Report on

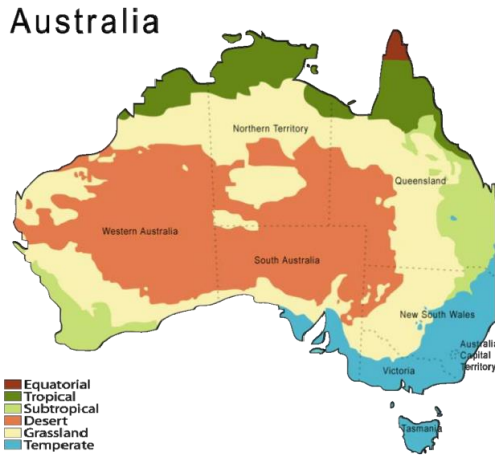
Exposure Visit to Study

Best Practices in Water Resources

Management Initiatives

In Australia

Under European Union- State Partnership Programme



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State Water Resources Planning Department
JLN Marg, Jaipur

Report on Exposure Visit to Study Best Practices in Water Resources Management initiatives in Australia

1.0: Introduction- EU-SPP Programme

The State Partnership Programme (SPP) with the European Union is an effort to support policy based water sector reforms. This programme is funded by a grant of 80 Million Euro (Rs 450 crore) by the EU. An agreement was signed for EU-SPP in August 2006. The initial tenure of the Programme is from January 2007 to December 2013. However, considering the implementation of the Programme Implementation Plan (PIP), an extension upto December 2015 has been recommended by the Government of India and is under consideration of the EU.

There is a provision for exposure visits to study the best practices in water resources management in other countries. This visit was organised in order to study the water resources initiatives in Australia and also to visit some important project sites.

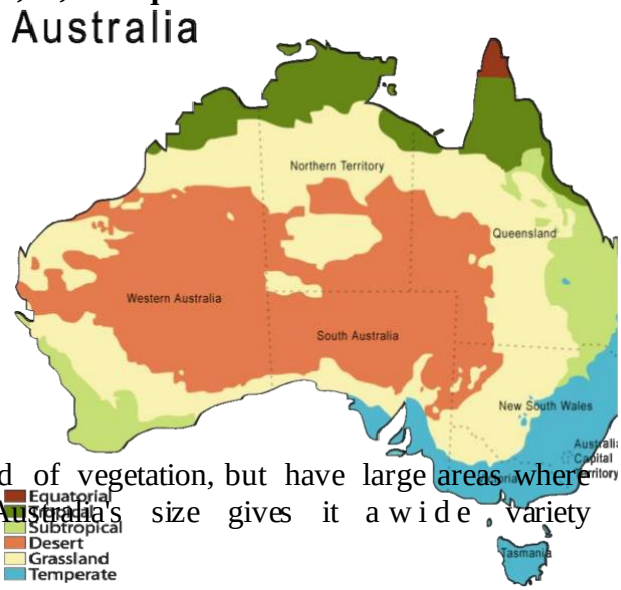
1.1: Objectives of the Visit

The main objective of the visit was to understand how Australia manages its water resources and issues related to water sector. Also to study the recent developments related to decentralisation of decision making and community participation. The visit also included discussions and inter-action with the public administrators, specialised cells and units for water management and field visits to see the data collection/ processing and dissemination in operation.

2.00: Brief about Australia

Australia's landmass of 7,617,930 square kilometres is on the Indo-Australian Plate. Surrounded by the Indian and Pacific oceans, it is separated from Asia by the Arafura and Timor seas, with the Coral Sea lying off the Queensland coast, and the Tasman Sea lying between Australia and New Zealand. The world's smallest continent and sixth largest country by total area, Australia—owing to its size and isolation—is often dubbed the "island continent", and is sometimes considered the world's largest island. Australia has 34,218 km of coastline (excluding all offshore islands), and claims an extensive Exclusive Economic Zone of 8,148,250 square km. This exclusive economic zone does not include the Australian Antarctic Territory. **Compared to this the area of India is 32,87,590 square km and that of Rajasthan is 3,42,239 square km.**

The deserts of Australia cover 3,71,000 square kilometres, or 18% of the Australian mainland. The largest of the landform types covering Australia, deserts – and their arid climatic conditions – are found primarily in the western plateau and interior lowlands of the country.



Deserts are not necessarily completely devoid of vegetation, but have large areas where vegetation is very limited in height or extent. Australia's size gives it a wide variety

of landscapes, with subtropical rainforests in the north-east, mountain ranges in the south-east, south-west and east, and dry desert in the centre. It is the flattest continent, with the oldest and least fertile soils; desert or semi-arid land commonly known as the outback makes up by far the largest portion of land. The driest inhabited continent, only its south-east and south-west corners have a temperate climate. The population of Australia is 2.32 crore (2013) and that of Rajasthan is 6.86 crore (2011). Density of population is only 2.8 inhabitants per square kilometre, which is among the lowest in the world, although a large proportion of the population lives along the temperate south-eastern coastline.

Eastern Australia is marked by the Great Dividing Range, which runs parallel to the coast of Queensland, New South Wales and much of Victoria. The northernmost point of the east coast is the tropical-rain forested Cape York Peninsula.

The climate of Australia is significantly influenced by ocean currents, including the Indian Ocean Dipole and the El Niño–Southern Oscillation, which is correlated with periodic drought, and the seasonal tropical low-pressure system that produces cyclones in northern Australia. These factors cause rainfall to vary markedly from year to year. Much of the northern part of the country has a tropical, predominantly summer-rainfall (monsoon) climate. The southwest corner of the country has a Mediterranean climate. Much of the southeast (including Tasmania) is temperate.

