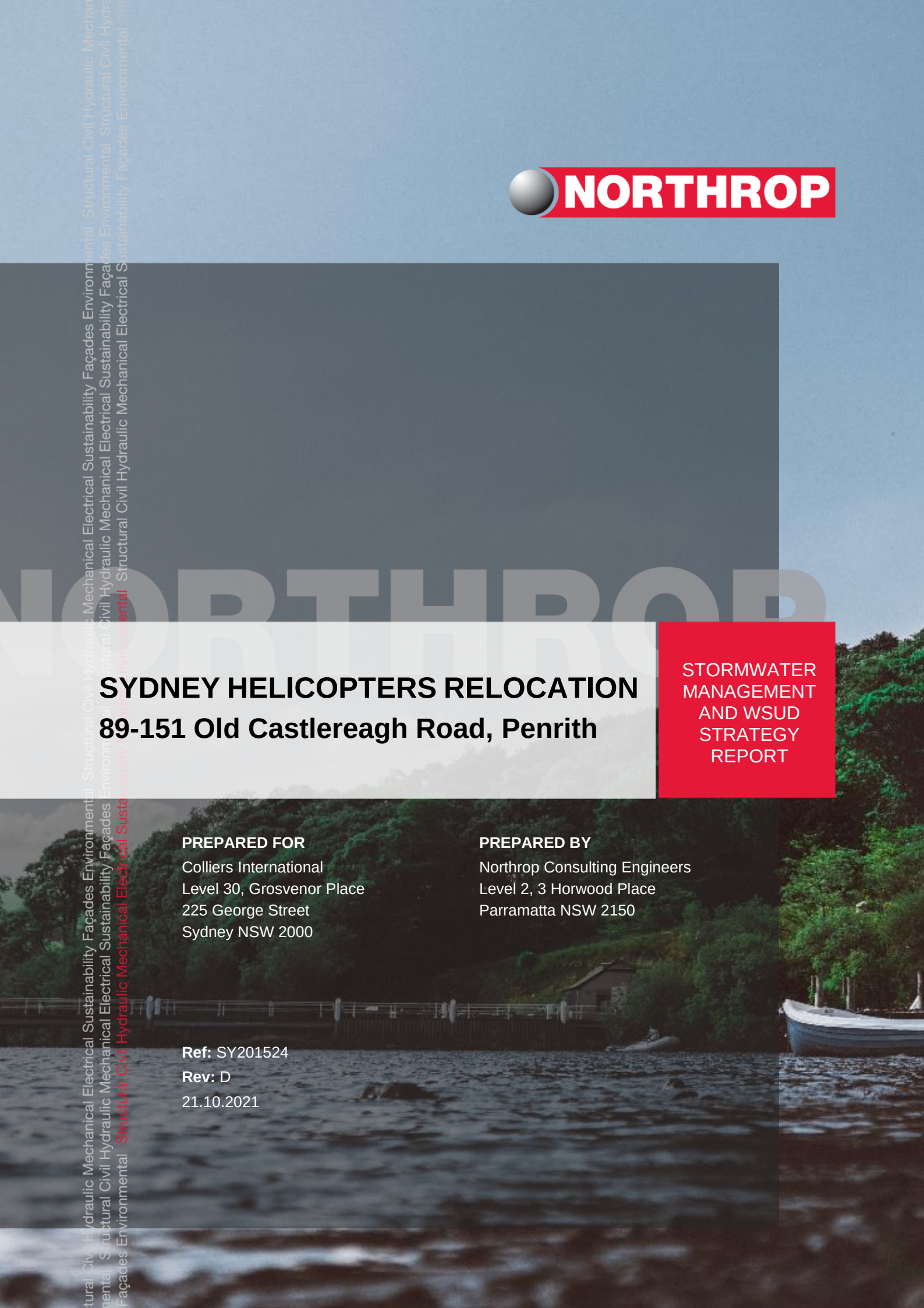

SYDNEY HELICOPTERS RELOCATION
89-151 Old Castlereagh Road, Penrith

STORMWATER MANAGEMENT AND WSUD STRATEGY REPORT

PREPARED FOR
Colliers International
Level 30, Grosvenor Place
225 George Street
Sydney NSW 2000

PREPARED BY
Northrop Consulting Engineers
Level 2, 3 Horwood Place
Parramatta NSW 2150

Ref: SY201524
Rev: D
21.10.2021

STORMWATER MANAGEMENT AND WSUD STRATEGY REPORT

Revision Schedule

Date	Revision	Issue	Prepared By	Approved By
24.09.2021	A	Draft Issue for Review	E. Wong	S. Noble
01.10.2021	B	Issued for Approval		S. Noble
06.10.2021	C	Issued for Approval		S. Noble
21.10.2021	D	Issued for Approval		S. Noble

Northrop Consulting Engineers Pty Ltd

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Table of Contents

1. INTRODUCTION

Northrop Consulting Engineers have been engaged by Colliers International Project Management Pty Ltd to prepare a Stormwater Management Design and Water Sensitive Urban Design (WSUD) Strategy Report in support of a Secretary's Environmental Assessment Requirements (SEARs) application to the Department of Planning Industry and Environment (DPIE). The application is for enabling works for the proposed Sydney Helicopter Relocation development (the project) at 89-151 Old Castlereagh Road, Castlereagh NSW 2749 (site).

The information provided herein is based on a review of the following:

- Current architectural site layout prepared by WMK Architecture;
- The Environmental Assessment Requirements (SEAR Number 1469)
- Environmental Planning and Assessment Act 1979 No 203
- State Environmental Planning Policy (Penrith Lakes Scheme) 1989 (1986 EPI 18) (SEPP)
- Local Council documents, information and guidelines (which provide the stormwater management requirements for the site in the absence of guidance in the EP&A Act, SEPP or LEP);
  - Penrith City Council Development Control Plan (DCP) 2014;
  - Penrith Water Sensitive Urban Design (WSUD) Policy 2013;
  - Penrith Stormwater Drainage Policy 2016;
- Dial Before You Dig (DBYD) information;
- Existing site survey

1.1 Subject Site

The Sydney Helicopters facility is to be relocated to 89-151 Old Castlereagh Road NSW 2749, located in Penrith City Council Local Government Area. The proposed site is located on Lot 2 DP101354 which is currently zoned as 'Tourism' within the SEPP. It is bounded by Old Castlereagh Road to the south, Penrith Lakes to the north, and properties to the east and west. The area of the subject site is approximately 2 hectares. It is currently occupied by an existing single storey office building, a single storey cottage, and two single storey sheds along with associated paths and landscaping.

Figure 1 Subject Site (SIX Maps 2021)

1.2 Proposed Development

Modifications to the existing site are proposed to accommodate the helicopter facility, including demolition of minor ancillary buildings, construction of approximately 1,185m^2 hardstand area adjoining the existing shed which will be used as a hanger and landscaping. The proposed plan is shown in the figure below.

