Second Japan - U.S. Workshop on Watershed and River System Management

July 17-22, 2003
Tsukuba, Ibaraki, Japan

SUMMARY REPORT

December 2003

Public Works Research Institute,
Japan
and
Bureau of Reclamation,
Department of the Interior,
U.S.A.

The United States and Japanese delegation members
at the
Second PWRI-USBR Workshop in Tsukuba, Ibaraki, Japan
July 17, 2003

Table of Contents

1. INTRODUCTION

The U.S. Bureau of Reclamation (USBR) and the Public Works Research Institute of Japan (PWRI) held the First Workshop on Watershed and River System Management at Long Beach in the United States on January 25, 2001. It was based on the Implementing Arrangement concluded between the U.S. Department of State and the Ministry of Foreign Affairs of Japan in November 2000. At the first workshop, the delegation of PWRI, led by Mr. Tsuneo Uesaka, Deputy Director-General of PWRI at that time, and the delegation of USBR, led by Mr. Robert Hickox, exchanged information on the projects and confirmed future plans for research cooperation. Furthermore, dam rehabilitation was added to the projects as a new research theme.

After the first workshop, there was a drastic restructuring of PWRI. PWRI was divided into two institutes, one is the National Institute of Land and Infrastructure Management that belongs to the Ministry of Land, Infrastructure and Transport, another is PWRI as the Incorporated Administrative Agency. The name was not changed, but PWRI has been independent from the government. After the restructuring, the research cooperation with USBR was taken over by PWRI. Because the original Implementing Arrangement was signed between the Japanese government and the U.S. government, it was necessary to sign a new agreement.

Implementing the new agreement was accompanied with some problems in USBR. In order to solve these problems, Mr. Hickox of USBR made great efforts to make the necessary adjustments between PWRI and the U.S. Department of the State. With his efforts, PWRI and USBR were able to sign almost the same Implementing Arrangement as the previous one at San Diego in June 2002. The signing was witnessed by Professor Takashi Asano. Dr. Asano was instrumental in getting PWRI and USBR to work together on this effort. The Second PWRI/USBR Workshop on Watershed and River System Management was convened on July 17, 2003, in Tsukuba, Ibaraki, Japan, to review the progress made on the joint research projects and discuss the detail of future cooperative research projects.

This document represents the summary of the Second PWRI/USBR Workshop.

Before the workshop opening, the USBR delegation, led by Dr. Chris Holdren, visited PWRI and met Dr. Tadahiko Sakamoto, Chief Executive of PWRI. Dr. Sakamoto extended a welcome to the USBR delegation. The delegation expressed thanks to Dr. Sakamoto for his arrangement of the Second PWRI/USBR Workshop.

Greeting with Chief Executive, PWRI, July 17, 2003

2. WORKSHOP AGENDA

(At the conference room in PWRI on July 17, 2003)

9:15-9:30 Group Photograph session

9:30-12:30 Plenary session

Welcome and opening remarks (Mr. I. Nagayama and Dr. C. Holdren)

Review of each project activities and future collaboration

Project 1: Water quality management to protect natural waters

- Floating Island -

Japan: Dr. K. Nakamura (PWRI)
USA: Dr. C. Holdren (USBR)

- Water Quality Management -

Japan: Mr. Y. Suzuki and Dr. H. Tanaka (PWRI)
USA: Dr. C. Holdren (USBR)

Project 2: Reservoir operation methods for sustaining water quality and ecosystems

- Reservoir Water Quality and Temperature Control -

Japan: Mr. J. Kashiwai (PWRI)
USA: Mr. T. Vermeyen (USBR)

- Design Methods of Dam Rehabilitation -

Japan: Dr. Y. Yamaguchi (PWRI)
USA: Mr. T. Vermeyen (USBR)

Project 3: Watershed management planning

- Decision-Making Support Tools -

Japan: Mr. J. Yoshitani (PWRI)
USA: Dr. D. Frevert (USBR)

- Watershed Management Planning Process -

Japan: Mr. J. Yoshitani (PWRI)
USA: Dr. D. Frevert (USBR)

Discussion of the framework of research-cooperation and planned next workshop

13:00-16:30 Parallel session

Discussion and Information exchange of each project

16:00-16:30 Drafting the summary report (Executive meeting)

Japan: Mr. I. Nagayama and Mr. J. Kashiwai (PWRI)
USA: Dr. C. Holdren (USBR)
Technical Adviser: Dr. T. Asano

16:30-17:45 Plenary session

Review and correction of summary report, including each project summary

17:45 End of business session

3. WORKSHOP ACTIVITIES

3.1. Welcome and Opening Remarks

Mr. Isao Nagayama, the Director of Hydraulic Engineering Research Group of PWRI, opened the Second PWRI/USBR Workshop on Watershed and River System Management at PWRI in Tsukuba on July 17, 2003. He extended a welcome to Dr. Chris Holdren and the U.S. delegation from the USBR. He also expressed his appreciation to Professor Takashi Asano for joining the workshop as a technical adviser. Mr. Nagayama expressed his gratitude to Mr. Robert Hickox for his great efforts of the adjustment between PWRI and the U.S. State Department to sign the Implementing Arrangement on the research cooperation and his arrangements for the Second Workshop. Mr. Nagayama stated that watershed and river system management had rapidly evolved through three phases in Japan: infrastructure building with dams and embankments, then harmonizing among infrastructure building, water quality and environment, then positive preserving water quality and environment. He emphasized the importance of a broad technical approach from a multi-disciplinary area to river management. He expected that valuable technologies for both countries would be established through research cooperation. Mr. Nagayama expressed his hope the workshop and technical tour would become a meaningful experience for USBR participants.

