User Guide: SpillGuard
(flood monitoring system for sewers).

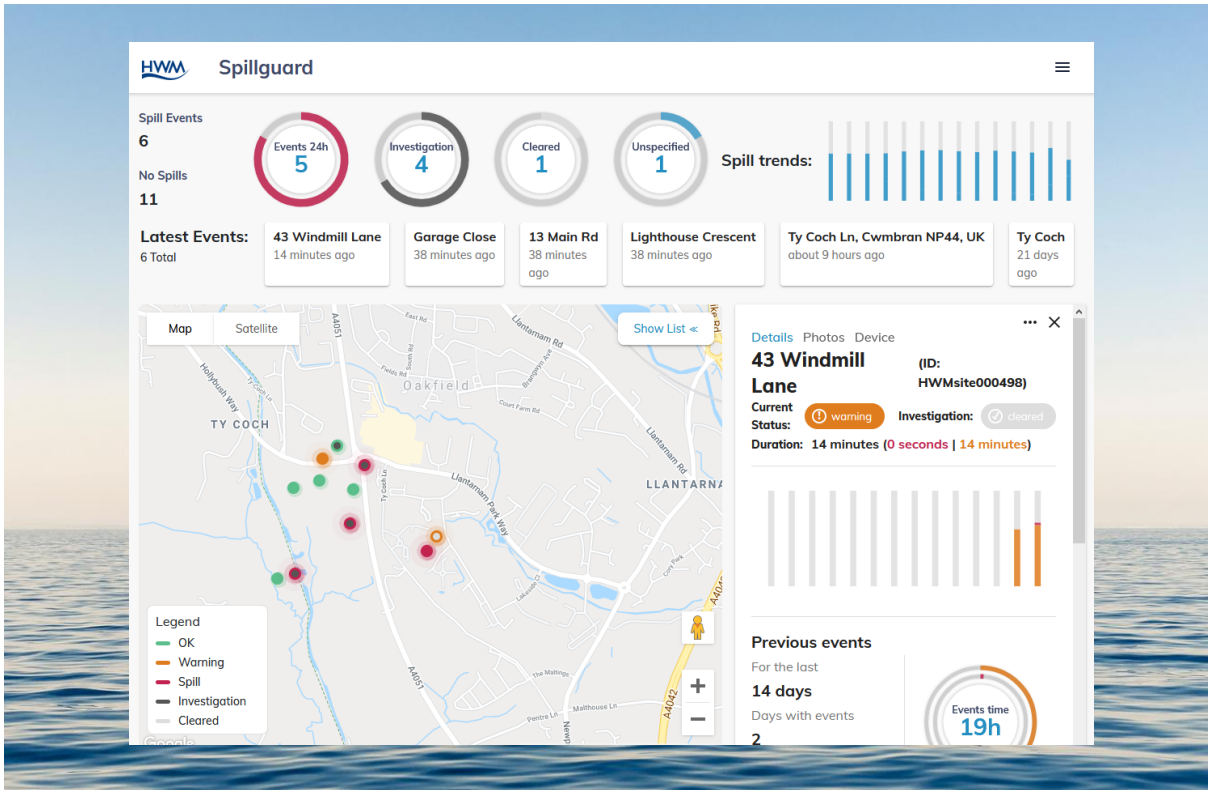


TABLE OF CONTENTS

1 Introduction 4

1.1 Documentation and Technical support 4

2 Overview of SpillGuard (spillage warning system) 5

2.1 Sensors 5

2.1.1 SpillSens 5

2.2 Loggers 5

2.3 System Server 6

2.3.1 SpillGuard Portal 6

2.3.2 Server administration 6

3 Using SpillGuard 7

3.1 Log into the SpillGuard system 7

3.2 Exploring the Map page (SpillGuard main page) 8

3.3 Site icon colour-code scheme 11

3.4 Operation of the system (Map page) 12

3.5 Terminology 14

3.6 Operation of the Dashboard 15

3.6.1 Dashboard display updates 15

3.6.2 Latest Events: Total counter 16

3.6.3 Latest Events: Event tiles 16

3.6.4 Live Sensor data: Spill Events counter 17

3.6.5 Live Sensor data: No Spills counter 17

3.6.6 Events 24h instrument 18

3.6.7 Investigation Tracking: Unspecified instrument 19

3.6.8 Investigation Tracking: Investigation instrument 20

3.6.9 Investigation Tracking: Cleared instrument 21

3.6.10 Spill trends graph 23

3.7 Controls within the Map Page 24

4 Driving the SpillGuard system 26

4.1 Map Icon controls 26

4.2 Finding sites that require attention 27

4.3 Viewing the List of Sites panel 28

4.4 Viewing Site details 32
4.4.1 Site: Live status indicators and controls 33
4.4.2 Site: 14-Day summary indicators and instruments 34
4.4.3 Site: Event history 37
4.4.4 Site: Photos 38
4.4.5 Site: Logger Device details 38
4.5 Tracking an Investigation. 39
4.6 Dashboard instruments (re-visited) 42
4.7 Investigation History: Event Notes 46
4.7.1 Adding a Note 46
4.7.2 Viewing notes for the current event 47
4.7.3 Viewing notes for previous events 48
5 Sending messages from SpillGuard (Alarm Subscription) 50
5.1 Overview 50
5.2 Starting and ending subscriptions 51
5.2.1 Subscribing to messages from individual sites 51
5.2.2 Subscribing to messages from all available sites 52
5.2.3 Ending subscription to messages from all available sites 52
5.2.4 Ending subscription to messages from individual sites 53

1 INTRODUCTION

1.1 DOCUMENTATION AND TECHNICAL SUPPORT

The manual introduces the reader to the SpillGuard portal of the HWM DataGate system.

This manual introduces users to the system in order for them to use it, but does not cover system administration, which is dealt with in a separate administration manual; Refer to MAN-3000-0002.

The majority of SpillGuard features are available for every user; if a feature is visible only with an 'administrator' account, this is highlighted in this guide. Please check with your system administrator to verify your access privilege (a regular user or an administrator).

Note: The system periodically has new features and updates released, thus you may observe slight changes in layout from those shown in this manual. Additionally, views can vary depending on what user-role you have been given and its permissions.

HWM provides limited in-situ support of SpillGuard by means of tool-tips or hints that may appear when hovering your mouse over certain controls or fields.

On-line help pages are also available from our support webpages:

https://www.hwmglobal.com/help-and-downloads/

Should you have any questions that are not covered by this manual or the system's online help, please contact the HWM Technical Support team on +44 (0) 1633 489479, or email cservice@hwm-water.com

2 OVERVIEW OF SPILLGUARD (SPILLAGE WARNING SYSTEM)

SpillGuard is one component of a wastewater spillage warning system provided by HWM-Water.

The system relies on **sensors** within the sewer system that detect when water levels are higher than expected, which could indicate that a sewer is obstructed and unable to operate correctly. The sensors are installed at various **sites**. They are connected to equipment known as a **logger device**. The logger device monitors the sensor and can send the measurement **data** and **messages** to a dedicated **server**. The server is also able to generate **webpages** for authorised users to view details of the current state of the sewer network. The server also allows **alarm** messages to be sent to users whenever a spill occurs, freeing them to get on with other tasks without missing events; the SpillGuard portal can be used to obtain further details whenever needed.

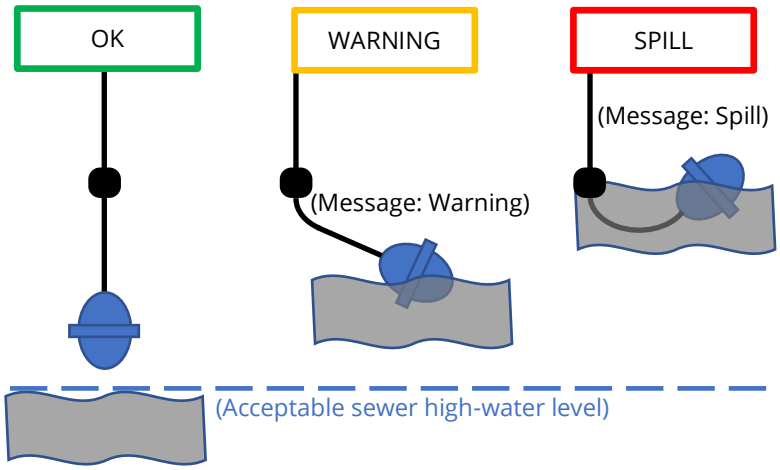
This manual gives an overview of the following aspects of the system:

- Sensors
- Messages into the system server
- Use of the system
- Web-pages – guide to content and instrumentation
- Icons
- Subscribing to receive messages from the system when events occur.

2.1 SENSORS

2.1.1 SpillSens

SpillSens is the name of a sensor used by the system.
It is a small float that is suspended, by a weighted cable, above the regular high-water level of a sewer.
If the water rises above this level it floats; the higher the water, the greater its angle.



2.2 LOGGERS

A logger is installed with the sensor. It monitors the sensor and sends messages to the server at specific angles. There are two angles programmed, hence it is able to provide a message giving an early “warning” alarm of a potential flood and then, later, a more severe “spill“ alarm message. It similarly sends end-of-spill-alarm and end-of-warning-alarm messages when the water falls, as the float returns towards its normal (OK) position.

2.3 SYSTEM SERVER

The system server receives messages and data from each site. It also allows a user to log into a website and use the system for one of the following purposes:

- Monitoring the sewer system.
- Administration of the system including:
    - Configuration of the system for use and the setup of devices.
    - Progressing the investigation of a site that has flooded.

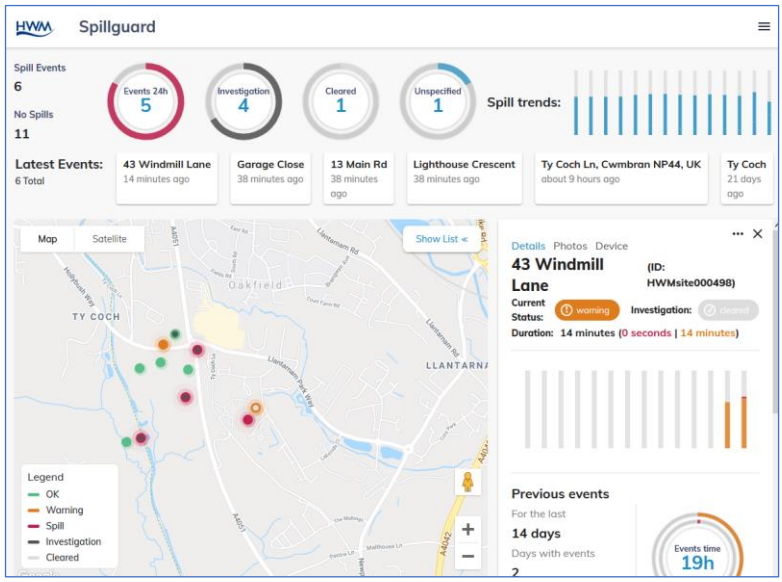
The server supports two separate user-roles for the above:

- **User**. (Use this manual for guidance).
  Regular users will use the system viewing portal, called SpillGuard.
- **Administrator**. (See also the guide for SpillGuard Administration, MAN-3000-0002).
  An installation technician may use a mobile-phone app that can handle some of the system administration whilst sensors and loggers are being installed; refer to the logger manual.
  All other settings will need to be carried out by an administrator.

Each user must log into the system using their allocated username and password.

2.3.1 SpillGuard Portal

The SpillGuard system provides various views into the current working state of the sewer network, including indicating sites where flood events are at risk of occurring, or have occurred. It is shown opposite.



- Users of the type “User” have access rights that are mainly read-only.
- Users of the type “Administrator” have additional access rights that make additional features available.

2.3.2 Server administration

Server administration is carried out by an administrator. Details are not provided here, but in the separate manual for SpillGuard administration.

3 USING SPILLGUARD

The SpillGuard website can be used from devices that support a standard web-browser. The system attempts to re-size items on pages to accommodate the available window size, sometimes collapsing items into a "button" when space becomes severely restricted. It is best viewed using a PC with a high-resolution display, at maximum window size.

Note: Images in this guide are produced using a PC with web-browser. The images you experience may change due to the device you are using.

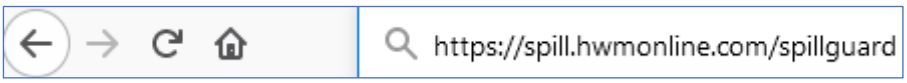
Control of the system when using a PC can be made with a keyboard and mouse.
For other devices, use the methods commonly available on the device user-interface (e.g. tap the screen instead of a mouse-click; move the screen area by swiping your finger instead of using the mouse with scrollbars).

3.1 LOG INTO THE SPILLGUARD SYSTEM

To use SpillGuard, a user must first log into the system. This provides the user's device with temporary access. After some time, or if the system is not being used, the user will be automatically logged out and will need to log back in again. This is a security measure and is normal operation.

Note: There are multiple servers in operation for SpillGuard and DataGate.
Refer to your sales contact to obtain details of *your server address or URL*.
The URLs (webpage links) used in this manual may not apply to you, so the URL you enter should be modified to match your particular server.

Open your web-browser and type the following URL (or your assigned URL) into the address-bar: e.g. https://spill.hwmonline.com/spillguard ; Then hit the return button.

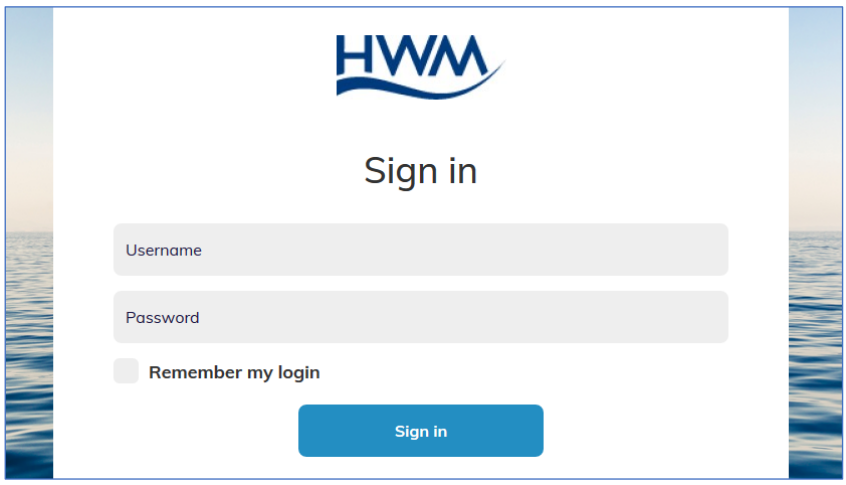


The server may re-direct you to another webpage, which is from an identity server.

You need to identify yourself using your assigned username and password.

Then click on "Sign In".

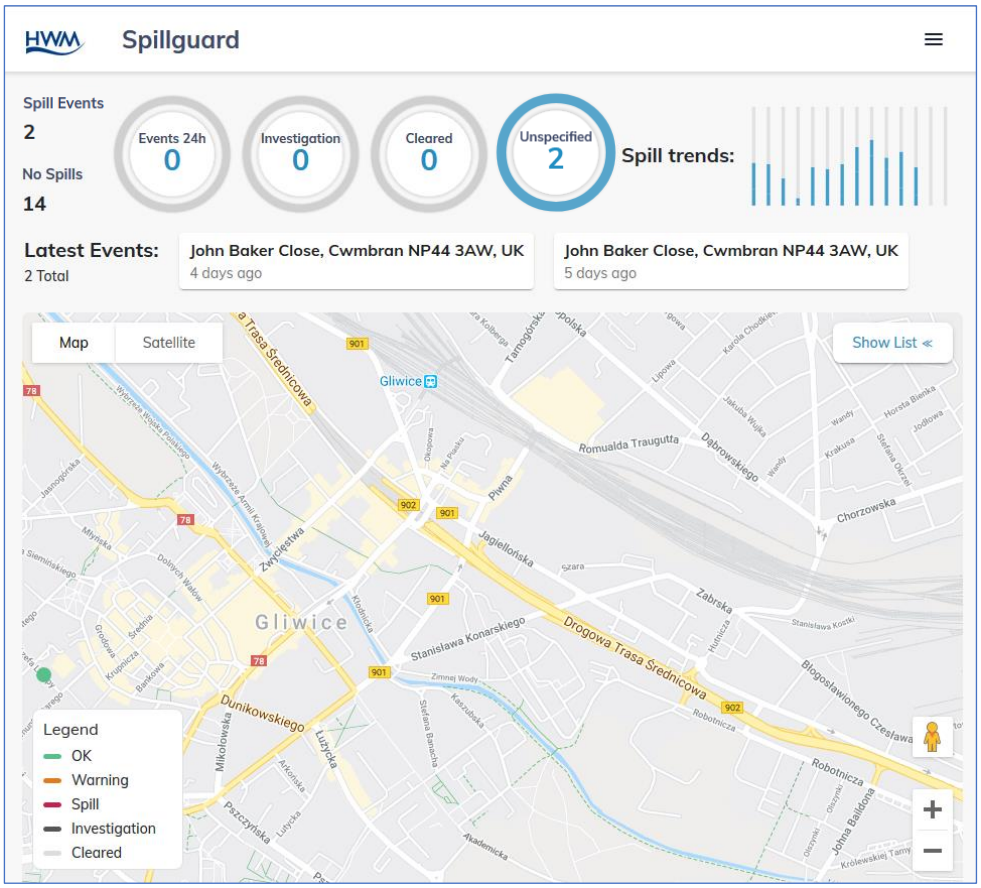
After a successful login, you will arrive at the SpillGuard main page.



3.2 EXPLORING THE MAP PAGE (SPILLGUARD MAIN PAGE)

The SpillGuard main page is shown opposite. It is sometimes called the "map page".