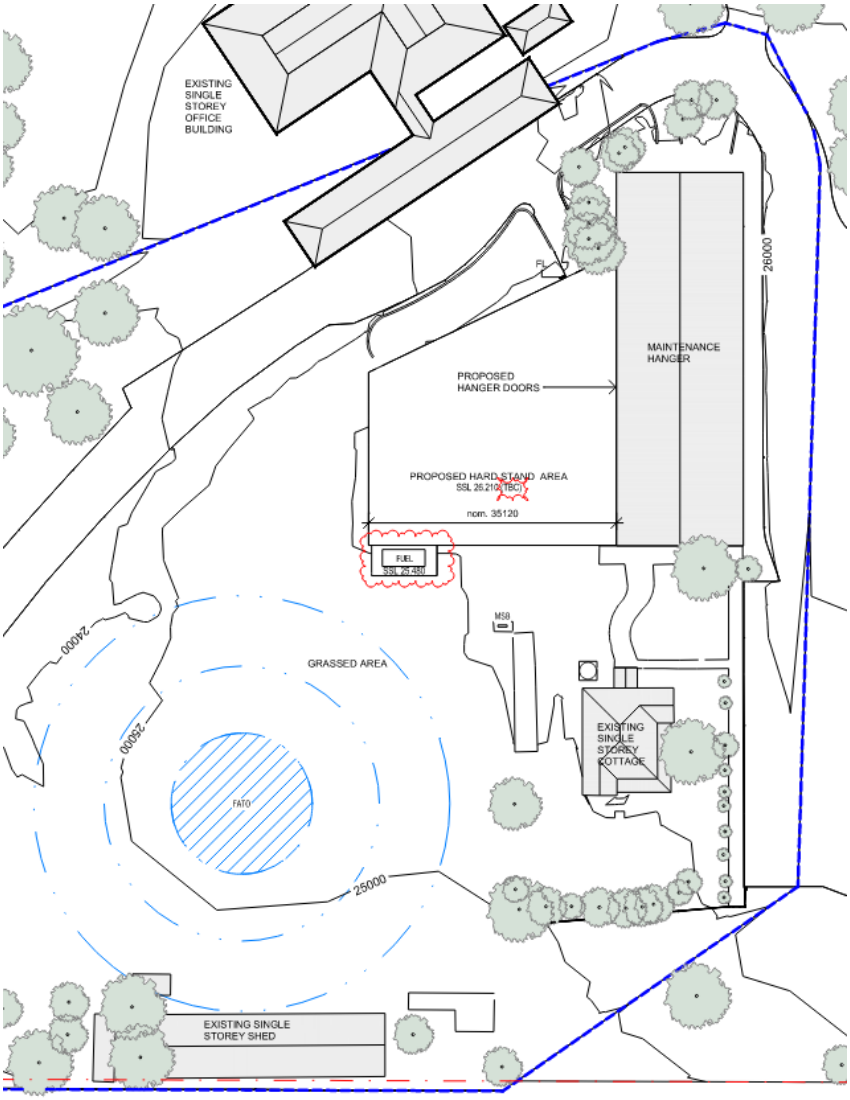


Figure 2 Proposed Site Layout (WMK Architecture)

1.3 Environmental Assessment Requirements

The Environmental Impact Statement (EIS) for the proposed development is required to address the SEARS issued under Section 4.12(8) of the Environmental Planning and Assessment Act 1979.

The SEARS under “Soil and Water” which will be address herein are:

- an assessment of the surface water and runoff impacts during construction and operation (including any association with the discharge of pollutants, fuel/oil leaks, chemical storage and fire safety equipment); proposed storm and wastewater disposal, including type, volumes, proposed treatment and management methods and re-use options and characterisation of the receiving waters;
- details of any potential discharge of pollutants to water and how potential water pollution would be mitigated;
- characterisation of the nature and extent of any contamination (including disturbance of sediments in Penrith Lakes) on the site and surrounding area;

- a Stormwater Management Plan that outlines the general stormwater management measures for the proposal, including erosion and sediment controls, and first flush systems;
- Water Sensitive Urban Design strategy addressing water conservation, water quality, water quantity, operation and maintenance.

1.4 Council Requirements

In the absence of specific Stormwater management and WSUD requirements (numerical targets) in the EP&A Act, SEPP, SEARs or the LEP, Penrith City Council's DCP becomes the governing document. Council's stormwater management requirements pertain to:

- water quantity management;
- water quality management and WSUD;
- and, rainwater water reuse;

thereby dictating required standards and targets that are to be met in addressing the SEARS.

1.4.1 Water Quantity Requirements

Council's Stormwater Drainage Policy 2016 outlines the design requirements for managing stormwater quantity. The relevant requirements for this development are:

- Surface drainage systems are to be designed to have capacity for the 5% AEP Storm
- The major (1% AEP storm) is to be conveyed overland

We note that Onsite Stormwater Detention is not required for this site as it is located outside of the catchments requiring OSD as per Penrith City Council's Stormwater Drainage Policy 2016, as shown below in Figure 3.

Figure 3 OSD Retention Area - Penrith North (Stormwater Drainage Policy 2016)

1.4.2 Water Quality and WSUD Requirements

As per Table 1 in Council's Water Sensitive Urban Design (WSUD) Policy factsheet, the proposed development is classified "Commercial & Industrial - Alterations and additions where the increase in the roofed or impervious area is equal to or greater than 250m", and therefore requires WSUD guidelines to be met.

As per Section C3.2 of the DCP the following water quality targets are to be met:

- Pollution Target Reduction Loads:
  a) 90% reduction in the post development mean annual load of total gross pollutants
  b) 85% reduction in the post development mean annual load of total suspended solids (TSS)
  c) 60% reduction in the post development mean annual load of total phosphorous (TP)
  d) 45% reduction in the post development mean annual load of total nitrogen (TN)
- Modelling for the determination of the mean annual loads of land uses must be undertaken in MUSIC and in accordance with the associated WSUD Technical Guidelines.
- Any changes to the flow rate and flow duration within the receiving watercourses as a result of the development shall be limited as far as practicable. Natural flow paths, discharge point and runoff volumes from the site should also be retained and maintained as far as practicable.
- Impervious areas directly connected to the stormwater system shall be minimised. Runoff from impervious areas such as roofs, driveways and rainwater tank overflows shall be directed onto grass and other landscaped areas designed to accept such flows.

1.4.3 Water Reuse Requirements

The performance criteria of these controls for this development type “Commercial & Industrial - Alterations and additions where the increase in the roofed and impervious area is equal to or greater than 250m” are as:

- to install rainwater tanks to meet 80% of non-potable demand including outdoor use, toilets, and laundry.

