

Milyang-gang

Map of River



Geographical Survey, MOCT, Korea

Table of Basic Data

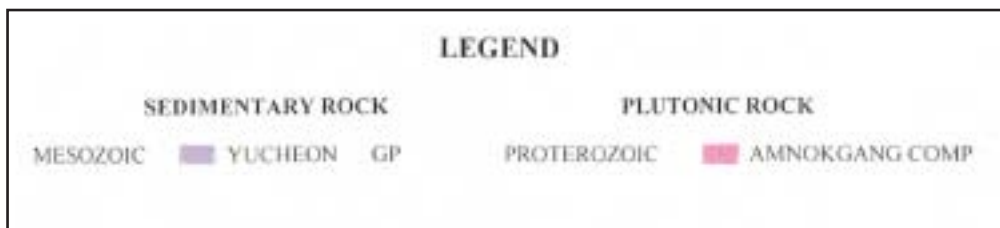
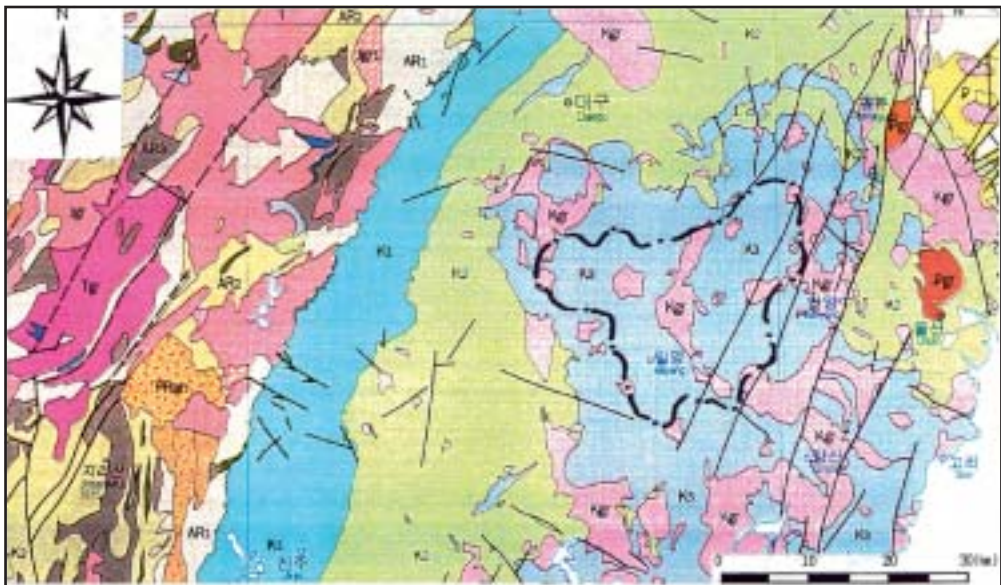
Name(s): Milyang-gang		Serial No. : Korea (R. of) -11
Location: Kyongnam Province, Korea	E 128° 32' ~ 129° 15'	N 35° 20' ~ 35° 40'
Area: 1,467.6 km ²	Length of the main stream: 96.2 km	
Origin: Mt. Kohyeon (1,033 m)	Highest Pt: Mt. Kaji (1,240 m)	
Outlet: Nakdong River	Lowest Pt: Confluence (11.2 m)	
Main geological features:		
Main tributaries: Tanjang-chun (358.40 km ²), Dongchang-chun (4.13 km ²), Chongdo-chun (341.33 km ²)		
Main lakes: None		
Main reservoirs: Unmun reservoir (135 × 10 ⁶ m ³ , 1994)		
Mean annual precipitation: 1,269.5 mm (1916 ~ 96) (basin average)		
Mean annual runoff: 34.3 m ³ /s at Milyang (1,359.0 km ²) (1973 ~ 96)		
Population: 200,000 (1994)	Main cities: Milyang, Chongdo	
Land use: Forest (80.1%), Rice paddy (12.7%), Urban (1.2%), Others (6.0%), (1993)		

