

# ECONOMIC INSTRUMENTS FOR WATER SECURITY AS AN ENGINE FOR GROWTH



**Zaragoza, 3-5 October 2011**

# OECD Green Growth Strategy (May 2011)

- A **green growth strategy** was recently adopted by the governing body of OECD, which is formed by the finance and economy ministers of the 34 OECD countries.
- Green growth means **fostering economic growth and development** while **ensuring that natural assets continue** to provide the resources and ecosystem services on which our well-being relies.

# Green Growth and Water

- What it means for water? The **lack of sufficient quantities of adequate quality water can significantly hinder growth**. At the same time, **water can be an engine for growth**: improved water management can generate huge benefits for health, agriculture, and industrial production.

# Water Security as an Engine for Growth

- For example, water supply and sanitation can generate **substantial benefits for public health, the economy and the environment**:
  - Benefit-to-cost ratios of achieving the MDGs can be as high as 7 to 1, mostly due to **time gains** and also reduction of water-borne diseases

OECD (2011), *Benefits of Investing in Water and Sanitation, an OECD Perspective*, OECD, Paris.

# Water Security: an Emerging Issue

- Need to provide an adequate supply of safe and nutritious food, on a sustainable basis, for the world's growing population (OECD Ministers of Agriculture, 2010)
  - At current fertility levels, the world population is set to reach 9 billion by 2050 (from today's nearly 7 billion) and could hit 10 billion by 2100 (UN DESA, 2011)
  - Future global food demand is expected to increase by some 70% by 2050 (FAO, 2011)

# Water Security Outlook is not optimistic

- A 55% increase in world water use is projected between 2000 and 2050 (OECD, forthcoming)
- By 2050 nearly half the world population will live in river basins under severe water stress, meaning in areas where withdrawals exceed safe levels
- According to the IPCC, serious shortages of water are projected in semi-arid regions of the world over the next 50 to 100 years, resulting from increased frequencies of droughts and water scarcity

# Water Security Outlook is not optimistic

Moreover,

- the degradation of water quality generates uncertainty about future water availability.
  - e.g. there is a multiplying number of water contaminants that threaten freshwater quality
- The number of major floods has increased
  - e.g. resulting in over 175 major floods over the last ten years in Europe (EEA 2010).

# Water Security: a Definition

- working definition: “Ensuring access to adequate quantities of water, of acceptable quality, for human consumption, productive and environmental uses, through effective application of demand and supply policies »
  - Supply
  - Demand
  - Quantity
  - Quality



# Policy Approaches to drive Water Security as an Engine for Growth

Need to frame the issue:

- Water management can be seen as a tool toward meeting **water security objectives**
- Economic instruments are part of the **water management 's policy toolkit**
- There are « **framework conditions** » to take account of

FRAMEWORK CONDITIONS: OTHER POLICIES

WATER MANAGEMENT POLICY TOOLKIT

WATER SECURITY

FRAMEWORK CONDITIONS: **SECTORAL & ENVIRONMENTAL POLICIES**

WATER POLICY: **ECONOMIC INSTRUMENTS**

WATER SECURITY

**SECTORAL & ENVIRONMENTAL POLICIES**

WATER POLICY

WATER SECURITY

# Water and Agricultural Policy

- The MDGs of halving the share of the global population suffering from hunger in 2015 compared with 1990 will not be met
- If people are hungry today, it is because they cannot afford to buy food, not because there is not enough available

# Water and Agricultural Policy

- There is a need to **further removing the trade barriers** that prevent developing countries from competing with rich country producers and providing help to develop the capacities needed to take advantage of opportunities in both domestic markets and abroad

Dewbre J. (2010), “Food Security”, *OECD Observer*, N 278, March 2010.

# Water and Energy Policy

- The need to increase energy security was the main objective underpinning the establishment of the International Energy Agency (IEA).
- According to the IEA, energy security can be described as “the uninterrupted physical availability at a price which is affordable, while respecting environment concerns”.

# Water and Energy Policy

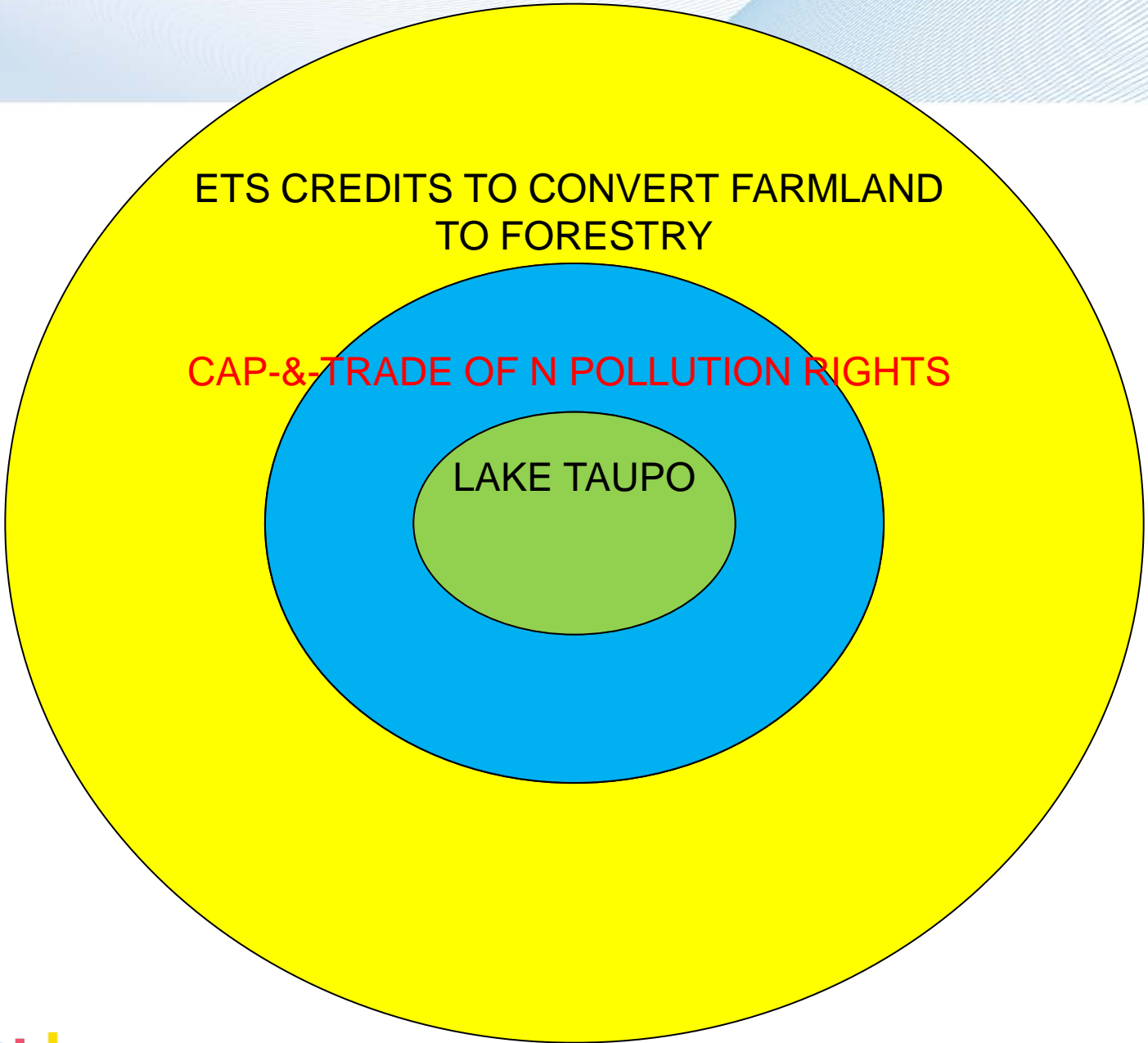
- **Government support for renewables** can, in principle, be justified by the long-term economic, energy security and environmental benefits they can bring, though it is essential that support mechanisms are cost-effective
- The increase is expected to come primarily from wind and hydropower, with **hydropower** remaining the most common form of renewable energy.

