

ACT AUDITOR–GENERAL’S REPORT
ACCEPTANCE OF STORMWATER ASSETS
REPORT NO. 1 / 2018

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Audit Team

Brett Stanton

Katinka Mutandadzi

Resolution Consulting Services (John McWilliam)

The support of Sophie Butler-Stratton and David Kelly is appreciated.

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The Speaker
ACT Legislative Assembly
Civic Square, London Circuit
CANBERRA ACT 2601

Dear Madam Speaker

I am pleased to forward to you a Performance Audit Report titled 'Acceptance of Stormwater Assets' for tabling in the Legislative Assembly pursuant to Subsection 17(5) of the *Auditor-General Act 1996*.

Yours sincerely



Dr Maxine Cooper
Auditor-General
31 January 2018

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SUMMARY

Stormwater assets are the second largest asset class for the ACT Government after public housing. They are the largest class of assets administered by the Transport Canberra and City Services Directorate (TCCS) (40 percent), followed by roads (34 percent) and bridges (15 percent).

Stormwater management fulfils a number of important functions, particularly in flooding and drainage control, public health and safety and ecosystem health. It is important therefore that stormwater assets are well managed. This includes providing optimal stormwater management solutions for new suburbs, taking steps to ensure that stormwater assets in existing areas continue to be appropriate to changing needs and having a program for the ongoing operation and maintenance of stormwater assets.

While stormwater assets are ultimately owned and managed by TCCS, the acceptance of stormwater assets involves a number of ACT Government agencies.¹ These include the:

- Environment, Planning and Sustainable Development Directorate;
- Suburban Land Agency; and
- Chief Minister, Treasury and Economic Development Directorate, which manages both the construction of ACT Government civil infrastructure works and the Environment Protection Authority (via Access Canberra).

Overall conclusion

The ACT Government has set clear asset management objectives for accepted stormwater assets in various documents, in particular the *ACT Water Strategy 2014-44*. However, these objectives may not be met due to deficiencies in the asset acceptance processes and the management of accepted stormwater assets.

The acceptance processes are particularly deficient with respect to the design of stormwater solutions as these are negotiated between agencies who have competing objectives for stormwater assets. This process needs to be replaced by one focused on adopting solutions that achieve the overall stormwater objectives of the ACT Government. This would reduce the risk that accepted assets may not meet these objectives. The process for developing stormwater solutions would be further enhanced by increased catchment-wide planning and explicit consideration at the design stage of how to fund the maintenance of proposed assets. Options for such funding need to be explored.

¹ In this report, 'agency' is used to refer to government agencies and 'entity' is used when other non-government organisations, such as ActewAGL, are also involved.

Significant remediation costs for accepted assets have been incurred by the Territory as a result of third party damage that occurred following their acceptance. While there is a stormwater education program underway, this needs to be complemented by a multi-agency strategy that incorporates a range of actions that reduces third party damage. There is also an urgent need to review the condition of stormwater assets in established areas of Canberra that will enable an assessment of the Territory's future stormwater needs.

Governance that supports the acceptance of stormwater assets needs to be improved through improvements in agencies' risk management and performance reporting, and the updating of some codes and standards that guide the design and acceptance of assets.

Chapter conclusions

STORMWATER LEGISLATIVE AND REGULATORY FRAMEWORK

The asset management objectives for accepted stormwater assets are clearly articulated in ACT legislation and policy, which are adequately supported by legislative codes, design standards and procedures. While the stormwater asset design codes and standards comply with, and in some instances exceed, relevant national standards, they require updating in some areas. In particular, the *Estate Development Code* requires amendment to include detailed information on gross pollutant removal targets and the *Waterways Water Sensitive Urban Design Code 2009* and the stormwater design standards need to be updated to reflect changes resulting from new Australian Rainfall and Runoff Guidelines released by the Geoscience Australia.

The effect of these updated guidelines could have potentially significant implications for the management of stormwater in the Territory (such as an improved understanding of the ability of the existing and planned stormwater infrastructure to cope with expected rain events).

STORMWATER ASSET ACCEPTANCE PROCESS

The roles and responsibilities of agencies involved in the stormwater asset acceptance process are clearly articulated. However, each agency, by their very function, seeks a different outcome from the development of stormwater solutions. As a result, an agency-focused negotiation process currently determines what design is to be used and consequently what asset is accepted. This needs to be replaced with a process that focuses on the ACT Government's stormwater objectives, so that optimal stormwater solutions are achieved. Not having this process carries the significant risk that accepted assets may not achieve the ACT Government's stormwater objectives, as articulated in legislation and policy.

The process to identify optimum stormwater asset solutions is hampered by a lack of catchment-wide planning across the Territory and the explicit consideration of the costs of the

operation and maintenance of accepted assets. At the design stage, potential risks occur when agency advice is not sought, or provided, as part of the development application process.

ARRANGEMENTS FOR MANAGING ACCEPTED STORMWATER ASSETS

There is an urgent need to prevent damage to accepted stormwater assets caused by building and other construction activity, which has led to significant remediation costs being borne by the Territory. While a stormwater education campaign is currently underway, this needs to be complemented by the development and implementation of a coordinated multi-agency strategy to address the range of factors that contribute to third-party damage.

There is also an urgent need for a review of the condition of existing stormwater assets and the development of an augmentation program. There has been no comprehensive review of the existing stormwater network since its development, and there is a limited understanding of the impact that new infill developments will have on the ability of these assets to perform during significant rain events. A lack of a preventative maintenance program increases the risks associated with these assets.

Better information is needed to help inform the development of a preventative maintenance program and the performance of the stormwater network. Performance measures to report on the achievement of ACT Government stormwater objectives are also needed. These could be reported publicly via the Water Report.

Key findings

STORMWATER LEGISLATIVE AND REGULATORY FRAMEWORK

Paragraph

The *Territory Plan* and the *Planning and Development Act 2007* provide a sound framework for the consideration of development applications involving stormwater assets and compare well with the policies of other state and territory jurisdictions.

2.10

The *ACT Water Strategy's* three outcome statements align with the best practice principles of other states. Furthermore, the subject matter expert for the audit, Storm Consulting, considered that 'the *ACT Water Strategy* provides [a] clear and firm policy basis of best practice stormwater management which is backed by the *Territory Plan*'. However, to ensure that the Strategy's outcome objectives are achieved, careful ongoing implementation over the thirty year life of the Strategy is required.

2.18

The *Estate Development Code* is considered to be 'relatively progressive and close to best practice', but needs to include gross pollutant removal targets of 70-90 percent to bring it into line with Victoria, Queensland and NSW, provide clearer guidance to

2.28

developers and help to achieve the outcomes of the Government’s *ACT Water Strategy*.

Considering the strong environmental focus of the ACT Government’s planning policies, the *Waterways Water Sensitive Urban Design Code 2009* needs to be one of the most extensive codes and be integrated within the requirements of the *Design Standards for Urban Infrastructure—Stormwater*. However, water sensitive urban design has developed significantly since 2009 when the Code was implemented. As a result, the Code needs to be improved in a number of areas to provide more effective management of stormwater and be backed with more practical applications and lessons learned since it was first implemented. 2.31

The stormwater chapter of the *Design Standards for Urban Infrastructure* is a detailed and lengthy document, which primarily focuses on traditional drainage design. Transport Canberra and City Services plans to replace these in February/March 2018 with a chapter in the new Municipal Infrastructure Standards, a draft of which was issued for comment in November 2015. Storm Consulting noted that, while the current and revised stormwater design standards provide reasonable guidance, they are based on the 1987 Australian Runoff and Rainfall Guidelines, and will require updating to reflect the 2016 Guidelines. 2.33

While Transport Canberra and City Services plans to release a replacement for the Design Standards in early 2018, both the *Waterways Water Sensitive Urban Design Code 2009* and the *Design Standards for Urban Infrastructure—Stormwater* — will need to be further amended to reflect changes resulting from the 2016 Australian Rainfall and Runoff Guidelines. 2.40

There will also be an ongoing need to ensure that the two Codes are aligned. In this regard, there would also be merit in combining the *Waterways Water Sensitive Urban Design Code 2009* and the *Design Standards for Urban Infrastructure—Stormwater*. A unified stormwater design guideline, which does not segregate traditional stormwater design from sustainable water sensitive urban design, would help ensure that the environmental aspects of stormwater design were seen to be as important as the hard engineered components and provide better guidance to designers. 2.41

STORMWATER ASSET ACCEPTANCE PROCESS Paragraph

The *Planning and Development Act 2007* requirement that deems all development applications as approved, unless agency advice indicating otherwise is received within 15 days, leaves the Territory at risk that inappropriate stormwater assets may be constructed and subsequently accepted. As a developer will have received design approval via the development application process, it may be difficult for Transport 3.20

Canberra and City Services not to accept the detailed design of the stormwater assets if they comply with the approved approach.

While the asset acceptance procedures provide adequate guidance on the asset acceptance process, the 'Assessment of Design Review Submissions' procedure for infill developments could be improved by specifically referring to the objectives of stormwater assets as set out in the relevant ACT Government policies to ensure that these policies are met. 3.29

Both the Environment, Planning and Sustainable Development Directorate and Transport Canberra and City Services advised that they have not undertaken catchment-wide planning for stormwater for the ACT and that detailed data on the hydrology of proposed new subdivision locations are not available. Developers are therefore required to undertake detailed hydrological studies of greenfield development areas to ensure that their stormwater management approaches will meet planning requirements, particularly those of the *ACT Water Strategy* and the *Waterways Water Sensitive Urban Design Code 2009*. 3.37

The absence of catchment-wide stormwater planning in the ACT presents the risk that stormwater management solutions will not be appropriate to meet those required in ACT water management policies. Developing such a plan would provide a sound basis for future stormwater planning. The Environment, Planning and Sustainable Development Directorate should provide the Minister for Planning and Land Management with options on how to undertake this catchment-wide stormwater planning. 3.38

A number of issues are arising at the design stage, partly due to a lack of detail in the *Waterways Water Sensitive Design Code 2009* (one of the reasons it needs updating), which in turn results in a heavy reliance on designers. 3.42

There is no effective process in place to ensure that options to support the operation and maintenance of suitable estate development are considered at the planning stage. 3.53

While changes to designs occur infrequently, by not allowing the Development, Review and Coordination Section in Transport Canberra and City Services a reasonable and practical opportunity to respond to proposed design changes that occur during construction (for example, by requiring a response in as little as a few hours), there is an increased risk that unacceptable design solutions may be implemented during the construction of stormwater assets. The Civil Infrastructure Branch and the Development, Review and Coordination Section should consider developing a formal process for the handling of such design changes. 3.69

At the conclusion of work on a project, a developer will provide certification that the work has been completed in accordance with the approved design and to the required standards, after which TCCS will arrange inspection by SMEC. However, certification by the developer is usually provided by one person for an entire project, not specifically for stormwater assets. As separate certification is not usually provided for each type of asset, there is limited assurance the certifier has the suitable qualifications and experience to provide stormwater certification.

3.74

ARRANGEMENTS FOR MANAGING ACCEPTED STORMWATER ASSETS

Paragraph

While the role of each individual agency in the asset acceptance process was well defined, responsibility for the management of stormwater assets within Transport Canberra and City Services was not.

4.3

Transport Canberra and City Services is currently undertaking a functional alignment review that is considering, among other issues, the division of responsibilities between its business units - Roads ACT and City Presentation. This provides an opportunity for Transport Canberra and City Services to also work with Environment, Planning and Sustainable Development to ensure that an effective cross-agency approach is taken to the overall management of stormwater assets. This needs to include consideration of the necessary level of expertise on stormwater management that is required within Government.

4.11

Transport Canberra and City Services has developed internal targets that measure the achievement of a key stormwater objective — reliable flood protection. However, the Directorate has not developed targets for its other key objective — management of stormwater discharges. This makes it difficult to assess whether these objectives are being achieved.

4.31

While the Roads ACT’s 2013 Strategic Asset Management Plan includes flood protection performance targets for stormwater assets, none relate to the quality of water exiting the stormwater system. Information gathered by the Environment, Planning and Sustainable Development Directorate in relation to stormwater asset performance against quality and quantity performance targets is not routinely shared with Transport Canberra and City Services.

4.51

Without arrangements to collect information on the performance of stormwater assets Transport Canberra and City Services has no ability to assess whether accepted asset types are achieving the intention of ACT Government objectives, thereby leaving the Territory at risk that inappropriate or poorly functioning assets are accepted.

4.52

Roads ACT's risk register could be improved by the identification of the following additional risks: 4.56

- damage to assets after operational acceptance;
- inadequately planning for the operation and maintenance of accepted assets; and
- adverse effects on the environment from poorly designed, operated, maintained assets.

While the environmental impact of stormwater management has been clearly identified in Environment, Planning and Sustainable Development Directorate documents, Transport Canberra and City Services has been less successful in identifying the environmental risks associated with the acceptance of stormwater assets. The risk register Roads ACT (in Transport Canberra and City Services) does not include potential environmental risks relating to the acceptance of assets. The Roads ACT 2013 Strategic Asset Management Plan touches only briefly on environmental risks but a more detailed consideration of this risk is warranted. 4.59

Asset data in IAMS are not complete and/or accurate. For example, the data on dams were not up-to-date (recently built dams had not been included). 4.65

While accepting that Transport Canberra and City Services has resource restrictions, adopting a preventative approach to the maintenance of stormwater assets, which targets known problem areas, could reduce problems occurring in the first place, resulting in improved performance of accepted assets. Analysis of defect data from its IAMS system would also provide the opportunity for Transport Canberra and City Services to identify problem areas and risks to the stormwater network and to take remedial action. 4.73

While EPSDD have initiated the *H2OK: Keeping our waterways healthy* stormwater education program, this does not provide a long-term solution to the third-party damage issue. A range of cross-agency measures will be required to help reduce the damage to stormwater (and other assets, such as landscaping) caused by building and other construction activity. 4.91

Transport Canberra and City Services advised that, with limited exceptions, the condition of stormwater assets in established areas of Canberra has not been reassessed since the development of those areas, despite the fact that there is a known flood risk in some locations. Where reviews have been completed, recommended augmentation work has not been undertaken in all cases and some of these reviews are no longer current. 4.94

There are no scheduled reviews of the condition of the stormwater infrastructure in established areas. To ensure that this infrastructure meets future stormwater needs, there needs to be an ongoing program for the review and augmentation of stormwater assets to alleviate flood hazards due to under-capacity of drainage systems. This is important also to ensure that the stormwater infrastructure can support new infill developments. 4.101

Recommendations

RECOMMENDATION 1 CHANGE TO THE ESTATE DEVELOPMENT CODE

The Environment, Planning and Sustainable Development Directorate should facilitate the amendment of the *Estate Development Code* to include a gross pollutant target (70-90 percent removal).

RECOMMENDATION 2 UPDATE OF DESIGN CODES AND STANDARDS

The Environment, Planning and Sustainable Development Directorate and Transport Canberra and City Services Directorate, respectively, should facilitate updates to the *Waterways Water Sensitive Urban Design Code 2009* and the Design Standards for Stormwater Infrastructure to reflect changes resulting from the 2016 Australian Rainfall and Runoff Guidelines.

RECOMMENDATION 3 ALIGNMENT OF DESIGN CODES AND STANDARDS

The Environment, Planning and Sustainable Development Directorate, in consultation with the Transport and City Services Directorate should:

- a) align the *Waterways Water Sensitive Urban Design Code 2009* with the new Design Standards for Municipal Infrastructure—Stormwater; and
- b) facilitate the amalgamation of these two documents so traditional drainage and water sensitive urban design are fully integrated.

RECOMMENDATION 4 REFERRAL ENTITY ADVICE

The Environment, Planning and Sustainable Development Directorate should:

- a) review the potential risks associated with accepting stormwater asset designs, without agency advice, as prescribed under Section 150 of the *Planning and Development Act 2007*; and
- b) prepare a mitigation strategy to address these risks, and, if legislative changes are required, advise the Minister for Planning and Land Management.

RECOMMENDATION 5 CATCHMENT-WIDE STORMWATER PLANNING

The Environment, Planning and Sustainable Development Directorate should identify options for conducting catchment-wide planning, and undertake analysis of stormwater needs, against which future development applications would be assessed. These options should be provided to the Minister for Planning and Land Management for consideration.

RECOMMENDATION 6 CONSIDERATION OF STORMWATER SOLUTIONS

The Environment, Planning and Sustainable Development and Transport Canberra and City Services Directorates, in consultation with the Suburban Land Agency, should develop a range of stormwater management solutions for new estates and subdivisions, in the context of a catchment-wide plan for the area, to ensure that the optimal solution and the means of financing it are adopted.

RECOMMENDATION 7 CERTIFICATION OF STORMWATER ASSETS

The Transport Canberra and City Services Directorate should require that certifications of stormwater assets are provided by engineers who are suitably qualified and experienced in stormwater design.

RECOMMENDATION 8 FUNCTIONAL REVIEW OF STORMWATER MANAGEMENT

The Transport Canberra and City Services Directorate in consultation with the Environment, Planning and Sustainable Development Directorate, should review arrangements for the management of stormwater assets to improve cross-agency management of stormwater.

RECOMMENDATION 9 STRATEGIC ASSET MANAGEMENT PLAN

Roads ACT should, no later than June 2018, update and adopt the Strategic Asset Management Plan, to reflect current stormwater management priorities.

RECOMMENDATION 10 DEVELOPMENT OF PERFORMANCE INDICATORS

The Environment, Planning and Sustainable Development and Transport Canberra and City Services Directorates should each develop performance measures for the achievement of ACT Government stormwater objectives, including the management of stormwater discharges. These should be publicly reported (for example, in the ACT Water Report).

RECOMMENDATION 11 ACHIEVING GOVERNMENT OBJECTIVES

Transport Canberra and City Services should amend the *Requirements for Design Acceptance Submissions* procedure to require:

- a) designers to demonstrate how proposed stormwater assets will achieve the objectives of the ACT Government; and
- b) consideration of stormwater objectives when assessing stormwater asset designs.

RECOMMENDATION 12 MONITORING THE PERFORMANCE OF STORMWATER ASSETS

The Transport Canberra and City Services Directorate should collect stormwater asset performance information, available from various agencies, for use in considering the acceptance of stormwater assets.

RECOMMENDATION 13 IDENTIFICATION OF RISK

The Development, Review and Coordination Section and Roads ACT and City Presentation business units in the Transport Canberra and City Services Directorate should:

- a) undertake a detailed analysis of the risks associated with the acceptance of stormwater assets;
- b) include treatments to reduce these risks in their relevant risk registers; and
- c) establish a formal process that communicates these risks to Directorate executives.

RECOMMENDATION 14 IMPROVING THE ACCURACY OF IAMS DATA

Transport Canberra and City Services should review all IAMS stormwater data to ascertain whether they are accurate and complete.

RECOMMENDATION 15 MANAGEMENT OF THE EXISTING STORMWATER NETWORK

Transport Canberra and City Services should:

- a) develop a preventative maintenance plan for stormwater assets; and
- b) clearly identify problem areas with, and risks to, the stormwater network.

If required, appropriate remedial action should be recommended to the Minister for Transport and City Services.

RECOMMENDATION 16 REDUCING DAMAGE TO ACCEPTED ASSETS

A working group (including representatives from Transport Canberra and City Services, Environment, Planning and Sustainable Development, the Suburban Land Agency, Access Canberra and other relevant entities) should be established to:

- a) develop a coordinated multi-agency strategy to reduce the damage to accepted assets caused by building and other construction activity; and
- b) report to the Minister for Planning and Land Management on actions to be taken, then subsequently the results of any actions undertaken.

RECOMMENDATION 17 REVIEW AND AUGMENTATION OF EXISTING STORMWATER INFRASTRUCTURE

Transport Canberra and City Services should develop a forward program for the ongoing review of stormwater infrastructure in established areas of Canberra and augmentation of the infrastructure where necessary. The forward program should be provided to the Minister for Transport and City Services for consideration and direction.

Agency responses

In accordance with subsection 18(2) of the *Auditor-General Act 1996*, the Transport Canberra and City Services Directorate, Environment, Planning and Sustainable Development Directorate, Suburban Land Agency and Chief Minister, Treasury and Economic Development Directorate were provided with:

- a draft proposed report for comment. All comments were considered and required changes were reflected in the final proposed report; and
- a final proposed report for further comment.

