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(SECOND STAGE)

VOL. 3

ANNEXES

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VOL. 3

G IRRIGATION

H M&I WATER SUPPLY

I ALTERNATIVE SOURCES FOR M&I WATER SUPPLY

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GLOSSARY

Local Terms of Administrative Areas

Do	-	Province
Gun	-	Subdivision of province, similar to a county
Myeon	-	Subdivision of a Gun
Ri	-	Village of community of more than one village
Eub	-	Town of the administrative level of a Myeon
Si	-	City of the administrative level of a Gun
Si	-	Special City of the administrative level of a Do
Gu	-	Subdivision of special city equivalent to Gun
Dong	-	Subdivision of Gu or Si equivalent to Myeon or Eub
Sa	-	Temple

Natural Features

San	-	Mountain
Cheon	-	Small river
Gang	-	Larger river
Do	-	Island
Bug	-	North
Dong	-	East
Nam	-	South
Seo	-	West

Spelling of names of places, rivers, etc.

The forms of English spelling of the regions, rivers, etc. that have been adopted are those promulgated by the National Ministry of Education.

CONVERSION FACTORS AND ABBREVIATIONS

1) Length

mm = millimetere
cm = centimetre
m = metre
km = kilometre

2) Areas

ha = $10^4 m^2$ = hectare
pyeong = 3.31 m^2
danbo = 300 pyeong = 992 m^2
jeongbo = 100 danbo = 0.992 ha

3) Volume

lit = 1,000 cm^3 = litre
Seok = Volume containing
100 kg unhulled rice
144 kg polished rice
105 kg barley
138 kg naked barley
141 kg polished barley
138 kg wheat
114 kg unhulled millet
124 kg polished millet
142 kg rye
135 kg corn
135 kg soybeans

4) Weight

mg = milligramme
g = gramme
kg = kilogramme
ton = 1,000 kg = ton
gwan = 3.75 kg
geun = 0.16 gwan = 600 g

5) Time

s = second
min = minute
h = hour
d = day
yr = year

6) Money

$ = US dollar
₩ = Won
$ = ₩ 485, 1978 price level
mill = $ 10^{-3}

7) Electrical Measures

V = Volt
A = Ampere
H = Hertz (cycle)
kV = Kilovolt
W = Watt
kW = Kilowatt
MW = Megawatt
kWh = Kilowatt hour
MWh = Megawatt hour
GWh = Gigawatt hour
ohm = Resistances
mho = Micromhos = conductance

8) Other Measures

ppm = parts per million
% = per cent
o/oo = per thousand
PS = Horse power (75 mkg/s)
pH = scale for acidity
°C = degree centigrade
10^3 = thousand
10^6 = million
10^9 = billion (milliard)

9) Derived measures are based on the same symbols:

m^3/s = cubic metre per second
ton/ha = ton per hectare
kWh/yr = kilowatt hour per year
kVA = kilovolt ampere

10) Technical Terms

BOD = Biochemical oxygen demand
dia. = Diameter
El. = Elevation above mean sea level
H = Height or water head
HWS = Reservoir high water surface
K = Potassium
LWS = Reservoir low water surface
N = Nitrogen
P = Phosphorus
PVC = Polyvinyl chloride
TSP = Triple superphosphate
TWS = Tailwater surface of turbine

ABBREVIATIONS

ADB	Asian Development Bank	
ADC	Agricultural Development Corporation	
BOK	Bank of Korea	
DMZ	Demilitarized Zone	
EPB	Economic Planning Board	
FAO	Food and Agriculture Organization of the United Nations	
FLIA	Farm Land Improvement Association	
HRBS	USAID/KOWACO Han River Basin Joint Survey Team	
IBRD	International Bank for Reconstruction and Development	
IR	International Rice Research Institute	
ISWACO	Industrial Site and Water Resources Development Corporation	
JICA	Japan International Cooperation Agency	
KECO	Korea Electricity Company	
KOWACO	Korea Water Resources Development Corporation, previous name of ISWACO	
MAF	Ministry of Agriculture and Fisheries	
MOC	Ministry of Construction	
NACF	National Agricultural Cooperatives Federation	
OECF	Overseas Economic Cooperation Fund, Japan	
ORD	Office of Rural Development	
PORD	Provincial Office of Rural Development	
UNDP	United Nations Development Programme	
UNSF	United Nations Special Fund	
US/AID	United States Agency for International Development	
USDA	United States Department of Agriculture	
USCE	United States Corps of Engineers	
KOR 13	UNDP/FAO	Soil Survey Project
KOR 16	UNDP/FAO	Pre-Investment Survey of the Nagdong River Basin Project
KOR 72	UNDP/FAO	Nagdong River Basin Delta Study
KOR 75	UNDP/FAO	Nagdong River Basin Development Project Feasibility Study

A N N E X G

IRRIGATION

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G 1 INTRODUCTION

This ANNEX presents the results of study on the agricultural land development, irrigation water requirement, irrigation water withdrawal and costs of irrigation facilities.

The above-mentioned subjects except the costs of irrigation facilities were all oriented to the water budget analysis in which river flow under the most unfavorable hydrological condition in 1962-1976 would be assumed to be reduced at different degrees by various water uses. The classification of cultivated area by irrigation facilities in the projection of land development was made taking into account the water withdrawal to take place and therefore it was not always the same as in usual classification which had mainly stressed the water management on farm. The irrigation water requirement was estimated to derive the material for the estimate of water withdrawal under the most unfavorable hydrological condition; October, 1967 to September, 1968 which would not necessarily be a standard year for the design of a specific project. Both the irrigation water requirement and return flow which would be available by the downstream users were considered in estimating the irrigation water withdrawal in the basin-wide water budget. The amount of return flow applied by KOR 16 and subsequent studies was accepted in the present study under the circumstances that experiment had not been carried out.

The costs of irrigation facilities was estimated based on the cost of actual projects and previous estimates. The results were incorporated in the estimate of the irrigation benefit in ANNEX F.

G 2 CLASSIFICATION OF FARMLAND BY IRRIGATION FACILITIES

G 2.1 Available Statistics

The Yearbook of Land and Water Development Statistics shows the hectareage of cultivated land, being published every year (Ref. G 1). The paddies belonging to FLIA have been classified by irrigation facilities for each Gun. FLIA farms have been regarded as fully irrigated and classified into reservoir, pump, weir, feed canal, infiltration gallery and tubewell. Non-FLIA paddies have been divided into the fully irrigated paddies and partially irrigated paddies and the same classification as for FLIA paddies has been applied for the fully irrigated non-FLIA paddies since 1971, being added with the replacement required and movable pump since 1975. Upland fields and consolidated paddy fields have been shown by Gun. The classification of paddies in Ref. G 1 has changed as shown in Table G 1.

The Agricultural Census in 1970 provides the hectareage of paddy and upland in each Myeon (Ref. G 2).

G 2.2 Classification of Cultivated Area in the Present Study

Paddy fields were often grouped into the fully irrigated, partially irrigated and rainfed lands from the viewpoints of adequacy of irrigation facilities and productivity in previous reports.

Taking into account the differences in the influence on the river flow, the present study classifies paddy field into three and upland into two as follows:

(1) Paddy depending on reservoir/groundwater: This group coincides with the reservoir, infiltration gallery and tubewell in the classification in Ref. G 1. The reservoir retains and supplements surface water through the year. Limited catchment area and storage capacity of reservoir may constrain the water use on field. The paddy depending on groundwater is grouped together with the paddy depending on reservoir, because of similar behaviour with the latter and small hectareage compared with the other types of paddy.

(2) Paddy depending on river: This group coincides with the pump, feed canal, weir and others in the classification in Ref. G 1. These paddies take water from river in accordance with water requirement but limited water in the river may constrain water withdrawal.

(3) Paddy supplementarily irrigated: This group includes the replacement required, movable pump and partially irrigated in the classification in Ref. G 1. These paddies are subject to water shortage due to inadequacy in either capacity of facilities or run-off on which the paddies depend.

(4) Irrigated upland: According to KOR 16 and KOR 72 studies, irrigated upland is limited to some orchard in the Nagdong river basin, but it will increase in the future. It is herein assumed that the irrigated upland all depends on river.

(5) Rainfed upland: Most upland is presently rainfed depending only on rainfall on its own area. The influence on the river flow is almost the same as on natural grassland.

The land consolidation was provided mainly on paddies depending on reservoirs and rivers, amounting to 19 % of total paddy. The paddies depending on reservoirs and rivers were further classified into consolidated and unconsolidated paddies, because the land consolidation would increase the water consumption.

The river stretch between the proposed damsite and estuary is herein called the main stream; other river stretches flowing into the damsite and the main stream are named the tributaries. The paddy depending on river and irrigated upland are accordingly subdivided into main stream depending and tributary depending. All other classifications depend on tributaries.

G 3 AGRICULTURAL LAND DEVELOPMENT IN THE THREE RIVER BASINS

G 3.1 Historical Land Development in the Whole Country

Fig. G 1 shows the historical record of cultivated area with indications of irrigation and land consolidation conditions. The cultivated area remarkably expanded during the first 5-year economic development period (1962-1966) and it increased from 2.03×10^6 ha in 1961 to the maximum of 2.32×10^6 ha in 1968. The area remained almost constant during the second 5-year plan period (1967-1971). However, a declining trend appeared at the end of the second 5-year plan period, due to the rapid expansion of urban and industrial areas. The area stood at 2.24×10^6 ha level during the third 5-year plan period (1972-1977). The paddy field has remained at 1.22×10^6 to 1.29×10^6 ha level since the beginning of the first 5-year plan period. The land consolidation has been provided since 1964 and it was completed for 250×10^3 ha of paddy by 1976.

Regarding the irrigation development on paddy, the fully irrigated paddy increased at an annual rate of 1.8 % between 1962 and 1968 as shown in Table G 2. It increased from 746×10^6 ha in 1968 to 983×10^3 ha in 1969, because the irrigation development was largely promoted after the serious drought damage which took place over the country in 1967 and 1968. The fully irrigated paddy increased to $1,082 \times 10^3$ ha until 1976, so far statistics indicated.

The irrigation facilities provided after 1967-1968 drought were mostly immediate measures such as movable pumps, tubewells, infiltration galleries, small weirs and other temporary structures. Some of them were deteriorated with the lapse of time. According to "the Drought Conquest Record" (Ref. G 4), "About 84 % of the total paddy fields are classified into the fully irrigated paddy and 208,300 ha corresponding to 16 % of the total paddy are the partially irrigated or rainfed paddies. However, 1,081,700 ha classified into the fully irrigated paddy include 130,026 ha of which facilities are so deteriorated as needing rehabilitation and 78,446 ha are fed by movable pumps. The total 208,472 ha

being equivalent to 16 % of the total paddy are not sufficiently irrigated under the drought year". Similar consequence was presented in "the History of Farm Land Improvement in Korea" as follows (Ref. G 5): "In the present statistics yearbook, the fully irrigated paddy field is 84 % of the total paddy, in addition 100,000 ha of the small scale and the large scale irrigation development projects are under construction. Accordingly almost all of the irrigation development projects seem to reach the full development level. On the other hand, according to the report of Investigation on Irrigation Water Sources Development Potentiality in Korea (Ref. G 6) executed on the basis of aerial photograph, the potential areas have been estimated at 360,000 ha of 3,631 areas in Korea. This means that 1,050,000 ha of the fully irrigated paddy, which is developed up to the present, includes 300,000 ha of non-fully irrigated paddy depending on reservoirs located in small valleys as well as considerable area requiring rehabilitation and auxiliary water sources to be developed in future within the benefited areas of various irrigation system. The construction cost for the above-mentioned 360,000 ha in 3,631 areas is estimated to be W 546 x 10^9 at 1975 price level". Under these circumstances, the replacement required and movable pump totalling about 200 x 10^3 ha have been separated from other classifications in the fully irrigated paddy since 1975 (Ref. G 1). It was assumed in the present study that the replacement required and movable pump was nil in 1970 and gradually increased to the 1975 level.

G 3.2 Planned and On-going Land Development Projects

G 3.2.1 The Han river basin

There are two large-scale agricultural development projects being investigated in the Han river basin (Fig. G 2). The South Han River Agricultural Development Project as outlined in Table G 3 will benefit 18 x 10^3 ha inthe Yeoju-Icheon area by use of water in the south Han river which will be amplified by the Chungju dam. The Gimpo Tideland Reclamation Project is one of the five priority projects which were selected among proposed 59 tideland projects in the west and south coasts based on a feasibility study by MAF/ADC in 1976 (Ref. G 7).

More detailed survey for the project was started in 1977. This project will create 3,600 ha of farm land in the tideland near the estuary of the Han river. The land will be fed with diverted water from the Han river and by a new desalted reservoir. The outline is shown in Table G 4.

G 3.2.2 The Nagdong river basin

There are three large scale agricultural land development projects under construction in the basin as shown in Fig. G 3 and outlined in Table G 5. The Namgan Area Development Project in Haman-Gun, Gyeongsang-nam Do, will benefit 12 x 10^3 ha by use of water in the Nam river and the small reservoirs. The project includes the development of a new water source, improvement of the irrigation and drainage facilities, land consolidation, land reclamation and river improvement. The Nagdong River Basin Development Project (Phase-I) includes the river improvement of 320 km benefitting 19 x 10^3 ha, irrigation and drainage facilities for 11.7 x 10^3 ha, and land consolidation and reclamation of 6.5 x 10^3 ha along the main stream and major tributaries in the upper Nagdong river basin. The Changyeong Project will improve the irrigation and drainage facilities in the ill-drainage area of 2.2 x 10^3 ha in Chanyeong-gun, Gyeongsang-nam Do.

There are six large-scale agricultural development projects planned in the basin as shown in Fig. G 3 and outlined in Table G 6. The Haewon Tideland Reclamation Project near the estuary of the Nagdong river will create 1,700 ha of the farm land and irrigate 800 ha of the existing tideland reclamation and the existing paddy in the hinterland, which will be fed with diverted water from the Nagdong river and by a new desalted reservoir. The Gyeongsang Area Development Project will benefit 7.1 x 10^3 ha in Gyeonsang and Cheongdo Guns by use of water stored in two reservoirs which will be newly constructed in two tributaries of Gumbo and Milyang rivers. The project includes the construction of two reservoirs, rehabilitation of irrigation facilities as well as land consolidation and reclamation. The Seonggo Area Development Project will benefit 4,500 ha in Seongju and Geryeong Guns, which will be fed with water from two reservoir. The Wichon Area Development Project will

benefit 7.9 x 10^3 ha in Euiseong and Gunwi Guns by the construction of reservoirs which will be constructed in tributaries of the Wi river. The project includes the rehabilitation of irrigation facilities, land consolidation and reclamation. The Naeseong Area Development Plan will benefit 3.5 x 10^3 ha including the rehabilitation of irrigation facilities, land consolidation and reclamation, and the construction of a new reservoir as a new water source. The Comprehensive Development Project of Naeseong Watershed in Gyeongsang-bug Do will benefit 23.9 x 10^3 ha including the development of new water sources, the construction of weirs and pump stations, land consolidation and reclamation as well as reforestration, torrent and erosion control.

G 3.2.3 The Seomjin river basin

There is no large-scale agricultural development plan in the basin. However, there are three large-scale tideland reclamation plans in the adjacent area facing to the Boseong, the Suncheon and the Yeosu bays. It is planned to construct the desalted reservoirs to irrigate the tideland reclamation paddy and the existing paddy fields in the hinterland.

G 3.3 Areal Distribution of Cultivated Area in the Basins

For the purpose of the water budget analysis, three basins were divided into small sub-basins with about 1,000 km^2 of the catchment area taking into account the locations of the existing and proposed dams, and the confluence of the major tributaries and main stem. The Han river basin was divided into 26, the Nagdong into 27 and the Seomjin into 7 sub-basins, respectively. The sub-basin divisions are shown in Figs. G 4 and G 5.

Basic data on the areal distribution of the cultivated area were taken from the Agricultural Census (Ref. G 2), in which all the survey results were compiled for each Myeon. In case that the watershed divides Myeon, cultivated area was adjusted in proportion to the areas involved in the Myeon. There is a certain difference in the cultivated areas at Gun level between the Yearbook and the Census. In the present

study, the Census data were adjusted in conformity with the Yearbook data. The paddy and upland area together with the catchment area in each sub-basin were estimated as shown in Table G 7.

G 3.4 Prospective Agricultural Land Development in the Three Basins

A projection was made for the future agricultural land development in each sub-basin up to 2001, in accordance with the classification of cultivated area explained in G 2.2. It was, in principle, based on the historical trend, but the physical limitation studied in ANNEX E, and the on-going and planned development projects were also taken into account. The large-scale agricultural development projects explained in G 3.2 were assumed to be completed by 2001 as shown in Table G 8.

As mentioned in G 2.2, the paddy depending on river and irrigated upland are subdivided into main stream depending paddy and tributary depending paddy. An estimate of existing and possible irrigation areas along the main stream between the proposed damsite and the estuary was provided by ADC. It was based on MAF/ADC study (Ref. G 6) and an assumption that the maximum pump delinery head would be 40 m.

It was assumed in the Interim Report that land consolidation would be provided for the areas of land slope up to 7 % and 80 % of the area would be consolidated by 2001. Regarding this assumption, the Government of Korea commented that 3 % rather than 7 % in maximum land gradient would be favorable. A check calculation after the comment showed that the assumed area for the land consolidation up to 2001 could be interpreted as all the land of the land gradient up to 3 % to 3.5 %. The consolidated paddy has not been classified by the irrigation facilities. It was herein assumed that the consolidated farms would be evenly provided on the paddies depending on reservoir and river.

As for the irrigated upland in the Han and Seomjin river basins it was assumed that the upland in the sub-basin near urban areas would be developed for irrigation by 10 % to 15 % and in other sub-basins the same proportion would be 5 %. For the Nagdong river basin, the projection by KOR 72 was followed.

The results of the projection are summarized in Table G 9 for each agricultural zone and in Tables G 10, G 11 and G 12 for each sub-basin. Figs. G 6 and G 7 illustrate the historical and projected agricultural land development.

G 4 IRRIGATION WATER REQUIREMENT

G 4.1 Basic Data

The irrigation water requirement in the period from October, 1967 to September, 1968 was estimated for the unconsolidated paddy and upland assuring that the irrigation facilities were adequate.

The incorporated meteorological data were daily rainfall and monthly pan evaporation for the above-mentioned period, and long averages of monthly pan evaporation, mean monthly air temperature, monthly mean relative humidity, monthly mean sunshine hours and monthly mean wind velocity. They were all compiled in ANNEX B.

The correlation between the agricultural zone and meteorological station were as shown in Table G 13. As for the Seomjin river basin, only rainfall had been recorded within the basin. Therefore, arithmetic mean of data except rainfall at Gwangju to the west and Jeonju to the north were regarded as representing the basin. The monthly mean meteorological record are reproduced from ANNEX B in Table G 14.

Historical and future cropping calenders estimated in ANNEX F were incorporated herein. They are summarized in Table G 15 and illustrated in Fig. G 8.

G 4.2 Irrigation Water Requirement on Paddy

G 4.2.1 Consumptive use

The consumptive use on paddy was estimated based on the monthly pan evaporation record. The consumptive use coefficient proposed by KOR 16 was devided into ten-day intervals and multiplied to the monthly pan evaporation for the consumptive use. The consumptive use coefficient of KOR 16 was based on various research results by ORD. Fig. G 9 shows the consumptive use coefficient applied in the present study, consumptive use coefficient curve by KOR 16 and consumptive use coefficient plotting by weight of dry matters which was studied by Kim, Choul Kee (Ref. G 10).

The estimated consumptive use for each decade is shown with a symbol CUF in Tables G 17 and G 18.

G 4.2.2 Puddling water requirement

In previous reports, the puddling water requirements adopted were 150 mm in KOR 16 (Ref. G 11), 200 mm in Chungju Multipurpose Dam Project (Ref. G 8) and 150 mm in Ogseo Comprehensive Agricultural Development Project (Ref. G 12). In the present study, the puddling water requirement was assumed to be 150 mm which consisted of 100 mm for soil saturation and 50 mm for the pondage in the paddy field.

