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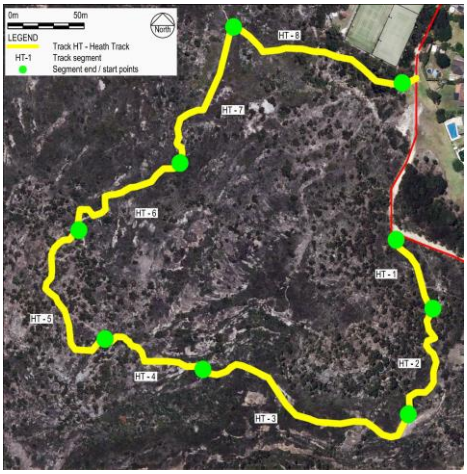
MANLY DAM WALKING TRACKS AUDIT



for
Northern Beaches Council
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"Manly Dam Walking Tracks Audit"

FINAL ISSUE

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1. Introduction and Background

1.1 Manly Warringah War Memorial Park

Manly Warringah War Memorial Park ("Manly Dam") is a 377 hectare Crown land reserve, set aside for the purposes of "public recreation", on Sydney's northern beaches. It sits adjacent to the residential areas of Manly Vale, North Balgowlah, Allambie Heights and Frenchs Forest and its western edge abuts Garigal National Park on the opposite side of Wakehurst Parkway.

The Park features an extensive area of typical Sydney sandstone bushland, including listed endangered ecological communities, located around the 30 hectare historic Manly Dam waterbody. The Park is a significant environmental and recreation asset. It is highly valued by the local community as a recreation venue, conservation area, scenic asset and for its water catchment function.

The Manly Warringah War Memorial Park (R68892) Reserve Trust is the appointed management authority for the Park. However the Northern Beaches Council manages the Trust's affairs and has responsibility for the Park's day-to-day management (on behalf of the Trust), and is effectively recognised by residents and visitors as the area's manager. The Council maintains a daily on-site management presence, with a Park Manager and Rangers, as well as visiting Council maintenance and other staff.

The Park offers a suite of leisure and recreation facilities – of differing standard and appealing to varying user groups. Developed and landscaped picnic areas fringe the south-western margin of the waterbody. These are popular facilities for picnicking, socialising and other passive leisure pursuits as well as offering access to the dam for swimming, waterplay and other water sports. The park is also a venue for sports and fitness training – both on-land and on-water. A boat ramp and other facilities are provided to support use of the waterbody for managed water-skiing and other water sports, and the Park is recognised as a regional water-skiing venue. An 11 kilometre long approved mountain bike circuit (mostly within the Park) is well patronised and an attraction at the regional level and beyond.

The Park offers over 16 kilometres of walking routes - including identified and marked walking tracks, less formal but well-established tracks, shorter linking or access tracks, and the Park's fire trail or management track network. These are well used for casual walking, dog-walking (on leash), social walking, fitness training and simply as a means of enjoying the Park's quiet bushland setting. The tracks are also regularly used by local school groups and others for educational activities and nature appreciation, as well as by small (escorted) groups from the special needs facilities that border parts of the Park.

1.1.1 Park Walking Track Network

The Park's visitor information identifies 7 walking tracks. As shown on Figure 1 the Park Circuit Track, Wildflower Walk and Nature Trial are the main walking tracks highlighted and promoted to visitors.

The Park Circuit Track (incorporating the Gulgadya Muru self-guided Aboriginal walk) runs mainly along the south-eastern and north-western slopes and margins of the dam. It connects

Figure 1 Park "Tracks and Trails" map (source: Northern Beaches Council)

with the main Fire Trail (and shared use mountain bike route) in the north-east, and the Wildflower Walk and Nature Trail (or Park access road) in the south-west, and the dam wall to offer a continuous loop walk around the dam. The Wildflower Walk and Nature Trail loop from the picnic areas. They offer picnickers an additional activity as well as an easily accessed, and relatively easy in the case of the Wildflower Walk, means of experiencing the Park's natural areas. The Nature Trail climbs higher on the Park's western ridge with some more difficult steep rocky sections but rewarding views.

The Park's "Tracks and Trails" map – Figure 1 – lists the McComb Hill Track in the far south-east (upslope of the Park entry), the Curl Curl Track and Eva's Track in the far north (connecting to the Aquatic Reserve sportsfields at Frenchs Forest), and the Heath Track looping off Allambie Heights as "Minor Walking Tracks".

As shown on Figure 1 a number of un-named "link" tracks connect the main walking track network to surrounding residential streets on the Park's eastern and southern boundaries. As a result the Park is very "permeable", with multiple access points for nearby residents and visitors, which adds to its levels of use and value for walking.

1.2 Aim and Objectives of the Manly Dam Walking Track Audit

Northern Beaches Council's aim in undertaking the Manly Dam walking track audit was to determine "track needs and opportunities for improvement to assist in ongoing management of the track network" and develop a "prioritised list of maintenance and improvement works" to inform future maintenance and capital works budgets.

The audit's specific objectives, as set out in the project brief, were:

- to "audit" the existing walking track network - in terms of identifying issues and providing recommendations and preliminary design solutions to give a quality user experience and ensure sustainability and safety - with the view to developing a prioritised works programme and costs for the network's upgrading and the implementation of improvements to the track network to assist in scheduling future works;
- to identify preliminary design solutions for user experience, sustainability and safety issues that are of sufficient detail to enable an experienced trail builder to quote for the delivery of upgrading works;
- to ensure the protection of the surrounding bushland environment and minimise any environmental impacts, and provide guidelines for sustainable track management;
- to ensure that any proposed upgrading works are consistent with the values, directives and actions set out in the adopted *Manly Warringah War Memorial Park Plan of Management*; and
- to ensure proposed upgrading works are designed in accordance with *AS 2156.1 Walking Tracks: Classification and Signage* and *AS 2156.2 Walking Tracks: Infrastructure Design* - considering the nature of the user experience to be achieved, and any constraints imposed by the localised landscape.

1.2.1 Audit Scope

The project brief identified the following tracks as the subjects of the audit:

- Manly Dam Circuit Track (incorporating the Gulgadya Maru Aboriginal Self-guided walk);
- Nature Trail;

- Wildflower Walk;
- Curl Curl Track;
- Eva's Track;
- Heath Track; and
- Mc Comb Hill Track.

The project brief also required consideration of "all un-named formal tracks linking the track system to surrounding areas and also informal tracks and access points". The tracks to be captured in this "other" grouping were clarified at the project inception meeting. The final set of fifteen tracks to be included in the audit, as shown on Figure 2, were (listed clockwise from the Park entry road):

- McComb Hill Track;
- Nature Trail Link Track;
- Nature Trail;
- Picnic Link Track;
- North Balgowlah Link Track;
- Wildflower Walk;
- Park Circuit Track (West);
- Curl Curl Track;
- Eva's Track;
- Heath Track;
- Park Circuit Track (East);
- Dam Shoreline Boardwalk;
- Monserra Road Entry (part fire trail, part informal track;
- Nyrang Road Fire Trail; and
- King Street Link Track.

Table 1 sets out the scope and requirements of the audit and audit report, and the relevant section(s) of this report that provide the required information to satisfy these requirements.

Table 1 Addressing the Audit Scope and Requirements

Scope / Requirement	Relevant Section of this Audit Report
Site analysis and assessment of the condition and performance of existing tracks (dividing longer tracks into distinctive sections/segments for workable maintenance regimes).	• **Section 4: Audit Outcomes – Track Condition and Detailed Audit Reports, for All Tracks**
Identification of all factors, opportunities and constraints influencing each track, including - landscape and soil characteristics, vegetation if relevant, existing track surface, track design, drainage, current alignment, access points and connections, public safety issues (hazards, risks and sightlines etc.) and signage (with reference to Council's *Signage Plan for Manly Dam*, review and comment on priorities).	• Included in the overall description of each *track segment* (each audited track comprises one or more track segments) in **Section 4: Audit Outcomes – Track Condition and Detailed Audit Reports, for All Tracks**. • Signage (where relevant) is addressed in "Recommended Works – Overall" and in the recommended works for each *treatment site* (*track segments* typically contain one or more discrete track *treatment sites*) in **Section 4: Audit Outcomes – Track Condition and Detailed Audit Reports, for All Tracks**.

Scope / Requirement	Relevant Section of this Audit Report
Overall Site Plan showing waypoints to identify track segments, with general descriptive overview.	• **Section 4: Audit Outcomes – Track Condition and Detailed Audit Reports, for All Tracks** incudes: ▫ a key plan (annotated aerial photo) for each audited track showing all identified *track segments* that make up that track; and ▫ GPS points for *track segment* start and end points, provided at the beginning of each *track segment* description.
Photo documentation and description of existing conditions or issues for each waypoint location/track segment.	• **Section 4: Audit Outcomes – Track Condition and Detailed Audit Reports, for All Tracks** includes: ▫ current condition description and photos for each *treatment site*; and ▫ "typical" illustrative photos of each *track segment* (as part of the overall description).
General and specific recommendations or options for track improvements - utilising track design principles and construction techniques/methodologies to minimise environmental impacts and maintenance costs.	• **Section 4: Audit Outcomes – Track Condition and Detailed Audit Reports, for All Tracks** includes "Recommended Works – Overall" for each track segment and recommended works for each *treatment site*.
Waypoints overlaid on site aerials showing locations where key issues are to be resolved and specifying design solutions and description.	An annotated aerial photo is provided for each *track segment* showing the location of all *treatment sites* where recommended track works have been identified (GPS points are also included at the beginning of each *treatment site* description) in **Section 4: Audit Outcomes – Track Condition and Detailed Audit Reports, for All Tracks**.
Design solutions documented to a level where a skilled track builder could implement the work.	Recommended track works are described, and linked to accompanying site photos, for all *treatment sites* identified in **Section 4: Audit Outcomes – Track Condition and Detailed Audit Reports, for All Tracks**.
Prioritised and itemised Works Program for each track segment or waypoint. Prioritisation to range from 'immediate attention required' to 'monitor ongoing condition' based on safety and/or environmental criteria.	**Section 2: Audit Outcomes – Prioritised Track Treatment Sites, for Each Track** includes all *treatment sites* identified within each track listed according to allocated priorities, with high priority sites identified due to safety issues (warranting "immediate attention") further differentiated. Section 1.6 describes that basis for prioritisation of recommended works at *treatment sites*.
Budget estimates for upgrade works, to assist Council with future budget estimates.	**Section 3: Audit Outcomes – Treatments Types and Number, and Orders of Cost, for Each Track** provides a total cost estimate for all recommended works for each track (as well as sub-totals for the cost of the various types of track treatments recommended within that track).
Signage recommendations.	Signage (where relevant) is addressed in "Recommended Works – Overall" and in the recommended works for each *treatment site* (*track segments* typically contain one or more discrete track *treatment sites*) in **Section 4: Audit Outcomes – Track Condition and Detailed Audit Reports, for All Tracks**.

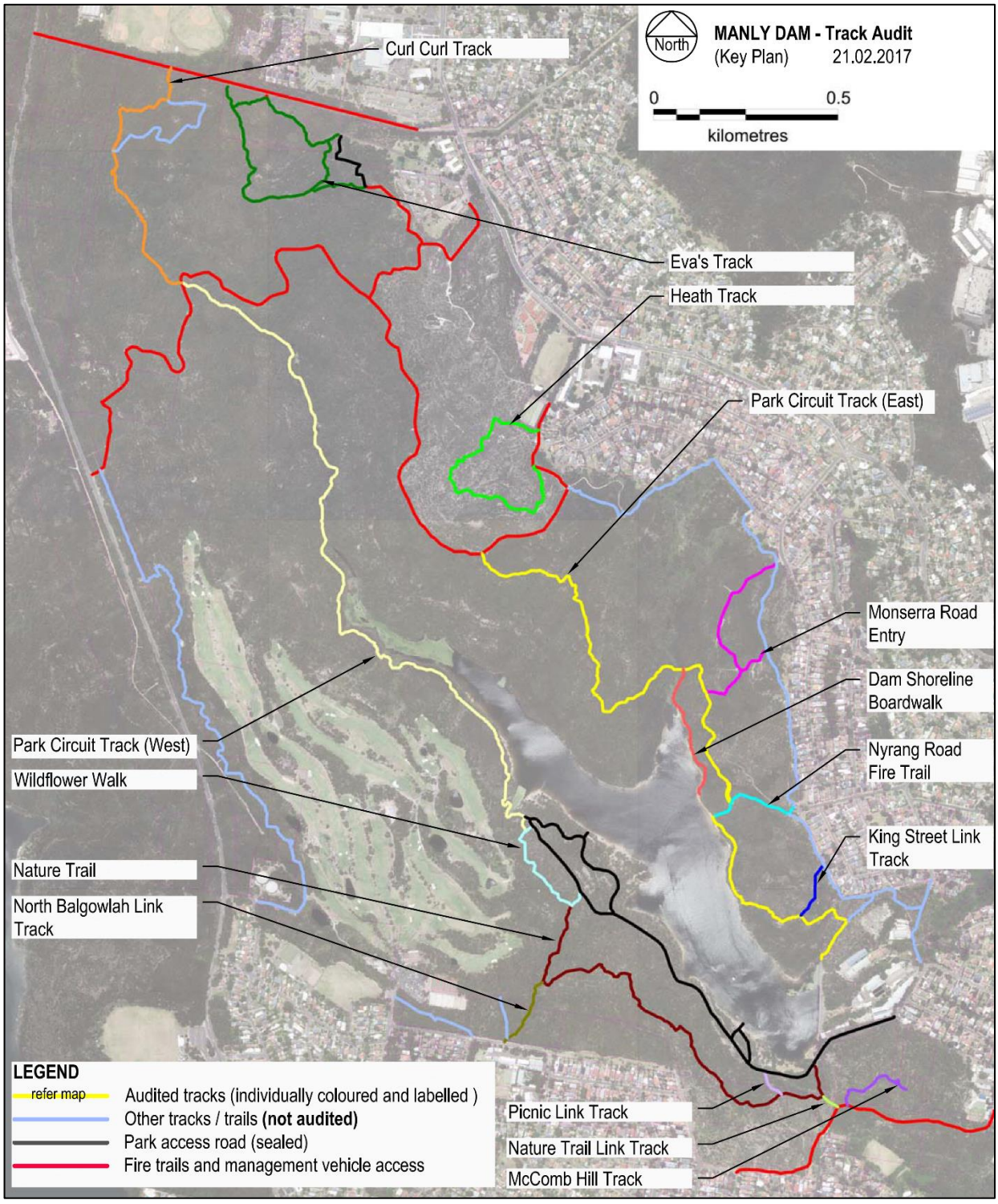


Figure 2 Subject walking tracks

1.2.2 Information Supplied by Council

Northern Beaches Council supplied (or provided access to) the following information to support the walking tracks audit:

- *Manly Warringah War Memorial Park Plan of Management 2014*;
- *Manly Dam: Signage Program* and *Manly Dam Sign Location Plan*;
- relevant layers on Council's Geographical Information System (GIS) in digital format and background aerial photography;
- soils and vegetation mapping, and accompanying descriptions, for Manly Dam; and
- *Warringah Regional Multiple-Use Trail Strategy 2007*.

1.3 Plan of Management Context

The walking track audit, and any proposed track upgrading works, was required to be consistent with the values, directions and actions described for the walking track network in the Park's adopted plan of management (*Manly Warringah War Memorial Park Plan of Management 2014*).

The key actions in the plan of management that relate to walking track standards, potential track upgrading, and track management are as follows.

- The current extent and configuration of the existing recreational tracks/trails network within the Park will generally be retained – with the additional or modified track/trail sections … as well as minor re-routings and other works. Action TT1 (under Tracks and Trails)

- Continue to maintain a network of safe and sustainably managed routes – of differing track standards/conditions, distance/duration and character – within the Park, to offer a choice of experiences. …. Track/trail re-routings and works may be undertaken as required for user safety and to minimise adverse impacts on the Park's values. Action TT2 (under Tracks and Trails) (

- Upgrade track standards/conditions, signposting and interpretation for all tracks, in particular the Nature Trail and Wildflower Walk to cater for less experienced and less confident users and offer a convenient bushland experience close to the picnic areas. Action TT4 (under Tracks and Trails)

- All approved tracks and trails will be maintained through a programmed system of inspections and maintenance, supported by responsive maintenance works as required. All maintenance, preventative and other works will be documented. Informal and unauthorised tracks will be closed and rehabilitated – and track alignment, design and treatments will endeavour to minimise the likelihood of the creation of unauthorised/alternative tracks. Action TT20 (under Tracks and Trails)

- That section of the Circuit Track through this area [the "core fauna habitat and refuge area" as described in the plan of management] – north from the Dam to the main fire trail – will not be significantly upgraded, and educational signage to be designed and installed. Action F2 (under Native Fauna)

- Continue to implement standard designs for track/trail development, track signage, interpretive signage … Designs to be in keeping with the Park's low-key character and natural setting. Action EP4 (under Environmental Protection and Sustainability)

- The plan of management's Implementation Table (Table 8) identifies "maintenance of [a] safe and sustainable track and trail network" as a high (continuing) management action, and to "upgrade walking tracks and directional signage, in particular the Nature Trail and Wildflower Walk" as a medium priority (site-specific or one-off) management action.

1.4 Target Track Standards

Considering the provisions of the Park's plan of management as well as the current management and condition of the walking track network, and with input from the Park Manager and Ranger staff, a Grade 3 Walk (as defined by the *Users Guide to the Australian Walking Track Grading System*) was selected as the most appropriate target track standard for the Park's walking track network as a whole.

Figure 3 sets out the key elements of a Grade 3 Walk (a Grade 3 Walk corresponds to a "Class 3 Track" under the *Australian Standard AS 2156.1-2001 (Walking Tracks - Part 1: Classification and Signage)*).

A Grade 3 Walk is suitable for most ages and fitness levels. It requires no bushwalking experience (although some bushwalking experience recommended) and a minimum level of specialised skills. It is typically a formed earthen track or modified walking surface (but can include sections of rough track surface as well as some "hardened" sections) and is mostly clear of intrusions and obstacles. Track width is variable, but less than 1,200 millimetres. Grade 3 tracks may have short steep hill sections and many steps. Walkers may encounter natural hazards such as steep slopes, unstable surfaces and minor water crossings. They are responsible for their own safety.

The Grade 3 Walk standard well matches the current condition of the Park's longer walking tracks – notably the Nature Trail, Park Circuit Track (West), Curl Curl Track, Eva's Track, Heath Track and Park Circuit Track (East).

The Park's plan of management identifies the Nature Trail and Wildflower Walk as potentially higher standard tracks within the overall walking track network – this is in recognition of their proximity to the picnic areas and potential for use by less experienced walkers.

A Grade 2 Walk offers a higher standard track, and an easier walking experience, when compared with a Grade 3 Walk. A Grade 2 Walk typically has a more modified track surface (as a compacted or "hardened" surface) and, significantly, easier grades with only a gentle hill section (or sections) and occasional steps. It requires no bushwalking experience with walkers only expected to exercise "normal care", and is subject to a higher and more frequent level of maintenance than a Grade 3 Walk.

Figure 4 sets out the key elements of a Grade 2 Walk (a Grade 2 Walk corresponds to a "Class 2 Track" under the *Australian Standard AS 2156.1-2001 (Walking Tracks - Part 1: Classification and Signage)* and Table 2 compares the key attributes of a Class 3 Track and a Class 2 Track as per the Australian Standard).

	Technical Description for Land Manager use	Walk Description for Public Information	Generic Description for Public Information
Grade of walk	Grade 3	Grade 3	Grade 3
Symbol			
Distance	Total distance of track must not exceed 20km.	Total distance of track to nearest 100 metre (eg 4.2km).	Suitable for most ages and fitness levels. Some bushwalking experience recommended. Tracks may have short steep hill sections a rough surface and many steps. Walks up to 20km.
Gradient	May exceed 1:10 (or 10% or 5.7 degrees) for short sections but generally no steeper than 1:10. *(AS 2165.1).*	Short steep hills.	
Quality of path	Formed earthen track, few obstacles. Generally a modified surface, sections may be hardened. Width: variable and less than 1200mm. Kept mostly clear of intrusions and obstacles. *(AS 2165.1).*	Formed track, some obstacles.	
Quality of markings	Track head signage and route markers at intersections and where track is indistinct.	Sign posted.	
Experience required	Users need no bushwalking experience and a minimum level of specialised skills. Users may encounter natural hazards such as steep slopes, unstable surfaces and minor water crossings. They are responsible for their own safety. *(AS 2165.1).*	Some bushwalking experience recommended.	
Time	Hours/days (eg 9hrs) or if the predicted time is less than an hour in 15 minute increments (eg 45 minutes).	Hours/days or if the predicted time is less than an hour 15 minute increments.	
Steps	Steps may be common. *(AS 2165.1).*	Many steps .	

Figure 3 Grade 3 Walk track standard/description
(Source: Users Guide to the Australian Walking Track Grading System, Parks Victoria)

	Technical Description for Land Manager use	Walk Description for Public Information	Generic Description for Public Information
Grade of walk	Grade 2	Grade 2	Grade 2
Symbol			
Distance	Total distance of track must not exceed 10km.	Total distance of track to nearest 100 metre (eg 4.2km).	No bushwalking experience required. The track is a hardened or compacted surface and may have a gentle hill section or sections and occasional steps. Walks no greater than 10km.
Gradient	The gradient is generally no steeper than 1:10 (or 10% or 5.7 degrees). *(AS 2165.1).*	Gentle hills.	
Quality of path	Generally a modified or hardened surface. Width: 900mm or more. Well maintained with minimal intrusions. *(AS 2165.1).*	Formed track.	
Quality of markings	Track head signage & route markers at intersections.	Clearly sign posted.	
Experience required	Users need no previous experience and are expected to exercise normal care regarding their personal safety. *(AS 2165.1).* Suitable for most ages and fitness levels.	No experience required.	
Time	30 minute increments (eg 1.5-2hrs) or if the predicted time is less than an hour in 15 minute increments (eg 30-45 minutes).	Time needed to complete track to nearest half hour or nearest 15 minute increment (eg 1-1.5hrs or 30-45 minutes).	
Steps	Minimal use of steps. *(AS 2165.1).*	Occasional steps .	

Figure 4 Grade 2 Walk track standard/description
(Source: Users Guide to the Australian Walking Track Grading System, Parks Victoria)

Table 2 Comparison of a Class 3 and Class 2 Track under the Australian Walking Track Standards

Attribute	Class 3 Track – Summary	Class 2 Track – Summary
Overall Description	**Opportunities – Well defined and maintained tracks but requiring some care by walkers. Walking in slightly modified natural environments. Requires a moderate level of fitness.** **Provision of facilities and interpretation uncommon.** **Opportunities to observe and appreciate the natural environment (limited use of interpretive signs or brochures).** **Sporadic encounters with other visitors.**	**Opportunities – Tracks are easy to walk. Offered to a large number of visitors.** **High level facilities and interpretation.** **Moderate to plentiful opportunities to learn about the natural environment (by the use of interpretive signs or brochures).** **Regular encounters with other visitors.**
Track Conditions	Generally a modified surface, some sections hardened. Regularly maintained. Width – variable and less than 1.2 metres. Minimum intrusions and obstacles.	Generally a modified hardened surface. Width – 0.9 metres or more. Good maintenance. Minimum intrusions.
Gradient	Short sections may exceed 1:10, but in general no steeper than 1:10. Steps may be common.	In general no steeper than 1:10. Use of steps kept to a minimum.
Signage	Signs for management and interpretation. Trackhead signage. Wayfinding and direction marking.	Signs for management and interpretation frequently used. Trackhead signage. Intersection and reassurance wayfinding, and track marking.
Infrastructure	Facilities not provided in most cases, other than for safety and environmental considerations. No camping permitted along the track (generally).	Facilities may include lookout platforms, seats and barrier rails. No camping permitted along the track (generally).
Terrain	Bushwalking experience not necessary, and minimum level of specialised skills required, but users to exercise due care. Common natural hazards may be encountered – including steep slopes, unstable/unsuitable surfaces, fallen/intruding vegetation, fauna, and minor water crossings.	No previous user experience required. Personal Safety – users to exercise normal care.
Weather	Navigation and safety may be affected by storms or extreme weather events.	N/A

(Source: Australian Standard AS 2156.1-2001 (Walking Tracks - Part 1: Classification and Signage)

Considering the plan of management's directions it would be appropriate that the target track standards for the Nature Trail and Wildflower Walk would be between a Grade 2 and a Grade 3 Walk. This would be feasible for the Wildflower Walk (as shown below). However the steeper sections of Nature Trail (particularly Segments NT-7 and NT-9 – as shown left – which contain steep rocky ascents and descents of the Park's higher western ridgeline) would prevent the Nature Trail being targeted at anything above a Grade 3 Walk.

1.4.1 Track Treatment Selection

"Track treatments" – that is, the recommended on-site track works and/or improvements to address track condition, safety, environmental or sustainability issues – were selected, in response to site-specific conditions and the issue(s) to be addressed, based on the consultant's experience and assessments as well as the application of best-practise walking track construction management manuals. Preference was given to best-practise guidelines targeting comparable environmental conditions and settings to those encountered at Manly Dam, particularly:

- *Park Facilities Manual (Part 5 Tracks and Related Structures)* – Office of Environment and Heritage, NSW National Parks and Wildlife Service, 2016;
- *Public Domain Technical Manual, Blue Mountains City Council (Part 2: Natural Areas, Parks and Reserves, Walking Track Infrastructure)* – Blue Mountains City Council, 2015; and
- *Walking Track Construction Guidelines: A Guide to the Construction and Maintenance of Walking Tracks* – NSW National Parks and Wildlife Service (S. Gorrell).

