Methods for the Implementation of Total Water Pollution Management(TWPM) in Chungnam Province, Korea

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? . Introduction

The total water pollution management(here-in-after refer to as TWPM) system seeks to harmonize conservation and development by allowing regional developments to be carried out in an environment-friendly manner and within the scope of achieving and maintaining the desired water quality. Under the system, water pollutant sources are managed so as to keep the total amount of pollutants in public watersheds under a certain level or total allowance in accordance with the water quality standards.

Any waterbody of Korea that currently attains water quality standards, but for which existing and readily available data and information on adverse declining trends indicate that water quality standards will likely be exceeded by the time. Over 60% of our assessed waters still do not meet the national water quality standards, possibly due to the strict criteria.

Conventionally water quality management in Korea has been enforced by the concentration-based system, hence there are no proper measures for the prevention of an excessive pollutant load over an environmental capacity. Regulation on concentration is easy to administer yet cannot control the increase in total pollutant load when pollutant sources are clustered together or aggregated densely. Even though regulation on total load is not easy to enforce and monitor, but it is possible to control the load of pollutants under a specified environmental capacity.

? . Current Status

1. Background of adopt in Chungnam Province

Located in the heart of Korean peninsula, Chungnam is rapidly growing due to its geographic accessability and proximity to Northeast Asia. As a result of its many advantages in location status, social overhead infrastructure and the potential for growth, the province is a part of Korea's emerging industrial belt area. For the management of environment-friendly and keep it with the sustainability along with the development, the province took TWPM system for water conservation within the waterbodies in Geum River passes through the region. The applied area for TWPM system within Geum River Watershed in Chungnam Province has 9 primary administrative autonomous units.

<Figure 1> Location of Chungnam Province

<Figure 2> Watershed segments in Korea

2. Scope of planning

2.1. Scope of time

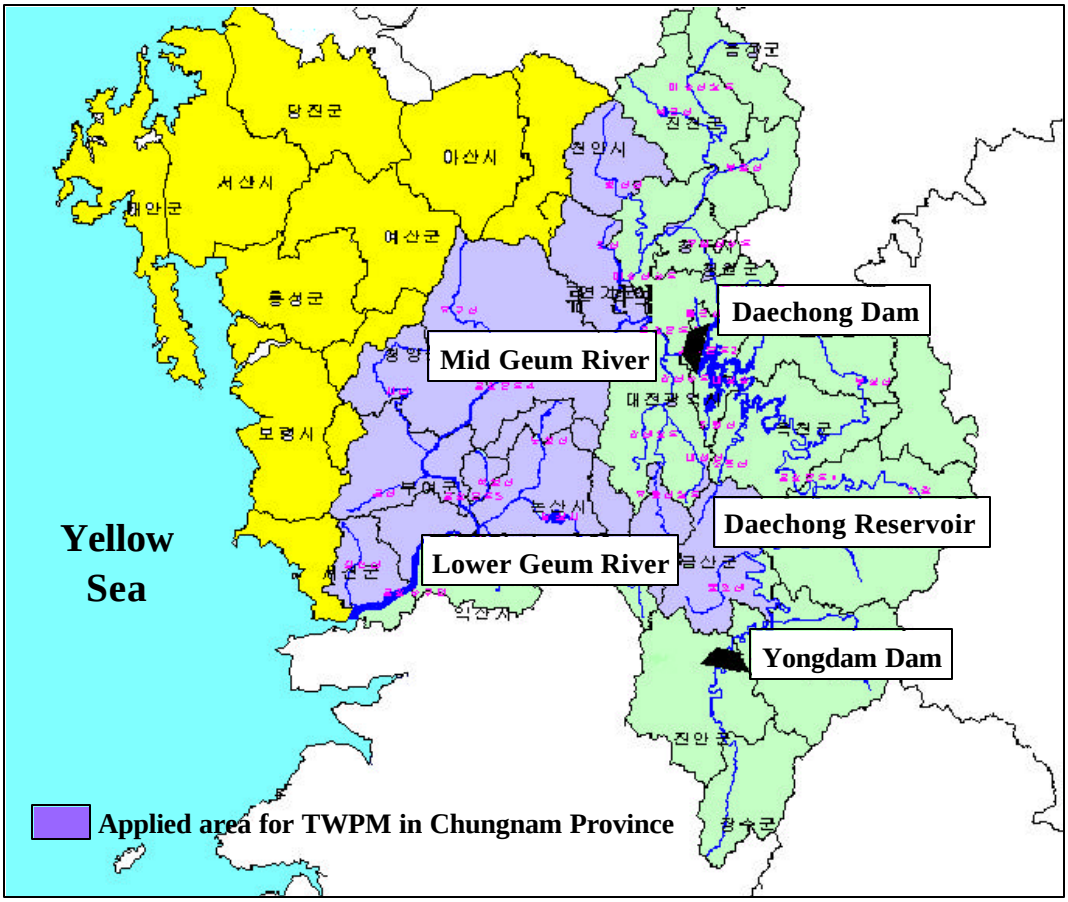
1) Standard for the survey of pollutant sources : December, 2002