G 4.2.3 Effective rainfall

Effective rainfall in each zone was estimated by applying the daily water balance method with the following assumption:

(1) Rainfall less than 5 mm/day is ineffective,
(2) Excess rainfall beyond 60 mm is ineffective, and
(3) Decreasing water depth (consumptive use plus percolation loss) in each month is;

May	8 mm/day	August	11 mm/day
June	9 mm/day	September	9 mm/day
July	9 mm/day	October	9 mm/day

The resulted effective rainfall is summarized for each decade together with the corresponding rainfall in Table G 16.

G 4.2.4 Percolation rate

According to the results of the field measurement by the quick method in the Nagdong river basin (KOR 16), the percolation rates varied widely from 0.1 to 10.0 mm/day. The average percolation rate was 4.1 mm/day and adopted rates were 5.0 mm/day in May and June, and 4.0 mm/day in the remaining cropping season in KOR 16 study. In the Han river basin, the rate adopted for the estimated of the water requirement was 5.4 mm/day in May and June, and 4.4 mm/day in the remaining season (Ref. G 8). In

the present study, the percolation rate was assumed to be the same as in KOR 16 study.

G 4.2.5 Farm irrigation requirement

The farm irrigation requirement was calculated by the following equation:

$$FR = CU + PW + PL - ER \quad \ldots\ldots\ldots\ldots \quad (G\ 1)$$

where, FR: Farm irrigation requirement (mm)
CU: Consumptive use (mm)
PW: Puddling water (mm)
PL: Percolation rate (mm)
ER: Effective rainfall (mm)

The estimated farm irrigation requirement per decade is shown with a symbol FIR in Tables G 17 and G 18.

G 4.2.6 Diversion irrigation requirement

The diversion irrigation requirement was calculated by applying the following irrigation efficiency:

(1)	Conveyance efficiency	90 %
(2)	Application efficiency	72 %
(3)	Overall irrigation efficiency	65 %

The diversion water requirement per decade for each cropping calendar is shown with a symbol DWR in Tables G 17 and G 18.

G 4.3 Irrigation Water Requirement on Upland

G 4.3.1 Consumptive use

The crop consumptive use was estimated as a product of the crop growth stage coefficient (kc) and the reference crop evapotranspiration (Ep) which was calculated by means of a modified Penman formula.

The modified Pauman formula expressed the reference crop evapotranspiration (Ep) as follows:

$$Ep = W.Rn + (1 - W)\cdot f(u)\cdot(ea - ed) \quad \ldots\ldots\ldots \quad (G\ 2)$$

where, Ep: Reference crop evapotranspiration (mm/day)

W: Temperature-related weighting factor

Rn: Net radiation in equivalent evaporation (mm/day)

f(u): Wind related function

ea: Saturation vapour pressure at mean air temperature (mbar)

ed: Mean actual vapour pressure of the air (mbar)

Average monthly values of Ep were calculated by applying long average values of meteorological data to the Equation (G 2). They are listed together with the long average pan evaporation Eo in Table G 19. The ratio C : Ep/Eo for each month, also shown in the table, was calculated to quickly estimate the value of Ep from the value of Eo for an arbitray year. Table G 20 shows the pan evaporation (Eo) and reference crop evapotranspiration (Ep) derived therefrom for each month between October, 1967 and September, 1968.

The crop growth stage coefficient (kc) for orchard in Ref. G 13 was assumed, because actually the upland irrigation was limited only on some orchard in the Nagdong river basin. Later on a calculation showed that this would be a reasonable approximation of the future cropping which was assumed in ANNEX F.

The values of assumed crop growth stage coefficient with a symbol kc, estimated monthly reference crop evapotranspiration with a symbol ETP and decade consumptive use with a symbol CUD calculated therefrom are shown in Table G 22.

G 4.3.2 Effective rainfall

Effective rainfall on the irrigated upland was estimated by applying the daily soil moisture balance method (Ref. G 15) similar to the method adopted in the case of the estimate of effective rainfall on paddy with the following assumption:

(1) Rainfall less than 5 mm per day is ineffective,

(2) Ready available soil moisture is 40 mm in depth, and

(3) Daily consumptive use is equal to the reference crop evapotranspiration per day (refer to Table G 20).

The estimated decade effective rainfall together with rainfall is summarized with a symbol ER in Table G 21.

G 4.3.3 Diversion irrigation requirement

The farm irrigation requirement was calculated by subtracting the effective rainfall from the consumptive use and shown with a symbol FIR in Table G 22.

Overall irrigation efficiency for upland irrigation consists of the conveyance and application efficiencies. In the present study, irrigation efficiency was assumed at 55 %, composite with the conveyance efficiency of 90 % and application efficiency of 61 %.

The estimated diversion irrigation requirement is shown with a symbol DWR for each decade in Table G 22.

G 5 NET AGRICULTURAL WATER WITHDRAWAL

G 5.1 Conception of Water Withdrawal

Rainfall on a ground surface becomes the surface run-off, evapotranspiration and percolation loss. The percolation loss becomes the surface run-off in a long run. Part of percolated water will turn to the surface run-off shortly after the rainfall. This part was regarded as practically available in the river as if the run-off immediately entering the river and named the return flow. The water withdrawal defined by KOR 16 was the loss in water in the process that rainfall became the surface flow: it consisted of the evapotranspiration and percolation loss less the return flow.

The water withdrawal may vary by water management condition. The evapotranspiration and percolation loss will be small if inadequately irrigated, while they will maintain the optimum values if adequately irrigated. The net water withdrawal was introduced as the increased water withdrawal under an irrigation condition compared with that under original land condition for which a natural grassland was assumed in the present study.

The procedure and assumptions employed for the estimate of the net water withdrawal by each type of cultivated land are described hereinafter.

G 5.2 Water Withdrawal by Natural Grassland

The net water withdrawal by a type of cultivated area was obtained by deducting the water withdrawal by natural grassland from that by the specified type of cultivated area. In calculating the water withdrawal by natural grassland, the evapotranspiration and percolation loss were estimated by 5-day moisture balance method with the following assumptions.

(1) The evapotranspiration was 0.8 times the reference crop evapotranspiration if water was sufficient, but it linearly changed between one tenth and full value when soil moisture varied from the wilting point to the field capacity.

(2) Field capacity (FC): 300 mm
Wilting point (WP) : 100 mm
(3) Percolation rate : 4 mm/day

The return flow of 50 % of the estimated percolation loss was assumed in calculating the water withdrawal.

G 5.3 Net Agricultural Water Withdrawal Per Unit Area

G 5.3.1 Paddy depending on river

Diversion irrigation requirement is expressed as follows:

$$DW = CU + PW + PL + CL + AL - ER \quad \ldots\ldots\ldots \quad (G\ 3)$$

where, DW: Diversion water requirement (mm)
CU: Consumptive use (mm)
PW: Puddling water (mm)
PL: Percolation rate (mm)
CL: Conveyance loss (mm)
AL: Application loss (mm)
ER: Effective rainfall (mm)

In the present study it was assumed that 50 % of the percolation loss and 70 % of the conveyance and application losses return to the river with little time lag. Accordingly the water withdrawal of farm (WW) is as follows:

$$WW = DW + ER - RF$$
$$= CU + PW + 0.5PL + 0.3\ (CL + AL) \quad \ldots\ldots \quad (G\ 4)$$

where, RF: Return flow

The estimated water withdrawal with a symbol WWF and net water withdrawal with a symbol NWW are shown in Tables G 17 and G18.

G 5.3.2 Paddy depending on reservoir

For the estimate of reservoir-withdrawal and the net withdrawal on the reservoir-depending paddy, the reservoir operation was made individually

for the five agricultural zones, assuming a typical reservoir in each zone.

A typical reservoir was set up referring to the Yearbook and the Drought Conquest Record (Refs. G 1 and G 2). Table G 23 shows the main features of reservoir in each agricultural zone.

Reservoir operation was made with the following assumptions:

(1) Evaporation from reservoir surface was assumed at 60 % of the pan evaporation,

(2) Rainfall of half decade was considered to occur at the beginning of each half decade,

(3) Run-off coefficient for half decade rainfall was assumed to be the same in KOR 72 study as follows:

Rainfall in half decade (mm)	Run-off coefficient
0 - 10	0
10 - 20	0.1
20 - 40	0.2
40 - 60	0.3
60 - 100	0.4
100	0.5

(4) The outflow from the reservoir varied in accordance with the diversion irrigation requirement.

(5) Initial water levels in the reservoir on January 1st, 1967 were used as shown in Table G 24.

Based on the above-mentioned assumptions, the reservoir operation was made for two consecutive years and the results in each agricultural zone are shown in Fig. G 11.

The increase of reservoir storage and evaporation from the reservoir are the positive withdrawal, while water supply for the irrigated paddy and overflow are negative. Consequently reservoir-withdrawal is obtained by subtracting the outflow from the inflow:

$$WWR = IF - OF \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (G\ 5)$$

where, WWR: Reservoir water withdrawal
IF: Inflow to reservoir
OF: Outflow from reservoir

Since the water withdrawal on farm can be calculated by the Equation (G 4), the withdrawal of the reservoir-irrigated paddy as a whole is WW + WWR.

For the period when the reservoir becomes empty, the water withdrawal can be obtained by the same procedures as applied to the paddy supplementarily irrigated (refer to G.5.3.3).

G 5.3.3 Paddy supplementarily irrigated

The water withdrawal on the paddy supplementarily irrigated was estimated by a soil moisture balance method with the following assumptions.

(1) The paddy supplementarily irrigated receives the run-off water from the catchment area which is three times the own paddy area.

(2) Run-off coefficient is the same as in the reservoir operation (refer to G 5.3.2).

(3) Field capacity (FC): 150 mm
Wilting point (WP) : 50 mm
Maximum pondage water depth: 100 mm

(4) Percolation rate: 5 mm/day in case the soil moisture more than field capacity

(5) Evaporation from soil surface before transplanting was 0.7 times the pan evaporation when soil moisture was more than field capacity, but it linearly changed between one tenth and full value when soil moisture varied from wilting point to the field capacity.

(6) The consumptive use was the same as on the irrigated paddy when the soil moisture was more than field capacity, but it linearly changed between one tenth and full values when the soil moisture varied from the wilting point to the field capacity.

The results of calculation are shown in Fig. 10.

The return flow of 50 % of the estimated percolation loss was assumed in calculating the water withdrawal.

G 5.3.4 Consolidated paddy

In calculating the water withdrawal on the consolidated paddy, the percolation rate was assumed to be 10 % higher than that of the unconsolidated paddy. Overall irrigation efficiency was assumed at 60 %. With these assumptions, the following increase percentage was estimated in calculating the water withdrawal caused by land consolidation.

(1)	Increase of diversion water requirement	15 - 20 %
(2)	Increase of water withdrawal of farm	5 - 6 %
(3)	Increase of net agricultural water withdrawal	8.5 - 10 %
(4)	Adopted increase percentage of net agricultural water withdrawal	9 %

On the basis of the above results, the net water withdrawal on the consolidated paddy was calculated for the reservoir-depending and river-depending paddy.

G 5.3.5 Irrigated upland

For the estimate of the water withdrawal on the irrigated upland, it was assumed that the irrigated orchard represented the upland irrigated in the basin and the diversion water requirement was calculated for each basin (refer to G 4.3). In the present, the return flow to be expected was assumed to be 50 % of the application loss including percolation loss and 70 % of conveyance loss.

The agricultural water withdrawal becomes:

$$WW = CU + PI + 0.5AL + 0.3CL \quad \ldots\ldots \quad (G\ 7)$$

where, WW: Water withdrawal on farm (mm)
CU: Consumptive use (mm)
PI: Pre-irrigation (mm)
AL: Application loss (mm)
CL: Conveyance loss (mm)

G 5.4 Net Water Withdrawal in the Basins

The net water withdrawals for each irrigation system in the basins were estimated on the basis of unit agricultural water withdrawal summarized in Tables G 25 and G 26. The results are summarized in Table G 27 and the net water withdrawals in each sub-basin are tabulated in Tables G 28, G 29 and G 30.

The net water withdrawal by the historical cropping pattern under the most unfavorable hydrological condition from October, 1967 to September, 1968 was estimated at 860 x 10^6 m^3 in the Han, 1,812 x 10^6 m^3 in the Nagdong, and 393 x 10^6 m^3 in the Seomjin river basin. Those values will be used for the estimate of the natural flow in the basin (refer to ANNEX K).

The net water withdrawal during the period of 1976-2001 is projected to increase from 938 x 10^6 m^3 to 1,294 x 10^6 m^3 in the Han, from 2,117 x 10^6 m^3 to 2,665 x 10^6 m^3 in the Nagdong and from 459 x 10^6 m^3 to 571 x 10^6 m^3 in the Seomjin river basin. The increase ratio during the above period is 38 % in the Han, 26 % in the Nagdong and 24 % in the Seomjin river basin, respectively.

G 6 UNIT CONSTRUCTION COST AND O & M COST

G 6.1 Unit Construction Cost

No specific area is delineated in this study for the agricultural land development. The construction cost will vary widely depending on the topographic condition from place to place and on irrigation system. In the present study, unit construction cost for the agricultural development was prepared on the basis of the "Performance of Agricultural Water Development Projects" (Ref. G 14), the cost estimate of "Namgang Area Development Project", "Performance of the Detailed Design and Cost Estimate by Union of FLIA" and "Chungju Multipurpose Dam Project". Therefore, all the cost was updated to 1978 price level by adopting the proportion of composition of cost items (KOR 75) and price index taken from "Monthly Statistics in Korea" published by EPB November, 1978 as shown in Tables G 31 and G 32.

The unit construction cost of reservoir and pump irrigation was estimated on the basis of the construction cost of the facilities completed by ADC in 1977 as shown in Table G 33 (Ref. G 14). The condition of location specially for pump irrigation is becoming unfavorable and the pump delivery head is becoming higher year by year. Taking account the above situation, 20 % of allowance for future pump irrigation were added to the unit construction cost of 1978 price level as shown in Table G 34.

The cost estimate for the tideland reclamation was prepared for Gimpo on the basis of the unit cost adopted in Chunju Multipurpose Dam Project, which were derived from the 44,000 ha of Ogseo Comprehensive Agricultural Development Project in the lower Geum river basin (refer to Table G 35). The above unit construction cost was also adopted in Haeweon tideland reclamation.

The construction cost for land consolidation was provided by the Union of FLIA, which was estimated on the basis of detailed design and 1978 unit price (refer to Table G 36).

The land reclamation is a work to change the barren, forest and upland to paddy land, which is the same as the land consolidation works regarding the contents of works and is regarded to add land clearing to the land consolidation. Thus the construction cost was estimated on the basis of the proportion of land consolidation to land reclamation taken from KOR 75 and the Namgang Area Development Project. The cost of the land clearing is 5 % to 7 % of the total cost of land consolidation, therefore in the present study 7 % was adopted for the estimate.

The construction cost of upland irrigation was prepared on the basis of the project cost of the Namgang Area Development Project revised by ADC in 1976 (Ref. Table G 37).

The irrigation development is unfavorably located year by year. Twenty percent of physical contingencies have been included for unforeseen construction problems, changes in costs and other unforeseen events. Table G 38 shows the unit construction cost for each agricultural land development, which was adopted in the present study.

G 6.2 O & M Cost

According to Ref. G 1, the water charge collected by FLIA was ₩ 36.2 x 10^3/ha for the reservoir irrigated paddy and ₩ 49.7 x 10^3/ha for the pump irrigated paddy in 1975. Based on these data, O & M cost of the irrigation facilities at 1978 price level was estimated as follows:

Reservoir	₩ 62 x 10^3/ha
Pump	₩ 87 x 10^3/ha
Tideland reclamation	₩ 144 x 10^3/ha
Land consolidation	₩ 18 x 10^3/ha
Land reclamation	₩ 20 x 10^3/ha
Upland irrigation	₩ 87 x 10^3/ha

REFERENCES

G 1 YEARBOOK OF LAND AND WATER DEVELOPMENT STATISTICS 1956-1977, MAF/ADC

G 2 AGRICULTURAL CENSUS 1970, MAF, 1974

G 3 YEARBOOK OF AGRICULTURE AND FORESTRY STATISTICS 1956-1977, MAF

G 4 DROUGHT CONQUEST RECORD, MAF/ADC, 1977

G 5 HISTORY OF FARM LAND IMPROVEMENT IN KOREA (Draft), MAF/ADC, 1977

G 6 INVESTIGATION ON IRRIGATION WATER SOURCES DEVELOPMENT POTENTIALITY IN KOREA (Draft), MAF/ADC, 1976

G 7 FEASIBILITY STUDY ON TIDELAND RECLAMATION DEVELOPMENT PROJECTS IN WEST-SOUTH COAST, MAF/ADC, 1976

G 8 FEASIBILITY STUDY ON CHUNGJU MULTIPURPOSE DAM PROJECT, IBRD/ISWACO, 1976

G 9 RECONNAISSANCE SURVEY REPORT FOR TIDELAND DEVELOPMENT PLANS OF WEST-SOUTH COAST IN KOREA, JICA, 1977

G 10 "STUDIES ON RELATIONS BETWEEN VARIOUS COEFFICIENTS OF EVAPOTRANSPIRATION AND QUANTITIES OF DRY MATTERS FOR TALL AND SHORT STATURED VARIETIES OF PADDY PRICE" Department of Agricultural Engineering, Chung-buk College, Korea, Choul Kee Kim, MARCH 1974

G 11 LAND AND WATER RESOURCE DEVELOPMENT PLANNING IN THE NAGDONG RIVER BASIN VOL. VIII; IX, KOR 16, 1971

G 12 OGSEO COMPREHENSIVE AGRICULTURAL DEVELOPMENT PROJECT, MAF/ADC, 1975

G 13 "IRRIGATION AND DRAINAGE PAPER" (WATER REQUIREMENT NO. 25) FAO, 1974

G 14 PERFORMANCE OF AGRICULTURAL WATER DEVELOPMENT PROJECTS, ADC, 1978

G 15 "IRRIGATION AND DRAINAGE PAPER" (EFFECTIVE RAINFALL NO. 25) FAO, 1974

Table G 1 CLASSIFICATION OF PADDY IN THE YEARBOOK OF LAND AND WATER DEVELOPMENT STATISTICS

1956 - 1969	1971 - 1974	1975 - 1976
FLIA		
Fully Irrigated	Fully Irrigated	Fully Irrigated
Reservoir	Reservoir	Reservoir
Pump	Pump	Pump
Weir	Weir	Weir
Feed canal	Feed Canal	Feed Canal
	Infiltration Gallary	Infiltration Gallery
	Tubewell	Tubewell
Non-FILIA		
Fully Irrigated	Fully Irrigated	Fully Irrigated
(No further	Reservoir	Reservoir
classification)	Pump	Pump
	Weir	Weir
	Feed Canal	Feed Canal
	Infiltration Gallery	Infiltration Gallery
	Tubewell	Tubewell
	Others	Others
		Replacement required
		Movable Pump
Partially Irrigated	Partially Irrigated	Partially Irrigated
Remarks		
By Gun for FLIA but by whole country for Non-FLIA	By Gun for both FLIA & Non-FLIA	By Gun for both FLIA & Non-FLIA

