

Transferring Ownership of Vegetated Stormwater Assets

Version 1, February 2012

waterbydesign

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Water by Design

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Healthy Waterways

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Glossary

This glossary defines words commonly used in relation to vegetated stormwater assets. Definitions given here fit the context of the words as they are used in this document.

Allotment-building phase For subdivisions, the period following the construction phase where individual lot owners undertake building of dwellings or other buildings relating to the occupation of the land.

Applicant or developer The party responsible for constructing and establishing assets in accordance with the design and conditions of approval. Developers (or other private parties) may construct and contribute assets to the local authority or to a body corporate, property owner, or similar private party as part of building works or as part of subdivisions. Local or state authorities may construct vegetated stormwater assets that will be publicly owned.

Asset handover See 'asset transfer'.

Asset owner The party who ultimately owns the asset and is responsible for the long-term management of the asset. Asset owners may either be local authorities, state governments, or water authorities for public assets, or a body corporate (or similar) for private assets. Sometimes referred to as the **ultimate owner**.

Asset transfer Used interchangeably with 'asset handover'; it refers to the change of ownership of an asset from the applicant or developer to the ultimate asset owner. Asset transfer occurs on the basis that the asset is functioning properly and the ultimate asset owner accepts ownership.

Bill of quantities A full schedule of works and maintenance items with relevant quantities prepared by a suitably qualified person.

Bond Financial security provided by a developer or applicant to ensure completion of specific works in order to fulfil conditions of development approval or operational works approval.

Construction phase The phase of subdivision development that includes bulk earthworks and provision of major infrastructure, such as roads, water supply, sewers, and drainage. Occurs prior to the allotment-building phase.

Contributed assets Assets that are constructed and established by a private party and transferred to public ownership. Typically, contributed assets are delivered by developers and handed to local authorities.

Contribution A payment given by the applicant or developer to the asset owner in lieu of constructing or establishing specific works as part of a development. Contributions are used by local authorities to construct or complete the asset at the end of the allotment-building phase.

Defect liability See 'On-maintenance'.

Establishment phase The period immediately after a vegetated stormwater asset is constructed when vegetation matures. This period will last for approximately two years for most vegetated stormwater assets.

Material Change of Use A development application or approval that allows a change to the designated use of a parcel of land (e.g. from rural to residential).

Off-maintenance The formal acceptance, by the ultimate owner, of the transfer of maintenance responsibility from the applicant following satisfactory completion of the on-maintenance period. Also known as the **end of the defect liability period**.

On-maintenance A period of time during which the asset owner has ownership of the asset but the applicant is responsible for undertaking maintenance. Also referred to as the **defects liability period**.

Operational works The construction phase of a development, during which all major earthworks, infrastructure, and landscaping is undertaken.

Operational works approval The approval and conditioning for operational works by a local authority based on detailed designs for the development or asset. Also known as **construction approval, construction certification approval, or engineering/landscape approval**.

Performance indicator Performance indicators are visual cues and quantitative measures that help to determine if assets are meeting their desired standards of service.

Plan sealing Endorsement by the local authority of the plan of survey for lots newly created as part of a reconfiguration of an existing lot (subdivision). Plan sealing is an important milestone as it allows lots to be sold. Also referred to as **plan of survey endorsement, subdivision certificate, statement of compliance of (civil) works, or issuing of title**.

Practical completion The completion of construction, or establishment of assets, whereby they are 'fit-for-purpose' or functional and ready for use as designed.

Reconfiguration of Lot

A development application or approval that allows the subdivision of a lot into multiple smaller lots.

Ultimate owner See 'Asset owner'.

Terminology used for key development stages

To assist in the use of this document across Australia, the common planning and development terminology used throughout Australia is set out below. Local governments often establish planning terminology and it can vary from the generic terms presented here.

| | Queensland | New South Wales | Victoria | South Australia | Western Australia | Tasmania |
|--------------------------|--|-------------------------------------|---|--|--|---|
| Development Stage | Development/ Planning Approval | Development/ Planning Approval | Development/ Planning Approval | Development Plan Approval | Subdivision Approval | Development Approval (Notification of a Permit) |
| | Operational Works Approval | Construction Certification Approval | Construction Approval | Engineering/ Landscape Approval | Approval Of Engineering/ Landscape Drawings | Engineering/ Landscape Approval |
| | Construction | Construction | Construction | Construction | Construction | Construction |
| | Practical Completion | Compliance Certificate | Practical Completion | Practical Completion | Practical Completion | Practical Completion |
| | Plan Sealing Compliance Approval (or Plan Sealing) | Subdivision Certificate | Statement of Compliance for Subdivision Works | | Clearance of Conditions and Issuing of Title | Plan Sealing |
| | On-Maintenance | Defect Liability Period | Defect Liability Period | Defect Liability Period | Maintenance Period | On-Maintenance |
| | Off-Maintenance | Off-Maintenance | End Defects and Liability Period Certificate of Completion issued | End Defects Liability Period - Certificate of Final Completion | Handover | Off-Maintenance |

ONE INTRODUCTION



1.1 Purpose of this document

This document provides guidance on how to transfer vegetated stormwater assets from the constructing party, typically the developer, to the long-term owners and managers of the assets, typically the local authority or a private entity (such as a body corporate), so that owners inherit assets that are functioning properly and that are meeting their design intent. It provides information, processes, and checklists to assist with each stage of the handover process. It covers swales, bioretention systems, constructed wetlands, and sediment basins.

The focus of *Transferring Ownership of Vegetated Stormwater Assets* is vegetated stormwater assets constructed as part of subdivisions. However, as many vegetated stormwater assets are created as part of other developments and remain in private ownership, handover options for private assets are included.

1.2 Why use this document

Waterways are an integral part of our lifestyle and economy, and urban stormwater run-off can significantly affect our waterways. Typically, a system of pits and pipes conveys stormwater from urban areas to receiving waterways more frequently and in greater volumes than what happens naturally. This stormwater carries large volumes of pollutants, such as nutrients, sediment, and litter. Vegetated stormwater assets, such as bioretention systems and wetlands, can reduce the impacts of urban stormwater, provided they are well planned, designed, constructed, and maintained.

A range of legislative, financial, environmental, and social imperatives is driving the need for vegetated stormwater assets across Australia. For example, in Queensland the State Planning Policy 4/10 Healthy Waters requires development to be planned, designed, constructed, and operated to manage stormwater in a way that protects waterways.

Vegetated stormwater assets are a relatively new form of asset. The systems and processes that ensure these assets are designed, constructed, and established properly are not consistently applied, often resulting in the asset owner receiving the assets at the wrong time or in poor condition. Owners need to inherit vegetated stormwater assets that are functioning properly and meeting their design intent in order to protect receiving environments and to avoid unnecessary maintenance burdens. In other words, to ensure that owners inherit assets rather than liabilities.

Transferring vegetated stormwater assets to their ultimate owners is complex because vegetated stormwater assets are generally a combination of both civil and landscape (or 'green') infrastructure. During the planning and delivery process, the asset owner has many opportunities to ensure vegetated stormwater assets function properly. This document identifies these opportunities and provides guidance about how to certify at each asset handover stage that the assets are functioning properly. This minimises the potential for the asset owner to be burdened with unnecessary maintenance or rectification costs due to inheriting a poorly functioning or failing system.

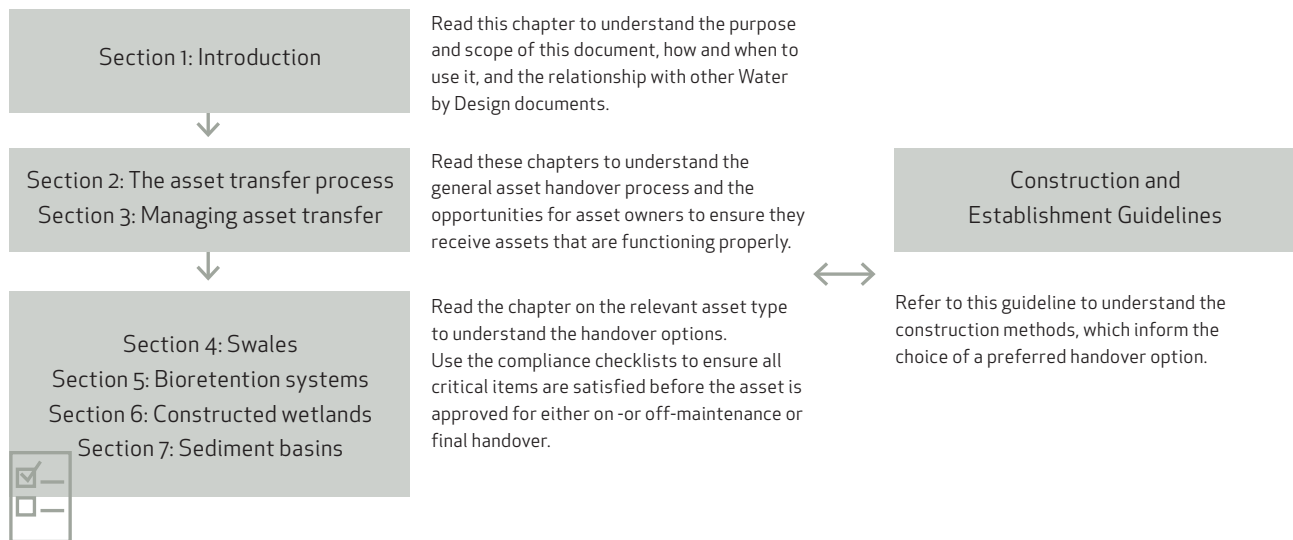
1.3 Who should use this document

As an effective asset handover process requires input and cooperation from a range of multi-disciplinary stakeholders, *Transferring Ownership of Vegetated Stormwater Assets* will be useful to a range of people working in land development and asset management. However, the document is primarily aimed at those responsible for managing the compliance and handover process. For public assets, the local authority or the state government will typically manage the handover process. Private entities, such as body corporates, will typically manage the handover process for assets that they will own. In other situations, such as small developments, private certifiers will manage the process.

1.4 How to use this document

Figure 1 illustrates how to use *Transferring Ownership of Vegetated Stormwater Assets*.

Figure 1: How to use *Transferring Ownership of Vegetated Stormwater Assets*



Sections 4 to 7 detail the handover options for swales, bioretention systems, constructed wetlands, and sediment basins. A process chart illustrates each handover option, including the construction, compliance, bonding, and development milestones. Figure 2 explains how to interpret the process charts. Asset owners can adapt the options presented in this document to suit their circumstances, including their planning scheme policies, the conditions of development approval, or the developer's desire to hand financial and maintenance responsibility over to the asset owner.

While the checklists in Sections 4 to 7 are intended to assist compliance officers and private certifiers undertake compliance inspections, the constructing party (e.g. site supervisors) can also use them so that they can have confidence that the assets are in an acceptable condition for handover.

Figure 2: How to interpret the asset handover process charts in Sections 4 to 7

Handover option identifier. Numbering is consistent with the construction methods (refer to the Construction and Establishment Guidelines).

Compliance inspections required prior to proceeding on to further activities. Compliance checklists for each inspection are provided in Sections 4 to 7.

Bonding/contribution requirements, including when and what type are to be collected and returned.

Figure 25: Wetland option 1b — bypass and early establishment with early handover

Permanent and temporary works required for the construction and establishment of the vegetated stormwater asset.

| CONSTRUCTION AND ESTABLISHMENT GUIDELINES | | ACCEPTING OWNERSHIP OF VEGETATED STORMWATER ASSETS | | |
|--|---|--|---|-----------------------|
| PERMANENT WORKS | TEMPORARY WORKS | COMPLIANCE INSPECTIONS | BONDING/ CONTRIBUTIONS | DEVELOPMENT MILESTONE |
| | | Pre-start | | |
| Earthworks/profiling | | | | |
| Liner and bunds | | | | |
| Hydraulic structures | | | | |
| Topsail | | | | |
| | Disconnect macrophyte zone | | | |
| Stabilise high flow bypass | | | | |
| | Sediment fences | Civil practical completion/ building phase protection | Collect contribution, civil maintenance bond, and vegetation performance bond | Plan sealing |
| | | | | Civil on-maintenance |
| Planting (macrophyte zone) | | | | |
| Landscape establishment and water level control (min. 12 months) | | | | |
| | | Civil off-maintenance + landscape practical completion | | |
| | | | | Off-maintenance |
| | | | Return maintenance and performance bonds | |
| | | | | Handover |
| | Interim macrophyte zone maintenance | 90% BUILDING COMPLETE | | |
| | Clean out inlet pond and re-connect macrophyte zone | | | |
| Planting and establishment (inlet pond) (min. 6 weeks) | | | | |
| | | Landscape off-maintenance/ final compliance inspection | | |
| Long-term maintenance | | | | |

Key development milestones.

'Handover' identifies the point where the responsibility for the asset is handed over to the ultimate owner.

Section shown in red indicates responsibilities of the asset owner after handover.

Note: the activities shown in red following handover are the responsibility of the asset owner

Details provided in the Construction and Establishment Guidelines.

Details provided in Section 3 of this document.

1.5 Relationship with other Water by Design resources

Figure 3 shows the key resource documents that Water by Design provides to help individuals and organisations sustainably manage urban water. These guidelines and resources assist stakeholders to plan, design, implement, and manage vegetated stormwater assets.

The documents of most relevance to constructing and managing vegetated stormwater assets are:

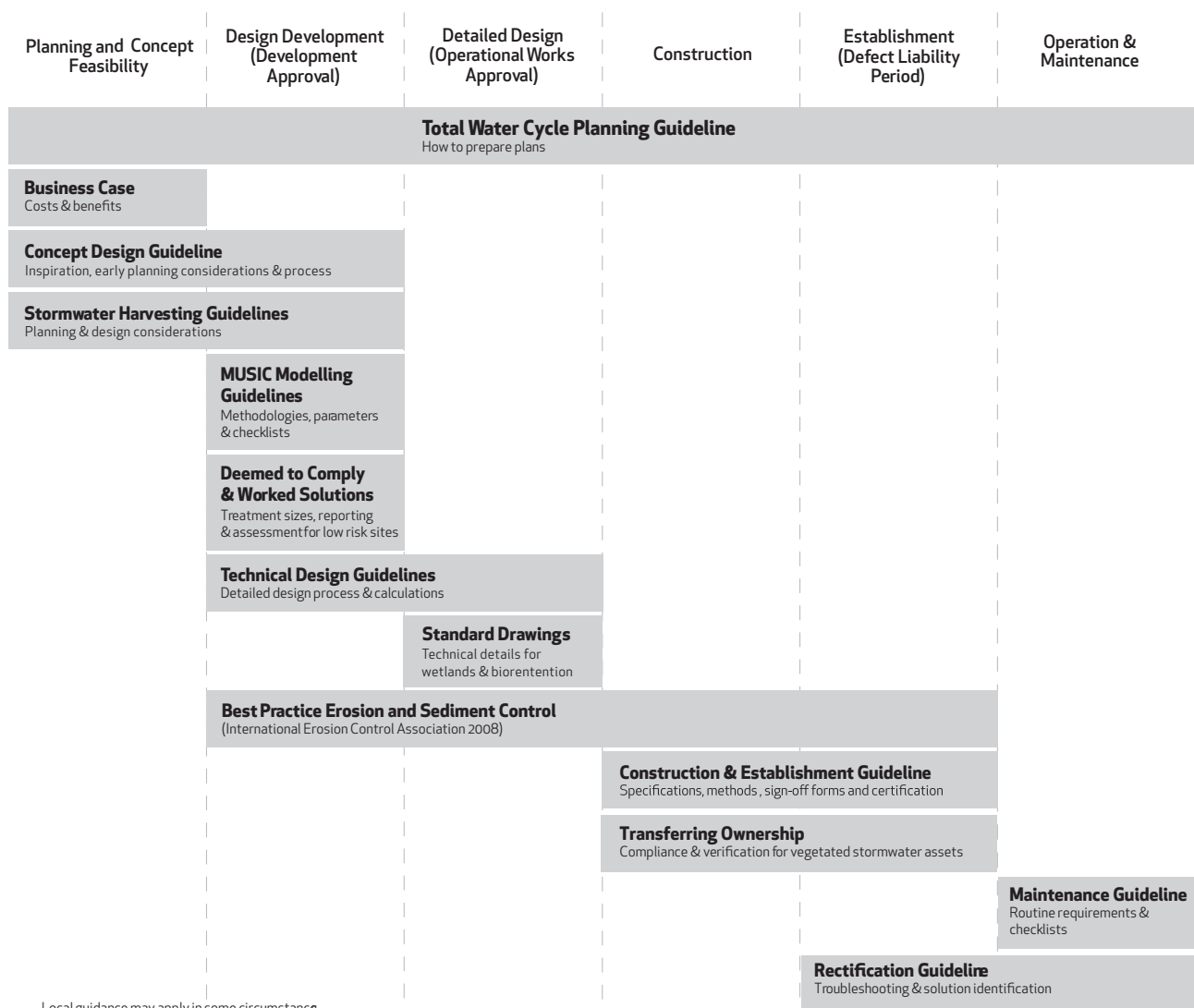
- *Construction and Establishment Guidelines* (Section 1.5.1)
- *Maintaining Vegetated Stormwater Assets* (Section 1.5.2)
- *Rectifying Vegetated Stormwater Assets* (Section 1.5.3)

1.5.1 Construction and Establishment Guidelines

The *Construction and Establishment Guidelines* outline the methods for constructing and establishing swales, bioretention systems, and wetlands. For each method, step-by-step instructions are included to ensure the assets are constructed properly. The guidelines provide sign-off forms for supervisors and designers to certify the assets before handing them over.

Figure 4 illustrates the relationship between *Transferring Ownership of Vegetated Stormwater Assets* and the *Construction and Establishment Guidelines*. The sign-off forms in the *Construction and Establishment Guidelines* and the checklists in *Transferring Ownership of Vegetated Stormwater Assets* form the basis for certification and compliance of the delivery and handover process.