No agency provided comments for inclusion in this Summary Chapter.

1 INTRODUCTION

Background

1.1 Urban stormwater is 'runoff from urban areas, including the major flows during and following rain as well as dry weather flows'.²

1.2 Stormwater management can serve to meet a number of objectives, including:

- flooding and drainage control;
- public health and safety;
- ecosystem health, both aquatic and terrestrial;
- economic considerations;
- recreational opportunities; and
- social considerations and aesthetic values.³

1.3 In the ACT, the Transport Canberra and City Services Directorate (TCCS) is responsible for the acceptance and management and maintenance of stormwater assets.

1.4 On its public website, TCCS explains the importance of the ACT's stormwater network as follows:

Urban development significantly increases the area of impervious surfaces from which rainfall quickly runs off. These surfaces include building roofs, paved areas, roads and carparks, and they can also include, but to a lesser extent, grassed and garden areas. A network of drains, channels and floodways have therefore been designed and built in the ACT to manage water in excess to the pipe capacity and direct this increased flow of stormwater to receiving waters. Directing the flow of stormwater runoff away from development benefits residents of the ACT by:

- providing safety to the public;
- protecting property;
- stabilising the landform and providing erosion control, and
- optimising the land available for urbanisation.

As stormwater runoff flows over the landscape it collects pollutants. Importantly, the stormwater network in the ACT incorporates various pollution control systems intended to remove pollution from water before it flows into the Murrumbidgee River.

² National Water Quality Management Strategy, Australian Guidelines for Urban Stormwater Management, 2000, p. 4.

³ *ibid*, p. 5.

Indirectly, the stormwater network provides a number of other benefits to the residents of the ACT. These include enhancing the urban landscape and providing recreational opportunities through the use of lakes and ponds.⁴

The Territory's stormwater infrastructure

- 1.5 Stormwater assets are the second largest asset class for the ACT Government after public housing. They are the largest class of assets administered by TCCS (40 percent), followed by roads (34 percent) and bridges (15 percent).
- 1.6 The Territory's stormwater infrastructure consists of sumps, stormwater pipes, stormwater channels, water quality pond embankments, cut-off drains, retarding basins, gross pollutant traps, dams and weirs. Definitions of these structures are at Appendix A. Details of the Territory's stormwater assets as at 30 June 2017, which were valued at \$2.7 billion in the 2016–17 TCCS annual report⁵, are shown at Table 1-1.

Table 1-1 ACT's stormwater assets as at 30 June 2017

Asset	Number	Measure
Culvert	638	Count
Cut-off drain	152	Km
Dam	18	Count
Floodway	28	Km
Gross pollutant trap	227	Count
Lined channel	66	Km
Manhole	32 526	Count
Overland flow path	2	Km
Retarding basin	519 169	Sq km
Sump	82 290	Count
Underground stormwater pipe	3 761	Km
Urban lakes and ponds	115	Count

Source: Transport Canberra and City Services IAMS data.

Note: See findings on the completeness of these data at paragraph 4.65.

Roles and responsibilities

- 1.7 Ultimate responsibility for stormwater asset acceptance lies with TCCS. However, a number of ACT Government agencies contribute to this process, either directly or indirectly. The specific role of each agency in the asset acceptance process is shown in Table 1-2.

⁴ Transport Canberra and City Services, http://www.tccs.act.gov.au/roads-paths/Road_Infrastructure_and_Maintenance/stormwater/stormwater-network [7 November 2017].

⁵ Transport Canberra and City Services Directorate, Annual Report 2016–17, Volume 1, p. 119.

- 1.8 Stormwater assets are constructed either:
- by a developer and gifted to the ACT Government; or
 - as part of the ACT Government capital works program.
- 1.9 These assets are then, after an acceptance process, owned and maintained by TCCS.

Table 1-2 Agency roles and responsibilities in asset acceptance

Transport Canberra and City Services (TCCS)
<p>City Services, a Division within Transport Canberra and City Services (TCCS), is the owner of stormwater assets and is responsible for their acceptance, management, operation and maintenance. This responsibility is spread across a number of business units:</p> <ul style="list-style-type: none"> • the acceptance of stormwater assets is managed by the Development, Review and Coordination Section in TCCS; • Roads ACT and City Presentation business units manage ‘hard’ assets (such as underground pipes and gross pollutant traps) and ‘soft’ assets (such as raingardens) respectively. <p>An increasing number of stormwater assets have both hard and soft elements to their design.</p> <p>TCCS has established a single shop front approach to support industry in undertaking development and projects across the Territory that will deliver TCCS assets. The Development, Review and Coordination business unit provides advice, guidance and direction on all assets associated with Roads ACT, City Presentation and ACT NOWaste. These include stormwater assets that will be ‘gifted’ to Roads ACT and City Presentation to manage and maintain after construction has been completed.</p>
Environment, Planning and Sustainable Development Directorate (EPSDD)
<p>The Environment, Planning and Sustainable Development Directorate is responsible for setting policy objectives for stormwater management. It is consulted about development applications and concept plans for the management of stormwater.</p> <p>EPSDD is also responsible for the development application process, which includes the examination of concept plans for stormwater, via its Planning Delivery Division, which exercises the role of the Planning and Land Authority under the <i>Planning and Development Act 2007</i> (Part 3.4).</p>
Suburban Land Agency
<p>The Suburban Land Agency is responsible for delivering the ACT Government’s suburban development program, including urban renewal in established town centres and suburbs. In relation to stormwater assets, the Suburban Land Agency is responsible for the design (using both in-house and consultant resources) and development of assets in greenfield areas, prior to the sale of blocks to the private sector. These stormwater assets are subject to the TCCS acceptance process from design approval to final acceptance.</p>
Chief Minister, Treasury and Economic Development Directorate (CMTEDD)
<p>The Chief Minister, Treasury and Economic Development Directorate has a two part involvement in stormwater asset acceptance via the Environment Protection Authority and its Capital Works business unit.</p> <p>The Environment Protection Authority has an indirect role in the acceptance of stormwater assets via its regulation of activities that impact the environment, and in the case of stormwater, activities that impact on the operation of stormwater assets.</p> <p>Civil Infrastructure (Capital Works) is responsible for the procurement and delivery of, and provision of complex advice on, civil infrastructure projects for the ACT Government. With limited exceptions (such as the Urban Renewal Program in the Community Services Directorate, Suburban Land Agency and City Renewal Authority), Civil Infrastructure manages all civil projects on behalf of Directorates, including</p>

design and construction activities, as well as the planning, business case development and oversight of infrastructure projects to support the land release program.

Stormwater capital works include:

- a rolling gross pollutant trap capital works program; and
- the ACT Healthy Waterways (Basin Priority) Project, which is managed by the EPSDD and comprises up to 25 projects across six catchment areas, including the development of Isabella Weir (as the ACT Government's 10% contribution).

Source: ACT Audit Office

Asset acceptance process

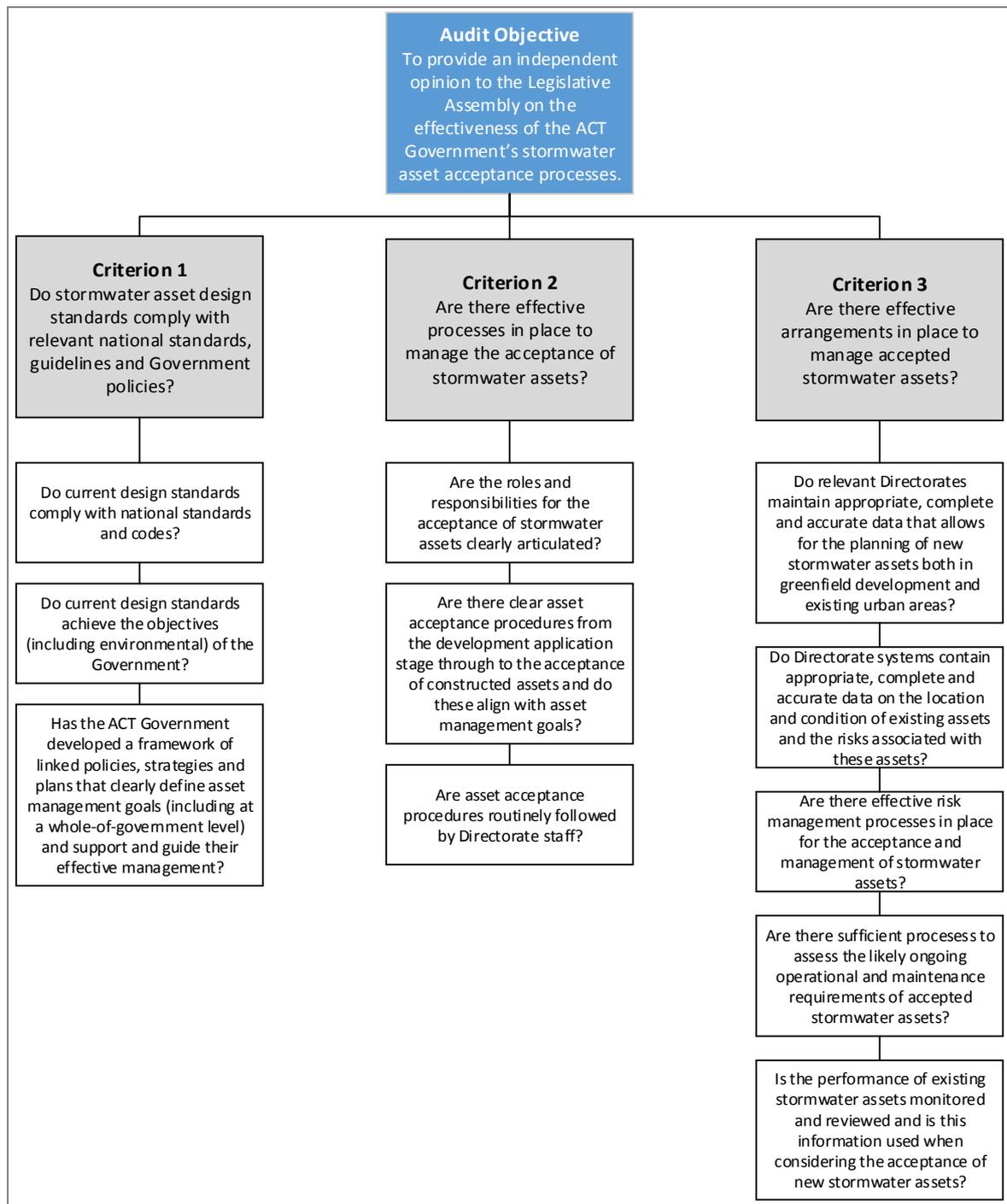
- 1.10 'Asset acceptance' describes the process of recognising and accepting for use constructed infrastructure assets.
- 1.11 Proposals for new stormwater assets are included in development applications, which are submitted to EPSDD for approval. EPSDD will consult relevant entities (TCCS, ActewAGL etc) about the application or satisfy itself that the views of those entities have been sought and are included with the application. Following approval of the development application, a developer must then seek design approval from TCCS (prior to the commencement of construction) for the stormwater assets, where they are expected to comply with the ACT's design standards for urban infrastructure.
- 1.12 Following satisfactory construction of the assets, the developer will request TCCS to provide *operational acceptance* of the asset.
- 1.13 TCCS' *final acceptance* of the asset is provided at the conclusion of the relevant defects liability period.

Audit objective, scope and approach

Audit objective and criteria

- 1.14 The objective of this audit is to provide an independent opinion to the Legislative Assembly on the effectiveness of the ACT Government's stormwater asset acceptance processes.
- 1.15 There are three audit criteria, as shown in Figure 1-1.

Figure 1-1 Audit objective and criteria



Source: Audit Office

Audit scope

1.16 The audit examined whether the ACT Government has:

- developed a framework of linked policies, strategies and plans that clearly define asset management goals (including at a whole-of-government level);
- adequate design standards in place for stormwater assets;

- sound stormwater infrastructure asset management data, against which it can assess the Territory's stormwater management needs; and
- developed and applied systems, processes and capabilities needed to implement this framework.

1.17 The audit did not examine the:

- procurement of stormwater assets;
- ongoing management of identified risks;
- operation and maintenance of the Territory's stormwater assets, except as it related to the remediation of the assets following their *operational acceptance*; and
- acceptance of stormwater assets in the ACT, which are maintained by the National Capital Authority on behalf of the Commonwealth of Australia.

1.18 The audit also did not examine the role of the City Renewal Authority as it had no involvement in the construction of stormwater assets prior to 30 June 2017.

Audit approach and method

1.19 In conducting the audit, the audit team:

- interviewed and had discussions with key staff of the selected directorates and agencies and with other stakeholders;
- identified and reviewed relevant information and documentation, including the governance and accountability framework and related policies and procedures, research documents and reports;
- identified and documented controls and procedures used to give effect to the policies and guidelines to ensure compliance, including asset management systems used to manage stormwater assets;
- reviewed relevant literature and work undertaken on this subject by other jurisdictions to identify better practices; and
- examined the process used to assess the acceptance of stormwater assets for 42 projects, where stormwater assets had been accepted by TCCS in the 2014–15, 2015–16 and 2016–17 financial years. These projects were selected to provide a range of both infill and greenfield projects in each of the three financial years. They included 12 greenfield projects, 24 infill projects, five greenfield infill projects and one greenfield upgrade project. Further details of the projects are at Table 1-3.

Table 1-3 Types of developments in projects selected for audit examination

Type of development	Number of projects
Estate development plan	12
Residential units	16
Townhouses	1
Residential and non-residential	1
Dual occupancy	3
Aged care facility	1
Commercial development	1
Hotel	2
Car park	1
Industrial facility	2
Services	1
Road upgrade	1
Total	42

Source: ACT Audit Office.

- 1.20 The Audit Office engaged a private firm, Storm Consulting, as part of the audit team to provide subject matter expertise. Storm Consulting is a civil and environmental engineering consultancy firm, based in Sydney and Melbourne, which provides Australia-wide civil infrastructure, stormwater and runoff, streams and waterways and sustainable water services. Its stormwater and runoff services include such things as hydrology, hydraulics and flooding, water quality treatment, stormwater networks, water sensitive urban design, stormwater management planning, stormwater outlet stabilisation and erosion and sediment control.
- 1.21 The audit adopted the Office's Performance Audit Methods and Practices (PAMPr) and related policies, practice statements and guidance papers. These policies and practices have been designed to comply with the requirements of the *Auditor-General Act 1996* and relevant professional standards (including *ASAE 3500 – Performance Engagements*).

2 STORMWATER LEGISLATIVE AND REGULATORY FRAMEWORK

2.1 This chapter assesses whether stormwater asset design standards comply with relevant national standards, guidelines and ACT Government policies.

Summary

Conclusion

The asset management objectives for accepted stormwater assets are clearly articulated in ACT legislation and policy, which are adequately supported by legislative codes, design standards and procedures. While the stormwater asset design codes and standards comply with, and in some instances exceed, relevant national standards, they require updating in some areas. In particular, the *Estate Development Code* requires amendment to include detailed information on gross pollutant removal targets and the *Waterways Water Sensitive Urban Design Code 2009* and the stormwater design standards need to be updated to reflect changes resulting from new Australian Rainfall and Runoff Guidelines released by the Geoscience Australia.

The effect of these updated guidelines could have potentially significant implications for the management of stormwater in the Territory (such as an improved understanding of the ability of the existing and planned stormwater infrastructure to cope with expected rain events).

Key findings

	Paragraph
The <i>Territory Plan</i> and the <i>Planning and Development Act 2007</i> provide a sound framework for the consideration of development applications involving stormwater assets and compare well with the policies of other state and territory jurisdictions.	2.10
The <i>ACT Water Strategy's</i> three outcome statements align with the best practice principles of other states. Furthermore, the subject matter expert for the audit, Storm Consulting, considered that 'the <i>ACT Water Strategy</i> provides [a] clear and firm policy basis of best practice stormwater management which is backed by the <i>Territory Plan</i> '. However, to ensure that the Strategy's outcome objectives are achieved, careful ongoing implementation over the thirty year life of the Strategy is required.	2.18
The <i>Estate Development Code</i> is considered to be 'relatively progressive and close to best practice', but needs to include gross pollutant removal targets of 70-90 percent to bring it into line with Victoria, Queensland and NSW, provide clearer guidance to	2.28

developers and help to achieve the outcomes of the Government's *ACT Water Strategy*.

Considering the strong environmental focus of the ACT Government's planning policies, the *Waterways Water Sensitive Urban Design Code 2009* needs to be one of the most extensive codes and be integrated within the requirements of the *Design Standards for Urban Infrastructure—Stormwater*. However, water sensitive urban design has developed significantly since 2009 when the Code was implemented. As a result, the Code needs to be improved in a number of areas to provide more effective management of stormwater and be backed with more practical applications and lessons learned since it was first implemented. 2.31

The stormwater chapter of the *Design Standards for Urban Infrastructure* is a detailed and lengthy document, which primarily focuses on traditional drainage design. Transport Canberra and City Services plans to replace these in February/March 2018 with a chapter in the new Municipal Infrastructure Standards, a draft of which was issued for comment in November 2015. Storm Consulting noted that, while the current and revised stormwater design standards provide reasonable guidance, they are based on the 1987 Australian Runoff and Rainfall Guidelines, and will require updating to reflect the 2016 Guidelines. 2.33

While Transport Canberra and City Services plans to release a replacement for the Design Standards in early 2018, both the *Waterways Water Sensitive Urban Design Code 2009* and the *Design Standards for Urban Infrastructure—Stormwater* — will need to be further amended to reflect changes resulting from the 2016 Australian Rainfall and Runoff Guidelines. 2.40

There will also be an ongoing need to ensure that the two Codes are aligned. In this regard, there would also be merit in combining the *Waterways Water Sensitive Urban Design Code 2009* and the *Design Standards for Urban Infrastructure—Stormwater*. A unified stormwater design guideline, which does not segregate traditional stormwater design from sustainable water sensitive urban design, would help ensure that the environmental aspects of stormwater design were seen to be as important as the hard engineered components and provide better guidance to designers. 2.41

Introduction

2.2 The legislative and regulatory framework for the management of stormwater in the ACT is set out in the ACT's planning legislation, policy and a number of specific codes, for which the Environment, Planning and Sustainable Development Directorate (EPSDD) has administrative responsibility. These are the:

- *Territory Plan*;
- *Planning and Development Act 2007*;
- *ACT Water Strategy 2014-2044—Striking the Balance* (August 2014); and
- *Estate Development Code* (effective 4 October 2013).

2.3 There are also design documents, which provide more detail for meeting the planning policies. The primary codes used for stormwater design are:

- *Waterways Water Sensitive Urban Design Code 2009*, for which the EPSDD is responsible; and
- *Design Standards for Urban Infrastructure—Stormwater*, for which Transport Canberra and City Services (TCCS) is responsible.

The Territory Plan

2.4 The *Territory Plan* guides planning and development in the ACT and is used:

- to manage development, in particular how land is used and what can be built;
- in the assessment of development applications; and
- to guide the development of new estate areas (future urban land) and manage public land.

2.5 In relation to stormwater assets, Principle 1.7 of the *Territory Plan* states that:

Land and water resources will be planned in accordance with the principles of integrated catchment management and water sensitive urban design. Policies will seek to protect identified environmental values, whilst focusing on opportunities for multi-purpose use of resources. Special attention is to be given to protecting sources of the Territory's water supply and to maintaining environmental flows in rivers and streams.

In planning future development and redevelopment, particular emphasis will be placed on cost-effective provision and management of existing and new infrastructure and services, taking into account whole-of-life and whole-of system costs, including the ecological footprint of proposed developments and activities.

- 2.6 This Principle makes it clear that the ACT Government has prioritised cost effective infrastructure assets that retain a focus on the environmental impact of the development and use of these assets. Storm Consulting, in its role as the subject matter expert, indicated that, 'compared to other states, this is a relatively progressive policy and would be considered best practice'. The audit agrees that this policy is appropriate.

Planning and Development Act 2007

- 2.7 The *Planning and Development Act 2007* aims to provide a planning system that 'contributes to the orderly and sustainable development of the ACT'.

