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DIGITAL GRID – ASSET MANAGEMENT

Demo Script

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Sep 2018

Strategy | Consulting | Digital | Technology | Operations

Connecting to the Asset Health Application Via AIP App Gallery

Open the following link in Chrome:
https://analyticapps.accenture.com/

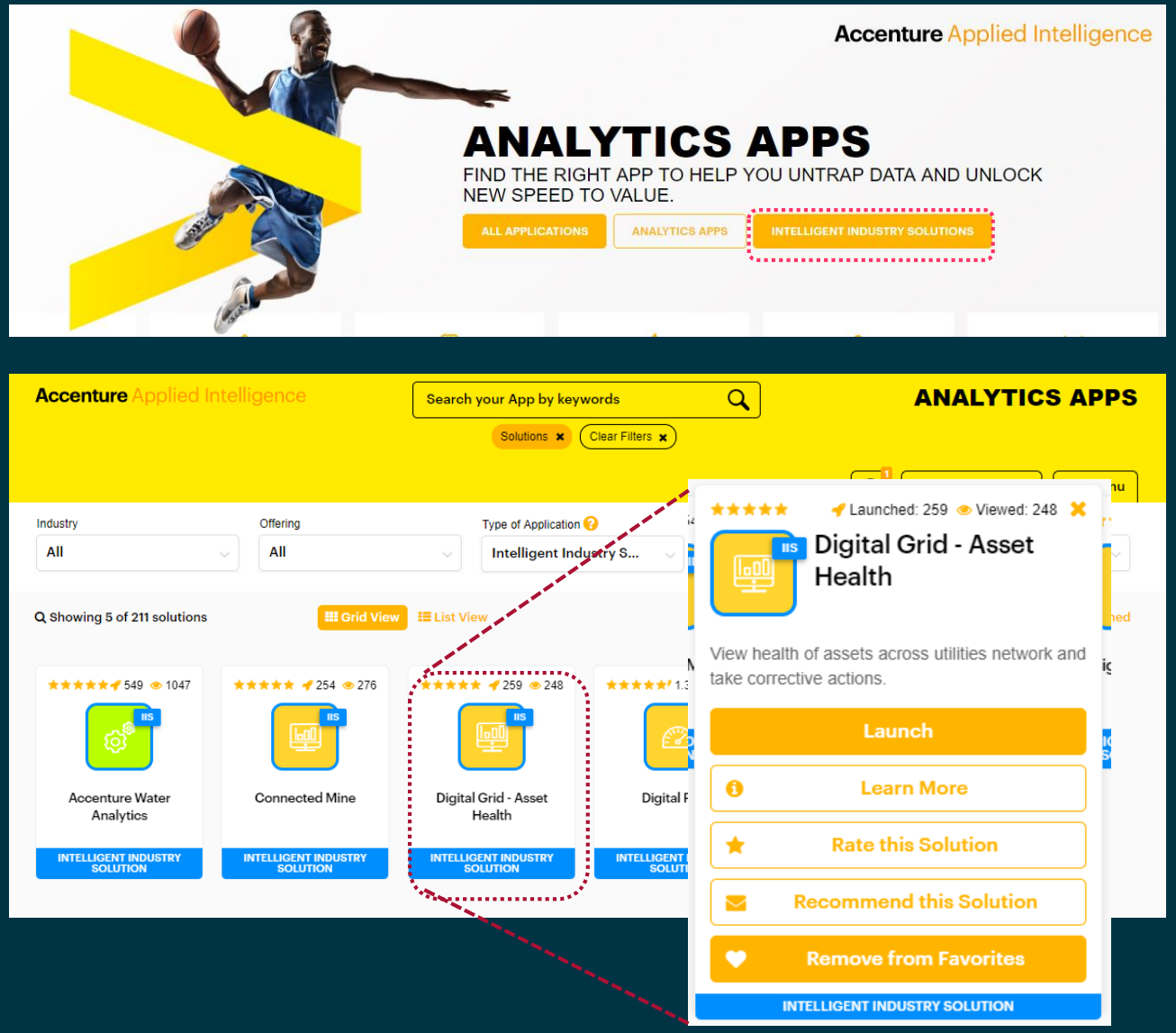
On the main dashboard page, select Type of Application = Intelligent Industry Solutions this will open showing the main industry solutions currently available

Click on Digital Grid – Asset Health tile to view the pop up

On the pop up, select

- Launch – will launch the application
- Learn More will open an information page containing stage0 deck, talk tracks and supporting materials for the application and demo
- Rate / Recommend Solution allows users to rate and feedback on the application

AIP App gallery apps are available anyone with an Accenture Enterprise ID.



Connecting to the Asset Health Application Via AIP App Gallery

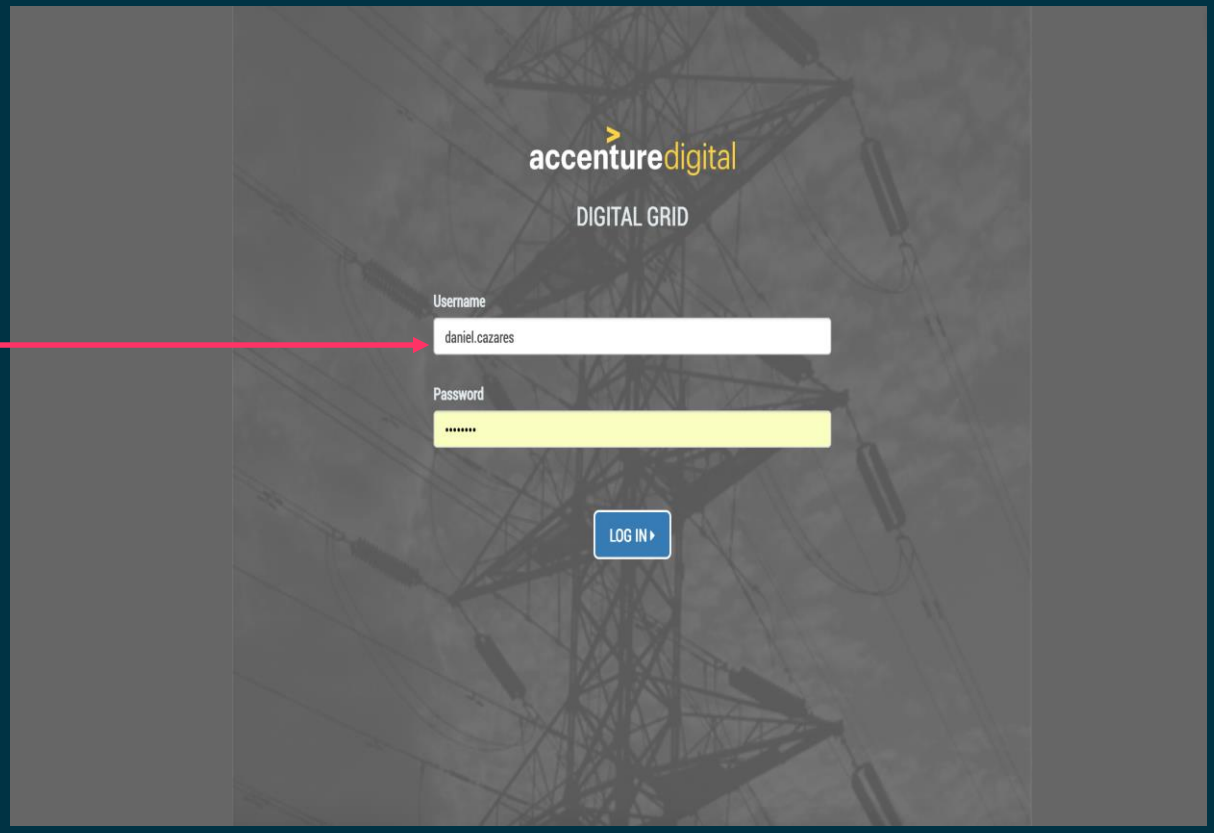
- Open the following link in Chrome:
- http://analyticappsshiny.accenture.com/digitalgrid/dist/#/login

This is the first screen the user sees when the application is launched

Enter in **Username** and **Password** for the user and click **Log In**

Username: daniel.cazares

Password: p@ssword



- For any issues accessing the Digital Grid – Asset Management demo, please connect via the Contacts page

ACCENTURE DIGITAL GRID DEMO: WHAT WE WILL SHOW YOU TODAY

A **highly visual analytics platform** that **aggregates and filters data** from multiple sources to provide **insights and clear calls to action**

SCENARIO 1	SCENARIO 2	SCENARIO 3	SCENARIO 4	SCENARIO 5
SUBSTATION ASSET HEALTH **VIEW THE CONDITION OF TRANSFORMERS & BREAKERS IN A SUBSTATION**	**CONSEQUENCE MODELLING** **CHANGE THE CONSEQUENCES OF FAILURE AND RECALCULATE ASSET RISK**	**INVESTMENT OPTIMISATION** **CONDUCT A NUMBER OF SCENARIOS TO OPTIMISE THE PORTFOLIO OF WORK**	**URD CABLES** **FORECASTS THE LOAD AND SELECTS RECOMMENDED ACTION FOR TRANSFORMER**	**GEOSPATIAL ANALYSIS** **ANALYSE THE LOAD DATA FOR ALL TRANSFORMERS**
Tom ***Substation Manager***	**Sarah** ***Risk & Investment Manager***	**Sarah** ***Risk & Investment Manager***	**Wayne** ***Distribution Engineer***	**Wayne** ***Distribution Engineer***

ACCENTURE DIGITAL GRID
SCENARIO 1 – RESPONDING TO AN ALERT ON THE SUBSTATION ASSET HEALTH SYSTEM

Tom
Substation Engineer

TOM STARTS HIS DAY AT THE PLANT

Logs into ADG to complete analysis on the transformer fleet within the substations

IDENTIFIES A TRANSFORMER WITH AN ELEVATED LIKELIHOOD OF FAILURE

The system indicates a transformer that has been flagged as elevated likelihood of failure

CONDUCTS AN ANALYSIS OF THE CAPTURED DATA FOR THE TRANSFORMER

Tom reviews all the data captured for the transformer. This includes reviewing the risk, work order history, dissolved gas analysis and sensor data.

IDENTIFIES THAT THERE IS A REGULAR OVERLOAD ON A PARTICULAR TRANSFORMER

After reviewing the sensor data, identifies that the transformer is overloaded on a regular basis and wants to conduct further tests on the overload to ensure damage is not being incurred

CREATES A WORK ORDER FOR AN ONSITE INSPECTION AND LOAD ANALYSIS

Creating a work order selecting a recommended action and updates the analysis notes. Tom then moves onto the next course of action for the

MOVES TO NEXT PROBLEMATIC TRANSFORMER

Digital Grid – Asset Management Demo scenarios

Scenario 1 – Asset Health

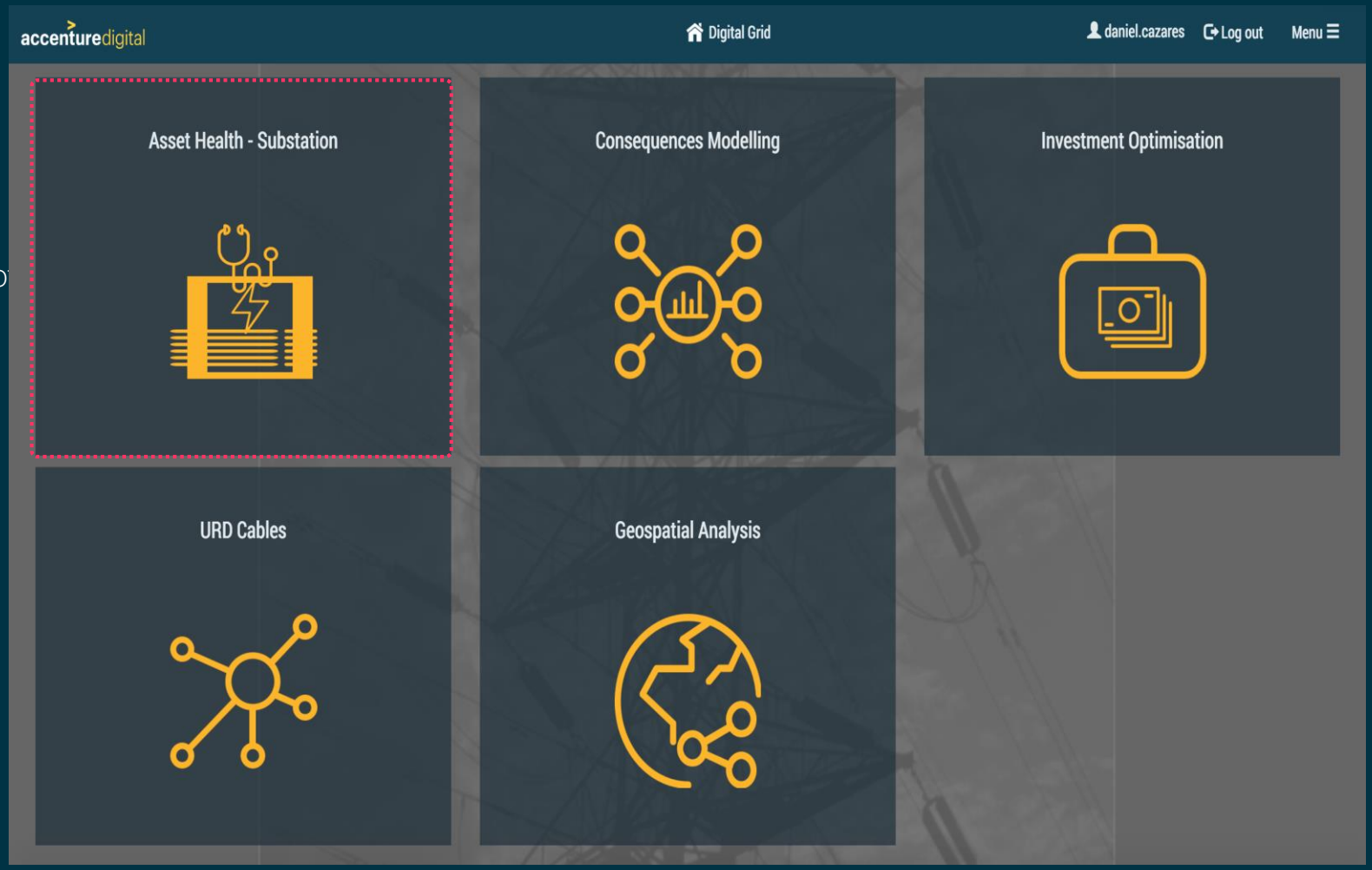
- Transformer engineer logs into the asset health system to complete analysis on the fleet of transformers
- Check the initial risk status of each of the transformers and decides to conduct deep analysis on one transformer
- Reviews the asset detailed view, checking all information available to determine any additional information regarding next steps on a transformer identified with elevated risk
- Checks the load on the particular transformer and determines the overload that seems to be breached on a regular basis
- Determines that need to conduct additional testing on the transformers and raises a work order to do this along with updating the notes against the system

Digital Grid – Landing Page

This is the first screen user sees when logged in to the application

Here, user will have an option to select the business unit o interest. User can choose one from following:

- Asset Health - Substation
- Consequences Modelling
- Investment Optimisation
- URD Cables
- Geospatial Analysis



Asset Class Summary

The user lands on the main asset class summary page, this will show all the asset classes the user has authorisations to.

- The icon shows the asset class in scope
- Likelihood of Failure (LoF) – this graphic shows the percentage of assets within each of the RAG status with a total of the number of assets in each status shown in the numbers below
- Risk – this is the % of assets within each RAG status for the risk valuation and the total number within each of the thresholds
- The table shows the worst case valuation of risk that the fleet of transformers contains. This is displayed using recognised percentiles of average, median, 75%, 80%, 90% and worst case.
- User clicks on the List button to view the ***Asset Class Details*** page

Asset Class List

The asset class list page details all the transformers in the fleet along with key pieces of information, such as Location, Transformer ID, Age, Manufacturer, Likelihood of Failure & Risk

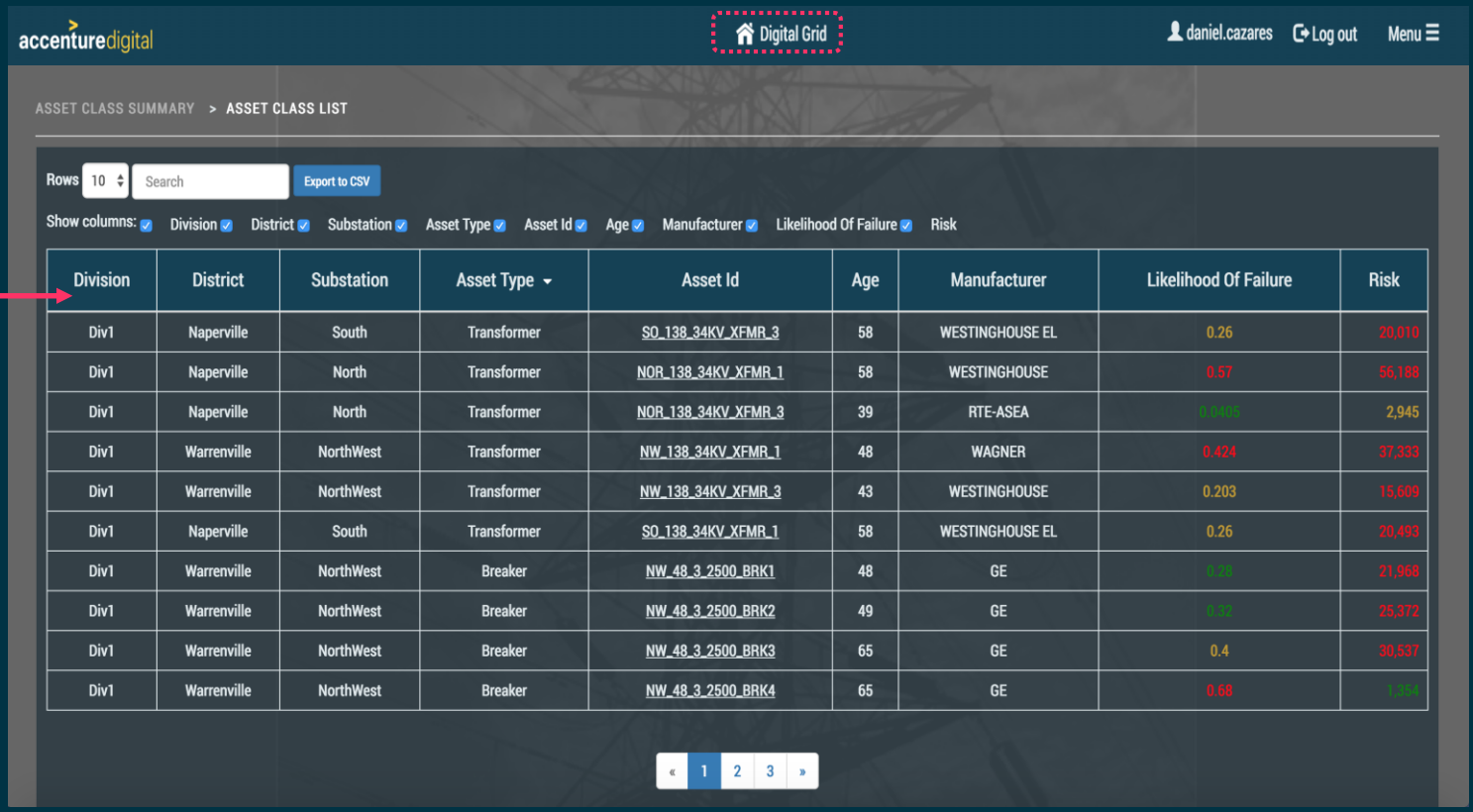
Show columns allows user to hide columns not needed

