

GUIDEANCE DOCUMENT 04 LOW IMPACT DESIGN MANUAL FOR THE AUCKLAND REGION: CHALLENGES AND SOLUTIONS TO IMPLEMENTING LID

Hayden Easton, Auckland Council.

Mark Lewis, Boffa Miskell Ltd.

Jane Puddephatt, MWH New Zealand Ltd.

ABSTRACT

This paper provides a brief synopsis of the new Auckland Council 'Guidance Document 04', the update to Technical Publication 124 'Low Impact Design Manual for the Auckland Region'. The paper specifically highlights and discusses the new elements captured within the document.

One of the most significant changes made to Technical Publication 124 is an upfront evaluation of the perceived challenges to Low Impact Design (LID) implementation, as identified by interviewed stakeholders. These challenges have been ordered into five key themes: policy planning; leadership; knowledge, skills and collaboration; economics; and construction, operation and maintenance. A complete breakdown of these five themes is provided.

The project team has examined potential mechanisms to overcome these challenges, which includes case studies where solutions have been implemented in New Zealand and internationally. Key points of this discussion are provided in the paper.

KEYWORDS

Low Impact Design, Technical Publication 124, Guidance Document 04

PRESENTER PROFILE

Hayden Easton is a Stormwater Technical Specialist with the Auckland Council. He has ten years professional experience as a research scientist, environmental monitoring officer, and stormwater advisor/specialist. His current role with the Auckland Council involves: Low Impact Design, Integrated Catchment Management Planning, stormwater research and monitoring.

1 INTRODUCTION

The Auckland Council has provided guidance for Low Impact Design (LID) through Technical Publication 124 (TP 124) 'Low Impact Design Manual for the Auckland Region' (ARC, 2000). TP 124 outlines the LID philosophy, provides principles for LID and guides practitioners as to how to implement LID within development.

Published in 2000, TP 124 is currently being updated by the Auckland Council. The updated document will be referred to as Guideline Document 04 (GD 04), with the same title as the previous TP 124. The rationale for updating TP124 was:

- TP 124 was published in 2000. Since this time, significant research and knowledge of LID has been built on.
- The application of TP 124 guidance to brownfield environments was previously perceived to be difficult by LID practitioners, but is now becoming more common practice.
- The definition of LID within TP 124, led numerous practitioners to believe that LID was primarily the installation of 'green' stormwater devices, rather than an integrated design approach.
- Practitioners had requested recognition of challenges to LID and identification of the potential mechanisms to improve the rate of LID implementation.
- There was a need to incorporate other advancing design practices such as urban design, and crime and injury prevention within the principles of LID.

GD 04 will be structured in three distinct volumes. The proposed volumes include the following:

- Volume One - Principles
 - Includes LID principles, drivers, and challenges and solutions.
- Volume Two - Practice
 - Parallels the design process to implement LID in across a range of environments.
- Volume Three – Case Studies
 - LID case studies.

The audience anticipated for each volume may differ, therefore guidance provided in each volume are tailored. The following discussion outlines a brief synopsis of each volume within GD 04. A more detailed focus on the LID challenges and solutions from Volume 1 is also provided.

2 GUIDANCE DOCUMENT 04 CONTENT

2.1 VOLUME ONE

Set to serve as an introduction to GD 04, Volume One defines LID, discusses the principles and drivers of LID, and the challenges and solutions for its implementation (figure 1).

VOLUME ONE: LOW IMPACT DESIGN PRINCIPLES



Figure 1. An illustrative depiction of the structure for GD 04 Volume 1.

Volume One is likely of interest to policy planners, regulators, and those preparing related materials on stormwater management. Information and discussion is therefore provided at a high level to cater for this wide ranging audience.

2.1.1 LID DEFINITION AND PRINCIPLES

As previously discussed, the current definition of LID contained within TP 124 has created a misconception in some sectors as to what LID is. Too often practitioners identify LID as the implementation of 'green' infrastructure, rather than as an integrated design approach to land development and stormwater management.

