

AUCKLAND COUNCIL STORMWATER NETWORK DISCHARGE CONSENT FRAMEWORK – BUILDING IN FLEXIBILITY

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ABSTRACT

The Auckland Council Stormwater Unit's regional approach to obtain network discharge consents is based on 10 large coastal water bodies (Consolidated Receiving Environments), which include the Waitematā and Manukau Harbours. Since amalgamation, the Stormwater Unit has evolved from the transition of operations from legacy councils to the transformation of stormwater management across Auckland. Central to this transformation is the Unit's ability to review the implementation of the Stormwater Unit's objectives and work programmes on a continuous basis, and in particular how this review will incorporate changes in community aspirations and priorities, as well as new technical information as it becomes available. This paper presents the processes that the Stormwater Unit is proposing to enable change under its network discharge consent (NDC), creating a NDC framework based on "continuous improvement." and elements of "adaptive management", in particular through targeted monitoring and structured review processes. The key elements are fostering ongoing and meaningful relationships with key stakeholders, as well as enabling mechanisms for incorporating new technical information and community feedback into its levels of service, best practicable option assessments, and work programmes.

KEYWORDS

Network discharge consent; stormwater; best practicable option; continuous improvement; adaptive management.

PRESENTER PROFILE

Janet Kidd has over 15 years of experience in environmental management including environmental assessments, compliance, environmental risk and liability management, particularly in the area of stormwater/marine discharges. She is currently working as a Senior Stormwater Specialist within the Auckland Council Stormwater Unit. Her role involves obtaining and managing the consents for the stormwater network infrastructure throughout the region, and includes consultation with internal and external stakeholders, technical review of ecological and water quality assessments, strategy formation, and compliance assessments and management.

1 INTRODUCTION

As an amalgamated unitary authority, Auckland Council (Council) is responsible for managing and minimising the community and environmental effects from its urban stormwater network. This is a requirement under the Resource Management and Local Government Acts and other legislation, as well as the expectation of Auckland's ratepayers, politicians and iwi. While a stormwater network is a fundamental element of

an urban area, its development and operation can lead to potentially significant adverse effects on communities and the natural environment.

Obtaining and complying with a network discharge consent (NDC) is central in giving assurance to the public that the Council is meeting its responsibilities in preventing or minimising the adverse effects of its urban stormwater discharges under a “best practicable option” (BPO) approach established in the relevant regional planning instruments: the Auckland Regional Plan: Air, Land and Water (ALW Plan); the Auckland Regional Plan: Coastal (Coastal Plan) and the recently notified Proposed Auckland Unitary Plan (PAUP).

While the overall goal is to minimise the effects from the public stormwater network, emerging information and technology, as well as changing expectations of stakeholders and ratepayers, means that priorities and methodologies for mitigating these impacts will constantly evolve. The NDC must therefore be framed to allow for flexibility, yet ensure that the environmental effects are managed and minimized and improvements achieved. This paper sets out the key components of the NDC framework that the Council’s Stormwater Unit is proposing to achieve this aim, one that is fundamentally based on continuous improvement and adaptive management monitoring and review processes as a fundamental component of the BPO.

2 CONTEXT

2.1 ADVERSE EFFECTS OF THE STORMWATER NETWORK

Council’s Stormwater Unit is responsible for managing a complex urban stormwater network, comprising a range of built and green infrastructure that discharge to diverse receiving environments across the region. With European settlement beginning in the Auckland region over 170 years ago, urban development led to a significant alteration of the region’s environment. This has led to the loss of many natural features, as land was modified and infrastructure built to support the needs of a growing city. As a result, the predominant method of drainage in urban areas is the constructed public drainage network, which comprises approximately 5,900 km of pipelines, 560 km of lined and unlined channels (not including roadside drains), 27,000 inlet and outfall structures, 2,600 soakholes, and some 10,000 km of open channel and streams in Auckland. In addition to the stormwater network, the older parts of the central city area were, and still are to a significant extent, served by a combined stormwater and wastewater network.

Over much of the region’s history the environmental effects of stormwater were not widely appreciated, and as a consequence, not actively managed. Rather, the focus for stormwater management over much of this period was on basic drainage, flood reduction and sewage disposal. It was not until the last two decades that the environmental effects of the stormwater discharge were recognised and actively minimised and mitigated. This has resulted in a wide range of infrastructure that has been constructed to assist in the management of stormwater quality, flood risk and stormwater flows, including modified natural features, such as constructed wetlands and ponds. Overall, Council owns and operates more than 500 stormwater management facilities, including approximately: 350 stormwater treatment and flood attenuation ponds, 25 wetlands, 160 detention tanks, 44 rain gardens, and numerous proprietary stormwater treatment devices.

In addition, streams and urban groundwater aquifers, are in themselves essential for conveying stormwater. Together with overland flowpaths these resources form an

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essential part of Auckland's drainage system, as they provide the natural drainage pathways for most catchments.

This long history of development has fundamentally shaped the characteristics and condition of the city's stormwater infrastructure and its natural environment, and has left a legacy of adverse effects on Auckland's coastal, streams and groundwater environment. These can be broadly summarised as follows:

Flooding: A number of buildings (residential, commercial, and industrial) and critical infrastructure are at risk of flooding. The problem will increase if past land use and development practices continue.

