

മാർച്ച് 2025



ലക്കം 1

അമൃത് വാർത്താ പത്രിക

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Azadi Ka
Amrit Mahotsav





അമൃത് 2.0 പദ്ധതിയിൽ ഉൾപ്പെടുത്തി നവീകരിച്ച ഏലൂർ ഇടംപടം കുളത്തിന്റെ ഉദ്ഘാടനം
ബഹു. വ്യവസായ വകുപ്പ് മന്ത്രി ശ്രീ. പി. രാജീവ് നിർവ്വഹിക്കുന്നു



അമൃത് വാർത്താ പത്രിക

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കേരള സർക്കാർ

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ഹൈഡ്രോ ജിയോളജിസ്റ്റ്

അസിസ്റ്റന്റ് എഡിറ്റർ
സാവിത്രി സജി ഇ.ആർ.



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നഗരസഭകളുടെയും പഞ്ചായത്തുകളുടെയും ഉത്സവമായ തദ്ദേശകം, കേരളത്തിലെ നഗരസഭകളുടെയും പഞ്ചായത്തുകളുടെയും ആസൂത്രണത്തിന്റെയും പദ്ധതി നടപ്പിൽ ആക്കുന്നതിന്റെയും ഒരു നേർ ചിത്രമായിരുന്നു. ഗ്രാമ നഗര മേഖലകളിലെ വിവിധ പ്രവർത്തനങ്ങളെ വരച്ചു കാണിക്കുന്ന പ്രദർശനം ഏവരുടെയും ശ്രദ്ധ പിടിച്ചുപറ്റി. പ്രത്യേകിച്ച് കേരള അമൃതിന്റെ സ്റ്റാളുകളിലൂടെ അതിവേഗം മുന്നേറി കൊണ്ടിരിക്കുന്ന നഗര വികസനത്തിന്റെ ഉദാത്ത മാതൃകകൾ ഏവരുടെയും പ്രശംസ ലഭിക്കുവാൻ സാധിച്ചതിൽ സന്തോഷവും ഒപ്പം അതിനായി പ്രവർത്തിച്ച സിറ്റി മിഷന്റെയും സ്റ്റേറ്റ് മിഷന്റെയും എല്ലാ എക്സ്പർട്ടുകളെയും അഭിനന്ദിക്കുന്നു. തുടർന്നും ഇത്തരത്തിലുള്ള പ്രവർത്തികൾ ചെയ്യാൻ കഴിയട്ടെ എന്നും ആശംസിക്കുന്നു.

അമൃത് പദ്ധതി വിലയിരുത്തലിന്റെ ഭാഗമായി കേന്ദ്ര സർക്കാർ നിയമിച്ച IRMA (NIUA) ടീം മൂന്ന് ജില്ലയിലെ പ്രവർത്തനങ്ങൾ (തിരുവനന്തപുരം, കൊല്ലം, എറണാകുളം) വിലയിരുത്തി കഴിഞ്ഞിരിക്കുന്നു. മറ്റ് ജില്ലകളിൽ തുടർന്നുള്ള മാസങ്ങളിൽ വിലയിരുത്തൽ പ്രതീക്ഷിക്കുന്നു. ഇതിന്റെ അടിസ്ഥാനത്തിലായിരിക്കും അടുത്ത ഫണ്ട് റിലീസിംഗ്. നിലവിൽ അമൃത് പദ്ധതിയുടെ പദ്ധതി വിഹിതം കൈമാറ്റം ചെയ്തിരുന്നത് പി.എഫ്.എം.എസ്. എസ്.എൻ.എ. സിസ്റ്റം വഴിയായിരുന്നു. എന്നാൽ കേന്ദ്ര സർക്കാരിന്റെ നിർദ്ദേശാനുസരണം പുതിയ പദ്ധതി വിതരണ സമ്പ്രദായമായ എസ്.എൻ.എ. സ്പർൾ മുഖേന നൽകുന്നതിന് ആദ്യ കേന്ദ്ര ഫണ്ട് വിഹിതത്തിന്റെ പൊപ്പോസൽ കേന്ദ്രസർക്കാരിന്റെ പരിഗണനയിലാണ്. വരുന്ന മാസങ്ങളിൽ ഫണ്ടിംഗ് ലഭ്യത ഉറപ്പാക്കി പൂർണ്ണ വിനിയോഗം സാധ്യമാകും എന്ന് പ്രതീക്ഷിക്കുന്നു. ഒപ്പം ഇതിനായി ഏവരുടെയും സഹകരണങ്ങൾ പ്രതീക്ഷിക്കുന്നു.

കേന്ദ്ര സർക്കാരിന്റെ പ്രത്യേക ധനസഹായ പദ്ധതിയുടെ റിഫോം ബെസ്റ്റ്ഡ് ഭാഗം 13 ൽ ഉൾപ്പെടുത്തി 124 കോടി രൂപ സംസ്ഥാനത്തിന് ലഭിക്കുവാൻ പ്രയത്നിച്ച എല്ലാവർക്കും പ്രത്യേകം അഭിനന്ദിക്കുന്നു. നമ്മുടെ നഗരങ്ങളുടെ അടിസ്ഥാന വികസനത്തിന് ഈ തുക ഉപയോഗപ്പെടുമെന്ന് പ്രതീക്ഷിക്കുന്നു.

ജില്ലാ സന്ദർശനങ്ങളുടെ ഭാഗമായി തൃശ്ശൂർ ജില്ലയിലെ വിവിധ പദ്ധതികൾ സന്ദർശിക്കുവാനും പുരോഗതി വിലയിരുത്തുവാനും സാധിച്ചു. തൃശ്ശൂർ, ഗുരുവായൂർ നഗരസഭകളുടെ അമൃത് പദ്ധതി പ്രവർത്തനങ്ങൾ മാതൃകാപരവും നവീനവുമായിരുന്നു. ഇതിന്റെ പ്രവർത്തനങ്ങൾ നടത്തിയ ഭരണസമിതികൾക്കും, ഉദ്യോഗസ്ഥർക്കും പ്രത്യേകം അഭിനന്ദനങ്ങൾ അർപ്പിക്കുന്നു.

മിഷൻ ഡയറക്ടർ



തദ്ദേശ ഭിനാമോഷണത്തിന്റെ ഭാഗമായി സംഘടിപ്പിച്ച എക്സിബിഷന്റെ ഉദ്ഘാടന ചടങ്ങ്



തദ്ദേശ ഭിനാമോഷണത്തിന്റെ ഭാഗമായി സംഘടിപ്പിച്ച വിജാബര ലോഷയാത്ര

അമൃത് വാർത്താ പത്രിക ഉള്ളടക്കം

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- 5 തദ്ദേശ ദിനാഘോഷം
- 10 നഗരങ്ങളുടെ മുഖഛായ മാറ്റി
കുളങ്ങളുടെ പുനരുദ്ധാരണം
- 12 The Anaerobic Baffled Reactor (ABR):
An Improved Solution for Kerala's
Septic Tanks
- 15 “Report on Apt Integrated
Water Governance Ensuring Blue
Print on Water Security in India”
- 28 TULIPS





തദ്ദേശ ദിനാഘോഷത്തിന്റെ ഭാഗമായി സംഘടിപ്പിച്ച കലാവിരുന്ന്





തദ്ദേശ ദിനാഘോഷം ഫെബ്രുവരി 19-ാം തീയതി ഗുരുവായൂരിൽ വച്ച് നടന്നു. ബഹു. മുഖ്യമന്ത്രി ആഘോഷ പരിപാടികൾ ഉദ്ഘാടനം ചെയ്തു. ത്രിതല പഞ്ചായത്ത് ഭരണ സംവിധാനത്തിന് അടിത്തറയായ റിപ്പോർട്ട് തയ്യാറാക്കിയ “പ്ലാൻ പ്രോജക്ട് കമ്മിറ്റിയുടെ അദ്ധ്യക്ഷനായിരുന്ന ബൽവന്ത് റായ് മേത്ത പഞ്ചായത്ത് രാജിന് നൽകിയ സാഭാവന കണക്കിലെടുത്ത് അദ്ദേഹത്തിന്റെ ജന്മദിനമായ ഫെബ്രുവരി 19 തദ്ദേശ ദിനമായി ആചരിക്കപ്പെടുന്നു.

ഈ വർഷത്തെ തദ്ദേശ ദിനാഘോഷ പരിപാടികൾ ഗുരുവായൂരിൽ വച്ച് നടത്തപ്പെട്ടു. ബഹു. മുഖ്യമന്ത്രി, ബഹു. മന്ത്രിമാർ, ജന പ്രതിനിധികൾ, തദ്ദേശ സ്ഥാപനങ്ങളിലെ ഉദ്യോഗസ്ഥർ, പൊതുജനങ്ങൾ ഉൾപ്പെടെ ജന പങ്കാളിത്തം കൊണ്ട് ശ്രദ്ധേയമായിരുന്നു ഈ വർഷത്തെ തദ്ദേശ ദിനാഘോഷം. തദ്ദേശ ദിനാഘോഷവുമായി ബന്ധപ്പെട്ട് ഫെബ്രുവരി 14 മുതൽ വ്യത്യസ്തമായ വിവിധ പരിപാടികൾ സംഘടിപ്പിക്കപ്പെട്ടു.



