

**TA-7131 (IND) – TECHNICAL ASSISTANCE FOR INSTITUTIONAL
DEVELOPMENT OF INTEGRATED WATER RESOURCES MANAGEMENT
IN ORISSA**

AN INPUT INTO

**THE ORISSA INTEGRATED IRRIGATED AGRICULTURE AND WATER MANAGEMENT
INVESTMENT PROGRAMME (OIIAWMIP)**

Final Report



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Final Report

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Acronyms

ADB	Asian Development Bank
BDP	Basin Development Programme (MRC)
BRIC	Brazil, Russia, India and China.
CDAP	Capacity Development Action Plan (in ISPM Project)
CE	Chief Engineer
CM	Chief Minister
DoWR	Department of Water Resources
DHI	DHI Water and Environment
DSS	Decision Support System
EA	Environmental Assessment
EIA	Environmental Impact Assessment
EiC	Engineer in Chief
GIS	Geographic Information Systems
GWP	Global Water Partnership
ICM	Integrated catchment management
ISPM	ADB Institutional Strengthening and Project Management Project
IWMI	International Water Management Institute
IWRM	Integrated Water Resources Management
IWC	International Water Centre, Brisbane
KIIT	Kalinga Institute of Industrial Technology
M&E	Monitoring and Evaluation
MASL	Mahaweli Authority of Sri Lanka
MCM	Million cubic metres
MSP	Multi-Stakeholder Platform
NAHRIM	National Hydraulic Research Institute of Malaysia
NGO	Non-government Organisation
NWRC	National Water Resources Council
O&M	Operation and Maintenance
OIIAWMIP	ADB Orissa Integrated Irrigated Agriculture and Water Management Investment Programme
OSG	Orissa State Government
OWPO	Orissa Water Planning Organisation
PSP	Private Sector Participation
RBO	River Basin Organisation
RETA 6470	ADB Regional Technical Assistance Project 6470
SA	Social Assessment
SA	Social Assessment
SAG	Stakeholder Advisory Group
SEA	Strategic Environmental Assessment
SIA	Social Impact Assessment
SWRB	State Water Resources Board
TA	Technical Assistance
TOR	Terms of Reference
WALMI	Water and Land Management Institute
WRA	Water Resources Assessment
WUA	Water Users Association (India)

Executive Summary

This document reports provides an action plan to implement water reforms in Orissa to address the imminent water challenges of the State. The report provides an overview of the water challenges of Orissa which include growing competition for water resources from industrial and urban development, in a variable hydrological environment .

The action plan is in two phases:

PHASE 1 - CAPACITY DEVELOPMENT

To commence immediately

- Strengthen grass-roots involvement by Water User Associations
- Strengthen Orissa Water Planning Organisation

PHASE 2 - IMPLEMENTING ACTIONS

Simultaneously over Years 1 to 4 (2010-14)

[1] INFORMED DIALOGUES & AWARENESS RAISING

Section 3.1

1. Dialogue in WUAs
2. River Basin Organisation Dialogues
3. State Level Dialogues
4. State-level Water Awareness & Advocacy Programme

[2] WATER ALLOCATION

Section 3.2

1. Recover O&M Costs
2. Establish State Water Regulatory Authority
3. Finalise Inter-state Water Sharing Arrangements

[3] WATER PLANNING

Section 3.3

1. Develop State and Sector Water Plans
2. Establish Baitarani Basin Resources Management Plan
3. Upgrade Hydrological Information System
4. Assess Environmental Flow Requirements

[4] WATER LAW

Section 3.4

1. Develop State Water Act

1.0 Orissa water challenges

There are many challenges facing the effective management of Orissa's water resources. In summary, these challenges include:

- Variability of the wet monsoon and consequences for year-round water availability;
- Falling per capita supply of water - a distribution or allocation problem;
- Failure of the water sector to pay its way - a pricing problem;
- Emergence of new water users (particularly industry, mining) placing additional demands on the supply system – an access, redistribution and compensation problem;
- Inadequate waste water management impacting on quality and supplies - this reflects behavioural and regulatory problems.

Previous studies and the assessments of government officers and NGOs all suggest that these challenges should be addressed through greater recognition of the economic value of water and its formal allocation between water use sectors¹ and dialogue with water stakeholders at all levels, particularly at grass roots. This prompted the 2008 consultants² to recommend IWRM (integrated water resources management) as an overall solution, and focus on **two core actions: informed dialogues and water allocation.**

In this 2010 TA, the consultants recognised the need for engagement with water stakeholders to better reveal issues and solutions. Consequently the consultancy team developed a participatory procedure, seeking input from organisations and individuals while gleaning information from other reports.

This section of the Final Report describes the various challenges facing Orissa. The consultants gained an understanding of these challenges from:

- Two special purpose Stakeholder Advisory Group meetings,
- Input from various NGO meetings and newsletters
- Data supplied by the Orissa Department of Water Resources,
- Discussions with senior staff of the Department of Water Resources and Central Water Commission,
- Priorities as documented in the State Water Policy of 2007, and

¹ These include:

2007: ADB TA-4815-IND *Public Expenditure Review*.

2007: *Assessment of Orissa Water Resources Institutions and Orissa Integrated Irrigated Agriculture and Water Management Project Framework (OIIAWMP Institutional Study)*. Orissa Integrated Irrigated Agriculture and Water Management Project (OIIAWMP) Project, Bhubaneswar.

2008: *Draft Final Report & Proposed Action Plan for IWRM in Orissa*. Orissa Integrated Irrigated Agriculture and Water Management Investment Program (OIIAWMIP). Technical Assistance for Integrated Water Resources Management (IWRM) in Orissa.

2008: *WALMI and DoWR Change Management Status Report*. Asian Development Bank, TA-4814-INDIA. Orissa Integrated Irrigated Agriculture and Water Management Investment Program. CTA for Project Processing and Capacity Development.

2009: Volume 1. Needs Assessment Main Report. And Volume IX. Needs Assessment Orissa. In *Development of Decision Support System for Integrated Water Resources Development and Management*. Hydrology Project-II. National Institute of Hydrology. DHI, Denmark.

² 2008: *Draft Final Report & Proposed Action Plan for IWRM in Orissa*, listed above.

- The direction of change as documented in the State Water Plan of 2004.

The **defining features of water resources management in Orissa** are³:

1. Provision of drinking water and water for domestic use (human and animal consumption),
2. Determination of requirements for environmental flows
3. Multiple use of irrigation (and drainage) water (agriculture, fisheries)
4. Potential to increase hydropower from 55% of the energy production to 60%
5. Rapidly increasing demand for water from industries
6. Navigation and other uses such as recreation and tourism
7. Inter-state water sharing (30% of Orissa's water comes from upstream states)
8. Limited capacity to capture additional monsoon flows
9. Water quality management (practically no urban wastewater is being treated)
10. Groundwater management - largely uncontrolled/important source of "self supply"
11. Regular extreme events (rainfall, floods and droughts)
12. Upstream watershed management, and
13. Salinity intrusion in coastal river reaches and deltas.

These features translate into numerous hydrological and management challenges.

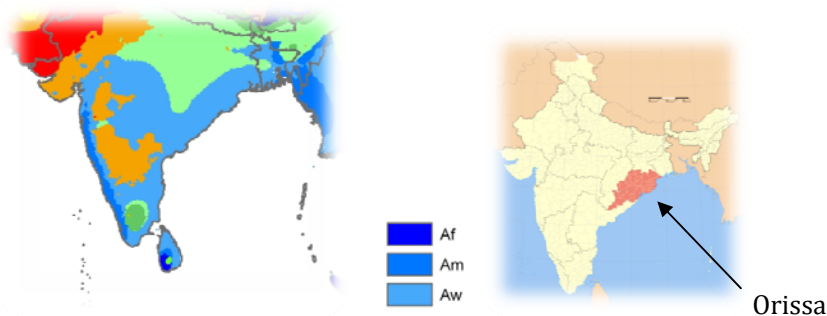
1.1 Hydrological challenges facing Orissa

1.1.1 Water availability

Water supplies for the Orissa population (36.8 millions) and the maintenance of environmental assets are highly dependent on rainfall during the monsoon. With an area of 155,820 km², the State has an average annual rainfall of approximately 1430 mm. Being on the eastern coast of India, Orissa is not directly influenced by south-west monsoon branch from the Bay of Bengal, but the annual cyclones from the Bay of Bengal bring heavy rain with two seasonal peaks, July-August and October-November. Like most of coastal eastern India and Sri Lanka, Orissa experiences a tropical wet/dry climate (Figure 1) (Köppen classification: Aw), characterised by:

- strong seasonality - almost 80% of the rain falls in the three wet monsoon months
- khariff season normally starts by 5th June on the coastal plain, and by 1st July the whole of the state is under its influence; by 15th October, the south-west monsoon withdraws completely from Orissa.
- during winter, all parts of the state remain almost dry except northern Orissa.

Figure 1. Extent of Tropical Wet-dry Climate in India



The average surface and ground water potential of the State is 141 BCM at present, including interstate water, and this is estimated to reduce to 129 BCM by 2050⁴. In the year 2001 it was

³ As specified in the *Draft Final Report & Proposed Action Plan for IWRM in Orissa, 2008*. Technical Assistance for Integrated Water Resources Management (IWRM) in Orissa Project

⁴ Orissa State Water Plan, 2004

estimated that the average surface water resources of the State were 120.4 BCM, with 75% dependable flow amounting to 95.5 BCM. In 2050, the average surface water supply is predicted to be 108.1 BCM with the 75% dependable flow amounting to 85.9 BCM.⁵

Per capita water availability varies throughout the state according to the relationship between water availability and population. Because the state's population is still expanding, the per capita supply of water will decline significantly over the next forty years as shown in Table 1.

Table 1. Per capita water availability 2001 and 2050 by river basins

Basin	Basin Area (Sq. Km)	Percentage (%)	Per Capita Water Availability-2001 (m ³)	Per Capita Water Availability-2050 (m ³)
Mahanadi	65,628	42.15	3651.06	2434
Brahmani	22,516	14.46	3634.95	1928
Baitarani	13,482	8.66	1976.01	1348 (*)
Rushikulya	8,963	5.76	1341.87	1021 (*)
Indravati	7,400	4.75	4967.08	3379
Kolab	10,300	6.61	2263.65	1623
Vansadhara	8,960	5.75	8174.97	5579
Nagavali	4,500	2.89	4921.89	3433
Budhabalang	6,354	4.08	1616.61	1412 (*)
Bahuda	890	0.57	5194.73	3758
Subernarekha	2,983	1.92	2365.24	1766
Area directly draining to sea	3,731	2.40		
Total / Average	155,707	100	3,358.17	2,218

(*) Water Stressed Situation

The long dry season means that surface water must be stored in sufficient quantity to last for the whole year. The State has developed 44 water storages that service major and medium irrigation schemes and 2,713 storages that service minor irrigation schemes. The total storage capacity is currently 16.7 BCM (Table 2).

Table 2. Water Storage India and Orissa

	India (BCM)	Orissa (BCM)
Storage Developed	174	16.7
Under Construction	75	3.3
Future	132	21.9
Total current & planned supply	381	41.9
Potential	1869	120
Live Storage per Million People	0.3	0.6

Source²

1.1.2 Water variability

The population of Orissa is 4% of that of India⁶ and it has 11% of the water resources of the nation. Although Orissa has ample water relative to its population (3,300 m³/yr/capita, well above the UN "stress limit" of 1,700 m³/yr/capita) this figure does not reflect the strong seasonality of supply. Nor does it reflect the future trends of reduced per capita water availability due to population growth, increased demands resulting from economic development, and increased water consumption in upstream states leading to decreasing inflows to Orissa (presently accounting for some 30% of total water availability).

These factors suggest an estimated reduction in water availability of 30% by 2050 (to some 2,200 m³/yr/capita, a low level in a monsoon climate). With increasing population and the associated

⁵ Orissa State Water Plan-2004

⁶ According to the 2001 Census.

increase in demand for food and water combined with the growth in mining and industrial activities, the demand for water from various sectors could increase to 55 BCM by 2051⁷.

Climate change may accelerate the water problems of Orissa further. The 4th Assessment report of the International Panel on Climate Change (IPCC, 2007) predicts a “projected decrease in the winter precipitation on the Indian subcontinent”, and “intense rain occurring in fewer days which implies increased frequency of floods during monsoon”. In the coastal areas these impacts are compounded by rising sea levels. However, further analysis of available information for Orissa is required to assess the extent and timing of the risk and response measures. The overall scenario points to increased flood risk and hydrological uncertainty.

1.1.3 Water quality

Monitoring results for Orissa’s six major rivers suggests a bleak situation where water quality rarely meets drinking standards. Some basins suffer poor water quality due to inadequate treatment of municipal and industrial effluents, leading to environmental degradation. Also there is serious water logging due to lack of drainage in the lower parts of most basins, resulting in saline intrusion, for example, in the Baitarani basin delta.

The State Pollution Control Board, Orissa, is monitoring the water quality of six rivers of the state, viz. Mahanadi, Brahmani, Rushikulya, Baitarani, Nagavali and Subarnarekha under the National Water Quality Monitoring Project (NWMP) (Tables 3, 4 and 5).

Table 3. Monitoring Stations for six Orissa river basins

Mahanadi: Hirakud reservoir Sambalpur u/s Sambalpur d/s Sonepur u/s Sonepur d/s Tikarpara Narasinghpur Cuttack u/s Cuttack d/s Paradeep d/s	<i>lb:</i> Sundargarh Jharsuguda Brajrajnagar u/s Brajrajnagar d/s <i>Kathajodi</i> Cuttack d/s <i>Kuakhai</i> Bhubaneswar u/s Bhubaneswar d/s <i>Birupa</i> Choudwar d/s	Brahmani: Panposh u/s Panposh d/s Rourkela d/s Bonaigarh Rengali Samal Talcher u/s Talcher d/s Bhuban Dharmasal Pattamundai	Baitarani: Joda Anandpur Jajpur Chandbali Rushikulya: Madhopur Potagarh	Nagavali: Jaykaypur d/s Rayagada d/s Subernarekha: Rajghat
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u/s – upstream; d/s - downstream

Table 4 lists the water quality parameters used throughout Orissa.

Table 4. Water quality parameters

Parameter	Measure
Physical parameters	Temperature, pH, Alkalinity, Total Suspended Solids (TSS).
Indicators of organic pollution	Dissolved oxygen (DO), Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Free ammonia –Nitrogen, Ammoniac (Ammonium +ammonia) - Nitrogen, total Kjeldahl Nitrogen (TKN).
Bacteriological parameters	Total Coliform and Faecal Coliform
Mineral constituents	Electrical conductivity (EC). Total dissolved solids (TDS), Boron, Sodium Absorption Ratio (SAR), Hardness, Chloride, Sulphate, Fluoride.
Nutrients	Nitrate (Nitrate + Nitrite)-Nitrogen, Phosphate-Phosphorous
Metals and other toxic compounds	Chromium (Cr) (total and hexavalent), Iron (Fe) Nickel(Ni) Copper (Cu), Zinc (Zn), Cadmium(Cd), Mercury(Hg), Lead (Pb), Cyanide (CN)
Biological indices	Saprobic index (SI) and Diversity Index (DI).

Water quality has been assessed in terms of three classification schemes – Use-based, Biological and Wholesomeness.

⁷ Orissa State Water Policy-2007

Use Based Classification

The standards prescribed for the tolerance limits for inland surface waters (IS:2296-1982-second revision) are:

- Class A - Drinking Water Source without conventional treatment but after disinfection
- Class B - Outdoor bathing
- Class C - Drinking water source with conventional treatment followed by disinfection
- Class D - Fish production and wild life habitat
- Class E - Irrigation, industrial cooling or controlled waste disposal

Biological Assessment of Water Quality

Biological assessment is based on the fact that pollution of water bodies causes changes in the physical and chemical environment of water, thereby disrupting ecological conditions. Through bio-monitoring, the cumulative effects of all the pollutants can be determined and the overall health of the ecosystem assessed.

Bio-monitoring results are generally expressed in terms of two indices: the saprobic index (SI) and diversity index (DI). Table 5 lists the criteria used for classification of water quality on the basis of biological indicators (Environmental Atlas of India, CPCB, 2001).

Table 5. Biological Indicators

Indicator	Water Quality
High Biodiversity DI >0.6; SI=6-10; BOD<3mg/1	Clean
Moderate Biodiversity DI=0.2-0.6; SI=2 to 6; BOD=3 to 6mg/1	Slight to Moderate Pollution
Poor Biodiversity DI < 0.2; SI<2; BOD>6 mg/1	Heavy to severe pollution

Wholesomeness

The *Water (Prevention and Control of Pollution) Act, 1974* governs water quality management. Its objective is to prevent and control water pollution and maintain or restore the wholesomeness of water.

Hence the first priority in water quality assessment and management should be to maintain and restore the water ecosystem. Accordingly specific requirements for 'Acceptable', 'Desirable' and 'Excellent' levels of wholesomeness with short, medium and long term goals have been laid down (Water Quality- Criteria and Goals, CPCB, MINARS/17/2001/2002).

The current water quality status of five Orissa rivers has been reported as follows:

Mahanadi

- The water quality at all stations except Sambalpur d/s, Cuttack d/s (Mahanadi and Kathjodi), Bhubaneswar d/d and Paradeep, can be classified as class C/D/E. The water quality at the downstream of Sambalpur, Cuttack and Bhubaneswar may be classified as Class D/E. In all cases, the parameter responsible for downgrading the water quality is TC, besides BOD for Sambalpur d/s, Cuttack d/s(Kathjodi) and Bhubaneswar d/s. Water quality at Paradeep does not qualify even for Class E due to several parameter (TC,EC,SAR, Chloride).
- Taking into consideration the observed biological indices and the BOD values, it may be concluded that the entire river stretch is in a state of slight to moderate pollution, as per the criteria given in Table 5.
- The water quality at all stations except Sonepur U/s, Tikarpar, Narsinghpur, Cuttack U/s and Bhubaneswar u/s are below acceptable level, due to mostly to FC and TKN an additional factor at Paradeep is EC.

Brahmani

- The water quality at all stations, except Panposh d/s, Rourkela d/s and Talcher d/s, can be classified as class C/D/E. Water quality at these three stations may qualify for class D/E. An intensive water quality study was undertaken at nine stations (Panposh u/s and d/s, Rourkela d/s, Barkote, Rengali inflow, Rengali Dam, Rengali outflow and samal) in the stretch Panposh (u/s) to Samal (downstream to Rengali reservoir), during October 2004 to January 2005 in respect of all the relevant parameters for Class D inland surface water, to ensure suitability of river water in this stretch for fish propagation observations do not indicate any cause for apprehension of any adverse impact of discharge of industrial effluent at Rourkela, on fishery resources.
- Taking into consideration the biological indices and the BOD values, the entire river stretch may be considered as in a state of slight to moderate pollution, as per the criteria given in Table 5.
- From the pH, DO, BOD, EC, N and TSS (except occasional deviation) values, the present level of wholesomeness of the river water may be considered as “desirable”.

Baitarani

- The water quality at Joda, Anandpur and Jajpur is classified as Class C. Water quality at Chandbali does not qualify for Class E.
- From the biological monitoring results it is found that the entire river stretch is in a state of slight to moderate pollution, as per the criteria given in Table 5.
- Considering pH, DO, BOD, EC and N values, the present level of wholesomeness of the river water may be considered as “Excellent”. Taking into consideration the TSS values, the water quality at Jajpur is downgraded to “Desirable”. The TSS observed at Chandbali in 2006 is quite high. However, on introduction of FC values in the above assessment, river water quality is not “acceptable” during the period under report except for a few locations.

Rushikulya

- Madhopur: Water quality of Rushikulya at Madhopur conforms to the Class C/D/E criteria (except for total coliform). From the values of the SI, DI and BOD, the river stretch at Madhopur may be considered as in a state of slight to moderate pollution, as per the criteria given in Table 4. In terms of wholesomeness, the water quality is acceptable with respect to all parameters except faecal coliform.

Nagavali

- Water quality of the interstate river Nagavali is monitored at two locations Jaykaypur D/s (at a distance of about 35 km from the origin) and Rayagada d/s (about 10 km d/s for Jaykaypur). The primary objective of choosing these two stations is to assess the impact of a large pulp and paper mill (M/s. J.K. Paper Mills Limited) at Jaykaypur and the impact of the Rayagada town further downstream.
- Because of low flows in the Nagavali river for most of the year, the effluent discharged from the paper mill (about 25000 m³/Day) is not likely to get diluted adequately and hence even if it meets the stipulated standards, the river water would still be significantly polluted, making it unsuitable for most uses.
- There is a general improvement in the water quality at Rayagada D/s indicating that there is practically no impact of the urban (Rayagada town) wastewater disposal.

Subernarekha

- Subernarekha is an interstate river with catchment areas in Jharkhand, West Bengal and Orissa. Only a small stretch (81 km, about 18%) of its total length of 446 km, flows through Orissa, before falling into the Bay of Bengal at Bhogari Block of Balasore district.
- In the Orissa portion of the basin, industrial and mining activities are almost nonexistent. There is only one class-II town (Jaleswar, population: about 22,000), which is located on its bank. Water quality of the river is determined at Rajghat (about 5 km downstream to Jaleswar and 60kms upstream to the confluence with sea).

- The river is expected to carry considerable pollution load from the industrial, mining and urban activities at Jharkhand and West Bengal. However, by the time it enters into Orissa, the river seems to have regenerated considerably. The concentrations of the metals expected from the mining activities at Jharkhand and West Bengal (e.g. iron, chromium, copper etc) are also found to be quite low with environmental significance and the water quality at Rajghat conforming to Class-C inland surface water. In terms of wholesomeness, the water quality satisfies the criteria for the 'desirable' class, with respect to all the parameters, except faecal coliform, in respect of which the water is of acceptable quality.

1.1.4 Challenges: floods and droughts

Extreme events such as extreme rainfall, floods and droughts visit the State regularly and cause human and economic losses, such as the 1999 Orissa Super Cyclone (Box 1). While dams and levees etc may mitigate some of the effects, additional management solutions are called for to increase preparedness and reduce losses. Flooding issues occur both in the downstream estuarine regions of Orissa as well as in upper basin areas.

There is the immediate need for:

- Improved flood forecasting technologies and warning dissemination practices for both riverine flooding and areas prone to storm surges in the coastal zones
- Construction of elevated flood refuges (flood-proofing) and improved rescue responses
- Increasing community resilience to flooding using the above practices and awareness raising
- Floodplain mapping, flood zoning and improved floodplain management to encourage appropriate uses in the most flood-prone locations.

Box 1. 1999 Super Cyclone in Orissa

Named 05B with winds of 155 mph (250 km/h), the cyclone dumped heavy torrential rain over southeast India, causing record breaking flooding in low-lying areas. When Cyclone 05B reached its peak intensity of 912 mb, it became the most intense Tropical Cyclone of the North Indian Basin.

Impacts:

- The storm surge was 26 feet (8 metres) and struck the coast of Orissa, travelling up to 20 km inland. 17,110 km² (6,600 mi²) of crops were destroyed and an additional 90 million trees were either uprooted or snapped off.
- Approximately 275,000 homes were destroyed leaving 1.67 million people homeless. Another 19.5 million people were affected by the super cyclone to some degree.
- A total of 9,803 people officially died from the storm with 40 others still missing, though it is believed that 15,000 people died. 8,119 of those fatalities were from the Jagatsinghpur district. Another 3,312 people were injured. 2,043 out of 5,700, or 36% of the residents of Padmapur perished.
- The number of domestic animal fatalities was around 2.5 million, though the number of livestock that perished in the cyclone amounted to only 406,000.[1] The high number of domestic animal deaths may have possibly had to do with around 5 million farmers losing their livelihood.
- The damage across fourteen districts in India resulted from the storm was approximately \$4.5 billion (1999 USD, \$5.1 billion 2005 USD).

For data sources, satellite images and cyclone track, see: http://en.wikipedia.org/wiki/Orissa_super_cyclone

As already mentioned, monsoon climates such as that experienced in Orissa, suffer a dry season every year. This within year variability has to be 'managed' with water storage and distribution systems. However, the annual dry season does not qualify as drought – it is normal and predictable. Drought is usually the result of a run of below average rainfall years resulting in severe draw-down on storages. Under such circumstances, supplies come under severe pressure. While it might be possible to draw more heavily on groundwater supplies, and transportation between areas can be used to fill critical supply gaps, the rationing of limited local water supplies should be attempted through manipulation of demand. Thus demand management measures can be introduced to distribute scarce supplies according to pre-determined priorities. Demand management under drought conditions might include physical rationing, punitive pricing and surveillance to discourage cheating. Longer term drought management should be pursued through more fundamental measures such as population

planning, computer-based water modelling and supply management within the limits of the natural system.

1.2 Management challenges

1.2.1 Introduction

Orissa's government-run water supply industry is suffering from a number of problems – some of them persistent and some relatively new. The main problem plaguing the public water sector at this time is chronic budgetary deficits. This problem is being caused by deep rooted institutional deficiencies that will require major changes to correct. Three reforms are needed to correct the problem of budget deficits:

Price setting: Until recently there has been no permanent, formal and authoritative system in place for reviewing and setting public sector water prices. This deficiency should be removed with introduction of the Orissa Water Regulatory Authority – due to be established within the next 12 months. It is expected that the Water Regulatory Authority will treat water as an economic good and set charges so that they recover supply costs as defined. This will not preclude, however, the possibility of delivering social justice through recognition of the users' capacity to pay for water. Thus the poor and under-privileged could be offered rebates and dispensations that specifically recognise their inability to afford commercial charges rates.

Applying and collecting charges: Currently there is no clear and logical division between supplying bulk water (a DoWR responsibility), retailing water and collection of charges. Depending on the scope to improve competition, DoWR should sell water to retailers who on-sell to final users. No third party should be involved in collecting water charges.

Confining the bulk water supply function to storage and distribution: Currently DoWR is responsible for the distribution of irrigation water within command areas. Recovering the O&M cost of this task is one of the major causes of water sector budget deficits. DoWR supply responsibilities beyond the point at which water enters the command area should be withdrawn as expeditiously as possible with farmer operated water user associations (WUAs) assuming responsibility for all activities inside their command area. The rate at which this transition can occur will partly depend on capacity building within WUAs. It is expected NGOs will assist with the transition by teaching farm leaders organisational and business management skills.

These reforms will result in a more business orientated and self reliant water sector. But the reforms will take several years to complete and will not be effective unless the work of the Water Regulatory Authority is complemented by structural and institutional reform from top to bottom.

There are several other pressing problems. A looming problem for the Orissa's water supply industry is competition for access to water specified in terms of source, volume, reliability and quality at a given time and place. While market forces would tend to distribute access to scarce water according to capacity to pay, the resultant outcomes are unlikely to be socially acceptable. Accordingly it is recommended that the State's Water Regulatory Authority be asked to introduce a formal system of user access rights. In the first instance, this system should take the form of renewable licenses that establish the conditions under which existing and new users could obtain a water allocation. The allocations would be advised annually based on the results of water balance modelling. Licenses would act to control the relationship between existing and new uses and the supplies of water expected to be available for extraction. In due course, user licenses could be replaced by entitlements that are more highly specified in terms of the ownership rights and responsibilities they give to water users. Entitlements would specify (among other things) the conditions under which the title (or rights) could be used and exchanged. The existence of entitlements would ensure that people with an established reliance on water would at least be compensated in the event that their rights were undermined or transferred to another party. Given growing competition for access, it is vital that transparent mechanisms are put in place for allowing water to flow to its highest and best use while properly compensating those holders who might have become non-competitive or have surplus supplies that they are prepared to trade on a temporary or permanent basis. Entitlements should also specify that water usage charges can be legally tied to capacity to pay. This provision would allow different rates to be applied according to sector.

Closely related to the problem of establishing formal access rights, is the issue of financing the creation of new water supplies. If India is to cope with future water supply pressures it will have to seek from users a contribution to the capital cost of putting additional storage and distribution schemes in place. This will be possible if prospective users or investors purchase shares in the scheme based on its estimated yield and capital cost. The capital contribution will entitle the buyers to a share of the yield, which they would then on-sell to water retailers or final users. For the purposes of preventing 'market domination' the government should limit the share of total capacity any single investor could acquire. But otherwise we see nothing wrong with private sector investment in water storages. Attracting private sector capital would ease the pressure on government capital raisings and lessen the scope for political interference in the setting of water charges. Such reforms would not preclude the continued provision of low cost water to the community's poor and under-privileged – as explained in the following box.

Box 2. Balancing economic reform and social justice

If water is to meet all the future demands it faces in Orissa it will have to be treated as an 'economic good'. This means water will have to be surrounded by the same 'instruments' as other marketed goods including definitions of quantity and quality, unit pricing, ownership and conditions of trade, etc – as explained throughout this paper. However, history and popular expectations demand that water be made universally available to all people – regardless of their capacity to pay. It is possible to have both. In practice it will be possible to develop policy that makes a distinction between commercial water and 'welfare' water. The latter would certainly include drinking water and might include subsistent irrigation in poor areas. The cost of providing free drinking water in public places should not pose any administrative challenges – charges could be absorbed through either the supplier's or municipal budgets. The situation is more complex where irrigation water is provided via the commercial network. How could DoWR, for example, administer 'social justice' among water users based on capacity to pay? It is recommended that 'water welfare' be administered by a specialist welfare agency. This agency would determine the eligibility of groups and individuals for 'welfare water' and would have a budget for paying rebates and allowances to achieve the objectives of the policy. This would allow water retailers to recoup charges for services rendered (a commercial imperative) while ensuring that the poor and under-privileged still have their basic water needs met.

1.2.2 Growing competition for water, especially from industry

Irrigation currently accounts for 93% of all water extractions in Orissa, with domestic and industrial use accounting for just 4 and 3% respectively. But this pattern is about to change. Increasing urbanization is leading to higher domestic and commercial water demands while industrial water demands are also increasing. Also significant are fisheries, energy and recreation/tourism. Table 6 lists current and project demands.

At present Orissa accounts for only 2% of India's industrial output. Within Orissa itself, industry is expected to grow from the present 19% of GDP to some 30-35% of GDP over the next 10 years. Industry is the single most important competitor to agriculture for water in the State and conflicts with the irrigation sector are already occurring. Some of the rapid increase in industrial water demands will be addressed by industries themselves through investments in storage, increased water use efficiency etc. Industries may use public-private partnerships to generate additional water. They are likely to invest in increased water use efficiency in irrigation, create new storage facilities and make social contributions.

Table 6. Water requirements for different uses

Uses	Year-2001			Year-2051		
	Surface	Ground	Total	Surface	Ground	Total
Domestic	0.798	1.198	1.996	1.202	1.803	3.006
Agriculture	18.00	4.688	22.688	40.00	9.408	49.408
Industry	0.606	0.100	0.706	1.750	0.20	1.950
Environment	21.00	8.40	29.40	21.00	8.40	29.40
Others	0.10	0.10	0.200	0.20	0.20	0.40
Total	40.504	14.486	54.99	64.152	20.01	84.463

(Quantities in BCM)

1.2.3 Water use efficiency

Conserving water and improving its use efficiency is a high priority because it will allow for increases in agricultural output without adversely affecting other use sectors. Water use efficiency can be increased by improving distribution, delivery and drainage and through better crop choices. Lack of proper drainage systems and overuse of irrigation water, causing water logging and soil salinisation are other areas needing attention.

Improving the efficiency and distribution of water for drinking and domestic use is less pressing but also necessary. The domestic sector consumes relatively little water per capita, but rapid urbanisation and rising living standards will increase urban water demands significantly (estimated threefold by 2040). The plan is to reduce urban water distribution losses from 40 to 50% to a more acceptable target of 15% in the near future. Domestic water supply is the first priority in the State Water Policy 2007 and observed accordingly by DoWR.

1.2.4 Environmental flows

Environmental flow is meant to preserve various values that can be associated with the natural environment in, and adjacent to, rivers and streams. To this end the Orissa State Water Policy (2007) assigns a second-tier priority to preservation of ecological values. But as human endeavour is an integral part of the environment there should be no suggestion that 'working' rivers can be returned to, or kept in, their original condition. This point notwithstanding, there is the need for an integrated approach, implemented by the appropriate agency which recognises and administers environmental flows. Thus identification and specification of the natural values could be administered by DoWR working with local stakeholder groups, who will be most affected by the implied trade-off between consumption and abstinence – needed to protect the natural values identified.

The 2004 State Water Plan recognises a 30% water requirement for environmental flows to the ecosystems, including the requirements of the two Ramsar sites of the State. The state of knowledge of these requirements, and approaches to address them through environmental flow methods, is currently low. The notional "30%" need to be translated into specific, seasonally defined requirements for specific locations.

The rainfall pattern in Orissa is monsoonal meaning that competition for water is most intense in March, April and May. However, the severity of this period has been tempered by the construction of large storages that allow flow (albeit unnatural) to be maintained in the river. While most of this flow might be intended for extraction, some might be retained in the 'system' for ecological purposes – as specified in the various river basin plans. Formal recognition of environmental flow will require it to be granted an entitlement in much the same way as a commercial user.

A synergy has already been developed between generation of hydro electricity and preservation of environmental flow. Thus water is held in storage during the months of January, February and March so that supplies can be released in April and May that generates electricity and simultaneously allows water to flow down the river to fulfil such needs as aquifer recharge, maintenance of fisheries and preservation of mangrove swamps. In the absence of a scientific approach to the 'identification and specification of natural values' mentioned above, a provisional 'environmental flow' should be assigned in every river basin plan. This convention will act to preserve a notional proportion of the total supply for the environment that can be adjusted as knowledge of the river ecology and the preferences of stakeholders are refined via successive water plans.

1.2.5 Problems with pricing and allocation of water

Chronic budget deficits

Orissa's State Finance Accounts reported that the ratio of O&M expenditure to receipts on Irrigation and Drainage activities over the period 2000-05 was **3.7 to 1**⁸. This situation is symptomatic of an unsustainable water sector with implications for the larger economy and society. While the deficits

⁸ ADB TA-4815-IND *Public Expenditure Review* p25.

will impact firstly on such things as service standards and water use efficiency, it is likely there will be more fundamental and long-lasting problems if solutions are not quickly devised and implemented.