- 2.8 While the Act does not have a particular focus on stormwater, Storm Consulting noted that it:

... does refer to the *Territory Plan* where water sensitive urban design is to be incorporated. It further discusses the preparation of an Environmental Impact Statement (EIS) which is to, amongst other requirements, consider the way stormwater is managed as part of a development. The *Planning and Development Act* also refers to the *Waterways Water Sensitive Urban Design Code*.

- 2.9 As with the *Territory Plan*, Storm Consulting concluded that the *Planning and Development Act 2007* encourages best practice stormwater management and is appropriate for the ACT. While the audit agrees with this overall assessment, the Act has very tight timeframes for consideration of development applications, which presents a risk to good decisions on optimal stormwater solutions. This is discussed further from paragraph 3.8.

- 2.10 The *Territory Plan* and the *Planning and Development Act 2007* provide a sound framework for the consideration of development applications involving stormwater assets and compare well with the policies of other state and territory jurisdictions.

ACT Water Strategy 2014-44

- 2.11 The *ACT Water Strategy 2014–44: Striking the Balance* (the *ACT Water Strategy*) guides the management of the Territory's water supply, management and catchment practices over the next thirty years. It takes the principles of the *Territory Plan* and quantifies what is required to meet those objectives. It identifies strategies and actions to guide water management to achieve the following outcomes:

- Outcome 1: Healthy Catchments and waterbodies
- Outcome 2: A sustainable water supply used efficiently
- Outcome 3: A community that values and enjoys clean, healthy catchments

- 2.12 For each of these three outcomes, the *ACT Water Strategy* identifies strategies and actions to guide water management in the ACT. The *ACT Water Strategy* is being implemented through five year implementation plans, with the effectiveness of implementation monitored through targets and indicators for each outcome.
- 2.13 Of the three outcomes, Outcome 1 directly involves the management of infrastructure assets and makes clear the Government’s focus on the improvement of stormwater management, particularly with a view to reducing the environmental impact of stormwater flows. Figure 2-1 details the strategies that support Outcome 1.

Figure 2-1 Outcome 1 – ACT Water Strategy 2014–44: Striking the Balance

Outcome 1: Healthy catchments and waterbodies	
<i>Well managed, functioning aquatic ecosystems that protect ecological values and contribute to the liveability of the ACT community.</i>	
STRATEGY 1: Achieve integrated catchment management across the ACT and region	
Actions	<ul style="list-style-type: none"> Strengthen coordination and collaboration for catchment management across the ACT and region. Enhance knowledge and spatial planning for water and catchment management. Integrate water cycle management and green infrastructure into the planning and design of urban environments. Improve water monitoring and analysis across the ACT and region.
STRATEGY 2: Protect and restore aquatic ecosystems in urban and non-urban areas	
Actions	<ul style="list-style-type: none"> Improve water quality and ecosystem health in the ACT and region’s rivers, lakes, aquifers, ponds and wetlands. Ensure appropriate management (volume, timing and quality) of environmental flows. Strengthen compliance and enforcement for water resource management.
STRATEGY 3: Manage stormwater and flooding	
Actions	<ul style="list-style-type: none"> Manage stormwater infrastructure sustainably. Improve planning, monitoring and compliance for stormwater management. Improve planning, information and regulation for flood management.

Source: *ACT Water Strategy 2014–44: Striking the Balance*, August 2014.

- 2.14 Included in the *ACT Water Strategy* are pollutant reduction targets for receiving waterways where developments have to ensure adequate water treatment is provided to meet these targets. For instance, for Outcome 1, the target is to improve the quality of water (as measured by a number of specified water quality indicators) by 30 percent across the thirty-year period of the Strategy.
- 2.15 Victoria has similar requirements as part of its state planning policy (Clause 56 of the Victoria Planning Provisions⁶) whereby larger developments are required to meet pollutant reduction targets. New South Wales and Queensland have similar policies for pollutant

⁶ Victorian Government, *Victoria Planning Provisions*, Sustainable Neighbourhoods, 2017.

reduction targets but, in New South Wales, compliance with neutral or beneficial effect criteria are also required in areas located within Sydney Water catchments.⁷

2.16 Examples of the environmental water aims of other jurisdictions, which were identified by Storm Consulting, are shown in Table 2-1.

Table 2-1 Examples of environmental stormwater aims in other jurisdictions

Jurisdiction	Environmental stormwater aims
New South Wales	<ul style="list-style-type: none"> • Water conservation. • Stormwater quality. • Waterway stability.
Victoria	<ul style="list-style-type: none"> • To reduce the use of drinking water. • To provide for the substitution of drinking water for non-drinking purposes with reused and recycled water. • To provide a waste water system that is adequate for the maintenance of public health and the management of effluent in an environmentally friendly manner. • To minimise damage to properties and inconvenience to residents from urban run-off. • To ensure that the street operates adequately during major storm events and provides for public safety. • To minimise increases in stormwater run-off and protect the environmental values and physical characteristics of receiving waters from degradation by urban run-off.
Queensland	<ul style="list-style-type: none"> • Protect natural ecosystems. • Integrate stormwater treatment into the urban landscape. • Protect water quality. • Reduce runoff and peak flows. • Add value while minimising development costs.

Source: Storm Consulting's analysis of ACT targets with those of the Victorian Government's Planning Provisions and those of following councils in other jurisdictions: NSW–Blacktown City Council; and QLD–Gold Coast City Council.

⁷ Water NSW states that:

It is safe to assume that a development will have no identifiable potential impact on water quality if the development is unlikely to result in:

- a concentration of flow of water;
- the impedance of flow of water;
- discharge of effluent, dust pollutants or stormwater; and
- other matters considered to result in a water quality impact, such as the potential for contamination.

In this case, the neutral or beneficial effect test is satisfied and consent can be issued with respect to water quality, without further detailed assessment regardless of the development type.

- 2.17 These examples indicate three main stormwater management goals, which are consistent with the three outcome statements in the *ACT Water Strategy*:
- improving stormwater runoff quality;
 - conserving potable water and using sustainable sources of water; and
 - protecting natural ecosystems for future generations to enjoy.
- 2.18 The *ACT Water Strategy*'s three outcome statements align with the best practice principles of other states. Furthermore, the subject matter expert for the audit, Storm Consulting, considered that 'the *ACT Water Strategy* provides [a] clear and firm policy basis of best practice stormwater management which is backed by the *Territory Plan*'. However, to ensure that the Strategy's outcome objectives are achieved, careful ongoing implementation over the thirty year life of the Strategy is required.

Estate Development Code

- 2.19 The purpose of the *Estate Development Code*⁸ is to provide additional planning, design and environmental controls to support the objectives of the relevant residential or industrial zone. It is used by EPSDD to assess a development application for an estate development plan and offers guidance to applicants preparing estate development plans. The *Estate Development Code* applies to all proposals in the Territory for the subdivision of land requiring the preparation of an estate development plan.
- 2.20 An estate development plan sets out the proposed subdivision pattern and infrastructure works for an estate. It must be submitted as a development application for approval by EPSDD. The Suburban Land Agency, as the developer of estates in the ACT, consults entities in preparing estate development plan applications prior to their submission.
- 2.21 EPSDD assesses the estate development plan against the relevant parts of the *Estate Development Code* and any applicable structure plan or precinct code, having regard also to comments it may have received from entities on the development application. EPSDD approval of the estate development plan is required before design acceptance can be obtained from TCCS, work can commence and leases issued for the subdivided blocks.
- 2.22 The Code contains a list of 'Rules' or specific requirements which must be followed for various aspects of estate development (such as, safety or water sensitive urban design). For example, the *Estate Development Code* contains rules that aim to protect the environment from the effects of development (Element 5—Environment Protection).⁹

⁸ ACT Government—Environment and Sustainable Development, *Estate Development Code*, August 2016.

⁹ These include rules relating to water sensitive urban design, sediment and erosion control, earthworks, tree protection, heritage, contamination and matters of environmental significance.

2.23 In terms of stormwater, the Code provides guidance on the type of developments needed to achieve water pollution reduction targets. In this way, it helps to provide a bridge between planning policies and design policies. Elements 5.1 and 5.2 of the Code are the most applicable to stormwater, where it states that:

- large developments (i.e. >5000m²) are required to meet the full pollutant removal targets of 60 percent suspended solids removal, 45 percent phosphorus removal and 40 percent nitrogen removal;
- medium to large developments (i.e. >2000m²) are also required to meet pre-development water quantity and other targets; and
- estates larger than 3000m² have to comply with Environment Protection Authority guidelines for sediment and erosion control.

2.24 In comparison, the pollutant removal targets of suspended solids, phosphorus and nitrogen are slightly lower than those of councils in other jurisdictions (see Table 2-2).

Table 2-2 Pollutant removal targets for larger developments for the ACT and other jurisdictions

State	Target removal (percent)		
	Suspended solids	Phosphorus	Nitrogen
ACT	60	45	40
NSW	85	65	45
VIC	80	45	45
QLD	80	60	45

Source: ACT Audit Office analysis of ACT targets with those of the Victorian Government's Planning Provisions (Clause 56 requires stormwater systems for all new residential subdivisions to meet best practice environmental management guidelines developed by a Victorian Stormwater Committee and published by the CSIRO in 1999) and those of the following councils in other jurisdictions: NSW—Blacktown City Council; and QLD—Gold Coast City Council.

2.25 Further, the Victorian state water quality requirements (Clause 56 of the Victorian Planning Provisions) require that discharges from all new residential estates for the 1.5 year average recurrence interval (ARI) remain at pre-development levels (that is, the development should not result in increased discharges). This is similar to the requirements for estates in the ACT of over 2000m² mentioned in paragraph 2.23 and is based on better practice environmental management guidelines published by the CSIRO.¹⁰

2.26 Although the majority of gross pollutants are usually caught while trying to capture the finer sediments (for example, suspended solids), floatable gross pollutants can easily bypass some gross pollutant traps and sedimentation basins.

¹⁰ Victorian Stormwater Committee, *Urban Stormwater—Best Practice Environmental Management Guidelines*, 1999.

- 2.27 Gross pollutants have a detrimental effect on the environment in that they often cause toxicity when they break down, can kill (by choking or suffocation by the removal of oxygen during decay) plants and animals, reducing light penetration into water for plant growth, etc. For these reasons, it is vital that gross pollutants are specifically mentioned and targeted for removal. This is not done in any code, policy or guideline in the ACT.
- 2.28 The *Estate Development Code* is considered to be ‘relatively progressive and close to best practice’, but needs to include gross pollutant removal targets of 70-90 percent to bring it into line with Victoria, Queensland and NSW, provide clearer guidance to developers and help to achieve the outcomes of the Government’s *ACT Water Strategy*.

RECOMMENDATION 1 CHANGE TO THE ESTATE DEVELOPMENT CODE

The Environment, Planning and Sustainable Development Directorate should facilitate the amendment of the *Estate Development Code* to include a gross pollutant target (70-90 percent removal).

Waterways Water Sensitive Urban Design Code

- 2.29 The purpose of the *Waterways Water Sensitive Urban Design Code 2009* (the WSUD Code) is to provide a method for implementing water sensitive urban design in the ACT and to assist in achieving targets set out in the ACT’s Water Strategy. Water sensitive urban design is still a relatively new concept compared to traditional drainage. The WSUD Code applies to:
- development of new residential neighbourhoods and estates;
 - re-development or infill development within the existing built environment; and
 - institutional, commercial and industrial developments (with a site area greater than 2000m²).
- 2.30 The WSUD Code provides mandatory performance targets for mains water use reduction and for stormwater quality and quantity management which must be met from a range of measures including those described in the code.
- 2.31 Considering the strong environmental focus of the ACT Government’s planning policies, the *Waterways Water Sensitive Urban Design Code 2009* needs to be one of the most extensive codes and be integrated within the requirements of the *Design Standards for Urban Infrastructure—Stormwater*. However, water sensitive urban design has developed significantly since 2009 when the Code was implemented. As a result, the Code needs to be improved in a number of areas to provide more effective management of stormwater and be backed with more practical applications and lessons learned since it was first implemented.

2.32 Storm Consulting identified a number of areas where the Code needs to be improved. These are listed at Table 2-3.

Table 2-3 Examples of where Storm Consulting identified that the WSUD Code needs to be improved

Section	Issue	Suggested improvement
2	Lack of risk assessment for water reuse – i.e. careful consideration must be given for safety of recycled/harvested water use.	Update section to include warnings and risk assessments of reusing water (this could include references to the <i>ACT Non Drinking Water Supply Code</i> which applies to utilities supplying non drinking water to customers).
3.3.2	Numerous (some outdated) wetland design guidelines. For example, Melbourne Water now refers to a new 2017 Wetland design guideline as opposed to the 2004 guideline listed. The listed link in the WSUD Code is no longer valid.	Review and update the wetland/pond design guidelines.
3.3.3	Limited gross pollutant design guidelines.	Update section to reflect newer guidelines and gross pollutant trap technology such as the greater Adelaide Region WSUD Technical Manual – Chapter 9 – Gross Pollutant Traps.
3.3.4	Numerous (some outdated) swale design guidelines.	Update to more recent guidelines particularly the CRC for Water Sensitive Cities Adoption Guidelines for Stormwater Biofiltration Systems (Federal Guidelines).
General	Lack of diversity in WSUD measures.	Create new Water Sensitive Urban Design system guidelines e.g. raingardens (also called bioretention systems in the ACT) and infiltration systems.

Source: Storm Consulting analysis.

Design Standards for Urban Infrastructure—Stormwater

2.33 The stormwater chapter of the *Design Standards for Urban Infrastructure* is a detailed and lengthy document, which primarily focuses on traditional drainage design. Transport Canberra and City Services plans to replace these in February/March 2018 with a chapter in the new Municipal Infrastructure Standards, a draft of which was issued for comment in November 2015. Storm Consulting noted that, while the current and revised stormwater design standards provide reasonable guidance, they are based on the 1987 Australian Runoff and Rainfall Guidelines, and will require updating to reflect the 2016 Guidelines.

- 2.34 The 2016 Australian Rainfall and Runoff Guidelines¹¹ provide better rainfall and runoff data. For example, they provide more accurate local data, resulting in the ability to more accurately determine the actual stormwater runoff generated from a catchment as opposed to the 1987 method. They will require changes in the way EPSDD and TCCS model storm events and design stormwater solutions for such events.
- 2.35 Geoscience Australia, which issued the Australian Rainfall and Runoff Guidelines, lists the main differences identified by between the 1987 and 2016 Guidelines on its website. These are shown in Table 2-4.

Table 2-4 Main differences between the 1987 and 2016 Australian Rainfall and Runoff (ARR) Guidelines

Category	ARR 1987	ARR 2016
<i>Design input</i>		
Intensity Frequency Duration (IFD)	Used Bureau of Meteorology rainfall gauges. Presented as static A2 maps.	Use Bureau of Meteorology and other agency gauges. Online
Areal Reduction Factors (ARF)	Based on USA data. Not available for long durations.	Based on Australian data.
Losses	Based on jurisdictional advice (personal communication).	National advice for rural and urban catchments.
Baseflow	Methods, but no ungauged catchment advice.	Australia-wide advice.
Temporal patterns	Average Variability Method Peak Burst. Patterns for less than 30 year average recurrence interval (ARI) and rare that 30 year ARI.	Temporal patterns based on historic records, multi-pattern for each design quantile and complete storms, with pre-burst considered.
<i>Method</i>		
At-site flood frequency analysis – gauged – ungauged	Probable Rational Method in some states.	Bayesian of L moments (probability method). Regional flood frequency.
Hydrograph estimation methods	Simple design event.	Ensemble and Monte Carlo.
Interaction of coastal and river flooding	Not considered.	ARR Project 18.
Blockage	Not considered.	Blockage Guidelines.
Safety design criteria	Not considered.	People, vehicle and building hazard curves.

Source: Geoscience Australia, Australian Rainfall and Runoff, <http://arr.ga.gov.au/about> [accessed 16 November 2017].

¹¹ Ball J, Babister M, Nathan R, Weeks W, Weinmann E, Retallik M, Testoni I (editors), Australian Rainfall and Runoff: A Guide to Flood Estimation in Australia, 2016, Commonwealth of Australia.

- 2.36 The 2016 Australian Rainfall and Runoff Guidelines better complement water sensitive urban design than the 1987 Guidelines currently used in the ACT design codes by providing more intensity frequency duration data and modelling storms as continuous flow, rather than event based (that is, same format as water quality modelling).
- 2.37 The new Australian Rainfall and Runoff Guidelines were finalised in November 2017 and the implications of them for the ACT have still to be assessed. TCCS, in cooperation with EPSDD, is planning to commission a consultant to undertake a review and provide to the Government a summary of required changes to the modelling and design standards to incorporate the 2016 Guidelines. EPSDD will be responsible for modelling the water flow changes for the ACT. The 2016 Guidelines are likely to have implications (such as pipe sizes and other infrastructure) for the ability of the existing and planned stormwater infrastructure to cope with expected rain events.
- 2.38 As TCCS has recognised in developing new Municipal Infrastructure Standards to replace the current *Design Standards for Urban Infrastructure*, the current Design Standards require updating in a number of areas. Examples of other areas where the current *Design Standards for Urban Infrastructure—Stormwater* require changing are listed in Table 2-5.

Table 2-5 Examples of where the *Design Standards for Urban Infrastructure—Stormwater* needed improvement

Section	Issue
General	Standards not updated from 1987 to 2106 Australian Rainfall and Runoff Guidelines
1.1.2.1	Outdated policies listed.
1.1.6	Water quality does not include <i>Waterways Water Sensitive Urban Design Code 2009</i> .
1.10.1.1	Gross pollutant trap types and design are somewhat outdated. Significant technology advances (particularly for proprietary gross pollutant traps) and research has occurred since the development of this code.
1.4.1.1	New pipe materials are available on the market which should be considered (e.g. high density polyethylene pipes).

Source: Storm Consulting analysis.

- 2.39 The draft Municipal Infrastructure Standards—Stormwater are based off the AUS-SPEC Base document 0074 Stormwater Drainage, which is a national standard. As such, the draft document is generally in line with standard national practice. The document also has a stronger focus on stormwater quality, which is an important objective for the ACT. Storm Consulting identified that, compared to the current Design Standards, the draft Municipal Infrastructure Standards—Stormwater:
- is more prescriptive for WSUD measures (e.g. refers to specific plant species, etc);
 - uses more recent rainfall data and so better reflects current climate in estimating stormwater runoff;
 - uses more descriptive parameters for water modelling programs which should result in more consistent water modelling through various projects;

- refers to a maintenance guideline as the basis upon which to design water quality components. This is a good measure to ensure the ACT is comfortable with the level of maintenance required; and
- has updated Gross Pollutant Trap selection to reflect more recent technologies which was missing in the current Design Standards.

Nonetheless, there are some areas which need to be reflected in the revised standards. These are shown in Table 2-6.

Table 2-6 Areas where the draft Municipal Infrastructure Standards—Stormwater should be improved

Issue	Recommended improvement
The document still appears to refer back to the old WSUD Code which is outdated.	As found earlier, the Waterways Water Sensitive Urban Design Code needs updating to reflect developments since the Code was first introduced in 2009 and to be more prescriptive.
Pollutant removal targets are listed. However, as with the Water Sensitive Urban Design policy, gross pollutant removal targets are not given.	Include Gross Pollutant targets as indicated at Recommendation 1.
The document is not complete. It contains highlighted sections where some information is missing. For example, Section 10.2 discusses materials of pipe and has a reference to “XXX” which is likely meant to state an Australian Standard.	Complete document before finalising.
The document is not fully adapted to the 2016 Australian Rainfall and Runoff Guidelines. However, it is referenced and certain components have been updated to match new terminology used in the 2016 Guidelines (e.g. rainfall probability has been expressed as AEP (Annual Exceedance Probability) instead of ARI (Average Recurrence Interval)).	As mentioned in the main report, ARR 2016 isn’t completely finished yet but should be considered for future updates.

Source: Storm Consulting analysis

2.40 While Transport Canberra and City Services plans to release a replacement for the Design Standards in early 2018, both the *Waterways Water Sensitive Urban Design Code 2009* and the *Design Standards for Urban Infrastructure—Stormwater* — will need to be further amended to reflect changes resulting from the 2016 Australian Rainfall and Runoff Guidelines.

