CRC for
Water Sensitive Cities

Scenario Tool worked example:
Highett Gasworks

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Australian Government
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Scenario Tool worked example: Highett Gasworks

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Executive summary

The Scenario Tool was used to assess how various development options will impact urban heat and the water cycle in a hypothetical development at the Highett Gasworks. The development scenarios are summarised in the table below.

The modelling showed:

- Creating roads, paving and buildings
    - o increases the site runoff from 5.9 ML/year to 24.1 ML/year
    - o increases the average land surface temperature by 4°C
    - o increases the air average temperature during a heatwave by 0.5°C.
- Harvesting rainwater from townhouse and apartment tower roofs for toilet flushing
    - o reduces runoff by 8.3 ML/year
    - o reduces potable water demand by 8.3 ML/year
- Harvesting stormwater from roads for parks irrigation reduces potable water demand by 1.7 ML/year.
- Addition of green roofs and ponds/water bodies
    - o reduces the average land surface temperature by 3.9°C
    - o reduces the average air temperature during a heatwave by 0.6°C
    - o reduces runoff by 8.3 ML/year
    - o increases irrigation demand by 6.4 ML/year.

The heat maps and water cycle infographics produced by the Scenario Tool clearly communicate the development impacts and benefits of including water sensitive initiatives. These results make the Scenario Tool useful in early planning stages to select appropriate water sensitive strategies for future developments.

Table 1: Scenario summary

<table>
<tr><th>Scenario</th><th>Overall impervious area</th><th>Rainwater harvesting</th><th>Stormwater harvesting</th><th>Other water sensitive initiatives</th></tr>
<tr><td>Baseline</td><td>~13%</td><td>No</td><td>No</td><td>No</td></tr>
<tr><td>No water sensitive initiatives (Future-NoWSI)</td><td rowspan="2">~70%</td><td>No</td><td>No</td><td>No</td></tr>
<tr><td>Business as usual (Future-BAU)</td><td rowspan="2">Yes

From individual townhouses and apartment towers for toilet flushing</td><td>No</td><td>No</td></tr>
<tr><td>Improved water sensitive cities (Future-WSI)</td><td>~57%</td><td>Yes

From roads for park irrigation</td><td>Green roofs

Ponds/water bodies</td></tr>
</table>

1 Introduction

This report outlines a worked example of the Cooperative Research Centre for Water Sensitive Cities' (CRCWSC) Scenario Tool applied to a hypothetical development at Highett Gasworks. The report provides site background, scenario selection, input data preparation, the model set up and finally, discussion on how to interpret model results.

1.1 Scenario Tool

The Water Sensitive Cities Scenario Tool is a computer modelling tool used for planning and assessing water sensitive development options. It enables users to simulate urban development and the performance of water management interventions dynamically over time. It is accessed online via a web browser and uses GIS to inform its modelling.

This online geospatial modelling tool:

- provides baseline data about land cover and buildings, and Australian meteorological conditions (although users can also upload customised datasets)
- simulates real life scenarios at the street, precinct or city scale
- outputs heat mapping
- models street level air temperature at fine spatial scales
- quantifies the flow of water in and out of an area.

Readers can access the Scenario Tool here.

1.2 Project site

The former Highett Gasworks site located at 1136–1138 Nepean Highway, Highett is an underutilised 6.3 ha urban landholding with excellent access to infrastructure, urban services and amenities. Development Victoria is planning to redevelop the site into a residential community within the City of Kingston.

The vision for the development is to provide a home to a diverse community. Spaces will be intentionally designed to enhance lifestyle and benefit the existing local community as well as future residents of the proposed development.

The redevelopment will include:

- a diverse range of homes of various sizes and types
- new streets with walking and cycling paths to connect the site with the local area and nearby open space
- well-designed open spaces
- environmentally sustainable principles with a focus on establishing a '20-minute neighbourhood' that reduces reliance on cars
- reuse of the heritage chimney as a site feature
- a high-quality landscape
- management of traffic to minimise impacts on surrounding streets.

2 Model inputs

2.1 Site layout

Since the site development layout was being prepared at the time of writing, a hypothetical future concept plan[1] was used for the Scenario Tool (Figure 1). This hypothetical layout will have six major apartment towers comprising around 1,000 dwellings. Each apartment tower will have a two-storey podium at the base which provides car parking. An additional ~40 townhouses are proposed in the north and north-western end of the site. Nearly 13% of the site is public open space consisting of one playground, two parks and one drainage reserve. A bike corridor is proposed along the western site boundary.

2.2 Water sensitive initiatives

To meet Victoria's best practice stormwater management guidelines, the site must adequately store and treat stormwater. A combination of rainwater harvesting tanks and in-ground storage was proposed in the public realm to meet overall site stormwater detention.

The proposed rainwater harvesting scheme harvested rainwater from all roofs except the podium carpark roofs. The estimated reuse demand and rainwater tank size are listed in Table 2. The carpark roofs were excluded because the lower-quality rainwater from these surfaces would need more treatment than typical roof runoff. Similarly, stormwater harvesting was excluded in public or private land due to intensive costs and risks associated with treatment. Initial discussions with the local water utility indicated connection to a third pipe recycled water reticulation was currently not feasible for the site. So, it was assumed recycled wastewater would not be available for this site.

Figure 1: **Hypothetical** concept plan (Source: Development Victoria)

1 The proposed concept plan is a hypothetical layout that represents a potential layout that complies with approved development plan overlay requirements. Site layout is yet to be finalised.

2.3 Selection of scenarios

The project team developed four scenarios, including a baseline, as follows.

Baseline

- Existing condition – vacant site

Scenario 1 – No Water Sensitive Initiatives (Future-NoWSI)

- Vacant land replaced by the hypothetical concept plan layout
- No water sensitive initiatives apart from street trees to meet council standards

Scenario 2 – Business as usual (Future-BAU)

- Builds on Scenario 1
- Rainwater harvesting from private roof areas (i.e. from apartment towers and townhouses) for private indoor non-potable use (toilet flushing), but no stormwater harvesting in the public realm

Scenario 3 – Improved Water Sensitive Initiatives (Future-WSI)

- Builds on Scenario 2
- Stormwater harvesting in public realm for public open space irrigation
- 75% of unoccupied podium roof areas to be covered by green roofs
- Addition of a potential pond/wetland to Park 2 (the open space in the middle of the site)

Table 2: Hypothetical rainwater harvesting – reuse demand and tank volumes

Location	Estimated reuse demand (L/day)	Rainwater tank size (kL)
Apartment block 1-6	43,116	320
Individual townhouse	60	2

2.4 Geographical information system (GIS) data

To represent different land use types in the scenario model, each layer was prepared in GeoJSON. One layer was prepared for each land use type (Figure 2). For example, all 15 apartment towers were included in a single GeoJSON file. The only exception was townhouse blocks where each block was imported as a separate GeoJSON file. A separate GeoJSON file was also created for the whole site, defined by the site boundary. The projections of the GeoJSON files were set to WSG:84 or EPSG: 4326 when preparing GIS layers.

All GIS layers except the site boundary were compressed using 'WinZip' to make it easy to upload them when preparing the model.

The GIS data set included the following:

- Site_boundary.geojson
- GIS_Layers.zip
    - o Towers_all.geojson(apartment towers)
    - o Podium_excluding_towers.geojson
    - o Townhouses.geojson
    - o Townhouse_block_1.geojson
    - o Townhouse_block_2.geojson
    - o Townhouse_block_3.geojson
    - o Roads.geojson
    - o Bike_corridor.geojson
    - o Parks.geojson
    - o Other_pervious_area.geojson.