When redefining the definition for LID, the GD 04 project team set a series of priorities which were deemed a necessity to represent. These were: to eliminate current confusion between device and design approach, identify that successful LID implementation requires an inter-disciplinary team, that LID can be achieved on multiple scales, and incorporates the principles of LID.

The proposed definition of LID within GD 04 is:

'Low Impact Design is an inter-disciplinary design approach to stormwater management that operates at complementary scales of the region, the catchment, and the site for planning and land development.'

'Low Impact Design seeks to protect, enhance, and ultimately utilise natural systems and processes for enhanced stormwater management, ecosystem services, and community outcomes'.

The principles for LID have been refined in GD 04 to allow each principle to be more explicit in its expectations. The proposed LID principles for GD 04 are:

- Promote inter-disciplinary planning and design.
- Protect the values and functions of natural ecosystems.
- Avoid stormwater effects or manage them as close to source as possible.
- Utilise natural systems and processes for stormwater management.

An obvious difference in comparing the above principles to TP 124, is that TP 124 had five principles. The difference has resulted from combining the TP 124 principles 'Achieve multiple objectives' and 'Integrate LID early in the design process', into 'Promote Inter-Disciplinary Planning and Design'. Rational for this were:

- To enable the promotion of an inter-disciplinary planning and design approach, it would inherently involve the inclusion of many disciplines and therefore achieve multiple outcomes.
- If successful promotion of inter-disciplinary planning and design were to occur, this would also intrinsically mean that LID objectives would have to be considered early in the design process.

Similarly, the TP 124 objectives 'Prevent rather than Mitigate' and 'Manage stormwater close to the point of origin as possible' have been combined into 'Avoid stormwater effects or manage them as close to source as possible'.

A new principle 'Protect the values and functions of natural ecosystems' has been provided. This new principle is set to provide a greater emphasis for the preservation of natural ecosystem function within land development. As examples, this can be in reference to the preservation of streams and their flood plains, riparian margins, wetlands, existing vegetation, fertile well drained soils and other natural ecological systems.

2.1.2 LID DRIVERS

This section of Volume One provides discussion of the principle drivers for LID in the Auckland region. These focus on areas that influence LID principles and practice, and directly benefit from LID implementation in the region. LID drivers include:

- Stormwater runoff volumes.
- Stormwater quality.
- Protection and enhancement of soils.
- Protection and enhancement of ecosystems.
- Community outcomes for stormwater management.
- Spatial planning.
- Economics.

2.1.3 CHALLENGES AND SOLUTIONS TO LID

Discussion of this section of Volume One is provided in section 3 of this paper.

2.2 VOLUME TWO

Volume Two provides guidance to land developers and their consultants to enable the implementation of LID in a range of environments. The structure of Volume Two (Figure 2) emulates the conceptual design process for land development. Earlier sections of Volume Two focus on site assessment and preparing a spatial framework. Later chapters set stormwater objectives and develop LID concepts.

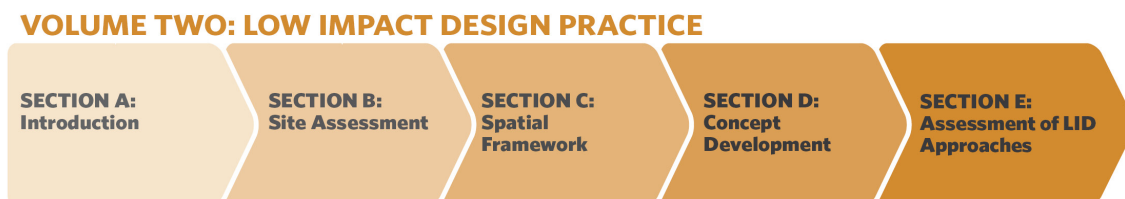


Figure 2. An illustrative depiction of the structure for GD 04 Volume 2.

