2. As-is Assessment of the Water Sector in Andhra Pradesh

2.1. Supply Scenario

The following sections briefly discuss the supply side scenario of the water sector in Andhra Pradesh.

2.1.1. Water Resources in Andhra Pradesh

Andhra Pradesh is a riverine state with 40 major, medium and minor rivers, of which 12 of them are inter-state rivers. AP is blessed with major rivers such as Godavari, Krishna, Vamsadhara, Pennar and Tungabhadra. However, it is the lowest riparian state even for these major rivers. Roughly 6 percent of the land area in the state is occupied by water bodies. In terms of hydrology, the state is divided into the 40 river basins as illustrated in the map (Figure 1).

![Figure 3 - Map based representation of River Basins in AP](image)

The total surface water availability at 75 percent dependability for all river basins is 56.37 BCM (1991 TMC), including flood waters, out of which the major contributors are 24.35 BCM (860 TMC) from Godavari, 15.06 BCM (532 TMC) + 4.26 BCM (150.5 TMC) (flood/surplus water) from Krishna and 2.76 BCM (97.6 TMC) from Pennar; accounting for 82 percent of the total surface water availability. A robust infrastructure and sustainable measures can counter the impacts of unreliable and inequitable rainfall distribution and mitigate the effect of natural calamities such as droughts and floods.
Geological Formations

Out of the 160,204 Sq.kms. of Andhra Pradesh, about 20 percent of the area is occupied by soft socks (Sedimentary and Alluvium formation and the remaining 80 percent of the area is covered with hard rocks (Compact geological formations).

Rainfall

The climate of Andhra Pradesh is typical of India’s semi-arid tropics, characterized by a rainy South West monsoon during June to October and a short spell of winter and the North East monsoon characterized by intense spells of rainfall due to cyclones. The cyclonic spells that generally occur during NE monsoons bring heavy downpours and often leave a trail of destruction.

The normal annual rainfall for the re-organised state is

(as per BES website) 966.2 mm compared to the corresponding figure of 940 mm for the erstwhile combined state. Though at gross level it appears that there is no change, the disparity among the regions is extreme as the most severely drought prone Rayalaseema region has become the western part of AP.

**Groundwater**

The overall stage of groundwater development or utilization is around 45 percent of the available resources which comes up to 14.88 BCM, thus utilizable balance is 18 BCM, about 55 percent of the total available quantity. An estimate by the State Groundwater Department in the same year suggested that 13.2 BCM of the 18 BCM is in command areas of major projects. 1.3 BCM could be in forested areas or other non-cultivable areas. Hence, actual balance resource available for further utilization in the state of AP (unified state) is just 3.5 BCM, which is only 10 percent of the available potential.

**2.1.2. Supply-side Water Balance in AP**

Andhra Pradesh gets 154.75 BCM from rainwater and 38.55 BCM from river flows from upper states. Of this, 49.07 BCM is available as surface water and 20.85 BCM as groundwater. Only a portion of this is usable water. The usable surface water is 41.67 BCM, for which the storage capacity created is 35.09 BCM. Excluding dead storage to be maintained in storage systems, live storage amounts to 28.06 BCM. Close to 24 BCM of water is lost due to evaporation and run-off. Due to the depleting groundwater recharge, the available groundwater is only 9.67 BCM. The supply side balance indicates that there is significant scope for enhancing water availability by increasing un-off capture. Figure 6 illustrates the supply side scenario of water in AP.
2.1.3. The Paradox of Spatial Inequity of Plenty and Scanty

Disparity is more severe when seen with water availability per Ha (both surface and ground water) in Andhra Pradesh. As seen from the Figure 8 the relative disparity among the regions is steeper in the re-organized state of AP when compared to the erstwhile combined state. The net result is farmers in the central districts of the state stand to lose due to inundation of crops due to intense precipitation and on the other hand by severe drought in the western portion of the state. This may further be accentuated by the impending characteristic of extremes due to climate change.

Out of the forty rivers of the state, three of the four major rivers flow in the central portion, i.e.; Pennar, Krishna and Godavari. Out of the total surface water availability of 56.37 BCM, the major contribution (82%) is from only three: the Godavari (24.35 BCM), the Krishna (15.06 + 4.26 (surplus) and the Pennar (2.76 BCM) rivers.

The following is the scenario after the division of the state:-

1. Spatial inequity in water availability has become more severe.
2. Out of the thirteen districts of AP, nine are partially or fully dependent on the Krishna and the Pennar rivers. Both states will have curtailed flows due to further allocations by KWDT2.
3. The inflows in Krishna river would be further delayed due to acquiring of capability by the upper states under the existing scheme of allocations under KWDT1 and further abstractions under KWDT2.
4. Among other things, the KWDT2 has emphasized that the allocations under KWDT1 (75 percent dependability) to be fulfilled first as a first charge. This calls for effective functioning of KWIB (Krishna water implementation Board) and KRMB.
5. The bulk of the flows to Andhra Pradesh have to flow from upper reaches located in upper riparian states as a lower riparian right. As these waters have to pass through the infrastructure of three upper states, the flows are susceptible to manipulation which would lead to delayed or denied inflows. This calls for efficient functioning of the KWIB (Krishna water implementation Board). The lowest state (AP) would suffer in case of functional deficiencies of the boards. AP has to ensure that the respective boards become operational and function efficiently. In any case, the flows would dwindle in the coming years whereas the needs due afflux of population, requirements for drinking, industrial use, food
production would steeply increase. The only way out to meet the rising needs is by improving the internal efficiencies.

The water resources under Krishna and Pennar rivers are more or less fully utilized, as projects are constructed or are in the pipeline to cater to the existing and committed needs. For meeting the future requirements as well as stabilizing the water resources of AP state, harnessing River Godavari waters is the only option. This calls for expeditious completion of Polavaram Project.

There are 736 groundwater basins in Andhra Pradesh, of which 614 basins across 574 mandals fall under the “safe” category. The remaining basins are categorized as Over Exploited (groundwater development is >100% of recharge), Critical (GW development is 90 to 100% of recharge) and Semi-Critical (GW development is 70 to 90% of recharge). The assessment of the groundwater status at a regional level suggests that there is further potential for groundwater development in the Coastal Andhra and Andhra regions. By increased development of groundwater in these regions, surface water can be conserved and transferred to regions with water stress.

<table>
<thead>
<tr>
<th>Region/State</th>
<th>Annual Groundwater availability (TMC)</th>
<th>Existing gross Groundwater draft for all uses (TMC)</th>
<th>Groundwater Balance TMC</th>
<th>Stage of GW Development %</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>NC</td>
<td>Total</td>
<td>C</td>
<td>NC</td>
</tr>
<tr>
<td>Coastal Andhra</td>
<td>291</td>
<td>172</td>
<td>61</td>
<td>65</td>
</tr>
<tr>
<td>Rayalaseema</td>
<td>44</td>
<td>153</td>
<td>15</td>
<td>104</td>
</tr>
<tr>
<td>Andhra Pradesh</td>
<td>335</td>
<td>325</td>
<td>76</td>
<td>169</td>
</tr>
</tbody>
</table>

C:Command  NC: Non Command

Source: Ground Water Department, Govt of AP, 2015

2.1.4. Water Utilization

Close to 96 percent of the available surface water, i.e., 28.11 BCM, is used for irrigation purposes. About 3 percent is used for domestic consumption and less than 1 percent for industrial purposes. In comparison to the other states in the country, as well as developed countries, water utilization in AP is highly skewed. In India, Maharashtra as a policy, allocates 10 percent of its water for industries and 12 percent for domestic consumption. In developed countries such as the USA, water allocation for agricultural purposes is only 33 percent, and 12 percent for domestic consumption and for industrial use (including power generation) is about 50 percent, on an average. The USGS report, Circular 1405, “Estimated Use of Water in the United States in 2010”
countries have been able to make water available for other sectors by adopting efficient water use and re-use methods.