2.5 Population estimate

'Population' is an input parameter for one of the workflow nodes used in the Water Cycle Module of the Scenario Tool. Since the proposed reuse application is toilet flushing, a future population projection for the apartment towers and townhouses was required. This was estimated by assuming an individual demand of 21 L/person/day for toilet flushing.[2]

Table 3 Estimated population

Location	Estimated population
Apartment block 1-6	2,055

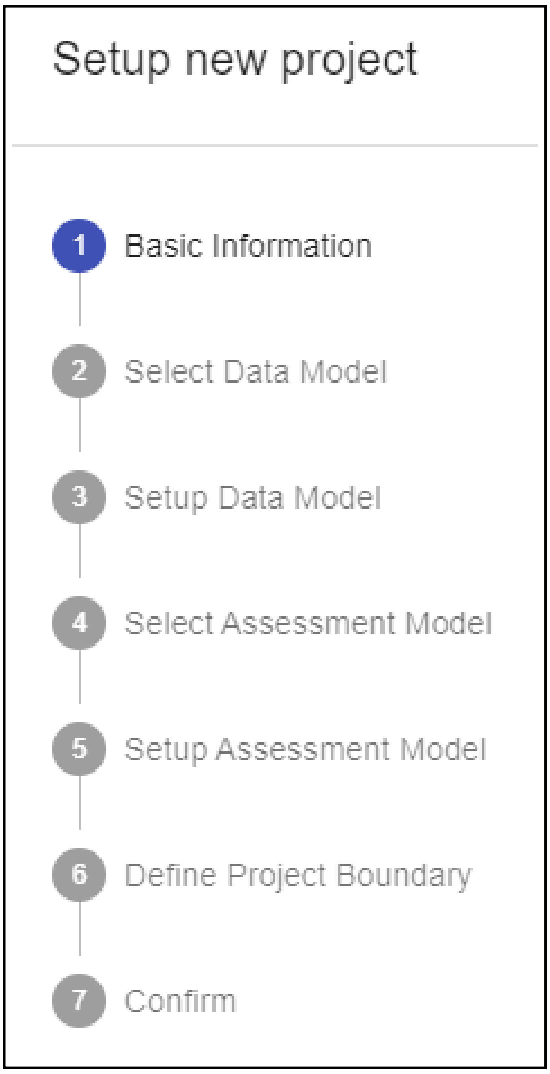
2 Healthy Land and Water (2018). *MUSIC Modelling Guidelines*, Healthy Land and Water Limited, Brisbane, Queensland. Table 4.3 Rainwater Tank Demands (Permanent Residential toilet demand in dwellings with full use of all water saving devices).

Figure 2: Geographical information system layers showing the hypothetical case study.

The proposed concept plan is a hypothetical layout that represents a potential layout that complies with approved development plan overlay requirements. Site layout is yet to be finalised.

3 Model setup

This section presents the steps followed in setting the Scenario Tool for the project. These steps can be used as guidance to undertake a similar analysis.



3.1 Create a project

1. Navigate to the Scenario Tool website (https://staging.wsc-scenario.org.au/) and log in using your registration details (otherwise register for the tool and then proceed to log in).
2. At the project dashboard, create a new project, name it, and set the region to Melbourne.
3. Select Geoscape as the data model[3].
4. Select advanced set up type.
   a. Simple set up is recommended for first time or non-advanced users.
      i. If simple set up is selected, steps 5 and 6 are not needed.
   a. Advanced set up is to be selected in this example because the grid size needs to be changed to suit the project scale.
      i. The default 20 m grid is too coarse for the project area.
5. To set up data model, only change the model parameter 'grid size' to 5 m.
6. To set up model assessment, set the 'grid size' in the TARGET Urban Heat Island assessment module to '5'.
7. Select the 'Land surface temperature', 'TARGET Urban Heat Island assessment' and 'Water balance modules'.
8. Upload the boundary file (site_boundary.geojson)
   a. The GeoJSON file is provided with the GIS dataset.
9. 'Submit' the project to initialise the model.
10. Upload the remaining GIS files after reaching the project dashboard.
    a. It is recommended to bulk upload all GIS layers as a 'Zip' file.
    b. Alternatively, GIS files can be uploaded individually.

3 Data provided by Geoscape is for research purposes only. There is an option to bring your own data. For details refer to Training Seminar 9 – Bring your own data available here.

3.2 Future scenario 1 – no water sensitive initiatives (Future–NoWSI)

This scenario will generate building footprints, define land cover/impervious fractions and also generate street trees.

11. To prepare the scenario, begin with the 'Clear area' node and set the area to 'Case study area'.
12. Next, add three 'Residential' nodes to create townhouses and apply parameters as per Table 4.
    a. The Residential workflow node is generally used to create a residential development for a given sub-area. It generates new parcels (individual lots), local streets and buildings.
    b. For this example, we are aiming to use this node to create ~40 townhouses within the area already allocated for townhouses; therefore we do not need to create local streets.
    c. To exclude the 'Local street generation', set the street offset parameter to the allowable minimum of 0.1 m (0 m offset is not feasible in the model).
    d. Similarly, street tress will be generated separately for the whole road network using a different workflow node. To exclude 'Street tree generation', set the street tree spacing parameter to the allowable maximum of 100,000 m.
    e. To specify the number of townhouses in each lot, another parameter needs to be changed:
        i. By default, dwellings/buildings can be created either when the parcel (individual lot) area is more than 280 m² or the building footprint is less than 80% of the total area.
        ii. To replicate the required number of townhouses within each block, set the parcel area parameter to 100 m² to allow dwellings to be created in smaller blocks. Further, adjust the block width parameter as specified in Table 4.

Table 4: Model parameters to generate townhouses

Parameter	Townhouse block 1	Townhouse block 2	Townhouse block 3
Workflow node	Residential	Residential	Residential
Area	Townhouse_block_1	Townhouse_block_2	Townhouse_block_3
City block width (m)	76	76	76
City block length (m)	200	200	200
Street offset (m)	**0.1**	**0.1**	**0.1**
Parcel width (m)	**6**	**4.7**	**5.24**
Parcel length (m)	**25**	**25**	**27**
Building height (m)	**8**	**8**	**8**
Site coverage	0.6	0.6	0.6
Residential units	1	1	1
Hardstand fraction	0.2	0.2	0.2
Garden fraction	0.2	0.2	0.2
Selected parcels	UPDATE dance4water_parcel_new SET landuse = "" WHERE percentage_filled < 0.80 or area < **100**	UPDATE dance4water_parcel_new SET landuse = "" WHERE percentage_filled < 0.80 or area < **100**	UPDATE dance4water_parcel_new SET landuse = "" WHERE percentage_filled < 0.80 or area < **100**
Tree canopy diameter	7	7	7
Percentage of lots with trees (%)	100	100	100
Number of trees per lot	1	1	1
Street tree spacing (m)	**100,000**	**100,000**	**100,000**
Intended output	*Generate 12 townhouses*	*Generate 12 townhouses*	*Generate 15 townhouses*

13. To create street trees, add the 'Generate street trees' node and apply the following parameters:
    a. Area: Roads.geojson
    b. Tree spacing (m): 12
    c. Tree canopy diameter (m): 5.
14. Finally, set up the remaining changes to landcover including apartment towers and podiums using the water cycle module's 'Create lot' workflow node as described in Table 5:
15. Run the scenario.

