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A framework for the production of
Drainage and Wastewater Management Plans

# Appendix D
# Options development and appraisal

Commissioned by Water UK in collaboration with Defra, Welsh Government, Ofwat, Environment Agency, Natural Resources Wales, Consumer Council for Water, ADEPT and Blueprint for Water

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# Notice

## D.1. Introduction

This appendix supplements the information provided within the main framework document for drainage and wastewater management plans (DWMPs). The main document (and appendices) aim to provide water and sewerage companies (hereinafter referred to as 'companies' or variations thereof), operating within England and Wales, with a framework within which DWMPs can be developed. The DWMP framework is also expected to be of relevance to other parts of the UK.

In defining the DWMP framework, the following planning areas have been defined:

- Level 3 (L3) tactical planning unit (TPU) – the basic TPU will be the wastewater treatment works (WwTW) and its catchment (or aggregations thereof for small catchments, or discrete sub-catchments for larger WwTW catchments).
- Level 2 (L2) strategic planning areas (SPAs) – an aggregation of L3 units into larger L2 SPAs.
- Level 1 (L1) water company DWMP – planning at L2 and L3 to be brought together within an overarching company level DWMP to provide a strategic, long-term plan for drainage and wastewater resilience and associated investment over the plan period.

For consistency the same terminology as used in the main report will be applied here.

Consistent with the overall aims of the DWMP framework, the options development and appraisal methodology has been developed to focus the level of planning effort, i.e. proportionate to the risks identified, with a view to providing a measure of consistency across the industry. The approach developed utilises some of the primary processes employed in producing a water resources management plan (WRMP); as such, many of the techniques will be familiar to companies but with adaptations where required to make them more appropriate to drainage and wastewater systems. It is recommended that engagement within companies of planners involved with DWMPs and those who have experience of WRMPs would be useful to share knowledge and experience, to facilitate ease of application.

A key principle in developing options is the need to work in collaboration with customers and stakeholders (including 'third parties') in their identification, co-creation and assessment. This will help promote and encourage optioneering on the broadest scale possible without losing the desired level of granularity to address priority risks. It also facilitates approaches that test aggregation of L3 TPUs and planning objectives, to define those options for the drainage and wastewater system that support and enable the widest range of benefits to customers and the community. This will be key in unlocking funding, removing constraints and ensuring the DWMP delivers multiple benefits across all drainage and wastewater systems.

## D.2. Overall approach to options development and appraisal

The aim of the options development and appraisal (ODA) process is to provide a framework that will enable companies to develop robust 'best value' interventions to identified exceedances of planning objectives where these arise in the planning period. A key principle in the development of the DWMP is that the ODA process should be undertaken for any L3 TPU where a risk is identified. Options appraisal should then include potential interventions at L3, L2 and L1 to produce an optimised L2 plan that delivers against the planning objectives for the L2 SPA and derived from those set at a company level.

The overall approach to the options development and appraisal process is shown schematically in Figure D-1. The approach outlined under 'options development and appraisal' is to be applied to each L3 TPU.

In summary, the outputs from the baseline risk and vulnerability assessment (BRAVA) and problem characterisation step will provide an indication of the planning approach to be taken for the L3 TPU that is appropriate to the complexity and scale of risks identified.

In focussing optioneering effort, the following list indicates the broad categorisation of option development approaches:

- **Standard** – process defaults to companies' existing investment planning practices to maintain or enhance existing levels of service.
- **Extended** – the options development and appraisal process will build upon standard processes to provide extended analytical approaches in support of investment planning practice (where DWMP minimum requirements are not met).
- **Complex** – the options development and appraisal process is undertaken considering a wide range of tools and approaches to explore:
  - Uncertainties in the forecasts;
  - The likely complexity of the interventions required to meet all planning objective exceedances is high involving multiple options and/or stakeholders and the potential lead in times are long.

It is acknowledged that optioneering complexity is a continuum and that, for simplicity, this has been represented as three distinct categories for decision making approaches. It is important that companies do not get too focussed on trying to categorise the scenarios into an optioneering approach.

The approach outlined is not intended to be prescriptive but demonstrates the principle that the outputs from the BRAVA and problem characterisation step should provide an indication of the level of optioneering required as a function of complexity, scale of risks identified and the timing as to when the risks materialise.

Having developed the options for all L3 TPUs within an L2 SPA, the options appraisal process is designed to produce a prioritised L2 plan that delivers against the planning objectives for the L2 SPA and derived from those set at a company level.

It is important to understand that the prioritised plan is not a 'delivery' vehicle, rather it is an element that feeds into the development of the L1 DWMP. Within the context of the L1 DWMP, and subsequently the business plan, additional constraints may require that some of the L2 proposals are deferred to subsequent planning cycles. As such it is important that companies develop as robust an understanding of the L3 TPU issues and scale of risk as possible, given inherent uncertainties, but also have in place resilience measures that allow effective responses should risks materialise in those L3s where interventions may be deferred in the L1 optimised plan.

