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RSLog

Overview of Features

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1. Introduction

For over 25 years, Rocscience has developed innovative solutions for civil, mining, and geotechnical engineers. Combining the latest research with our continuous cycle of software development, our mission is to deliver industry-leading geotechnical tools that are reliable and easy to use.

In February 2022, we released the first version of our cloud-based geotechnical data management software called RSLog. It is designed to manage the field data collected during subsurface investigation in a geotechnical or environmental project.

RSLog is a web application and can be accessed on any device connected to the internet (i.e. no installation needed). In addition to borehole logging, RSLog has a built-in Geographical Information System (GIS) for displaying boreholes and projects, geology maps, and importing external data layers (e.g. KML, KMZ, GPX, Shapefile, etc.). Data exchange features of RSLog allow importing DIGGS, gINT, AGS, and Wincore data files. In addition, RSLog project data could be exported to CSV, Excel, JSON, and Civil3D formats.

2. Borehole Data Management

2.1 Data Collection in the Field

In addition to using a web browser, the following data entry methods are available in RSLog:

- **RSLog Excel Templates:** These Excel templates are specifically designed for RSLog and allow data entry without the need for an internet connection. Once the data entry is completed, the user will upload the Excel files to RSLog and a project will be automatically created with accurate borehole data.
- **Tablet App (iOS & Android):** See Section 2.2 for details.

The current version of RSLog covers all input data required for civil, mining and transportation projects. RSLog's Settings page provides a wide spectrum of customizations from editing the 'lookup lists' to theme settings, hatch pattern colors, soil and rock classifications, and more (see Section 11).

Several data validation rules are implemented in RSLog data entry forms. This includes validating data types, expected range of data, relevance of certain inputs depending on borehole type, etc. To minimize data entry errors, dropdowns are used wherever possible (see Section 12).

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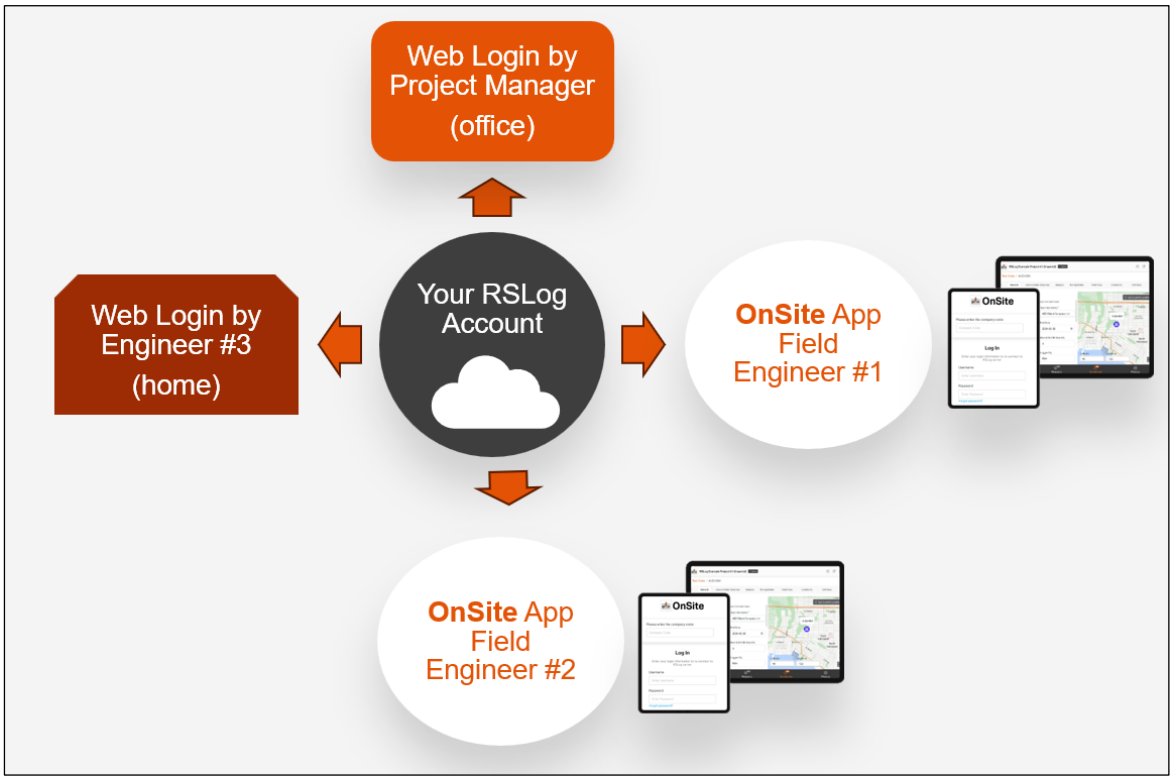
2.2 Tablet App

RSLog **OnSite** app works on any tablets with iOS or Android operating system and will work both online and offline. The data collected by the field engineers will be synced with your RSLog account from the field, providing office engineers access to the latest borehole data (see Appendix A for screenshots). In addition, users will be able to see the overall progress of the drilling program (see Section 3.2.2); this is especially helpful when multiple drill rigs are working concurrently for the same project.



2.3 Data Storage

If data collection is conducted by logging in to RSLog on a web browser, the data will be directly saved on the RSLog server. For RSLog server location options please refer to Section 19.

If the **OnSite** app is used for field data collection, the data will be stored locally on the device until the user syncs the data with their RSLog account. This data will remain on the tablet until deleted by the user.

2.4 Project Photos

Photos taken during site investigation can be uploaded and attached to a borehole, sample, field test, discontinuity, drill run. Please see Section 8.5 for the photos report.

RSLog also allows uploading field notes. These photos will be attached to the borehole and can be used during the quality management process.

2.5 Borehole Data

In RSLog, several pieces of data are collected for a borehole. Examples of top-level borehole data include but are not limited to name, depth, contractor, equipment, drilling date, logged by, entered by, reviewed by, approved by, coordinates, SPT hammer info, etc.

On the RSLog Settings page, users can customize the list of drilling methods, sample types, field tests, piezometer/well types, and more (see Section 11). Examples of borehole types covered by RSLog include all machine drilling methods, hand auger, and test pit excavation. The following sub-sections provide further details.

Once a borehole is created, it is automatically added to the GIS system (see Section 10).

2.5.1 *Coordinate Reference System (CRS)*

To enable RSLog's built-in GIS system, it is critical to enter coordinates for boreholes. The initial version of RSLog supported geographic (WGS 84) and Universal Transverse Mercator (UTM) coordinate systems.

The latest version of RSLog covers an additional 7,500 projected reference systems. This includes all State Plane Coordinate Systems (SPC), with a search feature that helps the user find the CRS based on EPSG code, FIPS code, city, or country (see Appendix A for a screenshot).

2.5.2 *Sampling*

RSLog covers all sampling methods (customizable). For each sample, user can enter From Depth, To Depth, Sample Type, Color (supports Munsell colors as well as manual entry), Moisture Level, Recovery Length, Recovery %, RQD, Location / Status and Description.

For rock cores, users can specify a comprehensive list of Drill Run input data as well as details for Discontinuities.

2.5.3 *Field Testing*

RSLog allows users to customize the list of field tests, therefore, technically all field tests are supported by RSLog (link to documentation). For each field test, the user can specify its columns (e.g. a CPTu test needs at least: Depth, q_c, f_s, and u_2 columns and user can add more columns if needed).

Specifically for Standard Penetration Test we have implemented ASTM D1586 with automatic calculation of N-value and all refusal cases. Energy Level, Hammer ID, Hammer

Weight, Drop Height, Lifting Mechanism, and Sampler Type can be detailed for each borehole.

Examples of the other common field tests that can be added to RSLog include:

- **Vane Shear Test:** RSLog has a built-in vane shear test that records both peak and residual undrained shear strength values.
- **Pressure-meter Testing (PMT)**: Users can enter the final test results (in this case: Menard modulus, limit pressure, etc.) in RSLog and present them in the boring log. However, processing of the PMT raw data is not covered.
- **Cone Penetration Testing (CPT):** RSLog has a built-in CPTu filed test that covers default columns: q_c, f_s, u_2 and Vs.
- **Flat-Plate Dilatometer**: Similar to the PMT, user can add a Flat-Plate Dilatometer test to RSLog data template and enter the test results.

For other tests such as packer test or in-situ permeability tests, users can add them to the list of field tests and the results will be presented in the borehole log, as long as the processing of raw data is carried out outside of RSLog.

For a field test, users can add a column that is automatically formatted by concatenation of other columns.

2.5.4 *Groundwater*

Users can enter two different types of groundwater levels in RSLog:

- **Water Level Observed During Site Investigation:** This is not considered the final, stable groundwater level; however, users can enter this data in RSLog and present it on the borehole log.
- **Piezometer/Well:** For each monitoring well, multiple groundwater level measurements (water depth, date, time, weather conditions) are entered in RSLog (see Section 2.5.6). Groundwater measurements can be presented on the borehole log as:
    a) a separate log column dedicated to water level, or
    b) groundwater symbol be shown on other log columns, or
    c) a table in the header or footer of the borehole log listing all groundwater readings.

In addition, a graphic representation of well construction is shown in cross-sections beside the boreholes (link to documentation).

Nested piezometers are supported.

2.5.5 *Lithologic Description*

The lithologic description of soil and rock layers supports the following classification systems (link to documentation):

- **AASHTO Soil Classification System:** RSLog supports the AASHTO Soil Classification System when defining a soil layer. On the Settings page user can assign a hatch pattern for each AASHTO soil type.
- **Unified Soil Classification System (USCS):** RSLog supports USCS when defining a soil layer for a borehole. Each USCS soil type has a built-in hatch pattern.
- **AGS Classification System**: In addition to AASHTO and USCS, RSLog covers all soil and rock classes defined by AGS 4.1.1.
- **Modified Burmister System**: This classification system is based on grain size and plasticity, but differs from the USCS in that it includes nomenclature to describe the soil's texture.
- **Rock**: Users can select various rock types and add detailed lithologic descriptions for a rock layer.

Overall, RSLog covers more than 230 hatch patterns for soil and rock. Users are able to upload (image file) their own hatch patterns to RSLog.

RSLog detailed data entry for lithologic description supports **Caltrans'** "Soil and Rock Logging, Classification, and Presentation Manual (2022 Edition)" which documents the standard of practice for describing and presenting soil and rock encountered during and after drilling investigations. Utilization of the **Caltrans** manual **is optional for RSLog users** (i.e. data entry in *Detailed* mode). This offers a more comprehensive data entry for soil components, drilling observations, isolated layers, interbedded layers, interim changes, borderline symbols, etc. In this method, all these data entries are done using various dropdowns and RSLog compiles them into a layer description. The layer description compiler is configurable (link to documentation).

2.5.6 *Instrumentation*

RSLog has a separate Instrumentation tab on the borehole data entry page. This includes entering details of the piezometer/well installation (including showing instrumentations such as vibrating wire in the well). Nested piezometers are supported.

Groundwater levels measured in the piezometers/wells can be recorded in RSLog and will be displayed in the borehole logs and cross-sections.

In addition, the Borehole Survey tab covers any measurements versus depth in a borehole. Examples of a borehole survey include inclinometer and sonar caliper data.

2.5.7 *Extra Tags*

Extra Tags are additional properties you can add to a borehole or project that allows further customization of RSLog. Users can create unlimited Extra Tags on the Settings page.

2.5.8 *Comments and Drilling Observations*

Comments/remarks may be entered and presented at a specific depth in the borehole log. These general comments are presented in the Comments/Additional Notes log column.

In addition, on the stratigraphy data entry page, Drilling Observations may be added to a stratum. This will be presented at the specified depth in the Lithologic Description log column (only available in *Detailed* data entry mode).

2.5.9 *Drilling into Bedrock*

For a rock layer, users can also enter Drill Runs and Discontinuities data. RSLog presents this data in the borehole log using different log column types in tabular and graphical formats:

- **Drill Runs:** Input data include depth range, run number, core box number, core diameter, TCR, RQD, RMR, SCR, TMR, joint spacing, strength level, and more. The program can calculate TCR and RQD. The future version of RSLog will calculate RMR and Q (NGI).
- **Discontinuities:** Input data include depth, α, β, JCR, and defect properties (type, shape, roughness, etc).

2.5.10 *Drilling Details*

The input data collected for Drilling Details include depth range, date and time, drilling method, borehole diameter, drill rod, drill bit, casing details, whether an instrument is installed, and general drilling notes.

In some cases, drilling of a borehole may be completed by utilizing more than one drilling method (e.g. started with auger drilling and later switched to core drilling due to refusal).

2.5.11 *SPT Hammer Info*

You can input SPT hammer data such as hammer ID, equipment type, energy level, drop height, hammer weight, lifting mechanism, sample type and sampler diameter. This data can be presented on the borehole log.