Dr. Holdren expressed his thanks on behalf of the US Delegation to Mr. Nagayama, Mr. Josuke Kashiwai and all the Japanese participants for their efforts to host and prepare for the Second PWRI/USBR Workshop on Watershed and River System Management. He stated that USBR was facing travel restrictions at that time, i.e., most international travel for the U.S. Department of the Interior had been restricted, so that three USBR representatives were in Tsukuba reflected how important the research cooperation was to USBR. Dr. Holdren expressed gratitude to Japanese representatives for their participation in the First Workshop at Long Beach, and expressed regrets for Mr. Hickox and Mr. John Boutwell were unable to participate in this workshop. He said that the U.S. delegation was looking forward to the technical tour, and was eager to learn about Japanese technology and research, to introduce them into the US, and also introduce those of the U.S. into Japan. Dr. Holdren stated he hoped the relationship between both organizations would evolve through the workshop. Again, Dr. Holdren expressed his thanks to Mr. Nagayama and Mr. Kashiwai for their efforts to make the workshop a reality, as well as Professor Asano for helping to develop this cooperative relationship.

Mr. Kashiwai then briefed the participants on the format of the meeting, the timetable, and the expected outcomes. He asked each project co-leader to prepare a summary of his project discussions and future work plan.

Following the plenary session, the delegates separated into three groups to discuss each project individually. An executive meeting was also held during this time.

Plenary session, PWRI, July 17, 2003

Plenary session, PWRI, July 17, 2003

3.2. Review and Discussion of Projects

3.2.1. Project 1: Water Quality Management to Protect Natural Waters

- Floating Island -

Co-leaders:
Japan: Mr. Takashi Ozawa (PWRI)
USA: Dr. Chris Holdren (USBR)
Discussants:
Japan: Dr. Keigo Nakamura (PWRI)
USA: Dr. Chris Holdren (USBR)

(A) Accomplishments

Dr. Chris Holdren presented results from experiments on floating islands in Lake Mead. The islands were designed with a superstructure made from boat docks to allow easy relocation. This became important as water levels in Lake Mead dropped over 20 m as a result of a drought during the study period.

Islands were planted with cattails and bulrush. Cattails were more effective than bulrush at removing nutrients from the water, probably because the root mass and length of cattail roots was larger and longer than that of bulrush.

The seeded island (bulrush only) established slowly and became very weedy the first growing season. The second growing season bulrush began to out-compete most of the weed species that had established on the floating islands voluntarily. *Phragmites australis* (reed) was the most aggressive plant to establish on the floating islands and might be very good at reducing nutrients thereby improving water quality similar to the Japanese Reed used in Japan.

Bulrush seed germination studies indicated that the collected seed needs to be stored wet and in the cold (refrigerator). The seed was prepared for germination by cleaning and placing in jars filled with water. The seed was stored in the dark, in a refrigerator, for four months or more. Using this method, germination of 70% and greater was achieved.

Removal of NO3-N by cattails and bulrush as water passed beneath the floating islands was identified. A gradual decrease in NO3-N was seen as the nutrient rich water passed beneath the floating islands.

Aquatic habitat is limited in Lake Mead. As a result, the islands quickly attracted a variety of wildlife, including fish, birds, turtles, and a pair of beavers.

Dr. Keigo Nakamura presented information on floating islands and other restoration techniques in Japan. More cost effective measures, including recycled plastic materials, waste tires and lightweight slurries, are starting to be used for floating island in Japan. As another trend, combination techniques such as floating island and solar activated charcoal purification system, have also been studied. He also presented the lake restoration project in Lake Kasumigaura. They conducted restorations in many places and succeeded in restoring many endangered species (some are locally extinct species), and beautiful landscapes.

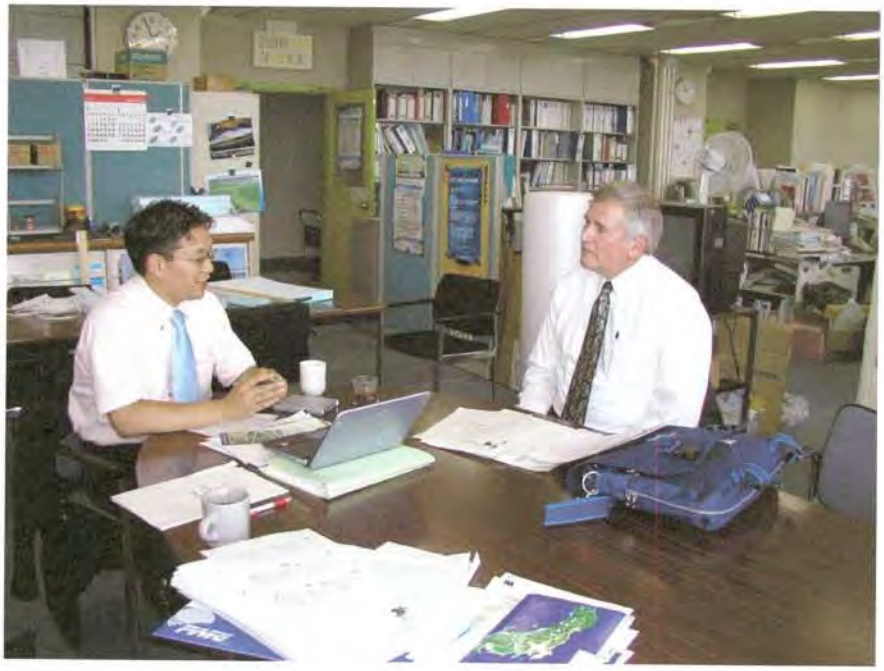
(B) Future Collaboration

The floating island is a quite attractive method, not only to improve water quality but also to enhance ecological function of lakes. However, the floating island is a very specific technique for improving water quality. Both sides feel the necessity of expanding our study field for improvement of water quality in Lakes or reservoirs. Therefore, we agreed to include the other treatment techniques using natural systems, or ecotechnology.

