APPENDIX I:

Programme appraisal

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1. Introduction

We have used an investment model to understand and inform our optimal water resources strategy over the period 2025 to 2065 given each of the supply-demand balance (SDB) futures and optimisation objectives (e.g. least cost or maximised benefit). For each model configuration five SDB scenarios have been run, representing a range of potential futures covering population growth uncertainty and climate change impact uncertainty. These futures are defined as:

- **Very Benign** – this represents a very low population growth future (<= nil migration) and low climate change impacts
- **Benign** – this represents a future with low population (probably around nil net migration) and low to medium climate change impacts
- **Mid-Range** – the mid-range future spans a range of possible combinations that could include high climate change impacts but low population growth, low climate change impacts but high population growth or medium population and climate change impacts
- **Plausible Adverse** – this represents a future with likely high population growth (>= +325 net migration) and medium to high climate change
- **Reasonable Worst** – this represents a future with high population growth (>= +700 net migration) and high climate change impacts

In this appendix, we often refer to “adverse futures”, which is used to mean both the plausible adverse and reasonable worst futures.

The investment model includes the cost and benefit of each option carried forward from the Options Appraisal stage. In addition to the DO benefit estimated, each option has a set of metric scores that are used to evaluate the best-value plan in addition to the least cost plan. These cover:

- **Resilience** – incorporating three resilience sub-metrics for reliability, adaptability and evolvability of each option
- **Environmental and social** – utilising the SEA benefit and disbenefit scores. With additional weight applied to ‘significant’ benefits or disbenefits.

Appendix H describes the model set up, development of the scenario framework, and the best value planning approach. While in this Appendix I, we focus on the outputs of the investment modelling to appraise the programme of options that are selected, in order to derive the preferred plan for the WRDMP.

1.1 Selecting the preferred plan

Figure 1-1 illustrates the process we have carried out to determine the best-value adaptive strategy. The output of this approach is a recommended plan that details immediate actions as well as potential actions that may be needed in certain futures or under specific circumstances. These are split into the following categories:

- **Immediate no regrets options** – these are required to be implemented as soon as practicable and, in all futures, (i.e. least regrets options)
- **High chance short/medium term options** – these are often selected in the short to medium term in the Mid-Range to Adverse futures. Where necessary further investigations should be started to facilitate implementation of these options when they may be required.
- **Potential long-term solutions** – these are only selected towards the end of the plan and in the Adverse futures

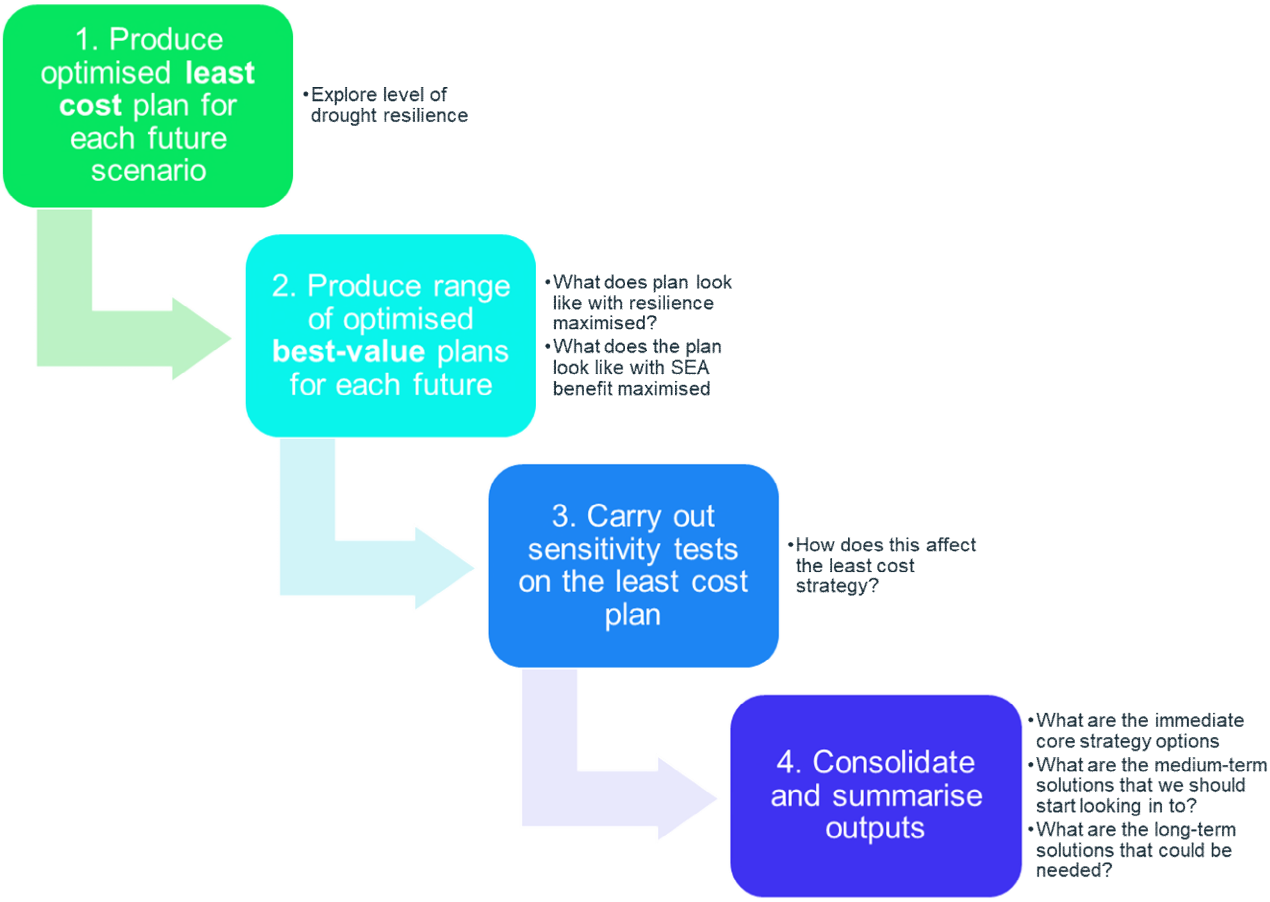

Figure 1-1 - Determining our recommended best-value strategy

1.2 Baseline scenario assumptions

1.2.1 Defining the level of service

For this plan Jersey Water wanted to extend the methods and approaches used in terms of data analysis and modelling and, through the use of stochastic weather data we have been able to explore system performance against a wide range of drought return periods. The current Water Resources Planning Guidelines for England & Wales specify that companies should aim to reach a '1 in 500 year' level of resilience (where failure is defined as an event causing the need to implement emergency drought orders) by 2039. For the previous plan Jersey Water worked to a worst historic event (the 1991/92 drought) which was estimated to be in the region of a 1 in 191 year event[1]. Several changes in the data inputs and approaches since the last plan make it difficult to draw a direct comparison with this estimate however, as highlighted in Appendix D our updated analysis as part of this work suggests a return period closer to 1 in 100, resulting in a lower than previously thought level of service. In order to retain a high standard of service to customers, Jersey Water would like to be able to meet a 1 in 100 level of service by 2030 in all future scenarios, and subsequently improve this by targetting a 1 in 500-year level of service by 2035 across all of the future scenarios.

[1] Appendix C. Water Source Yield Assessment, WRDMP21, Jersey Water

1.2.2 Base configuration for Investment Model

The default configuration for the investment model comprises:

- Multiple planning scenarios included within the investment model as follows:
  - NYAA
  - DYAA (1 in 10 drought return period)
  - 1 in 100 drought event
  - 1 in 500 drought event
- The risk of deficits in drought scenarios are accepted up to 2029 for a 1 in 100 drought event and up to 2034 for a 1 in 500 drought event. This enables options to be selected and constructed within the model and avoids this becoming the only factor in option selection.

Additional model runs and sensitivity tests have been carried out to analyse the impact of these factors.

1.2.3 PFAS regulation scenarios

The baseline position for the Programme Appraisal assumes no change to the current PFAS regulation standards. Under this situation boreholes can only be operated when the desalination plant is active to ensure appropriate levels of mixing and dilution. However, there is significant uncertainty over changes to PFAS regulation and higher standards could require action to implement PFAS treatment enhancement either at the source or at the works and to varying extents.

The level of PFAS regulation represents both an external uncertainty (i.e. it is not within the control of Jersey Water) as well as a short-term uncertainty as it is expected to be resolved by 2028. We have therefore considered and modelled two alternative scenarios in addition to the baseline position as illustrated in Figure 1-2. In the baseline scenario there is no change to current regulation requiring additional treatment however the investment model has the option to select a scheme to develop a new groundwater abstraction source at Pont Marquet with approximately 0.55 Ml/d benefit in a 1 in 500-year type event. As outlined, higher PFAS regulations may require more direct action such as PFAS treatment either at the source or at the works. Under these scenarios Jersey Water could regain full DO benefit from their existing boreholes and the operational constraints would no longer be an issue. Water resources modelling of the system suggests a benefit of approximately 0.56 Ml/d benefit in a 1 in 500-year type event. The most comprehensive treatment at both treatment works (under the alternative scenario 2) could deliver compliance to the highest standards and the greatest resilience; however it has the potential to be up to £14m more in CAPEX than alternative options that may target treatment at contaminated sources.

We have considered the impact of this uncertainty in terms of changes from the Baseline position as part of the sensitivity testing.

Figure 1-2 – PFAS regulation scenarios

1.3 Format of output

We have utilised a range of visualisation and tabulated summaries to understand the investment model outputs. The key output formats used in this appendix are:

- Comparison of total net present cost (NPC) of each strategy (also split into operating expenditure OPEX and capital expenditure CAPEX costs). This helps to understand the potential cost implications of future scenarios, strategy decisions and policy uncertainties.
- Visualisation of year of option selection and implementation across each of the future scenarios as a branch diagram (see Figure 1-3). This enables easy comparison of similarities and differences between the five plausible future scenarios.
- Visualisation of DO contribution to the SDB in a specific planning condition (e.g. 1 in 500 drought event) across each of the future scenarios (see Figure 1-4). This enables easy understanding of the size of option contribution to the SDB as well as the estimated SDB surplus/deficit under each future scenario and planning condition.

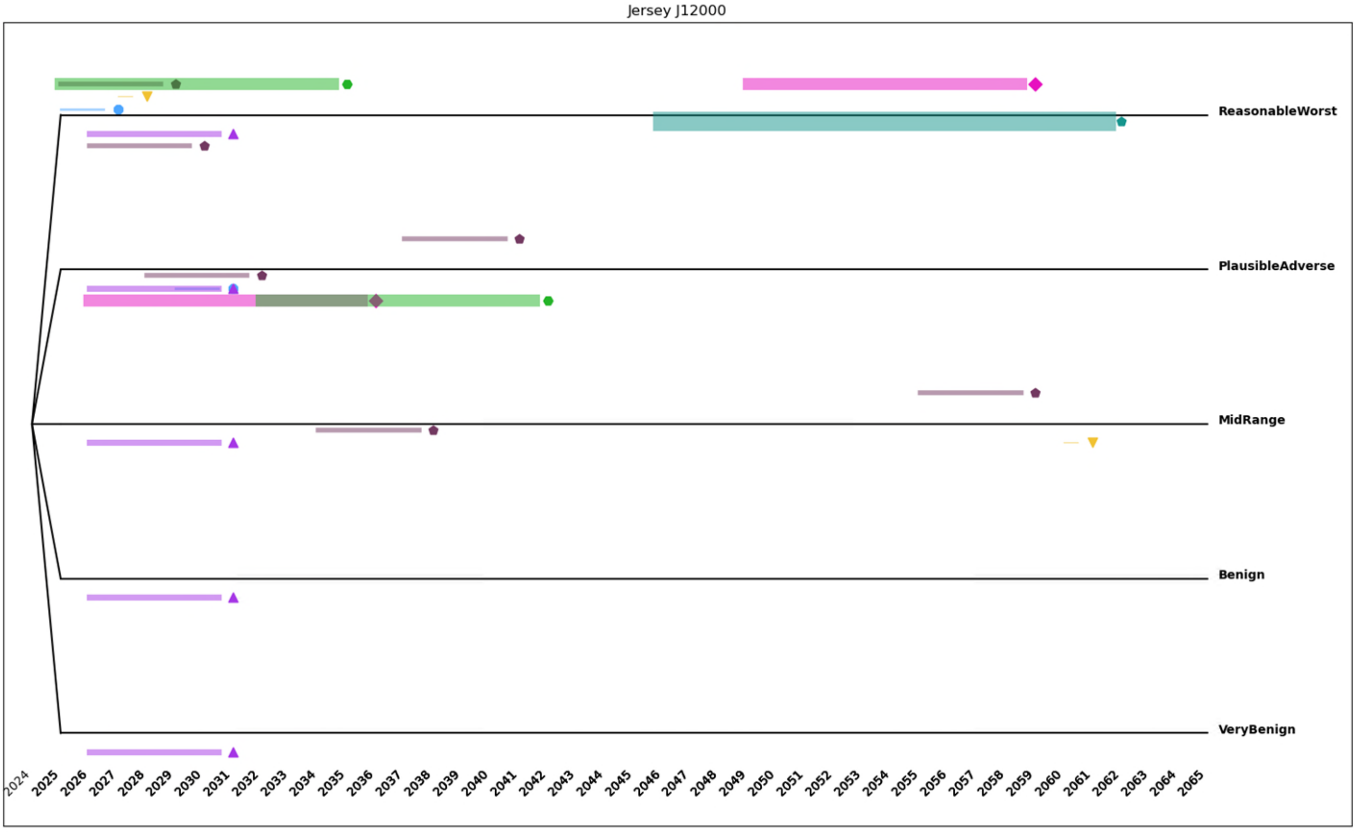

Figure 1-3 – Example of branch plot showing each of the future scenarios as branches with option selection. Option categories are represented by a different colour with the marker representing the implementation year and the bar showing the construction period, options with a longer construction period are shown with a thicker bar.