The failure of receipts to keep pace with expenditure can be traced in the first instance to a disconnect between how the respective prices are discovered and applied. DoWR's own operating and maintenance costs (dominated by wages) are derived more-or-less by market forces and are largely beyond its control. But water prices are set by the institutions that want to recover costs; unless the institutions have very good systems in place it is unlikely that their costs of supplying water and the receipts they take from sales will ever coincide. To assist our understanding of the situation it will be useful to look more closely at the water costs that have to be recovered and the methods currently being used to set charges.

The cost of providing regulated water is substantial (Table 7). The cost can be dissected into capital (to put in place the storage and delivery infrastructure) and operating and maintenance (O&M) to meet all the recurring costs of keeping the system functional. Hitherto the state has been prepared to suffer the capital costs of supplying water. Thus DoWR has generally not sought a capital contribution or a return on capital from the existing storage and distribution systems. This situation is likely to change with respect to future storages (needed to create 'new' water); the issues associated with this change are discussed in a later section. According to State Water Policy, however, current water users in Orissa should meet all the O&M costs⁹ of being provided with water products. There are several reasons why the receipts are failing to keep pace with O&M expenditure.

Table 7. Economic sector expenditures in Orissa

	2001-02	2002-03 (and % change on previous year)	2003-04 (and % change on previous year)	2004-05 (and % change on previous year)	2005-06 (and % change on previous year)
Irrigation and flood control	645	698 [8.2]	579 [-17.1]	694 [19.9]	719 [3.6]
Agriculture & allied activities	506	559 [10.5]	699 [25.1]	590 [-15.6]	615 [4.3]
Rural Development	448	469 [4.7]	459 [-2.1]	468 [2.0]	514 [9.8]
Total	1,599	1,726	1,737	1,752	1,848

Figures: crores of rupees

Source: State Finance at a Glance, AGs Report, 2005-06 as cited in¹⁰

Failure to adjust water prices quickly enough

The rates applying to irrigation water were raised in 1981, 1998 and 2002. This means that the charges imposed on khariff and rabi water have been increased only twice over the past 29 years. From 1981 to 2010, the price charged for class 1 irrigation water (the khariff rate) rose twice by an average of about 7.2 Rs/ha/year. This might seem a commendable effort but considering the prices were last raised in 2001-02, it is reasonable to conclude that the revenue curve is now tracking well below the cost curve (see ADB TA-4815-IND Table 4.1). This history, by itself, suggests the absence of a systematic and timely approach to price setting.

The wet season or khariff charge applied in Orissa is determined relative to the size of the project servicing the particular command area e.g., class 1 projects deliver 28¹¹ inches of water and cost farmers 250 Rs/ha/year whereas class 2 projects deliver 23 inches of water and cost farmers 188 Rs/ha/year, etc. These rates were set in 2002-03 and have not changed since that time.

Within a particular command area, farmers incur a charge for dry or rabi season water depending on the crop grown (e.g., the cost of irrigation water for Dalua has been set at 450 Rs/ha since 2002-03). For the purpose of imposing charges, an annual survey has to be undertaken (jointly by DoWR and the

⁹ Definitions of O&M costs vary between jurisdictions. Some will define O&M as simply the cash costs of keeping existing storages and channels operational. Elsewhere O&M might be taken to include depreciations and externalities.

¹⁰ ADB TA-4815-IND *Public Expenditure Review* p20.

¹¹ For further details of existing charges refer to the Orissa Water Act and annual reports issued by DoWR.

Revenue Department) that identifies the crop type and area for each farm. Actual charge rates (Rs/ha) vary substantially between crops, presumably to reflect the rates applied to crops historically in order to achieve their yield and price potential. As for the khariff charges, the rabi charges were last set in 2002-03 meaning that they are unlikely to cover the costs of O&M, even when the collection process is 100% efficient.

To maximise the effectiveness of price as a tool of economic management, it should be possible for payees and customers to understand every aspect of water prices as follows:

- What unit of measurement does the water price apply to (e.g. Rs per unit of water consumed over the past six months)
- Why is it imposed (in Orissa a charge is applied to recover the O&M cost of distributing water to customers)
- How do charges vary by sector (farmers who use water for irrigation are likely to pay a much lower rate than urban or industrial users – this is likely to reflect differences in capacity to pay)
- How does the price of water compare to other inputs (for farmers water is a factor of production just like fertiliser, seed, weed and pest control, harvesting, storage)
- How is the price derived (usually by cost accounting processes designed to recover a quantum amount – this task will fall to the new Water Regulatory Authority).

O&M role too long and complex

In Orissa, the O&M costs of irrigation water extend all the way from the headworks (that store the water) to inside command areas where the water is introduced to individual farms. Charges are currently applied to irrigation water for the purpose of recovering the O&M costs applicable to Irrigation and Drainage. These O&M charges (in Rs/ha) comprise two parts: a khariff charge related to the class of project the farmer occupies; and a rabi charge related to the crop-type grown. The same khariff and rabi rates apply throughout Orissa and have not been revised since 2001-02. The Revenue Department is responsible for collection of the O&M charges owed by farmers. While the Revenue Department collects a high proportion of the charges actually billed, the method by which charges are applied is flawed as the department has “... no clear information on how much area was actually irrigated”. On these grounds ADB TA-4815-IND (p 10) concluded that there exists an urgent need for water charges to be collected directly by the Pani Panchayats and that appropriate provision should (therefore) be made in the Pani Panchayats Act, 2003. Indeed the Act already allows Water User Associations to collect water charges giving them the potential to take direct responsibility for all O&M activities within their command areas. In addition, the National Water Policy (2002) guidelines ask for a “participatory approach to water resources management involving Pani Panchayats and local bodies in O&M and management of water infrastructure and facilities, with a view to management transfer”.

Most importantly, the current arrangements stop farmers from assuming responsibility for the operation and maintenance of their own command areas. Given that every command area will be somewhat different, it is only logical that each should be managed as a separate entity by a local management committee. Such an approach would avoid the complexities of trying to devise a state-wide ‘charges collection system’ that should be applied equitably and effectively to all Pani Panchayats.

Currently there are numerous inconsistencies in how the prices attached to irrigation water are expressed. Water units to which prices apply include gallons, cubic feet, litres, depth of water in inches, crop type and possibly others. For the khariff season, farmers pay a fixed charge per hectare or acre depending on the project area they fall into (class 1, 2, 3 or 4 corresponding to 28, 23, 18 and 9 inches of water and prices of 250 Rs/ha, 188 Rs/ha, 125 Rs/ha and 63 Rs/ha respectively). It is unlikely that all class 1, 2, 3 and 4 projects throughout the state are equally productivity and therefore due to pay the same rate. This problem could be addressed by devolving responsibility for collecting charges to the local level where it would be possible to determine actual costs and arrive at a close match between costs and charges. Communications and accounting would be greatly assisted by moving entirely to a common unit of measurement.

While water charges in Orissa are regulated and made public, it is not yet apparent how they are actually arrived at. The allocation of irrigation water, for example, is based on area and crop. While the area is fixed (in hectares) the return from the crop's nominal yield (in rupees) and the crop's water use efficiency (in kg yield / unit of applied water) are not fixed. Thus a critical aspect of water sector reform should be transparency. Water users should understand both the logic and application of allocation and pricing. Volumetric measurement, for example, would obviate the need to consider crop type when charging for water. It is expected that the **Water Regulatory Authority** will use explicit guidelines and economic and cost accounting principles for the purpose of arriving at a conjunction between total expenditure and total receipts.

Clarify roles and responsibilities

O&M responsibilities associated with supplying water currently extend from the storage headworks to inside irrigation command areas. Extending the government's O&M responsibilities beyond the customers' take-off point (i.e., where water enters command areas in the case of irrigation) is seen as a serious problem for the efficiency and sustainability of the whole water sector. Fortunately this problem is recognised by State Policy and it is certain that responsibilities will be transferred to WUAs as their administrative capacity is strengthened.

The DoWR is the principal provider of water products in Orissa. In this capacity, it acts as a direct-provider of water in the case of farmers, large-scale industry and mining (with costs recovered only from industry and mining). In the case of households the DoWR acts as a wholesaler, charging intermediaries on a volumetric basis. For towns and cities, DoWR effectively wholesales water to the Department of Public Health and this department retails to individual urban households. In the case of rural villages, DoWR wholesales water to the Department of Rural Water Supply and Sanitation, which then retails it to individual rural householders.

Given that irrigation accounts for up to 90% of total consumptive water from some storages, the share of overhead costs that can be appropriated from urban and industrial water users is relatively minor. This reality suggests a need for institutional changes that separate water storage, distribution and wholesaling from retailing responsibilities.

Industry and mining are significant potential customers for new water abstractions in Orissa but already there have been difficulties with respect to access rights and imposing tariffs. Several industrialists have challenged the rights of the state to govern their access to water and impose charges¹². Since the state's ownership of all water is prescribed in the national constitution, the manufacturer's legal challenge can be negated but the issue highlights the need for formal water entitlements that specify a link between capacity to pay and charge rates.

Integral to acceptable and sustainable water supplies is the notion of access certainty. Without a common understanding of how water is, or will be, allocated among users throughout the State and through time, there will be problems with recovering water charges and transferring access rights between sectors and customers. The rapid industrialisation of Orissa is acting to compound the problem of giving new water users access to supplies without compromising the expectations of traditional users. Clearly mutually satisfactory mechanisms are needed for allowing access rights to be transferred between parties.

Currently in Orissa, water is allocated by DoWR on a 'planned' but year-to-year basis. Fortunately, total water supplies are still large enough to allow an informal, *ad hoc* approach to meeting all demands. We suspect that as demand grows shortages will become more apparent, especially late in the dry season, and it will be desirable to take a more formal approach to assigning access rights.

Recovering the capital cost of creating new water

The prevailing financial issue for the water sector is recovery of operating and maintenance costs. Certainly recovery of O&M will be the main challenge that faces the **Water Regulatory Authority** when it commences operations. Government policy, however, requires that the water sector become 'physically and financially sustainable' by (also) recovering some part of the capital cost of supplying

¹² See para 336, OIIAWMP Institutional Study

regulated water to users. Our problem, therefore, is to prescribe the circumstances under which water users might contribute to the capital cost of water products.

In our view, it will **not** be possible to extract a capital contribution for existing storages that are already fully allocated. For these storages, the water 'rights' are already assigned (whether or not they were purchased) and attempting to impose a capital charge retrospectively would be viewed by users as unfair. Only where an existing storage has unallocated yield or a completely new storage is built (that will add to effective yield) will it be possible to seek a capital contribution from users.

Pressures on available water

Supply of water

Over the long term (that might be used for planning purposes) the quantity of water available to Orissa's natural environment and its population is essentially fixed, being a function of average rainfall (with associated run-off and capture events) and groundwater recharge. The ability to consume natural water is enhanced by physically regulating it, using storages and distribution networks. While water storages (such as dams and weirs) typically have a long life, allowing construction costs to be recovered over many years, all storage and distribution systems have operational and upkeep costs that should be recovered on an annual basis from customers.

As river basins become more developed and exploited, the scope for building effective additional storage diminishes. Along the pathway to 'full-development' it is possible to create 'new' water. So-called new water can be created by: a) constructing more storage, b) recycling used water, c) by importing it from the sea (after desalinating it) or d) tapping into an adjoining catchment¹³. Ultimately, however, manipulation of water supplies can only bring about marginal gains, making it necessary to place ever-more reliance on demand-side adjustments that act on consumption patterns. Fortunately, considerable scope exists to modify demand by introducing water use efficiency measures, raising water charges and imposing restrictions, etc. Thus once the limits to supply become apparent, effective outcomes will be dominated by demand-side adjustments aimed at ensuring water users have their needs met with minimal social and economic dislocation. The key to such a positive outcome, however, is pre-emptive planning and decisive actions using the various instruments of Integrated Water Resources Management.

Thus water user groups should be educated about the real costs associated with delivering to them specified water products and the imperative of shouldering an appropriate share of the cost burden. Integral to selling the message is demonstration of the link between 'paying a fair price' and getting 'a fair share of the available yield'. In practice, 'fair prices' can take into account the capacity of the user to pay. Thus industry might be expected to pay higher rates for water than (say) agriculture if it has a higher capacity to pay. Such an arrangement would imply a degree of cross-subsidisation (between users) but would assist with achieving balance between total costs and total expenditure. If Orissa wishes to structure charges according to 'capacity to pay' this should be stated in its policy and made clear in any licensing arrangements applying between water suppliers and users.

Water users should also be educated about the 'system yield' that is available for consumption. They should understand that the volume of water available in a given year is related to the total amount of water in storage (after taking into account predicted inflows) the volume that must be retained (for instance, as a carry-over reserve) the provision for environmental flows and other in-stream uses (such as navigation). These data are incorporated in the annual water plan for estimating the quantity of water available for sharing among recognised users within the geographic area served by the particular storage.

Demand for water

Within a defined area (such as the state of Orissa) the demand for water derives in the first instance from consumptive and non-consumptive uses. Non-consumptive water is retained in the riverine system to satisfy such extra-market demands as cultural and environmental amenity, navigation, aquaculture and various public uses associated with water bodies. While environmental flows tend to

¹³ These days, transferring water between catchments or basins is considered 'bad practice' due to the possibility of negative implications for the ecology of both the 'giving' and 'taking' catchments. It is unlikely, moreover, that the people living in the catchment from which water was taken will ever let the matter rest.

be unpriced (making it hard to assign them an economic value) they can be 'represented' in practice by the revealed preferences of the community.

Water supplies in excess of the total non-consumptive allowance can be extracted and allocated among domestic, agricultural and industrial users according to market and policy dictates. Leaving aside the natural environment, Orissa's demand for consumptive water is fundamentally related to aspects of its population – including its size, consumption habits, employment category, wealth distribution, stage of development, etc. In the case of Orissa, with an expanding population and industrialisation, the demand for water is likely to increase going forward. As noted above, changes in demand for water will be met by a complex array of adjustments.

There are many categories of users who value and purchase water according to how they assess its utility. Irrigated agriculture is currently the largest user of consumptive water but has a relatively low capacity to pay (per unit of water) compared to domestic and industrial users¹⁴. Even within agriculture there are considerable differences between regions, farmers and crops in capacity to pay for water, suggesting a need to send farmers clear price signals. Adjustments likely to emerge as demand for water becomes more apparent include gains in water use efficiency and a tendency for water to migrate out of agriculture and into higher order uses. The introduction of entitlements that link individuals or groups to access rights and recognises their capacity to pay should make future transfers of water between sectors relatively orderly and fair.

Critical qualities of water

The utility of water is directly proportional to its quality and accessibility. Supplementary water, regardless of user sector, is made accessible by the processes of capture, storage and distribution. The efficiency and effectiveness of accessibility can be expressed in term of cost per unit of volume and timeliness of actual delivery. Water quality, on the other hand, applies to the suitability of ambient water for particular uses. In Orissa, water has multiple uses including human and livestock consumption, industry, heating and cooling, irrigation of crops, recreation and tourism, spiritual renewal and bathing. While drinking water can be treated to make it safe for human consumption, this is costly and technically demanding.

Unfortunately there is still a high incidence of water pollution in Orissa, which often imposes additional costs and risks on water users. The water pollution control act (1974) is meant to 'make the polluter pay' and thereby minimise the externalities associated with water pollution. The evidence suggests there are still significant deficiencies in the current approach to water pollution in Orissa. We suspect there is a role for the **Water Regulatory Authority** in recommending various punitive measures that courts and regulators could apply to polluters. Two obvious measures are licensing of potential polluters and issuance of fines in the event of non-compliance with defined standards.

Thus a factory's license to operate might refer to water pollution in the following terms:

- Accreditation of the factory based on training undertaken by senior staff. The training would be delivered by a professional agency and the staff would have to pass an examination dealing with key aspects of water pollution and compliance with published standards.
- Employment of a trained Environmental Officer(s) who would monitor water quality (and other aspects of the environment) and submit routine reports to a central, independent monitoring agency.

¹⁴ Agriculture has a relatively low capacity to pay at this time because the Marginal Value Product (from irrigation) is low compared to the MVP from water used by industry. The relatively low MPV of irrigation water is exacerbated by high transmission losses between the storage dam and place of application. From an economic perspective, it is possible to view agriculture as the 'residual' water user – meaning it gets access to the quantum left over by higher-order users – who can afford to pay more. Households have a high capacity to pay for water because their gross needs are low compared to household income.

- The conditions under which the factory's license to operate might be suspended or withdrawn. The conditions would refer to specific aspects of water pollution tied to discharge¹⁵ monitoring and compliance standards.
- Employee training and awareness campaigns designed to make all staff conscious of responsibilities to the natural environment and the consequences of not meeting compliance standards.

Fines will only be effective if they are genuinely punitive and regulators and the courts combine to bring about more prosecutions. Public awareness campaigns should make people more conscientious about their personal responsibilities to the natural environment while garnering political support for a tough stance by law makers. If successful, these measures will reduce the costs and risks of using water.

From a marketing perspective, water can be substantially differentiated in terms of its location and suitability for particular uses and applications. By implication, there exists a 'wholesale water market' that will serve the state best if it operates openly and makes extensive use of regulations and price signals. However, water markets throughout the world are mostly operated by government instrumentalities, vested with near-monopoly powers. The issue, therefore, is how to make or assist government utilities (that control the water markets in Orissa) operate efficiently as required by both national and state water policies.

1.2.6 Other challenges

In addition, there are a number of other water management challenges facing Orissa (in no priority):

- **Navigation and other uses such as recreation and tourism.** Apart from the revival of the Orissa Coast Canal as an inland waterway no major navigation plans are envisaged in the State Water Plan 2004, but the recreation and tourism sectors may lead to growing water demands
- **Hydropower** presently accounts for 55% of the energy production in the State. The desired hydro-thermal mix is 60%-40%. In the future more than 90% of the thermal power may be exported to other states with little benefit for Orissa. The view of the sector is therefore that power production should not compromise requirements for flood control and water use requirements for other sectors.
- **Inter-state water sharing.** Orissa receives some 30% of its water from upstream states. With increasing development and water abstraction in these states discussions about water sharing arrangements are becoming increasingly serious
- **Groundwater management.** While surface water use is controlled by the State, groundwater use is largely uncontrolled and represents an important source of "self supply". Groundwater accounts for the majority of domestic use, and some 14% of irrigation use, but the total potential is only utilized some 25% statewide. However, locally overdrafts cause lowering of water tables. Groundwater is supposed to be used for domestic and smallholder farmer use only; industries are not supposed to use groundwater, but no effective enforcement is in place. The State has no groundwater act, and no mechanisms for managing conjunctive use of surface water and groundwater.
- **Watershed management in upstream catchments** holds the key to local land and water management with both local and basin benefits. Land use management and practices (including forest management) is key to control run-off and upper basin recharge. This obviously calls for "integration" between land, forest and water management. Furthermore, small water retaining structures (rainwater harvesting, tanks, artificial recharge) which contribute to conserving water, and also to reduce soil erosion and consequent downstream siltation.

¹⁵ Factory discharge that might violate pollution standards can stem from turbidity, nutrient enrichment, chemical contamination, salinisation of surface or groundwater and contamination by pathogens or other biological sources.

1.3 Approach

The various challenges discussed above can be addressed using an integrated approach to water resources management, supported by strong organisational and institutional arrangements.

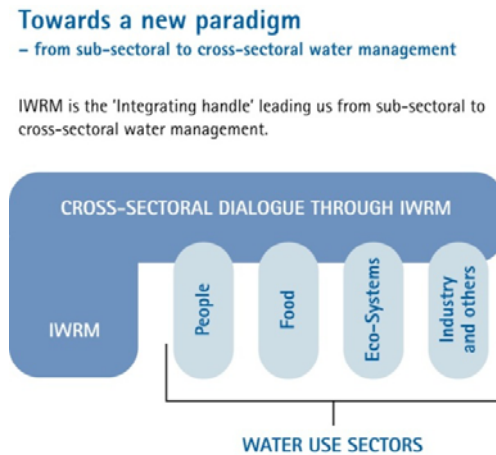
Integrated Water Resources Management (IWRM) is an approach that:

- allows all stakeholders make a tangible contribution, and
- coordinates action between different sectors to solve water problems (Figure 2).

More formally, IWRM is:

“a process that promotes the co-ordinated development and management of water, land and related resources in order to maximise the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems” (Global Water Partnership).

Figure 2. Cross-sectoral coordination through IWRM



Source: Global Water Partnership¹⁶

IWRM is not a new way of managing water resources – but it is an improved way, as it involves relevant stakeholders, recognises rights and responsibilities in water management and coordinates actions between government (the key public good stakeholder) and a wide range of other water stakeholders.

1.4 Proposed Action Plan for Strengthening Water Management in Orissa

1.4.1 Overview

Few efforts have been made to strengthen water resources management using coordination and stakeholder involvement and other IWRM principles to implement State Water Policy in Orissa with the aim of sustainable water management. This situation reflects limited leadership from the Orissa State Government and the organisational capacity Department of Water Resources, limited understanding and appreciation of the benefits of an integrated approach,¹⁷ a lack of effective coordination between different water departments and perhaps even an unwillingness to change. To address these constraints, this document presents **practical implementation options for DoWR as the lead agency**. But adoption will only occur with strong leadership and commitment from the highest levels of Orissa government.

¹⁶ Global Water Partnership Technical Advisory Committee (2000) *Integrated Water Resources Management*. TEC Paper #4. Global Water Partnership, Stockholm.

¹⁷ See our assessment of IWRM in Orissa in the Supplementary Documents in the Downloads at this TA project's blogspot: <http://ta7131iwrmodisha.blogspot.com/>

This **Action Plan covers the period 2010-14**. It supports the Institutional Strengthening and Project Management component (the 'ISPM Project') of the Orissa Integrated Irrigated Agriculture and Water Management Investment Programme. It includes actions, timelines, tasking and examples of 'best practice' learned from national and international experiences.

The action plan was generally agreed at a meeting with staff of the Orissa Department of Water Resources (DOWR) and the ISPM Project on February 4, 2010, following an assessment of IWRM implementation in Orissa (footnote below). It has since been revised through ongoing input from water stakeholders using workshops, field trips to the Baitarani Basin and the Pune Irrigation Circle (Maharashtra), a solicited discussion paper on improving the allocation and utilisation of water in Orissa (Annex 3), discussions with staff of DoWR and staff of the ISPM component of OIIAWMIP. The Action Plan was informed by a review of international and national experiences in IWRM and best practices for IWRM implementation (reported in the Inception Report of this project). As well, a framework for implementing IWRM was established in the 2008 TA on IWRM in Orissa and this also informed this project (see Table 8 for correspondence between the two TAs). The tasks specified in the road map reflect best practices for **a start-up phase of IWRM** at the State level.

The Action Plan is presented in this format is to facilitate its use by the DoWR and ISPM Project staff, the target audiences of this report. The Action Plan has:

- Achievable goals with realistic timeframes
- Easy to understand procedures
- Stepped approach with timelines
- Specified roles and responsibilities
- Suggested best practices to assist with implementation.

This Action Plan will require **leadership and commitment during the next four years**. The overall approach in this Action Plan is one based on strengthening OWPO (within DoWR).

1.4.2 Structure of this document

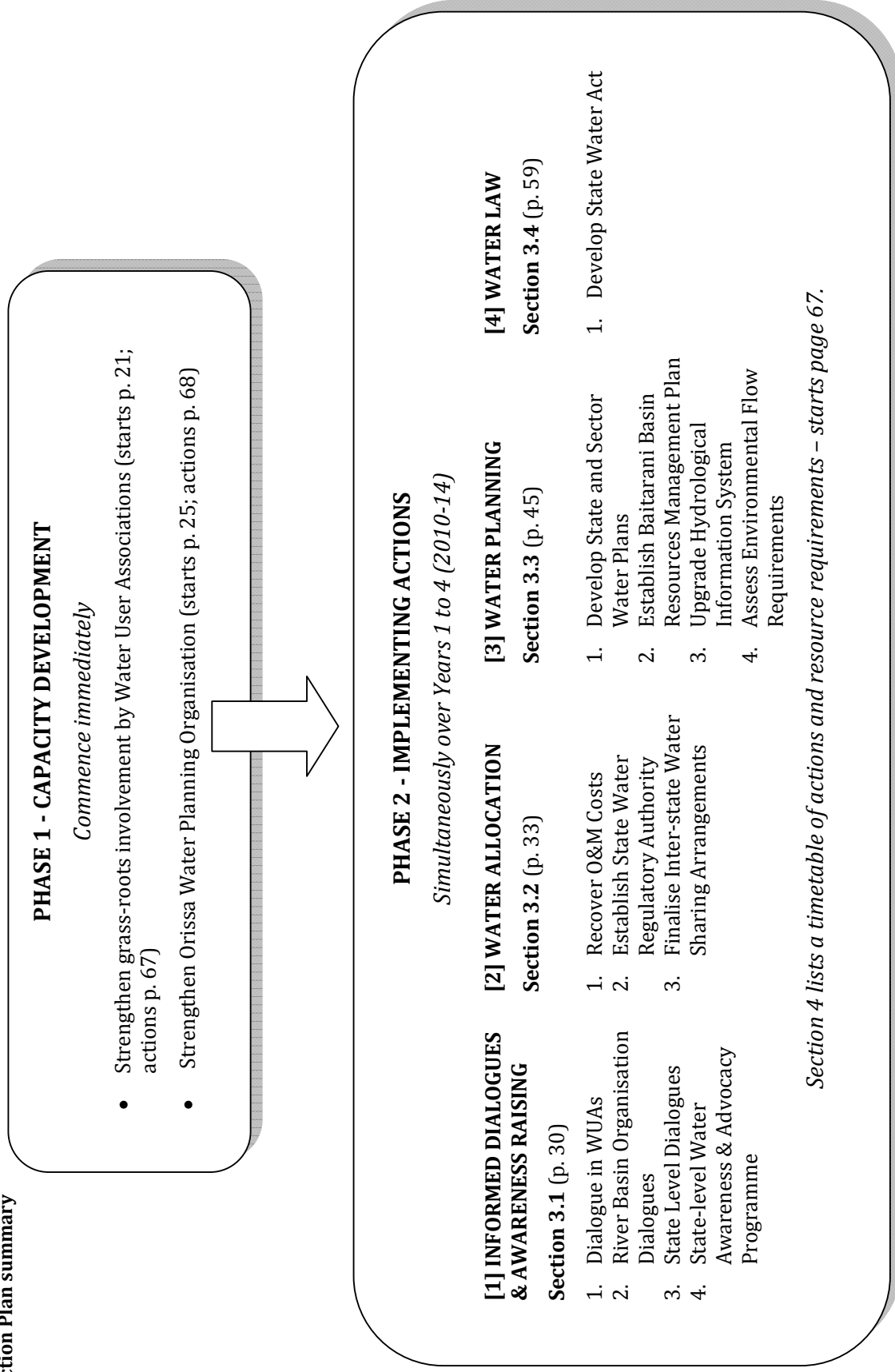
This report includes an Action Plan, divided into two phases and five groups of action items (Figure 3). The report includes four Annexes, including a discussion paper on improving the allocation and utilisation of water in Orissa.

Table 8. Relationship between actions prescribed in the 2008 IWRM TA Project and Action Plan activities

#	TYPE	IWRM ACTIONS *	INSTITUTIONAL MECHANISMS AND TOOLS						
			ACTION PLAN - PART A		ACTION PLAN - PART B				
			Capacity Development	B1 Informed Dialogues	B2 Water Planning	B3 Water Allocation and Tariffs	B4 Water Law Reform		
1	Organisational action	Develop a revised State Water Plan	X	X	X	X	X	X	
2	Organisational action	Review the legal framework for water resources management	X	X			X	X	
3	Organisational action	Review and revitalize the institutional mechanisms for water resources management (State Water Board and State Water resources Council)	X	X	X		X		
4	Organisational action	Review and decide on the possible creation of a State Water Resources Regulatory Authority and a water allocation system for Orissa	X	X	X		X	X	
5	Organisational action	Develop the River Basin Organization structure in Orissa	X	X	X		X		
6	Organisational action	Develop capacity within the DOWR - an inter-departmental and multi-disciplinary IWRM Directorate and the Orissa Water Planning Organization (OWPO)	X	X	X		X		
7	Human resources	Develop institutional and human capacity	X	X	X		X	X	
8	Organisational action	Develop a multi-stakeholder Orissa Water Partnership	X	X					
9	Human resources	Develop an awareness, advocacy and education program for IWRM	X	X					
10	Organisational action	Develop a State hydrological information system	X		X		X		
11	Organisational action	Develop a system to address environmental flow requirements	X	X	X		X		

* As specified in the Draft Final Report & Proposed Roadmap for IWRM in Orissa, 2008. Technical Assistance for Integrated Water Resources Management (IWRM) in Orissa Project.

Figure 3. Action Plan summary



2.0 Capacity development

The immediate focus of capacity building is to:

- A. Strengthen grass-roots/district involvement by Water User Associations (WUAs)
- B. Strengthen Orissa Water Planning Organisation

2.1 Immediate actions - strengthen grass-roots/district involvement by WUAs

2.2.1 Stakeholders

A water stakeholder is a person with a 'stake', a bargaining right, opinion, or position in a water management situation because of their use, ownership or involvement with water (Box 3). Grass-roots stakeholders include farmers, water user associations and Zilla Parishad organisations.

Box 3. Who is a stakeholder?



A stakeholder is:

- (i) A person or an organisation with an interest in water resources management or water-related development; or
- (ii) a person or an organisation likely to be affected, positively or negatively, by a water management plan or a water development.

The development of the Andhra Pradesh Water Vision is an example of how one government involved village stakeholders in surveys (Box 4).

Box 4. Andhra Pradesh Water Vision: gathering grass-roots stakeholder input (2002-03)

In the development of the Andhra Pradesh Water Vision, stakeholder 'water messages' were collected from over 600 people in village meetings. A local non-government organisation that specialises in collecting 'local voices', gathered the opinions of people who normally have very little, if any, access to government decision makers. This made sure that the voices of groups in remote locations were heard. The material gathered in this way was a key input to the Andhra Pradesh Water Vision.

But the process was limited in that it was a 'one way' process. The Government needs to put more effort into communicating what will happen once the Water Vision gets underway. This has not really happened, so the danger is that the people who participated may become frustrated and wonder about the value placed on their input.

Source: Andhra Pradesh Water Vision 2025

However, stakeholder participation can be time-consuming and costly and may not have clear outcomes. There has to be a **balance between informing all and involving a few**. To avert or minimise these problems, procedures for involving stakeholders need to be designed thoughtfully and implemented carefully (Box 5).

Box 5. Keys points to consider in designing stakeholder involvement

1. Ensure all relevant groups of water users are represented.
2. Avoid 'capture' of the process by minority or particularly articulate groups.
3. Subsidise if necessary to ensure a 'balance' of public and private participation.
4. Establish 'rules' to resolve disputes.

Source: GWP ToolBox www.gwptoolbox.org

2.2.2 Role of dialogues in water management

Dialogues are powerful tools to exchange information, opinions and ideas (Box 6). Dialogues can help coordinate action for improved water management and provide useful input into water planning, water allocation and water law reform.

Water sector reform in Orissa is entrusted to the DoWR. DoWR functioned for a long time as the Department of Irrigation and dialogues between water dependent sectors and the involvement of stakeholders in the planning and decision processes were not common. Dialogues are needed to strengthen the Department of Water Resources capacity to plan and manage water resources.

This TA project used dialogues – two Stakeholder Advisory Group meetings - one key water issues in Orissa, the second on gathering messages about Informed Dialogues appropriate to the Orissa situation. The third meeting will be to review this Action Plan. One of the key messages from the 2nd Stakeholder Advisory Group meeting was the need for **peer-led dialogues**:

- At village level – to couple scientific knowledge with farmers' wisdom to improve water management.
- At all levels (village, basin and State government) to bring about a change in attitudes and increase action (peer leaders act as change agents).

The meeting suggested DoWR identify peer leaders at all levels among water users, identify the influence of these peer leaders, then develop a **stakeholder dialogue map**. This will provide a useful way to improve communication between DoWR, proposed basin organisations and water user associations.

Four levels of stakeholder involvement and informed dialogues can occur (Figure 4):

- 'Grass-roots'/intermediate level
- River Basin Organisation level
- State level, and
- Inter-state/union level.

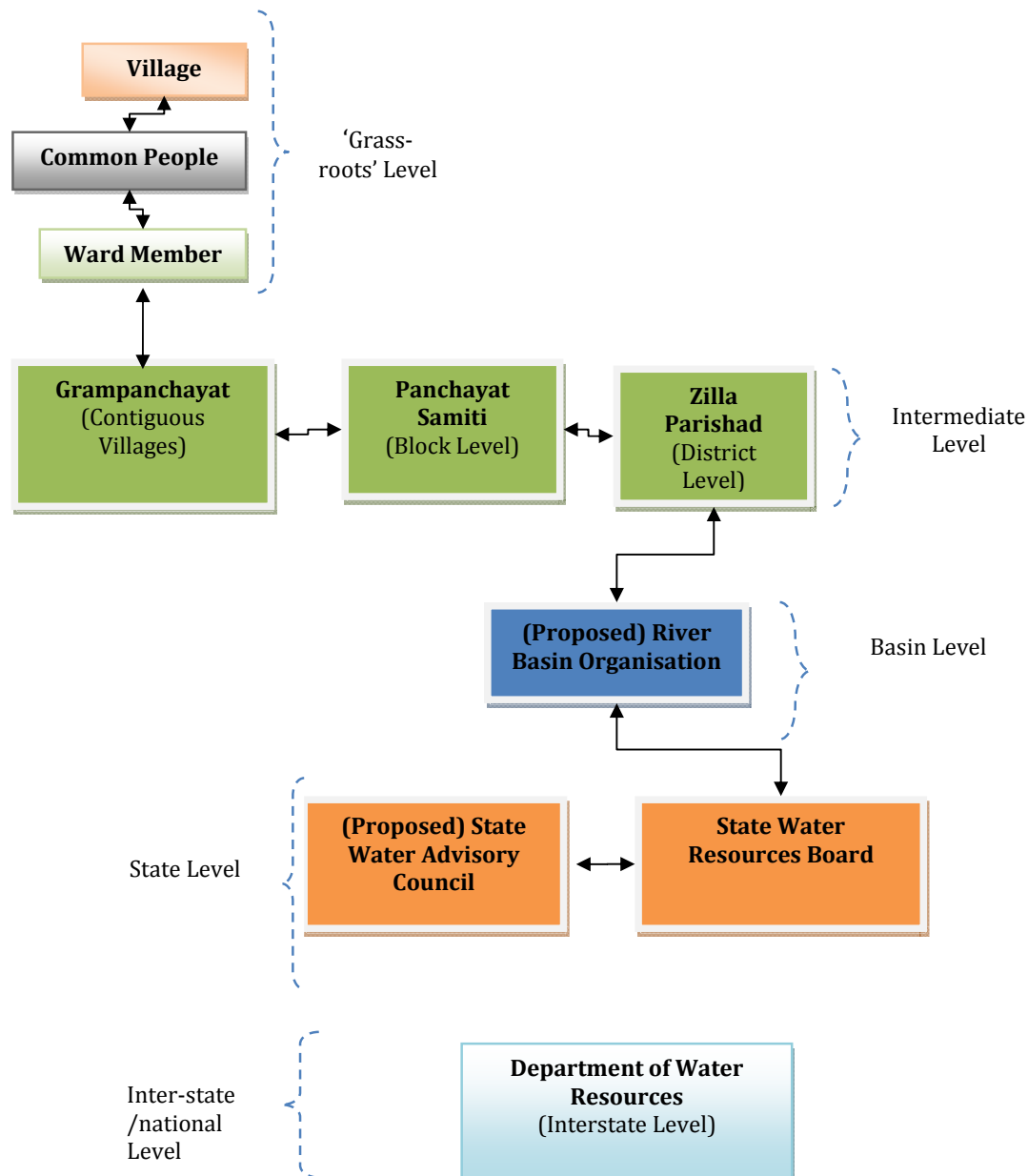
In all levels, we recommend use of information diagrams to inform water stakeholders of the issues, problems and solutions developed in this project.

