

Comprehensive Water Management in Japan (taking the Tsurumi River as example)

Shuji Unno

Director-General, Keihin Branch Work Office, Kanto Regional Development Bureau, Ministry of Land, Infrastructure and Transport, Japan

In the Tsurumi River basin, where the soundness of the water cycle is being lost due to the rapid urbanization progressed and increase of the rainfall-runoff to the river, the "River Basin Management Plan for the Tsurumi River Basin" is being formulated with local governments and residents within the river basin towards the rainfall-runoff control and sound water cycle.

I hope that our approach in the Tsurumi River basin helps as reference to address the problem of urbanization and water cycle in the Asia-Pacific region which expects rapid urbanization.

Key Words : *Basin awareness, Fostering an environmentally sound water cycle, River Basin Management Plan, Multi-natural and multi-functional comprehensive flood control, PDCA cycle*

1 . Introduction

The Tsurumi River Basin located between Tokyo, the capital city and Yokohama, the international city, has a population of about 18.4 million and is knowing a progressive urbanization. The Tsurumi River is an urban river flowing from its source in Tamagawa Hills into Tokyo Bay along 42.5 km and with a river basin area of 235km² (see Fig.1).

The shape of the river looks like an imaginary riparian animal, the "tapir" which is believed to eat bad dreams and keep only good dreams. The Tsurumi River basin is affectionately known to the public as the "Tapir river basin, Tsurumi River" with a vigorous civic activity. For example, in the headwaters of Tsurumi River, there is the so called square of headwaters spring (Genryu no Izumi Hiroba), which is daily managed by the civic group, "Tsurumi River Basin Networking. The place is equipped with biotope and promenade using the spring water of 1,300 m³ daily out-put. The basin area is popular among the public as recreation area.

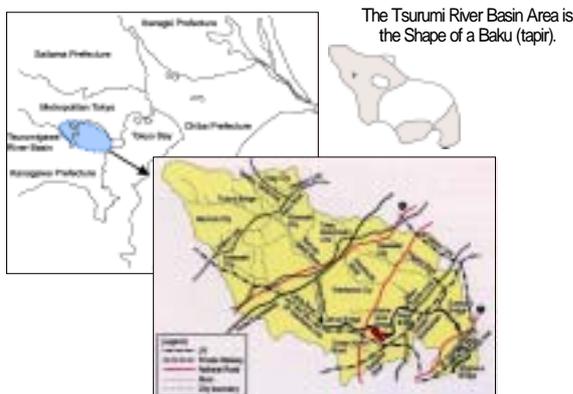


Fig.1. Tsurumi River basin map

2 . Tsurumi River, the history of the basin and its impact

(1) Urbanization of the river basin

The urbanization of the Tsurumi River began progressing rapidly after 1965. The basin holds the Keihin Industrial Belt, the crowded urban area in the low-lying area of the river mouth and the boomtown in the hilly zone of the upper and middle stream. In 1958, urbanization ratio in the basin accounted for 10% and had a population of 400,000. However, at present, the urbanization ratio and population reach 85% and 1,840,000 respectively (see Fig.2 and Photo 1).

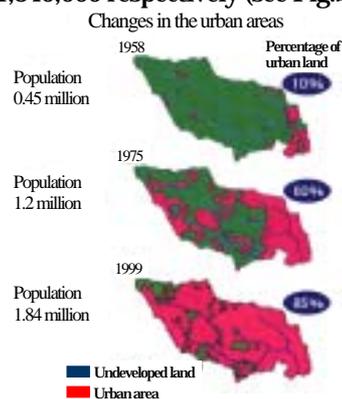


Photo 1 Urbanization in the downstream

Fig.2 Urbanization in the Tsurumi River basin

(2) Impacts and problems due to urbanization

The rapid development of the basin caused various impacts and problems in the river and its basin (see Fig.3). It rapidly disturbed water retention and retarding functions, increased the discharge and shortened the time of flood concentration. The rapid residential development also had the negative image of

decreasing the river channel discharge capacity due to Fig.4) resulting in the higher frequency of flood disasters (see Photo 2).