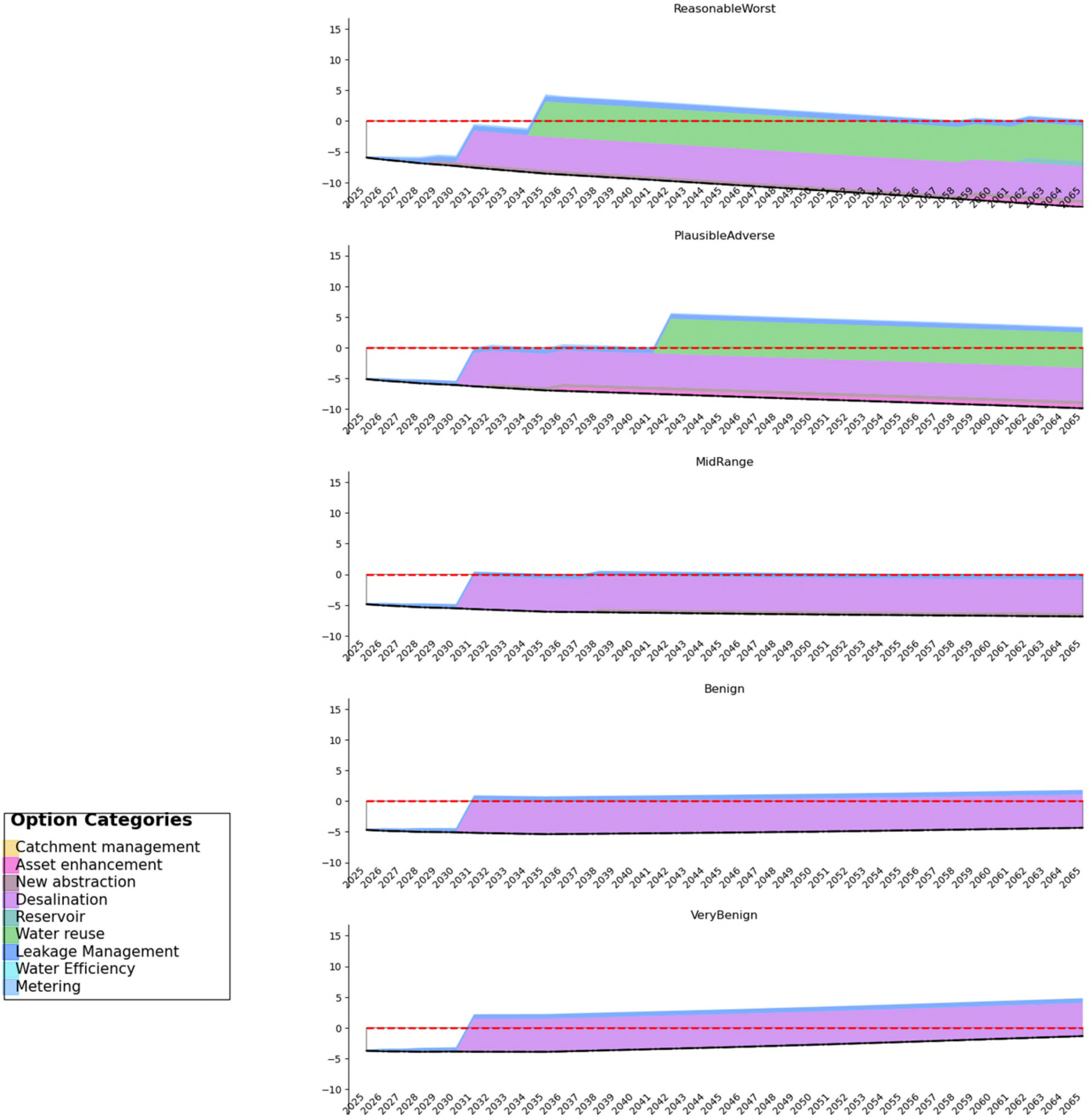

Figure 1-4 – Example of optimised output for the 1 in 500 planning condition across each of the future scenarios. The black line indicates the initial SDB and the red dotted line shows a zero SDB (i.e. no deficit/surplus). DO contribution to the SDB by each option type is indicated by the coloured segments.

2. Scenario outputs

This section summarises the investment model outputs for the optimised least cost strategy (Section 2.1) and for the best-value runs (Section 2.2). These reflect Steps 1 and 2 in Figure 1-1.

2.1 Least cost strategy

Figure 2-1 summarises the optimised least cost plan in terms of the options that are selected in all futures and which should be implemented at the outset, as well as the medium to long term schemes that are dependent on the future scenario that Jersey Water faces. Figure 2-2 shows the detailed option implementation across each of the futures. The key outputs from this least cost strategy run are:

- The La Rosiere desalination extension scheme is needed immediately and, in all futures (as seen in Figure 7-4 of the main report there is a deficit in the 1in100 and 1in500 planning conditions in all future scenarios)
- The base leakage reduction strategy is implemented in all futures to minimise the forecast leakage increase as a result of anticipated network pipe deterioration
- Reservoirs are unlikely to be the optimal short or medium term solution but could be needed in the long term in an adverse future
- DO benefit from a PFAS targeted response is needed in the Mid-Range and Adverse futures
- In the adverse futures an additional large scheme is likely to be needed, e.g. Bellozanne water reuse
- Smart metering is selected in the adverse futures
- Additional options may be needed and used to delay the need for additional resource, these include:
    - Fernlands
    - West-East transfer
    - Catchment measures

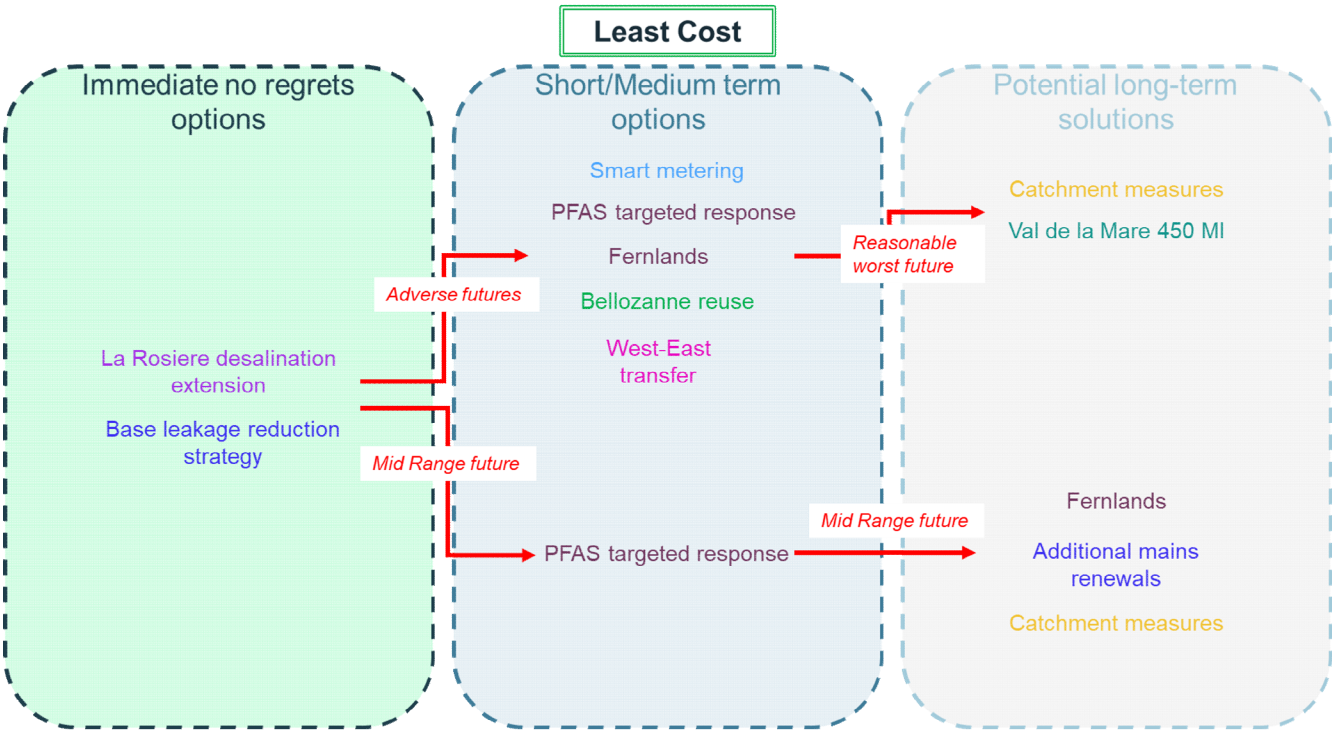

Figure 2-1 – Least cost strategy across scenario futures

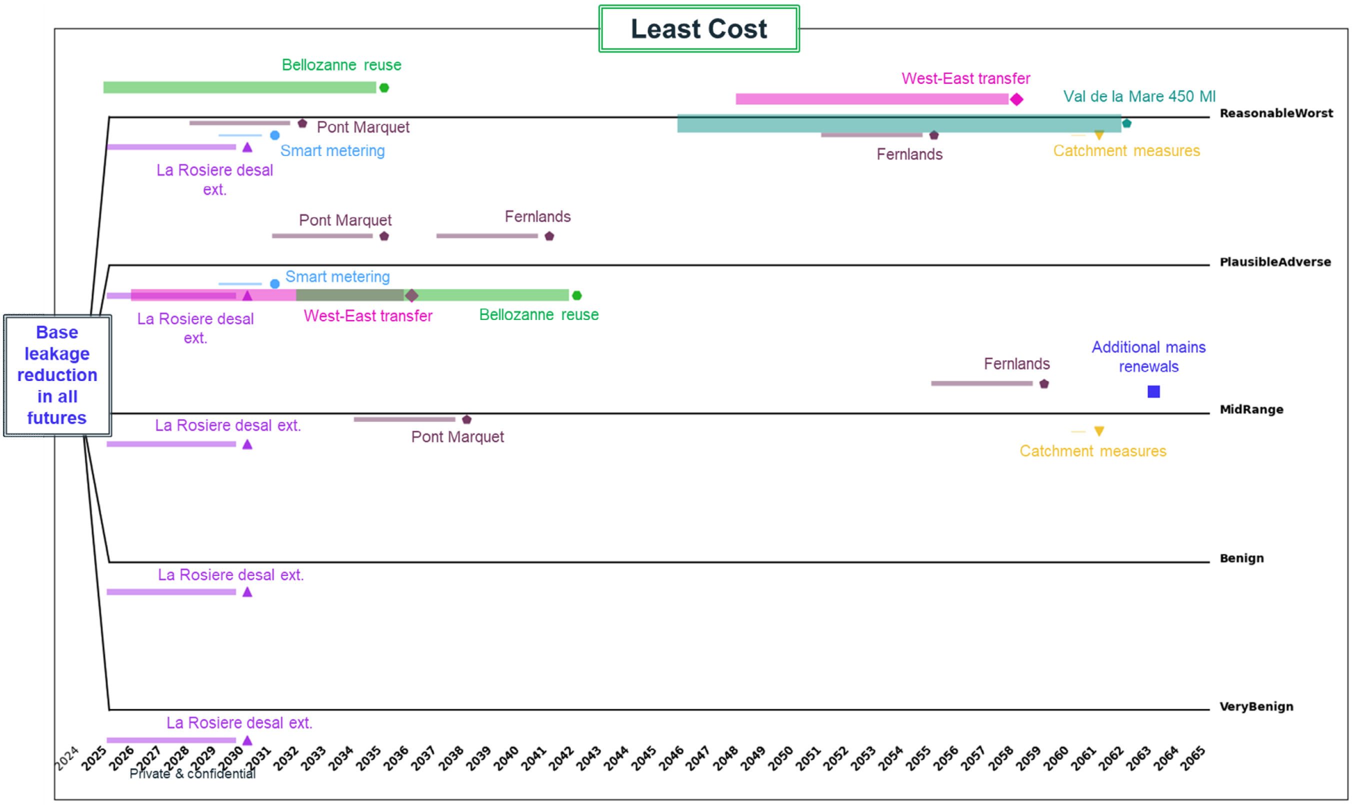

Figure 2-2 – Optimised least cost strategy across the five future scenarios.

Figure 2-3 shows the total NPC for each of the future scenarios in £m. This shows that across the Mid-Range to Benign futures there is only a small difference in the expected cost. However, the cost of the optimised strategy in the Plausible Adverse or Reasonable Worst futures could be significantly more expensive; around 4 to 5 times more expensive. A key part of this additional cost is due to the need for a second large resource option, such as Bellozanne water reuse.

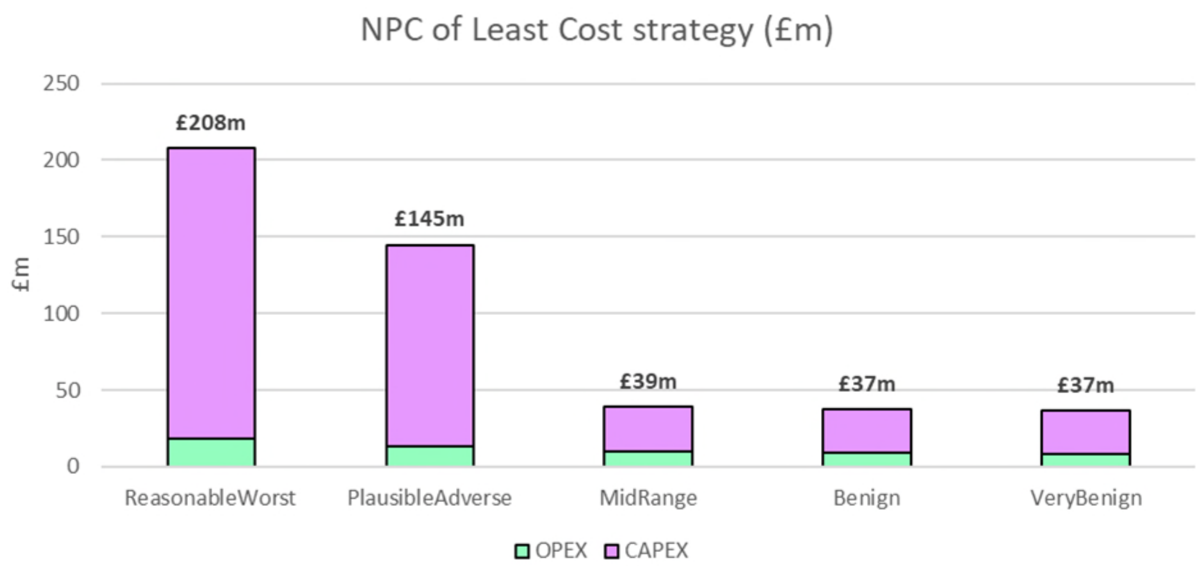

Figure 2-3 – Summary of total NPC (£m) for the least cost strategy.

2.1.1 Impact of drought return period

An additional least cost run was carried out with a 1 in 200-year drought event replacing the 1 in 500-year planning condition. Jersey Water are committed to providing the highest standard or reliability to their customers and a 1 in 500-year level of service is in line with the current Water Resources Planning Guidelines. However, they also want to ensure the strategy is affordable and there is an appropriate trade-off between cost and drought risk, and so this test aims to understand the potential cost implications of committing to the higher level of service. Figure 2-4 shows the total NPC across each of the futures for meeting the 1 in 500-year conditions (left hand columns) compared to meeting the 1 in 200-year conditions (right hand side columns). This shows that for the Mid-Range to Very Benign futures there is very little difference between the cost of the plan for 1 in 500-year compared to 1 in 200-year as the deficit can be largely met by Jersey Water's leakage reduction strategy and the La Rosiere desalination extension. However, committing to the 1 in 500-year condition does increase potential costs for the Adverse futures by up to 33%. This is largely related to needing to do schemes earlier to avoid deficit risks under the 1 in 500-year condition.