1. General Description

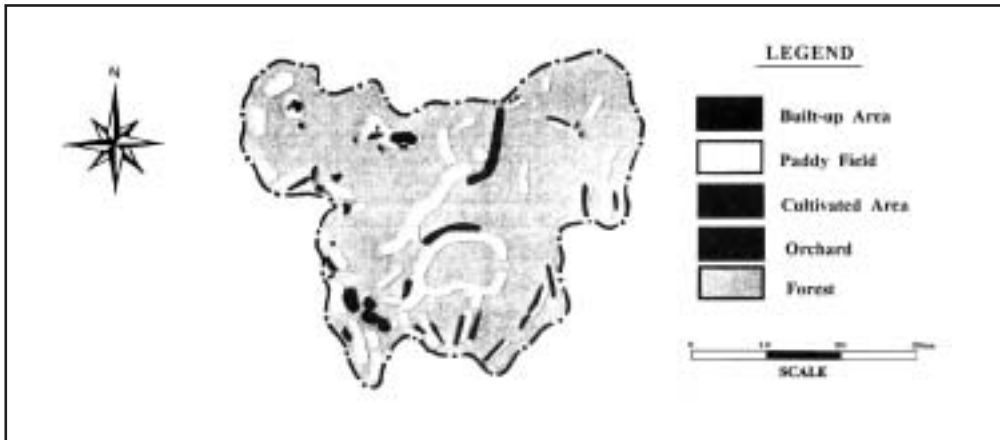
The Milyang-gang is one of the main tributaries of the Nakdong river flowing through the south eastern part of the Korean peninsula. The catchment area is 1,467.6 km² and the main stream, originating from Mt. Kohyeon (1,033 m), is 96.2 km long and flows into the downstream part of main stream of the Nakdong river. The average annual precipitation is 1,269 mm over the basin and the average annual discharge at Milyang (1,359 km²) was 34.3 m³/s in 1973~1996. The population of the basin was 200,000 in 1994. The Unnum dam, one of the main hydraulic structures in the basin, was built in 1994 to store 135 × 10⁶ m³ of water. The Milyang dam was to have been completed by 1998. These dams provide the cities of Taegu, Milyang and other areas with drinking water.

2. Geographical Information

2.1 Geological Map



2.2 Land Use Map

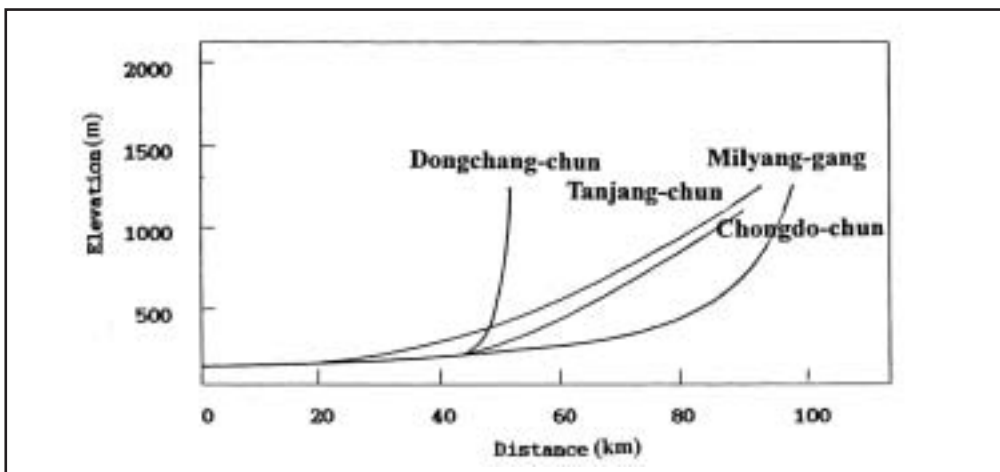


2.3 Characteristics of the River and the Main Tributaries

No.	Name of River	Length [km] Catchment area [km ²]	Highest peak [m]	Cities Population (1999)	Land use [%]
1	Milyang-gang (Main River)	96.20 1,467.6	Mt. Kaji 1,240	Milyang City 134,160	F (80.1) P (12.7) U (1.2) A (3.1) L (1.4) O (1.5)
2	Tanjang-chun (Tributary)	69.80 358.40	Mt. Kaji 1,240	Milyang City 134,160	
3	Dongchang-chun (Tributary)	5.30 4.13	Mt. Kaji 1,240	Chongdo Gun 56,827	
4	Chongdo-chun (Tributary)	41.00 341.33	Mt. Piseul 1,083	Chongdo Gun 56,827	