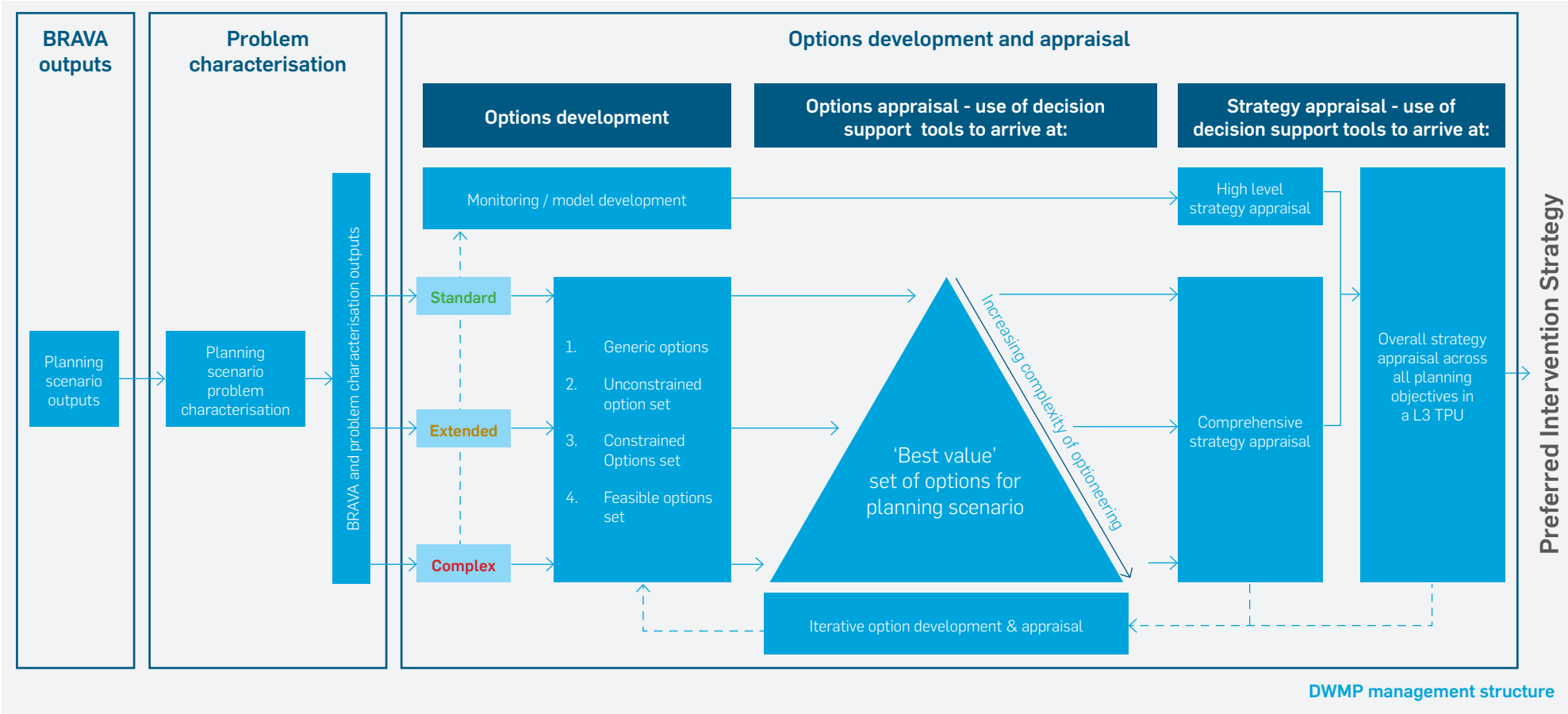



**Figure D-1 - Schematic outlining the L3 options development and appraisal process**

## D.3. Options development

In the WRMP the options development stage tends to follow a generic approach that is outlined in the following sections. In the context of the DWMP the expectation is that in the unconstrained options process all potential options should be considered; the screening process can rapidly remove unfeasible options such that a limited, 'constrained', set can be prioritised for further evaluation at the feasible options stage. It is noted that in the Storm Overflow Assessment Framework[1] (SOAF) a minimum of two options are recommended for consideration.

ODA is expected to proceed through the following stages (noting subsequent comments):

- Generic options - defines the range of potential option types for consideration across all aspects of drainage and wastewater planning.
- Unconstrained options - a broad spectrum of options derived primarily from the generic options list but with, where appropriate, the addition of site specific options.
- Constrained options - derived by assessing the unconstrained option list against a set of screening criteria created through engagement with L2 strategic planning groups (SPGs). It would be expected that the criteria agreed would be applicable to all L3s in the L2 SPA.
- Feasible options - a subset of the constrained options list. A range of criteria, based on more detailed information, is used to refine the constrained list to a range of feasible options. In the WRMP it is these options that would then be taken forward for inclusion in any investment modelling. However, for the DWMP it is recommended that a preferred option from the list of feasible options is selected, based on cost and benefits assessments, for the appropriate L3 and endorsement obtained through engagement within the L2 SPGs.

The WRMP guidance[2] approach is unconstrained options refined to feasible options; however, for some companies a constrained list is also derived either as a stage between unconstrained and feasible or as a selection stage after the feasible option refinement. As outlined in the following section, a proportionate approach is recommended and, where appropriate, companies can move directly from the unconstrained list to the feasible list provided that adequate assessment can be demonstrated. The key point is that screening should be auditable and robust to ensure that all appropriate options are fully considered whilst also refining the number of options down to a manageable number for decision support tools to handle. A key output from this process, in addition to a constrained list of options, is the development of a 'rejection register' to capture those options screened out and the reasoning for their rejection at this point in planning (see section D.3.2.1.).

### D.3.1. Proportionate optioneering

The level of detail/complexity associated with the ODA process adopted should be proportionate to the levels of risk identified, the timing of the risk materialisation and the confidence in the information being used to define the inputs.

#### D.3.1.1. Optioneering where risks are identified late in the planning horizon

The overall optioneering principles may appear onerous in circumstances where the risks are not forecast to appear until late in the planning horizon; however, it is considered important that companies should still follow the ODA process and demonstrate there are plans in place to address all risks that are forecast to arise within the planning horizon and that the DWMP is resilient and adaptable to future uncertainties that may bring forward (or defer) the need for intervention. The objective is to encourage companies to consider (in consultation with L2 SPGs as required) alternative approaches some of which could be developed well in advance of the risks materialising (e.g. where other risk management authorities (RMAs) may be considering interventions to address other issues specific to their systems but for which there could be added benefit to the water company), or which may need significant planning or investigations prior to their promotion.

Where appropriate (as for the example situation above), having identified the key drivers for exceedance and commenced the ODA, companies can develop selected options based on a more aggregated approach, grouping similar risks and addressing with non-specific options e.g. removal of 'x' hectares of impermeable surface (with location, etc. undefined), and costed on the basis of standard company cost curves.

In respect of benefits, companies can consider establishing benefit values at a high level which can be applied to such options. An additional output could be a need to include for additional monitoring in the interim period with a view to confirming when thresholds are being reached that could trigger earlier intervention. Conversely, monitoring may identify where thresholds are not being breached (e.g. elements of the supply/demand forecast are not realised) allowing refinement/reduction/re-programming of initial intervention proposals.

[1] https://www.water.org.uk/policy-topics/managing-sewage-and-drainage/drainage-and-wastewater-management-plans/
[2] Environment Agency, Final Water Resources Planning Guideline, May 2016

#### D.3.1.2. Optioneering for significant uncertainty in the near term

The non-specific options approach outlined above supports decision making in the medium to long-term but is not considered appropriate where the risks are forecast to materialise in the near term (defined as within the 5-year horizon) or where lead in times may be such that significant (but not necessarily material) investment may be required in the medium term.

In systems which might include significant future uncertainties, companies will need to consider the benefits of implementing different options (or sizes of the same option) over time to address capacity constraints as and when they are projected to materialise. For example, examining the cost benefit analysis outputs for a scheme developed now to address a 'deficit' in 25 years versus phased options to achieve the same outcomes. Where appropriate, companies can consider the benefits of developing detailed options for the near/medium-term with generic options applied in the long-term provided the company can demonstrate that investing in a larger scheme now would not offer the best value.

It should be noted that, while potentially less effective given the timescales under consideration, the application of adaptive pathway type approaches (section D.3.6.) can also be utilised to define staged interventions to deliver the required outcomes.

This might include a focus on monitoring and investigation, planning and then staged implementation, each of which may be defined as a particular investment without commitment to the following step where the future drivers may be uncertain or carry greater risk.

