出國報告：出國類別-參與研討會及參訪

2016年亞洲自來水事業人力資源網絡會議

服務機關：台灣自來水股份有限公司

姓名職稱：林冠伯 工程員

林芳伊 組員

黃鈺涵 組員

派赴國家：韓國

出國期間：105年11月1日至105年11月4日

報告日期：106 年 1 月 6 日

摘　要

本報告為105年11月1日起至105年11月4日止本公司參加「第九屆亞洲自來水事業人力資源網絡會議」及參訪相關設施之紀錄，內容構成包含亞洲自來水事業人力資源網絡會議介紹、會議行程安排、研討會發表內容、參訪行程，以及參訪心得與建議等項目。

本屆會議由韓國首爾市水務局主持，並有韓國水資源公社、泰國都會水務局、日本東京都水道局及本公司計5個機構之代表人員與會。本屆會議討論主題有二，分別為「提升危機管理的人力資源發展（HRD to promote risk management）」及「友善環境的水資源計畫與人力資源發展（Environment-friendly water projects and HRD）」，並由主辦單位安排參訪九宜（Guui）淨水場及生態園區「仙游島公園」，另有文化觀光行程如亂打秀、東大門設計廣場及景福宮。

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壹、亞洲自來水事業人力資源網絡會議（A1-HRD）簡介及目的

2007年，東京都水道局(The Bureau of Waterworks, Tokyo Metropolitan Government)為使亞洲各國家（城市）自來水事業機構在人力資源發展運用方面，能有經驗交流、知識共享的機會與溝通平台，發起了「亞洲自來水事業人力資源發展網絡會議」(Asian Waterworks Utilities Network of Human Resource Development)，並以各單字第一個字母簡稱為A1(WUN)-HRD，期能藉此平台促進各國間之國際交流，提升亞洲自來水事業之技術層次。

目前本溝通平台之成員共計5個國家、7個自來水事業單位，除發起者日本東京都水道局之外，尚有韓國水資源公社（Korea Water Resources Corporation）、韓國首爾市水務局（The Office of Waterworks, Seoul Metropolitan Government）、越南建設部第二建設協會（College of Construction No. 2, Vietnam Ministry of Construction）、泰國都會水務局（Metropolitan Waterworks Authority）、臺北自來水事業處及本公司，另蒙古自來水服務管理委員會（Water Services Regulatory Commission of Mongolia）亦以觀察員身份參與。除了每年召開會議外，東京都水道局亦不定期發佈 Newsletter，以更新會議資訊與近期各國間交流的訊息。

每年度舉行的人力資源網絡會議是各自來水事業機構間最重要的意見交流時間，由成員輪流主辦，除針對該年度的討論主題發表經驗分享外，亦對於各國近期關注及面臨的各項問題與挑戰進行討論，內容包含人力資源發展與各項專業經驗技術，並於討論會後參訪主辦國相關自來水設備及場域，希冀透過雙方經驗交流與分享，從中汲取各會員國自來水事業管理、技術及實務經驗，以提升本公司自來水專業技術水準及管理知能。

Vol. 23

A1-HRD Newsletter

Asian Waterworks Utilities Network of Human Resources Development

April, 19 2016

To the People of Taiwan

We would like to express our sympathy for the devastation of the earthquake that jolted the southern part of Taiwan on February 6. We are grieved to think of your distress and the damage caused by the earthquake. We pray that the disaster areas will be rebuilt soon.

The Schedule of the 9th Meeting Decided!

The schedule of the 9th Meeting has been decided: It will be held from **November 2 to 4**. As you already know, Seoul Metropolitan Government will host the Meeting.

It will have two themes: "HRD to promote risk management," and "Environment-friendly water projects and HRD." During the Meeting, we will have a presentation and discussion session. Moreover, although it is a tentative plan, Seoul Metropolitan Government kindly gives us a chance to visit their facilities such as Yeong-deung-po Water Purification Plant and Waterworks Museum.

We appreciate the efforts of the Seoul team as they prepare to host the Meeting.

Training program in Tokyo, Post-8th Meeting

The Bureau of Waterworks, Tokyo Metropolitan Government holds an annual training workshop entitled the "Overseas Survey Reports Seminar," aiming to increase the awareness and understanding of international situations among employees. In the seminar this year, the outline of A1-HRD and the success of the 8th Meeting were reported.

Approximately eighty employees, including those from supervising organizations, attended the seminar because of their keen interest in how to coordinate international meetings in the lead-up to hosting the IWA World Water Congress & Exhibition 2018 in Tokyo.

Updates from MWA

Metropolitan Waterworks Authority (MWA) held the ASEAN Waterworks Executive Meeting during 26th - 30th January 2016, at MWA HQ, Bangkok, Thailand, with participants from 10 water utilities in 8 ASEAN member states, together with Bhutan. It was a salute to the ASEAN Community (AC) and a stage allowing all participants to share knowledge and experience in water supply management, which promoted the development of human resources and organizations.

Moreover, MWA in cooperation with JICA arranged Water Treatment and Maintenance Training Course during 29th February - 4th March 2016, for staff from DIRECCAO NASIONAL DOS SERVICOS DE AGUA (DNSA), Timor- Leste. This training course aimed to improve the ability of DNSA staff in water treatment process and facility maintenance as well as deep well and pumping system.

ASEAN Waterworks Executive Meeting held during 26th - 30th January 2016, hosted by MWA

MWA arranged an training course during 29th February - 4th March 2016, for Timor- Leste

圖一、第23期Newsletter：日本東京都水道局關懷台灣0206地震災情及MWA最新消息

Vol. 24

A1-HRD Newsletter

Asian Waterworks Utilities Network of Human Resources Development

September, 7 2016

Dear Members of A1-HRD,

How are you doing?

It's been a very warm summer here in Tokyo. In Japan the fiscal year starts in April, so over the last few months we have completed some of the training programs we started at the beginning of the new fiscal year. We are now preparing for other training for the rest of the year.

This Newsletter is to give you information on the A1-HRD Meeting to be held in November, including the themes of the Meeting and local information about Seoul.

Also we will introduce the new Director of the Training Section and the person in charge of A1-HRD after personnel reshuffles at the Training and Technical Development Center of the Bureau of Waterworks, Tokyo Metropolitan Government. Both of them will be attending the Meeting in Seoul this year. They look forward to seeing you.

The 9th Meeting will be held in November!

As you know, this year's Meeting will be hosted by the Office of Waterworks, Seoul Metropolitan Government. The schedule and themes are as follows.

We look forward to having a lively exchange of views at Seoul.

Period:
From November 2 to 4, 2016

Place:
Seoul, Republic of Korea

Themes

★ "HRD to promote risk management"

★ "Environment-friendly water projects and HRD"

☆ Please choose one or both of the themes and make a presentation.

Please prepare for the Meeting!

Seoul

What is the host city Seoul like?

Seoul is a big city with a population of more than 10 million people and the base for the political and economic functions of the nation. The city is located in a basin in the central western part of the Korean Peninsula surrounded by mountains, one of which is Mt. Bukhansan. The Han River runs through the central part of the basin and Seoul, located approximately 60 kilometers upstream from the mouth of the river, is the hub of transportation.

We may have some wintry days in Seoul in the beginning of November when the 9th Meeting will be held, but it should still be nice autumn weather, so we should have relatively comfortable days.

Visiting Korea for the Meeting in November will be a useful opportunity to learn more about the waterworks in Seoul, and the culture and customs of Korea as well.

Tokyo Waterworks Bureau Training: International Relations Policies

The Tokyo Waterworks Bureau held a training course by issue titled "International Relations Policies" at the beginning of July with a view to deepening our employees' knowledge and understanding of international relations policies and reinforce their awareness of international waterworks situations.

Training of this type welcomes any employee who desires to participate, and provides the participants with knowledge and advice from instructors who have extensive experience in international affairs.

In the latter half of the training, the participants had group discussions with their instructors. We are striving to make our training sessions interesting and innovative, so as to foster young employees who will take responsibility for the Bureau's service in the future.

Scenes from the training

Introduction of new members of the Training Section at TWB

Mr. Kubo Mr. Kakehi Ms. Mae Ms. Okamoto

As a result of the new fiscal year personnel reshuffles, Mr. Sunao Kakehi took office of the Senior Director of the Training and Technical Development Center and Ms. Kumiko Mae took office of the Director of the Training Section at the Training and Technical Development Center.

The person in charge of A1-HRD is also a new transfer: Mr. Masatoshi Kubo, Deputy Director of the Training Section, will be responsible for the A1-HRD secretariat service this fiscal year, together with a staff member Ms. Yoriko Okamoto.

We would like to introduce them with photos here.Ms. Kumiko Mae, Director of the Training Section, and Mr. Masatoshi Kubo, Deputy Director of the same, will attend the Meeting in November.

圖二、第24期Newsletter：第九屆亞洲自來水人力資源網絡會議時間及主題確定

貳、第九屆亞洲自來水人力資源網絡會議議程安排

第九屆亞洲自來水人力資源網絡會議於105年11月2日至11月4日於韓國舉行，由韓國首爾市水務局主辦，除主辦單位外，本次參與成員尚有日本東京都水道局、韓國水資源公社、泰國都會水務局及本公司，總計有4個國家5個自來水事業機構，共計23名人員參與此屆會議。

會議第一天（11月2日）首先前往韓國首爾市水務局會議室，由首爾市水務局人力資源處處長Nho Serk-Tae致詞並由與會人員分別自我介紹後，隨即由主辦單位以簡報介紹首爾世界級的水—Arisu，及其相關自來水事業發展過程，接著由主辦單位贈送參與各國紀念品及大合照後，晚間於中國料理餐廳－世洋園舉行歡迎餐會，氣氛輕鬆愉快，各國人員互動熱絡。

第二天（11月3日）繼續於首爾市水務局會議室進行主題討論，各自來水事業單位就本屆會議主題「提升危機管理的人力資源發展（HRD to promote risk management）」及「友善環境的水資源計畫與人力資源發展（Environment-friendly water projects and HRD）」依序進行簡報發表及提問，本公司選擇以「友善環境的水資源計畫與人力資源發展（Environment-friendly water projects and HRD）」作為主題進行發表分享。茲因下一屆(第十屆)亞洲自來水人力資源網絡會議將由本公司舉辦，爰於意見交流時間由本公司主持會議，以共同討論方式決定下一屆會議的發表主題為「水質監測確保民眾健康與人力資源（Water quality monitoring and inspection to ensure the health of the public and HRD）」及「運用資訊科技強化供水管理及人力資源（Apply information technology to enhance water supply management and HRD）」二擇一。東京都水道局亦針對A1-HRD未來的展望提出建議，往後預計建置網路分享平台及增加訓練課程參訪等項目。另下午參訪行程安排參觀九宜淨水場（Guui Water Purification Center）及文化觀光活動「亂打秀（Nanta Show）」。

第三天（11月4日）行程安排上午參觀位於漢江上的「仙游島公園（Seonyudo Park）」，下午安排參訪文化觀光行程為東大門設計廣場（Dongdaemun Design Plaza）與景福宮（Gyeongbokgung Palace）。最後由韓國首爾水務局將參與各國成員送回飯店後，結束了本屆的會議行程。

表一、第九屆亞洲自來水事業人力資源網絡會議議程表

第一天 11月2日 星期三		
Time	Item	Remarks
15:30	飯店大廳集合	美華達飯店
16:00-18:00	首爾市水務局致歡迎詞 首爾市水務局簡介 紀念品交換 團體合照	韓國首爾市水務局辦公大樓會議室
18:00-20:00	歡迎晚會	
20:00-20:30	返回飯店	
第二天 11月3日 星期四		
Time	Item	Remarks
08:30	飯店大廳集合	美華達飯店
09:00-09:20	上半場簡報	韓國首爾市水務局
09:20-09:40		日本東京都水道局
09:40-10:00		本公司
10:00-10:15	休息時間	
10:15-10:35	下半場簡報	韓國水資源公社
10:35-10:55		泰國都會水務局
10:55-11:15		日本東京都水道局
11:15-12:00	綜合討論及研訂下年度主題	日本及本公司
12:00-13:00	午餐	
13:00-16:00	場站參訪	九宜淨水場
17:00-18:20	文化觀光	亂打秀
18:20-19:00	返回飯店	
第三天 11月4日 星期五		
Time	Item	Remarks
09:00	飯店大廳集合	美華達飯店
10:00-11:30	場站參訪	仙游島
11:30-12:30	午餐	
13:30-15:30	文化觀光	東大門設計廣場
15:30-16:30	文化觀光	景福宮
16:30-17:00	返回飯店	

首爾市水務局簡介

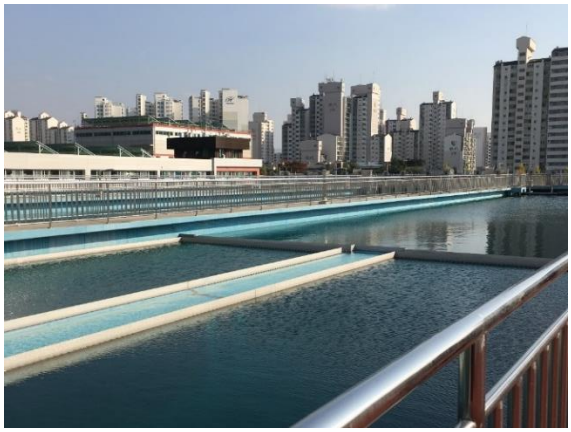
首爾市水務局贈送紀念品於本公司

與會人員大合照

歡迎晚會

會議主題發表

討論下一屆會議主題



參觀九宜淨水場

仙游島導覽

參觀東大門設計廣場

景福宮導覽

參、第九屆會議研討主題

本屆會議主題為「提升危機管理的人力資源發展（HRD to promote risk management）」及「友善環境的水資源計畫與人力資源發展(Environment-friendly water projects and HRD），茲就韓國首爾市水務局、日本東京都水道局及韓國水資源公社發表重點內容摘要如下：

一、主辦單位韓國首爾市水務局與Arisu簡介

2004年，韓國首爾市政府正式把首爾市的自來水的命名為「Arisu」，「Arisu」曾經是漢江的舊稱，代表著韓國首爾市把自來水作為品牌經營的企圖，希望在用戶心中建立「Always, Reliable, Innovative, Smart and User-friendly」可信賴的品牌形象，鼓勵民眾多使用自來水，減少購買市售及進口的礦泉水。

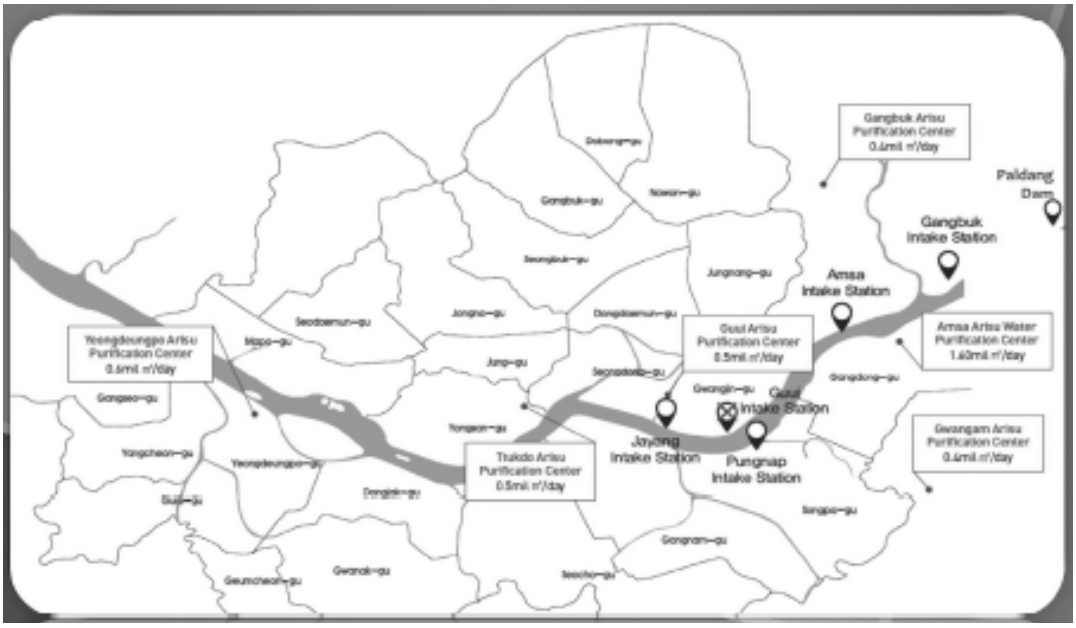
首爾市政府水務局成立於1908年，負責首爾市自來水供應，其政策概要為：構建大容量生產設施、生產世界最優質的自來水、構建無斷水的自來水供應體系、達到最穩定的供水效率、Arisu品質高級化、提供最優質的客戶服務。

首爾市政府水務局係由副市長為督導，總部設有總經理及管理、客服、生產、供水及設備管理等5個局處，共229人，另外轄屬有1個研究中心、8個供水辦公室、6個淨水廠及1個供水設備管理中心，研究人員92人、其它員工1,618人。

該區域主要水源來自漢江，供應首爾市內約1030萬人使用，每日平均配水量約313萬噸，最大處理量為430萬噸(6個淨水廠)，總管線長度為13,697公里，另外，轄內取水站為4處，配水池總容量約240萬噸(102座)及加壓站共設置205座。

由於氣候變化及環境變化導致強降雨、藻類增多，造成異味物質的發生，為了應對這些無法預測的情況及污染物質的流入，首爾市政府水務局引進水質

綜合管理系統，以加強原、淨水水質管理及按供應系統高效管理水質；另外，首爾市政府水務局近年也積極與國外水務單位合作，透過會議或網路建立水資源資訊交流平台。



圖三、漢江上設有多個取水站

二、各國會議主題發表摘要

（一）韓國首爾市水務局

1、基本介紹

首爾市政府水務局之基本介紹，包含：Arisu介紹、組織架構及供水設施說明大致與第一天簡報相同，於此不再重述。

2、Protection Methods of Freeze/Burst Water Meter

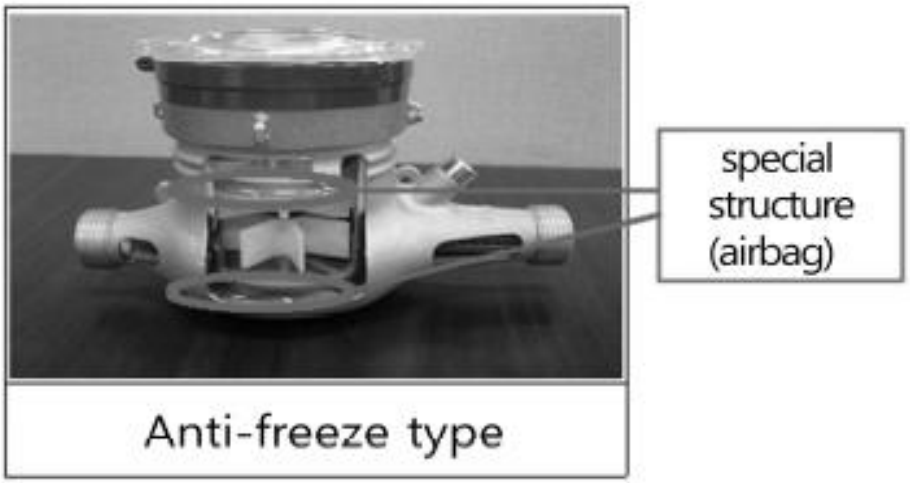
面對氣候異常，韓國冬季期間的穩定供水出現了問題，首爾市通過正在推動因應冬季寒流的“自來水水錶凍裂預防對策”透過提高凍裂安全水錶性能及普及率、提升水錶箱保溫性能和普及率、推動凍裂預防宣傳工作等積極作為，解除市民生活的不便，供應穩定的自來水，另亦透過持續的技術開發及各種凍裂預防措施，提高市民的生活質量。

經統計指出於2010年11月~2011年2月間共發生24,519次水錶爆裂事件、2015年11月~2016年2月間則發生5,928次，由數據可知透過對水錶的預先檢測、保養及強化，並對民眾宣導、加強員工教育訓練等作為，水表爆裂事件發生次數已有大幅下降趨勢，期許2016年11月~2017年2月可以達到無水錶爆裂事件發生的目標。

在預先檢測部份，係採區域性的管理系統，在冬季來臨前(三月~十月間)，由專業人員各別檢測轄區內抗凍能力較弱的水錶，並發展更好的水錶抗凍方法。

在水錶保養及強化部份，基本預防原則為「延遲凍結的速度」及「吸收膨脹」，阻止外部冷空氣的流入、保持水錶溫度並更換為抗凍水錶。另外，制訂預防計劃，按房屋類型分類設置預防措施(如：防風罩、水錶加熱器、抗凍水錶)。

在人力資源方面，首爾市政府水務局透過電視、廣播及報紙等公告宣導，讓民眾了解水錶爆裂的相關訊息及預防機制；另外對員工辦理災害安全管理、水錶爆裂事件等相關訓練課程，以提升從業人員因應緊急狀況之能力。



圖四、抗凍水錶的氣室（airbag）可以防止溫度變化時大約25%的影響

（二）日本東京都水道局

1、基本介紹

東京都水道局，屬東京都政府轄下之單位，該局供水範圍為東京都23區及多摩地區26個市町，供水面積約1,239km2，給水人口1,300萬人，普及率100%，用戶數約730萬戶，配水管長度2萬6,915km，最大供水能力為460萬CMD。

2、Capacity Building on Crisis Management in Tokyo

因氣候異常導致颱風、洪水、地震、海嘯等天災嚴重影響日本地區，使得該地區供水系統面臨極大考驗，東京都水道局為因應突發危機，建立了危機因應計畫，包含預防措施(相關設備抗震準備)

及緊急處置措施(地震後的供水計畫)。

表二、地震時緊急動員情形

地震震度	六級以上	五級	五級以下
活動時機	不經通知即達動員地點		按指令
成員	所有員工	第一組	按指令
佈署地點	辦公室	辦公室	辦公室
負責緊急供水員工	各緊急供水站		

預防措施係以「減輕地震對相關設備的破壞程度」及「確保地震後供水穩定」為首要目的，採取的措施有：地震前的預先準備(包括：成立緊急供水小組、緊急取水站、給民眾的取水袋、管線測漏、採用耐震接頭管線)，建立完整的緊急應變機制(包括：地震前的預防、地震後的供水及設備修復)，緊急應變訓練課程(包括：相關政府機關、民眾及學校講習)。

取水袋可負重6公斤，盛裝約6公升的水

3、Environment-friendly water projects and HRD

東京都水道局就環境議題研擬了一套5年計畫(2015~2019)，係以基礎環境政策、努力減少環境負荷、系統性宣導該計劃為架構推動，在商業營運和環境保護相互平衡的政策原則下，引進液壓發電努力以提高能源效率，減少環境負荷；在環境保護宣導部分，除了實施員工培訓會議外，並辦理實地參訪課程，透過相關活動分享知識、蒐集最新研究資訊並提升環境保護意識；另外亦建立環境管理

系統，藉由員工在相關課程中的回饋及意見，持續檢討修正該環境計畫。

在人力資源方面，為提升員工的環境保護意識，東京都水道局每年辦理1天的環境知識教育訓練，參與人數約60人，每年辦理3次水源涵養林實地教育訓練，參與人數約180人，全體員工每年必須參與30分鐘的環境教育訓練等訓練；另外東京都水道局每年編列預算補助員工參與相關環境教育訓練。

（三）韓國水資源公社

1、基本介紹

K-Water（韓國水資源公社）是韓國最主要水管理的國有公司，擁有40多年水資源管理的歷史，綜合水資源開發和提供公共和工業用水，自1967年成立以來，K-Water提供水資源的服務，包含有水資源管理、供水及污水處理、綠色能源發展、河川與運河整治及促進工業園區與新興城市的發展。

2、New approach of capacity building strategies to resolve global water issues

在人力資源發展策略上，為提升人員競爭力，K-water建立了訓練學院，以各種不同水資源基礎建設為教學環境，提供實用的學習相關知識，內部培訓：有320個課程，每年訓練1萬5千人；外部訓練：對於地方政府開設70種課程；對於私人公司開設20種課程；對於國際人員開設20種課程。

另為因應目前所面臨的全球氣候異常問題，設計了相關問題處理能力的訓練課程，以培養從業人員的危機處理能力；K-water亦建立了全球水資源合作及資訊交流的網路平台，鼓勵全球水資源人才參與該學院的訓練課程，經統計截至2016年9月，共有96個國家、3,438名學員參與了244個課程。

圖五、K-water具有多種基礎設施可進行多樣化的訓練

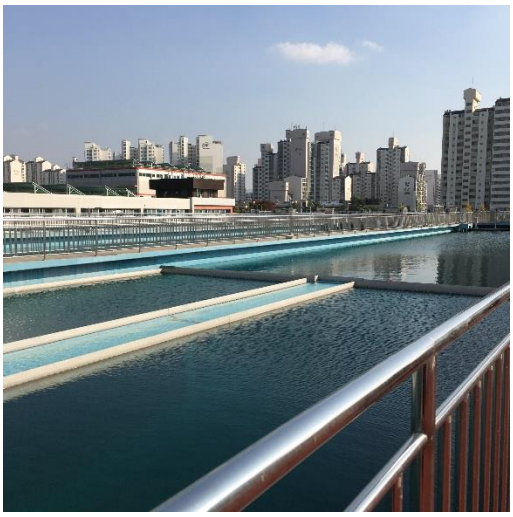
肆、參訪行程

一、九宜淨水場（Guui Purification Plant）

九宜淨水場位於韓國廣津區九宜洞，水源取自漢江，取水能力約為96萬CMD，設備處理能力為25萬CMD，平均出水量為18.2萬CMD，供水人口數約58萬人。

在九宜淨水場設有模場實習設施，並開設各類專家培訓課程；由首爾市水務局，將經驗豐富的優秀人員指定為講師，根據自來水市民不便事項實施現場實習培訓，以解除市民不便而不斷進行著多角度、創新性的努力。

九宜淨水場歷史悠久，是日主辦單位業就該淨水場歷史過程及相關舊有設備進行導覽解說，包括水處理設備介紹及操作機制說明，該淨水場係首爾各機關學校對於水資源發展教育的示範場域。



九宜淨水場的快濾池

臭氧儲存槽

藥品儲存槽

系統監控操作閥

志工導覽解說舊有設施

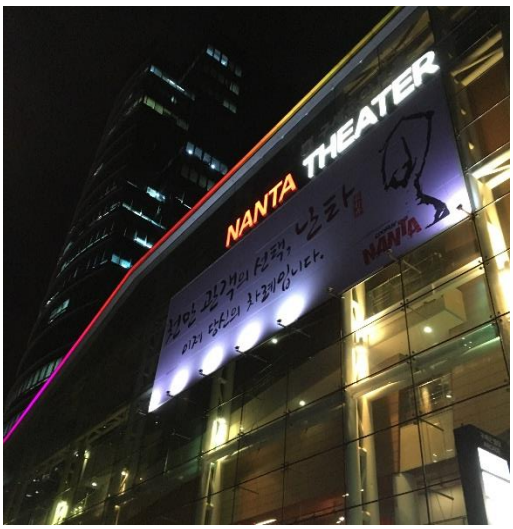
過去使用的控制閥

快混池

膠羽池

二、亂打秀（Nanta Show）

亂打秀是韓國有名的流行音樂劇，節目時間大約一個小時，劇中演員沒有台詞，依憑著演員的動作與表情來理解他們的故事情節及情緒演繹。亂打秀以他的音樂性著名，因故事背景是發生在廚房內，演員在劇中會以鍋、碗、瓢、盆、桶及鐵桌作為打擊樂器敲擊出精彩的節奏，時而加上武打、特技與華麗的切、炒料理動作，並有與觀眾的互動橋段，除了視覺與聽覺享受，還可以聞到食物的香味，非常有趣，讓我們這些國外來訪的觀眾，也可以看得津津有味。



位於首爾市區的亂打秀劇場

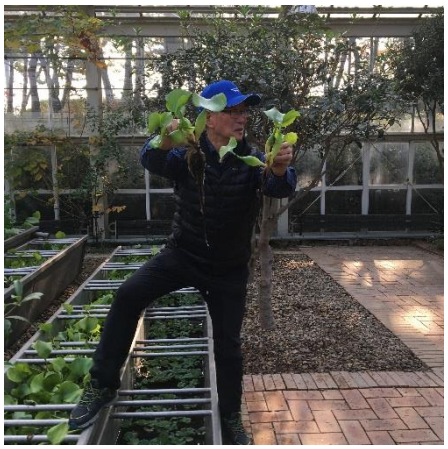
亂打秀的舞台

三、仙游島公園（Seonyudo Park）

仙游島公園是位於漢江間的一座小島，從楊花大橋即可進入園區。早期在1978年至2000年間，這裡建設為淨水場，在淨水場關閉後，直到2002年4月韓國將所餘淨水場設施改建成現在的仙游島公園，成為第一座資源再利用的生態公園。據說在淨水場拆除前，員工們在漢江兩岸種植許多桃樹，每逢春天桃花茂盛，頗為壯觀，因此有了「仙游島」這樣的名字。漢江是首爾市的水資源命脈，而仙游島公園則代表了首爾市為了恢復漢江自然生態的努力，極具深遠意義。

仙游島公園是一個長形的公園，從正門口進去每區都有不同面貌，其中有四個主要區域是利用了原本的淨水設施所建造，分別為水質淨化園、綠柱庭園、水生植物園及時間庭園，分述如下：

（一）水質淨化園：第一站為室內的水質淨化園，是將原有的藥品沉澱池改造修建而成，這裡種植許多水生植物，是大自然中天然的淨水技師，在水質淨化園及一旁的溫室都可以觀察各種水生植物的生長及淨水過程，而溫室內作為淨化水渠的不銹鋼水槽也是將原有的沉澱池使用設備進行改造和再利用的設施。



解說志工講解水生植物的淨水構造

冬天也可以觀察到水生植物的溫室

（二）綠柱庭園：通過仙游島故事館，可來到綠柱庭園。仙游島故事館展示著仙游島與漢江歷史文化，它是改造利用原本長方形的送水泵間建造而成，共有二樓的思索空間、一樓的企劃展覽室及地下室的視頻展覽館。綠柱庭園是將原本的淨水池拆除天棚後留下的建築支柱，支柱上爬佈滿了爬牆虎之類的藤蔓植物，井然有序、錯落有致，是一個休息與思考的空間，有趣的是，其中一根支柱沒有種植植物而是保留原本的建築形態，還可以藉由支柱顏色的深淺不同看見淨水池水平面的分界。

仙游島故事館展出淨水設施

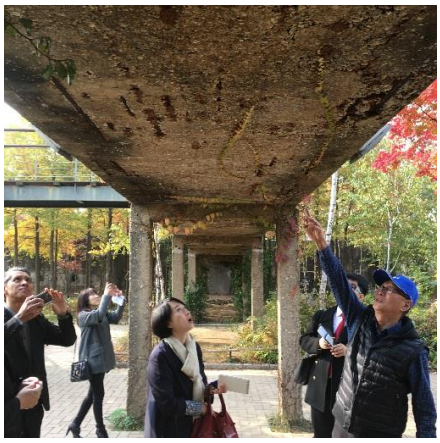
綠柱庭園

（三）水生植物園：改造原有的過濾池建造成水生植物園，可在戶外近處觀察各種水生植物的外觀及生長過程。由於水生植物對於環境變化較為敏感，藉由保護水生植物的生長，就能抑制環境與水質的汙染，進而保護自然生態界。因此這些水生植物成為了水質保護的天然指標。

原為淨水場過濾池水生植物園

志工解說水生植物對環境的重要性

（四）時間庭園：改造原有的藥品沉澱池，並用多種植物裝點而成的空間，是園區內最完整保留淨水場原有結構的改造設施，可欣賞多種不同植物組成的小型主題公園，在此落地生根的植物與日漸老化的建築結構形成強烈的對比，讓人感受到時間的痕跡。



植物佈滿了原有的建築結構

植物攀附在舊有淨水場外牆

此外還有一區改造了原有的濃縮槽與平衡槽，形成了四個圓形空間，作為休閒娛樂與環境教育所用，分別有環境遊樂場、圓形劇場、環境教室與洗手間，將原有的設施完美的再利用，成為一個寓教於樂的最佳場所。另外，園內的仙游亭與仙游橋皆可欣賞美麗的漢江風光，使仙游島公園不僅是個宜人的遊憩場所，更是教育下一代自然環境重要性的天然教室。

原有的存放藥劑的圓形柱

仙游橋上的漢江

用廢棄水管做成的遊樂區

利用原有設施改造成的環境教室

四、東大門設計廣場（Dongdaemun Design Plaza）

東大門設計廣場位於首爾市東大門，簡稱為DDP，除了是代表英文名稱的字首縮寫外，亦蘊含了這裡是夢想美好的世界（Dream）、實現設計創意思維（Design）、並分享豐富多彩的生活（Play）的地方。東大門設計廣場是世界規模最大的三維不規則建築，使用了四萬五千多片形狀各異的面板構成獨特的外觀，共有地上四樓至地下三樓的使用空間，作為推廣創意、藝術、設計、文化與相關生活及產業結合的地方，並二十四小時開放，成為市民休憩與享受多元文化的場所。

五、景福宮（Gyeongbokgung Palace）

景福宮為朝鮮王國的的正宮，也是朝鮮五大宮闕中規模最大的，經歷過王室鬥爭的大火焚燒了部分宮殿，中日戰爭的破壞及日治時期的拆建等，至2010年才正式完成重建。景福宮的正門稱作為光化門，其名取自「光照四方，教化萬方」之意，從光化門進入後，可欣賞到不同的宮殿建築。該場所設有韓、中、日、英四種不同語言的定時導覽，讓各國的訪客的都能深入了解朝鮮的王宮文化與歷史。

東大門設計廣場內部不規則樓梯

朝鮮大王用來舉辦宴會的慶會樓

伍、建議及參訪心得

本次至韓國首爾參加A1-HRD會議，除了分享本公司的「水資源友善環境」議題外，也聽取了其他國家在「風險管理」和「水資源友善環境」議題上的執行方式及人力資源發展策略，並經由會議中互相討論及提供建議，讓與會者都能進行交流與學習，雙方均受益良多，以下為參與本次會議之心得與建議：

一、國際資訊平台建置，增進溝通學習機會

全球環境變遷快速，又各地區外在天然環境不同，所面臨經營環境與困難亦有所差異，如韓國冬季會面臨水錶凍裂，而臺灣則是颱風季節時，水源有高濁度問題，惟就處理機制，如先分析問題、分類研擬處理策略、落實執行並檢核其效益及整體制度規劃部分仍可作為本公司未來政策推動之參考，且未來本國際會議將推動資訊交流平台建立，使成員均能透過網路共享、交流相關水資源知識，此部分亦是我們可以借鏡之處，如國內相關水資源單位(如：經濟部水利署、臺北自來水事業處、台水公司、農田水利會等)可建立一個共同平台，彼此相互交流與分享資訊，以提升國內水資源運用效率，並穩定國家發展。

二、促進國際間知識分享與技術交流

為汲取國外先進自來水事業之經營經驗與新知，本公司除辦理員工及各級主管之訓練外，每年均持續辦理國外研習、觀摩與交流，以提升本公司自來水專業技術水準與管理知能，其中為學習國際間知識與技術交流，本公司已於102年度與日本東京都水道局簽訂合作備忘錄(MOU)，以提升本公司自來水技術、用戶服務品質及人才培育等項目，並於105年派相關人員赴日本實地考察及學習其員工訓練設施，俾使本公司之員工訓練場所建置，更符合實際需求及國際趨勢。又韓國水資源公社亦透過A1-HRD會議，取得與本公司聯繫方式，進行該單位國際參訪活動，為增進國內水資源知識分享與交流，本公司安排韓國水資源公社至國內臺北翡翠水庫管理局、臺北自來水事業處、本公司第7區管理處之高級處理淨水場及澄清湖觀光區進行經驗分享與技術交流，促進國內外互相學習機會，也相信未來與國際間互動會越來越頻繁，使本公司能與先進國家進行標竿學習，增進拓展視野機會，提升本公司專業水準。

本公司與韓國水資源公社於會議中交流

參訪本公司大合照

三、創造親水體驗價值，提升本公司社會形象

本公司目前設置深溝水源生態園區及澄清湖高質水環境教育園區，營造兼具「水知識」「水安全」「水生態」和「水文化」的水源生態環境，並建構一個具有人文、藝術、科技、生態和教育的多功能環境學習場域，以推動生態保育及環境教育工作，而本次會議於第二天及第三天分別參訪九宜淨水場和仙游島，九宜淨水場因歷史悠久，除了有早期水處理設備及完善的導覽解說外，為因應首爾地區用水需求，該淨水場也設置了現代化的淨水處理設施；而仙游島則為兼具生態維護及淨水處理知識的教育園區，該兩園區除了提供學校教育外亦為民眾休閒遊憩的場所，在導覽過程中，兩園區參觀動線及流程十分順暢外，主辦單位解說亦十分清楚，並充分展現與參與者互動，使我們從中除吸收知識外，也有深刻良好印象，此為我們在辦理環境教育推廣時，值得學習地方，另外，首爾市水務局創立了一個屬於他們自己的自來水品牌「Arisu」，更設計他們的吉祥物「Ari」與「Asu」，以行銷自來水，提升企業形象，而本公司深溝水源生態園區亦有設計吉祥物「樂水精靈」，以其活力四射，充滿幹勁的表情，傳達員工秉持服務公約的工作態度，守護水源，期望作到「戶戶用水、滴滴用心、顧客滿意」的心，加深民眾來參訪園區印象。

首爾市水務局吉祥物「Ari」與「Asu」

深溝水源生態園區吉祥物「樂水精靈」

四、辦理國際會議經驗

本次參加第九屆亞洲自來水人力資源網絡會議，認識來自亞洲各國自來水領域專家，也藉此彼此互相交流學習，此次主辦單位首爾水務局不管在時間上、接待上及規劃流程上，整體均安排十分得宜，讓我們除了獲取新知外，也能感受他們辦理活動的用心，值得我們仿效，又本公司將辦理下一(第十)屆亞洲自來水人力資源網絡會議，希冀本公司在主辦時也能成功展現本公司優點，並讓各國成員有賓至如歸感覺。

I·SEOUL·U

November 2th ~ 4th, 2016

The 9th A1-HRD Meeting

Seoul Waterworks Authority
Seoul Metropolitan Government

Contents

Participants

No	Country	Name			Utility	Department	Title	E-mail Address
		(First Name)	(Family Name)					
1	Japan	Shigeru	Imai	Mr.	Bureau of Waterworks, Tokyo Metropolitan Government	FacilitiesDivision,TamaWaterworksReformPromotion Center	Director	imai-shigeru @waterworks.metro.tokto.jp
2	Japan	Daisuke	Kase	Mr.	Bureau of Waterworks, Tokyo Metropolitan Government	Shinjuku Service Station, Western Branch Office	Directo	kase-daisuke @waterworks.metro.tokto.jp
3	Japan	Masatoshi	Kubo	Mr.	Bureau of Waterworks, Tokyo Metropolitan Government	Training and Technical Development Center	Deputy Director	kubo-masatoshi @waterworks.metro.tokto.jp
4	Japan	Kumiko	Mae	Ms.	Bureau of Waterworks, Tokyo Metropolitan Government	Training and Technical Development Center	Director	mae-kumiko @waterworks.metro.tokto.jp
5	Korea	Hyoung-Joon	Koun	Mr.	K-water	Academy	Executive Director	hjkoun@kwater.or.kr
6	Korea	Tae-Gab	Kim	Mr.	K-water	Academy	General Manager	ktg2496@kwater.or.kr
7	Korea	Hyun-Suk	Kim	Mr.	K-water	Academy	Senior Manager	zhyunsuk@kwater.or.kr
8	Korea	Mina	Baik	Ms.	K-water	Academy	AssistantGovernor	bmn@kwater.or.kr
9	Korea	Serk-Tae	Nho	Mr.	Seoul Metropolitan Government Office of Waterworks	Human Resource Management Department	Director	nho1213@seoul.go.kr
10	Korea	Hyung-Goo	Kim	Mr.	Seoul Metropolitan Government Office of Waterworks	Measurement Management Department	Assistant Director	goos@seoul.go.kr
11	Mongolia	Purevjav	Erdenejav	Mr.	Water Services Regulatory Commission of Mongolia		Chairman	info@wsrc.mn
12	Taiwan	Kuan-Po	Lin	Ms.	Taiwan Water Corporation	Water Supply Department	Junior Engineer	kplin@mail.water.gov.tw
13	Taiwan	Fang-Yi	Lin	Ms.	Taiwan Water Corporation	Human Resource Department	Officer	fangyi@mail.water.gov.tw
14	Taiwan	Yu-Han	Huang	Ms.	Taiwan Water Corporation	Human Resource Department	Officer	kay788667 @mail.water.gov.tw
15	Thailand	Thanarat	Poorat	Mr.	Metropolitan Waterworks Authority	Waterworks Academic Development Department	Engineer Level 6	kook_civil@yahoo.com
16	Thailand	Supawoot	Tripasai	Mr.	Metropolitan Waterworks Authority	Strategic Planning and International Affairs Division	Engineer Level 7	supawoot@mwa.co.th
17	Thailand	Sutisa	Naksen	Ms.	Metropolitan Waterworks Authority	Waterworks Academic Development Department	Assistant Governor	

The 9th A1-HRD Schedules

- November 2 - 4, 2016
- The Office of Waterworks Seoul Metropolitan Government

Day 1
November 2 (Wed.), 2016

Time	Programs	Remarks
15:30	○ Meeting at the Lobby	Hotel Ramada
16:00~18:00	○ Welcome Address ○ Introduction of Seoul Waterworks, Q&A ○ Commemorative Item Exchange ○ Photo Time	Office of Waterworks (HQ)
18:00~20:00	○ Welcome Party	Restaurant (Seyangone)
20:00~20:30	○ Return to the Hotel	Hotel Ramada