In contrast, the predominant water use method in AP is flood irrigation, which not only leads to wastage of water, but also tends to reduce agricultural yield per unit of water and land. Excessive flood irrigation also leads to environmental problems such as lower soil fertility, soil salinity, and entry of fertiliser and pesticide residues into the aquatic ecosystem.

As AP strives to move towards a more industrial and urban economy, greater water allocation needs to be made for the industrial and domestic sectors. This can be achieved only by driving water use efficiency, primarily in the agriculture sector. While AP strives to enhance its agriculture production and increase its area under irrigation, the savings in water achieved by efficient water use and cropping practices will make more water available for the other sectors. It has also been scientifically proven that efficient irrigation practices such as micro-irrigation help improve crop yields per unit of land and water.

2.1.5. Infrastructure & Institutions for Water Storage and Supply

Water from nature reaches the end users by harnessing it by developing appropriate infrastructure. It is important to have a robust and advanced water supply infrastructure to supply water into the distribution network. The state of Andhra Pradesh has developed or is in the process of developing major storages (such as dams that are possible considering water availability and topography). Supporting infrastructure such as canals and water conservation structures (tanks) need to be enhanced further. Additionally, operational efficiencies need to be brought in.

Storage Infrastructure

The storage infrastructure falls under the purview of the Water Resources Department. The total storage capacity in the divided state of Andhra Pradesh is 35.09 BCM. Its utilization through these projects is 20.31 BCM. The utilization from other sources such as groundwater and Rabi crop utilization is 4.39 BCM and 3.40 BCM respectively.

<table>
<thead>
<tr>
<th>Table 3: Water Storage Capacity in Andhra Pradesh</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type of Project</strong></td>
</tr>
<tr>
<td>---------------------</td>
</tr>
<tr>
<td>Major Projects</td>
</tr>
<tr>
<td>Medium Projects</td>
</tr>
<tr>
<td>Minor Projects</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

Source: Water Resource Department, GoAP, 2015 Note: Storage Capacity includes dead storage

The total irrigation potential created in AP is 40.95 lakh Ha, while the actual area under irrigation is only 27.51 lakh Ha. There is a significant gap in the irrigation potential created and the area under irrigation at nearly 33 percent. The irrigation potential created by the major and medium projects is
27.89 Lakh Ha with a 24.40 percent gap in the area actually irrigated. For minor irrigation projects this gap is even more pronounced at 54.90 percent. The irrigation potential created is 10.36 lakh ha, while the actual area under irrigation from these minor projects is only 4.67 Lakh Ha. Similarly for lift irrigation projects, the gap is 34.60 percent with an irrigation potential of 2.69 Lakh Ha and only 1.76 lakh Ha under irrigation. The figure 11 illustrates this gap.

Urban Supply & Treatment

Urban Water Supply in Andhra Pradesh is under the purview of the Public Health and Municipal Engineering Department which is under the administrative control of the Municipal Administration and Urban Development Department at the Secretariat level. The Department is in charge of formulation, designs, and execution of water supply and sewerage schemes in all the 110 municipalities (including 97 municipalities, 12 Municipal Corporations and 1 Greater Municipal Corporation). After construction and operationalization, the Water Supply and Sewerage Schemes are handed over to the concerned Municipal Corporations and Municipalities for operation and maintenance. In 2015, 88 percent of the urban population is covered with piped water supply system in the urban areas of Andhra Pradesh. There is no metering in urban areas and flat rates are applied.

The current total capacity of sewage treatment facilities across the State is only 288 MLD, which has the ability to treat only 28 percent of the total sewage generated in the urban areas. The gap between sewage generated and treated is 52 percent considering that 80 percent of the water supplied comes back as sewage. The government of AP is planning to increase the capacity of the STPs by 178 MLD, which are in various stages of construction (Annexure 4).

Rural Water supply& treatment

Currently, the rural population constitutes 68 percent of the total population of Andhra Pradesh. As per data released by Ministry of Drinking Water and Sanitation in April 2014, Andhra Pradesh ranks 15th among the Indian states with only 35 percent of habitations fully covered with drinking water supply. In comparison, Uttar Pradesh ranks first in the country with 99 percent coverage. Out of 48,206 habitations, 4049 habitations (8.4 percent) in AP have only between 0-25 percent drinking water coverage. The figure 12 shows the percentage of rural water coverage across states in India.
The Rural Water Supply and Sanitation Department is the nodal agency in the state of Andhra Pradesh for providing drinking water and sanitation facilities in rural areas under RWS sector.

The aim of Rural Water Supply and Sanitation Department is to provide every rural person with adequate and safe drinking water to satisfy their basic needs on a sustainable basis. The Department aims achieve the following in the next 15 years:

- By 2017, at least 35 percent of households should have individual connections
- By 2022, every rural person should have access to 70 lpcd water within 50 meters of their homes.
- By 2029, provide drinking water to all households at 150 lpcd.

In order to supply water to the habitations, the infrastructure currently available with Rural Water Supply and Sanitation Department in presented in Table 4.

<table>
<thead>
<tr>
<th>Type of infrastructure</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hand pumps fitted to borewells</td>
<td>183,533</td>
</tr>
<tr>
<td>PWS/MPWS Schemes</td>
<td>28,173</td>
</tr>
<tr>
<td>CPWS Schemes</td>
<td>463</td>
</tr>
<tr>
<td>Water Testing Laboratories (Div-32, SD-73)</td>
<td>105</td>
</tr>
</tbody>
</table>

Source: Rural Water Supply Dept, GoAP, 2015

It can be inferred that the available infrastructure and the number of schemes are not sufficient to cater to the needs of the whole population. To supply water of acceptable quantity and quality to all users, adequate operation and Maintenance (O & M) of water supply system is equally important.

As per the 73rd Amendment on devolution of powers to local bodies, all Single Village Supply Schemes (SVS) are being maintained by the Gram Panchayats, Multi Village Supply Schemes (MVS) are under the maintenance of Zilla Parishads, and hand pumps are being maintained by Mandal Parishads. The Rural Water Supply and Sanitation (RWS&S) Department provides technical support to Panchayati Raj Institutions (PRIs). The Gram Panchayats/Mandal/Zilla Parishads receive funds for O&M of drinking water supply systems in rural areas. The O&M funds under NRDWP are being utilized for taking up major/special repairs to old aged SVS & MVS Schemes as per need so that the coverage of existing habitations is not affected. The funds required for Operation and Maintenance (O&M) of the above schemes are directly released to the Zilla Parishads, Gram Panchayats and Mandal Parishads by the concerned Commissioner.
Treatment Plants

To reduce water borne diseases, the Government has launched the NTR Sujala Pathakam scheme through which it proposes to establish 5,402 treatment units across the state.

Minimum of one habitation shall be covered for each Mandal in the first phase and minimum of 300 habitations to be covered in each district in 2014-15. The capacity and number of plants will be based on the population of the habitation. Per capita supply is taken at 5 liters per person. The water cans size would be of 20 liters or 10-12 liters, as per convenience of the families. During the first phase, preference is given to buildings having electricity. The District Authorities would identify the habitations where water quality is an issue and ensure that the Government buildings are available for installation of water treatment plant with power connection. Government has also decided to provide water for these treatment plants from the existing water source available in the village.

2.1.6. Water storage infrastructure

The water storage infrastructure as mentioned in the above section is segregated into major, medium and minor projects by the Water Resources Department.

Major and medium irrigation projects are defined by the Planning commission by their Cultural Command Areas (CCA). CCA is the basis for the design of water course and basis for the design of an irrigation project. It is the proportion of the Gross Command Area which is culturable and cultivable.

As per their definition,

- Major irrigation schemes are those schemes which have a Culturable Command Areas of More than 10,000 ha
- Medium irrigation schemes have a CCA of 2,000-10,000 ha
- Minor projects irrigate less than 2,000 ha.