#### D.3.1.3. Foreshortening of the options development process

While the principle is that the overall ODA process should be followed for all risks identified, a proportionate approach can lead companies to move from the unconstrained to feasible options list (bypassing the constrained options stage) in circumstances where the options set can be shown to be limited. It is likely that this will be the case for those L3s identified in the problem characterisation step of the BRAVA as being 'standard' and, where appropriate and justifiable, some of those identified as being 'extended'. In such circumstances, and aligning to the SOAF approach, it is recommended that where possible a minimum of two options are taken forward for consideration within the feasible options list and which will be subjected to more detailed cost and benefit assessments.

### D.3.2. Generic options

This step aligns with the WRMP planning processes and is generally undertaken at a business level. The objective is to define a range of generic option types that may be utilised to address a wide range of exceedances/constraints and, subsequent to a high-level assessment, reject those that do not meet a range of criteria.

The WRMP process[3] defines a series of management areas within which generic options could be considered. These effectively examine key options that could be used to address risks through management of either demand on, or supply to, the wastewater system. Table D-1 that follows outlines the key management areas identified for the wastewater system.

Table D-2 that follows provides examples of the types of options that could be included within each management area (not considered exhaustive). The process for developing the generic options is not being prescribed but it would be anticipated that this would be done through internal workshops involving personnel from across all elements of the wastewater business.

**Table D-1 - Indicative management areas for generic options**

| Management area | Description |
|---|---|
| Customer side management options | Generic options to manage the use of water in and arising from customer properties |
| Surface water management | Generic options within catchments to manage surface water flows entering the conveyance system |
| Combined and foul sewer systems | Generic options to manage flows within the conveyance system to minimise impacts on customers and the environment |
| Wastewater treatment works | Generic options to manage flows and loads at wastewater treatment works to minimise impacts on customers and the environment |

[3] UKWIR, 2012, WR27 Water Resources Planning Tools 2012, Economics of Balancing Supply and Demand (EBSD) Report

**Table D-2 - Example options as a function of management area**

| Management area | Generic option examples | Sub-option examples |
|---|---|---|
| Customer side management options | Water efficient appliances | Promote and make available water efficient appliances to reduce production of domestic wastewater |
| | Rainwater harvesting | Promote and make available rainwater harvesting systems |
| | Customer incentives | Promotion of incentives to reduce impermeable areas |
| | Domestic and business customer education | Likely focus at L1; however, where location specific issues are identified, activities could be targeted around what should and shouldn't be put down sewers |
| Surface water management | Surface water source control measures | Company installation of source control sustainable drainage systems (SuDS) |
| | | SuDS partnerships with key stakeholders |
| | Surface water pathway measures | Separate surface water from combined systems by constructing new surface water networks |
| | | Integrate surface water pathway measures into new and upgraded highway designs |
| Combined and foul sewer systems | Intelligent network operation | Implement widespread sewer/pumping station level monitoring, 'live' network modelling linked to operational responses |
| | Increase the capacity of existing foul / combined networks | Construct new stormwater storage systems |
| | | Replace or upgrade existing networks |
| | Wastewater transfers | Inter-catchment network transfers |
| | | Inter-catchment WwTWs transfers |
| Wastewater treatment | Treat or pre-treat wastewater in the network | Treat or pre-treat flows at existing pumping stations or within sewer network |
| | Increase treatment capacity | Upgrade existing works using more intensive processes |
| | | Add additional process streams |
| | Treatment works rationalisation | Replace existing treatment works with one large scale installation |
| | Increased treatment de-centralisation | Construct new small scale WwTW to reduce flows/loads on existing sites and networks |
| | | Third-party engagement to provide treatment capacity |
| | Modify consents and permits | Catchment consenting |
| | | Adaptive consenting (e.g. 'wet weather' relaxation) |
| | Catchment management initiatives | Initiatives to address fertiliser use and application |

Additional options may be considered that would apply at L1; these could include for example: customer engagement/ education on what should or shouldn't be flushed down toilets; and business customer engagement/education around disposal of fats, oils and grease. Such options can be included where specific issues are identified as a risk within catchments but ultimately the promotion of 'best practice' in sewer use is more likely to be considered at a company level.

The generic options need to be comprehensive and cover a wide range of options; these should include those addressed under all cost 'types' i.e. operational costs, capital maintenance, 'new' totex. In developing the list companies should seek to include innovative interventions alongside those that might be considered more 'traditional'. However, it is acknowledged that taking an innovative view could mean there are options that could rely on technologies that are not yet at a stage where implementation could be undertaken or which, based on current construction techniques, could not be applied to, for example, sewer networks. In defining a final list of generic options companies can employ a range of screening methods; however, the WRMP indicates that 'technical feasibility' is the primary criterion[4] and this same criterion is to be used for the DWMP.

If a scoring method is applied it is suggested that a sliding scale be developed between:

- High score 5 – well established technology/practice within the UK
- Low score 1 – no evidence of adoption of the technology/practice anywhere else in the world

In addition to 'technical feasibility', companies should apply engineering judgement to the final assessment to ensure that options that are taken forward to the final list are also practical. Table D-3 presents an example output from the generic options assessment. The key point here is that a consistent approach to the assessment of all options should be captured within a standard option proforma and included as part of the supporting evidence for the DWMP.

### D.3.2.1. Rejection register

It is important that companies retain a 'rejection register' of those options removed from the original list and the reasons for their rejection at this point in planning; as the DWMP process is revisited on a 5-yearly timescale, there is a requirement to review the rejected options. It may be that technology/ practice advancements have been made in the intervening period such that the rejected options may now be considered technically feasible and/or practical.

The final generic option list should be that on which the unconstrained options for specific L3 TPUs is based.

**Table D-3 - Example output for generic options assessment**

| Option ID | Option type | Option description | Technical feasibility score | Carry through to unconstrained list? | Reasons for rejection* |
|---|---|---|---|---|---|
| CE1 | Customer side demand management | Promotion of water efficiency devices | 5 | Y | N/A |
| SWM1 | Surface water management | Implementation of SuDS in partnership with stakeholders | 5 | Y | N/A |
| CFS1 | Combined and foul sewer systems | Removal of all surface water connections to sewers | 4 | N | Technically feasible but likely impractical for 'x, y, z' reasons in most catchments |
| CFS2 | Combined and foul sewer systems | Partial removal of surface water connections to sewers | 4 | Y | N/A |
| WWT1 | Wastewater treatment | In-pipe treatment | 1 | N | Limited experience to justify inclusion |

*__Note:__ Reasons should provide detail that will enable stakeholders to fully understand the reasoning

[4] Environment Agency, 2016, Final Water Resources Planning Guideline

### D.3.3. Unconstrained options list

Movement from generic options to an unconstrained options list is undertaken for each L3 where a constraint/exceedance has been identified in the BRAVA, or groupings of L3s where the problem characterisation output has demonstrated that the constraint/exceedances to be addressed (and potential complexity of resolution) are similar. Companies should develop a range of options that could address the identified constraint/exceedance. While the generic options should be the primary source, site specific conditions may require more bespoke options to be considered. It is recommended that the options selection process should be undertaken within the context of the following hierarchy (noting that the fourth and fifth bullet should be considered as having a similar priority):

- Behavioural – can measures be developed that are designed to change customer behaviour (e.g. promotion of water butts) address the issues;
- Planning area – are there inter-catchment, cross L2 SPA or inter-company options that could be utilised to address the issues;
- System operation (WwTWs and networks/network assets) – are there operational measures that can be adopted to address the issues;
- Partnership/'third parties' – are there measures that can be co-created with other RMAs or interested parties on the basis of apportioned risk or can services be provided by a third-party operator;
- Catchment – are there 'green' measures (e.g. sustainable drainage systems) that can be developed (alone or in partnership) that could resolve the issues;
- System upgrades / new assets – are there upgrades to the system that can be used to address the issues.