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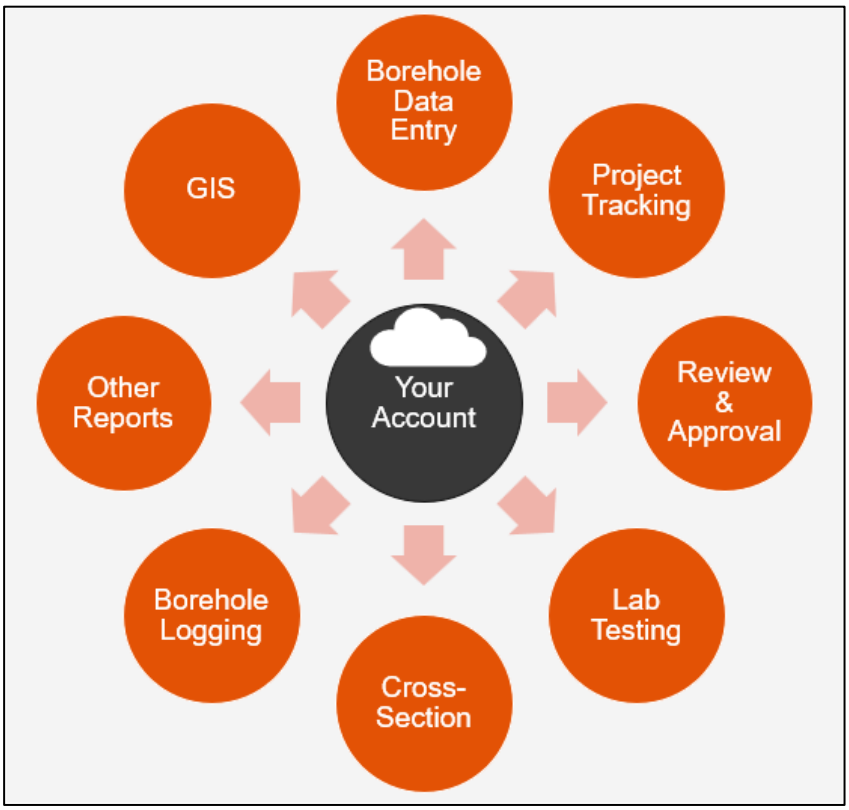
2.5.12 *Centralized Database*

The centralized database of RSLog guarantees streamlined and smooth communication between various features. Once borehole data is entered, several design and reporting features provide service by processing borehole data.



3. Field Investigation

3.1 Pre-Investigation Planner

Before commencing field investigation, users can use the Pre-Investigation Planning page to create a list of proposed boreholes for the subject project. Users can specify the location, depth, engineer in charge, samples, field tests, etc. for each planned borehole. If necessary, this list can be reviewed and edited prior to field investigation.

The list of planned boreholes could be printed and used by field engineers as a reference. In addition, users can import the list of proposed boreholes from an Excel (CSV) file.

The Pre-Investigation Planner tool is integrated with the **OnSite** app (see Section 2.2).

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3.2 Field Data Collection

3.2.1 *Team Collaboration*

During the site investigation, each field engineer enters data in the Tablet App or using a web browser. This data will be immediately available to all users in your account, including engineers in the office.

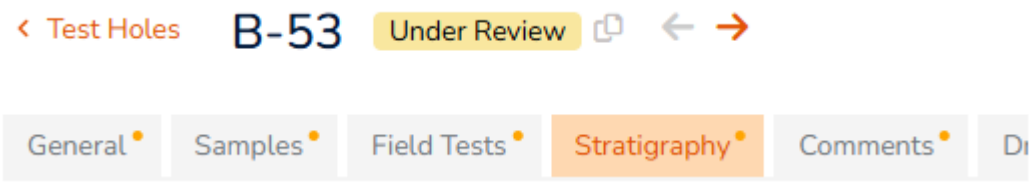
3.2.2 *Project Monitoring and Tracking*

RSLog helps project managers monitor the progress of site investigation with the following features:

a) **Progress Tracking:** On the list of boreholes, the overall progress of the field investigation is visualized as a colorful progress bar, indicating the number of boreholes with Completed status, versus Drilling status, etc.
b) **Draft Logs**: As soon as data is saved or pushed to the server (e.g. by the **OnSite** app), generating a draft borehole log is just one click away. These boreholes are automatically placed on the GIS map.

4. Quality Management System

RSLog's quality management system guides you through all stages of planning, site investigation, review and approval of the borehole. The status of each borehole with respect to the Quality Management is stated by its Quality Management Status displayed beside the borehole name and updated automatically during the workflow:



4.1 Quality Management Role

At project level, you can assign users to the project. This allows:

a) making project only visible to those users assigned to the project, and
b) specifying the Quality Management role of each user:
    a. **Field Logger**: user with this QM Role participates in data entry and notifying 'reviewers' when borehole is ready for review.
    b. **Reviewer**: user with this QM Role oversees reviewing the borehole log, providing comments, making sure that comments are implemented, and at the end to notify 'approvers'.

c. **Approver**: user with this QM Role reviews and approves the borehole log once the reviewers have completed their job. The approver can leave comments if necessary.
d. **Contract Administrator**: this is typically the user who creates the project in RSLog.

4.2 Quality Management Status

The following states are available for a borehole:

Site Investigation: field investigation for this borehole has been started. This state breaks down to sub-states of Planned, Abandoned, Canceled, Utility Locating, Drilling/Excavating, Backfilling, Completed, and Canceled.

Draft: borehole data entry is in progress and any borehole logs generated during this state are considered draft.

Under Review: borehole is ready for review. Typically the users with QM Role of Field Logger will notify reviewers. RSLog automatically sends an email to all reviewers letting them know that they can start their review process.

Reviewed: all reviewers have reviewed the log and any review comments have been resolved.

Approved: all approvers have reviewed the log and any approval comments have been resolved.

Data Locked: the user with QM Role of Contract Administrator can lock/unlock borehole data.

Users can add more statuses to the above-noted built-in Quality Management statuses if needed.

4.3 Review and Approval Comments

Once data entry of a borehole is completed, user can generate a draft borehole log for internal review. The following describes the tools available in RSLog for review and approval of a log:

a) Reviewing raw data in RSLog to identify conflicts or incomplete/erroneous data,
b) Generating draft borehole logs (PDF), then printing them and providing marked-up comments to field engineers to make corrections,
c) On the Test Hole Logs page, users can:
    i. View field notes pertaining to each borehole,

ii. Leave a 'Review Comment' for a specific borehole. Multiple users can leave their comments,
iii. View the list of all review comments and mark a comment as 'fixed',
iv. 'Approve' a borehole log once all the all the review comments of that log are marked as 'resolved'. User can leave an approval comment, if necessary,

5. Laboratory Testing

RSLog is designed as a borehole data management system with a centralized database for storing all field and lab test data. During the course of a project once lab test results become available user can import them to RSLog either manually or as a CSV file. Lab test results can be presented on the borehole logs.

5.1 Entering Lab Test Results

Entering the results of lab tests is carried out on Lab Tests page. Similar to the list of field tests, the list of laboratory tests is also customizable meaning users can add '**user-defined**' laboratory tests to RSLog's built-in list of lab tests. The following list shows the built-in lab tests covered in RSLog:

- **Particle Size Distribution:** test results comprise percent gravel, sand, silt, and clay.
- **Moisture Content & Density:** test results comprise moisture content and dry density.
- **Atterberg Limits:** test results comprise Liquid Limit (LL), Plastic Limit (PL) and Plasticity Index (PI).
- **Specific Gravity:** test results comprise Specific Gravity (Gs).
- **Organic Content:** test results comprise Organic Content.
- **Chemical Contents:** test results comprise pH, chloride, and sulphate.
- **Compaction Tests:** test results comprise compaction.
- **Hydraulic Conductivity:** test results comprise hydraulic conductivity and test method.
- **Consolidation:** test results comprise Cc, Cs, Pc.
- **Direct Shear Test:** test results comprise cohesion (C), internal friction angle (Φ) and test method.
- **Triaxial Compression Test:** test results comprise cohesion (C), internal friction angle (Φ) and test method.
- **Unconfined Compression Test:** test results comprise undrained shear strength Su.
- **Expansion Index:** test results comprise EI.

A screenshot of the Lab Test Results page is shown in Appendix A.

5.2 Lab Test Request

RSLog offers an efficient way to request lab testing on samples. A test request form is generated by exporting the request form to an Excel file which is shared with the lab staff for subsequent testing and updates. This Excel file contains the complete list of boreholes and their samples, with the details of requested tests, notes and test status. To update the lab test results:

- **Using RSLog Built-in Test Request Feature:** user can mark a sample for a specific test(s), change lab test status, leave notes for lab technician and update the test results.
- **By Importing From CSV File:** user can import the results of all lab tests of all boreholes by a single import of a CSV file.
- **By Importing From Excel File:** user can import the results of all lab tests, their associated notes and test status by a single import of an Excel file.

5.3 Processing Lab Tests

RSLog team is currently working on a major feature that allows processing raw data of various soil lab tests and providing customizable lab test reports. Please stay tuned for more updates.

6. Recommended Workflow

We recommend the following workflow for using RSLog in geotechnical / environmental projects (more details):

1. Use the Pre-Investigation Planner to create a list of proposed boreholes (see Section 3.1).
2. During field investigation, enter data using the **OnSite** app (see Section 2.2) or web browser.
3. Use RSLog's project monitoring tools to monitor the progress of field investigation (see Section 3.2.2).
4. Generate draft borehole logs and conduct initial reviews and corrections as necessary. Leave review comments, approve or lock the borehole as needed (see Section 4).
5. Once the lab test results are added to RSLog, generate borehole logs to check that the lab test results are not in conflict with field descriptions. Copies of all versions of borehole logs stay in RSLog's database and can be accessed at any time.
6. After completion of the project, feel free to (see Section 7):
   a) Archive the project,

b) Lock the project to avoid accidental editing or deletion of data, or
c) Transfer the project to a client (e.g. a Department of Transportation) using RSLog built-in project transfer feature.

7. Organizing the List of Projects

Projects in your RSLog account are divided into the following lists for easier data management:

- **Current**: This list shows active projects, meaning projects that are currently in field investigation, design, or review phases. During the course of a project, users can update the status of a project (Planning, Investigation, Design, Review, Completed, Archived, etc.) as necessary.
- **Archived**: Users can archive completed project, providing a 'clean' list of Current projects.
- **Transferred**: Users can digitally transfer an RSLog project to another RSLog account. For example, say a consultant is retained by a DoT to carry out field investigation and design for a project. Once the project is completed, the geotechnical/environmental consultant could digitally send the data right to the DoT through RSLog. This guarantees data integrity and a seamless, fast data transfer. No need for memory sticks and file upload.

In addition to the above, users can assign a project to certain users, lock a project (read only), and duplicate a project.

8. Generating Reports

All reports generated in RSLog are created as a PDF file and uploaded online for preview. Users can download the PDF file for further edit (if necessary) or for inclusion in the geotechnical report. RSLog covers the following reports:

8.1 Borehole Logs

Borehole logs may be generated with the following methods:

- On the borehole edit page, users can generate individual borehole logs using the Preview feature.
- Users can also generate a single PDF log comprising multiple boreholes. This is done through a separate page (Test Hole Log) where the following options are available:
    a) Select multiple boreholes,
    b) Attach standard legend sheets (PDF) to the borehole log,

c) Leave a review / approval comment for a specific borehole log,

d) Mark a borehole as 'Reviewed' or 'Approved',

e) Lock a borehole to avoid editing of its data, and

f) Download a copy of the previous versions of borehole logs generated by the user.

8.2 Site Location Map

This page features a map showing the location of the project. Users can customize the zoom level and switch between Map and Satellite views. To generate the site location map figure, users can enter the figure title and select a figure template (see Section 9.2).

8.3 Boreholes Location Map

This page features a map showing the locations of **all boreholes** in a project. Users can customize the zoom level, and switch between Map and Satellite views. To generate the borehole's location map figure, user enters the figure title and selects a figure template (see Section 9.2).

8.4 Cross-Section Report

Once the design of a cross-section is completed, in addition to exporting it to DXF and other file formats, users can generate a PDF report by selecting a figure template and entering a figure title.

8.5 Photos Report

In these reports, all project photos can be summarized in a PDF by placing a certain number of photos (i.e. 1, 2, 4, 8) on every page.

8.6 Project Summary Report

Creates a tabular report (Excel and PDF) comprising a list of all boreholes with user configurable general data, such as a list of samples, soil layers, field tests, etc. We expect this feature to be available by the end of Q1 2024.

8.7 Customized Reports

More reports can be easily created using the RSLog template designer by adding log columns such as depth scale, a customized graph showing field or lab tests (e.g. overlay of qc, fs, u2), and -if necessary- lithologic description.

8.8 Other Types of Reports

Rocscience is currently working on a **Query Builder** feature that allows users to run customized queries by diving deep into the RSLog database. The results would be

presented in tabular reports (Excel and PDF), maps, and graphs. We expect this feature to be available in Q4 2025.

9. Designing Report Templates

9.1 Borehole Log Templates

RSLog has a powerful log template designer that allows you to design the borehole logs to match your company style:

- **Paper Settings:** Users can select the paper size and margins,
- **Fonts:** Users can select font styles for each section of the log template,
- **Header/Footer Design:** With advanced graphical user-interface features, header and footer design in RSLog can be quickly mastered by anyone. Adding elements to the header and footer is done by drag & drop, and users can easily edit the properties of an element using a 'property grid' (see Appendix A for example screenshots).
- **Log Columns:** In a borehole log, the depth-related data is shown in various 'log columns.' Examples include samples, lithologic description, elevation, SPT graph, Atterberg limits, lab test results, drill runs, and more.

  Log columns offer the following features: add/remove, change order of columns, width, header text, and sub-columns. Our team is constantly adding more log columns to the template designer; for example, in our latest release of RSLog we introduced two new log columns: Customizable Graphs, where you can plot multiple data series on the same graph, and an Elevation log column with customizable labels and tick marks.

9.2 Figure Templates

A figure template is used for generating other types of reports (see Sections 8.2 to 8.8). Users can select paper settings and design their own header and footer to match their company standards.

9.3 Sharing Templates with Other RSLog Accounts

An RSLog user may share a log template with another RSLog account. This helps DoT' share their standard templates with consultants for geotechnical and environmental projects (link to documentation).

10. GIS System

10.1 Data Layers

RSLog has a powerful GIS system that shows the locations of all projects and boreholes on a map that supports roads, satellite, hybrid, and terrain map styles with various search options, and it has general features such as zoom, pan, scale bars (Imperial and Metric),

tilt, and compass. Other features of the GIS map include geology map, historical public boreholes, and public groundwater data. Major data layers incorporated into the GIS map include:

- **RSLog Boreholes:** Users can see the locations of all their RSLog projects and boreholes on the GIS map.
- **Public Historic Boreholes:** The locations of over 270,000 (and growing) public boreholes collected from various DoT's are available on RSLog GIS map (courtesy of www.geosetta.org).
- **Historical Datasets:** These are a user's previous projects (i.e. prior to switching to RSLog) that can be imported via a simple CSV import in RSLog. The locations of 'External' projects should be provided in geographic (WGS 84) as latitude/longitude. Alternatively, users can enter civic address of the location, and RSLog will use 'geocoding' to try and obtain the geographic coordinates automatically.

