Arboricultural Impact Assessment

RESOURCE RECOVERY LEARNING CENTRE
JULY 18, 2024

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Contents

Summary

Tree Management Strategies have been commissioned by Terroir to provide an Arboricultural Impact Assessment (AIA) considering nine trees for a Resource Recovery Learning Centre in West Nowra, refer to (Figure 1). The AIA forms part of a development application.

This report aims to:

- Assess the health and vitality of nine trees.
- Calculate the impact the proposed development will have on nine trees.
- Suggest sensitive construction or tree protection methods to retain high to medium value trees on the subject site or neighbouring site.
- Recommend the retention or removal of the subject trees.

The health, condition and retention values of nine trees are recorded in the Tree Data Schedule (Appendix 1) and shown in the Tree Impact Plan (Appendix 2).

The developmental Impacts are explored in Developmental Impact and Observations (Section 2) of this report.

Conclusion

Trees 3, 4, 5, 6 and 7 have major and total incursions into their TPZ's by the proposed development that requires their removal.

Tree 9 is unaffected by the development.

Trees 1, 2 and 8 are impacted by the development, however, with sensitive construction measures, tree protection and protect arborist supervision will remain health and viable.

An annual risk assessment for trees 1 and 2 is recommended to ensure their health, structure and the safety of people and property within their vicinity.

Recommendations

- Remove Trees 3, 4, 5, 6 and 7. Tree removal work to be undertaken in accordance with *AS 4373 Pruning of Amenity Trees*, using a qualified Arborist (minimum Australian Qualification Framework (AQF3) Level Arborist).
- Adhere to the Tree Management Plan (Section 3) of this report to ensure the ongoing health of Trees 1, 2 and 8 to be retained.
- A risk assessment by an AQF Level 5 arborist should be undertaken annually.

1. Introduction

Tree Management Strategies have been commissioned by Terroir to provide an Arboricultural Impact Assessment (AIA) considering nine trees for a Resource Recovery Learning Centre in West Nowra, refer to (Figure 1). The AIA forms part of a development application.

Shoalhaven City Council is the consenting authority for the development.

This report does not take into consideration the habitat value of the site but the retention value of individual trees and the associated developmental impacts.

This report aims to:

- Assess the health and vitality of nine trees.
- Calculate the impact the proposed development will have on nine trees.
- Suggest sensitive construction or tree protection methods to retain high to medium-value trees on the subject site or neighbouring site.
- Recommend the retention or removal of the subject tree.

Figure 1: Subject Site Highlighted in Red

2. Developmental Impacts and Observations

On 28-11-22 a site inspection was conducted. The health, condition, retention values and photographs of 9 trees are recorded in the Tree Data Schedule (Appendix 1) and shown on the Tree Impact Plan (Appendix 2).

The method for this report is outlined in (Appendix 3) Method.

All tree retention values are in accordance with IACA Significance of a Tree, Assessment Rating System (STARS) © (IACA 2010) ©.

The tree impacts detailed below are based on the plans referenced in (Section 4) of this report.

The incursions to the theoretical Tree Preservation Zones (TPZ) potentially affecting trees assessed on the subject site are shown in the Tree Impact Plan (Appendix 2).

Trees 3, 4, 5, 6 and 7 are given medium retention values due to their age, health and position in the landscape. Trees 3, 4, 5, 6 and 7 have major and total incursions into their TPZ's by the proposed development that requires their removal, refer to the Tree Impact Plan (Appendix 2).

Tree 9 is unaffected by the development, refer to the Tree Impact Plan (Appendix 2).

The incursions to Trees 1, 2 and 8 are explored below.

Tree 1

Tree 1 is given a medium retention value due to its age, health and position in the landscape. Tree 1 has impacts to its SRZ and TPZ by the:

1. Gabion Wall;
2. Building Envelope; and
3. Carpark Alignment.

To reduce these impacts to an acceptable level, sensitive construction measures are recommended.

Design modifications:

The construction methodology for the gabion wall, carpark and stormwater design was done in conjunction with the consulting arborist and engineers to ensure minimal tree impact.

Tree Sensitive construction:

1. The gabion wall within the SRZ and TPZ of Tree 1 will be of a pier and beam type construction, refer to the Tree Management Plan (Section 3) of this report.
2. The building envelope within the TPZ of Tree 1 is constructed on piers to minimise tree impacts, refer to the Tree Management Plan (Section 3) of this report.
3. The carpark within the TPZ of Tree 1 is to be constructed on ground level using GEOHEX, a permeable alternative to concrete or asphalt, refer to refer to the Tree Management Plan (Section 3) of this report.

Canopy incursion:

N/A

Tree Protection measures:

Trunk battening, ground Protection and project arborist supervision is recommended, refer to the Tree Management Plan (Section 3) of this report.

Recommendations:

- Retain Tree 1 adhering to the Tree Management Plan (Section 3) of this report.

Tree 2

Tree 2 is given a medium retention value due to its age, health and position in the landscape. Tree 2 has impacts to its SRZ and TPZ by the:

1. Gabion Wall;
2. Carpark Alignment.

To reduce these impacts to an acceptable level, sensitive construction measures are recommended.

Design modifications:

The construction methodology for the gabion wall, carpark and stormwater design was done in conjunction with the consulting arborist and engineers to ensure minimal tree impact.

Tree Sensitive construction:

1. The gabion wall within the SRZ and TPZ of Tree 2 will be of a pier and beam type construction, refer to the Tree Management Plan (Section 3) of this report.
2. The carpark within the TPZ of Tree 2 is to be constructed on ground level using GEOHEX, a permeable alternative to concrete or asphalt, refer to the Tree Management Plan (Section 3) of this report.

Canopy incursion:

N/A

Tree Protection measures:

Trunk Battening, Ground Protection and project arborist supervision is recommended, refer to the Tree Management Plan (Section 3) of this report.

Recommendations:

- Retain Tree 2 adhering to the Tree Management Plan (Section 3) of this report.

Tree 8

Tree 8 is given a medium retention value due to its age, health and position in the landscape. Tree 8 has potential root zone impacts by the Gabion Wall.

To reduce these impacts to an acceptable level, sensitive construction measures are recommended.

Design modifications:

The construction methodology for the gabion wall, carpark and stormwater design was done in conjunction with the consulting arborist and engineers to ensure minimal tree impact.

Tree Sensitive construction:

The gabion wall within the SRZ and TPZ of Tree 2 will be of a pier and beam type construction, refer to the Tree Management Plan (Section 3) of this report.

Canopy incursion:

N/A

Tree Protection measures:

Trunk Battening, Ground Protection and project arborist supervision is recommended, refer to the Tree Management Plan (Section 3) of this report.

Recommendations:

- Retain Tree 8 adhering to the Tree Management Plan (Section 3) of this report.

3. Tree Management Plan

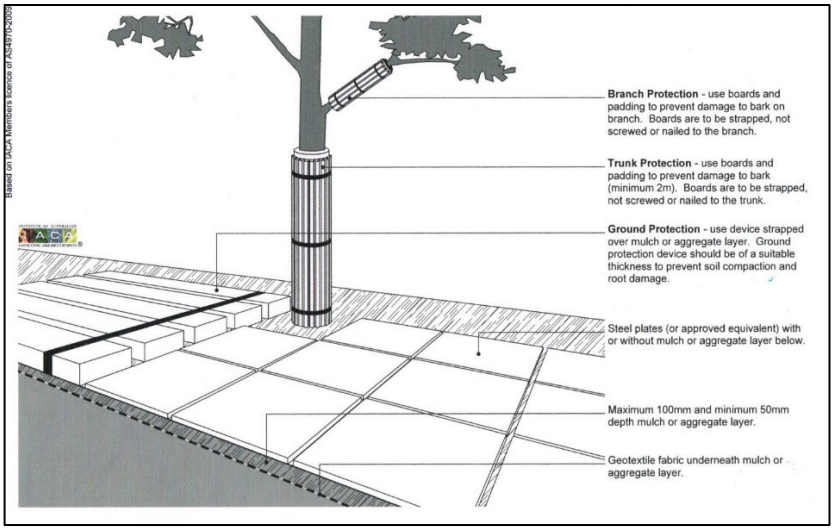
The Tree Management Plan is designed to offer detailed design modifications or sensitive construction methods and a step-by-step timeline for Tree Protection Measures.

Step 1: Trunk Battening and Ground Protection

To ensure the protection of trees potentially affected by the proposed development. Trunk Protection and ground protection is required for Trees 1, 2 and 8 as per the detail outline in (Figure 2).

The Project Arborist must certify the protection measures are installed to the required specifications prior to commencement of construction. The trunk protection and ground protection should remain in place for the duration of construction.