In respect of the first bullet, it is acknowledged that customer behaviour changes can take time to deliver benefits and that those benefits cannot be robustly defined. It is envisaged that, for all options where flow is a primary driver, targeted measures to promote water efficiency in the catchment will be implemented as part of any wider option. The benefits may be excluded from the appraisal process on the grounds that there is low certainty that they will be delivered; however, inclusion as a measure would be considered best practice.

Importantly, consideration needs to be given to:

- Adoption, where possible, of a range of options, moving through the hierarchy, with a view to ensuring the ultimate solution can demonstrate that system thinking and collaborative approaches are, or have been, core to developing the options required to managing the risks.
- Multiple benefits – are there measures that could be implemented that could deliver multiple benefits (potentially above and beyond that solely required for DWMP purposes) and address more than one driver or deliver more than one outcome.

Depending on the complexity of the problem being addressed, consideration should be given to options that might offer either single stage or multi-stage interventions (akin to adaptive pathways). These can be presented as: a standalone (single option); a phased standalone option; or a series of standalone options.

As an example, to address an identified risk of internal flooding the options might consider:

- Standalone option – sewer upgrades to accommodate additional flows;
- Phased standalone option – surface water management to reduce flows within the network causing flooding, with flow thresholds identified that would trigger further surface water management should thresholds be exceeded;
- Series of standalone options:
  - Install monitoring and identify thresholds that could trigger alternative pathways;
  - Promote water efficiency measures;
  - Development of surface water management interventions (e.g. SuDS) in partnership with other RMAs or without partnership working where viable and offering best value;
  - Sewer upgrades (where further SuDS development might be limited).

Where there is limited information, e.g. L3s, for which models are either not available or incomplete, companies are encouraged to utilise all information sources to derive an initial risk-based set of options. Where there is a need to develop new models to improve understanding of risk and hence increase the certainty of option identification then allowance should be made for such model developments, but this should not be the default position.

In moving to a constrained options list, a high-level screening process is envisaged that would encompass the following questions:

> Is the option technically feasible given site, operational (e.g. energy requirement, waste management) or option-specific circumstances?

> Is it cost effective (based on a simple high, medium, low cost assessment)?

> Does the option achieve the required outcome?

> Are there environmental risks (in establishment/operation and outcomes) that cannot be mitigated or benefits provided?

> Would the option likely be supported by customers (assessment based on company level understanding; it is not expected that customer research needs to be undertaken for every option)?

> Risk and uncertainty – does the option provide resilience against future uncertainties?

At this stage cost is not a specific indicator; however, as with the WRMP it is suggested that high level assessments are made (e.g. low, medium, high categories). In undertaking the assessment, for each option a simple 'yes/no' answer should be accompanied by a brief commentary on the issue that merits screening out from any further consideration. Companies can also exclude options even if they pass the initial screening if there are good reasons to do so (this could include reference to indicative cost assessments). The assessment is generally based on engineering judgement; as such, companies need to ensure that the reasoning behind any exclusions are set out in the rejection register for the L3 TPU. The results of the screening should be captured in an options rejection register.

As outlined previously, if the options list is limited companies can by-pass the constrained options list and move directly to the feasible options assessments.

### D.3.4. Constrained options list

The constrained options list comprises of those options that have passed the unconstrained options screening. For each option companies would need to undertake further development with a view to addressing the requirements of the screening criteria which would be applied to move options from the constrained to the feasible options list. As discussed above, this should include capturing where options provide benefit or outcomes at L3 or L2 scales.

Companies can be expected to draw upon existing practices and supplement with their own WRMP processes to derive a set of screening criteria that is appropriate. As a minimum it is suggested that the following (aligned to the unconstrained criteria) main and sub-set criteria would be applied:

> Feasibility and risk:

- Customer acceptability – does the option address specific customer concerns?
- Political acceptability – does the option address regulatory requirements (local and strategic)?
- Timeline for implementation – is a significant amount of work required to implement the option?
- Dependencies – does the option rely on, or provide an opportunity for, co-creation and implementation?
- 'Third parties' – does the option lend itself to third-party operators providing an alternative service?
- Planning and regulatory constraints – are there site-specific issues that would need to be addressed (e.g. planning permission)?

> Engineering and cost:

- Engineering complexity – how complex will the option be to develop from an engineering perspective? This should include consideration of staging/phasing of development.
- Cost – indicative costs based on more detailed investigations (low, medium, high).

> Performance:

- Outcomes - can the option deliver the desired outcome?
- Flexibility to adapt – does the option provide a mechanism to change path depending on materialisation of risk?
- Resilience – does the option increase resilience in the system above and beyond meeting desired outcomes?

> Operational – does the option impact on wider compliance risk in the system?

> Environmental – it is recommended that companies undertake a high-level assessment of environmental and social impacts, including potential impact on designated features / water bodies and a Water Framework Directive (WFD) assessment for each option. The assessment will assist in the development of an overall programme level Strategic Environmental Assessment (see section 6.3 of the main framework document). Elements for consideration include:

- WFD
- Habitats Regulations Assessment (internationally designated sites)
- SSSIs / national nature reserves (international and national level sites)
- Recreation
- Cultural heritage
- Flood risk

- International or national landscapes (area of outstanding natural beauty, national parks)
- Carbon
- Invasive species

To derive 'best value' interventions, companies are encouraged to seek collaborative opportunities for options that provide an environmental net gain (to be fully quantified where options progress to the feasible list).

Companies can develop their own scoring systems; however, as example, the criteria outlined could be assessed against a grading system moving from zero (positive/beneficial effect) through to 4 (major adverse effects/high risk). Summing the outputs would provide an overall score for the option against the screening criteria. Companies would need to decide their own level of risk acceptance in assessing that score which would ultimately lead to an option being screened out.

The process should include a description of how options may contribute to mitigating individual or groupings of identified risks and identified customer priorities, emphasising where options may be providing localised or more strategic benefits, accepting that both are important.