<table>
<thead>
<tr>
<th>Description</th>
<th>Irrigation Potential Created (in Acres)</th>
<th>Andhra Region</th>
<th>Rayalseema Region</th>
<th>Total (acre)</th>
<th>Total (Ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Irrigation Potential Created before 1956</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Major &amp; Medium</td>
<td>2,701,447</td>
<td>271,274</td>
<td>2,972,721</td>
<td>1,203,531</td>
<td></td>
</tr>
<tr>
<td>Irrigation Potential Created 1956 to 02/2015</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Major &amp; Medium</td>
<td>2,913,010</td>
<td>1,022,679</td>
<td>3,935,689</td>
<td>1,593,396</td>
<td></td>
</tr>
<tr>
<td>Irrigation Potential Created from 1956 to 02/2015</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minor Irrigation</td>
<td>1,930,169</td>
<td>630,275</td>
<td>2,560,444</td>
<td>1,036,617</td>
<td></td>
</tr>
<tr>
<td>APSIDC</td>
<td>611,681</td>
<td>91,746</td>
<td>703,426</td>
<td>284,788</td>
<td></td>
</tr>
<tr>
<td>Grand Total</td>
<td>8,156,306</td>
<td>2,015,973</td>
<td>10,172,280</td>
<td>4,118,332</td>
<td></td>
</tr>
</tbody>
</table>

**Major and Medium irrigation projects**

Irrigation potential takes into account the groundwater and surface area availability. However the irrigation potential created by the Major and Medium Irrigation Projects mostly exploit only the surface water resources. In Andhra Pradesh, the Major and Medium Irrigation projects account for 68 percent of the total Irrigation Potential.

The state however has planned new major and medium projects to be executed by 2019. The Action Plan from 2015 to 2019 shows a plan for 41 new projects covering an Irrigation Potential of 1,033,167 hectares. The summary of the new projects as planned for the state is given in Table 6:
The major challenges to be resolved to achieve the completion of the planned projects are related to: land acquisition, resettlement & rehabilitation, railway crossings, and national and state highway constructions. About 64,372 ha. (1.59 lakh acres) of additional land is further required to be acquired to provide land for the proposed projects. Land is further required for resettlement & rehabilitation of 195 affected villages. A total of 28 railway crossings need to be constructed along with a total of 29 national and state highways to be built to achieve the target of the major and medium projects. The capacity of AP to build new major & medium projects is more or less exhausted. However there is significant scope in enhancing the utilization of available water resources through efficiency measures.

Minor Irrigation projects

For ensuring spatial availability of water needs, focus has to be on minor irrigation projects. This will not only help in providing irrigation to areas away from major and medium command areas, but will also help in water conservation and provision of drinking water in a sustainable manner.

Minor Irrigation plays an important role in the development of agriculture and livelihoods particularly in drought prone areas and areas outside command of major irrigation sector by creating new ayacut and providing drinking water to villages during summer season. It is observed that benefits in agriculture through micro-irrigation shall be attained early by taking up repairs to minor irrigation sources.

Irrigation through Anicuts and open head channels covers an ayacut of 143,320 ha (3.54 lakh acres). The total capacity of MI tanks is 142.59 TMC and the total capacity of PR tanks is 84.99 TMC.

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[1] Presentation on Major-Medium Irrigation in Andhra Pradesh, Water Resources Department, GoAP, March 2015
Gap ayacut in Minor Irrigation

The ayacut irrigated by the minor irrigation systems have been getting reduced since 2012-13 (See Figure 14). The reasons for this increasing gap in ayacut irrigated under minor irrigation are manifold:

► Decrease in inflows to the tank due to inadequate rainfall, upstream obstructions, poor conditions of feeder channels
► Decrease in storage due to silting, encroachment, weeds etc.
► Deterioration of physical system: e.g., breaches in bunds, poor condition of bund with unstable slopes, non-uniform TBL, improper condition of surplus systems, defunct or inadequate functioning of sluices
► Poor Canal System for want of maintenance
► Poor water use efficiency due to mono-cropping of water intensive crops
► Improper distribution and scheduling of water to cover the entire ayacut

Lift Irrigation

Andhra Pradesh State Irrigation Development Corporation (APSIDC) was established in 1974 as a State Government undertaking for implementation of Lift Irrigation Schemes to provide irrigation facility to upland areas of small and marginal farmers and other weaker sections of the society with the funds provided by Government under various programmes either directly or through District administration and handing over the same to beneficiaries/agencies for operation and maintenance.

APSIDC has implemented 1,136 LI Schemes and created IP of 6.92 lakh acres in residual AP. The Government has made the following policy interventions to facilitate sustainability of lift irrigation schemes:

---

**Table 7 - District wise distribution of minor irrigation sources in Andhra Pradesh (2015)**

<table>
<thead>
<tr>
<th>S.No</th>
<th>District</th>
<th>Total</th>
<th>Tanks having Ayacut &gt; 100 Ac.</th>
<th>Tanks having &gt;40 ha Ayacut</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>No.</td>
<td>Ayacut (acre)</td>
<td>Ayacut (ha)</td>
<td>No.</td>
</tr>
<tr>
<td>1</td>
<td>Srikakulam</td>
<td>915</td>
<td>96,431</td>
<td>7,639</td>
<td>178,955</td>
</tr>
<tr>
<td>2</td>
<td>Vizianagaram</td>
<td>944</td>
<td>110,943</td>
<td>8,318</td>
<td>157,376</td>
</tr>
<tr>
<td>3</td>
<td>Visakhapatnam</td>
<td>232</td>
<td>157,798</td>
<td>4,253</td>
<td>192,021</td>
</tr>
<tr>
<td>4</td>
<td>East Godavari</td>
<td>263</td>
<td>91,012</td>
<td>1,253</td>
<td>72,867</td>
</tr>
<tr>
<td>5</td>
<td>West Godavari</td>
<td>335</td>
<td>81,246</td>
<td>3,111</td>
<td>31,409</td>
</tr>
<tr>
<td>6</td>
<td>Krishna</td>
<td>248</td>
<td>78,790</td>
<td>3,011</td>
<td>24,903</td>
</tr>
<tr>
<td>7</td>
<td>Guntur</td>
<td>81</td>
<td>22,478</td>
<td>9,100</td>
<td>9,230</td>
</tr>
<tr>
<td>8</td>
<td>Prakasam</td>
<td>339</td>
<td>121,949</td>
<td>551</td>
<td>18,293</td>
</tr>
<tr>
<td>9</td>
<td>SPSR Nellore</td>
<td>722</td>
<td>246,524</td>
<td>984</td>
<td>36,328</td>
</tr>
<tr>
<td>10</td>
<td>YSR Kadapa</td>
<td>234</td>
<td>75,593</td>
<td>1,542</td>
<td>32,279</td>
</tr>
<tr>
<td>11</td>
<td>Kurnool</td>
<td>157</td>
<td>68,342</td>
<td>454</td>
<td>11,818</td>
</tr>
<tr>
<td>12</td>
<td>Anantapur</td>
<td>303</td>
<td>89,897</td>
<td>2,199</td>
<td>52,039</td>
</tr>
<tr>
<td>13</td>
<td>Chittoor</td>
<td>668</td>
<td>163,753</td>
<td>7,395</td>
<td>136,554</td>
</tr>
<tr>
<td>Sub total</td>
<td>5,441</td>
<td>1404756</td>
<td>35,376</td>
<td>801,454</td>
<td>40,817</td>
</tr>
<tr>
<td>Anicuts&amp; open head channels</td>
<td>661</td>
<td>354,234</td>
<td>143,415</td>
<td>354,234</td>
<td>0</td>
</tr>
<tr>
<td>Grand total</td>
<td>6,102</td>
<td>1,758,990</td>
<td>712,142</td>
<td>35,376</td>
<td>801,454</td>
</tr>
</tbody>
</table>

**Source:** Water Resources Department, Government of AP, 2015
Water Resources Sector Paper

- All Lift Irrigation Schemes up to 2,500 ha (10,000 acres) to be with APSIDC
- Free power supply to all LI Schemes
- 16 hours power supply to HT supply LI Schemes with dedicated power lines
- Revival of defunct LI Schemes
- Schemes to be handed over to farmers committees for operation and maintenance
- Social Engineering implementation for improved participation of farmers.