Table 3 illustrates the track treatments – appropriate for a Grade 3 (or Grade 2) Walk – that have been most commonly recommended, grouped by type.

1.5 Carrying Out the Audit

The walking track audit was progressed via the following steps.

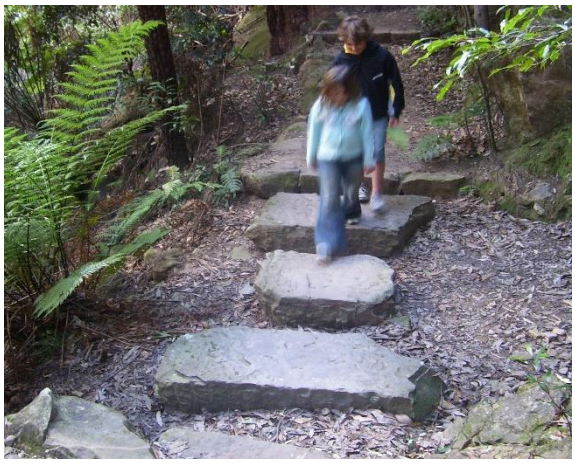
- An inception meeting with the Park Manager, on 18 May 2016, to confirm the audit scope (including agreement on the shorter "link" tracks and informal routes to be included in the audit), track standards, available data (including digital data), project deliverables, and operational matters.

Table 3 Typical Track Treatments (Appropriate for a Grade 3, or Grade 2, Walk)

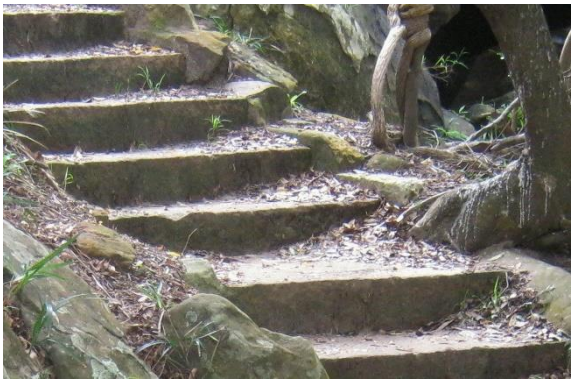
DRAINAGE	
	Sleeper waterbar
	Sleeper waterbar/step (dual function – with waterbar as primary role, more angled across track and extended well beyond downslope edge)
	Stone waterbar
	Stone-lined invert

	Stone gutter or box drain (built)
	Stone gutter/invert (cut into in-situ outcrop/pavement)
	Drainage deflection “wing” (beside boxed/edged steps, track edging, etc.)
	Low stone drainage diversion wall

SURFACE MODIFICATIONS	
	“Step-off” or “landing” tread stone (minor stone armour/flagging to harden/protect track surface and prevent dishing/wear or erosion below a step)
	Level track surface or tread(s) cut into in-situ outcrop/pavement
	Rock steps cut into situ outcrop/ledges
	Infill stone flagging and/or rock levelling or trimming to create a level or passable track surface (or treads) on/over in-situ outcrops/pavement/ledges

	Stone armoured/flagged track (with edge definition or boxing/retaining where required)
	Stepping stones (embedded)
STEPS	
	Sleeper step
	Sleeper step/waterbar (dual function – with step as primary role, less sharply angled across track)

	End blocks (“toe stones”) for sleeper treatments (to prevent end drainage flows, and/or contain tracks surface/tread or fill, and/or prevent avoidance)
	Sleeper step(s), boxed/edged with filled/compacted treads
	Stone step/riser (single)
	Stone steps (series)

	Stone steps, boxed/edged with filled/compacted treads
	Stone steps, stone flagged/armoured treads (with edge definition or boxing/retaining where required)
STEP-AND-RUNS (tread/run lengths in excess of one pace)	
	Sleeper step-and-run(s) – staggered single sleepers (open sided, open-ended)
	Sleeper step-and-run(s), boxed/edged with filled/compacted treads

	Stone step-and-run(s), boxed/edged with filled/compacted treads
	Stone step-and-run(s), stone flagged/armoured treads (with edge definition or boxing/retaining where required)
BOARDWALKS, STAIRS AND BUILT TREATMENTS	
	Timber stairs – off ground or elevated
 Source: www.fleetwoodurban.com.au	Fibreglass reinforced plastic stairs – off ground or elevated

	Timber boardwalk – low level/simple
	Fibreglass reinforced plastic boardwalk – low level/simple
	Timber boardwalk – combination (boardwalk, stairs, landings, step-and-runs)
	Fibreglass reinforced plastic boardwalk – combination (boardwalk, stairs, landings, step-and-runs)

CONTAINMENT AND BARRIERS	
 	Track edge definition/barrier – rock and rubble (to prevent track widening, braiding or treatment avoidance)
	Track edge definition/barrier – branch bundles (to prevent track widening, braiding or treatment avoidance)
	Safety railing/handrail (galvanised pipe)

	Safety railing/handrail (timber, or timber and wire)
	Safety railing/handrail (metal uprights/panels)
WAYFINDING	
	Totem-style wayfinding signage – dual sided.
	Simple direction marker – panel or totem.

- Document review – including *Manly Warringah War Memorial Park Plan of Management 2014, Manly Dam: Signage Program* including the *Manly Dam Sign Location Plan, Warringah Regional Multiple-Use Trail Strategy 2007*, *Australian Standard AS 2156.1-2001 Walking Tracks (Part 1 - Classification and Signage* and Part 2 - *Infrastructure Design),* and *Users Guide to the Australian Walking Track Grading System*.

- Interrogation and mapping based on Council's Geographical Information System (GIS) data – particularly the tracks/trails, soils and vegetation data layers and aerial photography – and preparation of base mapping for fieldwork.

- Preliminary fieldwork to trial the audit methodology, scope and reporting format.

- Meeting with Park Manager and Ranger staff, on 3 June 2016, to review preliminary audit report format and revise.

- Fieldwork to progressively undertake a detailed on-site audit of all 15 nominated tracks (as described in Section 1.5.1 below) – undertaken from May to November 2016. A major storm event (a NSW east coast low) in the Sydney region from 4 to 6 June 2016 severely impacted parts of the walking track network (including serious erosion and the displacement of some boardwalks) which necessitated additional fieldwork to re-audit some sections of track.

- Audit documentation and map preparation, and progressive supply to Park Manager for review. Preparation of approximate orders of cost for each track.

- Preparation and delivery of draft and final audit reports.

1.5.1 Fieldwork Methodology

The on-site component of the walking tracks audit was conducted as follows.

- Each track was walked twice in its entirety, once in each direction, to identify appropriate "'track segments".

  Track segments are comparatively homogenous or internally similar sections of track – as determined by observably consistent characteristics such as track width, substrate and surface conditions, gradient ranges, drainage, environmental setting, experience setting, and so on. As such each track segment has a consistent character (within a set range of assessment parameters) and is obviously different from the adjacent sections of a track. This approach offers a more meaningful division and description of a track – both for users (identifying lengths of track of the same standard, and offering a similar walking experience, that can be readily identified on-the-ground) and for land managers (identifying track segments likely to have comparable maintenance needs and management issues).

  The length of track segments were determined principally by the track conditions themselves, however a minimum track segment length (resolution) of 30 metres was applied. Once identified the start and end points of each track segment were marked on-ground (as shown right), with flour (biodegradable), and the location recorded using a

handheld GPS unit. Track segments were numbered consecutively, using the trail name as a prefix (e.g. for the Nature Trail – NT-1, NT-2, NT-3, etc.).

- Each track segment was walked again, at least twice, to record the required descriptive information including – general description and condition, tread width (mm), track surface, gradient range (degrees), alignment, terrain (landscape positon), soil, vegetation, existing track works and improvements, signs and wayfinding, user experience, and key issues. On-site soil and vegetation descriptions were later amended to match the mapped soil types and vegetation community information as provided by Council. Track works or management measures applicable to the entire segment were also identified during this walkover. These were typically routine track maintenance or management measures – such as opening windrows (as illustrated below) to prevent drainage capture and water ponding (with subsequent walker avoidance and track widening), surface maintenance (protruding rock/root removal) or levelling, vegetation trimming/clearance, maintaining boardwalks or other built elements, and monitoring requirements.. A photo record was made illustrating the typical segment condition or standard.


Windrow opening – before


Windrow opening – after

- Each track segment was then assessed to identify "treatment sites" – locations warranting on-site track works and/or improvements to address track condition, safety, environmental or sustainability issues. Treatment sites were labelled alphabetically, using the segment number as a prefix (e.g. for the Nature Trail Segment 1 (NT-1) – NT-1(A), NT-1(B), NT-1(C), etc.). Site locations were recorded using a handheld GPS unit (Garmin E-Trex 10) with all sites recorded to ±3 metres accuracy for at least two identical readings (within heavier vegetation cover, where two identical readings were not possible, site locations were averaged over at least 3 readings). For longer sites start and end points, and/or midpoints, were recorded. The current condition of each site was briefly recorded, highlighting any issues (such as drainage and guttering) or safety concerns as well as the condition and effectiveness of any existing track infrastructure. Equipment used included a handheld clinometer, compass, and 2.4 metre scale pole (with 100 millimetre increments). Recommended track treatments, including combined or sequential treatments for more complex sites, were then identified and documented on-site. A photo record was made of each site, demonstrating existing conditions and also allowing proposed treatments to be identified/highlighted. A priority was then allocated to each treatment site as part of the on-site assessment, with all priorities reviewed for each track as a whole when all treatment sites had been identified and assessed.

1.6 Treatment Priorities

The recommend works at each "treatment site" were allocated a priority by application of the following criteria.

- **HIGH** – Sites warranting works **as soon as possible** in order to address existing significant safety risks for users (or unacceptable safety risks or hazards for the identified track standard), and/or to address track condition or "usability/passability" inadequacies for the identified track standard, and/or to address significant existing environmental impacts or risks. Sites identified due to safety issues (warranting **immediate attention**) have been further differentiated.

- **Medium** – Sites warranting works to address less significant existing risks for track users or less significant environmental impacts, or to prevent major user hazards or environmental impacts from emerging. These works could be programmed into **future capital works programmes** and Park works schedules.

- low – Sites warranting works to address minor issues or to upgrade the track conditions (hazards, "usability", environmental impacts and sustainability) to the target track standard. These works could be progressively realised by inclusion into an **expanded Park's track/trial maintenance programme**.

- monitor – Sites warranting monitoring, as the sole management action or subsequent to the recommended treatments at particular sites.

1.7 Exclusions

Track conditions can change markedly over a short space of time – such as in response to major rain/weather events, drainage "capture" or altered surface flows, trample track creation or other modifications by users, vandalism or removal of signs and other infrastructure, actions of neighbouring landholders, etc. Therefore it must be acknowledged that any track audit will represent a "snapshot" of the tracks' condition and management requirements at a specific point in time only.

The audit did not detail routine track maintenance requirements – such as opening windrows, maintaining a safely navigable track surface (to the target track standard), vegetation trimming/clearance, maintaining built components and wayfinding signage, and monitoring – other than where these measures are recommended in association with site-specific track treatments or as "Recommended Works" identified for entire track segments.

The audit did not address:
- geotechnical assessments, or consideration or site/land stability issues (at the macro-scale);
- engineering/structural assessments of boardwalks, safety railings, lookouts and other "built" infrastructure;
- tree safety audits or arborist assessments (although some tree hazards were identified and documented where these were obvious);
- formal user safety or risk assessments;
- traffic safety issues at trackheads;
- cultural heritage surveys (for Aboriginal cultural heritage or historic heritage);
- user counts; and
- liaison with users/stakeholders (other than casual discussions with track users during fieldwork).

2. Audit Outcomes – Prioritised Track Treatment Sites, for Each Track

2.1 Overview

The walking track audit identified 523 "treatment sites" across all 15 audited tracks.

Of this total number, more than half the identified 523 "treatment sites" (299 sites or 57.1%) occur on just three of the 15 tracks (albeit the longest tracks) – the Nature Trail, Park Circuit Track (West) and Park Circuit Track (East) – as shown in Table 4.

As also shown on Table 4, of the 523 "treatment sites" identified:

- 58 are **HIGH** priority sites;
- 189 are **Medium** priority sites;
- 261 are low priority sites;
- 14 are monitor only sites; and
- 1 site has no works required.

Figure 5 shows the relative spread of sites across all tracks, both in total and by priority.

Table 4 Number of Sites, By Priority – For Each Track

TRACK	No. of Segments (Approx. Length)	NUMBER OF SITES				
		HIGH	Medium	low	monitor	TOTAL
McComb Hill	3 (256m)	0	2	6	0	**8**
Nature Trail Link	1 (48m)	3	5	2	0	**10**
Nature Trail	12 (1,346m)	19	37	49	4	**109**
Picnic Link	1 (83m)	0	4	4	1	**9**
North Balgowlah Link	1 (320m)	0	7	10	1	**18**
Wildflower Walk	3 (325m)	2	6	14	1	**23**
Park Circuit Track (West)	10 (2,131m)	15	32	54	3	**105** [1]
Curl Curl	6 (812m)	2	16	28	0	**46**
Eva's	10 (1,257m)	1	25	17	1	**44**
Heath	8 (820m)	2	15	16	0	**33**
Park Circuit Track (East)	16 (2,259m)	9	29	45	2	**85**
Dam Shoreline Boardwalk	2 (370m)	0	1	3	0	**4**
Monserra Road Entry	3 (625m)	4	8	4	0	**16**
Nyrang Road Fire Trail	2 (251m)	1	2	3	0	**6**
King Street Link	1 (157m)	0	0	6	1	**7**
TOTAL	**78**	**58**	**189**	**261**	**14**	**523** [1]

[1] Incudes 1 site with no works required

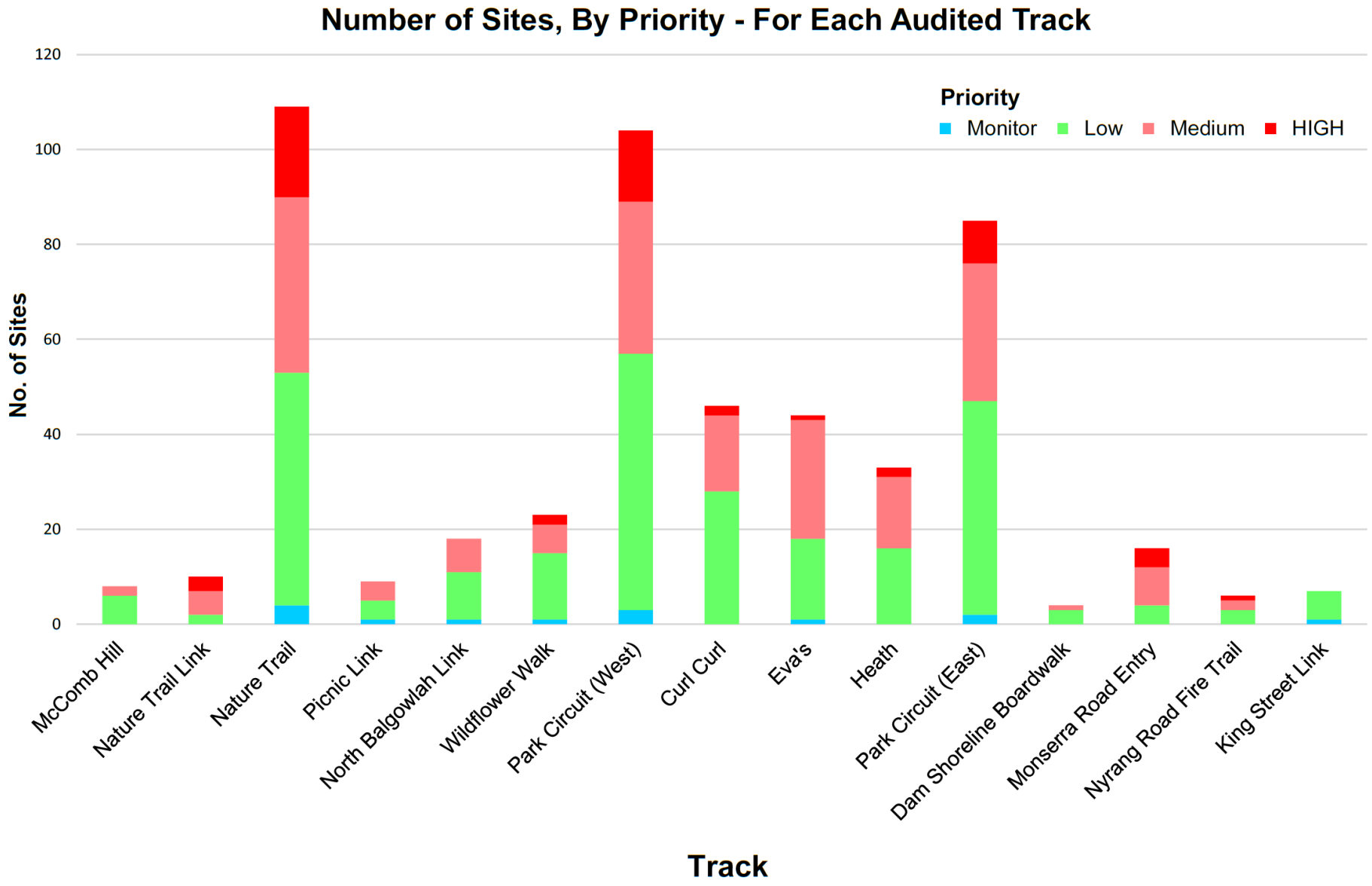


Figure 5 Number of sites, total and by priority, for each audited track

Track length is obviously a primary determinant of the number of sites identified for each of the 15 audited tracks. As noted, the longer Nature Trail, Park Circuit Track (West) and Park Circuit Track (East) have 109, 105 and 85 identified treatment sites respectively.

However terrain, slope, substrate, track alignment and the number of track treatments already in place (and effective) also have a significant bearing on track conditions and hence the number of treatments required. Recognising this, the number of treatments identified relative to the track length – or the "density" of track treatments required along a track overall – is perhaps a more useful indicator of overall track condition.

Table 5 shows this "average density" of treatment sites for each track. As shown this treatment site density varies markedly – from an average of one site every 4.8 metres on the Nature Trail Link to one site every 92.5 metres on the Dam Shoreline Boardwalk. However many tracks – 7 of the 15 tracks audited – averaged between one treatment site every 20 to 30 metres.

The 5 tracks exhibiting the highest average density of treatment sites are – in order – the Nature Trail Link Track, Picnic Link Track, Nature Trail, Wildflower Walk and Curl Curl Track. All have an average density of treatment sites of less than o 1 site every 20 metres.

Table 5 Tracks Ranked by Number of High Priority Treatment Sites and by the Average Density of Track Treatments

TRACK **Ranked by No. of HIGH Priority Treatment Sites** Length (No. of segments)	No. of **HIGH** Priority Sites	**TRACK** **Ranked by Averaged Density of Treatment Sites** Length (No. of segments)	Average distance between sites (m)
Top Ranked Five			
Nature Trail - 1,346m (12)	19	Nature Trail Link - 48m (1)	4.8
Park Circuit Track (W) - 2,131m (10)	15	Picnic Link - 83m (1)	9.2
Park Circuit Track (E) - 2,259m (16)	9	Nature Trail - 1,346m (12)	12.3
Monserra Road Entry - 625m (3)	4	Wildflower Walk - 325m (3)	14.1
Nature Trail Link - 48m (1)	3	Curl Curl - 812m (6)	17.7
Middle Ranked Five			
Wildflower Walk - 325m (3)	2*	North Balgowlah Link - 320m (1)	17.8
Heath - 820m (8)	2*	Park Circuit Track (W) - 2,131m (10)	20.3
Curl Curl - 812m (6)	2*	King Street Link - 157m (1)	22.4
Eva's - 1,257m (10)	1	Heath - 820m (8)	24.8
Nyrang Road Fire Trail - 251m (2)	1	Park Circuit Track (E) - 2,259m (16)	26.6
Lowest Ranked Five			
McComb Hill - 256m (3)	0	Eva's - 1,257m (10)	28.6
Picnic Link - 83m (1)	0	McComb Hill - 256m (3)	32.0
North Balgowlah Link - 320m (1)	0	Monserra Road Entry - 625m (3)	39.1
Dam Shoreline Boardwalk - 370m (2)	0	Nyrang Road Fire Trail - 251m (2)	41.8
King Street Link - 157m (1)	0	Dam Shoreline Boardwalk - 370m (2)	92.5

* Ranked by number of treatment sites identified due to safety issues.

The relative prioritisation of identified treatment sites can be used as another indicator of overall track condition. The proportion of low and medium priority sites within each track is broadly comparable. Between 20% and 86% of all sites within each track are identified as low priority, with a clustering of 7 tracks in the 40-60% band. The occurrence of medium priority sites is more tightly grouped, with all tracks having between 25% and 57% of sites identified as medium priority (excluding the King Street Link Track, which has no medium priority sites).

However the occurrence of high priority sites is far more variable, as shown on Tables 4 and 5.

High priority treatment sites are strongly concentrated along the Nature Trail, Park Circuit Track (West) and Park Circuit Track (East). Nearly 75% of the 58 sites identified as high priority occur on these three tracks – 19 on the Nature Trail, 15 on the Park Circuit Track (West) including numerous hazardous trees (rather than on-ground track elements), and 9 on the Park Circuit Track (East). The 4 high priority treatment sites identified on the Monserra Road Entry are all located on the informal, less maintained, sections of this track. The Nature Trail Link Track is notable for having 3 sites identified as high priority despite its short length (48 metres).

Together the number of high priority treatment sites and the density of track treatments can be useful decision tools to assist in the selection of tracks on which to focus capital works resources and upgrading or maintenance efforts. From Table 5 it can be seen that:

- the Nature Trail and the Nature Trail Link Track (highlighted red in Table 5) are ranked in the top 5 tracks for both high priority treatment sites and the average density of treatment sites;
- the Park Circuit Track (West) and Park Circuit Track (East) (highlighted pink) are ranked in the top 5 tracks for high priority treatment sites and in the top 10 tracks for average site density;
- the Monserra Road Entry is ranked 4th in terms of high priority treatment sites, but has a low density of sites overall;
- the Wildflower Walk, Heath Track and Curl Curl Track (highlighted yellow) are in the middle band of tracks in terms of high priority treatment sites and in the top 10 tracks for average site density; and
- Eva's Track and the Nyrang Road Fire Trail both have 1 high priority treatment site, but have a low density of sites overall.

2.2 Prioritised Track Treatment Sites, By Track

For each of the 15 audited tracks the following tables show all the identified treatment/work sites listed according to the assigned priorities of **HIGH**, **Medium** or **low** or monitor only. Refer to Section 1.6 for an explanation of these priority ratings.

Where a site with prioritised treatments/works is additionally recommend for monitoring, this is also indicated in the tables.

Sites recommended for **HIGH** priority works are further detailed as:

- sites considered high priority for safety reasons only (warranting immediate or short term attention) – listed in **red bold text**;
- sites considered high priority for both safety and other reasons (such as passability, sustainability, impact mitigation, etc.) – listed in red text; and
- sites considered high priority for track maintenance or upgrading reasons only (passability, sustainability, impact mitigation, etc.) – listed in plain text.

Table 6 McComb Hill Track – Prioritised Track Treatment Sites

McCOMB HILL TRACK – 3 Segments, 8 Sites			
HIGH	**Medium**	**low**	Monitor only
-	3(C) 3(end) [1] (and monitor)	1(A) 1(B) 2(A) 2(B) 3(A) 3(B)	-

[1] At end of Segment MHT-3, at Trig Station

Table 7 Nature Trail Link Track – Prioritised Track Treatment Sites

NATURE TRAIL LINK TRACK – 1 Segment, 10 Sites			
HIGH	**Medium**	**low**	Monitor only
1(E) 1(F) 1(G) (and monitor)	1(A) [1] 1(B) 1(C) 1(D) Junction with Nature Trail	1(H) 1(I)	-

[1] On Perimeter Fire Trail (SW of top end of Nature Trail Link Track)

Table 8 Nature Trail – Prioritised Track Treatment Sites

NATURE TRAIL – 12 Segments, 109 Sites			
HIGH	**Medium**	**low**	Monitor only
2(D) 5(H) 7(A) 7(D) (and monitor) 7(E) (and monitor) 7(G) (and monitor) 7(H) (and monitor) 7(J) (and monitor) 7(M) (and monitor) **8(A)** 8(D) 8(F) **8(G)** 9(A) 9(B)	1(A) [1] 2(A) (and monitor) 2(B) 2(C) Junction with Nature Trail Link Track 3(D) (and monitor) 3(F) 4(A) 5(B) 5(F) 5(G) 5(I) 5(J) (and monitor) 6(A) (and monitor)	1(B) 1(C) 1(D) 1(E) 1(F) 1(G) 1(H) 3(A) 3(B) (and monitor) 3(C) 3(E) 4(B) 4(C) 5(A) 5(C)	10(B) 11(D) 11(F) 12(A)

NATURE TRAIL – 12 Segments, 109 Sites (cont'd)			
HIGH	**Medium**	**low**	Monitor only
9(C)	6(B)	5(D)	
9(D)	6(D)	5(E)	
9(E)	6(G)	5(K)	
11(H)	6(H)	6(C)	
	6(I)	6(E)	
	6(J)	6(F)	
	6(K)	6(L)	
	6(N)	6(M)	
	6(O)	6(P)	
	7(B)	6(Q)	
	7(C) (and monitor)	6(R)	
	7(F)	7(K) (and monitor)	
	7(I)	8(B)	
	7(L)	8(C)	
	7(N)	8(E)	
	8(J) (and monitor)	8(H) (and monitor)	
	8(K)	8(I)	
	8(O)	8(L)	
	Junction with track south to APZ [2]	8(M)	
		8(N)	
	10(F)	9(F)	
	10(H)	10(A)	
	11(A)	10(C)	
	11(C)	10(D)	
		10(E)	
		10(G) (and monitor)	
		10(I)	
		10(J)	
		11(B)	
		11(E) (and monitor)	
		11(G)	
		12(B)	
		12(C)	
		Western trackhead [3]	

[1] Eastern trackhead, at Sir Roden Cutler VC Memorial Drive.
[2] Junction with track south to APZ (and junction of Segments NT-8 and NT-9).
[3] Western trackhead, at junction with Wildflower Walk.

