

DIGITAL DATA COLLECTION FOR GROUNDWATER MONITORING: ENUMERATOR MANUAL



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in South Asia

Aligned with



DIGITAL DATA COLLECTION FOR GROUNDWATER MONITORING: ENUMERATOR MANUAL

Prepared by:

Groundwater Resources Development Board (GWRDB)
International Maize and Wheat Improvement Centre (CIMMYT)

As a part of the:

Cereal Systems Initiative for South Asia (CSISA)

Funded By:

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Cereal Systems Initiative for South Asia

Preface

Groundwater holds immense value as a water resource in Nepal, particularly in the context of the Terai region. It stands out as one of the most critical resources, serving multiple essential purposes such as agriculture, drinking water supply, and industrial applications.

In the Terai, where agricultural activities thrive, groundwater takes center stage as a lifeline for farming communities. It facilitates year-round irrigation, ensuring that crops receive the necessary moisture even during dry spells. This accessibility to groundwater not only enhances agricultural productivity but also plays a pivotal role in reinforcing food security for the region. Recognizing the significance of groundwater and its sustainable management, the Government of Nepal (GON) established the Groundwater Resources Development Board (GWRDB) in 1976 under the Ministry of Energy, Water Resources and Irrigation (MoEWRI).

The Groundwater Resources Development Board (GWRDB), which is situated in Babarmahal, Kathmandu, is responsible for carrying out numerous groundwater-related projects throughout Nepal. One of the objectives involves monitoring the water level fluctuations of investigation tube wells, which is conducted regularly through its nine branch offices located in Biratnagar, Lahan, Mahottari, Birganj, Chitwan, Butwal, Dang, Nepalganj, and Dhangadhi.

Since the early 1990s, GWRDB has been engaged in groundwater monitoring using traditional paper-based methods, employing techniques such as the "wet point" and "Splash method" for groundwater level measurement. Numerous students and researchers have accessed these valuable data sets to support their academic studies and research reports.

To make the data collection process more efficient, accurate, and user-friendly, GWRDB has collaborated with CSISA for digital data collection for groundwater monitoring since 2020.

About CSISA

The Cereal Systems Initiative for South Asia (CSISA), established in 2009 is a regional initiative to sustainably increase the productivity of cereal-based cropping systems, thus improving food security and farmers' livelihoods in Bangladesh, India, and Nepal. CSISA works with public and private partners to support the widespread adoption of resource-conserving and climate-resilient farming technologies and practices.

The CSISA-Ukraine Response Activity, (2022-2024) is funded by the U.S. Agency for International Development (USAID) Nepal mission as a side investment to the broader CSISA program. The CSISA-Ukraine Response Activity is also strategically aligned with the One CGIAR Regional Integrated initiative Transforming Agrifood Systems in South Asia (TAFSSA) to support actions that improve equitable access to sustainable healthy diets, improve farmers' livelihoods and resilience, and conserve land, air, and water resources in South Asia.

Acknowledgements

This training manual on “Digital Data Collection for Groundwater Monitoring: Enumerator Manual” is an outcome of several years of work and workshops on digital data collection organized by Groundwater Resources Development Board(GWRDB) in collaboration with CIMMYT.

We would like to acknowledge the support and guidance provided by GWRDB throughout the entire process. Their expertise and resources have been invaluable in shaping this manual into a practical and effective tool for groundwater monitoring. We would also like to express our appreciation to the GWRDB enumerators, who contributed their time and insights, enabling us to refine the data collection process and produce a manual that reflects real-world needs and challenges.

Lastly, we would like to express our sincere gratitude to all those who provided support, read, wrote, offered comments, and assisted in editing, managing, and proofreading this manual. This manual is a testament to your commitment and will serve as a valuable resource for advancing groundwater monitoring efforts.

We hope that this training manual will be a valuable source of information for GWRDB to train the enumerators for digital data collection. Finally, we would like to thank all those who have contributed to the conceptualization, writing, and production of the manual.

Sincerely,

CIMMYT

About the training manual

This manual aims to help data collectors transition from paper-based to digital data collection. It provides a detailed guide on how to use the KoboCollect app on the KoboToolbox platform for monitoring groundwater wells.

The manual offers comprehensive guidance on the following key aspects:

1. Establishing a KoboToolbox account.
2. Installing the KoboCollect app on your device.
3. A step-by-step process for accessing and collecting groundwater monitoring well data using forms.
4. Detailed instructions for submitting and editing completed forms.
5. An explanation of the monitoring methodology.
6. Guidance on uploading newly created forms.

This manual is essential for field data collectors, as it reduces ambiguity and addresses outliers to enhance data quality and the overall collection process.

Disclaimer:

The material presented in this document represents the ideas and opinions and perspectives of the authors. It does not necessarily reflect the views of USAID nor the United States Government and shall not be used for advertising purposes.

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1. Introduction

1.1. Background

The Groundwater Resources Development Board (GWRDB) established in 1976 has been continuously monitoring the groundwater level in various parts of Nepal. Traditionally, the approach has been to measure the groundwater system and record the necessary data points (measuring point, groundwater level) via a paper-based approach. Digital data collection approach allows us to get data in real time and store it in the cloud without worrying about losing paper-based data. In the long term, students, researchers, policy makers and the Groundwater Resources Development Board will have initiated access to data.

In 2020, CIMMYT along with Groundwater Resources Development Board (GWRDB) initiated the work to shift from a paper-based data collection approach to a digital data collection approach. This manual outlines the step-by-step process to collect data digitally using data collection software.

KoboToolbox is a user friendly set of data entry and aggregation tools - it can be used for offline data collection. It is built on the same platform used by ODK and is easy to use.

1.2. Kobo system overview

Making data collection accessible to everyone, everywhere

Kobo hosts and maintains KoboToolbox, a data collection, management, and visualization platform used globally for research and social good. Our mission is to support open source data systems and technology for humanitarian action, development, environmental protection, peacebuilding, and human rights.