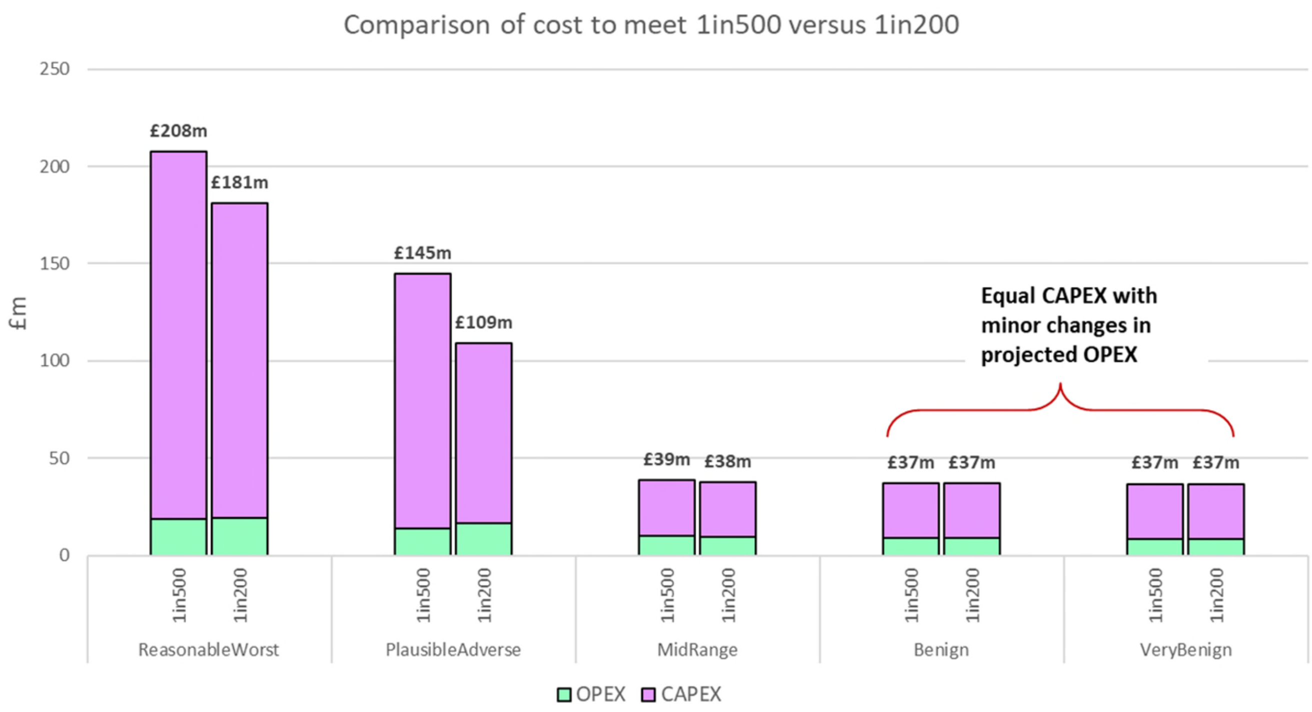

Figure 2-4 – Comparison of total NPC (£m) for the least cost strategy to meet a 1 in 500 or 1 in 200 year level of service.

2.1.2 Risk of delaying second large scheme

Jersey Water's leakage reduction strategy and the La Rosiere desalination plant extension are required immediately across all futures. However, in the Adverse futures the optimal solution implements additional schemes in the short-term (e.g. first 5-10 years) in order to minimise the risk of deficits in a drought. If Jersey Water implement just the leakage reduction strategy and the desalination plant extension the potential for a deficit in a 1 in 100-year type event occurs in 2044 in the Plausible Adverse future and immediately in 2031 in the Reasonable Worst future (the construction period for the desalination plant means that DO benefit cannot be realised before 2031). Figure 2-5 illustrates that in the Plausible Adverse future in order to avoid the risk of a deficit in a 1 in 100 type drought event a decision must be made in the first half of the 2030's on a second large scheme (e.g. Bellozanne wate reuse). Figure 2-5 also shows that in both Adverse futures there is a deficit risk in a 1 in 500-year type event that requires an additional large resource scheme to be implemented early in the 2030's. The potential for a deficit in a 1 in 100-year type drought in the Reasonable Worst scenario and in both Adverse futures for a 1 in 500-year type drought occurs before there is time to understand what future we may be in, and arguably suggests that additional schemes should be progressed in the short-term.

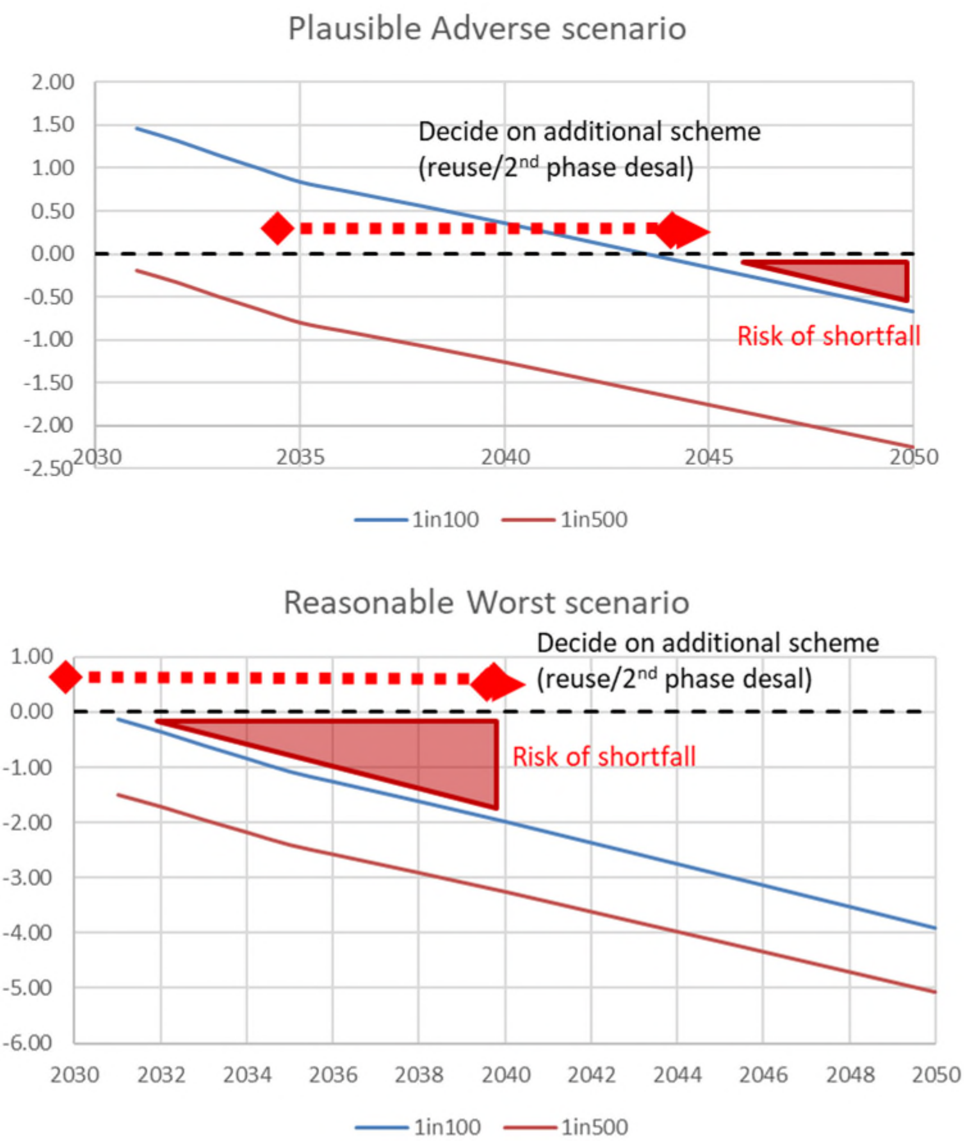

Figure 2-5 – Projected SDB under the 1 in 500 and 1 in 100 planning conditions in the Plausible Adverse future (top) and Reasonable Worst future (bottom) if only the base leakage reduction strategy and La Rosiere desalination extension are implemented. This shows that to avoid a risk of a deficit in a 1 in 100 type drought event works must be started on a second large resource scheme by 2034 or earlier. In both futures, to avoid a risk of deficit in a 1 in 500-year type drought event a second large resource scheme must also be implemented immediately.

2.2 Best-value plans

A best-value plan should represent options that will not only address the forecast SDB deficits, but also increase overall benefit to customers, the wider environment and society. While this should include consideration of cost it is not the only objective. We have carried out several investment model optimisations to explore what best-value looks like for the plan. To do this we have set the optimisation objective function to maximise benefits rather than minimise costs but applied a cost constraint on the total expected NPC cost (across all futures) to constrain the strategy to be within 10% or 20% of the total expected least cost NPC. As the resilience and SEA metrics are in different scales as well as potentially operating in opposing ways, we have carried out separate optimisations to explore the differing impacts of maximising resilience and maximising the environmental and social aims.

2.2.1 Maximised resilience

Figure 2-6 summarises the optimised strategy when seeking to maximise resilience within a percentage of the total expected least cost and Figure 2-7 shows the branched option selection. To explore the trade-offs we ran two versions of this analysis with a 10% cost constraint and with a 20% constraint (i.e. total expected cost no more than 20% of the total least cost). The results presented here are for the plan that maximises resilience to at no more than 20% of the least cost plan. This plan was similar to the 10% run but allowed for more understanding of where resilience could be added. The key points from this run are:

- Pont Marquet and Fernlands selected in all futures – as these are relatively cheap ways of gaining extra resource
- Bellozanne reuse selected in Mid Range as well as adverse futures
- Unresolved risk of deficit in 1 in 500-year event at end of planning period in the Reasonable Worst future (because there are no available options within the cost constraint)

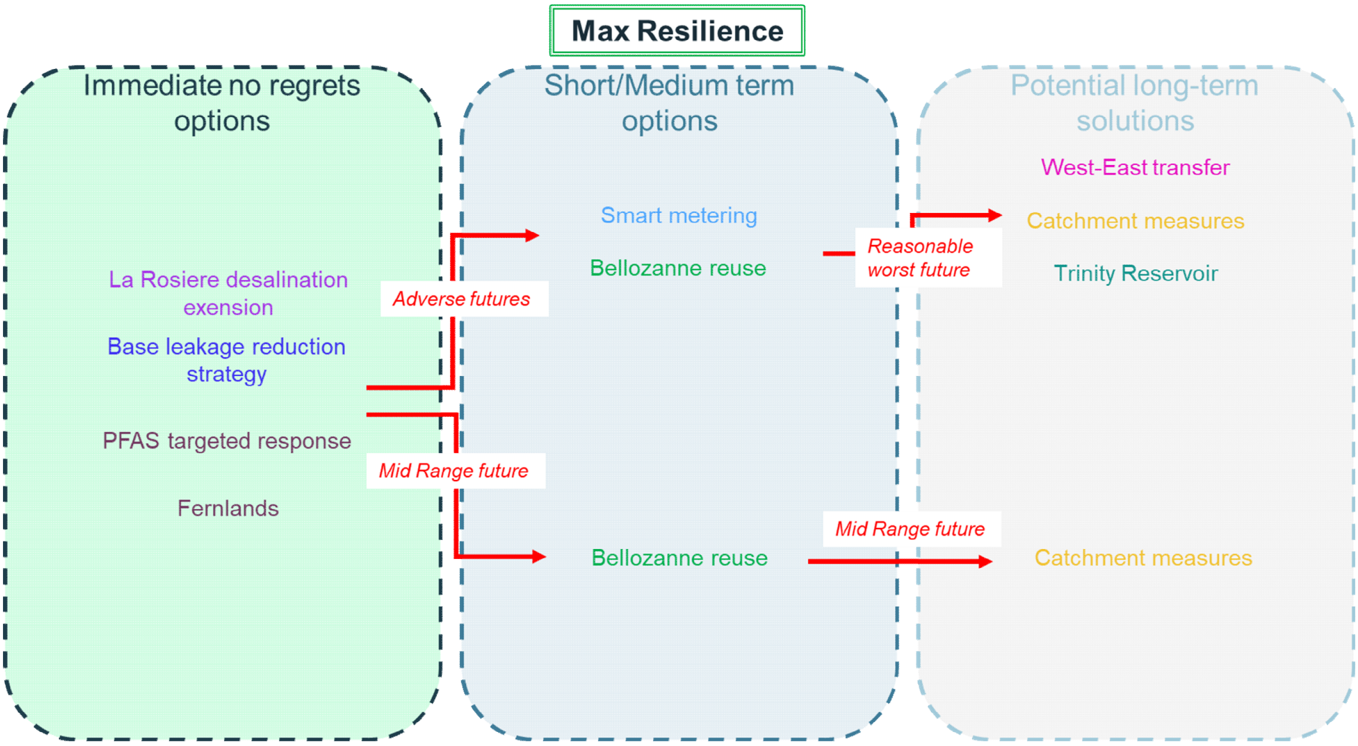

Figure 2-6 – Maximised resilience strategy across scenario futures

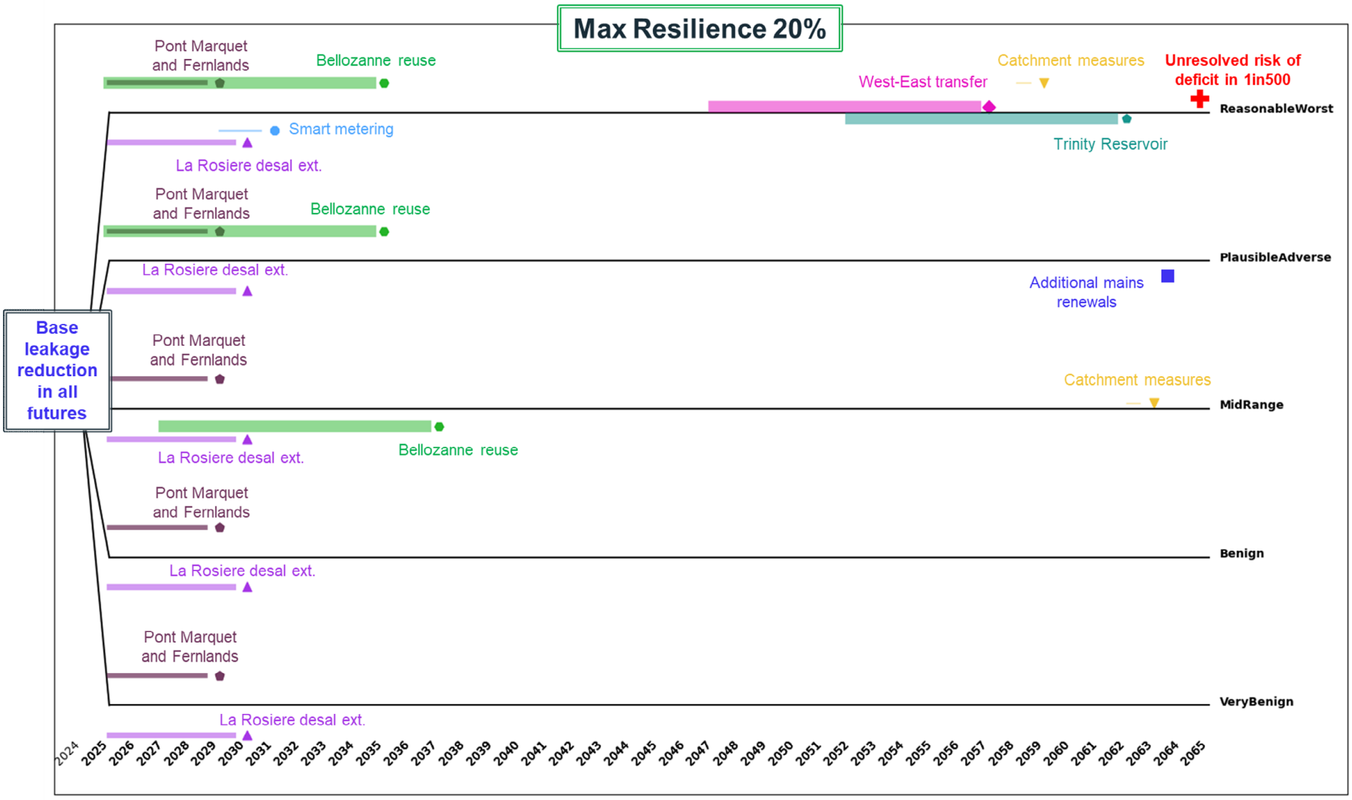

Figure 2-7 – Optimised maximised resilience strategy across the five future scenarios with total expected cost constrained to be no more than 20% more than the least cost strategy.