2. PROPOSED WSUD STRATEGY

The following section outlines the WSUD strategy for the site, as well as the modelling approach that was undertaken to prove the strategy will meet the SEARs and Council requirements outlined above.

One of the key concerns in SEARs for Soil and Water is the impact the development will have on the quality of stormwater runoff. There are two stages of the project that need that need to be considered when looking at stormwater quality: construction and operation, and different approaches are required for each.

2.1 Stormwater Management Strategy During Construction

During construction, re-grading of part of the site to enable the construction of the hardstand area will require removal of existing ground covering (consisting of both existing concrete slabs and vegetation), exposing the site soil and leaving it vulnerable to erosion during rainfall events. Water quality management during construction is governed by the industry standard “Blue Book” produced by Landcom, which mandates a range of temporary measures to be installed to protect receiving waterways from sediment laden runoff. The proposed measures for this site are documented on the “Sediment and Erosion Control Plan” prepared by Northrop as part of the drawing package, included in Appendix A. They include sediment fences to filter runoff from the site, turfing all exposed areas immediately after earthworks completion, and installing inlet filter traps existing stormwater pits. We note that a sediment basin is not required for this site as the area of works is less than 2000m^2.

2.2 Stormwater Management Strategy During Operation

Post construction, once the site is operational, permanent stormwater quality management measures are required to ensure ongoing treatment of runoff leaving the site. The development is in a rural setting and is not space constrained, so the proposed treatment method is a raingarden. Raingardens filter stormwater through a sandy substrate media and plants uptake nutrients from the water via biofiltration. A figure of the proposed raingarden design can be seen below in Figure 4. They also promote infiltration into the natural ground thereby attenuating peak flows that would otherwise go directly to receiving waters. The runoff from the proposed hardstand area will be collected by a grated drain along its western edge (sized to convey the 5% AEP flow in accordance with Council’s requirements), and directed to the raingarden for treatment, from which it will discharge into an existing Ø375 pipe. The existing stormwater network discharges via a headwall to a small dam on the property, any overflow from which would eventually make it to Penrith Lakes.

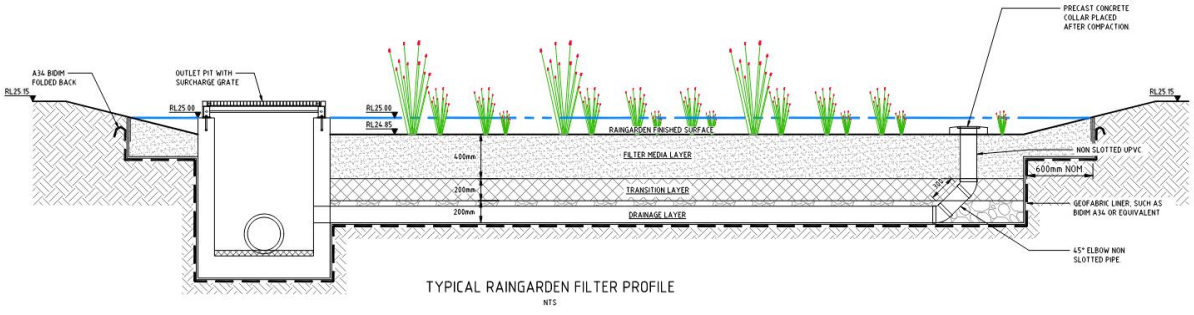


Figure 4: Proposed raingarden detail

In order to construct the hardstand at a suitable grade, some earthworks is required to interface with the existing levels. These batters and disturbed areas will be re-vegetated with top soil and turfed

immediately following completion of works. These areas have been included in the model as pervious catchments to landscaped “buffers”, as they simply sheet flow overland to other vegetated areas. A portion of the newly turfed areas drains to the raingarden, while the rest can be considered as being “not directly connected areas” which will flow over existing stable vegetated areas (buffers) before eventually reaching the receiving water.

In addition to the raingarden, a large rainwater harvesting and reuse system is proposed as part of the development, which will further decrease flow volumes leaving the site. Although no additional roof area is being proposed as part of the development, the rainwater runoff from the existing office building roof (a total of 1,117m^2) is proposed to be directed to three 25kL rainwater reuse tanks (totalling 75kL of storage), and used to supply all non-potable demands (including toilet flushing, outdoor irrigation, wash down facilities, etc). Downpipes on the building will be fitted with ‘first flush’ devices to ensure the first few millimetres of rain (which washes with it the accumulated pollutants on the roof) bypass the tanks, thereby ensuring a high quality of water available for reuse.

Finally, fuel storage on site will be via self bunded tanks, minimising the risks of leaks and spills.

In summary, the additional runoff quantity resulting from the hardstand development is to be compensated for via allowing that runoff to infiltrate through the use of a raingarden, and will also be compensated for by harvesting and reusing runoff from an existing impervious roof area. The quality of the hardstand runoff will be treated by the raingarden to remove pollutants such as total suspended solids, total nitrogen, total phosphorous, heavy metals and hydrocarbons. The proposed stormwater management methods are shown on the Siteworks and Stormwater Management Plan, included in Appendix B.

The maintenance of stormwater management devices is critical to ensure ongoing performance throughout the operational lifespan of the facility. An operation and maintenance schedule is included in Appendix D, outlining the essential tasks and recommended frequency.

2.3 MUSIC Modelling Method

The treatment train described above was modelled in MUSIC. Penrith City Council's MUSIC-Link default nodes were used, to ensure the Event Mean Concentration (EMC) values for different types of catchments were to Council's standard. A Screen shot of the MUSIC model is shown below in Figure 5.