Box 6. Dialogue methods

Dialogue is frequently described as conversation between two people. Here it refers to something more: a **negotiated discussion** between water stakeholders - intended to produce an agreement. Dialogues can occur in many ways:

1. Informal communication, social occasions, word of mouth
 2. Scheduled meetings
 3. Regular communication mechanisms (e.g. newsletters, e-mail)
 4. Web pages
 5. Intranet for joint development of plans, papers
 6. Information and database sharing procedures
 7. Shared databases for data exchange
- ... across sectors of the government, and among water stakeholders at all levels.

Figure 4. Structure of Dialogue Mechanisms from Local to State and Interstate Level



2.2.3 Informed dialogues at 'grass-roots' and district levels

In the state of Orissa, addressing the issues should start at the village level, which is administratively the lowest in the hierarchy. Different administrative levels in Orissa are:

- Village (Inhabited: 46,989 , Uninhabited: 4,068; Total: 51,057)¹⁸
(in the case of the urban sector, the appropriate lowest level will be defined depending on the type of local bodies)
- Block/Tehasil (314/316)
- Sub-Division (58)
- District (30)
- State (1)

The Indian constitution provides for three-tier Panchayati Raj Institutions (PRI) System (Figure 4). It encompasses people from the village level to the district level:

¹⁸ Source: Directorate of Economics & Statistics, Government of Orissa

- Grampanchayat (6234 with group of villages with contiguous boundary)
- Panchayat Samiti (314 at the block level)
- Zilla Parishad (30 at district level).

These are very strong institutions having legal provision with clear cut functions and responsibility. They look after all development issues at the respective levels. Water resources management can be incorporated in the mandate of these institutions. The PRIs have forums for discussion and dialogue and there is a strong potential for using the existing structure to promote stakeholder involvement, dialogues, coordinated management and cost-recovery.

The organizational structure of Pani Panchayat (Figure 5) is defined on the basis of irrigation command area i.e. starting from outlet command area, minor canal command area, distribution command area and to project level command area. This structure does not take into consideration any administrative limits of villages. The structure is well defined and takes care of each farmer's involvement at a local level. Dialogue and decision making starts at the lowest level (chak committee) and progresses to the highest level (State level committee).

At every level of organisational structure there are two committees namely:

- (i) a general body encompassing all stakeholders of irrigation and
- (ii) an executive committee with members elected from the general body.

The office bearers of the organisation are elected from the executive committee.

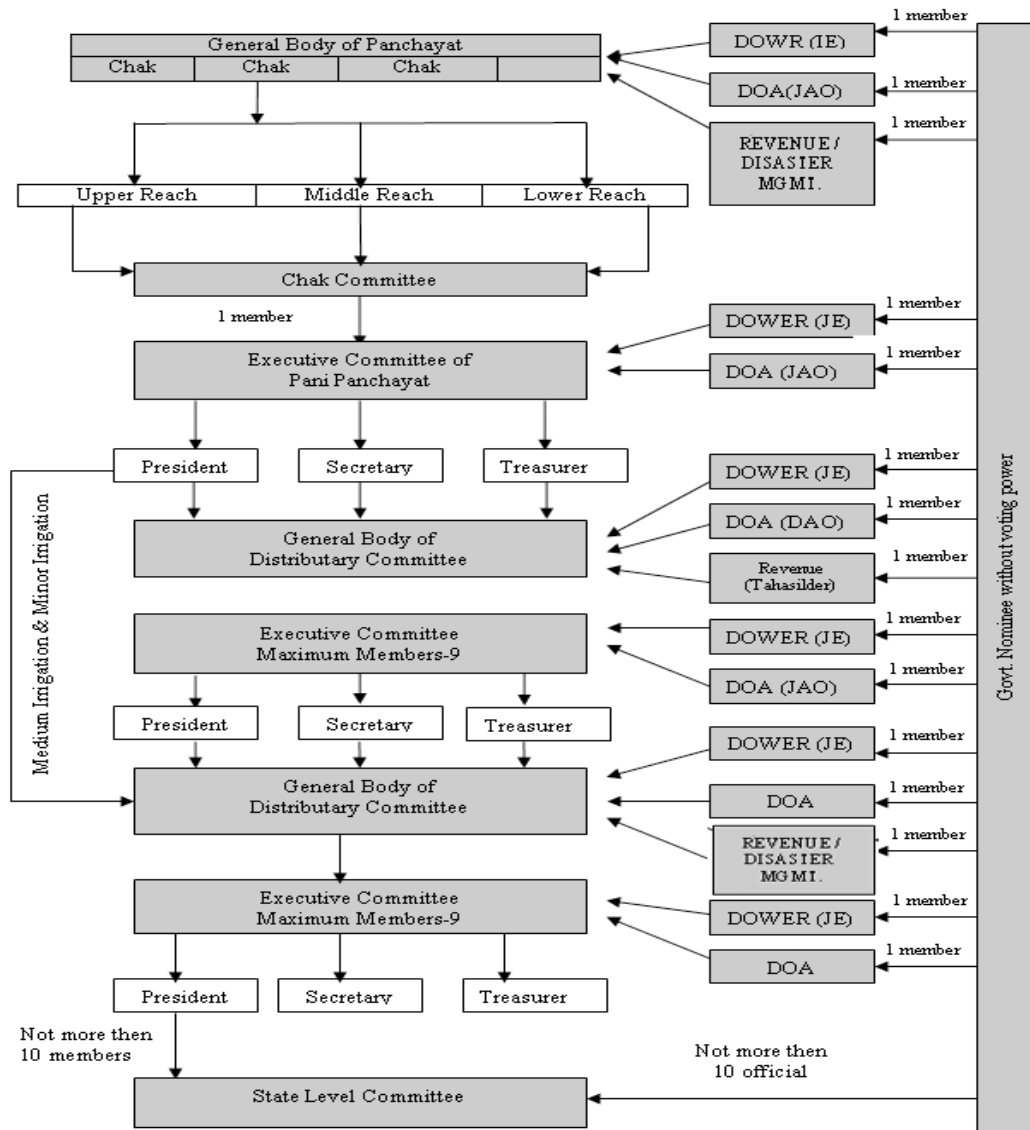
Some topics of water resources management which can be incorporated in the mandate of these institutions are:

- allocation of water among users in water user associations
- improvement of rate of cost recovery of O&M charges
- watershed development programmes, and
- land and water management plans at the sub-basin level.

The consultants recommend the Zilla Parishad (district level) be encouraged to progress these actions as relevant to their districts. This will require coordination between districts to develop programmes. The coordination can be lead by the proposed River Basin Organisations. As a first step, the PRI system can identify the best forums to dialogue water issues at the sub-basin level.

This will require significant investment in capacity development in the four topics listed in the bullets above. The capacity development actions are referred to in Section 4 of this Report.

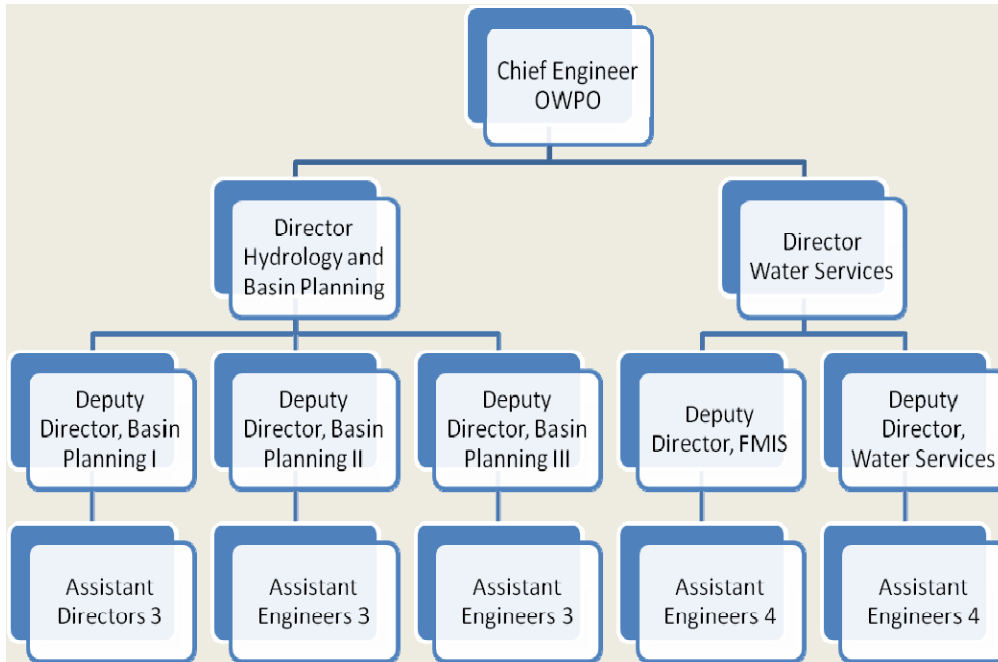
Figure 5. Organisational structure of Pani Panchayat



2.2 Immediate actions - strengthen Orissa Water Planning Organisation

The present structure of the OWPO is shown in Figure 6.

Figure 6. Existing OWPO Structure



The immediate actions are to redefine and strengthen the OWPO to spearhead improve water management in the State:

- 1) **Implement ISPM Capacity Development Action Plan** - OWPO put into mission mode on prioritised actions.
- 2) **Staffing** - As identified in the ISPM diagnostic analysis, significant changes to the staffing arrangements in OWPO will be required to provide the depth and range of experience and expertise required for effective implementation of water management. These changes are detailed in the ISPM Diagnostic Analysis Report submitted in June 2010.

The following positions should be retained or established and should not be linked to the ADB Loan component:

- CE, OWPO – IWRM Director
 - Director, Hydrology and Water Planning
 - Deputy Directors - Water Planning I, II, III (including State and basin level water allocation decision support system; water quality assessment and management)
 - Deputy Director - Water Information (databases and geographical information systems)
 - Deputy Director – Flood Management Information System
 - Director, Water Services
 - Deputy Director - Water Services
 - Deputy Director - Water Policy, Water Law and Regulatory Authority Support
 - Deputy Director – Water Services and Benchmarking (monitoring and evaluation).
- 3) **Appoint Key IWRM Advisor** in DoWR, to advise both Secretary and Engineer in Chief, OWPO, to support mainstreaming of IWRM in OSG. The position should not be linked to the ADB Loan component.
 - 4) **Agree on prioritised area of work** within the following areas:
 - (i) support pilot basin organisation (Baitarani),
 - (ii) coordinate State-wide dialogues and establish State water planning framework

2.2.1 Implement the proposed ISPM Capacity Development Action Plan

There is an immediate need to design and implement a Capacity Development Action Plan for OWPO. To do this, OWPO can be upgraded to a *mission oriented organisation in water resources management*. It is necessary to coordinate water resources management and planning beyond the irrigation sector, with industrial and urban water users and environmental interests. While the carriage of this Action Plan is the realm of the Department of Water Resources, it is recommended that **OWPO take the lead role to monitor, advise and manage coordination in the State.**

2.2.2 Staff strengthening in OWPO

As well as the appointments and designations listed above, there is the need to strengthen technical resources in OWPO to be the lead driver of the Action Plan, by:

- Taking steps to encourage staff self-improvement and enhanced performance through the introduction of merit-based selection for positions within the unit.
- Retitling all positions, apart from those mentioned in the next dot point, within OWPO below Deputy Director as “Engineer”. Furthermore, two levels of engineer should be recognised, being “Senior Engineer” and “Engineer” to allow for promotion of high performers and to recognise those that have advanced competence.
- In the short term, creating the following positions (as a minimum), funded and filled as a matter of urgency:
 - Environmental Flows Specialist
 - Economist
 - Technicians (IT and GIS)
 - Administrative officers (2)
- Training selected staff members to work with economists and environmentalists should also be undertaken.
- Lift skills base in:
 - Water planning and management – using adaptive management
 - Database development and maintenance
 - Decision support systems development and maintenance
 - GIS development and maintenance
- As part of the Capacity Development Action Plan process, prepare job descriptions and individual capacity development plans for each staff member in OWPO.

2.2.3 Appoint key advisor

The purpose of the Key Advisor to Principal Secretary cum Commissioner and Engineer-in-Chief OWPO to:

- provide strategic advice,
- coordinate procedures within DoWR to implement the activities in this Action Plan, in conjunction with the ISPM component of the Orissa Integrated Irrigated Agriculture and Water Management Investment Program.

2.2.4 Agree on work priorities

Agree on prioritised area of work within the following areas:

- water allocation/tariff reforms,
- establish and support the Water Regulatory Authority
- support pilot basin organisation (Baitarani),
- coordinate State-wide dialogues and establish State water planning framework
- link more closely with Hydrology II project and create GIS-based decision support system for Baitarani basin.

2.3 Further capacity development actions

The consultants in this TA (TA-7131) recognise the proposed ISPM **Capacity Development Action Plan for OWPO as the key instrument in achieving long term outcomes for sustainable water management, led by OWPO**, to assist its application in the Baitarani sub-basin (and many other tasks in water management). The consultants cannot stress this enough and more needs to be done to assist the process immediately. There is a real **need to provide mentoring, training and program direction and strengthening**.

2.3.1 Transition to a 'Water Mission'

The ISPM diagnostic analysis concluded that the structure of OWPO and its line of reporting are not suitable for the multi-disciplinary function of the unit. Internally, the unit could be restructured to better reflect the functions it is expected to perform. Externally, the situation where it reports through an Engineer in Chief position, with primary responsibility for irrigation planning and development has the potential for a bias towards the irrigation subsector, rather than across the entire water sector as is necessary for effective and sustainable water management.

Since 2007, DOWR has been considering the establishment of a Water Directorate to more effectively implement sustainable water management in Orissa. We use the term 'Water Mission' rather 'IWRM Directorate', as the latter is misleading – IWRM is a process, not a management unit. Under this proposal, a number of existing units within DoWR that are responsible for overall water management would be brought together to form a more integrated and coherent directorate. OWPO would be the centrepiece of such a directorate.

The consultants believe the goal should be to establish the Water Mission sooner rather than later (say by the end of 2011).

2.3.2 OWPO/DoWR Transformation - the '7S approach'

The transformation of OWPO from its existing situation to one of excellence in water resources management can be done in a structured, systematic way, and with an open mind for innovation. The OWPO staff are a group of people showing willingness to change and adopt innovation, backed by quality engineering skills, the ability to listen and discuss to find practical, workable solutions and a camaraderie to achieve effective, sustainable water management that is praiseworthy.

Short-term actions to transform OWPO have already been outlined. There is also a need to look at the overall approach to transforming OWPO. Table 9 outlines the '7S approach', incorporating training and mentoring.

Table 9. Paradigm shift needed for water agencies to implement an integrated approach to water management

'S' FACTOR	Old Paradigm ¹⁹ - single sector decisions	New Paradigm - decisions use coordination and adaptive management (learning by doing)
The Hard S's		
STRATEGY	Reactive - Meet regulations, focus on end-of-pipe - No specific environmental policy - Closed door to community	Proactive - Link between environmental excellence and competitiveness - Emphasis on continuous improvement - "Open Door" to community
STRUCTURE	Rigid - Steeply hierarchical - Weak or no links between OH&S, environmental management and service delivery	Flexible - Devolution of environmental responsibility to include 'grass roots' stakeholders as key deliverers of programmes - Flatter structure of organisation, team oriented - Integration of OH&S, environmental management and service delivery
SYSTEMS	Environmentally Exclusive - Minimum required to meet regulations	Environmentally Inclusive - Comprehensive Environmental Management Plan - Formalised communication links with community
The Soft S's		

¹⁹ Paradigm - means the way we operate, the 'way we do business' as a water department in government

'S' FACTOR	Old Paradigm ¹⁹ - single sector decisions	New Paradigm - decisions use coordination and adaptive management (learning by doing)
STYLE	Formal - Command and Control - Environment is a low priority of CEO	Committed - CEO vision, personal commitment and leadership - Demonstrated priority for senior management
STAFF	Directed - Performance measured by cost - No sense of ownership	Empowered - Environmental criteria in performance appraisal - Pride in activities in IRBM
SKILLS	Functional - Production and waste control	Problem-solving - Integrated approach to improvement - Innovation, problem solving skills highly regarded
SHARED VALUES/ SUPERORDINATE GOALS	Efficiency - maximise business output at least cost with minimum expenses	Excellence - Strive for optimal river basin management outcomes, using stepped approach

Source²⁰

2.3.3 OWPO training and mentoring

The consultants recommend that training and mentoring programs be developed to achieve capable, skilled and professional staff based on:

- Building on and enhancing past learning.
- Building and maintaining ownership within the OWPO, DoWR and Line Agencies.
- Enhancing technical expertise, particularly one linked to State water dialogues and State water planning, basin consultation and Pani Panchayat cost recovery programmes.
- Using adult education/professional training principles and practices including building capacity to design, deliver and evaluate training programmes based adult education principles and processes.
- Matching new knowledge and skills with problem solving mechanisms and effective communication.
- Building and maintaining links with other OWPO projects, programs and partners.

The Capacity Development Action Plan for OWPO will be prepared by the ISPM team. It is understood that as part of the process of developing that plan, job descriptions and individual capacity development plans for each staff member in OWPO will be prepared.

Contents of the Training Plan will need further discussion but can include the topics in Table 10.

Table 10. Training and mentoring topics

POSSIBLE TRAINING & MENTORING TOPICS
<p>Capacity Development Action Plan from ISPM Project [confirm with to Dr Geoff Wright, ISPM IWRM consultant]</p> <p>Suggested topics could include:</p> <ul style="list-style-type: none"> - Leadership development for senior OWPO staff: <ul style="list-style-type: none"> o Training in leadership competencies o Change in hierarchical structure o Freedom in expression of opinions and views - Water planning and management for OWPO staff <ul style="list-style-type: none"> o State Water Framework and planning techniques o How to prepare Basin Resource Management Plans (soft and hard technologies) - Cost-recovery development for Pani Panchayat organisations <ul style="list-style-type: none"> o Empowerment of water user associations

²⁰ Adapted from: <http://www.themanager.org/Models/7S Model.htm> and Waterman, Peters and Phillips (1980). Waterman, R. J., Peters, T., & Phillips, J. R. 1980, Structure is not Organisation. *Business Horizons* 23[3 (June)], 14-26.

POSSIBLE TRAINING & MENTORING TOPICS

- Role of State Government

Introduction to IWRM short course for OWPO and Training of Trainers (ToT) in IWRM for WALMI Trainers and appointment of mentors.

[content to be ascertained in discussions with OWPO, WALMI and ISPM consultants]

Series of training workshops/seminars in specific topics for all sectors [content to be ascertained in discussions with OWPO and ISPM consultants]

2.3.4 Monitoring and evaluating outcomes in Key Result Areas

As already discussed, the ISPM diagnostic analysis of OWPO identified five key areas that need to be addressed in the work of the office, as follows:

- Key Result Area 1: Institutional Arrangements
- Key Result Area 2: Water Resources Planning and Development
- Key Result Area 3: Water Resource Management
- Key Result Area 4: Data and Information
- Key Result Area 5: Administration

The consultants **recommend preparation and implementation of a monitoring and evaluation programme in these five key result areas using key performance indicators.**

3.0 Implementation tools

The challenges confronting Orissa's water sector can be addressed using four groups of tools:

- **Informed water dialogues** at district level, river basin level, state level and interstate level.
- Establishment of a **Water Regulatory Authority**, a state-wide **water allocation and tariffs** system, expanding O&M cost recovery by Pani Panchayats and the determination of basin environmental flows.
- **Water planning**, including a revised State Water Planning Framework (including Sector Water Plans, environmental flow assessments, river Basin Resource Management Plans, supported by a strengthened hydrological information system.
- **Water law reform**, proposing an Orissa Water Act, to support a revised State Water Plan.

3.1 Informed dialogues

3.1.1 River basin organisations (RBOs)

Dialogue at the river basin is also needed because water resources are frequently utilised inside the basin boundary. This means that the basin boundary can be superimposed on the administrative boundary to ascertain the exact administrative units, starting from the local level. Alternatively, if the organisation structure at the local level is based on sub-basins / stream orders then they will be a part basin level organisation. The consultants prepared and circulated to DoWR and ISPM consultants a discussion paper on the roles, responsibilities, functions and membership of a proposed river basin organisation. The paper recommended a significant revision of Government of Orissa's Resolution No. 5788/WR (26.02.07). The remainder of this section describes the proposed river basin organisation for the Baitarani basin, a pilot basin in Orissa for basin management.

The consultants recommend a **consultative committee form of river basin organisation** as a first step towards more developed basin organisations in Orissa. The functions of the RBOs include:

- **ADVICE and AWARENESS RAISING** - Advising governments and basin citizens:
 - Identification of water resources management issues at sub-basin and basin level and informing OSG and basin citizens
 - Basin-wide education and awareness raising on water resources management issues and solutions
 - Advising the DoWR on contents of the Basin Resource Management Plan with the benefit of local understandings of water and land resources management.
- **COORDINATING and MONITORING** - Co-ordinating and monitoring actions of a basin plan.
 - Coordinating implementation of a Basin Resource Management Plan with OSG. The lead in the State Water Plan should be taken by the Orissa State Water Board (SWB), strongly supported by the Orissa Water Planning Organisation (OWPO), in the Department of Water Resources; DoWR can provide a secretariat and technical support function to the basin organisation.
 - Preparation of a timeline of action with DoWR for immediate, short term (one year) and longer term (three years) actions to implement the Basin Resource Management Plan
 - Using evidence, monitoring and reporting progress and outcomes directly to OWPO, District Collectors and basin citizens within the basin's catchment area of the implementation of the River Basin Resource Management Plan.

The **membership** of an RBO can include:

- A representative / skills-based membership model to include District Collectors, line agencies, water user groups and other water stakeholders. It is imperative that members are familiar with and have substantial understanding of and experience in water resources management; members can be selected using a proportional voting process; this can be done through the capacity development programmes as outlined in this report.
- Membership should be limited to about 30-35 persons (which will require rationalisation by OWPO or through a voting or nomination process transparent to the general public)
- Broader representation of water interests using consultations and discussions in fora that extend beyond the RBO membership, for example by public meetings or via working groups.

Workable logistics to implement RBOs

Steps during the first two years can include:

- (1) **Awareness raising:** a basin wide water education and awareness raising using District level meetings with District Collectors; river and stream signage; media campaigns; and running a three year awareness raising programme, coupled to 1-2 small achievable projects;
- (2) **Basin champion:** Selection of a skilled, articulate and well connected champion to be lead project manager of the RBO, preferably with water resources management knowledge and experience;
- (3) **Staff coordination:** Selection of staff with skills in hydrology, coordinated project management and project monitoring;
- (4) **Staff negotiation:** Selection of staff with skills in hydrology, conflict resolution, negotiation and public relations.

Preferably, the Basin Champion and staff members should be found from among the RBO members. Such persons could be inducted by appointing a special purpose committee of the RBO.

As the RBO is a forum with multi-sectoral representatives, along with stakeholders, it is the ideal forum for basin level dialogue. Orissa State Government approved the concept of a multidisciplinary organisation (RBO) in 2007, to plan and monitor all water related activities in river basins.

The RBO will be a professional body for advising government on the management of water resources in the basin. The Chief Engineer and Basin Manager of the Basin will be the Member Secretary of the RBO. The DoWR will have one RBO cell to provide technical and other inputs.

The Baitarani basin is proposed as the first basin to establish this model. The focus of the proposed Baitarani RBO will be on creating an operational forum for inter-sectoral dialogue and stakeholder participation at basin level and below (district, block, and village). The first task is to commence a Baitarani Basin Resource Management Plan. **The consultants strongly recommend OWPO finalise current revised arrangements for formation of a Baitarani RBO and establish a programme of actions for that basin organisation.**

3.1.2 State Water Resources Board

The multi-sectoral State Water Resources Board (SWRB) was formed in 1993, chaired by the Chief Secretary, with ten Principal Secretaries (belonging to different sectors) as members. The SWRB is the highest organisation in the State for policy and principles on water development.

Features of the Board's work:

- Preparation of Orissa State Water Policy
- Integrated planning of State water resources
- Allocation of water resources among user sectors
- Prioritisation of Water Resources Development Schemes
- Enforcement of Environmental Management Plan (EMP)
- Acts and Rules regarding water resources development
- Formulation of a State Water Policy in 1994 (which includes the concept of participatory irrigation management)

The SWRB is the keystone organisation for water management in the State. **The consultants strongly recommend the SWRB take the lead in the coordination of water sector activities at the state level.** The State Government has the key role in linking more closely with:

- The drinking water sector – link to census data and use it for planning; link drinking water programmes to water harvesting practices
- The irrigation sector - dialogue with all government departments to assess overall perceptions about the adequacy of irrigation water supplies
- The industrial water use sector - assess water availability at the block level and where limited availability; include industrial water users in future SAG meetings and future dialogues
- The OSG Planning Commission, which has not been involved in dialogues to date
- The organisations and individuals with environmental interests - increase dialogue with grass roots organisations and with government departments with environmental management and assessment interests.

Also there needs to be a coordinating mechanism between departments to:

- discuss and plan water resources development and management using forecasting scenarios
- be informed by future water demands
- prioritise water demands and needs
- provide 'top-down' leadership.

The consultants recommend that Orissa Water Planning Organisation (OWPO) can take the lead in coordinating actions through the State Water Resources Board.

3.1.3 Informed Dialogues with Central Government and other States

Although water is a state matter, the actions of the Central Government, through the Department of Water Resources and Central Water Commission, as well as a number of acts such as the Environment Act, have major implications for state water resources management. Major projects receiving financial support from the central government and environmental impact assessments require sanction from the central level.

The State will also have to consider how to develop agreements with upstream states on water sharing. Inter-state issues will be addressed through inter-governmental level having technical and

administrative personnel. **The consultants strongly recommend the reactivation of the State Water Resources Board as a key agent to bring about coordination in water resources planning and management.**

3.1.4 State-wide water awareness, advocacy and education programme

As many water issues need broad public support and understanding, creating water awareness is also seen as important.

The aim is to engage the public in such issues as: water conservation; hygienic water use; preservation of aquatic ecosystems; water user awareness; developing self-regulating water institutions; increasing the willingness to pay or contribute to water services; awareness for planning for emergencies and strengthening political will.

The first Stakeholder Advisory Group in this project recognised awareness raising as one way of addressing Orissa's water challenges. **The consultants recommend the commencement of a State-wide water awareness, advocacy and education program, managed by OWPO, partnered with water awareness programme provider,** and using through methods such as:

- Direct use of conventional media (printed media, TV, radio) and/or non-conventional media (messages on water bills, games, transport tickets, comic books, etc)
- Organization of large events and endorsement by celebrities (generating media attention)
- Use of existing networks (religious networks, social movements, NGO networks, business associations), and
- Use of logos (e.g. a water drop) to give identity to the campaign.

Overall, there is the need to take a **specific water message to Orissa**. The OWPO can lead this as a core activity - identifying the key issues with other sectors - this can be the first step in the programme itself. This TA project identified some the key issues in Orissa in the 1st Stakeholder Advisory Group which are summarised in Box 7. There is the need to establish a shared Water Vision and a shared Water Message in Orissa to avoid undue capture of participation and the message by one group.

Box 7. Output from the 1st Stakeholder Advisory Group meeting, Bhubaneswar February 22, 2010

Solutions to Orissa Water issues:

- Improve Orissa's water institutions
- Strengthen water resources management practices
- Improve water quality
- Increase participation and raise awareness
- Build and use better information and assessments

Sectoral roles:

- Establish state and sectoral water development plans
- Inter-sectoral coordination and sectoral accountability
- Monitoring and information management

3.2 Water allocation and tariffs

3.2.1 Introduction

The Orissa State Water Policy makes four critical statements relevant to water allocation:

1. that "norms will be established for ensuring water rights commensurate with water rates",
2. that "participation of beneficiaries in the capital cost in suitable proportions will be established",
3. that "the cost of operation and maintenance will be fully recovered from the beneficiaries" and
4. that "polluters of water will be made to pay".

Delivery of this policy will require comprehensive management mechanisms to deal with planning, allocation, access rights, water charges, quality management and other regulations. The water allocation reforms discussed here were drawn from input by an international consultant with expertise in water resources economics, using:

- dialogues with DoWR staff and ISPM project consultants,
- a status and gap analysis of IWRM in Orissa, and a review of national and international best practices in IWRM²¹.

This section is focused on devising economic solutions to the problems currently confronting Orissa's water sector. Among the problems that will be analysed are the following:

- a) Persistent failure of water sector revenue to match its expenditure
- b) Inclusion of on-farm Operation and Maintenance activities among the state's responsibilities to water users
- c) Absence of a legally binding system of allocating access to water among competing uses and users and charging according to capacity to pay
- d) Insufficient economic incentives to lift water use efficiency
- e) No mechanisms for recovering the capital costs associated with creating new water.

Supplying bulk water to irrigation, households and industry has traditionally been a government responsibility. This remains the case in most jurisdictions but a growing sense of urgency now surrounds the need to:

- a) Make the water sector physically and financially sustainable through greater self-reliance;
- b) Recognise the limits to water supplies;
- c) Allocate water to maximise water use efficiency after meeting basic social imperatives; and
- d) Recover water supply costs directly from users.

Before going into the detail of the economic and accounting principles that agencies responsible for water supply should employ to properly balance the cost and income associated with delivering water to customers, it will be useful to make a few points about the history and literature relevant to water issues.

- a) The major reference for this section is *Assessment of Orissa Water Resources Institutions and Orissa Integrated Irrigated Agriculture and water Management Project Framework* (September 2007). Chapter 5 titled 'Sustainable Operation and Maintenance Financing' is most relevant and was used for the purpose of identifying problems and issues that need to be addressed. The relevant problems and reference relationships are as follows: budget deficits (paragraphs 322, 328); method of applying charges to encourage efficiency (paragraph 324); inclusion of on farm works in overall O&M (paragraphs 331, 337); recovery of capital costs (paragraph 322); challenge by heavy industries to water charges (paragraph 336).
- b) India's Finance Commission produces an annual assessment of 'revenue and expenditure' for major, medium and minor irrigation works in every state of the Union. The 12th and 13th assessments provide maintenance expenditure figures for each five year period 2005 to 2010 and size of works. Grant-in-aid assessments for the water sector in each state are also provided. All the data are expressed in aggregate terms with no reference to unit costs – such as per hectare or per farm. The Finance Commission involvement in the water sector is clearly entrenched and relevant to reform processes that seek to reduce dependence on centralised controls and devolve financial responsibility to a local level. It is possible that the direct

²¹ Reported in the

financial involvement of the Union in irrigation schemes is acting to reduce the incentive for the states to institute reform measures.

- c) The literature relevant to water reforms in India is extensive but focused very much on the nation's more progressive states such as Andhra Pradesh and Maharashtra. The aspirations and reforms sought by these states provide a clear indication of the pathway that Orissa should be taking. Several of the more pertinent messages coming out of the literature are noted below.
- d) The literature is critical of low water charges and poor collection rates, saying this situation contributes to: a) failure of the sector to balance expenditure and income; b) poor water use efficiency (or productivity); and c) lack of an economic incentive to save water.
- e) The literature emphasised that transferring irrigation project management to autonomous organisations creates a financial incentive for improving irrigation services. Also farmers are more likely to pay fees if they are involved in the decision making processes surrounding the operation of their particular command area.
- f) Unfortunately, the literature is relatively silent on two critical problems: a) exactly why water charges have not been increased for the purpose of allowing receipts to keep pace with expenditure; and b) how water access rights can be established and distributed among the various categories of water users. Both these problems are 'politically sensitive', implying a need to formulate prescriptive solutions.

The water reforms that are recommended in this paper for Orissa have already been partially implemented in several Indian states. This situation serves to validate the reforms proposed for Orissa and lends a note of urgency – especially in light of new industries establishing in the state and placing additional demands on water supplies.

In most developed countries, traditional water users have their access to water protected by an entitlement or licensing system. This system gives established users a degree of certainty about their access to water and allows them to be compensated if allocations from existing storages need to be re-allocated to higher value uses or the government wants to claw back water for a particular reason (such as environmental flow). The capital value of water licenses or entitlements should reflect the productivity of the water in its current use. This value will also reflect the holder's capacity to pay for the water they use and can (therefore) serve as a basis for differential charge rates.

Water licenses or entitlements can be held by corporate entities on behalf of individuals. Thus a town council could hold a water entitlement on behalf of all its ratepayers/households. This arrangement might allow the council to act as the water retailer or it could sell its entitlement and charging rights to specialised water retailer.