2.41 There will also be an ongoing need to ensure that the two Codes are aligned. In this regard, there would also be merit in combining the *Waterways Water Sensitive Urban Design Code 2009* and the *Design Standards for Urban Infrastructure—Stormwater*. A unified stormwater design guideline, which does not segregate traditional stormwater design from sustainable water sensitive urban design, would help ensure that the environmental aspects of stormwater design were seen to be as important as the hard engineered components and provide better guidance to designers.

- 2.42 Storm Consulting advised that the City of Kingston's *Civil Design Requirements for Developers—Part A: Integrated Stormwater Management 2016*¹² had taken this approach. It should be considered in future revisions of the Codes.

RECOMMENDATION 2 UPDATE OF DESIGN CODES AND STANDARDS

The Environment, Planning and Sustainable Development Directorate and Transport Canberra and City Services Directorate, respectively, should facilitate updates to the *Waterways Water Sensitive Urban Design Code 2009* and the Design Standards for Stormwater Infrastructure to reflect changes resulting from the 2016 Australian Rainfall and Runoff Guidelines.

RECOMMENDATION 3 ALIGNMENT OF DESIGN CODES AND STANDARDS

The Environment, Planning and Sustainable Development Directorate, in consultation with the Transport and City Services Directorate should:

- a) align the *Waterways Water Sensitive Urban Design Code 2009* with the new Design Standards for Municipal Infrastructure—Stormwater; and
- b) facilitate the amalgamation of these two documents so traditional drainage and water sensitive urban design are fully integrated.

¹² City of Kingston, *Civil Design Requirements for Developers—Part A: Integrated Stormwater Management*, Issue No. 4, May 2016.

3 STORMWATER ASSET ACCEPTANCE PROCESS

- 3.1 This chapter assesses the effectiveness of the processes in place to manage the acceptance of stormwater assets in the ACT.

Summary

Conclusion

The roles and responsibilities of agencies involved in the stormwater asset acceptance process are clearly articulated. However, each agency, by their very function, seeks a different outcome from the development of stormwater solutions. As a result, an agency-focused negotiation process currently determines what design is to be used and consequently what asset is accepted. This needs to be replaced with a process that focuses on the ACT Government's stormwater objectives, so that optimal stormwater solutions are achieved. Not having this process carries the significant risk that accepted assets may not achieve the ACT Government's stormwater objectives, as articulated in legislation and policy.

The process to identify optimum stormwater asset solutions is hampered by a lack of catchment-wide planning across the Territory and the explicit consideration of the costs of the operation and maintenance of accepted assets. At the design stage, potential risks occur when agency advice is not sought, or provided, as part of the development application process.

Key findings

	Paragraph
The <i>Planning and Development Act 2007</i> requirement that deems all development applications as approved, unless agency advice indicating otherwise is received within 15 days, leaves the Territory at risk that inappropriate stormwater assets may be constructed and subsequently accepted. As a developer will have received design approval via the development application process, it may be difficult for Transport Canberra and City Services not to accept the detailed design of the stormwater assets if they comply with the approved approach.	3.20
While the asset acceptance procedures provide adequate guidance on the asset acceptance process, the 'Assessment of Design Review Submissions' procedure for infill developments could be improved by specifically referring to the objectives of stormwater assets as set out in the relevant ACT Government policies to ensure that these policies are met.	3.29
Both the Environment, Planning and Sustainable Development Directorate and Transport Canberra and City Services advised that they have not undertaken	3.37

catchment-wide planning for stormwater for the ACT and that detailed data on the hydrology of proposed new subdivision locations are not available. Developers are therefore required to undertake detailed hydrological studies of greenfield development areas to ensure that their stormwater management approaches will meet planning requirements, particularly those of the *ACT Water Strategy* and the *Waterways Water Sensitive Urban Design Code 2009*.

The absence of catchment-wide stormwater planning in the ACT presents the risk that stormwater management solutions will not be appropriate to meet those required in ACT water management policies. Developing such a plan would provide a sound basis for future stormwater planning. The Environment, Planning and Sustainable Development Directorate should provide the Minister for Planning and Land Management with options on how to undertake this catchment-wide stormwater planning. 3.38

A number of issues are arising at the design stage, partly due to a lack of detail in the *Waterways Water Sensitive Design Code 2009* (one of the reasons it needs updating), which in turn results in a heavy reliance on designers. 3.42

There is no effective process in place to ensure that options to support the operation and maintenance of suitable estate development are considered at the planning stage. 3.53

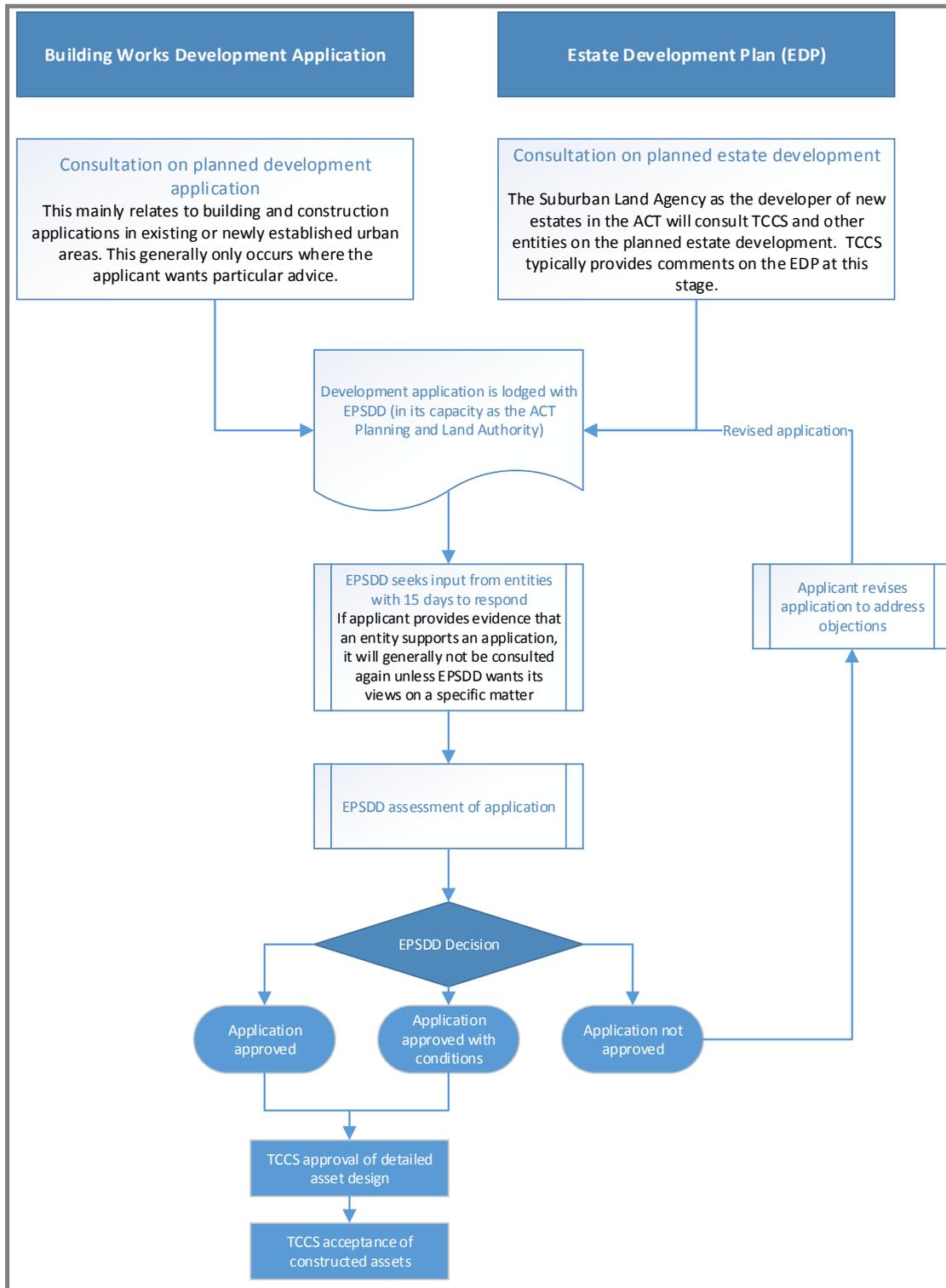
While changes to designs occur infrequently, by not allowing the Development, Review and Coordination Section in Transport Canberra and City Services a reasonable and practical opportunity to respond to proposed design changes that occur during construction (for example, by requiring a response in as little as a few hours), there is an increased risk that unacceptable design solutions may be implemented during the construction of stormwater assets. The Civil Infrastructure Branch and the Development, Review and Coordination Section should consider developing a formal process for the handling of such design changes. 3.69

At the conclusion of work on a project, a developer will provide certification that the work has been completed in accordance with the approved design and to the required standards, after which TCCS will arrange inspection by SMEC. However, certification by the developer is usually provided by one person for an entire project, not specifically for stormwater assets. As separate certification is not usually provided for each type of asset, there is limited assurance the certifier has the suitable qualifications and experience to provide stormwater certification. 3.74

Development application process

3.2 A simplified depiction of the process used for the approval of development applications with stormwater assets in the ACT is shown in Figure 3-1.

Figure 3-1 Development application and asset acceptance process



Source: ACT Audit Office

- 3.3 There are two types of development applications involving stormwater assets that are reviewed, assessed and accepted by Transport Canberra and City Services (TCCS) as compliant and suitable for purpose:
- development works including building approvals within existing or recently established urban areas submitted by developers and government Directorates; and
 - development works in new estates by or on behalf of the Suburban Land Agency (as the developer of new estates in the ACT) and other major infrastructure development works, such as arterial roads, related to new districts (such as Molonglo). As indicated in Figure 3-1, consultation with other agencies on these proposals occurs before a development application is submitted.
- 3.4 The primary purpose of the Development, Review and Coordination Section in TCCS is to ensure that municipal infrastructure assets accepted by TCCS on behalf of the ACT Government comply with current ACT and Australian Standards, applicable codes and guidelines and all applicable statutory and regulatory requirements.
- 3.5 Feedback on stormwater assets is provided at various stages throughout the development application and asset acceptance process. As part of the development application process coordinated by the Environment, Planning and Sustainable Development Directorate (EPSDD), stormwater plans may be submitted by developers. These plans may be submitted to TCCS for comment at this stage and, depending of the nature of the proposed development, be referred to Water Policy within EPSDD. However, there is still a requirement for applicants to seek separate detailed asset design acceptance of the stormwater assets at a later stage from the Development, Review and Coordination Section in TCCS (see Figure 3-2).
- 3.6 EPSDD will not refer development applications to an entity (for example TCCS or ActewAGL) for advice if:
- the authority is satisfied that the applicant has adequately consulted the entity in relation to the application not earlier than 6 months before the day the application is made;
 - the entity agrees in writing to the proposed development; and
 - EPSDD has no questions of the entity in relation to the application.
- 3.7 Both EPSDD and TCCS have formally documented the development application and asset acceptance process (in the form of flowcharts) that are consistent across the board. In addition, a comprehensive service level agreement exists between EPSDD and TCCS that outlines:
- ... expectations and administrative arrangements to streamline the development assessment process for TCCS and the planning and land authority.

- 3.8 The Development, Review and Coordination Section will respond to all development applications itself, where it considers that it has the necessary expertise. Where specialist expertise is required, it will consult Roads ACT on all 'hard' stormwater assets (traditional stormwater assets, such as gross pollutant traps and spillways) and City Presentation on 'soft' assets (water sensitive urban design assets, such as raingardens or bioretention systems¹³). This reflects a decision taken some years ago to consolidate most work on the acceptance of stormwater assets in the one area.
- 3.9 A protocol has been developed to help determine when Roads ACT and City Presentation should be consulted about development applications (the latest version of this protocol is dated October 2017). This lists when development applications are expected to be circulated within TCCS for wider comment. For example, under the protocol, both Roads ACT and City Presentation are expected to be consulted on estate development plans and other concept and master plans. While the protocol specifies when development applications should be circulated for wider comment, Roads ACT operation and maintenance staff indicated that there were occasions when they considered that it would have been preferable had they been consulted at the development application stage.
- 3.10 Under Section 149(2) of the *Planning and Development Act 2007*, entities consulted by EPSDD on development applications are required to provide advice within 15 working days of being sent the application. If an entity does not respond within that time, the entity is taken to have supported the application. Section 150 of the *Planning and Development Act 2007* prescribes the effect of no response from the referral entity as follows:
- ... if an entity fails to provide advice in accordance with section 149 in relation to a development application referred to the entity, the entity is taken to have given advice that the entity supports the application.
- 3.11 There is no provision in the ACT for TCCS, or other entities, to ask for additional time, although EPSDD can request additional information from entities or take account of late responses when making its own assessment of a development application. Also, as noted in paragraph 3.3, detailed consultation on estates occurs before a development application is submitted. This process can be lengthy.
- 3.12 In 2016-17, TCCS adopted a new performance indicator in relation to asset acceptance. Table 3-1 details this indicator, its target and the actual result for the financial year. It should be noted that the target for responses relates to all development applications referred to TCCS, and may include applications that do not include a stormwater element.

¹³ The terms raingardens and bioretention systems are used interchangeably for the same types of assets in the ACT.

Table 3-1 Asset acceptance performance indicator 2016–17

Accountability indicator	Original target 2016–17	Actual result 2016–17
Responses on development applications referred from EPSDD completed within agreed timeframes (15 days)	85%	89%

Source: Transport Canberra and City Services Directorate 2016-17 Annual Report

- 3.13 While the achieved result appears quite high, the result also indicates that one in ten requests for responses on development applications is not responded to within the legislated timeframe and, under the legislation, TCCS is therefore deemed to have supported the application.
- 3.14 In the selection of 42 development applications listed at Table 1-3, EPSDD consulted TCCS on 36 applications and was provided with a response to 34 (94 percent). For the six applications where EPSDD did not consult TCCS, TCCS was consulted at the pre-development application stage. For the two applications where TCCS did not provide a response, TCCS was deemed to have supported the application. Examining whether TCCS might have not supported applications where it did not respond was outside the scope of the audit, but this presents a risk that some unsupported stormwater management approaches might be approved by default.
- 3.15 Of the 34 applications where TCCS did provide a response, TCCS only responded to 24 applications (57 percent) within the prescribed 15 days, and had to be reminded by EPSDD of the need to reply in eight instances.¹⁴ In the nine cases where TCCS did not respond in 15 days, TCCS supported one application, supported six applications with conditions and did not support two applications. TCCS noted that it may have difficulties in responding to development applications in a timely way because of unplanned staff absences.
- 3.16 The 15 day response time to referrals was adopted by the ACT Government in response to a technical paper prepared by the ACT Planning and Land Authority in 2005 titled *'Streamlining development assessment and building approval processes in the ACT'*. The paper noted that:
- Legislation of this type could improve the system in a number of ways. In particular, the legislation could reduce... delays by setting out the maximum time for a referral agency to respond to a request for advice (similar, for example, to the current 15 day time limit for heritage matters)...

¹⁴ In one of the 34 cases, it could not be determined whether the response was provided in 15 days.

3.17 While the 2005 paper did not specifically discuss what should occur if no response was provided by a referral entity, it did infer that a development application could not be approved unless advice had been obtained from the referral agency, unlike the approach adopted in Section 149(2) of the *Planning and Development Act 2007*:

The suggested gains in certainty are obtained at the cost of some flexibility. Applications connected to prescribed referrals cannot be determined until advice has been sought, obtained and considered.

3.18 The ACT approach of a deemed approval where there is no response differs from the approach taken in other jurisdictions. In New South Wales, under the *Environmental Planning and Assessment Regulation 2000*, the consideration period given to consent authorities (the equivalent of the Territory's referral entity) is either 40 or 60 days, and a development application is taken to be refused if a consent authority has not determined the application within the deemed refusal period.

3.19 In Victoria, under the *Planning and Environment Act 1987*, the consideration period given to referral authorities (the equivalent of the Territory's referral entity) is either 10 or 60 days, and an applicant for a planning permit may apply to an Administrative Tribunal for review of the failure of the referral authority to grant the permit within the prescribed time. This implies that the effect of no response is to deny the application.

3.20 The *Planning and Development Act 2007* requirement that deems all development applications as approved, unless agency advice indicating otherwise is received within 15 days, leaves the Territory at risk that inappropriate stormwater assets may be constructed and subsequently accepted. As a developer will have received design approval via the development application process, it may be difficult for Transport Canberra and City Services not to accept the detailed design of the stormwater assets if they comply with the approved approach.

3.21 For this reason, it is considered that there would be merit in EPSDD reviewing the potential risks of accepting applications without first receiving agency advice on the stormwater assets and developing a mitigation strategy for the Government to address these risks.

RECOMMENDATION 4 REFERRAL ENTITY ADVICE

The Environment, Planning and Sustainable Development Directorate should:

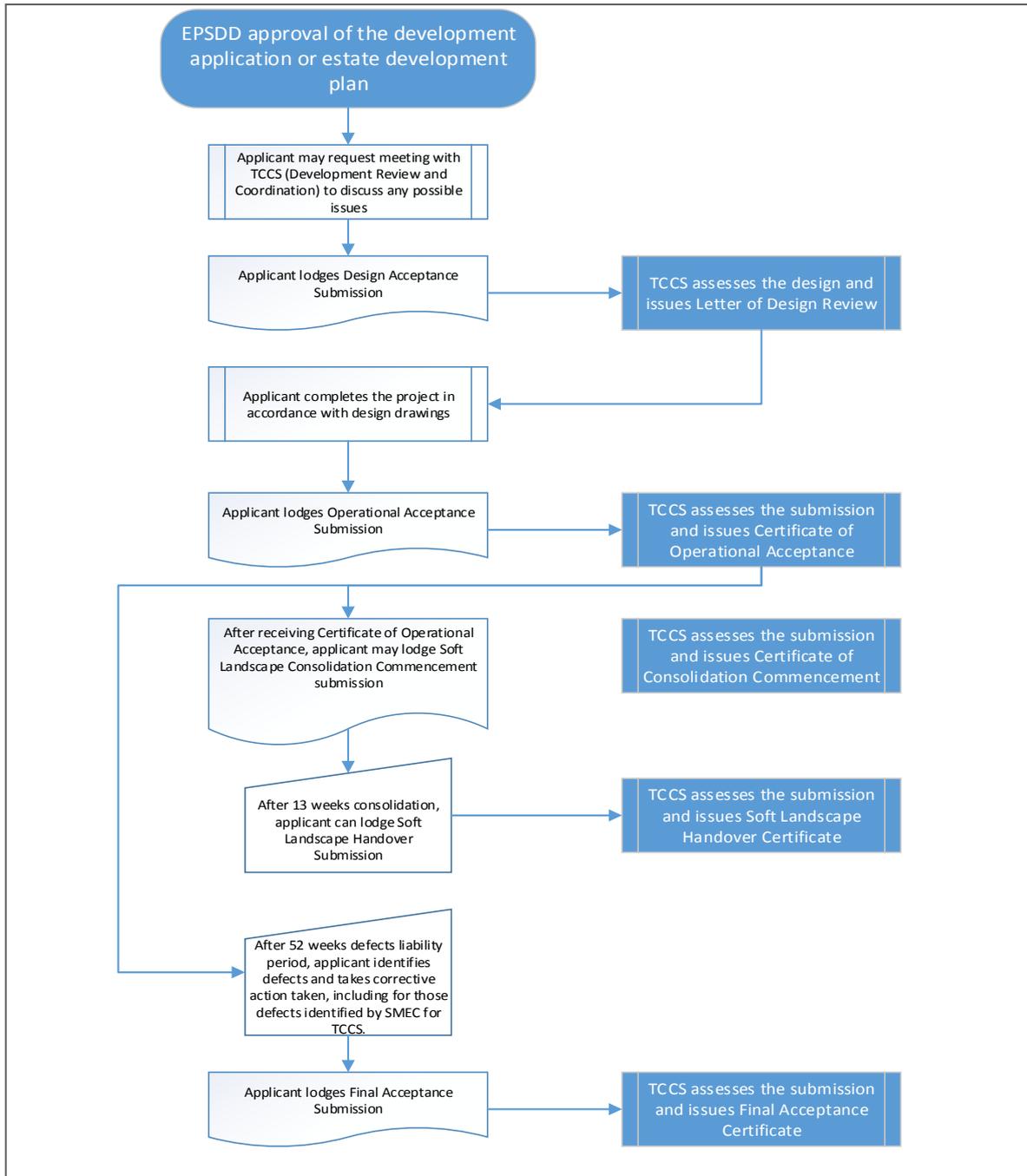
- a) review the potential risks associated with accepting stormwater asset designs, without agency advice, as prescribed under Section 150 of the *Planning and Development Act 2007*; and
- b) prepare a mitigation strategy to address these risks, and, if legislative changes are required, advise the Minister for Planning and Land Management.

