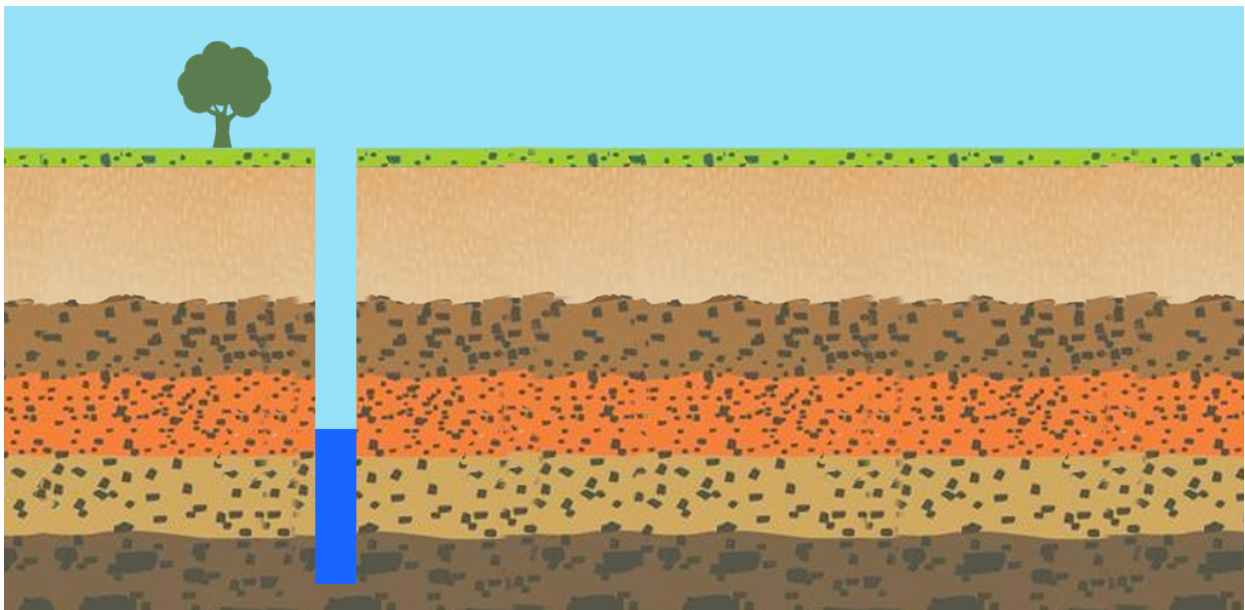# User manual

The Driller's Toolbox

Date: 6 May 2020
Product version: 2.0
Manual version: 1.0

Thank you for choosing The Driller's Toolbox

The Driller's Toolbox is a digital toolbox for groundwater development. It assists in common tasks such as geophysics resistivity measurements, drill log data capture and reporting, and pumping tests. The app contains simple user interfaces to make it easy to capture high-quality data, and after submission the user receives a PDF report plus the raw data in Excel, for further analysis. The app can handle both SI and Imperial units, is available in English, French, and Portuguese, and is only available for Android devices.

The Driller's Toolbox was created by Practica Foundation to address the information gap that exists in many low- and medium income countries, where valuable data related to developing groundwater is lost, not accessible, or of poor quality. We hope this app will adopted by the water sector, and will contribute to a higher standard of information collection and sharing. Our work has been supported by Groundwater Relief and Médecins sans Frontières (MSF).

The software has been carefully designed and programmed, and has been thoroughly tested. However, there are always the possibility of bugs or unexpected behavior, amongst others due to the large number of different Android devices that are used. If you have found a bug, have ideas for expanding the app with more functionality, or ideas for the clarification of the user interface, we'd love to hear from you. We would like to learn from your experiences, and would be grateful for any stories about how you use the software that you might want to share.

The best way to reach us is by sending us an email to: *support@practica.org*

Our office address is:
PRACTICA Foundation, Geulweg 16, 3356 LB Papendrecht, The Netherlands

Phone: +31 (0) 786 150 125

Website: practica.org

Table of contents

1.   Description of the Driller's toolbox

1.1   Intended use

The Driller's Toolbox is an app that is intended to be used by professionals in the groundwater development sector, such as drillers, supervisors, geophysicists, and hydrologists. The goal of the app is to capture data on resistivity measurements, drilling logs, and pumping tests.

1.2   Overview

The Driller's Toolbox consists of an Android smartphone application, and a backend that stores data and creates reports. Data captured by the smartphone is uploaded to the backend. There, a PDF report, Excel report or both are generated and stored. Users receive an email with the link to download reports.

1.3   Privacy and data ownership

Data entered by a user remains under the ownership of the user. The user grants Practica Foundation a license to use, transmit, store and display the data, so we can create reports. Practica Foundation is a supporter of open data, which is why we would like to make as much data as possible under an open data license. If data is made available under an open license depends on the agreement made between Practica and the user.

1.4   History

The Driller's Toolbox has been under development since 2015. It started out as an app to capture resistivity data for Vertical Electrical Soundings. At that time, it was known as the 'Bedrock' app. In 2018, a drill log module was added. In 2019, with the financial support of Médecins sans Frontières (MSF) and knowledge support of Groundwater Relief, we were able to add a pumping test module, which was completed in May 2020.

2.   Installing the app

Minimum requirements

This app needs a minimum Android version of 4.2. The app should work on any Android device, such as Samsung, LTC, Huawei, Motorola, etc. The app has been mainly tested on Samsung devices, so if you have a choice, this is preferred.
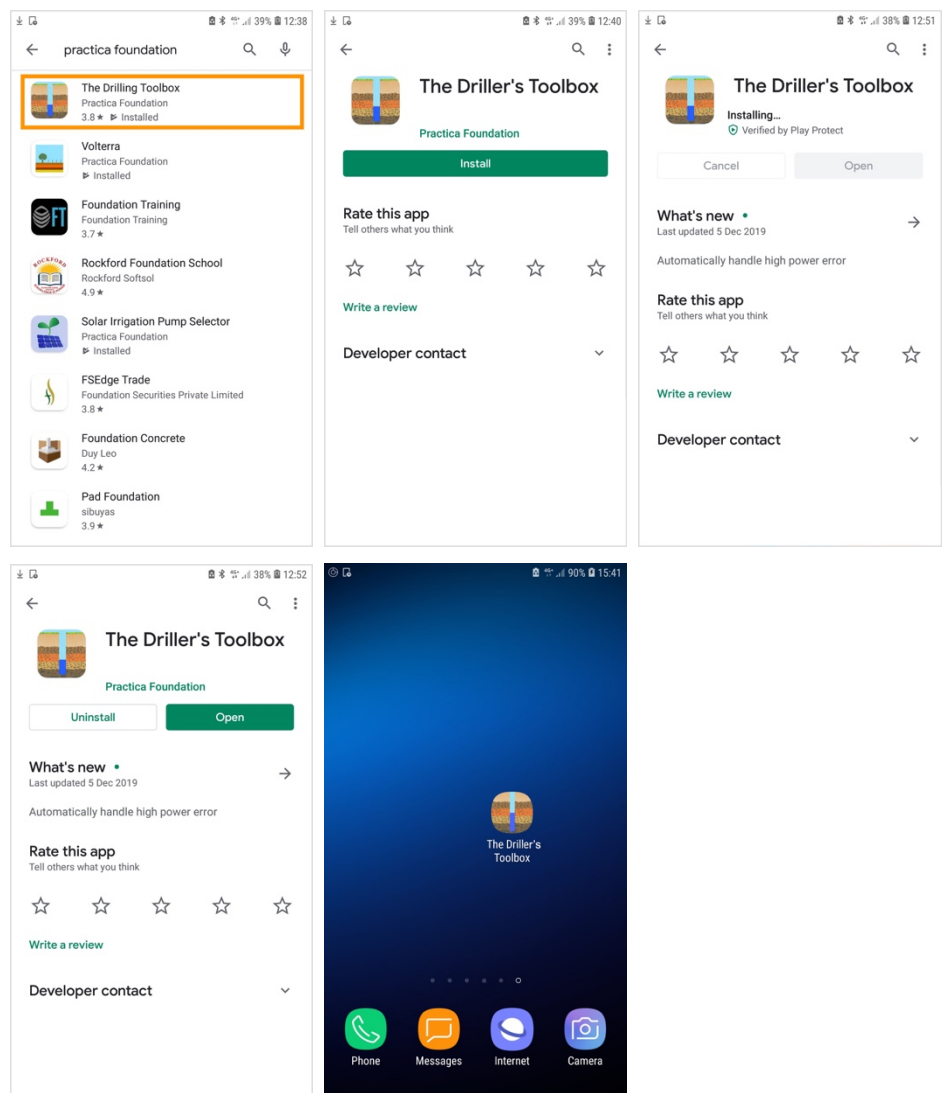
Other minimum requirements are:

- GPS
- Bluetooth

Installing the app

Getting the Volterra app

1. On your phone, go to the Google Play Store.

2. Search for "Practica Foundation". In the list, select "Driller's Toolbox".

3. Click 'Install'.

4. When the app has installed, put a link to it to the home screen of your phone.

3.   Getting started

Create a login

NOTE: to login to the app, you need to be connected to the internet. For the normal operation of the app, an internet connection is not needed.

Creating a login

1. Open the app

2. On the login screen, click 'New account'

3. Fill in your email address and your password, and click 'Create new account'

4. A verification code will be sent to you by email.

5. On the login screen, click 'Confirm account'

6. Enter your email address and the verification code.

7. You can now login to the app.

If you forget your password

1. If you have forgotten your password, go to the login page and click 'Forgot password'

2. A confirmation code will be sent to your email address.

3. Copy the confirmation code in the right field, and enter a new password. Click 'Set new password'.

4. You can now login with your new password.

Enter the license code

Enter the license code

1. If you have successfully logged in, you are presented with the license code screen.
2. Type in the license key that you have obtained from Practica. Click on 'Continue'. You can now use the app.

3. If you don't have a license key yet, please contact us at support@practica.org to obtain one.

4. You can use the app with full functionality for 2 months by clicking 'Free Trial'.

The Home screen

The home screen

1. After you enter the license code, you arrive at the home screen.

2. The home screen contains three icons: Profile, Projects, Data.

3. The menu at the top contains Log out and About.

4. At the bottom of the screen, the active project is shown.
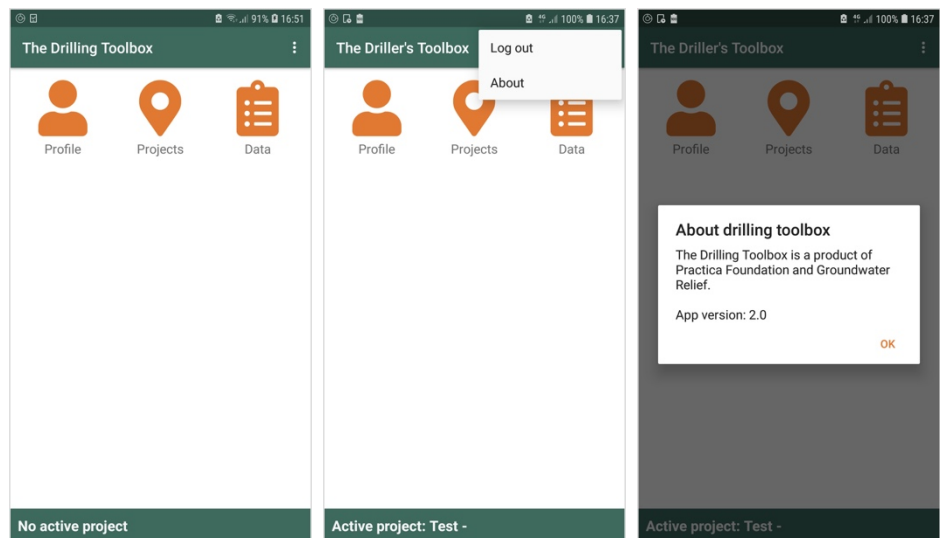
Creating a profile

Creating a profile

1. The profile contains information about the person collecting the data. It is used to determine ownership of the data, and where to send reports to. Only a single profile exists in the app, and you only need to create this once.