Table G 2 PADDY FIELD BY TYPE OF IRRIGATION IN KOREA

Unit: 10^3 ha

	Total	Irrigated Paddy FLIA	Irrigated Paddy Non-FLIA	Irrigated Paddy Total	Irrigated Paddy %	Partially Irrigated Paddies	Partially Irrigated Paddies %
1956	1,188	209	329	538	45	650	55
1961	1,211	264	401	665	55	546	45
1966	1,287	291	438	729	57	558	43
1968	1,290	294	452	746	58	544	42
1969	1,283	304	679	983	77	300	23
1970	(1,195)* 1,283	318	702	1,020	80	263	20
1971	1,265	319	703	1,022	81	243	19
1972	1,259	327	701	1,028	82	231	18
1973	1,263	334	708	1,042	83	221	17
1974	1,269	340	710	1,050	83	219	17
1975	1,276	365	(492) 700	(857) 1,065	(67) 83	211	17
1976	1,290	380	(493) 702	(873) 1,082	(68) 84	208	16
Seoul	3	2	-	2	67	1	33
Busan	1	-	(1) 1	(1) 1	100	-	-
Gyeonggi-Do	187	50	(68) 103	(118) 153	(63) 82	34	18
Gangweon-Do	59	10	(28) 44	(38) 54	(64) 92	5	8
Chungcheong Bug-Do	80	18	(30) 43	(48) 61	(60) 76	19	24
Chungcheong Nam-Do	181	57	(63) 90	(120) 147	(66) 81	34	19
Jeonla Bug-Do	172	87	(33) 51	(120) 138	(70) 80	34	20
Jeonla Nam-Do	216	61	(83) 117	(144) 178	(67) 82	38	18
Gyeonsang Bug-Do	212	47	(106) 140	(153) 187	(72) 88	25	12
Gyeongsang Nam-Do	175	48	(81) 110	(129) 158	(74) 90	17	10
Jeju-Do	1	-	(1) 1	(1) 1	(100) 100	-	-

Remarks: ( )*: Agricultural Census MAF 1970
( ) : Excluding "replacement required" and "movable pump"

Source : Year book of Land and Water Development Statistics MAF and ADC, 1977

Table G 3 THE SOUTH HAN RIVER AGRICULTURAL DEVELOPMENT PROJECT

1.	Location	Gyeonggi Do Yeoju Gun Icheong Gun
2.	Development Area	
	- Rehabilitation of irrigation facilities	8,100 ha
	- Land consolidation	5,800 ha
	- Land reclamation to paddy	1,100 ha
	- Land reclamation to upland	1,100 ha
	- Upland irrigation	1,900 ha
	- Total	18,000 ha
2.	Major Facilities	
	- Pumping station	8 Nos.
	- Regulating reservoir	3 Nos.
	- Reservoir	1 No.
	- Irrigation canal	310 km

Table G 4 THE GIMPO TIDELAND RECLAMATION PROJECT

1.	Location	Gyeonggi Do Gimpo Gun
2.	Tideland Reclamation Area	
	- Planned area	4,910 ha
	- Tideland reclamation	3,600 ha
	- Desalted reservoir area	573 ha
	- Others 737	737 ha
3.	Catchment Area	11,000 ha
4.	Storage Capacity of Desalted Reservoir	655 ha-m
5.	Sea Dike	14.2 km
6.	Drainage Sluce	6 Nos.
7.	Main Irrigation Canal	34.7 km

Source : Ref. G 7

Table G 5 LARGE-SCALE AGRICULTURAL LAND DEVELOPMENT PROJECT UNDER CONSTRUCTION IN THE NAGDONG RIVER BASIN

1. Namgang Area Development Project

- Location: Gyeonsang-nam Do
- Development area: 114,000 ha in the Nam river basin
- Project Works

(1)	Agricultural infrastructure	
	- New irrigation facilities	4,307 ha
	- Rehabilitation of irri. facilities	2,541 ha
	- Land consolidation	2,285 ha
	- Drainage facilities	1,234 ha
	- Rehabilitation of drainage facilities	394 ha
	- Land reclamation	1,720 ha
	- Land consolidation (pasture)	2,934 ha
(2)	Soil conservation	
	- Fuelwood plantation	15,053 ha
(3)	Agricultural modernization	
	- Demonstration pilot farm	
(4)	Improvement of rural living environment	

- Cost: (₩59 - ₩31) x 10^9 depending on method of implementation
- Period: 1977 - 1981 (Phase-I)
- IRR: 13.4 % to 16.0 % depending on the cases

2. Nagdong River Basin Development Project

	Whole Project	Phase-I
- Location	Gyeonsang-bug and -nam Dos	
- Development area	Area along the main stem and major tributaries in the Nagdong river basin	
- Project Works (River improvement)		
New levee construction	584 km	319 km
Heightening of levee	167 km	78 km
Bank protection	117 km	55 km
Net benefited area	37,399 ha	19,322 ha

Table G.5 Continued (2)

	Whole Project	Phase-I
(Drainage)		
Pump station	64 Nos.	35 Nos.
Drainage canal	145 km	79 km
Net benefited area	12,045 ha	8,044 ha
(Irrigation)		
Pump station	81 Nos.	44 Nos.
Irrigation canal	240 km	102 km
Net benefited area	8,959 ha	3,697 ha
(Land consolidation)		
Gross area	11,400 ha	5,100 ha
Net benefited area	10,381 ha	4,569 ha
(Land reclamation)		
Gross area	5,000 ha	2,800 ha
Net benefited area	4,541 ha	1,910 ha

- Cost ₩165 x 10^9
  (Foreign exchange component $119 x 10^6)
- IRR 17 %
- Construction Period 1978 - 1982 (Phase-I)

Remarks: The total of the net benefited are may not give the net project area because some areas are overlapping.

3. Chang Yeong Project

- Location Gyeongsang-nam Do
- Development area 2,147 ha
- Project Works Irrigation and drainage improvement 2,147 ha
- Cost ₩91 x 10^9
- Period 1976 - 1979

Table G 6 LARGE-SCALE AGRICULTURAL DEVELOPMENT PROJECT PLANS IN THE NAGDONG RIVER BASIN

1. Haeweon Tideland Reclamation Project

- Location	Gyeongsang-nam Do Changwan Gun
- Development area	2,500 ha
- Rehabilitation of existing tideland reclamation	450 ha
- Rehabilitation of existing paddy in the hinterland	350 ha
- Tideland reclamation	1,700 ha
- Desalted reservoir	1 No.
- Sea dike	12 km
- Levee	6 km
- Major irrigation canal	13 km

2. Gyeongsang Area Develpment Project

- Location	Gyeongsang-but Do Gyeongsong Gun Cheongdo Gun
- Development area	7,130 ha
- Rehabilitation of irrigation facilities	6,303 ha
- Land reclamation	827 ha
- Land consolidation	865 ha
- Reservoir	2 Nos.
- Irrigation canal	166 km

Table G 6 Continued (2)

3. Seonggo Area Development Project

- Location	Gyeconsang-bug Do Seongju Gun Geryeong Gun
- Development area (including rehabilitation of irrigation facilities)	4,500 ha
- Irrigation canal	115 km
- Reservoir	2 Nos.
- Pumping station	4 Nos.

4. Wicheon Area Development Project

- Location	Gyeongsang-bug Do Euiseong Gun Gunwi Gun
- Development area	7,950 ha
- Rehabilitation of irrigation facilities	7,630 ha
- Land reclamation	320 ha
- Land consolidation	1,200 ha
- Reservoir	29 Nos.
- Irrigation canal	292 km
- Pumping station	26 Nos.

5. Naeseong Area Development Project

- Location	Gyeonsang-bug Do Yecheon Gun Mungyeong Gun
- Development area	3,500 ha
- Rehabilitation of irrigation facilities	3,370 ha
- Land reclamation	130 ha
- Land consolidation	200 ha
- Reservoir	1 No.
- Irrigation canal	32 km

Table G 6 Continued (3)

6. Comprehensive Development Project of Naeseong Watershed

- Location Gyeonsang-bug Do

- Development area
69,000 ha in the Naeseong river watershed

- Project Works

Glassland for beef cattle bench terracing	4,497 ha
Upland irrigation	1,841 ha
Canal improvement	40 km
Dams	2,879 ha
Weirs, infiltration galleries and pumping stations	2,061 ha
Waterstorage-fish ponds	3 ha
Land consolidation and reclamation	2,349 ha
Reforestation	8,321 ha
Torrent control	7 km
Erosion control	1,957 ha
Farm road	192 km
Community development	- Seamaeul movement

Table G 7 DIVISION OF THE THREE BASIN

1. Han River Basin

Sub-basin Code No.	Area (km^2)	Cultivated Area in 1976 Paddy (ha)	Upland (ha)
01 (1)	718	20,950 (940)**	8,310
01 (2)	1,618	19,970	15,060
02	1,357	14,810	11,530
03 (1)	511	13,260	8,580
03 (2)	650	14,490	8,940
04 (1)*	276	2,040	2,150
04 (2)*	1,180	8,720	9,140
05	940	11,900	11,660
06 (1)*	679	5,530	8,200
06 (2)*	669	5,530	8,200
07 (1)*	1,193	4,590	11,540
07 (2)*	1,259	4,780	12,010
08	1,769	5,850	17,600
09	719	440	5,380
10 (1)*	1,134	1,060	6,980
10 (2)*	101	100	630
10 (3)*	473	450	2,960
11	638	3,420	3,200
12	780	2,960	4,040
13	1,473	5,950	9,260
14	1,034	3,750	5,710
15 (1)	1,660	2,320	5,270
15 (2)	1,043	900	2,970
16 (1)*	447	970	1,110
16 (2)*	583	1,280	1,460
17	3,040	3,000	3,450
TOTAL	25,944	159,020 (940)**	185,340

Remarks: ( )* : Areas of paddy field and upland were divided in proportion to the sub-basin area.

( )** : Shows the paddy field in the Incheon area outside of the river basin, not to be included in paddy area in the basin.

Table G 7 Continued (2)

2. Nagdong River Basin

	Sub-basin Code No.	Area (km^2)	Cultivated Area in 1976 Paddy (ha)	Upland (ha)
Northern Zone (NSB)	01	1,105	1,500	6,440
	02	483	2,000	4,150
	03	1,226	4,140	11,720
	04	604	2,660	4,650
	05	1,354	12,680	10,490
	06 (1)	530	10,190	4,970
	06 (2)	826	8,830	7,800
	06 (3)	733	10,040	9,000
	06 (4)	1,110	13,340	13,560
Central Zone (CSB)	05	737	12,370	6,070
	06 (1)	1,467	17,080	12,800
	06 (2)	899	12,130	8,020
	07	235	790	1,700
	08	1,309	17,310	12,900
	09	544	7,330	3,220
	10	768	14,330	8,940
	11	781	8,540	4,020
	12	925	10,200	5,540
	13	401	4,480	2,400
	14	808	12,250	7,680
Southern Zone (SSB)	15 (1)	1,266	14,170	6,050
	15 (2)*	755	8,390	4,230
	15 (3)*	264	2,950	1,480
	16	1,181	20,110	12,900
	17	977	23,430	10,400
	18	921	18,750	4,490
	19	1,447	15,420	7,660
	TOTAL	23,656	285,410	193,280

Remarks; ( )*: Areas of paddy field and upland were divided in proportion to the sub-basin area.

Table G 7 Continued (3)

3. Seomjin River Basin

Sub-basin Code No.	Area	Cultivated Area in 1976	
		Paddy	Upland
	(km^2)	(ha)	(ha)
01	1,129.4	12,150	6,130
02 (1)	309.3	3,170	1,840
02 (2)	735.0	8,120	4,480
02 (3)	275.0	5,320	1,680
03	664.0	10,000	3,680
04	1,058.3	18,410	8,680
05	763.0	6,990	6,990
TOTAL	4,934	64,160	33,480

Table G 8 ASSUMED COMPLETION TIME OF PLANNED AND ON-GOING LAND DEVELOPMENT PROJECTS

	Assumed completion time of the project
1. Han River Basin	
- Future development plans	
South Han River Development Project	1986
Gimpo Tideland Reclamation Project	1991
2. Nagdong River Basin	
- On-going projects	
Namgan Area Development Project	1986
Nagdong River Basin Development Project Phase-I	1986
Nagdong River Basin Development Project Phase-II	1991
Changyeong Project	1981
- Future development plans	
Haewon Tideland Reclamation Project	1991
Gyeongsong Area Development Project	2001
Seonggo Area Development Project	2001
Wichon Area Development Project	2001
Naeseong Area Development Project	2001
Comprehensive Development of Naeseong Watershed	1991

Table G 9 SUMMARY OF AGRICULTURAL LAND DEVELOPMENT IN THE THREE BASINS

1. Han River Basin

Unit: ha

	Paddy										Upland		
		Paddy Depending on Reservoir			Paddy Depending on River							Irrigated Upland	
						Tributary		Main[1/]					
	Total Paddy	Sub-total	Consolidated	Unconsolidated	Sub-total	Consolidated	Unconsolidated	Consolidated	Unconsolidated	Paddy Supplementarily Irrigated	Total Upland	Tributary	Main Stem[1/]
1968	159,300	15,610	860	14,750	67,090	2,370	48,630	2,070	14,020	76,600	207,750	-	-
1976	159,020 (940)*	24,190	3,790	20,400	77,970	7,750	52,300	6,630	11,290	56,860	185,340	-	-
1981	159,740 (940)*	26,190	7,850	18,340	81,990	16,660	45,100	10,690	9,540	51,560	183,750	2,320	760
1986	160,600 (940)*	26,890	11,370	15,520	90,470	23,810	36,950	16,990	12,720	43,240	182,850	4,700	1,510
1991	160,990 (4,540)**	29,000	15,450	13,550	94,380	31,710	31,690	20,130	10,850	37,520	182,000	7,020	2,270
1996	161,150 (4,540)**	30,700	19,460	11,240	98,580	39,800	26,330	23,440	9,010	31,870	180,950	9,450	3,020
2001	161,550 (4,540)**	32,550	23,620	8,930	102,550	47,420	21,190	26,960	6,980	26,450	179,750	11,820	3,730

Remarks; 1/ : Paddy and upland irrigated from the main stem downstream of the proposed dam.
( )* : The paddy field in the Incheon area outside the basin.
( )** : The paddy field in the Incheon area (940 ha) and Gimpo tideland reclamation area, outside the basin.

Both paddy fields outside the basin are not included in the above paddy field.

Table G 9 Continued (2)

2. Whole Nagdong River Basin

Unit: ha

	Paddy										Upland		
		Paddy Depending on Reservoir			Paddy Depending on River							Irrigated Upland	
						Tributary		Main[1/]					
	Total Paddy	Sub-total	Consolidated	Unconsolidated	Sub-total	Consolidated	Unconsolidated	Consolidated	Unconsolidated	Paddy Supplementarily Irrigated	Total Upland	Tributary	Main[1/] Stem
1968	285,070	72,850	10,620	62,230	94,760	9,410	64,630	3,910	16,810	117,460	205,800	7,340	1,110
1976	285,410	92,150	35,000	57,150	114,230	25,570	50,820	15,410	22,430	79,030	193,280	15,740	2,150
1981	285,800 (450)*	97,880	44,410	53,470	118,550	33,220	45,570	18,770	20,990	69,370	191,900	19,900	2,960
1986	285,950 (450)*	102,930	53,370	49,560	124,320	41,360	41,510	22,320	19,130	58,700	190,500	26,590	3,940
1991	286,350 (2,500)**	108,600	64,590	44,010	128,800	49,830	35,870	26,180	16,920	48,950	189,150	31,150	4,860
1996	286,600 (2,500)**	113,850	74,990	38,860	133,700	57,860	31,310	29,720	14,810	39,050	187,700	35,670	5,690
2001	286,900 (2,500)**	119,450	86,110	33,340	138,250	65,530	26,890	33,310	12,520	29,200	186,450	40,240	6,560

Remarks; 1/ : Paddy irrigated from the main stem downstream of the proposed dam.
( )* : The paddy area of tideland reclamation under construction.
( )** : The paddy area of tideland reclamation.

Both paddy fields are not included in the above paddy area.

Table G 9 Continued (3)

2.1 Northern Agricultural Zone (NSB)

Unit: ha

	Paddy										Upland		
		Paddy Depending on Reservoir			Paddy Depending on River						Irrigated Upland		
						Tributary		Main[1/]					
	Total Paddy	Sub-total	Consoli-dated	Uncon-solidated	Sub-total	Consoli-dated	Uncon-solidated	Consoli-dated	Uncon-solidated	Paddy Supple-mentarily Irrigated	Total Upland	Tributary	Main[1/] Stem
1968	64,100	10,670	1,200	9,470	22,440	2,100	18,390	250	1,700	30,990	75,100	2,430	270
1976	65,380	15,280	4,510	10,770	26,820	6,090	14,650	1,730	4,350	23,280	72,780	5,310	500
1981	65,600	16,830	6,460	10,370	28,470	8,810	13,200	2,230	4,230	20,300	72,400	6,600	720
1986	65,650	18,180	8,420	9,760	30,520	11,480	12,220	2,850	3,970	16,950	72,000	8,860	950
1991	65,850	19,650	10,540	9,110	32,250	14,080	11,000	3,430	3,740	13,950	71,700	10,160	1,140
1996	66,000	21,000	12,700	8,300	34,150	16,850	9,830	4,000	3,470	10,850	71,250	11,420	1,310
2001	66,200	22,500	14,920	7,580	36,100	19,660	8,720	4,520	3,200	7,600	70,900	12,710	1,490

Remarks; 1/ : Paddy irrigated from the main stem downstream of the proposed dam.

Table G 9 Continued (4)

2.2 Central Agricultural Zone (CSB)

Unit: ha

	Paddy										Upland		
		Paddy Depending on Reservoir			Paddy Depending on River							Irrigated Upland	
						Tributary		Main[1/]					
	Total Paddy	Sub-total	Consoli-dated	Uncon-solidated	Sub-total	Consoli-dated	Uncon-solidated	Consoli-dated	Uncon-solidated	Paddy Supple-mentarily Irrigated	Total Upland	Tributary	Main[1/] Stem
1968	117,980	37,580	5,770	31,810	32,260	3,900	23,990	870	3,500	48,140	80,220	3,570	620
1976	116,810	46,380	18,770	27,610	40,480	9,980	18,030	4,150	8,320	29,950	73,290	7,730	1,250
1981	117,000	48,800	23,270	25,530	41,530	12,500	16,070	5,230	7,730	26,670	72,650	9,820	1,630
1986	117,100	51,050	27,530	23,520	43,200	15,340	14,360	6,530	6,970	22,850	72,000	13,200	2,200
1991	117,300	53,400	32,360	21,040	44,500	17,930	12,670	7,760	6,140	19,400	71,250	15,430	2,720
1996	117,400	55,700	37,060	18,640	45,850	20,560	10,930	9,130	5,230	15,850	70,550	17,700	3,200
2001	117,500	58,050	42,060	15,990	47,350	23,060	9,530	10,380	4,380	12,100	69,950	20,150	3,750

Remarks; 1/ : Paddy irrigated from the main stem downstream of the proposed dam.

Table G 9 Continued (5)

2.3 Southern Agricultural Zone (SSB)

Unit: ha

	Paddy										Upland		
		Paddy Depending on Reservoir			Paddy Depending on River					Paddy Supplementarily Irrigated	Irrigated Upland		
						Tributary		Main 1/					
	Total Paddy	Sub-total	Consolidated	Unconsolidated	Sub-total	Consolidated	Unconsolidated	Consolidated	Unconsolidated		Total Upland	Tributary	Main 1/ Stem
1968	102,990	24,600	3,650	20,950	40,060	3,410	22,250	2,790	11,610	38,330	50,480	1,340	220
1976	103,220	30,490	11,720	18,770	46,930	9,500	18,140	9,530	9,760	25,800	47,210	2,700	400
1981	103,200 (450)*	32,250	14,680	17,570	48,550	11,910	16,300	11,310	9,030	22,400	46,850	3,480	610
1986	103,200 (450)*	33,700	17,420	16,280	50,600	14,540	14,930	12,940	8,190	18,900	46,500	4,530	790
1991	103,200 (2,500)**	35,550	21,690	13,860	52,050	17,820	12,200	14,990	7,040	15,600	46,200	5,560	1,000
1996	103,200 (2,500)**	37,150	25,230	11,920	53,700	20,450	10,550	16,590	6,110	12,350	45,900	6,550	1,180
2001	103,200 (2,500)**	38,900	29,130	9,770	54,800	22,810	8,640	18,410	4,940	9,500	45,600	7,380	1,320

Remarks; 1/ : Paddy irrigated from the main stem downstream of the proposed dam.
( )* : The paddy area of tideland reclamation under construction.
( )** : The paddy area of tideland reclamation.

