Operation and Maintenance Manual

Chapman Street, Werrington

8021905301

Prepared for
Lendlease Communities

13 November 2020

Cardno

Contact Information

Cardno (NSW/ACT) Pty Ltd
ABN 95 001 145 035

Level 9 - The Forum
203 Pacific Highway
St Leonards NSW 2065
Australia

www.cardno.com
Phone +61 2 9496 7700
Fax +61 2 9439 5170

Document Information

Prepared for	Lendlease Communities
Project Name	Chapman Street, Werrington
File Reference	80219053 WSUD Operations Manual Rev3.docx
Job Reference	8021905301
Date	13 November 2020
Version Number	3

Author(s):

Pak Lau
Senior Civil Engineer

Effective Date	13/11/2020

Approved By:

Aaron Gray
Senior Project Manager

Date Approved	13/11/2020

Document History

Version	Effective Date	Description of Revision	Prepared by	Reviewed by
1	28/02/2020	Issued for Client Review	PL	AG
2	21/07/2020	Issued for Council RFI	PL	AG
3	13/11/2020	Issued for Council Submission	AG	AG

Table of Contents

Appendices

1 Introduction

Cardno (NSW/ACT) has been engaged by Lendlease Communities to prepare civil engineering design documentations to support the proposed development at 16 Chapman Street, Werrington, legally described as Lot 1 in DP 1226122. . 16 Chapman St, Werrington is wholly located within the suburb of Werrington in the Penrith City Council (Council) Local Government Area (LGA) and is hereby referred to as the Subject Site.

The development of the Site will be staged to provide 265 residential lots, 14 industrial Lots, 10 Residue Lots for future Torrens subdivisions, 1 residue Lot for a future apartment development and one residue Lot for future Road. Stormwater drainage infrastructures have been designed to drain and treat the stormwater runoff to meet the design criteria as outlined in the Penrith City Council's DCP. There stormwater treatment train generally includes Gross Pollutant Trap (GPT) for primary treatment, bio-retention basins to remove Total Suspended Solids (TSS), Total Nitrogen (TN) and Total Phosphorus (TP). Stormwater detention basins are provided to attenuate peak flows from the development. The locations of the stormwater infrastructures and contributing catchments are shown in Figure 1-1.