2. Click on the 'Profile' icon to edit the profile, and fill in the fields. Make sure that the email address you provide is correct.

3. Click save to save the profile.

Creating a project

Creating a new project

1. All data is organized into projects. To create a new project, or change the active project, click on the 'Projects' icon.

2. The active project is shown, as well as the archived projects. There is always only a single project active.

3. To create a new project, click 'Create new project'. Fill in the project name, an optional reference, and the country, and click 'Save'

4. The new project automatically becomes the active project. If you now go back to the home screen, the active project is shown at the bottom.
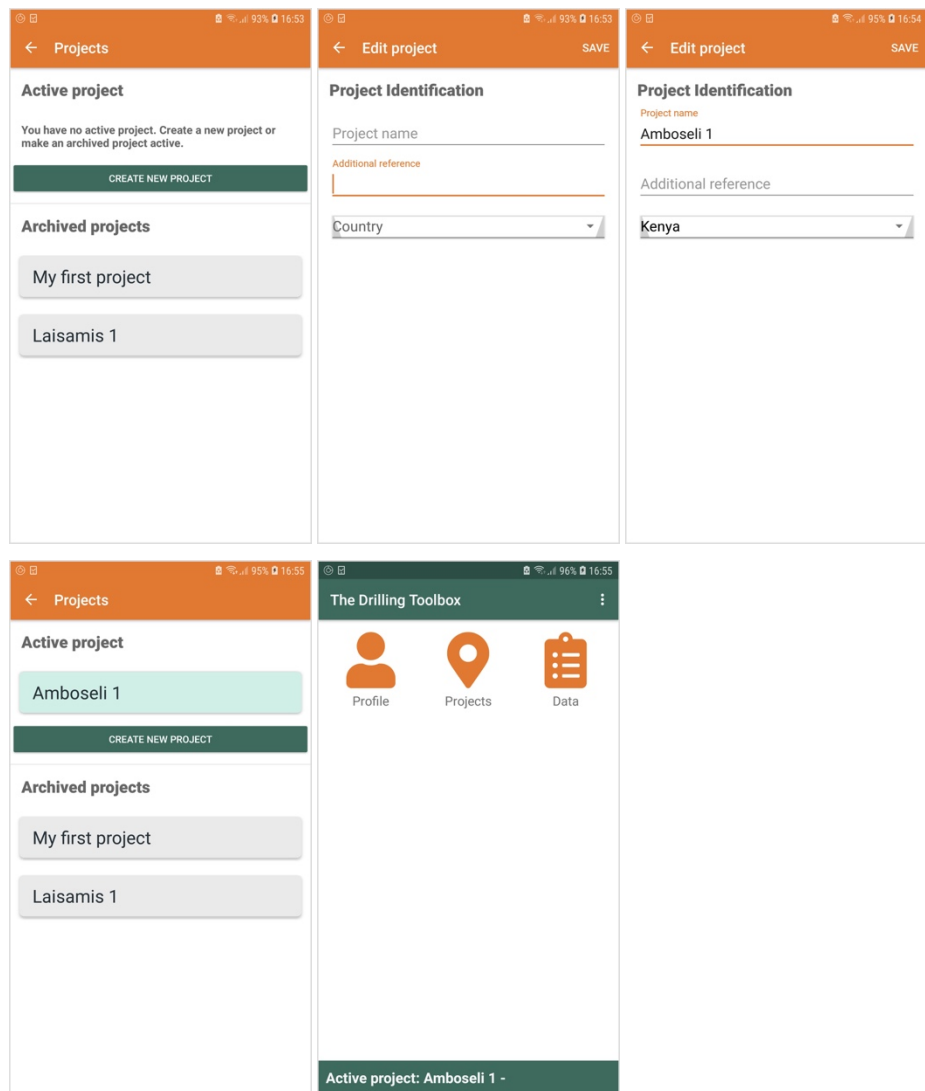
Changing the active project

1. If you already have an active project, and click 'create new project', you are asked if you want to archive the currently active project, and create a new one.

2. If you want to make an archived project active, click on the project and select 'Make this project active'

3. The active project can be edited by clicking it, and selecting 'Edit this project'
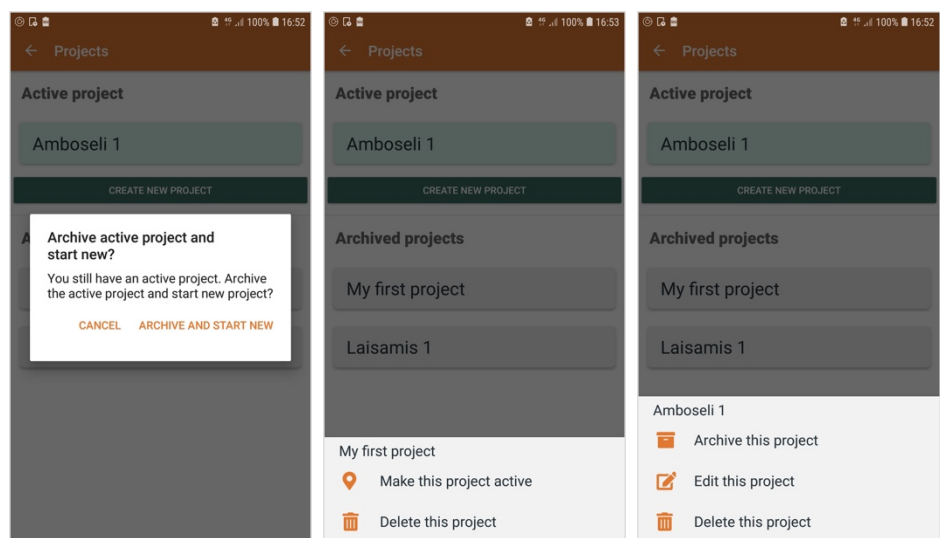
Creating a data item

Creating a data item

1. A drill log, pumping test, or VES / HEP measurement are all called 'Data items'. To create a new one, click on the 'data' icon on the home screen.

2. A list of all data items is displayed. An icon indicates the type of the data item.

3. Click on 'Create new data entry' to create a new item.

4. Fill in a reference, and select the type of the item, and click 'Create'.
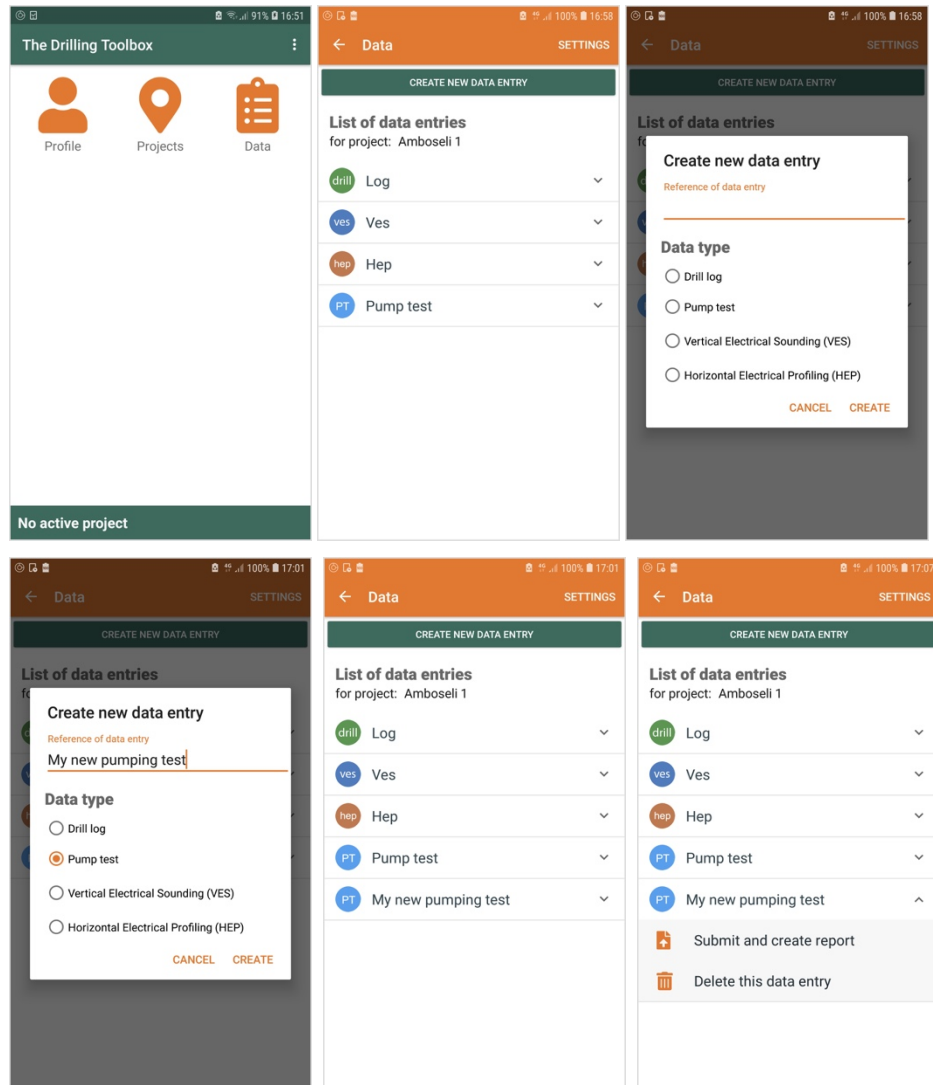
5. After saving, the new data item is displayed in the list.

6. By clicking on the arrow on the right, a menu is displayed. Here, the data item can be submitted to the server (so a report is created), and the data item can be deleted.

Global settings

1. On the data screen, globl settings can be accessed by clicking 'Settings' at the top right.

2. The units for length and flow can be specified here, as well as specific settings for modules.

3. For the drill log, the entry style for the layer thickness can be specified (either by end of layer, or layer thickness)

4. For the pumping test, the timing of measurement prompts can be changed.

5. These settings are applied to all the data items.
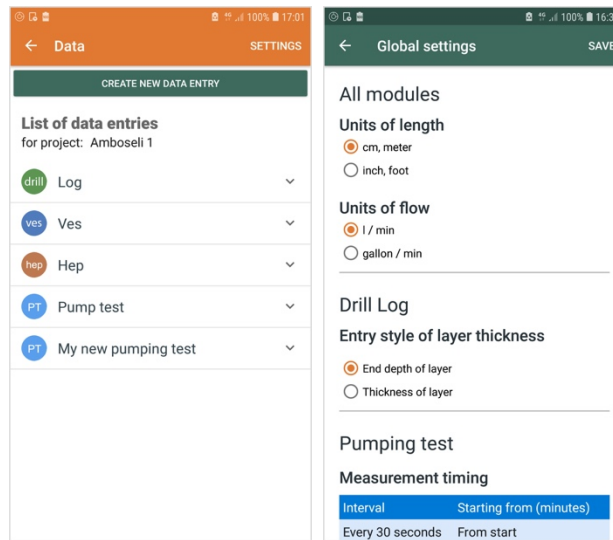
4. The Drill Log module

The purpose of the drill log module is to capture data during the drilling process. It captures information on geology, well lining and backfill, as well as other data such as static water table, date, operator and location, drilling technique, etc. The end result is a PDF drill log that presents all the information in a coherent way.

