經濟部

行政院所屬各機關因公出國人員出國報告書
（出國類別：其他－出席國際會議）

出席第22屆台美水資源技術合作年會及考察

Attending the 22nd Annual AIT-TECRO Water Resources Program

出國報告書（稿）

出國人：經濟部技監陳伸賢
經濟部水利署主任秘書田巧玲
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行政院諮議林耀淦
行政院經建會技正謝建弘
水利署水利規劃試驗所副工程司吳國維

出國地點：美國

出國期間：98年10月29日至11月8日

報告日期：99年01月05日

目錄

摘要

台美水資源技術年會係依經濟部水利署與美國內政部墾務局(Bureau of Reclamation, BOR)簽訂之「台美水資源發展技術支援協議」舉行，雙方藉由技術交流，保持密切合作關係；過去 20 餘年美國內政部墾務局依據該協議及經濟部水利署工作需求持續派遣專家學者來台指導，對台灣水資源重大建設計畫之順利推動及技術引進有重大貢獻。經濟部水利署為持續推動與美國內政部墾務局之技術合作關係，故籌組我國赴美代表團，並邀請相關專家學者與會，除援例進行第 22 屆水資源技術合作年會(22nd AIT-TECRO Water Resources Program Annual Review Meeting)之交流外，更期進一步促進台美水利部門之深厚情誼，建立更好的互動關係，對政府及本署提倡積極走向國際社會，拓展國際發展空間，有正面作用且助益甚大。

出席第 22 屆台美水資源技術合作年會及考察代表團於 10 月 29 日啟程由台北抵達美國洛杉磯，行程除至位於科羅拉多州丹佛市(Denver)之美國內政部墾務局辦理「第 22 屆台美水資源技術合作年會」外，並趁年會前考察位於加州洛杉磯東南方之鑽石谷水庫（Diamond Valley Lake）、內華達州美國重要蓄水設施—胡佛水壩(Hoover Dam)，以了解氣候變遷對大壩安全影響與因應對策。年會後返回加州奧克蘭，拜會舊金山東灣地區公共事務區管理處(East Bay Municipal Utility District, EBMUD)並參與由 EBMUD 舉辦之水系統研討會，針對因應地震對大壩加強之工程、水資源管理、以及莫拉克颱風對台灣大壩設計影響等議題進行意見交流。另安排拜會美國陸軍工兵團(US Army Corps of Engineers)設於加州大學戴維斯(Davis)分校之水文工程中心(HEC, Hydrologic Engineering Center)，以洽談未來我國水利人員送訓或邀請美方專家來台授課等相關事宜。最後赴舊金山拜會太平洋瓦斯與電力公司(Pacific Gas and Electricity, PG&E)，並與加州地區華裔工程

師舉行討論會與座談，會中針對莫拉克風災後政府規劃山坡地、整治土石流及水利政策等議題進行意見交流。隨後代表團於 11 月 7 日凌晨由舊金山搭機返台並於 11 月 8 日抵達桃園國際機場。

本次代表團赴美行程主要成果為與墾務局簽署第 22 屆台美水資源技術合作年會結論（The 22nd AIT-TECRO Annual Review Meeting Conclusion），會議結論除請美方參酌本署會中提出之意見修正 2009 年第 8 號附錄年度成果報告外，並議訂 2010 年工作內涵，工作項目包括第 6 號附錄之「湖山水庫現地技術諮詢」、「因應氣候變遷下水庫 PMP 及 PMF 防洪操作及案例諮詢服務」、「岩栓爆破工法及繞庫排砂技術諮詢服務」及第 8 號附錄之「臺灣河川河床沖淤研究」、「臺灣河川岸壁沖刷模組開發」、「石門水庫異重流數模開發」、「臺灣河川復育之技術諮詢」及「提供選擇性技術訓練課程」等 8 大議題。

結論與建議

一、結論

(一)第 22 屆台美水資源技術合作年會，台(經濟部水利署)美(美國內政部墾務局)雙方已於今(2009)年 11 月 3 日假美國墾務局技術服務中心舉行並圓滿完成。回顧過去 22 年合作成果，美方除於壩工及相關工程技術予以協助與諮詢外，並在河道輸砂及水利技術數值模式研發與技術移轉引進上，獲致豐碩之成果。

(二)本次代表團團員也深刻感受除了與協議有關之相關技術諮詢與服務外，經由台美水利技術長期合作關係，台美雙方已建立良好合作夥伴關係，經由美方協助與安排，使得我方代表團人員得以參訪墾務局及其協助安排之相關美國重大水利工程，對於外交處境艱難的台灣，台美水利合作關係應持續進行，藉由水利署與墾務局合作與交流，擴展台灣水利技術國際合作視野。

(三)「台美水資源發展技術支援協議」第 8 號附錄 2009 年工作檢討部份，水利署認可美方依年度工作內涵所提送之期末報告初稿（Rock Erosion Modeling for Rivers in Taiwan and Progress Report of Bank Erosion and Turbidity Current Modeling（SRH-2009-40）及 Sediment Considerations for Potential Dam Removal Projects（SRH-2009-39），依年會會議結論，美國墾務局應於明（2010）年 2 月底前參酌水利署所提之意見修正並提送年度計畫正式報告書。

(四)「台美水資源發展技術支援協議」明（2010）年度工作內涵部份，水利署提出之工作需求內涵共包括「湖山水庫現地技術諮詢」、「因應氣候變遷下水庫 PMP 及 PMF 到達超過原設計值時

之防洪操作及案例諮詢服務」、「岩栓爆破工法及繞庫排砂技術諮詢服務」、「臺灣河川河床沖淤研究」、「臺灣河川岸壁沖刷模組開發」、「石門水庫異重流層平均數模開發」、「臺灣河川復育之技術評論與諮詢」及「提供選擇性技術訓練課程」等 8 項，美國墾務局應於明（2010）年 1 月底前依據水利署所提之工作需求，依附錄六現地諮詢服務、附錄六文件技術諮詢、及附錄八，分別研擬年度工作計畫書送水利署核定辦理。

二、建議

(一)本次年會及參訪行程，事前均依實務需求並經過縝密規劃與安排，對我國水利工程決策與承辦人員規劃、設計、施工等技術之提升，有莫大幫助及助益。建議爾後經濟部水利署赴美參加台美會議人數，應以任務性質從寬、覈實派員與會，以符合提升水利工程規劃設計技能、工程技術需求。

(二)「台美水資源發展技術支援協議」為目前『台美雙方』就水資源技術合作僅存之唯一官方協定，建議以後台美合作議題應透過美國墾務局官方管道進行實質交流與合作，於實務操作方面，除配合年會輪流派員互相實際從事公務考察，並請美方提供技術諮詢、建議供我方參考落實外，為走向國際化既定政策，經濟部水利署應派遣專業人員赴美接受相關專業課程訓練，除加強兩國雙邊情誼外，對於我國未來水利工程建設必可提供諸多實質幫助。

(三)經由本次年會之台美水資源技術交流，會中代表團並與墾務局技術人員針對台灣及美國現階段水資源技術所面臨之挑戰及研究發展趨勢進行意見交流與討論，發現墾務局各單位之工程實務經驗及其專長領域很廣，除與本署長期合作之壩工及輸砂技術領域外，並對水資源環境、水利防洪及水資源緊急應變管

理等均專業團隊進行專業技術創新與開發，且長期與美國相關專業技術組織與學者有良好之合作關係。建議水利署可藉由與美國墾務局既有之合作基礎，擴展合作領域範圍來導入美國相關專業技術及其發展趨勢，除可強化與墾務局既有合作關係外，亦可藉由合作過程擴展水利署與美國墾務局其他合作夥伴關係。

(四)「第 23 屆（2010 年）台美水資源技術合作年會」將輪由我國舉辦，為利未來執行契合我方需求，我方除應積極邀請台灣相關產、官、學、研等專家學者參加外，對於美方墾務局代表團來台人數及層級更應擴大邀請，若有相關計畫性質相近及時間允許的話，建議合併辦理，俾使雙方合作獲致最大效益。

(五)水利署與墾務局之合作模式，建議應依此機制擴展至與其他單位合作關係，特別是本次行程中拜會之美國兵工團水文及水利科技組應持續努力建立合作夥伴關係，以強化台灣水理及輸砂數值模擬及詮釋技術。

(六)台灣外交處境艱難，建議水利署積極加入國際組織，以汲取相關工程技術資訊及參與國際事務，提高國際能見度。例如 PG&E 研討會中閻寅昌先生 (John Yen)建議水利署以團體會員名義加入位於加拿大蒙特婁市(Montreal, Canada)的能源發展技術創新中心(CEATI, Center for Energy Advancement through Technological Innovation)所屬之堰壩安全同業組織(Dam Safety Interest Group)，簡稱為 CEATI-DSIG，以國際技術交流與合作來突破困境。

壹、前言

我國於 1987 年與美國內政部墾務局簽訂「中美水壩工程設計建造之技術服務」協議，針對當時正興建中之鯉魚潭、南化及牡丹等大型水庫之設計施工等由墾務局提供技術服務；該技術服務協議乃透過我北美事務協調會(CCNAA)與美方在台協會(AIT)簽署合作合約，依實際需要，函請美方內政部墾務局派遣相關專家協助。因屬水庫興建事宜為主而訂為「中美水壩工程設計建造之技術支援協議」，後為擴展水資源技術合作之需要，於 1992 年簽訂第一號修正案，更名為「中美水資源發展技術支援協議」，並於 2004 年簽署第 8 號附錄時奉院指示再更名為「台美水資源發展技術支援協議」台美水資源發展技術支援協議，該協議下之實質工作內容係另述明於各附錄案中，至今計簽署有附錄 1 至附錄 8，目前僅第 6 號附錄第 1 號修正及第 8 號附錄第 1 號修正仍執行中。為促進台美雙方合作之實質效益，依協議規定每年由台美雙方輪流定期舉辦年會，以檢討當年度合作計畫成果以及策劃下年度工作計畫，第一屆於 1988 年由我方召集，今（2009） 年（第 22 屆年會）由美方主辦。

水利署代表團於 10 月 29 日啟程由台北前往美國洛杉磯後，於 10 月 30 日位於洛杉磯東南方 90 英里處之南加州大都會水資源局(The Metropolian Water District of Southern California）所屬之鑽石谷水庫（Diamond Valley Lake）參觀；10 月 31 由洛杉磯轉往拉斯維加斯，並於 11 月 1 日由墾務局人員陪同參訪所屬之胡佛水壩（Hoover Dam）；11 月 2 日搭機抵達科羅拉多丹佛市，並於 11 月 3 日赴墾務局技術服務中心參加「第 22 屆(2009 年)台美水資源技術合作年會」；11 月 4 日轉往奧克蘭舊金山東灣地區公共事務區管理處 EBMUD（East Bay Municipal Utility District）。隔日 11 月 5 日拜會位於加州大學戴維斯(Davis)分校之美國陸軍工兵團水文工程中心(HEC, Hydrologic Engineering Center, U.S. Army Corps of Engineers)洽談未來水利署送訓或邀請美方專家來台授課等相關事宜，當日返回舊金山途中，並順道

參觀加州防洪局之 Laurel Ball Field Park 滯洪池設施；11 月 6 日代表團訪美行程最後一天，假加州舊金山拜會太平洋瓦斯與電力公司（PG&E）會議室並與華裔專家學者舉行第二場水資源系統研討會。最後於 11 月 7 日由舊金山搭機返台。

貳、行程規劃及代表團成員

一、赴美行程規劃

今年(2009)「第 22 屆台美水資源技術合作年會」由美方舉辦，本年度雙方持續進行之合作內容為 2008 年簽署為期 4 年之第 8 號附錄，其工作內涵係由墾務局協助河川河床沖淤研究、河川岸壁沖刷模組開發、異重流層平均數模開發、河川復育之技術評論與諮詢及執行相關訓練計畫及技術移轉等工作。基於近年來水利署部分水庫工程計畫正進行重大改善或對策研擬計畫，考量大部分工程涉及水壩專業技術問題，墾務局技術服務中心建議水利署派員赴美考察水庫（壩）工程，以利工程人員技術交流與提升。

再依據 2009 年 7 月 1 日水利署召開台美水資源技術合作年會第一次籌備會議，赴美參訪標的訂定為：

1.風險管理

2.流域管理、水資源策略及管理

3.大壩滲漏、防災、防險、大壩修復或加高技術

4.海岸防護及河川復育

綜上，本次「出席第 22 屆台美水資源技術合作年會及考察」行程規劃，以風險管理、水資源管理及大壩安全維護等為主軸。經與墾務局及我旅美專家學者研商後，除安排赴墾務局技術服務中心召開「第 22 屆台美水資源技術合作年會」外，並規劃鑽石谷湖水庫(Diamond Valley Lake)、胡佛水壩(Hoover Dam)等水資源考察，以了解氣候變遷對大壩安全影響與因應對策。另由旅美產、學界專家、僑界代表分別於奧克蘭舊金山東灣地區公共事務區管理處(EBMUD)及舊金山 PG&E 分別舉辦水資源系統研習會，以討論因應地震對大壩加強之工程、水資源管理、莫拉克颱風對台灣

大壩設計影響，及與僑界交流莫拉克風災後政府規劃山坡地、整治土石流及水利政策等議題。期間並順道拜會美國陸軍工兵團水文工程中心(HEC, Hydrologic Engineering Center, U.S. Army Corps of Engineers)，商談未來水利署送訓或邀請美方專家來台授課之可行性及參觀加州防洪局之 Laurel Ball Field Park 滯洪池設施，以作為綜合治水防洪設施規劃之參考。

在水利署與美國內政部墾務局「台美水資源發展技術支援協議」基礎下雙方藉著例行年會及互訪等活動，多年來在水利工程的交流互動十分密切，雙方也均對此合作模式抱持肯定及支持的態度，為針對本年度雙方合作內容進行檢討及共同研商未來合作發展議題，由水利署應美方之邀組成訪問團赴美，希望在此協議之既有基礎上，穩定台美關係且繼續提升台美雙方水利科技交往的實質關係。訪問團赴美行程之規劃如下表 2-1 所列。

