

Watershed Management and Implementation of Total Pollution Load Management System (TPLMS) for Water in Korea

Hyun-Joo Moon

Korea Environment Institute

Abstract

Korea launched new national water quality improvement initiatives implementing watershed management and total pollution load management system (TPLMS). This paper summarizes these changes of water pollution management policy in Korea and implementation of TPLMS with discussion of the difficulties encountered in implementation. These Korean experiences can provide benchmarking references for the other Asian countries.

1. Water Pollution Management Policy in Korea

Water management policy in Korea mainly focused on the water resource development to support the increased water demands until 1980s. Management focus was shifted to water quality control and major investments were made to construct public owned treatment facilities since late 1980s. However, improvements of water qualities particularly in major reservoirs were not so satisfactory because of the limitation of end-of-pipe approaches, difficulties in pollution source control, resident's resistance on tighter regulations, and upstream- downstream conflicts on environmental regulations.

Korean government launched new national water quality improvement initiatives so called 'Comprehensive Water Management Measures for the Four Major River Basins (hereafter Comprehensive Water Management Plan, CWMP)' to effectively deal with such problems. Implementation of the CWMP is legally supported by the 'Acts Relating to Water Resources Management and Community Support for the Four Major River Basins (hereafter, 'Special Acts)'. New watershed-based management schemes those have been introduced and evolved in the establishment and implementation processes of the CWMP are briefly summarized in following table.

Table 1. The Changes of Water Quality Management Schemes

Conventional Policy By Water Quality Preservation Act	Watershed-based Policy By Special Acts
Special Measure Zone	Riparian Buffer Zone
Water Quality Criteria & Effluent Standard	Land Purchase System
Emission Charge	Total Pollution Load Management System
Support for Water Source Protection Area	⇒ Water Use Charge, TPL Excess Charge
	Financial Supports for Water Source Area
	Support for Civilian Water Quality Monitoring Activities
	River Basin Management Committee

2. Establishment of Watershed Management System in Korea

In the course of reforming the government's water quality policy for the five years, Korean government was challenged by severe resistance by the community people, self-governing bodies and civilian groups in the upper and downstream regions. As a result, the government established its planned watershed management system, following a number of difficult processes, such as convincing the residents of its need for such a system through more than 420 public hearings, explanatory meetings and panels.

The process of taking the special measures for four major rivers, which commenced in 1998, is significant in terms of the history of Korean environmental policy. Such measures are not just an administrative program by which some projects are developed and thereby investment is made as set forth by related laws, but involves a task to establish the "watershed management system" based on thorough analysis of its previous measures for water quality management. That is, the special measures for four major rivers are related to a reform program reflecting the conception of the nation's 21st century water management policy, as well as a blueprint for passing the Special Act on four major rivers.

Specially, in the course of establishing such measures, the government daringly abandoned its previous bureaucratically administrative practices which have been controlled by the central government, and had heart-to-heart discussions and debates with the residents in watershed regions. Based on the agreements with such community people, the government successfully established the watershed management system for four major rivers. This is deemed to be a victory achieved as a result of its hard efforts made for the five years (1998~2002) in order to accomplish its objective, the 'transformation into a watershed management system'. The following is the key contents adopted in taking the special measures for four major rivers.

- The measures are based on the discussions and agreements between the residents in the upper and downstream regions. The residents in the upper stream regions are not allowed to develop water or land resources unlimitedly without considering the situation of the residents in the downstream regions, whereas the residents in the downstream regions should not require overly heavy restrictions be placed upon the upper stream regions because of their own environmental needs. The primary principle was that reaching a compromise should be based on the agreements between the parties involved.
- By grafting the 'user pay principle' on the measures, the government introduced the 'water-use charge system'. This enabled the residents in each watershed region to secure their own funds required for watershed management, helping resolve the equity problem occurring between the restricted zones and the non-restricted zones.
- Introduced the buffer zone system and the total pollution load management system which become an effective measures for watershed management. This ensured a systematic basis for undertaking scientific and reasonable watershed management measures.
- Founded the 'basin management committee' as a decision-making body, and the 'watershed environment office' as an executive body for watershed management. This ensured effectiveness in the government's policy-making process and the strength of its executive system.
- The measures four major rivers created a community culture built based on enhanced community participation in debates, discussions and agreements with the government from the beginning stage - an underlying element of watershed management. That is, such measures helped form a frame for the 'co-prosperity of upper and down stream regions' through such reasonable debates, discussions and agreements between the members of each watershed - self-governing bodies, community people and civilian groups.