The map area is provided using a 3rd party map services provider, which the user may already be familiar with. It has controls to switch between a traditional map image and a satellite image.

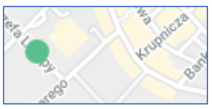


The map responds to various controls:

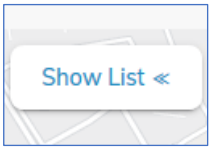
- To zoom in or out use the on-screen + / - controls. The scroll-wheel of the mouse can also be used for this purpose.
- Click on the map and move the mouse with the button held down to show another area within the map.

There is a key, titled "Legend". SpillGuard will over-lay information onto the map which shows the location of sites and a status indication of each site, colour coded as per this key.

Only one site location is shown here, with a status of "OK" (the green circle).



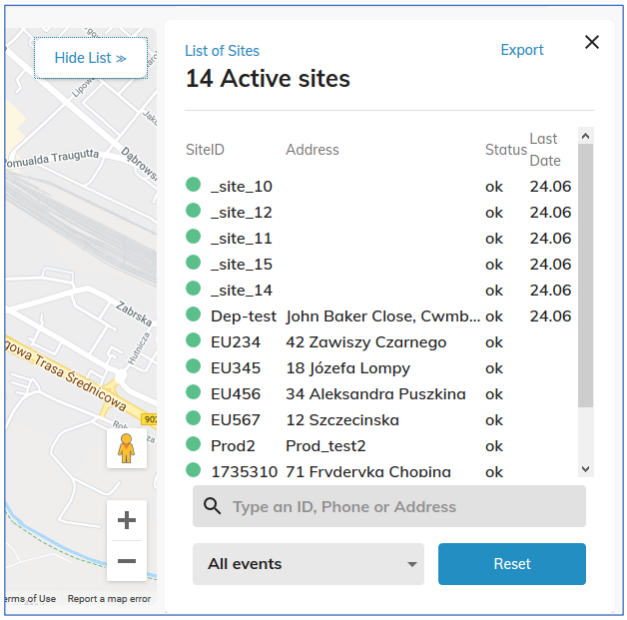
Additional information pages are available, but not presented in full. e.g. The "Show List <<" control is overlaid onto the map (see opposite).



Clicking on one of these controls will reveal additional information as a pop-out panel, or page, which can later be closed or collapsed so it is once more shown as the button control.

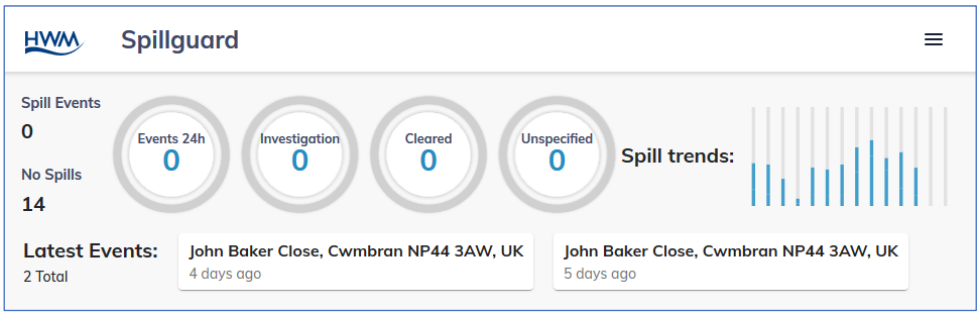
An example is shown opposite.

Clicking the “Show List <<” control produces a pop-out panel which covers part of the map area. It lists of all the sites available within this account.

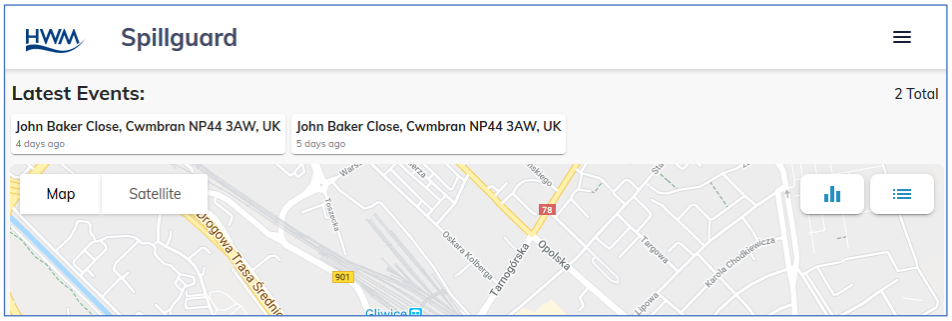


Click the “Hide List >>” button to collapse the displayed information and return to the full map area that was previously displayed. Alternatively, click on the panel’s close control, “X”.

The top of the page is known as the “dashboard” area.

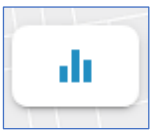


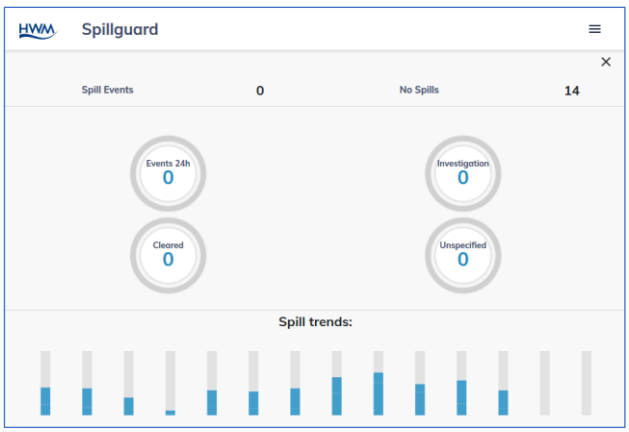
If the page is insufficiently wide, the dash-board area automatically collapses and becomes accessible by using a button control.



Click on the button shown to display the graphical information on its own page.

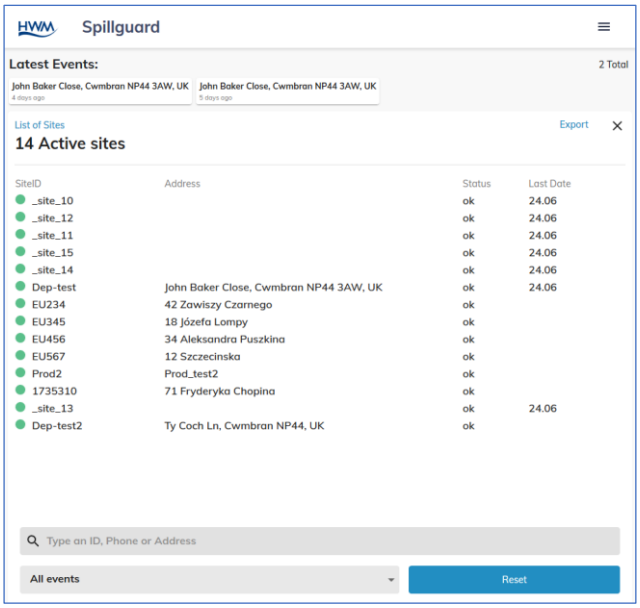
(Only available on small screens).





Click on the button shown to display the Latest Events tiles and a list of sites on its own page.

(Only available on small screens).



The map area, as described earlier, shows the location of sites on the sewer network which are being monitored.

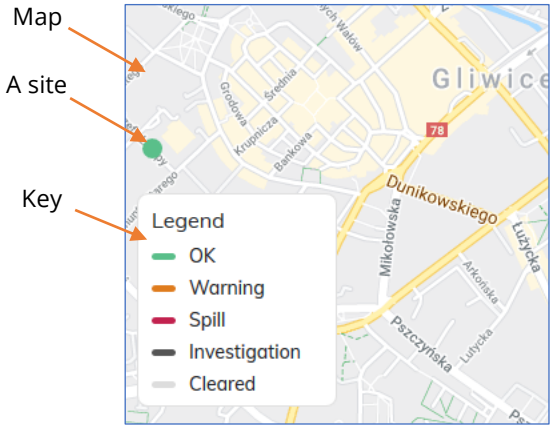
The key shows a colour code, but is actually used for encoding two separate aspects of the site:

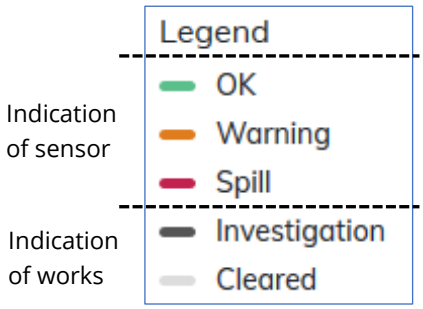
- Site Status (the sensor indication).
- Site Investigation status (the stage of any maintenance works).

This is illustrated opposite.

Site Status is discussed in sections 3.3, 3.4 and 4.4.

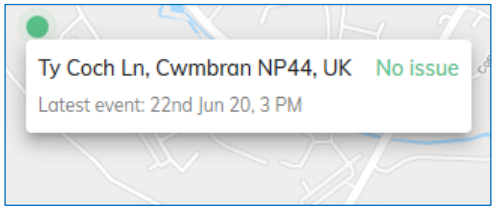
Site Investigation is discussed in section 4.5.





The site locations are shown as icons on the map with the appropriate colour-code. The icons can have some animation, if appropriate, in order to draw attention to any sites that are showing signs of flooding occurring. Sites that are “OK” have subtle animation in order to distinguish them as a SpillGuard site rather than a map feature.

Hovering the mouse over the site icon will show a pop-up information box until the mouse is moved away. The box contains some information about the site.

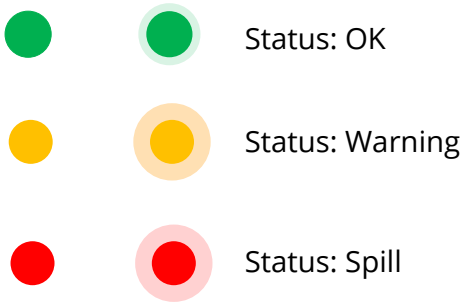


3.3 SITE ICON COLOUR-CODE SCHEME

Refer to the end of the previous section regarding the colour-code key on the map.

As described in section 2.2, the logger sends in messages whenever water is rising past both a first and then a second (higher) level. It similarly sends in messages when it has just gone below these levels. These messages provide an indication of the site flood status, which the system uses to form one part of the icon colour encoding.
The Map view has animated icons. Elsewhere (e.g. lists), the icons are not animated.

The icons are shown below (basic colour with some animated outer rings).



Status: OK

Status: Warning

Status: Spill

There is a very subtle animation with the green colour icon since it indicates an "OK" situation; the other icons have a more pronounced animation to attract more attention to themselves.

The above colour-codes reflect the basic scheme for the site sensor status. An additional piece of information (the site "investigation stage") is also encoded into the visual appearance of the icon. This takes the form of a black dot or a grey dot being *absent from* or *added to* the basic icons shown above. For example:

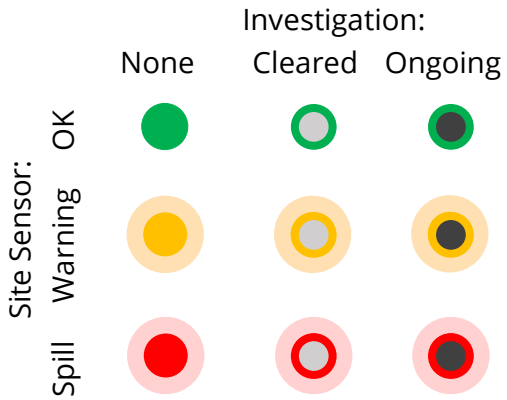
Investigation Stage: No recent investigation (none).

Investigation Stage: Investigation is active (ongoing).

Investigation Stage: Investigation has completed recently (cleared).

(Note: The above example for a green icon will similarly apply to the amber and red icons).

The entire set of icons, encoding both the site sensor status and also the investigation status is shown opposite.



3.4 Operation of the system (Map page)

The map page shows a region of map area, but not necessarily an area that includes all of the available sites. The user can use the zoom and other controls to set the map area to a position and zoom-level that suits themselves. The system does not change the map scale or re-position the viewed area without some interaction from the user, for example by clicking on a control.

The site icons operate **without** manual intervention as follows:

When a site is OK, it is shown with a green icon.

If a sewer blocks, water will begin to rise. Shortly after, the site's sensor begins to float, and the logger will send a message into the SpillGuard system for a "warning" condition. SpillGuard will:

Change the icon of the site to one which indicates a warning condition, complete with icon animation.

If the sewer water continues to rise, the sensor detects the higher water level and the logger will send a message into the SpillGuard system for a "spill" condition. SpillGuard will:

Change the icon of the site to one which indicates a warning condition, complete with icon animation.

If the sewer water starts to fall (e.g. maybe there is less demand placed on it, and the sewer is only partially blocked), the sensor detects the level has dropped below the higher water level threshold. The logger will send a message into the SpillGuard system to cancel the "spill" condition.
SpillGuard will:

Drop back to the earlier "warning" condition. It will change the icon of the site to one which indicates a warning, complete with icon animation.

If the sewer water continues to fall, the sensor detects the level has dropped below the lower water level threshold. The logger will send a message into the SpillGuard system to cancel the "warning" condition.
SpillGuard will:

Drop back to the regular "OK" condition. It will change the icon of the site to one which indicates an OK condition.

The site icons operate **with** manual intervention as follows:

When a site is OK, it is shown with a green icon.

If a sewer blocks, water will begin to rise. Shortly after the site's sensor begins to float the logger will send a message into the SpillGuard system for a "warning" condition. SpillGuard will:

Change the icon of the site to one which indicates a warning condition, complete with icon animation.

If the sewer water continues to rise, the sensor detects the higher water level and the logger will send a message into the SpillGuard system for a "spill" condition. SpillGuard will:

Change the icon of the site to one which indicates a warning condition, complete with icon animation.

A user of the type "administrator" may decide to progress the site through an investigation for removal of any blockage (partial or total). They can do this only whilst the site indicates either a warning or spill condition. Refer also to section 4.5 for how to do this.

The site icon will change to have a black center when the investigation is in progress. (Icon animation continues).

When the blockage is being cleared by the investigating team, an "administrator" user of the system can progress the investigation to show the problem *should be* cleared; the site should be draining. As the water level falls, the sensor detects changes, and the system receives messages to inform of this; an indication of Spill may change to Warning as the site continues to drain. The icon remains coloured grey in its center for up to 24 hours, showing that work has been done. If a new event begins during this time, the site is removed from being in the clearing stage and put back into normal operation (the icon will have the grey center removed).

Soon the site returns to an OK condition, with the sensor no longer floating. The system automatically removes a grey center after 24 hours.

Unless SpillGuard is being constantly monitored, an event may go un-noticed visually:

- An event tile can be shifted off-screen by newer events
- Where a partial blockage exists, icons can change through the cycle of green to red (when flooded due to a water surge) and then back to green (when the site has self-drained). This is particularly likely during heavy storms.

The system is designed mainly to indicate ***live conditions*** within the sewage network. It therefore does not expect a user to acknowledge every event it detects and decide on the appropriate action (investigate or dismiss). All recent events can however still be found by using the site list and an the assistance of an appropriate filter (e.g. "Events in the last 24 hours"; Refer to section 4.3).
Additionally, if the site has been included in alarm subscriptions each event will cause an alarm and the alarm will be forwarded to the user (see section 5). This occurs independent of the user being logged into or using the system web portal.

3.5 TERMINOLOGY

Sites can have "states", "events", and "maintenance stages", as explained below:

The **state** of a site refers to the sensor indication of a site. It can be one of the following:

- "OK". This the regular condition of the site when operating normally.
- "Warning" or "Spill". Both indicate an irregular condition of a site, indicating a possible flood problem.

The **maintenance stage** of a site refers to whether a site is:

- Operating normally (no maintenance stage exists), or
- Has a flood detected but no action is yet taken (a maintenance stage of "**new**", also known as "**unspecified**"), or
- A flood has been now been actioned for investigation (progressed to a maintenance stage of "**investigation**", also known as "**ongoing**") or
- A flood that was "ongoing" has now had work completed and should now be draining (progressed to a maintenance of "**Cleared**").

An **event** *begins* when the system receives a message from a logger (installed on a site) informing that a sensor, which previously indicated an OK water level, has just changed to indicate either a warning or spill condition; this **starts an event**.

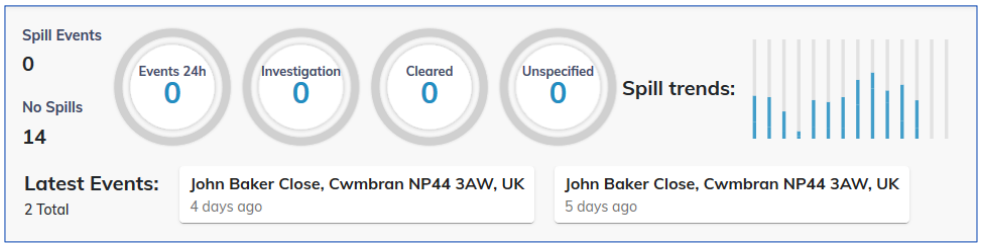
An **event** *ends* when the system receives a message from a logger (installed on a site) informing that a sensor, which previously indicated a high water level, has just changed to indicate an OK water level; this **ends an event**.

Thus, an event begins when high water is first detected and ends when high water is no longer detected; from start to end it is regarded as the same single event. It can be referred to as an "event" irrespective of whether it is completed or is still ongoing; To distinguish between the two conditions an additional terminology is introduced…

An "***active event***" is where the site *still has* unexpectedly high water detected. The event has started, but not ended; it is ongoing.