Creating a drill log item

1. On the home screen, click on the 'Data' icon

2. Click 'Create new data entry'

3. Give the drill log a name, and select 'Drill log' as the date type.

4. Click 'Create'. The drill log is now shown in the list of data entries.
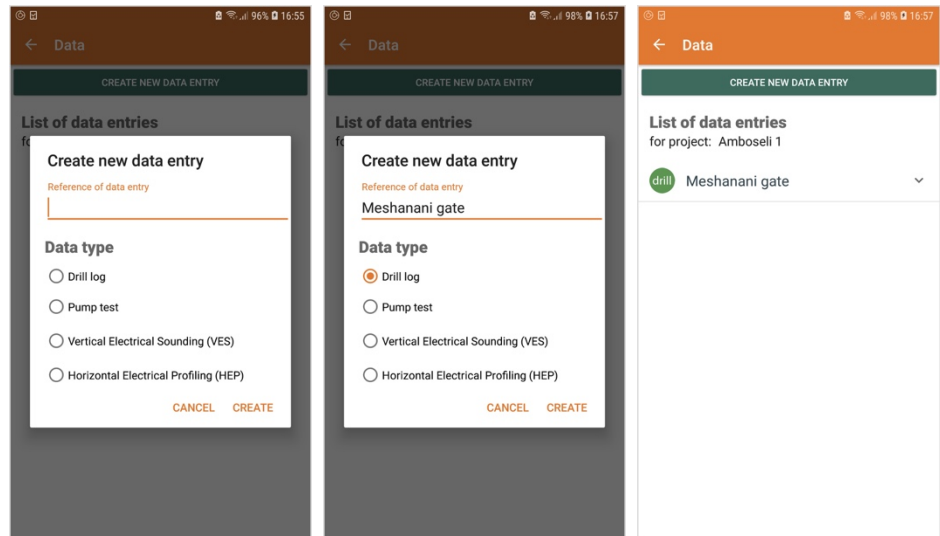
Filling in the drill log settings

1. In the data entry list, click on the drill log item.

2. When the drill log is opened for the first time, the settings screen is shown.

3. Capture the geolocation of the borehole by clicking 'Get Geolocation'. If GPS is off, you will be prompted to turn it on.

4. It is also possible to enter coordinates manually, by clicking 'Enter geolocation manually'. Be sure to enter the coordinates in WGS84 format (usual GPS format, for example lat,lon = 12.434383, 20.3428356) .

5. After you click 'Get geolocation', the device tries to get a GPS fix. The colour of the icon indicates the precision. Wait until the icon is green, and the button says 'Location found'.

6. Provide the name of the person who fills in the drill log.
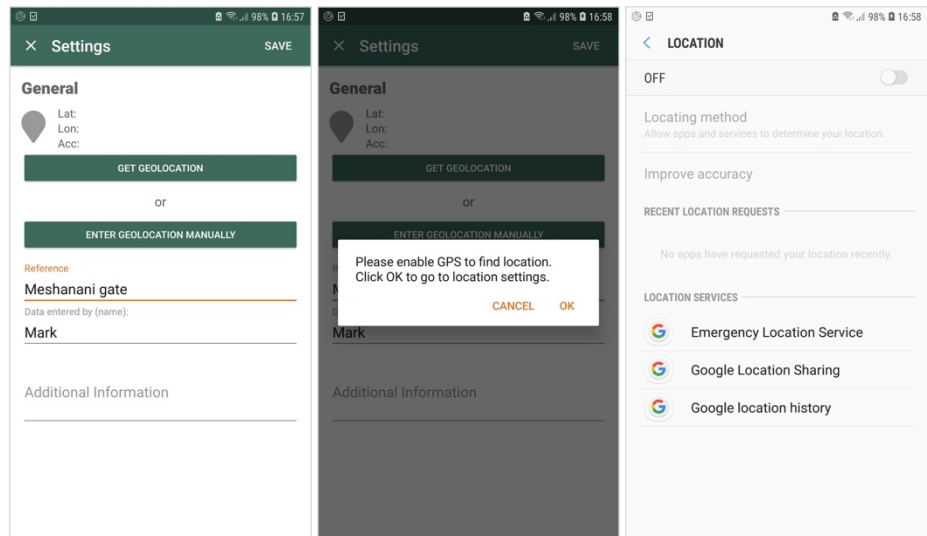
You can also edit the drill log reference here if needed, and add additional information.

7. Click 'Save' to save the settings.
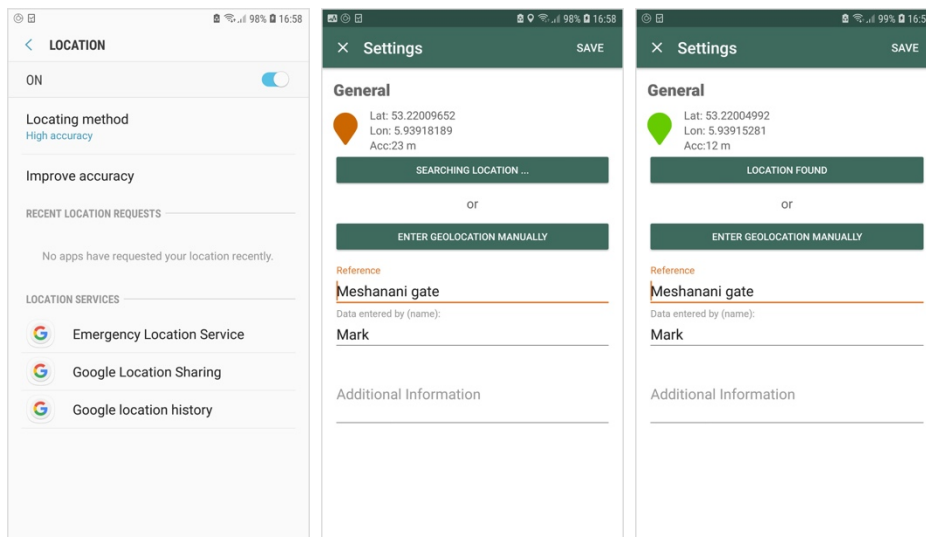
The drill log edit screen

1. In the data item list, click on the drill log. When the settings have been filled in, a screen is shown where the drill log can be edited.

2. The drill log has three columns: Geology, Lining, and Backfill. After the screen first opens, the Geology column is active. Other columns can be activated by clicking on the header word, so 'Lining' and 'Back' (short for Backfill).

3. At the bottom, buttons are present that are used to edit layers. From left to right: Add a new layer, Edit an existing layer, Divide a layer, Delete a layer, and Enter the water table. When the lining column is active, the last button is used to enter the pump depth.

4. The settings and summary (see below) information can be accessed by buttons at the top.
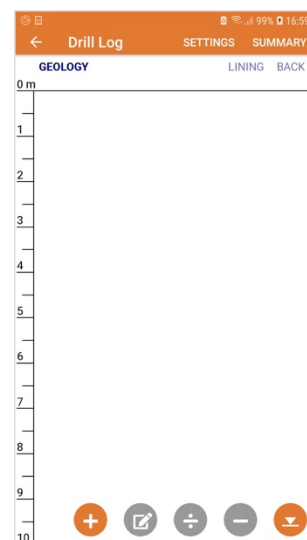
Adding a new layer

1. In the drill log screen, make sure the geology column is active

2. The first question is the end depth of the layer. The end of the previous layer is indicated above. There are two ways to enter this: as the end depth of the layer, or as a thickness of the layer. Which version is shown depends on the global settings, which can be changed in the data item list page.
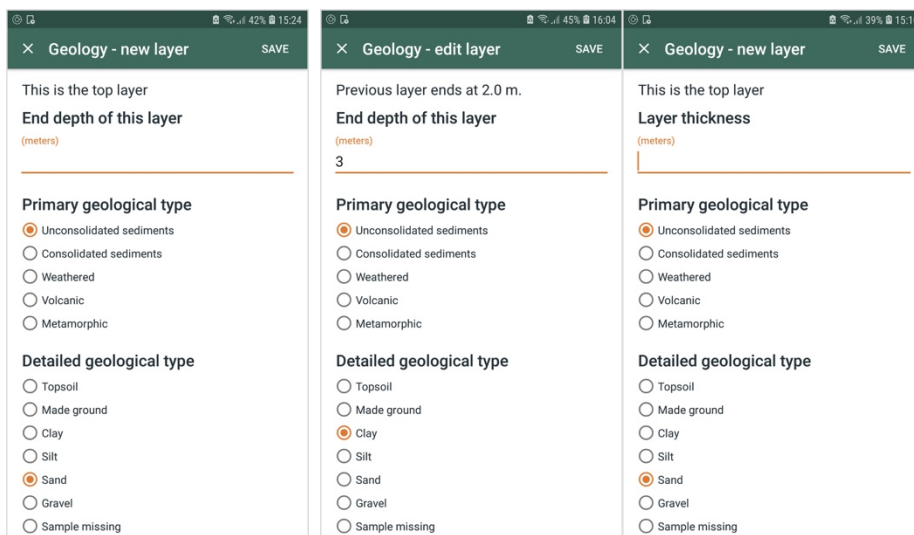
3. Secondly, the primary and detailed geological type are chosen. For each primary type that is selected, the relevant detailed types are displayed.

4. When the detailed type is silt, sand or gravel, the particle size can be specified.

5. In addition, the layer color and drill time can be entered, as well as other relevant information.

6. Click 'Save' to save the layer. The layer will be shown on the drill log, together with its description.

7. More layers can be added in the same way.

Editing a layer

1. To edit a layer, first select it by touching it. A blue border is shown when the layer is selected.

2. Click on the 'Edit' button (second from the left).

3. In the edit screen, make the changes you want to make, and click 'Save'.

Divide a layer in two

1. To divide a layer, first select it.

2. Click on the 'Divide' icon (3rd from the left).

3. Specify the depth at which you want to split the layer, and click 'Save'.

4. The layer is now divided in two layers, which have the same properties.
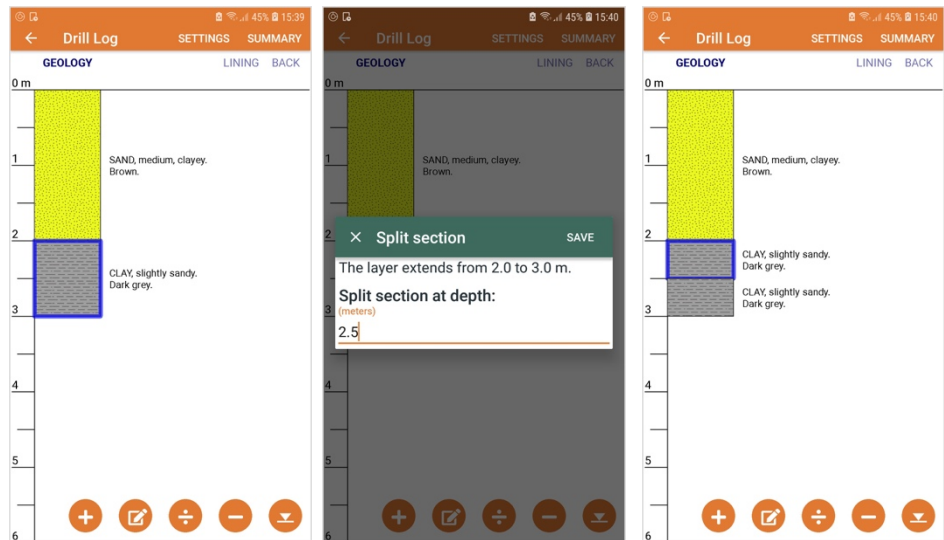
Delete a layer