*Dinner is not included except the 1st day

Day 2
November 3 (Thu.), 2016

Time	Programs	Remarks
08:30	○ Meeting at the Lobby	Hotel Ramada
09:00~12:00	○ Opening Address 【 Part.1 】 ○ Presentations (Seoul → Tokyo → Taiwan) ○ Coffee Break 【 Part.2 】 ○ Presentations (K-water → MWA → Tokyo) ○ Discussion (Next Year's Theme, etc.)	Office of Waterworks (HQ)
12:00~13:00	○ Lunch	Bento
13:00~16:00	○ Site Visit	Guii Purification Plant
14:00~18:20	○ Entertainment	Nanta (Non-verbal Performance)
18:20~19:00	○ Return to the Hotel	Hotel Ramada

Themes

★ “HRD to promote risk management”

★ “Environment-friendly water projects and HRD”

Session	Time	Subject	Speaker
Part.1	09:00~09:20	Protection Methods of Freeze/Burst Water Meter	**Hyung-Goo Kim** Seoul Metropolitan Gov.
	09:20~09:40	Capacity Building on Crisis Management in Tokyo	**Shigeru Imai** Tokyo Metropolitan Gov.
	09:40~10:00	Environment-friendly Water Project and HRD	**Kuan-po LIN** Taiwan Water Corp.
	10:00~10:15	Coffee Break	
Part.2	10:15~10:35	New approach of capacity building strategies to resolve global water issuses	**Hyoung-Joon Koun** K-water
	10:35~10:55	MWA Risk Management & HRD	**Supawoot Tripasai** Thailand Metropolitan Gov.
	10:55~11:15	Environment-friendly Water Projects and HRD	**Daisuke Kase** Tokyo Metropolitan Gov.
	11:15~12:00	Discussions	
	12:00~12:50	Lunch	

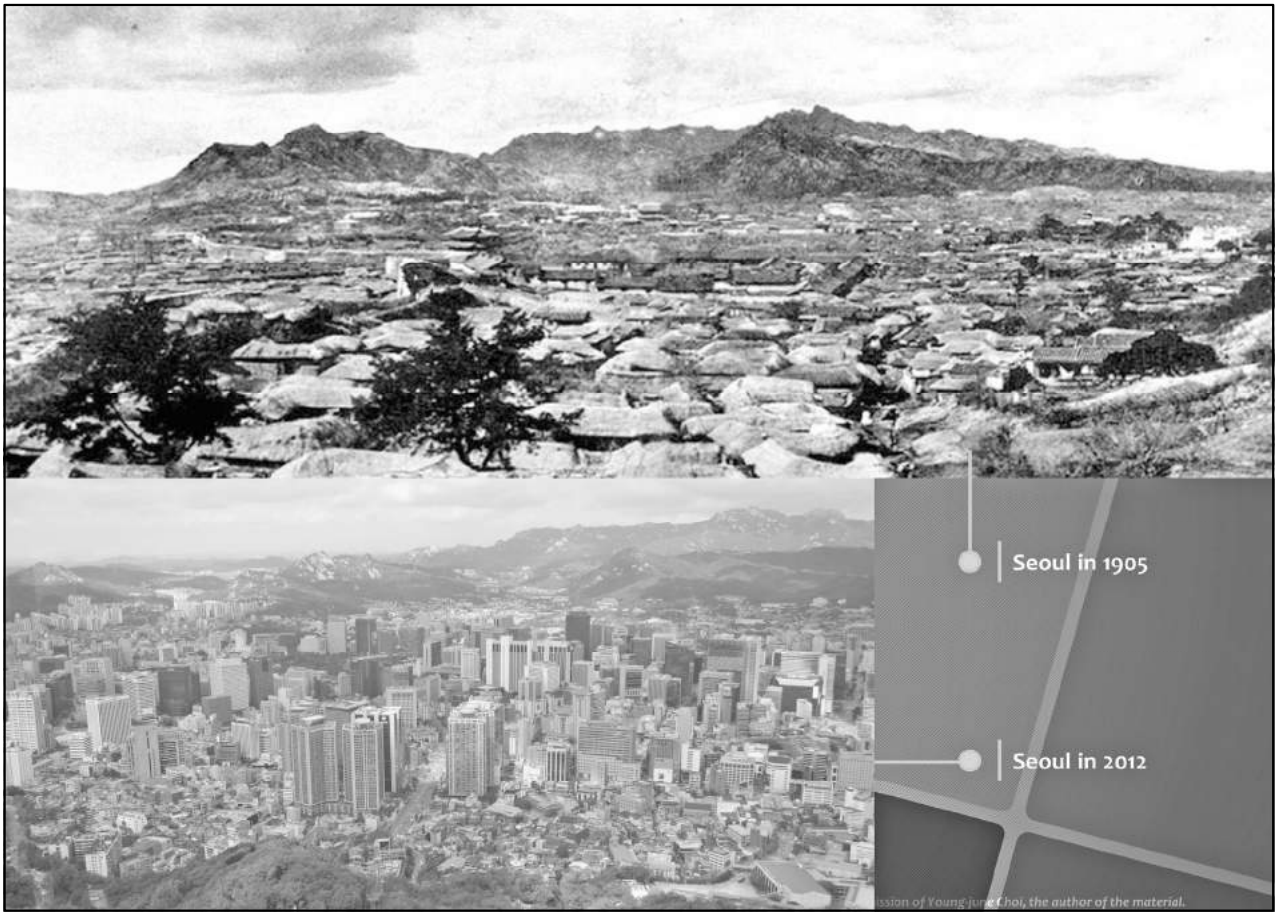
Day 3
November 4 (Fri.), 2016

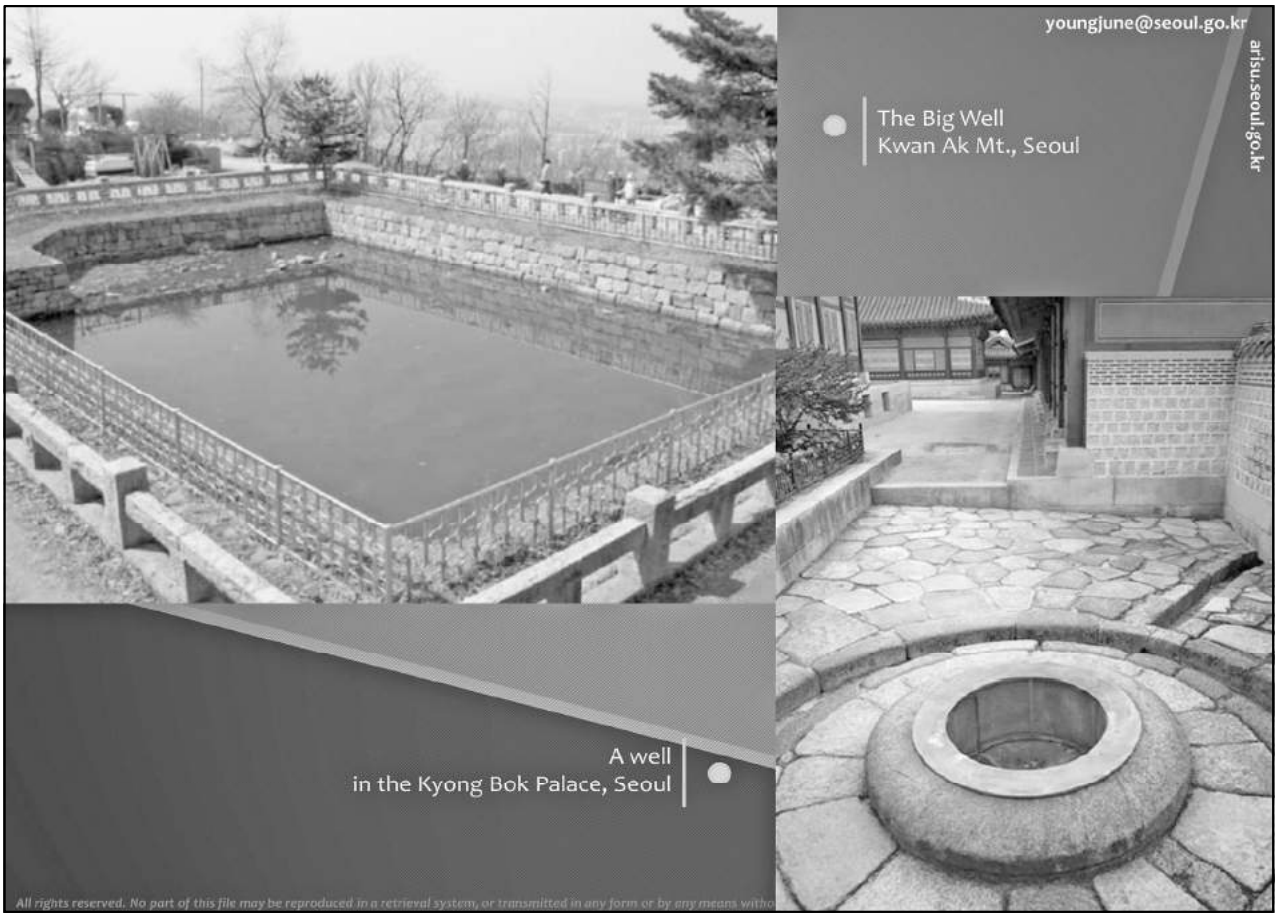
Time	Programs	Remarks
09:00	○ Meeting at the Lobby	Hotel Ramada
10:00~11:30	○ Site Visit (Reuse of Closed Water Treatment Plant)	Hangang River, Seon-yu Island
11:30~12:30	○ Lunch	Restaurant (Cafe NARU)
13:30~15:30	○ Sightseeing	Dongdaemun Design Plaza
15:30~16:30	○ Sightseeing	Gyeongbokgung Palace
16:30~17:00	○ Return to the Hotel	Hotel Ramada

Global Best Tap Water
ARISU

The Office of Waterworks,
Seoul Metropolitan Government


GLOBAL BEST TAP WATER,
ARISU
The Office of Waterworks, Seoul Metropolitan Government


Seoul in 1905
Seoul in 2012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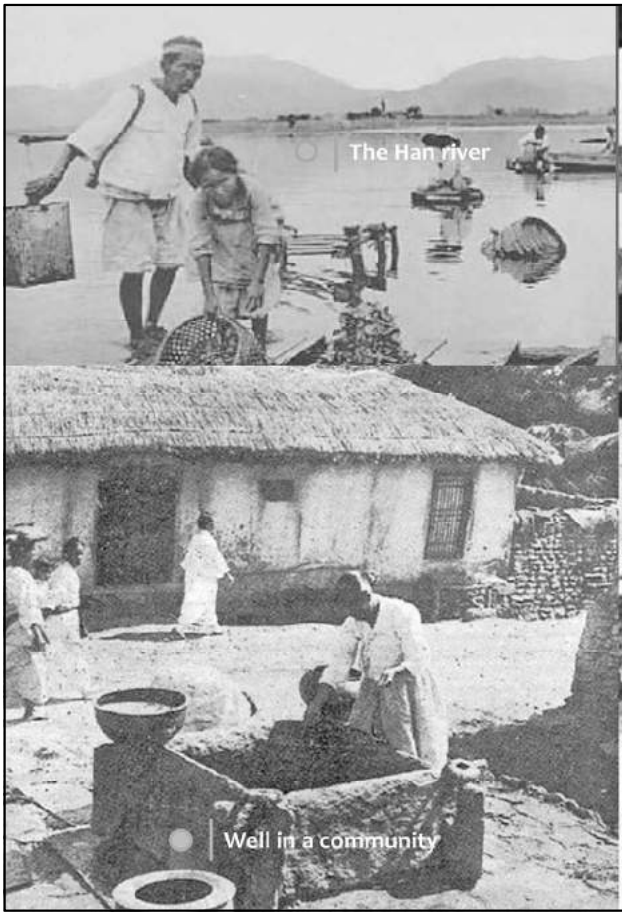
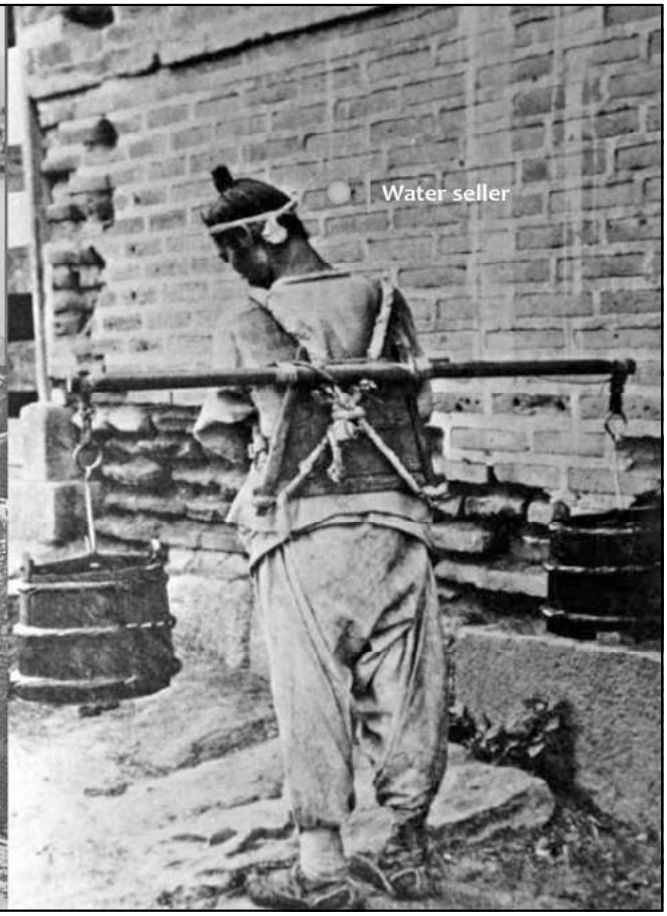
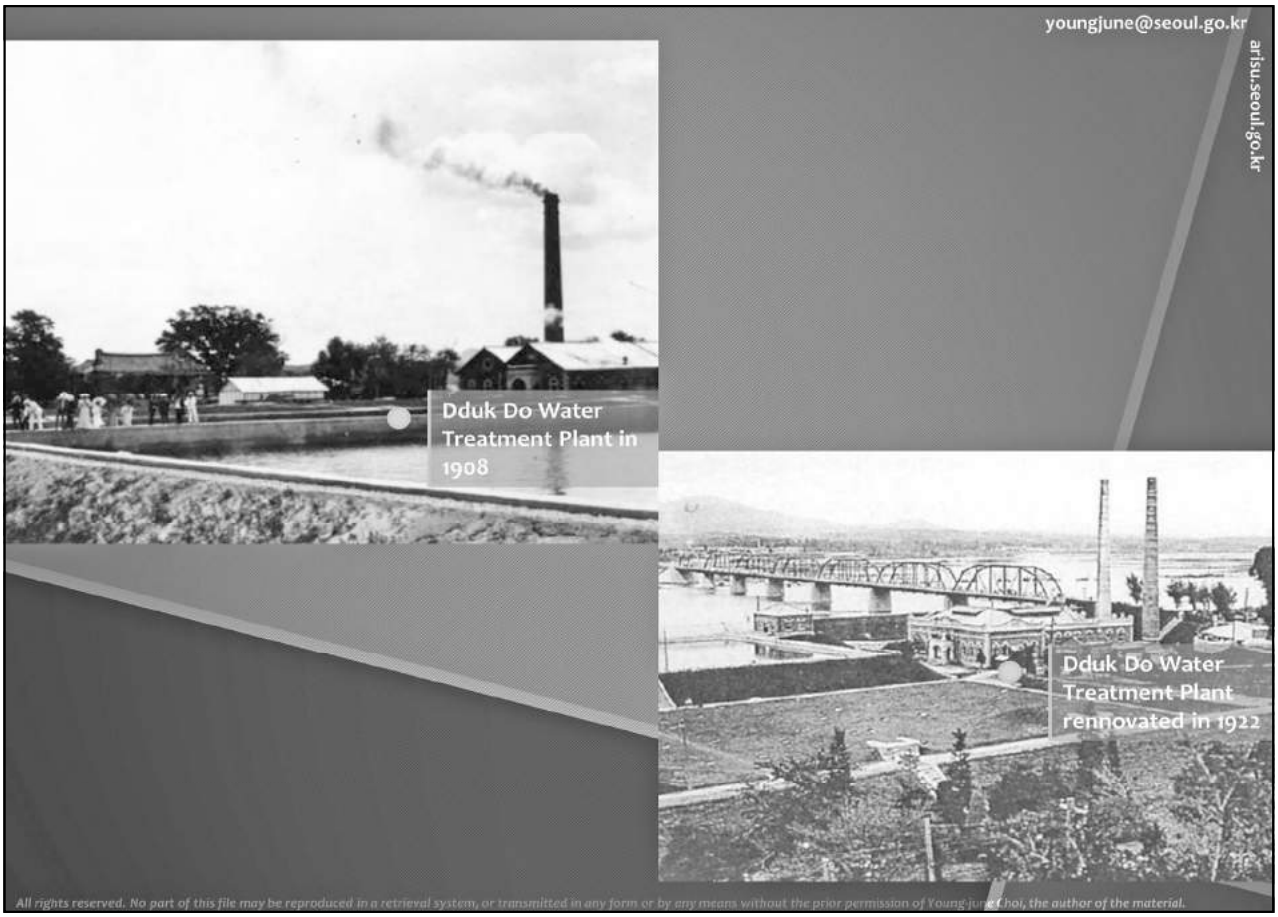
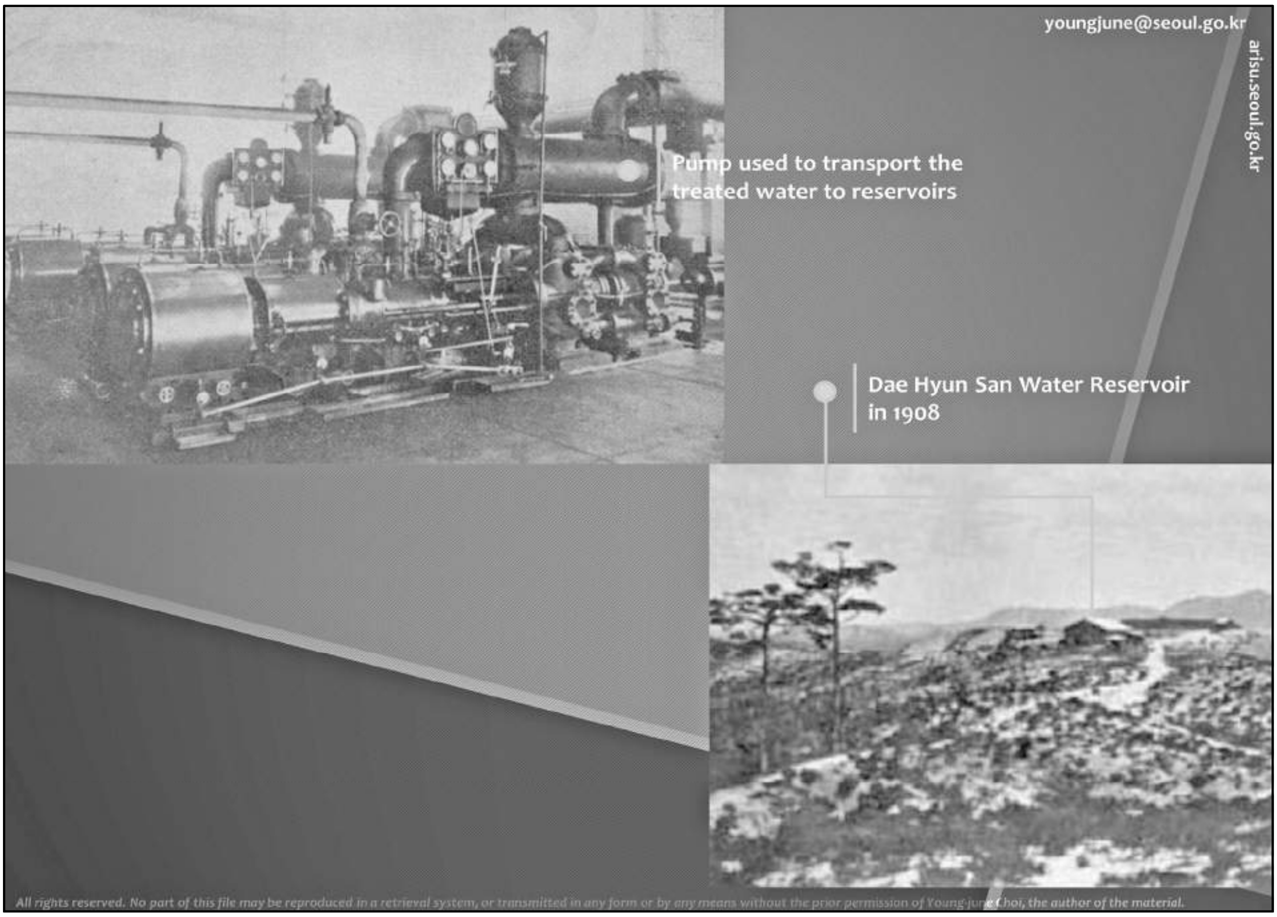
The Big Well
Kwan Ak Mt., Seoul
A well
in the Kyong Bok Palace, Seoul


The Han river
Well in a community


Water seller





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Pump used to transport the treated water to reservoirs
Dae Hyun San Water Reservoir in 1908
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Commercial on a newspaper The Independence, March 24, 1909
"Let's drink pure and tasty water"
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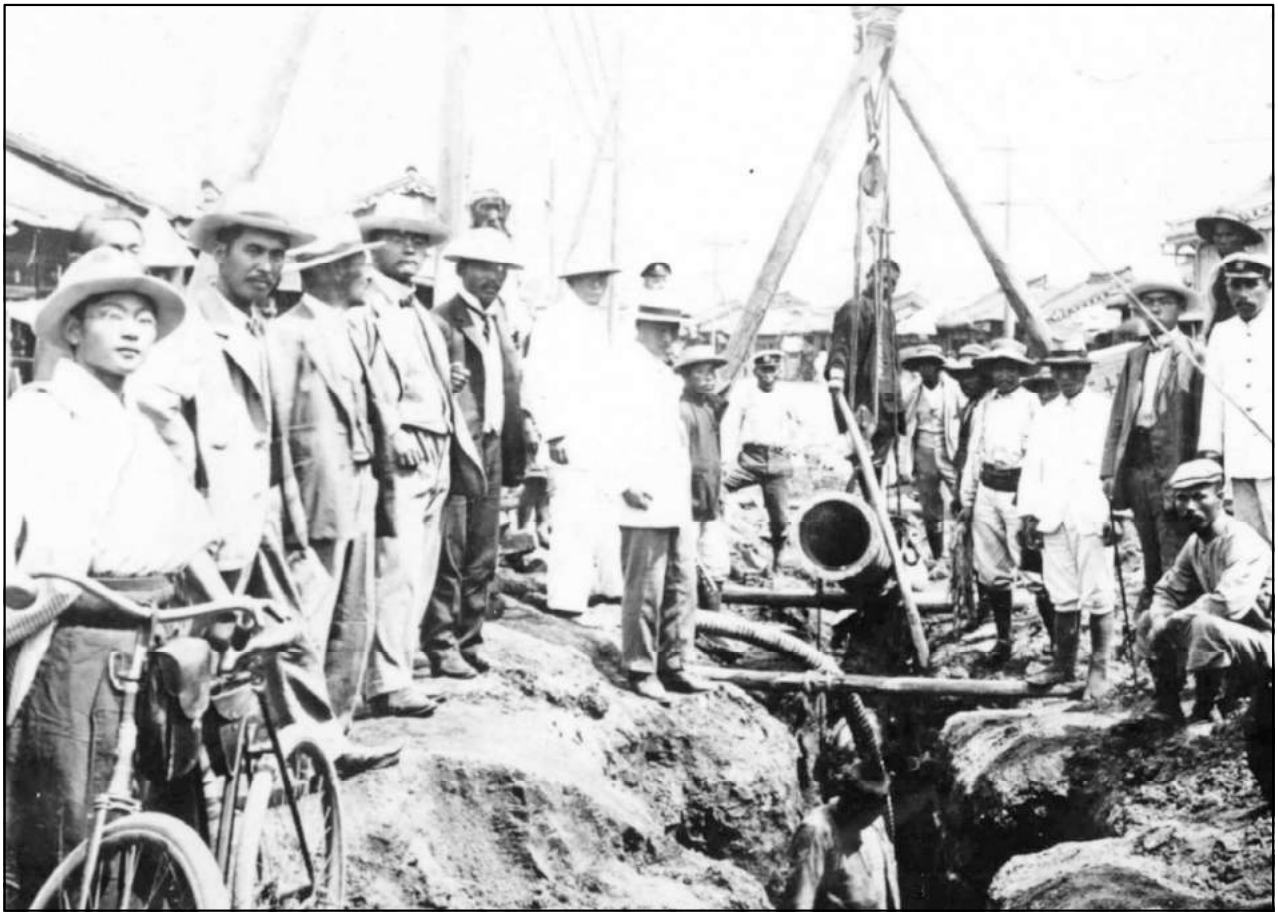

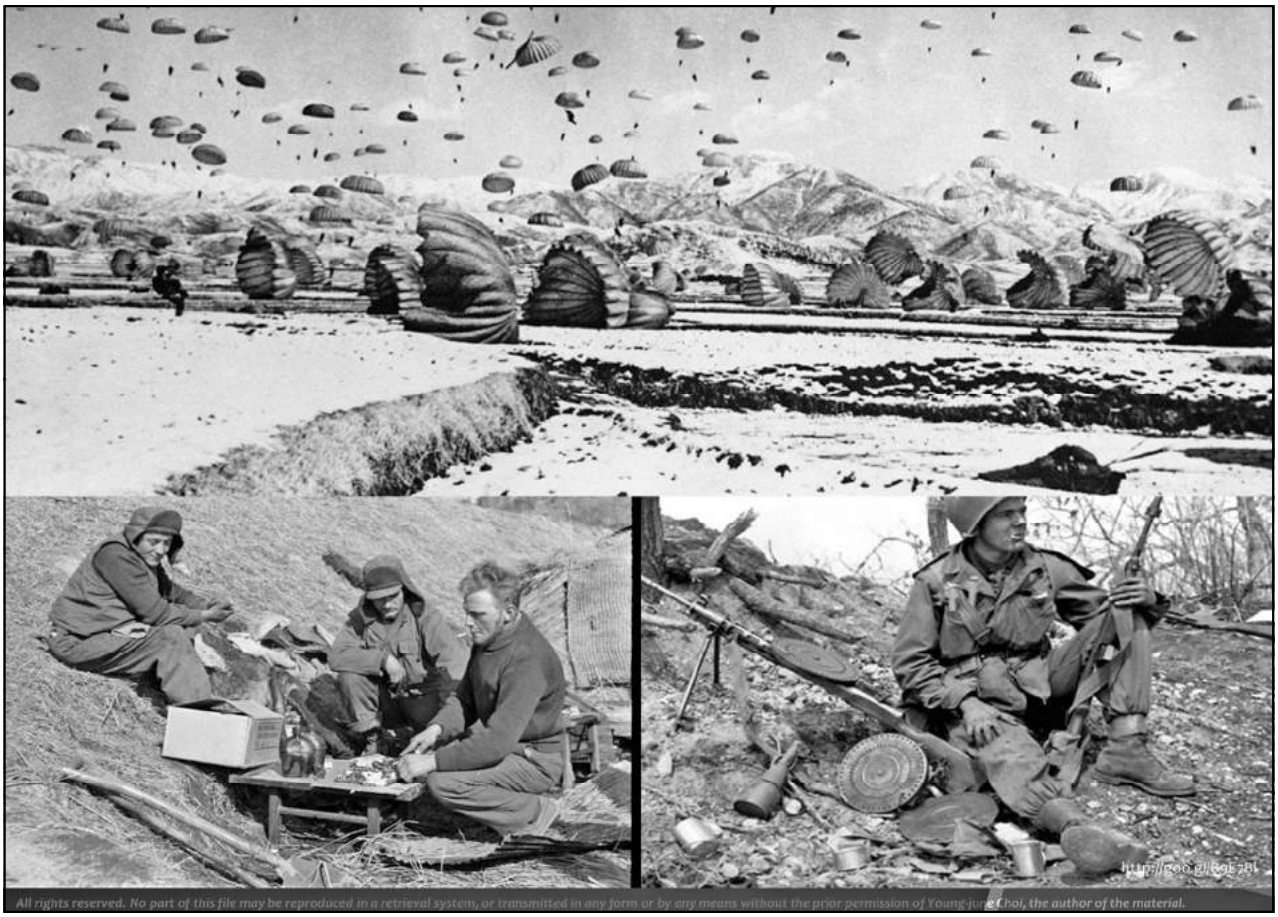

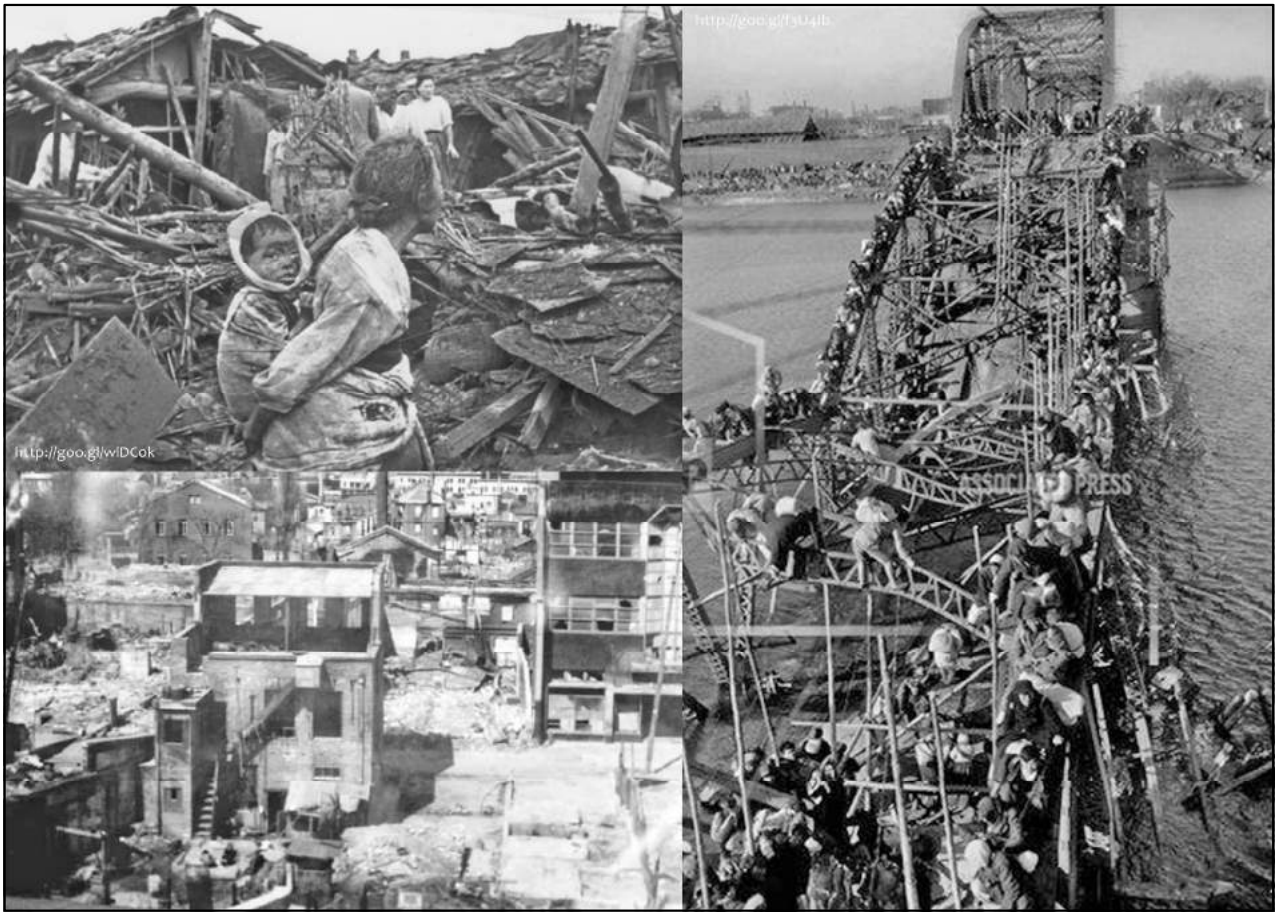
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STOP to return
to Seoul
참으십시요
Your house and
properties are secure.
Wait until food and
water service is
recovered
당신의住宅과財産은保護되고있다
食糧과水道가復旧될때까지
서울歸鄕은!
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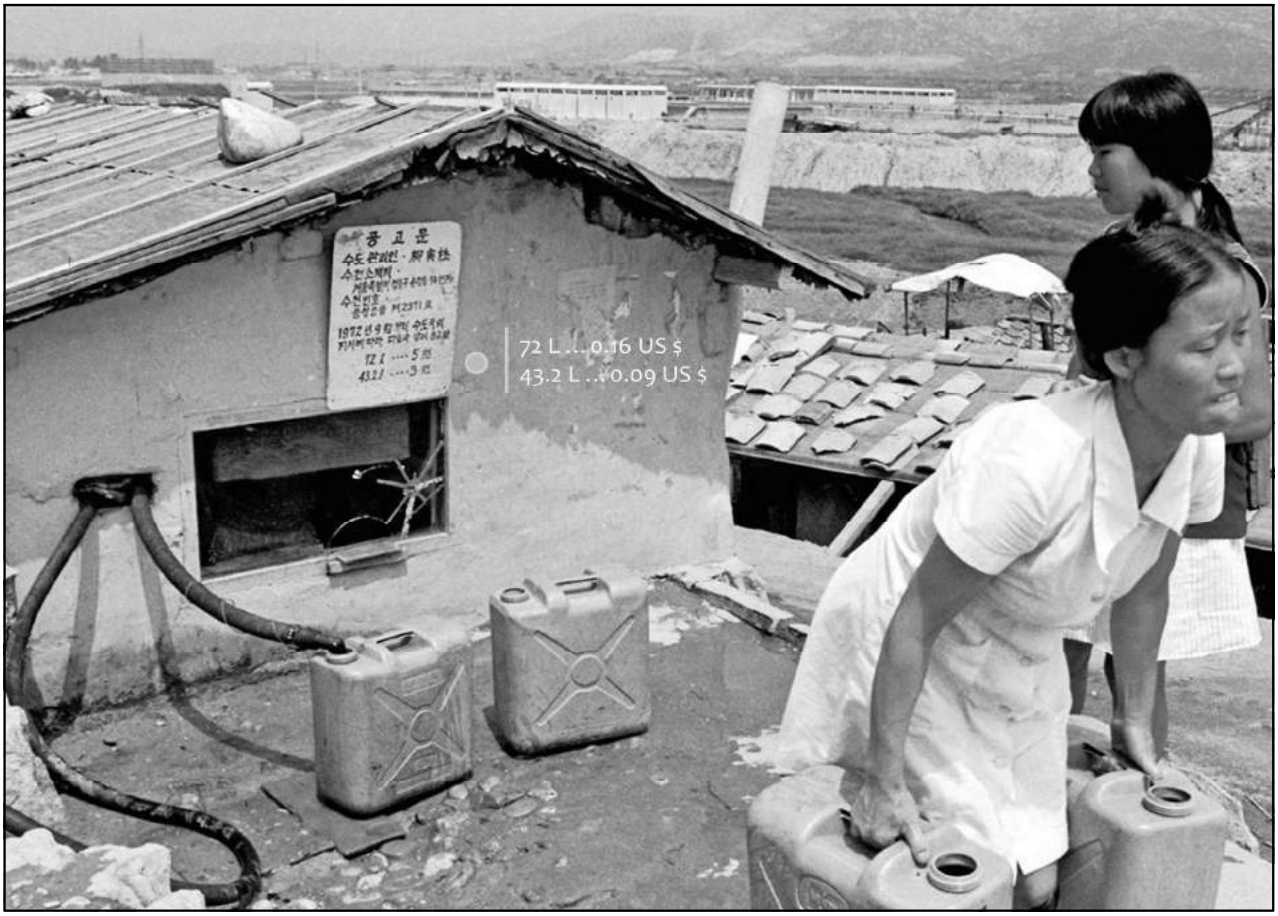
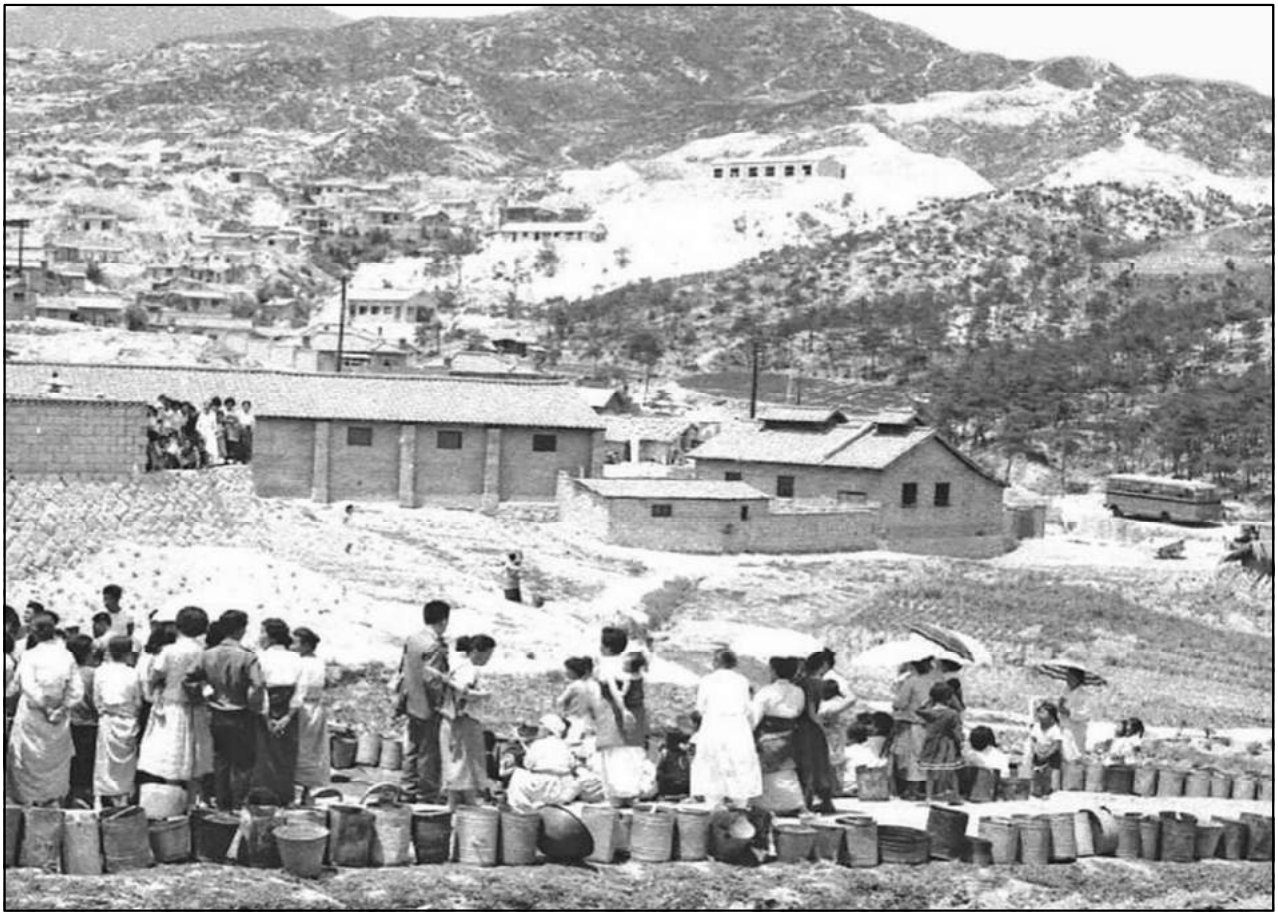
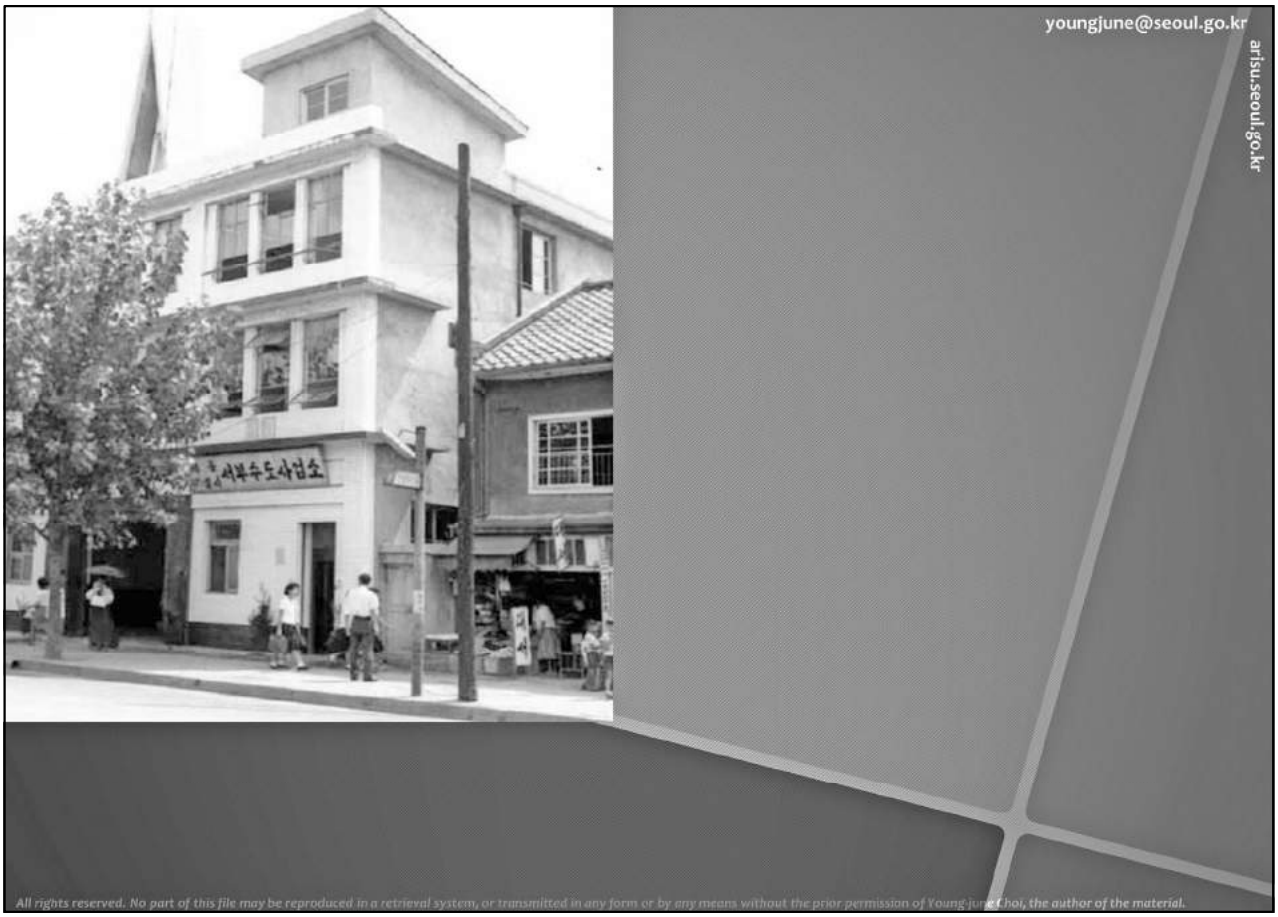
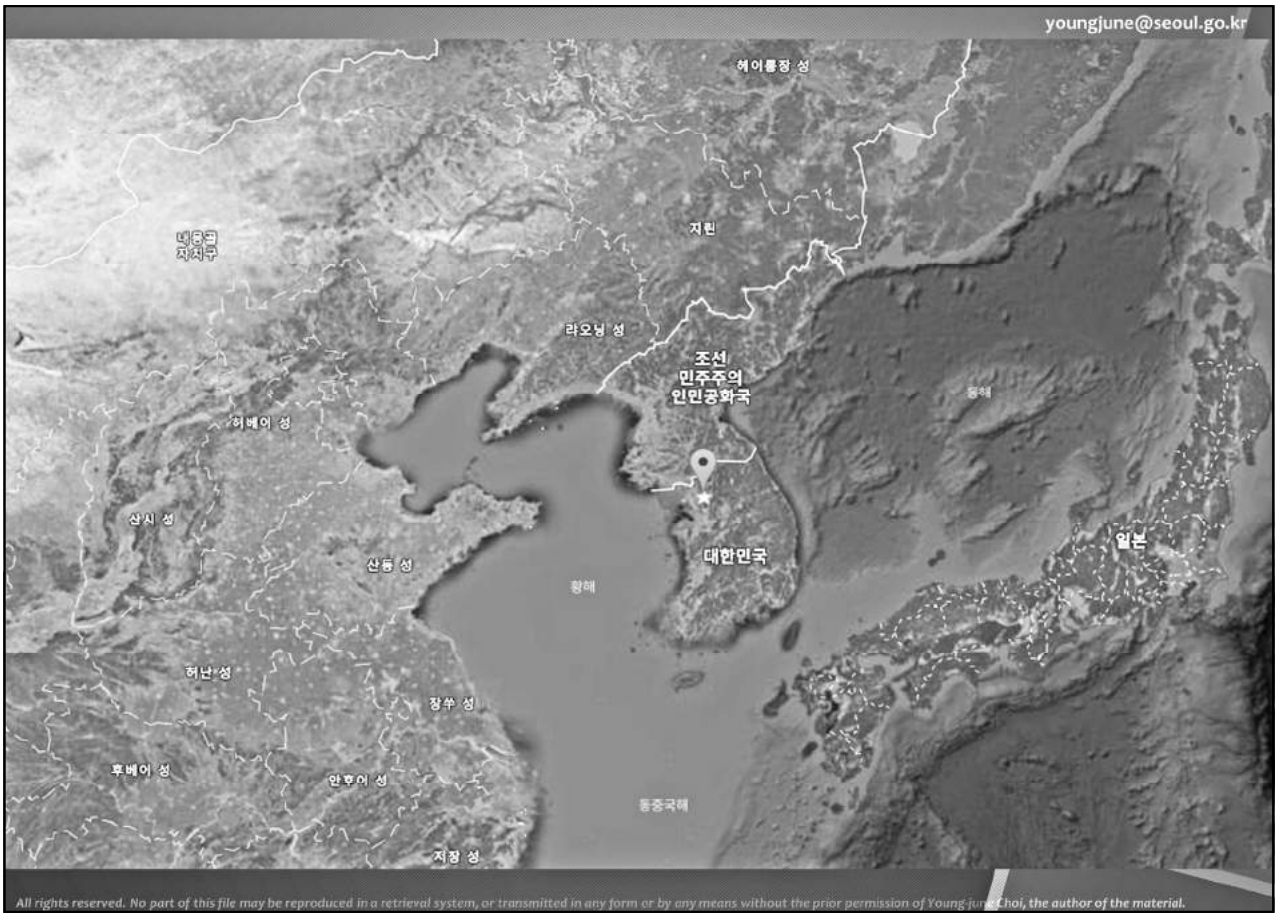