10.2 Query Boreholes in a Geographic Region

The GIS map shows the locations of all boreholes. Users can zoom to a specific area of the map to view the boreholes within that area. The upcoming **Query Builder** feature offers comprehensive search and filtering with displaying data on a map.

10.3 Search for a Project

Using the built-in GIS map search, users can find projects that meet a specific search criterion. By selecting a project from the list, the map zooms to the location of that project.

10.4 Import Data

You can import the following layers into the map:

- Any pre-existing boreholes (e.g. gINT or DIGGS) imported into RSLog (see Section 13.1) will be automatically shown on the GIS map.
- Locations of projects or boreholes using the 'External Projects' feature (see Section 9.1).
- Global and/or project-specific Google Earth (KML, KMZ), Shapefiles, GeoJSON, and GPX files. This can be done through the Layers tab " Uploaded section of the map.
- Link to external maps that are available in Open Geospatial Consortium (OGC) format. Examples of OGC geology maps may be found on USGS and OneGeology websites. This can be done through the Layers tab " Uploaded section of the map.

10.5 Export Data

Users can export the current view of the map to image format (PNG). The map data layers can be exported to Google Earth (KML) format. More export options could be added upon request.

11. Customizations

RSLog is designed with flexibility in mind. Various aspects of the program, and almost all dropdowns, may be customized at the account level (i.e. for all users under the same RSLog account). Customization can be done through several tabs on the Settings page.

11.1 General Settings

- **Default Values:** Users can specify default coordinate reference system, unit system, drilling method, sample type, etc. This saves data entry time.
- **Hatch Pattern Colors:** Users can assign a fore-color and back-color to each hatch pattern (USCS, AASHTO, AGS, Rock, and Other).
- **User-Defined Hatch Patterns:** Users are able to upload their own hatch pattern tiles and use it when defining a soil/rock layer.
- **Theme Settings:** Users can select the application font, date format, map markers etc.

11.2 Dropdown Lists

The following customizations apply to the dropdown lists used in various RSLog data entry pages:

- **Progress Status Levels:** Each project and borehole can be assigned a progress status. This helps tracking the progress of the project.
- **Extra Tags:** See Section 2.5.7 for details.
- **Soil / Rock Classifications:** Users can customize particle sizes/angularity/shape/etc., as well as moisture levels, strength levels, weathering levels, defect properties, and more.
- **Sample Types:** Users can edit the list of sample types.
- **Drilling Methods:** Users can edit the list of drilling methods.
- **Moisture Descriptors:** users can edit the list of moisture descriptors and their range of moisture.
- **Field Tests:** Users can add a field test to the list and specify the number of data columns associated to a field test. For example, test results for a pressure-meter test may include Menard modulus (E_m) and limit pressure (P_l).

- **Consistency**: Users can define the criteria for consistency and apparent density (SPT based criteria) of soil.
- **Piezometer/Well Types:** Users can edit the list of piezometer types, and top plug types.

11.3 Rich Text Formatting

The data entry for Lithologic Description (soil and rock) and for log template column-headers support Rich Text format (i.e. multiline text entry and bold, italic and underline styles).

11.4 Report Customization

Create your own figure template and borehole log template using RSLog template designer. With regards to the borehole logs, user can design both header & footer as well as log columns. For more details regarding report customization and various options to report SPT blow counts please see this article.

12. Data Validation

Several data validation rules are implemented in RSLog data entry forms. This includes validating data types, expected range of data, relevance of certain inputs based on borehole type, etc.

To minimize data entry errors, customizable dropdown lists are used wherever possible. More complex dropdowns allow searching for a specific item in the list.

12.1 Field Level Validation

Examples of field level validations implemented in RSLog include:

- **Data Types:** Depending on the type of data expected for each input field, it accepts either number or text.
- **Dropdown Lists:** where possible dropdowns are used in order to minimize data entry errors.
- **Date/Time Fields:** These input fields have a built-in date/time-picker to avoid inconsistent data entry.
- **Munsell Color List:** Users can select soil/rock colors from the list of Munsell colors (optional). Other colors (e.g. lines and texts) are selected from a color-picker.

12.2 Cross-Checks

A proper subsurface characterization comprises three main data components: material description (i.e. field observation), field testing, and lab test results.

The lithologic description presented on the borehole logs should be consistent with the field and lab test results. For example, the moisture level and consistency/apparent density (SPT based) in the lithologic description should not conflict with test data. RSLog automatically checks for these.

When users enter layer descriptions on the stratigraphy page, RSLog allows for cross-checking by presenting the summary of field and lab test results for that layer.

12.3 Spell Checker

This feature is available in all text data entry fields. Spell checking becomes more critical for lithologic description (soil and rock), sample description, comments, and location notes.

13. Subsurface Modelling

RSLog's innovative Cross-Section Designer feature creates two and three-dimensional subsurface visualizations. This feature is directly connected to the centralized database of boreholes in your project, and provides easy-to-use tools for designing cross-sections and exporting the results to DXF, Civil3D and more.

13.1 Design of Subsurface Profiles

Each cross-section provides a Profile View presenting the stick logs of all boreholes. RSLog's Cross-Section Designer has its own built-in drafting module where you can create fence diagrams, add annotations, and export to various formats (link to documentation).

a) Cross-sections are presented in three modes: Plan, Profile, and 3D. Users can create multiple cross-sections in a project (see Appendix A).

b) To create a cross-section on Plan view (map), a polyline is drawn by user. The flexible 'buffer zone' of the cross-section on Plan view allows automatic inclusion of nearby boreholes in the cross-section. These boreholes will be projected on the cross-section line, with their offset and distance automatically calculated.

c) On Profile view, users can connect layers together and draw lenses by drawing 'polygons'. Users can indicate the locations of underground utilities, piles, and proposed excavation levels as required.

d) Users can apply USCS, AASHTO, AGS, and Rock hatch patterns and colors to each stratum. Users can also draw groundwater tables, turn on SPT graphs, view piezometer/well data and more.

e) The depth-related datasets such as SPT or CPT, TCP, DCP, and Vs can be presented in graphical or tabular formats beside each borehole (see Appendix A).

f) The cross-section design may be exported to DXF, KMZ, JSON, PNG, SVG, Civil3D and OpenRoads.

13.2 Three-Dimensional Model

By switching to 3D Mode, the entire project site with all boreholes and cross-sections will be shown in an interactive 3D viewer. Users can add 3D terrain to the model; this terrain model is automatically generated by RSLog based on the LiDAR data obtained from various map servers for the subject site (see Appendix A).

The 3D model of the site can then be exported to various 3D graphic formats such as glTF, OBJ, and STL.

13.3 Log of Test Boring

The LoTB Mode is used for presenting borehole data in Log of Test Boring format. For details please refer to Section 5.2 of the Soil and Rock Logging, Classification, and Presentation Manual.

A screenshot of the LoTB feature is presented in Appendix A.

14. Integration with Other Systems

14.1 Import

- **DIGGS**: RSLog supports import from DIGGS (see Appendix A). The Rocscience team is working on export to DIGGS format.
- **gINT**: RSLog has an import feature that supports gINT and Wincore files. Based on our experience with other gINT users switching to RSLog, users can import most of their data into RSLog. Due to flexible design of gINT database, importing the entire data from gINT files may require customizations for a specific data template.
- **AGS**: The current version of RSLog supports import from AGS 4.1.1 and covers more than 150 AGS hatch patterns. We are working on a new version of AGS import feature that offers a more flexible AGS import, edit, and export process. Our log template designer fully supports AGS borehole logs.
- **CSV**: RSLog offers CSV import for all tables on all pages. The CSV import feature supports bulk import of data pertaining to multiple boreholes from a single CSV file (see details).
- **CADD:** RSLog exports cross-section and stratigraphy data to CSV, DXF, and Civil3D (specific CSV format). The current version of RSLog does not import DXF or DWG files. We see that importing DXF files to RSLog Cross-Section Designer would be beneficial to our users and plan to release the first version of this feature in Q3 2024.

- **RSLog Excel Templates:** These Excel templates are specifically designed for RSLog data entry. Once data entry is completed, users can upload the Excel files to RSLog and a project will be automatically created, with boreholes added based on the uploaded data.
- **Laboratory Test Results**: RSLog can import the lab test results from Excel (CSV) file. Importing data to RSLog is simple if all test results are saved in a single CSV file.
- **Cross-Section Designer**: This feature supports import of image files (e.g. electrical resistivity profile, geologic profiles, seismic refraction profile), point cloud (PCD), Wavefront Object files (OBJ) and GL Transmission Format (glTF).

Rocscience is open to discussing customized solutions for import from third-party lab test processing software, if necessary.

14.2 Export

- **DIGGS:** RSLog is fully compliant with DIGGS and supports both import and export.
- **Entire Project Data**: RSLog exports project and borehole data to Excel and our proprietary JSON format. The Excel export uses RSLog Excel Templates (see Section 2.1).
- **All Tables**: All tables in RSLog offer export to CSV, Excel, and PDF formats.
- **Maps**: Depending on the map, it can export data to PNG, KML, GPX and GeoJSON formats.
- **Cross-Section Designs:** The design of cross-sections can be exported to Autodesk DXF, which is a universal format supported by any drafting software. In addition, cross-sections can be exported to KMZ, JSON, PNG, SVG, Civil3D and OpenRoads. 3D view of the boreholes and cross-sections can be exported to Wavefront Object (OBJ, MTL), Lithography (STL) and GL Transmission Format (glTF).

14.3 Rocscience Programs

RSLog is designed as a central database for borehole data and can export data in file formats readable by other analysis programs.

RSLog is already integrated seamlessly with **Settle3**, **Slide2**, **Dips**, and **RSSeismic.** More integrations with other Rocscience programs are on the roadmap.

14.4 API Integration

We can provide API integration allowing third-party programs to connect to RSLog. Additional information may be provided upon request.

15. OCR Feature

The new groundbreaking Optical Character Recognition (OCR) feature in RSLog, offers the most cost-effective solution for handling large amounts of data through a safe and reliable data processing system.

OCR utilizes Artificial Intelligence (AI) to turn historic paper borehole logs into easily accessible database records, and all you need is an RSLog account. This enables consulting engineers, Departments of Transportation, and infrastructure owners to convert tens of thousands of borehole records to structured borehole data in a short period of time. This feature allows users to:

1. Scan historic borehole logs into PDF files.
2. Upload PDF files containing borehole logs.
3. Analyze the format of all pages in the PDF and create a list of unique log templates.
4. Review data elements and log columns and finalize the structure of log templates.
5. Confirm the log templates, then RSLog extracts data from all borehole logs.
6. View the extracted data in your RSLog account. This data will be placed on the GIS map and these boreholes become integral to your RSLog account.

To learn more about this feature please read this article.

16. User Management

RSLog offers role-based user management. A role is a set of permissions for actions available within RSLog, such as creating a project or generating a borehole log. Each RSLog user is assigned a Role which defines their level of access to RSLog features. Typically, your RSLog account administrator (i.e. your **admin** user) is the person who oversees user management.

- **System Roles:** The permissions of System roles cannot be altered by user. The following system roles are available in RSLog:
  a) **Admin role:** Users with this role will have full access to all pages and features in RSLog.
  b) **Viewer role:** User with this role will have read-only access to RSLog projects. RSLog offers a free Viewer user for each paid RSLog user.
- **Default Role:** RSLog comes with a default **Engineer** role with pre-defined permissions of the **Admin** role, except the access to user management page.

You can create new roles and add users to your RSLog account. The list of users may be imported from CSV file, if necessary. The maximum number of users allowed for your RSLog account depends on your license.

17. Office/Branch Management

This page is used by the Administrator of your RSLog account to manage the list of offices of your company. The purpose of this feature is to place users in different groups representing offices or branches of a company.

Projects are assigned to one or more offices. Users under these selected offices can be given Quality Management roles (see Section 4.0).

18. User Guide (documentation)

RSLog's user interface offers the following help features:

- Context-sensitive help and tooltips on all pages, as required,
- Comprehensive online documentation (user guide) that helps users learn how to use various features, and
- Articles and tutorial videos.

Each page in RSLog has its own documentation that can be accessed by clicking the Help button at the top-right corner of the page. The documentation website can be accessed at https://www.rocscience.com/help/rslog/documentation.

19. Enterprise Licensing Options

Rocscience offers a 20% discount for a purchase of more than 4 licenses, and a customized discount may be offered for more than 15 users. RSLog is available in two different packages:

Cloud Hosted: This is the public version of RSLog, with servers located in Canada or the US. Rocscience uses Microsoft Azure for handling data security, backup, and disaster recovery. The cost in this scenario is determined by the number of seats purchased. For the most up to date pricing, please visit our website.

On-Premises Installation: In this scenario, you will be provided with a setup package and installation manual for your IT team to install RSLog on your own server. All maintenance aspects of the server will be handled by your team. Rocscience provides up to 4 updates a year, covering bug fixes and new features at no additional cost. For the On-Premises package, the cost is determined by the initial account setup, licensing and server installation package, and the number of seats purchased.

For a personalized quote please contact our sales team.

20. Training and Troubleshooting

RSLog team provides two free 2-hour training sessions via Microsoft Teams.

For bug reports and troubleshooting we will set up a Microsoft Teams meeting within 2 business days from the receipt of the support ticket. If the issue cannot be resolved during the support session, it will be escalated to the development team for the implementation of a solution.

21. Software Support and Subsequent Updates

Rocscience is known for excellent customer support. We reply to user emails within 24 hours.

Cloud Hosted: We will deploy updates to RSLog website and users always benefit from the most up-to-date version every time they login. Users won't be charged for updates.