2.2.1 SITE ASSESSMENT

Site assessment captures the attributes and broader context of the site to map constraints and opportunities and determine appropriate land use patterns. Site assessment also highlights the relevant regulatory issues, providing a foundation to enter pre-application discussions and to meet statutory requirements in a manner that is most appropriate for site conditions.

2.2.2 SPATIAL FRAMEWORK

A framework which provides for preliminary design layout and potential land-use typologies based on appropriate development forms and a supporting environmental framework. The spatial framework approach for LID implementation was first demonstrated by Seyb and Lewis (2008).

2.2.3 CONCEPT DEVELOPMENT

The concept development phase advances the work of the spatial framework providing feasible development options to be reviewed by the project team. The concept phase advances LID principles through the application of specific stormwater management responses. Responses relate to the natural sequence of stormwater management within the catchment, including:

- Reducing stormwater runoff.
- At source treatment.
- Filtering and conveyance.
- Bioretention.
- Detention.
- Enhancing the receiving environment.

2.2.4 ASSESSMENT OF LID APPROACHES

An assessment framework is provided to track LID performance during design development, a means to monitor, assess, and adjust LID approaches through staging of operational phases, or as an assessment tool to promote pilot projects and future best practices.

Assessment can be made against known criteria, such as national standards or environmental accreditations (e.g. Green Star NZ, Leadership in Energy & Environmental Design (LEED)). However, if no criterion is applicable, the framework provides an assessment against a set of qualitative and quantitative indicators based on the approaches promoted by GD_04.

2.3 VOLUME THREE

Volume three provides a range of case studies that demonstrate the application of LID in a range of environments. The volume utilises a web portal (at the time of writing <http://cs.synergine.com/>) which has been developed through the FRST (Foundation for Research, Science and Technology) funded research programme Low Impact Urban Design and Development (LIUDD) (Landcare Research and the University of Auckland).

The web portal is a mechanism to provide information and examples of LID implementation across policy development, concept design and implementation processes. Case studies are sourced nationally and are regularly updated, therefore a range of topics and discussion is provided. Figure 3 illustrates the introduction page to the web portal.

