WASH Basins Training Material

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Introduction video by Katie Alcott

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Contents

List of acronyms

CSO - Civil Society Organisation
GIS – Geographic Information System
GPS - Global Positioning System
IWRM – Integrated Water Resources Management
MCM – Million Cubic Metres
MEL – Monitoring, Evaluation and Learning
NGO – Non-Governmental Organisation
SDG – Sustainable Development Goal
WASH – Water, Sanitation and Hygiene
WSP – Water Security Plan

Glossary

- **Aquifer -** An underground layer of water-bearing material, consisting of permeable or fractured rock, or of unconsolidated materials (gravel, sand, or silt)
- **Basin** – an area of land where all water, including surface water, ultimately flows into a single point, like a river mouth, lake, or ocean
- **Catchment** - an area of land where all the water from precipitation drains into a common body of water, such as a river, lake, or ocean
- **GIS** – Geographic Information System, a technology connecting data to a map and used to create, manage, analyse, and map all types of data.
- **Hydrology** – The study of movement, distribution, and quality of water on Earth. It encompasses the water cycle, water resources, and environmental watershed sustainability.
- **Hydrogeology** – A branch of geology that deals with the distribution and movement of groundwater in the soil and rocks of the Earth's crust. It focuses on the properties of aquifers and the interaction between groundwater and surface water.
- **Hydrometeorology** – The study of the transfer of water and energy between the land surface and the lower atmosphere. It combines aspects of meteorology and hydrology to understand and predict the impact of weather and climate on water resources.
- **Integrated –** Something being done in a coordinated and linked way, including multiple aspects
- **IWRM** – Integrated Water Resources Management, an approach based on the understanding that the different uses of finite water resources are interdependent within each water unit
- **Public finance** – The study and analysis of budgets and spending done by the government at central and regional levels.
- **Reach** - used by hydrologists when referring to a small section of a stream or river rather than its entire length
- **Sustainable (water) resource** – A reliable, safely managed source of water that can consistently supply water for the community needs for 300 or more days a year.
- **Toolkit** – A collection of resources, tools, skills used for a common purpose.
- **The WASH Basins Toolkit -** A toolkit that aims to support the sustainable development and management of community-level water, sanitation and hygiene (WASH).
- **Water balance –** An accounting of the inflow, outflow, and storage changes of water in a system, such as a watershed or aquifer. It helps in understanding the availability and distribution of water resources.
- **Water management** – The planning, developing, distributing, and managing the optimum use of water resources. It includes strategies and practices to ensure sustainable water supply, quality, and conservation.
- **Water Security Plan (WSP) -** Detailed project report that is the final output of the feasibility stage of a WASH service delivery project, setting out how the project should be implemented.
- **Watershed** - an area or ridge of land that separates waters flowing to different rivers, basins, or seas.

Module 1

What is the WASH Basins IWRM approach?

What will you learn in Module 1?

Module Contents

- Background to the WASH Basins Toolkit
- Overview of the WASH Basins IWRM approach
- What is the outcome of the process?
- Why is the Water Security Plan important?

What is the WASH Basins Toolkit?

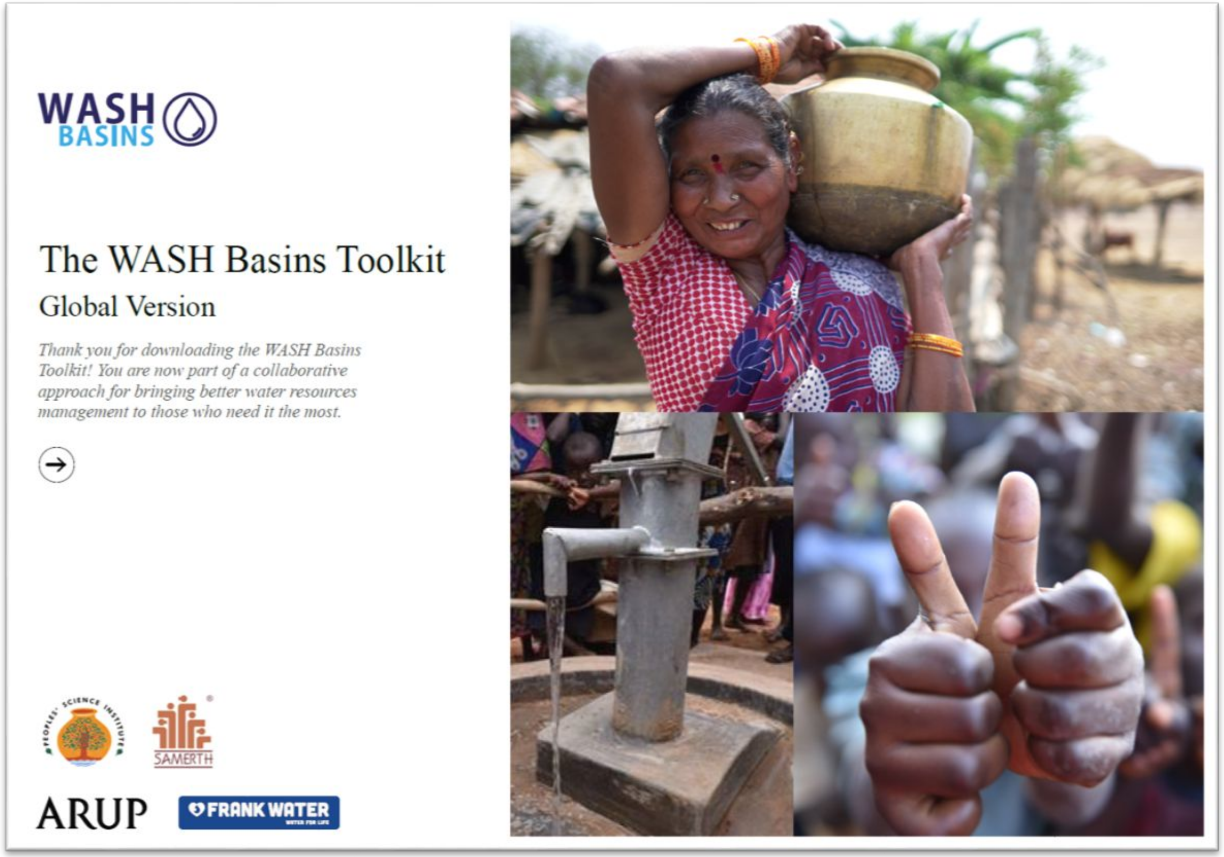
Starting in 2018, Arup, Frank Water and two India-based WASH NGOs - People's Science Institute (PSI) and Samerth Charitable Trust (Samerth) - collaborated to develop the WASH Basins Toolkit.

The Toolkit aims to support the development, implementation and management of sustainable, community-level water, sanitation and hygiene (WASH).

The Toolkit was originally trialled in India in 2020 and an updated global version launched in Kenya in 2022.

The WASH Basins Approach: To implement Integrated Water Resources Management (IWRM) principles in the management and provision of WASH.

The Toolkit, along with the android app, takes the user through the data collection, analysis and planning stages of the approach. The Toolkit guides the user through a sequential process, with practical steps and tools, resulting in the creation of a Water Security Plan (WSP).



Why was the Toolkit created?

Reference: https://sdgs.un.org/goals/goal6#overview

To empower communities and local governments to understand and manage water resources in a way that addresses the water needs of their areas, whilst responding to the needs of the national and international context.

Examples of national needs may include commitment to meeting UN Sustainable Development Goal 6 (SDG 6), in regard to water and sanitation provision, mitigating pressures on river basins and aquifers, as well as responding to climate change.

The desired outcome is to optimise the availability of water for domestic and agricultural purposes, and maximise sanitation and hygiene in marginalised communities by actively improving the understanding and monitoring of the resource and its use.

In turn, this will improve the livelihoods of the community, particularly for women and girls.

THE SUSTAINABLE DEVELOPMENT GOALS REPORT 2023: SPECIAL EDITION- UNSTATS.UN.ORG/SDGS/REPORT/2023/

What is IWRM?

Integrated Water Resources Management (IWRM) is an approach based on the understanding that the different uses of finite water resources are interdependent within each water unit i.e a watershed or catchment for surface water, or an aquifer for groundwater. Water resources need to be looked at holistically alongside water demand. IWRM promotes coordinated development and management of water resources, aiming to replace traditional sectoral and often fragmented policy approach.

The Global Water Partnership (GWP) defines IWRM as: "…a process which promotes the co-ordinated development and management of water, land and related resources, in order to maximise the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems" (Ref: www.gwp.org/en/GWP-CEE/about/why/what-is-iwrm/)

The IWRM approach is based on the understanding that the interconnected nature of water use is key to achieving a more integrated, sustainable approach to water management and provision of water, sanitation and hygiene. The different uses of finite water resources, such as drinking water, water for livestock, irrigation and industrial use, must be balanced and considered holistically with ecological sustainability. The approach encourages consideration of all types of water use, and planning how water resources can be shared equitably.

IWRM principles are supported by SDG 6, with Target 6.5 aiming to implement IWRM at all levels.

What is the WASH Basins IWRM approach?

Our Approach

Frank Water and its partners developed a new way to embed IWRM principles in the routine delivery of WASH services.

The WASH Basins Toolkit aims to share knowledge and make applying IWRM principles accessible to those delivering WASH projects on the ground. It provides a structured approach to data collection, analysis and water resource planning. This supports the user to assess water resources and uses and plan their sustainable management.

The Toolkit gives guidance to develop a standardised, repeatable and efficient workflow for delivery of WASH projects which implement IWRM principles. It can be used to develop a workflow for organisations that currently don't have well established processes. For other organisations, it can help fill in gaps, as well as providing guidance in addressing problems faced by those with well-established procedures.

Integrating IWRM into WASH

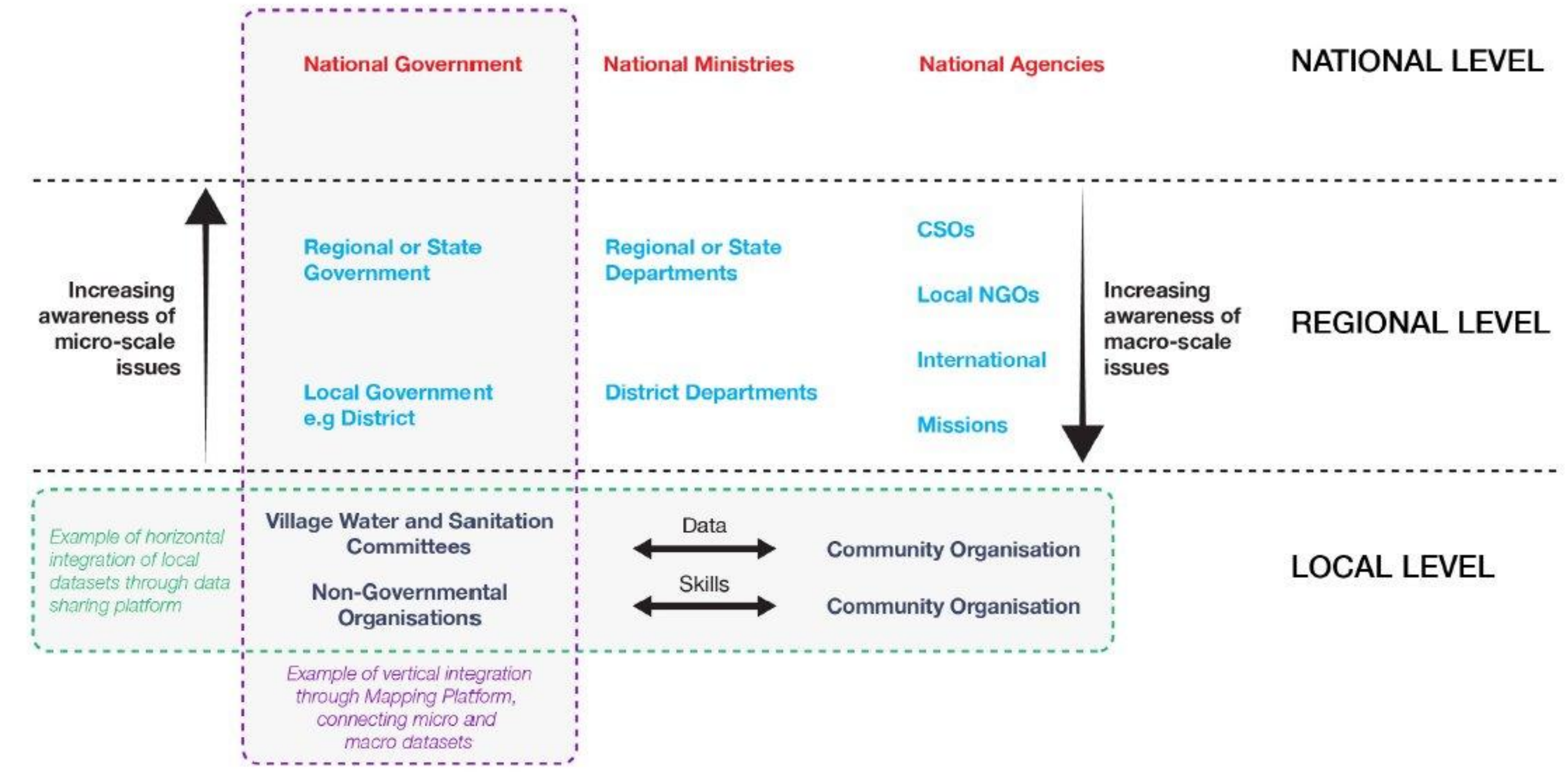
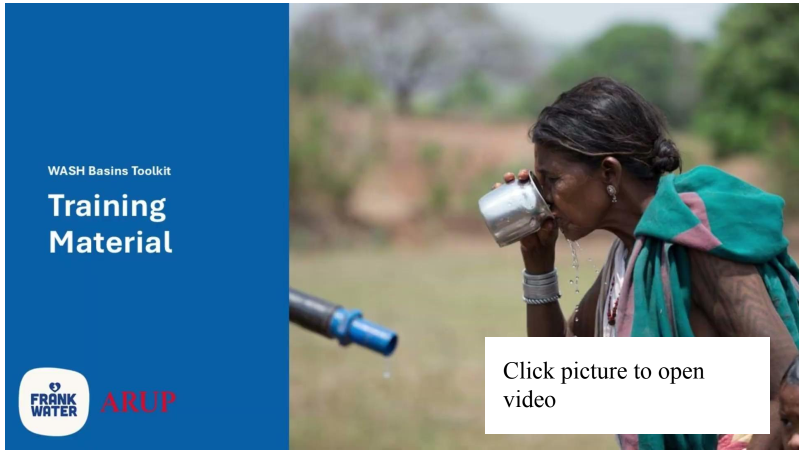


Figure 4 : Horizontal and vertical integration across the water resources management landscape



Click picture to open video

Expected Outcomes

Arup ©

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What is the outcome of the process?

Following the process set out in the WASH Basins Toolkit leads to the creation of a Water Security Plan (WSP).

The WSP is a detailed project report that is the final output of the WASH Basins approach, setting out how the project should be implemented. It brings together the information that has been gathered on the project, allowing others outside the project to understand the problems faced and how the proposed solutions have been arrived at.

amref health africa

WATER SECURITY PLAN FOR MORGO AND KIPPA SUBCATCHMENTS

ENKORIKA DIVISION

KAJIADO CENTRAL SUB COUNTY

KAJIADO COUNTY

JUNE 2023

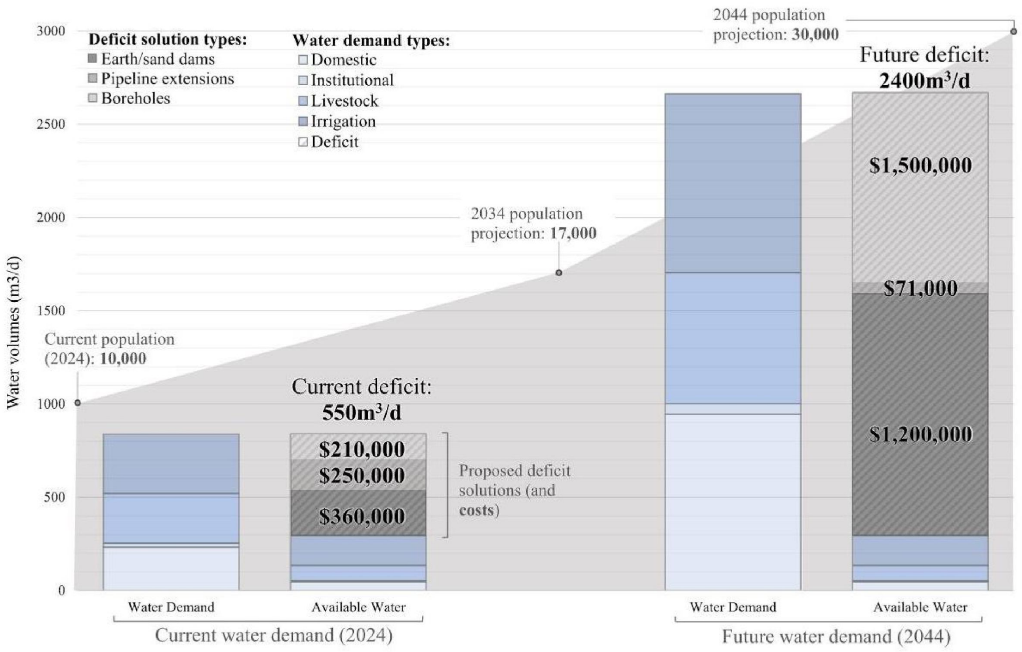
Front page of a WSP produced by Amref in Kajiado, Kenya

What do you do with a WSP?

The Water Security Plan (WSP) produced by this process is used to:

- Detail the WASH service delivery solutions and costs
- Enable a Project Implementation Agency (PIA) such as an NGO or CSO to deliver the project
- Enable a funding body or local government to fund delivery
- Document the delivery process of the project for future reference, including monitoring, evaluation and learning (MEL) requirements and reporting against SDG 6 Targets and Indicators, including Target 6.5 Indicator 6.5.1 ‘Degree of integrated water resources management implementation’

You will see more examples of WSPs and how they are used in Modules 6 and 7.



Demand type	Proposed intervention	Number of interventions	Average yield (m^3/d)	Total yield (m^3/d)	Net water balance (m^3)	Unit cost ($)	Total cost ($)
Domestic	Rehabilitation of boreholes	3	64	192	47	55,250	165,750
Institutional	Pipeline extensions from rehabilitated boreholes	3	0	0	36	30,000	90,000
Livestock		1	0	0	-50	30,000	30,000
	Earth dam	1	137	137	87	164,250	164,250
Irrigation	Using earth dam (above)	0	0	0	4		
External	Catered for by available sources	0	0	0	3		
Total		**8**	**201**	**329**	**3**		**450,000**

This graphs and table are from the WSP for the Morga sub-catchment in Kenya. The graph shows the water demand and availability, calculated using the IWRM WASH Basins approach. The table shows the proposed in the WSP to address the negative water balance.