IEA (2010), *World Energy Outlook 2010*, IEA, Paris.



# Water and Climate Policy

- Climate change policy appears to have significant spillover to other policy areas that affect water management. This includes sectors as diverse as energy, agriculture and forestry, not to mention transport, fisheries and tourism.
- **Mitigation measures have associated co-benefits** (and co-costs) for the aquatic environment



# Water and Climate Policy

- Similarly, information on the costs and **benefits of adaptation policy**, including ancillary costs and benefits would certainly contribute to better integrate adaptation concerns into water management planning.
- For example, it may prove more cost-effective to **support the creation of wetlands** (in which bacteria convert nitrate to nitrogen released to the atmosphere) than to encourage organic farming or afforestation of farmland (to reduce the level of fertilisation)

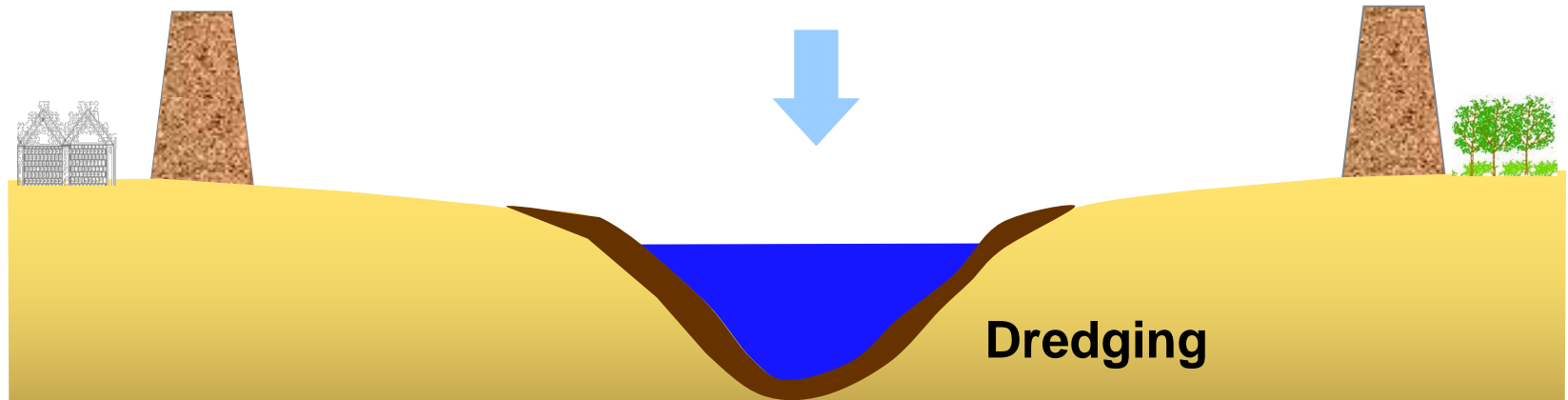
# Water and Nature Policy

- **Healthy ecosystems underpin sustainable water use**
  - e.g. 1 million urban dwellers rely on natural wetlands for wastewater retention and purification services (UNESCO–WWAP, 2009)
- **A key step in reducing water scarcity risks is to understand freshwater ecosystems better and to seek to optimise the range of goods and services these ecosystems provide to a broad range of stakeholders**

## e.g. FLOOD CONTROL POLICY

The engineering approach is often the most cost-effective option to protect densely populated and economically important areas.