It is found that crop productivity is higher in LI schemes. However, there are a few constraints which need to be addressed. Maintenance of LI schemes, paying the power supply bills and soil fertility issues (e.g., salinity) are major issues. Other constraints are collection of water tax, pumps and motor maintenance, cooperation from departments, cooperation amongst farmers and water availability.

AP Water Resources Development Corporation (APWRDC)

The Andhra Pradesh Water Resources Development Corporation was set up in 1997 for promotion and operation of irrigation projects, command area development and schemes for drinking water and industrial water supply to harness the water of rivers of the state of Andhra Pradesh and for matters connected therewith or incidental thereto including flood control.

The Andhra Pradesh Water Resources Development Corporation Act primarily seeks:

- to promote and operate irrigation projects and command area development including flood control;
- to plan, investigate, design, construct and manage the irrigation projects and do command area development;
- to plan, investigate, design, construct and manage drinking water supply schemes;
- to plan, investigate, design, construct and manage industrial water supply schemes;
- to promote irrigation related activities such as fisheries, pisciculture, floriculture, horticulture, sericulture, tissue culture etc; and
- to promote tourism, water sports and other related activities around the irrigation projects.

APWRDC has been given wide-ranging powers to manage the various sectoral uses of water. Under this act, Water Users Associations have been held responsible for maintenance of the canals and management of water. The Corporation shall, from time to time determine and levy water charges according to volume, for supply of water for irrigation, industrial and domestic purposes to the State Government, local authorities, Government agencies, cultivators and water users associations.

APSRDC is to undertake schemes or works, either jointly with other corporate bodies or institutions, or with Government or local authorities, or on agency basis in furtherance of the purposes for which the Corporation is established and all matters connected therewith. It is to promote irrigation related activities such as fisheries, pisciculture, floriculture, horticulture, sericulture, tissue culture as well as promote tourism, water sports and other related activities around the Irrigation projects.

2.2. Demand Scenario

To bring equity in the supply of water, it is necessary to understand the demand requirements of our society. Demand based...
planning is necessary for the overall growth of the economy. This demand also needs to be mapped to the infrastructure available and its utilization efficiency.

2.2.1. Demand side water balance

As mentioned earlier, 96 percent of the available water is supplied for irrigation purposes. The demand from the agriculture sector is estimated at 57.56 BCM. While some demand is being met by rainfall, the demand supply gap for the agriculture sector, by empirical calculations works out to be 11.45 BCM, reflecting a shortage in the availability of water in the State. However, when looked at holistically, close to 24 BCM of water is lost through evaporation and run-off. There is a huge disparity between areas where flood irrigation is practiced and areas which are water scarce. This underscores the need for efficiency in water use to meet the demand of agriculture as well as needs of other sectors which are now getting only a small share of water consumed. In comparison, the current industrial and domestic sector demand-supply gap is very small (0.015 BCM in industrial and 0.57BCM in domestic sectors). The total demand-supply gap across all sectors is estimated at 12.035 BCM. However, considering that industrial growth is envisaged to be fast tracked in AP and significant urbanization is expected over the next decade, the demand from industrial and domestic sectors is bound to increase.

<table>
<thead>
<tr>
<th>Sector</th>
<th>Demand</th>
<th>Gap</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture</td>
<td>57.56 BCM</td>
<td>11.45 BCM</td>
<td>Various Departments of Andhra Pradesh</td>
</tr>
<tr>
<td>Industrial</td>
<td>0.184 BCM</td>
<td>0.015 BCM</td>
<td>0.41 BCM (Assuming 135 lpcd for urban and 55 lpcd for rural)</td>
</tr>
<tr>
<td>Domestic</td>
<td>1.48 BCM</td>
<td>0.57 BCM</td>
<td>0.91 BCM (Assuming 135 lpcd for urban and 55 lpcd for rural)</td>
</tr>
</tbody>
</table>

2.2.2. Demand projections of water across sectors

The water consumption across sectors is expected to increase by at least 50 percent from the current 29.18 BCM to 42.68 BCM. The largest demand by volume will still be that of the agriculture sector, which is expected to increase from the current 28.11 BCM to 38.89 BCM. The biggest factor for consumption growth is set to be in the industrial sector, which is expected to increase ten times, i.e., from the current 0.17 BCM to 1.78 BCM. Domestic water consumption is also likely to increase from the current 0.9 BCM to 2.01 BCM.
### Table 8 - Sector-wise Projections for Water Demand (in BCM)

<table>
<thead>
<tr>
<th>Sector</th>
<th>2015</th>
<th>2022</th>
<th>2029</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domestic</td>
<td>0.90</td>
<td>1.84</td>
<td>2.01</td>
</tr>
<tr>
<td>Industry</td>
<td>0.17</td>
<td>0.64</td>
<td>1.36</td>
</tr>
<tr>
<td>Irrigation</td>
<td>28.11</td>
<td>33.24</td>
<td>38.89</td>
</tr>
<tr>
<td>Grand Total</td>
<td>29.18</td>
<td>35.68</td>
<td>42.68</td>
</tr>
</tbody>
</table>

**Source:** EY Assessments based on consultations with the department

**Assumptions:** * Rural and urban drinking water requirements estimated at 70 lpcd and 150 lpcd respectively

# Industrial water requirement estimated at 2022 GSDP projected at current prices and assuming a steady growth of 2% in water productivity from the current productivity of Rs. 17,870

### 2.2.3. Spatial distribution of projected rural water demand

The current spatial distribution of demand for rural water is as shown in Figure 9. It can be seen that currently, East and West Godavari districts have the highest water demand in rural areas due to high rural population. Kadapa, Nellore, Vishakapatnam and Vizianagaram have the lowest rural water demand.

The demand for rural water is projected to be the highest in East Godavari and West Godavari districts, and agriculture is expected to be the driving economic activity in these districts. The lowest projected demand for rural water is expected in Kadapa and Vizianagaram districts.

Over the years, the rural population is likely to decline in Vishakhapatnam, Krishna, Guntur, Prakasam, Nellore, Kadapa, Kurnool, and Chittoor districts. As a result, these districts indicate a fall in rural water demand. Based on current projections, Vishakhapatnam will experience a sharp fall in rural water demand between 2022 to 2029. Rural water demand is expected to increase in Vizianagaram district. Hence, the total water demand is expected to increase from the current 0.69 BCM to 0.82 BCM only by 2029.

![Geographical Variation in Existing Demand of Rural Water (2015 Scenario)](image-url)
2.2.4. Spatial distribution of projected urban water demand

The current spatial distribution of demand for urban water is shown in the Figure 18:

The demand for urban water is expected to be the highest in Vishakhapatnam and Krishna districts, which are highly urbanized and the urbanization is expected to increase even more. The demand is lowest in Srikakulam and Vizianagaram districts owing to low urban population.

The urban population is expected to rise across the State leading to a corresponding increase in demand for urban drinking water from the current 0.79 BCM to 1.19 BCM by 2029.

2.2.5. Water Use Efficiency

Agriculture

The objective of water use efficiency in agriculture is to bring more area under irrigation utilizing the available quantities of water and thus enhancing agricultural productivity. Increasing water use efficiency can be a decisive factor in increasing crop productivity. This is very important to ensure water availability even in drought prone regions of Andhra Pradesh. In addition, it has been well
established that efficient watering practices lead to increased yields. Table 12 in the following section illustrates the typical increases in yield while employing efficient irrigation practices.