USBR conducts many studies on constructed wetlands, which are becoming popular in Japan as well. USBR has substantial experience with constructed wetlands and has been developing more effective methods to improve water quality.

PWRI has been developing artificial lagoons, which are located at the river mouth in a lake. The artificial lagoon is a newly developed method and an effective countermeasure for non-point pollutants. Simultaneously, it can work as a superior habitat for young fish and especially water fowl.

We will continue to collaborate to develop water treatment methods using natural treatment systems.



Parallel session, PWRI, July 17, 2003

- Water Quality Management -

Co-leaders:

Japan: Dr. Hiroaki Tanaka and Mr. Yutaka Suzuki (PWRI)

USA: Dr. Chris Holdren (USBR)

Discussants:

Japan: Dr. Hiroaki Tanaka, Mr. Yutaka Suzuki, Mr. Mizuhiko Minamiyama and Mr. Jun Tsumori (PWRI)

USA: Dr. Chris Holdren (USBR)

(A) Accomplishments

Since the Long Beach Workshop was held in 2001, PWRI and USBR have proceeded with their studies on pathogen sources and control systems; methods for identifying endocrine disruptors (EDs) and determination of levels of EDs in reservoirs, rivers, wastewater and watersheds; and research on eutrophication and other water quality issues, that were identified in the 1st workshop. Study areas in both countries are affected by both urban and nonpoint source runoff.

With regard to the EDs, PWRI has intensively studied nonylphenol and female hormones from the view of their high potential for estrogenic activity. The effect of their removal by sewage treatment plants is expected to be evaluated on a watershed basis. The fate and reduction technology of EDs and *Cryptosporidium* in sewage treatment is expected to be another focus of the PWRI research.

The USGS, in collaboration with USBR and the National Park Service (NPS), recently completed an extensive study of potential endocrine disruptors in Lake Mead. That study investigated a number of potential endocrine disrupting compounds and also looked at hormones and other biological markers in carp. The Lake Mead work also involved studies of hormones in fish tissues and concentrations of potential endocrine disruptors.

Parallel session, PWRI, July 17, 2003

(B) Future Collaboration

The above-mentioned activities were carried out according to the cooperative research plan of "Water Quality Management to Protect Natural Waters" project that was agreed to by both sides at the 1st workshop. PWRI and USBR will continue these cooperative activities to obtain more fruitful results for the project. The following activities are proposed for future collaboration.

Both organizations will continue to exchange information on the progress of monitoring technology, remediation technology and watershed-based information on endocrine disruptors and pathogens.

Towards more extensive collaboration, both sides will include eutrophication control technology as an area of mutual interest. PWRI has started a research project for sediment release control in a reservoir by a high-content DO supply system. PWRI has conducted a pilot-scale field experiment in a reservoir. Improvement of DO in deep layer was clearly observed without destruction of the thermocline. The field data implied reduction of phosphorus release from the sediment and enhancement of nitrification and denitrification in the water column. Further investigation to determine the mechanism of effective control has been conducted.

USBR has a number of projects where nutrient control is an issue. These include Upper Klamath Lake, Oregon, where a number of strategies for nutrient control are under investigation, including watershed management, aeration, and dredging near lake inlets. Nutrient control is also an issue in Lake Mead, Nevada, Canyon Ferry Reservoir, Montana, and Horsetooth Reservoir, Colorado. Nutrient enrichment is under consideration for several lakes near Yakima, Washington, where reductions in salmon runs have eliminated a major nutrient source.

3.2.2. Project 2: Reservoir Operation Methods for Sustaining Water Quality and Ecosystems

- Reservoir Water Quality and Temperature Control -

Co-leaders:

Japan: Mr. Josuke Kashiwai (PWRI)
USA: Mr. Tracy Vermeyen (USBR)

Discussants:

Japan: Mr. Isao Nagayama, Mr. Josuke Kashiwai,
Mr. Toshiyuki Sakurai and Dr. Tomoyuki Suzuki (PWRI)
USA: Mr. Tracy Vermeyen (USBR)

(A) Accomplishments

Since the Long Beach Workshop was held in 2001, USBR and PWRI have exchanged many technical reports. USBR sent reports on acoustic Doppler velocity measurements collected near a municipal water intake in Lake Mead, measuring selective withdrawal characteristics in Folsom Lake, modeling hydraulic characteristics of a plunge zone in Whiskeytown reservoir, water quality modeling in Shasta Lake, design of selective withdrawal alternatives for Glen Canyon Dam, and water temperature management at Grand Coulee Dam. In the same period, PWRI forwarded translated reports on capture and accumulation of fine sediment in reservoirs and hydraulic characteristics of a tension radial gate.

Since the 1st workshop, USBR has undertaken many water quality modeling efforts on the Sacramento and American Rivers in northern California. Both of these models include modules that predict release water quality for Shasta and Folsom reservoirs. In addition, reservoir modeling and field measurements continue on Lake Mead in an effort to improve drinking water quality for residents on the Las Vegas Valley. Similarly, studies of Lake Powell and the Grand Canyon of the Colorado River are underway to improve habitat (temperatures and flows) for endangered species below Glen Canyon Dam. On the other side, PWRI has improved a vertical 2-D numerical model to predict flow and water quality (temperature and turbidity) in reservoirs by including vertical direction momentum equation and the k-ε turbulence model. PWRI has made field observations in Kawaji dam reservoir in order to understand flow in the reservoir during flood and collect field data for model verification. PWRI also has done physical model tests to understand basic characteristics of a curtain system designed for turbidity control.

(B) Future Collaboration

The above-mentioned activities were carried out according to the cooperative research plan of "The reservoir operation methods for sustaining water quality and ecosystems" project that was agreed to by both sides at the 1st workshop. PWRI and USBR need to continue these cooperative activities to obtain more fruitful results for the project, therefore, the following items that were identified in the 1st workshop, were proposed as a future collaboration plan.