Streams: Urbanisation and inadequate stormwater management adversely affects Auckland's urban streams and can cause a loss of aquatic habitat and biodiversity, resulting in biological degradation and impacts on ecological functioning of streams, and on community and Maori cultural values.

Estuaries and Harbours: Stormwater contaminants, sourced from urban land use, stream erosion and transport activities, accumulate in low energy marine environments such as estuaries and enclosed harbours and in some areas occur at levels that adversely affect marine life, community and Maori cultural values.

Groundwater: Groundwater aquifers underlying urban areas can be adversely affected by land development and stormwater discharges to ground soakage, although at the same time stormwater discharges can provide important recharge to aquifer systems.

Asset Management: The ability of the stormwater network to cost effectively meet the needs of current and future generations, and minimise adverse effects on receiving environments at an affordable cost, is dependent on the design, quality, maintenance and renewal of built assets and their interaction with natural and private networks. Auckland's rapid growth in greenfield areas has led to a large increase in vested stormwater assets, which brings with it a raft of quality control and future funding issues.

Growth: The way the region grows and develops, and our ability to address existing adverse effects, will determine the quality and health of our freshwater and near shore marine environment.

Adding to this complexity is the number of stakeholders both within and outside of Council who are, or have the potential to, impact on the region's stormwater discharges. The environmental effects caused by the stormwater network do not primarily result from the pipes and infrastructure themselves. Rather, the stormwater network is the conduit that gathers and concentrates the increased flows and associated contaminants that are created by urban development, and the subsequent use of these areas.

It is well known that impervious areas increase runoff during rain events, resulting in increased flooding and stream erosion. Diffuse discharges from vehicles, leaching of certain building materials, litter as well as poorly managed earthworking, industrial and commercial sites, all contribute to the pollution of waterways through the public network. Recent research has also indicated that impervious areas also result in increased temperatures in the stormwater runoff entering the region's streams and waterways, to levels that may affect ecosystem health, particularly in Auckland's small streams that are primarily fed by stormwater runoff.

The integration between land development and use is such that stormwater management of an urban network must inevitably include stakeholders that discharge to that network, including those within the Council such as Auckland Transport and WaterCare, as well as those outside of the Council, such as industrial and commercial sites, New Zealand Transport Authority, developers, and the general public.

2.2 BEST PRACTICABLE OPTION

It is within this context that a NDC framework must be established to appropriately manage and minimise adverse effects on communities and the environment. Fundamental to statutory provisions established in Auckland for stormwater network discharges is the identification and implementation of the “Best Practicable Option” or BPO.

The Resource Management Act defines BPO as:

In relation to a discharge of a contaminant or an emission of noise, means the best method for preventing or minimising the adverse effects on the environment having regard, among other things, to—

- (a) the nature of the discharge or emission and the sensitivity of the receiving environment to adverse effects; and*
- (b) the financial implications, and the effects on the environment, of that option when compared with other options; and*
- (c) the current state of technical knowledge and the likelihood that the option can be successfully applied*

The ALW Plan and the PAUP extend the assessment of matters to be considered to other matters such as the timeframe within which adverse effects can be addressed, the ability for the network operator to control third party effects and the benefits of maintaining and optimising existing infrastructure.

The BPO proposed for the mitigation of any given issue must account for factors such as the locality and pathway of discharge, the nature and sensitivity of the receiving environment, the extent of effects, community priorities for enhancement, as well as available technologies, cost and implementation timeframes of any given range of solutions.

Under the NDC framework, the Stormwater Unit is proposing to develop the BPO across four levels:

- Regional;
- Harbour or estuary receiving environment (termed Consolidated Receiving Environment or CRE (refer Figure 1 for locations));
- Sub-catchment (stream or stream reach catchments); and
- Project.

These four levels of BPO are detailed in Figure 2, and are aimed at demonstrating how strategic regional and CRE level priorities flow down into on-the-ground deliverables, such as capital improvement projects and programmes.

The process of developing and implementing the BPO is not a linear, “end-to-end” process – as it is constantly subject to change and new information. Therefore the other key element of the proposed approach to the BPO is flexibility to accommodate change. Findings and information gained throughout more detailed assessments continually contribute to improving the understanding of stormwater management across the region, which will in turn be used to refine the BPO over time to progressively improve stormwater management. This ensures that the BPO continues to stay relevant and applicable over time. Outlining this proposed continuous improvement process forms the subject of the remainder of the paper.