2) Standard for the survey of environmental data of watershed : December, 2002

3) Measurement of water quality and flow : September, 2003 ~ May, 2004

2.2. Scope of area and contents

The area for TWPM is applied to 9 counties in the Provincial administration unit which is included in Geum River Watershed, so the total is 3,833.5? . It is equal to 44.6% of the Provincial area.



<Figure 3> Chungnam Province and Geum River Watershed

In accordance of Technical Manual for Watershed Management(NIER, 2002. 11) and Basic Guidance for TWPM in Geum River Watershed(Directive of the Ministry of Environment No 535, 2002. 11), survey of environmental dat a and pollutant sources in the watershed. as well as measure the water quality and flow quantity in the main points. On the basis of these results, establish of implementation plans contained the estimation of waste load, water quality modeling and allocation of waste load along the unit watershed sections or individual pollutant sources. Approximately the major scope of planning process of TWPM is as follows:

1) Survey of environmental data in the watershed (meteorology, water resources, streams and reservoirs)

2) Survey of pollutant sources in the watershed(population, water use, livestock, fish farming, land use and its regulation, landfill leachate, environmental treatment facilities, influent quantity and quality, transferring quantity and quality by pipeline and/or tank-lorry, effluent quantity and quality, use of pesticide and fertilizer, domestic and industrial water supply)

3) Estimation of water pollution load

4) Survey of flow quantity and water quality

5) Modeling of water quality

6) Establishment of reduction plan and regional development plan by city or county

7) Allocation of waste load and setting the target quality by stream reach

8) Questionnaire survey and public involvement presentation

9) Making establishment guideline for implementation plan

? . Enforcement Framework on TWPM

1. Set Water Quality Target

For the enforcement of TWPM notice of watershed segment and its unit area is announced by the Minister of Environment to set water quality target in some segment as well as in the provincial boundary points.

Compared to this, another one of notice of water quality target governed by provincial administration is set by the governors or the minister of environment.

Governors can set the water quality target in the end point of unit watershed area which is governed by their own competence on condition of achieving the target, up to apply for the approval of basic plan. However, if governors want to set the target, then they should announce their intention in advance for setting the target clearly until the date fixed by the minister of environment. And if governors did not set the target for specific points then the minister of environment can do it optionally.

2. Basic Guidance for TWPM

In accordance of the Act Relating to Water Resource Management and Community Support for Geum River, the Guidance stipulates basic method for enforcement including objective materials, survey on pollutant sources and estimation of waste load, as well as establishment of basic and implementation plan initiated by local autonomous government.