On-Premises Installation: The price includes 4 free updates a year which will be emailed to your IT team. Rocscience will provide email and video call support during installation.

22. RSLog Roadmap

RSLog team is working hard to bring new features to RSLog. The following lists major features in our near future roadmap:

- Utilization of AI to process photos with the objective of extracting geotechnical data from the photo,
- Processing raw data of laboratory tests and generating test reports (in progress),
- Query builder (in progress)
- Calculation of RMR and NGI (Q) based on drill run and discontinuity data.

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Appendix A
RSLog Screenshots

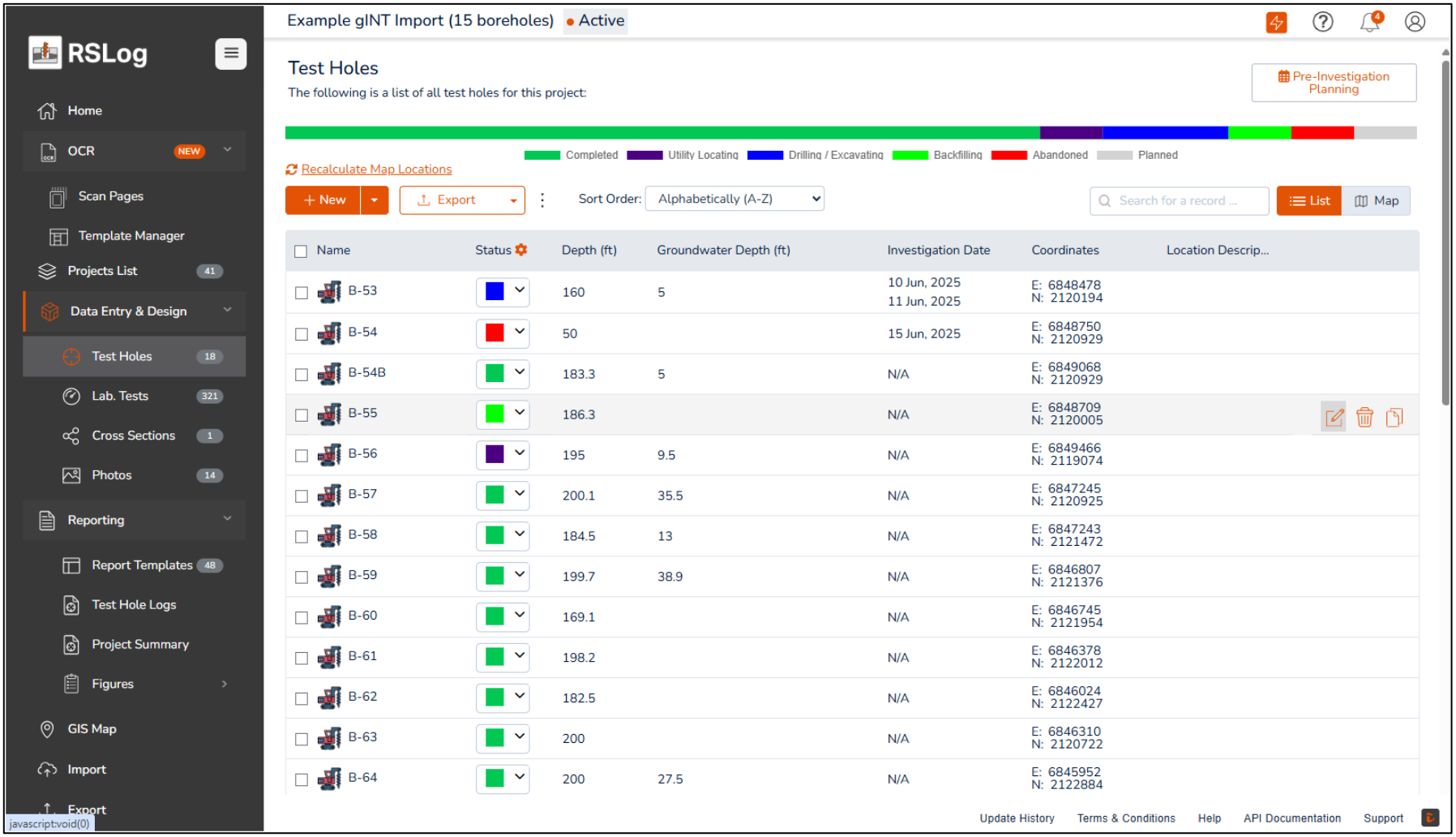

Figure 1: List of boreholes of a project.

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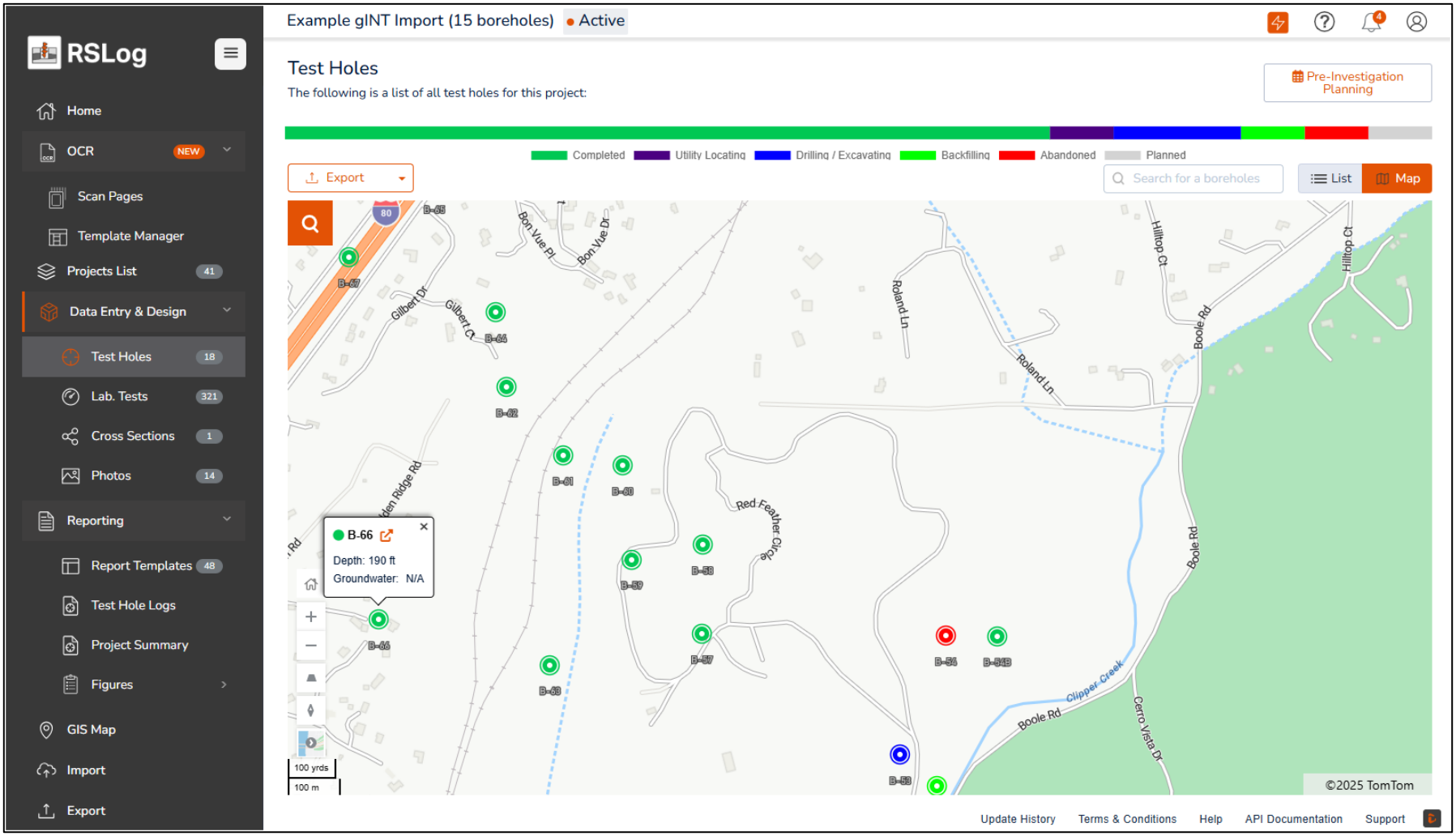

Figure 2: Locations of boreholes of a project on the map.

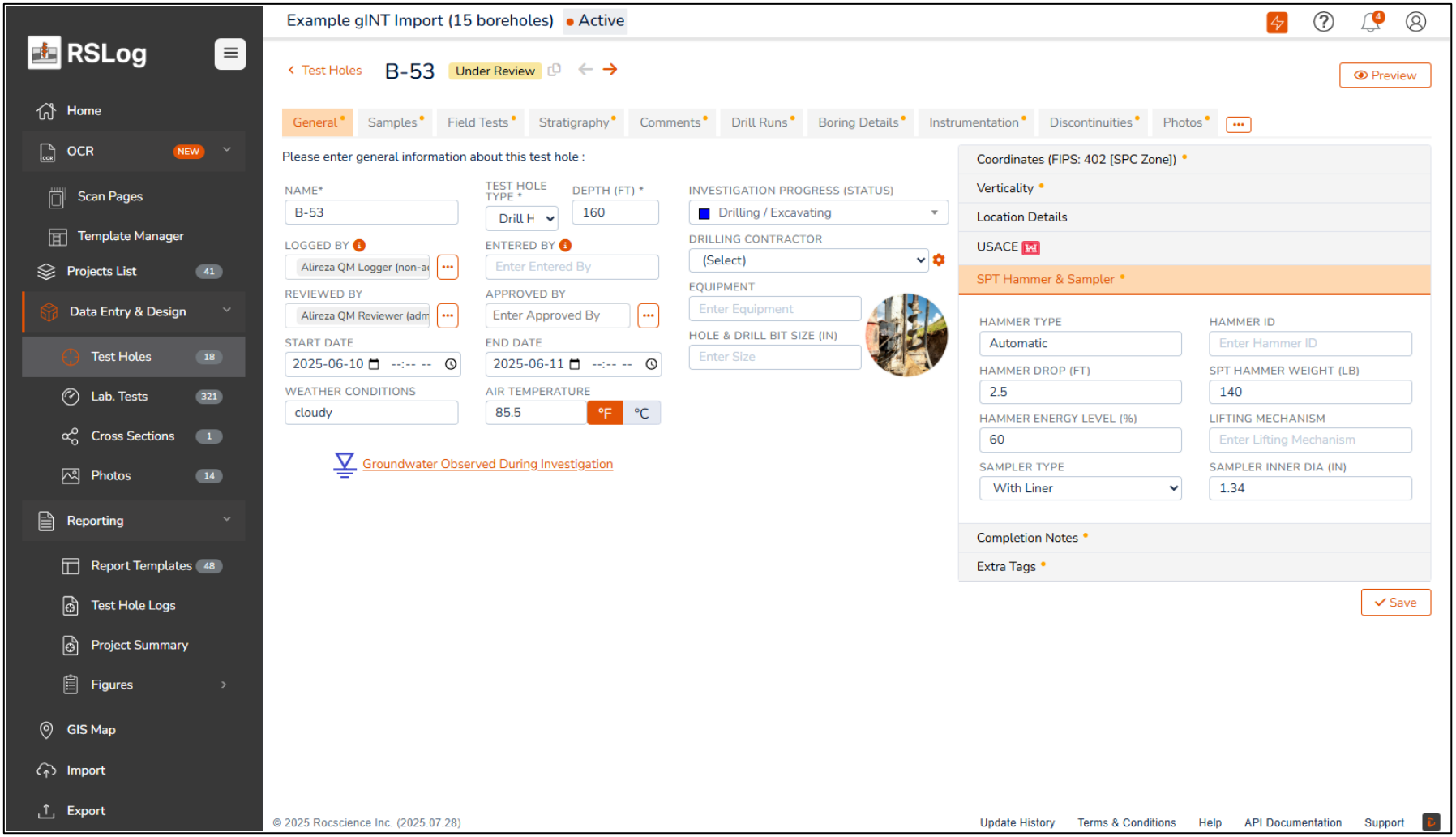

Figure 3: Borehole data entry page (General tab).