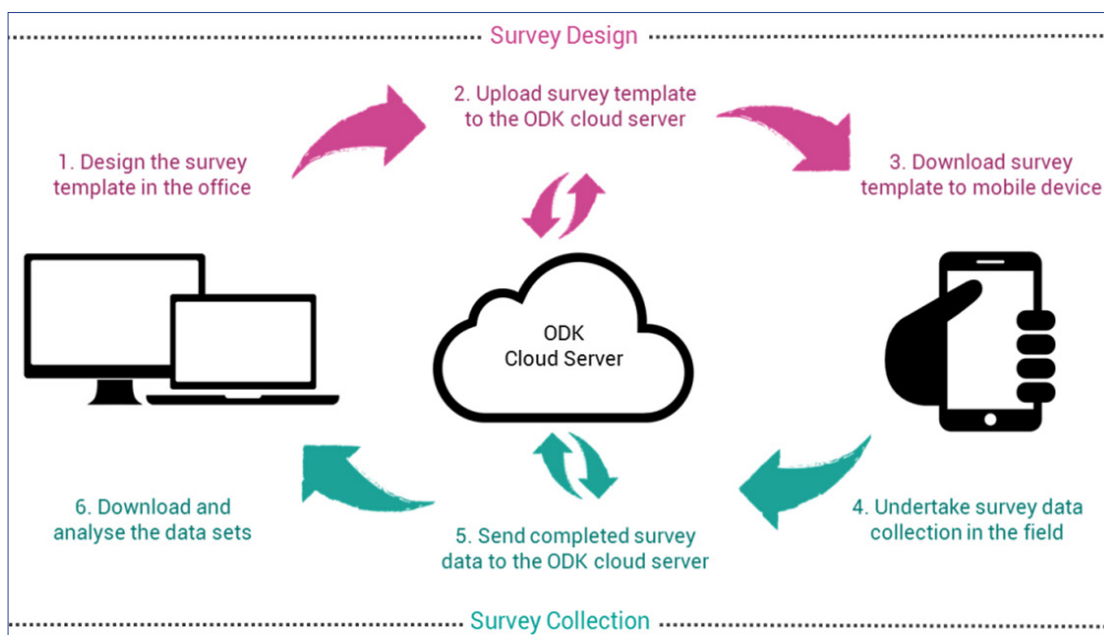
The KoboToolbox was developed by the Harvard Humanitarian Initiative using the ODK platform. It is an open-source suite of tools for data collection and analysis. It was developed for emergencies and other challenging environments. Humanitarian organizations can use the server hosted by OCHA with no restrictions as to the number of submissions.

Pros

- Free
- Easy form creation but also uses more advanced XLS Forms
- Works offline
- Collaborative with question library
- Collects GPS coordinates
- Exports as KML, XLS, and CSV
- Administrator's tools for coordinating field workers
- Do not need to set up a server (like ODK Aggregate) although you can if you wish to store data locally

Cons

- Photos and media files download as separate zip files, are not stored online, and need to be manually added to My Maps, Fusion Tables, etc.
- Download file limits
- Some server limits (except for humanitarian organizations)



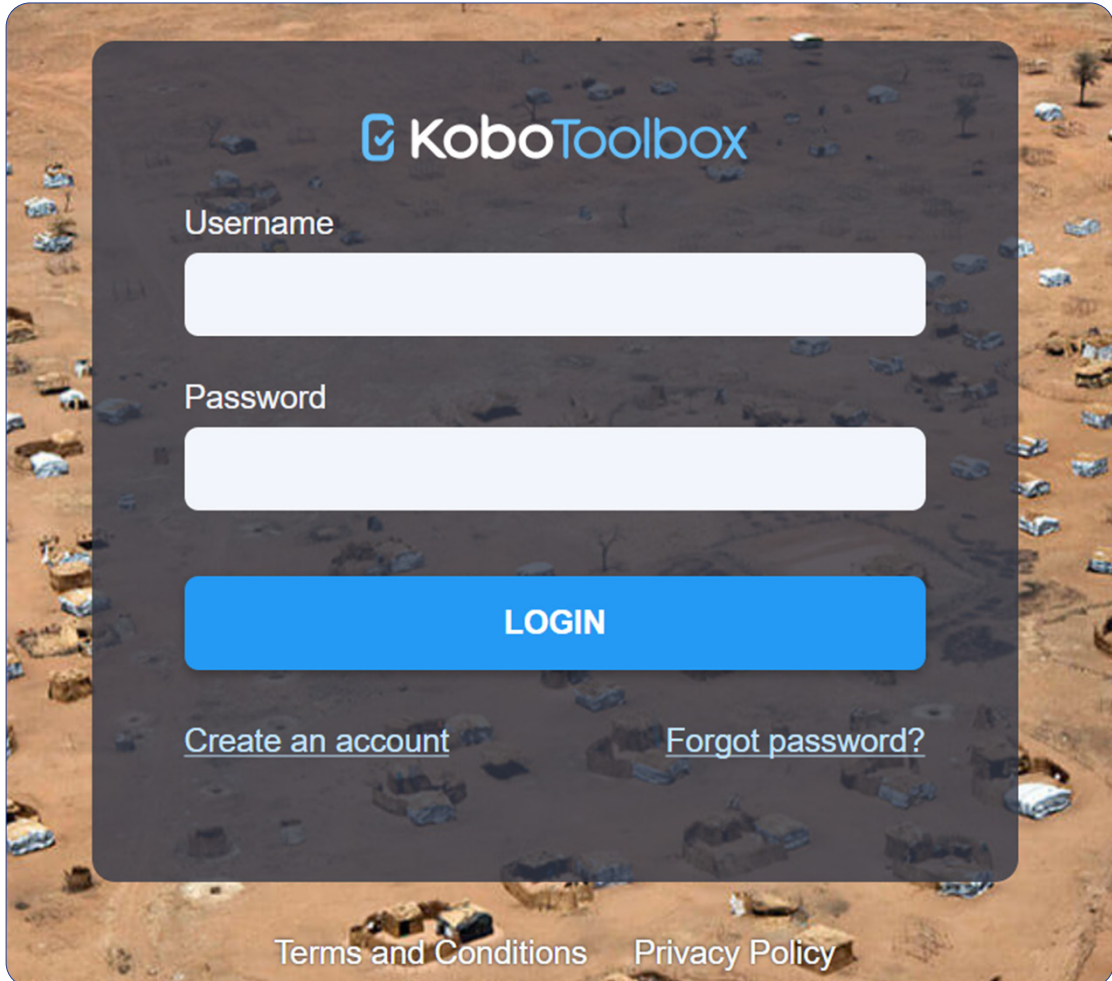
Source: <https://sites.orbital.co.ke/gis-data-collection>

Figure 1: Overall steps for data collection.