<Table 1> Target water quality in the major points of Geum River

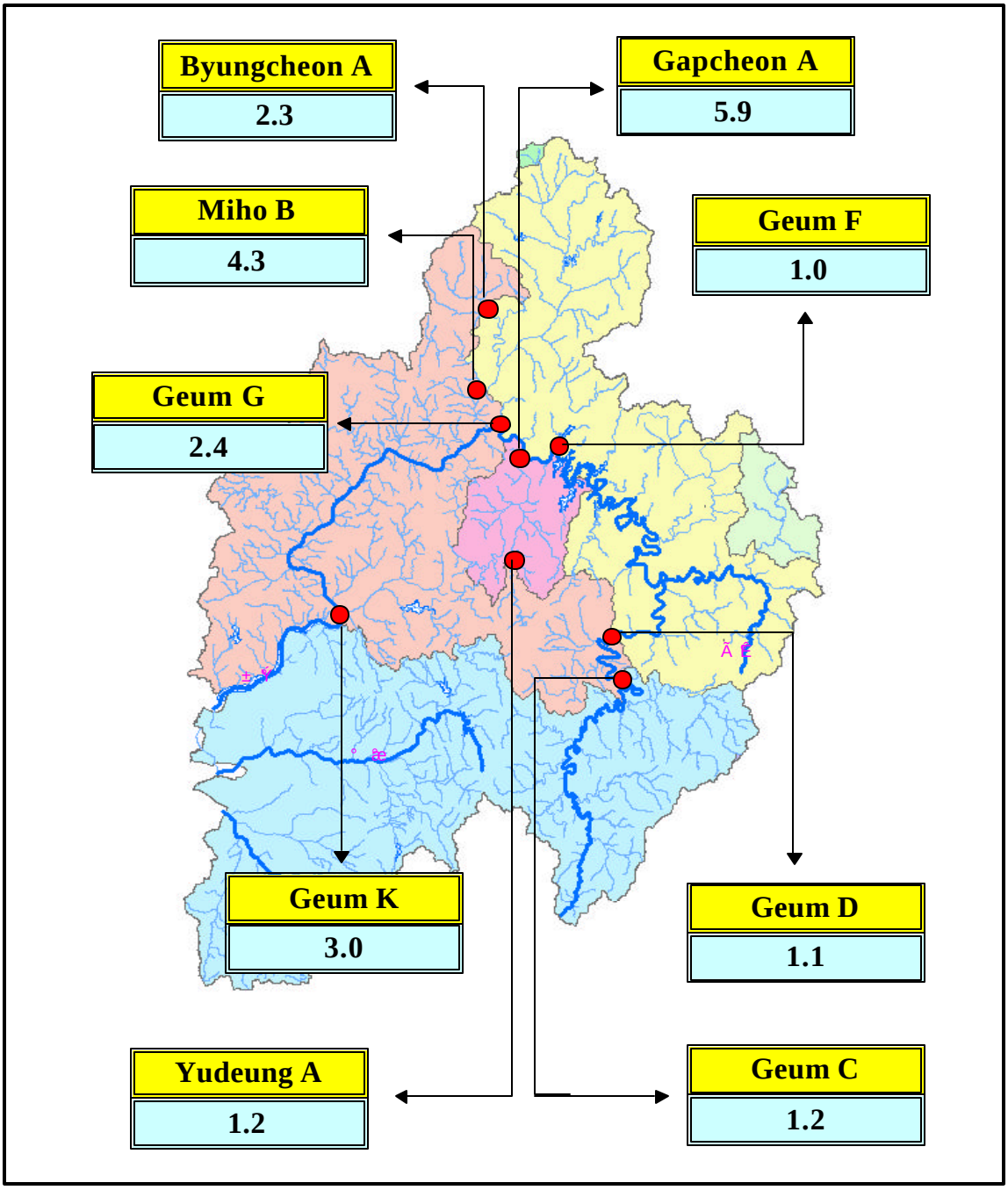
watershed segment	boundary point	draft target	adjusted target
Geum C	main stream in Jeonbuk-Chungnam	1.0	1.2
Geum D	main stream in Chungnam-Chungbuk	1.0	1.1
Geum F	main stream in Chungbuk-Daejeon	1.0	1.0
Yudeung A	Yudeung tributary in Chungnam-Daejeon	1.1	1.2
Gapcheon A	Gapcheon tributary in Daejeon-Chungbuk	5.9	5.9
Geum G	main stream in Chungbuk-Chungnam	2.3	2.4
Byungcheon A	Byungcheon tributary in Chungnam-Chungbuk	2.0	2.3
Miho B	Miho tributary in Chungbuk-Chungnam	3.6	4.3
Geum K	main stream in Chungnam-Jeonbuk	2.2	3.0

Remark : Unit of target quality is set by BOD5(mg/L)