表 2-1 水利署赴美第 22 屆台美年會及考察水資源行程

天數	日期	活動
第 1 天	10/29(四)	桃園中正機場搭長榮航空往洛杉磯
第 2 天	10/30(五)	參訪鑽石谷水壩
第 3 天	10/31(六)	從洛杉磯飛往拉斯維加斯
第 4 天	11/1(日)	參訪胡佛水壩－考察氣候變遷對大壩安全影響
第 5 天	11/2(一)	從拉斯維加斯飛往丹佛
第 6 天	11/3(二)	第 22 屆台美水資源技術合作年會
第 7 天	11/4(三)	從丹佛飛往奧克蘭
		至 EBMUD 參加水資源系統研習會（第 1 場）
第 8 天	11/5(四)	拜會 HEC 並洽談未來水利署送訓之相關安排
		拜會加州政府(防洪局)滯洪池
第 9 天	11/6(五)	前往 PG&E 參加水資源系統研習會（第 2 場）

天數	日期	活動
第 10 天	11/7(六)	凌晨從舊金山國際航站搭乘長榮航空飛往台灣
第 11 天	11/8(日)	抵達桃園中正機場

二、代表團成員

本次赴美國參加第 22 屆台美水資源技術合作年會，考察水資源及大壩工程與進行國際合作之訪問團，係由經濟部陳技監伸賢率團赴美，團員包括經濟部水利署田主任秘書巧玲、許簡任秘書榮娟、環興科技股份有限公司龔總經理誠山、行政院林諮議耀淦、經建會謝技正建弘、水利規劃試驗所吳副工程司國維及成功大學水工試驗所丁研究員崇峰等 8 位團員，團員名單見表 2-2。

表 2-2 我方代表團成員名單

姓名	服務單位	職稱
陳伸賢	經濟部	技監
田巧玲	經濟部水利署	主任秘書
龔誠山	環興科技股份有限公司	總經理
許榮娟	經濟部水利署	簡任秘書
謝建弘	行政院經濟建設委員會	技正
林耀淦	行政院第五組	諮議
吳國維	水利署水利規劃試驗所	副工程司
丁崇峰	成功大學水工試驗所	研究員

三、美方代表團成員

美方則由其內政部墾務局技術服務中主任 Lowell Pimley 帶領墾務局水資源、地工、環境、壩工、工程施工、泥沙運移、數值模擬等各專業工程師及相關部門主管與會，年會地點安排於科羅拉多州丹佛市（Denver, Colorado）美國內政部墾務局技術服務中心(Technical Service Center, Bureau of Reclamation) 舉行，美方代表團成員名單詳如表 2-3 所示。

表 2-3 美方代表團成員名單

姓名 Name	服務單位 Organization	職稱 Position
Lowell Pimley	Technical Service Center, BOR	Director
Michael Gabaldon	Technical Resources, BOR	Director
Dick Ives	Native American and International Affairs Office, BOR	Director
Craig H. Albertsen	Water and Enviromental Resources Division, TSC	Chief P. Engineer
David Raff	Flood Hydrology and Emergency Management Group, TSC	Technical Specialist
Thomas E. Hepler	Waterways and Concrete Dams Group,TSC	Team Leader, Civil Engineer
Dave Paul	Waterways and Concrete Dams Group,TSC	Civil Engineer
Leanna Principe	Commissioner's Office International Affairs - Denver	Team Leader
Angela M. Medina	Commissioner's Office International Affairs - Denver	Intl. Affairs Specialist
Tim Randle	Sedimentation and River Hydraulics Group, TSC	Manager, P. Engineer
Blair Greimann	Sedimentation and River Hydraulics Group, TSC	P. Engineer
Yong Lai	Sedimentation and River Hydraulics Group, TSC	Hydraulic Engineer
Jenniffer Bountry	Sedimentation and River Hydraulics Group, TSC	Hydraulic Engineer

參、台美水資源技術合作年會

本屆台美水資源合作年會（22nd Annual AIT-TECRO Water Resources Program）舉辦方式援例分別進行台美水資源合作正式年會及台美水資源技術交流兩大部分。其中台美水資源合作正式年會主要包括本年度執行成果進度檢討及明年度工作項目之研商兩議程；而台美水資源技術交流則針對台美雙方有關水資源技術之研究發展進行技術研討與交流。

水利署於第 21 屆（2008 年）台美水資源合作年會中提出之今（2009）年度工作需求中，僅第八號附錄工作項目於本（2009）年度執行，因此墾務局技術服務中心依據年度工作執行計畫書於年會前所完成執行成果期末報告初稿「Rock Erosion Modeling for Rivers in Taiwan and Progress Report of Bank Erosion and Turbidity Current Modeling」(SRH-2009-40)及「Sediment Considerations for Potential Dam Removal Projects」（SRH-2009-39）等 2 本技術文件，即藉本次年會進行工作進度及執行內容之檢討。

至於明（2010）年台美水資源技術合作方面，水利署依據台美水資源合作支援發展協議第六、八號附錄提出之工作需求內涵共包括「湖山水庫現地技術諮詢」、「因應氣候變遷下水庫 PMP 及 PMF 到達超過原設計值時之防洪操作及案例諮詢服務」、「岩栓爆破工法及繞庫排砂技術諮詢服務」、「臺灣河川河床沖淤研究」、「臺灣河川岸壁沖刷模組開發」、「石門水庫異重流層平均數模開發」、「臺灣河川復育之技術評論與諮詢」及「提供選擇性技術訓練課程」等 8 項，亦藉本次年會舉行進行研商議定。

第 22 屆台美水資源技術合作年會於 2009 年 11 月 3 日星期二於美國墾務局技術服務中心 682 會議室舉行，上午為台美水資源合作正式年會，下午則為台美水資源技術交流，議程分別如表 3-1 及 3-2。

表 3-1 第 22 屆台美水資源技術合作年會議程表

22nd AIT-TECRO Water Resources Annual Meeting	
8:45	Welcome and Opening Remarks - Lowell Pimley, Director, Technical Service Center, BOR - Chen Shen-Hsien, Counselor, MOEA, Taiwan
9:00	2009 Project Progress Report: Appendix 8 - Yong Lai and Blair Greimann, Sedimentation and River Hydraulics Group, TSC, BOR
9:30	Feedback Report on the 2009 Project Progress and Technical Support of BOR - Wu, Kuowei, Associate Engineer, WRPI, WRA, Taiwan
9:50	Discussion on the 2009 Project Progress Report -Moderator: Dick Ives, Director, Native American and International Affairs Office
10:15	Break
10:30	An Overview of Technical Assistance under Appendix 6 - Dave Paul/Tom Hepler, BOR, TSC, Waterways and Concrete Dams Group
10:45	Current and Future Needs: Taiwan WRA's Perspective -Wu, Kuowei, Associate Engineer, , WRPI, WRA, Taiwan
11:00	Discussion of 2010 Calendar Year Work Items Under both Appendix 6 and Appendix 8 Agreements
11:20	Summary and Concluding Remarks - Moderator: Tien, Chiao-Ling, Secertary General, WRA, Taiwan

表 3-2 第 22 屆台美水資源技術交流議程表

22nd AIT-TECRO Water Resources Annual Workshop	
13:00	"On the Theodore Roosevelt Dam Raise: the lake tap and cellular cofferdams" - Tom Hepler, BOR, TSC, Waterways and Concrete Dams Group
13:30	"On the dam removal experience at Reclamation" - Tim Randle, Manager, TSC, BOR, Sedimentation and RiverHydraulics Group
14:00	"Reclamation Climate Change Activities: Case Studies, Capabilities, and Gaps" - David Raff, TSC, BOR
14:30	Break
15:15	Study on River Bed Stability for reach Downstream of Shigang Dam in Dajia River" - Kung, Chen Shan, President, Sinotech Engineering Service Ltd., Taiwan
15:45	"Damage to Taiwan and Its Protential Impact on PMP for Taiwan Dam Design" - Kung, Chen Shan, President, Sinotech Engineering Service Ltd., Taiwan
16:15	Technical Discussion - Moderator: Tim Randle, Manager, TSC, BOR, Sedimentation and River Hydraulics Group
16:45	Summary and Concluding Remarks - Chen Shen-Hsien, Ex-Director General, WRA, Taiwan - Lowell Pimley, Director, Technical Service Center, BOR

本屆台美水資源合作年會相關重要事項紀實如下：

一、台美水資源正式年會記事：

由雙方團長共同主持會議，美方代表為墾務局技術服務中心主任 Lowell Pimley（Director, Technical Service Center, BOR），我方代表則由經濟部陳技監伸賢擔任。

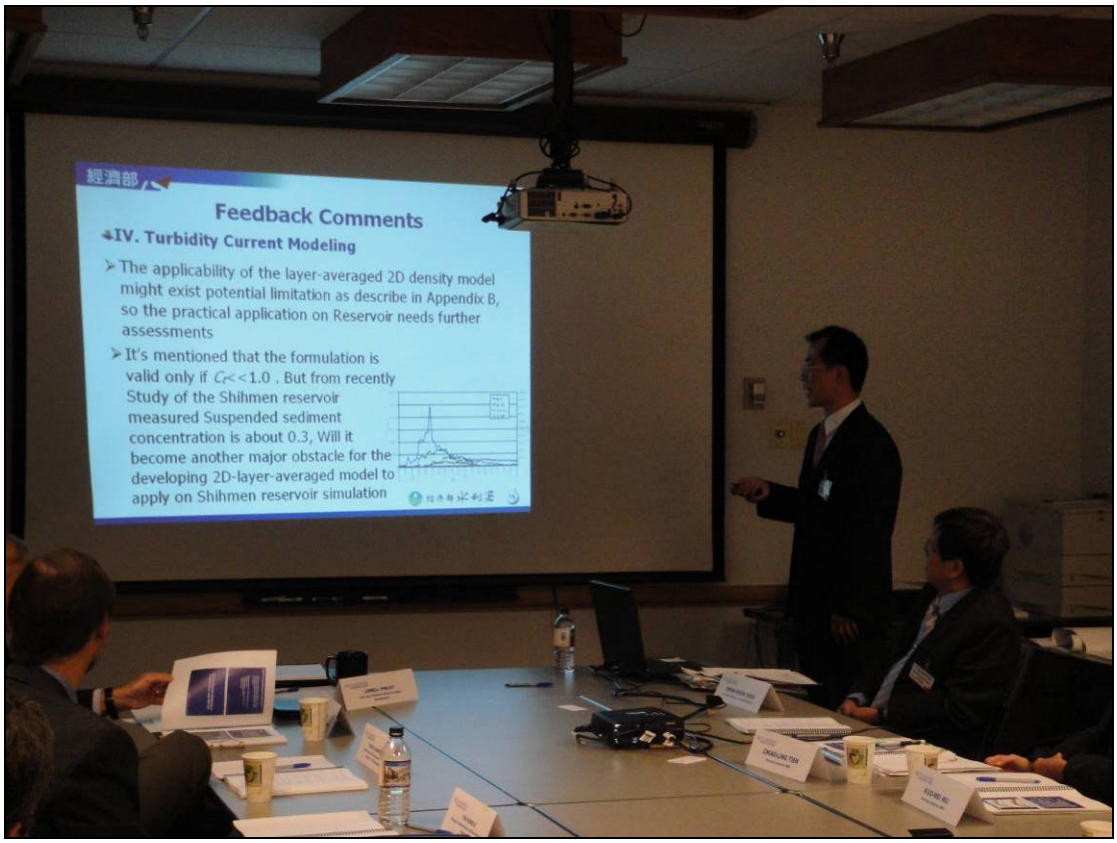
會議首先由美方墾務局技術中心主任 Lowell Pimley 介紹本次與會美方代表及表達歡迎我方代表團來訪之意，並說明美國對於水資源利用及管理課題相當重視，並且研究利用不斷進步的科技與技術，以處理相關水資源的問題，期望藉由年會的召開，能使台美雙方在水資源問題上的技術及研究成果能相互交流。接著由我方代表團團長陳技監伸賢致詞，針對美方多年來在台美水資源技術合作所付出之努力及獲致之豐富成果表示感謝（詳照片 3-1），另針對我方於第 21 屆年會時提出之第 6 號附錄工作需求未能如計畫執行表達我方歉意，美方並表示理解我方之立場。雙方團長致詞及介紹之後，依序由與會人員自我介紹後，議程正式開始。

年會議程之第一階段為台美水資源技術合作年度執行成果及進度檢討，首先由美國墾務局技術服務中心 Yong Lai 及 Blair Greimann（Sedimentation and River Hydraulics Group, TSC）分別針對第 8 號附錄之 2009 年工作進度及成果進行簡報(2009 Project Progress Report)，接著由水利署水利規劃試驗所吳國維副工程司代表台方連絡官，針對美方完成之年度成果期末報告初稿，進行工作內容及進度審查意見回饋簡報（Feedback Report on the 2009 Project Progress and Technical Support of BOR）；雙方簡報後隨即進行本年度成果、工作進度及審查意見交流（詳照片 3-2）。

經簡短休息後，由 Dave Paul（Waterways and Concrete Dams Group,TSC）進行台美水資源技術合作第 6 號附錄歷年合作成果回顧簡報後（An Overview of Technical Assistance under Appendix 6），再由水利署水利規劃試驗所吳國維副工程司代表連絡官提出水利署目前及未來工作需求簡報（Current and Future Needs: Taiwan WRA's Perspective），並由雙方代表團進行討論確定 2010 年台美水資源技術合作之工作內容（詳照片 3-3）。

經由進一步溝通與討論後，雙方達成本屆年會結論，由我方團長陳技監伸賢、美方墾務局技術服務中心主任 Lowell Pimley 於雙方代表團見證下共同簽署本次年會會議結論，簽署文件詳附件一（詳照片 3-4）。

照片 3-1 我方團長陳技監伸賢致詞



照片 3-2 我方代表進行審查意見回饋簡報

照片 3-3 台美雙方討論明年度工作內涵

照片 3-4 台美雙方簽署本次年會結論

二、參訪技術服務中心水資源研究實驗室：

因機會難得加上時程緊迫，美方人員利用中午休息時間由 Tim Randle（Manager, Sedimentation and River Hydraulics Group, TSC, BOR）帶領我方代表人員參觀美國墾務局 TSC 研究中心，該中心提供工程、研究、科學服務並從事於土木工程領域、環境工程領域、大地工程領域、基礎工程領域(水利、機械、機電工程)、水資源領域等相關之委託工作。