1. To delete a layer, first select it.

2. Click the 'Delete' icon (4th from the left).

3. Confirm the deletion by clicking 'OK'.

4. The layer is now deleted
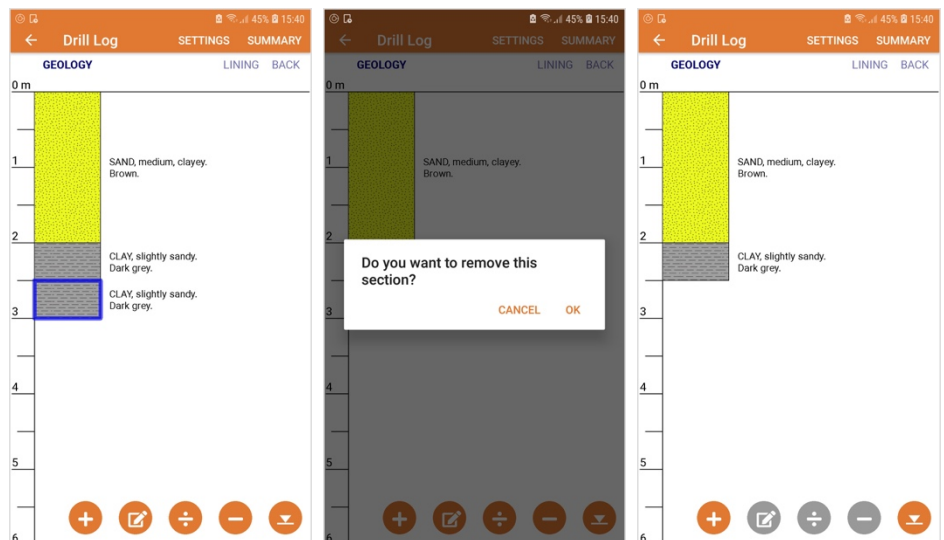
Add the water table

1. To add the water table, click on the 'Water table' icon (on the right).

2. Fill in the water table and click 'Save'.

3. The water table is indicated by a thin blue line, and a small blue triangle.
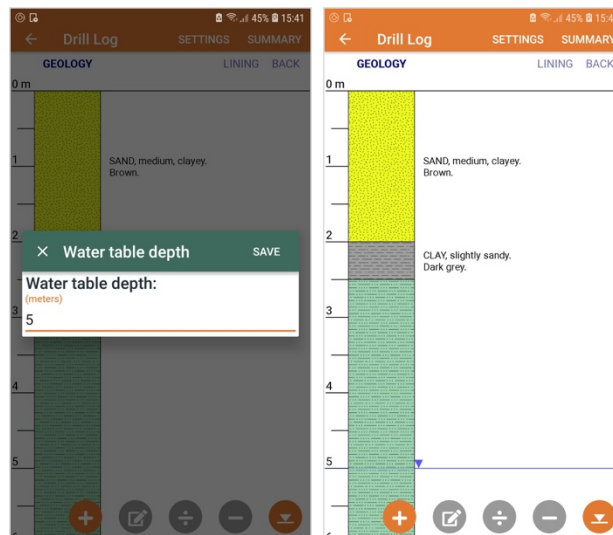
The lining column

1. To make the lining column active, click on the header title.

2. The icons are the same, with one difference: the last icon adds a pump depth.

3. To add a new lining section, click on the 'Add' icon (first from the left)

4. Enter the depth of the section (or the section thickness if you have specified that in the settings.

5. Select the lining type, material, and outer diameter.

6. If the lining type is 'screen', you can also specify the slot size.

7. The image on the right shows the result after adding three sections, of which the middle is a screen.

8. Click on 'Save' to save the section.
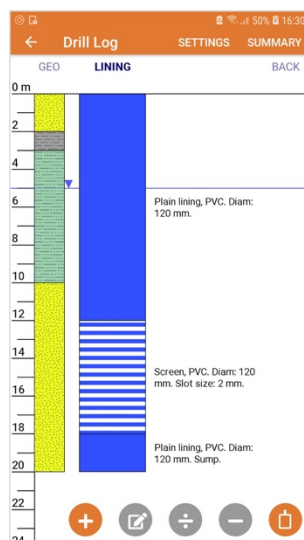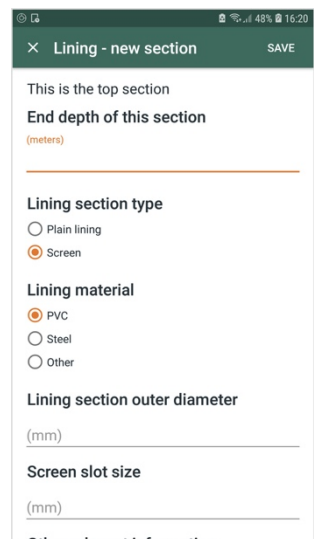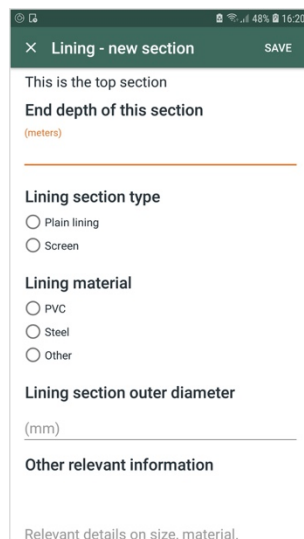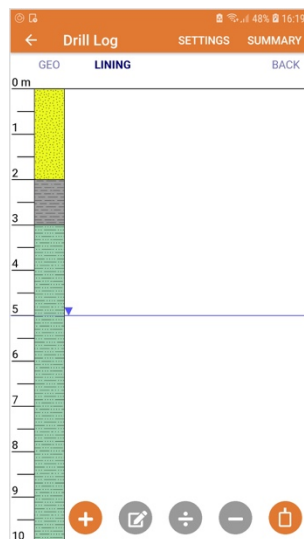
Editing, dividing, deleting lining sections

1. For editing, dividing and deleting lining sections, use the same icons as described above at the geology layer.

Adding a pump depth

1. To add a pump, click on the 'Add pump' icon (last on the right).

2. Specify the depth of the pump and click 'Save'.

3. The pump is indicated as a black rectangle.
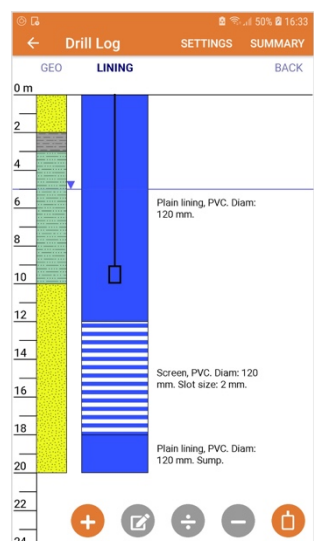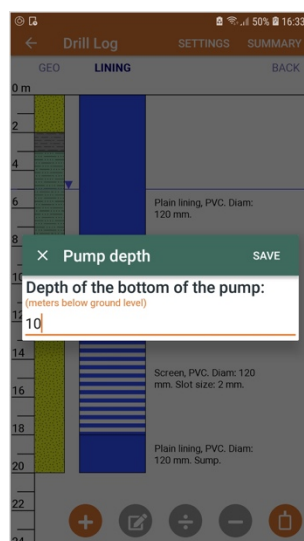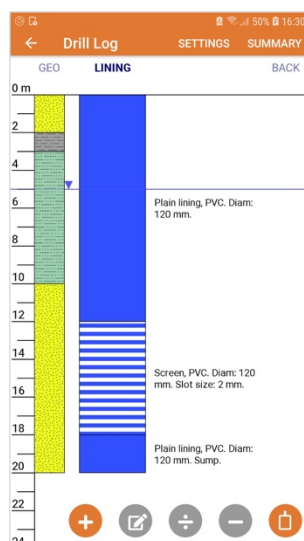
The backfill column

1. To make the backfill column active, click on the header title.

2. The icons are the same.

3. To add a new backfill section, click on the 'Add' icon (first from the left)

4. Enter the depth of the section (or the section thickness if you have specified that in the settings.

5. Specify the backfill layer function (such as top seal, sanitary seal, etc.), and the backfill material.

6. Specify any other relevant information, and click 'Save'.

7. The image on the right shows the result after three backfill sections have been added.
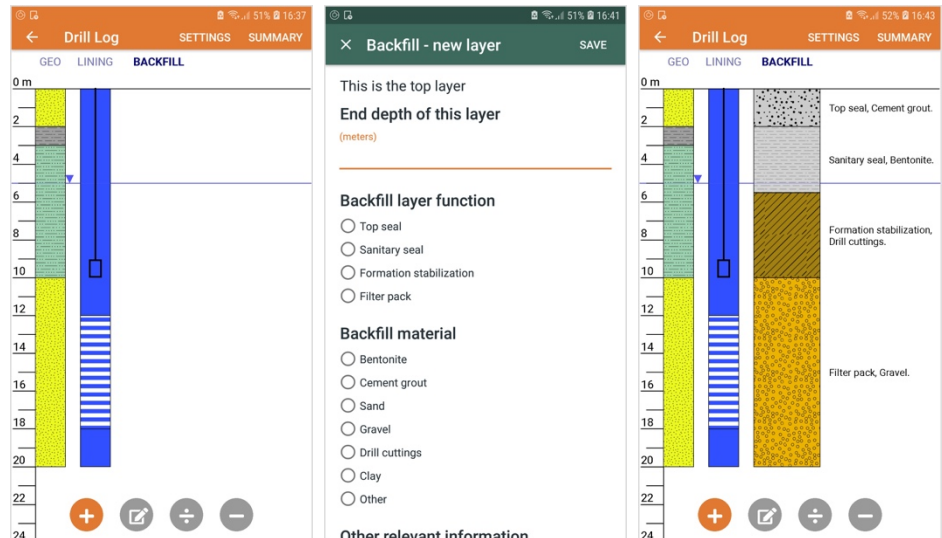
Adding summary information

1. To add summary information to the drill log, click on 'Summary' at the top of the screen.

2. You can fill in information such as the start and end date, drilling contractor, details on drilling and lining, well development, and other items.