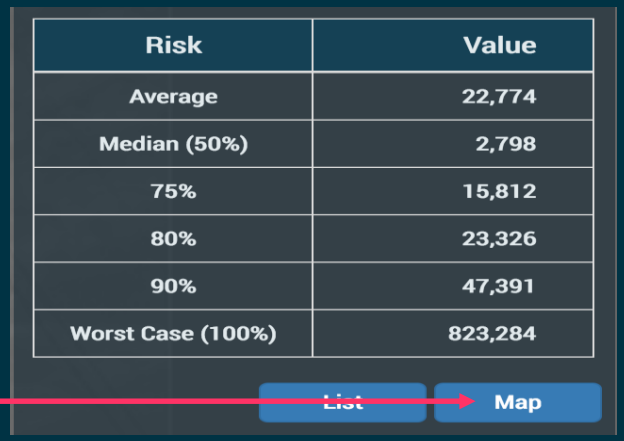
Each column header can be clicked to sort the column in ascending / descending order

The transformer we are interested in for this demo is NW_138_34KV_XFMR_1

For this demo, we will click on the **Digital Grid** icon on the menu to go back to home page and click the Asset Health business unit , this will bring the Asset Class Summary screen (to show the map functionality)

When back on the asset class summary page click on the map button

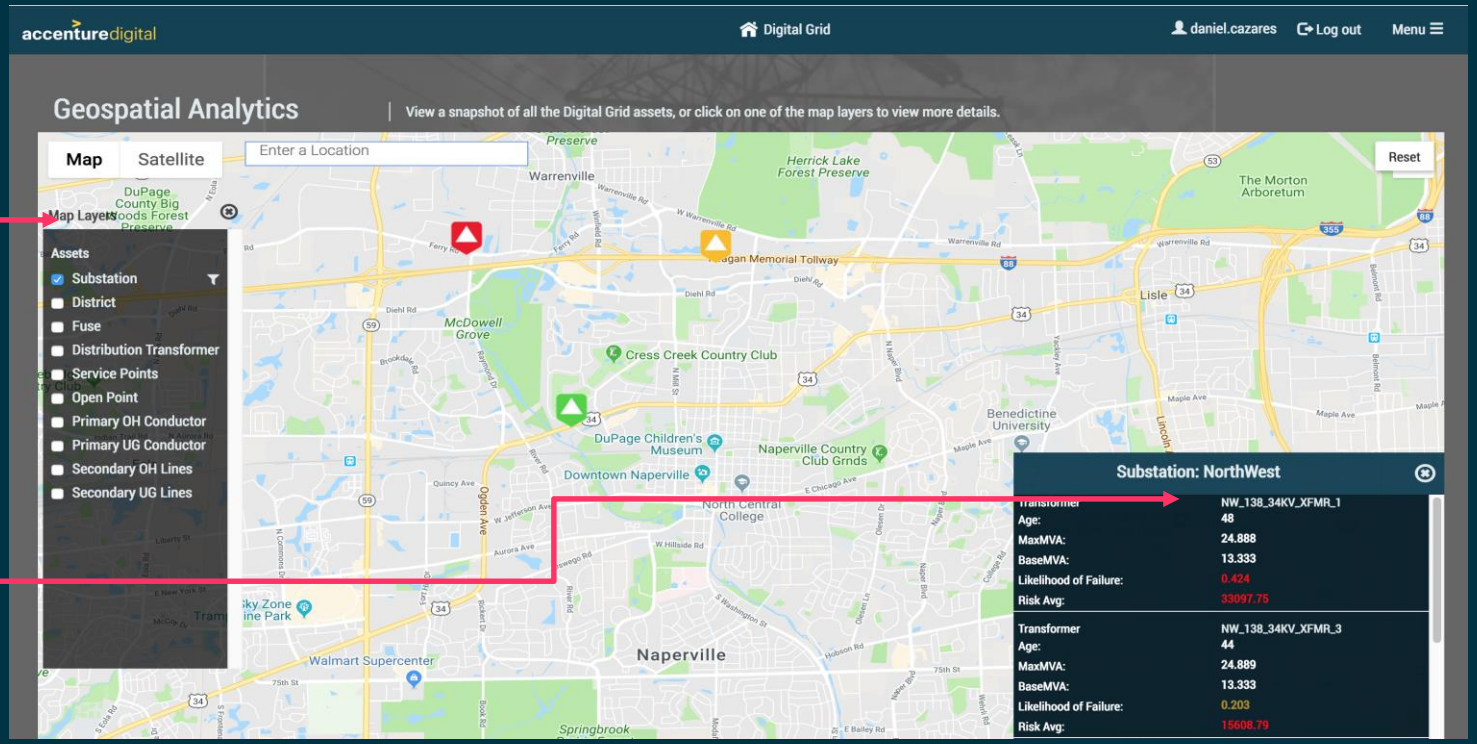




Asset Class Map View

The Geospatial view opens with a blank map of the service area in question.

- Click on the Map Layers button to expose the drop down of the asset classes that can be filtered on. In this case, select Substations to show these on the map
- We are interested in the substation coloured Red in the map view and click this to reveal the 2 transformers in this substation. As in the Asset Class list view, we are interested in NW_138_34KV_XFMR_1 transformer. Click on the hyperlink for this transformer to open the Asset Details page for Transformers
- If the user clicks on one of the breakers they will be taken to a different Asset Details page for Breakers



Asset Detailed View (Transformers1)

Asset detail view opens showing a lot of detail captured about the asset.

1) Floating Bar – this contains key pieces of information about the transformer that remains on top of the screen as the user scrolls down the screen

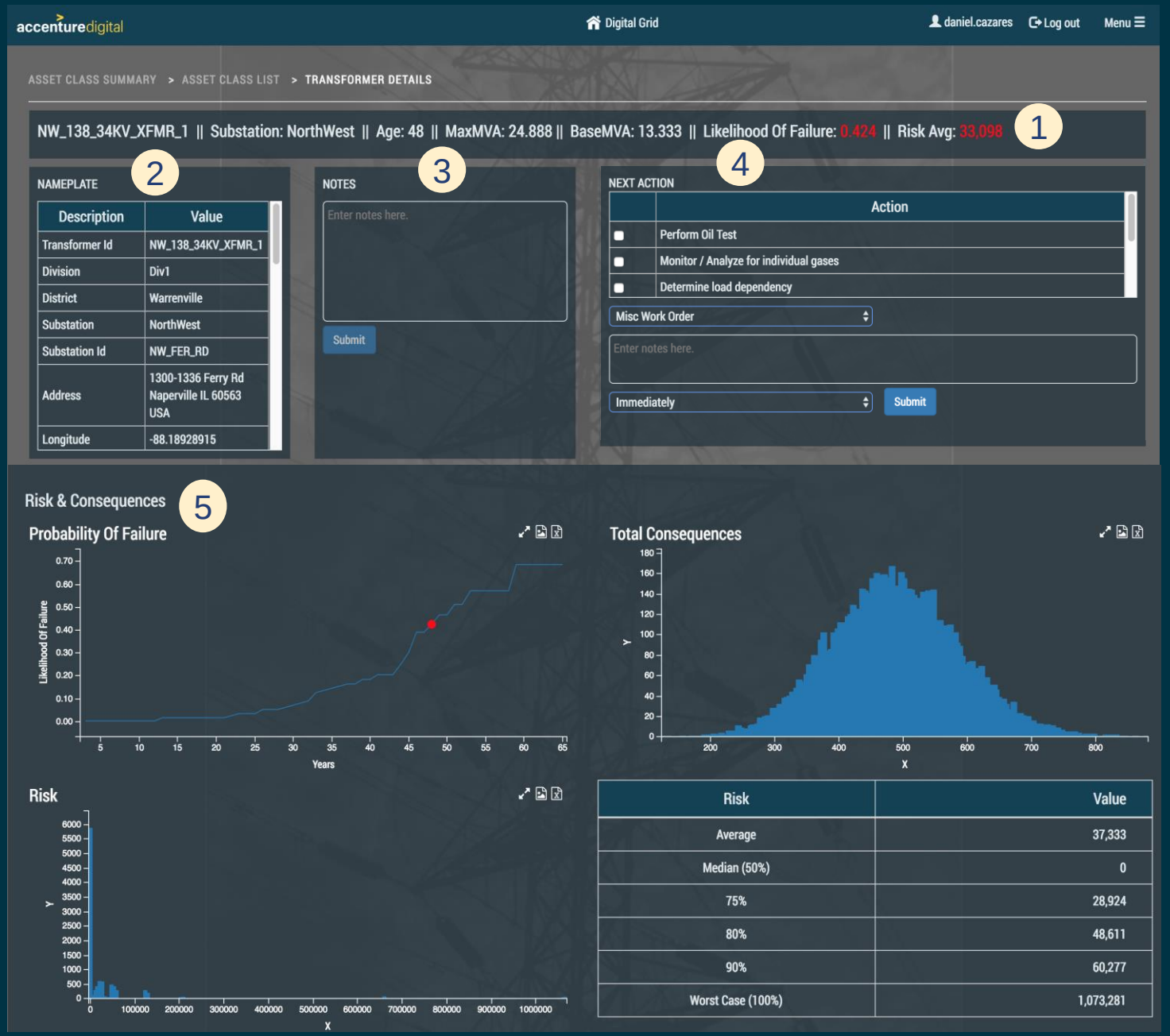
2) Nameplate – this shows the asset registry / nameplate information captured and typically consumed from the EAM system

3) Notes – view the most recent notes captured about the transformer from the substation engineer

4) Next Actions – suggested actions for the transformer based on a recommendation engine

5) Risk & Consequences section

- PoF of the transformer on the failure curve calculated as part of the overall transformer fleet
- Total consequences associated with distribution transformers
- Risk calculated as the PoF * Total Consequences
- Quartile valuation of risk shown in a table format



Asset Detailed View (Transformers2)

Continued from previous screen

6) Historical Events – The lollipop timeline shows all the major events recorded against the transformer from Work orders, inspections, gas measurements, outages etc.

7) DGA Table – table shows the actual dissolved gas readings over time along with the location of each in the Duval triangles (1,4 & 5)

8) DGA trend & 1st order difference – this graph shows the DGA trend and 1st order differences over the history of the readings, this helps identify the longer term trend of the DGA readings

9) Duval triangles (1,4 & 5) – shows the position of the readings based on the Duval methodology.

Asset Detailed View (Transformers3)

Continued from previous screen

Time-series analysis – This section shows an number of visualisations of the timeseries data for the transformer, the key measurements shown are

- Real Power
- Total Power
- Power Factor
- Reactive Power
- Voltage
- AMPS

A number of graphs are shown for each of the measurements

10) TS raw data values showing on 1 hourly intervals as captured from the historian system

11) Histogram of the TS data showing the distribution of values across regular sized intervals

12) Empirical Cumulative Distribution Function graph

13) Load duration curve

12 & 13 are shown only for real power and total power

Asset Detailed View (Breakers1)

Asset detail view opens showing a lot of detail captured about the asset.

1) Floating Bar – this contains key information about the breaker that remains on top of the screen as the user scrolls down the screen

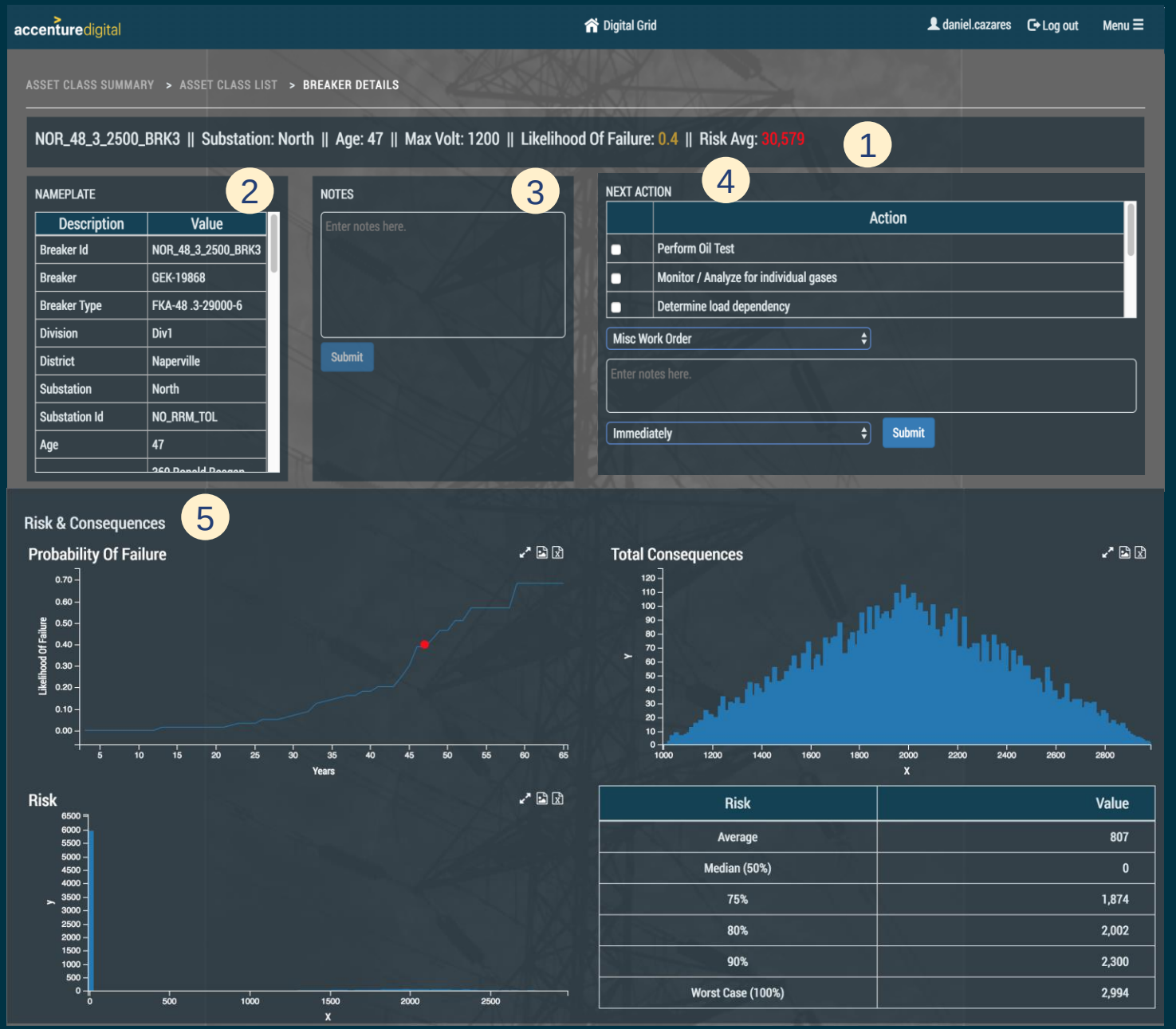
2) Nameplate – this shows the asset registry / nameplate information captured and typically consumed from the EAM system

3) Notes – view the most recent notes captured about the breaker from the substation engineer

4) Next Actions – suggested actions for the transformer based on a recommendation engine

5) Risk & Consequences section

- PoF of the breaker on the failure curve calculated as part of the overall breaker fleet
- Total consequences associated with distribution breakers
- Risk calculated as the PoF * Total Consequences
- Quartile valuation of risk shown in a table format



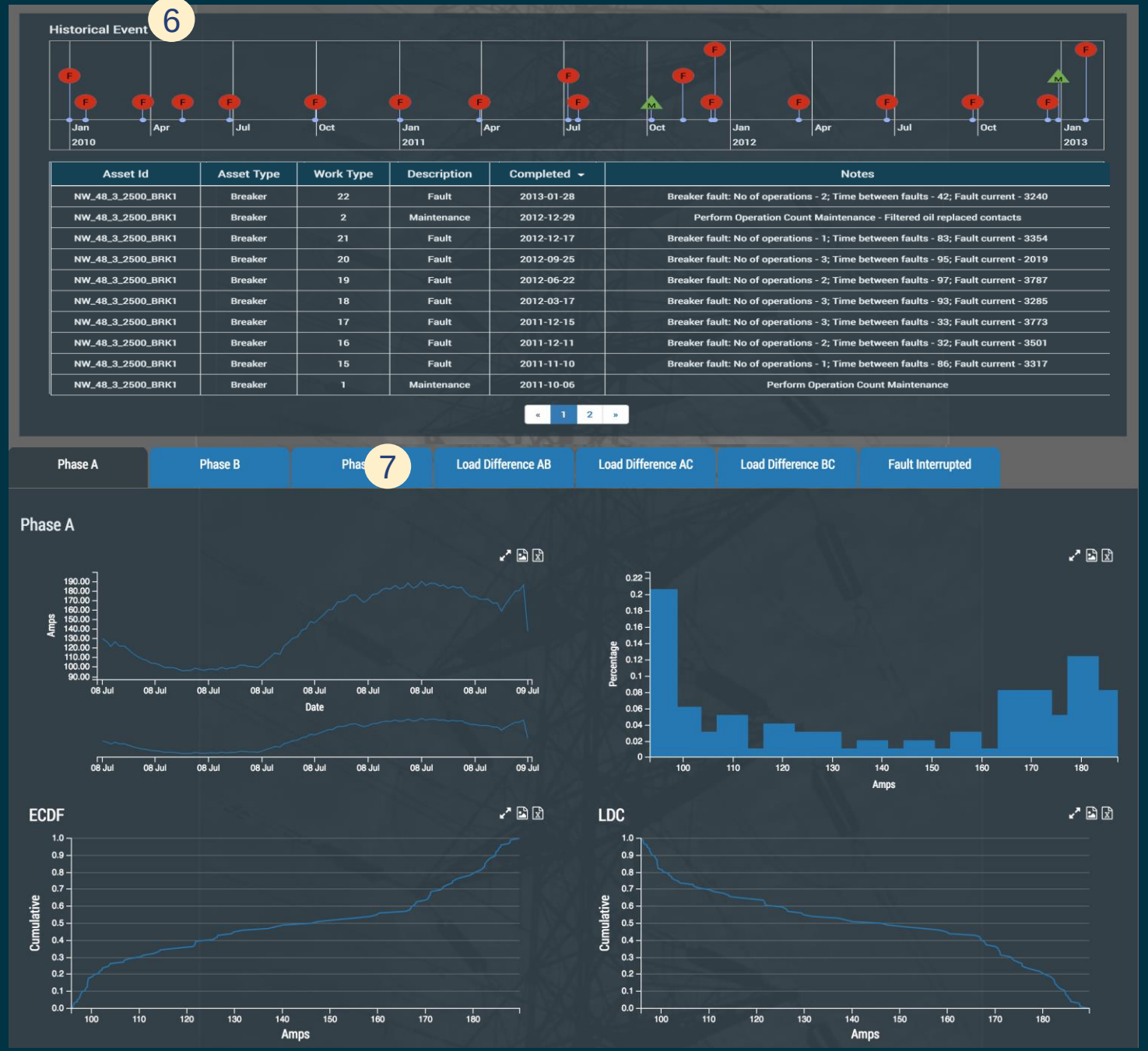
Asset Detailed View (Breakers2)

Continued from previous screen

6) Historical Events – The lollipop timeline shows all the major events recorded against the transformer from Work orders, inspections, gas measurements, outages etc.