3. Implementation of Total Pollution Load Management System (TPLMS)

Total Pollution Load Management System (TPLMS) has been introduced for efficient regional environmental management coping with the limitations of present water quality management policies. TPLMS for Water involves determining the target water quality standard for each block of the water systems, computing the maximum allowable load, and regulating or controlling the amount of pollutants discharged from the region within the maximum permissible load. This system is expected to help achieve a balance of preservation and development of a region by permitting regional development necessary solely within the extent in which the target level of water quality is attainable. It is just introduced and in the stage of implementation in four main watershed in Korea.

Korea's total pollution load management system discriminates Han River basin from the other three river basins. In the case of the Han River basin, regional governments may implement the TPLM voluntary bases, whereas for the other three river basins (Nakdong River, Geum River and Yeongsan River) should a regional government fail to meet its target water quality level, the implementation of TPLM is compulsory.

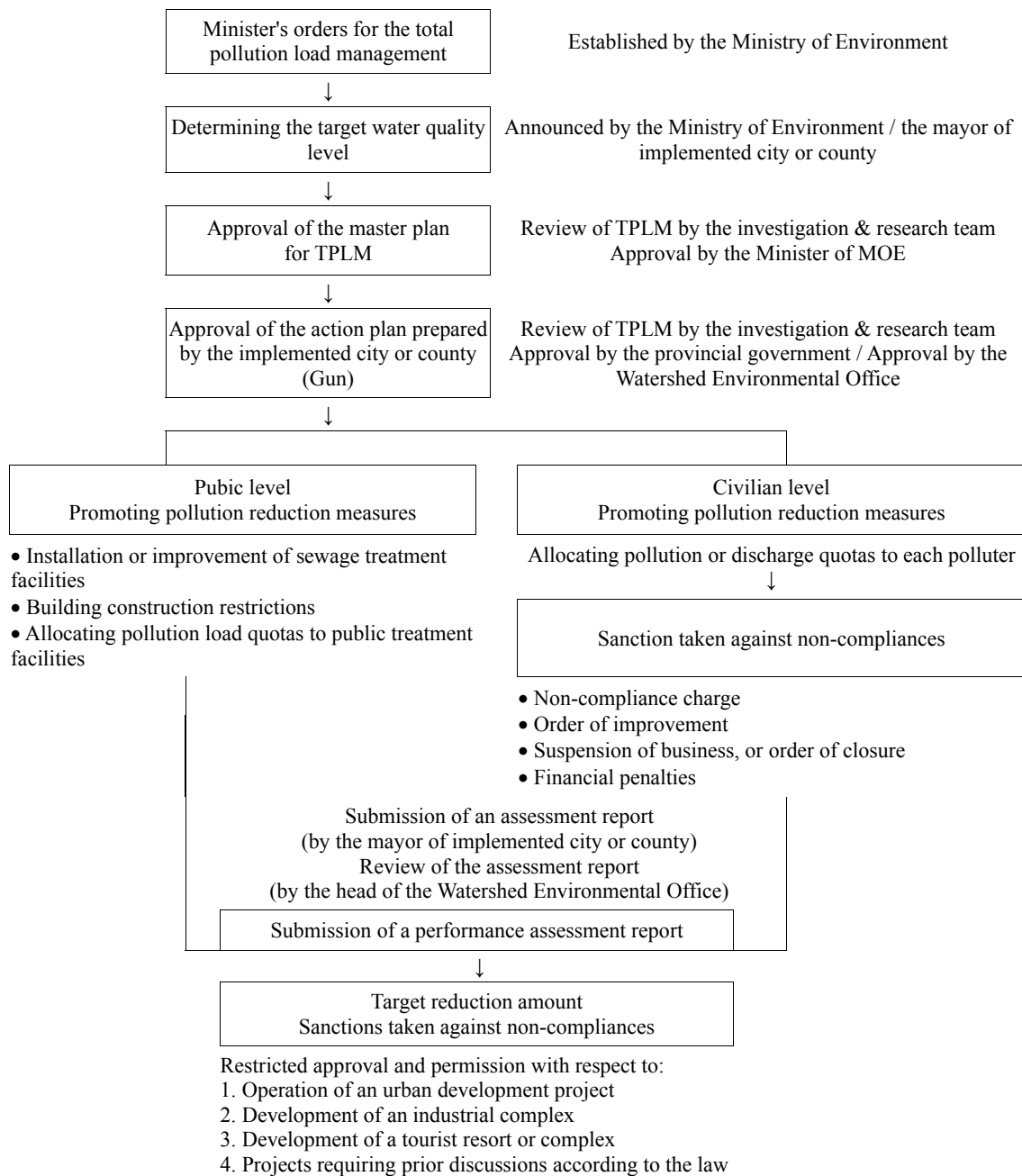


Figure 1. Implementation Process of Total Pollution Load Management.

4. Difficulties Encountered and Settlement of TPLM in Korea

4.1 Institutional Issues

Lack of incentive under voluntary implementation scheme. In case of Han River basin, TPLM implemented with voluntary scheme confronting residents' objection due to overlapped regulations such as Source Water Protection Zone, Special Management Region and Natural Environmental Preservation Area. Although voluntary scheme is the ideal policy in case of

successful implementation, it can encounter the implementation barriers as follow. The incentive system for inducing voluntary TPLM is not enough to induce TPLM directly. Therefore, the Ministry of Environment (ME) motivated local government with indirect pressure such as restriction on swage treatment facility permission, EIA and so on. Local governments tend to be forced to implement voluntary TPLM.

Also, as local governments, city and municipal authorities, take charge of implementation plan of TPLM, it can be hard to consider comprehensive measure to improve water quality of whole watershed area. For instance, if a municipality located in upper stream doesn't plan TPLM implementation, TPLM implementation plan of the down stream municipality might not be effective. In order to effective implementation of TPLM, it needs comprehensive plan reflecting on whole watershed areas.