水資源研究試驗室(WRRL)對於水工模型實作、現場試驗、水資源、水力學和流體力學等問題上的技術，皆有所長，並實地的應用於各項開發工程與新興水資源的管理上（詳照片 3-5）。

照片 3-5 美方人員解說墾務局水資源研究試驗室水工模型試驗

三、台美水資源技術交流記事：

下午台美技術交流首先則由墾務局技術服務中心水道及混凝土壩組 Tom Hepler（Waterways and Concrete Dams Group,TSC, BOR），針對希歐多爾羅斯福壩加高之岩栓爆破及單元圍堰工法(On the Theodore Roosevelt Dam Raise: the lake tap and cellular cofferdams)進行案例簡報。接著依序為技術服務中心輸砂及河川水利組 Tim Randle（Sedimentation and River Hydraulics Group）針對墾務局堰壩移除經驗（On the dam removal experience at Reclamation）進行簡介、水利防洪及應變管理組 David Raff（Flood Hydrology and Emergency Management Group）針對墾務局目前針對氣候變遷議題之案例研究、目前發展等（Reclamation Climate Change Activities: Case Studies, Capabilities, and Gaps）進行簡介。接續由我方環興科技顧問有限公司龔誠山總經理分別針對大甲溪石岡壩下游河床穩定研究(Study on River Bed Stability for reach Downstream of Shigang Dam in Dajia River)及台灣莫拉克颱風之降雨逕流特型及其對水庫集水區最大可能降雨與最大可能洪水之影響(The rainfall characteristics and runoff of Typhoon Morakot for P.M.P and P.M.F. in reservoir watersheds in Taiwan)進行簡報（詳照片 3-6）。最後由輸砂及河川水利組 Jenniffer Bountry(Sedimentation and River Hydraulics Group)針對墾務局 Savage Rapids 壩拆除案例（Removal of Savage Rapids Dam）進行詳細個案探討。

依序完成簡報後，雙方針對台灣目前水資源技術所面臨之挑戰及美國目前相關技術研究發展現況進行進行技術研討與綜合討論，俾供日後執行雙方技術合作之參考，會後並於會議室外進行團體合照，台美雙方人員相約並期待明年於台灣辦理之年會。

照片 3-6 我方代表（龔誠山總經理）進行技術交流簡報

照片 3-7 第 22 屆台美年會主要參加人員合照

四、台美水資源合作年會結論：

(一)2009 年工作檢討:

第 8 號附錄年度工作成果及進度經過檢討與討論後,台灣水利署接受美國墾務局所提出之年度報告「Rock Erosion Modeling for Rivers in Taiwan and Progress Report of Bank Erosion and Turbidity Current Modeling」（SRH-2009-40）及「Sediment Considerations for Potential Dam Removal Projects」（SRH-2009-39）初稿，並請墾務局參酌台灣水利署審查意見修正後，於明年二月底前提出正式報告。

(二)2010 年工作內涵：

水利署於年會中提出之 2010 年工作需求如下：

1.第六號附錄（Appendix 6）

(1)湖山水庫現地技術諮詢

(2)因應氣候變遷下水庫 PMP 及 PMF 到達超過原設計值時之防洪操作及案例諮詢服務

(3)岩栓爆破工法及繞庫排砂技術諮詢服務

2.第八號附錄（Appendix 8）

(1)臺灣河川河床沖淤研究

(2)臺灣河川岸壁沖刷模組開發

(3)石門水庫異重流數模開發

(4)臺灣河川復育之技術諮詢

(5)提供選擇性技術訓練課程

經過討論後，美國墾務局將依據本署提出之工作需求，於 2010 年 1 月底前研提 2010 年台美水利技術合作工作計畫書。

肆、水資源考察及研討會

一、參訪鑽石谷湖水庫(Diamond Valley Lake)

10 月 30 日代表團由洛杉磯搭車前往位於洛杉磯東南方 90 英里處之南加州大都會水資源局（The Metropolian Water District of Southern California）所屬之鑽石谷湖（Diamond Valley Lake）水庫進行水資源參訪，並由該管理中心駐地政府代表 Lynda Goldberg 女士接待，及 Steve Heathcoat 及 Christopher Hill 兩名專業工程師針對該水庫之建造目的、過程及相關營運管理措施做詳細介紹。

南加州大都會水資源局（The Metropolian Water District of Southern California）是州特許由 26 個成員合作之城市和公共供水之機構，服務加州 6 個郡約 1900 萬人口。該機構主要水源來自科羅拉多河和北加州的供水，並幫助其成員發展增加節約用水、回收、儲存和其他資源管理計畫。

鑽石谷湖水庫(Diamond Valley Lake)建造之目的主要為增加南加州地表水 2 倍的儲存量，確保西南部的 San Andreas 斷層 6 個月的緊急儲存水量，並降低乾旱和夏季高峰時期的缺水危機，提供該地區 1800 萬人可靠的用水供應。鑽石谷湖建於兩座山的鞍部，是南加州最新、最大的離槽水庫，其水源係科羅拉多河輸水管，經由聖地亞哥運河注入水庫前池，再以泵送方式由前池進入水庫。另加州銀木湖（silverwood lake）之供水以重力流入水庫。於 1995 年 9 月開始建造，分西大壩（West Dam）、東大壩（East Dam）及鞍霸（Saddle Dam），是美國歷史上最大的土方工程，包含 4000 多萬立方碼的基礎開挖和 1.1 億立方碼的路堤施工。於 1999 年 12 月完成，2000 年 3 月 18 日開始供水。水面面積： 4500 英畝、長 4.5 英里，寬 2 英里多；150 至 250 英尺深。有效水庫容量 81 萬英畝。相關參訪內容詳照片 4-1、4-2；鑽石谷湖簡介資料摘錄於附錄二。

照片 4-1　鑽石谷湖水庫工程師向代表團簡報

照片 4-2 代表團於鑽石谷湖水庫合照

三、參訪胡佛水壩(Hoover Dam)

11 月 1 日由美國墾務局,國際合作處主任 Mrs. Principe Leanna 安排並陪同參觀考察胡佛水壩，並由胡佛水壩管理中心人員說明水壩之建造過程，營運管理措施。

胡佛水壩這次來美的行程之一就是參訪胡佛水壩，它始建於 1931 年，最後一次澆灌混凝土為 1935 年，比預定計劃提前兩年。它是一座混凝土拱型重力壩，壩高 220 米，底寬 200 米，頂寬 14 米，堤長 377 米。這樣巨大的水壩相較於目前全世界其他水壩工程或許並不突出，但以 1931 年之工程技術而言，絕對稱得上是世界級的工程。

胡佛水壩係給水、發電、防洪等多目標營運之水庫，其取水口位於水壩上游側之塔式結構，壩頂開放為公路使用，因此遊客可至壩頂自由參觀，每年吸引約有 900 萬人參觀。

胡佛水壩截斷了科羅拉多河，水壩背面蓄水範圍長 118 公里的密德湖，成爲西半球最大的人工湖。水庫建造之初安裝了 9 台發電機,能發出 70 多萬千瓦的電力,乃當時世界上最大的水電站。後來發電機組增加到 17 台，總發電達到 208 萬千瓦，胡佛水壩的發電設施目前仍是世界上第 35 大的水力發電廠。而目前水庫及發電廠的營運皆由美國內政部所屬的墾務局辦理。

參訪團在離開胡佛水壩前，特地前往水庫的溢洪道參觀，胡佛水庫溢洪道分別位於大壩兩側之壩基附近，平行峽谷宣洩而下。分洪時，由上游而來的洪水將幾近垂直地進入分洪隧道，並於下游匯入科羅拉多河主流。分洪道在完工以後，歷史紀錄上僅有三次分洪，分別是 1941、1983 及 1999 年。相關參訪內容詳照片 4-3、4-4；胡佛水壩簡介摘錄如附件三。

照片 4-3 胡佛水壩管理中心人員解說水壩建設過程及其設施

照片 4-4 參訪胡佛水壩亞歷桑納水力發電機組

四、參訪 EBMUD 及 EBMUD 水資源系統研討會

11 月 4 日（星期三）早上代表團搭機離開丹佛市，並於美國西岸時間約 11 點抵達奧克蘭機場(Oakland Airport)。代表團一行由我國旅美大地工程專家孫一鴻博士接機後轉往東灣地區公共事務區管理處(East Bay Municipal Utility District, EBMUD)參與由 EBMUD 舉辦之第一場次水資源系統研討會。本研討會參與團體包括南加州愛迪生電力公司(Southern California Edison, SCE)、太平洋瓦斯與電力公司(Pacific Gas and Electricity, PG&E)及南加州大學博克萊分校(University of California, Berkeley)等單位。會議前由 EBMUD 指派調度管理部門 Clifford Chan 先生引導代表團參觀該部門對於服務地區生活用水供應之管控中心及緊急應變中心，同時簡介其供水管理系統架構，EBMUD 簡介資料摘錄如附錄四。會議由 EBMUD 工程及營建部門主管 Xavier Irias 先生簡單致詞後開始，並由 Clifford Chan 介紹 EBMUA 供水服務地區、水庫設施、管線系統及控制系統與相關操作管理經驗；由 Priyanka Jain 小姐說明 EBMUD 運作相關管理法規及與政府部門間之互動機制，以及由 Atta Yiadom 先生說明 EBMUD 為因應地震可能危及水庫安全，對於服務區北邊重要但老舊的 San Pablo 水庫壩體之相關補強措施。南加州愛迪生電力公司由 John Yen(閻寅昌先生)以該公司近年進行壩體安全評估專案研究為題進行評估方法報告與經驗分享，並由該公司工程師 Derick Dela Cruz 先生報告該公司建置潰壩後可模擬淹水可能致災範圍及預警與緊急應變措施現階段成果。PG&E 由孫一鴻博士報告該公司所屬發電水庫面臨地震、暴雨等天然災害之壩體安全維護管理措施。南加州大學博克萊分校由土木及環境工程系 Raymond B. Seed 教授以加州供水信賴度與洪水

安全為題，報告在面對無法藉由工程手段而免除或抵抗之可能風險與因應措施之現階段研究成果。代表團則由龔誠山總經理以莫拉克颱風為例，報告在全球氣候變遷條件下，對於以往壩體設計引用之 PMP 及 PMF 水文設計條件應當如何看待及修正，以確保水庫營運安全。

本研討會於各參與單位專題報告後，由會議主辦 Dar Chen(陳敏達)先生主持綜合討論，就相關工程設計經驗及法規限制等問題進行詢答，在各與會人員熱烈討論下，成功結束本研討會。第一場次水資源系統研討會之議程請參見表 4-1，出席人員名冊詳見附錄五。

EBMUD 為依據加州州議會於 1921 年通過之公共事務區域法(Municipal Utility District Act)而成立之自治公共事務管理單位，主要負責供應 Alameda 及 Contra Costa 郡自來水供給及污水處理等民生用水事務，服務範圍包括東舊金山灣區 Alameda、Albany、Berkeley 等 20 個市及 Alamo、Blackhawk、Castro Valley 等 15 個社區，約共 130 萬人之生活用水。EBMUD 原水水源來自 Mokelumne 河及地表逕流，主要為以 Pardee 水庫蓄存 Mokelumne 河水，經由 Mokelumne、Lafayette 及 Briones 等 3 條主要輸水道(Aqueduct)將原水送至 6 座淨水廠，並於 1941 年經增修條文立法通過處理生活污水業務，由位於 Oakland 之污水處理廠將收集之污水經 2 級處理後排入舊金山灣。EBMUD 年平均供水量約 2 億 2,000 萬加侖/日(約 83 萬噸/日)，污水處理量約 8,000 萬加侖/日(約 30 萬噸/日)。相關參訪及研討會照片 4-5、4-6。

表 4-1 EBMUD 水資源系統研討會(Water System Workshop)議程

時間	講題	報告人/單位
12:50–1:05	Pre-Workshop Tour of Op-Net System Display and Control	Clifford Chan, EBMUD
1:05 – 1:15	Opening Remark	Xavier Irias, EBMUD
1:15 – 1:45	EBMUD Water System Overview	Clifford Chan, EBMUD
1:45 – 2:15	Meeting Demands, Managing Resources	Priyanka Jain, EBMUD
2:15 – 2:45	Overview of the SCE Dam Safety Risk Assessment	John Yen, SCE
2:45 – 3:00	Break	
3:00 – 3:30	The Rainfall Characteristics and Runoff of Typhoon Morakot for PMP and PMF in Reservoir Watersheds in Taiwan	C.S. Kung, SinoTech
3:30 – 3:55	San Pablo Dam Seismic Upgrades	Atta Yiadom, EBMUD
3:55 – 4:20	Inundation Maps Considering “Domino Effect”	Derick Dela Cruz, SCE
4:20 – 4:40	Natural Hazard Management in PG&E	Joseph Sun, PGE
4:40 – 5:10	California Water Reliability and Flood Safety Issues: Addressing Untenable Risks	Ray Seed, UCB
5:10 – 5:40	General Discussions and Additional Q&As	Dar Chen, EBMUD

照片 4-5　EBMUD 人員介紹其管控中心

照片 4-6　EBMUD 研討會我方代表簡報

五、拜會 HEC 及參觀 Laurel Ball Field Park 滯洪池

本次赴美行程除參加第 22 屆台美年會 (22nd AIT-TECRO Annual Review Meeting)及考察水資源設施外，另一重要目的為拜會位於加州大學戴維斯(Davis)分校之美國陸軍工兵團水文工程中心 (HEC, Hydrologic Engineering Center, U.S. Army Corps of Engineers)，以洽談未來水利署送訓或邀請美方專家來台授課等相關事宜，以利提升國內水理分析能力與技術。