As for the unconstrained list companies should record within a rejection register the reasoning behind the exclusion of any option.

## D.3.5. Feasible options

The feasible list is a subset of either the unconstrained list (where limited options are possible and companies do not consider a constrained options list to be a useful screen) or the constrained list. It is a set of options that the company considers to be suitable to take forward for assessment to define the preferred option to meet the outcomes for the L3 TPU. As such, it should not include options with unalterable (and unacceptable) constraints that make them unsuitable for promotion (e.g. unacceptable environmental impacts that cannot be mitigated or options which have a high risk of failure).

The feasible list should include sufficient options to allow real choices and acknowledged trade-offs in determining an optimum or preferred option (as per the SOAF guidance a minimum of two options is recommended). For each of the feasible options (including third party options) companies are expected to produce:

> A description of the option including an appropriate schematic map and/or conceptual diagram showing the location, the risk areas, the main operational features, the areas over which the option is to be implemented, and any links or dependencies to other options.

> A description of how the option being described differs from baseline activities and the scale of the benefits to be achieved against single or multiple planning objectives.

> An assessment of customers' likely support for the option.

> An estimate of the time needed to investigate and implement the option, including the earliest start date.

> An assessment of the risks and uncertainty associated with the option.

> An assessment of the flexibility of the option to adapt to future uncertainty.

> An explanation of whether the option depends on an existing scheme or a proposed option (either within the company or as part of an external plan), or is mutually exclusive with another option.

> An assessment of factors or constraints specific to the option (e.g. planning risks).

> A description of how the option will be utilised and impact on costs.

> An assessment of the environmental impacts of the option, including the impacts on river basin management plan objectives. Option assessment should also take account of priority habitat maps for freshwaters and wetlands, and habitat restoration potential maps.

> A Habitats Regulations Assessment if an option could affect any designated European site.

> An assessment of the costs and benefits (see below).

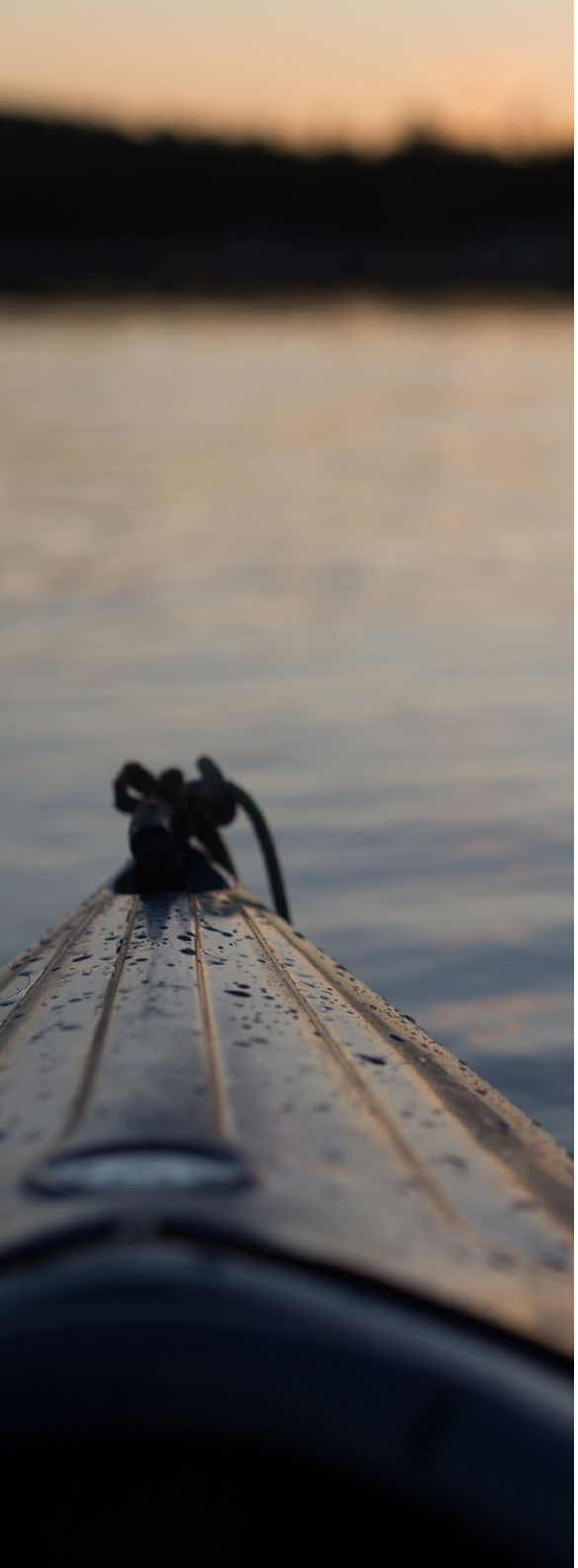
In support of investment planning optimisation and decision support tools in place or to be developed, cost and benefit information for each option should be developed, although this information would be summarised within the DWMP. This should include:

> A profile of the costs over an appropriate time span, split into capital (including maintenance and replacement costs); operating (both fixed and variable costs) and financing costs. Companies should utilise their standard approaches in calculating the net present value of the option costs.

> The environmental and social impacts of the option. Companies should undertake natural capital / ecosystem services type assessments to define the environmental and social impacts of the option. Detail is not provided here; guidance on the application of ecosystem services to water sector options appraisals is currently being developed by UKWIR[5] and companies will be expected to follow this guidance when it is finalised.

For each L3 companies should present the feasible options to the L2 SPGs and obtain an endorsement of the final option to be included as part of the L2 strategic plan and for consideration within the overall L1 DWMP.

[5] UKWIR Project CL04 - Implementing ecosystem service and natural and social capital accounting approaches



## D.3.6. Optioneering approaches to more complex problems

As indicated, in more complex systems which might include significant future uncertainties, companies will need to consider the benefits of implementing different options as a function of whether or not the risks materialise; however, the principles can be applied at a lower level of complexity.

At this stage in the DWMP development a single approach that companies should be adopting is not being specified; however, it is considered useful to highlight the types of processes that could be utilised. Adaptive pathways are one mechanism by which uncertain futures can be taken on board within the context of the long-term. In summary, the approach:

- Examines how uncertainty changes the impact (in the DWMP context specific drivers around flows/loads within the system);
- Defines the outcome to be achieved irrespective of the uncertainty (e.g. compliance with planning objectives);
- Provides a range of interventions that could be adopted depending on the extent to which the uncertainty materialises and impacts on defined system thresholds; and
- Provides triggers (or thresholds) which, based on appropriate monitoring, move the intervention pathway to secondary options if trigger values are exceeded.

Figure D-2 (taken from Jeuken, A. et al, 2014[6]) provides an example of the process. The figure, adapted from the Thames Estuary 2100 study which examined options flood risk as a result of sea level rises, shows high-level adaptation options and pathways developed (on the y-axis) shown relative to threshold levels increase in extreme water level (on the x-axis).