The aim and approach to TPLM of local government differ from that of ME. Local governments intend to implement TPLM for developing their area more within legal basis, on the other hand ME pursue comprehensive watershed management for actual water quality improvement. Therefore, there are conflicts of interest in setting of target water quality for TPLM and it's implementation between ME and regional government as well as between regions, and these can induce the difficulties in TPLM implementation.

Lack of capacity prevents local government from implementing TPLM actively. Local government officers are likely to delay the implementation of TPLM by temporal impediment of plan or setback of permission. This is not only because they are deficient in experiences also because TPLM is directly connected with their local development. Also, Regional difference in institutional and financial capacity of regional government can result in differences in implementation, and undesirable side effects in some region.

Differences in regional implementation conditions. Differences of environmental management condition in each region including socio-economic factors affect the performance and effect of TPLMS implementation. Uniform implementation of TPLMS disregarding difference in regional pollution reduction cost can result in social cost-inefficiency and regional inequity. Also, there is the lack of data and information for those affecting factors and conditions in each region as well as the behavioral and strategic changes in pollution management of regional polluters under TPLMS. Establishment of systematic approach for efficient pollution reduction in the region (cost-benefit analysis of each reduction methods, establishing optimal mix of pollution management methods, etc) as well as capacity building of local government are required.

4.2 Technical Issues

Besides institutional problems, there are technical issues such as estimating total pollution load, determining target water quality standard and allocating pollution load quotas.

First, TPLM requires accurate information on pollutant source and pollutant load in order to estimate management object, BOD. However, there are short of precise information on pollutant load and source and it can cause uncertainty. It is not easy to build up the confidential data such as water-purifier tanks, underground water and unreported pollution discharge facilities. Most of all estimating non-point source is the hardest part to estimate pollution load. Current measure to

estimate non-point source is deficient in that it does not reflect characteristic of storm water.

Second difficulty is to targeting water quality standards. Lack of frequent monitoring, insufficient number of monitoring points and large change of flow can be the fundamental limitation to determine target water quality standards. Current monitoring information has limitations for using as data for TPLM.