Figure 3: Vegetated stormwater asset timeline and supporting resources



The checklists in this document are based on information from the sign-off forms provided in the *Construction and Establishment Guidelines*. They have been modified to only contain the critical items that compliance officers or certifiers need to check to have confidence that a vegetated stormwater asset was built and established correctly and is functioning as intended. If compliance officers or private certifiers wish to undertake additional compliance inspections to ensure contractors correctly install other elements of vegetated stormwater assets, such as under-drainage inspection points for bioretention systems, they should use the sign-off forms in the *Construction and Establishment Guidelines* as a reference.

1.5.2 Maintaining Vegetated Stormwater Assets

Maintaining Vegetated Stormwater Assets helps asset managers and maintenance staff by providing practical and standard advice for maintaining swales, bioretention systems, constructed wetlands, and sediment basins. It contains:

- information to assist with planning for maintenance, including how often to undertake inspections and maintenance activities
- guidance on how to undertake typical maintenance activities

- checklists for recording the results of inspections and the maintenance activities undertaken

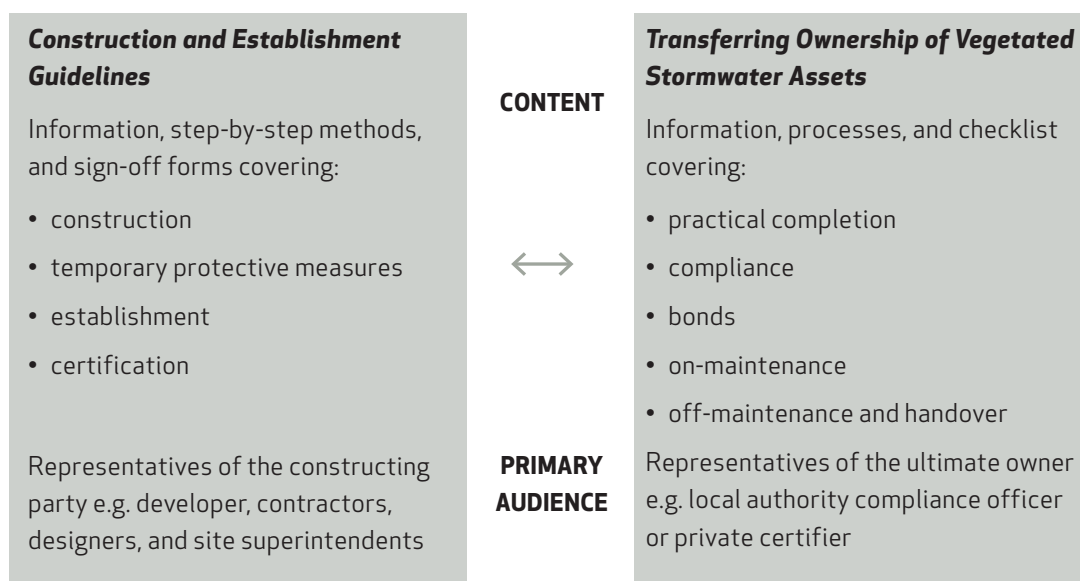
The inspection and maintenance checklists contain key performance indicators that field staff can use to identify whether assets are working properly.

1.5.3 Rectifying Vegetated Stormwater Assets

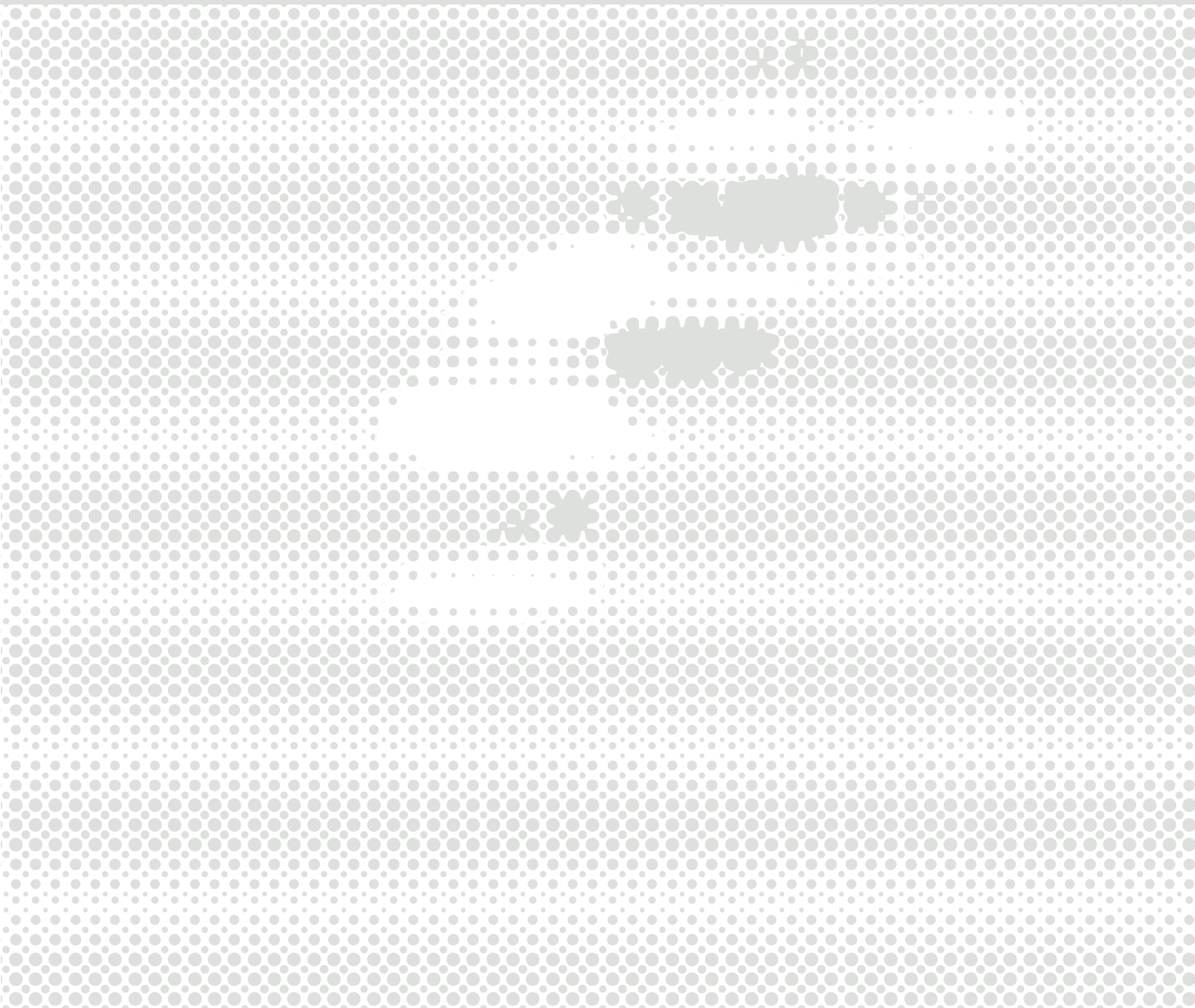
Rectifying Vegetated Stormwater Assets recommends how to repair under-performing or failing vegetated stormwater assets to their intended, functioning state. It provides:

- a process to determine whether to rectify an asset
- guidance on how to identify typical problems
- possible solutions for how to rectify problems.

Figure 4: Relationship between the *Construction and Establishment Guidelines* and *Transferring Ownership of Vegetated Stormwater Assets*



TWO THE ASSET TRANSFER PROCESS



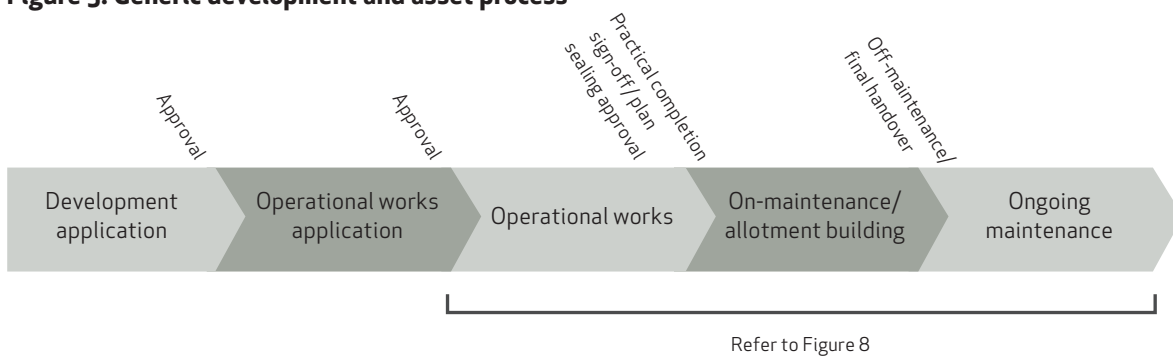
2.1 Overview

Asset transfer is not a single step: it is a process as part of an overall development where the ownership and responsibility for maintaining newly established infrastructure is progressively transferred to its ultimate owner. It involves:

- operational works (Section 2.1.1)
- practical completion (Section 2.1.2)
- plan sealing (Section 2.1.3)
- on-maintenance and allotment-building (Section 2.1.4)
- off-maintenance and final handover (Section 2.1.5)

Figure 5 illustrates the handover process within the context of the development approval process and ongoing maintenance by the ultimate owner (Refer to *Maintaining Vegetated Stormwater Assets*).

Figure 5: Generic development and asset process



2.1.1 Operational works

Following operational works approval, construction (or 'operational works') of vegetated stormwater assets can commence. During operational works, all major earthworks, infrastructure, and landscaping is typically constructed. The *Construction and Establishment Guidelines* outline the methods for constructing and establishing swales, bioretention systems, and wetlands.

2.1.2 Practical completion

Practical completion is when construction of an asset has been completed and it is 'fit-for-purpose' or functional and ready for use as designed. To achieve practical completion of the landscape elements, the vegetation needs to establish for at least one growing season, which is a minimum of 6–12 months depending on the time of planting (see Section 3.2.2).

Early practical completion occurs where the civil works are completed and go on-maintenance before the landscape elements. This approach exposes asset owners to the risk of the system failing from damage that may occur to the civil elements while the vegetation

is establishing. The asset owner should retain a suitable bond to cover this potential damage (see Section 3.4).

2.1.3 Plan sealing

Plan sealing occurs when the local authority endorses the survey plans for a development. The developer can then lodge the survey plans with the titles office for official creation of new lots. After plan sealing, the developer can sell lots to potential buyers, or receive payment for lots sold 'off the plan', and allotment-building can commence. The local authority will not give plan seal approval until the developer has met all the necessary conditions of development. If a development does not involve the creation of new lots (for example, the development application is for a Material Change of Use), the final building inspection plays the same role as plan sealing. Plan sealing can occur at different stages of infrastructure completion, as shown in Figure 6 and Figure 7.

Normal plan sealing occurs when all civil and landscape infrastructure are constructed and deemed fit-for-purpose i.e. practically complete. 'As constructed'

drawings must be approved and all relevant conditions of approval met before the local authority will endorse the survey plans.

Early plan sealing occurs when the local authority endorses the survey plans before the developer has constructed all of the infrastructure. An uncompleted works bond, submitted by the applicant as security before plan sealing (see Section 3.4), covers any remaining works.

To lower the risk of asset owners inheriting sub-standard vegetated stormwater assets, 'normal' plan sealing is preferred over 'early' plan sealing.

2.1.4 On-maintenance and allotment-building

The on-maintenance period starts when the asset owner sign-offs that an asset is practically complete i.e. it is ready for use or fit-for-purpose (see Section 3.2.2). On-maintenance involves the ultimate owner taking ownership of the asset while the developer continues maintenance works, including rectifying any defects. It serves as a defect liability or warranty period where the ultimate owner is able to inspect and verify that the asset is performing correctly under 'normal conditions' before taking responsibility for maintenance. The on-maintenance period for the civil elements may not coincide with the on-maintenance period for the landscape elements (i.e. the civil works may be completed and go on-maintenance before the landscaping). However, local authorities may choose to delay civil on-maintenance to coincide with landscape on-maintenance.

On-maintenance periods may not be required for private assets. The local authority has the right, through development approval conditions, to require certain levels of service to be met and can require or encourage private owners to adopt on-maintenance/defect liability periods and monetary bonds to secure the completion of the vegetated stormwater asset to the required standard.

The on-maintenance period will end once the ultimate owner approves the assets for off-maintenance. For vegetated stormwater assets, this needs to be performance-based rather than time-based. As such, it should not occur before the allotment-building phase (see Section 2.1.4) is largely complete or the local authority is confident there is a low risk that catchment activities will affect the asset. The allotment-building phase can commence after planning sealing, but the

timing of completion will depend on a number of factors: the scale of the development, the rate of lot sales, and the location of the assets in relation to the catchment. For large developments, the allotment-building phase can often continue for many years after completion of the subdivision. For smaller developments, the timing of the allotment-building phase is dependent on the rate of land sales. Typically on-maintenance periods of greater than 24 months will be needed for greenfield residential developments. Shorter on-maintenance periods may be feasible if the asset is well established and functioning at the start of on-maintenance. In such cases, a minimum of 12 months on-maintenance is required to provide sufficient evidence that the system is fully functional (see Section 3.2.4).

Figure 6: Example asset handover timeline
—normal plan sealing

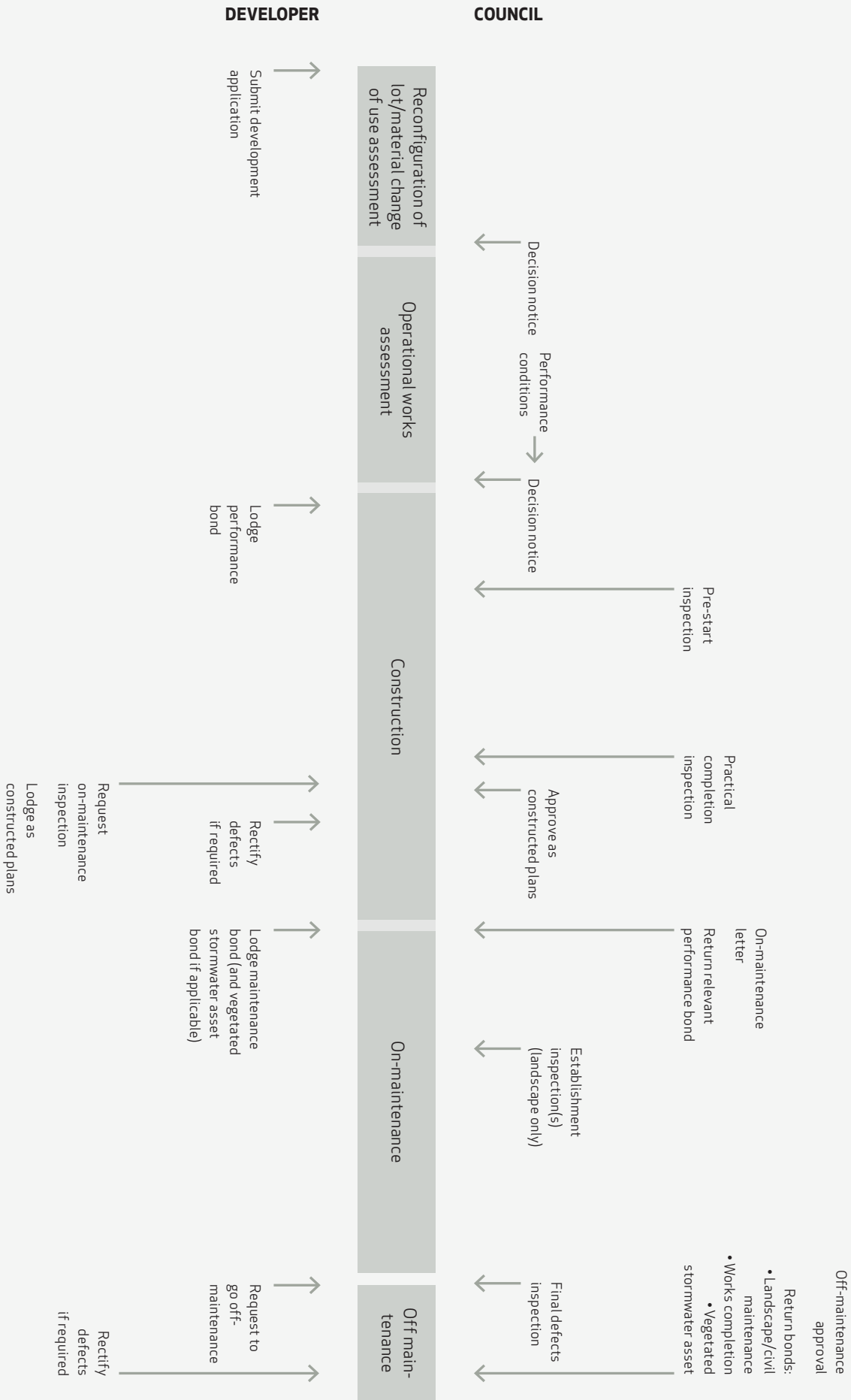
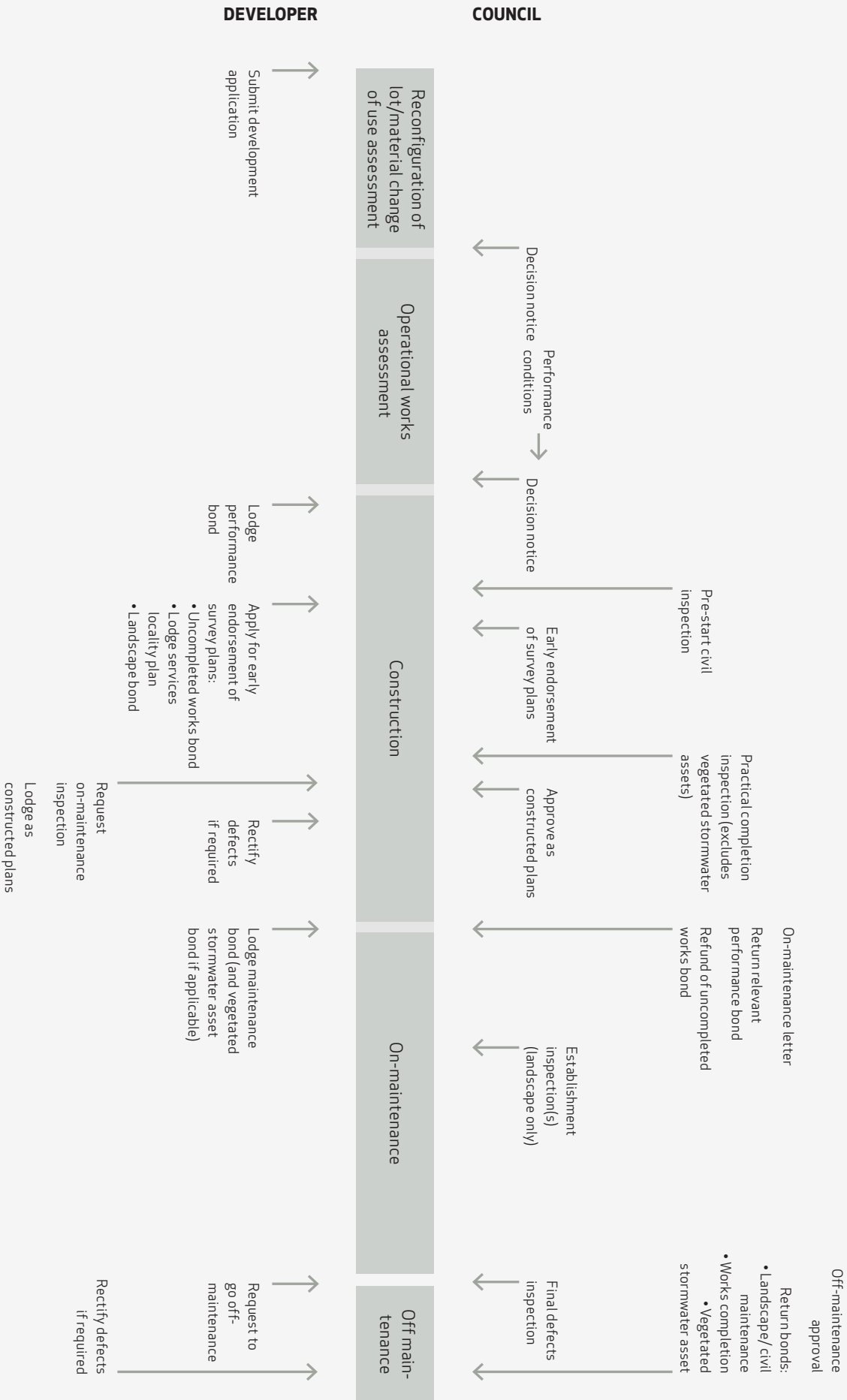