Quiz

Complete Sustainable Development Goals (SDG) 6:

Ensure availability and sustainable management of water and sanitation for ….

a) … livelihoods.
b) … all.
c) … domestic use.
d) … urban communities.

Quiz

Complete Sustainable Development Goals (SDG) 6:

Ensure availability and sustainable management of water and sanitation for ….

a) … livelihoods.
b) … all.
c) … domestic use.
d) … urban communities.

Answer: b) all. The goal aims to optimise the availability of water for both domestic and agricultural purposes, and maximise sanitation and hygiene by actively improving the understanding and monitoring of the resource and its use.

Quiz

Match the key term to the definition:

IWRM (Integrated Water Resource Management)

WSP (Water Security Plan)

WASH Basins Toolkit

WASH

Tool developed to support the sustainable development and management of community-level water, sanitation and hygiene. provides a structured approach to data collection, analysis and water resource planning

A process which promotes the co-ordinated development and management of water, land and related resources, in order to maximise the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems

Collective term for water, sanitation and hygiene

Detailed project report that is the final output of the feasibility stage of a WASH service delivery project.

Quiz

Match the key term to the definition:

Answers:

IWRM (Integrated Water Resource Management) - A process which promotes the co-ordinated development and management of water, land and related resources, in order to maximise the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems

WSP (Water Security Plan) - Detailed project report that is the final output of the feasibility stage of a WASH service delivery project.

WASH Basins Toolkit - Tool developed to support the sustainable development and management of community-level water, sanitation and hygiene. Provides a structured approach to data collection, analysis and water resource planning

WASH - Collective term for water, sanitation and hygiene

Module 2

What does WASH Basins IWRM planning need?

What will you learn in Module 2?

Module Contents

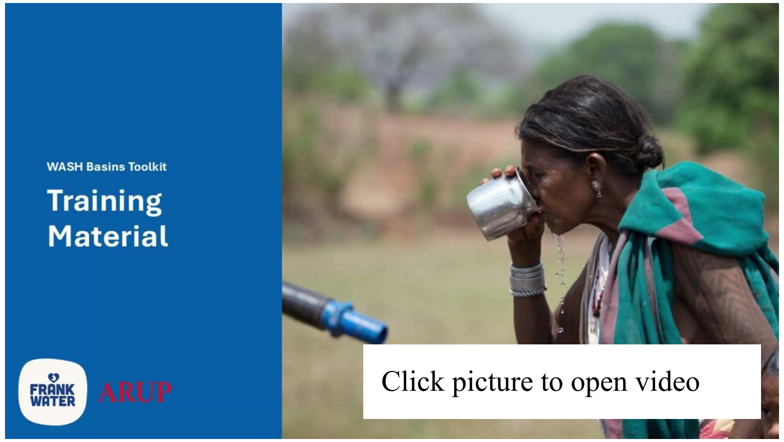
- How can the WASH Basins IWRM approach be used in different contexts?
- What information and data do you need before starting the process?
- How should you go about data collection?
- What happens when the WSP is complete?

What does IWRM planning need?

Planning contexts

Natural water systems occur within boundaries; these are hydrological boundaries such as watersheds and catchments, for surface water resources, or aquifers for groundwater resources. Module 3 will provide further background to hydrological and hydrogeological concepts for those without experience in this area.

IWRM uses these systems and respective boundaries as the units within which management of water occurs i.e. its existence and replenishment through rainfall (supply) and its use for human, animal and economic purposes (demand).



Sustainable WASH delivery, therefore, needs to work within the natural hydrological and hydrogeological boundaries, as well as the governance context that IWRM represents by building on the natural water boundaries. The natural water boundaries and IWRM boundaries are, therefore, important for planning.

In addition to the water boundaries identified above, administrative boundaries in a location (country, state, district, etc) also need to be taken into account. Such boundaries are critical to the WASH Basins approach because they represent the levels at which distribution of public finances for water management often occurs. This includes public finance for water resources management, WASH services or other water supply services. It is important to note that the administrative level at which public finance for WASH occurs varies from one country to another, and therefore it is important to define the relevant level for your location.

What does IWRM planning need?

Key definitions

Water or hydrological boundary

For surface water a hydrological boundary is defined as a special unit which is bound by physical features such as reaches and drainage. The hydrological boundary can often be defined by terms such as catchment river basin or watershed. Catchments or watersheds can vary significantly in size, from very large to very small. For the WASH Basins IWRM approach we usually refer to watersheds because these are often the smallest unit that wash NGOs encounter when working in villages and communities.

For groundwater, the relevant water management boundary is called an aquifer. This is a layer of rock sand or earth that contains water or allows water to pass through it. This boundary is called the hydrogeological boundary.

Administrative boundary

An administrative boundary can be defined as a physical area that is governed as a single administrative unit by a regional government or local government. The regional or local government should also have the authority to conduct planning budgeting and public works implementation in that specific administrative area. Commonly used administrative units include villages, districts, counties, states, etc. Please note that an administrative unit that is to be considered for IWRM planning should have clearly identified departments that manage water and have the responsibility for planning and sanctioning budgets for water projects.

What does IWRM planning need?

Selecting a boundary

It may not always be straightforward which boundary to choose for implementing the WASH Basins IWRM approach. The choice of unit must be based on the priorities of the project - for example which communities need water and what the priority locations are - as well as the conventions for water resources planning and management within the administrative unit or country. If, for example, a country encourages watershed management through the “ridge to valley” (i.e. catchment or watershed) approach then consider hydrological boundaries as the unit for applying the WASH Basins IWRM approach.

On the other hand, if the chances of developing a WSP are higher within the local planning authority boundaries, then administrative boundaries that are aligned to the planning authorities mandate must be chosen for applying the WASH Basins IWRM approach.

The following figures show some examples of administrative boundaries that have been used to apply their IWRM approach in Kenya, as well as the watershed or catchment boundaries for the same region of Kenya.

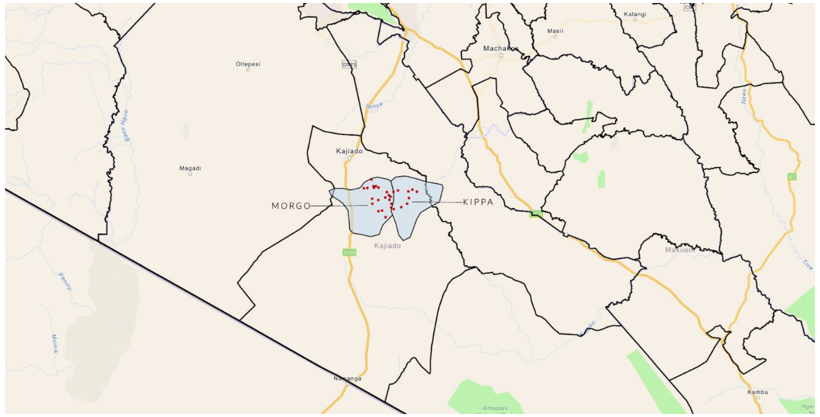


Figure shows Kenya trial study area watersheds for Morgo and Kippa against the national administrative boundaries

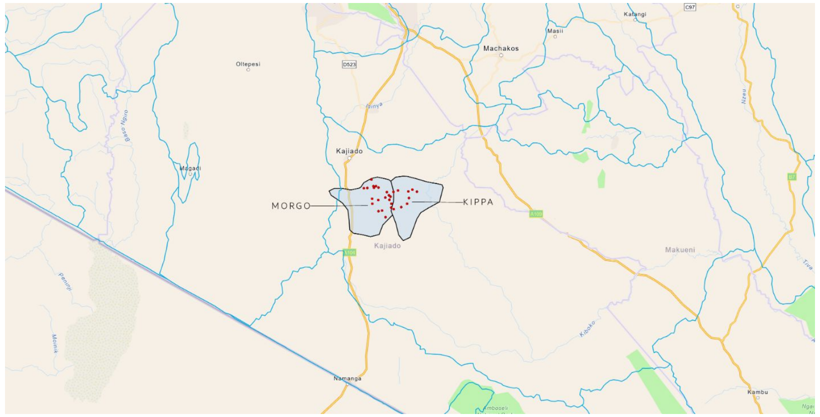


Figure shows Kenya trial study area watersheds for Morgo and Kippa against the national water body boundaries

What does IWRM planning need?

Data collection, analysis and information generation

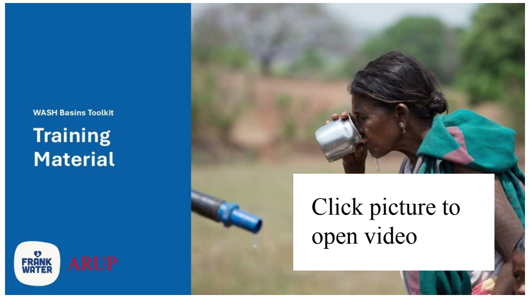
Once the boundaries for applying the WASH Basins IWRM approach have been decided, the next step is to consider what data needs to be collected, how it needs to be analysed and how useful information can be generated from this data.

In planning data collection, it is important to consider the different types of data needed (for example, human population, animal population, irrigated area, crops grown, number of springs, whether they are perennial or not, etc), as well as how it will be collected, how much of it needs to be collected and who will collect it (community-based staff or community mobilisers, for example). The WASH Basins IWRM approach champions the use of digital data collection using forms and templates on the app that have been developed and provided as part of the toolkit. These forms can be made adjusted and tailored for each project or organisation.

A key consideration is the number of staff available to collect data, and whether these need to be hired if they are not already part of the organisation's staff. Deployment of staff needs to be done in a consistent, organised and structured manner to ensure that data collection is also consistent, and that information generated from the data collected is reliable.

What does IWRM planning need?

Data collection, analysis and information generation



When collecting data a combination of data is needed. This usually comprises water availability data in the watershed, water demand data within the administrative or watershed boundary, and existing water sources and associated water quality. The type of data analysis that needs to be carried out will also be a factor in how a WASH organisation or NGO/CSO, applies the WASH Basins IWRM toolkit. For example, hydrological data may require the use of hydrological models, or just simple spreadsheet analysis. Hydrogeological data on the other hand, may require the use of specialist hydrogeological software to assess the productivity of aquifers through pump tests, for example.

The range of skills required to apply the WASH Basins IWRM approach also needs to be taken into consideration. An organisation may require a number of community-based staff to collect data in the field, as well as hydrologists or hydrogeologists to analyse the field data and turn it into usable information. WASH engineers or technicians may also be required to assess what infrastructure needs to be constructed or repaired and to cost up the financial requirements for that infrastructure. In addition, broad skills such as GIS analysts, monitoring and evaluation specialists, and health or hygiene specialists may also be required. Module 3 will cover this in detail.

Finally, it is important that managers and organisation leaders are also available to support the development of the WSP, engage with local administrators and sign-off on the WSP.

What does IWRM planning need?

What happens when the WSP is complete?

Once a WSP has been completed, submitted to the administrative office and accepted, it then needs to be implemented. The process of implementation, like the process of its development, also must be collaborative. It is a joint efforts between the WASH organisation (or NGO/CSO), the communities and the administrators.

Allocation of funds by the administrators is the key element to beginning the implementation stage. Therefore, it is important that the WSP is acknowledged and accepted by the administrative office.

The WASH organisation or NGO/CSO, can then go ahead to engage with construction companies or drilling companies to plan and finance the construction of the water sources that have been identified.

During the construction of the water sources, community mobilisers also need to remain engaged with the respective communities, in particular with the water and sanitation representatives, for example a water user committee.

Quiz

Which of the following are important in IWRM planning?

a) Administrative boundaries
b) Natural boundaries (hydrological and hydrogeological)
c) Both

Quiz

Which of the following are important in IWRM planning?

a) Administrative boundaries
b) Natural boundaries (hydrological and hydrogeological)
c) Both

Answer: c) Both need to be considered. Public finances for water management are based on administrative boundaries so are important for considering your funding context. Natural water systems occur with boundaries, which need to be considered to assess the water availability and demand in a system.

Quiz

What is a watershed?

a) A boundary for surface water
b) A boundary for groundwater
c) An administrative boundary

Quiz

What is a watershed?

a) A boundary for surface water
b) A boundary for groundwater
c) An administrative boundary

Answer – a) The hydrological boundary for surface water can be defined by a watershed or catchment. For the WASH Basins IWRM approach we usually refer to watersheds because these are often the smallest unit that wash NGOs encounter when working in villages and communities.

Quiz

Once you have selected the appropriate boundary, what are the next considerations?
Tick all that apply

a) Consider what data needs to be collected
b) Consider the number of staff available to collect data
c) Consider how much data needs to be collected

Quiz

Once you have selected the appropriate boundary, what are the next considerations?
Tick all that apply

a) Consider what data needs to be collected
b) Consider the number of staff available to collect data
c) Consider how much data needs to be collected

Answer: All are correct! Once the appropriate boundary for you project has been selected, you will need to consider the types of data that needs collecting. Then you can consider how much needs collecting and the staff requirements for this, and whether these need to be hired if they are not already part of the WASH organisation or NGO/CSO staff.

Module 3

What does implementing WASH IWRM need?

What will you learn in Module 3?

Module Contents:

- What technical skills will be required for the WASH Basins IWRM approach?
- Which tools are required?
- Importance of the governance context
- Consideration of funding context

What technical skills are required?

To implement the WASH Basins IWRM approach, the following skills will be needed:

- Community mobilisation skills – people to involve the local community in decision making and implementation. Preferably those with knowledge of water resource policy and laws.
- Hydrology and water engineering skills – professionals to assess water sources, infrastructure and design water supply systems
- Civil or mechanical engineering skills
- Collation and analysis of datasets may involve office-based staff with specialist skills e.g GIS specialists or technical analysis to gather geographic data and mapping, and carry out analysis to represent information visually
- Water resources assessment skills
- Analytical skills
- Project management – to coordinate the planning and execution of the WSP
- Infrastructure costing skills e.g quantity surveyor, civil engineer or civil engineering technician

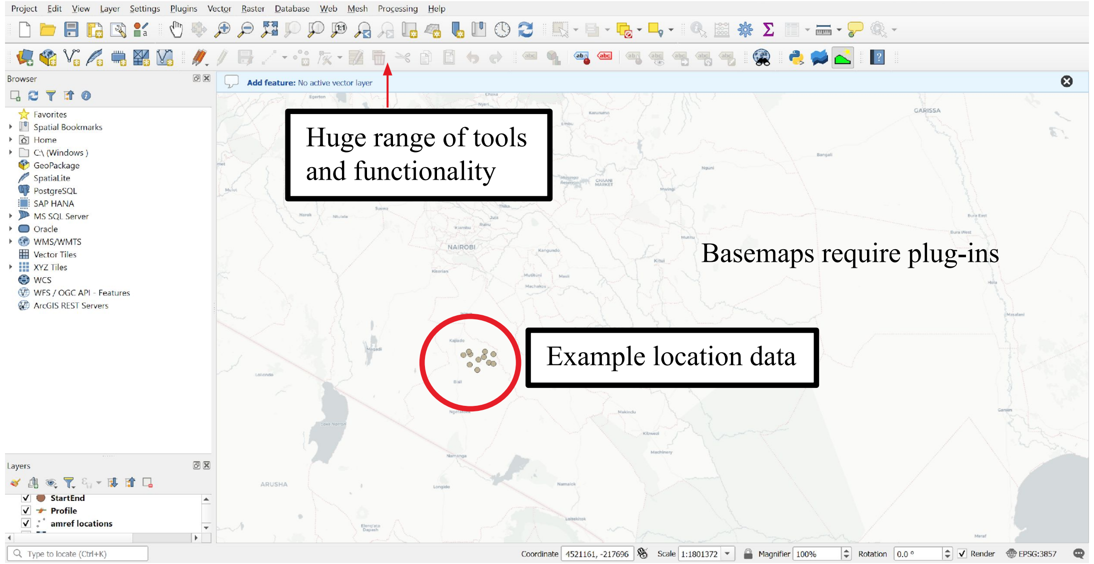
What tools are required?

To implement the WASH Basins IWRM approach, the following tools will be needed.

- Smartphones with Android to access the IWRM WASH Basins app to be used for data collection. Phones must be able to run a form in the browser and locally store data.
- GPS is required, which is often enabled on smartphones
- Camera – can be a phone camera
- GIS software - Commonly used professional GIS software includes ESRI's ArcGIS Pro. More affordable or free alternatives include QGIS (free) and GeoMedia. More details are given in the table in the next section.
- Computer to run GIS software on

Comparison of free mapping software

QGIS

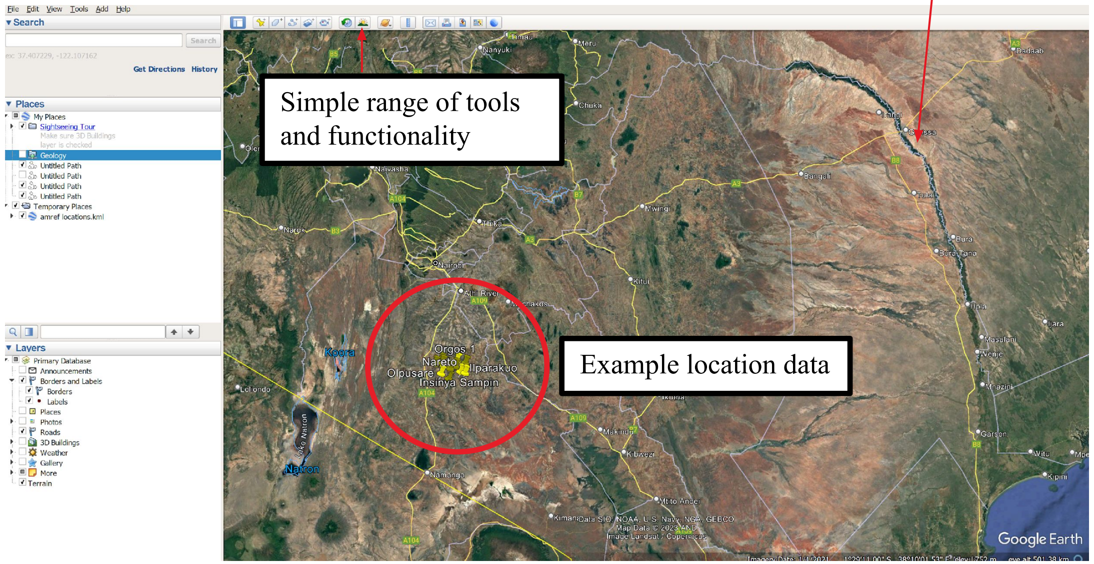


User-friendly, professional GIS application licensed under the GNU General Public License. Known for large user base, online support and thorough documentation, as well as extendibility with plugins. Suitable for extensive data handling, customisation, and analysis capabilities.