Both paddy fields are not included in the above paddy area.

Table G 9 Continued (6)

3. Seomjin River Basin

Unit: ha

	Paddy										Upland		
		Paddy Depending on Reservoir			Paddy Depending on River							Irrigated Upland	
						Tributary		Main[1/]					
	Total Paddy	Sub-total	Consolidated	Unconsolidated	Sub-total	Consolidated	Unconsolidated	Consolidated	Unconsolidated	Paddy Supplementarily Irrigated	Total Upland	Tributary	Main[1/] Stem
1967	63,600	16,970	280	16,690	16,240	310	15,205	60	665	30,390	36,470	-	-
1976	64,160	19,230	3,220	16,010	19,660	3,440	15,320	230	670	25,270	33,480	-	-
1981	64,370	20,350	6,340	14,010	20,900	6,500	13,400	360	640	23,120	33,680	240	60
1986	64,470	21,650	9,180	12,470	22,200	9,140	11,940	480	640	20,620	33,930	480	120
1991	64,600	22,950	11,660	11,290	23,500	11,790	10,530	550	630	18,150	34,150	810	190
1996	64,600	24,200	14,400	9,760	24,750	14,420	9,110	640	580	15,650	34,500	1,160	290
2001	64,700	25,500	16,750	8,750	26,000	16,850	7,900	800	450	13,200	34,800	1,600	400

Remarks; 1/: Paddy irrigated from the main stem downstream of the proposed dam.

Table G 10 AGRICULTURAL LAND DEVELOPMENT OF EACH SUB-BASIN IN THE HAN RIVER BASIN

Unit: 10^3 ha

Sub-basin Code No.	Year	Paddy								Upland		
			Reservoir-depend		River-depend				Supplementarily Irrigated			
					Tributary		Main Stem[1/]					
		Total	CON	UNC	CON	UNC	CON	UNC		Total	Tributary	Main Stem[1/]
HN-01 (1)	1968	21.74	0.04	0.21	0.13	0.60	1.96	9.34	9.46	8.06	-	-
	76	20.95	0.35	0.40	0.38	0.42	5.92	6.57	6.91	8.31	-	-
	81	21.00*	0.53	0.27	0.80	0.40	8.47	4.33	6.20	8.05	0.10	0.10
	86	21.00*	0.66	0.14	1.33	0.27	11.01	2.19	5.40	7.90	0.20	0.25
	91	21.00**	0.81	0.14	1.58	0.27	11.61	1.99	4.60	7.80	0.30	0.40
	96	21.00**	0.83	0.12	1.88	0.27	12.29	1.81	3.80	7.65	0.45	0.50
	2001	21.00**	0.98	0.12	2.14	0.26	12.88	1.62	3.00	7.50	0.60	0.60
HN-01 (2)	1968	21.76	0.06	1.86	0.21	6.49	0.03	2.67	10.44	16.75	-	-
	76	19.97	0.34	2.26	0.94	6.25	0.40	2.53	7.25	15.06	-	-
	81	19.90	0.81	1.89	2.25	5.25	0.94	2.26	6.50	14.90	0.20	0.25
	86	19.80	1.23	1.57	3.44	4.36	1.53	1.87	5.80	14.80	0.45	0.45
	91	19.70	1.68	1.27	4.65	3.50	2.07	1.53	5.00	14.70	0.65	0.65
	96	19.60	2.13	0.92	6.06	2.59	2.61	1.19	4.10	14.60	0.90	0.90
	2001	19.50	2.59	0.61	7.13	1.67	3.28	0.72	3.50	14.50	1.10	1.10
HN-02	1968	15.35	0.04	1.20	0.20	6.76	-	0.04	7.11	14.41	-	-
	76	14.81	0.15	1.74	0.59	7.29	-	0.04	5.00	11.53	-	-
	81	14.95	0.41	1.64	1.59	6.36	0.10	0.30	4.55	11.35	0.11	0.11
	86	14.90	0.73	1.47	2.64	5.36	0.23	0.57	3.90	11.30	0.22	0.22
	91	14.90	1.03	1.37	3.49	4.61	0.48	0.62	3.30	11.20	0.33	0.33
	96	14.95	1.38	1.22	4.35	3.85	0.77	0.63	2.75	11.10	0.44	0.44
	2001	15.00	1.67	1.03	5.15	3.15	1.18	0.82	2.00	11.00	0.55	0.55

Remarks; CON: Consolidated paddy. UNC: Unconsolidated paddy.
1/ : Main stem means the paddy depending on the river downstream of a proposed dam site.
* : Existing paddy field 940 ha in the Incheon area outside the basin is not included.
** : Existing paddy field 940 ha in the Incheon area and 3,600 ha in Gimpo tideland reclamation is not included.

Table G 10 Continued (2)

Unit: 10^3 ha

Sub-basin Code No.	Year	Paddy								Upland		
			Reservoir-depend		River-depend				Supple-mentarily Irrigated			
					Tributary		Main Stem[1/]					
		Total	CON	UNC	CON	UNC	CON	UNC		Total	Tributary	Main Stem[1/]
HN-03 (1)	1968	12.87	0.04	0.67	0.27	4.11	0.02	0.82	6.94	8.17	-	-
	76	13.26	0.30	2.23	0.64	4.66	0.08	0.93	4.42	8.58	-	-
	81	13.30	0.86	1.84	1.54	3.26	0.60	1.40	3.80	8.70	0.14	0.14
	86	14.00	0.88	1.12	0.40	0.50	3.22	6.88	1.00	9.00	0.28	0.28
	91	14.00	1.16	0.84	0.58	0.42	4.66	5.44	0.90	9.20	0.42	0.42
	96	14.00	1.40	0.60	0.77	0.33	6.03	4.07	0.80	9.40	0.56	0.56
	2001	14.00	1.60	0.40	0.96	0.24	7.44	2.66	0.70	9.50	0.70	0.70
HN-03 (2)	1968	14.15	0.16	2.12	0.35	4.55	0.02	0.16	6.79	8.81	-	-
	76	14.49	0.62	3.00	1.01	4.89	0.04	0.18	4.75	8.94	-	-
	81	14.55	1.27	2.58	2.02	4.08	0.11	0.14	4.35	9.00	0.16	0.04
	86	14.60	1.89	2.21	2.95	3.45	0.16	0.14	3.80	9.10	0.32	0.08
	91	14.65	2.58	1.87	3.83	2.77	0.19	0.16	3.25	9.20	0.48	0.12
	96	14.70	3.32	1.43	4.73	2.02	0.25	0.15	2.80	9.30	0.64	0.16
	2001	14.80	4.05	0.95	5.67	1.33	0.28	0.12	2.40	9.40	0.80	0.20
HN-04	1968	10.63	0.03	1.53	0.07	4.27	-	0.09	4.64	13.21	-	-
	76	10.76	0.16	1.85	0.41	4.74	-	0.11	3.49	11.29	-	-
	81	10.80	0.46	1.74	1.11	4.17	0.03	0.09	3.20	11.20	0.20	0.02
	86	10.85	0.80	1.55	1.84	3.57	0.07	0.07	2.95	11.10	0.40	0.04
	91	10.90	1.17	1.38	2.56	3.01	0.05	0.13	2.60	11.00	0.60	0.06
	96	10.95	1.62	1.23	3.14	2.43	0.09	0.09	2.35	10.90	0.80	0.08
	2001	11.00	2.14	1.06	3.76	1.84	0.10	0.10	2.00	10.80	1.00	0.10

Table G 10 Continued (3)

Unit: 10^3 ha

Sub-basin Code No.	Year	Paddy								Upland		
			Reservoir-depend		River-depend				Supplementarily Irrigated			
					Tributary		Main Stem[1/]					
		Total	CON	UNC	CON	UNC	CON	UNC		Total	Tributary	Main Stem[1/]
HN-05	1968	11.72	0.21	1.84	0.36	3.16	0.03	0.60	5.52	12.45	-	-
	76	11.90	0.70	2.22	1.01	3.20	0.17	0.59	4.01	11.66	-	-
	81	11.90	1.15	1.95	1.60	2.70	0.35	0.55	3.60	11.50	0.20	0.02
	86	11.95	1.57	1.63	2.19	2.26	0.54	0.51	3.25	11.35	0.40	0.04
	91	11.95	2.01	1.34	2.76	1.84	0.73	0.42	2.85	11.25	0.60	0.06
	96	12.00	2.42	1.03	3.33	1.42	0.95	0.45	2.40	11.10	0.80	0.08
	2001	12.00	2.88	0.72	3.92	0.98	1.20	0.30	2.00	11.00	1.00	0.10
HN-06	1968	11.01	0.18	2.13	0.31	3.29	-	-	5.10	17.55	-	-
	76	11.06	0.62	2.18	0.90	3.19	-	-	4.17	16.40	-	-
	81	11.10	1.05	1.95	1.55	2.85	-	-	3.70	16.25	0.32	-
	86	11.15	1.48	1.67	2.22	2.53	-	-	3.25	16.10	0.64	-
	91	11.20	1.97	1.48	2.83	2.12	-	-	2.80	16.00	0.96	-
	96	11.25	2.34	1.21	3.56	1.89	-	-	2.25	15.85	1.28	-
	2001	11.30	2.78	0.97	4.22	1.53	-	-	1.80	15.70	1.60	-
HN-07	1968	9.37	0.04	1.19	0.12	3.73	-	0.04	4.25	25.32	-	-
	76	9.37	0.14	1.57	0.36	4.12	-	0.04	3.14	23.55	-	-
	81	9.40	0.41	1.54	0.96	3.59	0.03	0.07	2.80	23.35	0.20	0.02
	86	9.40	0.69	1.41	1.55	3.15	0.06	0.09	2.45	23.20	0.40	0.04
	91	9.45	0.99	1.26	2.13	2.72	0.08	0.12	2.15	22.95	0.60	0.06
	96	9.45	1.32	1.13	2.65	2.25	0.13	0.17	1.80	22.75	0.80	0.08
	2001	9.50	1.64	0.96	3.15	1.85	0.21	0.19	1.50	22.50	1.00	0.10

Table G 10 Continued (4)

Unit: 10^3 ha

Sub-basin Code No.	Year	Paddy								Upland		
			Reservoir-depend		River-depend							
					Tributary		Main Stem[1/]					
		Total	CON	UNC	CON	UNC	CON	UNC	Supplementarily Irrigated	Total	Tributary	Main Stem[1/]
HN-08	1968	5.76	0.01	0.28	0.10	2.51	-	-	2.86	21.39	-	-
	76	5.85	0.04	0.34	0.30	2.79	-	-	2.38	17.60	-	-
	81	5.90	0.10	0.35	0.70	2.55	-	-	2.20	17.50	0.18	-
	86	5.90	0.17	0.33	1.13	2.27	-	-	2.00	17.45	0.36	-
	91	5.95	0.28	0.32	1.62	1.88	-	-	1.85	17.40	0.54	-
	96	5.95	0.38	0.27	2.12	1.53	-	-	1.65	17.35	0.72	-
	2001	6.00	0.47	0.23	2.53	1.27	-	-	1.50	17.30	0.90	-
HN-09	1968	0.43	0.01	-	-	0.10	-	0.17	0.15	6.68	-	-
	76	0.44	0.01	-	0.01	0.11	-	0.21	0.10	5.38	-	-
	81	0.44	0.01	-	0.02	0.10	0.02	0.20	0.09	5.30	0.02	0.03
	86	0.45	0.01	-	0.03	0.09	0.06	0.17	0.09	5.25	0.05	0.05
	91	0.45	0.01	-	0.04	0.08	0.09	0.16	0.07	5.15	0.07	0.08
	96	0.45	0.01	-	0.05	0.07	0.11	0.14	0.07	5.10	0.10	0.10
	2001	0.45	0.01	-	0.06	0.06	0.13	0.14	0.05	5.05	0.12	0.13
HN-10	1968	1.57	-	0.03	0.02	0.76	0.01	0.05	0.70	12.89	-	-
	76	1.61	-	0.04	0.09	0.85	0.02	0.05	0.56	10.57	-	-
	81	1.65	-	0.04	0.13	0.86	0.02	0.08	0.52	10.55	0.09	0.01
	86	1.65	0.01	0.03	0.23	0.83	0.02	0.08	0.45	10.50	0.18	0.02
	91	1.65	0.01	0.03	0.33	0.78	0.03	0.01	0.40	10.45	0.27	0.03
	96	1.65	0.02	0.02	0.43	0.78	0.03	0.07	0.30	10.40	0.36	0.04
	2001	1.65	0.02	0.02	0.54	0.72	0.04	0.06	0.25	10.35	0.45	0.05

Table G 10 Continued (5)

Unit: 10^3 ha

Sub-basin Code No.	Year	Paddy								Upland		
			Reservoir-depend		River-depend							
					Tributary		Main Stem[1/]		Supplementarily Irrigated			
		Total	CON	UNC	CON	UNC	CON	UNC		Total	Tributary	Main Stem[1/]
HN-11	1968	3.30	-	0.12	0.03	1.32	-	-	1.83	3.36	-	-
	76	3.42	0.01	0.20	0.12	1.52	-	-	1.57	3.20	-	-
	81	3.45	0.06	0.24	0.34	1.34	-	0.02	1.45	3.20	0.03	-
	86	3.50	0.09	0.21	0.59	1.32	0.02	0.02	1.25	3.15	0.06	-
	91	3.50	0.11	0.19	0.77	1.38	0.02	0.03	1.00	3.15	0.09	-
	96	3.55	0.15	0.20	1.03	1.31	0.02	0.04	0.80	3.10	0.12	-
	2001	3.60	0.18	0.17	1.29	1.29	0.03	0.04	0.60	3.10	0.15	-
HN-12	1968	2.94	-	0.15	0.04	1.12	-	-	1.63	4.63	-	-
	76	2.96	0.02	0.22	0.11	1.26	-	-	1.35	4.04	-	-
	81	3.00	0.05	0.25	0.24	1.19	0.01	0.01	1.25	4.00	0.04	-
	86	3.00	0.08	0.22	0.41	1.20	0.01	0.03	1.05	4.00	0.07	0.01
	91	3.00	0.12	0.23	0.57	1.17	0.01	0.05	0.85	4.00	0.11	0.01
	96	3.00	0.14	0.21	0.73	1.14	0.03	0.05	0.70	4.00	0.14	0.02
	2001	3.00	0.18	0.22	0.88	1.12	0.04	0.06	0.50	4.00	0.18	0.02
HN-13	1968	5.96	0.01	0.48	0.03	1.36	-	-	4.08	10.66	-	-
	76	5.95	0.04	0.70	0.10	1.52	-	-	3.59	9.26	-	-
	81	6.00	0.17	0.68	0.33	1.37	-	-	3.45	9.20	0.10	-
	86	6.00	0.32	0.58	0.68	1.22	-	-	3.20	9.15	0.20	-
	91	6.00	0.50	0.50	1.00	1.00	-	-	3.00	9.10	0.30	-
	96	6.00	0.68	0.42	1.32	0.83	-	-	2.75	9.05	0.40	-
	2001	6.00	0.85	0.35	1.65	0.65	-	-	2.50	9.00	0.50	-

Table G 10 Continued (6)

Unit: 10^3 ha

Sub-basin Code No.	Year	Paddy								Upland		
			Reservoir-depend		River-depend							
					Tributary		Main Stem[1/]		Supplementarily Irrigated			
		Total	CON	UNC	CON	UNC	CON	UNC		Total	Tributary	Main Stem[1/]
HN-14	1968	3.63	0.02	0.41	0.09	1.83	-	0.04	1.24	6.46	-	-
	76	3.75	0.08	0.56	0.27	2.03	-	0.04	0.77	5.71	-	-
	81	3.80	0.12	0.52	0.47	2.01	0.01	0.07	0.60	5.70	0.09	0.01
	86	3.80	0.19	0.51	0.67	1.81	0.04	0.08	0.50	5.65	0.18	0.02
	91	3.85	0.27	0.53	0.86	1.68	0.07	0.09	0.35	5.60	0.27	0.03
	96	3.85	0.34	0.46	1.07	1.48	0.09	0.11	0.30	5.55	0.36	0.04
	2001	3.90	0.43	0.42	1.28	1.27	0.09	0.11	0.30	5.50	0.45	0.05
HN-15 (1)	1968	2.34	-	0.09	0.02	1.17	-	-	1.06	6.06	-	-
	76	2.32	0.01	0.12	0.06	1.32	-	-	0.81	5.27	-	-
	81	2.35	0.02	0.13	0.23	1.20	-	0.02	0.75	5.20	0.04	0.01
	86	2.35	0.06	0.14	0.42	1.04	0.02	0.02	0.65	5.15	0.09	0.01
	91	2.35	0.09	0.11	0.67	0.85	0.04	0.04	0.55	5.10	0.13	0.02
	96	2.35	0.16	0.14	0.80	0.72	0.04	0.04	0.45	5.05	0.18	0.02
	2001	2.35	0.18	0.12	0.96	0.64	0.06	0.04	0.35	5.00	0.22	0.03
HN-15 (2)	1968	0.93	-	0.04	-	0.38	-	-	0.51	3.54	-	-
	76	0.90	-	0.05	0.01	0.43	-	-	0.41	2.97	-	-
	81	0.90	0.01	0.04	0.04	0.41	-	-	0.40	2.90	0.03	-
	86	0.90	0.02	0.07	0.08	0.38	-	-	0.35	2.90	0.06	-
	91	0.95	0.05	0.10	0.15	0.30	-	-	0.35	2.85	0.09	-
	96	0.95	0.07	0.08	0.23	0.27	-	-	0.30	2.85	0.12	-
	2001	0.95	0.09	0.06	0.31	0.24	-	-	0.25	2.80	0.15	-

Table G 10 Continued (7)

Unit: 10^3 ha

Sub-basin Code No.	Year	Paddy								Upland		
			Reservoir-depend		River-depend							
					Tributary		Main Stem[1/]		Supplementarily Irrigated			
		Total	CON	UNC	CON	UNC	CON	UNC		Tatal	Tributary	Main Stem[1/]
HN-16	1968	1.69	0.01	0.14	0.02	0.57	-	-	0.95	2.86	-	-
	76	2.25	0.05	0.36	0.09	0.83	-	-	0.92	2.57	-	-
	81	2.30	0.13	0.37	0.22	0.68	-	-	0.90	2.50	0.03	-
	86	2.30	0.20	0.30	0.40	0.60	-	-	0.80	2.50	0.06	-
	91	2.30	0.28	0.27	0.52	0.53	-	-	0.70	2.50	0.09	-
	96	2.35	0.32	0.23	0.68	0.47	-	-	0.65	2.45	0.12	-
	2001	2.35	0.40	0.20	0.80	0.40	-	-	0.55	2.45	0.15	-
HN-17	1968	2.60	-	0.26	-	1.00	-	-	1.34	4.49	-	-
	76	3.00	0.15	0.36	0.35	0.88	-	-	1.26	3.45	-	-
	81	3.05	0.23	0.32	0.52	0.73	-	-	1.25	3.40	0.04	-
	86	3.10	0.29	0.36	0.61	0.74	-	-	1.10	3.40	0.08	-
	91	3.15	0.33	0.32	0.77	0.78	-	-	0.95	3.40	0.12	-
	96	3.15	0.43	0.32	0.87	0.68	-	-	0.85	3.40	0.16	-
	2001	3.20	0.48	0.32	1.02	0.68	-	-	0.70	3.30	0.20	-

Table G 11 AGRICULTURAL LAND DEVELOPMENT OF EACH SUB-BASIN IN THE NAGDONG RIVER BASIN

Unit: 10^3 ha

Sub-basin Code No.	Year	Paddy								Upland		
			Reservoir-depend		River-depend							
					Tributary		Main Stem 1/					
		Total	CON	UNC	CON	UNC	CON	UNC	Supplementarily Irrigated	Total	Tributary	Main Stem 1/
(1) Northern Agricultural Zone (NSB)												
NG-01 (NSB)	1968	1.59	0.01	0.11	0.04	0.53	-	-	0.90	6.85	0.24	-
	76	1.50	0.04	0.14	0.12	0.52	-	-	0.68	6.44	0.52	-
	81	1.50	0.05	0.13	0.20	0.52	-	-	0.60	6.40	0.64	-
	86	1.50	0.06	0.12	0.24	0.53	-	-	0.55	6.35	0.85	-
	91	1.45	0.08	0.12	0.32	0.48	-	-	0.45	6.30	1.04	-
	96	1.45	0.10	0.10	0.40	0.45	-	-	0.40	6.25	1.21	-
	2001	1.45	0.11	0.09	0.49	0.41	-	-	0.35	6.20	1.40	-
NG-02 (NSB)	1968	2.01	0.03	0.33	0.08	0.81	-	-	0.76	4.96	0.26	-
	76	2.00	0.12	0.38	0.23	0.81	-	-	0.46	4.15	0.56	-
	81	2.00	0.17	0.38	0.33	0.72	-	-	0.40	4.15	0.67	-
	86	2.00	0.20	0.35	0.40	0.70	-	-	0.35	4.10	0.91	-
	91	1.95	0.24	0.31	0.51	0.64	-	-	0.25	4.10	1.14	-
	96	1.95	0.31	0.29	0.59	0.56	-	-	0.20	4.05	1.36	-
	2001	1.95	0.34	0.26	0.66	0.54	-	-	0.15	4.00	1.60	-
NG-03 (NSB)	1968	4.06	0.06	1.02	0.07	1.20	-	-	1.71	11.41	0.17	-
	76	4.14	0.19	1.16	0.21	1.32	-	-	1.26	11.72	0.37	-
	81	4.20	0.38	1.07	0.42	1.18	-	-	1.15	11.60	0.45	-
	86	4.20	0.53	1.02	0.57	1.13	-	-	0.95	11.50	0.60	-
	91	4.25	0.68	1.02	0.72	1.08	-	-	0.75	11.35	0.74	-
	96	4.30	0.83	0.97	0.87	1.03	-	-	0.60	11.20	0.86	-
	2001	4.30	0.97	0.93	1.03	0.97	-	-	0.40	11.10	1.00	-

Remarks; CON: Consolidated paddy. UNC: Unconsolidated paddy.
1/ : Main stem means the paddy depending on the river downstream of a proposed dam site.