Table 9 Picnic Link Track – Prioritised Track Treatment Sites

PICNIC LINK TRACK – 1 Segment, 9 Sites			
HIGH	**Medium**	**low**	Monitor only
	1(C) 1(E) 1(H) Junction with Nature Trail	1(B) 1(D) 1(F) 1(G)	1(A) (northern trackhead) [1]

[1] Northern trackhead, at Sir Roden Cutler VC Memorial Drive.

Table 10 North Balgowlah Link Track – Prioritised Track Treatment Sites

NORTH BALGOWLAH LINK TRACK – 1 Segments, 18 Sites			
HIGH	**Medium**	**low**	Monitor only
-	1(B) (and monitor) 1(F) (and monitor) 1(J) 1(L) 1(M) 1(N) 1(Q) (southern trackhead) [1]	Junction with Nature Trail 1(A) 1(C) (and monitor) 1(D) (and monitor) 1(E) (and monitor) 1(G) (and monitor) 1(I) 1(K) 1(O) 1(P)	1(H)

[1] Southern trackhead, at Manning Street boundary

Table 11 Wildflower Walk – Prioritised Track Treatment Sites

WILDFLOWER WALK – 3 Segments, 23 Sites (cont'd)			
HIGH	**Medium**	**low**	Monitor only
1(C) **1(D)**	1(E) 2(E) 3(E) 3(F) 3(G) 3(J)	1(A) (south-eastern trackhead) [1] Junction with Nature Trail 2(A) 2(B) 2(C) 2(D) 2(F) 3(A) 3(B)	1(B)

WILDFLOWER WALK – 3 Segments, 23 Sites (cont'd)			
HIGH	**Medium**	**low**	Monitor only
		3(C) 3(D) 3(H) Junction with Park Circuit Track (West) 3(I)	

[1] South-eastern trackhead, at north-western end of Sir Roden Cutler VC Memorial Drive.

Table 12 Park Circuit Track (West) – Prioritised Track Treatment Sites

PARK CIRCUIT TRACK (WEST) – 10 Segments, 105 Sites			
HIGH	**Medium**	**low**	Monitor only
1(J) **2(I)** **2(J)** **2(K)** **2(L)** **3(H)** 4(J) **4(M)** **4(O)** (and monitor) **4(S)** **6(B)** (and monitor) 6(D) 6(F) (and monitor) **7(A)** 10(I)	1(B) 1(C) 1(D) 1(E) 1(G) 1(H) (and monitor) 1(I) 2(E) 2(H) 3(C) 4(A) 4(I) [1] 4(L) 5(A) (and monitor) 5(E) (and monitor) 5(G) (monitor only) 6(A) 6(C) 6(E) 6(G) 7(B) 7(H) 8(A) (and monitor) 8(B) 9(D) 9(G) 10(A) 10(B) 10(J) (and monitor) 10(K) [2] 10(L) (and monitor)	Junction with Wildflower Walk [3] (and monitor) 1(A) 1(K) 2(A) 2(B) 2(C) 2(D) 2(F) 2(G) (and monitor) 2(M) (and monitor) 3(A) 3(B) 3(D) 3(E) 3(F) 3(G) 4(B) 4(C) 4(E) 4(F) 4(G) 4(H) 4(K) 4(N) 4(P) (and monitor) 4(Q) 4(R) 4(T) 5(B)	1(F) 4(D) 9(C)

PARK CIRCUIT TRACK (WEST) – 10 Segments, 105 Sites (cont'd)			
HIGH	**Medium**	**low**	Monitor only
	10(N)	5(C)	
		5(D) (and monitor)	
		5(F) (and monitor)	
		5(H)	
		7(C)	
		7(D)	
		7(E)	
		7(F)	
		7(G)	
		7(I)	
		7(J)	
		9(A) (and monitor)	
		9(B)	
		9(E)	
		9(F)	
		9(H)	
		9(I)	
		10(C)	
		10(D)	
		10(E)	
		10(F)	
		10(G) (and monitor)	
		10(H) (and monitor)	
		10(M)	
		10(O) [4]	

[1] On side track.
[2] Junction with side track.
[3] Junction with Wildflower Walk is south-eastern end of Park Circuit Track (West).
[4] Extra Site 10(P) (Segment 10 junction with Fire Trail and shared mountain bike circuit) = nil works.

Table 13 Curl Curl Track – Prioritised Track Treatment Sites

CURL CURL TRACK – 6 Segments, 46 Sites *			
HIGH	**Medium**	**low**	Monitor only
4(F) (and monitor)	Northern trackhead [1]	1(A)	-
5(G)	3(D)	1(B) (and monitor)	
	3(F) (and monitor)	1(C)	
	3(G)	1(D)	
	Disused track junction [2]	1(E)	
		1(F)	
	4(A)	Disused track junction (waterfall) [4]	
	4(D)		
	4(G)	1(G) (and monitor)	

CURL CURL TRACK – 6 Segments, 46 Sites * (cont'd)			
HIGH	**Medium**	**low**	Monitor only
	4(H) (and monitor)	1(H)	
	5(C)	1(I)	
	5(D)	3(A)	
	5(F)	3(B)	
	5(H)	3(C) (and monitor)	
	6(A)	3(E)	
	6(G) (and monitor)	4(B)	
	Southern trackhead [3]	4(C)	
		4(E) (and monitor)	
		5(A)	
		5(B)	
		5(E)	
		6(B)	
		6(C)	
		6(D)	
		6(E)	
		6(F)	
		6(H)	
		6(I)	
		6(J)	

* No recommended works in Segment CCT-2.
[1] Northern trackhead at pipeline.
[2] Junction (south) with closed/disused track.
[3] Southern trackhead at Fire Trail (and shared mountain bike circuit).
[4] Junction (north) with closed/disused track to upper waterfall.

Table 14 Eva's Track – Prioritised Track Treatment Sites

EVA'S TRACK – 10 Segments, 44 Sites *			
HIGH	**Medium**	**low**	Monitor only
4(D) (and monitor)	1(B)	1(A) [3]	3(C)
	1(C)	1(G) (and monitor)	
	1(D)	Junction of	
	1(E)	Segments ET-1, ET-	
	1(F)	2 and ET-10	
	1(H)	3(A)	
	3(B)	5(A)	
	4(A)	5(B)	
	4(B)	5(C)	
	4(C)	Throughout Segment	
	Northern end of	ET-6	
	Segment ET-5 [1]	6(A)	

EVA'S TRACK – 10 Segments, 44 Sites * (cont'd)			
HIGH	**Medium**	**low**	Monitor only
	Junction of Segments ET-5 and ET-6	6(B)	
	6(C)	7(A)	
	6(D)	7(B)	
	Junction of Segments ET-6 and ET-7	7(C)	
	Northern end of Segment ET-7 [2]	7(D)	
	7(E)	8(C) [4]	
	8(A)	9(A)	
	8(B)	9(E)	
	Junction of Segments ET-8 and ET-9		
	9(B)		
	9(C) (and monitor)		
	9(D)		
	9(F) (and monitor)		
	9(G)		

* No recommended works in Segments ET-2 and ET-10. Includes recommended works throughout Segment ET-6 as one (1) site. Excludes trample track off Segment ET-9.

[1] North-western trackhead (Segment ET-5) at pipeline.

[2] North-eastern trackhead (Segment ET-7) at pipeline.

[3] Trackhead/junction with North-west Fire Trail.

[4] Trackhead at western end of private road.

Table 15 Heath Track – Prioritised Track Treatment Sites

HEATH TRACK – 8 Segments, 33 Sites			
HIGH	**Medium**	**low**	Monitor only
3(A)	Southern/south-eastern trackhead	2(A)	-
6(B)		2(B)	
	3(B)	2(C)	
	4(A)	3(C)	
	4(C)	4(B)	
	Junction of Segments HT-4 and HT-5	4(D)	
		5(B)	
		5(C)	
	5(A) (high point off Heath Track [1])	6(A)	
		7(B)	
	5(D)	7(C)	

HEATH TRACK – 8 Segments, 33 Sites (cont'd)			
HIGH	**Medium**	**low**	Monitor only
	5(E) Junction of Segments HT-5 and HT-6 6(C) 6(D) 6(E) 7(A) 7(D) Northern/north-eastern trackhead [3]	Junction of Segments HT-7 and HT-8 [2] 8(A) 8(B) 8(C) 8(D)	

[1] High point/lookout on rocky ledge south-west of main/used route, accessed via informal track off disused/former loop of Heath Track.

[2] Junction of Segments HT-7 and HT-8 (as 90° bend), with un-named track to north/north-west.

[3] Northern/north-eastern trackhead, at tennis courts.

Table 16 Park Circuit Track (East) – Prioritised Track Treatment Sites

PARK CIRCUIT TRACK (EAST) – 16 Segments, 85 Sites *			
HIGH	**Medium**	**low**	Monitor only
1(A) 1(D) 3(A) [1] **3(A-midway)** [1] 9(C) to 9(D) [2] Off track below 9(C) [3] 12(E) 12(I) 16(C) (and monitor)	1(B) 1(F) 1(H) 2(C) 3(E) 4(A) 6(A) 7(B) 8(C) [4] 9(B) 9(E) 12(B) 12(C) 12(D) 12(F) 12(G) 12(H) (and monitor) 12(J) 13(F) 14(B) 14(E) 15(C)	1(C) 1(E) 1(G) 2(A) 2(B) 2(D) (track junction) [5] 2(E) 2(F) (and monitor) 2(G) 2(H) 3(B) 3(C) 3(D) 3(F) 5(A) 5(B) 6(B) 6(C) 6(D) (and monitor) 7(A) 8(A) (and monitor) 8(B)	10(B) 16(E)

PARK CIRCUIT TRACK (EAST) – 16 Segments, 85 Sites * (cont'd)			
HIGH	**Medium**	**low**	Monitor only
	15(F)	9(A)	
	15(G)	9(F)	
	15(H)	10(A)	
	15(I)	10(C)	
	15(J)	Throughout	
	16(B)	Segment PCT(E)-11	
	16(F)	12(A)	
		13(A)	
		13(B)	
		13(C)	
		13(D)	
		13(E)	
		14(A)	
		14(C)	
		14(D)	
		15(A)	
		15(B)	
		15(D) (and monitor)	
		15(E)	
		15(K)	
		15(L)	
		16(A)	
		16(D)	
		16(G) [6]	

* Includes recommended works throughout Segment PCT(E)-11 as one (1) site.
[1] Two works sites documented for Site PCT(E) - 3(A) = 3(A) and 3(A-midway).
[2] Site PCT(E) - 9(C) to Site PCT(E) - 9(D) documented as single works site.
[3] Off track, direct route straight up/down slope below (downslope of) Site PCT(E) - 9(C).
[4] Junction with Monserra Road Entry track (MRE -2) from upslope.
[5] Junction with King Street Link Track.
[6] Northern trackhead at Fire Trail (and shared mountain bike circuit).

Table 17 Dam Shoreline Boardwalk – Prioritised Track Treatment Sites

DAM SHORELINE BOARDWALK – 2 Segments, 4 Sites			
HIGH	**Medium**	**low**	Monitor only
	1(A)	1(B)	
		1(C) (and monitor)	
		2(A)	

Table 18 Monserra Road Entry – Prioritised Track Treatment Sites

MONSERRA ROAD ENTRY – 3 Segments, 16 Sites			
HIGH	**Medium**	**low**	Monitor only
2(C) 2(D) 2(G) 3(C)	2(A) Junction of Segments MRE-2 and MRE-3 2(E) 2(F) Junction of MRE-2 and Park Circuit Track (East) 3(A) 3(B) 3(D)	1(A) 1(B) 1(C) 2(B)	-

Table 19 Nyrang Road Fire Trail – Prioritised Track Treatment Sites

NYRANG ROAD FIRE TRAIL – 2 Segments, 6 Sites			
HIGH	**Medium**	**low**	Monitor only
2(C)	1(C) 2(B)	1(A) 1(B) 2(A)	-

Table 20 King Street Link Track – Prioritised Track Treatment Sites

KING STREET LINK TRACK – 1 Segment, 7 Sites			
HIGH	**Medium**	**low**	Monitor only
-	-	Junction with Park Circuit Track (East) 1(A) 1(B) 1(C) 1(D) 1(E)	1(F)

3. Audit Outcomes – Treatments Types and Number, and Orders of Cost, for Each Track

3.1 Overview

The detailed audit reports in Section 4 include, for each treatment site, the recommended types of treatments (waterbars, stone-lined invert, boxed sleeper steps, stone step-and-runs, waymarking signage etc. – as illustrated in Table 3) to address track condition, safety, environmental or sustainability issues. Totalling the number of recommended track treatments for each site, and then for each track, allows for an approximate order of cost to undertake all the recommended works for each of the 15 audited tracks to be estimated.

For each track the approximate total order of costs has been calculated for the total number of each recommended treatment type (using the estimated order of cost "per unit" by the number of that treatment type required). Treatments have been grouped according to the broad categories used in the overview of "Typical Track Treatments" in Table 3 (Section 1.4.1), as well as any site-specific or "one-off" treatments, or treatment combinations, particular to one (or more) sites a specific track. Adding these treatment sub-totals together gives the total approximate order of cost for all recommended works for each track. Table 21 gives the approximate order of cost to undertake all the recommended works for each of the 15 tracks.

Table 21 Total Approximate Order of Cost – For Each Track

TRACK	No. of Segments (Approx. Length)	APPROXIMATE TOTAL ORDER OF COST ($)	Approx. Order of Cost - per metre ($)
McComb Hill	3 (256m)	6,310	24.65
Nature Trail Link	1 (48m)	15,145	315.52
Nature Trail	12 (1,346m)	243,040	180.56
Picnic Link	1 (83m)	6,220	74.94
North Balgowlah Link	1 (320m)	20,550	64.22
Wildflower Walk	3 (325m)	12,620	38.83
Park Circuit Track (West)	10 (2,131m)	181,810	85.32
Curl Curl	6 (812m)	53,580	65.99
Eva's	10 (1,257m)	75,345	59.94
Heath	8 (820m)	37,235	45.41
Park Circuit Track (East)	16 (2,259m)	145,335	64.34
Dam Shoreline Boardwalk	2 (370m)	1,600	4.32
Monserra Road Entry	3 (625m)	48,070	76.91
Nyrang Road Fire Trail	2 (251m)	7,100	28.29
King Street Link	1 (157m)	1,700	10.83
TOTALS	**78 (11,060m)**	**$ 855,660**	**$ 77.37**

However these amounts should be considered approximate orders of cost only, as discussed in Section 3.3 below.

The total approximate orders of cost vary enormously across the 15 audited tracks – as expected given the vastly different track lengths involved as well as their varied settings (in terms of terrain/slope, substrate, drainage, etc.) and the resultant suite and total number of treatments required on each. Approximate total orders of cost range from $1,600 for the Dam Shoreline Boardwalk to $243,040 for the Nature Trail.

Table 21 also shows the approximate order of cost, per metre of track, to implement all of the recommended track treatments for each track. Most tracks – 9 of the 15 audited tracks – are estimated to fall into the $30-80 per metre order of cost range, to undertake all of the track upgrading and maintenance measures recommended. However the Nature Trail Link Track and Nature Trail are two tracks notably estimated to require considerably larger expenditure to implement all the recommended works – costing an average of over $315 and $180 per metre respectively. Upgrading the Nyrang Road Fire Trail, the McComb Hill Track, the King Street Link and the Dam Shoreline Boardwalk will all cost far less than the other tracks, per metre. The Dam Shoreline Boardwalk has the lowest estimated upgrading cost, of only $4.32 per metre to implement the recommended works at the 4 identified treatment sites.

3.2 Track Treatments and Approximate Orders of Cost

The following tables (Table 22 to Table 36) for each audited track, show the total number – and approximate total order of cost – for each of the treatment types recommended. The total approximate order of cost to undertake all the recommended works for each track is also indicated at the bottom of each table.

Table 22 McComb Hill Track – Track Treatments and Approximate Orders of Cost

McCOMB HILL TRACK – 3 Segments, 8 Sites			
TREATMENTS		**No. (length)**	**Approx. Order of Cost ($)**
DRAINAGE			
Sleeper	Sleeper waterbar – new	4	620
	Sleeper waterbar– extend existing	2	160
	Sleeper waterbar – new – extended (longer discharge or inflow/capture)	2	620
Stone-lined invert *(Simple)*		1	645
SURFACE WORKS / MODIFICATIONS			
Rock armour/flag tread (below step)		2	390
Cut/level tread(s) into in-situ rock outcrop/pavement		1	60
Cut step(s) into in-situ rock outcrop/ledge		1	90
Infilling rocks/blocks		1	40
Level and/or extend in-situ outcrop/pavement – by levelling treads and/or infill rocks or stone flagging *(Simple)*		2	1,230

McCOMB HILL TRACK – 3 Segments, 8 Sites (cont'd)			
TREATMENTS		**No. (length)**	**Approx. Order of Cost ($)**
Fill and compact erosion gutters, hollows or dips		1 (1 m)	50
STEPS			
Sleeper step – new		4	740
Stone	Stone step/riser – single	2	380
Stone	Stone steps – boxed – filled/compacted tread *(Simple)*	1	290
STEP-AND-RUNS (tread/run lengths in excess of one pace)			
Stone step-and-run(s) – boxed – filled/compacted tread *(Simple)*		1	590
BARRIERS/CONTAINMENT, TRACK EDGE DEFINITION & SAFETY			
Block/barrier - rock rubble		3 (9 m)	405
		TOTAL	**6,310**

Table 23 Nature Trail Link Track – Track Treatments and Approximate Orders of Cost

NATURE TRAIL LINK TRACK – 1 Segment, 10 Sites			
TREATMENTS		**No. (length)**	**Approx. Order of Cost ($)**
DRAINAGE			
Sleeper	Sleeper waterbar– extend existing	5	400
Sleeper	Sleeper waterbar – new – extended (longer discharge or inflow/capture)	3	930
Stone	Stone waterbar	1	210
Stone	Stone-lined invert *(Complex)*	2	1,790
Side drain ("catch/diversion" drain) – cut		1 (5 m)	125
Roll-over drains (on fire trails and management tracks)		1	1,250
SURFACE WORKS / MODIFICATIONS			
Rock armour/flag tread (below step)		1	195
Cut/level tread(s) into in-situ rock outcrop/pavement		2	120
Cut step(s) into in-situ rock outcrop/ledge		10	900
Infilling rocks/blocks		1	40
Level and/or extend in-situ outcrop/pavement – by levelling treads and/or infill rocks or stone flagging *(Simple)*		1	615
Level and/or extend in-situ outcrop/pavement – by levelling treads and/or infill rocks or stone flagging *(Complex)*		4	3,440
Stone armoured/flagged track surface		1 (2 m)	980
STEPS			
Sleeper	Sleeper step – new	2	370
Sleeper	Sleeper step – boxed – filled/compacted tread *(Simple)*	1	230
Stone step/riser – single		1	190

NATURE TRAIL LINK TRACK – 1 Segment, 10 Sites (cont'd)		
TREATMENTS	**No. (length)**	**Approx. Order of Cost ($)**
STEP-AND-RUNS (tread/run lengths in excess of one pace)		
Sleeper step-and-run(s) – boxed – filled/compacted tread *(Simple)*	1	345
BARRIERS/CONTAINMENT, TRACK EDGE DEFINITION & SAFETY		
Block/barrier - rock rubble	8 (47 m)	2,115
OTHERS & ONE OFFS		
Low post-and-rail timber fence (definition and containment/barrier along track edge)	1 (8 m)	900
	TOTAL	**15,145**

Table 24 Nature Trail – Track Treatments and Approximate Orders of Cost

NATURE TRAIL – 12 Segments, 109 Sites			
TREATMENTS		**No. (length)**	**Approx. Order of Cost ($)**
DRAINAGE			
Sleeper	Sleeper waterbar – new	35	5,425
	Sleeper waterbar– extend existing	8	640
	Sleeper waterbar – new – extended (longer discharge or inflow/capture)	10	3,100
Stone	Stone waterbar	2	420
	Stone-lined invert *(Simple)*	18	11,160
	Stone-lined invert *(Complex)*	16	14,320
Low stone drainage diversion wall		8 (20m)	4,300
Rock-lined drainage discharge gutter/outlet		1	210
Side drain ("catch/diversion" drain) – cut		1 (6m)	150
SURFACE WORKS / MODIFICATIONS			
Rock armour/flag tread (below step)		22	4,290
Cut/level tread(s) into in-situ rock outcrop/pavement		36	2,160
Cut step(s) into in-situ rock outcrop/ledge		19	1,170
Level and/or extend in-situ outcrop/pavement – by levelling treads and/or infill rocks or stone flagging *(Simple)*		6	3,690
Level and/or extend in-situ outcrop/pavement – by levelling treads and/or infill rocks or stone flagging *(Complex)*		7	6,020
Stone armoured/flagged track surface		9 (15m)	7,350
Stepping-stones – embedded		17	3,910
Fill and compact erosion gutters, hollows or dips		2 (3m)	150

NATURE TRAIL – 12 Segments, 109 Sites (cont'd)			
	TREATMENTS	**No. (length)**	**Approx. Order of Cost ($)**
STEPS			
Sleeper	Sleeper step – new	17	3,145
	Sleeper step – extend existing	3	285
	End block (rock) to existing sleeper step	6	240
	Sleeper step – boxed – filled/compacted tread *(Simple)*	19	4,370
	Sleeper step – boxed – filled/compacted tread *(Complex)*	9	2,925
Stone	Stone step/riser – single	35	6,650
	Stone steps – series of 2 or more *(Simple)*	64	14,080
	Stone steps – series of 2 or more *(Complex)*	39	12,090
	Stone steps – boxed – filled/compacted tread *(Simple)*	5	1,450
	Stone steps – boxed – stone armoured tread *(Simple)*	12	4,200
	Stone steps – boxed – stone armoured tread *(Complex)*	5	2,450
STEP-AND-RUNS (tread/run lengths in excess of one pace)			
Sleeper	Sleeper step-and-run(s) – boxed – filled/compacted tread *(Simple)*	22	7,590
	Sleeper step-and-run(s) – boxed – filled/compacted tread *(Complex)*	6	2,880
Stone	Stone step-and-run(s) – boxed – filled/compacted tread *(Simple)*	1	590
	Stone step-and-run(s) – boxed – filled/compacted tread *(Complex)*	9	7,425
	Stone step-and-run(s) – boxed – stone armoured tread *(Simple)*	2	1,950
	Stone step-and-run(s) – boxed – stone armoured tread *(Complex)*	7	9,555
BOARDWALKS, STAIRS & BUILT TREATMENTS			
Fibreglass Reinforced Plastic	FRP boardwalk – hand/safety railing one side	1 (6m)	9,630
	FRP combination (of boardwalk, steps, step-and-runs, landings) – no hand/safety railing	3 (42m)	39,690
	FRP combination (of boardwalk, steps, step-and-runs, landings) – hand/safety railing one side	1 (8m)	14,600
	FRP combination (of boardwalk, steps, step-and-runs, landings) – no hand/safety railing both sides	1 (5m)	13,525
BARRIERS/CONTAINMENT, TRACK EDGE DEFINITION & SAFETY			
Block/barrier - rock rubble		31 (113m)	5,085
Safety railing/handrail – galvanised pipe		3 (18m) *	5,400
WAYFINDING			
Simple direction markers		4	880
Other signs		5	1,100
OTHERS & ONE OFFS			
Minor track re-orientation (within cleared corridor), with closure/screening and rehabilitation of disused alignment		1 (3m)	300

NATURE TRAIL – 12 Segments, 109 Sites (cont'd)		
TREATMENTS	**No. (length)**	**Approx. Order of Cost ($)**
Built-up track (over low crest/roots), filled and compacted with sleeper boxing/retaining and sleeper step each end	1 (2m)	500
Rough rock wall or rough rock gutter (to divert flows) under FRP structures	4	1,000
	TOTAL	**243,040**

Table 25 Picnic Link Track – Track Treatments and Approximate Orders of Cost

PICNIC LINK TRACK – 1 Segment, 9 Sites			
TREATMENTS		**No. (length)**	**Approx. Order of Cost ($)**
DRAINAGE			
Sleeper waterbar – new		3	465
Stone	Stone-lined invert *(Simple)*	2	1,290
	Stone-lined invert *(Complex)*	2	1,790
SURFACE WORKS / MODIFICATIONS			
Rock armour/flag tread (below step)		3	585
Cut/level tread(s) into in-situ rock outcrop/pavement		6	360
Cut step(s) into in-situ rock outcrop/ledge		3	270
Level and/or extend in-situ outcrop/pavement – by levelling treads and/or infill rocks or stone flagging *(Simple)*		1	615
Stone armoured/flagged track surface		1 (1m)	490
BARRIERS/CONTAINMENT, TRACK EDGE DEFINITION & SAFETY			
Block/barrier - rock rubble		1 (3m)	135
Hazard marking		1	220
		TOTAL	**6,220**

Table 26 North Balgowlah Link Track – Track Treatments and Approximate Orders of Cost

