ATHENA INFONOMICS

TRAINING MANUAL ON DECISION SUPPORT TOOL FOR INTEGRATED WATER MANAGEMENT

DST

Integrated Rural Urban Water Management For Climate Based Adaptations (IAdapt)

Supported by

IDRC | CRDI

Canada

Implemented by

ICLEI Local Governments for Sustainability

ATHENA INFONOMICS

Indian Institute of Technology Madras

CGIAR Research Program on Water, Land and Ecosystems

Led by: IWMI International Water Management Institute

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Prepared by:
Athena Infonomics India Private Limited (AIIPL)

Registered Offices:
Chennai (HQ) and Delhi, India
Washington DC, USA

9/5, 1st Street,Venkateswara Nagar,
Adyar, Chennai, Tamil Nadu – 600 020, India
+91 44 – 423 27112/423 27113
www.athenainfonomics.com

Authors:
Anupama VS
anupama.vs@athenainfonomics.com

Ankit Chatri
ankit.c@athenainfonomics.com

Ansu Alexander
ansualexander17@gmail.com

Vijay Bhalaki
vijay.b@athenainfonomics.com

Design:
Albert Babu
albert.b@athenainfonomics.com

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ABOUT IDRC & PROJECT PARTNERS

Funding Agency

- **International Development Research Centre (IDRC)** is a Canadian Government Corporation, funding research in developing countries to promote growth, reduce poverty, and drive large-scale positive change. A Crown corporation, it supports leading thinkers who advance knowledge and solve practical development problems by providing resources, advice, and training to them. Working with development partners, IDRC multiplies the impact of their investment and brings innovations to more people around the world.

The Cities and Climate Change initiative of IDRC is supporting high quality, demand driven, policy relevant action research that engages local authorities, communities, and the private sector. It aims to help meet the adaptation deficit in small to medium sized cities or well defined subdivisions of large cities, where demographic pressure and environmental stresses are particularly acute.

Project Partners

- **ICLEI - Local Governments for Sustainability, South Asia** is the world's leading association of more than 1500 metropolises, cities, urban regions and towns. They promote local action for global sustainability and support cities to become sustainable, resilient, resource-efficient, biodiverse, low-carbon, productive, ecomobile; to build a smart infrastructure; and to develop an inclusive, green urban economy with sustainable procurement with the ultimate aim of achieving healthy and happy communities. ICLEI South Asia is the lead partner and is also leading project activities in Solapur as well development of the Catchment Management Plan framework.

- **Athena Infonomics India Private Limited** is a data-driven international development consultancy and is ranked as a FT1000 high growth company in Asia Pacific. Athena has projects across 20+ countries globally, serving over 60+ clients. It distinguishes itself by leveraging relevant social research methods and tools for deriving solutions. Athena leads projects activities in Vijayawada as well as development of the Decision Support Tool framework.

- **Indian Institute of Technology Madras (IIT M)** is one among the foremost institutes of national importance in higher technological education, basic and applied research. It has established itself as a premier centre for teaching, research and industrial consultancy in the country. IIT M is a knowledge partner and is primarily involved in hydrological and climatic research activities.

- **International Water Management Institute (IWMI)** is a non-profit, scientific research organization focusing on the sustainable use of water and land resources in developing countries. IWMI works in partnership with governments, civil society and the private sector to develop scalable agricultural water management solutions that have a real impact on poverty reduction, food security and ecosystem health. IWMI is a knowledge partner and is primarily involved in publication and dissemination activities as well as the development of the financial compendium for water management projects.

IADAPT PROJECT

Integrated Rural Urban Water Management for Climate Based Adaptations in Indian Cities (IAdapt) is a three year old project supported by the International Development Research Centre (IDRC) Canada, being implemented by consortium of 4 firms; ICLEI – Local Governments for Sustainability, South Asia in partnership with Athena Infonomics India Pvt Ltd, International Water Management Institute (IWMI) and Indian Institute of Technology, Madras.

The project focuses on empowering cities and its surrounding catchment to build an enabling ecosystem to empower user catchments to transition from traditional approaches of water management (which considers components of the water system as separate entities to be planned, implemented and operated with little reference to one another) to an 'Integrated Approach' based on the principles of Integrated Water Resources Management (IWRM) and Integrated Urban Water Management (IUWM).

The project is striving to create a framework for enhancing the climate resilience of cities and its surrounding catchment through effective management of water resources. Two pilot cities namely Vijayawada and Solapur have been taken up in the project period to demonstrate the benefits of transitioning towards an Integrated approach. To adopt and implement integrated water management at a catchment level, a combination of adaptation solutions covering institutional, technical, governance and monitoring enablers is being employed in the pilot catchments which include Participatory Catchment Planning (RURBAN platform), Decision Support Tool (DST), Catchment Management Plan (CMP) and multi pronged financing approaches.

GLOSSARY

Baseline Data
An initial set of observations or measurements used for comparison-a starting point.

Discharge
Refers to the outflow, and is used as a measure of the rate at which a volume of water passes at a given point.

Grey Water
Untreated, used water from a household or small commercial establishment (excluding that from toilets or other fixtures and appliances whose wastewater might have come into contact with human waste).

Groundwater Recharge
Inflow of water to a ground water reservoir (zone of saturation) from the surface. Infiltration of precipitation and its movement to the water table is one form of natural recharge.

Hydrology
The science dealing with the properties, distribution, and flow of water on or in the Earth.

Policy
A governing principle, plan, or consistent course of action developed in order to meet recognized needs and to achieve specific measurable outcomes. Policies are normally broad, conceptual documents that outline approaches and/or considerations to be taken into account by decision makers.

Runoff
Water that moves across (or through) soil on the land during snowmelt or rainstorms.

Sewage
The liquid waste from domestic, commercial, and industrial establishments.

Sewage Treatment
The processing of wastewater for the removal or reduction of contained solids or other undesirable constituents.

Stakeholder
An individual, organization, or government with a direct interest in a particular process or outcome.

Wastewater
A combination of liquid and water-carried pollutants from homes, businesses, industries, or farms; a mixture of water and dissolved or suspended solids.

Water Balance
A measure of the amount of water entering and the amount of water leaving a system. The ratio between the water assimilated into the body and that lost from the body.

DECISION MAKING SUPPORT THROUGH IADAPT PROJECT

Decision making support for the RURBAN platform through the IAdapt project

Decision Support Tool (DST)
Sensitise RURBAN platform members to capture impacts of climate change on water resources and develop innovative, equitable project responses to meet water demand.

Capacity Building
Sensitise RURBAN platform members on planning for integrated water management.

Catchment Management Plan (CMP)
Consultative process with the RURBAN platform to shift towards catchment based approaches in water management.

Compendium of Financing Sources
Inform the RURBAN platform members on alternative sources of financing to support CMP actions.

RURBAN PLATFORM
for water catchment level decision making

Activities addressed by the RURBAN platform

- Collectively map the key challenges
- Deliberate on viable alternatives
- Prioritise solution pathways based on DST inputs
- Develop a joint action plan
- Oversee implementation & monitor progress

Cities depend on water resources which transcend across municipal boundaries calling for partnerships to be developed between urban water managers and district level catchment managers. To mobilise both rural and urban stakeholders in a collaborative process to guide and support the implementation of new thinking in relation to climate adaptation, a multi-stakeholder RURBAN platform is designed under the IAdapt project. This platform is designed to evolve as an active cross-sectoral catchment network consisting of decision makers and practitioners from relevant government departments and citizen stakeholders to facilitate inter-agency collaboration and participatory decision making on water management.

To aid the RURBAN platform in mapping the key challenges, deliberating on solution pathways, prioritising them, developing a joint action plan and overseeing implementation and monitoring progress, multiple enablers have been designed under the IAdapt project.

- Decision Support Tool (DST) – A user friendly tool that simulates water supply and demand and articulates the relationship between the various components of the rural-urban water system. The tool will enable stakeholders understand the impacts of climate change and external interventions/investments across the user catchment and present appropriate adaptive measures in response.