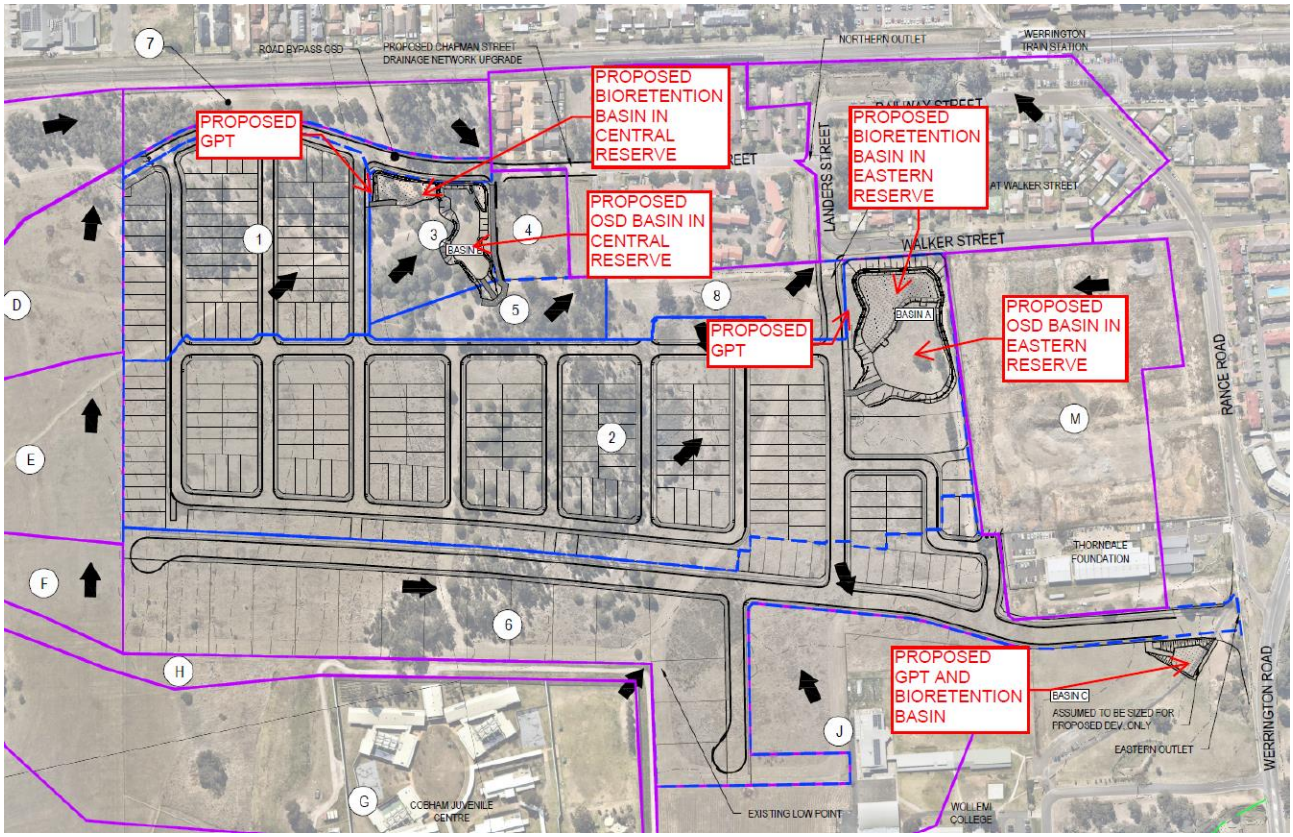

Figure 1-1 Location of stormwater infrastructure and catchments

This Manual sets out the draft parameters for the Operation and Maintenance for the elements associated with the proposed bio-retention and detention basin. It is intended that this document addresses the maintenance requirements for Basin 3, associated pit and pipe infrastructure and basin outlet structures. This Manual has five (5) categories;

a. Pit and Pipe Network including Gross Pollutant Trap,

b. Bio-retention/ Detention Basin Embankment and Outlets,

c. Bio-retention filter material,

d. Overland Flow Paths and Scour Protection, and

e. Subsoil Drainage.

2 Pit and Pipe Network

2.1 General

The subsurface pit and pipe network is a critical component of the proposed works. The pipe work associated with the development accepts flows from proposed road network catchments. Site specific pit and pipe work is designed to convey these flows to the bio-retention and detention basins with low flows being treated.

2.2 Inspection Frequency and Procedure

The pit and pipe network upstream of the proposed bio-retention and detention basins shall be inspected at intervals not exceeding twelve (12) months. Inspections should be undertaken by suitably qualified persons with an understanding and experience in the operation of similar systems.

Inspections should as a minimum;

a. Check that all grates, covers and lintels are in sound condition and are undamaged. Any signs of deterioration should be noted;

b. Check all pits for accumulation of sediment, debris or litter;

c. If pits are found to be affected by sediment, debris or litter, an assessment should be made as to whether the upstream and downstream pipes require cleaning;

d. Inspect outlet headwall and ensure it is in a sound, undamaged condition;

e. Check the area immediately surrounding the outlet headwall for signs of scour and/or sediment collection. If evidence of scour is found, rock lining or similar scour protection may need to be installed or replaced. The accumulation of sediment at the headwall may be an indication of system problems further upstream and additional investigations should be undertaken.

2.3 Maintenance Frequency and Procedure

Maintenance of the pit and pipe system should be undertaken as required following the above inspections.

Typical maintenance procedures that would need to be undertaken include;

a. Remove sediment, debris and litter from pits including lintels;

b. Remove sediment or other foreign material from pipes.

2.3.1 Removal of Sediment, Debris or Litter from Pits

Should sediment, debris or litter be detected within the stormwater pits, it is important that the foreign material be removed to ensure proper operation of the system.

a. Do not undertake maintenance works during periods of rain or when rain is likely;

b. Set up warning signs and/or tape around the works to inform passers-by that maintenance works are in progress and to stay clear. Traffic controls are to be installed in accordance with AS1742 and Council requirements;

c. Open all grates and covers to ensure access is gained to all chambers of the pit;

d. Remove any large debris or litter manually and dispose of off-site;

e. If possible, remove the accumulated sediment manually and dispose of off-site;

f. If manual sediment removal is not possible, sediment will need to be removed by a vacuum truck and disposed of off-site;

g. Following removal of the foreign material, the condition of the pit internally and any weir or diversion structure should be noted. Any damaged structure should be repaired;

h. At the completion of the work the access grates and covers should be closed ensuring that all locking devices are securely in place;

i. Remove all warning signage on completion of the works.