Water quality target by the watershed segment in Geum River

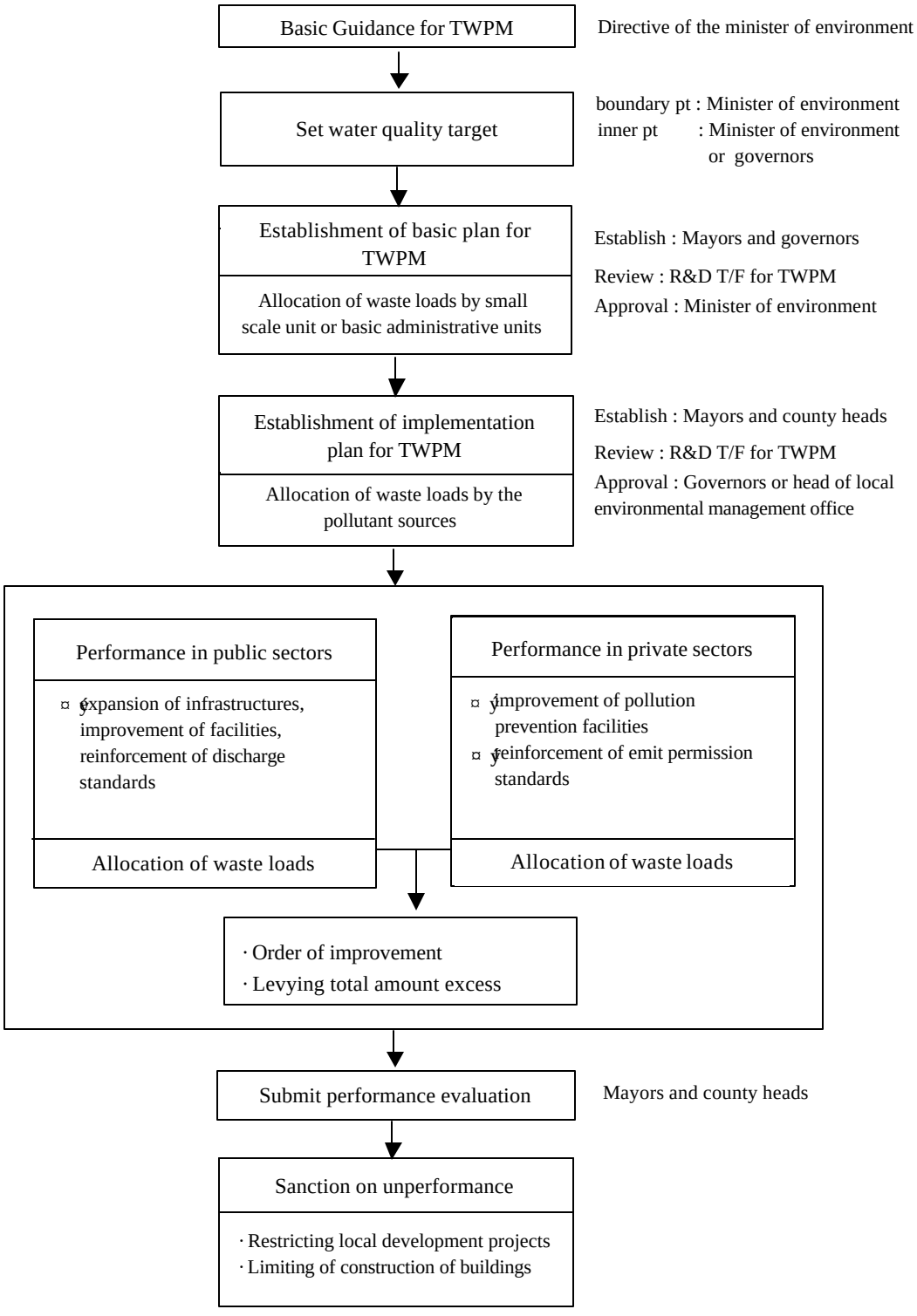
(Notice by the MOE, No. 2002-182)

Target water quality in the boundary points of Geum River Watershed(BOD_5)