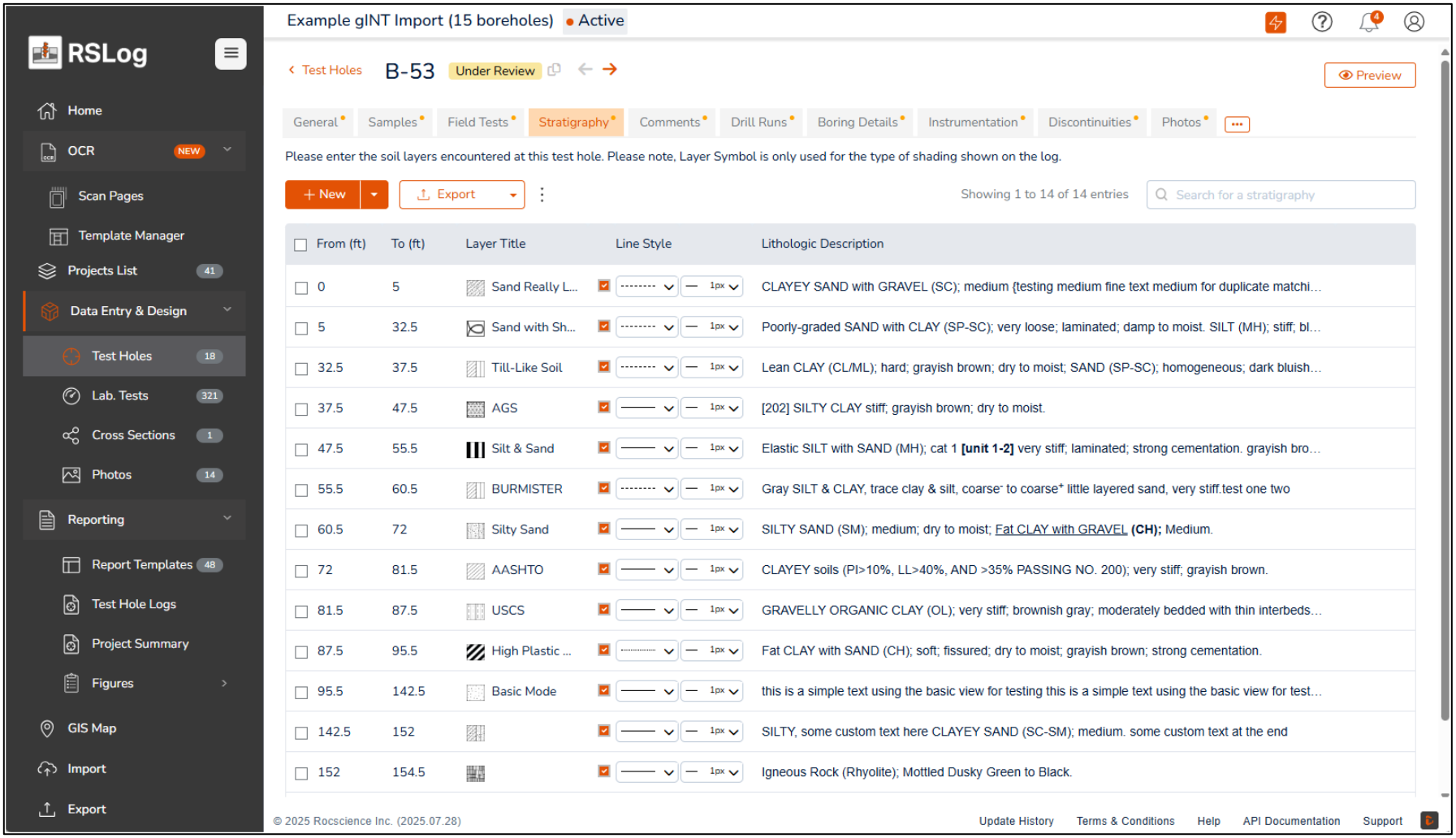

Figure 4: Stratigraphy page with list of soil / rock layers in a borehole.

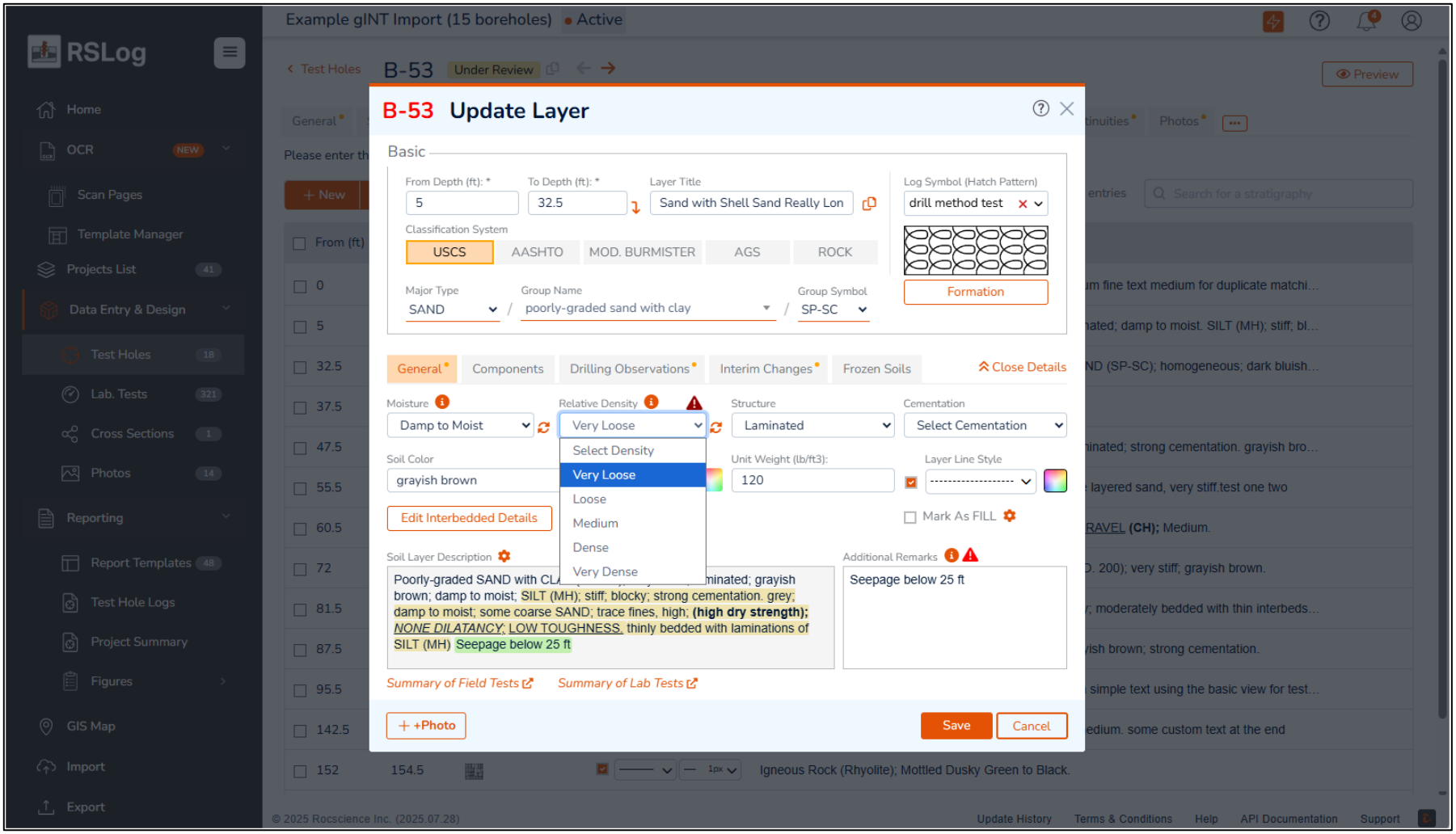

Figure 5: The dialog for editing lithologic description (Detailed mode).

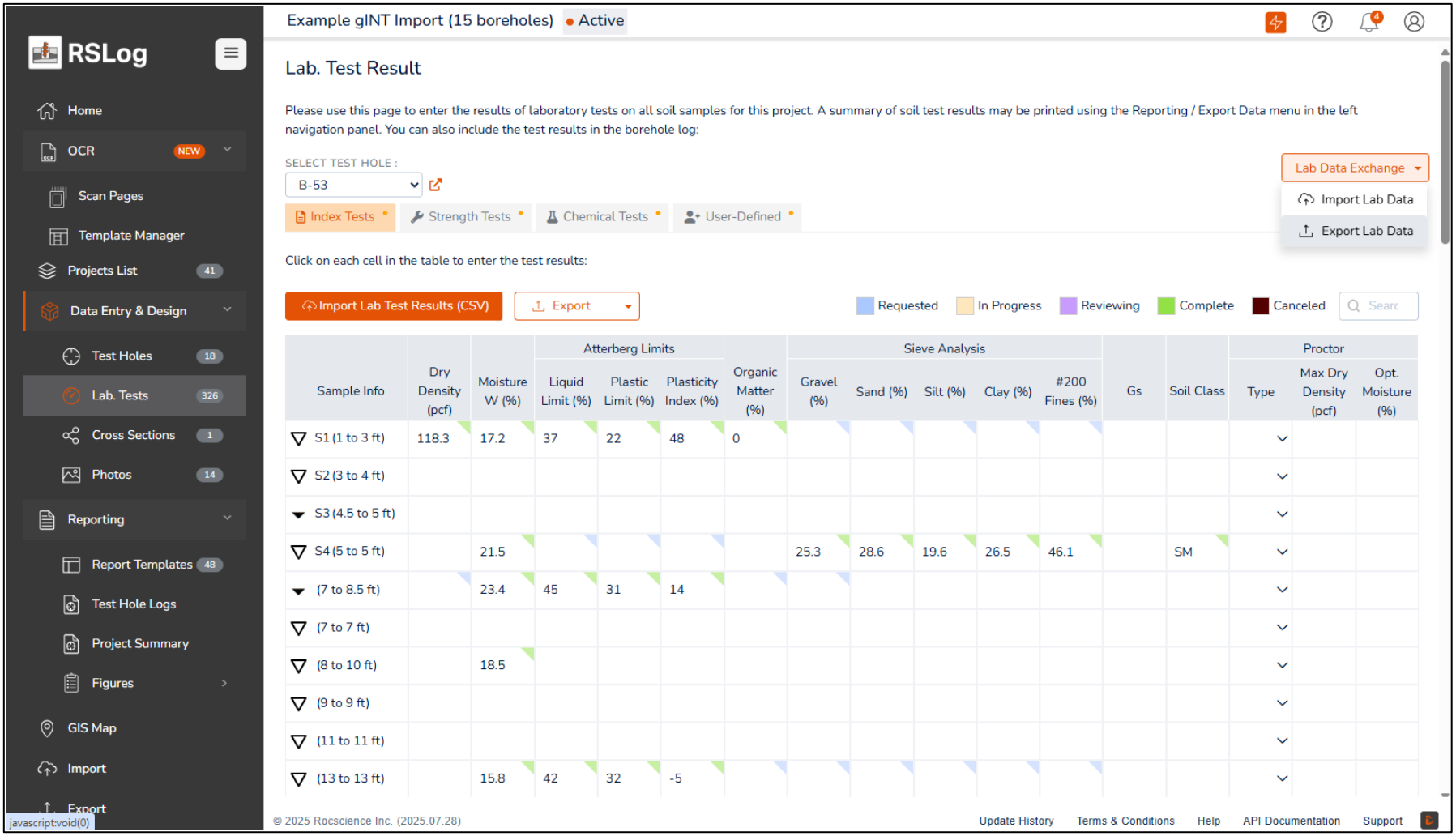

Figure 6: Lab test page with feature to order lab tests and exchange data with the lab.

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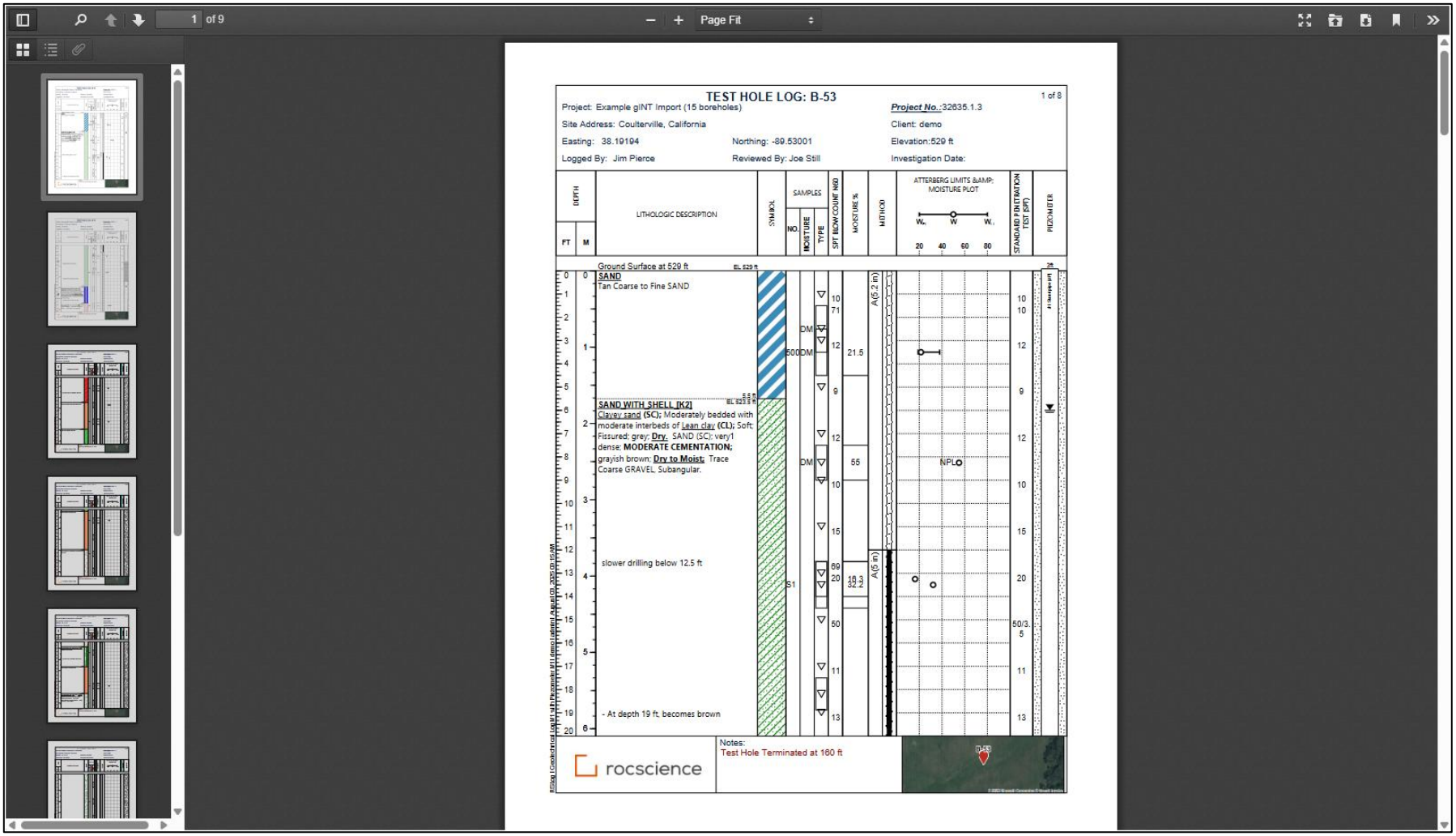

Figure 7: Example of the borehole log generated by RSLog.