Figure 1: Location of Auckland’s Consolidated Receiving Environments (CREs)

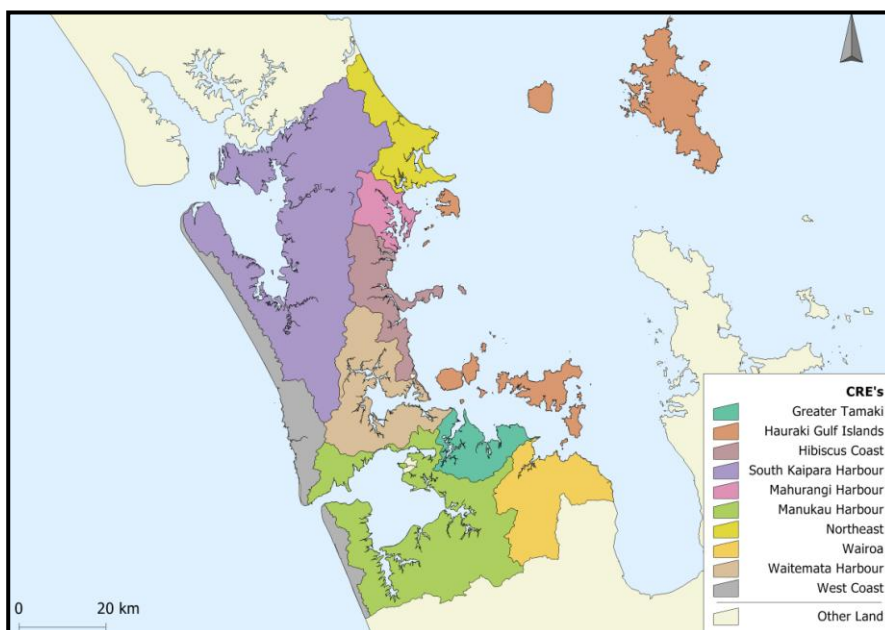
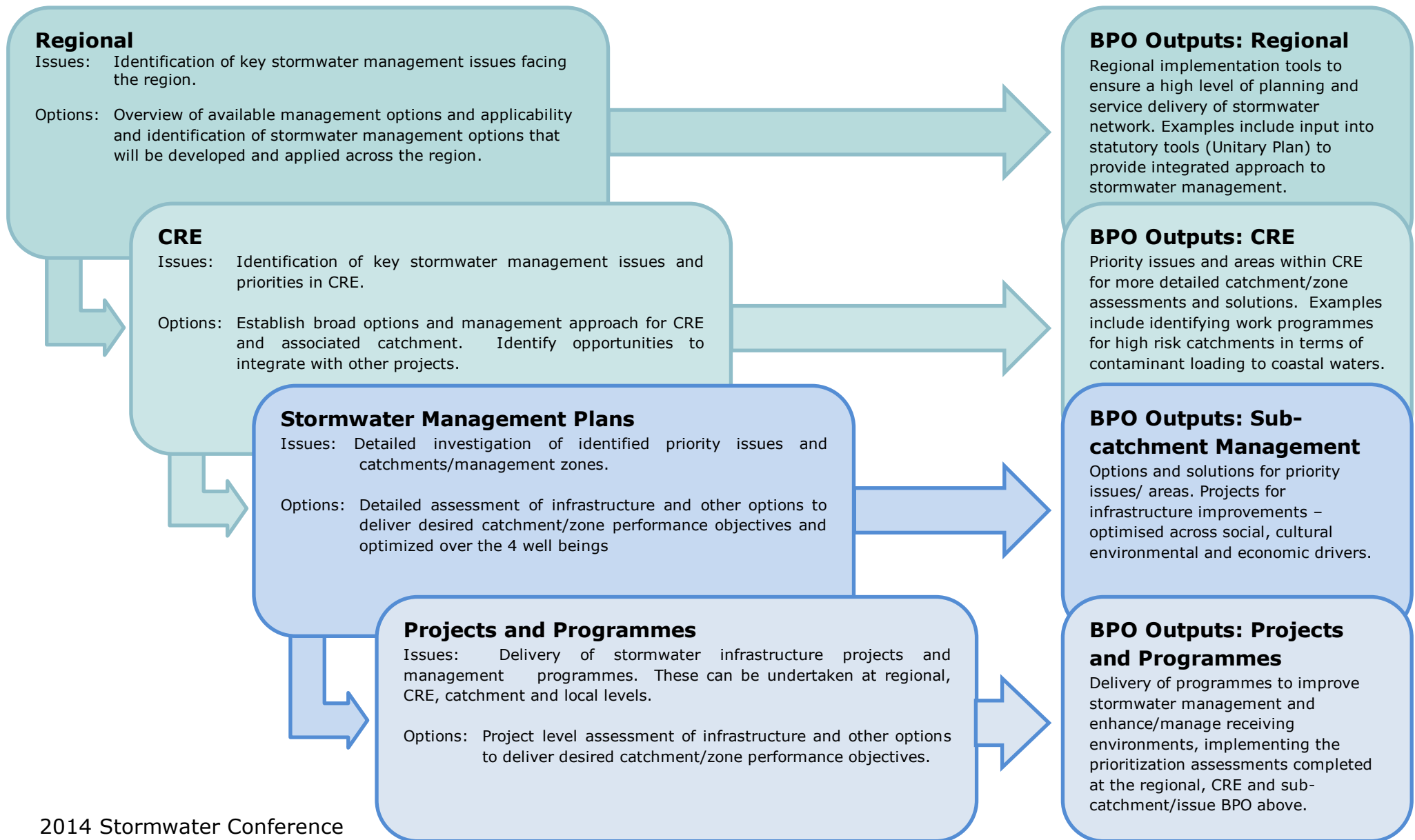


Figure 2: Proposed Four-tiered approach to BPO development and implementation



3 INCORPORATING CONTINUOUS IMPROVEMENT AND ADAPTIVE MANAGEMENT

A stormwater network is not static, but continues to evolve as development increases and improvements are implemented. Changes in stormwater flows will inevitably occur over time as a result of a range of activities including asset renewal and maintenance activities, the intensification of existing urban areas and greenfield development. In addition the priorities and methodologies for managing and minimising the effects of the environment from stormwater will also evolve with time, most notably through new information, changes in community expectations, and emerging technology and technical data.