Allocating pollution load quotas is the problem to be solved. Due to lack of institutional scheme, pollution load cannot be allocated into individual pollutant charging facilities. It is allocated only large-scaled pollution charging facilities rather than all of the small and medium sized facilities. Moreover, considering whole watershed, and allocation pollutant load can cause the conflict among local authorities. Even though allocation pollutant load has legal basis based on three Major River Special law including regulation and sanction measures, it is needed to be more realistic in the process of planning TPLM.

5. Implications of Korean Experiences to Asian Countries

Based on Korean experiences, the following can provide the implication to environmental management in order to achieve integrated and effective management of watersheds.

5.1 Effective Problem Solving by Adapting Watershed Management System

Since the watersheds mirror natural water flows, they provide a most reasonable foundation in managing water resources. Up to the present point, the Korean government's programs regarding the improvement of water quality have been focused on point-pollution sources or some particular waters including downstream regions or marshes. Such an approach may turn out to be successful in resolving some particular problems, but it is not effective in resolving the chronic problems which cause deterioration of water quality. The watershed management method can provide more accurate data & information necessary to find many stressors impacting the water resources, and such an information will help make decisions in taking measures necessary to conserve and restore given resources. Thus, the integrated watershed management system will ensure effective resolution of the water resource problem by taking all of such stressors into consideration to achieve reasonable allocation of water resources.

TPLM for water is based on a basin or watershed management system. In many Asian countries a watershed management system is not adopted yet. For effective environmental management, the transition to a watershed management system is necessary. The U.S. and the EU, like many other Asian countries, are characterized by the fact that administrative borders do not coincide with river basins, so considerable attention was paid to shared water resources issues. There is a strong need for integrated and sustainable water resources management to be implemented on the river basin scale, the natural unit of hydrology. These countries have created highly effective and resilient institutions for integrated river basin management.

5.2 Promotion of the Residents' Participation

The watershed management system can enhance the residents' awareness and support effectively. Once individual residents become concerned about their own watershed, they will not only participate in the government's conservation and restoration programs for such a watershed, but also become interested in the government's priorities and decisions regarding important matters.

As such, the watershed management system helps build such a participatory community, reduce complications, and induce the agreements between related parties necessary in taking measures required to accomplish the nation's environmental goals. This will further enhance the potential for the success of the government's environmental programs.

5.3 Active Development of Deregulated Environmental Management Plan

In addition to the conventional EM system, including land restrictions and installation of basic environmental facilities, implementing TPLM should be accompanied by the active development of a deregulated EM plan—such as environmentally friendly living patterns and environmentally friendly management of farmhouses and stables. A special focus should be on the emerging problem of non-point sources of water pollution. All sectors need to focus on minimizing the impact of non-point sources, beginning with the planning stage in developing water quality management programs and including developing training programs, establishing aquatic buffers and better site design, implementing erosion and sediment control projects, and installing BMP (Best Management Practices) facilities to reduce non-point sources.

5.4 Solving possible difficulties of TPLM implementation

As the experience in the United States, Japan, and Korea has shown, implementing TPLM can encounter both institutional and technical challenges. For example, local governments lack incentives to implement TPLM. Since TPLM is directly connected with regional development, some conflicts of interest can arise. In Korea, local governments tended to focus on complying with the legal regulations of implementing TPLM, while the central government pursued comprehensive watershed management for actual water quality improvement. It is important to establish schemes to induce the active participation of local governments. Another institutional challenge is the lack of local government capacity for TPLM implementation. Providing education programs for local government officials and workshops for public awareness can help solve this problem. In terms of technical issues, the lack of precise information on pollutant loads and sources can cause uncertainty. A TPLM committee for watershed management in each watershed can help resolve these conflicts and technical problems.

Capacity building for implementation of TPLMS and reduction of administrative cost are also important. Information provision for cost-effect pollution reduction, support of expertise for selection and implementation of optimal pollution reduction strategies, and provision of regional capacity building program are recommendable.

References

- Korea Ministry of Environment (2006), Environmental White Paper 2006.
Moon H. (2005). Regional Environmental Management with Total Pollution Load Management System, Korea Environment Institute.
Shin C., et. al. (2005). Impact Assessment of Conflicts in Compulsory Implementation of TPLMS in Han-River Basin, Korea Ministry of Environment.
<http://tmdl.nier.go.kr/>