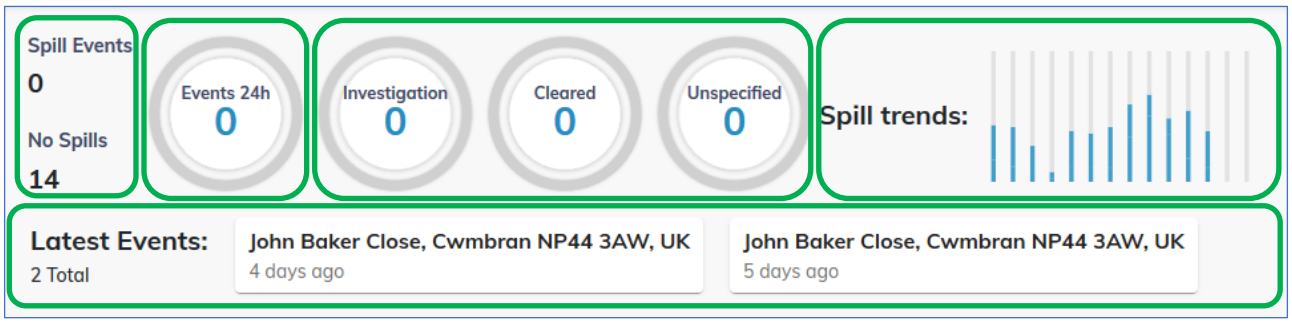
3.6 Operation of the Dashboard

The dashboard is shown opposite.



It is comprised of several instruments and information displays, discussed in later sections. The dashboard provides an overview of the system including spill trends.

The dashboard can be considered to be divided into areas dealing with different types of data, as below.



Explanations of each area and its content follow (later in this section).

3.6.1 Dashboard display updates

The instruments within the dashboard area show no data when the map page initially loads. Within a few seconds data is obtained from the system and the instruments display correctly; this is normal operation.

The instrument display remains unchanged unless one of the following occurs:

- The user triggers a page refresh using a browser control.
- A logger sends in a message indicating the start of a new event at a site.
- A logger sends in a message indicating the end of an active event at a site.
- A logger sends in a message indicating a change in water level at a site (warning to spill, or spill to warning).

The operation of the instruments is independent of the number of sites currently viewed within the map area.

Dashboard updates are also discussed in section 4.6.

3.6.2 Latest Events: Total counter

There is a "Total" field in the "Latest Events" area. This is a counter, which displays a quantity of *sites*. It shows the number of sites that have an active event (i.e. the data from the sensor on the site is currently detecting high water).

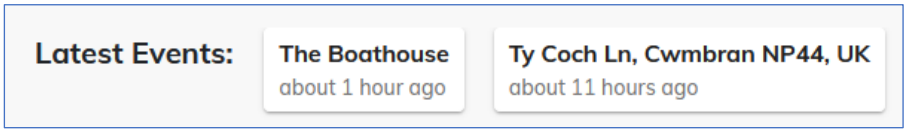
Counter Operation:

The system looks at the latest sensor data for all available sites and counts the number of sites where the data indicates an active event (detection of a high water level).

(The operation is effectively the same as the Spill Events counter, described in section 3.6.4).

3.6.3 Latest Events: Event tiles

Next to the "Latest Events" counter, there is an area which shows a set of **event tiles**. Each tile shows a site address and the time since the start of the currently active event.



- A tile is added to the left when a new event occurs, shifting existing tiles to the right.
- A tile is removed when its displayed event ends (i.e. the water has drained away).

In theory, there could be as many event tiles shown as the number of events displayed in the "total" counter. The system makes best use of the available area by shrinking tile-width wherever possible. It also selects the most appropriate events for display, but other events may exist.

Event tiles are produced as follows:

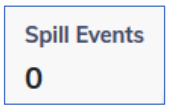
> The system selects sites that currently have an active event. It sorts this list of sites using the time when each of the current events began; most recent first. Tiles are then produced according to the ordering of the list.

- Sites with the most recent event *start-time* appear on the left.
- Sites with less recent ones are progressively listed to the right, as space allows.
- A displayed tile is deleted if the event ends (i.e. the site has drained).
  (To find such sites an alternative method must be used; refer to section 4.2).

There is *no change* to an event tile for any the following:

- Changing the investigation stage of any site.
- A site changing between the spill and warning states.

3.6.4 Live Sensor data: Spill Events counter



The dashboard includes a "Spill Events" counter, giving *live data* on the status of sites. It shows the current number of sites with ***possible flooding***.

i.e. Their sensors are detecting water at either the lower or higher levels (a warning or spill indication); an event is currently active.

3.6.5 Live Sensor data: No Spills counter

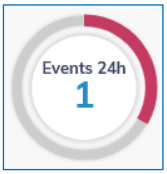
The dashboard includes a "No Spills" counter, giving *live data* on the status of sites. It shows the current number of sites with ***no flooding***.

i.e. Their sensors are not detecting water at either the lower or higher levels; water is absent; no currently active event exists.

Note: The total number of available sites can be found by adding together the values from both the counters just described.
(i.e. Total number of sites = Spill Events counter value + No Spills counter value)

3.6.6 Events 24h instrument

The **inside** of the instrument is a counter. The **outside** of the instrument is a donut graph.



Counter Operation:

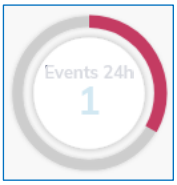
The counter does not represent a quantity of events, but a quantity of sites. It displays the total number of sites that currently have an active event, but only if the event *started* within the in the past 24 hours.

If a site has a flood which started within the 24-hour period, but subsequently the site has drained, it is no longer included in the count; the event is no longer active.

Changing the investigation stage of a site does not affect this counter.

Donut graph operation:

The **outside** of the "Events 24h" instrument is a donut graph.



The donut graph does not represent a quantity of events, but a quantity of sites. More precisely, it shows a *fraction* based on quantities of sites.

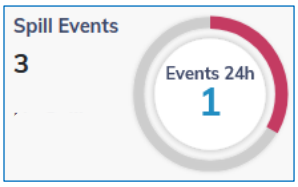
It is the ratio of $\frac{\text{Number of sites listed by the Events 24h counter}}{\text{Number of sites listed by the live Spill Events counter}}$

Note: A fraction of 0/0 is defined as 0 for this instrument; no part of the ring is filled.

The purpose of the donut graph is to give a ratio for *sites with currently active events*: Those active events occurring within the last 24hours ***vs*** total number of active events.

Example:

The diagram opposite shows there are 3 sites that have currently active events, but only 1 of those sites had an event which started in the past 24 hours. Therefore 1/3 of the donut graph ring is illuminated.



3.6.7 Investigation Tracking: Unspecified instrument

The **inside** of the instrument is a counter. The **outside** of the instrument is a donut graph.

Counter Operation:

The counter displays the total number of sites that have a currently active event, but which have not been progressed by an administrator into any stage of an investigation.
These sites are specified by the system as being at a stage of investigation called “new”.

The counter is updated:

- Whenever a message is received for a site indicating the beginning of a new event; the counter is incremented.
- Whenever an administrator changes one of the included sites so as to open an investigation; the counter is decremented.
- Whenever a message is received for one of the included sites indicating the end of an event; the counter is decremented.

Donut graph operation:

The **outside** of the “Investigation” instrument is a donut graph.

The donut graph represents a ratio based on quantity of sites.
More precisely, it shows a *fraction* based on quantities of sites.

It is the ratio of $\frac{\text{Number of sites listed by the Unspecified counter}}{\text{Number of sites listed by the live Spill Events counter}}$

Note: A fraction of 0/0 is defined as 0 for this instrument; no part of the ring is filled.

The purpose of the donut graph is to give a ratio for *sites with currently active events*:
Those that have *not been progressed to a stage of investigation or clearing* ***vs*** total.

Example:

The diagram opposite shows there are 3 sites that have currently active events, but 2 of those sites have not been progressed to an investigation or clearing stage. Therefore 2/3 of the donut graph ring is illuminated.

3.6.8 Investigation Tracking: Investigation instrument

The **inside** of the instrument is a counter. The **outside** of the instrument is a donut graph.

Counter Operation:

The counter represents a quantity of sites. It displays the total number of sites that have a currently active event, and which have been progressed by an administrator into an *investigation* stage. (i.e. A team has been requested to visit the site).

Sites are included in the count *only during an active event*; sites that have flooded and subsequently drained do not get shown in this count. Any site that drains whilst an investigation is still open results in the investigation stage automatically being closed.

The counter is updated:

- Whenever an administrator changes one of the sites so as to open an investigation; the counter is incremented.
- Whenever an administrator changes one of the included sites so as to clear an open investigation; the counter is decremented.
- Whenever a message is received for one of the included sites indicating the end of an event; the counter is decremented.

Donut graph operation:

The **outside** of the "Investigation" instrument is a donut graph.

The donut graph represents a ratio based on quantity of sites.
More precisely, it shows a *fraction* based on quantities of sites.

It is the ratio of $\frac{\text{Number of sites listed by the Investigation counter}}{\text{Number of sites listed by the live Spill Events counter}}$

Note: A fraction of 0/0 is defined as 0 for this instrument; no part of the ring is filled.

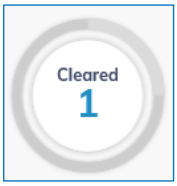
The purpose of the donut graph is to give a ratio for *sites with currently active events*:
Those that *have been progressed to the stage of investigation* ***vs*** total.

Example:

The diagram opposite shows there are 3 sites that have currently active events, and that 1 of those sites has been progressed to an investigation stage, but no further. Therefore 1/3 of the donut graph ring is illuminated.

3.6.9 Investigation Tracking: Cleared instrument

The **inside** of the instrument is a counter. The **outside** of the instrument is a donut graph.



Counter Operation:

The counter represents a quantity of sites. It displays the total number of sites which have been progressed by an administrator from a stage of "investigation" and into the stage of "cleared". (i.e. A team is in attendance at the site and has reported the blockage is cleared and that the site is draining).

Unlike the earlier described counters, this counter does not directly deal with live data and so requires an explanation, as follows:

- When a site is changed into the clearing stage, the counter is incremented. A timer is also started for the site, which usually keeps it in the "cleared" maintenance stage for the next 24 hours.
- A user of SpillGuard can (for the next 24 hours) visually monitor the site icon to confirm it reaches the OK state.
- After the 24 hours expires, the system checks the sensor indication of the site.
    - If no water is present, the maintenance stage exits the "cleared" stage and the site returns to normal operation (no maintenance indication). The "cleared" counter is decremented.
    - If water is present, the site has not drained; the event is still ongoing; clearing the block was unsuccessful. The site is removed from the stage of clearing, and back into the stage of "new" (equivalent to unspecified). The cleared counter is decremented; the Unspecified counter is incremented.
- If, during the 24-hour period, the site returns to an OK state and then subsequently re-floods, a new event becomes active. The timer is discontinued. The site is moved from the maintenance stage of Clearing back into the stage of New (equivalent to Unspecified).

Donut graph operation:

The **outside** of the "Investigation" instrument is a donut graph.

The colour-scheme is not very distinct, but the donut illuminates as a shade of grey that is lighter than the background colour.

The donut graph represents a ratio based on quantity of sites.
More precisely, it shows a *fraction* based on quantities of sites.

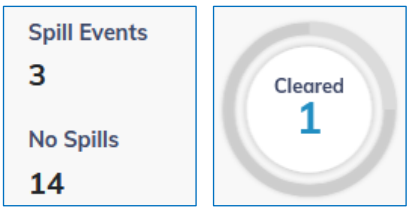
It is the ratio of

$$\frac{\text{Number of sites listed by the Cleared counter}}{\text{Number of sites included within the Spill Events OR the Cleared counters}}$$

Note: A fraction of 0/0 is defined as 0 for this instrument; no part of the ring is filled.

Example:

The diagram opposite shows there is currently 1 site with an investigation clearing, and 3 sites with live data from sensors showing an active event.
The site indicated in "Cleared" has actually drained, so is not included in the "Spill Events" sites.

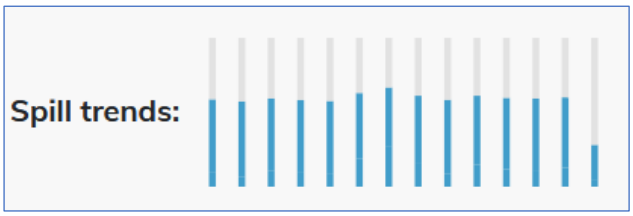


The calculation is $\frac{1}{3+1}$

Therefore 1/4 of the donut graph is shown in light grey.

3.6.10 Spill trends graph

The “Spill Trends” graph is a bar-chart.

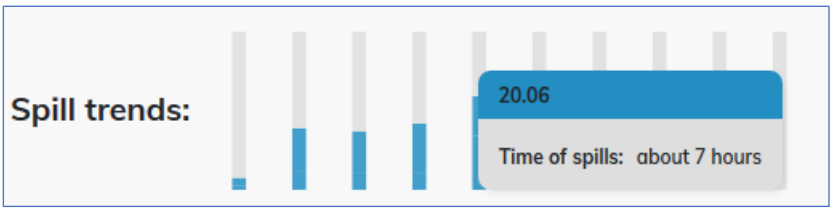


The intention of the graph is to provide a summary indication of the complete set of available sites … whether there has been a rising or falling trend of spillage problems.

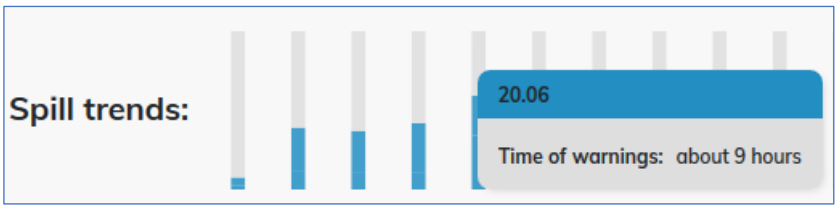
The graph X-axis shows 14 days of data, with one bar representing one day (from midnight to midnight). The Y-axis represents the combined total time of all sites spent indicating either a warning or spill. The Y-axis auto-scales according to the range of data, so some caution is needed in its interpretation; further inspection is needed to gauge the scale, which can be estimated using pop-up information as shown below.

The data for each column indicates the number of hours. It is divided into 2 areas, stacked on top of each other:

- “Time of warnings” (coloured blue)
- “Time of spills” (also coloured blue)



If you hover the mouse over the bar a pop-up box appears with the date, event description (warning or spill), and the total number of hours.

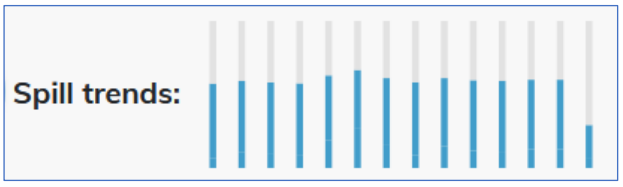


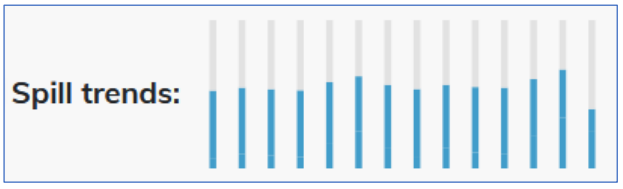
At midnight of each day, the columns shift to the left; the one at the far left is removed. A new (empty) column feeds into the right of the graph. The new column represents the new (current) day, starting at midnight.

The instrument is updated:

- Whenever an event ends.

The time accrued for any event therefore appears within the graph only once the event has ended.
This is illustrated as shown opposite, which shows the spill trends graph just before and just after an event (which spanned 3 days) ended; the data for last 3 days is adjusted.



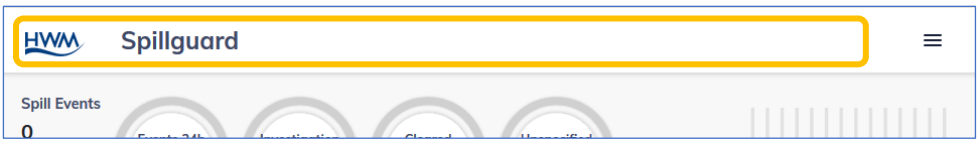


(The additional data also caused the graph to re-scale).

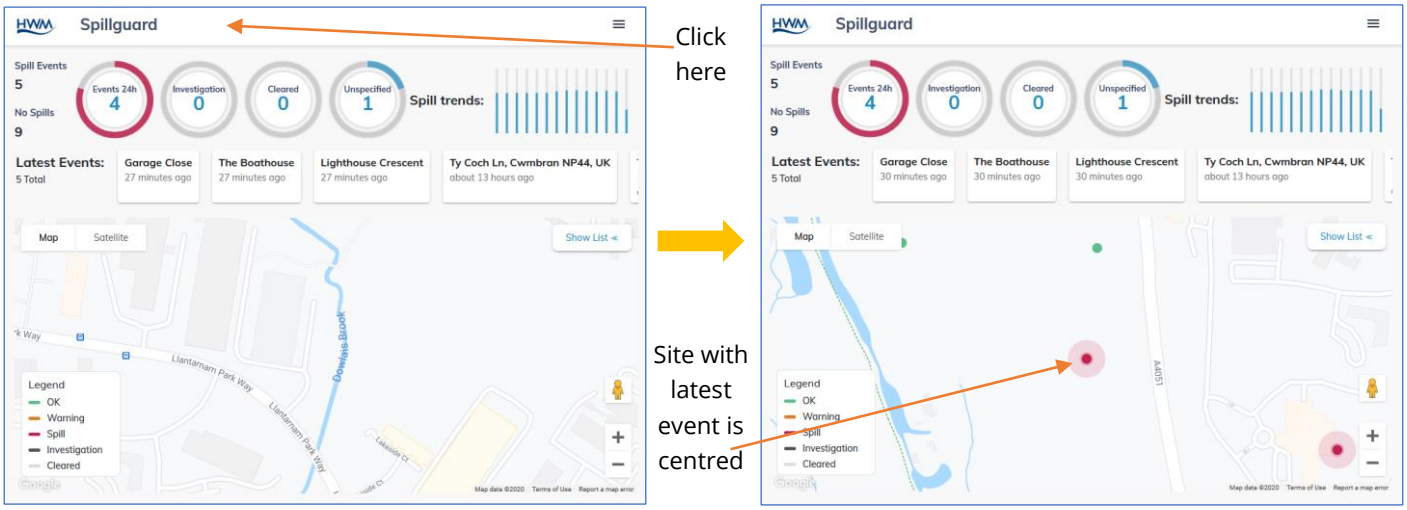
3.7 CONTROLS WITHIN THE MAP PAGE

The very top of the page shows the title-bar with the HWM and SpillGuard logos.