Getting started with QGIS: An Absolute Beginner's Guide to QGIS 3

Google Earth

Uses Google satellite imagery



Easy-to-use and familiar tool for visualisation, basic mapping and collaborative projects. Includes unique tools and features like StreetView, 3D terrain and buildings and high-resolution historical imagery.

Getting started with mapping in Google Earth: Making a Simple Map using Google Earth

The importance of the governance context

As we discussed in the previous module, the administrative or governance context is really important for delivering sustainable wash services when using the WASH Basins IWRM approach.

If the WSP is not accepted by the administrative unit responsible for funding water and sanitation services, it becomes really difficult to implement the plan. On the other hand, if the WSP that has been developed does not align to the administrative boundary at which funds are disbursed, then the plan may not be fully implementable. Equally, as we saw in Module 2, if the WSP is developed to match the administrative boundaries but does not relate to a watershed it may not be a sustainable plan.

In summary, WASH organisation or NGO/CSO, need to pay special attention to the local administrative and funding context while also ensuring that hydrological and hydrogeological boundaries are respected. This ensures that a WSP is financially and hydrologically sustainable, which is the intention of the WASH Basins IWRM approach.

Consideration of funding context

The cost of delivering a Water Security Plan (WSP) varies between organisations, depending on their scope of work, technical capacity or advocacy role. You will look at some case studies in Module 7.

To implement the WSP, organisations need to provide comprehensive engineering designs and accompanying detailed costs for each plan, including costs of materials and equipment as well as labour requirements. More detail on the development of the WSP will be given in Module 6.

The maintenance of proposed systems should also be considered, including the community plans to operate and maintain the systems and associated costs.

Action: Analyse the total government planned budget and spending related to water resources and WASH services in your area of work or administrative boundary.

Quiz

Which of the following need to be costed for implementing a WSP? Tick all that apply

a) Cost of materials for proposed design

b) Labour requirements

c) Ongoing maintenance costs

Quiz

Which of the following need to be costed for implementing a WSP? Tick all that apply

a) Cost of materials for proposed design

b) Labour requirements

c) Ongoing maintenance costs

Answer: All of the above! You will look in detail at the development of a WSP in Module 6 and the costing and delivery of a WSP in cases studies in Module 7.

Quiz

True or False? Expensive GIS software must be purchased to carry out the WASH Basins IWRM approach.

a) True

b) False

Quiz

True or False? Expensive GIS software must be purchased to carry out the WASH Basins IWRM approach.

a) True
b) False

Answer: False – While some professional GIS softwares are available, there are affordable and free alternatives available. For example, QGIS is free.

Quiz

Why is it important to consider the government context?

a) If the WSP does not align to the administrative boundary at which funds are disbursed, then the plan may not be fully implementable.

b) If the WSP does not relate to a watershed it may not be a sustainable plan as it may not have the full picture of water availability and demand.

c) Both

Quiz

Why is it important to consider which boundaries to align the WSP to?

a) If the WSP does not align to the administrative boundary at which funds are disbursed, then the plan may not be financially sustainable.

b) If the WSP does not relate to a watershed it may not be hydrologically sustainable as it may not have the full picture of water availability and demand.

c) Both

Answer: c) Both are correct. The administrative or governance context is really important to consider so that the plan can be implemented. At the same time, hydrological and hydrogeological boundaries need to be respected for the plan to be sustainable.

Module 4

What are the key principles of WASH Basins IWRM approach?

What are the key principles of IWRM in WASH?

The Toolkit provides guidance on the importance of developing a standardised, repeatable and efficient workflow for delivery of WASH projects which implement IWRM principles.

This module explores the following key principles of the approach:

1. Data collection using digital tools
2. GIS analysis
3. Hydrological analysis – an introduction to groundwater and aquifers
4. Water Balance Assessment
5. Aquifer recharge and augmentation

Data Collection

Data collection is important to understand a community's needs and problems, and to inform the next steps of the WASH delivery project. Therefore, the data collection needs to be as accurate and efficient as possible.

Many well-established WASH delivery projects have methods of data collection in place, such as household surveys. These are often carried out on paper and are then transcribed and any data errors are removed before it can be analysed.

Our approach: Use digital tools to carry out surveys rather than paper forms.

Data collection – using digital tools

The WASH Basins IWRM approach uses digital tools to collect information rather than on paper. The data is still collected in the same way, such as household surveys, but the surveyor fills out a digital form rather than paper. The data can then be exported in common file formats (e.g. Excel files or CSV files) for analysis. This removes the need to transcribe the data, meaning it is ready to analyse quicker and reduces likelihood of errors.

The WASH Basins IWRM app includes the digital forms needed for the data collection stages of the approach. The forms can be filled out by the surveyor offline. The data is then uploaded later when there is network connection. You will learn how to use these in Modules 5 & 6.

Examples of other available digital tools for WASH data collection include KoBo Toolbox and KoBo Collect app, mWater and Akvo Flow.

Data collected using the WASH Connect App is stored on Frank Water's secure server and is easily accessible by creating an account when logging in to the WASH Basins App.

Data collection – using digital tools

Comparison of paper and digital forms:

Paper forms:	Digital Forms:
Must be transcribed before the data can be analysed. This can take several weeks, depending on staff availability and workload.	Do not need to transcribe. This reduces workload and reduces the time between data collection and data analysis.
May be errors in transcription.	Reduces risk of error as data does not need transcribing.
Widely available	Requires phone with Android and download of the IWRM WASH Basins app. This can be downloaded in advance. Data collection can be done offline with no mobile or Wifi network required. The data is uploaded later.
Harder to compare data in many paper forms.	Easier to compare data, and any errors in the recorded data can be easily seen. A timestamp and geotag on the digital data also gives context to the data, making it more robust.
Data must be transcribed before it can be shared easily with other stakeholders.	Digitally collected data is easier to share with other stakeholders via the platform selected or in common file formats.

Data Collection

Quick question- Write down your answers to the following

Which methods of data collection have you used before?

Have you used digital forms?

If so – How have they been helpful?

If not – What would the benefits of digital forms be for your organisation? What do you need to think about before implementing this change?

GIS Analysis

A Geographical Information System (GIS) is a software system that can be used to capture, store, analyse and present spatial or geographic data. Desktop, mobile and web-based platforms can be used for data management, analysis and presentation.

The different GIS software available was detailed in Module 3 – 'What tools are required?'

Benefits of GIS:

- Visual presentation of information makes it accessible to shareholders
- GIS maps can be used easily in reports
- Supports the use of affordable and available portable devices for field data collection
- Helpful for comparing data and contexts
- Can export to common files, e.g. Excel, for external analysis

Considerations when introducing digital tools

Here are some considerations when introducing digital tools into your workflow:

- Surveyors will need training and time to learn how to use the digital tools for the first time
- May be some initial disruption when making changes to workflow
- Analysis software standard export formats and analysis options may not match an organisation's standardised reporting requirements.
- Risk that software access requirements and technical support may change or reduce without warning.
- Risk of free to use software being withdrawn due to lack of financial support.
- Make sure that your processes avoid duplication e.g map using the tools in the app rather than with Google Maps or standard GIS products

Considerations when introducing GIS

Additional considerations to those mentioned, when using GIS -

- Training and time will be required to learn how to use the software
- Less community involvement when using GIS for village information maps so may lead them to feel less involved
- May require specialist GIS skills

Hydrological Analysis

A key principle of IWRM is that the whole water system must be looked at holistically. To do this, we must understand the flow of water on Earth's surface and the cycle of circulation of the water between the earth and the atmosphere, called the hydrological cycle.

Processes in this cycle include:

- Evaporation – from land
- Transpiration – from plants
- Condensation – which forms clouds
- Precipitation – e.g. rainfall, snow, hail
- Runoff – flow of surface water on the land

Surface water is water that flows on the surface on the land, eventually flowing into water bodies such as lakes or rivers. The area of land in which the surface water flows to a particular river is known as the river 'basin', 'catchment' or 'watershed'. Hydrology is the study of the water cycle, including the flow of surface water.

Hydrological Analysis

Hydrological Analysis typically requires:

- Precipitation data – rainfall or snowfall depending on the area
- Stream and river flow data – typically long term time series of at least 10 years
- Land use data – including land cover and vegetation types
- Soil data – soil type, soil moisture, erosion factors
- Surface storage bodies – lakes, wetlands, artificial reservoirs
- Evaporation (from land) and evapotranspiration (from vegetation) data
- Topography data – variation in land elevation above sea level. Can be on contour maps or GIS digital elevation model (DEM)

Most of the GIS software discussed previously can be used for spatial analysis. Precipitation, river flow, storage and evaporation data can be found in national or regional databases and sources.

It is recommended that appropriate hydrology skills are developed through training or recruitment, to develop reliable and beneficial information.

Quick question

What is a watershed?

The watershed of a river is.....

a) The volume of water in the river

b) The area of land where the surface water flows into the river

c) The length of the river

Quick question

What is a watershed?

The watershed of a river is.....

a) The volume of water in the river

b) The area of land where the surface water flows into the river

c) The length of the river

Answer: b – The area of land where the surface water flows into the river. This is also known as the river 'basin' or 'catchment'. The surface water outside of the watershed will flow into a different water body.

Hydrogeological Analysis

A key principle of IWRM is that water resources and use must be looked at holistically. This means that the availability of sustainable water resources must be estimated, which requires a good understanding of water flow and storage.

Hydrogeology is a branch of geology that deals with the distribution and movement of groundwater in soil and rocks of the Earth's crust. It focuses on the properties of aquifers, which are layers of permeable rock or soil where groundwater is stored or flows through.

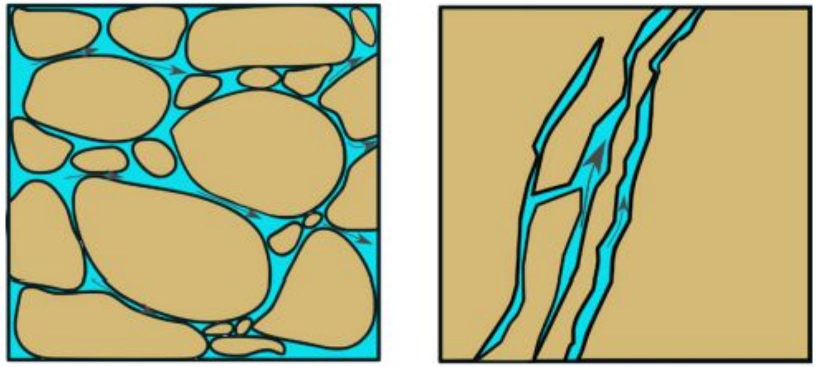
Groundwater is water that is stored between rocks below ground. These rocks are typically made of gravel, sandstone or crystalline rock e.g. limestone or volcanic rock (see diagram right).

The groundwater then flows through the spaces between the rocks, until it is eventually discharged, either at the surface (as springs or seeps) or entering rivers, streams or the sea.

Since groundwater is hidden below ground, it can be difficult to understand and manage, so the support of specialist hydrogeologists may be required.

This section will provide you with a brief introduction to groundwater.

Figure 27 : Flow Patterns Through Rock



Flow through pore spaces. The rate of flow is dependant on the size of spaces within the soil or rock. This is the common flow pattern in gravels, sands and sandstone rock.

Fracture Flow: Flow through fractures can be much higher than through pore spaces. Highly fractured rock will likely have a higher flow rate. This is the common flow pattern in crystalline rock such as lime-

Hydrogeological Analysis - Intro to Groundwater

Key concepts:

Aquifers - the rocks which store water and allow it to flow through

Unsaturated zone – layers of rock and soil where there are pores or voids not filled with water. Water infiltrates downwards.

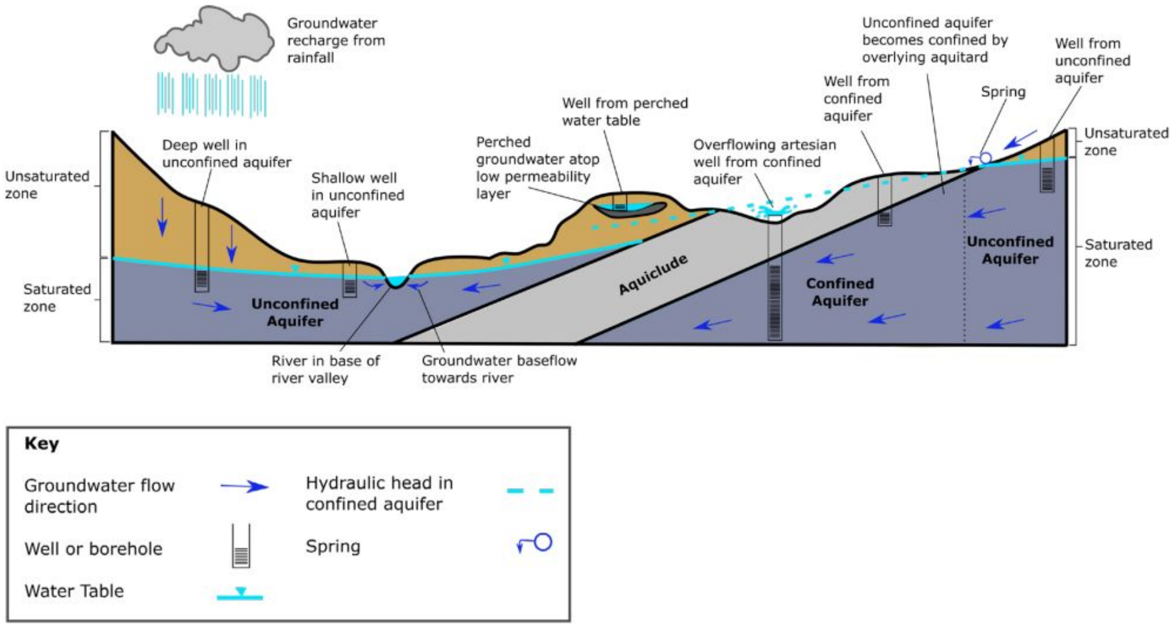
Saturated zone – area of the aquifer where all the pores and voids are fill of water. Water in this area is known as groundwater.

Water table – depth from the surface where groundwater is found. Can vary from a few centimetres to hundreds of metres.

Recharge – main input to the groundwater. Natural sources include rainfall, surface runoff and water bodies such as lakes. Sources from human activity include leakage for irrigation or deliberate aquifer recharge.

Flow – groundwater tends to flow laterally (sideways) following local topographic gradient.

Figure 28 : Diagram showing Confined and Unconfined aquifer systems



Hydrogeological Analysis

Quick question – What is the difference between an aquifer and groundwater? Write down your answer, then check below.

Answer – An aquifer is the geological formation, made up of rocks that stores water. Groundwater is the water than the aquifer stores.

Hydrogeological Analysis - Intro to Aquifers

Aquifers are the formations that store groundwater and allow it to flow through.

Properties of aquifers:

Porous – have space that water can fill

Permeable – allows water to move through

Types of aquifer:

Unconfined Aquifer - The upper boundary of the aquifer is a free groundwater surface. The pressure of the free surface is the same as the atmospheric pressure. These are also known as 'water table' aquifers because the free groundwater surface is the water table. See the image for an example.

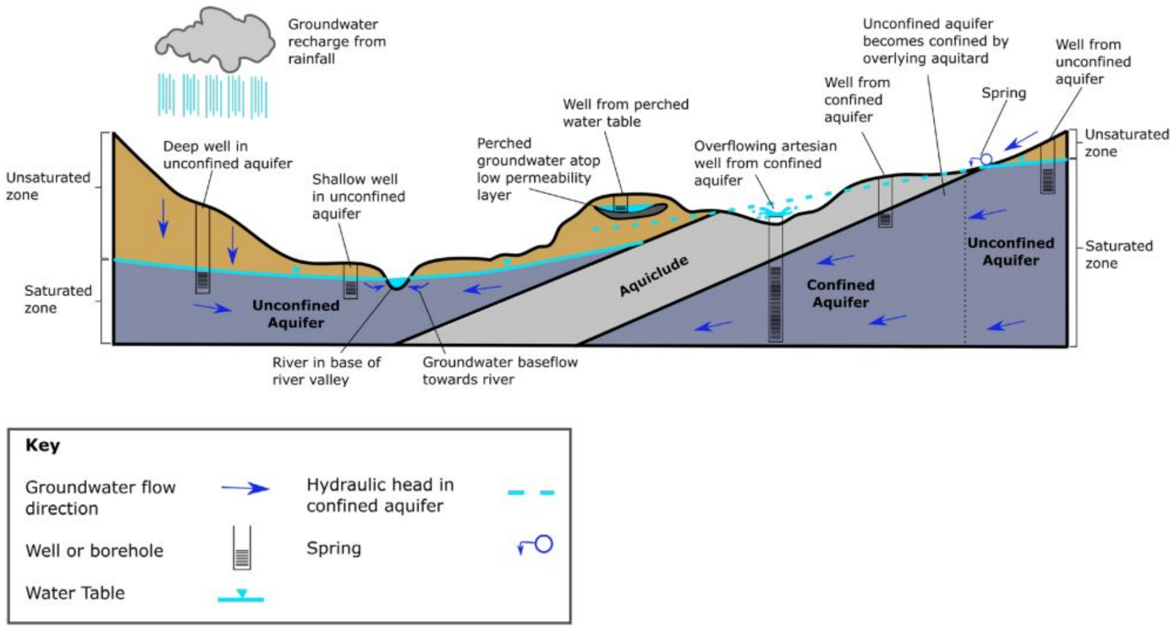
Confined Aquifer – The aquifer is fully saturated and its hydraulic head is in a low permeability area. This can be above the ground surface. Water here overflows naturally, in what is known as an artesian well. See the image for an example

Key words:

Aquiclude – Very low permeability formation that bounds the aquifer

Aquitard – A low permeability formation that can transmit significant quantities of groundwater. Aquifers are known as 'semi-confined' or 'leaky' if an aquitard allows leakage to or from it.

Figure 28 : Diagram showing Confined and Unconfined aquifer systems



Hydrogeological Analysis

Understanding the properties of an aquifer allows us to estimate the flow of the groundwater and understand its storage and sustainable yield. The WASH Basins Toolkit provides guidance for analysis, tools and methodologies to work out the groundwater parameters for aquifers.

The main parameters describing the aquifer's ability to transmit water include:

Parameter	Definition
Hydraulic conductivity (permeability)	Describes the velocity that groundwater would flow through the rock if there was a pressure gradient of 1 m per metre. Measured in metres/second (m/s)
Thickness	Thickness of aquifer. Measured in m.
Porosity	Void space within the rock. Determines how much water can be stored
Transmissivity	Describes the ability of an aquifer to transmit volumes of groundwater. Calculated as (hydraulic conductivity) x (thickness). Usually given in m^2/day.
Storage coefficient	Volume of water released from the aquifer storage when the water table falls by 1m. More accurate measure than porosity for measure groundwater storage.