2. Digital Data Collection Using KoboCollect

2.1. Creating account for data collection

1. Go to website (<https://kobo.humanitarianresponse.info>)

A screenshot of the KoboToolbox login interface. The background is an aerial view of a dry, arid landscape with small, scattered structures. Overlaid on this is a dark grey rectangular box containing the login form. At the top of the box is the KoboToolbox logo, which consists of a blue square icon with a white checkmark-like shape inside, followed by the text 'KoboToolbox' in a sans-serif font. Below the logo are two white input fields: the first is labeled 'Username' and the second is labeled 'Password'. Below these fields is a large blue button with the word 'LOGIN' in white capital letters. At the bottom of the box, there are two links: 'Create an account' on the left and 'Forgot password?' on the right, both in a smaller, lighter font. At the very bottom of the dark grey box, there are two more links: 'Terms and Conditions' and 'Privacy Policy', also in a smaller, lighter font.

2. Click on Create an account. Fill in the form, providing your details and email address. You will get the verification mail on your provided email address.

(You can log-in to the system if you have already created the account. Just enter the username and password and you will be ready to go.)

Create an account

Full name Organization name

Username

E-mail

Sector Country

Gender
☐ Male ☐ Female ☐ Other

Password

Password strength

Use a few words, avoid common phrases
No need for symbols, digits, or uppercase letters

Password confirmation

CREATE ACCOUNT

or [login](#)

KoboToolbox

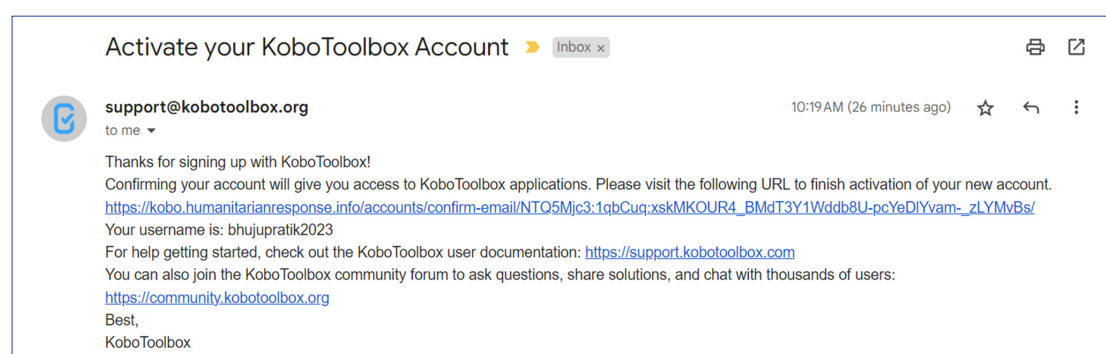
KoboToolbox is an integrated set of tools for building forms and collecting interview responses. It is built for easy and reliable use in difficult field settings, such as humanitarian emergencies or post-conflict environments.

It is free to create an account and collect data, with no limits on the number of data collection projects. Users can collect up to 10,000 form submissions with their projects per month and store up to 5GB of survey attachments collectively in their user account (photos, videos, audio recordings, PDF, etc.). If you require more submissions or storage, please contact us at info@kobotoolbox.org to arrange for a paid subscription.