From the figure 20, it can be inferred that the highest efficiencies can be achieved through Lift Irrigation schemes with the exception of Handri Niva Sujala Srananthi (HNSS) project which has been recently started and is yet to stabilize its ayacut.

**Industries**

Water is a socio-economic good. Hence, it is equally relevant to consider the output achieved from each unit of water supplied to sectors. The water use efficiency (Rs. crores/ TMC) in industries is much higher than the efficiency in agriculture. Although, water productivity in industries in Andhra Pradesh is higher than in agriculture, it is much lower than in other developed states such as Maharashtra. While Maharashtra is able to derive a value of Rs.31,337 Cr per TMC of water, AP is only able to derive half its value. This means that the industries in Maharashtra are able to generate more economic value from each unit of water they utilize.

Industry is the third largest user of fresh water in Andhra Pradesh. Usually, the industrial processes include one or all of the following activities where water is used: Pre-treatment, input for manufacturing, process coolant, washing, flushing. These activities not only produce significant wastewater, but also magnify the problems of water pollution if water is not treated properly. Almost 80 percent of the water provided to industries can be recycled and reused. Each of the processes mentioned above can be modified to ensure that water efficiency in the industries sector is maximized. Hence, the way forward for enhancing water use efficiency is through managing the demand for water.

**Agriculture**

The predominant irrigation method still continues to be the traditional method of flood Irrigation. This lead to loss of water due to deep percolation and evaporation and it also inhibits growth of useful aerobic bacteria at the root zone, which in turn impacts yield. Research conducted by the Indian National Committee on Irrigation and Drainage (INCID) clearly shows that the uses of proper irrigation techniques like micro irrigation and sprinklers, not only is there water savings but the yield also increases substantially. System Rice Intensification (SRI) does achieve both these

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Table 9: Industrial Water Productivity

<table>
<thead>
<tr>
<th>State</th>
<th>GSDP of Industries (Rs. Crores)</th>
<th>Quantity of water used (TMC)</th>
<th>Industrial Water Productivity (Rs. Crores/ TMC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Andhra Pradesh</td>
<td>107,224</td>
<td>6</td>
<td>17,870</td>
</tr>
<tr>
<td>Maharashtra</td>
<td>487,604</td>
<td>15.56</td>
<td>31,337</td>
</tr>
</tbody>
</table>

Source: Engineer-in-Chief, Water Resources Department, Water Charges Statement; MIDC supplies 1000 MLD of water, other sources 200 MLD

6 At current prices
7 Engineer-in-Chief, Water Resources Department, Water Charges Statement
8 MIDC supplies 1000 MLD of water, other sources 200 MLD
objectives, but increased labour intensity has not made it popular. SRI method is still a viable option especially in smaller fields following conjunctive water use (surface and groundwater).

Micro Irrigation (drip and sprinkler) was introduced in India since the 1990s. Currently it is being practiced in 0.7 Million Hectares of the total 4.134 Million Hectares (17%) in the re-carved state of AP. The on-farm irrigation efficiency under optimally designed drip irrigation system is about 90 percent while it is about 70 percent for sprinklers and only about 45 percent by other methods such as flood irrigation.

Irrigation and water use efficiency

The Government has already taken a policy decision to adopt micro irrigation in all new projects. APFMIS Act 1997 and the Water Vision 2020 had emphasized the importance of efficient and judicious water use.

Domestic Water

Against a total demand for drinking water of 1.48 BCM, the current supply is 0.91 BCM leaving a gap 0.57 BCM(38.5%). About 0.7 BCM of untreated grey and black water is being released into the lakes and streams causing pollution.

If reused and recycled properly, there can be several productive uses of waste water except human consumption. The used water, after primary treatment, can be used for gardening and toilet flushing. Secondary treatment of water can make it usable for more commercial purposes such as farm irrigation in peri-urban areas. This can lead to significant water savings. All leading countries have implemented such measures with great success. Singapore is a leader in recycling of water where each drop of water is recycled several times. Singapore has been also able to make recycled water of potable quality. Israel also recycles 75 percent of its domestic wastewater.

The way forward for our domestic use of water would be implementing the reuse and recycle techniques through changes in our building codes and designing systems with proper color coding for different uses. Currently the reuse and recycling of water is negligible. Even if 50 percent of the water is reused and recycled, the availability of ground water during the dry seasons would increase substantially. Conventional methods such as soak pits around homes for growing kitchen gardens and vegetable creepers can also save water as well as increase productivity.

Industrial Water

The total gap in industrial water demand supply is 0.015 BCM (8.2%). The total demand for industrial water is currently 0.184 BCM against the supply of 0.169 BCM. Maharashtra has been able to achieve a much higher return on water utilization (Refer Table 11) compared to AP. This shows that there huge scope for improving industrial water use efficiency in AP. Efficiency can be driven through recycling the water used in every industry. Experience shows that close to 80 percent of the water can be recycled on an average at every industrial unit. Additionally, collection of arrears is an important element to make funds available for the further developmental works and operation and maintenance activities.

<table>
<thead>
<tr>
<th>Crop</th>
<th>Yield (%)</th>
<th>Water saving (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Banana</td>
<td>52</td>
<td>45</td>
</tr>
<tr>
<td>Grapes</td>
<td>23</td>
<td>48</td>
</tr>
<tr>
<td>Pomegranate</td>
<td>98</td>
<td>45</td>
</tr>
<tr>
<td>Sugarcane</td>
<td>33</td>
<td>65</td>
</tr>
<tr>
<td>Cotton</td>
<td>27</td>
<td>53</td>
</tr>
<tr>
<td>Papaya</td>
<td>75</td>
<td>68</td>
</tr>
<tr>
<td>Chilli</td>
<td>44</td>
<td>62</td>
</tr>
</tbody>
</table>

Source: Indian National Committee on Irrigation and Drainage

Table 11: Water saving through drip irrigation
2.2.6. The Need for Demand Management

The United Nations has identified water resource management as one of the key factors for meeting the MDGs & SDGs to eradicate poverty, universalize education, promote equality, empower women, improve health and sustainability, etc.\textsuperscript{9} The demand for water has doubled in the last 50 years, while the total water available in the ecosystem has remained more or less constant.

The above analysis in the preceding sections shows that the demand for all the sectors will increase significantly over time as AP aspires to grow at a rapid pace and also meet the MDGs and SDGs. The demand supply gap for water is bound to increase if we continue to manage our water resources the way we do today. Table 10 depicts the status of demand and supply and the prevailing gap in BCM.

<table>
<thead>
<tr>
<th>Sector</th>
<th>Requirement (BCM)</th>
<th>Supply (BCM)</th>
<th>Gap (BCM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture(Irrigation)</td>
<td>39.66</td>
<td>28.11</td>
<td>11.45</td>
</tr>
<tr>
<td>Industrial</td>
<td>0.184</td>
<td>0.169</td>
<td>0.015</td>
</tr>
<tr>
<td>Domestic</td>
<td>1.48</td>
<td>0.91</td>
<td>0.57</td>
</tr>
<tr>
<td>Total</td>
<td>41.324</td>
<td>29.189</td>
<td>12.035</td>
</tr>
</tbody>
</table>

\textbf{Source: Water Resources Department, 2015}

It can be inferred from Table 10 that besides 96 percent of the water being supplied for agricultural demands, the demand-supply gap in agriculture is still the highest at 11.45 BCM. The domestic and industrial demands are considerably low. However as AP moves towards a more industrialized economy, this gap is bound to increase. Hence, one of the ways to ensure that we have adequate water available for our growth and environmental sustainability we have to judiciously manage the demand of each sector. Demand management would rely on our ability to be responsible towards the use of water and the quantity of water we reuse and recycle. One of the key factors in this is our ability to monitor the quantity of water supplied and incentivize judicious use of water. Volumetric flow meters with telescopic charges need to be introduced for all the three sectors, i.e., agriculture, domestic use and industries to enable this monitoring and incentivizing.