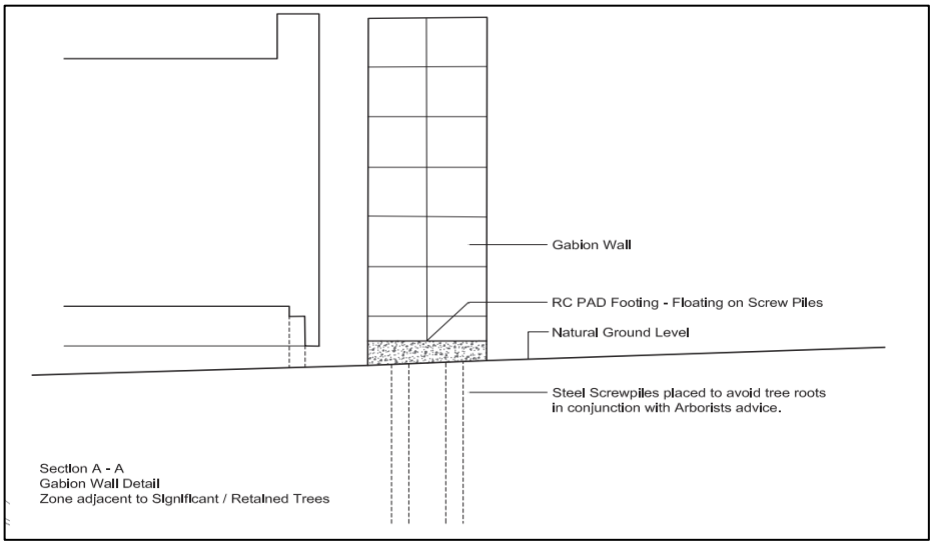
Figure 2: Trunk Battening Detail



Step 2: Gabion Wall Construction

The Gabion wall shall be constructed using a pier and beam design, refer to (Figure 3). The Project Arborist must supervise the gabion wall installation and certify no damage occurs to Trees 1, 2 and 8.

Figure 3: Pier and Beam Detail



Step 3: GEOPHEX Carpark Construction

The carpark alignment within the TPZ of Trees 1 and 2 is to be constructed on ground level using GEOHEX, a permeable alternative to concrete or asphalt, refer to the GEOHEX Specification (Appendix 4) of this report.

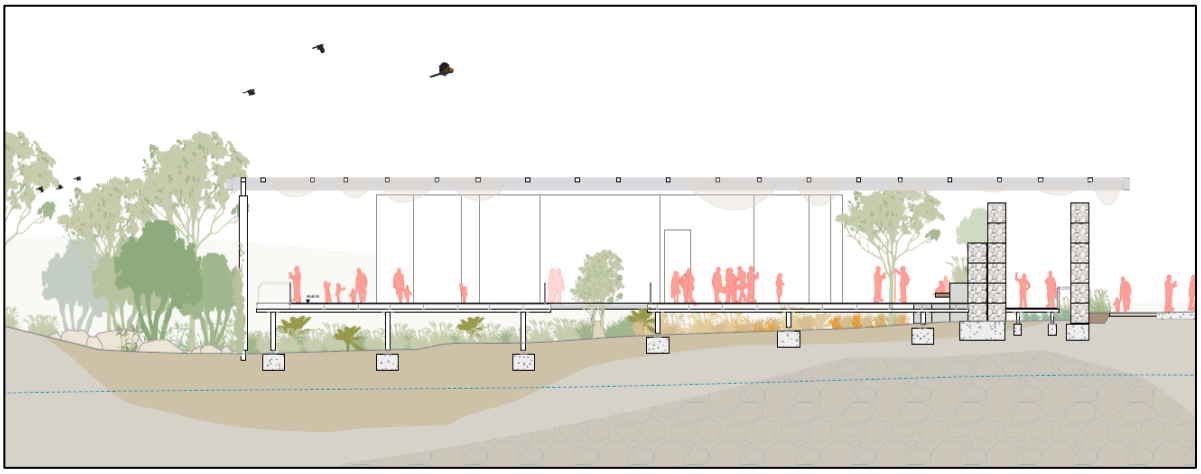
The Project Arborist must supervise the GEOHEX installation and certify no damage occurs to the root systems of Trees 1 and 2.

Step 4: Building Construction

The building is designed on piers to minimise root disturbance on Tree 1, refer to (Figure 4) for an exert from the supplied architectural plans. The piers within the TPZ of Tree 1 should be hand dug under the supervision of an AQF project arborist.

The Project Arborist must certify no damage occurs to the root systems of Tree 1.

Figure 4: Building Designed on Piers



Step 5: Monitoring

The Project Arborist must inspect all trees to be retained on a monthly basis, unless otherwise specified by the project arborist, for the duration of the project to ensure tree protection measures are being adhered to and the health of all trees are not being adversely affected. Monitoring to cease following the final inspection and report.

Step 6: General Exclusions within the TPZ

The following activities shall be excluded within the TPZ's of trees to be retained, to (Figure 5).

Figure 5: TPZ exclusions

4.2 ACTIVITIES RESTRICTED WITHIN THE TPZ

Activities generally excluded from the TPZ include but are not limited to—

(a) machine excavation including trenching;
(b) excavation for silt fencing;
(c) cultivation;
(d) storage;
(e) preparation of chemicals, including preparation of cement products;
(f) parking of vehicles and plant;
(g) refuelling;
(h) dumping of waste;
(i) wash down and cleaning of equipment;
(j) placement of fill;
(k) lighting of fires;
(l) soil level changes;
(m) temporary or permanent installation of utilities and signs, and
(n) physical damage to the tree.

The Project Arborist must be notified in the event any disturbance within the TPZ of trees to be retained is required.

Step 7: Final Certification

Upon completion of construction the Project Arborist will certify that the health and condition of all trees to be retained have not been adversely affected by the development.

4. Referenced Documents

Plans that were referred to for this report include:

Plan Title	Drawing Number	Consultant	Revision
Tree Impact Plan	Mun.TIP.01	Tree Management Strategies	18-07-2024
Architectural Plans	AG A_2302_DA_005	Terroir	July 2023
Stormwater Design	C6.01	WSce Pty Ltd	10-07-2024

5. Conclusions & Recommendations

Conclusion

Trees 3, 4, 5, 6 and 7 have major and total incursions into their TPZ's by the proposed development that requires their removal.

Tree 9 is unaffected by the development.

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An annual risk assessment for trees 1 and 2 is recommended to ensure their health, structure and the safety of people and property within their vicinity.

Recommendations

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- Adhere to the Tree Management Plan (Section 3) of this report to ensure the ongoing health of Trees 1, 2 and 8 to be retained.

- A risk assessment by an AQF Level 5 arborist should be undertaken annually.

6. References

Shigo, A., 1986, A New Tree Biology and Dictionary: facts, photos, and philosophies on trees and their problems and proper care, Snohomish, WA

Council of Standards Australia (August 2009)
The Australian Standard for the Protection of Trees on Development Sites (AS 4970 – 2009).

Harris, R., Clark, J. and Matheny, N., 2003, Integrated Management of Landscape Trees, Shrubs, and Vines, fourth edition, Prentice Hall, Australia

IACA, 2010, IACA Significance of a Tree, Assessment Rating System (STARS), Institute of Australian Consulting Arboriculturists, Australia, www.iaca.org.au

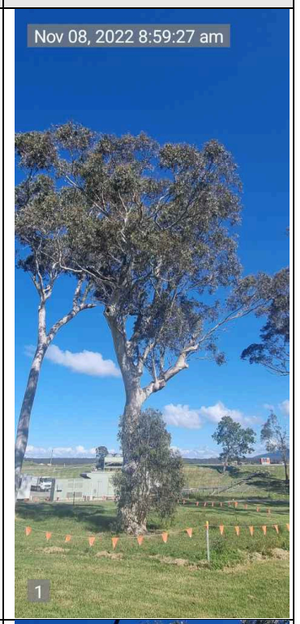
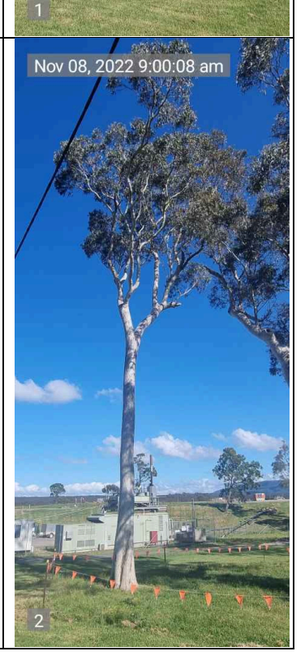
Lonsdale, D. (1999). *Principles of Tree Hazard Assessment and Management*. Forestry Commission,London.

Mattheck, C. and Breloer, H (1994) *The Body Language of Trees*. Research for Amenity Trees No.4,
The Stationery Office, London.