Table 5: Apartment blocks setup

Parameter	Podiums	Towers
Workflow node	Create lot	Create lot
Areas	Podium_excluding_towers	Tower_all
Persons	0	2,055
Lot template ID	1	1
Proportion of tree cover	0	0
Proportion of water cover	0	0
Proportion of grass cover	0	0
Proportion of irrigated grass cover	0	0
Proportion of roof cover	1	1
Proportion of road cover	0	0
Proportion of concrete cover	0	0

Table 6: Local roads and bike corridor setup

Parameter	Roads	Bike corridor
Workflow node	Create lot	Create lot
Areas	Roads	Bike_corridor
Persons	0	0
Lot template ID	1	1
Proportion of tree cover	0	0
Proportion of water cover	0	0
Proportion of grass cover	0.1	0
Proportion of irrigated grass cover	0	0
Proportion of roof cover	0	0
Proportion of road cover	0.8	0
Proportion of concrete cover	0.1	1

Table 7: Pervious area setup

Parameter	Parks	Other pervious areas
Workflow node	Create lot	Create lot
Areas	Parks	Otherpervious_area
Persons	0	0
Lot template ID	1	1
Proportion of tree cover	0.1	0
Proportion of water cover	0	0
Proportion of grass cover	0	1
Proportion of irrigated grass cover	0.8	0
Proportion of roof cover	0	0
Proportion of road cover	0	0
Proportion of concrete cover	0.1	0

3.3 Future scenario 2 – business as usual (Future–BAU)

Scenario 2 builds on Scenario 1 and simulates the business-as-usual case where rainwater harvesting (RWH) is implemented in townhouses and at apartment towers. For simplicity, all apartment tower reuse demands and storages will be lumped together in the model. Alternatively, each apartment block rainwater harvesting could be modelled individually.

16. First create a new scenario and set the scenario name to 'Future-BAU', and parent scenario as 'Future–NoWSI'.
17. Create a lot template using 'Lot template' node and change the parameters in Table 8. Leave all remaining parameters as default values.

Table 8: Lot template setup

Parameter	Value
Node	'Lot template'
Areas	'Townhouses'
Non potable stream	'Non potable demand'
Outdoor demand stream	'Outdoor demand'
Blackwater system	'Sewerage'
Greywater system	'Sewerage'

18. Set up lot-scale rainwater harvesting using the 'Lot scale storage' node. This node is applied to all the townhouse blocks at once instead of applying rainwater harvesting to each individual block. Each townhouse is connected to a 2 kL rainwater tank and the water collected will be supplied for toilet flushing.

Table 9: Lot scale storage

Parameter	Value
Node	'Lot scale storage'
Areas	'Townhouses'
Capture	'Roof runoff'
Reuse priority 1	'Non potable demand'
Reuse priority 2	'None'
Reuse priority 3	'None'
Storage volume (m^3)	'2'

To create sub-catchment scale stormwater harvesting from apartment tower roofs and reuse for toilet flushing within apartment blocks, an additional lot template is defined for the 'Towers_all' region. Then the area from which inflow is collected and the area at which reuse demand is generated must be defined, followed by defining the sub-catchment scale storage.

19. Create a new lot template using the 'Lot template' node and change the following parameters. Leave all remaining parameters as default values.

Table 10: Lot template setup

Parameter	Value
Node	'Lot template'
Areas	'Towers_all'
Non potable stream	'Non potable demand'
Outdoor demand stream	'Outdoor demand'
Blackwater system	'Sewerage'
Greywater system	'Sewerage'

3.4 Future scenario 3 – improved water sensitive initiatives (Future–WSI)

20. Define sub catchments using 'Sub catchment' node.

Table 11: Sub catchment setup

Parameter	Inflow	Demand
Node	Sub catchment	Sub catchment
Areas	Towers_all	Towers_all
Stream	Stormwater runoff[4]	Non potable demand

21. Define sub catchment storage using 'Sub catchment storage' node.

Table 12: Sub catchment scale rainwater harvesting setup

Parameter	Value
Node	'Sub catchment storage'
Areas	'Towers_all'
Sub catchment inflow	'Towers_all'
Stream	'Stormwater runoff'
Sub catchment demand ID priority 1	'Towers_all'
Stream	'Non potable demand'
Storage volume (m^3)	'320'

Scenario 3 builds on Scenario 2 and adds additional stormwater harvesting for irrigation, green roofs and water bodies.

In this scenario, 75% of the podium car parks roof area is converted into a green roof. Further, 20% of park/open space is converted to water bodies such as a wetland/pond.

22. To change land cover, use the 'Create lot' node as follows.

Table 13: Blue green infrastructure setup

Parameter	Podiums	Towers
Workflow node	Create lot	Create lot
Areas	Podium_excluding_towers	Parks
Persons	0	0
Lot template ID	1	1
Proportion of tree cover	0	0.1
Proportion of water cover	0	**0.2**
Proportion of grass cover	0	0
Proportion of irrigated grass cover	**0.75**	**0.6**
Proportion of roof cover	**0.25**	0
Proportion of road cover	0	0
Proportion of concrete cover	0	0.1

Stormwater harvested from road runoff is reused for public open space irrigation.

4 Roof cover is 100% of the area defined by towers. Therefore, stormwater runoff is roof runoff only.

23. Create two additional lot templates using the 'Lot template' node and change the following parameters. Leave all remaining parameters as default values.

Table 14: Lot template setup

Parameter	Value
Node	'Lot template'
Areas	'Roads'
Non-potable stream	'Non potable demand'
Outdoor demand stream	'Outdoor demand'
Blackwater system	'Sewerage'
Greywater system	'Sewerage'

24. Define sub catchment storage using the 'Sub catchment storage' node.

Table 15: Stormwater harvesting setup

Parameter	Value
Node	'Sub catchment storage'
Areas	'Roads'
Sub catchment inflow	'Roads'
Stream	'Stormwater runoff'
Sub catchment demand ID priority 1	'Parks'
Stream	'Outdoor demand'
Storage volume (m^3)	'360[5]'

25. Run the scenario.

5 Estimated in-ground storage to be provided in public realm to supplement stormwater retention when rainwater tanks are used in private realm.

4 Model results

4.1 Overview

Once each scenario is simulated, go to the overview tab at the top left-hand corner and select any scenario from the dropdown menu under the baseline. Then, a summary of model results for key indicators/parameters such as population, land cover, surface temperature, water demand, wastewater etc. will appear in the dashboard (Figure 3).

To investigate any results further, click on the relevant indicator. If spatial data is available (e.g. population, land cover, impervious area), it will be automatically displayed in the window. Charts, tables and other summary statistics of all scenarios will be displayed in in the right-hand panel.

4.2 Scenario comparison

To compare the difference between two scenarios, select each scenario from the context panel at the top left-hand corner (Figure 4). The dashboard will be updated to reflect the relative increase/decrease of each indicator. The map will show the relative increase/decrease of each indicator spatially (if spatial data is available).

Results can be further explored using charts, time series and tables. By default, the results for all scenarios are shown (Figure 5). Individual scenarios can be turned on and off as required. Further, by selecting a comparison scenario (top right-hand corner), the relative increase or decrease of any indicator can be easily evaluated (Figure 6).