7) Phase Loading by Phase (A, B, C)

- TS raw data values showing on 1 hourly intervals as captured from the historian system
- Histogram of the TS data showing the distribution of values across regular sized intervals
- Empirical Cumulative Distribution Function graph
- Load duration curve



Asset Id	Asset Type	Work Type	Description	Completed	Notes
NW_48_3_2500_BRK1	Breaker	22	Fault	2013-01-28	Breaker fault: No of operations - 2; Time between faults - 42; Fault current - 3240
NW_48_3_2500_BRK1	Breaker	2	Maintenance	2012-12-29	Perform Operation Count Maintenance - Filtered oil replaced contacts
NW_48_3_2500_BRK1	Breaker	21	Fault	2012-12-17	Breaker fault: No of operations - 1; Time between faults - 83; Fault current - 3354
NW_48_3_2500_BRK1	Breaker	20	Fault	2012-09-25	Breaker fault: No of operations - 3; Time between faults - 95; Fault current - 2019
NW_48_3_2500_BRK1	Breaker	19	Fault	2012-06-22	Breaker fault: No of operations - 2; Time between faults - 97; Fault current - 3787
NW_48_3_2500_BRK1	Breaker	18	Fault	2012-03-17	Breaker fault: No of operations - 3; Time between faults - 93; Fault current - 3285
NW_48_3_2500_BRK1	Breaker	17	Fault	2011-12-15	Breaker fault: No of operations - 3; Time between faults - 33; Fault current - 3773
NW_48_3_2500_BRK1	Breaker	16	Fault	2011-12-11	Breaker fault: No of operations - 2; Time between faults - 32; Fault current - 3501
NW_48_3_2500_BRK1	Breaker	15	Fault	2011-11-10	Breaker fault: No of operations - 1; Time between faults - 86; Fault current - 3317
NW_48_3_2500_BRK1	Breaker	1	Maintenance	2011-10-06	Perform Operation Count Maintenance

Asset Detailed View (Breakers3)

Continued from previous screen

8) Loading Difference AB, BC, AC– This section shows the phase loading differences between each of the phases, this is highlighted to show imbalances within the breaker phases

A number of graphs are shown for each of the measurements

- TS raw data values showing on 1 hourly intervals as captured from the historian system
- Histogram of the TS data showing the distribution of values across regular sized intervals

9) Faults Interrupted – This section shows a number of fault measurements from the Breaker including

- I^T cumulative faults interrupted
- Number of operations between PM
- Cumulative Operations from lifespan of the Breaker

ACCENTURE DIGITAL GRID

SCENARIO 2 – IDENTIFYING AND CHANGING THE CONSEQUENCES OF FAILURE AND RECALCULATING RISK

Sarah

Risk & Investment Manager

SARAH STARTS HER DAY IN THE OFFICE

Logs into ADG and checks the risk calculations for a type of transformer. Tom has reported that the risk valuation is very high for a particular type of transformer in the fleet

REVIEWS THE TRANSFORMER LOF, CONSEQUENCES AND RISK

Reviewing the Likelihood of Failure, Consequences of Failure and Risk associated, it is determined that the cost consequence for transformers <20Mva exceeds what would typically be incurred for this type of transformer

CLONE & EDIT EXISTING CONSEQUENCES SET

Sarah clones an existing set of consequences using the Transformers as the baseline.
Edits the costs consequences to reflect the lower cost consequences for <20MAV transformers and reviews the total impact.

MAP CONSEQUENCES TO <20MVA TRANSFORMERS

Navigates to the consequence mapping screen and filters to the subset of transformers meeting the <20MVA criteria and maps the new consequences to this transformer.

RECALCULATES RISK FOR NEWLY MAPPED TRANSFORMERS AND REVIEWS THE IMPACT THIS HAS ON THE OVERALL RISK FOR THE TRANSFORMER FLEET

Recalculates the risk for the transformers that have been remapped
Reviews the overall impact that this has on the transformer risk and on the fleet of transformers in general.

REVIEWS IMPACT ACROSS ALL TRANSFORMERS

Digital Grid – Asset Management Demo scenarios

Scenario 2 – Asset Health (Consequences Modelling)

- Engineer looks through the fleet of transformers and notices the risk on one of them is high but the consequences is too high / low for that type specification of transformers.
- Creates a request to amend the consequences for any transformers below a certain BaseMVA. User goes into the application, reviews the consequences for all transformers, determines that the cost (or another) needs to be amended but the rest can remain the same.
- User clones the existing consequences and saves them to the system
- User then edits the cost consequence for the <20Mva transformers and checks through the consequences and reviews the total impact and saves the consequences
- User then maps the required transformers to the new consequences that were created. This is then saved and user given the option to recalculate all risks based on the revised consequences
- User goes into the asset health for the changed transformers and reviews the consequences, these consequences are seen as more reflective of the situation for the transformer

Scenario 2 –Definitions

Consequence is defined as a probability distribution that reflects the consequences of a particular event happening to the asset. This is set on a current scale to enable normalisation however this could also be considered risk points.

Consequence Set – This is a number of individual consequences aligned to those laid out by the utility, in this instance we have configured the consequence set as Cost, Reliability, Safety and Total Impact.

Digital Grid – Landing Page

This is the first screen user sees when logged in to the application

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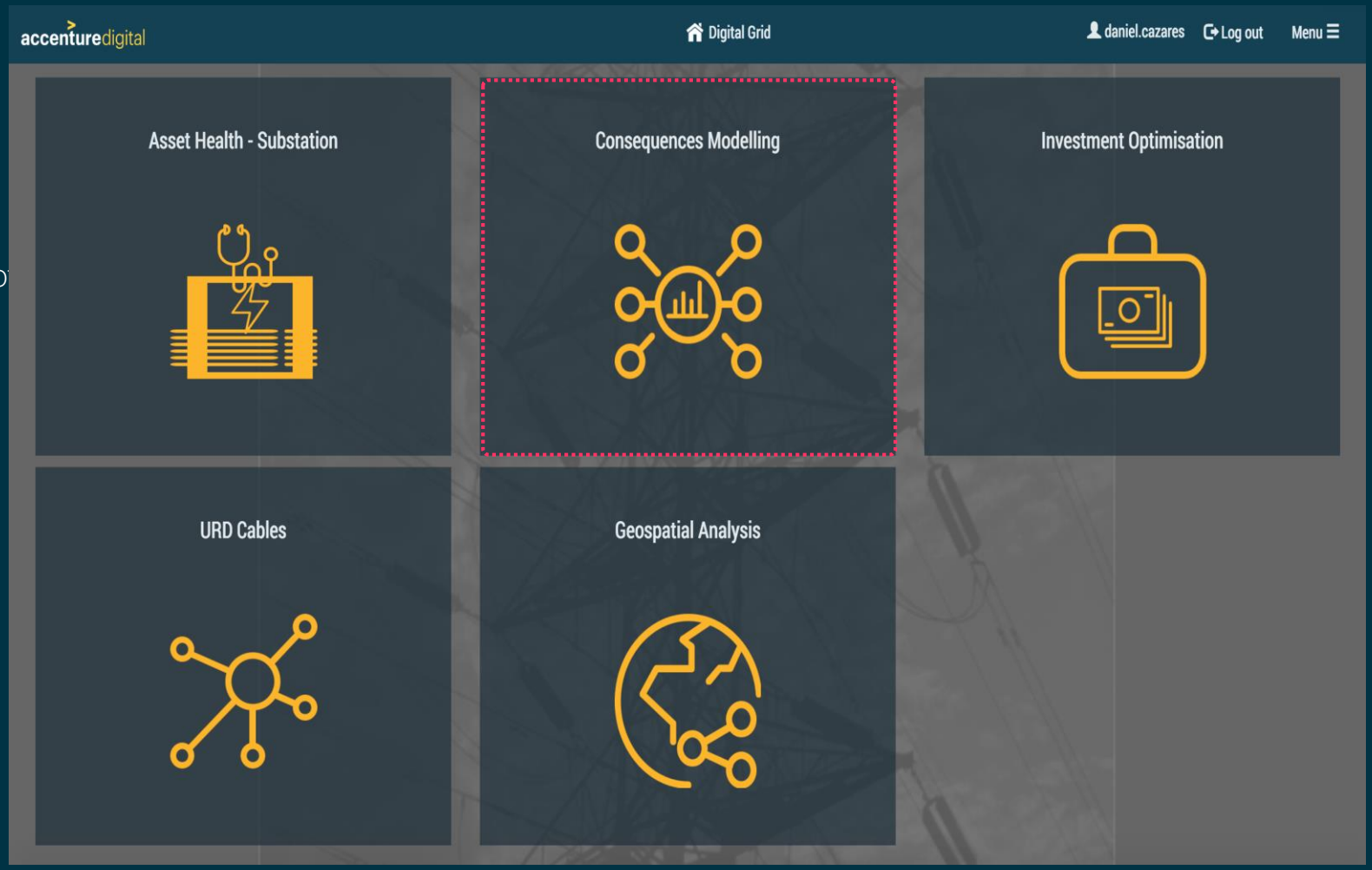
- Asset Health - Substation
- Consequences Modelling
- Investment Optimisation
- URD Cables
- Geospatial Analysis



Consequence Modelling Screen Overview

Menu Options

- Add – create a new set of consequences
- Clone – clone an existing set of consequences
- Edit – edit an existing set of consequences
- Map – Map the consequence set to individual assets with the option to recalculate the risk based on the changed consequences
- Save – save any amendments to the consequences

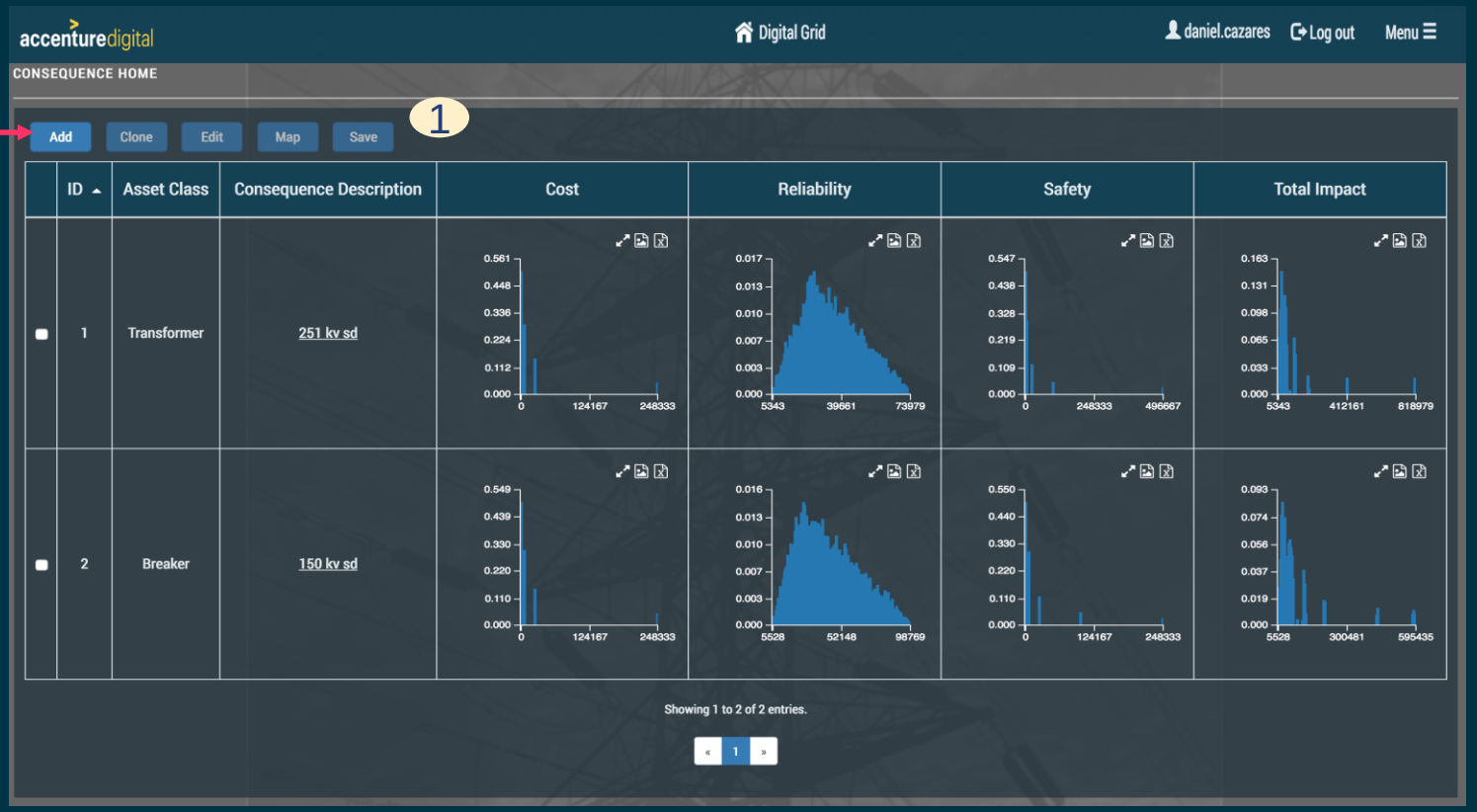
ID – Unique identifier for the consequence set

Asset class that the set of consequences is to be associated with

Consequence description to denote the asset subclass that this consequence set should be applied to

Cost, Reliability, Safety – probability distribution for each of the individual consequences

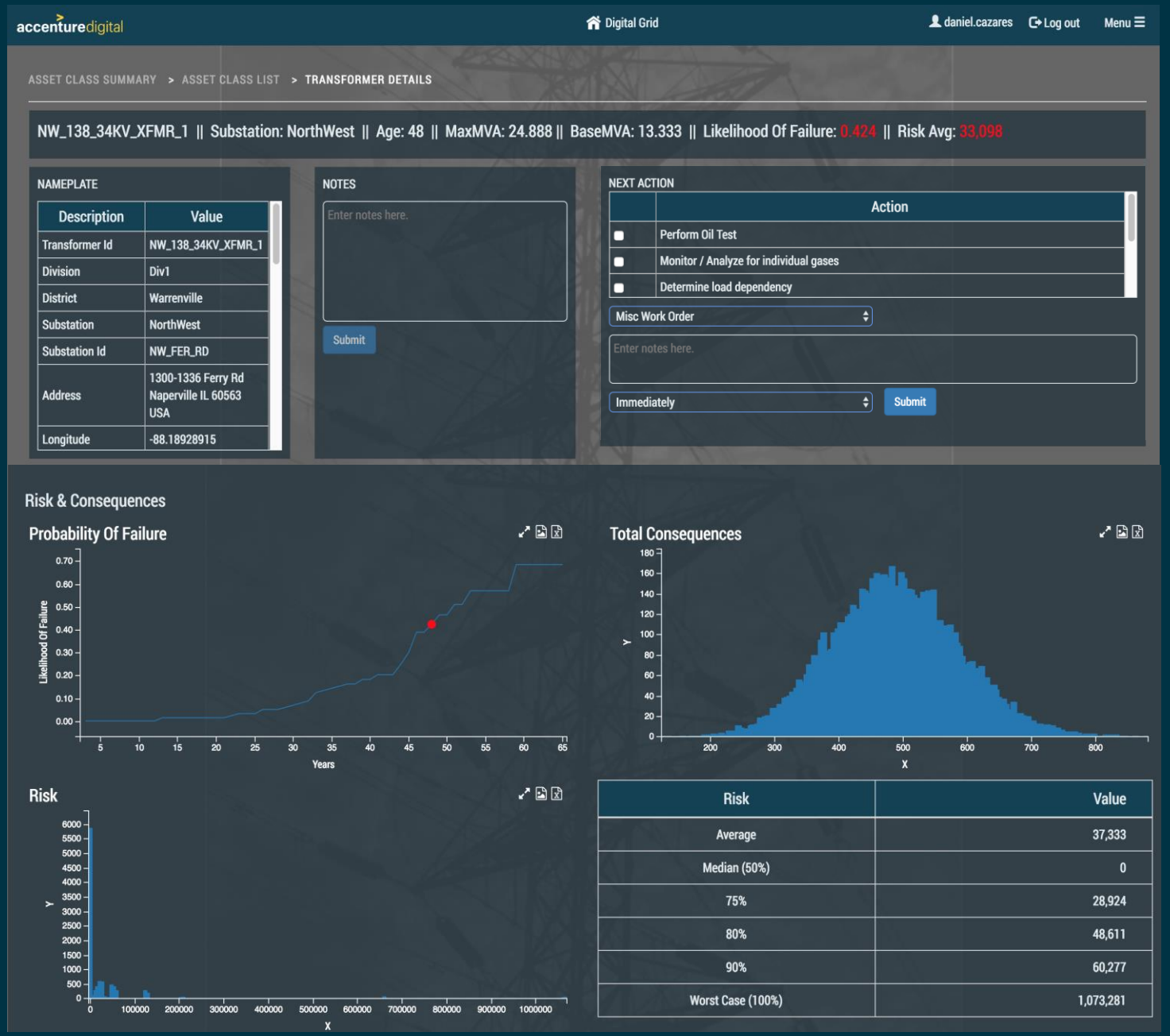
Total Impact – sum of the individual consequences



Asset Detailed View (1)

In the asset detail view the substation engineer views a transformer and notices that the risk value is very high considering the Likelihood of Failure.