3.2.2 Solutions to water sector problems

Given that 'useable water' is vital, scarce and costly, a range of mechanisms are needed to ensure 'good outcomes' in terms of:

- Creation of cost effective supply capacity,
- Equitable and efficient distribution among competing uses through time,
- Efficient and effective transfer of water from storage to distribution agencies and from distribution agencies to final users/consumers (assisted by water markets),
- Transparent pricing for the purpose of recovering costs and signalling to users the inherent value of water (a task to be performed by the Water Regulatory Authority),
- Effective servicing and cost recovery by agencies (such as water user associations),
- Integrated planning and administration that maintains system efficiency and sustainability,
- Responsible and sustainable consumption patterns, and
- Accommodation of likely future trends.

Below we address each of the problems identified in section 2. Consistent with the principles of IWRM, a range of institutional and economic tools are introduced to assist the adjustment processes and maintain an acceptable balance between water supply and demand through time.

Institutional reforms

Effective price setting

Pricing water according to how and where it is used is a challenging task (Box8). Making most irrigation and drainage O&M costs the responsibility of farmers will allow DoWR to focus on recovering costs from the other sectors – primarily water supply and sanitation for urban and industry customers. To assist with this task, the 13th Finance Commission has recommended the setting up of a Water Regulatory Authority (in each state) with the following functions:

- 1) To fix and regulate the water tariff system and charges for surface and sub-surface water used for domestic agriculture, industrial and other purposes
- 2) To determine and regulate the distribution of entitlement for various categories of uses as well as within each category of use
- 3) To periodically review and monitor the water sector cost and revenues.

Box 8. Capacity to Pay

Water industries throughout the world have had to grapple with the problem of pricing water according to how and where it is used. Thus crop irrigation consumes a lot of water relative to domestic or industry and this gives rise to vastly different abilities to pay for the water. Even within agriculture there are considerable differences in capacity to pay, depending on the type of crop grown and interactions between water and other inputs – such as soil quality and climate and the local agricultural economy. Domestic and industry users typically have a high capacity to pay because the volume of water consumed, and the associated charges, relative to household income or other costs, are low. Higher rates have to be charged for domestic and industry water because it is usually treated to potable standards and is reticulated to the users' front door. But the cost differences due to whether water is treated are usually trivial compared to difference in the volume of water consumed. This is why increasing WUE is so important to agriculture. In some situations, the capacity to pay issue is exacerbated by the cost of providing the water; if the water is expensive because it comes from a small, unreliable storage with high overhead costs, the users will have less capacity to pay than they would otherwise. Pricing water according to capacity to pay is most difficult where there is demonstrative competition, causing the application of capacity to pay principles to confer high opportunity costs on the supply system. Necessarily, therefore, the capacity to pay principle has to be delivered by government regulation. This might include legislating to require the supply agency to charge particular users higher or lower rates. Without legislation in place, those in the former category would certainly challenge being charged a higher rate for essentially the same product. Recognition of capacity to pay differences could also be delivered using a rebate system. This would have the advantage of being more targeted and would obviate the need for the water seller (a commercial entity) to recognising differences in capacity to pay and charge different rates accordingly. If water is to be recognised as an economic good, it will be desirable to separate its pricing from delivery of 'other' policy imperatives such as social welfare.

The establishment of a Water Regulatory Authority in Orissa with the functions as specified above is fully supported as it follows the practice found in many countries of placing an independent, permanent and expert authority in charge of setting the prices and trading rules to be applied by government owned monopolies. Making a standing authority responsible for reviewing and fixing water prices is seen as a critical step toward creation of a more sustainable water sector.

In addition to outlining the functions of the Water Regulatory Authorities, the Finance Commission will make available financial incentives to encourage the states to comply. If a state recovers at least 50% of the water charges mandated by its Authority, it will become eligible to receive grant money. To participate, the states will have to set up their Water Regulatory Authority by March 2012.

In the process of being established, the Water Regulatory Authority will have to make clear its policies, aims, responsibilities and limitations. Thus government policy with respect to cost sharing between sectors and distribution of water entitlements will have to be clearly specified – to prevent the Authority having to get enmeshed in policy issues that lie beyond its brief. In addition, the Authority will need unqualified access to the cost accounting information that supports DoWR service delivery.

To maximise the chances of success, the Authority's work should be complemented by at least two additional reforms, as outlined below.

Cost recovery

Farmers in the Pani Panchayats should be given full responsibility for constructing and maintaining the water distribution network within their own command area. Confronted with responsibility for their own destiny, the farmers could be expected to act quickly and decisively to improve the efficiency and effectiveness of their schemes. This should make it relatively easy to collect O&M charges from amongst their own ranks. The case supporting O&M collection by Pani Panchayats can be summarised thus:

Demarcation of responsibilities. As the farmers own the land that is benefited by the irrigation water it is only logical that they should meet all costs associated with utilising irrigation water. The government owns the infrastructure that regulates the water supply but its responsibilities should stop at the point where the water enters the Pani Panchayat command area.

Remove an area of concern. Under the current arrangements there are significant conceptual and political barriers to applying charges to farmers that recover an acceptable proportion of O&M costs. Making the WUAs directly responsible for O&M costs within command areas would remove a large obstacle to the government's overall goal of recovering all O&M costs from users.

To assist with implementation of these changes, the following assistance should be provided:

- **Institutional commitment:** Little will happen without the wholehearted commitment of DoWR and associated agencies and institutions. The necessary commitment should be secured via a declared belief, by the institutions, in the proposed changes and reform. This declaration would be followed by shared ownership of the processes that will bring about change.
- **Knowledge of farmer preferences and skill base:** A cross-section of farmers should be surveyed to ascertain their attitude towards assuming ownership of the O&M function. The same survey should assess the capacity of each particular Pani Panchayat to finance and manage their water distribution system. Also, the survey team should build a database of all the Pani Panchayats in Orissa, with details in terms of location, number of farms/owners, O&M status, crops grown (wet season and dry season) and the prevailing condition of the irrigation infrastructure.
- **Establish legal status, ownership and capabilities:** Pani Panchayats wanting to progress to self-reliance should be properly advised on the corporate structure they should adopt to meet their accounting and reporting responsibilities. Provision already exists in the Pani Panchayat Act to elect a Board comprising farmers from within their command area. All member farmers would be deemed shareholders. Consideration should be given to appointing to each Pani Panchayat Board at least one external director with business expertise. This will help to ensure the Pani Panchayats do in fact run as business entities.
- **Resourcing and training:** It will not be possible for Pani Panchayats to take over administration of their irrigation schemes without critical resourcing and training. Ultimately, they will need to employ personnel with skills in cost accounting, economics and basic earthworks – for effective water reticulation. The administrative staff will need to have good 'office' skills. Larger Pani Panchayats will be able to employ a fulltime superintendant and a deputy who will monitor water inflows and its distribution and invoice recipients accordingly. These personnel will also supervise the earth works needed to make the irrigation scheme effective and efficient. Smaller Pani Panchayats will reduce the overhead cost of employing professional staff by sharing. Consistent with the above, Pani Panchayats should be assisted to develop spreadsheets that identify and quantify all their costs. The spreadsheet should identify every cost category that moves independently through time. Charges will be computed to recover the costs according to a prescribed timetable. Theoretically, charges for any given year should move in concert with expected total costs and expected total yield. Applying flat unit charges (Rs/unit of water) to all members of

the group is recommended as some cost averaging will be more harmonious than trying to charge according to location within the scheme.

- **Alerting stakeholders about impending changes:** It is vital that farmers, and Pani Panchayat members in particular, are made aware of the opportunities and expectations being offered to them. Initially the extension effort should be focused on those groups with the greatest natural advantages and best human resources. These Pani Panchayats will take up the challenge quickest and set an example to other groups. It is expected that Pani Panchayats will get assistance from NGOs keen to support rural India.
- **Management issues:** Pani Panchayat leaders might come under pressure from particular members to make their water allocation more reliable, hold down charges and increase spending on their distribution headworks. Consistent with the Pani Panchayat Act, every Pani Panchayat business should have in place a constitution and governance principles that keep everyone focused on the corporate goals. Thus all activities will be undertaken according to the dictates of a corporate strategy, including the delivery of various social imperatives that might find their way into the Pani Panchayat's strategy via political influences and processes. This and all the other actions specified above should be progressed without delay.
- **Grant entitlements based on historical allocation:** Once the above reforms are reasonably progressed, consideration should be given to granting Pani Panchayats volumetric entitlements equal to the long-term average annual allocation. This will give each Pani Panchayats a basis for planning its long-term future. The Board of each Pani Panchayats should have discretion over allocation of the water among its members.
- **Transfer of O&M operations and cost collection responsibilities to 25 Pani Panchayats:** Training and resourcing to facilitate this transfer should occur over two and a half years and involve personnel seconded from OWPO and NGOs (who should be directed by OWPO staff). A permanent training staff of 12-15 is recommended, comprising a general manager, eight trainers and three clerical staff. This would allow two teams of two trainers to operate continuously in the field rotating one week on and one week off. The GM and trainers should be well trained themselves with commerce qualifications and a demonstrated capacity to work directly with farmers. We have not specified NGO staff numbers but for the first six months they should work directly with the OWPO trainers to ensure consistency and competence. Once NGO staff members have achieved a demonstrated level of competence they should form their own teams and work directly with WUAs according to resources. It is envisaged that the training teams will circulate among the 25 WUAs on a structured basis to maximise the chances of a comprehensive and varied training experience. To minimise logistical difficulties the 25 Pani Panchayats should be relatively concentrated and close to the offices from where the team operates. The training should include but not be limited to: on-farm WUE, business establishment and operating principles, spreadsheet skills, cost recovery and accounting, mandatory reporting requirements and communications.
- **Establishment of a water market with DoWR selling bulk water to specialised retailers:** This transition will require minimal adjustments within DoWR itself – since it already acts as a wholesaler of urban and village water. The major innovation will be the introduction of additional water retailers for the purposes of enhancing efficiency. In urban areas, city councils with a high capacity to service a geographic area (comprising households and factories etc) and collect charges are likely to be efficient retailers. In rural areas the major retailer is likely to be WUAs. A small staff with high-level legal and administrative skills will be needed to establish the guidelines and corporate structures for making the transition. Given the Water Regulatory Authority is likely to take the lead on structural reform, it might be best placed to give advice on where changes in the wholesaler / retailers interface are likely to prove beneficial.

Rationalise roles and responsibilities

If DoWR were to become a provider of bulk water supplies to WUAs, there would be a buffer between government and individual farmers. This would allow both parties to become more commercially orientated and more focused on core business.

Making the government's water supply and O&M responsibilities end at the customer's take-off point will absolve government agencies from the need and responsibility to collect O&M charges associated with earthworks within command areas. Relieved of responsibility for distribution of water within command areas, DoWR would be free to focus on its core business of providing and selling bulk water. This business would be underpinned by professional water planning and efficient operation of the water storage and distribution network.

DoWR is already a seller of bulk water to urban users but this position (in the supply chain) should be extended to all customers. In the case of irrigation water, the intermediary would become the local WUA. Some WUAs have already been established in rural Orissa but to date very few of them have become incorporated businesses with the skills and resources needed to run their own command area. Thus a transitional period will be required for the purposes of training and resourcing WUAs to assume full responsibility for O&M within their area.

Assignment of access rights

The access system advocated for adoption in Orissa should be implemented progressively. Initially, the user's access should be controlled by the issuing of simple licenses (indicating purpose, entity, water source and delivery point, nominal allocation based on volume or area, restrictions and basis for any charges). License holders would receive water allocations related to the license itself and the availability of water as indicated by the DoWR's water balance modelling. Once the license system is proven it can be upgraded for the purpose of giving water users greater certainty and transfer rights. At this point the access rights would be known as entitlements. For the purpose of rationalising the administration of entitlements, they might be held by corporates or entities (such as WUAs) on behalf of a large number of individual water users. Below we provide details on the need for entitlements and how they could be introduced to Orissa.

As water consumption can be related to population, the demand for water throughout India is expected to rise in the years ahead. If India's population continues to grow, the following is likely to happen:

- The volume of fresh water available per person will gradually fall and this will force the country to make adjustments. The adjustment process will manifest itself in changing patterns of distribution and consumption;
- Various forms of demand and supply management will be invoked so that there is no 'gap' between actual demand and supply; and
- Price and other economic instruments will play a large part in rationing supplies among water users. This will allow water to move to higher and better uses while compensating those users who lose their access rights in the process.

To bring about such a positive outcome, mechanisms will be needed for sharing scarce water resources among competing interests. The term 'water entitlement' refers to a legal right to *access* a certain volume or share of water under pre-determined conditions. It does *not* infer that a holder of an entitlement will get 100% of that water every year. Water entitlement systems exist in Maharashtra, Uttar Pradesh and Arunachal Pradesh.

These systems exist to facilitate "...judicious, equitable and sustainable management, allocation and utilisation of water resources (and) fix the rates of use of water for agriculture, industrial, drinking and other purposes". The Maharashtra Water Resources Regulation Act, 2005 also introduced trading in entitlements. This provision allows entitlements to be "...transferred, bartered, bought or sold on an annual or seasonal basis within a market system." It should be appreciated that an entitlement does not infer absolute ownership – it merely specifies the rights and conditions under which a particular user will 'hold' the right to access water.

The Orissa Irrigation Act specifies that land within a command area is entitled to receive irrigation water. This means that the entitlement to water is attached to the land i.e., the two factors of production are bundled. But transferable entitlements allow the water to move to other land or other uses. Under such circumstances the result might be better use of the water when measured in terms of monetary returns per unit of applied water²².

When the time is right, it is recommended that water entitlements are introduced and made transferable within defined supply regions. The 'defined region' might be a river basin, a smaller area serviced by a weir or check-dam, or an area under the management of a WUA. Transparent specification of the 'qualities' embedded in entitlements would serve to protect the economic interests of existing water users when, through time, new demands are placed on limited supplies.

It will be appreciated that while supplementary water supplies are abundant, there is little need for formal entitlements. But when there is overt competition among water users, entitlements are needed to specify the rights of established users and to make it possible for new users to gain access to supplies. A failure to pre-empt scarcity with the introduction of entitlements (or some similar mechanism) will leave everyone assuming that they can continue to access water as they have always done in the past²³. When and where this is no longer possible, there is likely to be discontent and social unrest.

While an entitlement specifies the terms and conditions applying to permanent water access, an **allocation specifies the volume or units of water that will be made available to a particular user in the upcoming season or year**. Thus annual allocations are one facet of a formal entitlement system. Allocations can vary between years depending on the assessed available supply from the system and decisions taken by DoWR regarding priorities. Apart from supply variability, the introduction of entitlements will lead to greater certainty about how and when water is allocated among different user groups. The introduction of entitlements would protect users from having their access rights withdrawn or given to someone else without any consultation or compensation. All details surrounding the respective rights and obligations of the supplier and users would have to be specified in legislation.

In the case of new schemes, there might be a 'problem' of deciding how entitlements should be distributed among farmers within command areas. Where demand (for entitlements) exceeds supply, some form of rationing will be necessary. Scarcity pricing is one method that could be used for distributing water rights and allocations among interested parties. The money raised by selling rights could be used to offset the capital cost of constructing the storage or distribution system.

Below we outline four methods for rationing water access rights among potential users. These methods have been applied in other countries but it is not being suggested that these examples should or could be used in Orissa. The methods are explained to give insights into how scarce water resources can be distributed to heighten the chances of it being used effectively and efficiently.

- a) **Limit the size of the command area:** Regardless of engineering considerations, the command area would be limited to the hectares that can be reliably supplied with irrigation water in the dry season. Then all farms falling within the 'reliable command area' would be either sold an entitlement (with legal rights) or gifted an entitlement. This method of distribution recognises that water supplies will ultimately be limiting.
- b) **Auction of fixed supply:** With the total safe yield and corresponding number of entitlements determined, the distribution among interested farmers could be 'decided' by an auction (resulting in a capital payment for the permanent right to so-many

²² The state should not want to limit its economic growth potential by locking factors of production (including water) into low value uses. On the other hand, it will want to guard against developments that are not sustainable and generate externalities that offend the adjoining community. The state will also want to preserve harmony between different sectors regardless of their capacity to generate wealth.

²³ Problems of this nature are already emerging. It is understood some new industries have taken water from rivers and streams as if this was their natural right. While all water rights are vested with the state in the first instance, the new entrants should be provided with guidelines as to how they can get access to reliable water. This could be made possible through the sale or granting of entitlements.

ML/year)²⁴. As this approach could result in some fragmentation of the command area, it would be necessary to place limits on the 'geographic eligibility' of bidders. Scarcity pricing, implicit in the process of auctioning rights, would see the water distributed to those farmers with the highest capacity to pay.

- c) **Water for all interested farmers:** Where 'distribution equity' is regarded as the dominant issue, the available yield could be split among all applicants. With this approach, farmers might only get irrigation water every second year and it might not be technically feasible to deliver supplementary water to every applicant's take-off point. Clearly this would result in large opportunity costs and production inefficiencies.
- d) **Ballot:** A compromise allocation system is balloting whereby farms that meet prescribed minimal standards would go into a ballot or lottery. The result would be distribution of the total expected yield, divided into relatively efficient allocations, to a defined number of farms – drawn at random from among contenders. This system might be most relevant to the re-distribution of small quantities if additional water that becomes available.

If a manufacturer – or any new user – wants water from a supply system that is already fully allocated, they will have to either buy entitlements from existing users or contribute towards the cost of creating new water. The former should be possible in practice but an exchange mechanism (or market) would be needed to allow the exchange to be executed. Clearly the price would have to be satisfactory to both parties. Even where the resource is not fully allocated, large unauthorised extractions should not be permitted.

Finally, entitlements, supported by property rights, provide a basis for water supply authorities or associations to recover fixed costs – which might be a high proportion of their total costs. Having a capacity to recover (some/most) costs independently of annual water sales is particularly important where supplies vary substantially through time due to periodic drought²⁵.

Thus all classes of water users subject to cost recovery charges (currently urban and industrial) could face a two-part tariff structured as follows:

- A **fixed charge** that acknowledges access (or entitlement) to reliable water. The size of this charge should be directly proportional to the 'quality' of the entitlement. In the case of Pani Panchayats, it might reflect the cost of keeping the member connected to the distribution network.
- A **variable cost** related to the actual volume of water purchased during the period. The charge rate (Rs/KL) should be the same for all users within a particular common area. Thus costs should be pooled within an area to simplify administration. However rates between areas and category of user are likely to vary depending on actual servicing costs and capacity to pay. Charging differential rates according to capacity to pay is consider 'good public policy' but it should be supported by appropriate legislation to prevent challenges from those users being asked to pay relatively high rates. Cost pooling between areas is not recommended as costs are likely to vary considerably (compared to within areas) and each area will want to operate independently.

Increasing water use efficiency

Low water use efficiency within Pani Panchayats provides the underlying rationale for the reforms advocated in this paper. WUE will be increased via four main innovations: a) consolidation of land

²⁴ The water supply association (the local PP) could decide whether the payment has to be made up-front or amortised and included with other annual charges.

²⁵ The reliability of water between seasons will depend on how 'fully' the long term average yield of the storage system has been allocated. If the yield has been fully allocated amongst users, periodic reductions in system yield – due for example to drought – will be reflected immediately in the volumes that can be allocated in affected years. Supply authorities will enhance the integrity of their systems by avoiding the temptation to 'over-allocate' expected yield. The more drought prone a particular storage catchment, the more conservative should be the allocation policy.

ownership; b) earthworks to give each farm its own direct supply channel; c) making Pani Panchayats solely responsible for maintenance of the distribution system that they administer and d) requiring Pani Panchayats to pay the full cost of O&M within their own command area. For most Pani Panchayats, the latter will imply significant increases in the charges applied to water. The Jakhade Committee of 1987 stated that "...the method and level of water rates that capture and convey the scarcity value of the resource can both induce efficiency and ensure full cost recovery"²⁶.

Water users in Orissa do not yet have access to formal entitlements, much less access to a market or exchange where they can purchase additional rights. Once the safe yield available within a particular river basin or system becomes fully allocated, it will be desirable to establish an exchange where access rights can be traded on a temporary or permanent basis. Ideally the exchange should function as a 'market place' where the access rights can be bought and sold. Over time, the exchange process would cause water to move to its highest and best use, thus maximising WUE. While no-one would be forced to sell their access rights, market forces would act through time to bring about efficient outcomes. The exchange could be operated by DoWR or some reputable third party.

With an exchange in place, a miner (for example) could indicate that they needed access rights equivalent to 500 ML/year. Subsequently, the exchange could canvass interest from existing entitlement holders in selling. The critical ingredient would be a well informed and transparent market that allows both sellers and buyers to evaluate offer prices in terms of perceptions of value. If the Marginal Value Product of water in the river basin is already high, then the miner would have to pay a relatively high price. But if their returns from water are much higher than from existing users, then an exchange should take place. It would be up to the exchange operator to negotiate a mutually acceptable figure and to complete the transaction with all legal obligations fulfilled. Of course the sellers would be giving up their water access right but in return they would have cash to invest in a new business.

Volumetric trading and pricing

There should be a long-term plan to make all water measurement units volumetric. Charging water users according to the measured volume of water consumed will maximise the clarity of price while simplifying the administration of collection. Following the installation of metres, all water allocations should be quoted in megalitres (ML) for agriculture and industry and kilolitres (KL) for domestic. When possible, off-take points should be equipped with meters so that supplies can be invoiced in terms of ML or KL without any particular reference to the user or application. With a common unit of measurement in place, the price will become more transparent and thereby positioned to become more pivotal in water-user decision making.

3.2.3 Water Regulatory Authority

Aims

It is expected that Orissa will have in place by March 2012, its own Water Regulatory Authority (the Authority). The Authority's main task will be fixing charges for surface and sub-surface water used for domestic, agriculture, industrial and other purposes. It is assumed that the charges will be fixed at rates designed to recover the costs of supplying water whether this be at the wholesale or retail level. It will be the responsibility of each particular water supplier to collect the rates mandated and advised by the Authority. The state will receive incentive grants if its responsible agencies collect at least 50% of the charges mandated by the Authority.

Tasks

Supporting tasks that the Authority will undertake include:

- a) *Recommendation of methods for distributing water among various categories of users as well as within each category of use.* Accordingly, the Authority will instruct the major suppliers of water on how they should govern access to water. It is assumed that access will be governed by a combination of regulations and market mechanisms, designed to optimise the balance

²⁶ Cited in "Institutional reform in Indian irrigation" by Ashok Gulati, Ruth Suseela Meinzen-Dick and K V Raju (International Food Policy Research Institute)

between traditional rights and economic efficiency. It is expected that the methods used to distribute water among competing needs will change through time depending on the pressures on the relationship between supply and demand.

- b) *Monitoring of costs and revenue of agencies involved in supplying water – whether as a wholesaler or a retailer.* For the purpose of recommending efficient prices, the Authority will need effective access of cost and revenue data. Since DoWR will remain the principal supplier of bulk water, the Authority might place several officers **inside** DoWR for the purpose of helping to set-up cost monitoring systems and feeding data directly to the Authority. A close working relationship should develop between the Authority and OWPO since the latter will have responsibility for water balance modelling within the state. Successful water pricing depends in a knowledge of supply costs and the water supply itself specified in terms of quantity, reliability and quality at given time and place.
- c) *Oversight structural changes that will make cost monitoring and control more efficient and effective.* This task refers to the current TA's recommendation regarding transfer of the on-farm O&M role to Pani Panchayats.
- d) *Recommendation of direct measures for protecting water quality against pollution.* The Authority will use its statutory powers to direct the major agencies in methods of protecting water quality. The methods are expected to include licensing and accreditation of potential polluters, community education for the purpose of engendering shared responsibility, punitive penalties and funding of pollution reduction research.

Setting of water prices

Rationalisation of the water supply system will make pricing more transparent and technically feasible. Thus if DoWR positions itself as a supplier of bulk water, with a relatively small number of customers and shorter supply lines, it should develop a far clearer picture of its costs and receipts. This will make working with the Authority more effective and efficient. It is expected the Authority would take the following approach to price fixing.

- a) *Set price paths according supply entity such as river basin or city or industry.* The Authority would investigate each supply entity on a systemic basis (e.g., reviews every 4-5 years) and recommend base level prices as well as how these should be rated and varied over the specified period. Different prices would apply according to location and sector. Consistent with the capacity to pay principle (see Box 7) industry and domestic rates should be set higher than for agriculture. Where Pani Panchayats collect water charges from their own members (for meeting internal O&M costs) there might be no additional water charges applied on farmers.
- b) *Prices should be set to recover efficient costs.* Because water prices in Orissa have failed to keep up with costs, the Authority's first task will putting in place a program for reviewing and lifting rates on a regular basis. If the Authority is successful, charges should start to catch up with costs within 7-8 years. Once supply costs and charges come into balance, the Authority might become more concerned with 'controlling' costs so that water users are not stuck with monopoly prices. 'Efficient prices' resemble those resulting from a competitive environment.

Staffing

To be successful, the Authority will have to be staffed with highly trained, professional people. The senior people might come from 'outside' and have experience with establishing new institutions. Training in economics should be a primary qualification but this should be complemented with cost accounting, knowledge of the water industry, public administration and infrastructure planning. Specific tasks already designated to the Authority include price fixing within the context of the water sector's total costs and revenue and distribution of access rights to water within and between user categories. It is likely this scope of work will be extended for the purpose of making its core functions effective. We believe the Authority should start out with a relatively small but highly skilled

staff. Once the Authority's role and responsibilities are fully understood it should be possible to use the core staff as a basis for any expansion thought appropriate. Thus a core staff of 20 – 30 is recommended, building to 40 – 50 after five years.

3.2.4 Conclusions

The focus of this paper has been on the contribution that micro economic reform can make to Integrated Water Resources Management in the Indian state of Orissa. Our analysis of the relevant issues surrounding water pricing and allocation can be summarised into short statements that can be matched to impending actions and outcomes. Associated actions will form the next stage of the current project. If the actions are performed in-full, the eventual outcome will be a more secure and efficient water future for all the citizens of Orissa.

Priority One: *The State of Orissa should establish its own Water Regulatory Authority for the purpose of making the water sector financially sustainable. It will do this by reviewing and setting the water prices to apply at delivery points according to time, place and user category. To this end it is recommended:*

That Orissa move quickly to establish a Water Regulatory Authority for the purpose of setting wholesale or retail water prices as appropriate. The prices might vary between user category and delivery points but should otherwise be set at levels that first establishes, and then maintains, a balance between public sector total costs and total receipts.

Priority Two: *Farmers should assume responsibility for all irrigation works and funding inside command areas: To this end we recommend:*

That Pani Panchayats (through their Water User Associations) be required to take responsibility for the O&M activities and associated funding applying to the water distribution network within their own command areas. Included in this responsibility would be collection of fees (sufficient to cover O&M costs) from among Association members.

The proportion of total water sector O&M costs that arise inside command areas is significant and difficult to monitor for the purposes of recovery. The solution to the problem of 'command area O&M costs' lies with rapid transfer of responsibility for all on farm irrigation and drainage activities to local Pani Panchayats (as outlined in the body of the paper). For the purpose of expediting the transition we recommend:

That Pani Panchayats be assisted to become effective and competent business entities by: a) incorporation to make them accountable and independent business entities, and b) appropriate training and resourcing of all Pani Panchayat members. Policy agencies should coordinate this work assisted by NGOs.

Priority Three: *DoWR should remove itself from the water retailing responsibilities. Orissa's DoWR currently handles all water 'activities' from building dams to retailing water to farmers. Saleth in her 2005 paper about institutional change said that a paradigm shift is needed from "...water resources development to allocation and management". The tasks of water allocation and management would be better served if DoWR vested water pricing and retailing with other agencies. To this end we recommend:*

That DoWR become Orissa's bulk water supplier. In this role it would sell water to several retailers appointed to service designated end user markets. Orissa could support several water retailers with servicing rights assigned by river basin or some other logical basis. Within the scope of this reform, Pani Panchayat WUAs could serve as water retailers or agents.

Priority Four: *Mechanisms should be introduced that explicitly recognise the prospect of water scarcity. Orissa's expanding population, rapidly rising living standards and growth in industry and mining all point to an increase in demand for water in the years ahead. Given that the supply of consumptive water is relatively fixed, if not falling, there exists a demonstrative need to introduce adjustment mechanisms. To this end we recommend:*

That Orissa's Water Regulatory Authority be made responsible for introduction of a comprehensive system of water licenses followed in due course by entitlements. Introduction of licenses and entitlements would protect the rights of traditional users while making it possible for new users to gain access to essential supplies. Licenses and entitlements should be used as the basis for differential charge rates, set according to the user's capacity to pay.

3.3 Water Planning

A water plan is critical for managing Orissa's water resources now and into the future as competing demands escalate. The Orissa DoWR already has a State Water Plan. The Plan attempts a state-wide approach to water management, yet it lacks integration:

- of water resources development with water resources management,
- within and between different sectors,
- of surface and groundwater use (conjunctive use)
- with and among stakeholders (not driven by a participatory processes), and
- with Orissa State Water Policy.

In the parallel ISPM project, it was found that the current State Water Plan,

"is mostly about presentation of data about the availability of water in the state and the demands for water by various sectors. While this information is useful, the plan only has a short section on the identification and analysis of issues, and only indicative actions are included.

Therefore, the updating and upgrading of the plan to provide a comprehensive document to guide the integrated development and management of its water resources is recommended as a matter of priority. It should be the primary instrument for integrated water resources management and improved coordination within the State. The type of plan recommended is envisaged as being different from traditional master planning that has been carried out in many countries, including India. Water master plans usually identify a range of development projects (sometimes called a "shelf" of projects). They may, to some extent, also identify the interactions between the development projects and other water sector issues. Such plans are development tools. However, these do not go far enough to guide an integrated approach to water resource management in the state.

On the other hand, the State Water Plan for Orissa should be a plan or planning system that acts as an ongoing water resources development and state-wide management tool."²⁷

The consultants recommend a **revision of the State Water Plan** to make it truly reflect State Water Policy and take a more integrated approach.

3.3.1 Introduction

Principles

Together with State Water Policy, the Strategy Paper on River Basin Planning issued by OWPO in September 2002 is a useful starting point to develop a Revised State Water Plan. The paper includes key principles for water resources management (Box 9).

²⁷ page 2 in Hydrosult IWRM Team, 2010. *Discussion Paper on State Water Planning Framework for Orissa*. Orissa Integrated Irrigated Agriculture and Water Management Investment Program. Institutional Strengthening and Project Management. Orissa Department of water Resources/Hydrosult, Bhubaneswar.

Box 9. Principles for effective water resources management and planning

Institutional and Management Principles, stressing the need for the clear definition of the roles of government and official bodies, the design of an effective structure and system of water resources management, the active participation of water users, and the establishment and maintenance of a comprehensive management information system.

Environmental Management Principles, which require balancing water-related activities with the needs of the environment to ensure sustainability, to conserve ecosystems, and to monitor environmental change.

Social Principles, calling for the provision of adequate water supply and sanitation facilities, the involvement of stakeholders and water users, and the consideration of gender implications in planning and implementation.

Economic and Financial Principles, requiring that water is considered as an economic good, that water tariffs be levied and that the demand and supply be managed so as to result in the rational allocation of the available water.

Information, Education and Communications Principles, underlining the importance of knowledge about water related activities, of pertinent education, and of appropriate communications and awareness building.

Technological Principles, calling for a balanced approach towards “hardware and software” components, and technology choices based on efficiency, appropriateness, cost, and suitability for local conditions.

The consultants recommend the use of these principles to develop a **water planning framework** which:

- Recognises that the water sector is dominated by a massive informal system of water users in irrigation now competing with large volume demands from other more formal water users in the industrial and urban sectors. Solutions for Orissa require accurate water availability assessments and demand and supply scenario modelling combined with greater use of dialogues with and between water users.
- Addresses the lack of capacity to make operational the plans developed by governments; solutions include divesting management to local levels and improving cost-recovery mechanisms. In Orissa, this can be done by strengthening the use of Pani Panchayats as a mechanism to recover costs.
- Recognises the strong seasonality of rainfall and runoff and the limits to further abstraction; so in Orissa there is the need to move dependence to alternatives (watershed development) while undertaking a massive effort to improve supply and delivery efficiencies and improved on farm practices in the irrigation sector.

In addition, the State Water Plan of 2004 identified many critical issues and problems to be addressed in the Orissa water sector (Box 10). These challenges are daunting but a well-designed State water planning framework can guide the process, identify workable options, and improve the likelihood of sustainable use and development of water resources of the State.

Box 10. Planning issues and problems

Laws and institutions

- Reform existing legal framework and stakeholder institutions to achieve objectives in a context of increasing water stress, and to coordinate actions in line with principles of Integrated Water Resource Management;
- Improve data on water quality and on water use and its impacts;
- Support Pani Panchayats in improving efficiency of irrigation water use;
- Form contemplated River Basin Organisations to maintain updated plans and wide participation in planning processes.

Environment

- Involve local populations in maintaining and restoring forest cover in upper watersheds;
- Enforce standards for discharge of pollutants and wastes;
- Preserve wetlands and determine required environmental flows.

Food Security via Irrigation:

- Improve utilization of existing schemes, presently around 70%;
- Complete 7 major and 12 medium projects under construction in 2004, and give priority to medium and minor projects;
- Expand groundwater exploitation, especially for dry-season irrigation;

Economic Development, Poverty Reduction, and Disaster Management:

- Promote higher-value crops and agro-industries;
- Investigate small-scale irrigation from groundwater or rainwater harvesting for benefit of marginal farmers;
- Consider flood protection works and drought proofing;
- Investigate inter-basin transfer and expanded water storage facilities.

Priority areas for intervention under the Plan are indicated as follows:

- Laws and institutions;
- Mining and industrial pollution;
- Urban water supply, sanitation and storm-water drainage;
- Raising output from existing irrigation schemes.

Source: Orissa State Water Plan. 2004

Separation of roles and responsibilities

One of the principles in Box 9 was the need for the clear definition of the roles of government and official bodies. Under the Indian constitution, the State owns all the surface water, while the Department of Water Resources, on behalf of Orissa, administers its supply via various storages, dotted throughout the state. After quarantining the non-consumptive portion of total supplies, a volume remains available for a range of consumptive purposes. DoWR acts as the direct seller of water in the case of farmers, large-scale industry and mining. In the case of households, DoWR acts like a wholesaler, charging intermediaries on a volumetric basis.