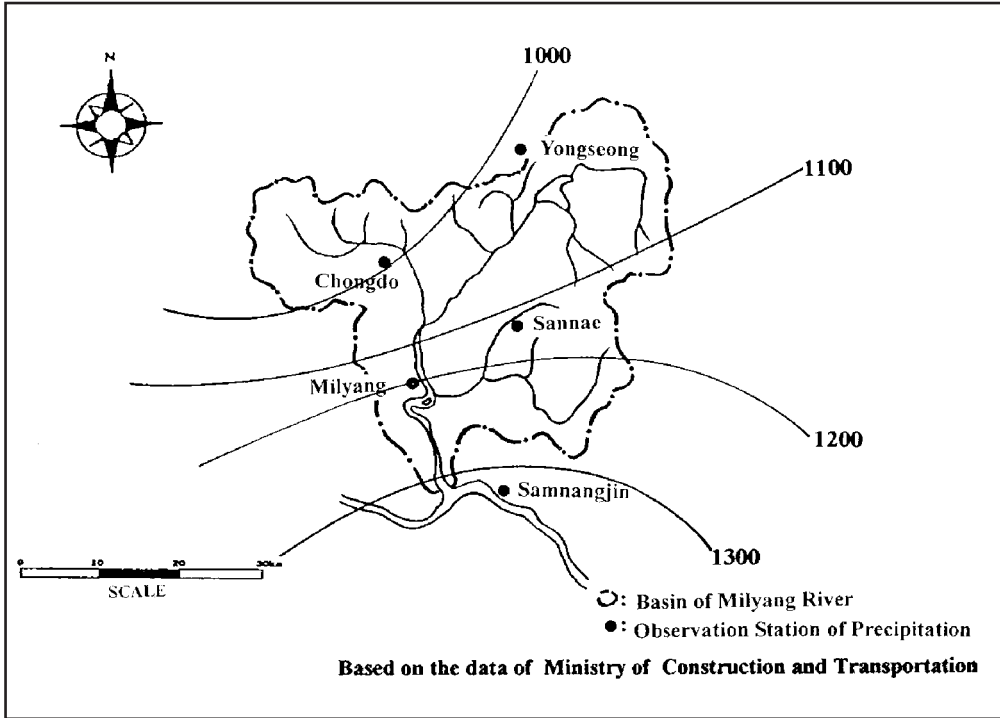
F: Forest L: Lake, river, marsh P: Paddy field U: Urban O: Orchard
A: Agricultural field (vegetable field, grass field)

2.4 Longitudinal Profiles



3. Climatological Information

3.1 Annual Isohyetal Map and Observation Stations



3.2 List of Meteorological Observation Stations

No.	Station	Elevation [m]	Location	Observation period	Mean annual Precipitation ¹⁾ [mm]	Mean annual Evaporation ²⁾ [mm]	Observation items
020620*	Milyang	19.8	N 35° 27' 30" E 128° 47' 17"	1916 ~ present	1,269.5	1,172.6	P (TB) E, DS
020700*	Chongdo	56.7	N 35° 41' 13" E 128° 45' 27"	1988 ~ present	1,049.6		P (TB)
020600*	Sannae	200.0	N 35° 34' 51" E 128° 53' 00"	1962 ~ present	1,118.4		P
024300*	Yongseong	250.0	N 35° 44' 53" E 128° 54' 34"	1988 ~ present	1,052.6		P

*: Serial number used by Ministry of Construction and Transportation

P: Precipitation E: Evaporation DS: Duration of sunshine TB: Tipping bucket with recording chart