美國陸軍工兵團水文工程中心所研發之 HEC-RAS 模式因高可靠性及經美國 FEMA 認證具實務功能，故為目前國內學術研究及工程設計界使用最廣泛之一維水理分析模式。該模式適用於底床坡度在 1/10 以下之河道地形，具圖型化操作、展示介面模式及多樣化實務等功能,除包含亞、超臨界流及混合流態(mixed regime)之河道水理計算外，並可針對橋樑、涵洞、堰、堤防、溢洪道及其他河工結構物進行水理模擬，提供 WSPRO 模式之橋墩沖刷估算，亦能進行河道改善工程及洪水平原管理、洪災保險等行洪區逾限利用之評估。2002 年以後，由於適用於超臨界與亞臨界流混合流況之河川變量流模擬程式，使得 HEC-RAS 模式除前述功能外，更可模擬潰堤、蓄水區(高灘地、滯洪區、離槽水庫)、抽水站、壓力涵管與控制(及非控制)溢洪等情況，運用範圍相當廣泛。

11 月 5 日（星期四）拜會 HEC 協商技術移轉行程由我國旅美水利專家鄔寶林博士協助安排，並由美國兵工團水文及水利科技組(Hydrology and Hydraulics Technology Division)組長 Jeff Harris 先生率同 2 位同仁與我代表團討論（詳見照片 4-7）。經協商可能合作方式為：

(一)由水利署循現有與美國懇務局合作模式，簽署台美技術合作備

忘錄，派遣我方技術人員到美參訓，或定期邀請美方研發人員抵台開設短期講習班，以講授 HEC 相關開發分析軟體之高階運用技術與相關應用等課程。

(二)由民間機關邀請 HEC 研發人員抵台講授高階運用技術與相關應用等課程。

兩種技術轉移方式，Harris 先生表示均可以考量配合。經代表團評估應以方案二較為可行，初期可由學術研究機關聯絡邀請美方適當研發人員來台短期授課，除可先建立雙方互信回饋管道，促進研發與使用者互動交流外，亦可強化國內工程及研究界整體運用 HEC-RAS 之分析能力（詳見照片 4-8）。

由戴維斯返回舊金山途中，並由鄔寶林博士引導參觀其任職加州防洪局期間負責規劃設計之 Laurel Ball Field Park 滯洪池設施，該設施係為因應社區開發後所增加逕流量，避免提高下游地區漫淹風險，而配合規劃之滯洪池公園。該滯洪池最大可蓄存 100 年降雨頻率之逕流量(蓄水位大致與公路路面平)，滯洪池底下有社區及鄰近區域匯入之排水管道及暫時蓄水設施，4 個角落各設有 1 座進退水口。設計上，當降雨小於 5 年頻率時，控制(服務)地區內之集中地表逕流量不會漫淹到滯洪池表面以上；25 年頻率時，水位大致會淹到滯洪池周邊步道與停車場之間，超過 100 年頻率則會淹過公路。滯洪池本身平時可作為運動場使用，供社區及鄰近地區民眾踢足球、打棒球等球類運動使用，設施相關照片詳見照片 4-9 至 4-10。

此滯洪池之規劃理念與目前國內推動新社區開發後必須吸納增加暴洪量之排水治理理念相近；由參觀過程可知其設施使用及維護狀況，研判應為相當成功案例，值得國內在核准新社區開發時參考。

照片 4-7 代表團與 HEC Jeff Harris 組長討論情形

照片 4-8 代表團與 HEC 人員合照

照片 4-9 加州防洪局 Laurel Ball Field Park 多功能滯洪池

照片 4-10 鄔寶林博士解說滯洪池排水系統設計原理

六、PG&E 水資源系統研討會

11 月 6 日（星期五）為代表團本次訪美行程最後一天，由於代表團此行離台前夕接獲外交部駐舊金山辦事處函知數位旅居金山灣區水利專家有意願來台參與 88 水災災後重建工作，故在時間有限之情況下，由孫一鴻博士籌劃並安排於 PG&E 公司會議室召開第二場次水資源系統研討會，同時邀請灣區相關華裔專家出席瞭解目前重建進度並參與討論。

本日研討會召開目的係以在美華人從事水壩工程之施工經驗分享及對莫拉克風災後對國內可能有幫助之重建工程技術討論。主要講題、報告人及所屬單位資料如表 4-2 所示，與會人員詳照片 4-11。本研討會由 Jim Zhou 先生（San Diego County Authority, ADCWA）講述該單位利用滾壓混凝土 (Roller Compacted Concrete, RCC)建壩之經驗，由於 RCC 之施工方式類似土石壩碾壓過程，採分層滾壓施作，故施工快速且對環境影響較低。由於 RCC 係一種低水分、以飛灰(Fly Ash)混和之細粒料混凝土，目前已成功運用於建造新壩(Olivenhain Dam, San Diego, California)及提高舊壩 San Vicente Dam 壩高。 Endi, Zhai 先生(翟恩地, HDR Engineering Inc.)以探討提高堤防或壩體安全議題，分享該公司修築 Sacramento 地區原有河岸土堤，施作不透水堤心之施工方式及經驗。John Yen(閻寅昌先生)則延續第一場次研討會報告題目，進一步說明 SCE 公司近年進行壩體安全評估專案研究之初步分析成果與評估方法未來發展方向。PG&E 孫一鴻博士則整理各壩體失敗案例以說明大壩興建過程從可行性分析、規劃設計到細部設計及操作維護等各階段之重要性，以及面對暴雨、地震等無法控制致災因子工程師之規劃設計與施工維護思維。代表團仍由龔誠山總經理報告莫拉克

颱風所帶來豐沛降雨對臺灣興建中或操作中水利建造物之影響，並配合以 3D 影像讓與會人士可充分瞭解本次風災之環境基本資料，以利釐清災情慘重主要導因為天災，而分人禍。綜合討論過程中，各與會人員並就未來災後重建可能措施及方向進行廣泛討論，意見如下：

(一)建議水利署積極加入國際組織，以汲取相關工程技術資訊及參與國際事務，提高國際能見度。例如位於加拿大蒙特婁市(Montreal, Canada)的能源發展技術創新中心(CEATI, Center for Energy Advancement through Technological Innovation)所屬之堰壩安全同業組織(Dam Safety Interest Group)，簡稱為CEATI-DSIG。

(二)針對 88 水災，建議邀請國內外專家舉辦論壇，以工程觀點探討致災成因與對策。會後藉由媒體正確宣導，以避免被泛政治化。

本次出席會議旅居金山灣區水利專家包括姚大凱先生、薛乃莊女士、李祖良先生及徐增樂先生，個別簡歷如下：

1.姚大凱先生：2007 年自聖荷西市政府工務局退休，現為灣區科技社團中國工程師協會理事。

2.薛乃莊女士：2008 年自 Santa Clara 區域水利局主管退休。

3.李祖良先生： Santa Clara 區域水利局災難防治專家。

4.徐增樂先生：美國陸軍兵工署工程師。

表 4-2 PG&E 水資源系統研討會(Water System Workshop)議程

時間	講題	報告人/單位
1:05 – 1:15	Opening Remark	Joseph Sun, PGE
9:00 – 9:30	RCC Dam Case Study	Jim Zhou,SDCWA
9:30– 10:00	Overview of Levees History, Current Issues, and Paths for the Future	Endi Zhai, HDR
10:00 –10:30	Executive Review of The SCE Dam Safety Risk Assessment Phase I Studies & Preliminary Results	John Yen, SCE
10:30 –10:45	Break	
10:45 –11:15	Follow-up discussion on 'Typhoon Morakot Damage in Taiwan & Potential Impact on PMP and PMF for Dam Design in Taiwan'	C.S. Kung, SinoTech
11:15 –11:45	Learning from Dam Failure Case Histories	Joseph Sun, PGE
11:45 –12:00	The Upcoming 2010 HydroVision International Conference (July 27-30,2010)	John Yen, SCE
12:00 –12:30	Open Discussions	Joseph Sun, PGE

照片 4-11 PG&E 水資源系統研討會與會人員合照

附錄一 年會結論

2009 Water Resources Program
The 22nd AIT-TECRO Annual Review Meeting
Conclusions

The 2009 22nd AIT-TECRO Annual Meeting was held on November 3, 2009 at the Technical Service Center, Bureau of Reclamation (Reclamation), in Denver, Colorado, USA. Delegates for the Water Resources Agency of Taiwan (WRA) and Bureau of Reclamation (Reclamation) discussed various issues related to the work accomplished in 2009, potential work items in 2010 under Appendix 6 and 8 Agreements, and other matters. The meeting has reached the following conclusions:

1. Conclusions about the 2009 work accomplishments under Appendix 8:

   - After review and discussions, WRA accepted the draft progress report, "Rock Erosion Modeling for Rivers in Taiwan and Progress Report of Bank Erosion and Turbidity Current Modeling," as the work accomplished in 2009. The final version of the report will be delivered in February, 2010, by incorporating review suggestions of WRA.

2. Proposed work items for the calendar year of 2010 that have been discussed:

   - Appendix 6
     - Technical assistance and on-site consultation for Hushan Dam construction
     - Consultation and case study on flood prevention operation on reservoirs to adapt to climate change
     - Consultation and case study on lake-tapping and sediment bypass tunnel
   - Appendix 8
     - Riverbed Degradation Study—Application to specific projects
     - Bank Erosion Modeling—Research of river bank erosion models for migration studies in Tachia and/or Choshui rivers
     - Density Current Modeling—Debug, testing, and evaluation of the model with benchmark density current flows
     - Technical consultation on river rehabilitation and restoration in Taiwan
     - Optional Technical Training

Reclamation will provide a proposal in January 2010 for the 2010 requested works.

SIGNATORIES

For MOEA, TAIWAN	For Reclamation, USA
Mr. Shen-Hsien Chen	Mr. Lowell Pimley
Counselor,	Director, Technical Service Center
Ministry of Economic Affairs	Bureau of Reclamation
	U.S. Department of the Interior

附錄二 鑽石谷湖簡介摘錄

Diamond Valley Lake

... at a glance

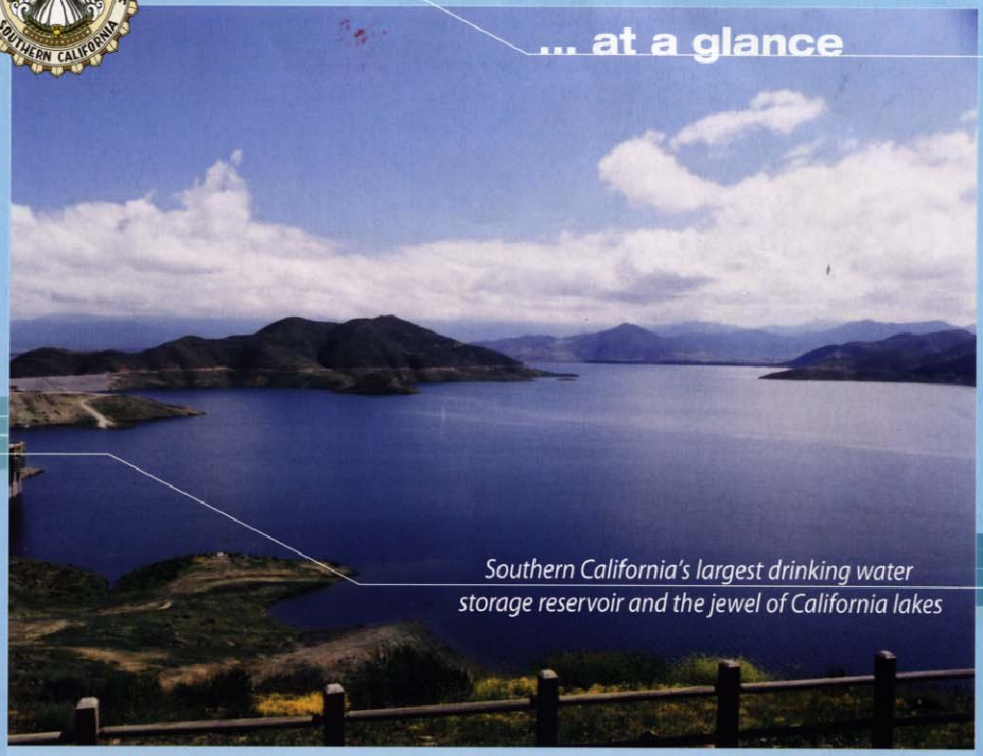


photo taken April 2001

Purpose:

- Almost doubles Southern California's surface storage
- Helps secure six months of emergency storage southwest of San Andreas Fault
- Reduces the threat of water shortages during drought and periods of peak summer use

Location:

- 90 miles southeast of Los Angeles
- Diamond and Domenigoni valleys near Hemet

Water Sources:

- California State Water Project from Lake Silverwood through the Inland Feeder and San Diego Canal
- Colorado River Aqueduct delivered through San Diego Canal

Facts & Features:

- 810,000 acre-feet or nearly 264 billion gallons capacity
- Area: 4,500 surface acres; 4.5 miles long, more than 2 miles wide; 150 to 250 feet deep
- Construction began September 1995; completed December 1999; dedication March 18, 2000

www.mwdh2o.com www.dvlake.com

About Metropolitan:
The Metropolitan Water District of Southern California is a state-chartered cooperative of 26 member agencies – cities and public water agencies – that serve about 19 million people in six counties. Metropolitan imports water from the Colorado River and Northern California to supplement local supplies, and helps its members to develop increased water conservation, recycling, storage and other resource-management programs.

Mission Statement
The mission of the Metropolitan Water District of Southern California is to provide its service area with adequate and reliable supplies of high-quality water to meet present and future needs in an environmentally and economically responsible way.