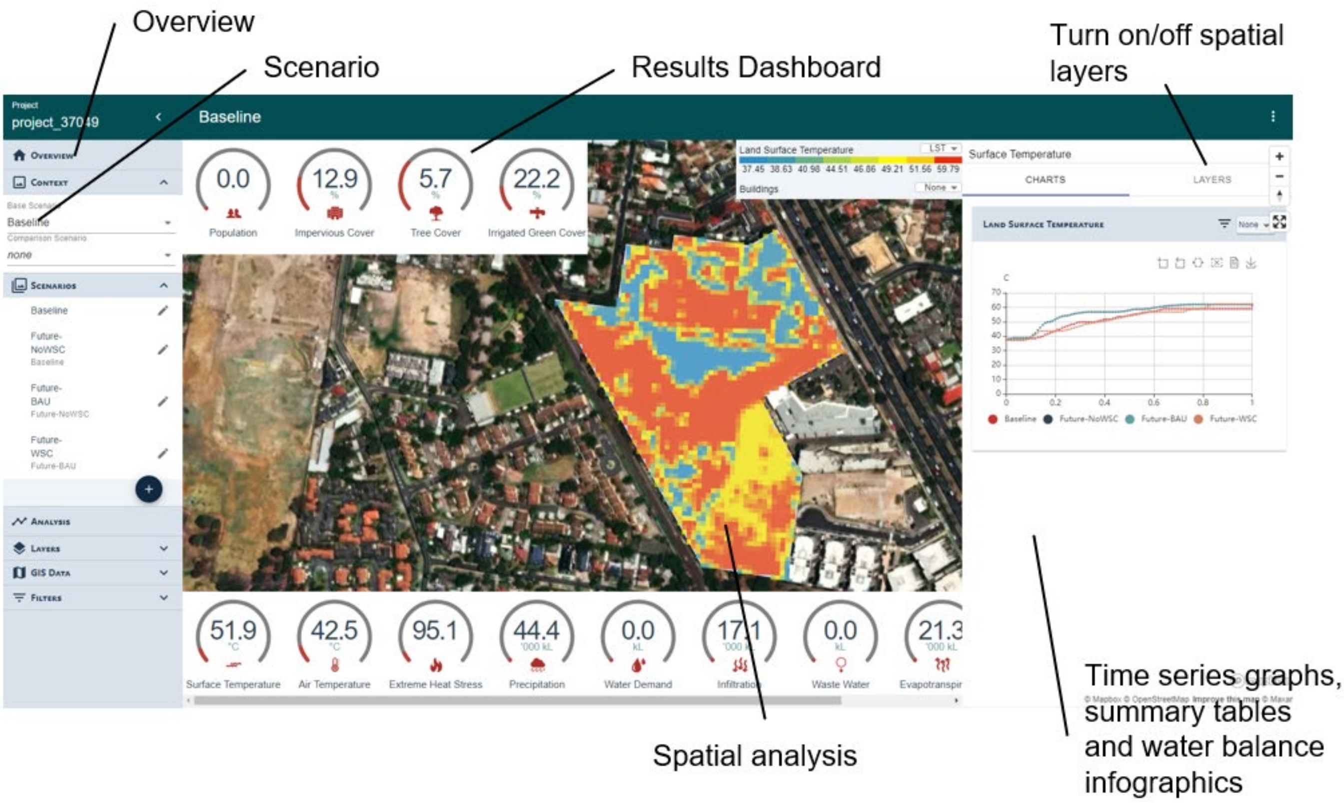


Figure 3: Results dashboard – single scenario

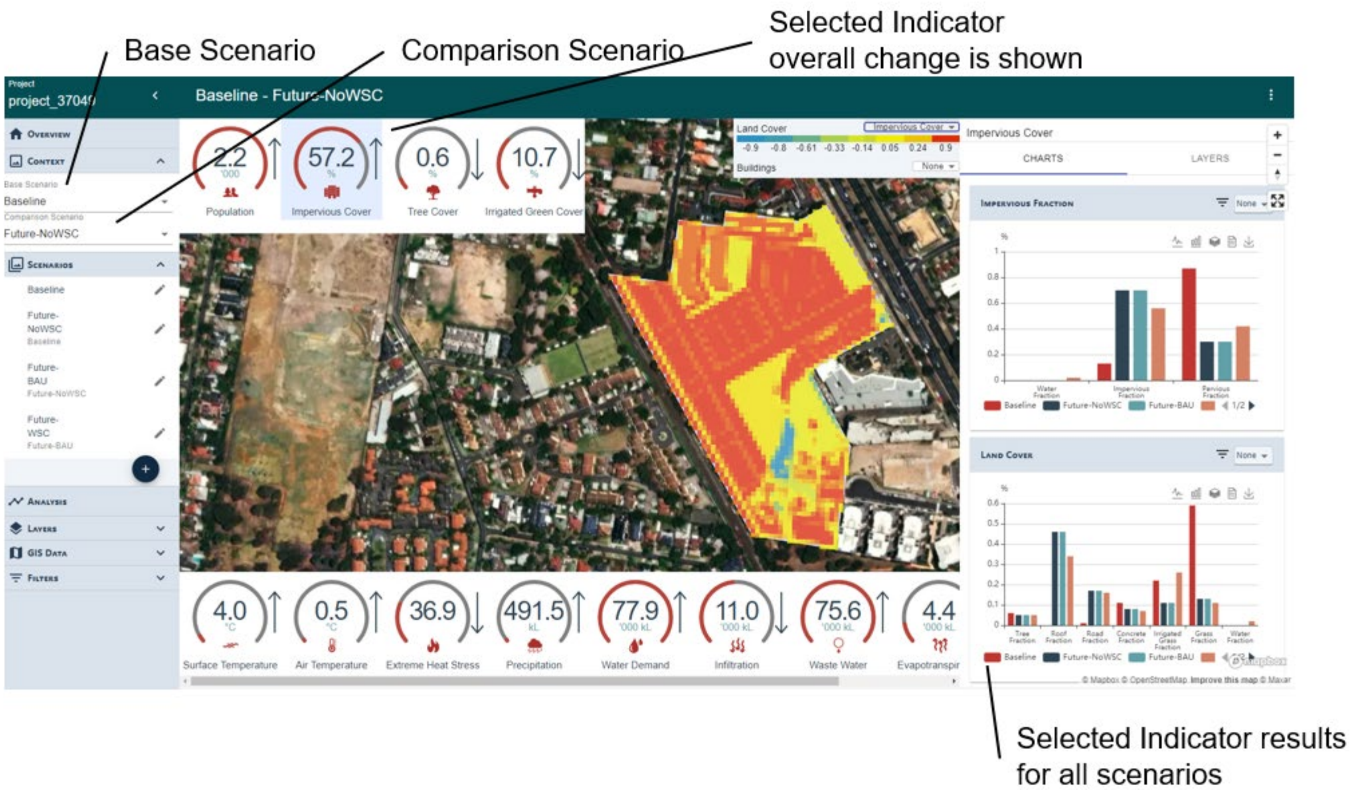


Figure 4: Scenario comparison – overview

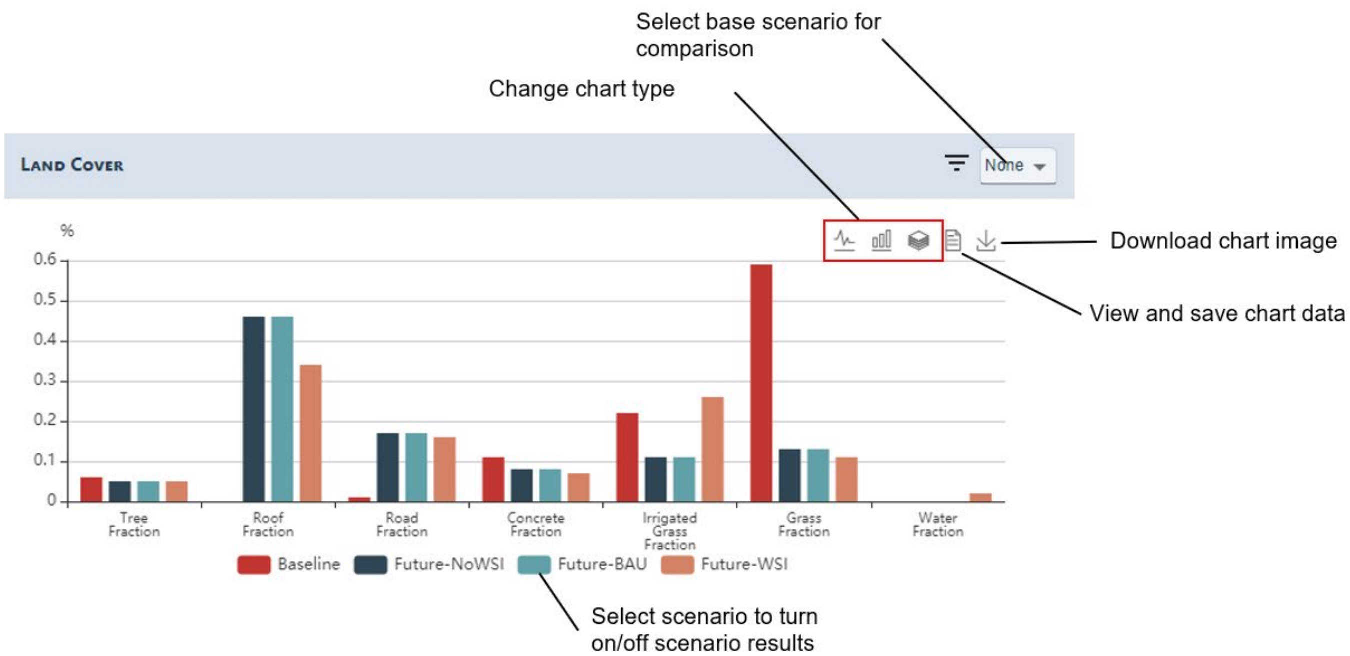


Figure 5: Results for each scenario in chart format

4.3 Microclimate

The impact of proposed water sensitive initiatives on microclimate is explored through the 'Land surface temperature' (LST) and 'TARGET' modules. As the name suggests, the LST module reports on the temperature of different surfaces. The TARGET module reports on air temperatures and human thermal comfort. Both can be used to understand changes in the heat island effect.

Land surface temperature

LST results are provided as charts as well as spatial distribution maps. These maps are useful in identifying hotspots within study areas and to identify the effectiveness of any urban heat mitigation strategy.

Figure 7 shows that the proposed development scenario increases the average LST by 4°C compared with the baseline. By contrast, the proposed Future-WSI scenario brings the average LST down to the same level as the baseline. LST distribution maps also highlight hotspots with future development. Figure 7 shows the LST is high in areas where future buildings and roads are proposed in all three future scenarios. On the other hand, LST is low in park areas, adjacent to street trees and also in areas with proposed green roof areas. In other words, green infrastructure is keeping the LST low compared with highly impervious surfaces.

LST comparison maps shown in Figure 8 are another useful tool to identify the effectiveness of proposed water sensitive initiatives. For instance, there is no change in LST between the Future-NoWSI and Future-BAU scenarios, because no changes are proposed in land surfaces. The only difference between the two scenarios is rainwater harvesting, which will be used for indoor uses only. By contrast, comparing the Future-NoWSI and Future-WSI scenarios shows that replacing 75% of the podium roof areas with green roofs lowers the LST by 3.9°C on average across the whole site and up to a ~18°C on podium roofs.

These results demonstrate the Scenario Tool's capability to evaluate the overall effectiveness of different water sensitive strategies as well as providing a clear understanding of the spatial distribution of such benefits. In this way, the Scenario Tool can be a useful screening tool in early project planning stages to select appropriate water sensitive strategies.