1) Period for the mean is from the beginning of the observation period to 1990

2) Measured by 20 cm pan

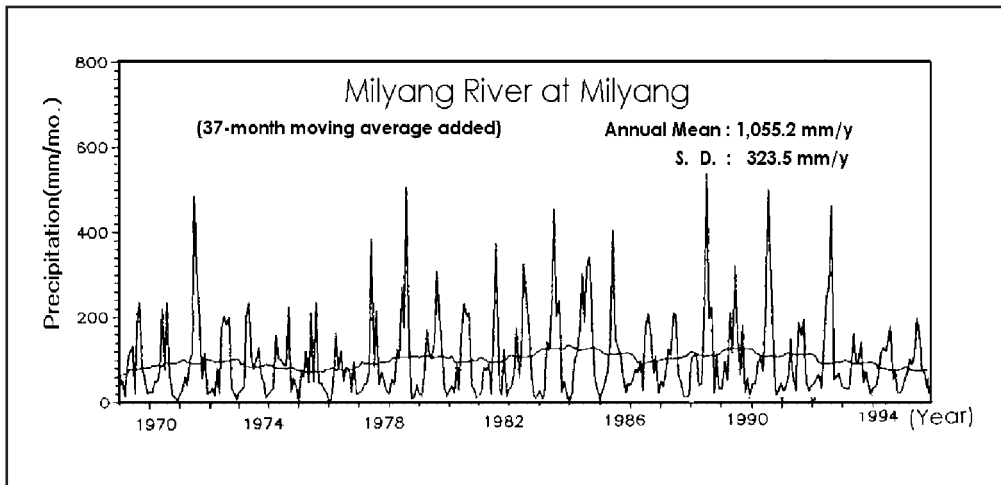
3.3 Monthly Climate Data

Station: Milyang

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Period for the mean
Temperature [°C]	-0.5	1.4	6.5	12.8	17.4	21.6	25.0	25.5	20.4	14.4	7.6	1.5	12.8	1960~1996
Precipitation [mm]	22.8	30.6	62.6	116.3	101.2	195.3	262.2	223.3	138.7	54.2	45.2	17.1	1,269.5	1916~1996
Evaporation [mm]*	53.7	63.0	96.0	118.5	142.9	137.0	128.6	135.3	100.8	88.9	58.9	49.1	1,172.6	1960~1996
Solar radiation [MJ/m ² /d]	8.1	11.3	12.6	13.4	16.2	15.4	14.1	14.9	13.1	12.2	10.6	7.9	12.5	1974~1996
Duration of sunshine [hr]	204	192	225	233	256	209	187	217	192	215	188	201	2,519	1974~1996

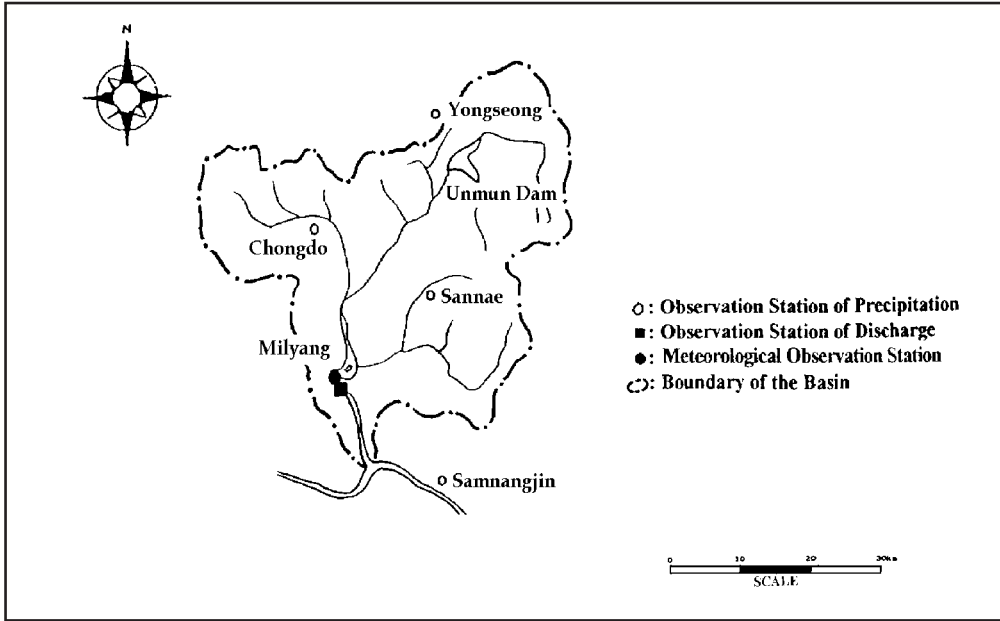
* measured by 20 cm pan

3.4 Long-term Variation of Monthly Precipitation Series



4. Hydrological Information

4.1 Map of Streamflow Observation Stations



4.2 List of Hydrological Observation Stations

No.	Station	Location	Catchment area (A) [km ²]	Observation Period	Observation items ¹⁾ [Frequency]
52*	Milyang	N 35° 28' E 128° 46'	1,359	1973 ~ 1996	H1

No.	\bar{Q} ²⁾ [m ³ /s]	Qmax ³⁾ [m ³ /s]	Qmax ⁴⁾ [m ³ /s]	Qmin ⁵⁾ [m ³ /s]	\bar{Q}/A [m ³ /s/100km ²]	Qmax/A [m ³ /s/100km ²]	Period of statistics
52*	34.3	2,595.4	1,012.9	1.90	2.52	190.9	1973 ~ 1996