2.01: Rajasthan and Australia:

The State of Rajasthan and Australia have many natural and geo physical conditions common. The climate, rainfall and water scarcity are as severe in Australia as in Rajasthan. Australia is the driest inhabited continent in the world. Rainfall is variable and droughts are common. Drought, climate change and water scarcity make water reforms and improved water management more necessary than ever. Erratic rainfall and reduced inflows have placed many rivers and ground water systems under stress, similar to Rajasthan, with adverse impacts on the environment. At the same time, the demand for urban and rural drinking water, industrial use and other sectors is increasing every year. This has necessitated the need for improvement in the existing water management system and to introduce modern technologies and methods to meet the challenges in water sector.

Exposure visit to Australia is a step in this direction and has provided a platform to get acquainted with the modern water management practices.

2.02: Deserts of Rajasthan

Rajasthan Desert covers an area of more than 2,00,000 km^2, within the Indian state of Rajasthan, covering the districts of Jaisalmer, Barmer, Bikaner and Jodhpur, and some region of the states of Punjab, Haryana and Gujarat. It is part of the Great Thar Desert (4,46,000 sqkm) and is a large, arid region in the north western part of the Indian subcontinent and forms a natural boundary running along the border between India and Pakistan.

The Thar Desert is thinly populated; the town of Bikaner is the largest city in the desert. The Northwestern thorn scrub forests lie in a band around the Thar Desert, between the desert and the Aravallis. This region receives less than 400 mm of rain in an average year. Temperatures can exceed 48 °C in the summer months and

drop below freezing in the winter.

The visit was organised at the invitation of **Centre of Excellence in Water Resources Management (ICEWaRM), Australia.**

2.03: Brief about ICEWaRM

International Centre of Excellence in Water Resources Management (ICEWaRM) is an Australian Government initiative being implemented by a national consortium of shareholders, supporters and associates. Partnership is a key feature of the Centre, which recognises that the pursuit of excellence in the increasingly important water resources management sector must be a collaboration task. It provides a national focus and international gateway to Australia's leading education, training and research expertise in water resources management. It organises international visits and exchange programmes for developing nations and also supports research programmes in water sector.

3.00 The Delegation

The delegation of nine officers was led by Dr. Lalit Mehra, Principal Secretary to Government, Water Resources and State Water Resources Planning Department and included senior officers from the Line Departments, which are partners in the EU-SPP. The list of delegation is appended at **Annex-1.**

The detailed Programme of the visit to Australia is appended at **Annex-2.** During the visit, meetings with key national agencies, officials and policy makers were organised and also field visits to important water resources projects and farms were also undertaken.

4.00: Meeting with National Water Commission, Australia

A meeting was organised with the National Water Commission, Australia on 23rd October. The National Water Commission is an independent statutory authority that reports to the Australian Government Minister for Climate Change and Water. The Commission operates under the auspices of the Council of Australian Government (COAG). The Commission was established under the National Water Commission Act 2004, to drive the national water reform agenda. It provides advice to COAG and the Australian Government on national water issues and assesses progress under the National Water Initiative (NWI).

The Commission also assists the Governments in implementing the NWI and administers the Australian Government's $ 200 million Raising National Water Standards Program. This programme offers support for projects that are improving Australia's national capacity to measure, monitor and manage its water resources.

The funds are directed at activities across following three strategic investment areas:

- Implementing the National Water Initiative
- Improving integrated water management across Australia
- Improving knowledge and understanding of water resources of the country.

During the meeting, a presentation was made on the objectives, activities and functions of the Commission by Mr Matt Kendall. There was a lively discussion and inter-action with the officials of the Commission and the delegation members.

4.10 : The National Water Initiative:

In Australia, primary responsibility for water management is vested in its eight state and territory governments. But, all governments recognised that better water management of the water resources is a national priority. Considering this, in the year 2004, the Council of Australian Governments (COAG) agreed on a policy blueprint to improve the way Australia manages its water resources called **The National Water Initiative.** The NWI includes more effective water planning to determine how the States share valuable water resources between competing uses, protection of significant environmental assets, expansion of water markets, and improved security of water supplies and entitlements.

The NWI is Australia's enduring blueprint for water reforms.NWI is designed to increase the efficiency of Australia's water use, leading to greater certainty for investment and productivity, for rural and urban communities and for the environment. The prime objective is to achieve a nationally compatible market, regulatory and planning based system of managing surface and ground water resources for rural and urban use that optimises economic, social and environmental outcomes.

5.00: Meeting with Murray Darling Basin Authority (MDBA):

5.10: Murray Darling Basin: The catchment areas of the Murray and Darling Rivers and their tributaries define the Murray- Darling Basin. Comprising 23 river valleys and extending over 1 million sq km, the Basin includes parts of New South Wales, Queensland, Victoria and South Australia, and all of the Australian Capital Territory. It drains around one-seventh of the Australian land mass and is one of the most significant agricultural areas in Australia.

Most of the 1 million km2 (14% of country) basin is flat, low-lying and far inland, and receives little direct rainfall. The many rivers it contains tend to be long and slow-flowing and carry a volume of water that is large only by Australian standards. There are about 15 major rivers in the Basin. The important being: Darling (2740 km); Murray (2530 km); Murrumbidgee (1690 km); Condamine- Culugoa (1375 km) and Lachlan (1370 Km).