As a result of this ongoing process of change and increased understanding, it is inevitable that the BPO for managing the adverse effects of the network must also evolve and adapt to ensure that it remains relevant. To enable continuous improvement and adaptation to occur, a cyclical, continuous improvement process of implementing the BPO is proposed (Figure 3). This is to be based on a six yearly review so as to align with the Long Term Plan (LTP) and Asset Management Plan (AMP) requirements of the Local Government Act.

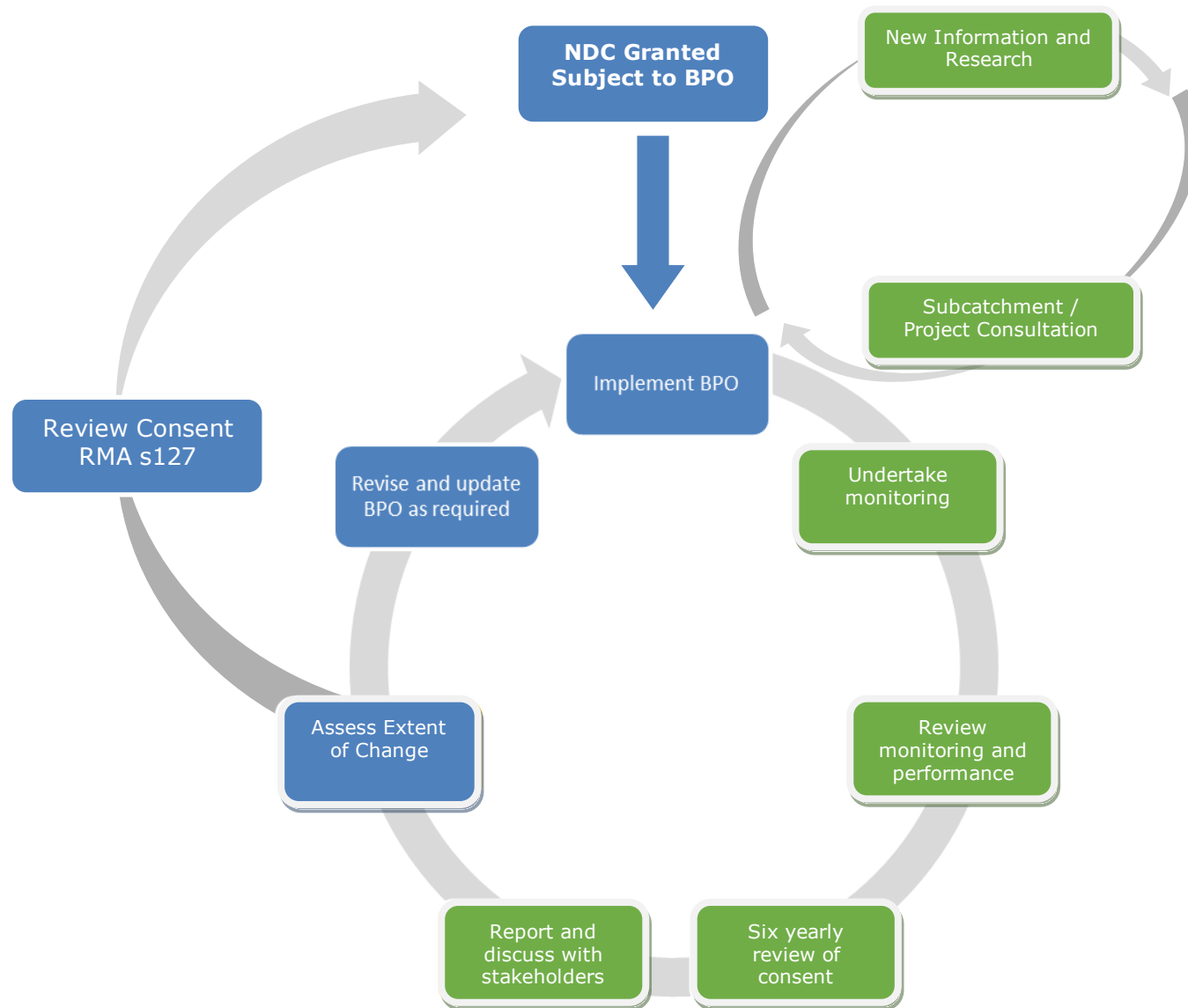
In order to accommodate this change, the proposed framework will incorporate three key mechanisms (highlighted in green in Figure 3):

- a) Fostering ongoing and meaningful relationships with key stakeholders,
- b) Enabling mechanisms for identifying and incorporating new technical information,
- c) Monitoring framework to assess whether improvements are being achieved.