Figure 7: Example asset handover timeline—early plan sealing



To manage the risk of damage or failure from high sediment loads and construction traffic during the allotment-building phase, the constructing party needs to select and follow a construction and establishment method specified in the *Construction and Establishment Guidelines*. It may not be necessary to protect the asset from sediment or construction traffic where the civil components are complete and the catchment is stabilised.

2.1.5 Off-maintenance and final handover

Once an asset is approved for off-maintenance (see Section 3.2.2), final handover of the asset can occur. This is where the ultimate owner accepts responsibility for maintenance and returns the bonds (if applicable) to the developer.

Off-maintenance should occur at the same time for the civil and landscape components. Avoid adopting different timing for civil and landscape components unless there is agreement between the local authority and developer to allow this to occur.

2.2 Timing of asset handover

The timing of when the ultimate owner accepts ownership and responsibility for maintaining the vegetated stormwater asset primarily depends on the type of asset, the construction and establishment method used, whether it will be publicly or privately owned, and whether a strategy of 'normal' handover or 'early' handover is adopted.

Normal handover is where the developer constructs and maintains responsibility for the vegetated stormwater asset until the civil and landscape on-maintenance period is satisfactorily completed (see Section 3.2.3), at which point the ultimate owner accepts responsibility

for the whole asset.

Early handover is where the developer constructs and protects the civil and protective elements only and transfers ownership of the asset to the ultimate owner after the civil on-maintenance period is satisfactorily complete. The developer gives the ultimate owner a financial contribution to complete constructing and establishing the asset and to maintain it while the vegetation is establishing (see Section 3.4.4).

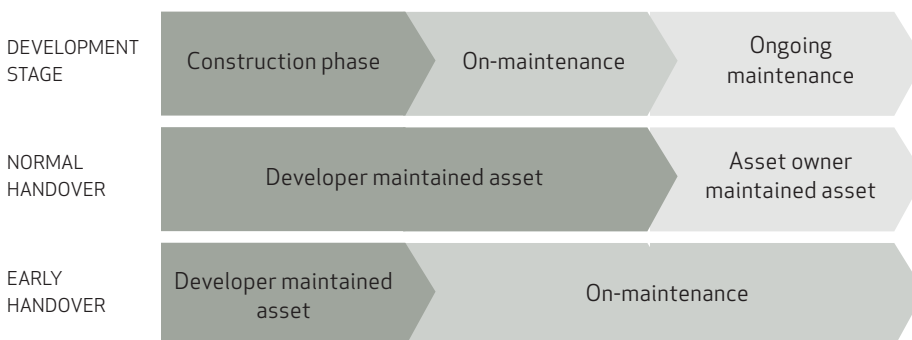
Early handover may be desirable where:

- any disturbances (e.g. allotment-building) within the contributing catchment are expected to be drawn out over a long period, which may either have a detrimental impact on the function of the assets or prolong the financial ties of the developer through conventional bonding arrangements¹
- the development is small and the developer wants to leave the site earlier than the landscape on-maintenance period would allow
- the ultimate owner would like to have greater control over the final quality of the asset

Figure 8 shows the scheduling of normal and early handover relative to the construction and on-maintenance phrases.

While the normal and early handover strategies form the basis of the handover options in this document (see Sections 3 to 6), assets owners can adapt the options to suit strategies that are hybrids of normal and early handover.

Figure 8: Comparison of normal handover and early handover options for vegetated stormwater assets



¹ Normal handover and bonding may require the developer to remain involved long after the last allotment has been sold, but the allotment-building phase may be protracted due to market factors.

THREE MANAGING ASSET TRANSFER



The ultimate owner has many opportunities to ensure they receive assets that are functioning properly. These opportunities include:

- defining minimum construction and handover requirements in policy and approval conditions (Section 3.1)
- ensuring satisfaction with construction and establishment by undertaking compliance inspections before accepting assets for on- or off-maintenance (Section 3.2)
- adopting measures to reduce the risks from early plan sealing (Section 3.3)
- using a financial instrument (i.e. bonds and contributions) as security (Section 3.4)

3.1 Defining minimum requirements

Local authorities need to define clearly the handover requirements for vegetated stormwater assets in policy documents or conditions of approval. This is to ensure that all parties understand the local authority's preferred option for transferring assets (including the associated obligations) before starting financial planning for, or construction of, the vegetated stormwater asset.

Where assets are to remain in private ownership, the local authority can require or encourage private owners to adopt on-maintenance/defect liability periods and monetary bonds to secure the completion of the vegetated stormwater asset to the required standard.

3.1.1 Determining policy

Local authorities can use *Transferring Ownership of Vegetated Stormwater Assets* to develop or update planning scheme policies and associated guidelines that define the requirements for operational works and handover of vegetated stormwater assets. Asset owners can either adopt directly the guidance or adapt it to suit specific requirements and to align with their existing asset management processes.

The policies and guidelines need to recognise that: vegetated stormwater assets need specific construction and establishment activities over and above the requirements of conventional civil and landscape infrastructure (refer to the *Construction and Establishment Guidelines*); and that civil and landscape elements of vegetated stormwater assets need to be managed in a coordinated way given their interlinked nature.

3.1.2 Setting conditions of approval

Local authorities should reference the relevant sections of this document and the *Construction and Establishment Guidelines* when writing development approval conditions, particularly for operational works, to outline clearly:

- the preferred construction and establishment method, including the timing of construction and how the asset will be protected during the allotment-building phase (see the *Construction and Establishment Guidelines*)
- certification requirements (see the *Construction and Establishment Guidelines*)
- compliance inspection requirements (see Section 3.2)
- practical completion requirements (see Section 3.2.2)
- on-maintenance requirements (See Section 3.2.3)
- off-maintenance requirements (See Section 3.2.4)
- bonding approaches for uncompleted works and maintenance (see Section 3.4)

Clear and detailed approval conditions are critical to successful handover of vegetated stormwater assets: they allow the preferred handover approach of the local authority to guide detailed design. Reinforcing these conditions as part of operational works approvals will also help to ensure handover of well-designed, well-constructed, and well-established assets.

If the engineering and landscape components of an application are undertaken separately, adopt a coordinated approach to minimise any inconsistencies between the approval conditions.

Water by Design has made available a set of draft standard approval conditions for engineering and landscape elements of vegetated stormwater assets². Local authorities can modify these conditions to suit individual development application processes and planning schemes.

²See www.waterbydesign.com.au.

3.2 Undertaking compliance inspections

Local authority compliance officers or private certifiers should undertake compliance inspections of vegetated stormwater assets at the following milestones:

- pre-start (Section 3.2.1)
- practical completion (Section 3.2.2)
- on-maintenance (Section 3.2.3)
- off-maintenance (Section 3.2.4)

The purpose of these inspections is to ensure the assets are constructed and established appropriately, that the conditions of approval are met, and that the assets meet the handover requirements. This will help to minimise the potential of the ultimate owner inheriting a poorly functioning or failing asset that will burden them with unnecessary maintenance or rectification. These inspections should be included as the minimum inspection requirements in approval conditions.

Where a local authority or state government is constructing an asset, they should undertake compliance inspections in order to ensure the asset achieves the required level of health and functionality.

3.2.1 Pre-start inspection

The purpose of this inspection is to ensure all developer and contractor roles and responsibilities are clear and all parties understand the approval conditions, desired construction outcomes, and handover process.

To avoid any delays in construction, the compliance officer or private certifier should confirm the inspections and the lead times needed to organise them at the pre-start meeting.

The following should attend the pre-start meeting:

- compliance officer/certifier
- developer
- contractor
- site supervisor
- designer

3.2.2 Practical completion inspection

The purpose of the practical completion inspection is to ensure the asset is constructed properly and sufficiently established before the ultimate owner it accepts for on-maintenance.

Compliance officers and certifiers should use the compliance checklists in Sections 4 to 7 to ensure

practical completion sign-off only occurs once:

- the developer has submitted all of the relevant certification documents i.e. the Construction and Establishment Sign-off Forms and supporting documents, which include the as-constructed survey and photos (refer to the *Construction and Establishment Guidelines* for details)
- the asset meets the performance indicators (the vegetation will need to have established for at least one growing season, which is a minimum of 6–12 months depending on the time of planting)
- all relevant conditions of approval are met, including the developer has submitted any material required by the conditions of approval, such as maintenance plans

If the asset is non-compliant, the local authority can request or condition the developer to undertake major changes to the asset before signing-off that it is practically complete. This is an ideal time to ensure the quality and function of the asset as there is significant financial incentive for developers to comply with all approval conditions in order to receive plan sealing (See Section 2.1.3).

The following should attend the practical completion inspection:

- compliance officer/certifier
- asset owner
- developer
- contractor
- site supervisor
- designer

3.2.3 On-maintenance inspection

A compliance officer or certifier can undertake random inspections throughout the on-maintenance period to ensure the developer is undertaking maintenance activities. The conditions of approval should specify the maintenance works that the developer needs to undertake during the on-maintenance period. If the developer fails to maintain the asset in accordance with the conditions of approval and the performance indicators (see Sections 4 to 7), the local authority can use the bond (see Section 3.4) to fund maintenance in order to prevent the system degrading or failing.

³ Additional information or submission requirements should be set out in the development or operational work conditions or via formal correspondence during compliance (i.e. at the pre-start meeting).

3.2.4 Off-maintenance inspection

The purpose of the off-maintenance inspection is to ensure the asset is free of defects and is functioning as designed so the ultimate owner can take responsibility of a healthy, stable, and functioning asset. It is the final chance for compliance officers and certifiers to identify any non-compliance with development and operational works approval conditions. This inspection should also highlight important maintenance issues in order to assist the ultimate owner with the scheduling of maintenance activities.

The assets should not be approved for off-maintenance until the asset meets the performance indicators in the off-maintenance and final inspection checklists in Sections 4 to 7 and, for subdivisions, the allotment-building phase is largely complete or the local authority is confident there is a low risk that catchment activities will affect the asset.

Compliance officers should use the compliance inspection checklists in Sections 4 to 7 to ensure off-maintenance approval only occurs once:

- the developer has provided
 - all of the relevant certification documents i.e. the Construction and Establishment Sign-off Forms and supporting documents, which include the as-constructed documentation and photos (refer to *Construction and Establishment Guidelines* for details)
 - details of any rectification activities undertaken during the on-maintenance period, including photos
 - details of the maintenance activities undertaken during the on-maintenance period (i.e. completed maintenance forms⁴), ideally including photos and costs of activities
- the asset meets the performance indicators
- the developer has submitted any other material required by the conditions of approval, such as maintenance plans⁵

The following should attend the off-maintenance inspection:

- compliance officer/certifier
- asset owner
- developer
- site supervisor
- designer

⁴ See *Maintaining Vegetated Stormwater Assets*

⁵ Additional information or submission requirements should be set out in the development or operational work conditions or via formal correspondence during compliance (i.e. at the pre-start meeting).

3.3 Minimising the risks associated with early plan sealing

Each local authority specifies minimum levels of completion for infrastructure before early plan sealing is possible. Typically all 'essential' infrastructure—the majority of bulk earthworks, water reticulation, sewerage, and drainage—needs to be constructed and fit-for-purpose. Generally local authorities have not classified vegetated stormwater assets as 'essential' infrastructure, and therefore completion of these assets is not a pre-requisite for plan sealing. This exposes local authorities to a number of risks, including:

- attention to detail on construction and completion of the asset is lower because early practical completion and plan sealing has been achieved
- the developer may leave the site or experience financial difficulty, leaving the vegetated stormwater assets incomplete
- bond values may not be large enough to complete unfinished works or to encourage developers to complete the works

To protect against these risks, local authorities should consider adopting one of, or a combination of, the following measures:

1. **Include the critical elements of the assets as 'essential' infrastructure.** Local authorities can adjust their policies to ensure that the critical elements of vegetated stormwater assets (see Table 1) are constructed and protected before plan sealing and before the allotment-building phase starts. Obtain an appropriate bond before plan sealing to cover the costs of completing, establishing, and maintaining the asset for the duration of the on-maintenance period only.
2. **Create a separate bond for vegetated stormwater assets.** As part of early plan sealing, there is typically a 90-day period for the developer to complete works before the local authority will release the uncompleted works bond. Some construction methods for vegetated stormwater assets involve partially completing the system and installing temporary protective measures to prevent failure during the allotment-building phase. Therefore, it is not possible to deliver an operational system within this timeframe. This document proposes a new, specific bond for uncompleted vegetated stormwater assets to rectify this situation (see Section 3.4.4).

3. **Ensure the bond value is correct.** If it is not possible to create a separate bond for vegetated stormwater assets, local authorities need to be satisfied that the value of any uncompleted works and maintenance bonds are large enough to cover construction and establishment of the vegetated stormwater assets, with a suitable risk and time margin built in. Local authorities need to take care not to accidentally release the bond if the vegetated stormwater assets are not complete.
4. **Install a sediment basin.** If adopting option 2 or 3 (above), the constructing party should install a construction phase sediment basin before plan sealing, preferably upstream of, or integrated into, any vegetated stormwater asset. The sediment basin will help to manage sediment while building works are being completed in the catchment and can remain in place if the developer leaves the site or experiences financial difficulty.
5. **Stabilise the catchment.** Include a development condition and compliance check that requires the developer to stabilise the entire development in accordance with best practice erosion and sediment control (IECA, 2008 or an equivalent local guide) before early plan sealing can occur. Implementing this type of condition will allow sufficient time to construct and protect the vegetated stormwater asset before plan sealing.

3.4 Using bonds and contributions

Bonds are a financial security that local authorities require from developers. Local authorities create bonds to:

- provide incentive for developers to undertake required works to a satisfactory standard and to meet conditions of approval before handing over assets
- minimise the risk of inheriting incomplete, poorly constructed, or failing assets
- fund completion of works if the developer abandons the asset.

The following sections describe the different types of bonds, their applicability for vegetated stormwater assets, how a bond value is calculated, the form of bonds, when to release bonds, and alternatives to bonds.

3.4.1 Types of bonds

Uncompleted works bonds

Uncompleted works bonds cover the cost of unfinished works if a developer applies for early sealing of survey plans. The bond must cover both civil and landscape elements of the works, and it is often split into separate civil and landscape bonds. Generally, local authorities will only accept uncompleted works bonds for non-essential infrastructure, such as amenity landscaping, if all other essential infrastructure is completed. Typically, local authorities have classified vegetated stormwater assets as non-essential infrastructure.