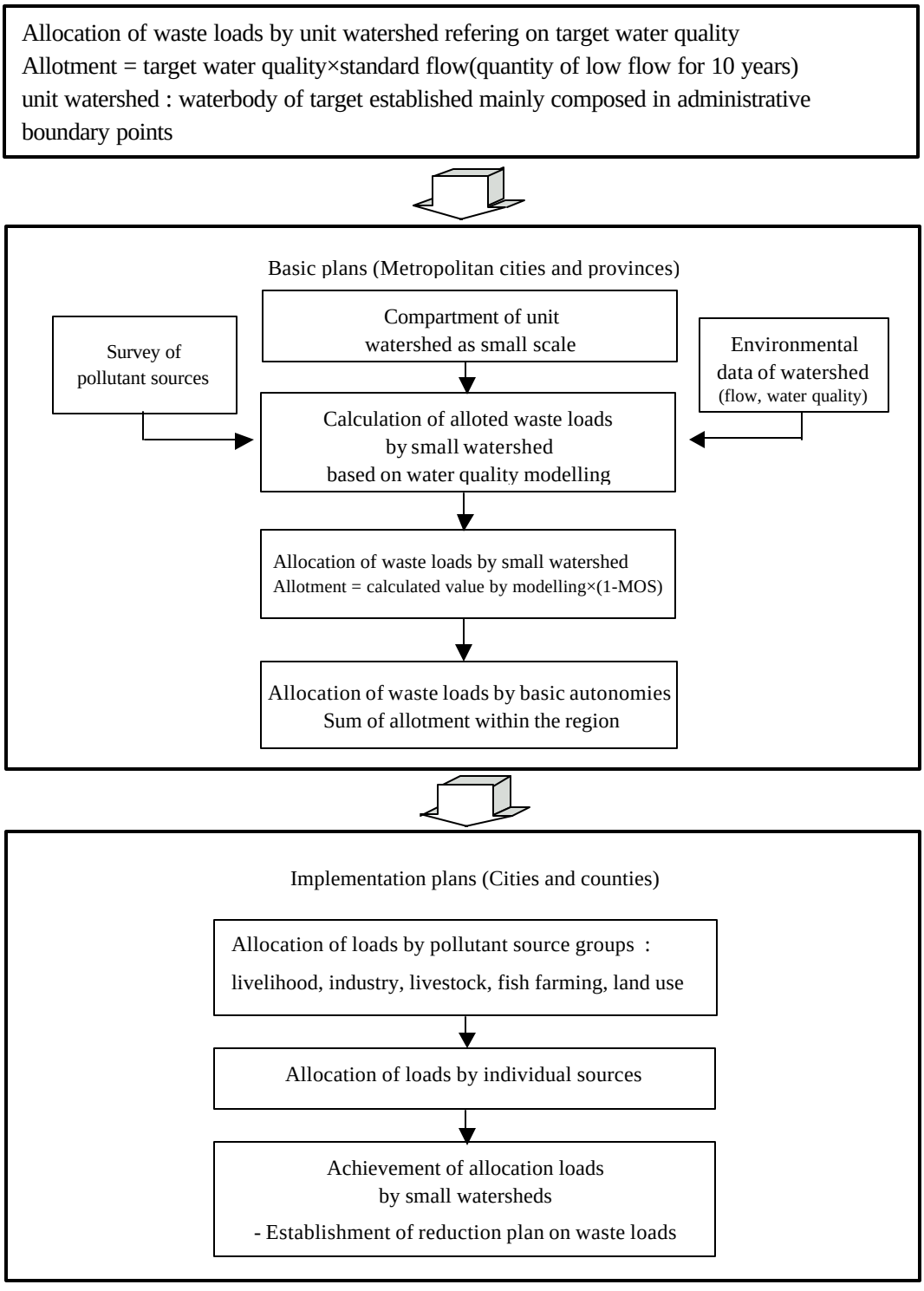


<Figure 4> Target water quality in the boundary points of Geum River

2.1 General procedure for Basic Guidance



<Figure 5> General promotion framework for TWPM



<Figure 6> Flowchart for planning

2.2 Contents of Basic Guidance

<Objective material for TWPM>

? The 1st planning period(2004~10) : BOD5

? The 2nd planning period(2011~15) : unsettled at present

Will be determined by research and discussion of R&D T/F and conferring with the watershed management committee until the end of 2005, and the draft for basic Guidance and setting the target will be prepared until the end of 2006 in parallel with the enforcement planning.

<Allocation of waste load by unit watershed>

In accordance of the notice separately from the Act Relating to Water Resource Management and Community Support for Geum River, allocation of waste load executed by the unit area in watershed segment for water quality

- Allotment = target water quality × standard flow(quantity of low flow for 10 years)

One of the allocation method based on the directive regulation is that administrative authority allocates the effluent allowance, which ignoring the discharger's will by setting the total effluent standard. This method has been calculated without considering the cost function and can be summarized as follows;