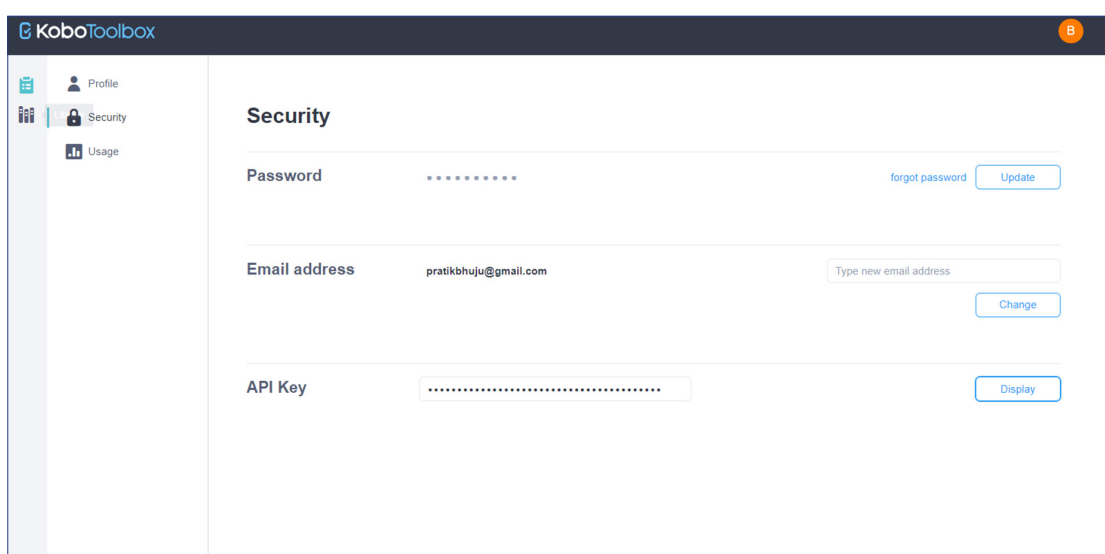
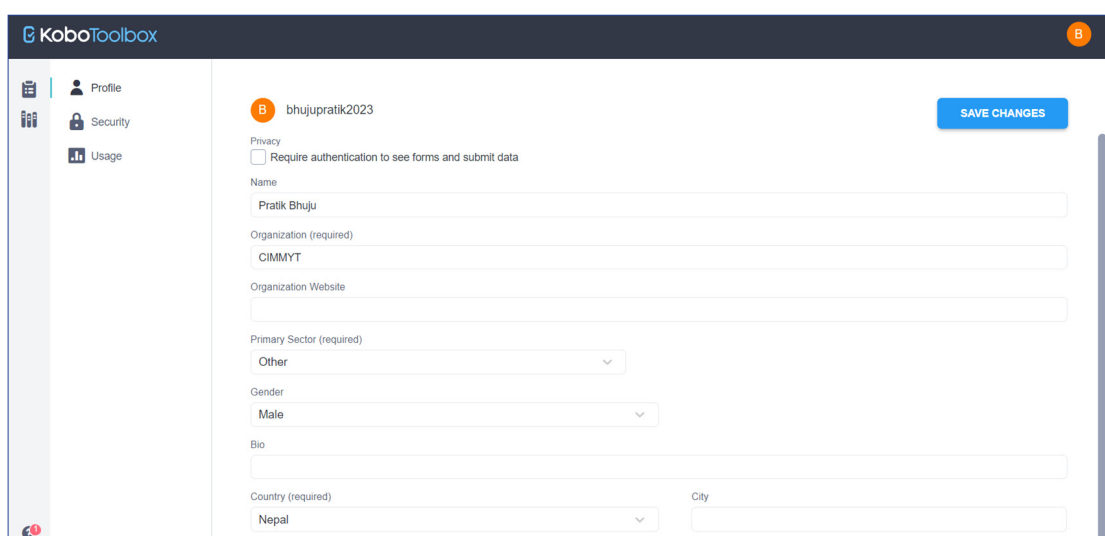
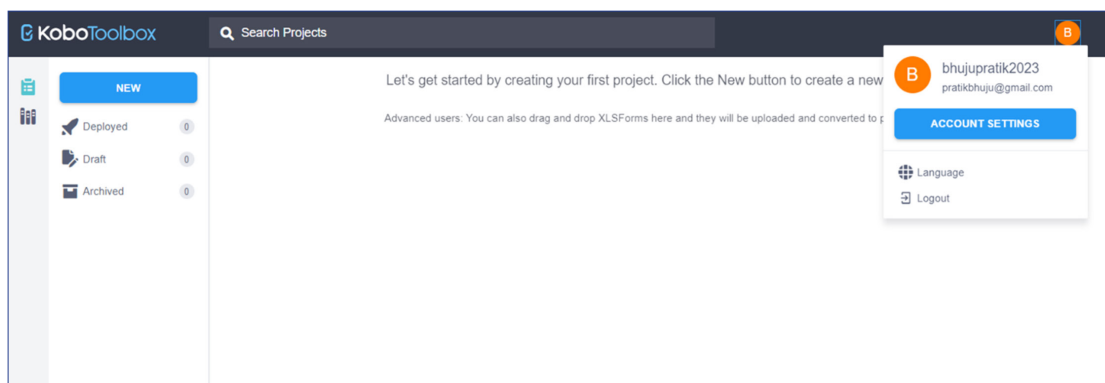
If you are an organization providing humanitarian assistance, please use OCHA's [KoboToolbox installation](#) instead, which provides an unlimited number of submissions.

[Terms of Service](#) | [Privacy Policy](#)

3. You will get an email verification request and click on the link for the activation as shown below. Once you verify your account, you can use KoboToolbox to collect data.



4. Now, you can log-in to the system and edit your profile by clicking the icon at the top right corner as shown in the figure below.



Note: This is a one-time exercise best done on a laptop.

2.2. Installing and setting up the app

KoboCollect is 'KoboToolbox's data collection app and can be installed on any Android phone or tablet through the Google Play Store. To install the app on your Android device: Goto Google play store, search for “ KoboCollect app” in search bar and press install to install the app.

Note: Alternatively, the ODKcollect app can also be downloaded from the app store but it is not available on ios devices.

2.2.1. Setup server URL on KoboCollect

After installing KoboCollect, you need to configure it so that it can be used together with your KoboToolbox account for data collection.

1. Open KoboCollect on your device



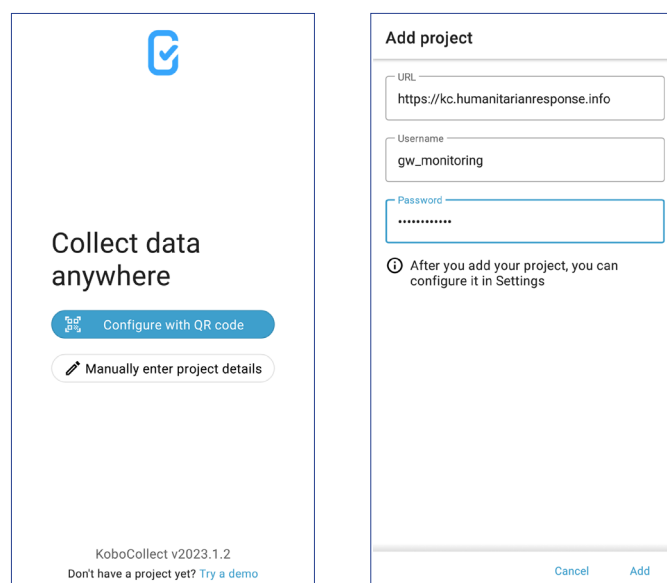
2. Press “Manually enter project details” and manually enter the URL provided including your username and password.

URL: <https://kc.humanitarianresponse.info>

OR,

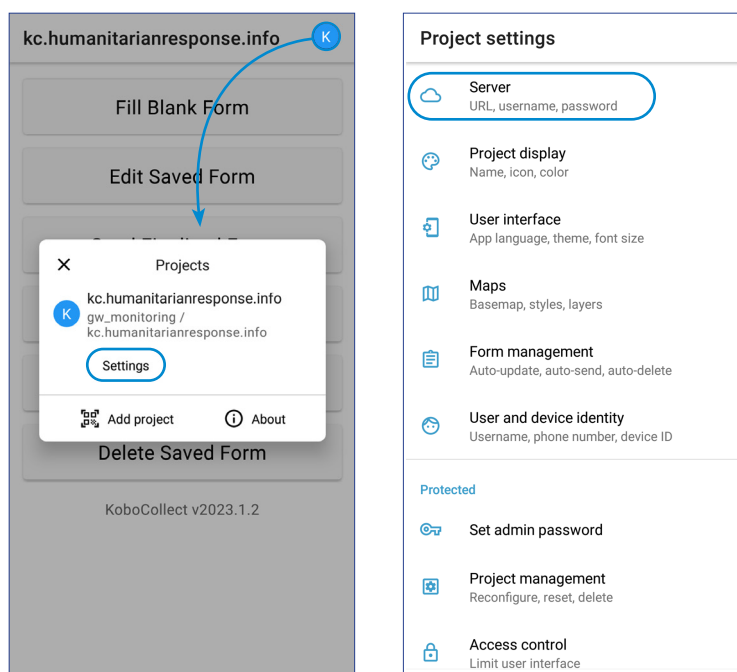
The project, including the form, can be added directly via QR code provided by the trainer during training sessions.