Total water flow in the Murray–Darling basin has averaged around 24,000 MCuM per year. This is the lowest rate of the world's major river systems. About 6.0 percent of Australia's total rainwater falls into the basin.In most years only half of this

quantity reaches the sea and in dry years much less. Estimated total annual flows for the basin have ranged from 5,000 MCuM in
1902 to 57,000 MCuM in 1956. The Basin is Australia's most important agricultural region, producing around one third of the country's food supply and contributes billions of dollars to the country's national economy. The natural environment of the Basin is important for tourism and recreation, and contains about 60,000 sq km of flood plains and 30,000 sq km wetlands.
The Murray- Darling Basin system has extreme variations in annual water inflows. High rainfall variability is one of the most significant challenges in managing the water resources of the Basin to meet social and economic needs while maintaining a sustainable environment.

5.11: The Murray–Darling Basin Authority: The Murray- Darling Basin Authority (MDBA) is an independent expertise based government agency responsible for planning and management of both surface and ground water across the Basin.

The primary role of the Authority as outlined in the Water Act 2007 includes:

- preparing and reviewing the Basin Plan
- measuring, monitoring and recording the quality and quantity of the Basin's Water resources
- supporting, encouraging and conducting research and investigations about the Basin's Water Resources
- developing equitable and sustainable use of Basin water resources
- disseminating information about the Basin's water resources; and
- engaging and educating the Australian community about the Basin's water resources.

The Authority members have expertise and experience in water, economics, the environment, natural resource management and agriculture. A number of Advisory Committees support the Authority's work.The MDBA comprises the Chair, Chief Executive and four part time members and is supported by an organisation of around 300 staff. It is assisted by a number of specialists and regional committees. These Committees provides advice to the MDBA on various environmental, social and economical aspects of water management in the Basin. MDBA reports to the Australian Government Minister for Water and to the Murray- Darling Basin Ministerial Council. This Council is comprised of water ministers from the Basin States.

A meeting was organised with the authorities of MDBA in their Corporate Office. In this meeting presentations on the activities and technical aspects of the Authority by Dr Joseph Davis, Senior Director of River Operations Management on the subject **"Assets and Operations under MDBA"** and Mr. Pradeep Sharma, Acting Senior Director of Water

Resources, on the subject **"Water Resources Planning and Management in MDBA".**

Average runoff in the Basin is 32,000 GL (MCum) shared by five States who have the responsibility for managing the water resources. The water use is 13,600 GL (MCum) and the flow to the sea is 5141 GL (MCum).

The important aspect of the system is that:

- All Water is owned by the States
- State Governments issue licences for various water uses according to the priority
  Types of water licences:
    - ***High Security***
    - ***Low Security***
    - ***Water Harvesting***
    - ***Supplementary Access***
    - ***Town Water Supply***
    - ***Stock and domestic***
    - ***Industrial water use***
    - ***Environmental water use***

The Murray Darling Basin is one of the best managed basins in the world. It manages all available water resources, allocations under competitive uses, works out availability of water for different uses and also resolves various issues related to the water utilisation. Depending on the flows in the basin the inter sectoral allocation is reviewed keeping in view the demands and available supplies to maintain a balance between different sectors. For proper allocation of water to various sectors, various models are used by the MDBA'.

Examples of models used by MDBA are:

- Continuous water accounting
- Salinity management strategy
- Cap on diversions
- Changed operating rules
- Environmental flow rules
- Interstate water trading
- Basin Plan
- Compliance and auditing

These models are developed by MDBA and are used for efficient water allocation and management.

In the presentation made by **Mr Joseph Davis**, details of the Assets under the MDBA and their operation were highlighted.

The ***Assets*** comprise the Hume Dam; the Dartmouth Dam; the Yarrandaga Weir, Lake Victoria; Menindee Lakes (four main lakes), and Locks and Weirs; Barrages.

The Asset Management:

- Assets are "controlled" by the River Murray Operations Joint Venture comprising Australian Government and states of NSW, Victoria and South Australia
- The Authority is the agent of the Joint Venture and funds and directs the Asset Management Program
- Each state has a Constructing Authority which is responsible for design, construction, operation and maintenance

These assets are managed by the MDBA considering the aspects relating to water sharing, system constraints, travel time from one asset to another and also the bulk water transfer.

The visit to MDBA and the deliberations and inter- action with the experts during their

presentation was very educative as the members could have an introduction to the latest water management methodologies.

6.00: Visit to e-Water: In the afternoon of 23rd October the delegation members visited the office of organisation "e-Water". **e-Water Source** is an Australian-wide collaboration effort backed by the Australian Government, built to meet the myriad climatic, geographic, water policy and governance settings across the country. Australia's first national river basin scale water modelling system, it represents a substantial step forward in managing the water resources of the country.
The Source modelling platform allows users to build on, rather than replace existing models. It has been developed to take a holistic approach to water management including human and ecological impacts. This includes integrating policy, addressing water savings and sharing for a whole river and connected groundwater systems including cities, agricultural and environmental demands. As such it boosts the capability of managers to use robust and defensible science to give advice to policy and decision makers.

e-Water Source enables local knowledge, data and models to be combined with industry best practice to generate effective, transparent catchment management scenarios and options. The software provides a framework for modelling the amounts of water and contaminants flowing though a catchment and into major rivers, wetlands, lakes, or estuaries. Source integrates an array of models, data and knowledge that can be used to simulate how climate and catchment variables (rainfall, evaporation, land use, vegetation) affect runoff, sediment and contaminants. The output can be used to offer clear scenarios and options for making improvements in a catchment.

e-Water Source can be used in planning and operations modes for river management and has been developed to address water sharing and savings for entire river and connected groundwater systems. It offers important new features and capabilities dealing with water reform, climate change and environmental water.
Source provides a consistent modelling environment to support transparent river management decisions. Fundamental to this design is the flexibility which makes it readily customisable and easy to update as new science becomes available. New capabilities can be incorporated via plug-ins developed to suit particular needs

A presentation was made by Dr Robert Carr, of e-water, on the use of models for water resources planning. Government of India, Ministry of Water Resources, has entered into an agreement with the Australian Government, wherein the Australian Government will help

India in preparation of Action Plans charting out various activities including IWRM in River Basins of the country. Initially the plan will be prepared for the Brahmani- Baitarni River Basin of Orissa. In this Project, ewater will extend the technology to the Indian Government. The models developed by ewater can be customised by users to address specific local problems and can also be pre- configured for typical IWRM situations.