Transport Canberra and City Services stormwater asset acceptance process

3.22 As shown in Figure 3-2, following the approval of a development application, the acceptance of stormwater assets by TCCS occurs in three stages:

- design acceptance;
- operational acceptance; and
- final acceptance.

Figure 3-2 Asset acceptance process following approval of the development application



Source: Transport Canberra and City Services, Asset Acceptance Flowchart.

3.23 Design acceptance must be obtained before construction commences and operational acceptance is obtained after the asset has been satisfactorily completed and is ready for use, but before TCCS provides final acceptance of the asset. Final acceptance is provided by TCCS on completion of the defects liability period.

- 3.24 TCCS has developed a number of procedures, applicable to all Development, Review and Coordination Section team members involved in the assessment of development applications to guide the acceptance of stormwater assets. The procedures cover each stage of the asset acceptance process from design approval to operational acceptance and were last updated in August 2017:
- Procedures for Assessment of Design Review Submissions;
 - Procedures for Assessment of Operational Acceptance Submissions; and
 - Procedures for Assessment of Final Acceptance Submissions.
- 3.25 These documents provide checklists to ensure that appropriate processes are followed. In 2016 TCCS also implemented a new electronic document register (ProjectWise), which is used to store documents lodged electronically by developers since that time and other internal TCCS documents relating to the development.
- 3.26 Roads ACT and City Presentation in TCCS contribute to the acceptance process at the design approval stage, if required under the protocol mentioned at paragraph 3.8. They also contribute to the acceptance phase once operational acceptance has occurred, and are responsible for the identification of any defects prior to final acceptance of the assets.
- 3.27 Overall the procedures adequately:
- define the responsibilities of each officer involved in the asset acceptance process;
 - detail the process by which asset acceptance (or rejection) should occur; and
 - identify the supporting documentation against which the submission should be assessed.
- 3.28 The audit found that these procedures are followed routinely (see paragraph 3.70).
- 3.29 While the asset acceptance procedures provide adequate guidance on the asset acceptance process, the 'Assessment of Design Review Submissions' procedure for infill developments could be improved by specifically referring to the objectives of stormwater assets as set out in the relevant ACT Government policies to ensure that these policies are met.
- 3.30 Ways of better achieving the stormwater objectives of the Government are considered in Chapter 4, with opportunities to improve asset acceptance procedures to help facilitate this being considered from paragraph 4.16.

Design acceptance of stormwater assets

3.31 Stormwater asset designs are expected to comply with the ACT's *Design Standards for Urban Infrastructure*. Development applicants are advised that:

In order to obtain the Certificate of Design Acceptance, fully detailed drawings (civil, landscape) prepared by suitably qualified persons for all off-site works including roads, driveways, footpaths, street lighting, storm water, landscaping (and any other issues that may be found by audit of the plans) and a design report in accordance with Ref No 06: "Requirements for Design Acceptance Submissions", must be certified by a Chartered Engineer/Landscape Architect and submitted to the Senior Manager, Development Review and Coordination, TCCS.

3.32 As noted at Figure 3-1, the development application may relate to an estate development plan (greenfield developments) or to a building works application.

Stormwater design acceptance for greenfield developments

3.33 For 'greenfield' sites (new subdivisions and estates), the development applications may relate to:

- the provision of major arterial roads and stormwater infrastructure for a major district, such as Molonglo;
- the development of individual estates within the suburbs covered by that district (estate development plans); and
- individual building and construction development applications, which are similar to building works for infill developments.

Stormwater design acceptance for major subdivisions

3.34 To ensure that stormwater is optimally managed, it is important that catchment-wide planning is undertaken, before stormwater solutions are developed for individual estates.

3.35 In some instances an Environmental Impact Statement (EIS) may also be needed. For example, an EIS was completed for the proposed Cravens Creek Water Quality Control Pond, in close proximity to the Molonglo River to support the Molonglo Stage 2 urban development.¹⁵ With the exception of the Cravens Creek EIS, recent developments in the Territory were exempt from the requirement to submit an EIS as the expected environmental impact of the development proposal had already been deemed to have been sufficiently addressed by other studies conducted by the Territory or Commonwealth Governments. These exemptions were approved by the relevant minister as required under the Planning and Development Act 2007. The adequacy of these studies was not examined as part of this audit.

¹⁵ ACT Government—Environment and Sustainable Development, *Cravens Creek Water Quality Control Pond—Environmental Impact Assessment Report*, March 2014.

- 3.36 The 2016 strategic review and analysis of ACT urban water quality management infrastructure, which was commissioned by EPSDD (the Alluvium Report), found that:

Strategic catchment planning is a significant gap in the ACT. One key issue is a lack of catchment-scale planning and analysis—WSUD targets are applied uniformly regardless of specific receiving water requirements, and with the focus firmly on issues at the estate scale. It is rare that anyone takes a broader view of large-scale treatment trains spanning entire catchments.

- 3.37 Both the Environment, Planning and Sustainable Development Directorate and Transport Canberra and City Services advised that they have not undertaken catchment-wide planning for stormwater for the ACT and that detailed data on the hydrology of proposed new subdivision locations are not available. Developers are therefore required to undertake detailed hydrological studies of greenfield development areas to ensure that their stormwater management approaches will meet planning requirements, particularly those of the *ACT Water Strategy* and the *Waterways Water Sensitive Urban Design Code 2009*.

- 3.38 The absence of catchment-wide stormwater planning in the ACT presents the risk that stormwater management solutions will not be appropriate to meet those required in ACT water management policies. Developing such a plan would provide a sound basis for future stormwater planning. The Environment, Planning and Sustainable Development Directorate should provide the Minister for Planning and Land Management with options on how to undertake this catchment-wide stormwater planning.

RECOMMENDATION 5 CATCHMENT-WIDE STORMWATER PLANNING

The Environment, Planning and Sustainable Development Directorate should identify options for conducting catchment-wide planning, and undertake analysis of stormwater needs, against which future development applications would be assessed. These options should be provided to the Minister for Planning and Land Management for consideration.

Stormwater design acceptance for estate developments

- 3.39 With estate development plans, the Suburban Land Agency, as the developer of new estates in the ACT, will typically consult entities, including TCCS, before they submit their development applications. There will often be a series of meetings to discuss planning of stormwater management for the estate. These initial consultations on the estates focus on the overall approach — water sensitive urban design and other design requirements, particularly the *Waterways Water Sensitive Urban Design Code 2009* (the WSUD Code) and the *Estate Development Code*.

- 3.40 Where these initial consultations have been held, and where the entities have agreed in writing to the development application, EPSDD will not seek further input about the application, unless it has specific questions about it. Where the development application does not provide evidence of prior consultation and agreement by TCCS, EPSDD will formally consult TCCS about it. As shown at Table 1-3, 12 estate development plans were selected

for examination during this audit. Of these, pre-development application meetings were sought and held in four cases. No meetings were sought for the remaining eight because of the consultation that had separately taken place between the Suburban Land Agency and TCCS.

- 3.41 Approval of the detailed design of the stormwater infrastructure in line with this overall approach is obtained separately from TCCS, which will issue a design review certificate after it has accepted the design.

Issues identified during the design acceptance stage

Design issues

- 3.42 A number of issues are arising at the design stage, partly due to a lack of detail in the Waterways Water Sensitive Design Code 2009 (one of the reasons it needs updating), which in turn results in a heavy reliance on designers.

- 3.43 Storm Consulting noted that:

... even with good Codes, there is still a reliance on the designer to use the code appropriately. Codes can't cover every design scenario so this is where more TCCS involvement and expertise is required.

- 3.44 While considerable efforts were made to implement effective stormwater management solutions in Wright and Coombs, given their location close to the Molonglo River, major problems occurred with the dams at Coombs.¹⁶ A special inspection report in March 2015 by SMEC identified a number of design problems with the stormwater infrastructure at Coombs. For example, the report identified that:

- the dam walls for Coombs Pond A and B were planted with shrubs and trees. This was considered to be a potential threat to the safety of the dam because it prevented identification of critical dam safety features, such as cracking, wet areas and seepage; and
- the discharge channel of a secondary spillway was located too close to the toe of an embankment, with a risk to the stability of the embankment.

¹⁶ TCCS advised that the then Land Development Agency worked closely with it to design the assets so that they could be maintained at less frequent intervals and could be readily maintained by TCCS service vehicles. Notwithstanding these efforts, there is still one gross pollutant trap at Coombs Pond B, which cannot be serviced because incorrect access was provided.

3.45 The Alluvium Report found that:

... many fundamental issues are arising at the design stage. Common issues across a range of treatment systems include:

- Many systems (including systems built within the last decade) lack the fundamental features which are standard practice for stormwater treatment systems, including high flow bypass, extended detention and adequate pre-treatment.
- Inlets and diversion systems are consistently designed poorly so that in many cases, very little water is able to enter stormwater treatment systems.
- Maintenance is given inadequate consideration at the design stage, so that there are access issues maintaining treatment systems, ponds and wetlands cannot be drained and bioretention systems lack flushing points.
- Poor vegetation selection appears to be one of the issues leading to vegetation failure in stormwater treatment systems.

Competing priorities of agencies in the design of stormwater assets

3.46 There is a tension between the objectives of some of the agencies involved in the acceptance of stormwater assets:

- Roads ACT and City Presentation within TCCS are primarily concerned with the efficient operation and maintenance of stormwater assets and their ability to do this;
- Water Policy within EPSDD is primarily concerned with the protection of the environment and the minimisation of the harmful effects of stormwater runoff and the development of assets that achieve this objective; and
- the Suburban Land Agency and the Planning Delivery Division of EPSDD are primarily concerned with continuing development within the ACT and on facilitating development and the timely sale of land.

3.47 While the focus of each of these agencies reflect their wider responsibilities, the differing objectives can conflict with each other when they are applied/considered during the acceptance process. For example, some stormwater solutions may be very effective in terms of minimising environmental impacts, but expensive for TCCS to maintain, and the staging of construction of stormwater assets to maximise revenue from the sale of land may lead to subsequent damage of the assets (discussed from paragraph 4.75).

3.48 Two separate reports have identified issues with governance arrangements as they relate to stormwater assets.

3.49 The Alluvium Report identified a tension between:

- a desire to provide for flexibility and innovation in the design process, to allow the industry to find the most cost-effective and efficient solutions to meet stormwater treatment targets and allow practices to evolve over time as new research and development occurs; and
- a desire for a certain level of predictability in new stormwater treatment systems (which are generally public assets), so that when they are handed over to government, their maintenance requirements are practical and well understood.

3.50 In February 2017 a report commissioned by TCCS identified that:

Various features of the current institutional arrangements fell well short of best-practice. Key among these were... misaligned incentives between those who are responsible for accepting assets and those responsible for the O&M of assets and a lack of transparency on the decision making processes for funding allocations and expenditure of allocations.

3.51 In considering new stormwater infrastructure, a major issue for TCCS is its ability to maintain the assets at a reasonable cost. In this regard, Storm Consulting advised that:

The main strain on the maintenance and operation budget is the WSUD components of the stormwater asset group. Traditional stormwater assets (i.e. sumps and pipes) require minimal maintenance as they only convey stormwater. WSUD assets aim to improve stormwater quality by removal of sediments such as nitrogen and phosphorus. This requires biological processes (e.g. wetlands, biofiltration) and the containment of sediments which require regular cleaning and maintenance to ensure the systems function properly.

The maintenance costs of WSUD systems are regularly overlooked in most jurisdictions which implement WSUD. This is also evident in the ACT. The WSUD assets in the ACT are already not maintained adequately due to budget constraints where further development will exacerbate the issue. Maintenance costs of stormwater assets should be re-considered and policies updated to suit what the ACT is capable of maintaining.

3.52 Because of resourcing concerns, both Roads ACT and City Presentation, when consulted, seek to ensure that the operation and maintenance requirements of the planned stormwater assets will be similar to those in other parts of the ACT. Examples of TCCS operation and maintenance concerns are listed in Table 3-2.

Table 3-2 Examples of operation and maintenance issues for TCCS

Issue	Detail
Cost of maintaining raingardens/bioretention systems <i>(For definition of raingardens—also called bioretention systems—see Appendix A)</i>	Water sensitive urban design assets are becoming an increasingly significant part of the overall stormwater asset value and require a larger proportion of the maintenance budget to keep them functioning. Because of TCCS’s limited capacity to maintain such systems, the Alluvium Report (confirmed by TCCS) found that many of the raingardens that it examined had not been maintained for several years. TCCS advised that this was not happening because of the higher maintenance requirements of these assets. For example, Crace and Forde have some 100 or more rain gardens and, where there normally would have been just a pipe that is cheap and easy to maintain, now ACT Roads has a complicated filter system that requires regular attention and specialist equipment to maintain.
Cost of maintaining other ‘soft’ assets	A <i>de facto</i> policy of implementing assets with a low operation and maintenance cost, also applies to other asset types, such as landscaping. For example, the City Presentation Team in TCCS advised that, at Crace, the developer planted out roundabouts and entrances to the estate as part of their landscaping of the estate. However, the City Presentation Team advised that it later removed much of this and replaced it with granite. This was due to concerns about the cost of maintaining the gardens, notwithstanding that, from a stormwater perspective, this was not ideal (because of the greater run-off from granite verges). In some instances, residents on the estate have taken it upon themselves to maintain some of the other gardens.
Use of gross pollutant traps <i>(For definition of gross pollutant traps see Appendix A)</i>	Vortex-style gross pollutant traps, using continuous deflection separation (CDS) technology, which extract finer particles than most of the gross pollutant traps used in the ACT, were installed in Coombs and Wright, as they were expected to achieve a better environmental result. However, TCCS advised that vortex-style gross pollutant traps are no longer being considered for use in new estate developments because of their higher operation and maintenance requirements. For example, proprietary gross pollutant traps are usually required to be cleaned out by education (vacuum removal) trucks at regular intervals. With limited numbers of contractors in the ACT with the expertise to carry out this work, the cost of doing this can be high. Nonetheless, Storm Consulting advised that this operation and maintenance cost could be reduced significantly if TCCS were to purchase education trucks, which would save on third party contractor costs. The use of vortex-style gross pollutant traps should not be excluded from consideration on operation and maintenance grounds, without first knowing whether they are the most appropriate stormwater solution and examining different financing options.

Source: Transport Canberra and City Services advice to the ACT Audit Office.

3.53 There is no effective process in place to ensure that options to support the operation and maintenance of suitable estate development are considered at the planning stage.

3.54 The absence of an accepted process for dealing with the cost of maintaining new stormwater infrastructure is highlighted both by the decision to no longer use vortex-style gross pollutant traps (see Table 3-2) and by consideration of the stormwater management solution for the planned Ginninderry estate, an ACT Government joint venture with the

private sector to develop a parcel of land that adjoins the Molonglo river in Belconnen's west.

3.55 The website for the Ginninderry development states the following:

From the start, our vision for Ginninderry has been to build a community of international significance, with innovation, diversity and ecological criteria at its core.

... Value-add infrastructure such as... some stormwater recycling for irrigation of public parks and spaces will also be provided.

3.56 The project has five fundamental objectives that underpin the sustainability vision:

- it is designed to be sustainable over time; socially, economically and ecologically with a low and reducing ecological footprint;
- it will respond to both the local and the global environment;
- it will provide for future beneficial change to occur in design, infrastructure and regulatory mechanisms;
- it will be cost effective, replicable and measurable, and
- it will act as a new model that others can follow.

3.57 With this development, the Suburban Land Agency advised that it undertook extensive consultation at the concept stage to ensure that the most appropriate stormwater management approach was adopted, given the environmentally sensitive nature of the development (avoiding runoff into the Murrumbidgee and Ginninderra Creek and other environmental considerations). The development of the master plan was guided by the Government's WSUD Code and employs a series of drainage ponds to collect stormwater, which will be used to irrigate the green areas on the estate. There are also river corridors which act as barriers between the Murrumbidgee and Ginninderra Creek and the residential parts of the estate.

3.58 While accepting that the proposed approach was sound and is used widely in other parts of Australia, the City Presentation Team in TCCS raised concerns that it would not have the capacity to provide the required level of maintenance of the irrigated areas and that the residents of this area would be receiving a higher level of amenity than residents of other areas. It therefore opposed the proposed stormwater solution. Nonetheless, given the proposed sensitivity of the planned Ginninderry estate, the stormwater solution developed by the Suburban Land Agency has been adopted, but a decision has still to be taken on how the cost of maintaining it will be met. The Suburban Land Agency advised that the Directors-General Water Group has agreed to establish a working party (involving Treasury, the Suburban Land Agency, EPSDD and TCCS) to explore ways of doing this. This working party has yet to report.¹⁷

¹⁷ As at October 2017, the working group had not met to consider this issue.

- 3.59 Under current practice, there is no guarantee that the optimal stormwater management solution will be adopted for new estates (that is, a solution that effectively meets the Government’s stormwater objectives at an appropriate cost). This is due to TCCS strong focus on adopting the least cost option for maintaining those assets and not necessarily the most appropriate stormwater management solution. In many cases, the optimal solution (achievement of stormwater objectives in a cost effective manner) is likely to require higher operation and maintenance costs. This requires that different options for financing the operation and maintenance of the assets be considered at the design stage.
- 3.60 There are various available options of financing the higher cost of solutions to stormwater management (and other facilities, such as landscaping). Options identified in a report to TCCS by Marsden Jacob and Associates in February 2017 include recognising the level of amenity that is provided to residents in the cost of the rates for those residents, for example, by including a location-specific stormwater (or other amenity operation and maintenance charge) in residents’ rates, having a simple stormwater levy and an increase in general rates.
- 3.61 Ensuring that various stormwater options are formally considered as part of the planning of the subdivisions and in the context of a catchment-wide plan would provide better assurance that the most cost effective stormwater management solution is adopted rather than the least cost solution. Such a process should include:
- consideration of different stormwater (and other estate asset) solutions that comply with the Government’s stormwater policies and performance criteria;
 - consideration of options to finance the operation and maintenance of the differing solutions; and
 - recommendations on the most cost effective stormwater management approach.

RECOMMENDATION 6 CONSIDERATION OF STORMWATER SOLUTIONS

The Environment, Planning and Sustainable Development and Transport Canberra and City Services Directorates, in consultation with the Suburban Land Agency, should develop a range of stormwater management solutions for new estates and subdivisions, in the context of a catchment-wide plan for the area, to ensure that the optimal solution and the means of financing it are adopted.

Stormwater design for infill developments

- 3.62 In established areas, most development applications relate to individual building and construction proposals (infill developments). However, adequate consideration is not given to the cumulative impact of these developments on the capacity of existing stormwater infrastructure and its ability to satisfactorily manage major storm events. This issue is considered further from paragraph 4.93.

- 3.63 With individual infill proposals, the audit found that:
- developers rarely requested pre-development application meetings to discuss stormwater issues. Of the 42 development applications with accepted stormwater assets that the audit examined, 30 related to infill developments. Of these, a pre-development application meeting was requested in only one instance; and
 - TCCS often raised stormwater management issues at the development application stage, while recognising that developers need to obtain design approval of stormwater assets from TCCS after approval of the development application, but before construction commenced. Of the 34 development applications examined by the audit, TCCS raised issues with stormwater plans in 14 applications (41 percent).
- 3.64 TCCS has well established processes in place for developers to use when submitting their design submissions. These include checklists for developers to identify relevant features of stormwater designs applying to their projects and for TCCS to use when assessing the designs. Once a design is approved, a certificate of design acceptance is provided to the developer. The audit found that these processes were routinely followed and were adequate.