Table 1: Recommended minimum construction requirements before plan sealing

| ASSET | MINIMUM LEVEL OF CONSTRUCTION PRIOR TO PLAN SEALING | CONSTRUCTION AND ESTABLISHMENT GUIDELINES REFERENCE |
|---------------------|---|---|
| Swale | Earthworks and profiling, hydraulic structures, turf or vegetation, and protective or sediment fencing | Step 13 |
| Bioretention system | Earthworks and profiling, impermeable liner (where applicable), hydraulic structures (where the limit of the works is for the system to act as temporary sediment basin), maintenance access, drainage and filter media layers, protective layers, and temporary bypass measures for all other construction methods | Step 24 (Option 1–3) Step 6 (Option 4) |
| Constructed wetland | Earthworks, impermeable liner (where applicable), hydraulic structures, maintenance access, high-flow bypass, and inlet or outlet stabilisation | Step 18 (Option 1) Step 12 (Option 2) |
| Sediment basin | Earthworks and profiling, impermeable liner (where applicable), hydraulic structures (pits, pipes and weirs), and maintenance access | Not covered |

Uncompleted works bonds, as they are typically used, are not ideal for vegetated stormwater assets for a number of reasons:

- An uncompleted works bond often requires completion of works within a 90-day period of lodgement of the bond or the bond terms must be renegotiated. Although the local authority rarely implements the time limit, and many bonds extend for months and years beyond the 90-day limit, the imposition of a time limit still represents a risk to both the developer and the local authority because vegetated stormwater assets take longer than 90 days to establish.
- Bonds for uncompleted works on vegetated stormwater assets are often part of an overall uncompleted works bond and can be inadvertently released (or reduced) when other civil and landscape works are completed, leaving insufficient bond to cover the vegetated stormwater asset component. In the bond agreement, refer to and value the vegetated stormwater asset components, or preferably, create a separate bond agreement for uncompleted works associated with vegetated stormwater assets.
- In some cases, separate uncompleted works bonds are issued for landscape and civil works. This can lead to confusion over what aspects of the vegetated stormwater asset the respective bonds cover, as well as bond valuations that are too low. It can also lead to the release of civil uncompleted works bonds while civil components of vegetated stormwater assets are uncomplete.

Maintenance bonds

Maintenance bonds cover the costs of maintaining civil and landscape works during the on-maintenance period. This bond is required before local authorities accept the civil and landscape elements as on-maintenance.

Maintenance bonds are often set at 5% of the overall development contract amount. Experience has shown that this amount is insufficient to cover the costs of maintaining vegetation associated with vegetated stormwater assets. Unless a dedicated bond for vegetated stormwater assets is used, the maintenance bond should be for at least two years and at least 1.5 times the expected maintenance obligations.

Performance bonds

An alternative to uncompleted works and maintenance bonds is performance bonds. Performance bonds ensure completed works satisfy specific conditions of the development approval. They are applied in situations such as load limits on roads, tree and vegetation protection, and erosion and sediment control. Due to the variable nature, and often unmeasurable monetary value of the conditions to which these bonds are applied (e.g. tree protection), they are commonly determined at the discretion of the local authority on a case-by-case basis and are valued to encourage compliance rather than to cover the actual remedial cost.

Performance bonds are not widely used for vegetated stormwater assets because they lack a time limit. However, local authorities have used performance bonds for components of vegetated stormwater assets, such as establishing vegetation and removing sediment from temporary sediment basins.

As-constructed bonds

If approving the as-constructed drawings will delay plan sealing, as-constructed bonds can be used to allow faster plan sealing. This type of bond is typically valued on a defined 'per drawing' bond amount and is submitted with the drawings when the developer is seeking approval from the local authority.

As-constructed drawings for vegetated stormwater assets should not be bonded. As-constructed bonds represent a risk to vegetated stormwater assets as the key elements, such as under-drains and pit connections, may not have been inspected for compliance prior to plan sealing. The developer should provide as-constructed information before the ultimate owner accepts the asset as practically complete or before early plan sealing occurs. The developer needs to submit the as-constructed information specified in the *Construction and Establishment Guidelines* to the local authority or private certifier. This may involve submitting as-constructed drawings for partially built assets.

Vegetated stormwater asset bonds

Local authorities can use a specific bond for vegetated stormwater assets as an alternative to an uncompleted works bond. This bond should be used in conjunction with a performance bond or maintenance bond. A specific bond for vegetated stormwater assets requires time-and performance-based targets, rather than just time-based targets.

This avoids needing to complete the works within a 90-day period or needing to renegotiate the bond terms.

A vegetated stormwater asset bond is a combination of the commonly used bond types but it has a greater level of security for both works and maintenance. It covers the full scope of works for construction, establishment, and maintenance and is held until the asset is fully functional and achieving the performance indicators specified in the compliance checklists in Sections 4 to 7. While incremental return of bonds may be feasible at key compliance checkpoints, retain sufficient bond to cover the risk of assets failing right up until the end of the allotment-building phase due to sediment loads.

Local authorities should link vegetated stormwater asset bonds to specific conditions in the development and operational works approval and only release when these conditions are fulfilled. Relate bonds to the total footprint of the asset, including the inlet structures, maintenance access, treatment surface areas, batters, and related vegetation.

Form of bond

Bonds lodged with the local authority should be in the form of either cash, bank cheque, or bank guarantee. Local authorities should not accept any other form of bond. The applicant needs to make bank guarantees to the benefit of the local authority and include the applicant or developer's name, be unconditional, as well as irrevocable, and have no expiry date. Planning scheme policies for each local authority contain additional requirements for bonds.

3.4.2 Bond value

The bond value for vegetated stormwater assets should be at least 1.5 times the total cost of construction, establishment, and maintenance for two years. This amount provides appropriate incentive for developers to complete the works to a satisfactory standard, as well as providing sufficient funds to rebuild a failed asset or complete the works if the developer abandons the site. It also allows for inflation of the cost of works if bond periods are protracted.

To determine the appropriate bond value, use one of the following methods:

- **Bill of quantities (preferred)**—the applicant or developer provides a full bill of quantities for the works and maintenance activities being bonded. To determine the appropriate bond amount, the local authority reviews the bill of quantities and applies

their standard unit rates to the works and materials contained in the bill of quantities. The applicant must provide a bill of quantities for both the capital works and maintenance activities for a period of two years. Such an approach requires the bill of quantities for vegetated stormwater assets to be separate from the bill of quantities for other civil and landscape assets.

- **Contract value**—the applicant or developer provides the civil and landscape contract for the works to the local authority for review. The local authority identifies and costs any missing capital or maintenance items (over two years) and adds these to the contract value.

The local authority should closely review the information provided by the developer to ensure it is an accurate representation of the works. Once the local authority is satisfied the bond value accurately represents the works required, they notify the developer who draws up and submits the bond agreement before the local authority releases the survey plans or signs-off on practical completion.

3.4.3 Release of bonds

A local authority should only release bonds when:

- the approval conditions, with which the bond is associated, have been fulfilled, documented, and approved
- the applicant has lodged a formal request for the release of bonds
- the local authority has undertaken a compliance inspection and confirmed that the asset is meeting its design intent and is fit-for-purpose in most situations i.e. approved for off-maintenance (See Section 3.2.4).

3.4.4 Alternative to bonds: developer contributions

Bonding assumes the developer maintains responsibility for establishing and maintaining vegetated stormwater assets until they are fully functional and transferred to the ultimate owner, which occurs when using a normal handover strategy. Use of an early handover strategy, where the developer constructs the civil and protective elements of the asset and hands them over to the local authority, requires the developer to give a monetary contribution to the local authority to complete works later.

Early handover with a developer contribution does not eliminate the need to use a traditional bond to secure the completion of specific approval conditions or on-maintenance requirements. Performance bonds for civil maintenance activities, such as sediment removal, may still be required to deliver the partially completed system to the ultimate owner for early handover.

In order to deliver vegetated stormwater assets to the start of their fully functional life, the value of the contribution must be a function of the construction, establishment, and maintenance costs. Additionally, the developer transfers a time and risk factor to the local authority by leaving the site early. The contribution must be large enough to protect the local authority, while remaining economically feasible for developers. A suitable contribution is a value between 1.75 and 2 times the value of the outstanding works and the establishment and maintenance costs for two years.

The advantage of developer contributions is that the local authority can control the quality of the construction and establishment of the asset. However, to achieve this they must also have the capacity to commission and undertake the works at the appropriate time.

Local authorities must be satisfied that the applicant has properly completed the interim works before early handover using maintenance or performance bonds. This will require the completion of relevant sign-off forms from the *Construction and Establishment Guidelines*, alongside the completion of relevant compliance inspections.

FOUR **SWALES**



4.1 Functions

The primary functions of a swale are to:

- slow the flow of stormwater and promote infiltration
- convey stormwater within a defined channel
- reduce stormwater pollutants through velocity reduction (settlement) and contact with dense vegetation or turf (adhesion)
- provide visual amenity

The photos in Figure 9 show examples of constructed swales that are ready for handover.

Figure 9: Swales ready for final handover



Photo: Shaun Leinster, Ecological Engineering



Photo: Shaun Leinster, DesignFlow

4.2 Handover options

Table 2 summaries handover options for swales that will be publicly owned. The handover options vary depending on whether a strategy of 'normal' handover or 'early' handover is adopted and the construction and establishment method⁶ used to reduce the risk of damage or failure from high sediment loads and construction traffic during the allotment-building phase. Process charts (Figure 10 to Figure 13) illustrate each handover option and detail the construction, compliance, bonding/contributions, and development milestones.

Where the civil components are complete and the catchment is stabilised, as may occur on a commercial or industrial site, it may not be necessary to protect the swale from sediment or construction traffic during the allotment-building phase. In these situations, adopt the process in Option 2a (Figure 12) or 2b (Figure 13), omitting the step of installing sediment fences.

For private assets, this document sets out one handover option (see Figure 15).



Photo: Shaun Leinster, Ecological Engineering

⁶ Refer to the *Construction and Establishment Guidelines* for details of the procedures, advantages, disadvantages, and other considerations for each method.

Table 2: Summary of handover options for publicly owned swales

| | HANDOVER OPTION | | | |
|------------------------|---|---|---|--|
| | 1A | 1B | 2A | 2B |
| Construction method | Surface protection—temporary vegetation | | Surface protection—permanent vegetation | |
| Handover strategy | Normal | Early | Normal | Early |
| Financial security | Bond | Contribution | Bond | Contribution |
| Advantages | <p>Fast response for erosion protection</p> <p>Prevents damage to final vegetation</p> <p>Provides some sediment capture</p> | <p>As for Option 1a</p> <p>Allows developer to handover and leave site early</p> <p>Provides ultimate owner with control over final swale quality</p> | <p>Vegetation is established early</p> <p>Higher amenity</p> | <p>As for Option 2a</p> <p>Allows developer to handover and leave site early</p> |
| Disadvantages | <p>Low amenity</p> <p>Vegetation must be established after allotment-building phase</p> <p>Delays asset handover</p> <p>Potential for complaints if unsightly</p> | <p>As for Option 1a (not incl. delays asset handover)</p> <p>Requires local authority capacity to undertake final works</p> | <p>Risk of damage to final vegetation</p> <p>May require resetting after allotment-building phase</p> <p>Relies on effective building site erosion and sediment control</p> | <p>As for Option 2a</p> <p>Local authority must enforce allotment-building phase controls</p> <p>Failed systems are a local authority responsibility</p> |
| Handover process chart | Figure 10 | Figure 11 | Figure 12 | Figure 13 |

5.2.1 Handover Process Charts

**Figure 10: Process chart of swale handover option 1a—
temporary vegetation with normal handover with bond**

| CONSTRUCTION AND ESTABLISHMENT GUIDELINES | | TRANSFERRING OWNERSHIP OF VEGETATED STORMWATER ASSETS | | |
|---|--|---|------------------------|---|
| PERMANENT WORKS | TEMPORARY WORKS | COMPLIANCE INSPECTIONS | BONDING/ CONTRIBUTIONS | DEVELOPMENT MILESTONE |
| | | Pre-start | | |
| Hydraulic structures | | | | |
| Earthworks /profiling | | | | |
| Topsoil | Sediment fences and temporary vegetation/ protection | Civil practical completion/ building phase protection | Collect bond | Plan sealing |
| | | | | Civil on-maintenance (min. 12 months) |
| | | 90% BUILDING COMPLETE | | |
| | Remove temporary protection and vegetation | | | |
| Re-profile swale | | | | |
| Planting (turf or vegetation) | | | | |
| Landscape establishment (min. 12 months) | | | | |
| | | Landscape practical completion | | |
| | | | | Landscape on-maintenance (min. 12 months) |
| | | Off-maintenance/ final compliance inspection | | |
| | | | | Civil and landscape off-maintenance |
| | | | Return bond | |
| | | | | Handover |
| Long-term maintenance | | | | |

Note: the activities shown in red following handover are the responsibility of the asset owner

**Figure 11: Process chart of swale handover option 1b—
temporary vegetation with early handover with contribution**

| CONSTRUCTION AND ESTABLISHMENT GUIDELINES | | TRANSFERRING OWNERSHIP OF VEGETATED STORMWATER ASSETS | | |
|---|--|---|---|---------------------------------------|
| PERMANENT WORKS | TEMPORARY WORKS | COMPLIANCE INSPECTIONS | BONDING/ CONTRIBUTIONS | DEVELOPMENT MILESTONE |
| | | Pre-start | | |
| Hydraulic structures | | | | |
| Earthworks /profiling | | | | |
| Topsoil | Sediment fences and temporary vegetation/ protection | Civil practical completion/ building phase protection | Collect contribution and civil maintenance bond | Plan sealing |
| | | | | Civil on-maintenance (min. 12 months) |
| | | Civil off-maintenance | | |
| | | | | Civil off-maintenance |
| | | | Return civil maintenance bond | |
| | | | | Handover |
| | Remove temporary protection and vegetation | 90% BUILDING COMPLETE | | |
| Re-profile swale | | | | |
| Planting (turf or vegetation) | | | | |
| Landscape establishment (min. 12 months) | | | | |
| | | Landscape practical completion+off-maintenance/ final compliance inspection | | |
| | | | | |
| Long-term maintenance | | | | |

Note: the activities shown in red following handover are the responsibility of the asset owner

**Figure 12: Process chart of swale handover option 2a—
permanent vegetation with normal handover**

| CONSTRUCTION AND ESTABLISHMENT GUIDELINES | | TRANSFERRING OWNERSHIP OF VEGETATED STORMWATER ASSETS | | |
|---|------------------------|--|------------------------|--|
| PERMANENT WORKS | TEMPORARY WORKS | COMPLIANCE INSPECTIONS | BONDING/ CONTRIBUTIONS | DEVELOPMENT MILESTONE |
| | | Pre-start | | |
| Hydraulic structures | | | | |
| Earthworks /profiling | | | | |
| Topsoil | | | | |
| Turf /vegetation | Sediment fences | Civil practical completion/ building phase protection | Collect bond | Plan sealing |
| | | | | Civil on-maintenance |
| Landscape establishment (min. 12 months) | | | | |
| | | Landscape practical completion | | |
| | | | | Landscape on-maintenance (min. 12 months) |
| | Interim maintenance | | | |
| | Remove sediment fences | 90% BUILDING COMPLETE | | |
| | | Off-maintenance/ final compliance inspection | | |
| | | | | Civil and landscape off-maintenance |
| | | | Return bond | |
| | | | | Handover |
| Long-term maintenance | | | | |

Note: the activities shown in red following handover are the responsibility of the asset owner

Figure 13: Process chart of swale handover option 2b— permanent vegetation with early handover

| CONSTRUCTION AND ESTABLISHMENT GUIDELINES | | TRANSFERRING OWNERSHIP OF VEGETATED STORMWATER ASSETS | | |
|---|------------------------|--|---|-----------------------|
| PERMANENT WORKS | TEMPORARY WORKS | COMPLIANCE INSPECTIONS | BONDING/ CONTRIBUTIONS | DEVELOPMENT MILESTONE |
| | | Pre-start | | |
| Hydraulic structures | | | | |
| Earthworks /profiling | | | | |
| Topsoil | | | | |
| Turf /vegetation | Sediment fences | Civil practical completion/ building phase protection | Collect contribution and civil maintenance bond | Plan sealing |
| | | | | Civil on-maintenance |
| Landscape establishment (min. 12 months) | | | | |
| | | Civil off-maintenance + landscape practical completion | | |
| | | | | Civil off-maintenance |
| | | | Return civil maintenance bond | |
| | | | | Handover |
| | Interim maintenance | | | |
| | Remove sediment fences | 90% BUILDING COMPLETE | | |
| | | Landscape off-maintenance/ final compliance inspection | | |
| Long-term maintenance | | | | |

Note: the activities shown in red following handover are the responsibility of the asset owner

Figure 14: Process chart of swale handover option 3— private asset handover

| CONSTRUCTION AND ESTABLISHMENT GUIDELINES | | ACCEPTING OWNERSHIP OF VEGETATED STORMWATER ASSETS | | |
|---|--|--|---|-----------------------|
| PERMANENT WORKS | TEMPORARY WORKS | COMPLIANCE INSPECTIONS | BONDING/ CONTRIBUTIONS | DEVELOPMENT MILESTONE |
| | | Pre-start | Collect performance bond (where required) | |
| Hydraulic structures | | | | |
| Earthworks/profiling | | | | |
| Topsoil | | | | |
| Turf / vegetation | Sediment control measures (where required) | Civil practical completion + final compliance inspection | Return performance bond (where required) | Commence use |
| | | | | Handover |
| Long-term maintenance program | | | | |

Note: the activities shown in red following handover are the responsibility of the asset owner

4.3 Compliance checklists

Compliance officers or private certifiers should undertake compliance inspections for swales at the points identified in each handover process chart⁷ using the following checklists:

- Swale compliance checklist 1: civil practical completion and allotment-building phase protection (Section 3.3.1)
- Swale compliance checklist 2: landscape practical completion⁸ (Section 3.3.2)
- Swale compliance checklist 3: off-maintenance or final compliance inspection (Section 3.3.3)

When adopting an early handover option, it is the local authority's responsibility to complete construction the asset after the civil on-maintenance period and to establish the landscaping. However, as shown on the process charts, the local authority should still undertake the landscape practical completion and off-maintenance/final compliance inspections to ensure the asset achieves the required level of health and functionality.