- Catchment Management Plan (CMP) – A participatory and demand driven plan for the catchment which will guide the development of future interventions while considering the supply side balance and impacts of climate change on water resources. The CMP offers a way to integrate different administrative, planning and regulatory systems and multiple demands in a user catchment, with focus on marginalised stakeholders, key consumers and key polluters.

- Compendium of financing sources – A compendium of potential financial options to identify the funding opportunities that can be tapped into for implementation of actions identified under the Catchment Management Action Plan with priority to identification of innovative funding mechanisms.

- Capacity Building – Efforts to empower stakeholders to transition towards an integrated water management approach through concentrated investments in stimulating changes in policy and practice in water management within governmental institutions and civil society.

CHARACTERISTICS OF A DECISION SUPPORT TOOL

A Decision Support Tool (DST) is a complimentary analytical platform, that collects, organizes, analyzes, and simulates data to facilitate decision making for stakeholders, with incorporation of contextual knowledge.

Pre-intervention review

Review of proposed projects or monitoring and evaluation of ongoing/already designed projects.

Sensitize stakeholders

Bridge the gap of lack of awareness on the benefits of the integrated urban water management.

Scenario management and alternative formulation

Support and provide information for project feasibility, and planning projects, and design and implementation.

Facilitate dialogue

Project or intervention made acceptable to all stakeholders through consensus building and conflict resolution.

Needs assessment

Evaluation of most critical areas of intervention across stakeholders based on current and future demand-supply assessment.

Scientifically informed decision making

List of water management strategies with incorporation of critical elements such as climate change, changing land use and cropping patterns.

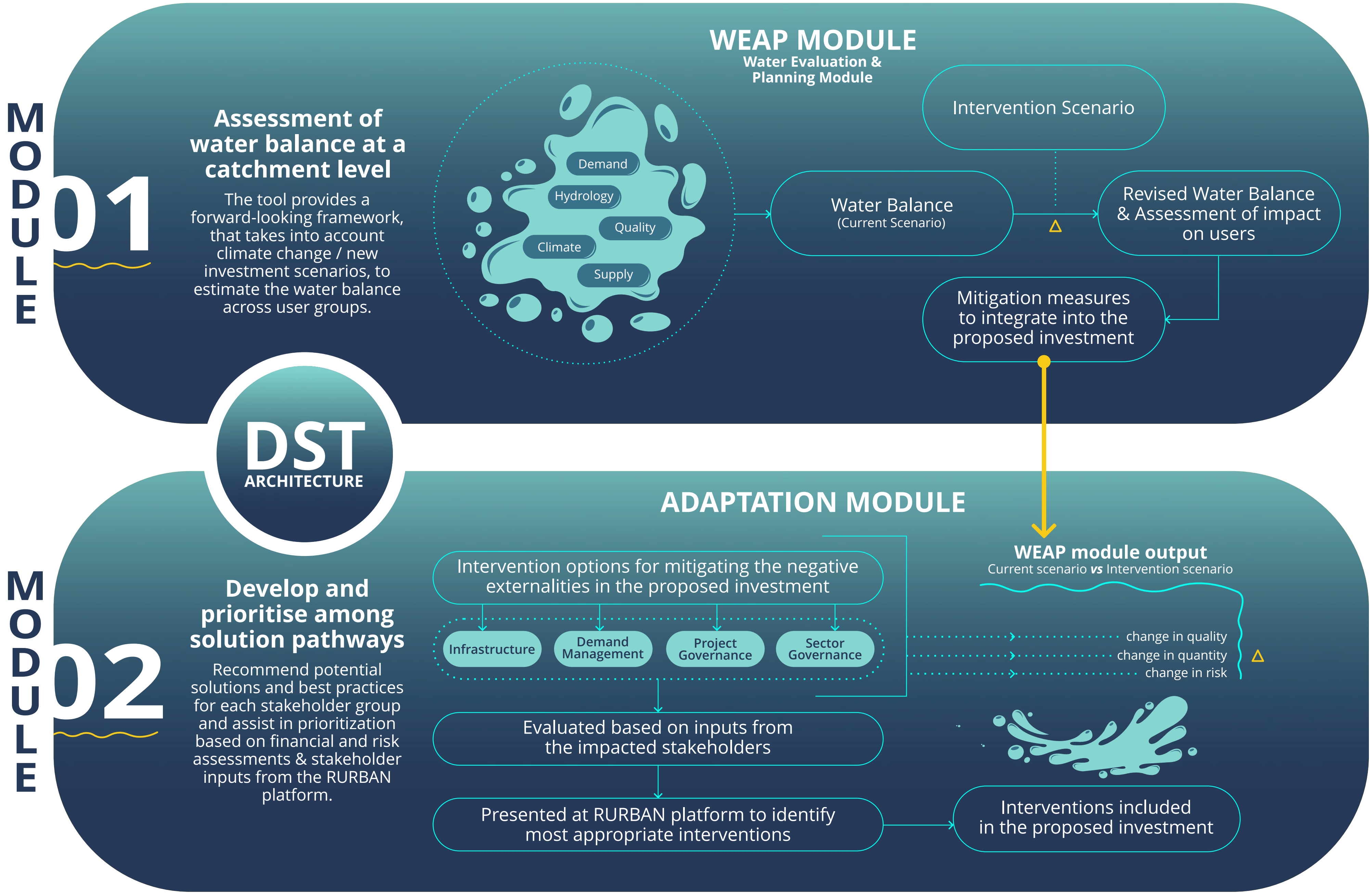
Integrated Water Resources Management (IWRM) at the river basin level deals with many facets of water management, from striving for water security for all purposes in a sustainable and equitable manner to being able to manage and mitigate disaster risks. This can be supported by a decision support tool. Typically, water management strategies are integrated with such a tool to provide a dynamic demand-supply analysis and water allocation to competing uses. The tool aims to simulate the performing ecosystem by empowering the catchment managers with simple rules for decision making and project prioritization. The visualization capacity within the decision support tool helps in improved dissemination of water related policies and decisions to both the scientific community and local community.

Tools for information management, socio-economic evaluation tools and an interactive platform for communicating and disseminating information to all lie in the forte of the DST, in addition to the applications illustrated. It provides a custom, flexible, and dedicated management system to assist decision makers and policy makers in*:

- Providing timely, transparent, scientifically-informed answers to important questions.
- Quickly and effectively streamline workflow, reduce time and cost requirements.
- Transform data and information into knowledge and produce understandable results and decisions.

* Collaborative decision support tools for water resources management - a scientific case study of Nairobi river catchment

DECISION SUPPORT TOOL ARCHITECTURE IN IADAPT PROJECT



Considering that the Catchment Management Plan (CMP) evaluates the critical areas for interventions across stakeholders and designs interventions/projects through an assessment of economic, social, environmental and financial benefits, the DST finds its niche in reviewing proposed interventions/projects to introduce adaptation for greater sustainability. Since interventions or projects in the urban and rural space originate from either local bodies or State departments with very little direct linkage to proposed interventions of the CMP, the DST will seek to highlight deficiencies of the proposed water resource projects in current conditions and future change pressures (climate induced and others) and present potential adaptation options and strategies to optimize the performance of the project such that they are in alignment to the concept of integrated water management.

The Decision Support Tool as conceptualised under the IAdapt project consists of two broad modules:

MODULE 01 WEAP

Water Evaluation and Planning (WEAP) is a computer tool developed by the Stockholm Environment Institute's U.S. Centre for integrated water resources planning, which provides a comprehensive, flexible, and user-friendly framework for development of water balances, scenario generation, planning, and policy analysis. It has an unique approach for conducting integrated water resources planning assessments across municipal and agricultural system, single catchments or complex transboundary river systems with a transparent structure to facilitate the engagement of diverse stakeholders.