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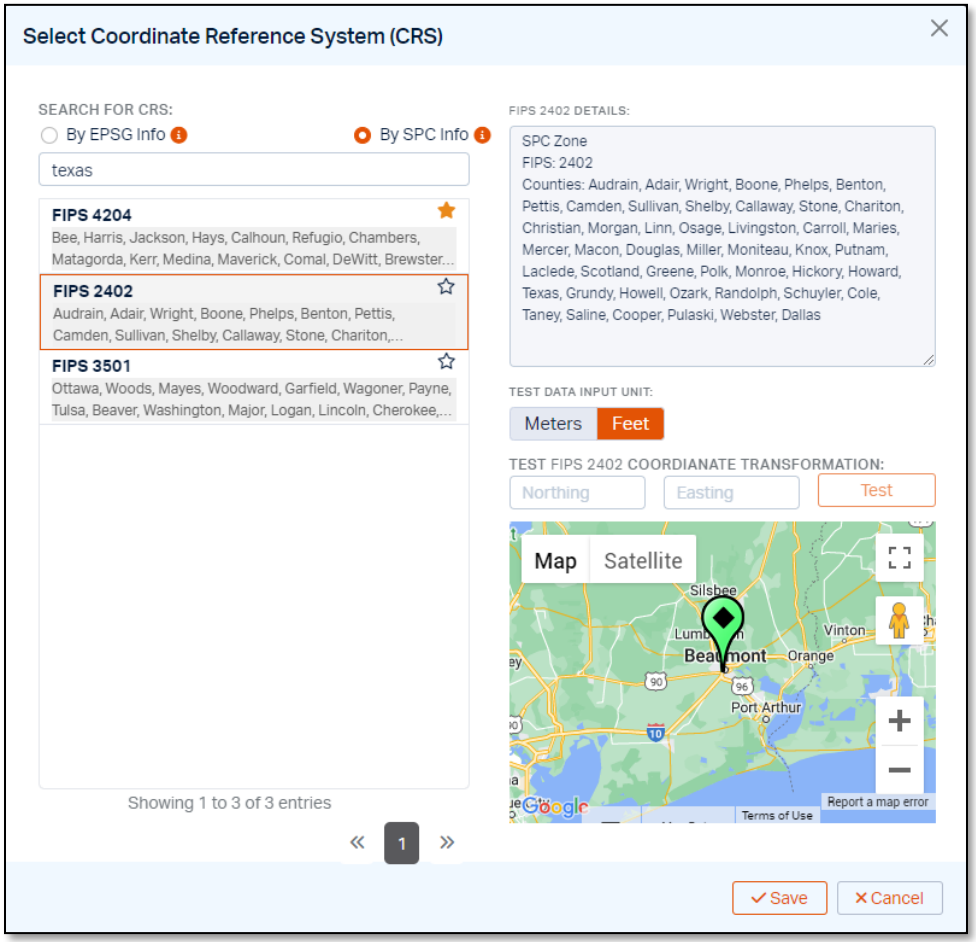

Figure 8: Dialog for selecting project coordinate system (geographic, UTM, EPSG code, SPC zone).

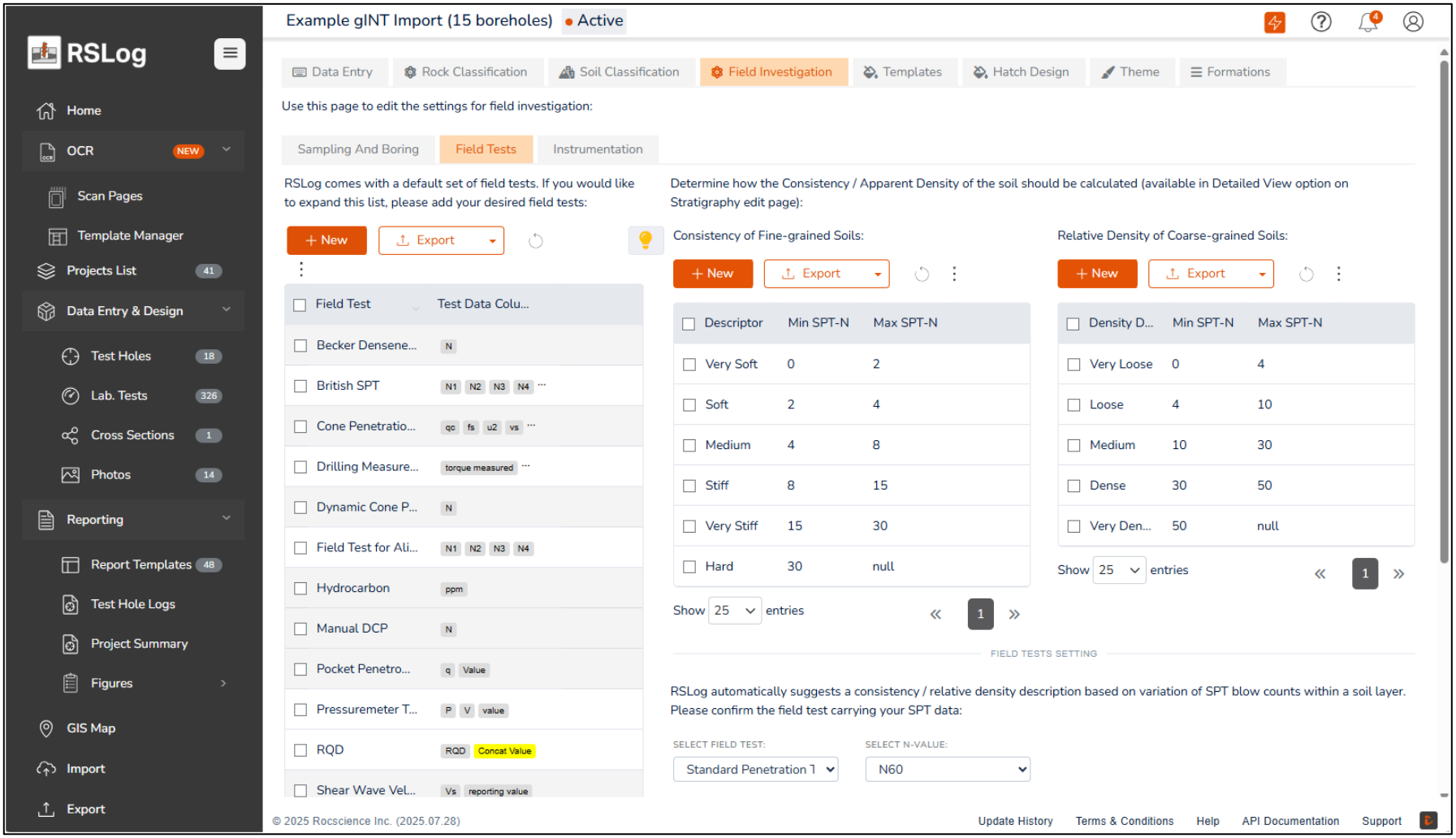

Figure 9: RSLog settings page allows customization of field tests, sample types, drilling methods etc.

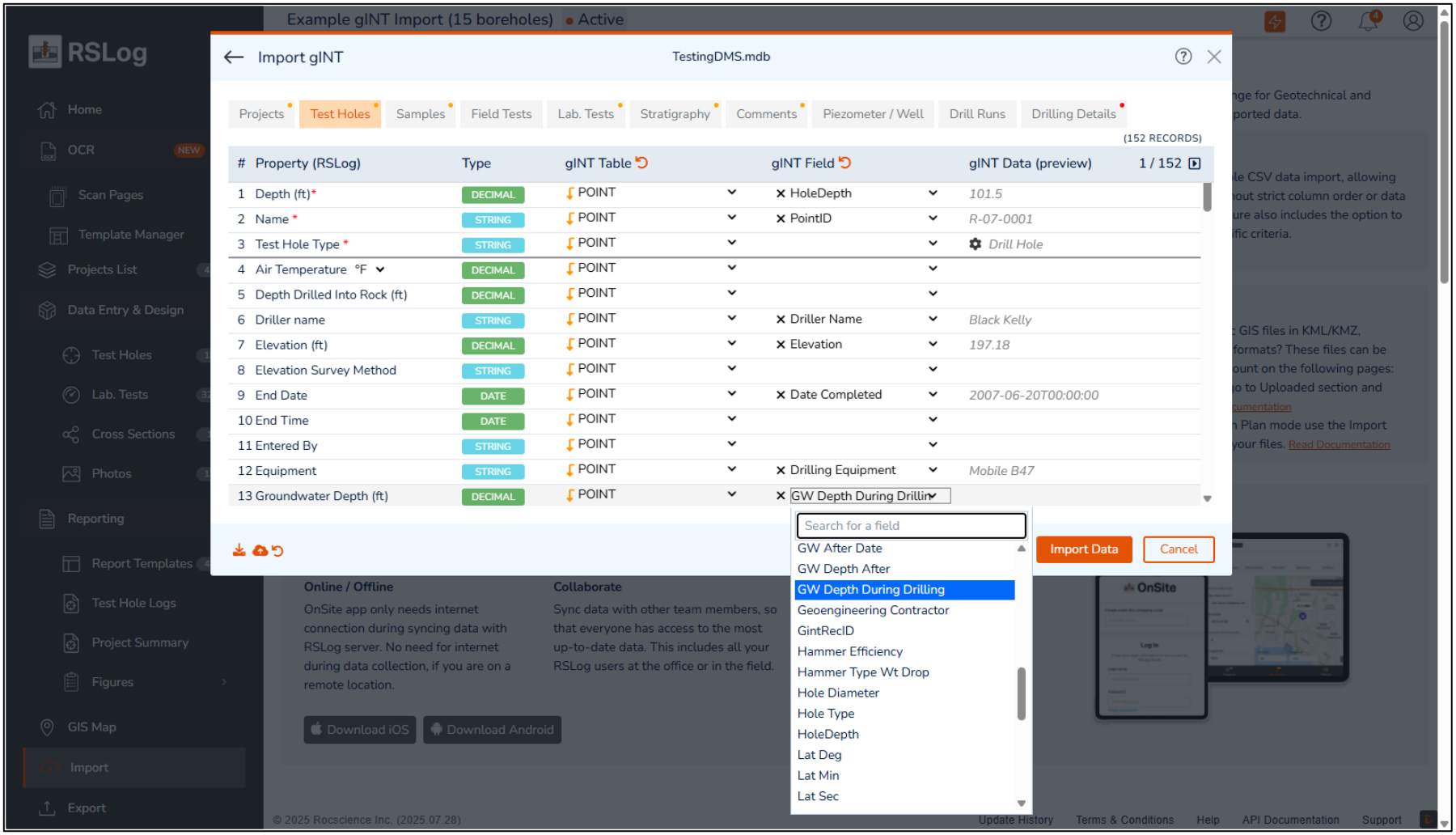

Figure 10: Dialog for importing gINT files and mapping data structures.

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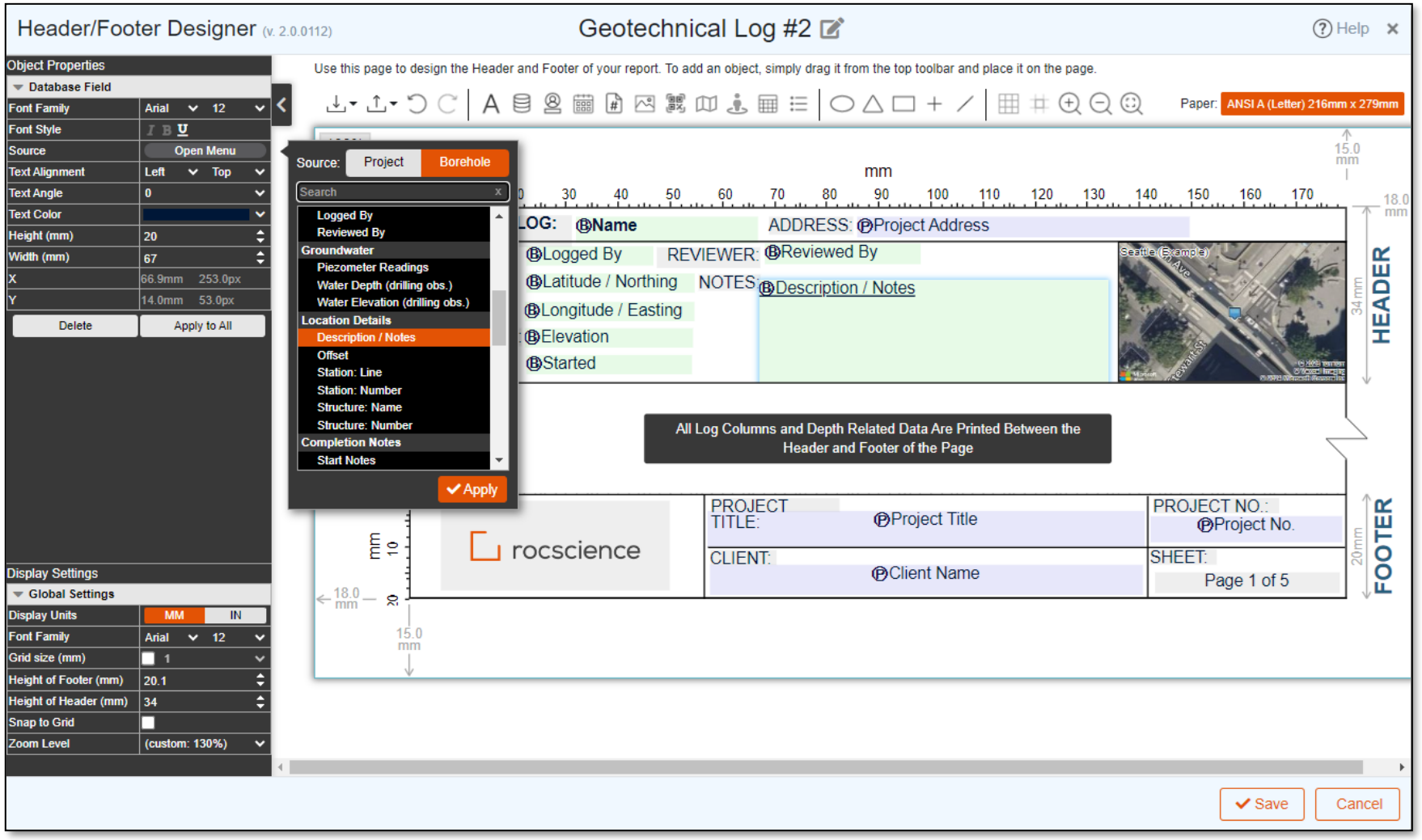

Figure 11: Header/Footer designer for borehole log template design.