More detail about the different steps in hydrological analysis will be given in Module 6, which goes through the stages of the WASH Basins IWRM approach. Detailed hydrological investigations require input from experienced scientists and are often beyond the scope of community scale WASH delivery projects. However, some geological assessment can be made by non-specialists, with training, and measurements of hydraulic properties can be made by pumping tests.

Quick question – An aquifer has a hydraulic conductivity of an aquifer is 0.1m/s and thickness of 2m. Calculate its transmissivity in m^2/day.

Answer: 0.1 x 2 = 0.2 m^2/s. Number of seconds in a day is 60 x 60 x 24 = 86400. Transmissivity = 0.2 x 86400 = 17280 m^2/day

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Hydrogeological Analysis - Intro to Aquifers

There are many ways to access groundwater, including:

Springs – Natural discharge points of groundwater at the surface of the ground, or directly into stream, lake or sea beds. If there is no perceptible current, it is known as a seep. Springs are often shallow so can be vulnerable to contamination and drought.

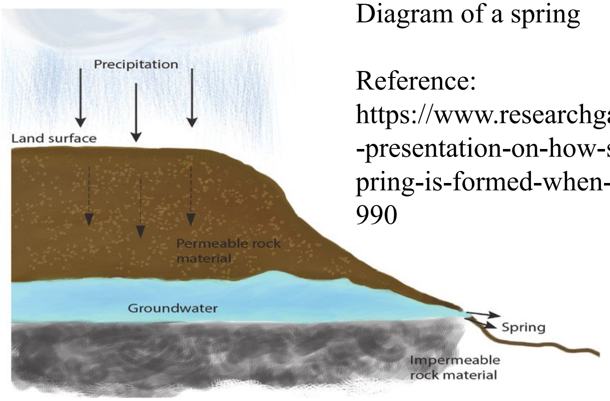


Diagram of a spring

Reference: https://www.researchgate.net/figure/llustrative-presentation-on-how-springs-are-formed-A-spring-is-formed-when-surface-of_fig1_324983990

Hand-dug wells – Dug by hand in soft materials to access water contained in an aquifer. Typically less than 20m deep and 1-2m in diameter, though diameters up to 8m are common in some parts of the world. Often need to be lined to protect them from collapsing. Larger diameters mean there is more storage, allowing water to accumulate when demand is low at night to be emptied when demand is high. Dug wells can be vulnerable to drought because they usually get water from shallow aquifer units.

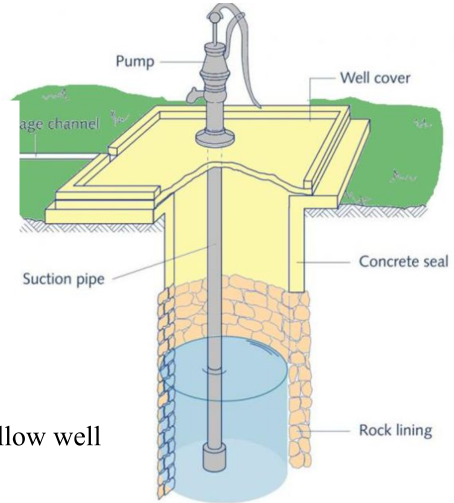


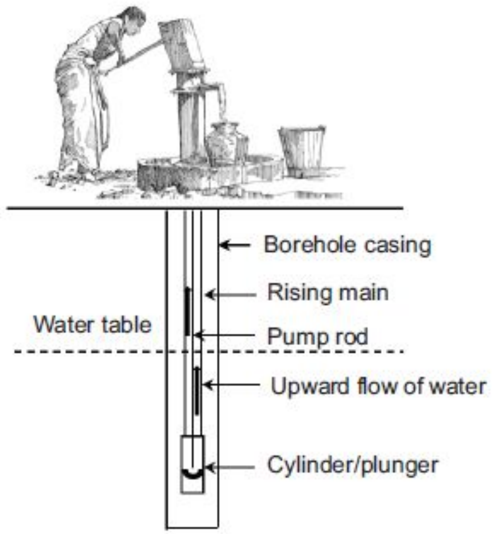
Diagram of a hand dug well or shallow well

Reference: https://www.wateraid.org/uk/publications/technical-brief-hand-pumps

Hydrogeological Analysis - Intro to Aquifers

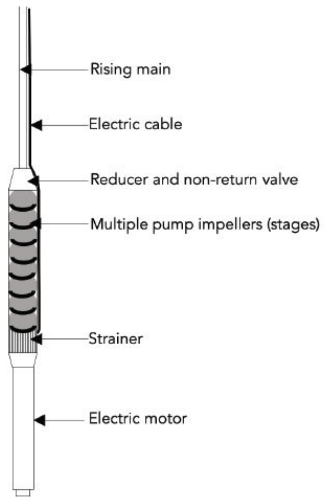
Boreholes or tube wells – A narrow hole drilled into the ground to access water contained in an aquifer. Most common water source in rural water supply projects. A pump and pipe are used to pull water out of the ground and then a screen is used to filter the water.

Borehole with hand pump:

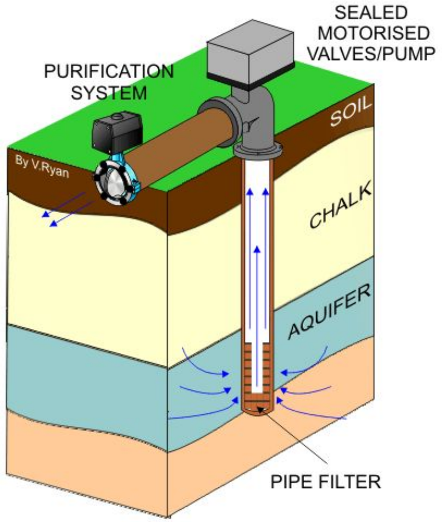


Reference:
Carter, Richard C. (2021) Rural Community Water Supply: Sustainable services for all, Rugby, UK: Practical Action Publishing

Borehole with mechanised pump:



Reference:
Carter, Richard C. (2021) Rural Community Water Supply: Sustainable services for all, Rugby, UK: Practical Action Publishing



Reference:
https://technologystudent.com/energy1/drkbore1.htm

Hydrogeological Analysis - Intro to Aquifers

Types of borehole:

- Bored or shallow wells – usually drilled into an unconfined water source less than 30m deep
- Consolidated or rock wells – drilled into rock formations containing no soil. Depths of 25m to 200m
- Unconsolidated or sand wells – drilled into a formation consisting of soil, sand, gravel or clay material that collapses upon itself. Always need to be screen and cased.

Drilling boreholes speeds up construction and means that wells can be drilled deeper and in harder rock. They can however be expensive and require specialist equipment and staff to construct and maintain.

Collector wells or infiltration galleries – Variety of alternative collection systems. Generally complex and expensive so beyond the scope of most WASH programmes

Hydrogeological Analysis - Pumping tests

Direct field measurements of hydraulic properties can be made by pumping tests. They usually involve observing the effects of constant pumping on the aquifer or the water level drawdown in observation well. It is a highly recommended part of groundwater resource investigation.

Pumping tests allow hydrogeologists to:

- Evaluate well performance
- Observe the drawdown and estimate its sustainable yield
- Estimate aquifer properties, including hydraulic conductivity and storage

This is done by measuring the rate of groundwater flow produced by pumping a well and observing any changes in the well. Pumping moves the groundwater in the aquifer towards the well, forming a cone of depression in the water table around the borehole. Its size and shape depend on the pumping rate and the aquifer properties.

There is a range of types of tests available, with different costs and equipment required.

Quick question

What is the study of movement, distribution, and quality of water on Earth called? It encompasses the water cycle, water resources, and environmental watershed sustainability.

a) Geology

b) Hydrology

c) Hydrogeology

d) Geography

Quick question

What is the study of movement, distribution, and quality of water on Earth called? It encompasses the water cycle, water resources, and environmental watershed sustainability.

a) Geology

b) Hydrology

c) Hydrogeology

d) Geography

Answer: Hydrology

Quick question

Which is the following are studied in hydrogeology?

Tick all that apply:

a) Aquifer
b) Surface water
c) Ground water
d) Watersheds

Quick question

Which is the following are studied in hydrogeology?

Tick all that apply:

a) Aquifer

b) Surface water

c) Ground water

d) Watersheds

Answer: (a) and (b) are studied in hydrogeology. The other options are studied in hydrology.

Water Balance Assessment

A Water Balance assessment brings together the information gathered about how much water is available, from catchments, watersheds or aquifers, with the information about how much water is required for human and livelihood needs.

Key Concepts:

Inputs – Rainfall and other precipitation

Influencing factors - Vegetation type, soil type and underlying geology, topography (catchments and sub-catchments)

Available resources - Streamflow, surface runoff, groundwater recharge, surface water storage

Outputs - Domestic, irrigation, livestock, industrial and other water demands (abstractions), as well as evapotranspiration

Due to the scale of information required, it is complex to develop a fully accurate water balance assessment. The aim is to have a reasonable level of accuracy to give communities a baseline balance between water need and availability. It also provides a means to continue monitoring this.

The Toolkit assumes two levels of accuracy, depending on availability of data and resources:

Fully quantitative – A data rich assessment, capturing the whole hydrological cycle. This is typically large scale and completed across a whole watershed or river basin.

Qualitative – Less available data, so may not capture all inputs and outputs. More common for smaller micro-catchments. Main approach to monitor changes in water availability is to look at changes in water table level.

The Toolkit provides a standardised Microsoft Excel workbook in which key information can be captured in order to provide a high-level baseline water balance assessment. You will look at the tool in more detail in Module 6.

Aquifer Recharge and Augmentation

Issues with water availability are often caused by the variability, timing and duration of water resource, rather than an absolute shortage. There is an opportunity to address these issues by storing water during the wet season for future use. The Toolkit details two methods, artificial aquifer recharge and soil improvement techniques, for this because of their suitability for community schemes in rural areas.

Artificial recharge of aquifers:

Aim – to store 'excess' surface water or stormwater run-off for future to help avoid the exhaustion of groundwater resource.

This method is effective when groundwater levels are declining, the aquifer is significantly desaturated, the unsaturated zone is of good permeability or there is inadequate groundwater in dry months.

Benefits:

- Little land wasted for storage
- Generally good quality
- Less evaporative losses from underground storage compared to surface storage

Aquifer Recharge and Augmentation

Artificial recharge techniques:

Subsurface techniques - usually include recharge of wells and boreholes with good quality silt-free surface water from farm ponds, streams or from rainwater collected from roofs. The water used for recharge must be of equal or better quality than the current groundwater.

Surface techniques - usually include a range of infiltration basins, check dams or percolation structures. The quality of the recharge water is less of an issue for these techniques because they is an element of natural filtration. A percolation tank is constructed by putting an earth bund with a side waste weir across a stream.

Aquifer Recharge and Augmentation

Rainwater harvesting:

Rainwater can be collected and reused onsite, rather than being allowed to run off. It can be collected from roofs and stored in a deep pit or storage tank. It can be used for irrigation and livestock. For domestic use, rainwater requires treatment. Harvested water can also be used for aquifer recharge.

Land and Soil management:

In tropical monsoon climates, converting land from forests to agricultural land often increases the direct runoff and decreases the groundwater flow. Managements to help reverse this include: gully rehabilitation, land enclosures, infiltration furrows with bunds, stone bunds, waterways, planting of trees and fodder plantation, and treatment of degraded soils. Which intervention is appropriate depends on the catchment area and vegetation species and will require long term qualitative studies to decide.

Quiz – what have you learnt?

1. Which of these are benefits of digital data collection? (Tick all that apply)

a) No need to transcribe the data, reducing errors

b) Less time and work needed between data collection and analysis than paper forms

c) No need to analyse the data

Quiz – what have you learnt?

1. Which of these are benefits of digital data collection over paper forms? (Tick all that apply)

a) No need to transcribe the data, reducing errors

b) Less time and work needed between data collection and analysis

c) No need to analyse the data

Answer: a and b are correct. c is incorrect – the next stage after data collection is data analysis. You will still need to analyse the data collected to inform the next steps of the project.

Quiz

True or False?

The boundaries of surface water units and groundwater units are the same.

a) True

b) False

Quiz

True or False?

The boundaries of surface water units and groundwater units are the same.

a) True

b) False

Answer: False – They do not match. A unit of surface water that flows into a river is the river basin. The equivalent unit for groundwater is an aquifer. They are different and require different approaches to analysis.

Quiz

2. What is the aim of aquifer recharge?

a) To store water for future use to prevent groundwater being exhausted

b) To increase surface runoff

c) To reduce water use

Answer: A

Quiz

2. What is the aim of aquifer recharge?

a) To store water for future use to prevent groundwater being exhausted

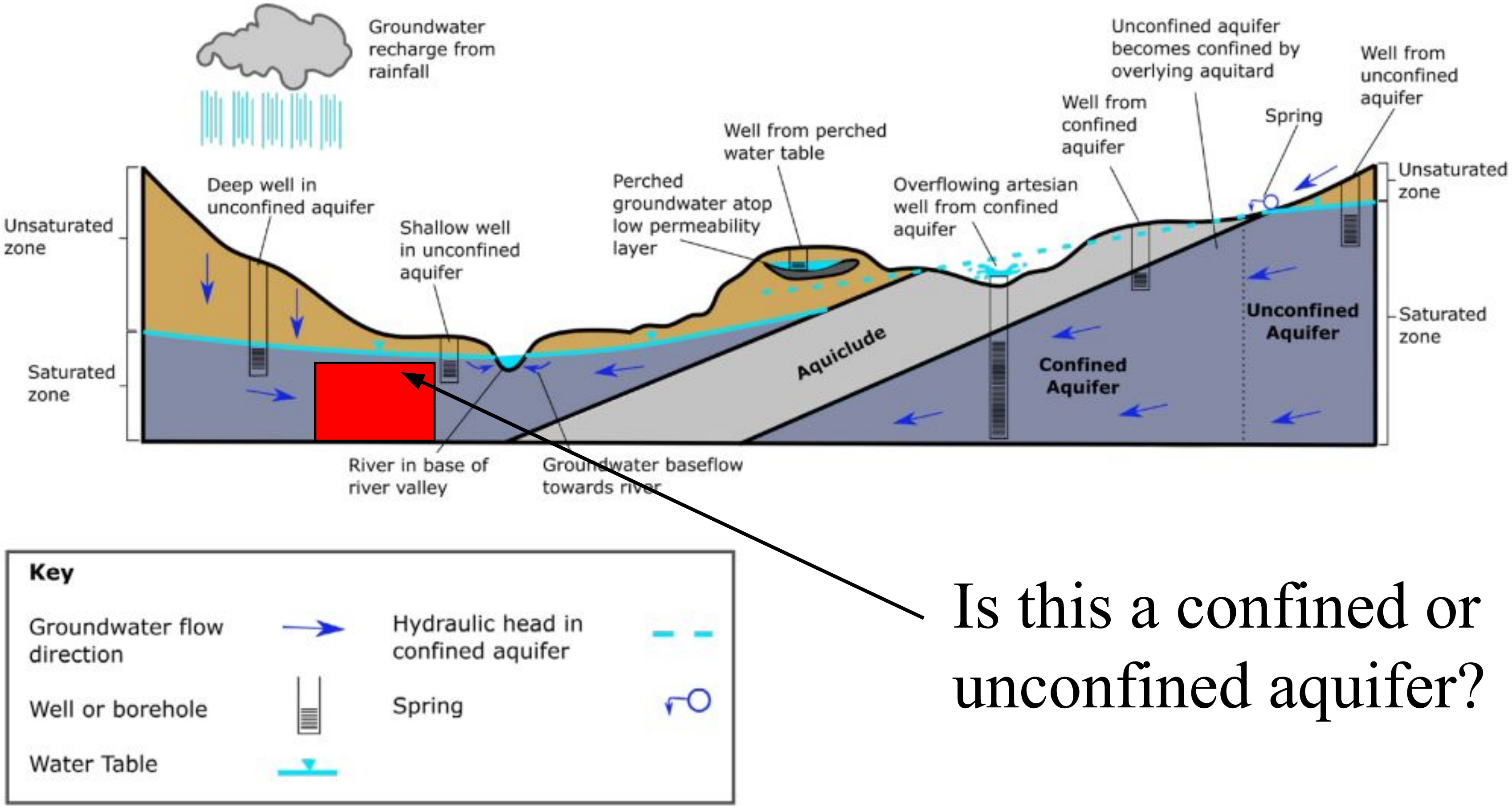
b) To increase surface runoff

c) To reduce water use

Answer: A

Quiz

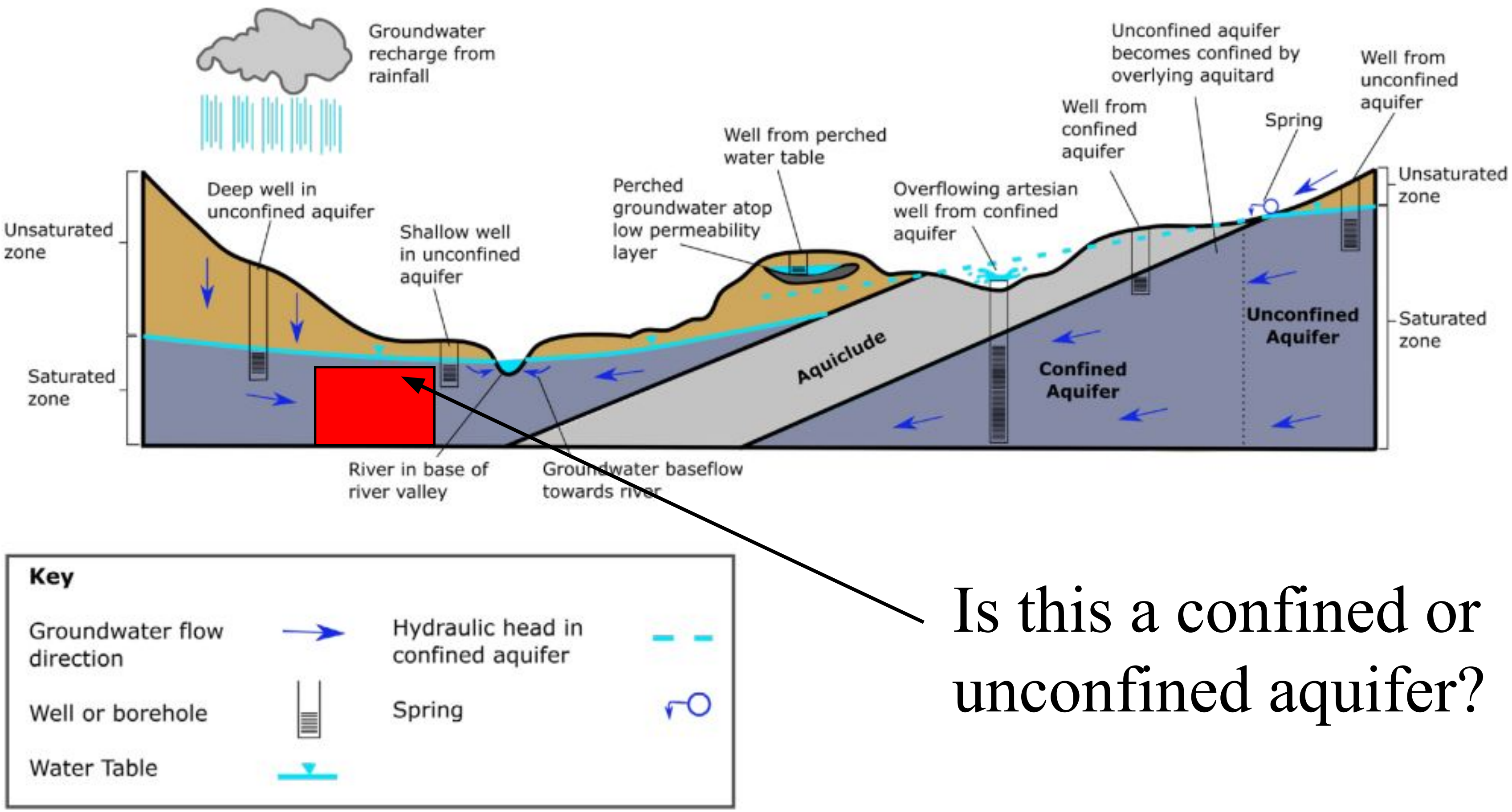
Figure 28 : Diagram showing Confined and Unconfined aquifer systems



Is this a confined or unconfined aquifer?