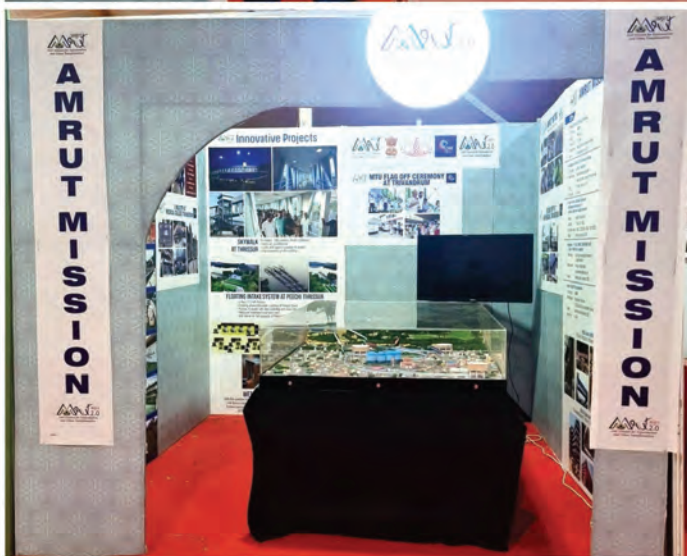


ഫെബ്രുവരി 14 ന് തദ്ദേശ ദിനാഘോഷത്തോടനുബന്ധിച്ച് നടന്ന എക്സിബിഷൻ ബഹു. തദ്ദേശ സ്വയംഭരണ വകുപ്പ് മന്ത്രി ഉദ്ഘാടനം ചെയ്തു. വിവിധ വകുപ്പുകളുടെയും സ്ഥാപനങ്ങളുടെയും സ്റ്റാളുകൾ എക്സിബിഷന്റെ ഭാഗമായി ഉണ്ടായിരുന്നു. വളരെയധികം വിജ്ഞാനപ്രദവും വിവരദായകവുമായിരുന്നു എക്സിബിഷൻ. എക്സിബിഷൻ ഉദ്ഘാടനത്തോടനുബന്ധിച്ച് 'നിറവ്' എന്ന സംഗീത നിശയും സംഘടിപ്പിച്ചിരുന്നു. ഫെബ്രുവരി 15 ന് ഇരുപതിൽപരം തദ്ദേശ സ്ഥാപനങ്ങൾ പങ്കെടുത്ത വിളംബര ഘോഷയാത്ര നടന്നു. തുടർന്ന് മല്ലൂരി ടീം അവതരിപ്പിച്ച വാദ്യോപകരണ സംഗീത പരിപാടി ഉണ്ടായിരുന്നു. ഫെബ്രുവരി 16 ന് 'ഇപ്റ്റ്' നാട്ടരങ്ങ് അവതരിപ്പിക്കുന്ന "പാട്ടും പടവെട്ടും" എന്ന പരിപാടി ഉണ്ടായിരുന്നു. ഫെബ്രുവരി 17 ന് പ്രൊഫ. ആർ.എൽ.വി. രാമകൃഷ്ണൻ & ടീം അവതരിപ്പിച്ച 'നൃത്ത ത്രയം' എന്ന പരിപാടിയും ചലച്ചിത്ര താരം കൃഷ്ണ പ്രഭ അവതരിപ്പിച്ച മെഗാ ഷോയും ആഘോഷ പരിപാടികളുടെ ഭാഗമായി സംഘടിപ്പിച്ചിരുന്നു. ഗായകൻ പി. ജയചന്ദ്രൻ അനുസ്മരണ പരിപാടിയായ 'ഉപാസന' എന്ന പരിപാടി ഫെബ്രുവരി 18 ന് വൈകിട്ട് 6 മണിക്ക് നടന്നു. വിവിധ വേദികളിലായി വിവിധ ധങ്ങളായ പരിപാടികളും ചർച്ചാ ക്ലാസ്സുകളുമായി നടന്ന പരിപാടിയിൽ സംസ്ഥാനത്തെ മുഴുവൻ തദ്ദേശ സ്ഥാപനങ്ങളിലെ പ്രതിനിധികളും ഉദ്യോഗസ്ഥരും പങ്കെടുത്തു. സമ്മേളനത്തിൽ ഈ വർഷം മികച്ച തദ്ദേശ സ്ഥാപനങ്ങൾക്കുള്ള സ്വരാജ് ട്രോഫി ഉൾപ്പെടെയുള്ള വിവിധ സമ്മാനങ്ങൾ വിതരണം ചെയ്തു.











നഗരങ്ങളുടെ മുഖഛായ മാറ്റി കുളങ്ങളുടെ പുനരുദ്ധാരണം

ഒരു പ്രദേശത്തിന്റെ ഭൗതികവും സാംസ്കാരികവുമായ വികസനത്തിനും നിലനിൽപ്പിനും ഒഴിവാക്കാനാകാത്ത ഘടകമാണ് ജലാശയങ്ങൾ. ചെറുതും വലുതുമായ ജലാശയങ്ങൾ കൊണ്ട് സമൃദ്ധമാണ് കേരളം. ഈ ജലാശയങ്ങളിലെ പ്രധാന ഘടകമാണ് കുളങ്ങൾ. മികച്ച ഭൂഗർഭ ജലസ്രോതസ്സുകളാണ് ഇത്തരം കുളങ്ങൾ. നഗര വൽക്കരണ തോത് കൂട്ടുന്നതിനനുസരിച്ച് ജീവിത ചര്യകളിലുണ്ടായ മാറ്റം കുളങ്ങളുടെ പരിപാലനത്തെയും സംരക്ഷണത്തെയും ബാധിച്ചു. നഗര പ്രദേശങ്ങളിൽ സ്ഥിതിചെയ്യുന്ന മിക്ക കുളങ്ങളും ഇന്ന് ഉപയോഗ ശൂന്യമാണ്. പ്ലാസ്റ്റിക്കും മറ്റ് മാലിന്യങ്ങളും കൊണ്ട് നിറഞ്ഞ് പരിസരമാകെ മലിനമാക്കുകയും കൊതുകുകളുടെ പ്രജനന കേന്ദ്രങ്ങളായിരിക്കുകയാണ്.

ഈ അവസ്ഥയിൽ നിന്ന് കുളങ്ങളെ സംരക്ഷിക്കുകയും ഭൂഗർഭ ജലസ്രോതസ്സ് ഉറപ്പ് വരുത്തുകയും ചെയ്യുക എന്ന ലക്ഷ്യത്തോടെ അമൃത് 2.0 പദ്ധതിയിലുൾപ്പെടുത്തി സംസ്ഥാനത്തെ വിവിധ നഗരസഭകളിലായി 368 കുളങ്ങളാണ് പുനരുദ്ധാരണം നടത്തുവാനായി നിശ്ചയിച്ചിട്ടുള്ളത്. ഇതിൽ 72 കുളങ്ങളുടെ പുനരുദ്ധാരണ പ്രവൃത്തികൾ പൂർത്തീകരിച്ചു.

സംസ്ഥാനത്തെ വിവിധ നഗരസഭകളിൽ സ്ഥിതി ചെയ്യുന്നതും മികച്ച ജലാശയങ്ങളും പരമ്പരാഗത ജലസ്രോതസ്സുകളുമായ 368 കുളങ്ങളുടെ പുനരുദ്ധാരണ പ്രവൃത്തികളാണ് അമൃത് പദ്ധതിയിൽ ഉൾപ്പെടുത്തി നടപ്പാക്കുന്നത്. വളരെ നാളുകളായി ശോചനീയാവസ്ഥയിൽ ഉപയോഗ ശൂന്യമായി കിടന്നിരുന്ന ജലാശയങ്ങളെ പുനരുദ്ധാരണത്തിലൂടെ നാടിന് ഉപയോഗപ്രദമാക്കുവാനും ജലസ്രോതസ്സായി സംരക്ഷിക്കുവാനും സാധിക്കും. ജലം സംഭരിക്കുന്നതിനും, ജലസേചനത്തിനും, കുളിക്കുന്നതിനും മറ്റാവശ്യങ്ങൾക്കും ഉതകുന്ന രീതിയിലാണ് ഈ കുളങ്ങൾ നവീകരിച്ചിരിക്കുന്നത്.



പുനരുദ്ധാരണ പ്രവൃത്തികൾ പൂർത്തീകരിച്ച മണ്ണാർക്കട മൂനീസിപ്പാലിറ്റിയിലെ ചോമേരി കുളം



പുനരുദ്ധാരണ പ്രവൃത്തികൾ പൂർത്തീകരിച്ച വടകര
മുനിസിപ്പാലിറ്റിയിലെ ഇല്ലത്ത് താഴെ കുളം



പുനരുദ്ധാരണ പ്രവൃത്തികൾ പൂർത്തീകരിച്ച തൃശ്ശൂർ
കോർപ്പറേഷനിലെ കൈത കുളം



പുനരുദ്ധാരണ പ്രവൃത്തികൾ പൂർത്തീകരിച്ച തൃശ്ശൂർ
കോർപ്പറേഷനിലെ പുത്തൻ കുളം



പുനരുദ്ധാരണ പ്രവൃത്തികൾ പൂർത്തീകരിച്ച നീലേശ്വരം
മുനിസിപ്പാലിറ്റിയിലെ പാലായി കുളം



പുനരുദ്ധാരണ പ്രവൃത്തികൾ പൂർത്തീകരിച്ച നീലേശ്വരം
മുനിസിപ്പാലിറ്റിയിലെ നാരാകുളങ്ങൾ കുളം



പുനരുദ്ധാരണ പ്രവൃത്തികൾ പൂർത്തീകരിച്ച പന്തളം
മുനിസിപ്പാലിറ്റിയിലെ വേമ്പു കുളം



പുനരുദ്ധാരണ പ്രവൃത്തികൾ പൂർത്തീകരിച്ച ആന്തൂർ
മുനിസിപ്പാലിറ്റിയിലെ കുഞ്ഞുകുളം



പുനരുദ്ധാരണ പ്രവൃത്തികൾ പൂർത്തീകരിച്ച കൊയിലാണ്ടി
മുനിസിപ്പാലിറ്റിയിലെ നാനാചിറ കുളം



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The Anaerobic Baffled Reactor (ABR): An Improved Solution for Kerala's Septic Tanks

The increasing demand for more efficient wastewater treatment systems, driven by stricter discharge standards, has highlighted the benefits of anaerobic digestion, especially for high-strength wastewater. In comparison to aerobic processes, anaerobic systems consume less energy and generate less sludge, resulting in lower operational costs. Over the years, high-rate anaerobic reactors have been developed to address the primary challenge of anaerobic treatment—long hydraulic retention times (HRT). These high-rate reactors separate HRT from solid retention time (SRT), allowing slow-growing anaerobic bacteria to remain in the system despite wastewater flow, minimizing the HRT and significantly improving removal efficiencies.