3. Click 'Save' to save the summary information.
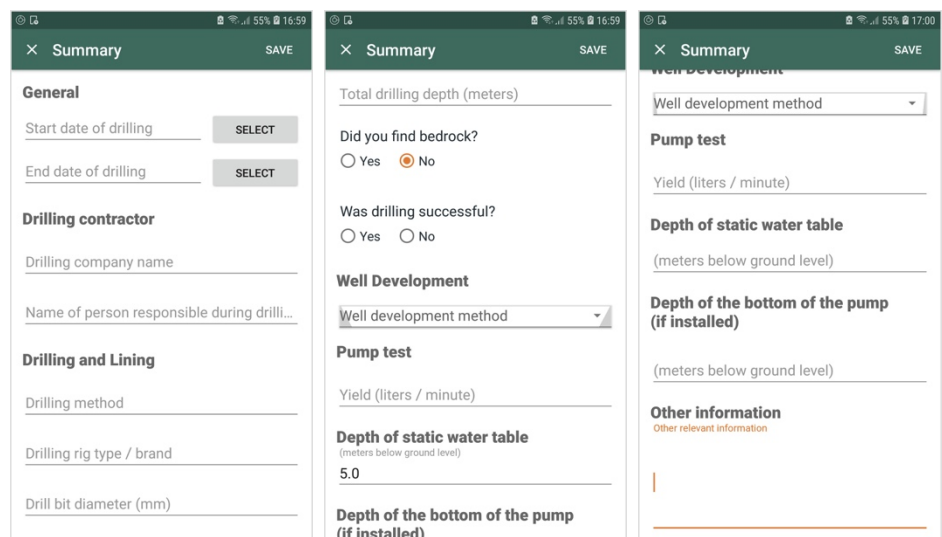
Getting the report

1. To submit data and get your report, go to the data page, and click on the

small arrow on the right of the item you want to submit

2. Click on 'Submit and create report'

3. In the dialog, confirm by clicking 'OK'.

4. The data will be sent to the server, and your report will be created, and sent to the email you have specified.
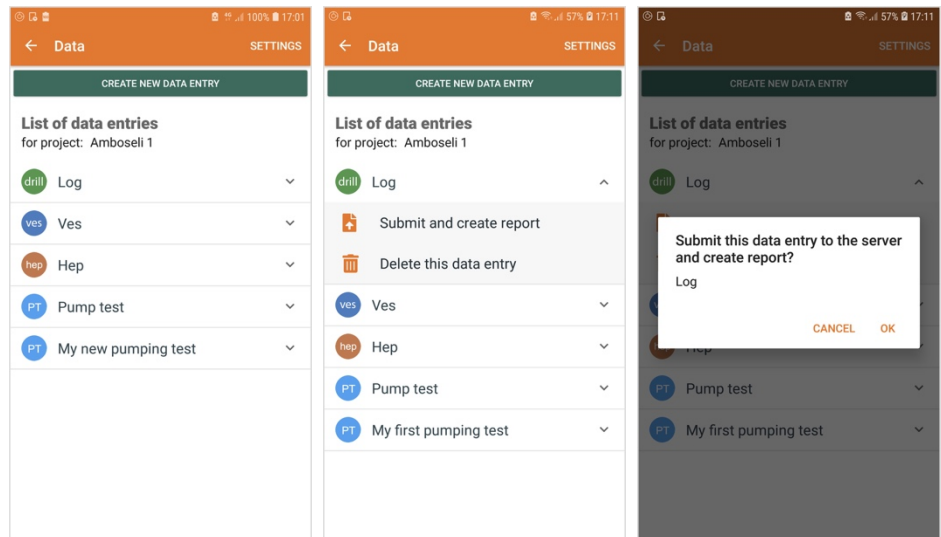
The Drill Log report

1. The report you receive by email is a PDF file, which has all the information entered in the app. (latitude and longitude grayed out in image)

Project name:	**Luriki**	Start date:	**2018-11-09**	Location:	**Juba, Central state**
Additional ref:	**Juba**	End date:	**2018-11-16**	Country:	**South Sudan**
Company:	**Practica**	Drill bit diam (mm):	**170**	Latitude:	
Contact person:	**Robert Vuik**	Total drill depth (m):	**14.1**	Longitude:	
Drilling method:	**Manual rotary jetting**	Total well depth (m):	**14.1**	Altitude (m):	**464**
Drilling successful?	**Yes**	Well devel.:	**Bailing + Surging / Plunger + Overpumping with engine pump + ...**	Yield (l/m):	**75**

Logged by: **Robert Vuik**

5.   The VES module

The purpose of the VES module is to capture resistivity information of the ground during Vertical Electrical Soundings. It supports both Wenner and Schlumberger arrays, as well as a range of ways to input data. It can both be used with commercial equipment such as a Terrameter, or with the Practica Volterra 3 device, or with even with locally made equipment. The end result is a PDF report with all the data, graphs, and a range of models. In addition, the raw data is sent as an Excel file, for further analysis.

Creating a new VES survey

1. Select the data icon on the home screen. Click on 'Create new data entry' and select VES (Vertical Electrical Sounding). Give the data entry a name. After you click 'Create', the new entry will appear in the list.

2. When you first open the item by clicking on it, the settings screen will be shown. Here, you can capture a geolocation by clicking on 'Get geolocation'. Manual entry is also possible.

3. Further down the page, select the electrode array type (Wenner or Schlumberger), and the input method. Click 'Save' to save the settings.

4. Different input methods are available: through the Practica Volterra 3 device, through direct entry of resistance or resistivity, and through direct entry of voltage and current.
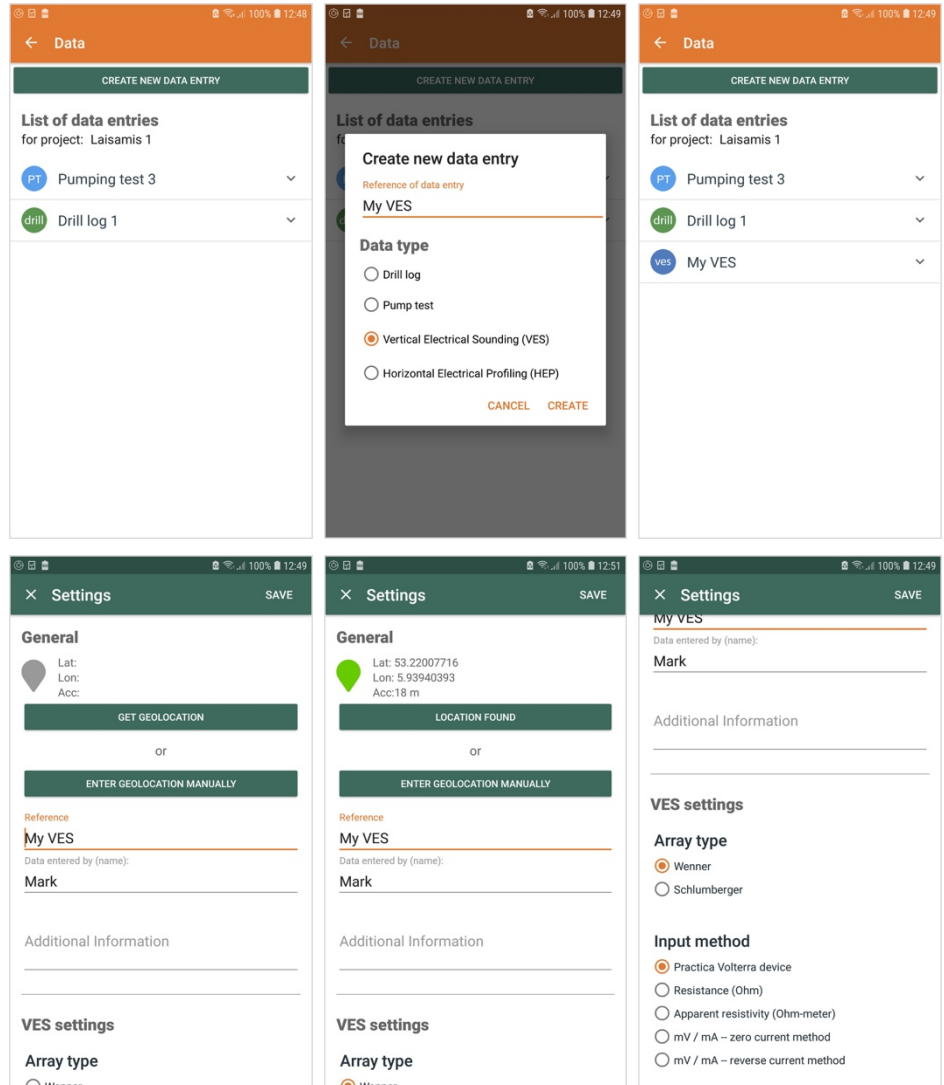
Manual data entry

In addition to the Volterra 3 device, There are different ways to enter data, depending on the settings. The different ways are shown on the right, from left to right.

1. Entry of resistance in Ohm. Based on the array spacing, the app calculates the apparent resistivity. For Wenner arrays, this is $\rho_{app} = k \cdot R$, where k is the geometrical factor. For Wenner $k = 2\pi a$.

2. Entry of apparent resistivity in Ohm-meter
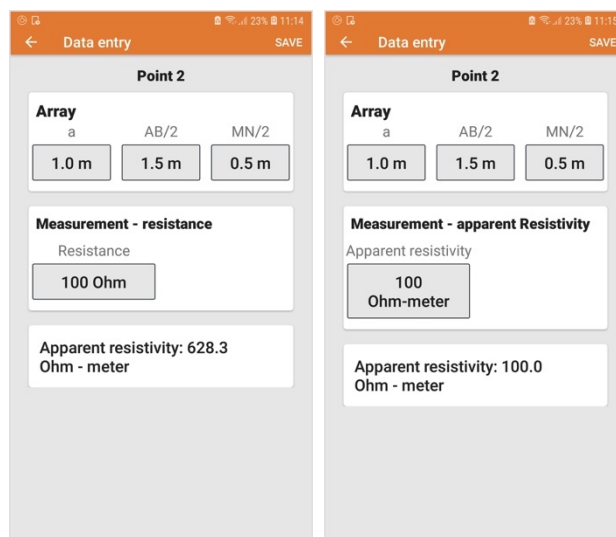
3. Entry of voltage/current through the zero-current method. Here, the first measurement is done with zero current, and the second measurement with current. In this way, the self-potential is corrected for. (for use with locally-made equipment)

4. Entry through the reverse current method. Here, four measurements are done, where the current is reversed after each measurement. In this way, the self potential is corrected for. (for use with locally-made equipment, which also reverses the measurement direction of the voltage)

Doing a measurement with the Practica Volterra 3 device

1. A list of electrode spacings is shown. Position the electrodes correctly and select the right item.

2. Turn on the Volterra device.

3. A screen is shown with the electrode spacings of the measurement. Click on 'Go to Volterra device'. This will open the Volterra app on the phone, and transition to it.

4. In the Volterra app, do the measurement as described in the Volterra manual

5. Note that the Volterra app is now aware of the electrode spacings, and will calculate the resistivity.

6. When the measurement is done, click on 'Accept result'. Click on 'ok' to confirm. This returns to the Drillers' Toolbox app, and shows the result.

7. When you go back to the list, you see a green checkmark for the measurements that have been done.

8. Select the 'Chart' tab to see a chart of the results.
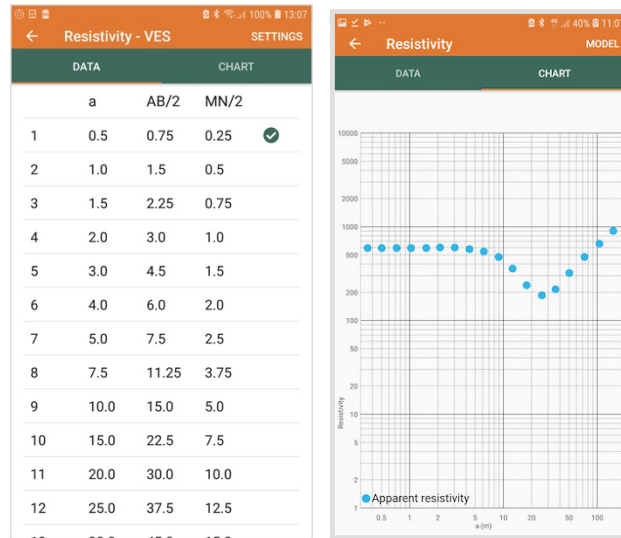
Getting the data report

When all the measurements are finished, you will want to submit the data and receive the data report. To do this, click on the small arrow next to the data entry. Next, click 'Submit and create report'. Confirm by clicking 'Ok'.