NORTH BALGOWLAH LINK TRACK – 1 Segments, 18 Sites			
TREATMENTS		**No. (length)**	**Approx. Order of Cost ($)**
DRAINAGE			
Sleeper	Sleeper waterbar – new	7	1,085
	Sleeper waterbar– extend existing	1	80

NORTH BALGOWLAH LINK TRACK – 1 Segments, 18 Sites (cont'd)			
TREATMENTS		**No. (length)**	**Approx. Order of Cost ($)**
Sleeper	Sleeper waterbar – new – extended (longer discharge or inflow/capture)	11	3,410
Stone	Stone waterbar	1	210
Stone	Stone-lined invert *(Complex)*	1	895
Low mounds (and windrow) barriers and drainage diversions		1 (2m)	120
SURFACE WORKS / MODIFICATIONS			
Cut/level tread(s) into in-situ rock outcrop/pavement		2	120
Stone armoured/flagged track surface		1 (2m)	980
Fill and compact erosion gutters, hollows or dips		1 (1m)	50
Track edge retaining sleepers		3	465
STEPS			
Sleeper	Sleeper step – new	20	3,700
Sleeper	End block (rock) to existing sleeper step	7	280
Sleeper	Sleeper step – boxed – filled/compacted tread *(Simple)*	1	230
Stone	Stone step/riser – single	1	190
Stone	Stone steps – series of 2 or more *(Simple)*	2	440
Stone	Stone steps – boxed – stone armoured tread *(Simple)*	1	350
STEP-AND-RUNS (tread/run lengths in excess of one pace)			
Sleeper step-and-run(s) – boxed – filled/compacted tread *(Simple)*		5	1,725
BOARDWALKS, STAIRS & BUILT TREATMENTS			
FRP boardwalk – no hand/safety railing		1 (6m)	4,350
WAYFINDING			
Simple direction markers		1	220
Routed signs		1	1,200
OTHERS & ONE OFFS			
Reinstate and stabilise edge of compacted decomposed granite footpath at trackhead on Park boundary		1 (2 m)	450
		TOTAL	**20,550**

Table 27 Wildflower Walk – Track Treatments and Approximate Orders of Cost

WILDFLOWER WALK – 3 Segments, 23 Sites			
TREATMENTS		**No. (length)**	**Approx. Order of Cost ($)**
DRAINAGE			
Sleeper	Sleeper waterbar – new	9	1,395
Sleeper	Sleeper waterbar– extend existing	1	80

WILDFLOWER WALK – 3 Segments, 23 Sites (cont'd)			
TREATMENTS		**No. (length)**	**Approx. Order of Cost ($)**
Stone waterbar		2	420
Low stone drainage diversion wall		1 (1 m)	215
SURFACE WORKS / MODIFICATIONS			
Rock armour/flag tread (below step)		1	195
Cut/level tread(s) into in-situ rock outcrop/pavement		4	240
Infilling rocks/blocks		1	40
Level and/or extend in-situ outcrop/pavement – by levelling treads and/or infill rocks or stone flagging *(Simple)*		3	1,845
Stone armoured/flagged track surface		4 (5 m)	2,450
Fill and compact erosion gutters, hollows or dips		2 (3 m)	150
STEPS			
Sleeper	Sleeper step – new	7	1,295
	Sleeper step – boxed – filled/compacted tread *(Simple)*	1	230
Stone	Stone step/riser – single	10	1,900
	Stone steps – series of 2 or more *(Simple)*	3	660
BARRIERS/CONTAINMENT, TRACK EDGE DEFINITION & SAFETY			
Block/barrier - rock rubble		5 (17 m)	765
Hazard marking		1	220
WAYFINDING			
Simple direction markers		1	220
OTHERS & ONE OFFS			
Reinstate missing decking plank (long) to N end of wide timber bridge at W trackhead/entry		1	300
		TOTAL	**12,620**

Table 28 Park Circuit Track (West) – Track Treatments and Approximate Orders of Cost

PARK CIRCUIT TRACK (WEST) – 10 Segments, 105 Sites			
TREATMENTS		**No. (length)**	**Approx. Order of Cost ($)**
DRAINAGE			
Sleeper	Sleeper waterbar – new	41	6,355
	Sleeper waterbar– extend existing	4	320
	Sleeper waterbar – new – extended (longer discharge or inflow/capture)	20	6,200
Stone	Stone waterbar	9	1,890
	Stone-lined invert *(Simple)*	2	1,290

PARK CIRCUIT TRACK (WEST) – 10 Segments, 105 Sites (cont'd)			
TREATMENTS		**No. (length)**	**Approx. Order of Cost ($)**
Stone	Stone-lined invert *(Complex)*	3	2,685
	Stone gutter/invert – cut into in-situ outcrop/pavement	2 (4 m)	680
Rock-lined drainage discharge gutter/outlet		2	420
SURFACE WORKS / MODIFICATIONS			
Rock armour/flag tread (below step)		2	390
Cut/level tread(s) into in-situ rock outcrop/pavement		16	960
Cut step(s) into in-situ rock outcrop/ledge		4	360
Level and/or extend in-situ outcrop/pavement – by levelling treads and/or infill rocks or stone flagging *(Simple)*		6	3,690
Level and/or extend in-situ outcrop/pavement – by levelling treads and/or infill rocks or stone flagging *(Complex)*		2	1,720
Stone armoured/flagged track surface		10 (29 m)	14,210
Fill and compact erosion gutters, hollows or dips		5 (9 m)	450
Track edge retaining – sleepers		5	775
Track edge retaining – stone		3 (9 m)	2,205
STEPS			
Sleeper	Sleeper step – new	9	1,665
	Sleeper step – extend existing	4	380
	Sleeper step – boxed – filled/compacted tread *(Simple)*	16	3,680
	Sleeper step – boxed – filled/compacted tread *(Complex)*	17	5,525
Stone	Stone step/riser – single	11	2,090
	Stone steps – series of 2 or more *(Simple)*	8	1,760
	Stone steps – boxed – filled/compacted tread *(Simple)*	2	580
	Stone steps – boxed – stone armoured tread *(Simple)*	7	2,450
STEP-AND-RUNS (tread/run lengths in excess of one pace)			
Sleeper	Sleeper step-and-run(s) – boxed – filled/compacted tread *(Simple)*	7	2,415
	Sleeper step-and-run(s) – boxed – filled/compacted tread *(Complex)*	1	480
Stone	Stone step-and-run(s) – boxed – filled/compacted tread *(Simple)*	2	1,180
	Stone step-and-run(s) – boxed – stone armoured tread *(Simple)*	2	1,950
BOARDWALKS, STAIRS & BUILT TREATMENTS			
Timber	Timber boardwalk/bridge – new or extend existing	3 (5 m)	4,475
	Timber boardwalk/bridge – repair existing (plank replacement)	3	150
FRP	FRP boardwalk – no hand/safety railing	6 (55 m)	39,875
	FRP steps – no hand/safety railing [1]	7 (5m)	4,725
	FRP combination (of boardwalk, steps, step-and-runs, landings) – no hand/safety railing	3 (41 m)	38,745

PARK CIRCUIT TRACK (WEST) – 10 Segments, 105 Sites (cont'd)			
TREATMENTS		**No. (length)**	**Approx. Order of Cost ($)**
BARRIERS/CONTAINMENT, TRACK EDGE DEFINITION & SAFETY			
Block/barrier - rock rubble		12 (32 m)	1,440
Block/barrier - branches		14 (83 m)	2,075
Railing	Safety railing/handrail – galvanised pipe	5 (26 m)	7,800
	Safety railing/handrail – timber, or timber and wire	1 (8 m)	7,040
Hazard marking		3	660
WAYFINDING			
Simple direction markers		1	220
Other signs		5	1,100
OTHERS & ONE OFFS			
Stone retaining wall (high side of track)		2 (5 m)	1,500
Large embedded trackside rock (flood protection)		10 (5 m)	2,500
Rough rock wall or rough rock gutter (to divert flows) under diversion under FRP structures		3	750
		TOTAL	**181,810**

Table 29 Curl Curl Track – Track Treatments and Approximate Orders of Cost

CURL CURL TRACK – 6 Segments, 46 Sites			
TREATMENTS		**No. (length)**	**Approx. Order of Cost ($)**
DRAINAGE			
Sleeper	Sleeper waterbar – new	25	3,875
	Sleeper waterbar– extend existing	8	640
	Sleeper waterbar – new – extended (longer discharge or inflow/capture)	2	620
Stone	Stone-lined invert *(Simple)*	5	3,225
	Stone-lined invert *(Complex)*	4	3,580
Low stone drainage diversion wall		1 (2m)	430
Rock-lined drainage discharge gutter/outlet		1	210
SURFACE WORKS / MODIFICATIONS			
Rock armour/flag tread (below step)		4	780
Cut/level tread(s) into in-situ rock outcrop/pavement		9	540
Cut step(s) into in-situ rock outcrop/ledge		13	1,170
Level and/or extend in-situ outcrop/pavement – by levelling treads and/or infill rocks or stone flagging *(Simple)*		9	5,535
Level and/or extend in-situ outcrop/pavement – by levelling treads and/or infill rocks or stone flagging *(Complex)*		1	860

CURL CURL TRACK – 6 Segments, 46 Sites (cont'd)			
TREATMENTS		**No. (length)**	**Approx. Order of Cost ($)**
Stone armoured/flagged track surface		2 (5m)	2,450
Stepping-stones – embedded		6	1,380
Fill and compact erosion gutters, hollows or dips		2 (4m)	200
STEPS			
Sleeper	Sleeper step – new	10	1,850
	End block (rock) to existing sleeper step	19	760
	Sleeper step – boxed – filled/compacted tread *(Simple)*	3	690
	Sleeper step – boxed – filled/compacted tread *(Complex)*	2	650
Stone	Stone step/riser – single	7	1,330
	Stone steps – series of 2 or more *(Simple)*	7	1,540
	Stone steps – boxed – filled/compacted tread *(Simple)*	9	2,610
	Stone steps – boxed – stone armoured tread *(Simple)*	6	2,100
STEP-AND-RUNS (tread/run lengths in excess of one pace)			
Sleeper	Sleeper step-and-run(s) – filled/compacted tread *(Simple)*	5	1,425
	Sleeper step-and-run(s) – boxed – filled/compacted tread *(Simple)*	3	1,035
	Sleeper step-and-run(s) – boxed – filled/compacted tread *(Complex)*	4	1,920
Stone	Stone step-and-run(s) – boxed – stone armoured tread *(Simple)*	5	4,875
BOARDWALKS, STAIRS & BUILT TREATMENTS			
FRP boardwalk – no hand/safety railing		1 (5m)	3,625
BARRIERS/CONTAINMENT, TRACK EDGE DEFINITION & SAFETY			
Block/barrier - rock rubble		11 (39m)	1,755
WAYFINDING			
Routed signs		1	1,200
Other signs		1	220
OTHERS & ONE OFFS			
Embedded large rocks (with flat upper tread or stepping-stone type) set into bank of drainage line		2	500
		TOTAL	**53,580**

Table 30 Eva's Track – Track Treatments and Approximate Orders of Cost

EVA'S TRACK – 10 Segments, 44 Sites			
TREATMENTS		**No. (length)**	**Approx. Order of Cost ($)**
DRAINAGE			
Sleeper	Sleeper waterbar – new	40	6,200
	Sleeper waterbar– extend existing	2	160
	Sleeper waterbar – new – extended (longer discharge or inflow/capture)	10	3,100
Stone	Stone waterbar	11	2,310
	Stone-lined invert *(Simple)*	4	2,580
	Stone-lined invert *(Complex)*	7	6,265
	Stone gutter/invert – cut into in-situ outcrop/pavement	2 (5 m)	850
Side drain ("catch/diversion" drain) – cut		1 (5 m)	125
Low mounds (and windrow-style barriers) for drainage diversion		1 (3 m)	180
SURFACE WORKS / MODIFICATIONS			
Rock armour/flag tread (below step)		7	1,365
Cut/level tread(s) into in-situ rock outcrop/pavement		5	300
Cut step(s) into in-situ rock outcrop/ledge		2	180
Level and/or extend in-situ outcrop/pavement – by levelling treads and/or infill rocks or stone flagging *(Simple)*		5	3,075
Level and/or extend in-situ outcrop/pavement – by levelling treads and/or infill rocks or stone flagging *(Complex)*		1	860
Stone armoured/flagged track surface		5 (7 m)	3,430
Fill and compact erosion gutters, hollows or dips		5 (12 m)	600
Track edge retaining sleepers		2	310
STEPS			
Sleeper	Sleeper step – new	1	185
	End block (rock) to existing sleeper step	4	160
	Sleeper step – boxed – filled/compacted tread *(Simple)*	7	1,610
	Sleeper step – boxed – filled/compacted tread *(Complex)*	4	1,300
Stone	Stone step/riser – single	17	3,230
	Stone steps – series of 2 or more *(Simple)*	2	440
	Stone steps – series of 2 or more *(Complex)*	7	2,170
	Stone steps – boxed – filled/compacted tread *(Simple)*	2	580
	Stone steps – boxed – filled/compacted tread *(Complex)*	3	1,215
	Stone steps – boxed – stone armoured tread *(Simple)*	9	3,150
	Stone steps – boxed – stone armoured tread *(Complex)*	2	980
STEP-AND-RUNS (tread/run lengths in excess of one pace)			
Sleeper	Sleeper step-and-run(s) – boxed – filled/compacted tread *(Simple)*	3	1,035
	Sleeper step-and-run(s) – boxed – filled/compacted tread *(Complex)*	14	6,720

EVA'S TRACK – 10 Segments, 44 Sites (cont'd)			
TREATMENTS		**No. (length)**	**Approx. Order of Cost ($)**
Stone	Stone step-and-run(s) – boxed – filled/compacted tread *(Complex)*	2	1,650
	Stone step-and-run(s) – boxed – stone armoured tread *(Complex)*	9	12,285
BARRIERS/CONTAINMENT, TRACK EDGE DEFINITION & SAFETY			
Block/barrier - rock rubble		13 (102 m)	4,590
Block/barrier - branches		9 (45 m)	1,125
Hazard marking		1	220
WAYFINDING			
Simple direction markers		2	440
Other signs		1	220
TREATMENTS		**No. (length)**	**Approx. Order of Cost ($)**
OTHERS & ONE OFFS			
Repair/reinstall trackhead (regulatory) sign		1	150
		TOTAL	**75,345**

Table 31 Heath Track – Track Treatments and Approximate Orders of Cost

HEATH TRACK – 8 Segments, 33 Sites			
TREATMENTS		**No. (length)**	**Approx. Order of Cost ($)**
DRAINAGE			
Sleeper waterbar – new		11	1,705
Stone	Stone waterbar	4	840
	Stone-lined invert *(Simple)*	8	5,160
	Stone-lined invert *(Complex)*	3	2,685
	Stone gutter/invert – cut into in-situ outcrop/pavement	2 (3 m)	510
Low stone drainage diversion wall		2 (5 m)	1,075
Rock-lined drainage discharge gutter/outlet		2	420
SURFACE WORKS / MODIFICATIONS			
Rock armour/flag tread (below step)		11	2,145
Cut/level tread(s) into in-situ rock outcrop/pavement		2	120
Cut step(s) into in-situ rock outcrop/ledge		7	630
Level and/or extend in-situ outcrop/pavement – by levelling treads and/or infill rocks or stone flagging *(Simple)*		7	4,305

HEATH TRACK – 8 Segments, 33 Sites (cont'd)			
TREATMENTS		**No. (length)**	**Approx. Order of Cost ($)**
Level and/or extend in-situ outcrop/pavement – by levelling treads and/or infill rocks or stone flagging *(Complex)*		1	860
Stone armoured/flagged track surface		2 (4 m)	1,960
Fill and compact erosion gutters, hollows or dips		4 (8 m)	400
STEPS			
Sleeper step – new		2	370
Stone	Stone step/riser – single	16	3,040
	Stone steps – series of 2 or more *(Simple)*	16	3,520
	Stone steps – boxed – filled/compacted tread *(Simple)*	3	870
	Stone steps – boxed – filled/compacted tread *(Complex)*	1	405
	Stone steps – boxed – stone armoured tread *(Simple)*	6	2,100
STEP-AND-RUNS (tread/run lengths in excess of one pace)			
Sleeper	Sleeper step-and-run(s) – staggered single sleeper steps and/or step/waterbars, open-ended	1	185
	Sleeper step-and-run(s) – boxed – filled/compacted tread *(Complex)*	1	480
Stone step-and-run(s) – boxed – filled/compacted tread *(Complex)*		1	825
BARRIERS/CONTAINMENT, TRACK EDGE DEFINITION & SAFETY			
Block/barrier - rock rubble		12 (29 m)	1,305
WAYFINDING			
Simple direction markers		3	660
Other signs		3	660
		TOTAL	**37,235**

Table 32 Park Circuit Track (East) – Track Treatments and Approximate Orders of Cost

PARK CIRCUIT TRACK (EAST) – 16 Segments, 85 Sites			
TREATMENTS		**No. (length)**	**Approx. Order of Cost ($)**
DRAINAGE			
Sleeper	Sleeper waterbar – new	60 [1]	9,300
	Sleeper waterbar– extend existing	23	1,840
	Sleeper waterbar – new – extended (longer discharge or inflow/capture)	7	2,170
Stone	Stone waterbar	1	210
	Stone-lined invert *(Simple)*	12 [2]	7,740
	Stone-lined invert *(Complex)*	9	8,055
Low mounds (and windrow-style barriers) for drainage diversion		1 (5 m)	300

PARK CIRCUIT TRACK (EAST) – 16 Segments, 85 Sites (cont'd)			
TREATMENTS		**No. (length)**	**Approx. Order of Cost ($)**
SURFACE WORKS / MODIFICATIONS			
Rock armour/flag tread (below step)		5	975
Cut/level tread(s) into in-situ rock outcrop/pavement		6	360
Cut step(s) into in-situ rock outcrop/ledge		11 [3]	990
Level and/or extend in-situ outcrop/pavement – by levelling treads and/or infill rocks or stone flagging *(Simple)*		4	2,460
Level and/or extend in-situ outcrop/pavement – by levelling treads and/or infill rocks or stone flagging *(Complex)*		6	5,160
Stone armoured/flagged track surface		5 (21 m) [4]	10,290
Stepping-stones – embedded		1	230
Fill and compact erosion gutters, hollows or dips		4 (9 m)	450
Track edge retaining sleepers		5	775
Track edge retaining – stone		2 (3m)	735
STEPS			
Sleeper	Sleeper step – new	2	370
	Sleeper step – extend existing	10	950
	End block (rock) to existing sleeper step	19	760
Stone	Stone step/riser – single	13 [5]	2,470
	Stone steps – series of 2 or more *(Simple)*	28 [6]	6,160
	Stone steps – series of 2 or more *(Complex)*	8 [7]	2,480
	Stone steps – boxed – filled/compacted tread *(Simple)*	24 [8]	6,960
	Stone steps – boxed – filled/compacted tread *(Complex)*	5	2,025
	Stone steps – boxed – stone armoured tread *(Simple)*	2	700
	Stone steps – boxed – stone armoured tread *(Complex)*	4	1,960
STEP-AND-RUNS (tread/run lengths in excess of one pace)			
Sleeper	Sleeper step-and-run(s) – filled/compacted tread *(Simple)*	9	2,565
	Sleeper step-and-run(s) – filled/compacted tread *(Complex)*	2	680
	Sleeper step-and-run(s) – boxed – filled/compacted tread *(Simple)*	5	1,725
Stone	Stone step-and-run(s) – boxed – filled/compacted tread *(Simple)*	3	1,770
	Stone step-and-run(s) – boxed – filled/compacted tread *(Complex)*	4	3,300
	Stone step-and-run(s) – boxed – stone armoured tread *(Simple)*	6	5,850
	Stone step-and-run(s) – boxed – stone armoured tread *(Complex)*	2	2,730

PARK CIRCUIT TRACK (EAST) – 16 Segments, 85 Sites (cont'd)			
TREATMENTS		**No. (length)**	**Approx. Order of Cost ($)**
BOARDWALKS, STAIRS & BUILT TREATMENTS			
FRP	FRP combination (of boardwalk, steps, step-and-runs, landings) – no hand/safety railing	2 (19 m)	17,955
	FRP combination (of boardwalk, steps, step-and-runs, landings) – hand/safety railing one side	1 (7 m)	12,775
BARRIERS/CONTAINMENT, TRACK EDGE DEFINITION & SAFETY			
Block/barrier - rock rubble		18 (84 m) [9]	3,780
Safety railing/handrail – timber, or timber and wire		1 (12 m)	10,560
WAYFINDING			
Simple direction markers		1	220
Routed signs		1	1,200
OTHERS & ONE OFFS			
Rock retaining wall to low side track edge		1 (2m)	800
Retain and support (infilling) existing sleeper waterbar at top of slope/steps		1	400
Timber drainage diversion "wings" to edge of existing sleeper steps		4	200
Angled stone flagging to edge of sewer lid		1	200
Wide gutter under existing timber boardwalk		1	250
Stormwater detention/stilling pond off end of spoon drain off Fire Trial (upslope of track)		1	1,500
		TOTAL	**145,335**

Table 33 Dam Shoreline Boardwalk – Track Treatments and Approximate Orders of Cost

DAM SHORELINE BOARDWALK – 2 Segments, 4 Sites			
TREATMENTS		**No. (length)**	**Approx. Order of Cost ($)**
DRAINAGE			
Sleeper	Sleeper waterbar – new	3	465
	Sleeper waterbar– extend existing	2	160
Low mounds (and windrow-style barriers) for drainage diversion		1 (2 m)	120
STEP-AND-RUNS (tread/run lengths in excess of one pace)			
	Sleeper step-and-run(s) – boxed – filled/compacted tread *(Simple)*	1	345
BARRIERS/CONTAINMENT, TRACK EDGE DEFINITION & SAFETY			
Block/barrier - rock rubble		1 (3 m)	135

DAM SHORELINE BOARDWALK – 2 Segments, 4 Sites (cont'd)		
TREATMENTS	**No. (length)**	**Approx. Order of Cost ($)**
OTHERS & ONE OFFS		
Remove sleeper waterbar and re-contour disused track junction	1	300
Remove log post and direction arrow	1	75
	TOTAL	**1,600**

Table 34 Monserra Road Entry – Track Treatments and Approximate Orders of Cost

MONSERRA ROAD ENTRY – 3 Segments, 16 Sites			
TREATMENTS		**No. (length)**	**Approx. Order of Cost ($)**
DRAINAGE			
Sleeper	Sleeper waterbar – new	17	2,635
	Sleeper waterbar – new – extended (longer discharge or inflow/capture)	2	620
Stone	Stone waterbar	2	420
	Stone-lined invert *(Complex)*	3	1,935
	Stone gutter/invert – cut into in-situ outcrop/pavement	1 (3m)	510
Roll-over drains (on fire trails and management tracks)		3	3,750
SURFACE WORKS / MODIFICATIONS			
Rock armour/flag tread (below step)		1	195
Cut/level tread(s) into in-situ rock outcrop/pavement		5	300
Cut step(s) into in-situ rock outcrop/ledge		5	450
Level and/or extend in-situ outcrop/pavement – by levelling treads and/or infill rocks or stone flagging *(Simple)*		2	1,230
Level and/or extend in-situ outcrop/pavement – by levelling treads and/or infill rocks or stone flagging *(Complex)*		12	10,320
Stone armoured/flagged track surface		1 (2 m)	980
Fill and compact erosion gutters, hollows or dips		3 (23 m)	1,150
STEPS			
Sleeper	Sleeper step – new	20	3,700
	Sleeper step – boxed – filled/compacted tread *(Simple)*	4	920
	Sleeper step – boxed – filled/compacted tread *(Complex)*	7	2,275
Stone	Stone step/riser – single	10	1,900
	Stone steps – series of 2 or more *(Simple)*	16	3,520
	Stone steps – boxed – filled/compacted tread *(Simple)*	2	580
	Stone steps – boxed – stone armoured tread *(Simple)*	5	1,750

MONSERRA ROAD ENTRY – 3 Segments, 16 Sites (cont'd)			
TREATMENTS		**No. (length)**	**Approx. Order of Cost ($)**
STEP-AND-RUNS (tread/run lengths in excess of one pace)			
Sleeper	Sleeper step-and-run(s) – filled/compacted tread *(Complex)*	6	2,040
	Sleeper step-and-run(s) – boxed – filled/compacted tread *(Simple)*	2	690
	Sleeper step-and-run(s) – boxed – filled/compacted tread *(Complex)*	12	5,760
WAYFINDING			
Simple direction markers		2	440
		TOTAL	**48,070**

Table 35 Nyrang Road Fire Trail – Track Treatments and Approximate Orders of Cost

NYRANG ROAD FIRE TRAIL – 2 Segments, 6 Sites		
TREATMENTS	**No. (length)**	**Approx. Order of Cost ($)**
DRAINAGE		
Roll-over drains (on fire trails and management tracks)	5	6,250
SURFACE WORKS / MODIFICATIONS		
Fill and compact erosion gutters, hollows or dips	1 (5m)	250
OTHERS & ONE OFFS		
Enlarge existing side gutter and build low mound trackside to divert outflows away from trail (downslope)	1 (7m)	600
	TOTAL	**7,100**

Table 36 King Street Link Track – Track Treatments and Approximate Orders of Cost

KING STREET LINK TRACK – 1 Segment, 7 Sites			
TREATMENTS		**No. (length)**	**Approx. Order of Cost ($)**
DRAINAGE			
Sleeper	Sleeper waterbar – new	5	775
	Sleeper waterbar – new – extended (longer discharge or inflow/capture)	1	310
SURFACE WORKS / MODIFICATIONS			
Level and/or extend in-situ outcrop/pavement – by levelling treads and/or infill rocks or stone flagging *(Simple)*		1	615
		TOTAL	**1,700**

3.3 Basis for Order of Cost Estimates, and Limitations

The cost basis and other information on which the preceding approximate orders of cost have been estimated have been drawn from a number of sources, including:

- advice from Council regarding the scope, components and costs of previous track upgrading and construction contracts within the Park;
- industry charge-out and rate guidelines - notably the *Guideline Schedule of Rates for Landscape Works* by the Landscape Association of NSW and ACT;
- publicly available catalogues and price lists from commercial suppliers (preferably local suppliers) – such as Australian Native Landscapes, ACE Landscape Supplies, Turtle Nursery and Landscape Supplies, Kimberley Sandstone Sydney, and contract stonemasons; and
- cost data from comparable/previous projects (by Gondwana Consulting and others), notably track and trail projects undertaken for the NSW National Parks and Wildlife Service.