(Note: The QR code is kept confidential to prevent the form from being misused.)



The image displays two screenshots of the KoboCollect application interface. The left screenshot shows the main screen with the KoboCollect logo at the top, the text "Collect data anywhere" in the center, and two buttons: "Configure with QR code" and "Manually enter project details". At the bottom, it says "KoboCollect v2023.1.2" and "Don't have a project yet? Try a demo". The right screenshot shows the "Add project" screen with fields for "URL" (https://kc.humanitarianresponse.info), "Username" (gw_monitoring), and "Password" (masked with dots). Below the fields is a note: "After you add your project, you can configure it in Settings". At the bottom are "Cancel" and "Add" buttons.

3. Access the General Settings by locating the **K** icon located on the upper right corner of the screen. Click on the icon, then select "Settings." Within the Project settings menu, choose "Server."



4. In the Server Settings, enter the username and password (Username: XXXXX, password: XXXXX) - provided/created by the trainer. Only then will the user be able to Get Blank Form from the home screen menu of KoboCollect app.

Server Settings	
Type	KoboToolbox
URL	https://kc.humanitarianresponse.info
Username	bhujupratik2023
Password	*****

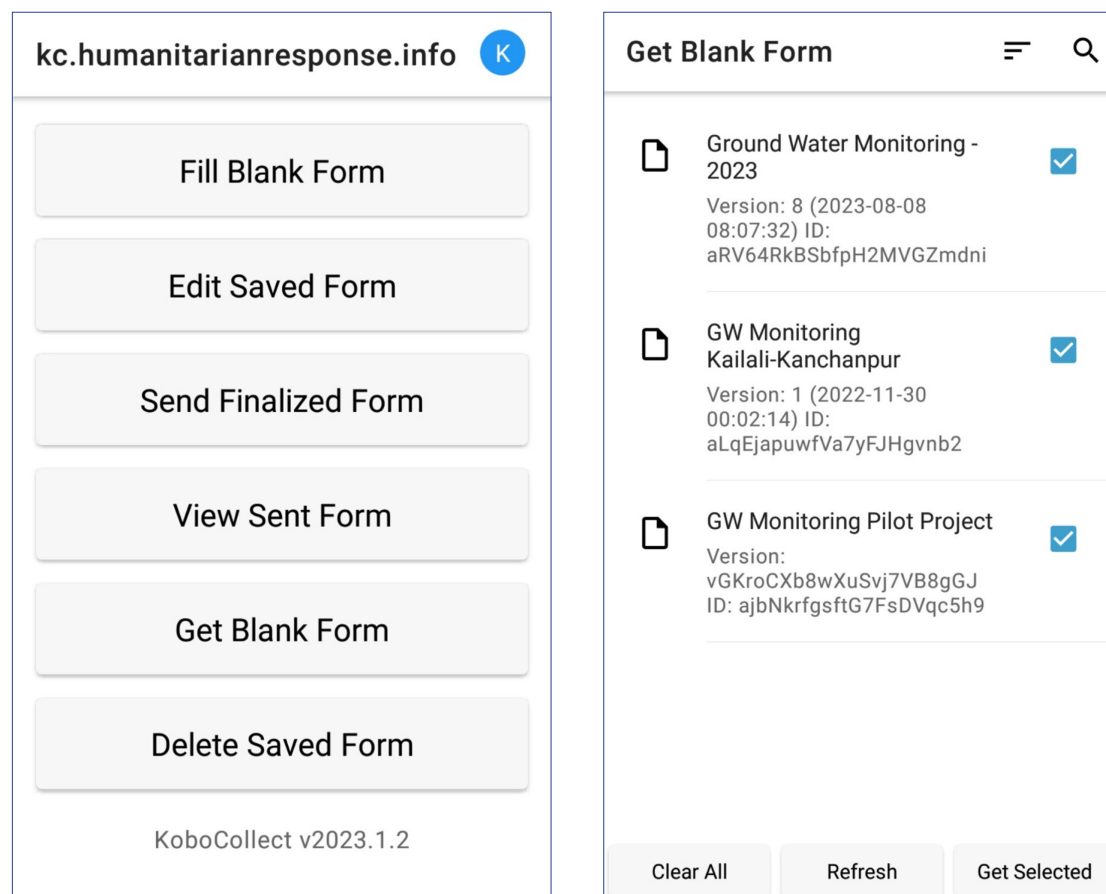
Note: The username and password are kept confidential to prevent the form from being misused.

2.3. Using the data collection app

2.3.1. Download blank forms from your account

Make sure you are connected to the internet on your device

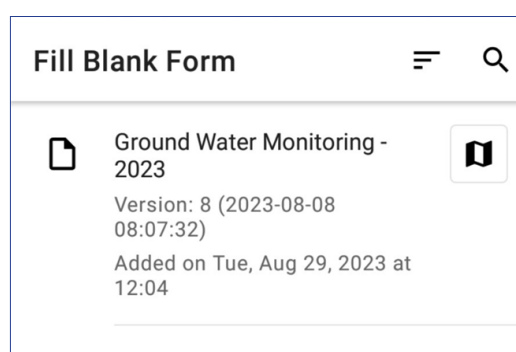
1. On the home screen menu of KoboCollect app, select **Get Blank Form**
2. A list of all your forms from your different projects will be shown. Click **Select All** (or select the ones you wish to download), then click **Get Selected**.



2.3.2. Collect data by filling in blank forms.

At this point, you no longer need an internet connection. The blank forms and the following submissions will stay on your device until you regain an internet connection. Once you get internet access, you can send the data submissions to the server.