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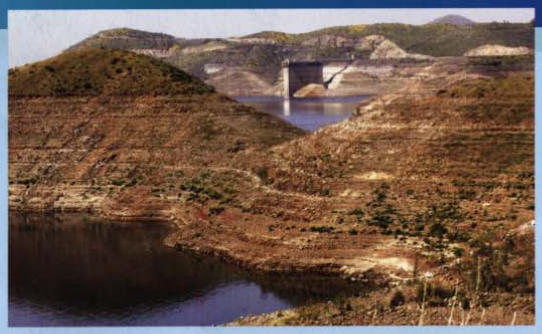


Effects of drought are evident

photo taken March 2009

BENEFITS

Resource Management:

- Allows water, stored when plentiful, to be slowly released, helping improve the region's groundwater recharge programs
- Gives operational flexibility; provides water by gravity flow to most of MWD service area
- Provides up to 26 megawatts of hydro-electric generation

Environmental:

- Creates the 13,000-acre Southwest Riverside County Multispecies Reserve that includes land around the reservoir, Lake Skinner and the 2,5000-acre Dr. Roy E. Shipley Reserve

Marina:

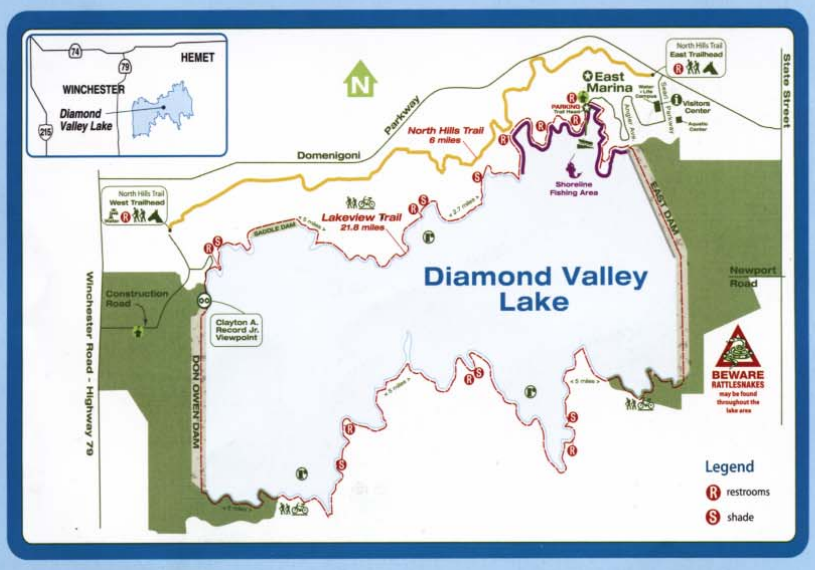
- Opened Oct. 3, 2003
- Marina store, bait, fishing supplies and light refreshments
- World-class fishery

www.mwdh2o.com www.dvlake.com

- 50-boat rental fleet; reservations recommended:
  - –Bass boats
  - –Pontoon boats
  - –Basic fishing boats
- 3 miles of shoreline fishing
- Information, entry and boat rental fees: (877) DVL-LAKE (385-5253) or www.dvlake.com
- Reservations: (800) 590-LAKE (590-5253) or (951) 926-7201 (Marina) or www.dvmarina.com

Recreation:

- Multi-use trails; North Hills hiking and equestrian segment, 6 miles
- Lakeview Hiking and Bicycling Trail, 21.8 miles, enter at Searl Parkway
- Visitors Center, Searl Parkway
- Western Center for Archaeology and Paleontology, Searl Parkway
- Valley-Wide Recreation and Park District Regional Aquatic Center and Community Park, Searl Parkway



Conservation & more

... at a glance

Overview

While Southern California's population and economy continue to grow, its water supply doesn't. In the next 15 years, our region is expected to gain as many as 2.6 million new residents. That's almost like having everyone in the state of Kansas move west. Meeting this future demand is what we are hard at work on every day.

Not only will there be more cups to fill, but Metropolitan's existing sources of imported water are under constant pressure from competing users, political demands and environmental constraints. Whether we can find acceptable solutions for greater reliability in the San Francisco Bay/San Joaquin Delta and Colorado River is far from certain. This adds greater emphasis on Metropolitan and its member agencies to develop all of the available local supplies.

Despite the challenges, Southern California's water future remains promising. Our efforts have taken hold and provide a balanced mix of water resources. Water saved or produced through conservation, recovering contaminated groundwater and water recycling equals the combined water needs of San Francisco, Oakland and the Silicon Valley.

Water Efficiency

Conservation is a basic element of Metropolitan's long-term water management strategy. Our expanding commitment has resulted in more water-saving opportunities through California Friendly programs, such as one with homebuilders that cuts water use 20 percent over the average household.

In hot, dry areas, landscape irrigation can account for as much as 70 percent of the summer water use in single-family homes. Metropolitan expanded its conservation programs with new outdoor water-saving actions that encourage consumers to tune up their irrigation systems and to consider native and California Friendly plants for their landscaping choices.

When it comes to saving water, Metropolitan has led the way with new technologies and some of the most innovative conservation programs in the nation. The Integrated Resources Plan Update sets a target that by 2025 Southern California's conservation measures, along with plumbing code-based savings and savings from price increases, will save more than 1.1 million acre-feet of drinking water a year.

Metropolitan-Assisted Local Resources

	Investment	Water Saved
Conservation		
2007	$20 million	118,000 af
Cumulative	$205 million	977,000 af
Water Recycling		
2007	$19	98,000 af
Cumulative	$173 million	912,000 af
Groundwater Recovery		
2007	$9 million	49,000 af
Cumulative	$71 million	381,000 af

Water Recycling

Water recycling programs use advanced treatment technologies to clean wastewater that would otherwise be unusable and go to the sea. Most recycled water is used for landscape irrigation, industrial process water and for purposes other than human consumption. Recycling is an effective way to stretch our water supplies. Metropolitan partners with its member agencies to provide financial assistance for delivered recycled water. Through this arrangement, we have helped support 45 operating projects throughout our region.

Groundwater Recovery

When groundwater basins become unusable due to naturally occurring minerals, chemical contamination or increasing salinity, water agencies are faced with a choice. They can rely more heavily on imported supplies or they can recover the water by treating it. Metropolitan provides financial assistance to its member agencies to build and operate groundwater treatment projects to recover this valuable resource. There are currently 18 projects operating and others are under development.

More than 20 years ago, Metropolitan created a local projects program to provide financial incentives for projects that delivered recycled water. Building on that success, we created a second program for recovering brackish groundwater. About 10 years ago, the two programs merged into the Local Resources Program, which provides up to $250 per acre-foot a year to local agencies to improve regional water supply reliability. Metropolitan targets 500,000 acre-feet a year for combined water recycling, groundwater recovery and seawater desalination.

Looking Ahead

Making every drop count has become the lifestyle of Southern Californians. Our water-efficient practices have set standards that distinguish us from the rest of the nation.

Southern California's water supply is coming full circle. During the late 1800s, the region depended on limited rainfall and local supplies. In the 1900s came the dream of aqueducts and bringing water in from the Colorado River, while nearly a half century later the State Water Project offered to fill even more the Southland's water supply picture. Thirty years later, the Integrated Resource Plan focuses on balanced management and development of local and imported water supplies. The success of these programs ensures reliable water supply for Southern California through 2025.

High-efficiency clothes washers and rotor sprayhead sprinklers save water.

About Metropolitan

The Metropolitan Water District of Southern California is a state-chartered cooperative of 26 member agencies—cities and public water agencies—that serve about 18 million people in six counties. Metropolitan imports water from the Colorado River and Northern California to supplement local supplies, and helps its members to develop increased water conservation, recycling, storage and other resource-management programs.

Mission Statement

The mission of the Metropolitan Water District of Southern California is to provide its service area with adequate and reliable supplies of high-quality water to meet present and future needs in an environmentally and economically responsible way.

Metropolitan Water District of Southern California
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Los Angeles, CA 90054-0153

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mwdh2o.com

7/08 3M

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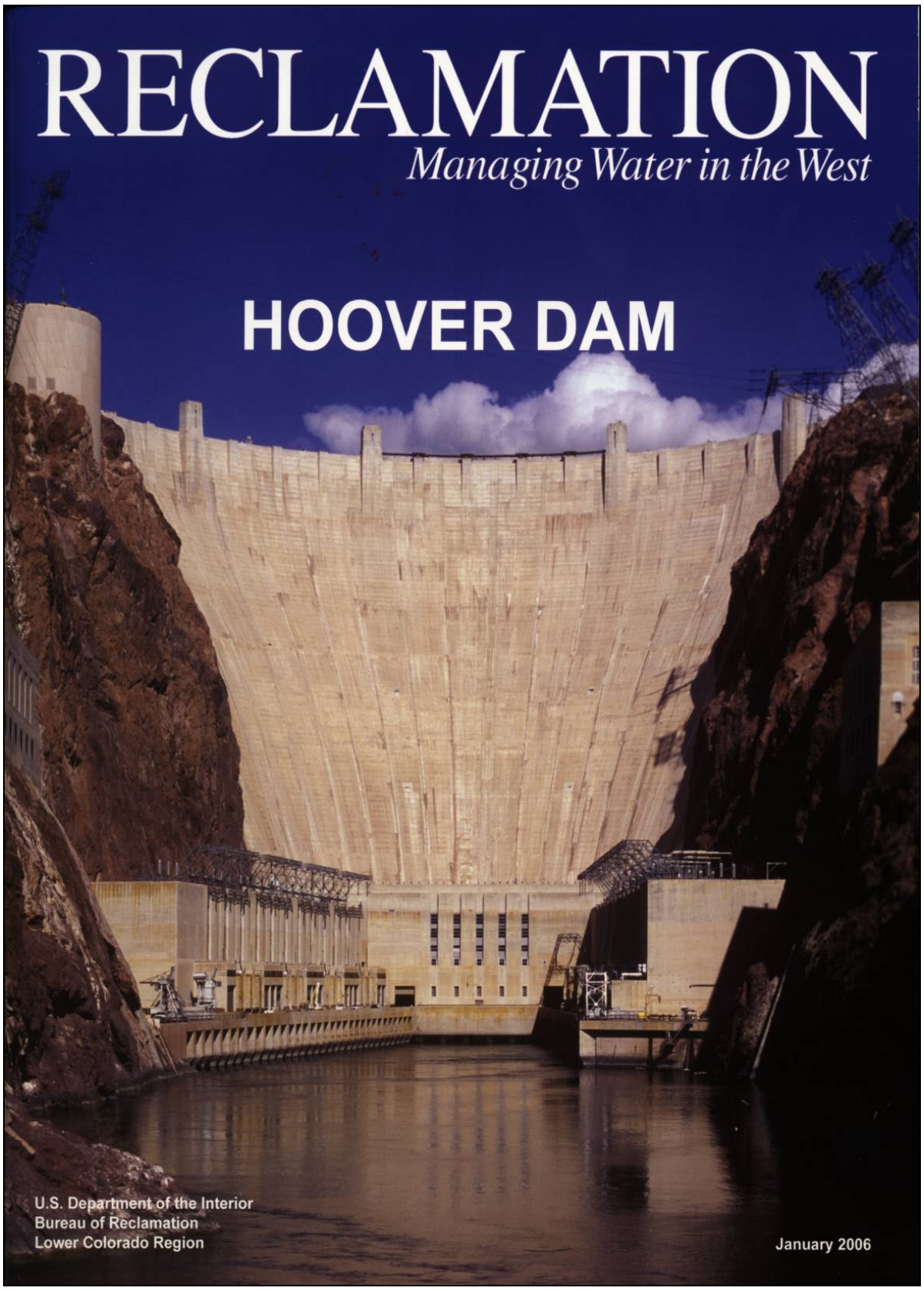
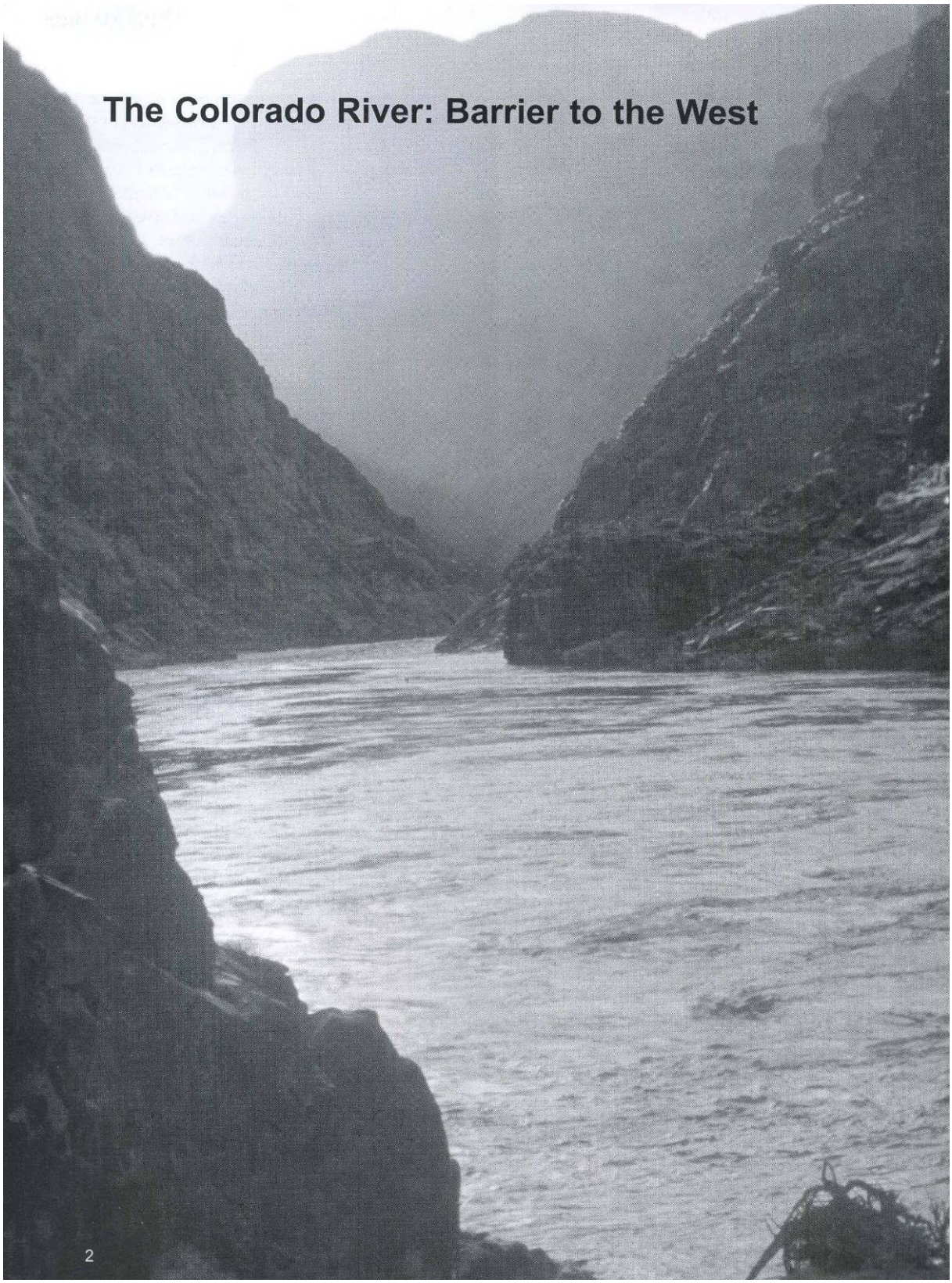
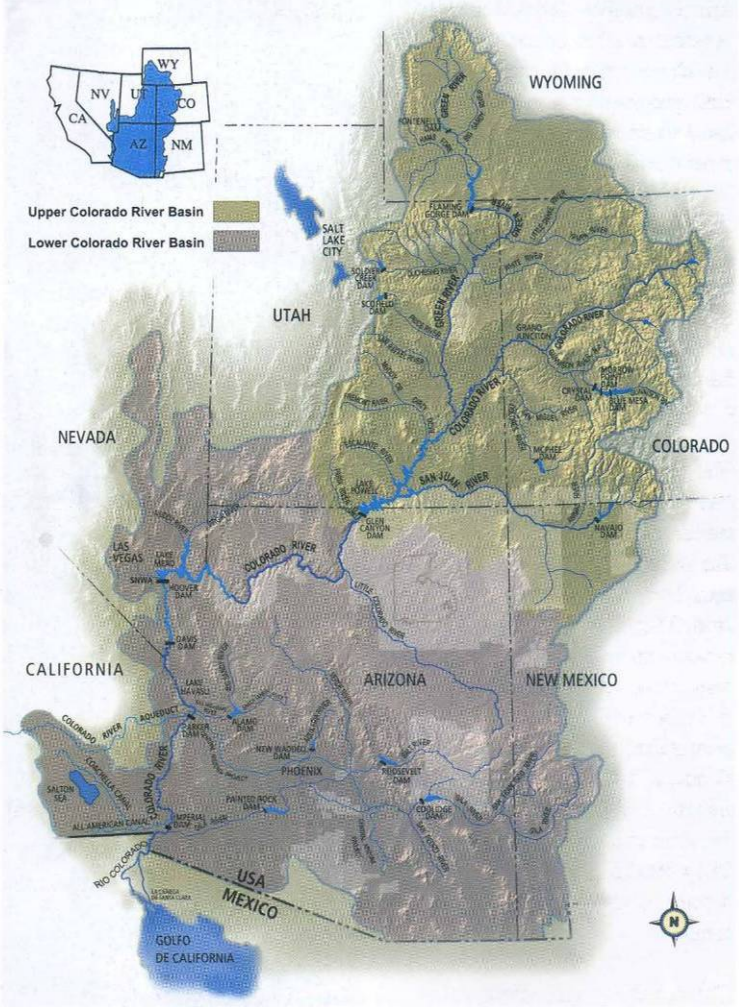