Photo 2-1 Flood (Kohoku area, Sept 1976)



Photo 2-2 Flood (Tsurumi area, Sept 1982)



Photo 2-3 Flood (Kohoku area, Aug 1994)

The basin has faced a critical impasse situation and it was impossible to ensure the security of flood control with the traditional idea of river maintenance, due to the progress in the development. Consequently in 1976, the authority established the “Flood Disaster Mitigation Plan Committee” composed of academic experts, local authorities and river managers in the Tsurumi River basin. The committee started to work on the maintenance of the river and flood control measures simultaneously. This approach took the lead in establishing nation’s Comprehensive Flood Control Measures.

Later, in 1981, the authority formulated the “Tsurumi River Basin Improvement Plan”, and thereafter in 1989, adopting the new ideas of “New River Basin Maintenance Plan” as institutionalized comprehensive flood control measure. About 3,300 disaster mitigation

regulating reservoirs of 2,8million m³ have also been established as a part of basin measures. As for the measures within the river bed, the drainage capacity has nearly doubled compared to that of 1975 as a result of large-sized dredging operation. Thus, the security for flood control has been steadily improving.

Moreover, the construction of the “Tsurumi River Multipurpose Retarding Basin” has been launched as a core of the river measures. The construction is now in its final phase just before its opening in 2003. “Yokohama International Stadium” is located within the Multipurpose Retarding Basin. The stadium is famous for holding the final match of the World Cup organized by Japan and Korea in June 2002, and was completed with the piloti method (see Photo 3).

However, taking a look at the actual situation regarding the conservation of water retention function of the disaster mitigation regulating reservoir, considered as the core for the Comprehensive Flood Control Measures in the basin, we can observe a shortfall of 80m³/s as opposed to the volume of water retention measure, of 290m³/s, set up in the “new Basin Improvement Plan”. This adverse impact is due to the progress of small-scale development and the lack of understanding towards the Comprehensive Flood Control Measures by the administrative initiatives. Moreover, it is impossible to reserve the water retention function, required in the basin, due to the partial refilling of the disaster mitigation regulating reservoir.

Moreover, because of a strong pressure in the basin, a continuous insufficiency in the control of the land-use measure taking the basin and the river into account has been noticed. Due to the factors cited above, although the progresses of the river maintenance, there exists a continuous delay of flood measure control within the basin.



Photo 3 Tsurumi River Multipurpose Retarding Basin under construction



Fig. 3. Issues around the basin and river

Furthermore, new-type of urban flood disaster due to unusual heavy rain occurs in various parts of Japan. In the Tsurumi River basin, the new urban specific problem is acknowledged as the urbanized flood plain area. At the time of unusual heavy rain, the population, asset and especially the underground shopping area and subway are at the risk of threat and damages (Photo 4).

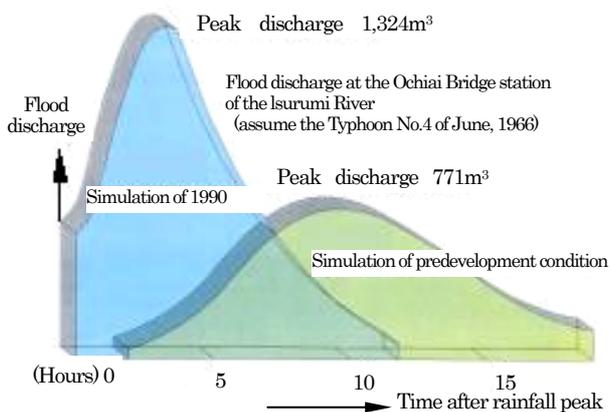


Fig.4. Increase in discharge and decrease in time of flood concentration



Photo 4 Inundation of the subway (1999 : Fukuoka City)

In the Tsurumi River, after the urbanization, the decrease of the rainwater percolation due to the increase of the impermeable area, and the sewage bypass resulted in the decrease in the percentage of the river base flow. Normally, domestic wastewater occupies the

large portion of the river water. The discharge of downstream of the sewage treatment plant is high but normal discharge of the tributary is declining every year after the peak of around 1975 (Photo 5). The development of the river channel has also been done emphasizing the flood control so many steep revetment covered with the concrete were made. It results in the problem in the preservation of the ecosystem, incursion of the ground water, the river utilization and the recreation in the river.