1. Back in the main home screen, select **Fill Blank Form**.
2. Select the form you wish to fill out and enter data.



3. Now you may go through and start answering all the questions (Pressing next or swiping left)
4. In the app, you will see each question one by one. Below you can find an overview of all questions with explanations:
5. First, you need to enter your name and select the name of the state from the list:

The image displays two sequential screens from the 'Ground Water Monitoring' application. The first screen, titled 'Main Group > Enumerator_details', features a red asterisk followed by the text '* Enumerator Name' and a text input field. Below the input field is a 'NEXT >' button. The second screen, titled 'Main Group > Locations', features a red asterisk followed by the text '* Select State'. Below this text is a list of seven states, each preceded by a radio button: Koshi, Madesh, Bagmati, Gandaki, Lumbini, Karnali, and Sudhur Paschim. At the bottom of this screen are two buttons: '< BACK' on the left and 'NEXT >' on the right.

6. Then select the name of the district

The image shows a screenshot of the 'Ground Water Monitoring' application at the 'Select District' screen. The screen title is 'Main Group > Locations'. Below the title, there is a red asterisk followed by the text '* Select District'. Underneath, there is a list of nine districts, each preceded by a radio button: Arghakhanchi, Banke, Bardiya, Dang, Gulmi, Kapilbastu, Nawalparasi_W, Palpa, and Pyuthan. At the bottom of the screen, there are two buttons: '< BACK' on the left and 'NEXT >' on the right.

7. Click on Start GeoPoint for Geographic location, please use the GPS function of the tablet/ phone to locate the GPS location of the well:

Ground Water Moni...

Main Group > Locations

* Geographic location

Change Location

Latitude: N 27°39'16"
Longitude: E 85°19'33"
Altitude: 1283.3m
Accuracy: 96.26m

< BACK NEXT >

Note: Please wait until GPS accuracy is 5 meters or less.

9. This will open the list of existing monitoring wells by their number. Please select the monitoring well you are going to enter the data.

Ground Water Moni...

Main Group > Locations

* Well No.

S.No: 1 - Well No:
☐ 1-045/46(BK)1 Location:
Rohini Khola

S.No: 2 - Well No:
☐ 1-045/46(BK)2 Location:
Jabdhawa

S.No: 3 - Well No:
☐ 1-045/46(BK)3 Location:
Banktuwa

S.No: 4 - Well No:
☐ 1-045/46(BK)4 Location:
Channawa

S.No: 5 - Well No:
☐ 1-045/46(BK)5 Location:

< BACK NEXT >

8. Afterwards you need to select whether you are collecting information for a shallow or deep well.

Ground Water Moni...

Main Group > Locations

* Well type :

☒ Shallow well

☐ Deep well

< BACK NEXT >

10. The measurement point (MP) (in meters) is auto generated

Ground Water Moni...

Main Group > Measurement

"Your MP is 0.2 meters(m) above ground."

< BACK NEXT >

11. After that, you need to take a photo of the measurement in which one can read the number you entered and where/how you measured it.

Ground Water Moni...

Main Group > Measurement

* Photo of Well: Use the camera to take a clear photo of the well outlet with a marked measurement point

Take Picture

Choose Image

< BACK NEXT >

13. After that enter the value of measurement of wet point on tape (in meters).

Ground Water Moni...

Main Group > Measurement

* Measurement of wet point on tape (in m)

< BACK NEXT >

1 2 3

4 5 6 Done

7 8 9 .-

0

12. Enter the total length of the measuring tape in meters

Ground Water Moni...

Main Group > Measurement

* Measurement of tape at measurement point (MP) (in m)

< BACK NEXT >

1 2 3

4 5 6 Done

7 8 9 .-

0

Note: If the method of measure is splash method, then the measurement of wet point is 0. Please measure with great care and as mentioned above (e.g., with a consistent reference point at the well outlet)

14. It displays the calculated groundwater level below the ground surface

The screenshot shows the 'Ground Water Monitoring' app interface. At the top, there's a title bar with 'Ground Water Moni...' and icons for save, share, and menu. Below the title bar, the breadcrumb 'Main Group > Measurement' is visible. The main content area displays the text: "The water level is 2.8 m below ground". At the bottom, there are two buttons: '< BACK' on the left and 'NEXT >' on the right.

- 16: you can also enter them as audio

The screenshot shows the 'Ground Water Monitoring' app interface. At the top, there's a title bar with 'Ground Water Moni...' and icons for save, share, and menu. Below the title bar, the breadcrumb 'Main Group > Measurement' is visible. The main content area displays the text: "Audio Notes: Use the Phone's microphone to record any notes". Below this text, there are two blue buttons: 'Record Sound' and 'Choose Sound'. At the bottom, there are two buttons: '< BACK' on the left and 'NEXT >' on the right.

15. If you have notes about the measurements.

The screenshot shows the 'Ground Water Monitoring' app interface. At the top, there's a title bar with 'Ground Water Moni...' and icons for save, share, and menu. Below the title bar, the breadcrumb 'Main Group > Measurement' is visible. The main content area displays the text: "Notes" followed by a text input field. At the bottom, there are two buttons: '< BACK' on the left and 'NEXT >' on the right. A keyboard is visible at the bottom of the screen.