7. Appendices

Appendix 1: Tree Data Schedule

APPENDIX 1 – TREE DATA SCHEDULE

No	Genus-species	Common Name	DAB metres (radius) Above Buttress	DBH metres (radius) Breast Ht	SRZ (radius) Metres	TPZ (radius) Metres	Height Metres	Age Young, Semi-Mature, Mature Over Mature	Canopy Spread (Metres) (radius)	Health Good Fair Fair/Poor Poor Dead	Condition Good Fair Fair/Poor Poor Failed	Useful Life Expectancy High Medium Low	Landscape significance High Medium Low	Retention value High Medium Low	Notes	Photo
1	*Eucalyptus racemosa*	Scribbly Gum	1.20	1.03	3.57	12.36	16.00	Mature	8.00	Fair	Fair	Medium	Medium	Medium	Tree has habitat hollows. Basal wound and decay observed.	
2	*Eucalyptus racemosa*	Scribbly Gum	0.90	0.75	3.17	9.00	18.00	Mature	6.00	Fair	Fair/Poor	Medium	Medium	Medium	Tree Hollows observed.	

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3	*Eucalyptus gummifera*	Red Bloodwood	0.55	0.40	2.57	4.80	16.00	Mature	6.00	Fair/Poor	Fair/Poor	Medium	Medium	Medium		
4	*Eucalyptus racemosa*	Scribbly Gum	0.45	0.33	2.37	3.96	16.00	Mature	6.00	Fair/Poor	Fair/Poor	Medium	Medium	Medium		

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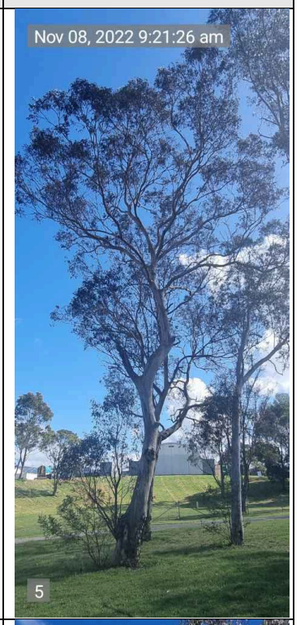
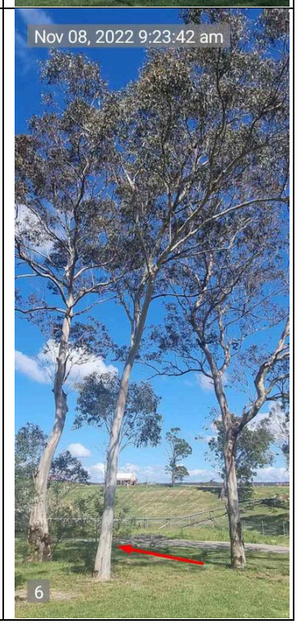
5	*Eucalyptus punctata*	Grey Gum	0.80	0.65	3.01	7.80	16.00	Mature	8.00	Fair	Fair/Poor	Medium	Medium	Medium	Basal wound and decay observed.	
6	*Eucalyptus racemosa*	Scribbly Gum	0.45	0.36	2.37	4.32	16.00	Mature	6.00	Fair	Fair/Poor	Medium	Medium	Medium		

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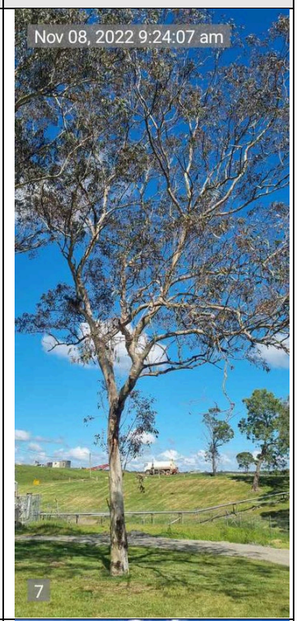
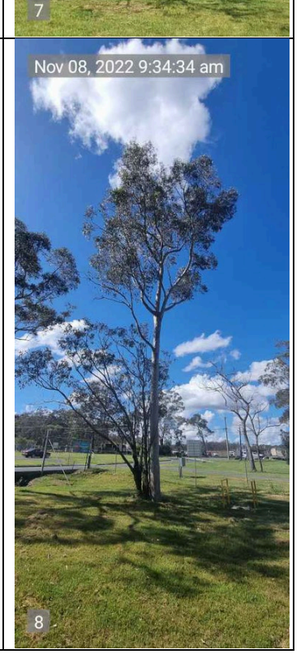
7	*Eucalyptus punctata*	Grey Gum	0.58	0.46	2.63	5.52	16.00	Mature	8.00	Fair	Fair/Poor	Medium	Medium	Medium		
8	*Eucalyptus racemosa*	Scribbly Gum	0.45	0.35	2.37	4.20	16.00	Mature	6.00	Fair	Fair/Poor	Medium	Medium	Medium		

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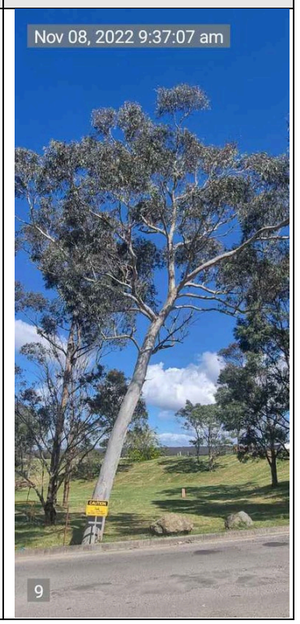
9	*Eucalyptus racemosa*	Scribbly Gum	0.65	0.54	2.76	6.48	14.00	Mature	6.00	Fair	Fair/Poor	Medium	Medium	Medium		

Appendix 2: Tree Impact Plan

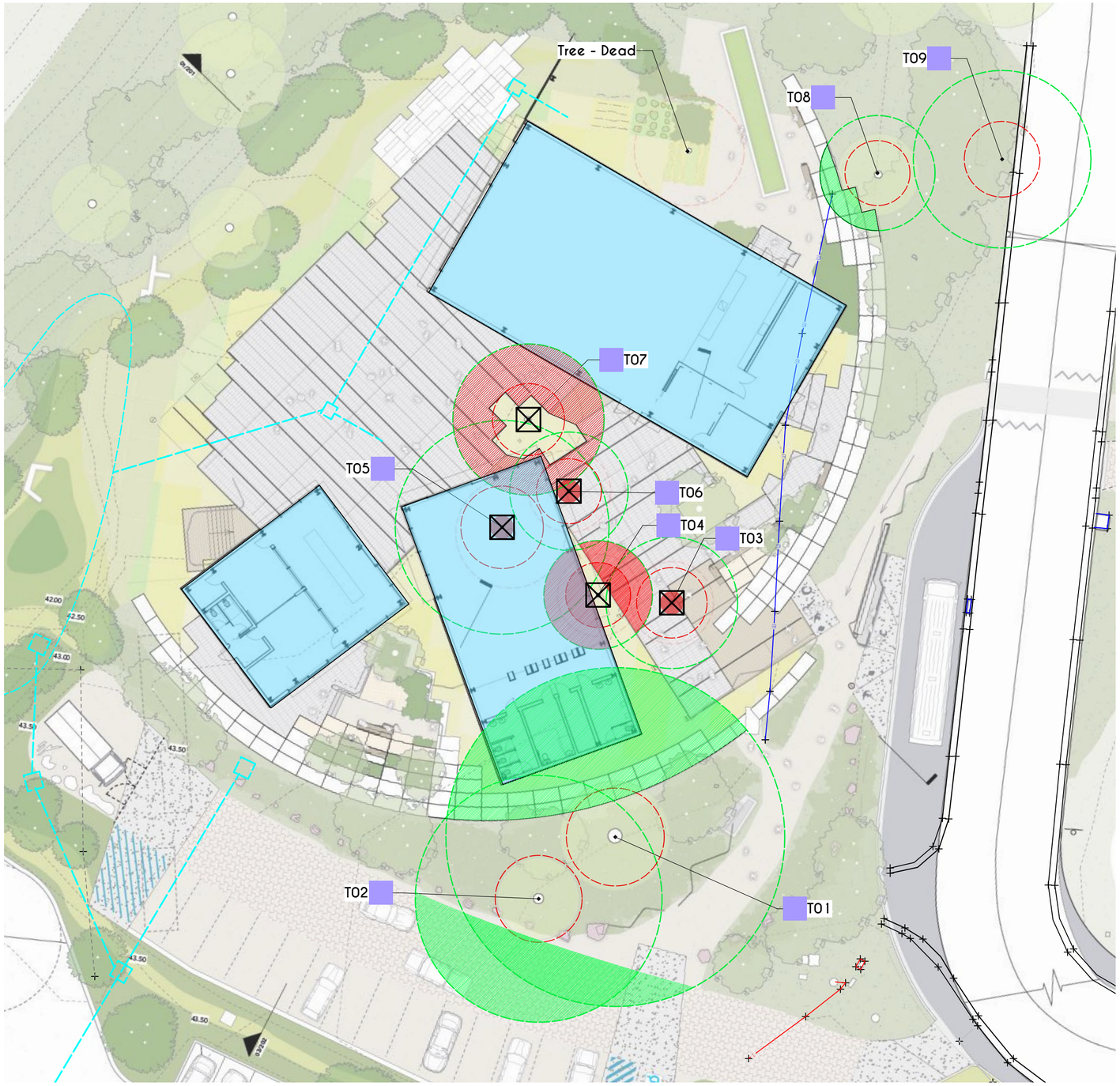
Tree Impact Plan - Appendix 2

Legend

- TPZ - Tree Protection Zone
- SRZ - Structural Root Zone
- Incursion Zone - Building Works
- Incursion Zone - Sensetive Construction
- Trunk Impact
- Tree To Be Removed
- Proposed Building
- Stormwater