Outcomes from each of these mechanisms will feed into the Council's stormwater levels of service, best practicable option assessments, and work programmes.

Providing flexibility within the resource consent needs to be balanced against the outcomes (preventing/minimising adverse effects) that are being delivered through the consent. That is, community priorities or new information may result in a change to the extent that the desired outcomes and associated consent obligations are no longer valid. For this reason the NDC Implementation and Review process includes an RMA consent review process, should outcomes deviate significantly from those anticipated through the consent.

Figure 3: Proposed NDC implementation and review processes



3.1 FOSTERING ONGOING AND MEANINGFUL RELATIONSHIPS WITH KEY STAKEHOLDERS

Stakeholder consultation is proposed at all four levels of BPO development and implementation depicted in Figure 2. In general terms, the regional and CRE level consultation will predominantly focus on identifying priorities for stormwater management, with consultation at the sub-catchment and project level primarily seeking feedback on specific solutions and projects identified to address those priorities. By engaging at all levels through well designed and focused consultation, the Stormwater Unit seeks quality engagement with stakeholders, with the aim of strengthening and consolidating the long term relationships needed for on-going catchment-based initiatives and environmental outcomes to be achieved, both by the Stormwater Unit and its key stakeholders.

In order to obtain an understanding of the high-level priorities of the Council with respect to stormwater priorities at the regional and consolidated receiving environment (CRE) level, it is proposed that stakeholders will be asked to provide feedback on two key questions:

1. *From the stormwater issues identified, what do you think are the **priorities** for the CRE and what must be most urgently addressed?*
2. *From the Council Stormwater Unit's responsibilities, what do you think are the **criteria** that council should use for selecting stormwater management priorities?*

These questions will be asked under the context that it is neither practically possible nor affordable to address all the negative effects of stormwater discharges, including existing effects. Therefore resources need to be directed to where the Council can make the most difference, in accordance with identified priorities. In this regard, the consultation outcomes will help to frame the high-level priorities for the stormwater management, from a stakeholder (cultural/ social) perspective.

Such a consultation exercise was recently completed for the Waitematā Harbour CRE, as a means of providing input and direction for the BPO to support the consent application. It is included here as an example of the possible type of consultation that could occur as part of the ongoing review process.

For the first question, stakeholders were requested to rank the seven key issues from 1 (being the highest priority) to 7 (being the lowest priority). The seven key issues were:

- managing growth,
- managing infrastructure/ assets,
- managing flooding (or the risk of flooding),
- urban stream management,
- contamination of the estuaries and harbour,
- managing stormwater discharges to groundwater, and
- stormwater effects on the wastewater network.

The second consultation question requested feedback on the criteria that guide how, through the NDC process, the Stormwater Unit selects its priorities for stormwater management in the CRE. Stakeholders were asked to rank the criteria as low, medium or high, and to also add any other criteria that they deemed important in selecting priorities.

A range of key stakeholder groups were identified, with recommended potential levels of consultation assigned in accordance with the classifications of the International Association for Public Participation (IAP2) public participation spectrum. Stakeholders were divided into four key categories: governance (including local boards, councillors and the Mayor’s Office), internal staff, external stakeholders and iwi.

As an example, for Waitematā Harbour CRE, 93 organisations and 16 iwi were identified as key external stakeholders, as listed in Table 1 (Ira, 2013). Stakeholders were directly informed of the process via emails, post or agenda reports. Attached to the letters and agenda reports was a consultation information pack which provided information on the stormwater issues and adverse effects to help inform input.

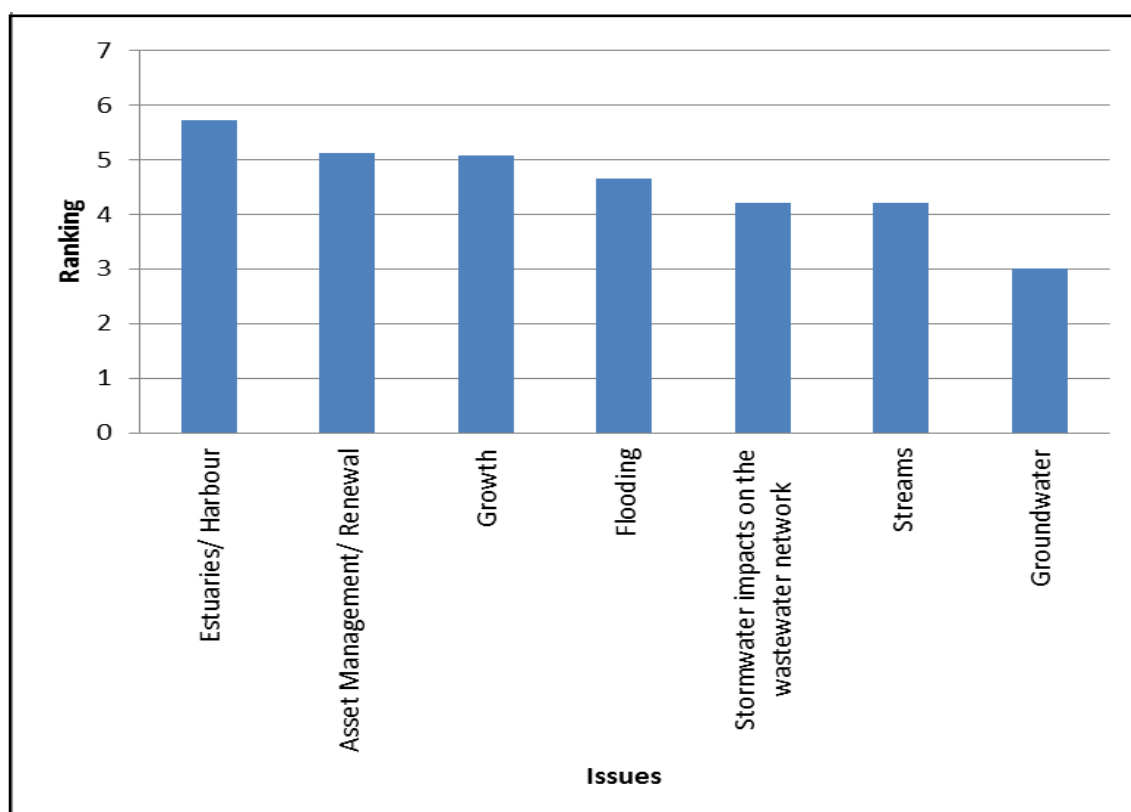
Table 1: Key external stakeholders consulted for the Waitematā Harbour CRE