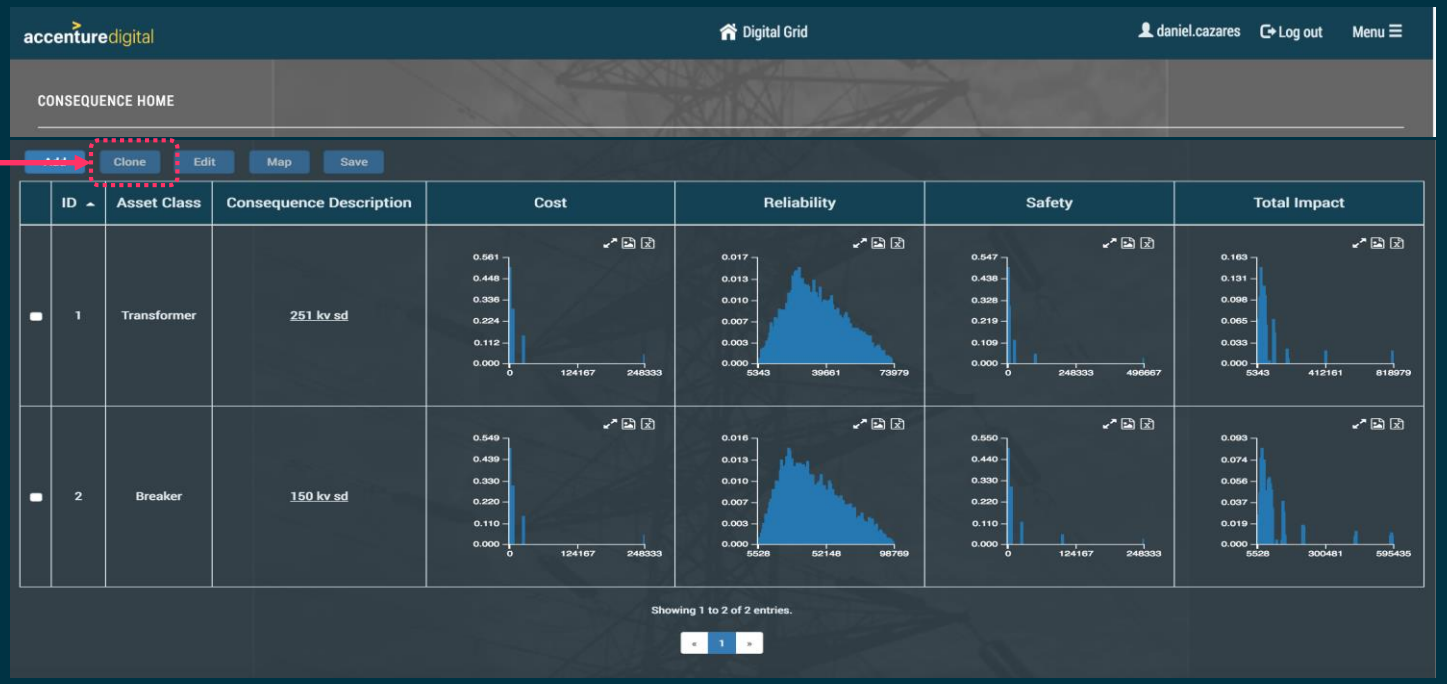
They raise a request to change the consequences of failure for any transformers where the BaseMVA is below a certain threshold.



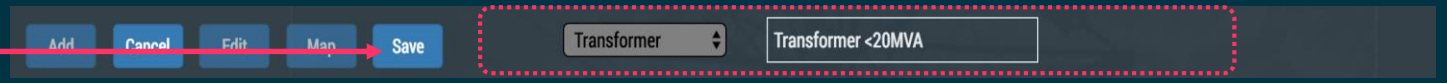
Consequence Modelling Screen

The consequences modelling screen opens on the main page showing the main consequences for each of the major asset classes in scope.

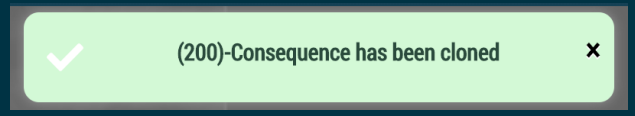
Risk manager highlights the asset class / consequence and clicks on the clone button to duplicate this asset class.



Risk manager will be prompted for a Consequence description to set it apart from the existing ones and clicks save



A message then appears confirming that the consequences have been cloned

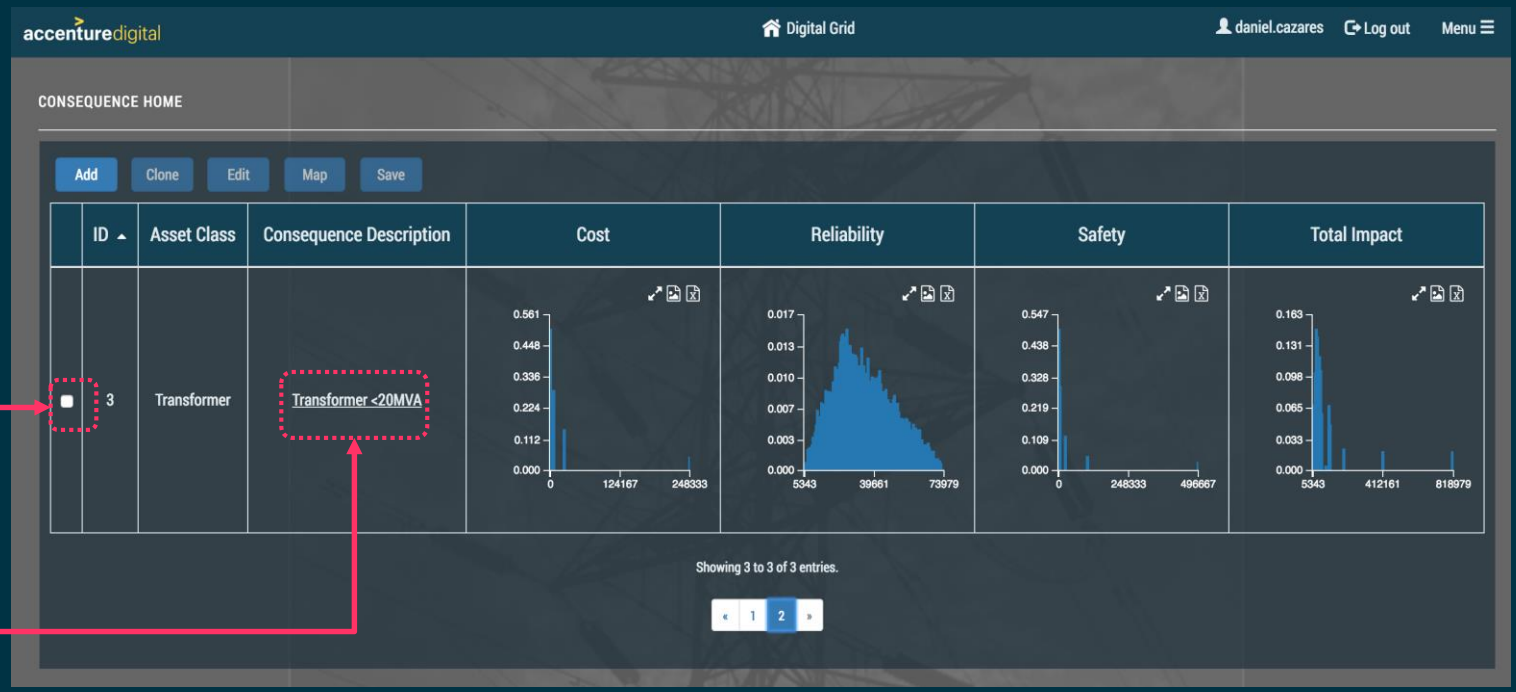


Consequence Modelling

Once cloned the new set of consequences are available in the Consequence Modelling screen

To Edit the consequence description, check the record to be changed and click on the Edit button to edit the Consequence Description

To access the consequence details screen, click on the hyperlink for the consequence description



Consequence Modelling

The consequence modelling screen contains the following sections

1) Tabs showing the consequence categories (Cost, Reliability, Safety) and Total Impact

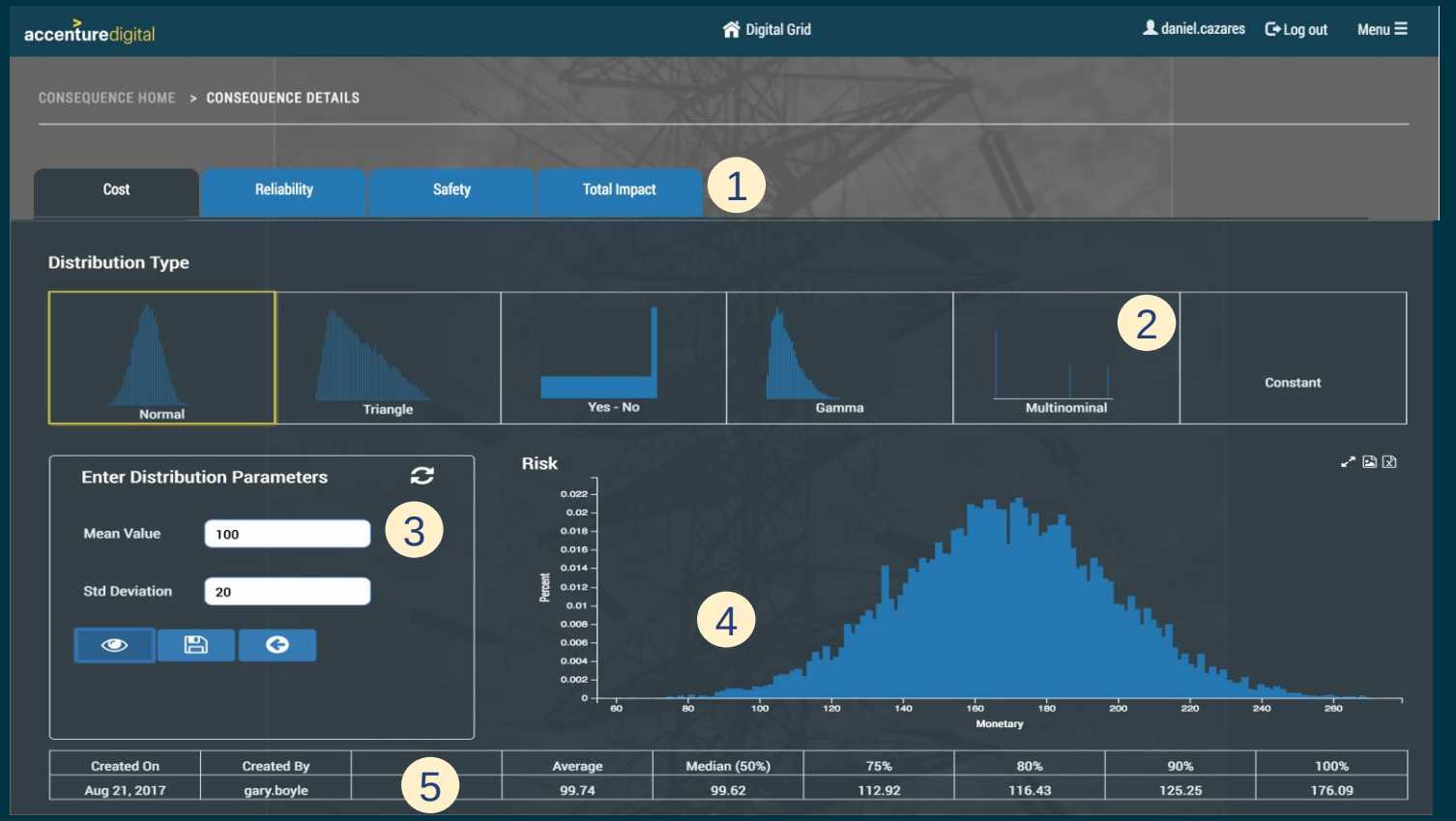
2) The type of probability distribution that is being used for the consequence (Normal, Triangle, Yes / No, Gamma, MultiNominal or Constant)

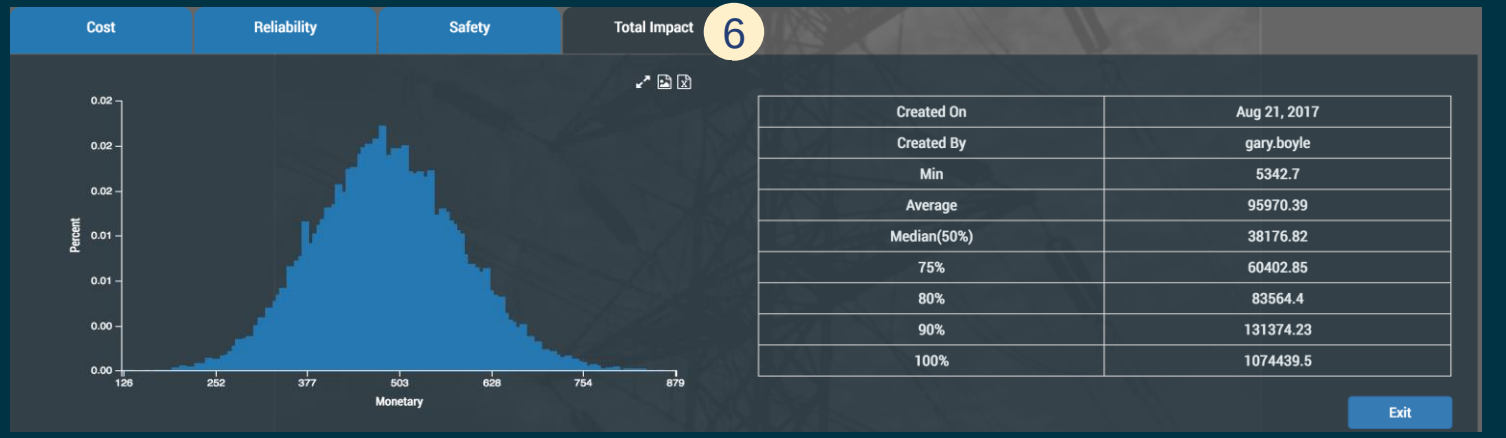
3) Depending on the type of distribution selected, the distribution parameters will differ

4) Histogram graph shows the 10,000 value random probability distribution shown in 150 bins

5) Table shows the information on when it was cxreated and percentile information (Average, Median, 75%, 80%, 90% and 100%)

6) The total impact tab, contains the sum of the individual consequences and the percentiles.





Consequence Modelling

Within the scenario the user selects the relevant consequence that they wish to change. In this case reliability will be changed.

Select the distribution type if a different one is required, this case we will select Triangle and enter the required parameters Minimum, Likeliest and Maximum

Click on the View button to view the updated distribution with the revised parameters

Once this is acceptable, click on the save button to save this distribution as the default for this distribution set.

If not needed then click Exit which will close the screen without saving this distribution.

Check the remaining tabs and especially the Total Impact in the final tab and click exit to return to the Consequence main screen

Select the updated consequence using the check box and click on the Map button

Consequence Modelling

On the Consequence Modelling landing page, select the updated consequence using the check box and click on the Map button

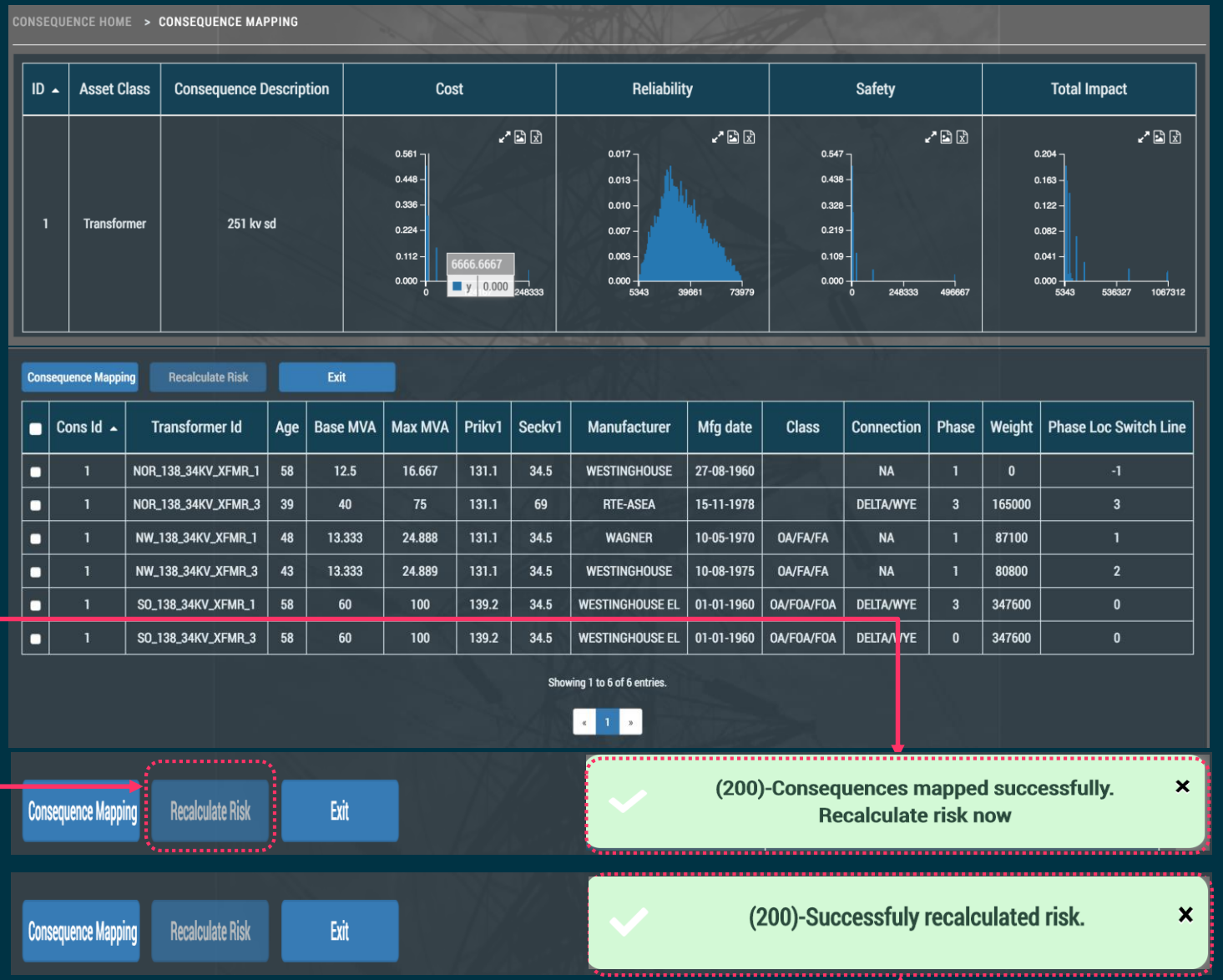
This opens the Mapping screen showing the consequences and the assets that this can be mapped to.

Filtering options are available for the assets to filter by Age, Manufacturer and asset specific measures

Once filtered, user selects assets to be mapped by clicking on the check box. Once all selected, click the Consequence Mapping button to remap. Once complete this shows the message shown.

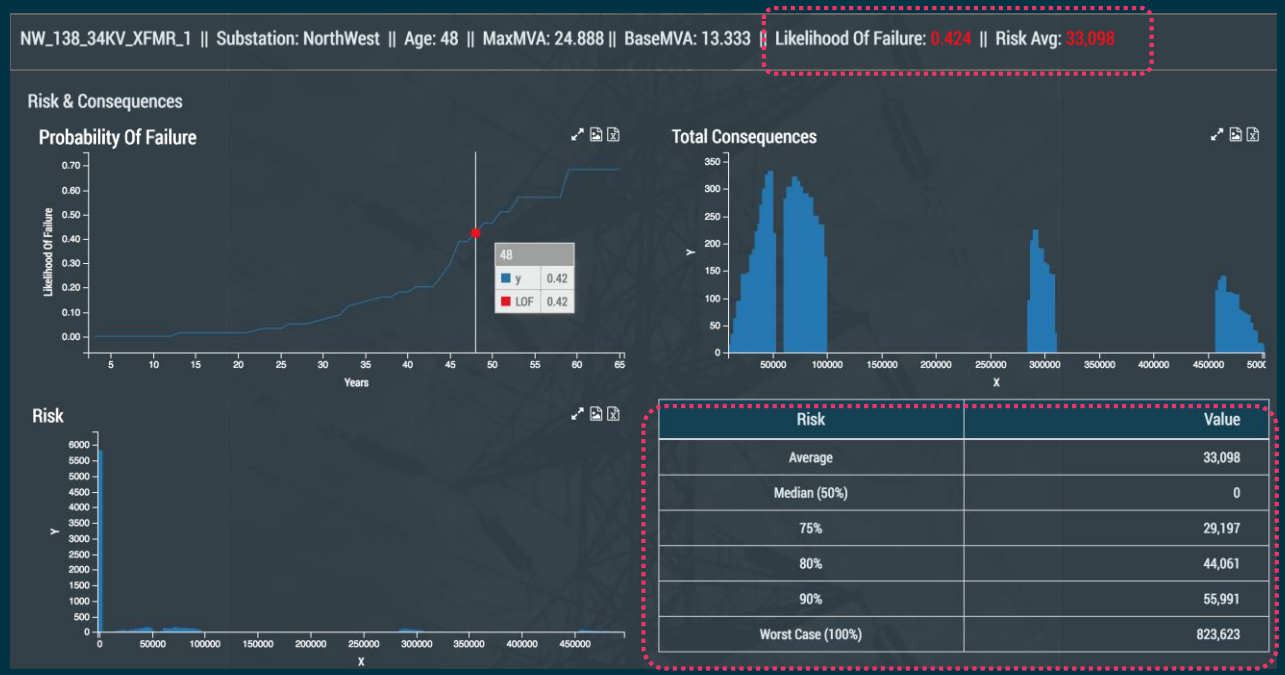
Recalculate Risk button then becomes active to allow user to recalculate the underlying risk associated with these assets on the new consequences.