*: Serial number used by Ministry of Construction and Transportation

1) H1: water level in recording chart

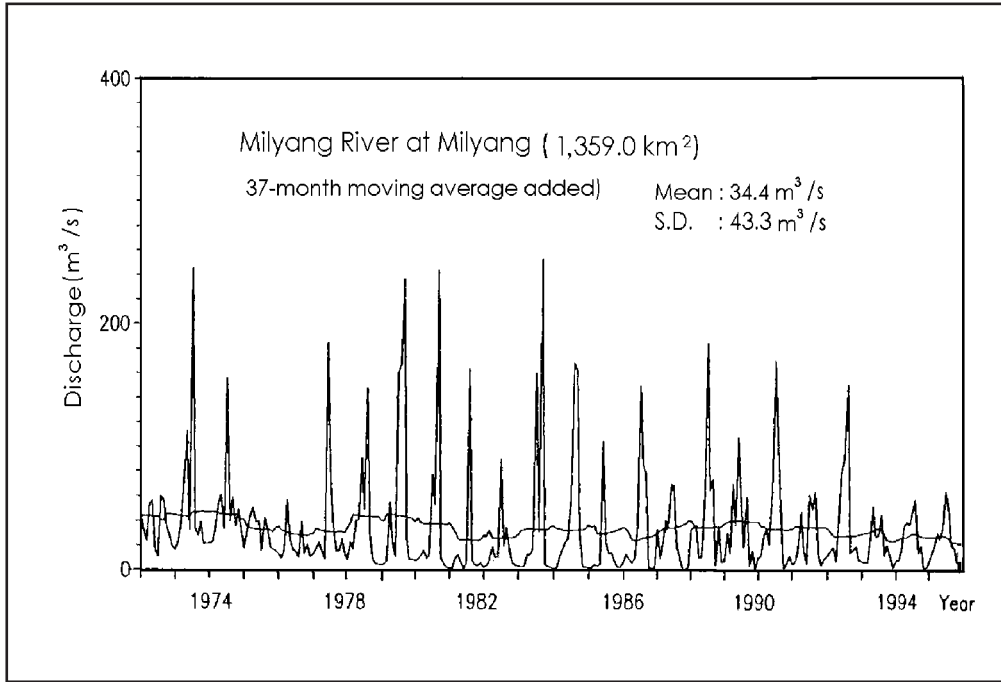
2) Mean annual discharge

3) Maximum discharge

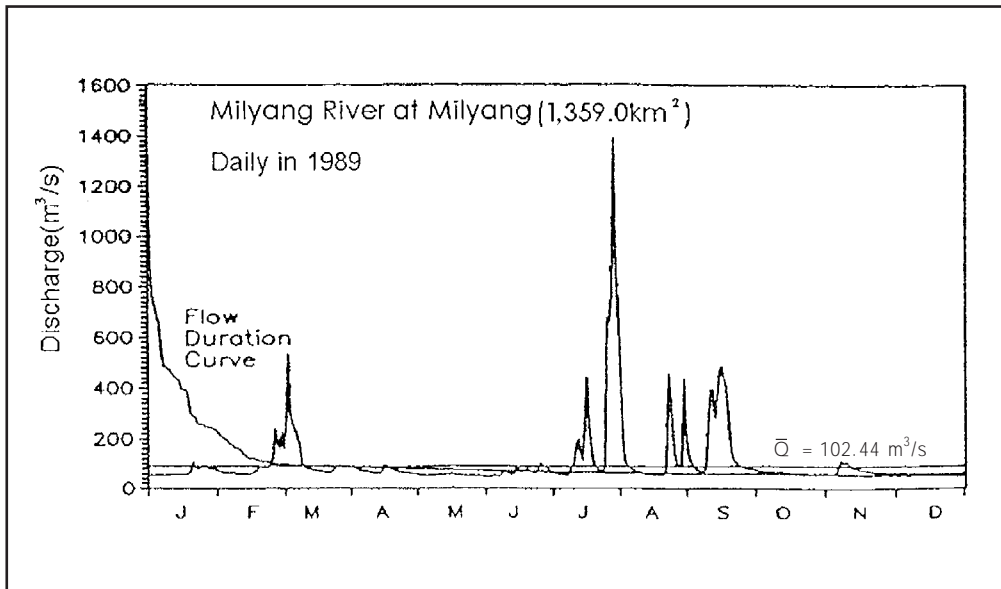
4) Mean annual maximum discharge