Stakeholder Group	Identified Key Stakeholders	
Iwi	Ngati Wai	Ngati Wai
		Ngati Manuhiri
		Ngati Rehua
	Ngati Whatua	Ngati Whatua
		Te Uri o Hau
		Ngati Whatua o Kaipara
		Ngati Whatua o Orakei
	Waiohū-Tamaki	Te Kawerau a Maki
		Ngai Tai ki Tamaki
		Ngati Tamaoho
		Te Akitai-Waiohū
		Ngai Te Ata-Waiohū
	Marutuahu	Ngati Paoa
		Ngati Whanaunga
		Ngati Maru
		Ngati Tamatera
Network operators external to Council	NZ Transport Agency (NZTA) Auckland Infrastructure Forum (AIF) Kiwi Rail	

Stakeholder Group	Identified Key Stakeholders
Central government and other government agencies	Department of Conservation Hauraki Gulf Forum Ministry of Primary Industries Auckland Regional Public Health Service (ARPHS) Ministry for Environment Housing NZ Corp Ministry of Business, Innovation and Employment Institute of Environmental Science Research NIWA Defence Force
Environment and recreational interests	Environmental Defence Society Forest and Bird Protection Society Friends of the Earth Waitematā Harbour Clean-up Trust Sustainable Coastlines NZ Recreational Fishing Council Legasea Underwater specialist NZ Underwater Association Yachting New Zealand 40 yachting, sailing or boating clubs in Auckland
Community interests	Auckland Community Development Alliance
Business interests	Employers and Manufacturers Association (EMA) Property Council Auckland Chamber of Commerce Marinas(Bayswater Marina, Hobson West Marina, Pier 21 Marina Centre, Viaduct Harbour Marina ,Westhaven Marina, Viaduct Harbour Marine Village, Orakei Marina Development) Marine Transport Association: Sea Link, Fullers Ferries, Auckland Coastguard

Figure 4 depicts the feedback received on the first consultation question, and highlights that contamination of the Waitematā Harbour and its estuaries was considered the highest priority and to be most urgently addressed. This was followed closely by asset management, and addressing growth and flooding. However, there is not a large difference between the highest and lowest ranked issue, reflecting the diversity of interests represented by the stakeholders.

Figure 4: Prioritisation of stormwater issues for the Waitematā Harbour CRE consultation process



Feedback on the second consultation question, relating to criteria that the Stormwater Unit should use to prioritise expenditure on each of the identified issues, was more varied and is summarised briefly in Table 2 below.

Table 2: Consultation feedback on criteria for prioritisation of expenditure in the Waitematā Harbour CRE

Issue	Feedback
<i>Growth</i>	Managing effects from future development in greenfield areas and sensitive receiving environments is important. In addition, with respect to infill and intensification, council identified priorities rank as the highest criterion for prioritisation.
<i>Asset management</i>	Asset condition and criticality is the key criterion that should be used to prioritise asset management expenditure. In addition, discussions at the workshops indicated that understanding existing conditions and performance of assets is critical to their management.

Issue	Feedback
<i>Flooding</i>	68% of respondents ranked “flooding occurrence” as a high criterion for prioritisation. Redevelopment opportunities and multiple benefits of flooding projects were also ranked fairly high. Existing flooding and damage, and cost to manage flooding issues were of medium importance.
<i>Urban stream management</i>	The “opportunities to leverage outcomes” criterion was ranked highest (70%), followed closely by existing ecological values (64%) and ease of intervention (52%).
<i>Contamination of the estuaries and harbour</i>	Contaminant loads and dispersal, and marine ecology are the two highest criteria. These two criteria are closely linked with existing contaminant levels, as those areas that have high loads tend to have high sediment concentration levels and a corresponding negative effect on marine ecology. The rankings therefore indicate a focus on ensuring highly degraded areas are remediated and relatively “clean” areas are protected from further degradation.
<i>Groundwater</i>	Treatment of disposed stormwater to ground is the highest ranked criterion. This mirrors feedback on the forms which suggested that there should be greater protection of groundwater resources from contaminated stormwater discharges, particularly where groundwater is being used for water supply purposes.
<i>Stormwater Effects on the Wastewater Network</i>	Public risk is the highest priority. Public health issues along the Waitematā Harbour waterfront area was identified as either a concern or a significant concern for all stakeholders.