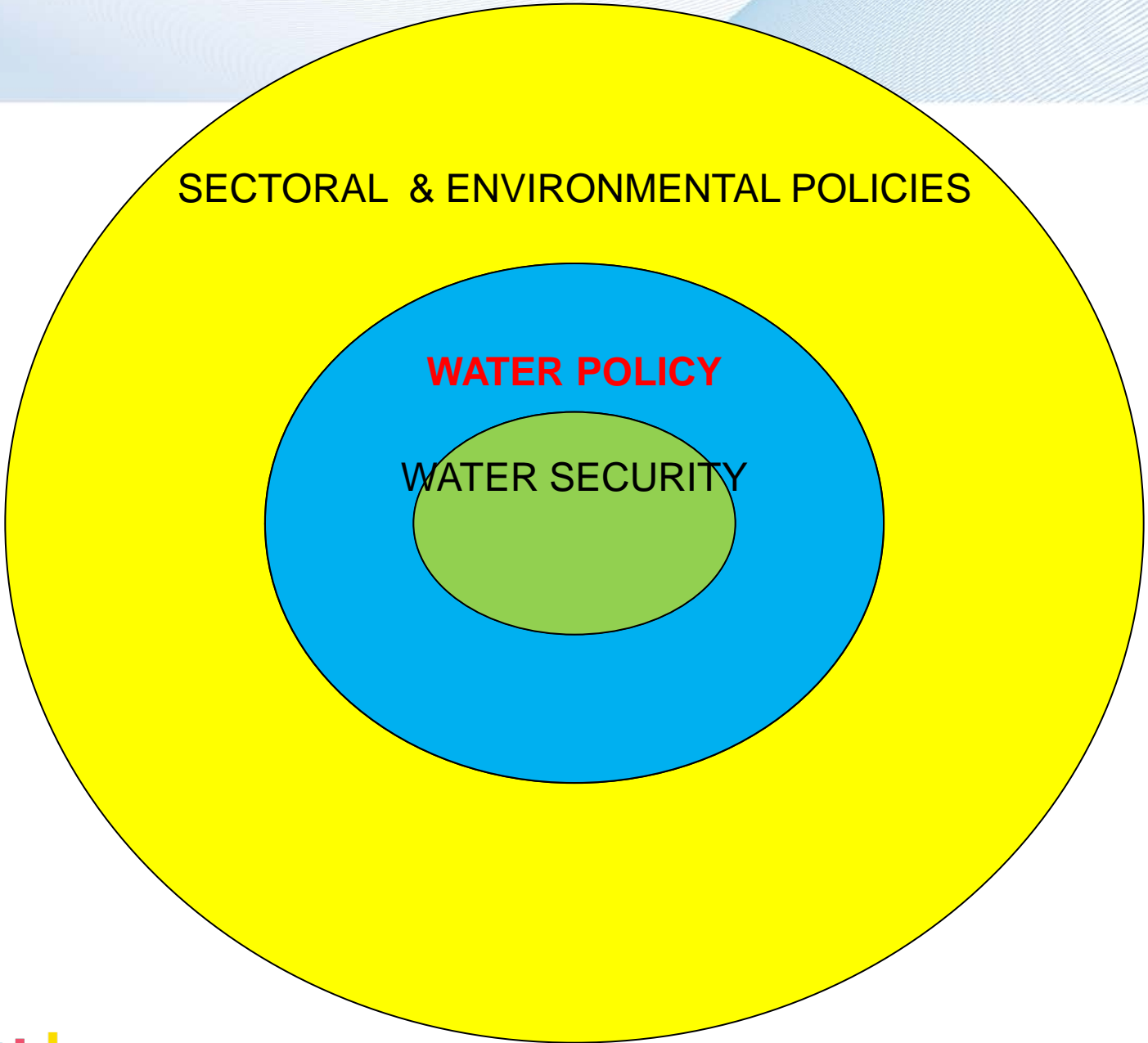
Water Level Decline by Dredging

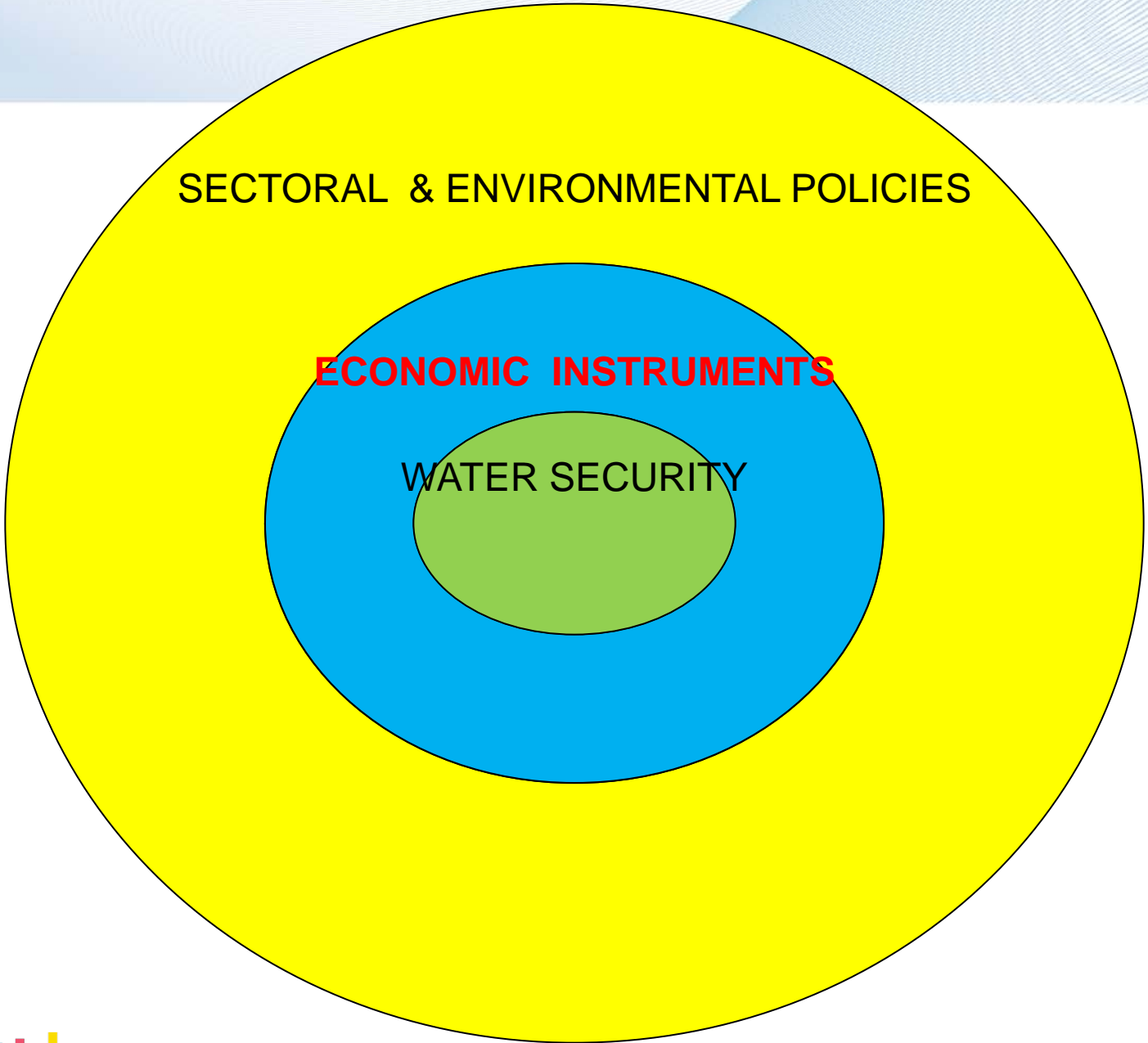


# Water and Nature Policy

- To control floods, **investments in land-use changes and floodplain restoration** can be justified economically in the long run (next 100 years) if, besides the expected value of the damage avoided, the additional non-priced socioeconomic benefits associated with these measures are taken into account
  - The net welfare gain would then also include improving river accessibility for recreational reasons and conserving high levels of biodiversity

Brouwer and Van Ek, 2004.







# Recommended EIs for Security of Water Supply

<b>Economic Instrument (EI)</b>	<b>Advantages of use</b>
<b>Marginal social cost pricing incorporating the scarcity value of water</b>	Signals the optimal time to invest in water infrastructure so that supply is augmented efficiently
<b>International and regional water markets</b>	Allows trade of water from areas of surplus to increase the water supply in areas of scarcity

