0 | 5 | 16 |
| 23 | 0 | 24 | 22 | 0 | 0 | 33 | 0 | 0 | 0 | 0 | 4 | 18 |
| 24 | 8 | 0 | 19 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 4 |
| 25 | 39 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 21 | 6 |
| 26 | 3 | 60 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 40 | 18 | 0 |
| 27 | 5 | 19 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 0 | 26 | 0 |
| 28 | 0 | 60 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 16 | 10 | 0 |
| 29 | 0 |  | 0 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 18 | 0 |
| 30 | 0 |  | 68 | 25 | 0 | 0 | 0 | 0 | 0 | 0 | 28 | 0 |
| 31 | 0 |  | 0 |  | 0 |  | 0 | 0 |  | 0 |  | 0 |
| Total | 430 | 558 | 252 | 111 | 37 | 177 | 69 | 0 | 10 | 100 | 402 | 163 |
| Total of year |  |  |  |  |  |  |  |  |  |  |  | 2,309 |
| **Precipitation** | **Numbers of days** | | | | | | | | | | | |
| 0mm | 11 | 8 | 18 | 22 | 28 | 25 | 28 | 31 | 29 | 27 | 11 | 19 |
| 0<p<2mm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2≦p<5mm | 2 | 2 | 1 | 2 | 0 | 1 | 2 | 0 | 0 | 0 | 1 | 3 |
| 5≦p<10mm | 2 | 0 | 4 | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 4 | 3 |
| 10≦p<20mm | 8 | 5 | 3 | 0 | 1 | 0 | 0 | 0 | 1 | 2 | 5 | 4 |
| 20≦p<30mm | 2 | 5 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 6 | 1 |
| 30≦p<50mm | 5 | 6 | 2 | 0 | 0 | 3 | 0 | 0 | 0 | 2 | 2 | 1 |
| over50mm | 1 | 2 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 |
| Total | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 |

Note: Data: 1980~2003, except 1985, 1990, 1991, 2001 and 2002 (19 years)
Source: JICA Study Team

Observatory: Waduk Krisak peng Skat 34, Wonogiri, Indonesia (Unit: mm)

1996

| Date | Jan. | Feb. | Mar. | Apr. | May | Jun. | Jul. | Aug. | Sep. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 0 | 29 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 |
| 2 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 30 |
| 3 | 11 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 50 | 0 | 14 |
| 4 | 16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 3 | 17 |
| 5 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 31 |
| 6 | 10 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 20 | 8 |
| 7 | 6 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 8 | 4 | 7 | 50 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 |
| 9 | 2 | 28 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 |
| 10 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 55 | 0 | 0 | 8 | 0 |
| 11 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 |
| 12 | 27 | 23 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| 13 | 25 | 7 | 60 | 0 | 0 | 13 | 0 | 0 | 0 | 0 | 0 | 73 |
| 14 | 31 | 0 | 34 | 0 | 0 | 0 | 0 | 0 | 0 | 13 | 0 | 24 |
| 15 | 0 | 0 | 3 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 |
| 16 | 7 | 0 | 46 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 12 | 0 |
| 17 | 0 | 0 | 50 | 26 | 0 | 0 | 0 | 0 | 0 | 12 | 39 | 0 |
| 18 | 19 | 12 | 0 | 16 | 0 | 0 | 0 | 0 | 0 | 0 | 45 | 0 |
| 19 | 6 | 25 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 22 | 3 |
| 20 | 34 | 5 | 9 | 18 | 0 | 0 | 0 | 0 | 0 | 5 | 10 | 0 |
| 21 | 10 | 43 | 0 | 0 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22 | 56 | 15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 |
| 23 | 0 | 31 | 32 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 23 | 0 |
| 24 | 41 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 28 | 0 |
| 25 | 28 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 19 | 0 | 0 |
| 26 | 0 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 27 | 28 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 21 | 0 | 5 |
| 28 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 8 | 0 | 0 | 0 | 31 |
| 29 | 39 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 0 |
| 30 | 0 |  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 0 | 6 |
| 31 | 0 |  | 0 |  | 0 |  | 0 | 0 |  | 0 |  | 0 |
| Total | 404 | 243 | 331 | 76 | 12 | 18 | 0 | 63 | 0 | 147 | 216 | 272 |
| Total of year |  |  |  |  |  |  |  |  |  |  |  | 1,782 |
| **Precipitation** | **Numbers of days** | | | | | | | | | | | |
| 0mm | 11 | 13 | 18 | 23 | 30 | 28 | 31 | 29 | 30 | 20 | 19 | 15 |
| 0<p<2mm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2≦p<5mm | 3 | 1 | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 4 |
| 5≦p<10mm | 3 | 7 | 3 | 1 | 0 | 1 | 0 | 1 | 0 | 5 | 2 | 4 |
| 10≦p<20mm | 5 | 2 | 0 | 2 | 1 | 1 | 0 | 0 | 0 | 3 | 2 | 3 |
| 20≦p<30mm | 4 | 4 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 1 |
| 30≦p<50mm | 4 | 2 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 3 |
| over50mm | 1 | 0 | 3 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 1 |
| Total | 31 | 29 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 |

Data: 1980~2003, except 1985, 1990, 1991, 2001 and 2002 (19 years)
JICA Study Team

Observatory: Waduk Krisak peng Skat 34, Wonogiri, Indonesia (Unit: mm)

1997

| Date | Jan. | Feb. | Mar. | Apr. | May | Jun. | Jul. | Aug. | Sep. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 20 | 0 | 0 | 0 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | 2 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 25 |
| 3 | 0 | 0 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 5 | 13 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 38 |
| 6 | 0 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7 | 0 | 0 | 0 | 19 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 8 | 27 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| 9 | 55 | 17 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10 | 16 | 13 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 56 | 0 |
| 11 | 0 | 0 | 60 | 105 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 12 | 0 | 15 | 0 | 77 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 16 |
| 13 | 0 | 17 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 13 |
| 14 | 66 | 6 | 0 | 23 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 39 |
| 15 | 38 | 40 | 0 | 51 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| 16 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 17 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 18 | 0 | 0 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 19 | 26 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 20 | 0 | 0 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 21 | 0 | 12 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 |
| 23 | 2 | 5 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| 24 | 28 | 12 | 15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 |
| 25 | 16 | 39 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 22 | 0 | 0 |
| 26 | 13 | 28 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 27 | 0 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 0 |
| 28 | 0 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 25 | 0 |
| 29 | 7 |  | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 17 | 24 |
| 30 | 0 |  | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 31 | 0 |  | 0 |  | 0 |  | 0 | 0 |  | 0 |  | 0 |
| Total | 329 | 233 | 108 | 302 | 21 | 0 | 0 | 0 | 0 | 22 | 106 | 177 |
| Total of year |  |  |  |  |  |  |  |  |  |  |  | 1,298 |
| **Precipitation** | **Numbers of days** | | | | | | | | | | | |
| 0mm | 17 | 14 | 25 | 19 | 28 | 30 | 31 | 31 | 30 | 30 | 26 | 20 |
| 0<p<2mm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2≦p<5mm | 2 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| 5≦p<10mm | 1 | 3 | 3 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 2 |
| 10≦p<20mm | 4 | 8 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 2 |
| 20≦p<30mm | 4 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 2 |
| 30≦p<50mm | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| over50mm | 2 | 0 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| Total | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 |

Note: Data: 1980~2003, except 1985, 1990, 1991, 2001 and 2002 (19 years)
Source: JICA Study Team

Observatory: Waduk Krisak peng Skat 34, Wonogiri, Indonesia (Unit: mm)

1998

| Date | Jan. | Feb. | Mar. | Apr. | May | Jun. | Jul. | Aug. | Sep. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 30 | 23 | 23 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 10 |
| 2 | 0 | 0 | 17 | 17 | 8 | 0 | 33 | 0 | 0 | 0 | 0 | 0 |
| 3 | 0 | 0 | 0 | 0 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 4 | 0 | 10 | 0 | 0 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 |
| 5 | 0 | 0 | 4 | 4 | 44 | 19 | 0 | 0 | 0 | 0 | 0 | 0 |
| 6 | 0 | 49 | 0 | 0 | 0 | 54 | 2 | 0 | 0 | 0 | 0 | 0 |
| 7 | 8 | 0 | 26 | 26 | 0 | 0 | 6 | 19 | 0 | 0 | 0 | 0 |
| 8 | 7 | 0 | 3 | 3 | 0 | 0 | 43 | 0 | 0 | 0 | 0 | 0 |
| 9 | 10 | 0 | 0 | 0 | 5 | 0 | 30 | 0 | 0 | 0 | 0 | 0 |
| 10 | 3 | 22 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 11 | 0 | 0 | 17 | 17 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 12 | 0 | 26 | 51 | 51 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 |
| 13 | 0 | 20 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 |
| 14 | 0 | 0 | 0 | 0 | 23 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 15 | 0 | 0 | 0 | 47 | 0 | 15 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16 | 0 | 25 | 54 | 0 | 0 | 28 | 0 | 0 | 0 | 0 | 0 | 0 |
| 17 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 30 | 0 |
| 18 | 11 | 52 | 0 | 0 | 28 | 0 | 0 | 0 | 0 | 23 | 12 | 107 |
| 19 | 0 | 15 | 0 | 20 | 0 | 0 | 4 | 0 | 0 | 3 | 0 | 22 |
| 20 | 0 | 14 | 66 | 0 | 0 | 0 | 0 | 0 | 12 | 79 | 0 | 0 |
| 21 | 10 | 9 | 0 | 28 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 60 |
| 22 | 11 | 4 | 0 | 0 | 0 | 32 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23 | 0 | 10 | 31 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 40 |
| 24 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 48 | 0 | 0 |
| 25 | 0 | 0 | 15 | 0 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 |
| 26 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 |
| 27 | 8 | 0 | 17 | 20 | 2 | 0 | 0 | 0 | 30 | 0 | 0 | 0 |
| 28 | 0 | 0 | 34 | 0 | 0 | 0 | 50 | 0 | 10 | 0 | 0 | 0 |
| 29 | 20 |  | 0 | 2 | 0 | 0 | 68 | 0 | 5 | 33 | 3 | 20 |
| 30 | 0 |  | 0 | 0 | 0 | 0 | 0 | 0 | 12 | 33 | 0 | 8 |
| 31 | 0 |  | 0 |  | 0 |  | 0 | 0 |  | 0 |  | 0 |
| Total | 88 | 286 | 361 | 258 | 138 | 160 | 243 | 19 | 69 | 219 | 45 | 277 |
| Total of year |  |  |  |  |  |  |  |  |  |  |  | 2,163 |
| **Precipitation** | **Numbers of days** | | | | | | | | | | | |
| 0mm | 22 | 15 | 17 | 18 | 23 | 23 | 21 | 30 | 25 | 25 | 27 | 23 |
| 0<p<2mm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2≦p<5mm | 1 | 1 | 3 | 3 | 1 | 0 | 4 | 0 | 0 | 1 | 1 | 0 |
| 5≦p<10mm | 3 | 1 | 0 | 0 | 3 | 2 | 1 | 0 | 1 | 0 | 0 | 1 |
| 10≦p<20mm | 4 | 4 | 4 | 2 | 0 | 2 | 0 | 1 | 3 | 0 | 1 | 2 |
| 20≦p<30mm | 1 | 4 | 2 | 5 | 3 | 1 | 0 | 0 | 0 | 1 | 0 | 2 |
| 30≦p<50mm | 0 | 2 | 2 | 1 | 1 | 1 | 3 | 0 | 1 | 3 | 1 | 1 |
| over50mm | 0 | 1 | 3 | 1 | 0 | 1 | 2 | 0 | 0 | 1 | 0 | 2 |
| Total | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 |

Data: 1980~2003, except 1985, 1990, 1991, 2001 and 2002 (19 years)
JICA Study Team

# Table 2.3.5 Rainy Days by Precipitation (5/5)

Observatory: Waduk Krisak peng Skat 34, Wonogiri, Indonesia (Unit: mm)

| | 1999 | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date | Jan. | Feb. | Mar. | Apr. | May | Jun. | Jul. | Aug. | Sep. | Oct. | Nov. | Dec. |
| 1 | 0 | 6 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | 0 | 4 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3 | 0 | 17 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 37 | 0 |
| 4 | 0 | 16 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 55 |
| 5 | 0 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 |
| 6 | 0 | 0 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7 | 0 | 4 | 60 | 28 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 8 | 0 | 3 | 38 | 0 | 32 | 0 | 0 | 0 | 0 | 0 | 0 | 68 |
| 9 | 0 | 69 | 0 | 0 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 5 |
| 10 | 0 | 0 | 73 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 11 | 0 | 27 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 37 | 59 |
| 12 | 0 | 20 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 13 | 0 | 0 | 15 | 9 | 0 | 0 | 0 | 0 | 0 | 8 | 0 | 45 |
| 14 | 0 | 0 | 22 | 7 | 0 | 0 | 0 | 0 | 0 | 13 | 0 | 41 |
| 15 | 0 | 0 | 19 | 50 | 0 | 0 | 0 | 0 | 0 | 0 | 26 | 0 |
| 16 | 39 | 0 | 21 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 0 |
| 17 | 0 | 3 | 6 | 39 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 18 | 0 | 0 | 30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 19 | 0 | 0 | 32 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 47 | 0 |
| 20 | 24 | 22 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 83 | 0 | 0 |
| 21 | 0 | 50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 |
| 22 | 0 | 21 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 50 |
| 23 | 0 | 22 | 0 | 0 | 0 | 18 | 0 | 0 | 0 | 0 | 30 | 9 |
| 24 | 11 | 29 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 50 | 19 |
| 25 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 28 | 0 |
| 26 | 19 | 18 | 15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 17 | 21 |
| 27 | 0 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 16 | 0 | 0 |
| 28 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 17 | 0 | 8 |
| 29 | 69 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 | 0 | 15 |
| 30 | 0 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 0 |
| 31 | 0 | | 0 | | 0 | | 0 | 0 | | 0 | | 24 |
| Total | 168 | 352 | 369 | 145 | 40 | 18 | 0 | 0 | 0 | 152 | 287 | 432 |
| Total of year | | | | | | | | | | | | 1,963 |
| **Precipitation** | **Numbers of days** | | | | | | | | | | | |
| 0mm | 25 | 9 | 14 | 23 | 29 | 29 | 31 | 31 | 30 | 24 | 20 | 16 |
| 0<p<2mm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2≦p<5mm | 0 | 5 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 5≦p<10mm | 1 | 3 | 2 | 4 | 1 | 0 | 0 | 0 | 0 | 3 | 1 | 5 |
| 10≦p<20mm | 2 | 3 | 5 | 0 | 0 | 1 | 0 | 0 | 0 | 3 | 2 | 2 |
| 20≦p<30mm | 1 | 6 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 |
| 30≦p<50mm | 1 | 0 | 3 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 4 | 2 |
| over50mm | 1 | 2 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 4 |
| Total | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 |

Note: Data: 1980~2003, except 1985, 1990, 1991, 2001 and 2002 (19 years)
Source: JICA Study Team

Observatory: Waduk Krisak peng Skat 34, Wonogiri, Indonesia (Unit: mm)

| | 2000 | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date | Jan. | Feb. | Mar. | Apr. | May | Jun. | Jul. | Aug. | Sep. | Oct. | Nov. | Dec. |
| 1 | 24 | 0 | 29 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | 0 | 27 | 0 | 28 | 0 | 0 | 0 | 0 | 0 | 0 | 13 | 0 |
| 3 | 0 | 0 | 7 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 15 | 0 |
| 4 | 0 | 94 | 0 | 4 | 53 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 5 | 5 | 53 | 32 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 6 | 0 | 0 | 19 | 0 | 50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7 | 0 | 9 | 0 | 87 | 0 | 15 | 0 | 0 | 0 | 0 | 12 | 0 |
| 8 | 0 | 20 | 22 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 9 | 0 | 17 | 48 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10 | 44 | 0 | 42 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 | 0 |
| 11 | 0 | 0 | 0 | 25 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 41 |
| 12 | 37 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 49 |
| 13 | 0 | 49 | 50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 91 |
| 14 | 0 | 0 | 27 | 69 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 51 |
| 15 | 0 | 28 | 0 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 |
| 16 | 0 | 0 | 0 | 35 | 0 | 0 | 0 | 0 | 0 | 0 | 35 | 37 |
| 17 | 4 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 18 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 19 | 5 | 0 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 20 | 0 | 5 | 0 | 0 | 25 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 21 | 30 | 14 | 41 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22 | 14 | 0 | 4 | 10 | 21 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23 | 18 | 33 | 0 | 31 | 0 | 0 | 0 | 0 | 0 | 0 | 105 | 0 |
| 24 | 0 | 0 | 0 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 25 | 0 | 0 | 0 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 26 | 0 | 0 | 0 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 27 | 6 | 22 | 0 | 26 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 28 | 0 | 0 | 21 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 15 | 0 |
| 29 | 0 | 0 | 16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30 | 6 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 31 | 4 | | 0 | | 0 | | 0 | 0 | | 0 | | 0 |
| Total | 197 | 371 | 368 | 381 | 149 | 15 | 0 | 0 | 0 | 0 | 217 | 269 |
| Total of year | | | | | | | | | | | | 1,967 |
| **Precipitation** | **Numbers of days** | | | | | | | | | | | |
| 0mm | 19 | 17 | 17 | 15 | 27 | 29 | 31 | 31 | 30 | 31 | 21 | 26 |
| 0<p<2mm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2≦p<5mm | 2 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 5≦p<10mm | 4 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 |
| 10≦p<20mm | 2 | 2 | 3 | 6 | 0 | 1 | 0 | 0 | 0 | 0 | 4 | 0 |
| 20≦p<30mm | 1 | 4 | 4 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30≦p<50mm | 3 | 2 | 4 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 |
| over50mm | 0 | 2 | 1 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 2 |
| Total | 31 | 29 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 |

Data: 1980~2003, except 1985, 1990, 1991, 2001 and 2002 (19 years)
JICA Study Team

Observatory: Waduk Krisak peng Skat 34, Wonogiri, Indonesia (Unit: mm)

| | 2003 | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date | Jan. | Feb. | Mar. | Apr. | May | Jun. | Jul. | Aug. | Sep. | Oct. | Nov. | Dec. |
| 1 | 0 | 63 | 0 | 0 | 15 | 0 | 0 | 0 | 0 | 0 | 49 | 0 |
| 2 | 26 | 28 | 10 | 0 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 10 |
| 3 | 64 | 13 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 13 | 20 |
| 4 | 68 | 18 | 39 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 5 | 0 | 0 | 40 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 6 | 0 | 0 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 25 | 0 | 45 |
| 7 | 0 | 29 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| 9 | 0 | 12 | 48 | 0 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10 | 0 | 15 | 0 | 0 | 0 | 10 | 0 | 0 | 0 | 0 | 0 | 75 |
| 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 40 |
| 12 | 0 | 0 | 0 | 0 | 58 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 13 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 24 |
| 14 | 0 | 25 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 15 | 0 | 0 | 43 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16 | 0 | 31 | 15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 17 | 0 | 70 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 23 | 0 |
| 18 | 0 | 17 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 19 | 0 | 25 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 20 | 0 | 43 | 45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 70 |
| 21 | 0 | 32 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 |
| 22 | 15 | 0 | 29 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 21 |
| 23 | 66 | 0 | 0 | 60 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 |
| 24 | 25 | 22 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 |
| 25 | 0 | 47 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 18 | 0 |
| 26 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 18 | 10 | 0 |
| 27 | 0 | 45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 28 | 0 | 13 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 0 |
| 29 | 37 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30 | 9 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 13 | 0 |
| 31 | 0 | | 0 | | 0 | | 0 | 0 | | 11 | | 0 |
| Total | 315 | 548 | 293 | 60 | 103 | 10 | 0 | 0 | 0 | 60 | 126 | 327 |
| Total of year | | | | | | | | | | | | 1,842 |
| **Precipitation** | **Numbers of days** | | | | | | | | | | | |
| 0mm | 22 | 10 | 21 | 29 | 26 | 29 | 31 | 31 | 30 | 27 | 24 | 19 |
| 0<p<2mm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2≦p<5mm | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 5≦p<10mm | 2 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 3 |
| 10≦p<20mm | 1 | 6 | 4 | 0 | 1 | 1 | 0 | 0 | 0 | 2 | 4 | 1 |
| 20≦p<30mm | 2 | 5 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 3 |
| 30≦p<50mm | 1 | 5 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 |
| over50mm | 3 | 2 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| Total | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 |

Note: Data: 1980~2003, except 1985, 1990, 1991, 2001 and 2002 (19 years)
Source: JICA Study Team

## Table 2.3.6 Rainy Days in Month (1/3)

Observatory: Waduk Krisak peng Skat 34, Wonogiri, Indonesia (Unit: days)

| Year | Precipitation | Jan. | Feb. | Mar. | Apr. | May | Jun. | Jul. | Aug. | Sep. | Oct. | Nov. | Dec. | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1980** | 0mm | 17 | 12 | 22 | 13 | 29 | 30 | 29 | 29 | 30 | 31 | 15 | 23 | 280 |
| | 0<p<2mm | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| | 2≦p<5mm | 0 | 2 | 1 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 9 |
| | 5≦p<10mm | 6 | 2 | 1 | 2 | 0 | 0 | 0 | 1 | 0 | 0 | 3 | 2 | 17 |
| | 10≦p<20mm | 1 | 6 | 2 | 3 | 0 | 0 | 2 | 0 | 0 | 0 | 6 | 1 | 21 |
| | 20≦p<30mm | 4 | 3 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 2 | 17 |
| | 30≦p<50mm | 1 | 1 | 2 | 4 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 11 |
| | over 50mm | 2 | 3 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 10 |
| **1981** | 0mm | 14 | 17 | 13 | 20 | 24 | 25 | 23 | 30 | 27 | 25 | 20 | 22 | 260 |
| | 0<p<2mm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 2≦p<5mm | 1 | 0 | 3 | 0 | 1 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 8 |
| | 5≦p<10mm | 5 | 2 | 4 | 3 | 2 | 2 | 2 | 0 | 0 | 0 | 3 | 1 | 24 |
| | 10≦p<20mm | 5 | 4 | 3 | 5 | 0 | 3 | 2 | 0 | 2 | 2 | 4 | 5 | 35 |
| | 20≦p<30mm | 1 | 2 | 4 | 0 | 4 | 0 | 1 | 1 | 1 | 1 | 1 | 2 | 18 |
| | 30≦p<50mm | 3 | 2 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 11 |
| | over 50mm | 2 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 0 | 9 |
| **1982** | 0mm | 18 | 14 | 21 | 20 | 31 | 30 | 31 | 31 | 30 | 31 | 28 | 21 | 306 |
| | 0<p<2mm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 |
| | 2≦p<5mm | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 5 |
| | 5≦p<10mm | 2 | 7 | 4 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 15 |
| | 10≦p<20mm | 3 | 0 | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 11 |
| | 20≦p<30mm | 3 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 6 |
| | 30≦p<50mm | 2 | 3 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 13 |
| | over 50mm | 2 | 3 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 8 |
| **1983** | 0mm | 19 | 17 | 18 | 24 | 19 | 29 | 31 | 31 | 30 | 24 | 11 | 24 | 277 |
| | 0<p<2mm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 2≦p<5mm | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 5 |
| | 5≦p<10mm | 1 | 3 | 3 | 0 | 6 | 0 | 0 | 0 | 0 | 2 | 11 | 0 | 26 |
| | 10≦p<20mm | 4 | 3 | 1 | 2 | 3 | 0 | 0 | 0 | 0 | 2 | 3 | 2 | 20 |
| | 20≦p<30mm | 4 | 2 | 5 | 2 | 0 | 1 | 0 | 0 | 0 | 1 | 2 | 3 | 20 |
| | 30≦p<50mm | 1 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 7 |
| | over 50mm | 2 | 1 | 1 | 0 | 3 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 10 |
| **1984** | 0mm | 10 | 13 | 15 | 16 | 24 | 28 | 30 | 31 | 20 | 29 | 22 | 13 | 251 |
| | 0<p<2mm | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| | 2≦p<5mm | 1 | 0 | 1 | 1 | 3 | 0 | 0 | 0 | 3 | 1 | 1 | 3 | 14 |
| | 5≦p<10mm | 5 | 2 | 5 | 4 | 1 | 0 | 0 | 0 | 1 | 0 | 2 | 3 | 23 |
| | 10≦p<20mm | 5 | 4 | 4 | 4 | 3 | 2 | 0 | 0 | 1 | 0 | 0 | 8 | 31 |
| | 20≦p<30mm | 3 | 5 | 2 | 2 | 0 | 0 | 0 | 0 | 3 | 1 | 3 | 3 | 22 |
| | 30≦p<50mm | 5 | 3 | 3 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 15 |
| | over 50mm | 2 | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 9 |
| **1986** | 0mm | 7 | 10 | 11 | 20 | 29 | 26 | 30 | 31 | 26 | 27 | 20 | 26 | 263 |
| | 0<p<2mm | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 2 |
| | 2≦p<5mm | 2 | 3 | 5 | 3 | 0 | 1 | 0 | 0 | 1 | 2 | 0 | 0 | 17 |
| | 5≦p<10mm | 11 | 6 | 4 | 2 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 2 | 29 |
| | 10≦p<20mm | 2 | 5 | 5 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 5 | 1 | 21 |
| | 20≦p<30mm | 5 | 2 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 12 |
| | 30≦p<50mm | 3 | 2 | 2 | 1 | 1 | 2 | 0 | 0 | 2 | 1 | 2 | 0 | 16 |
| | over 50mm | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 5 |
| **1987** | 0mm | 11 | 17 | 22 | 30 | 26 | 28 | 29 | 31 | 30 | 31 | 25 | 26 | 306 |
| | 0<p<2mm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 2≦p<5mm | 3 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 4 |
| | 5≦p<10mm | 5 | 4 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 2 | 2 | 16 |
| | 10≦p<20mm | 1 | 1 | 4 | 0 | 3 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 11 |
| | 20≦p<30mm | 6 | 1 | 1 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 12 |
| | 30≦p<50mm | 1 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 8 |
| | over 50mm | 4 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 8 |

## Table 2.3.6 Rainy Days in Month (2/3)

Observatory: Waduk Krisak peng Skat 34, Wonogiri, Indonesia (Unit: days)

| Year | Precipitation | Jan. | Feb. | Mar. | Apr. | May | Jun. | Jul. | Aug. | Sep. | Oct. | Nov. | Dec. | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1988** | 0mm | 13 | 13 | 18 | 24 | 22 | 26 | 31 | 31 | 28 | 25 | 19 | 15 | 265 |
| | 0<p<2mm | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| | 2≦p<5mm | 3 | 5 | 1 | 0 | 1 | 0 | 0 | 0 | 2 | 0 | 1 | 0 | 13 |
| | 5≦p<10mm | 4 | 3 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 3 | 2 | 4 | 19 |
| | 10≦p<20mm | 6 | 1 | 6 | 2 | 3 | 0 | 0 | 0 | 0 | 2 | 1 | 3 | 24 |
| | 20≦p<30mm | 2 | 3 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 4 | 13 |
| | 30≦p<50mm | 2 | 3 | 1 | 3 | 3 | 2 | 0 | 0 | 0 | 0 | 5 | 3 | 22 |
| | over 50mm | 0 | 1 | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 9 |
| **1989** | 0mm | 13 | 6 | 15 | 19 | 20 | 24 | 23 | 29 | 30 | 29 | 25 | 23 | 256 |
| | 0<p<2mm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 2≦p<5mm | 1 | 1 | 6 | 2 | 4 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 17 |
| | 5≦p<10mm | 3 | 7 | 5 | 6 | 2 | 1 | 2 | 1 | 0 | 0 | 0 | 3 | 30 |
| | 10≦p<20mm | 7 | 7 | 5 | 3 | 1 | 2 | 2 | 1 | 0 | 2 | 3 | 1 | 34 |
| | 20≦p<30mm | 4 | 4 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 11 |
| | 30≦p<50mm | 2 | 3 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 8 |
| | over 50mm | 1 | 0 | 0 | 0 | 1 | 2 | 2 | 0 | 0 | 0 | 1 | 2 | 9 |
| **1992** | 0mm | 14 | 14 | 14 | 18 | 26 | 26 | 31 | 25 | 23 | 22 | 17 | 21 | 251 |
| | 0<p<2mm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 2≦p<5mm | 1 | 0 | 1 | 2 | 1 | 0 | 0 | 0 | 1 | 2 | 2 | 2 | 12 |
| | 5≦p<10mm | 4 | 0 | 3 | 2 | 2 | 2 | 0 | 0 | 2 | 2 | 6 | 4 | 27 |
| | 10≦p<20mm | 5 | 7 | 5 | 3 | 1 | 0 | 0 | 1 | 3 | 1 | 1 | 1 | 28 |
| | 20≦p<30mm | 1 | 2 | 4 | 1 | 0 | 0 | 0 | 2 | 1 | 2 | 1 | 1 | 15 |
| | 30≦p<50mm | 2 | 3 | 4 | 2 | 1 | 1 | 0 | 2 | 0 | 0 | 1 | 1 | 17 |
| | over 50mm | 4 | 3 | 0 | 2 | 0 | 1 | 0 | 1 | 0 | 2 | 2 | 1 | 16 |
| **1993** | 0mm | 17 | 12 | 20 | 18 | 28 | 28 | 31 | 30 | 30 | 31 | 22 | 17 | 284 |
| | 0<p<2mm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 2≦p<5mm | 2 | 3 | 1 | 2 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 11 |
| | 5≦p<10mm | 1 | 4 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 14 |
| | 10≦p<20mm | 5 | 2 | 1 | 1 | 1 | 2 | 0 | 0 | 0 | 0 | 2 | 2 | 16 |
| | 20≦p<30mm | 1 | 3 | 2 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 3 | 15 |
| | 30≦p<50mm | 5 | 2 | 1 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 15 |
| | over 50mm | 0 | 2 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 10 |
| **1994** | 0mm | 12 | 12 | 10 | 21 | 31 | 30 | 30 | 31 | 30 | 30 | 21 | 21 | 279 |
| | 0<p<2mm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 2≦p<5mm | 4 | 3 | 2 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 3 | 2 | 17 |
| | 5≦p<10mm | 4 | 3 | 5 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 15 |
| | 10≦p<20mm | 2 | 3 | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 4 | 16 |
| | 20≦p<30mm | 4 | 3 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 14 |
| | 30≦p<50mm | 5 | 3 | 5 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 17 |
| | over 50mm | 0 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 7 |
| **1995** | 0mm | 11 | 8 | 18 | 22 | 28 | 25 | 28 | 31 | 29 | 27 | 11 | 19 | 257 |
| | 0<p<2mm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 2≦p<5mm | 2 | 2 | 1 | 2 | 0 | 1 | 2 | 0 | 0 | 0 | 1 | 3 | 14 |
| | 5≦p<10mm | 2 | 0 | 4 | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 4 | 3 | 18 |
| | 10≦p<20mm | 8 | 5 | 3 | 0 | 1 | 0 | 0 | 0 | 1 | 2 | 5 | 4 | 29 |
| | 20≦p<30mm | 2 | 5 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 6 | 1 | 18 |
| | 30≦p<50mm | 5 | 6 | 2 | 0 | 0 | 3 | 0 | 0 | 0 | 2 | 2 | 1 | 21 |
| | over 50mm | 1 | 2 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 8 |
| **1996** | 0mm | 11 | 13 | 18 | 23 | 30 | 28 | 31 | 29 | 30 | 20 | 19 | 15 | 267 |
| | 0<p<2mm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 2≦p<5mm | 3 | 1 | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 4 | 16 |
| | 5≦p<10mm | 3 | 7 | 3 | 1 | 0 | 1 | 0 | 1 | 0 | 5 | 2 | 4 | 27 |
| | 10≦p<20mm | 5 | 2 | 0 | 2 | 1 | 1 | 0 | 0 | 0 | 3 | 2 | 3 | 19 |
| | 20≦p<30mm | 4 | 4 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 1 | 16 |
| | 30≦p<50mm | 4 | 2 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 3 | 14 |
| | over 50mm | 1 | 0 | 3 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 7 |

## Table 2.3.6 Rainy Days in Month (3/3)

Observatory: Waduk Krisak peng Skat 34, Wonogiri, Indonesia (Unit: days)

| Year | Precipitation | Jan. | Feb. | Mar. | Apr. | May | Jun. | Jul. | Aug. | Sep. | Oct. | Nov. | Dec. | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1997** | 0mm | 17 | 14 | 25 | 19 | 28 | 30 | 31 | 31 | 30 | 30 | 26 | 20 | 301 |
| | 0<p<2mm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 2≦p<5mm | 2 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 8 |
| | 5≦p<10mm | 1 | 3 | 3 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 15 |
| | 10≦p<20mm | 4 | 8 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 19 |
| | 20≦p<30mm | 4 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 2 | 10 |
| | 30≦p<50mm | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 5 |
| | over 50mm | 2 | 0 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 7 |
| **1998** | 0mm | 22 | 15 | 17 | 18 | 23 | 23 | 21 | 30 | 25 | 25 | 27 | 23 | 269 |
| | 0<p<2mm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 2≦p<5mm | 1 | 1 | 3 | 3 | 1 | 0 | 4 | 0 | 0 | 1 | 1 | 0 | 15 |
| | 5≦p<10mm | 3 | 1 | 0 | 0 | 3 | 2 | 1 | 0 | 1 | 0 | 0 | 1 | 12 |
| | 10≦p<20mm | 4 | 4 | 4 | 2 | 0 | 2 | 0 | 1 | 3 | 0 | 1 | 2 | 23 |
| | 20≦p<30mm | 1 | 4 | 2 | 5 | 3 | 1 | 0 | 0 | 0 | 1 | 0 | 2 | 19 |
| | 30≦p<50mm | 0 | 2 | 2 | 1 | 1 | 1 | 3 | 0 | 1 | 3 | 1 | 1 | 16 |
| | over 50mm | 0 | 1 | 3 | 1 | 0 | 1 | 2 | 0 | 0 | 1 | 0 | 2 | 11 |
| **1999** | 0mm | 25 | 9 | 14 | 23 | 29 | 29 | 31 | 31 | 30 | 24 | 20 | 16 | 281 |
| | 0<p<2mm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 2≦p<5mm | 0 | 5 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 |
| | 5≦p<10mm | 1 | 3 | 2 | 4 | 1 | 0 | 0 | 0 | 0 | 3 | 1 | 5 | 20 |
| | 10≦p<20mm | 2 | 3 | 5 | 0 | 0 | 1 | 0 | 0 | 0 | 3 | 2 | 2 | 18 |
| | 20≦p<30mm | 1 | 6 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 14 |
| | 30≦p<50mm | 1 | 0 | 3 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 4 | 2 | 12 |
| | over 50mm | 1 | 2 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 4 | 12 |
| **2000** | 0mm | 19 | 17 | 17 | 15 | 27 | 29 | 31 | 31 | 30 | 31 | 21 | 26 | 294 |
| | 0<p<2mm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 2≦p<5mm | 2 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 |
| | 5≦p<10mm | 4 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 11 |
| | 10≦p<20mm | 2 | 2 | 3 | 6 | 0 | 1 | 0 | 0 | 0 | 0 | 4 | 0 | 18 |
| | 20≦p<30mm | 1 | 4 | 4 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 |
| | 30≦p<50mm | 3 | 2 | 4 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 15 |
| | over 50mm | 0 | 2 | 1 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 10 |
| **2003** | 0mm | 22 | 10 | 21 | 29 | 26 | 29 | 31 | 31 | 30 | 27 | 24 | 19 | 299 |
| | 0<p<2mm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 2≦p<5mm | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 |
| | 5≦p<10mm | 2 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 3 | 7 |
| | 10≦p<20mm | 1 | 6 | 4 | 0 | 1 | 1 | 0 | 0 | 0 | 2 | 4 | 1 | 20 |
| | 20≦p<30mm | 2 | 5 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 3 | 14 |
| | 30≦p<50mm | 1 | 5 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 14 |
| | over 50mm | 3 | 2 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 9 |
| **Average of 1980~2003, except 1985, 1990, 1991, 2001 and 2002 (19 years)** | | | | | | | | | | | | | | |
| **Year** | **Precipitation** | **Jan.** | **Feb.** | **Mar.** | **Apr.** | **May** | **Jun.** | **Jul.** | **Aug.** | **Sep.** | **Oct.** | **Nov.** | **Dec.** | **Total** |
| | 0mm | 15.37 | 12.79 | 17.32 | 20.63 | 26.32 | 27.53 | 29.11 | 30.21 | 28.32 | 27.32 | 20.68 | 20.53 | 276.13 |
| | 0<p<2mm | 0.05 | 0.00 | 0.05 | 0.11 | 0.00 | 0.00 | 0.05 | 0.00 | 0.00 | 0.00 | 0.05 | 0.00 | 0.31 |
| | 2≦p<5mm | 1.53 | 1.42 | 1.79 | 1.53 | 0.74 | 0.16 | 0.68 | 0.05 | 0.37 | 0.37 | 0.79 | 1.05 | 10.48 |
| | 5≦p<10mm | 3.53 | 3.11 | 2.89 | 1.84 | 1.16 | 0.53 | 0.26 | 0.16 | 0.26 | 0.89 | 2.26 | 2.32 | 19.21 |
| | 10≦p<20mm | 3.79 | 3.84 | 3.32 | 2.21 | 1.00 | 0.84 | 0.37 | 0.16 | 0.53 | 1.05 | 2.32 | 2.37 | 21.80 |
| | 20≦p<30mm | 2.79 | 3.16 | 2.00 | 1.53 | 0.79 | 0.21 | 0.05 | 0.16 | 0.26 | 0.53 | 1.58 | 1.68 | 14.74 |
| | 30≦p<50mm | 2.47 | 2.53 | 2.37 | 1.26 | 0.47 | 0.47 | 0.21 | 0.16 | 0.21 | 0.42 | 1.37 | 1.58 | 13.52 |
| | over 50mm | 1.47 | 1.47 | 1.26 | 0.89 | 0.53 | 0.26 | 0.26 | 0.11 | 0.05 | 0.42 | 0.95 | 1.47 | 9.14 |
| **19** | Total | 31.00 | 28.32 | 31.00 | 30.00 | 31.01 | 30.00 | 30.99 | 31.01 | 30.00 | 31.00 | 30.00 | 31.00 | 365.33 |

Source: JICA Study Team

## Table 2.3.7 Work Suspension Days due to Rainfall

(Unit: days)

1. Averaged number of rainfall days (1980-1998), Sakkoli observatory ($A_1$)

| Rainfall | Jan. | Feb. | Mar. | Apr. | May | Jun. | Jul. | Aug. | Sep. | Oct. | Nov. | Dec. | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0mm | 15.37 | 12.79 | 17.32 | 20.63 | 26.32 | 27.53 | 29.11 | 30.21 | 28.32 | 27.32 | 20.68 | 20.53 | 276.13 |
| 0<p<2mm | 0.05 | 0.00 | 0.05 | 0.11 | 0.00 | 0.00 | 0.05 | 0.00 | 0.00 | 0.00 | 0.05 | 0.00 | 0.31 |
| 2≦p<5mm | 1.53 | 1.42 | 1.79 | 1.53 | 0.74 | 0.16 | 0.68 | 0.05 | 0.37 | 0.37 | 0.79 | 1.05 | 10.48 |
| 5≦p<10mm | 3.53 | 3.11 | 2.89 | 1.84 | 1.16 | 0.53 | 0.26 | 0.16 | 0.26 | 0.89 | 2.26 | 2.32 | 19.21 |
| 10≦p<20mm | 3.79 | 3.84 | 3.32 | 2.21 | 1.00 | 0.84 | 0.37 | 0.16 | 0.53 | 1.05 | 2.32 | 2.37 | 21.80 |
| 20≦p<30mm | 2.79 | 3.16 | 2.00 | 1.53 | 0.79 | 0.21 | 0.05 | 0.16 | 0.26 | 0.53 | 1.58 | 1.68 | 14.74 |
| 30≦p<50mm | 2.47 | 2.53 | 2.37 | 1.26 | 0.47 | 0.47 | 0.21 | 0.16 | 0.21 | 0.42 | 1.37 | 1.58 | 13.52 |
| over 50mm | 1.47 | 1.47 | 1.26 | 0.89 | 0.53 | 0.26 | 0.26 | 0.11 | 0.05 | 0.42 | 0.95 | 1.47 | 9.14 |
| Total | 31.00 | 28.32 | 31.00 | 30.00 | 31.01 | 30.00 | 30.99 | 31.01 | 30.00 | 31.00 | 30.00 | 31.00 | 365.33 |

2. Estimated work suspension days due to rainfall ($B_1$= $A_1$ x Criteia (suspension))

**1) Earthworks**

| Criteria (suspension) | | Jan. | Feb. | Mar. | Apr. | May | Jun. | Jul. | Aug. | Sep. | Oct. | Nov. | Dec. | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0mm | **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 | 0.0 |
| 0<p<2mm | **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 | 0.0 |
| 2≦p<5mm | **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 | 0.0 |
| 5≦p<10mm | **0.5** | 1.8 | 1.6 | 1.4 | 0.9 | 0.6 | 0.3 | 0.1 | 0.1 | 0.1 | 0.4 | 1.1 | 1.2 | 9.6 |
| 10≦p<20mm | **1.0** | 3.8 | 3.8 | 3.3 | 2.2 | 1.0 | 0.8 | 0.4 | 0.2 | 0.5 | 1.1 | 2.3 | 2.4 | 21.8 |
| 20≦p<30mm | **1.0** | 2.8 | 3.2 | 2.0 | 1.5 | 0.8 | 0.2 | 0.1 | 0.2 | 0.3 | 0.5 | 1.6 | 1.7 | 14.9 |
| 30≦p<50mm | **2.0** | 4.9 | 5.1 | 4.7 | 2.5 | 0.9 | 0.9 | 0.4 | 0.3 | 0.4 | 0.8 | 2.7 | 3.2 | 26.8 |
| over 50mm | **3.0** | 4.4 | 4.4 | 3.8 | 2.7 | 1.6 | 0.8 | 0.8 | 0.3 | 0.2 | 1.3 | 2.9 | 4.4 | 27.6 |
| **Total** | | **17.7** | **18.1** | **15.2** | **9.8** | **4.9** | **3.0** | **1.8** | **1.1** | **1.5** | **4.1** | **10.6** | **12.9** | **100.7** |

**2) Concrete/ Riprap/ Masonry works**

| Criteria (suspension) | | Jan. | Feb. | Mar. | Apr. | May | Jun. | Jul. | Aug. | Sep. | Oct. | Nov. | Dec. | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0mm | **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 | 0.0 |
| 0<p<2mm | **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 | 0.0 |
| 2≦p<5mm | **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 | 0.0 |
| 5≦p<10mm | **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 | 0.0 |
| 10≦p<20mm | **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 | 0.0 |
| 20≦p<30mm | **1.0** | 2.8 | 3.2 | 2.0 | 1.5 | 0.8 | 0.2 | 0.1 | 0.2 | 0.3 | 0.5 | 1.6 | 1.7 | 14.9 |
| 30≦p<50mm | **1.0** | 2.5 | 2.5 | 2.4 | 1.3 | 0.5 | 0.5 | 0.2 | 0.2 | 0.2 | 0.4 | 1.4 | 1.6 | 13.7 |
| over 50mm | **1.0** | 1.5 | 1.5 | 1.3 | 0.9 | 0.5 | 0.3 | 0.3 | 0.1 | 0.1 | 0.4 | 1.0 | 1.5 | 9.4 |
| **Total** | | **6.8** | **7.2** | **5.7** | **3.7** | **1.8** | **1.0** | **0.6** | **0.5** | **0.6** | **1.3** | **4.0** | **4.8** | **38.0** |

**3) Dredging/ Tunnel works**

| Criteria (suspension) | | Jan. | Feb. | Mar. | Apr. | May | Jun. | Jul. | Aug. | Sep. | Oct. | Nov. | Dec. | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0mm | **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 | 0.0 |
| 0<p<2mm | **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 | 0.0 |
| 2≦p<5mm | **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 | 0.0 |
| 5≦p<10mm | **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 | 0.0 |
| 10≦p<20mm | **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 | 0.0 |
| 20≦p<30mm | **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 | 0.0 |
| 30≦p<50mm | **1.0** | 2.5 | 2.5 | 2.4 | 1.3 | 0.5 | 0.5 | 0.2 | 0.2 | 0.2 | 0.4 | 1.4 | 1.6 | 13.7 |
| over 50mm | **1.0** | 1.5 | 1.5 | 1.3 | 0.9 | 0.5 | 0.3 | 0.3 | 0.1 | 0.1 | 0.4 | 1.0 | 1.5 | 9.4 |
| **Total** | | **4.0** | **4.0** | **3.7** | **2.2** | **1.0** | **0.8** | **0.5** | **0.3** | **0.3** | **0.8** | **2.4** | **3.1** | **23.1** |

Source: JICA Study Team

## Table 2.3.8 Estimate of Workable Days

(Unit: days)

| No. | Description | Jan. | Feb. | Mar. | Apr. | May | Jun. | Jul. | Aug. | Sep. | Oct. | Nov. | Dec. | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Calender days* | | | | | | | | | | | | | | |
| a. | Number of calendar days in 2005 | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 | 365 |
| b. | Number of holidays and Sundays in 2005 (*1) | 7 | 6 | 6 | 5 | 7 | 4 | 5 | 5 | 5 | 5 | 6 | 4 | 65 |
| c. | Rate of holidays (= b./a.) | 23% | 21% | 19% | 17% | 23% | 13% | 16% | 16% | 17% | 16% | 20% | 13% | 18% |
| *Workable days* | | | | | | | | | | | | | | |
| ***1.*** | ***Earthworks*** | | | | | | | | | | | | | |
| d. | Work suspension days due to rainfall (*2) | 17.7 | 18.1 | 15.2 | 9.8 | 4.9 | 3.0 | 1.8 | 1.1 | 1.5 | 4.1 | 10.6 | 12.9 | 100.7 |
| e. | Overlapping work suspension days due to rainfall with holidays (= d. x c.) | 4.0 | 3.9 | 2.9 | 1.6 | 1.1 | 0.4 | 0.3 | 0.2 | 0.3 | 0.7 | 2.1 | 1.7 | 19.1 |
| f. | Net work suspension days due to rainfall except for holidays (= d. - e.) | 13.7 | 14.2 | 12.3 | 8.2 | 3.8 | 2.6 | 1.5 | 0.9 | 1.3 | 3.4 | 8.5 | 11.2 | 81.6 |
| g. | Workable days (= a. - b. -f.), and the rounded off | 10.3 | 7.8 | 12.7 | 16.8 | 20.2 | 23.4 | 24.5 | 25.1 | 23.8 | 22.6 | 15.5 | 15.8 | 218.4 |
| | | **10** | **8** | **13** | **17** | **20** | **23** | **24** | **25** | **24** | **23** | **16** | **16** | **219** |
| ***2.*** | ***Concrete/riprap/masonry works*** | | | | | | | | | | | | | |
| d. | Work suspension days due to rainfall (*2) | 6.8 | 7.2 | 5.7 | 3.7 | 1.8 | 1.0 | 0.6 | 0.5 | 0.6 | 1.3 | 4.0 | 4.8 | 38.0 |
| e. | Overlapping work suspension days due to rainfall with holidays (= d. x c.) | 1.5 | 1.5 | 1.1 | 0.6 | 0.4 | 0.1 | 0.1 | 0.1 | 0.1 | 0.2 | 0.8 | 0.6 | 7.2 |
| f. | Net work suspension days due to rainfall except for holidays (= d. - e.) | 5.3 | 5.7 | 4.6 | 3.1 | 1.4 | 0.9 | 0.5 | 0.4 | 0.5 | 1.1 | 3.2 | 4.2 | 30.8 |
| g. | Workable days (= a. - b. -f.), and the rounded off | 18.7 | 16.3 | 20.4 | 21.9 | 22.6 | 25.1 | 25.5 | 25.6 | 24.5 | 24.9 | 20.8 | 22.8 | 269.2 |
| | | **19** | **16** | **20** | **22** | **23** | **25** | **25** | **26** | **25** | **25** | **21** | **23** | **270** |
| ***3.*** | ***Dredging/tunnel works*** | | | | | | | | | | | | | |
| d. | Work suspension days due to rainfall (*2) | 4.0 | 4.0 | 3.7 | 2.2 | 1.0 | 0.8 | 0.5 | 0.3 | 0.3 | 0.8 | 2.4 | 3.1 | 23.1 |
| e. | Overlapping work suspension days due to rainfall with holidays (= d. x c.) | 0.9 | 0.9 | 0.7 | 0.4 | 0.2 | 0.1 | 0.1 | 0.0 | 0.1 | 0.1 | 0.5 | 0.4 | 4.4 |
| f. | Net work suspension days due to rainfall except for holidays (= d. - e.) | 3.1 | 3.1 | 3.0 | 1.8 | 0.8 | 0.7 | 0.4 | 0.3 | 0.3 | 0.7 | 1.9 | 2.7 | 18.7 |
| g. | Workable days (= a. - b. -f.), and the rounded off | 20.9 | 18.9 | 22.0 | 23.2 | 23.2 | 25.3 | 25.6 | 25.7 | 24.8 | 25.3 | 22.1 | 24.3 | 281.3 |
| | | **21** | **19** | **22** | **23** | **23** | **25** | **26** | **26** | **25** | **25** | **22** | **24** | **281** |

Source: JICA Study Team

Note: (*1); The number of days is counted in the calendar of 2005. The overlapping days of holiday and Sunday are already deducted.