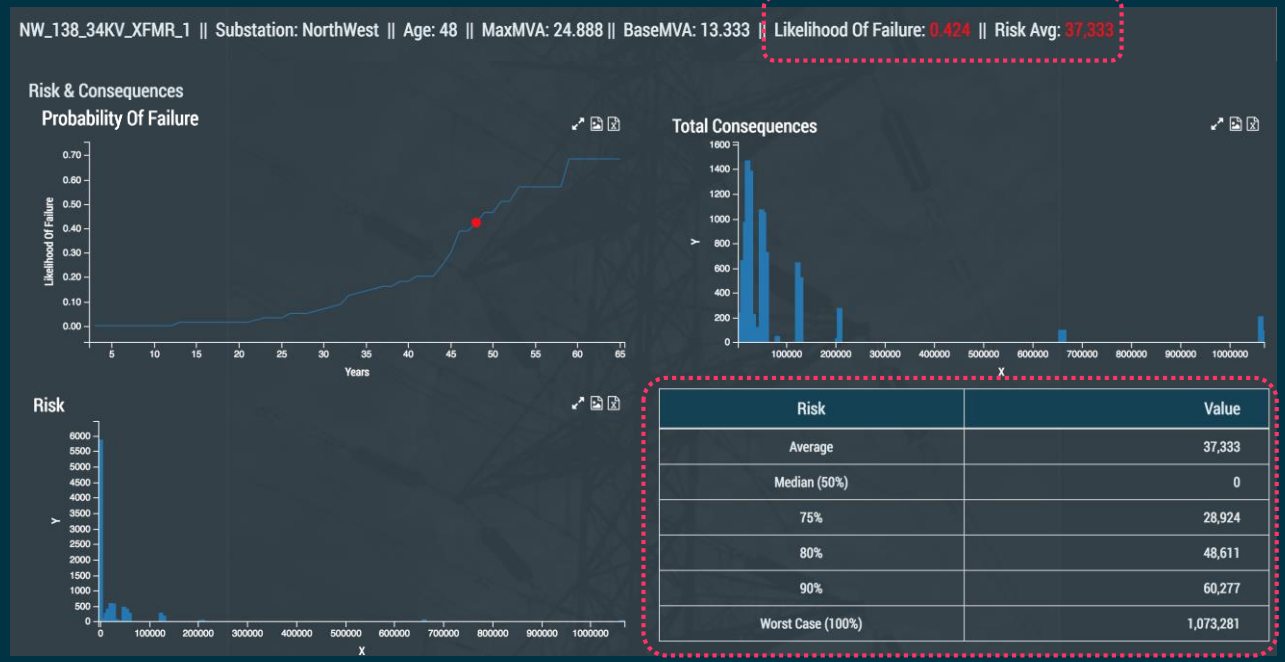
Once risk has been recalculated, the following message appears



Consequence Modelling

After remapping the consequences then return to the original asset and view the updated Risk Average and the other percentile risks associated with it





ACCENTURE DIGITAL GRID
SCENARIO 3 – INVESTMENT OPTIMISATION

Sarah
Risk & Investment Manager

SARAH REVIEWS THE EXISTING OPTIMISATION SCENARIOS WITHIN IO APP

Accesses the IO application and reviews the existing scenarios that have been created. Requested to make some amendments to the scenario based on feedback in the review rounds

CLONES AN EXISTING SCENARIO TO MAKE CHANGES

Clones an existing scenario and uses this as the baseline scenario to make the changes to

AMEND SCENARIO LEVEL CONSTRAINTS

Accesses the new scenario and makes a number of changes to the overall budget amounts available in each of the years and the minimum allocation % for the regions

AMEND PROJECT LEVEL CONSTRAINTS

Following feedback, changes a number of the project level constraints including
Projects being mandatory
Projects being required to be completed in certain years

REOPTIMIZE THE SCENARIO AND CONDUCT SCENARIO COMPARISON

Reoptimizes the scenario and reviews the portfolio key metrics to determine if this is a better scenario based on the changes requested.

SCENARIO IS DISTRIBUTED TO BE REVIEWED AND APPROVED

Digital Grid – Asset Management Demo scenarios

Scenario 3 – Investment optimisation

- Investment optimisation analyst reviews the available scenarios in the IO application
- Clones an existing scenario and edits the scenario name
- Edits the scenario configuration parameters including:
  - Changes the budget amounts in the configuration screen
  - % allocation of budget to each of the regions
- Amends the years some projects can take place in and makes one of the project mandatory

- Once happy with the changes that have been made the analyst solves the scenario in the system
- Returns to the scenario overview page and reviews the results of the scenarios.
- Creates a filter on a number of the scenarios and eventually choses one to be reviewed by the project managers for progression into the next years plan

Digital Grid – Landing Page

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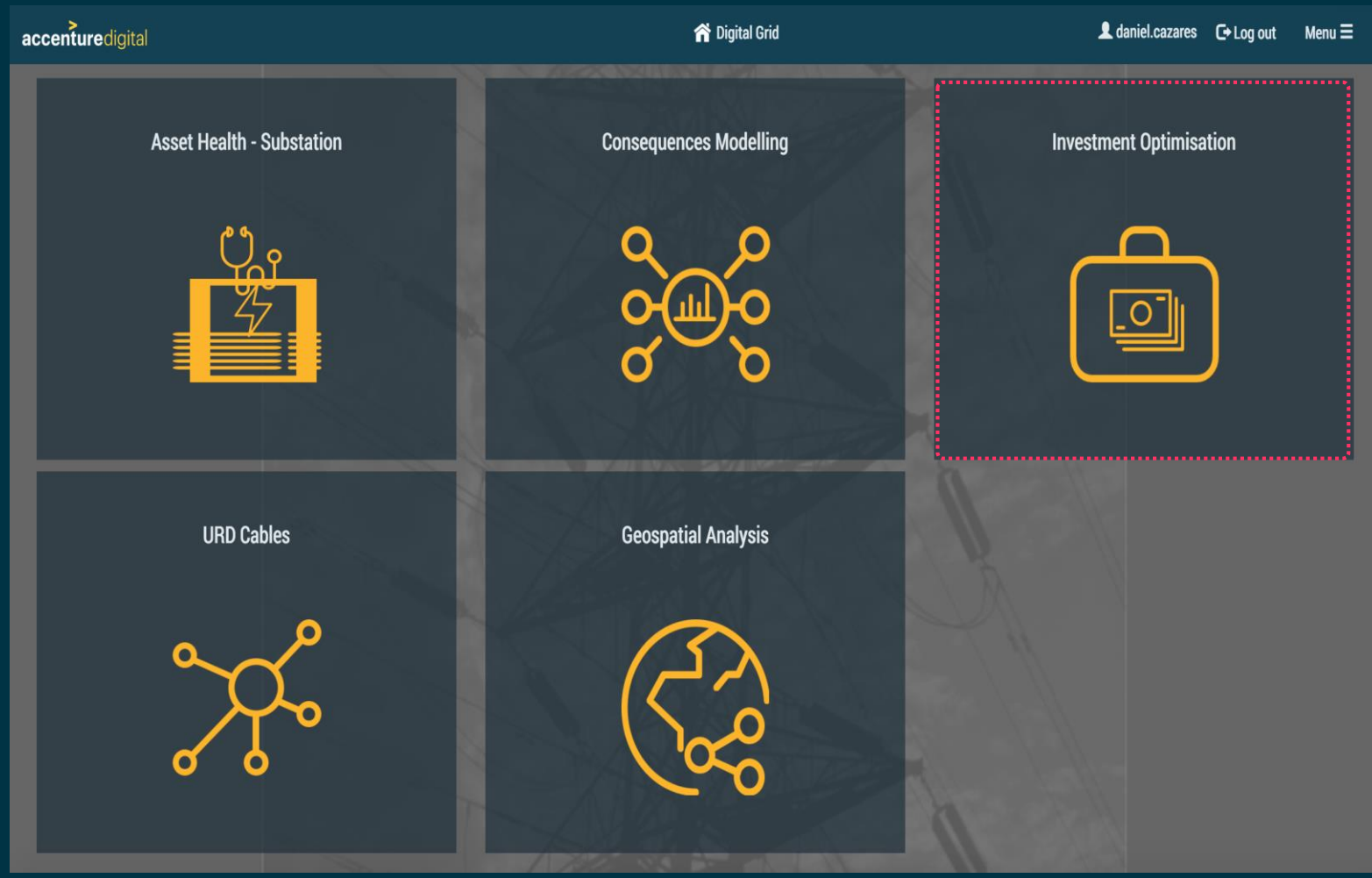
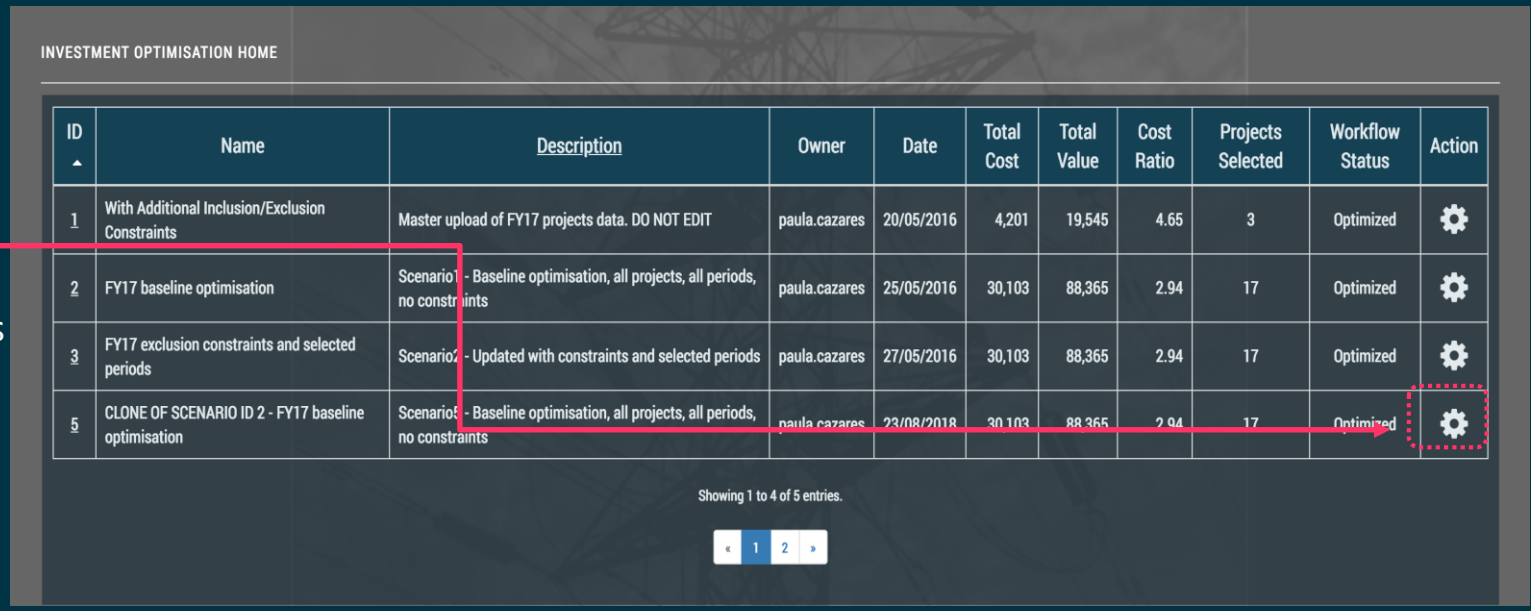


Scenario Overview

The investment analysts reviews the existing list of investment scenarios and decides to create a new scenario based on feedback received from an investment approver

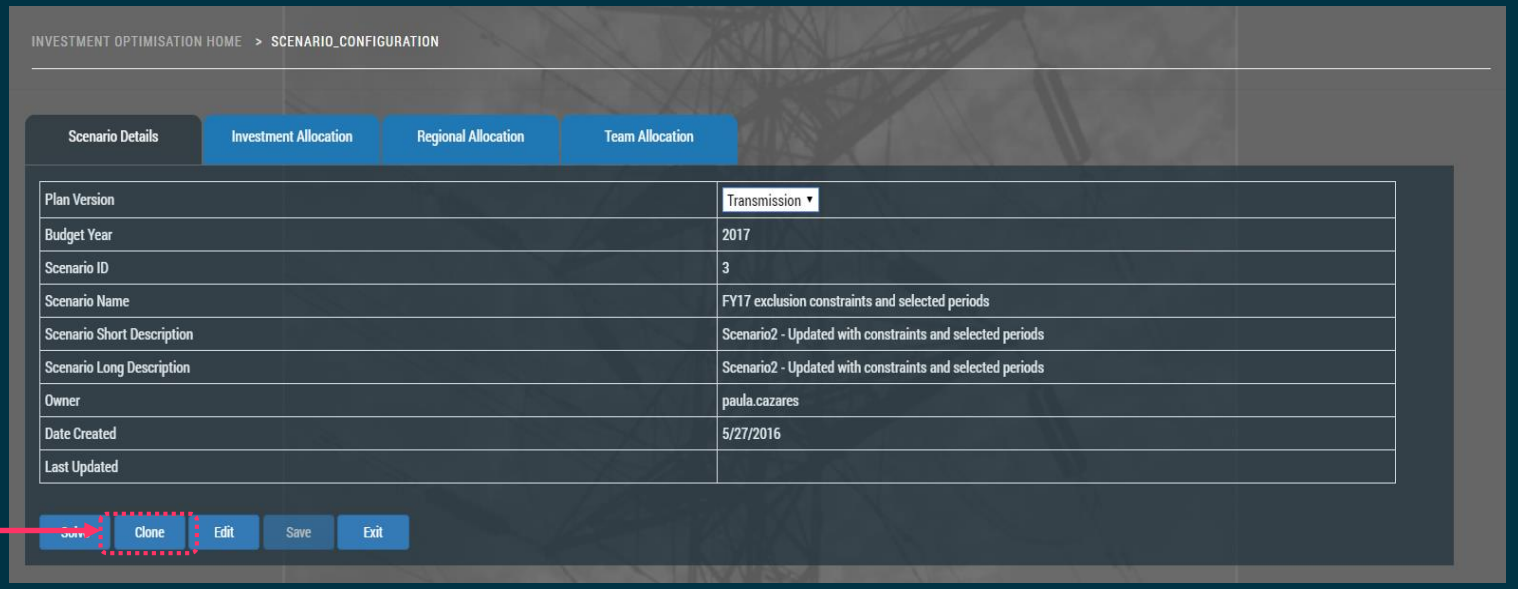
Analyst navigates to the scenario in question and clicks on the cog icon to open the configuration screen for that particular scenario



Scenario Configuration

The configuration screen will open with the selected scenario on display.

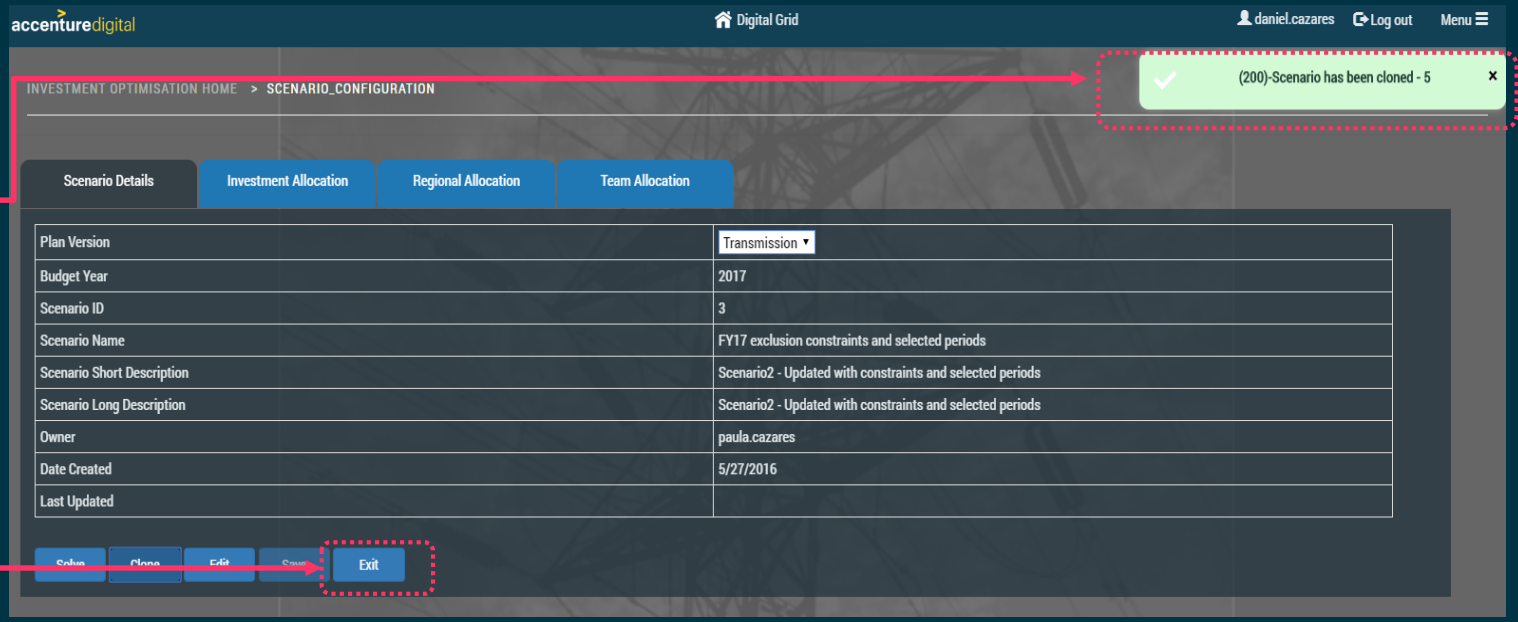
Analysts selects the Clone button to create a clone of this scenario



Once the system has cloned the scenario a message will appear telling the user that the scenario has been cloned and giving the new scenario ID

User Navigates back to the Scenario Overview screen by clicking on the Exit Button.