In this model, we will take in demand, supply, quality and hydrology inputs, and project the water balance for a horizon year, which will basically reflect the allocation of the available grades of water (supply) among the various users (demand). The proposed intervention data points will then be added to the current scenario water balance model to simulate a revised water balance model after which the impacts it has on meeting the water demand and quality will be analysed.

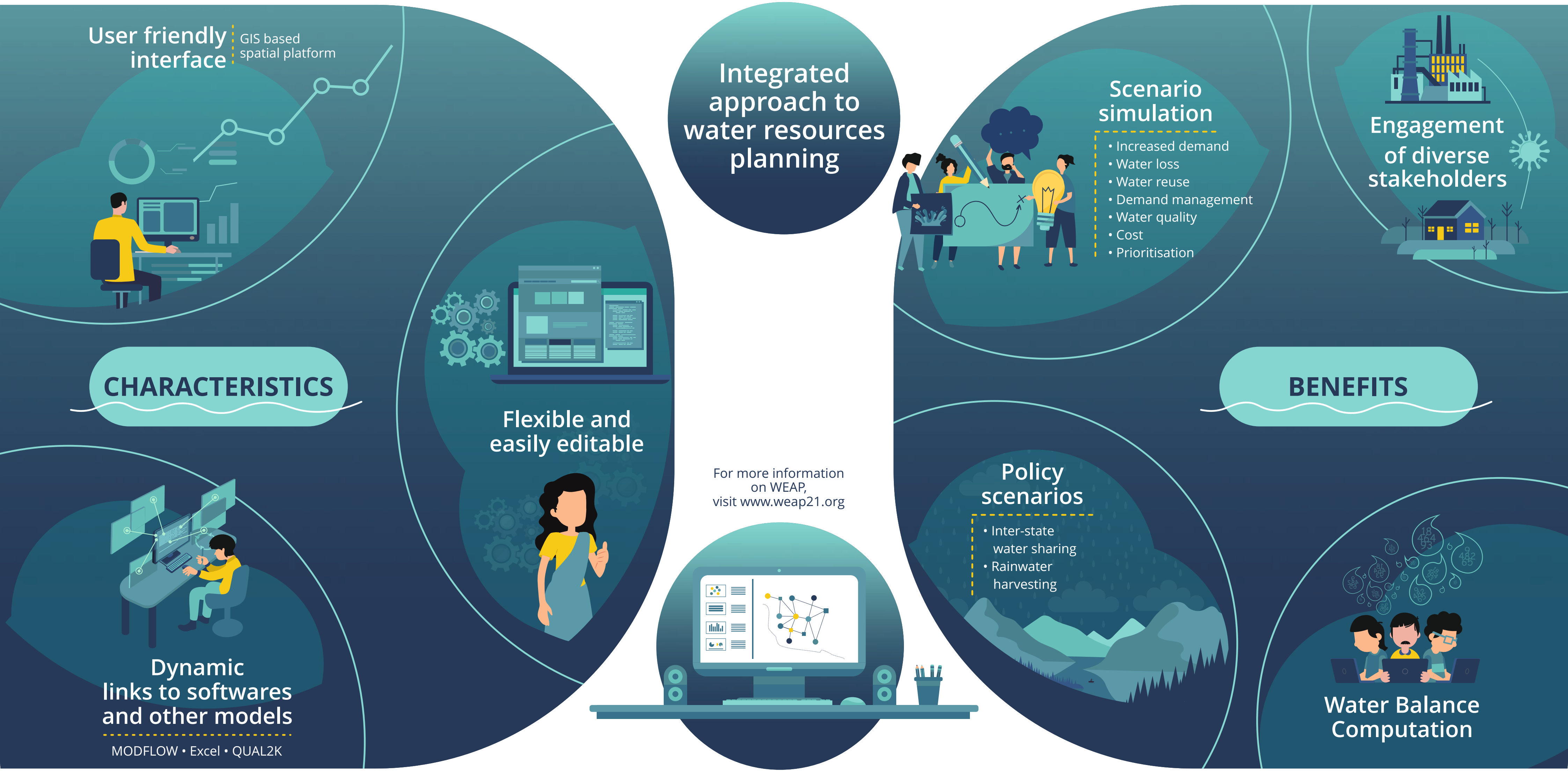
MODULE 02 Adaptation

The adaptation module consists of a multi-level list of potential intervention options that can be used as adaptations to ensure adherence of the proposed project to IWRM concepts. The adaptations may be in the context of addressing the negative quantity / quality / risk impacts on stakeholders in a project/intervention scenario.

In an attempt to address the negative externalities on stakeholders, mitigation measures will be curated and proposed to be integrated into the proposed interventions. This will be done through a look up excel which will compile all potential adaptive responses to a variety of projects, along with rules for selection of the most appropriate subset for a model output, based on a combination of suitability factors. However the final choice of the solutions will be derived through a consultative process to ensure high levels of ownership towards the proposed solutions across stakeholder groups.

MODULE 01 MODULE 02

CHARACTERISTICS OF THE WATER EVALUATION AND PLANNING (WEAP) SOFTWARE



The WEAP System model was developed to enable evaluation of planning and management issues associated with water resources development. The WEAP model can be applied to both municipal and agricultural systems and can address a wide range of issues including sectoral demand analyses, water conservation, water rights and allocation priorities, streamflow simulation, reservoir operation, ecosystem requirements and project cost-benefit analyses (SEI 2001).

WEAP model has two primary functions:

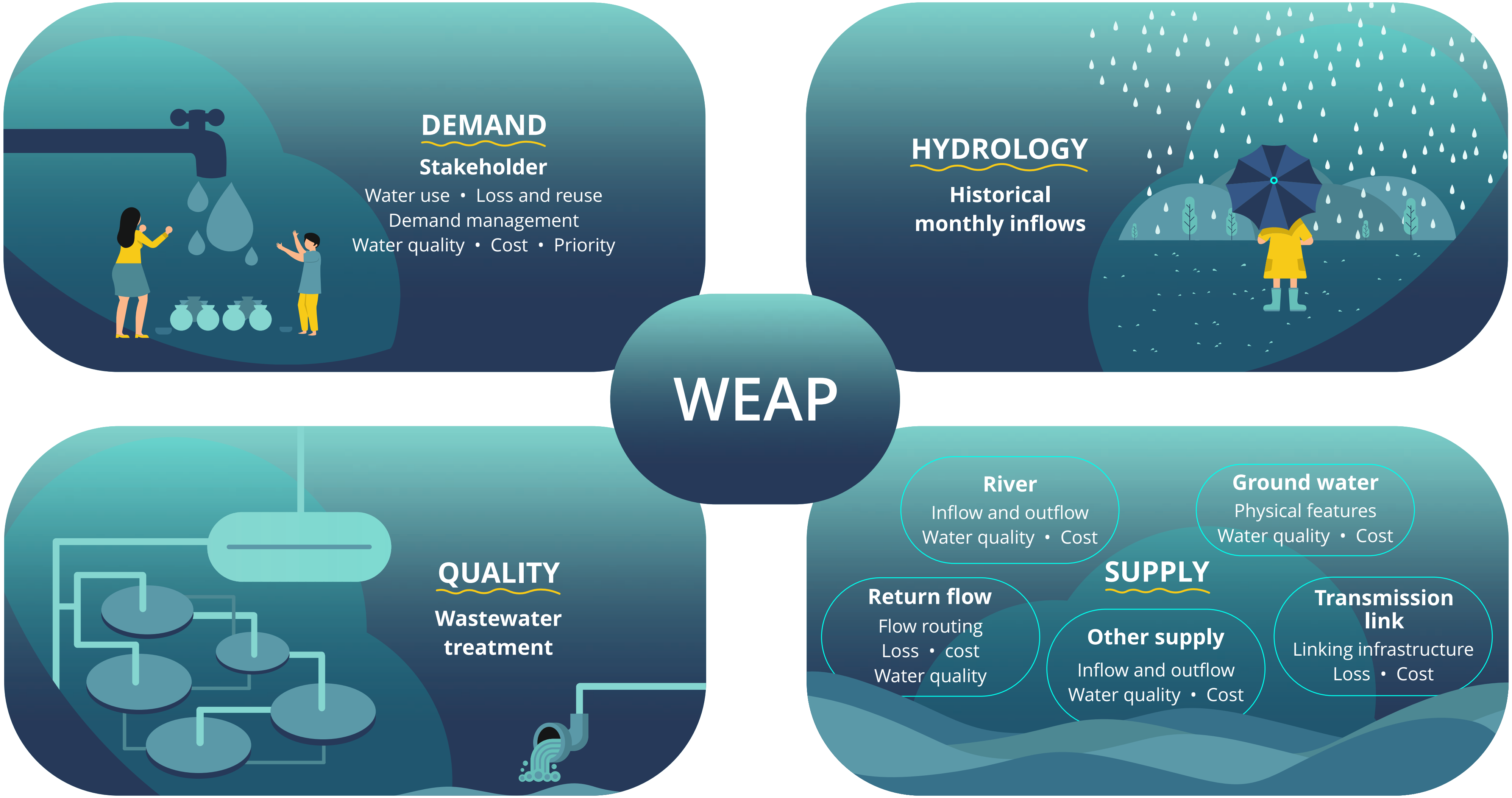
- Simulation of natural hydrological processes (e.g., evapotranspiration, runoff and infiltration) to enable assessment of the availability of water within a catchment.
- Simulation of anthropogenic activities superimposed on the natural system to influence water resources and their allocation (i.e., consumptive and non-consumptive water demands) to enable evaluation of the impact of human water use.