# Recommended EIs to Reduce Water Demand

<b>Economic Instrument (EI)</b>	<b>Advantages of use</b>
<b>Regional water markets</b>	Allows trade of water from low to high value uses creating incentives to use water efficiently and reduce demand
<b>Marginal social cost pricing incorporating the scarcity value of water</b>	Reduces demand for water during periods of scarcity

# Recommended EIs for Security of Water Quantity

<b>Economic Instrument (EI)</b>	<b>Advantages of use</b>
<b>Buy-backs of water use rights</b>	Secures water for environmental flows and offsets economic losses

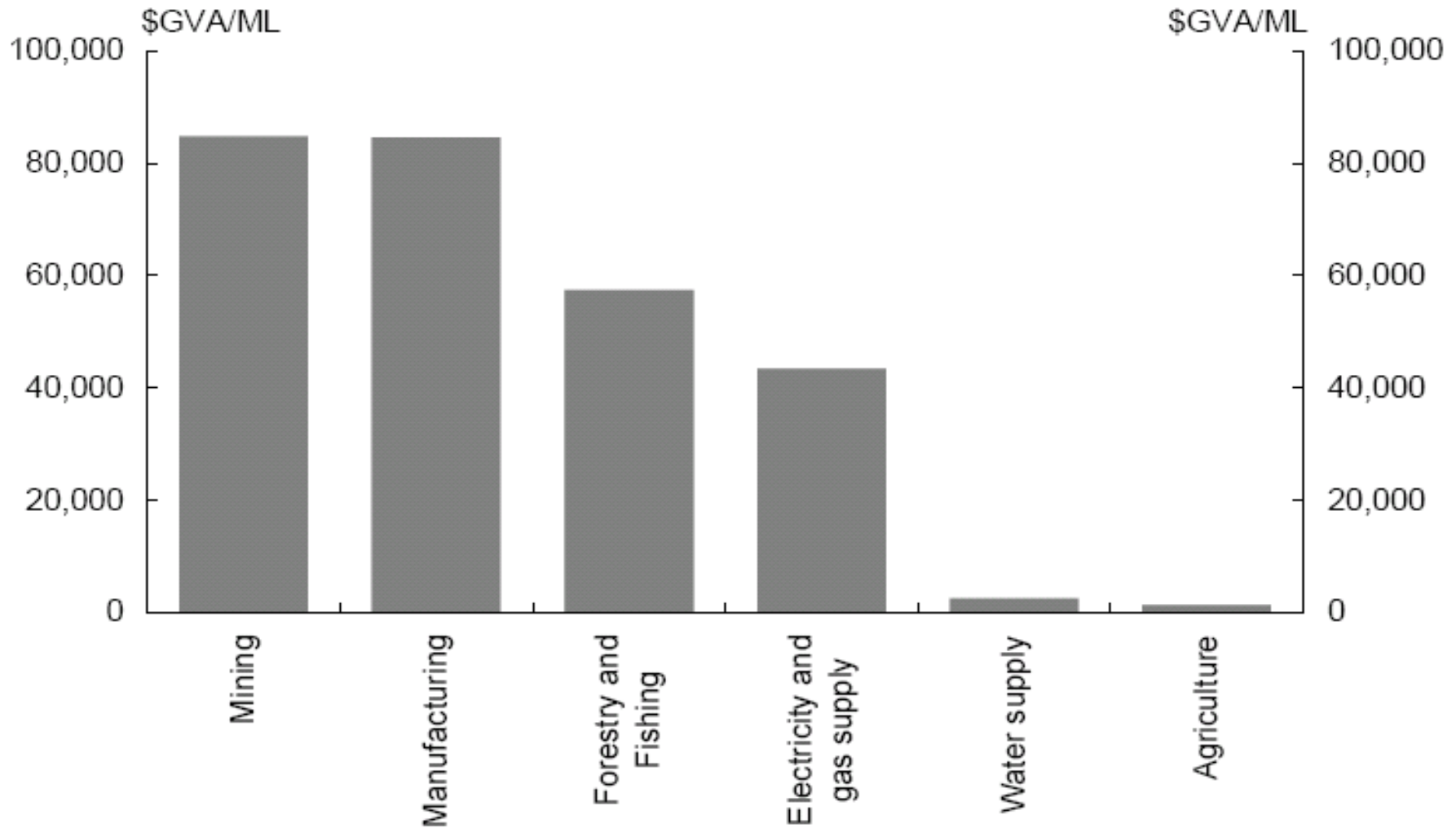
# Recommended EIs for Security of Water Quality

<b>Economic Instrument (EI)</b>	<b>Advantages of use</b>
<b>Emission permit trading for point and non-point pollution</b>	Allows pollution to be reduced from the lowest cost sources
<b>Emission taxes</b>	Creates ongoing incentive for all sources to reduce pollution