(*2); Days are counted based on the precipitation record of the Waduk Krisak peng Skat 34 observatory for the period of 19 years 1980~2003, except 1985, 1990, 1991, 2001 and 2002 (19 years).

## Table 2.4.2 Production Rate of Construction Equipment (1/10)

**<1> Bulldozer, 15t** **bulldozing (cutting and pushing)**

$Q = 60 \times q \times f \times E / Cm$

Where,
- Q: Hourly production (m3/hr)
- q: Moldboard capacity (m3)

  $q = 0.624 \times L_b \times H_b^2$

  $0.624 = (1/(2\tan(\phi+\alpha)) + \varepsilon) \times \nu \times d$

  Where,
  - $\phi$; Angle of slope (= 30degree)
  - $\alpha$; Angle of work slope (= 0degree)
  - $\varepsilon$; Coefficient by material (= 0)
  - $\nu$; Coefficient by material (= 0.8)
  - d; Coefficient by pushing distance (= 0.9)
  - $L_b$; Length of moldboard in meter
  - $H_b$; Height of moldboard in meter
- f: Soil conversion factor
- E: Job-management factor
- Cm: Cycle time (min.)

  Cm= 0.038 x L + 0.20 (min)

  Where, L; Averaged dozing distance (m)

  L= 20 m

| Material | q | f | E | Cm | Q |
|---|---|---|---|---|---|
| (Bank measurement) | | | | | |
| Clayey soil | 2.56 | 0.769 | 0.45 | 0.96 | 55 |
| Sandy soil | 2.56 | 0.833 | 0.50 | 0.96 | 67 |
| Gravelly soil | 2.56 | 0.833 | 0.45 | 0.96 | 60 |
| Soft rock | 2.56 | 0.769 | 0.30 | 0.96 | 37 |
| Semi-hard rock | 2.56 | 0.625 | 0.30 | 0.96 | 30 |
| Hard rock | 2.56 | 0.606 | 0.30 | 0.96 | 29 |
| (Embankment measurement) | | | | | |
| Core | 2.56 | 0.692 | 0.45 | 0.96 | 50 |
| Filter, sand | 2.56 | 0.792 | 0.55 | 0.96 | 70 |

Source: JICA Study Team

**<2> Bulldozer, 21t** **bulldozing (cutting and pushing)**

$Q = 60 \times q \times f \times E / Cm$

Where,
- Q: Hourly production (m3/hr)
- q: Moldboard capacity (m3)

  $q = 0.624 \times L_b \times H_b^2$

  $0.624 = (1/(2\tan(\phi+\alpha)) + \varepsilon) \times \nu \times d$

  Where,
  - $\phi$; Angle of slope (= 30degree)
  - $\alpha$; Angle of work slope (= 0degree)
  - $\varepsilon$; Coefficient by material (= 0)
  - $\nu$; Coefficient by material (= 0.8)
  - d; Coefficient by pushing distance (= 0.9)
  - $L_b$; Length of moldboard in meter
  - $H_b$; Height of moldboard in meter
- f: Soil conversion factor
- E: Job-management factor
- Cm: Cycle time (min.)

  Cm= 0.038 x L + 0.20 (min)

  Where, L; Averaged dozing distance (m)

  L= 20 m

## Table 2.4.2 Production Rate of Construction Equipment (2/10)

| Material | q | f | E | Cm | Q |
|---|---|---|---|---|---|
| (Bank measurement) | | | | | |
| Clayey soil | 3.31 | 0.769 | 0.45 | 0.96 | 72 |
| Sandy soil | 3.31 | 0.833 | 0.50 | 0.96 | 86 |
| Gravelly soil | 3.31 | 0.833 | 0.45 | 0.96 | 78 |
| Soft rock | 3.31 | 0.769 | 0.30 | 0.96 | 48 |
| Semi-hard rock | 3.31 | 0.625 | 0.30 | 0.96 | 39 |
| Hard rock | 3.31 | 0.606 | 0.30 | 0.96 | 38 |
| (Embankment measurement) | | | | | |
| Core | 3.31 | 0.692 | 0.45 | 0.96 | 64 |
| Filter, sand | 3.31 | 0.792 | 0.55 | 0.96 | 90 |

Source: JICA Study Team

**<3> Bulldozer, 15t spreading**

Q= W x V x D x f x E / N

Where,
- Q: Hourly production (m3/hr)
- W: Effective spreading width (m)
- V: Working speed (m/hr)
- D: Spreading height (m)
- f: Soil conversion factor
- E: Job-management factor
- N: Passing time (time)

| Material | | W | V | D | f | E | N1 | Q |
|---|---|---|---|---|---|---|---|---|
| (Bank measurement) | | | | | | | | |
| Clayey soil | | 2.98 | 1,600 | 0.30 | 0.769 | 0.50 | 4 | 138 |
| Clayey soil | 11t | 2.77 | 1,600 | 0.30 | 0.769 | 0.50 | 4 | 128 |
| Sandy soil | | 2.98 | 1,600 | 0.30 | 0.833 | 0.50 | 4 | 149 |
| Gravelly soil | | 2.98 | 1,600 | 0.30 | 0.833 | 0.50 | 4 | 149 |
| Soft rock | | 2.98 | 1,600 | 0.30 | 0.769 | 0.50 | 4 | 138 |
| Semi-hard rock | | 2.98 | 1,600 | 0.30 | 0.625 | 0.50 | 4 | 112 |
| Hard rock | | 2.98 | 1,600 | 0.30 | 0.606 | 0.50 | 4 | 109 |
| Core | | 2.98 | 1,600 | 0.30 | 0.769 | 0.50 | 4 | 138 |
| Filter, sand | | 2.98 | 1,600 | 0.30 | 0.833 | 0.50 | 4 | 149 |
| Rockfill, rip-rap | | 2.98 | 1,600 | 0.30 | 0.606 | 0.50 | 4 | 109 |
| Quarry rock | | 2.98 | 1,600 | 0.30 | 0.606 | 0.50 | 4 | 109 |
| Aggregate | | 2.98 | 1,600 | 0.30 | 0.606 | 0.50 | 4 | 109 |
| (Embankment measurement) | | | | | | | | |
| Clayey soil | | 2.98 | 1,600 | 0.30 | 0.692 | 0.50 | 4 | 124 |
| Clayey soil | 11t | 2.77 | 1,600 | 0.30 | 0.692 | 0.50 | 4 | 116 |
| Sandy soil | | 2.98 | 1,600 | 0.30 | 0.750 | 0.50 | 4 | 135 |
| Gravelly soil | | 2.98 | 1,600 | 0.30 | 0.750 | 0.50 | 4 | 135 |
| Soft rock | | 2.98 | 1,600 | 0.30 | 0.885 | 0.50 | 4 | 159 |
| Semi-hard rock | | 2.98 | 1,600 | 0.30 | 0.781 | 0.50 | 4 | 140 |
| Hard rock | | 2.98 | 1,600 | 0.30 | 0.848 | 0.50 | 4 | 152 |
| Core | | 2.98 | 1,600 | 0.30 | 0.692 | 0.50 | 4 | 124 |
| Filter, sand | | 2.98 | 1,600 | 0.30 | 0.792 | 0.50 | 4 | 142 |
| Rockfill, rip-rap | | 2.98 | 1,600 | 0.30 | 0.848 | 0.50 | 4 | 152 |
| Quarry rock | | 2.98 | 1,600 | 0.30 | 0.848 | 0.50 | 4 | 152 |
| Aggregate | | 2.98 | 1,600 | 0.30 | 0.848 | 0.50 | 4 | 152 |

Source: JICA Study Team

## Table 2.4.2 Production Rate of Construction Equipment (3/10)

**<4> Backhoe, 1.0m3 excavation, (including loading)**

Q= 3,600 x q x k x f x E / Cm

Where,
- Q: Hourly production (m3/hr)
- q: Moldboard capacity, struck (m3)
- k: Coefficient of bucket
- E: Job-management factor
- f: Soil conversion factor
- Cm: Cycle time (sec)

Production rate (Q):

| Material | q | k | f | E | Cm | Q |
|---|---|---|---|---|---|---|
| (Bank measurement) | | | | | | |
| Clayey soil | 0.70 | 0.60 | 0.769 | 0.70 | 32 | 25 |
| Sandy soil | 0.70 | 0.80 | 0.833 | 0.70 | 28 | 42 |
| Gravelly soil | 0.70 | 0.70 | 0.833 | 0.70 | 28 | 37 |
| Soft rock | 0.70 | 0.60 | 0.769 | 0.70 | 36 | 23 |
| Semi-hard rock | 0.70 | 0.60 | 0.625 | 0.70 | 36 | 18 |
| Hard rock | 0.70 | 0.60 | 0.606 | 0.70 | 36 | 18 |
| (Embankment measurement) | | | | | | |
| Core | 0.70 | 0.60 | 0.692 | 0.70 | 28 | 26 |
| Filter, sand | 0.70 | 1.00 | 0.792 | 0.70 | 25 | 56 |
| Rockfill, rip-rap | 0.70 | 0.60 | 0.848 | 0.70 | 32 | 28 |

Source: JICA Study Team

**<5> Wheel loader, 2.3m3 loading**

Q= 3,600 x q x k x f x E / CM

Where,
- Q: Hourly production (m3/hr)
- q: Bucket capacity (m3)
- k: Coefficient of bucket
- f: Soil conversion factor
- E: Job-management factor (E= 0.6~0.8)
- CM: Cycle time (sec)

CM= m x L + t1 + t2

Where,
- m: Coefficient
  m= 1.8sec/m for wheel type,
  m= 2.0sec/m for crawler type
- L: Transportation distance (one-way) (m),
  In case not specified otherwose, L= 8m.
- t1: Time for dipping up materials (sec)
- t2: Time for gear change, spotting, loading and waiting (sec),
  ordinary t2= 12sec

Cycle time (CM):

| Site | Material | m | L (m) | t1 (sec) | t2 (sec) | CM (sec) |
|---|---|---|---|---|---|---|
| | for (Bank measurement) | | | | | |
| | Clayey soil | 1.8 | 8 | 10 | 12 | 36 |
| | Sandy soil | 1.8 | 8 | 6 | 12 | 32 |
| | Gravelly soil | 1.8 | 8 | 6 | 12 | 32 |
| | Soft rock | 1.8 | 8 | 15 | 12 | 41 |
| | Semi-hard rock | 1.8 | 8 | 15 | 12 | 41 |
| | Hard rock | 1.8 | 8 | 15 | 12 | 41 |
| | for (Embankment measurement) | | | | | |
| | Clayey soil | 1.8 | 8 | 10 | 12 | 36 |
| | Sandy soil | 1.8 | 8 | 6 | 12 | 32 |
| | Gravelly soil | 1.8 | 8 | 6 | 12 | 32 |
| | Core | 1.8 | 8 | 10 | 12 | 36 |
| | Filter, sand | 1.8 | 8 | 6 | 12 | 32 |
| | Rockfill, rip-rap | 1.8 | 8 | 15 | 12 | 41 |

## Table 2.4.2 Production Rate of Construction Equipment (4/10)

Production rate (Q):

| Material | q | k | f | E | CM | Q |
|---|---|---|---|---|---|---|
| (Bank measurement) | | | | | | |
| Clayey soil | 2.3 | 0.75 | 0.769 | 0.70 | 36 | 93 |
| Sandy soil | 2.3 | 0.80 | 0.833 | 0.70 | 32 | 121 |
| Gravelly soil | 2.3 | 0.75 | 0.833 | 0.70 | 32 | 113 |
| Soft rock | 2.3 | 0.65 | 0.769 | 0.70 | 41 | 71 |
| Semi-hard rock | 2.3 | 0.65 | 0.625 | 0.70 | 41 | 57 |
| Hard rock | 2.3 | 0.65 | 0.606 | 0.70 | 41 | 56 |
| (Embankment measurement) | | | | | | |
| Clayey soil | 2.3 | 0.75 | 0.692 | 0.70 | 36 | 84 |
| Sandy soil | 2.3 | 0.80 | 0.750 | 0.70 | 32 | 109 |
| Gravelly soil | 2.3 | 0.75 | 0.750 | 0.70 | 32 | 102 |
| Core | 2.3 | 0.75 | 0.692 | 0.70 | 36 | 84 |
| Filter, sand | 2.3 | 0.90 | 0.792 | 0.70 | 32 | 129 |
| Rockfill, rip-rap | 2.3 | 0.65 | 0.848 | 0.70 | 41 | 78 |

Source: JICA Study Team

**<6> Dump truck, 10t hauling and unloading**

Q= 60 x C x f x E / Cm

Where, Q: Hourly production (m3/hr)

C: Loading capacity of truck (m3), in loose measurement,
Smaller value of Vw (limited volume from maximum loading weight) or
Vs (struck bed capacity in volume)

| Class of dump truck | Materials | Wmax (ton) | Unit weight (t/m3) | Vw (m3) | Vs (m3) | C (m3) |
|---|---|---|---|---|---|---|
| 2 ton | Clayey soil | 2.0 | 1.27 | 1.57 | 1.54 | 1.54 |
| 4 ton | Clayey soil | 4.0 | 1.27 | 3.15 | 2.66 | 2.66 |
| 8 ton | Clayey soil | 8.0 | 1.27 | 6.30 | 5.26 | 5.26 |
| 10 ton | Clayey soil | 11.0 | 1.27 | 8.66 | 6.60 | 6.60 |

f: Soil conversion factor

E: Job management factor (E= 0.9)

Cm: Cycle time (min.)

Cm= T0 + T1 + T2 + T3

Where, T0: Time for loading (min), T0= Cms x n/60/Es

Where, Cms: Cycle time for loading equipment (sec)

n: Number of loading cycle

n= C/qo x K

Where, C: Loading capa. of truck (m3)

qo: Backet capa. of loading equip.

K: Coefficient of bucket

Number of loading cycle (n), sandy soil:

| Class of dump truck | Kind and class of loading equip. | | C | qo | K | n |
|---|---|---|---|---|---|---|
| 10 ton | Loader | 1.6 m3 | 6.60 | 1.6 | 0.90 | 5 |
| 10 ton | Loader | 2.3 m3 | 6.60 | 2.3 | 0.90 | 4 |
| 10 ton | Loader | 2.6 m3 | 6.60 | 2.6 | 0.90 | 3 |
| 10 ton | Loader | 2.9 m3 | 6.60 | 2.9 | 0.90 | 3 |
| 10 ton | Loader | 3.2 m3 | 6.60 | 3.2 | 0.90 | 3 |
| 10 ton | Loader | 5.4 m3 | 6.60 | 5.4 | 0.90 | 2 |
| 10 ton | Backh. | 0.6 m3 | 6.60 | 0.5 | 0.90 | 15 |
| 10 ton | Backh. | 1.0 m3 | 6.60 | 0.7 | 0.90 | 11 |

Es: Job management factor of loading equipment

## Table 2.4.2 Production Rate of Construction Equipment (5/10)

T1: Time for hauling (min), T1= 60 x D1/V1
Where, D1: Hauling distance (km), one-way
V1: Hauling speed (km/hr)
T2: Time for returning (min), T2= 60 x D2/V2
Where, D2: Returnig distance (km)
V2: Returning speed (km/hr)
T3: Time for unloading, including waiting time (min)

Cycle time (Cm), combined with wheel loader, 2.3m3:

| Haul. dist. (km) | Time section | Load. equip. | Cms (sec) | n | Es | Wide road section Dist. (km) | Speed (km/hr) | Time (min) | Narrow road section Dist. (km) | Speed (km/hr) | Time (min) | Total time (min) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.25 | T0 | WL2.3 | 36 | 4 | 0.70 | | | | | | | 3 |
| | T1 | | | | | 0.00 | 25 | 0 | 0.25 | 15 | 1 | 1 |
| | T2 | | | | | 0.00 | 30 | 0 | 0.25 | 20 | 1 | 1 |
| | T3 | | | | | | | | | | | 8 |
| | | | | | Total of cycle time (0.25 km) | | | | | | | 13 |
| 0.50 | T0 | WL2.3 | 36 | 4 | 0.70 | | | | | | | 3 |
| | T1 | | | | | 0.00 | 25 | 0 | 0.50 | 15 | 2 | 2 |
| | T2 | | | | | 0.00 | 30 | 0 | 0.50 | 20 | 2 | 2 |
| | T3 | | | | | | | | | | | 8 |
| | | | | | Total of cycle time (0.50 km) | | | | | | | 15 |
| 1.00 | T0 | WL2.3 | 36 | 4 | 0.70 | | | | | | | 3 |
| | T1 | | | | | 0.00 | 25 | 0 | 1.00 | 15 | 4 | 4 |
| | T2 | | | | | 0.00 | 30 | 0 | 1.00 | 20 | 3 | 3 |
| | T3 | | | | | | | | | | | 8 |
| | | | | | Total of cycle time (1.00 km) | | | | | | | 18 |
| 2.00 | T0 | WL2.3 | 36 | 4 | 0.70 | | | | | | | 3 |
| | T1 | | | | | 0.00 | 25 | 0 | 2.00 | 15 | 8 | 8 |
| | T2 | | | | | 0.00 | 30 | 0 | 2.00 | 20 | 6 | 6 |
| | T3 | | | | | | | | | | | 8 |
| | | | | | Total of cycle time (2.00 km) | | | | | | | 25 |
| 2.50 | T0 | WL2.3 | 36 | 4 | 0.70 | | | | | | | 3 |
| | T1 | | | | | 0.50 | 25 | 1 | 2.00 | 15 | 8 | 9 |
| | T2 | | | | | 0.50 | 30 | 1 | 2.00 | 20 | 6 | 7 |
| | T3 | | | | | | | | | | | 8 |
| | | | | | Total of cycle time (2.50 km) | | | | | | | 27 |
| 5.00 | T0 | WL2.3 | 36 | 4 | 0.70 | | | | | | | 3 |
| | T1 | | | | | 2.00 | 25 | 5 | 3.00 | 15 | 12 | 17 |
| | T2 | | | | | 2.00 | 30 | 4 | 3.00 | 20 | 9 | 13 |
| | T3 | | | | | | | | | | | 8 |
| | | | | | Total of cycle time (5.00 km) | | | | | | | 41 |

Cycle time (Cm), combined with backhoe, 1.0m3:

| Haul. dist. (km) | Time section | Load. equip. | Cms (sec) | n | Es | Wide road section Dist. (km) | Speed (km/hr) | Time (min) | Narrow road section Dist. (km) | Speed (km/hr) | Time (min) | Total time (min) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.25 | T0 | Bh1.0 | 32 | 11 | 0.70 | | | | | | | 8 |
| | T1 | | | | | 0.00 | 25 | 0 | 0.25 | 15 | 1 | 1 |
| | T2 | | | | | 0.00 | 30 | 0 | 0.25 | 20 | 1 | 1 |
| | T3 | | | | | | | | | | | 8 |
| | | | | | Total of cycle time (0.25 km) | | | | | | | 18 |
| 0.50 | T0 | Bh1.0 | 32 | 11 | 0.70 | | | | | | | 8 |
| | T1 | | | | | 0.00 | 25 | 0 | 0.50 | 15 | 2 | 2 |
| | T2 | | | | | 0.00 | 30 | 0 | 0.50 | 20 | 2 | 2 |
| | T3 | | | | | | | | | | | 8 |
| | | | | | Total of cycle time (0.50 km) | | | | | | | 20 |
| 1.00 | T0 | Bh1.0 | 32 | 11 | 0.70 | | | | | | | 8 |
| | T1 | | | | | 0.00 | 25 | 0 | 1.00 | 15 | 4 | 4 |
| | T2 | | | | | 0.00 | 30 | 0 | 1.00 | 20 | 3 | 3 |

## Table 2.4.2 Production Rate of Construction Equipment (6/10)

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | T3 | | | | | | | | | | 8 |
| | | | | | Total of cycle time (1.00 km) | | | | | | 23 |
| 2.00 | T0 | Bh1.0 | 32 | 11 | 0.70 | | | | | | 8 |
| | T1 | | | | | 0.00 | 25 | 0 | 2.00 | 15 | 8 | 8 |
| | T2 | | | | | 0.00 | 30 | 0 | 2.00 | 20 | 6 | 6 |
| | T3 | | | | | | | | | | | 8 |
| | | | | | Total of cycle time (2.00 km) | | | | | | | 30 |
| 2.50 | T0 | Bh1.0 | 32 | 11 | 0.70 | | | | | | | 8 |
| | T1 | | | | | 0.50 | 25 | 1 | 2.00 | 15 | 8 | 9 |
| | T2 | | | | | 0.50 | 30 | 1 | 2.00 | 20 | 6 | 7 |
| | T3 | | | | | | | | | | | 8 |
| | | | | | Total of cycle time (2.50 km) | | | | | | | 32 |
| 5.00 | T0 | Bh1.0 | 32 | 11 | 0.70 | | | | | | | 8 |
| | T1 | | | | | 2.00 | 25 | 5 | 3.00 | 15 | 12 | 17 |
| | T2 | | | | | 2.00 | 30 | 4 | 3.00 | 20 | 9 | 13 |
| | T3 | | | | | | | | | | | 8 |
| | | | | | Total of cycle time (5.00 km) | | | | | | | 46 |

Production rate (Q), combined with wheel loader, 2.3m3:

| Class of dump truck | Materials | Hauling dist. (km) | C (m3) | f | E | Cm (min) | Q (m3/hr, ton/hr) |
|---|---|---|---|---|---|---|---|
| (Bank measuement) | | | | | | | |
| 10 ton | Clayey soil | 0.25 | 6.60 | 0.769 | 0.9 | 13 | 21 m3/hr |
| 10 ton | Clayey soil | 0.50 | 6.60 | 0.769 | 0.9 | 15 | 18 m3/hr |
| 10 ton | Clayey soil | 1.00 | 6.60 | 0.769 | 0.9 | 18 | 15 m3/hr |
| 10 ton | Clayey soil | 2.00 | 6.60 | 0.769 | 0.9 | 25 | 11 m3/hr |
| 10 ton | Clayey soil | 2.50 | 6.60 | 0.769 | 0.9 | 27 | 10 m3/hr |
| 10 ton | Clayey soil | 5.00 | 6.60 | 0.769 | 0.9 | 41 | 7 m3/hr |
| 10 ton | Sandy soil | 0.25 | 6.60 | 0.833 | 0.9 | 13 | 23 m3/hr |
| 10 ton | Sandy soil | 0.50 | 6.60 | 0.833 | 0.9 | 15 | 20 m3/hr |
| 10 ton | Sandy soil | 1.00 | 6.60 | 0.833 | 0.9 | 18 | 16 m3/hr |
| 10 ton | Sandy soil | 2.00 | 6.60 | 0.833 | 0.9 | 25 | 12 m3/hr |
| 10 ton | Sandy soil | 2.50 | 6.60 | 0.833 | 0.9 | 27 | 11 m3/hr |
| 10 ton | Sandy soil | 5.00 | 6.60 | 0.833 | 0.9 | 41 | 7 m3/hr |
| 10 ton | Gravelly soil | 0.25 | 6.60 | 0.833 | 0.9 | 13 | 23 m3/hr |
| 10 ton | Gravelly soil | 0.50 | 6.60 | 0.833 | 0.9 | 15 | 20 m3/hr |
| 10 ton | Gravelly soil | 1.00 | 6.60 | 0.833 | 0.9 | 18 | 16 m3/hr |
| 10 ton | Gravelly soil | 2.00 | 6.60 | 0.833 | 0.9 | 25 | 12 m3/hr |
| 10 ton | Gravelly soil | 2.50 | 6.60 | 0.833 | 0.9 | 27 | 11 m3/hr |
| 10 ton | Gravelly soil | 5.00 | 6.60 | 0.833 | 0.9 | 41 | 7 m3/hr |
| 10 ton | Soft rock | 0.25 | 6.60 | 0.769 | 0.9 | 13 | 21 m3/hr |
| 10 ton | Soft rock | 0.50 | 6.60 | 0.769 | 0.9 | 15 | 18 m3/hr |
| 10 ton | Soft rock | 1.00 | 6.60 | 0.769 | 0.9 | 18 | 15 m3/hr |
| 10 ton | Soft rock | 2.00 | 6.60 | 0.769 | 0.9 | 25 | 11 m3/hr |
| 10 ton | Soft rock | 2.50 | 6.60 | 0.769 | 0.9 | 27 | 10 m3/hr |
| 10 ton | Soft rock | 5.00 | 6.60 | 0.769 | 0.9 | 41 | 7 m3/hr |
| 10 ton | Semi-hard rock | 0.25 | 6.60 | 0.625 | 0.9 | 13 | 17 m3/hr |
| 10 ton | Semi-hard rock | 0.50 | 6.60 | 0.625 | 0.9 | 15 | 15 m3/hr |
| 10 ton | Semi-hard rock | 1.00 | 6.60 | 0.625 | 0.9 | 18 | 12 m3/hr |
| 10 ton | Semi-hard rock | 2.00 | 6.60 | 0.625 | 0.9 | 25 | 9 m3/hr |
| 10 ton | Semi-hard rock | 2.50 | 6.60 | 0.625 | 0.9 | 27 | 8 m3/hr |
| 10 ton | Semi-hard rock | 5.00 | 6.60 | 0.625 | 0.9 | 41 | 5 m3/hr |
| 10 ton | Hard rock | 0.25 | 6.60 | 0.606 | 0.9 | 13 | 17 m3/hr |
| 10 ton | Hard rock | 0.50 | 6.60 | 0.606 | 0.9 | 15 | 14 m3/hr |
| 10 ton | Hard rock | 1.00 | 6.60 | 0.606 | 0.9 | 18 | 12 m3/hr |
| 10 ton | Hard rock | 2.00 | 6.60 | 0.606 | 0.9 | 25 | 9 m3/hr |
| 10 ton | Hard rock | 2.50 | 6.60 | 0.606 | 0.9 | 27 | 8 m3/hr |
| 10 ton | Hard rock | 5.00 | 6.60 | 0.606 | 0.9 | 41 | 5 m3/hr |
| (Embankment measurement) | | | | | | | |
| 10 ton | Clayey soil | 0.25 | 6.60 | 0.692 | 0.9 | 13 | 19 m3/hr |

## Table 2.4.2 Production Rate of Construction Equipment (7/10)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 10 ton | Clayey soil | 0.50 | 6.60 | 0.692 | 0.9 | 15 | 16 m3/hr |
| 10 ton | Clayey soil | 1.00 | 6.60 | 0.692 | 0.9 | 18 | 14 m3/hr |
| 10 ton | Clayey soil | 2.00 | 6.60 | 0.692 | 0.9 | 25 | 10 m3/hr |
| 10 ton | Clayey soil | 2.50 | 6.60 | 0.692 | 0.9 | 27 | 9 m3/hr |
| 10 ton | Clayey soil | 5.00 | 6.60 | 0.692 | 0.9 | 41 | 6 m3/hr |
| 10 ton | Sandy soil | 0.25 | 6.60 | 0.750 | 0.9 | 13 | 21 m3/hr |
| 10 ton | Sandy soil | 0.50 | 6.60 | 0.750 | 0.9 | 15 | 18 m3/hr |
| 10 ton | Sandy soil | 1.00 | 6.60 | 0.750 | 0.9 | 18 | 15 m3/hr |
| 10 ton | Sandy soil | 2.00 | 6.60 | 0.750 | 0.9 | 25 | 11 m3/hr |
| 10 ton | Sandy soil | 2.50 | 6.60 | 0.750 | 0.9 | 27 | 10 m3/hr |
| 10 ton | Sandy soil | 5.00 | 6.60 | 0.750 | 0.9 | 41 | 7 m3/hr |
| 10 ton | Gravelly soil | 0.25 | 6.60 | 0.750 | 0.9 | 13 | 21 m3/hr |
| 10 ton | Gravelly soil | 0.50 | 6.60 | 0.750 | 0.9 | 15 | 18 m3/hr |
| 10 ton | Gravelly soil | 1.00 | 6.60 | 0.750 | 0.9 | 18 | 15 m3/hr |
| 10 ton | Gravelly soil | 2.00 | 6.60 | 0.750 | 0.9 | 25 | 11 m3/hr |
| 10 ton | Gravelly soil | 2.50 | 6.60 | 0.750 | 0.9 | 27 | 10 m3/hr |
| 10 ton | Gravelly soil | 5.00 | 6.60 | 0.750 | 0.9 | 41 | 7 m3/hr |
| 10 ton | Core | 0.25 | 6.60 | 0.692 | 0.9 | 13 | 19 m3/hr |
| 10 ton | Core | 0.50 | 6.60 | 0.692 | 0.9 | 15 | 16 m3/hr |
| 10 ton | Core | 1.00 | 6.60 | 0.692 | 0.9 | 18 | 14 m3/hr |
| 10 ton | Core | 2.00 | 6.60 | 0.692 | 0.9 | 25 | 10 m3/hr |
| 10 ton | Core | 2.50 | 6.60 | 0.692 | 0.9 | 27 | 9 m3/hr |
| 10 ton | Core | 5.00 | 6.60 | 0.692 | 0.9 | 41 | 6 m3/hr |
| 10 ton | Filter, sand | 0.25 | 6.60 | 0.792 | 0.9 | 13 | 22 m3/hr |
| 10 ton | Filter, sand | 0.50 | 6.60 | 0.792 | 0.9 | 15 | 19 m3/hr |
| 10 ton | Filter, sand | 1.00 | 6.60 | 0.792 | 0.9 | 18 | 16 m3/hr |
| 10 ton | Filter, sand | 2.00 | 6.60 | 0.792 | 0.9 | 25 | 11 m3/hr |
| 10 ton | Filter, sand | 2.50 | 6.60 | 0.792 | 0.9 | 27 | 10 m3/hr |
| 10 ton | Filter, sand | 5.00 | 6.60 | 0.792 | 0.9 | 41 | 7 m3/hr |
| 10 ton | Rockfill, rip-rap | 0.25 | 6.60 | 0.848 | 0.9 | 13 | 23 m3/hr |
| 10 ton | Rockfill, rip-rap | 0.50 | 6.60 | 0.848 | 0.9 | 15 | 20 m3/hr |
| 10 ton | Rockfill, rip-rap | 1.00 | 6.60 | 0.848 | 0.9 | 18 | 17 m3/hr |
| 10 ton | Rockfill, rip-rap | 2.00 | 6.60 | 0.848 | 0.9 | 25 | 12 m3/hr |
| 10 ton | Rockfill, rip-rap | 2.50 | 6.60 | 0.848 | 0.9 | 27 | 11 m3/hr |
| 10 ton | Rockfill, rip-rap | 5.00 | 6.60 | 0.848 | 0.9 | 41 | 7 m3/hr |

Production rate (Q), combined with backhoe, 1.0m3:

| Class of dump truck | Materials | Hauling dist. (km) | C (m3) | f | E | Cm (min) | Q (m3/hr, ton/hr) |
|---|---|---|---|---|---|---|---|
| (Bank measuement) | | | | | | | |
| 10 ton | Clayey soil | 0.25 | 6.60 | 0.769 | 0.9 | 18 | 15 m3/hr |
| 10 ton | Clayey soil | 0.50 | 6.60 | 0.769 | 0.9 | 20 | 14 m3/hr |
| 10 ton | Clayey soil | 1.00 | 6.60 | 0.769 | 0.9 | 23 | 12 m3/hr |
| 10 ton | Clayey soil | 2.00 | 6.60 | 0.769 | 0.9 | 30 | 9 m3/hr |
| 10 ton | Clayey soil | 2.50 | 6.60 | 0.769 | 0.9 | 32 | 9 m3/hr |
| 10 ton | Clayey soil | 5.00 | 6.60 | 0.769 | 0.9 | 46 | 6 m3/hr |
| 10 ton | Sandy soil | 0.25 | 6.60 | 0.833 | 0.9 | 18 | 16 m3/hr |
| 10 ton | Sandy soil | 0.50 | 6.60 | 0.833 | 0.9 | 20 | 15 m3/hr |
| 10 ton | Sandy soil | 1.00 | 6.60 | 0.833 | 0.9 | 23 | 13 m3/hr |
| 10 ton | Sandy soil | 2.00 | 6.60 | 0.833 | 0.9 | 30 | 10 m3/hr |
| 10 ton | Sandy soil | 2.50 | 6.60 | 0.833 | 0.9 | 32 | 9 m3/hr |
| 10 ton | Sandy soil | 5.00 | 6.60 | 0.833 | 0.9 | 46 | 6 m3/hr |
| 10 ton | Gravelly soil | 0.25 | 6.60 | 0.833 | 0.9 | 18 | 16 m3/hr |
| 10 ton | Gravelly soil | 0.50 | 6.60 | 0.833 | 0.9 | 20 | 15 m3/hr |
| 10 ton | Gravelly soil | 1.00 | 6.60 | 0.833 | 0.9 | 23 | 13 m3/hr |
| 10 ton | Gravelly soil | 2.00 | 6.60 | 0.833 | 0.9 | 30 | 10 m3/hr |
| 10 ton | Gravelly soil | 2.50 | 6.60 | 0.833 | 0.9 | 32 | 9 m3/hr |
| 10 ton | Gravelly soil | 5.00 | 6.60 | 0.833 | 0.9 | 46 | 6 m3/hr |
| 10 ton | Soft rock | 0.25 | 6.60 | 0.769 | 0.9 | 18 | 15 m3/hr |
| 10 ton | Soft rock | 0.50 | 6.60 | 0.769 | 0.9 | 20 | 14 m3/hr |

## Table 2.4.2 Production Rate of Construction Equipment (8/10)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 10 ton | Soft rock | 1.00 | 6.60 | 0.769 | 0.9 | 23 | 12 m3/hr |
| 10 ton | Soft rock | 2.00 | 6.60 | 0.769 | 0.9 | 30 | 9 m3/hr |
| 10 ton | Soft rock | 2.50 | 6.60 | 0.769 | 0.9 | 32 | 9 m3/hr |
| 10 ton | Soft rock | 5.00 | 6.60 | 0.769 | 0.9 | 46 | 6 m3/hr |
| 10 ton | Semi-hard rock | 0.25 | 6.60 | 0.625 | 0.9 | 18 | 12 m3/hr |
| 10 ton | Semi-hard rock | 0.50 | 6.60 | 0.625 | 0.9 | 20 | 11 m3/hr |
| 10 ton | Semi-hard rock | 1.00 | 6.60 | 0.625 | 0.9 | 23 | 10 m3/hr |
| 10 ton | Semi-hard rock | 2.00 | 6.60 | 0.625 | 0.9 | 30 | 7 m3/hr |
| 10 ton | Semi-hard rock | 2.50 | 6.60 | 0.625 | 0.9 | 32 | 7 m3/hr |
| 10 ton | Semi-hard rock | 5.00 | 6.60 | 0.625 | 0.9 | 46 | 5 m3/hr |
| 10 ton | Hard rock | 0.25 | 6.60 | 0.606 | 0.9 | 18 | 12 m3/hr |
| 10 ton | Hard rock | 0.50 | 6.60 | 0.606 | 0.9 | 20 | 11 m3/hr |
| 10 ton | Hard rock | 1.00 | 6.60 | 0.606 | 0.9 | 23 | 9 m3/hr |
| 10 ton | Hard rock | 2.00 | 6.60 | 0.606 | 0.9 | 30 | 7 m3/hr |
| 10 ton | Hard rock | 2.50 | 6.60 | 0.606 | 0.9 | 32 | 7 m3/hr |
| 10 ton | Hard rock | 5.00 | 6.60 | 0.606 | 0.9 | 46 | 5 m3/hr |
| (Embankment measurement) | | | | | | | |
| 10 ton | Clayey soil | 0.25 | 6.60 | 0.692 | 0.9 | 18 | 14 m3/hr |
| 10 ton | Clayey soil | 0.50 | 6.60 | 0.692 | 0.9 | 20 | 12 m3/hr |
| 10 ton | Clayey soil | 1.00 | 6.60 | 0.692 | 0.9 | 23 | 11 m3/hr |
| 10 ton | Clayey soil | 2.00 | 6.60 | 0.692 | 0.9 | 30 | 8 m3/hr |
| 10 ton | Clayey soil | 2.50 | 6.60 | 0.692 | 0.9 | 32 | 8 m3/hr |
| 10 ton | Clayey soil | 5.00 | 6.60 | 0.692 | 0.9 | 46 | 5 m3/hr |
| 10 ton | Sandy soil | 0.25 | 6.60 | 0.750 | 0.9 | 18 | 15 m3/hr |
| 10 ton | Sandy soil | 0.50 | 6.60 | 0.750 | 0.9 | 20 | 13 m3/hr |
| 10 ton | Sandy soil | 1.00 | 6.60 | 0.750 | 0.9 | 23 | 12 m3/hr |
| 10 ton | Sandy soil | 2.00 | 6.60 | 0.750 | 0.9 | 30 | 9 m3/hr |
| 10 ton | Sandy soil | 2.50 | 6.60 | 0.750 | 0.9 | 32 | 8 m3/hr |
| 10 ton | Sandy soil | 5.00 | 6.60 | 0.750 | 0.9 | 46 | 6 m3/hr |
| 10 ton | Gravelly soil | 0.25 | 6.60 | 0.750 | 0.9 | 18 | 15 m3/hr |
| 10 ton | Gravelly soil | 0.50 | 6.60 | 0.750 | 0.9 | 20 | 13 m3/hr |
| 10 ton | Gravelly soil | 1.00 | 6.60 | 0.750 | 0.9 | 23 | 12 m3/hr |
| 10 ton | Gravelly soil | 2.00 | 6.60 | 0.750 | 0.9 | 30 | 9 m3/hr |
| 10 ton | Gravelly soil | 2.50 | 6.60 | 0.750 | 0.9 | 32 | 8 m3/hr |
| 10 ton | Gravelly soil | 5.00 | 6.60 | 0.750 | 0.9 | 46 | 6 m3/hr |
| 10 ton | Core | 0.25 | 6.60 | 0.692 | 0.9 | 18 | 14 m3/hr |
| 10 ton | Core | 0.50 | 6.60 | 0.692 | 0.9 | 20 | 12 m3/hr |
| 10 ton | Core | 1.00 | 6.60 | 0.692 | 0.9 | 23 | 11 m3/hr |
| 10 ton | Core | 2.00 | 6.60 | 0.692 | 0.9 | 30 | 8 m3/hr |
| 10 ton | Core | 2.50 | 6.60 | 0.692 | 0.9 | 32 | 8 m3/hr |
| 10 ton | Core | 5.00 | 6.60 | 0.692 | 0.9 | 46 | 5 m3/hr |
| 10 ton | Filter, sand | 0.25 | 6.60 | 0.792 | 0.9 | 18 | 16 m3/hr |
| 10 ton | Filter, sand | 0.50 | 6.60 | 0.792 | 0.9 | 20 | 14 m3/hr |
| 10 ton | Filter, sand | 1.00 | 6.60 | 0.792 | 0.9 | 23 | 12 m3/hr |
| 10 ton | Filter, sand | 2.00 | 6.60 | 0.792 | 0.9 | 30 | 9 m3/hr |
| 10 ton | Filter, sand | 2.50 | 6.60 | 0.792 | 0.9 | 32 | 9 m3/hr |
| 10 ton | Filter, sand | 5.00 | 6.60 | 0.792 | 0.9 | 46 | 6 m3/hr |
| 10 ton | Rockfill, rip-rap | 0.25 | 6.60 | 0.848 | 0.9 | 18 | 17 m3/hr |
| 10 ton | Rockfill, rip-rap | 0.50 | 6.60 | 0.848 | 0.9 | 20 | 15 m3/hr |
| 10 ton | Rockfill, rip-rap | 1.00 | 6.60 | 0.848 | 0.9 | 23 | 13 m3/hr |
| 10 ton | Rockfill, rip-rap | 2.00 | 6.60 | 0.848 | 0.9 | 30 | 10 m3/hr |
| 10 ton | Rockfill, rip-rap | 2.50 | 6.60 | 0.848 | 0.9 | 32 | 9 m3/hr |
| 10 ton | Rockfill, rip-rap | 5.00 | 6.60 | 0.848 | 0.9 | 46 | 7 m3/hr |