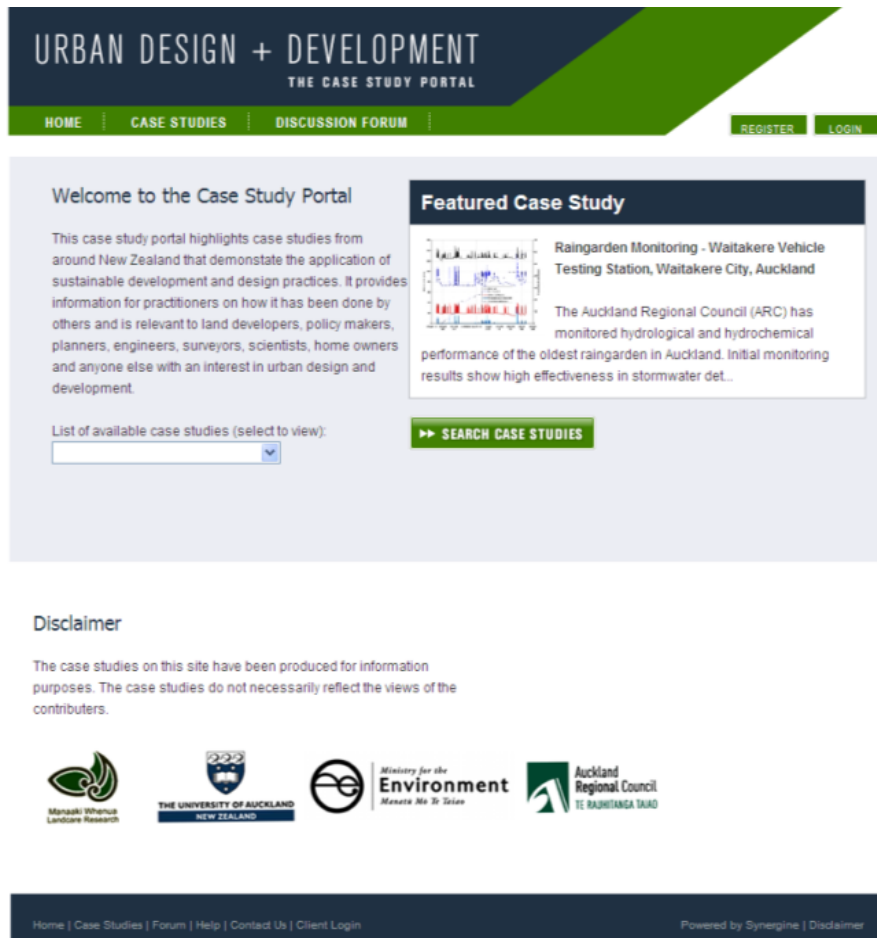


Figure 3: Snapshot of web portal introduction page

The structure of each case study is grouped into specific sections:

- Strategy.
 - Context.
 - Strategic overview.
- Design.
 - Project approach.
 - Technical innovation.
- Outcomes.
 - Outcomes to date.
 - Issues to consider.
 - Key lessons.
 - Key information.

This structure was developed to specifically to direct users to the most relevant information for their needs.

3 LID CHALLENGES AND POTENTIAL RESOLUTIONS

As previously outlined, Volume One provides a discussion on the challenges of LID implementation. Examples of how these challenges can be resolved are also provided.

The principles and practices of LID are not new and have been evolving over the past 25 years. Despite this, LID has only received limited consideration in mainstream planning and implementation of land development activities in New Zealand (Puddephatt and Heslop, 2007). Furthermore, Dempsey and Dixon (2005) note that whilst there have been some positive actions and intentions to pursue LID in New Zealand, research and experience shows that widespread implementation is hindered by a range of impediments.

Through existing literature and stakeholder engagement, five challenges to the implementation of LID were identified. These are:

- Policy planning.
- Leadership.
- Knowledge, skills and collaboration.
- Economics.
- Construction, operation and maintenance.

Stakeholder engagement identified examples where the subject challenge has been overcome. These were supplemented by a literature review. Preferences were for New Zealand based examples but in some instances international examples provided a preferred approach or more detailed information.

The following provides a breakdown of challenges and examples of mechanisms to overcome them.

3.1 POLICY PLANNING

Many land developers claim planning and consent approval processes prevent LID approaches. The following provides specific areas where this might occur, identified by literature review and stakeholders.

3.1.1 LID integration with policies and plans.

In Auckland, the current policy framework seeks selection of stormwater management approaches by 'the best practicable option'. This approach is enabling for LID, as it does accommodate the 'four wellbeings' of the local government act and therefore provides for a holistic assessment.

However, it can be difficult to deliver integrated stormwater management approaches, where stormwater outcomes are driven by 'effects based' assessment criteria of the Resource Management Act.

3.1.2 LID policy incentives.

The challenge with developing policy incentives for LID is the difficulty in calculating the 'value' (economic or other) that LID provides, and therefore the appropriate nature or scale of incentive for LID implementation.

3.1.3 Integrated land use planning.

There are three key pieces of legislation which influence land use planning at the catchment and regional scale. These are the Resource Management Act (RMA), the Local Government Act (LGA), and the Land Transport Management Act (LTMA). A lack of integration between legislative processes can limit the recognition and realisation of multiple benefits to communities from LID approaches.

3.1.4 Aligning rules, guidelines, and engineering codes.

In some circumstances, conventional engineering design standards are the only reference for assessing compliance and consent approval. Enhancing discretion in engineering guidance and better aligning these with land use planning tools/processes will provide more opportunity to integrate LID design approaches and deliver site specific stormwater management solutions.

3.1.5 The pre-application process.

Recent amendments to the RMA limit the ability for Councils to request additional information to support resource consent applications and this has typically led to greater scrutiny of the proposal prior to lodgement. This presents an opportunity for greater discussion in the development concept design and pre-application phase of a project and the discussion of a preferred design approach, such as LID, prior to lodging a consent application.