All order of cost estimates are in 2017 dollars, and inclusive of GST. They have been prepared on the assumption that the recommended track works will be undertaken using small machinery and tools (as illustrated) by on-site labour intensive crews – as typically employed for walking track construction in natural areas – and that tracks (or sections of track) would be closed while works were in progress (to allow for time savings and the most efficient construction methods).

The orders of cost, both the rates estimated for the various treatment types and the total orders of cost for each track, must be acknowledged as being approximate or broad indications of cost only. A range of factors will determine the actual costs for carrying out the recommended works on any given section of track – most significantly the accessibility of the work sites/segments will be a key cost determinant. Other factors such as contract size and scope (with potential costs or economies of scale), the degree of works mechanisation possible, latent site conditions, final design of built elements such as boardwalks and stairs (and especially footing types and requirements), the potential to source materials (such as rock rubble or branch barriers) from within the Park, and changes to track conditions post this audit (such as due to major storm events or wildfires) will also influence the final completion costs.

Although the total upgrading/construction costs will ultimately vary from the order of cost estimates provided, they are nevertheless useful in also indicating the comparative volume or magnitude of works required between the various walking tracks within the Park.

3.3.1 Cost Estimates – By Track Treatment

Table 37 shows order of cost estimates for each of the recommended track treatments most frequently identified during this audit. These “per unit” cost estimates have been applied in preparing the total approximate order of cost for each of the 15 audited tracks.

For cost estimate purposes some of the on-ground more “built” treatments recommended – notably steps and step-and-runs – have been identified as being either “simple” or “complex” –

see Tables 22 to 36 above, and Table 37 below. This is in recognition that some sites will present greater challenges or difficulties for larger on-ground treatments – due to site-specific or "micro-terrain" issues (such as rock outcrops, changes in slope, drainage and guttering, fill and level alteration or re-contouring requirements, the remains of existing treatments, tree locations, etc.) – or because of the proximity and sequencing or integration of the recommended treatments at a location. Such sites will require additional time and effort in undertaking the recommended works, and so a 140% "loading" has been applied to the estimated "unit rates" for treatments at sites assessed as potentially "complex" (compared to the rate estimated for "simple" sites). (The exception being complex "sleeper step-and-run(s) with filled/compacted tread" which are only subject to a 120% loading.)

Explanatory notes have been included for some treatments in Table 37 as further background for the order of cost estimate identified.

Table 37 Per Unit Order of Cost for Typical Track Treatments

TYPICAL TRACK TREATMENT		Approx. Order of Cost – Rates ($)	Notes (key components, length, area, etc.)
DRAINAGE			
Sleeper	Sleeper waterbar – new	155	One 2.4m x 200mm x 100mm hardwood sleeper
	Sleeper waterbar– extend existing	80	1.2m long - using half a 2.4m x 200mm x 100mm, hardwood sleeper
	Sleeper waterbar – new – extended (longer discharge or inflow/capture)	310	Two 2.4m x 200mm x 100mm hardwood sleeper
Stone	Stone waterbar	210	Embedded sandstone "ballast blocks" (400x200x200mm) x 5
	Stone-lined invert *(Simple)*	645	1m wide, 1.4m long (across track), mixed stone surface of sandstone flagging and ballast blocks
	Stone-lined invert *(Complex)*	895	
	Stone gutter (box drain) – built	805	200mm wide x 200mm deep and 1.6m long (across track), using 16 sandstone "ballast blocks" (400x200x200mm)
	Stone gutter/invert – cut into in-situ outcrop/pavement	170 per m	500mm wide x 200mm deep
Low stone drainage diversion wall		215 per m	Based on sandstone "ballast blocks" (400x200x200mm)
Rock-lined drainage discharge gutter/outlet		210	Allows for 0.5 sq m rip/rap or irregular placed rocks (bush rock or "random dimension" block)
Side drain ("catch/diversion" drain) – cut		25 m	Dug to 500mm wide and 300mm deep
Low mounds (and windrow-style barriers) for drainage diversion		60 per m	Allows for 400mm wide and 200mm high, using crushed sandstone or coarse fill

TYPICAL TRACK TREATMENT		Approx. Order of Cost – Rates ($)	Notes (key components, length, area, etc.)
Roll-over drains (on fire trails and management tracks)		1,250	RFS/NPWS style, compacted crushed sandstone or coarse fill
SURFACE WORKS / MODIFICATIONS			
Rock armour/flag tread (below step)		195	Allows for sandstone flagging or ballast blocks, 900mm wide by 500mm run inlaid level with track surface
Cut/level tread(s) into in-situ rock outcrop/pavement		60 per tread	300mm tread x 900mm wide, hand tool and/or compressor cutting
Cut step(s) into in-situ rock outcrop/ledge		90 per step	300mm tread x 200mm riser, hand tool and/or compressor cutting
Infilling rocks/blocks		40	Allows for 1 "random dimension" block
Level and/or extend in-situ outcrop/pavement – by levelling treads and/or infill rocks or stone flagging *(Simple)*		615	Allows for 1 sq m rock levelling by hand tool and/or compressor cutting, and 1 sq m sandstone flagging
Level and/or extend in-situ outcrop/pavement – by levelling treads and/or infill rocks or stone flagging *(Complex)*		860	
Stone armoured/flagged track surface		490 per m	900mm wide track (for 1m length), 75mm sandstone flagging (rough finish)
Stepping-stones – embedded		230	Based on embedded sandstone block 500x500x500mm
Fill and compact erosion gutters, hollows or dips		50 per m	Allow for 0.25 cubic metre of crushed sandstone or coarse fill
Track edge retaining sleepers		155	One 2.4m x 200mm x 100mm hardwood sleeper
Track edge retaining – stone		245	Based on sandstone "ballast blocks" (400x200x200mm)
STEPS			
Sleeper	Sleeper step – new	185	One 2.4m x 200mm x 100mm hardwood sleeper
	Sleeper step – extend existing	95	1.2m long - using half a 2.4m x 200mm x 100mm, hardwood sleeper
	End block (rock) to existing sleeper step	40	Allows for 1 "random dimension" block
	Sleeper step – boxed – filled/compacted tread *(Simple)*	230	Using 2.4m x 200mm x 100mm hardwood sleepers, with crushed sandstone fill, and max 500mm tread
	Sleeper step – boxed – filled/compacted tread *(Complex)*	325	

TYPICAL TRACK TREATMENT		Approx. Order of Cost – Rates ($)	Notes (key components, length, area, etc.)
Stone	Stone step/riser – single	190	Allows for single sandstone log 500x500x1000mm, **or** 4 sandstone ballast blocks and 2 "random dimension" blocks, **or** 6 "random dimension" blocks
	Stone steps – series of 2 or more *(Simple)*	220 per step	300-350mm treads, allows for using sandstone logs (500x500x1000mm), **or** sandstone ballast blocks **and/or** "random dimension" blocks
	Stone steps – series of 2 or more *(Complex)*	310 per step	
	Stone steps – boxed – filled/compacted tread *(Simple)*	290 per step	300-350mm treads, allows for using sandstone ballast blocks **and/or** "random dimension" blocks, with crushed sandstone fill, max 500mm tread
	Stone steps – boxed – filled/compacted tread *(Complex)*	405 per step	
	Stone steps – boxed – stone armoured tread *(Simple)*	350 per step	300-350mm treads, allows for using sandstone ballast blocks **and/or** "random dimension" blocks, and 75mm sandstone flagging, max 500mm tread
	Stone steps – boxed – stone armoured tread *(Complex)*	490 per step	
STEP-AND-RUNS (tread/run lengths in excess of one pace)			
Sleeper	Sleeper step-and-run(s) – staggered single sleeper steps and/or step/waterbars, open-ended	185 per step-and-run	One 2.4m x 200mm x 100mm hardwood sleeper
	Sleeper step-and-run(s) – filled/compacted tread *(Simple)*	285 per step-and-run	One 2.4m x 200mm x 100mm hardwood sleeper, allows for some crushed sandstone or coarse fill
	Sleeper step-and-run(s) – filled/compacted tread *(Complex)*	340 per step-and-run	
	Sleeper step-and-run(s) – boxed – filled/compacted tread *(Simple)*	345 per step-and-run	Using 2.4m x 200mm x 100mm hardwood sleepers, with crushed sandstone fill, and based on 1.5m long run
	Sleeper step-and-run(s) – boxed – filled/compacted tread *(Complex)*	480 per step-and-run	
Stone	Stone step-and-run(s) – boxed – filled/compacted tread *(Simple)*	590 per step-and-run	Allows for using sandstone ballast blocks **and/or** "random dimension" blocks, with crushed sandstone fill, and based on 1.5m long run
	Stone step-and-run(s) – boxed – filled/compacted tread *(Complex)*	825 per step-and-run	
	Stone step-and-run(s) – boxed – stone armoured tread *(Simple)*	975 per step-and-run	Allows for using sandstone ballast blocks **and/or** "random dimension" blocks, with 75mm sandstone flagging, and based on 1.5m long run
	Stone step-and-run(s) – boxed – stone armoured tread *(Complex)*	1,365 per step-and-run	
BOARDWALKS, STAIRS AND BUILT TREATMENTS			
Timber	Timber boardwalk/bridge – new or extend existing	895 per m	900mm wide, on timber uprights (no toe boards)
	Timber boardwalk/bridge – repair existing (plank replacement)	50	Hardwood plank

TYPICAL TRACK TREATMENT		Approx. Order of Cost – Rates ($)	Notes (key components, length, area, etc.)
Fibreglass Reinforced Plastic	FRP boardwalk – no hand/safety railing	725 per m	900mm wide FRP Mini-mesh on metal superstructure (no toe boards)
	FRP boardwalk – hand/safety railing one side	1,695 per m	900mm wide FRP mini-mesh on metal superstructure, with railing(s) of hardwood uprights and top rail and tensioned wires
	FRP boardwalk – hand/safety railing both sides	2,485 per m	
	FRP stairs/steps – no hand/safety railing	945 per m	900mm wide FRP Mini-mesh on metal superstructure
	FRP stairs/steps – hand/safety railing one side	1,825 per m	900mm wide FRP mini-mesh on metal superstructure, with railing(s) of hardwood uprights and top rail and tensioned wires
	FRP stairs/steps – hand/safety railing both sides	2,705 per m	
Fibreglass Reinforced Plastic	FRP combination (of boardwalk, steps, step-and-runs, landings) – no hand/safety railing	945 per m	900mm wide FRP Mini-mesh on metal superstructure (no toe boards)
	FRP combination (of boardwalk, steps, step-and-runs, landings) – hand/safety railing one side	1,825 per m	900mm wide FRP mini-mesh on metal superstructure, with railing(s) of hardwood uprights and top rail and tensioned wires
	FRP combination (of boardwalk, steps, step-and-runs, landings) – hand/safety railing both sides	2,705 per m	
BARRIERS/CONTAINMENT, TRACK EDGE DEFINITION AND SAFETY			
Block/barrier - rock rubble		45 sq m	Sandstone spalls or offcuts, including rough/random placement
Block/barrier - branches		25 sq m	Assumes locally sourced (no cost), placement and peg/secure only
Railing	Safety railing/handrail – galvanised pipe	300 per m	Double galvanised pipe
	Safety railing/handrail – timber, or timber and wire	880 per m	Hardwood uprights and top rail and tensioned wires
	Safety railing/handrail – metal uprights/panels)	990 per m	Metal uprights/panels
Hazard marking		220	
WAYFINDING			
Simple direction markers		220	
Routed signs		1200	Allows for 75mm letters on 135mm high timber slats, painted
Other signs		220	

3.3.2 Order of Cost Exclusions

The approximate orders of cost in Tables 22 to 36 do not include minor or routine works (especially where these are not associated with other/larger works) that would normally be considered part of routine walking track maintenance and management, including:

- vegetation trimming and maintaining track clearances;
- removing hazardous trees or branches;
- cleaning and maintenance of waterbars or waterbars/steps;
- opening windrows;
- opening or cutting outlet gutters (from waterbars, ponding areas, etc.);
- removing stumps, protruding roots, fallen logs, etc.;
- minor rock levelling and removal (rock lips, ledges, rubble, etc.);
- levelling or compacting track surfaces;
- realigning existing sleeper treatments (e.g. angling a sleeper step to also serve as a waterbar);
- minor hazard marking/painting (e.g. uneven boardwalks boards, low branches etc.); and
- closure, screening and rehabilitation of trample tracks or disused sections of track.

The order of cost estimates also do include assessment, design and approval expenses that may be associated with proposed track works, including:

- flora and fauna surveys, or Aboriginal cultural heritage or historic heritage investigations, as part of the project approval process;
- risk and/or public safety assessments;
- geotechnical, subsidence, flooding or soil contamination investigations;
- preparation of SEE's and REFs, or other project approval documentation;
- engineering details/specifications where required (such as for boardwalk and stair design);
- specification and tender document preparation;
- disposal fees for demolition materials and waste; and
- erosion and sediment control works, during and after construction.

4. Audit Outcomes – Track Condition and Detailed Audit Reports, for All Tracks

4.1 Overview

This section provides the detailed audit reports for all 15 tracks.

Detailed audit reports are provided for each of the following 15 tracks. Each track is presented, as well as coded and page numbered, separately in its own section – to allow individual track reports to be extracted for costing, contracting or on-site/operational use. Audit reports are sequenced starting from the park entry road and working clockwise – starting with the McComb Hill Track and ending with the King Street Link Track – as follows:

- McComb Hill Track ("MHT") – 3 segments – 12 pages;
- Nature Trail Link Track ("NTLT") – 1 segment – 10 pages;
- Nature Trail ("NT") – 12 segments – 88 pages;
- Picnic Link Track ("PLT") – 1 segment – 7 pages;
- North Balgowlah Link Track ("NBLT") – 1 segment – 15 pages;
- Wildflower Walk ("WW") – 3 segments – 18 pages;
- Park Circuit Track (West) ("PCT(W)") – 10 segments – 81 pages;
- Curl Curl Track ("CCT") – 6 segments – 41 pages;
- Eva's Track ("ET") – 10 segments – 47 pages;
- Heath Track ("HT") – 8 segments – 33 pages;
- Park Circuit Track (East) ("PCT(E)") – 16 segments – 66pages;
- Dam Shoreline Boardwalk ("DSB") – 2 segments – 9 pages;
- Monserra Road Entry ("MRE") – 3 segments – 15 pages;
- Nyrang Road Fire Trail ("NRFT") – 2 segments – 7 pages; and
- King Street Link Track ("KSLT") – 1 segment – 5 pages.

4.2 Audit Reports Format

The audit report for each track commences with a key plan (annotated aerial photograph) of that entire track, showing the location and numbering of the component track segments. Segments are named and labelled numerically (e.g. Heath Track 1, Heath Track 2, etc.).

This is followed by the detailed audit for each segment, comprising:

- an annotated aerial photograph of the segment locating and labelling the treatment sites identified – treatment sites are, usually, named alphabetically within each track segment (e.g. e.g. Heath Track 1(A) abbreviated as HT-1(A), Heath Track 1(B) or HT-1(B), Heath Track 1(C) or HT-1(C), etc.);
- GPS co-ordinates for the segment start and end points;

- an overall description of the segment and its key management, maintenance and user experience elements, covering – general description and condition, tread width (mm), track surface, gradient (degrees), alignment, terrain, soil, vegetation, track works and improvements, signs and wayfinding, user experience, and key issues;
- recommended works applying to the segment as a whole – typically routine maintenance and monitoring as well as measures that may be particular to or prominent within a segment, as well as signage measures previously identified in the *Manly Dam Sign Location Plan*);
- the "Recommended Works – Site-specific" section, where each works or treatment site identified within the segment is addressed, is at the centre of the audit report (and forms the bulk of the information provided for a segment) and incudes -
    - the "Site ID" or individual name/number,
    - a site's GPS co-ordinates (or start and end points for longer sites),
    - a brief description of the current condition,
    - the recommended works (itemised and described),
    - the site's allocated priority (see Section 1.6 for an explanation of the priorities used) with in some instances, mainly for higher priority sites, the reasons underpinning the allocated priority (e.g. safety, passability, trafficability, environmental impact limitation, sustainability, or to protect downslope treatments), and
    - accompanying photograph(s) of the site, usually with the recommended works indicated/arrowed.

The following descriptors or conventions have been used in the audit reports.

Abbreviations

- Directions – all directions have been abbreviated to N, S, E, W, NW, NE, etc.;
- Measurements – all measurements are abbreviated (mm, m, etc.);
- "NSL" – natural surface level (height of the unmodified natural ground surface flanking the track).

Track Cross-section Descriptors

<table>
<tr><td>Dished
  </td><td>Benched
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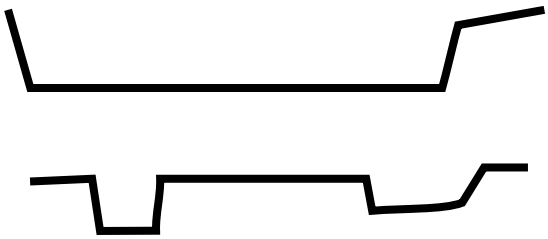
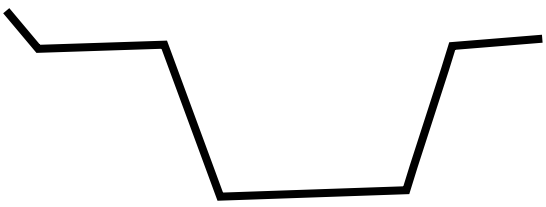
<tr><td>Guttered
  </td><td>Entrenched
  </td></tr>
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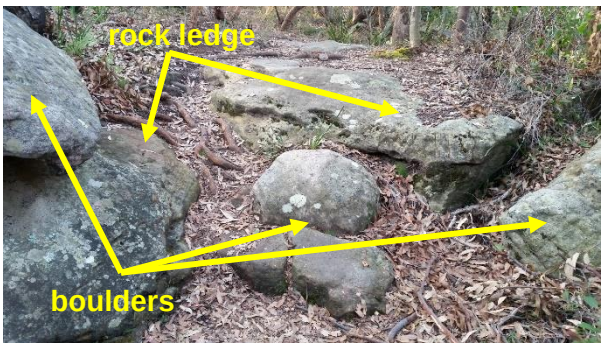
Slope/Gradient Descriptors

- Flat to nearly flat = less than 1°
  (less than 1 in 57 gradient, or less than 1.8 % grade)
- Gentle = 1-3°
  (1 in 57 to 1 in 19 gradient, or; or 1.8-5.2% grade)

- Gentle / Moderate = 4-8°
  (1 in 14.5 to 1 in 7 gradient, or 7.0-14.1% grade
- Moderate = 9-15°
  (1 in 6.5 to 1 in 3.5 gradient, or 15.8-26.8% grade)

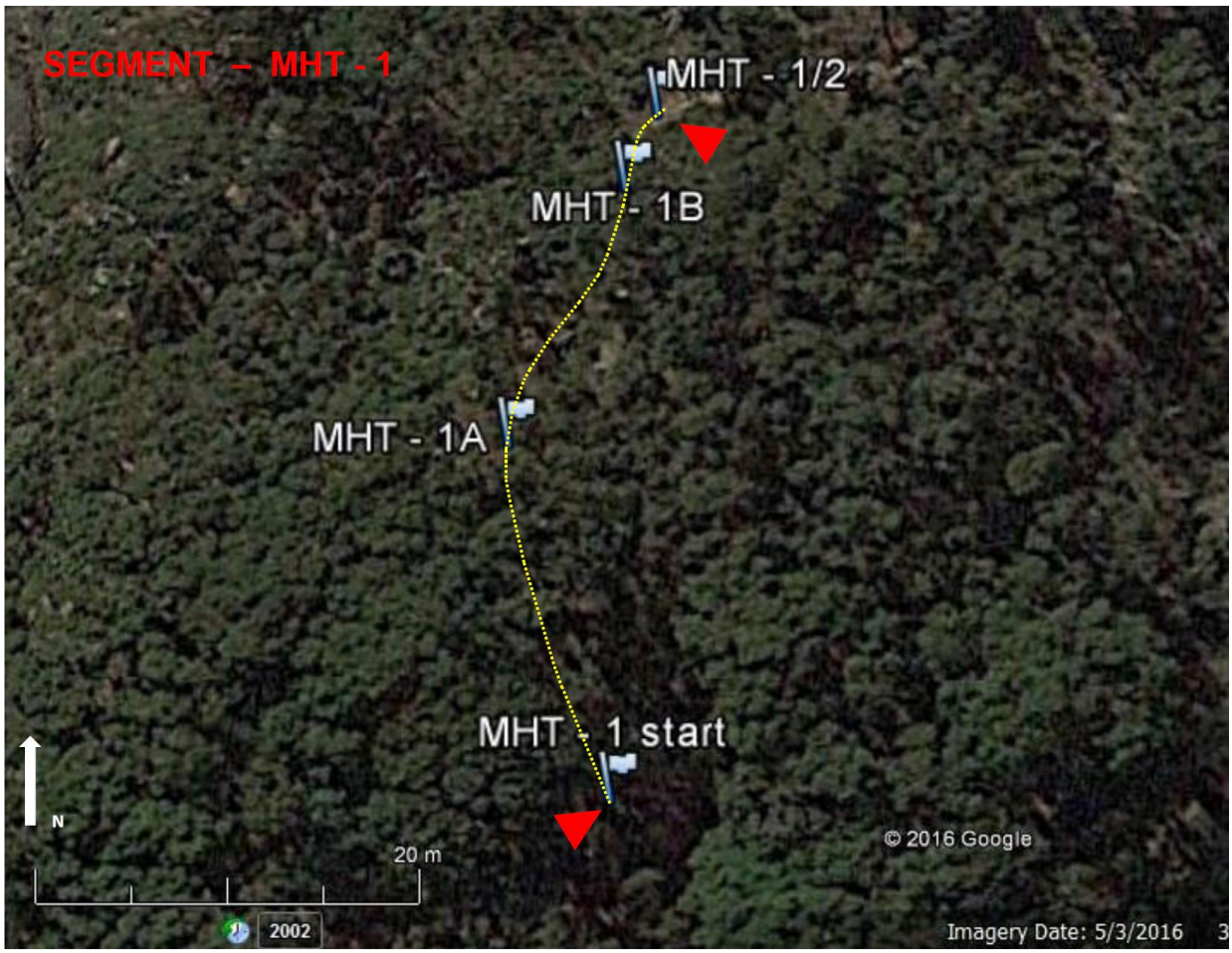
- Steep = 16-30°
  (1 in 3.4 to 1 in 1.7 gradient, or 28.7- 57.7% grade)
- Very Steep = greater than 30° (greater than 1 in 1.7 gradient, or greater than 57.7% grade)

Rock Descriptors



McCOMB HILL TRACK - SEGMENTS 1 to 3

SEGMENT McCOMB HILL TRACK - 1



SEGMENT: MHT - 1	
Start Point: 338569 6260422 **(junction with Perimeter Fire Trail and Shared Path)**	**End Point: 338569 6260456**
General Description and Condition: Short section of well-defined track (40m approx.) across a flat to gently sloped saddle/ridge of open Eucalypt forest with open/burnt understory. Good/fair condition. *Tread Width (mm):* 800-1,000mm wide, widens to 2m towards S end (junction with Perimeter Fire Trail). *Track Surface:* Mostly compacted sand gently dished to 50mm deep with embedded rock and gravel, occasional roots/stumps, drainage flows (to S) down most of segment but no active erosion, area of loose/deposited sand at N end (run-on and deposition area from upslope track, next segment). *Gradient (degrees):* Gentle, 3-4°. *Alignment:* Straight to very gently curved in N, with bend at N end to next segment/upslope. *Terrain:* Upper hillslope, on saddle/ridge. *Soil:* Lambert (Erosional), undulating to rolling low hills on Hawkesbury Sandstone (enters Hawkesbury (Colluvial) on rugged, rolling to very steep hills on Hawkesbury Sandstone at far N end).	

Vegetation: Bloodwood-Scribbly Gum Woodland (part of Sydney Coastal Dry Sclerophyll Forest).

Track Works and Improvements: Timber sleeper waterbar/step at N end, partially burnt with flows over/through (Site MHT-1(B)). 2 old log posts near S end (possibly former vehicle barriers ?).

Signs and Wayfinding: New signage/directional totem at S end, at junction with Perimeter Fire Trail and Shared Path. Log post with metal directional arrow at N end (fair condition).

User Experience: Easy walking, through very open timbered ridge/saddle just off Perimeter Fire Trail and Shared Path, filtered views to dam.

Key Issues: Excluding bikes/mountain bikes from adjacent Perimeter Fire Trail and Shared Path, minor potential for drainage capture.

Recommended Works – Overall

- Open windrows to minimise drainage capture/ponding.
- Ongoing cleaning and maintenance of waterbars.
- Upgrade wayfinding at N end.
- Continued bikes/mountain bikes exclusion enforcement.