Source: JICA Study Team

## Table 2.4.2 Production Rate of Construction Equipment (9/10)

**<7> Vibrohammer, El., 40kW driving or extraction of steel sheet pile**

Q = 60 x H x L x 0.4 / CM

Where,
- Q; Daily production (m2/day)
- H; Daily working hours (hrs/day)
- L; Length of pile (m)
- CM; Cycle time of driving or extraction per one sheet (min/sheet)

CM = ((0.75 + r x Nmax) x l +a) x K / F

Where,
- a; Job Coefficient
- r; Job Coefficient
- l; Piling length or extraction length (m)
- Nmax; Max N-value
- K; Steel pile coefficient
- F; Working efficient

F = 1.0 + (f1 +f2 + f3)
- f1; Obstruction factor (-0.05, 0, or +0.05)
- f2; Working space factor (-0.05, 0, or +0.05)
- f3; Scale factor (-0.05, 0, or +0.05)

| Type | Work | H | L | a | r | l | Nmax | K | F | CM | Q |
|---|---|---|---|---|---|---|---|---|---|---|---|
| III | Driving | 6.50 | 11.0 | 3.38 | 0.02 | 10.0 | 5 | 1.11 | 0.90 | 14.65 | 117.1 |
| | Extraction | 6.50 | 15.0 | 3.24 | 0.00 | 14.0 | 5 | 1.11 | 0.90 | 16.95 | 138.1 |
| IV | Driving | 6.50 | 11.0 | 3.18 | 0.02 | 10.0 | 5 | 1.18 | 0.90 | 15.31 | 112.1 |
| | Extraction | 6.50 | 15.0 | 3.05 | 0.00 | 14.0 | 5 | 1.18 | 0.90 | 17.77 | 131.7 |

Source: JICA Study Team

**<8> Vibratory roller, 3-5t compaction**

Q= V x W x D x f x E / N (m3/hr)

Q= V x W x E / N (m2/hr)

Where,
- Q: Hourly production (m3/hr), (m2/hr)
- V: Working speed (m/hr)
- W: Effective spreading width (m)
- D: Finishing depth (m)
- f: Soil conversion factor
- E: Job-management factor
- N: Passing time (time)

| Material | V | W | D | f | E | N | Q | |
|---|---|---|---|---|---|---|---|---|
| (Embankment measurement) | | | | | | | | |
| Earthfill | 1,000 | 0.80 | 0.30 | 1.000 | 0.70 | 8 | 21 | (m3/hr) |
| | 1,000 | 0.80 | | | 0.70 | 8 | 70 | (m2/hr) |

Source: JICA Study Team

**<9> Vibratory roller, 8-10t compaction**

Q= V x W x D x f x E / N (m3/hr)

Q= V x W x E / N (m2/hr)

Where,
- Q: Hourly production (m3/hr), (m2/hr)
- V: Working speed (m/hr)
- W: Effective spreading width (m)
- D: Finishing depth (m)
- f: Soil conversion factor
- E: Job-management factor
- N: Passing time (time)

| Material | V | B | D | F | E | N | Q | |
|---|---|---|---|---|---|---|---|---|
| (Embankment measurement) | | | | | | | | |
| Earthfill | 1,000 | 1.70 | 0.30 | 1.000 | 0.70 | 8 | 45 | (m3/hr) |
| | 1,000 | 1.70 | | | 0.70 | 8 | 149 | (m2/hr) |

Source: JICA Study Team

## Table 2.4.2 Production Rate of Construction Equipment (10/10)

**<10> Concrete pump car, w/boom placing concrete**

Q = Q1 x E

Where, Q; Hourly production (m3/hr)
Q1; Nominal hourly production (m3/hr)
E; Job-management factor

| Nominal capa. | Equipment code | Q1 | E | Q |
|---|---|---|---|---|
| 20 m3/hr | E090321 | 20 | 0.30 | 6.0 |
| 30 m3/hr | E090322 | 30 | 0.30 | 9.0 |
| 45 m3/hr | E090323 | 45 | 0.30 | 13.5 |
| 60 m3/hr | E090324 | 60 | 0.30 | 18.0 |
| 80 m3/hr | E090325 | 80 | 0.30 | 24.0 |
| 100 m3/hr | E090326 | 100 | 0.30 | 30.0 |

Source: JICA Study Team

## Table 2.4.4 Production Rate of Cutter-suction Dredger

Q= q x E1 x E2 x E3 x E4 x E5 x E6 x T

Where,
- Q: Daily production (m3/day)
- q: Hourly production (m3/hr)
- E1: Coefficient by booster condition
- E2: Coefficient by soil depth
- E3: Coefficient by working area
- E4: Coefficient by working section
- E5: Coefficient by waves condition
- E6: Coefficient by other conditions
- T: Operation hours per day (Standard: 13hr/day)

Input_1:

| PS (D-) | Soil | N-value | L1 | q | L | nE1 | | D (reference) | |
|---|---|---|---|---|---|---|---|---|---|
| | | | (m) | (m3/hr) | (m) | (Nr.) | | (m) | |
| 200 | clayey | 3~5 | 800 | 40 | 1,250 | 1 | | 1.5 | ~ 5.0 |
| 250 | clayey | 3~5 | 1,000 | 42 | 1,250 | 1 | | 1.5 | ~ 6.0 |
| 420 | clayey | 3~5 | 1,000 | 74 | 1,250 | 1 | | 2.5 | ~ 8.0 |
| 600 | clayey | 3~5 | 1,400 | 109 | 1,250 | 0 | | 3.0 | ~ 10.0 |
| 1,350 | clayey | 3~5 | 1,400 | 215 | 1,250 | 0 | | 3.0 | ~ 15.0 |
| 2,250 | clayey | 3~5 | 1,400 | 484 | 1,250 | 0 | | 6.0 | ~ 14.0 |
| 3,200 | clayey | 3~5 | 1,400 | 659 | 1,250 | 0 | | 7.0 | ~ 15.0 |
| 4,000 | clayey | 3~5 | 1,600 | 795 | 1,250 | 0 | | 8.0 | ~ 17.0 |
| 6,000 | clayey | 3~5 | 2,200 | 1,099 | 1,250 | 0 | | 10.0 | ~ 21.0 |
| 8,000 | clayey | 3~5 | 2,800 | 1,299 | 1,250 | 0 | | 11.0 | ~ 24.0 |

Note:
- L1: Standard discharge pipe length (length without booster) (m)
- q: Standard hourly production (m3/hr)
- L: Discharge pipe length at site (m)
- nE1: Numbers of booster pumps (Nr.)
- D: Dredging depth (m)

Input_2:

| PS (D-) | q | nE1 | E2 | E3 | E4 | E5 | E6 | Shift | T |
|---|---|---|---|---|---|---|---|---|---|
| | (m3/hr) | (Nr.) | | | | | | (Nr.) | (hr/day) |
| 200 | 40 | 1 | fair | fair | fair | fair | no other condition | 2 | 13 |
| 250 | 42 | 1 | fair | fair | fair | fair | no other condition | 2 | 13 |
| 420 | 74 | 1 | fair | fair | fair | fair | no other condition | 2 | 13 |
| 600 | 109 | 0 | fair | fair | fair | fair | no other condition | 2 | 13 |
| 1,350 | 215 | 0 | fair | fair | fair | fair | no other condition | 2 | 16 |
| 2,250 | 484 | 0 | fair | fair | fair | fair | no other condition | 2 | 13 |
| 3,200 | 659 | 0 | fair | fair | fair | fair | no other condition | 2 | 13 |
| 4,000 | 795 | 0 | fair | fair | fair | fair | no other condition | 2 | 13 |
| 6,000 | 1,099 | 0 | fair | fair | fair | fair | no other condition | 2 | 13 |
| 8,000 | 1,299 | 0 | fair | fair | fair | fair | no other condition | 2 | 13 |

Computation:

| PS (D-) | q | E1 | E2 | E3 | E4 | E5 | E6 | Shift | T | Qh | Qd |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | (m3/hr) | | | | | | | (Nr.) | (hr/day) | (m3/hr) | (m3/day) |
| 200 | 40 | 0.85 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 2 | 13 | **34** | 442 |
| 250 | 42 | 0.85 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 2 | 13 | **36** | 468 |
| 420 | 74 | 0.85 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 2 | 13 | **63** | 819 |
| 600 | 109 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 2 | 13 | **109** | **1,417** |
| 1,350 | 215 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 2 | 16 | **215** | 3,440 |
| 2,250 | 484 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 2 | 13 | **484** | 6,292 |
| 3,200 | 659 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 2 | 13 | **659** | 8,567 |
| 4,000 | 795 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 2 | 13 | **795** | 10,335 |
| 6,000 | 1,099 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 2 | 13 | **1,099** | 14,287 |
| 8,000 | 1,299 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 2 | 13 | **1,299** | 16,887 |

Source: JICA Study Team

Note: Estimation is made based on "Kogata Pump-sen Kouji Sekkei Sekisan Manual (Small Type Cutter-suction Dredger Design and Estimate Manual)" and "Un-yu-shou Kouwan Doboku Ukeoi Kouji Sekisan Kijun (Norm of Cost Estimate for Harbour-construction Works, Ministry of Land Infrastructure and Transport, Japan)".

## Table 2.5.1 Estimate of Labor Resources

| No. | Item | Unit | Q'ty | Remarks |
|---|---|---|---|---|
| **1. Sediment storage reservoir works** | | | | |
| 1) | Operator | man.day | 16,115 | /*1 |
| 2) | Foreman | man.day | 8,790 | /*2 |
| 3) | Skilled worker | man.day | 23,928 | /*3 |
| 4) | Common worker | man.day | 47,856 | /*3 |
| | Sub-total | | 96,690 | /*4 |
| | (for reference) | | | |
| | (1) Total workable day | day | 418 | |
| | (2) Averaged daily employment | man/day | 231 | |
| **2. Procurement of dredger** | | | | |
| 1) | Skilled worker | man.day | 90 | |
| 2) | Common worker | man.day | 180 | |
| | Sub-total | | 270 | |
| **3. Watershed conservation works (Keduang)** | | | | |
| 1) | Villagers manpower | man.day | 3,285,000 | |
| | Sub-total | | 3,285,000 | |
| | **Total** | | **3,381,960** | |

Source: JICA Study Team

Note:

*1: Operator's man-day is set at the total operation days of construction equipment.

*2: Foreman's man-day is estimated at one per total labor requirement.

*3: Skilled workers and common workers are estimated at the rate of 1:2 each other.

*4: Total labore is estimated about six times as the operators.

## Table 2.5.2 Estimate of Material Resources

| No. | Item | Unit | Q'ty | Remarks |
|---|---|---|---|---|
| **1.** | **Sediment storage reservoir works** | | | |
| 1) | Light oil | m3 | 1,521 | /*1 |
| 2) | Heavy oil | m3 | 313 | /*1 |
| 3) | Timber, plank | m3 | 290 | /*2 |
| 4) | Timber, square | m3 | 580 | /*2 |
| 5) | Timber, log | m3 | 290 | /*2 |
| 6) | Plywood | m3 | 1,160 | /*2 |
| | (Breakdown) | | | |
| | (1) Averaged concrete thickness | m | 0.50 | |
| | (2) Averaged formworks area | m2 | 293,640 | |
| | (3) Material thickness | m | 0.018 | |
| | (3) Use time | cycle | 5 | |
| | (4) Material loss | - | 10% | |
| | (5) Estimated plywood | m3 | 1,160 | |
| 7) | Cement, portland | ton | 25,440 | /*2 |
| | (Breakdown) | | | |
| | (1) Concrete | m3 | 73,410 | |
| | /1 Spillway | m3 | 35,110 | |
| | /2 Closure dike | m3 | 3,300 | |
| | /3 Overflow weir | m3 | 35,000 | |
| | (2) Unit cement quantity | kg/m3 | 330 | |
| | (3) Material loss | - | 5% | |
| | (4) Estimated cement | ton | 25,440 | |
| 8) | AE agent | L | 36,710 | /*2 |
| 9) | Water reducing agent | L | 36,710 | /*2 |
| 10) | Rebar | ton | 3,850 | /*2 |
| 11) | Steel sheet pile | ton | 4,450 | |
| 12) | Steel radial gate | ton | 170 | |
| 13) | Steel slide gate | ton | 2 | |
| **2.** | **Procurement of dredger** | | | |
| 1) | Cutter-suction dredger, 600PS | unit | 1 | |
| 2) | Anchor barge, 3t D | unit | 1 | |
| 3) | Light oil | m3 | 1 | /*1 |
| **3.** | **Watershed conservation works (Keduang)** | | | |
| 1) | Stone, for masonry | m3 | 64,000 | |

Source: JICA Study Team

Note:

*1: Fuel consumption is estimated based on the operation hours of construction equipment.

*2: Materials are estimated based on the concrete work quantities.

# Table 2.5.3 Estimate of Equipment Resources

| No. | Item | Rated power | | Equipment | |
|---|---|---|---|---|---|
| | | (kw) | (PS) | (month) | (unit, max.) |
| **1.** | **Sediment storage reservoir works** | | | | |
| 1) | Operation of major equipment | | | | |
| | (1) Bulldozer, 11t | 79 | 106 | 54 | 6 |
| | (2) Bulldozer, 21t | 152 | 207 | 42 | 6 |
| | (3) Wheel loader, 2.3m3 | 103 | 140 | 50 | 5 |
| | (4) Dump truck, 10t | 246 | 334 | 249 | 24 |
| | (5) Crawler crane, 50t | 102 | 139 | 6 | 1 |
| | (6) Truck crane, 200t | 191 | 260 | 6 | 1 |
| | (7) Vibrohammer, elec., 40kW | 40 | 54 | 6 | 1 |
| | (8) Vibratory roller, 3~5t | 19 | 26 | 104 | 13 |
| | (9) Concrete pump car, 55m3/h | 127 | 173 | 28 | 3 |
| | (10) Cutter-suction dredger, 600PS | 441 | 600 | 6 | 1 |
| | Sub-total | | | 551 | |
| 2) | Operation of supporting equipment | | | | |
| | (1) Bulldozer, 10t, swamp | 52 | 71 | 24 | 12 |
| | (2) Backhoe, 1.0m3 | 164 | 223 | 24 | 4 |
| | (3) Truck, 4t, w/2.9t crane | 132 | 179 | 50 | 4 |
| | (4) Fuel tank truck, 4kl | 137 | 186 | 50 | 2 |
| | (5) Motor grader, 3.1m | 85 | 116 | 50 | 2 |
| | (6) Vibratory roller, 8~10t | 77 | 105 | 25 | 2 |
| | (7) Agitator truck, 4m3 | 213 | 290 | 12 | 4 |
| | (8) Anchor barge, 3t D | 44 | 60 | 6 | 1 |
| | (9) Generator, 10kVA | 13 | 18 | 52 | 4 |
| | (10) Generator, 100kVA | 92 | 125 | 26 | 1 |
| | Sub-total | | | 319 | |
| | **Total** | | | **870** | |
| **2.** | **Procurement of dredger** | | | | |
| 1) | Installation (assembling) works | | | | |
| | (1) Crawler crane, 50t | 102 | 139 | 1 | 1 |
| | **Total** | | | **1** | |
| **3.** | **Watershed conservation works (Keduang)** | | | | |
| - | No construction equipment will be used for these works. | | | 0 | 0 |

Source: JICA Study Team

## Table 3.3.1 Comparison of Labor Wage

| No. | Trade | Unit | A | B |
|---|---|---|---|---|
| | | | (Rp.) | (Rp.) |
| 1. | Foreman | day | 40,700 | 65,505 |
| 2. | Operator | day | - | 59,550 |
| 3. | Assitant operator | day | - | 53,595 |
| 4. | Carpenter | day | - | 47,640 |
| 5. | Skilled worker | day | 35,600 | - |
| 6. | Semi-skilled worker | day | 30,500 | - |
| 7. | Common worker | day | 25,400 | 35,730 |
| 8. | Surveyor | day | - | 65,505 |
| 9. | Assitant surveyor | day | - | 53,595 |

Source: Contract data on the Solo River rehabilitation works, PBS, compared by JICA Study Team

Note:

A: PT. Waskita Karya

B: PT. Sac Nusantara

- Price level: December 2006
- The values are daywork rate in the work contracts.

## Table 3.3.2 Comparison of Material Price

| Code | Item | Unit | A | B | Price to be applied | |
|---|---|---|---|---|---|---|
| | | | (Rp.) | (Rp.) | (Rp.) | ($) |
| M101020 | Light oil, for diesel engine | lit. | 4,300 | 36,944 | 4,300 | 0.5 |
| M241010 | Timber, plank | cu.m | 3,500,000 | - | 3,500,000 | 386.7 |
| M241020 | Timber, square | cu.m | 3,250,000 | 3,416,667 | 3,250,000 | 359.1 |
| M241030 | Timber, log | cu.m | 2,500,000 | 2,694,444 | 2,500,000 | 276.2 |
| M242010 | Plywood, for form work | cu.m | 6,510,000 | 4,621,000 | 4,621,000 | 510.6 |
| M301010 | Cement, Portland | ton | 600,000 | 972,222 | 600,000 | 66.3 |
| M302010 | AE agent | lit. | 9,000 | 9,444 | 9,000 | 1.0 |
| M302020 | Water reducing agent | lit. | 11,000 | 10,000 | 10,000 | 1.1 |
| M325030 | Precast RC pipe, dia.= 300mm, l= 1.0m | nr. | 154,100 | 125,046 | 125,046 | 13.8 |
| M325040 | Precast RC pipe, dia.= 400mm, l= 1.0m | nr. | 263,350 | 156,922 | 156,922 | 17.3 |
| M326030 | RC U-flume, B300 | lin.m | 423,000 | 1,500,000 | 423,000 | 46.7 |
| M404070 | Rip rap, for rockfill | cu.m | 115,000 | 72,222 | 72,222 | 8.0 |
| M404072 | Rip rap, for masonry | cu.m | 135,000 | 83,333 | 83,333 | 9.2 |
| M501020 | Reinforcing bar, deformed | ton | 7,850,000 | 6,333,333 | 6,333,333 | 699.8 |
| M502000 | Steel sheet pile, | ton | 8,500,000 | 9,271,111 | 8,500,000 | 939.2 |
| M508450 | Gabion, mattress, 2 x 1 x 0.5m | nr. | 250,000 | 347,778 | 250,000 | 27.6 |

Source: JICA Study Team

Note:

A: PT. Wijaya Karya

B: PT. Waskita Karya

- Price level: December 2006

- Excahnge rate: $ 1.0= Y 118.92

- Excahnge rate: $ 1.0= Rp. 9,050

## Table 3.3.3 Comparison of Equipment Rental Rate

| No. | Equiment | Specifications | A | | B | | Rate to be applied | |
|---|---|---|---|---|---|---|---|---|
| | | | Rate per month | Mobiliz. & demobilization cost | Rate per month | Mobiliz. & demobilization cost | | |
| | | | (Rp.) | (Rp.) | (Rp.) | (Rp.) | (Rp.) | ($) |
| 1. | Bulldozer, 11t | 78kW (106PS) | 37,000,000 | 5,000,000 | 2,174,400,000 | 36,000,000 | 37,000,000 | 4,088 |
| 2. | Bulldozer, 21t | 152kW (207PS) | 47,200,000 | 7,000,000 | 67,325,000 | 36,000,000 | 47,200,000 | 5,215 |
| 3. | Bulldozer, w/ripper, 21t | 171kW (232PS) | 55,200,000 | 7,000,000 | 71,500,000 | 12,000,000 | 55,200,000 | 6,099 |
| 4. | Bulldozer, w/ripper, 32t | 231kW (314PS) | 65,000,000 | 8,500,000 | 74,275,000 | 12,000,000 | 65,000,000 | 7,182 |
| 5. | Motor scraper, 16m3 | struck 16m3, twin-engine | 45,000,000 | 7,000,000 | 74,275,000 | 12,000,000 | 45,000,000 | 4,972 |
| 6. | Backhoe, 0.35m3 | struck 0.35m3, heaped 0.45m3 | 27,500,000 | 5,000,000 | 53,450,000 | 12,000,000 | 27,500,000 | 3,039 |
| 7. | Backhoe, 0.6m3 | struck 0.6m3, heaped 0.8m3 | 37,000,000 | 5,000,000 | 60,400,000 | 72,000,000 | 37,000,000 | 4,088 |
| 8. | Backhoe, 1.0m3 | struck 1.0m3, heaped 1.4m3 | 47,200,000 | 7,000,000 | 67,325,000 | 36,000,000 | 47,200,000 | 5,215 |
| 9. | Wheel loader, 2.3m3 | heaped 2.3m3, 103kW (140PS) | 57,000,000 | 7,000,000 | 74,275,000 | 64,800,000 | 57,000,000 | 6,298 |
| 10. | Dump truck, 10t | 246kW (334PS) | 18,000,000 | 500,000 | 41,525,000 | 72,000,000 | 18,000,000 | 1,989 |
| 11. | Truck trailer, 32t | truck tractor w/trailer | 50,000,000 | 1,500,000 | 138,050,000 | 13,200,000 | 50,000,000 | 5,525 |
| 12. | Truck-bed crane, 2t-4t | truck loacing capacity 4t, crane capacity 2t | 15,000,000 | 500,000 | 46,500,000 | 13,200,000 | 15,000,000 | 1,657 |
| 13. | Cargo truck, 11t | 257kW (349PS) | 19,000,000 | 750,000 | 57,700,000 | 21,600,000 | 19,000,000 | 2,099 |
| 14. | Sprinkler truck, 5.5-6.5kl | water tank truck, 132kW (179PS) | 13,000,000 | 500,000 | 37,350,000 | 16,800,000 | 13,000,000 | 1,436 |
| 15. | Fuel tank truck, 1-1.5kl | | 20,000,000 | 500,000 | 40,150,000 | 14,400,000 | 20,000,000 | 2,210 |
| 16. | Crawler crane, 35t~40t | mechanical drive winch, lattice boom, 94kW (128PS) | 59,000,000 | 10,000,000 | 145,825,000 | 21,600,000 | 59,000,000 | 6,519 |
| 17. | Crawler crane, 50t | mechanical drive winch, lattice boom, 102kW (139PS) | 69,000,000 | 10,000,000 | 197,650,000 | 20,400,000 | 69,000,000 | 7,624 |
| 18. | Truck crane, hydraulic, 11t | telescopic, 107kW (145PS) | 25,000,000 | 2,500,000 | 42,925,000 | 20,400,000 | 25,000,000 | 2,762 |
| 19. | Truck crane, hydraulic, 30t | telescopic, 165kW (224PS) | 66,000,000 | 3,500,000 | 47,075,000 | 20,400,000 | 47,075,000 | 5,202 |
| 20. | Truck crane, hydraulic, 50t | telescopic, 250kW (340PS) | 75,000,000 | 4,000,000 | 60,975,000 | 48,000,000 | 60,975,000 | 6,738 |
| 21. | Vibratory pile driver, 40kW | | 15,000,000 | 250,000 | 105,800,000 | 96,000,000 | 15,000,000 | 1,657 |
| 22. | Heavy breaker, 1300kg | hydrawlic type, excluding base machine | 65,000,000 | 250,000 | 146,075,000 | 48,000,000 | 65,000,000 | 7,182 |
| 23. | Motor grader, 3.1m | blade width 3.1m, 85kW (116PS) | 45,000,000 | 5,000,000 | 67,325,000 | 21,600,000 | 45,000,000 | 4,972 |
| 24. | Vibratory roller, 2.5t | 19kw (26PS) | 13,000,000 | 1,500,000 | 53,450,000 | 46,800,000 | 13,000,000 | 1,436 |
| 25. | Vibratory roller, 8-10t | 77kw (105PS) | 51,000,000 | 4,000,000 | 67,325,000 | 79,200,000 | 51,000,000 | 5,635 |
| 26. | Concrete plant, pan, 0.75m3 x 1 | portable (truck rigged), 45m3/h, 75kW | 130,000,000 | 96,000,000 | 50,425,000 | 96,000,000 | 50,425,000 | 5,572 |
| 27. | Agitator truck, 1.5m3 | 138kW (188PS) | 20,000,000 | 1,000,000 | 58,200,000 | 50,400,000 | 20,000,000 | 2,210 |
| 28. | Agitator truck, 4m3 | 213kW (290PS) | 25,000,000 | 1,000,000 | 65,150,000 | 64,800,000 | 25,000,000 | 2,762 |
| 29. | Concrete pump car, 90m3/hr | boom type, 199kW (271PS) | 45,000,000 | 1,500,000 | 152,975,000 | 20,400,000 | 45,000,000 | 4,972 |
| 30. | Bulldozer, super swamp, 4 t | 34 kW (46PS) | - | - | 67,325,000 | 31,200,000 | 67,325,000 | 7,439 |
| 31. | Bulldozer, super swamp, 10 t | 52 kW (71PS) | - | - | 67,325,000 | 31,200,000 | 67,325,000 | 7,439 |
| 32. | Cutter suction dredger, 600PS | 441 kW (600PS) | 337,120,000 | 50,000,000 | 1,778,025,000 | 480,000,000 | 337,120,000 | 37,251 |
| 33. | Anchor barge, 5t D | 66 kW (90PS) | 40,000,000 | 20,000,000 | 162,500,000 | 360,000,000 | 40,000,000 | 4,420 |
| 34. | Anchor barge, 10t D | 132 kW (180PS) | 50,000,000 | 25,000,000 | 169,450,000 | 420,000,000 | 50,000,000 | 5,525 |
| 35. | Anchor barge, 15t D | 177 kW (240PS) | 60,000,000 | 30,000,000 | 176,400,000 | 480,000,000 | 60,000,000 | 6,630 |

Source: JICA Study Team

Note:

A: PT. Wijaya Karya

B: PT. Waskita Karya

- Maintenance and repair cost is included in the rate.
- Operator cost is included in the rate.
- Fuel cost is included in the rate.
- Price level: December 2006
- Excahnge rate: $ 1.0= Y 118.92
- Excahnge rate: $ 1.0= Rp. 9,050

## Table 3.3.4 Labor Wage for Estimation

| Code | Trade | Unit | F.C | L.C | Total | | Basic wage | Surcharge1/*1 | Surcharge2/*2 | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | *a* | *b= h* | *c= a+b* | *d= c* | *e* | *f* | *g* | *h= e+f+g* |
| | | | (Y) | (Rp.) | (Rp.) | ($) | (Rp.) | (Rp.) | (Rp.) | (Rp.) |
| L0010 | Foreman | m.d | - | 38,280 | 38,280 | 4.2 | 29,000 | 4,350 | 4,930 | 38,280 |
| L0012 | Fleet captain | m.d | - | 61,248 | 61,248 | 6.8 | 46,400 | 6,960 | 7,888 | 61,248 |
| L0110 | Operator | m.d | - | 32,076 | 32,076 | 3.5 | 24,300 | 3,645 | 4,131 | 32,076 |
| L0112 | Assitant operator | m.d | - | 29,436 | 29,436 | 3.3 | 22,300 | 3,345 | 3,791 | 29,436 |
| L0120 | Teamster | m.d | - | 32,076 | 32,076 | 3.5 | 24,300 | 3,645 | 4,131 | 32,076 |
| L0130 | Driver | m.d | - | 29,436 | 29,436 | 3.3 | 22,300 | 3,345 | 3,791 | 29,436 |
| L0150 | Crewman, senior | m.d | - | 43,296 | 43,296 | 4.8 | 32,800 | 4,920 | 5,576 | 43,296 |
| L0157 | Crewman, common | m.d | - | 23,100 | 23,100 | 2.6 | 17,500 | 2,625 | 2,975 | 23,100 |
| L0210 | Mechanic | m.d | - | 32,076 | 32,076 | 3.5 | 24,300 | 3,645 | 4,131 | 32,076 |
| L0220 | Electrician | m.d | - | 32,076 | 32,076 | 3.5 | 24,300 | 3,645 | 4,131 | 32,076 |
| L0310 | Carpenter | m.d | - | 29,436 | 29,436 | 3.3 | 22,300 | 3,345 | 3,791 | 29,436 |
| L0340 | Rigger | m.d | - | 29,436 | 29,436 | 3.3 | 22,300 | 3,345 | 3,791 | 29,436 |
| L0410 | Form worker | m.d | - | 29,436 | 29,436 | 3.3 | 22,300 | 3,345 | 3,791 | 29,436 |
| L0420 | Steel setter | m.d | - | 29,436 | 29,436 | 3.3 | 22,300 | 3,345 | 3,791 | 29,436 |
| L0422 | Reinforcing worker | m.d | - | 29,436 | 29,436 | 3.3 | 22,300 | 3,345 | 3,791 | 29,436 |
| L0430 | Concrete worker | m.d | - | 29,436 | 29,436 | 3.3 | 22,300 | 3,345 | 3,791 | 29,436 |
| L0510 | Mason | m.d | - | 29,436 | 29,436 | 3.3 | 22,300 | 3,345 | 3,791 | 29,436 |
| L0512 | Gabion worker | m.d | - | 29,436 | 29,436 | 3.3 | 22,300 | 3,345 | 3,791 | 29,436 |
| L0910 | Semiskilled worker | m.d | - | 23,100 | 23,100 | 2.6 | 17,500 | 2,625 | 2,975 | 23,100 |
| L0920 | Common worker | m.d | - | 22,044 | 22,044 | 2.4 | 16,700 | 2,505 | 2,839 | 22,044 |

Source: JICA Study Team

Note: - Price level: December, 2006 Indonesia
Exchange rate: $1.0= Y 118.92
Exchange rate: $1.0= Rp. 9,050
Exchange rate: Y1.0= Rp. 76.1
Exchange rate: Rp.1.0= Y 0.0131

*1: Surcharge1: 15% Employer's Provident Fund (EPF; 12%) and Employer's Trust Fund (ETF, 3%).

*2: Surcharge2: 17% Overtime for Saturday (=17%= 1-(5+2)/6)

## Table 3.3.5 Material Price for Estimation

| Code | Material | Unit | F.C | L.C | Total |
|---|---|---|---|---|---|
| | | | (Y) | (Rp.) | ($) |
| **Fuel** | | | | | |
| M101020 | Light oil | lit. | - | 4,300 | 0.5 |
| M101030 | Heavy oil | lit. | - | 3,142 | 0.3 |
| M103010 | Lubricant | lit. | - | 24,800 | 2.7 |
| **Timber, from and support** | | | | | |
| M241010 | Timber, plank | cu.m | - | 3,500,000 | 386.7 |
| M241020 | Timber, square | cu.m | - | 3,250,000 | 359.1 |
| M241030 | Timber, log | cu.m | - | 2,500,000 | 276.2 |
| M242010 | Plywood | cu.m | - | 4,621,000 | 510.6 |
| M245010 | Form oil | lit. | - | 3,142 | 0.3 |
| **Cement and agent** | | | | | |
| M301010 | Cement, Portland | ton | - | 600,000 | 66.3 |
| M302010 | AE agent | lit. | - | 9,000 | 1.0 |
| M302020 | Water reducing agent | lit. | - | 10,000 | 1.1 |
| **Concrete product** | | | | | |
| M320015 | Concrete, K175 (Ex-plant) | cu.m | - | 410,000 | 45.3 |
| M320025 | Concrete, K225 (Ex-plant) | cu.m | - | 425,000 | 47.0 |
| M320030 | Concrete, K275 (Ex-plant) | cu.m | - | 455,000 | 50.3 |
| M320040 | Concrete, K350 40 (Ex-plant) | cu.m | - | 495,000 | 54.7 |
| **Earth and rock materials** | | | | | |
| M404060 | Stone, for masonry | cu.m | - | 83,333 | 9.2 |
| **Iron and steel** | | | | | |
| M501010 | Reinforcing bar, deformed | ton | - | 6,333,333 | 699.8 |
| M502000 | Steel sheet pile | ton | - | 8,500,000 | 939.2 |

Source: JICA Study Team

Note: - Price level: December, 2006, Indonesia

Exchange rate: $1.0= Y 118.92

Exchange rate: $1.0= Rp. 9,050

Exchange rate: Y1.0= Rp. 76.1

Exchange rate: Rp.1.0= Y 0.0131

- Prices are values before tax.

## Table 3.3.6 Equipment Rental Rate for Estimation

| Code | Equipment | Unit | Hourly/daily cost F.C | Hourly/daily cost L.C | Fuel consump. | Operator/ teamster(T) | Monthly rental rate | Operation hours per month/*1 |
|---|---|---|---|---|---|---|---|---|
| | | | (Y) | (Rp.) | (lit./hr) | (m.d) | (Rp./M) | (h/M) |
| E010115 | Bulldozer, 11t | hr | 0 | 310,924 | 13.8 | 0.15 | 37,000,000 | 119 |
| E010117 | Bulldozer, 21t | hr | 0 | 396,639 | 28.6 | 0.15 | 47,200,000 | 119 |
| E010141 | Bulldozer, SLGCP, 4t | hr | 0 | 565,756 | 5.9 | 0.15 | 67,325,000 | 119 |
| E010142 | Bulldozer, SLGCP, 10t | hr | 0 | 565,756 | 10.6 | 0.15 | 67,325,000 | 119 |
| E010152 | Bulldozer, w/ripper, 21t | hr | 0 | 463,866 | 30.9 | 0.15 | 55,200,000 | 119 |
| E010153 | Bulldozer, w/ripper, 32t | hr | 0 | 546,218 | 43.9 | 0.15 | 65,000,000 | 119 |
| E020212 | Backhoe, 0.35m3 | hr | 0 | 231,092 | 10.4 | 0.15 | 27,500,000 | 119 |
| E020215 | Backhoe, 0.6m3 | hr | 0 | 310,924 | 17.4 | 0.15 | 37,000,000 | 119 |
| E020218 | Backhoe, 1m3 | hr | 0 | 396,639 | 28.3 | 0.15 | 47,200,000 | 119 |
| E020639 | Wheel loader, 2.3m3 | hr | 0 | 478,992 | 17.9 | 0.15 | 57,000,000 | 119 |
| E030105 | Dump truck,10t | hr | 0 | 151,261 | 13.4 | 0.15 | 18,000,000 | 119 |
| E040133 | Crawler crane, hyd., 35t | hr | 0 | 495,798 | 10.5 | 0.15 | 59,000,000 | 119 |
| E040135 | Crawler crane, hyd., 50t | hr | 0 | 579,832 | 10.9 | 0.15 | 69,000,000 | 119 |
| E040222 | Truck crane, hyd., 11t | hr | 0 | 210,084 | 8.5 | 0.15 | 25,000,000 | 119 |
| E040226 | Truck crane, hyd., 30t | hr | 0 | 395,588 | 10.6 | 0.15 | 47,075,000 | 119 |
| E040228 | Truck crane, hyd., 50t | hr | 0 | 512,395 | 12.5 | 0.15 | 60,975,000 | 119 |
| E050316 | Vibrohammer, El., 40 kW | hr | 0 | 126,050 | 12.2 | 0.15 | 15,000,000 | 119 |
| E070113 | Motor grader, 3.1m | hr | 0 | 378,151 | 9.3 | 0.15 | 45,000,000 | 119 |
| E080422 | Vibratory roller, 2.5-2.8t | hr | 0 | 109,244 | 2.7 | 0.15 | 13,000,000 | 119 |
| E080423 | Vibratory roller, 3-5t | hr | 0 | 42,098 | 3.3 | 0.15 | 26,000,000 | 119 |
| E080425 | Vibratory roller, 8-10t | hr | 0 | 428,571 | 15.0 | 0.15 | 51,000,000 | 119 |
| E090142 | Concrete plant, pan, 0.75m3*1 | hr | 0 | 345,377 | 37.5 | 0.60 | 50,425,000 | 146 |
| E090212 | Agitator truck, 1.5m3 | hr | 0 | 136,986 | 8.3 | 0.15 | 20,000,000 | 146 |
| E090214 | Agitator truck, 4m3 | hr | 0 | 171,233 | 11.9 | 0.15 | 25,000,000 | 146 |
| E090325 | Concrete pump car, 55m3/hr | hr | 0 | 308,219 | 14.0 | 0.15 | 45,000,000 | 146 |
| E301213 | Cutter-suction dredger, 600PS | day | 0 | 14,657,391 | 1731.6 | 1.00 | 337,120,000 | 23 (d/M) |
| E301215 | Anchor barge, 5t D | day | 0 | 1,739,130 | 259.7 | 1.00 | 40,000,000 | 23 (d/M) |

Source: JICA Study Team

Note: Price level: December, 2006

| | |
|---|---|
| Exchange rate: $1.0= Y | 118.92 |
| Exchange rate: $1.0= Rp. | 9,050 |
| Exchange rate: Y1.0= Rp. | 76.1 |
| Exchange rate: Rp.1.0= Y | 0.01314 |

*1: 119h/M= 6.5h/d x 219d/Y / 12M/Y for earthworks
146h/M= 6.5h/d x 270d/Y / 12M/Y for concrete works
23d/M= 281d/Y / 12M/Y for dredging works

- Prices are values before tax.

# Table 3.3.8 Breakdown of Unit Cost (1/7)

Project name: Study on Countermeasures for Sedimentation in Wonogiri Multipurpose Dam Reservoir
Code in system: S2-10-10-30008
Work item: **Steel sheet piling (driving by vibrohammer)**
Description: piling by vibrohammer, steel sheet pile U-III (10m)
Hauling distance: -
Unit: **ton** Type U-III: (W)400 x (h)125 x (t)13 mm, 60kg/m, 150kg/m2
Construction q'ty: 6 ton basis

| No. | Item | Unit | Q'ty | Unit price F.C (Y) | Unit price L.C (Rp.) | Amount F.C (Y) | Amount L.C (Rp.) | Amount Total (Rp.) | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| **1.** | **Labor** | | | | | | | | |
| | Foreman | m.d | 0.76 | - | 38,280 | - | 29,180 | | |
| | | | 0.70 | - | - | - | - | | |
| | Common worker | m.d | 0.60 | - | 22,044 | - | 13,226 | | |
| | Rigger | m.d | 1.22 | - | 29,436 | - | 35,912 | | |
| | | | - | - | - | - | - | | |
| | | | - | - | - | - | - | | |
| | | | - | - | - | - | - | | |
| | | | - | - | - | - | - | | |
| | Miscellaneous | | 5% | | | - | 3,916 | | |
| | Sub-total of 1. | | | | | - | 82,234 | 82,234 | (0%) |
| **2.** | **Material** | | | | | | | | |
| | | | 53.58 | - | - | - | - | | |
| | Lubricant | lit. | 1.61 | - | 24,800 | - | 39,860 | | |
| | Steel sheet pile | ton | 6.00 | - | 8,500,000 | - | 51,000,000 | | |
| | | | - | - | - | - | - | | |
| | | | - | - | - | - | - | | |
| | | | - | - | - | - | - | | |
| | | | - | - | - | - | - | | |
| | | | - | - | - | - | - | | |
| | Miscellaneous | | 5% | | | - | 2,551,993 | | |
| | Sub-total of 2. | | | | | - | 53,591,853 | 53,591,853 | (74%) |
| **3.** | **Equipment** | | | | | | | | |
| | Vibrohammer, El., 40 kW | hr | 2.32 | - | 126,050 | - | 292,346 | | |
| | Crawler crane, hyd., 50t | hr | 2.32 | - | 579,832 | - | 1,344,798 | | |
| | | | - | - | - | - | - | | |
| | | | - | - | - | - | - | | |
| | | | - | - | - | - | - | | |
| | | | - | - | - | - | - | | |
| | | | - | - | - | - | - | | |
| | | | - | - | - | - | - | | |
| | Miscellaneous | | 5% | | | - | 81,857 | | |
| | Sub-total of 3. | | | | | - | 1,719,001 | 1,719,001 | (2%) |
| | Total of 1.-3. | | | | | - | 55,393,089 | | |
| **4.** | **Overhead and profit** | | **30%** | | | **-** | **16,617,927** | **16,617,927** | **(23%)** |
| | Total of 1.-4. (per 6 ton) | | | | | - | 72,011,016 | 72,011,016 | (100%) |
| | **Unit cost (per ton)** | | | | | **-** | **12,001,836** | **12,001,836** | |

Note: Price level: December, 2006

| | | Amount ($) | | |
|---|---|---|---|---|
| | | F.C | L.C | Total |
| Exchange rate: $1.0= Y | 118.92 | | | |
| Exchange rate: $1.0= Rp. | 9,050 | **0** | **1,326** | **1,326** |
| Exchange rate: Y1.0= Rp. | 76.1 | (0%) | (100%) | (100%) |

- Prices are values before tax.

Source: JICA Study Team

## Table 3.3.8 Breakdown of Unit Cost (2/7)

Project name: Study on Countermeasures for Sedimentation in Wonogiri Multipurpose Dam Reservoir
Code in system: E1-40-14-02500
Work item: **Excavation, common**
Description: bulldozing (cutting and pushing), L= 20m, loading by wheel loader, hauling and spreading,
Hauling distance: 1,000m
Unit: **m3**
Construction q'ty: 100 m3 basis

| No. | Item | Unit | Q'ty | Unit price F.C (Y) | Unit price L.C (Rp.) | Amount F.C (Y) | Amount L.C (Rp.) | Amount Total (Rp.) | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| **1.** | **Labor** | | | | | | | | |
| | Foreman | m.d | 0.15 | - | 38,280 | - | 5,692 | | |
| | | | 1.49 | - | - | - | - | | |
| | | | - | - | - | - | - | | |
| | | | - | - | - | - | - | | |
| | | | - | - | - | - | - | | |
| | | | - | - | - | - | - | | |
| | | | - | - | - | - | - | | |
| | | | - | - | - | - | - | | |
| | Miscellaneous | | 5% | | | - | 285 | | |
| | Sub-total of 1. | | | | | - | 5,976 | 5,976 | (0%) |
| **2.** | **Material** | | | | | | | | |
| | | | 159.08 | - | - | - | - | | |
| | Lubricant | lit. | 4.77 | - | 24,800 | - | 118,359 | | |
| | | | - | - | - | - | - | | |
| | | | - | - | - | - | - | | |
| | | | - | - | - | - | - | | |
| | | | - | - | - | - | - | | |
| | | | - | - | - | - | - | | |
| | | | - | - | - | - | - | | |
| | Miscellaneous | | 5% | | | - | 5,918 | | |
| | Sub-total of 2. | | | | | - | 124,277 | 124,277 | (4%) |
| **3.** | **Equipment** | | | | | | | | |
| | Bulldozer, 21t | hr | 1.39 | - | 396,639 | - | 550,888 | | |
| | Wheel loader, 2.3m3 | hr | 1.08 | - | 478,992 | - | 515,045 | | |
| | Dump truck,10t | hr | 6.67 | - | 151,261 | - | 1,008,407 | | |
| | Bulldozer, 11t | hr | 0.78 | - | 310,924 | - | 242,909 | | |
| | | | - | - | - | - | - | | |
| | | | - | - | - | - | - | | |
| | | | - | - | - | - | - | | |
| | | | - | - | - | - | - | | |
| | Miscellaneous | | 5% | | | - | 115,862 | | |
| | Sub-total of 3. | | | | | - | 2,433,111 | 2,433,111 | (73%) |
| | Total of 1.-3. | | | | | - | 2,563,364 | | |
| **4.** | **Overhead and profit** | | **30%** | | | **-** | **769,009** | **769,009** | **(23%)** |
| | Total of 1.-4. (per 100 m3) | | | | | - | 3,332,373 | 3,332,373 | (100%) |
| | **Unit cost (per m3)** | | | | | **-** | **33,324** | **33,324** | |

Note: Price level: December, 2006

| | | Amount ($) | | |
|---|---|---|---|---|
| | | F.C | L.C | Total |
| Exchange rate: $1.0= Y | 118.92 | | | |
| Exchange rate: $1.0= Rp. | 9,050 | **0** | **4** | **4** |
| Exchange rate: Y1.0= Rp. | 76.1 | (0%) | (100%) | (100%) |

- Prices are values before tax.