The light blue line illustrates a possible 'route' where a decision maker would initially follow high-level adaptation option 2 then switch to high-level adaptation option 4 if sea level was found to increase faster than predicted. In developing the 'route' consideration would need to be given to the 'best value' approach.

As indicated, such approaches are likely to provide greatest benefit where more complex interventions or programmes are being considered; however, simpler optioneering approaches that utilise similar concepts could be considered for less complex plans to test the 'route' being taken. For example, managing the issues associated surface water flows could involve an adaptive pathway that examines operational measures (real time weather and flow management) as an initial option with residual risks managed by a 'green' intervention as and when flow triggers indicate that thresholds are being exceeded.

Figure D-3 - Costs and benefits arising from a traditional approach to option development to Figure D-5[7] outline how adaptive pathways, aligned to ecosystem service approaches to benefits assessments, have the potential to deliver greater overall benefits when compared to more traditional engineering approaches. As previously, the process offers an effective approach in the face of high levels of uncertainty but should not necessarily be seen as only applicable to large, complex problems but also of value for smaller less complex problems.

[6] Jeuken, A. et al, Lessons learnt from adaptation planning in four deltas and coastal cities, Journal of Water and Climate Change, December 2014

[7] Taken from the draft UKWIR report 'Implementing Ecosystem and Natural and Social Capital Accounting Approaches – Phase1.' Note - this approach will be tested further and hence this draft is subject to change. The aim is to finalise the approach in time for potential use in conjunction with the DWMP Framework.

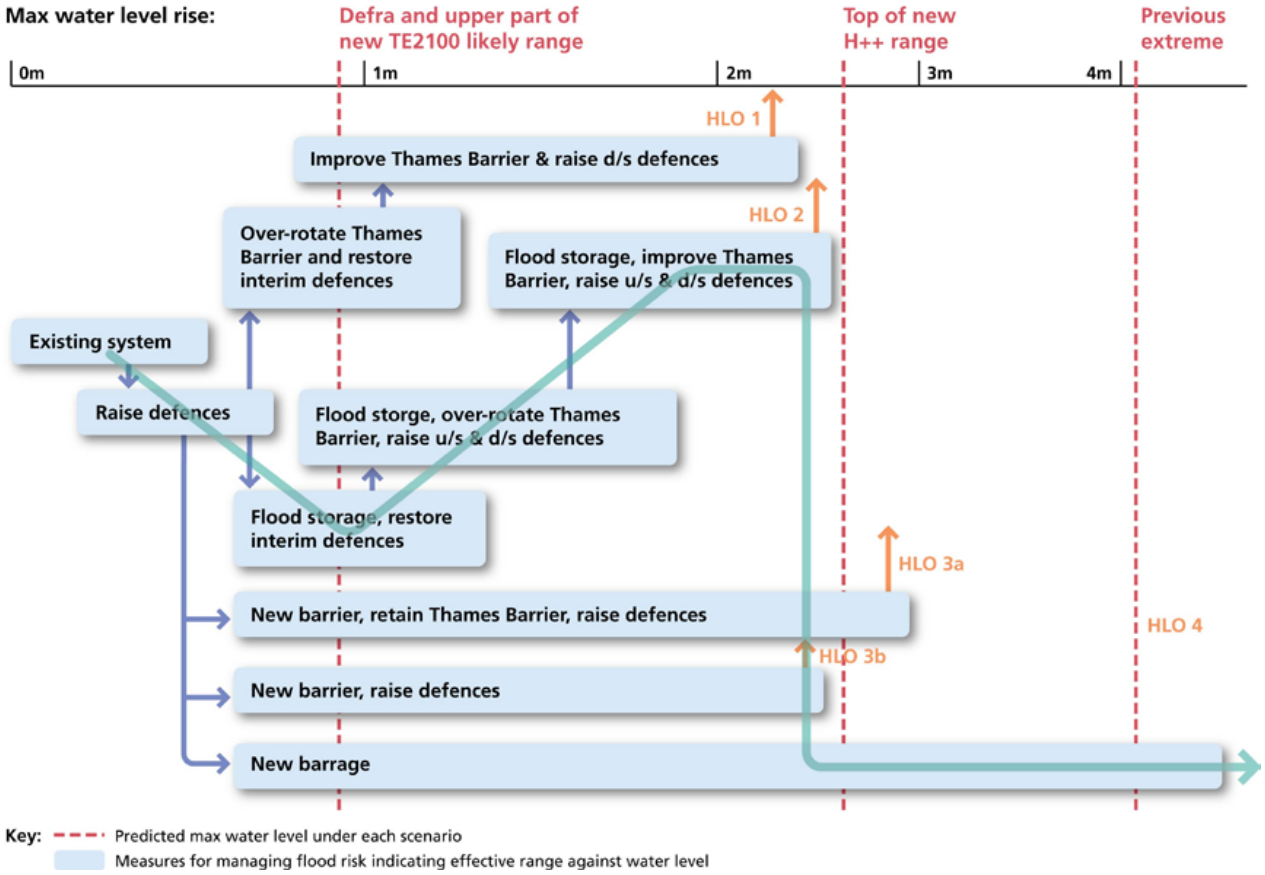



Figure D-2 - Example of the application of adaptive pathway approaches to uncertainty

Photo courtesy of susdrain (https://www.susdrain.org/resources/images.html)

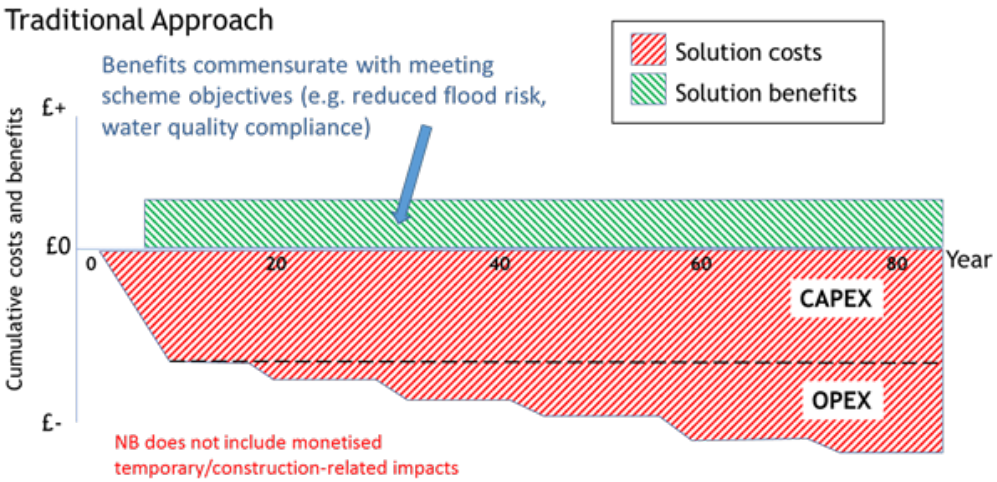



Figure D-3 - Costs and benefits arising from a traditional approach to option development