공 고 문
72 L ..0.16 US $
43.2 L ..0.09 US $



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지린
라오닝 성
조선
민주주의
인민공화국
동해
대한민국
일본
황해
산시 성
산둥 성
허난 성
장쑤 성
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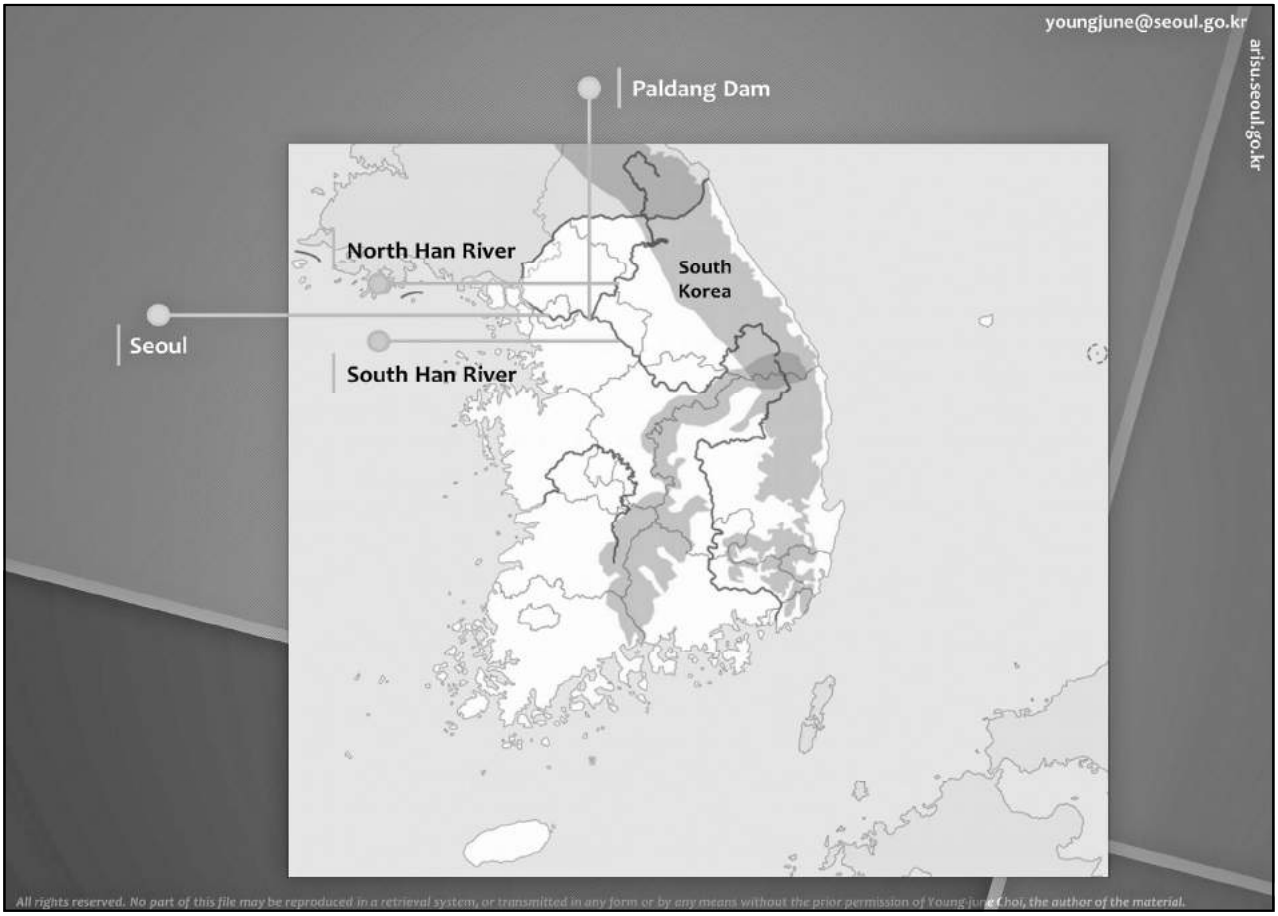
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Paldang Dam
North Han River
South Korea
Seoul
South Han River
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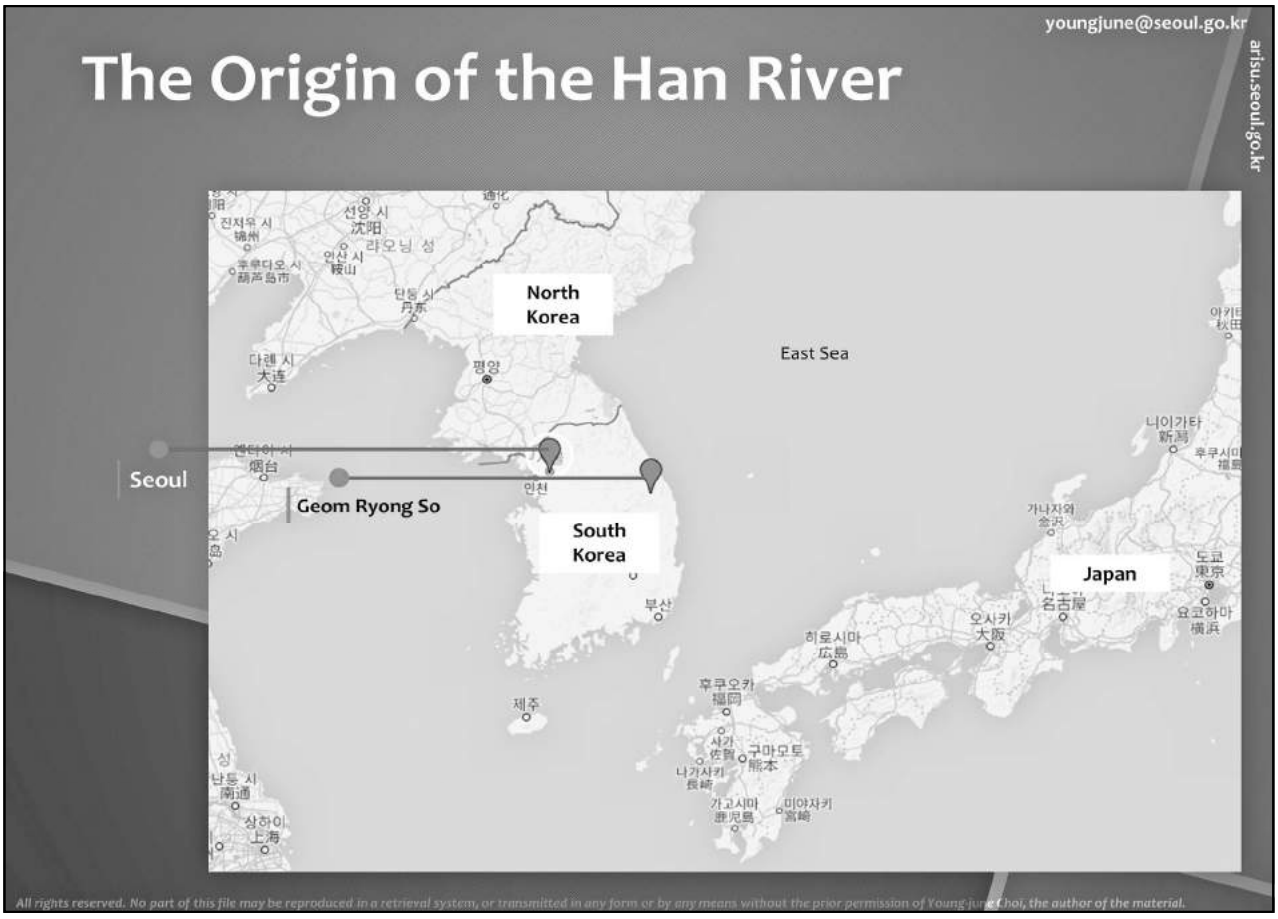
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The Origin of the Han River
North Korea
East Sea
Seoul
Geom Ryong So
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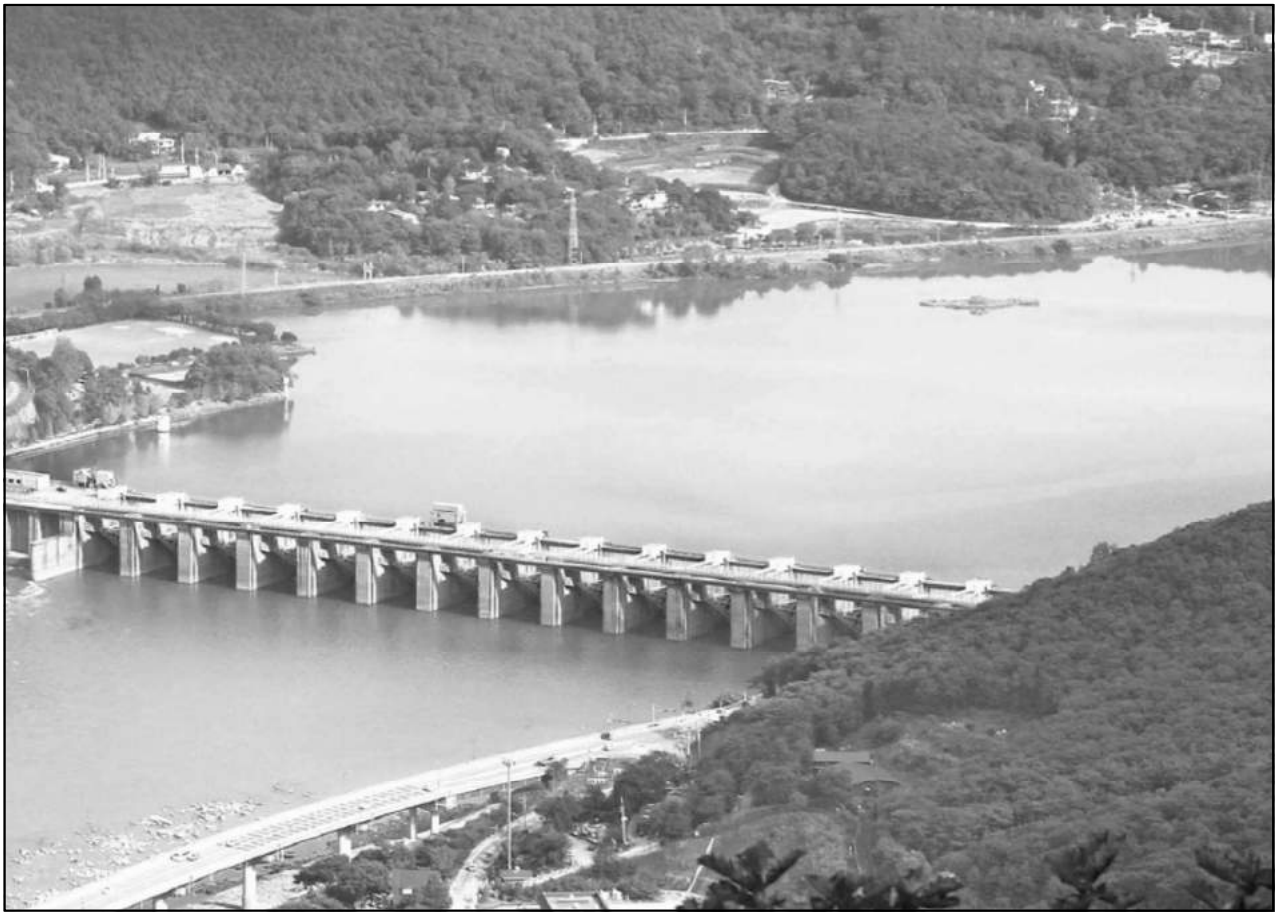

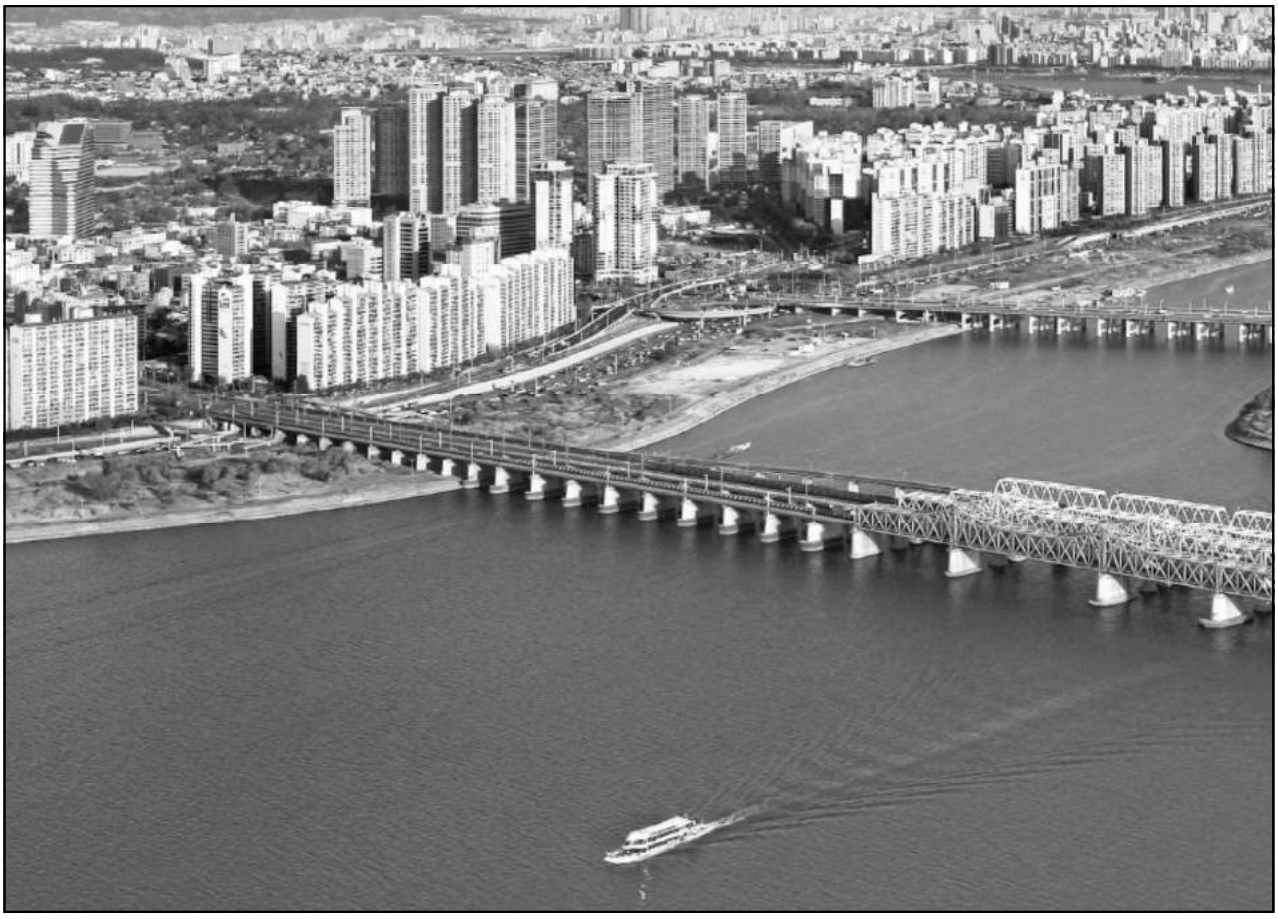

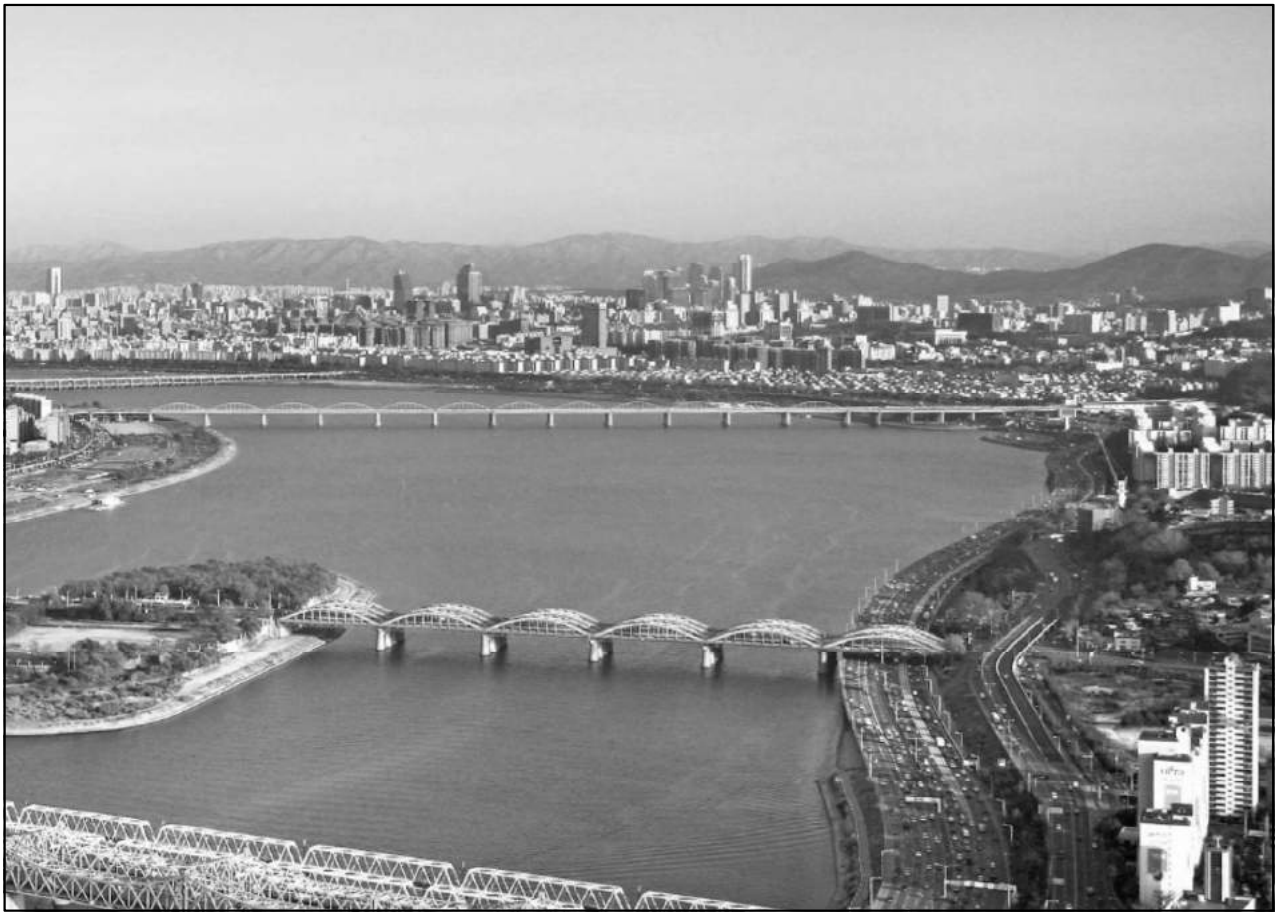

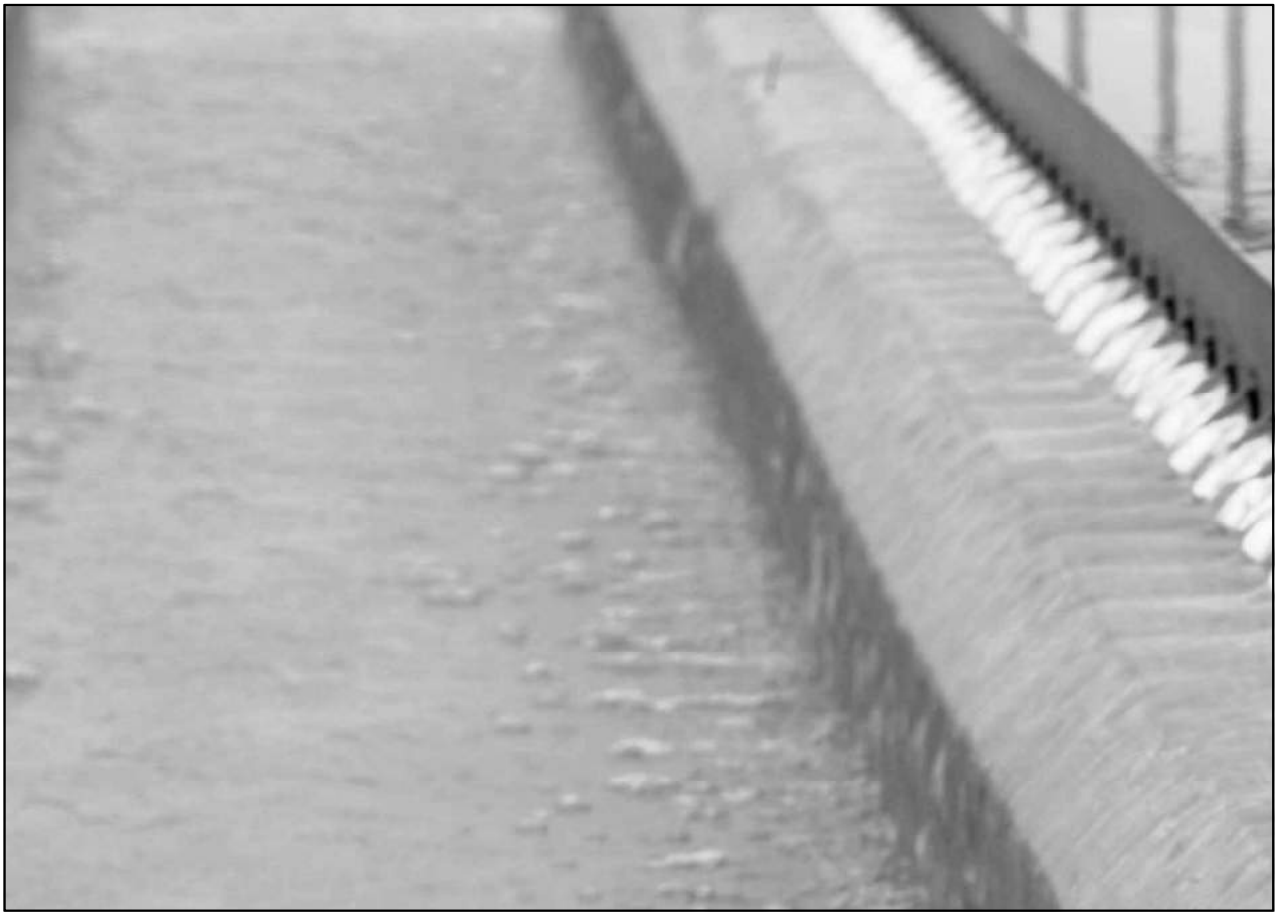


The clean and attractive global city of Seoul
휴 잭맨 서울특별시 홍보대사 위촉
Seouls Goodwill Ambassador Appointm
For Hugh Michael Jackman
SEOUL METROPOLITAN GOVERNMENT
Hi Seoul


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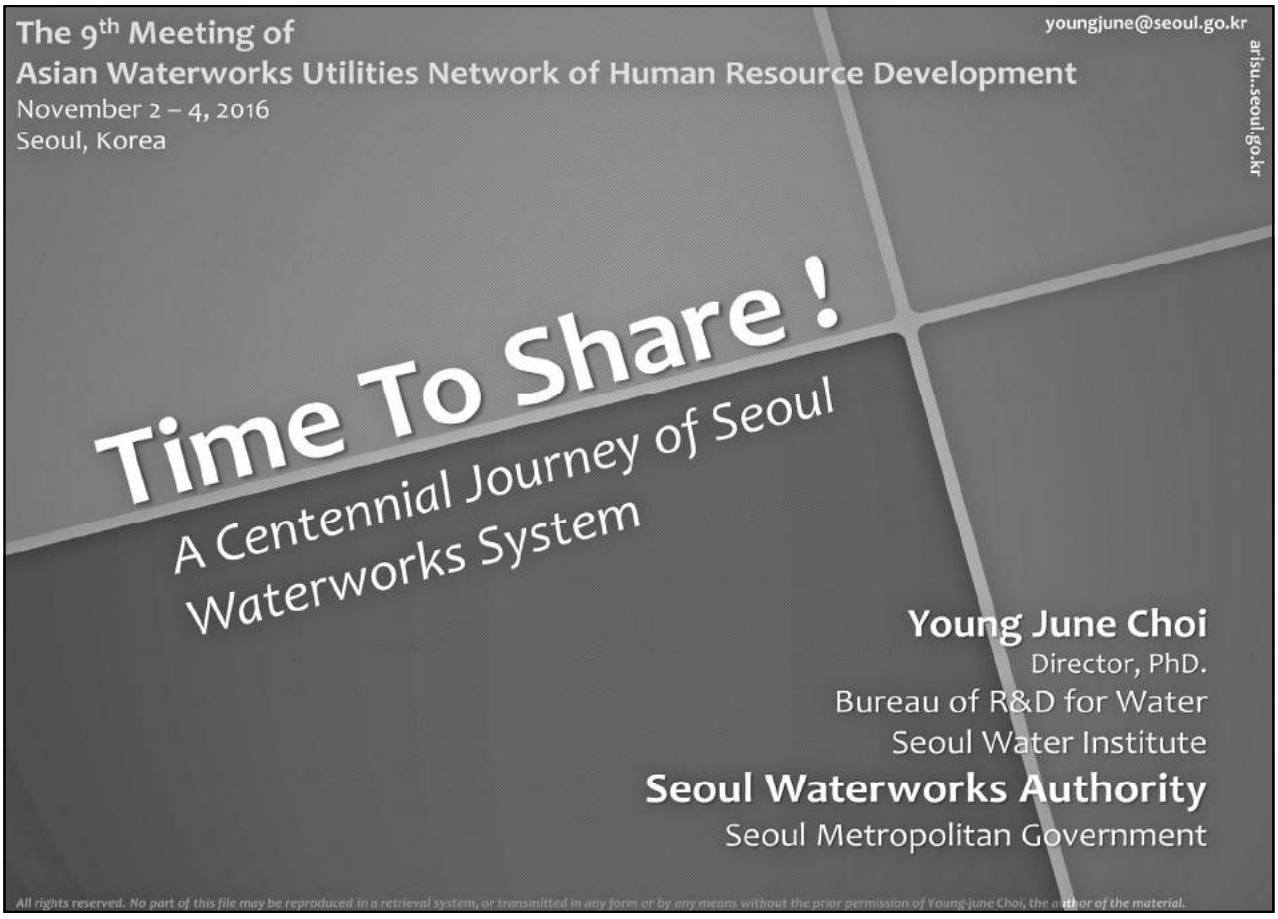
The 9th Meeting of
Asian Waterworks Utilities Network of Human Resource Development
November 2 – 4, 2016
Seoul, Korea
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Time To Share !
A Centennial Journey of Seoul Waterworks System
Young June Choi
Director, PhD.
Bureau of R&D for Water
Seoul Water Institute
Seoul Waterworks Authority
Seoul Metropolitan Government
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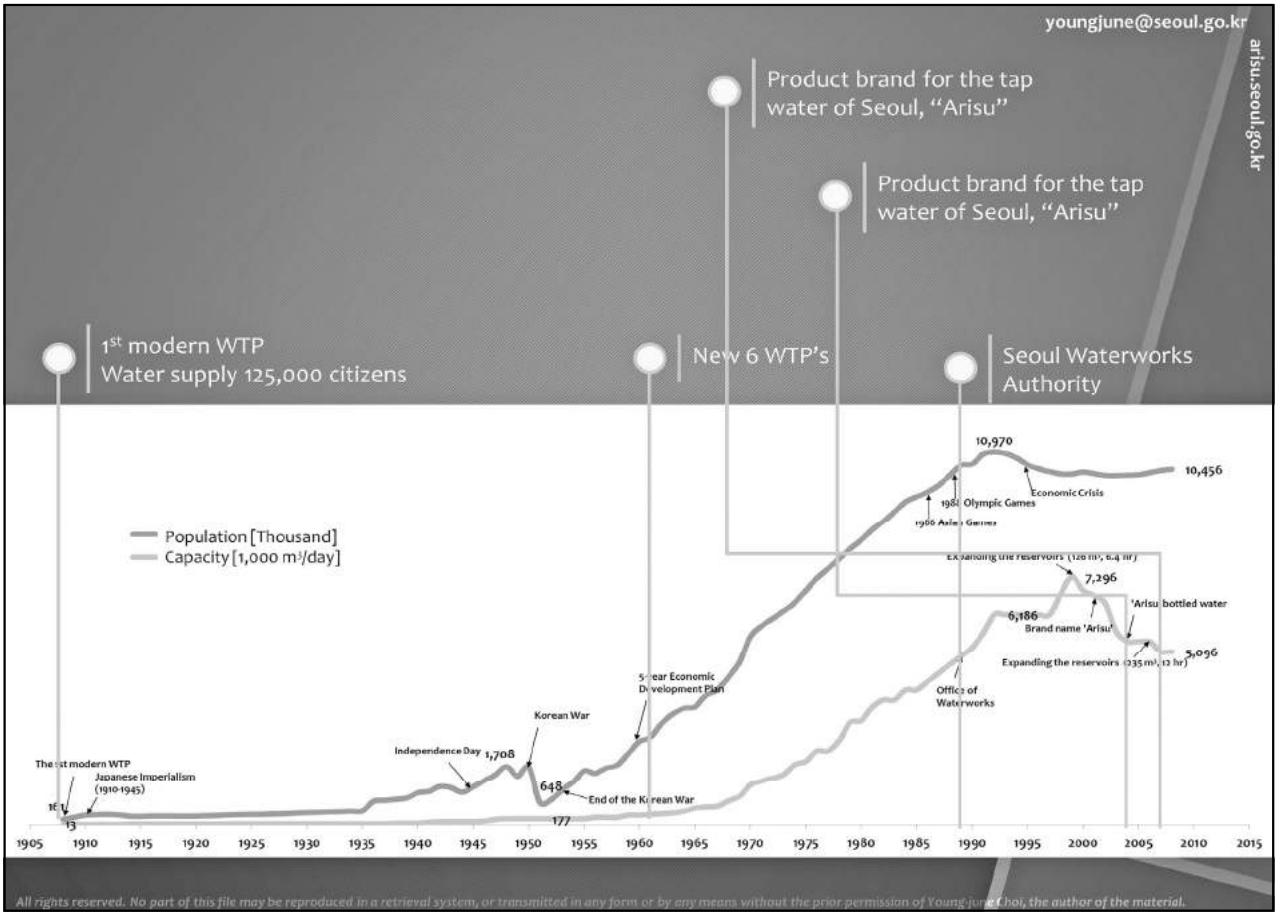