Next, check your email for the report to be delivered. This might take a few minutes.
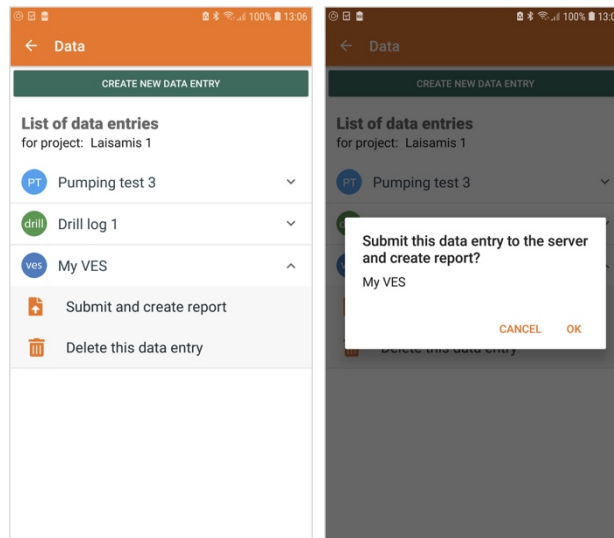
The data report

The data report is a PDF file that contains the meta-data such as name and location, a map of the location, the raw data, a chart of the data, and various models (3,4,5 layer models and Occam's inverse model), that can be used to support interpretation.

In addition, the email contains a link to the raw data in Excel format.
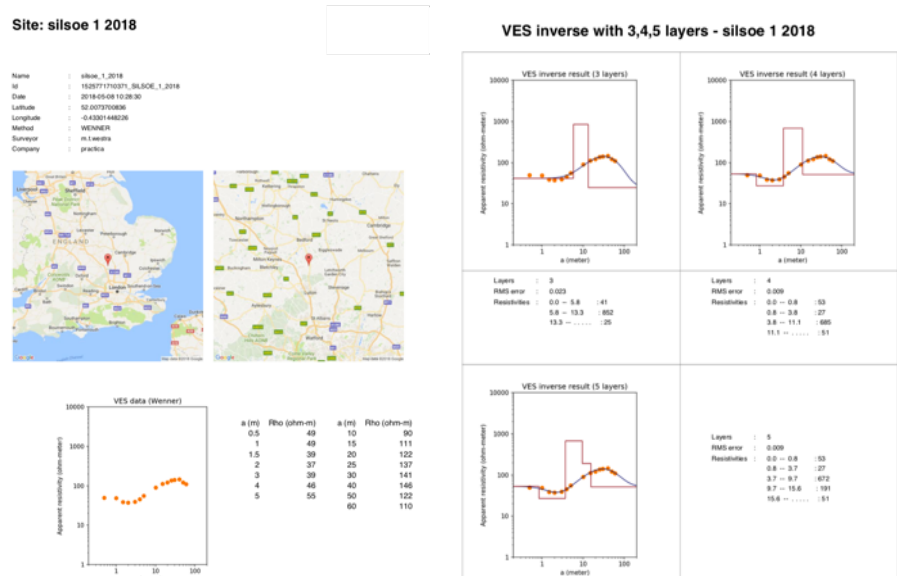
Occam VES inverse - silsoe 1 2018

VES inverse result (Occam)
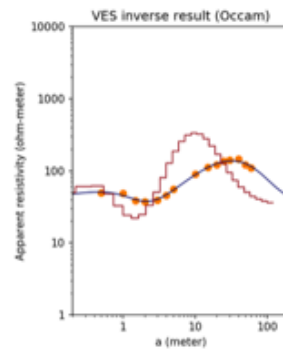
6.   The HEP module

The purpose of the HEP module is to capture resistivity information of the ground during Horizontal Electrical Profiling. During such a profiling, an array with a fixed electrode distance is translated horizontally over the ground. In this way, the apparent resistivity at a single depth of investigation is measured at different points across the profile. For example, this can be used to find optimal drilling locations, or to find fracture systems in weathered bedrock.

It supports the same arrays and input methods as the VES module. The end result is a PDF report with all the data, graphs, and a range of models. In addition, the raw data is sent as an Excel file, for further analysis.

Because the location of each point is important, geolocation is captured for each individual point.

Setting up a HEP measurement

1. In the data list, click on 'Create new data entry'.

2. Select 'HEP' and provide a name. Click 'Create' to create the HEP item.

3. Click on the HEP item to open it. If the item is opened for the first time, the settings menu is shown.

4. Capture the location of the first point by clicking 'Get Geolocation'. This works the same as in the VES module.

5. You can edit the name of the HEP item, and can provide a name of the person who enters the data.

6. Select the array type and input method, and specify the electrode spacing.

Doing a HEP measurement

1. When you first go to the HEP screen, there are three points with labels 1, 2, and 3. To open a point, click on it.

2. Capture the geolocation of the point, and the resistivity value. The input method depends on what you have selected in the settings.

3. Save the point by clicking 'Save'.

Adding additional points

1. To add additional points, fill in a label and click 'Create new point'. The new point is added to the end of the list.

2. To delete a point, click on the small arrow on the right, and confirm the deletion by clicking 'OK'

3. The image on the right shows the result after adding a number of points.

Chart and Map

1. To show the data on a chart, click the Chart tab.

2. To see the data on a map, click on the Map tab

Getting the data report

1. When all the measurements are finished, you will want to submit the data and receive the data report. To do this, click on the small arrow next to the data entry. Next, click 'Submit and create report'. Confirm by clicking 'Ok'.

2. **Next, check your email for the report to be delivered. This might take a few minutes.**
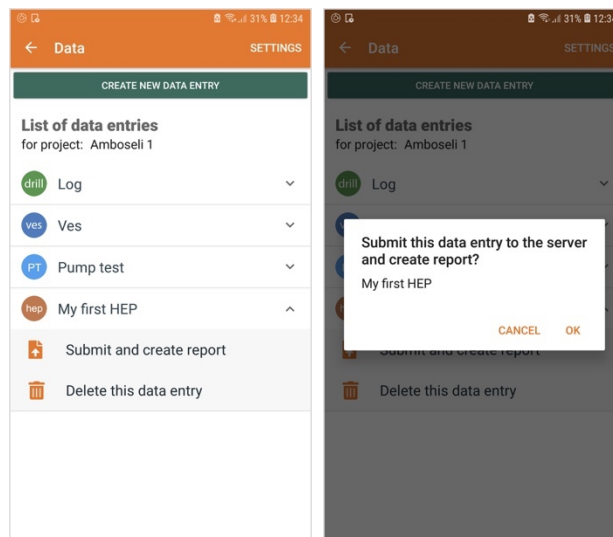
The report

1. The report contains the meta-data of the HEP measurement, two maps, a graph of the data, and the raw data.

2. In addition, an Excel file is sent with the raw data, for further analysis.

Site: My first HEP

|			
Project name	: Amboseli 1	Date	: 2020-05-08
VES reference	: My first HEP	Latitude	: 53.22009271
VES method	: WENNER	Longitude	: 5.93935314
Data entry by	: Mark	Location	: 9251, Friesland
Company	: Mark	Country	: Nederland
		Additional info	:
Id	: 5c47fd0-ff97-439d-840b-46c0b88225d3		

Digital tools for Groundwater Development is a product by Practica Foundation, supported by Groundwater Relief and MSF. Maps: OpenStreetMap, Google   a2098d5f-5c47ffd0
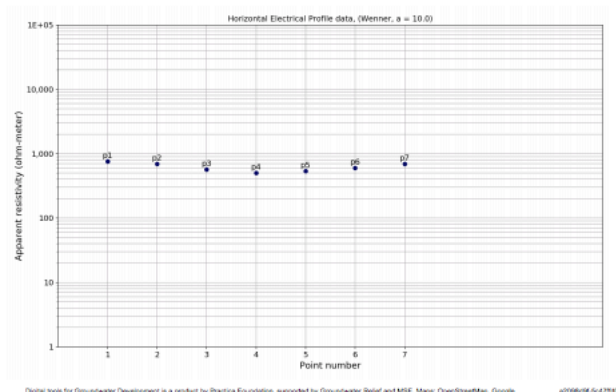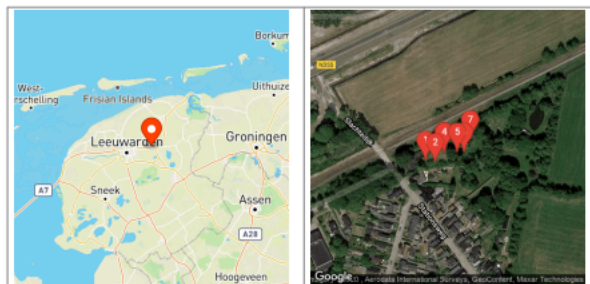
Point	Label	a (m)	Rho (Ω m)	Latitude	Longitude	Comment
1	p1	10.0	754.0	53.220078	5.9394636	near a tree
2	p2	10.0	691.2	53.22006	5.939606	
3	p3	10.0	565.5	53.22016	5.9397507	
4	p4	10.0	502.7	53.220158	5.939749	
5	p5	10.0	534.1	53.220154	5.9399548	
6	p6	10.0	596.9	53.220158	5.9400635	
7	p7	10.0	691.2	53.220272	5.9401526	

7. The Pumping test module

The purpose of the pumping test module is to capture data for a pumping test. This manual does not explain in detail how to conduct a pumping test – a separate manual is available for that.

Creating a pumping test item

1. In the data list, click on 'Create new data entry'.

2. Select 'Pump test' and provide a name. Click 'Create' to create the Pumping test item.

3. Click on the Pumping test item to open it. Three buttons are shown: setup, measurements, and view/edit data.

Setting up the pumping test

1. Open the pumping test item by clicking on it. Select 'Set up' to set up the pumping test.

2. The setup page consists of six tabs: general, pump test, borehole, level, discharge and quality.

3. General tab – information on the reference of the well and pumping test, name of testing company and supervisor

4. Pumptest tab – the length of static water level measurments, the type of pumping test and step length, the type of pump used, and the pump intake.

5. Borehole tab – location of the borehole, description and height of datum, and well dimensions.

6. Level tab – the method used to measure the water level, and the static water level.

7. Discharge tab – the method used to measure the discharge.

8. Quality tab – the water quality parameters the user wants to capture.

Pump information

1. In the pumptest tab, you can select a pump that was used for the test. To avoid having to type in the same pump information for each pump test, you can create a pump spec.

2. Do this by clicking on the three dots at the top, and select 'Manage Pump Specs'. This opens a list of pumps.

3. Click 'Create new pump' to create a new one, or click on an existing pump to open it for editing.

4. Once you have created a pump, click on the 'Please select pump' button, and select the pump you want.

Doing a measurement

1. Click on the 'Measurements' button.

2. This shows three tabs, for Level, Discharge and Quality measurements.

3. The level tab is opened by default.

The level measurement tab consists of two main areas: the top part which gives information related to timing of the various phases of the test (steps, constant rate, recovery), and the bottom part where measurements are captured.

The **top part** contains:

- Buttons to move from one phase to the next, or to stop the test
- A text field showing the status (current testing phase)
- A text field showing how much time is remaining in this phase
- An overall timing counter for the present phase
- A yellow bar that counts down to when the next measurement should be taken
- A text field that shows how much time remains until the next measurement should be taken.