Figure 2-8 compares the capacity plots in the 1 in 500 year planning condition between the least cost plan and the maximised resilience plan. This shows the Mid-Range to Very Benign futures have a greater surplus DO under the maximised resilience plan. Under the maximised resilience plan the Adverse futures have a smaller surplus, due to the cost constraint placed on option selection and the use of higher scoring resilient schemes earlier in the planning period.

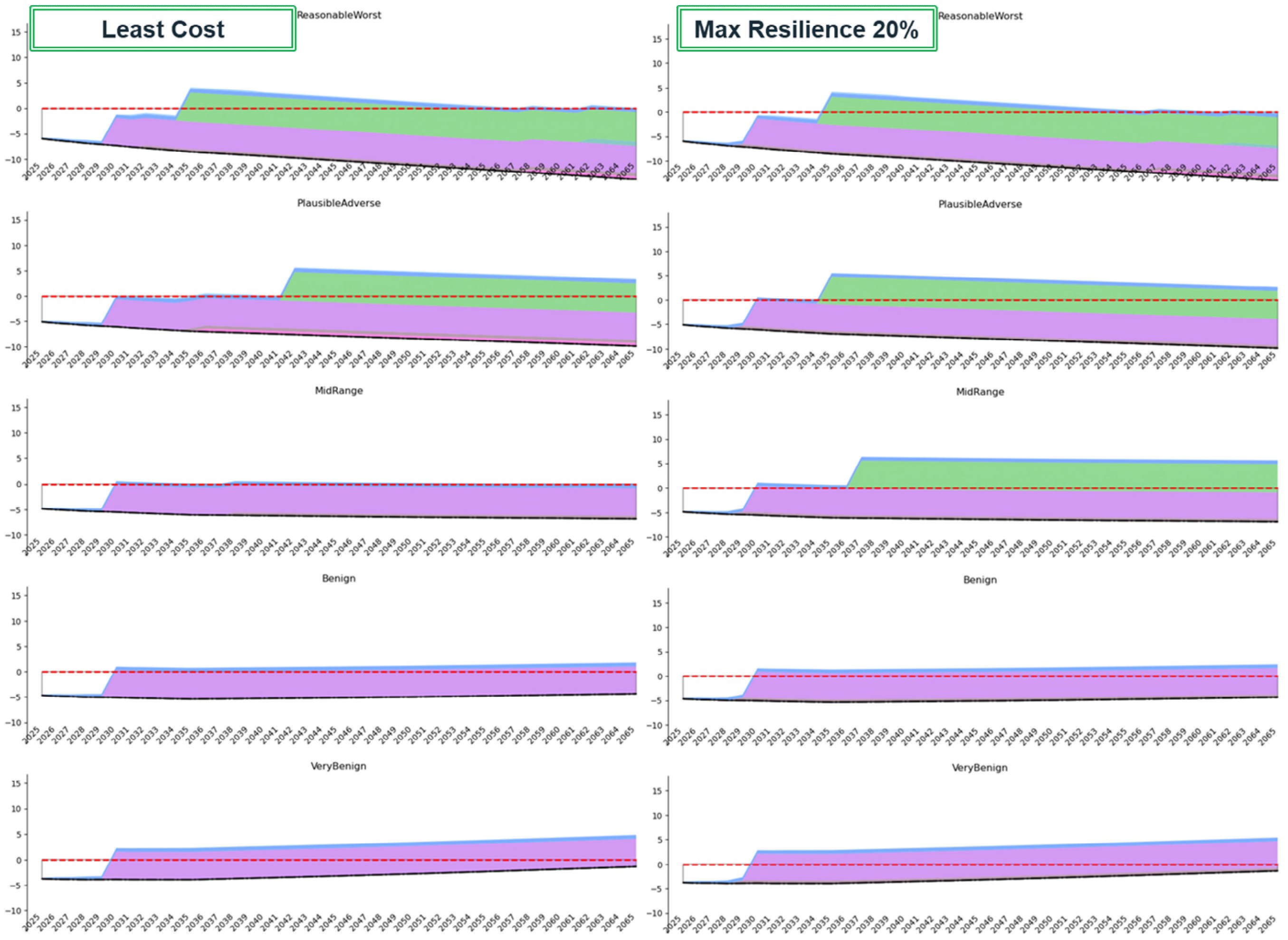

Figure 2-8 – Illustration of 1 in 500 capacities under the least cost strategy (left) and maximised resilience strategy (right). This shows a higher potential surplus in the Mid-Range to Very Benign futures under the maximised resilience strategy.

2.2.2 Maximised SEA

Figure 2-9 summarises the optimised strategy when seeking to maximise the SEA score within a percentage of the total expected least cost and Figure 2-10 shows the future branches option selection. As with the resilience runs we carried out both a 10% and 20% test with the results in this report showing the plan constrained to no more than 20% of the total least cost. This plan was similar to the 10% run but allowed for more understanding of where resilience could be added. The key points from this run are:

- Catchment measures and smart metering carried out in all futures
- Otherwise similar to the least cost plan

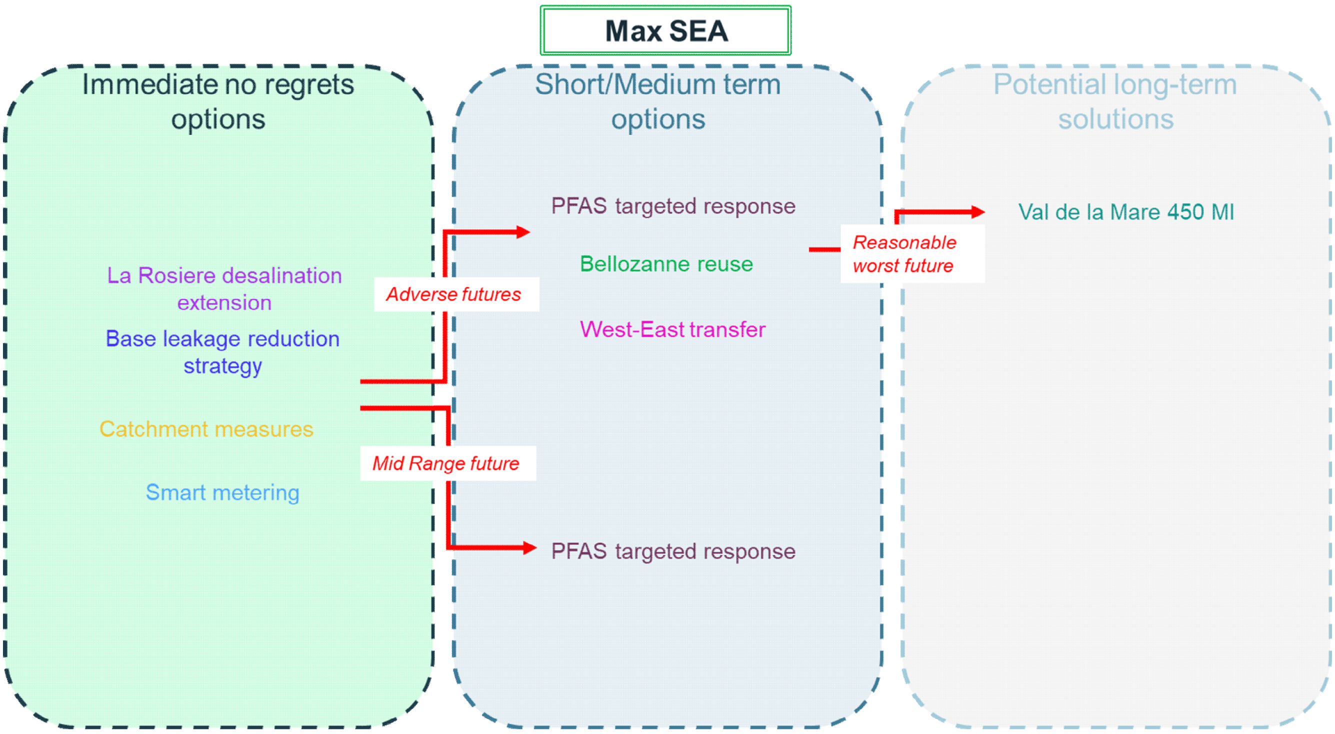

Figure 2-9 – Maximised SEA strategy across scenario futures

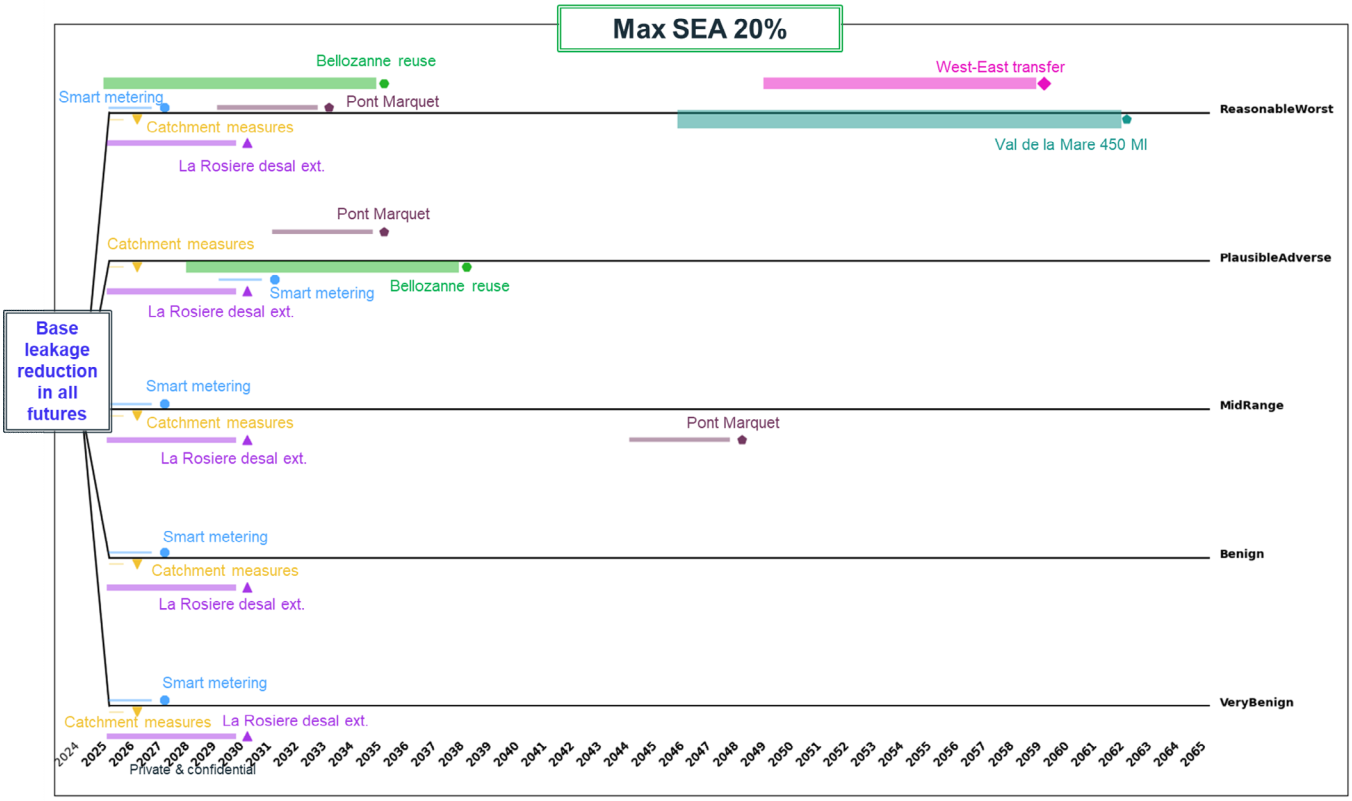

Figure 2-10 – Optimised maximised SEA strategy across the five future scenarios with total expected cost constrained to be no more than 20% more than the least cost strategy.

2.2.3 Summary of best-value outputs

Table 2-1 compares the option selection between the least cost and maximised benefit investment model runs. This suggests that Pont Marquet and Fernlands may be beneficial schemes to improve the overall resilience. Similarly, while comparatively small in terms of DO benefit the smart metering and catchment measures options may be beneficial to consider from an environmental and social aspect. Figure 2-11 compares the estimated NPC cost for each plan and across each future (the optimised runs constrained the total expected cost across all futures rather than the individual cost within each future). This shows a significant increase in the cost of the plan in the Mid Range future under maximised resilience, due to the implementation of Bellozanne water reuse. In the maximised SEA plan there is an increase of approximately £22m in the Mid Range and Benign futures due to the implementation of smart metering and catchment measures.

Table 2-1 - Comparison of option selection under the least cost, maximised resilience and maximised SEA plans

	Least Cost strategy	**Max Resilience (within 20% of least cost)**	**Max SEA (within 20% of least cost)**
No Regrets options	Leakage reduction activities	Leakage reduction activities	Leakage reduction activities
	La Rosiere desalination extension	La Rosiere desalination extension	La Rosiere desalination extension
		Fernlands	**Smart metering**
		Pont Marquet	**Catchment measures**
Short / Medium term options – start preparatory works	Smart metering	Smart metering	Pont Marquet
	Pont Marquet	Bellozanne reuse	West-East Transfer
	Fernlands		Bellozanne reuse
	West-East Transfer		
	Bellozanne reuse		
Potential long-term options	Additional mains renewals	West-East Transfer	Val de la Mare 450 Ml
	Catchment measures	Catchment measures	
		Trinity Reservoir	

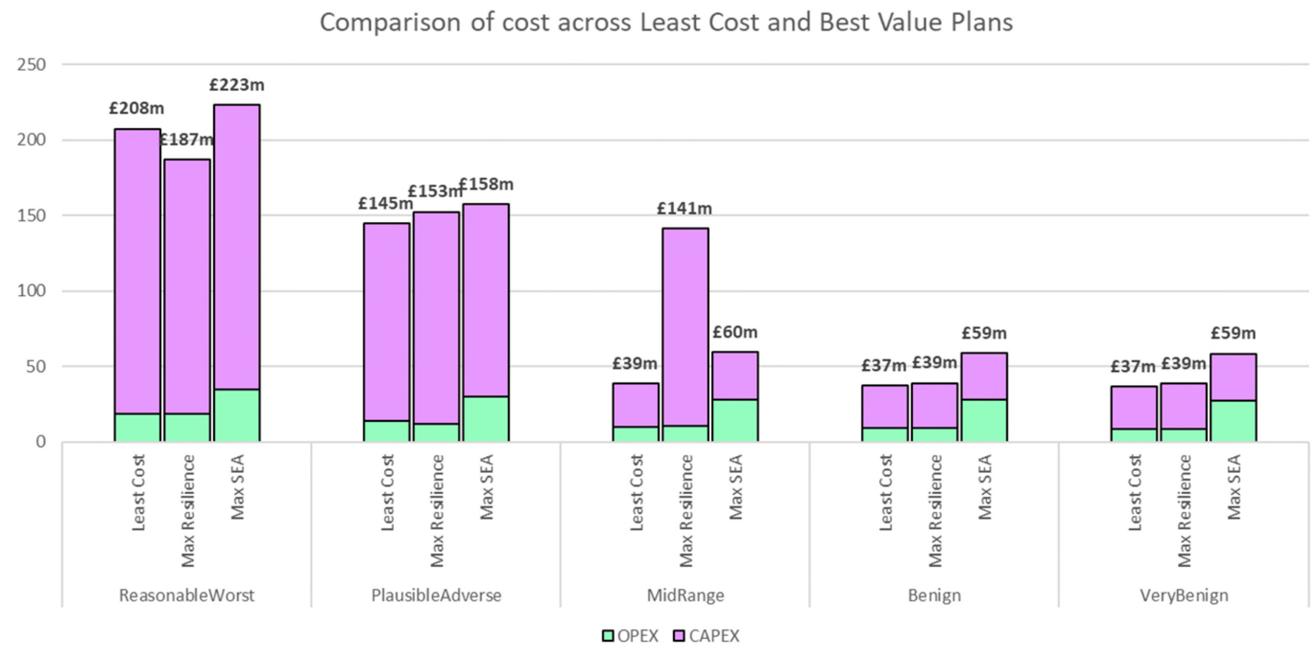

Figure 2-11 – Comparison of total NPC (£m) for the least cost strategy and the maximised Resilience and SEA runs. The Best-Value runs were constrained such that the total expected cost across all futures was not more than 20% greater than the total expected least cost strategy.