Quiz

Figure 28 : Diagram showing Confined and Unconfined aquifer systems



Is this a confined or unconfined aquifer?

Answer: It is an unconfined aquifer. Unconfined aquifers have a free groundwater surface whereas confined aquifers are fully saturated.

Confined aquifers may be better protected from water quality issues. Confined aquifers can also result in artesian wells which can flow on their own due to pressure from the confinement.

Quiz

What are the inputs in a Water Balance Assessment?

A) Vegetation type, soil type and underlying geology, topography (catchments and sub-catchments)

B) Domestic, irrigation, livestock, industrial and other water demands (abstractions), as well as evapotranspiration

C) Rainfall and other precipitation

Quiz

What are the inputs in a Water Balance Assessment?

A) Vegetation type, soil type and underlying geology, topography (catchments and sub-catchments)

B) Domestic, irrigation, livestock, industrial and other water demands (abstractions), as well as evapotranspiration

C) Rainfall and other precipitation

Answer: C – Rainfall and other precipitation

Module 5

Overview of the WASH Basins IWRM Toolkit and App

What will you learn in Module 5?

Module Contents:

- How to use the IWRM WASH Basins Toolkit
- How to use the IWRM WASH Basins app
- Overview of the Tools and Templates (forms)

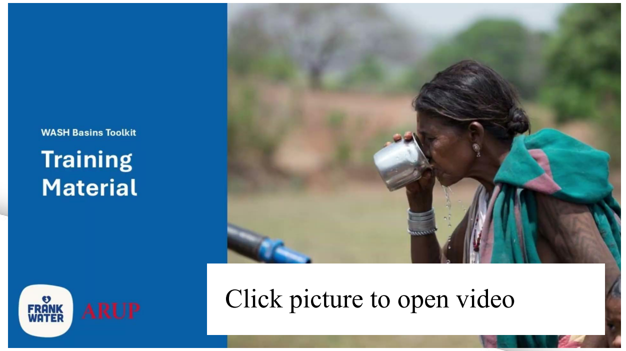
How does the Toolkit work?

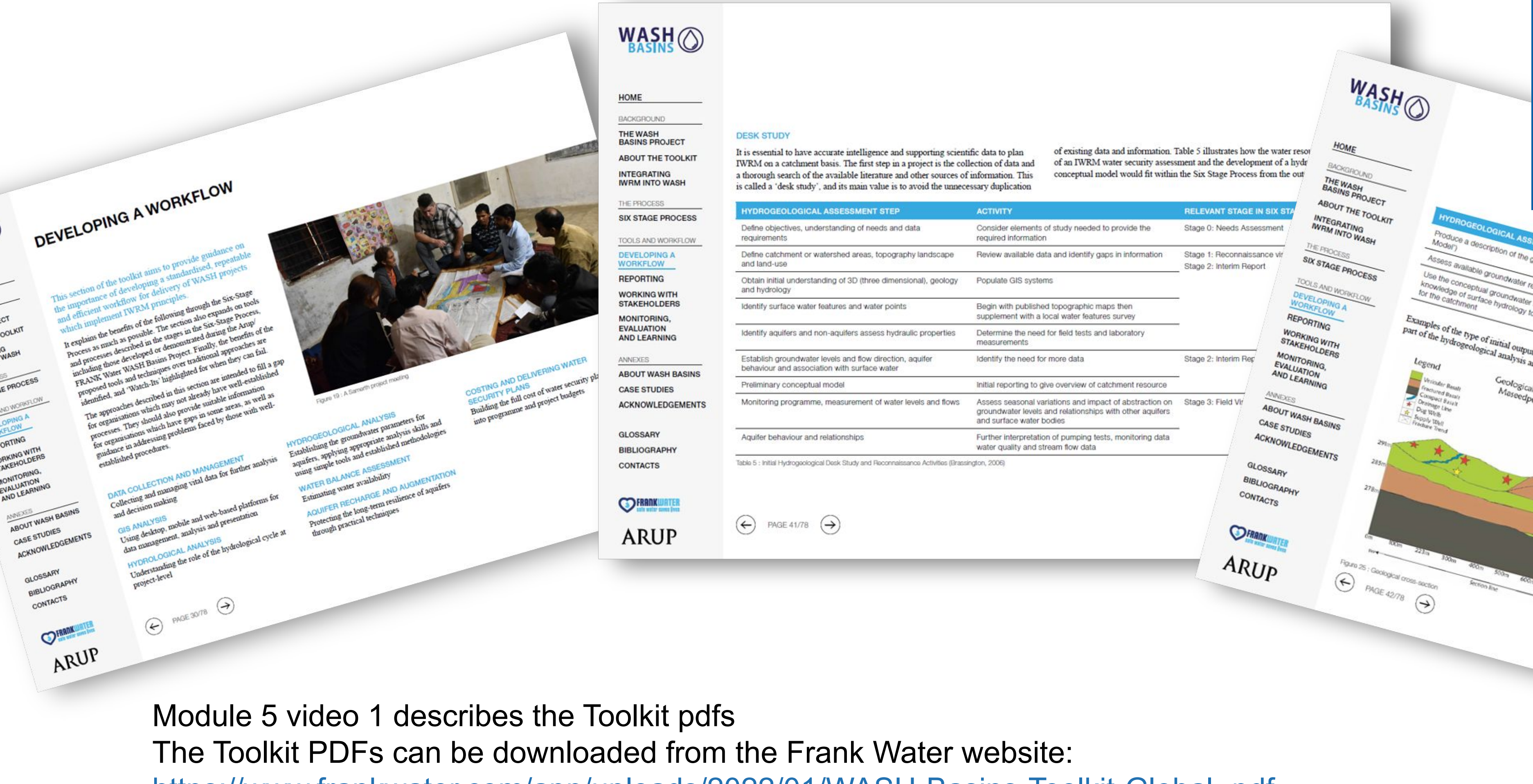
WASH Basins Toolkit: Empowers communities and local governments to understand and manage water resources in a way that addresses the water needs of their areas, whilst responding to the needs of the national and international context

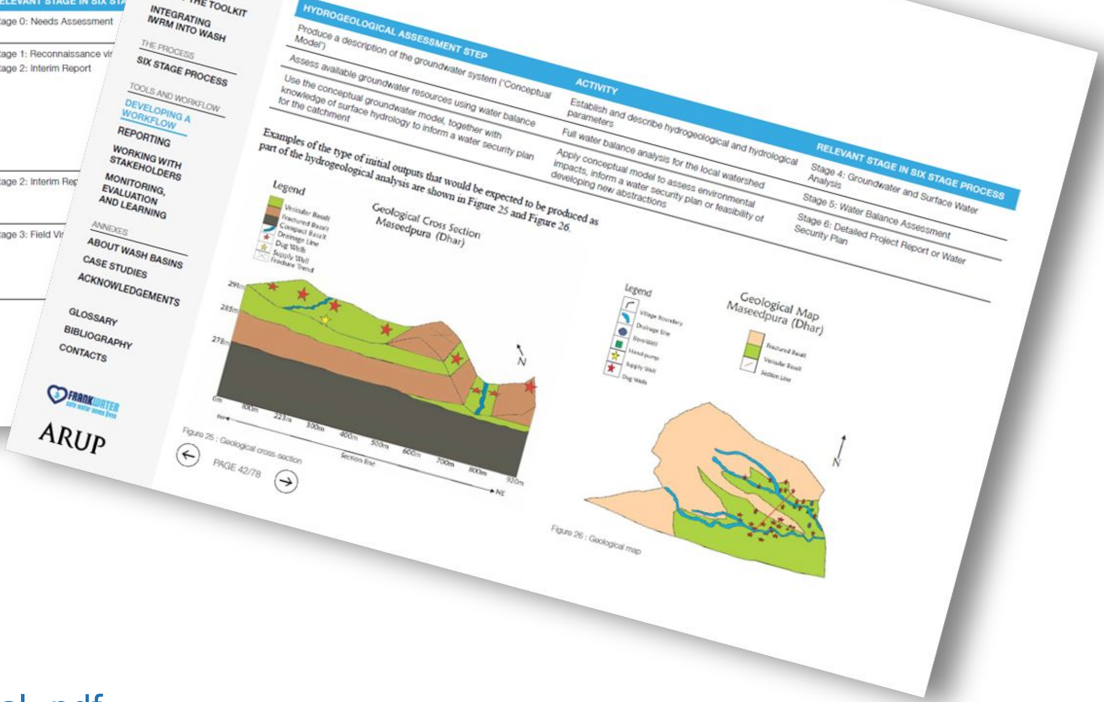
Digital Toolkit: Enables a structured approach to data collection, analysis & sharing on key indicators of water availability & use

The Toolkit comprises of an Interactive PDF, which provides information about WASH Basins IWRM approach, including a background to IWRM and how to set up a workflow. The Toolkit works best on a laptop or computer. When in the field, the WASH Basins app can be used for quick reference and to access the digital forms. In this module, you will learn how to navigate both the Toolkit and app.

How to use the Toolkit PDFs







Module 5 video 1 describes the Toolkit pdfs
The Toolkit PDFs can be downloaded from the Frank Water website:
https://www.frankwater.com/app/uploads/2022/01/WASH-Basins-Toolkit-Global-.pdf

This video introduces the content of the PDFs and how to navigate them. The Six Stages introduced in the video will be explored in more detail in the next Module.

Quick question

Open the Toolkit PDFs. You can download them from https://www.frankwater.com/about-us/what-we-do/wash-tapp-tools-for-effective-water-security-planning/

Check you know where to locate the Background information, information on the Six Stage Process and on Tools and Workflow.

Find the page on Stage 1 – Reconnaissance Visit.

Question: What is the purpose of this stage?

a) To understand the parameters relating to water availability and use in the community

b) To complete household surveys

c) To analyse the surface water quality

Quick question

Open the Toolkit PDFs. You can download them from
https://www.frankwater.com/about-us/what-we-do/wash-tapp-tools-for-effective-water-security-planning/

Check you know where to locate the Background information, information on the Six Stage Process and on Tools and Workflow.

Find the page on Stage 1 – Reconnaissance Visit.

Question: What is the purpose of this stage?

a) To understand the parameters relating to water availability and use in the community

b) To complete household surveys

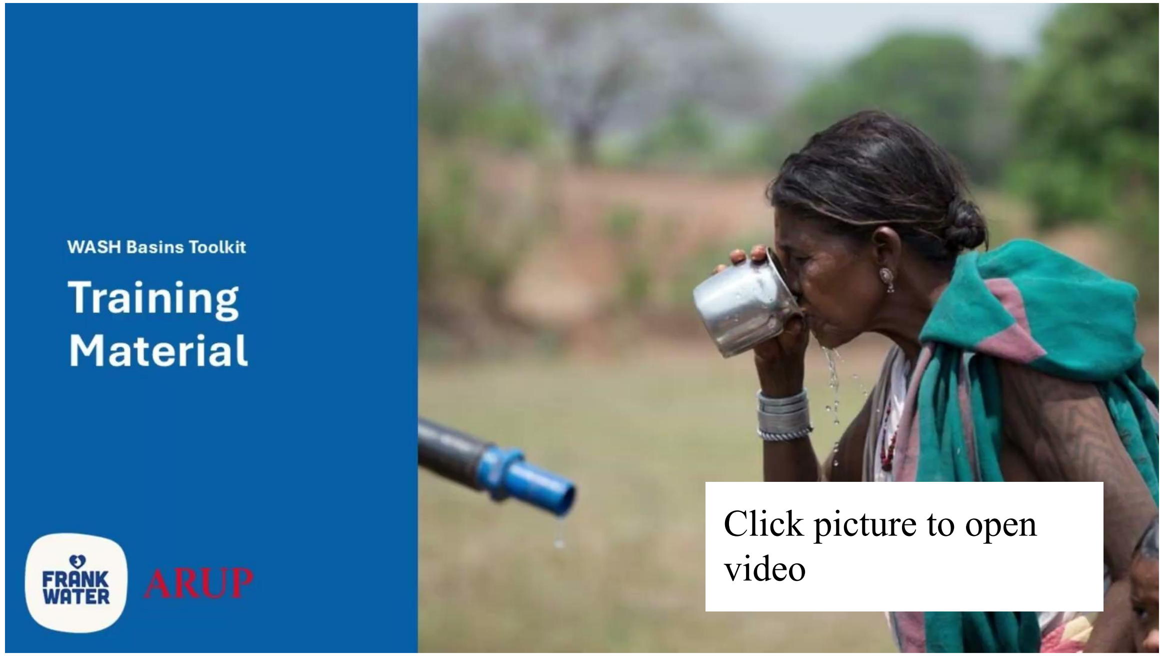
c) To analyse the surface water quality

Answer: a – To understand the parameters relating to water availability and use in the community

You will find out more about this Stage in the next Module. Before moving on, check that you are happy navigating the Toolkit PDFs and where to find the different sections outlined in the video.

What is the WASH Basins app?

This video guides introduces you to the contents of the WASH Basins IWRM app.



Click picture to open video

Quick question

Open the app and go to the Background tab. Explore the modules on this page.

Can you find the definition of WASH? Read the information and answer the following question:

Question: Why are water, sanitation and hygiene often grouped together in funding and service delivery?

a) Hygiene is dependent on water

b) Water quality depends on sanitation provision

c) Water, sanitation and hygiene are all interdependent

Quick question

Answer:

Water, sanitation and hygiene are all interdependent, meaning that each depends on the presence of the others.

How do I navigate the app?

This video guides you through the 6-Stage and Form tabs in the app. You will explore each of the Six Stages in more detail in the next Module.

Click picture to open video

Quick question

Open the app and check that you can find the information on each of the stages and links to the forms. Each of the 6 Stages will be explored in more detail in the next Module.

Use the app to answer this question.

Question: Which of these forms is to be used in Stage 3?

a) Surface Water Source Survey

b) Annual Water level monitoring Form

c) Water Security Household Survey

Quick question

Question: Which of these forms is to be used in Stage 3?

a) Surface Water Source Survey

b) Annual Water level monitoring Form

c) Water Security Household Survey

Answer: c) Water Security Household Survey

The Forms tab in the app can be used to quickly access the forms relevant to each Stage.

Quiz

True or False?

The Background tab in the app provides all the information given in the Toolkit pdfs.

Quiz

True or False?

The Background tab in the app provides all the information given in the Toolkit pdfs.

Answer: False – the Background tab in the app gives definitions of key words and summaries of the information in the Toolkit. It is designed to be used for quick reference when in the field. The Toolkit provides more detail.

Quiz

Where can you go to quickly access the forms when working in the field? If unsure, open up the app and have a look.

a) In the Toolkit pdfs

b) In the final tab in the app

c) In the first tab in the app

Quiz

Where can you go to quickly access the forms when working in the field?

a) In the Toolkit pdfs

b) In the final tab in the app

c) In the first tab in the app

Answer: The forms can be quickly accessed in the final tab in the app – the 'Forms' tab. They are also linked in the Toolkit and the 6-Stage tab in the app, but the Forms tab is an easy place to go to access them quickly.

Module 6

The WASH Basins IWRM approach

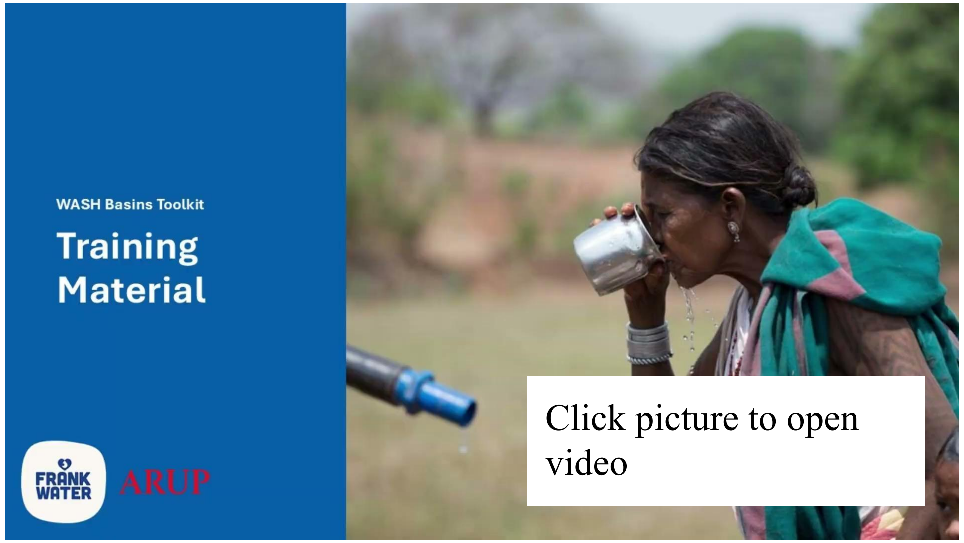
What will you learn in Module 6?