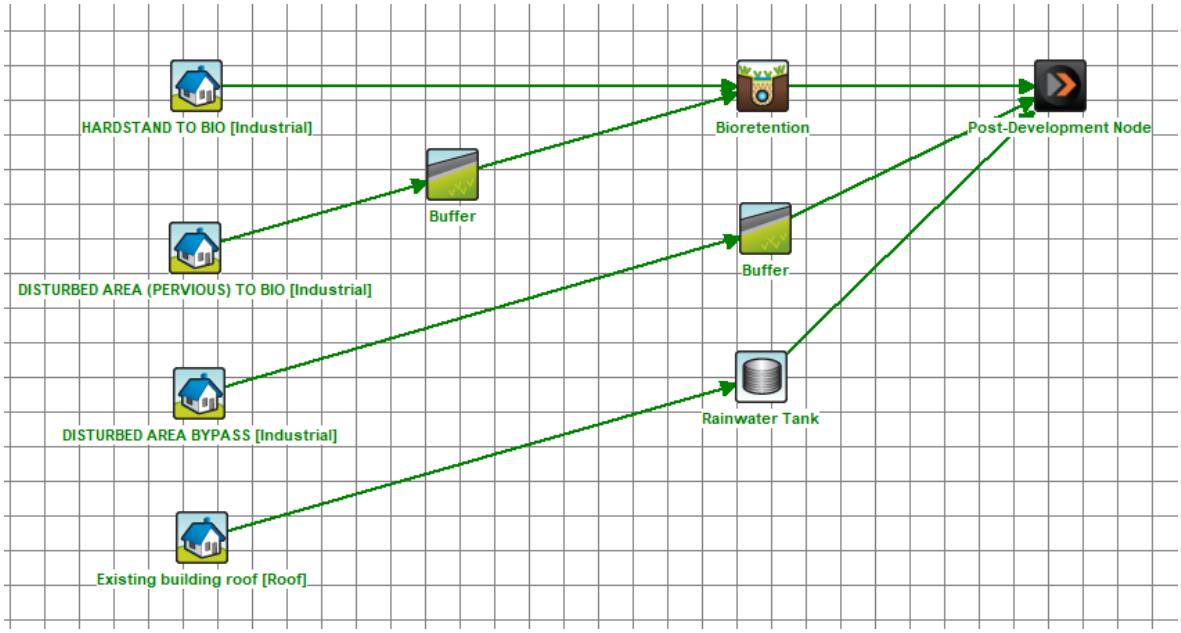


Figure 5: MUSIC Model Screen Shot

2.3.1 Rainfall Data

This model was built using Penrith City Council's MUSIC-Link, therefore adopting their default rainfall data.

2.3.2 Catchment Data

The site was modelled as an industrial catchment. The hardstand area was modelled as 100% impervious, with the surrounding batters and disturbed areas modelled as pervious. Note only areas within the limit of works was modelled in MUSIC, apart from the existing office building roof which was also modelled to incorporate the rainwater harvesting reuse system and check it meets Council's requirements. The catchment plan informing the MUSIC model is included in Appendix C.

2.3.3 Treatment Nodes

Table 1, 2 and 3 below summarise the treatment nodes in the MUSIC treatment train, and provides the values modelled for key model parameters, along with a justification for their selection.

Table 1: Raingarden Model Parameters

RAINGARDEN PARAMETER	ADOPTED VALUE	JUSTIFICATION
Surface Area	26.7 m^2	Resulting ponding area with 1 in 4 batters
Filtration Area	15 m^2	Required area to meet targets

Media Depth	0.6 m	Within in PCC's acceptable range
Extended Detention Depth	0.15 m	Minimum in PCC's acceptable range
Exfiltration rate	3.6 mm/hr	Conservative estimate based on soil type. Note: PCC generally requires lined basins however in this rural setting it is appropriate and beneficial to allow infiltration into the natural ground.

Table 2: Rainwater Tank Model Parameters

RAINGARDEN PARAMETER	ADOPTED VALUE	JUSTIFICATION
Total tank volume	75kL	3 x 25kL tanks proposed
Initial volume	25kL	Assumed 1/3rd full at start of simulation
Annual Demand	400kL/yr	0.4kL/m^2/year irrigation rate assuming 1000m^2 of landscaping will be irrigated
Daily Demand	0.5kL/day	100L/day/ toilet, assuming 5 toilets

Table 3: Buffer Model Parameters

BUFFER NODE PARAMETER	ADOPTED VALUE	JUSTIFICATON
Percentage of upstream area buffered	100%	All landscaped batters and disturbed areas are not "directly connected" so will flow over stable vegetated areas prior to reaching the receiving waterway.
Buffer Area	50%	Max permitted in MUISC (in reality the buffer area is larger than the area being buffered)
Exfiltration Rate	3.6mm/hr	Conservative estimate for soil type in the area.

2.4 MUSIC Results

The results from the MUSIC model are shown below in table 4 where it can be seen that the proposed treatment train meets Council's pollutant reduction targets. MUSIC does not model hydrocarbon and heavy mental removal, however research into the typical removal rates for well designed bioretention systems, summarised by the Cooperative Research Centre (CRC) for Water Sensitive Cities, in their 'Adoption Guidelines for Stormwater Biofiltration Systems' (2015), suggests that bioretention basins (or raingardens) are very effective in the removal of both hydrocarbons and heavy metals.

They found that a high fraction of heavy metals are bound to sediment particles and therefore the removal rates are strongly correlated to the removal rates for sediment. The raingarden modelled in this study was achieving sediment removal rates of around 85%, therefore similar removal rates of heavy metals can be expected.

Raingardens have been found to treat small loadings of hydrocarbons effectively (as opposed to large loadings such as oil spills) via retention in the media and then subsequently being broken down by microbial respiration processes. The CRC estimate the removal of hydrocarbons via biofiltration (i.e. the raingarden) to be around 99% for a well-designed system, varying depending on design, loading, climate, and season.

Table 4: MUSIC Model Results

POLLUTANT	SOURCE LOAD (kg/yr)	RESIDUAL LOAD (kg/yr)	% REDUCTION	TARGET / ACHIEVED?
Total Suspended Solids (TSS)	166	26.1	85%	85% / ✓
Total Phosphorus (TP)	0.345	0.113	67 %	60% / ✓
Total Nitrogen (TN)	3.28	1.35	59%	45% / ✓
Gross Pollutants	38.6	0.107	99%	90% / ✓

3. CONCLUSION

The proposed stormwater management and water sensitive urban design (WSUD) measures proposed herein have been designed in order to meet the SEARS, with specific targets adopted from Penrith City Council's guidelines. A summary of how each of the SEARS have been addressed is outlined below.