3. Sensitivity testing

To ensure a robust preferred plan we identified and tested the plan against specific policies, assumptions, stresses and uncertainties that may be relevant to the selection of the preferred plan (Step 3 in Figure 1-1). Table 3-1 summarises the sensitivities carried out as well as the findings from these. Detailed outputs of these sensitivity runs are provided in the following sub-section (3.1).

Table 3-1 – Headline findings from sensitivity tests

Sensitivity Description	Headline impact on least cost strategy
Alternative PFAS regulation scenarios. PFAS treatment enhancement (S-B2) brought in by 2030 in all futures.	In Mid-Range and Adverse futures Fernlands implemented earlier as well as PFAS treatment. No change to Benign futures except a slightly increased surplus.
La Rosiere desalination plant extension not available	An alternative large resource is needed in all futures immediately (Bellozanne water reuse). Additional resource is also required from additional mains renewals and the reservoir options, although unable to resolve the risk of deficit in the 1 in 500-year in the Reasonable Worst future without the desalination extension.
Bellozanne reuse not available	The Adverse futures require additional resource from reservoirs but there remains an unresolved risk of deficit in the 1 in 500-year in the Reasonable Worst future.
Bellozanne reuse is 10% more expensive	No change.

Sensitivity Description	Headline impact on least cost strategy
Bellozanne reuse is 10% cheaper	In Plausible Adverse future Bellozanne reuse is implemented immediately without the need to defer with other schemes (e.g. Pont Marquet, Fernlands, West-East transfer).
Both La Rosiere desalination plant extension and Bellozanne reuse options are not available	Trinity Reservoir and Val de la Mare 1200 Ml reservoirs implemented in all futures except the Very Benign. However, these are unable to fully resolve the risk of deficit in the Mid-Range to Adverse futures in a 1 in 500-year type event and in the Adverse futures in a 1 in 100-year type event.
Force in Trinity (Trinity Reservoir) reservoir by 2040	Defers need for Bellozanne water reuse in Plausible Adverse future but water reuse still required in Adverse futures.
Explore plan sensitivity to cost of Trinity (Trinity Reservoir) reservoir (e.g. 10% to 60% cheaper)	Trinity Reservoir only selected when costs reduced by >50% (against variant where costs are already shared) and then only in Plausible Adverse future. Second large resource option (e.g. Bellozanne water reuse is still selected).
Loss of existing reservoirs Grands Vaux or Vallee de Vaux on the strategy if required for flood attenuation purposes	No change to Very Benign future. Pont Marquet required in addition to desalination and leakage reduction in Benign future. In Mid-Range future West-East transfer, smart metering, additional mains renewals and Trinity Reservoir are implemented. In adverse futures water reuse implemented earlier and larger reservoir schemes required in Reasonable Worst future.
Impact of meeting a Target 110 PCC level by 2035	Due to time constraints, this was tested on Mid-Range future only. Only core no regrets options required (e.g. leakage reduction strategy and desalination extension).
Include draft values for La Gigoulande Quarry	Selected in place of Val de la Mare in Reasonable Worst future and selected to delay need for Bellozanne reuse in Plausible Adverse future.

3.1 Detailed outputs

3.1.1 PFAS regulation scenarios

As outlined in Section 1.2.3 and illustrated in Figure 1-2 we have considered 3 PFAS scenarios. In the baseline scenario there is no change to the current regulation requiring additional treatment however the investment model has the option to select a scheme to develop a new groundwater abstraction source at Pont Marquet with approximately 0.55 Ml/d benefit in a 1 in 500-year type event. Under scenario 1 higher PFAS regulations require PFAS treatment to target contaminated sources, and in scenario 2 the most stringent envisaged PFAS regulations require additional treatment at both our works. The most comprehensive treatment at both treatment works (under the alternative scenario 2) could deliver compliance to the highest standards and the greatest resilience; however, it has the potential to be up to £14m more in CAPEX than alternative options that may target treatment at contaminated sources.

In the baseline PFAS scenario (i.e. no change to current PFAS regulation) the option to develop an additional borehole at Pont Marquet is selected in the Mid-Range and Adverse futures. In the event of higher PFAS standards (e.g. scenario 1 or 2) this option will not be sufficient and further PFAS treatment will be required. We have modelled the estimated DO benefit from PFAS treatment at effected sources suggesting the potential DO benefit to be similar to the Pont Marquet borehole in a 1 in 500-year type drought event (although higher during non-drought periods). Figure 3-1 illustrates the optimised least cost strategy under the alternative PFAS scenarios where PFAS treatment enhancement at PFAS effected sources is brought in by 2030 in all futures. Under this scenario the

Benign futures benefit from the increase in DO to provide greater resilience. In the Mid-Range to Adverse futures PFAS treatment enhancement is utilised in place of the additional borehole at Pont Marquet resulting in little difference from the baseline strategy.

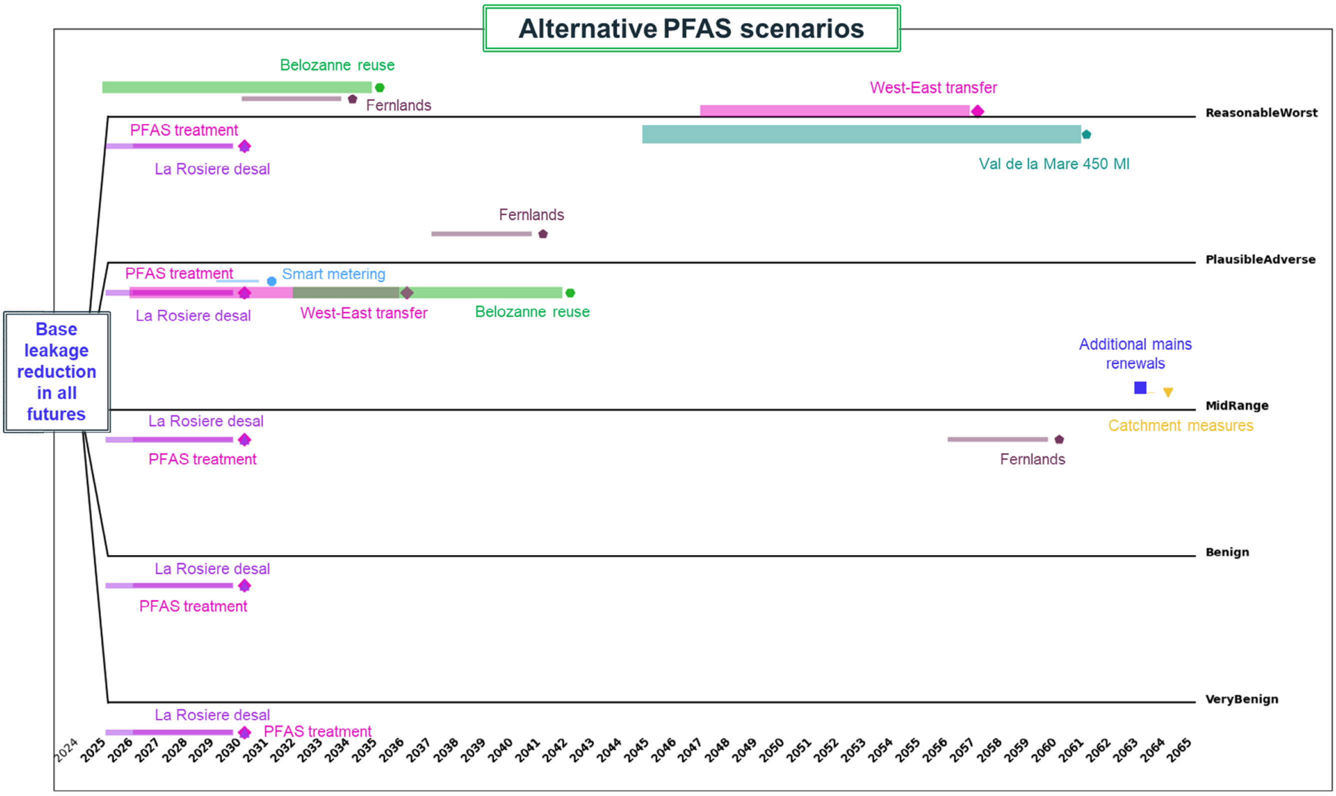

Figure 3-1 – Optimised least cost strategy under alternative PFAS scenarios with higher PFAS standards requiring further treatment

The main impact therefore can be seen in the comparison of estimated plan costs (Figure 3-2). Initial cost estimates to meet the highest level of PFAS regulation (i.e. PFAS treatment at both works) suggest CAPEX up to £28m which is approximately twice the previously estimated costs for PFAS treatment enhancement at source (S-B2 – Supply measures basket 2 for treatment enhancement to target PFAS contaminated sources)[2]. Figure 3-2 shows that in terms of the estimated total net present costs (NPC) there is a relatively consistent impact across all futures with PFAS scenario 1 increasing the plan by up to £12m NPC and PFAS scenario 2 increasing the plan by up to £25m NPC in the Mid-Range future.

[2] At the time of writing, estimated operating costs for this have not been derived and so we have assumed equal OPEX to S-B2.

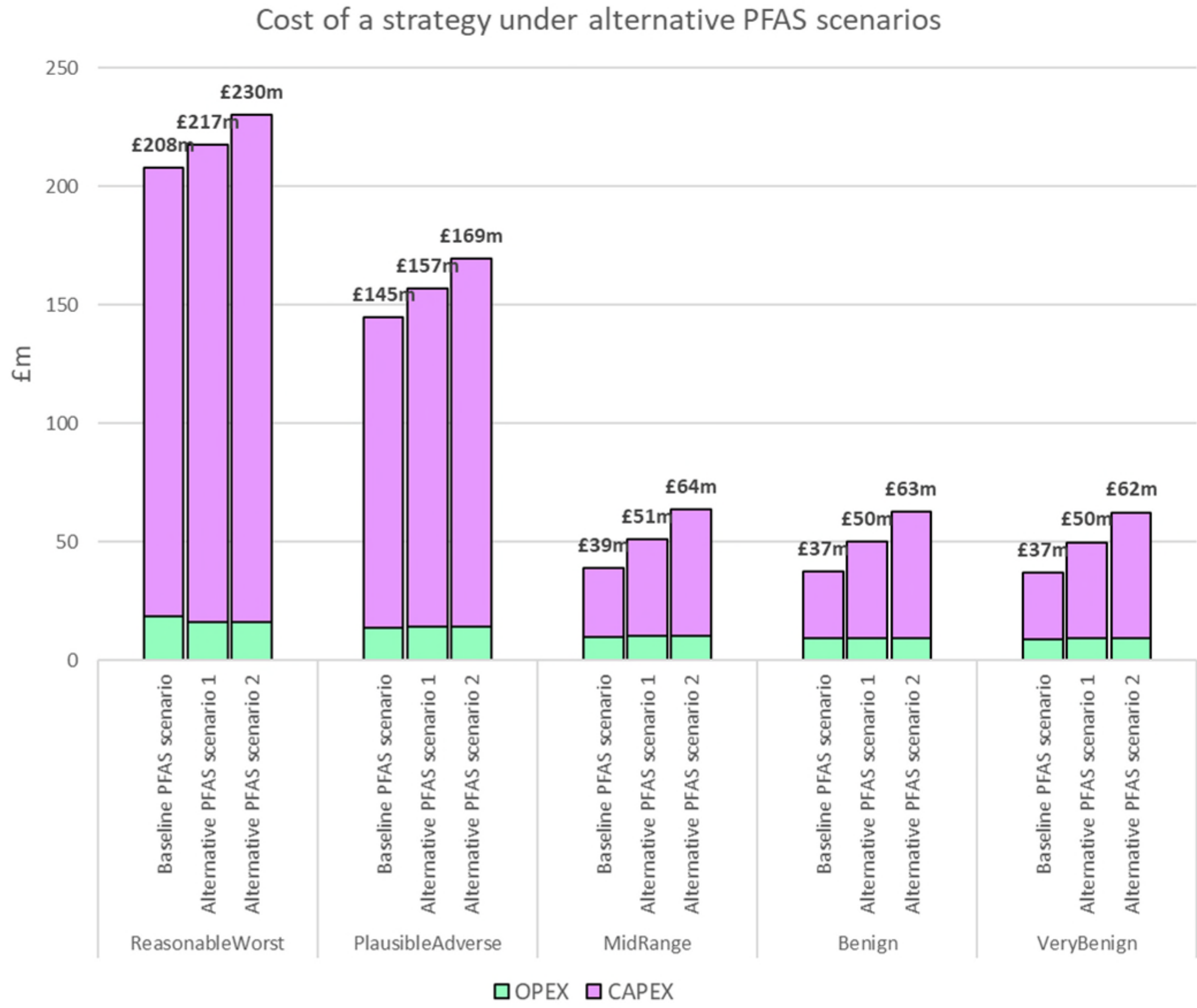

Figure 3-2 – Comparison of total NPC (£m) for the least cost strategy under the Baseline and alternative PFAS scenarios

3.1.2 La Rosiere desalination extension not available

The La Rosiere desalination plant extension option is a core part of our preferred plan. Under this test where the extension of the plan cannot be delivered, an alternative large resource scheme is needed in all futures immediately (e.g. Bellozanne water reuse). In the Adverse futures both Trinity Reservoir and Val de la Mare reservoirs are selected however there remains an unresolved risk of deficit in the Reasonable Worst future from 2048 in a 1 in 500-year type event and from 2060 in a 1 in 100-year type event. This risk highlights the importance of Jersey Water's strategy on this desalination extension option.

Figure 3-3 compares the estimated NPC of the base least cost strategy and with the desalination extension option excluded. This shows a significant projected increase in the cost of the plan across all futures.