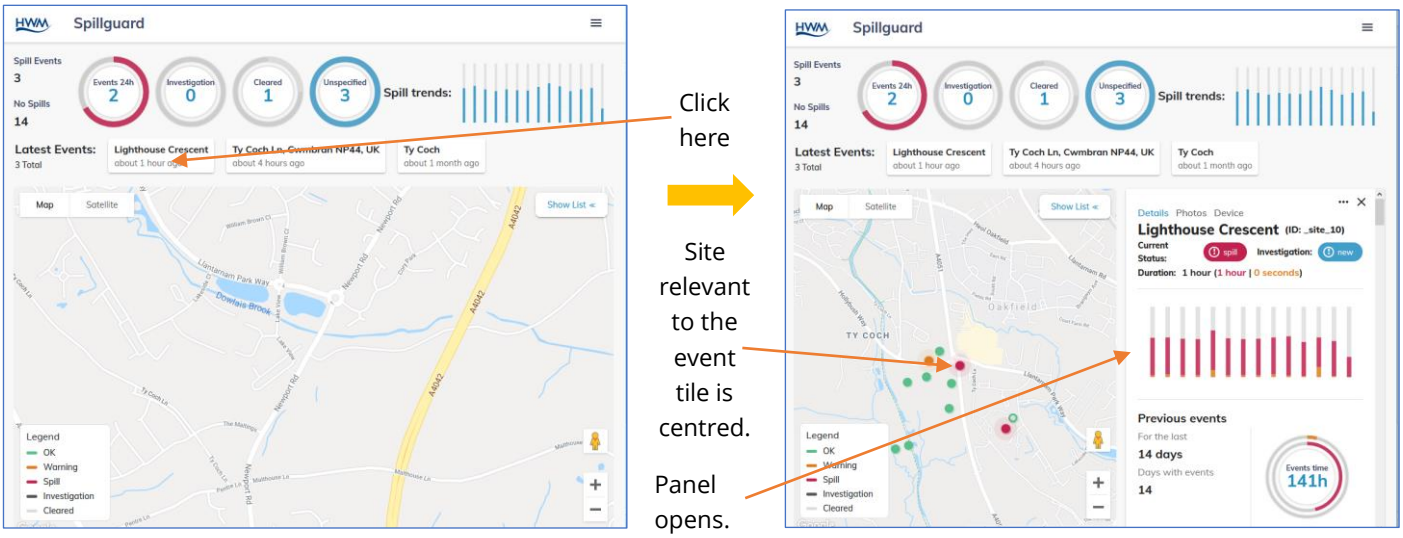
Clicking anywhere on the title bar closes any open panel and then re-draws the map area. The map is centred on the site with the latest reported spill event.



The re-centred map is not re-scaled; the user is required to set an appropriate zoom level to see where the site is located.

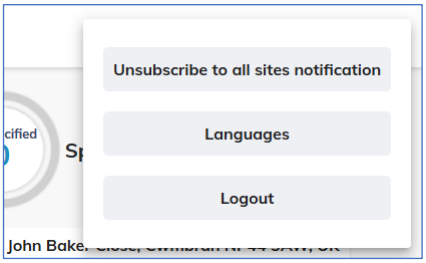


Clicking on an event tile opens the Site Details panel and loads the details for the relevant site. The map area is re-drawn and centred onto the relevant site.



Clicking on the icon in the right of the title bar opens up a menu with options to:

- “Unsubscribe to all sites notification” (see section 5).
- Change the system language setting.
- Logout from the system.



4 DRIVING THE SPILLGUARD SYSTEM

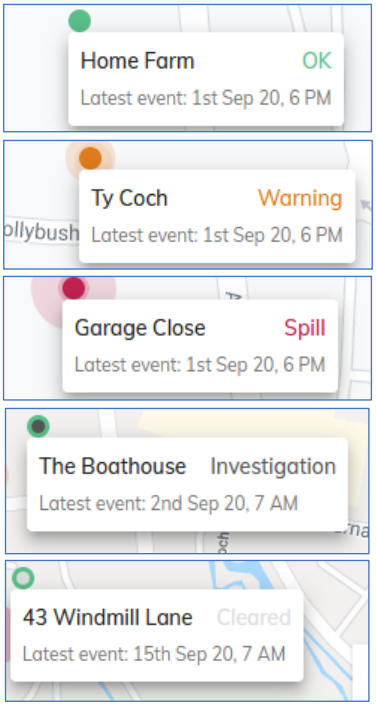
The map area of the display does not generally re-position or re-size itself except where the user has interacted with some control.

Site icons on the map will update within a few seconds whenever a message is received which is relevant to a site currently being displayed; the icon will be re-coloured according to the latest status derived from the sensor position.

Received messages will also cause changes (if relevant) to any instrumentation that is being displayed, including the event tiles.

4.1 MAP ICON CONTROLS

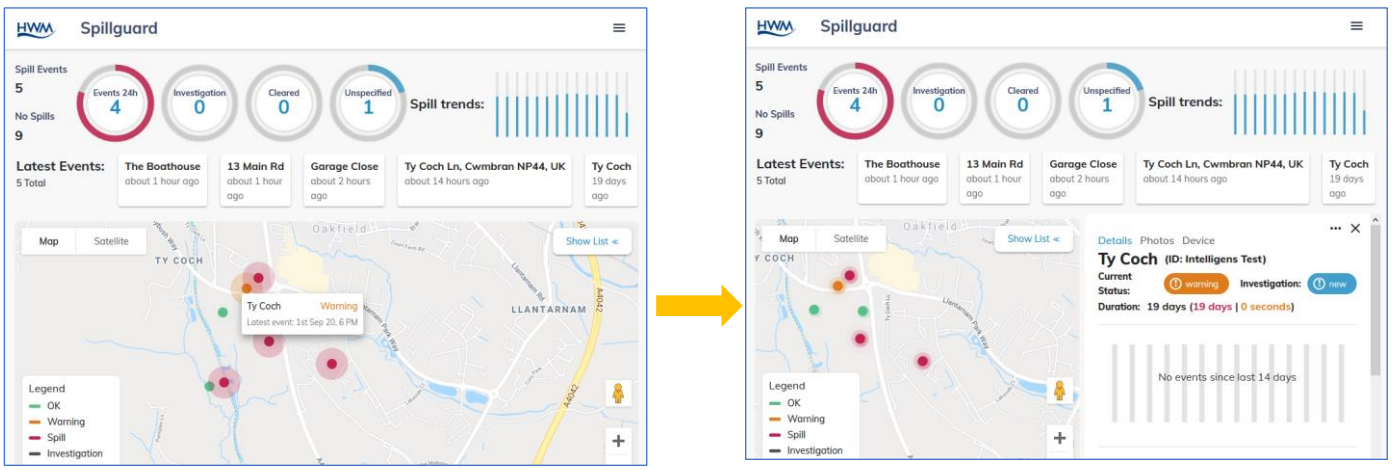
Hovering the mouse over a site icon will provide a pop-up information box about the site.



The panel lists:

- An address for the site (if it has the details recorded).
- The start time of the latest event.
- A colour-coded status of the site (the sensor indication).
  - "OK".
  - "Warning".
  - "Spill".
- Where a site has an investigation ongoing, the sensor indication is replaced by an indication of the investigation stage.
  - Investigation.
  - Cleared.

Clicking on a site icon will re-position the map to allow space for the site details panel, which is loaded with details for the chosen site.



4.2 FINDING SITES THAT REQUIRE ATTENTION

The SpillSens screen is partially refreshed whenever appropriate (e.g. when a message is received or when the user interacts with a control).

Sites that require attention can be found using a variety of methods including:

- The map icons.
- The event tiles, when used in conjunction with the site details page.
- The site list.

The map icons give a direct visual indication of sites that have a high water level. This indication includes whether an investigation is already in progress (refer to the icon meanings within section 3.3).

Sites with the most recent events are shown in the event tile area, but without indication as to whether the site is already under investigation. Clicking on the tile will load the site details panel and re-center the map to show the site icon; these both provide an indication of the investigation status (see section 3.3 for icon descriptions and section 4.4 for an explanation of the site details panel). It is possible that some sites which require attention are no longer visible in the event-tile area (e.g. if there have been more recent events). It is, however, possible to find sites that require attention using the Site List panel (see below and also section 4.3).

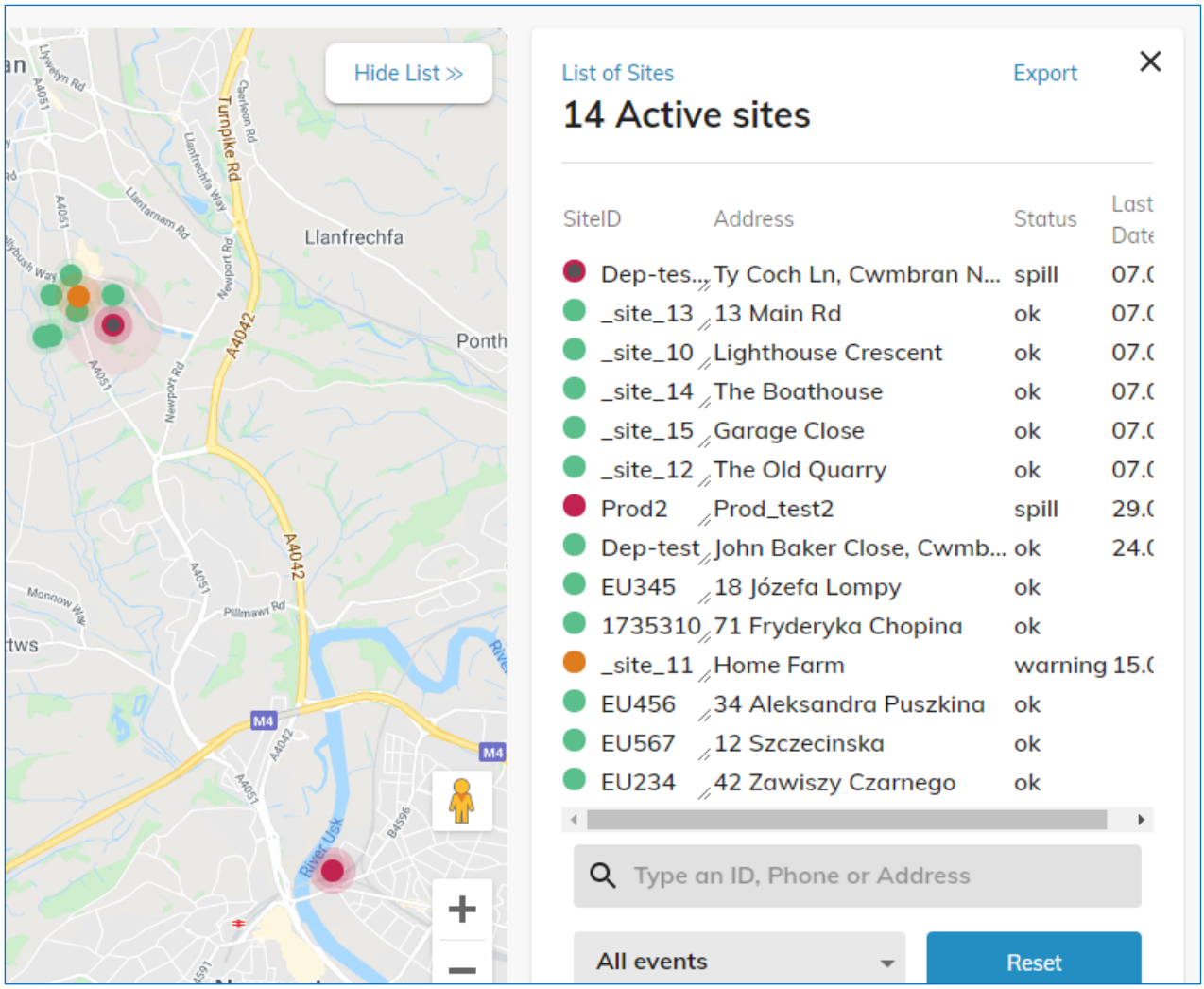
The Sites list panel can be used to find sites requiring attention, including sites that had a temporary spill which drained of its own accord (e.g. a partial blockage).

e.g. By using a suitable filter selection, the user can list all sites which have had an event in the last 24 hours.

Note: The system also has the ability to track sites which require attention by using the system functionality to send alarm messages to a destination external to itself (see section 5).

4.3 VIEWING THE LIST OF SITES PANEL

The “List of Sites” panel can be accessed from the map page, as described in section 3.2.

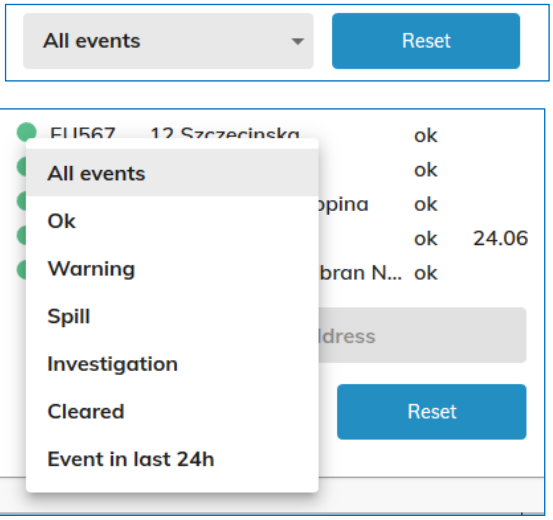


It lists all of the sites available within the account, up to 100 sites at a time. The site search and filter options will allow the user to search and refine the list as needed.

It shows:

- An Icon which represents the current status of the site.
  This includes both the *live sensor status* and also any *investigation stage*.
- Site ID
- Site Address
- The current site status, as text (from the site sensor).
- The last date a logger deployed on the site successfully called into the system with site data.

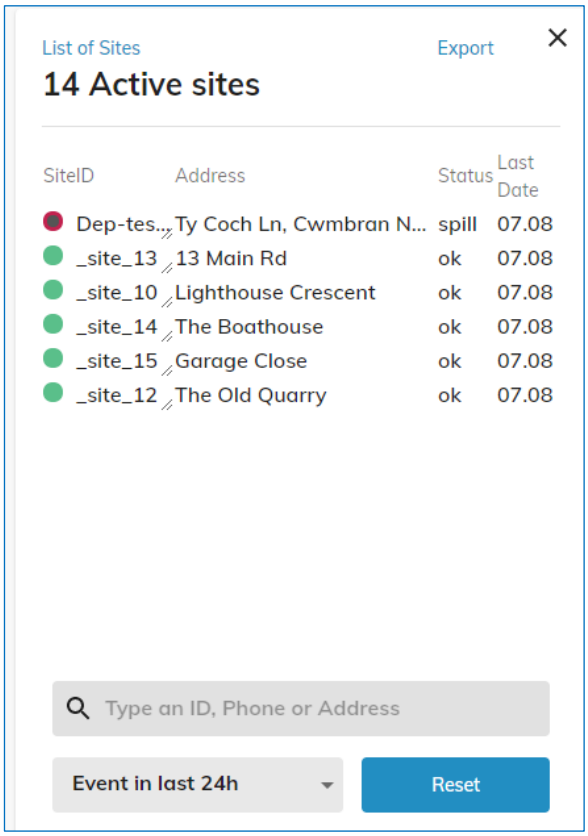
If you wish to look for sites with a specific state, you can apply a filter to the list contents.
The available selections are shown opposite.



The default filter is “All events”; this should be read as meaning “no filter applied”; all sites within the account are shown.

Filters can be applied to select only those sites with a specific sensor state or a specific investigation state.

A particularly useful filter is “Event in last 24h”. This filter lists any site that has had a sensor indicating a *warning* or *spill* event which started within the last 24 hours. The filter includes sites independent of what its current state is, and so it can be used to look for sites which recently required attention but that may now have been excluded from being shown via other instruments.