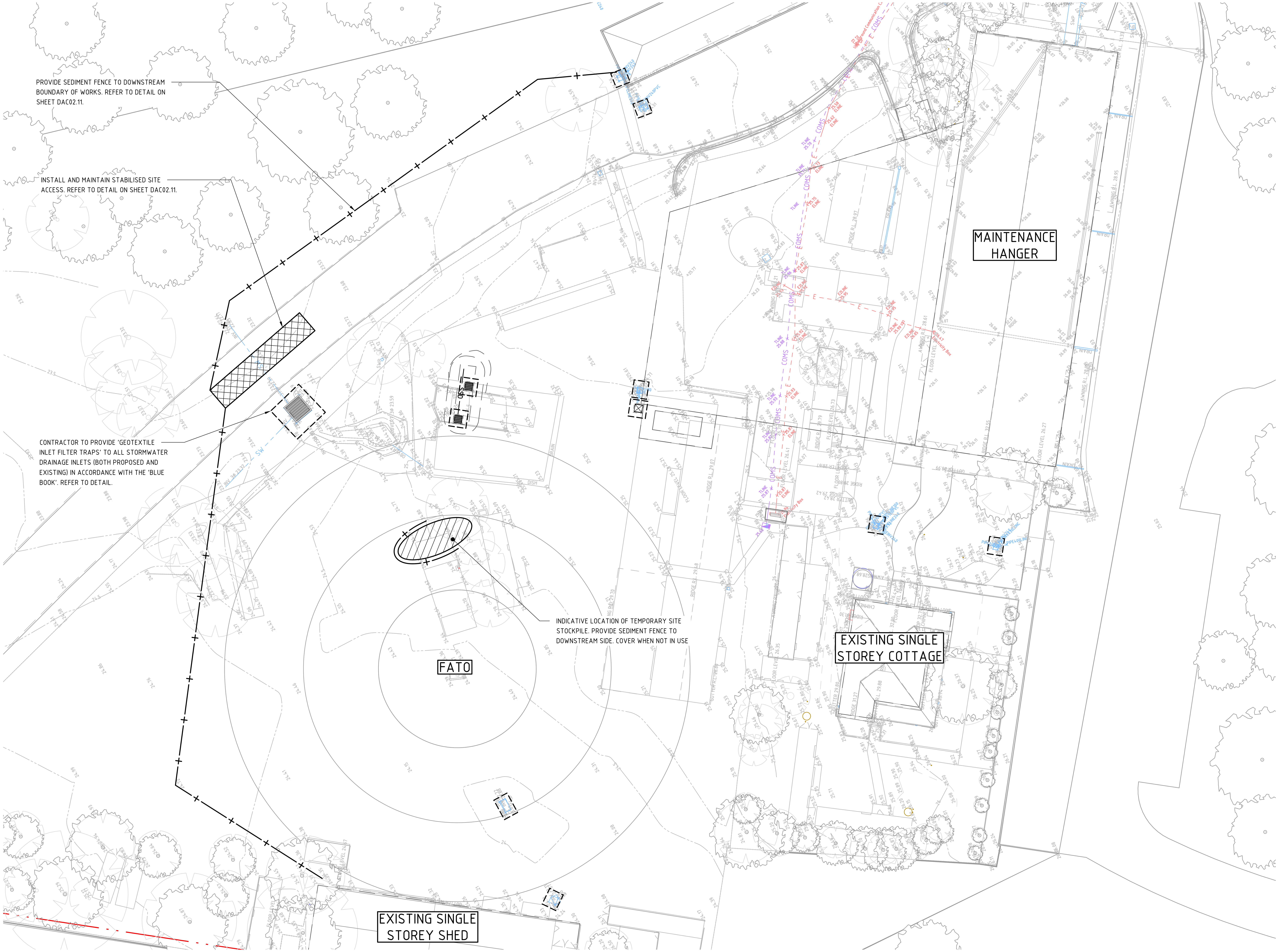
SEARS (SOIL AND WATER):	SUMMARY OF HOW REQUIREMENT IS ADDRESSED:
An assessment of the surface water and runoff impacts during construction and operation (including any association with the discharge of pollutants, fuel/oil leaks, chemical storage and fire safety equipment); proposed storm and wastewater disposal, including type, volumes, proposed treatment and management methods and re-use options and characterisation of the receiving waters.	The surface water runoff during construction will be managed via sediment and erosion control measures in accordance with the industry standard 'blue book', including sediment fences and re-turfing disturbed areas as soon as possible. Surface water runoff during operation of the site will be largely due to the proposed concrete hardstand, which will be treated via a raingarden sized to meet Penrith City Council's water quality requirements. Raingardens are effective in the removal of most pollutants including suspended solids, nitrogen, phosphorous, heavy metals and hydrocarbons. The risk of large fuel or oil leaks are to be mitigated through the use of self bunded fuel storage units. Reuse opportunities for the site are being maximised with rainwater harvesting proposed from the entire roof area of the existing office building.
Details of any potential discharge of pollutants to water and how potential water pollution would be mitigated.	In general, this site is expected to be a relatively clean development, with the main contaminant likely to be sediment and hydrocarbons due to vehicle movements around the site, which can be effectively mitigated through the raingarden.
Characterisation of the nature and extent of any contamination (including disturbance of sediments in Penrith Lakes) on the site and surrounding area.	The source pollution and residual pollution (after treatment) for the site was modelled in MUSIC assuming pollutant loading typical for an industrial site. The proposed treatment measures have been shown in the modelling to effectively reduce the pollution levels in accordance with Penrith City Council's pollution removal targets. The proposed treatment measures will also be effective at minimising flow entering the receiving water (Penrith Lakes) by promoting infiltration and reuse. Furthermore, runoff from the proposed works, once discharged into the existing stormwater network, will enter an existing dam on the property before travelling over 70m to Penrith Lakes (in events where the dam overtops). Therefore the impact on

	Penrith Lakes, including disturbance of sediments, is likely to be negligible.
A Stormwater Management Plan that outlines the general stormwater management measures for the proposal, including erosion and sediment controls, and first flush systems.	Contained herein
Water Sensitive Urban Design strategy addressing water conservation, water quality, water quantity, operation and maintenance.	Contained herein, with the operation and maintenance schedule contained in Appendix D.

Additionally, the DPIE have requested that the development's impact on the Sydney International Regatta Centre be addressed. Stormwater from this development is proposed to be treated in accordance with best practice guidelines, removing sediment, nutrients and hydrocarbons prior to discharging off site. The quality of the stormwater post development is expected to be far improved compared to the existing runoff quality, as the proposed development will see a decrease in impervious area and the introduction of treatment measures. While the site does border the Sydney International Regatta Centre, stormwater from the site is first intercepted by a large dam, vegetated around its perimeter with wetland planting (such as Lomandra longifolia, Carex appressa, Melaleuca stypheloides and Melaleuca decora), as shown in the photo below of the dam. Thus after at-source treatment via the raingarden, stormwater then flow via a system of vegetated swales and ponds, to the large dam where it will be further polished prior to overflow into the regatta centre.

Figure 6: Existing dam intercepting runoff from the site, prior to discharging to the Sydney International Regatta Centre.

APPENDIX A – SEDIMENT AND EROSION CONTROL PLAN



LEGEND

- SITE BOUNDARY LINE
- EXISTING ELECTRICITY
- EXISTING TELECOMUNICATIONS
- EXISTING STORMWATER
- EXISTING SEWER
- EXISTING CONTOURS
- SEDIMENT FENCE
- SECURITY FENCE
- GEOTEXTILE INLET FILTER TRAPS
- SITE ACCESS GATE
- STABILISED SITE ACCESS
- STOCKPILE

GENERAL NOTES:

1. REFER SPECIFICATIONS NOTES FOR SEDIMENT AND SOIL EROSION CONTROL GENERAL REQUIREMENTS.
2. ALL WORKS TO BE CARRIED OUT IN ACCORDANCE WITH PENRITH LAKES SEPP / PENRITH CITY COUNCIL / RELEVANT AUTHORITY SPECIFICATIONS AND DETAILS.
3. ALL SEDIMENT AND SOIL EROSION CONTROL MEASURES TO BE INSTALLED IN ACCORDANCE WITH THE 'BLUE BOOK'. CONTRACTOR TO ENSURE THESE MEASURES ARE IN PLACE AND MAINTAINED AT ALL TIMES DURING CONSTRUCTION WORKS.
4. CONTRACTOR TO PROVIDE 'WIRE MESH AND GRAVEL SEDIMENT FILTER' TO ALL PAVED / ROAD AREAS (BOTH PROPOSED AND EXISTING) IN ACCORDANCE WITH THE 'BLUE BOOK'.
5. CONTRACTOR TO PROVIDE 'GEOTEXTILE INLET FILTER TRAPS' TO ALL STORMWATER DRAINAGE INLETS (BOTH PROPOSED AND EXISTING) IN ACCORDANCE WITH THE 'BLUE BOOK'
6. CONTRACTOR TO IMMEDIATELY TOP SOIL AND TURF ALL AREAS DISTURBED BY THE WORKS TO MINIMISE SEDIMENT RUNOFF.