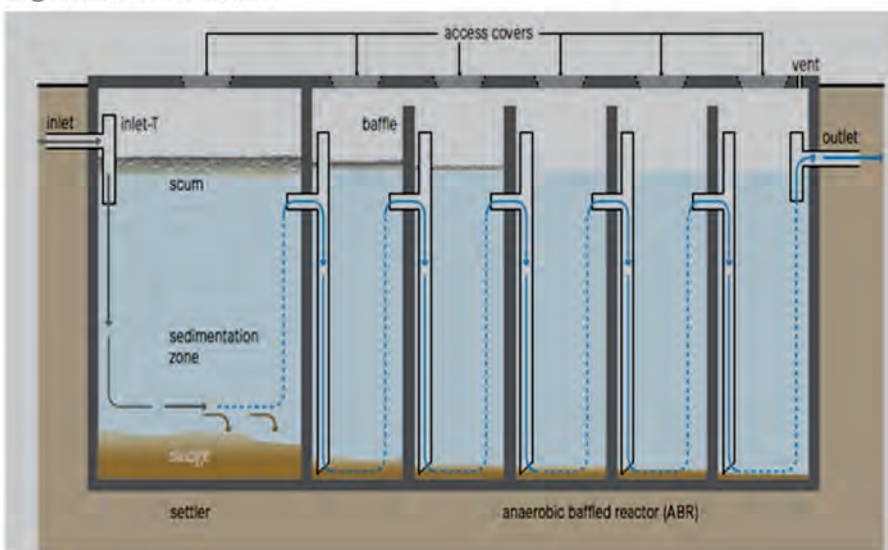
Background and Theory

One such high-rate reactor is the Anaerobic Baffled Reactor (ABR), which can be seen as an improved version of traditional septic tanks. Developed by McCarty and colleagues at Stanford University, the ABR is designed as a series of upflow anaerobic sludge blanket (UASB) reactors, divided into multiple compartments. These reactors guide wastewater through a series of vertical baffles that force it to flow under and over each compartment. This up-and-down flow reduces bacteria washout, ensuring the retention of active biomass without the need for fixed media. The bacteria within the reactor rise and settle with gas production in each compartment but move horizontally at a slow rate, resulting in an SRT of approximately 100 days at an HRT of 20 hours. This slow horizontal movement facilitates better interaction between wastewater and biomass, even with short HRTs ranging from 6 to 20 hours.

The anaerobic digestion process in the ABR involves several bacterial groups. The hydrolytic fermentative (acidogenic) bacteria break down complex polymers into organic acids, alcohols, sugars, hydrogen, and carbon dioxide. Hydrogen-producing and acetogenic organisms convert these products into acetate and carbon dioxide, while methanogens convert these compounds into methane. The four stages of anaerobic digestion are: hydrolysis, acidogenesis, acetogenesis, and methanogenesis.

Although ABRs are not widely deployed at a large scale, they offer several advantages over other established systems. One of the most significant benefits is the ABR's ability to separate acidogenesis and methanogenesis along the reactor, allowing different bacterial groups to thrive in their optimal conditions. This separation allows the ABR to function as a two-phase system, which increases bacterial activity by up to four times. Furthermore, the separation helps protect the bacteria from toxic substances and enhances their resistance to environmental fluctuations such as pH, temperature, and organic loading.

Despite their effectiveness in removing organic material and suspended solids from low-strength wastewater, anaerobic processes, including ABRs, are not efficient at removing nitrogen, phosphorus, or pathogenic organisms.



Post-treatment, often aerobic, is necessary to remove residual COD, total suspended solids (TSS), and reduce nutrient and pathogen concentrations. For example, ABRs are often used in the DEWATS (Decentralized Wastewater Treatment System) in peri-urban areas, where a combination of primary sedimentation, ABR, anaerobic filters, and planted gravel bed filters are used for secondary and tertiary treatment.

ABRs require minimal energy, primarily for maintaining temperature, as the flow is driven by the pressure head at the influent. There is no need for mechanical mixing, and the system operates without power during normal conditions. Additionally, methane produced during anaerobic treatment can be captured for energy generation. Anaerobic systems also produce significantly less sludge than aerobic systems. This sludge, if treated properly, can be used as fertilizer, eliminating disposal needs.

Studies have shown that the construction cost of an ABR is 20% less than that of UASB reactors and five times less than a conventional activated sludge plant, making ABRs an affordable option for small towns. The simple design of the ABR makes it easy to build and maintain, making it particularly suitable for low-income areas. Moreover, the system is stable, requiring minimal long-term maintenance and operator expertise.

The ABR can be seen as an improvement to traditional septic tanks, offering more effective treatment through its baffle design and enhanced contact time between wastewater and biomass. This upflow chamber design enhances the removal and digestion of organic matter, achieving BOD reductions of 75-95% and TSS reductions of 80-90%, significantly outperforming traditional septic tanks.

Design Considerations

An ABR typically includes a sedimentation chamber at the front to remove settleable solids. In smaller-scale, stand-alone units, this is integrated into the system, but it can also be separated if necessary (e.g., using existing septic tanks).



Units without a settling compartment are suited for (semi-) centralized treatment plants, where modular or prefabricated units are used. Common inflow ranges from 2 to 200 m³ per day, and key design parameters include an HRT of 48 to 72 hours, upflow velocity below 0.6 m/h, and 3 to 6 upflow chambers. The chambers can be connected via vertical pipes or baffles, with accessibility for maintenance ensured through access ports.

In terms of biogas production, ABRs typically do not capture methane due to its limited volume, but the system should be vented to allow for controlled release of gases.

Appropriateness for Kerala

The ABR presents a viable solution to the challenges faced by Kerala's poorly performing septic tanks, which are often ineffective at treating wastewater, particularly in densely populated areas. The ABR offers an efficient, low-cost alternative to traditional septic tanks and can be adapted to various scales, from households to larger community-based systems. It is especially suited for areas with a consistent generation of blackwater and greywater. ABRs can be implemented in decentralized settings, where existing simplified sewer systems are in place, and are particularly advantageous where land space is limited, as they are typically installed underground.

However, ABRs are not particularly effective at removing nutrients and pathogens, meaning that additional post-treatment, such as aerobic treatment or nutrient removal technologies, may be necessary to meet stringent effluent standards.

Health and Safety Aspects

Under normal conditions, ABR systems prevent user contact with influent and effluent. However, both the effluent and sludge contain high levels of pathogenic organisms and must be handled with care. The effluent may also contain odorous compounds, which may require additional polishing treatment. Careful design and location of ABRs are essential to minimize odour-related issues in the surrounding community.

Operation and Maintenance

ABRs typically require a start-up period of about 8 months to reach full treatment capacity, as the anaerobic biomass needs time to establish itself. To reduce the start-up period, the ABR can be inoculated with anaerobic bacteria, such as fresh cow dung or septic tank sludge. Maintenance primarily involves monitoring scum and sludge levels, with periodic desludging every 1 to 3 years, using motorized emptying and transport technologies. Routine inspections are necessary to ensure the system remains watertight.



Construction of different toilet blocks connected to two pre-fabricated fibreglass reactor comprising a settling chamber, an aerobic baffled reactor and a final anaerobic filter unit. Source: BORDA (2009)

Pros and Cons

Pros:

- Resistant to organic and hydraulic shock loads
- No electrical energy required
- Low operating costs
- Long service life
- High BOD reduction
- Low sludge production, with stabilized sludge
- Moderate area requirement (can be installed underground)

Cons:

- Requires expert design and construction
- Limited reduction of nutrients and pathogens
- Effluent and sludge require further treatment or appropriate disposal

In conclusion, the ABR offers a promising solution to the wastewater treatment challenges in Kerala, providing an effective and cost-efficient alternative to traditional septic tanks. While further treatment may be necessary to remove nutrients and pathogens, the ABR represents a significant improvement over current systems, particularly in terms of organic matter removal and reduced operational costs.

References.

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അമ്യൂൽ 2.0 പദ്ധതിയിൽ ഉൾപ്പെടുത്തി നവീകരിച്ച ആലപ്പുഴയിലെ പഞ്ചാരത്തോട്



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“Report on Apt Integrated Water Governance Ensuring Blue Print on Water Security in India”

Governance is a complex product of social and political interactions in which different societal actors are involved at different levels. In the case of water governance, these interactions directly generate policy outcomes affecting drinking Water, agriculture, food, health, Education, Economic development and poverty alleviation. Indeed, Water governance is not about a single organisation that manages a water system; it is about the ability of mutual development to add value (Hamdy and Ragab, 2009; Hamdy et al., 2011). Nowadays, many countries are in the process of changing how water is governed. From a practical point of view, critically means formulating, setting in place and implementing water policies, legislation and regulations (Tortajada,2010). Governance should reflect broader concerns, such as issues of **accountability, control, responsiveness, transparency and participation, in addition to important issues like economic growth and efficiency (OECD, 2011)**. Water governance requires organisational/managerial, financial, legal and institutional, and social capacities for sustainability of efforts and capacities for efficient water Governance ensuring water Security.