Retention Value

- High
- Medium
- Low



Incursion

T01, T02 & T08
No Impact. See Arborist Report

T03, T05 & T06
Trunk Impact

T04
SRZ = 17.65qm
Building Works
Incursion Zone =11.77qm
Incursion = 66.69%

TPZ = 49.27sqm
Building Works
Incursion Zone =39.35sqm
Incursion = 79.87%

T07
SRZ = 21.73qm
Building Works
Incursion Zone =6.31qm
Incursion = 29.04%

TPZ = 95.73sqm
Building Works
Incursion Zone =74.81sqm
Incursion = 78.15%

T09
No Impact

0 10 15 20 25M

N

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DATE: 17/07/2024	DWG: MunTIP01	REVISION: 01	SCALE @ A2 1:250	DRAWN Mark Hill

ADDRESS 36 Bridge Rd
Nowra

PLAN TITLE Tree Impact Plan

Appendix 3: Method

Site Assessment

From the ground, the following information was recorded and displayed in the Tree Data Schedule (Appendix 1).

- Tree genus and species.
- Approximate height spread if deemed applicable.
- Trunk diameter at breast height and above the buttress.
- Age class: young, semi mature, mature, over mature.
- Health.
- Condition.

Observations were recorded and photographed.

Research

The following legislation, documents or websites were reviewed:

- The Australian Standard for the Protection of Trees on Development Sites (AS 4970 – 2009).
- Shoalhaven City Council Development Control Plan 2014.
- Shoalhaven City Council Local Environmental Plan 2014.

Tree Data Schedule Method

The health and condition of trees assessed are shown in the Tree Data Schedule (**Appendix 1**) with the methods explained below:

Tree Health

Overall Health (Vigour/Vitality)	Tree vigour is exhibited by crown density, crown cover, leaf colour, leaf size, leaf texture, presence of epicormic growth, ability to withstand predation by pest and disease, resistance and degree of dieback.
Good (Excellent)	Good tree vigour exhibited by no decline in overall health and vigour, height and shape. The specimen is observed to be of excellent condition displaying characteristics that is known for that particular species (what would be the expected condition for that particular species of that age in that location), 0% dieback, full crown density, leaf health, no pest or disease present.
Fair	Fair tree vigour exhibited by moderate decline in overall health and vigour, height and shape. The specimen is observed to be of moderate condition by not displaying characteristics adequately that is known for that particular species (what would be expected for that particular species of that age in that location), less than 10% dieback, 90% of crown foliage density, more than 90% leaf health, acceptable level of pest or disease is evident for the assessing arborist (where it is considered the tree's overall health or condition will not be affected or lead to irreversible decline from pest or disease).
Fair/Poor	Fair to poor tree vigour exhibited by considerable decline in overall health and vigour, height and shape. The specimen is observed to be of less than acceptable condition by not displaying characteristics adequately that is known for that particular species (what would be expected for that particular species of that age in that location), 10-20% dieback, considerable foliage deficiencies, 70-90% foliage density, 70-90% leaf health, pest or disease infestation at acceptable thresholds for the assessing arborist (where it is considered the tree's overall health or condition will not be affected or lead to irreversible decline from pest or disease).

Poor	Poor vigour exhibited by substantial decline in overall health and vigour, height and shape. The specimen is observed to be of poor condition by not displaying characteristics adequately that is known for that particular species (what would be expected for that particular species of that age in that location), 20-30% dieback, considerable foliage deficiencies, 50-70% leaf health, pest or disease infestation at unacceptable infestation level that exceeds thresholds for the assessing arborist (where it is considered the tree's overall health or condition will be affected or lead to irreversible decline from pest or disease).
Very Poor	Very poor vigour exhibited by irreversible decline in overall health and vigour, height and shape. The specimen is observed to be of less than acceptable condition by not displaying characteristics adequately that is known for that particular species (what would be expected for that particular species of that age in that location), 15-50% dieback; severe foliage deficiencies; 30-50% density; 30-50% leaf health; pest or disease infestation at severe infestation level that exceeds thresholds for the assessing arborist (where it is considered the tree's overall health or condition will be affected or lead to irreversible decline from pest or disease).
Dead	Dead tree vigour exhibited by complete decline in overall health and vigour, height and shape. The specimen is observed to be dead by not displaying any characteristics adequately that is known for that particular species (what would be expected for that particular species of that age in that location), tree holds less than 15% foliage; branching is dead throughout canopy, pest or disease infestation at severe infestation level that exceeds thresholds for the assessing arborist (where it is considered the tree's overall health or condition will be affected or lead to irreversible decline from pest or disease).

Tree Condition

Overall Condition (Structure/Stability)	The tree condition as identified by the arborist in regard to defects in structure and stability.
Good (Exceptional specimen)	No damage or decay observed to the root plate, visible basal and /or root flare, stable in ground, well tapered branches with sound open unions. All characteristics within thresholds for the assessing arborist.
Fair (Standard tree – no observable major defects to suggest that there is an increased likelihood of tree or part of tree failure)	Minor damage or decay observed to root plate, trunk or primary branches or branch unions (1st or 2nd branch order or scaffolding branch), well-formed branch unions, minor branch end weight or over-extensions within thresholds for the assessing arborist.
Fair/Poor	Moderate damage or decay observed to root plate, trunk or primary branches or branch unions (1st or 2nd branch order or scaffolding branch); minimal basal/root flare; acute branch; past branch failure(s); moderate branch end-weight or over-extension approaching thresholds for the assessing arborist.
Poor	Major damage or decay observed to root plate, trunk or primary branches or branch unions (1st or 2nd branch order or scaffolding branch) no observable basal and /or root flare; acute branch unions starting to include bark; major branch end-weight or over-extension at or exceeds thresholds for the assessing arborist.
Very Poor	Excessive damage or decay observed to root plate, trunk, primary branch or branch unions (1st or 2nd branch order or scaffolding branch), excessive decay or hollows compromising the structural integrity, unstable in ground, excessive branch end-weight, included-bark unions, exceeding thresholds for assessing arborist. Failure probable.
Failed	Failure of root plate or trunk or primary branch or branch unions (1st or 2nd branch order or scaffolding branch) or active split between branch unions or severe damage to primary tree structure.

IACA Significance of a Tree, Assessment Rating System (STARS) © (IACA 2010) ©

In the development of this document IACA acknowledges the contribution and original concept of the Footprint Green Tree Significance & Retention Value Matrix, developed by Footprint Green Pty Ltd in June 2001.

The landscape significance of a tree is an essential criterion to establish the importance that a particular tree may have on a site. However, rating the significance of a tree becomes subjective and difficult to ascertain in a consistent and repetitive fashion due to assessor bias. It is therefore necessary to have a rating system utilising structured qualitative criteria to assist in determining the retention value for a tree. To assist this process all definitions for terms used in the Tree Significance - Assessment Criteria and Tree Retention Value - Priority Matrix, are taken from the IACA Dictionary for Managing Trees in Urban Environments 2009.

This rating system will assist in the planning processes for proposed works, above and below ground where trees are to be retained on or adjacent a development site. The system uses a scale of High, Medium and Low significance in the landscape. Once the landscape significance of an individual tree has been defined, the retention value can be determined.

Tree Significance - Assessment Criteria

High Significance in landscape

- The tree is in good condition and good vigour. The tree has a form typical for the species.
- The tree is a remnant or is a planted locally indigenous specimen and/or is rare or uncommon in the local area or of botanical interest or of substantial age.
- The tree is listed as a Heritage Item, Threatened Species or part of an Endangered Ecological Community or listed on a council's Significant Tree Register.
- The tree is visually prominent and visible from a considerable distance when viewed from most directions within the landscape due to its size and scale and makes a positive contribution to the local amenity.
- The tree supports social and cultural sentiments or spiritual associations, reflected by the broader population or community group or has commemorative values.
- The tree's growth is unrestricted by above and below ground influences, supporting its ability to reach dimensions typical for the taxa in situ - tree is appropriate to the site conditions.