WEAP is a therefore a model-building tool, used to create simulations of water demand, supply, runoff, evapotranspiration, infiltration, crop irrigation requirements, instream flow requirements, ecosystem services, groundwater and surface storage, reservoir operations, and pollution generation, treatment, discharge and instream water quality, all under scenarios of varying policy, hydrology, climate, land use, technology and socio-economic factors.

WEAP can also dynamically link to models such as the USGS MODFLOW groundwater flow model and the US EPA QUAL2K surface water quality model.

Moreover, WEAP is an intuitive graphical interface with a simple yet powerful means for constructing, viewing and modifying the system and its data with a graphical drag and drop GIS based interface. The main functions – loading data, calculating and reviewing results – are handled through an interactive screen structure that prompts the user, catches errors and provides on-screen guidance. The expandable and adaptable data structures of WEAP accommodates the evolving needs of water analysts in addressing a wide range of issues, e.g., water conservation, water rights and allocation priorities, groundwater and streamflow simulations, reservoir operations, hydropower generation, pollution tracking, ecosystem requirements, vulnerability assessments, and project benefit-cost analyses. In addition, it allows users to develop their own set of variables and equations to further refine and/or adapt the analysis to local constraints and conditions through a transparent structures which facilitates engagement of diverse stakeholders in an open process.

DATA INPUTS FOR WEAP SOFTWARE

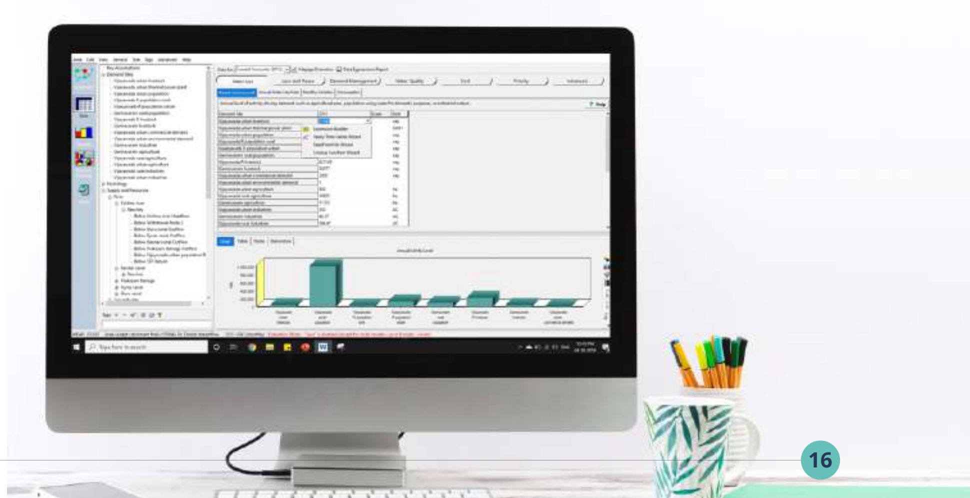


Notes: Key assumptions can be made. Eg: Population growth rate, Supply increase / decrease.

WEAP provides for a dynamic data entry platform which include several steps. The study definition sets up the time frame, spatial boundary, system components and configuration of the problem. The Current Accounts, which can be viewed as a calibration step, provides a snapshot of actual water demand, pollution loads, resources and supplies for the system. Key assumptions may be built into the Current Accounts to represent policies, costs and factors that affect demand, pollution, supply and hydrology. Scenarios are built on the Current Accounts and allows one to explore the impact of alternative assumptions or policies on future water availability and use. In the end, the scenarios are evaluated with regard to water sufficiency, costs and benefits, compatibility with environmental targets, and sensitivity to uncertainty in key variables.

To allow simulation of water allocation, the elements that comprise the water demand-supply system and their spatial relationship are characterized for the catchment under consideration. The system is represented in terms of its various water sources (e.g., surface water, groundwater, desalinization and water reuse elements); withdrawal, transmission, reservoirs, and wastewater treatment facilities, and water demands (i.e., user-defined sectors but typically comprising industry, mines, irrigation, domestic supply, etc.). The data structure and level of detail can be customized (e.g., by combining demand sites) to correspond to the requirements of a particular analysis and constraints imposed by limited data. A graphical interface facilitates visualization of the physical features of the system and their layout within the catchment. The WEAP model essentially performs a mass balance of flow sequentially down a river system, making allowance for abstractions and inflows. (SEI 2001)

Typically, the WEAP model is applied by configuring the system to simulate a recent "baseline" year, for which the water availability and demands can be confidently determined. The model is then used to simulate alternative scenarios (i.e., plausible futures based on "what if" propositions) to assess the impact of different development and management options. The model optimizes water use in the catchment using an iterative Linear Programming algorithm, whose objective is to maximize the water delivered to demand sites, according to a set of user-defined priorities. All demand sites are assigned a priority between 1 and 99, where 1 is the highest priority and 99 the lowest. When water is limited, the algorithm is formulated to progressively restrict water allocation to those demand sites given the lowest priority. Return flows can also be plotted from the demand sites back to the supply source. For example, the model allows for the addition of waste water treatment plants to which return flows from the demand nodes can be routed. The treated water from the wastewater treatment plant can then be plotted back to the demand nodes for reuse through the transmission links.