Water Governance: What Is It All About?

Water governance has more to do with people than water. Therefore, the emphasis should be on connecting people in order to combat compartmentalisation. From a governance perspective, water management is not only about Hydrology, hydraulics, or water purification/treatment plants, but rather the hearts and minds of the people and their vital interests, those requiring the involvement of all relevant stakeholders in bring forth the effective water Governance and water security.

Water governance is about “**joint decision-making**”. It is about consensus-building and conflict resolution, as well as external legitimisation, which implies accountability. It mainly focuses on process and progresses. Governance arrangements can only work if the processes associated with the underlying systems are understood at levels.

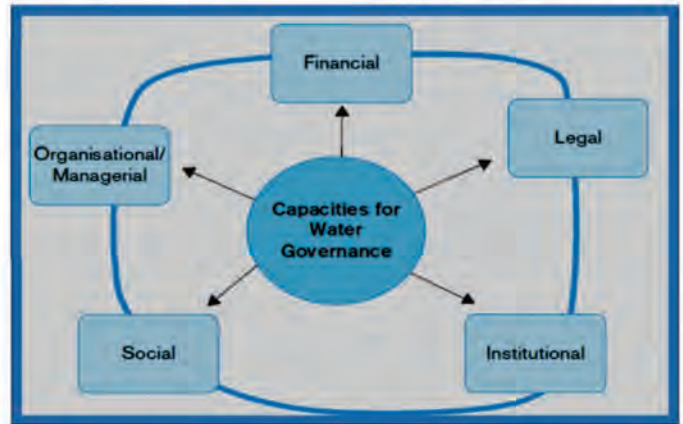


Fig: 1: Capacities of water Governance (OECD)
Ref: (OECD Documents)

It is to be emphasised that the concept of governance as applied to water refers to the capability of a social system to mobilise energies in a coherent manner for the sustainable development of water resources. Good Water Governance denotes the **Social, Political, Economic, Environmental, Institutional/ administrative perspectives that encourage using water resources effectively, efficiently and judiciously**. It essentially distinguishes what amount of water, when and how it is distributed, and who has the right to water, its related services, and their benefits. Most of the persistent challenges in the world are about water and its availability in terms of **quantity and quality**. Such challenges can only be effectively addressed through adequate governance of available water resources (**surface and sub-surface water resources**).

It is a major reason for concern that how societies choose and manage to control their water resources and services will significantly impact both the sustainability of water resources and the livelihoods of people. Accessing water resources is ultimately a necessity of survival, and in many circumstances, it can assist in the avoidance of the cycle of poverty. Therefore, reducing global poverty and improving the standard of living depends on improving water governance aspects.

By addressing the vulnerability of the source water and properly adopting strategies on the protection plans whereby allocating the available water resources judiciously for multifarious usages to minimize conflicts. Good water governance is essential for achieving water security at micro to macro levels. It contains social, economic, political, and environmental components that must all be carefully considered and effectively addressed to prevent disagreements. Water governance faces a multifaceted challenge due to the elusive nature of water. Water related conflicts arises between the economic and ecosystem sectors over water allocation. Human interventions, driven by the pursuit of short-term economic gains, often disrupt flow regimes, resulting in significant downstream ecosystem losses. The Sustainable Development Goals (SDGs) cannot be attained without effective water resource management/ governance.

Defining Water Governance by various institutions:

At present, there is no universally agreed upon definition for water governance, and its ethical implementation and political dimensions are a matter of National and International debate. Water governance can be perceived in its broadest sense as comprising all **social, political, economic and administrative organizations** and institutions, as well as their relationships to water resource development and management.

The Global Water Partnership (GWP, 2003) defined water governance as the range of political, social, economic and administrative systems that are in place to develop and manage water resources, and the delivery of water services, at different levels of society.

The UNDP (2004) defines water governance as referring to the range of political social and economic processes and institutions through which governments, the private sector and civil society make decisions about how best to use, allocate, develop and manage water resources.

Water governance is therefore the set of systems that control decision-making with regard to water resource development and management. It is therefore more about the way in which decisions are made, i.e. **how, by whom and under what conditions, than about the decisions themselves (Moench et al., 2003).**

Effective Water Governance Coordination (Reference: Moech and etal 2003)



Figure 2: Effective Water Governance Coordination (Reference: Moech and etal 2003)

Water Governance: The Four Dimensions by Tropp (2005).

Water governance has four dimensions: **Social, Economic, Environmental and Political (Tropp, 2005).** The social dimension points to the equitable use of Water Resources. The economic one draws attention to the efficient use of water resources and its role in over-all Economic growth.



Figure 3 : Water Governance Dimensions (Source: Tropp, 2005).

The political dimension is mainly directed at granting water stakeholders and citizens at large equal democratic opportunities to influence and monitor political processes and outcomes. It aims to ensure greater water equity for women as well as other socially, economically and politically disadvantaged groups.

The environmental dimension of water governance refers to sustainable water use and eco-system integrity, with emphasis on its essential role for maintaining a healthy environment. Water quality degradation is consequently a serious threat to environmental sustainability and public health, and it will also reduce the use options of the water that is available.

OECD Principles of Water Governance:

The OECD Principles on Water Governance provide a framework for effective, efficient, and inclusive water management. They emphasize the importance of clear roles and responsibilities, ensuring that all levels of government are coordinated and coherent in their actions. Stakeholder engagement is crucial, promoting inclusive and informed decision-making. Transparency and integrity are essential to building trust and accountability in water governance. The principles also advocate for robust financial management to ensure sustainable water services. Innovation and data are encouraged to drive continuous improvement. Capacity development is vital for equipping institutions and individuals with the skills needed for effective water governance. Regular monitoring and evaluation help track progress and adapt strategies as needed. The principles also highlight the importance of managing trade-offs between water policy objectives. Finally, they underscore the need for resilience, preparing for and adapting to water-related risks and uncertainties. The OECD principles are adopted in many of the developing countries towards effective, efficient trust and Engagement based water governance.

OECD PRINCIPLES AND PILLARS OF WATER GOVERNANCE

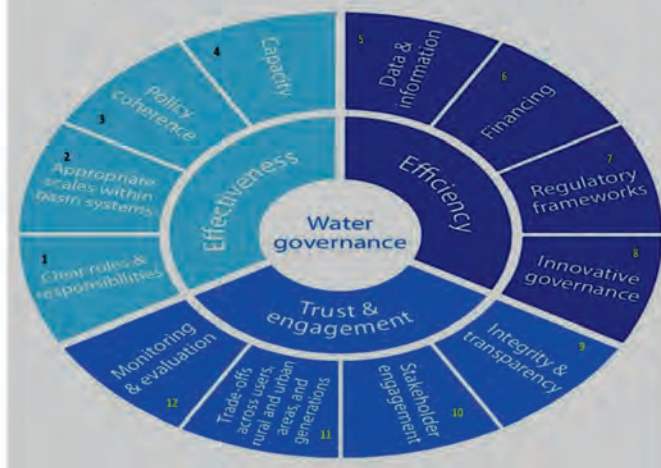


Fig: 4 :OECD PRINCIPLES AND PILLARS OF WATER GOVERNANCE

OECD (Organization of Economic Cooperation and Development) Principles of Water Governance



OECD: "12. PRINCIPLES OF WATER GOVERNANCE"
(REF: OECD Document)

Water Governance: Common Pillars:

PILLARS/ FRAMEWORK OF WATER GOVERNANCE

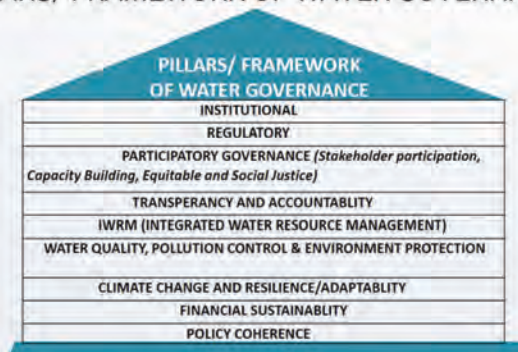


Figure No:5 : Pillars/ Frame work of water Governance developed from inspiration to OECD document.