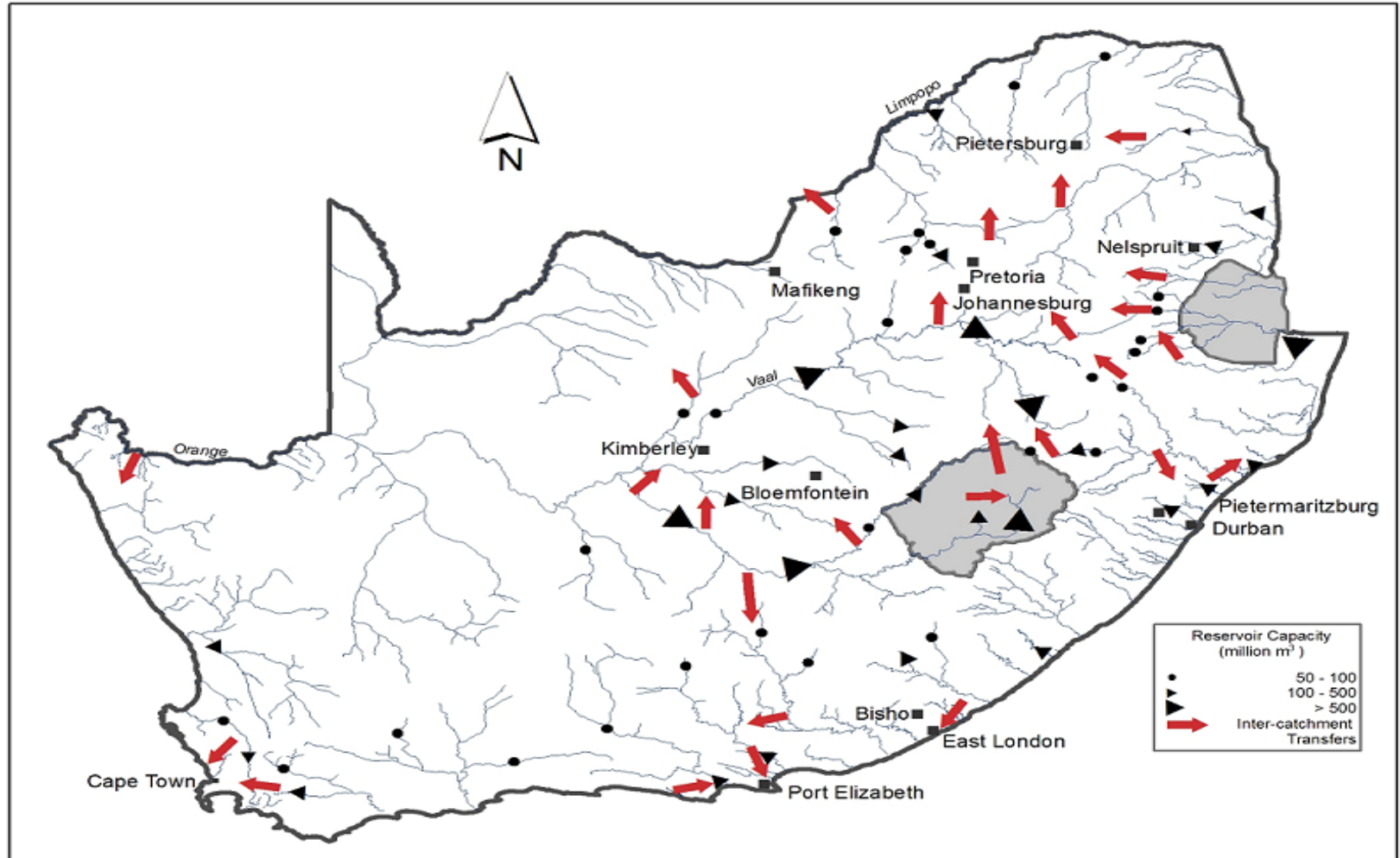
# South Africa

- A green, well-watered east coastline rings the arid but economically important mining regions of the west interior,
- >> links between water and development.

# Gross value added per megalitre of water used in selected industries



# Interbasin Transfers in South Africa



# Interbasin Transfers in South Africa

- Some areas may have excess water at the same time that others are experiencing water scarcity.
- This gives rise to different marginal values of water across different areas; water, for example, is less valuable in a flooded area than in a drought affected area
- This difference in the marginal value of water creates **gains from trade** if water resources can be spatially reallocated to their most valued use.



# Interbasin Transfers in South Africa

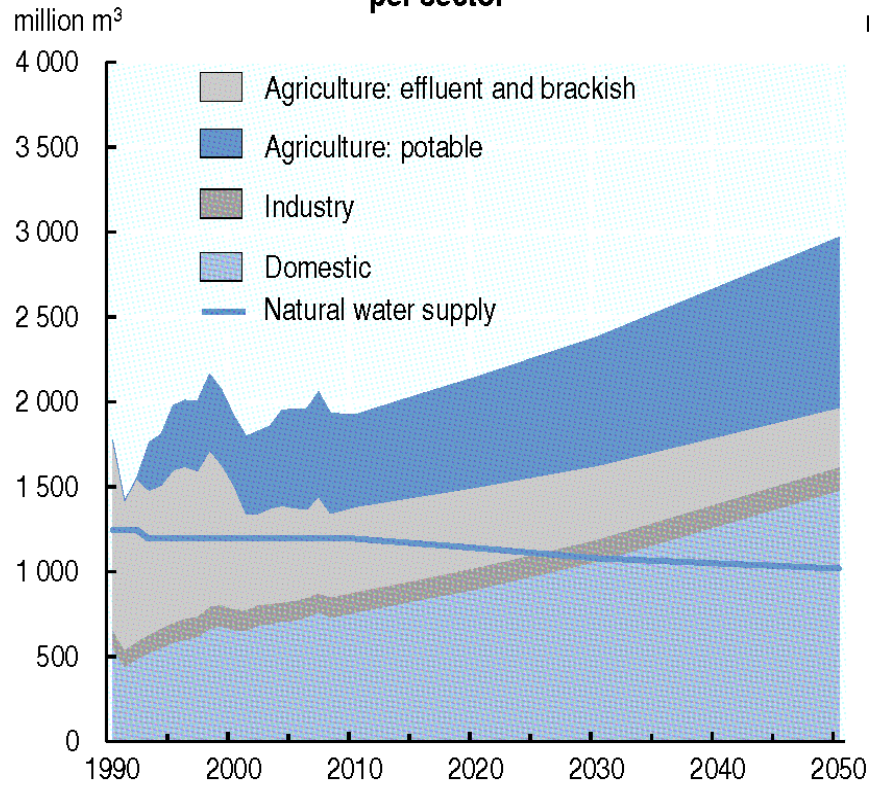
- Despite the potential magnitude of environmental costs (reduced environmental flows, loss of natural habitats, etc.) and social costs (lack of access to water for indigenous people, relocation of communities etc.), there have been **few cost-benefit analyses of inter-basin trading**, and the full impact of such schemes, particularly in terms of their environmental impact, have not fully been explored