Minimize $Z=? GPi \cdot Xi$

Constraints $? GPi \cdot (1-Xi) \cdot Dij+BODj = BOD(g)j , 0=Xi=1$

Where, GPi : generation of total BOD pollutant in point i

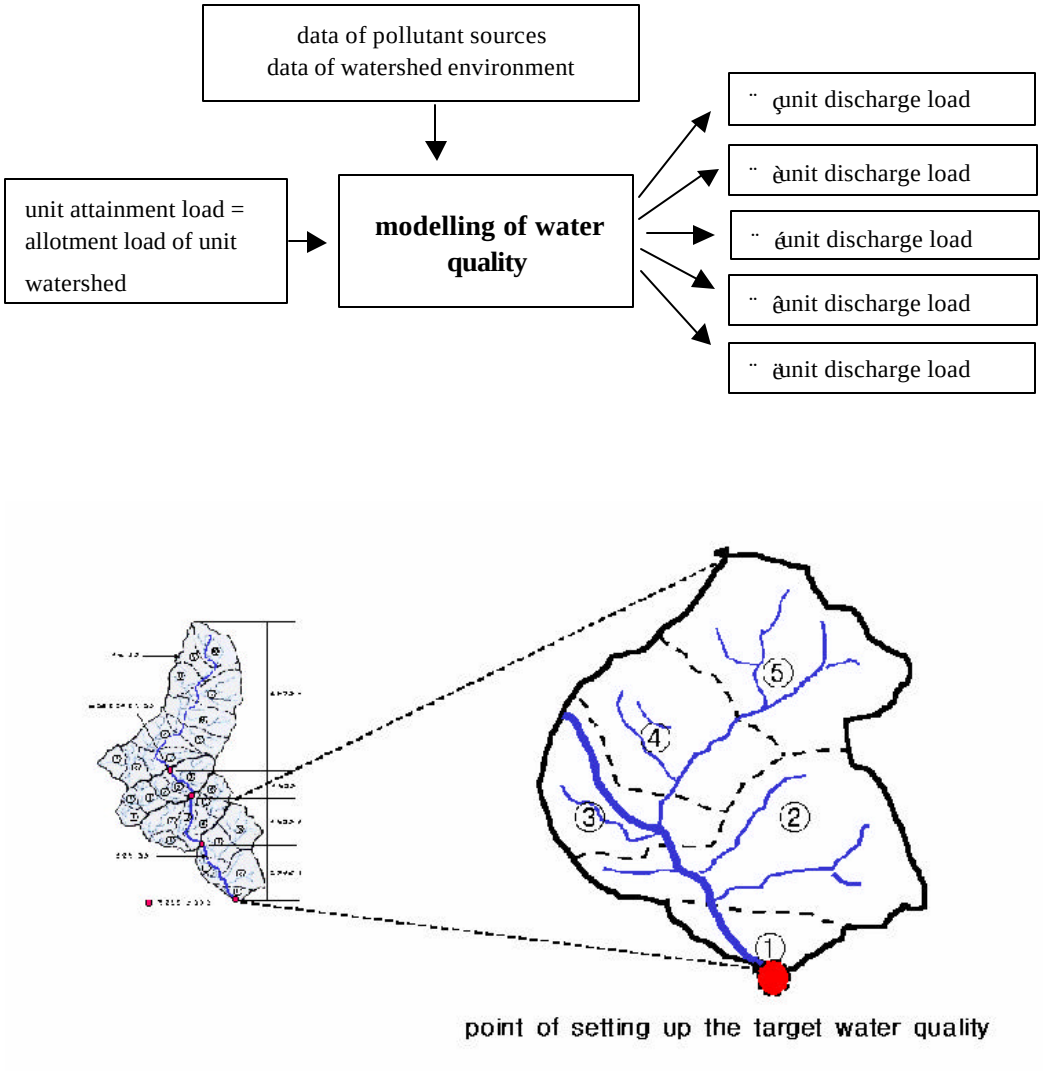
BOD(g)j : target BOD load in point j

BODj : basic BOD load in point j

Dij : marginal BOD increase unit by emission from point i to j

Xi : reduction rate in point i

Compared to this, another one of notice of water quality target governed by provincial administration is set by the governors or the minister of environment. As shown below, if water quality target is set in at the end of watershed being composed of 5 segments, then total waste load is allotted to 5 unit sections suitable for each other.