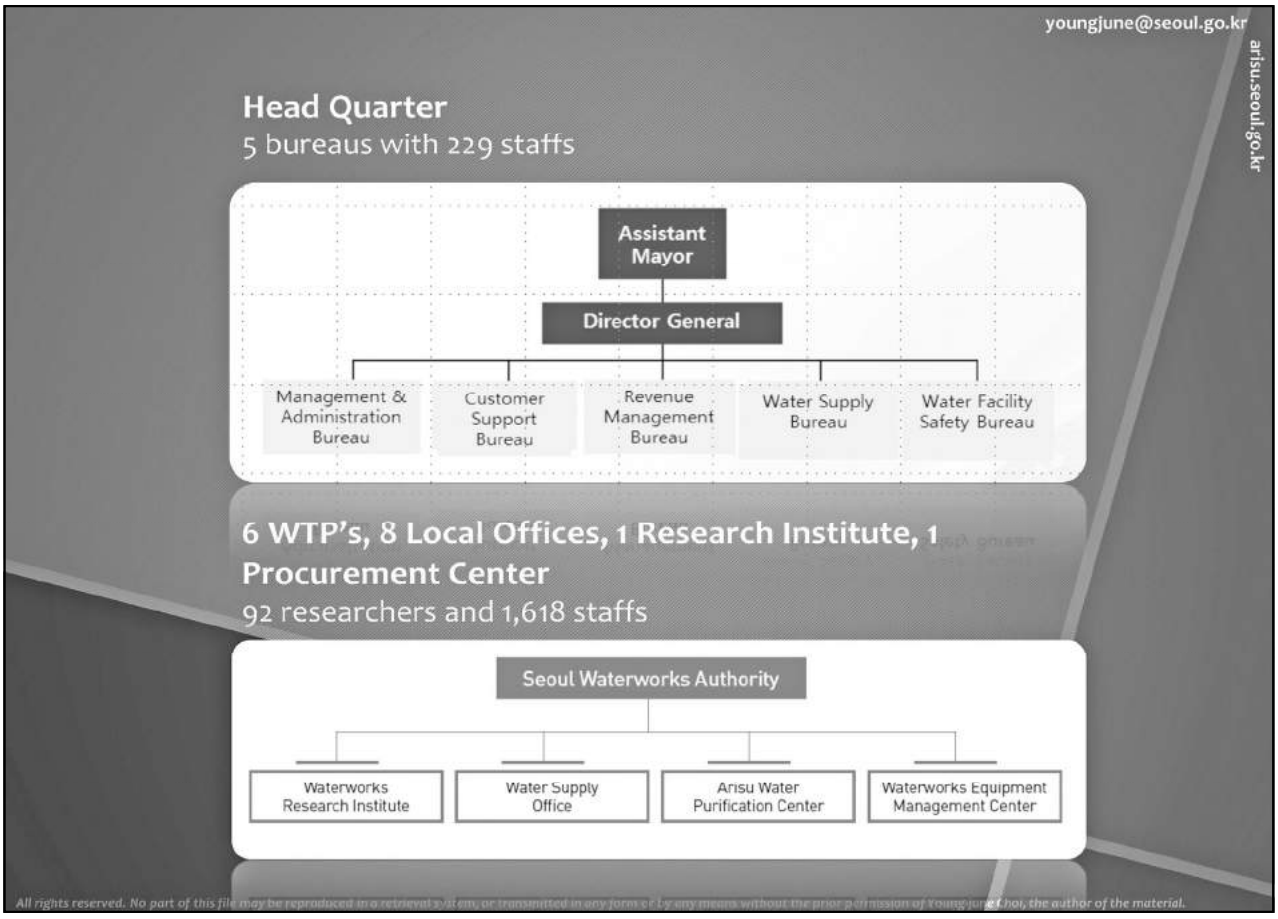

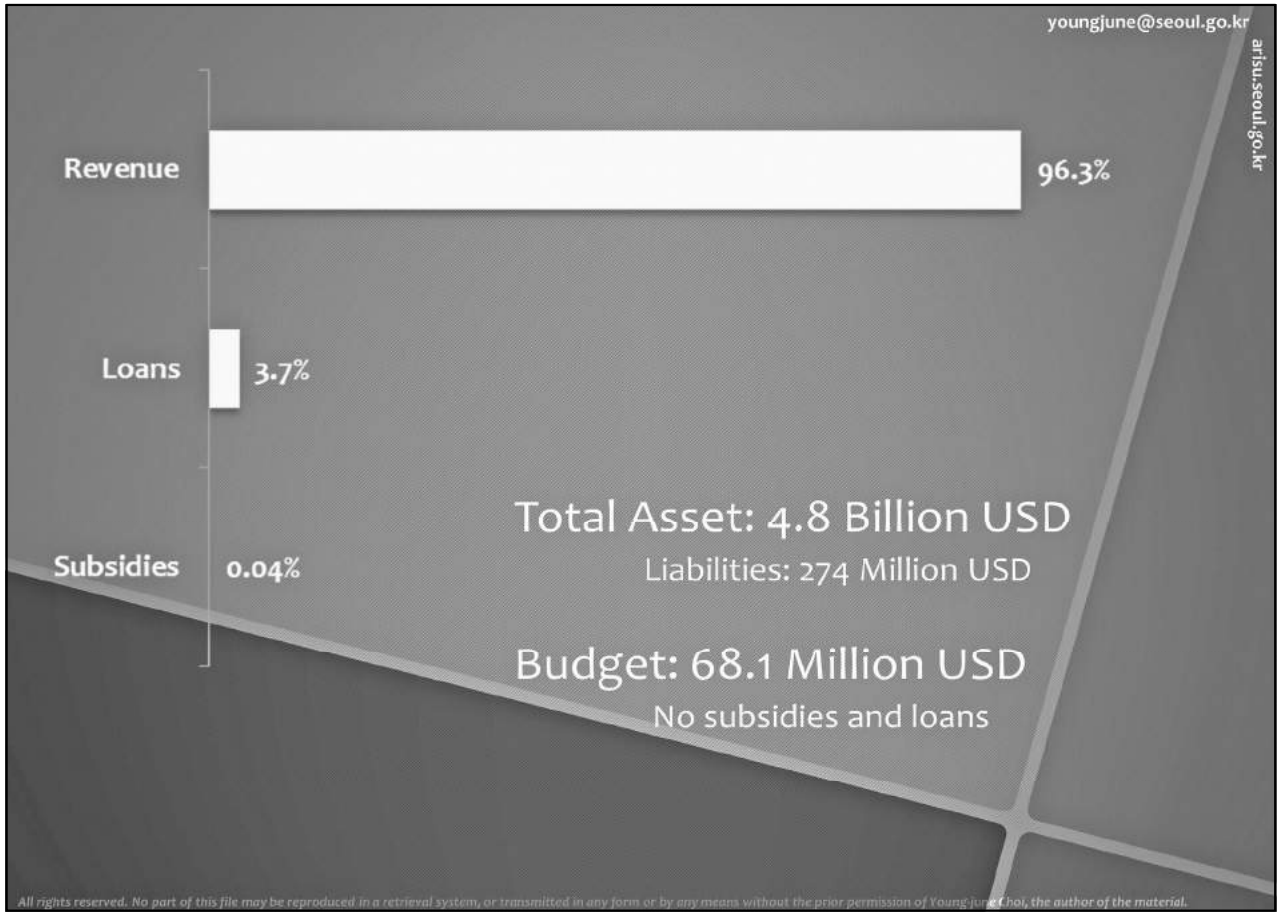
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Revenue
96.3%
Loans
3.7%
Subsidies
0.04%
Total Asset: 4.8 Billion USD
Liabilities: 274 Million USD
Budget: 68.1 Million USD
No subsidies and loans
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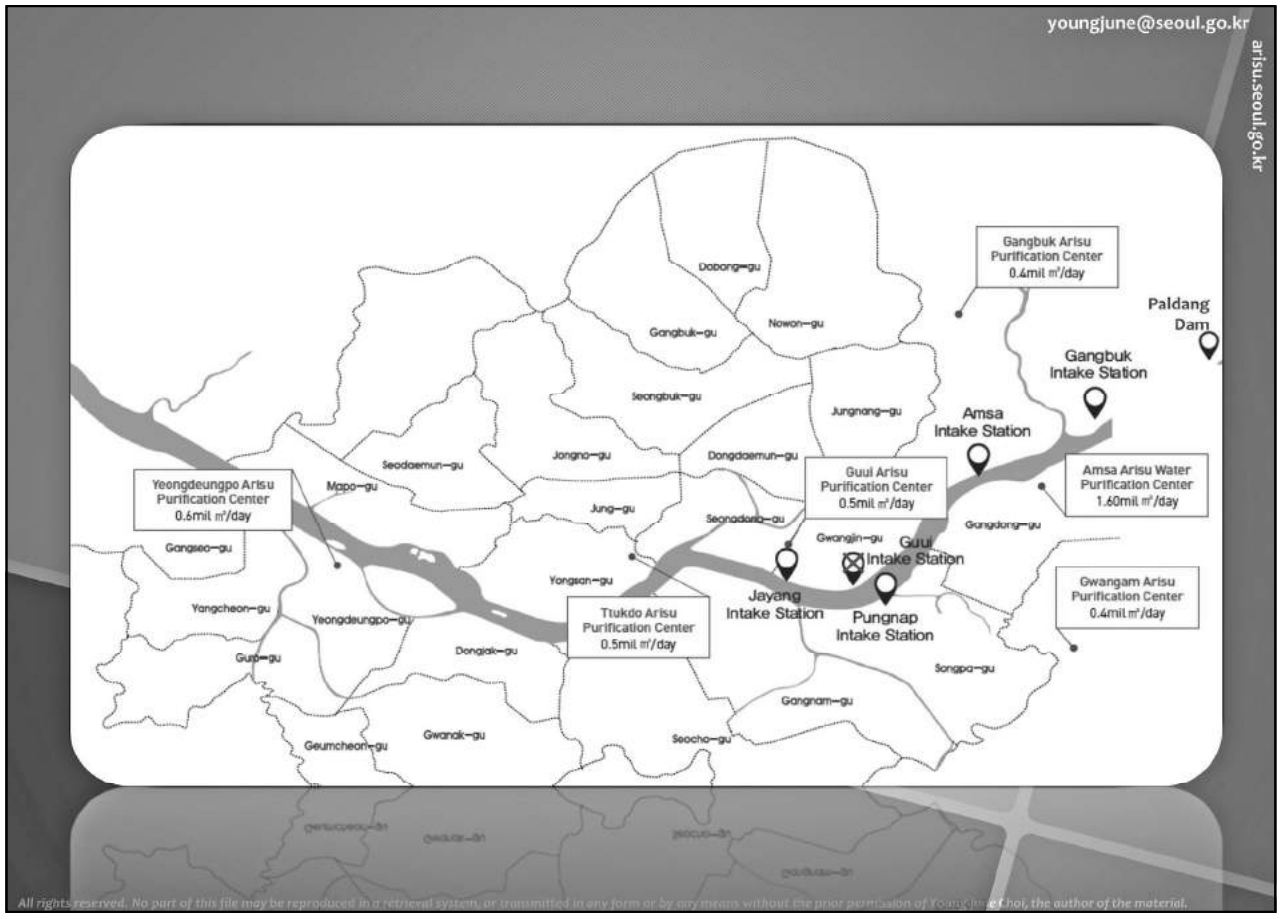
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Gangbuk Arisu Purification Center 0.4mil m³/day
Paldang Dam
Gangbuk Intake Station
Amsa Intake Station
Amsa Arisu Water Purification Center 1.60mil m³/day
Guui Arisu Purification Center 0.5mil m³/day
Guui Intake Station
Jayang Intake Station
Pungnap Intake Station
Ttukdo Arisu Purification Center 0.5mil m³/day
Gwangam Arisu Purification Center 0.4mil m³/day
Yeongdeungpo Arisu Purification Center 0.6mil m³/day
Dobong-gu
Nowon-gu
Gangbuk-gu
Seongbuk-gu
Jungnang-gu
Seodaemun-gu
Jongno-gu
Dongdaemun-gu
Mapo-gu
Jung-gu
Seongdong-gu
Gwangjin-gu
Gangseo-gu
Yangcheon-gu
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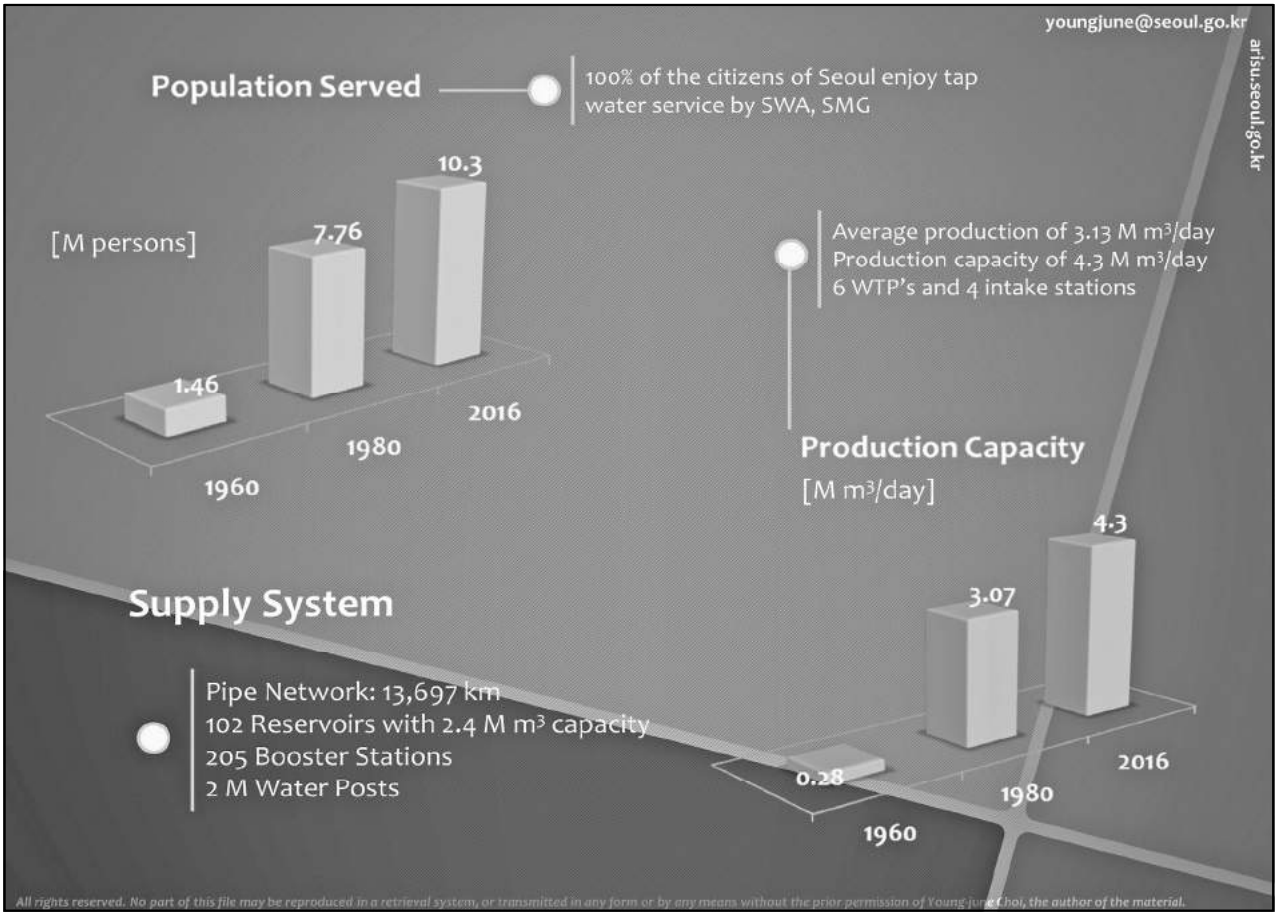
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Population Served
100% of the citizens of Seoul enjoy tap water service by SWA, SMG
[M persons]
10.3
7.76
1.46
2016
1980
1960
Average production of 3.13 M m³/day
Production capacity of 4.3 M m³/day
6 WTP's and 4 intake stations
Production Capacity
[M m³/day]
4.3
3.07
0.28
2016
1980
1960
Supply System
Pipe Network: 13,697 km
102 Reservoirs with 2.4 M m³ capacity
205 Booster Stations
2 M Water Posts
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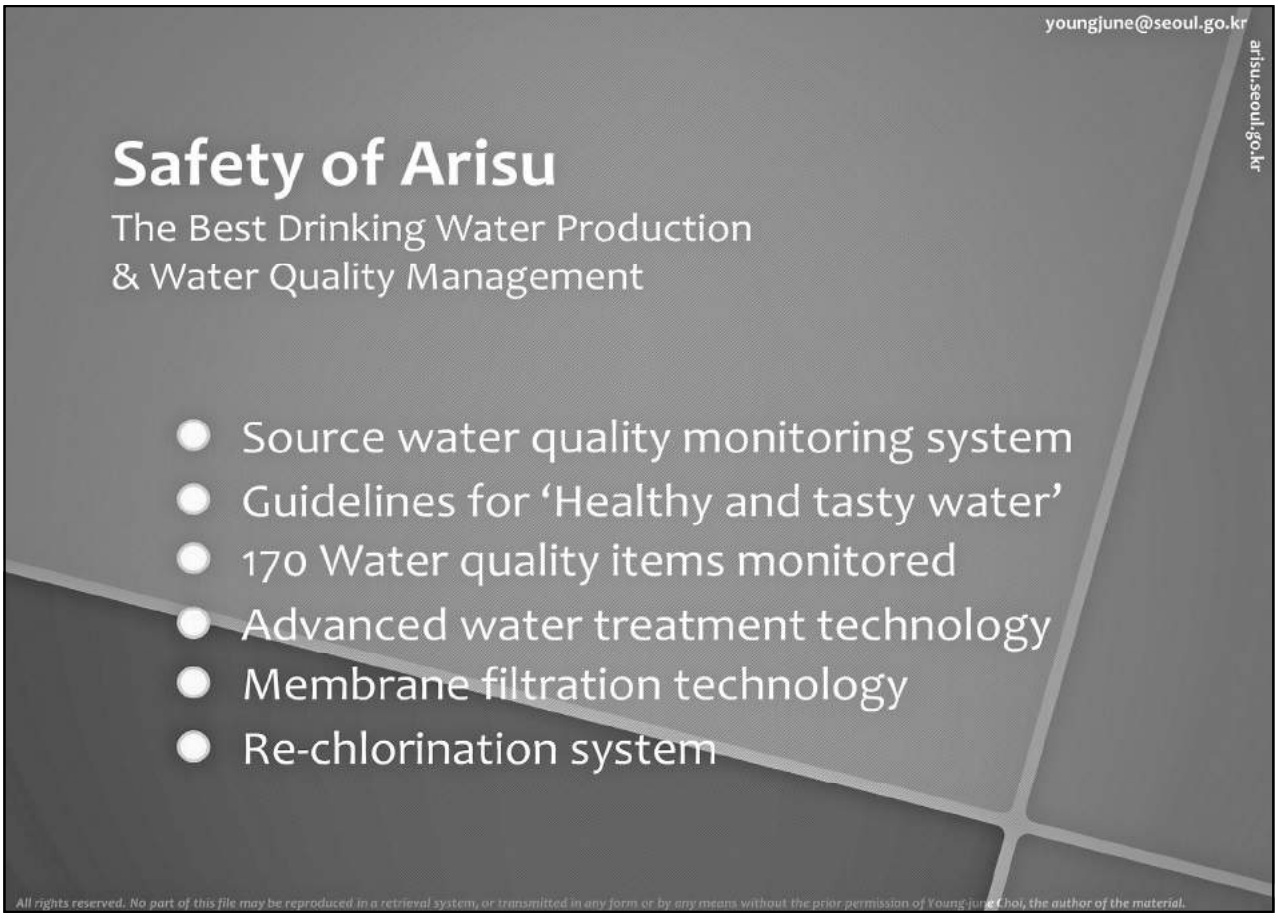
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Safety of Arisu
The Best Drinking Water Production
& Water Quality Management
Source water quality monitoring system
Guidelines for 'Healthy and tasty water'
170 Water quality items monitored
Advanced water treatment technology
Membrane filtration technology
Re-chlorination system
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Source water quality monitoring system

- Tele-Metering System
  - operated by the central government
- Real-time water quality monitoring system
  - 198 monitoring sites all over the supply chain in Seoul
  - Including the 4 source water intake stations
- Biological water quality monitoring system
  - Biological monitoring and warning system
  - Daphina magna (water flea), electrochemical signal of microbes, alage

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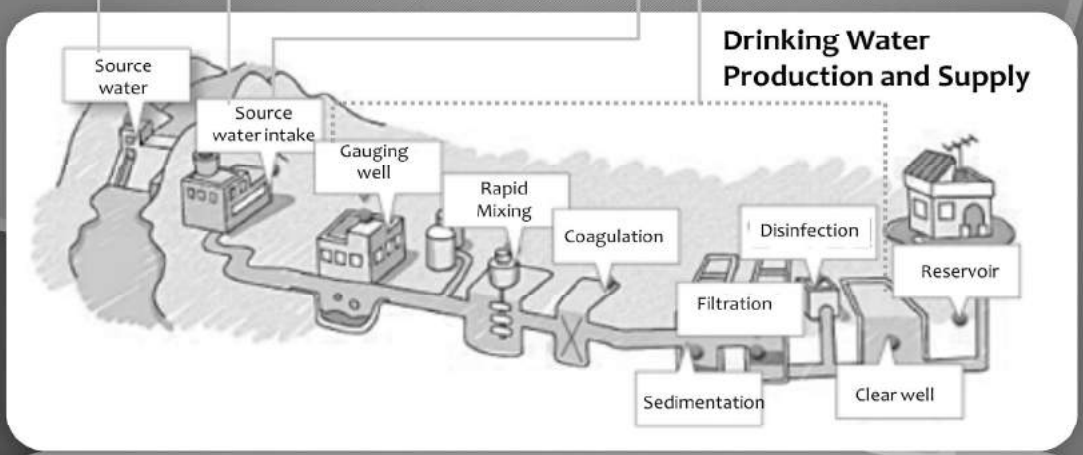
Source Water: 28 sites
Monthly and quarterly
29 WQ items

Intake Stations: 5 sites
Daily, weekly, quarterly, yearly
158 WQ items
Biological WQ alert systems

Realtime WQ monitoring system
9 WQ items

Water Treatment Plant
47 WQ items (by WTP)
170 WQ items (by SWI)



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WQ Monitoring in Water Supply System

- WQ Monitoring at taps: 450 sites (monthly)
- WQ Monitoring in supply system: 70 sites (quarterly)
- Community centers and hospitals: 25 sites (yearly)
- Seoul Tap Water Quality Assurance Program: 260,000 households
- Water Reservoirs and Extremities: 188 sites (real-time), 17 sites (twice a week)
- Water Fountains in schools: 1,724 sites 19,686 fountains (monthly, quarterly)

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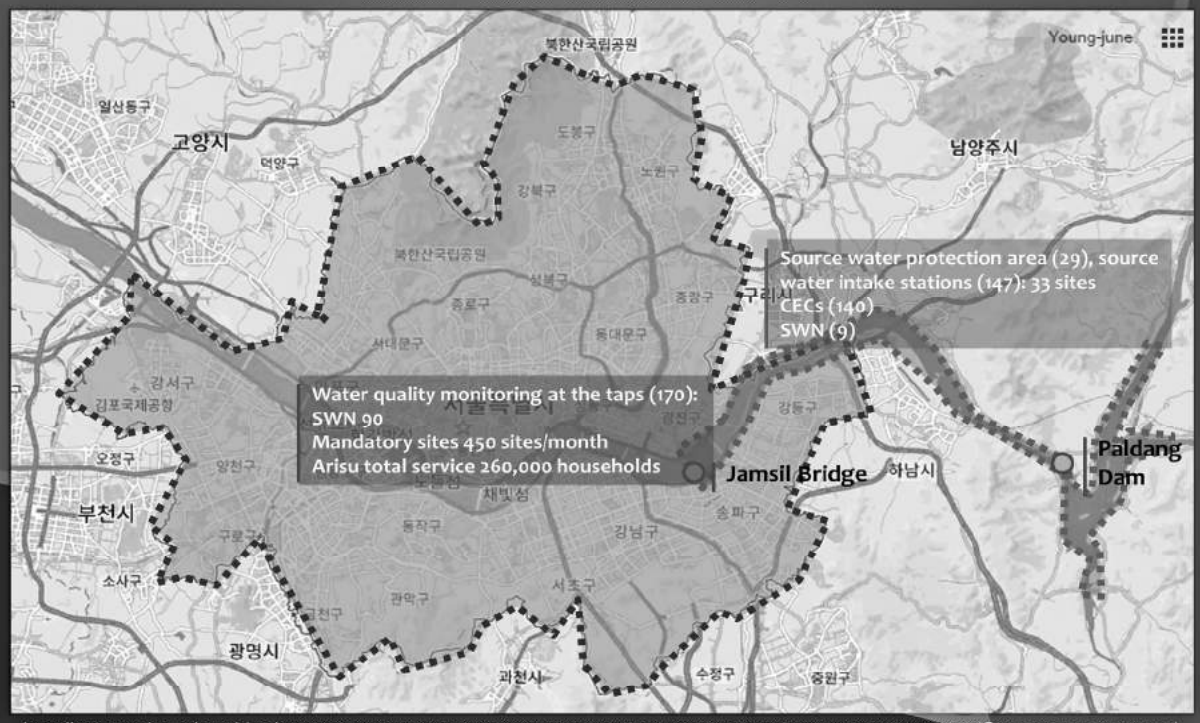
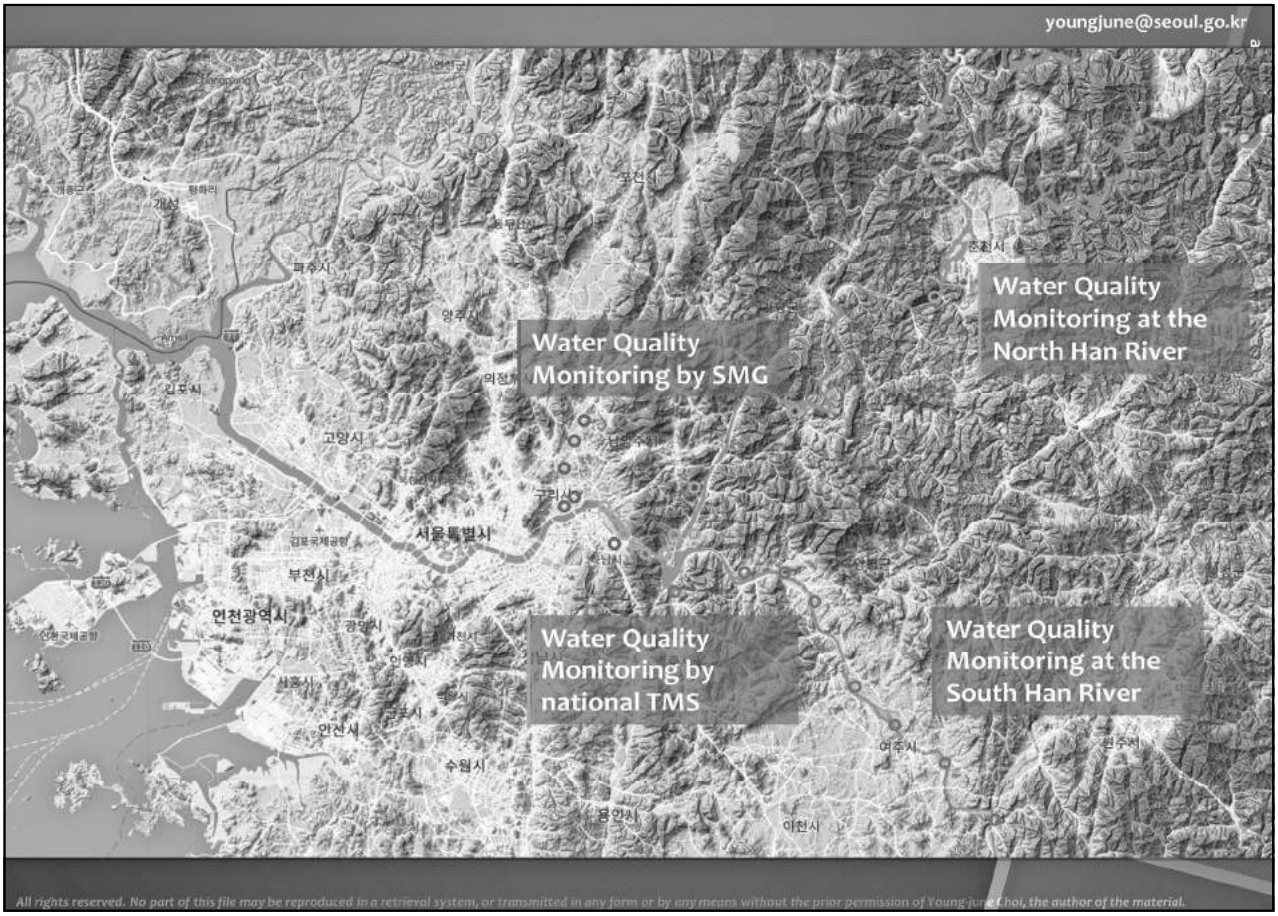


https://www.google.com/maps/place/%EB%8C%80%ED%95%9C%EB%AF%BC%EA%B5%AD+%EC%84%9C%EC%9A%B8%ED%8A%B9%EB%B3%84%EC%8B%9C/@37.536982,127.0678901,11z/data=!4m5!3m4!1s0x357ca28b61c565cd:0x858aedb4e4ea83eb!8m2!3d37.566535!4d126.9779692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Water Quality Monitoring by SMG
Water Quality Monitoring at the North Han River
Water Quality Monitoring by national TMS
Water Quality Monitoring at the South Han River
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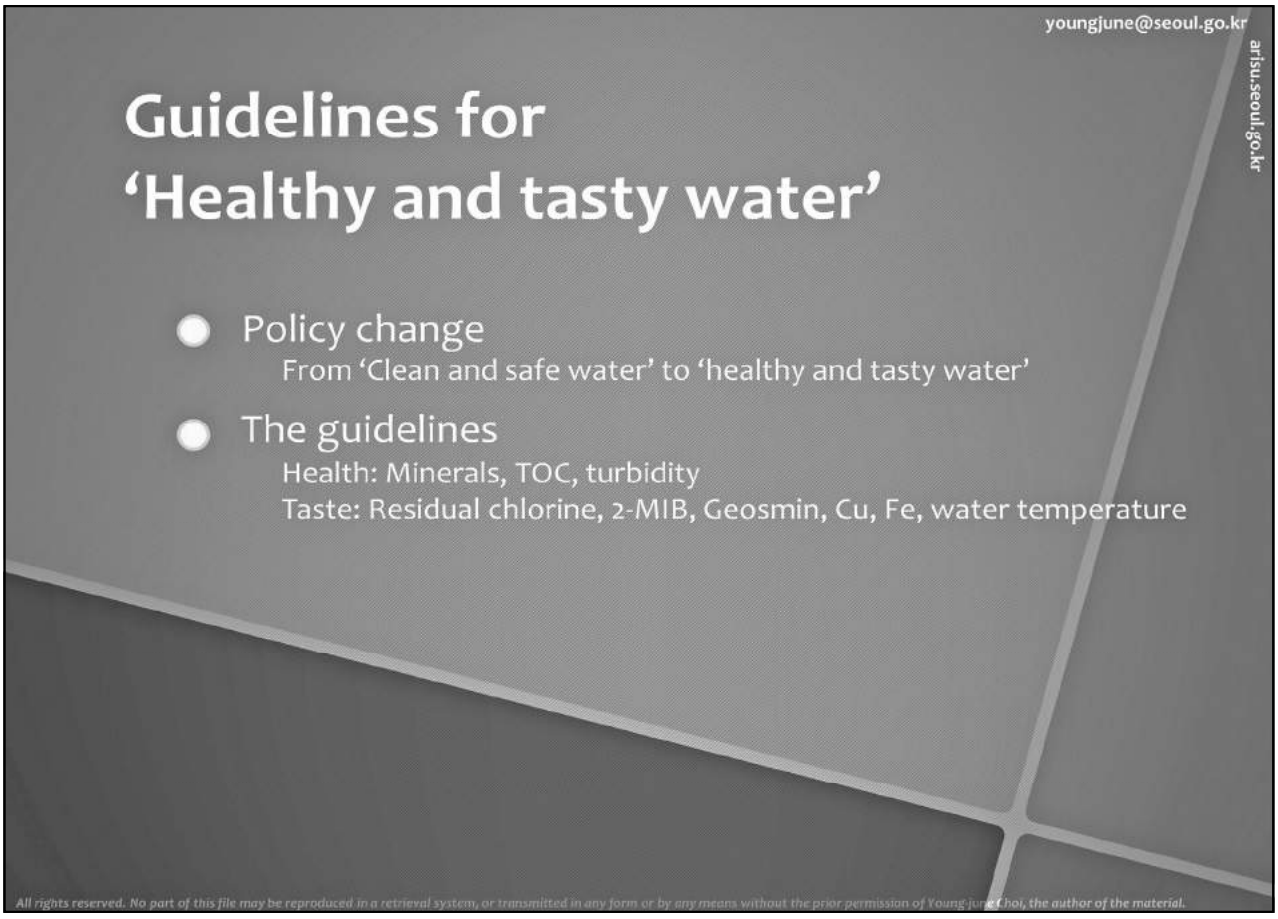
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Guidelines for
'Healthy and tasty water'
Policy change
From 'Clean and safe water' to 'healthy and tasty water'
The guidelines
Health: Minerals, TOC, turbidity
Taste: Residual chlorine, 2-MIB, Geosmin, Cu, Fe, water temperature
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Guidelines for 'Healthy and tasty water'

Cat.	Index	Unit	Std. for drinking water	Guideline
Health related	Minerals (Ca, Mg, Na, K)	mg/L		20 – 100
	TOC	mg/L	5.0	1.0
	Turbidity	NTU	0.5	0.3
Taste related	Residual chlorine	mg/L	< 4.0	0.1 – 0.3
	2-MIB	ng/L	20	< 8.0
	Geosmin	ng/L	20	< 8.0
	Copper	mg/L	1.0	< 0.05
	Iron	mg/L	0.3	< 0.05
	Water temperature	°C	-	4 – 15

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arisu.seoul.go.kr

Water quality monitoring system

- From Source to Tap
  - 24-hour real-time water quality monitoring system
  - WHO level 170 water quality items monitored
  - Water quality test at tap: all the residential area
- Seoul Water-Now System

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Seoul Water-Now System

Real-time Drinking Water Quality Monitoring System

Total	Treatment process(12)		Distribution System (188)		
	Intake	WTP	Reservoir	Booster ST.	Tap
200	6	6	99	12	77

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Monitoring Item

[As of 2011]

Process		Site (186)	Monitored WQ Parameters	
			WQ Management [staffs]	WQ Open [citizens]
Treatment Process (12)	Source Water (6)	Intake station (6)	Turbidity, water temperature, pH, phenol, cyan, NH_3-N, TOC (7)	turbidity, pH, water temperature (3)
	Treatment Process	Gauging well	turbidity, alkalinity, pH, residual chlorine, water temperature, electric conductivity (6)	-
		Settling basin	turbidity, pH, alkalinity, residual chlorine (4)	
		Filter basin	Turbidity (1)	
	Treated water (6)	Supplied water (6)	turbidity, pH, residual chlorine, electric conductivity, water temperature, inactivation rate (6)	turbidity, pH, residual chlorine, electric conductivity, water temperature (5)
Distribution (174)		Reservoirs/booster station (97)	turbidity, pH, residual chlorine, electric conductivity, water temperature (5)	
		Taps (77)		

감시지점	항목	탁도(NTU) 측정값	탁도(NTU) 기준치	pH 측정값	pH 기준치	잔류염소(mg/L) 측정값	잔류염소(mg/L) 기준치	수질상태
구의취수장		6.714	-	7.6	-	-	-	마시기 적합
구의정수센타		0.022	만족	7.0	만족	0.46	만족	마시기 적합
아차산배수지		0.010	만족	7.2	만족	0.36	만족	마시기 적합
용마배수지		0.040	만족	7.1	만족	0.33	만족	마시기 적합
할계배수지		0.050	만족	7.2	만족	0.33	만족	마시기 적합
구의2동		0.040	만족	7.3	만족	0.29	만족	마시기 적합
독도(자양)취수장		4.800	-	8.3	-	-	-	마시기 적합
독도정수센타		0.050	만족	7.2	만족	0.48	만족	마시기 적합
먹는물 수질기준(환경부)		0.5NTU이하		5.8 ~ 8.5		4mg/L 이하		

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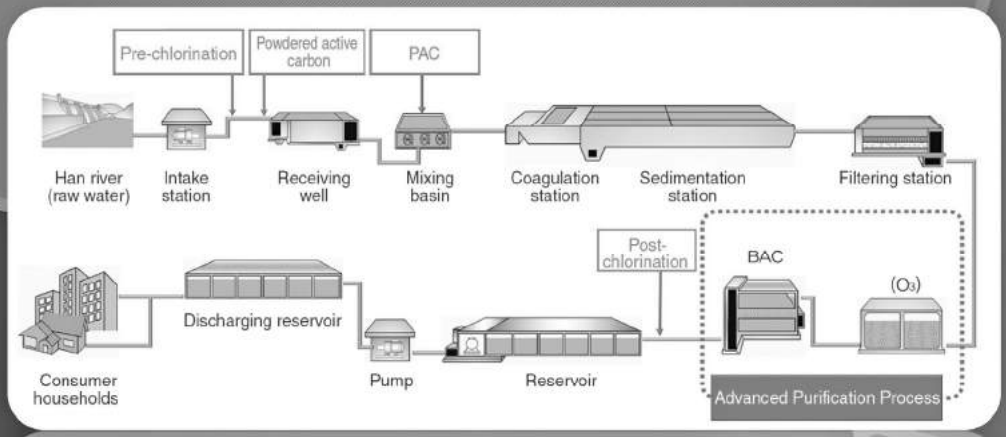
Advanced Water Treatment

- Advance water treatment process
  - Taste and odor causing materials, 2-MIB and geosmin
  - EDC's and CEC's including PPCP's and POP's
  - Ozonation and GAC



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Membrane Filtration

- R&D with the central government
  - Ministry of Environments
  - Dec. 2014 ~ May 2011
  - Total budget: 109.4 M USD
- The 1st and largest membrane filtration WTP
  - Production capacity 50,000 m^3/day


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NEWSIS
최첨단 국산 막여과
정수장 준공식
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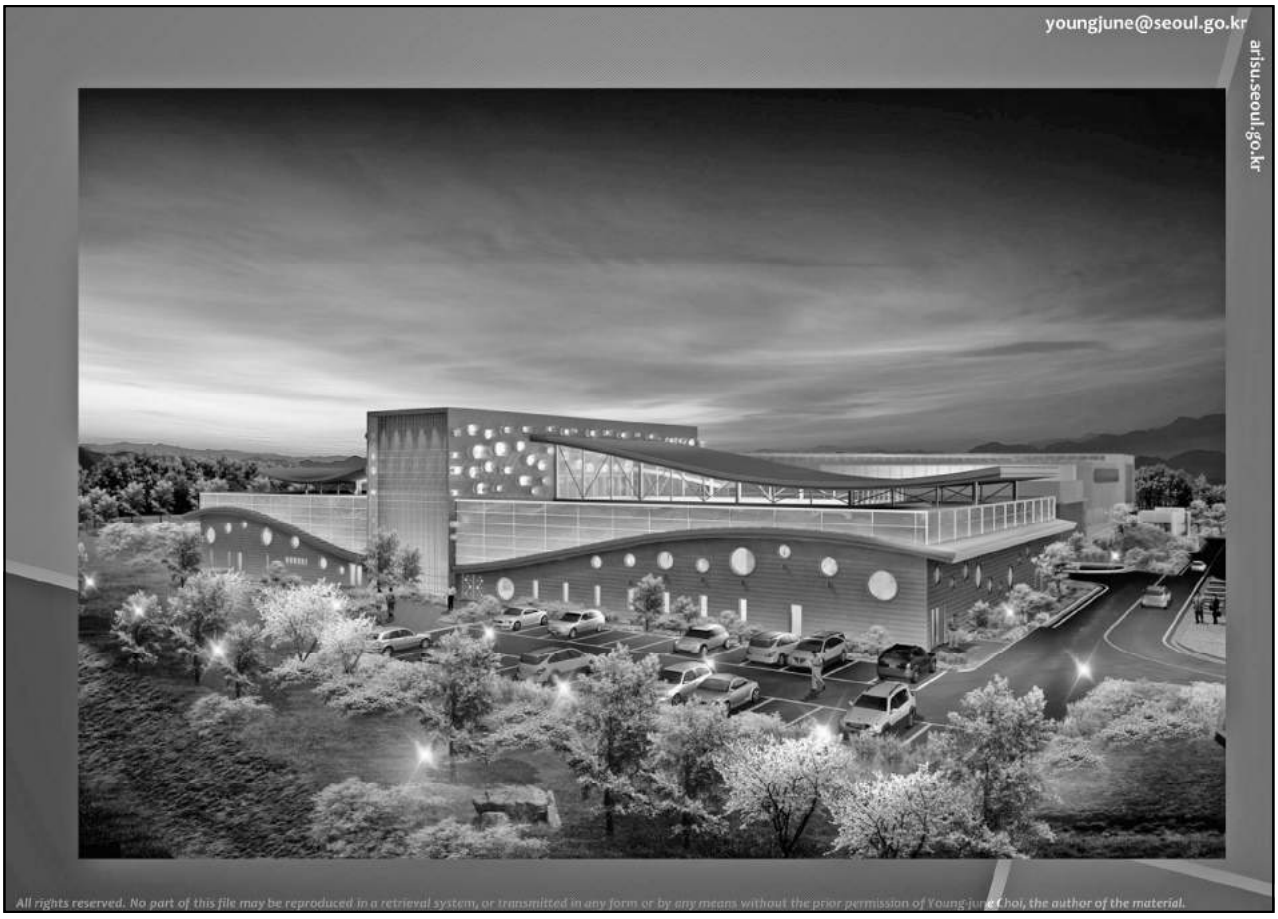
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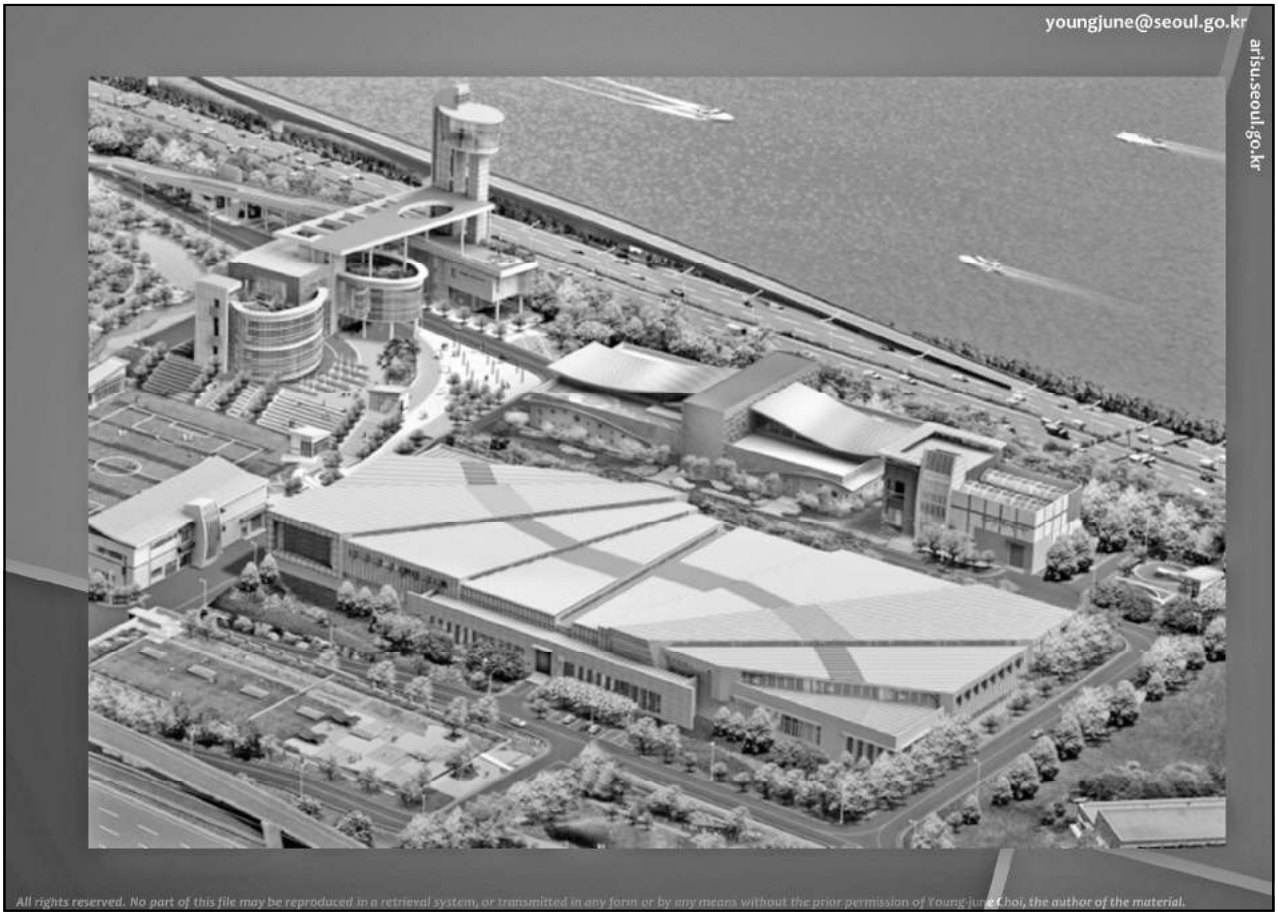
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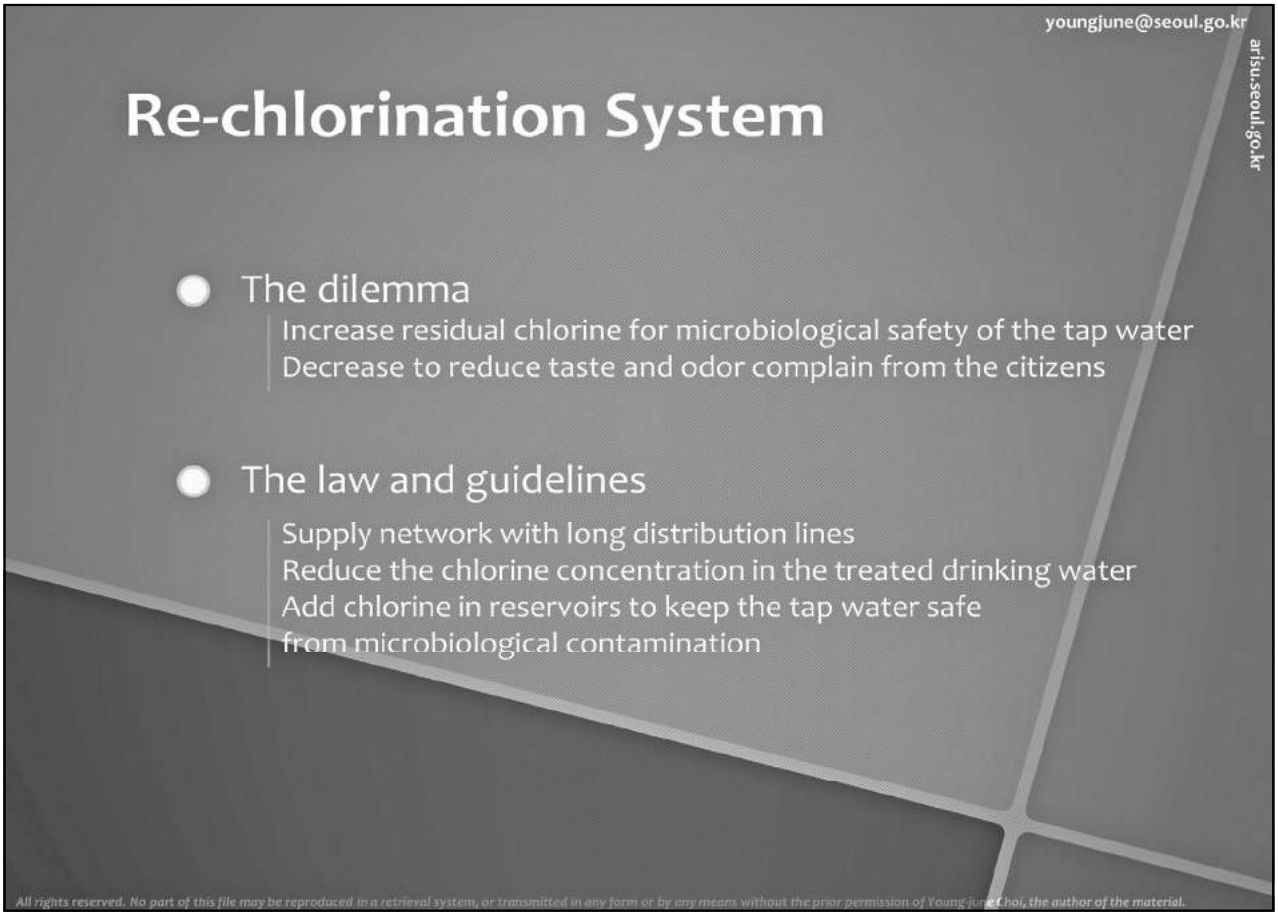
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Re-chlorination System
The dilemma
Increase residual chlorine for microbiological safety of the tap water
Decrease to reduce taste and odor complain from the citizens
The law and guidelines
Supply network with long distribution lines
Reduce the chlorine concentration in the treated drinking water
Add chlorine in reservoirs to keep the tap water safe
from microbiological contamination
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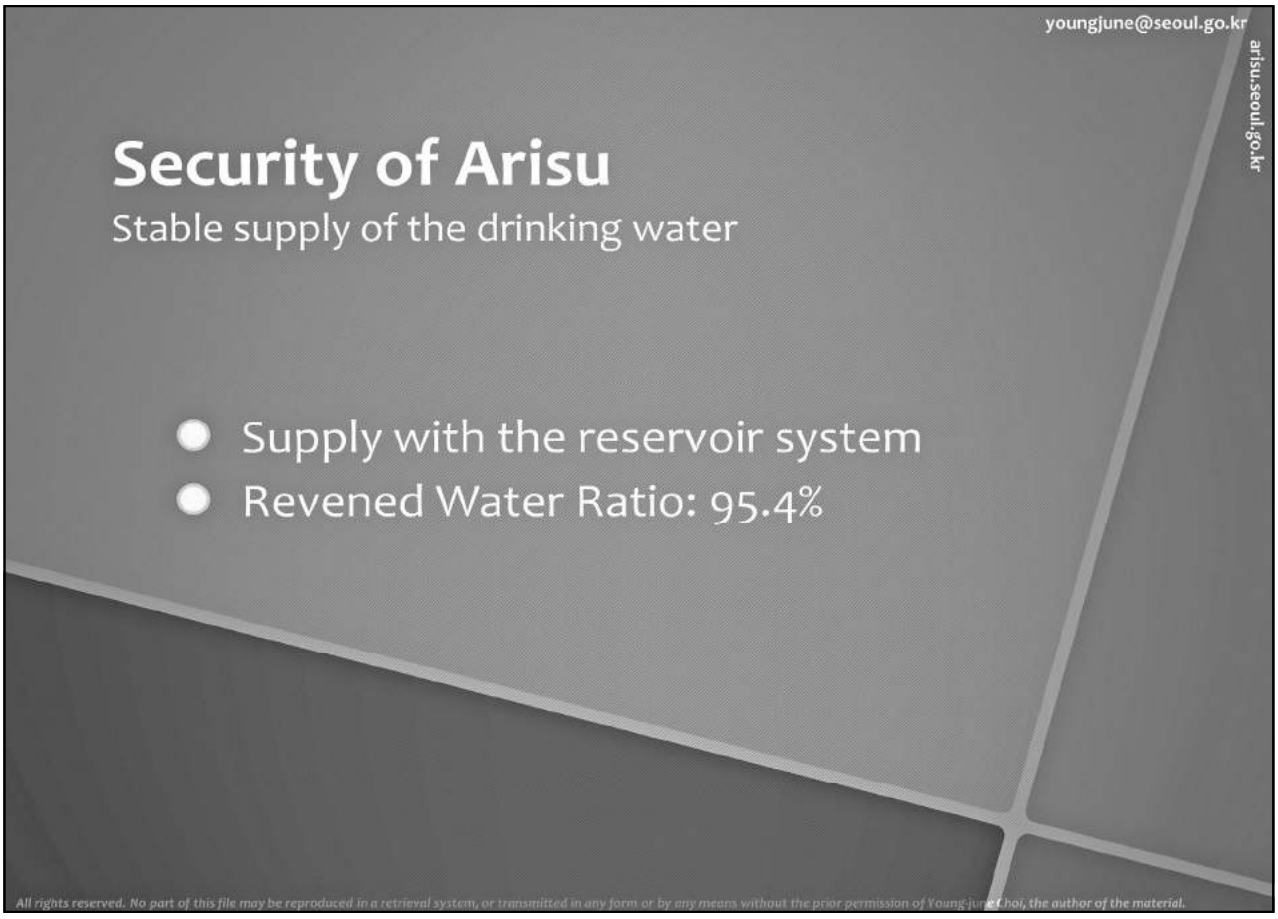
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Security of Arisu
Stable supply of the drinking water
Supply with the reservoir system
Revened Water Ratio: 95.4%
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Reservoirs