5) Mean annual minimum discharge

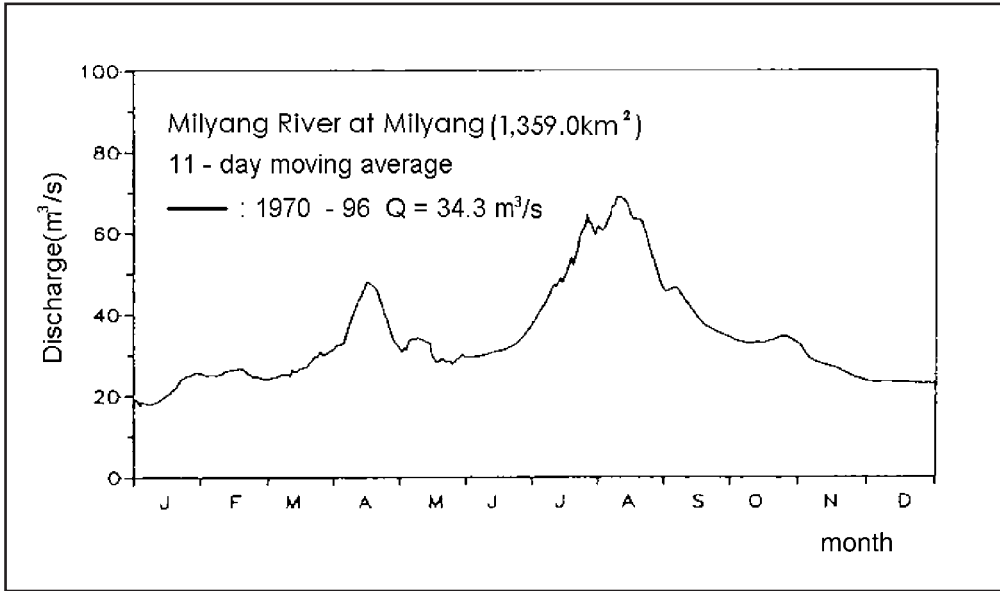
4.3 Long-term Variation of Monthly Discharge Series



4.4 Annual Pattern of Discharge Series



4.5 Unique Hydrological Features



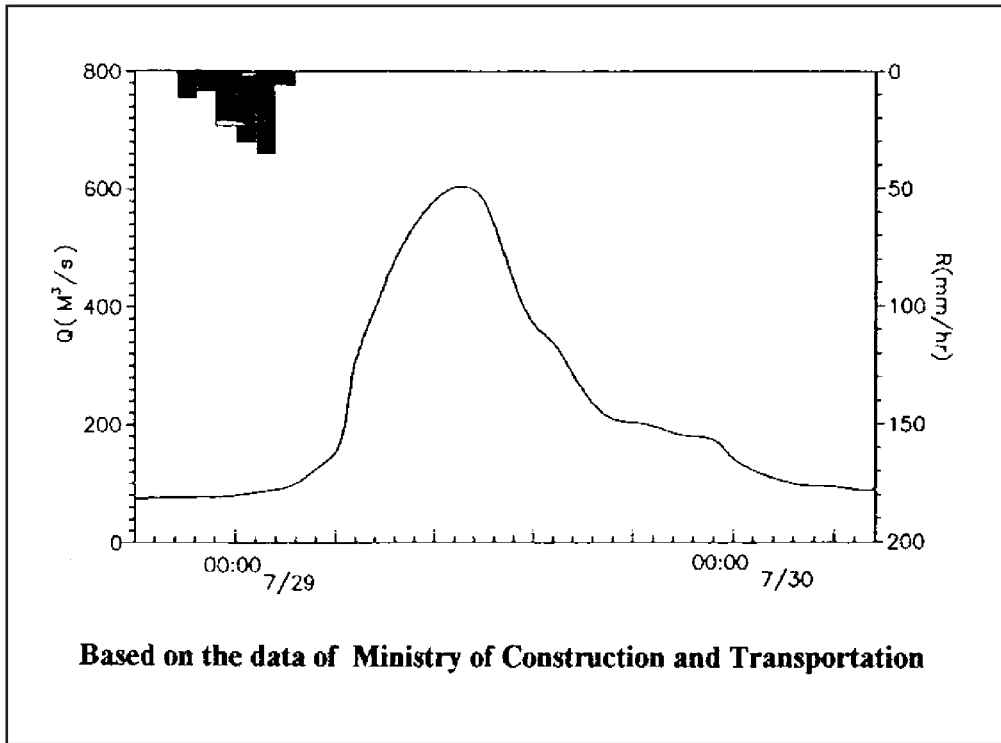
4.6 Annual Maximum and Minimum Discharges