2.3.2 Removal of Sediment, Debris or Litter from Pipes

Should sediment, debris or litter be detected within the stormwater pipes, it is important that the foreign material be removed to ensure proper operation of the system.

a. Do not undertake maintenance works during periods of rain or when rain is likely;

b. Set up warning signs and/or tape around the works to inform passers-by that maintenance works are in progress and to stay clear. Traffic controls are to be installed in accordance with AS1742 and Council requirements;

c. The removal of any foreign material is to be undertaken in stages with each stage clearing only a single reach of pipe;

d. Open all grates and covers to ensure clear access is gained to upstream and downstream pipes;

e. Using a timber board or similar means, block off the outlet pipe from the downstream pit to prevent sediment from discharging further down the system;

f. At the upstream pit, use pressurised water or a similar method to flush the accumulated material to the downstream pit. Note that non potable water may be suitable for this purpose;

g. Using a vacuum truck or similar method to collect the flushing water and associated foreign material from the downstream pit;

h. Repeat the above steps for downstream reaches of the pipe network;

i. At the completion of the work the access grates and covers should be closed ensuring that all locking devices are securely in place;

j. Remove all warning signage on completion of the works.

Other non-routine maintenance operations that may need to be undertaken include;

a. Repair or replacement of pit grates and covers;

b. Repair of damaged weirs or other diversion structures;

c. Rectification or addition of scour protection at the outlet headwall.

2.4 Reporting Requirements

An example of an Inspection Maintenance Report is included in **Appendix A**. The report should, at a minimum, make note of the items listed in Section 2.2.

These reports should be kept on file as a record of when inspections were undertaken and what conditions were found on site.

3 Overland Flow Paths

3.1 General

Overland flow paths capture and direct surface flows discharging them to areas where they can be managed appropriately. Overland flow swales shall be provided upstream of the basin and downstream of the basin weir.

3.2 Inspection Frequency and Procedure

The overland flow paths should be inspected at intervals not exceeding twelve (12) months. Inspections should be undertaken by suitably qualified persons with an understanding and experience in the operation of similar systems.

Inspections should as a minimum;

a. Check for signs of scour or erosion along the length of the swale and in areas immediately around the swale. Eroded or scoured areas may be an indication of excessive velocities;

b. Check for signs of sediment deposition. Sediment deposition may be caused by sediment laden stormwater and/or low flow velocities;

c. Check to ensure the capacity of the swale has not been reduced by foreign materials such as litter or debris;

d. Check for infestation by weeds or other foreign species;

e. Where applicable, vegetation of swales should be checked for health and height;

f. The outlet of the swales should be checked for signs of scour or sediment accumulation.

3.3 Maintenance Frequency and Procedure

Maintenance of the overland flow swales may be separated into regular and routine tasks.

Regular maintenance includes frequently undertaken tasks such as mowing of vegetated swales.

Routine maintenance involves tasks that are undertaken as site conditions require and may include;

a. Removal of sediment build up;

b. Removal of weeds and other foreign species;

c. Restoration of the swales due to scour or erosion,

3.3.1 Mowing Vegetated Swales

Vegetated swales should be mowed at regular intervals to maintain swale capacity and improve aesthetics of the area.

During summer months it is recommended that the swales be mown at intervals not exceeding two (2) to three (3) weeks. During winter months mowing should be undertaken every four (4) to six (6) weeks. These intervals are approximate and may be varied to suit site conditions;

a. Do not undertake maintenance works during periods of rain or when rain is likely;

b. Set up warning signs and/or tape around the works to inform passers-by that maintenance works are in progress and to stay clear. Traffic controls are to be installed in accordance with AS1742 and Council requirements;

c. Mowing is to be undertaken by push or ride-on mowers at the discretion of the maintenance contractor;

d. Collected clippings are to be disposed of off-site;

e. Footpath and surrounding areas are to be swept or blown clean;

f. Remove all warning signage on completion of the works.

3.3.2 Removal of Sediment Build-up

Should sediment or other foreign material accumulate or build up within the swales, it should be removed to ensure the capacity of the swales is not reduced;

a. Do not undertake maintenance works during periods of rain or when rain is likely;

b. Set up warning signs and/or tape around the works to inform passers-by that maintenance works are in progress and to stay clear. Traffic controls are to be installed in accordance with AS1742 and Council requirements;

c. Collected sediment should be removed manually to minimise disturbance to the swale and surrounding area;

d. Care should be taken to ensure minimal damage to the vegetation or lining of the swales and surrounding area during sediment removal;

e. Collected sediment is to be disposed of off-site;

f. Remove all warning signage on completion of the works.