Changes to the design of stormwater assets

- 3.65 Advice from TCCS is sought by developers (including areas within the ACT Government, such as the Suburban Land Agency and the Civil Infrastructure Branch, Infrastructure Finance and Capital Works Division in the Chief Minister, Treasury and Economic Development Directorate) on proposed changes to asset designs that may occur during the construction phase.
- 3.66 The Civil Infrastructure Branch advised that:
- ... where changes to design are required due to unforeseen circumstances, there will be consultation with stakeholders, but the time available for such changes is often contractually limited and again stakeholders do not always respond or respond on time (there are potential penalties where a Principal causes unnecessary delay to work).
- 3.67 However, the Branch has also advised that design changes do not occur frequently.
- 3.68 The Civil Infrastructure Branch will contact the Development, Review and Coordination Section in TCCS about design changes. This consultation period is often short (sometimes as little as a few hours), as any delays may halt development unnecessarily. As with advice sought on development applications, the Civil Infrastructure Branch takes a failure to provide a response in the requested timeframe as acceptance of the proposed change and this may result in an unacceptable solution being implemented.
- 3.69 While changes to designs occur infrequently, by not allowing the Development, Review and Coordination Section in Transport Canberra and City Services a reasonable and practical opportunity to respond to proposed design changes that occur during construction (for example, by requiring a response in as little as a few hours), there is an increased risk that

unacceptable design solutions may be implemented during the construction of stormwater assets. The Civil Infrastructure Branch and the Development, Review and Coordination Section should consider developing a formal process for the handling of such design changes.

Acceptance of constructed stormwater assets

- 3.70 Once a project has been completed, the developer will provide certification that the work has been executed in accordance with the approved design. TCCS then arranges for all completed assets to be independently inspected before issuing a certificate of operational acceptance. This is done on behalf of TCCS by the Snowy Mountain Engineering Corporation (SMEC), which reports to TCCS on any defects that may need to be remedied. TCCS first entered into a contract with SMEC for acceptance inspection work for the period 2012–14. The contract has since been extended to January 2018. TCCS advised that a new tender for these services will be called in early 2018.
- 3.71 Developers are required to submit CCTV (video) footage of the stormwater network, which is reviewed by SMEC in conjunction with a site assessment of the completed work to certify that they have been built in accordance with the approved designs. If defects or inconsistencies are found, the developer is required to rectify the issues until a satisfactory SMEC report is provided to TCCS. The SMEC reports were frequently included in the supporting documents provided by developers in their requests for operational acceptance. Where this did not happen, SMEC reports were separately provided to TCCS. The audit found that operational inspections for TCCS were routinely completed.
- 3.72 When reviewing documentation for the selected accepted assets Storm Consulting found that TCCS staff had followed the required acceptance processes, but evidence of adequate follow-up of identified issues was not always available. For example:
- in one instance pipes had been changed from reinforced concrete to polypropylene (BlackMAX), which is not an approved material under the *Design Standards for Urban Infrastructure-Stormwater*, but has been accepted under the ACT's Engineering Advisory Note EAN 05. This advisory note requires the designer to approve the use of BlackMAX pipes, which was done. However, the designer referred to *Australian Standard AS3725—Design for installation of buried concrete pipes*, whereas *AS2566.2 Buried flexible pipes—Installation* should have been used, which raises questions about the level of consideration given to the requested change and the knowledge of the designer, on whom there is strong reliance in the design of stormwater assets; and
 - in another instance the SMEC inspection report identified that there was sedimentation in the sump, but there was no indication of remedial action being taken (which, if no remedial action had been taken, would have become a maintenance burden on TCCS).

3.73 While TCCS does arrange inspection of assets by SMEC before they are accepted, the Directorate is nonetheless heavily reliant on certification by the contractor for satisfactory completion of the work. This is because there can be little supervision of work by the Government during the construction phase. For example, Capital Works advised that the supervision of work during construction is dependent on the type of contract used. There are two types of contracts and the arrangements for each is as follows:

- GC21 contract (Design and Construct):¹⁸ Both the Contractor and Principal (Infrastructure Finance and Capital Works in the Chief Minister, Treasury and Economic Development Directorate) appoint authorised persons to act for them (referred to as the Principal's Authorised Person – PAP and Contractors Authorised Person – CAP), and they are generally required to identify surveillance officers as part of their tendered teams. Infrastructure Finance and Capital Works mainly use this type of contract. The Contractor is responsible for certifying the quality of work done, with specific hold points that the PAP or surveillance officer is required to sign off to ensure that the quality assurance plan submitted by the contractor is delivered in accordance with the contract. On occasions, the Contractor may engage a person from another company to undertake a peer review; and
- AS2124 contract:¹⁹ This is more generally used for medium to low risk construction works, and requires the Principal to engage an independent superintendent.

3.74 At the conclusion of work on a project, a developer will provide certification that the work has been completed in accordance with the approved design and to the required standards, after which TCCS will arrange inspection by SMEC. However, certification by the developer is usually provided by one person for an entire project, not specifically for stormwater assets. As separate certification is not usually provided for each type of asset, there is limited assurance the certifier has the suitable qualifications and experience to provide stormwater certification.

3.75 Separate certification of stormwater assets would help to ensure that the certifications were being provided by suitably qualified and experienced engineers. TCCS advised that it is currently considering doing this.

RECOMMENDATION 7 CERTIFICATION OF STORMWATER ASSETS

The Transport Canberra and City Services Directorate should require that certifications of stormwater assets are provided by engineers who are suitably qualified and experienced in stormwater design.

¹⁸ This is a modified form of a NSW Government contract.

¹⁹ An Australian Standard contract.

- 3.76 Most certificates of operational acceptance include a list of conditions that must be met in order to obtain final acceptance. For AS2124 contracts, these include a requirement to rectify all defects during the defects liability period. GC21 contracts require the project to be defects free at project completion. In the projects examined by the audit team, where defects were identified, they were found to have been rectified. At the end of the defects liability period, a certificate of final acceptance is issued.
- 3.77 While assets are accepted in accordance with established procedures, they can be compromised or damaged after they have been accepted. This is a significant issue and is considered further from paragraph 4.75.

4 ARRANGEMENTS FOR MANAGING ACCEPTED STORMWATER ASSETS

- 4.1 This chapter examines whether there are effective arrangements in place to manage accepted stormwater assets. This includes consideration of data and risk management, strategic asset management, stormwater infrastructure planning and performance reporting.

Summary

Conclusion

There is an urgent need to prevent damage to accepted stormwater assets caused by building and other construction activity, which has led to significant remediation costs being borne by the Territory. While a stormwater education campaign is currently underway, this needs to be complemented by the development and implementation of a coordinated multi-agency strategy to address the range of factors that contribute to third-party damage.

There is also an urgent need for a review of the condition of existing stormwater assets and the development of an augmentation program. There has been no comprehensive review of the existing stormwater network since its development, and there is a limited understanding of the impact that new infill developments will have on the ability of these assets to perform during significant rain events. A lack of a preventative maintenance program increases the risks associated with these assets.

Better information is needed to help inform the development of a preventative maintenance program and the performance of the stormwater network. Performance measures to report on the achievement of ACT Government stormwater objectives are also needed. These could be reported publicly via the Water Report.

Key findings

	Paragraph
While the role of each individual agency in the asset acceptance process was well defined, responsibility for the management of stormwater assets within Transport Canberra and City Services was not.	4.3
Transport Canberra and City Services is currently undertaking a functional alignment review that is considering, among other issues, the division of responsibilities between its business units - Roads ACT and City Presentation. This provides an opportunity for Transport Canberra and City Services to also work with Environment, Planning and	4.11

Sustainable Development to ensure that an effective cross-agency approach is taken to the overall management of stormwater assets. This needs to include consideration of the necessary level of expertise on stormwater management that is required within Government.	
Transport Canberra and City Services has developed internal targets that measure the achievement of a key stormwater objective — reliable flood protection. However, the Directorate has not developed targets for its other key objective — management of stormwater discharges. This makes it difficult to assess whether these objectives are being achieved.	4.31
While the Roads ACT’s 2013 Strategic Asset Management Plan includes flood protection performance targets for stormwater assets, none relate to the quality of water exiting the stormwater system. Information gathered by the Environment, Planning and Sustainable Development Directorate in relation to stormwater asset performance against quality and quantity performance targets is not routinely shared with Transport Canberra and City Services.	4.51
Without arrangements to collect information on the performance of stormwater assets Transport Canberra and City Services has no ability to assess whether accepted asset types are achieving the intention of ACT Government objectives, thereby leaving the Territory at risk that inappropriate or poorly functioning assets are accepted.	4.52
Roads ACT’s risk register could be improved by the identification of the following additional risks: <ul style="list-style-type: none"> • damage to assets after operational acceptance; • inadequately planning for the operation and maintenance of accepted assets; and • adverse effects on the environment from poorly designed, operated, maintained assets. 	4.56
While the environmental impact of stormwater management has been clearly identified in Environment, Planning and Sustainable Development Directorate documents, Transport Canberra and City Services has been less successful in identifying the environmental risks associated with the acceptance of stormwater assets. The risk register Roads ACT (in Transport Canberra and City Services) does not include potential environmental risks relating to the acceptance of assets. The Roads ACT 2013 Strategic Asset Management Plan touches only briefly on environmental risks but a more detailed consideration of this risk is warranted.	4.59
Asset data in IAMS are not complete and/or accurate. For example, the data on dams were not up-to-date (recently built dams had not been included).	4.65

While accepting that Transport Canberra and City Services has resource restrictions, adopting a preventative approach to the maintenance of stormwater assets, which targets known problem areas, could reduce problems occurring in the first place, resulting in improved performance of accepted assets. Analysis of defect data from its IAMS system would also provide the opportunity for Transport Canberra and City Services to identify problem areas and risks to the stormwater network and to take remedial action. 4.73

While EPSDD have initiated the *H2OK: Keeping our waterways healthy* stormwater education program, this does not provide a long-term solution to the third-party damage issue. A range of cross-agency measures will be required to help reduce the damage to stormwater (and other assets, such as landscaping) caused by building and other construction activity. 4.91

Transport Canberra and City Services advised that, with limited exceptions, the condition of stormwater assets in established areas of Canberra has not been reassessed since the development of those areas, despite the fact that there is a known flood risk in some locations. Where reviews have been completed, recommended augmentation work has not been undertaken in all cases and some of these reviews are no longer current. 4.94

There are no scheduled reviews of the condition of the stormwater infrastructure in established areas. To ensure that this infrastructure meets future stormwater needs, there needs to be an ongoing program for the review and augmentation of stormwater assets to alleviate flood hazards due to under-capacity of drainage systems. This is important also to ensure that the stormwater infrastructure can support new infill developments. 4.101

Context

4.2 While the audit did not examine the ongoing management of accepted stormwater assets by Transport Canberra and City Services (TCCS) it did examine the following elements of asset management:

- responsibility for managing stormwater assets — Responsibility for assets was examined as it affects nearly every element of the acceptance process, including issues such as design feedback, risk management and protection of assets (discussed from paragraph 4.12);
- objectives of stormwater assets — It is important to consider the objectives of stormwater assets, and achievement of those objectives, when considering what assets types to accept (discussed from paragraph 4.16);
- risk management — Identifying and managing the risks associated with accepted assets is important when considering issues such as the protection of assets, ensuring

adequate approval processes, planning for adequate maintenance of assets (to ensure their optimal performance) and protection of the environment from the effects of stormwater discharges (discussed from paragraph 4.53); and

- monitoring the condition and performance of accepted assets — Without the collection of complete data on the condition and performance of stormwater assets it's difficult for TCCS to identify what assets should be accepted as future stormwater solutions (discussed from paragraph 4.64).

Responsibility for managing accepted stormwater assets

4.3 While the role of each individual agency in the asset acceptance process was well defined, responsibility for the management of stormwater assets within Transport Canberra and City Services was not.

4.4 The February 2017 Marsden Jacob and Associates report, *Funding Arrangements for the operations, maintenance and renewal of Territory Stormwater Assets* (the Marsden Jacob report), identified that:

Various features of the current institutional arrangements fell well short of best-practice. Key among these were ambiguity regarding roles and responsibilities for stormwater WQ asset O&M...

This had led to a number of operational frictions.

4.5 Stormwater assets are managed and maintained by either Roads ACT or City Presentation, depending on the type of asset. The split is largely based on whether the asset is 'hard' or 'soft'. However, this split is not always clear cut as there are an increasing number of stormwater assets that have both hard and soft elements to their design making it difficult to allocate operation and maintenance to a single business unit. While a Memorandum of Understanding (MOU) has been signed by both Roads ACT and City Presentation identifying which area is responsible for the management of each individual stormwater asset type, the most recent version of this MOU is dated September 2016 and is over a year out of date.

4.6 Clarity around which business unit in TCCS is responsible for each stormwater asset is important for a number of reasons. Understanding which area is responsible for various asset types allows:

- the Development, Review and Coordination Section to refer any queries regarding proposed stormwater asset designs to the appropriate area;
- business units to seek appropriate operation and maintenance funding, particularly when considering the acceptance of new assets;
- stormwater assets to be appropriately operated and maintained, which then increases the likelihood that they will operate in their intended manner and contribute to the achievement of stormwater objectives; and
- each business unit to report on the performance of their stormwater assets.

- 4.7 The Marsden Jacob report flagged the creation of a single stormwater unit as a potential way to provide improved oversight of stormwater management in the ACT:

This option would result in all O&M functions relating to stormwater assets in the ACT moving into a dedicated business unit of TCCS (for example, 'Stormwater ACT'). The business unit would receive budget appropriations for that purpose, and be required to publicly report on performance criteria via either a separate annual report, or as a section of the TCCS annual report. This arrangement would be similar to that currently in place for ACTION.

- 4.8 However, the Marsden Jacob report ultimately recommended that TCCS:

... consider the relative merits of the institutional reform options outlined in this report. In doing so, TCCS should formally engage with ESPD to better understand the ongoing policy developments around funding and institutional reform for stormwater water quality assets in the ACT to ensure efficient and effective reform options from a whole-of-government perspective are identified.

- 4.9 This recommendation was accepted by TCCS.

- 4.10 An effective cross-agency approach to the design and acceptance of stormwater solutions and to their ongoing review, operation and maintenance and augmentation is needed. This requires a high level of expertise in stormwater. The ACT Audit Office team was advised that in the past there was a separate stormwater unit in the former Territory and Municipal Services Directorate and that, with the disbanding of this unit, there had been a loss of expertise and focus on effective stormwater management. While the audit does not have a view on whether such a separate stormwater unit is needed, it is important that stormwater assets as a major category of government assets require strong management and a high level of expertise.

- 4.11 Transport Canberra and City Services is currently undertaking a functional alignment review that is considering, among other issues, the division of responsibilities between its business units - Roads ACT and City Presentation. This provides an opportunity for Transport Canberra and City Services to also work with Environment, Planning and Sustainable Development to ensure that an effective cross-agency approach is taken to the overall management of stormwater assets. This needs to include consideration of the necessary level of expertise on stormwater management that is required within Government.

RECOMMENDATION 8 FUNCTIONAL REVIEW OF STORMWATER MANAGEMENT

The Transport Canberra and City Services Directorate in consultation with the Environment, Planning and Sustainable Development Directorate, should review arrangements for the management of stormwater assets to improve cross-agency management of stormwater.

Strategic planning for stormwater assets

- 4.12 A three-year Strategic Asset Management Plan was developed in 2013 by the Strategic Planning and Development Section within Roads ACT and, while out-of-date, remains operational.
- 4.13 The purpose of the 2013 Strategic Asset Management Plan is to guide planning for the acquisition, use and disposal of infrastructure assets, including stormwater assets, by TCCS. The Directorate prepares its Strategic Asset Management Plan to manage asset performance, capability and condition in accordance with the assets operational requirements. This involves developing medium to long term plans that consider the purpose of assets, where they should be located and what condition they need to be in.
- 4.14 The Strategic Planning and Development Section advised that it has been developing a replacement Strategic Asset Management Plan for the period 2016–19. This revised Plan was due to have been updated by December 2016, and so is currently a year behind schedule. It is important that this Plan is updated as soon as possible to reflect changes in priorities that have occurred over the past three years.
- 4.15 The Strategic Planning and Development Section advised that the revised plan would be finalised by the end of June 2018.

RECOMMENDATION 9 STRATEGIC ASSET MANAGEMENT PLAN

Roads ACT should, no later than June 2018, update and adopt the Strategic Asset Management Plan, to reflect current stormwater management priorities.

Achieving the objectives of stormwater assets

Setting performance targets for stormwater assets

- 4.16 Determining whether the objectives of stormwater assets have been achieved can be done by evaluating the results of targets developed to measure an agency's performance against these objectives.
- 4.17 The *Waterways Water Sensitive Urban Design Code 2009* (the WSUD Code) sets out mandatory targets for stormwater quality and quantity management and details those responsible for meeting these targets. The targets must be met for all new developments and redevelopments.

4.18 The WSUD Code states that:

The objectives for stormwater quality management will be achieved by the combination of works undertaken by the Government, through its development and capital works program, and by private sector works undertaken in new developments and redevelopments.

The responsibility for meeting targets on development or redevelopment sites lies with the developer or builder, while responsibility for meeting the regional or catchment-wide targets lies with Government. The Government will continue to develop, prioritise and implement larger-scale WSUD stormwater measures, such as lakes, ponds and wetlands, to ensure that the catchment-wide targets are achieved. These targets are shown in the table below. They refer to reduction in pollutant export compared to an urban catchment with no water quality management controls. These targets must be met for all developments greater than 2000 m².

4.19 Table 4-1 sets out the WSUD Code targets for stormwater quality management. These targets refer to a reduction in pollutant export compared to an urban catchment with no water quality management controls. These targets must be met for all developments greater than 2000 m².

Table 4-1 Targets for stormwater quality management

	Development or redevelopment sites	Regional or catchment-wide
Reduction in average annual suspended solids (SS) export load	60%	85%
Reduction in average annual total phosphorus (TP) export load	45%	70%
Reduction in average annual total nitrogen (TN) export load	40%	60%

Source: *Waterways Water Sensitive Urban Design Code 2009*

4.20 The WSUD code further explains that the intent may be achieved where:

- adequate provision is made for measures during construction to ensure that the landform is stabilised and erosion is controlled;
- the system design maximises the interception, retention and removal of water-borne pollutants prior to their discharge to receiving waters;
- the system design minimises the environmental impact of urban run-off on surface receiving water quality and on other aspects of the natural environment, such as creek configuration and existing vegetation, by employing all possible techniques that are technically appropriate and effective in reducing run-off and pollution travel in the catchment;
- the system design ensures the continuation, in healthy condition, of a wide diversity of wetland environments (including ephemeral wetlands) in the urban landscape; and
- point sources of pollution in the catchment are identified and their impact minimised until they can be eliminated.

4.21 Table 4-2 sets out the WSUD Code targets for stormwater quantity management.

Table 4-2 Targets for stormwater quantity management

Quantity management measure	Target
Reduction of runoff peak flow to no more than the pre-development levels and release captured flow over a period of 1 to 3 days	3 Month ARI ²⁰
Reduction of peak flows to pre-development levels	5 year to 100 year ARI

Source: *Waterways Water Sensitive Urban Design Code 2009*

4.22 The WSUD Code further states that opportunities should be sought to utilise stormwater as a substitution for mains water, particularly for the irrigation of sportsgrounds and public open space. Where this is proposed, there is a requirement to comply with environmental flow guidelines.

4.23 Good stormwater outcomes may be achieved where:

- the stormwater system is designed to have capacity to control flows up to the relevant design flood;
- the capacity of downstream stormwater systems is not exceeded;
- downstream natural waterways are protected against erosion;
- design of the stormwater system is undertaken by qualified personnel, using recognised and locally accepted hydrological and hydraulic parameters and design methodology; and
- the design and construction of the stormwater system are in accordance with the requirements of the relevant authorities.

4.24 In addition to those targets listed in the WSUD Code, the Environment, Planning and Sustainable Development Directorate (EPSDD) has included one accountability indicator in its annual statement of performance that relates to the quality of water resources in the ACT ('assess data and prepare a public report on the use and quality of the water resources in the ACT'). This data is publicly reported in the form of the annual ACT Water Report.