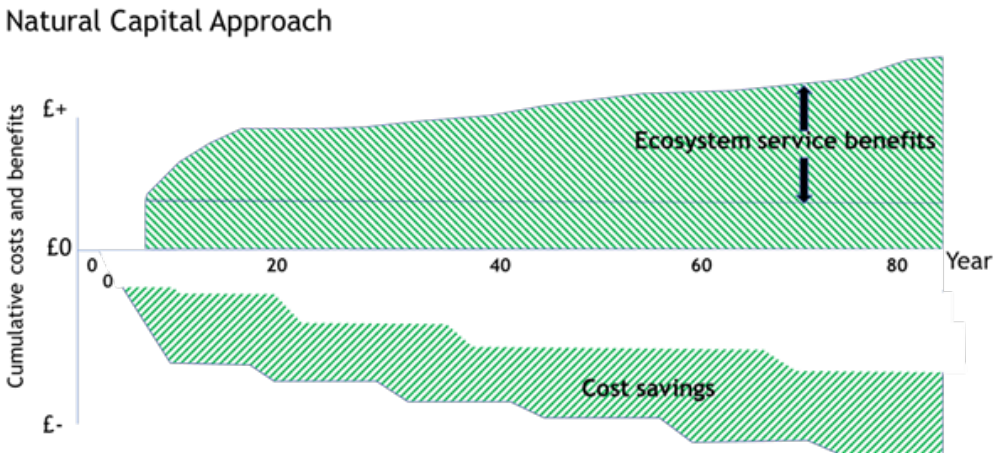



Figure D-5 - Potential cost and benefit impacts of adaptive pathway/ecosystem services methods when compared to traditional approaches

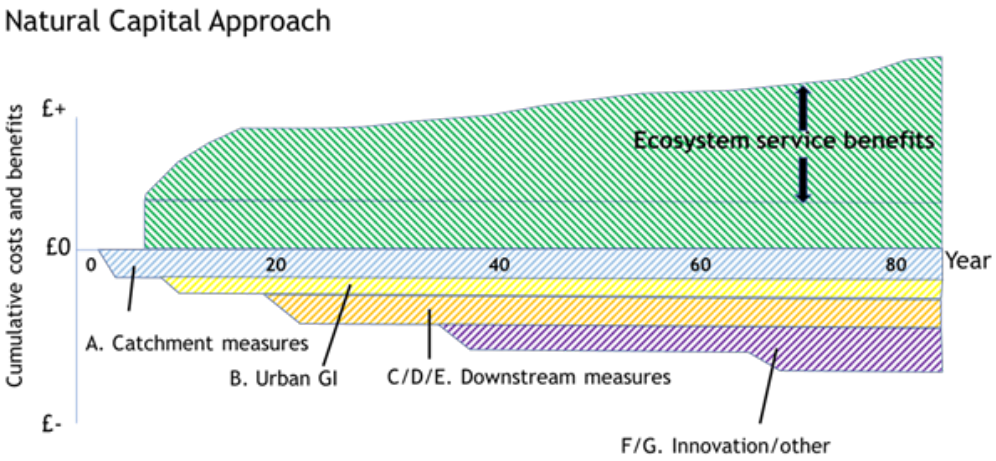



Figure D-4 - Costs and benefits arising from an adaptive pathway approach as assessed using ecosystem services

The figures suggest that adaptive pathway approaches can produce long term (system-wide) cost savings and that the application of an ecosystem services / natural capital approach, that recognises a wider range of benefit areas, can provide a more reflective measure of benefits that can be obtained.

Adaptive pathways are one option to formalise scenario planning approaches; the level of complexity associated with the optioneering process should be proportionate to the risks being managed. However, it should be recognised that while adaptive pathway approaches are generally more applicable to more complex problems they can be applied at any level of optioneering suffice to say that, when planning for the longer-term, companies will need to develop/adopt mechanisms that allow for decision making that takes account of all plan uncertainties.

### D.3.7. Resilience measures

The resilience assessment will have identified key areas that will be required to be addressed. Given the hazards/consequences included in the assessment it is likely that many of the options will be non-specific (but, for example, sized to the specific catchment needs); as such, it is not considered necessary for the resilience options to undergo the same level of development and appraisal. Costs should be developed based on companies' existing costing practices. It is recommended that the options are collated at L2, to demonstrate that 'local' resilience issues have been addressed, and in the L1 DWMP documentation to demonstrate a company's overall resilience position.

### D.3.8. Level 2 options appraisal

The plan should be developed in consultation with L2 SPGs but should reflect that which offers 'best value' (considering costs and benefits) as opposed to simply least cost because more expensive interventions may have greater customer support and provide wider environmental benefits.

In the following outline of the L2 appraisal process, reference is made to the establishment of an 'initial' prioritised L2 plan; this reflects that the L2 plans are one step in the process of deriving the L1 DWMP. There has to be an understanding from all stakeholders in L2 SPGs that the 'initial' prioritised L2 plan is one which, if funding was not constrained, all interventions selected would be undertaken to meet the identified standard of service. Under the current planning regime, there are clearly funding constraints and, as such, outside of those interventions that are mandatory, these drive 'competition' between the needs in this context of each L2 SPA with interventions that are taken through to the L1 DWMP (and potentially to the business plan). A balance needs to be achieved between an appropriate level of risk, and an acceptable level of service and overall bill impacts.

This stage of the DWMP, therefore, will provide a key engagement and positioning point with stakeholders, informing them of the issues and risks and the indicative plan that results. In turn, this will inform their decisions on willingness to pay, based on a fuller and richer appreciation of the issues and opportunities, and costs versus trade-offs in standards of service that may result from the decisions they make.

As such there will be iterations between the developed L1 DWMP and the L2 plans which could see elements of L2 plans, which may have been prioritised, excluded and deferred for consideration in the next planning period subject to the trade-offs agreed. The L2 prioritised plan **should not** therefore be seen as a delivery plan but part of the wider assessment required to derive an overall plan for investment to achieve a level of service (against planning objectives) that customers are willing to pay for.

Whilst the investment plan will be based on detailed data on a year by year basis, communication of the 'initial' prioritised L2 plan to stakeholders and presentation within the DWMP might focus on less granular timescales required for interventions. For example, companies may wish to define and prioritise those interventions to be developed within the context of a 5-year, 5 to 10-year, and 10-25-year (or longer depending on the approach being taken) planning horizon.