These outcomes are in the process of being incorporated into the Stormwater Unit’s prioritisation processes, work programmes, and BPO assessments, as will the outcomes of consultation for the other CREs as they are completed (the Greater Tamaki, Hauraki Gulf Islands and Manukau are currently underway). This initial consultation exercise will form the baseline for future consultation to be undertaken at regular intervals, which will then feed into the review cycle outlined in Figure 3. The scope and stakeholders involved will be reconsidered during each review cycle, based on willingness to participate, ongoing levels of engagement and funding.

3.2 ENABLING MECHANISMS FOR IDENTIFYING AND INCORPORATING NEW TECHNICAL INFORMATION

A fundamental element of the proposed BPO is on-going research and investigation, in particular the filling of significant information gaps that may influence management priorities. Issues that have been identified as requiring increased understanding to inform the BPO will be included under the Stormwater Unit works programme as areas of further research. This will include working collaboratively with the Council’s Research, Investigations & Monitoring Unit (RIMU) and other entities undertaking research (e.g., universities and crown research institutes). As an example, current gaps identified during the technical assessments of the Waitematā Harbour CRE are summarised in Table 3.

Table 3: Key information gaps currently identified for the Waitematā Harbour CRE

Issue	Identified Gaps
<i>Growth</i>	Continued monitoring with accessible and standardised records of remedial works, which describes what was done, where and when it was done, who did it, and what the outcome was, to inform best practice in water sensitive design.
<i>Asset Management</i>	<p>Continue to collect and input data in the GIS stormwater asset database.</p> <p>Continue to assess the criticality of stormwater assets across the region.</p>
<i>Flooding</i>	Continue to refine the number of flooded floors across the region, particularly for smaller flood events such as the 10 and 20 year.
<i>Urban stream management</i>	<p>Assess the role of streams and the stormwater network as a conduit for litter.</p> <p>Review the distribution and quality of inanga spawning habitat.</p> <p>Undertake surveys of the priority streams that have not been fully assessed, e.g. streams walks.</p> <p>Obtain further information on natural and created wetland locations, quality and values.</p>
<i>The Waitematā Harbour and estuaries</i>	<p>Other contaminant sources to the Waitematā Harbour CRE need to be confirmed, and the combined influence of stormwater and other contaminant sources on local and broader patterns of coastal contamination need to be determined.</p> <p>The Waitematā Harbour model needs to be up-dated to incorporate the: landuse changes that have occurred since 2003; revised patterns in future growth enabled through the Unitary Plan; Unitary Plan provisions for contaminant management; contaminant loads from other sources; longer time series of contaminant monitoring data; and, the natural phasing out of galvanised steel roofs.</p> <p>The effects of litter on the coastal environment.</p> <p>Technical developments related to contaminants of emerging concern.</p>
<i>Groundwater</i>	<p>The factors influencing groundwater chemistry in the urban basalt aquifer, and the relative importance of stormwater discharges.</p> <p>Trends in groundwater quality within the urban basalt aquifers.</p> <p>The implications of "elevated" groundwater metal concentrations in basalt areas.</p>

As part of the regional BPO, these areas as well as other gaps identified by the Stormwater Unit, are in the process of being submitted into the works programme for further assessment and prioritisation under available funding levels. It is a proactive programme, with the end aim of improving information on key stormwater management areas to help better prioritise and target mitigation.

3.3 MONITORING STRATEGY

Structured monitoring is essential in the review and refinement of the BPO. This will be implemented through the development and implementation of a region wide monitoring plan, building on environmental monitoring currently undertaken by RIMU as well as within the Stormwater Unit.

However measuring stormwater outcomes is a complex issue, not only due to the number of internal Council and external stakeholders contributing to stormwater effects and solutions, but also due to the dynamic nature of receiving environments, and the often significant timeframe between actions and environmental response. The key question is how can the Stormwater Unit determine if it is achieving what it sets out to do and if those actions have made a difference to environmental outcomes?

As a result, an "Orders of Outcomes" (Olsen, 2003) approach is being proposed as a way to provide a clear link between the vision and the outcomes that the Council is trying to achieve, and the actions that it will need to take to get there in a logical and structured way. The Orders of Outcomes approach recognizes that achieving tangible change in higher level outcomes (such as positive receiving environment response) is a step wise process. Some environmental improvements, such as improved water or sediment quality, can take decades to materialise, and are the end result of a series of actions and interventions before measurable benefits are observed.