The present system of water distribution suffers limitations in the areas of cost recovery, distribution efficiency, water use efficiency and lack of metering of industrial uses. Effective water management requires the establishment of an institutional environment that will improve outcomes in water resources management and development.

This environment includes the separation of State water functions into those of service provider, resources manager and regulator (Figure 7 and Box 11). There is the need to apply this approach to Orissa water management²⁸. This separation will:

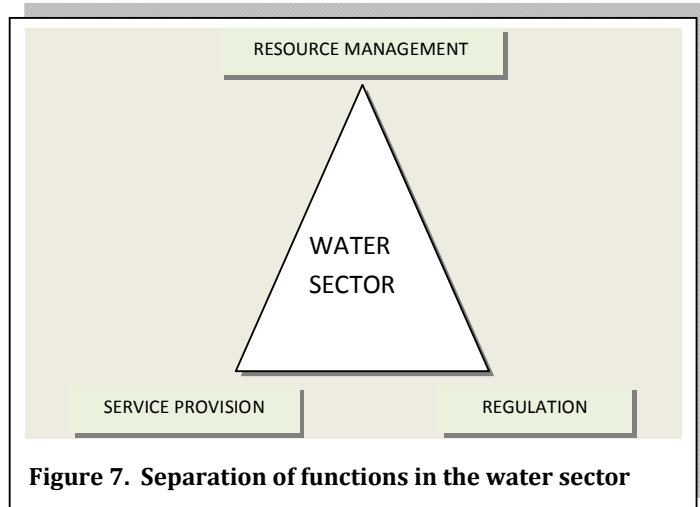


Figure 7. Separation of functions in the water sector

²⁸ As documented in the project report: Anonymous, 2008. *WALMI and DoWR Change Management Status Report*. Asian Development Bank, TA-4814-INDIA. Orissa Integrated Irrigated Agriculture and Water Management Investment Program. CTA for Project Processing and Capacity Development.

- Allow DoWR to operate as the State wholesaler (provider) of bulk water to local entities (water user associations) and separate this role from that of the resources manager;
- Avoid capture of the resource management function by the irrigation service provider within DoWR ;
- Avoid the irrigation service delivery functions of DoWR reporting “to itself” ;
- Make clear which parts of the water sector are managed by which organisation;
- Lead to more self-reliance at the local level in water management.

The solution lies in creating a water resources management division separate from the provision of irrigation services. In this way it will more accurately reflect the name ‘Department of Water Resources’.

Implementation of this model will take some time due to the skills shortage in the DoWR. The consultants recommend this separation process emerge gradually through the actions of the companion ISPM project. This can occur by:

- Immediate transfer of O&M works and funding responsibilities to the Pani Panchayats using available mechanisms. This will require significant investment in capacity development actions and are referred to in Section 4 of this Report.
- Develop parallel organisations to DoWR with links from top to bottom and vice versa - River Basin Organisations
- Reform of water laws.

The consultants recommend professional development support to the existing Director of Water Planning and Hydrology and the two Deputy Directors involved in water resources planning and staff from the Orissa Governments’ Finance Department. This support can be in the form of a **training course in water sector governance** which will provide tools to guide the separation of roles and responsibilities, including financing, reporting and accountability mechanisms.

Box 11. Separation of roles and responsibilities in the water sector

The natural resources manager –

- Undertakes strategic water assessments.
- Develops policies and strategies to comply with national objectives and with standards set by the regulator. Also develops and oversees a strategic water research program.
- Develops legislation to support regulatory standards and policies.
- Plans and allocates water.
- Manages quantity and quality for surface water and groundwater.
- Supports inter-agency and community driven basin coordination.
- Develops water sector capacity building programs.
- Promotes public participation and water awareness.

The operator/service provider –

- Builds and operates water supply, sewerage, drainage and irrigation systems.
- Maintains infrastructure.
- Provides technical advice and assistance to others.
- Charges others for services provided.
- Operates under some form of contract (s), usually to the regulator for operating rights and to the resource manager for utilisation of the water resource.

Regulator/standard setter –

- Develops and implements a financial/economic or pricing regulatory regime.
- Develops water quality and other natural resource objectives, standards or guidelines.
- Audits the performance of the water sector as to compliance with standards.

Source: Millington, P. 1999, *River Basin Management - Its Role in Major Water Infrastructure Projects (Draft)*. Cape Town, South Africa, World Commission on Dams Secretariat. *World Commission on Dams Thematic Reviews. Institutional Processes V.3 River Basins - Institutional Frameworks and Management Options*

The process of adaptive planning and management

For effective water planning and management today, the planning process needs to be **ongoing** and **adaptive** (Figure 8). It is not linear in the sense that a plan is finished; rather it goes through a series of stages, with feedback loops that are constantly monitored and evaluated and new procedures continue.

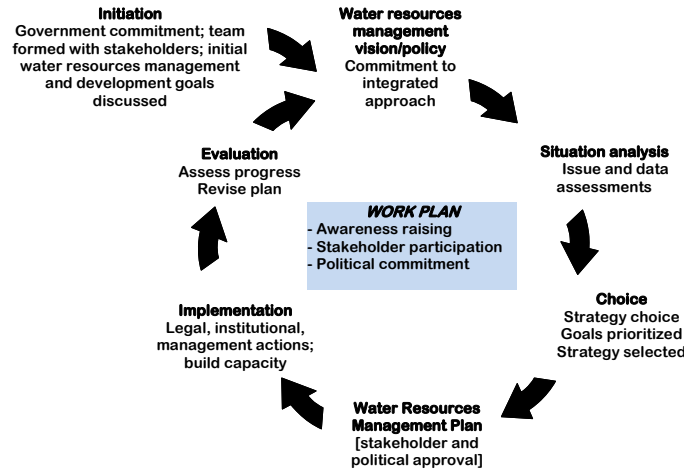


Figure 8. The ongoing, adaptive management cycle for water planning

Source: Modified from Cap-Net

An effective planning process:

- Learns from past experiences (**Evaluation**),
- Incorporates new initiatives, policies, information as they emerge (**Initiation**). This current IWRM initiative in Orissa is one of these.
- Planning teams are formed to create a **Work Plan** (this can occur in OWPO)
- With stakeholders (using the dialogue processes in Section A), the team create a **Vision** of what needs to be done (e.g. a '*Water Vision for Integrated Land and Water Resources Development and Management of the Baitarani Basin*')
- The team undertakes a **Situation Analysis** to know state of the water resource and how it is being used and future plans for its use; GIS can be used to plot the information at a basin level;
- Goals are identified at this stage;
- The planning team prepares a **Strategy** and makes a **Choice** of what needs to be done (decision support systems are helpful here);
- A draft **IWRM Plan** is developed (this could be a Sector Plan, a Basin Resource Management Plan or the entire State Water Plan (assuming the first two have already been done). These plans require significant resources to develop - both in government agencies (staff, equipment, time) and by engaging the water stakeholders at the level the planning is being done. Organisations like OWPO (DoWR) need to be **well equipped** to do the task.
- The plan is then **implemented** using: legal tools that already exist, e.g. a 'State Water Act' (if these do not exist, legal reform will be needed); the institutional tools (e.g. cost recovery of O&M costs by farmers); management instruments (e.g. Basin Resource Management Plans, ongoing dialogues with stakeholders, water awareness campaigns, improvements to water resources assessments).

- After a period of time (say 2-3 years), the plan is **evaluated** to assess the progress made, where more efforts are needed and to revise the plan. Here the planning team learns from its experience of implementing the plan, makes the requisite changes and proceeds.
- In this way, the **cycle of adaptive management continues**.

A comprehensive water sector plan for the whole of Orissa will need to deal with all the important issues related to water resources, and other related natural resources, such as land, forests and fisheries that impact on, or are impacted by, decisions about water management. The suggested approach is to consider the State Water Plan as a **suite of interrelated plans** (Figure 9).

Drawing directly from the ISPM consultants' report²⁹, we recommend the use of the Framework Plan, Basin Resource Management Plans and Sector Plans.

3.3.2 Revised State Water Plan/Framework

The State Water Plan provides strategic direction for state water resource development and management. It comprises several components.

State Water Plan

- translates national policies and strategies into the state context (that is, the national policies and strategies are the “starting point” and the “driving force”);
- takes into account of trans-boundary water management issues and, in particular, any agreements made with neighbouring states over water management (for instance on the Mahanadi River);
- describes the physical and institutional characteristics of the state, including available water resources, the state of the catchments and the environment, socio-economic factors, present arrangements for water management, and so on (note that this could be presented as a separate volume of the plan);
- presents information on trends in water use, population and industrial growth and an analysis of the interactions among them;
- sets the broad goals and objectives for integrated water resource management in the state, both at the central and district levels;
- indicates the priorities for these goals and objectives;
- identifies the problems and issues, constraints, opportunities and so on which will impact on the achievement of the goals and objectives;
- establishes the principles upon which management of water resources are to be based;
- identifies the key stakeholders in water resource management in the state, including the environment, and the community at large;

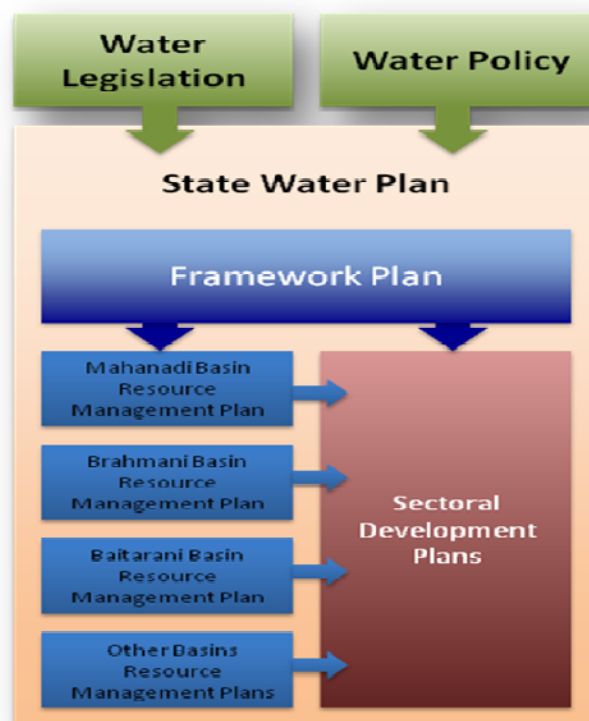


Figure 9. Proposed structure of the State Water Plan/Framework

Source: see footnote below

²⁹ Discussion Paper on State Water Planning Framework for Orissa, February, 2010. Institutional Strengthening and Project Management. Orissa Integrated Irrigated Agriculture and Water Management Project.

- describes the institutional arrangements for coordination of water resource management in the state;
- establishes a procedure for resolving operational and allocation conflicts among water users and between water users;
- provides directions for preparing guidelines on management of water resources;
- provides for arrangements to ensure that a consistent system for collecting, archiving and analysing water resources data exists for the state and that they satisfy the state's water management requirements;
- describes the agreed standards for such things as water quality, level of flood protection, reliability of water supply for various purposes, including the maintenance of important ecosystems and so on.

At present, there are constraints and deficiencies in water planning procedures in Orissa. Working closely with ISPM project (also in OIIAWMIP), the TA-7131 consultants developed draft contents of the State Water Plan and a proposed time line with associated actions. The contents are listed in the bullets above and possible chapter titles are provided in Box 12. The time line is shown in the Work Plan (Section 4). This requires a review of current State Water Plan in the light of available new river Basin Resource Management Plans (discussed below) by 2012, and the completion of all river Basin Resource Management Plans and the State IWRM Plan by third quarter of 2013.

Box 12. Proposed Contents of a Revised Orissa State Water Plan

The content of state water plans vary according to purpose, economic development imperatives, environmental flow provisions and state-wide conditions.

A state level water plan can include:

- Description of the water resources
- Land use inventories
- Current water availability and demands
- Pollution source inventories
- Aquatic and terrestrial ecosystem needs
- Vulnerability to drought, floods and other extreme meteorological events
- Identification of stakeholders and mechanisms for participation
- Implications of changing land use
- Identification of priority issues (impact issues or user requirement issues) including impacts of climate change
- Short- and long-term goals
- Coordination mechanisms between sectors for sector water management plans
- Water related development scenarios, future water demands + risk assessments
- Water allocation and water quality objectives
- Strategy, measures and action plans for the achievement of goals, including sub-basin management plans
- Financing of water use and management
- Responsibility and schedules for implementation
- Mechanisms for monitoring and updating
- Annexes including specific studies such as areas of significant environmental problems

Basin Resource Management Plans (or River Basin Plans)

There are eleven river basins in Orissa and it is appropriate that each should have an IWRM plan to guide development and management of the water resources of the particular basin. The Basin Resource Management Plans³⁰:

- must be consistent with the framework plan.
- provide more specific strategies and detailed actions than the framework plan.

³⁰ Note that the term "Basin Resource Management Plans" is preferred because it emphasises the fact that they are not just about infrastructure development. "Land and Water Management Plans" is another term for these that is used in Australia.

- cover such areas as surface water allocation, conservation and exploitation, groundwater management, watershed, riverine, wetlands management and water quality management;
- determine (or ensures consistency in determinations made by others): the water allocated to water uses, including the maintenance of important ecosystems (present and planned for the future); rules for water allocation in drought; rules preventing inequitable impacts to result from the decisions of one water user on others;
- specify the system of controls for the prevention and/or mitigation of water pollution, which may include: control of wastewater discharges from point sources; control of drainage discharges (including irrigation); controls, plans and/or measures for preventing diffuse pollution of water from land-based activities, such as the use of agricultural chemicals;
- establish rules and policies to manage the impact of flooding, and mitigation and prevention measures, affecting communities and water users in the state;
- identify any demand management strategies that may be required to conserve water resources when and where there are scarce;
- specify the impacts of climate change on water resources, demands and mitigation and adaptive measures;
- specify what systems are in place to: protect riparian land and vegetation; control excavation of sand and gravel from river banks and beds; prevent the blocking or diversion of rivers and streams; and
- describe environmental safeguards to be put in place for protection of water resources and associated wetlands and floodplains, through such things as: reservation of protected catchment areas and fisheries; reforestation of bare and degraded land; planning controls for sensitive areas (for example, high quality shallow aquifers); ensuring water is provided for high priority environmental features.

Overall, the Basin Resource Management Plan will guide use of preferred management options relevant to the most critical water and land resource management issues in the basin. The TA-7131 consultants developed a draft outline of a River Basin Plan (Table 11). The Basin Resource Management Plan can be prepared by OWPO using advice from the RBO and information prepared in a Basin Profile and a Basin Investment Road Map³¹.

Table 11. Draft Basin Resource Management Plan - proposed contents

Chapter	Title
1	Introduction - Roles and Responsibilities, Goals
2	Information system
3	Identification of priority issues and possible projects
4	Basin water allocations
5	Protection and environmental safeguards
6	Informal and formal sector participation
7	Implementation
8	Monitoring plan
9	Research plan

Sectoral Development Plans

In Orissa, sectoral planning (including plans for industry, irrigation, urban development, forestry and so on) is done by administrative units, at national and state/provincial levels. In the case of Orissa, the State Government will be attempting to optimise the use of the available natural resources (water, land, minerals and so on) across the entire State. This is appropriate, as optimisation of resource development and management at basin level (particularly where the river basins are small) is likely to lead to sub-optimal use of resources state-wide. Therefore, it will be important to link the sectoral plans to the basin plans at local level. To some extent the sectoral plans “drive” the basin plans (for instance, the location of irrigation schemes, mines, and so on, are more likely to be made by considering the overall objectives of the State), but also the Basin Resource Management Plans must inform the sectoral plans (for example, where are sufficient water resources available to establish or expand irrigation, industries and urban centres, and what are the constraints imposed by the imperative to protect water quality). The Sectoral Development Plans:

³¹ As outlined in RETA 6470 and ISPM projects.

- will normally and appropriately be a number of plans developed by the line departments that manage (sectoral) resources that impact, or are impacted by, water resource management (including, irrigation, agriculture, industry, mining, urban development, rural development, fisheries);
- should recognise river basins, so should list and summarize the development projects proposed to be implemented to meet the individual basin goals and objectives;
- set out and compare the costs and benefits: financial and economic, including economic internal rate of return (EIRR), social and environmental;
- establish the priorities for the proposed projects;
- outline the strategies to be adopted to maximize the sum of benefits, and minimize adverse impacts on the environment and social situation (for instance, resettlement), for each of the projects;
- provide an action plan for the development of each of the project proposals (for instance, the pre-feasibility and feasibility studies, environmental impact assessment, detailed design, implementation plan and so on).

3.3.3 Hydrological Information System

In order to achieve effective water planning, it is imperative to have timely, accurate and comprehensive information about water resources using hydrological information systems (HIS). The capability of OSG to collect, manage and exchange water resources information is critical.

Proposed Actions

Action item 11 of the *Proposed Action Plan for IWRM in Orissa*³² proposes to develop a hydrological information system for collection, processing, archiving and dissemination of water-related data. Water planning; allocation and tariff are three vital instruments whose sound analysis and action depends on timely and accurate hydrological information system.

Policy Directive

Article 2.5 of Orissa State Water Policy (2007) stipulates that in order to facilitate planning and development of water resources, a modern hydrological information system would be developed which would include collection, processing, archiving and dissemination of water related data. The water related data would include hydrological, meteorological, topographical, geo-morphological, demographic, ecological data and data relating to land, soil, water quality, forest cover, crop cover etc. These can form the information set of the assessment component of a water planning process and be stored as layers in a GIS.

The Orissa State Water Policy also calls for “a state of the art data storage centre for the purpose. Decision Support Systems will be developed for making use of the data and geographical information system in the water resources field. There will be a certain degree of standardisation and transparency in collection and dissemination of the data system”.

Status on Hydrological Information System

In Orissa, a structured HIS was initiated through World Bank assisted Hydrology Project in 1997. The aim of the Hydrology Project was to develop comprehensive, inter-related, easily accessible and user friendly databases covering all aspects of hydrological cycle, including surface and ground water in terms of quantity and quality and climatic measurements.

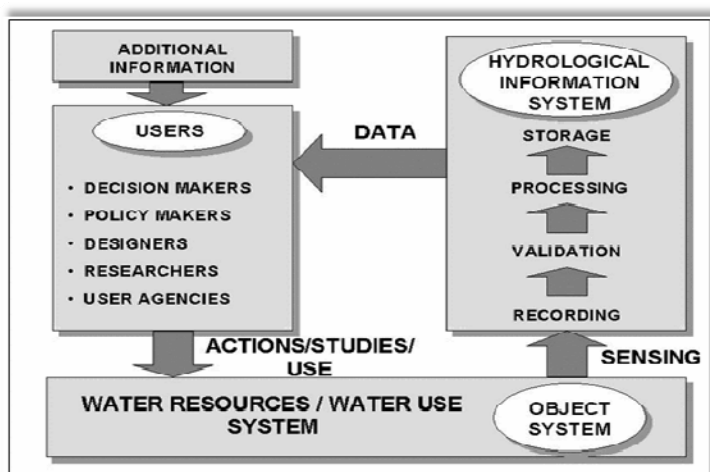
The project further aimed at making the hydrological information available for planning and management of water resources and other legitimate uses and promoting its utilization. The ultimate aim of the project was to deliver a functional, demand-driven HIS with improved institutional capacity to build, operate and utilize the HIS to the benefit of the different user groups and to encourage cooperation among the different participating agencies through data exchange. The development of

³² Action proposed in the report on *Action Plan for IWRM in Orissa (TA-4814(IND) Project Processing and Capacity Development , Integrated Water Resources Management, 2008)*

the databases would support major aspects of India's Water Policy, particularly with regards to water allocation and planning and management of water resources at the National, State, Basin and Project level.

Under this project, data collection and information on hydrological and meteorological variables are being collected and stored in the State Hydrometry and Data Centre. This HIS can be used and shared by the Hydrological Data User Group. The HIS (Figure 10) created under HP-I provides a sound basis for moving towards improved and modern planning and design of water resources development and long-term water resource management using tools such as hydrological modelling, DSS and hydrologic design aids.

Figure 10. Schematic diagram of HP-1 Project Hydrological Information System



The present system of hydrological data gathering and management in DoWR can be augmented using this project. DoWR can upgrade its current water balance models and associated flow measurement systems to undertake sound and rational water allocation. There is also the need to supplement water quality information into this system so that water allocations consider water quality parameters in volumetric allocations. The consultants found limited evidence of these processes during the project and suggest interaction be strengthened with the World Bank assisted Hydrology Project.

Utility of Hydrological Information System

Further to the above comments, Orissa is presently part of the second phase of hydrology project (HP-II) where the utilisation of HIS will be made for effective water resources planning, development and management. This includes modelling and DSS that will provide water authorities well-structured, user-friendly, practical and complete water resources management information system. It will assist the decision makers in taking the right decisions on the basis of good comparison of different strategies under various scenarios. Operational plans addressed by a DSS also include the improvement of water use efficiency.

In terms of GIS data, there are 11 theme areas of data set available in the scale of 1:50000. As GIS is a powerful tool for management of water resources, it is evidently reflected in the water policy of the State and some actions had already been taken place although not much use has been made to date. However, the consultants saw limited development of these assets in DoWR and as a result, we recommend the following actions.

Recommended Work Plan

Concrete actions need to be proposed for consolidating the HIS, setting up of a GIS unit, application of DSS and hydrological modelling tools for making operational IWRM in the State.

In this respect, different actions proposed to be implemented are:

- **Inter-sectoral coordination:** Water resource available in the State is meant for all sectoral uses. Obviously, sectoral demand, plan and uses need to be available for better planning and management of water. The data and information relevant to all the sectors must be readily

accessible to the OWPO and respective RBOs for development, planning and management of water resources in the respective basins.

- **Institutional Development:** At present, State Hydrometry and Data Centre is the central place for data and information archival on surface and ground water. This data primarily refers to features which can help in the estimation of water resources of the state. This unit was set up with the assistance of the World Bank supported hydrology project (Phase-I) for developing the hydrological information system pertaining to all river basins of the state.

However, effective water resources management needs much more information than what is at present being taken up by the data centre. Besides, State Water Policy clearly stipulates various actions and sector's involvement in this process. Thus, the State Hydrometry and Data Centre need to expand its scope and coordinate with all other water related sectors for data storage, analysis and uses in the relevant activities.

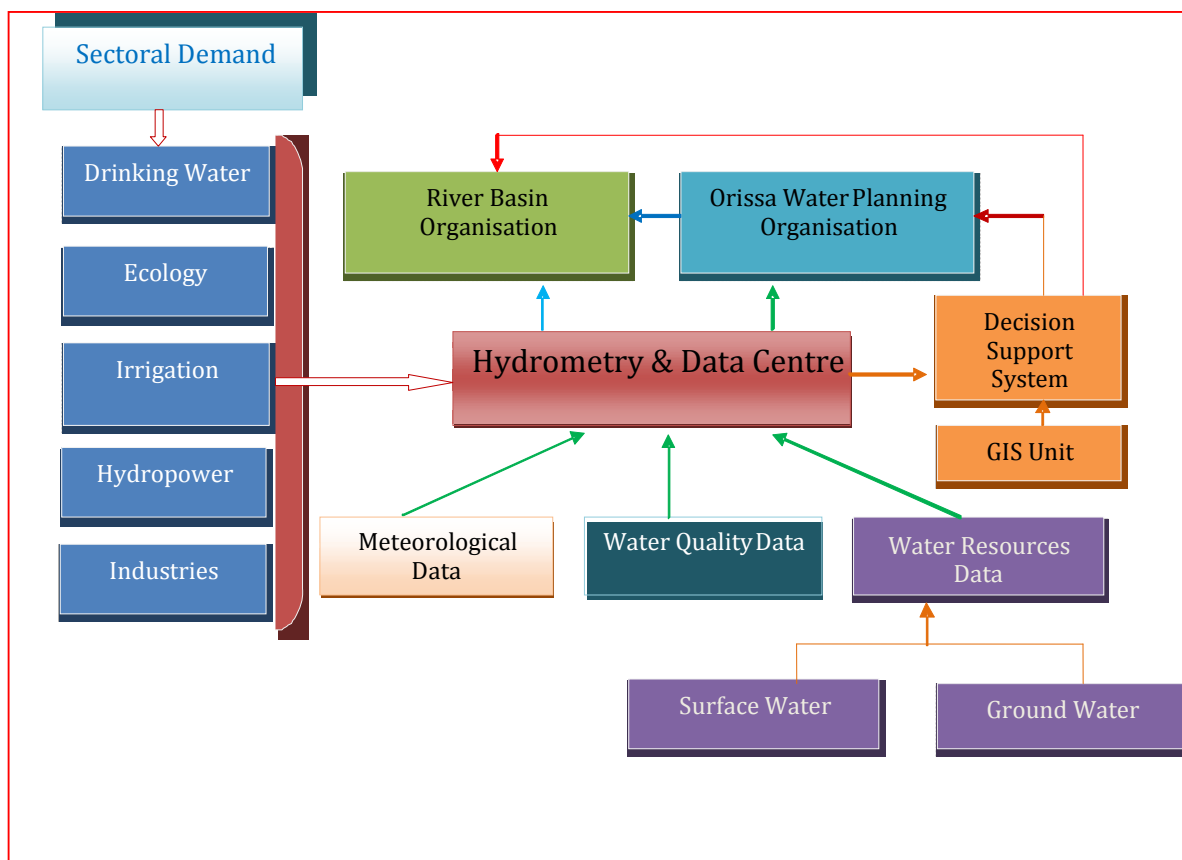
- **Support of World Bank HP-II Project:** In the second phase of World Bank assisted hydrology project, it envisaged to strengthen the capacity of hydrology departments (surface and groundwater) to develop and sustain the use of the HIS for hydrological designs and decision tools which will create an enabling environment for improved integrated water resources planning and management. It is further programmed to develop and use decision support system which will provide water management authorities a well-structured, user-friendly, practical and complete water resources management information system.
- **Framework of Integrated Data and Management Information System:** IWRM at river basin level as well as at the state level (OWPO) is a decision making process for water resources management encompassing all sectors. Thus, data and information related to all sectors should be available for effective decision-making. This can be achieved through an "integrated data and information management system" along with decision-making tools. The framework is presented in Fig. 11.

This frame work takes into account:

- The central unit will be the State Hydrometry and Data Centre, which will be mandated to take proactive and leading role in developing sectoral coordination on related data and information system
- Sectoral water demand and uses including future planning can be achieved through linkages with the other sector's existing data base and relevant information system at the respective sector level in conformity to the requirements stipulated in the State Water Policy-2007
- Water resources data and information of both surface and ground water
- Meteorological data both from the state and national agencies
- Water quality data both on surface and ground water. Besides, appropriate coordination need to be developed with the sectors managing ecological sites of importance
- Setting up of a dedicated GIS unit in the centre along with proper capacity development on uses of GIS and DSS in the planning and management process. This has to be the integral part for providing the support to the RBOs and OWPO.

The consultants have developed **specific action items** in response to these existing and proposed activities and these are listed in Section 4.

Figure 11. Framework of Integrated Data and Information Management System



3.3.4 Environmental Flow Assessments

Environmental flow has been variously defined in the following terms: natural flows or water left untouched or specifically released to supply the needs of the environment' or it is stated as 'flow for nature', or 'minimum flow in the river or 'ecological reserve' or 'water requirement for both terrestrial and aquatic ecosystem' etc. While environmental flow has been defined in many different ways, its objective is to maintain the natural health of the river system, through both spatial and temporal dimensions (Box 13).

Most Indian rivers are highly regulated due to construction of multipurpose reservoirs for domestic supply, irrigation, hydropower and fisheries. In addition, there are numerous barrages or weirs constructed in the rivers for assisting water diversion. Long stretches of rivers have been channelised by embankments. Many of these reaches can now go almost completely dry, except during the rainy season, as the flow is diverted for irrigation and other needs. At present many rivers are receiving large discharges of industrial effluents, fertilizers and pesticides from agricultural practices and domestic wastes. The heavy exploitation of many rivers means that environmental flow has been severely compromised.

There are two main methods of setting environmental flow targets:

- (i) Detailed assessment, using primarily holistic methods, or methods based on habitat modelling and the revealed preferences of local inhabitants. (The chances of applying this method in India are faint due to lack of appropriate databases) and
- (ii) Rapid, desktop assessment using primarily ecological relevant hydrological characteristics (indices) or analysis of hydrological time series.

Box 13. Perspectives on environmental flows

Linking Environmental Flows to Integrated Water Resources Management

1. the aquatic (and related terrestrial) ecosystem provides habitat for fish, invertebrates, and other fauna and flora. The aquatic ecosystem is thus a water consuming sector just like agriculture, energy, and domestic and industrial supply.
2. the design and operation of hydraulic infrastructure for water supply, sewerage, irrigation, hydropower, and flood control often affect ecosystems, both upstream and downstream of the infrastructure, and communities—farming, pastoral, and fishing—dependent on those ecosystems. Conversely, the reoperation and rehabilitation of existing infrastructure have been used to support the successful restoration of degraded riverine ecosystems.
3. integrated water resources planning and management are facilitated by policies, laws, strategies, and plans that are multi-sectoral, based on the allocation of water for all uses; protection of water quality and control of pollution; protection and restoration of lake basins, watersheds, groundwater aquifers, and wetlands; and control and management of invasive species.

Source: *Environmental Flows in Water Resources Policies, Plans, and Project*. World Bank

Water for Nature – Environmental Flow Requirements

Stipulation of a desirable environment flow requirement (EFR) for riverine eco-system in water rich basins needs more investigation and proper substantiation. However, the EFRs need to be recognized as a valid requirement. Their estimation methods could be ad hoc and hydrology based, initially. Better methods based on water regimes required by different species as also based on the tradeoffs between environmental flow and uses, as preferred by the society, need to be evolved. The Brahmani case has provided an interested situation where requirements of fisheries in the lower (food sector), maintaining bio-diversity of the fragile mangrove ecosystems of Bhitarkanika and possibly river navigation below Talcher are to be met apart from irrigation requirements of the deltaic region. This needs a special study to establish if the existing Rengali reservoir operation could be modified to meet these complementary and competing uses.

Source: *Water Resources Assessment of Brahmani River Basin, India: A document to analyse the future scenarios of a relatively water-rich basin as support to country water policies*, Country Policy Support Programme (CPSP), ICID, August-2005

The National Commission for Integrated Water Resource Development Plan (NCIWRDP 1999) accepts that it is difficult to estimate the amount of water needed for environmental purposes. They pointed out that the knowledge base for estimating this requirement is very limited.

Although the concept of environmental flow is understood and generally appreciated by the relevant government agencies, little work has been done on quantifying the actual volume of water required to protect key environmental standards. Environmental flow assessment and allocation are certainly of paramount importance to the sustainability of rivers and its usefulness. There is a pressing need to develop techniques especially applicable to environmental flow in the context of Orissa.

Environmental Flow and Orissa State Water Plan-2004

As Orissa has distinct wet or monsoon and dry seasons the concept of average seasonal flow (ASF) should be used. The proportion of ASF to be prescribed as EF should be decided in consultation with local experts. Tables 12 and 13 refer to the proportions of ASF that have been taken for deciding EF for the basin.

Table 12. Proportion of average seasonal flows prescribed as environmental flows

Monsoon	Non-Monsoon	Quality
40%	50%	Outstanding
30%	45%	Excellent
20%	30%	Good
10%	20%	Poor
<10%	<20%	Severe Degradation

Table 13. Environmental flow retained in the State water balance

DEMAND	SURFACE WATER (MCUM)		GROUND WATER (MCUM)	
	2001	2051	2001	2051
Domestic	798	1202	1198	1803
Agriculture	18000	40000	4688	9408
Industry	606	1750	100	200
Environment	21000	21000	8400	8400
Others	100	200	100	200
Total	40504	64152	14486	20011
Water available	70000	70000	21000	21000

Note: - Water demand is approximate environment demand has been taken as **30%** for surface water and **40%** of ground water.

The consultants, recommend a **stepped approach to assessment of environment flow regimes for Orissa:**

- A **study to define ecological standards** that river management organisations (DoWR and proposed Basin Organisations) will be required to achieve;
- In the absence of a scientific approach to the 'identification and specification of natural values', a **provisional 'environmental flow'** should be assigned in every river basin plan;
- Establish a '**State convention on environmental flows basin by basin**', led by OWPO in DoWR, to preserve a notional proportion and a notional duration of the total supply and establish this with local stakeholder groups, who will be most affected by the implied trade-off between consumption and abstinence.

3.3.5 Inter-state issues

It is estimated that 30% of Orissa's annual flow comes from the neighbouring states. Therefore the State will have to develop agreements with upstream states on water sharing arrangements, as per the Inter-State River Water Disputes Act, 1956 (ISRWD Act, 1956). These agreements will predicate the determination of available water supplies in Orissa.

Inter-State Agreements

According to the Indian constitution states are the owners of water and as such each state has to enter into an agreement with co-basin states for sharing water. Table 14 lists Orissa's inter-state basins.

Table 14. Orissa's Inter-state basins

State	Rivers	Year of Agreement
West Bengal	Subarnarekha	1978
Jharkhand	Brahmani Subarnarekha Baitarani	1978 with Bihar
Chhattisgarh	Mahanadi Indravati	1983 with Madhya Pradesh 1978
Andhra Pradesh	Vansadhara Nagavali Kolab Bahuda Jhanjavati	1962 1978 1975 1978

In the Mahanadi basin, the inter-state agreement between Chhattisgarh (formerly Madhya Pradesh) and Orissa covers the water shares of tributaries like Ong, Jonk, and Udanti. There is no clear agreement regarding water shares in the main stem of Mahanadi whereas the riparian rights of Hirakud dam have been discussed in the inter-state meetings (Panchamarhi and Bhubaneswar). There is a need to have an agreement in this regard so that developments in upstream of Hirakud dam pay due regard to Hirakud. Advance warning before release of water from dams upstream of the Hirakud dam during flood events has also been discussed.