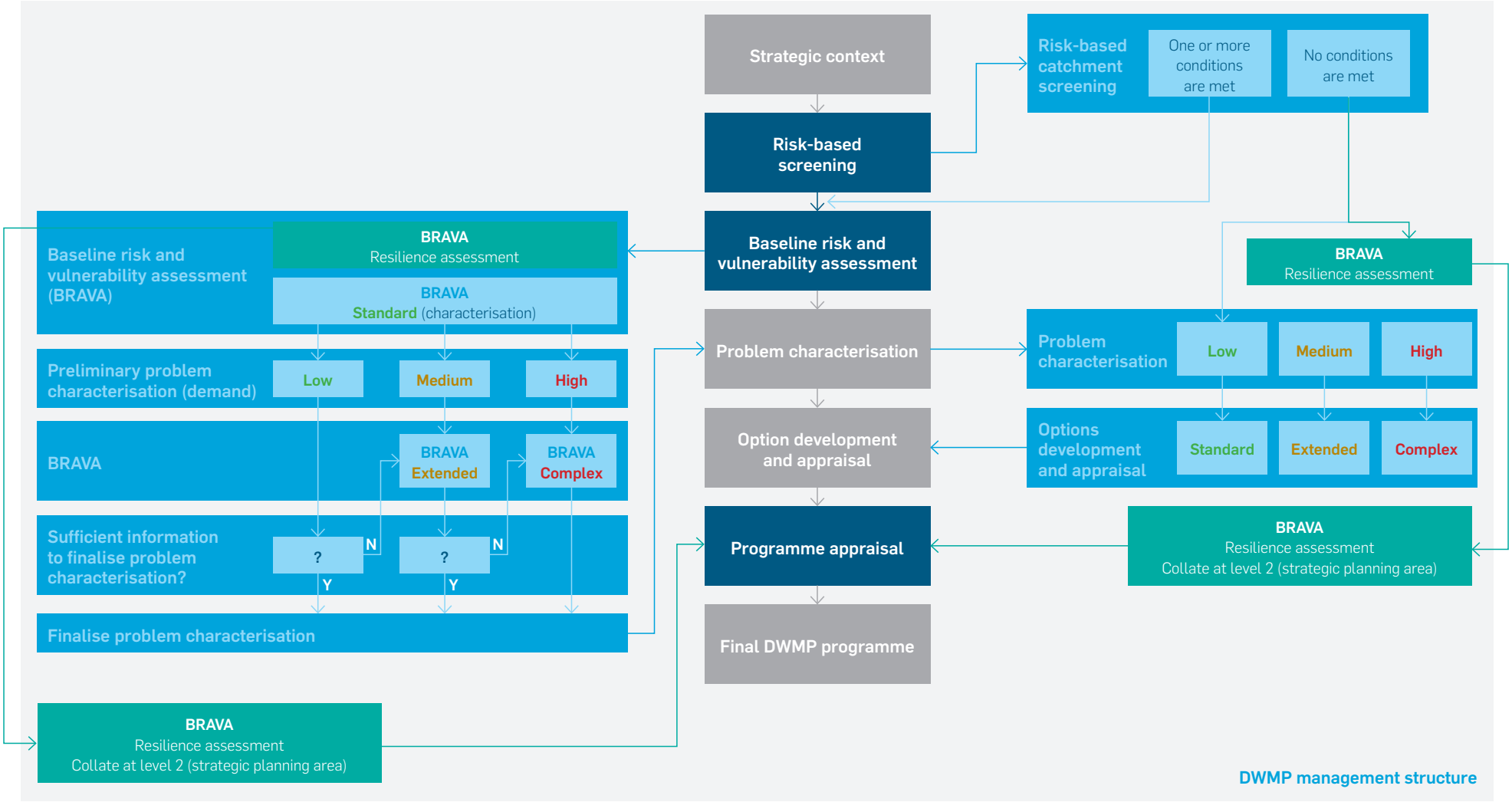



Figure D-6 - Resilience assessments within the context of the DWMP

Within each planning horizon the following are envisaged:

- Those interventions which have statutory drivers (e.g. WINEP) will be mandated as the company must act to manage the risks. Within the context of the WINEP, the timelines can be significant particularly where, for example, catchment management is the proposed way forward. For such interventions it is important that all costs (investigations, implementation, etc.) are considered within the context of any cost/benefit assessment but that spend is allocated to the appropriate planning period;
- Those non-statutory interventions developed to address, for example, new development, climate change and other regulatory drivers, and for which a 'best value' option has been developed, should be prioritised maximising best value, whilst delivering planning objective targets. It is envisaged that the prioritisation process would take account of:
  - Net present value of the cost/ benefits for the interventions
  - Customer preference
  - Interventions that are indicated as delivering multiple benefits
  - Interventions that involve co-creation with others and, specifically, provide alternative mechanisms for funding
  - The degree of uncertainty associated with the drivers/ intervention
- Those interventions that cover more than one planning period (given long lead in times) should be considered for prioritisation within the period in which initial work would be required.
- Those elements that are related to wider resilience of the system (as outlined in section D.3.7.). It is recommended that the options are collated and prioritised at L2. For example, ensuring that filter works are resilient to low temperatures, a prioritisation process may put the initial focus on those works with tight ammonia permit conditions; residual interventions with lower risk to compliance can be considered for inclusion in subsequent planning periods.

It is likely that for many L2 SPAs the prioritised plan will be clear from the assessments undertaken; for more complex systems companies may need to undertake more extensive analyses particularly where multiple planning problems have been identified. Companies can consider prioritising of planning objectives (based on customer 'willingness to pay') and select (in consultation with L2 SPGs) alternative options which may deliver against priority planning objectives but only partially against others (where the consequences might be considered marginal). Ultimately that plan which delivers 'best value' against all planning objectives would be the optimal plan.

No specific decision support tools are being set out in this document; there are a range of optimiser software models available that enable, for example, multi-criteria type analyses. It is recommended that companies examine the alternatives with a view to utilising that which best suits their needs.

### D.3.9. Level 2 area plans

Companies should present the outputs from the ODA within L2 area plans; these should detail the assessments undertaken and the options identified, and outline how it has derived the 'initial' L2 prioritised plan that will, in isolation from other L2 plans, meet planning objectives in the near, medium and long-term. An example of the form of presentation of outputs is provided in section 3.5 (of the main framework document) and appendix F.

It is these 'initial' L2 prioritised plans that will be taken through to the L1 optimisation process. As outlined previously, there will be an iterative process; in defining the L1 optimised plan, the outputs from each L2 will need to be assessed as part of the whole which could result in a trade-off of interventions meaning that some proposed interventions are deferred and omitted from the final plan. To reiterate, the L2 plans are not delivery proposals but a key element that feeds into the development of the final DWMP.

John Sutherland / Gian Illari / Brian Arkell
Atkins Limited
Woodcote Grove
Ashley Road
Epsom
Surrey
KT18 5BW

Tel: +44 (0)1372 726140
Fax: +44 (0)1372 740055