3.3.3 Removal of Weeds and Foreign Species

Weeds or foreign species that have begun growing within the swales should be removed to ensure the planted species is not starved of nutrients etc.;

a. Set up warning signs and/or tape around the works to inform passers-by that maintenance works are in progress and to stay clear. Traffic controls are to be installed in accordance with AS1742 and Council requirements;

b. Weeds or foreign species should be removed by hand or locally sprayed with a glyphosate based pesticide;

c. If weeds are removed by hand, any loose soil that remains should be firmly re-compacted. Any remaining divots should be filled and compacted;

d. If glyphosate is used the manufacturer's recommendations and safety procedures should be adhered;

e. Collected waste is to be disposed of off-site;

f. Remove all warning signage on completion of the works.

3.3.4 Restoration of Swale Due to Scour or Erosion

Areas of swale that have been affected due to scour or erosion should be repaired to restore the integrity of the swale and minimise the risk of further damage;

a. Set up warning signs and/or tape around the works to inform passers-by that maintenance works are in progress and to stay clear. Traffic controls are to be installed in accordance with AS1742 and Council requirements;

b. Fill areas affected with locally scoured organic soil. This fill should be compacted to match the shape and profile of the surrounding swale area;

c. In vegetated swales, areas that have been restored should be sown with seeds to match the established vegetation. Sowing of seeds should be undertaken in accordance with the supplier's recommendations;

d. Where the swale is rock lined, displaced rock should be collected and used over the area to be restored. Should additional rock be required, it shall have similar properties to that of the existing rock;

e. Remove all warning signage on completion of the works.

3.4 Reporting Requirements

An example of an Inspection Maintenance Report is included in **Appendix A**. The report should, at a minimum, make note of the items listed in Section 3.2.

These reports should be kept on file as a record of when inspections were undertaken and what conditions were found on site.

4 Rip-Rap at Outlets into Bio-retention Basins

4.1 General

Rip-rap at the upstream end of the bio-retention basins acts to remove scour and distribute flows across the filter material. Under performance of the rip-pap may cause localised scouring within the bio-retention basin and creation of preferential low flow paths that in turn, affect nutrient removal.

4.2 Inspection Frequency and Procedure

The rip-rap should be inspected at intervals not exceeding twelve (12) months. Inspections should be undertaken by suitably qualified persons with an understanding and experience in the operation of similar systems.

Inspections should as a minimum;

a. Check that the rip-rap is in sound condition and has not been damaged by debris or other means;

b. Check for the accumulation of sediment or other foreign material;

c. Check for signs of dislodgement or movement.

4.3 Maintenance Frequency and Procedure

Maintenance of rip-rap should be undertaken as required following the above twelve (12) monthly inspections.

Typical maintenance procedures that would need to be undertaken include;

d. Removal of sediment or other foreign material;

e. Restoration of rip-rap scour protection as required.

4.3.1 Restoration of Scour Protection (Rip-Rap)

The rip-rap immediately upstream of the bio-retention basin minimises erosion within the basin. Any damage to the scour protection should be rectified to ensure satisfactory performance of the system.

f. Do not undertake maintenance works during periods of rain or when rain is likely;

g. If sediment has collected in the rip-rap that may have been displaced, manually remove sediment and dispose of off-site;

h. Collect the rip-rap that has been displaced and reuse to restore the scour protection;

i. If additional rock be required to complete the restoration, it shall have similar properties to that of the existing rock.

4.4 Reporting Requirements

An example of an Inspection Maintenance Report is included in **Appendix** Error! Reference source not f ound.. The report should, at a minimum, make note of the items listed in Section 4.2.

These reports should be kept on file as a record of when inspections were undertaken and what conditions were found on site.

5 Subsoil Drainage

5.1 General

The subsurface pipe and pit network is a vital component of the bio-retention system. Subsoil drainage below the filter material collect filtered stormwater flows before discharging this water into the natural stream and creek system.

5.2 Inspection Frequency and Procedure

The subsoil network should be inspected at intervals not exceeding twelve (12) month. Inspections should be undertaken by suitably qualified persons with an understanding and experience in the operation of similar systems.

Inspections should as a minimum;

a. Check that all access and clean out points are intact and free from damage;

b. Inspect the outlet points from the subsoil drainage to determine if sediment build up is present. If sediment has accumulated at the outlet it may be an indication that the system requires flushing.

5.3 Maintenance Frequency and Procedure

Maintenance of the pit and pipe system should be undertaken as required following the above 12 monthly inspections.