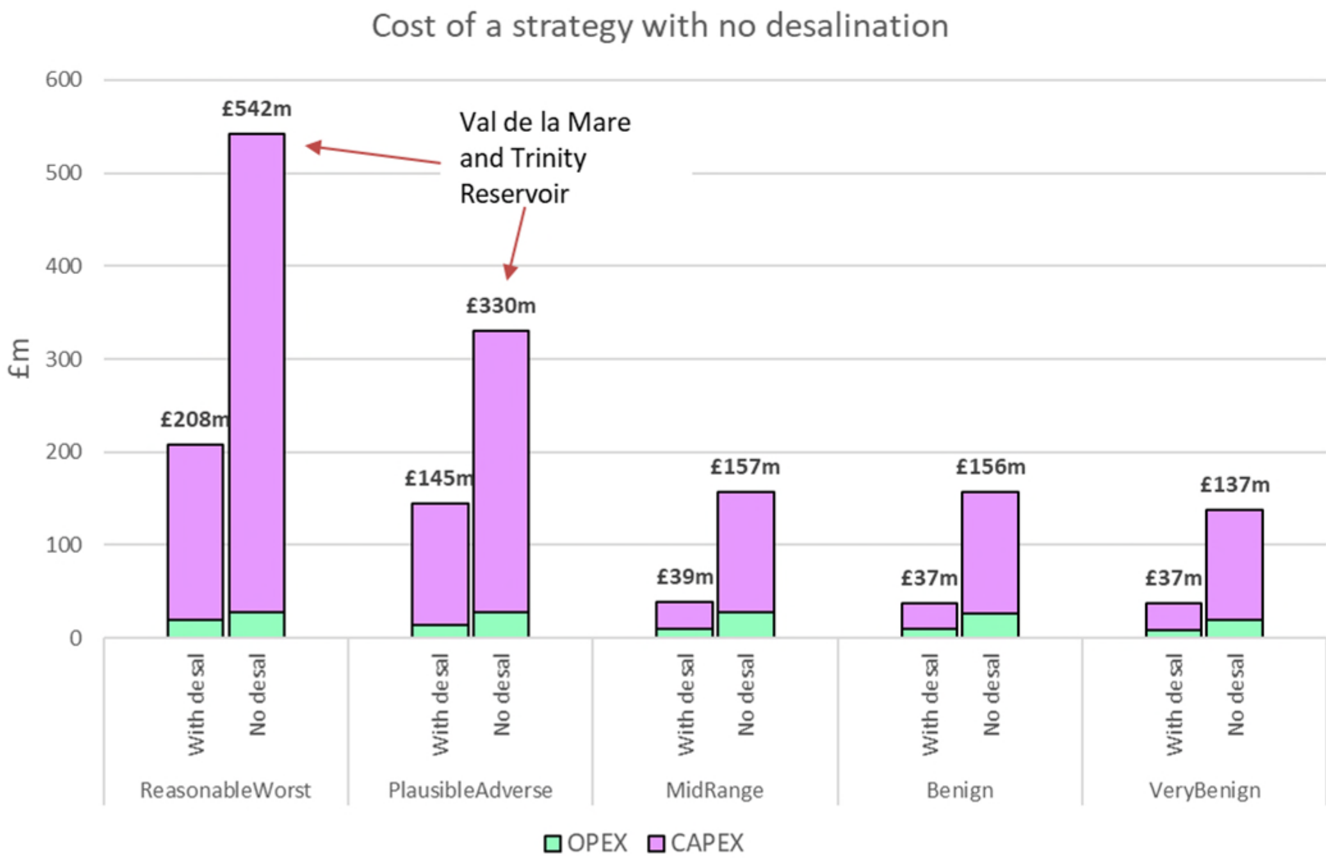

Figure 3-3 – Comparison of total NPC (£m) for the least cost strategy with La Rosiere desalination extension available and without the desalination extension option.

3.1.3 Bellozanne water reuse not available

Even with the La Rosiere desalination extension scheme there remains a high chance that Jersey Water will need a second additional large resource in the Adverse futures from the Bellozanne water reuse option. If this is not available, then both Trinity and Val de la Mare reservoirs are needed in the Adverse futures in place of the reuse option. However there remains an unresolved risk of deficit in the Reasonable Worst future from 2048 in a 1 in 500-year type event and from 2060 in a 1 in 100-year type event.

Figure 3-4 compares the estimated NPC of the base least cost strategy and with water reuse excluded. This shows a significant increase in estimated NPC in the Adverse futures. At present we do not know what future we will end up in and therefore this shows the importance of undertaking feasibility investigations and planning for the Bellozanne water reuse option (or a similar large resource scheme) to the resilience of future supplies.

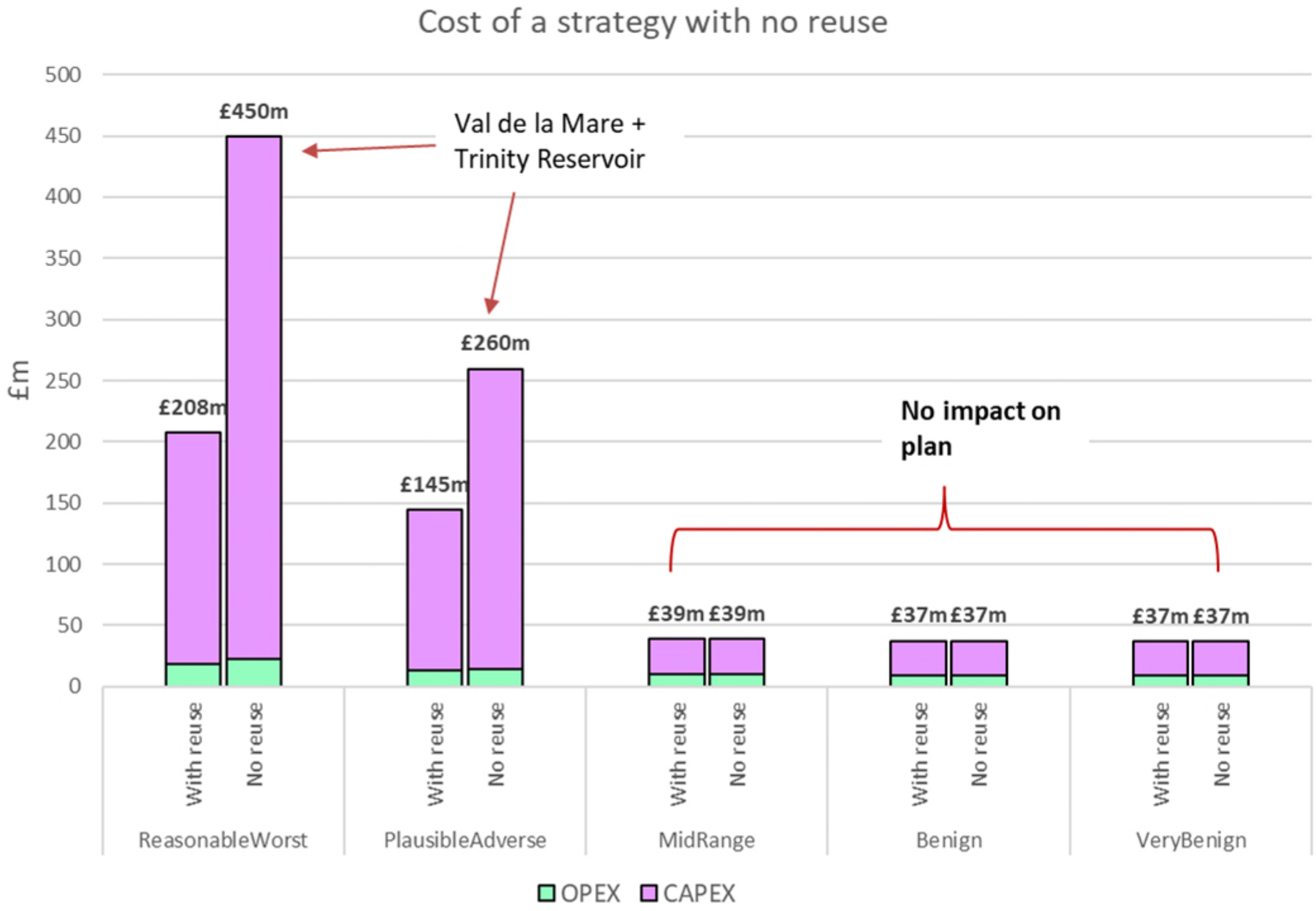

Figure 3-4 – Comparison of total NPC (£m) for the least cost strategy with Bellozanne water reuse available and without the reuse option.

3.1.4 Trinity Reservoir taken forward in all futures

Figure 3-5 shows the estimated NPC in all futures if the Trinity Reservoir scheme is implemented by 2040 providing a benefit of up to 0.61Ml/d in a 1 in 500 year drought scenario. This shows a significant increase in costs of approximately £75m (net present cost) in the Mid-Range to Benign futures and an increase of approximately £50m-£65m NPC in the Adverse futures. The increase in the Adverse futures is slightly less as the additional resource from the Trinity Reservoir allows other schemes to be delayed, although it does not negate the need for additional schemes entirely. This can be seen in Figure 3-6 which shows that in the Plausible Adverse future Bellozanne water reuse is implemented later because of the benefit from Trinity Reservoir and, in the Reasonable Worst future additional resource from the Val de la Mare 450 Ml reservoir is only required right at the end of the planning horizon.

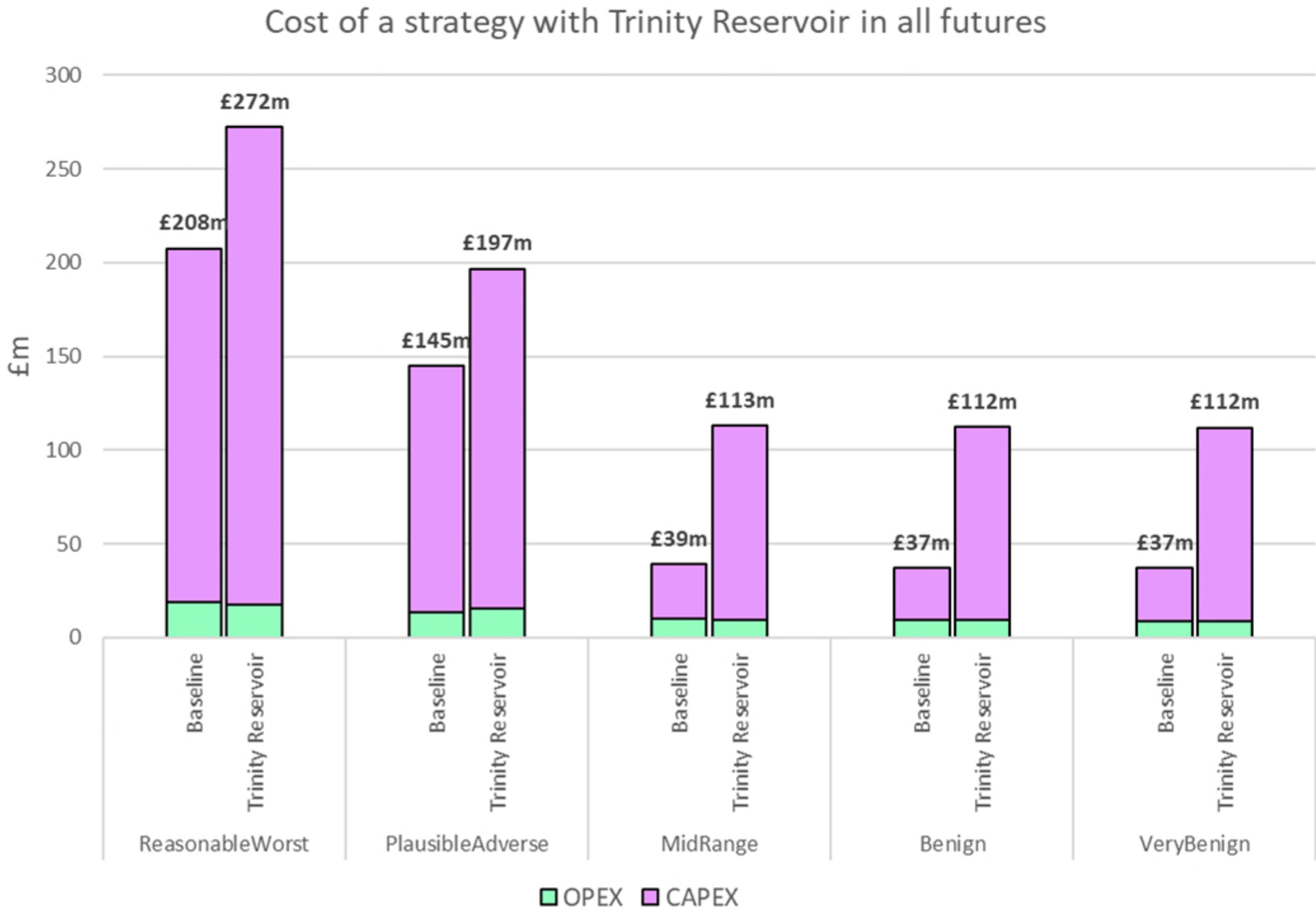

Figure 3-5 – Comparison of total NPC (£m) for the least cost base strategy and with Trinity Reservoir implemented in all futures.

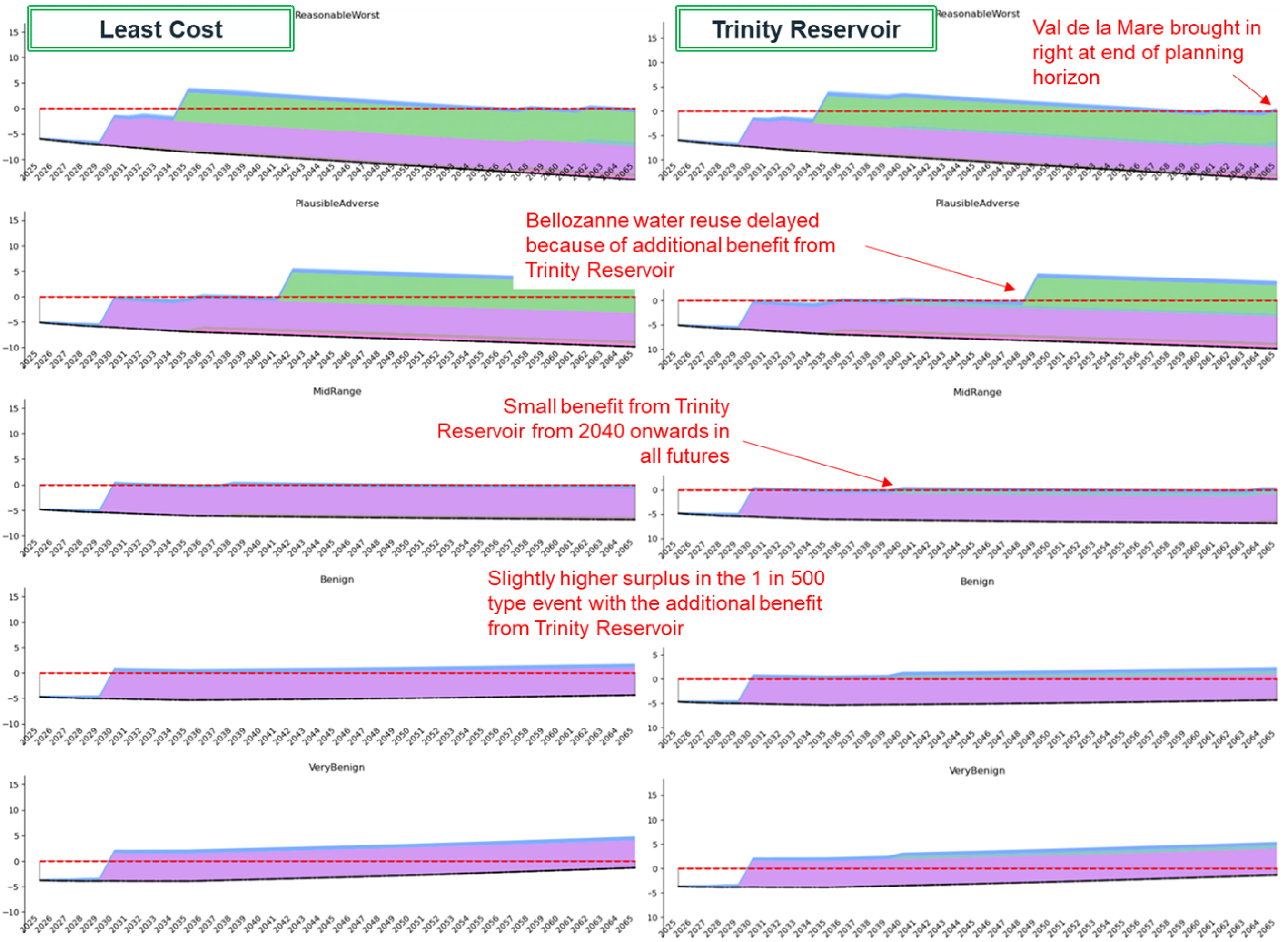

Figure 3-6 – Illustration of 1 in 500 capacities under the least cost strategy (left) and with Trinity Reservoir implemented in all futures (right). This shows a higher potential surplus in the Mid-Range to Very Benign futures as well as the potential to delay the need for other additional resources in the Adverse futures.