Most governance principles for managing water resources and services are based on common pillars. They have been variously combined in different frameworks, thereby emphasising the following universal aspects of governance (Lockwood *et al.*, 2008):

- **Legitimacy of the organisations/ Authority to government;**
- **Transparency in decision-making processes;**
- **Accountability of actors with regard to their responsibilities, including integrity concerns;**
- **Inclusiveness of the different stakeholders;**
- **Fairness in service delivery or allocation and uses;**
- **Integration of water policymaking at the horizontal and vertical level;**
- **Capacity of the organisations and individuals managing water;**
- **Adaptability to a Changing environment**

Water Governance Cycle:

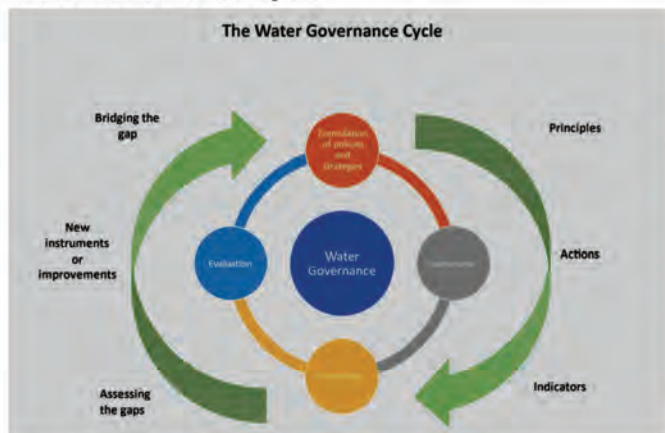


Figure No:6 Water Governance Cycle. (Evolved in due reference to OECD Documents)

The water governance cycle is a framework that outlines the processes and interactions involved in managing water resources sustainably available. It incorporates the roles and responsibilities of various stakeholders, the policies and regulations in place, and the mechanisms for ensuring the effective management of water resources by apt implementation of projects and its appropriate monitoring and evaluation.

1. Assessment/Evaluation and Data Collection:

From the Hydrological perspective, Understanding the water availability, distribution, and quality within a region is the far most criteria. Further to which activities like monitoring of rivers, lakes, groundwater, and precipitation/ rainfall pattern is quite important. The various tools that can be employed are Remote sensing, GIS, hydrological models, Rainfall pattern climate resilience factors and field surveys.

The next in line would be to understand the Socio-economic Assessment involves evaluating water demand and usage patterns across different sectors (agriculture, industry, domestic). The proposed activities include Surveys, economic analysis, and demographic studies.

2. Policy and Legislation:

The Policy Formulation is an important factor to guide water resource management for different sector and its prioritization. This has to be carried out by stakeholder consultations, expert opinion and input, and policy drafting. The output would be in terms of National water policies, regional agreements, and sectoral policies.

Establishing legal frameworks to enforce water policies is an important milestone. Drafting and enacting laws, setting regulations, and creating standard are important in terms of Water laws, regulations, permits, and licenses.

3. Institutional Framework:

It is mandatory to Define roles and responsibilities of various organizations involved in water governance by Creating or Restructuring water management agencies, setting up coordination mechanisms etc, with defined Ministries, regulatory bodies, river basin organizations/Authority and water user associations etc.

Enhancing the capabilities of institutions and individuals to manage water resources by various capacity building Training programs, workshops, technical assistance, and knowledge sharing are to be done to enhance skilled workforce, enhanced institutional capacities, and improved management practices.

4. Planning and Decision Making:

Integrated Water Resources Management (IWRM) aspect to be promoted by Coordinating the development and management of water, land, and related resources. The multi-stakeholder platforms, scenario analysis, and planning processes are to be in place to develop IWRM plans, basin management plans, and strategic action plans.

Participatory Planning involving stakeholders in the decision-making processes through public consultations, participatory mapping, and stakeholder meetings to bring forth Inclusive plans, stakeholder buy-in, and improved governance.

5. Implementation Strategy:

Executing water management projects and initiatives like construction of infrastructure, restoration projects, and conservation programs should be perfectly planned and implemented in terms of Dams, irrigation systems, wastewater treatment plants, and protected areas.

All the systems operation and management should be a day-to-day affair with defined trouble shooting mechanism of water management systems. Effective Maintenance of infrastructure, water allocation, and quality control are the prime factors to be considered for efficient water delivery, reduced losses (Non-Revenue Water), implementation of **"SMART elements"** and consistent water quality monitoring.

6. Monitoring and Evaluation:

Performance Monitoring by tracking the effectiveness of water management strategies and projects through data collection, performance indicators, and regular reporting with various Monitoring and Evaluation reports, performance dashboards, and compliance audits.

Assessing the long-term impacts of water management policies and projects with Impact assessment studies, cost-benefit analysis, and feedback loops are important through regular Evaluation reports, impact assessments, policy recommendations, and adaptive management strategies.

7. Feedback and Adaptation:

Incorporating lessons learned into future planning and implementation, through Review meetings, policy adjustments, and adaptive management practices, will help to revised policies, improved practices, and enhanced resilience.

Ensuring continuous stakeholder involvement and feedback through Community forums, stakeholder surveys, and collaborative platforms. This can bring forth sustained stakeholder engagement, trust building, and cooperative management. The water Governance cycle is reiterative, allowing for continuous improvement and adaptation in water governance to address emerging challenges and changing conditions time to time.

Keys to Good Governance:

For good governance to develop, overall conditions and the general environment must be made favourable: the parties concerned must be amenable to collective decision-making; effective and functional organisations need to be developed; and policy, legal and political frameworks must be suitable to the goals that are being pursued for the common good (Rhoades, 1996; Loolman, 2003; Tihonen, 2004). For these complex interrelationships to succeed, it must be taken into consideration that they are interdependent and that no single sector, public or private, has the knowledge, information or power to solve the changing societal challenges on its own. Today, it is well recognised, both politically and technically, that water security, food security and environment sustainability will never be achieved unless we have good water governance. The keys to good governance are summarised as below:



Figure : 7, Keys to Good Water Governance
(Source: Abdel-Dayem and Odeh, 2010).

Water Governance: Multilevel Frame Work System:

The over-abstraction and contamination of aquifers and water resources worldwide pose significant challenges to food security, ecosystem health, and safe drinking water supply. This also increases the likelihood of subsidence and other serious repercussions.

Water is highly sensitive to and reliant on multi-level governance scenarios due to its inherent qualities. It connects people, places, and sectors across geographical and temporal scales, meaning that hydrological and administrative boundaries often do not align. Freshwater management, covering both surface and groundwater, is a topic of global and local importance that involves a diverse range of public, private, and non-profit stakeholders in decision-making, policy formulation, and project implementation.

Water is a very capital-intensive industry that requires significant investment, and water policy is complex and interconnected with crucial areas of development such as health, environment, agriculture, energy, spatial planning, regional development, and poverty alleviation. It creates interdependencies across government levels that require coordination among all line departments and community organization to avoid fragmentation.

Dealing with future water difficulties raises several questions such as "who should do what?", "why?", "at what level of government?", and "how?". Effective policy responses will only be viable if stakeholders are adequately engaged, cohesive policies are in place, and regulatory frameworks are well-designed. Additionally, sufficient capacity, integrity, and transparency should be ensured, and appropriate and accessible information should be made available.

To be fit for the future, institutions must adapt to changing circumstances, and policy continuity and political will are crucial in transitioning to more inclusive and sustainable practices.

The lack of adequate governance is one of the most significant difficulties confronting water policy formulation and execution.

Effective water policies require inclusive decision-making. However, the concept of "**Integrated Water Resources Management**" has led to inconsistencies within and across countries. Therefore, it is essential to have operationalization frameworks that consider the short, medium, and long-term. The principle is aim to help governments at all levels develop water governance that addresses current and future water concerns.

To effectively tackle current and future challenges, it is crucial to establish strong public policies that aim to achieve measurable objectives within specific time frames and at an appropriate scale. This requires a clear allocation of responsibilities among competent authorities, along with continuous monitoring and evaluation. Effective water governance can play a vital role in the development and implementation of such policies, with shared responsibility among different levels of government, civil society, businesses, and a diverse range of stakeholders. Through collaboration, policymakers can realize the economic, social, and environmental benefits of good water governance.

Water Governance: The Challenges:

The challenges of water governance are enormous when it comes to bureaucratic implementation, public participation, sustainable management of water resources, and the provision of water services. Different interpretations of integrated water management, competing interests among different sectors/stakeholders, power dynamics, and lack of capacity-building are just some examples of the challenges involved. It is worth noting that water decisions are anchored in governance systems across three levels: government, civil society and the private sector. Facilitating dynamic interactions – dialogues and partnerships – among them is critical for improving water governance reform and implementation (Rogers et al., 2003; UNDP.). The governance of multi-purpose and hydrologically interconnected natural resources requires many functions in order to provide efficient, equitable and sustainable services where by many different actors are involved in water governance and the resulting governance structures.

Water Governance: Major Coordination Gaps:

The below figure: shows the major types of coordination gaps found in water governance in India. In practice, many of these gaps overlap in terms of the solution intended to address them. This can be clearly observed in the definition of each one.

Multi-level Governance Framework : Mind the Gaps, Bridge the Gaps



Figure: 8: Water Governance: Multilevel Coordination Gaps:
(Evolved from OECD Document reference)

- ♦ **Objective Gap:** The objective gap in water governance involves a disparity between ambitious policies and their actual implementation. Inadequate infrastructure and financial constraints hinder effective water management. Poor coordination among stakeholders further exacerbates the issue. Community involvement is often insufficient, leading to policies that fail to address local needs.
- ♦ **Administrative Gap:** Geographical Mismatch between Hydrological and Administrative Boundaries.
- ♦ **Information Gap:** Asymmetries of Information between various authorities in-charge of policy making or implementation of water policy and between public and non- Governmental actors.
- ♦ **Policy Gap:** Sectoral fragmentation of water -related tasks amongst Government ministries and agencies that hinders integrated policy Development.
- ♦ **Capacity Gap:** Local institutions actors have insufficient capacity on water management to effectively apply water policy in terms of scientific and technical competencies, size and Quality of Infrastructure etc..
- ♦ **Funding Gap:** Unstable or insufficient revenues undermine effective implementation of water responsibilities at various level of Governance.
- ♦ **Accountability Gap:** The accountability gap in water governance clearly bring forth a lack of strong delineation of responsibilities among various governing bodies/ stakeholders. This results in inefficiencies and mismanagement of water resources. Public participation is often limited, leading to a disconnect between policy-making and community needs. Additionally, insufficient regulatory frameworks and enforcement exacerbate the problem, hindering sustainable water management.