Source: JICA Study Team

## Table 3.3.8 Breakdown of Unit Cost (3/7)

Project name: Study on Countermeasures for Sedimentation in Wonogiri Multipurpose Dam Reservoir
Code in system: E1-70-30-01000
Work item: **Excavation, forebay**
Description: cutter-suction dredger, 600PS, including discharge through pipeline
Hauling distance: 1,000m
Unit: **m3**
Construction q'ty: 1417 m3 basis

| No. | Item | Unit | Q'ty | Unit price F.C (Y) | Unit price L.C (Rp.) | Amount F.C (Y) | Amount L.C (Rp.) | Amount Total (Rp.) | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| **1.** | **Labor** | | | | | | | | |
| | Fleet captain | m.d | 1.00 | - | 61,248 | - | 61,248 | | |
| | Crewman, senior | m.d | 2.00 | - | 43,296 | - | 86,592 | | |
| | Crewman, common | m.d | 18.00 | - | 23,100 | - | 415,800 | | |
| | Common worker | m.d | 4.00 | - | 22,044 | - | 88,176 | | |
| | | | 1.80 | - | - | - | - | | |
| | Common worker | m.d | 10.00 | - | 22,044 | - | 220,440 | | |
| | | | - | - | - | - | - | | |
| | | | - | - | - | - | - | | |
| | Miscellaneous | | 5% | | | - | 43,613 | | |
| | Sub-total of 1. | | | | | - | 915,869 | 915,869 | (2%) |
| **2.** | **Material** | | | | | | | | |
| | Heavy oil | lit. | 1991.30 | - | 3,142 | - | 6,256,665 | | |
| | | | 1991.30 | - | - | - | - | | |
| | Lubricant | lit. | 119.48 | - | 24,800 | - | 2,963,054 | | |
| | | | - | - | - | - | - | | |
| | | | - | - | - | - | - | | |
| | | | - | - | - | - | - | | |
| | | | - | - | - | - | - | | |
| | | | - | - | - | - | - | | |
| | Miscellaneous | | 5% | | | - | 460,986 | | |
| | Sub-total of 2. | | | | | - | 9,680,705 | 9,680,705 | (21%) |
| **3.** | **Equipment** | | | | | | | | |
| | Cutter-suction dredger, 600PS | day | 1.00 | - | 14,657,391 | - | 14,657,391 | | |
| | Anchor barge, 5t D | day | 1.00 | - | 1,739,130 | - | 1,739,130 | | |
| | Bulldozer, 11t | hr | 12.00 | - | 310,924 | - | 3,731,088 | | |
| | | | - | - | - | - | - | | |
| | | | - | - | - | - | - | | |
| | | | - | - | - | - | - | | |
| | | | - | - | - | - | - | | |
| | | | - | - | - | - | - | | |
| | Miscellaneous | | 20% | | | - | 4,025,522 | | |
| | Sub-total of 3. | | | | | - | 24,153,131 | 24,153,131 | (53%) |
| | Total of 1.-3. | | | | | - | 34,749,705 | | |
| **4.** | **Overhead and profit** | | **30%** | | | **-** | **10,424,911** | **10,424,911** | **(23%)** |
| | Total of 1.-4. (per 1417 m3) | | | | | - | 45,174,616 | 45,174,616 | (100%) |
| | **Unit cost (per m3)** | | | | | **-** | **31,880** | **31,880** | |

Note: Price level: December, 2006

| | | Amount ($) | | |
|---|---|---|---|---|
| | | F.C | L.C | Total |
| Exchange rate: $1.0= Y | 118.92 | | | |
| Exchange rate: $1.0= Rp. | 9,050 | **0** | **4** | **4** |
| Exchange rate: Y1.0= Rp. | 76.1 | (0%) | (100%) | (100%) |

- Prices are values before tax.

Source: JICA Study Team

## Table 3.3.8 Breakdown of Unit Cost (4/7)

Project name: Study on Countermeasures for Sedimentation in Wonogiri Multipurpose Dam Reservoir
Code in system: E3-30-22-00000
Work item: **Backfilling**
Description: throwing and spreading by backhoe, compaction by vibratory roller
Hauling distance: -
Unit: **m3**
Construction q'ty: 100 m3 basis

| No. | Item | Unit | Q'ty | Unit price F.C (Y) | Unit price L.C (Rp.) | Amount F.C (Y) | Amount L.C (Rp.) | Amount Total (Rp.) | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| **1.** | **Labor** | | | | | | | | |
| | Foreman | m.d | 0.62 | - | 38,280 | - | 23,740 | | |
| | | | 1.20 | - | - | - | - | | |
| | | | 4.76 | - | - | - | - | | |
| | Common worker | m.d | 0.24 | - | 22,044 | - | 5,289 | | |
| | | | - | - | - | - | - | | |
| | | | - | - | - | - | - | | |
| | | | - | - | - | - | - | | |
| | | | - | - | - | - | - | | |
| | Miscellaneous | | 5% | | | - | 1,451 | | |
| | Sub-total of 1. | | | | | - | 30,480 | 30,480 | (2%) |
| **2.** | **Material** | | | | | | | | |
| | | | 72.02 | - | - | - | - | | |
| | Lubricant | lit. | 2.16 | - | 24,800 | - | 53,587 | | |
| | | | - | - | - | - | - | | |
| | | | - | - | - | - | - | | |
| | | | - | - | - | - | - | | |
| | | | - | - | - | - | - | | |
| | | | - | - | - | - | - | | |
| | | | - | - | - | - | - | | |
| | Miscellaneous | | 5% | | | - | 2,679 | | |
| | Sub-total of 2. | | | | | - | 56,266 | 56,266 | (3%) |
| **3.** | **Equipment** | | | | | | | | |
| | Backhoe, 0.6m3 | hr | 3.24 | - | 310,924 | - | 1,006,227 | | |
| | Vibratory roller, 3-5t | hr | 4.76 | - | 42,098 | - | 200,467 | | |
| | | | - | - | - | - | - | | |
| | | | - | - | - | - | - | | |
| | | | - | - | - | - | - | | |
| | | | - | - | - | - | - | | |
| | | | - | - | - | - | - | | |
| | | | - | - | - | - | - | | |
| | Miscellaneous | | 5% | | | - | 60,335 | | |
| | Sub-total of 3. | | | | | - | 1,267,028 | 1,267,028 | (72%) |
| | Total of 1.-3. | | | | | - | 1,353,774 | | |
| **4.** | **Overhead and profit** | | **30%** | | | **-** | **406,132** | **406,132** | **(23%)** |
| | Total of 1.-4. (per 100 m3) | | | | | - | 1,759,906 | 1,759,906 | (100%) |
| | **Unit cost (per m3)** | | | | | **-** | **17,599** | **17,599** | |

Note: Price level: December, 2006

| | | Amount ($) F.C | L.C | Total |
|---|---|---|---|---|
| Exchange rate: $1.0= Y | 118.92 | | | |
| Exchange rate: $1.0= Rp. | 9,050 | **0** | **2** | **2** |
| Exchange rate: Y1.0= Rp. | 76.1 | (0%) | (100%) | (100%) |

- Prices are values before tax.

Source: JICA Study Team

# Table 3.3.8 Breakdown of Unit Cost (5/7)

Project name: Study on Countermeasures for Sedimentation in Wonogiri Multipurpose Dam Reservoir
Code in system: E3-10-10-00000
Work item: **Filling**
Description: loading, hauling, spreading and compaction
Hauling distance: 1,000m
Unit: **m3**
Construction q'ty: 100 m3 basis

| No. | Item | Unit | Q'ty | Unit price F.C (Y) | Unit price L.C (Rp.) | Amount F.C (Y) | Amount L.C (Rp.) | Amount Total (Rp.) | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| **1.** | **Labor** | | | | | | | | |
| | Foreman | m.d | 0.25 | - | 38,280 | - | 9,545 | | |
| | | | 2.09 | - | - | - | - | | |
| | Common worker | m.d | 0.40 | - | 22,044 | - | 8,818 | | |
| | | | - | - | - | - | - | | |
| | | | - | - | - | - | - | | |
| | | | - | - | - | - | - | | |
| | | | - | - | - | - | - | | |
| | | | - | - | - | - | - | | |
| | Miscellaneous | | 5% | | | - | 918 | | |
| | Sub-total of 1. | | | | | - | 19,281 | 19,281 | (1%) |
| **2.** | **Material** | | | | | | | | |
| | | | 144.63 | - | - | - | - | | |
| | Lubricant | lit. | 4.34 | - | 24,800 | - | 107,608 | | |
| | | | - | - | - | - | - | | |
| | | | - | - | - | - | - | | |
| | | | - | - | - | - | - | | |
| | | | - | - | - | - | - | | |
| | | | - | - | - | - | - | | |
| | | | - | - | - | - | - | | |
| | Miscellaneous | | 5% | | | - | 5,380 | | |
| | Sub-total of 2. | | | | | - | 112,989 | 112,989 | (4%) |
| **3.** | **Equipment** | | | | | | | | |
| | Wheel loader, 2.3m3 | hr | 1.19 | - | 478,992 | - | 570,229 | | |
| | Dump truck,10t | hr | 7.14 | - | 151,261 | - | 1,080,436 | | |
| | Bulldozer, 11t | hr | 0.86 | - | 310,924 | - | 268,038 | | |
| | Vibratory roller, 3-5t | hr | 4.76 | - | 42,098 | - | 200,467 | | |
| | | | - | - | - | - | - | | |
| | | | - | - | - | - | - | | |
| | | | - | - | - | - | - | | |
| | | | - | - | - | - | - | | |
| | Miscellaneous | | 5% | | | - | 105,958 | | |
| | Sub-total of 3. | | | | | - | 2,225,127 | 2,225,127 | (73%) |
| | Total of 1.-3. | | | | | - | 2,357,397 | | |
| **4.** | **Overhead and profit** | | **30%** | | | **-** | **707,219** | **707,219** | **(23%)** |
| | Total of 1.-4. (per 100 m3) | | | | | - | 3,064,616 | 3,064,616 | (100%) |
| | **Unit cost (per m3)** | | | | | **-** | **30,646** | **30,646** | |

Note: Price level: December, 2006

| | | Amount ($) | | |
|---|---|---|---|---|
| | | F.C | L.C | Total |
| Exchange rate: $1.0= Y | 118.92 | | | |
| Exchange rate: $1.0= Rp. | 9,050 | **0** | **3** | **3** |
| Exchange rate: Y1.0= Rp. | 76.1 | (0%) | (100%) | (100%) |

- Prices are values before tax.

Source: JICA Study Team

# Table 3.3.8 Breakdown of Unit Rate (6/7)

Project name: Study on Countermeasures for Sedimentation in Wonogiri Multipurpose Dam Reservoir
Code for project:
Code in system: C3-20-20-00000
Work item: **Concrete**
Description: formwork, concrete, ex-plant, hauling, placing
Hauling distance: 40,000m
Unit: **m3**
Construction q'ty: 100 m3 basis

| No. | Item | Unit | Q'ty | Unit price F.C (Y) | Unit price L.C (Rp.) | Amount F.C (Y) | Amount L.C (Rp.) | Total (Rp.) | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| **1.** | **Labor** | | | | | | | | |
| | Foreman | m.d | 1.26 | - | 38,280 | - | 48,318 | | |
| | | | 12.83 | - | - | - | - | | |
| | Form worker | m.d | 36.40 | - | 29,436 | - | 1,071,470 | | |
| | Common worker | m.d | 17.20 | - | 22,044 | - | 379,157 | | |
| | | | - | - | - | - | - | | |
| | | | - | - | - | - | - | | |
| | | | - | - | - | - | - | | |
| | | | - | - | - | - | - | | |
| | Miscellaneous | | 5% | | | - | 74,947 | | |
| | Sub-total of 1. | | | | | - | 1,573,892 | 1,573,892 | (2%) |
| **2.** | **Material** | | | | | | | | |
| | | | 990.39 | - | - | - | - | | |
| | Lubricant | lit. | 29.71 | - | 24,800 | - | 736,853 | | |
| | Plywood | cu.m | 1.60 | - | 4,621,000 | - | 7,393,600 | | |
| | Timber, square | cu.m | 1.20 | - | 3,250,000 | - | 3,900,000 | | |
| | Form oil | lit. | 40.00 | - | 3,142 | - | 125,680 | | |
| | Concrete, K275 (Ex-plant) | cu.m | 100.00 | - | 455,000 | - | 45,500,000 | | |
| | | | - | - | - | - | - | | |
| | | | - | - | - | - | - | | |
| | | | - | - | - | - | - | | |
| | | | - | - | - | - | - | | |
| | Miscellaneous | | 5% | | | - | 2,882,807 | | |
| | Sub-total of 2. | | | | | - | 60,538,939 | 60,538,939 | (59%) |
| **3.** | **Equipment** | | | | | | | | |
| | Truck crane, hyd., 11t | hr | 10.42 | - | 210,084 | - | 2,188,375 | | |
| | Agitator truck, 4m3 | hr | 71.43 | - | 171,233 | - | 12,230,929 | | |
| | Concrete pump car, 55m3/hr | hr | 3.70 | - | 308,219 | - | 1,141,552 | | |
| | | | - | - | - | - | - | | |
| | | | - | - | - | - | - | | |
| | | | - | - | - | - | - | | |
| | | | - | - | - | - | - | | |
| | | | - | - | - | - | - | | |
| | Miscellaneous | | 5% | | | - | 778,043 | | |
| | Sub-total of 3. | | | | | - | 16,338,898 | 16,338,898 | (16%) |
| | Total of 1.-3. | | | | | - | 78,451,730 | | |
| **4.** | **Overhead and profit** | | **30%** | | | **-** | **23,535,519** | **23,535,519** | **(23%)** |
| | Total of 1.-4. (per 100 m3) | | | | | - | 101,987,249 | 101,987,249 | (100%) |
| | **Unit cost (per m3)** | | | | | **-** | **1,019,872** | **1,019,872** | |

Note: Price level: December, 2006

| | | Amount ($) | | |
|---|---|---|---|---|
| | | F.C | L.C | Total |
| Exchange rate: $1.0= Y | 118.92 | | | |
| Exchange rate: $1.0= Rp. | 9,050 | **0** | **113** | **113** |
| Exchange rate: Y1.0= Rp. | 76.1 | (0%) | (100%) | (100%) |

- Prices are values before tax.

## Table 3.3.8 Breakdown of Unit Cost (7/7)

Project name: Study on Countermeasures for Sedimentation in Wonogiri Multipurpose Dam Reservoir
Code in system: S3-10-10-16025
Work item: **Rebar works**
Description: D16-25mm, deformed, rebar bending, rebar cutting, rebar assembly
Hauling distance: -
Unit: **ton**
Construction q'ty: 1 ton basis

| No. | Item | Unit | Q'ty | Unit price F.C (Y) | Unit price L.C (Rp.) | Amount F.C (Y) | Amount L.C (Rp.) | Amount Total (Rp.) | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| **1.** | **Labor** | | | | | | | | |
| | Foreman | m.d | 0.07 | - | 38,280 | - | 2,595 | | |
| | | | 0.08 | - | - | - | - | | |
| | Reinforcing worker | m.d | 4.80 | - | 29,436 | - | 141,293 | | |
| | Common worker | m.d | 1.90 | - | 22,044 | - | 41,884 | | |
| | | | - | - | - | - | - | | |
| | | | - | - | - | - | - | | |
| | | | - | - | - | - | - | | |
| | | | - | - | - | - | - | | |
| | Miscellaneous | | 5% | | | - | 9,289 | | |
| | Sub-total of 1. | | | | | - | 195,060 | 195,060 | (2%) |
| **2.** | **Material** | | | | | | | | |
| | | | 4.43 | - | - | - | - | | |
| | Lubricant | lit. | 0.13 | - | 24,800 | - | 3,294 | | |
| | Reinforcing bar, deformed | ton | 1.00 | - | 6,333,333 | - | 6,333,333 | | |
| | | | - | - | - | - | - | | |
| | | | - | - | - | - | - | | |
| | | | - | - | - | - | - | | |
| | | | - | - | - | - | - | | |
| | | | - | - | - | - | - | | |
| | Miscellaneous | | 3% | | | - | 190,099 | | |
| | Sub-total of 2. | | | | | - | 6,526,726 | 6,526,726 | (73%) |
| **3.** | **Equipment** | | | | | | | | |
| | Truck crane, hyd., 11t | hr | 0.52 | - | 210,084 | - | 109,419 | | |
| | | | - | - | - | - | - | | |
| | | | - | - | - | - | - | | |
| | | | - | - | - | - | - | | |
| | | | - | - | - | - | - | | |
| | | | - | - | - | - | - | | |
| | | | - | - | - | - | - | | |
| | | | - | - | - | - | - | | |
| | Miscellaneous | | 5% | | | - | 5,471 | | |
| | Sub-total of 3. | | | | | - | 114,890 | 114,890 | (1%) |
| | Total of 1.-3. | | | | | - | 6,836,675 | | |
| **4.** | **Overhead and profit** | | **30%** | | | **-** | **2,051,002** | **2,051,002** | **(23%)** |
| | Total of 1.-4. (per 1 ton) | | | | | - | 8,887,677 | 8,887,677 | (100%) |
| | **Unit cost (per ton)** | | | | | **-** | **8,887,677** | **8,887,677** | |

Note: Price level: December, 2006

| | | Amount ($) | | |
|---|---|---|---|---|
| | Exchange rate: $1.0= Y 118.92 | F.C | L.C | Total |
| | Exchange rate: $1.0= Rp. 9,050 | **0** | **982** | **982** |
| | Exchange rate: Y1.0= Rp. 76.1 | (0%) | (100%) | (100%) |

- Prices are values before tax.

Source: JICA Study Team

## Table 3.3.9 Estimate of Construction Cost (1/3)

| Item | Unit | Quantity | Unit cost | Amount |
|---|---|---|---|---|
| | | | ($) | ($, thousand) |
| [Summary] | | | | |
| - Construction cost | | | | 54,914 |
| - Contingencies | | | | 13,684 |
| **Total** | | | | **68,598** |
| [Breakdown 1] | | | | |
| - Construction cost | | | | |
| A. Sediment storage reservoir works and dredger procurement | | | | |
| 1. Sediment storage reservoir works | | | | 40,318 |
| 2. Procurement of dredger | | | | 3,579 |
| Sub-total for A. | | | | 43,897 |
| B. Watershed conservation works | | | | |
| Sub-total for B. | | | | 11,017 |
| Total of A.+B. | | | | 54,914 |
| - Contingencies | | | | |
| A. Sediment storage reservoir works and dredger procurement | | | | |
| 1. Sediment storage reservoir works | | | | 11,451 |
| 2. Procurement of dredger | | | | 404 |
| Sub-total for A. | | | | 11,855 |
| B. Watershed conservation works | | | | |
| Sub-total for B. | | | | 1,829 |
| Total of A.+B. | | | | 13,684 |
| **Total of Construction cost and Contingencies** | | | | **68,598** |

## Table 3.3.9 Estimate of Construction Cost (2/3)

| Item | Unit | Quantity | Unit cost | Amount |
|---|---|---|---|---|
| | | | ($) | ($, thousand) |
| [Breakdown 2 (1/2)] | | | | |
| A. Sediment storage reservoir works and dredger procurement | | | | |
| **1. Sediment storage reservoir works** | | | | |
| 1) Temporary works, 10% for 2)+3)+4) | | | 10% | 2,932 |
| 2) Spillway | | | | |
| (1) Excavation | m3 | 389,240 | 4 | 1,557 |
| (2) Backfilling | m3 | 134,970 | 2 | 270 |
| (3) Concrete | m3 | 93,320 | 113 | 10,545 |
| (4) Reinforcing bar | t | 4,666 | 982 | 4,582 |
| (5) Radial gate | t | 170 | 14,000 | 2,380 |
| (6) Excavation, fore bay | m3 | 183,000 | 4 | 732 |
| Sub-total for 2) | | | | 20,066 |
| 3) Closure dike | | | | |
| (1) Steel sheet pile | t | 4,450 | 1,326 | 5,901 |
| (2) Filling, for dike | m3 | 167,800 | 3 | 503 |
| (3) Concrete | m3 | 4,500 | 113 | 509 |
| (4) Reinforcing bar | t | 225 | 982 | 221 |
| Sub-total for 3) | | | | 7,134 |
| 4) Overflow dike | | | | |
| (1) Excavation | m3 | 29,750 | 4 | 119 |
| (2) Filling, for reservoir road | m3 | 61,600 | 3 | 185 |
| (3) Concrete | m3 | 11,000 | 113 | 1,243 |
| (4) Reinforcing bar | t | 550 | 982 | 540 |
| (5) Slide gate | t | 5 | 7,000 | 35 |
| Sub-total for 4) | | | | 2,122 |
| 5) Other works | | | 25% | 8,064 |
| Total of 1) to 5) | | | | 40,318 |
| 6) Contingencies | | | | |
| (1) Physical contingency | | | 20% | 8,064 |
| (2) Price contingency | | | 7% | 3,387 |
| Total for 6) | | | | 11,451 |
| **Total for 1.** | | | | **51,769** |
| **2. Procurement of dredger** | | | | |
| 1) Cutter suction dredger | unit | 1 | 2,987,000 | 2,987 |
| 2) Anchor barge 3t D | unit | 1 | 267,000 | 267 |
| 3) Other equipment | | | 10% | 325 |
| Total of 1) to 3) | | | | 3,579 |
| 4) Contingencies | | | | |
| (1) Physical contingency | | | 5% | 179 |
| (2) Price contingency | | | 6% | 225 |
| Total for 4) | | | | 404 |
| **Total for 2.** | | | | **3,983** |
| **Total for A.** | | | | **55,752** |

## Table 3.3.9 Estimate of Construction Cost (3/3)

| Item | Unit | Quantity | Unit cost | Amount |
|---|---|---|---|---|
| | | | ($) | ($, thousand) |
| [Breakdown 2 (2/2)] | | | | |
| B. Watershed conservation works | | | | |
| **1. Watershed conservation works** | | | | |
| 1) Land preparation | | | | |
| (1) Terracing | | | | |
| /1 Cutting and filling | m3 | 4,673,000 | 0.69 | 3,224 |
| (2) Waterway and drop | | | | |
| /1 Stone material | m3 | 44,000 | 8.48 | 373 |
| /2 Excavation | m3 | 62,000 | 0.58 | 36 |
| /3 Masonry work | m3 | 40,000 | 10.64 | 426 |
| (3) Lip and rizer, planting | | | | |
| /1 Seedling, grass, for lip | nr. | 83,858,000 | 0.0100 | 839 |
| /2 Seedling, shrub, for lip | nr. | 5,032,000 | 0.0700 | 352 |
| /3 Seedling, grass, for riser | nr. | 115,938,000 | 0.0015 | 174 |
| /4 Planting work, for lip | m | 25,158,000 | 0.01 | 252 |
| /5 Planting work, for riser | m2 | 23,188,000 | 0.02 | 464 |
| 2) Side ditches (housing yard) | | | | |
| (1) Side ditch | | | | |
| /1 Stone material | m3 | 20,000 | 8.48 | 170 |
| /2 Excavation | m3 | 29,000 | 0.58 | 17 |
| /3 Masonry work | m3 | 18,000 | 10.64 | 192 |
| (2) Hedge row | | | | |
| /1 Shrub, for hedge row | nr. | 4,467,000 | 0.07 | 313 |
| /2 Planting work | m2 | 558,000 | 0.02 | 11 |
| 3) Agro-forestry and annual crop | | | | |
| (1) Agro-forestry and annual crop | L.S | | | 3,075 |
| 4) Support program | | | | |
| (1) Support program | L.S | | | 1,099 |
| Total of 1) to 4) | | | | 11,017 |
| 5) Contingencies | | | | |
| (1) Physical contingency | | | 10% | 1,102 |
| (2) Price contingency | | | 6% | 727 |
| Total for 6) | | | | 1,829 |
| **Total for 1.** | | | | **12,846** |
| **Total for B.** | | | | **12,846** |

Source: JICA Study Team

Note:
- Price level: December 2006
  - Excange rate: $ 1.0= Y 118.92
  - Excange rate: $ 1.0= Rp. 9,050
  - Excange rate: Y 1.0= Rp. 76.1
- Costs are vlues before tax.
- Refer to Figure 3.3.1 for the price contingency.

# Table 3.3.10 Estimate of Consulting Service Cost (1/2)

| Item | | Amount |
|---|---|---|
| | | ($, thousand) |
| [Summary] | | |
| 1. Consulting service cost | | 5,491 |
| 2. Contingencies | | 1,428 |
| **Total** | | **6,919** |
| [Breakdown 1] | | |
| A. Consulting for sediment storage reservoir works and dredger procurement | | |
| 1. Consulting service cost | | 4,118 |
| 2. Contingencies | | 1,071 |
| Total for A. | | 5,189 |
| B. Consulting for watershed conservation works | | |
| 1. Consulting service cost | | 1,373 |
| 2. Contingencies | | 357 |
| Total for A. | | 1,730 |
| **Total of A. and B.** | | **6,919** |
| [Breakdown 2] | | |
| Total consulting service cost is estimated below./*1 | | |
| **1. Consulting service cost** | | |
| - Construction cost | | 54,914 |
| 1) Consulting service cost (10% of Construction cost) | 10% | **5,491** |
| [Breakdown 3] | | |
| Total consulting service cost is divided below./*2 | | |
| 1. Consulting service cost | | 5,491 |
| A. Consulting for sediment storage reservoir works and dredger procurement | 75% | 4,118 |
| B. Consulting for watershed conservation works | 25% | 1,373 |
| [Breakdown 4] | | |
| A. Consulting for sediment storage reservoir works and dredger procurement | | |
| 1. Consulting service cost | | 4,118 |
| 2. Contingencies | | |
| 1) Physical contingency | 20% | 824 |
| 2) Price contingency | 5% | 247 |
| Total for 2. | | 1,071 |
| Total of 1. and 2. | | 5,189 |
| B. Consulting for watershed conservation works | | |
| 1. Consulting service cost | | 1,373 |
| 2. Contingencies | | |
| 1) Physical contingency | 20% | 275 |
| 2) Price contingency | 5% | 82 |
| Total for 2. | | 357 |
| Total of 1. and 2. | | 1,730 |
| **Total of A. and B.** | | **6,919** |

# Table 3.3.10 Estimate of Consulting Service Cost (2/2)

| Item | Amount |
|---|---|
| | ($, thousand) |
| [Breakdown 5] | |
| 1. Consulting service cost | |
| A. Consulting for sediment storage reservoir works and dredger procurement | 4,118 |
| B. Consulting for watershed conservation works | 1,373 |
| Total for 1. | 5,491 |
| 2. Contingencies | |
| A. Consulting for sediment storage reservoir works and dredger procurement | 1,071 |
| B. Consulting for watershed conservation works | 357 |
| Total for 2. | 1,428 |
| **Total of 1. and 2.** | **6,919** |

Source: JICA Study Team

Note:
- Price level: December 2006
  - Excange rate: $ 1.0= Y 118.92
  - Excange rate: $ 1.0= Rp. 9,050
  - Excange rate: Y 1.0= Rp. 76.1
- Unit cost for land acquisition: $. 5.5 per square meter; converted from Rp. 50,000 per square meter
- Refer to Figure 3.3.1 for the price contingency.

*1: Consulting service cost (excluding contingencies) is estimated multiplying the construction cost (excluding contingencies) by the rate of the following.

10%

*2: Consulting service cost is divided into two categories in the proportion of the following.

75% for Item A. [Sediment storage reservoir works and equipment procurement]

25% for Item B. [Watershed conservation works]

## Table 3.3.11 Estimate of Land Acquition Cost

| Item | Unit | Quantity | Unit cost | Amount |
|---|---|---|---|---|
| | | | ($) | ($, thousand) |
| **1. Land acquition** | | | | |
| 1) Land acquition | m2 | 10,000 | 5.5 | 55 |
| 2) Compensation (Nil) | m2 | - | - | - |
| 3) Resettlement (Nil) | m2 | - | - | - |
| Sub-total of 1) to 3) | | | | 55 |
| 4) Contingencies | | | | |
| (1) Physical contingency | | | 20% | 11 |
| (2) Price contingency | | | 5% | 3 |
| Sub-total for 4) | | | | 14 |
| **Total for 1.** | | | | **69** |

Source: JICA Study Team

Note:
- Price level: December 2006
  - Excange rate: $ 1.0= Y 118.92
  - Excange rate: $ 1.0= Rp. 9,050
  - Excange rate: Y 1.0= Rp. 76.1
- Unit cost for land acquisition: $. 5.5 per square meter; converted from Rp. 50,000 per square meter
- Refer to Figure 3.3.1 for the price contingency.

## Table 3.3.12 Estimate of Administrative Expenses (1/2)

| Item | | Amount |
|---|---|---|
| | | ($, thousand) |
| [Summary] | | |
| 1. Administrative expenses | | 549 |
| 2. Contingencies | | 142 |
| **Total** | | **691** |
| [Breakdown 1] | | |
| A. Administration for sediment storage reservoir works and dredger procurement | | |
| 1. Administrative expenses | | 412 |
| 2. Contingencies | | 107 |
| Total for A. | | 519 |
| B. Administration for watershed conservation works | | |
| 1. Administrative expenses | | 137 |
| 2. Contingencies | | 35 |
| Total for A. | | 172 |
| **Total of A. and B.** | | **691** |
| [Breakdown 2] | | |
| Total consulting service cost is estimated below./*1 | | |
| **1. Administrative expenses** | | |
| - Construction cost | | 54,914 |
| 1) Administrative expenses (1% of Construction cost) | 1% | **549** |
| [Breakdown 3] | | |
| Total consulting service cost is divided below./*2 | | |
| 1. Administrative expenses | | 549 |
| A. Administration for sediment storage reservoir works and dredger procurement | 75% | 412 |
| B. Administration for watershed conservation works | 25% | 137 |
| [Breakdown 4] | | |
| A. Administration for sediment storage reservoir works and dredger procurement | | |
| 1. Administrative expenses | | 412 |
| 2. Contingencies | | |
| 1) Physical contingency | 20% | 82 |
| 2) Price contingency | 5% | 25 |
| Total for 2. | | 107 |
| Total of 1. and 2. | | 519 |
| B. Administration for watershed conservation works | | |
| 1. Administrative expenses | | 137 |
| 2. Contingencies | | |
| 1) Physical contingency | 20% | 27 |
| 2) Price contingency | 5% | 8 |
| Total for 2. | | 35 |
| Total of 1. and 2. | | 172 |
| **Total of A. and B.** | | **691** |

## Table 3.3.12 Estimate of Administrative Expenses (2/2)

| Item | Amount |
|---|---|
| | ($, thousand) |
| [Breakdown 5] | |
| 1. Administrative expenses | |
| A. Administration for sediment storage reservoir works and dredger procurement | 412 |
| B. Administration for watershed conservation works | 137 |
| Total for 1. | 549 |
| 2. Contingencies | |
| A. Administration for sediment storage reservoir works and dredger procurement | 107 |
| B. Administration for watershed conservation works | 35 |
| Total for 2. | 142 |
| **Total of 1. and 2.** | **691** |

Source: JICA Study Team

Note:
- Price level: December 2006
  - Excange rate: $ 1.0= Y 118.92
  - Excange rate: $ 1.0= Rp. 9,050
  - Excange rate: Y 1.0= Rp. 76.1
- Unit cost for land acquisition: $. 5.5 per square meter; converted from Rp. 50,000 per square meter
- Refer to Figure 3.3.1 for the price contingency.

*1: Administrative expenses (excluding contingencies) is estimated multiplying the construction cost (excluding contingencies) by the rate of the following.

1%

*2: Administrative expenses is divided into two categories in the proportion of the following.

75% for Item A. [Sediment storage reservoir works and equipment procurement]

25% for Item B. [Watershed conservation works]

## Table 3.3.13 Estimate of Project Cost

[Summary]

| Item | Amount |
|---|---|
| | ($, thousand) |
| I. Construction cost | 54,914 |
| II. Consulting service cost | 5,491 |
| III. Land acquition cost | 69 |
| IV. Administrative expenses | 691 |
| V. Contingencies | 15,112 |
| VI. Tax and duty (for I, II, & V) | 7,552 |
| **Total of I. to VI.** | **83,829** |

[Breakdown 1: Cost by category]

| Item | | | Amount |
|---|---|---|---|
| | | | ($, thousand) |
| A. Sediment storage reservoir works and dredger procurement | | | |
| I. Construction works | | | 43,897 |
| II. Consulting service cost | | | 4,118 |
| III. Land acquition cost | | | 69 |
| IV. Administrative expenses | | | 519 |
| V. Contingencies | | | 12,926 |
| 1. for Constrction works | | (11,855) | |
| 2. for Consulting services | | (1,071) | |
| VI. Tax and duty (for I, II, & V) | 10% | | 6,094 |
| Sub-total for A. | | | 67,623 |
| B. Watershed conservation works | | | |
| I. Construction works | | | 11,017 |
| II. Consulting service cost | | | 1,373 |
| III. Land acquition cost | | | - |
| V. Administrative expenses | | | 172 |
| V. Contingencies | | | 2,186 |
| 1. for Constrction works | | (1,829) | |
| 2. for Consulting services | | (357) | |
| VI. Tax and duty (for I, II, & V) | 10% | | 1,458 |
| Sub-total for B. | | | 16,206 |
| **Total of A.+B.** | | | **83,829** |

[Breakdown 2: Cost by funds]

| Item | Amount under a foreign loan (Loan) | Amount under GOI budget (GOI) |
|---|---|---|
| | ($, thousand) | ($, thousand) |
| I. Construction cost | 54,914 | - |
| II. Consulting service cost | 5,491 | - |
| III. Land acquition cost | - | 69 |
| IV. Administrative expenses | - | 691 |
| V. Contingencies | 15,112 | - |
| VI. Tax and duty (for I, II, & V) | - | 7,552 |
| Total of I. to VI. | 75,517 | 8,312 |
| **Total of Loan and GOI** | | **83,829** |

Source: JICA Study Team

Note:
- Price level: December 2006
  - Excange rate: $ 1.0= Y 118.92
  - Excange rate: $ 1.0= Rp. 9,050
  - Excange rate: Y 1.0= Rp. 76.1
- Each of cost items includes physical and price contingencies.
- Item 'tax and duty' indicates value of VAT for Items I. and II.

# Table 3.3.14 Estimate of Operation and Maintenance Cost

**[A] Base data**

| Code | Item of works | Total cost | Breakdown: Earth-works | Concrete works | Metal works | Equip-ment |
|---|---|---|---|---|---|---|
| | | ($, tho.) | ($, tho.) | ($, tho.) | ($, tho.) | ($, tho.) |
| 100 | Sediment storage reservoir works | 51,769 | 19,580 | 28,313 | 3,876 | - |
| 200 | Procurement of dredger | 3,983 | - | - | - | 3,983 |
| 300 | Watershed conservation works | 12,846 | 12,846 | - | - | - |

**[B] Expected lifetime**

| Code | Item of works | Earth-works | Concrete works | Metal works | Equipment | |
|---|---|---|---|---|---|---|
| | | (year) | (year) | (year) | (year) | |
| 100 | Sediment storage reservoir works | 20 | 50 | 25 | - | |
| 200 | Procurement of dredger | 20 | 50 | 25 | 27 | /*1 |
| 300 | Watershed conservation works | 2 | 50 | 25 | - | |

Note: *1: Value of 'Kensetsu Kikai-tou Sonryou-hyou, 2005' (Japan Construction Mechanization Association); 18 multiplied by 1.5.

**[C] Maintenance and repair rate through life**

| Code | Item of works | Earth-works | Concrete works | Metal works | Equipment | |
|---|---|---|---|---|---|---|
| | | (%) | (%) | (%) | (%) | |
| 100 | Sediment storage reservoir works | 75 | 50 | 50 | - | |
| 200 | Procurement of dredger | 75 | 50 | 50 | 100 | /*1 |
| 300 | Watershed conservation works | 75 | 50 | 50 | - | |

Note: *1: Value of 'Kensetsu Kikai-tou Sonryou-hyou, 2005' (Japan Construction Mechanization Association); 135% multiplied by 0.75.

**[D] Maintenance and repair rate cost (per annum)**

| Code | Item of works | Mainte., total | Earth-works | Concrete works | Metal works | Equipment |
|---|---|---|---|---|---|---|
| | | ($, tho.) | ($, tho.) | ($, tho.) | ($, tho.) | ($, tho.) |
| 100 | Sediment storage reservoir works | 1,095 | 734 | 283 | 78 | - |
| 200 | Procurement of dredger | 148 | - | - | - | 148 |
| 300 | Watershed conservation works | 4,817 | 4,817 | - | - | - |

Note: - [D]= [A] / [B] x [C]/100

**[E] Operation cost (energy consumption, per annum)**

| Code | Item of equipment | Rated power | Fuel consump. | Yearly ope. hr/*4 | Yearly consump. | Operation cost/*1 | |
|---|---|---|---|---|---|---|---|
| | | (kW) | (L/kW/hr) | (hr) | (L) | ($) | |
| 100 | Sediment storage reservoir works | | | | | | |
| | (fore bay) | | | | | | |
| | Bulldozer, 4t, swamp | 34 | 0.175 | 3,846 | 22,884 | 12,100 | /*2 |
| | Crawler loader, 2.3m3 | 151 | 0.175 | 14 | 370 | 200 | /*2 |
| | Dump truck, 10t (hauling= 1km) | 246 | 0.050 | 67 | 824 | 400 | /*2 |
| | | | | Sub-total for 100 | | 12,700 | |
| 200 | Procurement of dredger | | | | | | |
| | (in front of intake, by cutter-suction dredger) | | | | | | |
| | Cutter-suction dredger, 600PS | 441 | 0.381 | 917 | 154,075 | 59,300 | /*3 |
| | (in front of intake, by syphon dredger) | | | | | | |
| | Generator, 10kVA (for siphon pump and agitator) | 13 | 0.170 | - | - | - | /*2 |
| | | | | Sub-total for 200 | | 59,300 | |
| 300 | Watershed conservation works | | | | | | |
| | (Nil) | - | - | - | - | - | |

Note: *1: The rate of 10% is added to the amount for lubricant and others.

| Fuel | Price (Rp./L) | Exch. rate (Rp./$) | Price ($/L) |
|---|---|---|---|
| *2: Light oil (diesel) | 4,300 | 9,050 | 0.48 |
| *3: Heavy oil | 3,142 | 9,050 | 0.35 |

*4: computed below;

| Code | Equipment | Hourly production | Yearly work q'ty | Yearly ope. hr |
|---|---|---|---|---|
| 100 | Sediment storage reservoir works | | | |
| | (fore bay) | | | |
| | Bulldozer, 4t, swamp | 3 | 10,000 | 3,846 |
| | Crawler loader, 2.3m3 | 70 | 1,000 | 14 |
| | Dump truck, 10t (hauling= 1km) | 15 | 1,000 | 67 |
| 200 | Procurement of dredger | | | |
| | (in front of intake, by cutter-suction dredger) | | | |
| | Cutter-suction dredger, 600PS | 109 | 100,000 | 917 |
| | (in front of intake, by syphon dredger) | | | |
| | Generator, 10kVA (for siphon pump and agitator) | 546 | - | - |
| 300 | Watershed conservation works | | | |
| | (Nil) | (Nil) | (Nil) | (Nil) |

**[F] Operation and maintenance cost (per annum)**

| Code | Item of works | Operation cost | Maintenance cost | Total O&M cost | Yearly production | O&M cost per m3 | |
|---|---|---|---|---|---|---|---|
| | | ($) | ($) | ($) | (m3) | ($) | |
| 100 | Sediment storage reservoir works | 12,700 | 1,095 | **13,795** | 300,000 | 0.046 | /*1 |
| 200 | Procurement of dredger | 59,300 | 148 | **59,448** | 100,000 | 0.594 | /*1 |
| 300 | Watershed conservation works | - | 4,817 | **4,817** | 470,000 | 0.010 | /*2 |

Note: - [F]= [D] + [E]

*1: for 'yearly production', Quantity of sediment to be evacuated

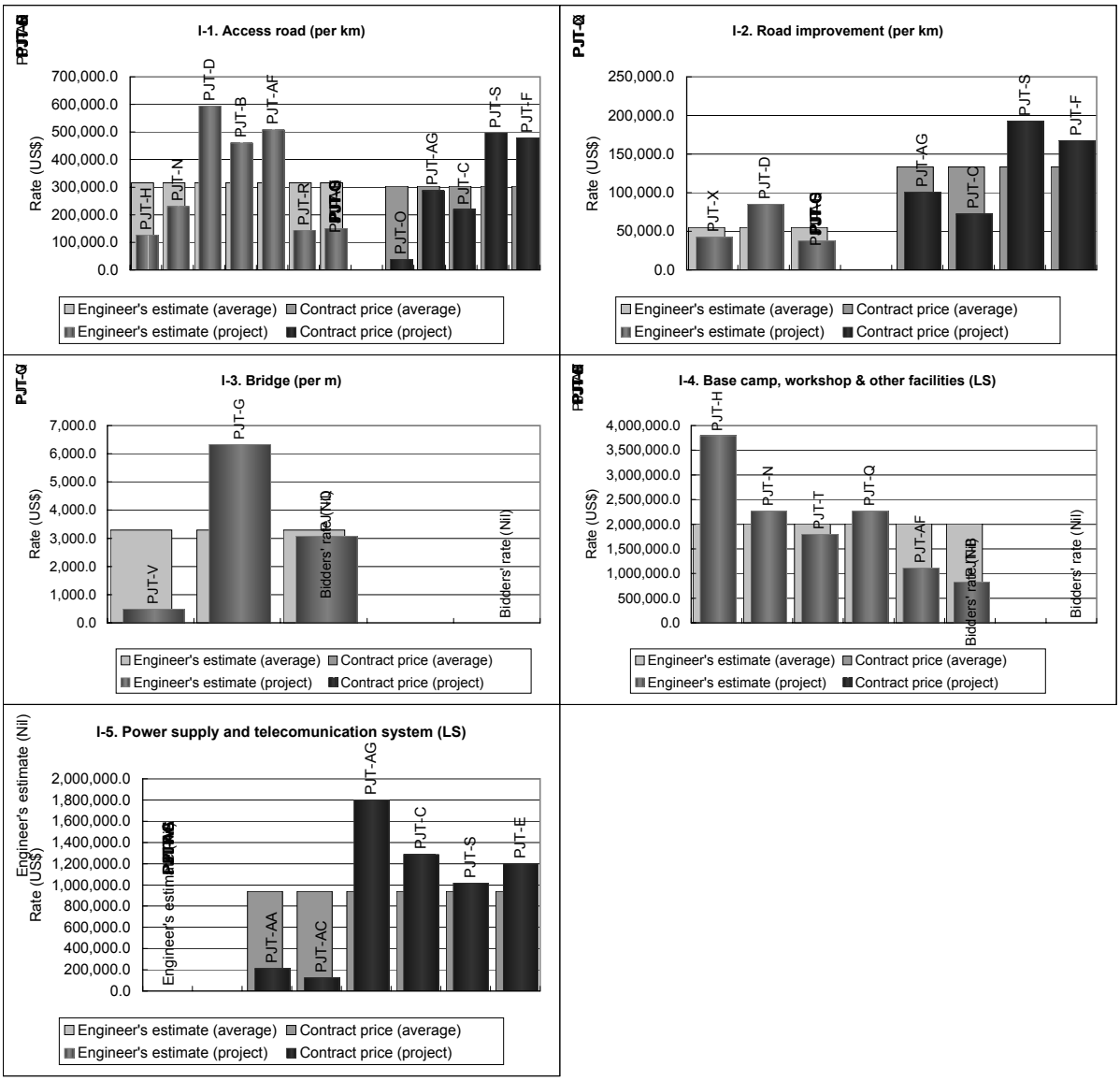
*2: for 'yearly production', Quantity of deductive sediment to be deposited (8,067,000t x 18.6% /1.064= 1,410,000m3)