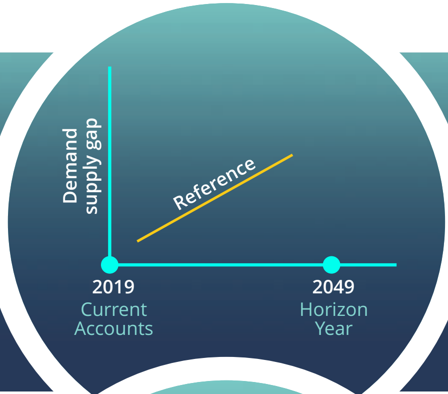


SCENARIO SIMULATION ON WEAP SOFTWARE

CURRENT ACCOUNTS
Base year of the model e.g., 2019

HORIZON YEAR
Last year of scenario simulation e.g., 2049

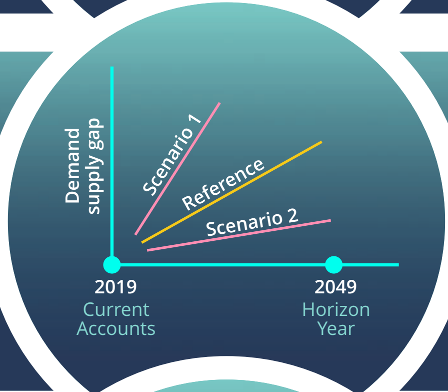
REFERENCE
Simulate likely evolution of water balance without external intervention



WHAT IF SCENARIOS
Alterations in reference water balance post external interventions

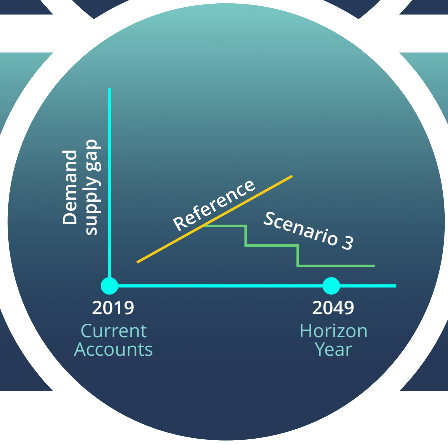
Examples

High population growth	Demand management policies
Increase/decrease in rainfall	Waste water reuse policy
Occurrence of flood/drought year	Rainwater harvesting policy



STARTUP YEAR AND INTERVENTION TIMELINE

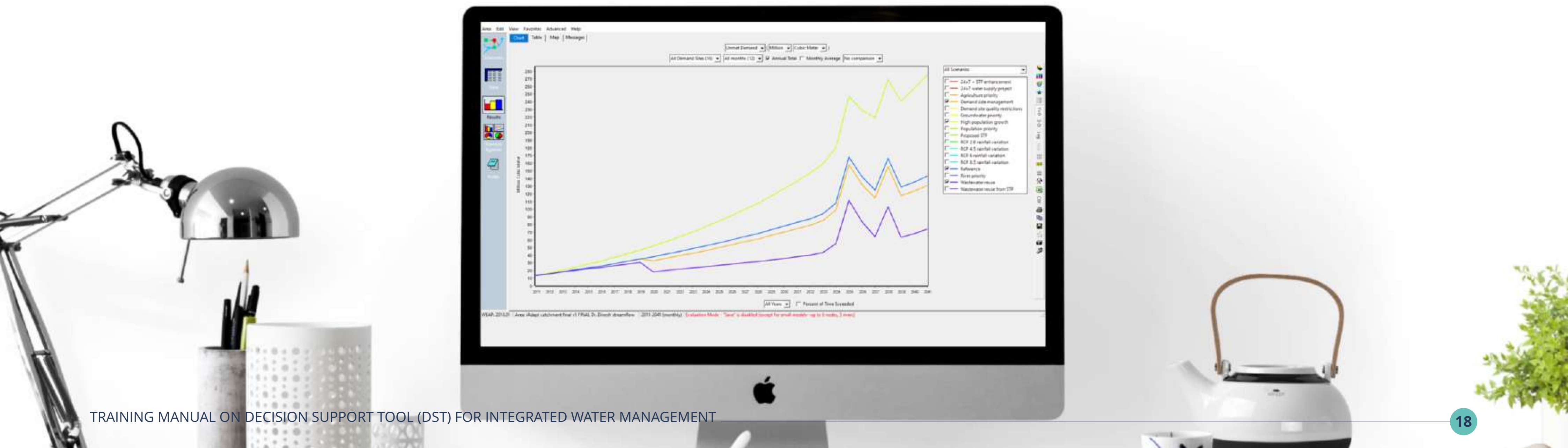
- Start up year of a government intervention could be anywhere between the current accounts and horizon year
- There might also be an incremental introduction of the intervention



A scenario can be defined as a plausible description of how the future may develop, based on a coherent and internally consistent set of assumptions about key relationships and driving forces. Scenario analysis is at the heart of using WEAP and they are self-consistent story-lines of how a future system might evolve over time in a particular socio-economic setting and under a particular set of policy and technology conditions. The comparison of these alternative scenarios are easily understood by the stakeholders and proves to be a useful guide to development policy for water systems from local to regional scales.

In WEAP the typical scenario modeling effort consists of three steps. First, a "Current Accounts" year is chosen to serve as the base year of the model. A "Reference" scenario is established from the Current Accounts to simulate likely evolution of the system without intervention. Finally, "what-if" scenarios can be created to alter the "Reference Scenario" and evaluate the effects of changes in policies and/or technologies.

The results from the scenarios analysis can address a broad range of "what if" questions, such as: What if population growth and economic development patterns change? What if groundwater is further exploited? What if water conservation methods are introduced? What if demand management policies are introduced? What if a water-recycling program is implemented? What if a more efficient irrigation technique is implemented? What if the mix of agricultural crops changes? What if climate change alters the hydrology? What if a new water system project is introduced? These scenarios may be introduced as a linear interpolation or step function based on how the intervention is introduced. Also the results of the scenarios analysis may be viewed simultaneously for easy comparison of their effects on the water system.