There is no inter-state agreement between Jharkhand (Bihar) and Orissa regarding sharing water from the Brahmani River. The riparian use of Rengali Project could be protected with an agreement, but would be difficult to guarantee due to poor monitoring. Water shares of Subarnarekha, Vansadhara, Nagavali, Kolab (Sabari and Sileru), Bahuda, Jhanjavati and Indravati have been well covered in inter-state agreements. Recently there has been some dispute with Chhattisgarh over diversion of Indravati water to river Kolab in Jaura Nala. Matters regarding power from Hirakud (5 MW), and irrigation for Jonk Dam need be discussed and settled (Box 14).

There exists an inter-state joint control board for Subarnarekha and Balimela. It is necessary to have RBOs for all the inter-state rivers to discuss and settle developments in these basins.

The consultants recommend:

(a) An immediate study to review and identify the equitable water benefit shares attributed to Orissa and to upstream states, and of current and future sharing options, with the study outcomes delivered by Q2, 2011.

(b) Using outputs of (a), the rapid finalisation by OSG of agreements between Orissa and neighbouring states.

This will provide OSG with improved security of water entitlements.

Box 14. Recent Interstate Water Dispute (Orissa & Andhra Pradesh)

The State of Orissa in February 2006 sent a complaint to the Central Government under Section 3 of the Inter-State River Water Disputes (ISRWD) Act, 1956 regarding water disputes between the Government of Orissa and Government of Andhra Pradesh pertaining to Inter-State River Vansadhara for constitution of a Inter-State Water Disputes Tribunal for adjudication.

The main grievance of the State of Orissa in the complaint sent to the Central Government is basically adverse effect of the executive action of Govt. of Andhra Pradesh in undertaking the construction of a canal taking off from the river Vansadhara called as flood flow canal at Katragada and failure of Govt. of Andhra Pradesh to implement the terms of inter-State agreement understanding etc. relating to use, distribution and control of waters of inter-State river Vansadhara and its valley.

Basic contention of State of Orissa in the complaint is that the flood flow canal would result in drying up the existing river bed and consequent shifting of the river affecting ground water table. It has also raised the issue of scientific assessment of available water in Vansadhara at Katragada and Gotta Barrage and the basis for sharing the available water.

Source: Ministry of Water Resources, Government of India (website, accessed May 2010)

3.4 Water law and regulatory reform

This section includes a discussion on:

- Establishment of Orissa Water Regulatory Authority, and
- A review of existing Orissa water law.

3.4.1 Establishment of the Orissa Water Regulatory Authority

13th Finance Commission of India recommendations

While recommending grants for Water Sector Management in the State, the 13th Finance Commission, in para – 12.55 of their report, observed:

“Injudicious inter-sectoral and intra-sectoral distribution of water amongst various categories of water users, low water use efficiency, fragmented approach to water users, low water use efficiency, fragmented approach to water resources planning and development, low water charges and meagre recovery are some of the major problems associated with the management of water resources in the country. A statutory autonomous institution at the state level could help in addressing these issues”.

The Commission, in para – 12.56 of their report, recommended setting up of a “Water Regulatory Authority” in each state and specification of a minimum level of recovery of water charges. The proposed regulatory authority would be given the following functions:

- To fix and regulate the water tariff system and charges for surface and sub-surface water used for domestic, agriculture, industrial and other purposes

- To determine and regulate the distribution of entitlement for various categories of uses as well as within each category of use
- To periodically review and monitor the water sector costs and revenues

Water regulatory authorities in India

Some Indian states have initiated water sector reforms to improve the performance using the establishment of a regulatory authority, including Maharashtra, Uttar Pradesh, Arunachal Pradesh and Andhra Pradesh. Except for Andhra Pradesh, the regulatory authority setup/to be set up in the states are primarily meant to take care of allocations, entitlements and water tariff issues etc. However, in case of Andhra Pradesh, the legislation is more towards strengthening the Water User Associations.

It is expected that the Government of Orissa will establish its own Water Regulatory Authority for fixing water tariffs and establishing water rights and entitlements. Only four other Indian states have enacted this mechanism: Maharashtra (Maharashtra Water Resources Regulatory Act), Uttar Pradesh (Uttar Pradesh Water Management and Regulatory Commission Act), Andhra Pradesh (Andhra Pradesh Water Resources Regulatory Commission) and Arunachal Pradesh (Arunachal Pradesh Water Resources Regulatory Authority Act). Table 15 highlights the salient features of the existing legislation on the water regulatory authorities of three Indian states.

The Acts prevailing in Maharashtra and Arunachal Pradesh are similar; Uttar Pradesh is also more or less similar to Maharashtra where as Andhra Pradesh's act is quite different in nature. The Acts of Maharashtra, Uttar Pradesh and Arunachal Pradesh have clear provision of entitlements but not so in Andhra Pradesh (Table 15).

Table 15. Definitions of entitlements, sub-surface entitlements, allocations and water user entities in the water regulatory acts of Maharashtra, Uttar Pradesh and Arunachal Pradesh

Maharashtra Act No 18 of 2005	Uttar Pradesh Act No. 26 of 2008	Arunachal Pradesh Act No 15 of 2006
ENTITLEMENT		
"Entitlement" means any authorization by any River Basin Agency to use the water for the purposes of this Act;	"Entitlement" means any authorization by the Commission to use the water for the specified purpose under this Act;	"Entitlement" means any authorisation by any river basin agency to use the water for the purposes of this Act ;
"Aggregate Bulk Water Entitlement" means an aggregate of Entitlements issued to a group or association of Water User Entities for the purpose of joint management of the Bulk Water Entitlements;		"Aggregate Bulk Water Entitlement" means an aggregate of Entitlements issued to a group or association of Water User Entities for the purpose of joint management of the Bulk Water Entitlements ;
"Bulk Water Entitlement" shall mean the volumetric entitlement to a share of the surface water resources produced by a project, river system or storage facility, for a specific category or Categories of Use, and deliverable within a specific period of time as specifically provided in the order granting the Entitlement	"Bulk Water Entitlement" means the volumetric authorization given by the Commission to a share of water resources produced by a project, river system or storage facility, for a specific period of time as specifically provided in the order granting the entitlement;	"Bulk Water Entitlement" shall mean the volumetric entitlement to a share of the surface water resources produced by a project, river system or storage facility, for a specific category or Categories of Use, and deliverable within a specific period of time as specifically provided in the order granting the Entitlement ;
"Individual Water Entitlement" means any authorization by the Authority to use the water other than Bulk Water Entitlement or an Aggregate Bulk Water Entitlement;	"Individual Water Entitlement" means any authorization by the Commission to use the water for specified purpose under this Act other than bulk water entitlement;	"Individual Water Entitlement" means any authorization by the Authority to use the water other than Bulk Water Entitlement or an Aggregate Bulk Water Entitlement
SUB-SURFACE/GROUNDWATER ENTITLEMENT		
"sub-surface entitlement" means an Individual or Bulk Water Entitlement to a volumetric quantity of water to be extracted in the command area of the irrigation project from a tube well, bore well or other well or by any other means of extraction of sub-surface water, or a group or field or wells duly and legally permitted, registered and constructed in accordance with standards prescribed by the Authority;	"Ground Water entitlement" means an individual or bulk water entitlement to a volumetric quantity of water to be extracted from a tubewell, borewell or other well or by any other means of extraction of ground water, or a group or field or wells duly and legally permitted, registered and constructed in accordance with standards prescribed by the authority	"Sub-surface entitlement" means an individual or Bulk Water Entitlement to a volumetric quantity of water to be extracted in the command area of the irrigation project from a tube well, bore well or other well or by any other means of extraction of sub-surface water, or a group or field or wells duly and legally permitted, registered and constructed in accordance with standards prescribed by the Authority;
ALLOCATION		

Maharashtra Act No 18 of 2005	Uttar Pradesh Act No. 26 of 2008	Arunachal Pradesh Act No 15 of 2006
"allocation" means the portion or percentage of an Entitlement declared annually or seasonally by the Prescribed Authority to be made available to the holder of an Entitlement based upon the availability of water for the period within the sub-basin, river basin, project or storage facility for that season or year; and during water crisis or scarcity on the principle of proportionate entitlement.		"Allocation" means the portion or percentage of an Entitlement declared annually or seasonally by the Prescribed Authority to be made available to the holder of an Entitlement based upon the availability of water for the period within the sub-basin, river basin , project or storage facility for that season or year ; and during water crisis or scarcity on the principle of proportionate entitlement.
"Quota" means a volumetric quantity of water made available to an Entitlement holder, which is derived by multiplying an Entitlement by the annual or seasonal allocation percentage;	"Quota" means a volumetric quantity of water made available to an entitlement holder, which is derived by multiplying an entitlement by annual or seasonal allocation percentage;	"Quota" means a volumetric quantity of water made available to an Entitlement holder, which is derived by multiplying an Entitlement by the annual or seasonal allocation percentage;
"Volumetric" means a measurement of water on the basis of volume as per the norms of the Bureau of Indian Standard		"Volumetric" means a measurement of water on the basis of volume as per the norms of the Bureau of Indian Standard
WATER USER ENTITY		
"Water User Entity" means any Water User's Association, Utility, Industrial User's Association, Other User's Association or any other group (or individual) which is authorized by the Authority to receive and utilize a water Entitlement;	"Water User Entity" means any Water User entity including Water Users' Association, utility, Industrial Users' Association or any other group or individual which is authorized by the Commission to receive and utilize a water entitlement	"Water User Entity" means any Water User's Association, Utility, Industrial User's Association, other User's Association, or any other group (or individual) which is authorized by the Authority to receive and utilize a water Entitlement

Boxes 15-17 list the powers and functions of water regulatory authorities in four Indian states. These vary according to the requirements of each state.

Box 15. Powers and functions of the Maharashtra Water Regulatory Authority

1. determine the distribution of entitlements for various categories of use
2. determine the priority of equitable distribution of water available
3. establish a water tariff system
4. administer and manage interstate water resources apportionment on river systems
5. review and clear water resources projects
6. proposed lay down the criteria and monitor the issuance of entitlements.
7. lay down the criteria for modification in entitlements
8. fix the criteria for trading of water entitlements or quotas
9. entitlements may be subject to review at intervals
10. shall adjust the quantities of water to be made available to all entitlements
11. apportion the entitlement to the use of the water of the state between water using categories.
12. establish a system of enforcement, monitoring and measurement of the entitlements
13. promote efficient use of water and to minimize the wastage
14. determine and ensure that cross-subsidies between categories of use,
15. develop the state water entitlement data base
16. facilitate and ensure development, maintenance and dissemination of a comprehensive hydro-meteorological information data base.

Source: Maharashtra Act No. 18 of 2005

Box 16. Powers and functions of the Uttar Pradesh Water Regulatory Authority

1. to approve the integrated state water plan/basin plans
2. to determine the allocation and distribution of entitlements
3. criteria for modifications in the entitlements
4. review and accord clearance to new water resources projects
5. establish a system of enforcement, monitoring and measurement of the entitlements
6. framework for the preservation and protection of the quality of surface and ground water resources
7. withdraw the entitlement or take any action as deemed necessary in case any water user entity pollutes or causes to pollute
8. impose penalty on any organization or agency
9. review the entitlement
10. register and monitor bulk water entitlement
11. fix and regulate a water tariff system
12. determine and fix the rate of cess to be charged from owner of lands

Source: Uttar Pradesh Act No. 26 of 2008

Box 17. Powers and functions of the Andhra Pradesh Water Regulatory Authority

1. determine the water requirement for various categories of users
2. determine the requirement of irrigation water for the various levels of farmers organizations
3. determine the adequate operation and maintenance (O&M) cost
4. state shall ensure provisions for full operation and maintenance requirements of such projects as determined by the commission
5. providing guidelines / procedures / modalities for plough back of operation & maintenance amount to the farmers organizations
6. ensure that the principle of "tail to head" irrigation
7. to promote efficient use of water resources and minimizing wastage of water
8. ensure publication of an annual report
9. devise a suitable mechanism for financial incentives/disincentives to the farmer's organizations

Source: Andhra Pradesh Regulatory Commission Act 2009.

Box 18. Powers and functions of the Arunachal Pradesh Water Regulatory Authority

1. to determine the distribution of entitlements for various categories of use and the equitable distribution of entitlements of water within each category of use on such terms and conditions as may be prescribed
2. to enforce the decision or orders issued under this act
3. to determine the priority of equitable distribution of water available at the water resource project, sub-basin and river basin levels during periods of scarcity
4. to establish a water tariff system, and to fix the criteria for water charges at sub-basin, river basin and state level after ascertaining the views of the beneficiary public , based on the principle that the water charges shall reflect the full recovery of the cost of the irrigation management , administration, operation and maintenance of water resources project
5. to administer and manage interstate water resources apportionment on river systems of the state
6. to review and clear water resources projects proposed at the sub- basin and river basin level to ensure that a proposal is in conformity with integrated state water plan and also with regard to the economic, hydrologic and environmental viability and where relevant, on the state's obligations under tribunals, agreements, or decrees involving interstate entitlements : provided that, while clearing the new water resources projects by the concerned for construction proposed by river basin agencies, the authority shall ensure that governor's directives issued from time to time, relating to investment priority for removal of regional imbalance are strictly observed
7. to lay down the criteria and monitor the issuance of entitlements.
8. to lay down the criteria for modification in entitlements for the diversion,, storage and use of the surface and sub-surface waters of the state.
9. to fix the criteria for trading of water entitlements or quotas on the annual or seasonal basis by a water entitlement holder.
10. entitlements may be subject to review at intervals of not less than three years and then , only if warranted by concerns about, the sustainability of the level of allocation
11. bulk water entitlements shall be registered by the river basin agency and shall be monitored by the authority or its duly delegated competent representative
12. basin agency and the authority and in compliance with the rules of the authority promulgated for this purpose. all approved transfers shall be entered into the registry of entitlements of the authority
13. in the event of water scarcity , the authority, in compliance with its policy and rules for allocating such scarcity, shall adjust the quantities of water to be made available to all entitlements and shall permit the temporary transfer of water entitlements between users and categories of users in accordance with the approval of the river basin agencies
14. to establish regulatory system for the water resources of the state , including surface and subsurface waters, to regulate the use of these waters, apportion the entitlement to the use of the water of the state between water using categories.
15. to establish a system of enforcement, monitoring and measurement of the entitlements for the use of water that will ensure that the actual use of water , both in quantity and type of use are in compliance with the entitlements as issued by the authority,
16. to administer the use and entitlement of water resources within the state in a manner consistent with the state water policy to ensure the compliance of the obligation of state with regard to the apportionment of interstate waters between the state and others states
17. to promote efficient use of water and to minimize the wastage of water and to fix reasonable use criteria for each category of use
18. to determine and ensure that cross -subsidies between categories of used if any, being given by the government are totally offset by stable funding from such cross-subsidies or government payments to assure that the sustainable operation and maintenance of the water management and delivery systems within the state are not jeopardised in any way
19. to develop the state water entitlement data base that shall clearly record all entitlements issued for the use of water within the state , any transfers of entitlements and a record of deliveries and uses made as a result of those entitlements
20. to facilitate and ensure development , maintenance and dissemination of a comprehensive hydro -meteorological information data base in co-operation with the river basin agencies
21. the authority shall review and revise , the water charges after every three years
22. the authority may ensure that the irrigation status report is published by the government every year , such report shall contain all statistical data relating to irrigation including details in respect of district wise irrigation potential created and its actual utilisation
23. such other powers, function and duties as may be prescribed.

Source: Arunachal Pradesh Act No 15 of 2006

Policy directives for establishing a water regulatory authority in Orissa

The need for a water regulatory authority was foreseen in the Orissa State Water Policy-2007:

- a. “the State will explore the possibility of setting up a regulatory authority for fixation of water rates in order to achieve full cost recovery of the O&M charges”
- b. “norms will be established for ensuring water rights commensurate with water rates”.

The State Water Policy of Orissa also states that,

“development of water resource involves huge capital investment. Creation of necessary infrastructure will continue to remain in the domain of public investment. Participation of beneficiaries in the capital cost in suitable proportions will be encouraged through appropriate schemes. There will be differential water rates for different categories of uses. The cost of operation and management will be fully recovered from the beneficiaries. Norms will be established for ensuring water rights commensurate with water rates. The State will explore the possibility of setting up a regulatory authority for fixation of water rates in order to achieve full cost recovery of the O&M charges.”

These policy directives suggest that water reform in Orissa is a State imperative. The consultants endorse the functions of a proposed water regulatory Authority for Orissa as suggested by the 13th Finance Commission of India, and listed above.

3.4.2 Review of water laws

Action 2 of the 2008 “Proposed Action Plan for IWRM in Orissa³³” was to review the legal framework for water resources management, leading to recommendations on update and harmonization of water related legislation and development of a Water Act for Orissa”. The consultants subsequently examined water laws in this TA in the context of Orissa water policy, formulated initially in 1994 and revised it 2007. IWRM components are shown in Box 19.

Box 19. Orissa State Water Policy (2007) - IWRM component

1. water is replenishable but finite resource
2. the hydrological unit should be the unit of development and management
3. preparation of the State Water Plan and development of the water resources require an appropriate institutional and legal framework to support the activities
4. water resources department shall prepare macro level multi sectoral River Basin Plans
5. the OWPO will interact with various stakeholders for preparation of these plans
6. the plans prepared by OWPO will be ground-truthed through the River Basin Organizations (RBOs)
7. participation of beneficiaries in the capital cost in suitable proportions
8. differential water rates for different categories of uses
9. cost of operation and management will be fully recovered from the beneficiaries
10. norms will be established for ensuring water rights commensurate with water rates
11. the requirement of environmental flow in the river
12. requirement of water for maintenance of the riverine ecosystems

Water Laws

This section presents the results of the review of water laws. The consultants consider the existing Water Policy suffices at present to enable effective water resources management and planning. Orissa has several acts/laws relevant to the water use sector (Box 20). Consolidate of these and others into one act might act to improve integration and consistency.

³³ Action proposed in the report on Action Plan for IWRM in Orissa (TA-4814(IND) Project Processing and Capacity Development, Integrated Water Resources Management, 2008).

Box 20. Summary of existing Orissa water law

i. Orissa Irrigation Act and Rules:

The Orissa Irrigation Act was framed in 1959 and Rules in 1961. Most of the water related activities were governed by these act and rules. Amendments are made as when required to take care the emerging requirements in the governance of water.

This Act and Rules primarily takes care of (i) specify who can use canal water, and for what purpose (ii) defines use rights -- not ownership (iii) use rights are granted only to people who have land in command areas (iv) defines "Government water source" (v) it also prescribes basic water rates applicable to various classes of irrigation systems (vii) confers some power on the Executive Engineer such as authority to grant water licenses to industries or businesses

ii. Orissa Pani Panchayat Act & Rules:

In conformity to the provisions contained in the national and state water policies, participatory irrigation management is being adopted by various states. For this purpose, Orissa has formulated acts like; Orissa Pani Panchayat Act, 2002; Orissa Pani Panchayat Rules, 2003.

The act and rules stipulates the (i) the organization structure (ii) duties and functions of different farmers' organizations (iii) election process (iv) government representation in the organization (v) some water management functions like cropping plan based on water allocation /entitlement, operation and maintenance, helping in cost recovery, settling the conflict, power to levy, Collect fee and water tax etc.

iii. Groundwater

Orissa does not have any ground water act.

iv. Water (Prevention and Control of Pollution) Act, 1974:

Orissa State Prevention and Control of Pollution Board was constituted in pursuance to the Water (Prevention and Control of Pollution) Amendment Act, 1974. This Act takes care of the different pollution including water pollution also.

v. Orissa Water Supply and Sewerage Board Act, 1991:

An act to provide for the establishment of a water supply and sewerage board for rapid development and proper regulation of water supply and sewerage services in the state of Orissa.

Harmonization of water related legislation

Tables 16 and 17 report our findings regarding the adequacy of Orissa water policies, laws and regulations for addressing IWRM. The analyses will help to harmonize legislation for achieving IWRM outcomes.

Table 16. Analysis of policies, acts and laws

Item	Existing Situation	Sufficiency requirements in terms of IWRM actions
Policy	Orissa State Water Policy-2007	Sufficient platform exists Provision in terms of multi-sectoral water resources planning and management
Act	Irrigation Participatory Irrigation Management Pollution Control Water & Sewage	Insufficient in terms of addressing all sectors Acts on sector basis Predominantly on irrigation Cost recovery mechanism is not well defined. No specific act on drinking water and groundwater
Regulatory Mechanism	Scope exist in the water policy No specific act is in place	Non existence of act on water management regulations In order to address the mechanism on integrated planning, management, cost recovery, entitlement such mechanism need to be in place
Entitlement	PIM Act of state contain this word which is viewed in terms of allocated water	Insufficient situation to address this; Inadequate to take up this aspect needs appropriate policy and act

Table 17. Analysis of management instruments

Item	Existing Situation	Sufficiency requirements in terms of IWRM actions
Water resources assessment	Department of Water Resources is in charge on behalf of the State (Indian Constitution says water is a state subject)	Rigorous hydro-meteorological information planning and sharing
Plans for IWRM	Not available	Subsequent to this TA-7131(IND) report, IWRM Basin Plan will be initiated
Demand management	Supply based management in terms of all sectoral uses	Improved information exchange with water right and entitlement Existing set-up need to be linked to other non-irrigation sectors Regulatory mechanism is the key
Social change instruments	Policy says about stake-holder participation. Now it is limited to participatory irrigation management through act	Stakeholder participation across the sector Regulatory Mechanism is the key
Regulatory instruments	Non-existing	Need appropriate act in order to put it in place
Conflict resolution	Limited option in Act relating to PIM	This is a strong parameter in terms of inter and intra sector water conflict Regulatory mechanism is the key
Economic instruments	Limited option in terms of Act, although Policy is clear on this	This is another strong parameter of IWRM Regulatory Mechanism is the key
Information management and exchange	Water information exchange is done on requisition	Need to have act or mandate for inter sectoral information management and exchange

The consultants recommend a review of State water laws and institutional arrangements to identify legal tools to:

- (i) Support the creation of a revised State Water Plan**
- (ii) Establish the proposed State Water Resources Regulatory Authority and**
- (iii) Prepare State Water Act.**

The consultants also recommend strengthening the institutional and human capacity of DoWR in legal matters, as part of the Capacity Development Action Plan discussed earlier in this report. This will help in having a comprehensive State Water Act in order to establish the framework for water resources development, management and regulation in the State ensuring inter-sectoral coordination and stakeholder participation. This is in addition to lifting the level of managerial skills in DoWR.

4.0 Timetable and resource requirements for action

Key to resource requirements (last column): numbers refer to person years; letters refer to: N = new; E = existing resources

4.1 Capacity Development (Section 2 of Report)

#	ACTION ITEM	Q3 2010	Q3 2010	Q1 2011	Q2 2011	Q3 2011	Q4 2011	Q1 2012	Q2 2012	Q3 2012	Q4 2012	Q1 2013	Q2 2013	Q3 2013	Q4 2013	Q1 2014	Q2 2014	ACTION REQUIRED BY	OUTPUTS	RESOURCES
	Train & Mentor WUAs, RBOs and OWPO Staff; Statewide Water Awareness Programme																			
1	Training programme for Zilla Parishads on water message collection at WUA level, and transfer to RBOs	X	X	X	X	X	X	X	X	X	X	X	X	X				WALMI	Plan in place and implemented	5N
2	Training programme for WUAs to improve capacity for cost recovery of O&M	X	X	X	X	X	X	X	X	X	X	X	X	X				WALMI	Plan in place and implemented	5N
3	Introduction to water management short course for OWPO and Training of Trainers (ToT) for WALMI Trainers and appointment of mentors; focus topics: water reform, water use efficiency and ownership of improved water management processes.	X	X															IWC and ISPM project	Short course & ToT Course completed	1N
4	Capacity Development Action Plan from ISPM Project	X	X	X	X	X	X	X	X	X	X	X	X	X				CE, OWPO and ISPM Project	Short course & ToT Course completed	TBC
5	Series of training workshops/seminars in specific topics for all sectors to raise awareness of water reform, water use efficiency and ownership of		X	X	X	X	X	X	X	X	X	X	X	X		X	X	OWPO/WALMI	Workshops completed	5N

#	ACTION ITEM	Q3 2010	Q1 2011	Q2 2011	Q3 2011	Q4 2011	Q1 2012	Q2 2012	Q3 2012	Q4 2012	Q1 2013	Q2 2013	Q3 2013	Q4 2013	Q1 2014	Q2 2014	ACTION REQUIRED BY	OUTPUTS	RESOURCES
	improved water management processes.																		
	Reform OWPO and WALMI																		
6	Redefine current OWPO leadership	X															DoWR and part of CDAP (ISPM Project)	Positions redefined and officers in place	0.1E
7	Appoint Key IWRM Advisor to DoWR Secretary & OWPO IWRM Director	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	OSG/DoWR	Advisor appointed	4N

4.2 Informed Dialogues (Section 3.1 of this Report)

#	ACTION ITEM	Q3 2010	Q1 2011	Q2 2011	Q3 2011	Q4 2011	Q1 2012	Q2 2012	Q3 2012	Q4 2012	Q1 2013	Q2 2013	Q3 2013	Q4 2013	Q1 2014	Q2 2014	ACTION REQUIRED BY	OUTPUTS	RESOURCES
	Dialogue in WUAs																		
8	Mainstream water in PRI structure in Baitarani Basin		X	X													WUAs and WALMI	Inclusion in agenda items	1N
9	Prepare action plan for water dialogues addressing key local issues for inclusion in Basin Resource Management Plans				X	X			X				X	X			WUAs and WALMI	Action plans	10N
	River Basin Organisation Dialogues																		
10	Finalise Baitarani RBO Resolution	X															OWPO	Baitarani RBO Resolution notified	0.1E

#	ACTION ITEM	Q3 2010	Q3 2010	Q1 2011	Q2 2011	Q3 2011	Q4 2011	Q1 2012	Q2 2012	Q3 2012	Q4 2012	Q1 2013	Q2 2013	Q3 2013	Q4 2013	Q1 2014	Q2 2014	ACTION REQUIRED BY	OUTPUTS	RESOURCES
11	Establish Baitarani RBO, agree on RBO functions	X																OWPO/BM	Baitarani RBO established	0.1E
12	Undertake two Baitarani pilot projects: (1)water O&M cost recovery; (2) project nominated by RBO			X	X	X	X	X	X	X	X							OWPO/ Baitarani RBO	Project completed	24E
13	Establish River Basin Organisations in other Orissa basins							X	X	X	X	X	X	X	X			OWPO/CE & BMS	Other RBOs established	12E
	State Level Dialogues																			
14	Reactivate the SWRB for key water allocation and dialogue instruments with increased interaction with OWPO	X	X	X	X	X	X	X	X	X	X	X	X	X	X			Principal Secretary DoWR and ISPM Project	OWPO on SWRB agenda	4E
	State-level Water Awareness & Advocacy Programme																			
15	Development of information and advocacy material targeting the public, (including children) and the media, prepared in both English and Oriya		X	X	X	X	X	X										OWPO & WALMI	Materials developed	6N 6E
16	Planning and execution of an awareness program/campaign, with support to WALMI and NGOs (donors and ADB)		X	X	X	X	X	X										OWPO & WALMI with ISPM Project (Communication Plan)	Campaigns completed	6N 6E

4.3 Water Allocation and Tariffs (Section 3.2 of this Report)

#	ACTION ITEM	Q3 2010	Q3 2010	Q1 2011	Q2 2011	Q3 2011	Q4 2011	Q1 2012	Q2 2012	Q3 2012	Q4 2012	Q1 2013	Q2 2013	Q3 2013	Q4 2013	Q1 2014	Q2 2014	ACTION REQUIRED BY	OUTPUTS	RESOURCES
	Recover O&M Costs																			
17	Transfer O&M cost recovery to WUAs, starting in Baitarani Basin. Project focused on 25 Pani Panchayats which have potential to start & are physically accessible to Baitarani pilot experiences	X	X	X	X	X	X	X	X	X	X							OWPO, NGOs	O&M implemented in 25 PPs	12-15 N
	Establish State Water Regulatory Authority																			
18	Establish Orissa Water Regulatory Authority [OWRA]				X	X	X	X										Inter-departmental Task Force with advice from ISPM Project	OWRA formed	4E (Task Force) 20-30N expanding to 40-50 N(OWRA)
19	Introduction of a comprehensive system of access rights (licenses and entitlements)											X	X	X	X	X	X	OWRA, DoWR OWPO, DoWR	Entitlements system in place	10N
	Finalise Inter-state Water Sharing Arrangements																			
20	Undertake study to review and determine optimum benefits shares between Orissa and neighbouring states	X	X	X	X	X	X	X	X									OWPO/Water Resources Board	Benefit shares study completed	5N
21	Establish new interstate agreements on water benefit sharing between																	OWPO/Water Resources Board/DoWR	Interstate agreements	4N

#	ACTION ITEM	Q3 2010	Q1 2011	Q2 2011	Q3 2011	Q4 2011	Q1 2012	Q2 2012	Q3 2012	Q4 2012	Q1 2013	Q2 2013	Q3 2013	Q4 2013	Q1 2014	Q2 2014	ACTION REQUIRED BY	OUTPUTS	RESOURCES
	Establish Baitarani Basin Resources Management Plan																		
27	Preparation and finalisation of the Baitarani Basin Profile [by July 31, 2010]	X															OWPO	Baitarani Profile	2E
28	Preparation of Baitarani Resource Management Plan (River Basin Plan)	X	X	X	X	X											OWPO & Baitarani RBO with RFTA / ISPM Projects	Baitarani IWRM Plan	5E
29	Phased formation of similar working groups in other river basins				X	X	X	X	X	X	X	X	X	X	X	X	OWPO	River Basin Resource Management Plans for all Orissa river basins	25E
	Upgrade Hydrological Information System																		
30	Develop coordination group in DoWR & OWPO with World Bank Hydrology Program II to establish project connections & future data sharing on IWRM aspects in GIS, Modelling and DSS systems.	X															EIC (P&D) and CE(OWPO) and facilitated by ISPM Project	Coordination Established	2N
31	Cooperation with		X	X													EIC(P&D) /	IWRM	2N

#	ACTION ITEM	Q3 2010	Q3 2010	Q1 2011	Q2 2011	Q3 2011	Q4 2011	Q1 2012	Q2 2012	Q3 2012	Q4 2012	Q1 2013	Q2 2013	Q3 2013	Q4 2013	Q1 2014	Q2 2014	ACTION REQUIRED BY	OUTPUTS	RESOURCES
	World Bank Hydrology Program II to add IWRM aspects in the GIS, Modelling and DSS systems																	CE(OWPPO) /Director, Hydrometry	components are taken care	
32	Review and prioritize existing information systems and identify additional support structures with assistance of external support from TA (ADB)	X	X															CE(OWPPO)/Director, Hydrology & Water Planning	Report & Work Plan in place	2E
33	Design a framework for an integrated data and information management system along with decision making tools with assistance of Hydrology II project, with assistance of external support from TA (ADB)		X	X	X	X	X											CE(OWPPO) / Director, Hydrology & Water Planning & Director, Hydrometry	Integration is achieved	5E 5N
34	Recommend procedures to develop a State Water Data Management Plan					X	X											CE(OWPPO) / Director, Hydrology & Water Planning/ Director Hydrometry	Plan in place	1E
	Assess Environmental Flow Requirements																			
35	Review previous	X	X	X	X													OWPO	Previous Studies	2N

#	ACTION ITEM	Q3 2010	Q3 2010	Q1 2011	Q2 2011	Q3 2011	Q4 2011	Q1 2012	Q2 2012	Q3 2012	Q4 2012	Q1 2013	Q2 2013	Q3 2013	Q4 2013	Q1 2014	Q2 2014	ACTION REQUIRED BY	OUTPUTS	RESOURCES
	environmental flow studies in similar environments to Orissa (including previous EF studies in the Brahmani/Baitarani and Chilika), in Orissa & India																		Report	
36	Link to Hydrology II project & identify data needs to undertake future environmental flow allocations by 2012		X	X	X													OWPO	Needs Assessment Report	2N
37	Establish TA for an international/local environmental water resources specialists (ADB) to support study including cooperation with local universities		X	X	X	X												OWPO	TA in place and Report delivered	2N
38	Using outputs of study, develop preliminary recommendations regarding environmental flows; implement environmental flow regimes							X	X									Eng-in-Chief, DoWR	Recommendations and practices implemented	2N

4.5 Water Law Reform (Section 3.4 of this Report)

#	ACTION ITEM	Q3 2010	Q3 2010	Q1 2011	Q2 2011	Q3 2011	Q4 2011	Q1 2012	Q2 2012	Q3 2012	Q4 2012	Q1 2013	Q2 2013	Q3 2013	Q4 2013	Q1 2014	Q2 2014	ACTION REQUIRED BY	OUTPUTS	RESOURCES
	Develop State																			

#	ACTION ITEM	Q3 2010	Q3 2010	Q1 2011	Q2 2011	Q3 2011	Q4 2011	Q1 2012	Q2 2012	Q3 2012	Q4 2012	Q1 2013	Q2 2013	Q3 2013	Q4 2013	Q1 2014	Q2 2014	ACTION REQUIRED BY	OUTPUTS	RESOURCES
	Water Act																			
39	Formation of Review & Drafting Committee (ORDC) (see note below)	X	X															DoWR	ORDC formed	02.E
40	Prepare ToR for TA for international/local Legislation Specialists (ADB) for (1) below		X															DoWR & ADB	Terms of Reference	0.2E
41	Undertake TA by international/local Legislation Specialists (ADB) for note below			X	X													DoWR	Water law reform report	1N
42	Submit Legislation Study to SWRB for consideration and decision by Orissa Legislative Assembly, including dialogue with GoJ, during 2012-13						X	X	X	X								OWPO/DoWR	Decision on water law reforms	1E
43	Preparation of a draft <i>State Water Act</i>					X	X	X										OWPO/ Consultants both Water & legal expertise	Draft State Water Act	1E
44	Consideration of recommendations by SWRB, and other competent bodies affected by them											X	X					OWPO/DoWR/SWRB	Comments receive on draft State Water Act	1E
45	Consideration of recommendations by Orissa Legislative Assembly													X	X	X	X	DoWR/Law Department	Decision by legislature on Act	1E

Note: (a) The Review & Drafting Committee, comprising international and local staff, will report to the SWRB through the Principal Secretary of DOWR; purpose: to review present water related legislation, and make recommendations for revisions and harmonization of existing legislation, and development of new legislation.