3.1.5 Flood attenuation scheme goes ahead

If the proposed flood attenuation scheme goes ahead, Jersey Water could lose output from Grands Vaux and Vallee de Vaux without a substantial re-engineering of the raw water system. We have carried out water resources modelling to estimate the impact this could have on reliable supplies which we estimate to be a reduction in DO of between 1.1 Ml/d (1 in 500-year type event) to 3.4 Ml/d (Normal year planning conditions). This sensitivity test seeks to understand how that may affect the preferred plan. As can be seen from Figure 3-7 the impact on estimated cost is minimal in the Benign futures as the Very Benign future has enough capacity (in purely DO terms) to absorb the loss while maintaining the level of service and the Benign future implements the Pont Marquet borehole scheme. In the Mid-Range future smart metering, the West-East transfer and the Pont Marquet borehole scheme are used to add additional resource in the short-medium term and Trinity Reservoir as well as additional mains renewals are selected in the late 2040's. In the Reasonable Worst future the planned schemes are needed earlier as well as additional resource from a larger Val de la Mare reservoir (750 Ml variant, compared to 450 Ml) alongside the Trinity Reservoir. Figure 3-8 shows the branch plot for this sensitivity test.

Figure 3-7 shows there is a large potential range of cost impacts depending on which future we end up in. In the Reasonable Worst future, the scheme could result in an additional cost of up to £88m NPC over the least cost strategy.

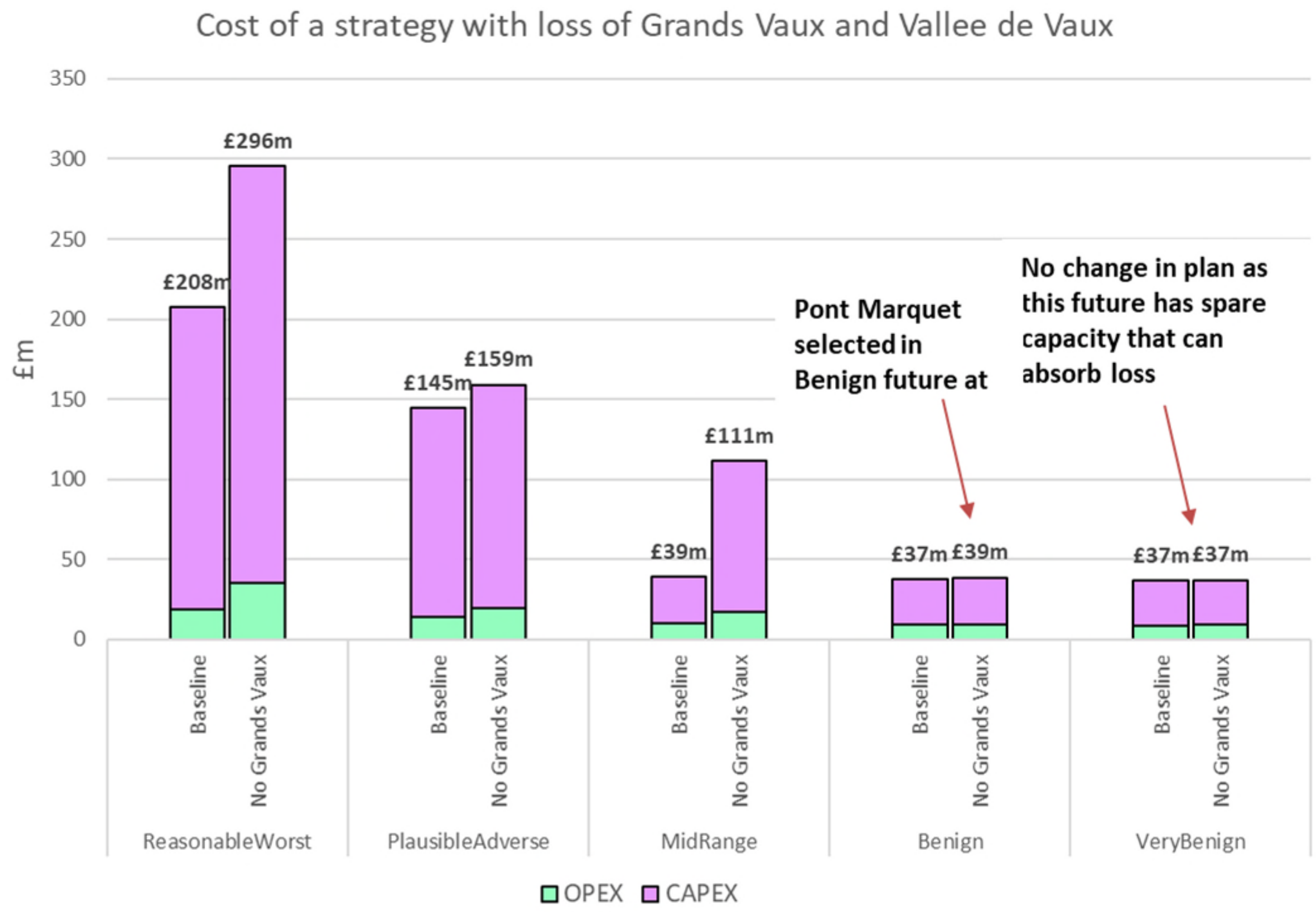

Figure 3-7 – Comparison of total NPC (£m) for the least cost base strategy and with SDB write down due to flood attenuation scheme.

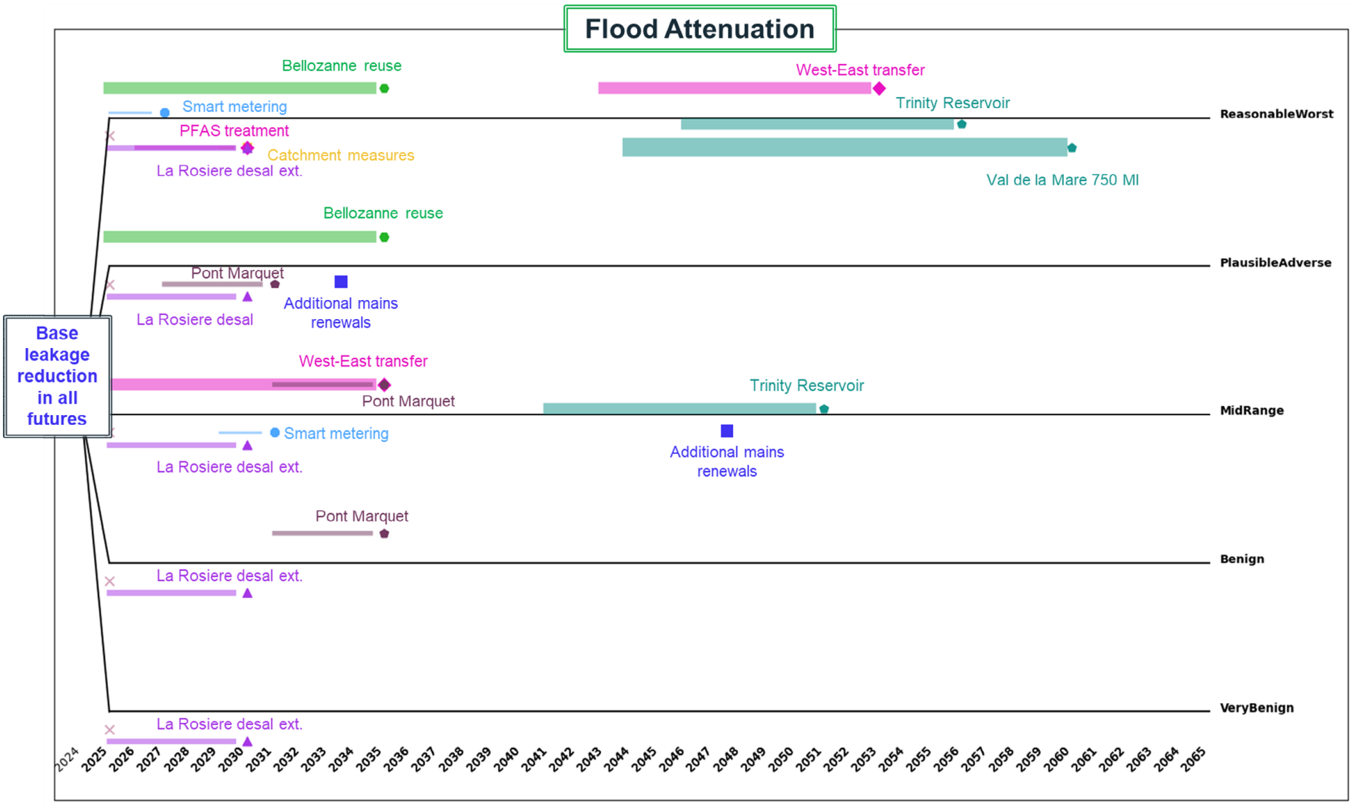

Figure 3-8 – Optimised least cost strategy if flood attenuation scheme goes ahead.

3.1.6 Target 110 PCC

Jersey Water are ambitious in maintaining and improving their already below average PCC levels. This sensitivity was therefore aimed at understanding the benefit that a further reduction in PCC could have on the need for new resources and consequently the total cost of the plan. Note that the costs of delivering PCC reductions below the already low levels have not been calculated, nor has the feasibility of delivering 110 l/h/d PCC been fully assessed. This would likely require efforts from Jersey Government and other stakeholders, in terms of encouraging uptake of highly water efficient devices and other changes through regulations and other incentives, in addition to activities by Jersey Water.

Due to time and modelling constraints, this sensitivity was carried out on just the Mid-Range future scenario and showed that with the additional demand reduction represented by this target the projected SDB could be improved by over 2 Ml/d (see Figure 3-9). The investment modelling outputs showed that this was sufficient to negate the need for any additional options after the implementation of the base leakage reduction and La Rosiere desalination extension. This suggested a NPC saving of up to £1.8m in the Mid-Range future. Although not modelled the potential scale of cost savings would be greater in the Plausible Adverse and Reasonable Worst futures.

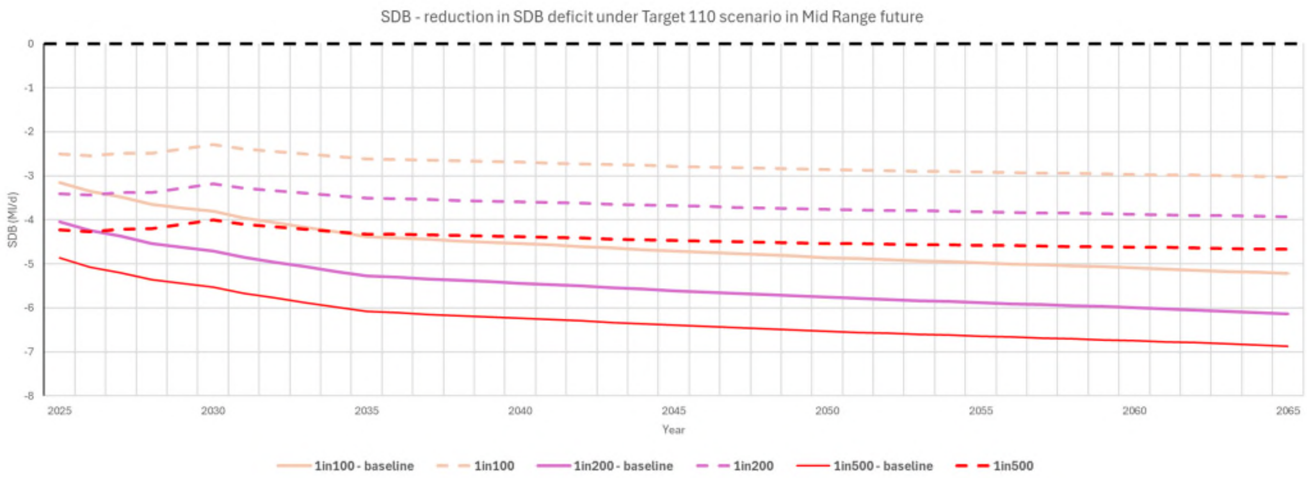

Figure 3-9 – Projected SDB for the Mid-Range future under the baseline and with Target100 PCC scenario

4. Preferred plan

As outlined in the previous sections we have carried out extensive investment modelling to develop a best-value and adaptive strategy that is robust and resilient to future uncertainties. As part of this we have accepted that there may be a risk of deficits in an extreme 1 in 500-year type drought event for the first 10 years of the plan, (up to 2035) and a severe 1 in 100-year type of drought event for the first 5 years (up to 2030).

Across all runs and in all futures the core no regrets options include the base leakage reduction strategy (illustrated in Figure 4-1 below) and the La Rosiere desalination plant extension. There is a significant increase in the estimated cost if the desalination plant extension is not available.

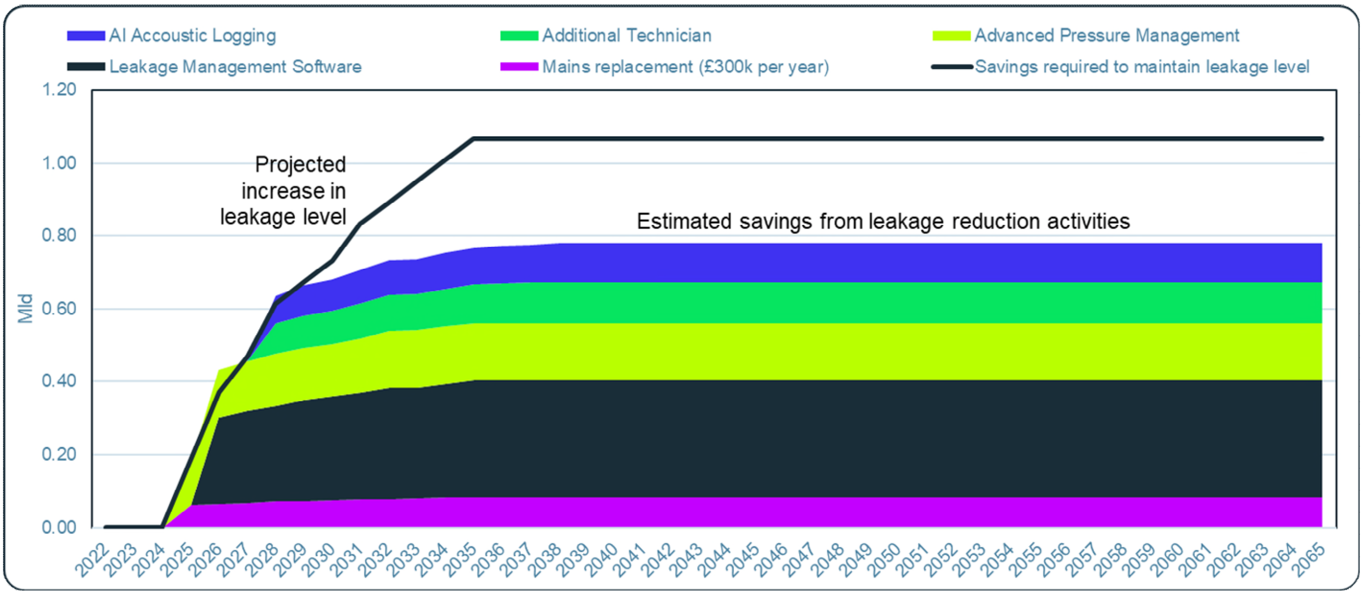

Figure 4-1 – Illustration of base leakage reduction strategy aimed at minimising the risk of leakage increase.