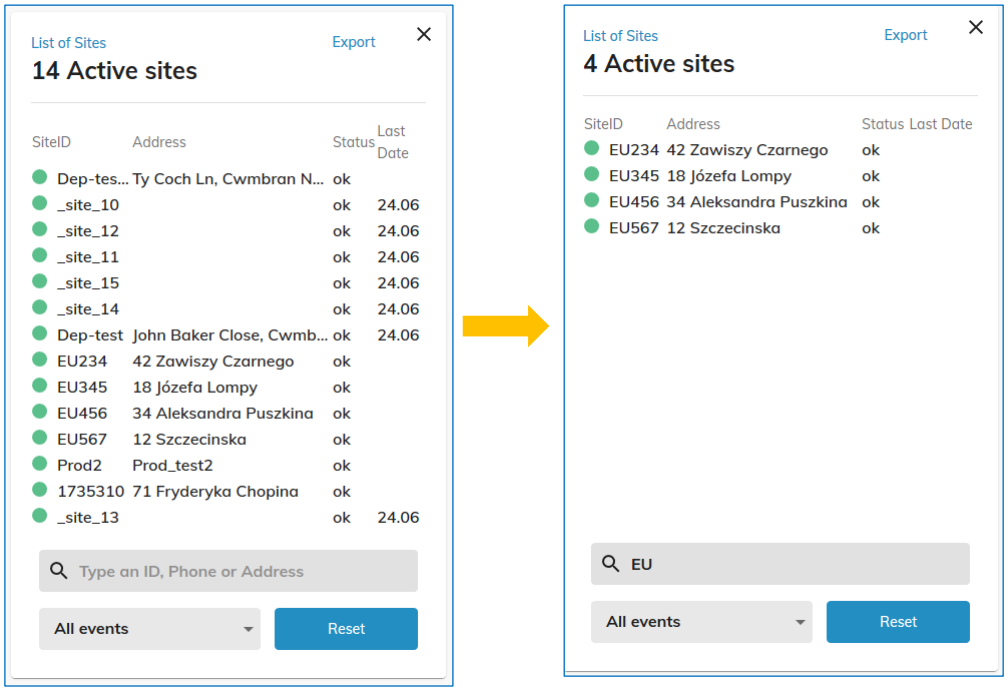
e.g:

- Any event which occurred in the past 24 hours which the user missed due to SpillGuard being left unattended or not in use.
- Sites with an event that are no longer visible as an event tile, having been moved off-screen.
- Sites with an event which both started and ended within the last 24 hours (so the event is no longer active).

If you wish to look for sites with a specific site ID, phone number (sometimes called an SMS number), or address you can apply a filter to the list contents.

e.g.
To search for a site that has a Site ID beginning in “EU”, type “EU” into the search box.

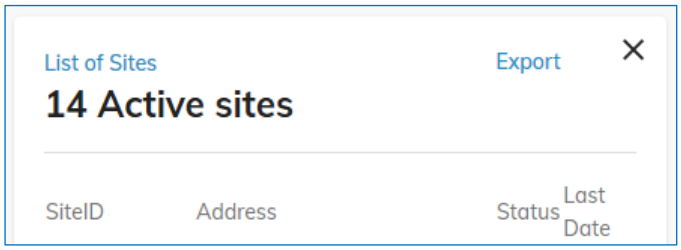
After the first 2 or more characters have been typed, the list filter activates and the list reduces.



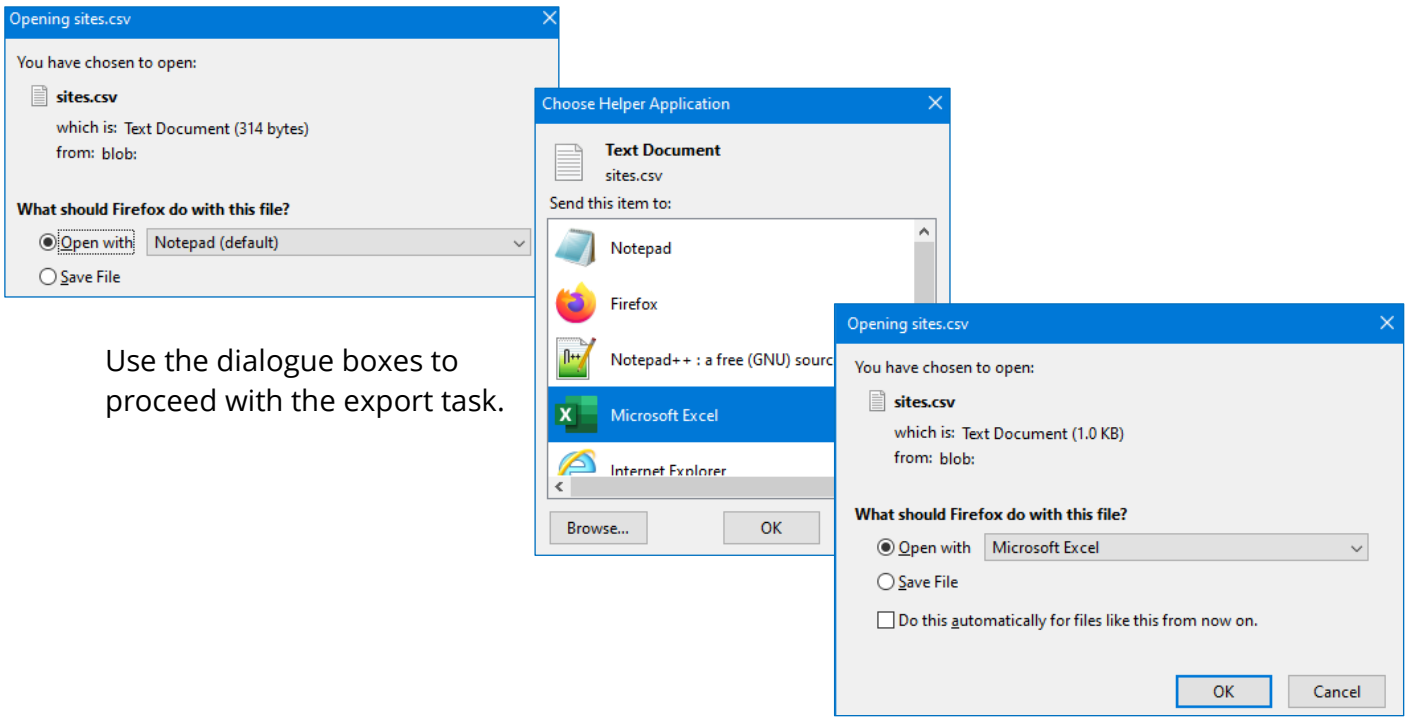
Use the “Reset” button to clear all applied filters.

Clicking on any line of the listed sites will load the Site Details panel for the chosen site (see section 4.4).

To export details regarding the sites that are listed (with any applied filter), click on the “Export” control.



Choose whether to open or save the file.



Use the dialogue boxes to proceed with the export task.

The file will open in the selected application but may require further adjustment to be correctly formatted (e.g. text to table conversion within the viewing app).

	A	B	C	D	E	F
1	SiteId	Address	Status	MaintenanceStatus	PhoneNumber	LastEventDate
2	Dep-test2	Ty Coch Ln, Cwmbran NP44, UK	Ok		44792483539285	
3	_site_10		Ok		882360011641560	06/24/2020 06:15:00 +00:00
4	_site_12		Ok		882360011641562	06/24/2020 06:15:00 +00:00
5	_site_11		Ok		882360011641561	06/24/2020 06:15:00 +00:00
6	_site_15		Ok		882360011641565	06/24/2020 06:15:00 +00:00
7	_site_14		Ok		882360011641567	06/24/2020 06:15:00 +00:00
8	Dep-test	John Baker Close, Cwmbran NP44 3AW, UK	Ok		44792483539285	06/24/2020 05:13:00 +00:00
9	EU234	42 Zawiszy Czarnego	Ok		450850123456786	
10	EU345	18 JÃ³zefa Lompy	Ok		450850123456787	
11	EU456	34 Aleksandra Puszkina	Ok		450850123456788	
12	EU567	12 Szczecinska	Ok		450850123456789	
13	Prod2	Prod_test2	Ok		44792483541529	
14	1735310	71 Fryderyka Chopina	Ok		450850123456785	
15	_site_13		Ok		882360011641563	06/24/2020 06:15:00 +00:00

4.4 VIEWING SITE DETAILS

Site-specific details can be seen using the Site Details panel. This can be accessed via several methods including:

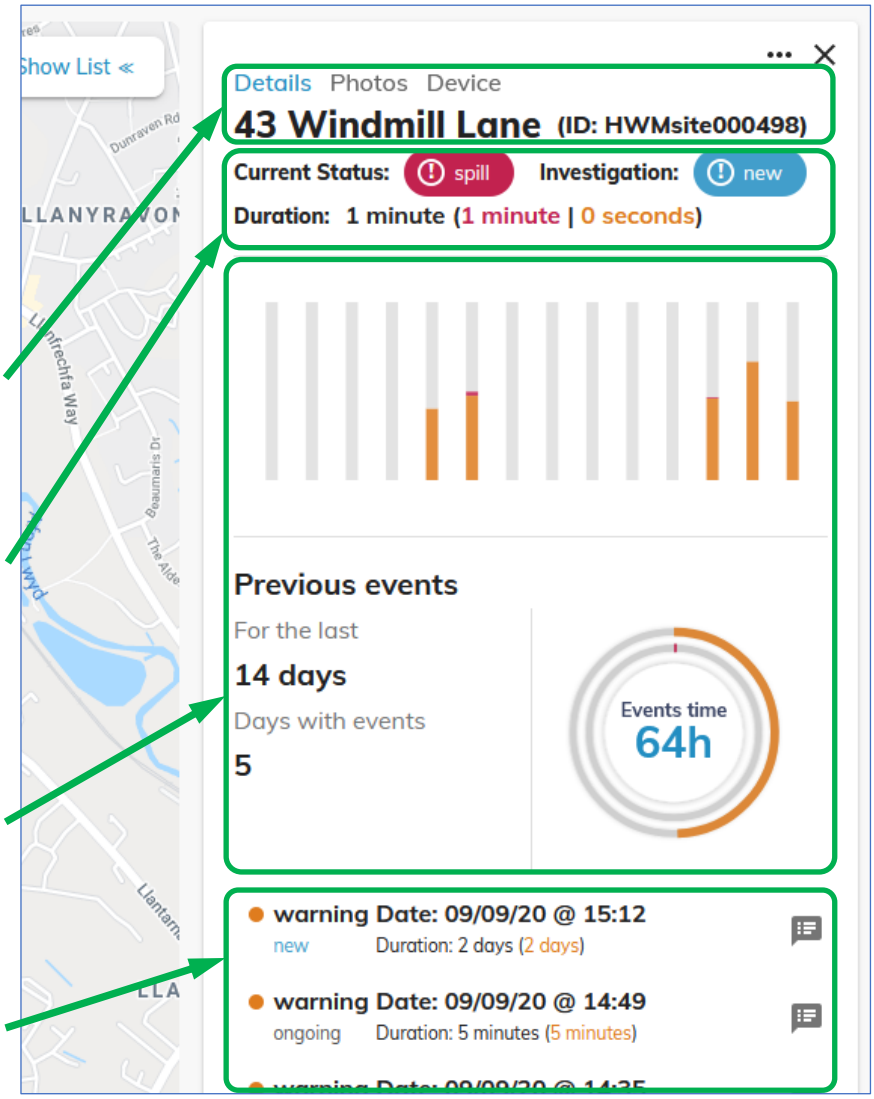
- Clicking on a site icon within the map.
- Clicking on the line listing a site within the Site List panel.

The Site Details panel is shown opposite.

It normally displaces part of the map area, which is re-drawn in a smaller area.

It contains 4 general areas:

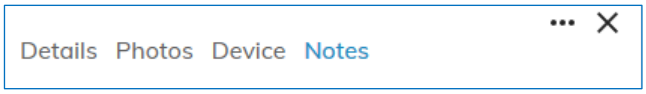
- A set of tabs to select between various sets of information.
- Information and controls relating to any currently active event
- Some instrumentation relating to previous events from the past 14 days.
- A history of events which have occurred for this site.

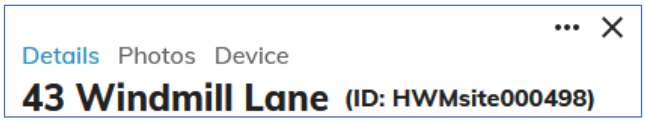


Explanations of instrumentation and event history follow (later in this section).

The panel instruments show no data initially. Within a few seconds data is obtained from the system and the instruments display correctly; this is normal operation.

The top of the panel displays a set of tabs. This sometimes includes a “Notes” tab, but only if an event is currently active.





Below the Details tab are details of the site:

- An identifier (Site ID) and
- The address recorded for the site.

The “X” control closes down the panel, whereas the “…” control gives access to a menu.

Other tabs give access to:

- Photos uploaded and linked to the site.
- Details of the logger device installed on the site.
- Notes (if entered by an Administrator user) related to the currently active event.

4.4.1 Site: Live status indicators and controls

The Site details panel displays the current status (sensor indication) of the site, colour coded:

- OK, or
- Warning, or
- Spill.

When there is a possible flood condition an additional field appears, which indicates the current stage of investigation (also colour coded):

- New (also known as “unspecified”), or
- Ongoing (also known as “investigation”), or
- Cleared.

The investigation stage indicator also acts as a button-control which gives access to a menu (see section 4.5).

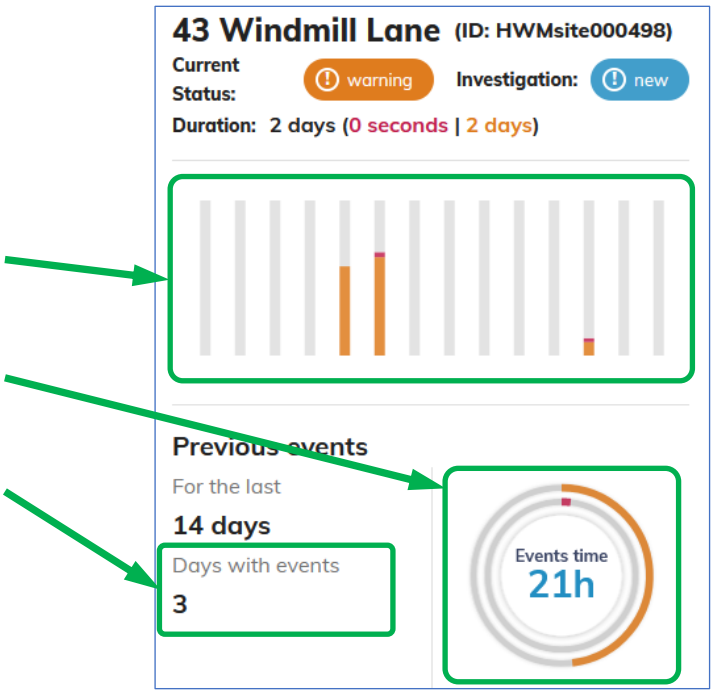
Where a site is indicating a possible flood condition, the Duration field shows the approximate periods of time for the currently active event.

The time format is: total duration, duration in spill, duration in warning.

4.4.2 Site: 14-Day summary indicators and instruments

Below the live status area there is an area which summarises the past 14 days. This consists of:

- A bar-graph which shows the spill trends for the selected site.
- A donut graph instrument with dual rings.
- A "Days with events" counter.



The spill trends graph shows a 14-day history of the time accumulated in both warning and spill conditions for the selected site. Where a site floods and drains several times during a day, the column will accumulate the total time spent in each state.

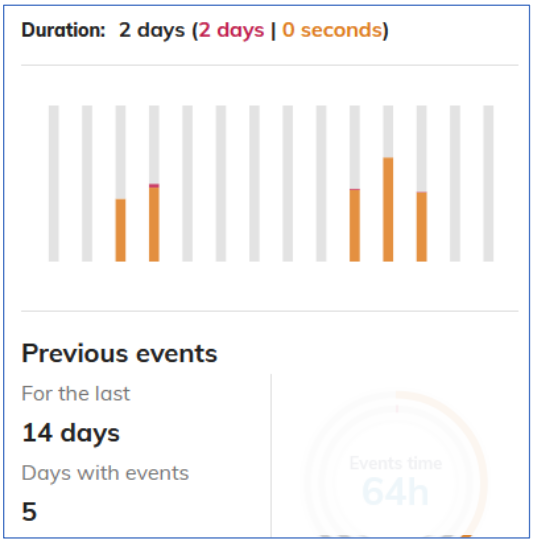
The orange and red areas of each bar correspond to the time the site sensor was indicating a condition of a warning or spill, respectively.

Hovering the mouse over each bar will provide details of each part of a column.

The instruments within this area deal with the data of *completed events*. The data from any event currently active has no bearing in the instrument readings until it ends. Upon an event ending, the instruments are updated with the additional data.

This is demonstrated in the diagram below … an event which has been active for a duration of 2 days does not get included in the graph as it has not yet ended.

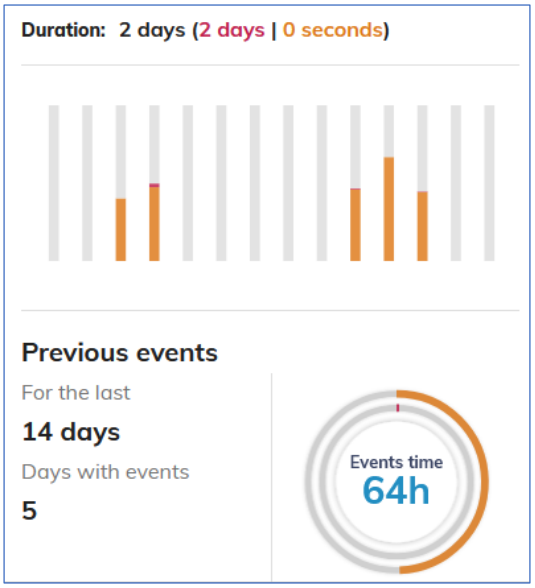
The "Days with events" counter mirrors the content of the bar-graph. The bar-graph shows events which occupy 5 columns (days); the counter therefore displays "5"; any currently active event does not yet have any bearing on the counter.



The "Events time" counter mirrors the content of the bar-graph, showing the accumulated time from each of the displayed columns. Again, any currently active event does not yet have any bearing on the counter.

The do-nut rings display the fraction of time occupied by each type of event vs the total time of occupied columns (days with events * 24 hours).