Determining whether the desired outcomes are "on-track" to being achieved requires monitoring and evaluation across the range of outcome levels and, importantly, of the 'actions' or 'interventions'. The monitoring strategy therefore contains requirements across the multiple levels of outcomes, not just measurable changes in the environment, to assess whether progress is being achieved and, importantly, ensure that information is collected in the short-medium term as an indicator of the longer term responses sought. Collecting and reporting on representative information at all orders of outcomes will enable the Stormwater Unit, Auckland Council, and its stakeholders to review and evaluate whether work programmes are being implemented and are effective both in the short-medium term, as well as identify where improvements can be made.

In line with the approach of Olsen (2003), the monitoring strategy proposed has four Orders of Outcomes, as follows:

- 1st Order:* *Enabling conditions that must be in place for higher level outcomes to be achieved.* This captures the tools, processes, planning provisions, funding, etc. necessary to deliver higher level outcomes are in place.
- 2nd Order:* *Observable changes in uptake or practice.* This entails observable changes in uptake or practice, for instance adoption of regional standards, improved stormwater management etc.
- 3rd Order:* *Measurable changes in the social, cultural, environmental and economic state.* This encompasses measurable changes in the social, cultural, environmental and economic state through monitoring; e.g. reduced flooding, improved water quality and other community and environmental outcomes.

4th Order: The vision. Achieving the 1st-3rd Order outcomes above demonstrates how the vision or objectives are being met.

A theoretical example of how the Order of Outcomes approach can be applied to the monitoring of streams is highlighted below. It is intended that as part of the completion of the consenting framework, these criteria will be reviewed and refined for streams, as well as similar criteria put forward for the remaining issues of growth, flooding, asset management, groundwater, harbours and estuaries and stormwater effects on wastewater network.

Table 4: Example Order of Outcomes Approach for Monitoring of Streams

1st Order – Enable
<p>Regional forward works programme to protect and enhance amenity and other values of our waterways developed and maintained in accordance with LTP and AMP funding provisions.</p> <p>Priority streams for enhancement and restoration opportunities identified.</p> <p>Community involvement encouraged through environmental programmes (Sustainable Catchments, Waicare, EnviroSchools)</p>
2nd Order: Observable Implementation of Programmes
<p>Number of works projects delivered in accordance with regional forward works programme to protect and enhance amenity and other values of our waterways.</p> <p>Number of community environmental programmes led or supported.</p>
3rd Order: Measurable Changes in Environment and Community
<p>Water Quality Monitoring of Streams (metals, temp, DO, nutrients, microorganisms, and TSS)</p> <p>Number of people involved with / attended environmental programmes on annual basis</p> <p>Stream Ecological Surveys and Habitat Quality (Macroinvertebrate Community Index and Stream Ecological Valuation)</p> <p>Flow Rates (base and peak flow rates/volumes)</p> <p>Erosion (length of stream bank km, number of outfall identified with erosion issues)</p> <p>Stream Loss / Daylighting (total length of regions stream (km))</p>
4th Order: The Vision
<p>Stream, groundwater and coastal water values are maintained and enhanced and communities are connected with them.</p>

As always, there is a trade-off between the amount of monitoring that is desired/ideal and cost/resource commitment of doing so. Monitoring will therefore focus on using the information from existing programmes, that often have a wider purpose, and the use of regional representative and measurable indicators. This aspect of the programme continues to evolve as the key issues and approaches continue to be developed.

3.4 REVIEW AND RESPONSE PROCESSES

As depicted in Figure 3, the process is then to implement a review that incorporates the results of the monitoring and stakeholder feedback, to assess whether the Stormwater Unit is on-track to achieve the desired outcomes, and whether the new stakeholder feedback or information received triggers further refinement or even a change in approach.

The review process depicted in Figure 3 provides for an assessment of change and the refinement of the BPO within bounds established within the resource consent. However, a major change may trigger a requirement to change the conditions of consent to give effect to a new direction or significantly different priorities. This recognises that while flexibility is essential to the effective implementation of a NDC, there are bounds to ensure that the statutory obligations of the resource consent are not compromised. It is anticipated that, if required, this would be proactively undertaken by the Stormwater Unit via a RMA s.127 review.

4 CONCLUSIONS

Managing and minimising the effects of the urban stormwater network must account for diverse variables and interactions including the existing and future network, the nature and sensitivity of the receiving environment(s), stakeholders' views and inputs and the practical realities of operating and developing a major network at a region-wide scale.

It is not a static process. As the city grows, new information is made available, and community priorities and expectations change, processes are needed for informing, updating and refining the management approach within the context of the BPO as provided for by the Auckland regional plans and the PAUP.

As part of its NDCs, the Stormwater Unit is proposing quality engagement with stakeholders, the review of new information, and monitoring and research as mechanisms to capture these changes. This is then utilised in review processes to help refine the BPO within the bounds provided for in the consent or to amend the NDC if necessary in response to a significant change.

As the consent application for the city's urban network infrastructure is processed and the consent implemented, it is anticipated that these processes themselves will be refined. Therefore the processes outlined here are, and will continue to be, 'work in progress'. Nonetheless they form the building blocks of ensuring that the network discharge consent adapts and remains relevant for decades to come.

ACKNOWLEDGEMENTS

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