Source: JICA Study Team

# *Figures*

## A. POWER ENGINEERING WORKS

### I. Preparatory Works (1/1)

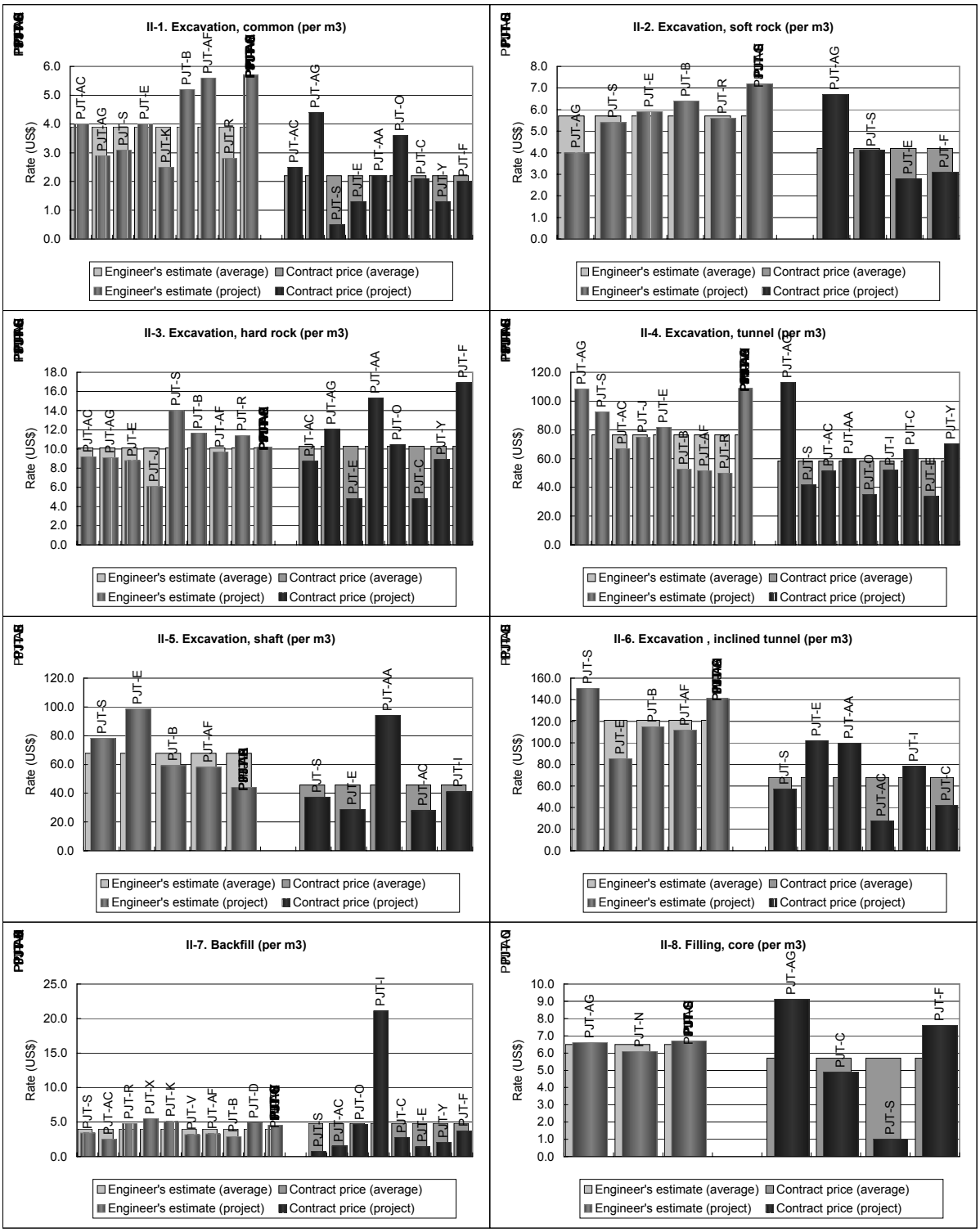



Source: JICA Study Team

**Figure 1.3.1 Updated Work Rates (as of 2005) (1/7)**

## A. POWER ENGINEERING WORKS

### II. Civil Works (1/3)

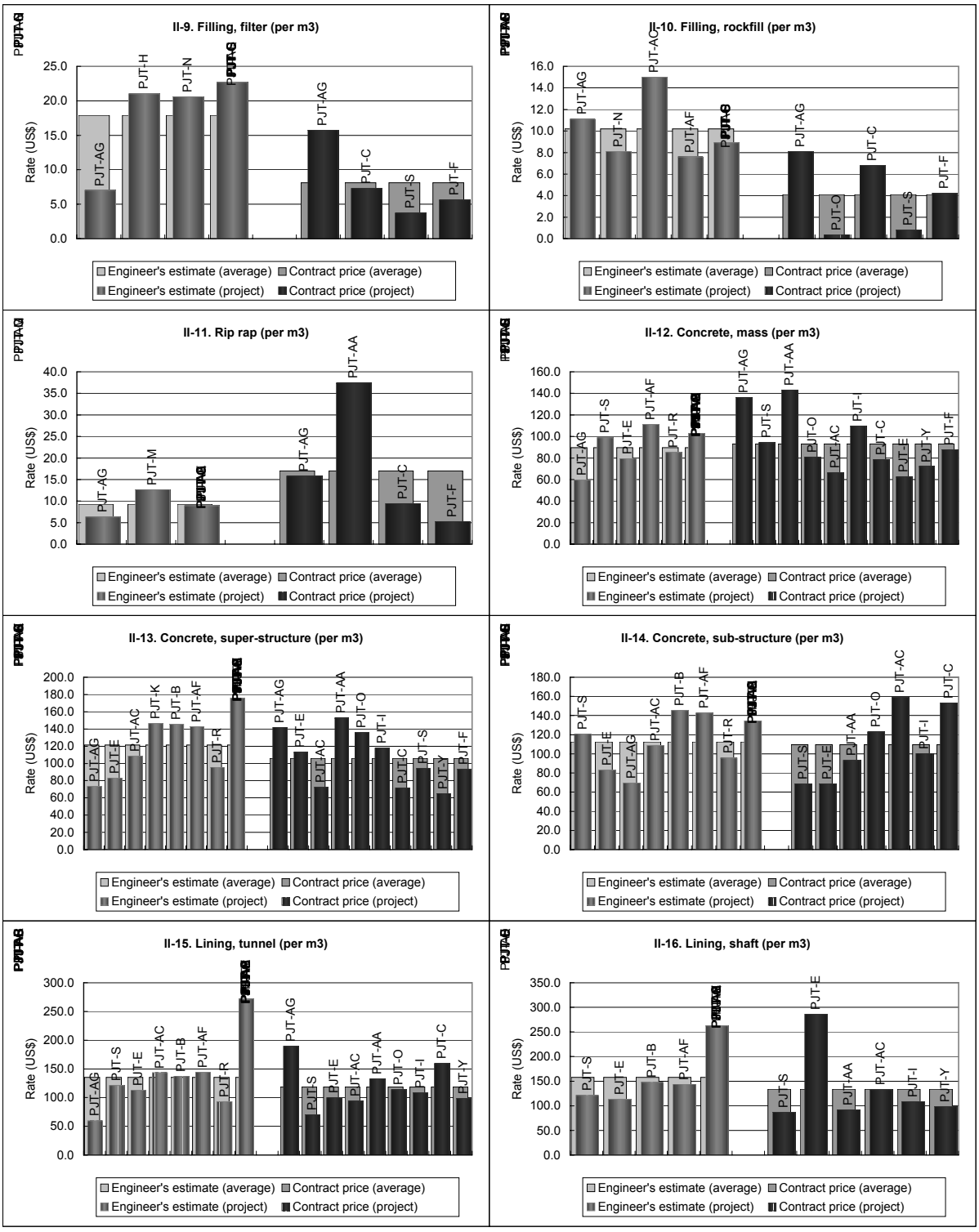



Source: JICA Study Team

**Figure 1.3.1 Updated Work Rates (as of 2005) (2/7)**

## A. POWER ENGINEERING WORKS

### II. Civil Works (2/3)

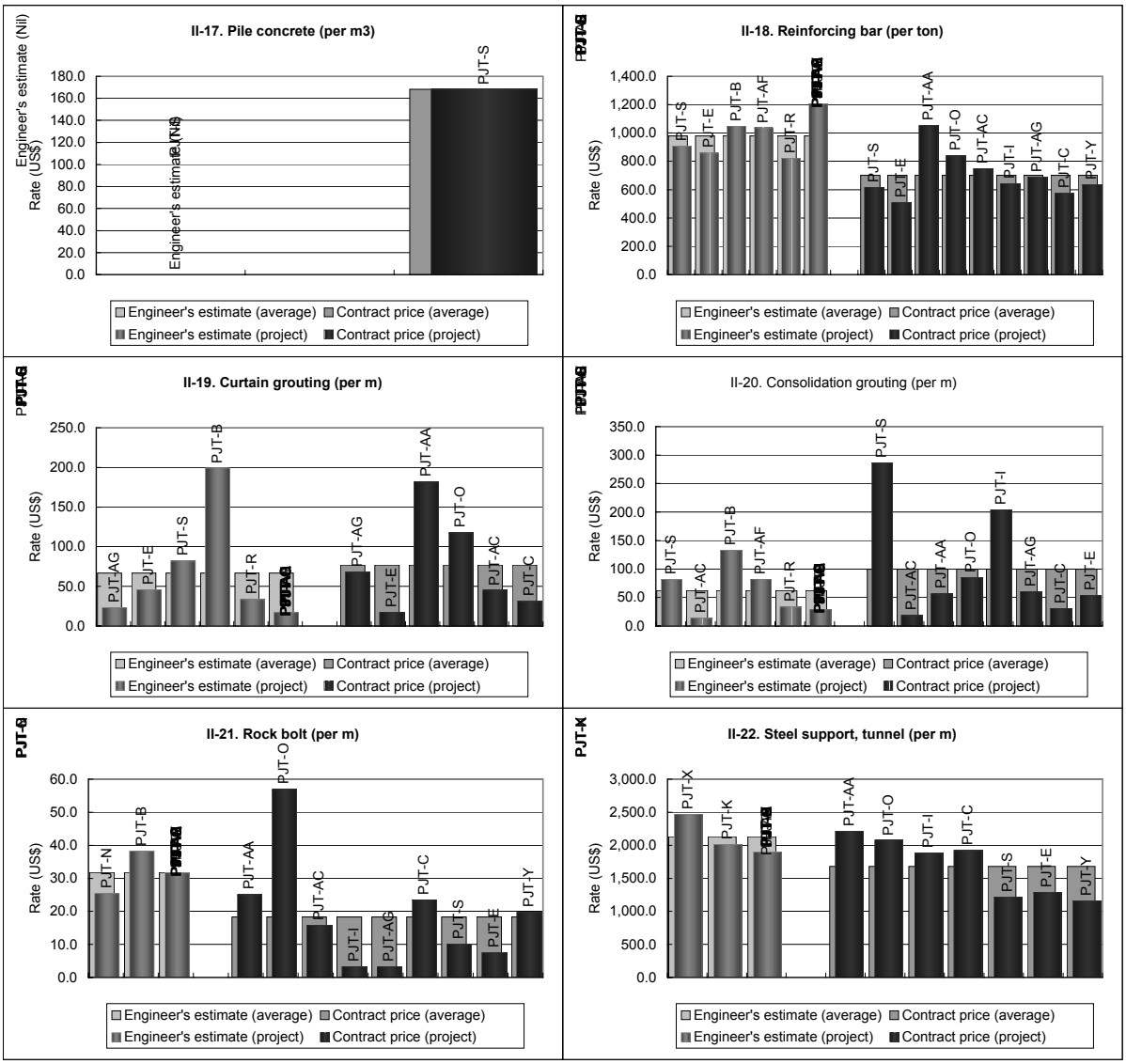



Source: JICA Study Team

**Figure 1.3.1 Updated Work Rates (as of 2005) (3/7)**

## A. POWER ENGINEERING WORKS

### II. Civil Works (3/3)

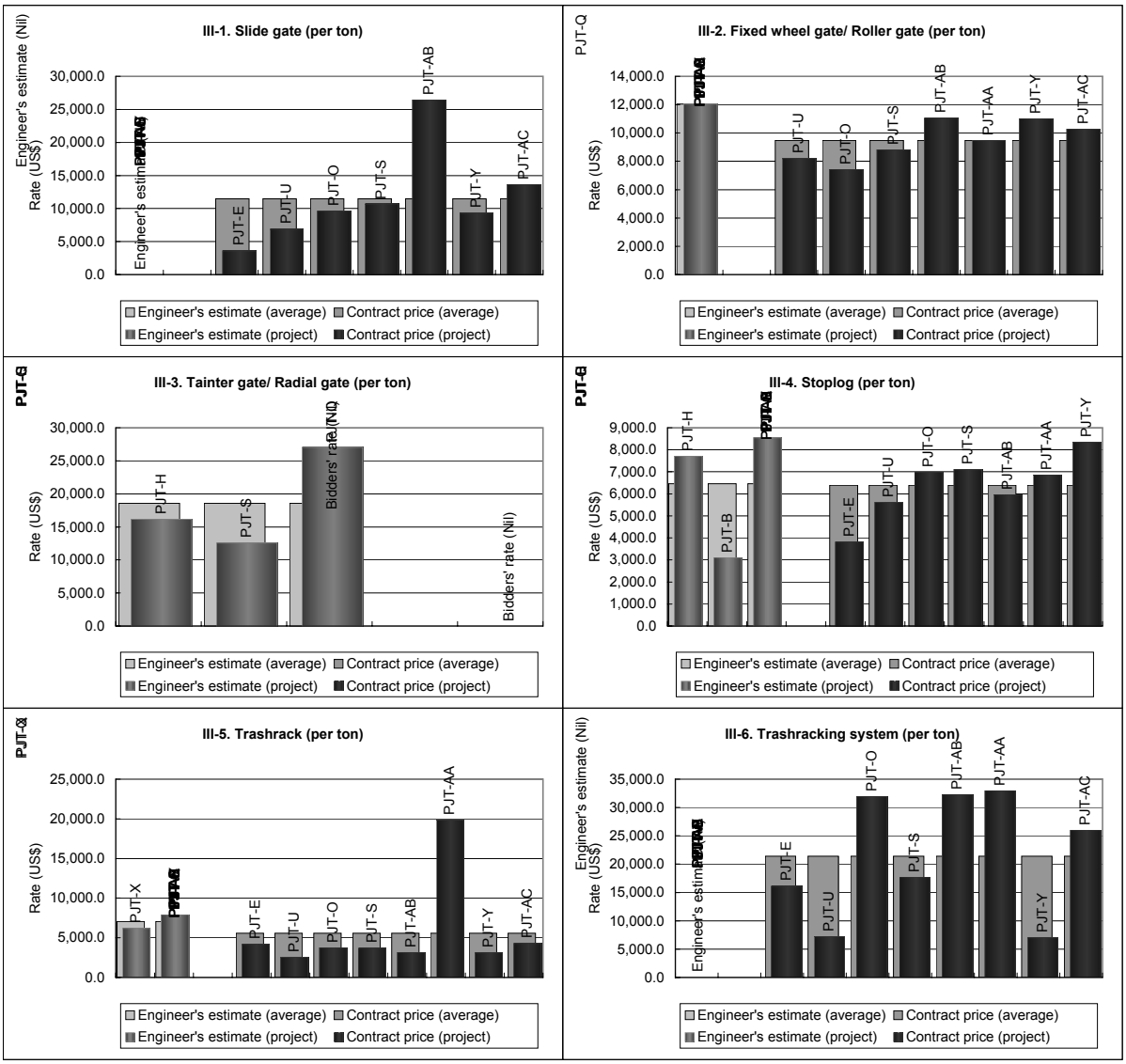



Source: JICA Study Team

**Figure 1.3.1 Updated Work Rates (as of 2005) (4/7)**

## A. POWER ENGINEERING WORKS

### III. Metal Works (1/1)

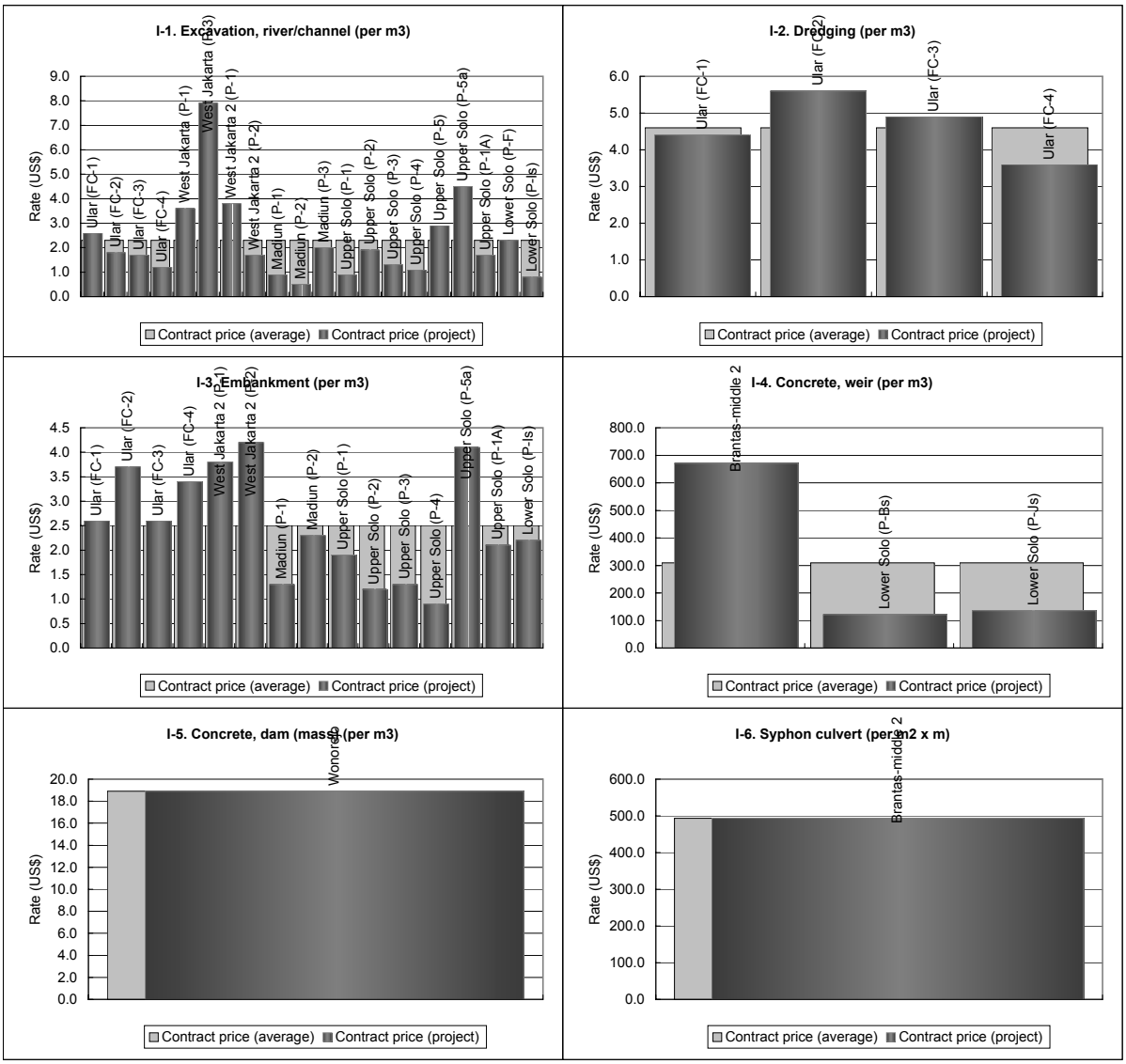



Source: JICA Study Team

**Figure 1.3.1 Updated Work Rates (as of 2005) (5/7)**

## B. RIVER IMPROVEMENT WORKS

### I. Civil Works (1/1)

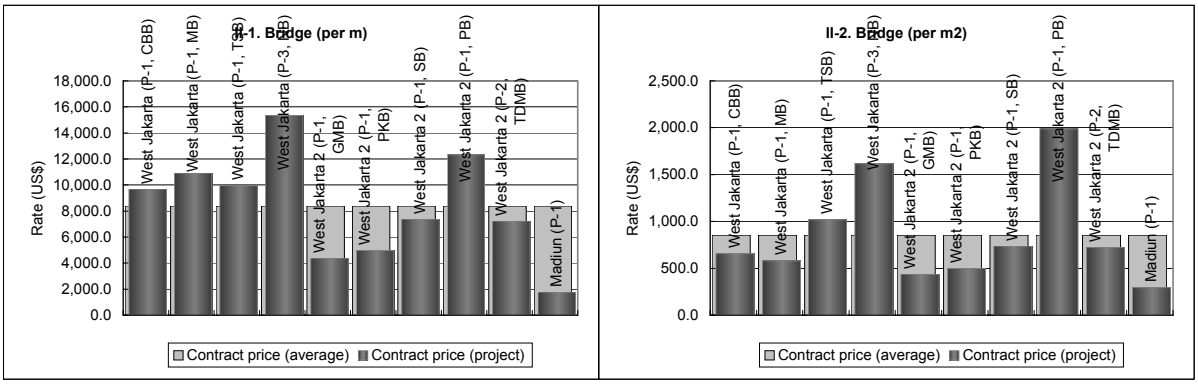



Source: JICA Study Team

**Figure 1.3.1 Updated Work Rates (as of 2005) (6/7)**

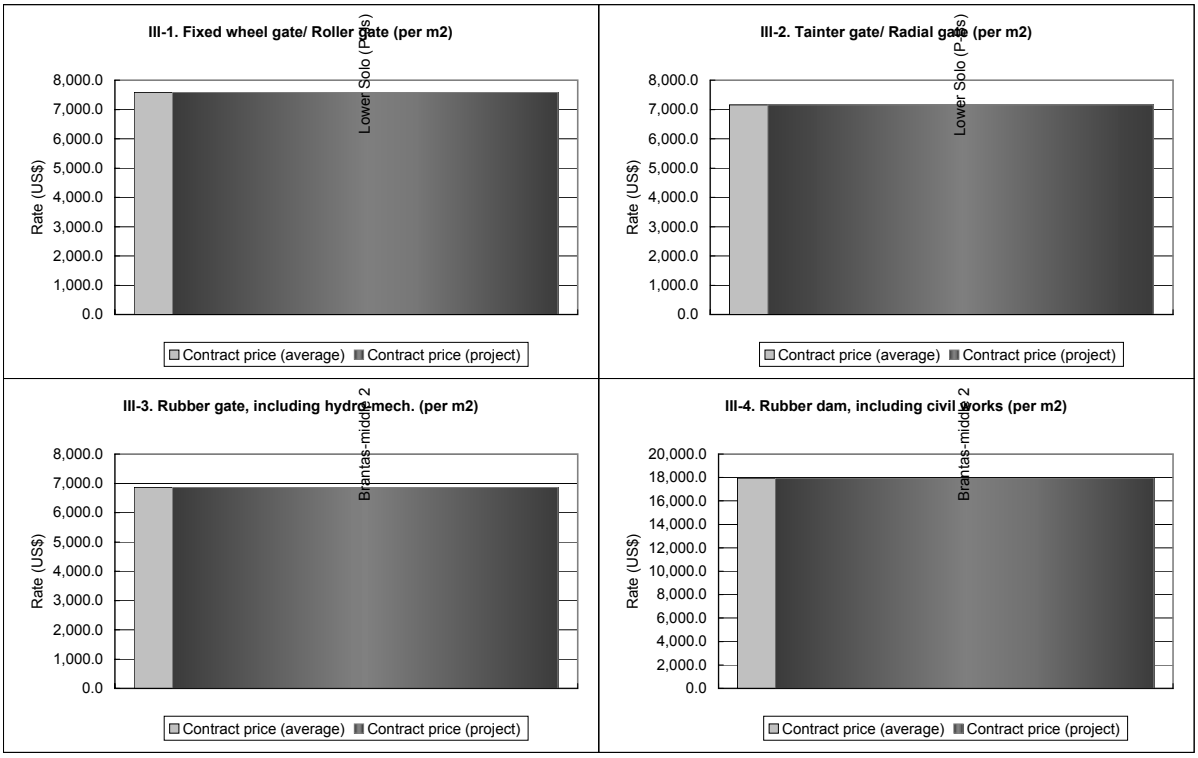
## B. RIVER IMPROVEMENT WORKS

### II. Bridge Works (1/1)



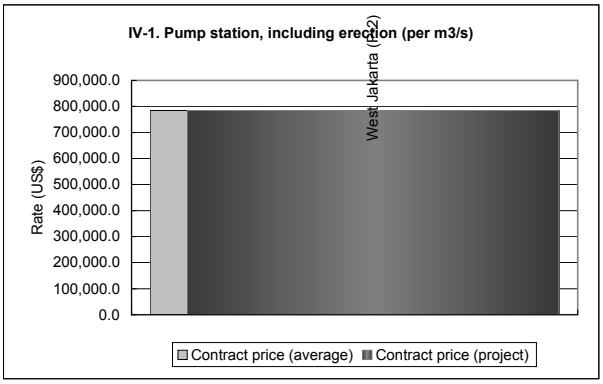

Source: JICA Study Team

### III. Metal Works (1/1)



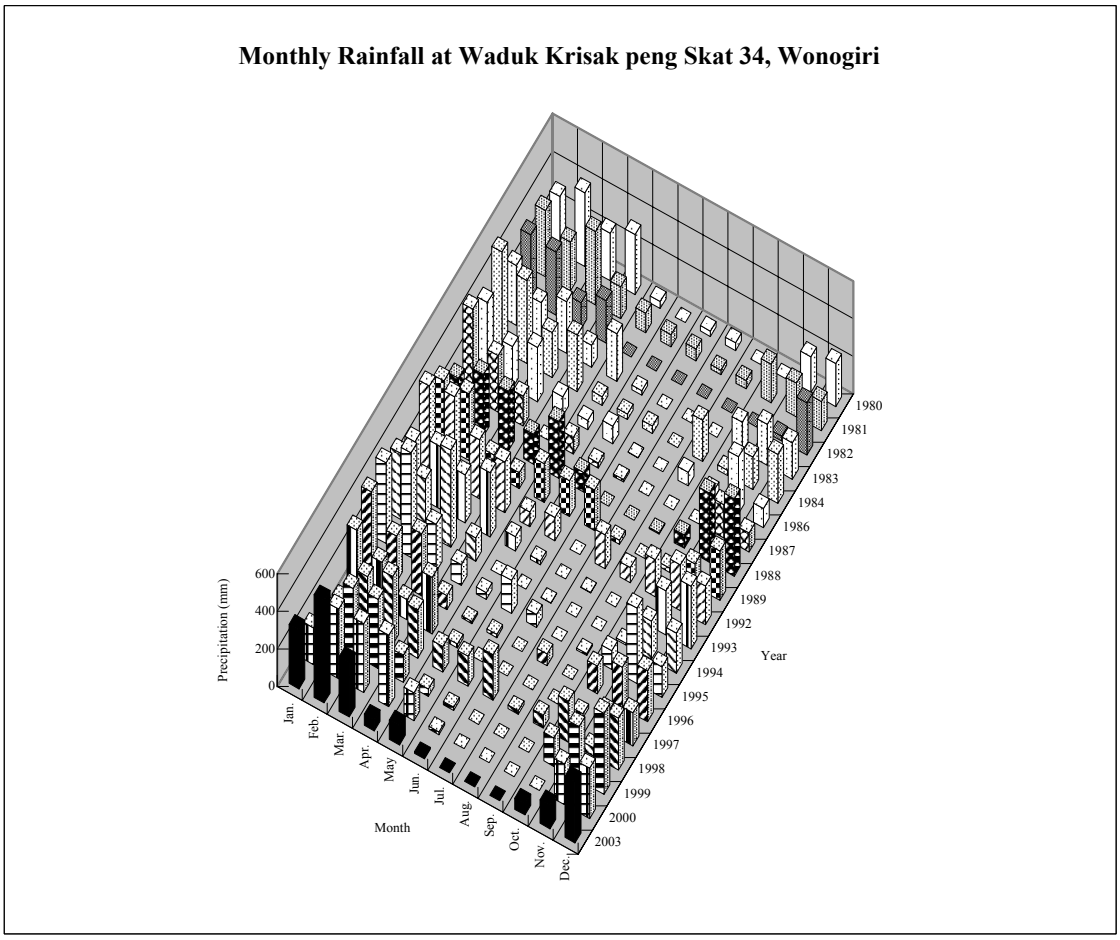

Source: JICA Study Team

### IV. Equipment (1/1)

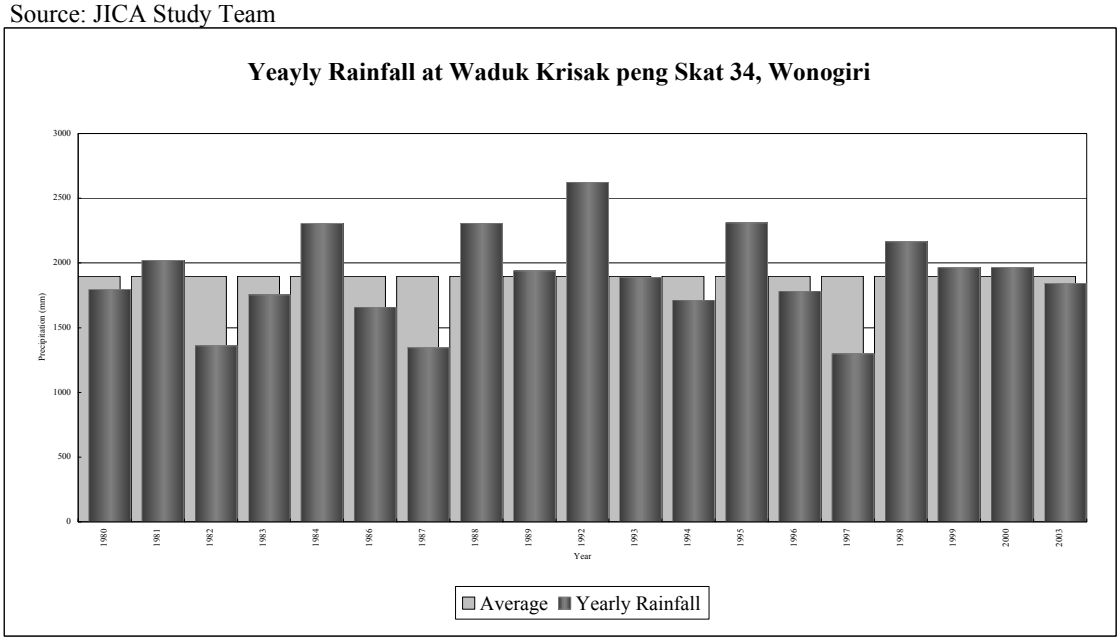



**Source: JICA Study Team**

**Figure 1.3.1 Updated Work Rates (as of 2005) (7/7)**




Source: JICA Study Team




Source: JICA Study Team

**Figure 2.3.1 Monthly and Yearly Rainfall at Wonogiri**

| Component | Works | Work quantity | Major equipment (name) | Specifications (kW, PS) | Production rate (/h) | (/d) | Required equipment (unit.d) |
|---|---|---|---|---|---|---|---|
| **1. Mobilization** | | | | | | | |
| 1) Preparatory works | site transportation | - | Truck, 4t, w/2.9t crane | 132kW(179PS) | - | - | - |
| **2. Spillway** | | | | | | | |
| 1) Excavation | excavation | 370,000 m3 | Bulldozer, 21t | 152kW(207PS) | 72 | 468 | 791 |
| (excavated materials) | loading | 323,530 m3 | Wheel loader, 2.3m3 | 151kW(205PS) | 93 | 605 | 536 |
| (hauling= 1 km) | hauling | 323,530 m3 | Dump truck, 10t | 246kW(334PS) | 15 | 98 | 3,319 |
| | spreading | 323,530 m3 | Bulldozer, 11t | 78kW(106PS) | 116 | 754 | 430 |
| 2) Concrete | pump placing | 35,110 m3 | Concrete pump car, 55m3/h | 121kW(165PS) | 17 | 107 | 328 |
| 3) Backfilling | spreading | 46,470 m3 | Bulldozer, 11t | 78kW(106PS) | 116 | 754 | 62 |
| | compaction | 46,470 m3 | Vibratory roller, 3~5t | 21kW(29PS) | 21 | 137 | 341 |
| 4) Gate erection | hoisting | 170 t | Truck crane, 200t | 309kW(420PS) | - | - | - |
| 5) Forbay/*1 | dredging | 183,000 m3 | Cutter-suction dredger, 600PS | 600PS | 109 | 1,417 | 130 |
| **2. Closure dike** | | | | | | | |
| 1) Piling | piling (m2) | 23,790 m2 | Vibrohammer, elec., 40kW | 40kW | 112 | 728 | 33 |
| | crane for piler (m2) | 23,790 m2 | Crawler crane, 50t | 132kW(179PS) | 112 | 728 | 33 |
| 2) Filling/*2 | loading | 167,800 m3 | Wheel loader, 2.3m3 | 151kW(205PS) | 84 | 546 | 308 |
| (hauling= 1 km) | hauling | 167,800 m3 | Dump truck, 10t | 246kW(334PS) | 15 | 98 | 1,722 |
| | spreading | 167,800 m3 | Bulldozer, 11t | 78kW(106PS) | 116 | 754 | 223 |
| | compaction | 167,800 m3 | Vibratory roller, 3~5t | 21kW(29PS) | 21 | 137 | 1,230 |
| **3. Overflow weir** | | | | | | | |
| 1) Excavation | excavation | 29,750 m3 | Bulldozer, 21t | 152kW(207PS) | 72 | 468 | 64 |
| | loading | 29,750 m3 | Wheel loader, 2.3m3 | 151kW(205PS) | 93 | 605 | 50 |
| (hauling= 0.5 km) | hauling | 29,750 m3 | Dump truck, 10t | 246kW(334PS) | 18 | 117 | 255 |
| | spreading | 29,750 m3 | Bulldozer, 11t | 78kW(106PS) | 116 | 754 | 40 |
| 2) Concrete | pump placing | 11,000 m3 | Concrete pump car, 55m3/h | 121kW(165PS) | 17 | 107 | 103 |
| 3) Reservoir dike/*3 | spreading | 61,600 m3 | Bulldozer, 11t | 78kW(106PS) | 116 | 754 | 82 |
| | compaction | 61,600 m3 | Vibratory roller, 3~5t | 21kW(29PS) | 21 | 137 | 452 |
| 4) Gate erection | hoisting | 5 t | Truck crane, 200t | 309kW(420PS) | - | - | - |
| **4. Demobilization** | | | | | | | |
| 1) Site cleaning | site transportation | - | Truck, 4t, w/2.9t crane | 132kW(179PS) | - | - | - |

Source: JICA Study Team

Note: Daily operation hour: 6.5 hr/d

*1: If water level is low, dry excavation would be performed with bulldozers.

*2: The excavated materials at the spillway site would be once stocked, and be diverted for filling closure dike.

*3: The excavated materials would be fully diverted for filling reservoir road.

\- Major work items are discussed to estimate the work schedule.

**Figure 2.4.1 Work Schedule of Sediment Storage Reservoir (1/2)**
**(Equipment requirement analysis)**

| Component | Works | Work quantity | Major equipment (name) | Specifications (kW, PS) | Production rate (/h) | (/d) | Required equipment (unit.d) |
|---|---|---|---|---|---|---|---|
| **1. Mobilization** | | | | | | | |
| 1) Preparatory works | site transportation | - | Truck, 4t, w/2.9t crane | 132kW(179PS) | - | - | - |
| **2. Spillway** | | | | | | | |
| 1) Excavation | excavation | 370,000 m3 | Bulldozer, 21t | 152kW(207PS) | 72 | 468 | 791 |
| (excavated materials) | loading | 323,530 m3 | Wheel loader, 2.3m3 | 151kW(205PS) | 93 | 605 | 536 |
| (hauling= 1 km) | hauling | 323,530 m3 | Dump truck, 10t | 246kW(334PS) | 15 | 98 | 3,319 |
| | spreading | 323,530 m3 | Bulldozer, 11t | 78kW(106PS) | 116 | 754 | 430 |
| 2) Concrete | pump placing | 35,110 m3 | Concrete pump car, 55m3/h | 121kW(165PS) | 17 | 107 | 328 |
| 3) Backfilling | spreading | 46,470 m3 | Bulldozer, 11t | 78kW(106PS) | 116 | 754 | 62 |
| | compaction | 46,470 m3 | Vibratory roller, 3~5t | 21kW(29PS) | 21 | 137 | 341 |
| 4) Gate erection | hoisting | 170 t | Truck crane, 200t | 309kW(420PS) | - | - | - |
| 5) Forbay/*1 | dredging | 183,000 m3 | Cutter-suction dredger, 600PS | 600PS | 109 | 1,417 | 130 |
| **2. Closure dike** | | | | | | | |
| 1) Piling | piling (m2) | 23,790 m2 | Vibrohammer, elec., 40kW | 40kW | 112 | 728 | 33 |
| | crane for piler (m2) | 23,790 m2 | Crawler crane, 50t | 132kW(179PS) | 112 | 728 | 33 |
| 2) Filling/*2 | loading | 167,800 m3 | Wheel loader, 2.3m3 | 151kW(205PS) | 84 | 546 | 308 |
| (hauling= 1 km) | hauling | 167,800 m3 | Dump truck, 10t | 246kW(334PS) | 15 | 98 | 1,722 |
| | spreading | 167,800 m3 | Bulldozer, 11t | 78kW(106PS) | 116 | 754 | 223 |
| | compaction | 167,800 m3 | Vibratory roller, 3~5t | 21kW(29PS) | 21 | 137 | 1,230 |
| **3. Overflow weir** | | | | | | | |
| 1) Excavation | excavation | 29,750 m3 | Bulldozer, 21t | 152kW(207PS) | 72 | 468 | 64 |
| | loading | 29,750 m3 | Wheel loader, 2.3m3 | 151kW(205PS) | 93 | 605 | 50 |
| (hauling= 0.5 km) | hauling | 29,750 m3 | Dump truck, 10t | 246kW(334PS) | 18 | 117 | 255 |
| | spreading | 29,750 m3 | Bulldozer, 11t | 78kW(106PS) | 116 | 754 | 40 |
| 2) Concrete | pump placing | 11,000 m3 | Concrete pump car, 55m3/h | 121kW(165PS) | 17 | 107 | 103 |
| 3) Reservoir dike/*3 | spreading | 61,600 m3 | Bulldozer, 11t | 78kW(106PS) | 116 | 754 | 82 |
| | compaction | 61,600 m3 | Vibratory roller, 3~5t | 21kW(29PS) | 21 | 137 | 452 |
| 4) Gate erection | hoisting | 5 t | Truck crane, 200t | 309kW(420PS) | - | - | - |
| **4. Demobilization** | | | | | | | |
| 1) Site cleaning | site transportation | - | Truck, 4t, w/2.9t crane | 132kW(179PS) | - | - | - |

Source: JICA Study Team

Note: Daily operation hour: 6.5 hr/d

*1: If water level is low, dry excavation would be performed with bulldozers.

*2: The excavated materials at the spillway site would be once stocked, and be diverted for filling closure dike.

*3: The excavated materials would be fully diverted for filling reservoir road.

\- Major work items are discussed to estimate the work schedule.