The phases and the duration of each phase are defined in the "Set up" part described above, on the 'Pumptest' tab.

The default measurement schedule is:

- First ten minutes: every 30 seconds
- 10-30 minutes: every minute
- After 30 minutes: every 5 minutes

This can be changed in the global settings.

The measurements always start with a period in which static water level data is collected. The duration of this phase is defined in the Set Up part.

The top part just provides timing hints, and captures the moment when a new phase of the test begins. However, it is also possible to ignore the timing hints completely, and just capture measurements. Measurements are always taken with the absolute time (clock time), which means that they are independent of the timing hints in the top section.

The **bottom part** contains:

- A button 'Now', which, when clicked, captures the current clock time. This field cannot be edited directly.
- A button 'Level' in which a water level measurement can be filled in.
- An optional comment field
- A clear button, and a save button.

This part is used as follows:

- A measurement is taken at a certain time. The user clicks 'Now' at the moment the measurement is taken.

- The user fills in the level, and an optional comment
- The user clicks 'save'. After this, the data is saved and the fields are cleared. The save button is only shown when valid data is present.
- If the user wants to clear faulty data, she can correct the data, or click 'clear' to clear all the fields.

NOTE: it is important to click on 'save' to actually save the data.

Latest data and chart

1. A chart of the data can be shown by clicking the 'chart' icon at the bottom left

The latest three measurements can be shown by click the 'info' icon at the bottom right.
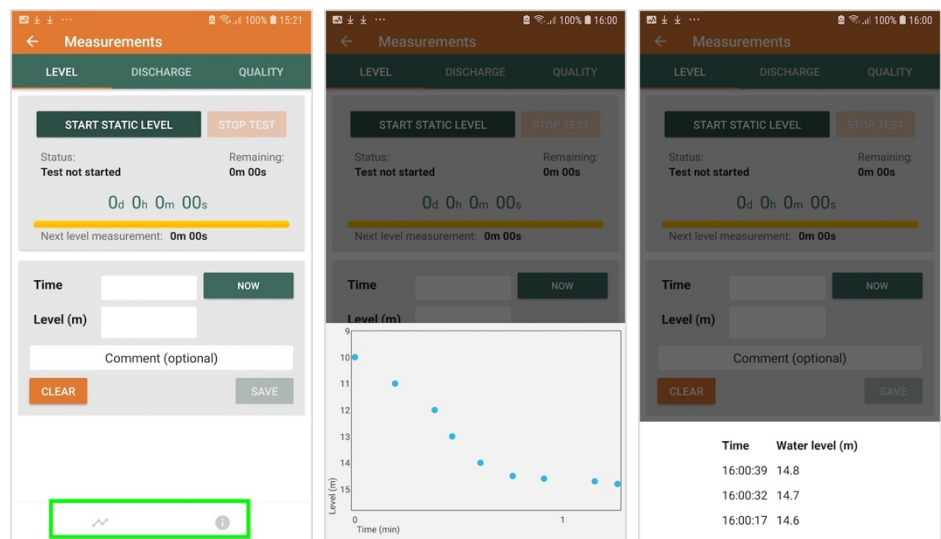
Capturing discharge data

The discharge tab consists of three sections:

- An area indicating the status of the pumping test (same as in level tab)
- An area where a bucket test can be done
- An area that captures and saves the data

Currently, the discharge tab only supports bucket tests. It works as follows:

- Fill in the size of the barrel in liters
- When you start to fill the barrel, click 'start filling'. The stopwatch starts to run.
- When the barrel is full, click 'Bucket full'
- The phone computes the time the measurement was taken, and the discharge, and fills in the fields.
- The user can add an optional comment, and click 'save', which saves the data and clears the fields.

NOTE: the 'NOW' button is only needed when data is filled in manually. When the barrel timer is used, the time is automatically filled in.

If discharge data needs to be filled in manually, it can be done in the view/edit screen.

The buttons for chart and recent measurements have not been implemented yet.

Capturing quality information

The quality tab consists of two areas:

- An area indicating the status of the pumping test (same as in level tab)
- An area that captures and saves the data

The 'Now' button works the same as above.

Quality measurements can be entered in the fields. When 'save' is clicked, the data is saved and the fields are cleared.

Not all fields need to be filled in always.

Only fields are shown that have been selected in the Set Up quality tab.

Viewing and editing data

1. In this part of the app, existing data can be edited, and new data can be added manually. However, this is a bit more complex then using the main Measurement screens, and therefore should only be used sparingly – to correct wrong entries for example.

2. The view / edit section shows four tabs, for Level, Discharge, Quality, and State. The first three are shown on the right. Each tab shows a list of measurements, ordered in time.

3. Click on an item to open it for editing, or click on the small

arrow to get a 'Delete point' button. The state of the pumping test (static level measurements, step 1..n, constant rate, recovery) is shown as the first item.

Editing an item

1. When you click on an item in one of the tabs, an edit screen is shown with the relevant fields. When you click on the time field, you get a time-input field.

2. When you click on the '+' button, you can create a new item.

3. To save the point, click 'Save'.

Receiving discharge data

1. The Bucket Test app created by Practica Foundation (freely available on Google Play) can be used to capture discharge data. This is useful when the person collecting the level data and the person collecting the discharge data are at some distance from each other.

2. To receive data from the Bucket Test app, go to the View/Data screen of the data item, go to the Discharge tab and click 'Receive Data'.

3. Click 'Start connection'. On the Bucket Test app, also initiate the start connection (see below).

4. When the connection is established (this can take a

while), click on the 'Click to transfer' button on the Bucket Test app. This initiates the data transfer.

5. Once the data has been transferred successfully, the button is colored green.

6. The data now appears in the list in the Driller's Toolbox app.
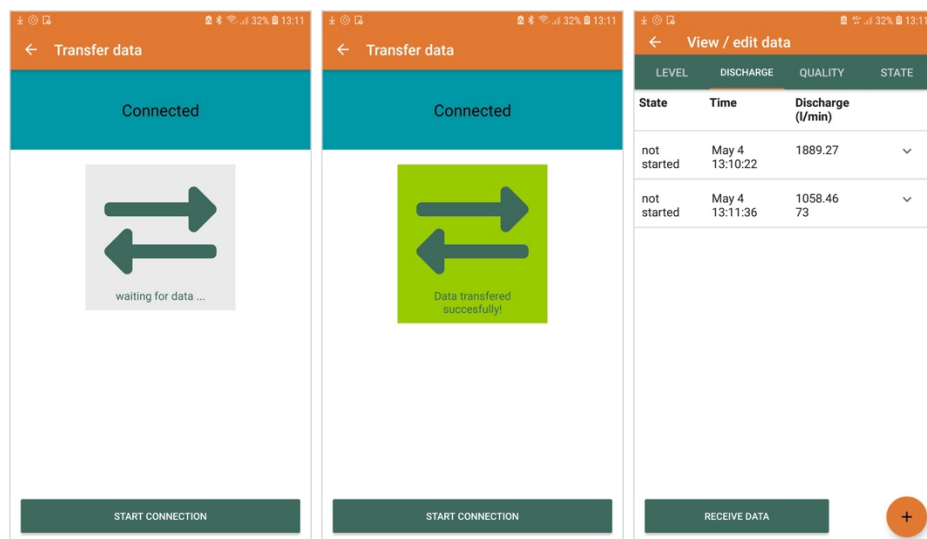
The State tab

1. In the state tab, you can change or edit moments in time when the state of the pumping test was changed. This will not often be needed, but could happen when you want to cycle through the states when something happens, such as a temporary pump failure.

2. When you click on an item, you can edit it.

3. The item represents the **starting point** of a new phase.
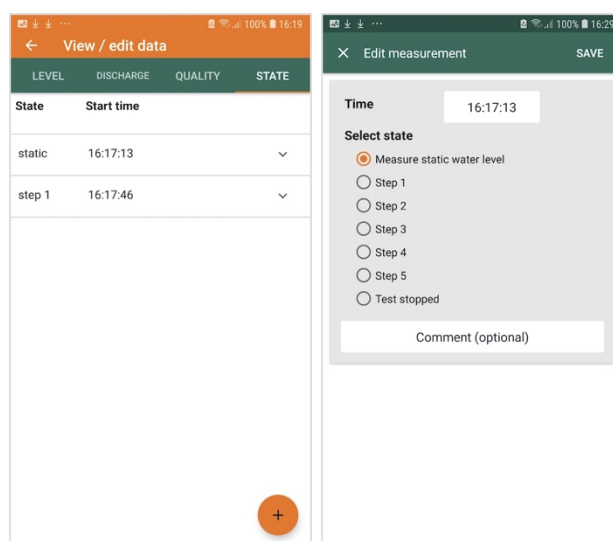
Getting the data report

1. When all the measurements are finished, you will want to submit the data and receive the data report.

2. To do this, click on the small arrow next to the data entry. Next, click 'Submit and create report'. Confirm by clicking 'Ok'.

3. Next, check your email for the report to be delivered. This might take a few minutes.

The report

The report is an Excel file with six tabs: site info, setup info, water level data, water level chart, discharge data, and quality data.

On the right, screenshots of a number of these tabs are shown.

Site tab

	A	B
1	**Site information**	
2		
3	Project	
4	Data entry reference	SI BH 0729
5	Additional info	
6		
7		
8	Date	2020-02-19
9	identifier	
10	identifier2	
11	Name (from profile)	
12	Company (from profile)	

Tabs: site | setup | water level | water level chart | discharge | quality

Water level tab

	Clock time	Phase start	Phase	Total time since start	Time since start of phase	Depth to water (below datum)	Rest water level	Drawdown	Depth to water (below ground level)	Comment
	meas	meas	meas	meas	meas	meas	meas	calc	calc	
				minutes	minutes	meter	meter	meter	meter	
10	2020-02-19, 08:50:03	Static level		-41.63	0					
11	2020-02-19, 08:50:07		Static level	-41.56	0.07	11.35	6.02	5.33	10.65	
12	2020-02-19, 08:51:11		Static level	-40.49	1.14	10.6	6.02	4.58	9.9	Just turned pump off for recovery before starting step test
13	2020-02-19, 08:54:05		Static level	-37.58	4.04	9.95	6.02	3.93	9.25	
14	2020-02-19, 08:57:52		Static level	-33.81	7.82	9.62	6.02	3.6	8.92	
15	2020-02-19, 08:59:14		Static level	-32.44	9.19	9.54	6.02	3.52	8.84	
16	2020-02-19, 09:01:10		Static level	-30.51	11.11	9.43	6.02	3.41	8.73	
17	2020-02-19, 09:15:33		Static level	-16.12	25.5	8.87	6.02	2.85	8.17	
18	2020-02-19, 09:22:45		Static level	-8.92	32.7	8.67	6.02	2.65	7.97	
19	2020-02-19, 09:27:45		Static level	-3.93	37.7	8.55	6.02	2.53	7.85	
20	2020-02-19, 09:31:40	Step 1		0	0					
21	2020-02-19, 09:31:51		Step 1	0.17	0.17	9.34	6.02	3.32	8.64	
22	2020-02-19, 09:32:06		Step 1	0.44	0.44	10.05	6.02	4.03	9.35	
23	2020-02-19, 09:32:40		Step 1	1	1	11.07	6.02	5.05	10.37	
24	2020-02-19, 09:33:11		Step 1	1.51	1.51	11.72	6.02	5.7	11.02	
25	2020-02-19, 09:33:45		Step 1	2.08	2.08	12.07	6.02	6.05	11.37	
26	2020-02-19, 09:34:12		Step 1	2.53	2.53	12.32	6.02	6.3	11.62	