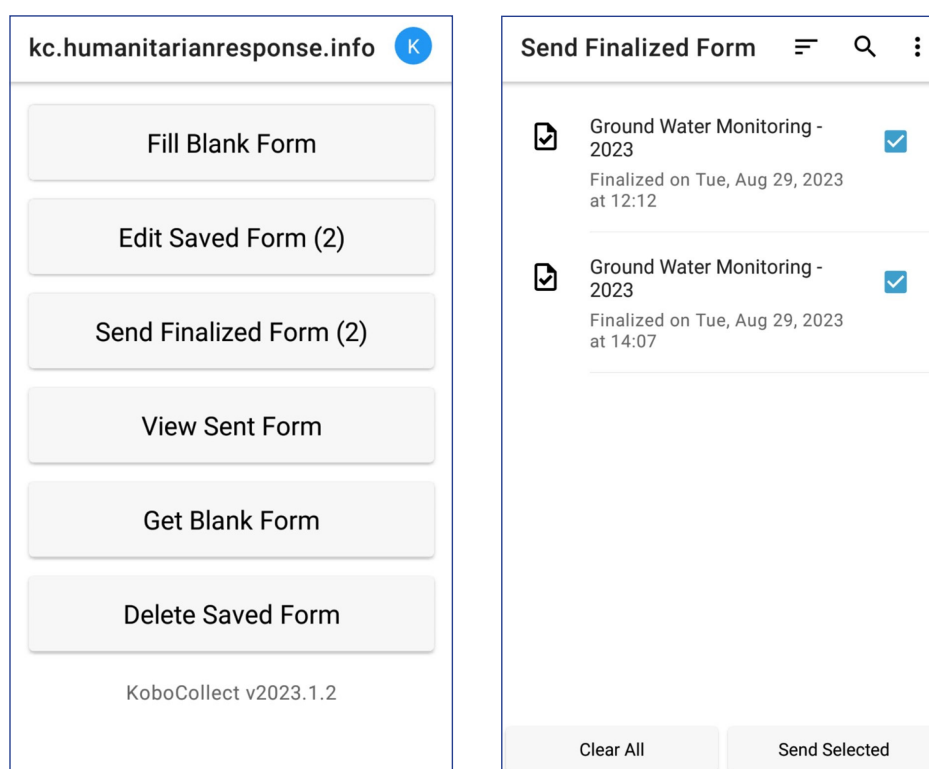
17. When you reach the end of the form, click on Save Form and Exit (making sure the form is marked as "finalized")

The screenshot shows the 'Ground Water Monitoring' app interface. At the top, there's a title bar with 'Ground Water Moni...' and icons for save, share, and menu. Below the title bar, the breadcrumb 'Main Group > Measurement' is visible. The main content area displays the text: "You are at the end of Ground Water Monitoring - 2023." Below this text, there's a text input field with the text: "Name this form" and "Ground Water Monitoring - 2023". Below the input field, there's a checkbox labeled "Mark form as finalized" which is checked. Below the checkbox, there's a blue button labeled "Save Form and Exit". At the bottom, there is a button labeled '< BACK'.

2.3.3. Uploading finalized data to the server

After completing the form fill up, follow these steps to upload the collected data to your KoboToolbox account and server. If you have an internet connection at the well site - please upload the form right after you complete it.

1. Ensure you are connected to the internet on your device.
2. From the home screen in the KoboCollect app, click on Send Finalized Form
3. A list of your most recently collected forms appears.
4. Click Select All (or select the ones you wish to send), then click Send Selected.



2.3.4. Editing data in KoboCollect

Once you have completed filling out the forms, it is possible to edit and make corrections of the collected data in KoboCollect, before sending them to the server.

1. Select Edit Saved Form on the home screen of KoboCollect app.
2. You will see a list of Saved Forms. Choose the one that you wish to make corrections to.
3. Make changes as needed, and then press Save Form and Exit.
4. Repeat the process if you wish to make corrections to multiple Saved Forms.

3. Annex

Groundwater monitoring methodology

Two different methods are being used in the field to collect the groundwater level data. The “Wet point method” and “Splash method”.

Most of the monitoring wells are sticking out from the ground, and, therefore, we would firstly need to measure the length of the portion that is sticking outside of the ground. We call this the measurement point (mp), and this value is to later be subtracted to get the real value of groundwater depth.

3.1. The Wet point method

In the wet point method,

- The measuring tape of length (l) is dropped into the well and some part of it is submerged into the water.
- Because the tape was submerged a certain portion of the tape would be wet. Upon retrieving the tape from the well, the value of the of the wet point(wp) is to be recorded.
- The wet point(wp) value will then be subtracted along with subtraction of the measuring point to get the actual depth of the groundwater level.

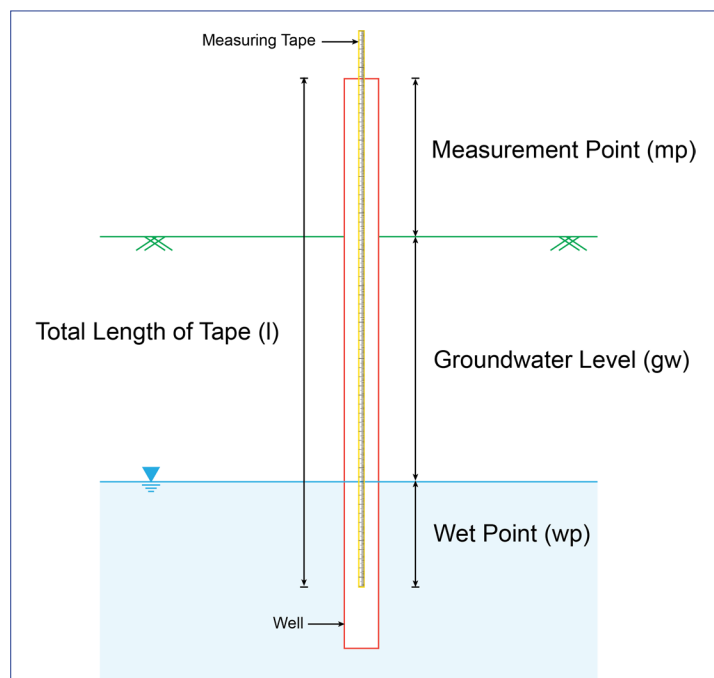


Figure 2: Wet Point Method

Total Length of Tape (l) = Measuring point (mp) + Groundwater Level (gw) + Wet Point (wp)

∴ Groundwater Level (gw) = Total Length of Tape (l) - Measurement point (mp) - Wet Point (wp)

3.2. The Splash method

In the splash method the measuring tape is not submerged into the water,

i. Instead, once a splash is heard as the measuring tape encounters groundwater, the tape is taken out and the length is taken.

ii. The wet point, therefore, will also be 0 by default in this case. (Applicable when entering in the tablet)