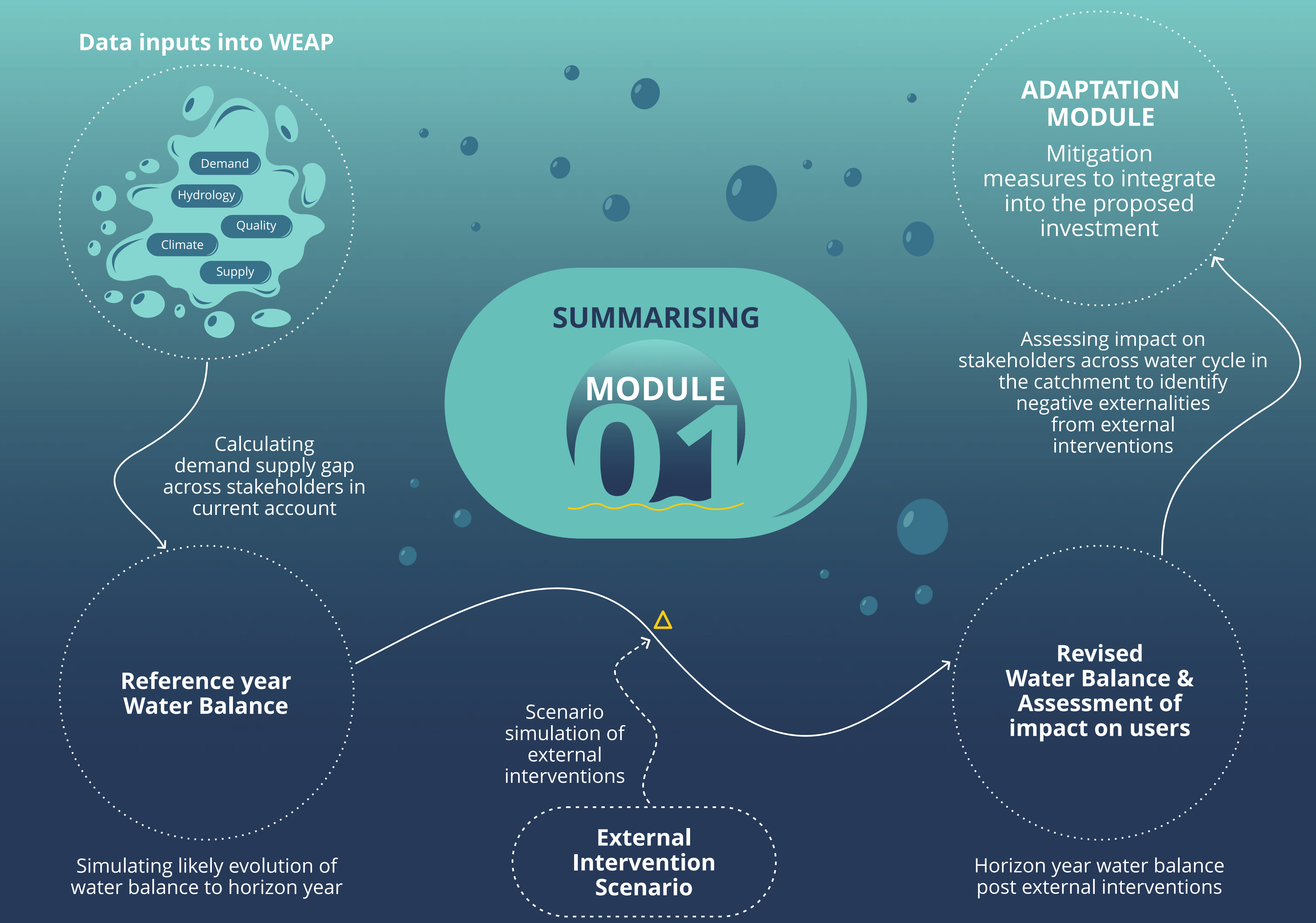


RESULTS IN WEAP SOFTWARE

WEAP interface has an array of data analysis functions and offers a wide range of display options such as scenarios comparison, stakeholder impact comparison, water balance either year-wise or month-wise, for any period within the study horizon.

The results view is a general purpose reporting tool for reviewing the results of the scenario calculations in either chart, table or displayed on the schematic. The reports are available either as graphs, tables or maps and can be saved as text, graphic or spreadsheet files. Each report maybe customized by changing the list of nodes displayed (e.g., demand sites), scenarios, time period, graph type, unit, gridlines, color, or background image.

The advantage of WEAP is that the results can be exported, viewed and shared in various forms. For instance, data can be exported to an excel, where data modifications and further filtering can be made and imported back into WEAP. Addition of a raster layer and changes in the colors can also be made and exported as an image file for easy communication purposes.


Data inputs into WEAP
Demand
Hydrology
Quality
Climate
Supply
Calculating demand supply gap across stakeholders in current account
SUMMARISING
MODULE 01
ADAPTATION MODULE
Mitigation measures to integrate into the proposed investment
Assessing impact on stakeholders across water cycle in the catchment to identify negative externalities from external interventions
Reference year Water Balance
Simulating likely evolution of water balance to horizon year
Scenario simulation of external interventions
External Intervention Scenario
Revised Water Balance & Assessment of impact on users
Horizon year water balance post external interventions

To summarise module 1 of the Decision Support Tool as indicated in the flowchart,

1. Present demand of the various stakeholders across both rural and urban areas of the user catchment is calculated. Likewise, present supply delivered from different sources to each of these stakeholders is also calculated. Based on the demand and supply gap, a basic demand supply gap can be generated. However, adding additional layers of quality could potentially reduce the supply delivered since the supply doesn't meet the quality required for a particular demand node. Similarly layers of climate and hydrology is added which could further impede quantity of supply and risk factors associated with climate change.

2. Using the above inputs, a comprehensive water balance (demand supply gap) is calculated across stakeholders for the current year and based on the past history of rainfall received, a water balance model is generated for the horizon year which may reflect an increase/decrease in demand supply gap for each stakeholder from current year to horizon year.

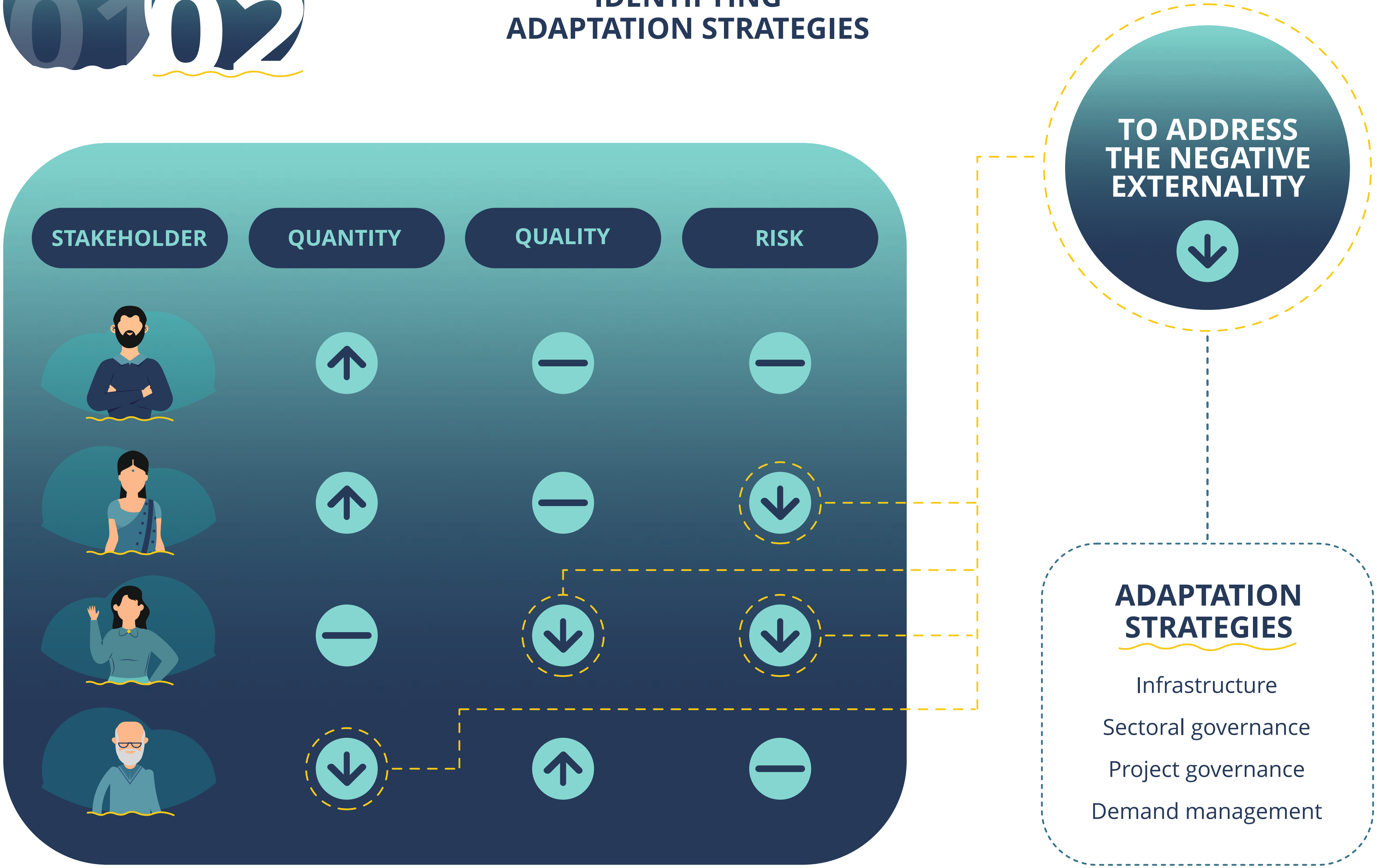
3. Having developed a base water balance model, various scenarios are simulated on the model. Scenarios could be an expected change in the temperature/rainfall which could change the supply expected to receive, or it could something as simple as a high population growth owing to the growing urbanisation in the region, or it could be governmental policies being implemented in the region or specific projects planned to be executed in certain administrative jurisdictions of the catchment. Government policies such as making rain water harvesting being made mandatory in all households, incentivising use of fixtures which reduce demand at household level, etc could definitely have an impact on the water balance. Similarly, Governmental interventions such as focused hard or soft interventions in the water system being planned in the catchment can create a change in the water balance. All of these external interventions can be simulated as scenarios.