Table G 11 Continued (2)

Unit: 10^3 ha

Sub-basin Code No.	Year	Paddy								Upland		
			Reservoir-depend		River-depend							
					Tributary		Main Stem[1/]					
		Total	CON	UNC	CON	UNC	CON	UNC	Supplementarily Irrigated	Total	Tributary	Main Stem[1/]
NG-04	1968	2.67	0.06	0.76	0.04	0.51	0.02	0.39	0.89	5.03	0.11	0.02
(NSB)	76	2.66	0.19	0.84	0.12	0.52	0.07	0.42	0.50	4.65	0.25	0.03
	81	2.70	0.26	0.84	0.15	0.49	0.14	0.37	0.45	4.60	0.30	0.04
	86	2.70	0.35	0.75	0.23	0.50	0.17	0.35	0.35	4.60	0.41	0.05
	91	2.70	0.48	0.67	0.31	0.42	0.21	0.31	0.30	4.55	0.52	0.06
	96	2.70	0.59	0.56	0.40	0.38	0.26	0.26	0.25	4.55	0.63	0.07
	2001	2.70	0.72	0.48	0.47	0.31	0.31	0.21	0.20	4.50	0.72	0.08
NG-05	1968	12.09	0.31	2.47	0.35	3.15	0.09	0.75	4.97	10.55	0.20	0.20
(NSB)	76	12.68	0.98	2.92	0.20	0.59	1.17	3.38	3.44	10.49	0.36	0.37
	81	12.70	1.31	2.79	0.30	0.65	1.49	3.26	2.90	10.40	0.56	0.56
	86	12.75	1.60	2.60	0.50	0.75	1.90	3.05	2.35	10.35	0.75	0.74
	91	12.80	1.89	2.41	0.65	0.80	2.26	2.89	1.90	10.30	0.90	0.90
	96	12.90	2.16	2.24	0.81	0.84	2.63	2.72	1.50	10.25	1.05	1.05
	2001	13.00	2.43	2.07	1.10	0.90	2.97	2.53	1.00	10.20	1.20	1.20
NG-06	1968	9.80	0.36	1.64	0.30	1.35	0.14	0.56	5.45	5.37	0.39	0.05
(1)	76	10.19	1.21	1.55	0.79	1.01	0.49	0.55	4.59	4.97	0.87	0.10
(NSB)	81	10.20	1.53	1.47	1.07	1.03	0.60	0.60	3.90	4.90	1.08	0.12
	86	10.20	1.85	1.40	1.37	1.03	0.78	0.57	3.20	4.85	1.44	0.16
	91	10.25	2.20	1.30	1.64	0.96	0.96	0.54	2.65	4.85	1.57	0.18
	96	10.25	2.48	1.22	2.01	0.99	1.11	0.49	1.95	4.80	1.71	0.19
	2001	10.30	2.81	1.09	2.45	0.95	1.24	0.46	1.30	4.80	1.84	0.21

Table G 11 Continued (3)

Unit: 10^3 ha

Sub-basin Code No.	Year	Paddy								Upland		
			Reservoir-depend		River-depend							
					Tributary		Main Stem[1/]					
		Total	CON	UNC	CON	UNC	CON	UNC	Supplementarily Irrigated	Total	Tributary	Main Stem[1/]
NG-06	1968	8.67	0.16	1.14	0.41	2.95	-	-	4.01	8.10	0.30	-
(2)	76	8.83	0.55	1.21	1.22	2.80	-	-	3.05	7.80	0.67	-
(NSB)	81	8.90	0.78	1.12	1.82	2.58	-	-	2.60	7.75	0.80	-
	86	8.90	1.05	1.05	2.35	2.35	-	-	2.10	7.70	1.10	-
	91	8.95	1.34	1.01	2.86	2.19	-	-	1.55	7.70	1.20	-
	96	8.95	1.66	0.89	3.44	1.91	-	-	1.05	7.65	1.30	-
	2001	9.00	1.99	0.81	4.01	1.69	-	-	0.50	7.60	1.40	-
NG-06	1968	9.58	0.12	1.08	0.38	3.40	-	-	4.60	9.53	0.48	-
(3)	76	10.04	0.82	1.13	1.98	2.68	-	-	3.43	9.00	1.07	-
(NSB)	81	10.05	1.13	1.12	2.37	2.38	-	-	3.05	9.00	1.30	-
	86	10.05	1.38	1.12	2.72	2.28	-	-	2.55	8.95	1.75	-
	91	10.10	1.68	1.17	3.02	2.13	-	-	2.10	8.95	1.90	-
	96	10.10	2.05	1.15	3.35	1.95	-	-	1.60	8.90	2.10	-
	2001	10.10	2.40	1.20	3.60	1.80	-	-	1.10	8.90	2.25	-
NG-06	1968	13.63	0.09	0.92	0.43	4.49	-	-	7.70	13.30	0.28	-
(4)	76	13.34	0.41	1.44	1.22	4.40	-	-	5.87	13.56	0.64	-
(NSB)	81	13.35	0.85	1.45	2.15	3.65	-	-	5.25	13.60	0.80	-
	86	13.35	1.40	1.35	3.10	2.95	-	-	4.55	13.60	1.05	-
	91	13.40	1.95	1.10	4.05	2.30	-	-	4.00	13.60	1.15	-
	96	13.40	2.52	0.88	4.98	1.72	-	-	3.30	13.60	1.20	-
	2001	13.40	3.15	0.65	5.85	1.15	-	-	2.60	13.60	1.30	-

Table G 11 Continued (4)

Unit: 10^3 ha

Sub-basin Code No.	Year	Paddy								Upland		
			Reservoir-depend		River-depend							
					Tributary		Main Stem[1/]		Supplementarily Irrigated			
		Total	CON	UNC	CON	UNC	CON	UNC		Total	Tributary	Main Stem[1/]
(2) Central Agricultural Zone (CSB)												
NG-05	1968	12.42	0.79	2.81	0.15	0.38	0.43	1.53	6.33	7.07	0.21	0.21
(CSB)	76	12.37	2.67	2.18	0.28	0.22	1.32	2.10	3.60	6.07	0.38	0.38
	81	12.40	3.00	2.00	0.33	0.22	1.67	1.93	3.25	6.00	0.55	0.55
	86	12.40	3.30	1.85	0.38	0.22	2.02	1.73	2.90	5.95	0.75	0.75
	91	12.40	3.55	1.75	0.44	0.21	2.41	1.49	2.55	5.90	1.00	1.00
	96	12.40	3.83	1.57	0.50	0.20	2.87	1.18	2.25	5.80	1.20	1.20
	2001	12.40	4.13	1.37	0.53	0.17	3.34	0.86	2.00	5.70	1.40	1.40
NG-06	1968	16.57	0.88	5.92	0.46	3.11	0.03	0.06	6.11	13.47	0.50	-
(1)	76	17.08	2.78	5.63	0.40	0.82	1.10	2.06	4.29	12.80	1.07	-
(CSB)	81	17.10	3.65	5.25	0.50	0.72	1.25	1.91	3.82	12.65	1.30	-
	86	17.15	4.28	5.02	0.60	0.70	1.52	1.68	3.35	12.50	1.80	-
	91	17.20	5.11	4.54	0.82	0.73	1.67	1.53	2.80	12.40	2.25	-
	96	17.25	5.87	4.08	1.06	0.73	1.87	1.39	2.25	12.30	2.75	-
	2001	17.30	6.70	3.60	1.26	0.68	2.04	1.22	1.80	12.20	3.30	-
NG-06	1968	12.59	0.31	1.75	1.02	5.51	-	-	4.00	7.78	0.30	-
(2)	76	12.13	1.16	1.66	2.99	4.37	-	-	1.95	8.02	0.68	-
(CSB)	81	12.10	1.41	1.59	3.49	3.91	-	-	1.70	8.05	0.85	-
	86	12.10	1.70	1.50	4.00	3.50	-	-	1.40	8.00	1.10	-
	91	12.10	2.04	1.41	4.36	3.09	-	-	1.20	8.00	1.45	-
	96	12.10	2.34	1.31	4.86	2.69	-	-	0.90	8.00	1.75	-
	2001	12.10	2.73	1.17	5.27	2.33	-	-	0.60	8.00	2.10	-

Table G 11 Continued (5)

Unit: 10^3 ha

Sub-basin Code No.	Year	Paddy								Upland		
			Reservoir-depend		River-depend							
					Tributary		Main Stem[1/]					
		Total	CON	UNC	CON	UNC	CON	UNC	Supplementarily Irrigated	Total	Tributary	Main Stem[1/]
NG-07	1968	0.82	0.09	0.33	0.03	0.12	-	-	0.25	1.78	-	-
(CSB)	76	0.79	0.26	0.23	0.10	0.80	-	-	0.12	1.70	-	-
	81	0.80	0.29	0.26	0.11	0.90	-	-	0.05	1.70	0.10	-
	86	0.80	0.29	0.26	0.11	0.90	-	-	0.05	1.70	0.15	-
	91	0.80	0.33	0.22	0.12	0.80	-	-	0.05	1.65	0.20	-
	96	0.80	0.33	0.22	0.12	0.80	-	-	0.05	1.65	0.25	-
	2001	0.80	0.37	0.18	0.13	0.70	-	-	0.05	1.65	0.30	-
NG-08	1968	19.51	1.58	8.92	0.36	2.27	-	-	6.38	12.96	1.63	-
(CSB)	76	17.31	4.91	6.52	1.14	1.66	-	-	3.08	12.90	3.55	-
	81	17.30	5.83	5.82	1.37	1.48	-	-	2.80	12.85	4.40	-
	86	17.25	6.64	5.21	1.76	1.29	-	-	2.35	12.85	5.80	-
	91	17.20	7.65	4.50	1.95	1.20	-	-	1.90	12.80	6.20	-
	96	17.10	8.56	3.84	2.24	0.96	-	-	1.50	12.80	6.60	-
	2001	17.00	9.45	3.15	2.55	0.95	-	-	0.90	12.80	7.00	-
NG-09	1968	8.06	0.55	2.53	0.31	1.28	-	-	3.39	5.01	-	-
(CSB)	76	7.33	1.81	1.67	0.88	0.82	-	-	2.15	3.22	0.05	-
	81	7.30	2.09	1.51	1.01	0.74	-	-	1.95	3.20	0.10	-
	86	7.25	2.36	1.39	1.14	0.66	-	-	1.70	3.15	0.15	-
	91	7.20	2.73	1.17	1.27	0.53	-	-	1.50	3.10	0.20	-
	96	7.15	3.12	0.98	1.38	0.42	-	-	1.25	3.05	0.25	-
	2001	7.10	3.53	0.72	1.47	0.33	-	-	1.05	3.00	0.30	-

Table G 11 Continued (6)

Unit: 10^3 ha

Sub-basin Code No.	Year	Paddy								Upland		
			Reservoir-depend		River-depend				Supplementarily Irrigated			
					Tributary		Main Stem[1/]					
		Total	CON	UNC	CON	UNC	CON	UNC		Total	Tributary	Main Stem[1/]
NG-10	1968	13.65	0.53	2.60	0.51	2.69	0.29	1.41	5.62	10.19	0.40	0.40
(CSB)	76	14.33	1.74	2.60	1.16	1.74	1.27	3.53	2.29	8.94	0.85	0.85
	81	14.40	2.28	2.27	1.48	1.47	1.74	3.26	1.90	8.90	1.05	1.05
	86	14.50	2.86	1.99	1.77	1.23	2.17	2.98	1.50	8.80	1.40	1.40
	91	14.70	3.38	1.67	2.04	1.01	2.78	2.52	1.30	8.60	1.65	1.65
	96	14.85	4.01	1.34	2.32	0.78	3.27	2.18	0.95	8.45	1.90	1.90
	2001	15.00	4.59	1.01	2.62	0.58	3.79	1.81	0.60	8.30	2.20	2.20
NG-11	1968	8.14	0.25	1.52	0.42	2.60	-	-	3.35	4.55	0.03	-
(CSB)	76	8.54	0.83	1.60	1.26	2.44	-	-	2.41	4.02	0.07	-
	81	8.60	1.13	1.62	1.47	2.18	-	-	2.20	3.95	0.10	-
	86	8.60	1.42	1.53	1.78	1.97	-	-	1.90	3.90	0.15	-
	91	8.60	1.70	1.45	2.10	1.75	-	-	1.60	3.85	0.20	-
	96	8.60	2.10	1.40	2.30	1.50	-	-	1.30	3.80	0.30	-
	2001	8.60	2.44	1.26	2.56	1.34	-	-	1.00	3.80	0.40	-
NG-12	1968	9.97	0.08	1.30	0.20	3.35	-	-	5.04	5.69	0.45	-
(CSB)	76	10.20	0.27	1.67	0.59	3.67	-	-	4.00	5.54	0.98	-
	81	10.20	0.59	1.61	1.21	3.19	-	-	3.60	5.50	1.20	-
	86	10.20	1.03	1.47	1.87	2.73	-	-	3.10	5.45	1.60	-
	91	10.20	1.48	1.32	2.52	2.28	-	-	2.60	5.40	1.85	-
	96	10.20	1.92	1.13	3.08	1.87	-	-	2.20	5.35	2.10	-
	2001	10.20	2.41	0.99	3.59	1.51	-	-	1.70	5.30	2.40	-

Table G 11 Continued (7)

Unit: 10^3 ha

Sub-basin Code No.	Year	Paddy								Upland		
			Reservoir-depend		River-depend							
					Tributary		Main Stem[1/]					
		Total	CON	UNC	CON	UNC	CON	UNC	Supplementarily Irrigated	Total	Tributary	Main Stem[1/]
NG-13	1968	4.39	0.08	0.82	0.10	0.91	-	-	2.48	2.59	0.02	-
(CSB)	76	4.48	0.28	0.89	0.28	0.92	-	-	2.11	2.40	0.04	-
	81	4.50	0.40	0.90	0.40	0.90	-	-	1.90	2.35	0.05	-
	86	4.50	0.57	0.88	0.53	0.87	-	-	1.65	2.30	0.10	-
	91	4.50	0.70	0.85	0.70	0.85	-	-	1.40	2.30	0.15	-
	96	4.50	0.87	0.83	0.83	0.82	-	-	1.15	2.25	0.20	-
	2001	4.50	1.04	0.81	0.96	0.79	-	-	0.90	2.20	0.20	
NG-14	1968	11.86	0.63	3.31	0.34	1.77	0.12	0.50	5.19	9.13	0.03	0.01
(CSB)	76	12.25	2.06	2.96	0.90	1.29	0.46	0.63	3.95	7.68	0.06	0.02
	81	12.30	2.60	2.70	1.13	1.17	0.57	0.63	3.50	7.50	0.12	0.03
	86	12.35	3.08	2.42	1.40	1.10	0.82	0.58	2.95	7.40	0.20	0.05
	91	12.40	3.69	2.16	1.61	0.94	0.90	0.60	2.50	7.25	0.28	0.07
	96	12.45	4.11	1.94	1.87	0.88	1.12	0.48	2.05	7.10	0.40	0.10
	2001	12.50	4.67	1.73	2.12	0.78	1.21	0.49	1.50	7.00	0.55	0.15
(3) Southern Agricultural Zone (SSB)												
NG-15	1968	14.19	0.31	2.78	0.47	4.20	0.07	0.53	5.83	6.48	0.09	0.01
(1)	76	14.17	1.02	2.77	1.40	3.77	0.22	0.74	4.25	6.05	0.18	0.02
(SSB)	81	14.20	1.39	2.81	1.73	3.52	0.38	0.67	3.70	5.90	0.22	0.03
	86	14.20	1.44	3.06	1.76	3.74	0.40	0.70	3.10	5.85	0.27	0.03
	91	14.20	2.48	2.47	2.78	2.77	0.54	0.66	2.50	5.80	0.36	0.04
	96	14.20	3.00	2.35	3.25	2.55	0.65	0.60	1.80	5.75	0.45	0.05
	2001	14.20	3.60	2.20	3.66	2.24	0.74	0.56	1.20	5.70	0.54	0.06

Table G 11 Continued (8)

Unit: 10^3 ha

Sub-basin Code No.	Year	Paddy								Upland		
			Reservoir-depend		River-depend				Supple-mentarily Irrigated			
					Tributary		Main Stem[1/]					
		Total	CON	UNC	CON	UNC	CON	UNC		Total	Tributary	Main Stem[1/]
NG-15	1968	11.24	0.14	1.79	0.28	3.86	-	0.04	5.13	6.30	0.09	0.01
(2)	76	11.34	0.46	2.08	0.85	4.05	-	0.04	3.86	5.71	0.18	0.02
(SSB)	81	11.30	0.81	1.99	1.46	3.59	0.03	0.02	3.40	5.70	0.22	0.03
	86	11.30	1.23	1.77	2.14	3.08	0.03	0.05	3.00	5.65	0.27	0.03
	91	11.30	1.66	1.59	2.71	2.66	0.03	0.05	2.60	5.60	0.36	0.04
	96	11.30	2.10	1.45	3.27	2.28	0.03	0.07	2.10	5.55	0.45	0.05
	2001	11.30	2.58	1.22	3.88	1.82	0.04	0.06	1.70	5.50	0.54	0.06
NG-16	1968	19.65	0.90	4.09	0.43	1.97	0.55	2.46	9.25	14.33	0.19	0.08
(SSB)	76	20.11	2.88	3.52	1.13	1.39	1.85	2.11	7.23	12.90	0.31	0.14
	81	20.10	3.65	3.10	1.38	1.17	2.37	2.03	6.40	12.90	0.43	0.19
	86	20.10	4.37	2.68	1.71	1.04	2.92	1.88	5.50	12.90	0.55	0.24
	91	20.10	5.11	2.29	1.93	0.87	3.56	1.64	4.70	12.90	0.67	0.29
	96	20.10	5.78	1.92	2.25	0.75	4.17	1.43	3.80	12.90	0.79	0.34
	2001	20.10	6.64	1.46	2.46	0.54	4.90	1.10	3.00	12.90	0.90	0.40
NG-17	1968	23.73	1.10	5.79	1.16	6.45	0.37	1.93	6.93	10.85	0.15	0.06
(SSB)	76	23.43	3.46	4.77	2.91	4.02	1.84	2.77	3.66	10.40	0.27	0.11
	81	23.40	4.00	4.50	3.32	3.74	2.38	2.56	2.90	10.30	0.45	0.20
	86	23.40	4.61	4.09	3.95	3.50	2.64	2.41	2.20	10.20	0.63	0.27
	91	23.40	5.31	3.69	4.45	3.10	3.24	1.91	1.70	10.10	0.80	0.35
	96	23.40	5.98	3.22	5.01	2.69	3.38	1.92	1.20	10.05	0.91	0.89
	2001	23.40	6.60	2.70	5.50	2.25	3.75	1.70	0.90	10.00	1.00	0.40