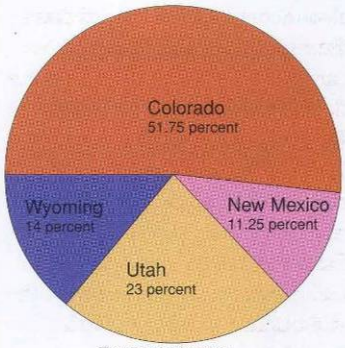

The Colorado River: Barrier to the West
2

bers on November 24, 1922, in Santa Fe, New Mexico. For this reason, it is often referred to as the Santa Fe Compact. The compact was approved over a period of years by the Basin State legislatures and the United States. The Compact officially divided the Colorado River Basin into the Upper and Lower Basin divisions at Lee Ferry, which is on the mainstem of the Colorado River in northern Arizona, approximately 30 river miles south of the Utah/Arizona boundary.

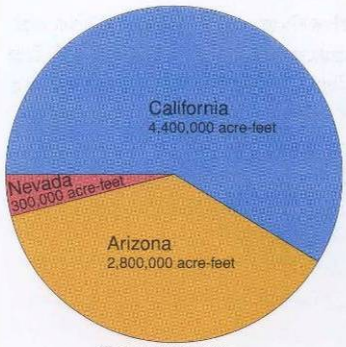
The term "Upper Basin" means those parts of the States of Arizona, Colorado, New Mexico, Utah, and Wyoming from which waters naturally drain into the Colorado River system above Lee Ferry, and all parts of these States that are not part of the river's drainage system, but which may benefit from waters diverted from the system above Lee Ferry.

The term "Lower Basin" means those parts of the States of





The upper basin states water division.



The lower basin states water division.

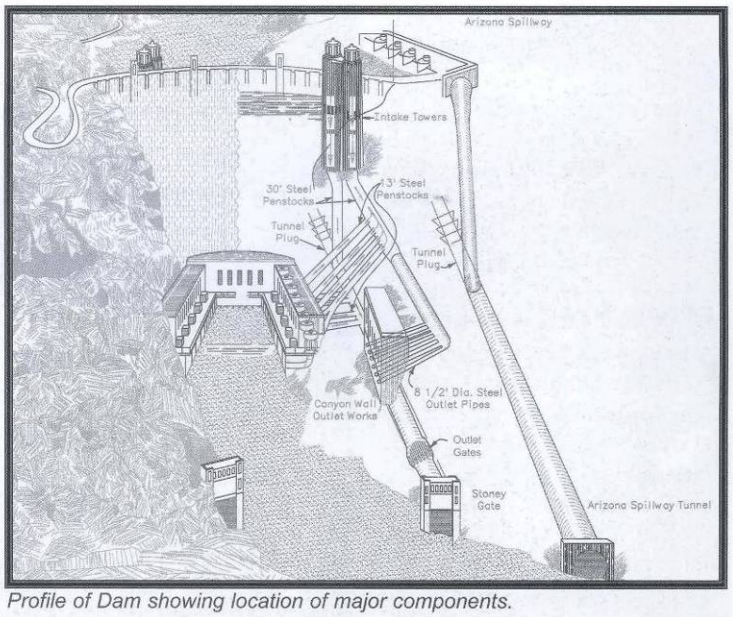
the upstream portions of the two inner diversion tunnels were plugged with concrete, and a steel gate was lowered at the outer diversion tunnel inlet on the Arizona side of the river, leaving one tunnel with gates and valves, so water could continue to be delivered downstream. On February 1, 1935, behind the unfinished dam, water started to rise. For the first time in history, the Colorado River had been harnessed and its waters began to form Lake Mead.

When the waters of reservoir had risen to the base of the intake towers, 260 feet above the riverbed, the remaining tunnel on the Nevada side was closed, and water deliveries began from the dam.

By midsummer the new reservoir held more than 3 million acre-feet of water and had a maximum depth of 271 feet. The muddy river was transformed into a lake of clear blue water sparkling in the desert sun as the sediment began settling in the reservoir. No longer would the lower basin of the river flow reddish-brown.

Concrete placement continued, and the crest of the dam was reached March 23, 1935. By the summer of 1936 all concrete – 3,250,335 cubic yards or 6,600,000 tons – was in place.

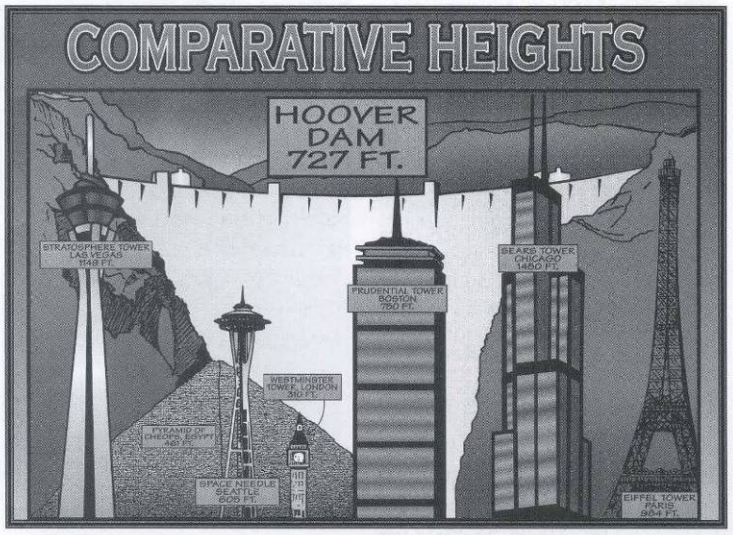
In less than two years, 5,000 workers had built a structure



Profile of Dam showing location of major components.

greater in volume than the largest pyramid in Egypt, which, according to Herodotus, an ancient Greek historian who lived more than 2,000 years ago, required 100,000 men working 20 years to complete.

The dam towers 726.4 feet above bedrock, a distance equivalent to the height of a 70 story building. It has a base thickness of 660 feet, or the length of two ordinary residential blocks; is 45 feet thick at the crest; and



Height of Hoover Dam compared to other structures.

Colorado River Water Allocation

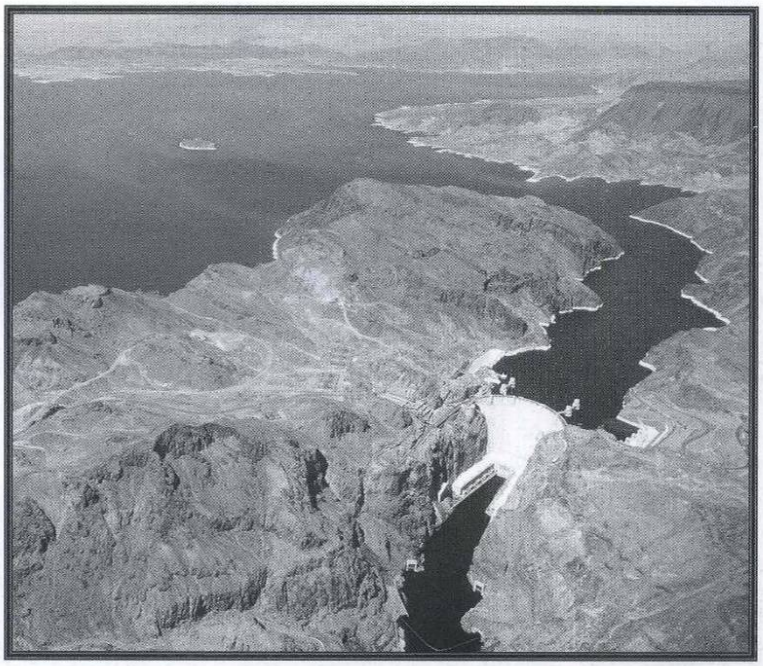
What States have beneficial interests in the Colorado River system?

Those lying within the Colorado River Basin: Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming. Each of these States is party to the Colorado River Compact entered into in Santa Fe, New Mexico, on November 24, 1922.

How is the Colorado River Basin divided?

The Colorado River Compact divided the Colorado River Basin into the Upper Basin and the Lower Basin. The division point is Lee Ferry, a point in the mainstem of the Colorado River about 30 river miles south of the Utah/Arizona boundary. The "Upper Basin" includes those parts of the States of Colorado, New Mexico, Utah, and Wyoming within and from which waters naturally drain into the Colorado River system above Lee Ferry, and all parts of these States that are not part of the river's drainage system but may benefit from water diverted from the system above Lee Ferry.

The "Lower Basin" includes those parts of the States of Arizona, California, and Nevada, within and from which waters naturally drain into the Colorado River system below Lee Ferry, and all parts of these States that are not part of the river's drainage system but may benefit from water diverted from the system below Lee Ferry.



Aerial view of Hoover Dam.

How is Colorado River water apportioned?

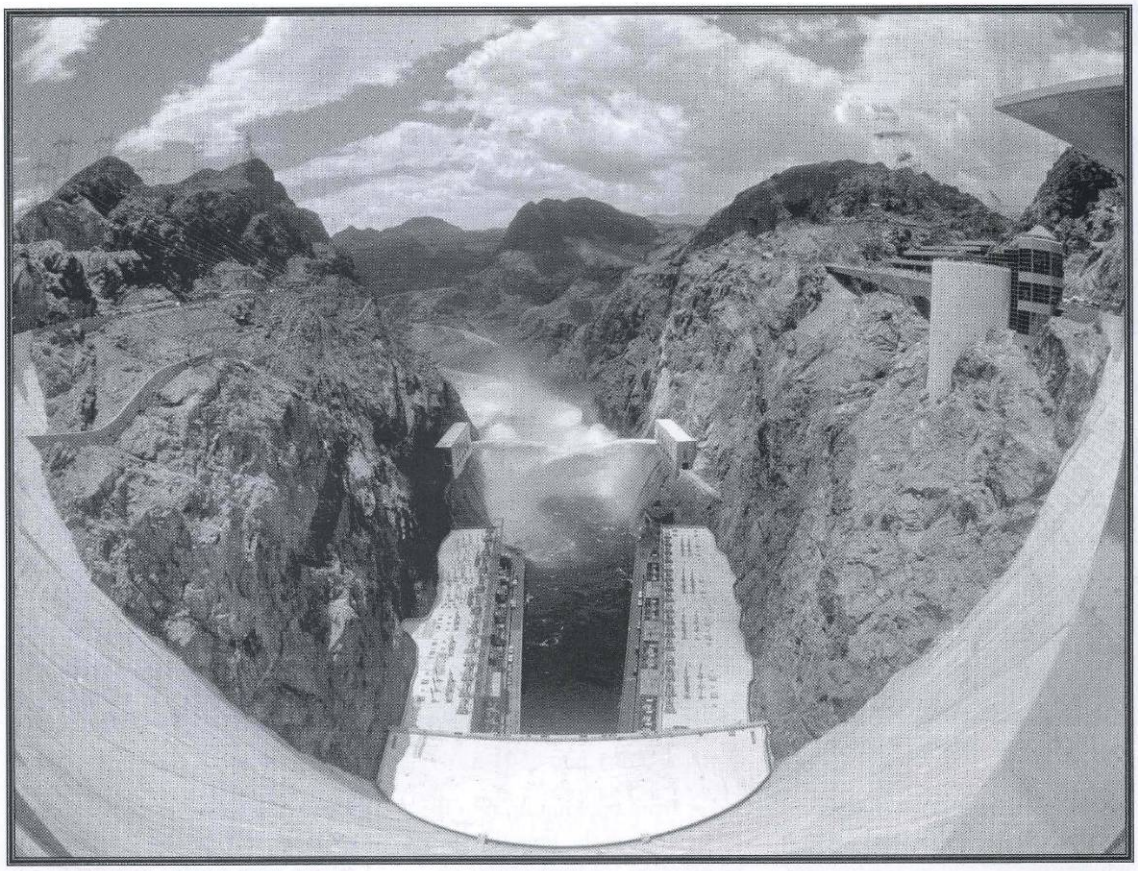
The 1922 Colorado River Compact apportioned to each basin the exclusive, beneficial consumptive use of 7,500,000 acre feet of water per year from the Colorado River system in perpetuity. In addition, the compact gave to the Lower Basin the right to increase its annual beneficial consumptive use of such water by 1,000,000 acre feet.