4. Based on these scenarios, the water balance can be reassessed for the horizon year and the impacts of these interventions on each of the stakeholders can be evaluated. However, special attention must be given to interventions being planned by the government in certain administrative jurisdictions of the user catchment. Unknowingly other stakeholders outside of the administrative jurisdiction but within the same user catchment might be negatively impacted due to the investment being planned.

5. The DST through WEAP will identify the negative externalities on any stakeholder due to a proposed governmental intervention which brings us to the end of Module 1 and leads to Module 2 which will help us identify mitigation measures to address the negative externalities.

MODULE 02

IDENTIFYING ADAPTATION STRATEGIES



In Module 2, we identify externalities (positive/negative) across all stakeholders which may result from a proposed project planned by the government. Three kinds of impacts maybe enlisted across stakeholders and they include increase/decrease in quantity, increase/ decrease in quality and a possibility of a risk. As indicated in the illustration below, adaptation strategies will be identified to address the negative externalities to stakeholders across the three indicators.

A set of broad adaptations has been drawn up across four areas:

1

Infrastructure: Infrastructure oriented adaptations fall into four categories – changing infrastructure specifications of a proposed project, upgradation and retrofitting of existing infrastructure, increasing utilization of existing infrastructure and creation of new infrastructure (in that order of preference). Infrastructure interventions will be sensitive to the nature of the issue and will span the value chain (bulk sourcing, transmission, distribution and treatment).

2

Demand management: Adaptations around demand management are primarily directed at two user groups – rural (agriculture) and urban households. These adaptations are in the areas of decreasing demand through IEC/BCC campaigns, through supporting low water footprint products and technologies, through pricing nudges, through support for accelerating structural change (e.g. cropping patterns, industries) and by reallocating grades of supply across demand nodes.

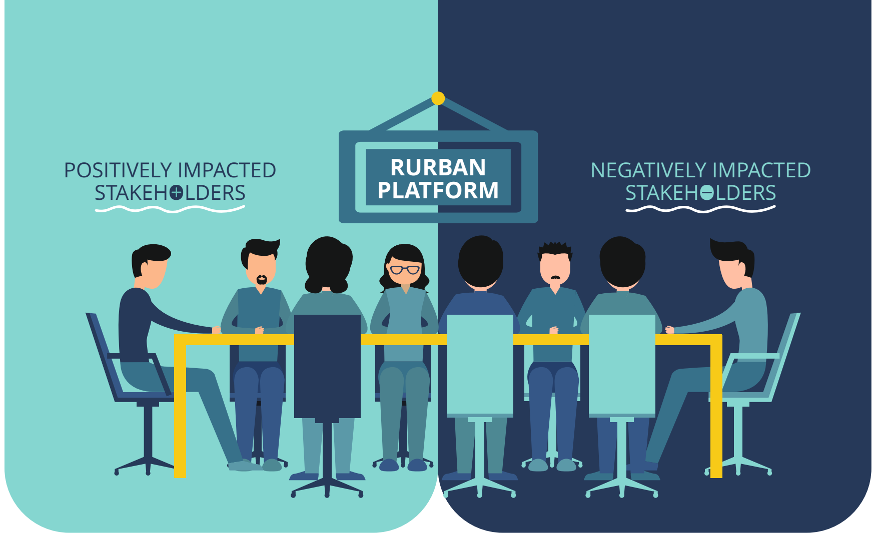
3

Project Governance: Project adaptations are usually the easiest to implement since the DST is applied at the formative stage of project interventions. Such adaptations range from expanding project stakeholder groups and sharing information, to more structural changes on project scope and financing. It should be remembered that such adaptations are not necessarily focused on increasing project costs. In many cases where there are positive externalities from the project, a share of these can be monetized and help support project viability.

4

Sectoral Governance: These include adaptations which are out of scope of the project, since they go beyond the project mandate, and/or require resources which cannot be raised within the project.

MODULE 01 MODULE 02



QUESTIONS TO STAKEHOLDERS

CAPACITY
Technical, Financial capacity

SUPPLY
Availability of water resources and supply services

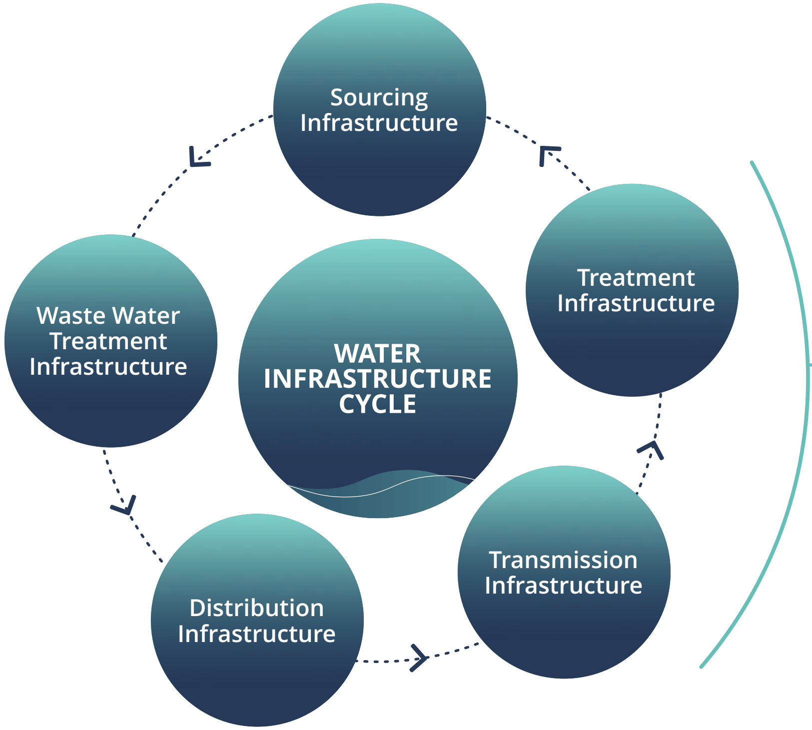
INFRASTRUCTURE
Capacity of current infrastructure across the water cycle

PROJECT
Proposed projects across the water cycle

DEMAND
Current demand across stakeholders and its management

SECTORAL GOVERNANCE
Governance of water management

PRIORITISING ADAPTATION STRATEGIES



RESPONSES FROM STAKEHOLDERS

HIGH MEDIUM LOW

YES NO

Scoring based on Responses

Prioritising Adaptation Strategies based on Response scoring

While the listed types of adaptation strategies provide an idea of the nature of adaptations, even within an area, there is considerable variation in the level of cost and effort required to implement an adaptation. Hence, it is important that the DST is able to rank these adaptations in an ascending order of implementation cost, so that the most cost-effective alternatives for a particular WEAP scenario are shortlisted. This tool has included such a mapping which demonstrates relevant alternatives for each kind of issue (quality, quantity and risk) at the forefront.