Table G 11 Continued (9)

Unit: 10^3 ha

Sub-basin Code No.	Year	Paddy								Upland		
			Reservoir-depend		River-depend							
					Tributary		Main Stem[1/]		Supplementarily Irrigated			
		Total	CON	UNC	CON	UNC	CON	UNC		Total	Tributary	Main Stem[1/]
NG-18 (SSB)	1968	19.23	0.59	2.07	0.48	1.70	1.80	6.65	5.94	4.41	0.06	0.06
	76	18.75	1.94	1.47	1.42	1.07	5.62	4.10	3.13	4.49	0.11	0.11
	81	18.80*	2.27	1.33	1.58	0.92	6.15	3.75	2.80	4.40	0.16	0.16
	86	18.80*	2.58	1.22	1.77	0.83	6.95	3.15	2.30	4.30	0.21	0.22
	91	18.80**	2.96	1.04	1.92	0.68	7.62	2.78	1.80	4.42	0.27	0.28
	96	18.80**	3.36	0.84	2.08	0.52	8.36	2.09	1.55	4.10	0.35	0.35
	2001	18.80**	3.78	0.62	2.24	0.36	8.98	1.52	1.30	4.00	0.40	0.40
NG-19 (SSB)	1968	14.95	0.61	4.43	0.59	4.07	-	-	5.25	8.11	0.76	-
	76	15.42	1.96	4.16	1.79	3.84	-	-	3.67	7.66	1.65	-
	81	15.40	2.56	3.84	2.44	3.36	-	-	3.20	7.65	2.00	-
	86	15.40	3.19	3.46	3.21	2.74	-	-	2.80	7.60	2.60	-
	91	15.40	4.17	2.78	4.03	2.12	-	-	2.30	7.60	3.10	-
	96	15.40	5.01	2.14	4.59	1.76	-	-	1.90	7.55	3.60	-
	2001	15.40	5.93	1.57	5.07	1.43	-	-	1.40	7.50	4.00	-

Remarks; *: Tideland reclamation under execution, 450 ha, is not included.
**: Tideland reclamation, 2,500 ha in total, is not included.
Irrigation water for both areas is fed from the Nagdong river.

Table G 12 AGRICULTURAL LAND DEVELOPMENT OF EACH SUB-BASIN IN THE SEOMJIN RIVER BASIN

Unit: 10^3 ha

Sub-basin Code No.	Year	Paddy								Upland		
			Reservoir-depend		River-depend				Supplementarily Irrigated			
					Tributary		Main Stem 1/					
		Total	CON	UNC	CON	UNC	CON	UNC		Total	Tributary	Main Stem 1/
SM-01	1968	12.55	0.10	2.56	0.18	4.49	0.06	0.60	4.56	6.59	-	-
	76	12.15	0.93	2.56	1.28	3.49	0.22	0.59	3.08	6.13	-	-
	81	12.15	1.27	2.48	1.62	3.13	0.31	0.59	2.75	6.10	0.05	0.05
	86	12.10	1.56	2.44	1.84	2.86	0.40	0.60	2.40	6.10	0.10	0.10
	91	12.10	1.87	2.38	2.06	2.64	0.47	0.58	2.10	6.05	0.15	0.15
	96	12.05	2.30	2.20	2.35	2.27	0.55	0.53	1.85	6.05	0.22	0.23
	2001	12.00	2.70	2.10	2.60	1.90	0.70	0.40	1.60	6.00	0.30	0.30
SM-02 (1)	1968	3.17	0.01	0.93	0.01	0.68	-	0.06	1.48	1.98	-	-
	76	3.17	0.28	0.71	0.26	0.63	0.01	0.08	1.20	1.84	-	-
	81	3.18	0.47	0.55	0.43	0.52	0.05	0.05	1.11	1.85	-	0.01
	86	3.20	0.67	0.41	0.60	0.40	0.08	0.04	1.00	1.87	-	0.02
	91	3.21	0.74	0.40	0.68	0.37	0.08	0.05	0.89	1.90	-	0.04
	96	3.22	0.84	0.35	0.77	0.33	0.09	0.05	0.79	1.92	-	0.06
	2001	3.23	0.90	0.34	0.90	0.28	0.10	0.05	0.66	1.96	-	0.10
SM-02 (2)	1968	8.17	0.03	2.40	0.02	1.89	-	-	3.83	4.84	-	-
	76	8.12	0.75	1.79	0.75	1.78	-	-	3.05	4.84	-	-
	81	8.20	1.20	1.45	1.05	1.63	-	-	2.87	4.51	0.03	-
	86	8.24	1.70	1.09	1.70	1.19	-	-	2.56	4.57	0.06	-
	91	8.27	1.90	1.04	2.00	1.03	-	-	2.30	4.62	0.12	-
	96	8.29	2.10	0.95	2.30	0.91	-	-	2.03	4.68	0.18	-
	2001	8.32	2.35	0.83	2.55	0.87	-	-	1.72	4.76	0.20	-

Remarks; CON: Consolidated paddy. UNC: Unconsolidated paddy.
1/ : Main stem means the paddy depending on the river downstream of a proposed dam site.

Table G 12 Continued (2)

Unit: 10^3 ha

Sub-basin Code No.	Year	Paddy								Upland		
			Reservoir-depend		River-depend							
					Tributary		Main Stem[1/]					
		Total	CON	UNC	CON	UNC	CON	UNC	Supplementarily Irrigated	Total	Tributary	Main Stem[1/]
SM-02	1968	5.36	0.02	1.57	0.01	1.25	-	-	2.51	1.81	-	-
(3)	76	5.32	0.50	1.16	0.45	1.21	-	-	2.00	1.68	-	-
	81	5.37	0.80	0.93	1.00	0.77	-	-	1.87	1.69	0.01	-
	86	5.41	1.10	0.73	1.15	0.74	-	-	1.69	1.71	0.02	-
	91	5.42	1.25	0.67	1.35	0.64	-	-	1.51	1.73	0.04	-
	96	5.44	1.40	0.61	1.50	0.60	-	-	1.33	1.75	0.06	-
	2001	5.45	1.50	0.58	1.70	0.55	-	-	1.12	1.78	0.10	-
SM-03	1969	9.85	0.05	2.10	0.05	2.63	-	-	5.02	4.31	-	-
	76	10.00	0.26	2.33	0.33	2.81	-	-	4.27	3.68	-	-
	81	10.00	0.90	1.85	1.10	2.25	-	-	3.90	3.75	0.05	-
	86	10.00	1.40	1.70	1.60	1.90	-	-	3.40	3.80	0.10	-
	91	10.00	1.90	1.50	2.10	1.60	-	-	2.90	3.85	0.15	-
	96	10.00	2.40	1.30	2.60	1.30	-	-	2.40	3.90	0.20	-
	2001	10.00	2.90	1.10	3.00	1.00	-	-	2.00	4.00	0.30	-
SM-04	1968	17.76	0.04	4.96	0.02	3.58	-	-	9.16	9.52	-	-
	76	18.41	0.40	5.09	0.33	4.37	-	-	8.22	8.68	-	-
	81	18.45	1.30	4.50	1.10	4.00	-	-	7.55	8.75	0.05	-
	86	18.50	2.10	3.95	1.90	3.65	-	-	6.90	8.80	0.10	-
	91	18.55	3.00	3.30	3.00	3.10	-	-	6.15	8.85	0.20	-
	96	18.55	4.00	2.55	4.00	2.65	-	-	5.35	8.95	0.30	-
	2001	18.60	4.60	2.20	4.90	2.30	-	-	4.60	9.00	0.40	-

Table G 12 Continued (3)

Unit: 10^3 ha

Sub-basin Code No.	Year	Paddy								Upland		
			Reservoir-depend		River-depend							
					Tributary		Main Stem[1/]		Supplementarily Irrigated			
		Total	CON	UNC	CON	UNC	CON	UNC		Total	Tributary	Main Stem[1/]
SM-05	1968	6.74	0.03	2.17	0.02	0.69	-	-	3.83	7.42	-	-
	76	6.99	0.10	2.37	0.04	1.03	-	-	3.45	6.99	-	-
	81	7.02	0.40	2.25	0.20	1.10	-	-	3.07	7.03	0.05	-
	86	7.02	0.65	2.15	0.35	1.20	-	-	2.67	7.08	0.10	-
	91	7.05	1.00	2.00	0.60	1.15	-	-	2.30	7.15	0.15	-
	96	7.05	1.40	1.80	0.90	1.05	-	-	1.90	7.25	0.20	-
	2001	7.10	1.80	1.60	1.20	1.00	-	-	1.50	7.30	0.30	-

Table G 13 CORRELATION BETWEEN AGRICULTURAL ZONE AND REPRESENTING METEOROLOGICAL STATION

Agricultural Zone	Representing Station
Han river basin	Seoul
Northern Nagdong river basin (NSB)	Chupungryeong
Central Nagdong river basin (CSB)	Daegu
Southern Nagdong river basin (SSB)	Busan
Seomjin river basin	Gurye for rainfall, Gwangju & Jeonju for other data

Table G 14 THE MONTHLY MEAN METEOROLOGICAL RECORD AT THE REPRESENTATIVE STATIONS

	Precipitation	Temperature	Relative Humidity	Sunshine Hours	Wind Velocity	Pan Evaporation
	mm	°C	%	hr	m/sec	mm
1. Han River Basin (Seoul) (1952-1976)*						
Jan.	22	-4	66	165	2.5	37
Feb.	31	-1	65	165	2.7	46
Mar.	50	4	65	198	3.0	78
Apr.	97	11	64	200	3.0	114
May	91	17	65	228	2.6	153
June	138	21	74	184	2.2	142
July	402	24	83	121	2.3	115
Aug.	267	25	80	154	2.2	130
Sep.	176	20	74	175	2.0	108
Oct.	53	14	69	207	1.9	89
Nov.	44	7	68	152	2.3	57
Dec.	21	-1	66	146	2.4	40
Total	1,392					1,109
(Average)		(11)	(70)	(175)	(2.4)	
2. Nagdong River Basin						
2.1 Northern Agricultural Zone (Chupungryeong), NSB (1953-1976)*						
Jan.	29	-3	65	175	4.3	55
Feb.	36	0	65	174	4.0	63
Mar.	62	4	62	209	3.8	102
Apr.	94	11	62	215	3.3	137
May	89	17	62	248	3.0	180
June	131	21	72	204	2.4	159
July	293	24	82	162	2.0	136
Aug.	200	25	81	190	2.1	149
Sep.	132	19	79	176	2.1	113
Oct.	52	13	72	210	2.4	100
Nov.	49	6	69	173	2.8	68
Dec.	26	0	67	171	3.9	55
Total	1,193					1,317
(Average)		(11)	(70)	(192)	(3.0)	

Remarks; ( )*: Observation period.

Monthly mean meteological record were reproduced from ANNEX B.

Table G 14 Continued (2)

	Precipitation	Temperature	Relative Humidity	Sunshine Hours	Wind Velocity	Pan Evaporation
	mm	°C	%	hr	m/sec	mm
2.2 Central Agricultural Zone (Daegu), CSB (1952-1976)*						
Jan.	20	-1	59	188	3.6	61
Feb.	30	1	61	177	3.5	65
Mar.	48	6	60	210	3.7	105
Apr.	79	13	63	205	3.6	133
May	77	18	64	224	3.2	169
June	111	22	70	191	3.2	167
July	244	26	77	164	3.1	156
Aug.	180	26	75	191	3.0	169
Sep.	123	21	75	167	2.7	114
Oct.	46	15	69	201	2.5	96
Nov.	37	8	67	177	2.9	67
Dec.	19	2	63	181	3.2	59
Total	1,014					1,361
(Average)		(13)	(67)	(190)	(3.2)	
2.3 Southern Agricultural Zone (Busan), SSB (1952-1976)*						
Jan.	27	2	52	191	4.8	79
Feb.	54	4	55	172	4.8	78
Mar.	83	8	59	198	4.8	104
Apr.	153	13	68	184	4.7	112
May	158	17	72	213	4.1	130
June	203	20	80	175	4.0	123
July	254	24	86	148	4.6	122
Aug.	197	26	81	208	4.4	152
Sep.	193	22	75	162	4.3	115
Oct.	61	17	64	196	4.0	114
Nov.	62	11	59	184	4.2	91
Dec.	32	5	53	193	4.5	84
Total	1,477					1,304
(Average)		(14)	(67)	(185)	(4.4)	

Table G 14 Continued (3)

	Precipitation	Temperature	Relative Humidity	Sunshine Hours	Wind Velocity	Pan Evaporation
	mm	°C	%	hr	m/sec	mm
3. Seomjin River Basin						
3.1 Gwangju (1952-1976)*						
Jan.	34	0	73	163	2.3	48
Feb.	45	2	70	164	2.6	57
Mar.	66	6	68	207	2.7	94
Apr.	118	12	69	203	2.5	120
May	109	18	71	227	2.2	151
June	152	21	75	194	2.1	158
July	267	26	82	167	2.4	153
Aug.	211	26	79	216	2.1	165
Sep.	176	21	77	188	1.8	119
Oct.	57	15	73	215	1.7	100
Nov.	51	8	73	174	2.0	65
Dec.	33	3	72	157	2.1	49
Total	1,319					1,279
(Average)		(13)	(74)	(190)	(2.2)	
3.2 Jeonju (1952-1976)*						
Jan.	34	-1	73	149	1.2	36
Feb.	41	1	73	151	1.3	42
Mar.	64	5	71	196	1.5	74
Apr.	107	12	71	197	1.6	108
May	100	18	69	229	1.4	145
June	129	22	76	190	1.3	148
July	298	26	81	144	1.4	135
Aug.	237	26	80	196	1.2	146
Sep.	161	21	79	182	1.0	105
Oct.	58	14	75	205	1.0	86
Nov.	52	8	75	158	1.0	52
Dec.	30	2	74	143	1.1	38
Total	1,311					1,115
(Average)		(13)	(75)	(178)	(1.2)	

Table G 15 CROPPING CALENDAR AND TRANSPLANTING PERIOD IN EACH AGRICULTURAL ZONE

			Historical Cropping Pattern				Future Cropping Pattern			
			Single Cropping		Two Cropping		Single Cropping		Two Cropping	
			TRA	TON	TRA	TON	TRA	TON	TRA	TON
			(1968)*							
1.	Han River Basin	Area ratio (%)	89	-	11	-	-	65	16	19
		TP period	June 1-10	-	June 21-30	-	-	May 21-31	June 16-25	June 11-20
2.	Nagdong River Basin			(1968)*						
	- Northern Z. (NSB)	Area ratio (%)	49	-	51	-	10	46	9	35
		TP period	June 1-10	-	June 21-30	-	June 6-20	May 21-31	June 16-25	June 11-20
			(1968)*							
	- Central Z. (CSB)	Area ratio (%)	11	-	89	-	12	6	-	82
		TP period	June 11-20	-	June 21-30	-	June 6-20	May 21-31	-	June 11-20
			(1968)*							
	- Southern Z. (SSB)	Area ratio (%)	18	-	82	-	14	5	-	81
		TP period	June 21-30	-	June 21-30	-	June 6-20	May 21-31	-	June 11-20
			(1967)*							
3.	Seomjin River Basin	Area ratio (%)	28	-	72	-	7	13	21	59
		TP period	June 21-30	-	June 21-30	-	June 6-20	May 21-31	June 16-20	June 11-20

Remarks; TP: Transplanting period. TON: New veriety.
TRA: Traditional veriety. ( )*: Year of the historical cropping pattern.

Table G 16 ESTIMATED EFFECTIVE RAINFALL ON PADDY

Unit: mm

			Han River Basin		Nagdong River Basin						Seomjin River Basin	
			Seoul		Chupungryeong		Daegu		Busan		Gurye	
Year	Month	Decade	R	ER	R	ER	R	ER	R	ER	R	ER
1967	Oct.	1	12	12	2	-	26	26	4	-	-	-
		2	14	-	20	19	15	-	25	21	7	6
		3	1	-	2	-	-	-	-	-	-	-
1968	May	1	13	13	11	10	15	13	8	-	40	38
		2	25	20	29	26	17	17	119	112	17	11
		3	16	11	9	-	-	-	9	8	8	8
	June	1	37	34	50	48	39	38	18	12	80	68
		2	4	-	-	-	-	-	1	-	4	-
		3	-	-	3	-	3	-	-	-	21	21
	July	1	165	104	22	19	22	10	23	19	15	9
		2	200	113	183	87	125	87	91	85	26	24
		3	48	14	21	15	44	41	107	87	1	-
	Aug.	1	82	79	78	71	49	43	105	86	106	104
		2	108	106	82	80	209	95	115	111	256	101
		3	173	57	23	20	30	28	87	44	35	33
	Sep.	1	100	69	19	19	16	16	14	12	47	47
		2	25	23	29	18	32	31	60	59	44	43
		3	1	-	-	-	2	-	21	14	-	-

Remarks; R: Decade rainfall.
ER: Decade effective rainfall.
Period: October 1967 to September 1968

Table G 17 IRRIGATION WATER REQUIREMENT AND NET AGRICULTURAL WATER WITHDRAWAL (HISTORICAL CROPPING PATTERN)

Unit: mm

		1967			1968																
		Oct.			Apr.		May			June			July			Aug.			Sep.		
		1	2	3	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
1. Han River Basin																					
	PEM		(87)		(143)			(137)			(169)			(115)			(143)			(121)	
	PED	28	28	31	48	48	44	44	49	56	56	57	37	37	41	46	46	51	41	40	40
	ER	12	-	-	-	-	13	20	11	34	-	-	104	113	14	79	106	57	69	23	-
S.TRA	CUF	28	14			1	2	2	14	37	45	57	41	46	53	62	64	69	53	50	48
(89%)	FIR	36	14			13	5	4	81	142	95	107	-	-	83	23	-	56	24	67	88
	DWR	55	22			19	7	7	125	219	146	165	-	-	128	36	-	86	37	103	135
	WWF	6	2			14	5	5	88	174	85	99	61	66	89	86	84	100	77	81	82
	NWW	25	7			14	4	4	83	157	69	87	38	31	45	44	38	52	41	45	49
W.TRA	CUF	35	34	16				1	2	3	16	38	30	37	45	58	60	69	57	54	52
(11%)	FIR	43	34	16				12	5	4	86	175	-	-	75	19	-	56	28	71	92
	DWR	66	52	24				18	8	6	132	270	-	-	116	28	-	86	44	109	142
	WWF	52	39	18				14	5	5	90	180	50	57	79	80	80	100	82	85	87
	NWW	33	22	10				14	4	4	84	169	27	22	35	38	34	52	46	49	54

Remarks;
- PEM: Monthly pan evaporation
- PED: Decade pan evaporation estimated on the basis of monthly value
- ER: Effective rainfall
- CUF: Consumptive use on farm
- FIR: Farm irrigation requirement
- DWR: Division water requirement
- WWF: Agricultural water withdrawal on farm
- NWW: Net agricultural water withdrawal
- S: Single cropping
- W: Two cropping
- TRA: Traditional variety
- TON: New variety
- (%): Areal proportion

Table G 17 Continued (2)