3.1.6 Consent approval.

LID design approaches can incur time delays in the approval process, and may lead to increased costs and risk of litigation for the applicant when they differ from 'standard' practice. This can be due to limited understanding or acceptance of LID approaches by regulatory approval officers and the use of conventional engineering design standards to guide approvals.

3.1.7 Solutions.

Approaches that could be pursued to address the policy planning challenges identified above include:

- Integrating or enhancing reference to LID principles in policies and plans.
- The development of rules to allow flexible design approaches, including lot layout, land use zoning, and building practices if they adhere to LID and urban design principles.
- Active discussion between regulatory approval teams, policy planners, and technical staff to ensure regulatory plans are practical and can be effectively implemented.
- Review council infrastructure and reserve contributions policies to identify opportunities to incentivise LID.
- Provide for market incentives to land developers, such as increased yields from clustered development.

- Provide a mechanism for broader LID objectives relating to landscape, ecology, and urban design are integrated with regional policy frameworks for open space, growth, and infrastructure.
- Review and update engineering manuals to integrate LID principles and approaches
- Establish an 'Advisory Panel' to inform LID approaches during concept design and pre-application stages of development. This could provide 'pre-approval' for design and enhance efficiency of the consenting process.
- Improving knowledge of LID across regulatory approval teams.
- Introduce targeted processes for consent applications that incorporate LID (e.g. fast tracking LID consent processes, or providing LID applications managers).

3.2 LEADERSHIP

Leaders and champions play a critical role in initiating and driving processes for change. Strong leadership and multiple advocates are critical in facilitating the uptake of LID. For successful leadership to occur, an enabling environment must also be evident, where resources are easily accessible and supported.

The following lists three challenges that must be acknowledged to provide an enabling environment for LID leaders and champions to succeed.

3.2.1 Advocates and leadership.

LID champions play an important role as advisors to political leaders. Providing awareness of LID at a consistent level of advocacy across political cycles and changes in leadership is essential for the success of LID.

3.2.2 Best practice examples.

'Conventional' stormwater management practices are seen as 'proven' technologies. It is therefore imperative that land developers are provided quality examples of LID implementation to address any perceived risks and demonstrate implementation. Best practice examples are also a means to inspire land developers for the beneficial outcomes of LID approaches.

3.2.3 Co-ordination and collaboration.

The principles of LID require collaboration between a range of professional disciplines to deliver quality outcomes and multiple benefits. For this reason, LID requires a co-ordinated and collaborative approach across council departments and between professional disciplines.

3.2.4 Solutions.

Within GD 04 many methods to overcome the challenges of leadership were identified, including:

- Define tasks and performance measures involving LID in the role descriptions of stormwater managers.
- Establish and implement LID education at internal (to council) and external forums.
- Develop LID networks to share knowledge and pursue collaborative initiatives.

- Introduce mandatory requirements for LID in public agency projects.
- Provide public demonstration projects with council assets and incorporate interpretive signs and materials.
- Provide for formal and informal opportunities to share knowledge between catchment planners, consent engineers, and infrastructure/asset managers.
- Provide decision-making tools in a single GIS platform across council departments.
- Develop public-private partnerships to engender discussion between council and the development community.

3.3 KNOWLEDGE, SKILLS AND COLLABORATION

An understanding of LID principles and the skills to deliver LID outcomes are critical for the effective implementation of the approach. These are required across professional disciplines and the community, particularly within councils and the development industry.

3.3.1 Council knowledge.

Due to the nature of council structures, there is often a limited opportunity for council staff to develop knowledge and gain practical experience across all phases of LID design, approval, implementation and maintenance. This often means developers must liaise with many council officers regarding one project which can be inefficient as it requires more time and resources.