Reference Data (from Set Up)
Units for water level measurement: meter
Height of measuring point (datum) above ground level: 0.7 meter
Rest water level (units below datum): 6.02 meter
Elevation of Measuring Point above sea level (if known): -

meas: measured data
calc: calculated data

Water level chart tab

	A	B	C	D	E	F	G	H	I	J	K
1	**Water level charts**										

Drawdown (meter)

Time since start (minutes)

Drawdown

Discharge

	A	B	C	D	E	F	G	H
1	**Discharge**			**Reference Data (from Set Up)**				
2				Units for flow measurement		l/min		
3	meas: measured data			Type of flow measurement		Manual entry		
4	calc: calculated data							
5								
6								
7	meas	meas	meas	meas	meas	meas		
8	Clock time	Phase start	Phase	Total time since start	Time since start of phase	Discharge	Comment	
9				minutes	minutes	l/min		
10	2020-02-19, 08:50:03	Static level		-41.63	0			
11	2020-02-19, 09:31:40	Step 1		0	0			
12	2020-02-19, 09:35:30		Step 1	3.82	3.82	51		
13	2020-02-19, 09:42:00		Step 1	10.33	10.33	50		
14	2020-02-19, 09:52:00	Step 2		20.33	0			
15	2020-02-19, 09:53:00		Step 2	21.33	1	243		
16	2020-02-19, 09:58:00		Step 2	26.33	6	241		
17	2020-02-19, 10:12:00		Step 2	40.33	20	229		
18	2020-02-19, 10:13:58	Step 3		42.29	0			
19	2020-02-19, 10:27:00		Step 3	55.32	13.03	302		
20	2020-02-19, 10:32:00		Step 3	60.32	18.03	290		
21	2020-02-19, 10:34:30	Test stopped		62.83	0			
22								

Quality parameters

|	A	B	C	D	E	F	G	H	I	J
1	**Quality parameters**									
2										
3										
4										
5										
6	Clock time	Phase start	Phase	Total time since start	Time since start of phase	Electrical Conductivity	Turbidity	Temperature	pH	Comment
7				minutes	minutes	mS - m	NTU	deg C		
8	2020-02-18, 20:03:30		Before test	-808.17	0	360	5		8.29	
9	2020-02-18, 20:06:00		Before test	-805.67	2.51	360	5		8.28	
10	2020-02-18, 20:26:00		Before test	-785.68	22.5	360	15		7.94	
11	2020-02-18, 20:35:00		Before test	-776.67	31.51	370	10			
12	2020-02-18, 20:45:00		Before test	-766.68	41.49	360	40			
13	2020-02-18, 20:50:00		Before test	-761.67	46.5	370	200			
14	2020-02-18, 20:55:00		Before test	-756.68	51.49	370	50			
15	2020-02-18, 21:00:00		Before test	-751.68	56.5	370	15			
16	2020-02-18, 21:05:00		Before test	-746.68	61.5	360	20			
17	2020-02-19, 08:50:03	Static level		-41.63	0					
18	2020-02-19, 09:31:40	Step 1		0	0					
19	2020-02-19, 09:52:00	Step 2		20.33	0					
20	2020-02-19, 10:13:58	Step 3		42.29	0					
21	2020-02-19, 10:34:30	Test stopped		62.83	0					
22										
23										
24										

8.   The Bucket Test app

The bucket test app is a companion app to the Driller's Toolbox app. The reason for the app is that in many cases, during a pumping test the discharge measurements are not performed at the same location as the level measurements, but at some distance. This is done to restrict the influence of the water on the water table near the well. Therefore, data is usually captured by two people – one at the well, and one at the end of the discharge pipe. The data is then combined after the measurements are completed.

To make this possible with the Driller's Toolbox app, we made the Bucket Test app that can be used to collected discharge data on a second phone, which can then be transferred to the phone where the rest of the data is collected. The Bucket Test app is a free app, and can also be used independently of the Driller's Toolbox app.

Getting the app

1. On your phone, go to the Google Play Store.

2. Search for "Practica Foundation". In the list, select "Driller's Toolbox".

3. Click 'Install'.

4. When the app has installed, put a link to it to the home screen of your phone.
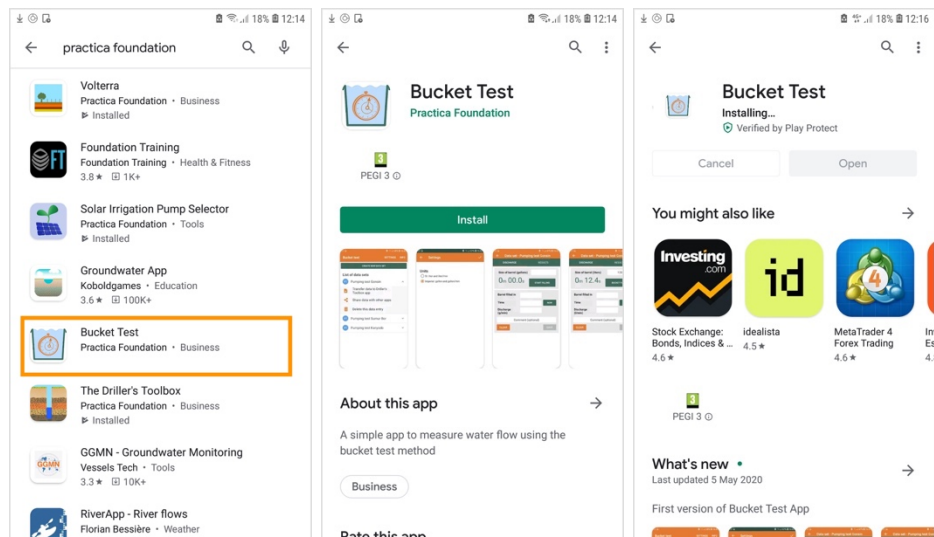
The main screen

1. The main screen shows a list of data sets. Each data set consists of a set of discharge measurements.

2. To create a new dataset, click on 'Create new data set', and provide a name. The new data set is shown at the bottom of the list.

3. The units used (SI or imperial) can be changed through the 'Settings' menu item.

4. Clicking on an item opens it.

5. Clicking on the small triangle on the right opens a menu. Here, the data set can be transferred to the Driller's Toolbox app, shared with other apps, or deleted.
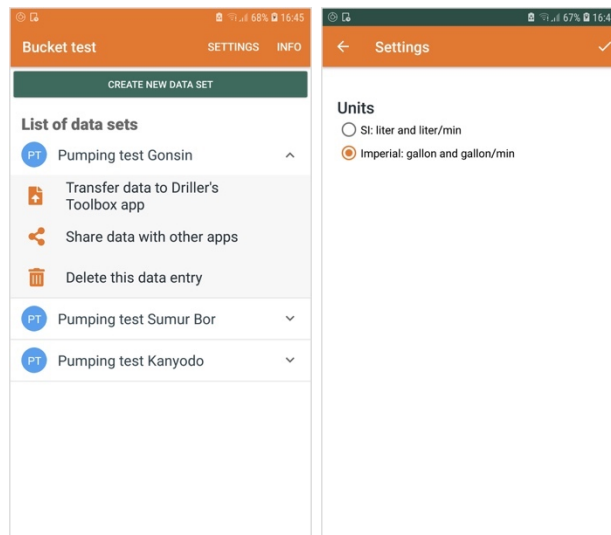
Doing a measurement

1. Create a data set in the main screen, and open it.

2. When the data set is opened, two tabs are shown: discharge and results. Doing a measurement works in the same way as in the Driller's Toolbox app. (see above)

3. NOTE: the 'NOW' button is only needed when data is filled in manually, without the bucket timer. If the bucket timer is used, the time is automatically filled in.

Viewing and editing the data

1. On the results tab, a list of all the discharge measurements are displayed in this data set.

2. By clicking on an item, it can be edited.

3. By clicking on the small triangle on the right, the item can be deleted.

Transferring data

1. To transfer data, click on the small triangle on the right of the data set, and select 'Transfer data to Driller's Toolbox app'.

2. On the Driller's Toolbox app, go to the View/Edit screen of the data item you want to add the discharge data to, and select the discharge app. There, click on the 'Receive Data' button. (see above)

3. In the Bucker Test app, click on 'Start connection'. The phone will now try to contact the other phone.

4. Once the connection has been established (this can take a

while), click on 'Click to transfer' button to initiate the data transfer.

5. Once the data transfer is complete, the button is shown as green.

6. On the Driller's Toolbox app, the data will now appear in the list of discharge data.

Sharing data

1. To share data with other apps, click on 'Share data with other apps' in the menu of the data set.

2. Select the app you want to use

3. Depending on your choice (email, WhatsApp, notebook), the data is entered into the body of the message, and can be sent.
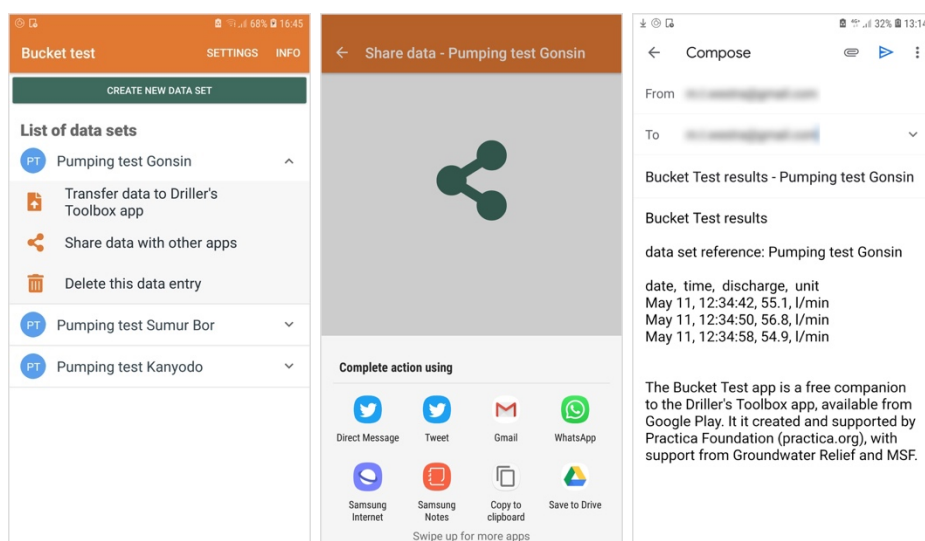
9. Troubleshooting

Although we have done our best to make sure the software works as intended, there is always the possibility of an error or bug. If you have found a bug, have ideas for expanding the app with more functionality, or ideas for the clarification of the user interface, we'd love to hear from you. We would like to learn from your experiences, and would be grateful for any stories about how you use the software that you might want to share.

The best way to reach us is by sending us an email to: *support@practica.org*

How to provide feedback or log a bug report

To make it easier for us to understand a bug report, we would like to ask you to use the following template when getting into contact with us:

1. The version number of the app you are using (from the 'About' menu item on the front screen)
2. The phone brand and android version you are using (for the android verion: on your phone, go to 'settings', 'About phone', 'software information', and note the 'Android version'.
3. Steps to reproduce the bug
4. The expected result (what you thought was supposed to happen)
5. The actual result
6. Visual proof (screenshot, video).

This will guarantee that we can quickly track down and fix a bug, when it occurs.