DRAWN: A.SUTHIPHOSUWAN DESIGNED: E.JACOBS JOB MANAGER: S.NOBLE VERIFIER:

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1	ISSUED FOR APPROVAL	AS		SN	30.09.21

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ARCHITECT: WMK

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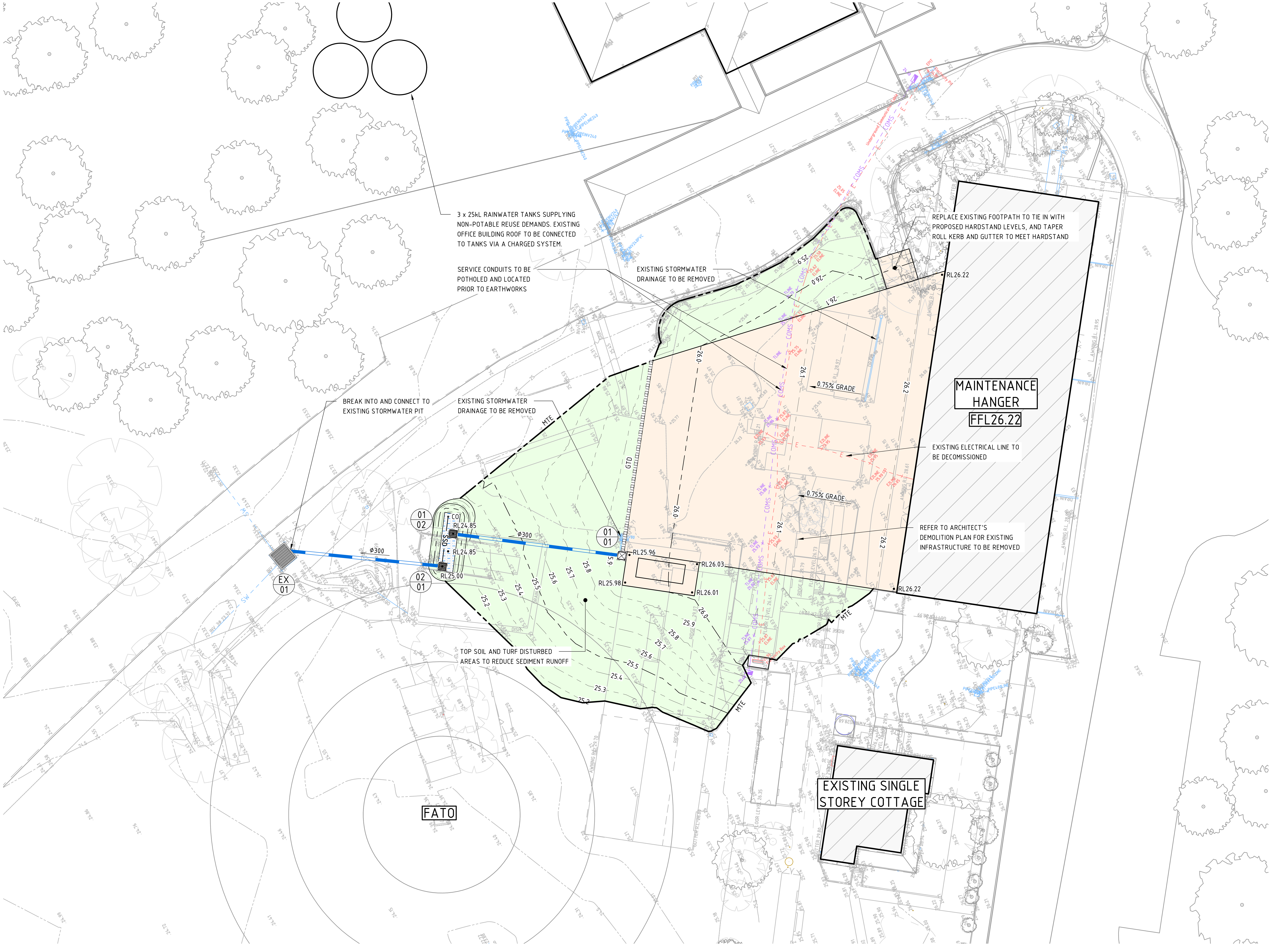
PROJECT: SYDNEY HELICOPTERS
89-151 OLD CASTLEREAGH ROAD, CASTLEREAGH

DRAWING TITLE: CIVIL ENGINEERING PACKAGE
CONCEPT SEDIMENT AND SOIL EROSION CONTROL PLAN

JOB NUMBER: 201524
DRAWING NUMBER: DAC02.01
REVISION: 1
DRAWING SHEET SIZE = A1

APPENDIX B – SITEWORKS AND STORMWATER MANAGEMENT PLAN



LEGEND

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- EXISTING TELECOMMUNICATIONS
- EXISTING STORMWATER
- EXISTING SEWER
- FFLXX.XX — PROPOSED FINISHED FLOOR LEVEL
- • RLXX.XX — PROPOSED SPOT HEIGHT
- X.X — DIRECTION OF GRADE
- BATTERS
- CONTOURS
- EXISTING CONTOURS
- Ø150 — STORMWATER PIPE
- EXISTING DRAINAGE STRUCTURE
- NEW DRAINAGE STRUCTURE
- A / 1 — STORMWATER PIT TAG LINE ID / STRUCTURE No
- GTD — GRATED TRENCH DRAIN
- SSD — SUBSOIL DRAINAGE LINE
- • CO — SUBSOIL DRAINAGE CLEAROUT
- LIMIT OF WORKS
- MTE — MATCH TO EXISTING
- EXISTING BUILDING
- CONCRETE HARDSTAND REFER SHEET C10.01 FOR DETAIL
- TURF AND TOPSOIL
- RAINGARDEN REFER SHEET C10.01 FOR DETAIL

GENERAL NOTES:

1. REFER SPECIFICATIONS NOTES FOR STORMWATER AND SITEWORKS GENERAL REQUIREMENTS.
2. ALL WORKS TO BE CARRIED OUT IN ACCORDANCE WITH PENRITH LAKES SEPP / COUNCIL / RELEVANT AUTHORITY SPECIFICATIONS AND DETAILS.
3. CAD FILES TO BE SUPPLIED IN AUTOCAD FORMAT FOR SETOUT PURPOSES (UPON REQUEST).
4. SUBSOIL DRAINAGE TO RETAINING WALLS, KERBS AND SWALE DRAINS NOT SHOWN FOR CLARITY - REFER RELEVANT DETAILS.
5. REFER 'STORMWATER PIT SCHEDULE' OR LONGSECTIONS FOR PIT INFORMATION.
6. CONTRACTOR TO ALLOW TO ADJUST AND LIAISE WITH RELEVANT SERVICE AUTHORITIES IN RELATION TO EXISTING SERVICE ADJUSTMENT AND MODIFICATIONS.