Meanwhile, the water quality became worse due to the increase of domestic wastewater brought by urbanization, but the normal water quality of the Tsurumi River is being improved by the progress of the sewage system. However, it is still insufficient compared to the quality of before the urbanization (see Fig.5 and Fig.6). Recently, the new water quality problems of endocrine disrupter or increase of non-point source pollutant in the first phase of the rainfall are becoming remarkable in these days.



Photo 5 Decrease in the normal discharge of the tributary

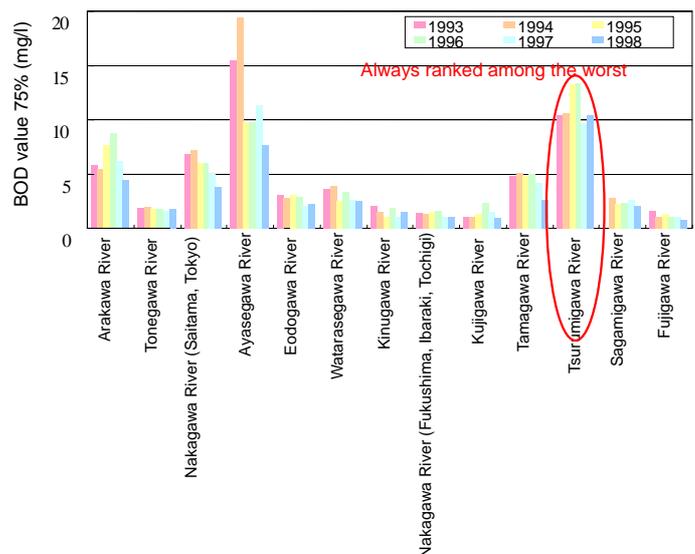


Fig.5. Water quality of Class A rivers in Kanto region (Between 166 nationally managed rivers of class A rivers)

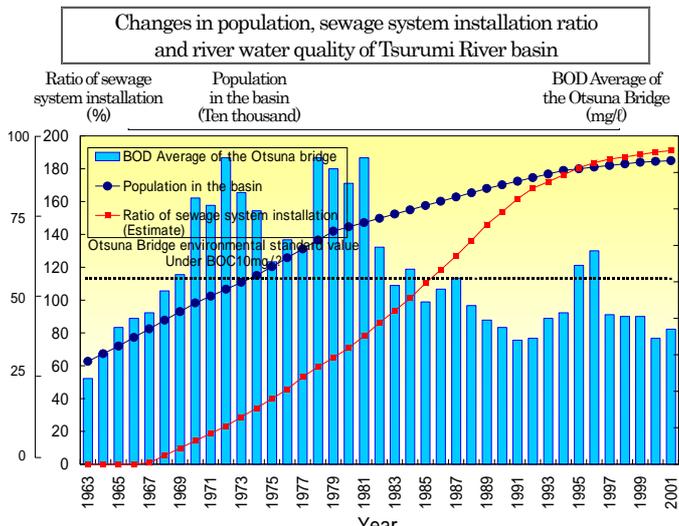


Fig.6. Population growth, sewage improvement and river water quality

The “Yato”, which is the shallow valley complexly etched out, holds rich natural environment and water retention and retarding functions. It characterizes the landscape of the Tsurumi River basin. Except for the green areas expected to be kept as rural area, most of the basin is expected to be urbanized, and large-scale housing land development is in progress in the hilly zone of the upper and middle reaches, so Yato is vanishing (see Photo 6).