Medium Significance in landscape

- The tree is in fair to good condition and good or low vigour.
- The tree has form typical or atypical of the species.
- The tree is a planted locally indigenous or a common species with its taxa commonly planted in the local area.
- The tree is visible from surrounding properties, although not visually prominent as partially obstructed by other vegetation or buildings when viewed from the street.
- The tree provides a fair contribution to the visual character and amenity of the local area.
- The tree's growth is moderately restricted by above or below ground influences, reducing its ability to reach dimensions typical for the taxa in situ.

Low Significance in landscape

- The tree is in fair to poor condition and good or low vigour.
- The tree has form atypical of the species.
- The tree is not visible or is partly visible from surrounding properties as obstructed by other vegetation or buildings.
- The tree provides a minor contribution or has a negative impact on the visual character and amenity of the local area.
- The tree is a young specimen which may or may not have reached dimension to be protected by local Tree Preservation orders or similar protection mechanisms and can easily be replaced with a suitable specimen.
- The tree's growth is severely restricted by above or below ground influences, unlikely to reach dimensions typical for the taxa in situ - tree is inappropriate to the site conditions.
- The tree is listed as exempt under the provisions of the local Council Tree Preservation Order or similar protection mechanisms.
- The tree has a wound or defect that has potential to become structurally unsound.
- Environmental Pest/Noxious Weed Species.
- The tree is an Environmental Pest Species due to its invasiveness or poisonous/allergenic properties.
- The tree is a declared noxious weed by legislation.
- Hazardous and or Irreversible Decline.
- The tree is structurally unsound and/or unstable and is considered potentially dangerous.
- The tree is dead, or is in irreversible decline, or has the potential to fail or collapse in full or part in the immediate to short term.

The tree is to have a minimum of three (3) criteria in a category to be classified in that group.

Note: The assessment criteria are for individual trees only, however, can be applied to a mono-cultural stand in entirety.

Useful Life Expectancy (ULE)

Useful life expectancy (ULE) is a measure of a trees remaining lifespan regarding its health, condition and locality ULE categories were measured as:

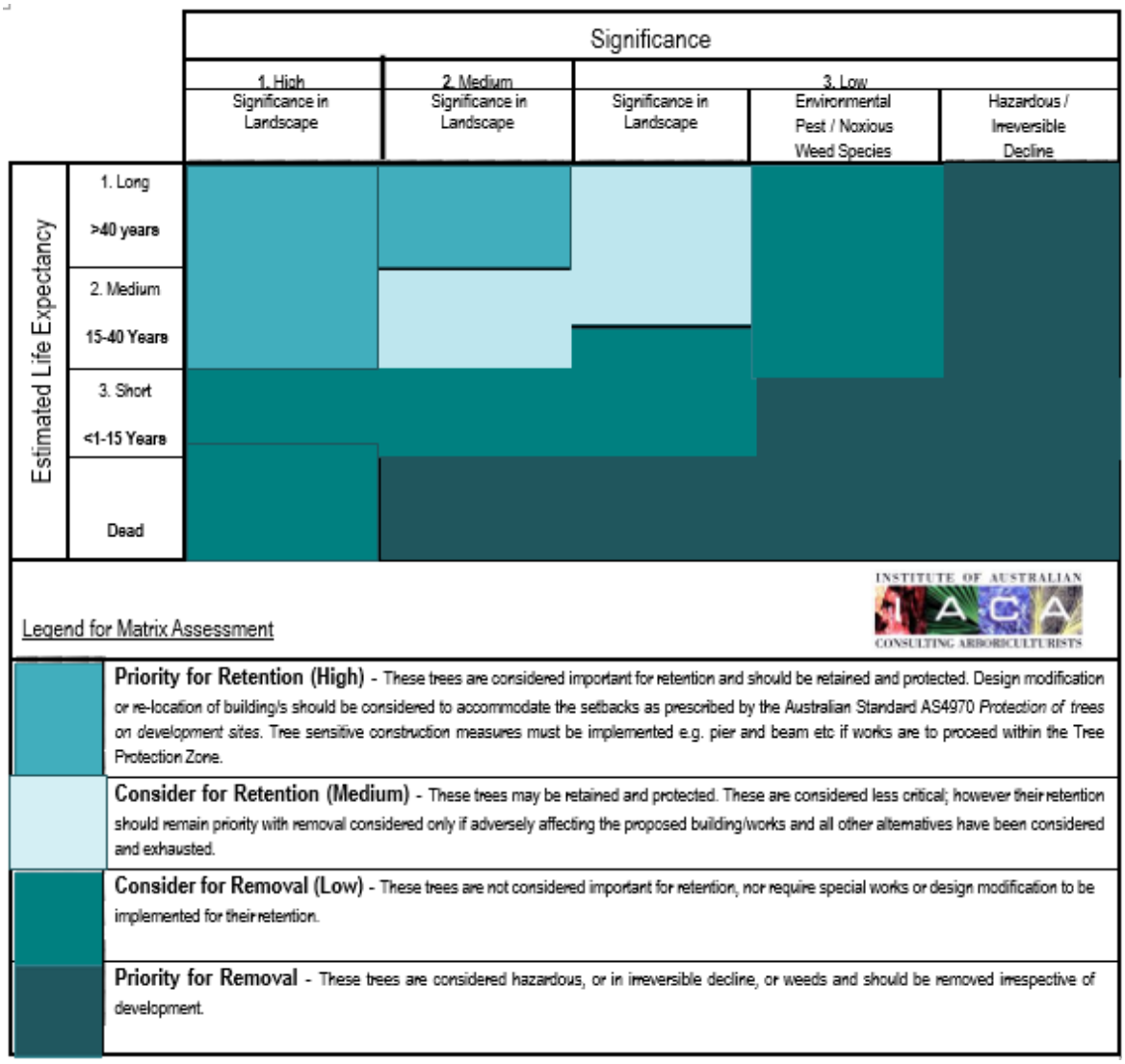
a) Long (greater than 40 years)

b) Medium (between 15 and 40 years)

c) Short (between 1 and 15 years)

d) Dead

Tree Retention Value - Priority Matrix



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Draper BD and Richards PA 2009, *Dictionary for Managing Trees in Urban Environments*, Institute of Australian Consulting Arboriculturist (IACA), CSIRO Publishing, Collingwood, Victoria, Australia.

Footprint Green Pty Ltd 2001, *Footprint Green Tree Significance & Retention Value Matrix*, Avalon, NSW Australia, www.footprintgreen.com.au

Tree Protection Zone and Structural Root Zone Method

Following the VTA, The Tree Preservation Zones and Structural Root zones were calculated and added to the Tree Data Schedule (Appendix 1) and the Tree Impact Plan (Appendix 2) with the methods explained below:

The Structural Root Zone (SRZ) is the area around the base of a tree required for its stability. The woody root growth and soil cohesion in this area are necessary to hold the tree upright; therefore, there are no variations to its size. The SRZ is normally circular with the trunk at its centre and is expressed by its radius in metres (AS – 4970). Due to the potential of causing instability of a tree, it is highly recommended that no roots within its SRZ are pruned or removed. SRZ, which is the area required for tree stability, was calculated as follows: SRZ radius = (D x 50) 0.42 x 0.64.

The Tree Protection Zone (TPZ) is the principle means of protecting trees on development sites. The TPZ is a combination of the root area and crown area that requires protection. It is an area isolated from construction disturbance, so that the tree remains viable (AS – 4970). The radius of the TPZ is calculated for each tree by multiplying its DBH x 12. TPZ = DBH x 12 (DBH = trunk diameter measured at 1.4m above ground level). The radius of the TPZ is measured from COT (Centre of the trunk).

Variations to the Tree Protection Zone (TPZ)

General
It may be possible to encroach into or make variations to the standard TPZ. Encroachment Includes excavation, compacted fill and machine trenching.

Minor encroachment
If the proposed encroachment is less than 10% of the area of the TPZ and is outside the SRZ, detailed root investigations should not be required. The area lost to this encroachment should be compensated for elsewhere and contiguous with the TPZ. Variations must be made by the project arborist considering relevant factors. (Figure 6) demonstrates some examples of possible encroachment into the TPZ up to 10% of the area.