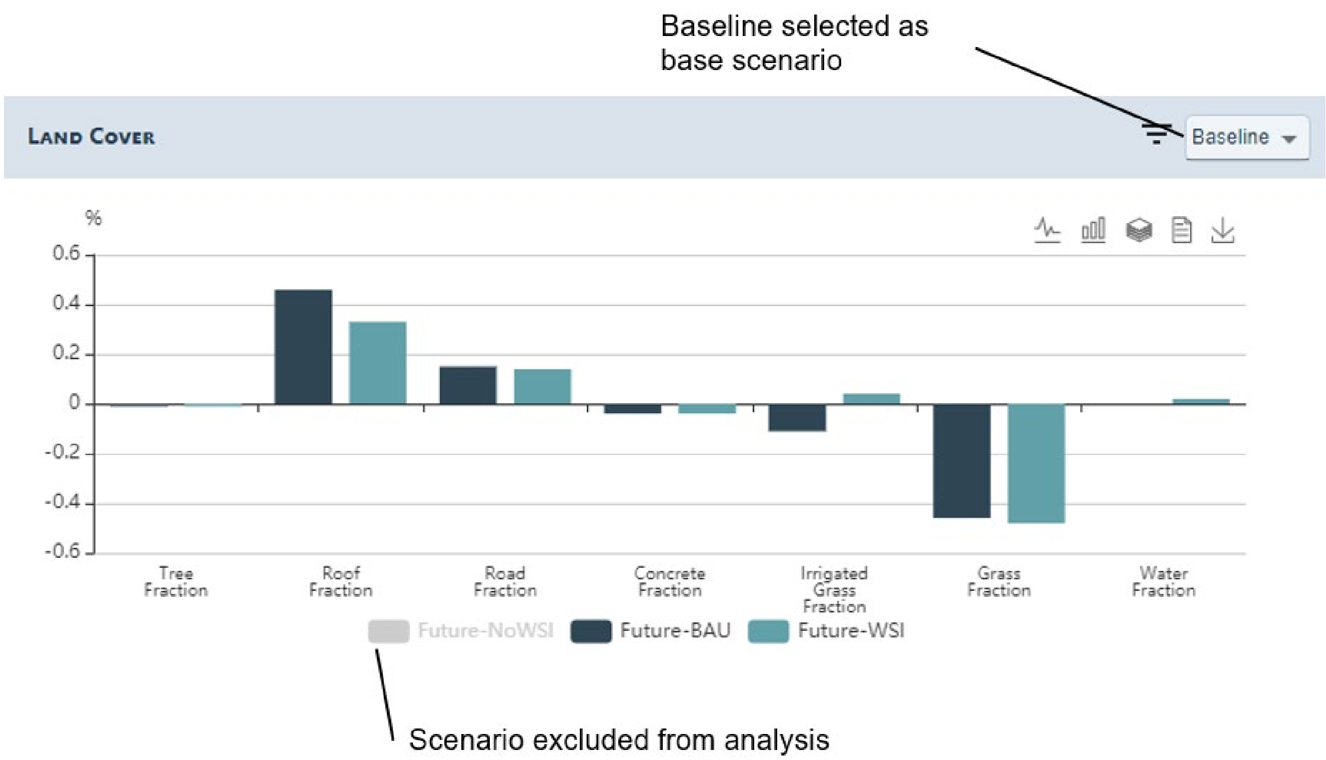


Figure 6: Scenario comparison – chart

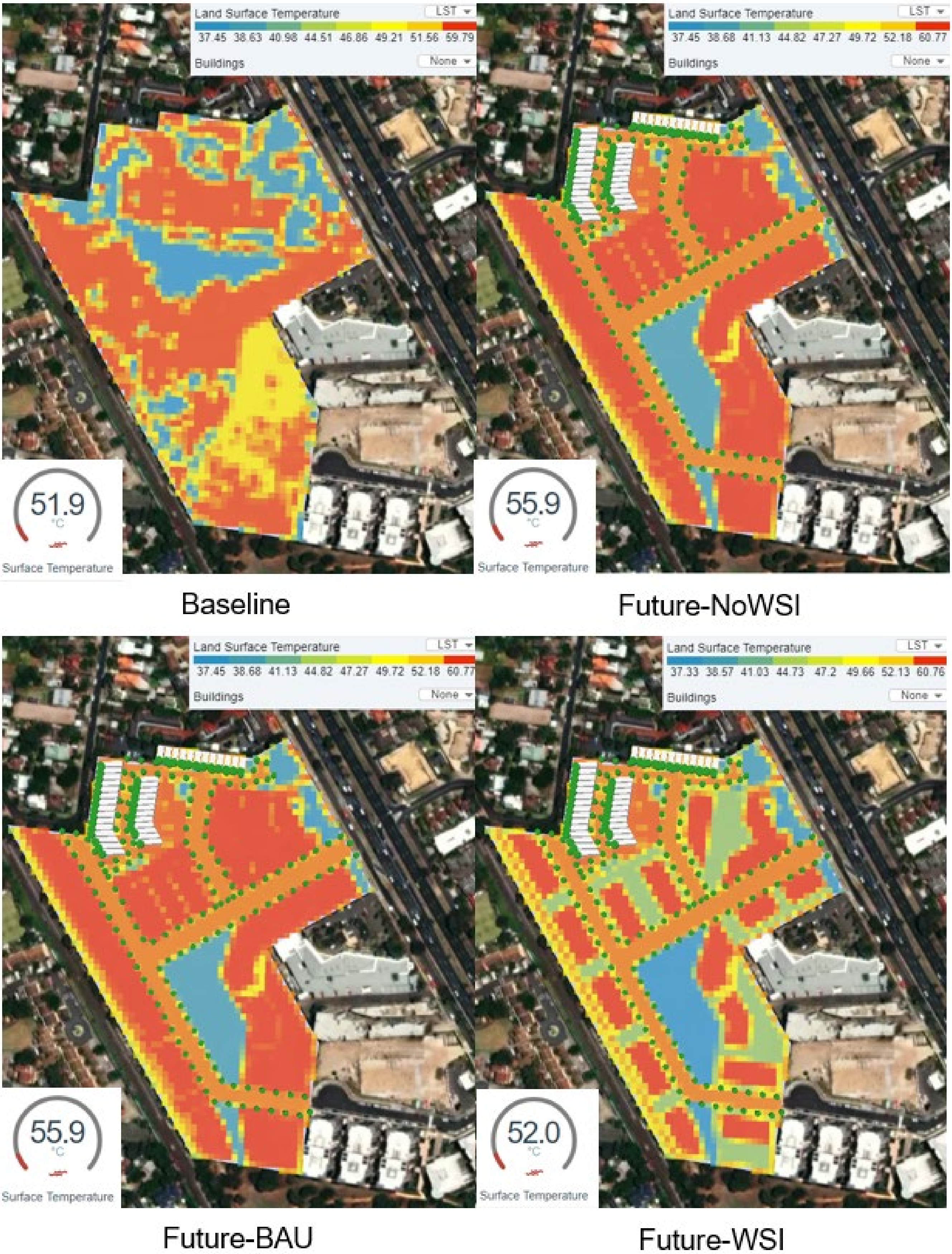


Figure 7: Land surface temperature comparison

TARGET

A summary of the average air temperature results is shown in Figure 9. The business-as-usual development (Future–BAU) increases the average temperature by 0.5°C during a heatwave compared with the baseline. Introducing green roofs in the Future–WSI scenario brings down the average air temperature to levels similar to baseline (as was the case in the LST comparisons). These results again demonstrate the microclimate benefits of green roofs.

As well as average air temperature statistics, heat maps are a great tool to compare the spatial distribution of air temperature. The Scenario Tool produces daily air temperature maps at 4 am and 4 pm within a 3-day heatwave as well as the average air temperature. Figure 10 shows the relative change in daily 4 am air temperature in Future–BAU and Future–NoWSI scenarios compared with the Future–NoWSI scenario. (Note: black grid cells represent building footprint.) A decrease in air temperature adjacent to podium roofs clearly demonstrates the benefit of green roofs.