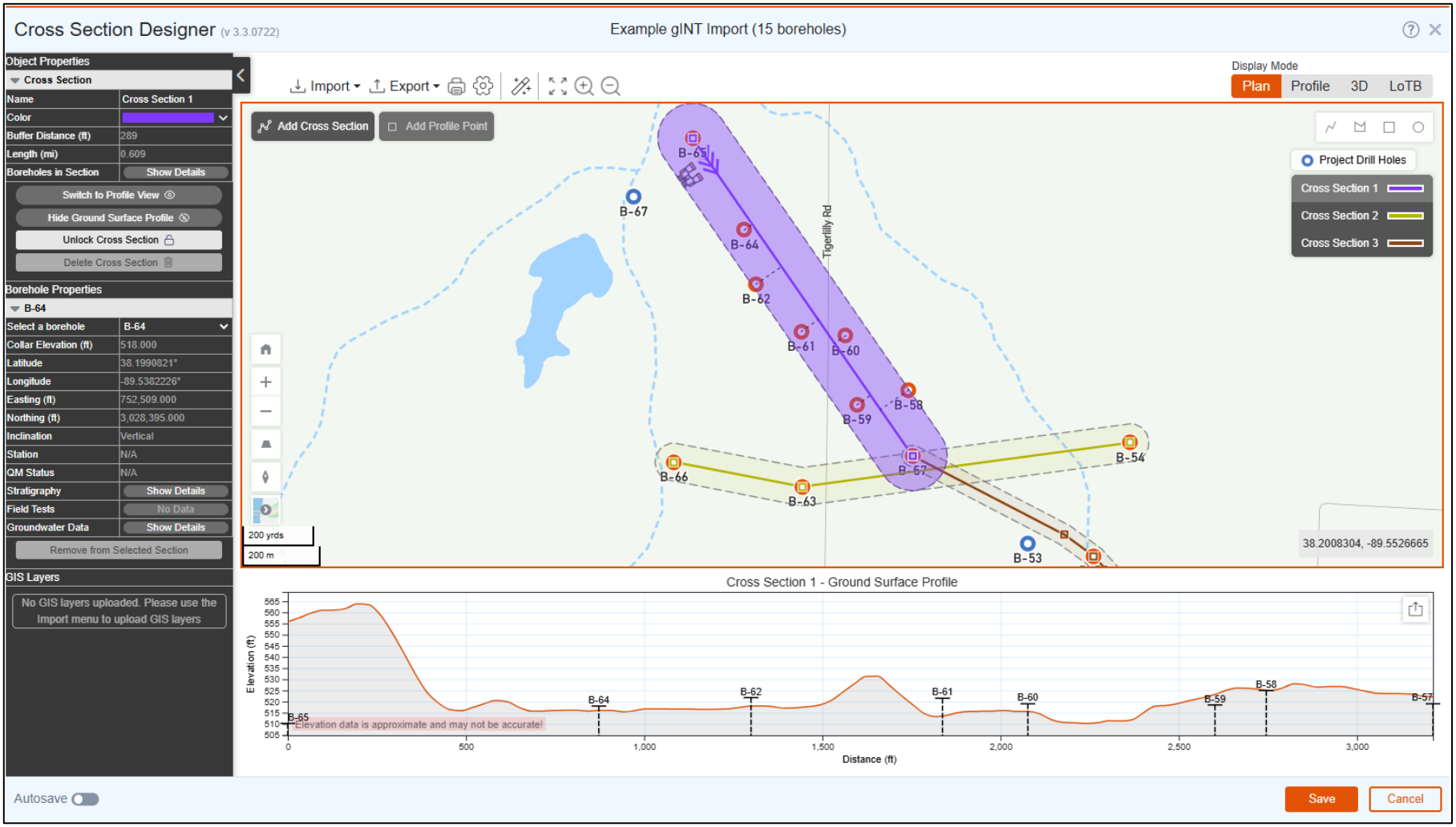

Figure 12: Cross-section designer module in Plan mode.

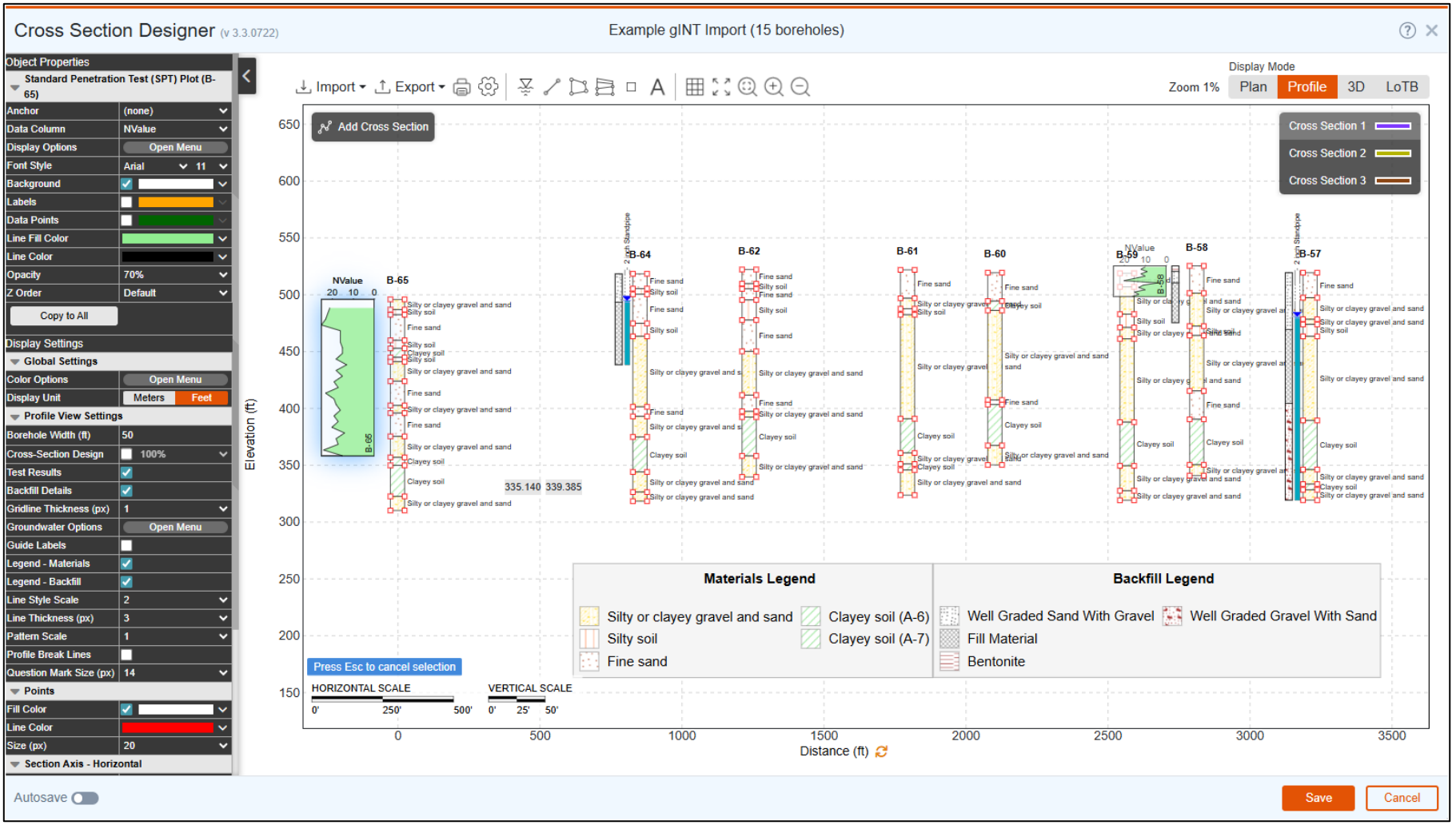

Figure 13: Cross-section designer module in Profile mode (stick logs).

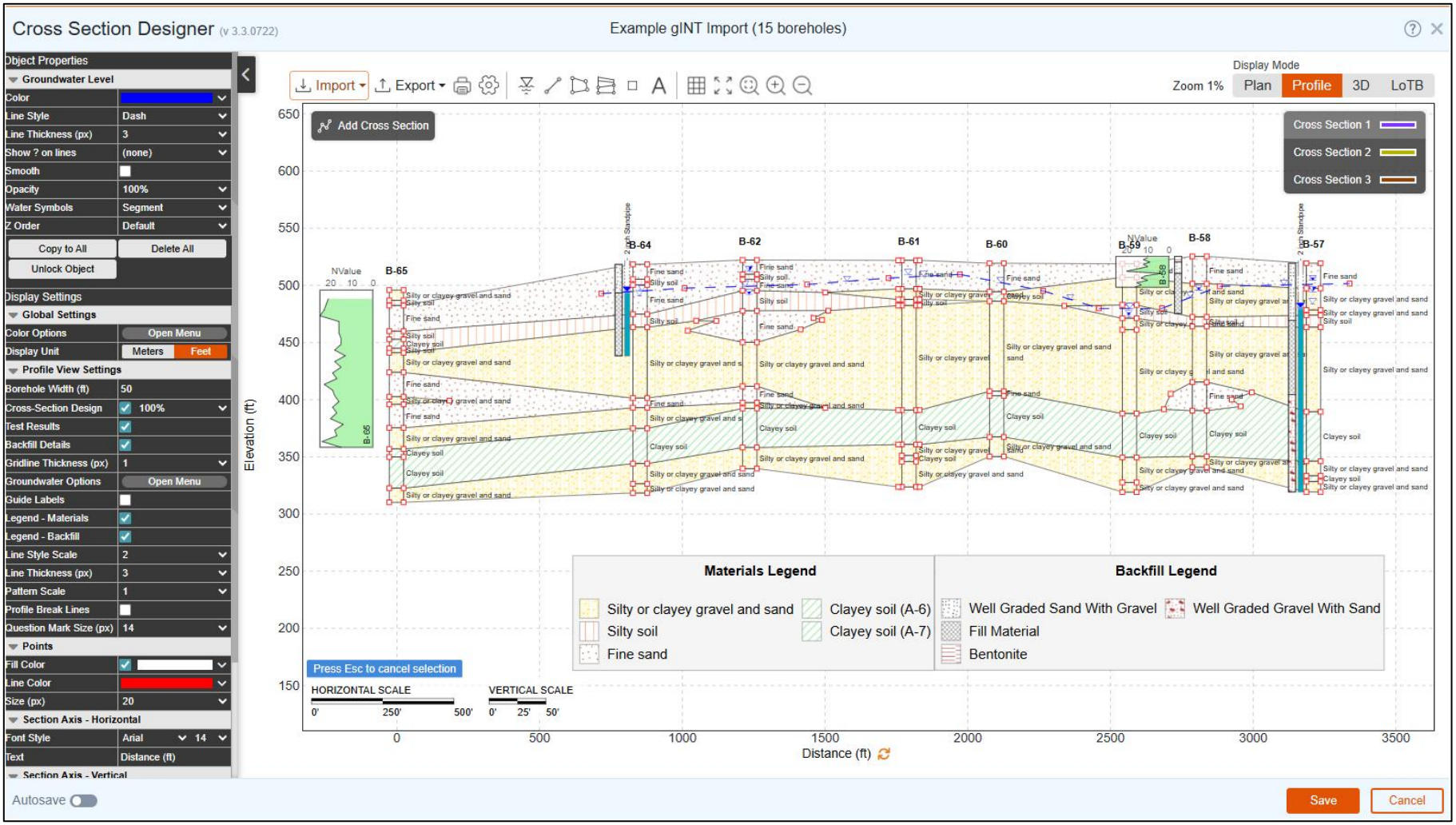

Figure 14: Cross-section designer module in Profile view (showing stratigraphy).