Unit: mm

		1967			1968																
		Oct.			Apr.		May			June			July			Aug.			Sep.		
		1	2	3	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
2.	Nagdong River Basin																				
2.1	Northern Zone (NSB)																				
	PEM		(113)			(163)			(151)			(189)			(150)			(154)			(123)	
	PED	38	38	37	54	55	48	48	55	63	63	63	48	48	54	50	50	54	41	41	41
	ER	-	19	-	-	-	10	26	-	48	-	-	19	87	15	71	80	20	19	18	-
S.TRA	CUF	38	19			1	2	2	15	42	50	63	53	60	70	68	70	73	53	51	49
(49%)	FIR	58	10			13	5	4	87	134	100	113	74	13	99	37	30	97	74	73	89
	DWR	89	15			19	8	6	134	206	154	174	114	20	153	56	46	149	114	113	137
	WWF	57	21			14	5	5	91	177	92	106	85	82	108	93	95	111	85	83	84
	NWW	39	12			14	4	4	86	163	77	94	74	54	80	60	56	72	59	58	63
W.TRA	CUF	48	46	19				1	3	3	18	42	38	48	59	63	65	73	57	55	53
(51%)	FIR	68	27	19				12	7	3	88	179	59	1	88	32	25	97	78	77	93
	DWR	104	41	28				18	10	5	135	276	91	2	136	48	38	149	121	119	144
	WWF	68	50	21				14	6	5	92	185	68	68	96	88	89	111	90	88	88
	NWW	50	32	13				14	6	4	86	174	57	40	68	55	50	72	64	63	67
2.2	Central Zone (CSB)																				
	PEM		(103)			(144)			(157)			(203)			(155)			(156)			(121)	
	PED	34	34	35	48	48	51	51	55	67	67	69	50	50	55	50	50	56	41	40	40
	ER	26	-	-	-	-	13	17	-	38	-	-	10	87	41	43	95	28	16	31	-
S.TRA	CUF	41	34	18			1	2	3	20	45	55	50	55	69	65	68	78	55	52	50
(11%)	FIR	35	34	18			12	5	7	75	182	105	80	8	72	62	13	94	79	61	90
	DWR	54	52	27			19	7	10	116	280	162	123	12	110	95	19	145	122	94	138
	WWF	56	39	20			14	5	6	93	188	97	83	76	102	95	90	116	88	82	85
	NWW	40	22	12			14	4	5	85	173	86	73	52	74	67	51	69	55	52	61

Table G 17 Continued (3)

Unit: mm

		1967			1968																
		Oct.			Apr.		May			June			July			Aug.			Sep.		
		1	2	3	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
W.TRA	CUR	43	41	18				1	3	3	19	46	40	50	61	63	65	76	57	54	52
(89%)	FIR	63	41	18				12	7	4	89	183	70	3	64	60	10	92	81	63	92
	DWR	96	63	27				19	10	6	137	282	108	5	98	92	15	141	125	97	142
	WWF	63	47	20				14	6	6	93	189	71	70	93	92	87	112	91	84	87
	NWW	47	30	12				14	5	5	87	179	61	46	65	64	48	65	58	54	63
2.3 Southern Zone (SSB)																					
	PEM		(128)		(115)			(119)			(147)			(119)			(156)			(98)	
	PED	42	42	44			38	38	43	49	49	49	38	38	43	50	50	56	33	33	32
	ER	-	21	-			-	112	8	12	-	-	19	85	87	86	111	44	12	59	14
S.TRA	CUF	53	50	22				1	2	2	14	32	30	38	47	63	65	76	46	45	42
(18%)	FIR	73	29	22				9	5	5	84	168	51	-	4	17	-	76	74	26	68
	DWR	112	45	34				14	8	8	129	259	79	-	7	25	-	116	114	39	104
	WWF	74	55	26				13	5	5	87	172	59	57	70	85	84	110	78	69	73
	NWW	63	41	20				12	3	3	80	160	47	39	43	42	38	52	46	35	42
W.TRA	CUF	52	50	22				1	2	2	14	32	30	38	47	63	65	76	46	45	42
(82%)	FIR	73	29	22				9	5	5	84	168	51	-	4	17	-	76	74	26	68
	DWR	112	45	34				14	8	8	129	259	79	-	7	25	-	116	114	39	104
	WWF	74	55	26				13	5	5	87	172	59	57	70	85	84	110	78	69	73
	NWW	63	41	20				12	3	3	80	160	47	39	43	42	38	52	46	35	42

Table G 17 Continued (4)

Unit: mm

		1967			1968																	
		Oct.			Apr.		May			June			July			Aug.			Sep.		
		1	2	3	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
3. Seomjin River Basin																						
	PEM		(112)			(135)			(131)			(177)			(155)			(125)			(120)	
	PED	36	36	40	45	45	42	42	47	59	59	59	50	50	55	40	40	45	40	40	40
	ER	-	6	-	-	-	38	11	8	68	-	21	9	24	-	104	101	33	47	43	-
S.TRA	CUF	45	43	20				1	2	3	17	38	40	50	61	50	52	61	56	54	52
(28%)	FIR	65	43	20				12	6	2	87	155	71	66	105	-	-	72	49	51	92
	DWR	100	66	31				19	9	3	133	239	109	102	161	-	-	110	75	78	142
	WWF	66	50	23				14	5	5	90	176	71	81	99	70	72	94	84	82	87
	NWW	57	42	19				13	4	3	81	156	53	62	84	51	37	56	50	48	54
W.TRA	CUF	45	43	20				1	2	3	17	38	40	50	61	50	52	61	56	54	52
(72%)	FIR	65	43	20				12	6	2	87	155	71	66	105	-	-	72	49	51	92
	DWR	100	60	31				19	9	3	133	239	109	102	161	-	-	110	75	78	142
	WWF	66	50	23				14	5	5	90	176	71	81	99	70	72	94	84	82	87
	NWW	57	42	19				13	4	3	81	156	53	62	84	51	37	56	50	48	54

Table G 18 IRRIGATION WATER REQUIREMENT AND NET AGRICULTURAL WATER WITHDRAWAL
(FUTURE CROPPING PATTERN)

Unit: mm

		1967			1968																	
		Oct.			Apr.		May			June			July			Aug.			Sep.		
		1	2	3	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
1.	Han River Basin																				
	PEM		(87)		(143)			(137)			(169)			(115)			(143)			(121)	
	PED	28	28	31	48	48	44	44	49	56	56	57	37	37	41	46	46	51	41	40	40
	ER	12	-	-	-	-	13	20	11	34	-	-	104	113	14	79	106	57	69	23	-
S.TON	CUF				1	2	2	12	32	45	56	63	46	48	55	64	62	66	51	48	20
(65%)	FIR				13	6	5	74	163	61	106	113	-	-	85	25	-	53	22	55	30
	DWR				19	9	7	114	250	94	163	173	-	-	131	39	-	82	34	85	46
	WWF				14	5	5	84	174	80	98	106	66	68	91	89	81	97	75	72	30
	NWW				13	4	4	79	162	63	82	94	43	33	47	47	35	49	39	36	13
W.TRA	CUF	35	27	6		1	2	2	2	3	22	40	30	37	45	58	60	69	57	54	52
(16%)	FIR	53	37	6		13	5	4	5	4	151	130	-	-	75	19	-	56	28	71	92
	DWR	82	57	10		19	7	7	8	6	232	200	-	-	116	28	-	86	44	109	142
	WWF	59	32	7		14	5	5	5	5	161	126	50	57	79	80	80	100	82	85	87
	NWW	40	18	4		14	4	4	4	4	152	114	27	22	35	38	34	52	46	49	54
W.TON	CUF	14				1	2	2	2	12	29	46	37	41	51	60	62	71	55	52	48
(19%)	FIR	18				7	8	4	5	52	172	96	-	-	81	21	-	58	26	69	78
	DWR	28				10	13	7	8	79	264	147	-	-	125	32	-	90	41	106	120
	WWF	22				7	9	5	5	63	181	86	57	61	86	83	82	103	80	83	76
	NWW	12				7	8	4	4	58	169	74	34	26	42	41	36	55	44	47	43

Remarks; PEM: Monthly pan evaportation
PED: Decade pan evaporation estimated on the basis of monthly value
ER: Effective rainfall
CUF: Consumptive use on farm
FIR: Farm irrigation requirement
DWR: Diversion water requirement
WWF: Agricultural water withdrawal on farm
NWW: Net agricultural water withdrawal
S: Single cropping
W: Two cropping
TRA: Traditional variety
TON: New variety
(%): Areal proportion

Table G 18 Continued (2)

Unit: mm

		1967			1968																
		Oct.			Apr.		May			June			July			Aug.			Sept.		
		1	2	3	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
2.	Nagdong River Basin																				
2.1	Northern Zone (NSB)																				
	PEM		(113)		(163)			(151)			(189)			(150)			(154)			(123)	
	PED	38	38	37	54	55	48	48	55	63	63	63	48	48	54	50	50	54	41	41	41
	EF	-	19	-	-	-	10	26	-	48	-	-	19	87	15	71	80	20	19	28	-
S.TRA	CUF	34	11			0	2	2	6	31	50	63	53	60	70	68	70	73	53	51	49
(10%)	FIR	44	6			4	11	4	24	112	130	113	74	13	99	37	30	97	74	63	84
	DWR	68	9			6	16	6	37	173	201	174	114	20	153	56	46	149	114	97	130
	WWF	46	12			4	12	5	24	147	126	106	85	82	108	93	95	111	85	81	80
	NWW	30	7			4	11	4	22	136	111	94	74	54	80	60	56	72	59	56	59
S.TON	CUF				1	3	2	13	36	50	63	69	60	62	73	70	68	70	51	49	21
(46%)	FIR				13	6	5	73	177	52	113	119	81	15	102	39	28	94	72	51	31
	DWR				19	10	8	112	272	81	174	184	125	24	157	60	42	145	111	79	47
	WWF				14	5	5	85	180	84	106	114	93	85	111	96	92	107	83	72	30
	NWW				14	4	4	80	168	69	91	102	82	57	83	63	53	68	57	47	19
W.TRA	CUF	48	36	7		1	2	2	3	3	25	44	38	48	59	63	65	73	57	55	53
(9%)	FIR	68	21	7		13	5	4	7	3	154	134	59	1	88	32	25	97	78	67	93
	DWR	104	33	11		19	8	6	10	5	236	206	91	2	136	48	38	149	121	104	144
	WWF	68	40	9		14	5	5	6	5	164	131	68	68	96	88	89	111	90	86	88
	NWW	50	26	6		14	4	4	5	4	155	119	57	40	68	55	50	72	64	61	67
W.TON	CUF	19				1	2	2	3	13	33	50	48	53	68	65	68	76	55	53	49
(35%)	FIR	29				7	9	4	7	49	176	100	69	6	97	34	28	100	76	65	79
	DWR	45				10	13	6	10	75	270	154	106	9	148	52	42	153	117	100	122
	WWF	29				7	9	5	6	64	185	92	79	74	105	90	92	114	88	84	77
	NWW	20				7	8	4	5	59	174	80	68	46	77	57	53	75	62	59	56

Table G 18 Continued (3)

Unit: mm

		1967			1968																
		Oct.			Apr.		May			June			July			Aug.			Sep.		
		1	2	3	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
2.2 Central Zone (CSB)																					
	PEM		(103)		(144)			(157)			(203)			(155)			(156)			(121)	
	PED	34	34	35	48	48	51	51	55	67	67	69	50	50	55	50	50	56	41	40	40
	ER	26	-	-	-	-	13	17	-	38	-	-	10	87	41	43	95	28	16	31	-
S.TRA	CUF	31	10			-	2	2	6	33	54	69	55	63	72	68	70	76	53	50	48
(12%)	FIR	17	10			4	11	5	24	121	134	119	85	16	75	65	15	92	77	59	83
	DWR	26	16			6	16	7	37	187	206	183	131	24	115	99	23	141	119	91	128
	WWF	38	12			4	12	5	24	150	130	113	89	85	106	98	92	112	86	80	79
	NWW	24	7			4	11	4	22	137	114	102	79	61	78	70	53	65	53	50	55
S.TON	CUF				1	2	2	14	36	54	67	76	63	65	74	70	68	73	51	48	20
(6%)	FIR				13	6	5	77	177	66	117	126	93	18	77	67	13	89	75	47	30
	DWR				19	9	8	119	272	101	180	194	142	28	119	103	19	137	116	72	46
	WWF				14	5	5	87	180	89	111	121	97	88	109	101	90	109	83	71	30
	NWW				13	4	4	81	167	70	95	110	87	64	81	73	51	62	50	41	18
W.TON	CUF	17				1	2	2	3	14	35	55	50	55	69	65	68	78	55	52	48
(82%)	FIR	14				7	9	5	7	53	178	105	80	8	72	62	13	94	79	61	78
	DWR	22				10	13	7	10	81	272	162	123	12	110	95	19	145	122	94	120
	WWF	24				7	9	5	6	65	188	97	83	76	102	95	90	116	88	82	76
	NWW	8				7	8	4	5	59	176	86	73	52	74	67	51	69	55	52	52

Table G 18 Continued (4)

Unit: mm

		1967			1968																	
		Oct.			Apr.		May			June			July			Aug.			Sep.		
		1	2	3	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
2.3 Southern Zone (SSB)																					
	PEM		(128)		(115)			(119)			(147)			(119)			(156)			(98)	
	PED	42	42	44	38	39	38	38	43	49	49	49	38	38	43	50	50	56	33	33	32
	ER	-	21	-	-	-	-	112	8	12	-	-	19	85	87	86	111	44	12	59	14
S.TRA	CUR	38	13			-	1	2	5	24	39	49	42	48	56	68	70	76	43	41	38
(14%)	FIR	48	6			4	11	-	22	131	119	99	63	3	13	22	-	76	71	22	59
	DWR	74	10			6	17	-	33	201	183	152	97	4	20	33	-	116	109	34	91
	WWF	51	14			4	11	3	22	143	113	90	72	68	80	91	90	110	74	65	65
	NWW	41	10			4	10	1	18	128	95	77	60	50	53	48	44	52	42	31	34
S.TON	CUF				1	2	2	11	28	39	49	54	48	49	58	70	68	73	41	40	16
(5%)	FIR				12	5	5	36	162	77	99	104	69	4	15	24	-	73	69	11	19
	DWR				19	8	8	55	249	119	152	160	105	7	23	37	-	112	107	16	29
	WWF				14	5	4	76	170	77	90	96	79	70	83	94	87	107	72	56	24
	NWW				13	4	3	67	146	55	72	83	67	52	56	51	41	49	40	22	8
W.TON	CUF	21				1	1	2	2	10	26	39	38	42	54	65	68	78	45	43	38
(81%)	FIR	31				7	9	-	5	57	168	89	59	-	11	19	-	78	73	24	54
	DWR	48				10	14	-	8	87	259	137	91	-	17	29	-	121	112	37	84
	WWF	31				7	9	3	5	62	177	79	68	61	77	88	87	113	76	67	62
	NWW	25				7	8	1	3	55	163	66	56	43	50	45	41	55	44	33	31

Table G 18 Continued (5)

Unit: mm

		1967			1968																	
		Oct.			Apr.		May			June			July			Aug.			Sep.		
		1	2	3	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
3. Seomjin River Basin																						
	PEM		(112)		(135)			(131)			(177)			(155)			(125)			(120)	
	PED	36	36	40	45	45	42	42	47	59	59	59	50	50	55	40	40	45	40	40	40
	ER	-	6	-	-	-	38	11	8	68	-	21	9	24	-	104	101	33	47	43	-
S.TRA	CUF	32	11			-	1	2	5	29	47	59	55	63	72	54	56	61	52	50	48
(7%)	FIR	42	9			4	9	5	22	96	127	88	86	79	112	-	-	72	45	47	83
	DWR	65	14			6	14	7	34	148	196	135	132	121	172	-	-	110	69	72	128
	WWF	44	12			4	11	5	23	142	123	98	89	95	110	74	76	94	79	78	79
	NWW	36	10			4	10	4	20	127	101	77	71	76	95	54	41	56	45	44	46
S.TON	CUF				1	2	2	12	31	47	59	65	63	65	74	56	54	59	50	48	20
(13%)	FIR				12	6	3	77	164	29	109	94	94	81	118	-	-	70	43	35	30
	DWR				19	9	4	119	253	45	168	144	144	125	182	-	-	107	66	54	46
	WWF				14	5	4	84	173	77	102	105	98	98	115	76	74	92	77	69	30
	NWW				13	4	3	77	157	55	80	84	80	79	100	57	39	54	43	35	13
W.TRA	CUF	45	35	8		1	2	2	2	3	24	41	40	50	61	50	52	61	56	54	52
(21%)	FIR	65	30	8		12	3	5	6	2	152	110	71	66	105	-	-	72	49	51	92
	DWR	100	46	12		19	4	7	9	3	234	170	109	102	161	-	-	110	75	78	142
	WWF	66	39	9		14	4	5	5	5	162	124	71	81	99	70	72	94	84	82	87
	NWW	57	33	8		13	3	4	4	3	149	123	53	62	84	51	37	56	50	48	53
W.TON	CUF	18				1	1	2	2	12	31	47	50	55	69	52	54	63	54	52	48
(59%)	FIR	28				7	7	5	6	42	173	76	81	71	113	-	-	74	47	49	78
	DWR	43				10	11	7	9	65	267	117	125	109	173	-	-	114	72	75	120
	WWF	28				7	9	5	5	62	183	85	83	86	109	72	74	97	82	80	76
	NWW	23				7	8	4	4	55	166	64	65	67	94	53	39	59	48	46	43

Table G 19 MONTHLY MEAN REFERENCE CROP EVAPOTRANSPIRATION[1/] AND PAN EVAPORATION

Unit: mm/day

	Han River			Seomjin River						
	Seoul			Gwangju			Jeonju			Average
	Ep	Eo	C	Ep	Eo	C	Ep	Eo	C	C
Jan.	16	37	0.43	28	48	0.58	12	36	0.33	0.46
Feb.	34	46	0.74	40	57	0.70	33	42	0.79	0.75
Mar.	67	78	0.86	70	94	0.74	58	74	0.78	0.76
Apr.	104	114	0.91	98	120	0.82	89	108	0.82	0.82
May	138	153	0.90	135	151	0.89	121	145	0.83	0.86
June	132	142	0.93	134	158	0.85	124	148	0.84	0.85
July	122	115	1.06	138	153	0.90	127	135	0.94	0.92
Aug.	128	130	0.98	140	165	0.85	128	146	0.88	0.87
Sep.	96	108	0.89	101	119	0.85	89	105	0.85	0.85
Oct.	66	89	0.74	67	100	0.67	59	86	0.69	0.68
Nov.	39	57	0.68	39	65	0.60	29	52	0.56	0.58
Dec.	23	40	0.58	25	49	0.51	22	38	0.58	0.55
Total	965	1,109		1,015	1,279		891	1,115		

	Nagdong River								
	Busan			Daegu			Chupungryeong		
	Ep	Eo	C	Ep	Eo	C	Ep	Eo	C
Jan.	72	79	0.91	36	61	0.59	39	55	0.71
Feb.	76	78	0.97	26	65	0.40	47	63	0.75
Mar.	106	104	1.02	84	105	0.80	81	102	0.79
Apr.	119	112	1.06	114	133	0.86	111	137	0.81
May	144	130	1.11	148	169	0.88	147	180	0.82
June	133	123	1.08	149	167	0.89	137	159	0.86
July	133	122	1.09	154	156	0.99	127	136	0.93
Aug.	158	152	1.04	152	169	0.90	129	149	0.87
Sep.	125	115	1.09	103	114	0.90	91	113	0.81
Oct.	114	114	1.00	76	96	0.79	70	100	0.70
Nov.	81	91	0.89	46	67	0.69	43	68	0.63
Dec.	69	84	0.82	35	59	0.59	37	55	0.67
Total	1,330	1,304		1,123	1,361		1,059	1,317	

Remarks; 1/: Estimated by a modified Penman formula (Ref. G 13)
Ep: Estimated reference crop evapotranspiration
Eo: Pan evaporation
C: C = Ep/Eo

Observation Period: Seoul ; 1954 - 1976, Busan; 1952 - 1976,
Gwanju; 1952 - 1976, Daegu; 1952 - 1976,
Jeonju; 1952 - 1976, Chupungreong; 1953 - 1976,

Table G 20 ESTIMATED REFERENCE CROP EVAPOTRANSPIRATION IN 1967 AND 1968

Unit: mm/day

Year	Month	Han River			Seomjin River				
		Seoul			Gwangju	Jeonju	Average		
		C	Eo	Ep	C	Eo	Eo	Eo	Ep
1967	Oct.	0.74	87	64	0.68	123	101	112	76
1968	Apr.	0.91	143	130	0.82	134	135	135	111
	May	0.90	137	123	0.86	131	131	131	113
	June	0.93	169	157	0.85	174	180	177	150
	July	1.06	115	122	0.92	189	120	155	143
	Aug.	0.98	143	140	0.87	141	109	125	109
	Sep.	0.89	121	108	0.85	123	117	120	102

Year	Month	Nagdong River								
		Busan			Daegu			Chupungryeong		
		C	Eo	Ep	C	Eo	Ep	C	Eo	Ep
1967	Oct.	1.00	128	128	0.79	103	81	0.70	113	79
1968	Apr.	1.06	115	122	0.86	144	124	0.81	163	132
	May	1.11	119	132	0.88	157	138	0.82	151	124
	June	1.08	147	159	0.89	203	181	0.86	189	163
	July	1.09	119	130	0.99	155	153	0.93	150	140
	Aug.	1.04	156	162	0.90	156	140	0.87	154	134
	Sep.	1.09	98	107	0.90	121	109	0.81	123	100

Remarks; Eo: Pan evaporation
Ep: Estimated reference crop evapotranspiration by using the ratio C in Table G 19.