The checklists contain the critical items that compliance officers or certifiers need to check to ensure a swale is functioning as intended. The critical items include:

- documents for supporting certification (e.g. soil supplier's certification of topsoil), which the site superintendent should provide when submitting the Construction and Establishment Sign-off Forms
- performance indicators, which must be met for the system to be functioning correctly
- surface protection measures (where applicable)

The ultimate asset owner should not accept a swale for either on- or off-maintenance or final handover until the critical items are satisfied. The developer must rectify any problems (refer to *Rectifying Vegetated Stormwater Assets*).

Given there can be a number of discrete systems within a development, efficiencies may be realised by completing the checklists on a sample of swales only and undertaking a visual inspection of the rest.

⁷ See the 'Compliance Inspections' column in Figure 10 to Figure 14.

⁸ This checklist may not be applicable to private assets where on-maintenance periods are not required.

4.3.1 Swale compliance checklist 1: civil practical completion and allotment-building phase protection

SWALE COMPLIANCE CHECKLIST 1: CIVIL PRACTICAL COMPLETION AND ALLOTMENT-BUILDING PHASE PROTECTION

Undertake this inspection before plan sealing/final building inspection and civil on-maintenance for public assets or before the final compliance inspection for private assets, and once the:

- swale has been bulked out and profiled
- protective measures have been installed (either temporary vegetation or permanent vegetation with protection)

| | | | |
|--|------------------------------|----------------------------------|----------------|
| Inspector: | | Date: | |
| Address/Lot/Location: | | | |
| Application/Approval No. : | | | |
| Attendees: | | | |
| Items | Complies (√/x/NA) | Action (if non-compliant) | Initial |
| Certification⁹ | | | |
| Completed Construction and Establishment Sign-Off Forms A, B, and C provided with photos and as-constructed documentation | | | |
| Designer's certification of functional elements provided | | | |
| Civil engineer's certification of structural elements provided | | | |
| Soil supplier's certification of topsoil provided | | | |
| Performance indicators | | | |
| As-constructed survey shows surface levels are within ± 25 mm of design levels | | | |
| No significant mounds or depressions | | | |
| As-constructed survey shows structures are within ± 25 mm of design levels | | | |
| Minimum set down of 60 mm from flush kerb (where applicable) to finished turf/ mulch level OR Minimum set down of 100 mm from flush kerb (where applicable) to finished topsoil level | | | |

⁹ Refer to the Construction and Establishment Guidelines for more information.

| | | | |
|---|--|--|--|
| Minimum topsoil depth of 150 mm for turf OR Minimum topsoil depth of 200mm for groundcovers/small shrubs | | | |
|---|--|--|--|

Construction and establishment method (If applicable tick one and complete relevant section below)

Method 1: Surface protection with temporary vegetation

Method 2: Surface protection with permanent vegetation

| | | | |
|--|--|--|--|
| Method 1: Surface protection with temporary vegetation | | | |
| Sediment fences installed around full perimeter of swale | | | |
| Temporary vegetation installed over swale surface or invert | | | |
| Turf (where used) laid perpendicular to flow path | | | |
| Hydroseed (where used) has binding agent and provides complete cover | | | |
| Option 2: Surface protection with permanent vegetation | | | |
| Sediment fences installed around full perimeter of swale | | | |
| Full vegetation or turf cover installed | | | |
| Correct mulch of appropriate depth used and secured in place | | | |

COMMENTS

NEXT STEPS

If all items are compliant, the inspector can sign-off that the swale passed the inspection.

If any items are non-compliant, the applicant must rectify the problem(s) and submit photographic evidence or the relevant certification documents to demonstrate it has rectified the non-compliance before the inspector can sign-off that the swale has passed the inspection.

Once the swale has passed the inspection, if it is to be a private asset, the inspector should complete Swale compliance checklist 3: off-maintenance prior to approving the asset for final handover. If it is to be a public asset, the local authority should collect the appropriate bonds, plan seal, and approve the civil elements for on-maintenance.

COMPLIANCE SIGN-OFF

| | | |
|-------------------|-------------------|--------------|
| Inspector: | Signature: | Date: |
|-------------------|-------------------|--------------|

4.3.2 Swale compliance checklist 2: landscape practical completion

SWALE COMPLIANCE CHECKLIST 2: LANDSCAPE PRACTICAL COMPLETION

Undertake this inspection once the vegetation has established for at least one growing season (6–12 months). Where on-maintenance periods are not required for private assets, this checklist may not be applicable.

| | | | |
|--|--------------------------|----------------------------------|----------------|
| Inspector: | | Date: | |
| Address/Lot/Location: | | | |
| Application/Approval No. : | | | |
| Attendees: | | | |
| Items | Complies (✓/x/NA) | Action (if non-compliant) | Initial |
| Certification¹⁰ | | | |
| Completed Construction and Establishment Sign-Off Forms A, B, C, and D provided with supporting documentation i.e. photos, as-constructed drawings showing final species and plant numbers | | | |
| Designer's or ecologist's certification of plant species | | | |
| Performance indicators | | | |
| No litter | | | |
| No erosion in the banks, batters, or around the structures | | | |
| As-constructed survey shows structures are within ± 25 mm of design levels | | | |
| For turf swales, 100% vegetation cover i.e. no exposed soil | | | |
| For non-turfed swales, minimum 90% vegetation cover | | | |
| Plants healthy and free from disease | | | |
| No weeds | | | |

¹⁰ Refer to the *Construction and Establishment Guidelines* for more information.

COMMENTS

NEXT STEPS

If all items are compliant, the inspector can sign-off that the swale passed the inspection.

If any items are non-compliant, the applicant must rectify the problem(s) and submit photographic evidence or the relevant certification documents to demonstrate it has rectified the non-compliance before the inspector can sign-off that the swale has passed the inspection.

Once the swale has passed the inspection, if it is to be a public asset, the local authority can approve the swale for an on-maintenance period of at least 12 months.

COMPLIANCE SIGN-OFF

| | | |
|-------------------|-------------------|--------------|
| Inspector: | Signature: | Date: |
|-------------------|-------------------|--------------|

4.3.3 Swale compliance checklist 3: off-maintenance or final compliance inspection

SWALE COMPLIANCE CHECKLIST 3: OFF-MAINTENANCE OR FINAL COMPLIANCE INSPECTION

For public assets, undertake this inspection at the end of the on-maintenance period. This may be performance-based (i.e. after the allotment-building phase is complete and the performance indicators are achieved) or time-based (i.e. a minimum period of 12 months).

| | | | |
|---|------------------------------|----------------------------------|----------------|
| Inspector: | | Date: | |
| Address/Lot/Location: | | | |
| Application/Approval No. : | | | |
| Attendees: | | | |
| Items | Complies (√/x/NA) | Action (if non-compliant) | Initial |
| Evidence provided to demonstrate that any items, which were non-compliant during previous inspections, have been resolved | | | |
| Certification¹¹ | | | |
| Completed Construction and Establishment Sign-off Forms A, B, C, D, and E provided | | | |
| Details of any rectification actions are provided, including photos | | | |
| Completed maintenance forms are provided ¹² | | | |
| Maintenance plan (if applicable) provided | | | |
| Performance indicators | | | |
| No litter | | | |
| No erosion in the banks, batters, or around the structures | | | |
| No accumulated sediment in the base of, or inflow points to, the swale | | | |
| For turf swales, 100% vegetation cover i.e. no exposed soil | | | |
| For non-turfed swales, minimum 90% vegetation cover | | | |
| Plants healthy and free from disease | | | |
| No weeds | | | |

¹¹ Refer to the *Construction and Establishment Guidelines* for more information.

¹² See *Maintaining Vegetated Stormwater Assets*

COMMENTS

NEXT STEPS

If all items are compliant, the inspector can sign-off that the swale passed the inspection.

If any items are non-compliant, the applicant must rectify the problem(s) and submit photographic evidence or the relevant certification documents to demonstrate it has rectified the non-compliance before the inspector can sign-off that the swale has passed the inspection.

Once the swale has passed the inspection, if it is to be a public asset, the local authority can approve the swale for off-maintenance and return any outstanding security bonds for the swale. If it is to be a private asset, the inspector can approve the asset for final handover.

COMPLIANCE SIGN-OFF

| | | |
|-------------------|-------------------|--------------|
| Inspector: | Signature: | Date: |
|-------------------|-------------------|--------------|

FIVE BIORETENTION SYSTEMS



5.1 Functions

The primary functions of a bioretention system are to:

- capture and filter stormwater through dense vegetation
- percolate stormwater through prescribed filter media and infiltrate it into surrounding soils and/or discharge it to downstream drainage
- allow high flow to bypass or pass over the bioretention area in a controlled manner

- provide visual amenity and promote ecology within urban zones

The photos in Figure 15 show examples of constructed bioretention systems that are ready for handover.

Figure 15: Bioretention systems ready for final handover



Photo: Shaun Leinster, DesignFlow



Photo: Shaun Leinster, DesignFlow



Photo: Shaun Leinster, Ecological Engineering



Photo: Shaun Leinster, DesignFlow



Photo: Shaun Leinster, DesignFlow



Photo: Shaun Leinster, DesignFlow

5.2 Handover options

Table 3 summarises handover options for bioretention systems that will be publicly owned. The handover options vary depending on whether a strategy of 'normal' handover or 'early' handover is adopted and the construction and establishment method¹³ used to reduce the risk of damage or failure from high sediment loads and construction traffic during the allotment-building phase. Process charts (Figure 16 to Figure 21) illustrate each handover option and detail the construction, compliance, bonding/contributions, and development milestones.

When the civil components are complete and the catchment is stabilised, as may occur on a commercial or industrial site, it may not be necessary to protect the bioretention system from sediment and construction traffic during the allotment-building phase. In these situations, adopt the process in Option 1a (Figure 16) or 1b (Figure 17), omitting the temporary works step of protective turf layer installation/removal.

For private assets, this document sets out one handover option (see Figure 22).

¹³ Refer to the *Construction and Establishment Guidelines* for details of the procedures, advantages, disadvantages, and other considerations for each method.

Table 3: Summary of handover options for publicly owned bioretention systems

| | | HANDOVER OPTION | | | | | | | |
|------------------------|---|--|---|---|---|--|---|--|---------------------------|
| | | 1A | 1B | 2A | 2B | 3A | 3B | 4A | 4B |
| Construction method | Surface protection | | | | | | | | |
| Handover strategy | Normal | Normal | Early | Normal | Early | Normal | Early | Normal | Early |
| Security | Bond | Bond | Contribution | Bond | Contribution | Bond | Contribution | Bond | Contribution |
| Advantages | Protects filter media Low maintenance during allotment-building phase Moderate amenity | As for Option 1a Allows developer to leave early Local authority has quality control over final system | Protects filter media Early establishment of vegetation High amenity Reduced handover period | As for 2a Allows developer to leave early Local authority has quality control over final system | Protects filter media High level of protection for receiving environment in allotment-building phase Moderate amenity | As for Option 3a Allows developer to leave early Local authority has quality control over final system | No risk to bioretention during allotment-building phase High level of protection for receiving environment in allotment-building phase | As for Option 4a Allows developer to leave early Local authority has quality control over final system | Leave as a sediment basin |
| Disadvantages | Moderate protection to receiving environment Delayed vegetation establishment and handover | As for Option 1a Requires local authority capacity to undertake final works | Low receiving environment protection Landscape requires irrigation while offline | As for Option 2a Local authority has less quality control than Option 1b | Additional space requirements Delayed vegetation establishment and handover | As for Option 3a Local authority responsible for sediment basin Requires local authority capacity to undertake final works | Poor landscape amenity Delayed construction and handover Management of sediment basin | Poor amenity Requires local authority capacity to undertake final works Management of sediment basin | |
| Handover process chart | Figure 16 | Figure 17 | Figure 18 | Figure 19 | Figure 16 | Figure 17 | Figure 20 | Figure 21 | |

5.2.1 Handover Process Charts

Figure 16: Process chart of bioretention handover option 1a (and 3a) — surface protection with normal handover

| CONSTRUCTION AND ESTABLISHMENT GUIDELINES | | TRANSFERRING OWNERSHIP OF VEGETATED STORMWATER ASSETS | | |
|--|--|--|------------------------|---|
| PERMANENT WORKS | TEMPORARY WORKS | COMPLIANCE INSPECTIONS | BONDING/ CONTRIBUTIONS | DEVELOPMENT MILESTONE |
| | | Pre-start | | |
| Hydraulic structures | | | | |
| Earthworks /profiling | | | | |
| Liner | | | | |
| Underdrains and cleanouts | | | | |
| | | Earthworks, underdrainage installation, and media supply | | |
| Drainage layer, transition layer, and filter media | | | | |
| | Sediment fences and protective cloth layer | | | |
| Coarse sediment forebay | | | | |
| | Protective turf layer | Civil practical completion/ building phase protection | Collect bond | Plan sealing |
| | | | | Civil on-maintenance (min. 12 months) |
| | | 90% BUILDING COMPLETE | | |
| | Remove protective layers | | | |
| Mulching and planting | | | | |
| Landscape establishment (min. 12 months) | | | | |
| | | Landscape practical completion | | |
| | | | | Landscape on-maintenance (min. 12 months) |
| | | Off-maintenance/ final compliance inspection | | |
| | | | | Civil and landscape off-maintenance |
| | | | Return bond | |
| | | | | Handover |
| Long-term maintenance | | | | |

Note: the activities shown in red following handover are the responsibility of the asset owner

**Figure 17: Process chart of bioretention handover option 1b (and 3b)—
surface protection with early handover**

| CONSTRUCTION AND ESTABLISHMENT GUIDELINES | | TRANSFERRING OWNERSHIP OF VEGETATED STORMWATER ASSETS | | |
|--|--|---|-------------------------------|---------------------------------------|
| PERMANENT WORKS | TEMPORARY WORKS | COMPLIANCE INSPECTIONS | BONDING/ CONTRIBUTIONS | DEVELOPMENT MILESTONE |
| | | Pre-start | | |
| Hydraulic structures | | | | |
| Earthworks /profiling | | | | |
| Liner | | | | |
| Underdrains and cleanouts | | | | |
| | | Earthworks, underdrainage installation, and media supply | | |
| Drainage layer, transition layer, and filter media | | | | |
| | Sediment fences and protective cloth layer | | | |
| Coarse sediment forebay | | | | |
| | Protective turf layer | Civil practical completion/ building phase protection | Collect bond | Plan sealing |
| | | | | Civil on-maintenance (min. 12 months) |
| | | Civil off-maintenance | | |
| | | | | Civil off-maintenance |
| | | | Return civil maintenance bond | |
| | | | | Handover |
| | | 90% BUILDING COMPLETE | | |
| | Remove protective layers | | | |
| Mulching and planting | | | | |
| Landscape establishment (min. 12 months) | | | | |
| | | Landscape practical completion + off-maintenance/ final compliance inspection | | |
| Long-term maintenance | | | | |

Note: the activities shown in red following handover are the responsibility of the asset owner

Figure 18: Process chart of bioretention handover option 2a—bypass and early establishment with normal handover

| CONSTRUCTION AND ESTABLISHMENT GUIDELINES | | TRANSFERRING OWNERSHIP OF VEGETATED STORMWATER ASSETS | | |
|--|---|---|------------------------|---|
| PERMANENT WORKS | TEMPORARY WORKS | COMPLIANCE INSPECTIONS | BONDING/ CONTRIBUTIONS | DEVELOPMENT MILESTONE |
| | | Pre-start | | |
| Hydraulic structures | | | | |
| Earthworks/profiling | | | | |
| Liner | | | | |
| Underdrains and cleanouts | | | | |
| | | Earthworks, under-drainage installation, and media supply | | |
| Drainage layer Transition layer Filter media | | | | |
| | Sediment fences | | | |
| Course sediment forebay | | | | |
| | Bypass bund and protective layer (inlet area) | Civil practical completion/ building phase protection | Collect bond | Plan sealing |
| | | | | Civil on-maintenance |
| Mulching and planting | | | | |
| Landscape establishment (min. 12 months) | | Landscape practical completion | | |
| | | | | Landscape on-maintenance (min. 12 months) |
| | Interim maintenance | | | |
| | Remove protective layers and bund | 90% BUILDING COMPLETE | | |
| Mulching, planting, and establishment (inlet area) | | | | |
| | | Off-maintenance/ final compliance inspection | | Civil and landscape off-maintenance |
| | | | Return bond | |
| | | | | Handover |
| Long-term maintenance | | | | |

Note: the activities shown in red following handover are the responsibility of the asset owner

Figure 19: Process chart of bioretention handover option 2b—bypass and early establishment with early handover

| CONSTRUCTION AND ESTABLISHMENT GUIDELINES | | TRANSFERRING OWNERSHIP OF VEGETATED STORMWATER ASSETS | | |
|--|--|--|---|-----------------------|
| PERMANENT WORKS | TEMPORARY WORKS | COMPLIANCE INSPECTIONS | BONDING/ CONTRIBUTIONS | DEVELOPMENT MILESTONE |
| | | Pre-start | | |
| Hydraulic structures | | | | |
| Earthworks/profiling | | | | |
| Liner | | | | |
| Underdrains and cleanouts | | | | |
| | | Earthworks, under-drainage installation, and media supply | | |
| Drainage layer Transition layer Filter media | | | | |
| | Sediment fences | | | |
| Course sediment forebay | | | | |
| | Bypass bund and protective layer (inlet area) | Civil practical completion/ building phase protection | Contribution, civil maintenance bond, and vegetation performance bond | Plan sealing |
| | | | | Civil on-maintenance |
| Mulching and planting | | | | |
| Landscape establishment (min. 12 months) | | | | |
| | | Civil off-maintenance + landscape practical completion | | |
| | | | | Civil off-maintenance |
| | | | Return civil maintenance bond and vegetation performance bond | |
| | | | | Handover |
| | Interim maintenance | | | |
| | Remove protective layers and bund (inlet area) | WHEN 90% BUILDING COMPLETE | | |
| Mulching, planting and establishment (inlet area) | | | | |
| | | Landscape practical completion + off-maintenance/ final compliance inspection | | |
| Long-term maintenance | | | | |

Note: the activities shown in red following handover are the responsibility of the asset owner