Besides, the development of hills and plateaus, the housing land development in the alluvial plain along the river as well as the small-scale development at the bottom of the cliffs, whose value is visually and ecologically important, are also in progress. The green areas are fragmented as well as decreased.

The decrease of green area and Yato triggers many negative impacts on the inhabit, growth and breeding of plants and animals; heat island phenomenon; and fire mitigation.

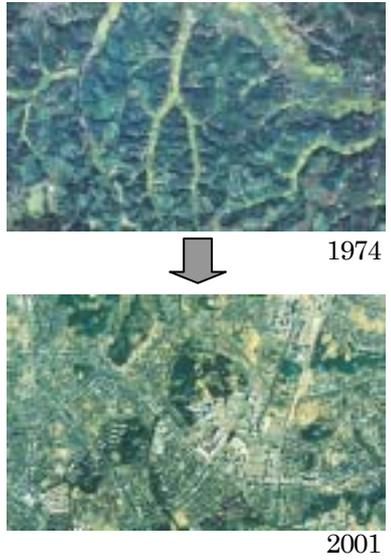


Photo 6 Decrease in the green area and Yato due to the urbanization

During the Hanshin-Awaji Earthquake occurred on 17th January in 1995, the river water was utilized as domestic water for laundry and toilet flushing. As the river and vacant land like parks and green areas prevented the fire spreading, the importance of the river in the city with respect to disaster prevention was realized anew. In the Tsurumi River basin, the crowded city spreads along the lower reach increasing the risk of the disaster. Hence, it is required to examine the value of the river for disaster prevention as well as planned utilization of river space and river water in earthquakes or fire disasters.

Before the high economic growth, the Tsurumi River and its surrounding natural environment served as children’s playground. The ensuing urbanization made the river environment worse and the residents’ interests in the waterfront dropped off. Recently, as water quality is improving, the residents are looking much to the waterfront. In the 1980s, civic groups engaged in the environmental conservation and developing communities were established. In 1991, the “Tsurumi River Basin Networking (TR Net)” was set up to work together throughout the entire basin. These activities are found effective to raise the citizens’ interests in the river and promote the public awareness of the “basin”.

3. The new point of view for addressing the issues

(1) Evolutionary phase of the Comprehensive Flood Control Measures

Human activities such as rapid urbanization, neglecting future condition of the river and its basin, fully account for the severe problems related to flood control, water use, and environmental conditions of the Tsurumi River. It is required that all the administrative authorities, community and public, involved land use and water development, corporate and collaborate with the active initiatives, and to set and implement the various countermeasures aiming to restore the river basin into an ideal harmonized condition.

In recent years, the phrase “fostering of an environmentally sound water in the basin” is proposed as a keyword to integrate water measure. This means, to put water function, such as works on flood control, water use and environmental conservation within the basin, into appropriate and well-balanced condition, within the water cycle (see fig.6).

The Tsurumi River is a cradle basin for flood control from the basin point of view, so called “Comprehensive Flood Control”. When providing “Comprehensive Flood

Control” intertwined with the concepts of water cycle cited above, we plan not only to perform flood control, but also to draw up an environmentally sound water cycle for the river and its basin by promoting the multi-natural and multi-function, regarding future water measures. It is, therefore, required from each stakeholder to establish their identity, assume their responsibilities and roles to participate widely is promoting the sustainable development of harmonized region. We need to realize the “Basin Management” concept not only by seeing an each element in the region and the city from a “Basin” perspective point of view, but also via comprehensive concept, referred to as the “fostering of an environmentally sound water cycle”, in the Tsurumi River Basin.