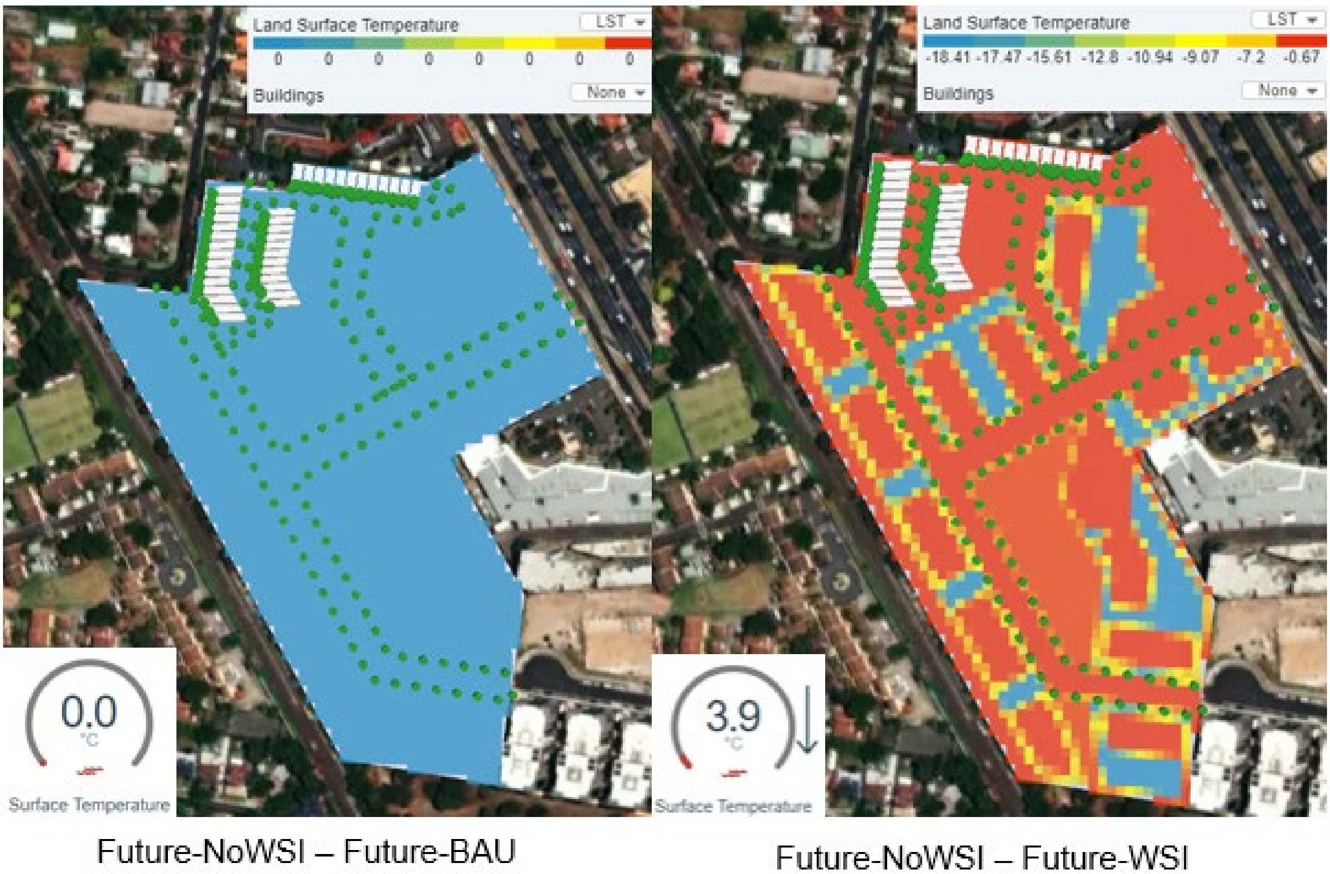


Figure 8: LST comparison – baseline and future scenarios

Air Temperature

None

Drag headers here to group by

Scenarios	Average Air Temperature
Baseline	42.55
Future-NoWSI	43.03
Future-BAU	43.03
Future-WSI	42.44

Figure 9: Average air temperature

Future-NoWSI – Future-BAU

Future-NoWSI – Future-WSI

Figure 10: Change of TARGET (Day 1 4 am Air Temperature) compared with Future-NoWSI scenario (spatial data)

Figure 11 shows the temporal changes in air temperature during the modelled 3-day heatwave. It is another tool to identify at what time of day the proposed water sensitive initiatives are most effective. In this case study, the relative change or the decrease in air temperature is generally greater outside the daylight hours.

4.4 Urban Water Cycle

Water balance infographics (Figure 12) provide a quick snapshot of the benefits of proposed water initiatives. For instance, the estimated potable water demand of the proposed development (Future–NoWSI) is 77.9 ML/year. The proposed rainwater harvesting scheme (Future–BAU scenario) lowers the potable water demand to 69.6 ML/year with 8.3 ML/year to be supplemented by rainwater harvesting. Further, in the Future-WSI scenario, reuse volume is increased to 10 ML with the addition of stormwater harvesting. However, the overall water demand (both potable and non-potable) has gone up to 84.3 ML/year due to increased irrigation demand from green roofs created in podium roof areas. The infographics also show that the proposed development (Future–NoWSI) increases runoff from 5.9 ML/year to 24.1 ML/year and proposed rainwater and stormwater harvesting interventions (Future–WSI) reduce the runoff down to 9.9 ML/year.

Time series graphs and summary tables of lot-scale and sub catchment-scale storage behaviour are other useful tools that can be used to optimise proposed harvesting strategies. Lot-scale and sub catchment-scale storage summary table data are shown in Table 16 and Table 17 respectively. Table 16 shows that 2 kL rainwater tanks proposed at townhouses supply 0.5 ML/year while rainwater tanks (Total volume of 320 kL) proposed for apartment towers supply 7.8 ML/year for toilet flushing. Additional in-ground storage of 360 kL (to collect road runoff) provides 1.7 ML/year for public open space irrigation.

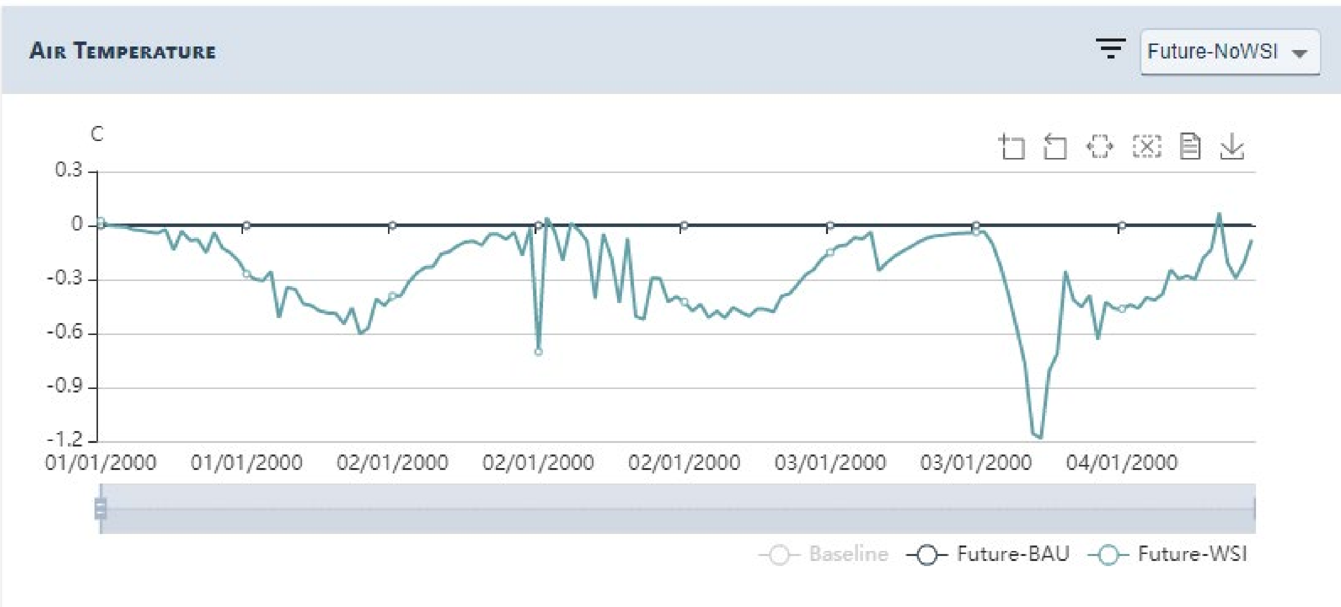


Figure 11: Relative change in air temperature compared with Future–NoWSI over 3-day period (time series)