- Capacity of reservoirs
  - 1.6 M m³ (2000) 2.4 M m³ (2014); 5 hours to 17 hours
- The benefits
  - Stable water supply even with emergent situations
  - Water pressure control
  - Prohibiting unwanted water quality change
  - Parks for the citizens

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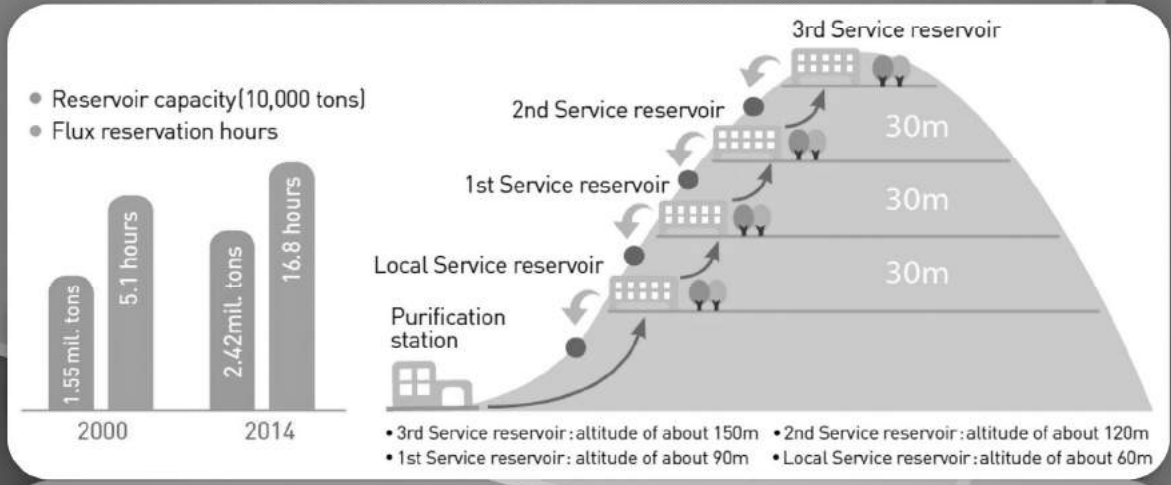
Reservoirs



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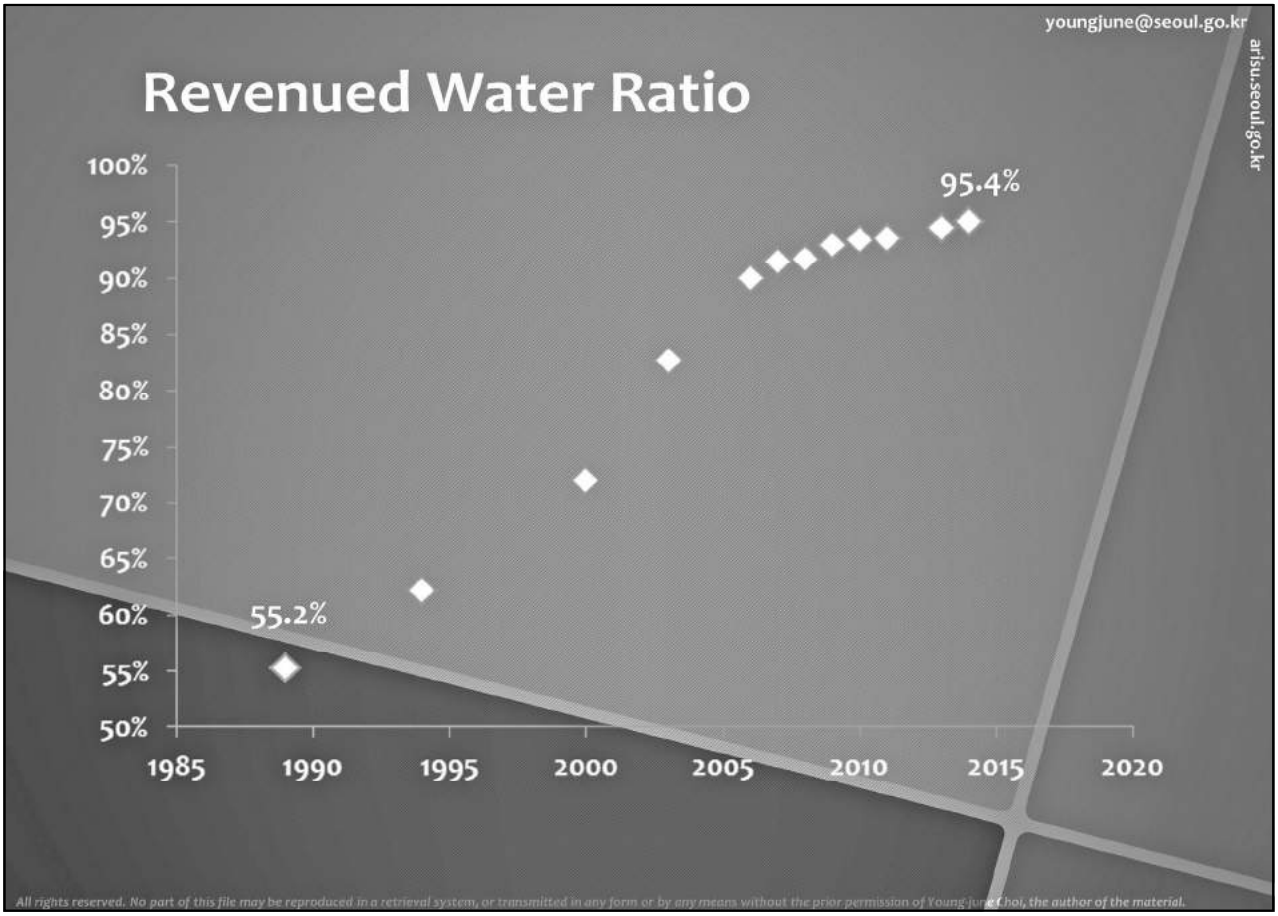
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Revenued Water Ratio
100%
95%
90%
85%
80%
75%
70%
65%
60%
55%
50%
95.4%
55.2%
1985
1990
1995
2000
2005
2010
2015
2020
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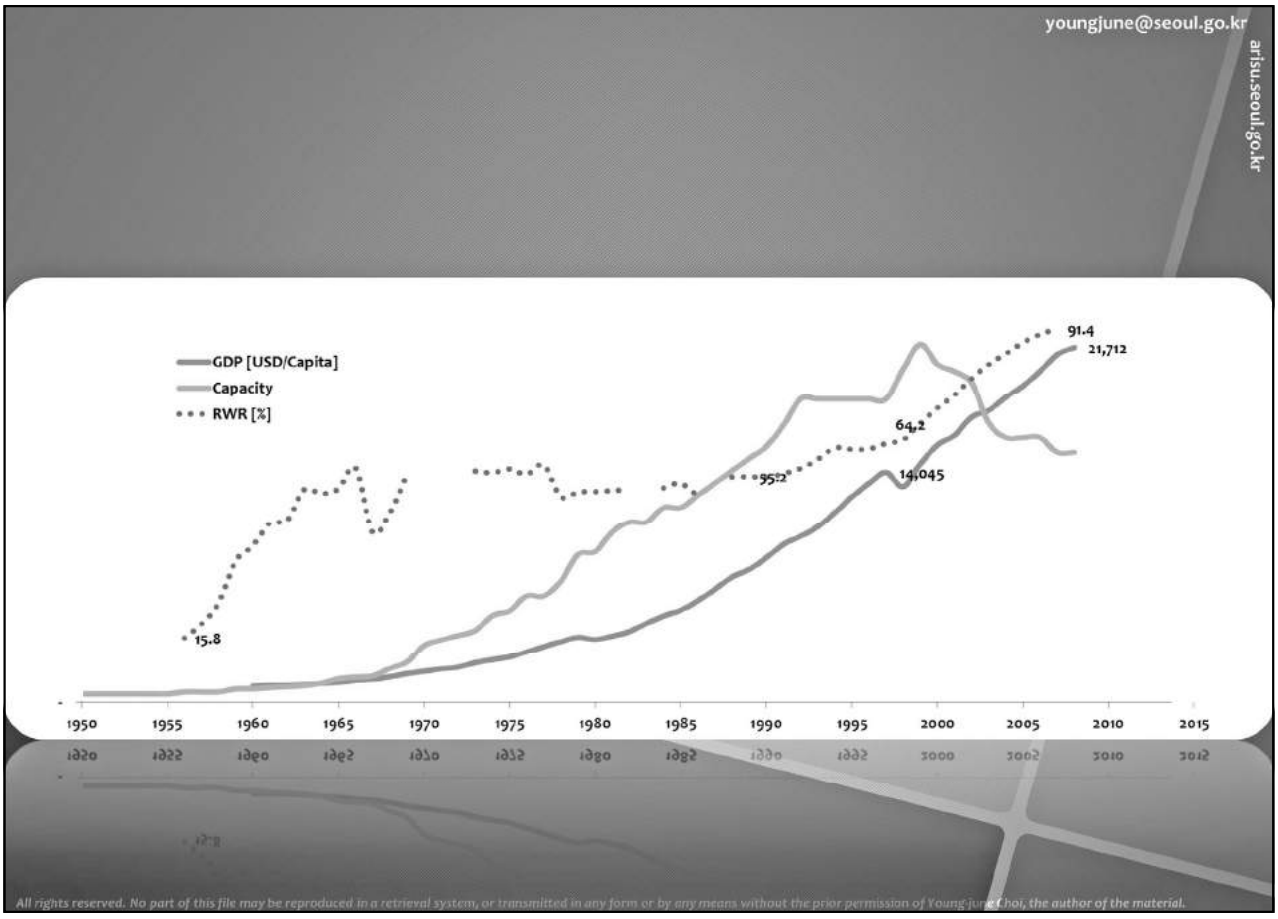
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GDP [USD/Capita]
Capacity
RWR [%]
91.4
21,712
64.2
14,045
55.2
15.8
1950
1955
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
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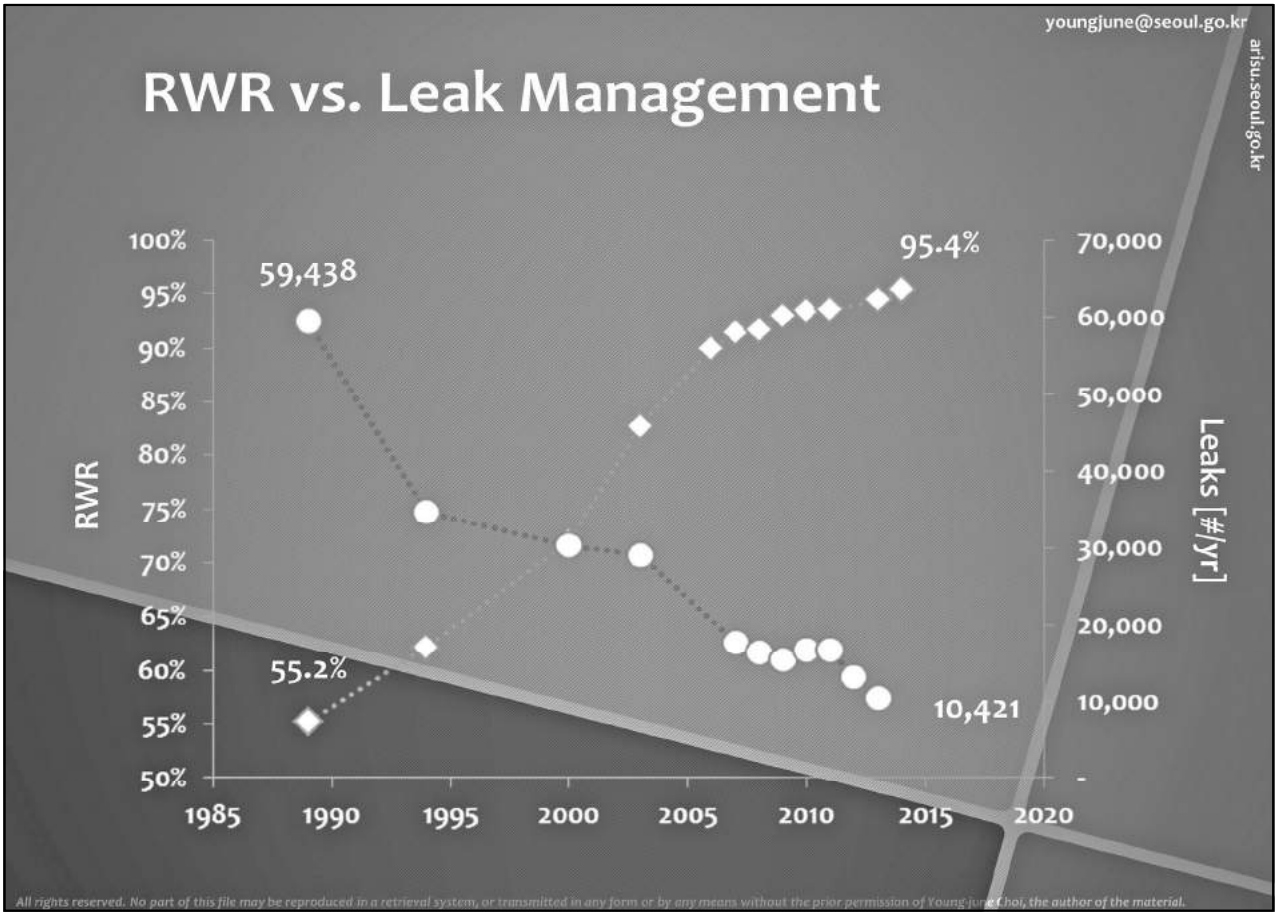
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RWR vs. Leak Management
RWR
Leaks [#/yr]
100%
95%
90%
85%
80%
75%
70%
65%
60%
55%
50%
70,000
60,000
50,000
40,000
30,000
20,000
10,000
-
1985
1990
1995
2000
2005
2010
2015
2020
59,438
55.2%
95.4%
10,421
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Global Collaboration
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Oversea Market Exploitation with PPP model
Consulting project for the waterworks systems, PMB island, Brunei (2012)
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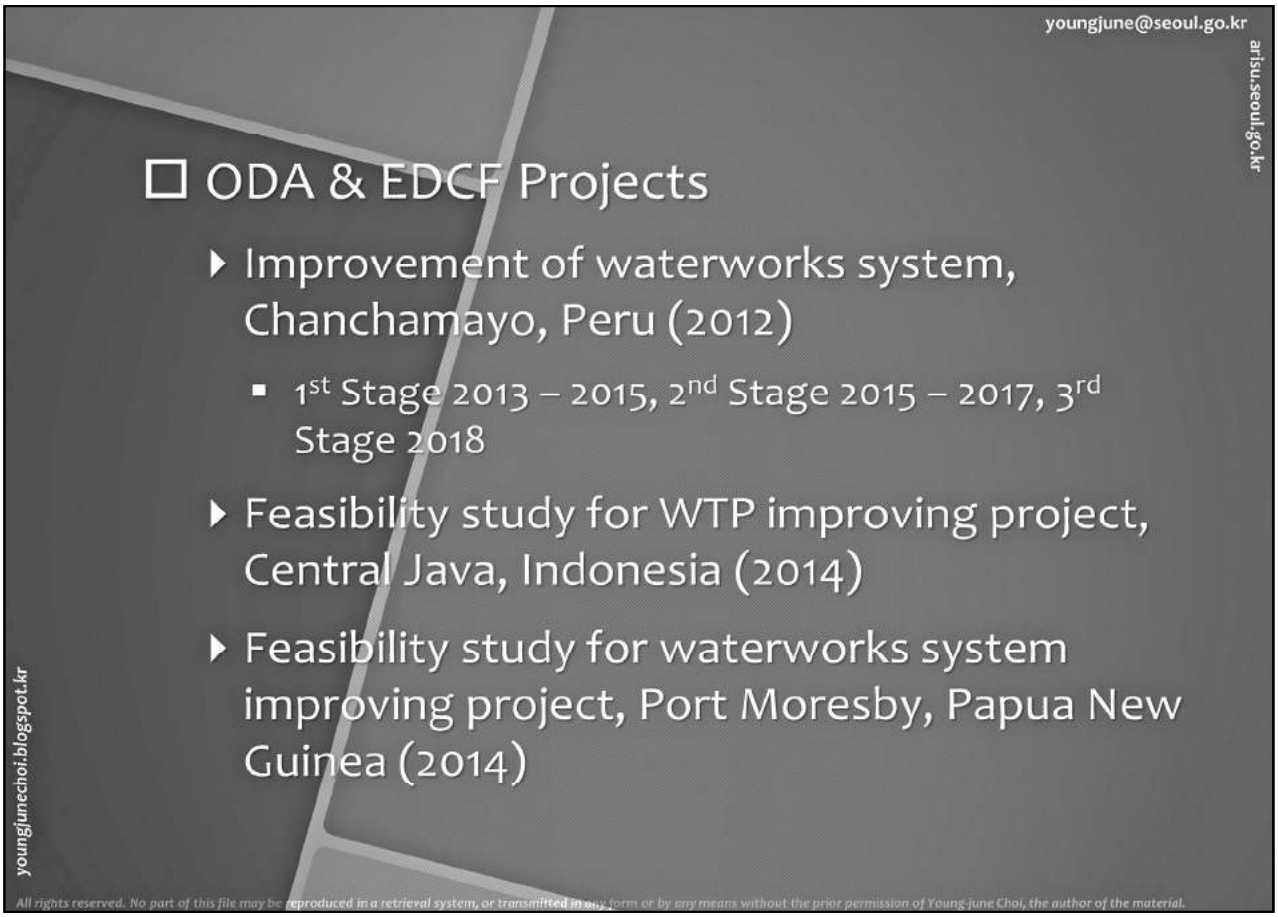
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ODA & EDCF Projects
Improvement of waterworks system, Chanchamayo, Peru (2012)
1st Stage 2013 – 2015, 2nd Stage 2015 – 2017, 3rd Stage 2018
Feasibility study for WTP improving project, Central Java, Indonesia (2014)
Feasibility study for waterworks system improving project, Port Moresby, Papua New Guinea (2014)
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CONTRACT SIGNING FOR CONSULTANCY SERVICES FOR PROPOSED CONSTRUCTION OF PULAU MUARA BESAR BRIDGE, ROAD AND UTILITIES
Welcome, PERU Invitated Training Group
November 20. 2012 ~ November 24. 2012
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MOU Signing Ceremony
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Key Words
Climate change
Sustainability
Resiliency
Knowledge sharing (Global collaboration)
Customer satisfaction
Financial control for the future
Leading edge techs
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Arisu
Healthy & Yummy
Tap water of Seoul
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Day 2
November 3 (Thu.), 2016

Time	Programs	Remarks
08:30	○ Meeting at the Lobby	Hotel Ramada
09:00~12:00	○ Opening Address 【 Part.1 】 ○ Presentations (Seoul → Tokyo → Taiwan) ○ Coffee Break 【 Part.2 】 ○ Presentations (K-water → MWA → Tokyo) ○ Discussion (Next Year's Theme, etc.)	Office of Waterworks (HQ)
12:00~13:00	○ Lunch	Bento
13:00~16:00	○ Site Visit	Guii Purification Plant
14:00~18:20	○ Entertainment	Nanta (Non-verbal Performance)
18:20~19:00	○ Return to the Hotel	Hotel Ramada

Themes

★ “HRD to promote risk management”

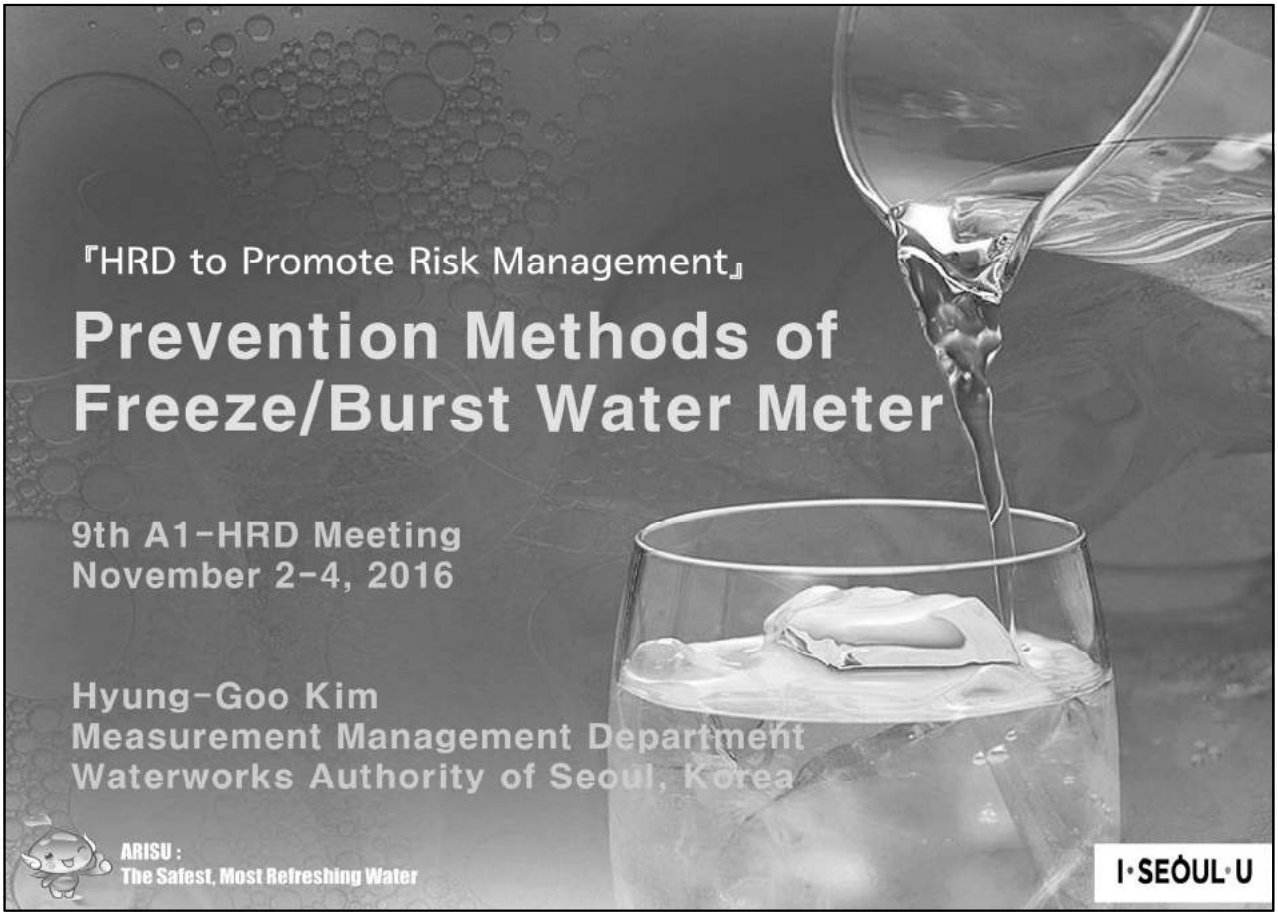
★ “Environment-friendly water projects and HRD”

Session	Time	Subject	Speaker
Part.1	09:00~09:20	Protection Methods of Freeze/Burst Water Meter	**Hyung-Goo Kim** Seoul Metropolitan Gov.
	09:20~09:40	Capacity Building on Crisis Management in Tokyo	**Shigeru Imai** Tokyo Metropolitan Gov.
	09:40~10:00	Environment-friendly Water Project and HRD	**Kuan-po LIN** Taiwan Water Corp.
	10:00~10:15	Coffee Break	
Part.2	10:15~10:35	New approach of capacity building strategies to resolve global water issuses	**Hyoung-Joon Koun** K-water
	10:35~10:55	MWA Risk Management & HRD	**Supawoot Tripasai** Thailand Metropolitan Gov.
	10:55~11:15	Environment-friendly Water Projects and HRD	**Daisuke Kase** Tokyo Metropolitan Gov.
	11:15~12:00	Discussions	
	12:00~12:50	Lunch	

1

Protection Methods of Freeze/Burst Water Meter

Hyung-Goo Kim
Seoul Metropolitan Government



Contents

I·SEOUL·U

Ⅰ. General Status of Seoul Waterworks

ARISU :
The Safest, Most Refreshing Water

General Status of Seoul Waterworks

❖ Arisu

○ Old name for the Han-River in Goguryeo dynasty (BC. 37 ~ AD 668)

○ Name of Seoul' brand of tap water since 2004

○ Made in Seoul, Recognized Around the World!

June 2009	UN's Grand Prize in the public administration service category
Sep 2010	Global Water Industry Project Innovation Award
Sep 2012	Quality certification by the National Sanitation Foundation International (NSF)

4

General Status of Seoul Waterworks

Mission

○ Our mission(policy) is to provide Healthy and Tasty tap water(Arisu).

Capacity & Facilities

○ Population Served : 10.3 million

○ Production Capacity : 4.45 million tons/day (6 Water Purification Plants)

○ Average Water Supply : 3.13million tons/day

○ Revenue Water Rate : 95% (in 2016)

Length of Pipelines	Distribution Reservoirs	Booster Stations	Water Meters
13,696 km	102 (2.42 mil. tons)	205	2.14 mil.

5

General Status of Seoul Waterworks

❖ Mission

○ ARISU : Always, Reliable, Innovative, Smart, and User-friendly

Water Production

- Intensive water quality testing
- 100% advanced water purification system
- Chlorine re-dispersion facility

Water Distribution

- Zero interruption
- Above 95% of revenue water ratio
- Pipe-network maintenance project
- Direct water supply

Operation & Management

- Arisu total service
- AIIS ; Arisu Integrated Information System
- Arisu Small hydro-power plant
- Overseas support

6

I·SEOUL·U

Ⅱ. Zero interruption : Prevention Methods of Freeze/Burst Water Meter

ARISU :
The Safest, Most Refreshing Water

Prevention Methods of Freeze/Burst Water Meter

A Background

❖ What is the「Freeze and Burst」?

8

Prevention Methods of Freeze/Burst Water Meter

A Background

❖ What is the 「Freeze and Burst」 ?

Temperature Drop ➡ Freeze Water ➡ Swelling ➡ Burst (Water Meter, Pipes)

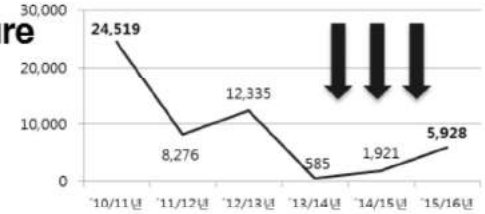
9

Prevention Methods of Freeze/Burst Water Meter

A Background

❖ Number of Freeze and Burst of Water Meters

- **Comparison of Similar Temperature**
  - 2010.11. ~ 2011.2. : 24,519 cases
  - 2015.11. ~ 2016.2. : 5,928 cases



	'10/11	'11/12	'12/13	'13/14	'14/15	'15/16
Lowest Temperature	-17.8℃ (-0.4℉)	-17.1℃ (1.22℉)	-16.4℃ (2.84℉)	-10.5℃ (13.1℉)	-13.2℃ (-8.2℉)	-18.0℃ (-0.4℉)
Below -16℃ days in a row	8day ('11.1.24 ~1.31)	3day ('12.2.01 ~2.03)	5day ('12.12.23 ~12.27)	None	2day ('15.2.08 ~2.09)	8day ('16.1.18 ~1.25)
Number of Freeze and Burst	24,519	8,276	12,335	585	1,921	5,928

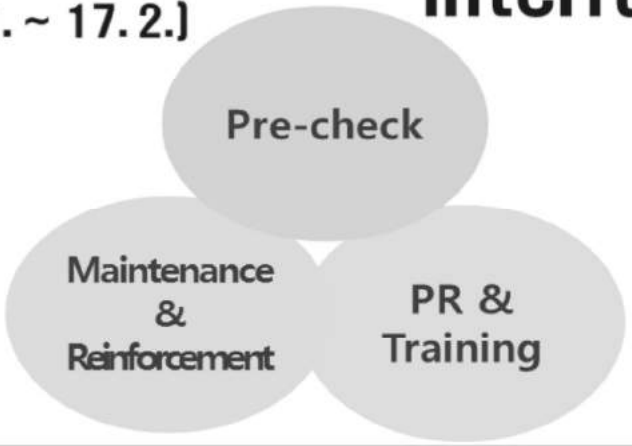
10

Prevention Methods of Freeze/Burst Water Meter

B **Overview : Zero Interruption!**

❖ **Number of Freeze and Burst**

Number of Freeze and Burst ('16. 11. ~ 17. 2.) = **Zero Interruption!**



11

Prevention Methods of Freeze/Burst Water Meter

C **Prevention Measures**

Pre-check

- **Running the 'Area Manager' System**
  - checking divided area by each expert
- **Checking freeze vulnerable households**
  - before the winter season (March~October)
  - address, feature, countermeasure, etc.
- **Devising better ways to prevent freeze**

12

Prevention Methods of Freeze/Burst Water Meter

c Prevention Measures

Maintenance & Reinforcement

< Basic principles of prevention >

- **Delaying pace of freezing**
  - blocking the inflow of outside cold air
  - keeping warmth of water meter
  - dropping tap water slightly
- **Absorption swelling**
  - anti-freeze water meter

13

Prevention Methods of Freeze/Burst Water Meter

c Prevention Measures

Maintenance & Reinforcement

< Customized Prevention Plan >

- **Classfying by house types**
  - Single-unit housing
  - Multi-unit housing : Apartment, villa, etc.
- **Prevention Measures**
  - Wind cover (PE material)
  - Water meter warmer
  - anti-freeze water meter

14

Prevention Methods of Freeze/Burst Water Meter

C Prevention Measures

Maintenance & Reinforcement

❖ PE Cover against the cold wind

- **Attached to outside of water meter container**
- **Blocking Inflow of cold air from outside**
  - ※ Inner temperature raised about 3.26℃
    (Result by Seoul Water Research Institution)
- **Number of installation : 366,000 sheet(in 2016)**
  - ※ 359,000 sheet in 2015, 354,520 sheet in 2014
- **Target : Apartment(corridor access type), Multiplex House, Villa, Single House, etc.**
- **Date of Completion(estimated) : 15th November, 2016**

15

Prevention Methods of Freeze/Burst Water Meter

C Prevention Measures

Maintenance & Reinforcement

❖ PE Cover against the cold wind

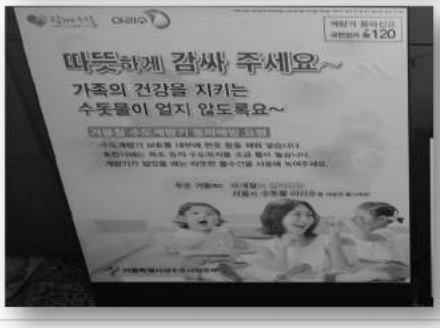
- **Design preference survey**
- **5 draft design → 1 design → revised design(final)**

16

Prevention Methods of Freeze/Burst Water Meter

C Prevention Measures

Maintenance & Reinforcement



17

Prevention Methods of Freeze/Burst Water Meter

C Prevention Measures

Maintenance & Reinforcement

❖ **Water Meter Warmer** (in the water meter container)

- **Substitute of existing styrofoams, old clothes, etc.**
  - → **Foamed polyethylene, thickness : 60mm**
- **Good warmer for water meter Prevention**
  - ※ Inner temperature raised about 1.6 ~ 5.6℃
- **Metering through the transparent window**
- **Installation Amount : 32,000 ea**
  - ※ 2014 : 5,908ea, 2015 : 23,320ea

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Prevention Methods of Freeze/Burst Water Meter

C Prevention Measures

Maintenance & Reinforcement

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Prevention Methods of Freeze/Burst Water Meter

C Prevention Measures

Maintenance & Reinforcement

❖ Video Clip

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Prevention Methods of Freeze/Burst Water Meter

C Prevention Measures

Maintenance & Reinforcement

❖ Anti-Freeze Water Meter

- **Airbag-installed water meter**
- **Strong for Freeze & Burst by Absorbing Swelling**
- **Amount(in 2017) : 17,700ea ※ Total : 243,531ea(since2004)**

※ Cost comparison(15mm) : general $12, anti-freeze $33

- **Installation Target**

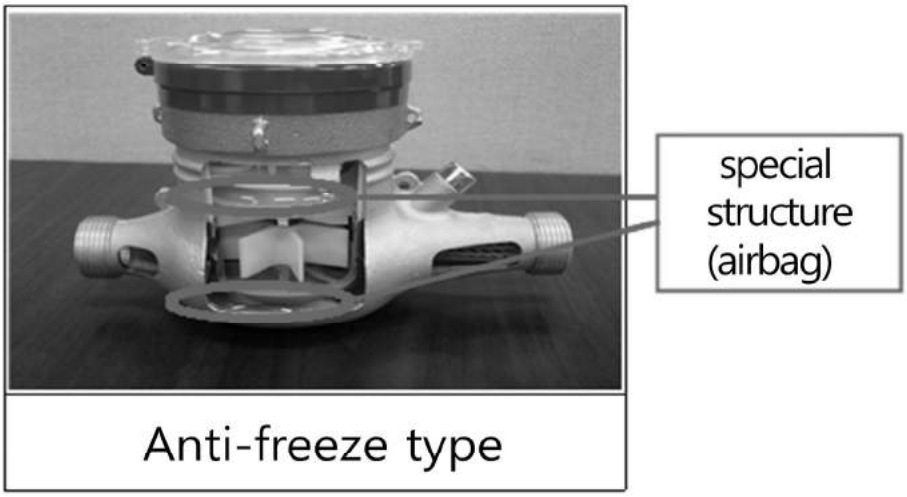
* **Pre-Installation in vulnerable households in accordance with pre-check results**
* **In case of occurring freeze and burst**

21

Prevention Methods of Freeze/Burst Water Meter

C Prevention Measures

Maintenance & Reinforcement



Anti-freeze type

22

Prevention Methods of Freeze/Burst Water Meter

C Prevention Measures

Maintenance & Reinforcement

❖ Other Efforts

- Research on new 'freeze-free' method
- Stop up the crack with silicon, air cap, etc.
- New & empty building monitoring
- Reinforcement work (Exposed, low-depth meters)

23

Prevention Methods of Freeze/Burst Water Meter

C Prevention Measures

PR & Training

< PR to all Seoul citizens>

· Bill, TV, Radio, Newspaper, SNS

· Public Announcement

< Staff Training >

· Disaster and Safety Management

· Water meter OJT course

· Training by each waterworks office

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Prevention Methods of Freeze/Burst Water Meter

D Training Programs

❖ Disaster & Safety Management

PR & Training

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I·SEOUL·U

Ⅲ. Conclusion

ARISU :
The Safest, Most Refreshing Water

Conclusion

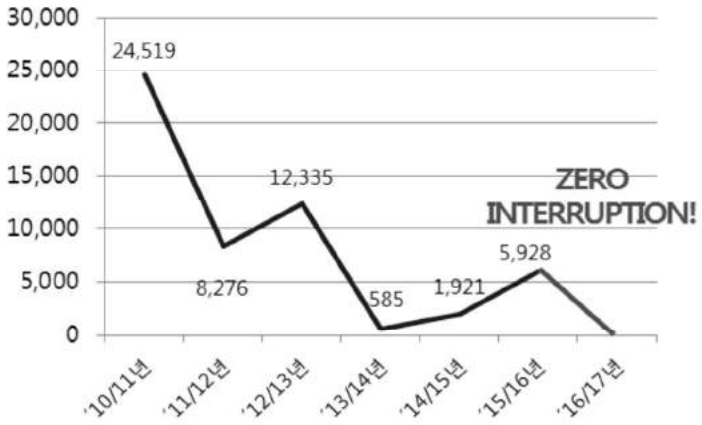
ZERO INTERRUPTION!

Pre-check	Maintenance Reinforcement	PR & Training
- 'Area Manager'	- Wind cover (PE material)	- PR to all Seoul citizens
- Vulnerable house	- Water meter warmer	- Staff Training
- Devise new method	- Anti-freeze water meter	

27

Conclusion

Nothing Ventured, Nothing Gained!