Water Governance and Water Management:

The terms “Water governance” and “Water Management” are sometimes used interchangeably, but water governance should be distinguished from water management. Water management is about achieving goals, preferably in a functionally and socially responsive and efficient manner, with a given set of means and largely within a given set of conditions and constraints. Water governance is about identifying, choosing or adhering to values and translating these values. This is the key difference between water governance and IWRM (Lautze et al., 2011).



Figure No: 9 The IWRM-Governance Nexus.
Source: Abdel-Dayem and Odeh, 2010.

Water Governance in Sectoral Water Management:

Good water governance in the various sectors like agriculture, Municipal and rural/Urban water supply, industrial usages etc entails shifting from a generally construction-oriented focus to a management perspective. Some prescriptions for improved Sectoral water governance include:

- **Treating water as an economic good;**
- **Decentralisation and establishing effective participatory structures and processes;**
- **Stopping water management fragmentation and shifting to IWRM;**
- **Mainstreaming gender issues in water resource use and management;**
- **Treated water reuse in industries should be made mandatory,**
- **Appropriate maintenance and management of water distribution infrastructures,**
- **Maintaining the quantity and quality of water resources**
- **Introducing new implemental water laws and policies; and**

Declaring water as state property and creating water rights.

Overall, it should be remembered that, without good water governance, it would not be possible, in any country, to achieve water security on a long-term basis.

Current Water Governance/Management Scenario in India:

Despite the growing demand for a shift in water governance from a **traditional engineering approach to a more holistic integrated water resource management and governance framework**, are yet to make any perceptible change in their water governance architecture. This reluctance to change has resulted in numerous ecological problems and conflicts at different levels, with several gaps in existing institutional mechanisms and statutes.

To address these emerging challenges in water governance in India, an attempt has been made to chart a path by defining the broad outlines of a national water policy, as well as a state water policy (2008) specific to Kerala. However, most states in India are yet to fully adopt Integrated Water Resource Management (IWRM). **India's hydro-technocratic sector continues to follow outdated concepts of water resource development, prioritizing short-term economic gains over long-term sustainability issues.**

India is trying to make significant efforts over the past decade to establish an all-encompassing framework for water governance. In 2016, two bills - **the Draft National Water Framework Bill and the Model Bill for the Conservation, Protection, Regulation, and Management of Groundwater were proposed.** Additionally, a report titled '**A 21st Century Institutional Architecture for India's Water Reforms**', was published by a committees led by Mihir Shah, an expert in economics, water, and Rural development. In 2019, the Ministry of Jal Shakti established a committee of independent experts, led by Mr. Shah, to draft a new National Water Policy. While the report was submitted in 2021, the draft policy has yet to be presented for consideration in the parliament.

Although there have been efforts for a shift towards a more holistic and integrated water resource management and governance framework, India's water governance architecture has yet to show significant change. This reluctance to change has resulted in ecological problems and conflicts at various levels, with existing institutional mechanisms and statutes having many gaps. However, efforts are being made to address these challenges by charting a path towards better water governance in India and Kerala. One way to do this is by identifying the broad contours of a national water policy as well as a state water policy (2008) of Kerala. Despite some progress, most states in India have yet to fully embrace the transition to **integrated Water Resource Management.**

As modern civilization has advanced, humans have developed larger engineering infrastructures capable of altering water flow patterns through storage reservoirs/dams and its apt diversion. The widespread use of large dams, accompanied by the implementation of more powerful pumping technologies to abstract groundwater from aquifers, enabled substantial control over surface and groundwater resources.

These dams provided flood control and hydroelectric power, and were beneficial during water shortages and in addressing disparities in water availability across regions. The introduction of irrigation canals facilitated the cultivation of crops in new areas and extended the growing seasons for agricultural produce.

However, over time, it became clear that water scarcity was not just a spatial issue that could be solved by diverting water from water-rich to water-scarce zones. Pursuing a strategy solely focused on intensifying interventions in the hydrological cycle became counter-productive, causing adverse effects on basin ecosystems. Instead, a fresh, holistic, and interdisciplinary approach to water governance is needed, with various stakeholders involved in decision-making and action. Research has shown that the conventional '**business-as-usual**' approach to water management is no longer sustainable and will likely result in significant stress and provoke conflicts among stakeholders.

in 2022, reports suggested that the NITI Aayog, an Indian think-tank, planned to release a draft recommendation paper on various instruments for water trading in public domain for consultations. These instruments under consideration include spot trading, derivative instruments like futures trading, and tradable licenses. Currently, the NITI Aayog has presented a document on exchanging treated wastewater rights and entitlements through a transparent platform. The role of water markets is to enable efficient price discovery that reflects the scarcity value of the resource. This is not the case with ad-hoc water charges often set by governments or water regulators. Efficient water demand management can only happen when the market price signals the physical availability or future scarcity. This presents a clear case for India to consider such markets for efficient water governance.

It is important to understand the need for a systematic approach to water governance that covers both groundwater and surface water related to river basins. River basins operate as integrated systems, where every component is interconnected and changes in one part can affect others across space and time. Water resources should always be perceived as a dynamic element that is integral to the eco-hydrological cycle, rather than just a stock of material resources to be used based on human needs and convenience.

Economically, water has value in all its competing uses, including those for ecosystems. Therefore, it is important to recognize ecosystem services associated with water and flow patterns. Water should be seen as an economic asset within a broader ecological-economic framework. Socially, it is also important to consider affordability and equity criteria when recognizing the value of water.

The river basin, including both surface water and groundwater aquifers, should be the primary unit of governance for water management. Continually increasing water supply is not necessary for sustained economic growth or food security. Instead, focus should be on exploring technologies for water-saving, conservation, and reuse of treated water. A comprehensive evaluation of water development projects within the entire hydrological cycle is necessary.

To understand the social, ecological, and economic roles played by both surface and groundwater resources, a transparent and interdisciplinary knowledge base is essential. Policymaking, decision-making, and cost-sharing across various sectors (such as drinking and domestic, industry, agriculture, urban development, navigation, and ecosystem maintenance) should be integrated. However, priority should be given to poverty reduction strategies, especially in terms of ensuring the right to water and promoting sustainable livelihoods.

Gender considerations play a crucial role in water resource management. **The Dublin Statement acknowledges the important contributions of women in providing, managing, and protecting water resources.**

Water conflicts in India are often caused by a narrow perspective that guides plan to increase water supply. This perspective is driven by traditional engineering and neo-classical economic thinking. This reductionist approach, also known as **'Arithmetic Hydrology,'** oversimplifies governance challenges and overlooks critical variables that can lead to subsequent water management problems.

The existing water governance paradigm, which primarily relies on structural interventions to control water flows, is no longer sustainable. The current water technocracy appears hesitant to implement policy reforms, and efforts to bring about change face resistance from those who advocate for the status quo. Recent calls for change, such as the recommendations presented in the 2016 report 'A 21st Century Institutional Architecture for India's Water Reforms' (Mihir Shah et al.), suggested establishing a multidisciplinary National Water Commission and emphasized the need for greater involvement of social scientists and professionals from management and other specialized disciplines. However, these recommendations were strongly criticized by the existing water technocracy.

Towards a New National Water Policy Devolvement:

In November 2019, India's Ministry of Jal Sakti set up a committee to draft a new water policy. A marked departure from past committees, this was an independent committee of experts beyond direct governmental control, and tasked with recommending innovative policies towards a more effective water governance regime in India. The committee received suggestions from various water governance stakeholders, indicating the need for a paradigm shift in water governance from the traditional constructionist thinking based on structural engineering to a more grounded, realistic and holistic thinking to combat the newer challenges of the twenty-first century. (Mihir Shah's 1st Jayanta Bandyopadhyay Endowment Lecture on Water Governance," XII Biennial Conference of the Indian Society for Ecological Economics, January 31 – February 2, 2024). The committee submitted its report in 2021, pushing strongly to move beyond the command-and-control water governance policy towards a much-needed integrated model. Some of the key recommendations of the committee are as follows:

The policy acknowledges the constraints of continually augmenting water supply and advocates a transition towards demand management. Most importantly, addressing India's water crisis hinges primarily on crop diversification. The policy recommends diversifying public procurement practices to include Nutri cereals, pulses, and oilseeds. These procured crops will play a crucial role in providing children nourishment through mid-day meals and the public distribution system to provide food grains to millions of citizens. Such a measure aims to encourage and incentivise the farmers to diversify their crop choices, leading to substantial water conservation. Additionally, establishing this link can contribute to addressing health challenges, such as malnutrition and diabetes, owing to the superior nutritional composition of these crops. In this regard, initiatives under the National Water Mission, such as the **'SahiFasal'** campaign to nudge farmers in water-stressed areas to grow crops that are not water intensive, are significant.

"Reduce-Recycle-Reuse" shall become the foundational blueprint to ensure integrated urban/rural water supply and wastewater management. This includes ensuring proper treatment of sewage and the eco-restoration of urban river stretches by practising decentralised wastewater management. All non-potable uses of water, such as flushing, fire protection, and vehicle washing, must compulsorily shift to treated wastewater reuse strategy as part of **"Water Circularity"**.