Annex 1. Reports on Stakeholder Advisory Group Workshops

1.1 Workshop background statement

Background

Under the Orissa Integrated Irrigated Agriculture and Water Management Investment programme (OIIAWMIP), the Asian Development Bank is supporting the Orissa State Government's establishment and operationalising of integrated water resources management (IWRM), a provision of the Orissa State Water Policy. This approach occurs at state and selected river basin levels with stakeholder consultations and awareness, and capacity building of the concerned sector organizations.

A Technical Assistance project in IWRM (called the 'TA-7131 [IND] in IWRM') was established to support this work. The project has provision for a Stakeholder Advisory Group (SAG) comprising eminent local experts including those from local academia and consultants, NGOs active in the sector and other stakeholder organizations.

The purpose of this group is to provide strategic advice on the implementation of IWRM at State and local levels. The group, with others from State Government, may well be the catalyst for an advisory function to high levels of State Government in later stages of implementation of IWRM in the State.

Dates

Three workshops are planned, with the first workshop to be held on 19th February, 2010. The workshop will be held in Bhubaneswar at a location to be determined.

Purpose of the first workshop

- Introduce the project to key water stakeholders and to increase awareness of IWRM activities
- Capture the experience, ideas and ways forward for IWRM
- Capture what is happening in the field in water resources management
- Identify how far we can go with implementation of proposed IWRM roadmap
- Establish ownership of the IWRM process with key water stakeholders.

1.2 1st Workshop - Theme: Orissa's Water Issues

1.2.1 Outcome 1: Solutions to Orissa's water issues

These are the solutions proposed by the workshop participants at the first Stakeholder Advisory Group meeting, February 22, 2010.

Improve Orissa's water institutions

1. Form a State Level apex body to co-ordinate legislators, administrators and stakeholders with decentralization of power to district levels.
2. Create a water allocation system linked to the availability of water and water pricing.
3. Create a sub-basin regulatory body with all stake holders participation to consider water resources management issues.
4. Safeguard riparian rights with other water user rights by maintaining a minimum river flow to ensure continued access to freshwater.
5. Create legislation to support IWRM: for land use change, conservation, allocation, distribution, use/ misuse and pollution, over exploitation of groundwater.
6. Safeguard Orissa's water interests on inter-state agreements and in a national perspective

Strengthen water resources management practices

7. Increase conjunctive use of ground and surface water.

8. Use an effective ground water recharge method which minimises runoff and maximises opportunities for rainfed agriculture. RWHS must be compulsory for recharging groundwater.
9. Use state of art technology water conservation techniques.
10. Improve water use efficiency by agriculture, industry, mining and urban sectors.
11. Improve drainage management.
12. Establish secure water supplies by conserving water where it falls.
13. Preserve, strengthen and widen the use of traditional coping mechanisms (for water conservation, drought, floods) and strengthening them with technical inputs.
14. Implement structural and non – structural solutions for flood risk reduction.
15. Use a deficit planning approach (use aqua crop) for agriculture.
16. Synchronize hydropower generation with irrigation practices for more efficient use of power and water.
17. Increase storage capacity by constructing new dams, barrages, weirs and check dams, coupled with more widespread use of conservation practices such as rain water harvesting.

Improve water quality

18. Implement effective regulations on water quality.
19. Develop water treatment plans for reuse.

Increase participation and raise awareness

20. Increase the involvement of stakeholders in water resources management.
21. Create an appropriate forum to redress grievances in water sharing and management.
22. Raise awareness across all levels, collect feedback for improvement of water management practices, including water quality.

Build & use better information and assessments

23. Create robust, hydrologic data bases reflecting availability of resources both qualitatively and quantitatively and ensure it is in the public domain.
24. Manage the databases on a geographical basis of three water zones: Coastal, Western and Tribal Zones and map out the different types of water problems, availability, management issues and solutions for each zone.
25. Increase research and development on water use.

1.2.2 Outcome 2: Sectoral roles

These are the sectoral roles identified by the workshop participants at the first Stakeholder Advisory Group meeting, February 22, 2010.

Establish state and sectoral water development plans

1. Create a State Water Plan comprising Sectoral Development Plans to manage future development.
2. Ensure the State Water Plan is supported by policy, regulation, water assessments and participatory processes.
3. Ensure water planning in each sector is dynamic - being revisited regularly - preparing and reviewing water plans.
4. Prepare ranked options and allocate shares in water plans on a consensus basis.
5. Insist on conjunctive use and environment flow requirements by each sector.
6. Use a demand based approach in agricultural sector for use optimization, with crop planning dependent on agro-climatic conditions.
7. Use a water auditing approach in industry sector with compliance and monitoring mechanisms.
8. In the domestic sector, increase the use of conjunctive water sources and water conservation systems.
9. Increase the use of hydropower by the energy sector.

10. Increase the use of afforestation and conservation of forests in watershed development programmes.
11. Prioritise the actions of PRIs (Panchayat Raj Institutions) for water conservation, monitoring, and management for proper use of water and to solve water conflicts.
12. At community level, increase the use of Pallasabha and NGOs to look after the interest of the people and bring out the problems and solutions in Sector and State Water Plans.

Inter-sectoral coordination and sectoral accountability

13. Ensure that the Water Resources Department becomes the water 'caretaker' and is the nodal agency in coordinating all sectors' water management plans.
14. Analyse stakeholders' water demands and then determine allocations.
15. Establish forums for inter-sectoral linkages at all levels – State, basin, panchayat, village.
16. Establish mechanisms to ensure each sector is responsible for recycling and reuse, water conservation and management.

Monitoring and information management

17. Establish a state-wide monitoring mechanism involving participation of each sector to ensure agreed water allocations are maintained.
18. Establish a water information system in the public domain (IEC) to facilitate accountable water sharing and monitoring of water quality from each sector's effluents.

1.2.3 Participant list

Name	Organisation
Abinash Roul	DOWR
Achyut Das	NGO – Agragamee
Akshaya Kumar Das	DOWR
Ashok Kumar Mahasuar	O/o Director of Agriculture & Food Production, Orissa, BBSR
Ashutosh Dash	Planning, DoWR
B. K. James	DOWM
B.N. Rath	ISPM Specialist
Bharat Hansdah	Agriculture
Bipin Bihari Barik	Aragamee
Debraj Swain	OWPO
Dr Bitanjaya Das	ADB TA-7131 Consultant
Dr Bruce Hooper	ADB TA-7131 Consultant
Dr Geoff Wright	ADB ISPM Consultant
Dr Tue Kell Nielsen	ADB RETA-6470 Consultant
Dr. A. Galvez	ISPM
Er. B. B. Singhsamant	ADB ISPM Consultant
Hrushikesh Mishra	O/o the EIC,WR, OWPO
Lingaraj Gouda	Dam Safety, Water Resources
Nanda K Mohapatra	OWPO, DOWR
Niranjan Mishra	OWPO, BBSR
Niranjan Sahu	Watershed Mission
P. K. Prusty	Forest & Env. Dept. G.O.O
PHANI BHUSAN ROUT	URBAN DEVELOPMENT (PHEO)
Pragyan Bharati	Orissa State Water Sanitation Mission
Pramod Pradhan	Joint Director of Industries Directorate of Industries, Cuttack
Pravat Kumar Das	W.R.
PRIYABRATA SATPATHY	BAITARANI INTIATIVE
Probodha Kumar Sahoo	DOWR
ROBERT A MOHAMMED	ADB ISPM CONSULTANT
S.K. Mohapatra	Groundwater
S.S. Sahu	OWPO
Satyabrata Mohanty	Hydrometry, Bhubaneswar
SIBASISH PADHI	DOWR
SISIR KANTA DASH	URBAN DEVELOPMENT (PHEO)
SUBRAT RATH	DOWR
Sunanda Ku. Mohapatra	OWPO, Water Resources

1.3 2nd Workshop - Theme: Informed Dialogues

Saturday April 17, 2010

Location: 3rd Floor, Engineer-in-Chief, Water Resources

1.3.1 Background Information

Why a need for dialogues?

The 1st workshop pointed in the direction of taking important steps towards IWRM at policy and resolution (acts of government) level. These documents represent a “necessary but not sufficient” condition for action. The challenge now is to put “meat on the bones” and translate intentions into operations.

The Department of Water Resources is still basically an organization with focus on irrigation, and operationalisation of the multi-sectoral dialogue between water dependent sectors, and the involvement of stakeholders in the planning and decision processes, has yet to take off.

A new coordinated approach to water resources management needs to be developed, which works through **dialogues**:

- ✦ Between key sectors which using and affected by water resources
- ✦ Between stakeholders

and building on that, creating:

- ✦ Awareness about water issues and a participatory framework to address them
- ✦ An improved legal and institutional framework for IWRM
- ✦ A knowledge base to support this, and
- ✦ Capacity building at all levels, and among all stakeholder groups

Operationalising IWRM requires initiatives at basically three levels:

- ✦ The local level, from the villages to the RBO
- ✦ The basin/RBO level
- ✦ The State level

The purpose of this 2nd workshop is to gain feedback on the **ways forward for informed dialogues** for IWRM at four levels:

- ✦ The local level
- ✦ The basin level
- ✦ The State level
- ✦ Central Government and Inter-State levels

There is the need to know:

- ✦ **who is involved,**
- ✦ **how are they involved,**
- ✦ **what can be done at each level to dialogue water, and**
- ✦ **how do we coordinate dialogue actions between levels?**

The meeting was chaired by Mr N.K. Mohapatra and Er. S. Behera, Department of Water Resources, who requested comments from the workshop participants. Dr Hooper (ADB Consultant) introduced the project and the purpose of the workshop. Mr N. Mohapatra outlined the changing nature of water demands in the State and the need for (1) a framework of integrated planning and management, and (2) dialogue between different sector to address these current and future water demands.

1.3.2 Outcomes

The discussion which followed has been grouped into the following topics:

DoWR Focus

- ✦ DoWR can focus on improving irrigation practices but also incorporate watershed development, water conservation, basin level planning, micro-level water harvesting, conjunctive use
- ✦ Harness support of media to broaden DoWR focus
- ✦ Stronger links between DoWR and watershed development department and organisations are needed
- ✦ The success of watershed development³⁴ suggests DoWR use:
 - A peer led model - to bring about change in attitudes and increase action (peer leaders act as change agents); the peer led process was questioned: Is this an extension service at the PRI level? Can peer to peer dialogue work amongst the PRIs? The response was that there is the need to know *what* to dialogue and *how* to dialogue between PRIs - this questions must be asked first.
 - A peer led model - this suggests that water users themselves identify the peer leaders first, then the peer influences, and incorporate this information as a stakeholder/peer influence map³⁵
 - Collection of village level wisdom coupled to scientific knowledge to improve water management

Failure to Implement

- ✦ One speaker told the story of his childhood experiences: he once saw evidence of coordinated management and planning then (linking check dam construction with fisheries improvements) but this has gone; advocated greater use of youth to collect information, to become active in local water management and to use their involvement in local water resources management and planning to keep implementation occurring.

Information framework to assist dialogues

- ✦ There is a need for an information framework to assist dialogues, including:
 - Databases with relevant water information - available to all levels in ways people and organisations can use them
 - Information apart from hydrological information, including local wisdom on water management
- ✦ Demand assessments of water resources, done at different levels:
 - Recommendation was to do demand forecasts at block level
 - A 30 year time frame was suggested for demand forecasts and these be requested from each sector; DoWR to do this demand forecasting assessment, and do it now.
 - Demand forecasting should reflect current & future availability of water
 - Demand forecasting requires a process to incorporate views into the planning process, including at the block level
 - Need to know what questions to ask at block level and link these questions to those asked at basin and State level
 - A State-wide awareness campaign is needed to lift understanding of local water situation; Hydrology II Project has capacity to do this, with information being delivered to District Collectors: a block and District information dissemination programme is required
- ✦ The hydrological unit can be used as a tool for an information framework - need a rational building block for water resources data, information (including wisdom), management, and planning:

³⁴ The watershed development department has a survey which can be of use to DoWR on this topic

³⁵ Editor's comment: for example, this can be done at State Government, Basin, PRI/block levels and mapped in a GIS to show realms of information exchange.

- The sub-basin level of one river basin (e.g. 4 sub-basins in the Baitarani) was suggested as the hydrological unit for assessment, management and information storage and exchange;
- Lower (more finite) hydrological units (such as catchments of 1st order streams or blocks) become both illogical and impractical as groundwater resources do not vary significantly at this level)
- The size of this level (the sub-basin) suggest a useful framework for dialogue³⁶

Levels of Dialogue

- ✦ Role of PRI:
 - Dialogues required at village level using a realistic, systematic approach: that is, linked to Panchayat Raj institutions (PRIs); water resources management requires inputs to address environmental issues and agricultural development at PRI level
- ✦ Role of basin organisations:
 - Orissa State Government wishes to establish river basin organisations: a two tiered system of State level and basin level decision-making
 - There needs to be a nodal contact point in DoWR for dialogue each basin in Orissa - can the current Basin E-i-C's role be enhanced to collect sub-basin level water information and management issues; focus on key priority issue: ensure availability of drinking water, before larger big picture issues of basin management are addressed?
 - Should administration of river basin organisations be independent of District administrations?
- ✦ Role of State Government - link more closely to sectors:
 - With drinking water sector - link to census data and use it for planning; link drinking water programmes to more widespread use of water harvesting practices
 - With irrigation sector - dialogue with all government departments, not just DoWR to determine if there really is enough water as many claim
 - With industrial water use sector - assess water availability at the block level and where limited availability, disallow industrial development; the industrial sector must be included in future SAG meetings and future dialogues
 - With the OSG Planning Commission which has not been involved in dialogues to date
 - With organisations & individuals with environmental interests - increase dialogue with grass roots organisations and with government departments with environmental management and assessment interests
 - There needs to be a synergy / coordinating mechanism between departments to:
 - discuss and plan water resources development and management using forecasting scenarios
 - be informed by future water demands
 - prioritise water demands and needs
 - provide 'top-down' leadership
 - The sequence of action for dialogue should be OSG-led (top-down) first, then bottom-up second; why? Because water information taken to public should be put together in a way that makes sense.

The Baitarani Basin Initiative

- ✦ To repeat above, Orissa State Government (OSG) wishes to establish river basin organisations: a two tiered system of State level and basin level decision-making
- ✦ A Baitarani River basin organisation will be established as a pilot basin organisation - dialogue can occur between OSG and basin water users

³⁶ Editor's comment: this suggests (for example in the Baitarani) about four sub-basin management units spread across several districts; some rationalisation will be necessary if District Collectors become key players in basin organisations. Overall, this appears to be a useful water resources management unit as it can be used to gain local ownership and input through dialogues and a method to link information between OSG and block levels using District Collectors.

- ✦ There needs to be:
 - an accurate basin water assessment mapped on a GIS (Geographic Information System) for the Baitarani, and done at sub-basin level as lowest unit of recording data
 - a focus on water *sources* in this assessment, not just use
 - meetings held at this level should be reported to DoWR
- ✦ The next SAG Workshop could be held in a basin, perhaps Baitarani.

Annex 2. TA-7131 - Project Information

Consultancy team

The consultancy team comprised Dr Bruce Hooper, Principal, DHI India and Australia, Dr Bitanjaya Das, DHI India and Head, KIIT-DHI Centre for Water Modelling & Professor & Dean, School of Civil Engineering, KIIT University, Bhubaneswar, Orissa, and Mr Ian Whan, Managing Director, Alliance Resource Economics, Brisbane, Australia.

Terms of reference

For Dr Hooper, International IWRM Specialist:

- 1) Synthesise the status and gaps of operationalising IWRM in the light of the emerging water sector issues in Orissa, based on available reports.
- 2) Analyse national and international best practices and lessons, and ways to address particular issues and constraints in India, advising on the work of the national IWRM specialist in this regard.
- 3) Assess and recommend appropriate IWRM functions (including fixing water tariff, managing water allocation and entitlements/rights, other regulatory functions, etc., as well as process management towards IWRM operationalisation), and institutional setup and arrangements at the state level.
- 4) Assess and recommend appropriate structure and functions of the pilot RBO to be set up in the Baitarani River basin, and facilitate their establishment with national water resources planning specialist.
- 5) Develop a comprehensive roadmap towards operationalising IWRM at state and basin levels in Orissa, with detailed work plans including the TORs for the follow-on studies and technical assistance to this end.
- 6) Assist the consultative process in proceeding with the above studies, with the facilitation of advisory group meetings and state level workshops.

2. For Dr Das, National IWRM Specialist:

- 1) Assess the latest development of IWRM in India in particular in the states having advanced institutional setup (e.g., Maharashtra), including the process, lessons, and key issues for Orissa.
- 2) Synthesize the status of various IWRM functions, institutional responsibilities and legal bases, and performance, and assess the weaknesses and possible measures for improvement for Orissa, as an input to international consultant.
- 3) Assess the present status and performance of water and related data base and decision support systems for IWRM.
- 4) Support any other tasks assigned by the international team leader in undertaking his/her assigned tasks.

3. For Mr Ian Whan, International Water Resources Economist:

- (i) Become familiarized with the TA, its scope, and progress of IWRM reforms in Orissa;
- (ii) Review the information and materials collected in consultation with national IWRM specialist of the TA regarding the water tariff systems in Orissa and other states in India;
- (iii) Propose an appropriate structure of the discussion paper on water tariff systems and finalize the structure in consultation with TA team leader, DOWR, and ADB;
- (iv) Synthesize the rationale and principles of water tariff in different uses on the basis of the consultant's international experience, and the materials collected from India;

- (v) Synthesize the present systems (principles, analytical basis, and institutional arrangements) and issues of water tariff fixation in Orissa;
- (vi) Provide cross state and cross country overview of various good and similar practices in other states in India and other advanced countries;
- (vii) Provide options and recommendations that might be considered in Orissa;
- (viii) Submit the draft discussion paper, and finalize the paper after receiving and addressing comments from the reviewers.

Annex 3. Improving the Allocation and Utilisation of Water in Orissa – A discussion paper

Summary

The major problem: Orissa's government-run water supply industry is suffering from a number of problems – some of them persistent and some relatively new. The main problem plaguing the public water sector at this time is chronic budgetary deficits, with expenditure almost always exceeding receipts. This problem is being caused by deep rooted institutional deficiencies that will require major changes to correct. Three reforms are needed to correct the problem of budget deficits:

Price setting: Until recently there has been no permanent, formal and authoritative system in place for reviewing and setting public sector water prices. This deficiency should be removed with introduction of the Orissa Water Regulatory Authority – due to be established within the next 12 months. It is expected that the Water Regulatory Authority will treat water as an economic good and set charges so that they recover supply costs as defined. This will not preclude, however, the possibility of delivering social justice through recognition of the users' capacity to pay for water. Thus the poor and under-privileged could be offered rebates and allowances that specifically recognise their inability to afford commercial charge rates.

Applying and collecting charges: Currently there is no clear and logical division between supplying bulk water (a DoWR responsibility), retailing water and collection of charges. Depending on the scope to improve competition, DoWR should sell water to retailers who on-sell to final users. No third party should be involved in collecting water charges.

Confining the bulk water supply function to storage and distribution: Currently DoWR is responsible for the distribution of irrigation water within command areas. Recovering the O&M cost of this task is one of the major causes of water sector budget deficits. DoWR supply responsibilities beyond the point at which water enters the command area should be withdrawn as expeditiously as possible with farmer operated water user associations (WUAs) assuming responsibility for all activities inside their command area. The rate at which this transition can occur will partly depend on capacity building within WUAs. It is expected NGOs will assist with the transition by teaching farm leaders organisational and business management skills.

These reforms will result in a more business orientated and self reliant water sector. But the reforms will take several years to complete and will not be effective unless the work of the Water Regulatory Authority is complemented by structural and institutional reform from top to bottom.

Other pressing problems: A looming problem for the Orissa's water supply industry is competition for access to water specified in terms of source, volume, reliability and quality at a given time and place. While market forces would tend to distribute access to scarce water according to capacity to pay, the resultant outcomes are unlikely to be socially acceptable. Accordingly it is recommended that the State's Water Regulatory Authority be asked to introduce a formal system of user access rights. In the first instance, this system should take the form of renewable licenses that establish the conditions under which existing and new users could obtain a water allocation. The allocations would be advised annually based on the results of water balance modelling. Licenses would act to control the relationship between existing and new uses and the supplies of water expected to be available for extraction. In due course, user licenses could be replaced by entitlements that are more highly specified in terms of the ownership rights and responsibilities they give to water users. Entitlements would specify (among other things) the conditions under which the title (or rights) could be used and exchanged. The existence of entitlements would ensure that people with an established reliance on water would at least be compensated in the event that their rights were undermined or transferred to another party. Given growing competition for access, it is vital that transparent mechanisms are put in place for allowing water to flow to its highest and best use while properly compensating those holders who might have become non-competitive or have surplus supplies that they are prepared to trade on a temporary or permanent basis. Entitlements should also specify that water usage charges

can be legally tied to capacity to pay. This provision would allow different rates to be applied according to sector.

Closely related to the problem of establishing formal access rights, is the issue of financing the creation of new water supplies. If India is to cope with future water supply pressures it will have to seek from users a contribution to the capital cost of putting additional storage and distribution schemes in place. This will be possible if prospective users or investors purchase shares in the scheme based on its estimated yield and capital cost. The capital contribution will entitle the buyers to a share of the yield, which they would then on-sell to water retailers or final users. For the purposes of preventing 'market domination' the government should limit the share of total capacity any single investor could acquire. But otherwise we see nothing wrong with private sector investment in water storages. Attracting private sector capital would ease the pressure on government capital raisings and lessen the scope for political interference in the setting of water charges. Such reforms would not preclude the continued provision of low cost water to the community's poor and under-privileged – as explained in the box following.

Balancing economic reform and social justice: If water is to meet all the future demands it faces in Orissa it will have to be treated as an 'economic good'. This means water will have to be surrounded by the same 'instruments' as other marketed goods including definitions of quantity and quality, unit pricing, ownership and conditions of trade, etc – as explained throughout this paper. However, history and popular expectations demand that water be made universally available to all people – regardless of their capacity to pay. It is possible to have both. In practice it will be possible to develop policy that makes a distinction between commercial water and 'welfare' water. The latter would certainly include drinking water and might include subsistence irrigation in poor areas. The cost of providing free drinking water in public places should not pose any administrative challenges – charges could be absorbed through either the supplier's or municipal budgets. The situation is more complex where irrigation water is provided via the commercial network. How could DoWR, for example, administer 'social justice' among water users based on capacity to pay? It is recommended that 'water welfare' be administered by a specialist welfare agency. This agency would determine the eligibility of groups and individuals for 'welfare water' and would have a budget for paying rebates and allowances to achieve the objectives of the policy. This would allow water retailers to recoup charges for services rendered (a commercial imperative) while ensuring that the poor and under-privileged still have their basic water needs met.

3.1 Introduction

This discussion paper is focused on devising economic solutions to the problems currently confronting Orissa's water sector. Among the problems that will be analysed are the following:

- Persistent failure of water sector revenue to match its expenditure
- Inclusion of on-farm Operation and Maintenance activities among the state's responsibilities to water users
- Absence of a legally binding system of allocating access to water among competing uses and users and charging according to capacity to pay
- Insufficient economic incentives to lift water use efficiency
- No mechanisms for recovering the capital costs associated with creating new water.

Supplying bulk water to irrigation, households and industry has traditionally been a government responsibility. This remains the case in most jurisdictions but a growing sense of urgency now surrounds the need to:

- Make the water sector physically and financially sustainable through greater self-reliance;
- Recognise the limits to water supplies;
- Allocate water to maximise water use efficiency after meeting basic social imperatives; and
- Recover water supply costs directly from users.

Before going into the detail of the economic and accounting principles that agencies responsible for water supply should employ to properly balance the cost and income associated with delivering water to customers, it will be useful to make a few points about the history and literature relevant to water issues.

- a) The major reference for this discussion paper is *Assessment of Orissa Water Resources Institutions and Orissa Integrated Irrigated Agriculture and water Management Project Framework* (September 2007). Chapter 5 titled 'Sustainable Operation and Maintenance Financing' is most relevant and was used for the purpose of identifying problems and issues that need to be addressed. The relevant problems and reference relationships are as follows: budget deficits (paragraphs 322, 328); method of applying charges to encourage efficiency (paragraph 324); inclusion of on farm works in overall O&M (paragraphs 331, 337); recovery of capital costs (paragraph 322); challenge by heavy industries to water charges (paragraph 336).
- b) India's Finance Commission produces an annual assessment of 'revenue and expenditure' for major, medium and minor irrigation works in every state of the Union. The 12th and 13th assessments provide maintenance expenditure figures for each five year period 2005 to 2010 and size of works. Grant-in-aid assessments for the water sector in each state are also provided. All the data are expressed in aggregate terms with no reference to unit costs – such as per hectare or per farm. The Finance Commission involvement in the water sector is clearly entrenched and relevant to reform processes that seek to reduce dependence on centralised controls and devolve financial responsibility to a local level. It is possible that the direct financial involvement of the Union in irrigation schemes is acting to reduce the incentive for the states to institute reform measures.
- c) The literature relevant to water reforms in India is extensive but focused very much on the nation's more progressive states such as Andhra Pradesh and Maharashtra. The aspirations and reforms sought by these states provide a clear indication of the pathway that Orissa should be taking. Several of the more pertinent messages coming out of the literature are noted below.
- d) The literature is critical of low water charges and poor collection rates, saying this situation contributes to: a) failure of the sector to balance expenditure and income; b) poor water use efficiency (or productivity); and c) lack of an economic incentive to save water.
- e) The literature emphasised that transferring irrigation project management to autonomous organisations creates a financial incentive for improving irrigation services. Also farmers are more likely to pay fees if they are involved in the decision making processes surrounding the operation of their particular command area.
- f) Unfortunately, the literature is relatively silent on two critical problems: a) exactly why water charges have not been increased for the purpose of allowing receipts to keep pace with expenditure; and b) how water access rights can be established and distributed among the various categories of water users. Both these problems are 'politically sensitive', implying a need to formulate prescriptive solutions.

The water reforms that are recommended in this paper for Orissa have already been partially implemented in several Indian states. This situation serves to validate the reforms proposed for Orissa and lends a note of urgency – especially in light of new industries establishing in the state and placing additional demands on water supplies.

In most developed countries, traditional water users have their access to water protected by an entitlement or licensing system. This system gives established users a degree of certainty about their access to water and allows them to be compensated if allocations from existing storages need to be re-allocated to higher value uses or the government wants to claw back water for a particular reason (such as environmental flow). The capital value of water licenses or entitlements should reflect the productivity of the water in its current use. This value will also reflect the holder's capacity to pay for the water they use and can (therefore) serve as a basis for differential charge rates.

Water licenses or entitlements can be held by corporate entities on behalf of individuals. Thus a town council could hold a water entitlement on behalf of all its ratepayers/households. This arrangement might allow the council to act as the water retailer or it could sell its entitlement and charging rights to a specialised water retailer.

3.2 Problems with pricing and allocation of water

This section is devoted to identifying and analysing the problems currently besetting the Orissa water sector. Section 3 is devoted to providing solutions and action plans.

3.2.1 Chronic budget deficits

Orissa's State Finance Accounts reported that the ratio of O&M expenditure to receipts on Irrigation and Drainage activities over the period 2000-05 was 3.7 to 1³⁷. This situation is symptomatic of an unsustainable water sector with implications for the larger economy and society. While the deficits will impact firstly on such things as service standards and water use efficiency, it is likely there will be more fundamental and long-lasting problems if solutions are not quickly devised and implemented.

The failure of receipts to keep pace with expenditure can be traced in the first instance to a disconnect between how the respective prices are discovered and applied. DoWR's own operating and maintenance costs (dominated by wages) are derived more-or-less by market forces and are largely beyond its control. But water prices are set by the institutions that want to recover costs; unless the institutions have very good systems in place it is unlikely that their costs of supplying water and the receipts they take from sales will ever coincide. To assist our understanding of the situation it will be useful to look more closely at the water costs that have to be recovered and the methods currently being used to set charges.

The cost of providing regulated water can be dissected into capital (to put in place the storage and delivery infrastructure) and operating and maintenance (O&M) to meet all the recurring costs of keeping the system functional. Hitherto the state has been prepared to suffer the capital costs of supplying water. Thus DoWR has generally not sought a capital contribution or a return on capital from the existing storage and distribution systems. This situation is likely to change with respect to future storages (needed to create 'new' water); the issues associated with this change are discussed in a later section. According to State Water Policy, however, current water users in Orissa should meet all the O&M costs³⁸ of being provided with water products. There are several reasons why the receipts are failing to keep pace with O&M expenditure.

3.2.2 Failure to adjust water prices quickly enough

The rates applying to irrigation water were raised in 1981, 1998 and 2002. This means that the charges imposed on khariff and rabi water have been increased only twice over the past 29 years. From 1981 to 2010, the price charged for class 1 irrigation water (the khariff rate) rose twice by an average of about 7.2 Rs/ha/year. This might seem a commendable effort but considering the prices were last raised in 2001-02, it is reasonable to conclude that the revenue curve is now tracking well below the cost curve (see ADB TA-4815-IND table 4.1). This history, by itself, suggests the absence of a systematic and timely approach to price setting.

The wet season or khariff charge applied in Orissa is determined relative to the size of the project servicing the particular command area e.g., class 1 projects deliver 28³⁹ inches of water and cost farmers 250 Rs/ha/year whereas class 2 projects deliver 23 inches of water and cost farmers 188 Rs/ha/year, etc. These rates were set in 2002-03 and have not changed since that time.

Within a particular command area, farmers incur a charge for dry or rabi season water depending on the crop grown (e.g., the cost of irrigation water for Dalua has been set at 450 Rs/ha since 2002-03).

³⁷ ADB TA-4815-IND *Public Expenditure Review* p25.

³⁸ Definitions of O&M costs vary between jurisdictions. Some will define O&M as simply the cash costs of keeping existing storages and channels operational. Elsewhere O&M might be taken to include depreciations and externalities.

³⁹ For further details of existing charges refer to the Orissa Water Act and annual reports issued by DoWR.

For the purpose of imposing charges, an annual survey has to be undertaken (jointly by DoWR and the Revenue Department) that identifies the crop type and area for each farm. Actual charge rates (Rs/ha) vary substantially between crops, presumably to reflect the rates applied to crops historically in order to achieve their yield and price potential. As for the khariff charges, the rabi charges were last set in 2002-03 meaning that they are unlikely to cover the costs of O&M, even when the collection process is 100% efficient.

To maximise the effectiveness of price as a tool of economic management, it should be possible for payees and customers to understand every aspect of water prices as follows:

- What unit of measurement does the water price apply to (e.g. Rs per unit of water consumed over the past six months)
- Why is it imposed (in Orissa a charge is applied to recover the O&M cost of distributing water to customers)
- How do charges vary by sector (farmers who use water for irrigation are likely to pay a much lower rate than urban or industrial users – this is likely to reflect differences in capacity to pay)
- How does the price of water compare to other inputs (for farmers water is a factor of production just like fertiliser, seed, weed and pest control, harvesting, storage)
- How is the price derived (usually by cost accounting processes designed to recover a quantum amount – this task will fall to the new Water Regulatory Authority)?

3.2.3 O&M role too long and complex

In Orissa, the O&M costs of irrigation water extend all the way from the headworks (that store the water) to inside command areas where the water is introduced to individual farms. Charges are currently applied to irrigation water for the purpose of recovering the O&M costs applicable to Irrigation and Drainage. These O&M charges (in Rs/ha) comprise two parts: a khariff charge related to the class of project the farmer occupies; and a rabi charge related to the crop-type grown. The same khariff and rabi rates apply throughout Orissa and have not been revised since 2001-02. The Revenue Department is responsible for collection of the O&M charges owed by farmers. While the Revenue Department collects a high proportion of the charges actually billed, the method by which charges are applied is flawed as the department has “... no clear information on how much area was actually irrigated”. On these grounds ADB TA-4815-IND (p 10) concluded that there exists an urgent need for water charges to be collected directly by the Pani Panchayats and that appropriate provision should (therefore) be made in the Pani Panchayats Act, 2003. Indeed the Act already allows Water User Associations to collect water charges giving them the potential to take direct responsibility for all O&M activities within their command areas. In addition, the National Water Policy (2002) guidelines ask for a “participatory approach to water resources management involving Pani Panchayats and local bodies in O&M and management of water infrastructure and facilities, with a view to management transfer”.

Most importantly, the current arrangements stop farmers from assuming responsibility for the operation and maintenance of their own command areas. Given that every command area will be somewhat different, it is only logical that each should be managed as a separate entity by a local management committee. Such an approach would avoid the complexities of trying to devise a state-wide ‘charges collection system’ that should be applied equitably and effectively to all Pani Panchayats.

Currently there are numerous inconsistencies in how the prices attached to irrigation water are expressed. Water units to which prices apply include gallons, cubic feet, litres, depth of water in inches, crop type and possibly others. For the khariff season, farmers pay a fixed charge per hectare or acre depending on the project area they fall into (class 1, 2, 3 or 4 corresponding to 28, 23, 18 and 9 inches of water and prices of 250 Rs/ha, 188 Rs/ha, 125 Rs/ha and 63 Rs/ha respectively). It is unlikely that all class 1, 2, 3 and 4 projects throughout the state are equally productivity and therefore due to pay the same rate. This problem could be addressed by devolving responsibility for collecting

charges to the local level where it would be possible to determine actual costs and arrive at a close match between costs and charges. Communications and accounting would be greatly assisted by moving entirely to a common unit of measurement.

While water charges in Orissa are regulated and made public, it is not yet apparent how they are actually arrived at. The allocation of irrigation water, for example, is based on area and crop. While the area is fixed (in hectares) the return from the crop's nominal yield (in rupees) and the crop's water use efficiency (in kg yield / unit of applied water) are not fixed. Thus a critical aspect of water sector reform should be transparency. Water users should understand both the logic and application of allocation and pricing. Volumetric measurement, for example, would obviate the need to consider crop type when charging for water. It is expected that the **Water Regulatory Authority** will use explicit guidelines and economic and cost accounting principles for the purpose of arriving at a conjunction between total expenditure and total receipts.