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I·SEOUL·U

IV. Q & A

ARISU :
The Safest, Most Refreshing Water

2

Capacity Building on Crisis Management in Tokyo

Shigeru Imai
Tokyo Metropolitan Government

Capacity Building on Crisis Management in Tokyo

3RD NOV. 2016

Shigeru Imai

Director of Construction
Tama Waterworks Reform Promotion Center
Tokyo Metropolitan Government

Contents

1

Outline of the Tokyo Waterworks

Pervasion	100 %
Service area	1,239 km^2
Population served	13.2 million
Number of service connections	7.3 million
Maximum distribution amount per day	4.6 million m^3/day
Total length of distribution pipes	26,915 km

(note) Service area, population served, pervasion and number of service connections are numbers as of October 1st 2015

Bureau of Waterworks
Tokyo Metropolitan Government

3

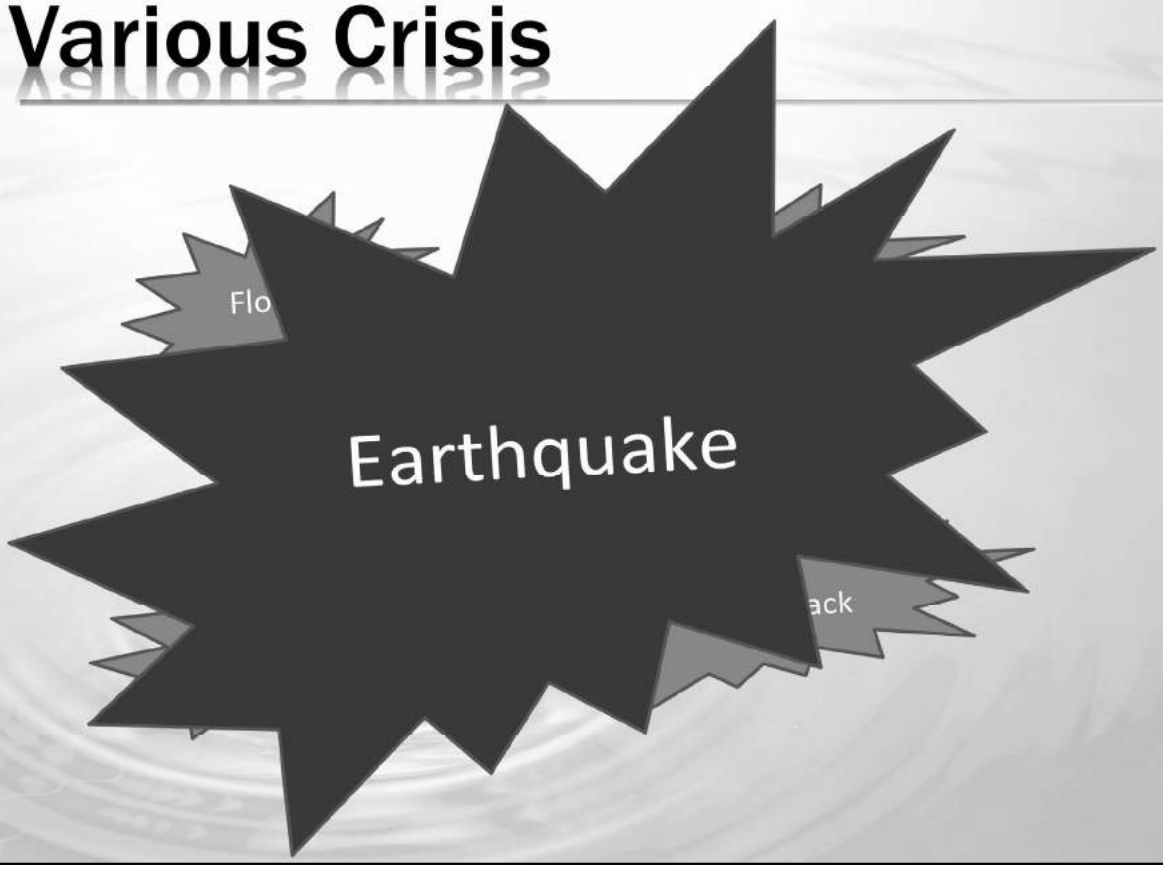

2 Crisis in Tokyo


Earthquake Damage at Kumamoto
in April 2016
5

Tsunami Attacked Coastal City/Town at Tohoku in 2011

6

Various Crisis



7

Leakage Checks at Kumamoto

8

Carrying water bag to Kumamoto

- Our team carried 10,000 water bags to Kumamoto
- Our team drove 1,200 km for 2 days
- These photos taken on 20th April 2016

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Plan against Crisis

Preventive Measures

Plan against earthquake

Emergency Measures

Action Plan for water supply after earthquake

11

Preventive Measures

Plan against earthquake

Objective

- To mitigate damage of water facilities by earthquake
- To keep water supply as stable as possible after earthquake

System of plan

- Improvement of earthquake-resistant water facilities
- Offering water after earthquake

12

Damage to Water Supply Facilities

ϕ2400mm Pipe (Flexible Joint), Sennan-Senen Regional Waterworks
by Miyagi Prefectural Government

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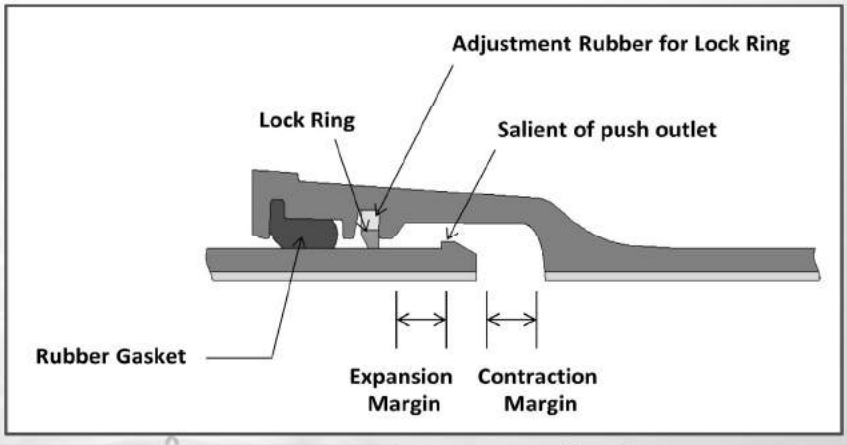
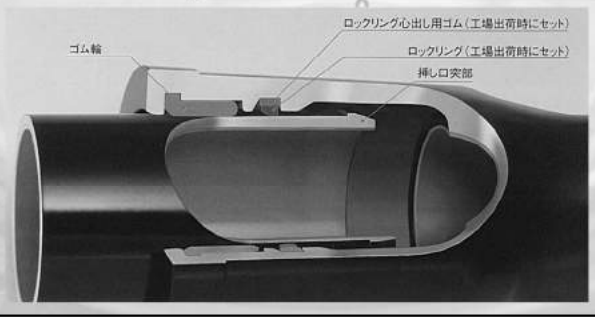
Earthquake-resistant Joint Pipe





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Emergency Measures

Action Plan for water supply after earthquake

Objective

- To set up an emergency team
- To keep water supply as stable as possible after earthquake

System of plan

- Emergency water supply after earthquake to residents
- Check & repair facilities

15

Emergency Measures

Action Plan for water supply after earthquake

Objective of plan

To set up an emergency team after earthquake

Recovery of normal water supply (Quantity, pressure)

Delivery of water as soon as possible

16

Target of Emergency Activities

Recovery of water supply

- Recovering water supply in 30 days for residents, in 3 days for capital main offices after earthquake occurred

Emergency water supply

- Distribution water at emergency water supply station

Announcement

- Notifying public of restrictions, Interruptions and recovery

17

Activities we should act

■Set up of emergency water supply head quarters

In case of

- Serious damage by earthquake in water supply
- Set up TMG emergency head quarters
- Earth quake over seismic intensity 6^-

■Set up of information room

18

Disposition of Staff

Earthquake intensity	Over 6^-	5^+	Under 5^-
Activities	To come for activity point without notification		By order
Staff	All staff	First group	By order
Place	At the office	At the office	At the office
Staff for Emergency of Supply	At emergency Water supply station		

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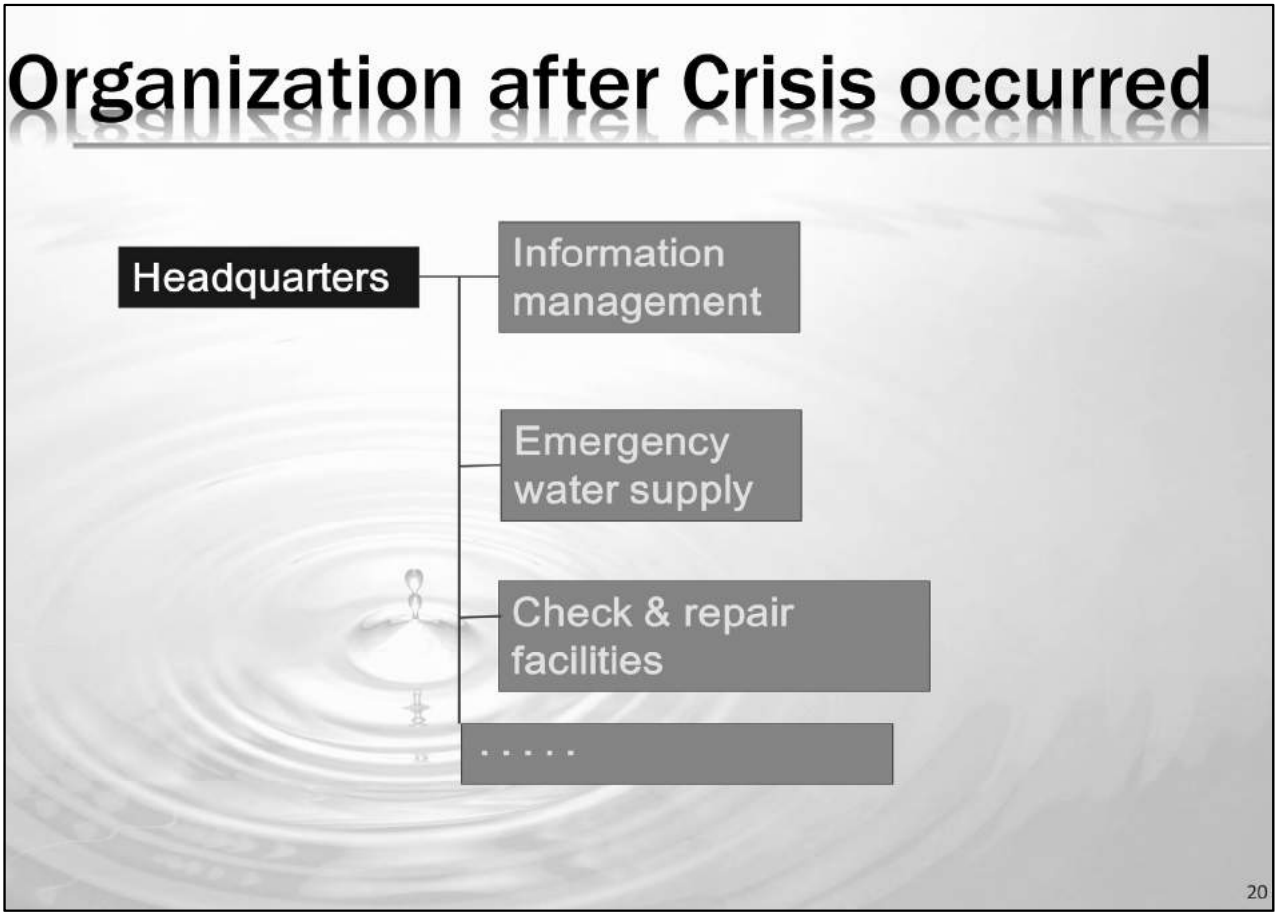
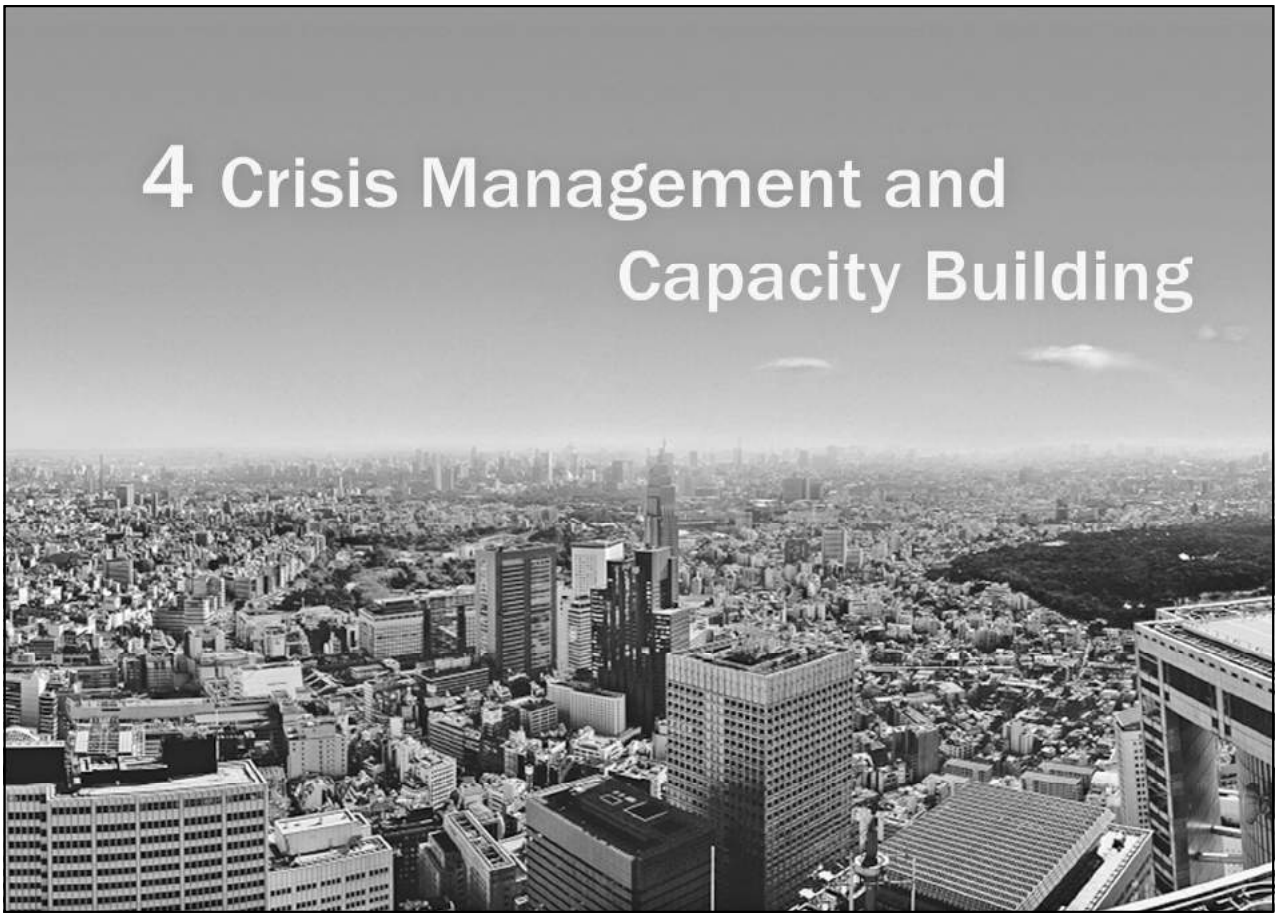

Organization after Crisis occurred
Headquarters
Information management
Emergency water supply
Check & repair facilities
. . . . .
20


4 Crisis Management and Capacity Building

4-1 Main Activities after Crisis

22

4-2 Emergency Water Supply Station

災害時給水ステーション(給水拠点)一覧 (災害時給水ステーション(給水拠点)一覧はこちらからどうぞ)

地図上の番号をクリックすると小窓で施設名、所在地を表示します。
小窓が開かない場合は、一覧にてご確認ください。

下図をクリックすると拡大します。

Tama 23 Wards

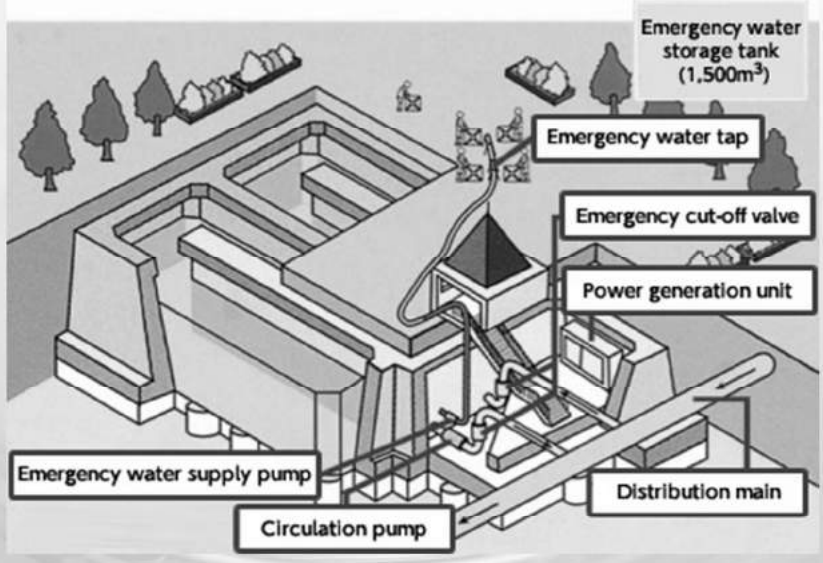
Area	Number
23 Wards	102
Tama	110
Total	212

- Residents can access tank in 2km
- Residents can get information of tank location by our HP

23

4-3Emergency Water Supply Station Structure

How emergency water storage tanks work



- Volume of tank 1,500m³
- Automatically shut down after earthquake
- Emergency water tap is equipped

24

Do we keep sufficient capacity after earthquake?

Our background is

- We can't forecast when as earthquake occur.
- Sufficient staff can't gather because transport system doesn't work.
- A few staff who can come to office have to take action.

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4-4 Training program

	Training Program
(1)	Training with residents and administrative staff such as city office
(2)	Training with neighbor utilities
(3)	Training for earthquake after working hours/on weekend
(4)	Joint Training with utilities outside Tokyo
(5)	Water suspension experience training

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(1)Training with Residents and Administrative Staff such as City Office

27

Emergency Water Supply Activity

At emergency water tap

By trucks

By temporary stand tap

Emergency water supply to hospital by truck

28

Emergency Water Supply Station of Our Facility such as Pumping Station

29

Emergency Water Supply Station of Our Facility such as Pumping Station

30

Our Policy was Changed to Use Emergency Water Supply Station such as Our Facilities

Premise

- Secured keeping of water facilities
- Effective water supply at emergency situation

Before

- Only our staff open the door of emergency water supply station

Now

- Not only our staff but responsible person of neighborhood association can access emergency water supply station

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Residents in Training at Emergency Water Supply Station

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(2) Training with Neighboring Utilities

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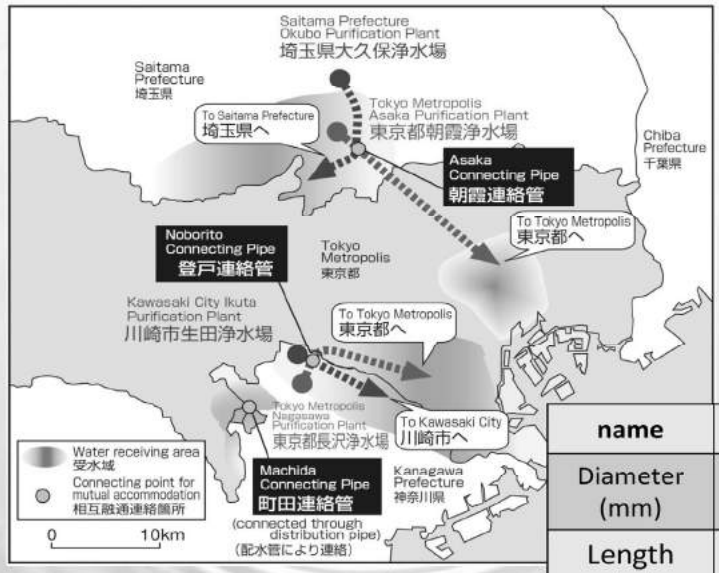
Cooperation with Neighboring Utilities



name	Asaka	Noborito	Machida
Diameter (mm)	800	800	400
Length (m)	44	35	54
Quantity (m3/d)	100,000	100,000	15,000

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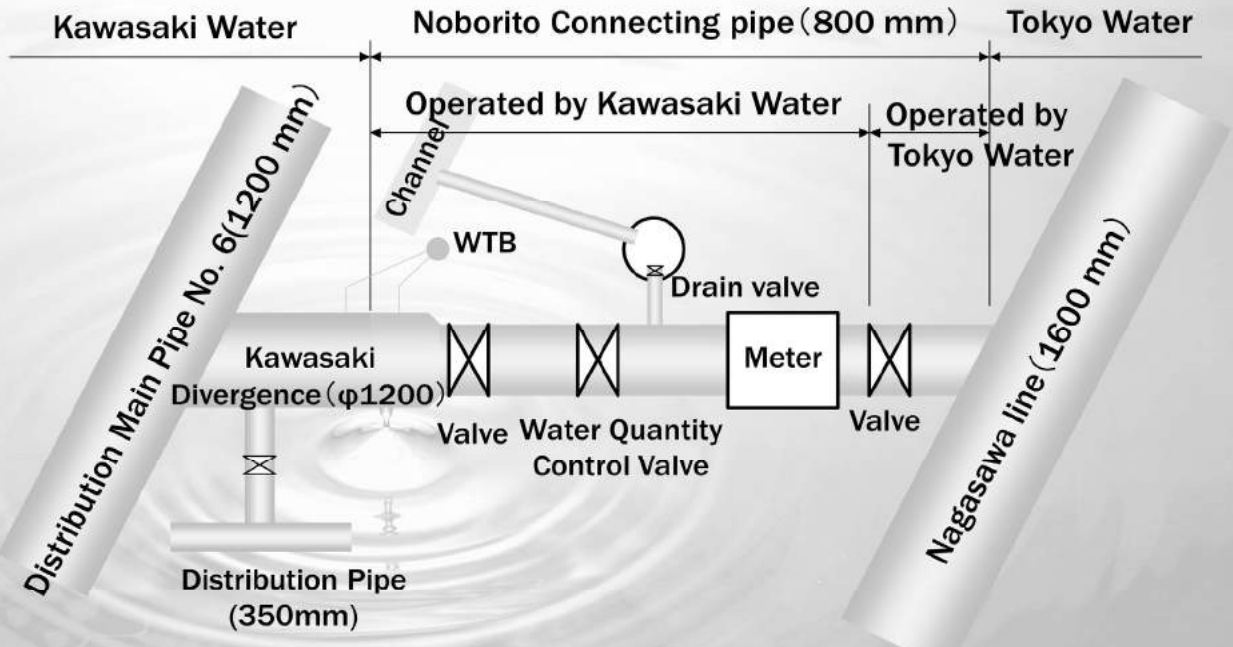
Structure of Noborito Connecting Pipe



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Training at Noborito Connecting Pipe

Operation of valve

Operation of valve by staff

Valve opener by truck power

Check of water quality
: residual chlorine

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(3) Training for Earthquake after working hours/on weekend

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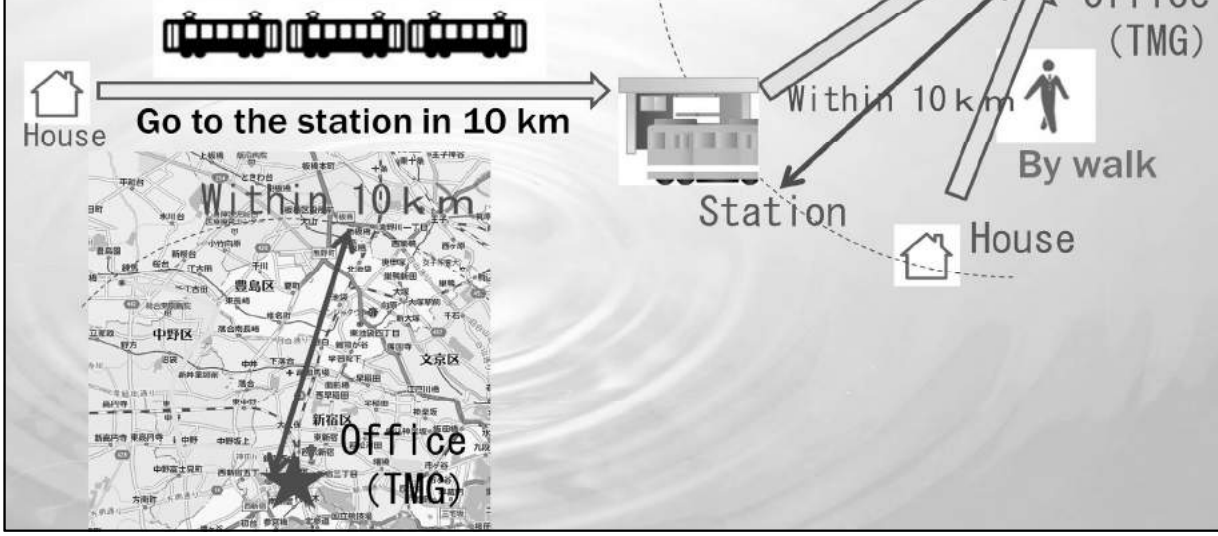
Training for Earthquake on weekend

- To set up headquarters on weekend
- To come to the station within 10 km from the office
- Then walk to the office with checking situation of available street / facilities



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Training for Earthquake on Holiday

First group is to work as temporal HQ until full function will resume

To set up the headquarters with limited staff
To collect information such as damage to facilities
To notify public of water situation

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Display of data collection PC

40

(4) Joint Training with Utilities outside Tokyo

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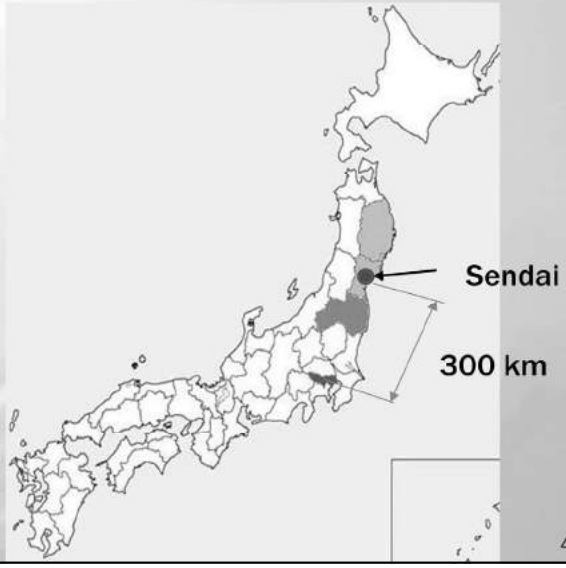
Joint Training

Joint Training with Sendai Water

Based on the agreement of 19 major water utilities to support each other.



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Program of Joint Training with Sendai Water

1st day Afternoon
Call support / Decision to send team

2nd day Full day
Tokyo team departed for Sendai and the team made plan for emergency water supply after arrival

3rd day Full day
Training for emergency water supply in field / Meeting

4th day Morning
Site visit to damaged area by Great East Japan Earthquake in 2011

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Making plan for emergency water supply

Training to fill water to Tokyo tank track

Training of resident carrying water bags on their shoulder

Line up to show unity between Sendai water and Tokyo water

44

Joint Training with Okayama Water

Joint Training with Okayama Water

Based on the same framework.
First time Training at Okayama.

45

Program of Joint Training with Okayama Water

1st day Afternoon
Call support / Decision to send team

2nd day Full day
Tokyo team departed for Okayama

3rd day Full day
The team arrived at Okayama
Held Meeting for emergency activities

4th day Full day
Training for emergency water supply at the hospital / Meeting / Departed for Tokyo

5th Evening
The team arrived at Tokyo

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Emergency water supply at hospital

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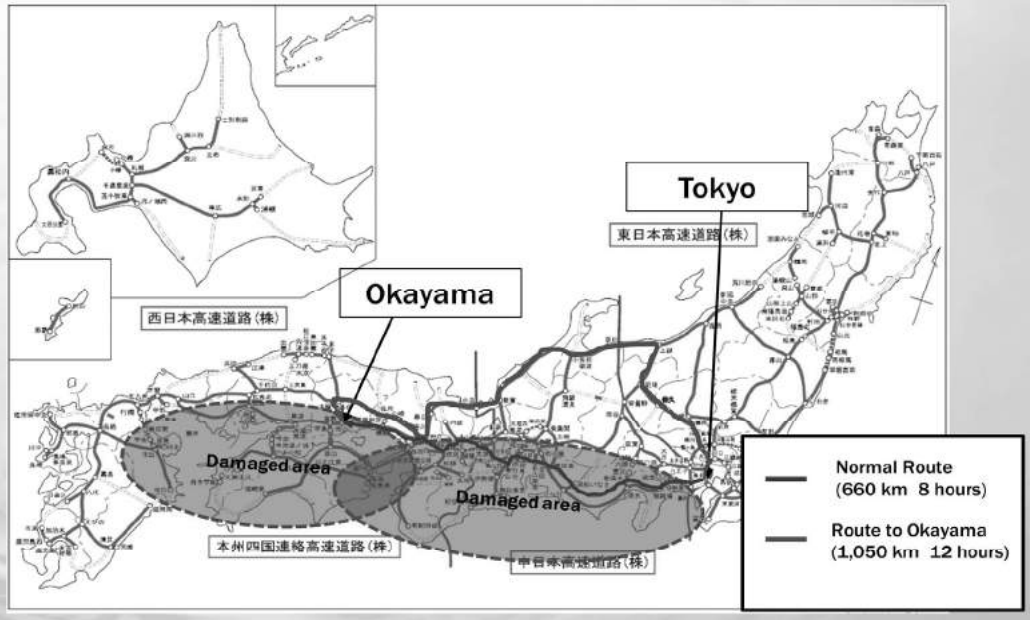
The Route to Okayama Water



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(5) Water suspension experience training

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■ **Objective of training**

To recognize importance of water by experience of life without limited water for 2 days

■ **Scale /program**

Over 200 High school students join this program.

They stayed at school for one night with carrying water

50

4-5 Trainings at Training Center

Training course	Fixed Number	Frequency	Period
Training on crisis management and crisis prevention	100	1/year	0.5day
Practical training on crisis management	8	4/year	1.0day
Practical training on information collection system at earthquake disaster	24	8/year	0.5day

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5 Conclusion

- We can't foresee when crisis will happen.
- We have to extend our capabilities step by step.
- Let's challenge new way to overcome difficulties.
- We must share our knowledge to mitigate against disasters.

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ır attention
The IWA World Water Congress & Exhibition
2018 TOKYO
September, 2018
Tokyo Big Sight
See you in IWA congress in 2018 TOKYO
Bureau of Waterworks Tokyo Metropolitan Government
JAPAN WATER WORKS ASSOCIATION
Japan Society on Water Environment
BUREAU of SEWERAGE TOKYO METROPOLITAN GOVERNMENT
JSWA Japan Sewage Works Association
vernment

3

Environment-friendly Water Project and HRD

Kuan-po LIN
Taiwan Water Corp.

Environment-friendly Water Project and HRD

Taiwan Water Corporation

LIN, Kuan - po

1

Outline

Brief Introduction of TWC

- Service Areas and Water Supply Systems
- Organization and HR Structure

TWC's environment-friendly water project and HRD

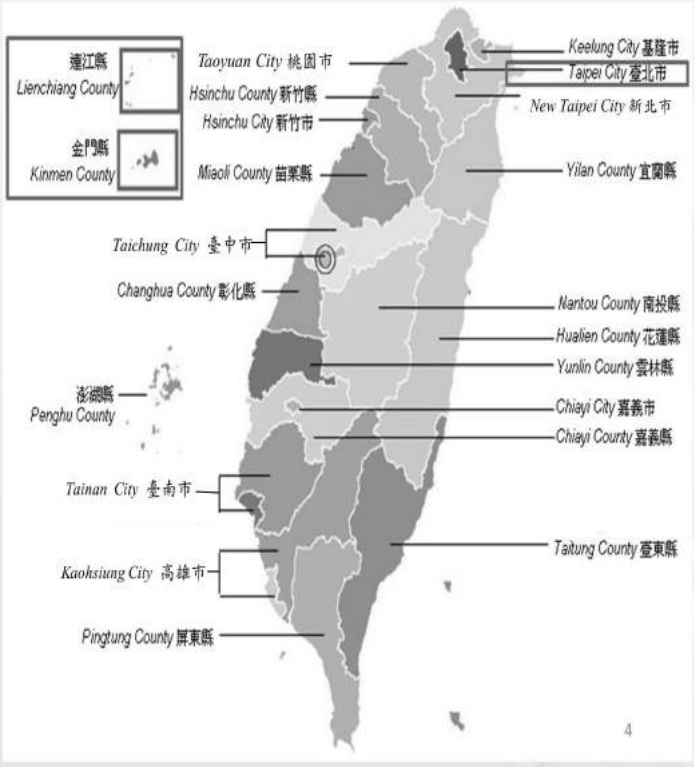
- Shen-gou water ecological park

Conclusion

- Future Prospects

Brief Introduction of TWC

Service Area



- a state-owned enterprise develops public water-supply systems island-wide, excluding Taipei City, Kinmen County, and Lienchiang County

Pipe Bridge

Water comes from...

- No. of reservoir barrage in Taiwan ： 258 for hydroelectric power, farmland irrigation or daily water usage.
- No. of reservoir barrage TWC manages： 21 for public water sources, commercial and industrial development.

Water Purification Facilities

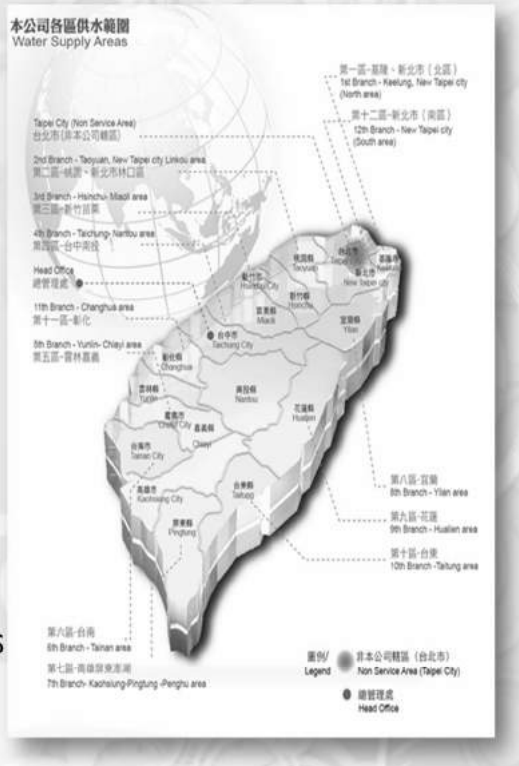
- It requires the effort of every TWC staff, in their respective positions, striving to provide the best quality of tap water for users.

Subscribers

Water Supply Systems

- No. of water supply systems : 149
- Water production capacity : 13,415,000 CMD
- Average water supply : 11,410,000 CMD
- Self-owned reservoirs : 21
- Water purification station : 37 (with treatment capacity of 50,000 CMD or more)
- Subscriber: 18,734,288
- Pipeline length: 59,288 km
- Coverage : 96.61%

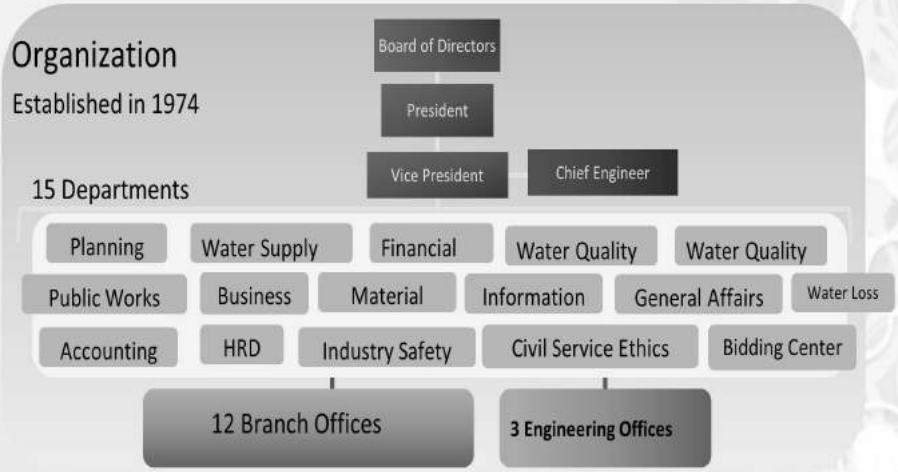
- On average, each employee serves 1,205 customers



Organization and HR Structure of TWC

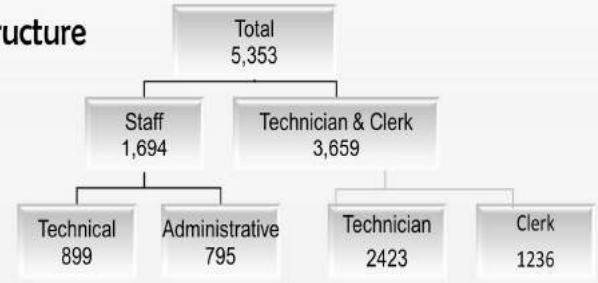
Organization

Established in 1974



126 water treatment and service centers

HR Structure



Main office

- coordinating all the businesses
- planning for the annual projects
- reporting all the operations and activities to the higher authority

12 Branchs

- water supply of different geological areas

3 Engineering offices

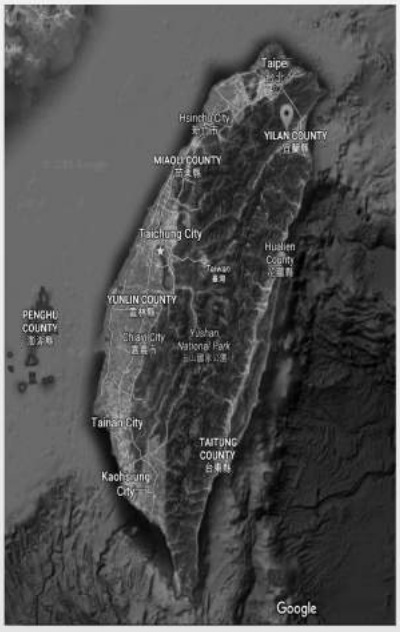
- piping planning and construction supervision.

Brief Introduction of TWC

Environment-friendly water project

Shen-gou water ecological park

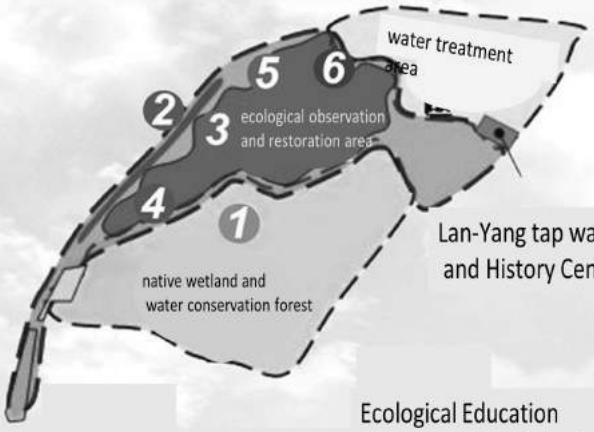
Shen-gou water purification station



Surface water 30,000 CMD
Groundwater 50,000 CMD
Purification capacity ：82,000 CMD

Operating mechanism : surface water is normally in use, while ground water is required to support when the turbidity of the raw water increases or the amount is insufficient.

Shen-gou water ecological park



Habitat conservation
1. Ecological Bird observation area
2. Ecological area for fish
3. Ecological Water Observation Area

Ecological Education
4. Native waterfront forest
5. Beetle restoration area
6. Wetland plant restoration area (Ecological pool)

Entire area : 23 hectares

Occupancy percentage
water treatment area : 10%

Ecological observation and restoration area: 40%

Native wetland and water conservation forest: 50%

Shen-gou water ecological park

- **Purpose**

Protecting natural environment, ensuring biodiversity , and maintaining ecological balance in order to reach water source and environmental sustainability.

- **Vision**

To develop as national water ecological education center with high quality.

- **Concept**

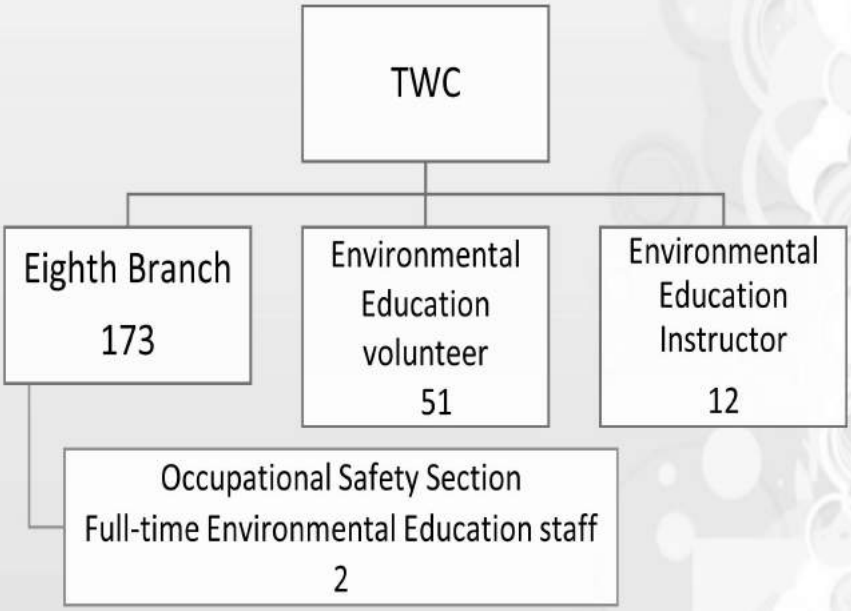
To create a water ecological environment which possesses 「knowledge of water」, 「safety of water」, 「ecology of water」, and 「culture of water」

- **Goal**

To establish a multifunctional environmental learning space containing humanities, arts, science and technology, ecology and education.

Shen-gou water ecological park

Human resources



Job scope

Full-time Environmental Education staff	• Local cultural communication, website management and learning outcomes archive, coordination of workers and sites
Environmental Education Instructor	• Designing, developing and performing environmental education programs, planning and performing outdoor learning activities
Environmental Education Volunteer	• To manage the environmental commentary for visiting groups, assisting the environmental education programs for environmental teachers

Volunteer Recruitment

2014.04.26
The recruitment session of Environmental education volunteer

The recruitment of environmental education volunteer – **5 sessions/year**

The training program for environmental education instructor and volunteer – **6 sessions/year**

- These projects are set to advocate education and cultivate tour staff.
- Besides cultural inheritance, the purpose of the training sessions or volunteer sharing is to let more people understand the process of water purification, the impact of climate change, and the importance of water sources better.

Training

- Participating environmental education training programs held by government agencies.
- Min. Training hours/person/year: 100hrs
- Visiting other educational parks.

By sharing real cases and performing program activities, staff's abilities to integrate environmentally important issues into commentary will be enhanced.

Furthermore, staff goes into campus as well to understand the promotion of environmental education and the utilization of the teaching materials. It helps to gain profound understanding about educational practices in campus, and to further improve the class design and teaching for current demands.

Human resources

Review meeting

Volunteer meeting

- Quarterly meetings to share recent environmental education programs, outdoor learning activities, and tour outcomes of the park.
- Based on actual condition, adjustment of the program material, planning of subsequent promotions, and arranging for activities will be made.