Typical maintenance procedures that would need to be undertaken include replacement of access and clean out points as required.

Additionally, the subsoil drainage system should be flushed not less than once during the first twelve months of operation and at intervals not exceeding twenty four (24) months thereafter.

5.3.1 Flushing of Subsoil Drainage Lines

Accumulated sediment within the subsoil drainage system should be flushed at regular intervals to ensure proper operation of the subsoil network;

a. Do not undertake maintenance works during periods of rain or when rain is likely;

b. Set up warning signs and/or tape around the works area;

c. Determine the discharge point of the subsoil pipe to be flushed;

d. If the discharge point is a stormwater pit, use a timber board or similar means to block the pit outlet to prevent sediment from being discharged to the receiving waters;

e. If the subsoil drainage discharges to a headwall, provide sediment fencing or sand bags around the outlet to prevent sediment from being discharged to the receiving waters;

f. Use a pressurised water hose or similar means to flush the accumulated sediment to its discharge point. Note that several clean out points may need to be accessed along the subsoil drainage line, Non potable water may be suitable for this purpose;

g. Remove collected sediment from the discharge point manually or by using a vacuum truck. Dispose sediment off site;

h. At the completion of the work the access grates and covers should be closed ensuring that all locking devices are securely in place;

i. Remove all warning signage on completion of the works.

5.4 Reporting Requirements

An example of an Inspection Maintenance Report is included in **Appendix A**. The report should, at a minimum, make note of the items listed in Section 5.2.

These reports should be kept on file as a record of when inspections were undertaken and what conditions were found on site.

6 Bio-retention Filter Material

6.1 General

The bio-retention basins utilises a number of physical and biological processes to remove pollutants from stormwater. Sediment accumulation within the filter material affects the performance and as such, should be removed periodically.

6.2 Inspection Frequency and Procedure

The bio-retention basins should be inspected at intervals not exceeding twelve (12) months. Inspections should be undertaken by suitably qualified persons with an understanding and experience in the operation of similar systems.

Inspections should as a minimum;

a. Undertake a review of plant growth within the filter material zone. Plant growth should be uniform and vigorous. Check for areas where plant growth is slower or where plants have died. This may be an indication of contamination of the planting matrix or other sub surface problems. Take note of plant conditions, height etc.;

b. Check for evidence of scour or preferential flow paths. If these exist it is likely that the flow is not evenly distributed;

c. Sediment accumulation will occur over time within the base of the bio-retention basin. Once sediment has accumulated to approximately 100mm in depth, the based should be stripped and renewed.

6.3 Maintenance Frequency and Procedure

Maintenance of the bio-retention basins base and filter material should be undertaken as required following the above 12 monthly inspections.

Typical maintenance procedures that would need to be undertaken include replacement of planting in localised areas and pruning or timing of existing vegetation.

Additionally, once 100mm of sediment has been accumulated it will be necessary to strip and replant the base area.

6.3.1 Replanting of Localised Areas

Areas of filter material where vegetation has died need to be replaced to ensure longevity of the basin and to maximise pollutant removal capacity.

a. Do not undertake maintenance works during periods of rain or when rain is likely;

b. Set up warning signs and/or tape around the works area;

c. Access areas that require replanting and determine access points to minimise disturbance to filter material;

d. Manually remove any dead or dying vegetation and dispose of off-site;

e. Replant the area with plant species to match those present within the filter material and in accordance with the Landscape Specification (by others);

f. Dispose all pots, tubes etc. off site;

g. Remove all warning signage only following completion of the works;

h. Re-establish planting in accordance with the Landscape Specification and Landscape Operation and Maintenance Manual (by others).

6.3.2 Stripping and Replanting of Filter Material

Accumulated sediment should be stripped once a depth of 100mm is reached. Assuming upstream controls remain functioning, stripping of the filter material should only be required every five (5) to ten (10) years.

a. Do not undertake maintenance works during periods of rain or when rain is likely;

b. Set up warning signs and/or tape around the works area;

c. Only machinery with a ground pressure less than 30KPa is permitted to access the filter material. The ground pressure of Councils maintenance machines should be ascertained prior to accessing the filter media area. Mini Excavators or wide track excavators would be appropriate for use, as would be compact track loaders.