The user navigates to the new Scenario ID and clicks on the configuration button to get back the Scenario Configuration page



Scenario Configuration

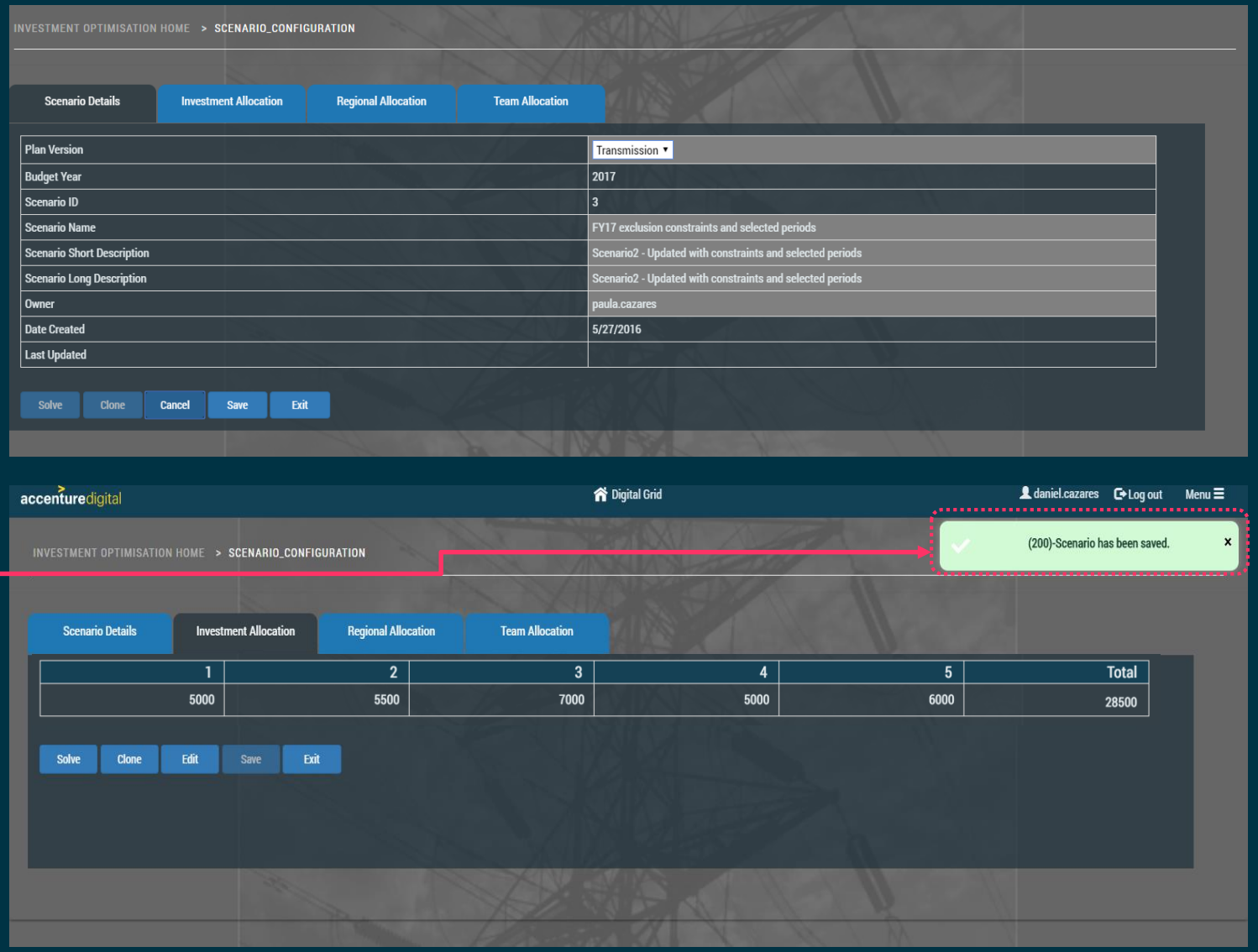
Analyst clicks on the Edit button (once clicked this changes to Cancel). This shows a number of fields that can be edited, such as name & descriptions.

Update the name and description and click save

Select Investment Allocation tab and adjust the budget amounts in each period to flex the potential budget available. (Recommend changing the budget by 1m per period to show a difference in the optimisation outcome)

Click Save to get a Scenario has been saved message

Click Exit to return to the Scenario Overview page. Click on the details hyperlink for the new scenario to access the Scenario Details page



Scenario Details Page

Scenario details page is made up of several sections

1) All projects in the scenario are listed along with the cost, value and periods the project can be selected in

2) Project Description – high level details on the project

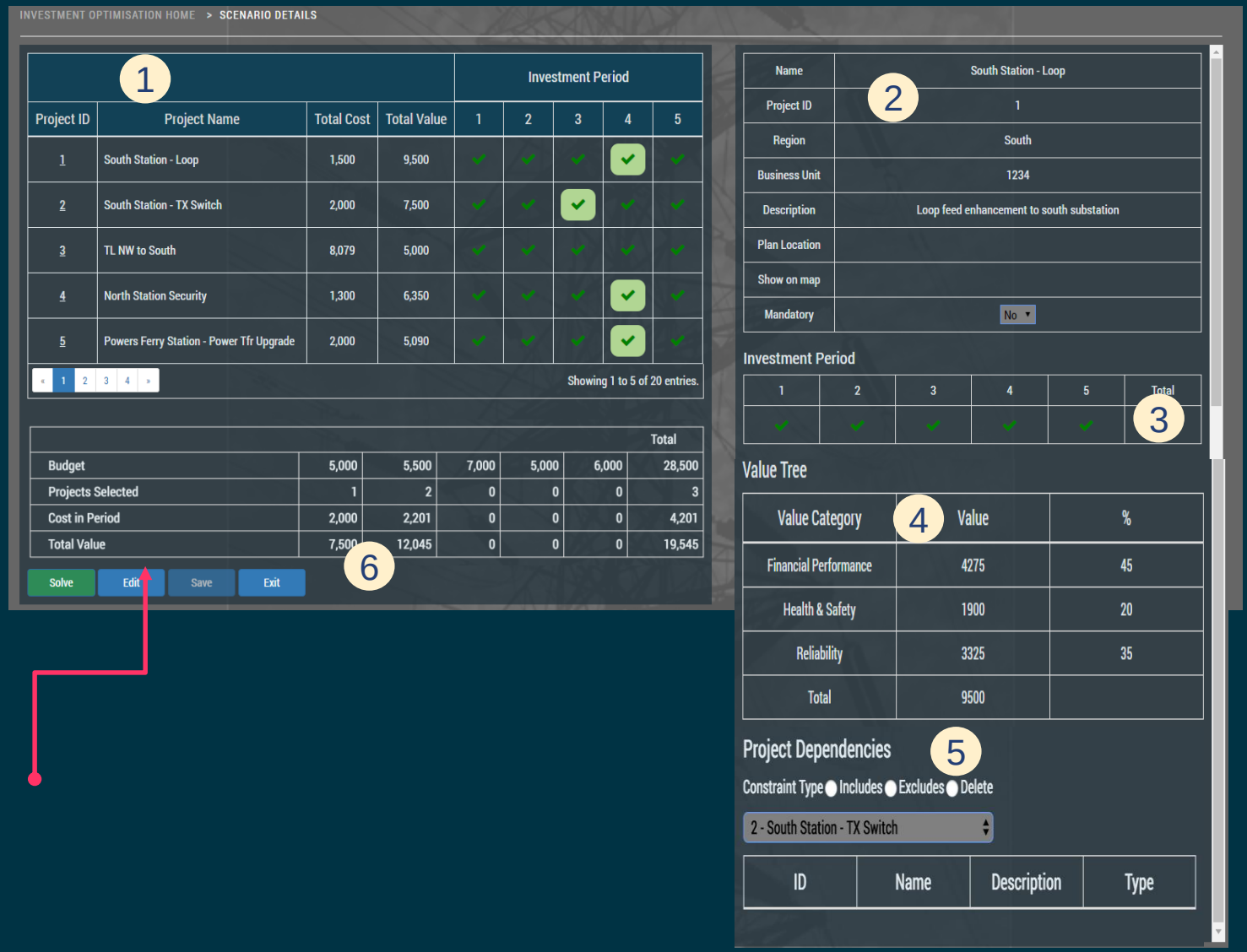
3) Investment periods that the project can be selected in

4) Value tree – breakdown of the value in each of the consequence categories

5) Project inclusion / exclusion dependencies

6) Summary information on the scenario

   - If the project has not been solved this will contain total budget for the scenario and the breakdown by period of this. The Solve button will show in blue
   - If the project has been solved, the solve button will appear in blue and additional information will appear for the summary info including the projects selected, costs, total value against budget



Scenario Details Page

To make changes to a particular project, click on the Project ID and the right hand panel will refresh

Select the Edit button, a number of highlighted fields will then show to enable editing. Make the appropriate changes to the project selections, such as

Project mandatory – yes / no option

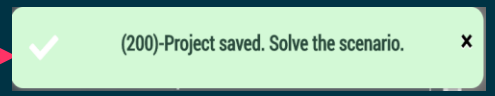
Investment Period selected – these need to be continuous periods

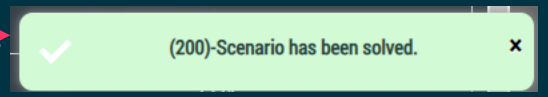
Inclusion / Exclusion constraints.

- Inclusion – where Project 1 AND project 2 need to be selected together.
- Exclusion – where project 4 OR project 5 can be selected (Either or, not both)

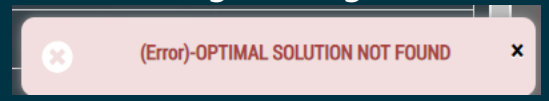
Once complete, select save. This will trigger this message.

To solve the project, click on solve button, the will update as follows





If the optimisation routine cannot solve the optimisation then the following message will occur.



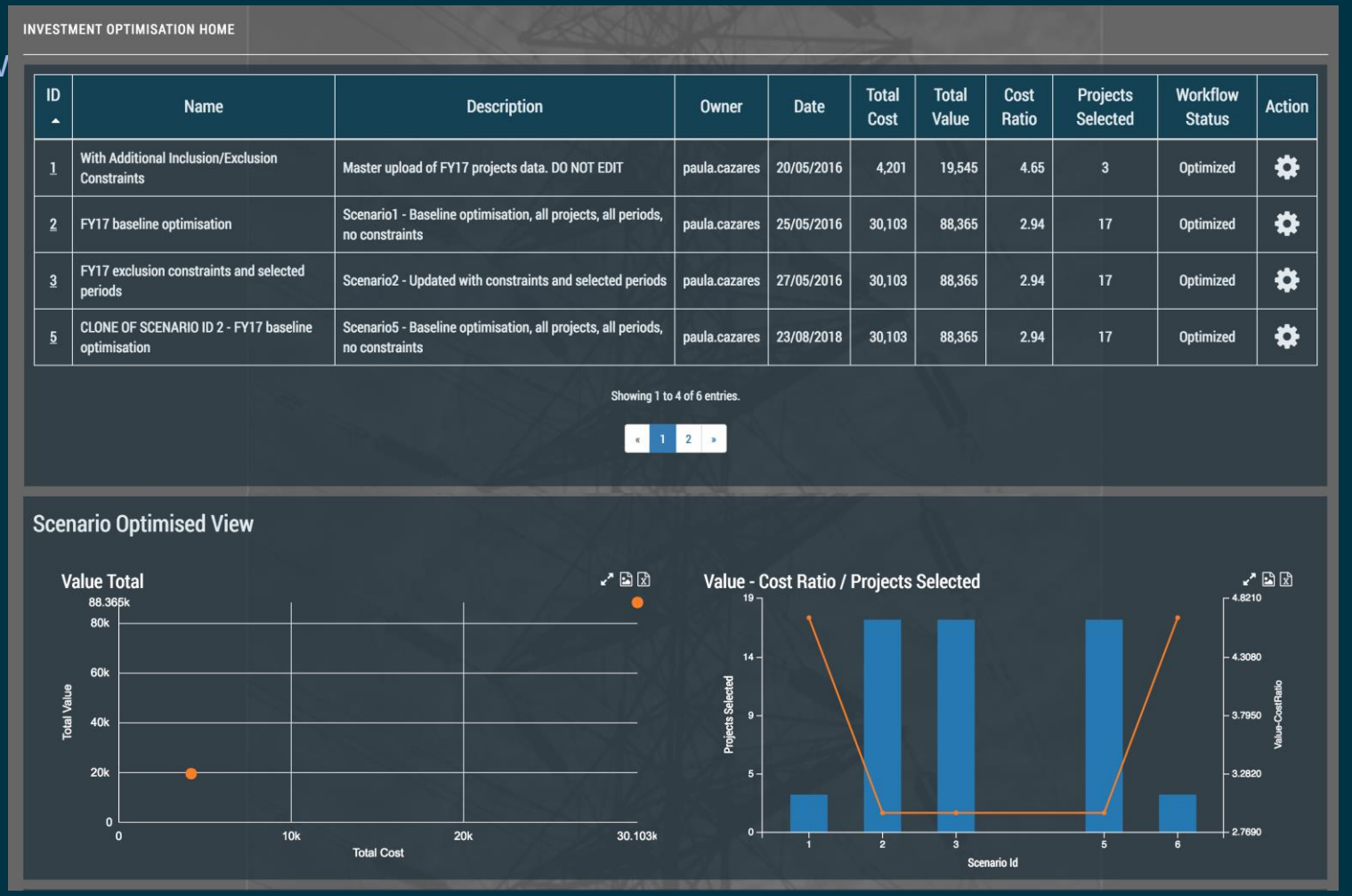
In this case, the only solution is to modify the criteria in order to solve it

Scenario Overview – Scenario Optimised View

Once a number of scenarios have been solved, return to the scenario overview screen to view the results initially in a table view. Filtering can be applied to this table

Total Value against Total Cost scatter plot shows the curve of total cost against value, this can be used to highlight where the benefit exceeds others

Value – cost ratio & projects selected shows the value to cost ratio and the number of projects selected in each of the scenarios. This enables the analyst to determine the best scenarios to go forward with.



Scenario Overview – Project Optimised Vie

The Project Optimised View enables the analyst to see the projects that are selected most often, the cost, value and value to cost ratio.

This view enables the analyst to check on the projects that should always be considered and helps refine the view on statistically the most popular projects from an optimisation perspective.

ACCENTURE DIGITAL GRID
SCENARIO 4 – DISTRIBUTION ASSET HEALTH URD LOOPS

Wayne
Distribution Engineer

WAYNE REVIEWS THE LOOP POPULATION AND FILTERS THE OVERALL LIST TO SHOW THE HIGHEST PRIORITY LOOPS

Overall loop list is shown with ability to filter on the high priority loops for further investigation

SELECTS A SINGLE LOOP TO ANALYSE

Engineer reviews the LoF, Severity and Risk of the loop. Assesses the historical events to have occurred and looks at the overall loop makeup

REVIEWS THE AGGREGATED METER DATA FOR THE TRANSFORMERS TO UNDERSTAND BETTER THE OVERLOAD

Using the aggregated meter to transformer data as a proxy for load, the engineer can see if the transformer is overloaded along with indicators of duration and intensity. Also view voltage sag / swell events if the meter captured this

MODEL 5 YEAR LOAD FORECASTING TO AND ITS IMPACT ON THE SYSTEM & RECOMMEND A COURSE OF ACTION

Engineer finally utilises the load forecasting tool to determine the 5 year load growth based on parameters that they are able to configured at calculation time.

DETERMINES A COURSE OF ACTION TO CARRY OUT ON THE LOOP AND RECORDS NOTES

After reviewing all the available data and forecasting the load the engineer selects a recommended action and records the notes against the transformer.

DISTRIBUTION ENGINEER PROCEEDS TO ANALYSE NEXT LOOP

Digital Grid – Asset Management Demo scenarios

Scenario 4 – Distribution Asset Health URD Loops

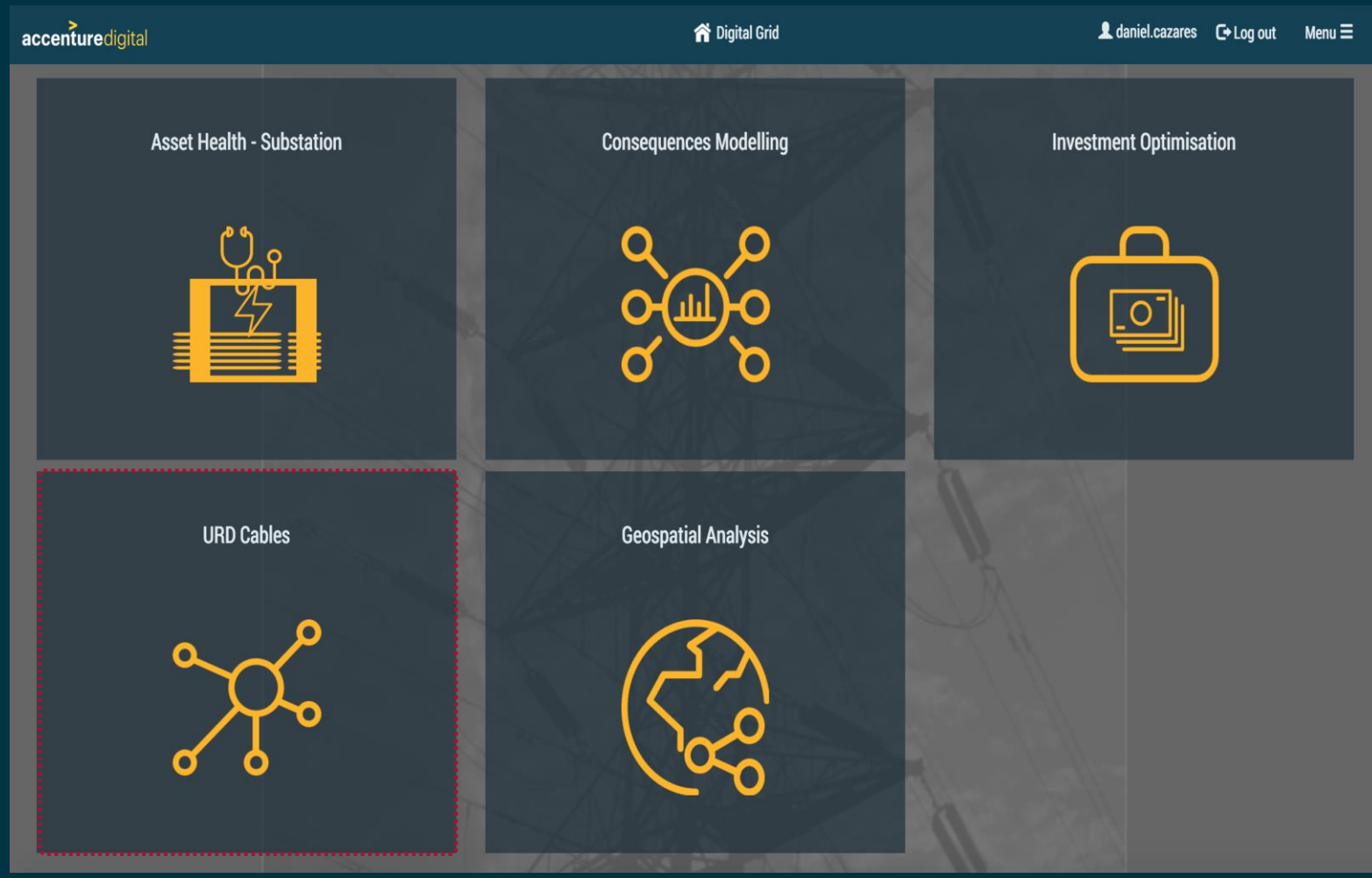
- Distribution engineer reviews the asset health calculations for all the URD loops in their area
- Filters and sorts the list to show the highest risk loops and starts investigations using the risk, outage, work order and associated meter data
- Selects a single loop and reviews the data for LoF, severity and Risk
- Selects a single transformer and reviews the timeseries data derived from all meters associated to the transformer. Reviews the Load, Voltage patterns and KVA Above & KVA Above Hours.
- In determining the potential load on the system, uses the load modelling algorithm built into the system to give a view on peak loads on that transformer in 5 years time.
- Following the review the decision is made that this Loop will be scheduled for an inspection and remediation plan put in place to upgrade a number of transformers on the loop to a higher capacity following the analysis.