It is the ratio of $\frac{\text{Number of hours in each state}}{\text{Days with events counter x 24 hours}}$

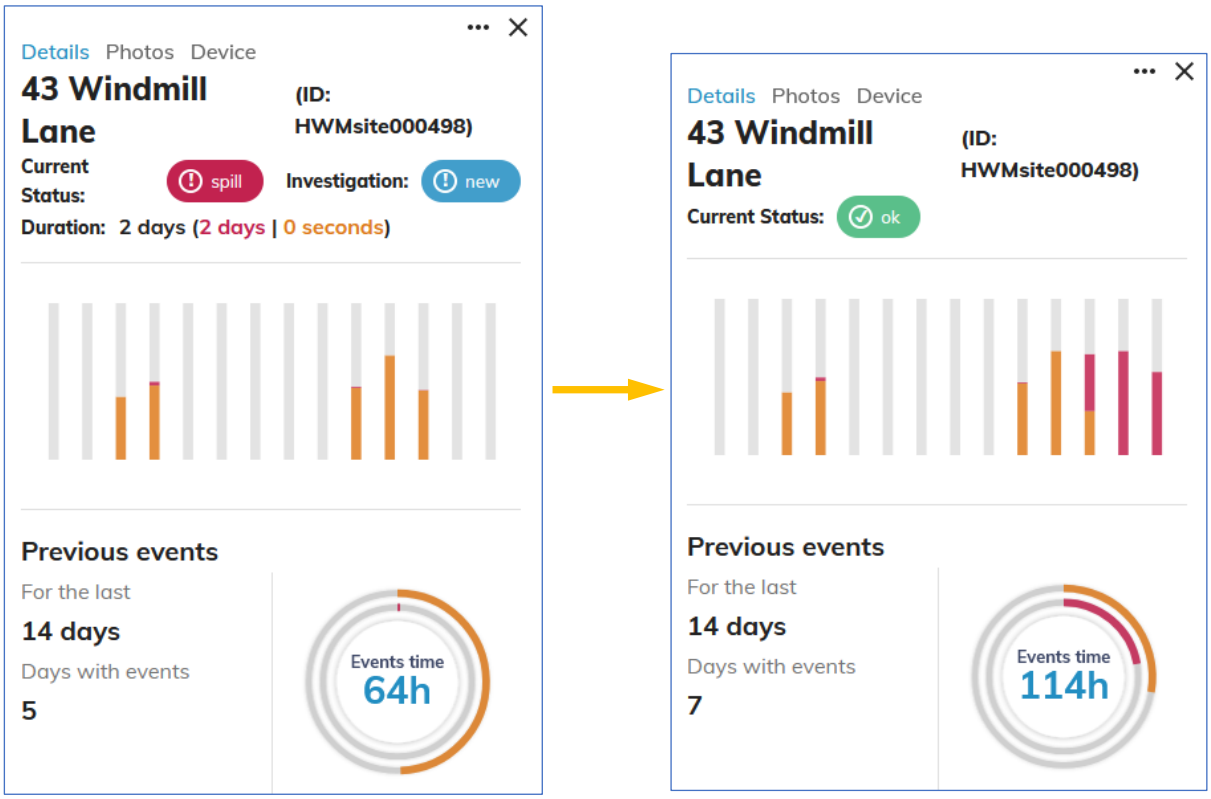


Again, any currently active event does not yet have any bearing on the rings.

Upon an event ending, the instruments are updated with the additional data, as illustrated in the example below.

Example:

A site has been in a Spill condition for 50 hours. The diagrams below show the instruments immediately before and immediately after the event closing...



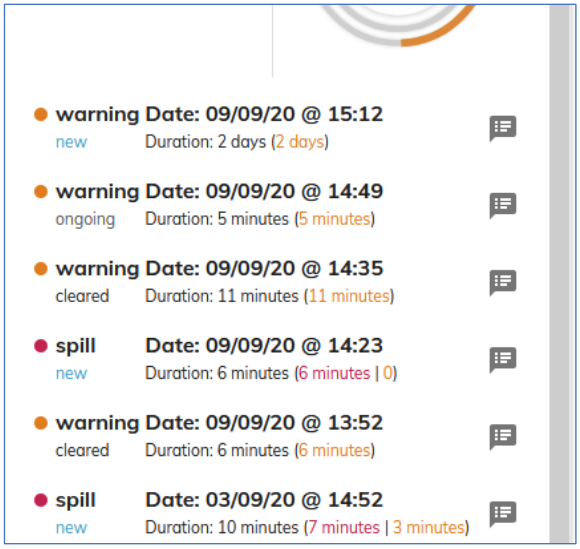
Total time:	5 days = 120 hours	7 days = 168 hours
Warning:	63 hours is = 53% of total time	63 hours is = 38% of total time
Spill:	01 hours is = 01% of total time	51 hours is = 30% of total time

4.4.3 Site: Event history

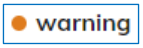
Below the 14-day summary area there is a list. The list shows any history of previous site events, but does not include any currently active event.

Use the scrollbar to view the complete list if required.

Each event listed includes a colour-coded icon, which indicates the highest water-level alarm during the event.

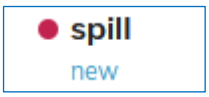


- The highest level was Spill. 

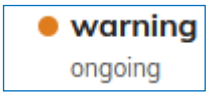
- The highest level was Warning. 

Beneath the “highest alarm” icon there is an indication of the progress of any investigation for the event. It is “frozen” at the time the active event ended (i.e. when the site drained).

- Stage 1 is “New” (also called “unspecified”).
    - No action was taken for this event.



- Stage 2 is “Ongoing” (also called “investigation”).
    - The site drained before the investigation team arrived, or
    - The site drained before the system was updated to show “cleared”.



- Stage 3 is “cleared”.
    - The system was updated to “cleared” and the site drained within 24 hours.

If any notes were saved whilst an event was active, they can be viewed by clicking on the note icon adjacent to the event. (See also section 4.7)

The event history list holds up to 100 entries.

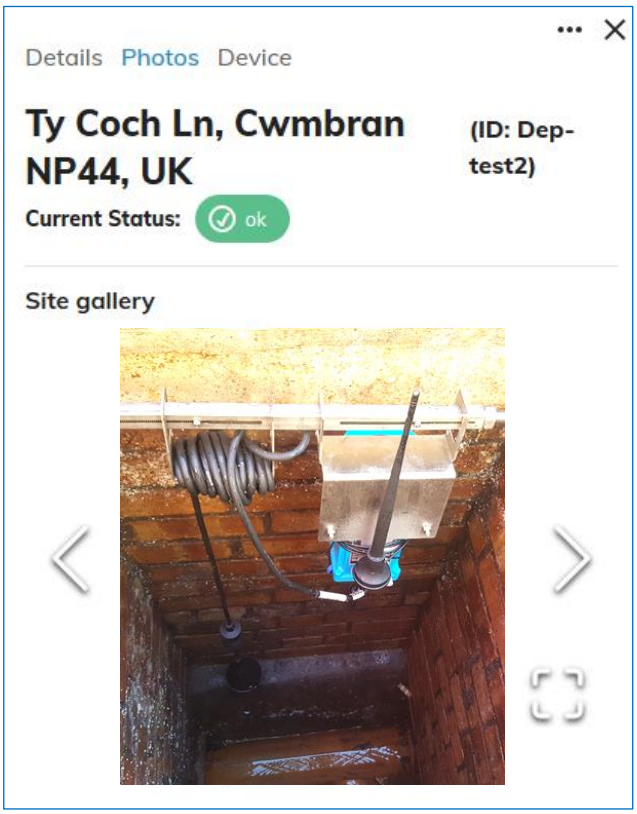
4.4.4 Site: Photos

The system is able to store photos for the site (typically these will be taken during installation and uploaded by the installer using a mobile phone app).

To view any photos that exist, select the Photos tab.

Photos can be shown, one at a time. Use left and right arrows to cycle through any photos.

The “enlarge” control expands the view to full-screen, or conversely returns it to being a smaller window.

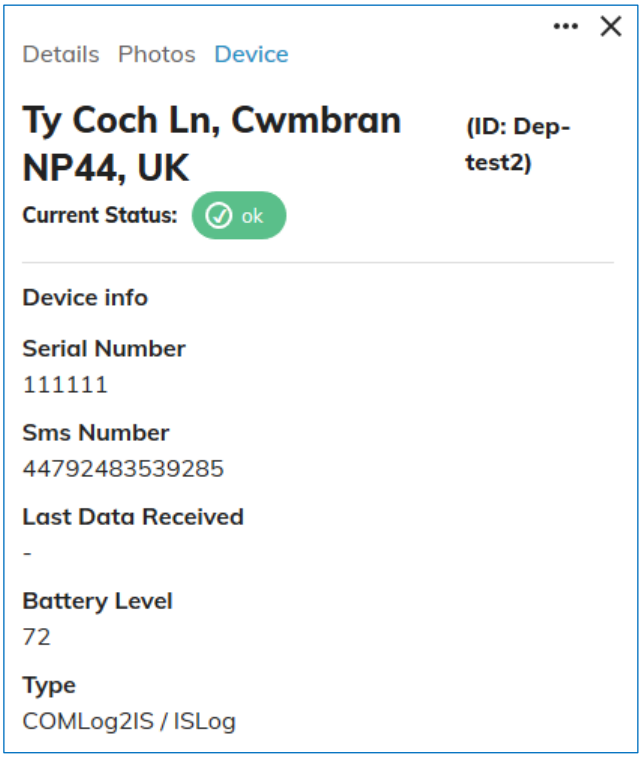


4.4.5 Site: Logger Device details

To see details of which type of logger is installed and other device-related details, select the “Device” tab.

It shows:

- Device serial number.
- Device SMS (Telephone) number.
- Date and time when the logger last successfully called into the system.
  Device battery voltage (in units of 100mV).
- The logger model type (i.e. logger family).



4.5 Tracking an Investigation.

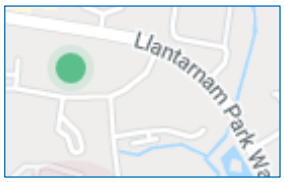
Refer to section 4.2 regarding finding sites that require attention.

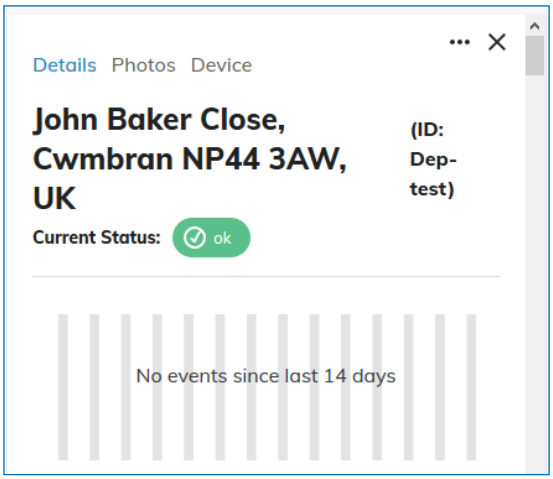
A site where an event has occurred can have the progress of any investigation team tracked on the system. This reflects if the event at the site is being investigated or if an investigation has progressed to the stage of being completed. These require manual updates to be made from within the Site Details panel of the relevant sites. The Site details panel was discussed in section 4.4.

The display opposite shows a site which is not currently indicating a warning or a spill; it is OK.

The corresponding site icon is shown as a green circle, indicating an OK condition

The "Current Status" is also showing an "OK" condition, and there is no "Investigation" field.





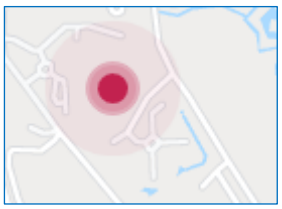
No investigation can be started from this condition (there is no button available).

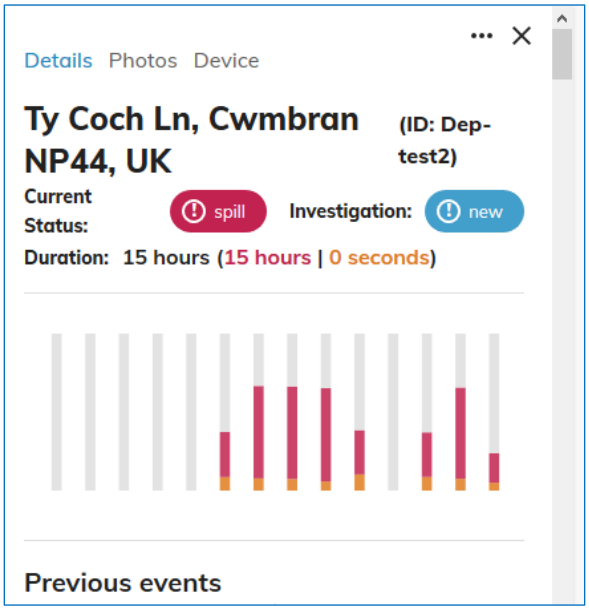
The display opposite shows a different site which is currently indicating a spill.

The corresponding site icon is shown as an animated red circle, indicating a spill condition.

The "Current Status" is also showing a "spill" condition.

Now there is also an "Investigation:" field, complete with a button which is indicating "new". ("New" indicates no investigation has been started on the site for this current event).



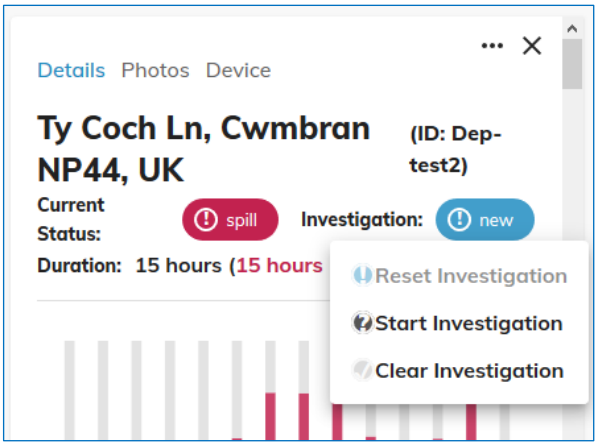


An investigation can be started from this condition. (It can be started from an active *warning* or an active *spill* condition).

Click on the "(!) new" button.

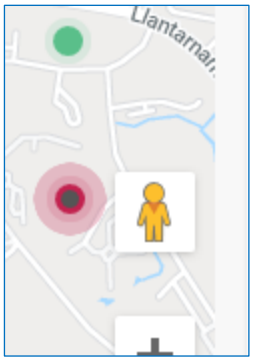
Users of the type "administrator" will be shown a menu which gives the option to start an investigation.

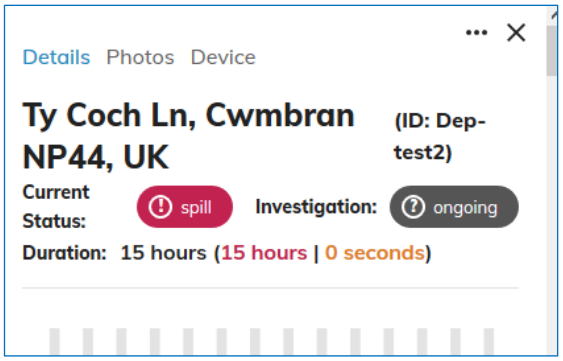
Select "Start Investigation".



The investigation status changes to "ongoing".

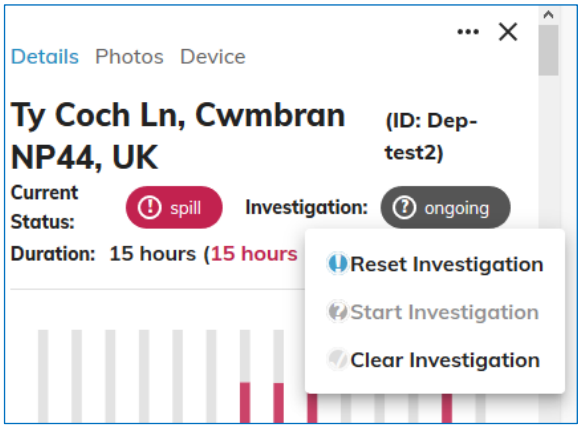
The map icon now shows a black dot in the center, indicating an investigation is ongoing.





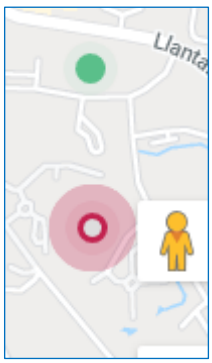
The menu options now offers administrators new options to either reset or clear the investigation.

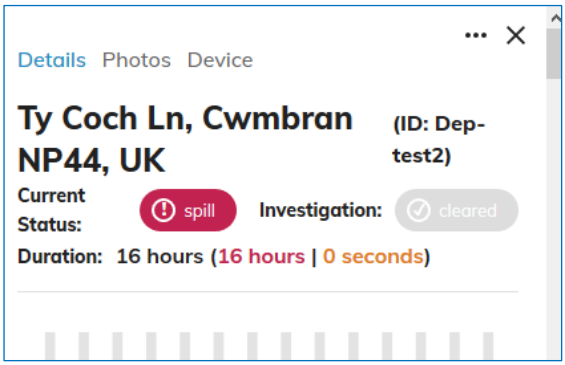
Selecting "Reset investigation" will take the site investigation back to the previous condition of "new" (e.g. if a visit to site had to be cancelled). The icon center dot will also be removed.



The action to progress to the "clear" stage must be taken (by an administrator) when the site has been visited and work to clear the blockage is about to be undertaken.

Clicking "Clear Investigation" will take the site investigation to the condition of "cleared".

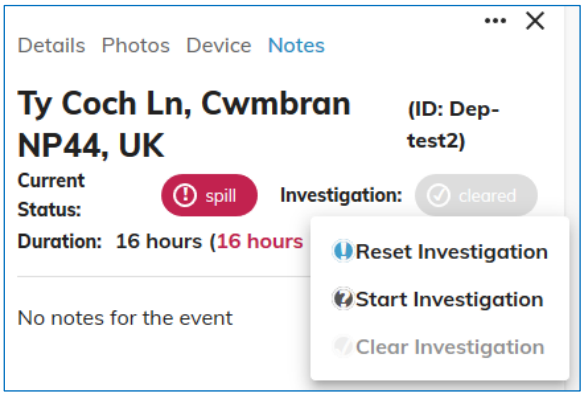




The icon now shows a grey dot in the center, indicating the investigation is completed, the work is being done, and the site should be now be draining or cleared.