Station: Milyang

Year	Maximum		Minimum		Year	Maximum		Minimum	
	Date	Discharge ¹⁾ [m ³ /s]	Month	Discharge ²⁾ [m ³ /s]		Date	Discharge ¹⁾ [m ³ /s]	Month	Discharge ²⁾ [m ³ /s]
1973	9.01	236.2	4	5.7	1985	6.24	799.1	2	1.8
1974	5.19	719.8	11	1.6	1986	6.25	922.7	2	2.0
1975	9.16	609.6	2	1.3	1987	7.16	437.7	3	0.2
1976	6.08	1,472.7	1	1.6	1988	7.26	348.0	2	3.1
1977	7.28	400.5	12	1.2	1989	7.29	1,226.6	1	1.4
1978	6.18	2,147.4	11	1.8	1990	6.20	757.9	12	1.7
1979	8.25	2,595.4	1	2.6	1991	8.23	1,370.8	1	1.9
1980	9.11	1,229.6	1	1.4	1992	9.24	804.3	2	2.1
1981	8.30	1,880.6	11	1.8	1993	8.22	1,175.1	11	2.0
1982	8.14	1,761.1	2	3.2	1994	8.01	588.0	1	0.5
1983	8.17	860.9	12	2.4	1995	9.12	263.4	1	0.6
1984	7.07	1,478.9	1	2.1	1996	9.09	224.7	2	1.7

1), 2) Instantaneous observation by recording chart

4.7 Hyetographs and Hydrographs of Major Floods

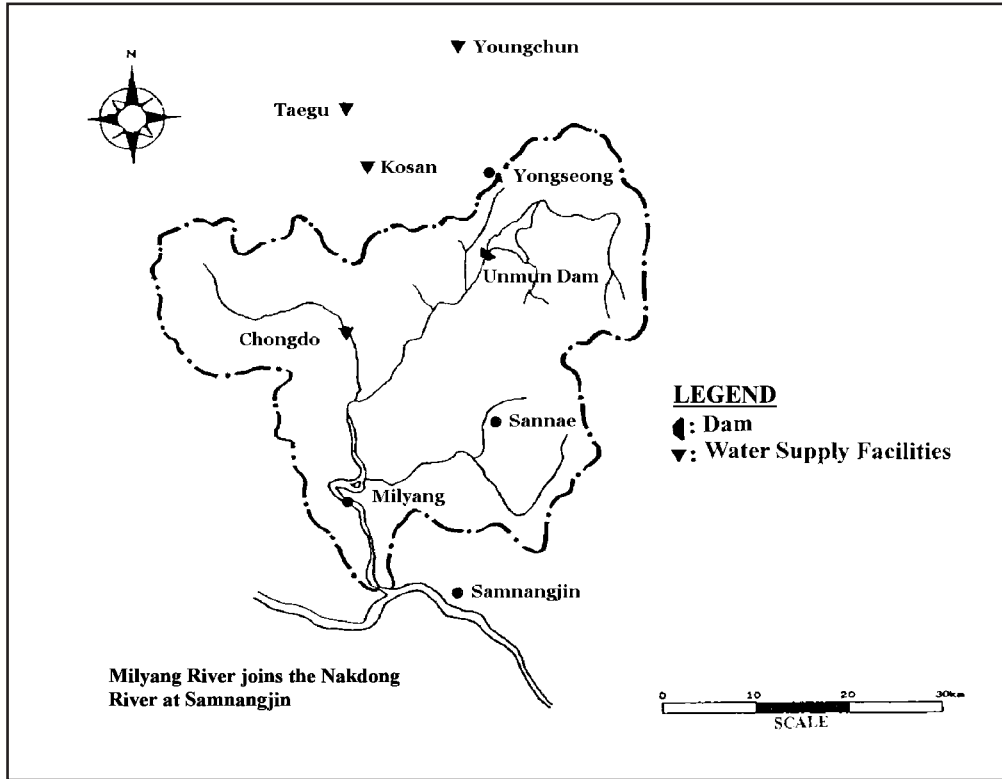


5. Water Resources

5.1 General Description

The Milyang river basin occupies about 6.2% of the Nakdong river basin, and agricultural and forestry areas in this basin are about 3.1% and 80.1% of the total basin area, respectively. The runoff of the river in the dry season is very small while floods are frequent in the wet season. The average annual precipitation in the basin is far greater than the average value for the whole of Korea, and most of the precipitation occurs between June and September. Because of the above average precipitation and its variability, floods or drought are likely almost every year. The Unnum reservoir provides domestic water supply for cities in the basin with the water being treated at the Jain and Unnum purification plants.