The models developed by ewater can be used for river basin planning in the State, in which it would be possible to address various issues related to surface and ground water availability, environmental issues, present and future projected demands and anticipated availability. The organisation has already taken up the studies in Orissa. Once the reports are received and approved by the MoWR, the State Government can also request MoWR, GoI to take up basin studies in Rajasthan also.

7.00: Visit to Hume Dam:

On 24th October 2013, the delegation members visited the famous Hume Dam. This is one of the most important structures in the country.

The Hume Dam is on the Murray River 16 kilometres upstream from Albury-Wodonga. The primary purpose of the Hume Dam is to conserve water in periods of high river flow for later release in periods of low river flow; in other words, the Hume Dam was built to change the flow of the Murray River to meet agricultural goals. Water from the dam is mainly used for irrigation in Victoria, New South Wales and South Australia but water is also diverted from the Murray River for domestic use, for industrial use and for urban water supplies in South Australia.

While the primary purpose of the Hume Dam is for water conservation, mainly for irrigation, the dam also has a flood-mitigation function if water storage space is available. The Hume Dam also incorporates a hydro-electric power station and the water storage is available for recreational pursuits and water sports.

In 1915 the River Murray Waters Agreement, ratified by the Commonwealth Government and the governments of Victoria, New South Wales and South Australia, provided for water storage on the upper Murray and the site of the Hume Dam was subsequently selected from 25 alternatives. Construction began in 1919 with planned capacity of 1,360 gigalitres (MCum). In 1924 planned capacity was increased to 2,470 gigalitres (MCum) but this was reduced to 1,540 gigalitres (MCum) due to the Depression. Construction was completed in 1936.

The Snowy Mountains Scheme provided increased water flows in the Murray River and the Hume Dam was enlarged as part of the Snowy scheme to its current capacity of 3,038 gigalitres (MCum). This work, including the addition of 29 spillway gates, was completed in 1961. In 1957 a 50 megawatt hydro-electric station was incorporated into the Hume Dam to generate power from released water.

Description:
The dam itself is made up of four embankments and a concrete spillway section. Total length is 1,616 metres. Capacity is 3,038 gigalitres (MCum). The spillway hoist bridge is 51 metres above the bed of the storage. Total surface area is 201.9 square kilometres. The two longest earthen embankments (numbers 1 and 4), on either side of the concrete spillway section have a central concrete core 1.8 metres thick at the base, tapering to 0.6 metres at the top. On both sides of the core wall there is a narrow zone of selected clay as well a vertical drainage zone on the downstream side. The remainder of the embankments are earth. The core concrete wall is an impervious waterproof wall while the surrounding earth and clay provides the strength for the wall.

Operation:
The Hume dam is the primary regulating storage in the Murray system and receives water from its own catchment, from the Dartmouth Dam (on the Mitta Mitta River) and from the Snowy scheme. The volume of water in the Hume storage usually increases during winter and spring, although inflow in a drought year may be only about ten per cent of inflow in a flood year. Water is released into the Murray River from November to May, primarily to supply irrigation water. The storage is full enough to spill water on average one year in two; although there can be several drier years in succession when it does not spill.

While the storage is being filled a minimum of 600 megalitres (Thousand Cum) per day is released to provide sufficient water flow for downstream environmental needs and to ensure the health of river bank vegetation. Filling typically lasts from the end of the irrigation season in mid-May to late winter or spring and may overlap with flood control. If space is available in the storage, flooding flows from upstream will be absorbed and downstream regions will be fully protected from flood. But if the storage is full then flood inflows are passed downstream via the spillway gates and power station without endangering the dam itself. If storage levels and inflow are high in winter or spring, before the irrigation season, then water may be released to provide space in the storage to mitigate floods; this "pre-release" water is in excess of downstream needs but does not exceed river channel carrying capacity. Hume Reservoir provides significant flood protection for downstream areas but once the storage is full its flood mitigation potential is very limited until water is released.

As the irrigation season begins, water is released into the Murray River. Water takes 25 days to reach the South Australian border so releases must be made well in advance of requirement. During the peak of the growing season the daily demand in South Australia and in the irrigation areas along the Murray can exceed 30,000 megalitres a day but the river channel can handle only 25,000 megalitres a day between the Hume and Yarrawonga. Further downstream, narrowing in the river at the Barmah Choke near the Barmah Millewa forest can handle only 8,500 megalitres a day before flooding occurs; a further 2,000 megalitres a day can be sent via the Edward River.

As far as possible, releases are lower than channel full capacity to minimise disruption for people living and working along the river. To minimise the need for high flows, efforts are made to release water to lower storages, such as Lake Victoria near the South Australian border, early in the season. The dam and its regulation systems are well maintained. The surroundings are picturesque and well developed. This is also a favourite picnic spot for the local people as well for tourists. The Hume Dam is amongst the most important assets managed by MDBA. The entire command area under Hume Dam is very well managed through computerised control system regarding water requirements and releases.