2.2.7. Water for preserving the natural ecosystem

While water use for agriculture is the highest in the State, irrigation water use is mostly consumptive and returns very little water to the ecosystem, especially when the irrigation efficiency is high. The rivers in the State are fed by run-off from the monsoons experiencing floods. The riverine wetlands form important habitats for a large part of the natural life diversity. River waters are prone to high concentration of pollutants when depletion of river waters occurs, which in turn affect aquatic ecosystems.

AP is home to a wide range of ecosystem diversity which either influences the natural river flows or is dependent on the same. The natural ecosystems in the State are:

- **Hills:** mainly in the Eastern Ghats
- **Wetlands:** Natural systems: Kolleru and Pulicat; Artificial systems: Nagarjunasagar and Srisailam reservoirs
- **Mangroves:** Coringa
- **Plateaux:** Deccan and Central Plateau of Rayalaseema
- **Rivers:** Krishna, Godavari and Pennar
- **Coasts, Estuaries and Forests:** Largely dry deciduous forests, with variations from the near moist deciduous of the eastern Highlands to the scrub of Rayalaseema.

\textsuperscript{9} United Nations Department of Economic and Social Affairs 2015
Forests

Forest cover is a critical element in the hydrological cycle as it functions as a natural sponge – absorbing rainwater and supplying the rainwater to river basins and watersheds, forming a major source of surface water. A healthy forest cover also checks soil erosion and siltation, mitigating the effects of floods. In Andhra Pradesh the forest cover is around 23 percent of the land area (6.2 million ha)\(^{10}\) which includes five types of forests such as, Tropical dry deciduous, Tropical Thorn, Tropical moist deciduous, Tropical evergreen, Littoral and swampy forests.

The reserve forest in the State accounts for 5.76 percent of the total geographic area which includes four national parks and 21 wildlife sanctuaries. The State has some comprehensive programs running such as the Joint Forest Management initiative for forest area near villages to be managed by village-level forest protection committees.

Rivers

The flow of rivers is affected by the creation of reservoir and barrages across rivers and flowing systems are replaced by many lacustrine bodies. Quality of river water is indicated by ecological balance and biodiversity which includes fisheries. Quality of rivers is directly connected to flow regimes and minimum silt concentration. In Andhra Pradesh, with the exception of Godavari, extraction of water for drinking, irrigation, industry and other demands is considerable, this coupled with the large amounts of waste-loaded water from sewage, industries and agriculture run-off enter the rivers – affecting the quality of the river waters. The river systems being converted in to a series of lacustrine bodies and deterioration of quality of river-water have an adverse effect on the aquatic wildlife in the river system in the State.

Wetlands

Wetlands are important habitats in the context of Andhra Pradesh. They carry valuable ecological as well as socio-economic value for the people of the State including flood control, wildlife resources, water transport, fisheries, microclimate stabilization, water supply to people, wildlife, natural systems or natural processes and toxic pollutant retention.

The State has a treasure trove of large reservoirs and lakes and in addition has a large number of tanks, large and small which is the habitat for a wide variety of bio-diversity. These bodies have been neglected and fallen into disuse. The pollutants entering into water bodies is also a concern in the State, where entry of municipal, agriculture and industrial waste has caused extensive pollution and high eutrophication of the waters.

The recent floods and extensive inundation of coastal Tamil Nadu, especially Chennai city is attributed to the destruction of to the ecosystem especially wetlands and water bodies in as much as to general climate change factors.

Coastal Zone

The State has a long and extended coastline (974 kms) which is critical for a variety of economic and livelihood activities. Agriculture, aquaculture, industry and tourism are all supported by the coastal areas. The coast is crisscrossed by a total of 40 rivers important among which are the Krishna, Godavari, Pennar and other minor rivers. Two important lakes namely, Kolleru and Pulicat lakes drain in the Bay of Bengal.

Andhra Pradesh is one of the major maritime States in the Country, with 9 districts along the coast dotted with 453 maritime villages, 280 fish-landing centres, and two major harbors at Visakhapatnam and Kakinada. Through a notification issued in 1991, the central Government

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sought to protect the 500 m zone from the High tide line all along the coast. Under the said notification, a number of activities such as buildings, industries, disposal of waste, drawal of groundwater, extraction of resources and land reclamation is either banned or restricted within the zone.

The Government of Andhra Pradesh has also taken measures to protect the development along the coast line by constituting the Shore Area Development Authority (SADA) to protect and improve the coastal environment. The Authority is charged with prevention, abatement, and control of environmental pollution.

**2.2.8. Institutional Set-up for Supply & Demand Management in AP**

Considering the limited availability of storage capacity and fast depleting resources, GoAP has taken initiatives to strengthen demand management of water to inculcate a sense of ownership among users to preserve and conserve water resources. Strengthening of demand management institutions is critical for achieving water efficiency and ensuring water availability for all sectors.

The GoAP has set reforms into motion in institutional setup for its water resource management. At present, it is concentrated at the state and the community level in putting together a policy and administrative structure. Some of the initiatives undertaken are: passing of an act for establishment of a Water Resources Regulator, Water Management Committee, restructuring of the I&CAD Department (renamed as Water Resources Department), strengthening farmers’ organizations such as Water User Associations (WUAs), Distributary Committees and Project Committees.

Broadly, the institutions can be categorized under State level, District level and Panchayati level. Further classification can be done on the basis of functionality of the institutions. The institutional and regulatory framework for water resources management in the state is discussed below.

At the state level, several institutions are functioning, which carry out regulatory, monitoring, implementation/support for management of water resources. There are several Departments which are tasked with differing functionality based on the type of water usage and demand/supply needs in the state. The demand side management in the state is done though several committees which are implementing or monitoring programmers and schemes. The state also has several supporting institutions such as corporations and institutions.

**Water Resources Department**

The Water Resources Department is the custodian of all the water resources in the State. It is the overarching department for water resource management in the state, mandated with regulating and monitoring all matters related to water resources such as flow measurement, regulation, storage, flood control, irrigation, construction of dams and canals, and drought management. In the past, the Department had undertaken massive infrastructure projects such as the Nagarjunasagar dam, Srisailam dam, Sir Arthur Cotton Barrage, and Prakasam Barrage. It is also responsible for vast areas of irrigated ayacut in the state under various projects through a vast network of canals and channels.

Considering the challenges before the department, it needs to develop a broader outlook for managing all the water resources, the policy on allocation, and convergence with other water departments such as Urban Development, Rural Development, and Ground Water, and APSIDC and the Andhra Pradesh Pollution Control Board as opposed to its current orientation which only focuses on surface water while quality control does not fall into its purview.
Rural Water Supply and Sanitation Department

The Rural Water Supply and Sanitation (RWSS) Department is the nodal agency in the State for providing drinking water and sanitation facilities in rural areas under RWS sector. The basic functionality of the RWSS Department is the following:

- Spot sources (Borewells fitted with Hand Pumps)
- Protected Water Supply Schemes (for one habitation/village)
- Comprehensive Protected Water Supply Schemes

The projects undertaken by the RWSS are implemented through the following institutional structure which reaches out to the village level. The institutional arrangement supports a progressive decentralization and devolution to the PRIs, with increased community participation, financial sustainability and enhanced accountability at all the levels.

- **State Level:** The Executive Committee of the State Water and Sanitation Mission (SWSM) steers the implementation at the state level. The Executive Committee of SWSM, headed by Secretary RWSSD is responsible for planning and policy formulation; capacity building; fund flow; approval of annual plan and budget allocation; review, monitoring and evaluation of the Sector and District Programs. The State Project Support Unit assists SWSM in monitoring and implementing policy decisions regarding relating to all aspects including Community Participation, Communications and Capacity Building.