3.3.2 Land developer and practitioner knowledge.

Within the public sector, LID implementation is still uncommon practice in land development and land use planning. It is therefore important to build on both the knowledge and skill base of the professional sector in order to provide for quality outcomes and reduce the risk of inadequate design or implementation.

3.3.3 Public knowledge.

Outreach activities and education materials on LID will increase awareness for the general public. In turn the public may become advocates for LID, changing market forces by seeking LID development and through their expectation of LID approaches in Council services.

3.3.4 Data and information.

There is a need for more widespread monitoring and evaluation programmes to provide quantifiable data to inform decision making and asset management for both traditional and LID approaches to stormwater management.

3.3.5 Misconceptions about LID.

As previously stated, LID is often confused with 'green infrastructure', rather than as an integrated design approach operating at multiple scales and based on broad environmental principles.

3.3.6 Solutions.

Approaches to overcome some of the above challenges require financial investment and time. Also, like any field of expertise, education and maintaining knowledge and skills requires ongoing implementation as the workforce, development sector, and communities

change and evolve. Below are a selection of the mechanisms identified to improve knowledge, skills and collaboration.

- Education and awareness initiatives to enhance political and regulatory understanding of LID (e.g. seminars, 'brown bag' presentations, short courses, field days etc).
- Establish a LID 'task force' to operate across regulatory and asset management departments to identify LID opportunities and support teams in delivering quality LID solutions.
- Establish and facilitate professional networks and tools for sharing information, experiences, lessons and best practice on LID.
- Develop a comprehensive LID education course for policy and practice.
- Establish a national LID conference to facilitate knowledge sharing across industry professionals.
- Install 'interpretive signs' alongside LID practices in public spaces to enhance community understanding of LID principles, practices, and values.
- Promote community initiatives that will engage the public in LID activities (e.g. information field days, catchment planning options assessments, walking tours, planting days etc).
- Include information on property titles explaining LID approaches and stormwater devices on their and adjacent properties.
- Develop and implement monitoring and evaluation programmes for LID (Feeney, 2009 – see this reference for discussion on this topic).
- Develop a clear definition and set of principles for LID.
- Acknowledge mistakes, identify failures, and use the experience to improve future LID projects.

3.4 ECONOMICS

Clearly there is a cost associated with increasing system complexity and performance, but there is also an increase in value that LID approaches can add to urban and natural environments. The understanding of costs versus benefits is complex, but there is a need to recognise both value and cost when assessing LID options for stormwater management.

A significant challenge in describing the true cost and value of LID structural techniques is the difference in accounting systems used for assessing traditional infrastructure and an LID approach. Investment in stormwater infrastructure is often based on 'cost effectiveness' for a given level of service. This methodology fails to account for non-financial values or multiple benefits provided by a LID approach (e.g. environmental quality, amenity) (Vesely, 2009).

3.4.1 Determining cost and benefits across asset groups.

Because LID can provide multifunctional outcomes, it can be challenging to estimate capital and operational costs for LID when the approach is managed across a range of functional budgets (e.g. roads, parks, stormwater, and private property).

3.4.2 Attributing value to LID.

It can be difficult to quantify the environmental and 'ancillary' benefits of LID (e.g. amenity, safety, recreation, environmental quality) in economic terms to inform conventional cost/benefit analyses. This can be due to the limited availability of nationally relevant data on non-market values of LID and the time required to inform a meaningful analysis.

3.4.3 Cost of interdisciplinary planning and design approaches.

Iterative and inter-disciplinary design can be perceived as time consuming and therefore costly for developers who take an LID approach. This can be due to the amount of time taken to obtain regulatory approval prior to any perceived development right. This may impact on investment obligations such as loan repayments and the potential impact on variable market values.

3.4.4 Resources and funding mechanisms.

It is recognised that there is a need to investigate and identify appropriate funding mechanisms to support long term stormwater management across the region (Price Waterhouse Cooper *et al.* 2004).