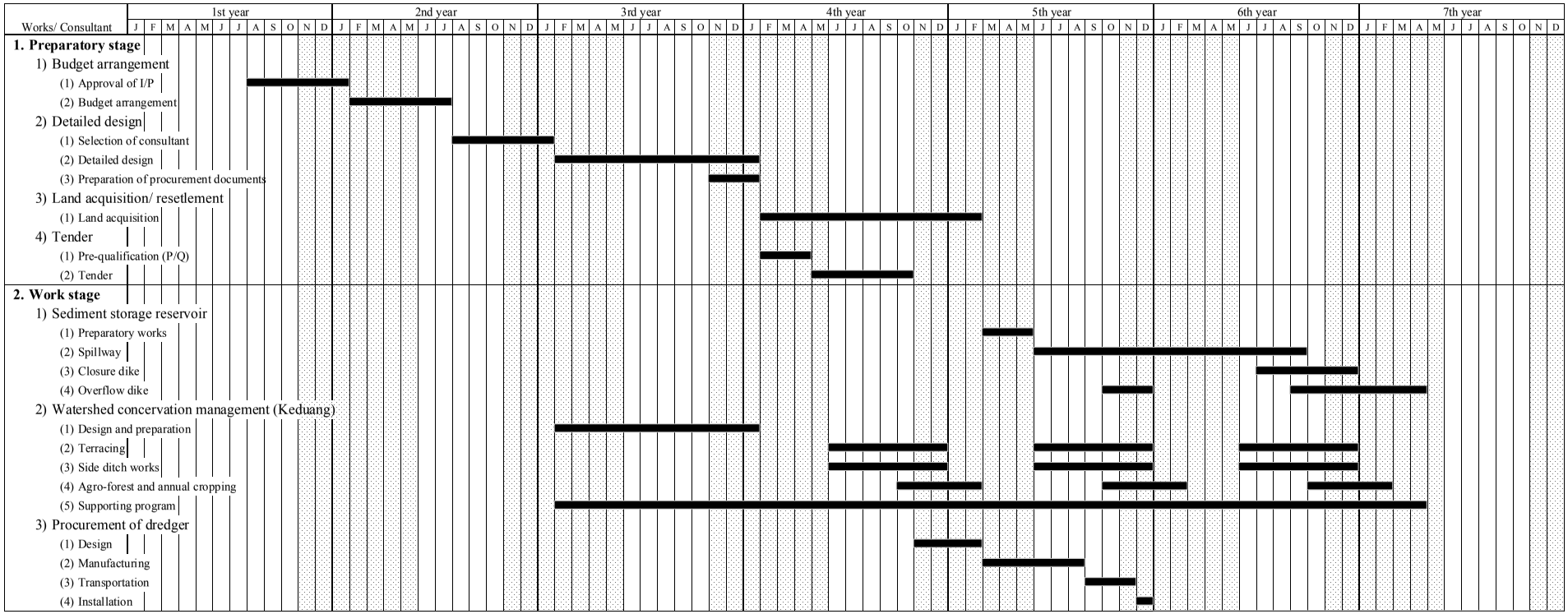
**Figure 2.4.1 Work Schedule of Sediment Storage Reservoir (1/2)**
**(Equipment requirement analysis)**

| Component | Work quantity | Major equipment | 1st year J | F | M | A | M | J | J | A | S | O | N | D | 2nd year J | F | M | A | M | J | J | A | S | O | N | D | 3rd year J | F | M | A | M | J | J | A | S | O | N | D | Equipment total | max-imum opera-tion |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 10 | 8 | 13 | 17 | 20 | 23 | 24 | 25 | 24 | 23 | 16 | 16 | 10 | 8 | 13 | 17 | 20 | 23 | 24 | 25 | 24 | 23 | 16 | 16 | 10 | 8 | 13 | 17 | 20 | 23 | 24 | 25 | 24 | 23 | 16 | 16 | /*a | |
| | | | 19 | 16 | 20 | 22 | 23 | 25 | 25 | 26 | 25 | 25 | 21 | 23 | 19 | 16 | 20 | 22 | 23 | 25 | 25 | 26 | 25 | 25 | 21 | 23 | 19 | 16 | 20 | 22 | 23 | 25 | 25 | 26 | 25 | 25 | 21 | 23 | /*b | |
| | | | 21 | 19 | 22 | 23 | 23 | 25 | 26 | 26 | 25 | 25 | 22 | 24 | 21 | 19 | 22 | 23 | 23 | 25 | 26 | 26 | 25 | 25 | 22 | 24 | 21 | 19 | 22 | 23 | 23 | 25 | 26 | 26 | 25 | 25 | 22 | 24 | /*c | |
| **1. Mobilization** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1) Preparatory works | - | - | | | 1 | 1 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | (unit.M) | |
| **2. Spillway** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1) Excavation | 370,000 m3 | Bulldozer, 21t | | | | | | 5 | 5 | 6 | 6 | 5 | 5 | 5 | | | | | | | | | | | | | | | | | | | | | | | | | 37 | 6 |
| (excavated materials) | 323,530 m3 | Wheel loader, 2.3m3 | | | | | | 4 | 4 | 4 | 4 | 4 | 4 | 4 | | | | | | | | | | | | | | | | | | | | | | | | | 28 | 4 |
| (hauling= 1 km) | 323,530 m3 | Dump truck, 10t | | | | | | 22 | 22 | 22 | 22 | 22 | 22 | 22 | | | | | | | | | | | | | | | | | | | | | | | | | 154 | 22 |
| | 323,530 m3 | Bulldozer, 11t | | | | | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | | | | | | | | | | | | | | | | | | | | | | | | | 21 | 3 |
| 2) Concrete | 35,110 m3 | Concrete pump car, 55m3/h | | | | | | | 3 | 3 | 2 | 2 | 2 | | | | | | | | | | | | | | | | | | | | | | | | | 14 | 3 |
| 3) Backfilling | 46,470 m3 | Bulldozer, 11t | | | | | | | | 1 | 1 | 1 | 1 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | 5 | 1 |
| | 46,470 m3 | Vibratory roller, 3~5t | | | | | | | | 3 | 4 | 4 | 3 | 3 | | | | | | | | | | | | | | | | | | | | | | | | | 17 | 4 |
| 4) Gate erection | 170 t | Truck crane, 200t | | | | | | | | | | | | | 1 | 1 | 1 | | | | | | | | | | | | | | | | | | | | | 3 | 1 |
| 5) Forbay/*1 | 183,000 m3 | Cutter-suction dredger, 600PS | | | | | | | | | | | | | | | | 1 | 1 | 1 | 1 | 1 | 1 | | | | | | | | | | | | | | | 6 | 1 |
| **2. Closure dike** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1) Piling | 23,790 m2 | Vibrohammer, elec., 40kW | | | | | | | | | | | | | | | | | | | | 1 | 1 | 1 | 1 | 1 | | | | | | | | | | | | | 6 | 1 |
| | 23,790 m2 | Crawler crane, 50t | | | | | | | | | | | | | | | | | | | | 1 | 1 | 1 | 1 | 1 | | | | | | | | | | | | | 6 | 1 |
| 2) Filling/*2 | 167,800 m3 | Wheel loader, 2.3m3 | | | | | | | | | | | | | | | | | | | | 2 | 2 | 3 | 3 | 3 | 2 | | | | | | | | | | | | 15 | 3 |
| (hauling= 1 km) | 167,800 m3 | Dump truck, 10t | | | | | | | | | | | | | | | | | | | | 13 | 13 | 14 | 14 | 13 | | | | | | | | | | | | | 81 | 14 |
| | 167,800 m3 | Bulldozer, 11t | | | | | | | | | | | | | | | | | | | | 2 | 2 | 2 | 2 | 2 | | | | | | | | | | | | | 12 | 2 |
| | 167,800 m3 | Vibratory roller, 3~5t | | | | | | | | | | | | | | | | | | | | 9 | 9 | 10 | 10 | 10 | 10 | | | | | | | | | | | | 58 | 10 |
| **3. Overflow weir** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1) Excavation | 29,750 m3 | Bulldozer, 21t | | | | | | | | | | 1 | 1 | 1 | | | | | | | | | | 1 | 1 | | | | | | | | | | | | | | 5 | 1 |
| | 29,750 m3 | Wheel loader, 2.3m3 | | | | | | | | | | 1 | 1 | 1 | | | | | | | | | | 1 | 1 | 1 | 1 | | | | | | | | | | | | 7 | 1 |
| (hauling= 0.5 km) | 29,750 m3 | Dump truck, 10t | | | | | | | | | | 2 | 2 | 2 | | | | | | | | | | 2 | 2 | 2 | 2 | | | | | | | | | | | | 14 | 2 |
| | 29,750 m3 | Bulldozer, 11t | | | | | | | | | | 1 | 1 | 1 | | | | | | | | | | 1 | 1 | 1 | 1 | | | | | | | | | | | | 7 | 1 |
| 2) Concrete | 11,000 m3 | Concrete pump car, 55m3/h | | | | | | | | | | 1 | 1 | 1 | | | | | | | | | | 3 | 3 | 3 | 2 | | | | | | | | | | | | 14 | 3 |
| 3) Reservoir dike/*3 | 61,600 m3 | Bulldozer, 11t | | | | | | | | | | | 1 | 1 | | | | | | | | | | 1 | 1 | 1 | 1 | | 1 | 1 | 1 | | | | | | | 9 | 1 |
| | 61,600 m3 | Vibratory roller, 3~5t | | | | | | | | | | | 4 | 4 | | | | | | | | | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | | | | | | | | 29 | 4 |
| 4) Gate erection | 5 t | Truck crane, 200t | | | | | | | | | | | | | | | | | | | | | | | 1 | 1 | 1 | | | | | | | | | | | | 3 | 1 |
| **4. Demobilization** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1) Site cleaning | - | - | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | Total: | 551 | |

| Note: | Equipment | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | total | max. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *a: Monthly workable days for earthworks | Bulldozer, 11t | 0 | 0 | 0 | 0 | 0 | 3 | 3 | 4 | 4 | 5 | 6 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 4 | 4 | 4 | 4 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 54 | 6 |
| *b: Monthly workable days for concrete works | Bulldozer, 21t | 0 | 0 | 0 | 0 | 0 | 5 | 5 | 6 | 6 | 6 | 6 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 42 | 6 |
| *c: Monthly workable days for dredging works | Wheel loader, 2.3m3 | 0 | 0 | 0 | 0 | 0 | 4 | 4 | 4 | 4 | 5 | 5 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 4 | 4 | 4 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 50 | 5 |
| - Figures in shedule cells are euipment numbers. | Dump truck, 10t | 0 | 0 | 0 | 0 | 0 | 22 | 22 | 22 | 22 | 24 | 24 | 24 | 0 | 0 | 0 | 0 | 0 | 0 | 13 | 13 | 16 | 16 | 16 | 15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 249 | 24 |
| - The hatched columns mean wet season. | Crawler crane, 50t | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 1 |
| - The graph is the rule curve for the reservoir. | Truck crane, 200t | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 1 |
| | Vibrohammer, elec., 40kW | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 1 |
| | Vibratory roller, 3~5t | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 4 | 4 | 7 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 9 | 9 | 13 | 13 | 13 | 13 | 3 | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 104 | 13 |
| | Concrete pump car, 55m3/h | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 3 | 3 | 3 | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 3 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 28 | 3 |
| | Cutter-suction dredger, 600PS | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 1 |

Source: JICA Study Team Note: - Graph shows the rule curve of the Wonogiri reservoir; Values in columns mean the numbers of equipment to be used for the works.

**Figure 2.4.1 Work Schedule of Sediment Storage Reservoir (2/2)**
**(Equipment scheduling)**




Source: JICA Study Team

Note: - The hatched columns mean wet season.

**Figure 2.4.2 Proposed Project Implementation Schedule**

| Item | Year 0 | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Year 6 | Year 7 | Total |
|---|---|---|---|---|---|---|---|---|---|
| **Implementation portion** | | | | | | | | | |
| 1. Construction | | | | | | | | | |
| 1) Sediment storage reservoir works | | 0% | 0% | 0% | 0% | **40%** | **50%** | **10%** | 100% |
| 2) Procurement of dredger | | 0% | 0% | 0% | **10%** | **90%** | 0% | 0% | 100% |
| 3) Watershed conservation works | | 0% | 0% | 0% | **28%** | **33%** | **33%** | **6%** | 100% |
| 2. Consultant | | | | | | | | | |
| 1) Consulting services | | 0% | 0% | **28%** | **15%** | **25%** | **21%** | **11%** | 100% |
| 3. Land acquisition | | | | | | | | | |
| 1) Land acquition | | 0% | 0% | 0% | **90%** | **10%** | 0% | 0% | 100% |
| 4. Administration | | | | | | | | | |
| 1) Administrative expenses | | 0% | **5%** | **20%** | **20%** | **20%** | **20%** | **15%** | 100% |
| **Escalation portion** | | | | | | | | | |
| 1. Works | | | | | | | | | |
| 1) Sediment storage reservoir works | | 0% | 0% | 0% | 0% | 2% | 4% | 1% | **7%** |
| 2) Procurement of dredger | | 0% | 0% | 0% | 0% | 6% | 0% | 0% | **6%** |
| 3) Watershed conservation works | | 0% | 0% | 0% | 1% | 2% | 2% | 1% | **6%** |
| 2. Consultant | | | | | | | | | |
| 1) Consulting services | | 0% | 0% | 1% | 1% | 2% | 2% | 1% | **6%** |
| 3. Land acquisition | | | | | | | | | |
| 1) Land acquition | | 0% | 0% | 0% | 4% | 1% | 0% | 0% | **5%** |
| 4. Administration | | | | | | | | | |
| 1) Administrative expenses | | 0% | 0% | 1% | 1% | 1% | 1% | 1% | **6%** |

Source: JICA Study Team

Note: - Price leve (= Year 0): 2006

- Escalation per annum: 1.2%

(As the project cost is estimated in U.S. dollar, escalation rate of foreign currency is applied.)

**Figure 3.3.1 Estimate of Price Contingency**

# *Attachment 1*
# *Breakdown of Watershed Conservation Works*

## Table A1.1 Coding for Watershed Conservation Works

| Land classification | Land gradient | | | | |
|---|---|---|---|---|---|
| | 0-8% | 8-15% | 15-25% | 25-40% | over 40% |
| 1. Upland field | | | | | |
| 1) Good quality bench terrace | US1T1 | US2T1 | US3T1 | US4T1 | US5T1 |
| 2) Medium quality bench terrace | US1T2 | US2T2 | US3T2 | US4T2 | US5T2 |
| 3) Fair to poor quality bench terrace | US1T3 | US2T3 | US3T3 | US4T3 | US5T3 |
| 4) Traditional terrace | US1T4 | US2T4 | US3T4 | US4T4 | US5T4 |
| 5) Composite (non-terrace/ only ridge) | US1T5 | US2T5 | US3T5 | US4T5 | US5T5 |
| 2. Settlement area | | | | | |
| 1) Composite (non-terrace/ only ridge) | PS1T5 | PS2T5 | PS3T5 | PS4T5 | PS5T5 |
| 3. Housing yard | | | | | |
| 1) Housing yard | HS1 | HS2 | HS3 | HS4 | HS5 |

Source: JICA Study Team

## Table A1.2 Area to be Development

| | | [Master Plan] | | | | | | | | | [Feasibility Study] | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Code** | **Kuduang** | **Tirtomoyo** | **Temon** | **Upper Solo** | **Alang** | **Ngunggahan** | **Wuryantoro** | **Remnant** | **Total** | **Kuduang** | |
| | | (ha) | (ha) | (ha) | (ha) | (ha) | (ha) | (ha) | (ha) | **(ha)** | | (ha) |
| 1. Upland Field | | | | | | | | | | | | |
| 1) Bench terrace, good | | | | | | | | | | | | |
| | US1T1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** | US1T1 | 0 |
| 2) Bench terrace, medium | | | | | | | | | | | | |
| | US1T2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** | US1T2 | 0 |
| | US2T2 | 23 | 30 | 0 | 0 | 0 | 0 | 86 | 0 | **139** | US2T2 | 6 |
| | US3T2 | 20 | 10 | 0 | 0 | 1 | 16 | 121 | 23 | **191** | US3T2 | 8 |
| | US4T2 | 19 | 17 | 0 | 25 | 19 | 7 | 41 | 22 | **150** | US4T2 | 7 |
| | US5T2 | 12 | 32 | 0 | 18 | 20 | 11 | 28 | 17 | **138** | US5T2 | 3 |
| Sub-total | | 74 | 89 | 0 | 43 | 40 | 34 | 276 | 62 | **618** | | 24 |
| 3) Bench terrace, fair/poor | | | | | | | | | | | | |
| | US1T3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **1** | US1T3 | 0 |
| | US2T3 | 736 | 217 | 245 | 89 | 378 | 3 | 169 | 11 | **1,848** | US2T3 | 984 |
| | US3T3 | 868 | 339 | 166 | 190 | 160 | 13 | 97 | 29 | **1,862** | US3T3 | 1,027 |
| | US4T3 | 807 | 440 | 110 | 211 | 62 | 6 | 38 | 19 | **1,693** | US4T3 | 870 |
| | US5T3 | 1,322 | 710 | 110 | 262 | 53 | 25 | 22 | 11 | **2,515** | US5T3 | 1,392 |
| Sub-total | | 3,734 | 1,706 | 631 | 752 | 653 | 47 | 326 | 70 | **7,919** | | 4,273 |
| 4) Traditional terrace | | | | | | | | | | | | |
| | US1T4 | 7 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | **9** | US1T4 | 3 |
| | US2T4 | 147 | 46 | 7 | 204 | 3 | 49 | 14 | 58 | **528** | US2T4 | 40 |
| | US3T4 | 101 | 100 | 16 | 397 | 7 | 96 | 36 | 99 | **852** | US3T4 | 33 |
| | US4T4 | 58 | 112 | 15 | 439 | 19 | 81 | 15 | 72 | **811** | US4T4 | 26 |
| | US5T4 | 128 | 102 | 4 | 408 | 0 | 120 | 67 | 71 | **900** | US5T4 | 71 |
| Sub-total | | 441 | 360 | 42 | 1,448 | 31 | 346 | 132 | 300 | **3,100** | | 173 |
| 5) Composite (non-terrace/ only ridge) | | | | | | | | | | | | |
| | US1T5 | 51 | 99 | 47 | 61 | 0 | 15 | 12 | 27 | **312** | US1T5 | 1 |
| | US2T5 | 74 | 209 | 96 | 350 | 316 | 176 | 31 | 40 | **1,292** | US2T5 | 9 |
| | US3T5 | 92 | 456 | 144 | 664 | 471 | 251 | 50 | 46 | **2,174** | US3T5 | 31 |
| | US4T5 | 79 | 694 | 157 | 779 | 449 | 196 | 44 | 53 | **2,451** | US4T5 | 44 |
| | US5T5 | 201 | 1,128 | 162 | 826 | 337 | 150 | 68 | 84 | **2,956** | US5T5 | 82 |
| Sub-total | | 497 | 2,586 | 606 | 2,680 | 1,573 | 788 | 205 | 250 | **9,185** | | 167 |
| 2. Settlement area | | | | | | | | | | | | |
| 1) Composite (non-terrace/ only ridge) | | | | | | | | | | | | |
| | PS1T5 | 1,471 | 341 | 48 | 233 | 103 | 38 | 414 | 47 | **2,695** | PS1T6 | 1,520 |
| | PS2T5 | 1,820 | 417 | 199 | 496 | 404 | 136 | 200 | 53 | **3,725** | PS2T6 | 1,765 |
| | PS3T5 | 1,071 | 379 | 115 | 457 | 199 | 141 | 80 | 43 | **2,485** | PS3T6 | 1,039 |
| | PS4T5 | 400 | 288 | 44 | 273 | 84 | 59 | 28 | 20 | **1,196** | PS4T6 | 394 |
| | PS5T5 | 364 | 195 | 12 | 163 | 46 | 44 | 18 | 8 | **850** | PS5T6 | 365 |
| Sub-total | | 5,126 | 1,620 | 418 | 1,622 | 836 | 418 | 740 | 171 | **10,951** | | 5,083 |
| 3. Housing yard | | | | | | | | | | | | |
| 1) Housing yard | | | | | | | | | | | | |
| | HS1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | **1** | HS1 | 0 |
| | HS2 | 566 | 82 | 40 | 71 | 22 | 13 | 27 | 7 | **828** | HS2 | 569 |
| | HS3 | 363 | 131 | 26 | 96 | 30 | 25 | 14 | 7 | **692** | HS3 | 372 |
| | HS4 | 190 | 158 | 16 | 101 | 20 | 16 | 9 | 9 | **519** | HS4 | 185 |
| | HS5 | 269 | 157 | 6 | 85 | 23 | 15 | 9 | 5 | **569** | HS5 | 270 |
| Sub-total | | 1,388 | 529 | 88 | 353 | 95 | 69 | 59 | 28 | **2,609** | | 1,396 |
| **Total** | | **11,260** | **6,890** | **1,785** | **6,898** | **3,228** | **1,702** | **1,738** | **881** | **34,382** | | **11,116** |

Source: JICA Study Team

## Table A1.3 Wages and Unit Prices

| No. | Code | Item | Unit | Unit rate | Rate by project | Project rate | Rate equiv. |
|---|---|---|---|---|---|---|---|
| | | | | (Rp.) | | (Rp.) | ($) |
| 1. Labor wage | | | | | | | |
| | L.com.50 | Common workder | m.d | 20,000 | 50% | 10,000 | 1.00 |
| | L.com.75 | Common workder | m.d | 20,000 | 75% | 15,000 | 1.49 |
| 2. Unit price of material | | | | | | | |
| | M.bamboo | Bamboo, D= 100mm, L= 5m | m | 5,000 | 100% | 5,000 | 0.50 |
| | M.sand | Sand | m3 | 79,000 | 100% | 79,000 | 7.87 |
| | M.stone | Stone, for masonry | m3 | 85,100 | 100% | 85,100 | 8.48 |
| | M.lip.gr | Grass seedling, for lip | nr. | 100 | 100% | 100 | 0.01 |
| | M.lip.sh | Shrub seedling, for lip | nr. | 700 | 100% | 700 | 0.07 |
| | M.riser.gr | Grass seedling, for riser | nr. | 15 | 100% | 15 | 0.0015 |
| | M.shrub | Shrub | nr. | 700 | 100% | 700 | 0.07 |
| | M.seed | Seed for annual crop | kg | 700 | 100% | 700 | 0.07 |
| | M.seedling | Seedling, for perenial crop | nr. | 6,500 | 100% | 6,500 | 0.65 |
| | M.compo | Compost | kg | 500 | 100% | 500 | 0.05 |
| | M.che | Chemical fertilizer | kg | 1,900 | 100% | 1,900 | 0.19 |

Source: JICA Study Team

Note: - Price level: December, 2005

- Excange rate: US$ 1.0= Rp. 10,035

## Table A1.4 Production Rate of Manpower

| No. | Work item | Work unit | Basic rate | Adjust-ment | Rate adopted |
|---|---|---|---|---|---|
| | | | (m.d) | | (m.d) |
| 1. Land preparation | | | | | |
| 1) Terracing | | | | | |
| (1) | Cutting and filling | m3 | 0.46 | 1.00 | 0.46 |
| | /1 Cutting | m3 | 0.23 | | |
| | /2 Filling | m3 | 0.23 | | |
| 2) Waterway and drop | | | | | |
| (1) | Excavation, cutting | m3 | 0.39 | 1.00 | 0.39 |
| (2) | Masonry work | m3 | 7.14 | 1.00 | 7.14 |
| 3) Lip and rizer, planting | | | | | |
| (1) | Planting work, lip & riser | | | | |
| | /1 Planting, linier | m | 0.008 | 1.00 | 0.008 |
| | /2 Planting, area | m2 | 0.02 | 1.00 | 0.02 |
| 2. Side ditches (housing yard) | | | | | |
| 1) Side ditch | | | | | |
| (1) | Excavation | m3 | 0.39 | 1.00 | 0.39 |
| (2) | Masonry work | m3 | 7.14 | 1.00 | 7.14 |
| 2) Hedg row | | | | | |
| (1) | Planting work, hedge row | m2 | 0.02 | 1.00 | 0.02 |

Source: JICA Study Team

# Table A1.5 Dimensions of Works

**A. Land preparation works, at upland field**

| Land gradient **Ls** | Terracing | | | | | | Drain | | Lip | | Riser | Field | Stream drain | | | | | Drop | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Aver-aged gradient **s** | Height of a terrace **Ht** | Nr. of terrace **Nt** (= 100 x s/Ht) | Width of a terrace **Wt** (= 100/Nt) | Width of a riser/*1 **Wr** (= Ht x 0.5) | Width of a bench **Wb** (= Wt-Wr) | Width of bench drain **Wd** | Depth of bench drain **Dd** | Width of a lip **Wl** | Height of lip **Hl** | Slope length of a riser **Sr** (= $\sqrt{(Ht^2+Wr^2)}$) | Width of net field area **Wf** (= Wb-Wl) | Catch-ment area **Ac** | Width of stream drain **Wstd** | Height of stream drain **Hstd** | Interval of stream drain **Istd** | Number of stream drain **Nstd** | Height of drop for stream drain **Hdrp** | Masonry work volume Width **Wdrp** | Height **Hdrp** | Length **Ldrp** | Number of drop **Ndrp** |
| | | (m) | (nr./ha) | (m) | (m) | (m) | (m) | (m) | (m) | (m) | (m) | (m) | (ha) | (m) | (m) | (m) | (nr.) | (m) | (m) | (m) | (m) | (nr.) |
| 1. 0-8% | 4% | 0.60 | 6.67 | 14.99 | 0.18 | 14.81 | 0.25 | 0.10 | 0.20 | 0.10 | 0.63 | 14.61 | 4.0-5.0 | 0.30 | 0.20 | 75.00 | 1.33 | 0.60 | 0.30 | 0.10 | 0.60 | 8.87 |
| 2. 8-15% | 12% | 0.70 | 17.14 | 5.83 | 0.21 | 5.62 | 0.25 | 0.10 | 0.20 | 0.10 | 0.73 | 5.42 | 3.0-4.0 | 0.30 | 0.20 | 75.00 | 1.33 | 0.70 | 0.30 | 0.10 | 0.60 | 22.80 |
| 3. 15-25% | 20% | 0.80 | 25.00 | 4.00 | 0.24 | 3.76 | 0.25 | 0.10 | 0.20 | 0.10 | 0.84 | 3.56 | 2.0-3.0 | 0.20 | 0.20 | 75.00 | 1.33 | 0.80 | 0.30 | 0.10 | 0.60 | 33.25 |
| 4. 25-40% | 33% | 1.00 | 33.00 | 3.03 | 0.30 | 2.73 | 0.25 | 0.10 | 0.20 | 0.10 | 1.04 | 2.53 | 1.0-2.0 | 0.20 | 0.20 | 75.00 | 1.33 | 1.00 | 0.30 | 0.10 | 0.60 | 43.89 |
| 5. over 40% | 50% | 1.00 | 50.00 | 2.00 | 0.30 | 1.70 | 0.25 | 0.10 | 0.20 | 0.10 | 1.04 | 1.50 | 0.5-1.0 | 0.20 | 0.20 | 75.00 | 1.33 | 1.00 | 0.30 | 0.10 | 0.60 | 66.50 |

Source: JICA Study Team

Note: - Dimensions are caltulated in a typical area of 1ha of 100m wide and 100m long.

*1: Slope= 1:0.3

**B. Side ditch and hedge row works, at housing yard**

| Land gradient **Ls** | Aver-aged gradient **s** | Lateral drain (lateral with contor) | | | | | | | Collector drain (vertical with contor) | | | | | | | Hedge row | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Width of canal **Wld** | Height of canal **Hld** | Crown of a side wall **Cld** | Bottom of a side wall **Bld** | Thick-ness of bottom **Tld** | Interval of canal **Ild** | Number of canal **Nld** | Width of canal **Wcd** | Height of canal **Hcd** | Crown of a side wall **Ccd** | Bottom of a side wall **Bcd** | Thick-ness of bottom **Tcd** | Interval of canal **Icd** | Number of canal **Ncd** | Number of hedge row seedlings **Nshr** | Area of hedge row **Ahr** |
| | | (m) | (m) | (m) | (m) | (m) | (m) | (nr.) | (m) | (m) | (m) | (m) | (m) | (m) | (nr.) | (nr./ha) | (m2/ha) |
| 1. 0-8% | 4% | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 0.00 |
| 2. 8-15% | 12% | 0.40 | 0.20 | 0.10 | 0.10 | 0.10 | 200.00 | 0.50 | 0.20 | 0.20 | 0.10 | 0.10 | 0.10 | 100.00 | 1.00 | 3,200.00 | 400.00 |
| 3. 15-25% | 20% | 0.40 | 0.20 | 0.10 | 0.10 | 0.10 | 200.00 | 0.50 | 0.20 | 0.20 | 0.10 | 0.10 | 0.10 | 100.00 | 1.00 | 3,200.00 | 400.00 |
| 4. 25-40% | 33% | 0.30 | 0.20 | 0.10 | 0.10 | 0.10 | 200.00 | 0.50 | 0.20 | 0.20 | 0.10 | 0.10 | 0.10 | 100.00 | 1.00 | 3,200.00 | 400.00 |
| 5. over 40% | 50% | 0.30 | 0.20 | 0.10 | 0.10 | 0.10 | 200.00 | 0.50 | 0.20 | 0.20 | 0.10 | 0.10 | 0.10 | 100.00 | 1.00 | 3,200.00 | 400.00 |

Source: JICA Study Team

# Table A1.6 Unit Quantity for Land preparation

| Land classification | | | Stripping/*1 | Width of a bench | Height of a terrace | Nr. of terrace | Cut and fill | | | | Waterway and drop | | | | | | | | | Lip and riser planting | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | simple compute | V01+V03 | Work intensity | Work volume | Width of stream drain | Height of stream drain | Number of stream drain | Volume of excavation | Drop | | | Volume of masonry work | Volume of stone material | Length of lip | Slope length of a riser | Area of riser | Densiry | | | Number | | |
| | | | | | | | | | | | | | | | Width | Height | Length | | | | | | lip grass | lip shrub | riser grass | lip grass | lip shrub | riser grass |
| | Ls | s | V01 | Wb | Ht | Nt | V02 | V03 | int | V04 | Wstd | Hstd | Nstd | V11 | Wdrp | Hdrp | Ldrp | V12 | V13 | Ll | Sr | Arp | Dlc | Dls | Drg | Nlc | Nls | Nrg |
| | | | (m3/ha) | (m) | (m) | (nr.) | (m3/ha) | (m3/ha) | | | (m) | (m) | (nr.) | (m3/ha) | (m) | (m) | (m) | (m3/ha) | (m3/ha) | (m/ha) | (m) | (m2/ha) | (m/nr.) | (m/nr.) | (m2/nr.) | (nr./ha) | (nr./ha) | (nr./ha) |
| 1. Upland field | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1) Good quality bench terrace | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| (1) | 0-8% | 4% | 0 | 14.81 | 0.60 | 6.67 | 740.00 | 740.00 | 0% | - | 0.30 | 0.20 | 1.33 | - | 0.30 | 0.60 | 0.60 | - | - | - | 0.63 | - | 0.30 | 5.00 | 0.20 | - | - | - |
| (2) | 8-15% | 12% | 0 | 5.62 | 0.70 | 17.14 | 842.00 | 842.00 | 0% | - | 0.30 | 0.20 | 1.33 | - | 0.30 | 0.70 | 0.60 | - | - | - | 0.73 | - | 0.30 | 5.00 | 0.20 | - | - | - |
| (3) | 15-25% | 20% | 0 | 3.76 | 0.80 | 25.00 | 940.00 | 940.00 | 0% | - | 0.20 | 0.20 | 1.33 | - | 0.30 | 0.80 | 0.60 | - | - | - | 0.84 | - | 0.30 | 5.00 | 0.20 | - | - | - |
| (4) | 25-40% | 33% | 0 | 2.73 | 1.00 | 33.00 | 1,126.00 | 1,126.00 | 0% | - | 0.20 | 0.20 | 1.33 | - | 0.30 | 1.00 | 0.60 | - | - | - | 1.04 | - | 0.30 | 5.00 | 0.20 | - | - | - |
| (5) | over 40% | 50% | 0 | 1.70 | 1.00 | 50.00 | 1,062.00 | 1,062.00 | 0% | - | 0.20 | 0.20 | 1.33 | - | 0.30 | 1.00 | 0.60 | - | - | - | 1.04 | - | 0.30 | 5.00 | 0.20 | - | - | - |
| 2) Medium quality bench terrace | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| (1) | 0-8% | 4% | 500 | 14.81 | 0.60 | 6.67 | 740.00 | 1,240.00 | 0% | - | 0.30 | 0.20 | 1.33 | 8.00 | 0.30 | 0.60 | 0.60 | 0.72 | 0.79 | 667 | 0.63 | 420 | 0.30 | 5.00 | 0.20 | 2,223 | 133 | 2,100 |
| (2) | 8-15% | 12% | 500 | 5.62 | 0.70 | 17.14 | 842.00 | 1,342.00 | 0% | - | 0.30 | 0.20 | 1.33 | 8.00 | 0.30 | 0.70 | 0.60 | 2.16 | 2.38 | 1,714 | 0.73 | 1,251 | 0.30 | 5.00 | 0.20 | 5,713 | 343 | 6,255 |
| (3) | 15-25% | 20% | 500 | 3.76 | 0.80 | 25.00 | 940.00 | 1,440.00 | 0% | - | 0.20 | 0.20 | 1.33 | 5.00 | 0.30 | 0.80 | 0.60 | 3.60 | 3.96 | 2,500 | 0.84 | 2,100 | 0.30 | 5.00 | 0.20 | 8,333 | 500 | 10,500 |
| (4) | 25-40% | 33% | 500 | 2.73 | 1.00 | 33.00 | 1,126.00 | 1,626.00 | 0% | - | 0.20 | 0.20 | 1.33 | 5.00 | 0.30 | 1.00 | 0.60 | 5.94 | 6.53 | 3,300 | 1.04 | 3,432 | 0.30 | 5.00 | 0.20 | 11,000 | 660 | 17,160 |
| (5) | over 40% | 50% | 500 | 1.70 | 1.00 | 50.00 | 1,062.00 | 1,562.00 | 0% | - | 0.20 | 0.20 | 1.33 | 5.00 | 0.30 | 1.00 | 0.60 | 9.00 | 9.90 | 5,000 | 1.04 | 5,200 | 0.30 | 5.00 | 0.20 | 16,667 | 1,000 | 26,000 |
| 3) Fair to poor quality bench terrace | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| (1) | 0-8% | 4% | 500 | 14.81 | 0.60 | 6.67 | 740.00 | 1,240.00 | 0% | - | 0.30 | 0.20 | 1.33 | 8.00 | 0.30 | 0.60 | 0.60 | 0.72 | 0.79 | 667 | 0.63 | 420 | 0.30 | 5.00 | 0.20 | 2,223 | 133 | 2,100 |
| (2) | 8-15% | 12% | 500 | 5.62 | 0.70 | 17.14 | 842.00 | 1,342.00 | 0% | - | 0.30 | 0.20 | 1.33 | 8.00 | 0.30 | 0.70 | 0.60 | 2.16 | 2.38 | 1,714 | 0.73 | 1,251 | 0.30 | 5.00 | 0.20 | 5,713 | 343 | 6,255 |
| (3) | 15-25% | 20% | 500 | 3.76 | 0.80 | 25.00 | 940.00 | 1,440.00 | 0% | - | 0.20 | 0.20 | 1.33 | 5.00 | 0.30 | 0.80 | 0.60 | 3.60 | 3.96 | 2,500 | 0.84 | 2,100 | 0.30 | 5.00 | 0.20 | 8,333 | 500 | 10,500 |
| (4) | 25-40% | 33% | 500 | 2.73 | 1.00 | 33.00 | 1,126.00 | 1,626.00 | 0% | - | 0.20 | 0.20 | 1.33 | 5.00 | 0.30 | 1.00 | 0.60 | 5.94 | 6.53 | 3,300 | 1.04 | 3,432 | 0.30 | 5.00 | 0.20 | 11,000 | 660 | 17,160 |
| (5) | over 40% | 50% | 500 | 1.70 | 1.00 | 50.00 | 1,062.00 | 1,562.00 | 0% | - | 0.20 | 0.20 | 1.33 | 5.00 | 0.30 | 1.00 | 0.60 | 9.00 | 9.90 | 5,000 | 1.04 | 5,200 | 0.30 | 5.00 | 0.20 | 16,667 | 1,000 | 26,000 |
| 4) Traditional terrace | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| (1) | 0-8% | 4% | 500 | 14.81 | 0.60 | 6.67 | 740.00 | 1,240.00 | 50% | 620.00 | 0.30 | 0.20 | 1.33 | 8.00 | 0.30 | 0.60 | 0.60 | 0.72 | 0.79 | 667 | 0.63 | 420 | 0.30 | 5.00 | 0.20 | 2,223 | 133 | 2,100 |
| (2) | 8-15% | 12% | 500 | 5.62 | 0.70 | 17.14 | 842.00 | 1,342.00 | 50% | 671.00 | 0.30 | 0.20 | 1.33 | 8.00 | 0.30 | 0.70 | 0.60 | 2.16 | 2.38 | 1,714 | 0.73 | 1,251 | 0.30 | 5.00 | 0.20 | 5,713 | 343 | 6,255 |
| (3) | 15-25% | 20% | 500 | 3.76 | 0.80 | 25.00 | 940.00 | 1,440.00 | 50% | 720.00 | 0.20 | 0.20 | 1.33 | 5.00 | 0.30 | 0.80 | 0.60 | 3.60 | 3.96 | 2,500 | 0.84 | 2,100 | 0.30 | 5.00 | 0.20 | 8,333 | 500 | 10,500 |
| (4) | 25-40% | 33% | 500 | 2.73 | 1.00 | 33.00 | 1,126.00 | 1,626.00 | 50% | 813.00 | 0.20 | 0.20 | 1.33 | 5.00 | 0.30 | 1.00 | 0.60 | 5.94 | 6.53 | 3,300 | 1.04 | 3,432 | 0.30 | 5.00 | 0.20 | 11,000 | 660 | 17,160 |
| (5) | over 40% | 50% | 500 | 1.70 | 1.00 | 50.00 | 1,062.00 | 1,562.00 | 50% | 781.00 | 0.20 | 0.20 | 1.33 | 5.00 | 0.30 | 1.00 | 0.60 | 9.00 | 9.90 | 5,000 | 1.04 | 5,200 | 0.30 | 5.00 | 0.20 | 16,667 | 1,000 | 26,000 |
| 5) Composite (non-terrace/ only ridge) | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| (1) | 0-8% | 4% | 500 | 14.81 | 0.60 | 6.67 | 740.00 | 1,240.00 | 75% | 930.00 | 0.30 | 0.20 | 1.33 | 8.00 | 0.30 | 0.60 | 0.60 | 0.72 | 0.79 | 667 | 0.63 | 420 | 0.30 | 5.00 | 0.20 | 2,223 | 133 | 2,100 |
| (2) | 8-15% | 12% | 500 | 5.62 | 0.70 | 17.14 | 842.00 | 1,342.00 | 75% | 1,007.00 | 0.30 | 0.20 | 1.33 | 8.00 | 0.30 | 0.70 | 0.60 | 2.16 | 2.38 | 1,714 | 0.73 | 1,251 | 0.30 | 5.00 | 0.20 | 5,713 | 343 | 6,255 |
| (3) | 15-25% | 20% | 500 | 3.76 | 0.80 | 25.00 | 940.00 | 1,440.00 | 75% | 1,080.00 | 0.20 | 0.20 | 1.33 | 5.00 | 0.30 | 0.80 | 0.60 | 3.60 | 3.96 | 2,500 | 0.84 | 2,100 | 0.30 | 5.00 | 0.20 | 8,333 | 500 | 10,500 |
| (4) | 25-40% | 33% | 500 | 2.73 | 1.00 | 33.00 | 1,126.00 | 1,626.00 | 75% | 1,220.00 | 0.20 | 0.20 | 1.33 | 5.00 | 0.30 | 1.00 | 0.60 | 5.94 | 6.53 | 3,300 | 1.04 | 3,432 | 0.30 | 5.00 | 0.20 | 11,000 | 660 | 17,160 |
| (5) | over 40% | 50% | 500 | 1.70 | 1.00 | 50.00 | 1,062.00 | 1,562.00 | 75% | 1,172.00 | 0.20 | 0.20 | 1.33 | 5.00 | 0.30 | 1.00 | 0.60 | 9.00 | 9.90 | 5,000 | 1.04 | 5,200 | 0.30 | 5.00 | 0.20 | 16,667 | 1,000 | 26,000 |
| 2. Settlement area | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1) Composite (non-terrace/ only ridge) | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| (1) | 0-8% | 4% | 500 | 14.81 | 0.60 | 6.67 | 740.00 | 1,240.00 | 63% | 775.00 | 0.30 | 0.20 | 1.33 | 8.00 | 0.30 | 0.60 | 0.60 | 0.72 | 0.79 | 667 | 0.63 | 420 | 0.30 | 5.00 | 0.20 | 2,223 | 133 | 2,100 |
| (2) | 8-15% | 12% | 500 | 5.62 | 0.70 | 17.14 | 842.00 | 1,342.00 | 63% | 839.00 | 0.30 | 0.20 | 1.33 | 8.00 | 0.30 | 0.70 | 0.60 | 2.16 | 2.38 | 1,714 | 0.73 | 1,251 | 0.30 | 5.00 | 0.20 | 5,713 | 343 | 6,255 |
| (3) | 15-25% | 20% | 500 | 3.76 | 0.80 | 25.00 | 940.00 | 1,440.00 | 63% | 900.00 | 0.20 | 0.20 | 1.33 | 5.00 | 0.30 | 0.80 | 0.60 | 3.60 | 3.96 | 2,500 | 0.84 | 2,100 | 0.30 | 5.00 | 0.20 | 8,333 | 500 | 10,500 |
| (4) | 25-40% | 33% | 500 | 2.73 | 1.00 | 33.00 | 1,126.00 | 1,626.00 | 63% | 1,016.00 | 0.20 | 0.20 | 1.33 | 5.00 | 0.30 | 1.00 | 0.60 | 5.94 | 6.53 | 3,300 | 1.04 | 3,432 | 0.30 | 5.00 | 0.20 | 11,000 | 660 | 17,160 |
| (5) | over 40% | 50% | 500 | 1.70 | 1.00 | 50.00 | 1,062.00 | 1,562.00 | 63% | 976.00 | 0.20 | 0.20 | 1.33 | 5.00 | 0.30 | 1.00 | 0.60 | 9.00 | 9.90 | 5,000 | 1.04 | 5,200 | 0.30 | 5.00 | 0.20 | 16,667 | 1,000 | 26,000 |

Source: JICA Study Team

Note: *1: t= 10cm

# Table A1.7 Unit Quantity for Side Ditch and Hedge Row

| Land classification | | | Lateral drain (lateral with contor) | | | | | | Collector drain (vertical with contor) | | | | | | Side ditch | | | | Hedge row | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Ls** | **s** | Width of canal **Wld** (m) | Height of canal **Hld** (m) | Crown of a side wall **Cld** (m) | Bottom of a side wall **Bld** (m) | Thick-ness of bottom **Tld** (m) | Number of canal **Nld** (nr.) | Width of canal **Wcd** (m) | Height of canal **Hcd** (m) | Crown of a side wall **Ccd** (m) | Bottom of a side wall **Bcd** (m) | Thick-ness of bottom **Tcd** (m) | Number of canal **Ncd** (nr.) | Exca-vation **V21** (m3/ha) | Volume of canal **V22** (m3/ha) | Volume of masory work **V23** (m3/ha) | Volume of stone material **V24** (m3/ha) | Number of hedge row seedlings **Nshr** (nr./ha) | Area of hedge row **Ahr** (m2/ha) |
| 3. Housing yard | | | | | | | | | | | | | | | | | | | | |
| 1) Housing yard | | | | | | | | | | | | | | | | | | | | |
| (1) | 0-8% | 4% | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| (2) | 8-15% | 12% | 0.40 | 0.20 | 0.10 | 0.10 | 0.10 | 0.50 | 0.20 | 0.20 | 0.10 | 0.10 | 0.10 | 1.00 | 21.00 | 8.00 | 13.00 | 14.30 | 3,200.00 | 400.00 |
| (3) | 15-25% | 20% | 0.40 | 0.20 | 0.10 | 0.10 | 0.10 | 0.50 | 0.20 | 0.20 | 0.10 | 0.10 | 0.10 | 1.00 | 21.00 | 8.00 | 13.00 | 14.30 | 3,200.00 | 400.00 |
| (4) | 25-40% | 33% | 0.30 | 0.20 | 0.10 | 0.10 | 0.10 | 0.50 | 0.20 | 0.20 | 0.10 | 0.10 | 0.10 | 1.00 | 19.50 | 7.00 | 12.50 | 13.75 | 3,200.00 | 400.00 |
| (5) | over 40% | 50% | 0.30 | 0.20 | 0.10 | 0.10 | 0.10 | 0.50 | 0.20 | 0.20 | 0.10 | 0.10 | 0.10 | 1.00 | 19.50 | 7.00 | 12.50 | 13.75 | 3,200.00 | 400.00 |