Digital Grid – Landing Page

This is the first screen user sees when logged in to the application

Here, user will have an option to select the business unit of interest. User can choose one from following:

- Asset Health – Substation
- Consequences Modelling
- Investment Optimisation
- URD Cables
- Geospatial Analysis



URD Summary View

The user lands on the main asset class summary page, this shows all the URD looks in the population. There are a number of main sections to view

- Likelihood of Failure – graph shows the number of loops where the Likelihood of Failure is within certain configurable thresholds
- Risk – graph shows the overall Risk score for the URD loops where they fall within certain configurable thresholds
- Table view gives a number of high level details for each of the loops including
- Name plate info, age & length
- Number of assets on the loop (fuses, transformers & spans)
- Key severity measures – customers, equipment characteristics & outage counts etc
- Risk measures – LoF, Severity and Risk calculations
- User clicks on Loop 1217 to view the URD Loop Details data.

Division	District	Substation	Loop Id	Age	Loop Length	Transformer	Span	Fuse	Customer Count	Live Front	Step Down	Outage	Water Outage	LOF	Severity	Risk
Div1	47	North	L1234	26	3945	9	9	1	73	0	0	1	0	1	2.25	2.25
Div1	47	North	L1235	42	1855	4	4	1	37	0	0	0	0	4.88	1.25	6.1
Div1	47	North	L1239	41	1307	3	3	1	26	1	0	0	0	4.32	1.75	7.56
Div1	47	North	L1241	19	2010	5	5	1	41	0	0	7	1	1	10	10
Div1	47	North	L1266	39	685	2	2	1	5	1	0	1	0	3.29	2.5	8.23
Div1	47	North	L1267	41	1217	4	4	1	24	0	0	3	0	4.32	4.25	18.37

URD Summary View – Filter Options

Continued from previous screen

- Engineer clicks on the Likelihood of Failure and Risk graphs to dynamically filter the population of loops
- Can select a column header to sort ascending / descending
- Finally clicks on the LoopID hyperlink to view the details of the loop

Division	District	Substation	Loop Id	Age	Loop Length	Transformer	Span	Fuse	Customer Count	Live Front	Step Down	Outage	Water Outage	LOF	Severity	Risk
Div1	47	North	L1234	26	3945	9	9	1	73	0	0	1	0	1	2.25	2.25
Div1	47	North	L1235	42	1855	4	4	1	37	0	0	0	0	4.88	1.25	6.1
Div1	47	North	L1239	41	1307	3	3	1	26	1	0	0	0	4.32	1.75	7.56
Div1	47	North	L1241	19	2010	5	5	1	41	0	0	7	1	1	10	10
Div1	47	North	L1266	39	685	2	2	1	5	1	0	1	0	3.29	2.5	8.23
Div1	47	North	L1267	41	1217	4	4	1	24	0	0	3	0	4.32	4.25	18.37

URD Detailed View (1)

The URD Cables detailed page opens showing the following sections

1) Header Bar – lists out the Loop ID, Substation area, Age, Length, LoF, Severity and Risk for the Loop

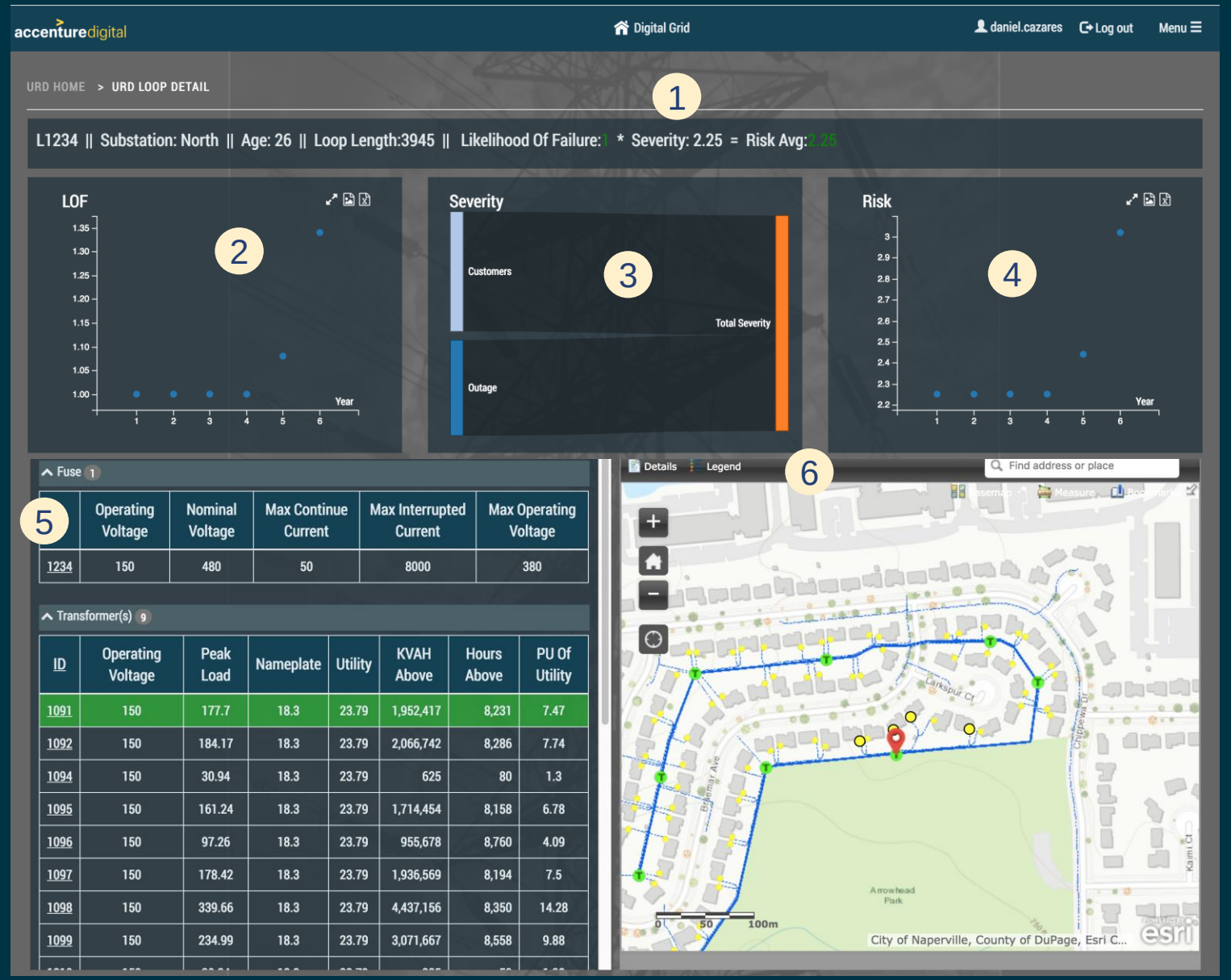
2) Likelihood of Failure (LoF) forecasted out for the next 5 years

3) Overall severity and how much the constituency parts feed into the overall severity for the loop. In this example the overall severity is made up of Customer (1.25) + Outage (1) + LiveFront (0.5) = Overall Severity (2.75)

4) Risk forecasted out for the next 5 years based on Risk = LoF * Severity

5) Hierarchy component view for the Loop, split by asset type including key information for each of the components

6) Embedded ESRI view of the loop. This is directly linked to the client ESRI system to ensure tight integration between ESRI and the ARIS application. User can click in the Hierarchical view or the map icons to select a transformer to view additional sensor data.



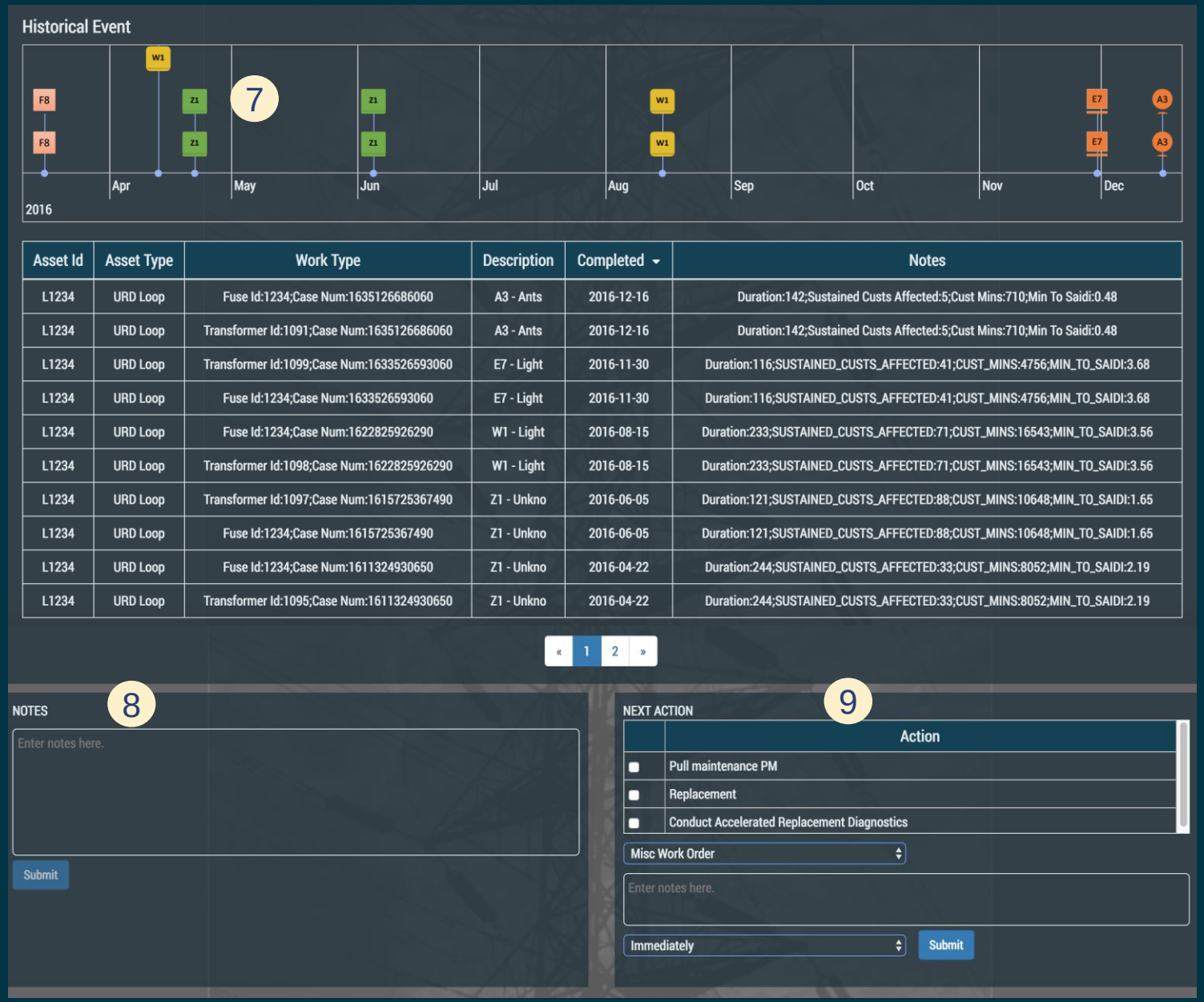
URD Detailed View (2)

Continued from previous screen

7) Historical Events – The lollipop timeline shows all the major events recorded against the URD loop including outages and work orders & inspections. The timeline can be zoomed into to allow a more granular view

8) Notes section – Notes section can be utilised to hold comments, observations and notes related to the loop.

9) Next actions – based on the findings from the inspection, a work order can be raised by clicking on the next action. This will be integrated with the work order management system.



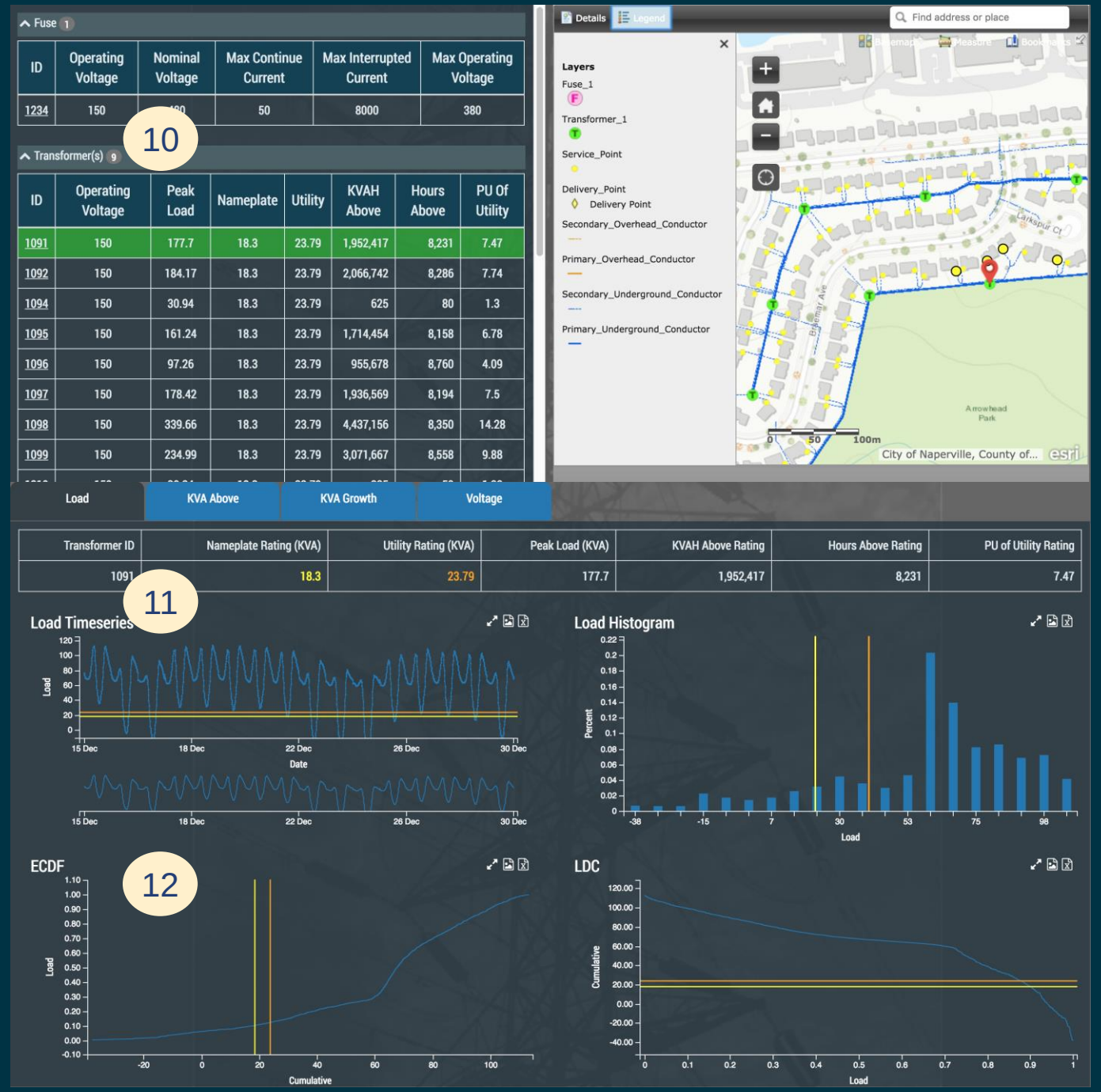
URD Detailed View (3)

Continued from previous screen

10) Hierarchy Component View – Additional sensor data can be accessed when clicking on the transformers in the component hierarchy. The map view will zoom to highlight the transformer selected and also show the secondary cables and attached meters to the transformer

11) Transformer Timeseries analysis section will open to allowing the user to view a number of metrics calculated by aggregating the data provided by smart meters utilising the transformer meter mapping.

12) Load data is shown as timeseries data, histogram, ECDF and LDC. The yellow and amber lines represent the nameplate and utility rating for the transformer. This helps the user quality to determine the level of overload on the transformers in the system.



URD Detailed View (4)

Continued from previous screen

13) KVA Above – Calculated as the total KVA Above Rating and the Hours Above Rating calculated on the daily aggregated meter data. These give an indication of the intensity and duration of the overload on the transformer

14) Voltage is shown where voltage data is captured for a meter on the loop. This shows the voltage normalised at 1, and patterns over the last 14 days and over the last year to give an indication of sag / swell events on the transformer.

URD Detailed View (5)

Continued from previous screen

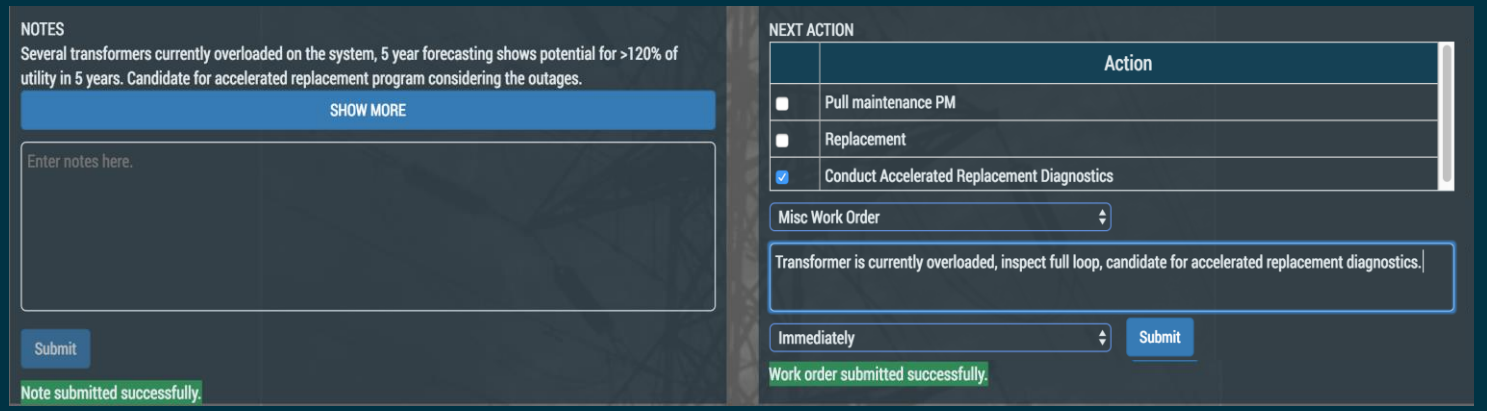
15) KVA Growth – This section allows the distribution engineer to model load growth on the transformers in the loop at an individual level. The modelling parameters are:

- Increased base load growth in either KVA or % increase
- Trend growth using linear additive forecasting by a % increase in each year
- Forecasting years allows the engineer to model growth and view the results at the end of the x year period. For simplicity this is limited to 5 years in this demo.
- The graphs will show the yearly max KVA + growth over the next 5 years alongside the Load Duration Curve of the results in 5 years time. This will allow the engineer to make planning decisions within the application without needing to use a separate application.