5.2 Map of Water Resource Systems



5.3 List of Major Water Resources Facilities

Major Reservoir

Name of river	Name of dam	Catchment area [km ²]	Gross capacity [10 ⁶ m ³]	Effective capacity [10 ⁶ m ³]	Purpose ¹⁾	Year of completion
Milyang	Unmun Dam	301.3	135.3	126.17	W, A, I	1994

1) W: Municipal water supply I: Industrial use A: Agricultural use.

Major Inter-basin Transfer

Name of transfer line	Name of rivers connected		Length [km]	Maximum capacity [m ³ /s]	Purposes ¹⁾	Year of completion
	From	To				
Chongdo Conveyance Channel	Unmun Dam	Chongdo	27.4	0.19	W, A	1995
Taegu Conveyance Channel	Unmun Dam	Taegu	27.5	3.47	W, I	1994
Youngchon Conveyance Channel	Unmun Dam	Youngchon	24.6	0.46	W, I	1994

1) W: Municipal water supply I: Industrial use A: Agricultural use.

5.4 Major Floods and Droughts

Major Floods

Date	Peak discharge [m ³ /s]	Rainfall [mm] Duration	Meteorological cause	Dead and missing	Major damages (Districts affected)
1972.7.4	1,082.4	124.5	Typhoon	2	Milyang City Changdo Gun
1978.6.18	2,147.4	227.9	Typhoon	3	Milyang City Changdo Gun
1979.8.25	2,595.4	271.4	Typhoon		Milyang City Changdo Gun
1989.7.29	1,426.6	138.5	Typhoon	1	Milyang City Changdo Gun
1993.8.22	1,175.1	133.5	Typhoon		Milyang City Changdo Gun

Major Droughts

Period	Areas affected	Major damages and counteractions
1976. 6 ~ 9	Milyang City Chongdo Gun	Supply cut ratio at the first stage: 11%
1982. 8 ~ 11	Milyang City Chongdo Gun	Supply cut ratio at the first stage: 16%
1994. 7 ~ 10	Milyang City Chongdo Gun	Supply cut ratio at the first stage: 20%

5.5 Groundwater and Water Quality

River Water Quality¹⁾ at Dongchang-chun²⁾ in 1996

Date	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
pH	7.3	7.8	7.1	7.8	7.0	6.8	7.2	7.1	8.2	7.8	7.7	7.8
BOD [mg/l]	0.8	2.6	2.6	3.0	2.3	2.3	3.2	2.3	4.2	3.0	1.6	2.2
CODMn [mg/l]	1.2	3.7	3.0	3.8	4.6	7.2	6.5	4.3	4.9	6.4	2.7	5.9
SS [mg/l]	2.0	12.4	2.0	7.2	17.5	58.8	19.2	20.8	5.5	7.5	2.5	6.0
Coliform group [MPN/100ml] ³⁾	33	17	27	33	34	35	220	110	110	130	79	540
Discharge [m ³ /s] ⁴⁾	-	-	-	-	3.7	1.3	-	-	-	-	-	-

1) Observed once a month on a dry day normally several days after rainfall.

2) Located near Chongdo Gun 18 km from Unmun dam

3) Measurement method: BGLB (brilliant green lactose bile) method.

4) Discharge on the observation date.

6. Socio-cultural Characteristics

The Milyang river is located in the south eastern part of the Korean peninsula. The railroad between Seoul and Pusan, the “Kyongbusun”, goes through Milyang city, the main city of the basin. The “Kyongbusun” also passes through the city of Chongdo in this basin. In addition, the Pusan-Taegu expressway runs parallel to the Seoul-Pusan railway line. Thus these cities lie on an important route from Seoul and Taejun to Ulsan, one of the largest industrial cities in Korea, and Pusan, the most important trade port.

7. References, Databooks and Bibliography

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Lee, S. T., Optimal Water Allocation Model through Inter-Basin Water Transfer, Proceedings of IWRA Beijing Seminar on Inter-Basin Water Transfer, Beijing, China 1986 (5.2, 5.3)

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