4.25 The completion of the ACT Water Report for 2015–16 was delayed due to a revised presentation timetable and competing tasks generated from external reporting to Commonwealth agencies, in particular the Murray Darling Basin Authority. The report has yet to be finalised but is expected to be publicly available by the end of 2017.

4.26 While the ACT Water Report generally reports on water quality across the Territory, it does not specifically measure the achievement of the Waterways Water Sensitive Urban Design Code's stormwater quality and quantity targets. Information on the achievement of these key Government stormwater objectives needs to be made publicly available in this report.

²⁰ The ARI is the long-term average number of years between the occurrence of a flood as big as or larger than the selected event

- 4.27 While EPSDD collate information on stormwater objectives that relate to its agency responsibilities (stormwater quality and quantity), TCCS has differing objectives that relate to its agency objectives.
- 4.28 In relation to the acceptance of stormwater assets Roads ACT's 2013 Strategic Asset Management Plan notes that:
- The purpose of drainage is to protect life and property as well as the road edge and substructure from erosion and divert runoff into the main stormwater system. Drainage includes open drains, grassy swales, surface water channels and pipe drainage.
- 4.29 The Roads ACT's 2013 Strategic Asset Management Plan further notes that:
- Stormwater discharges need to be managed to prevent pollutants from entering waterways. Roads provide a number or [sic] potential contaminants such as metals (from vehicles), hydrocarbons, gross pollutants (litter) and herbicides (from vegetation control). These can cause adverse effects for flora and fauna in receiving waters.
- 4.30 In terms of the objectives of stormwater, as with the *Territory Plan*, the *ACT Water Strategy* and the *Estate Development Code*, it is again clear that the ACT Government has prioritised the protection of life and property and the quality of water discharged from the stormwater system.
- 4.31 Transport Canberra and City Services has developed internal targets that measure the achievement of a key stormwater objective — reliable flood protection. However, the Directorate has not developed targets for its other key objective — management of stormwater discharges. This makes it difficult to assess whether these objectives are being achieved.
- 4.32 Table 4-3 sets out the flood protection targets contained in Roads ACT's 2013 Strategic Asset Management Plan.

Table 4-3 Transport Canberra and City Services flood protection targets

Measure	2015–16 Target	2016–17 to 2021–22 Target
No of reported blockages in stormwater system	780	Approximately 790
Number of complaints about gross pollutant traps per year	20	Approximately 20
Percentage of dam inspections carried out	100%	100%

Source: Roads ACT 2013 Strategic Asset Management Plan

- 4.33 No ACT Government agency has developed any publicly reported performance measures that monitor the performance of stormwater assets against specific Government objectives or targets (such as those set out in the *Waterways Water Sensitive Urban Design Code 2009*). Such material should be published (for example, in the ACT Water Report) as it provides the community with information regarding the achievement of key Government objectives for the Territory's second largest asset type.

RECOMMENDATION 10 DEVELOPMENT OF PERFORMANCE INDICATORS

The Environment, Planning and Sustainable Development and Transport Canberra and City Services Directorates should each develop performance measures for the achievement of ACT Government stormwater objectives, including the management of stormwater discharges. These should be publicly reported (for example, in the ACT Water Report).

Achieving performance targets of stormwater assets

- 4.34 The responsibility for achieving performance targets on development or redevelopment sites lies with the developer or builder, while responsibility for meeting the regional or catchment-wide targets lies with Government.
- 4.35 The WSUD Code states that:
- Development applications and building approvals are required to be submitted for new developments. The various assessment codes in the *Territory Plan* provide the rules criteria that must be met in relation to WSUD and demonstrate that the relevant targets will be achieved.
- 4.36 In order to assess whether proposed assets would achieve the targets and objectives of the ACT Government, consideration must be given to this ability at the design acceptance stage.
- 4.37 The *Assessment of Design Review Submissions* procedure (discussed at paragraph 3.24) refers users to a document titled *Requirements for Design Acceptance Submissions*, that establishes mandatory design requirements to be included in any submission requesting design acceptance. Included in this document are both general requirements and asset specific requirements that direct the user to include information such as project descriptions, scope of works, design drawings and specifications and details (if any) of any water sensitive urban design initiatives.
- 4.38 While the *Requirements for Design Acceptance Submissions* procedure requires designers involved in estate developments to prepare a plan that illustrates any proposed water sensitive urban design outcomes in accordance with the *Waterways Water Sensitive Urban Design Code 2009*, it does not require designers involved in infill projects (typically redevelopment projects) to provide information on how the asset will achieve the targets set out in the *Waterways Water Sensitive Urban Design Code*.
- 4.39 Without specific consideration of ACT Government stormwater targets and objectives at the design acceptance stage, it is difficult to assess whether accepted assets have the ability to achieve the intentions of ACT Government objectives. Furthermore, under the existing negotiation processes, individual agency priorities may dominate. This presents a risk that ACT Government stormwater objectives may not be met.

- 4.40 To help address this risk, the *Requirements for Design Acceptance Submissions* procedure needs to be improved by specifically referring to the targets and objectives of stormwater assets as set out in the relevant ACT Government policies.
- 4.41 At present, when considering asset designs, TCCS prioritises its internal objective, to reduce operation and maintenance costs associated with stormwater assets, ahead of optimal stormwater management approaches. The impacts of this approach are discussed further from paragraph 3.57.

RECOMMENDATION 11 ACHIEVING GOVERNMENT OBJECTIVES

Transport Canberra and City Services should amend the *Requirements for Design Acceptance Submissions* procedure to require:

- a) designers to demonstrate how proposed stormwater assets will achieve the objectives of the ACT Government; and
- b) consideration of stormwater objectives when assessing stormwater asset designs.

Monitoring the achievement of performance targets

Environment, Planning and Sustainable Development Directorate

- 4.42 The EPSDD is responsible for monitoring the stormwater quality and quantity performance targets as set out in the WSUD Code.
- 4.43 The 2016 internal audit report titled *A Strategic Review and Analysis of ACT Urban Water Quality Management Infrastructure* noted that:

Previous studies in the ACT have provided limited information on the quantitative performance of stormwater treatment systems. While there have been a significant number of water quality monitoring studies (including some ongoing), these have mostly been focused on developing a general picture of catchment and waterway health, rather than measuring the performance of stormwater treatment systems.

- 4.44 In addition the report noted that:

... with a large number of stormwater treatment systems being constructed both in new developments and as retrofit projects, the performance of these systems is a significant concern in the ACT, and this includes questions not only over “macro scale” performance, but also at the micro scale. There is a significant concern that there is currently no way to know whether ... models are providing accurate performance predictions or whether the WSUD Code pollutant load reduction targets are actually being met.

- 4.45 A 2014 review of the WSUD Code recommended that:

EPD leads the development of a water quality and flows modelling and monitoring program, focusing on understanding the performance of WSUD assets against modelled results and building internal capacity within the ACT Government in modelling and monitoring.

4.46 In response to these recommendations, EPSDD informed the audit team that it was:

... developing a revised Integrated Water Monitoring program. A draft Plan is being considered by our Executive at the moment.

In addition to this a catchment model (known as Source) that estimates water quality/quantity outcomes at the catchment scale has been developed. This will give EPSDD the capacity to review the Regional Water Strategy targets.

At a “block to estate” scale EPSDD has invested in calibrating the MUSIC model to assess the impact of developments on water quality and quantity. The MUSIC model is a standard “off the shelf” generic model used by many jurisdictions. This calibration is targeted at ensuring that the parameters within the model reflect Canberra local conditions in terms of soil types, climate, rainfall etc.

To compliment this, EPSDD also bought 6 model licences to be used by 4 directorates involved in the approval and assessment process. EPSDD also organised training for key staff so they were more adept at understanding the relevant WSUD issues and better able to interrogate information provided by developers in the development application process.

The ACT Healthy Waterways project (\$85M ACT/Commonwealth funded water quality project) is developing an asset evaluation plan (draft version) to evaluate the actual performance of ACT Healthy Waterways WSUD asset performance against the MUSIC model predicted performance. This will be undertaken once ACT Healthy Waterways assets have been established. In addition, a range of specific monitoring is to be undertaken to assist in the broader evaluation of the performance of WSUD structures in the ACT, and the collection of baseline information in the ACT for calibrating MUSIC model. Asset Evaluation Plan (AEP) the Integrated Water Monitoring (draft) is attached for your information.

4.47 At the time of audit, the Directorate had yet to finalise the governance arrangements for reporting and monitoring of this information, meaning that responsibility for these actions has not been allocated. Aside from reporting this information to the Commonwealth Government, the information should also be regularly reported to groups such as the Directors-General Water Group to improve the internal management of stormwater asset performance.

Transport Canberra and City Services

4.48 The performance targets included in the Roads ACT’s 2013 Strategic Asset Management Plan relate to reliable flood protection. These are detailed in Table 4-3 above.

4.49 Data on the number of requests received in relation to reported blockages in stormwater system and the number of complaints about gross pollutant traps per year are reported on a monthly basis via Access Canberra. Roads ACT advised that the:

Roads ACT SAMP is currently evolving into a more ‘living document’, which will be updated more frequently to reflect changing circumstances and in this light it is anticipated that the performance measures will be updated and reported annually.

4.50 This approach is considered better practice as it will allow information users more structured access to data when required.

- 4.51 While the Roads ACT's 2013 Strategic Asset Management Plan includes flood protection performance targets for stormwater assets, none relate to the quality of water exiting the stormwater system. Information gathered by the Environment, Planning and Sustainable Development Directorate in relation to stormwater asset performance against quality and quantity performance targets is not routinely shared with Transport Canberra and City Services.
- 4.52 Without arrangements to collect information on the performance of stormwater assets Transport Canberra and City Services has no ability to assess whether accepted asset types are achieving the intention of ACT Government objectives, thereby leaving the Territory at risk that inappropriate or poorly functioning assets are accepted.

RECOMMENDATION 12 MONITORING THE PERFORMANCE OF STORMWATER ASSETS

The Transport Canberra and City Services Directorate should collect stormwater asset performance information, available from various agencies, for use in considering the acceptance of stormwater assets.

Risk management

- 4.53 Only Roads ACT has identified any specific risks associated with accepting stormwater assets.
- 4.54 In 2016–17 the Roads ACT's risk register listed the receipt of substandard assets as a high risk, and included the following as possible contributors to this risk:
- poor asset design approval and acceptance processes;
 - deterioration of asset;
 - inadequate approval process;
 - lack of specialist knowledge when approving designs;
 - non-compliance of design standards;
 - non-conformance with, or departure from, standard process;
 - inherit non-compliant gifted assets;
 - Roads ACT not consulted during the asset design process; and
 - Roads ACT commentary on works is ignored.
- 4.55 The audit team considered this to be a reasonably comprehensive list of risks that could be adopted by each business unit involved in the asset acceptance process.

- 4.56 Roads ACT's risk register could be improved by the identification of the following additional risks:
- damage to assets after operational acceptance;
 - inadequately planning for the operation and maintenance of accepted assets; and
 - adverse effects on the environment from poorly designed, operated, maintained assets.
- 4.57 The Roads ACT 2013 Strategic Asset Management Plan includes four mitigation strategies to address the risk of pollutants entering waterways, two of which relate to the acceptance of assets, primarily detailing particular asset types that should be considered:
- retention dams, swales, outfall structures and retarding basins to dissipate flows; and
 - construction of gross pollutant traps, water quality ponds and lakes.
- 4.58 No other risks (such as those mentioned at paragraph 4.54) were identified in relation to the acceptance of assets.
- 4.59 While the environmental impact of stormwater management has been clearly identified in Environment, Planning and Sustainable Development Directorate documents, Transport Canberra and City Services has been less successful in identifying the environmental risks associated with the acceptance of stormwater assets. The risk register Roads ACT (in Transport Canberra and City Services) does not include potential environmental risks relating to the acceptance of assets. The Roads ACT 2013 Strategic Asset Management Plan touches only briefly on environmental risks but a more detailed consideration of this risk is warranted.
- 4.60 Results of fieldwork during the audit revealed that the majority of the identified risks had eventuated at some point during the acceptance of some stormwater assets, and some unidentified risks, such as inadequately planning for the operation and maintenance of accepted assets, and damage to assets after operational acceptance, were a pervasive theme. These issues are discussed in more depth from paragraph 4.64.
- 4.61 The communication of risk, especially in regard to accepting particular assets, does not occur formally within business units.
- 4.62 For example, TCCS accepted a number of high performing gross pollutant traps which subsequently proved to be expensive to maintain and led to a reduction in the number of times the traps were emptied (in an attempt to reduce costs). The eventual outcome was that TCCS no longer accepts traps of this nature, preferring to use traps that remove fewer contaminants and are less expensive to maintain. There was no evidence to indicate that any issues relating to the use of these high performing gross pollutant traps had been formally communicated between the responsible agencies/business units.
- 4.63 The effects of accepting assets that have proved costly to maintain have been highlighted informally by a number of staff within TCCS but do not appear to have been

comprehensively quantified. The Roads ACT 2013 Strategic Asset Management Plan and an internal audit have identified a maintenance funding shortfall but do not relate this back specifically to the acceptance of assets, rather to the operation and maintenance of existing assets.

RECOMMENDATION 13 IDENTIFICATION OF RISK

The Development, Review and Coordination Section and Roads ACT and City Presentation business units in the Transport Canberra and City Services Directorate should:

- a) undertake a detailed analysis of the risks associated with the acceptance of stormwater assets;
- b) include treatments to reduce these risks in their relevant risk registers; and
- c) establish a formal process that communicates these risks to Directorate executives.

Monitoring the condition and performance of accepted stormwater assets

Management of newly accepted stormwater assets

- 4.64 Once TCCS has accepted an asset, data relating to the accepted asset are recorded in the Directorate's integrated asset management system (IAMS). Detailed data are available for each asset recorded in the system. For instance, there is a detailed description of the technical characteristics of the asset, its date of construction/installation and the GPS coordinates of the asset. Using the information in IAMS, it is possible to get a detailed map of the stormwater network throughout the ACT.
- 4.65 Asset data in IAMS are not complete and/or accurate. For example, the data on dams were not up-to-date (recently built dams had not been included).
- 4.66 Roads ACT advised that the data will be updated and reconciled once a planned replacement system is in place (TCCS advised that it is currently inviting tenders for a replacement system, since IAMS has now been in use for over 10 years). Nonetheless, there would be merit in updating and reconciling the data before the new system is in place, since IAMS does provide valuable asset information, which supports the development of new infrastructure and the operation and maintenance of the existing infrastructure. This will ensure all relevant data will also be transferred to the new system.
- 4.67 Other data integrity issues identified by a 2013 review of the system included that:
- IAMS does not contain a complete listing of all asset records that were migrated from the previous information system when it was implemented in 2005; and

- some assets that might be considered a risk to the public if not maintained adequately (such as dams) had not been recorded in IAMS and, while efforts had been made to address this, there was a gap in the ongoing upkeep to ensure the completeness of the data.
- 4.68 After an asset has been included in IAMS, defects and capital improvements can be recorded and monitored using the system. Roads ACT uses IAMS to log defect notices and the corrective action it has taken. City Presentation does not use IAMS for this purpose; it only uses IAMS as an asset register. This reflects a decision it took when IAMS was first implemented around 10 years ago not to use the system. It advised that it uses purchase orders to manage its maintenance work and plans to use the new asset management system when it is available. However, City Presentation intend to use the information system for this purpose once it's upgraded.
- 4.69 Both Roads ACT and City Presentation advised that, because of resource limitations, their maintenance of stormwater assets is primarily reactive, that is, their priority is to respond to notifications from the public and their own staff of identified problems and there is limited capacity to do other work. This has resulted in limited routine operational maintenance (some pipes are not being inspected and may have been blocked for years), and other more substantive preventative maintenance not being carried out. This has an impact on the functioning of newly accepted stormwater assets.
- 4.70 Stormwater assets are prone to failure if not maintained effectively. Examples of problems identified by Alluvium, that were likely caused by the reactive approach taken by TCCS, are:
- with most gross pollutant traps used in the ACT being designed to be serviced around twice a year and after any rain event of 25 mm or more (Roads ACT advised that it is unable to achieve this frequency), organic matter accumulating in the gross pollutant traps decomposes anaerobically between cleanouts, causing re-release of pollutants. Many proprietary gross pollutant traps which are not maintained according to manufacturers' specifications are prone to failure; and
 - ponds, lakes and wetlands are only desilted occasionally, when sediment builds to a level demanding action, resulting in poor water quality and the re-release of pollutants from materials building up in the water body.
- 4.71 In the case of dams, Roads ACT arranges for both monthly and annual dam safety inspection reports to be prepared, as required by the *Utilities (Technical Regulation) Act 2014*. Correction of problems identified in these reports are prioritised and (due to a lack of resources) some take years to be rectified.
- 4.72 Table 4-4 provides a breakdown of stormwater expenditure for the three financial years, 2014–15 to 2016–17. It shows that in 2016–17, only 5 percent of stormwater maintenance expenditure was on preventative maintenance, compared to 13 percent in 2015–16 and

3 percent in 2014–15, and 73 percent was reactive, compared to 65 percent in 2015–16 and 71 percent in 2014–15.²¹

Table 4-4 Roads ACT stormwater maintenance expenditure (2014–15 to 2016–17)

Component	2014–15		2015–16		2016–17	
	\$	%	\$	%	\$	%
Program development	287 144	4%	202 000	2%	253 000	3%
Above ground maintenance	334 903	5%	276 000	3%	571 000	6%
Below ground maintenance	3 548 402	49%	3 604 000	39%	3 728 000	42%
Gross pollutant trap operation	1 245 045	17%	2 024 000	22%	2 148 000	24%
Coordination (administrative costs)	282 984	4%	283 000	3%	298 000	3%
Preventative maintenance	200 213	3%	1 230 000	13%	452 000	5%
Street sweeping	1 346 345	19%	1 519 000	17%	1 367 000	16%
Total	7 245 036	100%	9 138 000	100%	8 817 000	100%

Source: Roads ACT

- 4.73 While accepting that Transport Canberra and City Services has resource restrictions, adopting a preventative approach to the maintenance of stormwater assets, which targets known problem areas, could reduce problems occurring in the first place, resulting in improved performance of accepted assets. Analysis of defect data from its IAMS system would also provide the opportunity for Transport Canberra and City Services to identify problem areas and risks to the stormwater network and to take remedial action.
- 4.74 It is also important that the City Presentation Team in TCCS adopt a preventative approach to its maintenance of stormwater assets. Given that a replacement system for IAMS is expected to be available in six to twelve months, it may be necessary for the City Presentation Team to await the introduction of that replacement information system, rather than immediately using IAMS. However, the City Presentation Team should use the new system as soon as it is available to help monitor and plan the maintenance of the stormwater assets for which it is responsible.

RECOMMENDATION 14 IMPROVING THE ACCURACY OF IAMS DATA

Transport Canberra and City Services should review all IAMS stormwater data to ascertain whether they are accurate and complete.

²¹ Reactive expenditure excludes expenditure on program development, coordination and street sweeping.

RECOMMENDATION 15 MANAGEMENT OF THE EXISTING STORMWATER NETWORK

Transport Canberra and City Services should:

- a) develop a preventative maintenance plan for stormwater assets; and
- b) clearly identify problem areas with, and risks to, the stormwater network.

If required, appropriate remedial action should be recommended to the Minister for Transport and City Services.

Remediation of damage to accepted stormwater assets

4.75 There are several guidelines that have been issued by the Environment Protection Authority, that aim to protect the environment, that need to be followed during the construction process:

- *Environmental Protection Guidelines for Construction and Land Development in the ACT*;²²
- *Environmental Regulation & Protection Compliance & Enforcement Guideline 2016*; and
- six information sheets referenced in these Guidelines and available on the Access Canberra website.²³

4.76 These guidelines regulate and enforce the protection of the environment. In terms of stormwater, it ensures that stormwater runoff during construction does not carry excessive sediment loads to the receiving waterways or already constructed water quality systems such as wetlands. Excessive sediment transportation can clog water treatment systems, such as wetlands and gross pollutant traps, and require rectification and maintenance by the ACT government following the acceptance of assets.