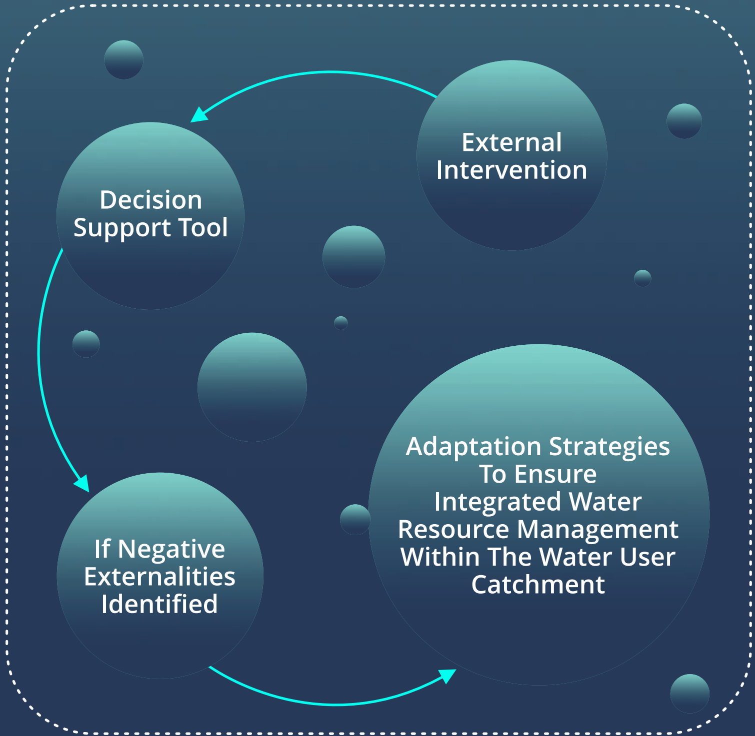
As indicated in the illustration, in addition to the outputs of the water balance (WEAP) model, the adaptation shortlisting also takes into consideration stakeholder specific elements. These go into identifying most suitable alternatives (e.g. infrastructure retrofitting and capacity utilization are usually preferable alternatives to development of greenfield infrastructure, but these presume availability of infrastructure; project governance changes are usually easier to implement compared to sectoral governance improvement, but these require the proposed project to be in a certain stage of planning etc.). These inputs will be taken from each of the RURBAN stakeholders, at least those who are impacted by the project (positively or negatively) as per the WEAP model through a simple to administer questionnaire along with secondary data since most of this information is usually in public domain. Based on this, a shortlist will be placed in front of the RURBAN platform.

Once the shortlisted intervention possibilities are identified, they are laid out to specific invitees from the RURBAN platform who are impacted (positively or negatively) through the intervention. These stakeholders can then consultatively identify most appropriate interventions based on a combination of implementation costs and benefits. To support them in doing so, some key elements of such a cost-benefit assessment approach will be laid out including factors such as Financial costs and resource availability taking into consideration lifecycle costs of the intervention alternatives and sources of meeting such funding (internal and potential external sources) in light of the financial capacity of stakeholders, technical capability, people and process maturity, gestation time vs. intervention timelines.

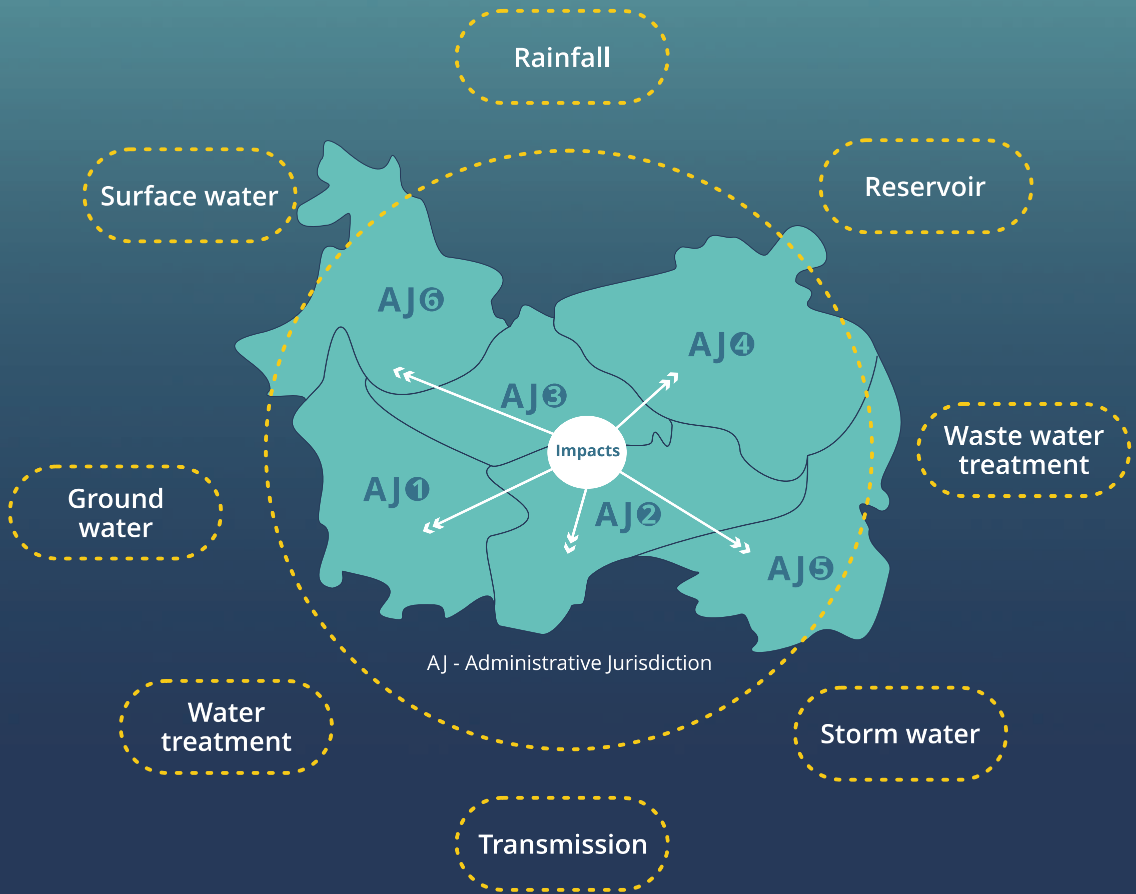
If in course of the consultations, the benefits of the interventions are felt to outweigh the costs, appropriate representations may be made to higher levels of decision making (State and Central) to provide resources and support for the interventions.

DECISION MAKING SUPPORT THROUGH IADAPT PROJECT

- An external intervention in one administrative jurisdiction has impacts on other water dependent administrative jurisdictions
- Impacts across the entire water cycle within the user catchment which is beyond a singular administration jurisdiction is assessed
- Adaptation strategies are designed to address the negative externalities of an external intervention on any stakeholder within the user catchment



WATER USER CATCHMENT



Water policy and management need to reflect the fundamentally interconnected nature of hydrological resources, and Integrated Water Resource Management (IWRM) is the accepted alternative to the sector-by-sector management style that has dominated the past. The basis of IWRM is that the many different uses of water resources are interdependent. For example, high irrigation demands mean less freshwater for drinking or industrial use; contaminated municipal and industrial wastewater means polluted rivers and threat to ecosystems. It is therefore evident that the current water resource management which is done in isolation of a sector of the water cycle or of an administrative jurisdiction doesn't take into consideration all users in the catchment.

Based on the IWRM principles of social equity, economic efficiency and environmental sustainability, the following questions must be answered,

- How will my decision/ action affect access for other users to water or the benefits from its use?
- Will my decision/ action result in the 'most efficient use of the available financial & water resources?'
- How will my decision/ action affect the functioning of natural systems?

It is therefore imperative that catchment managers ensure equal access of adequate water quantity and quality to all users such that when water allocations are being made, rights of all users to the benefits gained from the use of water is considered. In this context, the Decision Support Tool (DST) will serve as a valuable tool in helping catchment managers make socially equitable decisions. Considering that an intervention on any one sector of the water cycle within a administrative jurisdiction has impacts across other sectors of the water cycle and other users in neighbouring administrative jurisdictions, interventions should be re-designed taking into consideration all the users who are dependent on the same water user catchment. The DST will assess every intervention being planned by the catchment managers and identify if there are any negative externalities in quantity, quality or risk on any user within the catchment due to the proposed interventions and if so, the DST will recommend adaptation strategies to address the possible negative externalities. Through this the DST can ensure the implementation of the IWRM principles within the water user catchment.

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ATHENA INFONOMICS

Athena Infonomics is a data-driven global consultancy which combines social science research methods and ICT tools to drive innovation in policies, processes and programs in international development. Athena Infonomics has offices in India and Washington, D.C., alongside program hubs across Sub-Saharan Africa and South Asia.

Athena Infonomics India Private Limited
9/5, 1st Street, Venkateswara Nagar, Adyar, Chennai, Tamil Nadu – 600 020, India
+91 44 – 423 27112/423 27113 www.athenainfonomics.com