Recommended Works – Site-specific (Priority)

Site ID: **MHT – 1(A)**

Location: 338562 6260439 Embedded rock/outcrop (slightly angled) and smaller embedded rocks beside Angophora, gap between rocks with drainage down to S, 2 timber (log) posts

Works:

Build waterbar above rock/outcrop.

Fill narrow gap/drain with rock, and match to existing levels.

(low)

Site ID: **MHT – 1(B)**

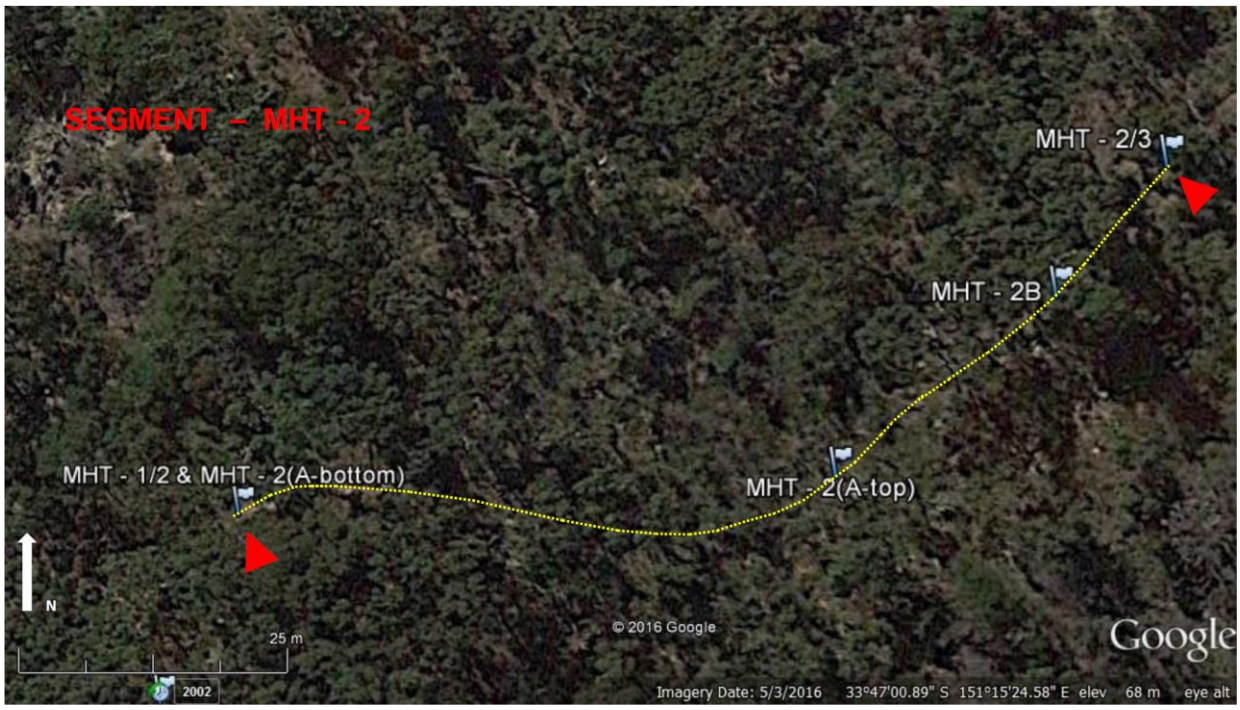
Location: 338568 6260452 Waterbar with burnt end, full/failed and flows over/through gap.

Works:

Replace/repair waterbar and clean out.

(low)

SEGMENT McCOMB HILL TRACK - 2



SEGMENT: MHT - 2	
Start Point: 338569 6260456	**End Point: 338645 6260486**

General Description and Condition: Very well-defined track (100m approx.) with multiple (+30) track treatments, gently curving up/down and across a slope low open Eucalypt woodland (open forest at lower end) with a sparse understorey. Good condition.

Tread Width (mm): Main wear path is 900-1600mm wide, within wider track treatments.

Track Surface: Compacted sand with laterite gravel as treads of step-and-runs/steps, some areas of loose sand (lower on segment), rock outrcops/ledges and minor rock pavement (in upper part of segment), occasional roots, drainage down track but limited scour/erosion.

Gradient (degrees): Gentle/moderate gradient, 5-7°, with short section to 9.5°.

Alignment: Sweeping curve across, and up/down, gentle/moderate side slope.

Terrain: Upper hillslope, saddle to knoll/crest.

Soil: Hawkesbury (Colluvial) on rugged, rolling to very steep hills on Hawkesbury Sandstone.

Vegetation: Bloodwood-Scribbly Gum Woodland (part of Sydney Coastal Dry Sclerophyll Forest).

Track Works and Improvements: Run of 28 wide (2.4m) sleeper step-and-runs and occasional steps (some boxed a few with stone end blocks) and 2 sleeper waterbars (1 with an old log step above on lower two-thirds of segment (Site MHT – 2(A). 4 wide (2.4m) sleeper steps and step-and-runs, and 2 sleeper waterbars, in upper third of segment. Numerous treatments boxed, or with stone end blocks (especially in upper third of segment). Most treatments are scorched or burnt in places, but still serviceable.

Signs and Wayfinding: Nil.

User Experience: Relatively easy walking (due to multiple track treatments) up/down hillside in pleasant low open woodland setting, grass trees add interest.

Key Issues: Potential for scour over and around sleeper steps/waterbars. Burnt sleeper track treatments. Track widening around steps/treatments.

Recommended Works – Overall

- On-going maintenance and cleaning of waterbars, steps/waterbars and other drainage treatments.
- Repair or replace burnt treatments, or section of treatments, as/when required.
- Monitor for scour over drainage treatments – with adaptive management/remediation as/if required.
- Monitor for track widening (step/treatment avoidance) – with adaptive management/remediation as/if required.

Recommended Works – Site-specific (Priority)

Site ID: MHT – 2(B)

Location: 338569 6260456 bottom
338620 6260461 top

Run of 28 wide (2.4m) sleeper step-and-runs and occasional steps (some boxed a few with stone end blocks), 2 sleeper waterbars (1 with an old log step above, in lower third of site), most timbers are scorched or burnt but still serviceable, compacted sand with laterite gravel, lower 7-8 step-and-runs are full of loose sand, occasional roots, 5° on lower section 9.5° in middle 7° on shorter upper section, middle and upper treatments still have some freeboard but drainage over all treatments (but no problems/scour), main track 900-1600mm wide within wider step-and-runs.

Works:

Clean out step-and-runs and waterbars (mainly lower section).

Repair/replace 4 burnt timbers - or just cut and replace burnt ends (or box ends, or install end blocking stones).

Extend waterbar and replace old log step with new waterbar above (at old log step/waterbar in lower third).

(low)

Site ID: MHT – 2(B)

Location: 338636 6260476 Rock shelf/ledge with embedded and broken rock, roots and gravel/stones below, 2 rock outcrops above with “natural” step in lower ledge, drainage down, track 800-1200mm wide (but indistinct over wide rock ledges angling across track) some track widening (especially in S).

Works:

Install waterbar above, with extended outlet to discharge beyond rock shelf/ledge and well off track.

Block/barrier (rock rubble) gap and drainage path beside upper ledge (over root beside Scribbly Gum).

Square-up step off upper ledge (cut step into, or build rock step onto, in-situ ledge), and rock armour landing below.

Use natural step off lower rock shelf/ledge, rock armour landing/tread below and level protruding rock.

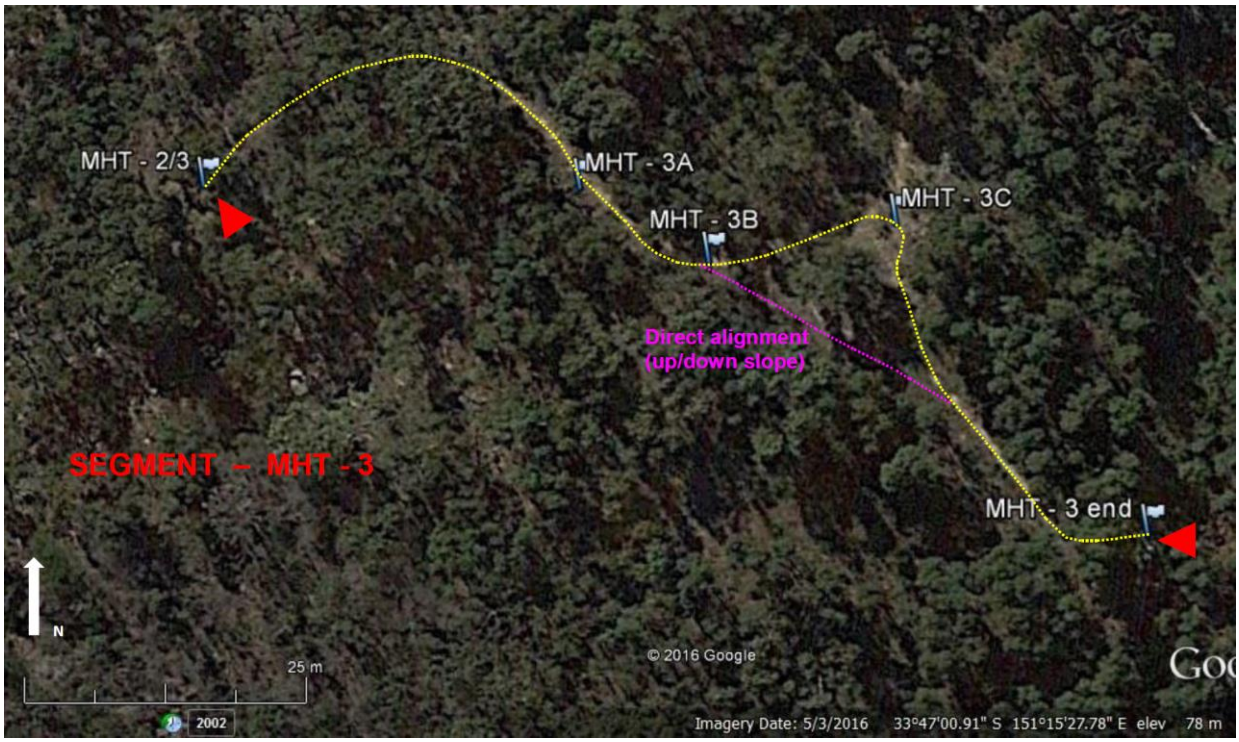
Block/barrier (rock rubble) below/SW of rock shelf/ledge to direct users onto flat rock outcrop along low side of rock shelf/ledge.

Build 2 boxed stone steps (lower one as a step-and-run) off lower flat rock outcrop leading to W with bend back onto track.

Block/barrier (rock rubble) higher direct route to S/SW and embedded rock area to W to direct users onto flat rock outcrop along low side of rock shelf/ledge.

(low)

SEGMENT McCOMB HILL TRACK - 3



SEGMENT: MHT - 3	
Start Point: 338645 6260486	**End Point: 338725 6260458 (at Trig Station)**

General Description and Condition: Very well-defined track (110m approx.) across and sharply up/down slope to hill summit, with some loose rocky sections and "loop" around small stand of trees on crest, through recovering open Eucalypt woodland with a grassy understorey. Fair/good condition.

Tread Width (mm): Mostly 900-1,200mm, widens up to 1.8m around "loop" on crest.

Track Surface: Mostly compacted sand with some sandy/clay on upper/E section with regular laterite gravels and embedded rocks, gently sloped rock outcrops with small ledges as "natural" steps on lower/W end, increasing embedded and broken rock on upper/W section (including minor areas of laterite capping). Drainage down track with only limited scour on lower (flatter) sections but up to 50-75mm deep on upper (steeper) sections.

Gradient (degrees): Gentle/moderate, 4-5° on lower/W section and to 6° on upper/E section.

Alignment: Gently curving across slope in W then more sharply up/down slope in E two-thirds, includes "loop" around small copse of Eucalypts on crest in E.

Terrain: Upper hillslope and crest.

Soil: Hawkesbury (Colluvial) on rugged, rolling to very steep hills on Hawkesbury Sandstone.

Vegetation: Bloodwood-Scribbly Gum Woodland (part of Sydney Coastal Dry Sclerophyll Forest).

Track Works and Improvements: 4 sleeper waterbars and 2 sleeper waterbars/steps, most full of sediment and failed with drainage flows over.

Signs and Wayfinding: Nil.

User Experience: Generally easy walking up/down hillside to Trig Station (feature of interest) at high point, some loose rocky track sections require care, filtered views to dam and Allambie Heights skyline from rock ledge beside lower/W end of segment. Distinct well-used trample track at E end (but quickly becoming overgrown and unclear), and multiple trample tracks, potentially confusing.

Key Issues: Multiple informal trample tracks and potential confusion for users – including distinct and well-used track to off "loop" on crest (Site MHT-(C)), short trample track to rock ledge off lower/W end, and multiple trample tracks off Trig Station at end of segment. Drainage flows over and around waterbars, and waterbar cleaning and maintenance. Drainage capture on slopes with potential for further erosion. Several informal uses, notably "cubby-houses" at E end.

Recommended Works – Overall

- Closure, disguising and rehabilitation of informal trample tracks (if not to be retained and managed as part of approved track network).
- Ongoing cleaning and maintenance of waterbars.
- Monitor drainage capture/erosion and track condition on rocky slopes – with adaptive management/remediation as/if required.
- Monitor for new track creation and informal uses beyond acceptable impact levels – with responsive/adaptive management as required.
- Signposting McComb Hill Track as a dead-end "there-and-back" route. Closure signposting on trample tracks (to avoid walker confusion).

Recommended Works – Site-specific (Priority)

Site ID: **MHT – 3A**

Location: 338678 6260486 Loose sandstone and laterite gravel on 6° slope, dished to 50-75mm BNSL with drainage flows, low laterite outcrop with lip in bottom third, embedded sandstone blocks as natural step but central gap with drainage flows through/down, low sandstone pavement/outcrop and sleeper waterbar (full/failed, with drainage flows over) at top.

Works:

Extend and clean-out existing waterbar.

Stone-lined invert below low sandstone pavement/outcrop (but above embedded sandstone blocks).

Rock armour infill gap embedded sandstone blocks and formalise/stabilise as stone step, level landing.

Build stone step off lower laterite outcrop and backfill to low laterite outcrop (tread at least 500mm long)

(low)

Site ID: **MHT – 3B**

Location: 338688 6260480 Compacted sand/clay and laterite gravel and embedded laterite rocks on 3.5° slope, drainage flows down track from "loop" on crest, dished track 900mm wide with mounds/windrows alongside track (especially to the N).

Works:

Build waterbar/step to catch and divert drainage flows down track from "loop" on crest upslope, cut discharge channel or extended outlet through mound to N (if required).

(low)

Site ID: **MHT – 3C**

Location: 338707 6260484 "Loop" track in crest around small copse of Eucalypts, 1-1.2m wide compacted sand and laterite gravels/stones, track to N side of tree is more heavily used, track to S of trees runs more directly up/down slope, sloped 4° down to W, "cubby-house" of sticks in centre of trees.

Distinct and well-used but unmanaged track to N off "loop", leads downslope to NE to wire mesh fence, then around corner of fence to exit at primary school, some use on W end of informal but track quickly becomes less distinct off crest and very little use once off hill (and especially after wire fence).

Works:

Close/block, disguise and rehabilitate S side of loop track (to S of trees) and install waterbar(s) to divert flows before running onto site/track downslope to W.

Close/block and disguise upper section of unmanaged track to N off "loop" (if not to be retained and managed as part of approved track network).

(Medium – for environmental/sustainability and user orientation/safety issues)

Site ID: **MHT – 3 (end) C**

Location: 338725 6260458 End of MHT at Trig Station, set in long grass and open spindly Eucalypts (fire regrowth) amongst sandstone boulders/outcrops. Track from "loop" (Site MHT-3(C)) of compacted and loose sand with laterite gravel, 600-700mm wide, up 1.5° slope. Multiple trample tracks away from Trig Station, with numerous clearings, "cubby-houses" and small fireplaces/fire-scars.

Works:

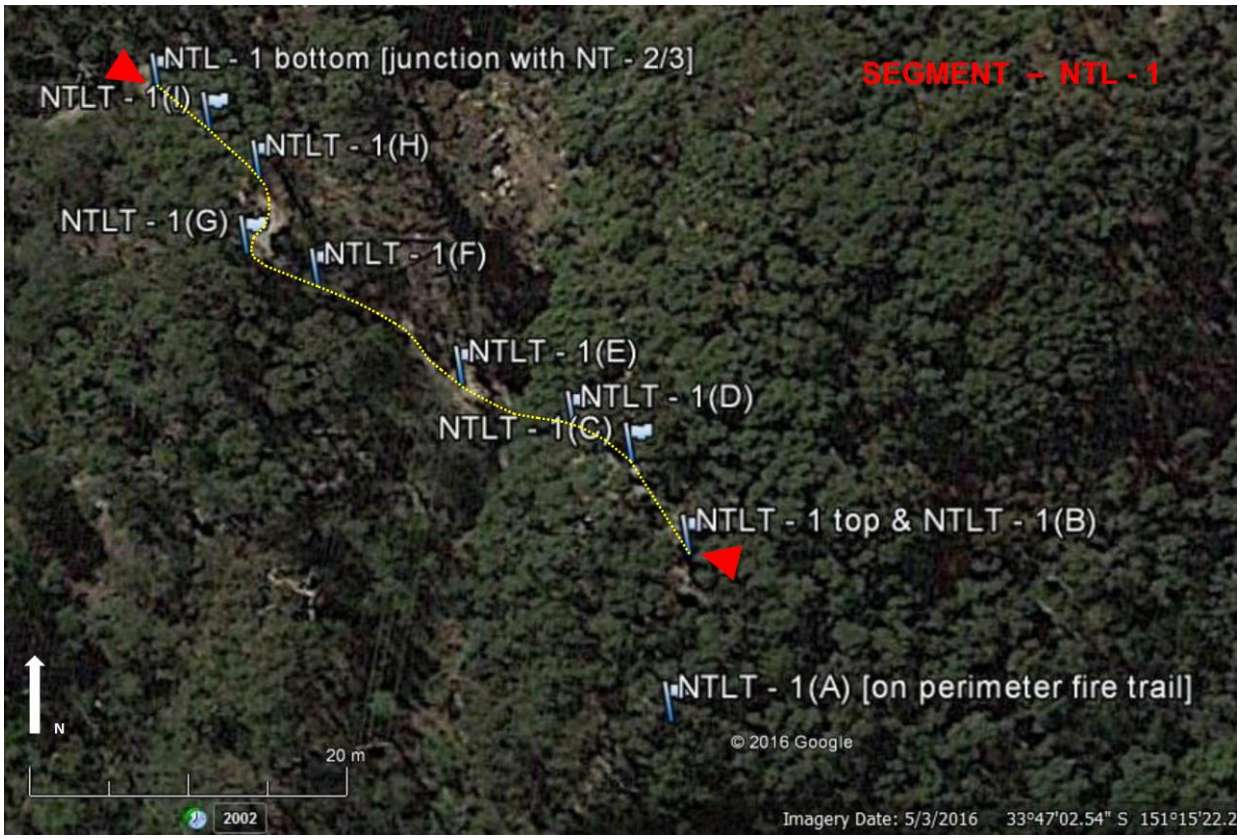
Close/block and disguise trample tracks away from Trig Station.

Monitor for new track creation and informal uses beyond acceptable impact levels with responsive/adaptive management as required).

(low)

NATURE TRAIL LINK TRACK - SEGMENT 1 ONLY

SEGMENT NTL - 1



SEGMENT: NTL – 1	
Start Point: 338538 6260410 **(Perimeter Fire Trail and Shared Path – top of segment)**	**End Point: 338501 6260440** **(junction with Nature Trail [NT-2 and NT-3] – bottom of segment)**
General Description and Condition: Short (55m approx.) section of wide rocky track, almost directly up/down a moderate slope between the Perimeter Fire Trail at top/E end and Nature Trail at bottom/W end. Numerous treatments, especially in lower half, but drainage capture, scour and safety issues. Fair condition only. Through open Angophora forest at top/E half with burnt understory, lower half is open Eucalypt woodland with a mixed shrub understorey. *Tread Width (mm):* Mostly very wide track – 1.8 to 2.8m. Minor sections 1,200-1,500mm wide. *Track Surface:* Large areas of sloping and angled rock outcrops or layered pavement, broken rock and loose rocks/gravels on slopes, minor flatter areas often covered by loose/deposited sand, minor areas of compacted and on lower/W end. Considerable drainage capture (including off Perimeter Fire Trail at top/E end), and continuing flows down track with scour to 350mm below NSL. *Gradient (degrees):* Predominantly moderate slope - 8° to 11°. *Alignment:* Almost directly up/down moderate rocky hillslope. *Terrain:* Mid/upper hillslope. *Soil:* Lambert (Erosional), undulating to rolling low hills on Hawkesbury Sandstone.	

Vegetation: Lower two-thirds of track is through Bloodwood-Scribbly Gum Woodland and upper third is Peppermint Angophora Forest (both are part of Sydney Coastal Dry Sclerophyll Forest).

Track Works and Improvements: Numerous track treatments – 10 sleeper steps, 4 sleeper waterbars, 1 pole waterbar, 1 log waterbar, and 1 stone step. All waterbars full of sediment and failed with drainage flows over and/or around.

Signs and Wayfinding: New signage/directional totem at junction with Perimeter Fire Trail at top/E end. Small routered timber sign "McComb Hill" with arrow E/upslope (up sleeper steps) and "Nature Trail" with arrow W along contour at junction with Nature Trail (at bottom/W end) , good condition. No other wayfinding signage en-route.

User Experience: Moderately challenging ascent/descent on a degraded, but short, section of track with some slip/trip hazards. Attractive views to dam, and Allambie Heights skyline, but power lines passing overhead (with vegetation trimming beneath) and burnt understorey are detracting elements.

Key Issues: Slip hazard on loose sand over sloped/angled rocks. Continued track widening and environmental impacts. Continued drainage capture and scour/deposition. Continued treatment failure. Evidence of regular mountain bike use. High maintenance section.

Recommended Works – Overall

- Remove/level protruding rocks and roots.
- Clean-out waterbars and steps, and maintenance/cleaning of drainage treatments.
- Address slip hazards – see recommended works for specific sites.
- Pull-in track width, block and provide edge definition and containment/barrier (rock rubble) where required.

- Monitor for scour over/around track treatments, stability of rock steps, and degrading rotting of timber waterbars/steps (replace as/if required) – with adaptive management/remediation as/if required.
- Monitor for track widening and step/treatment avoidance – with adaptive management/remediation as/if required.
- Continued mountain bikes exclusion and enforcement (consider "kissing gate", or stile, and wing fencing at a suitable "defensible" site on upper section of the segment near the Perimeter Fire Trail junction – see site NTL – 1(D)).
- Upgrade signage at bottom/W junction with Nature Trail, as per Manly Dam Sign Location Plan.

Recommended Works – Site-specific (Priority)

Site ID: **NTL – 1(A) (<u>Note</u> - on Perimeter Fire Trail 10M from top of NTL)**

Location: 338537 6260400 Located on the Perimeter Fire Trail 10m SW of junction (top) of NTL. Management trail.

Works:

Install "rollover" to redirect flows along fire trail (and from steep slope up to SW) off trail before junction with NTL, and reduce flows able to be captured/diverted onto walking track.

(Medium – for sustainability/impact issues [divert drainage before top of segment])

Site ID: **NTL – 1(B) (top of segment)**

Location: 338538 6260410 Junction with Perimeter Fire Trail and mountain bike circuit at top of segment, 4m wide splayed "fish-tail" junction (especially to N), track surface of embedded rock plus loose sand and gravel, considerable drainage down onto track from fire trail (from both directions), existing sleeper waterbar across part of track but large gap with flows around at N end (and discharges onto widened track). New signage/directional totem at junction.

Works:

Pull-in track width along N edge, block access with edge definition and containment/barrier (rock rubble).

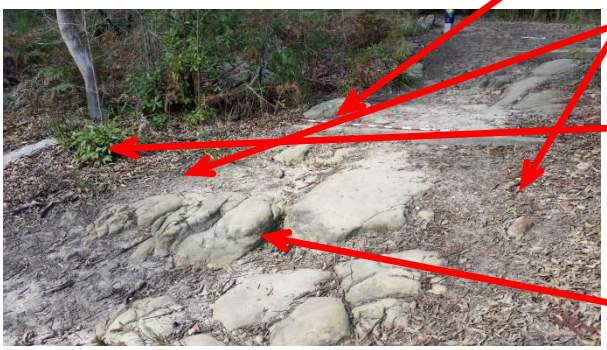
Install new extended waterbar 1m above existing waterbar, discharge to N north with extended outlet of cut channel well off track.

Relocate existing waterbar and extend to discharge well off track to N.

Level protruding rocks downslope of existing waterbar, rock armour to level/infill if required (as will be main route when track is pulled in).

Relocate new signage/directional totem if required (after track is pulled in).

(Medium – for sustainability/impact issues [divert drainage at top of segment], and passability of track downslope)



Site ID: **NTL – 1(C)**

Location: 338535 6260416 Sleeper waterbar (full of sediment and failed with drainage flows over) above squared/level rock outcrops, some loose rocks/sand, track to 2.4m wide.

Works:

Clean-out and extend waterbar to N (or install a new longer waterbar discharging to N).

Pull-in track width along both edges, block access with edge definition and containment/barrier (rock rubble).

Build a gutter paralleling N side of track (beyond rubble barrier) to direct discharge from waterbar, and flows off track, downslope towards outlet from stone-lined invert at next site (Site NTL-1(D)).

Rock armour infill to level uneven/broken areas of in-situ outcrops.