4.77 All agencies involved in this audit advised that stormwater assets are regularly damaged or compromised by building and other construction activity and require remediation following acceptance of the assets. Ongoing damage to assets by building and other construction activities may also be identified during the acceptance of assets. The remediation costs of accepted assets are generally borne by the Government (mainly Roads ACT and City Presentation in TCCS) and can be significant.

4.78 Roads ACT estimated that, over the three years from 2014–15 to 2016–17, it incurred total costs of between \$1.5 million and \$1.8 million (or around 7 percent of its total expenditure for maintenance of stormwater assets) in cleaning and maintaining gross pollutant traps alone on new estates. Some of these costs were related to normal maintenance of these

²² ACT Environment Protection Authority, *Environment Protection Guidelines for Construction and Land Development in the ACT*, March 2011.

²³ See https://www.accesscanberra.act.gov.au/app/answers/detail/a_id/3267 [accessed 16 November 2017].

traps, but Roads ACT advised that a significant component related to remediation of the traps, where there had been high levels of sedimentation from building sites.

4.79 Examples of damage caused to stormwater assets, including Coombs ponds, and heavy siltation resulting from work being carried out after handover of stormwater assets are shown at Table 4-5.

Table 4-5 Examples of damage to stormwater assets

Location	Details
Coombs ponds	<p>As at November 2017, costs of around \$750 000 had been incurred on the remediation of two ponds at Coombs. Most of this damage was caused by heavy sedimentation of the dams from surrounding building sites, notwithstanding measures taken by the LDA to prevent this and after the ponds had been handed over to TCCS.</p>  <p>This photo from a report on third party damage to Coombs Pond A shows a new bike path that was installed after Coombs pond A was completed and handed over to then Territory and Municipal Services. There was no erosion control installed and the disturbed area was not seeded or turfed. The picture shows efforts being made by the third party developer who caused the damage to clean up the silt that had covered the path at the bottom of the hill. A significant amount of silt entered the pond and was not cleaned out.</p>
Coombs	<p>Problems can occur with the staging of development. An asset can be completed and handed over and then work is done, so damaging the handed over asset.</p>  <p>This photo shows damage to completed and handed over landscape when a new drainage line that was installed on the southern side of Coombs A. There were no sediment controls or stockpile protection installed by the developer. This resulted in a large amount of sediment entering the pond.</p>
Cravens Creek	<p>In September 2016, a contractor reported on Cravens Creek that:</p> <p>There has been a substantial amount of silt deposited into the gross pollutant trap from upstream since last Wednesday's ... site inspection. See attached photos. The Baramy Maintenance and Service Manual section 2 iii (attached) states the vane array area within the gross pollutant trap is to be cleaned out after 75mm of sediment has</p>

Location	Details
	<p>accumulated. Currently there is approx. 300mm of silt deposited up against the vane.</p> <p>Advice was sought on action to be taken. In its response to the contractor, TCCS noted that:</p> <p>You can see the kind of thing that we were talking about, this happened at Coombs ponds for a couple of years and as the areas surrounding Craven Creek become disturbed from new development this amount of sediment can wash over our landscapes.</p>  <p>The photo shows heavy siltation of the pond at Craven's Creek resulting from development work after the handover of the asset. While the photograph demonstrates that the trap is working, it also evidences the high siltation caused by the post-handover development work.</p>

Source: Transport Canberra and City Services (photo 2).

- 4.80 The Environment Protection Authority, via Access Canberra, requires developers and builders to put erosion and sediment controls in place and to be responsible for the damage they cause, but erosion and sedimentation continues to occur, and all agencies consulted during the course of the audit accepted that there is limited enforcement of the obligations placed on developers and builders.
- 4.81 For instance, an inspection report prepared for the Land Development Agency on the civil works (including stormwater works) for the Moncrieff East residential estate (Stages 2A and 2B) identified that damage had occurred from builders' activities and that this damage was ongoing. There was also a later email at the final inspection report that indicated that a gross pollutant trap on the estate had not been cleaned (and may have never been cleaned during the defects period).
- 4.82 In some cases, siltation is due to 'soft' stormwater assets being built and established 'online'. This means that the stormwater and subsequent silt laden site runoff is allowed to flow into the raingarden before handover to the ACT Government. These assets are being built in areas surrounded by stripped topsoil. Contamination with silt is inevitable, if it connected to the drainage system while the area is so unstable.
- 4.83 The proper establishment of a raingarden or bioretention basin requires that it be kept 'offline' during establishment. TCCS considers that the establishment period needs to be significantly longer than the standard 13 weeks, and it has stipulated 24 months establishment for the healthy waterways projects. Only once the raingarden has been fully established and development largely completed should it be brought online to filter

stormwater runoff and be handed over to the ACT Government, with the concomitant resourcing for maintenance being provided.

4.84 The then Territory and Municipal Services Directorate produced a report in December 2013 on third-party damage to accepted assets.²⁴ This report, which was prepared following consultation with other Directorates, identified a range of factors contributing to third-party damage, including:

- small block sizes, making it difficult for builders to store equipment and supplies within the property boundary;
- limited parking or access for construction vehicles, requiring them to park on verges or drive over the verges, which may have been landscaped as part of the estate development;
- uncoordinated or irregular enforcement of good building and construction practices, and a limited number of staff undertaking enforcement activity;
- unauthorised works on and use of unleased land; and
- a lack of awareness by sub-contractors of compliance requirements.

4.85 The 2013 review recommended that a working group be established to identify solutions to the third-party damage problem. However, TCCS advised that little action was taken on the report at the time; a campaign targeted at improving building practices was the only action taken.

4.86 The Alluvium Report also identified the lack of enforcement of erosion and sediment control practices on development sites as a regulatory issue requiring attention. It said that:

Erosion and sediment control is mixed during the estate development phase (e.g. poor erosion and sediment control has been an issue at Coombs) and virtually non-existent during the house-building phase. This has had a significant impact on a number of stormwater treatment assets that have either been put in place within estate development before house-building was complete, or at some stage in their life experienced significant development somewhere in their catchment.

4.87 Options to help address the issue were identified by various directorate staff during the course of the audit. These included:

- more active compliance activity:
 - both TCCS and the Suburban Land Agency claimed that, because of stronger enforcement, builders who worked in both the ACT and Queanbeyan were more careful to ensure that their building sites were well managed in Queanbeyan than they were in the ACT; and
 - both TCCS and the Suburban Land Agency advised that they were open to their rangers being authorised by the Environment Protection Authority to undertake compliance work on their behalf when a builder or contractor was found to be in

²⁴ TAMS, *Managing Building and Developments—3rd Party Damage*, December 2013.

breach of their requirement to prevent erosion or other activity which might damage or require remediation of stormwater assets. This would greatly expand the compliance capacity of the Government;

- delaying the construction of assets with a high risk of damage until later in the development of the estates, so reducing the risk of the assets being damaged (although the Suburban Land Agency was concerned that this approach could compromise the integrity of the estate development); and
- making the developer (the Suburban Land Agency and their private partners) responsible for the operation and maintenance of assets until the estates are sufficiently well developed that the risk of damage following acceptance is low. The latter would strengthen the case for the Suburban Land Agency to have enforcement powers to help prevent poor building practice.

4.88 In 2017 EPSDD launched the *H2OK: Keeping our waterways healthy* stormwater education program for the ACT and Region. The program will run until June 2019. The program aims to reduce pollutants entering local lakes and waterways generated by the practices and behaviours from the community (including individuals, commercial businesses, government and industry) in an endeavour to build a culture of improved practices across the region.

4.89 The communication and engagement strategy for the program lists the building and construction industry as an audience, as:

... diffuse sources from sites have the potential to release soil, sediment and wastes (rubbish, plastic, paints and chemicals) that enter stormwater drains which flow into our lakes and rivers of the ACT and region.

4.90 The education campaign includes:

- A scoping audit to determine current behaviours around erosion and sediment control compared with industry standards.
- Raising awareness about the impact development can have on stormwater and receiving waterways in the ACT and region.
- Developing industry and cross-government (ACT Government directorates and regional council) partnerships to ensure the relevant regulations are highlighted via all workshops and training activities.
- Encouraging site managers and construction workers to adopt positive behaviours and implement and maintain measures to help protect water quality.
- The roll-out of print media and radio campaign messaging including promotional collateral to coincide with the release of updated erosion and sediment control guidelines in the ACT.
- Training videos which are being prepared for industry toolbox talks and training on sediment and erosion controls.
- Involve Access Canberra (EPA) for a regulation blitz on environment controls on building and construction sites across the ACT and region.
- Establishing stormwater ambassadors who can spread the word and help to build capacity and catchment knowledge within the building and construction industry.
- Promoting the H2OK: Keeping our waterways healthy program brand and key message – only rain down the stormwater drain.

- 4.91 While EPSDD have initiated the *H2OK: Keeping our waterways healthy* stormwater education program, this does not provide a long-term solution to the third-party damage issue. A range of cross-agency measures will be required to help reduce the damage to stormwater (and other assets, such as landscaping) caused by building and other construction activity.
- 4.92 Relevant entities (including but not limited to TCCS, EPSDD, the Suburban Land Agency and Access Canberra) need to develop a coordinated approach to address this issue for the consideration of the relevant Minister. Such an approach could include:
- the staging of construction activity to reduce the potential for damage to constructed assets;
 - greater enforcement of requirements for builders to implement measures to reduce erosion from their building sites; and
 - the timing of the handover of the assets to TCCS when there is a low risk that the assets will be damaged and soft assets (rain gardens and landscaping) have been stabilised.

RECOMMENDATION 16 REDUCING DAMAGE TO ACCEPTED ASSETS

A working group (including representatives from Transport Canberra and City Services, Environment, Planning and Sustainable Development, the Suburban Land Agency, Access Canberra and other relevant entities) should be established to:

- a) develop a coordinated multi-agency strategy to reduce the damage to accepted assets caused by building and other construction activity; and
- b) report to the Minister for Planning and Land Management on actions to be taken, then subsequently the results of any actions undertaken.

Monitoring the condition of accepted assets

- 4.93 The Alluvium Report found that:
- ... many catchments are in transition (e.g. with new development occurring upstream of old development) and older treatment systems are sometimes no longer appropriate as new development takes place upstream.
- 4.94 Transport Canberra and City Services advised that, with limited exceptions, the condition of stormwater assets in established areas of Canberra has not been reassessed since the development of those areas, despite the fact that there is a known flood risk in some locations. Where reviews have been completed, recommended augmentation work has not been undertaken in all cases and some of these reviews are no longer current.

4.95 TCCS advised that areas where there is a current known flood risk include Fyshwick, Chapman, Duffy, Lyons, Page, Red Hill/Griffith, Weetangera and Barton/Forrest. It also advised that:

- the ACT Government has completed or partially completed augmentation of the stormwater infrastructure in the following locations: Ainslie (Wakefield Avenue, Wakefield Gardens and Ainslie Football Park); Ainslie/Braddon/Turner (Corroboree Park through Haig Park); Chapman/Duffy (Stage 1 and retarding basin completed—Stages 2 and 3 yet to be completed); Cook (Molloy Crescent); Holder; Page/Weetangera (Stage 1—Stages 2 and 3 yet to be completed); Turner (Holder Avenue); and Yarralumla; and
- in addition to these locations, reviews of the stormwater infrastructure have been completed, but work has not yet started on augmentation of the stormwater infrastructure at: Barton/Forrest (Commonwealth Government has completed work for which it is responsible, but the ACT Government has still to complete its part of the work); Red Hill/Griffith; and Lyons.

4.96 TCCS advised that there is an increased risk that the stormwater infrastructure in many established areas of Canberra will be unable to cope with major rain events. This is because the stormwater network has not been augmented to help manage increased or more concentrated flows from:

- infill developments, such as multi-unit high rise infill developments in many established areas. These developments reduce the amount of open space to help absorb stormwater, so leading to more concentrated flows. At one location in Dickson where a multi-unit complex is being developed, the need for upgraded stormwater infrastructure in the locality was identified by the developer. This is currently being considered by TCCS; and
- new estates which have been developed close to older areas and where the new stormwater infrastructure is connected to the stormwater infrastructure in the surrounding areas (for example, Lawson, which is surrounded by, and has links to the stormwater infrastructure at, Kaleen, Giralang and McKellar). The impact of new developments on the existing infrastructure and funding for augmentation of this infrastructure should be considered as part of the development of new estates, but TCCS advised that this is not happening.

4.97 The impact of climate change on the capacity of the stormwater infrastructure to handle more severe weather events has also not been assessed.

4.98 Finally, much of the existing stormwater infrastructure is ageing and needs to be reviewed to determine when it needs to be replaced or augmented. The Roads ACT 2013 Strategic Asset Management Plan stated that:

... it's estimated that 75% of the stormwater asset is approximately half way through the theoretical design life, it's important to understand the condition of the asset and determine how well it is performing. However, there is only a small amount of information regarding the physical condition of the stormwater asset group. This is due to the combination of the size of

the asset, and that the majority of the asset is underground and the condition can only be assessed through the use of specialist CCTV surveys, rather than visual inspections. The only formal condition assessment undertaken was in 2001, and was entitled '*Strategic Study into Asset Management, Condition Audit and Development of Performance Based Standards: Part C – Stormwater Study*'.

This particular study inspected stormwater pipes for their structural condition in the suburbs of Barton, Griffith, Deakin, Campbell, Hughes, Fisher, Weston and Duffy and covered only 1 per cent (approx.) of the whole of the stormwater pipe asset.

Although this is insufficient information to gauge the condition of the whole stormwater pipe network, according to the study it was consistently found that the condition of the smaller pipes was much worse than that of the larger pipes (note that 51 percent of all Roads ACT stormwater pipes are in the 'small' class) and approximately 11 per cent of the total length of stormwater pipes surveyed were found to be blocked - significantly impacting the capacity of the system during a rain event.

- 4.99 Roads ACT also assessed the condition of pipes by interrogating records of maintenance activities between 2009 and 2012. This assessment was also reported in the Roads ACT 2013 Strategic Asset Management Plan:

The year 2008/09 has a low level of reported maintenance requests when compared against 2010, 2011 and even 2012 (noting that the period of 2001 – 2009 was predominantly a period of drought). A little over 5 times as many maintenance requests were lodged in 2009/2010 compared with 2008/2009 which can be directly attributed to the floods which occurred during that year. Reported sump blockages had a significant drop of 42% between 2011 to 2012 and pipe blockages decreased by 12 per cent during the same period. Other maintenance request categories returned to their pre 2010/11 levels in 2012, however levels of blocked sumps and pipe maintenance requests are still quite high by comparison.

Overall the two categories with the highest reported maintenance requests are the 'pipe blockages' and 'blocked sump' categories. Pipe blockages were reported 1746 times over the three year period, which equates to approximately *one blockage for every two kilometres* of stormwater pipe in the stormwater asset group. A break down of the reported blockages is supplied below, and is consistent with the findings of the original condition report in that the "small" stormwater pipes have resulted in the most number of blockages. This may be an indicator of their service condition.

Possibly linked to the blockages in the underground pipe work is the high number of blocked sumps also recorded during the same period. Although in total, the sump blockages recorded is over 3 per cent (2250 recorded maintenance requests) of total sump assets, it is likely that some of the pipe blockages may have been caused by *potential* sump blockages passing into the underground system unchecked and then causing a blockage further downstream in the pipe system.

Blockages may be in part attributable to pipe condition but also the high numbers of deciduous trees in Canberra and consequently the high levels of leaf litter which are uninhibited by current management.

- 4.100 Where flooding occurs because of a failure of the part of the Government to augment the stormwater infrastructure to help manage increased flows as a result of developments approved by the Government, there is an increased risk of claims for compensation from people whose properties have been flooded.

4.101 There are no scheduled reviews of the condition of the stormwater infrastructure in established areas. To ensure that this infrastructure meets future stormwater needs, there needs to be an ongoing program for the review and augmentation of stormwater assets to alleviate flood hazards due to under-capacity of drainage systems. This is important also to ensure that the stormwater infrastructure can support new infill developments.

RECOMMENDATION 17 REVIEW AND AUGMENTATION OF EXISTING STORMWATER INFRASTRUCTURE

Transport Canberra and City Services should develop a forward program for the ongoing review of stormwater infrastructure in established areas of Canberra and augmentation of the infrastructure where necessary. The forward program should be provided to the Minister for Transport and City Services for consideration and direction.

APPENDIX A: STORMWATER ASSET DESCRIPTIONS

Table A-1 Stormwater asset descriptions

Asset	Description
Sumps	The purpose of a sump is to act as an inlet for stormwater runoff from the surface to the underground pipe network.
Pipes	The underground stormwater pipelines range from 100mm diameter tie lines collecting discharge from individual leases, to pipes greater than 1200mm diameter. Around 77 percent of stormwater pipe assets consist of the small (<450mm) diameter pipe range. The design life of pipe assets is approximately 80 – 100 years.
Maintenance holes	Maintenance holes provide convenient access for inspection, maintenance and repair of underground stormwater pipes.
Surcharge structures	Surcharge structures are provided along the underground pipe network so that in high rainfall events, the excess stormwater from the pipe network can spill to the surface and be removed safely by above ground creeks, channels and floodways.
Cut-off drains	Cut-off drains are purpose built channels and swales located on the high side of properties, and are provided to route stormwater away from residential housing, roads, etc. that may be at risk due to run off from higher ground. The cut-off drains collect and transport the stormwater to the rest of the stormwater system for removal.
Small channels	Small channels collect flows generated by small urban catchments and convey them to major channels or underground pipes.
Swales	Swale drains are mildly sloping vegetated surfaces that collect stormwater runoff from roads, car parks, footpath and other impervious surfaces. They are normally located downstream of impervious surfaces and are designed to slow the runoff velocity to enable infiltration, sedimentation and trapping of pollutants. They may not be recorded in the stormwater asset group as they are considered to be open space in many cases.
Gross pollutant traps (GPTs)	Gross Pollutant Traps are pollution control devices which function to intercept and retain gross pollutants, litter, sediment and debris. GPTs can be located at the outlet of the urban stormwater system prior to discharge into natural streams, lakes or rivers or at intermediate locations around the system to reduce blockages downstream.
Lined channels	Lined channels form a part of the major above ground stormwater system. They are designed to collect and transport large volumes of stormwater above ground during large rainfall events.
Floodways/engineered waterways	The primary function of a floodway is to collect and safely convey stormwater runoff from events up to and including the 100 year Average Recurrence Interval (ARI). They are generally constructed of a grass surface with or without low flow concrete inverts or pipe inverts.
Retarding basins	The purpose of retarding basins is to attenuate peak flows from the major drainage system by temporarily storing runoff and releasing the flows at a reduced flow rate. Retarding basins generally provide, and are constructed with other functions such as playing fields, water features and car parks. When

Asset	Description
	combined with ponds or lakes, they also act to remove pollutants by various physical, chemical and biological processes.
Raingardens	Rain gardens (also called bioretention systems) in their simplest form are shallow depressions with absorbent, yet free draining soil and planted with vegetation that can withstand temporary flooding. They are generally self-watering, low maintenance gardens designed to protect our waterways and lakes by capturing stormwater which runs off hard surfaces after it rains. They also mimic the natural water retention of undeveloped land and reduce the volume of rainwater running off into drains from impervious surfaces (surfaces that fluids, like water, cannot pass through). They also treat low level pollution and nutrients in stormwater by using physical processes in the soil and biological properties of plants, roots and microbes.

Source: Roads ACT, Draft Strategic Management Plan 2016–19—Stormwater Lifecycle, pp. 11-13 and ACT Healthy Waterways website.

Audit reports

Reports Published in 2017-18	
Report No. 11 – 2017	2016-17 Financial Audits - Financial Results and Audit Findings
Report No. 10 – 2017	2016-17 Financial Audits – Overview
Report No. 09 – 2017	Annual Report 2016-17
Report No. 08 – 2017	Selected ACT Government agencies’ management of Public Art
Reports Published in 2016-17	
Report No. 07 – 2017	Public Housing Renewal Program
Report No. 06 – 2017	Mental Health Services – Transition from Acute Care
Report No. 05 – 2017	Maintenance of Selected Road Infrastructure Assets
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