Module Contents:

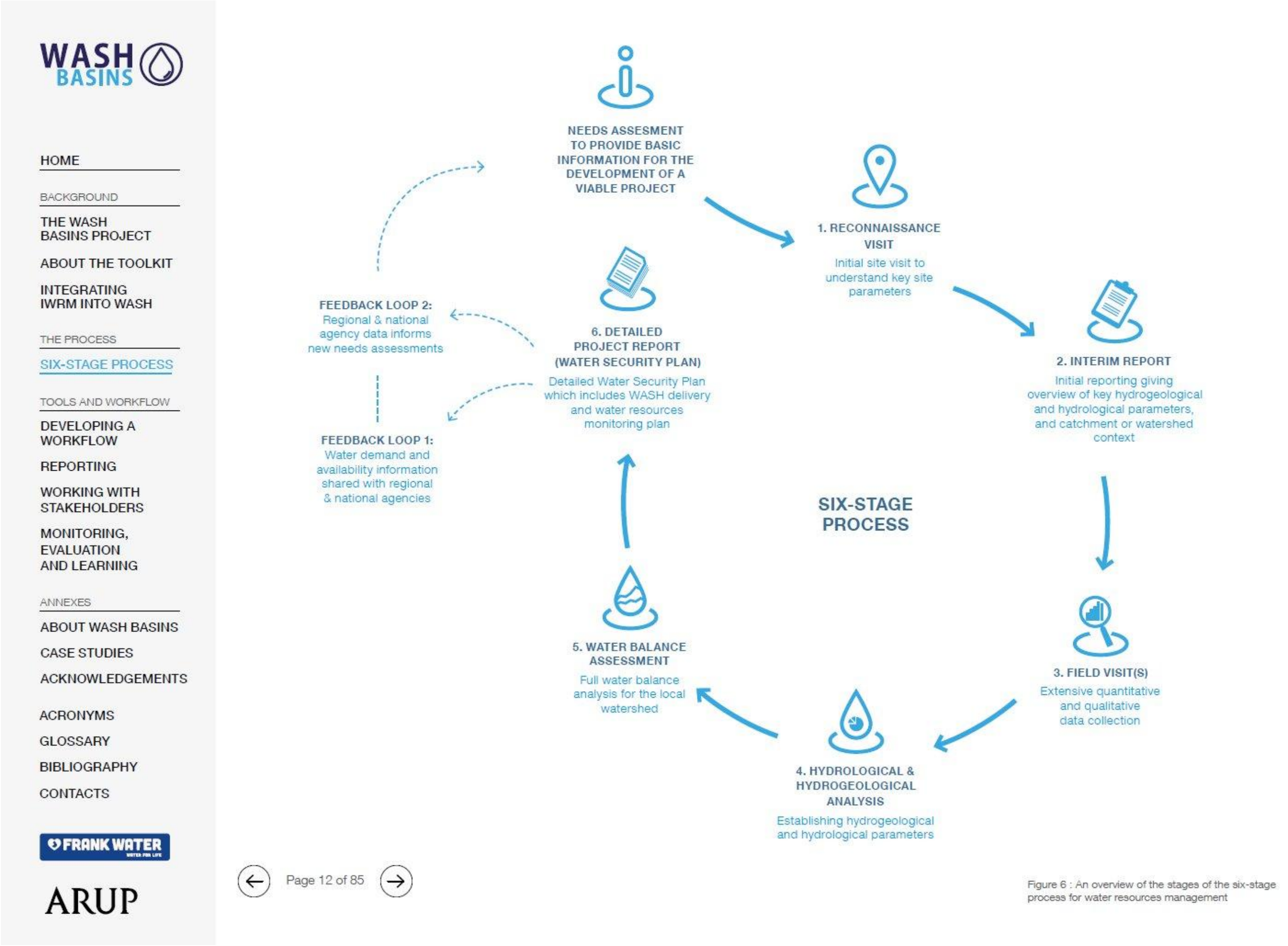
- What is the IWRM WASH Basins Toolkit process?
- Data collection (Stages 0, 1, 2 and 3)
- Data analysis (Stages 4 and 5)
- Planning (Stage 6)

The Six Stage Process

This video gives an overview of the stages of the WASH Basins IWRM approach.



Click picture to open video



Quick question

True or False?

The Six Stages can be completed in any order

a) True

b) False

Quick question

True or False?

The Six Stages can be completed in any order

a) True

b) False

Answer: False – the stages follow a sequential process. Each step feeds into the next, so the stages must be completed one after the other in the order laid out in the Toolkit.

Quick question

Where can information about the Six Stages be found?

a) In the WASH Basins Toolkit PDFs
b) In the WASH Basins IWRM app
c) In both the Toolkit and the app

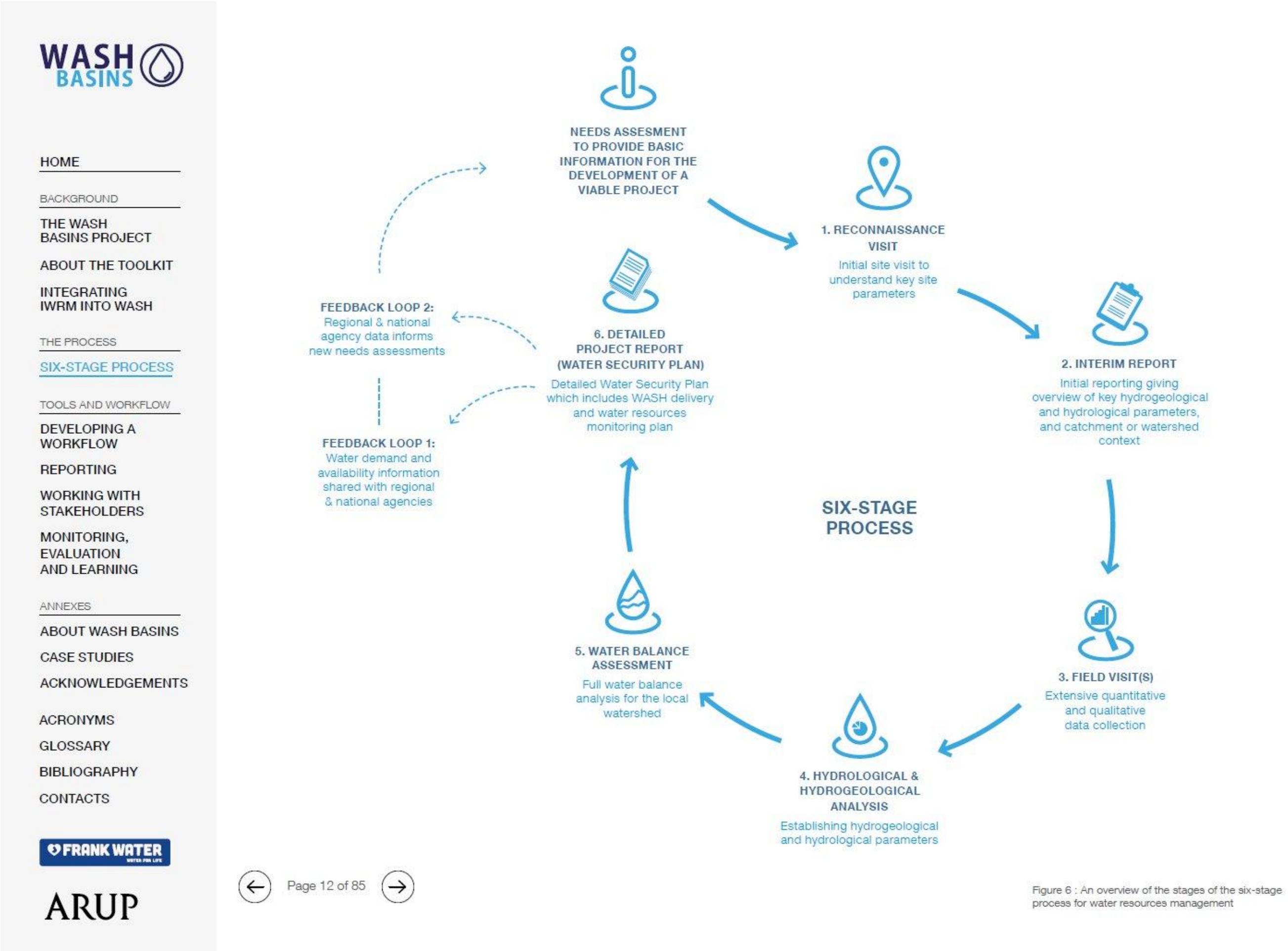
Quick question

Where can information about the Six Stages be found?

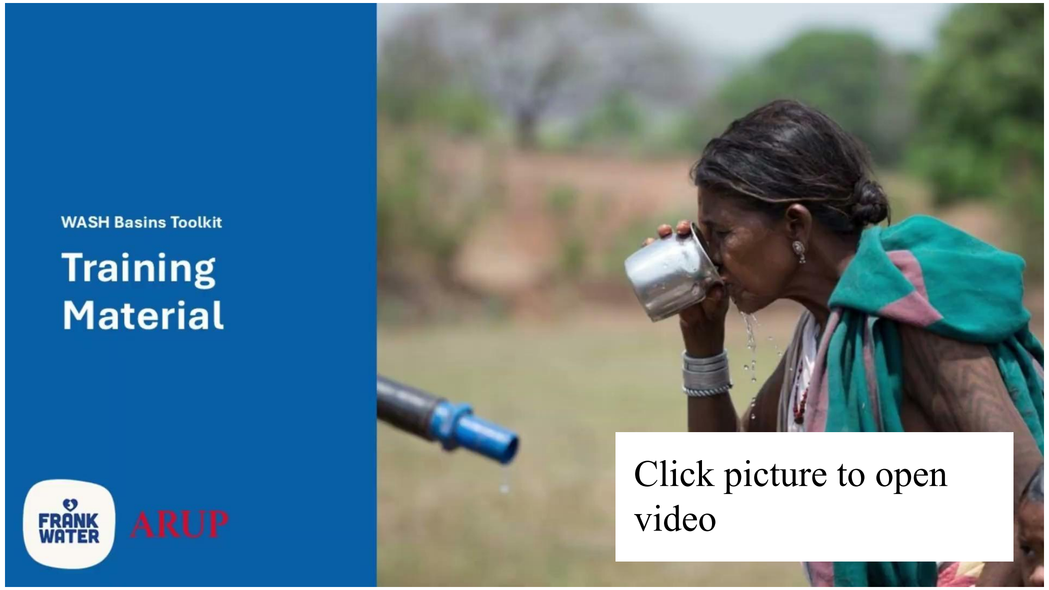
a) In the WASH Basins Toolkit PDFs
b) In the WASH Basins IWRM app
c) In both the Toolkit and the app

Answer: c) - You can find details about the Six Stages in both the Toolkit PDFs and in the app. The Toolkit is easier to use on a desktop, whereas the app is easier to use on a phone and more appropriate for checking information when in the field.

Data Collection Stages



This video will give you an overview of Stages 1-3, where most of the data is collected.



Click picture to open video

Data Collection Stages

Before moving on, take some time to look at the tasks and forms that need to be completed in Stages 1-3. Have a look at the checklist below. These questions that should be thought about when planning the data collection and to check everything has been collected afterwards.

Checklist for preliminary information about the area of interest (habitation / village / ward / municipality / town / city:

- Have you identified and made an inventory of available water sources?
- Have you identified major water sources in terms of number of people using the source, quantified the source and obtained a water quality test?
- Have you noted down the currently water sources, storage and supply infrastructure and its condition?
- Have you listed all the relevant policies and regulations applicable to the region of interest?
- Have you checked the Six Stage Process and associated data forms to ensure that the team understands and is equipped to undertake data collection?
- If the Six Stage Process is difficult to achieve, have you checked if a community needs assessment is done or if data is already available informing water needs of the area of interest?

Quick question

Open the Surface Water Source Survey, to be completed at Stage 1. You can open it from the Toolkit PDFs or the app. How can you fill in the GPS coordinate of the Water Source location?

Tick all that apply

a) By typing in the coordinates

b) Using GPS on your phone

c) Searching the location in the search boxes

d) Clicking on the location on the map using the cursor

Quick question

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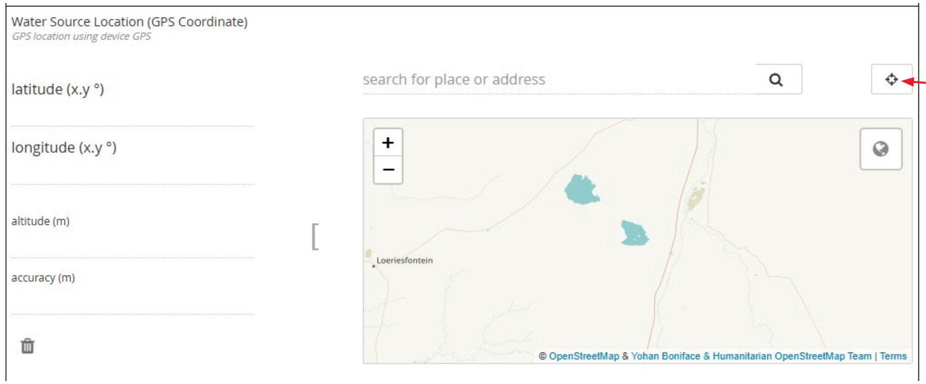


'Use my location' button to location using GPS in the field.

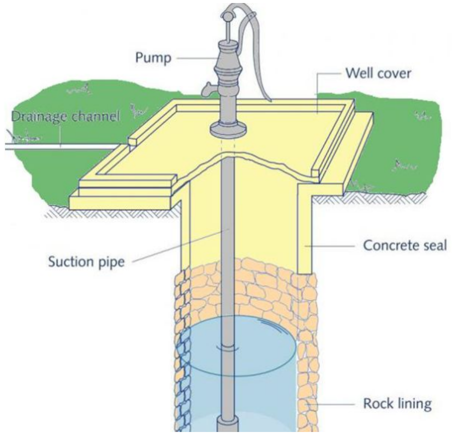
Answer: All of the above are correct. When in the field, the quickest way is to use your phone's GPS.

Quick question

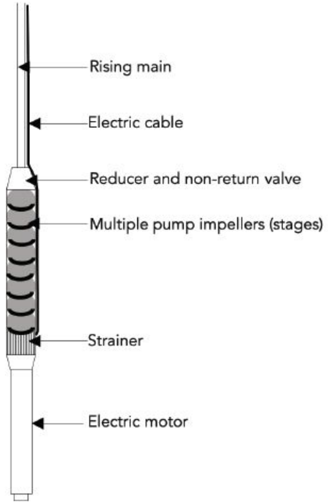
These are the options for types of groundwater sources in the 'Groundwater Source Survey' in Stage 1. Can you match them to the photos?

Borehole with hand pump, Borehole with mechanised pump, Shallow well, Spring

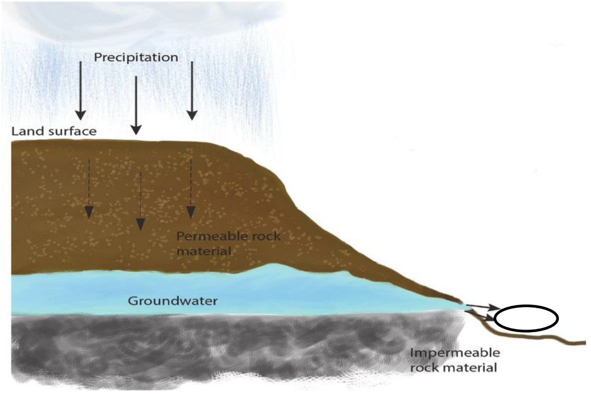
Reference: J.MacArthur, Handpump Standardisation in Sub Saharan Africa, Rural Water Supply Network, 2015



Reference: https://www.wateraid.org/uk/publications/technical-brief-hand-pumps



Reference:
Carter, Richard C. (2021) Rural Community Water Supply:
Sustainable services for all, Rugby, UK: Practical Action Publishing



Reference: https://www.researchgate.net/figure/Illustrative-presentation-on-how-springs-are-formed-A-spring-is-formed-when-surface-of_fig1_324983990

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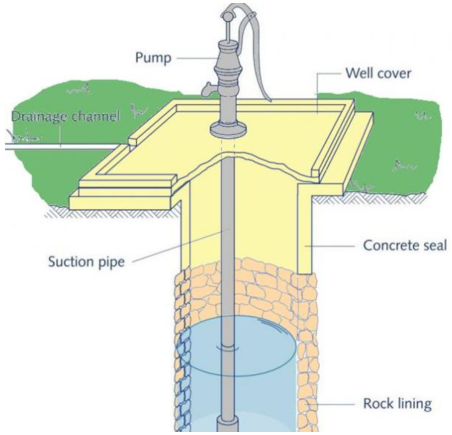
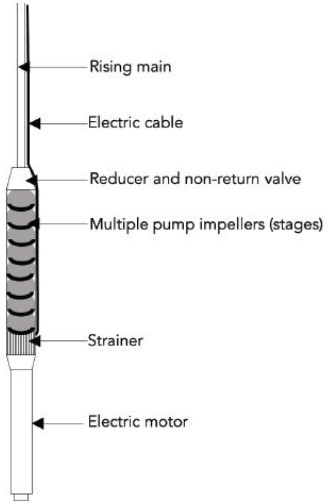
Shallow well



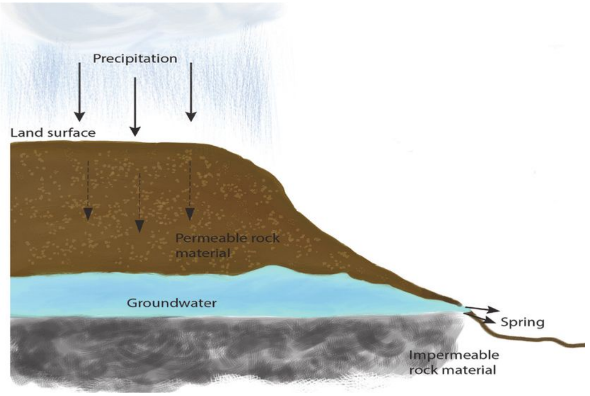
Reference: https://www.wateraid.org/uk/publications/technical-brief-hand-pumps

Borehole with mechanised pump



Reference:
Carter, Richard C. (2021) Rural Community Water Supply:
Sustainable services for all, Rugby, UK: Practical Action Publishing

Spring



Reference: https://www.researchgate.net/figure/llustrative-presentation-on-how-springs-are-formed-A-spring-is-formed-when-surface-of_fig1_324983990

Quick question

One of the tasks in Stage 2 is to report on the geography, hydrology and hydrogeology of watershed, including rainfall, surface water and groundwater patterns.

Match these terms to their definitions:

Geography	A branch of geology that deals with the distribution and movement of groundwater in the soil and rocks of the Earth's crust. It focuses on the properties of aquifers and the interaction between groundwater and surface water.
Hydrology	The study of movement, distribution, and quality of water on Earth. It encompasses the water cycle, water resources, and environmental watershed sustainability.
Hydrogeology	Water that is stored between rocks below ground.
Watershed	The study of physical features of the Earth.
Groundwater	An area of land that separates the water flowing into different rivers, basins or seas.