Source: JICA Study Team

# Table A1.8 Work Quantities for Land preparation (1/2) <entire basin>

| Land classification | | | Propo-sed Area | Cut & fill work volume | Volume of exca-vation | Volume of masonry work | Volume of stone material | Length of lip | Area of riser | lip grass | lip shrub | riser grass | Work volume | Volume of exca-vation | Volume of masonry work | Volume of stone material | Length of lip | Area of riser | lip grass | lip shrub | riser grass |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Ls** | **s** | | **V04** | **V11** | **V12** | **V13** | **Ll** | **Arp** | **Nlc** | **Nls** | **Nrg** | **V04** | **V11** | **V12** | **V13** | **Ll** | **Arp** | **Nlc** | **Nls** | **Nrg** |
| | | | (ha) | (m3/ha) | (m3/ha) | (m3/ha) | (m3/ha) | (m/ha) | (m2/ha) | (nr./ha) | (nr./ha) | (nr./ha) | (m3) | (m3) | (m3) | (m3) | (m) | (m2) | (nr.) | (nr.) | (nr.) |
| 1. Upland field | | | | | | | | | | | | | | | | | | | | | |
| 1) Good quality bench terrace | | | | | | | | | | | | | | | | | | | | | |
| (1) | 0-8% | 4% | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| (2) | 8-15% | 12% | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| (3) | 15-25% | 20% | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| (4) | 25-40% | 33% | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| (5) | over 40% | 50% | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2) Medium quality bench terrace | | | | | | | | | | | | | | | | | | | | | |
| (1) | 0-8% | 4% | - | - | 8.00 | 0.72 | 0.79 | 667 | 420 | 2,223 | 133 | 2,100 | - | - | - | - | - | - | - | - | - |
| (2) | 8-15% | 12% | 139 | - | 8.00 | 2.16 | 2.38 | 1,714 | 1,251 | 5,713 | 343 | 6,255 | - | 1,112 | 300 | 331 | 238,246 | 173,889 | 794,107 | 47,677 | 869,445 |
| (3) | 15-25% | 20% | 191 | - | 5.00 | 3.60 | 3.96 | 2,500 | 2,100 | 8,333 | 500 | 10,500 | - | 955 | 688 | 756 | 477,500 | 401,100 | 1,591,603 | 95,500 | 2,005,500 |
| (4) | 25-40% | 33% | 150 | - | 5.00 | 5.94 | 6.53 | 3,300 | 3,432 | 11,000 | 660 | 17,160 | - | 750 | 891 | 980 | 495,000 | 514,800 | 1,650,000 | 99,000 | 2,574,000 |
| (5) | over 40% | 50% | 138 | - | 5.00 | 9.00 | 9.90 | 5,000 | 5,200 | 16,667 | 1,000 | 26,000 | - | 690 | 1,242 | 1,366 | 690,000 | 717,600 | 2,300,046 | 138,000 | 3,588,000 |
| 3) Fair to poor quality bench terrace | | | | | | | | | | | | | | | | | | | | | |
| (1) | 0-8% | 4% | 1 | - | 8.00 | 0.72 | 0.79 | 667 | 420 | 2,223 | 133 | 2,100 | - | 8 | 1 | 1 | 667 | 420 | 2,223 | 133 | 2,100 |
| (2) | 8-15% | 12% | 1,848 | - | 8.00 | 2.16 | 2.38 | 1,714 | 1,251 | 5,713 | 343 | 6,255 | - | 14,784 | 3,992 | 4,398 | 3,167,472 | 2,311,848 | 10,557,624 | 633,864 | 11,559,240 |
| (3) | 15-25% | 20% | 1,862 | - | 5.00 | 3.60 | 3.96 | 2,500 | 2,100 | 8,333 | 500 | 10,500 | - | 9,310 | 6,703 | 7,374 | 4,655,000 | 3,910,200 | 15,516,046 | 931,000 | 19,551,000 |
| (4) | 25-40% | 33% | 1,693 | - | 5.00 | 5.94 | 6.53 | 3,300 | 3,432 | 11,000 | 660 | 17,160 | - | 8,465 | 10,056 | 11,055 | 5,586,900 | 5,810,376 | 18,623,000 | 1,117,380 | 29,051,880 |
| (5) | over 40% | 50% | 2,515 | - | 5.00 | 9.00 | 9.90 | 5,000 | 5,200 | 16,667 | 1,000 | 26,000 | - | 12,575 | 22,635 | 24,899 | 12,575,000 | 13,078,000 | 41,917,505 | 2,515,000 | 65,390,000 |
| 4) Traditional terrace | | | | | | | | | | | | | | | | | | | | | |
| (1) | 0-8% | 4% | 9 | 620.00 | 8.00 | 0.72 | 0.79 | 667 | 420 | 2,223 | 133 | 2,100 | 5,580 | 72 | 6 | 7 | 6,003 | 3,780 | 20,007 | 1,197 | 18,900 |
| (2) | 8-15% | 12% | 528 | 671.00 | 8.00 | 2.16 | 2.38 | 1,714 | 1,251 | 5,713 | 343 | 6,255 | 354,288 | 4,224 | 1,140 | 1,257 | 904,992 | 660,528 | 3,016,464 | 181,104 | 3,302,640 |
| (3) | 15-25% | 20% | 852 | 720.00 | 5.00 | 3.60 | 3.96 | 2,500 | 2,100 | 8,333 | 500 | 10,500 | 613,440 | 4,260 | 3,067 | 3,374 | 2,130,000 | 1,789,200 | 7,099,716 | 426,000 | 8,946,000 |
| (4) | 25-40% | 33% | 811 | 813.00 | 5.00 | 5.94 | 6.53 | 3,300 | 3,432 | 11,000 | 660 | 17,160 | 659,343 | 4,055 | 4,817 | 5,296 | 2,676,300 | 2,783,352 | 8,921,000 | 535,260 | 13,916,760 |
| (5) | over 40% | 50% | 900 | 781.00 | 5.00 | 9.00 | 9.90 | 5,000 | 5,200 | 16,667 | 1,000 | 26,000 | 702,900 | 4,500 | 8,100 | 8,910 | 4,500,000 | 4,680,000 | 15,000,300 | 900,000 | 23,400,000 |
| 5) Composite (non-terrace/ only ridge) | | | | | | | | | | | | | | | | | | | | | |
| (1) | 0-8% | 4% | 312 | 930.00 | 8.00 | 0.72 | 0.79 | 667 | 420 | 2,223 | 133 | 2,100 | 290,160 | 2,496 | 225 | 246 | 208,104 | 131,040 | 693,576 | 41,496 | 655,200 |
| (2) | 8-15% | 12% | 1,292 | 1,007.00 | 8.00 | 2.16 | 2.38 | 1,714 | 1,251 | 5,713 | 343 | 6,255 | 1,301,044 | 10,336 | 2,791 | 3,075 | 2,214,488 | 1,616,292 | 7,381,196 | 443,156 | 8,081,460 |
| (3) | 15-25% | 20% | 2,174 | 1,080.00 | 5.00 | 3.60 | 3.96 | 2,500 | 2,100 | 8,333 | 500 | 10,500 | 2,347,920 | 10,870 | 7,826 | 8,609 | 5,435,000 | 4,565,400 | 18,115,942 | 1,087,000 | 22,827,000 |
| (4) | 25-40% | 33% | 2,451 | 1,220.00 | 5.00 | 5.94 | 6.53 | 3,300 | 3,432 | 11,000 | 660 | 17,160 | 2,990,220 | 12,255 | 14,559 | 16,005 | 8,088,300 | 8,411,832 | 26,961,000 | 1,617,660 | 42,059,160 |
| (5) | over 40% | 50% | 2,956 | 1,172.00 | 5.00 | 9.00 | 9.90 | 5,000 | 5,200 | 16,667 | 1,000 | 26,000 | 3,464,432 | 14,780 | 26,604 | 29,264 | 14,780,000 | 15,371,200 | 49,267,652 | 2,956,000 | 76,856,000 |
| 2. Settlement area | | | | | | | | | | | | | | | | | | | | | |
| 1) Composite (non-terrace/ only ridge) | | | | | | | | | | | | | | | | | | | | | |
| (1) | 0-8% | 4% | 2,695 | 775.00 | 8.00 | 0.72 | 0.79 | 667 | 420 | 2,223 | 133 | 2,100 | 2,088,625 | 21,560 | 1,940 | 2,129 | 1,797,565 | 1,131,900 | 5,990,985 | 358,435 | 5,659,500 |
| (2) | 8-15% | 12% | 3,725 | 839.00 | 8.00 | 2.16 | 2.38 | 1,714 | 1,251 | 5,713 | 343 | 6,255 | 3,125,275 | 29,800 | 8,046 | 8,866 | 6,384,650 | 4,659,975 | 21,280,925 | 1,277,675 | 23,299,875 |
| (3) | 15-25% | 20% | 2,485 | 900.00 | 5.00 | 3.60 | 3.96 | 2,500 | 2,100 | 8,333 | 500 | 10,500 | 2,236,500 | 12,425 | 8,946 | 9,841 | 6,212,500 | 5,218,500 | 20,707,505 | 1,242,500 | 26,092,500 |
| (4) | 25-40% | 33% | 1,196 | 1,016.00 | 5.00 | 5.94 | 6.53 | 3,300 | 3,432 | 11,000 | 660 | 17,160 | 1,215,136 | 5,980 | 7,104 | 7,810 | 3,946,800 | 4,104,672 | 13,156,000 | 789,360 | 20,523,360 |
| (5) | over 40% | 50% | 850 | 976.00 | 5.00 | 9.00 | 9.90 | 5,000 | 5,200 | 16,667 | 1,000 | 26,000 | 829,600 | 4,250 | 7,650 | 8,415 | 4,250,000 | 4,420,000 | 14,166,950 | 850,000 | 22,100,000 |
| | | | | | | | | | | | | | 22,224,463 | 190,512 | 149,329 | 164,264 | 91,420,487 | 86,465,904 | 304,731,372 | 18,284,397 | 432,329,520 |
| **Total** | | | **31,773** | | | | | | | | | | **22,224,000** | **191,000** | **149,000** | **164,000** | **91,420,000** | **86,466,000** | **304,731,000** | **18,284,000** | **432,330,000** |

Source: JICA Study Team

# Table A1.8 Work Quantities for Land preparation (2/2) <Keduang basin>

| Land classification | | | Propo-sed Area | Cut & fill work volume | Volume of exca-vation | Volume of masonry work | Volume of stone material | Length of lip | Area of riser | lip grass | lip shrub | riser grass | Work volume | Volume of exca-vation | Volume of masonry work | Volume of stone material | Length of lip | Area of riser | lip grass | lip shrub | riser grass |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Ls** | | **s** | | **V04** | **V11** | **V12** | **V13** | **Ll** | **Arp** | **Nlc** | **Nls** | **Nrg** | **V04** | **V11** | **V12** | **V13** | **Ll** | **Arp** | **Nlc** | **Nls** | **Nrg** |
| | | | (ha) | (m3/ha) | (m3/ha) | (m3/ha) | (m3/ha) | (m/ha) | (m2/ha) | (nr./ha) | (nr./ha) | (nr./ha) | (m3) | (m3) | (m3) | (m3) | (m) | (m2) | (nr.) | (nr.) | (nr.) |
| 1. Upland field | | | | | | | | | | | | | | | | | | | | | |
| 1) Good quality bench terrace | | | | | | | | | | | | | | | | | | | | | |
| (1) | 0-8% | 4% | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| (2) | 8-15% | 12% | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| (3) | 15-25% | 20% | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| (4) | 25-40% | 33% | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| (5) | over 40% | 50% | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2) Medium quality bench terrace | | | | | | | | | | | | | | | | | | | | | |
| (1) | 0-8% | 4% | - | - | 8.00 | 0.72 | 0.79 | 667 | 420 | 2,223 | 133 | 2,100 | - | - | - | - | - | - | - | - | - |
| (2) | 8-15% | 12% | 6 | - | 8.00 | 2.16 | 2.38 | 1,714 | 1,251 | 5,713 | 343 | 6,255 | - | 48 | 13 | 14 | 10,284 | 7,506 | 34,278 | 2,058 | 37,530 |
| (3) | 15-25% | 20% | 8 | - | 5.00 | 3.60 | 3.96 | 2,500 | 2,100 | 8,333 | 500 | 10,500 | - | 40 | 29 | 32 | 20,000 | 16,800 | 66,664 | 4,000 | 84,000 |
| (4) | 25-40% | 33% | 7 | - | 5.00 | 5.94 | 6.53 | 3,300 | 3,432 | 11,000 | 660 | 17,160 | - | 35 | 42 | 46 | 23,100 | 24,024 | 77,000 | 4,620 | 120,120 |
| (5) | over 40% | 50% | 3 | - | 5.00 | 9.00 | 9.90 | 5,000 | 5,200 | 16,667 | 1,000 | 26,000 | - | 15 | 27 | 30 | 15,000 | 15,600 | 50,001 | 3,000 | 78,000 |
| 3) Fair to poor quality bench terrace | | | | | | | | | | | | | | | | | | | | | |
| (1) | 0-8% | 4% | - | - | 8.00 | 0.72 | 0.79 | 667 | 420 | 2,223 | 133 | 2,100 | - | - | - | - | - | - | - | - | - |
| (2) | 8-15% | 12% | 984 | - | 8.00 | 2.16 | 2.38 | 1,714 | 1,251 | 5,713 | 343 | 6,255 | - | 7,872 | 2,125 | 2,342 | 1,686,576 | 1,230,984 | 5,621,592 | 337,512 | 6,154,920 |
| (3) | 15-25% | 20% | 1,027 | - | 5.00 | 3.60 | 3.96 | 2,500 | 2,100 | 8,333 | 500 | 10,500 | - | 5,135 | 3,697 | 4,067 | 2,567,500 | 2,156,700 | 8,557,991 | 513,500 | 10,783,500 |
| (4) | 25-40% | 33% | 870 | - | 5.00 | 5.94 | 6.53 | 3,300 | 3,432 | 11,000 | 660 | 17,160 | - | 4,350 | 5,168 | 5,681 | 2,871,000 | 2,985,840 | 9,570,000 | 574,200 | 14,929,200 |
| (5) | over 40% | 50% | 1,392 | - | 5.00 | 9.00 | 9.90 | 5,000 | 5,200 | 16,667 | 1,000 | 26,000 | - | 6,960 | 12,528 | 13,781 | 6,960,000 | 7,238,400 | 23,200,464 | 1,392,000 | 36,192,000 |
| 4) Traditional terrace | | | | | | | | | | | | | | | | | | | | | |
| (1) | 0-8% | 4% | 3 | 620.00 | 8.00 | 0.72 | 0.79 | 667 | 420 | 2,223 | 133 | 2,100 | 1,860 | 24 | 2 | 2 | 2,001 | 1,260 | 6,669 | 399 | 6,300 |
| (2) | 8-15% | 12% | 40 | 671.00 | 8.00 | 2.16 | 2.38 | 1,714 | 1,251 | 5,713 | 343 | 6,255 | 26,840 | 320 | 86 | 95 | 68,560 | 50,040 | 228,520 | 13,720 | 250,200 |
| (3) | 15-25% | 20% | 33 | 720.00 | 5.00 | 3.60 | 3.96 | 2,500 | 2,100 | 8,333 | 500 | 10,500 | 23,760 | 165 | 119 | 131 | 82,500 | 69,300 | 274,989 | 16,500 | 346,500 |
| (4) | 25-40% | 33% | 26 | 813.00 | 5.00 | 5.94 | 6.53 | 3,300 | 3,432 | 11,000 | 660 | 17,160 | 21,138 | 130 | 154 | 170 | 85,800 | 89,232 | 286,000 | 17,160 | 446,160 |
| (5) | over 40% | 50% | 71 | 781.00 | 5.00 | 9.00 | 9.90 | 5,000 | 5,200 | 16,667 | 1,000 | 26,000 | 55,451 | 355 | 639 | 703 | 355,000 | 369,200 | 1,183,357 | 71,000 | 1,846,000 |
| 5) Composite (non-terrace/ only ridge) | | | | | | | | | | | | | | | | | | | | | |
| (1) | 0-8% | 4% | 1 | 930.00 | 8.00 | 0.72 | 0.79 | 667 | 420 | 2,223 | 133 | 2,100 | 930 | 8 | 1 | 1 | 667 | 420 | 2,223 | 133 | 2,100 |
| (2) | 8-15% | 12% | 9 | 1,007.00 | 8.00 | 2.16 | 2.38 | 1,714 | 1,251 | 5,713 | 343 | 6,255 | 9,063 | 72 | 19 | 21 | 15,426 | 11,259 | 51,417 | 3,087 | 56,295 |
| (3) | 15-25% | 20% | 31 | 1,080.00 | 5.00 | 3.60 | 3.96 | 2,500 | 2,100 | 8,333 | 500 | 10,500 | 33,480 | 155 | 112 | 123 | 77,500 | 65,100 | 258,323 | 15,500 | 325,500 |
| (4) | 25-40% | 33% | 44 | 1,220.00 | 5.00 | 5.94 | 6.53 | 3,300 | 3,432 | 11,000 | 660 | 17,160 | 53,680 | 220 | 261 | 287 | 145,200 | 151,008 | 484,000 | 29,040 | 755,040 |
| (5) | over 40% | 50% | 82 | 1,172.00 | 5.00 | 9.00 | 9.90 | 5,000 | 5,200 | 16,667 | 1,000 | 26,000 | 96,104 | 410 | 738 | 812 | 410,000 | 426,400 | 1,366,694 | 82,000 | 2,132,000 |
| 2. Settlement area | | | | | | | | | | | | | | | | | | | | | |
| 1) Composite (non-terrace/ only ridge) | | | | | | | | | | | | | | | | | | | | | |
| (1) | 0-8% | 4% | 1,520 | 775.00 | 8.00 | 0.72 | 0.79 | 667 | 420 | 2,223 | 133 | 2,100 | 1,178,000 | 12,160 | 1,094 | 1,201 | 1,013,840 | 638,400 | 3,378,960 | 202,160 | 3,192,000 |
| (2) | 8-15% | 12% | 1,765 | 839.00 | 8.00 | 2.16 | 2.38 | 1,714 | 1,251 | 5,713 | 343 | 6,255 | 1,480,835 | 14,120 | 3,812 | 4,201 | 3,025,210 | 2,208,015 | 10,083,445 | 605,395 | 11,040,075 |
| (3) | 15-25% | 20% | 1,039 | 900.00 | 5.00 | 3.60 | 3.96 | 2,500 | 2,100 | 8,333 | 500 | 10,500 | 935,100 | 5,195 | 3,740 | 4,114 | 2,597,500 | 2,181,900 | 8,657,987 | 519,500 | 10,909,500 |
| (4) | 25-40% | 33% | 394 | 1,016.00 | 5.00 | 5.94 | 6.53 | 3,300 | 3,432 | 11,000 | 660 | 17,160 | 400,304 | 1,970 | 2,340 | 2,573 | 1,300,200 | 1,352,208 | 4,334,000 | 260,040 | 6,761,040 |
| (5) | over 40% | 50% | 365 | 976.00 | 5.00 | 9.00 | 9.90 | 5,000 | 5,200 | 16,667 | 1,000 | 26,000 | 356,240 | 1,825 | 3,285 | 3,614 | 1,825,000 | 1,898,000 | 6,083,455 | 365,000 | 9,490,000 |
| | | | | | | | | | | | | | 4,672,785 | 61,584 | 40,031 | 44,041 | 25,157,864 | 23,187,596 | 83,858,029 | 5,031,524 | 115,937,980 |
| **Total** | | | **9,720** | | | | | | | | | | **4,673,000** | **62,000** | **40,000** | **44,000** | **25,158,000** | **23,188,000** | **83,858,000** | **5,032,000** | **115,938,000** |

Source: JICA Study Team

## Table A1.9 Work Quantities for Side Ditch and Hedge Row (1/2)

## <entire basin>

| Land classification | | | Propo-sed Area | Side ditch | | | Number of hedge row seedlings | Area of hedge row | Side ditch | | | Number of hedge row seedlings | Area of hedge row |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Ls** | **s** | | Exca-vation **V21** | Volume of masory work **V23** | Volume of stone material **V24** | **Nshr** | **Ahr** | Exca-vation **V21** | Volume of masory work **V23** | Volume of stone material **V24** | **Nshr** | **Ahr** |
| | | | (ha) | (m3/ha) | (m3/ha) | (m3/ha) | (nr./ha) | (m2/ha) | (m3) | (m3) | (m3) | (nr.) | (m2) |
| 3. Housing yard | | | | | | | | | | | | | |
| 1) Housing yard | | | | | | | | | | | | | |
| (1) | 0-8% | 4% | 1 | - | - | - | - | - | - | - | - | - | - |
| (2) | 8-15% | 12% | 828 | 21.00 | 13.00 | 14.30 | 3,200 | 400 | 17,388 | 10,764 | 11,840 | 2,649,600 | 331,200 |
| (3) | 15-25% | 20% | 692 | 21.00 | 13.00 | 14.30 | 3,200 | 400 | 14,532 | 8,996 | 9,896 | 2,214,400 | 276,800 |
| (4) | 25-40% | 33% | 519 | 19.50 | 12.50 | 13.75 | 3,200 | 400 | 10,121 | 6,488 | 7,136 | 1,660,800 | 207,600 |
| (5) | over 40% | 50% | 569 | 19.50 | 12.50 | 13.75 | 3,200 | 400 | 11,096 | 7,113 | 7,824 | 1,820,800 | 227,600 |
| | | | | | | | | | 53,137 | 33,361 | 36,696 | 8,345,600 | 1,043,200 |
| **Total** | | | **2,609** | | | | | | **53,000** | **33,000** | **37,000** | **8,346,000** | **1,043,000** |

Source: JICA Study Team

## Table A1.9 Work Quantities for Side Ditch and Hedge Row (2/2)

## <Keduang basin>

| Land classification | | | Propo-sed Area | Side ditch | | | Number of hedge row seedlings | Area of hedge row | Side ditch | | | Number of hedge row seedlings | Area of hedge row |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Ls** | **s** | | Exca-vation **V21** | Volume of masory work **V23** | Volume of stone material **V24** | **Nshr** | **Ahr** | Exca-vation **V21** | Volume of masory work **V23** | Volume of stone material **V24** | **Nshr** | **Ahr** |
| | | | (ha) | (m3/ha) | (m3/ha) | (m3/ha) | (nr./ha) | (m2/ha) | (m3) | (m3) | (m3) | (nr.) | (m2) |
| 3. Housing yard | | | | | | | | | | | | | |
| 1) Housing yard | | | | | | | | | | | | | |
| (1) | 0-8% | 4% | - | - | - | - | - | - | - | - | - | - | - |
| (2) | 8-15% | 12% | 569 | 21.00 | 13.00 | 14.30 | 3,200 | 400 | 11,949 | 7,397 | 8,137 | 1,820,800 | 227,600 |
| (3) | 15-25% | 20% | 372 | 21.00 | 13.00 | 14.30 | 3,200 | 400 | 7,812 | 4,836 | 5,320 | 1,190,400 | 148,800 |
| (4) | 25-40% | 33% | 185 | 19.50 | 12.50 | 13.75 | 3,200 | 400 | 3,608 | 2,313 | 2,544 | 592,000 | 74,000 |
| (5) | over 40% | 50% | 270 | 19.50 | 12.50 | 13.75 | 3,200 | 400 | 5,265 | 3,375 | 3,713 | 864,000 | 108,000 |
| | | | | | | | | | 28,634 | 17,921 | 19,714 | 4,467,200 | 558,400 |
| **Total** | | | **1,396** | | | | | | **29,000** | **18,000** | **20,000** | **4,467,000** | **558,000** |

Source: JICA Study Team

## Table A1.10 Unit Cost for Works

| No. | Work item | Work unit | Production rate *a* | Daily wage *b* | Work rate *c= a x b* | Material unit price *d* | Unit cost *e= c+d* |
|---|---|---|---|---|---|---|---|
| | | | (m.d) | ($) | ($) | ($) | ($) |
| 1. Land preparation | | | | | | | |
| 1) Terracing | | | | | | | |
| (1) | Cutting and filling | m3 | 0.46 | 1.49 | 0.69 | - | **0.69** |
| 2) Waterway and drop | | | | | | | |
| (1) | Stone material | m3 | - | - | - | 8.48 | **8.48** |
| (2) | Excavation | m3 | 0.39 | 1.49 | 0.58 | - | **0.58** |
| (3) | Masonry work | m3 | 7.14 | 1.49 | 10.64 | - | **10.64** |
| 3) Lip and rizer, planting | | | | | | | |
| (1) | Seedling, grass, for lip | nr. | - | - | - | 0.01 | **0.01** |
| (2) | Seedling, shrub, for lip | nr. | - | - | - | 0.07 | **0.07** |
| (3) | Seedling, grass, for riser | nr. | - | - | - | 0.0015 | **0.0015** |
| (4) | Planting work, for lip | m | 0.01 | 1.00 | 0.01 | - | **0.01** |
| (5) | Planting work, for riser | m2 | 0.02 | 1.00 | 0.02 | - | **0.02** |
| 2. Side ditches (housing yard) | | | | | | | |
| 1) Side ditch | | | | | | | |
| (1) | Stone material | m3 | - | - | - | 8.48 | **8.48** |
| (2) | Excavation | m3 | 0.39 | 1.49 | 0.58 | - | **0.58** |
| (3) | Masonry work | m3 | 7.14 | 1.49 | 10.64 | - | **10.64** |
| 2) Hedge row | | | | | | | |
| (1) | Shrub, for hedge row | nr. | - | - | - | 0.07 | **0.07** |
| (2) | Planting work, hedge row | m2 | 0.02 | 1.00 | 0.02 | - | **0.02** |

Source: JICA Study Team

# Table A1.11 Breakdown of Agro-forestry and Annual Crop

| Land classification | | | Nr. of terrace | Width of net field area | Net cropping area | Agro-f. | | Annual c. | | | | [Master plan] | | [Feasibility study] | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Proposed Area | Amount | Proposed Area | Amount |
| | **Ls** | **s** | **Nt** | **Wf** | **Anc** | **Rfr** | ***a*** **Rfd** | **Rcgr** | **Rcnr** | ***b*** **Rcnd** | ***a+b*** **Rafac** | | | | |
| | | | (nr./ha) | (m) | (ha/ha) | (Rp./ha) | ($/ha) | (Rp./ha) | (Rp./ha) | ($/ha) | ($/ha) | (ha) | ($) | (ha) | ($) |
| 1. Upland field | | | | | | | | | | | | | | | |
| 1) Good quality bench terrace | | | | | | | | | | | | | | | |
| (1) | 0-8% | 4% | 6.67 | 14.61 | 0.974 | 230,000 | 23 | 2,850,000 | 2,775,900 | 277 | 300 | - | - | - | - |
| (2) | 8-15% | 12% | 17.14 | 5.42 | 0.929 | 665,000 | 66 | 2,625,000 | 2,438,625 | 243 | 309 | - | - | - | - |
| (3) | 15-25% | 20% | 25.00 | 3.56 | 0.890 | 1,315,000 | 131 | 2,250,000 | 2,002,500 | 200 | 331 | - | - | - | - |
| (4) | 25-40% | 33% | 33.00 | 2.53 | 0.835 | 1,440,000 | 143 | 1,875,000 | 1,565,625 | 156 | 299 | - | - | - | - |
| (5) | over 40% | 50% | 50.00 | 1.50 | 0.750 | 2,245,000 | 224 | 1,500,000 | 1,125,000 | 112 | 336 | - | - | - | - |
| 2) Medium quality bench terrace | | | | | | | | | | | | | | | |
| (1) | 0-8% | 4% | 6.67 | 14.61 | 0.974 | 230,000 | 23 | 2,850,000 | 2,775,900 | 277 | 300 | - | - | - | - |
| (2) | 8-15% | 12% | 17.14 | 5.42 | 0.929 | 665,000 | 66 | 2,625,000 | 2,438,625 | 243 | 309 | 139 | 42,951 | 6 | 1,854 |
| (3) | 15-25% | 20% | 25.00 | 3.56 | 0.890 | 1,315,000 | 131 | 2,250,000 | 2,002,500 | 200 | 331 | 191 | 63,221 | 8 | 2,648 |
| (4) | 25-40% | 33% | 33.00 | 2.53 | 0.835 | 1,440,000 | 143 | 1,875,000 | 1,565,625 | 156 | 299 | 150 | 44,850 | 7 | 2,093 |
| (5) | over 40% | 50% | 50.00 | 1.50 | 0.750 | 2,245,000 | 224 | 1,500,000 | 1,125,000 | 112 | 336 | 138 | 46,368 | 3 | 1,008 |
| 3) Fair to poor quality bench terrace | | | | | | | | | | | | | | | |
| (1) | 0-8% | 4% | 6.67 | 14.61 | 0.974 | 230,000 | 23 | 2,850,000 | 2,775,900 | 277 | 300 | 1 | 300 | - | - |
| (2) | 8-15% | 12% | 17.14 | 5.42 | 0.929 | 665,000 | 66 | 2,625,000 | 2,438,625 | 243 | 309 | 1,848 | 571,032 | 984 | 304,056 |
| (3) | 15-25% | 20% | 25.00 | 3.56 | 0.890 | 1,315,000 | 131 | 2,250,000 | 2,002,500 | 200 | 331 | 1,862 | 616,322 | 1,027 | 339,937 |
| (4) | 25-40% | 33% | 33.00 | 2.53 | 0.835 | 1,440,000 | 143 | 1,875,000 | 1,565,625 | 156 | 299 | 1,693 | 506,207 | 870 | 260,130 |
| (5) | over 40% | 50% | 50.00 | 1.50 | 0.750 | 2,245,000 | 224 | 1,500,000 | 1,125,000 | 112 | 336 | 2,515 | 845,040 | 1,392 | 467,712 |
| 4) Traditional terrace | | | | | | | | | | | | | | | |
| (1) | 0-8% | 4% | 6.67 | 14.61 | 0.974 | 230,000 | 23 | 2,850,000 | 2,775,900 | 277 | 300 | 9 | 2,700 | 3 | 900 |
| (2) | 8-15% | 12% | 17.14 | 5.42 | 0.929 | 665,000 | 66 | 2,625,000 | 2,438,625 | 243 | 309 | 528 | 163,152 | 40 | 12,360 |
| (3) | 15-25% | 20% | 25.00 | 3.56 | 0.890 | 1,315,000 | 131 | 2,250,000 | 2,002,500 | 200 | 331 | 852 | 282,012 | 33 | 10,923 |
| (4) | 25-40% | 33% | 33.00 | 2.53 | 0.835 | 1,440,000 | 143 | 1,875,000 | 1,565,625 | 156 | 299 | 811 | 242,489 | 26 | 7,774 |
| (5) | over 40% | 50% | 50.00 | 1.50 | 0.750 | 2,245,000 | 224 | 1,500,000 | 1,125,000 | 112 | 336 | 900 | 302,400 | 71 | 23,856 |
| 5) Composite (non-terrace/ only ridge) | | | | | | | | | | | | | | | |
| (1) | 0-8% | 4% | 6.67 | 14.61 | 0.974 | 230,000 | 23 | 2,850,000 | 2,775,900 | 277 | 300 | 312 | 93,600 | 1 | 300 |
| (2) | 8-15% | 12% | 17.14 | 5.42 | 0.929 | 665,000 | 66 | 2,625,000 | 2,438,625 | 243 | 309 | 1,292 | 399,228 | 9 | 2,781 |
| (3) | 15-25% | 20% | 25.00 | 3.56 | 0.890 | 1,315,000 | 131 | 2,250,000 | 2,002,500 | 200 | 331 | 2,174 | 719,594 | 31 | 10,261 |
| (4) | 25-40% | 33% | 33.00 | 2.53 | 0.835 | 1,440,000 | 143 | 1,875,000 | 1,565,625 | 156 | 299 | 2,451 | 732,849 | 44 | 13,156 |
| (5) | over 40% | 50% | 50.00 | 1.50 | 0.750 | 2,245,000 | 224 | 1,500,000 | 1,125,000 | 112 | 336 | 2,956 | 993,216 | 82 | 27,552 |
| 2. Settlement area | | | | | | | | | | | | | | | |
| 1) Composite (non-terrace/ only ridge) | | | | | | | | | | | | | | | |
| (1) | 0-8% | 4% | 6.67 | 14.61 | 0.974 | 230,000 | 23 | 2,850,000 | 2,775,900 | 277 | 300 | 2,695 | 808,500 | 1,520 | 456,000 |
| (2) | 8-15% | 12% | 17.14 | 5.42 | 0.929 | 665,000 | 66 | 2,625,000 | 2,438,625 | 243 | 309 | 3,725 | 1,151,025 | 1,765 | 545,385 |
| (3) | 15-25% | 20% | 25.00 | 3.56 | 0.890 | 1,315,000 | 131 | 2,250,000 | 2,002,500 | 200 | 331 | 2,485 | 822,535 | 1,039 | 343,909 |
| (4) | 25-40% | 33% | 33.00 | 2.53 | 0.835 | 1,440,000 | 143 | 1,875,000 | 1,565,625 | 156 | 299 | 1,196 | 357,604 | 394 | 117,806 |
| (5) | over 40% | 50% | 50.00 | 1.50 | 0.750 | 2,245,000 | 224 | 1,500,000 | 1,125,000 | 112 | 336 | 850 | 285,600 | 365 | 122,640 |
| | | | | | | | | | | | | | 10,092,795 | | 3,075,041 |
| **Total** | | | | | | | | | | | | **31,773** | **10,093,000** | **9,720** | **3,075,000** |

Source: JICA Study Team

Note: - Exchange rate: $ 1.0= Rp. 10,035

## Table A1-12 Breakdown of Support Program

| Description | Rp million |
|---|---|
| *A. support Program for soil and water conservation measures-1* | |
| 1 Farmer groups empowerment package program | |
| 1.1 Farmer group formation program | 5 |
| 1.2 Farmer groups empowment program | |
| 1.2.1 key farmer training program | 15 |
| 1.2.2 conservation demonstration program | 10 |
| 1.3 Mass guidance program | 6 |
| 1.4 Need Inventory meeting | 3 |
| 2 Package program for Operation/implementation of conservationMeasure | |
| 2.1 Terrace formatin guidance program | |
| 2.1.1 technical guidance | 3 |
| 2.1.2 Support package | - |
| 2.2 Agroforestry development program | |
| 2.2.1 technial guidance | 5 |
| 2.2.2 suport package | - |
| 2.3 Fariming support program | |
| 2.3.1 Technical guidance | 3 |
| 2.4 Gield guidance progeam | |
| 2.4.1 inception technical suidance and suport | 3 |
| 2.4.2 follow up technical support | 3 |
| 3 Field staff empowerment program | |
| 3.1 Field staff training | 12 |
| **Sub-total** | **68** |
| *B. support Program for land management and agricltural promotion measures-1* | |
| 2.1 Technical development program | 9 |
| 2.2 Demonstration program | 45 |
| 2.3 Pilot demonstration field of tree crops/tree | 15 |
| 2.4 Farmer and farmer group training program | 21 |
| 2.5 Palawija seed production | 78 |
| 2.6 Livestock promotion program | 755 |
| 2.7 Strengtheningof logistic support for extension activities | 705 |
| **Sub-total** | **1,628** |
| *C. support programs for community development for 180 villages* | |
| 1 village action plan for soil conservation | |
| 1.1 Implemntaiton of village assessment for 180villages | 540 |
| 1.2 Formation of village action plan for 180 villages | 900 |
| 2 Establishment of implementaiton committee for 180 villages | 360 |
| 3 Guidance of village grant fund | |
| 3.1 Formulation of fund use plan | 900 |
| 3.2 Formulation of draft plan | 90 |
| 3.3 operation of the fund | 8,100 |
| **Sub-total** | **10,890** |
| **Total** | **12,586** |
| **($, million)** | **1.254** |

Source: JICA Study Team

## Table A1.13 Estimate of Work Cost

| Item | Unit | Unit cost | [M/P] Entire basin | | [F/S] Keduang basin | |
|---|---|---|---|---|---|---|
| | | | Q'ty | Amount | Q'ty | Amount |
| | | ($) | | ($, thousand) | | ($, thousand) |
| 1. Land preparation | | | | | | |
| 1) Terracing | | | | | | |
| (1) Cutting and filling | m3 | 0.69 | 22,224,000 | 15,335 | 4,673,000 | 3,224 |
| 2) Waterway and drop | | | | | | |
| (1) Stone material | m3 | 8.48 | 164,000 | 1,391 | 44,000 | 373 |
| (2) Excavation | m3 | 0.58 | 191,000 | 111 | 62,000 | 36 |
| (3) Masonry work | m3 | 10.64 | 149,000 | 1,585 | 40,000 | 426 |
| 3) Lip and rizer, planting | | | | | | |
| (1) Seedling, grass, for lip | nr. | 0.01 | 304,731,000 | 3,047 | 83,858,000 | 839 |
| (2) Seedling, shrub, for lip | nr. | 0.07 | 18,284,000 | 1,280 | 5,032,000 | 352 |
| (3) Seedling, grass, for riser | nr. | 0.0015 | 432,330,000 | 648 | 115,938,000 | 174 |
| (4) Planting work, for lip | m | 0.01 | 91,420,000 | 914 | 25,158,000 | 252 |
| (5) Planting work, for riser | m2 | 0.02 | 86,466,000 | 1,729 | 23,188,000 | 464 |
| 2. Side ditches (housing yard) | | | | | | |
| 1) Side ditch | | | | | | |
| (1) Stone material | m3 | 8.48 | 37,000 | 314 | 20,000 | 170 |
| (2) Excavation | m3 | 0.58 | 53,000 | 31 | 29,000 | 17 |
| (3) Masonry work | m3 | 10.64 | 33,000 | 351 | 18,000 | 192 |
| 2) Hedge row | | | | | | |
| (1) Shrub, for hedge row | nr. | 0.07 | 8,346,000 | 584 | 4,467,000 | 313 |
| (2) Planting work, hedge row | m2 | 0.02 | 1,043,000 | 21 | 558,000 | 11 |
| 3. Agro-forestry and annual crop | | | | | | |
| 1) Agro-forestry and annual crop | L.S | | | 10,093 | | 3,075 |
| 4. Support program | | | | | | |
| 1) Support program | L.S | | | 1,254 | | 1,099 |
| **Total of 1. to 4.** | | | | **38,688** | | **11,017** |

Source: JICA Study Team

| | | | |
|---|---|---|---|
| Upland field (ha): | 31,773 | : | 9,720 |
| All area (ha): | 34,382 | : | 11,116 |
| Cost of support program for F/S (Rp., million): | | | 11,026 |

# *Attachment 2*
# *Quotations*

**JICA Study Team**

Quotation from Wijaya

**From:** "Cowox Madiun" <cowox_madiun@yahoo.co.id>
**To:** <wonogiri@indo.net.id>
**Sent:** Friday, January 05, 2007 2:26 PM
**Attach:** Equipment(r)_v01.xls
**Subject:** Data

---

## Form of Quotation for Construction Materials (1)

**Fax. 0271-730-448 (Office hour only, thank you.)**
**e-mail : <wonogiri@indo.net.id>**
Mr. K. Yamada
Construction Planner, Nippon Koei Co., Ltd.
under JICA study team

Work site: Wonogiri dam reservoir, Wonogiri District, Central Java Province

| Code | Materials | Qantities | (*1) Unit | (*2) Unit price | (*3) Amount |
|---|---|---|---|---|---|
| | | | | [] $<br>[] Rp | [] $<br>[] Rp |
| M101020 | Light oil, for diesel engine | 10.000 | lit. | 4.300 | 43.000.000 |
| M241010 | Timber, plank | 2 | cu.m | 3.500.000 | 7.000.000 |
| M241020 | Timber, square | 2 | cu.m | 3.250.000 | 6.500.000 |
| M241030 | Timber, log | 2 | cu.m | 2.500.000 | 5.000.000 |
| M242010 | Plywood, for form work | 50 | Sq.m | 78.125 | 3.906.250 |
| M301010 | Cement, Portland | 1.000 | ton | 600.000 | 600.000.000 |
| M302010 | AE agent | 1.000 | lit. | 9.000 | 9.000.000 |
| M302020 | Water reducing agent | 1.000 | lit. | 11.000 | 11.000.000 |
| M325030 | Precast RC pipe, dia.= 300mm, l= 1.0m | 100 | nr. | 154.100 | 15.410.000 |
| M325040 | Precast RC pipe, dia.= 400mm, l= 1.0m | 100 | nr. | 263.350 | 26.335.000 |
| M326030 | RC U-flume, B300 | 1.000 | lin.m | 423.000 | 423.000.000 |
| M404070 | Rip rap, for rockfill | 1.000 | cu.m | 115.000 | 115.000.000 |
| M404072 | Rip rap, for masonry | 500 | cu.m | 135.000 | 67.500.000 |
| M501020 | Reinforcing bar, deformed | 250 | ton | 7.850.000 | 1.962.500.000 |
| M502000 | Steel sheet pile, | 1.000 | ton | 8.500.000 | 8.500.000.000 |
| M508450 | Gabion, mattress, 2 x 1 x 0.5m | 50 | nr. | 250.000 | 12.500.000 |
| | **Total** | | | | **11.807.651.250** |

Note: (*1): The unit 'nr.' means number.
(*2): Mark the currency of transaction, [v] $ or [v] Rp, to fill the unit price.
Quote the price at the Wonogiri dam reservoir.
**The unit price shall be of before tax.**
(*3): Mark the currency of transaction, [v] $ or [v] Rp, to fill the amount.

Company name: PT. WIJAYA KARYA

Address: Jl. Tengku Umar No. 21 Semarang

Telephone: 024 - 8318135

Facsimile: _____

Signature: _____

Date: _____

## Form of Quotation for Rental Rate of Construction Equipment (1)


**Fax. 0271-730-448 (Office hour only, thank you.)**
**e-mail : <wonogiri@indo.net.id>**
Mr. K. Yamada
Construction Planner, Nippon Koei Co., Ltd.
under JICA study team


Work site: Wonogiri dam reservoir, Wonogiri District, Central Java Province
Work type: Reservoir works (spillway, steel sheet piling, dredging)

to be not checked,
to be nil
(confirmed on Jan. 26'07)

| No. | Equipment | (*1) Specifications | Number of equipment | Rental months | (*2) Total months | Rate per month (*3) | Amount (*4) | (*5) Mobiliz. & demobiliz. cost included | (*5) Mobiliz. & demobiliz. cost separately | (*6) Maintenance and repair cost included | (*6) Maintenance and repair cost separately | (*6) Maintenance and repair cost excluding | (*7) Operator included | (*7) Operator separately | (*7) Operator excluding | (*8) Fuel cost included | (*8) Fuel cost excluding |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | [] $<br>[] Rp | [] $<br>[] Rp | | [v] $<br>[v] Rp | | [] $/month<br>[] Rp/month | | | [] $/month<br>[] Rp/month | | | |
| 1. | Bulldozer, 11t | 78kW (106PS) | 3 | 12 | 36 | 37,000,000 | 1,332,000,000 | [] | 5,000,000 | [v] | | [] | [v] | | [v] | [v] | [] |
| 2. | Bulldozer, 21t | 152kW (207PS) | 3 | 12 | 36 | 47,200,000 | 1,699,200,000 | [] | 7,000,000 | [v] | | [] | [v] | | [v] | [v] | [] |
| 3. | Bulldozer, w/ripper, 21t | 171kW (232PS) | 1 | 12 | 12 | 55,200,000 | 662,400,000 | [] | 7,000,000 | [v] | | [] | [v] | | [v] | [v] | [] |
| 4. | Bulldozer, w/ripper, 32t | 231kW (314PS) | 1 | 12 | 12 | 65,000,000 | 780,000,000 | [] | 8,500,000 | [v] | | [] | [v] | | [v] | [v] | [] |
| 5. | Motor scraper, 16m3 | struck 16m3, twin-engine | 1 | 12 | 12 | 45,000,000 | 540,000,000 | [] | 7,000,000 | [v] | | [] | [v] | | [v] | [v] | [] |
| 6. | Backhoe, 0.35m3 | struck 0.35m3, heaped 0.45m3 | 1 | 12 | 12 | 27,500,000 | 330,000,000 | [] | 5,000,000 | [v] | | [] | [v] | | [v] | [v] | [] |
| 7. | Backhoe, 0.6m3 | struck 0.6m3, heaped 0.8m3 | 6 | 12 | 72 | 37,000,000 | 2,664,000,000 | [] | 5,000,000 | [v] | | [] | [v] | | [v] | [v] | [] |
| 8. | Backhoe, 1.0m3 | struck 1.0m3, heaped 1.4m3 | 3 | 12 | 36 | 47,200,000 | 1,699,200,000 | [] | 7,000,000 | [v] | | [] | [v] | | [v] | [v] | [] |
| 9. | Wheel loader, 2.3m3 | heaped 2.3m3, 103kW (140PS) | 6 | 12 | 72 | 57,000,000 | 4,104,000,000 | [] | 7,000,000 | [v] | | [] | [v] | | [v] | [v] | [] |
| 10. | Dump truck, 10t | 246kW (334PS) | 12 | 12 | 144 | 18,000,000 | 2,592,000,000 | [] | 500,000 | [v] | | [] | [v] | | [v] | [v] | [] |
| 11. | Truck trailer, 32t | truck tractor w/trailer | 1 | 12 | 12 | 50,000,000 | 600,000,000 | [] | 1,500,000 | [v] | | [] | [v] | | [v] | [v] | [] |
| 12. | Truck-bed crane, 2t-4t | truck loading capacity 4t, crane capacity 2t | 1 | 12 | 12 | 15,000,000 | 180,000,000 | [] | 500,000 | [v] | | [] | [v] | | [v] | [v] | [] |
| 13. | Cargo truck, 11t | 257kW (349PS) | 2 | 12 | 24 | 19,000,000 | 456,000,000 | [] | 750,000 | [v] | | [] | [v] | | [v] | [v] | [] |
| 14. | Sprinkler truck, 5.5-6.5kl | water tank truck, 132kW (179PS) | 2 | 12 | 24 | 13,000,000 | 312,000,000 | [] | 500,000 | [v] | | [] | [v] | | [v] | [v] | [] |
| 15. | Fuel tank truck, 1-1.5kl | | 2 | 12 | 24 | 20,000,000 | 480,000,000 | [] | 500,000 | [v] | | [] | [v] | | [v] | [v] | [] |
| 16. | Crawler crane, 35t-40t | mechanical drive winch, lattice boom, 94kW (128PS) | 2 | 12 | 24 | 59,000,000 | 1,416,000,000 | [] | 10,000,000 | [v] | | [] | [v] | | [v] | [v] | [] |
| 17. | Crawler crane, 50t | mechanical drive winch, lattice boom, 102kW (139PS) | 1 | 1 | 1 | 69,000,000 | 69,000,000 | [] | 10,000,000 | [v] | | [] | [v] | | [v] | [v] | [] |
| 18. | Truck crane, hydraulic, 11t | telescopic, 107kW (145PS) | 1 | 6 | 6 | 25,000,000 | 150,000,000 | [] | 2,500,000 | [v] | | [] | [v] | | [v] | [v] | [] |
| 19. | Truck crane, hydraulic, 30t | telescopic, 165kW (224PS) | 1 | 6 | 6 | 66,000,000 | 396,000,000 | [] | 3,500,000 | [v] | | [] | [v] | | [v] | [v] | [] |
| 20. | Truck crane, hydraulic, 50t | telescopic, 250kW (340PS) | 1 | 6 | 6 | 75,000,000 | 450,000,000 | [] | 4,000,000 | [v] | | [] | [v] | | [v] | [v] | [] |
| 21. | Vibratory pile driver, 40kW | | 2 | 12 | 24 | 15,000,000 | 360,000,000 | [] | 250,000 | [v] | | [] | [v] | | [v] | [v] | [] |
| 22. | Heavy breaker, 1300kg | hydrawlic type, excluding base machine | 1 | 3 | 3 | 65,000,000 | 195,000,000 | [] | 250,000 | [v] | | [] | [v] | | [v] | [v] | [] |
| 23. | Motor grader, 3.1m | blade width 3.1m, 85kW (116PS) | 2 | 12 | 24 | 45,000,000 | 1,080,000,000 | [] | 5,000,000 | [v] | | [] | [v] | | [v] | [v] | [] |
| 24. | Vibratory roller, 2.5t | 19kw (26PS) | 3 | 12 | 36 | 13,000,000 | 468,000,000 | [] | 1,500,000 | [v] | | [] | [v] | | [v] | [v] | [] |
| 25. | Vibratory roller, 8-10t | 77kw (105PS) | 6 | 12 | 72 | 51,000,000 | 3,672,000,000 | [] | 4,000,000 | [v] | | [] | [v] | | [v] | [v] | [] |
| 26. | Concrete plant, pan, 0.75m3 x 1 | portable (truck rigged), 45m3/h, 75kW | 1 | 12 | 12 | 130,000,000 | 1,560,000,000 | [] | 96,000,000 | [v] | | [] | [v] | | [v] | [v] | [] |
| 27. | Agitator truck, 1.5m3 | 138kW (188PS) | 6 | 12 | 72 | 20,000,000 | 1,440,000,000 | [] | 1,000,000 | [v] | | [] | [v] | | [v] | [v] | [] |
| 28. | Agitator truck, 4m3 | 213kW (290PS) | 6 | 12 | 72 | 25,000,000 | 1,800,000,000 | [] | 1,000,000 | [v] | | [] | [v] | | [v] | [v] | [] |
| 29. | Concrete pump car, 90m3/hr | boom type, 199kW (271PS) | 1 | 12 | 12 | 45,000,000 | 540,000,000 | [] | 1,500,000 | [v] | | [] | [v] | | [v] | [v] | [] |
| 30. | Bulldozer, super swamp, 4 t | 34 kW (46PS) | 2 | 6 | 12 | 0 | | [] | | [v] | | [] | [v] | | [v] | [v] | [] |
| 31. | Bulldozer, super swamp, 10 t | 52 kW (71PS) | 2 | 6 | 12 | 0 | | [] | | [v] | | [] | [v] | | [v] | [v] | [] |
| 32. | Cutter suction dredger, 600PS | 441 kW (600PS) | 1 | 12 | 12 | 337,120,000 | 4,045,440,000 | [] | 50,000,000 | [v] | | [] | [v] | | [v] | [v] | [] |
| 33. | Anchor barge, 5t D | 66 kW (90PS) | 1 | 12 | 12 | 40,000,000 | 480,000,000 | [] | 20,000,000 | [v] | | [] | [v] | | [v] | [v] | [] |
| 34. | Anchor barge, 10t D | 132 kW (180PS) | 1 | 12 | 12 | 50,000,000 | 600,000,000 | [] | 25,000,000 | [v] | | [] | [v] | | [v] | [v] | [] |
| 35. | Anchor barge, 15t D | 177 kW (240PS) | 1 | 12 | 12 | 60,000,000 | 720,000,000 | [] | 30,000,000 | [v] | | [] | [v] | | [v] | [v] | [] |
| | | Total | | | | | 37,872,240,000 | | 328,250,000 | | | | | | | | |

Note:
(*1): Values in kW and PS indicate approximate output of the equipment.
(*2): Total months are the products of 'number of equipment' and 'rental months'.
(*3): Mark the currency of transaction, [v] $ or [v] Rp, to fill monthly rental rate of equipment. The rate shall be of before tax.
(*4): Mark the currency of transaction, [v] $ or [v] Rp, to fill the product of 'total month' and 'rate per month'.
(*5): When the rate includes mobilization and demobilization cost, mark [v] under the 'included' column.
When you charge said cost separately, mark the currency of transaction, [v] $ or [v] Rp, to fill the cost of mobilization and demobilization per equipment under the 'separately' column.
(*6): When the rate includes maintenance and repair cost, mark [v] under the 'included' column.
When you charge said cost separately, mark the currency of transaction, [v] $ or [v] Rp, to fill the monthly charge for the maintenance and repair per equipment under the 'separately' column.
When said cost is charged depending on the actual expenditure or is borne by the user, mark [v] under the 'excuding' column.
(*7): When the rate includes operator's wage, mark [v] under the 'included' column.
When you charge said wage separately, mark the currency of transaction, [v] $ or [v] Rp, to fill the monthly charge for the operator per equipment under the 'separately' column.
When said wage is charged depending on the actual expenditure or is borne by the user, mark [v] under the 'excuding' column.
(*8): When the rate includes fuel cost, mark [v] under the 'included' column. When said cost is charged depending on the actual expenditure or is borne by the user, mark [v] under the 'excuding' column.