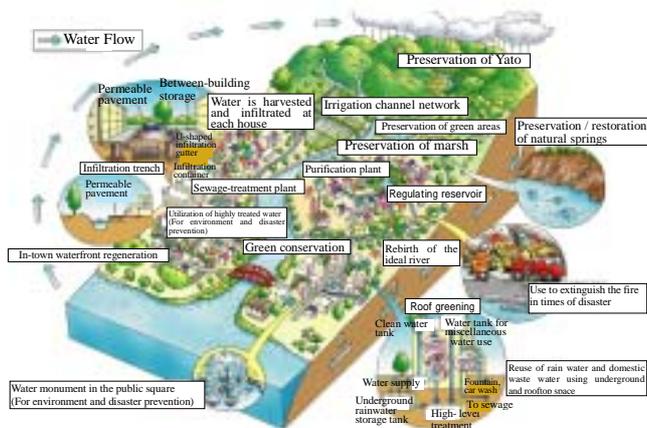


Fig.6. Image of the sound water cycle

(2) Proposal for the drawing up of the River Basin Management Plan for the Tsurumi River Basin

In addition to the traditional flood control, measures taken in the time of flood, we have picked out the issues in each field such as water cycle, natural environment, countermeasures for the times of earthquake/fire and Riverfront recreation, to address sound water cycle in the basin. Furthermore in October 1998, a preparatory commission was inaugurated to prepare the “proposal for the drawing up of the River Basin Management Plan for the Tsurumi River Basin” which illustrates the policies for basic countermeasures and possible future measures.

In the commission, diversified examinations were performed among more than 100 members; commissioners consist of experts in many fields and people in charge of the administration; with the chairperson, professor Katsumi Mushiake at the Tokyo university. The statements were finally integrated in May 2001 in the preparatory commissions.

The Basin Management was arranged considering 5 elements for examination: times of flooding, normal

times, natural environment, times of earthquake/fire, and riverfront recreation for the examinations. The Management here is not a general management and operation but means that each relevant measure will be regulated and integrated in a comprehensive way under the related administrative bodies and private entities. This sound management should be promoted by stimulating the active participation of residents and businesses in the basin with a flexible correspondence to the changes of states.

Taking into account current effects of the measures, the concrete implementation of the examination was put forward after the analysis of the steady flow etc, using various simulations. Using actual data on the situation of the Tsurumi River and its Basin, issues and predictions of future situation were performed using updated technology (see Fig.7).

The simulation of water cycle indicates that the flood flow would increase and that the increased volume of sewage water occupies most of the normal flow in the case of a simple progress of urbanization.

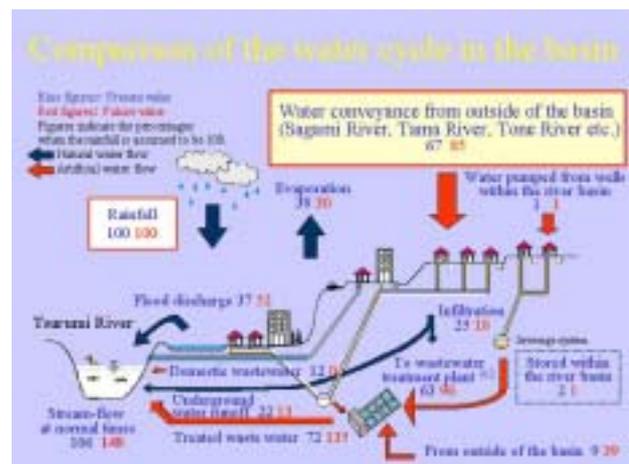


Fig.7. Forecasting of annual water budget using the water cycle simulation

In the proposal, it is indicated that we work on the consensus building for the promotion of policies by examining the institutional maintenance and implemented systems.

It is also indicated that the efforts will be made for the extension of dialogue between the public and the administration by paying sufficient attention to the cooperation of residents in the basin to reflect their opinions through the wide range of information disclosure.

Moreover, additional indications were made for necessities to draw up the “River Basin Management Plan for the Tsurumi River Basin”, which clearly shows the ideal conditions of the river and its basin. The

policies to implement and identities to realize them mainly to establish the promotion organizations for addressing the issues basin-wide and to arrange the appropriate framework considering the role played by preexisting organizations such as the Conference for the Comprehensive Flood Control Measures and the Basin Round Table Discussion.