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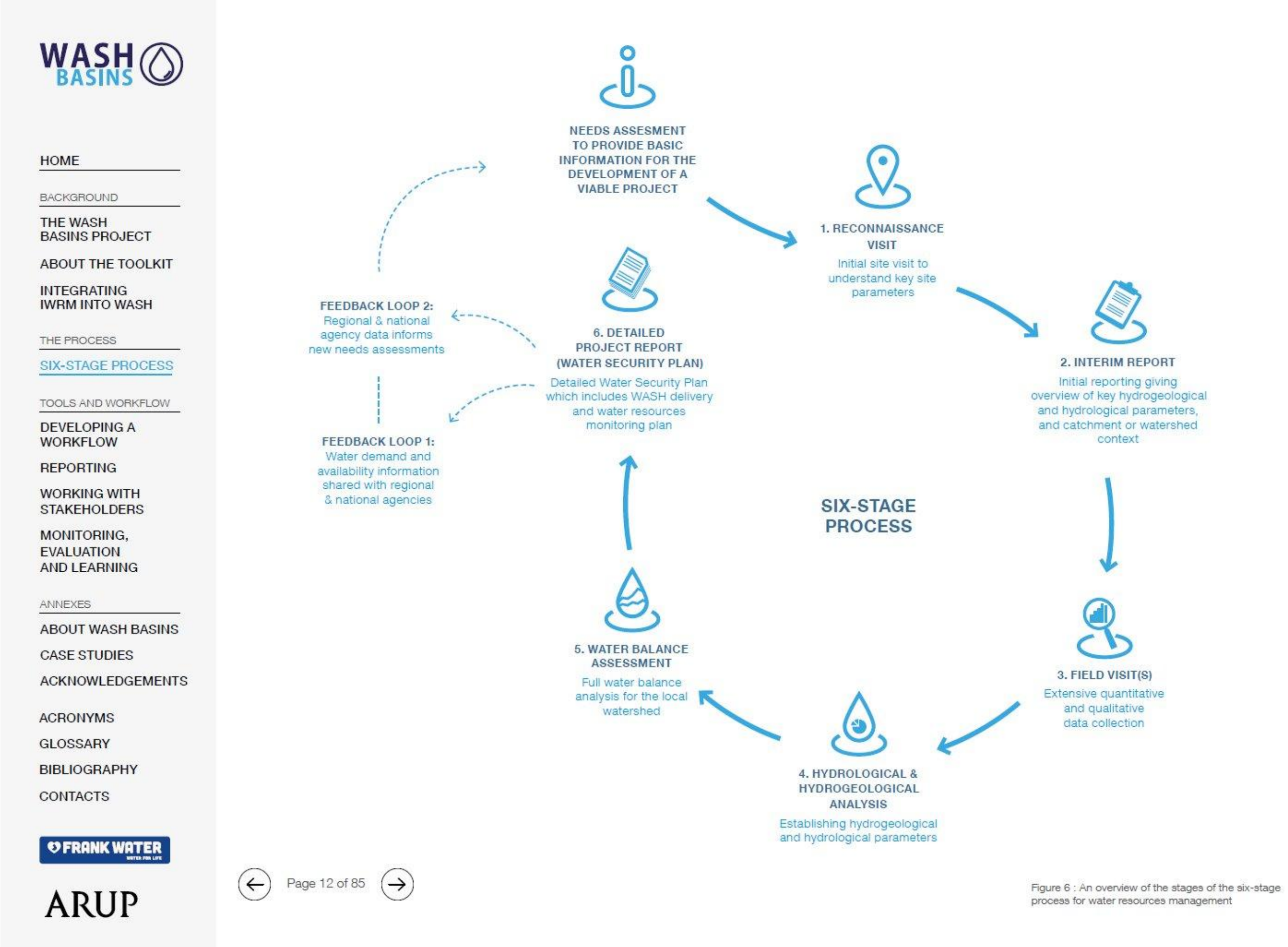
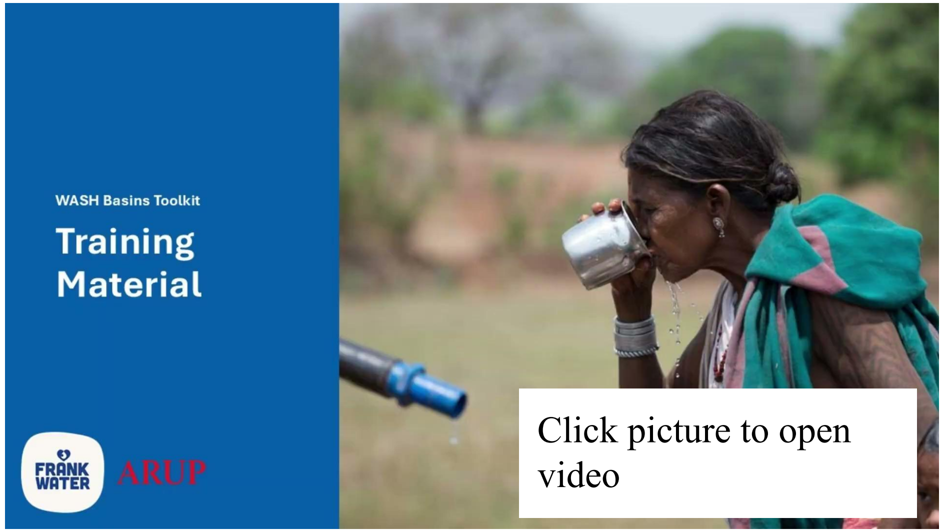
Data Analysis Stages

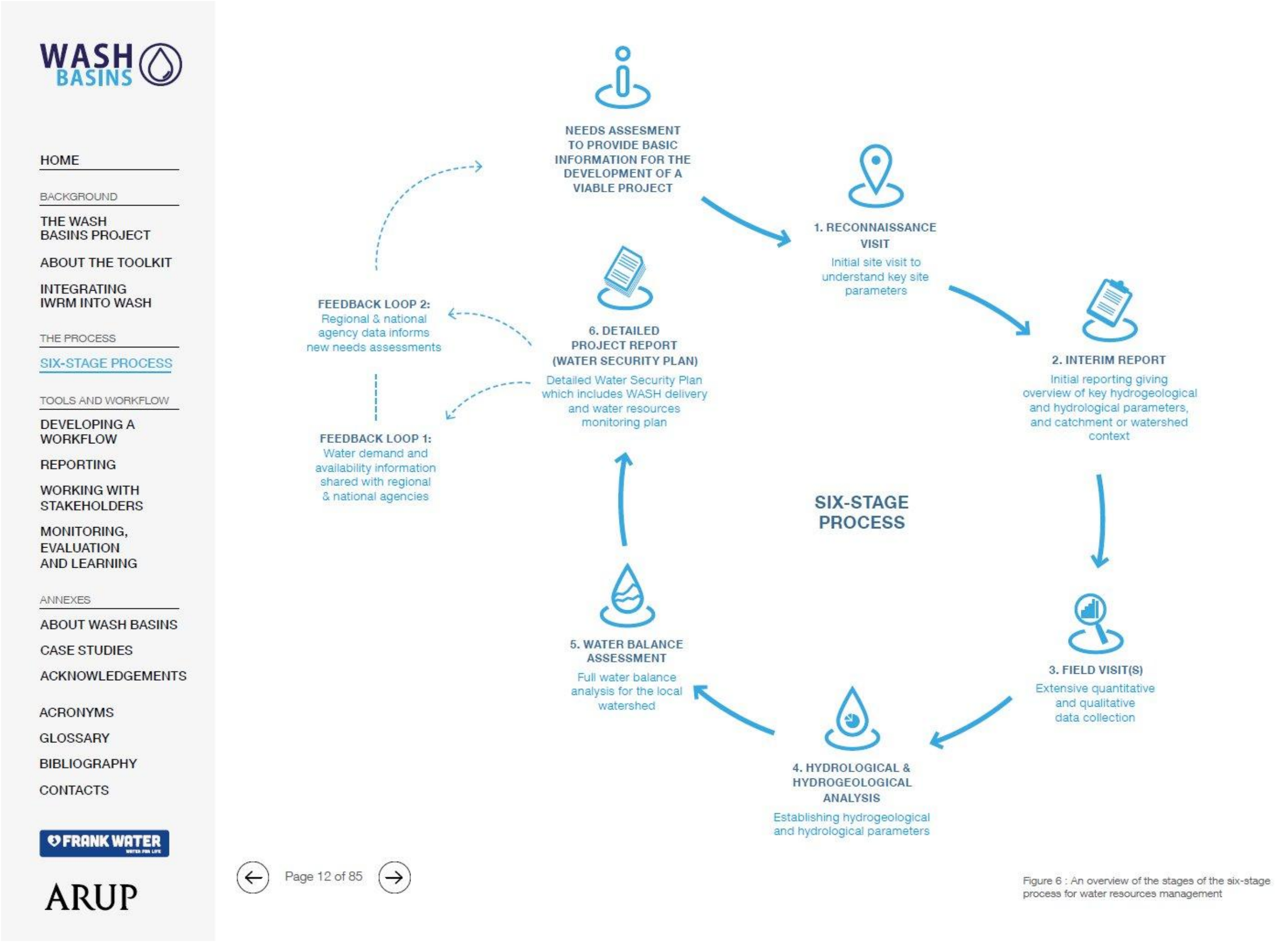


Next you will learn about Stages 4-5.



Click picture to open video

Planning Stage



This video will give you an overview of Stage 6.

Click picture to open video

Example WSP

Here is the contents from a WSP produced by Amref, following the Six Stage Process in the Toolkit:

Contents

Planning Stages

Read through the questions in this checklist. These are questions that will be important to think about while developing a WSP.

Checklist for WSP development:

- Have you defined water security goals and objectives for the area of interest?
- Have you included short-term and long-term needs? If yes, indicate the time periods accounted for, in years.
- Have you created a budget and funding plan?
- Have you engaged with the local community and stakeholders for input?
- Have you suggested what types of new infrastructure is required to achieve water security?
- Have you accounted for the water quality monitoring process and identified how this will be done in the area of interest?
- Have you included a process for regular water quality test?
- Have you included provisions for maintenance and repair infrastructure as needed?
- Have you checked for compliance with legal and regulatory norms as applicable in the region?
- Are guidelines for review and update of the plan included?
- Does the plan need to include emergency preparedness – contingency plans for droughts, floods, or other emergencies?

Quick Question

Which of the following should be included in the WSP?

a) Conclusions from the Water Balance Assessment
b) Proposed solutions
c) Estimates of costs for proposed solutions
d) How you will continue to gather and monitor information
e) All of the above

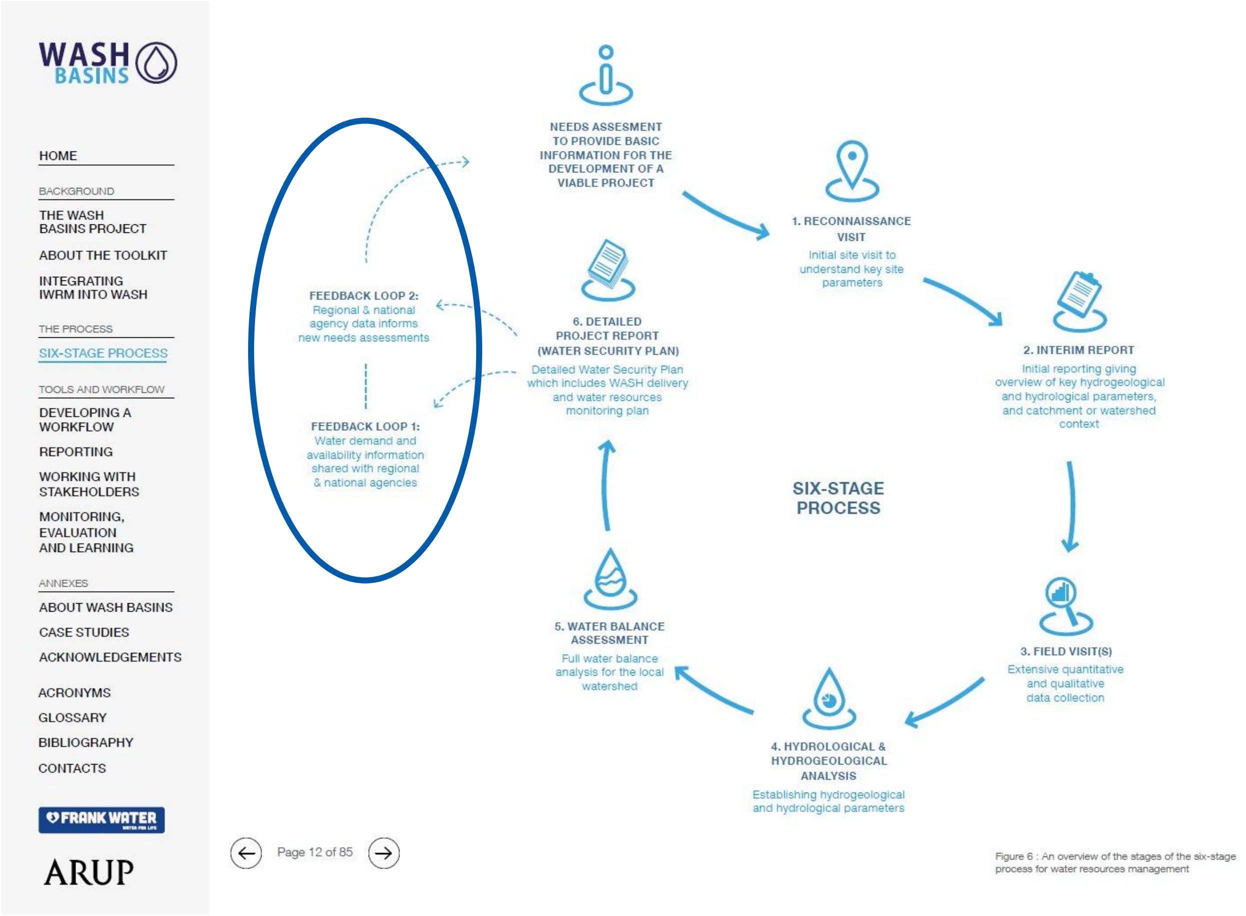
Quick Question

Which of the following should be included in the WSP?

a) Conclusions from the Water Balance Assessment
b) Proposed solutions
c) Estimates of costs for proposed solutions
d) How you will continue to gather and monitor information
e) All of the above

Answer- (e) all of the above should be detailed in the WSP.

Feedback loop



The WSP can be used to inform both regional and national agencies of water demand and availability and to fund WASH solutions.

Data from regional and national agencies can then be used to inform future needs assessments for future projects.

What happens to the WSP?

The WSP is an advisory tool that can be submitted to the relevant authority or NGO for WASH resource planning.

Actions emerging from a WSP can include:

- Advocacy
- Improving WASH planning and initiating data-driven action
- Enhanced budget targeting
- Training public officials

In the next section, you will look at case studies to see different outcomes from following the Toolkit's approach and producing a WSP.

Quiz

True or False?

The data collection forms in the app can be completed in any order.

Quiz

True or False?

The data collection forms in the app can be completed in any order.

Answer: False - the forms feed into each other, so should be completed in order. The Toolkit and app tell you which Stage in the process each form needs completing.

Quiz

True or False?

A Needs Assessment always need completing before Stage 1.

Quiz

True or False?

A Needs Assessment always need completing before Stage 1.

False - Whether a Needs Assessment should be completed depends on how well the organisation knows the location they are working in. Organisations that have been working in the location for a long time and know the community well can likely skip to Stage 1. It may also be the case that previous projects have already carried out a needs assessment or it has been done as part of government routine planning.

Quiz

True or False?

The data collection forms can be filled out on your phone while offline.

Quiz

True or False?

The data collection forms can be filled out on your phone while offline.

Answer: True. You can complete the forms in the app while offline in the field. The forms will then be uploaded later when you have connection again.

Module 7

Case studies: WSPs developed using the WASH Basins IWRM approach

What will you learn in Module 7?

Module Contents:

In this section, you will explore case studies of the IWRM WASH Basins approach and see examples of actions emerging from a completed WSP.

Case Studies:

- Amref's pilot in Kajiado, Kenya
- Samerth’s team in Kawardha district of Chhattisgarh, India

Case Study – Amref Trial

Kenya

<u>Background:</u>

In 2022, Frank Water and Arup partnered with Amref to trial to global version of the WASH Basins Toolkit in Kenya, with data collection commencing in the following year. Amref is an international NGO, which focuses on health services. The project team for the trial was taken from their WASH programme team in Kenya.

The regions Morgo and Kippa, in Kajiado were selected for the trial. This is in the southern part of Kenya.

The Six Stage Process was carried out, including an initial Needs Assessment.

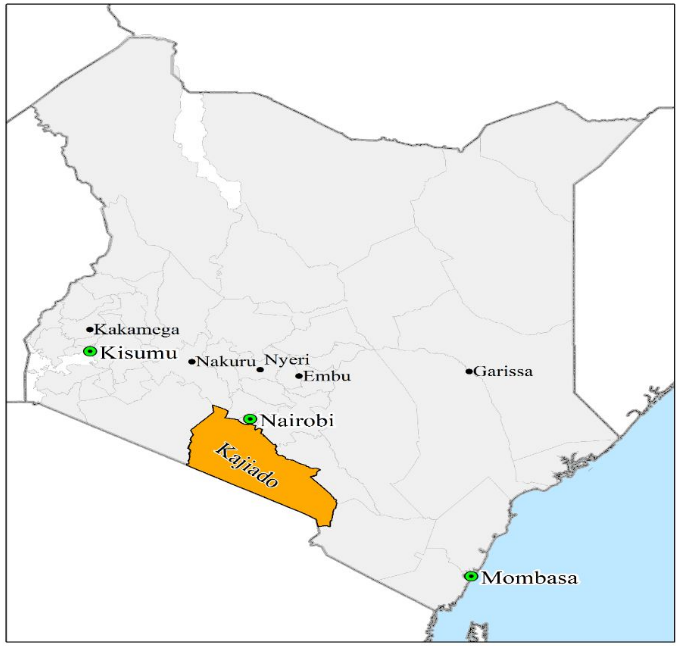


Image source: National Environment Management Authority (National Environment Management Authority (NEMA) - Kajiado County) Accessed: 23/04/25

Case Study – Amref Trial

Six Stage Process – Data Collection:

Data was collected using the forms in the WASH Connect App.

From the surveys, the teams found that there are a significant number of pastoralist communities, with livestock as their primary source of income and sustenance, in the region. Water was important for livestock to drink and for pasture in grazing areas.

Olpopongi cattle troughs

Unnamed swamp

Case Study – Amref Trial

<u>Six Stage Process – Data Collection:</u>

Kajiado experiences periods of prolonged drought, so groundwater is the primary source of water for agricultural and domestic use. Challenges included water scarcity in prolonged dry periods, long distances required to reach water points and changing rainfall patterns due to climate change.

Ilparakuo river and sand dam

Olpopongi water kiosk

Case Study – Amref Trial

<u>Six Stage Process – Data Collection:</u>

Data was collected using the forms in the WASH Connect App.

From the surveys, the teams found that there are a significant number of pastoralist communities, with livestock as their primary source of income and sustenance, in the region. Water was important for livestock to drink and for pasture in grazing areas.

Kajiado experiences periods of prolonged drought, so groundwater is the primary source of water for agricultural and domestic use. Challenges included water scarcity in prolonged dry periods, long distances required to reach water points and changing rainfall patterns due to climate change.