   Alternatively, bog mats or boards placed along the path of the excavator would disburse the pressure.

d. Strip vegetation and accumulated sediment so that stripped levels of the upper and lower basin areas are uniformly graded;

e. Once machine stripping is complete and stripped levels have been verified, manually remove material from around the weir wall;

f. Dispose of stripped material off site;

g. Replant the filter material in accordance with the Landscape Specification and Landscape Operation and Maintenance Manual (by others);

h. Re-establish vegetation in accordance with the Landscape Specification and Landscape Operation and Maintenance Manual (by others);

i. Remove all warning signage only following completion of the works.

6.4 Reporting Requirements

An example of an Inspection Maintenance Report is included in **Appendix A**. The report should, at a minimum, make note of the items listed in Section 6.2.

For water quality sampling, a separate report is required including a discussion of the sampling results. A comparison of the results against the level of compliance is required. Where testing indicates non-compliance, then the report must include recommendations for corrective action.

Water quality sampling and monitoring reports must be submitted to Penrith City Council at the commencement of monitoring and six (6) months after the initial sampling.

These reports should be kept on file as a record of when inspections were undertaken and what conditions were found on site.

7 Bio-retention Basin Outlets

7.1 General

The outlet of the basin discharges water from the basin once the ponding exceeds the extended detention for water quality. The weir discharges as overland flow to the receiving waters.

7.2 Inspection Frequency and Procedure

The outlets should be externally inspected at intervals not exceeding twelve (12) months. Inspections should be undertaken by suitably qualified persons with an understanding and experience in the operation of similar systems.

Inspections should as a minimum;

a. Check for debris, litter or other foreign material caught or trapped on/in the outlet. Make note of the size and type of debris to assist the maintenance crew in organising equipment and resources;

b. Check for signs of damage or deterioration of the outlets. This may include damage to the concrete pits or grates;

c. Inspect the area around the outlet for signs or erosion or scour;

d. Inspect the outlet pipe scour protection. Check rip-rap for signs of dislodgement or movement.

7.3 Maintenance Frequency and Procedure

Maintenance of the outlet system should be undertaken as required following the above 12 monthly inspections.

Typical maintenance procedures that would need to be undertaken include;

a. Remove sediment, debris and litter from pits and downstream scour protection;

b. Remove sediment or other foreign material from pipes.

7.3.1 Removal of Sediment, Debris or Litter from Pits

Should sediment, debris or litter be detected within the outlets it is important that the foreign material be removed to ensure proper operation of the system;

a. Do not undertake maintenance works during periods of rain or when rain is likely;

b. Set up warning signs and/or tape around the works;

c. Open all grates and covers to ensure access is gained to all chambers of the pit;

d. Remove any large debris or litter manually and dispose of off-site;

e. If possible, remove the accumulated sediment manually and dispose of off-site;

f. If manual sediment removal is not possible, sediment will need to be removed by a vacuum truck and disposed of off-site;

g. Following removal of the foreign material, the condition of the pit internally and any weir or diversion structure should be noted. Any damaged structure should be repaired;

h. At the completion of the work the access grates and covers should be closed ensuring that all locking devices are securely in place;

i. Remove all warning signage on completion of the works.

7.3.2 Removal of Sediment, Debris or Litter from Pipes

Should sediment, debris or litter be detected within the stormwater pipes it is important that the foreign material be removed to ensure proper operation of the system;

a. Do not undertake maintenance works during periods of rain or when rain is likely;

b. Set up warning signs and/or tape around the works;

c. The removal of any foreign material is to be undertaken in stages with each stage clearing only a single reach of pipe;

d. Open all grates and covers to ensure clear access is gained to upstream and downstream pipes;

e. Provide sediment fencing or sand bags around the outlet to prevent sediment from being discharged to the receiving waters;

f. Use a pressurised water hose or similar means to flush the accumulated sediment to its discharge point. Note that several clean out points may need to be accessed along the subsoil drainage line, Non potable water may be suitable for this purpose;

g. Remove collected sediment from the discharge point manually or by using a vacuum truck. Dispose sediment off site;

h. At the completion of the work the access grates and covers should be closed ensuring that all locking devices are securely in place;

i. Remove all warning signage on completion of the works.

Other non-routine maintenance operations that may need to be undertaken include;

a. Repair or replacement of pit grates and covers;

b. Repair of damaged weirs or other diversion structures;

c. Rectification or addition of scour protection at the outlet headwall.

7.4 Reporting Requirements

An example of an Inspection Maintenance Report is included in **Appendix A**. The report should, at a minimum, make note of the items listed in Section 7.2.

These reports should be kept on file as a record of when inspections were undertaken and what conditions were found on site.

APPENDIX A

MAINTENANCE CHECKLIST