- **District Level:** At the district level, the District Water Sanitation Committee is set up to govern the project implementation at the districts through ensuring decentralization at the Panchayati levels. At the district level the Multi Village Scheme - Water Supply Committee is formed to planning, designing, procurement and implementation of Single Village Schemes and Multi Village Scheme.

- **Village Level:** The Gram Panchayat Water & Sanitation Committee formed at the Gram Panchayat level takes care of all intra-village facilities in terms of designing and implementing the projects. The Self Help Groups at the village level are responsible for closely interacting with the GPs/ GP-WSCs for executing their responsibilities.

Ground Water Department

The Ground Water Department in Andhra Pradesh is a state level institution involved in: (i) Systematic and scientific development of groundwater, and (ii) Assessment and Management in different Agro-climatic Zones and Hydrogeological formations for sustainability. It functions as a monitoring agency and carries out the following functions.

- Periodical estimation of basin (watershed) wise groundwater resources
- Delineation of potential groundwater zones
- Investigation and identification of feasible sites for wells, artificial recharge structures
- Groundwater levels and water quality monitoring through observation wells network (more than 3000 Observation wells, including Piezometers fixed with Digital Water Level Recorders with Telemetry system)
- Exploratory and Production wells drilling
- Environmental clearances for Industries and Sand mining
- Special Groundwater studies using Remote Sensing and GIS tools
- Studies for Conjunctive use in Major Command Areas

The department is well equipped with knowledge of groundwater assessment, estimation, well site investigations and lithology and an established network of observation wells to monitor groundwater. It has competent manpower to manage the various professional tasks. The challenge facing the department is the rapidly declining groundwater table due to overexploitation of groundwater.
The Department is playing only a monitoring role and presently has no regulatory authority which limits its effectiveness. The multiplicity of organizations and agencies handling groundwater and weak inter-agency coordination in the State are issues that need to be resolved at the earliest. There is a need for the Ground Water Department to transform itself into a groundwater management agency with statutory powers for sustainability. An updated APWALT Act would go a long way in institutionalizing laudable initiatives such as participatory groundwater management.¹¹

**Urban Water Supply Department**

Urban Water Supply falls under the purview of Public Health and Municipal Engineering Department, and is responsible for the comprehensive design and execution of Water Supply and Sewerage Schemes in all the 97 Municipalities, 12 Municipal Corporations and 1 Grater Municipal Corporation in the state. The main function of the department is to supply water to all the ULBs, provide scientific disposal and treatment of waste water in all ULBs and industries. The department also has Technical Control over all the Engineering works in these Municipal Towns and Corporations. After completion, the Water Supply and Sewerage Schemes are being handed over to the concerned Municipal Corporations and Municipalities for operation and maintenance.

The key urban services being provided by the Public Health and Municipal Engineering Department is decentralized through the municipalities and ULBs. The engineering wing of urban municipalities is responsible for providing urban water supply from source to the end consumer. The Municipal Corporations and the ULBs are responsible for the planning, design, procurement and execution of projects. The PHMED has significantly enhanced its operational efficiency through use of technology for monitoring and communicating between the state and field level officers. However, lack of funds and multi-level approvals are hurdles that PHMED faces during execution of works.

**Integrated Watershed Management Programme (IWMP)**

Being run under the Rural Water Supply and Sanitation Department, the Integrated Watershed Management Programme (IWMP) was launched to restore the ecological balance by harnessing, conserving and developing degraded natural resources such as soil, vegetative cover and water and to create sustainable livelihoods for asset less farmers. The institutional structure for implementing IWMP has dedicated institutions with professional teams at state level and DWMA with financial assistance to dedicated institutions. Currently, 431 projects covering an area of 18.08 lakh ha., are covered under the programme.¹²

- **State Level:** For Implementation of the IWMP watersheds, State Level Nodal Agency (SLNA) has been constituted by the State Government. The SLNA consists of representatives from NRAA, Central Nodal Ministry and facilitates in routing funds from the Centre.
- **District Level:** The District Water Management Agency (DWMA) implements 75 percent of the sanctioned watershed projects through Project Officers of the line departments and 25 percent of the projects are implemented through by the Village Watershed Committees.
- **Village Level:** At the Village level, the Project Implementing Agencies would carry out the watershed projects through the Village Organizations and Watershed Committees formed by the representatives of the SHGs.

**Institutions for Demand-Side Management**

The Andhra Pradesh Water Resources Regulatory Commission is tasked with regulation and effective utilization of water resources within the state to ensure sustainable and scientific management. The commission is currently not operational for which rules need to be framed and

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¹¹ Participatory Groundwater Management in the Andhra Pradesh Community Based Tank Management Project has been recognized as a leading best practice (runner up for the ‘Water for Life’ UN-Water Best Practices Award, 2014)

notified. There is also a need to establish this independent regulator with necessary key
functionaries such as water management, economics, finance, design, research & training,
irrigation, power, infrastructure experts, a representation from all stakeholder segments for
effective functioning of the commission.

Andhra Pradesh State Irrigation Development Corporation (APSIDC)

AOSIDC was established in 1974 as an autonomous corporation with the objective of providing
irrigation facilities to upland areas to uplift small and marginal farmers including SCs and STs with
the funds provided by the State Government. APSIDC was responsible for implementing Lift
Irrigation Schemes, borewells, tubewells and infiltration wells to provide irrigation facilities. Since
2004, APSIDC is responsible to manage only lift irrigation schemes covering up to 4,000 ha ayacut.

Some of the key initiatives currently being undertaken by APSIDC are:

► Development of a website along with mobile application for monitoring the Demand-
Collection-Balance of water rate at commissioned schemes linked to details of beneficiaries,
such as Aadhaar card number, crops raised.
► Proposal for Implementation of Micro Irrigation System at all Lift Irrigation Schemes.

Water Management Committee

The Water Management Committee is a body operating at the state level which is mandated with
integrated water resource management and is headed by top bureaucrats in the state including the
Chief Secretary and members from all concerned water departments. The committee was
established to achieve convergence and coordination among the various departments in water
sector and other water user agencies and to take decisions on policy and reforms, regulation and
performance and convergence on water related issues. However, there are several issues
concerned with the committee: It does not function as a formal institution in the state and presently
the meetings of the committe are not regular. There is a need for an independent institution which
is a water management institution to monitor if the instructions of the Government and the water
regulator are being effectively implemented by the entire water resources sector such as,
agriculture, industries, drinking water, water quality and sanitation. The proposed institution will
also ensure proper functioning of cross-cutting mechanisms such as eProcurement systems in
consultation with the Government.

State Level Committee for IWPM (Integrated Watershed Planning and Management)

Integrated Watershed Planning and Management is a technical committee advising the Government
on integrated water planning and management, including reviewing and improving water use
efficiency covering all major and minor river basins in the state. However, there are lacunae in the
programme itself where it is currently shuffling supplies while the programme must focus on
efficient demand management. There is also a need for providing equitable water availability and
efficiency improvement through incentives and disincentives.

Command Area Development Committee

Command Area Development Committee functions as state level body to provide regular O&M
budget to the farmer organizations in the state, their capacity building and to assess performance
of irrigation projects for improving the overall agricultural productivity in the state.

Panchayati Level Institutions

Water User Associations: As part of the irrigation reforms and participatory irrigation management
in Andhra Pradesh and to promote farmers participation in water, the farmer’s organization was
The objective of the Farmers Association is:

- To promote and secure distribution of water among its users
- Adequate maintenance of the irrigation system
- Efficient and economical utilization of water (to encourage modernization of agriculture)
- To optimize agricultural production
- To protect the environment, and to ensure ecological balance by involving the farmers inculcating a sense of ownership of the irrigation system in accordance with the water budget and the operational plan

The Farmers Organizations (FO) were constituted in a three tier system where each tier has been divided based on the irrigation system. For Minor Irrigation systems, the FO is the Water User Associations (WUAs); for medium irrigation systems, the FO consists of WUAs and Project Committee at the project level; and for major irrigation systems FOs constitutes the WUAs, Distributary Committee and Project Committee.