Below are some examples of information collected during the surveys, using the WASH Connect App.

Livestock water demand, Morgo sub catchment

Livestock type	Total Population	Livestock Unit Factor	Equivalent Livestock Unit	Average Demand per Livestock (l/day)	Total demand (l/day)	Total demand (m3/day)
Cattle	4,415	0.33	1471.67	50	73,583	73.58
Donkeys	318	0.20	63.60	50	3,180	3.18
Goats	9,679	0.07	645.27	50	32,263	32.26
Sheep	4,689	0.004	312.60	50	15,630	15.63
Chicken	3,851		13.75	50	688	0.69
Total	**22,951**				**125,344**	**125.34**

Domestic Water Availability, based on the household survey

	Morgo	Kippa	Total
Human Population	7,859	2,260	10,119
Average water available for surveyed households (l/hh/day)	36.14	36.14	36.14
Average household size	8	8	8
Average water available per capita (l/c/day)	4.52	4.52	4.52
Total water available (m3/day)	35.50	10.21	45.71

Case Study – Amref Trial

WSP Outputs

Six Stage Process – Data Analysis and developing the WSP:

Data from field visits on water use and sources was analysed as well as publicly available geospatial data.

The Stages in the Toolkit were followed to analyse the data and produce a WSP. For example, this table lays out interventions proposed in the WSP to address the negative water balance at Morgo sub-catchment:

Demand type	Proposed intervention	Number of interventions	Average yield (m^3/d)	Total yield (m^3/d)	Net water balance (m^3)	Unit cost ($)	Total cost ($)
Domestic	Rehabilitation of boreholes	3	64	192	47	55,250	165,750
Institutional	Pipeline extensions from rehabilitated boreholes	3	0	0	36	30,000	90,000
Livestock		1	0	0	-50	30,000	30,000
	Earth dam	1	137	137	87	164,250	164,250
Irrigation	Using earth dam (above)	0	0	0	4		
External	Catered for by available sources	0	0	0	3		
Total		**8**	**201**	**329**	**3**		**450,000**

The WSP gave detailed descriptions about what would be involved in each intervention and the total costs for the plans.

Case Study – Amref Trial

Outcomes:

The Toolkit provided a structured methodology to produce a WSP. Previously, there was no standard approach, so proposals from different communities were found to differ greatly. This made them difficult to compare and implement. Water Security Planning was not being done in a structured way and different organisations held different pieces of information. One of the main benefits found of the Toolkit is that it gives a structured approach, meaning that WSP are more comparable. This would be very useful if widely adopted.

It also provided a data driven approach. The app was found easy to use and helpful for reference in the field. Amref also found that more data was collected using the app on this project, than in other similar projects without it.

Case Study – Amref Trial

Lesson Learnt:
A key learning from the trial was the importance of context. Considering contextual information such as governance structure and funding options is important when using the Toolkit and for implementing the WSP.

Refer back to Modules 2 and 3 for more information.

Another recommendation from the trial was to make the steps needed for data collection at each Stage clear. Checklists were suggested, which have been included in Module 6 at the relevant Stages.

Enkishui water pan

Case Study – Samerth Trial

India

Background:

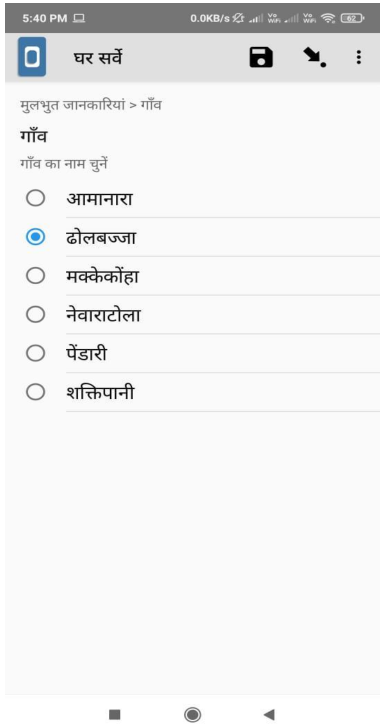
In 2019, Frank Water and Arup worked with Samerth Charitable Trust (Samerth) to develop and trial the first version of the WASH Basins Toolkit in Chhattisgarh State in India. Samerth is an Indian NGO which focuses on WASH services in marginalised communities in central India. The project team worked with the Samerth team in the Dholbajja area.

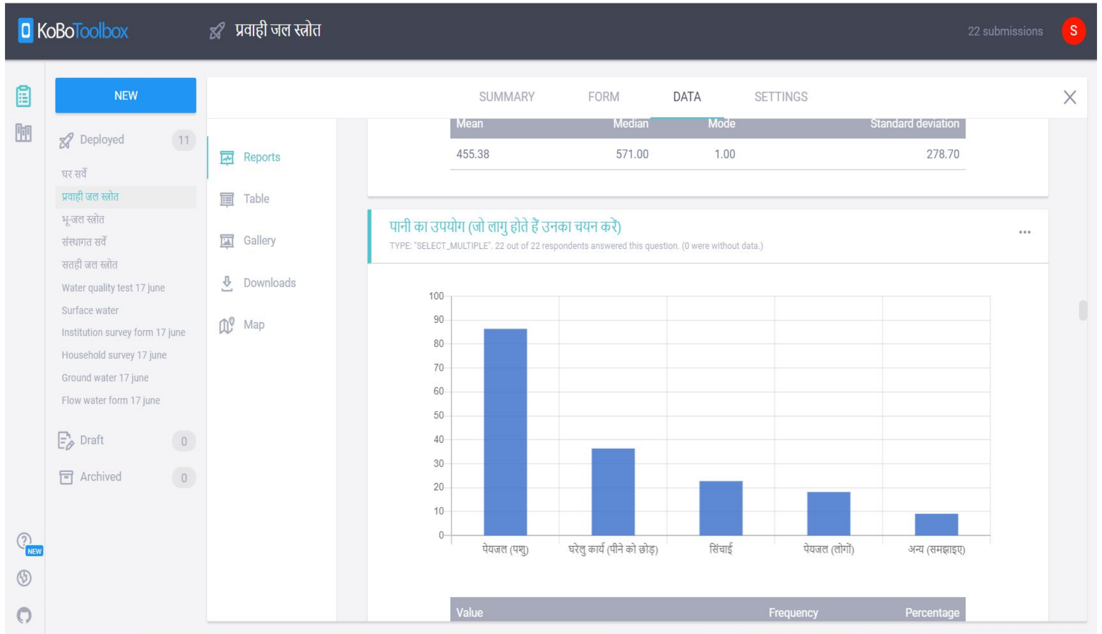
The Six Stage Process was carried out, following a Needs Assessment previously carried out by Samerth.

Case Study – Samerth Trial

<u>Six Stage Process – Data Collection:</u>

Data was collected using digital forms. Below are some examples of the survey and graphs using digital data collection. KoBo was used as the WASH Connect App had not been developed at the time, however, the functionality is very similar to the WASH Connect App.





Household water use survey

Water flow survey - to check water availability, it's GPS coordinates and use

Case Study – Samerth Trial

<u>Six Stage Process – Data Collection:</u>

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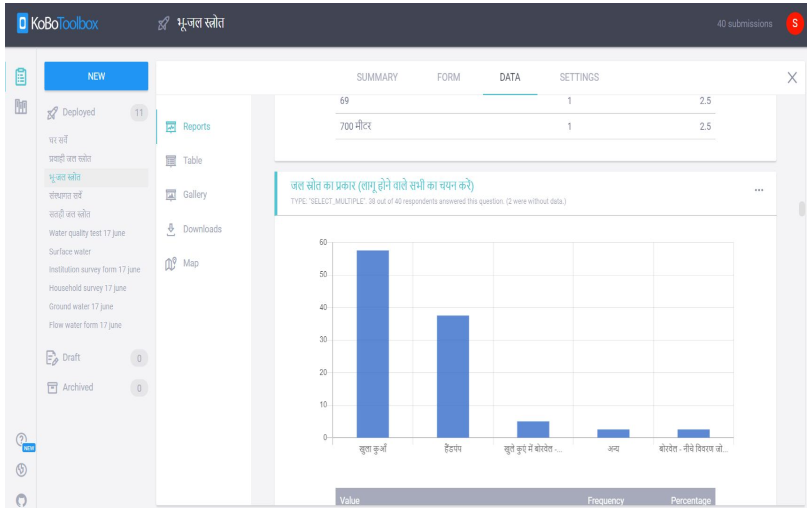
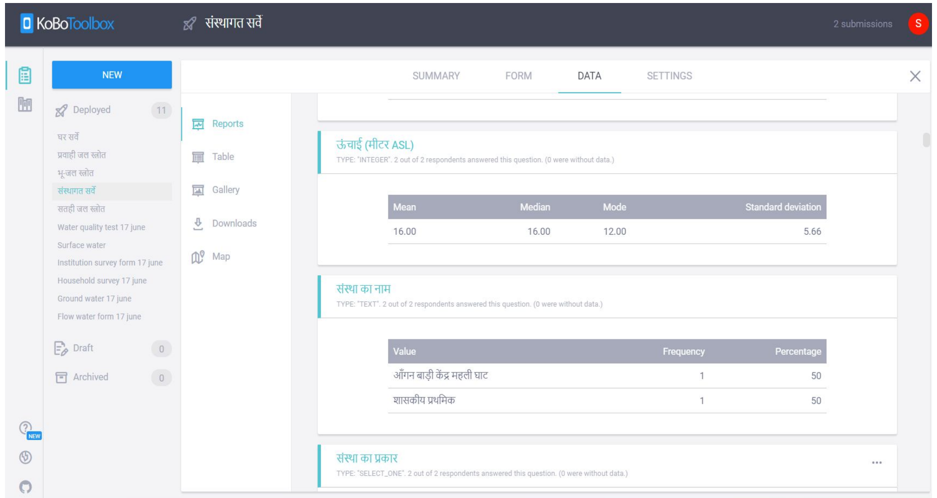


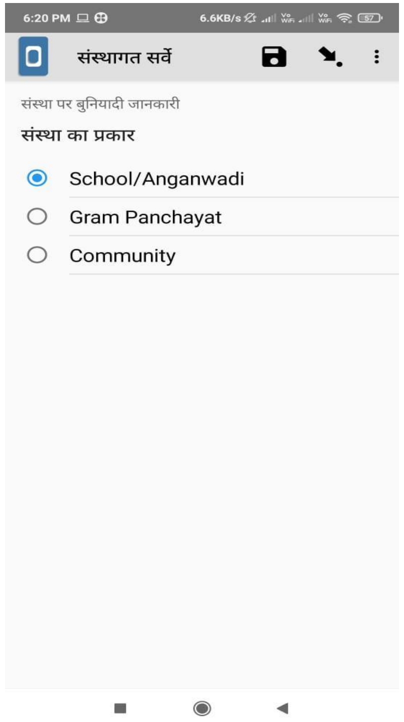
Groundwater survey - to check the availability of water, source GPS Coordinates, type of casing and its use is collected.

Case Study – Samerth Trial

Six Stage Process – Data Collection:

Data was collected using digital forms. Below are some examples of the survey and graphs using digital data collection.





Institutional water survey - to check the availability of water in Institution, Quantity requirement and location of water sources used.

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Case Study – Samerth Trial

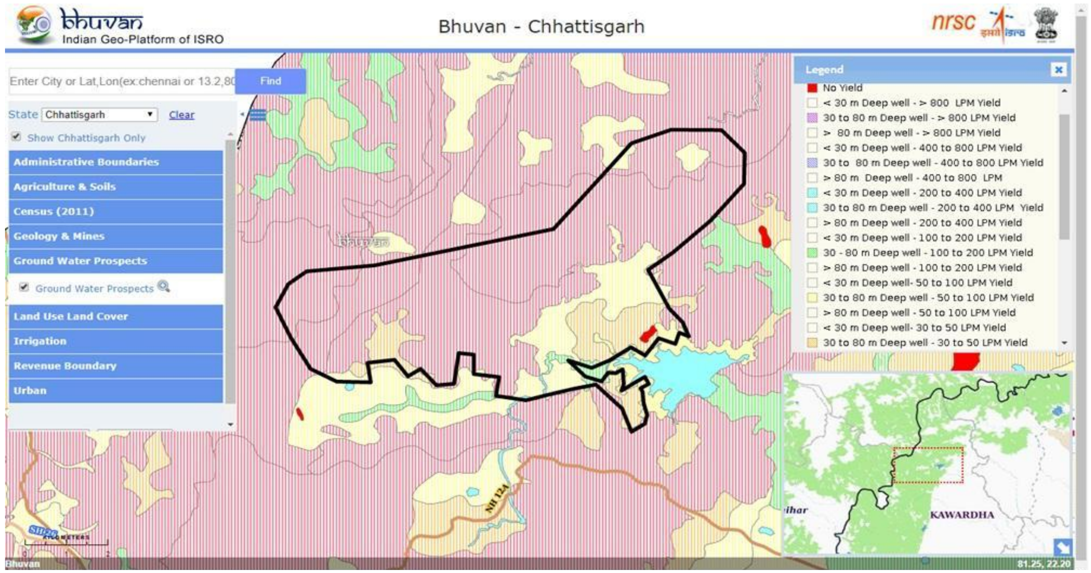
Six Stage Process – Data Collection:

Data was collected using digital forms. Below are some examples of the survey and graphs using digital data collection.

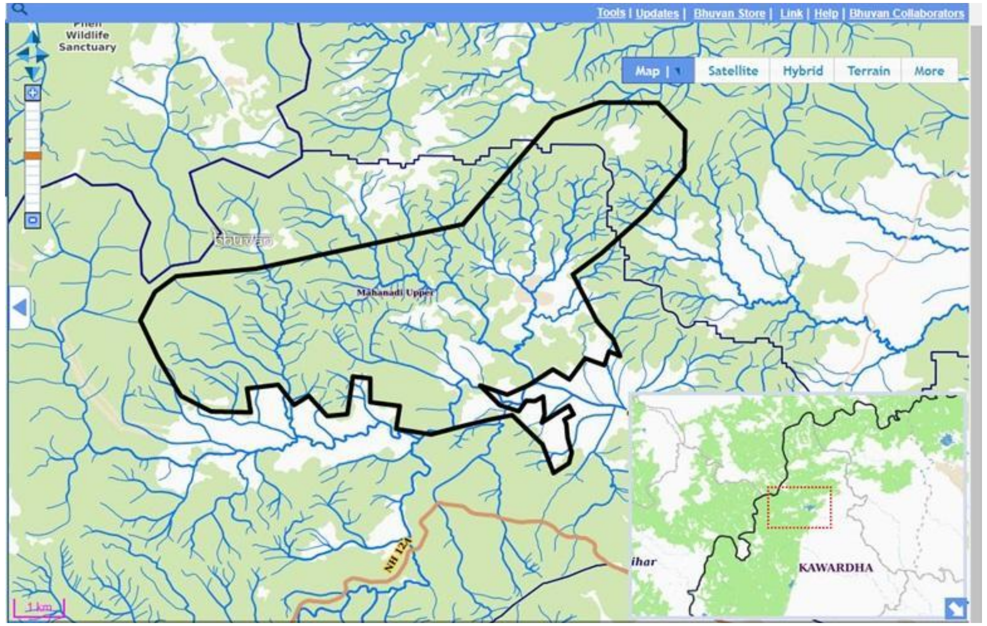
Water quality test - To check the quality of water and its chemical Composition of water resources.

Case Study – Samerth Trial

<u>Six Stage Process – Data Collection:</u>
Project area showing groundwater and surface water systems.



Ground Water Prospects



Drainage Line map

Case Study – Samerth Trial

WSP Outputs

Six Stage Process – Data Analysis and developing the WSP:

The data collected using digital collection methods was analysed to assess the water balance and feed into the WSP. For example, this table lays out the annual water requirements for each village:

Sn	Village	Human requirements (megalitres mL)	Livelihood requirements (megalitres mL)	Forest requirements (megalitres mL)	Agriculture requirements (megalitres mL)
1	Dholbajja	15.6	14.8	6,262	2,716
2	Shaktipani	7.2	5.6	1,087	1,799
3	Newratola	11.2	9.9	4,822	1,862
4	Aamanara	6.7	7.9	2,460	2,296
5	Pendari	2.9	0.9	375	350
6	Makkekonha	3.8	3.4	3,975	1,078
Total:		47.5	42.6	18,982	10,101

Case Study – Samerth Trial

WSP Outputs

Six Stage Process – Data Analysis and developing the WSP:

The water availability was also analysed. This table shows the annual amount of water stored in one of the watershed and the balance with the water demand from that watershed.

No. of Micro Watershed	9
Water from rain	47.3 (million cubic metres MCM)
Water runoff	0.6 (million cubic metres MCM)
Quantity of water can be stored in watershed	46.7 (million cubic metres MCM)
Requirement of water in 1 year	20.4 (million cubic metres MCM)
Watershed Balance	26.3 (million cubic metres MCM)

Case Study – Samerth Trial

WSP Outputs

Six Stage Process – Data Analysis and developing the WSP:

The WSP then laid out the following plan, based on the analysis of water demand and availability in each village.

Sn	Plan	Quantity	Unit
1	30*40 Model	108.33	Hectare
2	Farm bunding	178.44	Hectare
3	Farm Pond	25	No.
4	Well	34	No.
5	Plantation	171.8	Hectare
6	Contour Trench	74	Hectare
7	Bolder Check	3256	No.
8	Gabion	38	No.
9	Pond	4	No.
10	Earthen dam	7	No.

Case Study – Samerth Trial

Outcomes

Outcomes from the WSP:

The following were constructed, following the recommendations in the WSP:

Storage from an earth dam

Shallow wells

Rainwater harvesting tank

Case Study – Samerth Trial

Outcomes

<u>Outcomes from using digital tools:</u>

Using digital tools rather than paper based forms for data collection was found to speed up the process and reduce the risk of error. The outcomes of this are summarised in the table.

S.N0.	Activity	Before App	In App
1	Data Collection of Household	30 minutes per HH	20-25 minutes per HH
2	Entry of Data collected	10 minutes per HH sheets	NA
3	Data Collection of Water resources	10-15 minutes per resource	10-15 minutes per resources
4	Entry of Data collected	10 Minutes	NA
5	Accuracy	Low	High
6	Types Error generally occurred	• Error in typing. • Error in typing of Units. • Error in typing of Coordinates. • Misplace of Hardcopy by field team during transportation or making entry.	• Less chances of error in typing. • All units are predefined. • GPS coordinates collected Automatically through App.

Feedback

Feedback request

- Improvements to training
  - How would you rate the training on a scale of 1 – 10
  - Do you have any thoughts on how the training could improve?
- Thoughts on WASH Basins IWRM approach
  - Do you have any thoughts on the WASH Basins approach?

Please send any feedback or comments to hello@frankwater.com