Company name: PT. WIJAYA KARYA
Address: Jl. Tengku Umar No. 21 Semarang
Telephone: 024 - 8318135
Facsimile:
Signature:
Date:

12-A2-3

DEPARTEMEN PERKERJAAN UMUM
DIREKTORAT JENDERAL SUMBER DAYA AIR
INDUK PELAKSANA KEGIATAN PENGEMBANGAN WILAYAH SUNGAI BENGAWAN SOLO
JL. Solo – Kartosuro Km. 7 PO. Box 267 Telp. (0271) 716428 Fax.(0271)-716428
SURAKARTA – 57102

Nomor : PR.06.01- Aa.11.02/200
Lampiran : 3 (tiga) lembar

Surakarta, 8 Desember 2006

Kepada Yth.,
**Kepala Cabang PT. Wijaya Karya**
Wil. Jawa Tengah & D.I. Yogyakarta
di
**Semarang**
(Fax. No. 024-8318135)

Perihal : **Mohon pengisian data Cost Estimate**

Dalam rangka penyelesaian Studi Penanggulangan Sedimentasi Waduk Serbaguna Wonogiri, yang diselenggarakan oleh Direktorat Jenderal Sumber Daya Air, Departemen Pekerjaan Umum bekerjasama dengan JICA (Japan International Corporation Agency), dengan hormat kami sampaikan bahwa untuk keperluan pembuatan perkiraan biaya (Cost Estimate) diperlukan data (form terlampir) yang meliputi ;

1. Form of Quotation for Construction Material (1)
2. Form of Quotation for Construction Equipment (1)
3. Form of Quotation for Rental Rate of Construction Equipment (1)

Pengisian data tersebut agar dapat segera kami terima melalui alamat e-mail kami : wonogiri@indo.net.id atau Fax. No. 0271-730448.

Demikian, atas perhatian dan kerjasamanya, kami ucapkan terima kasih.

a.n. Pemimpin
Kepala Staf Perencanaan,

Ir. Tri Rohadi, Dipl. HE
NIP. 110 025811

Tembusan kepada Yth.,
1. Pemimpin IPK-PWS-BS (sebagai Laporan)
2. JICA Study Team (Surakarta)
3. Arsip.

Quotation from Waskita

**JICA Study Team**

**From:** "karsono neno" <karsono_neno@yahoo.com>
**To:** <wonogiri@indo.net.id>
**Sent:** Friday, January 05, 2007 4:13 PM
**Attach:** Rental Rate.xls
**Subject:** Form Of Quotation-3 for Rental Rate

Jakarta, 05 Januari 2007

Kepada Yth. Bpk. Ekoyanto/Eko
di Tempat

Dengan hormat,

Bersama ini kami sampaikan data Form of Quotation-3 for Rental Rate of Construction Equipment dalam rangka Studi Penanggulangan Waduk Serbaguna Wonogiri sesuai dengan form yang Bapak kirimkan.

Demikian data yang bisa kami berikan untuk dapat dipergunakan sebagaimana mestinya.

Atas perhatian dan kerjasamnya kami ucapkan terimakasih.

Hormat kami,
PT Waskita karya Divisi III
Bagian Anggaran

Karsono

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## Form of Quotation for Construction Material (1)

**Work site : Wonogiri dam reservoir, Wonogiri District, Central Java Province**

| Code | Material | Quantities | Unit | Unit price (Rp.) | Amount (Rp.) |
|---|---|---|---|---|---|
| M101020 | Light oil, for diesel engine | 10.000 | lit. | 36.944,44 | 369.444.444,44 |
| M241010 | Timber, plank | 2 | cu.m | 1.861.111,11 | 3.722.222,22 |
| M241020 | Timber, square | 2 | cu.m | 3.416.666,67 | 6.833.333,33 |
| M241030 | Timber, log | 2 | cu.m | 2.694.444,44 | 5.388.888,89 |
| M242010 | Plywood, for form work | 50 | sqm | 55.456,79 | 2.772.839,51 |
| M301010 | Cement, portland | 1.000 | ton | 972.222,22 | 972.222.222,22 |
| M302010 | AE agent | 1.000 | lit. | 9.444,44 | 9.444.444,44 |
| M302020 | Water reducing agent | 1.000 | lit. | 10.000,00 | 10.000.000,00 |
| M325030 | Precast RC pipe, dia. = 300mm, l= 1.0m | 100 | nr. | 125.045,54 | 12.504.553,73 |
| M325040 | Precast RC pipe, dia. = 300mm, l= 1.0m | 100 | nr. | 156.921,68 | 15.692.167,58 |
| M326030 | RC U-flume, B300 | 1000 | lin.m | 1.500.000,00 | 1.500.000.000,00 |
| M404070 | Rip rap, for rockfill | 1000 | ton | 72.222,22 | 72.222.222,22 |
| M404072 | Rip rap, for masonry | 500 | ton | 83.333,33 | 41.666.666,67 |
| M501020 | Reinforcing bar, deformed | 250 | ton | 6.333.333,33 | 1.583.333.333,33 |
| M502000 | steel sheet pile, | 1000 | ton | 9.271.111,11 | 9.271.111.111,11 |
| M508450 | Gabion, mattress, 2 x 1 x 0.5m | 50 | nr. | 347.777,78 | 17.388.888,89 |
| | **Total** | | | | 13.893.747.338,60 |

Note : (*1) : The unit "nr" means number
(*2) : Mark the currency of transaction, (v) $ or (v) Rp, to fill unit price
Quote the price at the Wonogiri dan Reservoir
Time unit price shall be of before tax.
(*3) : Mark the currency of transaction, (v) $ or (v) Rp, to fill the amount.

Company name **PT.WASKITA KARYA**
Address Telephone JL.M.T.Haryono Kav.10-Cawang Jakarta 13340
Facsimile 021 - 8515510

Signature **Ir. Desi Arryani**
Date December 22, 2006

## Form of Quotation for Rental Rate of Construction Equipment (1)

Fax. 0271-730-448 (Office hour only, thank you.)
e-mail : <wonogiri@indo.net.id>
Mr. K. Yamada
Construction Planner, Nippon Koei Co., Ltd.
under JICA study team

Work site: Wonogiri dam reservoir, Wonogiri District, Central Java Province
Work type: Reservoir works (spillway, steel sheet piling, dredging)

| No. | Equipment | Specifications | (*1) Number of equipment | Rental months | (*2) Total months | (*3) Rate per month | (*4) Amount | (*5) Mobiliz. & demobiliz. cost included | (*5) Mobiliz. & demobiliz. cost separately | (*6) Maintenance and repair cost included | (*6) Maintenance and repair cost separately | (*6) Maintenance and repair cost excluding | (*7) Operator included | (*7) Operator separately | (*7) Operator excluding | (*8) Fuel cost included | (*8) Fuel cost excluding |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | [ ] $<br>[ ] Rp | [ ] $<br>[ ] Rp | | [ ] $<br>[ v ] Rp | | [ ] $/month<br>[ ] Rp/month | | | [ ] $/month<br>[ ] Rp/month | | | |
| 1. | Bulldozer, 11t | 78kW (106PS) | 3 | 12 | 36 | 2.174.400.000 | 78.278.400.000 | [ ] | 36.000.000 | [ v ] | - | [ ] | [ v ] | - | [ ] | [ v ] | [ ] |
| 2. | Bulldozer, 21t | 152kW (207PS) | 3 | 12 | 36 | 67.325.000 | 2.423.700.000 | [ ] | 36.000.000,00 | [ v ] | - | [ ] | [ v ] | - | [ ] | [ v ] | [ ] |
| 3. | Bulldozer, w/ripper, 21t | 171kW (232PS) | 1 | 12 | 12 | 71.500.000 | 858.000.000 | [ ] | 12.000.000,00 | [ v ] | - | [ ] | [ v ] | - | [ ] | [ v ] | [ ] |
| 4. | Bulldozer, w/ripper, 32t | 231kW (314PS) | 1 | 12 | 12 | 74.275.000 | 891.300.000 | [ ] | 12.000.000,00 | [ v ] | - | [ ] | [ v ] | - | [ ] | [ v ] | [ ] |
| 5. | Motor scraper, 16m3 | struck 16m3, twin-engine | 1 | 12 | 12 | 74.275.000 | 891.300.000 | [ ] | 12.000.000,00 | [ v ] | - | [ ] | [ v ] | - | [ ] | [ v ] | [ ] |
| 6. | Backhoe, 0.35m3 | struck 0.35m3, heaped 0.45m3 | 1 | 12 | 12 | 53.450.000 | 641.400.000 | [ ] | 12.000.000,00 | [ v ] | - | [ ] | [ v ] | - | [ ] | [ v ] | [ ] |
| 7. | Backhoe, 0.6m3 | struck 0.6m3, heaped 0.8m3 | 6 | 12 | 72 | 60.400.000 | 4.348.800.000 | [ ] | 72.000.000,00 | [ v ] | - | [ ] | [ v ] | - | [ ] | [ v ] | [ ] |
| 8. | Backhoe, 1.0m3 | struck 1.0m3, heaped 1.4m3 | 3 | 12 | 36 | 67.325.000 | 2.423.700.000 | [ ] | 36.000.000,00 | [ v ] | - | [ ] | [ v ] | - | [ ] | [ v ] | [ ] |
| 9. | Wheel loader, 2.3m3 | heaped 2.3m3, 103kW (140PS) | 6 | 12 | 72 | 74.275.000 | 5.347.800.000 | [ ] | 64.800.000,00 | [ v ] | - | [ ] | [ v ] | - | [ ] | [ v ] | [ ] |
| 10. | Dump truck, 10t | 246kW (334PS) | 12 | 12 | 144 | 41.525.000 | 5.979.600.000 | [ ] | 72.000.000,00 | [ v ] | - | [ ] | [ v ] | - | [ ] | [ v ] | [ ] |
| 11. | Truck trailer, 32t | truck tractor w/trailer | 1 | 12 | 12 | 138.050.000 | 1.656.600.000 | [ ] | 13.200.000,00 | [ v ] | - | [ ] | [ v ] | - | [ ] | [ v ] | [ ] |
| 12. | Truck-bed crane, 2t-4t | truck loading capacity 4t, crane capacity 2t | 1 | 12 | 12 | 46.500.000 | 558.000.000 | [ ] | 13.200.000,00 | [ v ] | - | [ ] | [ v ] | - | [ ] | [ v ] | [ ] |
| 13. | Cargo truck, 11t | 257kW (349PS) | 2 | 12 | 24 | 57.700.000 | 1.384.800.000 | [ ] | 21.600.000,00 | [ v ] | - | [ ] | [ v ] | - | [ ] | [ v ] | [ ] |
| 14. | Sprinkler truck, 5.5-6.5kl | water tank truck, 132kW (179PS) | 2 | 12 | 24 | 37.350.000 | 896.400.000 | [ ] | 16.800.000,00 | [ v ] | - | [ ] | [ v ] | - | [ ] | [ v ] | [ ] |
| 15. | Fuel tank truck, 1-1.5kl | | 2 | 12 | 24 | 40.150.000 | 963.600.000 | [ ] | 14.400.000,00 | [ v ] | - | [ ] | [ v ] | - | [ ] | [ v ] | [ ] |
| 16. | Crawler crane, 35t-40t | mechanical drive winch, lattice boom, 94kW (128PS) | 2 | 12 | 24 | 145.825.000 | 3.499.800.000 | [ ] | 21.600.000,00 | [ v ] | - | [ ] | [ v ] | - | [ ] | [ v ] | [ ] |
| 17. | Crawler crane, 50t | mechanical drive winch, lattice boom, 102kW (139PS) | 1 | 1 | 1 | 197.650.000 | 197.650.000 | [ ] | 20.400.000,00 | [ v ] | - | [ ] | [ v ] | - | [ ] | [ v ] | [ ] |
| 18. | Truck crane, hydraulic, 11t | telescopic, 107kW (145PS) | 1 | 6 | 6 | 42.925.000 | 257.550.000 | [ ] | 20.400.000,00 | [ v ] | - | [ ] | [ v ] | - | [ ] | [ v ] | [ ] |
| 19. | Truck crane, hydraulic, 30t | telescopic, 165kW (224PS) | 1 | 6 | 6 | 47.075.000 | 282.450.000 | [ ] | 20.400.000,00 | [ v ] | - | [ ] | [ v ] | - | [ ] | [ v ] | [ ] |
| 20. | Truck crane, hydraulic, 50t | telescopic, 250kW (340PS) | 1 | 6 | 6 | 60.975.000 | 365.850.000 | [ ] | 48.000.000,00 | [ v ] | - | [ ] | [ v ] | - | [ ] | [ v ] | [ ] |
| 21. | Vibratory pile driver, 40kW | | 2 | 12 | 24 | 105.800.000 | 2.539.200.000 | [ ] | 96.000.000,00 | [ v ] | - | [ ] | [ v ] | - | [ ] | [ v ] | [ ] |
| 22. | Heavy breaker, 1300kg | hydrawlic type, excluding base machine | 1 | 3 | 3 | 146.075.000 | 438.225.000 | [ ] | 48.000.000,00 | [ v ] | - | [ ] | [ v ] | - | [ ] | [ v ] | [ ] |
| 23. | Motor grader, 3.1m | blade width 3.1m, 85kW (116PS) | 2 | 12 | 24 | 67.325.000 | 1.615.800.000 | [ ] | 21.600.000,00 | [ v ] | - | [ ] | [ v ] | - | [ ] | [ v ] | [ ] |
| 24. | Vibratory roller, 2.5t | 19kw (26PS) | 3 | 12 | 36 | 53.450.000 | 1.924.200.000 | [ ] | 46.800.000,00 | [ v ] | - | [ ] | [ v ] | - | [ ] | [ v ] | [ ] |
| 25. | Vibratory roller, 8-10t | 77kw (105PS) | 6 | 12 | 72 | 67.325.000 | 4.847.400.000 | [ ] | 79.200.000,00 | [ v ] | - | [ ] | [ v ] | - | [ ] | [ v ] | [ ] |
| 26. | Concrete plant, pan, 0.75m3 x 1 | portable (truck rigged), 45m3/h, 75kW | 1 | 12 | 12 | 50.425.000 | 605.100.000 | [ ] | 96.000.000,00 | [ v ] | - | [ ] | [ v ] | - | [ ] | [ v ] | [ ] |
| 27. | Agitator truck, 1.5m3 | 138kW (188PS) | 6 | 12 | 72 | 58.200.000 | 4.190.400.000 | [ ] | 50.400.000,00 | [ v ] | - | [ ] | [ v ] | - | [ ] | [ v ] | [ ] |
| 28. | Agitator truck, 4m3 | 213kW (290PS) | 6 | 12 | 72 | 65.150.000 | 4.690.800.000 | [ ] | 64.800.000,00 | [ v ] | - | [ ] | [ v ] | - | [ ] | [ v ] | [ ] |
| 29. | Concrete pump car, 90m3/hr | boom type, 199kW (271PS) | 1 | 12 | 12 | 152.975.000 | 1.835.700.000 | [ ] | 20.400.000,00 | [ v ] | - | [ ] | [ v ] | - | [ ] | [ v ] | [ ] |
| 30. | Bulldozer, super swamp, 4 t | 34 kW (46PS) | 2 | 6 | 12 | 67.325.000 | 807.900.000 | | 31.200.000,00 | [ v ] | - | | [ v ] | - | | [ v ] | |
| 31. | Bulldozer, super swamp, 10 t | 52 kW (71PS) | 2 | 6 | 12 | 67.325.000 | 807.900.000 | | 31.200.000,00 | [ v ] | - | | [ v ] | - | | [ v ] | |
| 32. | Cutter suction dredger, 600PS | 441 kW (600PS) | 1 | 12 | 12 | 1.778.025.000 | 21.336.300.000 | | 480.000.000,00 | [ v ] | - | | [ v ] | - | | [ v ] | |
| 33. | Anchor barge, 5t D | 66 kW (90PS) | 1 | 12 | 12 | 162.500.000 | 1.950.000.000 | | 360.000.000,00 | [ v ] | - | | [ v ] | - | | [ v ] | |
| 34. | Anchor barge, 10t D | 132 kW (180PS) | 1 | 12 | 12 | 169.450.000 | 2.033.400.000 | | 420.000.000,00 | [ v ] | - | | [ v ] | - | | [ v ] | |
| 35. | Anchor barge, 15t D | 177 kW (240PS) | 1 | 12 | 12 | 176.400.000 | 2.116.800.000 | | 480.000.000,00 | [ v ] | - | | [ v ] | - | | [ v ] | |
| | | Total | | | | | 163.885.825.000 | | 2.900.400.000 | | | | | | | | |

Note: (*1): Values in kW and PS indicate approximate output of the equipment.
(*2): Total months are the products of 'number of equipment' and 'rental months'.
(*3): Mark the currency of transaction, [v] $ or [v] Rp, to fill monthly rental rate of equipment. The rate shall be of before tax.
(*4): Mark the currency of transaction, [v] $ or [v] Rp, to fill the product of 'total month' and 'rate per month'.
(*5): When the rate includes mobilization and demobilization cost, mark [v] under the 'included' column.
When you charge said cost separately, mark the currency of transaction, [v] $ or [v] Rp, to fill the cost of mobilization and demobilization per equipment under the 'separately' column.
(*6): When the rate includes maintenance and repair cost, mark [v] under the 'included' column.
When you charge said cost separately, mark the currency of transaction, [v] $ or [v] Rp, to fill the monthly charge for the maintenance and repair per equipment under the 'separately' column.
When said cost is charged depending on the actual expenditure or is borne by the user, mark [v] under the 'excuding' column.

When you charge said wage separately, mark the currency of transaction, [v] $ or [v] Rp, to fill the monthly charge for the operator per equipment under the 'separately' column.
When said wage is charged depending on the actual expenditure or is borne by the user, mark [v] under the 'excuding' column.
(*8): When the rate includes fuel cost, mark [v] under the 'included' column. When said cost is charged depending on the actual expenditure or is borne by the user, mark [v] under the 'excuding' column.

Company name: Persero PT.Waskita Karya
Address: Jl. MT.Haryono Kav. No.10 Cawang, Jakarta Timur
Telephone: 021 - 8515550
Facsimile: 021 - 8515510
Signature: Ir.Desi Arryani
Date: January 05 th , 2007

DEPARTEMEN PERKERJAAN UMUM
DIREKTORAT JENDERAL SUMBER DAYA AIR
INDUK PELAKSANA KEGIATAN PENGEMBANGAN WILAYAH SUNGAI BENGAWAN SOLO
JL. Solo – Kartosuro Km. 7 PO. Box 267 Telp. (0271) 716428 Fax.(0271)-716428
SURAKARTA – 57102

Nomor : PR.06.01- Aa.11.02/ 202
Lampiran : 3 (tiga) lember

Surakarta, 8 Desember 2006

Kepada Yth.,
**Ibu Ir. Desy Aryani**
**Kepala Divisi III PT. Waskita Karya**
Jl. Biru Laut X Kav.10
Cawang
di **J a k a r t a,** 13340
*Tel. 021-851555, Fax. 021-8508506*

Perihal : **Mohon pengisian data Cost Estimate**

Dalam rangka penyelesaian Studi Penanggulangan Sedimentasi Waduk Serbaguna Wonogiri, yang diselenggarakan oleh Direktorat Jenderal Sumber Daya Air, Departemen Pekerjaan Umum bekerjasama dengan JICA (Japan Internacional Corporation Agency), dengan hormat kami sampaikan bahwa untuk keperluan pembuatan perkiraan biaya (Cost Estimate) diperlukan data (form terlampir) yang meliputi ;

1. Form of Quotation for Construction Material (1)
2. Form of Quotation for Construction Equipment (1)
3. Form of Quotation for Rental Rate of Construction Equipment (1)

Pengisian data tersebut agar dapat segera kami terima melalui alamat e-mail kami : wonogiri@indo.net.id atau Fax. No. 0271-730448.

Demikian, atas perhatian dan kerjasamanya, kami ucapkan terima kasih.

a.n. Pemimpin
Kepala Staf Perencanaan,

Ir. Tri Rohadi, Dipl. HE
NIP. 110 025811

Tembusan kepada Yth.,
1. Pemimpin IPK-PWS-BS (sebagai Laporan)
2. JICA Study Team (Surakarta)
3. Arsip.

**JICA Study Team** Quotation from Trakindo

**From:** <staff_tusmg@trakindo.co.id>
**To:** <wonogiri@indo.net.id>
**Cc:** <staff_tusmg@trakindo.co.id>
**Sent:** Friday, January 05, 2007 11:15 AM
**Attach:** Equipment(p)_v01.xls
**Subject:** Quotation For Construction Equipment

To : Mr. K. Yamada,
Mr. Eddy

Dear Mr. K. Yamada
Here we sent the subject above, based on your inquiry for construction equipment
Should you need further information, please don't hesitate to call us.
Thank you

Adi Dwi Darma
PT. Trakindo Utama
Jl. Pamularsih 93, Semarang
Tel : 024-7616123
Mobile : 08122867818

# Form of Quotation for Construction Equipment (1)

**Fax. 0271-730-448 (Office hour only, thank you.)**
**e-mail : <wonogiri@indo.net.id>**
Mr. K. Yamada
Construction Planner, Nippon Koei Co., Ltd.
under JICA study team

Work site: Wonogiri dam reservoir, Wonogiri District, Central Java Province
Work type: Reservoir works (spillway, steel sheet piling, dredging)

| No. | Equiment | Specifications (*1) | Number of equipment | Rate (*2) | Amount (*3) | |
|---|---|---|---|---|---|---|
| | | | | [] $ [] Rp √ | [] $ [] Rp √ | |
| 1. | Bulldozer, 11t | 78kW (106PS) | 3 | 136.500 | 409.500 | D5N 86kW 13,5t |
| 2. | Bulldozer, 21t | 152kW (207PS) | 3 | 193.200 | 579.600 | D7G 149kW 20t |
| 3. | Bulldozer, w/ripper, 21t | 171kW (232PS) | 1 | 217.100 | 217.100 | D7R Series II 179kW 27t |
| 4. | Bulldozer, w/ripper, 32t | 231kW (314PS) | 1 | 412.700 | 412.700 | D8R 231kW 38t |
| 5. | Motor scraper, 16m3 | struck 16m3, twin-engine | 1 | 680000 | 680.000 | 637G 18m3 Twin Engine |
| 6. | Backhoe, 0.35m3 | struck 0.35m3, heaped 0.45m3 | 1 | 90.500 | 90.500 | 311 CU 0.45 m3 |
| 7. | Backhoe, 0.6m3 | struck 0.6m3, heaped 0.8m3 | 6 | 105.000 | 630.000 | 320D 0.8 m3 |
| 8. | Backhoe, 1.0m3 | struck 1.0m3, heaped 1.4m3 | 3 | 105.000 | 315.000 | 320D 1.4 m3 |
| 9. | Wheel loader, 2.3m3 | heaped 2.3m3, 103kW (140PS) | 6 | 126.000 | 756.000 | 924Gz 102kW 2.1m3 |
| 10. | Dump truck, 10t | 246kW (334PS) | 12 | | | - |
| 11. | Truck trailer, 32t | truck tractor w/trailer | 1 | | | - |
| 12. | Truck-bed crane, 2t-4t | truck loacing capacity 4t, crane capacity 2t | 1 | | | - |
| 13. | Cargo truck, 11t | 257kW (349PS) | 2 | | | - |
| 14. | Sprinkler truck, 5.5-6.5kl | water tank truck, 132kW (179PS) | 2 | | | - |
| 15. | Fuel tank truck, 1-1.5kl | | 2 | | | - |
| 16. | Crawler crane, 35t~40t | mechanical drive winch, lattice boom, 94kW (128PS) | 2 | | | - |
| 17. | Crawler crane, 50t | mechanical drive winch, lattice boom, 102kW (139PS) | 1 | | | - |
| 18. | Truck crane, hydraulic, 11t | telescopic, 107kW (145PS) | 1 | | | - |
| 19. | Truck crane, hydraulic, 30t | telescopic, 165kW (224PS) | 1 | | | - |
| 20. | Truck crane, hydraulic, 50t | telescopic, 250kW (340PS) | 1 | | | - |
| 21. | Vibratory pile driver, 40kW | | 2 | | | - |
| 22. | Heavy breaker, 1300kg | hydrawlic type, excluding base machine | 1 | 155.000 | 155.000 | 320D H120C s 1300 kg |
| 23. | Motor grader, 3.1m | blade width 3.1m, 85kW (116PS) | 2 | 135.500 | 271.000 | 120H 104kW |
| 24. | Vibratory roller, 2.5t | 19kw (26PS) | 3 | 45.900 | 137.700 | CB 214B 24kW 2.5t Double |
| 25. | Vibratory roller, 8-10t | 77kw (105PS) | 6 | 79.500 | 477.000 | CS 533E 97kW 10.8t |
| 26. | Concrete plant, pan, 0.75m3 x 1 | portable (truck rigged), 45m3/h, 75kW | 1 | | | - |
| 27. | Agitator truck, 1.5m3 | 138kW (188PS) | 6 | | | - |
| 28. | Agitator truck, 4m3 | 213kW (290PS) | 6 | | | - |
| 29. | Concrete pump car, 90m3/hr | boom type, 199kW (271PS) | 1 | | | - |
| 30. | Bulldozer, super swamp, 4 t | 34 kW (46PS) | 2 | 85.000 | 170.000 | D3G LGP 52kW 7.7t |
| 31. | Bulldozer, super swamp, 10 t | 52 kW (71PS) | 2 | 143.500 | 287.000 | D5G LGP 67kW 9.2t |
| 32. | Cutter suction dredger, 600PS | 441 kW (600PS) | 1 | | | - |
| 33. | Anchor barge, 5t D | 66 kW (90PS) | 1 | | | - |
| 34. | Anchor barge, 10t D | 132 kW (180PS) | 1 | | | - |
| 35. | Anchor barge, 15t D | 177 kW (240PS) | 1 | | | - |
| | | Total | | | 5.588.100 | |

Note: (*1): Values in kW and PS indicate approximate output of the equipment.
(*2): Mark the currency of transaction, [v] $ or [v] Rp, to fill rate (unit price) of equipment at site. The rate shall be of before tax.
(*3): Mark the currency of transaction, [v] $ or [v] Rp, to fill the product of 'number of equipment' and 'rate'.

Company name: PT. TRAKINDO UTAMA

Address: JL. PAMULARSIH NO. 93 SEMARANG

Telephone: 024 - 7616123

Facsimile: 024 - 7616114

Signature: ADI DWI DARMA / Mobile : 08122867818

Date: Januari 2,2007

DEPARTEMEN PERKERJAAN UMUM
DIREKTORAT JENDERAL SUMBER DAYA AIR
INDUK PELAKSANA KEGIATAN PENGEMBANGAN WILAYAH SUNGAI BENGAWAN SOLO
JL. Solo – Kartosuro Km. 7 PO. Box 267 Telp. (0271) 716428 Fax.(0271)-716428
SURAKARTA – 57102

Nomor : PR.06.01-Aa.11.02/ 201 - 2006
Lampiran : 3 (tiga) lembar

Surakarta, 8 Desember 2006

Kepada Yth.,
**PT. Trakindo Utama**
Jl. Pamularsih, Semarang
di
**S e m a r a n g**
*Tel. 024-76112, Fax. 024-7616114*
(Up. Bp. Adi, Marketing)

Perihal : **Mohon pengisian data Cost Estimate**

Dalam rangka penyelesaian Studi Penanggulangan Sedimentasi Waduk Serbaguna Wonogiri, yang diselenggarakan oleh Direktorat Jenderal Sumber Daya Air, Departemen Pekerjaan Umum bekerjasama dengan JICA (Japan Internacional Corporation Agency), dengan hormat kami sampaikan bahwa untuk keperluan pembuatan perkiraan biaya (Cost Estimate) diperlukan data (form terlampir) yang meliputi ;

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2. Form of Quotation for Construction Equipment (1)
3. Form of Quotation for Rental Rate of Construction Equipment (1)

Pengisian data tersebut agar dapat segera kami terima melalui alamat e-mail kami : wonogiri@indo.net.id atau Fax. No. 0271-730448.

Demikian, atas perhatian dan kerjasamanya, kami ucapkan terima kasih.

11-Dec-06

a.n. Pemimpin
Kepala Staf Perencanaan,

Ir. Tri Rohadi, Dipl. HE
NIP. 110 025811

Tembusan kepada Yth.,
1. Pemimpin IPK-PWS-BS (sebagai Laporan)
2. JICA Study Team (surakarta)
3. Arsip

# *Attachment 3*
# *Price List*

642 4/2 - 64 3 216

PERTAMINA

Semarang 30 Januari 2006
Nomor : 098 /E24100/2006-S3

SVC : CAB. YOGYA.

Lamp. :
Perihal : Harga Keekonomian BBM PERTAMINA

0271-651365
Bag Pengadaan

Yang Terhormat
Konsumen Industri & Bunker
PT. PERTAMINA (PERSERO) UPms IV
Di
JAWA TENGAH & DIY

minimal 8000 liter

Surat Keputusan Direktur Pemasaran & Niaga Pertamina Nomor Kpts-044/F00000/2006-S0 tanggal 30 Januari 2006, terhitung mulai tanggal 01 Pebruari 2006 jam : 00.00 WIB, harga jual Keekonomian BBM Sektor Industri & Bunker per liter jenis-jenis tersebut dibawah ini disesuaikan seperti pada Price List Harga Jual keekonomian tersebut di bawah ini :

| Jenis BBM | Price List | |
|---|---|---|
| | Rp./Ltr | US Cnt/Ltr |
| Premium | Rp4.930 | S 50,40 |
| Minyak Tanah | Rp5.740 | S 58,70 |
| Minyak Solar | | |
| Transportasi | Rp5.440 | S 55,60 |
| Industri | Rp5.200 | S 53,20 |
| Minyak Diesel | | |
| Industri | Rp5.020 | 51,30 |
| Minyak Bakar (MFO) | | |
| Industri | Rp3.380 | 34,50 |

Jan. or

obtained by Mr Eko yant

750 -

500 - 750 RMK

4.886,20/kl

(2927,10/kl)

RINE

Harga Jual BBM Industri tersebut termasuk PPN 10% , BBM transportasi termasuk PPN 10% & PBBKB 5% harga tersebut berlaku pada tanggal Sales Order (SO) diterbitkan dan loco Supply Point.

Demikian, atas perhatiannya diucapkan terima kasih

Sulfur content 3.5%

Unit Pemasaran IV
Pjs. Kepala Penjualan

PT PERTAMINA UNIT PEMASARAN IV SEMARANG (PERSERO)

Ruslan W. Marbun

tank lorry

transportation
220 k
300 km

8 kl

Rp. 215/l ← 16 kl tank/Rp. 3,432,000 before tax (PPN10%)

300km

3,380
215
Rp. 3,595/l at Wonogiri
as of Dec. '05

2927 transportation
+) 215
3,142/l → to be applied

Kantor Unit Pemasaran IV
Jalan Pemuda 114
Semarang 50131
T +62 24 354 5341 (4 Lines) F +62 24 354 7502
www.pertamina.com

# DAFTAR HARGA BETON SIAP PAKAI
## PT. JAYA READYMIX
WILAYAH SOLO DAN SEKITARNYA

Berlaku mulai : 01 Januari 2007

Jl. Raya Telukan Km.7 Grogol Sukoharjo
Phone : ( 0271 ) 620839
Fax. ( 0271 ) 620839

| UTU | SLUMP | HARGA / M3 | HRG+PPN 10 % |
|---|---|---|---|
| B0 | 10+2 | Rp. 360,000.00 | Rp. 396,000.00 |
| K100 | 10+2 | Rp. 395,000.00 | Rp. 434,500.00 |
| K125 | 10+2 | Rp. 400,000.00 | Rp. 440,000.00 |
| K150 | 10+2 | Rp. 405,000.00 | Rp. 445,500.00 |
| K175 | 10+2 | Rp. 410,000.00 | Rp. 451,000.00 |
| K200 | 10+2 | Rp. 420,000.00 | Rp. 462,000.00 |
| K225 | 10+2 | Rp. 425,000.00 | Rp. 467,500.00 |
| K250 | 10+2 | Rp. 440,000.00 | Rp. 484,000.00 |
| K275 | 10+2 | Rp. 455,000.00 | Rp. 500,500.00 |
| K300 | 10+2 | Rp. 465,000.00 | Rp. 511,500.00 |
| K325 | 10+2 | Rp. 475,000.00 | Rp. 522,500.00 |
| K350 | 10+2 | Rp. 495,000.00 | Rp. 544,500.00 |
| K375 | 10+2 | Rp. 505,000.00 | Rp. 555,500.00 |
| K400 | 10+2 | Rp. 520,000.00 | Rp. 572,000.00 |
| K425 | 10+2 | Rp. 530,000.00 | Rp. 583,000.00 |
| K450 | 10+2 | Rp. 545,000.00 | Rp. 599,500.00 |
| K475 | 10+2 | Rp. 555,000.00 | Rp. 610,500.00 |
| K500 | 10+2 | Rp. 565,000.00 | Rp. 621,500.00 |

rga tersebut tidak mengikat sewaktu - waktu dapat berubah
nai dengan perubahan harga material, BBM dll.
ya penggunaan Pompa beton : Rp. 1,500,000,- , untuk
asitas cor s/d 80 m3, selebihnya Rp. 20,000,-/M3
ya penggunaan Vibrator : Rp. 200,000,- , /unit.

U2-A3-2


# DAFTAR HARGA BETON SIAP PAKAI
## PT. JAYA READYMIX
WILAYAH SOLO DAN SEKITARNYA

Berlaku mulai : 01 Januari 2007

Jl. Raya Telukan Km.7 Grogol Sukoharjo
Phone : ( 0271 ) 620839
Fax. ( 0271 ) 620839


| MUTU | SLUMP | HARGA / M3 | HRG+PPN 10 % |
|---|---|---|---|
| B0 | 10+2 | Rp. 360,000.00 | Rp. 396,000.00 |
| K100 | 10+2 | Rp. 395,000.00 | Rp. 434,500.00 |
| K125 | 10+2 | Rp. 400,000.00 | Rp. 440,000.00 |
| K150 | 10+2 | Rp. 405,000.00 | Rp. 445,500.00 |
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| K225 | 10+2 | Rp. 425,000.00 | Rp. 467,500.00 |
| K250 | 10+2 | Rp. 440,000.00 | Rp. 484,000.00 |
| K275 | 10+2 | Rp. 455,000.00 | Rp. 500,500.00 |
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| K325 | 10+2 | Rp. 475,000.00 | Rp. 522,500.00 |
| K350 | 10+2 | Rp. 495,000.00 | Rp. 544,500.00 |
| K375 | 10+2 | Rp. 505,000.00 | Rp. 555,500.00 |
| K400 | 10+2 | Rp. 520,000.00 | Rp. 572,000.00 |
| K425 | 10+2 | Rp. 530,000.00 | Rp. 583,000.00 |
| K450 | 10+2 | Rp. 545,000.00 | Rp. 599,500.00 |
| K475 | 10+2 | Rp. 555,000.00 | Rp. 610,500.00 |
| K500 | 10+2 | Rp. 565,000.00 | Rp. 621,500.00 |

Harga tersebut tidak mengikat sewaktu - waktu dapat berubah
sesuai dengan perubahan harga material, BBM dll.
Biaya penggunaan Pompa beton : Rp. 1,500,000,- , untuk
kapasitas cor s/d 80 m3, selebihnya Rp. 20,000,-/M3
Biaya penggunaan Vibrator : Rp. 200,000,- , /unit.


# DAFTAR HARGA BETON SIAP PAKAI
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Phone : ( 0271 ) 620839
Fax. ( 0271 ) 620839


| MUTU | SLUMP | HARGA / M3 | HRG+PPN 10 % |
|---|---|---|---|
| B0 | 10+2 | Rp. 360,000.00 | Rp. 396,000.00 |
| K100 | 10+2 | Rp. 395,000.00 | Rp. 434,500.00 |
| K125 | 10+2 | Rp. 400,000.00 | Rp. 440,000.00 |
| K150 | 10+2 | Rp. 405,000.00 | Rp. 445,500.00 |
| K175 | 10+2 | Rp. 410,000.00 | Rp. 451,000.00 |
| K200 | 10+2 | Rp. 420,000.00 | Rp. 462,000.00 |
| K225 | 10+2 | Rp. 425,000.00 | Rp. 467,500.00 |
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| K325 | 10+2 | Rp. 475,000.00 | Rp. 522,500.00 |
| K350 | 10+2 | Rp. 495,000.00 | Rp. 544,500.00 |
| K375 | 10+2 | Rp. 505,000.00 | Rp. 555,500.00 |
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| K475 | 10+2 | Rp. 555,000.00 | Rp. 610,500.00 |
| K500 | 10+2 | Rp. 565,000.00 | Rp. 621,500.00 |

Harga tersebut tidak mengikat sewaktu - waktu dapat berubah
sesuai dengan perubahan harga material, BBM dll.
Biaya penggunaan Pompa beton : Rp. 1,500,000,- , untuk
kapasitas cor s/d 80 m3, selebihnya Rp. 20,000,-/M3
Biaya penggunaan Vibrator : Rp. 200,000,- , /unit.

Price list ready mixed concrete (1/2) Jan. 2007

Price of ready-mixed concrete (2/2) Jan. 30/07



# PT BENGAWAN READYMIX

Jl. Raya Solo - Boyolali Km.18 Teras , Boyolali
Telp & Fax ( 0276 ) 322494

Daftar Harga Adukan Beton Siap Pakai ( Readymix ) adalah sebagai berikut :

| NO | KARAKTERISTIK | SLUMP | HARGA |
|---|---|---|---|
| 01 | B0 | | Rp. 320.000,- |
| 02 | K 100 | 10 + 2 | Rp. 335.000,- |
| 03 | K 125 | 10 + 2 | Rp. 350.000,- |
| 04 | K 150 | 10 + 2 | Rp. 365.000,- |
| 05 | K 175 | 10 + 2 | Rp. 380.000,- |
| 06 | K 200 | 10 + 2 | Rp. 395.000,- |
| 07 | K 225 | 10 + 2 | Rp. 410.000,- |
| 08 | K 250 | 10 + 2 | Rp. 430.000,- |
| 09 | K 275 | 10 + 2 | Rp. 450.000,- |
| 10 | K 300 | 10 + 2 | Rp. 470.000,- |
| 11 | K 325 | 10 + 2 | Rp. 490.000,- |
| 12 | K 350 | 10 + 2 | Rp. 510.000,- |
| 13 | K 375 | 10 + 2 | Rp. 530.000,- |
| 14 | K 400 | 10 + 2 | Rp. 550.000,- |

Harga tersebut di atas sudah termasuk PPN 10 %

Biaya pemakaian pompa ( CP ) Rp.1.400.000,- untuk volume maximal 80 M³ over volume Rp. 15.000,- per M³ dengan jarak pipa maximal 40 M , untuk sekali pemakaian.

Untuk pengiriman diluar radius 25 Km dari Base Camp dikenakan biaya luar kota disesuaikan dengan jaraknya.

Harga tersebut diatas dapat berubah sewaktu - waktu apabila terjadi perubahan harga bahan baku , BBM dan monetary policy.

Boyolali, 30 - 01 - 2007

BRM PT. BENGAWAN READYMIX
JL. RAYA SOLO - BOYOLALI KM. 18 ☎ (0276) 322494
TERAS - BOYOLALI

Eddy Susilo

Direktur