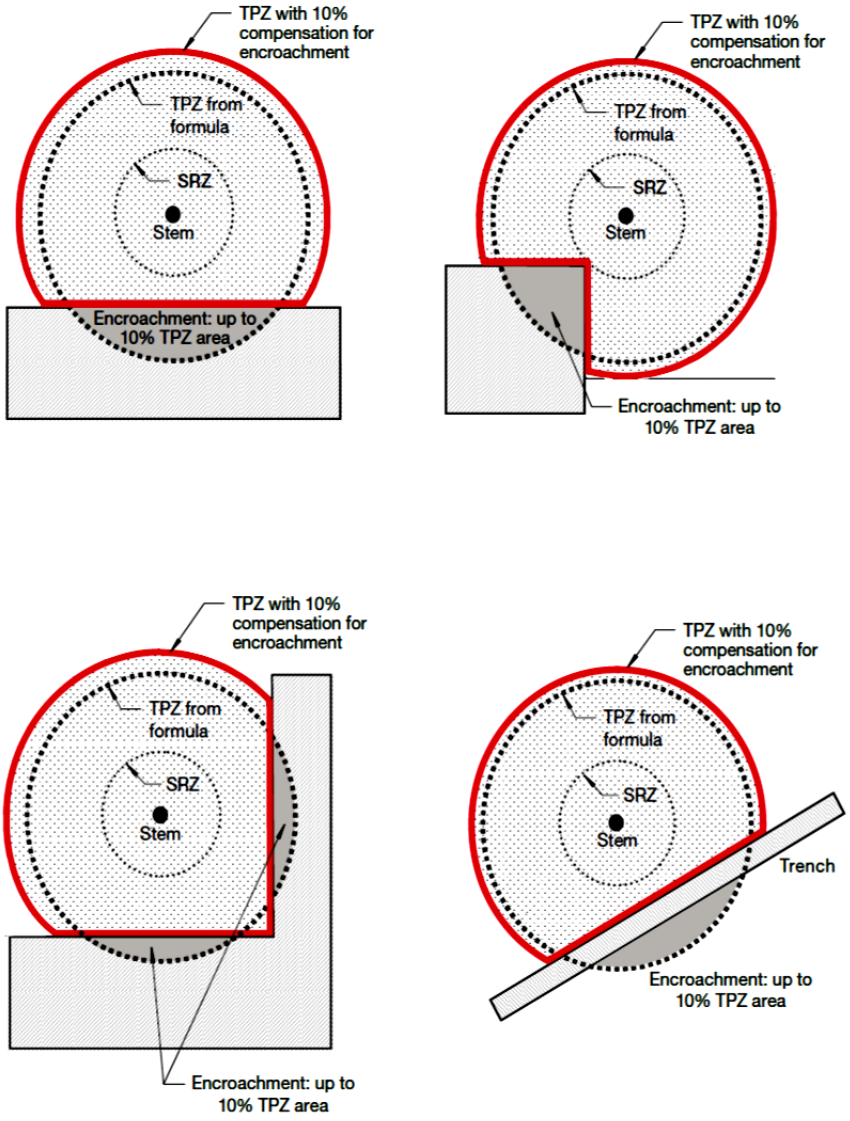
Major encroachment
If the proposed encroachment is greater than 10% of the TPZ or inside the SRZ the project arborist must demonstrate that the tree(s) would remain viable. The area lost to this encroachment should be compensated for elsewhere and contiguous with the TPZ. This may require root investigation by non-destructive methods and consideration of relevant factors listed in the Clause.

Figure 6

ENCROACHMENT INTO TREE PROTECTION ZONE

(Informative)

Encroachment into the tree protection zone (TPZ) is sometimes unavoidable. Figure D1 provides examples of TPZ encroachment by area, to assist in reducing the impact of such incursions.



NOTE: Less than 10% TPZ area and outside SRZ. Any loss of TPZ compensated for elsewhere.

Appendix 4: GEOHEX Specification

GEOHEX

AUSTRALIA'S FAVOURITE SOIL EROSION CONTROL SYSTEM

Product Information and Installation Guide

Why GEOHEX™?

The GEOHEX™ Erosion Control System is a unique and innovative ground stabilisation technology that is easy to use and quick to install.

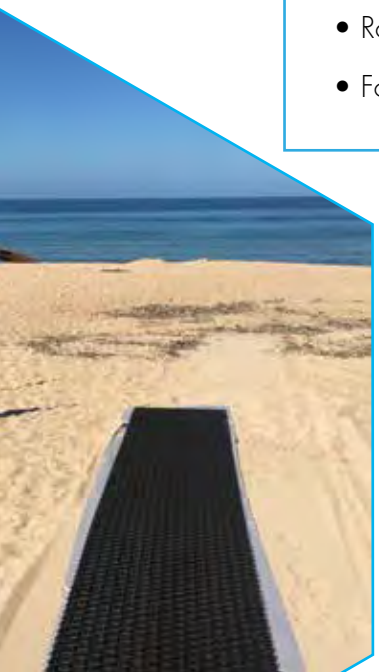
GEOHEX™ is a permeable ground stabilisation technology that has been engineered for use in multiple applications ranging from soil & turf stabilisation for the enhancement of water saving measures, to the reinforcement of roads in and around construction sites.

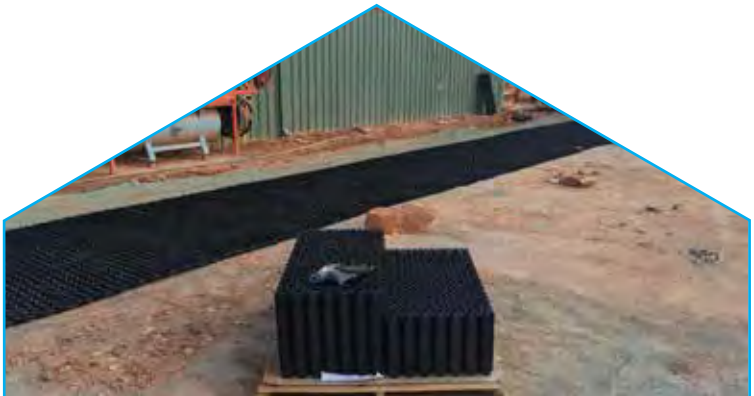
With a load rating of 1,200 tonnes per square metre, the GEOHEX™ Erosion Control System is a safe and cost effective substitute for concrete in many applications. Made from 100% recycled plastic, it is environmentally friendly and it's lightweight design reduces logistic costs, while at the same time, increasing ground stability and water conservation.

Designed and manufactured in Australia to ISO9001:2014 standards, GEOHEX™ is made from high impact resistant, 100% recycled co-polymer polypropylene.

GEOHEX™ can be used for soil, turf, embankment and road stabilisation in or around:

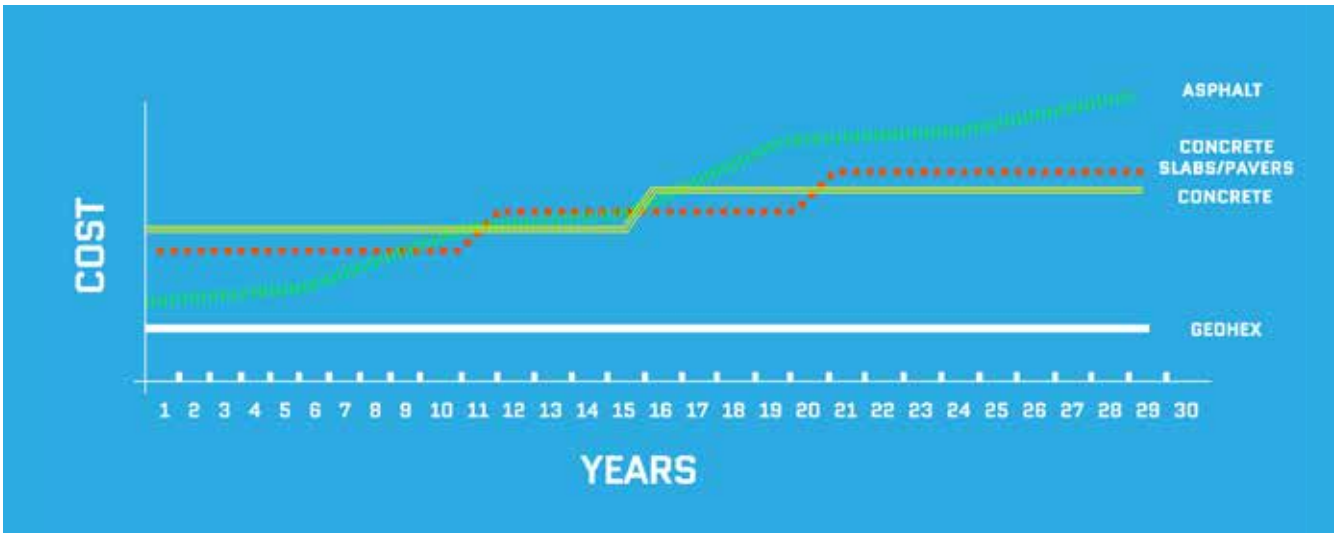
- Cattle and equine feedlots
- Approaches and exists to livestock yards
- Rural gateways & driveways
- Residential & commercial driveways
- Landscaping applications
- Road works
- Footpaths
- Sportsgrounds
- Golf courses
- Parking areas
- Council landfills
- Civil projects
- Resource development sites
- Tailings and waste dams
- Dump walls