If, after 24 hours, the site sensor is showing an OK condition, the Investigation field and grey dot in the center of the icon will disappear.

Whilst in the investigation state of “cleared”, the administrator is also given controls to be able to manually reset (to “new”) or open up the investigation once more.

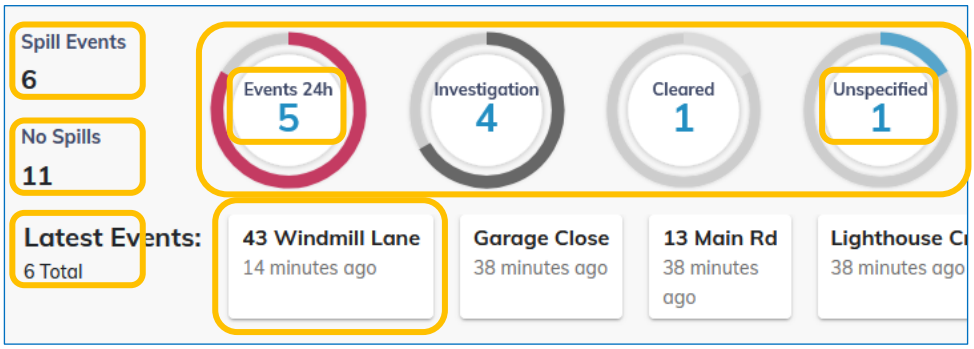


4.6 DASHBOARD INSTRUMENTS (RE-VISITED)

This section considers how the system and its instruments dynamically respond to an example sequence of changes.

Changes when a new event begins:

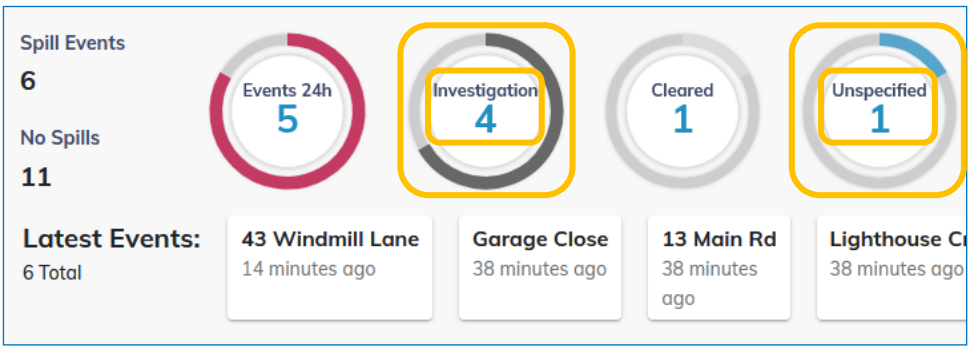
When a site, which was previously OK and not in any investigation stage, goes into an alarm state, the dashboard is updated as follows:



- Spill Events (live data) increments.
- No Spills (live data) decrements.
- Latest events increments; this is a new event.
- An event tile is made for the new event.
- Events 24h increments; the new event was within the last 24-hours.
- Unspecified increments; No investigation is currently open; it is “new”.
- The donut rings of all instruments are updated since they are dependent on the Spill Events value.

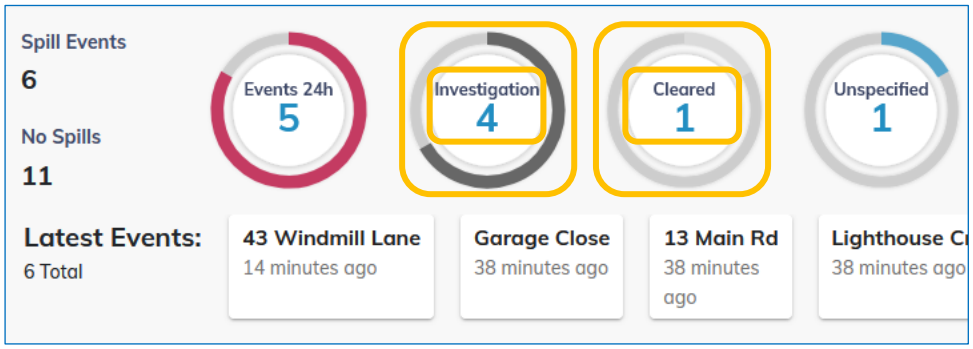
Changes when the site is progressed through investigation stages:

When the site has an investigation opened, such that it is changed to the “ongoing investigation” stage, the dashboard is updated as follows:



- Investigation increments; there is now an investigation open.
- Unspecified decrements; one of its previous sites is now in the investigation stage.
- The donut rings of the Investigation and Unspecified instruments are updated since the counter value of each has changed.

When the site is being visited, and the blockage is in the process of being cleared, the site has its investigation stage modified such that it is in the “cleared” stage.



The dashboard is updated as follows:

- Cleared increments; there is now an additional site in the cleared stage.
- Investigation decrements; one of its previous sites has now moved into the cleared investigation stage.
- The donut rings of the Cleared and Investigation instruments are updated since the counter value of each has changed.

There is more than an instrument update happening when a site is progressed to the stage of clearing, as explained below:

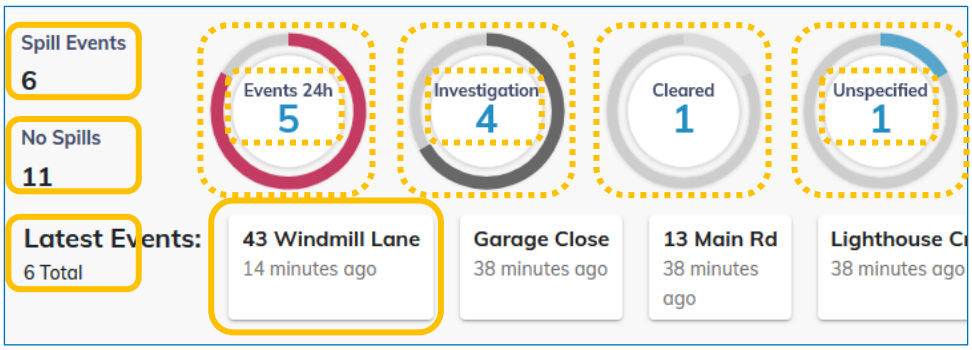
Changing the site into the “clearing” stage starts a timer within the server which *holds the site in the “clearing” stage* for *up to* 24-hours, and then releases the site into normal operation. Whilst the site is within the timer holding period, the following items can be affected:

- The cleared instrument.
- The map-view and site-list panel icons.
- Pop-up information seen when hovering a mouse over a site icon in the map view.

After the timer completes the 24-hours period the site is removed from inclusion in the “cleared” counter and the icons behave normally. Similarly, if a site that is held by the timer in the “cleared” stage, but has a new event occur … it will be released early from being under timer control.

Changes when an event ends:

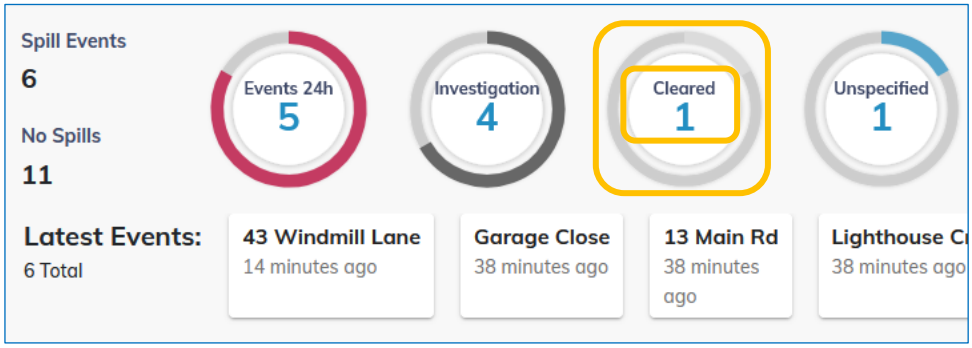
When a site is un-blocked (or was only partially blocked) and subsequently drains…
The dashboard is updated as follows:



- Spill Events (live data) decrements.
- No Spills (live data) increments.
- Latest events decrements; this is no longer an active event.
- The event tile is deleted; this is no longer an active event.
- If the event began less than 24 hours earlier:
    - the Events 24h value decrements; the event is no longer active.
    - The donut ring of the Events 24h instrument is updated; the Events 24h counter was changed.
- If the site was in the stage of “new”:
    - the “Unspecified” counter decrements.
    - The donut ring of the “Unspecified” instrument is updated; the counter was changed.
- If the site was in the stage of “investigation”:
    - the investigation counter decrements; the investigation was automatically ended.
    - The donut ring of the investigation instrument is updated; the counter was changed.
- If the site was in the stage of “Cleared”:
    - No change occurs; the counter value is held but is under the control of a timer.
    - The donut ring of the cleared instrument is updated; the Spill Events counter value was changed.

Changes when a site "cleared timer" ends:

When the clearing hold-timer for the site reaches 24-hours, the dashboard is updated as follows:



- The Cleared counter decrements.
- The donut ring of the Cleared instrument is updated; the counter value has changed.

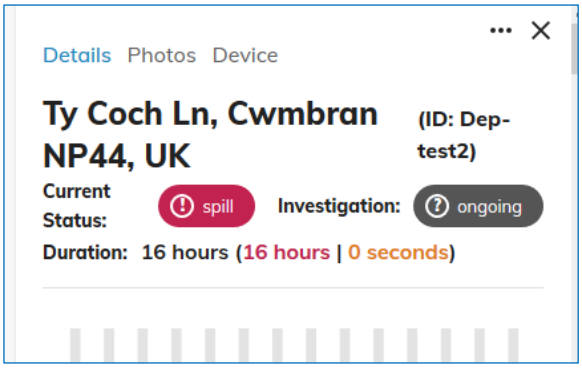
4.7 Investigation History: Event Notes

The Investigation history is a manually completed set of notes regarding any site investigations.
The system allows only administrator users to be able to add notes. All users can read notes.

4.7.1 Adding a Note

Whilst an investigation is ongoing, an administrator can add a note to the investigation (or more precisely, to an *active event*) whilst in any of the following investigation stages:

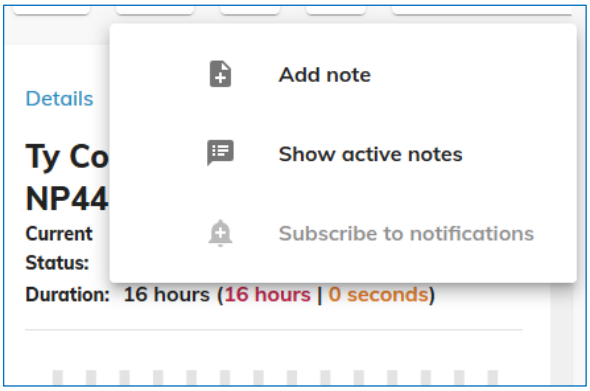
- New.
- Ongoing.
- Cleared.

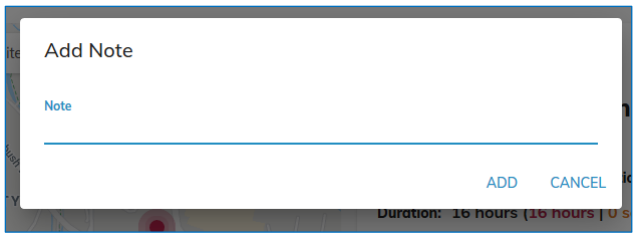


Click on the ellipsis "…" menu button.

Then select "Add Note" from the menu.

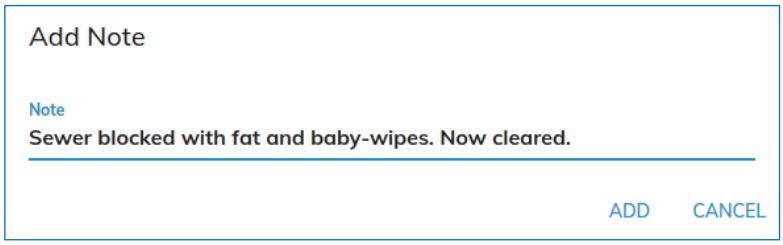
An "Add Note" box appears…





Complete the note with whatever information your company requires.

Click on "Add" to save it.



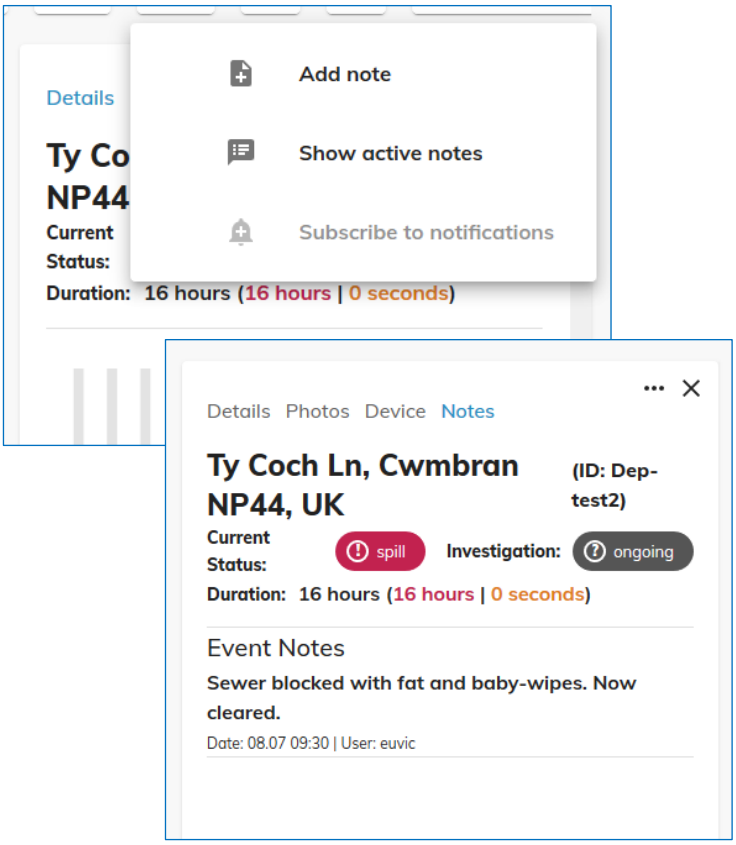
4.7.2 Viewing notes for the current event

Whilst the event is still active:

Notes are stored such that they are linked to an *event*.

To view the notes of the currently active event, click on the ellipsis "…" menu button.

Then select "Show active notes". (Active implies the event is still ongoing; the site is still flooded).



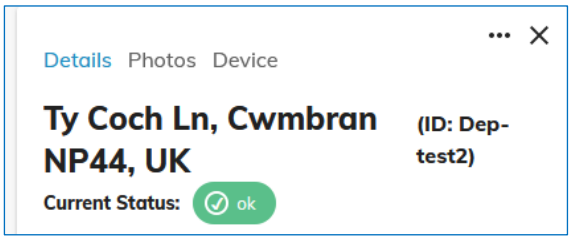
The notes for the currently active event are shown.

(This is equivalent to selecting the "Notes" tab).

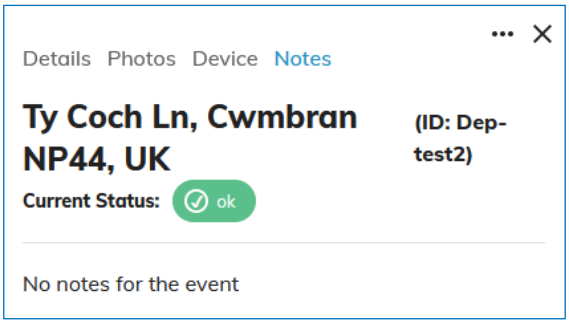
If the event has closed:

It is possible that whilst a team is making an on-site investigation the site will drain, thus ending the event.

- Only notes related to the currently active spill event will be visible in this section. Where the event has ended, there will be no "notes" tab shown.



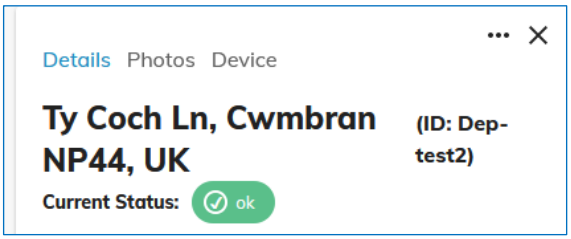
- The notes tab can still be reached via the "show active notes" menu option, but will simply inform you there are no notes available; any notes will have been saved and linked to an earlier event.



The following section details how to retrieve notes from earlier events.

4.7.3 Viewing notes for previous events

To see the notes for previous events, select the sites “Details” tab.



Check each listed event (start from the top of the list and progress downwards) to see if any relevant notes are recorded.

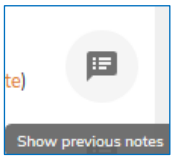
For example:

The “Details” tab shows the site event history, for the last 14 days.

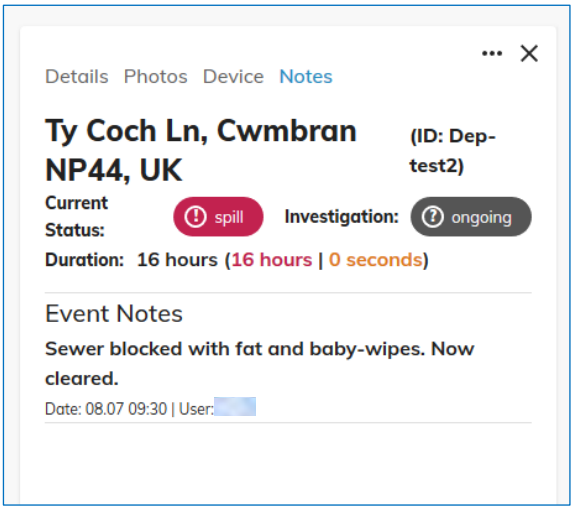
Where there have been multiple events, each event is listed.