3.4.5 Solutions.

Within GD 04 many methods to overcome the challenges of economics were identified. Below provides a small sample of these:

- Collection and collation of cost data for LID approaches (planning, capital and operational expenditure) to inform decision making as a condition of Council LID incentives or grants.
- Continue to develop and promote comprehensive stormwater costing tools (i.e. Landcare Research COSTNZ).
- Demonstrate the value of LID approaches for developers and community through real estate case studies and other repeatable and comparative metrics.
- Undertake value assessments and 'willingness to pay' surveys for urban water improvement activities to identify interest and support for improvement activities and build a political mandate for LID.
- Expedite and/or subsidise LID appropriate development approaches through appropriate policy incentives and the consent approval process.

3.5 CONSTRUCTION, OPERATION AND MAINTENANCE

The key to designing effective stormwater systems is to ensure an integrated approach to design that considers ongoing operation and maintenance (Puddephatt and Heslop, 2008)

3.5.1 Timing and phasing of development.

LID devices can be damaged during site development when implemented early without adequate protection. This can lead to significant remediation costs and in some case reinstatement of the entire LID device.

3.5.2 Quality assurance of construction.

The construction of LID involves multiparty participation which can add complexity to the contractual relationships developed for project delivery. The perception of risk of failure and associated liabilities (professional and financial) among stakeholders can potentially lead to high costs for implementation (Olorunkiya, J. *et al.*, 2010).

3.5.3 Ownership and liability.

It is important to identify who will be responsible for the operation and maintenance of LID devices following installation. These parties should be involved early in the design process to participate in decisions that will influence the ability to effectively operate and maintain the device.

In instances, private property owners can be unaware of the presence of LID devices when purchasing a house or section and surprised when informed of their responsibilities for operation and maintenance.

3.5.4 Solutions.

The challenges with construction, operation and maintenance are very demanding. These challenges are what the general public can see. Without recognising and addressing these challenges, a public perception that 'LID devices fail' can be created. This is then usually followed by the inevitable decommissioning of the device and loss of support for a LID approach. The following are a small sample of the approaches to help overcome the construction, operation and maintenance challenges.

- Develop methods to protect LID practices between installation and completion of small site developments.
- Prepare and enforce small site controls to minimise the risk of damage to LID approaches.
- Establish certification processes for contractors installing LID devices, and site inspectors responsible for approving LID devices once installation is complete.
- Involve designers in the supervision of construction for the installation of LID devices to ensure correct implementation is undertaken according to design and site conditions.
- Determine the long term owner (e.g. council asset manager, site owner) of LID devices and involve them in the LID design process.
- Establish a formal asset 'hand over' process for LID practices to ensure they are designed to specification and operating appropriately before transfer of ownership.
- Detail LID device and maintenance requirements on the council property file and Land Information Memorandum (LIM) for private property.

4 GUIDANCE DOCUMENT 04 STATUS

At the time of writing, GD 04 is currently in a draft status. Preliminary drafts have undergone review and comments have been incorporated. The current draft is anticipated to be sent to external technical working groups for comment in the near future. Simultaneously, the draft will also to be sent for international peer review for comment. The international peer review is primarily to assess the consistency of GD 04 with international best practice.

The finalisation and publication of GD 04 will occur once comment has been received and incorporated.

5 CONCLUSIONS

The update to Technical Publication 124 has been occurring for a number of years. Preliminary work such as Seyb and Lewis (2008) and Lewis *et al.* (2010) were undertaken to fill recognised gaps as identified by Auckland Council. Since the completion of these technical reports, a significant amount of internal (Auckland Council) and external engagement has occurred. This engagement has further refined the content of Guidance Document 04.

Whilst positive actions towards improving the amount of LID implementation in the Auckland region have occurred, challenges are still apparent for practitioners. This paper summarises these challenges into five key themes. Potential responses to these challenges have been provided. From the outcomes provided in GD 04, it is intended that developer's expectations for Council and the industry to facilitate LID can be better realised, and in consequence, allow a greater implementation of LID to be achieved.

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