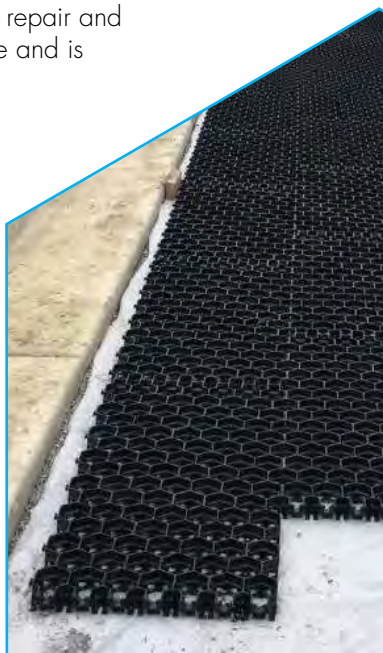


Competitive Advantage

	GEOHEX™ EROSION CONTROL SYSTEM	CONCRETE	ASPHALT	CONCRETE SLAB/ TRADITIONAL PAVERS
Longevity:	15 – 20 years	15 – 20 years	5 – 10 years	10 – 15 years
Materials:	Polypropylene paver	Cement, steel, mesh, formwork	Tar & aggragate mixture	Pre-cast slabs
Maintenance:	Very low Grass/gravel maintenance	Low Prone to cracking & unevenness	High Top seal every 2 years	Low Prone to cracking & unevenness
Cost:	$	$$$	$$$	$$
Appearance:	Various fills to suit landscape requirements	Uniform	Uniform	Uniform, higher cost options available
Permeability:	100%	None	None	15 – 30%
Sustainability:	Low impact Manufactured using 100% recycled material. Product also lightweight and recyclable.	High impact Not recyclable or reusable.	High impact Not recyclable or reusable.	High impact Not recyclable or reusable. Requires waste dump.

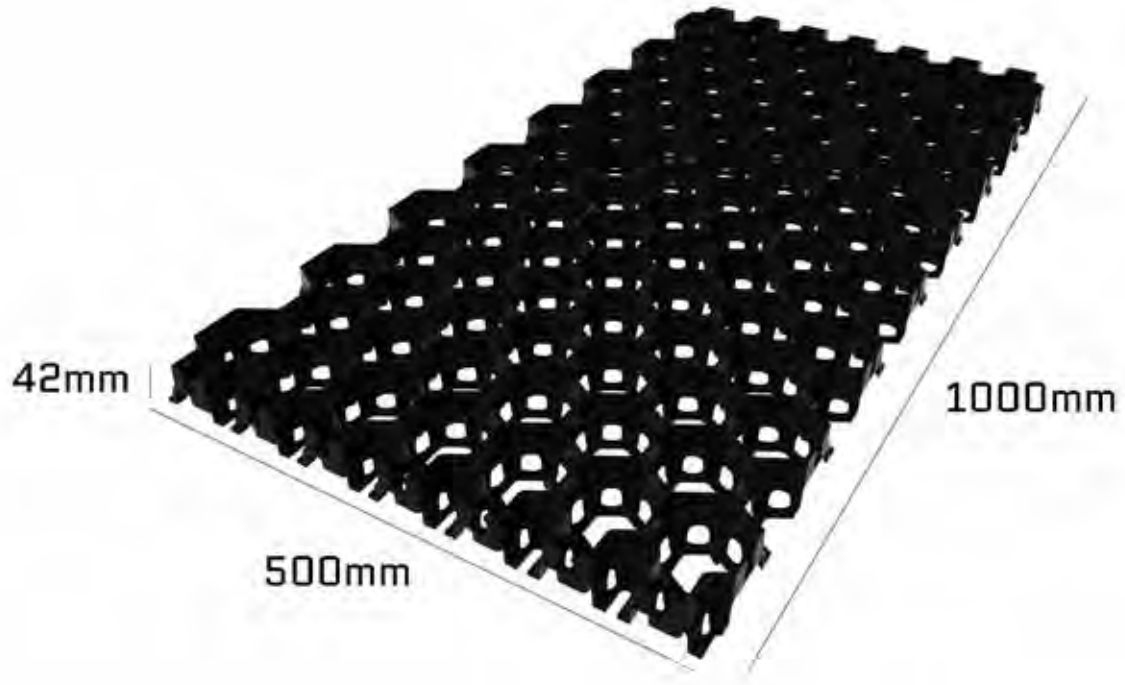


Compared to other ground stabilisation alternatives, GEOHEX™ remains a cost effective, reliable option to prevent soil erosion. Materials like asphalt, concrete and bitumen can require repair and maintenance, increasing it's cost over time. GEOHEX™ requires little to no maintenance and is manufactured to last.



Technical Specifications

Material:	Recycled high impact, co-polymer polypropylene
Specifications:	L 1000mm x W 500mm x H 42mm - 2 GEOHEX™ pavers = 1 square metre
Maximum Load Bearing Capacity:	1200 t/sqm (filled) 300 t/sqm (unfilled)
Weight:	2.3 kg
Temperature Range:	– 45°C to 100°C
Pallet Quantity:	170 units or 85m^2 to a standard pallet (2.1m)
Colour:	Black (custom colours available on request)
Water Permeability:	99.7%
Sustainability:	100% Recyclable
Infill Requirements:	1m^3 per 20m^2 of GEOHEX™
Connection Method:	Clip lock system
Applications:	Equine yards, cattle yards, livestock feedlots, cattle troughs, stables, rural roads & driveways, walkways, car parks, turf and grass driveways, residential driveways, garden landscaping solutions, hardstand areas, public spaces, sloped land* and more.



*For best results, we recommend installing on a maximum slope of 10mm.

Why use GEOHEX™

100% recyclable

Can be laid in any weather

Non-toxic to humans, animals & plants

Easy DIY install

More cost effective than concrete

Lightweight & durable

Can be cut to size

Custom colours available

Nests neatly for efficient storage & transportation

Non-reactive to solvents, oils, chemicals and water

Reduces maintenance costs

Technical Specs

FILL MATERIAL	PROCEDURE	TIPS
Lime (crushed/granular)	Use at a diameter of up to 15mm and ensure medium to high levels of compaction.	Avoid lime with a high clay content as the surface will become excessively slippery.
Pumice	Great for drainage and soft surface requirements.	Ensure good compaction and low sand content.
Blue metal and recycled crusher/cracker dust	Very good compacter and useful for exits and entry roads.	Needs thorough and uniform compaction.
Rotten stone (also known a riverstone)	Good for bovine hooves and is also preferable for many other livestock.	Must be no bigger than 15mm in diameter. Can get slippery when wet. Must be soft enough to avoid damaging the GEOHEX™ Erosion Control System.
Soil	Only use where extremely soft surfaces are required. Ensure a very high level of compaction. Also good for areas where the promotion of turf growth is required.	Ensure the soil is clean and free of contaminants such as large rocks, metal or glass. Can be mixed with 10% to 15% washed sand.
Other	Fine, rock or soil like material that is less than 15mm in diameter.	Avoid any fillings that have high stone content or sharp edges.

Installation Guidelines

The GEOHEX™ Erosion Control System is a unique ground stabilisation and sediment control technology with a multitude of uses and easy installation. An ideal solution for rural and farming, civil construction, commercial and residential applications, GEOHEX™ can be used for temporary roads, walkways, car parks, landscaping and more. GEOHEX™ is a cost-effective, simple, and sustainable alternative to concrete or asphalt.

Step 1. Prepare the site by excavating a depth of 200mm .

GEOHEX™ works most effectively when sitting flush with the surrounding ground level. Please allow for the height of GEOHEX™ pavers (42mm) when excavating pre-installation.

Please note, depending on the weight GEOHEX™ will be withstanding in your installation, excavating an additional 10mm to allow for the installation of an aggregate drainable road base may be beneficial. Please see weight guide below for more information.