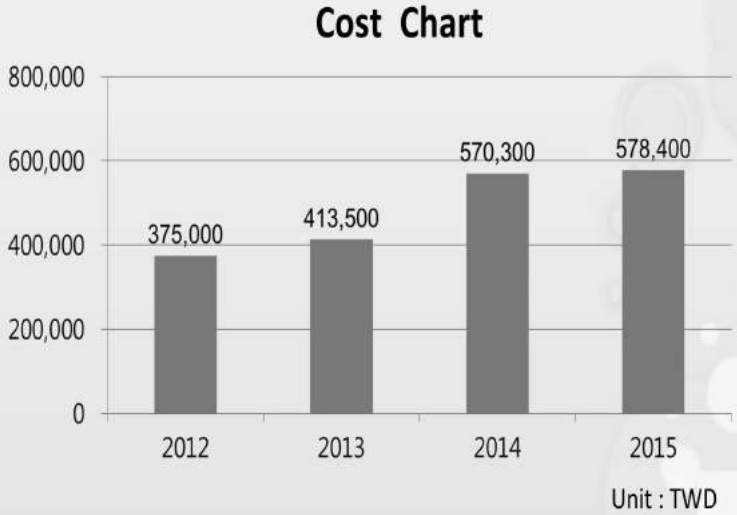
Funding over the years

	2012	2013	2014	2015	2016
Company budget	4,612,460	662,262	1,036,200	8,430,400	2,203,644
Government subsidy	670,000	396,000	238,710	387,000	42,000
Total	5,282,460	1,058,262	1,274,910	8,817,400	2,245,644

Unit : TWD

- TWC has invested considerable funding annually to support environmental education
- The government subsidizes relative expenses yearly for installment of hardware and software within the park

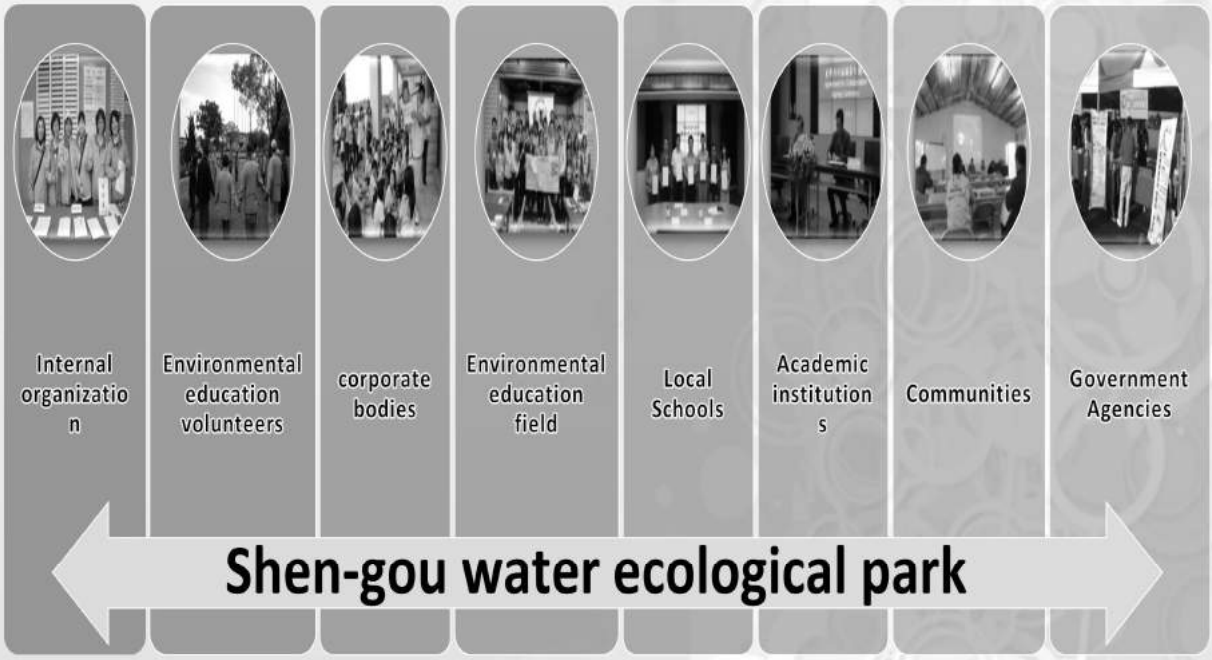
Training cost for volunteers



Unit : TWD

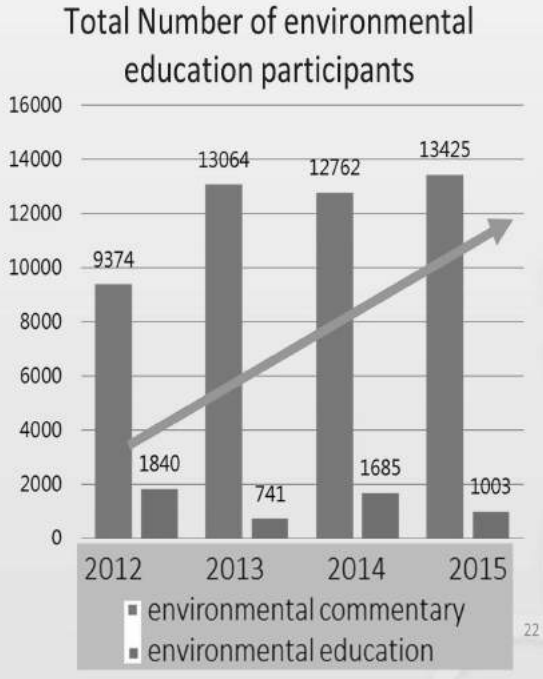
- In order to upgrade the competency of the volunteers and instructors, TWC invests significant budgets every year to conduct personnel training.
- By doing this, TWC ensures the improvement of overall quality and the effective delivery of the objectives of environmental education.

Collaboration with external partners to promote environmental education



21

The specific achievements, outcomes, and benefits of environmental education



22

- Along with the promotion of environmental education, visitor numbers grow steadily throughout the years.
- Except for the environmental education activities, the lavish nature of the park makes it a wonderful place for family recreation. During holiday seasons, the number of visitors is substantial.

Shen-gou water ecological park

Outcomes and benefits of environmental education

Environmental education for school and society

- TWC's water-train campus promotion
- Promotion of water source programs
- Entry invitation for disadvantaged groups for program experience
- Subsidy for schools' outdoor learning activities
- Conducting water-source workshops for teachers
- Conducting trainings for junior commentators

24

1、TWC's water-train campus promotion

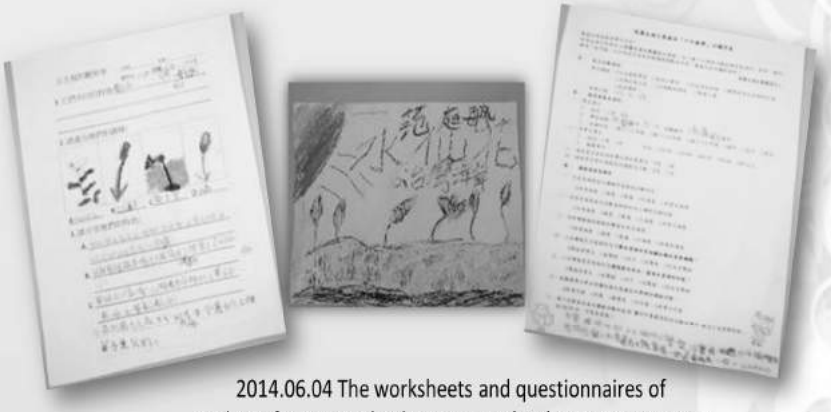
- **Achievements**：10 sessions in 2015, a total of 397 students participated.
- **Benefits**：almost 85% students expressed better understanding of water source conservation

2015.09.01 TWC's water-train to Cisian elementary school

25

2、Promotion of water source programs

- **Achievements**：yearly average of participants：13,000
- **Benefits**：The average satisfaction of participants is higher than 89%



2014.06.04 The worksheets and questionnaires of students from Nan-Shi elementary school in New Taipei City

2013.06.07 Students from Chung-Shan elementary school in Ilan are observing the characteristics of aquatic plants

26

3、Entry invitation for disadvantaged groups for program experience

- **Achievements**：5 sessions of「water source, so it is」activities in 2014, 4 social welfare groups, total no. of participants：195
- **Benefits**：glad to have this opportunity for the participants and the families to experience water source activities (By the Director of Autism Welfare Association in Ilan)

2014.08.13 Participants from autism association holding self-made creations

27

4、Subsidy for schools'outdoor learning activities

- **Achievements**：The program - Children's words for fun water exploration - held during 2013 and 2014 was subsidized for the transportation fees of 20 sessions. There were 682 students.
- **Benefits**：Students indicated the willingness of daily conservation and caring for water sources. Also, they wished to return for other educational activities. The average satisfaction reached 90%.

2013.06.20 The outdoor learning of Dah-Jou elementary school in Ilan

28

5、Water-source workshops for teachers

- **Achievements**：With upwards extending concepts, there are averagely 20 schools choosing to send their teachers to come for water-source workshops.
- **Benefits**：The average satisfaction of teachers is more than 87%

2014.02.19 The workshop for teachers from Shen-Gou elementary school

2014.04.02 The workshop for teachers from Wu-Jie elementary school

29

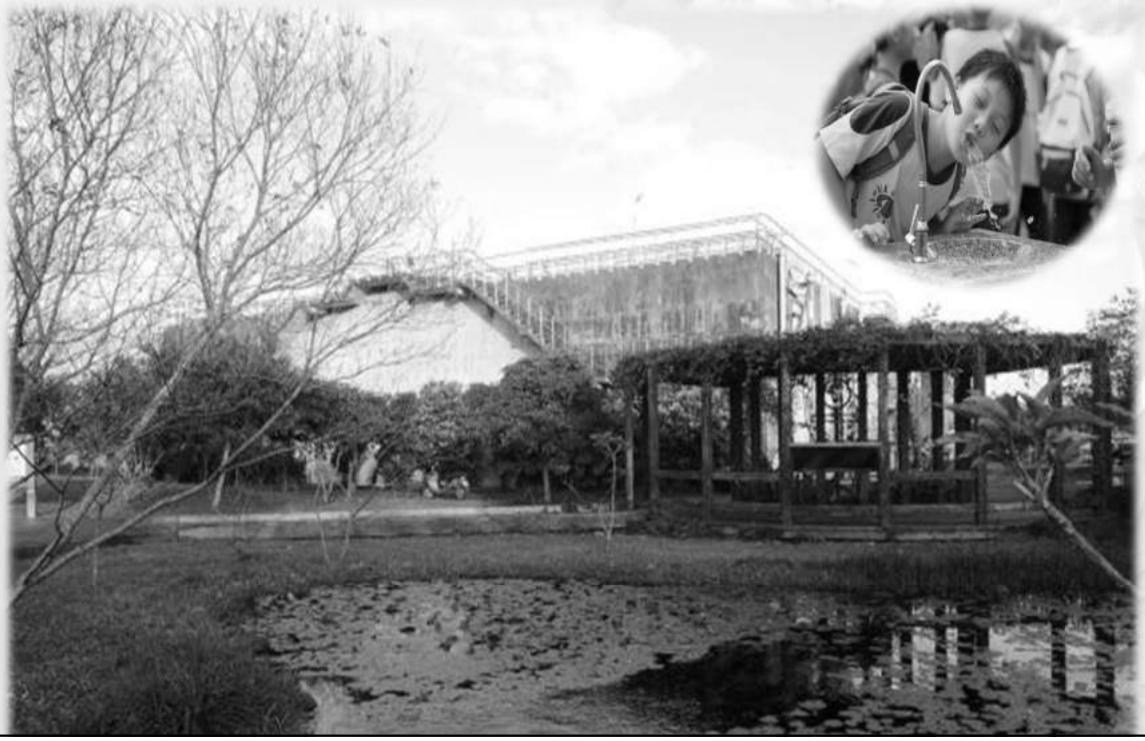
6、Trainings for junior commentators

- **Achievements**：With downwards extending concepts, there was one session of training held in 2014. The total number of junior commentators completed training was 17.
- **Benefits**：Assisting services for 70 people. Visitors'feedbacks were highly positive , indicating the courage and clear explanation.

2014.08.28 Junior commentators giving talks

30

Future Prospects



Future Prospects

Based on the existing foundations, we wish to promote environmental education and to pursue excellence continuously via the park. In accordance with the purpose and the goal of its establishment, we have set the plans for short, mid, and long terms on 6 aspects, which are “wise utilization of water resources”, “To monitor and maintain biological resources”, “Optimization of field operation and management”, “Development of well-designed programs”, “ To enhance manpower abilities”, “To keep environmental sustainability and fresh water to drink”.

Self expectations

As a state-owned business, the company actively involves in the promotion of environmental education. During these years, it has provided environmental learning services for all social circles. It will continue to strive and hope to become the domestic **benchmark for water-source educational center.** Moreover, the company would like to offer programs with more diversity and integrity. We wish to contribute more to water resources and environmental sustainability.




33

Cheng-cing Lake


- Cheng-cing Lake is another environment-friendly water project of TWC, that surrounded by trees and flowers. The scenery is very beautiful, quiet and attractive. so the lake is not only a water source but also a sightseeing area for kaohsiung.

Thank you for your attention

4

New approach of capacity building strategies to resolve global water issues

Hyoung-Joon Koun
K-water

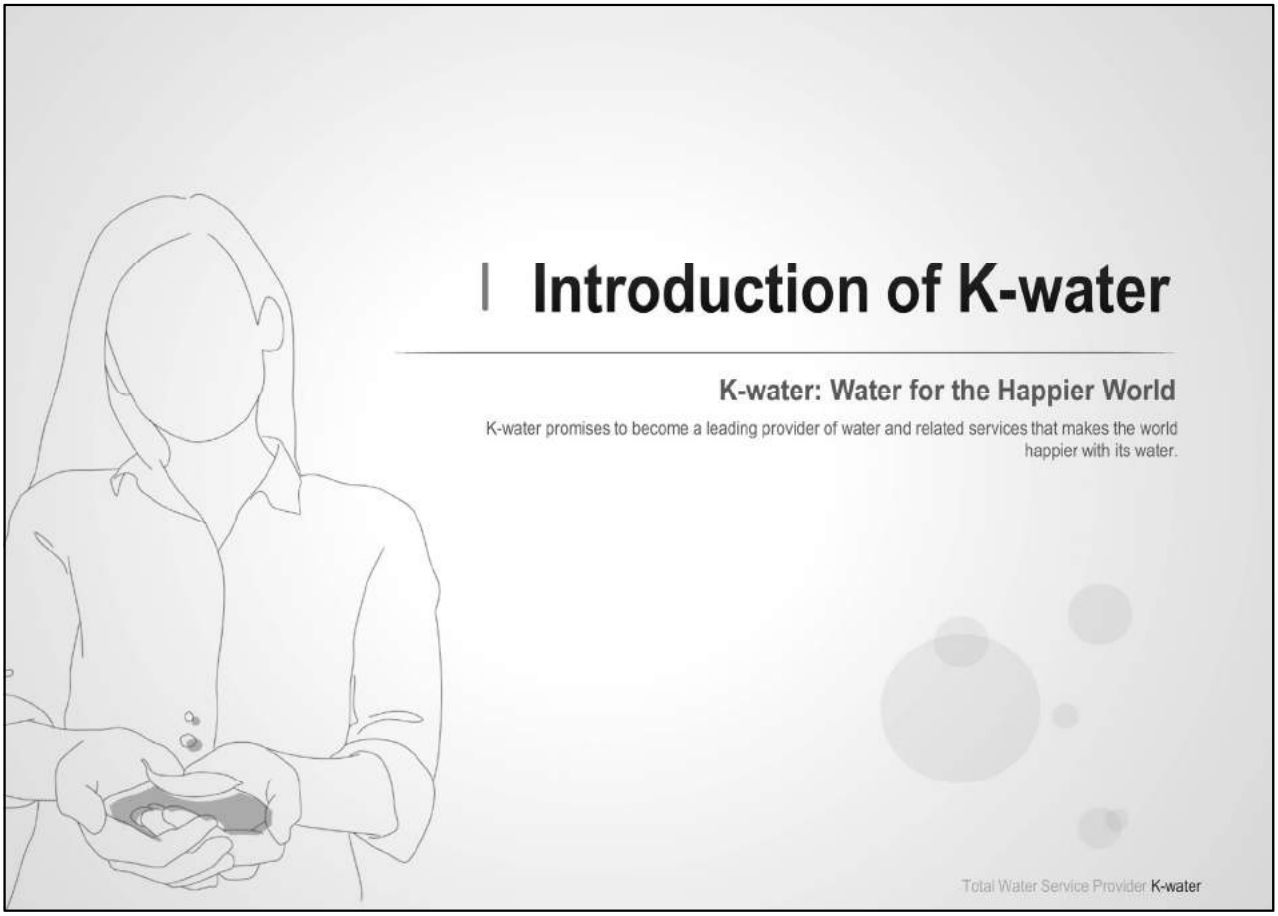
New Approach of Capacity Building Strategies to Resolve Global Water Issues

Learn, Act and Achieve

K water Academy

Contents

K water


Introduction of K-water
K-water: Water for the Happier World
K-water promises to become a leading provider of water and related services that makes the world happier with its water.
Total Water Service Provider K-water


1. About K-water
K water
A major public-service corporation in Korea
with a history of 50 years of global water management
K water
Total Water Service Provider
Water Resources
Water Supply and Sewerage
Clean Energy
River Restoration and Canals
Providing Industrial Water and Seawater Desalination

2. K-water Business

K water

01 IWRM

IWRM(Integrated Water Resource Management) Projects
Realizes the one-stop water management of dams & rivers with the IWRM system

Flood control through multipurpose dams
4.9 billion m³
- Operation & maintenance of 17 multipurpose dams, 14 dams dedicated to water supply, and 16 multi-functional weirs
- Responsible for 95% of the gross domestic flood control capacity

Water supply
12.4 billion m³
- Responsible for 68% of the gross dam water supply
- Five dams currently under construction

02 Water Supply

Healthy Water Supply Projects
Supplies healthy water with the intelligent water management system

Population water-serviced by K-water
22.23 million
- Responsible for 46% of the gross domestic waterworks
- Annual water supply : 2.5 billion

Tap-water sales
KRW **2** trillion
- Daily installed capacity of 34 regional water networks : 17.55 million

03 Clean Energy

Clean Energy Projects
Leads the energy industry by developing new & renewable energy with water

Installed capacity of new & renewable energy plants
1,345 MW
- Yearly energy production of hydropower, tidal power, solar photovoltaic power and wind power plants 1,703GWh/yr
- Possible to replace 3 million barrels of oil per year

Developing floating solar power system
1,200 MW
- Development of the world's first commercial model of the floating solar photovoltaic power generation system, SOLATUS (500 kW)
- Will introduce SOLATUS in 12 dams by 2022.

04 Overseas Business

Overseas Projects
Provides the world with total water solutions involving in the whole process of water cycle

64 projects in **24** countries
(completed as of now)

17 projects in **12** countries
(currently underway)

|| K-water Academy

Learn, Act and Achieve!

Total Water Service Provider K-water

1. HRD Strategy

K water

Best Global Water Academy

Enhancing Global Competitiveness as the Smart Water Management Leader

Water Education Hub
Leading the future of water education with cooperative network

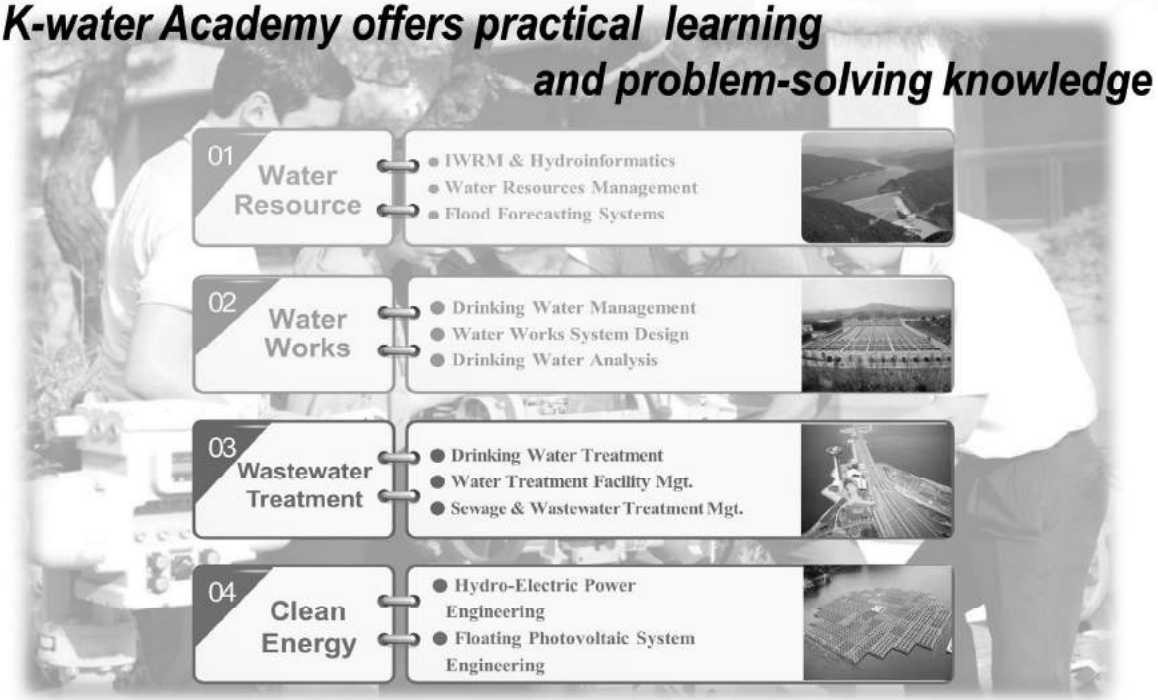
High Performance Orientation
The best provider of water education services

Global Infra Enhancement
The expansion of global education infra

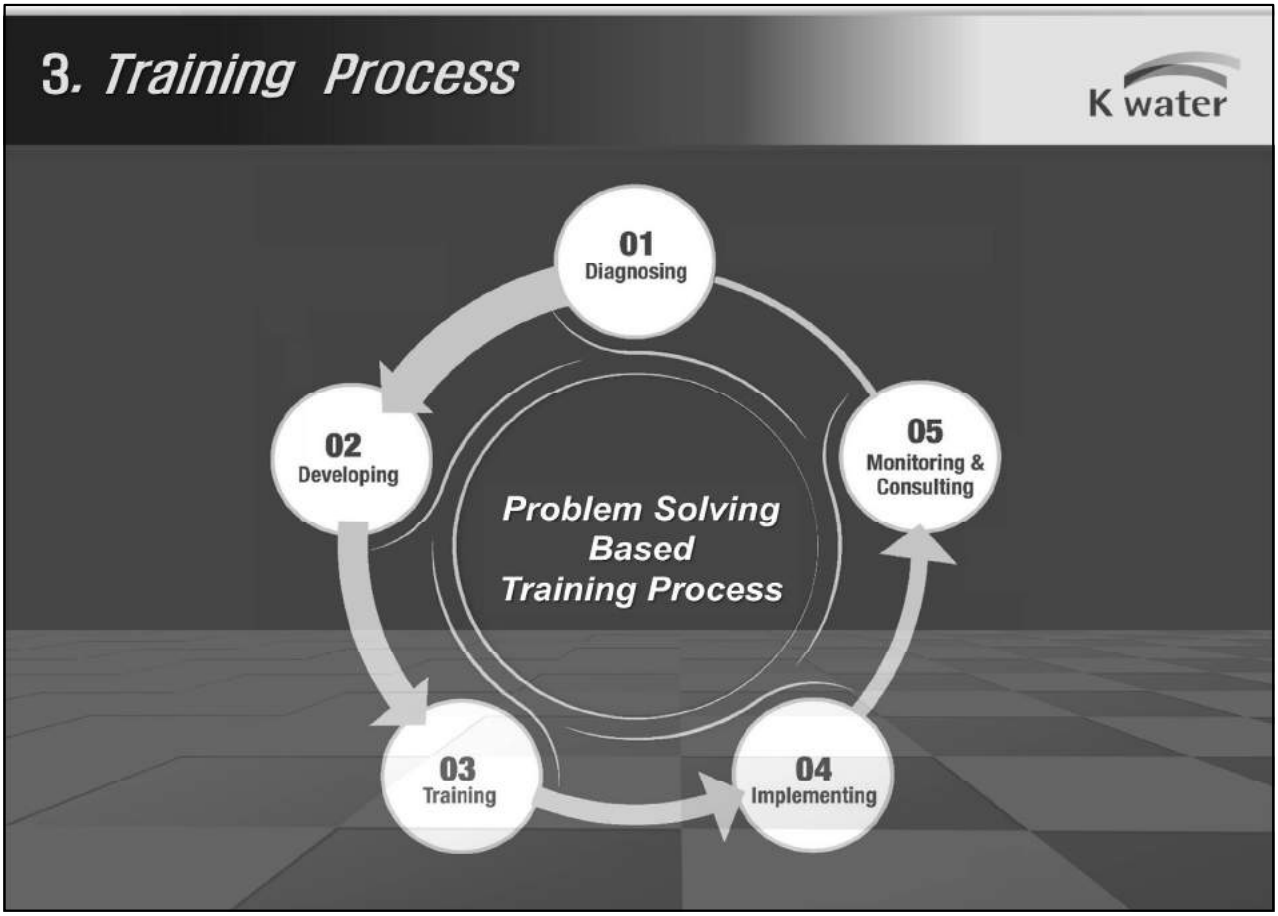
2. Training Features

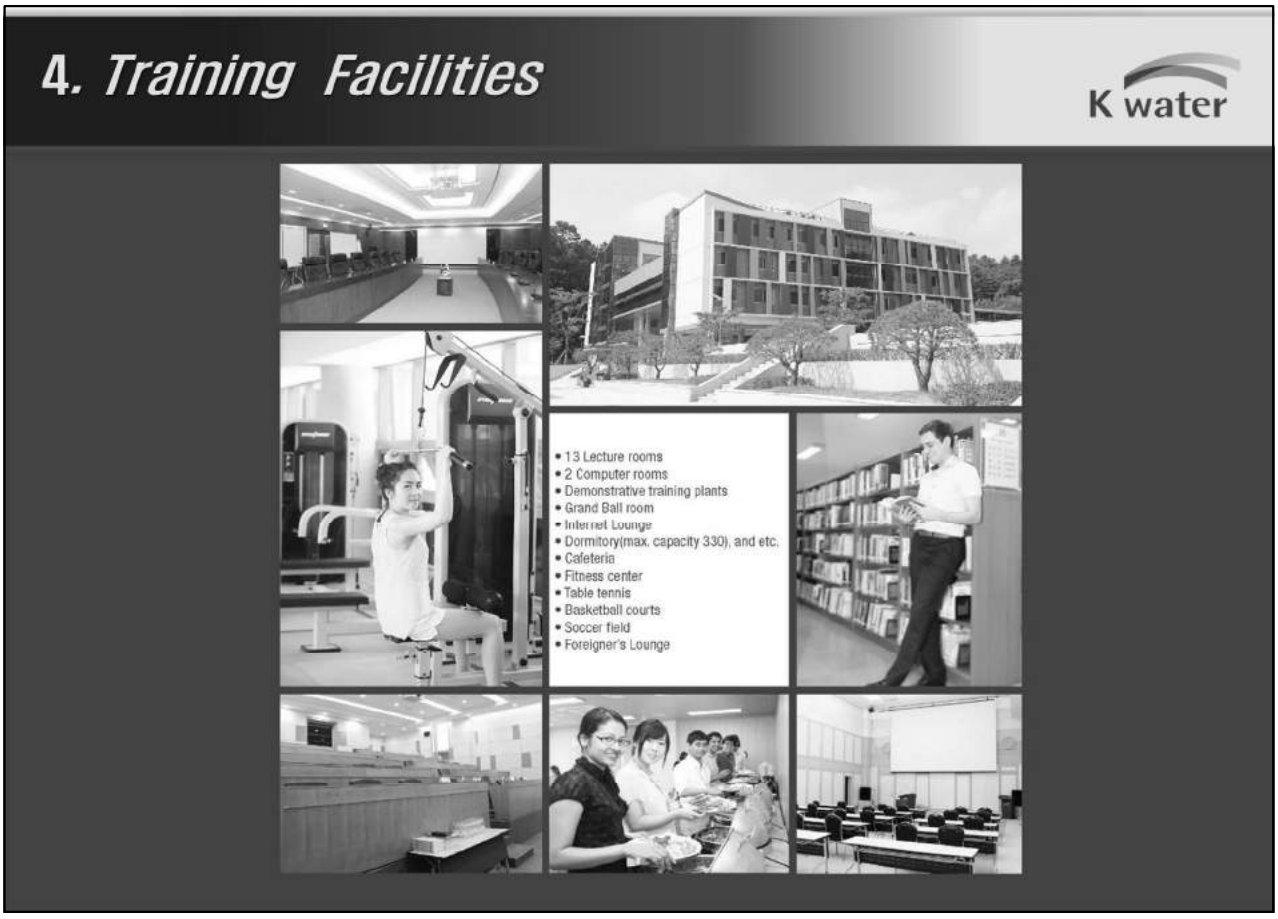
K water

K-water Academy offers practical learning and problem-solving knowledge



01 Water Resource	● IWRM & Hydroinformatics ● Water Resources Management ● Flood Forecasting Systems	
02 Water Works	● Drinking Water Management ● Water Works System Design ● Drinking Water Analysis	
03 Wastewater Treatment	● Drinking Water Treatment ● Water Treatment Facility Mgt. ● Sewage & Wastewater Treatment Mgt.	
04 Clean Energy	● Hydro-Electric Power Engineering ● Floating Photovoltaic System Engineering	


3. Training Process
K water
01
Diagnosing
02
Developing
03
Training
04
Implementing
05
Monitoring &
Consulting
Problem Solving
Based
Training Process


4. Training Facilities
K water
• 13 Lecture rooms
• 2 Computer rooms
• Demonstrative training plants
• Grand Ball room
• Internet Lounge
• Dormitory(max. capacity 330), and etc.
• Cafeteria
• Fitness center
• Table tennis
• Basketball courts
• Soccer field
• Foreigner's Lounge

5. Various Training Infrastructure

K water

6. Training Programs and Modules

K water

Nurturing global water experts by operating 48 Modules

1 Water Resources (11)
- Water Source Investigation and Hydrologic Analysis
- Dam Planning
- Dam Design and Engineering etc.

2 Drinking Water (13)
- Water Treatment Plant Planning
- Water Intaking
- Conventional Water Treatment Plants Design and Engineering etc.

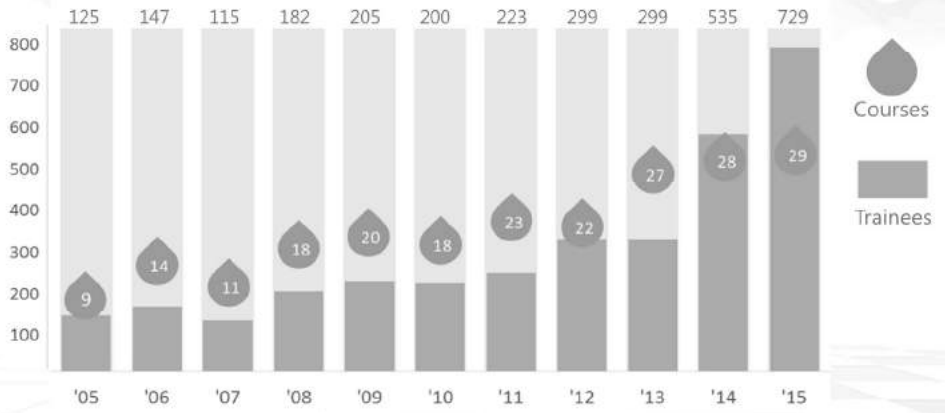
3 Wastewater Reuse (9)
- Public Sewage Planning
- Conventional Wastewater Treatment plants Design and Engineering
- Advanced Wastewater Treatment Plants Design and Engineering

4 Water Policy (6)
- Water Policy Management
- Water and Environmental Policy and Law
- EIA in Water Resources etc.

5 Finance (9)
- Water Budget Analysis
- Analysis of Working Cost Economic Evaluation
- Water Tariff etc.

7. Capacity Building Results

K water



244 Courses, 3,438 Alumni
from 96 Countries until Sept, 2016

8. Success Cases of K-water Action Learning

K water

1. K-water's Knowledge Data Base

Knowledge data base accumulated by operating over 300 in-house & 100 international & domestic (government officials, corporates, etc.) training programs annually

2. Diverse Learning Methods

Adopting 5-step process → To effectively determine problem & to establish long-term MP

Workshops and Consulting Sessions → to further enhance the effectiveness

4. K-water's Learning Infrastructure

K-water manages & operates state-of-the-art facilities throughout Korea.

Our programs enable participants to gain hands-on learning experiences.

3. The Problem Solving Methods

K-water specialists provide variety of problem solving methods, which can be applied to achieve a successful outcome

III New Water Issues & Capacity Building

Total Water Service Provider K-water

1. *Water Issues are Changing*

K water

Smart Water Management Initiative

Global Cooperation & Network for Education

Water Resources Mgmt.

Water Security (flood, draught)
Water Policy (master plan etc.)

Water Supply & Sanitation

Non Revenue Water
Water Quality

New
WATER ISSUES
Climate Change

I W R M

Integrated Water
Resources Management
Hydro Power (generation)

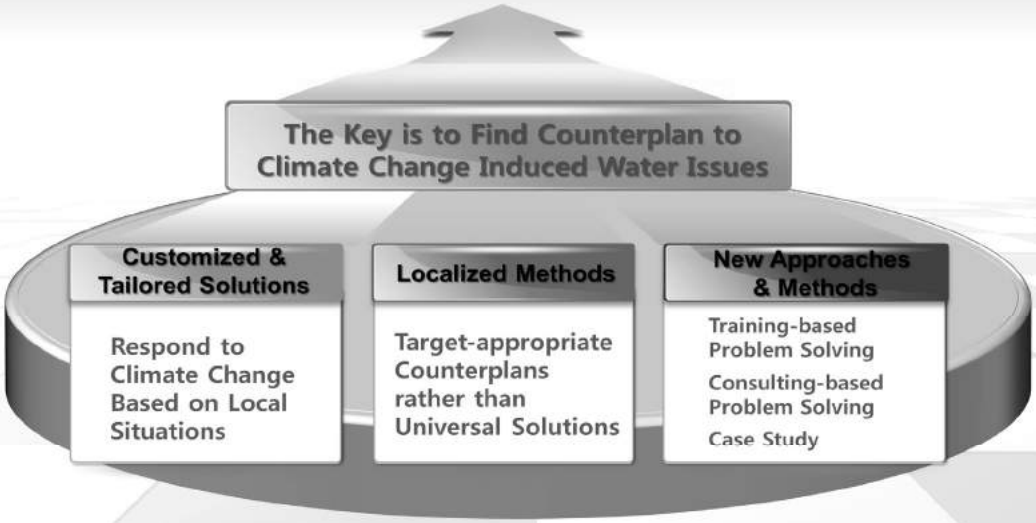
Clean Energy

Developing Clean Energy
Tidal, Solar, Wind

2. Problem Solving Capacity is the KEY

K water

To Establish the Counterplan through Problem-Solving Education & Capacity Building to Enable Sustainable Capabilities



3. Our Effort to Build Problem Solving Capacity

K water

Continued Efforts and Investments by ADB, WB, UNESCO, etc.

Case 1	Action Learning Based Problem Solving
Case 2	Technical Assistance Based Solution Seeking
Process	Focus Selection→Problem Diagnosis→Counterplan Development→Capacity Building→Implementation & Feedback

✓ **[Limitations] Long Duration, Budget, Discontinued Feedback**

4. Difficulties in High Performance Insurance

K water

Issues Difficulties with Securing Sufficient Budget & Measuring Quantifiable Performance Outcomes

1) Difficult to Measure Performance Outcome due to Long Duration

Limited on-site visit and communication, difficulties in long-term dispatchment of experts and provision of continued and regular feedback

2) Limited Budget

Travel expenses, expert dispatchment expenditures, on-site & invitational training fees, etc.

3) Obstacles in Feedback

Changes in consultants and on-site personnel during the long duration of projects, difficulties in preserving and storing knowledge data

IV New approach of Capacity Building Strategies

Total Water Service Provider K-water

1. New approach of Capacity Building Strategy

K water

Issues Key to Effective Action Learning →
Cost, Communication & Feedback, Duration

Solution) "Low Cost" & "High Efficiency" On-line Portal Based Education System

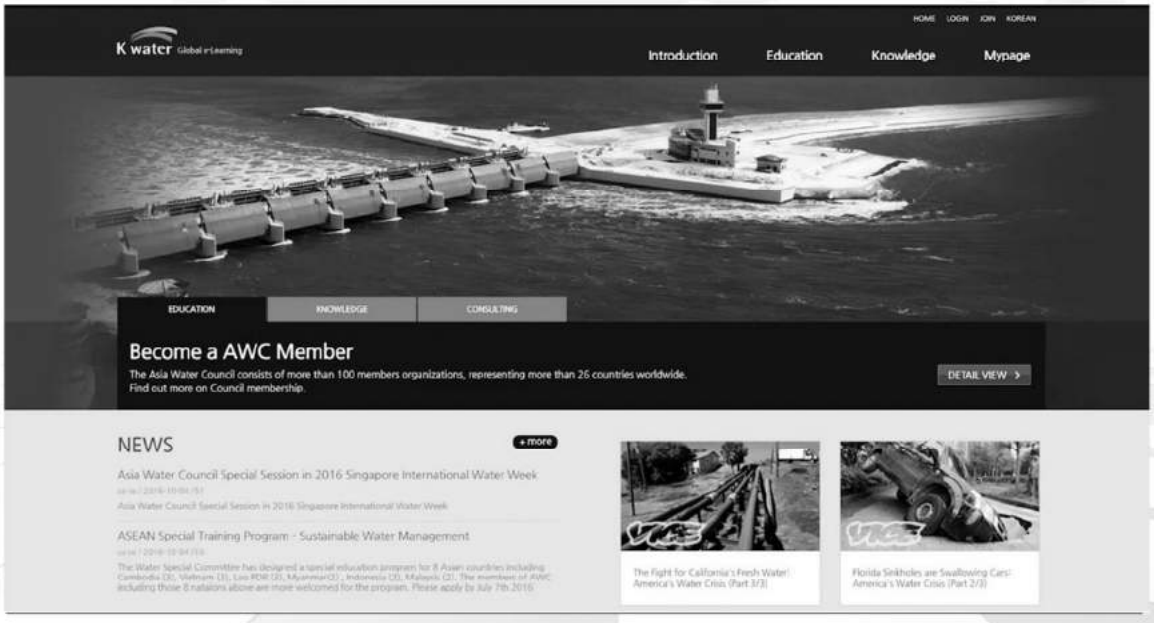
- Incorporating the portal as the base platform for education
  →Users share their progress and receive instant consulting and feedback from the experts
- Problem Solving Knowledge Data Base of Case Studies, Knowhow, etc.

Expected Outcome) Effective & Continued Water Education for ALL

- "Prosumer" Based Knowledge Sharing Case Study Center (Producer + Consumer)
- Effective Problem Solving with Supports from Multi-Consultants
- Membership Based O&M to Provide Advanced and Constructive Consulting Services
- Specialized Water Resources Courses Provided (on-line courses)
- On-line Meetings & Workshops, Video Conference Center

2. K-water Global Learning Portal

K water




K water
THANK YOU
K-water Academy
Learn, Act and Achieve!

5

MWA Risk Management & HRD

Supawoot Tripasai
Thailand Metropolitan Government

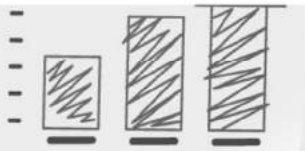
การประปานครหลวง
METROPOLITAN WATERWORKS AUTHORITY

MWAIT
MWA Waterworks Institute of Thailand
สถาบันพัฒนาวิชาการประปา

MWA Risk Management

&

HRD



October 2016

Metropolitan Waterworks Authority (MWA)
Thailand

- Washirawit Powichit
- Supawoot Tripasai

MWA Waterworks Institute of Thailand

Contents

- ❑ About MWAIT -- the HRD Center of MWA
- ❑ Organization Risk Management
- ❑ HRD Model
- ❑ HRD to promote Risk Management

About MWAIT

MWA Waterworks Institute of Thailand (MWAIT) was developed from MWA Waterworks Academy and it was officially established in 2014

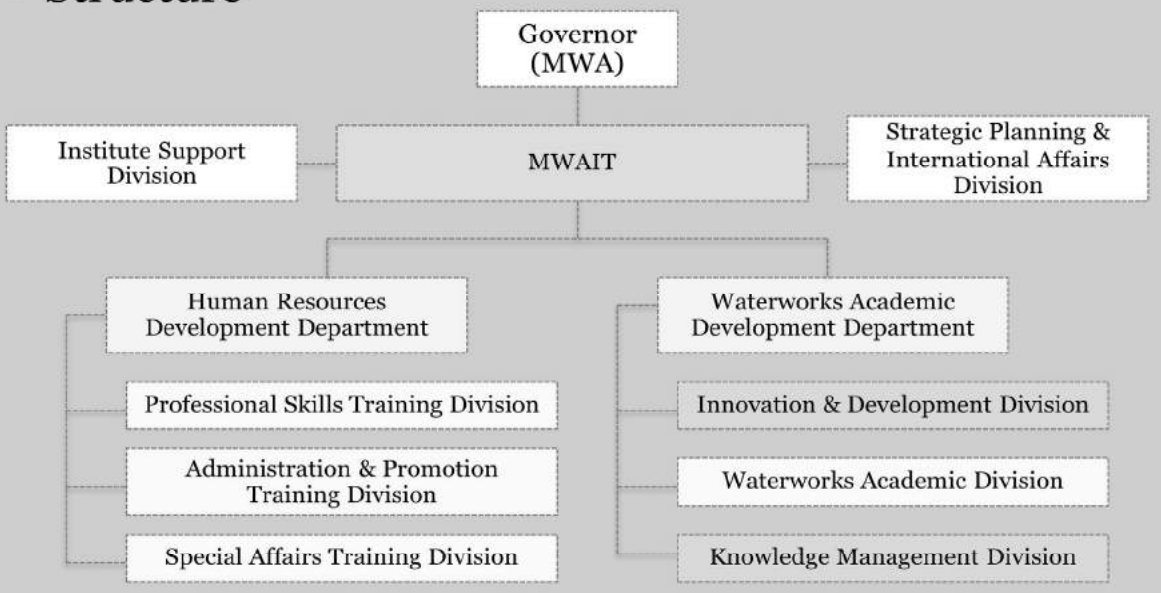
HRD Human Resource Development

KM Knowledge Management

RDI Research Development and Innovation

About MWAIT

- Structure



About MWAIT

Vision

To be an excellent waterworks institute

Mission

- To develop waterworks knowledge
- To develop professional staff with expertise in waterworks
- To provide research & development and create innovation to add value to the organization.