4. River Basin Management Plan for the Tsurumi River Basin

(1) Promotion structure of the formulation of Basin Water Master Plan

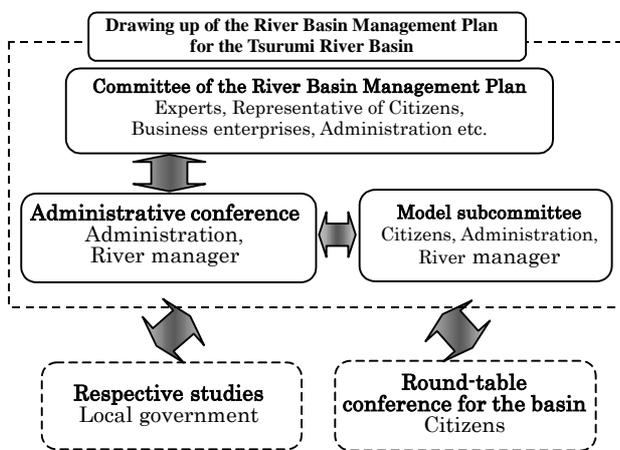


Fig.8. Promotion structure of the River Basin Management Plan. Based on the proposal of the preparatory committee, “Tsurumi River Basin Water Committee” of experts, civic groups and administrative authority was established in February 2002 followed by the establishment of the administrative council and the model subcommittee so that the promotion structure to establish the River Basin Management Plan is consolidated and full-fledged planning structure is initiated. (see Fig.8)

(2) Framework and promotion of the Basin Water Master Plan

The River Basin Management Plan for the Tsurumi River Basin aims at the safe, comfortable and affluent city life and conservation of the precious natural environment in the city. It shows the direction in a couple of decades of the ideal basin and sound water cycle toward the development of reliable relationship between human society and water. In addition, it specifies the related measures and their actors. Based on the above, it shows the basic points to realize by cooperation and coalition of the related parties for the

sustainable development.

The River Basin Management Plan consists of “fundamental principles”, “Basin Water Management” and “promotion policies”. The “fundamental principles” shows the ideal image of the basin and the viewpoint and direction to address to realize that. (Fig.9)

The “Basin Water Management” is classified into five areas of times of flooding; normal times; natural environment; times of earthquake/fire; and riverfront recreation. It gives the basic policies, planning objectives, development of the measures (policy of development for medium and long term); and basin planning.

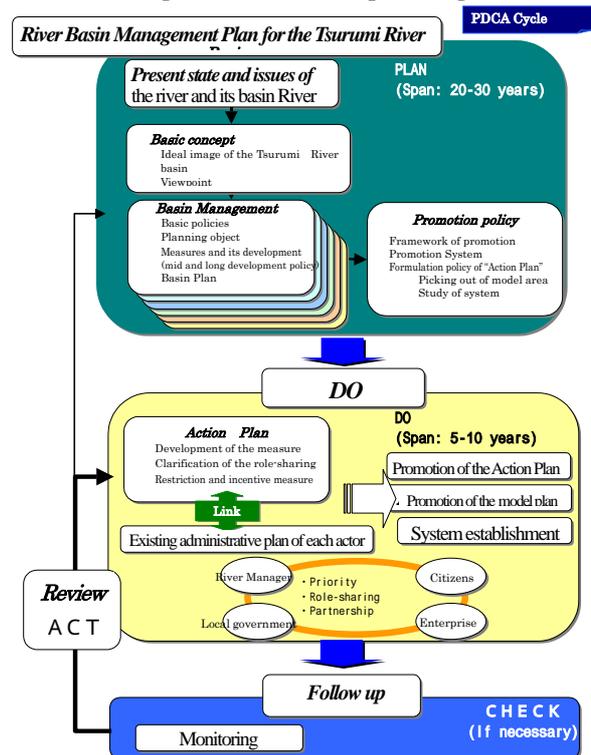


Fig.9. Structure and promotion of the Basin Water Master Plan

The “promotion policy” shows the formulation policies including the framework of process promotion/action showing the basic concept of P (Plan) – D (Do) – C (Check) – A (Action) cycle; the promotion structure to determine the appropriate initiative establishment, role-sharing and coalition between public, enterprise, local authority and nation; the selection of model areas as leading project to implement them; and the examination of the system.