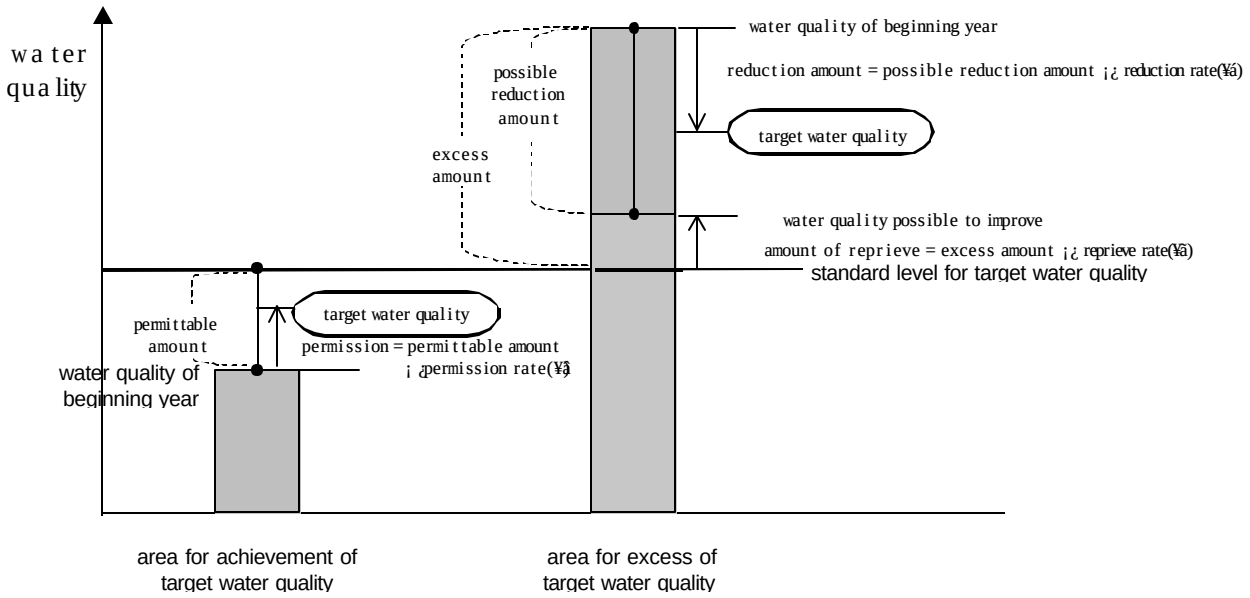
<Figure 7> Diagram for waste load allocation

<Establishment of basic plan>

? Dividing the unit watershed in small scale

? Allotment of waste load by local autonomy : Total load of allotment by small watershed controlled over its own administrative district.

Estimating the unit discharge load due to modeling by small scale to satisfy the allotment, where pollutants discharged in the area are being self-purified and they are transferred as unit attainment load in



<Figure 8> Conceptual diagram for setting of target water quality

some watershed set by water quality target.

During the estimation process of standard discharge by small-scale segment, governors can adjust the allotted quantity by the process of listening the pertinent primary administrative autonomies. For the calibration of uncertainty brought about modeling during the estimation of standard discharge, allocation of waste load within small watershed made by taking into account of the margin of safety.

Allotment = calculated value by modeling × (1-MOS)

<Establishment of implementation plan>

First, allocate the total waste load in some small watershed by the group of pollutant sources classified as main categories of livelihood, industry, livestock, fish farming and land use. And then reallocate the divided load by individual source. Metropolitan mayor, city mayor and county heads fix the method on allotment through the listening of objects applicable to the system.

Estimate reduction target for the achievement of allotment set by small watershed, and the allotment for regional development which is composed of natural increase of pollutant sources and economic growth, then distribute the total sum during the implementation period by annually.

3. Basic plan

Time limit of request for approval of the 1st basic plan based on the Act Relating to Water Resource Management and Community Support for Geum River, is just before mid-July, 2004.

Subject of planning establishment : Within the unit watershed for TWPM announced by the minister of environment, the province which occupied the largest area establish the plan. However, if raised formal objection then head of local environmental management office can adjust it within the watershed.
Planning period : Basically 5 years, but during the 1st stage, it is set from 2004 to 2010 by the annex of enforcement regulation.
Object of exception for approval of planning change : Allotment of small scale watershed, local autonomy, and relevant articles that do not changed the Guidance of enforcement plan.
Main contents : Distinguish of TWPM unit area by small scale section. Survey of required data for planning such as land use, pollutant sources and environmental status of watershed is made by the basic Guidance for unit watershed and small-scale section. If unit watershed for TWPM is composed of more than 2 provinces, then relevant governors share the data for planning including environmental data for watershed, survey of pollutant sources and estimating results of load. To achieve the goal of allotment of waste load, allocation distributed by autonomy and/or small-scale watershed unit.