URD Detailed View (5)

Continued from previous screen

16) Engineer selects a recommended action to conduct accelerated replacement diagnostics on the loop and a recommendation that it is placed for immediate replacement following the inspection. Engineer also updates the notes with the findings from the inspection to ensure clear visibility.



ACCENTURE DIGITAL GRID
SCENARIO 5 – GEOSPATIAL ANALYSIS

Wayne
Distribution Engineer

WAYNE REVIEWS THE LOOP POPULATION AND FILTERS THE OVERALL LIST TO SHOW THE HIGHEST PRIORITY LOOPS

Overall loop list is shown with ability to filter on the high priority loops for further investigation

SELECTS A SINGLE LOOP TO ANALYSE

Engineer reviews the LoF, Severity and Risk of the loop. Assesses the historical events to have occurred and looks at the overall loop makeup

REVIEWS THE AGGREGATED METER DATA FOR THE TRANSFORMERS TO UNDERSTAND BETTER THE OVERLOAD

Using the aggregated meter to transformer data as a proxy for load, the engineer can see if the transformer is overloaded along with indicators of duration and intensity. Also view voltage sag / swell events if the meter captured this

MODEL 5 YEAR LOAD FORECASTING TO AND ITS IMPACT ON THE SYSTEM & RECOMMEND A COURSE OF ACTION

Engineer finally utilises the load forecasting tool to determine the 5 year load growth based on parameters that they are able to configured at calculation time.

DETERMINES A COURSE OF ACTION TO CARRY OUT ON THE LOOP AND RECORDS NOTES

After reviewing all the available data and forecasting the load the engineer selects a recommended action and records the notes against the transformer.

DISTRIBUTION ENGINEER PROCEEDS TO ANALYSE NEXT LOOP

Digital Grid – Asset Management Demo scenarios

Scenario 5 – Geospatial Analysis

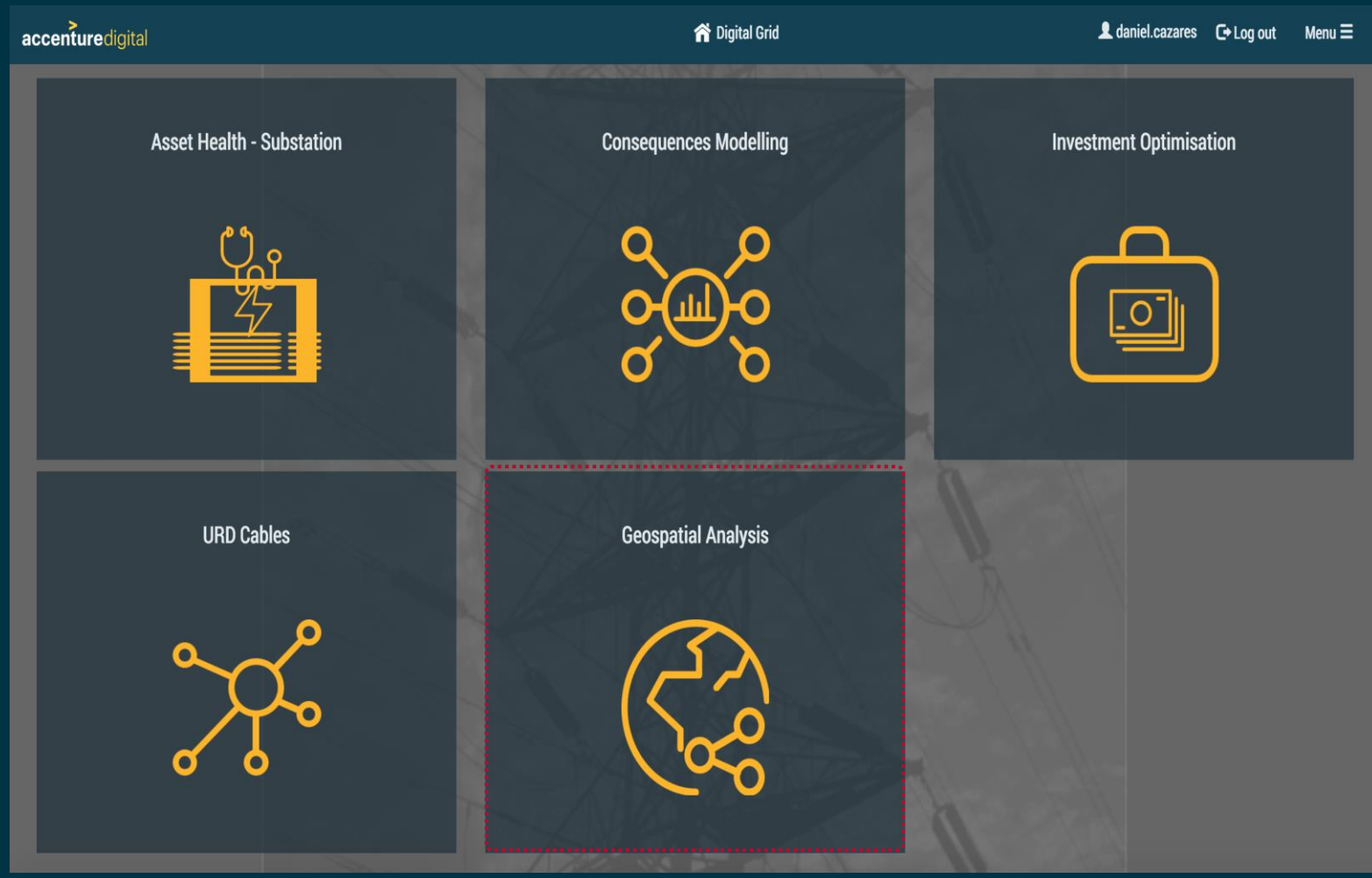
- Distribution engineer reviews the asset health calculations for all the URD loops in their area

Digital Grid – Landing Page

This is the first screen user sees when logged in to the application

Here, user will have an option to select the business unit of interest. User can choose one from following:

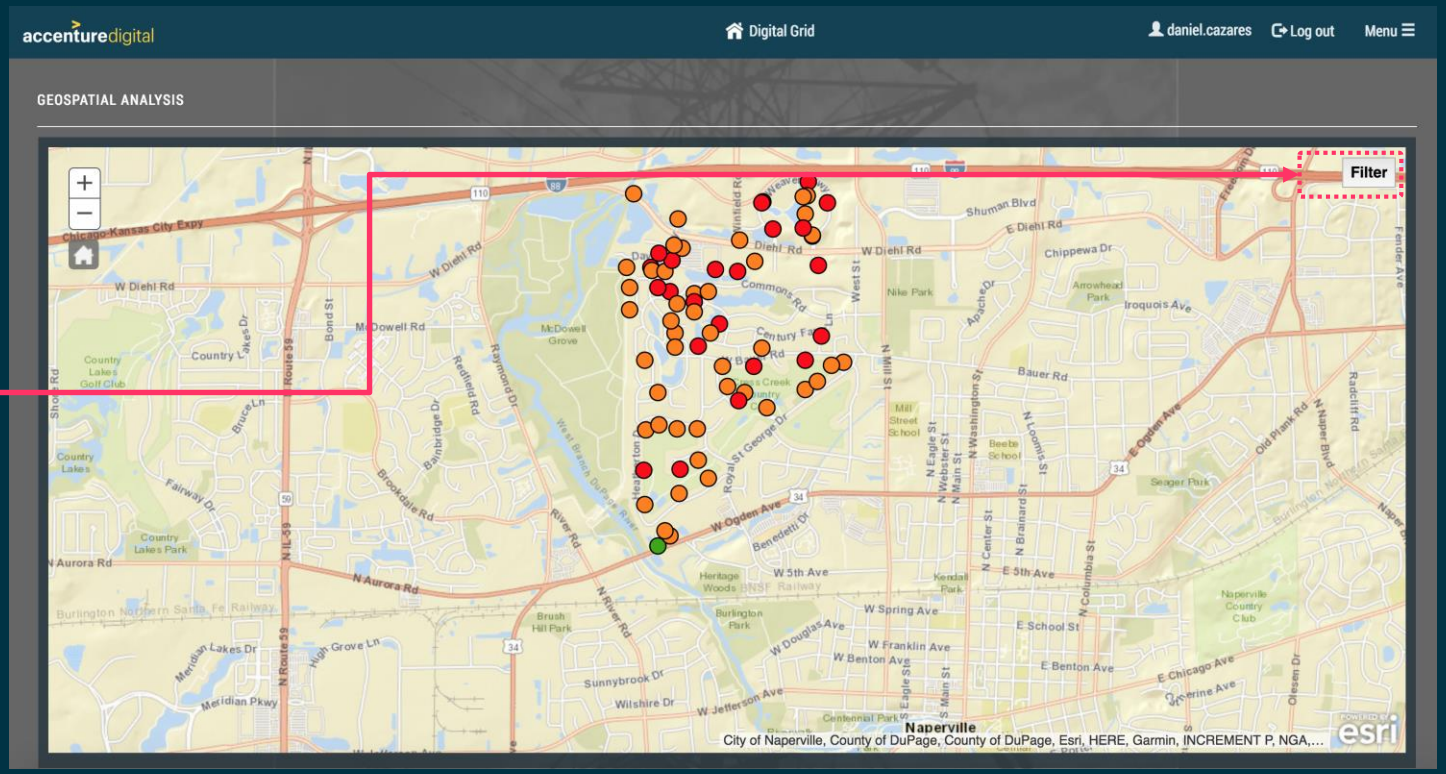
- Asset Health – Substation
- Consequences Modelling
- Investment Optimisation
- URD Cables
- Geospatial Analysis



Geospatial home page view

A map will be displayed by default along with the transformers highlighted in Red, Amber and Green colours based on their PU of Utility rating values.

User can then click the filter button on map to open the filter panel and apply certain parameters to view different values of transformers.

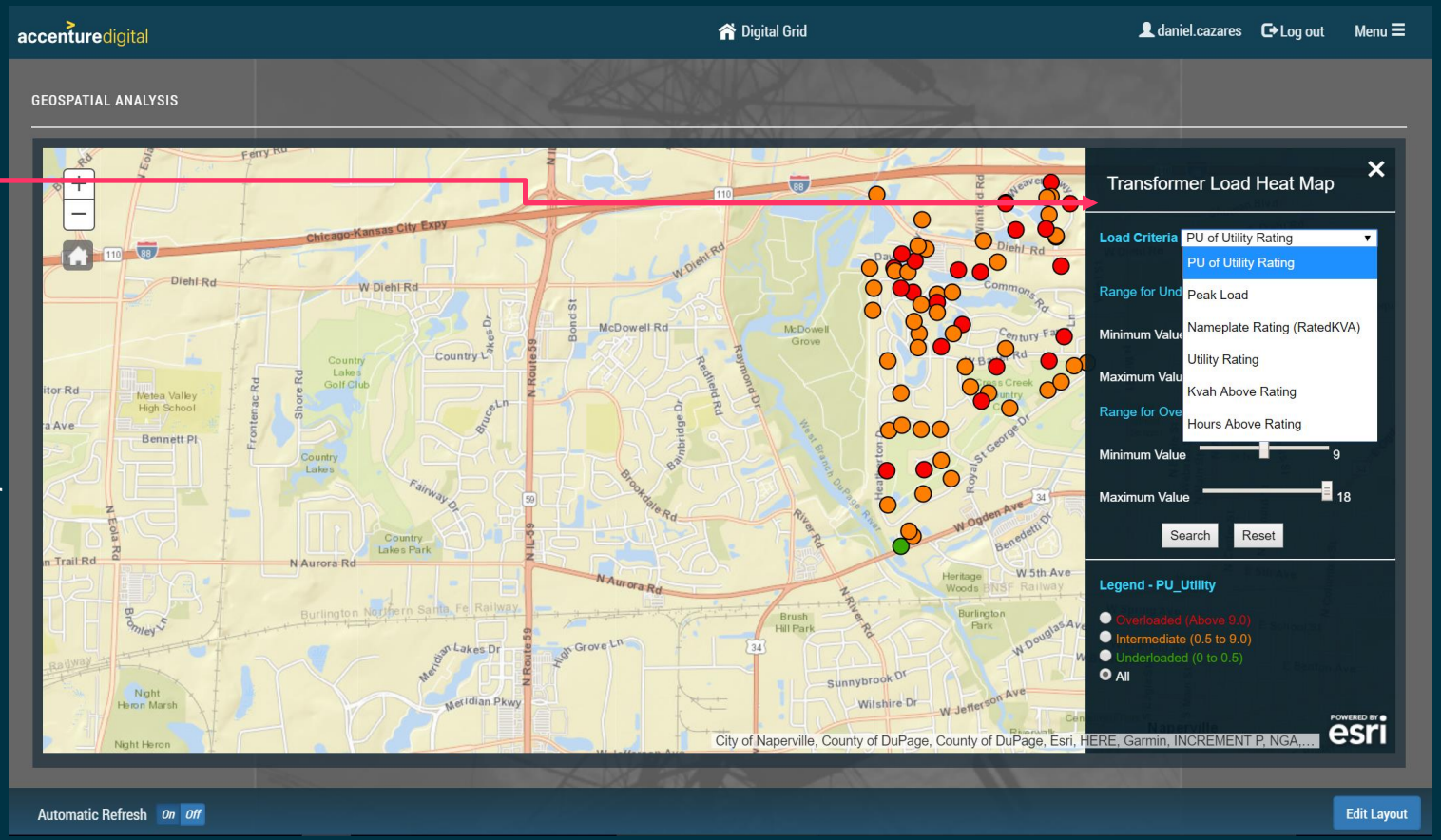


Geospatial home page view

Filter panel opens to with default of PU of Utility Rating showing.

Use the drop down on Load Criteria to view the other transformer specific metrics that can be configured. In this case we have the following:

- Nameplate rating – standard rating from transformer manufacturer
- Utility Rating – many utilities will allow a level of overloading on transformers (in this case 30%)
- Peak Load – highest individual load on the transformer over the last year
- PU of Utility Rating – Peak Unit of utility rating, the factor overloaded on the utility rating
- Kvah above rating – Total kvah overload on the transformer for data over the last year (intensity of the overload)
- Hours above rating – total hours where the transformer was overloaded (duration of the overload)

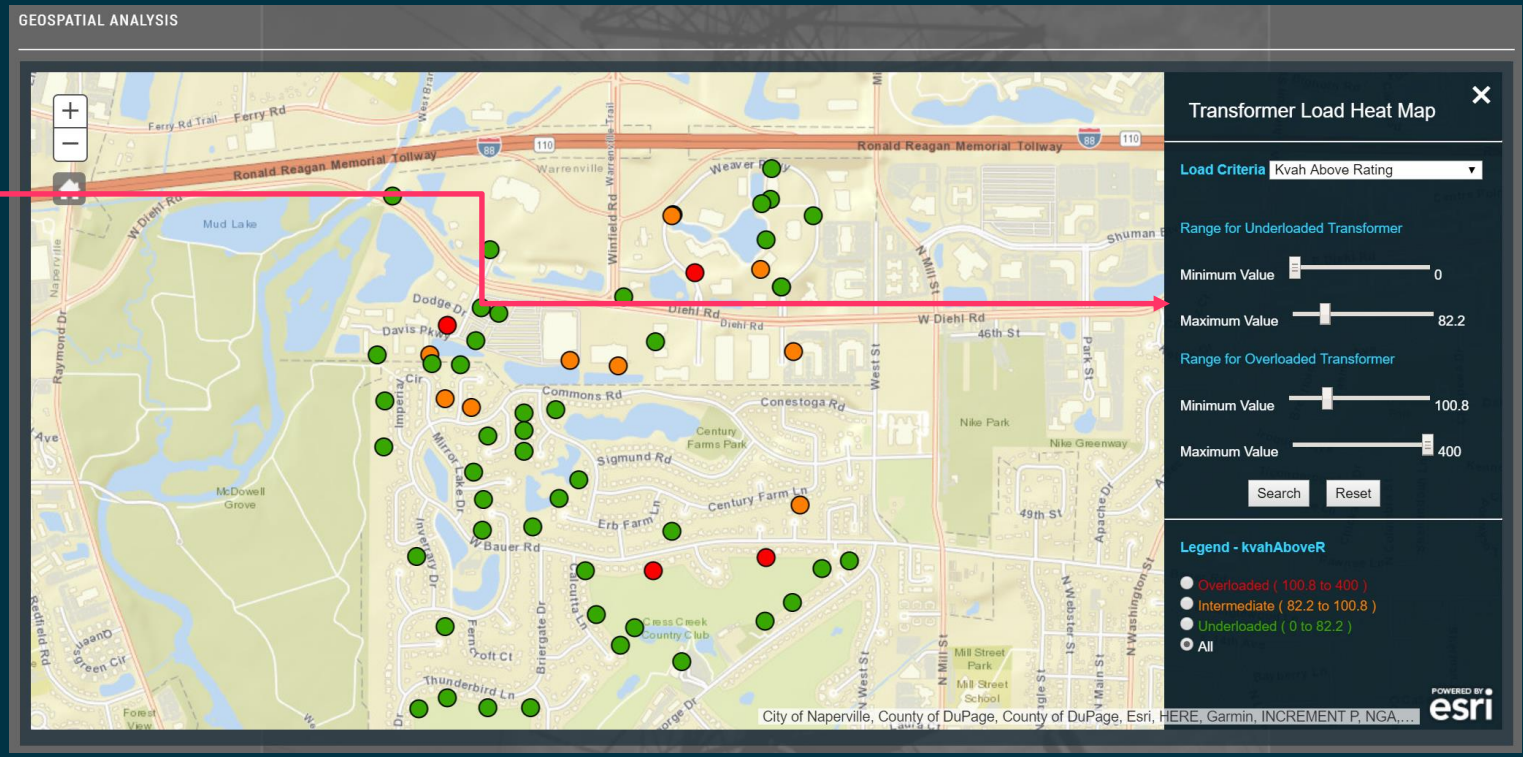


Geospatial home page view

This application allows the user to define threshold values for Red, Amber & Green status.

Select the min / max value of underload and min/max value for overload. Click on the search button to refresh the display. The Amber category will be determined as the range from the Max of the Underload to the Min of the overload.

This allows the user to select different parameters for the transformers in use whilst doing analysis



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