(Medium – for sustainability/impact and passability issues)

Site ID: **NTL – 1(D)**

Location: 338531 6260418 Flat deposition area of loose sand above sleeper waterbar, waterbar is partly rotted and has end rocks/blocks at each end but is full of sediment and failed with drainage over and scour below as well as drainage around S end, then sloping and angled rock outcrops (layered) downslope with compacted/loose and loose rocks/gravel to N, drainage flows down entire site, track to 2.8m wide.

Works:

Install large stone-lined invert on upper flat, with extended outlet discharging to N, into natural dip to NE (also pick up flows down trackside gutter from upslope site - Site NTL-1(C)).

Clean out waterbar and extend to S, to butt into slope and catch/divert drainage off slope and down S side of track. Replace waterbar if too rotted to re-use.

Build stone step onto sloped/angled outcrop and rock armour landing below, level outcrops to match/extend built/armoured treads.

Pull-in track width along both edges, block access with edge definition and containment/barrier (rock rubble).

Potential site for a “kissing gate”, with wing fencing extending either side of track (to physical barriers, such as slope to S or gully to N), to prevent/deter mountain bike access and use – site is “defendable location” that is visible from junction with Perimeter Fire Trail (to reinforce no bike access message) and reasonably flat (avoid a sloped or disguised site, as difficult for bikes to stop)

(Medium – for sustainability/impact and passability issues)

Site ID: **NTL – 1(E)**

Location: 338524 6260421 (midpoint)
14m section of track at 8° slope, angled and sloping rock outcrops (in 2 parts with long sleeper waterbar midway), sleeper waterbars also at top and bottom, all waterbars are full of sediment and failed with drainage over and some scour, loose sand alongside outcrops and on small flat/depositional areas above waterbars, loose sand and sloped/angled and uneven rock outcrops are a trip hazard, width narrows from 3m wide at top to 1.2m at bottom, track widening along S side (due to walkers avoid angled rocks and waterbars), drainage flows down entire site and track mostly 200mm below NSL, some embedded/broken rock on lower sides, power lines above.

Works:

Clean-out lower waterbar.

Reinstate/replace upper 2 waterbars and clean-out, extend S to catch/divert drainage down S side of track (if needed after narrowing).

Extend outlets on all waterbars to discharge well off track (lower waterbar discharges into natural dip to N of track).

Install post-and-rail fence along N side of track to prevent avoidance and track widening (also potentially connecting to wings fence at Site NTL-1(D) upslope).

Cut 7-8 wide steps or step-and-runs into angled ledges with extra rock infill/armouring if outcrop layers are unstable, and extend to N with rock armouring and matching stone steps. Pull-in track width along both edges, block access with edge definition and containment/barrier (rock rubble). (Alternative treatment if outcrop layers crumble or breakup - install boxed timber steps with tread of compacted rubble and fill [use rubble from removal of ledges as fill]).

(HIGH - for safety/passability and sustainability/impact issues)

Site ID: **NTL – 1(F)**

Location: 338514 6260427 Long pole waterbar full of sediment and failed with drainage flows and scoured/undercut downslope plus loose rocks. 2 sleeper steps/waterbars above. Treads of loose sand and gravel. Track 1.8-2.2m wide

Works:

Clean-out steps/waterbars.

Install stone-lined invert, with extended outlet discharging N/NW into in-situ dip (remove/open mound 5m N off track and block/mound on downslope side, to avoid backflows onto track and direct outflows into dip).

Reinstate pole waterbar and extend to S to butt into slope and catch/divert drainage off slope and down S side of track.

Pull in track width and block with edge definition and containment/barrier (rock rubble), and rock armour remaining/narrowed landing below pole waterbar.

(HIGH - for sustainability/impact issues [to divert flows before site downslope])

Site ID: **NTL – 1(G)**

Location: 338509 6260429 Large sloping angled rock outcrops/ledges, 1.5-2.6m wide with 9° slope, drainage gutter around S side with loose rocks/gravel and with erosion/scarp at bottom/SW 600mm high, loose sand over sloping angled rock layers present a slip hazard (most walkers use drainage gutter to S, but loose rocks and roots are a hazard here), wide boxed step below with loose/compacted sand treads, drainage down/over entire site.

Works:

Cut steps and treads into in-situ rock layers, with rock armour infill to build-on/level as necessary (7-8 steps, at least 1m wide).

Fill/block drainage gutter to south, build rock waterbar off S side of outcrop at/near top of gutter to divert drainage.

Adjust/rebuild lower boxed step, at least 1m wide, to align with new steps up/down rock outcrop (and monitor for requirement to rock armour tread/landing), pull in redundant track width and block/barrier (rock rubble).

(HIGH - for safety/passability issues)

Site ID: **NTL – 1(H)**

Location: 338509 6260434 Sleeper step/waterbar, loose sand above, full of sediment and failed with drainage over and some scour, deeply dished track downslope of step/waterbar to 250mm below NSL for 1.8-2m with surface of compacted sand and embedded rock 2.2-2.4 m wide.

Works:

Clean out step/waterbar.

Install a wide boxed step-and-run 1.2-1.5m below step/waterbar and fill/compact above/upslope over embedded rocks

Pull-in track width along both edges, block access with edge definition and containment/barrier (rock rubble).

(low)

Site ID: **NTL – 1(I)**

Location: 338505 6260438 Old rotted pole step/waterbar with placed stone step/flagging below, waterbar full of sediment and failed with drainage flows over, track scour to S to 350mm below NSL, loose sand and gravel plus , embedded rock to S, 2.2-2.4m wide.

Works:

Replace rotted pole with 1 or 2 sleeper step/waterbars.

Pull-in track width along both edges, block access with edge definition and containment/barrier (rock rubble).

(low)

Site ID: **Junction with Nature Trail (at Segments NT-2 and NT-3)**

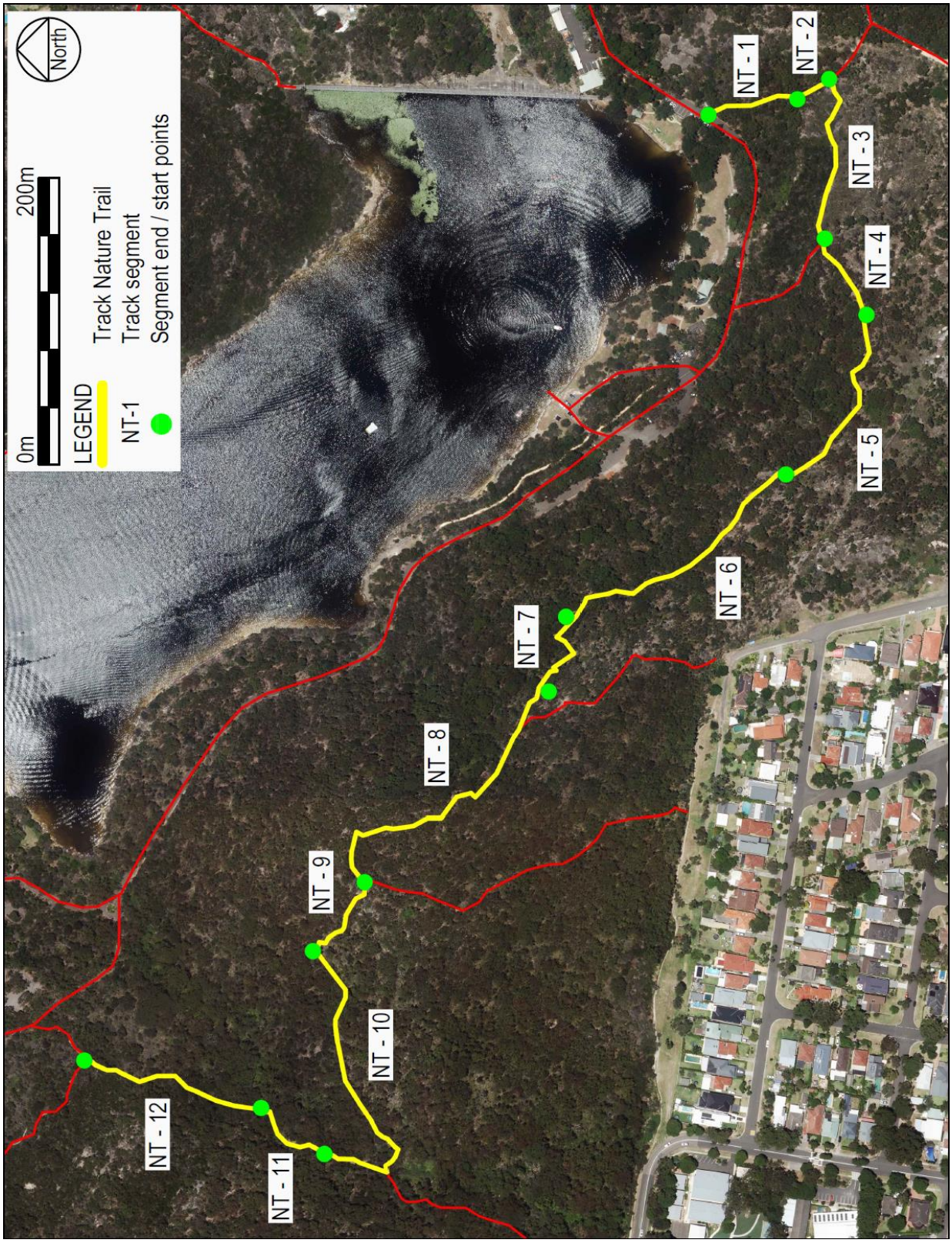
Location: 338501 6260440 Small routered timber sign “McComb Hill” with arrow E/upslope (up sleeper steps) and “Nature Trail” with arrow W along contour. Good condition.

Works:

Upgrade signage at junction of Nature Trail Link Track and Nature Trail, as per Manly Dam Sign Location Plan.

(Medium)

NATURE TRAIL – SEGMENTS 1 TO 12



SEGMENT NATURE TRAIL - 1

SEGMENT: NT - 1	
Start Point: 338476 6260524 **Nature Trail trackhead (East), at park access road (Sir Roden Cutler VC Memorial Drive)**	**End Point: 338487 6260462**
General Description and Condition: Short (65m approx.) section of broad well-defined track from a trackhead off the main park access road along a gentle, then gentle/moderate, slope on W side of a valley to the base of a rock ledge climb, through attractive open Eucalypt forest (with medium shrub storey to the W, but open burnt understorey to the E and powerlines upslope). Frequent and effective track treatments and new trackhead signage. Good condition. *Tread Width (mm):* Mostly 1,200-1,800mm, some sections narrow to 900mm while others widen to 2,400mm. *Track Surface:* Mix of loose/deposited sand on lower sections and compacted sand on upper section, areas of loose and embedded laterite gravel. Slightly dished in places. Drainage down much of track surface, but few erosion issues due to regular treatments.	

Gradient (degrees): Flat to gently sloped on lower section, but mostly gentle/moderate gradient (5-8.5°).

Alignment: Mostly straight to very gently curving (at lower N end), and sharply aligned (angled across/perpendicular to contours) up/down lower slope.

Terrain: Lower hillslope.

Soil: Hawkesbury (Colluvial) – rugged, rolling to very steep hills on Hawkesbury Sandstone.

Vegetation: Peppermint Angophora Forest (part of Sydney Coastal Dry Sclerophyll Forest) with a very minor area of Sandstone Heath at lower/N end.

Track Works and Improvements: Extended run of sleeper steps (x 25, a few also boxed/edged on low side) and sleeper waterbars (x 9), as well as a log/pole waterbar (x 1) and an "edging" sleeper (x 1). All waterbars and steps are full of sediment (failed) with drainage flows over, but infrequent scour problems due to frequency and spacing of treatments. Some sleeper steps/waterbars are rotting in parts. (Older, closed and overgrown, track to SE at upper end – including old/burnt sign 6m off track. Old posts to W side of track in bush.)

Signs and Wayfinding: New tall metal sign/panel listing walking tracks on W side of dam (with map and orientation information), excellent condition (new), and log post with 2 pictograms ("walkers" and "no bikes"), good condition – both at N trackhead. Interpretive shelter in bay beside access road immediately NE of trackhead. Log post with larger "Dogs Prohibited" text and pictogram, facing upslope, 20m S of trackhead. No wayfinding en-route.

User Experience: Easy walking, with steady climb, through pleasant open forest on edge of (and within earshot of) developed/facilities area. Open/burnt understory, and views of powerlines overhead, to E detracts slightly form setting.

Key Issues: Drainage capture, potential for scour over and around timber waterbars/steps, walkers safety at N trackhead on a park access road.

Recommended Works – Overall

- Maintenance and cleaning of waterbars, waterbars/steps and other drainage treatments.
- Open windrows to minimise drainage capture/ponding.
- Monitor for scour over drainage treatments and rotting of timbers sleepers (replace as/if required) – with adaptive management/remediation as/if required.
- Monitor for visitor safety at N trackhead adjacent to park access road (install additional measures – signage, chicanes, gate [inwards/S opening] – as/if required).
- Retain a "capability filter" at, or just inside, N trackhead – see site NT – 1(B).

Recommended Works – Site-specific (Priority)

Site ID: **NT – 1(A)**

Location: 338476 6260524 Eastern entry to Nature Trail, at park access road (Sir Roden Cutler VC Memorial Drive) opposite war memorial, old log/pole step retaining loose sand tread above, but rotting/broken and trip hazard beside road.

Works:

Replace steps and pull back from road edge.

(Medium – safety issue, trip hazard at road edge)

Site ID: **NT – 1(B)**

Location: 338480 6260517 Sloped rock outcrop with broken/embedded rock below, uneven outcrop with gravel above, slightly scoured sleeper steps below, 900-1200mm wide, 9° slope.

Works:

No works proposed. Leave as is - as a "filter" so track will not be appealing to less capable/mobile walkers or poorly prepared (e.g. wrong footwear)

(low)

Site ID: **NT – 1(C)**

Location: 338484 6260510 Sleeper step (300mm high), scour over and around W end, entrenched 100mm below NSL below.

Works:

Extend sleeper step to west (or replace), and clean out.

New sleeper step below existing, fill and compact tread above/behind (fill can be delivered to site from nearby park access road, to S).

(low)

Site ID: **NT – 1(D)**

Location: 338481 6260506 Sleeper waterbar with flow/scour and around west end (just downslope of "Dogs Prohibited" sign).

Works:

Extend waterbar.

(low)

Site ID: **NT – 1(E)**

Location: 338481 6260499 Sleeper waterbar, full/failed with scour over and 400mm step off, track dished to 150mm below NSL downslope/below.)

Works:

Clean out waterbar.

New sleeper step below existing, fill and compact tread above/behind (fill can be delivered via park access road, to S).

(low)

Site ID: **NT – 1(F)**

Location: 338483 6260492 Sleeper waterbar, full/failed with scour over and 250-300mm step off to dished/eroded track surface of compacted sandy clay with laterite gravels (eroded to 150mm below NSL), sleeper set along high/W side of track.

Works:

Clean out waterbar.

New sleeper step between low end of waterbar and trackside sleeper, fill and compact tread above/behind (fill can be delivered to site from nearby park access road, to S).

(low)

Site ID: **NT – 1(G)**

Location: 338488 6260476 Sleeper step (also acting as a waterbar). Wide sleeper step with rotten underside downslope/below. Short sleeper step downslope/below with scour around W end.

Works:

Clean out upper step, extend or replace as sleeper waterbar (discharging to W).

Replace rotting (middle) sleeper step, and clean out.

Extend (or replace) lower sleeper step, and clean out.

(low)

Site ID: **NT – 1(H)**

Location: 338486 6260464 Sleeper step, full and failed with scour over and 250mm step off, sleeper step full and failed 1400mm downslope/below.

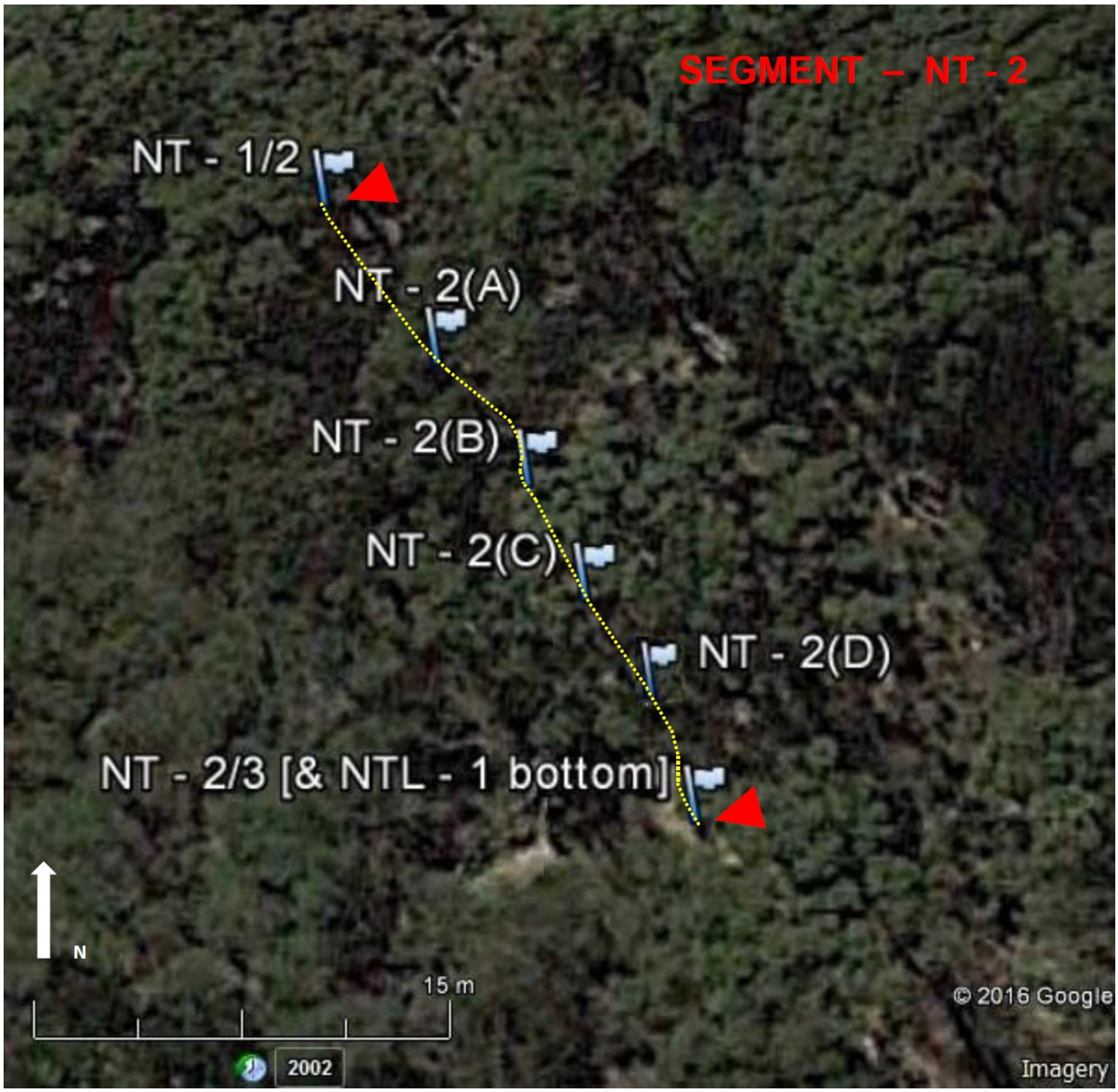
Works:

Rock armour/flagging on step off upper step.

Replace/reinstall lower step as a waterbar (discharging to W).

(low)

SEGMENT NATURE TRAIL - 2



SEGMENT: NT - 2	
Start Point: 338487 6260462	**End Point: 338501 6260440** **Junction with Nature Trail Link Track**
General Description and Condition: Short (35m approx.) steep section of track up/down a rock ledge (below) and rocky slope (above) almost entirely on rock outcrops, with numerous stone steps and a built rock wall near the upper/S end (where the Nature Trail Link Track joins from the SE upslope, and Nature Trail bends 90° to W/SW as Segment NT-3). Drainage flows down almost the entire segment, with several erosion/scour issues. . Through attractive open Eucalypt forest (with medium shrub storey to the W, but open burnt understorey to the E and powerlines upslope). Fair condition only, and some potential user hazards. *Tread Width (mm):* 350-1500mm, varies between narrow stone steps and wider rock outcrops.	

Track Surface: Predominantly rock ledge, outcrops and pavement as well as built stone steps, with minor sand/clay areas at upper/S end. Drainage down most of track, with scour in softer substrate and flows down/over stone treatments.

Gradient (degrees): Steep (to 18°) on rock ledge and steps, moderate slopes (to 12°) elsewhere.

Alignment: Angled up/down rock ledge on lower half, and sharply aligned (angled across/perpendicular to contours) up/down rocky slope on upper half.

Terrain: Break in slope (rock ledge) between lower and midslopes.

Soil: Lambert (Erosional) – undulating to rolling low hills on Hawkesbury Sandstone.

Vegetation: Sandstone Heath.

Track Works and Improvements: Run of 12 stone steps on rock ledge, with 4 sleeper steps above. Sleeper step, 2 older log steps (1 as a split pair), and 5 rock steps up/onto a built stone wall, with log waterbar above, in upper/S half.

Signs and Wayfinding: Nil

User Experience: Short steep climb/descent over rock ledge, slightly challenging for less experienced/capable walker, but assisted by stone steps, Narrow steps, slippery (if or wet with a sand film) surfaces of rounded rock outcrops, and partially obscured rock wall/drop (from above) may be a hazard for some users. Pleasant open forest setting, near (within earshot of) developed/facilities area, but open/burnt understory to E and views of powerlines overhead, detracts slightly form setting.

Key Issues: Continued drainage capture and flows down track, potential for undercutting or destabilising rock steps and other improvements, potential user hazards, poor wayfinding at junction with Nature Trail Link Track at upper/S end

Recommended Works – Overall

- Maintenance and cleaning of waterbars, waterbars/steps and other drainage treatments.
- Monitor for stability of stone steps and surface slipperiness, especially where subject to continued drainage flows – with adaptive management/remediation as/if required.
- Monitor for scour over drainage treatments and rotting of timbers sleepers (replace as/if required) – with adaptive management/remediation as/if required.
- Upgrade signage at junction with Nature Trail Link Track at upper/S as per Manly Dam Sign Location Plan – see Segment NT-3 below.

Recommended Works – Site-specific (Priority)

Site ID: **NT – 2(A)**

Location: 338491 6260456 Run of 12 stone steps, 350-950mm wide (paired rocks towards bottom, narrower to top), down side of steep sloped rock ledge with boulders to east, 2.8m total level difference, 18° slope, drainage down rock face to W of steps flows onto lowest 4 steps (with some scouring around rock steps, but stable) then flows down track (into next segment – NT-1), flatter uneven area at top (with 90° turn to W off top step, at flatter top of ledge).

Works:

Infill stonework around scoured steps and inset rocks at bottom, with additional blocks or rubble barrier to define W edge and keep walkers on stone steps.

Monitor 2x largest steps at base of ledge for undercutting or instability (located in run-on zone for drainage flows down rock face).

Cut/level tread on top of rock ledge bedside/W of top step (to provide a safe "landing" and approach for walkers heading down, especially if wet/slippery).

Install low rock wall along top of ledge – from boulder upslope to N/NW (past the *Lomandra*) to catch/divert flows and seepage into existing crevice down face of rock ledge to W (and away from track/steps).

(Medium – for passability/safety issues)

Site ID: **NT – 2(B)**

Location: 338495 6260452 4 sleeper steps between outcrops/boulders (at top of site NT – 2A), 550-1500mm wide, drainage flows down/over steps with scouring in loose sand, 400mm high step off bottom step, second step from top is rotting (boxed on E side and loose sand in tread above).

Works:

Rock armour/flagging on all treads (to protect against continued flows down/over).

Replace rotting sleeper step.

Install additional boxed step off lower step, built onto top of rock ledge below, fill and rock armour/flagged tread.

(Medium – for passability/safety issues)

Site ID: **NT –2(C)**

Location: 338497 6260448 Long sloped/rounded rock outcrop/pavement, loose slippery sand on rock/track, drainage flows down E side with scour into flanking clay/sand and stones, sleeper step at top, drainage pools in dip and loose sand below on E side (with placed rock) then flows back onto track, 900-1200mm wide, 6.5m at 9° slope, 1.2m total level difference. Sleeper step above.

Works:

Level tread on step off/below timber step at top (required to provide stable footing in area of drainage flows across track/outcrop from W).

Cut 2-3 step-and-runs, or level treads, into upper end of outcrop/pavement.

Cut 3-4 steps into low end of rounded outcrop/pavement.

Cut back adjacent clay/sand along E side of rounded outcrop/pavement, and used rock armour/flagging to make “V” profiled side drain.

Waterbar off NE lower corner of rounded outcrop/pavement, and bottom of V- drain, discharging to NE.

(Medium – for passability and sustainability/impact issues)

Site ID: **NT – 2(D)**

Location: 338450 6260445

Bottom to top:

- sleeper step, full and failed with flows/scour over E end, 300mm step off;
- log step (split pair), full and failed with scour around E end;
- short log step (split/pair), embedded rock to west, flows/scour around both ends;
- 5 rock steps (600-1400mm wide) up/onto a built stone wall above (stone wall extends to NW), third step is narrow only 200mm wide, second step (from top) is an old concrete slab, top step has hump in centre, total step height of 1.2m, drainage flows over/down steps, steps are off-centre from track above (safety issue);
- drop off stone wall to east of steps is over 1m (safety issue);
- log waterbar along top of stone wall (and above steps) (trip hazard, safety issue), waterbar is full of sediment (and grassed on W end), discharges to NW.

Works:

Rock armour/flagging below lowest sleeper step.