Table G 21 ESTIMATED EFFECTIVE RAINFALL ON IRRIGATED UPLAND

Unit: mm

			Han River Basin		Nagdong River Basin						Seomjin River Basin	
			Seoul		Chupungryeong		Daegu		Busan		Gurye	
Year	Month	Decade	R	ER	R	ER	R	ER	R	ER	R	ER
1967	Oct.	1	12	12	2	-	26	26	4	-	-	-
		2	14	13	20	19	15	15	25	24	7	3
		3	1	-	2	-	-	-	-	-	-	-
1968	Apr.	1	41	30	8	6	15	8	27	23	15	13
		2	-	-	32	22	21	14	17	10	28	23
		3	4	-	1	-	1	-	8	8	2	-
	May	1	4	-	11	10	15	13	8	-	40	38
		2	13	13	29	26	17	16	119	73	17	11
		3	25	20	9	-	-	-	9	9	8	7
	June	1	37	16	50	21	39	12	18	11	80	40
		2	4	-	-	-	-	-	1	-	4	-
		3	-	-	3	-	3	-	-	-	21	21
	July	1	165	52	22	19	22	10	23	19	15	9
		2	200	47	183	36	125	24	91	34	26	23
		3	48	5	21	16	44	25	107	21	1	-
	Aug.	1	82	32	78	46	49	34	105	46	106	60
		2	108	54	82	41	209	56	155	57	256	42
		3	173	14	23	2	30	18	87	20	35	11
	Sep.	1	100	11	19	13	16	11	14	12	47	40
		2	25	14	29	28	32	31	60	46	44	44
		3	1	-	-	-	2	-	21	14	-	-

Remarks; R: Rainfall
ER: Effective rainfall

Table G 22 IRRIGATION WATER REQUIREMENT AND NET AGRICULTURAL WATER WITHDRAWAL ON UPLAND

Unit: mm

	1967			1968																	
	Oct.			Apr.			May			June			July			Aug.			Sep.		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
k_c	(0.85)			(0.5)			(0.75)			(1.0)			(1.1)			(1.1)			(1.1)		
1. Han River Basin																					
ETP	(64)			(130)			(123)			(157)			(121)			(140)			(107)		
CUD	18	18	18	21	22	22	29	30	33	52	52	53	42	43	48	50	50	54	40	39	39
ER	12	13	-	30	-	-	13	20	11	16	-	-	52	47	5	32	54	14	11	14	-
FIR	6	5	18	40	22	22	16	10	22	36	52	53	-	-	43	18	-	40	29	25	39
DWR	10	9	33	73	40	40	29	18	40	65	95	96	-	-	78	33	-	73	53	45	71
WWF	24	20	25	55	30	30	35	34	41	65	71	73	42	43	64	57	50	69	51	48	54
NWW	6	3	9	35	10	15	22	22	28	48	55	61	19	8	20	15	4	21	15	12	21
2. Ngdong River Basin																					
2.1 Northern Zone (NSB)																					
ETP	(79)			(132)			(124)			(163)			(140)			(134)			(100)		
CUD	22	22	23	22	22	22	30	30	33	54	54	55	50	50	54	47	47	53	37	37	36
ER	-	19	-	6	22	-	10	26	-	21	-	-	19	36	16	46	41	2	13	28	-
FIR	22	3	23	40	-	22	20	4	33	33	54	55	31	14	38	1	6	51	24	9	36
DWR	40	5	42	73	-	40	36	7	60	60	98	100	56	25	69	2	11	93	44	16	65
WWF	30	23	32	37	22	30	37	31	45	66	74	76	62	55	68	47	49	72	46	40	49
NWW	12	5	16	21	7	15	25	19	32	51	59	64	51	27	40	14	10	33	20	15	28

Remarks;
*: Inclusive of pre-irrigation
k_c: Crop coefficient
ETP: Monthly reference crop evapotranspiration
CUD: Consumptive use per decase estimated on the basis of the monthly consumptive use
ER: Effective rainfall
FIR: Farm irrigation requirement
DWR: Diversion water requirement
WWF: Agricultural water withdrawal on farm
NWW: Net agricultural water withdrawal

Table G 22 Continued (2)

Unit: mm

		1967			1968																	
		Oct.			Apr.			May			June			July			Aug.			Sep.		
		1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
	k_c	(0.85)			(0.5)			(0.75)			(1.1)			(1.1)			(1.1)			(1.1)		
2.2	Central Zone (CSB)																					
	ETP	(81)			(124)			(138)			(181)			(153)			(140)			(109)		
	CUD	23	22	24	20	21	21	33	34	37	60	60	61	54	54	60	50	50	54	41	40	39
	ER	26	15	-	8	14	-	13	16	-	12	-	-	10	24	25	34	50	18	11	31	-
	FIR	-	7	24	40*	7	21	20	18	37	48	60	61	44	30	35	16	-	36	30	9	39
	DWR	-	12	44	73	13	38	36	33	67	87	109	111	80	55	64	29	-	65	55	16	71
	WWF	23	25	33	35	24	29	40	41	51	78	82	84	70	65	73	56	50	67	52	43	54
	NWW	7	8	17	17	6	13	24	27	37	59	66	73	60	41	45	28	11	20	19	13	30
2.3	Southern Zone (SSB)																					
	ETP	(128)			(122)			(132)			(159)			(130)			(162)			(107)		
	CUD	36	35	38	19	20	22	31	32	36	51	51	57	46	46	51	57	57	64	40	39	39
	ER	-	21	-	19	10	8	-	32	9	11	-	-	19	34	21	46	57	20	12	39	14
	FIR	36	14	38	40*	10	14	31	-	27	40	51	57	27	12	30	11	-	44	28	-	25
	DWR	65	25	69	73	18	25	56	-	49	73	93	104	49	22	55	20	-	80	51	-	45
	WWF	49	40	52	34	24	27	43	32	46	66	70	78	56	50	62	61	57	80	50	39	48
	NWW	38	26	40	14	4	9	29	9	20	44	52	65	44	32	35	18	11	22	18	5	17
3.	Seomjin River Basin																					
	ETP	(76)			(111)			(113)			(150)			(143)			(109)			(102)		
	CUD	21	21	23	18	19	19	27	27	31	50	50	50	50	51	56	39	39	42	38	38	36
	ER	-	3	-	13	23	-	38	11	7	40	-	21	9	23	-	60	42	11	40	44	-
	FIR	21	18	23	40	-	19	-	16	24	10	50	29	41	28	56	-	-	31	-	-	36
	DWR	38	33	42	73	-	35	-	29	44	18	91	53	75	51	102	-	-	56	-	-	65
	WWF	29	28	32	55	19	26	27	33	40	54	69	61	65	61	77	39	39	54	39	38	49
	NWW	20	20	25	35	-	8	7	15	23	32	47	40	47	42	62	20	4	16	4	4	16

Table G 23 CORRELATION AMONG THE STORAGE CAPACITY, CATCHMENT AREA, RESERVOIR AREA AND BENEFITED AREA IN EACH AGRICULTURAL ZONE

	(1) Capacity ha-m	(2) Catchment Area ha	(3) Reservoir Area ha	(4) Benefited Area ha	(5) (1)/(4) m	(6) (2)/(4)	(7) (3)/(4)	(8) (1)/(3) m	IWL %
1. Han River Basin									
FLIA	5,980	61,900	1,050	8,980	0.670	6.9	0.117	5.7	
Non-FLIA	3,060	49,000*	670*	8,920	0.340	5.5*	0.075	4.6*	
Total	9,040	110,900	1,720	17,900	(0.510)	(6.2)	(0.096)	(5.3)	80
2. Nagdong River Basin									
2.1 Northern Zone (NSB)									
FLIA	2,940	39,200	580	4,700	0.630	8.3	0.123	5.1	
Non-FLIA	2,240	54,400*	550*	8,200	0.280	6.6*	0.067*	4.1*	
Total	5,180	93,600	1,130	12,900	(0.400)	(7.3)	(0.088)	(4.6)	70
2.2 Central Zone (CSB)									
FLIA	9.200	102.500	1.870	14.500	630	7.1	0.129	4.9	
Non-FLIA	9,680	141,900*	2,480*	24,900	390	5.7*	0.100*	3.9*	
Total	18,880	244,400	4,350	39,400	(0.480)	(6.2)	(0.110)	(4.3)	50
2.3 Southern Zone (SSB)									
FLIA	3,500	39,100	1,130	8,600	410	4.5	0.131	3.1	
Non-FLIA	4,510	73,700*	1,810*	20,300	220	3.6*	0.089*	2.5*	
Total	8,010	112,800	2,940	28,900	(0.280)	(3.9)	(0.102)	(2.7)	45
3. Seomjin River Basin									
FLIA	4,720	76,500	1,043	10,200	460	7.5	0.103	4.5	
Non-FLIA	2,750	54,200*	785*	9,030	305	6.0*	0.087*	3.5*	
Total	7,470	130,700	1,828	19,230	(0.390)	(6.8)	(0.095)	(4.1)	70

Remarks; *: Estimated on the basis of dimensions of FLIA's reservoir
**: Collected from the Drought Conquest Record (Ref. G 4 and see Table G 25)
IWL: Initial water level for reservoir operation

Source : FLIA's reservoir (Ref. G 1), Non-FLIA's reservoir (Ref. G 4)

Table G 24 ACTUAL STORAGE CAPACITY IN JANUARY 1976 AND ITS STORAGE CAPACITY PLANNED

Unit: 10^6 m^3

	FLIA		Non-FLIA		Total			Initial Water Level
	PSC	ASC	PSC	ASC	PSC	ASC	PSC/ASC (%)	to be adopted (%)
1. Han River Basin	45.6	39.2	30.6	23.8	76.2	63.0	83	80
2. Nagdong River Basin								
-Northern Z.(NSB)	24.6	21.6	22.4	13.6	47.0	35.2	75	70
-Central Z. (CSB)	83.7	47.9	96.8	45.8	180.5	93.7	52	50
-Southern Z.(SSB)	39.3	20.4	45.1	18.2	84.4	38.6	46	45
3. Seomjin River Basin	80.8	64.0	27.5	18.6	108.3	82.6	76	70

Remarks; PSC: Planned reservoir storage capacity
ASC: Actual storage capacity in Jan. 1976

Source : Drought Conquest Record (Ref. G 4)

Table G 25 NET AGRICULTURAL WATER WITHDRAWAL PER UNIT AREA (HISTORICAL CROPPING PATTERN)

Unit: mm

1. Han River Basin

Year	Month	Decade	Paddy Depending on River CON	Paddy Depending on River UNC	Paddy Depending on Reservoir CON	Paddy Depending on Reservoir UNC	PSI	IU
1967	Oct.	1	28	26	16	16	-	6
		2	9	8	24	23	-	3
		3	1	1	-	-	-	9
	Nov.		-	-	44	44	-	-
	Dec.		-	-	-	-	-	-
1968	Jan.		-	-	8	8	-	-
	Feb.		-	-	7	7	-	-
	Mar.		-	-	9	9	-	-
	Apr.	1	-	-	52	52	-	35 1/
		2	-	-	-	-	-	10
		3	13	12	-4	-5	-	15
	May	1	4	4	6	6	-	22
		2	7	6	26	25	-	22
		3	81	74	-22	-29	-	28
	June	1	153	140	4	-9	-	48
		2	76	70	18	12	-	55
		3	105	96	108	99	-	61
	July	1	40	37	518	515	27	20
		2	33	30	58	55	34	8
		3	48	44	-135	-139	17	20
	Aug.	1	47	43	162	158	22	15
		2	41	38	62	59	43	4
		3	57	52	-28	-33	37	21
	Sep.	1	45	41	97	93	41	15
		2	49	45	-37	-41	9	14
		3	55	50	-81	-86	-	21
	Total		892	817	912	839	230	452

Remarks;
1/: Including pre-irrigation
CON: Consolidated paddy
UNC: Unconsolidated paddy
PSI: Paddy supplementarily irrigated
IU: Irrigated upland

Table G 25 Continued (2)

Unit: mm

2. Nagdong River Basin

2.1 Northern Zone (NSB)

Year	Month	Decade	Paddy Depending on River CON	Paddy Depending on River UNC	Paddy Depending on Reservoir CON	Paddy Depending on Reservoir UNC	PSI	IU
1967	Oct.	1	49	45	-48	-52	5	12
		2	24	22	55	53	7	5
		3	8	7	-6	-7	2	16
	Nov.		-	-	144	144	-	-
	Dec.		-	-	-	-	-	-
1968	Jan.		-	-	-	-	-	-
	Feb.		-	-	-	-	-	-
	Mar.		-	-	28	28	-	-
	Apr.	1	-	-	-	-	-	21 1/
		2	-	-	50	50	-	7
		3	8	7	-1	-2	-	15
	May	1	2	2	7	7	-	25
		2	10	9	37	36	-	19
		3	49	45	-22	-26	-	32
	June	1	89	82	77	70	-	51
		2	89	82	-55	-62	-	59
		3	147	135	72	72	-	64
	July	1	71	65	42	42	15	51
		2	50	46	452	448	57	27
		3	81	74	-31	-38	48	50
	Aug.	1	62	57	133	128	60	14
		2	58	53	92	87	56	10
		3	78	72	-49	-55	38	33
	Sep.	1	68	62	-34	-40	13	20
		2	65	60	-26	-31	9	15
		3	71	65	-14	-20	4	28
	Total		1,079	990	903	832	314	564

Remarks; 1/: Including pre-irrigation
CON: Consolidated paddy
UNC: Unconsolidated paddy
PSI: Paddy supplementarily irrigated
IU: Irrigated upland

Table G 25 Continued (3)

Unit: mm

2.2 Central Zone (CSB)

Year	Month	Decade	Paddy Depending on River CON	Paddy Depending on River UNC	Paddy Depending on Reservoir CON	Paddy Depending on Reservoir UNC	PSI	IU
1967	Oct.	1	50	46	5	1	12	7
		2	31	29	26	24	10	8
		3	13	12	9	8	5	17
	Nov.		-	-	54	54	-	-
	Dec.		-	-	-	-	-	-
1968	Jan.		-	-	-	-	-	-
	Feb.		-	-	-	-	-	-
	Mar.		-	-	46	46	-	-
	Apr.	1	-	-	11	11	-	17 1/
		2	-	-	28	28	-	6
		3	-	-	-	-	-	13
	May	1	2	2	11	11	-	24
		2	13	12	8	7	-	27
		3	5	5	-5	-5	-	37
	June	1	14	13	37	36	-	59
		2	105	96	2	-7	-	66
		3	183	168	187	172	-	73
	July	1	68	62	71	65	6	60
		2	51	47	238	234	56	41
		3	72	66	11	11	64	45
	Aug.	1	70	64	-17	-17	48	28
		2	53	49	393	389	46	11
		3	72	66	-60	-66	40	20
	Sep.	1	63	58	-49	-54	11	19
		2	59	54	-5	-10	9	13
		3	69	63	-73	-79	3	30
	Total		993	912	928	859	310	621

Remarks; 1/: Including pre-irrigation
CON: Consolidated paddy
UNC: Unconsolidated paddy
PSI: Paddy supplementarily irrigated
IU: Irrigated upland

Table G 25 Continued (4)

Unit: mm

2.3 Southern Zone (SSB)

Year	Month	Decade	Paddy Depending on River CON	Paddy Depending on River UNC	Paddy Depending on Reservoir CON	Paddy Depending on Reservoir UNC	PSI	IU
1967	Oct.	1	68	63	36	31	8	38
		2	44	41	23	20	11	36
		3	22	20	10	8	2	40
	Nov.		-	-	61	61	-	-
	Dec.		-	-	-	-	-	-
1968	Jan.		-	-	-	-	-	-
	Feb.		-	-	6	6	-	-
	Mar.		-	-	56	56	-	-
	Apr.	1	-	-	23	23	-	14 1/
		2	-	-	8	8	-	4
		3	-	-	-	-	-	9
	May	1	-	-	-	-	-	29
		2	13	12	160	159	-	9
		3	3	3	-5	-5	-	20
	June	1	3	3	2	2	-	44
		2	87	80	-42	-49	-	52
		3	174	160	20	20	-	65
	July	1	51	47	24	24	9	44
		2	43	39	177	173	30	32
		3	47	43	188	184	48	35
	Aug.	1	46	42	40	36	45	18
		2	41	38	57	54	37	11
		3	57	52	-57	-62	31	22
	Sep.	1	50	46	-58	-62	5	18
		2	38	35	60	57	29	5
		3	46	42	-24	-28	7	17
	Total		833	766	765	716	262	562

Remarks; 1/: Including pre-irrigation
CON: Consolidated paddy
UNC: Unconsolidated paddy
PSI: Paddy supplementarily irrigated
IU: Irrigated upland

Table G 25 Continued (5)

Unit: mm

3. Seomjin River Basin

Year	Month	Decade	Paddy Depending on River CON	Paddy Depending on River UNC	Paddy Depending on Reservoir CON	Paddy Depending on Reservoir UNC	PSI	IU
1967	Oct.	1	62	57	15	14	2	20
		2	46	42	1	1	-	20
		3	21	19	1	1	-	25
	Nov.		-	-	135	135	-	-
	Dec.		-	-	-	-	-	-
1968	Jan.		-	-	-	-	-	-
	Feb.		-	-	1	1	-	-
	Mar.		-	-	68	68	-	-
	Apr.	1	-	-	12	12	-	35
		2	-	-	35	35	-	-
		3	-	-	-	-	-	8
	May	1	-	-	56	56	-	7
		2	14	13	18	17	-	15
		3	4	4	-9	-9	-	23
	June	1	3	3	125	125	-	32
		2	88	81	21	14	30	47
		3	170	156	14	-	19	40
	July	1	58	53	-116	-121	14	47
		2	67	62	50	45	22	42
		3	92	84	35	27	16	62
	Aug.	1	56	51	283	278	50	20
		2	40	37	206	203	45	4
		3	61	56	7	2	42	16
	Sep.	1	55	50	63	58	39	4
		2	52	48	26	22	25	4
		3	59	54	-51	-56	5	16
	Total		948	870	996	928	309	487

Remarks; 1/: Including pre-irrigation
CON: Consolidated paddy
UNC: Unconsolidated paddy
PSI: Paddy supplementarily irrigated
IU: Irrigated upland