# Israel

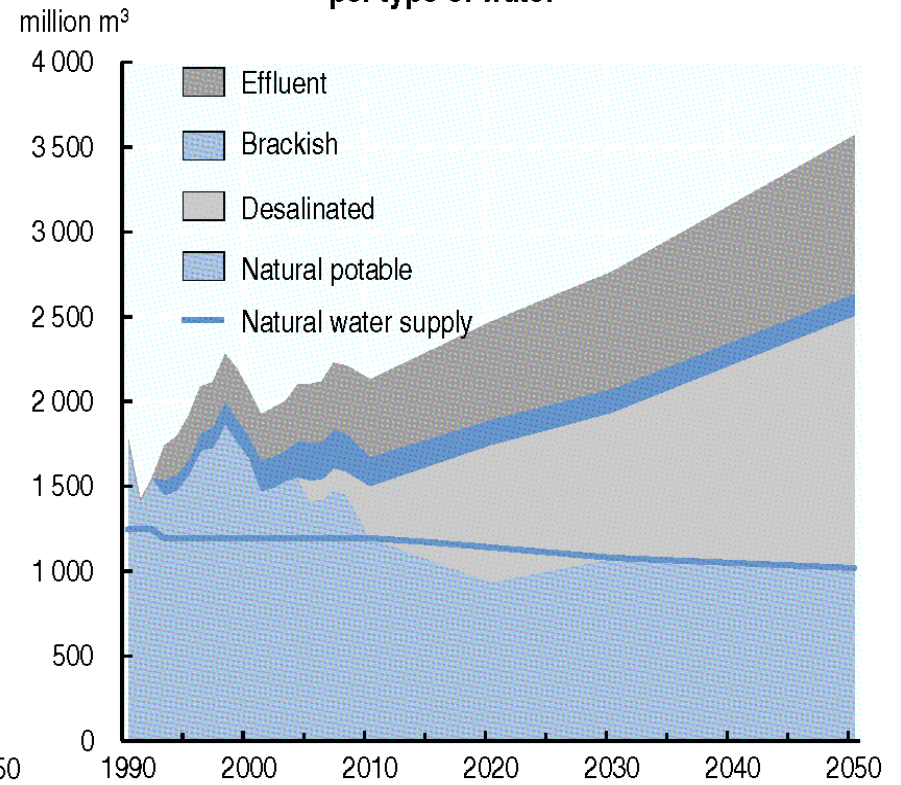
- Israel's limited water resources are under severe pressure due to its geo-climatic location, rapidly expanding population, growing economy, and water pollution loads.
- Pressures on water resources have intensified in recent years, as Israel has faced the worst water crisis in its history. From 2003/04 to 2010/11, the country experienced almost seven consecutive years of drought.

# Israel

**Water consumption outlook to 2050, per sector**



**Water consumption outlook to 2050, per type of water**



Source: Water Authority, Planning Department.

# Israel



# Innovation in Israel

- Israel has pioneered water-efficient technologies such as drip irrigation, soil aquifer treatment for reuse of treated wastewater, brackish and seawater desalination, and large-scale filtration of lake water.

# Water Pricing in Israel

- There has been increasing reliance on economic incentives to reduce demand for scarce water resources.
  - Practically all water consumption is metered. Use of “smart metering” is growing.
  - Water prices have significantly increased, and rising block tariffs provide incentives to conserve water resources.

# Australia

- The policy approaches adopted in much of Australia provide examples of a transition from an engineering-based water management system to one that increasingly incorporates economic instruments.
- The 2004 National Water Initiative (NWI) sets out the broad framework for Australia's market based approach.

# Australia





# Australia's Water Markets

- Australia's water trade is a centrepiece of national water reform and has become a **multi-billion dollar market** since the first reported trades in the 1980s.
- The ability to trade water, largely in the Murray-Darling Basin, has delivered real benefits to irrigators, regional communities and the environment.

# Australia

## AUSTRALIAN DRAINAGE DIVISIONS AND RIVER BASINS

### VIII TIMOR SEA DIVISION

- |                       |                                |
|-----------------------|--------------------------------|
| 1 Cape Leveque Coast  | 14 Daly River                  |
| 2 Fitzroy River       | 15 Finniss River               |
| 3 Lennard River       | 16 Bathurst & Melville Islands |
| 4 Isard River         | 17 Adelaide River              |
| 5 Prince Regent River | 18 Mary River                  |
| 6 King Edward River   | 19 Wildman River               |
| 7 Drysdale River      | 20 South Alligator River       |
| 8 Penicost River      | 21 East Alligator River        |
| 9 Ord River           | 22 Goomadeel River             |
| 10 Keep River         | 23 Liverpool River             |
| 11 Victoria River     | 24 Blyth River                 |
| 12 Fitzmaurice River  | 25 Goyder River                |
| 13 Moyle River        | 26 Buckingham River            |

### VII INDIAN OCEAN DIVISION

- Greenough River
- Murchison River
- Woodroffe River
- Goodeyne River
- Lynsbe-Moyle rivers
- Adribouton River
- Onslow Coast
- Fortessue River
- Port Headland Coast
- De Grey River