The policy recognises that the substantial quantity of water that is stored in dams is not being judiciously utilised for irrigational purposes. It suggested that deploying pressurised closed conveyance pipelines along with the **Supervisory Control and Data Acquisition systems (SCADA)** and pressurised micro-irrigation can help in expanding irrigated areas at an affordable cost. The policy also identifies improving the water quality as a key priority area. It proposes that the water ministries at the Centre and state levels include a water quality department to ensure the effective monitoring of the possible lapses that result in the dilution of water quality. The policy emphatically advocates for adopting state-of-the-art, low-cost, low-energy, and eco-sensitive technologies for sewage treatment. It also recommends creating a task force to monitor and develop a better understanding of probable water contaminants.

Special focus is advocated to be given to ensuring the supply of water through **"nature-based solutions (NBS)"** which are sustainable, such as the rejuvenation of catchment areas that can be incentivised through compensation for ecosystem services. Specially **designed 'blue-green infrastructure,'** such as rain gardens and bio-swales, restored rivers with wet meadows, wetlands constructed for bioremediation, urban parks, permeable pavements, and green roofs are some of the recommended innovations.

The policy prioritises the sustainable and equitable management of groundwater with special emphasis on the **participatory groundwater management**. Sufficient information on aquifer boundaries, water storage capacities, and flows should be lucidly provided to all the stakeholders, designated as custodians of their aquifers. In this direction, the Central Ground Water Board has undertaken an Aquifer Mapping and Management Programme during the XII Plan, under the Ground Water Management and Regulation scheme, aimed at delineating aquifer disposition and their characterisation to prepare aquifer/area-specific groundwater management plans with community participation. (PIB Report, Ministry of Jal Sakti, Government of India, December 16, 2021)

Predominantly, water policy in India has taken a majorly instrumentalist view of the rivers, catalysing its precipitous degradation over the years. Invoking the reverential relationship that the people of India historically have with the rivers, the new national water policy gives high priority to the imperative of river protection and revitalisation. It recommends several initiatives to restore river flows, such as the revegetation of catchments, regulation of groundwater extraction, river-bed pumping, and the mining of sand and boulders. It also advocates for drafting a Rights of Rivers Act that should include their right to flow, to meander, and to meet the sea. (Sayanangshu Modak, "Rivers and their legal rights," ORF Expert Speak, October 29, 2021)

Government departments at the central and various state levels especially Kerala works in a compartmentalised manner without the much-required communication and consultation that effective water governance in a diverse federal landscape demand. Institutional reforms to ensure greater synergy, coordination, and information-sharing between various governmental departments dealing with irrigation and drinking water, Industrial water usage, surface and groundwater, and wastewater reuse is a crucial prerequisite to ensure an integrated and efficient water governance infrastructure in India. (Mihir Shah, "What India's new water policy seeks to deliver," The Indian Express, October 30, 2021)

The crux of the problem with water governance is the fragmented nature of administrative design, which is further aggravated by federal conflicts over water management. A holistic and integrated planning formulated on the ecosystems-based approach calls for greater vertical federal coordination between the Centre and the states, and horizontal coordination among the states. In addition to the creation of stronger institutions of governance, federal cooperation entails an interplay of politics since river basins are as much a political unit as they are a natural one.

The new policy also recommends the creation of a unified multidisciplinary, multistakeholder National Water Commission, which would become an exemplar for states to follow. Government water departments primarily include only professionals from the civil engineering, hydrology, and hydrogeology fields.

However, to foster an integrated, transdisciplinary, and multidimensional approach to water governance, interaction with other crucial experts in water management, social mobilisation, agronomy, soil science, hydrometeorology, public health, river ecology, and ecological economics is extremely important. Building durable partnerships with the primary stakeholders of water by including them in the consultation of institutional mechanisms, along with drawing from the sustainable indigenous knowledge of water conservation, are also key recommendations for a resilient water policy in India.

What is Water Security?

Water security in India refers to the sustainable availability, quality, and equitable distribution of water resources to meet the needs of individuals, communities, agriculture, industries, and ecosystems while managing risks like scarcity, pollution, and climate variability. Water security in India is about ensuring the **sustainable and equitable availability of water for present and future generations**. Water security in India deals with **four main domains for intervention viz.....**

Water Access: Whether the population & industry have access to water, and will continue to have it after internalising climate change effects & identifying trans-boundary conflicts?

Water Quality: Whether the water accessed by the population has the right quality so as not to threaten public health now, and in the future. Also, whether the industry has access to good quality water to not affect public health through their products & operations.

Water Equity: Whether the population has access to water in sufficient quantity to meet certain minimum living standards, and at the right price based on ability to pay. Similarly, whether industry has enough water at the right price.

Climate Resilience of water systems: How climate change is affecting & will affect water access & equity along with risks associated with water disasters. What adaptation & mitigation measures need to be implemented?

Introduction to India's Water Security:

Water Availability: India is home to 18% of the worldwide human population and 15% of the worldwide animal population. However, it has just 4% of worldwide freshwater assets.

Water Stress: India is classified as a water-stressed country, with per capita water availability decreasing over the years. In terms of per capita water availability, India ranks **133rd out of 180 countries in 2021 with 1,544 cubic meters per year per person**.

According to the Composite Water Management Index (CWMI) report of 2019, around 75% of households in India do not have access to drinking water at their premises, and **70% of the country's water is contaminated**.

Increasing Water Demand: Urban water demand in India is projected to increase from 42 billion cubic meters in 2000 to 74 billion cubic meters in 2050. This increase in demand is due to the growing population, increased urbanization, and rising incomes.

Groundwater depletion: India is the largest user of groundwater with a fourth of the total global withdrawal. Indian cities cater to about 48% of its water supply from groundwater. **The overall stage of groundwater extraction in the country is 60.08%.**

Water security challenges for India:

India is experiencing rapid urbanisation which increases demand for water as affluence levels rise. Besides, a large portion of our agriculture still uses flood irrigation which is the most inefficient method of irrigation apart from the fact that the cropping patterns favour economics over water supply sustainability. To add to these challenges climate change is breathing down our necks which jeopardises water resources & increases risks of water related disasters. Further, India's water resources are heavily polluted, with industrial and agricultural waste, as well as untreated sewage, being discharged into rivers and other bodies of water. According to a report by the Central Pollution Control Board, only 37% of India's wastewater is treated before being discharged into rivers. Further, agriculture accounts for around 80% of India's water consumption, with irrigation being the largest user of water with traditional irrigation practices like flood irrigation and open canals which are highly inefficient, with up to 60% of the water lost to evaporation and seepage. Moreover, the water use efficiency of crops in India is also relatively low compared to other countries, mainly due to the use of low-yielding crop varieties, inadequate soil and water management practices, and insufficient adoption of modern irrigation technologies. Moreover, Groundwater, regarded as a "common pool resource", has historically witnessed little control over its extraction. About 87% of total annual groundwater extraction is for irrigation use in agriculture. India's water resources are also affected by climate change, with changing rainfall patterns and increasing frequency and intensity of droughts and floods. According to the Climate Risk Index 2021, India is the seventh-most vulnerable country to the impacts of climate change. There is a lack of effective water management policies and governance in India, with fragmented institutional arrangements, weak regulatory frameworks, and inadequate enforcement of water laws.

While taking note of all the challenges elaborated above India specific needs to mitigate the challenges are derived with about 22 recommendations agreed under the "Water Vision @ 2047" in 2023. These recommendations are as follows:

1. **Climate change - Adaptation & mitigation strategies for protecting water resources**
2. **Supply & demand management,**
3. **Application of IoT, remote sensing & other technologies,**
4. **Building piped infrastructure network.**
5. **Proper O&M of irrigation infrastructure & promotion of micro-irrigation systems,**
6. **Jan Bhagidari - Enhanced people's participation at community level**

7. **Creating a single state water regulatory body,**
8. **Rationalised & practical water tariffs**
9. **Recycle & reuse of treated wastewater,**
10. **Drinking water source sustainability**
11. **Spring shed management in hilly region**
12. **Managed aquifer recharge strategies**
13. **Promote water budgeting at various levels**
14. **Enhancement of water storage**
15. **Effective sediment management**
16. **According highest priority to drinking water**
17. **Encouragement to inter-basin water transfers,**
18. **Adopting appropriate cropping patterns as per the water resources availability,**
19. **Developing a river basin management plan for all river basins, monitoring river health & maintaining environmental flow in rivers,**
20. **Regular safety & inspection of dams,**
21. **Jal Shakti Abhiyan & conservation programs (Catch the Rain campaign)**
22. **Expedite flood plain zoning with flood forecasting & early warning systems, etc**

For the purpose of action-oriented policy interventions, the above 22 recommendations are grouped into 5 categories as follows:

1. **Climate resilience & River health**
2. **Water Governance,**
3. **Water use Efficiency & Reuse of treated wastewater**
4. **Water storage & Judicious Management**
5. **People's participation or Jan Bhagidari.**



Figure:10. Water Security and its attributes.