8.00: Visit to Shepparton/ Tatura

The delegation visited large scale irrigation schemes and farms in the Shepporton and Tatura areas on 25th October. The canal system, control structures, water demands and releases are all managed by well laid-out control mechanism and operated by a team of well trained technical personnel. In this regard, a visit to the organisation Goulbourn Murray water was arranged in the morning session. In this session, presentations were made by the authorities responsible for management of the water resources in the area.

8.10: Goulburn Murray Water:

Goulburn Murray Water (GMW) is a statutory Corporation established under the Victorian Water Act (1989). GMW has functions and powers to store, manage and deliver water across most of Northern Australia. Presentations were made by Mr Phil Hoare, Head of Customer Support, GMW and Mr Mark Bailey, Manager, Water Resources and also by Mr David Dowell.

The key responsibilities of GMW are:

- Managing the delivery of water to its irrigation and water districts and maintaining the infrastructure for these districts
- Implementing Governments regulations and policy for ground water and surface water resource management in accordance with delegated powers
- Delivery of GMW's Connections Project
- Harvesting, storing and maintaining water in its reservoirs and dams
- GMW services a region of 68,000 sq km, bordered by the Great Dividing Range to the south, the River Murray to the north, and stretching from Corryong in the east to Nyah in the west. The key infrastructure under GMW includes:
- 6300 km of irrigation channels
- 16 large dams and 3000 km of irrigation drains.
- 76,000 structures,6,900 km of channels and 900 km of pipes
- GMW also operates salinity- mitigation works in the region is also the Victorian Authority for the Murray Darling Basin Authority (MDBA).
- The most important aspect of water management by GMW is the concept of water entitlements, share of water by each shareholder and water trading.
- The entire system is computerised with all details of water availability, time and quantum of water demands and water trade.
- GMW also manages and regulates about 50 % of Victoria's groundwater resources.
- Other key functions include license and management bore construction and

ground water use, develop and administer statutory and local resources management plans and recommend resource allocation limits

- All operations are controlled by Central System Operations by using modernised technology.

The delegation members also visited the farms where the equipment were installed and operated under the centrally operated system. Actual demand of water was conveyed to the control room and water was delivered in the channel.

This technology and centrally operated control system facilitates ensuring timely supply of water in the field channels. It was informed that the stakeholder has to convey his demand of water 48 hours in advance to ensure its delivery at desired time and quantity.

9.00: Visit to Melbourne:

The delegation members visited Melbourne City on 26th October. During the day we visited one of the most popular Cricket Grounds in the world, The Melbourne Cricket Ground (MCG). Also visited various galleries, museums and other places of interest in the complex. Also visited the famous Tennis Ground the Rod Lever Arena, where the Australian Open, which is one of the four Grand Slam Tournaments is held.

During the journey by road, we also visited some big farms where grapes were grown, by using well laid out Drip Irrigation System. It was informed that big vineyards are used primarily to use the crop for brewing famous wine of Australia. This is an important economic activity, as the Australian wine is very popular. In all vineyards, drip irrigation system is practiced.

10.00: Visit to Lower Lakes and Murray River Mouth: The delegation members visited the Lower Lakes and Murray River Mouth, where the River meets the ocean. We also visited the Goolwa Barrage under MDBA, where the River meets the sea. The lower lakes, Coorong and Murray Mouth icon site extends over 1,40,000 ha. It features mosaic of 23 different wetlands types, from fresh water lakes to hyper marine lagoons. This is highly significant conservation area in Australia recognised internationally as breeding ground for many species of native fish and water birds.

Keeping Murray mouth open ensures that Coorong remains an important estuary freshened by sea water helping reducing salinity and allows fish to migrate between the sea and the Coorong. Murray mouth is the only place where contaminants such as silt, salt and nutrients can be discharged from the Murray Darling Basin into the ocean. So closure of the mouth has serious ecological consequences.
River Murray Barrages were constructed in the year 1940. At this place Murray Mouth Sand Pumping Project is also undertaken by the Government.

11.00: Meeting with Department of PIRSA:

On 28th October, a meeting was organised with senior officers of the Government in Adelaide. In this meeting, presentations were made by Mr Andrew Johnson, Executive Director, Department of Primary Industries and Regions South Australia (PIRSA) and Ms Julia Grant, Executive Director, Policy and Strategy. In these presentations, brief history of Murray Darling Basin operations, MDB Agreement, Basin Plans which became an enforceable instrument in March 2013 were explained and discussed. The Agreed Water Policy Objectives were defined as under:

- Water security
- Water use efficiency
- Water for the environment
- Sustainable supply
- Tradability of water
- Better metering and water accounting
- Improved science, socio-economic input to decisions
- Better, more participatory, water decision making

The most important aspect of the water management in Australia is the entitlements to the shareholders and water trading. The basic idea is that once a shareholder gets water as per his entitlement, and the water is surplus, he can trade that water with other shareholders. This gives an opportunity to both the partners to make best use of the available water. Even in the cases where the water allocation is less than the entitlement and the shareholders think that this quantity of water will not cater to their requirements, they can trade that water with others and can use the money elsewhere in better propositions.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12.00: Department of Environment, Water and Natural Resources (DEWNR):

The Department of Environment, Water and Natural Resources (DEWNR) was created on 1st July 2012 to bring together environment and natural resources management in South Australia. The new Department was created by amalgamating the Department for Water and the Department of Environment and Natural Resources.