**Figure 20: Process chart of bioretention handover option 4a—
leave as a sediment basin with normal handover**

| CONSTRUCTION AND ESTABLISHMENT GUIDELINES | | TRANSFERRING OWNERSHIP OF VEGETATED STORMWATER ASSETS | | |
|--|---------------------------|---|------------------------|---|
| PERMANENT WORKS | TEMPORARY WORKS | COMPLIANCE INSPECTIONS | BONDING/ CONTRIBUTIONS | DEVELOPMENT MILESTONE |
| | | Pre-start | | |
| Hydraulic structures | | | | |
| Earthworks/profiling | Sediment basin structures | Sediment basin civil practical completion | Collect bond | Plan sealing |
| | | Note: Use the Sediment Basin Compliance Checklist for this inspection | | Civil on-maintenance |
| | | 90% BUILDING COMPLETE | | |
| | Sediment cleanout | | | |
| Trimming/profiling | | | | |
| Liner | | | | |
| Underdrains and cleanouts | | | | |
| | | Earthworks, underdrainage installation, and media supply | | |
| Drainage layer, transition layer, and filter media | | | | |
| Coarse sediment forebay | | | | |
| | | Civil practical completion | | |
| Mulching and planting | | | | |
| Landscape establishment (min. 12 months) | | | | |
| | | Landscape practical completion | | |
| | | | | Landscape on-maintenance (min. 12 months) |
| | | Off-maintenance/ final compliance inspection | | |
| | | | | Civil and landscape off-maintenance |
| | | | Return bond | |
| | | | | Handover |
| Long-term maintenance | | | | |

Note: the activities shown in red following handover are the responsibility of the asset owner

Figure 21: Process chart of bioretention handover option 4b—leave as a sediment basin with early handover

| CONSTRUCTION AND ESTABLISHMENT GUIDELINES | | TRANSFERRING OWNERSHIP OF VEGETATED STORMWATER ASSETS | | |
|--|---------------------------|---|--|---------------------------------------|
| PERMANENT WORKS | TEMPORARY WORKS | COMPLIANCE INSPECTIONS | BONDING/ CONTRIBUTIONS | DEVELOPMENT MILESTONE |
| | | Pre-start | | |
| Hydraulic structures | | | | |
| Earthworks/profiling | Sediment basin structures | Sediment basin civil practical completion | Collect contribution, performance bond (sediment cleanout), and civil maintenance bond | Plan sealing |
| | | Note: Use the Sediment Basin Compliance Checklist for this inspection | | Civil on-maintenance (min. 12 months) |
| | | Civil off-maintenance | | |
| | | | | Civil off-maintenance |
| | | | Return civil maintenance bond | |
| | | 90% BUILDING COMPLETE | | |
| | Sediment cleanout | | | |
| | | Sediment basin cleanout (no checklist) | | |
| | | | Return performance bond | |
| | | | | Handover |
| Trimming/profiling | | | | |
| Liner | | | | |
| Underdrains and cleanouts | | | | |
| | | Earthworks, underdrainage, installation, and media supply | | |
| Drainage layer, transition layer, and filter media | | | | |
| Coarse sediment forebay | | | | |
| | | Civil practical completion | | |
| Mulching and planting | | | | |
| Landscape establishment (min. 12 months) | | | | |
| | | Landscape practical completion + off-maintenance/ final compliance inspection | | |
| Long-term maintenance | | | | |

Note: the activities shown in red following handover are the responsibility of the asset owner

Figure 28: Process chart of bioretention handover option 5— private asset handover

| CONSTRUCTION AND ESTABLISHMENT GUIDELINES | | ACCEPTING OWNERSHIP OF VEGETATED STORMWATER ASSETS | | |
|--|--|--|---|-----------------------|
| PERMANENT WORKS | TEMPORARY WORKS | COMPLIANCE INSPECTIONS | BONDING/ CONTRIBUTIONS | DEVELOPMENT MILESTONE |
| | | Pre-start | Collect performance bond (where required) | |
| Hydraulic structures | | | | |
| Earthworks/profiling | | | | |
| Liner | | | | |
| Underdrains and cleanouts | Sediment control measures (where required) | | | |
| | | Earthworks, underdrainage installation, and media supply | | |
| Drainage layer, transition layer, and filter media | | | | |
| Coarse sediment forebay | | | | |
| Planting and establishment | | | | |
| | | Final compliance inspection | Return performance bond (where required) | Commence use |
| | | | | Handover |
| Long-term maintenance | | | | |

Note: the activities shown in red following handover are the responsibility of the asset owner

5.3 Compliance checklists

Compliance officers or private certifiers should undertake compliance inspections for bioretention systems at the points identified in each handover process chart¹⁴ using the following checklists:

- Bioretention compliance checklist 1: earthworks, under-drainage installation, and media supply (Section 4.3.1)
- Bioretention compliance checklist 2: civil practical completion and allotment-building phase protection¹⁵ (Section 4.3.2)
- Bioretention compliance checklist 3: landscape practical completion¹⁶ (Section 4.3.3)
- Bioretention compliance checklist 4: off-maintenance and/or final compliance inspection (Section 4.3.4)

When adopting an early handover option, it is the local authority's responsibility to complete construction of the asset after the civil on-maintenance period and to establish the landscaping. However, as shown on the process charts, the local authority should still undertake the landscape practical completion and off-maintenance/final compliance inspection to ensure the asset achieves the required level of health and functionality.

The checklists contain the critical items that compliance officers or certifiers need to check to ensure a bioretention system is functioning as intended. The critical items include:

- documents for supporting certification (e.g. soil supplier's certification of topsoil), which the site superintendent should provide when submitting the Construction and Establishment Sign-off Forms
- performance indicators, which must be met for the system to be functioning correctly
- surface protection measures (Checklist 2 only)

The ultimate asset owner should not accept a bioretention system for on- or off-maintenance or final handover until the critical items are satisfied. The developer must rectify any problems (refer to *Rectifying Vegetated Stormwater Assets*).

As failure of a single street-scale system is not as critical as the failure of a large bioretention basin, a reduced compliance checklist may be appropriate to allow for rapid and repetitive inspections across multiple systems. Alternatively, the checklists may be completed on a sample of systems only, with visual inspection undertaken of the rest.

¹⁴ See the 'Compliance Inspections' column in Figure 16 to Figure 22.

¹⁵ Where building phase protection and on-maintenance periods are not required, this checklist may not be applicable to private assets. If this checklist is not applicable, complete Checklist 4: off-maintenance or Final Inspection.

¹⁶ Where on-maintenance periods are not required for private assets, this checklist may not be applicable.

5.3.1 Bioretention compliance checklist 1: earthworks, under-drainage installation, and media supply

BIORETENTION COMPLIANCE CHECKLIST 1: EARTHWORKS, UNDER-DRAINAGE INSTALLATION, AND MEDIA SUPPLY

Undertake this compliance inspection:

- when earthworks are complete
- when under-drain pipes are installed
- when the drainage, transition, and filter media has been tested and either delivered to site or ready for delivery
- before backfilling of drainage, transition, or filter media commences

| | | | |
|---|------------------------------|----------------------------------|----------------|
| Inspector: | | Date: | |
| Address/Lot/Location: | | | |
| Application/Approval No. : | | | |
| Attendees: | | | |
| Items | Complies (√/x/NA) | Action (if non-compliant) | Initial |
| Certification¹⁷ | | | |
| Completed Construction and Establishment Sign-Off Forms A, B, and C provided with photos and as-constructed documentation | | | |
| Designer's certification of functional elements provided | | | |
| Civil engineer's certification of structural elements provided | | | |
| Soil supplier's certification of topsoil provided | | | |
| NATA-registered laboratory testing results and delivery dockets provided | | | |
| Performance indicators | | | |
| As-constructed survey shows base levels are within ± 50 mm of design levels | | | |
| The base has no significant mounds or depressions | | | |
| As constructed survey shows under-drains are within ± 25mm of design levels | | | |
| Under-drain clean-out points 150mm above design filter media level | | | |

¹⁷ Refer to the Construction and Establishment Guidelines for more information.

| | | | |
|---|--|--|--|
| Under-drains and cleanouts installed as per design | | | |
| Under-drains flushed | | | |
| As constructed survey shows the outlet pit and weirs are within $\pm 25\text{mm}$ of design levels for non-streetscape bioretention and within $\pm 15\text{mm}$ for streetscape bioretention | | | |
| The outlet pipe(s) is free draining to receiving waterway or drainage with no ponding or backwatering into the system | | | |
| As constructed survey shows the bunds are within $\pm 50\text{mm}$ of design levels | | | |
| As constructed survey shows the embankments are within $\pm 50\text{mm}$ of design levels | | | |
| Drainage layer material meets specifications | | | |
| Transition layer material meets specifications | | | |
| Filter media meets the relevant specifications | | | |
| Test results provided show hydraulic conductivity is between 100mm/hr to 500mm/hr, 750mm/hr max | | | |

COMMENTS

NEXT STEPS

If all items are compliant, the inspector can sign-off that the bioretention system passed the inspection.

If any items are non-compliant, the applicant must rectify the problem(s) and submit photographic evidence or the relevant certification documents to demonstrate it has rectified the non-compliance before the inspector can sign-off that the bioretention system has passed the inspection.

Once the bioretention system has passed the inspection, the filter media and allotment-building phase protection (where applicable) can be installed.

COMPLIANCE SIGN-OFF

| | | |
|-------------------|-------------------|--------------|
| Inspector: | Signature: | Date: |
|-------------------|-------------------|--------------|

5.3.2 Bioretention compliance checklist 2: civil practical completion and allotment-building phase protection

BIORETENTION COMPLIANCE CHECKLIST 2: CIVIL PRACTICAL COMPLETION AND ALLOTMENT-BUILDING PHASE PROTECTION

Undertake this compliance inspection before plan sealing and civil on-maintenance for public assets or before the final compliance inspection for private assets, and once the:

- drainage layer, transition layer and filter media layers are installed
- surface protection and bypass measures are installed (Construction and Establishment methods 1, 2, and 3 only)

Where allotment-building phase protection and on-maintenance periods are not required for private assets, this checklist may not be applicable. If this checklist is not applicable, complete Checklist 4: Off-maintenance or Final Inspection.

When adopting Handover Option 4a or 4b, use Sediment basin compliance checklist 1: civil practical completion before plan sealing. Use Bioretention compliance checklist 2 only after converting the temporary sediment basin into a bioretention system.

| | | | |
|--|--|----------------------------------|----------------|
| Inspector: | | Date: | |
| Address/Lot/Location: | | | |
| Application/Approval No. : | | | |
| Attendees: | | | |
| Adopted Asset Handover Option (tick one) | | | |
| Normal Handover | Early Handover (with contribution) | | |
| <input type="checkbox"/> Option 1a: surface protection + normal handover | <input type="checkbox"/> Option 1b: surface protection + early handover | | |
| <input type="checkbox"/> Option 2a: bypass and early establishment + normal handover | <input type="checkbox"/> Option 2b: bypass and early establishment + early handover | | |
| <input type="checkbox"/> Option 3a: sediment basin and surface protection + normal handover | <input type="checkbox"/> Option 3b: sediment basin and surface protection + early handover | | |
| <input type="checkbox"/> Option 4a: leave as a sediment basin + normal handover | <input type="checkbox"/> Option 4b: leave as a sediment basin + early handover | | |
| <input type="checkbox"/> Option 5: private asset handover | | | |
| Item | Complies (✓/x/NA) | Action (if non-compliant) | Initial |
| GENERAL | | | |
| Certification¹⁸ | | | |
| Completed Construction and Establishment Sign-Off Forms A, B, C, D, E, and F provided with supporting documents i.e. photos and as-constructed documentation | | | |
| Bioretention designer's certification of functional elements | | | |

¹⁸ Refer to the *Construction and Establishment Guidelines* for more information.

| | | | |
|---|--|--|--|
| Civil engineer's certification of structural elements | | | |
| Soil supplier's certification of filter media, transition layers, and drainage layers | | | |
| NATA-registered laboratory test results and delivery docket | | | |

Performance indicators

| | | | |
|--|--|--|--|
| As constructed survey shows the drainage layer is within ± 25mm of design depths | | | |
| As constructed survey shows the transition layer is within ± 25mm of design depths | | | |
| For systems <300m ² , as constructed survey shows the filter media depth is within ± 25mm of design levels. For systems >300m ² , as constructed survey shows the filter media depth is within ± 40mm of design levels. | | | |
| Filter media surface has no significant mounds or depressions | | | |
| In-situ test results provided show in situ hydraulic conductivity > 50mm/hr (100mm/hr preferred) | | | |
| No erosion in the banks, batters, or around structures | | | |
| Coarse sediment forebay installed (if required) and maintenance access provided | | | |

Construction and Establishment Method

- Method 1: Surface protection**
- Method 2: Bypass and early establishment**
- Method 3: Sediment basin upstream of surface protected bioretention**

| | | | |
|--|--|--|--|
| All) Continuous sediment fences installed around perimeter of filter media and top of batter | | | |
| All) Where landscape works are not to commence immediately then cover batters with filter cloth | | | |
| (Method 1 and 3) Protective covering (filter cloth ± 25 mm topsoil + turf) installed across entire filter media area of system | | | |

| | | | |
|---|--|--|--|
| (Method 2 only) Temporary bund installed (where required) to prevent stormwater runoff from entering bulk of system. Bund keyed into batters of bioretention system and crest level higher than pits and weirs. | | | |
| Method 2 only) Temporary protective covering (filter cloth + 25 mm topsoil + turf) installed within banded area | | | |
| (Method 3 only) Upstream sediment basin constructed and connected to protected bioretention system | | | |

COMMENTS

NEXT STEPS

If all items are compliant, the inspector can sign-off that the bioretention system passed the inspection.

If any items are non-compliant, the applicant must rectify the problem(s) and submit photographic evidence or the relevant certification documents to demonstrate it has rectified the non-compliance before the inspector can sign-off that the bioretention system has passed the inspection.

Once the bioretention system has passed the inspection, if it is to be a public asset, the local authority should collect the appropriate bonds, plan seal, and approve the civil elements for on-maintenance.

COMPLIANCE SIGN-OFF

| | | |
|-------------------|-------------------|--------------|
| Inspector: | Signature: | Date: |
|-------------------|-------------------|--------------|

5.3.3 Bioretention compliance checklist 3: landscape practical completion

BIORETENTION COMPLIANCE CHECKLIST 3: LANDSCAPE PRACTICAL COMPLETION

Undertaken this inspection once the:

- allotment-building phase protective measures have been removed (where relevant)
- vegetation has established for at least one growing season (6–12 months)

Where on-maintenance periods are not required for private assets, this checklist may not be applicable.

| | | | |
|---|------------------------------|----------------------------------|----------------|
| Inspector: | | Date: | |
| Address/Lot/Location: | | | |
| Application/Approval No. : | | | |
| Attendees: | | | |
| Items | Complies (√/x/NA) | Action (if non-compliant) | Initial |
| Certification¹⁹ | | | |
| Completed Construction and Establishment Sign-off Forms A, B, C, D, E, F, G, and H provided with supporting documents i.e. photos and as-constructed drawings showing final species and plant numbers | | | |
| Designer's or ecologist's certification of plant species | | | |
| Performance indicators | | | |
| Final topsoil and filter media levels are consistent with design levels (±25mm for systems less than 300m ² ; ±40mm for systems equal to or greater than 300m ²) | | | |
| In-situ compliance testing, as per <i>Construction and Establishment Guidelines</i> and FAWB (2009) specifications, provided by developer. Hydraulic conductivity > 50 mm/hr (100 mm/hr preferred) | | | |
| No erosion | | | |
| No major depressions in filter media | | | |
| Under-drain pipes flushed to remove initial ingress of material | | | |

¹⁹ Refer to the *Construction and Establishment Guidelines* for more information.

| | | | |
|--|--|--|--|
| Sediment forebay (if required) operating correctly and maintenance access in place | | | |
| No litter | | | |
| Minimum 90% vegetation cover of filter media surface and batters | | | |
| Average plant height greater than 500 mm | | | |
| Plants healthy and free from disease | | | |
| No weeds | | | |

COMMENTS

NEXT STEPS

If all items are compliant, the inspector can sign-off that the bioretention system passed the inspection.

If any items are non-compliant, the applicant must rectify the problem(s) and submit photographic evidence or the relevant certification documents to demonstrate it has rectified the non-compliance before the inspector can sign-off that the bioretention system has passed the inspection.

Once the bioretention system has passed the inspection, the local authority can approve the system for an on-maintenance period of at least 12 months.

COMPLIANCE SIGN-OFF

| Inspector: | Signature | Date |
|------------|-----------|------|
|------------|-----------|------|

5.3.4 Bioretention compliance checklist 4: off-maintenance or final compliance inspection

BIORETENTION COMPLIANCE CHECKLIST 4: OFF-MAINTENANCE OR FINAL COMPLIANCE INSPECTION

For public assets, undertake this inspection at the end of the on-maintenance period. This may be performance-based (i.e. after the allotment-building phase is complete and the performance indicators are being achieved) or time-based (i.e. a minimum period of 12 months).

For private assets, undertake this inspection prior to commencing use of the bioretention system.

| | | | |
|---|------------------------------|----------------------------------|----------------|
| Inspector: | | Date: | |
| Address/Lot/Location: | | | |
| Application/Approval No. : | | | |
| Attendees: | | | |
| Items | Complies (✓/x/NA) | Action (if non-compliant) | Initial |
| Evidence provided to demonstrate that any items, which were non-compliant during previous inspections, have been resolved | | | |
| Certification²⁰ | | | |
| Completed Construction and Establishment Sign-off Forms A, B, C, D, E, F, G, and H provided with supporting documents i.e. photos and as-constructed drawings showing final species and plant numbers | | | |
| Details of any rectification actions are provided, including photos | | | |
| Completed maintenance forms are provided ²¹ | | | |
| Maintenance plan (if applicable) provided in hard copy and digital format | | | |
| Performance indicators | | | |
| No litter | | | |
| No erosion in the banks, batters, and around structures | | | |
| No major depressions in filter media | | | |

²⁰ Refer to the *Construction and Establishment Guidelines* for more information.