### VI SOUTHWEST COAST DIVISION

- |                    |                      |
|--------------------|----------------------|
| 1 Esperance Coast  | 11 Fredon River      |
| 2 Albany Coast     | 12 Collier River     |
| 3 Denmark Coast    | 13 Harvey River      |
| 4 Kent River       | 14 Murray River      |
| 5 Frankland River  | 15 Avon River        |
| 6 Swanon River     | 16 Swan Coast        |
| 7 Warren River     | 17 Moore-Hill rivers |
| 8 Donnelly River   | 18 Yarra Yarra Lakes |
| 9 Bushwood River   | 19 Ingham            |
| 10 Bassettin Coast |                      |

### XII WESTERN PLATEAU DIVISION

- |                |          |
|----------------|----------|
| 1 Gairdner     | 6 Mookay |
| 2 Nullarbor    | 7 Burt   |
| 3 Warburton    | 8 Wiso   |
| 4 Salt Lake    | 9 Barkly |
| 5 Sandy Desert |          |

### XI BILLOO-BANCANNIA DIVISION

- Bulloo River
- Lake Bancannia

### V SOUTH AUSTRALIAN GULF DIVISION

- |                     |                    |
|---------------------|--------------------|
| 1 Flathou Peninsula | 5 Mannjombi Coast  |
| 2 Mopong River      | 6 Willeroo Creek   |
| 3 Onkaparinga River | 7 Lake Tonens      |
| 4 Torrens River     | 8 Spencer Gulf     |
| 5 Gender River      | 9 Eyre Peninsula   |
| 6 Wakefield River   | 10 Kangaroo Island |
| 7 Broughton River   |                    |

### IV MURRAY-DARLING DIVISION

- |                       |                            |
|-----------------------|----------------------------|
| 1 Upper Murray River  | 14 Salween                 |
| 2 Kiewa River         | 15 Wimmera-Avon rivers     |
| 3 Ovens River         | 16 Border Rivers           |
| 4 Biron River         | 17 Moore River             |
| 5 Goulburn River      | 18 Campaspe River          |
| 6 Campaspe River      | 19 Namoi River             |
| 7 Loddon River        | 20 Castlereagh River       |
| 8 Avoca River         | 21 Macintyre-Bogan rivers  |
| 9 Murray Riverina     | 22 Condamine-Culgoe rivers |
| 10 Murrumbidgee River | 23 Warrego River           |
| 11 Lake George        | 24 Paroo River             |
| 12 Lachlan River      | 25 Darling River           |
| 13 Boreas             | 26 Lower Murray River      |

### X LAKE EYRE DIVISION

- Georgina River
- Diamantina River
- Coober Creek
- Lake Frome
- Finkle River
- Toad River
- Hay River

### IX GULF OF CARPENTARIA DIVISION

- |                       |                          |
|-----------------------|--------------------------|
| 1 Kodjalong River     | 16 Norman River          |
| 2 Walker River        | 17 Gilbert River         |
| 3 Roper River         | 18 Gwyden River          |
| 4 Towns River         | 19 Mitchell River        |
| 5 Linnies Eight River | 20 Coleman River         |
| 6 Rouse River         | 21 Hydrolyt River        |
| 7 McArthur River      | 22 Archer River          |
| 8 Robinson River      | 23 Walton River          |
| 9 Calvert River       | 24 Embury River          |
| 10 Settlement Creek   | 25 Werlock River         |
| 11 Mornington Island  | 26 Duke River            |
| 12 Nicholson River    | 27 Jardine River         |
| 13 Leichhardt River   | 28 Torres Strait Islands |
| 14 Morning Inlet      | 29 Groote Eylandt        |
| 15 Flinders River     |                          |

### I NORTHEAST COAST DIVISION

- |                            |                        |
|----------------------------|------------------------|
| 1 Jaxby Jaxby Creek        | 24 O'Connell River     |
| 2 Olive-Pascoe rivers      | 25 Pioneer River       |
| 3 Lockhart River           | 26 Plains Creek        |
| 4 Stewart River            | 27 Gays River          |
| 5 Hammonby River           | 28 Shoemaker Creek     |
| 6 Jennie River             | 29 Water Park Creek    |
| 7 Endeavour River          | 30 Fitzroy River       |
| 8 Daintree River           | 31 Curtis Island       |
| 9 Mossman River            | 32 Calliope River      |
| 10 Barron River            | 33 Boyne River         |
| 11 Mulgrave-Russell Rivers | 34 Bullock Creek       |
| 12 Johnstone River         | 35 Kolan River         |
| 13 Tully River             | 36 Burnett River       |
| 14 Murray River            | 37 Burum River         |
| 15 Hinchbrook Island       | 38 Mary River          |
| 16 Herbert River           | 39 Fraser Island       |
| 17 Black River             | 40 Noosa River         |
| 18 Moon River              | 41 Maroochy River      |
| 19 Houghton River          | 42 Brisbane River      |
| 20 Burdekin River          | 43 Brisbane River      |
| 21 Dion River              | 44 Stradbroke Islands  |
| 22 Proserpine River        | 45 Logan-Albert rivers |
| 23 Whitsunday Island       | 46 South Coast         |

### II SOUTHEAST COAST DIVISION

- |                               |                         |
|-------------------------------|-------------------------|
| 1 Tweed River                 | 20 Tonnire River        |
| 2 Brunswick River             | 21 East Gippsland       |
| 3 Richmond River              | 22 Snowy River          |
| 4 Clarence River              | 23 Tambo River          |
| 5 Bellinger River             | 24 Mitchell River (vic) |
| 6 Macintyre River             | 25 Thomson River        |
| 7 Hastings River              | 26 Latrobe River        |
| 8 Manning River               | 27 South Coastland      |
| 9 Kanah River                 | 28 Burdulo River        |
| 10 Hunter River               | 29 Yarra River          |
| 11 Macquarie-Tuggerah Lakes   | 30 Maribyrnong River    |
| 12 Hawkesbury River           | 31 Werribee River       |
| 13 Sydney Coast-Georges River | 32 Mooroolbath River    |
| 14 Volongong Coast            | 33 Barwon River         |
| 15 Shoalhaven River           | 34 Lake Copangina       |
| 16 Clyde River-Jarvis Bay     | 35 Clwyd Coast          |
| 17 Moruya River               | 36 Hopkins River        |
| 18 Turoosa River              | 37 Port Phillip Coast   |
| 19 Sago River                 | 38 Glenelg River        |
|                               | 39 Milcent River        |