DEWNR's role in managing the State's natural resources ranges from policy leadership to on-ground delivery with regional Natural Resources Management Boards. The issues on which the Departments works include water security, climate change, sustainable land management, public estate management and biodiversity conservation. DEWNR provides practical advice to government, industry and communities to achieve productive and balanced use of natural resources and to help improve the condition and resilience of our natural systems.

DEWNR works closely with communities and a diverse range of partners to help them make good decisions about how the natural resources are used and managed, and to help South Australians care for the land, water and sea.
DEWNR is part of the Environment and Conservation Portfolio and reports to the Minister for Sustainability, Environment and Conservation, and Minister for Water and the River Murray. DEWNR's work helps government achieve its priorities and is informed by the government's commitments set out in South Australia's Strategic Plan and the State Natural Resources Management Plan and also by the Corporate Plan 2012-2014.

Creation of a separate Department by amalgamating water, natural resources and environment is a major policy reform initiated by Australia. It helps in integrated planning of natural resources, wherein all aspects related to water, environment, forests etc are suitably addressed on one platform. This has also greatly reduced inter sectoral disputes and conflicting interests and helped in improved environmentally sustainable planning of natural resources including water.

13.00: Visit to Rainwater/Stormwater Harvesting Structure: The delegation visited a site where large scale stormwater harvesting structure was constructed. The water in the rainy season on the roads is diverted into an underground reservoir through drains alongside the roads. The water enters into the reservoir through filters, so that the impurities, tree leaves, *kankar* etc are prevented from entering the reservoir. The water so collected in the reservoir is used by pumping in case of need in dry season for irrigation. It was informed that such structures are constructed successfully at many places to store storm water during rains to be used later when needed.

14.00: Conclusion of the Visit: The exposure visit to Australia concluded with the visit to rain/stormwater harvesting system. During this visit, the members had a firsthand experience of technological advances made by Australia in the field of water resources management.

15.00: **Important Features of Water Resources Management in Australia:** During the exposure visit, the delegation members acquainted themselves with the water resources scenario in Australia and also the management aspects of water resources. Some of the important features of water resources management in Australia are as under:

15.01 National Water Initiative

The NWI is a policy blueprint to improve the way Australia manages its water resources. The NWI includes more effective water planning to determine how the States share valuable water resources between competing uses, protection of significant environmental assets, expansion of water markets, and improved security of water supplies and entitlements. The implementation of NWI is the responsibility of the National Water Commission.

15.02 National Water Commission

The Commission was established under the National Water Commission Act 2004, to drive the national water reform agenda. The Commission is an independent statutory authority that provides advice to the Council of Australian Governments (COAG) and the Australian Government on national water issues and assesses progress under the National Water Initiative (NWI). This programme offers support for projects that are improving Australia's national capacity to measure, monitor and manage its water resources. The Commission's activities include following strategic areas:

- Implementing the National Water Initiative
- Improving integrated water management across Australia
- Improving knowledge and understanding of water resources of the country.

In Rajasthan, the proposed State Water Regulatory Authority can shoulder the responsibility of Integrated Water Resources planning and Management across the State. A programme on the lines of NWI, can be launched under the aegis of WRA as "Rajasthan State Water Initiative" encompassing all issues relevant to water availability and present and projected water demands by various sectors in consultation with concerned departments, agencies and NGOs involved in water sector development, subject matter specialists etc. This would facilitate the State Government prepare short term and long term plans for implementation for sustainability.

15.03 Murray Darling Basin Authority

The Murray Darling Basin Authority (NDBA) is a unique example how the waters of various River Basins in a country can be managed. The MDBA is an independent expertise based government agency responsible for planning and management of both surface and ground water across the Basin. In India, setting up independent River Basin Organisation (RBO) is under consideration of the Government of India for a pretty long time. Organisational structure, functions, role and responsibilities of the RBA were also suggested. But no headway could be made in this direction, mainly due to conflicting socio political reasons. This type of organisation in the State can pave way for better

utilisation of the available water for different purposes, explore possibility of inter basin transfer within the state, regulate and control surface as well as ground water and prepare long and short term plans.

Rajasthan can consider setting up a River Basin Organisation (RBO) for development, harnessing and managing water resources on pilot basis. An initiative can be made with a basin wherein no interstate issues are involved. A proposal, in consultation with the MoWR and CWC can be prepared. The experience of MDBA in managing the water resources in Murray darling Basin can be highlighted before the politicians, senior bureaucrats and experts. If possible, delegations can be sent to study the functioning and success story of MDBA for its replication in Rajasthan. However, before setting up RBO, mass scale awareness programmes, persuasion, involvement of farmers, education and training needs to be undertaken for its acceptability.

15.04 Use of Advanced Technology

Water management can be improved significantly by using advanced technology in water distribution, control and canal regulation. The organisations like "e water" and Goulbourn Murray Water are using advanced computerised technology, automated gate control system for releasing desired discharge in the channels at specified time and quantity. Central system operation and complete canal network is available on computer and is able to be controlled from office control room. Similarly, motorised Head Regulators and automated gates along channels network are installed and controlled from central control room through computers. In addition, improved metering system for measuring discharges in channels also helps in ensuring supply of water at right time and in required quantity. Devices are installed in field to measure the discharge. The farmer has to inform the control room about his requirement of water at time and outlet at least 48 hours in advance. The control room works out the distribution system to ensure supply of this discharge, which can be measured on the meters installed in the field.