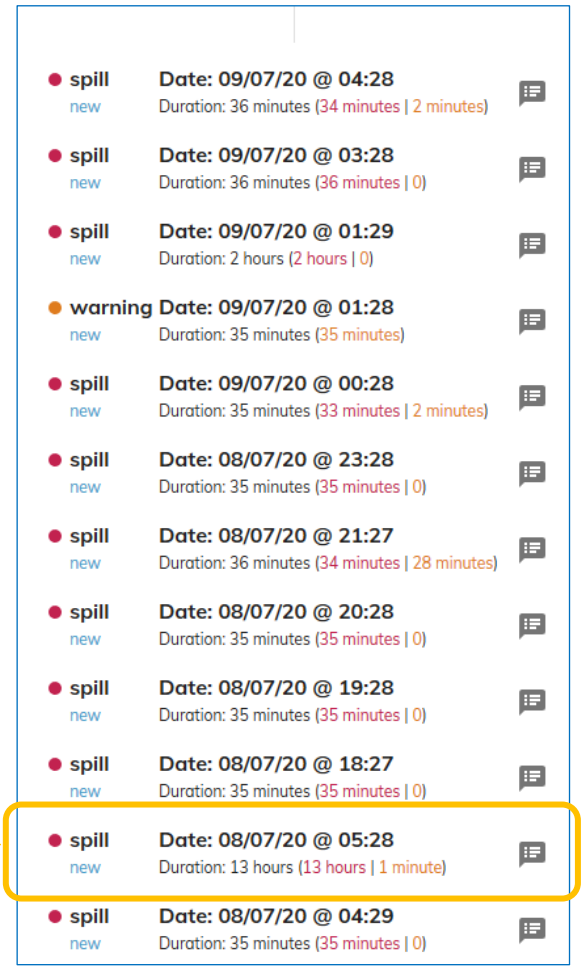
Next to each event there is a “show previous notes” button.

Click on the notes button to show any notes; where required, search through each of the listed events to find all relevant notes.



For instance, if a note was added on the date of 08/07/20, at 9:30…

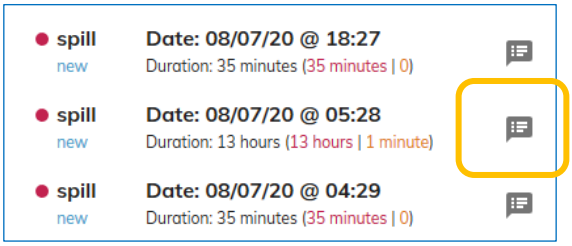


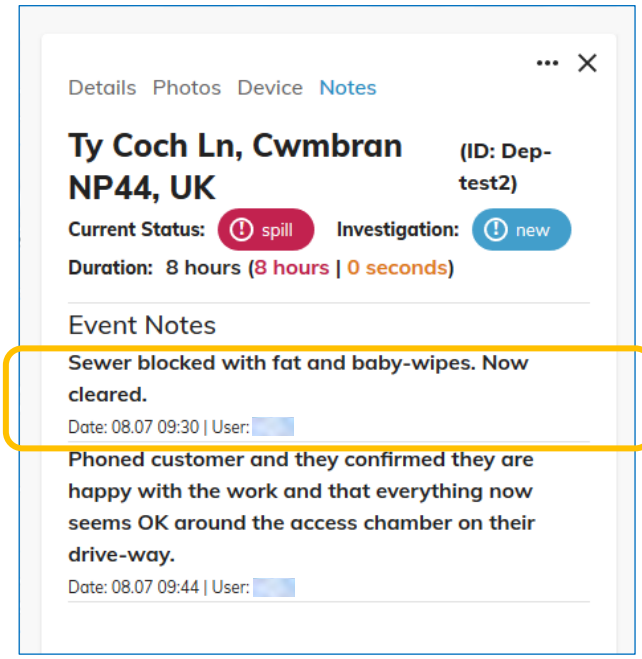


… this particular notes will be located within the event which started on the date of 08/07/20, at 05.28 (as this event lasted for 13 hours).

Click on the notes icon next to that event...

... and the note added at 9:30 can be found amongst any other notes added whilst that particular event was still active.





5 SENDING MESSAGES FROM SPILLGUARD (ALARM SUBSCRIPTION)

5.1 OVERVIEW

Sites are monitored by logger devices. These check their sensors regularly to check for any change in the site condition (e.g. rising water). If a change is found, the logger sends a message (usually referred to as an "alarm") to the server. The server records the message and interprets its meaning in relation to how the site should now be represented using the SpillGuard display (as seen using a web-browser). There is however an alternative method for SpillGuard to give any significant information to the user; it can also (if so programmed) forward the alarm message out of the system. This is commonly called "alarm forwarding".

The system administrator must set up any users who require this feature (alarm forwarding) enabled. There are options for receiving information via SMS (a text message to your mobile phone) or via e-mail (to your e-mail account).

Although a user may have been set up to be able to receive messages, no alarms will be forwarded unless the user actually *subscribes* to receive them.

A user can subscribe to:

- Individual sites.
- Groups of sites (by subscribing to an account, which contains a set of sites).

For individual sites, any subscribed site that receives an alarm (e.g. from a logger deployed on the site) will have the alarm forwarded to them via their chosen route(s).

For accounts, any site within the subscribed account that receives an alarm (e.g. from a logger deployed on the site) will have the alarm forwarded to them via their chosen route(s). For this specific context, "within" includes any site *associated to* the account and in addition any site *directly owned by* the account within the database. The advantage of subscribing to an account is that any new sites added to the account will automatically be included in the alarm forwarding selection.

SpillGuard allows a user to subscribe or unsubscribe to specific sites or the entire account through a control within the portal. However, if a site is also within an account that has been subscribed to, it will not be possible to deactivate the subscription to the individual site.

The format of messages that are delivered to a user by SpillGuard is selected by an administrator, from a set of available options.

5.2 STARTING AND ENDING SUBSCRIPTIONS

5.2.1 Subscribing to messages from individual sites

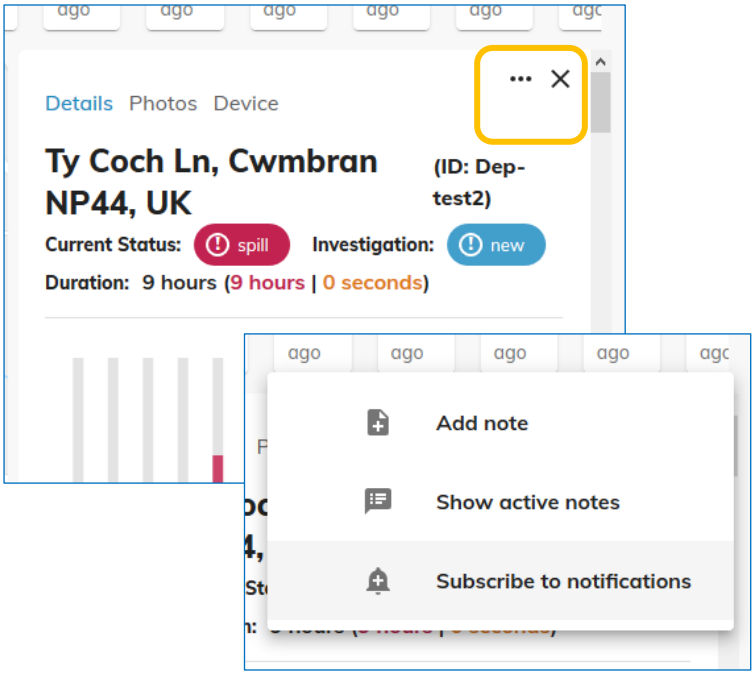
It is possible to subscribe to an individual site.

The site must first be selected and shown in the site details panel.

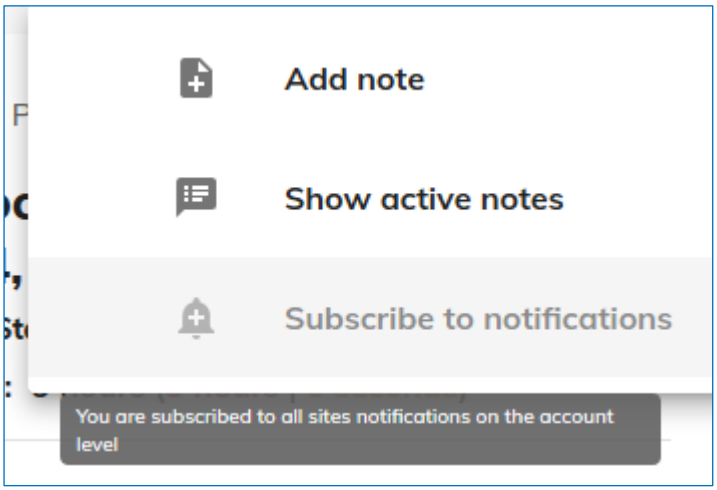
Within this panel, click on the "..." button, which is a site-specific menu control.

The menu contents depend on the current subscription status of the site ... here the site has not already been subscribed to, so it is possible to subscribe to it.

To subscribe to the site, click on "Subscribe to notifications".

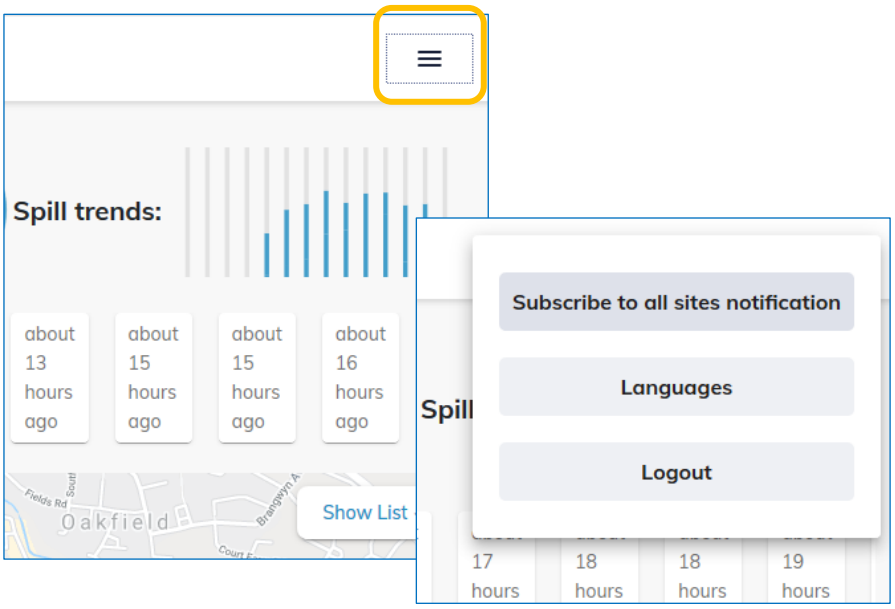


Under certain circumstances, it is not possible to subscribe to the individual site.
For example, the option is not available (greyed out) in the diagram opposite.
If you hover over the menu option, a pop-up notice informs you there is no need to select this as you will already receive alarms because the entire group of available sites has been subscribed to collectively (as sites within the account).



5.2.2 Subscribing to messages from all available sites

Click on the menu button at the top-right of the map page; the map-page menu is revealed, which is a system-wide control for the user.

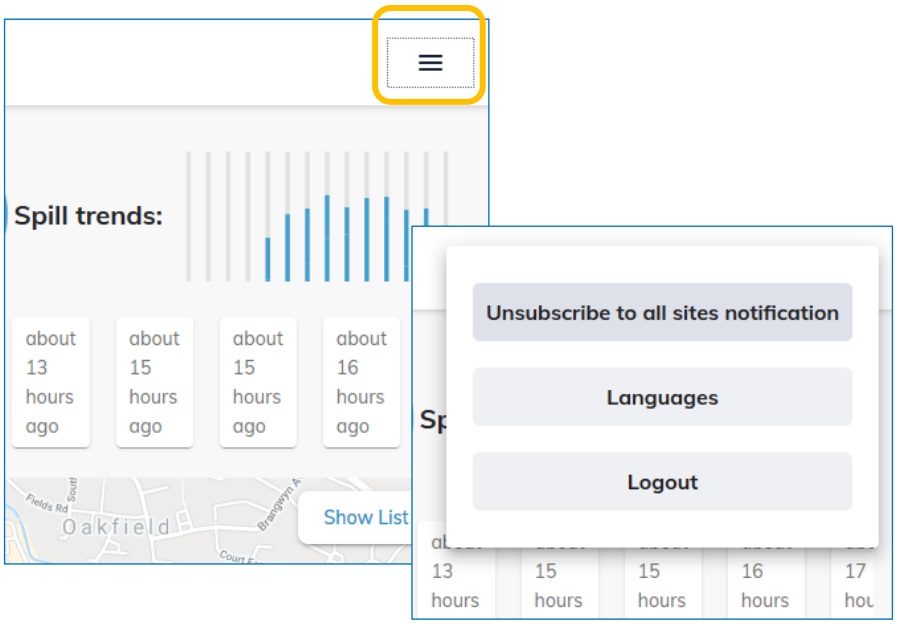


The menu contents vary according to what has already been subscribed to. Here, since it has not already been done, it is possible to subscribe to all the sites (as a collective group) which are available to the account.

To subscribe to the group of sites, click on “Subscribe to all sites notification”.

5.2.3 Ending subscription to messages from all available sites

Click on the menu button at the top-right of the map page; the menu is revealed.



The menu contents vary according to what has already been subscribed to. Here, the collective group of all sites which are within the account have already been subscribed to.

To unsubscribe to the group of sites, click on “Unsubscribe to all sites notification”.

5.2.4 Ending subscription to messages from individual sites

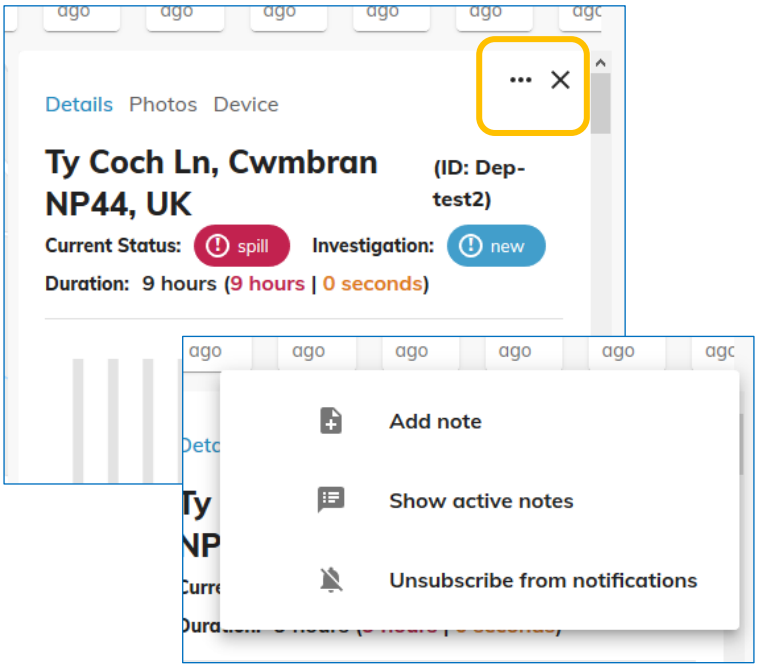
It is sometimes possible to unsubscribe to an individual site.

The site must first be selected and shown in the site details panel.

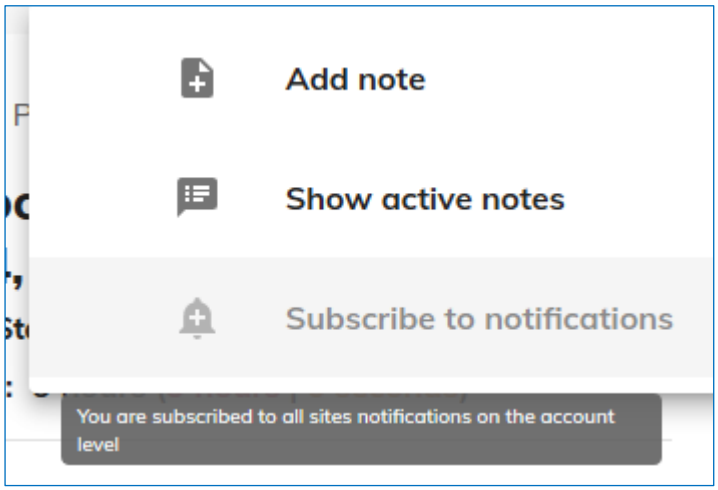
Within this panel, click on the "…" button, which is a menu control.

A menu is shown. The menu contents depend on the current subscription status of the site … here the site has already been subscribed to, so it is possible to unsubscribe to it.

To subscribe to the site, click on "Unsubscribe from notifications".



Under certain circumstances, it is not possible to unsubscribe to the individual site.
For example, the option is not available (greyed out) in the diagram opposite. (Notwithstanding that it reads "subscribe" rather than "unsubscribe").
If you hover over the menu option, a pop-up notice informs you that will already receive alarms because the entire group of available sites has been subscribed to collectively (as sites within the account). It is not possible to remove a site from this collective subscription.



If the account level (collective) subscription is cancelled, any previous settings for individual site settings are restored to whatever they previously were.

HWM-Water Ltd.
Ty Coch House
Llantarnam Park Way
Cwmbran
NP44 3AW
United Kingdom
+44 (0)1633 489479
www.hwmglobal.com

MAN-3000-0001-A October 2020.