### III TASMANIAN DIVISION

- |                                |                            |
|--------------------------------|----------------------------|
| 1 Flinders-Cape Barren Islands | 11 Sandy Cape Coast        |
| 2 East Coast                   | 12 Arthar River            |
| 3 Coal River                   | 13 King Island             |
| 4 Derwent River Coast          | 14 Smithton-Burnie Coast   |
| 5 Kingston Coast               | 15 South River             |
| 6 Huon River                   | 16 Mersey River            |
| 7 South-West Coast             | 17 Subicoy River           |
| 8 Gordon River                 | 18 Tamar River             |
| 9 King-Henry Rivers            | 19 Papan-Ringaroona Rivers |
| 10 Pieman River                |                            |

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# Australia's Water Markets

- **Better information about prices would encourage market participation** and deliver more efficient transactions.
- There is scope to develop new water markets outside the Murray-Darling Basin and to encourage the developing trade in groundwater

National Water Commission (2011), *Strengthening Australia's Water Markets*, NWC, Canberra.

# Questions to South Africa

- **The National Water Resource Strategy (2004) contemplates three main policy options to address water security:**
  1. *Demand side measures* to increase water availability and improve the efficiency of water use;
  2. *Re-allocation of water*, including the possibility of moving water from lower to higher benefit uses by trading water use authorisations; and,
  3. *Supply side measures* through the construction of new dams and related infrastructure, including inter-catchment transfers.

# Question 1 to South Africa

1. On the demand side, although pricing is seen as an instrument to encourage the more efficient use of water, water conservation and a shift from lower to higher value uses, it has not been strongly applied to date. Exceptions being new stand alone water resource developments for economic use, such as mining, where the full cost of water from such development is to be carried by the users.

What have been the impediments to wider implementation of **water pricing** in South Africa?

# Question 2 to South Africa

2. The National Water Resource Strategy sets the allocation priorities (in descending order):
  - i. 'Reserve' (basic human needs and environment).
  - ii. International obligations
  - iii. Social needs (e.g. poverty alleviation)
  - iv. Strategic needs to the economy (e.g. electrical cooling)
  - v. General economic use (e.g. irrigation)

What have been the impediments to implement **water trading** for the last allocation category (general economic use)?

# Question 3 to South Africa

3. Delays have been experienced with respect to the implementation of some large new water resource developments, which are partly attributable to a lack of sufficient institutional capacity. South Africa tends to under spend available funds due to a lack of capacity.

Where does such funding come from and how South Africa intends to deal with **financial resource raising for major water infrastructure expansion** in the coming years (e.g. state budget versus water tariffs)?

# Questions to Israel

- Israel's has set specific targets for gradually reducing reliance on natural potable water during the coming decades, in the context of the increase in water demand:
  1. decrease domestic per capita water consumption;
  2. More than double the supply of desalinated seawater by 2025 and more than double it again by 2050;
  3. decrease reliance on potable water for agriculture, and concomitantly increase use of treated domestic wastewater (effluent)



# Question 1 to Israel

1. Strong **pricing signals** have been introduced in the domestic sector to encourage reduced per capita consumption. A way to make consumers respond to changes in marginal price is to introduce a new price block in an increasing block pricing schedule. In Israel a third block was added to water bills in 2009, with a much higher tariff. The new block (known as the “drought tax”) was to apply to large consumers in the event of exacerbated drought conditions.

Where do you stand with implementation of the “drought tax”, which was temporarily suspended in 2010 in response to social protest?

# Question 2 to Israel

- In January 2010 tariffs for the domestic sector were raised by 40%, mainly to recover the cost of the recently built large-scale seawater desalination facilities.

How Israel intends to deal with **financial resource raising for major water infrastructure expansion** in the coming years (e.g. state budget versus water tariffs)?

# Question 3 to Israel

- A quota of potable water is allocated to the agricultural sector each year to create incentives for efficient water use. However about 35% of agricultural uses of potable and reused water are still cross-subsidised by the household sector and receive a relatively large share of public support.

What are the impediments to **trading water quotas** among different agricultural producers ?

# Questions to Australia

- Australia's approach to water policy is to recognize that water use, be it for human consumption, production or to provide ecosystem services, is a valuable and scarce input that needs to be priced properly and managed actively to be used effectively. This entails:
  1. Water markets and setting a price on water in generating/facilitating water security and additional economic activity;
  2. government incentives in assuring water security and improving efficiency;
  3. supporting policy and regulations

# Question 1 to Australia

1. **Water trading** has grown significantly over the last decade. Key factors have been to (i) separate property rights of water from land, and (ii) strengthen the national competition regulator.

Are limitations on permanent transfers, transfers between catchment areas and transfers of irrigation water to other uses still in force in Australia? (e.g. several states prohibited or capped the ownership of water rights by persons not owning or occupying land, or restricted the proportion of entitlements in any given catchment that could be held by non-farm users, reflecting a fear that water rights might be bought up for speculative purposes. As a result, water markets are often inaccessible to urban users.)

# Question 2 to Australia

2. The national government is purchasing water entitlements to help reestablish a sustainable balance in use between agriculture and the environment (water buy backs). The government is also funding investments in on and off farm irrigation with a view to increase irrigation efficiency (and return some of the water savings back to the environment).

Has sufficient attention being paid to benefit cost analysis of **government funding into irrigation water infrastructure**? Did Australia collect information (e.g. non-market valuation studies) to assess the marginal social benefit of more water for the environment and determine the efficient quantity of water to be reallocated?

# Question 3 to Australia

3. Large-scale water infrastructure to supply major urban areas was funded (partly or entirely) from increases in water supply prices to consumers. As a result, water prices have increased significantly (e.g. more than doubling in Canberra in real terms between 2005 and 2010). By 2020 40% of urban water consumption could come from sources not tapped in 2005: this includes large-scale water recycling, storm-water capture and desalination facilities.

Is it intended to further rely on **water price increases to finance new infrastructure for urban supply?**