4. Implementation plan

Subject of planning establishment: Individual autonomy within the unit watershed exceeding the target water quality

Criterion of judgment for exceeding the set target: Local environmental management office select the end point of unit watershed by conferring with the pertinent province. Since January 2003, water quality is measured and evaluated by the enforcement regulation of the Act Relating to Water Resource Management and Community Support for Geum River. If measured data for 3 years exceeded two times consecutively, then that area is determined as an objective unit watershed for the enforcement of TWPM and announced to the relevant administrative autonomy. However, if judgment for the establishment of implementation plan is difficult to measure the water quality for 3 years, then follow the provisional stipulation referred to as the annex of enforcement regulation.

Period for implementation plan : Basically same with the basic planning period as 5 years, but the period for enforcement is different with each local autonomy during the 1st phage(2004~2010). Hence, the period for planning based on the law is as follows;

<Table 2> Method of judgment for the selection of object

watershed	applied area	applied time limit	applied period and frequency
Geum River Watershed	metropolitan and city area	July, 2005	2-year measuring data, 1 time
	counties belong to Daecheong Reservoir watershed	July, 2006	3-year measuring data, 1 time

<Table 3> Period for application of implementation plan

watershed	applied area	applied period
Geum River Watershed	metropolitan and city area	August, 2005~December, 2010
	counties in the area of Daecheong Reservoir watershed	August, 2006~December, 2010
	other area of counties	August, 2008~December, 2010

<Request for approval and responsible agency>

Area that target water quality is set by mayor and/or governor : approval by mayor and/or governor with deliberation of the head of local environmental management office

Area that target water quality is set by minister of environment : approval by the head of local environmental management office just passing through the competent mayor and/or governor

Allocation of waste load by grouped or individual pollutant sources to achieve the allotment imposed to small-scale watershed or local administrative unit.

Determination of regional development quantity and load reduction target to achieve the allotment imposed to small-scale watershed or local administrative unit. Distribution of load due to regional development annually and the establishment of developing plan. Establishment of load reduction plan to achieve the imposed allotment

5. Performance measure for implementation plan

Allocation of waste load

Agent in charge of allocation for the objects is classified as 2 categories.

Publicly-owned treatment facilities(wastewater, sewage, night-soil and livestock) : head of local environmental management office

Discharging facilities except publicly-owned : mayors and county heads

Method of allocation

Allocation subject should announce the waste load, time for performance and discharging quantity divided by objects within 30 days before approval of implementation plan.

Allocation object should submit the detailed statement to keep up with the allotment including improvement, installation of apparatus for measuring the discharge, emission quantity by final outlet to the responsible agent within 60 days before fulfilling the plan.

Reviewing the material submitted, if recognized to exceed the load allocated, agent can assign the discharge additionally by final outlet with measurement directly.

Sanction in unfulfillment

One of major economic disincentive method is levying total excess fund. Total amount excess charge is imposed to the object exceeding the load allocated or emission quantity. However, if emission charge is levied in accordance with the Water Quality Conservation Act(WQCA), Act on the Disposal of Sewage, Excreta and Livestock Wastewater(ADSEL) and/or a fine for default by the Special Law on Regulation of Environmental Crime(SLREC), then reduce the amount of charge equivalent to the levied.

Agent can order the measure for improvement of pollution prevention to the enterprise exceeding the allotted load or emission quantity, even if it does not comply with, then tighten control over the measure to the suspension of operation, levying penalty and even to the closure of emission facilities.

Restriction of building permit

Agencies concerned including mayors and county heads can restrict the construction of building if target water quality is exceeded on the ground of the Act Relating to Water Resource Management and Community Support for Geum River. If building permit is restricted, then area for permit, object and period should announce in advance.

6. Evaluation of performance of implementation plan

Mayors and county heads report the evaluation of performance to the local environmental management office and watershed management committee at the end of March yearly. After reviewing the evaluation report, local environmental management office requires work out a countermeasure and fulfillment for the needs satisfactory.

7. Sanction on unperformance of TWPM system

Restriction of development permission in urban planning, industrial complex, resort and tourist attraction projects is levied. Restriction of location of large emission facility is also taken, such as above Class? which discharges wastewater more than 200? per day based on the Water Quality Conservation Act(WQCA)