MWAIT - HRD

In-house

- Core Courses (Training for Promotion)
- Managerial & Leadership Courses
- Professional Skill Courses (Functional Courses)
- Waterworks Specialty Courses

Public

- Training Program for Executives
- Training Program for Staff

Non-Training

- Scholarship
- E-Learning
- E-library
- Coaching
- On the Job Training
- Job Assignment
- Job Rotation
- Self Learning
- Site Visit

MWAIT - HRD

MWAIT Training Service

Domestic

- MWA Staff
- Local Administrative Officers
- Municipalities

International

- Vietnam,
- Bhutan,
- Lao PDR,
- Timor Leste, etc.

Organization Risk Management

- Structure

Governor (MWA)

Deputy Governor (Planning & Development)

Assistant Governor (Planning & Development)

Risk Management Department

Business Risk Management Division

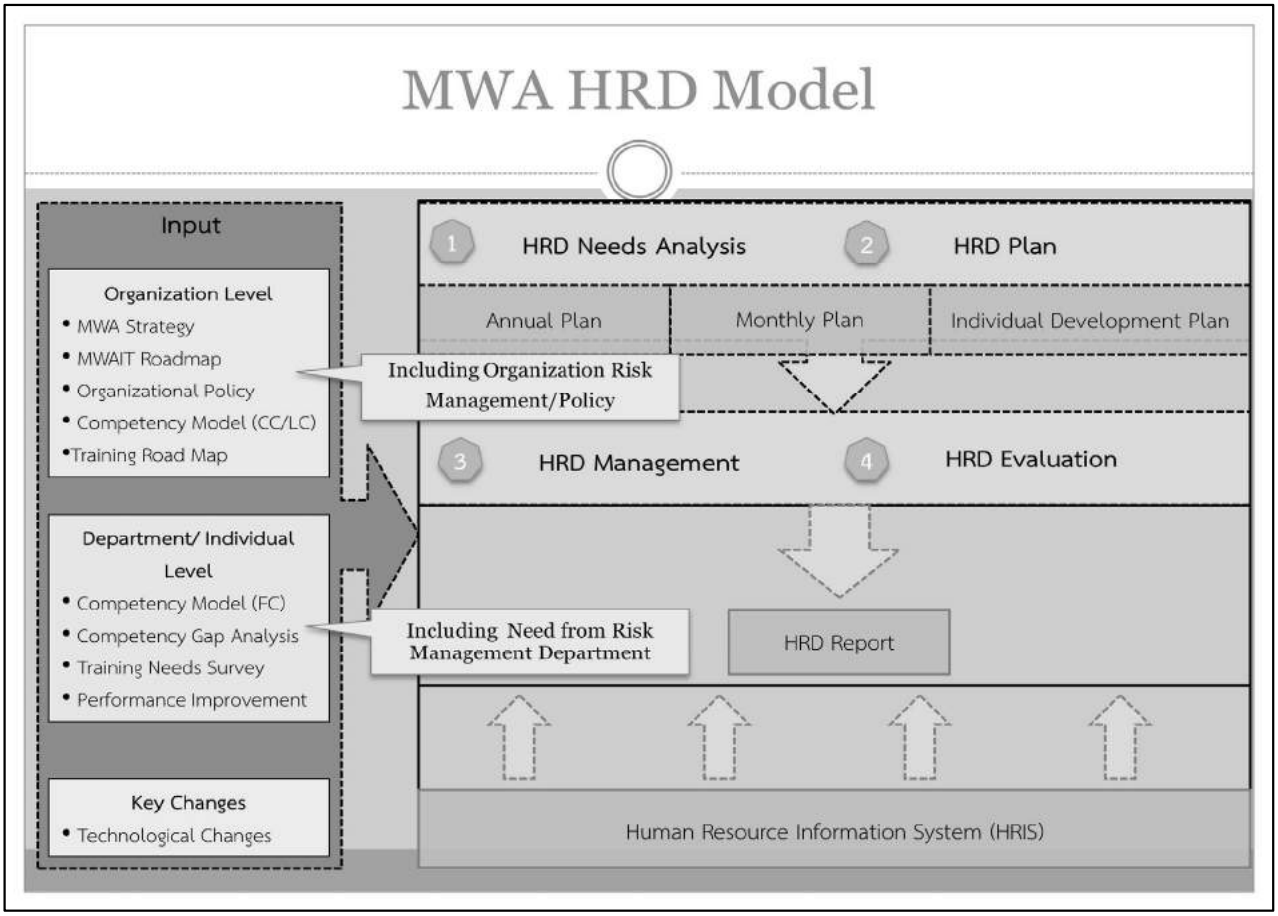
Operational Risk Management Division

Internal Control System Coordinating Division

To manage risk throughout the organization to achieve sustainable growth and prosperity


Organization Risk Management
Objective Setting
Risk Identification
Risk Assessment
Risk Response
Control Activities
Monitoring
Information & Communication

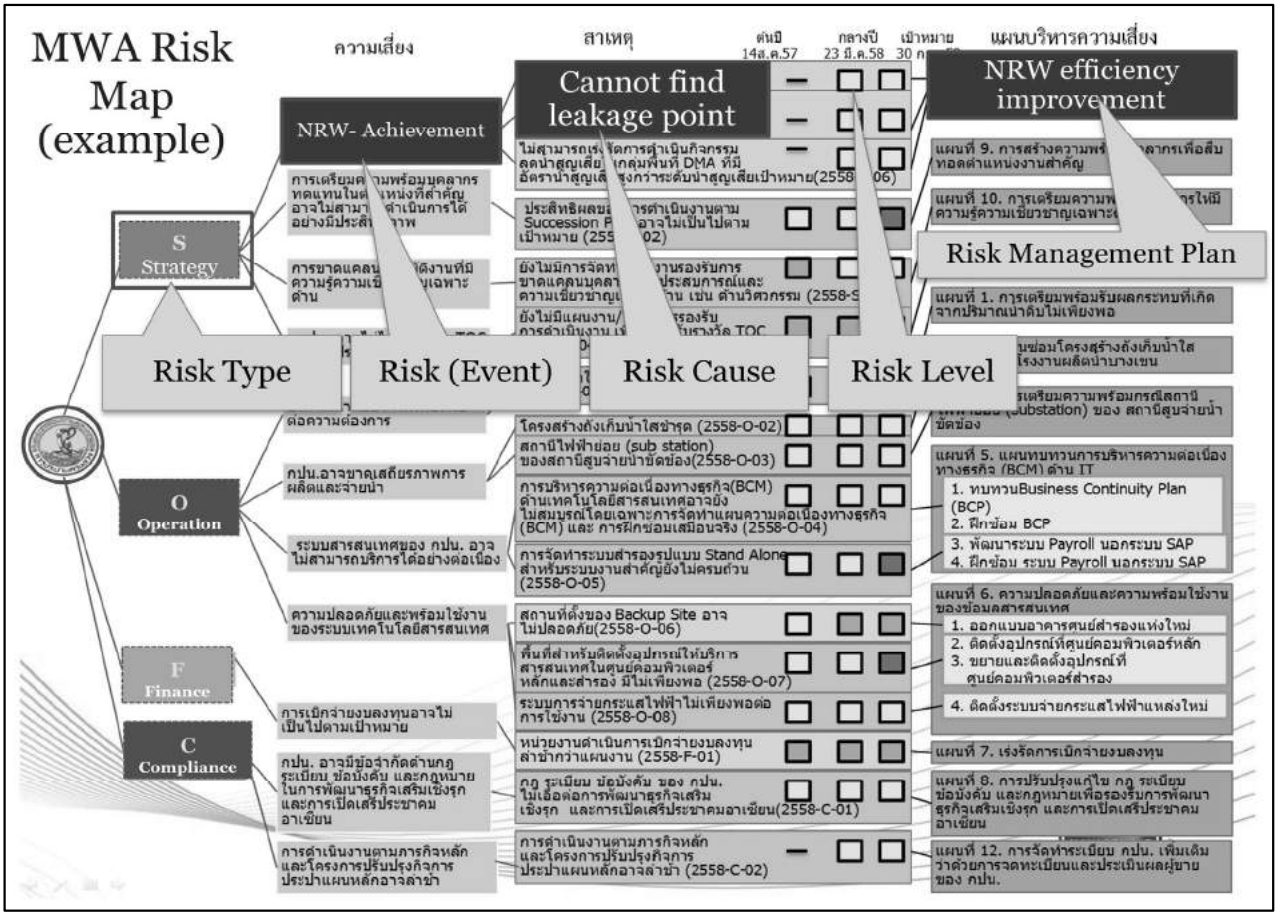

Organization Risk Management
Risk Identification
Balanced ScoreCard
Objective
Risk Event
Risk Type
Strategy
Operation
Finance
Compliance
Financial
Customer
Internal Process
Learning & Growth
HRD
Workshop
Information System
Risk Universe
Historical Risk Data
External Factors

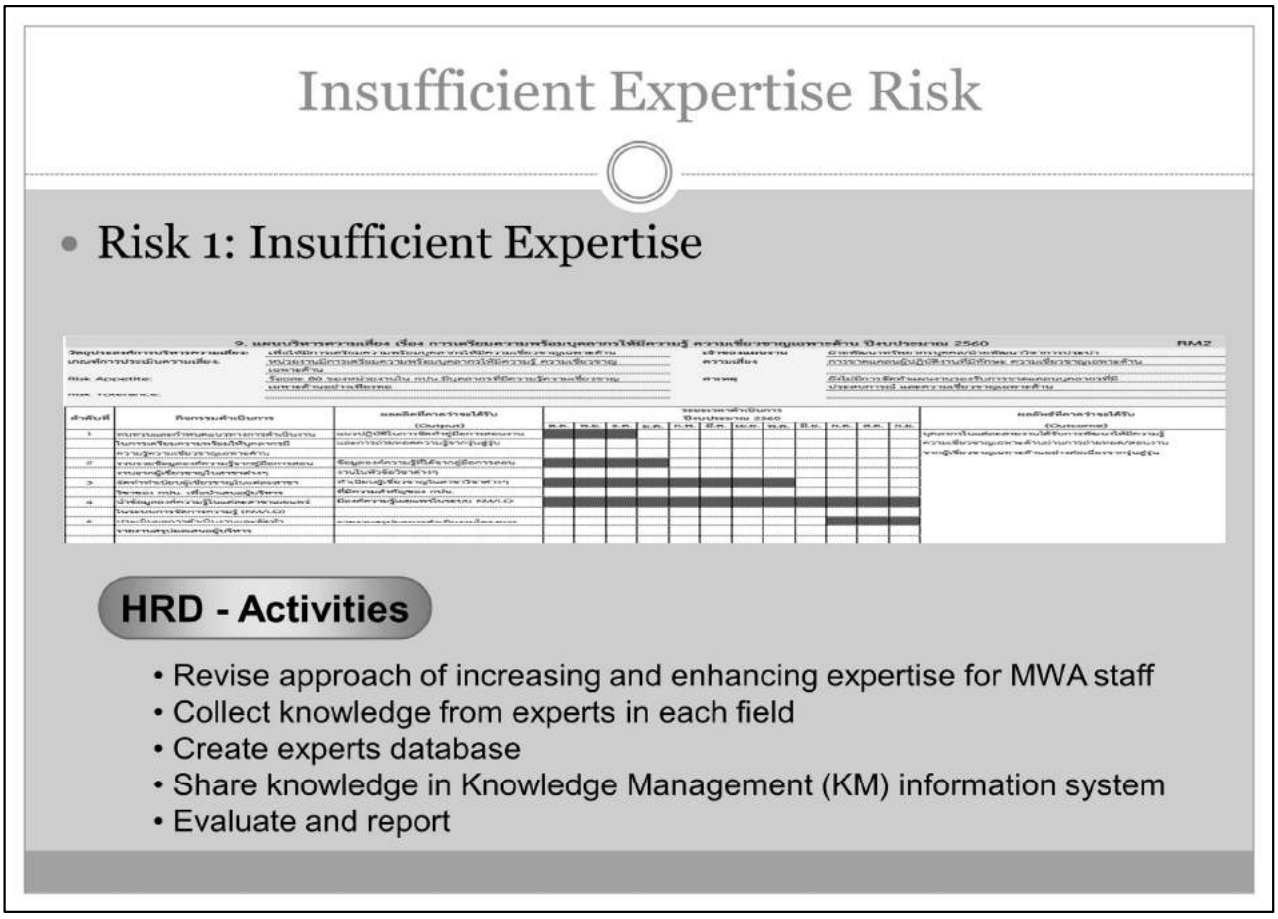

MWA HRD Model
Input
Organization Level
• MWA Strategy
• MWAIT Roadmap
• Organizational Policy
• Competency Model (CC/LC)
•Training Road Map
Department/ Individual Level
• Competency Model (FC)
• Competency Gap Analysis
• Training Needs Survey
• Performance Improvement
Key Changes
• Technological Changes
Including Organization Risk Management/Policy
Including Need from Risk Management Department
1 HRD Needs Analysis
2 HRD Plan
Annual Plan
Monthly Plan
Individual Development Plan
3 HRD Management
4 HRD Evaluation
HRD Report
Human Resource Information System (HRIS)


HRD to promote Risk Management
Organization Risk (HRD perspective)
HRD need for Risk Management Dept.
MWAIT
MWA Waterworks Institute of Thailand
สถาบันพัฒนาวิชาการประปา
HRD Process


Examples of Organization Risk
Risk Matrix
Impact
Likelihood
Risk Level
Extreme
High
Moderate
Low


Examples of Organization Risk
Risk Matrix
Insufficient expertise
Non-Revenue Water Achievement
Impact
Likelihood
Risk Level
Extreme
High
Moderate
Low


MWA Risk Map (example)
ความเสี่ยง
สาเหตุ
ต้นปี 14ส.ค.57
กลางปี 23 มี.ค.58
เป้าหมาย 30
แผนบริหารความเสี่ยง
NRW- Achievement
Cannot find leakage point
NRW efficiency improvement
Risk Management Plan
S Strategy
O Operation
F Finance
C Compliance
Risk Type
Risk (Event)
Risk Cause
Risk Level
โครงสร้างถังเก็บน้ำใสชำรุด (2558-O-02)
สถานีไฟฟ้าย่อย (sub station) ของสถานีสูบจ่ายน้ำขัดข้อง(2558-O-03)
การบริหารความต่อเนื่องทางธุรกิจ(BCM) ด้านเทคโนโลยีสารสนเทศอาจยังไม่สมบูรณ์โดยเฉพาะการจัดทำแผนความต่อเนื่องทางธุรกิจ (BCM) และ การฝึกซ้อมเสมือนจริง (2558-O-04)
การจัดทำระบบสำรองรูปแบบ Stand Alone สำหรับระบบงานสำคัญยังไม่ครบถ้วน (2558-O-05)
สถานที่ตั้งของ Backup Site อาจไม่ปลอดภัย(2558-O-06)
พื้นที่สำหรับติดตั้งอุปกรณ์ให้บริการสารสนเทศในศูนย์คอมพิวเตอร์หลักและสำรอง มีไม่เพียงพอ (2558-O-07)
ระบบการจ่ายกระแสไฟฟ้าไม่เพียงพอต่อการใช้งาน (2558-O-08)
หน่วยงานดำเนินการเบิกจ่ายงบลงทุนล่าช้ากว่าแผนงาน (2558-F-01)
กฎ ระเบียบ ข้อบังคับ ของ กปน. ไม่เอื้อต่อการพัฒนาธุรกิจเสริมเชิงรุก และการเปิดเสรีประชาคมอาเซียน(2558-C-01)
การดำเนินงานตามภารกิจหลักและโครงการปรับปรุงกิจการประปาแผนหลักอาจล่าช้า (2558-C-02)
แผนที่ 1. การเตรียมพร้อมรับผลกระทบที่เกิดจากปริมาณน้ำดิบไม่เพียงพอ
แผนที่ 5. แผนทบทวนการบริหารความต่อเนื่องทางธุรกิจ (BCM) ด้าน IT
1. ทบทวนBusiness Continuity Plan (BCP)
2. ฝึกซ้อม BCP
3. พัฒนาระบบ Payroll นอกระบบ SAP
4. ฝึกซ้อม ระบบ Payroll นอกระบบ SAP
แผนที่ 6. ความปลอดภัยและความพร้อมใช้งานของข้อมูลสารสนเทศ
1. ออกแบบอาคารศูนย์สำรองแห่งใหม่
2. ติดตั้งอุปกรณ์ที่ศูนย์คอมพิวเตอร์หลัก
3. ขยายและติดตั้งอุปกรณ์ที่ศูนย์คอมพิวเตอร์สำรอง
4. ติดตั้งระบบจ่ายกระแสไฟฟ้าแหล่งใหม่
แผนที่ 7. เร่งรัดการเบิกจ่ายงบลงทุน
แผนที่ 8. การปรับปรุงแก้ไข กฎ ระเบียบ ข้อบังคับ และกฎหมายเพื่อรองรับการพัฒนาธุรกิจเสริมเชิงรุก และการเปิดเสรีประชาคมอาเซียน
แผนที่ 12. การจัดทำระเบียบ กปน. เพิ่มเติมว่าด้วยการจดทะเบียนและประเมินผลผู้ขายของ กปน.


Insufficient Expertise Risk
Risk 1: Insufficient Expertise
HRD - Activities
• Revise approach of increasing and enhancing expertise for MWA staff
• Collect knowledge from experts in each field
• Create experts database
• Share knowledge in Knowledge Management (KM) information system
• Evaluate and report

Non Revenue Water Achievement Risk

- Risk : 1. Cannot find leakage point efficiently

HRD - Activities

- On the job Training for new “Attack Team”
- new knowledge capture (in case of new technology)
- Advance public training course in Pipe Leakage Survey
- Amateur Pipe Leakage Survey Project

Non Revenue Water Achievement Risk

- Risk : 2. Cannot manage District Metering Area (DMA) efficiently

HRD - Activities

- Provide training courses:
  - Water Loss Management Application (WLMA) for both staff and outsource
  - Foundation of water loss

HRD to support Risk Management Department/ Risk Management Related Group

- Training Program

Program	Target group				
	Top Executive	Executive	Staff	Risk Management Department	Risk Management Working Group
Workshop on Risk Identification and Risk Assessment	/			/	/
Risk Identification and Risk Assessment in GRC (Risk Management Information System)		/		/	
Risk Plan Report in GRC			/	/	
Risk Analysis for Management Design				/	
MWA risk management					

HRD to support Risk Management Department/ Risk Management Related Group

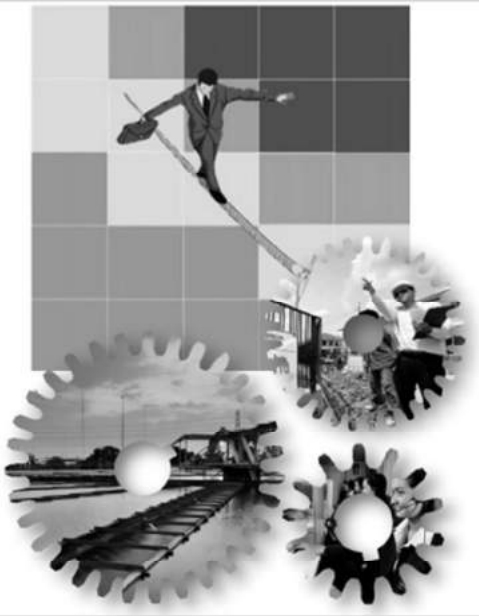
- Training Program (Cont.)

Program	Target group				
	Top Executive	Executive	Staff	Risk Management Department	Risk Management Working Group
Business Continuity Management (BCM)	/	/	/	/	/
COSO 2013				/	
Water Safety Plan			/	/	
Governance Risk Compliance (GRC) v.s. Enterprise Risk Management (ERM)				/	
Crisis Management	/	/	/	/	/
ISO 22301 :2012				/	

Conclusion

HRD promotes risk management by

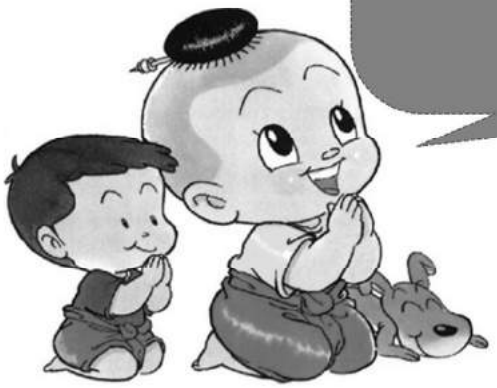
- Addressing organization risk in HRD perspective
- Develop risk management related persons to have knowledge and skill to manage organization risk efficiently



การประปานครหลวง
METROPOLITAN WATERWORKS AUTHORITY

MWAIT
MWA Waterworks Institute of Thailand
สถาบันพัฒนาวิชาการประปา

Thank You



6

Environment-friendly Water Projects and HRD

Daisuke Kase
Tokyo Metropolitan Government

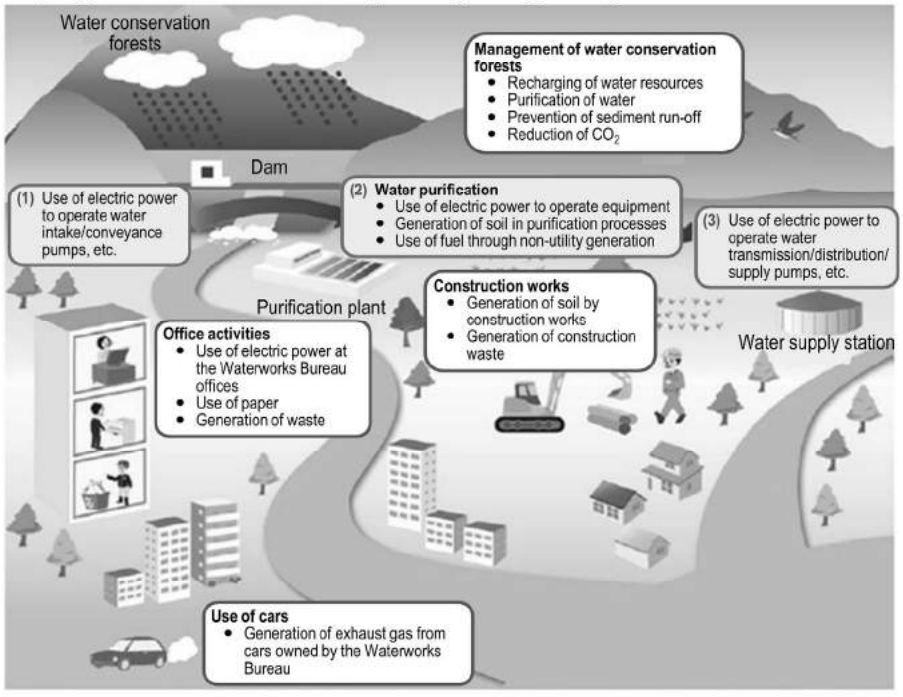
Contents of Today's Presentation

1. • Tokyo Waterworks Environmental Plan
2. • Raising Environmental Awareness

1. Tokyo Waterworks Environmental Plan

Environmental Aspects of Waterworks

◆ **Environmental aspects refer to factors of waterworks activities that affect the environment by either helping its conservation or impacting it negatively.**



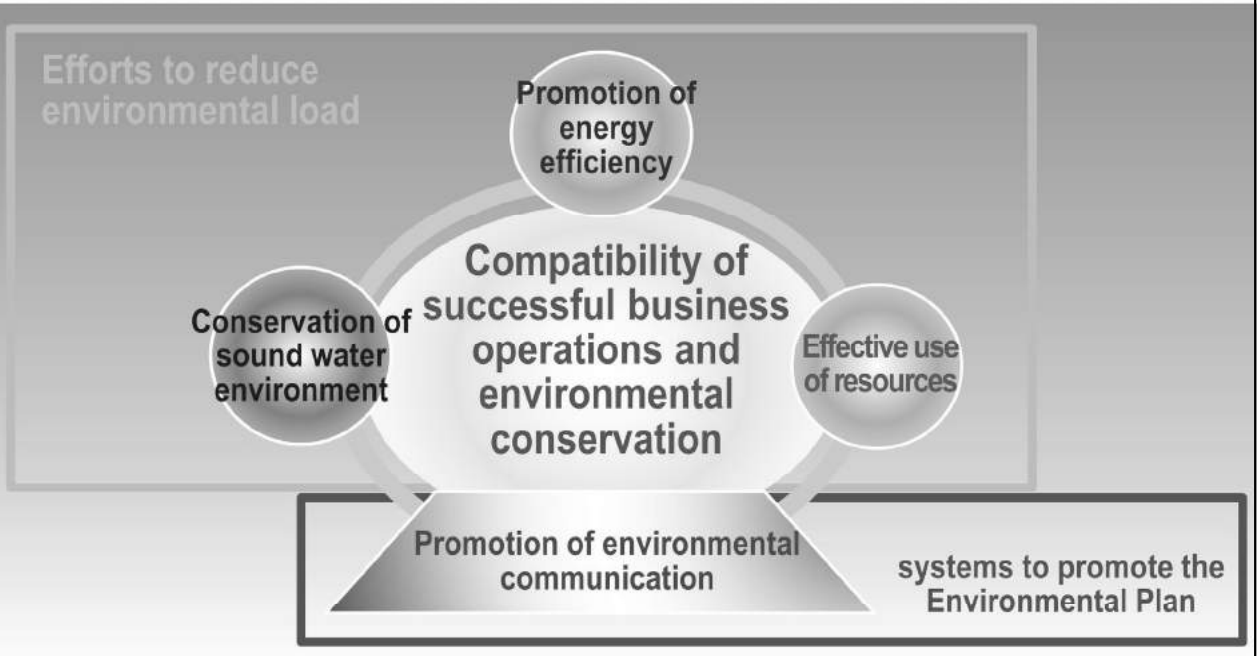
Five-Year Environmental Plan of Tokyo Waterworks

Period of the Plan: From 2015 to 2019

Structure of the Five-Year Environmental Plan

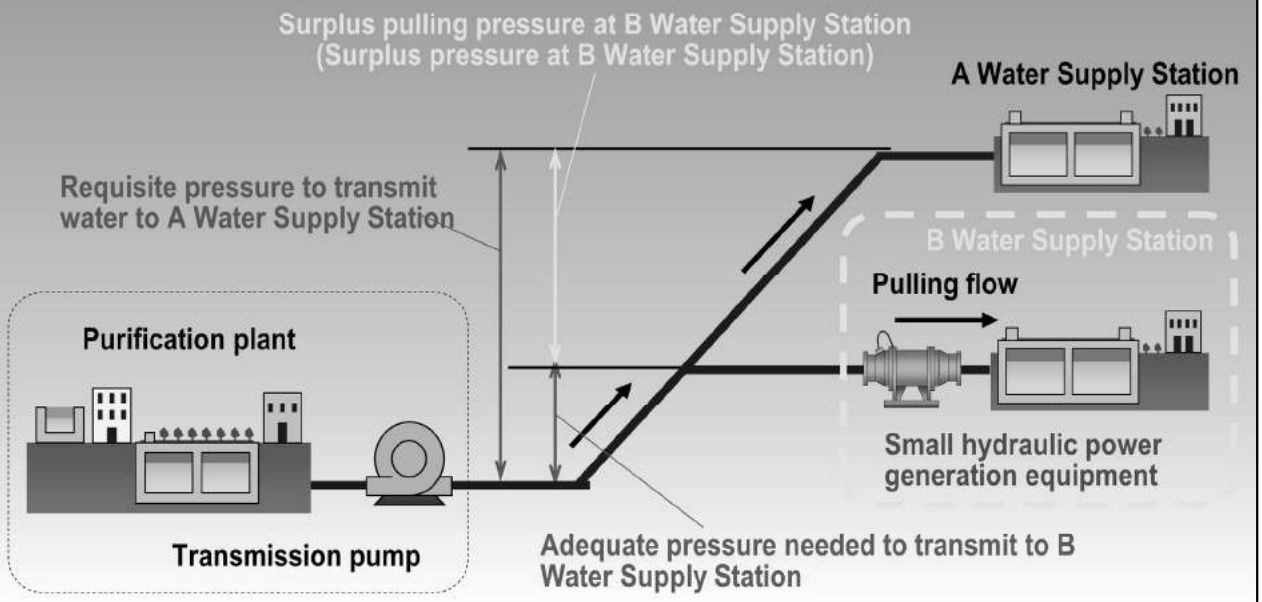
- Basic environmental policies
- Efforts to reduce environmental load
- Mechanism and systems to promote the plan

Basic Environmental Policies



Efforts to Promote Energy Efficiency

◆ Introduction of small hydraulic power generation

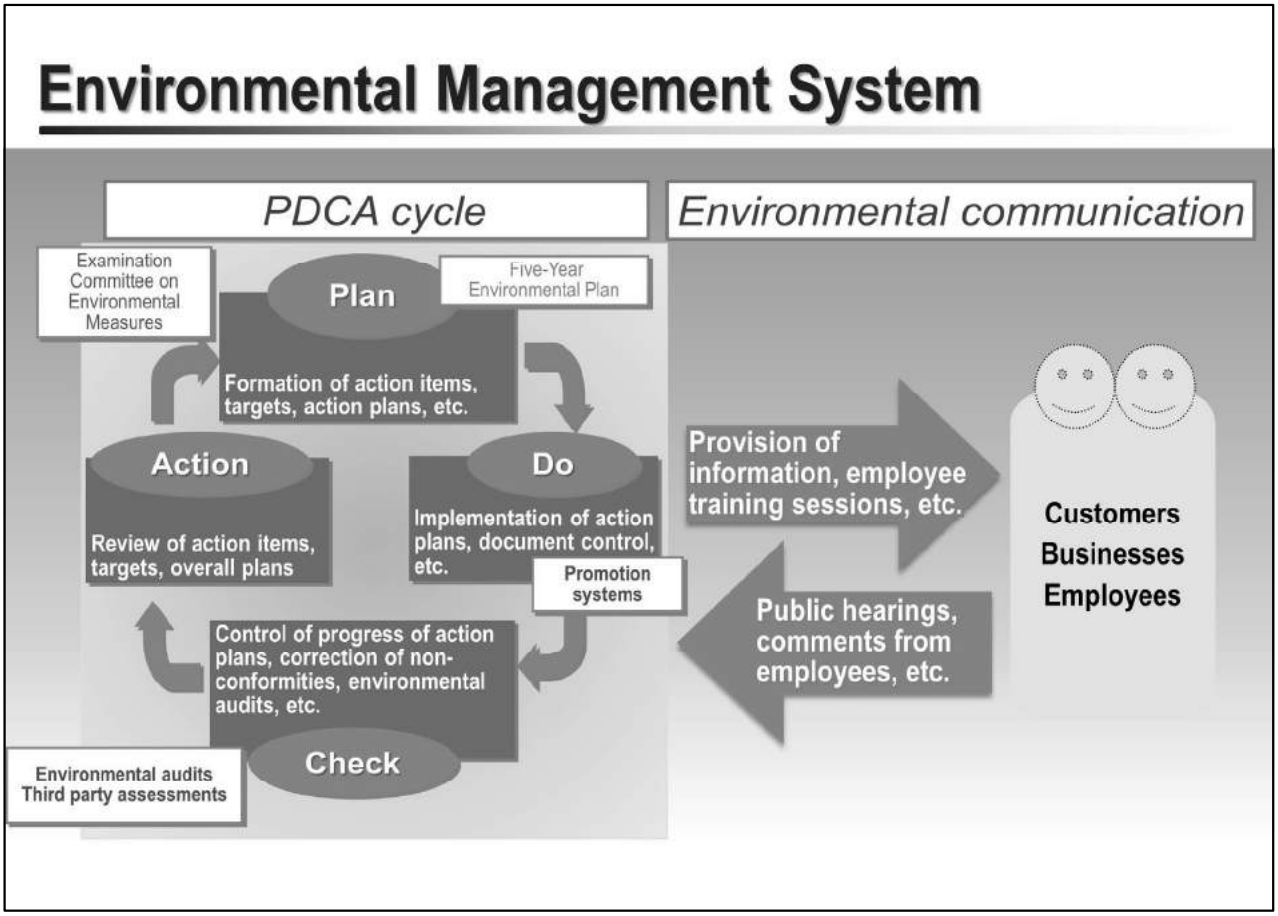


Promotion of Environmental Communication

◆ Implementation of waterworks caravan (visiting classes)

◆ Implementation of employee training sessions

- Acquisition of basic knowledge on the environment
- Sharing of information & knowledge
- Improvement of environmental awareness
- Collection of latest case study information


Environmental Management System
PDCA cycle
Environmental communication
Examination Committee on Environmental Measures
Plan
Five-Year Environmental Plan
Formation of action items, targets, action plans, etc.
Action
Review of action items, targets, overall plans
Do
Implementation of action plans, document control, etc.
Promotion systems
Control of progress of action plans, correction of non-conformities, environmental audits, etc.
Check
Environmental audits
Third party assessments
Provision of information, employee training sessions, etc.
Public hearings, comments from employees, etc.
Customers
Businesses
Employees


2. Raising Environmental Awareness of the Employees

Training Sessions towards Raising Environmental Awareness

To provide knowledge and raise awareness

- The environment and use of technologies
- Hands-on experience at water conservation forest

Support for self-development

- Training towards an energy manager qualification
- Classes for waste disposal facility technical managers

Promotion of the Environmental Plan

- Promotion of the Environmental Plan
  1. Training to develop trainers
  2. Training for all the employees concerned for the "Promotion of the Environmental Plan"
  3. Training to develop environmental auditors

Training to Provide Knowledge and Raise Awareness

Name of training	Number of trainees	Number of days	Frequency
The Environment and Use of Technologies	60 people	1.0 day	Once/year

Contents of training

- Basic knowledge on environmental issues
- Latest information on environmental issues
- Efforts of Tokyo Waterworks Bureau
- Environmental issues concerning waterworks

FY 2016 "The Environment and Use of Technologies"

Theme 1 Trends and technologies inside and outside Japan concerning environmental issues
Theme 2 Tokyo Waterworks 10-Year Plan for Energy Efficiency
Theme 3 Administrative issues and technologies for measures at the Bureau of Environment, TMG

Training to Provide Knowledge and Raise Awareness

Name of training	Number of trainees	Number of days	Frequency
Hands-on Experience at Water Conservation Forest	180 people	1.0 day	Three times/year

Contents of training

- Visit water conservation forests that are a fundamental resource for waterworks
- Get first-hand experience in water conservation forest management operations (young tree branch pruning, underbrush trimming, etc.)

Eligible employees: Newly hired employees, recently transferred department/section managers, newly promoted section managers


Visit to a 100-year old forest

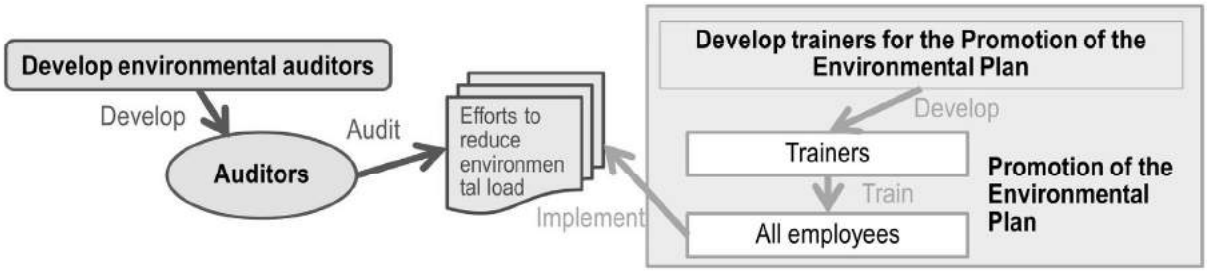

Instructions on how to prune young tree braches


Hands-on experience of young tree branch pruning

Training to Promote the Environmental Plan

Name of training	Number of trainees	Number of days	Frequency
Promotion of the Environmental Plan	All employees	30 min	Once/year
Trainer Development	70 people	0.5 day	Twice/year
Environmental Auditor Development	12 people	1.0 day	Once/year

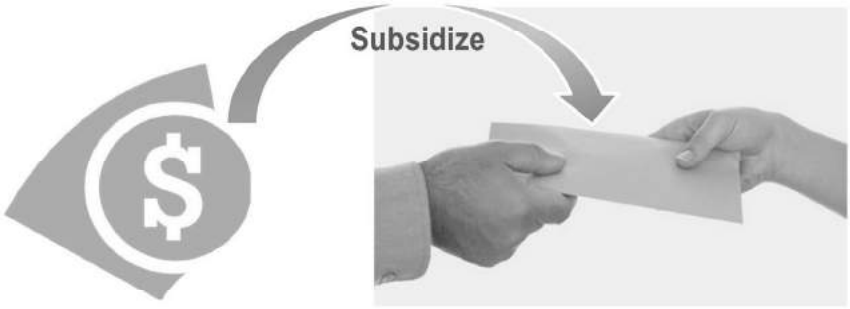
- Promotion of the Environmental Plan: Communicate the contents of the Environmental Plan to all employees.
- Trainer Development: Develop trainers for the "Promotion of the Environmental Plan."
- Environmental Auditor Development: Develop environmental auditors proficient in conducting environmental audits.



Support for Self-Development

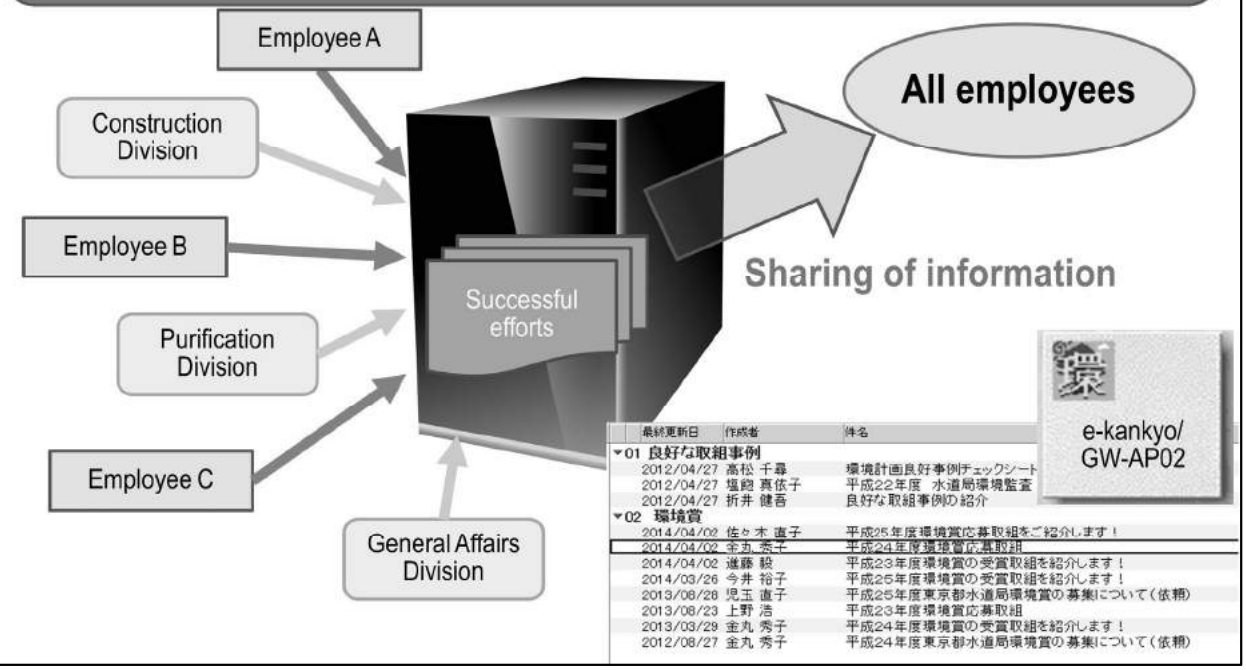
Name of training	Number of trainees
Energy Manager Qualification Training	15 people/year
Class for Waste Disposal Facility Technical Managers	3 people/year

- Qualified energy manager: Improves and supervises the usage of energy.
- Waste disposal facility technical manager: Supervises to ensure that there are no violations of maintenance/management standards at waste disposal facilities.



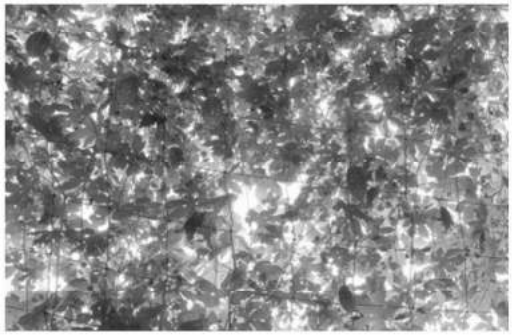
Data Base toward Raising Environmental Awareness

○ e-Kankyo (e-Environment, a data base within the Waterworks Bureau)



Examples of Successful Efforts

○ Installation of green walls



What is a green wall?
- Plants block the sunlight.
- Plants transpire the direct heat of sunlight together with moisture.
- Plants help mitigate temperature extremes.

Air conditioning effectiveness increases.

We have installed green walls at water supply offices.

Water Supply Works Image Improvement Competition

Participating entities	Number of participants
Companies that have received orders for water supply construction works from the Tokyo Waterworks Bureau	**73 for 2014 72 for 2015**

- ◆ Appropriate measures to respond to residents' concerns at work sites
- ◆ Active environmental measures considering the needs of the community
- ◆ Easy-to-understand public relations activities for waterworks
- ◆ Other notable efforts

Effects
- ◆ **Implementation of environmentally-friendly water supply works**
- ◆ **Improvement of environmental awareness in water supply construction businesses**
- ◆ **The image of water supply construction works**

Examples of company's efforts

Use of LED for night-time lighting

Use of carts and bicycles

Rechargeable lighting by sunlight

Eco-cap campaign

Note

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Note