Various Steps taken by the Central Government for Effective Water Management and Promoting Water Security:

Projects/ Mission	Activity Dealt.
Jal Jeevan Mission	It Is Envisioned to Provide Safe and Adequate Drinking Water Through Individual Household Tap Connections By 2024 to all Households in Rural India
AMRUT MISSION	AMRUT Mission 2.0 focuses on ensuring universal access to safe drinking water in urban areas through functional household tap connections (FHTCs). It emphasizes water conservation, source sustainability, and real-time quality monitoring using advanced technologies like IoT and AI. The mission aims to reduce water losses, (NRW by 20%, promote wastewater reuse, and strengthen urban water infrastructure. By prioritizing community participation and innovative solutions towards waterbody rejuvenation etc to ensure sustainable and resilient drinking water and urban water management.
Jal Shakti Abhiyaan	It Was Launched In 2019, A Time-Bound Campaign with A Mission Mode Approach Intended to Improve Water Availability Including Groundwater Conditions In The Water-Stressed Blocks Of 256 Districts In India
Jal Kranti Abhiyan	Focuses On Active Efforts to Revolutionize Villages and Cities Through Block-Level Water Conservation Schemes
National Water Policy	The Policy Advocates Rainwater Harvesting and Conservation of Water and Highlights the Need for Augmenting the Availability of Water Through Direct Use of Rainfall....
National Water Mission	Aims To Conserve Water, Minimize Wastage and Ensure More Equitable Distribution Both Across and Within States Through Integrated Water Resources Development and Management
Groundwater Legislation	Ministry Has Circulated a Model Bill to All The States/UTs to Enable Them To Enact Suitable Groundwater Legislation For The Regulation Of Its Development, Which Also Includes The Provision Of Rainwater Harvesting. So far, 19 States/Uts Have Adopted and Implemented Groundwater Legislation
Atal Bhujal Yojana Abhyayan.	It Is an Rs.6000 Crore Scheme with World Bank Funding, For Sustainable Management of Groundwater with Community Participation Is Being Taken up In the Identified Over-Exploited and Water-Stressed Areas
National Water Awards	The National Water Awards in India are organized by the Ministry of Jal Shakti to recognize and encourage efforts in water conservation, efficient use, and sustainable management. These awards honour individuals, organizations, and states for exemplary initiatives like rainwater harvesting, water reuse, and groundwater recharge. Categories include Best State, District, Urban Local Body, NGO, and more. The awards aim to inspire grassroots innovation and strengthen community participation in addressing water challenges. They align with the government's vision of achieving water security and sustainability across the country.

Conclusion and Way Forward:

Ensuring water security in India requires a comprehensive approach to good water governance that addresses current challenges and anticipates future needs. The following concluding remarks summarize the essential elements of such a strategy:

- ♦ Integrated and Participatory Approaches are the essentials of Water governance. It should be inclusive, involving stakeholders from government, private sectors, communities, and civil society. Integrating water management across sectors like agriculture, industry, and urban planning ensures sustainable usage and allocation.
- ♦ Leveraging advanced technologies such as AI, IoT, and satellite imagery for water quality monitoring and resource mapping enhances transparency, efficiency, and accuracy towards data driven decision-making processes. This helps in proactive management of water resources.
- ♦ Using various predictive modelling analytics for drought and flood management.
- ♦ Promotion of Drip and Micro-Irrigation Systems in Promoting water-efficient irrigation in agriculture,
- ♦ Mapping groundwater and surface levels and water quality spread for better water resources planning by using remote sensing Satellite Imagery and GIS based applications,
- ♦ Clear policies, robust legal frameworks, and effective institutions are essential. These structures should enforce equitable water distribution, prevent over-extraction, and protect ecosystems etc as part of Strengthening various Institutional Frameworks.
- ♦ Community Empowerment and Awareness by engaging local communities in water conservation efforts and raising awareness about the value of water can foster responsible water consumption, awareness, empowerment and stewardship at the grassroots level.
- ♦ Water governance strategies should prioritize the sustainability of water resources and enhance resilience against climate change impacts, such as droughts, floods, and changing precipitation patterns ensuring sustainability.
- ♦ Encouraging innovation in water management technologies and securing investments in infrastructure can improve water supply, distribution systems, and wastewater treatment.
- ♦ **Ensuring access to safe and sufficient water for all, particularly marginalized and vulnerable populations, is critical for achieving social equity and enhancing quality of life.**
- ♦ By fostering collaboration, embracing technology, and prioritizing sustainable practices, India can strengthen its water governance framework. This will not only secure the country's water future but also contribute to its socio-economic development, environmental sustainability, and global commitments such as the Sustainable Development Goals (SDGs).
- ♦ Empowering local governance bodies like Panchayati Raj Institutions (PRIs) to manage water resources as part of decentralized planning ensuring sustainability as water use does not compromise future generations' needs.
- ♦ Invest in modernizing irrigation infrastructures, develop efficient urban water supply and sanitation systems, Build and maintain reservoirs, check dams, and water treatment plants.
- ♦ Transparency and Accountability aspects with Clear policies and mechanisms to hold stakeholders accountable. Promote a robust legal framework for water rights and usage, Strengthening implementation of pollution control laws.
- ♦ Implementation of polluter-pays principles for industries causing water pollution, encourage public-private partnerships (PPPs) for water infrastructure projects, provide subsidies for adopting water-saving technologies in agriculture.
- ♦ Establish a National Water Informatics Centre for centralized data collection and analysis for data driven decision making.
- ♦ The Way Forward would be multi-Stakeholder Collaboration among Governments, NGOs, industries, and communities must work together, Capacity Building and knowledge upgradation Training to local bodies and officials in water management practices.
- ♦ Integrate water management with climate adaptation strategies, fostering Research and Innovation in water-saving technologies and efficient management systems.
- ♦ As a whole Water security is the backbone of sustainable development in India. Through apt governance that integrates policy, technology, community participation, and environmental conservation, where in India can achieve water security and ensure equitable access to this vital resource.

"Jai Hai Tuo Kal Hai"

"വെള്ളമുണ്ടെങ്കിൽ ഭാവിയുണ്ട്"

(If There is Water, there is a Future.)

"This simple yet profound adage emphasizes the essence of good governance for ensuring water Security. It highlights the interdependence between water Resources and the well-being of society, emphasizing sustainable management and equitable distribution for a secure and prosperous future".



തദ്ദേശ ദിനാഘോഷത്തോടനുബന്ധിച്ച് അമൃത് കേരള നടത്തിയ സ്റ്റാൾ സന്ദർശിച്ചവർ

TULIP Internship “Transforming Passion into Expertise”



As an intern at AMRUT, I gained valuable knowledge in water and wastewater treatment systems. The internship helped me develop skills in project monitoring, data analysis, Excel management, and communication. The supportive mentorship and collaborative environment significantly contributed to my professional growth, making this experience a pivotal step in my career by equipping me with practical skills and a deeper understanding of the sector.

Parvathy S M, Water Sector Intern

My internship in Water and Wastewater Treatment provided invaluable hands-on experience in monitoring and optimizing water quality processes. I worked alongside experienced professionals, gaining practical skills in monitoring water quality and optimizing treatment processes. This opportunity deepened my technical skills and confidence in pursuing a career in environmental engineering.

Anisha Susan Mathew, Water Sector Intern



I actively engaged in urban development projects in Kerala, focusing on policy formulation and sustainable city planning. Utilizing GIS, data analysis, and technical documentation, I contributed to key urban reforms that enhance infrastructure and governance. This internship strengthened my problem-solving and technical skills, offering valuable insights into urban planning and policy implementation.

Iyryn Anna Johnson, Capacity Building Intern

I am truly grateful for the opportunity to intern at AMRUT Kerala in the Finance Department. This experience has greatly enhanced my knowledge of financial operations and urban development policies while allowing me to work alongside a supportive and knowledgeable team. The skills and insights I gained here will be invaluable as I move forward in my career. As I embark on a new journey, I sincerely thank the AMRUT Kerala team for their guidance and encouragement.

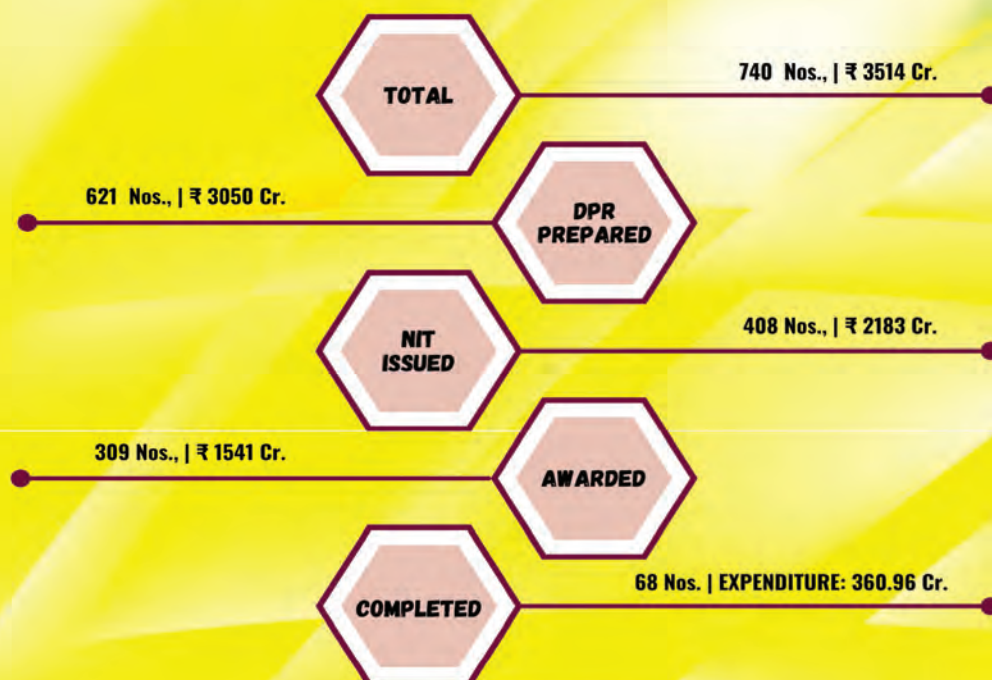
Lia Mary Louis, Municipal Finance Intern



AMRUT 1 PROGRESS



AMRUT 2.0 PROGRESS





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