This type of advanced technology can be adopted in the State also. For this purpose, a major irrigation project like Mahi or Bisalpur can be taken up on pilot basis. The selected project should have well laid out canal and distribution system. A comprehensive project for introducing advanced technology for canal regulation and water distribution can be prepared in consultation with one of the Australian organisation by outsourcing. The selected organisation can prepare a detailed project report (DPR) for the pilot project for consideration and approval of the Government. The Project then can be implemented in phases.

15.05 Water Entitlements

Water Entitlements are an important feature of the Australian water management system. The water entitlement ensures that the stakeholder has the right mix for his irrigation business today and into the future. The water share of a stakeholder defines the volume of "storage space" he holds in the water storages, (dams and weirs) that harvest and store water in the regulated river system. It also defines the share of water resources of a stakeholder in the regulated river system. It is the amount of water available to each stakeholder each year and is called a seasonal allocation and is

expressed as a % of his water share. Each allocation announcement involves dividing the amount of water available for a high or low reliability allocation by the volume of high or low water shares in that system.

The shareholder also has the opportunity to carry over unused allocation from one season to the next. Water shares are the basis for sharing O&M costs across all entitlement holders in that system.

The entitlements are clearly defined and supply of water is ensured in the system. The stakeholders therefore are willing to pay the O&M charges as per their share. In the Pilot Project selected for introducing advanced technology, water entitlements should also be clearly announced so that the farmers are aware of their share in the stored water available for distribution.

15.06 Water Trading

Water trading is the most significant aspect of the Australian water management strategy. The concept is very simple. The entitlement of a farmer or stakeholder in the stored water is decided and announced by the controlling authorities. In case the stakeholder receives water less than his share, which cannot be utilised by him fruitfully in a financially viable method, he can trade his share of water with another stakeholder at a rate prescribed by the authorities, who can use this additional water for increasing his command, use for industry or in any other way to get maximum benefit out of it. This is mutually beneficial for both the parties and widely accepted and acknowledged as an effective tool for water utilisation. Similarly, in case of excess water than the fixed share, received by a stakeholder, he has the option to trade that water with others for mutual benefit. Besides, the shareholders have the opportunity to hold their share and carry over the unutilised share/part from one season to the next. This system enables the shareholders to optimally utilise their share of water in the most efficient, economical and systematic way.

Water trading concept can be introduced in the State in the canal command area in the North. In the IGNP, Gang and Bhakra canal systems, warabandi is being successfully practiced for a long time. In these systems, farmers' share in available water is also decided in accordance with their land holdings. This is similar to the water entitlements in Australia. However, with some difference. In Australia, in addition to the farmers, water allocation for other uses is also announced, like for industries, whereas, here only farmers' share is fixed. For introducing this system successfully, a lot of spade work will be required. Notifying the areas of each stakeholder, introduction of modern techniques for water distribution and measurement, canal control structures, automated gates along channels will be required. Over and above, for acceptability of this concept of water trading, widespread awareness programmes, both for farmers and public representatives will have to be taken up.

15.07 Creation of DEWNR

The Department of Environment, Water and Natural Resources (DEWNR) was created on 1st July 2012 to bring together environment and natural resources management in South Australia. The new Department was created by amalgamating the

Department for Water and the Department of Environment and Natural Resources. This is an important policy decision towards better water resources management in Australia. Like India, it was observed that the water resources projects got delayed mainly because of environmental and forest related issues. In most of the water resources projects, environmental impact studies are conducted. Protection of environment has become a matter of concern for all countries.

By creation of a separate Department dealing with water resources, environment and forests and natural resources, many hurdles which are faced in approval of development projects are sorted out much faster. This ensures water resources development with concern for environment and natural resources protection.

For integrated and multidisciplinary planning of water and other natural resources, it is necessary that inter sectoral conflicts and issues are addressed at a common platform. Creation of a separate Department for this purpose has paid rich dividends. The water resources projects are being implemented with greater concern for environment. This has resulted in timely approvals and has minimised inter sectoral clash of interests. In Rajasthan also, the State Government may consider bringing all water related departments, environment and forest under one umbrella.

16.00 Lessons learnt

The exposure visit to Australia has proved very useful for the delegation members and the State Government. Australia has made commendable progress in managing its water resources. Administrative and technological policy reforms have been successfully implemented in the field. Some of the important lessons learnt from the visit are as under:

- Integrated planning, development and management of available surface and ground water resources is necessary. The National Water Initiative programme launched in Australia has made it possible to develop water resources in a most scientific way.
- River Basin Organisations (RBO) are essential for integrated and inter disciplinary development and management of water resources. The experience and success story of Murray Darling Basin Authority (MDBA) has won accolades the world over in water resources management. This is perhaps the best managed River Basin in the world.
- Active involvement of stakeholders in the river basin planning is necessary. Their orientation, awareness, active participation in decision making, acceptance to the rules and regulations laid down by the Government, education and training are some of the most significant aspects in river basin management.
- Introduction of advanced technology in regulation, distribution, measurement and monitoring of water resources is the essence of success in water resources management. The entire operations in the Murray darling Basin are computer operated and are centrally controlled by trained operators. The stakeholders are also aware of their rights and system operation so that they can convey their water demands and also monitor it.
- Water entitlements of stakeholders are well defined and notified. They have the option of trading their water share with others. The entitlements are given to the farmers, industry, urban water supply corporations, investors, environment managers from ground surface water. Water entitlement are registered like land records. Customers can buy, sell and carry over their water entitlements to next season under intimation to the Authorities.