1. Continue to share technical information and related data on projects associated with the program.

2. Verification and improvement of numerical calculations for reservoir models to evaluate reservoir water quality and selective withdrawal structures, including methods to optimize intake elevations and flows.

3. To collect and exchange field and model data on selective withdrawal structures, such as Shasta, Glen Canyon, Hungry Horse and Kawaji dam. Flow, temperature, density, and turbidity are the parameters of interest for this data exchange.

4. Focus future coordination work on our common interest in numerical models and the collection of water quality and hydraulic data in reservoirs.

5. Exchange methods and criteria used to select appropriate numerical models and validation data sets to address water quality problems of common interest.

6. Exchange field and physical model data on the design and evaluation of selective withdrawal structures and reservoir sediment/turbidity control structures

- Design Methods of Dam Rehabilitation -

Co-leaders:

Japan: Dr. Yoshikazu Yamaguchi (PWRI)
USA: Mr. Tracy Vermeyen (USBR)

Discussants:

Japan: Mr. Isao Nagayama, Dr. Yoshikazu Yamaguchi, Mr. Takashi Sasaki, Mr. Hiroyuki Sato and Mr. Kenichi Kanenawa (PWRI)
USA: Mr. Tracy Vermeyen (USBR)

(A) Accomplishments

In Japan, social constraints concerning dam construction have been increasing, while locations suitable for dam construction are decreasing. However, there is still a strong demand for dam construction. Such a background leads to the attempt at redevelopment of existing dams.

There are three major ways to redevelop the existing dams, as follows:

1) Increasing storage capacity of reservoirs, heightening of existing dams, and excavation & dredging of sediment in reservoir
2) Modification of reservoir system operation
3) Improving the supply water quality

PWRI has conducted research on redevelopment of existing dams under the one of PWRI's priority research projects, "Research on efficient construction and redevelopment of dams considering surrounding environment", since the Japanese fiscal year of 2001. To date, the following results have been obtained:

Through the study on the heightening of concrete gravity dams using Finite Element Method (FEM) analysis, the effects of water level during construction, the scale of heightening, and the deformability of rock foundation on stress distribution in a dam body have been evaluated. Several important points were extracted for the rational design of the heightening of concrete gravity dams. The rational design procedure for installing new discharge facilities in existing dams has also been studied.

PWRI has performed seepage, stability and banking analyses for heightened embankment dams in order to investigate the rational design method for heightening of embankment dams. In addition, PWRI has investigated the rational evaluation of physical properties of an existing dam body and its foundation using high-density resistively prospecting.

The USBR has been actively involved with a formal safety of dams program since April 1977 (Executive Order which initiated the reparation of federal guidelines for the safety of dams). Based on USBR's dam safety information system (DSIS), the agency has responsibility for 532 dams and dikes, some of which exceed 213 meters (700 feet) in structural height. Of these, 89 structures are concrete dams, including gravity, arch, and buttress dams. Also, with very few exceptions, each of the 532 dams and dikes have appurtenant structure waterways (specifically, spillways and outlet works) that are key to the safe performance of the dams and dikes. The dams and dikes include nearly every type of design and construction used in the United States over the past 100 years.

Since the initiation of a formal dam safety program, USBR has implemented a wide spectrum of

structural modifications to mitigate safety of dams (SOD) deficiencies. The process of sorting through all the possible alternatives to determine the most appropriate modification (fix) begins with a multidisciplinary team developing a "shopping list" of potential fixes. The list of fixes is then evaluated, based on site-specific conditions, risk to the public, technical feasibility, economics, environmental considerations, political considerations, and input/feedback from public involvement activities. Depending on the SOD deficiency(s), the shopping list of modifications may be associated with several categories of modifications.

The categories of structural fixes for concrete dams and appurtenant structure waterways include: fixes for flood deficiencies, fixes for hydraulic deficiencies, and fixes for structural deficiencies. A few recent examples of structural modifications, which included dam heightening for Bartlett and Roosevelt Dams.

(B) Future Collaboration

(1) We will continue to focus our efforts on the continuous exchange of results of research activities and general technical information related to design methods for dam rehabilitation.

(2) We will review and compare the state of practice in the U.S. and Japan regarding design methods for dam rehabilitation.

(3) We will collect and exchange technical information on design methods of previous and current dam rehabilitation projects, and will promote the development of joint research cooperation.

Parallel session, PWRI, July 17, 2003

3.2.3. Project 3: Watershed Management Planning

Co-leaders:

USA: Dr. Donald Frevert (USBR) and Dr. George Leavesley (USGS)
Japan: Mr. Junichi Yoshitani (PWRI)

Discussants:

USA: Dr. Donald Frevert (USBR)
Japan: Mr. Junichi Yoshitani, Mr. Kazuhiko Fukami,
Dr. Yicheng Wang and Dr. Hyosok Chae (PWRI)

This project consists of:
(1) Tool development; and
(2) Decision Process.

Mr. Makoto Kaneki of PWRI and Dr. Terry Fulp of USBR were co-leaders when the first workshop was held in March 2001 in Long Beach, California. Mr. Junichi Yoshitani replaced Mr. Kankei when PWRI was reorganized in April 2001. In November 2002, Dr. Yichen Wang joined PWRI as a water management simulation specialist on the main research staff in charge of tool development. In January 2003, Dr. Fulp was replaced by Dr. Donald Frevert because of Dr. Fulp's new assignment in Boulder City, Nevada as the River Operations Manager. Currently co-leaders are Yoshitani and Frevert.