**Functions of WUA:** The Water User Associations are responsible for operational plans, budgeting, accounting, resource mobilization and water efficiency amongst land owners and users. The functions in details are as given below.

- To prepare and implement a warabandi schedule\(^{14}\) for each irrigation season, consistent with the operational plan, based upon the entitlement, area, soil and cropping pattern as approved by the Distributary Committee, or as the case may be, the Project Committee
- Plan for the maintenance of irrigation systems
- to regulate the use of water among the various pipe outlets under its area of operation according to the warabandi schedule of the system;
- to promote economy in the use of water allocated;
- to assist the Revenue Department in the preparation of demand and collection of water rates;
- to maintain a register of landholders as published by the Revenue Department;
- to prepare and maintain a register of co-opted members;
- to prepare and maintain an inventory of the irrigation system within the area of operation;
- to monitor flow of water for irrigation;
- to resolve the disputes, if any between the members and water users in its area of operation;
- to raise resources;
- to maintain accounts;
- to cause annual audit of its accounts;
- to assist in the conduct of elections to the Managing Committee;
- to maintain other records as may be prescribed;
- to abide by the decisions of the Distributary and Project Committees to conduct General Body Meetings, as may be prescribed;
- to encourage avenue plantation on canal bunds and tank bunds by leasing such bunds;
- to conduct regular water budgeting and also to conduct periodical social audit, as may be prescribed;
- to encourage modernization of agriculture in its area of operation; and
- to maintain the feeder channels of minor irrigation tanks by the respective Water Users Association, in the manner prescribed

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\(^{13}\) AFMIS (Amendment) Act, 2005
\(^{14}\) Warabandi means, a system of distribution of water allocation to water users by turn, according to an approved schedule indicating the day, duration of the time of supply.
Pollution Control Board

Andhra Pradesh Pollution Control Board follows a three-tier operational structure with Board, Zonal and Regional offices. The state government has adopted the model of decentralization with respect to the powers of the pollution control board. The model followed in the state is such that the state government enforces regulations such as environmental clearances based on the feedback provided by the Andhra Pradesh Pollution Control Board. The board has been instrumental in enforcing the Water (Prevention and Control of Pollution) Act, 1974 as one of its primary functions with the objective of restoring the wholesomeness of water for the State.

Several actions have already been recommended to strengthen the institutional capacity of the Andhra Pradesh State Pollution Control Board:

- Filling in the vacant positions through recruitment of trained personnel
- Monitoring and testing of the technical skills of the existing and new staff
- Introduction of training programmes for staff to build their technical capacity, especially in the area of coastal zone management
- Setting up an integrated training and capacity building protocol

2.3. Existing Policies and Acts Applicable to the Water Sector

There are several Acts, Rules and Policies that have evolved over the years in the State, and there also certain central policies which the State needs to abide by. The key Acts, Rules and Policies relevant to the water sector are listed below:

- Indian Easements Act, 1882
- Indian Vessels Act, 1917
- Entry 56, List II of Constitution of India-water is a state subject, 1950
- Inter-state Water Disputes Act, 1956 - resolution of disputes

Source: 12th Five Year Plan of Andhra Pradesh
The objectives and coverage of these policies is tabulated below.

<table>
<thead>
<tr>
<th>S.No</th>
<th>Act / Policy</th>
<th>Objective of the Act / Policy</th>
<th>Coverage</th>
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</table>
| 1    | The Andhra Pradesh Irrigation Utilization and Command Area Development Act, 1984 | The Act provides for creation of Command area development authority which functions to:  
- Formulate and implement schemes for development of command areas;  
- Ensure integrated utilization of water flows;  
- Co-ordinate work relating to command area development;  
- Arrange systematic land development, including planning, construction and maintenance of field channels, field drains, farm roads and ayacut roads;  
- Formulate conjunctive use of surface and ground water;  
- Strengthen agricultural extension activities;  
- Other functions envisaged in the Act. | The Act envisages to provide for an accelerated increase in agriculture and allied production in the State of Andhra Pradesh through a programme of comprehensive and systematic development on scientific and modern lines of command areas, comprising measures, for optimum use of lands and water, prevention of land erosion and water logging, improvement of soil fertility and regulation of cropping pattern, and for proper maintenance and upkeep of irrigation systems in the State for ensuring maximum benefits to the cultivators under the command areas. |
| 2    | The Andhra Pradesh Farmers Management of Irrigation Act, 1997 | The Act provides for farmers' participation in the management of irrigation systems by giving farmers' organizations an effective role in the management and maintenance of the irrigation system for effective and reliable supply and distribution of water. | Creation of Water Users' Associations consisting of all the water users who are land holders in a water users' area and all other water users co-opted in a water users' area. The farmers' organization shall promote and secure distribution of water among its users, adequate maintenance of the irrigation system, efficient and economical utilization of water to optimize agricultural production, to protect the environment, and to ensure ecological balance by involving the farmers, inculcating a sense of ownership of the irrigation system in accordance with the water budget and operational plan. |
| 3    | Andhra Pradesh Water, Trees and Land Act, 2002 | Under the Act an Authority has been constituted at the State, District and Mandal level and administrators for the same were to be appointed. | The functions of the Authority under the Act are as following:  
- promote water conservation and enhancement of tree cover in the State;  
- regulate the exploitation of ground and surface water in the State;  
- make regulations for the functioning of the authorities at District and Mandal level;  
- advise Government on the legislative and administrative measures for the conservation of natural resources;  
- advise on economic measures to be taken by the Government as incentives or disincentives relating to taxes, levies, fees or other charges to promote conservation of natural resources;  
- advise on strengthening public participation in conservation of natural resources in such a way that equity in access to water in different basins, sub-basins and regions in the State is maintained;  
- advise the Government on the constitution and... |
## Table 11 Policy and Legal Framework for Water Resources in Andhra Pradesh

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<tr>
<th>S.No</th>
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<th>Coverage</th>
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</table>
| 4    | Andhra Pradesh Water Resources Regulatory Commissions Act, 2009 | An act to provide for the establishment of the Andhra Pradesh Water Resources Regulatory Commission for the regulation of water resources within the state, facilitate effective utilization of water resources within the state to ensure its sustainable and scientific management for drinking, agriculture, industrial and other purposes | Function of the commission include:  
- determine the water requirement for various category of users on a yearly / Seasonal basis;  
- To determine the requirement of irrigation water for the various levels of Farmers Organisations based on cropping pattern approved by the project authorities;  
- To determine the adequate O&M cost of irrigation / multipurpose water projects  
- Promoting efficient management of irrigation water  
- Promoting efficient use of water resources and minimizing wastage of water |

### Policies/ Others

| 5    | AP State Water Policy 2008                          | The objective of the Andhra Pradesh State Water Policy, is to ensure the comprehensive multi-sectoral planning, development and management of the State’s water resources, and effective, efficient, equitable and sustainable service delivery for various water uses | The policy covers aspects such as:  
- Ensuring water security to entire population by ensuring adequate clean, hygienic, accessible, affordable and safe water for all  
- Improving water management and efficiency by integrating and coordinating efforts by all concerned institutions / organisations in developing a policy framework for planning water resources, augmenting them and putting them to productive use.  
- Effective participation of users in development and management of the state’s water resources  
- Promotion of sustainable use of groundwater  
- Maintain and sustain ecological balance by conserving and protecting water bodies and wetlands, through regulation and enforcement of standards for water infrastructure, usage and disposal. |