DRAWN: A.SUTHIPHOSUWAN DESIGNED: E.JACOBS JOB MANAGER: S.NOBLE VERIFIER:

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REVISION	DESCRIPTION	ISSUED	VER'D	APP'D	DATE
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2	ISSUED FOR APPROVAL	AS		SN	30.09.21

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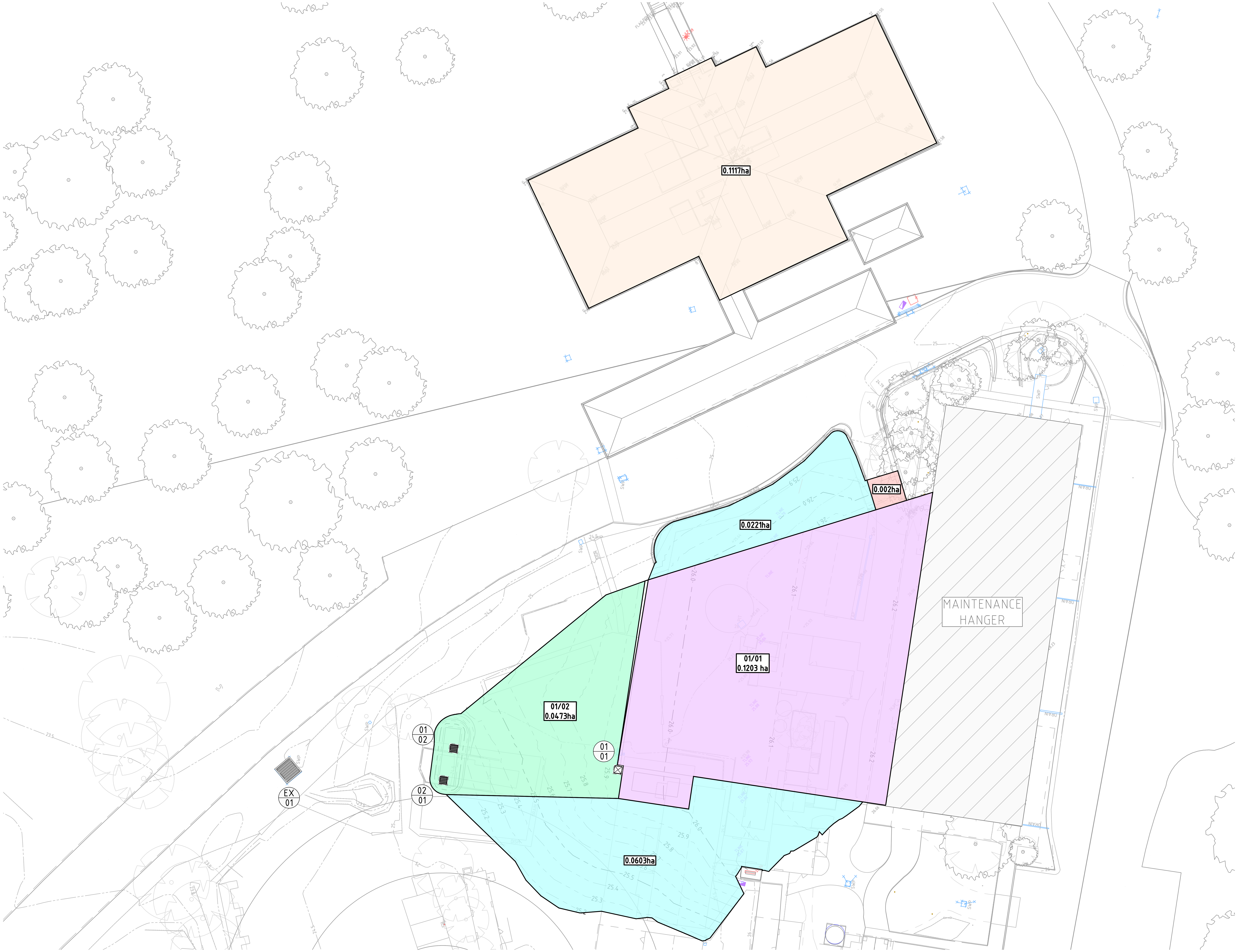
PROJECT: SYDNEY HELICOPTERS
89-151 OLD CASTLEREAGH ROAD, CASTLEREAGH

DRAWING TITLE: CIVIL ENGINEERING PACKAGE
SITEWORKS AND STORMWATER MANAGEMENT PLAN

JOB NUMBER: 201524
DRAWING NUMBER: DAC04.01
REVISION: 2
DRAWING SHEET SIZE = A1

APPENDIX C – CATCHMENT PLAN



DRAWN: A.SUTHIPHOSUWAN DESIGNED: E.JACOBS JOB MANAGER: S.NOBLE VERIFIER:

LEGEND

- SITE BOUNDARY LINE
- EXISTING CONTOURS
- CATCHMENT BOUNDARY
- EXISTING DRAINAGE STRUCTURE
- NEW DRAINAGE STRUCTURE
- A / 1 — STORMWATER PIT TAG, LINE ID / STRUCTURE No
- EXISTING OFFICE BUILDING ROOF TO RAINWATER REUSE TANKS
- PROPOSED HARDSTAND TO RAINGARDEN
- IMPERVIOUS AREA BYPASS
- LANDSCAPING TO RAINGARDEN
- LANDSCAPING BUFFER
- X-X / X.XXX ha — CATCHMENT'S STORMWATER PIT ID, CATCHMENT AREA (ha)

GENERAL NOTES:

1. REFER TO STORMWATER MANAGEMENT AND WSUD REPORT AND MUSIC MODEL FOR FURTHER INFORMATION

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REVISION	DESCRIPTION	ISSUED	VER'D	APP'D	DATE
1	ISSUED FOR APPROVAL	AS		SN	30.09.21