Concerning tool development, the main focus has been on application of RiverWare developed at the Center for Advanced Decision Support for Water and Environmental Systems (CADSWES), the University of Colorado. Since the workshop in 2001, Dr. Fulp visited PWRI and some rivers in Japan to demonstrate RiverWare at PWRI, Mr. Steve Setzer visited PWRI in March 2003 to provide additional guidance on the use of RiverWare. Dr.Wang analyzed the applicability of RiverWare to water balance analysis, unique water use in Japanese river basins, and management alternatives. Fundamental differences between the U.S. and Japan on water use and management were noted. The U.S. has much more complicated policies for reservoir operation compared to Japan. More water is utilized in paddy fields in Japan as compared to the US.

Future collaboration will focus on the Yasugawa river basin in Japan and one or two river basins from the WARSMP program and take an approach of understanding hydrology and water use in the basin, water problems, and alternatives. PWRI and USBR will exchange reports on the need for future modifications of RiverWare. PWRI is expected to attend the annual meeting of RiverWare users and possibly individual meetings with CADSWES to discuss modification of RiverWare to improve applicability to local needs.

Concerning the decision process, USBR personnel (Mr. Thayne Coulter and Ms. Deena Larsen) visited Japan in August 2000 to discuss their training document, "How to Get Things Done." Later PWRI published a Japanese version of "How to Get Things Done" in March 2001 for field offices of the Ministry of Construction. Future collaboration plans will be discussed at the next meeting.

3.3. Summary

At the final plenary session, discussion results from each group and the executive meeting were reviewed, modified and approved.

The agreements were reached on the following five topics:

1. Both PWRI and USBR agreed on the value and significance of the collaboration in research, and that research collaboration continue through future workshops.

2. After the U.S. co-leader for Project 2 - Dam Rehabilitation is selected the project topics of future collaboration will be set. The new co-leader should be able to coordinate work on various aspects of dam structures.

3. It was agreed that research cooperation for Project 1 - Floating Islands will be expanded to include studies on littoral zones and wetlands.

4. For the forthcoming workshop, the U.S. side suggested either Colorado or Washington State as possible venues. It was agreed that the workshop will be held in the Pacific Northwest, possibly in coordination with the USGS meeting planned for August 2005.

5. It was agreed that the next workshop will be a two-day meeting in which the researchers will present their results. The additional time will allow for extensive discussions and question-and-answer sessions.

Executive Meeting, PWRI, July 17, 2003

3.4. Field Trips

Several field trips were conducted in the days following the conclusion of the business meeting. These trips were focused on a variety of hydrologic, water quality, water resources, and environmental issues germane to the subject areas of the Implementing Arrangement Projects.

3.4.1. Kogasaki Water Purification Facility (July 18, 2003)

Field trip leader: Mr. Hiroyuki Suzuki*)

****) Head of Water Adjustment Division, Edogawa Office of River, Kanto Regional Development Bureau, Ministry of Land, Infrastructure and Transport (MLIT)***

The Kogasaki water purification facility is located in the middle reaches of Edo River in the Kanto region. The Edo River is an important source of water supply for a metropolitan area. The Saka River is a tributary of Edo River. Its water is polluted by domestic wastewater and an excess of phytoplankton. There is a water purification plant for water supply downstream of the junction of The Edo and Saka Rivers where water pollution had been a problem. The Kogasaki water purification facility was constructed in 1998 to purify water from Saka River by the catalytic oxidation method through gravels with aeration. The length of the channel used for water purification is about 30 m. Its discharge capacity is about 2.5 m^3/s. This facility can remove 60-70% of BOD, SS, ammonia, 2-methylisoborneol (2-MIB), contribute to improved water quality and preserve the natural environment. Mr. Suzuki guided the delegation and explained the function of the facility. He also discussed operation and management of the facility with the delegation.

Kogasaki Water Purification Facility, Chiba, July 18, 2003

3.4.2. The Metropolitan Area Outer Discharge Channel (July 18, 2003)

Field trip leader: Mr. Minoru Santo [*)]

*) ***Head of Discharge Channel Division, Edogawa Office of River, Kanto Regional Development Bureau, MLIT***

The Ministry of Land, Infrastructure and Transport is constructing the Metropolitan Area Outer Discharge Channel to release the water of The Naka, Kuramatsu and Otoshifurutone Rivers into the Edo River during flooding in the Kanto region. Completion of the outer discharge channel will reduce the area flooded from the 76 km^2 recorded during the 1982 flood to about 16 km^2. The outer discharge channel is an under-ground discharge channel. Its characteristics are as follows: total length, about 6.3 km; installation depth, about 50 m; cross-sectional shape, circle; inside diameter, 10.6 m; planned flow rate, 25 m^3/s (Naka River inflow), 100 m^3/s (Kuramatsu River inflow), 85 m^3/s (Otoshifurutone River inflow), 200 m^3/s (discharge to Edo River, note: inflow time difference is taken into account). Mr. Santo provided a guided tour and an explanation of the discharge channel tunnel and construction of the vertical shafts. He and the delegation discussed flood control issues and the function of the outer discharge channel.

Tunnel Channel, The Metropolitan Area Outer Discharge Channel, Chiba, July 18, 2003

Vertical Shaft, The Metropolitan Area Outer Discharge Channel,
Chiba, July 18, 2003

3.4.3. Operation Room for Disaster Prevention, Kanto Regional Development Bureau (July 18, 2003)

***Field trip leader: Mr. Takemi Kenmochi*[*)]**

[*)] Senior Officer for Disaster Prevention,
Kanto Regional Development Bureau, MLIT

The Kanto Regional Development Bureau is located in the Saitama New Urban Center that includes 18 administrative organizations of 10 ministries and government offices. The Saitama New Urban Center is designated as the wide area disaster protection center. The center has advanced disaster protection functions and support systems, such as earthquake-resistant designed buildings, a heliport for emergencies, and a wireless communication network for disaster protection. The Operation Room for Disaster Prevention is in the Kanto Regional Development Bureau's building. The room is used as the disaster management headquarters for earthquakes, storms and floods, volcano eruptions, marine and road accidents, major fires, and so on. The room has information collecting, information analysis and communications functions, including computer networks, large monitors, various meeting rooms and communication control systems to process information as sound, facsimile, still picture, animation and electronic data. Mr. Kenmochi guided the delegation and explained the function of the operation room and its facilities. He also discussed disaster prevention measures and activities with the delegation.