How much water did the Colorado River Compact apportion to each State?

The Colorado River Compact did not apportion water to any State.

On October 11, 1948, the Upper Basin States entered into the Upper Colorado River Basin Compact, which apportioned use of the Upper Basin waters among them. The compact permits Arizona to use 50,000 acre feet of water annually from the upper Colorado River system, and apportioned the remaining water to the Upper Basin States in the following percentages: Colorado, 51.75 percent; New Mexico, 11.25 percent; Utah, 23 percent; and Wyoming, 14 percent.

The Lower Basin States of Arizona, California, and Nevada were not able to reach agreement. The Boulder Canyon Project Act of 1928 apportioned 4.4 million acre-feet to



Jet flow gates in Hoover Dam's outlet works release water during a test in June 1998. The flow was about 42,000 cfs, or 315,000 gallons per second.

diameter–branch off the 30-foot penstocks to deliver water to the outlet works.

How is water released through the outlet works?

Water releases from the outlet works are controlled by "jet flow gates." There are two of these gates in each of the valve houses, which are concrete structures located 180 feet above the river on each side of the canyon downstream of the dam, and four gates in each of the lower outlets at river level. The valves can be used to bypass water around the dam under emergency or flood conditions, although they have never been used for that purpose. Primarily, they are used to empty the penstocks for maintenance work.

What are the main characteristics of the penstock and outlet pipes?

The penstock and outlet pipes range from 8-1/2 to 30 feet in diameter, and have a total length of about 14,800 feet. The pipes were fabricated from 44,000 tons of 2-3/4-inch boilerplate steel. Each 22-foot section of pipe used to construct the penstocks weighed between 135 and 186 tons.

What is the maximum water release capacity of the generating units and outlet works?

With all valves open and all generators operating, the generating units and outlet works can release 96,000 cubic feet of water per second from Lake Mead. That's enough to fill

about 34 average-size swimming pools each second.

Is there any other way to release water from Lake Mead?

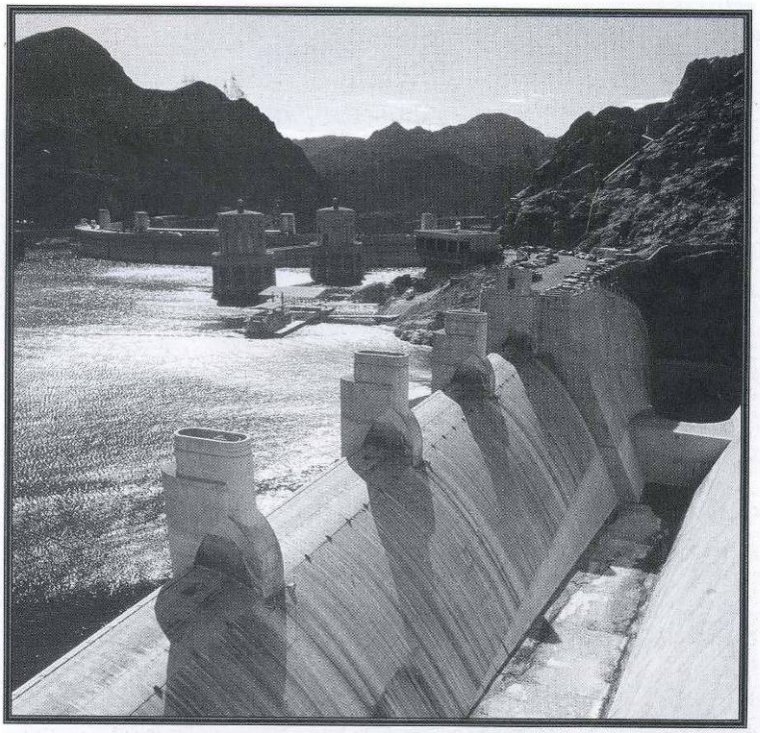
Yes, water can also be released through Hoover Dam's spillways.

What are the spillways?

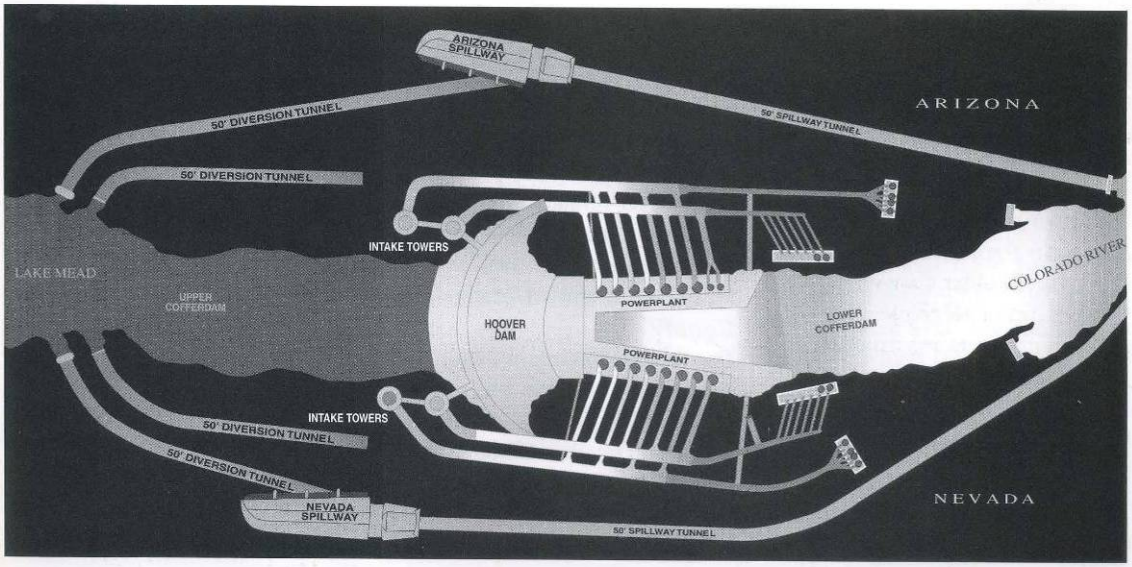
They are concrete-lined open channels about 650 feet long, 150 feet wide, and 170 feet deep located on each side of the canyon upstream of the dam. The spillways are designed to prevent water from flowing over the top of the dam, protecting the powerhouse below. Each spillway is large enough to float a U.S. Navy battleship.

How often are the spillways used?

The spillways have only been used once, in 1983, for operational purposes.



Hoover Dam spillway

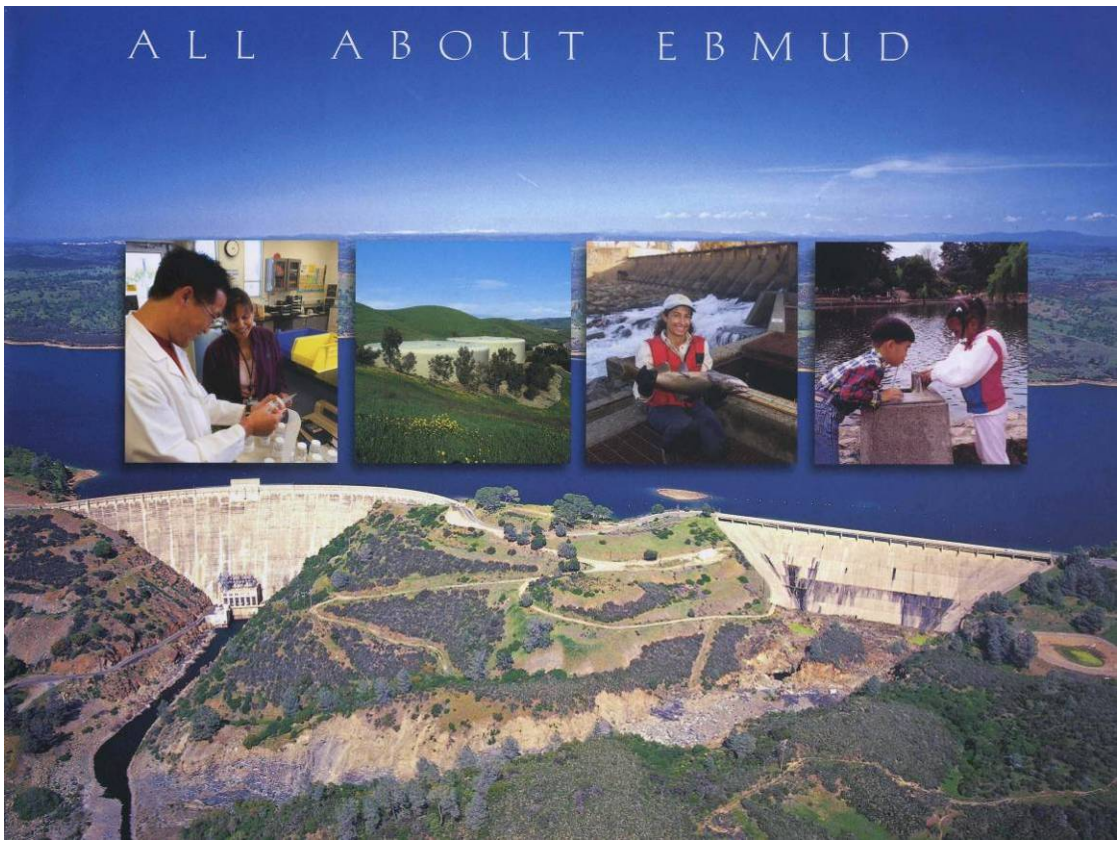


Hoover Dam's Awards

An Engineering Icon *- Hoover Dam has been recognized by some of the nation's most prestigious associations as an icon of extraordinary engineering and design. Honors bestowed on the dam include:*

- **1955** - Named one of America's Seven Civil Engineering Wonders by the American Society of Civil Engineers.
- **1985** - Named a National Historic Civil Engineering Landmark by the American Society of Civil Engineers.
- **1994** - Named one of America's Seven Modern Engineering Wonders by the American Society of Civil Engineers.
- **1999** - Selected as #5 in the Top 10 Construction Achievements of the 20th Century by members of the Construction Industry Manufacturers Association, the National Aggregates Association, and the National Ready Mixed Concrete Association.
- **2001** - Named a Civil Engineering Monument of the Millennium by the American Society of Civil Engineers.
  Named one of the Top 10 Public Works Projects of the Century by the American Public Works Association.
- **2002** - Hoover Dam Penstock System declared a Historical Welded Structure by the American Welding Society.
- **2005** - Hoover Dam and Lake Mead were designated the 2005 Outstanding Environmental and Engineering Geologic Project by the Association of Engineering Geologists.

附錄四 EBMUD 簡介資料摘錄

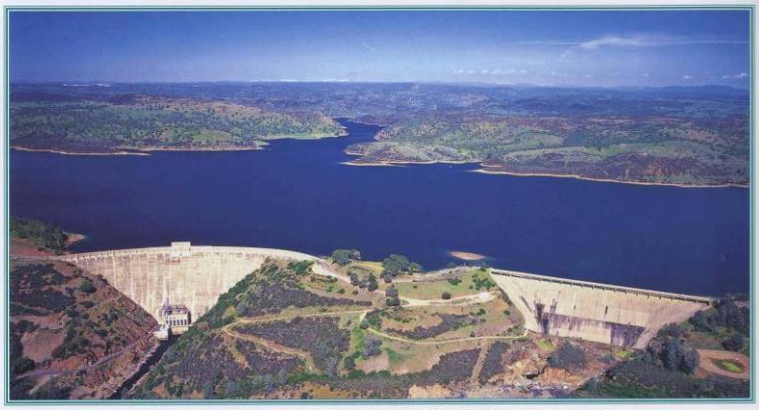


Overview

EBMUD is a publicly owned utility committed to serving people and the environment.

The East Bay Municipal Utility District supplies water and provides wastewater treatment for parts of Alameda and Contra Costa counties. The District's water system serves approximately 1.3 million people in a 325-square-mile area extending from Crockett in the north, southward to San Lorenzo (encompassing Oakland, Berkeley and Alameda), eastward from San Francisco Bay to Walnut Creek, and south through the San Ramon Valley. The wastewater system serves approximately 642,000 people in an 83-square-mile area of Alameda and Contra Costa counties along the Bay's east shore, extending from Richmond in the north to San Leandro in the south.