The best-value runs that maximise resilience and environmental objectives are largely consistent with the least cost outputs but suggest a couple of key considerations:

- The Pont Marquet borehole scheme and Fernlands are cost-efficient ways of adding resilience in all futures.
- Smart metering and catchment measures provide additional environmental and social benefits in all futures.

Based on these findings, we propose that the core short-term strategy includes:

- Base leakage reduction strategy (schedule of activities from start of plan)
- La Rosiere desalination plant extension to be operational from 2030
- Continuation and enhancement of ongoing catchment measures (driven by environmental and social objectives)
- Roll-out of smart metering (driven by environmental and social objectives). Jersey Water are currently undertaking a pilot study in this area and therefore will confirm the scale and speed of roll-out following the findings of that study.
- Implementation of the Fernlands stream abstraction scheme (driven by resilience objectives)
- A PFAS targeted solution by 2030. the exact solution will be dependent on resolving uncertainty around PFAS regulation. This will improve overall resilience as well as responding to the outstanding uncertainty over the level of PFAS regulation that Jersey Water will be held to.

Figure 4-5 illustrates the optimised strategy in all futures under these core actions, highlighting the additional schemes that could be needed under an Adverse future. This shows that in an Adverse future there is a need to make additional decisions in the near term to avoid a prolonged risk of deficits (see Section 2.1.2).

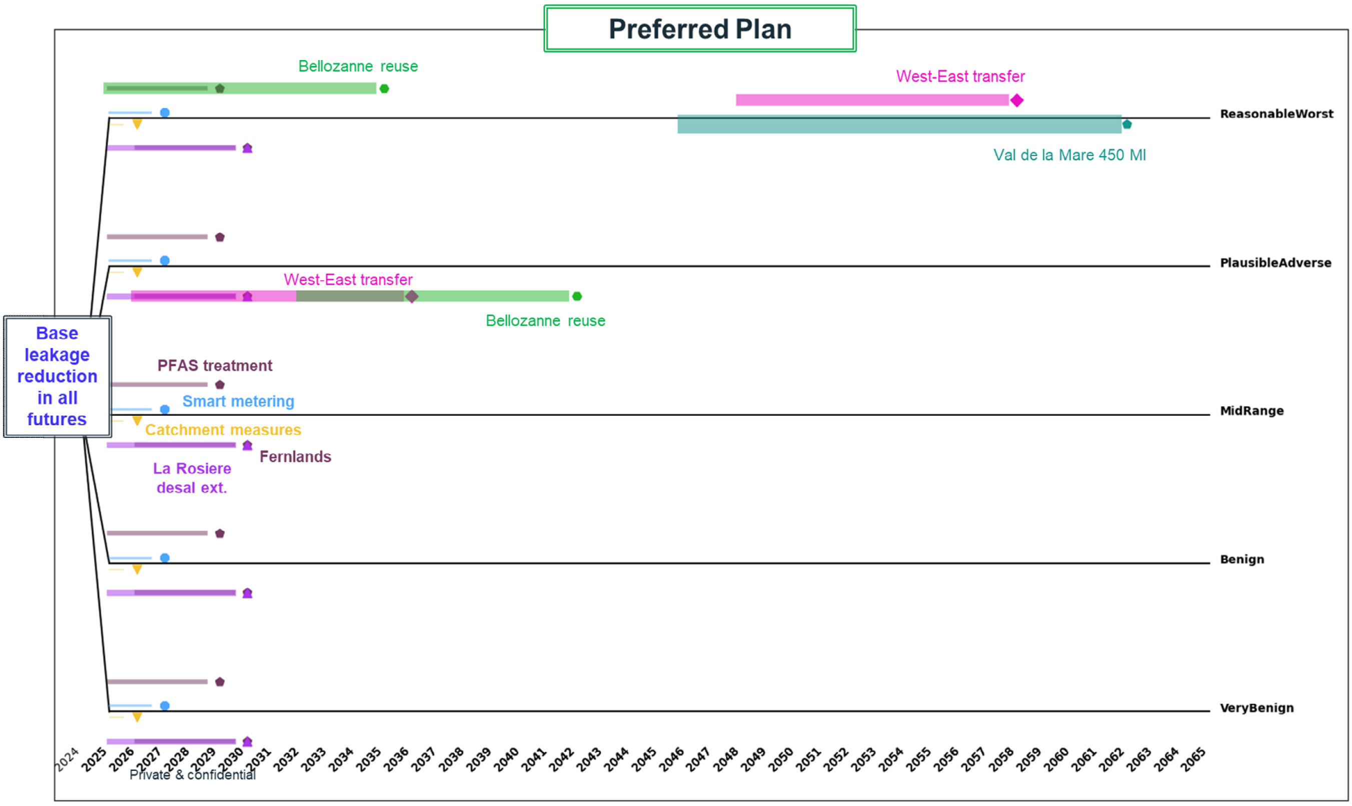

Figure 4-2 – Preferred plan including the implementation of all core options in the short term (labelled in bold in just the Mid-Range branch). Additional options required in Adverse futures are highlighted and labelled.

In an Adverse future an additional large resource scheme is likely to be needed, although the need for this could be delayed slightly through the implementation of the West-East transfer. This need suggests the prudence of undertaking feasibility studies and investigations in the short term to reduce the lead-in time for a further major development such as:

- Bellozanne water reuse
- Next phase of desalination extension (beyond 16.2 Ml/d capacity)

However, given the long planning and construction periods for such a large scheme Figure 4-3 illustrates the potential deficit risks in either the Reasonable Worst or Plausible Adverse futures by delaying the decision on such a scheme. In the Plausible Adverse future this shows a risk of deficit in a 1 in 500-year type drought from 2036 onwards and from 2053 in a 1 in 100 year type drought. In the Reasonable Worst future there is an ongoing risk of deficit in a 1 in 500-year drought event and from 2036 in a 1 in 100-year drought event.

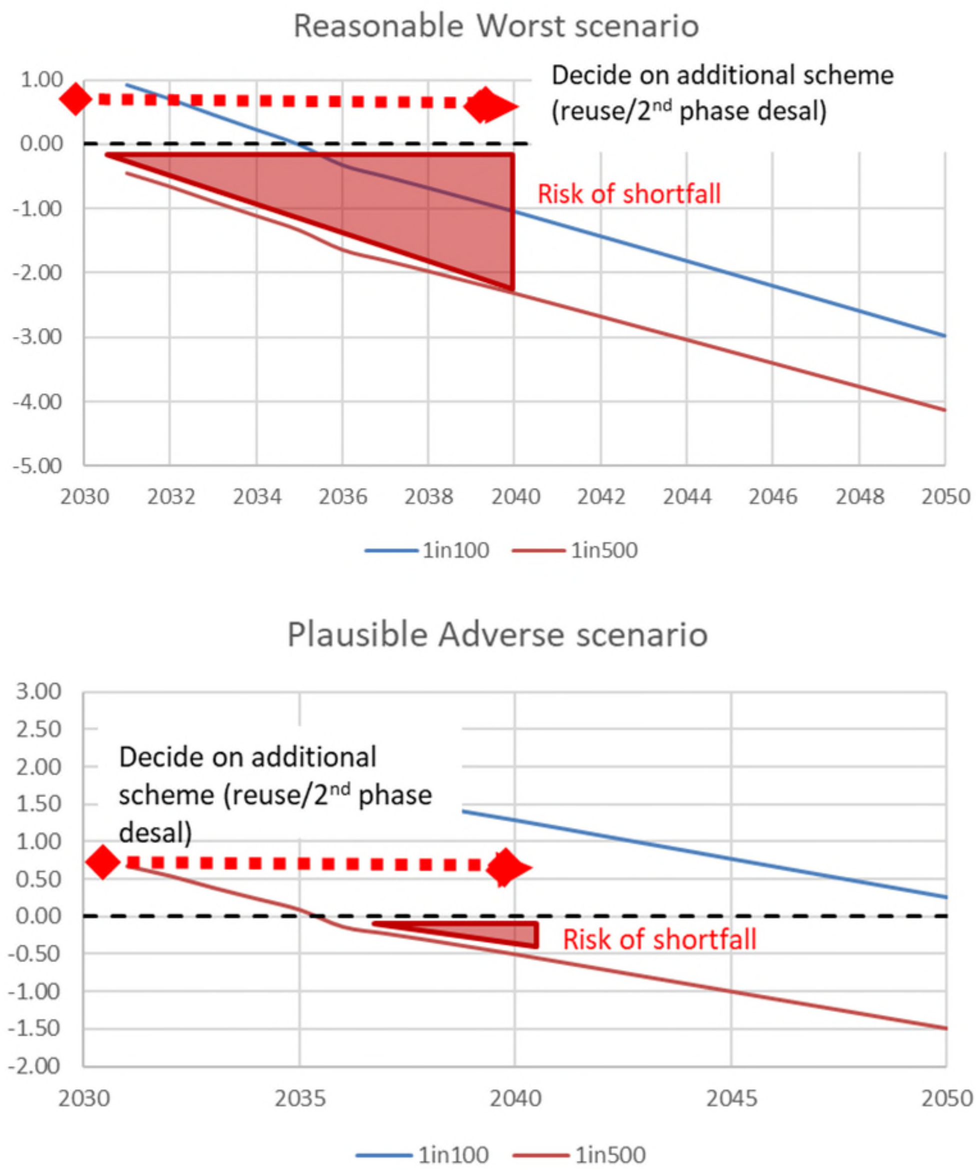

Figure 4-3 – Projected SDB under the 1 in 500 and 1 in 100 planning conditions in the Plausible Adverse future (top) and Reasonable Worst future (bottom) if the core recommended options are implemented in the short term. This shows that if we are in an Adverse future and the decision to build a second large scheme resource is delayed until 2030 this may mean accepting a risk of deficits in a 1 in 100 or 1 in 500 type event before the scheme can be implemented.

4.1 Monitoring the current situation

A key part of producing an adaptive strategy is monitoring where we believe we are in the present to understand which future pathway we are most likely to be on. The key elements of the scenario framework include population growth and climate change impacts. We therefore propose two key approaches.

Monitoring population growth

The population forecasts are developed and released by the Jersey Statistics Unit. These are updated roughly every 10 years which will provide an opportunity to assess the driving inputs in the demand forecast model. Additionally, Jersey Water can compare actual annual demand figures against the five demand forecasts to understand which scenario we are following most closely.

Monitoring climate change impacts

This is a much harder driver to track as it is difficult to disentangle climate change impacts from natural weather variability in the short term. We therefore propose to monitor two key variables:

- Trends in annual average temperatures
- Annual total precipitation – looking at the trend in dry years

As outlined in Appendix B climate change assessment the climate scenarios have been taken from the UKCP18 RCP8.5 probabilistic projections. The probabilistic projections are provided as change factors from the 1981-2000 base period. An approach to track the current situation could therefore be to calculate observed trends in the temperature anomalies (see Figure 4-4 for an example) and overlay these onto the probabilistic projection plumes (see Figure 4-5).

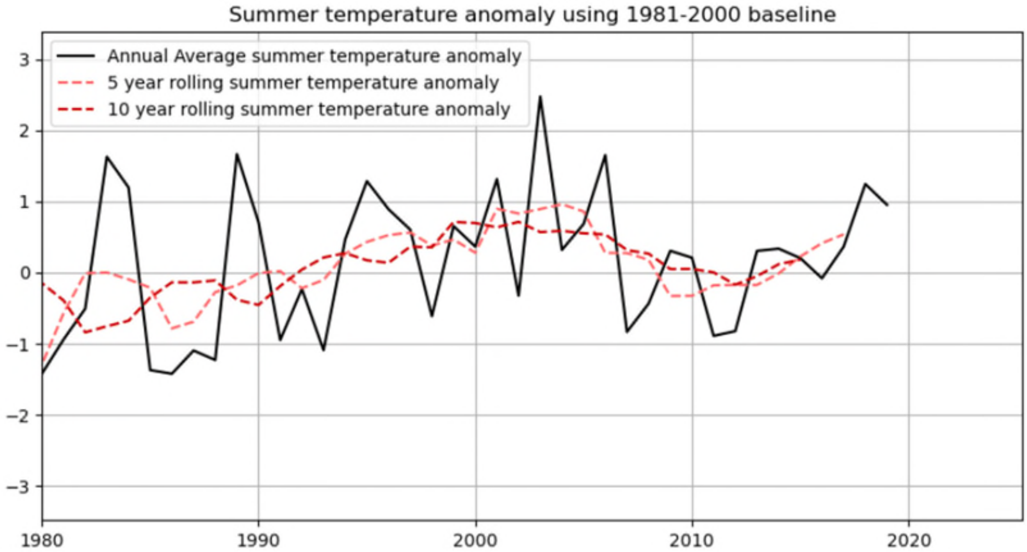

Figure 4-4 – Observed summer temperature anomalies relative to 1981-2000 baseline for Jersey. With trends indicated by the 5 and 10 year rolling average calculations.

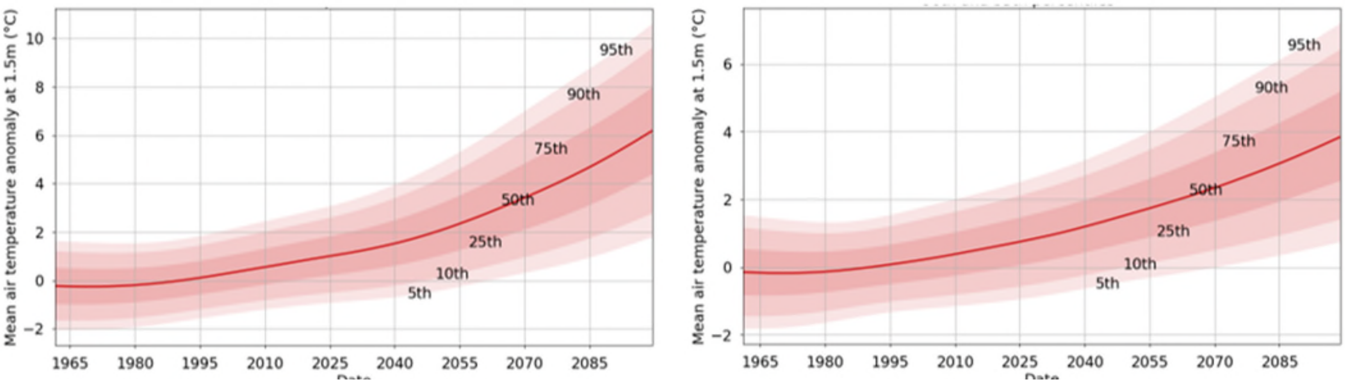

Figure 4-5 – Plume plots of 3-month summer (left) and 3-month winter (right) average probabilistic temperature change (degrees Celsius) factor projections relative to 1981-2000 baseline for RCP8.5.