Operation Room for Disaster Prevention,
Kanto Regional Development Bureau, Saitama, July 18, 2003

3.4.4. Kitakamigawa Integrated Dam and Reservoir Group Management Office (July 19, 2003)

Field trip leader: Mr. Keiji Yoshida[*)] and Mr. Masakatsu Takeda[**)]

[*)] Head of 1st Research Division, Iwate Office of River and National Highway, Tohoku Regional Bureau, MLIT

[**)] Senior officer, Kitakamigawa Integrated Dam and Reservoir Group Management Office, Tohoku Regional Bureau, MLIT

The Kitakami River is the largest river in the Tohoku region in the northern part of Honshu Island. Approximately 1.32 million people inhabit this river basin. The Kitakami River is distinguished by the fact that it has a relatively gentle gradient compared with other rivers in Japan. Water damage has long plagued residents, since water is unable to drain away when the level of the Kitakami River rises at flood time. In 1950, shortly after the end of the war, Japan enacted the law for Comprehensive Development of the National Land. The Kitakami River became the first location in the country to be designated under a scheme for projects for the comprehensive development of specified areas. Comparable to the Tennessee Valley Authority (TVA) project in U.S., the Kitakami river initiative was a grand plan known as the Kitakami Valley Authority (KVA). The plan's objectives included flood control measures, electric power generation and the promotion of various industries. The KVA project entailed the construction of five large dams – Ishibuchi, Gosho, Shijushida, Tase and Yuda in the main Kitakami River and its tributaries. Mr. Yoshida and Mr. Takeda explained to the delegation the outline of the Kitakami River basin and the integrated operation and management of five large dams. The delegation discussed water resources development and flood control in this watershed with them.

Kitakamigawa Integrated Dam and Reservoir Management Office, Iwate, July 19, 2003

3.4.5. Shijushida Dam (July 19, 2003)

Field trip leader: Mr. Yoshio Narita[*)], *Mr. Keiji Yoshida and Mr. Masakatsu Takeda*

[*)] Head of 2nd Management Division, Kitakamigawa Integrated Dam and Reservoir Group Management Office, Tohoku Regional Bureau, MLIT

Shijushida Dam was completed in 1968 as the fourth dam of five large dams in the Kitakami River system. Its characteristics are as follows: type, compound type of gravity type concrete and earth fill type; height, 50 m; catchment area, 1,196 km^2; total storage capacity, 47,100,000 m^3; planned discharge, 700 m^3/s, maximum generating capacity, 15,100 kW(kilowatts). The purposes of the dam are flood control and hydroelectric power generation. There was a mine in the catchment area before dam construction. After closure of the mine, the water of the river was acidified and polluted and many fishes died downstream. After completion of the dam, a neutralizer was added into river water upstream of the dam, then, the water quality was improved and fishes were able to live in the river downstream of the dam. However, large amounts of neutralized materials accumulated in the reservoir. Mr. Narita explained to the delegation about Shijushida dam, water quality improvement measures and historical changes in water quality of the Kitakami River. He also discussed the effect of water quality measures and the response of residents to water quality with the delegation.

Shijushida Dam, Iwate, July 19, 2003

3.4.6. Gosho Dam (July 19, 2003)

Field trip leader: Mr. Kunie Shimada*), Mr. Keiji Yoshida
and Mr. Masakatsu Takeda

*) ***Head of 3rd Management Division, Kitakamigawa Integrated Dam and Reservoir Group Management Office, Tohoku Regional Bureau, MLIT***

Gosho Dam was completed in 1982 as the fifth dam of five large dams in the Kitakami river system. Its characteristics are as follows: type, compound type of gravity type concrete and rock fill type; height, 52.5 m; catchment area, 635 km^2; total storage capacity, 65,000,000 m^3; planned discharge, 1,200 m^3/s, maximum generating capacity, 13,000 kW(kilowatts). The purposes of the dam are flood control, irrigation, domestic water use and hydroelectric power generation. In Gosho Reservoir, an environmental improvement project has been implemented, and recreational sites are provided. After the reservoir filled two wetlands (area, 91 ha and 42 ha) have been formed, and various creatures inhabit them. The habitat and growth of animals and plants is being investigated. As a result, 245 species of plants and 396 species of insects were confirmed. Many fish, birds and animals also inhabit the area. The wetlands are blessed by abundant nature. Mr. Shimada guided the delegation through Gosho Dam and wetlands, and explained the future of the dam and the formation process of wetlands. The delegation discussed environmental improvement method for the reservoirs with him.