At present, toward the formulation of 2005, the Tsurumi River Basin Water Committee is having vigorous discussions in cooperation with the administrative council and the model subcommittee.

For the formulation of the River Basin Management Plan, it is important to develop the existing system and new measures under the appropriate role-sharing, for

the disclosure of information and dialogues between basin residents, enterprises, relevant departments of basin local authorities and the measures supported by quantitative effects. For that purpose, we are going to propose the establishment of a round-table conference to reflect the citizens' views, and the basin management combined and synthesized with each management issue.

5 . Reference elements

(1) Review and lesson in the Tsurumi River basin

In the Tsurumi River basin, the rapid urbanization preceded the river improvement and various problems occurred consequently. It is important for the Asian countries, where the development is expected at present, to take measures in advance making “collaboration with urban planning” and “land use control” within the river basin.

In the “Comprehensive Flood Control Measures” addressing both Tsurumi River and its basin, we had a certain effect in the engagement of discharge control by disaster mitigation regulating reservoirs, under an administrative advice, to address the wide-scale development meanwhile sufficient water retention function has not been obtained in the small-wide development. It is important that the regulation or ordinance obliging the setting of disaster mitigation regulating reservoir or collecting and infiltrating equipment at each household are established and that each basin residents understands the necessity of water retention/infiltration function. As an approach to establish a law, based on the actual increase of flood disaster in the urban area due to the torrential rain, the Ministry of Land, Infrastructure and Transport is currently discussing to formulate the “bill for the flood measure for specified urban river (provisional)” to enable the implementation of the unified flood damage measures by the river/sewage managers and the local authorities.

Besides, from our reflection to give the priority to flood control measures, the comprehensive measures containing water cycle (water volume, water quality), preservation and regeneration of the natural environment, disaster prevention and riverfront recreation are recommended. For that purpose, the basin-wide formulation of the “Comprehensive Basin Water Management” to realize the sound water cycle is important.

(2) Issues in the formulation of the River Basin Management Plan

To solve the various problems of river and basin, it is important to regard “restructuring the ideal image of river and town from the basin viewpoint” and “adopting the viewpoint of water cycle for the land use” as the basic stance (principle).

To realize this basic stance, it is important to work on the formulation of the Comprehensive Basin Water Management (River Basin Management Plan). It is also essential to build up the human and structural framework in the administration and to raise the awareness toward the voluntary community developing through public participation and the environment recovery.

In addition, as well as clarifying the respective responsibilities and roles of administrative body, public and enterprises, in developing the concrete measures based on the PDCA cycle of the Basin Water Management Plan, it is important to examine and formulate the promotion organization structure. In the later, public, enterprises, local governments, and nation must collaborate and work throughout the entire basin. The implementation measures like progress management of plans or actual situations, revision, information communication and environment learning are also important.

6. Conclusion

In Japan, the recognition of the need of long-term approach toward the national land management shifting the focus from economy to environment resulted in the adoption of “rehabilitation of nature coexistence type basin area and city” in the Council for Science and Technology Policy. According to the agreement of related five services, the study was launched in 2002 for the outcome of “rehabilitation of nature, water/material cycle, communication in basin and city”, “Conservation and rehabilitation of water environment and ecosystem”, “Rehabilitation of water, greenery and environment in the city”.

The Tsurumi River basin is its pilot case and we would like to do our best for the effective result toward the sustainable evolution of the basin.

Reference

1) Preparatory Committee of the River Basin Management Plan for the Tsurumi River Basin : The Restoration of the Tsurumi River and Tsurumi River

Basin, Proposals for the drawing up of the River Basin Management Plan for the Tsurumi River Basin, 2001.

2) Tsurumi River Basin Water Bureau : River Basin Management Plan for the Tsurumi River Basin, Tsurumi River Basin Water Committee, 1st – 4th, 2002