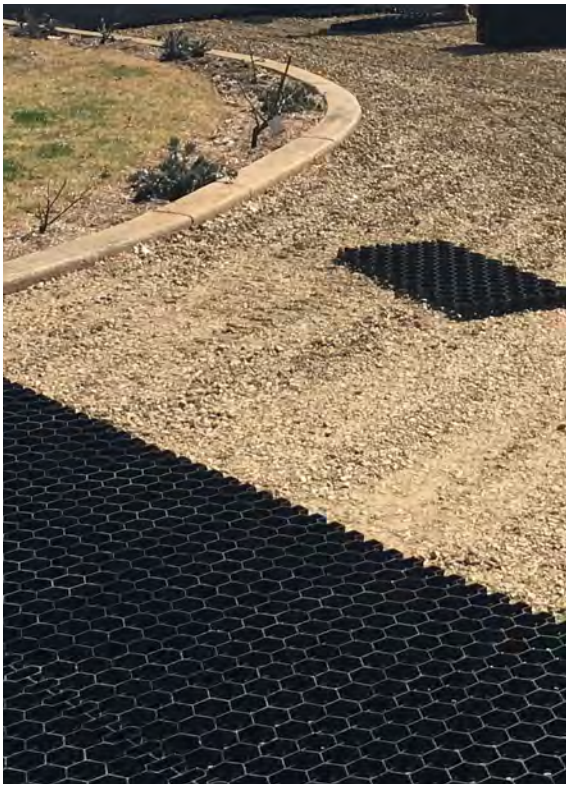
Installing a quality edging can also support installation best practices of GEOHEX™. Existing earth can be used as a natural edge, as can a number of other edging materials like timber, metal, and concrete.

When installing edging for your GEOHEX™ installation, allow 15mm on the surrounding edges for expansion.

Step 2. If the base is a reactive soil or sand, lay a geofabric over the leveled base before installing an aggregate drainable road base. Lightly compact the site to ensure a level installation of GEOHEX™

Please note, the thickness of your base depends on type of traffic travelling over the GEOHEX™ pavers. It's important the base is level with no pot- holes, high spots or large rocks sticking up through the base.

Installation Guidelines



Step 3. Once the drainage base has been lightly compacted, start laying the GEOHEX™ pavers. When laying GEOHEX™, be sure that the male lugs are facing towards the outer edges of the install. This ensures the next piece you lay aligns the male lugs and female joints.

To be sure GEOHEX™ pavers are correctly connected, stand on the connection point of the pavers, on the male lug side to be sure you feel it clip into the female joints. Once connected, there is a small amount of flexibility in the pavers, allowing for some movement to make minor adjustments and for the pavers to follow ground contours.

Remember, GEOHEX™ can be cut with a number of different tools for a clean and safe install. A circular saw is quick and will deliver reasonably straight edges, while a reciprocating saw will allow trimming around curves.

Step 4. Once you have laid GEOHEX™ as outlined in Step 3, fill GEOHEX™ with the aggregate of your choice.

Please note, depending on your installation, different aggregate choices may suit your install better than others. Once you have installed your choice of aggregate for best results, compact the aggregate or soil as much as possible.

1m3 of aggregate is required per 20m2 of GEOHEX™.

Aggregate Base Recommendations

Driveways – Any aggregate choice will suit, provided the aggregate is no larger than 10mm-15mm in diameter. For sloped driveways, please see Slopes for more information.

Horse Stables – Any aggregate choice will suit, provided the aggregate is no larger than 10mm-15mm in diameter.

Cattle Yards – Any aggregate choice will suit, provided the aggregate is no larger than 10mm-15mm.

Lawns – Compact soil to the top of the GEOHEX™ pavers before watering and fillimg in any spots that are uneven. Turf can then be laid over the top of the GEOHEX™ pavers. Alternatively, seed or spray grass can used.

Pictured Cattle Yard

Installing GEOHEX™ on sloped surfaces

When installing GEOHEX™ on any slope, it is best practice to secure the pavers with 150mm - 300mm landscaping screws with a 17mm bugle head. The number of screws per needed per panel is relative to the angle of the sloped surface the product is being installed on.

Please note when laying GEOHEX™ on a slope, it is important not to overfill the GEOHEX™ paver. Overfilling may result in aggregate being lifted from within the honeycomb cell. We recommend using an aggregate of 10mm -15mm in diameter to allow for ample drainage.

For adjoining areas on sloped installations, divert high levels of runoff water away from the GEOHEX™ installation site to prevent erosion forming under the product.

For subterranean installations, 100mm x 200mm plinths may be used at a depth of 200mm to stabilise ground movement beneath GEOHEX™. Refer to your current state building codes for more detailed reference information.

Important note – For best results, slopes over 15 degrees we recommend a certified engineering evaluation and site report prior to installation.

For all sloped installations or more detailed advice on your specific GEOHEX™ installation, contact our team of Territory Sales Managers on (02) 9603 5322.

GEOHEX™ Base Depth Guide

Base depth			
0mm – 50mm	Foot traffic only		
50mm – 100mm	Turf stabilising	Horse stables	Feeders & troughs
100 – 150mm	Driveways	Horse yards	Sheep & cattle yards
150mm – 200mm	Commercial driveways	Equine arenas	Mining applications

This table is based on non - reactive soils only. For advice on reactive soils, please contact the GEOHEX™ team on (02) 9603 5322.

Frequently Asked Questions

Q: Can the GEOHEX™ Erosion Control System be used anywhere?

A: Yes, the GEOHEX™ Erosion Control System can be used in any type of soil or geological configuration.

Q: How big are the GEOHEX™ pavers?

A: The GEOHEX™ pavers come in a standard size of 0.5sqm, however, panels can be cut to size to suit your specific installation if required.

Q: How does the GEOHEX™ Erosion Control System promote safety?

A: The GEOHEX™ Erosion Control System stablises turf and ground areas, meaning there is a lot less potential for accidents to occur. It also minimises the risk of machinery or livestock getting bogged in muddy areas. By using the GEOHEX™ Erosion Control System in landscape applications, embankment subsidence and large movements of soil and rock can be easily prevented.

Q: How does the GEOHEX™ Erosion Control System promote water conservation?

A: The unique, hexagonal and porous design of the GEOHEX™ Erosion Control System means that water is captured in the soil which can then be diverted into storage and detention tanks. This lowers the amount of surface water runoff, meaning less soil erosion and allows rainwater to be used for secondary purposes.

Q: How heavy are the GEOHEX™ pavers?

A: Each GEOHEX™ standard 0.5sqm pavers weigh 2.3kg (unfilled).

Q: Is the GEOHEX™ Erosion Control System strong?

A: Yes, the GEOHEX™ Erosion Control System is very strong, and has a maximum load bearing capacity of 1,200 t/sqm when filled. This is far more than a standard semi-trailer truck for instance, which has a nominal wheel load of about 5/t.m2 per axle.

Q: Is the GEOHEX™ Erosion Control System safe to use in the ground?

A: The GEOHEX™ Erosion Control System is non-toxic to humans, animals and plants and also non-reactive to solvents, oils, chemicals and water.

Q: How far down do I need to excavate to lay the GEOHEX™ pavers?

A: We recommend excavating down to a minimum of 200mm however, final excavation will need to be determined by the existing material in the installation area. For example, water soaked mud and very sandy soils will require a thicker base than solid clay or rock bases. We also recommend laying a 150mm compacted road base sub-layer prior to installing the GEOHEX™ pavers.

Frequently Asked Questions

Q: What is the best way to lay the GEOHEX™ pavers once the base has been prepared?

A: We recommend laying the GEOHEX™ pavers starting in one corner with the male lugs facing outward and female lugs facing the next paver to be laid on both sides. Once you've determined the start point, lay the pavers in a staggered pattern for strength and durability, and simply click into place.

Q: Can I adjust or move the GEOHEX™ pavers once installed?

A: There is a small amount of flexibility in the GEOHEX™ pavers to allow for movement if you need to make minor adjustments or follow any ground contours.

Q: Can the GEOHEX™ Erosion Control System be used on sloped ground?

A: Yes, the GEOHEX™ Erosion Control System can be used on sloped ground. For best results we recommend laying on inclines of 10mm or less but for inclines greater than 10mm we recommend the use of ground pins to secure the paver. Type 17 Bugle Head Screws, galvanised and a minimum of 300mm long can be screwed into the sub-grade without the need for hammering through the cell material.

Q: What infill material can I use with the GEOHEX™ Erosion Control System?

A: While excess materal from the excavation is acceptable for infill, a granulate material made up of a mix of size and grade that packs down into the matrix will deliver the best result. For roads, we recommend cracker dust, road base or limestone. Please note that aggregate larger than 15mm will not settle well into the void.

Q: How much infill is required to fill a GEOHEX™ paver?

A: 1m^3 of aggregate will cover approximately 20m^2 of Geohex.

GEOHEX

Disclaimer: The information provided herein is for reference purposes only. It is intended as a guide and will not apply to every circumstance as both site conditions and intended use varies. Determination of the suitability of use of the product given the site conditions and intended function is the sole responsibility of the user. We recommend the user seek the advice of a Civil Engineer to assess site conditions and recommend a suitable site preparation procedure using locally available materials and machinery to ensure a successful installation. We accept no responsibility for failure to seek appropriate installation advice prior to the installation of GEOHEX™.

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