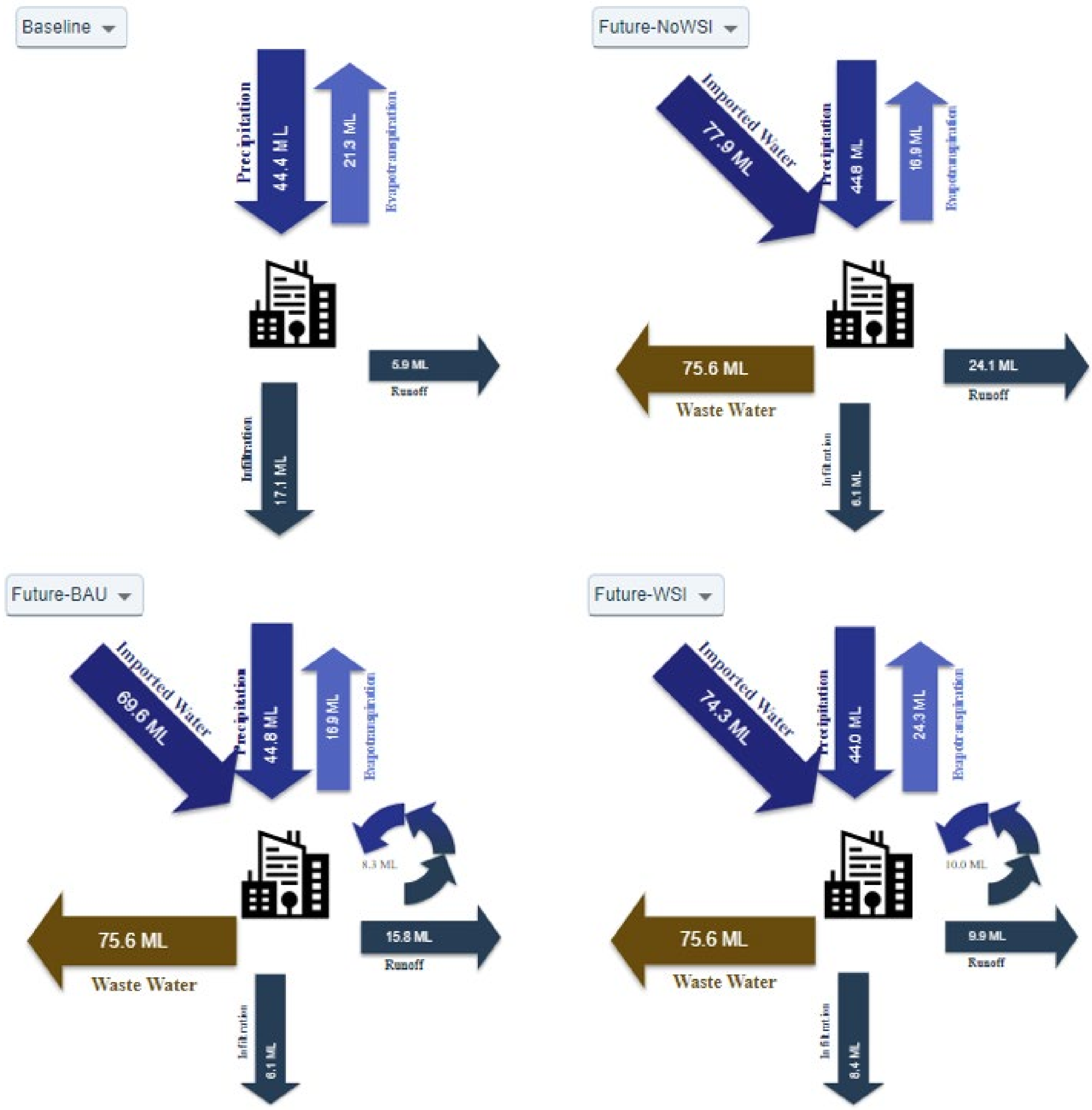


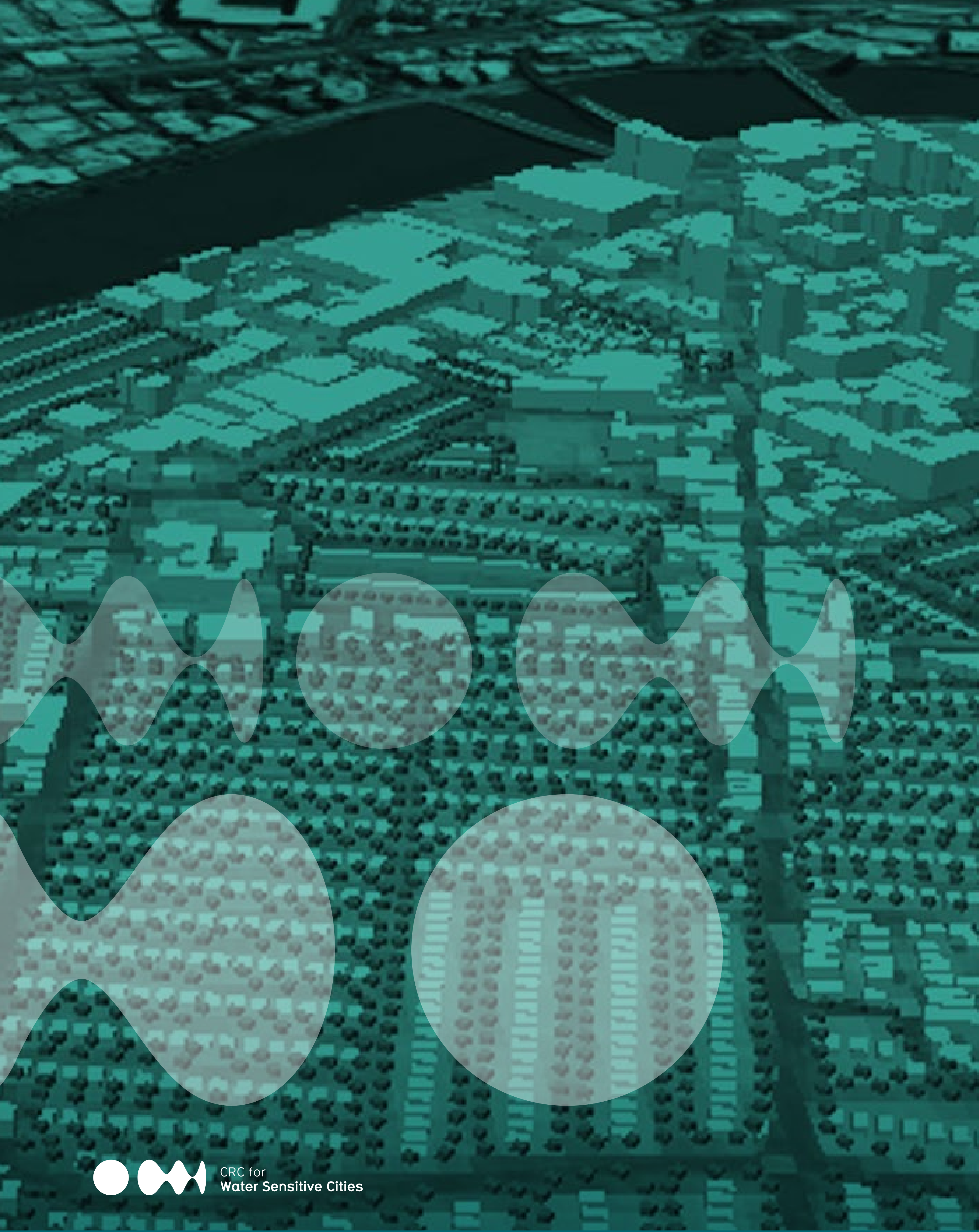
Figure 12: Water balance infographic

Table 16: Lot scale storage summary

Scenario	Wb lot template ID	Inflow stream	Demand stream 0	Demand stream 1	Demand stream 2	Volume	Provided volume (kL)	Spills	Dry
Future-BAU	1	Roof runoff	Non potable demand	None	None	2	464.06	30	21
Future-WSI	1	Roof runoff	Non potable demand	None	None	2	464.06	30	21

Table 17: Sub catchment scale storage summary

Scenario	Inflow stream	Demand stream	Volume	Provided volume (kL)	Dry	Spills
Future-BAU	Stormwater runoff	Non potable demand	320	7839.85	153	29
Future-WSI	Stormwater runoff	Non potable demand	320	7839.85	153	29
Future-WSI	Stormwater runoff	Outdoor demand	360	1670.36	110	4



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