- Water Trade is an effective tool for efficient utilisation of the available water. The concept of water trade with mutual consent has been very successful both in the condition of scarcity and surplus water scenario.
- Creation of Department of Environment, Water and Natural Resources (DEWNR) in July 2012 to bring together environment and natural resources management by amalgamating the Department for Water and the Department of Environment and Natural Resources has been very effective in sorting out inter departmental disputes and issues in the interest of environment conservation and protection.
- Waste water is treated and recycled and reused for non agricultural purposes. At few places separate pipelines are laid for fresh [potable water and treated water for gardening etc with clear demarcation. Treatment, recycle and reuse of water has now become necessary.

17.00 The Way Forward

On the basis of exposure visit, discussions held with various administrative and technical organisations, it is suggested that the State Government may consider introducing innovations in water resources management in phases. Suggested short and long term measures are as under:

17.01 Short Term Measures

In order to improve overall water resources management scenario in the state, following short term measures are suggested:

- Preparation of integrated basin level plans for all river basins in the State. This work is being carried out presently by Tahal Consultants under EU SPP Programme.
- Selection of one Irrigation Project or canal system on pilot basis for introducing modern technologies like automated gates, measuring devices, computerised water distribution system for releasing water as per requirement.
- Rehabilitation, restoration and modernisation of canal system of this pilot project so that modern technologies can be introduced.
- Preparation of Project Proposal for this pilot project by outsourcing, preferably to international water management organisations such as e-water of Australia.
- Empowerment and awareness generation of Water User Associations, water user groups regarding use of their water share, remedial measures for increasing efficiency of water application.
- More exposure visits by delegations comprising engineers, farmers, administrators, policy makers and politicians to get first hand experience of innovative strategies and best practices introduced in other countries to generate awareness and pave way for acceptability of new technologies and policy reforms.
- Proper documentation of decided water shares of stakeholders in the selected project.

17.02 Long Term Measures

- Setting up River Basin Organisation (RBO) in a selected basin for efficiently managing water resources on the lines of Murray Darling Basin Authority.
- Defining water entitlements of stakeholders for different water users such as agriculture, industry, domestic water supply agencies in the selected basin or project.
- Introduction of the concept of "Water Trade" in the State to facilitate the stakeholders to trade their share of water for mutual benefit. This would be an onerous task, as the local public representatives will have to accept this concept for its successful implementation.
- Defining the role and responsibility of the proposed Water regulatory Authority (WRA) to bring all water sector activities under one umbrella.
- Introduction of new legislations, wherever necessary, as per new policy reforms for efficient water management.
- Creation of a separate Department for integrated planning of water resources projects with proper representation of environment, forest and natural resources agencies.

Annexure-1

Names of delegates from Government of Rajasthan for the visit to Australia in October 2013

1. Dr. Lalit Mehra, Principal Secretary, WRD/SWRPD, Jaipur
2. Shri Pyare Lal Solanki, Chief Engineer, Water Resources Department, Jaipur
3. Shri Pradeep Mathur, Chief Engineer, SWRPD, Jaipur
4. Shri Narendra Kumar Meena, Chief Engineer, GWD, Jodhpur
5. Shri Rajeh Kumar Bhardwaj, Additional Chief Engineer, RD&PR, Jaipur
6. Shri Mahesh Chand Parewa, Executive Engineer, SWRPD, Jaipur
7. Shri Dharmesh Kumar, Executive Engineer, SWRPD, Jaipur
8. Shri Virendra Kumar Balana, Executive Engineer, PHED, Jaipur
9. Shri Dinesh Kumar Nagori, Executive Engineer, PHED, Pokaran

Annexure-2

Study Tour Programme

Date	Location	Activity
Tue 22 Oct 2013 Day – 1	Arrive Canberra	Rest and recovery. Local sightseeing available Light briefing
Wed 23 Oct 2013 Day – 2	Canberra	Overview of water management in Australia, meetings with key national agencies and officials-policy and technical e.g. • National Water Commission • Murray-Darling Basin Authority • Department of Sustainability, Environment, Water, Population and communities (sew/pac) • eWater • Bureau of Meteorology • CSIRO
Thu 24 Oct 2013 Day – 3	Canberra – Albury – Shepparton	Travel by coach to Murray River at Albury(Hume Dam), down the river looking at one or two major structures to Shepparton(large surface irrigation)
Fri 25 Oct 2013 Day – 4	Shepparton/Tatura-Melbourne	Full day in information sessions and field visits inspecting large scale Irrigation scheme in Shepparton/ Tatura focusing on (i) Irrigation efficiency, (ii) Water logging, (iii) recycling drainage water, (iv) Agronomic practices to reduce evaporation. Meetings with regional agency (Goulburn-Murray water), farmer representatives, visit selected farms. Travel by coach to Melbourne
Sat 26 Oct 2013 Day – 5	Melbourne – Adelaide	Meetings with state water agencies (counterparts) in Melbourne Experts presentation on policy and guidelines for safe use of recycled water including data processing /analysis and dissemination processes and tools. Travel by air to Adelaide
Sun 27 Oct 2013 Day - 6	Adelaide	-Meetings with key state agencies, site visits to municipal desalination facility, water re-use schemes. -Sites visits to view rainwater harvesting and treatment, aquifer storage and recovery, recap of visit and findings for reporting.
Mon 28 Oct 2013 Day – 7	South Australia Adelaide -	Travel by coach to Lower Lakes and Murray River Mouth. Travel by air to Adelaide, stay at Adelaide
Tue 29 Oct 2013 Day - 8	Adelaide via Melbourne to Delhi Return international flights	Travel by air from Adelaide to Delhi via Melbourne.