²¹ See *Maintaining Vegetated Stormwater Assets*

| | | | |
|--|--|--|--|
| Sediment forebay operating correctly, is clear of sediment (recently cleaned), and maintenance access in place | | | |
| In-situ hydraulic conductivity > 50mm/hr (100mm/hr preferred) | | | |
| Under-drain clean out points have secured caps | | | |
| Minimum 90% cover of vegetation, with mulch covering the remainder | | | |
| Average plant height >500mm | | | |
| Plants healthy and free from disease | | | |
| No weeds | | | |

COMMENTS

NEXT STEPS

If all items are compliant, the inspector can sign-off that the bioretention system passed the inspection.

If any items are non-compliant, the applicant must rectify the problem(s) and submit photographic evidence or the relevant certification documents to demonstrate it has rectified the non-compliance before the inspector can sign-off that the bioretention system has passed the inspection.

Once the bioretention system has passed the inspection, if it is to be a public asset, the local authority can approve the bioretention system for off-maintenance and return any outstanding security bonds for the system. For public assets, the inspector can approve the asset for final handover.

COMPLIANCE SIGN-OFF

| | | |
|-------------------|-------------------|--------------|
| Inspector: | Signature: | Date: |
|-------------------|-------------------|--------------|

SIX CONSTRUCTED WETLANDS



6.1 Functions

The primary functions of a constructed wetland are to:

- capture and retain sediment through settling within the water column
- remove nutrients through chemical and biological transformations by biofilms and macrophytes
- regulate flows entering downstream treatment waterways or channels
- provide habitat for aquatic fauna
- provide visual amenity

The photos in Figure 23 show examples of constructed wetlands that are ready for handover.

Figure 23: Constructed wetlands ready for final handover



Photos: Shaun Leinster, DesignFlow

6.2 Handover options

Table 4 summarises handover options for constructed wetlands that will be publicly owned. The handover options vary depending on whether a strategy of 'normal' handover or 'early' handover is adopted and the construction and establishment method²² used to reduce the risk of damage or failure from high sediment loads and construction traffic during the allotment-building phase. Process charts (Figure 24 to Figure 27) illustrate each handover option and detail the construction, compliance, bonding/contributions, and development milestones.

Where the civil components are complete and the catchment is stabilised, as may occur on a commercial or industrial site, it may not be necessary to protect the constructed wetland from sediment during the allotment-building phase. In these situations, adopt Option 1a (Figure 24), omitting the temporary works steps once the vegetation is established.

For private assets, this document sets out one handover option (see Figure 28).



²² Refer to the *Construction and Establishment Guidelines* for details of the procedures, advantages, disadvantages, and other considerations for each method.

Table 4: Summary of handover options for publicly owned wetlands

| | HANDOVER OPTION | | | |
|------------------------|--|--|---|---|
| | 1A | 1B | 2A | 2B |
| Construction method * | Bypass and early establishment | | Leave as a sediment basin | |
| Handover strategy | Normal | Early | Normal | Early |
| Financial security | Bond | Contribution | Bond | Contribution |
| Advantages | <p>Early establishment of vegetation</p> <p>Protects vegetation from the allotment-building phase</p> <p>High amenity</p> <p>Reduced establishment and handover period</p> | <p>As for Option 1a</p> <p>Allows developer to leave site early</p> <p>Local authority has quality control over final wetland system</p> | <p>No risk to wetland during allotment-building phase</p> <p>High level of protection for receiving environment in allotment-building phase</p> | <p>As for Option 2a</p> <p>Allows developer to leave early</p> <p>Local authority has quality control over final system</p> |
| Disadvantages | <p>Moderate protection of receiving environment but reliant on effective building site erosion and sediment control</p> <p>Water requirements for establishment while offline (no runoff entering)</p> | <p>As for Option 1a</p> <p>Requires local authority capacity to undertake final works</p> | <p>Poor landscape amenity</p> <p>Delayed construction and handover</p> <p>Management of sediment basin</p> | <p>Poor amenity</p> <p>Requires local authority capacity to undertake final works</p> <p>Management of sediment basin</p> |
| Handover process chart | Figure 24 | Figure 25 | Figure 26 | Figure 27 |

6.2.1 Handover Process Charts

Figure 24: Process chart of wetland handover option 1a—bypass and early establishment with normal handover

| CONSTRUCTION AND ESTABLISHMENT GUIDELINES | | ACCEPTING OWNERSHIP OF VEGETATED STORMWATER ASSETS | | |
|--|--|--|------------------------|--|
| PERMANENT WORKS | TEMPORARY WORKS | COMPLIANCE INSPECTIONS | BONDING/ CONTRIBUTIONS | DEVELOPMENT MILESTONE |
| | | Pre-start | | |
| Earthworks/profiling | | | | |
| Liner and bunds | | | | |
| Hydraulic structures | | | | |
| Topsoil | | | | |
| | Disconnect macrophyte zone | | | |
| Stabilise high flow bypass | | | | |
| | Sediment fences | Civil practical completion/ building phase protection | Collect bond | Plan sealing |
| | | | | Civil on-maintenance (min. 12 months) |
| Planting (macrophyte zone) | | | | |
| Landscape establishment and water level control (min. 12 months) | | | | |
| | | Landscape practical completion | | |
| | | | | Landscape on-maintenance (min. 12 months) |
| | Interim macrophyte zone maintenance | | | |
| | | 90% BUILDING COMPLETE | | |
| | Clean out inlet pond and re-connect macrophyte zone | | | |
| Planting and establishment (inlet pond) (min. 6 weeks) | | | | |
| | | Off-maintenance/ final compliance inspection | | |
| | | | | Civil and landscape off-maintenance |
| | | | Return bond | |
| | | | | Handover |
| Long-term maintenance | | | | |

Note: the activities shown in red following handover are the responsibility of the asset owner

**Figure 25: Process chart of wetland handover option 1b—
bypass and early establishment with early handover**

| CONSTRUCTION AND ESTABLISHMENT GUIDELINES | | ACCEPTING OWNERSHIP OF VEGETATED STORMWATER ASSETS | | |
|--|--|--|---|-----------------------|
| PERMANENT WORKS | TEMPORARY WORKS | COMPLIANCE INSPECTIONS | BONDING/ CONTRIBUTIONS | DEVELOPMENT MILESTONE |
| | | Pre-start | | |
| Earthworks/profiling | | | | |
| Liner and bunds | | | | |
| Hydraulic structures | | | | |
| Topsail | | | | |
| | Disconnect macrophyte zone | | | |
| Stabilise high flow bypass | | | | |
| | Sediment fences | Civil practical completion/ building phase protection | Collect contribution, civil maintenance bond, and vegetation performance bond | Plan sealing |
| | | | | Civil on-maintenance |
| Planting (macrophyte zone) | | | | |
| Landscape establishment and water level control (min. 12 months) | | | | |
| | | Civil off-maintenance + landscape practical completion | | |
| | | | | Civil off-maintenance |
| | | | Return maintenance and performance bonds | |
| | | | | Handover |
| | Interim macrophyte zone maintenance | | | |
| | Clean out inlet pond and re-connect macrophyte zone | 90% BUILDING COMPLETE | | |
| Planting and establishment (inlet pond) (min. 6 weeks) | | | | |
| | | Landscape off-maintenance/ final compliance inspection | | |
| Long-term maintenance | | | | |

Note: the activities shown in red following handover are the responsibility of the asset owner

**Figure 26: Process chart of wetland handover option 2a—
leave as a sediment basin with normal handover**

| CONSTRUCTION AND ESTABLISHMENT GUIDELINES | | ACCEPTING OWNERSHIP OF VEGETATED STORMWATER ASSETS | | |
|--|----------------------------|--|------------------------|---|
| PERMANENT WORKS | TEMPORARY WORKS | COMPLIANCE INSPECTIONS | BONDING/ CONTRIBUTIONS | DEVELOPMENT MILESTONE |
| | | Pre-start | | |
| Earthworks/profiling | | | | |
| Liner and bunds | | | | |
| Hydraulic structures | | | | |
| Stabilise high flow bypass | Sediment basin structures | Civil practical completion/ building phase protection | Collect bond | Plan sealing |
| | | | | Civil on-maintenance |
| | | 90% BUILDING COMPLETE | | |
| | Sediment cleanout | | | |
| Topsoil | | | | |
| | Disconnect macrophyte zone | | | |
| Planting (macrophyte and inlet zones) | | | | |
| Landscape establishment and water level control (min. 12 months) | | | | |
| | Re-connect macrophyte zone | Landscape practical completion | | |
| | | | | Landscape on-maintenance (min. 12 months) |
| | | Off-maintenance/ final compliance inspection | | |
| | | | | Civil and landscape off-maintenance |
| | | | Return bond | |
| | | | | Handover |
| Long-term maintenance | | | | |

Note: the activities shown in red following handover are the responsibility of the asset owner

**Figure 27: Process chart of wetland handover option 2b—
leave as a sediment basin with early handover**

| CONSTRUCTION AND ESTABLISHMENT GUIDELINES | | ACCEPTING OWNERSHIP OF VEGETATED STORMWATER ASSETS | | |
|--|--|--|---|--|
| PERMANENT WORKS | TEMPORARY WORKS | COMPLIANCE INSPECTIONS | BONDING/ CONTRIBUTIONS | DEVELOPMENT MILESTONE |
| | | Pre-start | | |
| Earthworks/profiling | | | | |
| Liner and bunds | | | | |
| Hydraulic structures | | | | |
| Stabilise high flow bypass | Sediment basin structures | Civil practical completion/ building phase protection | Collect contribution, performance bond (sediment cleanout), and civil maintenance bond | Plan sealing |
| | | | | Civil on-maintenance (min. 12 months) |
| | | Civil off-maintenance | | |
| | | | | Civil off-maintenance |
| | | | Return civil maintenance bond | |
| | | 90% BUILDING COMPLETE | | |
| | Sediment cleanout | | | |
| | | Sediment basin cleanout (no checklist) | Return performance bond | |
| | | | | Handover |
| Topsoil | | | | |
| | Disconnect macrophyte zone | | | |
| Planting (macrophyte and inlet zones) | | | | |
| Landscape establishment and water level control (min. 12 months) | | | | |
| | Re-open connection to macrophyte zone | | | |
| | | Landscape practical completion+ off-maintenance/ final compliance inspection | | |
| Long-term maintenance | | | | |

Note: the activities shown in red following handover are the responsibility of the asset owner

Figure 22: Process chart of wetland handover option 3— private asset handover

| CONSTRUCTION AND ESTABLISHMENT GUIDELINES | | ACCEPTING OWNERSHIP OF VEGETATED STORMWATER ASSETS | | |
|---|--|--|---|-----------------------|
| PERMANENT WORKS | TEMPORARY WORKS | COMPLIANCE INSPECTIONS | BONDING/ CONTRIBUTIONS | DEVELOPMENT MILESTONE |
| | | Pre-start | Collect performance bond (where required) | |
| Earthworks/ profiling | | | | |
| Liner and bunds | | | | |
| Hydraulic structures | Sediment control measures (where required) | | | |
| | | Earthworks, layout, and structures | | |
| Topsoil | | | | |
| Planting, water level control and establishment | | | | |
| | | Final compliance inspection | Return performance bond (where required) | Commence use |
| | | | | Handover |
| Long-term maintenance | | | | |

Note: the activities shown in red following handover are the responsibility of the asset owner

6.3 Compliance checklists

Compliance officers or private certifiers should undertake compliance inspections for constructed wetlands at the points identified in each handover process chart²³ using the following checklists:

- Constructed wetland compliance checklist 1: civil practical completion and allotment-building phase protection (Section 3.3.1)
- Constructed wetland compliance checklist 2: landscape practical completion²⁴ (Section 3.3.2)
- Constructed wetland compliance checklist 3: off-maintenance or final compliance inspection (Section 3.3.3)

When adopting an early handover option, it is the local authority's responsibility to complete construction of the asset after the civil on-maintenance period and to establish the landscaping. However, as shown on the process charts, the local authority should still undertake the landscape practical completion and off-maintenance/final compliance inspection to ensure the asset achieves the required level of asset health and functionality.

The checklists contain the critical items that compliance officers or certifiers need to check to ensure a wetland is functioning as intended. The critical items include:

- documents for supporting certification (e.g. soil supplier's certification of topsoil), which the site superintendent should provide when submitting the Construction and Establishment Sign-off Forms
- performance indicators, which must be met for the system to be functioning correctly
- surface protection measures (Checklist 1 only)

The ultimate owner should not accept a wetland for either on- or off-maintenance or final handover until the critical items are satisfied. The developer must rectify any problems (refer to *Rectifying Vegetated Stormwater Assets*).

²³ See the 'Compliance Inspections' column in Figure 24 to Figure 28.

²⁴ This checklist may not be applicable to private assets where on-maintenance periods are not required.

6.3.1 Constructed wetland compliance checklist 1: civil practical completion and allotment-building phase protection

CONSTRUCTED WETLAND COMPLIANCE CHECKLIST 1: CIVIL PRACTICAL COMPLETION AND ALLOTMENT-BUILDING PHASE PROTECTION

Undertake this compliance inspection before plan sealing and civil on-maintenance for public assets or before the final compliance inspection for private assets, and once the:

- wetland areas have been excavated, profiled, and topsoiled
- hydraulic structures have been installed
- macrophyte zone has been temporarily disconnected from the inlet pond

| | | | |
|---|--------------------------|---|----------------|
| Inspector: | | Date: | |
| Address/Lot/Location: | | | |
| Application/Approval No. : | | | |
| Attendees: | | | |
| Adopted Asset Handover Option (tick one) | | | |
| Normal Handover | | Early Handover (with contribution) | |
| <input type="checkbox"/> Option 1a: bypass and early establishment + normal handover | | <input type="checkbox"/> Option 1b: bypass and early establishment + early handover | |
| <input type="checkbox"/> Option 2a: leave as a sediment basin + normal handover | | <input type="checkbox"/> Option 2b: leave as a sediment basin + early handover | |
| Item | Complies (✓/x/NA) | Action (if non-compliant) | Initial |
| Certification of civil works | | | |
| Completed Construction and Establishment Sign-off Forms A, B, C, D, and E provided with supporting documents i.e. photos and as-constructed documentation | | | |
| As-constructed survey of finished levels and structures provided | | | |
| Performance indicators | | | |
| Bulk earthworks are within ± 50 mm of design levels | | | |
| Earthworks have no significant mounds or depressions | | | |
| Outlet (riser pipe orifice plate or equivalent) is in accordance with the approved design and water level is being controlled ²⁵ to support vegetation establishment | | | |

²⁵ Refer to *Construction and Establishment Guidelines*

| | | | |
|--|--|--|--|
| Inlet pipe and headwall at correct locations and levels (± 25 mm) | | | |
| Inlet zone connection pit or pipe (from inlet pond to macrophyte zone) is correct dimensions, location, and level (± 25 mm) | | | |
| Outlet riser connection (from macrophyte zone to outlet) is correct dimensions, location, and level (± 25 mm) | | | |
| Outlet pipe (from macrophyte zone) and headwall are correct dimensions, location, and levels (± 25 mm) | | | |
| High-flow bypass weir and channel protective measures in place (i.e. weir is correct length and keyed in at ends and sufficient scour protection in place) | | | |
| No ponding or backwatering into wetland system through the outlet | | | |
| Topsoil applied to wetland to a minimum 200 mm depth | | | |
| Maximum extended detention depth is 0.5 m | | | |
| Inlet pond installed and maintenance access provided | | | |

If the wetland macrophyte zone is to be planted and kept offline during the allotment-building phase, or if there is no allotment-building phase, complete the following section. Alternatively, if the whole wetland is to remain as a sediment basin until the end of allotment-building phase, complete the following section after the allotment-building phase is finished.

| | | | |
|--|--|--|--|
| Topsoil applied to wetland to a minimum 200 mm depth | | | |
| As-constructed survey of wetland surface and surrounding bunds completed and set-out correct | | | |
| Final topsoil levels are consistent with design levels (± 50 mm). THIS IS CRITICAL IN THE MACROPHYTE ZONE | | | |
| Surface is smooth and free of local depressions and debris | | | |
| Rock protection provided where required | | | |
| Inlet zone disconnected from macrophyte zone (i.e. plates placed on overflow pit and secured) | | | |

COMMENTS

NEXT STEPS

If all items are compliant, the inspector can sign-off that the wetland passed the inspection.

If any items are non-compliant, the applicant must rectify the problem(s) and submit photographic evidence or the relevant certification documents to demonstrate it has rectified the non-compliance before the inspector can sign-off that the wetland has passed the inspection.

Once the wetland has passed the inspection, if it is to be a private asset, wetland construction can proceed to topsoiling, vegetation planting, and establishment. If it is to be a public asset, the local authority should collect the appropriate bonds, plan seal, and approve the civil elements for on-maintenance. Wetland construction can then proceed.