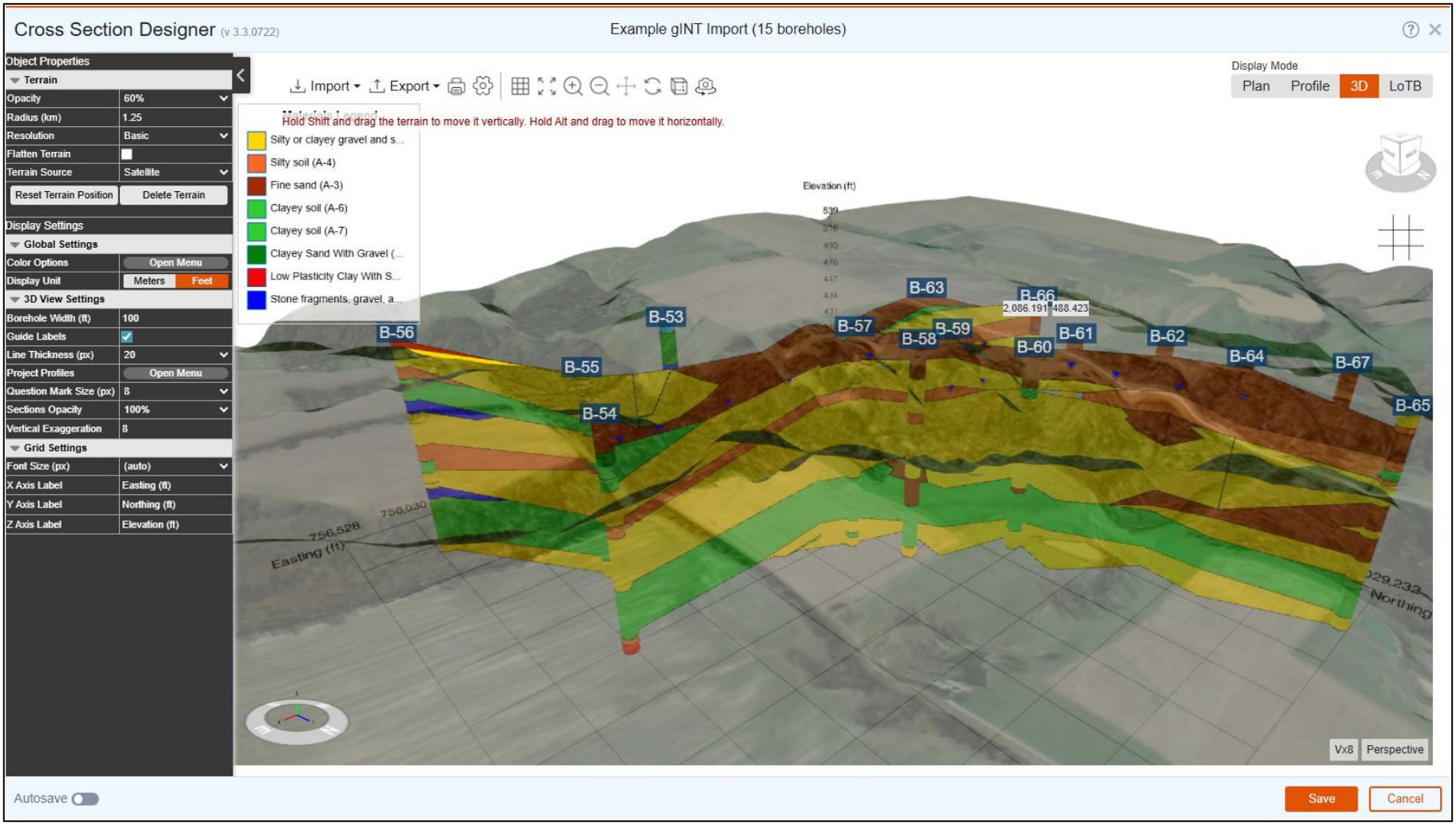

Figure 15: Cross-section designer module in 3D mode.

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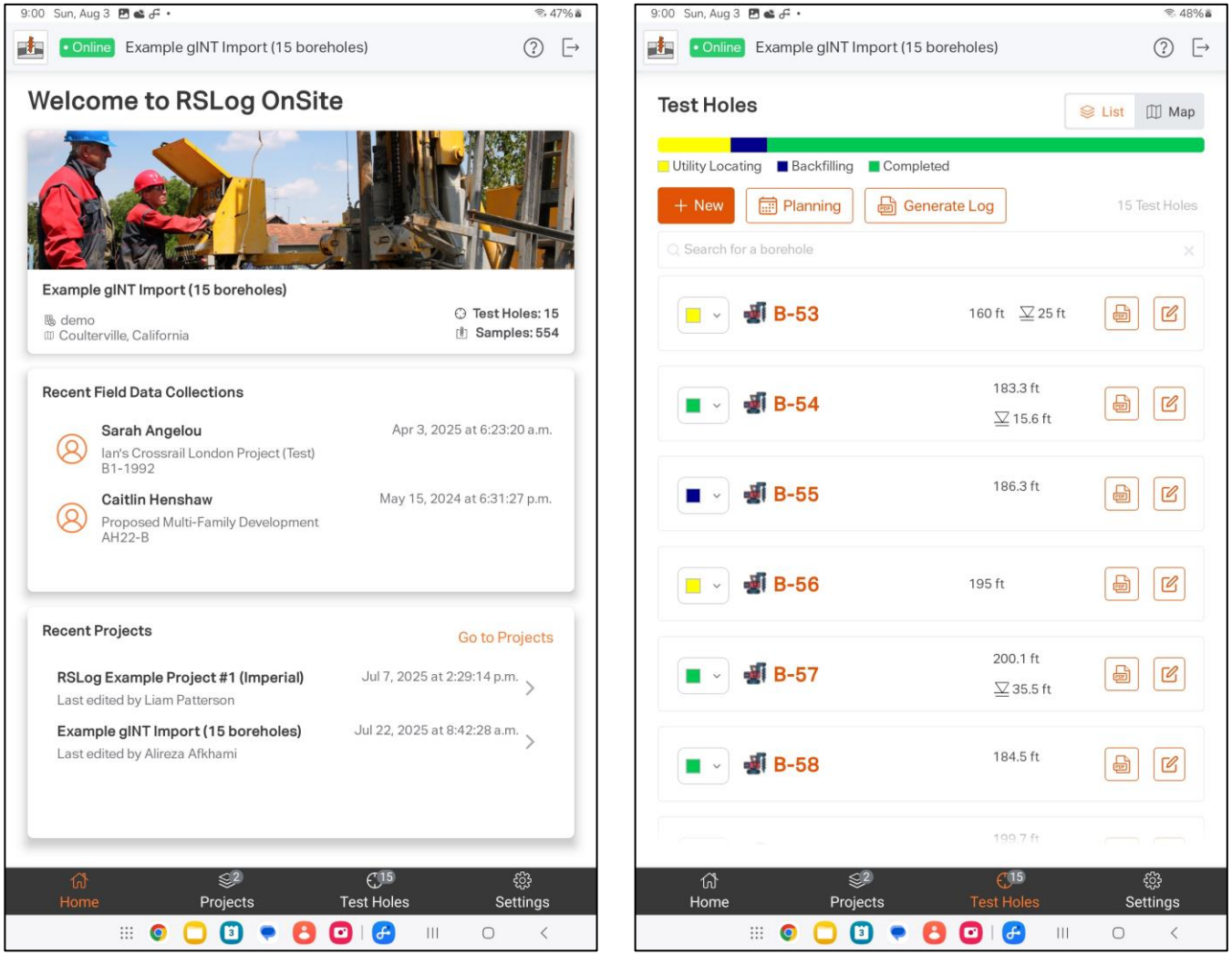

Figure 16: **OnSite** app (iOS/Android): home page (left) and list of boreholes (right).

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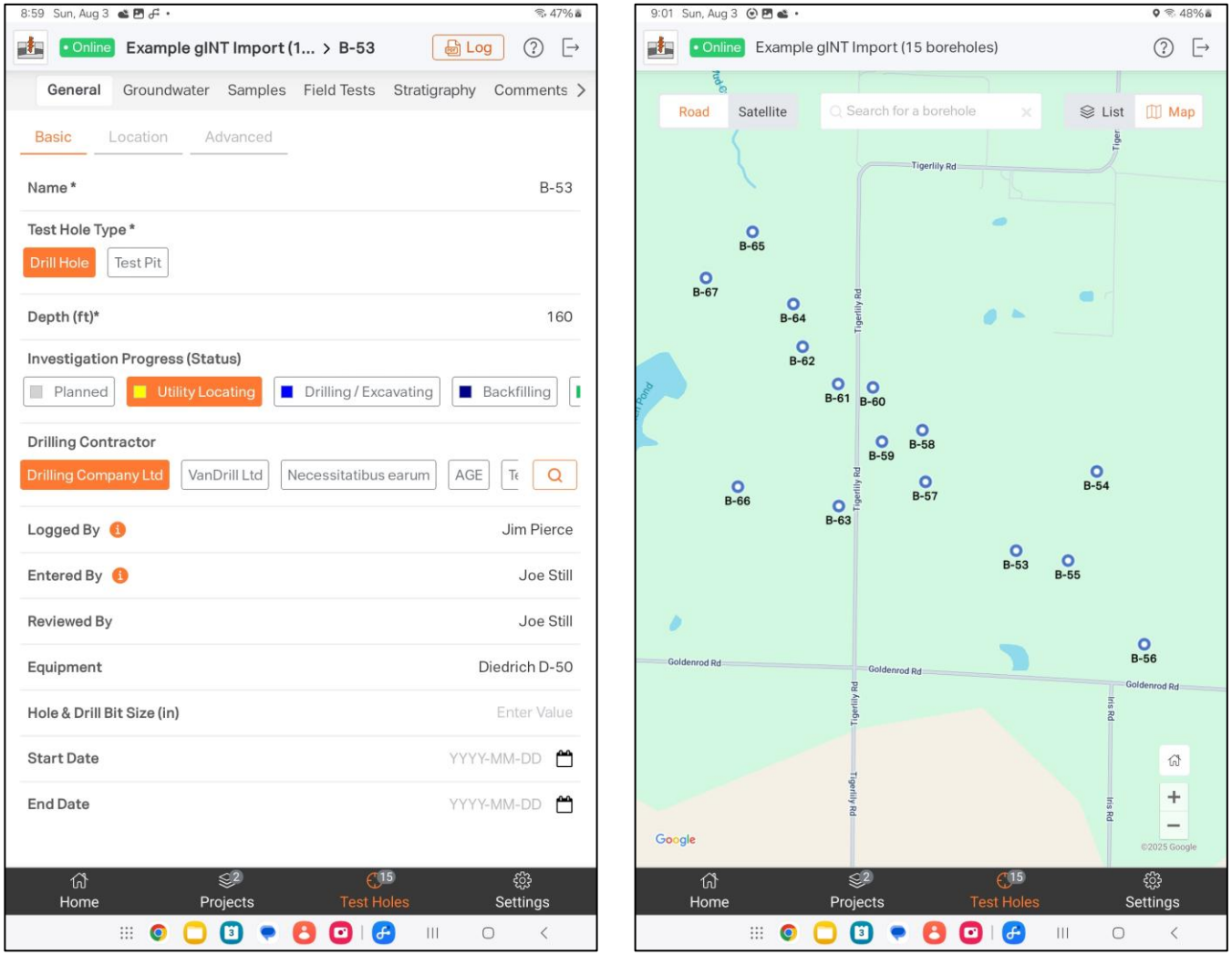

Figure 17: **OnSite** app (iOS/Android): borehole data entry (left) and map of boreholes (right).

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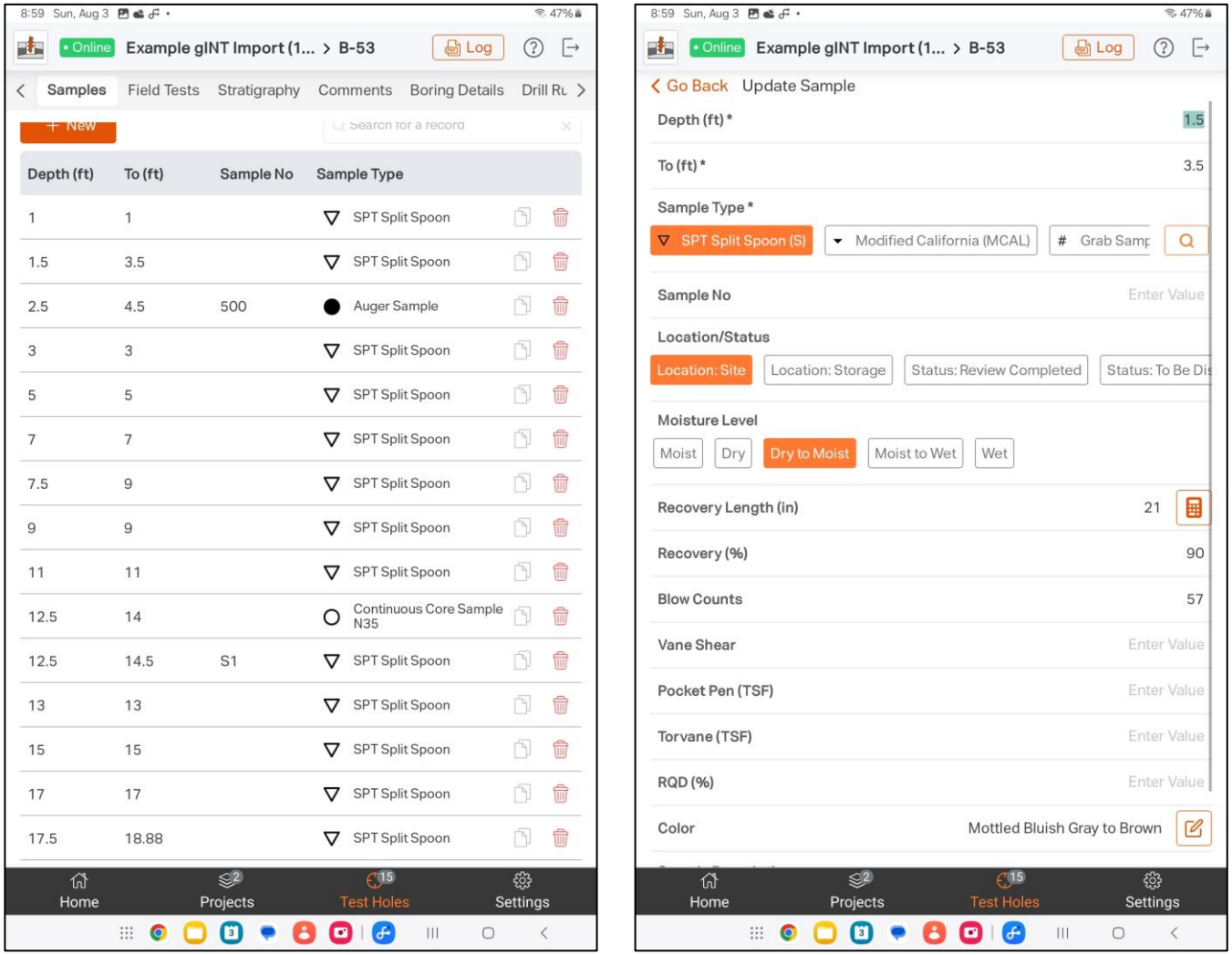

Figure 18: **OnSite** app (iOS/Android): list of samples (left) and sample data entry page (right).