CLIENT: Colliers International

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89-151 OLD CASTLEREAGH ROAD, CASTLEREAGH

DRAWING TITLE: CIVIL ENGINEERING PACKAGE
STORMWATER CATCHMENT PLAN

JOB NUMBER: 201524
DRAWING NUMBER: DAC05.41
REVISION: 1
DRAWING SHEET SIZE = A1

APPENDIX D – OPERATION AND MAINTENANCE SCHEDULE

STORMWATER OPERATIONS AND MAINTENANCE SCHEDULE

Inspected by: ……

Date of Inspection: ……

Next Inspection: ……

Item(s) to be Inspected	Frequency	Performed by	Maintenance Procedure	Maintenance Undertaken	Further Maintenance Required	Inspected By (initial)
General						
Stormwater surface inlet and junction pits	4 Monthly/ After Major Storm	Owner/ Internal Maintenance Staff or Contractor	Remove grate and inspect internal walls and base, repair where required. Remove any collected sediment, debris, litter and vegetation (e.g. Vacuum/ Eductor truck). Inspect and ensure grate is clear of sediment, debris, litter and vegetation. Ensure flush placement of grate on refitment.			
General inspection of complete stormwater drainage system (that is visible - including roof gutters)	Bi-annually	Owner/ Internal Maintenance Staff or Contractor	Inspect all drainage structure noting any dilapidation, carry out required repairs.			
Eaves/Box Guttering System and Downpipes	6 Monthly/ After Major Storm	Owner/ Internal Maintenance Staff or Contractor	Inspect and remove any build-up of sediment, debris, litter and vegetation within gutter system.			

Item(s) to be Inspected	Frequency	Performed by	Maintenance Procedure	Maintenance Undertaken	Further Maintenance Required	Inspected By (initial)
Rainwater Tank						
First flush Devices	6 Monthly	Owner/ Internal Maintenance Staff or Contractor	Inspect first flush devices to ensure correct operation. Remove accumulated litter and debris. If device is not functioning properly repair or replace.			
Internal Inspection	6 Monthly	Owner/ Internal Maintenance Staff or Contractor	Check for evidence of access by animals, birds or insect including the presence of mosquito larvae. If present, identify access point and close. If evidence of algae growth, find and close points of light entry.			
Tank and Lids	6 Monthly	Owner/ Internal Maintenance Staff or Contractor	Check structural integrity of tank including roof and access covers. Any dilapidation including holes or gaps are to be noted and repaired.			
Sediment Accumulation within Tank	Every 2 Years (or once sump capacity is reached)	Specialist Contractor	De-sludge tank(s) by engaging professional cleaner			
Raingarden - Horticultural						

Item(s) to be Inspected	Frequency	Performed by	Maintenance Procedure	Maintenance Undertaken	Further Maintenance Required	Inspected By (initial)
Establishment	Weekly (if establishing during dry season), high frequency during first 3 months. After, bi-monthly in wetter months and monthly in dry season.	Owner/ Internal Maintenance Staff or Contractor	Inspect after construction, check the vegetation cover development and the drainage properties (check if flow enters freely, covering the entire surface, ponding occurs to the designed depth, high flows bypass, and infiltration rates are acceptable). New seedlings require regular watering and irrigation and protection from high sediment loads and flows. All other plants to be watered and irrigated when necessary. Inspect after first rain. **Establishment inspections must be done up until 2 years.**			
Plant health and cover	3 Monthly, additional checking during long dry spells	Owner/ Internal Maintenance Staff or Contractor	Inspect plants for signs of disease, die-back, pest infection, stunted growth, or senescent plants. Check the plant coverage across the surface. If necessary, treat, prune or remove and replace as necessary, aiming to maintain the original planting densities. Irrigate or water plants during long dry periods. Ensure vegetation is still in place. Remove and replace any plants that are dead or beyond a reasonable level of rehabilitation. Trim vegetation to a height that is suitable for the plant type. Where required fertilise plants with appropriate fertiliser for plant type.			
Weeds	3 Monthly	Owner/ Internal Maintenance Staff or Contractor	Check for weeds; if present, manually remove it, avoid using herbicides.			

Item(s) to be Inspected	Frequency	Performed by	Maintenance Procedure	Maintenance Undertaken	Further Maintenance Required	Inspected By (initial)
Bio-Retention Filter Media						
Sediment accumulation/ clogging	3 Monthly, after rain, after first major storm	Owner/ Internal Maintenance Staff or Contractor	Check for accumulation of an impermeable layer (such as oily and clayey sediment) or other sediment depositions, ponding of waters for more than a few hours or widespread moss growth. Repair minor accumulations by raking away mulch and scarifying the surface of the filter media between plants and if feasible, manually remove accumulated sediment. Investigate and remediate the cause of any poor drainage.			
Holes, Erosion or scour	3 Monthly, after rain	Owner/ Internal Maintenance Staff or Contractor	Inspect for erosion, scour or any preferential flow paths, particularly near to inflow points and batter slopes. Repair and infill using compatible material. Add energy dissipaters or reconfigure to improve bypass capacity if necessary.			
Damage	6 Monthly	Owner/ Internal Maintenance Staff or Contractor	Check for damage from vehicle or pedestrian traffic, such as worn paths. Repair with compatible material.			
Litter Control	3 Monthly	Owner/ Internal Maintenance Staff or Contractor	Inspect for litter and remove. During Establishment all organic litter is to be removed. If necessary, use pre-treatment measures if litter is a major recurring problem.			

Item(s) to be Inspected	Frequency	Performed by	Maintenance Procedure	Maintenance Undertaken	Further Maintenance Required	Inspected By (initial)
Raingarden - Drainage						
Inlet and Outlet Pits	6 Monthly (Monthly if there is construction in the catchment) and occasionally after rain	Owner/ Internal Maintenance Staff or Contractor	Ensure grates over pits are clear of litter and debris, inspect the pit for dislodged or damaged pit covers, and structural integrity. Check stormwater inlet grate condition is free from corrosion, (especially corners and welds) damage or blockage. Remove sediment from pits and entry sites.			
Trash screen	6 Monthly	Owner/ Internal Maintenance Staff or Contractor	Inspect trash screen to ensure correct operation. Ensure trash screen is clean and free of debris. Ensure screen fixings are secure and free from corrosion. Repair as required. Refit trash screen and ensure it is secure.			
Underdrain and Clearout points	6 Monthly, after rain	Owner/ Internal Maintenance Staff or Contractor	Ensure that the underdrain pipe is not blocked, if necessary, unclog it with a drain snake or pressure cleaner.			
Outlet Pipe	6 Monthly	Owner/ Internal Maintenance Staff or Contractor	Remove grate and screen. Check upstream and downstream end of pipe and remove any blockages. Flush outlet pipe to confirm it drains freely. Ensure no damage to downstream daylighting end with rock protection securely in place.			