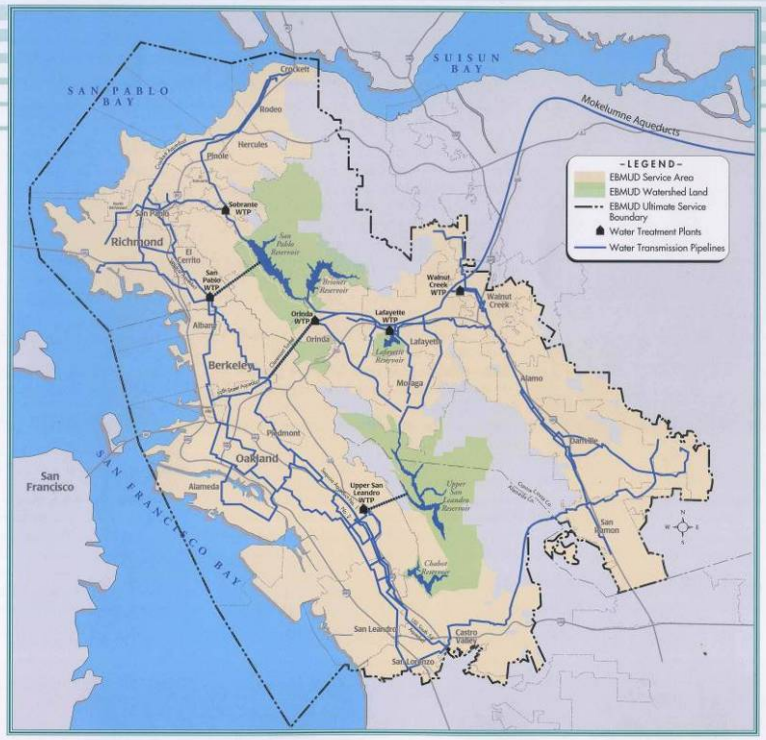
EBMUD is a publicly owned utility formed under the Municipal Utility District Act passed by the California Legislature in 1921. The Act permits formation of multi-purpose government agencies to provide public services on a regional basis. In accordance with the Act's provisions, voters in the east San Francisco Bay Area created EBMUD in 1923 to provide water service. The MUD Act was amended in 1941 to enable formation of special districts. In 1944, voters in six East Bay cities elected to form EBMUD's Special District No. 1 to treat wastewater released into the Bay. Wastewater treatment for those cities began in 1951 and was expanded 20 years later to include Kensington, El Cerrito and a part of Richmond.



Mokelumne River water is collected in Pardee Reservoir in the Sierra foothills for East Bay communities. Pardee Dam is on the left; the spillway is on the right.

EBMUD has a seven-member Board of Directors publicly elected from wards within the District's service area. The District's mission statement reflects its commitment to the community and the environment: *To manage the natural resources with which the District is entrusted; to provide reliable, high-quality water and wastewater services at fair and reasonable rates for the people of the East Bay; and to preserve and protect the environment for future generations.*

The Water System



The Water System

Camanche Reservoir has a capacity of 417,120 acre feet. During the 1988 drought year, Camanche became virtually dry, dropping to just 10,000 acre feet—two percent of capacity.

RAW WATER AQUEDUCTS AND TUNNELS

Raw (untreated) water from Pardee Reservoir is transported 91 miles to East Bay water treatment plants or terminal reservoirs through the Pardee Tunnel, the Mokelumne Aqueducts and the Lafayette Aqueducts. Water leaving Pardee flows by gravity to the Bay Area.

Mokelumne Aqueducts–Raw water from Pardee Reservoir moves through the Pardee Tunnel to the three Mokelumne Aqueducts near Valley Springs in Calaveras County. The Mokelumne Aqueducts carry water the remaining 82 miles to the east end of two Lafayette Aqueducts at Walnut Creek.

Lafayette and Briones Aqueducts–Lafayette Aqueduct No. 1 extends seven miles from Walnut Creek to the Orinda Water Treatmant Plant. Lafayette Aqueduct No. 2 runs seven miles from Walnut Creek to the Briones Diversion Works near Orinda. Here, the supply can be pumped (or diverted) through the Briones Aqueduct into Briones Reservoir, discharged into San Pablo Reservoir, or diverted to the Orinda Water Treatment Plant.

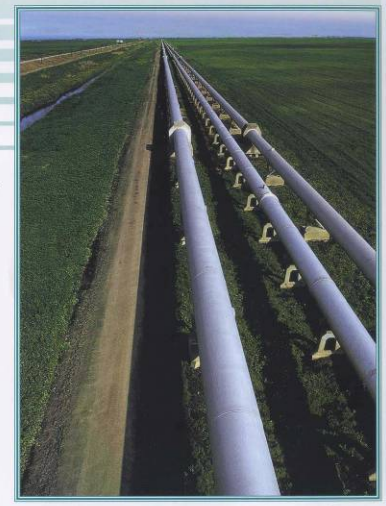
Either or both Lafayette Aqueducts can be used to divert Mokelumne water from Pardee to the District's water treatment plants or to terminal reservoirs.

Tunnels–Raw water from San Pablo and Upper San Leandro reservoirs is delivered to water treatment plants through two horseshoe-shaped tunnels. San Pablo Tunnel carries water 2.6 miles from the San Pablo Reservoir to the San Pablo Water Treatment Plant. Upper San Leandro Tunnel carries water just over a mile from Upper San Leandro Reservoir to the Upper San Leandro Water Treatment Plant.

EAST BAY TERMINAL RESERVOIRS

Water not immediately put through water treatment plants and distributed is stored in five East Bay terminal reservoirs. Their combined maximum capacity is 155,150 acre feet of untreated water, a four-to-six-month supply.

San Pablo Reservoir is the northernmost of the five. East of San Pablo Reservoir is Briones, EBMUD's largest local reservoir. Lafayette Reservoir is located in the City of Lafayette, and to the south are Upper San Leandro Reservoir and Chabot Reservoir.



The Mokelumne Aqueducts carry high-quality Sierra water about 90 miles from Pardee Reservoir to the East Bay.

WATER DISTRIBUTION

After the water treatment plants, water is distributed throughout EBMUD's service area, which is divided into more than 120 pressure zones ranging in elevation from sea level to 1,450 feet. Approximately 50 percent of treated water is distributed to customers by gravity. The water distribution network includes 4,100 miles of pipe, 140 pumping plants and 170 neighborhood reservoirs (tanks storing treated drinking water) having a total capacity of 830 million gallons. EBMUD serves approximately 1.3 million customers at an annual average of approximately 220 million gallons per day.

Treated water goes to customers through miles of pipes and distribution reservoirs and tanks. At left is Summit Reservoir in Berkeley (capacity 37 million gallons).

Water Quality

The Orinda Water Treatment Plant treats water for more than half of EBMUD's customers.

TREATMENT PLANTS

Six water treatment plants in the EBMUD system are capable of filtering and processing a combined total of more than 375 million gallons of water daily. The water treatment plants are Upper San Leandro in Oakland, San Pablo in Kensington (standby only), Sobrante in El Sobrante, and plants located in and named for Orinda, Lafayette and Walnut Creek. Orinda Water Treatment Plant is the largest, with a peak capacity of 200 MGD.

TREATMENT PROCESSES

Raw water can contain impurities such as sediment, bacteria and algae and other microorganisms. These are effectively removed by full, conventional treatment—consisting of six basic steps described on the next page—at the Upper San Leandro, San Pablo and Sobrante water treatment plants. Upper San Leandro and Sobrante conduct an additional step, ozonation.

These plants treat water from the East Bay terminal reservoirs. Orinda, Lafayette and Walnut Creek water treatment plants use only coagulation, filtration, and disinfection, because their water comes directly from the Mokelumne Aqueducts and needs less treatment.

Every drop of water delivered to customers is filtered through sand and anthracite–a granular form of coal. All six water treatment plants also provide fluoridation.

Water Conservation

EBMUD takes a comprehensive approach to water conservation–including the use of printed publications–to achieve measurable water savings.

For more than thirty years EBMUD has been a leader in water conservation. The District currently supports one of the largest and most comprehensive water conservation programs in California. Since the early 1970s, EBMUD has spent millions of dollars on system leak detection, school and public education, and a wide variety of conservation assistance programs and customer incentives.

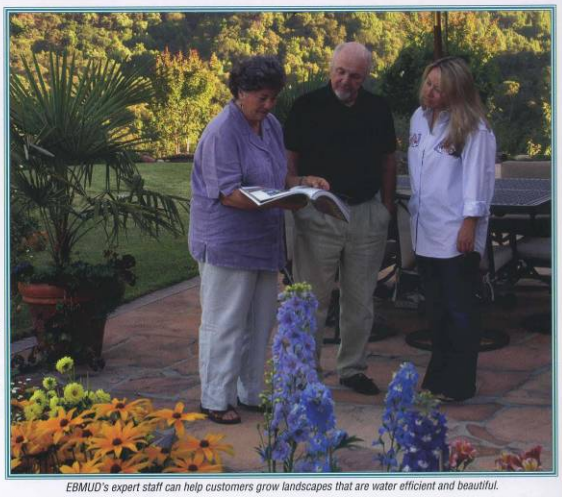
EBMUD's 1994 Water Conservation Master Plan is an integral part of the District's long-range plan for assuring an adequate future water supply. The master plan guides District conservation efforts and is designed to achieve cost-effective and sustained water savings. EBMUD takes a scientific approach to water conservation, testing water conservation products, conducting research and measuring the amount of water our customers save through conservation.

EBMUD offers water conservation services for all customers, including free water surveys and water-saving devices, financial incentives for installing water-saving fixtures, appliances and equipment, and education and outreach programs.

Water surveys consist of an on-site evaluation of water use and recommendations for increasing water use efficiency. For residential and small business customers, EBMUD offers a free self-survey kit with instructions and simple tools for performing a water survey.

Financial incentives include rebates for replacing high-volume toilets with water-saving models, rebates for installing high-efficiency residential or commercial-grade clothes washers, and rebates for replacing conventional urinals with high-efficiency models. Residential and business customers also may qualify for a rebate for replacing high-water-use landscapes with landscapes that use little or no water. Business customers can obtain technical and financial assistance in implementing equipment or process changes that reduce water use. The level of assistance is based on the amount of water the measure is estimated to save.

Education and outreach activities include school and public education programs, demonstration gardens and exhibits, workshops, presentations, information booths at community and professional events, and publications. Since 1974, EBMUD has provided water conservation curricula and supplemental materials to teachers and students through Project WATER (Water Awareness Through Education and Research). Other school-based programs include sponsorship of performances with environmental and conservation messages by the National Theater for Children, conservation workshops for teachers, and a program that provides small grants to schools for water-conserving garden projects.



EBMUD's expert staff can help customers grow landscapes that are water efficient and beautiful.

Historical Highlights

Highest total storage of record in local reservoirs	March 4, 1983
Pardee Power Plant Third Unit completed and in service	June 1983
Camanche Power Plant completed and in service	August 1983
Highest of record annual power generation at Pardee and Camanche powerhouses	1984
Water Supply Availability and Deficiency Policy adopted	May 1985
Dedication of the Wastewater Power Generation Station, which uses methane gas to produce energy	July 1985
Urban Water Management Plan adopted	November 1985
East Bay Infiltration/Inflow Correction Program began	January 1986
Policy adopted on interruptible sales of surplus water	October 1986
Wet Weather Capital Improvement Program began	January 1987
Wet Weather Program's National Pollution Discharge Elimination System permit issued	March 1987
Water shortage emergency declared because of drought	March 1988 - September 1989
OP/NET computerized system began controlling distribution system	December 1988
Water Supply Management Program adopted	May 9, 1989
Loma Prieta earthquake damaged EBMUD water and wastewater systems	October 17, 1989
Firestorm in the Oakland-Berkeley hills cut off 2,400 water services and destroyed more than 3,300 homes	October 20, 1991
Six-year Drought Conservation Program ended	April 1, 1993
Updated Water Supply Management Program adopted	October 26, 1993
Seismic Improvement Program adopted to strengthen the water system over 10 years at a cost of $189 million	November 22, 1994
EBMUD's North Richmond Water Reclamation Plant began operation to provide recycled water to the Chevron Refinery for industrial cooling	June 1995
$700 million in water system revenue bonds authorized	February 13, 1996
East Bay Watershed Master Plan adopted	March 12, 1996
The highest Mokelumne River flows in EBMUD history spilled over Pardee Dam	January 2, 1997
Action plan adopted to reduce MTBE and other gasoline components in EBMUD water	Jan. 13, 1998
EBMUD converted from chlorine to chloramine as the water distribution system disinfectant	February 23-April 27, 1998
Wet Weather Program completed	October 1999
Joint powers agreement signed with Sacramento County to establish the Freeport Regional Water Authority	February 2002
Completed upgrade of Mokelumne River Fish Hatchery	October 2002
EBMUD receives patent for safer biosolids (wastewater) processing	January 2003
Completed installation of 11-mile Southern Loop emergency pipeline	June 2004
Mokelumne Aqueducts flooded due to Jones Tract levee break	June 2004
EBMUD named to EPA Top 25 Green Power Partners list	April 2005
Claremont Tunnel seismic retrofit completed	February 2007

The Power Generation Station recovers most of the available energy from methane gas to produce electrical power needed for wastewater treatment.

About The District Organization

BOARD OF DIRECTORS BY WARD

Board Member	Ward	Board Member	Ward
Lesa R. McIntosh	1	Andy Katz	4
John A. Coleman	2	Doug Linney	5
		William B. Patterson	6
Katy Foulkes	3	Frank Mellon	7

EBMUD has a seven-member Board of Directors publicly elected from wards within the service area. Board members serve four-year terms. Board meetings are open to the public and held on the second and fourth Tuesdays of each month at 1:15 p.m. in the EBMUD Board Room, second floor, 375 Eleventh Street, Oakland, California.

ADMINISTRATIVE PROFILE

The District has approximately 2,000 employees under the administrative direction of an appointed General Manager and management staff. Most employees are represented by the American Federation of State, County and Municipal Employees, Locals 444 and 2019; the International Federation of Professional and Technical Engineers, Local 21; and the International Union of Operating Engineers, Local 39.

In 1984, the Board of Directors adopted a Minority Business and Women Enterprise Policy to formalize its established practice of increasing the amount of District business contracted with minority- and female-owned businesses and professional services. In 1998, the Board replaced this program and policy with the Contract Equity Policy and Program and also adopted a policy to increase workforce diversity among District contractors. In 1991, the Board adopted a policy preventing sexual harassment in the workplace. The Board annually reaffirms the District's Equal Employment Opportunity policies and an Affirmative Action Plan. EBMUD is proud to be a leader in taking legal, proactive steps in support of a diverse workforce and in removing all artificial barriers in the workplace to equal employment opportunity.

FINANCIAL PROFILE

EBMUD's revenues come from a variety of sources, including sales of water and hydroelectric power, meter service charges, sewage treatment charges, a wet-weather facilities charge, and a small amount from property taxes.

The 2008 fiscal year budget of $732 million for the water system includes $417 million in capital improvement appropriations. The wastewater system budget of $180 million includes $104 million in capital improvement appropriations.

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附錄五 EBMUD 水資源系統研討會人員名冊

Water System Workshop

November 4, 2009

Taiwan Water Resources Agency, UC Berkeley, Southern California Edison, PG&E, East Bay Municipal Utility District

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