Wetland, Gosho Dam, Iwate, July 19, 2003

3.4.7. Ichinoseki Retarding Basin (July 19, 2003)

Field trip leader: Mr. Hiroshi Sugiyama[*], *Mr. Tohru Yamazaki*[**] *and Mr. Keiji Yoshida*

[*] *Head of Ichinoseki Branch Work Office, Iwate Office of River and National Highway, Tohoku Regional Bureau, MLIT*

[**] *Supervisor, Iwate Office of River and National Highway, Tohoku Regional Bureau, MLIT*

The Ichinoseki – Hiraizumi area, located midway along the Kitakami River, suffers frequent flood damage due to the bottleneck in the downstream reach of the river. In order to regulate flood discharge with five large dams, the Ichinoseki Retarding Basin was designed in the flood control plan of Kitakami River system. According to the plan, the retarding basin will cut the peak discharge by 1900 m^3/s. The retarding basin is made up of three basins. The No.1 basin (820 ha) uses a double-line embankment system made up of an encircling levy protecting downtown from flooding from the main river and small embankments right in front of the river. The No.2 basin (470 ha) and The No.3 basin (160 ha) are enclosed by the mountains in the rear and have small embankments in front of the river. During the construction of the embankment, the remains of an ancient city (12th century) were discovered. To preserve the remains, the route of the embankment was changed. Mr. Sugiyama explained the operation of the retarding basin project and guided a tour of the central management center to control many drainage pump facilities and water gates around the retarding basins. He discussed the cooperation of residents on the retarding basin project.

Office, Ichinoseki Retarding Basin, Iwate, July 19, 2003

3.4.8. Lake Shikotsu (July 20, 2003)

Field trip leader: Mr. Leo Hirano[*)]*, Mr. Taizo Ida*[**)] *and Mr. Nobuyuki Hotta*[***)]

[*)] *Deputy-Director, River Planning Division, Construction Department, Hokkaido Regional Development Bureau, MLIT*

[**)] *Head, Ishikari River Water Management Research Office, Planning Division, Ishikari River Development and Construction Department, Hokkaido Regional Development Bureau, MLIT*

[***)] *Construction Supervisor, River Planning Division, Construction Department, Hokkaido Regional Development Bureau, MLIT*

Lake Shikotsu is located at the west side of Hokkaido. The Lake is the source of Chitose River. Its dimensions are as follows: surface area, 78 km^2; circumference, 40 km; maximum depth 360 m; and average depth 256 m. The lake is the second deepest lake in Japan and the northernmost ice-free lake in Japan. The lake is surrounded by about 1000 m high mountains and a primeval forest, including broadleaved and coniferous trees. The water in the lake is clear as less sediment flows into the lake. Mr. Hirano and Mr. Ida explained the Ishikari River, Chitose River, the water quality of the lake and the salmon run up the Chitose River.

Lake Shikotsu, Hokkaido, July 20, 2003

3.4.9. Salmon and Trout Resources Management Center (July 20, 2003)

Field trip leader: Mr. Toshimasa Takahashi*[*)], *Mr. Leo Hirano,
Mr. Taizo Ida and Mr. Nobuyuki Hotta

*[*)] **Sub-Director, Chitose Branch Office, National SALMON Resources Center, Incorporated Administrative Agency***

The Salmon and Trout Resources Management Center (STRMC) is a salmon and trout hatchery. The hatchery is located in the upper reaches of the Chitose River in Chitose City. The delegation observed several species and sizes of salmon and trout in the aquariums and visited the hatchery facilities. Mr. Takahashi explained the history of the hatchery and the hatching system and facility. He discussed the migration of salmon and trout and how to mark the salmon.

Salmon and Trout Resources Management Center, Hokkaido, July 20, 2003

3.4.10. Chitose Salmon Aquarium (July 20, 2003)
Field trip leader: Mr. Leo Hirano, Mr. Taizo Ida and Mr. Nobuyuki Hotta

The Chitose Salmon Aquarium, located in Chitose City, is the museum of salmon and freshwater fish that live in northern area of Japan. There are big aquariums, a room under the surface of the river to observe wild fish in the river, a waterwheel to capture wild salmon and so on. People can study the ecology of salmon and freshwater fish at the aquarium. Mr. Hirano explained that the waterwheel captures all wild salmon, because salmon can't go upstream through the upper dams. Almost all salmon captured there are used for hatching at the Salmon and Trout Resources Management Center.

Chitose Salmon Aquarium, Hokkaido, July 20, 2003

3.4.11. Izarigawa Dam (July 20, 2003)

Field trip leader: Mr. Takashi Tamagawa*), Mr. Leo Hirano, Mr. Taizo Ida and Mr. Nobuyuki Hotta

*) ***Director, Izari River Dam Operation Office, Ishikari River Development and Construction Department, Hokkaido Regional Development Bureau, MLIT***

Izarigawa Dam is located in the Eniwa City between Sapporo and Chitose City. The dam was built in 1980. Its characteristics are as follows: type, rock fill; dam height, 45.5 m; crest length, 270.0 m; dam volume, 647,000 m^3; catchment area, 113.3 km^2; flood high water level (surcharge water level), 176.5 m; normal high water level, 164.3 m; lowest low water level, 154.6 m; total storage capacity, 15,300,000 m^3; and effective storage capacity, 14,100,000 m^3. The purposes of the dam are flood control, domestic water supply and maintaining clear streams.

Mr. Tamagawa explained about the dam, the water quality problem in the reservoir and its countermeasures. The delegation observed one of the countermeasures, an aeration system, and discussed the effects of the countermeasures.

Izarigawa Dam, Hokkaido, July 20, 2003

3.4.12. Moizari River (July 20, 2003)

Field trip leader: Mr. Leo Hirano, Mr. Taizo Ida and Mr. Nobuyuki Hotta

The Moizari River flows through Eniwa City. The river used to be a flourishing one where salmon spawned. However, the river channel was straightened in the flood protection project and repaired as a three-surface-armored channel by laying blocks between 1955 and 1975. The number of salmon going upstream decreased and the flood control ability of this area declined along with rapid urbanization of Eniwa City. Then flood disasters occurred. Consequently, it was decided to undertake a river improvement project beginning in 1986. In 1990, this project was designated as a "Model Project of Hometown Rivers". The Moizari River was reborn as a safe, pristine, natural and rich river in 1997. Mr. Hirano explained that some salmon recently came to go upstream the river and to spawn in this area. The delegation discussed the influence of planting or diversifying the river cross-sections on the flood discharge and the reaction of the inhabitants.