3.2.4 Clarify roles and responsibilities

O&M responsibilities associated with supplying water currently extend from the storage headworks to inside irrigation command areas. Extending the government's O&M responsibilities beyond the customers' take-off point (i.e., where water enters command areas in the case of irrigation) is seen as a serious problem for the efficiency and sustainability of the whole water sector. Fortunately this problem is recognised by State Policy and it is certain that responsibilities will be transferred to WUAs as their administrative capacity is strengthened.

The DoWR is the principal provider of water products in Orissa. In this capacity, it acts as a direct-provider of water in the case of farmers, large-scale industry and mining (with costs recovered only from industry and mining). In the case of households the DoWR acts as a wholesaler, charging intermediaries on a volumetric basis. For towns and cities, DoWR effectively wholesales water to the Department of Public Health and this department retails to individual urban households. In the case of rural villages, DoWR wholesales water to the Department of Rural Water Supply and Sanitation, which then retails it to individual rural householders.

Given that irrigation accounts for up to 90% of total consumptive water from some storages, the share of overhead costs that can be appropriated from urban and industrial water users is relatively minor. This reality suggests a need for institutional changes that separate water storage, distribution and wholesaling from retailing responsibilities.

Industry and mining are significant potential customers for new water abstractions in Orissa but already there have been difficulties with respect to access rights and imposing tariffs. Several industrialists have challenged the rights of the state to govern their access to water and impose charges⁴⁰. Since the state's ownership of all water is prescribed in the national constitution, the manufacturer's legal challenge can be negated but the issue highlights the need for formal water entitlements that specify a link between capacity to pay and charge rates.

Integral to acceptable and sustainable water supplies is the notion of access certainty. Without a common understanding of how water is, or will be, allocated among users throughout the State and through time, there will be problems with recovering water charges and transferring access rights between sectors and customers. The rapid industrialisation of Orissa is acting to compound the problem of giving new water users access to supplies without compromising the expectations of traditional users. Clearly mutually satisfactory mechanisms are needed for allowing access rights to be transferred between parties.

Currently in Orissa, water is allocated by DoWR on a 'planned' but year-to-year basis. Fortunately, total water supplies are still large enough to allow an informal, *ad hoc* approach to meeting all demands. We suspect that as demand grows shortages will become more apparent, especially late in the dry season, and it will be desirable to take a more formal approach to assigning access rights.

⁴⁰ See paragraph 336, OIIAWMP Institutional Study

3.2.5 Recovering the capital cost of creating new water

The prevailing financial issue for the water sector is recovery of operating and maintenance costs. Certainly recovery of O&M is the main focus of this discussion paper and will be the main challenge that faces the **Water Regulatory Authority** when it commences operations. Government policy, however, requires that the water sector become 'physically and financially sustainable' by (also) recovering some part of the capital cost of supplying regulated water to users. Our problem, therefore, is to prescribe the circumstances under which water users might contribute to the capital cost of water products.

In our view, it will **not** be possible to extract a capital contribution for existing storages that are already fully allocated. For these storages, the water 'rights' are already assigned (whether or not they were purchased) and attempting to impose a capital charge retrospectively would be viewed by users as unfair. Only where an existing storage has unallocated yield or a completely new storage is built (that will add to effective yield) will it be possible to seek a capital contribution from users.

3.3 Environmental flow

Environmental flow is meant to preserve various values that can be associated with the natural environment in, and adjacent to, rivers and streams. To this end the Orissa State Water Policy (2007) assigns a second-tier priority to preservation of ecological values. But as human endeavour is an integral part of the environment there should be no suggestion that 'working' rivers can be returned to, or kept in, their original condition. This point notwithstanding, integrated water resource management (implemented by the appropriate agency) has an obvious role to play in recognition and administration of environmental flows. Thus identification and specification of the natural values could be administered by DoWR working with local stakeholder groups, who will be most affected by the implied trade-off between consumption and abstinence – needed to protect the natural values identified. The rainfall pattern in Orissa is monsoonal meaning that competition for water is most intense in March, April and May. However, the severity of this period has been tempered by the construction of large storages that allow flow (albeit unnatural) to be maintained in the river. While most of this flow might be intended for extraction, some might be retained in the 'system' for ecological purposes – as specified in the various river basin plans. Formal recognition of environmental flow will require it to be granted an entitlement in much the same way as a commercial user.

A synergy has already been developed between generation of hydro electricity and preservation of environmental flow. Thus water is held in storage during the months of January, February and March so that supplies can be released in April and May that generates electricity and simultaneously allows water to flow down the river to fulfil such needs as aquifer recharge, maintenance of fisheries and preservation of mangrove swamps. In the absence of a scientific approach to the 'identification and specification of natural values' mentioned above, a provisional 'environmental flow' should be assigned in every river basin plan. This convention will act to preserve a notional proportion of the total supply for the environment that can be adjusted as knowledge of the river ecology and the preferences of stakeholders are refined via successive water plans.

3.4 Pressures on available water

3.4.1 Supply of water

Over the long term (that might be used for planning purposes) the quantity of water available to Orissa's natural environment and its population is essentially fixed, being a function of average rainfall (with associated run-off and capture events) and groundwater recharge. The ability to consume natural water is enhanced by physically regulating it, using storages and distribution networks. While water storages (such as dams and weirs) typically have a long life, allowing construction costs to be recovered over many years, all storage and distribution systems have operational and upkeep costs that should be recovered on an annual basis from customers.

As river basins become more developed and exploited, the scope for building effective additional storage diminishes. Along the pathway to 'full-development' it is possible to create 'new' water. So-

called new water can be created by: a) constructing more storage, b) recycling used water, c) by importing it from the sea (after desalinating it) or d) tapping into an adjoining catchment⁴¹. Ultimately, however, manipulation of water supplies can only bring about marginal gains, making it necessary to place ever-more reliance on demand-side adjustments that act on consumption patterns. Fortunately, considerable scope exists to modify demand by introducing water use efficiency measures, raising water charges and imposing restrictions, etc. Thus once the limits to supply become apparent, effective outcomes will be dominated by demand-side adjustments aimed at ensuring water users have their needs met with minimal social and economic dislocation. The key to such a positive outcome, however, is pre-emptive planning and decisive actions using the various instruments of Integrated Water Resources Management.

Thus water user groups should be educated about the real costs associated with delivering to them specified water products and the imperative of shouldering an appropriate share of the cost burden. Integral to selling the message is demonstration of the link between 'paying a fair price' and getting 'a fair share of the available yield'. In practice, 'fair prices' can take into account the capacity of the user to pay. Thus industry might be expected to pay higher rates for water than (say) agriculture if it has a higher capacity to pay. Such an arrangement would imply a degree of cross-subsidisation (between users) but would assist with achieving balance between total costs and total expenditure. If Orissa wishes to structure charges according to 'capacity to pay' this should be stated in its policy and made clear in any licensing arrangements applying between water suppliers and users.

Water users should also be educated about the 'system yield' that is available for consumption. They should understand that the volume of water available in a given year is related to the total amount of water in storage (after taking into account predicted inflows) the volume that must be retained (for instance, as a carry-over reserve) the provision for environmental flows and other in-stream uses (such as navigation). These data are incorporated in the annual water plan for estimating the quantity of water available for sharing among recognised users within the geographic area served by the particular storage.

3.4.2 Demand for water

Within a defined area (such as the state of Orissa) the demand for water derives in the first instance from consumptive and non-consumptive uses. Non-consumptive water is retained in the riverine system to satisfy such extra-market demands as cultural and environmental amenity, navigation, aquaculture and various public uses associated with water bodies. While environmental flows tend to be unpriced (making it hard to assign them an economic value) they can be 'represented' in practice by the revealed preferences of the community.

Water supplies in excess of the total non-consumptive allowance can be extracted and allocated among domestic, agricultural and industrial users according to market and policy dictates. Leaving aside the natural environment, Orissa's demand for consumptive water is fundamentally related to aspects of its population – including its size, consumption habits, employment category, wealth distribution, stage of development, etc. In the case of Orissa, with an expanding population and industrialisation, the demand for water is likely to increase going forward. As noted above, changes in demand for water will be met by a complex array of adjustments.

There are many categories of users who value and purchase water according to how they assess its utility. Irrigated agriculture is currently the largest user of consumptive water but has a relatively low capacity to pay (per unit of water) compared to domestic and industrial users⁴². Even within

⁴¹ These days, transferring water between catchments or basins is considered 'bad practice' due to the possibility of negative implications for the ecology of both the 'giving' and 'taking' catchments. It is unlikely, moreover, that the people living in the catchment from which water was taken will ever let the matter rest.

⁴² Agriculture has a relatively low capacity to pay at this time because the Marginal Value Product (from irrigation) is low compared to the MVP from water used by industry. The relatively low MPV of irrigation water is exacerbated by high transmission losses between the storage dam and place of application. From an economic perspective, it is possible to view agriculture as the 'residual' water user – meaning it gets access to the quantum left over by higher-order users – who can afford to pay more. Households have a high capacity to pay for water because their gross needs are low compared to household income.

agriculture there are considerable differences between regions, farmers and crops in capacity to pay for water, suggesting a need to send farmers clear price signals. Adjustments likely to emerge as demand for water becomes more apparent include gains in water use efficiency and a tendency for water to migrate out of agriculture and into higher order uses. The introduction of entitlements that link individuals or groups to access rights and recognises their capacity to pay should make future transfers of water between sectors relatively orderly and fair.

3.4.3 Critical qualities of water

The utility of water is directly proportional to its quality and accessibility. Supplementary water, regardless of user sector, is made accessible by the processes of capture, storage and distribution. The efficiency and effectiveness of accessibility can be expressed in term of cost per unit of volume and timeliness of actual delivery. Water quality, on the other hand, applies to the suitability of ambient water for particular uses. In Orissa, water has multiple uses including human and livestock consumption, industry, heating and cooling, irrigation of crops, recreation and tourism, spiritual renewal and bathing. While drinking water can be treated to make it safe for human consumption, this is costly and technically demanding.

Unfortunately there is still a high incidence of water pollution in Orissa, which often imposes additional costs and risks on water users. The water pollution control act (1974) is meant to 'make the polluter pay' and thereby minimise the externalities associated with water pollution. The evidence suggests there are still significant deficiencies in the current approach to water pollution in Orissa. We suspect there could be a role for the **Water Regulatory Authority** in recommending various punitive measures that courts and regulators could apply to polluters. Two obvious measures are licensing of potential polluters and issuance of fines in the event of non-compliance with defined standards.

Thus a factory's license to operate might refer to water pollution in the following terms:

- Accreditation of the factory based on training undertaken by senior staff. The training would be delivered by a professional agency and the staff would have to pass an examination dealing with key aspects of water pollution and compliance with published standards.
- Employment of a trained Environmental Officer(s) who would monitor water quality (and other aspects of the environment) and submit routine reports to a central, independent monitoring agency.
- The conditions under which the factory's license to operate might be suspended or withdrawn. The conditions would refer to specific aspects of water pollution tied to discharge⁴³ monitoring and compliance standards.
- Employee training and awareness campaigns designed to make all staff conscious of responsibilities to the natural environment and the consequences of not meeting compliance standards.

Fines will only be effective if they are genuinely punitive and regulators and the courts combine to bring about more prosecutions. Public awareness campaigns should make people more conscientious about their personal responsibilities to the natural environment while garnering political support for a tough stance by law makers. If successful, these measures will reduce the costs and risks of using water.

From an economic perspective, water can be substantially differentiated in terms of its location and suitability for particular uses and applications. Water exchanges throughout the world are mostly operated by government instrumentalities, vested with near-monopoly powers. The issue, therefore, is how to make or assist government agencies (that control water distribution in Orissa) to operate efficiently as required by both national and state water policies.

⁴³ Factory discharge that might violate pollution standards can stem from turbidity, nutrient enrichment, chemical contamination, salinisation of surface or groundwater and contamination by pathogens or other biological sources.

3.5 Solutions to water sector problems

Given that 'useful water' is vital, scarce and costly, a range of mechanisms are needed to ensure 'good outcomes' in terms of:

- Creation of cost effective supply capacity,
- Equitable and efficient distribution among competing uses through time,
- Efficient and effective transfer of water from storage to distribution agencies and from distribution agencies to final users/consumers,
- Transparent pricing for the purpose of recovering costs and signalling to users the inherent value of water (a task to be performed by the Water Regulatory Authority),
- Effective servicing and cost recovery by agencies (such as water user associations),
- Integrated planning and administration that maintains system efficiency and sustainability,
- Responsible and sustainable consumption patterns, and
- Accommodation of likely future trends.

Below we address each of the problems identified in section 2. Consistent with the principles of IWRM, a range of institutional and economic tools are introduced to assist the adjustment processes and maintain an acceptable balance between water supply and demand through time.

3.5.1 Institutional reform

Effective price setting

Making most Irrigation and Drainage O&M costs the responsibility of farmers will allow DoWR to focus on recovering costs from the other sectors – primarily water supply and sanitation for urban and industry customers. To assist with this task, the 13th Finance Commission has recommended the setting up of a Water Regulatory Authority (in each state) with the following functions:

- 1) To fix and regulate the water tariff system and charges for surface and sub-surface water used for domestic agriculture, industrial and other purposes
- 2) To determine and regulate the distribution of entitlement for various categories of uses as well as within each category of use
- 3) To periodically review and monitor the water sector cost and revenues.

The establishment of a Water Regulatory Authority in Orissa with the functions as specified above is fully supported as it follows the practice found in many countries of placing an independent, permanent and expert authority in charge of setting the prices and trading rules to be applied by government owned monopolies. Making a standing authority responsible for reviewing and fixing water prices is seen as a critical step toward creation of a more sustainable water sector.

In addition to outlining the functions of the Water Regulatory Authorities, the Finance Commission will make available financial incentives to encourage the states to comply. If a state recovers at least 50% of the water charges mandated by its Authority, it will become eligible to receive grant money. To participate, the states will have to set up their Water Regulatory Authority by March 2012.

In the process of being established, the Water Regulatory Authority will have to make clear its policies, aims, responsibilities and limitations. Thus government policy with respect to cost sharing between sectors and distribution of water entitlements will have to be clearly specified – to prevent the Authority having to get enmeshed in issues that lie beyond its brief. In addition, the Authority will need unqualified access to the cost accounting information that supports DoWR service delivery.

To maximise the chances of success, the Authority's work should be complemented by at least two additional reforms, as outlined below.

Simplify the O&M task

Farmers in the Pani Panchayats should be given full responsibility for constructing and maintaining the water distribution network within their own command area. Confronted with responsibility for their own destiny, the farmers could be expected to act quickly and decisively to improve the efficiency and effectiveness of their schemes. This should make it relatively easy to collect O&M charges from amongst their own ranks. The case supporting O&M collection by Pani Panchayats can be summarised thus:

Demarcation of responsibilities. As the farmers own the land that is benefited by the irrigation water it is only logical that they should meet all costs associated with utilising irrigation water⁴⁴. The government owns the infrastructure that regulates the water supply but its responsibilities should stop at the point where the water enters the Pani Panchayat command area.

Remove an area of concern. Under the current arrangements there are significant conceptual and political barriers to applying charges to farmers that recover an acceptable proportion of O&M costs. Making the WUAs directly responsible for O&M costs within command areas would remove a large obstacle to the government's overall goal of recovering all O&M costs from users.

To assist with implementation of these changes, the following assistance should be provided:

- *Institutional commitment:* Little will happen without the wholehearted commitment of DoWR and associated agencies and institutions. The necessary commitment should be secured via a declared belief, by the institutions, in the proposed changes and reform. This declaration would be followed by shared ownership of the processes that will bring about change.
- *Knowledge of farmer preferences and skill base:* A cross-section of farmers should be surveyed to ascertain their attitude towards assuming ownership of the O&M function. The same survey should assess the capacity of each particular Pani Panchayat to finance and manage their water distribution system. Also, the survey team should build a database of all the Pani Panchayats in Orissa, with details in terms of location, number of farms/owners, O&M status, crops grown (wet season and dry season) and the prevailing condition of the irrigation infrastructure.
- *Establish legal status, ownership and capabilities:* Pani Panchayats wanting to progress to self-reliance should be properly advised on the corporate structure they should adopt to meet their accounting and reporting responsibilities. Provision already exists in the Pani Panchayat Act to elect a Board comprising farmers from within their command area. All member farmers would be deemed shareholders. Consideration should be given to appointing to each Pani Panchayat Board at least one external director with business expertise.
- *Resourcing and training:* It will not be possible for Pani Panchayats to take over administration of their irrigation schemes without critical resourcing and training. Ultimately, they will need to employ personnel with skills in cost accounting, economics and basic earthworks – for effective water reticulation. The administrative staff will need to have good 'office' skills. Larger Pani Panchayats will be able to employ a fulltime superintendant and a deputy who will monitor water inflows and its distribution and invoice recipients accordingly. These personnel will also supervise the earth works needed to make the irrigation scheme effective and efficient. Smaller Pani Panchayats will reduce the overhead cost of employing professional staff by sharing. Consistent with the above, Pani Panchayats should be assisted to develop spreadsheets that identify and quantify all their costs. The spreadsheet should identify every cost category that moves independently through time. Charges will be computed to recover the costs according to a prescribed timetable. Theoretically, charges for any given year should move in concert with expected total costs and expected total yield. Applying flat unit charges (Rs/unit of water) to all members of the group is recommended as some cost averaging will be more harmonious than trying to charge according to location within the scheme.

⁴⁴ Tenant and share farmers do not own the land that they work. In this case equitable arrangement will be entered into for the purpose of sharing the cost of capital works needed for water distribution and drainage.

- *Alerting stakeholders about impending changes:* It is vital that farmers, and Pani Panchayat members in particular, are made aware of the opportunities and expectations being offered to them. Initially the extension effort should be focused on those groups with the greatest natural advantages and best human resources. These Pani Panchayats will take up the challenge quickest and set an example to other groups. It is expected that Pani Panchayats will get assistance from NGOs keen to support rural India.
- *Management issues:* Pani Panchayat leaders might come under pressure from particular members to make their water allocation more reliable, hold down charges and increase spending on their distribution headworks. Consistent with the Pani Panchayat Act, every Pani Panchayat business should have in place a constitution and governance principles that keep everyone focused on the corporate goals. Thus all activities will be undertaken according to the dictates of a corporate strategy, including the delivery of various social imperatives that might find their way into the Pani Panchayats' strategy via political influences and processes. This and all the other actions specified above should be progressed without delay.
- *Grant entitlements based on historical allocation:* Once the above reforms are reasonably progressed, consideration should be given to granting Pani Panchayats volumetric entitlements equal to the long-term average annual allocation. This will give each Pani Panchayats a basis for planning its long-term future. The Board of each Pani Panchayats should have discretion over allocation of the water among its members.

Rationalise roles and responsibilities

If DoWR were to become a provider of bulk water supplies to WUAs, there would be a buffer between government and individual farmers. This would allow both parties to become more commercially orientated and more focused on core business.

Making the government's water supply and O&M responsibilities end at the customer's take-off point will absolve government agencies from the need and responsibility to collect O&M charges associated with earthworks within command areas. Relieved of responsibility for distribution of water within command areas, DoWR would be free to focus on its core business of providing and selling bulk water. This business would be underpinned by professional water planning and efficient operation of the water storage and distribution network.

DoWR is already a seller of bulk water to urban users but this position (in the supply chain) should be extended to all customers. In the case of irrigation water, the intermediary would become the local WUA. Some WUAs have already been established in rural Orissa but to date very few of them have become incorporated businesses with the skills and resources needed to run their own command area. Thus a transitional period will be required for the purposes of training and resourcing WUAs to assume full responsibility for O&M within their area.

3.5.2 Assignment of access rights

The access system advocated for adoption in Orissa should be implemented progressively. Initially, the user's access should be controlled by the issuing of simple licenses (indicating purpose, entity, water source and delivery point, nominal allocation based on volume or area, restrictions and basis for any charges). License holders would receive water allocations related to the license itself and the availability of water as indicated by the DoWR's water balance modelling. Once the license system is proven it can be upgraded for the purpose of giving water users greater certainty and transfer rights. At this point the access rights would be known as entitlements. For the purpose of rationalising the administration of entitlements, they might be held by corporates or entities (such as WUAs) on behalf of a large number of individual water users. Below we provide details on the need for entitlements and how they could be introduced to Orissa.

As water consumption can be related to population, the demand for water throughout India is expected to rise in the years ahead. If India's population continues to grow, the following is likely to happen:

- The volume of fresh water available per person will gradually fall and this will force the country to make adjustments. The adjustment process will manifest itself in changing patterns of distribution and consumption;
- Various forms of demand and supply management will be invoked so that there is no 'gap' between actual demand and supply; and
- Price and other economic instruments will play a large part in rationing supplies among water users. This will allow water to move to higher and better uses while compensating those users who lose their access rights in the process.

To bring about such a positive outcome, mechanisms will be needed for sharing scarce water resources among competing interests. The term 'water entitlement' refers to a legal right to *access* a certain volume or share of water under pre-determined conditions. It does *not* infer that a holder of an entitlement will get 100% of that water every year. Water entitlement systems exist in Maharashtra, Uttar Pradesh and Arunachal Pradesh.

These systems exist to facilitate "...judicious, equitable and sustainable management, allocation and utilisation of water resources (and) fix the rates of use of water for agriculture, industrial, drinking and other purposes". The Maharashtra Water Resources Regulation Act, 2005 also introduced trading in entitlements. This provision allows entitlements to be "...transferred, bartered, bought or sold on an annual or seasonal basis within a market system." It should be appreciated that an entitlement does not infer absolute ownership – it merely specifies the rights and conditions under which a particular user will 'hold' the right to access water.

The Orissa Irrigation Act specifies that land within a command area is entitled to receive irrigation water. This means that the entitlement to water is attached to the land i.e., the two factors of production are bundled. But transferable entitlements allow the water to move to other land or other uses. Under such circumstances the result might be better use of the water when measured in terms of monetary returns per unit of applied water⁴⁵.

It is recommended that water entitlements are introduced and made transferable within defined supply regions, when appropriate. The 'defined region' might be a river basin, a smaller area serviced by a weir or check-dam, or an area under the management of a WUA. Transparent specification of the 'qualities' embedded in entitlements would serve to protect the economic interests of existing water users when, through time, new demands are placed on limited supplies.

It will be appreciated that while supplementary water supplies are abundant, there is little need for formal entitlements. But when there is overt competition among water users, entitlements are needed to specify the rights of established users and to make it possible for new users to gain access to supplies. A failure to pre-empt scarcity with the introduction of entitlements (or some similar mechanism) will leave everyone assuming that they can continue to access water as they have always done in the past⁴⁶. When and where this is no longer possible, there is likely to be discontent and social unrest.

While an entitlement specifies the terms and conditions applying to permanent water access, an **allocation specifies the volume or units of water that will be made available to a particular user in the upcoming season or year**. Thus annual allocations are one facet of a formal entitlement system. Allocations can vary between years depending on the assessed available supply from the system and decisions taken by DoWR regarding priorities. Apart from supply variability, the introduction of entitlements will lead to greater certainty about how and when water is allocated

⁴⁵ The state should not want to limit its economic growth potential by locking factors of production (including water) into low value uses. On the other hand, it will want to guard against developments that are not sustainable and generate externalities that offend the adjoining community. The state will also want to preserve harmony between different sectors regardless of their capacity to generate wealth.

⁴⁶ Problems of this nature are already emerging. It is understood some new industries have taken water from rivers and streams as if this was their natural right. While all water rights are vested with the state in the first instance, the new entrants should be provided with guidelines as to how they can get access to reliable water. This could be made possible through the sale or granting of entitlements.

among different user groups. The introduction of entitlements would protect users from having their access rights withdrawn or given to someone else without any consultation or compensation. All details surrounding the respective rights and obligations of the supplier and users would have to be specified in legislation.

In the case of new schemes, there might be a 'problem' of deciding how entitlements should be distributed among farmers within command areas. Where demand (for entitlements) exceeds supply, some form of rationing will be necessary. Scarcity pricing is one method that could be used for distributing water rights and allocations among interested parties. The money raised by selling rights could be used to offset the capital cost of constructing the storage or distribution system.

Below we outline four methods for rationing water access rights among potential users. These methods have been applied in other countries but it is not being suggested that these examples should or could be used in Orissa. The methods are explained to give insights into how scarce water resources can be distributed to heighten the chances of it being used effectively and efficiently.

- 1) **Limit the size of the command area:** Regardless of engineering considerations, the command area would be limited to the hectares that can be reliably supplied with irrigation water in the dry season. Then all farms falling within the 'reliable command area' would be either sold an entitlement (with legal rights) or gifted an entitlement. This method of distribution recognises that water supplies will ultimately be limiting.
- 2) **Auction of fixed supply:** With the total safe yield and corresponding number of entitlements determined, the distribution among interested farmers could be 'decided' by an auction (resulting in a capital payment for the permanent right to so-many ML/year)⁴⁷. As this approach could result in some fragmentation of the command area, it would be necessary to place limits on the 'geographic eligibility' of bidders. Scarcity pricing, implicit in the process of auctioning rights, would see the water distributed to those farmers with the highest capacity to pay.
- 3) **Water for all interested farmers:** Where 'distribution equity' is regarded as the dominant issue, the available yield could be split among all applicants. With this approach, farmers might only get irrigation water every second year and it might not be technically feasible to deliver supplementary water to every applicant's take-off point. Clearly this would result in large opportunity costs and production inefficiencies.
- 4) **Ballot:** A compromise allocation system is balloting whereby farms that meet prescribed minimal standards would go into a ballot or lottery. The result would be distribution of the total expected yield, divided into relatively efficient allocations, to a defined number of farms – drawn at random from among contenders. This system might be most relevant to the re-distribution of small quantities if additional water that becomes available.

If a manufacturer – or any new user – wants water from a supply system that is already fully allocated, they will have to either buy entitlements from existing users or contribute towards the cost of creating new water. The former should be possible in practice but an exchange mechanism (or market) would be needed to allow the exchange to be executed. Clearly the price would have to be satisfactory to both parties. Even where the resource is not fully allocated, large unauthorised extractions should not be permitted.

Finally, entitlements, supported by property rights, provide a basis for water supply authorities or associations to recover fixed costs – which might be a high proportion of their total costs. Having a capacity to recover (some/most) costs independently of annual water sales is particularly important where supplies vary substantially through time due to periodic drought⁴⁸.

⁴⁷ The water supply association (the local PP) could decide whether the payment has to be made up-front or amortised and included with other annual charges.

⁴⁸ The reliability of water between seasons will depend on how 'fully' the long term average yield of the storage system has been allocated. If the yield has been fully allocated amongst users, periodic reductions in system yield – due for example to drought – will be reflected immediately in the volumes that can be allocated in affected years.

Thus all classes of water users subject to cost recovery charges (currently urban and industrial) could face a two-part tariff structured as follows:

- 1) A **fixed charge** that acknowledges access (or entitlement) to reliable water. The size of this charge should be directly proportional to the 'quality' of the entitlement. In the case of Pani Panchayats, it might reflect the cost of keeping the member connected to the distribution network.
- 2) A **variable cost** related to the actual volume of water purchased during the period. The charge rate (Rs/KL) should be the same for all users within a particular common area. Thus costs should be pooled within an area to simplify administration. However rates between areas and category of user are likely to vary depending on actual servicing costs and capacity to pay. Charging differential rates according to capacity to pay is consider 'good public policy' but it should be supported by appropriate legislation to prevent challenges from those users being asked to pay relatively high rates. Cost pooling between areas is not recommended as costs are likely to vary considerably (compared to within areas) and each area will want to operate independently.

3.5.3 Increasing water use efficiency

Low water use efficiency within Pani Panchayats provides the underlying rationale for the reforms advocated in this paper. WUE will be increased via four main innovations: a) consolidation of land ownership; b) earthworks to give each farm its own direct supply channel; c) making Pani Panchayats solely responsible for maintenance of the distribution system that they administer and d) requiring Pani Panchayats to pay the full cost of O&M within their own command area. For most Pani Panchayats, the latter will imply significant increases in the charges applied to water. The Jakhade Committee of 1987 stated that "...the method and level of water rates that capture and convey the scarcity value of the resource can both induce efficiency and ensure full cost recovery"⁴⁹.

Water users in Orissa do not yet have access to formal entitlements, much less access to a market or exchange where they can purchase additional rights. Once the safe yield available within a particular river basin or system becomes fully allocated, it will be desirable to establish an exchange where access rights can be traded on a temporary or permanent basis. Ideally the exchange should function as a 'market place' where the access rights can be bought and sold. Over time, the exchange process would cause water to move to its highest and best use, thus maximising WUE. While no-one would be forced to sell their access rights, market forces would act through time to bring about efficient outcomes. The exchange could be operated by DoWR or some reputable third party.

With an exchange in place, a miner (for example) could indicate that they needed access rights equivalent to 500 ML/year. Subsequently, the exchange could canvass interest from existing entitlement holders in selling. The critical ingredient would be a well informed and transparent market that allows both sellers and buyers to evaluate offer prices in terms of perceptions of value. If the Marginal Value Product of water in the river basin is already high, then the miner would have to pay a relatively high price. But if their returns from water are much higher than from existing users, then an exchange should take place. It would be up to the exchange operator to negotiate a mutually acceptable figure and to complete the transaction with all legal obligations fulfilled. Of course the sellers would be giving up their water access right but in return they would have cash to invest in a new business.

3.5.4 Volumetric trading and pricing

There should be a long-term plan to make all water measurement units volumetric. Charging water users according to the measured volume of water consumed will maximise the clarity of price while simplifying the administration of collection. Following the installation of metres, all water allocations

Supply authorities will enhance the integrity of their systems by avoiding the temptation to 'over-allocate' expected yield. The more drought prone a particular storage catchment, the more conservative should be the allocation policy.

⁴⁹ Cited in "Institutional reform in Indian irrigation" by Ashok Gulati, Ruth Suseela Meinzen-Dick and K V Raju (International Food Policy Research Institute)

should be quoted in megalitres (ML) for agriculture and industry and kilolitres (KL) for domestic. When possible, off-take points should be equipped with meters so that supplies can be invoiced in terms of ML or KL without any particular reference to the user or application. With a common unit of measurement in place, the price will become more transparent and thereby positioned to become more pivotal in water-user decision making.

4.0 Conclusions

The focus of this paper has been on the contribution that micro economic reform can make to Integrated Water Resources Management in the Indian state of Orissa. Our analysis of the relevant issues surrounding water pricing and allocation can be summarised into short statements that can be matched to impending actions and outcomes. Associated actions will form the next stage of the current project. If the actions are performed in-full, the eventual outcome will be a more secure and efficient water future for all the citizens of Orissa.

Priority One: *The State of Orissa should establish its own Water Regulatory Authority for the purpose of making the water sector financially sustainable. It will do this by periodically reviewing and setting the water prices to apply at delivery points according to time, place and user category. To this end it is recommended:*

That Orissa move quickly to establish a Water Regulatory Authority for the purpose of setting wholesale or retail water prices as appropriate. The prices might vary between user category and delivery points but should otherwise be set at levels that first establishes, and then maintains, a balance between public sector total costs and total receipts.

Priority Two: *Farmers should assume responsibility for all irrigation works and funding inside command areas: To this end we recommend:*

That Pani Panchayats (through their Water User Associations) be required to take responsibility for the O&M activities and associated funding applying to the water distribution network within their own command areas. Included in this responsibility would be collection of fees (sufficient to cover O&M costs) from among Association members.

The proportion of total water sector O&M costs that arise inside command areas is significant and difficult to monitor for the purposes of recovery. The solution to the problem of 'command area O&M costs' lies with rapid transfer of responsibility for all on farm irrigation and drainage activities to local Pani Panchayats (as outlined in the body of the paper). For the purpose of expediting the transition we recommend:

That Pani Panchayats be assisted to become effective and competent business entities by: a) incorporation to make them accountable and independent business entities, and b) appropriate training and resourcing of all Pani Panchayat members. Policy agencies should coordinate this work assisted by NGOs.

Priority Three: *DoWR should remove itself from the water retailing responsibilities. Orissa's DoWR currently handles all water 'activities' from building dams to retailing water to farmers. Saleth in her 2005 paper about institutional change said that a paradigm shift is needed from "...water resources development to allocation and management". The tasks of water allocation and management would be better served if DoWR vested water pricing and retailing with other agencies. To this end we recommend:*

That DoWR become Orissa's bulk water supplier. In this role it would sell water to several retailers appointed to service designated end user markets. Orissa could support several water retailers with servicing rights assigned by river basin or some other logical basis. Within the scope of this reform, Pani Panchayat WUAs could serve as water retailers or agents.

Priority Four: *Mechanisms should be introduced that explicitly recognise the prospect of water scarcity. Orissa's expanding population, rapidly rising living standards and growth in industry and mining all*

point to an increase in demand for water in the years ahead. Given that the supply of consumptive water is relatively fixed, if not falling, there exists a demonstrative need to introduce adjustment mechanisms. To this end we recommend:

That Orissa's Water Regulatory Authority be made responsible for introduction of a comprehensive system of water licenses followed in due course by entitlements. Introduction of licenses and entitlements would protect the rights of traditional users while making it possible for new users to gain access to essential supplies. Licenses and entitlements should be used as the basis for differential charge rates, set according to the user's capacity to pay.

Annex 4. Items Reviewed in This Project

4.1 Papers and reports

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4.2 Acts, Resolutions, Policies

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4.3 Websites

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Institutional Strengthening & Project Management [project blogspot] <http://oiiawmip-ism.blogspot.com/?zx=bc3bf0518d1fed99>

Integrated Water Resources Management in Australia
<http://www.environment.gov.au/water/publications/action/case-studies/index.html>

OIIAWMIP project (Externally Aided Projects)
<http://www.dowrorissa.gov.in/EAP/OIIAWMIP/OIIAWMIP.pdf>

RETA 6470 Institutional Strengthening & Project Management [project website:
<http://www.crbom.org/RETA6470/>]

TA-7131 IWRM in Orissa, India [project blogspot] <http://ta7131iwrnOrissa.blogspot.com/>

Water pricing and cost recovery: <http://www.dowrorissa.gov.in/WaterPricing/WaterPricing.pdf>