COMPLIANCE SIGN-OFF

| | | |
|-------------------|------------------|--------------|
| Inspector: | Signature | Date: |
|-------------------|------------------|--------------|

6.3.2 Constructed wetland compliance checklist 2: landscape practical completion

CONSTRUCTED WETLAND COMPLIANCE CHECKLIST 2: LANDSCAPE PRACTICAL COMPLETION

Undertake this inspection once the:

- allotment-building phase protective measures (where relevant) have been removed
- vegetation has established for at least one growing season (6–12 months)

Where on-maintenance periods are not required for private assets, this checklist may not be applicable.

| | | | |
|---|------------------------------|----------------------------------|----------------|
| Inspector: | | Date: | |
| Address/Lot/Location: | | | |
| Application/Approval No. : | | | |
| Attendees: | | | |
| Items | Complies (√/x/NA) | Action (if non-compliant) | Initial |
| Certification of landscape works | | | |
| Completed Construction and Establishment Sign-off Forms A, B, C, D, E, F, G, and H provided with supporting documents i.e. photos and as-constructed documentation | | | |
| Certification of civil works provided as per <i>Construction and Establishment Guidelines</i> | | | |
| Performance indicators | | | |
| Wetland is holding water (not leaking) Water level should remain within 0.3 m below the normal water level during dry conditions | | | |
| Outlet (riser pipe orifice plate or equivalent) is in accordance with the approved design and water level is being controlled ²⁶ to support vegetation establishment | | | |
| Outlet is free draining (no ponding or backwatering from receiving drainage into wetland) | | | |
| No sediment accumulated in macrophyte zone | | | |

²⁶ Refer to *Construction and Establishment Guidelines*

| | | | |
|---|--|--|--|
| Correct mulch has been installed to batters and bunds above the extended detention and secured in place | | | |
| No litter | | | |
| No erosion or scour | | | |
| No weeds | | | |
| Macrophyte zone plants established with minimum 80% vegetation cover and plants are a minimum 300 mm above normal water level | | | |
| Batter planting is establishing with minimum 90% vegetation cover of banks/batters | | | |

COMMENTS

NEXT STEPS

If all items are compliant, the inspector can sign-off that the wetland passed the inspection.

If any items are non-compliant, the applicant must rectify the problem(s) and submit photographic evidence or the relevant certification documents to demonstrate it has rectified the non-compliance before the inspector can sign-off that the wetland has passed the inspection.

Once the wetland has passed the inspection, if it is to be a public asset, the local authority can approve the wetland for an on-maintenance period of at least 12 months.

COMPLIANCE SIGN-OFF

| | | |
|-------------------|-------------------|--------------|
| Inspector: | Signature: | Date: |
|-------------------|-------------------|--------------|

6.3.3 Constructed wetland compliance checklist 3: off-maintenance or final compliance inspection

CONSTRUCTED WETLAND COMPLIANCE CHECKLIST 3: OFF-MAINTENANCE OR FINAL COMPLIANCE INSPECTION

Undertake this compliance at the end of the on-maintenance period. This may be performance-based (i.e. after the allotment-building phase is largely complete and the performance indicators are being achieved) or time-based (i.e. minimum period of 12 months).

| | | | |
|---|------------------------------|----------------------------------|----------------|
| Inspector: | | Date: | |
| Address/Lot/Location: | | | |
| Application/Approval No. : | | | |
| Attendees: | | | |
| Items | Complies (√/x/NA) | Action (if non-compliant) | Initial |
| Evidence provided to demonstrate that any items, which were non-compliant during previous inspections, have been resolved | | | |
| Certification²⁷ | | | |
| Photos provided | | | |
| Details of any rectification actions are provided, including photos | | | |
| Completed maintenance forms ²⁸ are provided | | | |
| Maintenance plan (if applicable) provided | | | |
| Performance indicators | | | |
| No litter | | | |
| No erosion or scour | | | |
| No sediment accumulated in macrophyte zone | | | |
| Water level control is operating appropriately and wetland is not leaking | | | |
| Maximum extended detention depth is 0.5 m above normal water level | | | |
| No isolated pools/depressions that could provide mosquito habitat | | | |

²⁷ Refer to the *Construction and Establishment Guidelines* for more information.

²⁸ See *Maintaining Vegetated Stormwater Assets*

| | | | |
|---|--|--|--|
| Minimum 80% vegetation cover of wetland surface. | | | |
| Average plant height >500 mm above normal water level | | | |
| Plants healthy and free from disease | | | |
| No weeds | | | |
| Outlet is free draining (no ponding or backwatering from receiving draining into wetland) | | | |

COMMENTS

NEXT STEPS

If all items are compliant, the inspector can sign-off that the wetland passed the inspection.

If any items are non-compliant, the applicant must rectify the problem(s) and submit photographic evidence or the relevant certification documents to demonstrate it has rectified the non-compliance before the inspector can sign-off that the wetland has passed the inspection.

Once the wetland has passed the inspection, if it is to be a public asset, the local authority can approve the wetland for off-maintenance and return any outstanding security bonds for the wetland. If it is to be a private asset, the inspector can approve the asset for final handover.

COMPLIANCE SIGN-OFF

| | | |
|-------------------|-------------------|--------------|
| Inspector: | Signature: | Date: |
|-------------------|-------------------|--------------|

SEVEN **SEDIMENT BASINS**



This section is about permanent sediment basins, which are typically used upstream of wetlands or large bioretention systems as inlet ponds. It does not apply to temporary sediment basins associated with erosion and sediment control activities during the construction phase.

7.1 Functions

The primary functions of a sediment basin are to:

- capture and retain coarse to medium sized sediment through settling within the water column
- regulate flows entering downstream treatment measures or channel

Unlike other assets in this document, vegetation does not form a primary functional element of sediment

basins; vegetation is included for amenity, screening, and public safety.

7.2 Handover options

Table 5 summaries handover options for sediment basins that will be publicly owned. The handover options vary depending on whether a strategy of 'normal' handover or 'early' handover is adopted. Process charts (Figure 29 and Figure 30) illustrate each handover option and detail the construction, compliance, bonding/contributions, and development milestones.

This document sets out one handover option for private assets (see Figure 31).

Table 5: Summary of handover options for publicly owned sediment basins

| | HANDOVER OPTION | |
|-------------------------------|---|--|
| | 1A | 1B |
| Construction method | Full construction | Civil construction |
| Handover strategy | Normal | Early handover |
| Security | Bond | Contribution |
| Advantages | Responsibility for site erosion and sediment control remains with developer | Allows developer to leave the site early Local authority gains control of sediment basin operation (managed cleanout) |
| Disadvantages | Low landscape amenity Handover is delayed until vegetation establishes | Poor erosion and sediment control in the catchment becomes the local authority's issue |
| Handover process chart | Figure 29 | Figure 30 |

7.2.1 Handover Process Charts

Figure 29: Process chart of sediment basin handover option 1a— full construction with normal handover

| CONSTRUCTION AND ESTABLISHMENT GUIDELINES | | ACCEPTING OWNERSHIP OF VEGETATED STORMWATER ASSETS | | |
|--|---------------------------|--|------------------------|---|
| PERMANENT WORKS | TEMPORARY WORKS | COMPLIANCE INSPECTIONS | BONDING/ CONTRIBUTIONS | DEVELOPMENT MILESTONE |
| | | Pre-start | | |
| Earthworks/profiling | | | | |
| Liner and bunds | | | | |
| Hydraulic structures | | | | |
| Stabilise high flow bypass | Sediment basin structures | Civil practical completion | Collect bond | Plan sealing |
| | | | | Civil on-maintenance |
| | Sediment cleanout | 90% BUILDING COMPLETE | | |
| Topsoil | | | | |
| Landscape planting | | | | |
| Landscape establishment and water level control (min. 12 months) | | Landscape practical completion | | |
| | | | | Landscape on-maintenance (min. 12 months) |
| | | Off-maintenance/ final compliance inspection | | |
| | | | | Civil and landscape off-maintenance |
| | | | Return bond | |
| | | | | Handover |
| Long-term maintenance | | | | |

Note: the activities shown in red following handover are the responsibility of the asset owner

**Figure 30: Process chart of sediment basin handover option 1b—
civil construction with early handover**

| CONSTRUCTION AND ESTABLISHMENT GUIDELINES | | ACCEPTING OWNERSHIP OF VEGETATED STORMWATER ASSETS | | |
|--|---------------------------|--|--|---------------------------------------|
| PERMANENT WORKS | TEMPORARY WORKS | COMPLIANCE INSPECTIONS | BONDING/ CONTRIBUTIONS | DEVELOPMENT MILESTONE |
| | | Pre-start | | |
| Earthworks/profiling | | | | |
| Liner and bunds | | | | |
| Hydraulic structures | | | | |
| Stabilise high flow bypass | Sediment basin structures | Civil practical completion | Collect contribution, sediment basin performance bond (cleanout), and civil maintenance bond | Plan sealing |
| | | | | Civil on-maintenance (min. 12 months) |
| | | Civil off-maintenance | | |
| | | | | Civil off-maintenance |
| | | | Return civil maintenance bond | |
| | Sediment cleanout | 90% BUILDING COMPLETE | | |
| | | Sediment basin cleanout (no checklist) | Return performance bond | |
| | | | | Handover |
| Topsoil | | | | |
| Landscape planting | | | | |
| Landscape establishment and water level control (min. 12 months) | | | | |
| | | Landscape practical completion + off-maintenance/final compliance inspection | | |
| Long-term maintenance | | | | |

Note: the activities shown in red following handover are the responsibility of the asset owner

Figure 31: Process chart of sediment basin handover option 2— private asset handover

| CONSTRUCTION AND ESTABLISHMENT GUIDELINES | | ACCEPTING OWNERSHIP OF VEGETATED STORMWATER ASSETS | | |
|---|-----------------|--|---|-----------------------|
| PERMANENT WORKS | TEMPORARY WORKS | COMPLIANCE INSPECTIONS | BONDING/ CONTRIBUTIONS | DEVELOPMENT MILESTONE |
| | | Pre-start | Collect performance bond (where required) | |
| Earthworks/ profiling | | | | |
| Liner and bunds | | | | |
| Hydraulic structures | | | | |
| | | Earthworks, layout, and structures | | |
| Topsoil | | | | |
| Planting and establishment | | | | |
| | | Final compliance inspection | Return performance bond (where required) | Commence use |
| | | | | Handover |
| Long-term maintenance | | | | |

Note: the activities shown in red following handover are the responsibility of the asset owner

7.3 Compliance checklists

Compliance officers or private certifiers should undertake compliance inspections for sediment basins at the points identified in each handover process chart²⁹ using the following checklists:

- Sediment basin compliance checklist 1: civil practical completion (Section 6.3.1)
- Sediment basin compliance checklist 2: landscape practical completion³⁰ (Section 6.3.2)
- Sediment basin compliance checklist 3: off-maintenance or final compliance inspection (Section 6.3.3)

When adopting the early handover option, it is the local authority's responsibility to complete construction of the asset after the civil on-maintenance period and to establish the landscaping. However, as shown on the process charts, the local authority should still undertake the landscape practical completion and off-maintenance/final compliance inspection to ensure the asset achieves the required level of health and functionality.

The checklists contain the critical items that compliance officers or certifiers need to check to ensure a sediment basin is functioning as intended. The critical items include:

- documents for supporting certification (e.g. as-constructed drawings), which the site superintendent should provide
- performance indicators, which must be met for the system to be functioning correctly

The ultimate owner should not accept a sediment basin for on- or off-maintenance or final handover until the critical items are satisfied. The developer must rectify any problems (refer to *Rectifying Vegetated Stormwater Assets*).

²⁹ See the "Compliance Inspections" column in Figure 29 to Figure 31.

³⁰ This checklist may not be applicable to private assets where on-maintenance periods are not required.

7.3.1 Sediment basin compliance checklist 1: civil practical completion

SEDIMENT BASIN COMPLIANCE CHECKLIST 1: CIVIL PRACTICAL COMPLETION

Undertake this inspection before plan sealing and civil on-maintenance for public assets or before the final compliance inspection for private assets, and once the:

- sediment basin areas have been excavated, profiled, and topsoiled (where applicable)
- hydraulic structures have been installed
- high-flow bypass (overflow) weir and channel have been constructed and stabilised

| | | | |
|---|------------------------------|----------------------------------|----------------|
| Inspector: | | Date: | |
| Address/Lot/Location: | | | |
| Application/Approval No. : | | | |
| Attendees: | | | |
| Items³¹ | Complies (√/x/NA) | Action (if non-compliant) | Initial |
| Certification | | | |
| As-constructed survey and surrounding bunds completed | | | |
| Performance indicators | | | |
| Set out and surface levels are correct (as-constructed survey) | | | |
| Geotechnical engineer certification of in-situ compaction or liner placement (where required) | | | |
| Minimum 200 mm topsoil present to all areas other than zones deeper than 200mm | | | |
| Inlet pipes and headwalls at correct locations and levels (± 25 mm) | | | |
| Energy dissipation and scour protection provided at inlets | | | |
| Outlet pit is correct size, location, and level (± 25 mm) | | | |
| Outlet pipe and headwall at correct locations and level (± 25 mm) | | | |
| Outlet structure has appropriate grate structure to minimise blockage | | | |

³¹ The *Construction and Establishment Guidelines* currently do not contain construction and establishment checklists for sediment basins.

| | | | |
|--|--|--|--|
| Seepage collars installed to all pipe outlets from sediment basin (project engineer to confirm) | | | |
| Bypass weir is correct length and level (below lowest point in bund or batter) and keyed in at ends | | | |
| Bypass weir and channel protective measures in place (i.e. turf or rock installed and where required, reinforced turf) | | | |
| Maintenance access provided | | | |
| Rock or concrete base constructed in bottom of sediment basin | | | |

COMMENTS

NEXT STEPS

If all items are compliant, the inspector can sign-off that the sediment basin passed the inspection.

If any items are non-compliant, the applicant must rectify the problem(s) and submit photographic evidence or the relevant certification documents to demonstrate it has rectified the non-compliance before the inspector can sign-off that the sediment basin has passed the inspection.

Once the sediment basin has passed the inspection, if it is to be a private asset, construction can proceed to topsoiling, vegetation planting, and establishment. If it is to be a public asset, the local authority should collect the appropriate bonds, plan seal, and approve the civil elements for on-maintenance.

COMPLIANCE SIGN-OFF

| | | |
|-------------------|-------------------|--------------|
| Inspector: | Signature: | Date: |
|-------------------|-------------------|--------------|

7.3.2 Sediment basin compliance checklist 2: landscape practical completion

SEDIMENT BASIN COMPLIANCE CHECKLIST 2: LANDSCAPE PRACTICAL COMPLETION

Undertake this inspection once the vegetation has established for at least one growing season (6–12 months).

Where on-maintenance periods are not required for private assets, this checklist may not be applicable.

| | | | |
|---|------------------------------|----------------------------------|----------------|
| Inspector: | | Date: | |
| Address/Lot/Location: | | | |
| Application/Approval No. : | | | |
| Attendees: | | | |
| Items³² | Complies (√/x/NA) | Action (if non-compliant) | Initial |
| Performance indicators | | | |
| Water level control is operating appropriately (correct normal water level) | | | |
| Planting layout is as per design | | | |
| Correct mulch has been installed to batters and bunds above the extended detention level and secured in place | | | |
| No litter | | | |
| No erosion or scour | | | |
| Maintenance access provided into sediment basin | | | |
| Minimum 2 m band of vegetation to edge: - 90% cover of vegetated edge | | | |
| Plants healthy and free from disease | | | |
| No weeds | | | |

COMMENTS

³²The Construction and Establishment Guidelines currently do not contain construction and establishment checklists for sediment basins.

NEXT STEPS

If all items are compliant, the inspector can sign-off that the sediment basin passed the inspection.

If any items are non-compliant, the applicant must rectify the problem(s) and submit photographic evidence or the relevant certification documents to demonstrate it has rectified the non-compliance before the inspector can sign-off that the sediment basin has passed the inspection.

Once the sediment basin has passed the inspection, if it is to be a public asset, the local authority can approve the sediment basin for an on-maintenance period of at least 12 months.

COMPLIANCE SIGN-OFF

| | | |
|-------------------|-------------------|--------------|
| Inspector: | Signature: | Date: |
|-------------------|-------------------|--------------|

7.3.3 Sediment basin compliance checklist 3: off-maintenance or final compliance inspection

SEDIMENT BASIN COMPLIANCE CHECKLIST: OFF-MAINTENANCE AND FINAL COMPLIANCE INSPECTION

For public assets, undertake this inspection at the end of the on-maintenance period. This may be performance-based (i.e. after the allotment-building phase is complete and the performance indicators are being achieved) or time-based (i.e. a minimum period of 12 months). For private assets, undertake this inspection prior to commencing use of the sediment basin.

| | | | |
|---|------------------------------|----------------------------------|----------------|
| Inspector: | | Date: | |
| Address/Lot/Location: | | | |
| Application/Approval No. : | | | |
| Attendees: | | | |
| Items | Complies (√/x/NA) | Action (if non-compliant) | Initial |
| Evidence provided to demonstrate that any items, which were non-compliant during previous inspections, have been resolved | | | |
| Certification | | | |
| Photo log provided (min 1 photo every three months) | | | |
| Details of any rectification actions are provided, including photos | | | |
| Completed maintenance forms are provided | | | |
| Maintenance plan (if applicable) provided ³³ | | | |
| Performance indicators | | | |
| No litter or debris | | | |
| No erosion or scour | | | |
| No blockage or damage to the outlets or weirs | | | |
| No sediment accumulated (i.e. the sediment basin has been recently cleaned and the water depth is 2 m or minimum 1.5 m) | | | |
| No evidence of sediment deposited downstream | | | |

³³ See *Maintaining Vegetated Stormwater Assets*

| | | | |
|--|--|--|--|
| Minimum 2 m band of vegetation to edge: - 90% cover of vegetated edge (minimal bare patches). Any areas without established vegetation cover are mulched. | | | |
| Average plant height >500 mm | | | |
| No weeds | | | |
| Plants healthy and free from disease | | | |

COMMENTS

NEXT STEPS

If all items are compliant, the inspector can sign-off that the sediment basin passed the inspection.

If any items are non-compliant, the applicant must rectify the problem(s) and submit photographic evidence or the relevant certification documents to demonstrate it has rectified the non-compliance before the inspector can sign-off that the sediment basin has passed the inspection.

Once the sediment basin has passed the inspection, if it is to be a public asset, the local authority can approve the sediment basin for off-maintenance and return any outstanding security bonds for the sediment basin. If it is to be a private asset, the inspector can approve the asset for final handover.

COMPLIANCE SIGN-OFF

| | | | |
|-------------------|-------------------|--|--------------|
| Inspector: | Signature: | | Date: |
|-------------------|-------------------|--|--------------|

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