Moizari river, Hokkaido, July 20, 2003

3.4.13. Takisato Dam (July 21, 2003)

Field trip leader: Mr. Tsuneo Kaga [*], Mr. Leo Hirano and Mr. Taizo Ida

[*] Director, Takisato Dam Operation Office, Ishikari River Development and Construction Department, Hokkaido Regional Development Bureau, MLIT

Takisato Dam is located in Ashibetsu City. It was built in 1999. Its characteristics are as follows: type, gravity type concrete dam; dam height, 50.0 m; crest length, 445.0 m; dam volume, 455,000 m^3; catchment area, 1,662.0 km^2; flood high water level (surcharge water level), 159.5 m; normal high water level 150.9 m; lowest low water level 142.4 m; total storage capacity, 108,000,000 m^3; effective storage capacity, 85,000,000 m^3; flood control discharge, 1,200 m^3/s; and basic flood discharge, 2,400 m^3/s. The purposes of the dam are flood control, maintaining clear streams, irrigation, water supply for 4 cities and hydroelectric power generation.

Mr. Kaga explained the management systems, facilities at the dam, and environment and nature around the dam.

Operation Room, Takisato Dam, Hokkaido, July 21, 2003

Takisato Dam, Hokkaido, July 21, 2003

3.4.14. Chubetsu Dam (July 21, 2003)

Field trip leader: Mr. Kazuo Ebata [*], Mr. Leo Hirano and Mr. Taizo Ida

[*] Deputy-Director, Chubetsu Dam Construction Office, Asahikawa Development and Construction Department, Hokkaido Regional Development Bureau, MLIT

Chubetsu Dam is located in Higashikawa that is the town next to Asahikawa City. It has been under construction from 1994 to 2006. Its characteristics are as follows: type, compound type of gravity type concrete and rock fill type; dam height, 86.0 m; crest length, 290.0 m (concrete dam), 595.0 m (fill dam); dam volume, 980,000 m^3 (concrete dam), 7,740,000 m^3 (fill dam); catchment area, 238.9 km^2; flood high water level (surcharge water level), 419.8 m; normal high water level, 414.0 m; lowest low water level 387.5 m; total storage capacity, 93,000,000 m^3; effective storage capacity, 79,000,000 m^3. The purposes of the dam are flood control, maintaining clear streams, irrigation, water supply and hydroelectric power generation.

Mr. Ebata explained the construction method of the dam in detail. The delegation discussed functions of the selective intake facility, and the way to place concrete under low temperature.

Chubetsu Dam, Hokkaido, July 21, 2003

Chubetsu Dam, Hokkaido, July 21, 2003

3.4.15. Kushiro Wetlands National Park (July 22, 2003)

Field trip leader: Mr. Yasuyuki Hirai) and Mr. Takayasu Fujita**)*

**) Director, River Division, Kushiro Development and Construction Department, Hokkaido Regional Development Bureau, MLIT*

***) Director For River Planning, River Division, Kushiro Development and Construction Department, Hokkaido Regional Development Bureau, MLIT*

Kushiro wetland is located in Kushiro City, on the east side of Hokkaido. The wetland is the biggest and one of the best natural environments in Japan. The wetland was registered at the Ramsar Convention in 1980.

It is important not only for wildlife habitat, but also for human beings as a reservoir that stores, purifies water, controls flooding as in a retarding basin, and moderates the regional climate. Therefore, the wetland is a property that should be conserved. The recent expansion of economic activities in the catchment area has resulted in a remarkable decrease in the wetland boundary, and the vegetation has changed rapidly from colonies of reed and sedge to black alder forest. Therefore, the wetland managers need to develop countermeasures based on various practical investigations and evaluations for the conservation and recovery of the wetland.

The long-term target of countermeasures is to restore the environment to its state when the wetland was registered at the Ramsar Convention in 1980. To achieve this goal, the loads in the catchment basin and from the rivers need to be reduced at least to the levels recorded in 1980. Its specific goals are as follows: controlling inflow of sediment, regeneration of the wetland, controlling the wetland vegetation, restoring straightened rivers to meandering courses, and so on.

Mr. Hirai explained the boundries, nature, present state and management issues of the wetland. The delegation discussed the change of vegetation and wildlife, and the relationship between wetland and city.

Kushiro wetlands National Park, Hokkaido, July 22, 2003

3.4.16. Kushiro Retarding Basin (July 22, 2003)
Field trip leader: Mr. Yasuyuki Hirai and Mr. Takayasu Fujita

The purposes of Kushiro retarding basin are flood control and sediment control. In the retarding basin, a trial project has been carried out. The aim of the project is to control the vegetation and to regenerate the wetland environment by means of water level control in the basin. As a result of water level control, the area of wetland has been increased, and the growth rate of black alder has dropped. Mr. Hirai explained the retarding basin and the trial project in detail. He also discussed the effect of the project and the method to restore the wetland environment with the delegation.

Kushiro Retarding basin, Hokkaido, July 22, 2003

3.4.17. Kushiro River Restoration Project Site (July 22, 2003)
Field trip leader: Mr. Yasuyuki Hirai and Mr. Takayasu Fujita

In order to increase discharge capacity of the river channel, a part of the Kushiro River channel was straightened. After the river channel was straightened, the river environment changed from its original state, and a large amount of sediment was transported to a downstream wetland. To improve these situations, the Kushiro River Restoration Project was planned. During the first stage of the project, a part of the straightened channel in the upper reaches of the Kushiro River (length of channel, about 2 km) is supposed to be restored to a meandering channel. Mr. Hirai and Mr. Fujita guided the delegation to the project site channel and explained the project. The delegation discussed river environment restoration and sediment transport in Kushiro River with them.

Kushiro River Restoration Project Site, Hokkaido, July 22, 2003

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