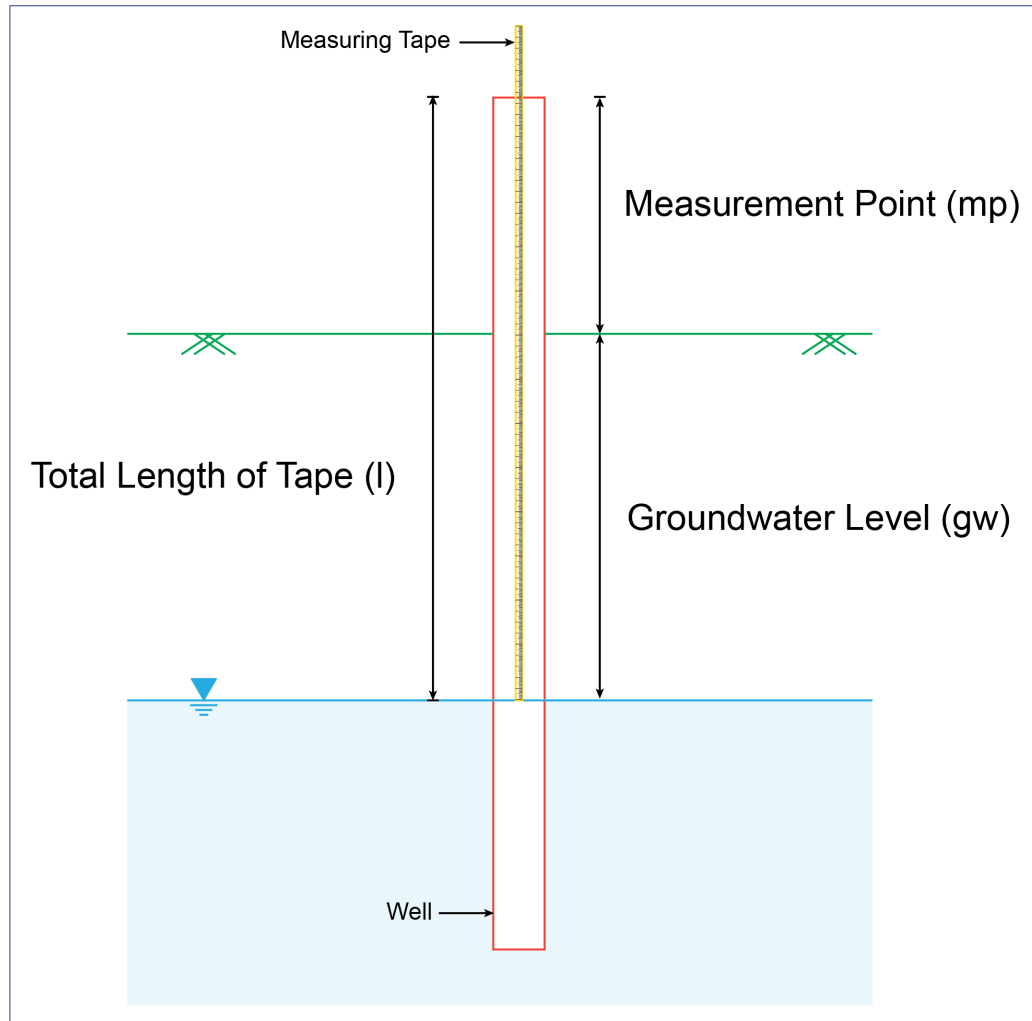


Figure 3: Splash Method

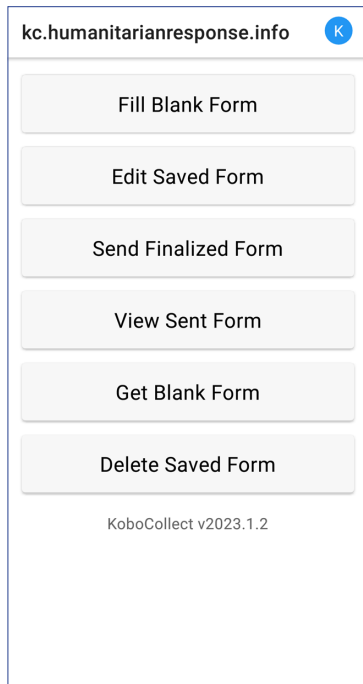
Total Length of Tape (l) = Measurement point (mp) + Groundwater Level (gw)

∴ Groundwater Level (gw) = Total Length of Tape (l) - Measurement point (mp)

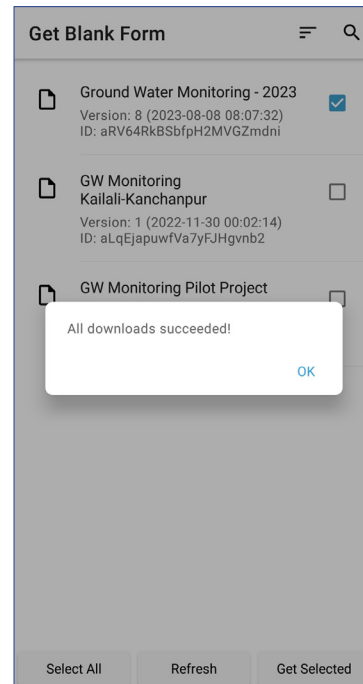
Note: The measurement points always need to be taken. If the measurement point is on ground level, then the measurement point is 0.

3.3. How to update to a new form

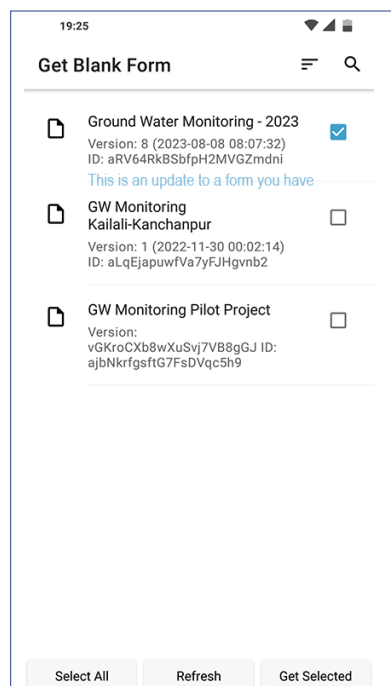
- i. Go to KoboCollect app Home page and select Get Blank Form



- iii. When the selected form is downloaded it shows "All downloads succeeded!" press OK to continue



- ii. Choose the updated form from the list and press Get Selected



- iv. New updated form will be available inside Blank Form.