Replace split/pair log step with 2 stone steps, fill and level above with rock armour/flagging with fall to E, include stone-lined invert discharging to E (cut outlet channel through mound beside track to E) (rock armour/flagging needed to protect against continued flows down/over).

Replace short log step with boxed stone step, built onto in-situ outcrop, rock armour/flagging on tread to bottom step above/upslope.

Level tread on existing top stone step (cut level or infill flagging) to minimise trip hazard, and level hump at rear of fourth step.

Clean out log waterbar above steps (and wall) and extend to NW, so discharge doesn't backflow onto track below wall.

Realign track above/approaching stone steps (and wall) to meet steps square-on, barrier/block (rock rubble) alignment to E to direct walkers away from wall/drop and onto steps.

New/additional waterbar at least 1m above top of steps (and wall), with extended discharge to NW to prevent backflow to track.

(HIGH - for safety/passability and sustainability/impact issues)

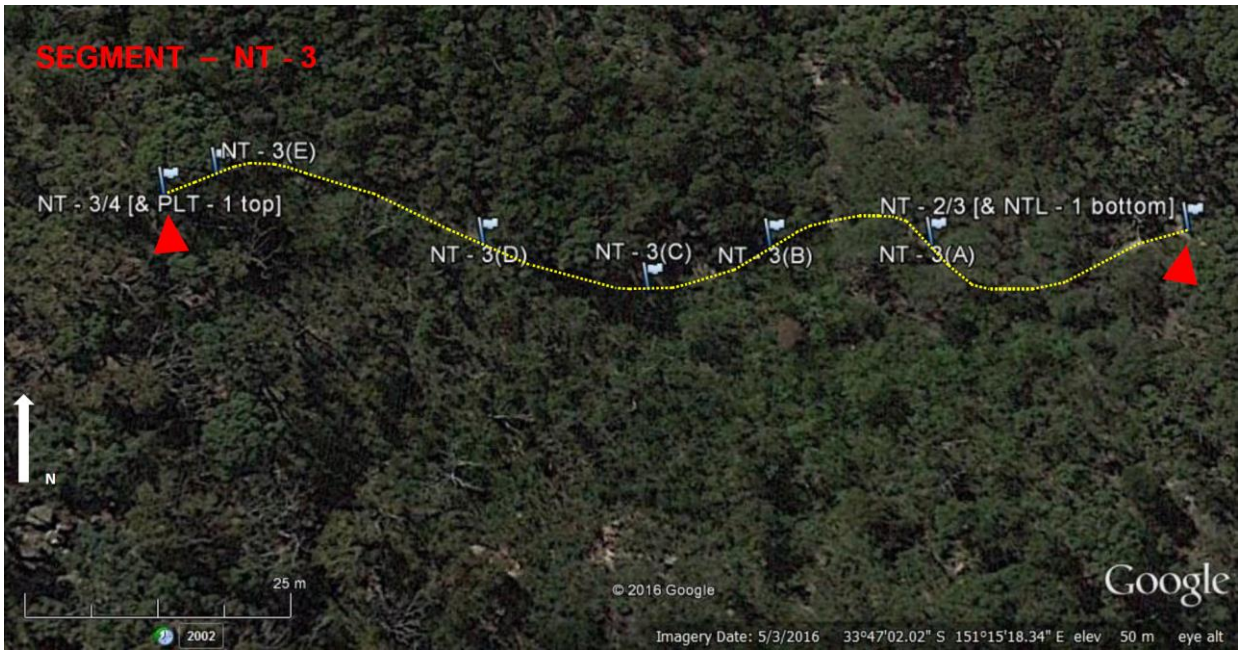
Site ID: Junction with Nature Trail Link Track (from SE upslope), and Nature Trail turns 90° to W/SW as Segment NT-3)

Location: 338501 6260440

Works:

See Segment NT-3 below.

SEGMENT NATURE TRAIL - 3



SEGMENT: NT - 3	
Start Point: 338501 6260440 **Junction with Nature Trail Link Track**	**End Point: 338390 6260443** **Junction with Picnic Area Link Track**

General Description and Condition: Well defined track (125 m approx.) mostly gently undulating across slope along contour, with short section up/down rock outcrop/pavement near E end. Areas of rock pavements (mainly in E) and several ponding/wet areas (mainly in centre) with temporary/informal treatments. Mixed low Banksia heath upslope with occasional Eucalypt and previously burnt areas, tall heath and scattered Eucalypts downslope. Generally good condition, but ponding /wet areas are fair condition only.

Tread Width (mm): Mostly 600-800mm, widening to 1200-1500m at obstacles or up to 1,900mm where walkers avoid ponding/wet areas.

Track Surface: Mostly compacted sand, moist in ponding/seepage areas, gently dished to 50-75 mm in places. Angled/uneven rock pavements and large/flat outcrops on upper E end and slope (site NT-3(A)), occasional protruding lip/edge to outcrops and pavement (especially at E end). Three ponding seepage wet areas (14m, 3m and 4m long) in centre, and seepage over rock outcrops/pavement in places. Occasional rock outcrops, roots and areas of laterite gravel (towards W end).

Gradient (degrees): Mainly gentle gradients, <1-3° to 4° in places, with dips/low points (ponding/seepage areas). Short steeper section 8-12° over rock outcrop/pavement in E.

Alignment: Gently curving alignment across slope, mostly undulating along contour.

Terrain: Mid hillslope.

Soil: Hawkesbury (Colluvial) – rugged, rolling to very steep hills on Hawkesbury Sandstone.

Vegetation: Mostly sandstone heath with area of Bloodwood-Scribbly Gum Woodland (part of Sydney Coastal Dry Sclerophyll Forest) at W end.

Track Works and Improvements: Run of 4 wide boxed timber steps (good condition, with some imported fill in treads). Several loose planks (and lain branches) as ad hoc/informal wet area crossings.

Signs and Wayfinding: Small routered timber track identification and directional sign at junction with Nature Trail Link Track at E end, good condition. Small old style interpretation panel (x 1) en-route, fair condition only. Small routered timber track identification and directional sign at junction with Picnic Area Link Track at W end, dislodged (leaning against tree stump) and poor condition.

User Experience: Easy walking in average quality bushland, but compromised in places by wet track sections.

Key Issues: Drainage and seepage capture with wet areas for long periods after rain, track widening to avoid wet areas, informal track works by user at wet areas, minor trip hazards on protruding rock lips/edges.




Recommended Works – Overall

- Open windrows to minimise drainage/seepage capture and ponding.
- Remove of level lips/edges of protruding embedded rocks and rock pavements.
- Monitor for need for additional treatments – such as low level boardwalks or high side "catch drain" or low rock walls – if track sections are still wet/muddy.
- Monitoring and responsive management for track widening, especially at ponding areas and other obstacles/challenges.
- Upgrade signage at junction with Nature Trail Link Track at E end, and at Picnic Area Link Track at W end, as per Manly Dam Sign Location Plan.

Recommended Works – Site-specific (Priority)

***Site ID: Junction with Nature Trail Link Track (from SE upslope), and Nature Trail turns 90° to N/NW downslope as Segment NT-2*)**

Location: 338501 6260440 Small routered timber sign "McComb Hill" with arrow E/upslope (up sleeper steps) and "Nature Trail" with arrow W along contour. Good condition.

Works:

Upgrade signage at junction with Nature Trail Link Track at upper/S as per Manly Dam Sign Location Plan.

(Medium)

***Site ID:* NT – 3(A)**

Location: 338475 6260438 (centre)

Sloped rock outcrop/ledge with crevices and angled boulders in lower half, 19m long 12° slope overall (6m above middle boulders is steepest), placed flat rock as step at a "natural" step/ledge midway on outcrop on NE side (but obstructed by shrub/branch), small sand/soil flat behind boulders.

Works:

Cut 3-4 level treads (at least 700mm wide) on centreline of upper rock outcrop.

Cut step (on centreline) into lower edge of upper outcrop.

Rock armour/flagging in gap above/behind midway boulders (to protect against continued flows down/over).

Block/barrier (with rubble or fill) on SW side of middle boulders/gap to define the preferred centreline alignment.

Level top of angled central boulder.

Square-off lower edge of angled central boulder, relocate placed rock step to below central boulder, and build extra rock step off.

Block/barrier (with rubble or fill) to NE to define route.

Low rock wall to extend/block natural gutter across upper outcrop and direct drainage off outcrop away from track towards the N/NE.

(low)

Site ID: **NT – 3(B)**

Location: 338457 6260438 14m long seepage/ponding area 1-1.5m wide, compacted moist sand track loose sleeper and laid branches, also receives runoff from rock outcrop to E (site NT-3(A)). Timber plank and laid branches as ad hoc/informal treatments.

Works:

Open low side windrows at all ponding sites.

Waterbar at E end, built onto bottom edge of rock outcrop to E (site NT-3(A)), with extended outlet to NW to discharge well off track.

Install large flat stepping stones at E (wetter) and for 7m, define and barrier/block edges of track (with rock rubble or similar) to prevent avoidance/widening. Monitor for effectiveness of stepping stones (subsidence, avoidance, etc.) and need for alternative treatment (low level boardwalk or high side "catch drain", or low rock walls, to channelise flow across track).

Monitor western 7m for need to install stepping stones (or alternative treatments).

(low, and monitor)

Site ID: **NT –3(C)**

Location: 338444 6260433 1-1.2m wide compacted moist sand track, ponding area with seepage and cross flows, 3m long, timber plank as ad hoc/informal treatment.

Works:

Install wide shallow stone lined invert with central flat step stone, drain to NE downslope (high side "catch drain", or low stone wall, may also be needed to channelise flow).

(low)

Site ID: **NT – 3(D)**

Location: 338427 6260438 Seepage and cross flow, 4m long ponding area and wet/muddy sand track between two flat rock outcrops, loose plank on track as ad hoc/informal treatment, track widening due to avoidance out to 1.9m.

Works:

Install large flat stepping stones, define and barrier/block edges of track (with rock rubble or similar) to prevent avoidance/widening. Monitor for effectiveness of stepping stones (subsidence, avoidance, etc.) and need for alternative treatment (low level boardwalk or high side "catch drain", or low rock walls, to channelise flow across track).

(Medium – for sustainability/impact and passability issues)

Site ID: **NT – 3(E)**

Location: 338396 6260445 Dished track to 50mm deep, of compacted sand and gravel/rocks with remnant stump, on 4° gradient with drainage flows down.

Works:

Remove stump and backfill hole with similar material.

Install waterbar.

(low)

Site ID: Junction with Picnic Area Link Track (from N/NW downslope)

Location: 338390 6260443 Small routered timber sign for "Nature Trail", with "McComb Hill" and "Section 3" both with directional arrows. Dislodged (leaning against tree stump) and in poor condition.

Works:

Upgrade signage at junction as per Manly Dam Sign Location Plan.

(Medium)

SEGMENT NATURE TRAIL - 4

SEGMENT: NT - 4	
Start Point: 338390 6260443 **Junction with Picnic Area Link Track**	**End Point: 338337 6260414**

General Description and Condition: Short (70m approx.) section of well-defined track angling across a moderate rocky slope with considerable track treatments (mostly sleeper steps and step-and-runs, plus some stone steps). Track angles across up/down slope with shorter landings/benching between more sloping sections. Rock ledges besides central section of track, an incorporated into track in upper/W half. Open Eucalypt forest with open mixed understorey, and large rock ledges/cliffline upslope above track. Generally good condition, but sites only good/fair condition.

Tread Width (mm): Varies from 300mm on narrower rock steps to 1,400-1,600mm (at widest) on sleeper steps. Track narrows from E end/junction towards upper/W end

Track Surface: Compacted sand and gravels mainly on lower/E half, some loose (deposited) sand on lower sections/treads, and between rock outcrops in W. Some rounded gravel fill on lower treads near junction at E end. Occasional embedded rock and roots. Regular rock outcrops in upper/W half.

Gradient (degrees): Mostly moderate or gentle/moderate gradient (8.5-13°), short steeper sections (to 14° gradient) and several gentle sections (1.5-3° gradient) where the track "benches" across contours between longer sections angled up/down across slope.

Alignment: Mostly angled across up/down slope, with shorter landings/benching between more sloping sections.

Terrain: Mid hillslope.

Soil: Hawkesbury (Colluvial) – rugged, rolling to very steep hills on Hawkesbury Sandstone.

Vegetation: Bloodwood-Scribbly Gum Woodland (part of Sydney Coastal Dry Sclerophyll Forest).

Track Works and Improvements: Extended run of sleeper steps and step-and-runs on lower/E half (x 32, 16 of which area boxed on lower side) sleeper waterbars (x 2), edge/retaining sleepers on low side (x 2) and 8 rock steps (mostly on upper W half). Sleeper treatments all in good of good/fair condition (only 1 old/rotting), but all full of sediment and failed with drainage flows over (but no scours - due to frequency of treatments). Junction with Picnic Area Link Track, at E end, boxed by sleepers on high and low sides.

Signs and Wayfinding: Small routered timber track identification and directional sign at junction with Picnic Area Link Track at E end, dislodged (leaning against tree stump) and poor condition. Old post with metal directional arrows at E end. New "Gulgadya Muru" Aboriginal self-guided walk interpretive panel (x 1) at W end – good condition. Small old style interpretation panel (x 1) en-route, fair condition only.

User Experience: Relatively easy climb or decent, but care required on steeper/eroded sections with protruding roots and on narrow stone steps.

Key Issues: Potential for scour over and around sleeper steps/waterbars, drainage capture and flows down track.




Recommended Works – Overall

- Open windrows to minimise drainage and seepage capture/ponding.
- Clean-out steps and waterbars, and maintenance/cleaning of drainage treatments.
- Monitor for scour over drainage treatments and rotting of timber sleepers (replace as/if required) – with adaptive management/remediation as/if required.
- Remove protruding roots.
- Upgrade signage at junction with Picnic Area Link Track at W end, as per Manly Dam Sign Location Plan.

Recommended Works – Site-specific (Priority)

Site ID: Junction with Picnic Area Link Track (from N/NW downslope)

Location: 338390 6260443

Works:

See Segment NT-3 above.

Site ID: **NT – 4(A)**

Location: 338364 6260430 Exposed roots protruding to 250mm high on slope around boulder, drains down, 1.1m 8m total level difference over 4.5m, 14° gradient around tree/boulder with drainage flows down track

Works:

Waterbar above to discharge above boulder.

Install 6 boxed steps over roots on a curved alignment around tree, with filled and compacted treads

(Medium – for passability/safety issues)

Site ID: **NT – 4(B)**

Location: 338356 6260425 Upper - large square rock step and smaller rock step below cleft/funnel between rock ledges/outcrops. Lower - rounded rock step, with embedded rocks and sloped rock outcrop below.

Works:

Infill and level cleft between rock ledges with rock armour/flagging as a stable upper step or tread.

Replace rounded step with wider squared stone step.

Additional flat rock step at low end (relocate/re-use embedded rocks).

(low)

Site ID: **NT –4(C)**

Location: 338342 6260416 Stone step to high side of angled and irregular rock outcrop, track worn along high side/lip then off to placed flat rock at NW end beside grass tree (2.5m long).

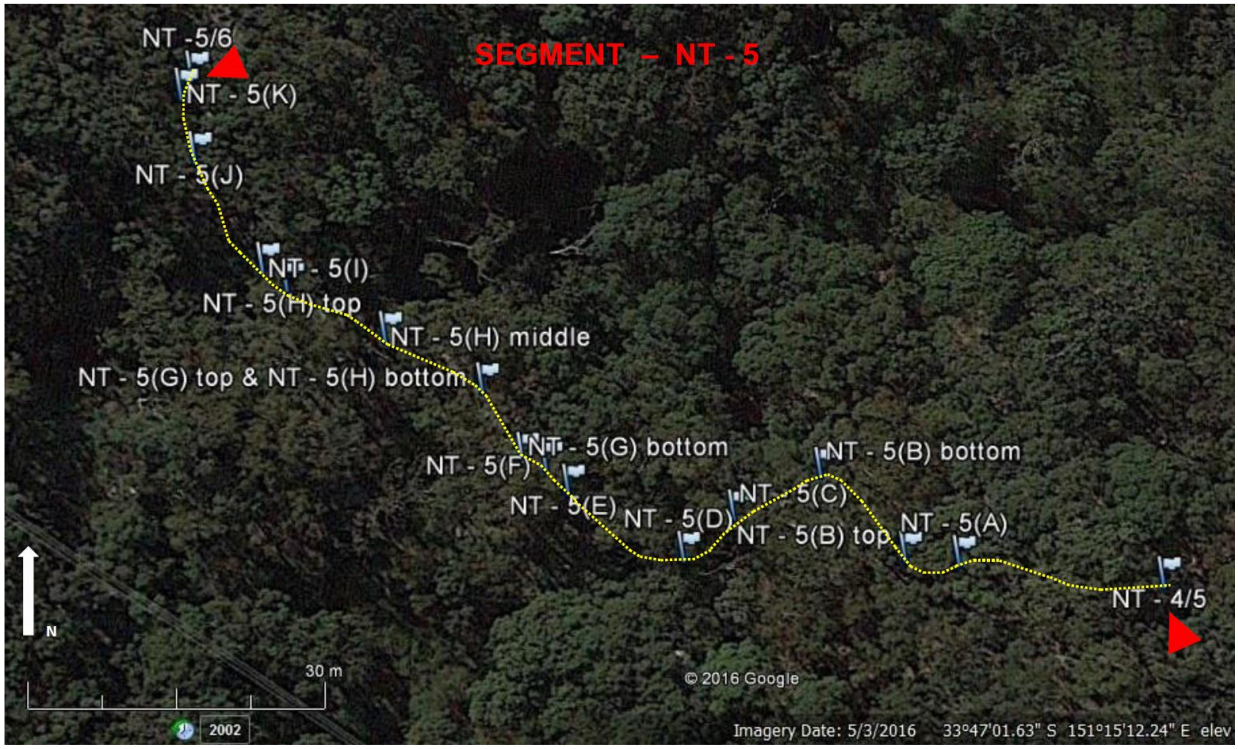
Works:

Cut upslope lip of outcrop to match/level with rock armour/flagging along worn footpad along high side of outcrop.

Rock infill gap and level outcrop beside grass (retain/save grass tree).

(low)

SEGMENT NATURE TRAIL - 5



SEGMENT: NT - 5	
Start Point: 338337 6260414	**End Point: 338226 6260470**

General Description and Condition: Short (130m approx.) section of mostly steep track angled sharply across (up/down) a moderate to steep rocky hillslope, crossing small drainage line in SE. Mostly poor to very poor condition NW of drainage line, and fair condition E of drainage line. Through open Eucalypt forest with a mixed medium understorey on moderate slope with numerous rocky outcrops.

Tread Width (mm): Mostly 600-1300, widening to 1500mm around obstacles or steps.

Track Surface: Predominately embedded and protruding rocks, roots and some loose rocks (hazards) in uneven compacted/eroded sand on steeper rocky slopes between rock ledges and benches – mainly NW of drainage line/bridge. Drainage flows down track, deeply scoured in places. Widening/detouring around obstacles or step avoidance. Compacted sand and embedded rock, benched high side to 200mm in parts, E of drainage line/bridge.

Gradient (degrees): Predominately moderate to steep (10° to 19° gradient), smaller areas of gentle to moderate slopes (to 4° to 6° gradient) mainly E of drainage line/bridge.

Alignment: Predominately a "kinked" alignment stepping up/down the moderate or steep rocky slope NW of drainage line/bridge with steep angled sloped section linking minor flatter runs, and winding alignment on lower slopes (mainly E of drainage line/bridge).

Terrain: Mid hillslope (moderate to steep, with small drainage line/valley)

Soil: Hawkesbury (Colluvial) – rugged, rolling to very steep hills on Hawkesbury Sandstone.

Vegetation: Bloodwood-Scribbly Gum Woodland east of drainage line/bridge, and Peppermint Angophora Forest on steep rocky slope NW of drainage line/bridge (both part of Sydney Coastal Dry Sclerophyll Forest).

Track Works and Improvements: Low timber bridge over drainage line (at 338273 6260419), good condition, 900mm wide with post/log railing on downstream side above 800 drop to

creekbed. Multiple other track treatments (most on the moderate or steep rocky slope NW of drainage line/bridge) – 35-40 rock steps, 3 boxed timber steps, 8 timber steps, 6 waterbars. Most in poor to very poor condition.

Signs and Wayfinding: Small old style interpretation panel (x 1) en-route, fair condition only. No wayfinding/directional signage.

User Experience: Moderately challenging ascent/descent on a degraded section of track. Glimpses to Allambie skyline through trees, within earshot of picnic areas and park access/circulation road.

Key Issues: Continued drainage capture, scour and treatment failure on steeper rocky section. Track widening and environmental impacts. High maintenance section. Few options for realignment on steep rocky slope NW of drainage line/bridge.




Recommended Works – Overall

- Remove/level protruding rocks and roots.
- Clean-out steps and waterbars, and maintenance/cleaning of drainage treatments.
- Open windrows to minimise drainage and seepage capture/ponding.
- Monitor for scour over/around track treatments, stability of rock steps, and degrading rotting of timber waterbars/steps (replace as/if required) – with adaptive management/remediation as/if required.
- Monitor for track widening and step/treatment avoidance – with adaptive management/remediation as/if required.

Recommended Works – Site-specific (Priority)

Site ID: **NT – 5(A)**

Location: 338314 6260416 Compacted sand/clay benched track, 1,000mm wide, embedded and protruding rocks, 4° gradient.

Works:

Install 2 boxed step-and-runs with filled and compacted treads, pull-in track width with edge definition and containment/barrier (rock rubble) and remove protruding rocks.

(low)

Site ID: **NT – 5(B)**

Location: 338308 6260417 top/SE
338298 620426 bottom/NW

19m track angled up/down rocky slope, 15-17° gradient, 600-1500mm wide, compacted sand with embedded and loose rocks. Drainage flows down track with scour to +300mm over/around obstacles. Top – 8-9 placed stone steps, upper 6 steps in fair condition, steps 7 and 8 poor, and 400mm drop off step 9 (at bottom). Middle - widened slope of embedded and protruding rocks and roots, to large boulder or rounded outcrop below with track/detour (and flows) around both sides, main track runs NE of boulder as benched/sloping track to 250mm wide. Bottom - placed sloping rock/flagging at top of rounded outcrop, track of compacted sand and embedded rocks curve below outcrop and then retained by fallen tree with step off.

Works:

Waterbar at top to catch/divert flows.

Extend/reinforce stone step 7 (pair), and build new stone step 8 between in-situ rocks with rock armoured/flagged level landing below.

Build stone step with armoured tread onto in-situ outcrop below last step (#9), remove root and install stone-lined invert (discharging to NE) with new stone step off low side of invert.

Build 3 boxed step-and-runs (stone preferably) with filled/compacted treads, with “wings” on outer side to prevent/divert flows down/around edge.

Pull-in track, barrier/block (rock rubble) inside of curve.

Stone-lined invert, below lower step, built onto upper corner of boulder/outcrop.

Build 3 boxed stone steps off/around low/NE side of boulder/outcrop, armour treads and landing off lower step (retain on outer/lower side as needed).

Build boxed step-and-run (stone preferably, or timber) with filled/compacted tread, with stone-lined invert below onto top of lower outcrop (to channel flows from upslope).

Pull-in track, and barrier/block (rock rubble).

Build 3 boxed stone steps off/around low/NE side of lower outcrop, remove retaining log and rock armour/flagging landing off last step.

(Medium – for sustainability/impact and passability issues)

Site ID: **NT – 5(C)**

Location: 338288 6260421 Old log waterbar part way across track. Root and embedded rock upslope.

Works:

Remove old log. Install new boxed step-and-run, fill upslope/behind to cover embedded rock and root.

(low)

Site ID: **NT – 5(D)**

Location: 338282 6260416 Embedded and protruding rocks at top of 9° gradient slope with 2 old/decayed sleeper steps (on SE approach to small timber bridge).

Works:

Build 2 boxed timber steps, with filled and compacted treads, at top cover/level over protruding rocks.

Build waterbar off in-situ rock on upper third. Level rocks to NE.

Replace rotten / decayed sleeper steps, angled to also serve as waterbars (to divert flows, and sediment, before end of timber bridge below).

(low – water/sediment diversion required to protect end of timber bridge from being buried and rotting)

Site ID: **NT – 5(E)**

Location: 338269 6260424 Embedded rock and compacted sand, boulders beside track, part of old sleeper, and roots, 4m long, 5° slope (on NW approach to small timber bridge).

Works:

Install stone-lined invert above rock step.

Build rock step at upper end, built on in-situ rock.

Build 2 step-and-runs with filled and compacted treads, boxed/edge to retain on downslope side.

(low)

Site ID: **NT – 5(F)**

Location: 338266 6260426 5m long section of embedded rocks and compacted sand track, 11° gradient, part of old sleeper, 2 boulders at top act as "natural" step with an old sleeper step (900mm total height)

Works:

Install stone-lined invert above rock steps.

Build 3 rock steps at top between and below boulders.

Build 2 steps then a run upslope/above with filled/compacted tread and boxed/edge to retain on downslope side over lower rocks.

(Medium - for sustainability/impact issues, to contain track widening)

Site ID: **NT – 5(G)**

Location: 338264 6260427 bottom
338258 6260435 top (and bottom of Site NT – 5(H))

Total 1.7m rise over 9.5m section of track, failed (and detoured) log waterbar at bottom, compacted sand and embedded rocks in middle, then failed rock steps of large placed rocks above (with some track widening/avoidance to lower side, boulders then rock ledge (400mm step off), drain flows down entre section.

Works:

Build 2 steps, then a step-and-run upslope/above for 2-2.5m long with filled/compacted tread and boxed/edge to retain on downslope side.

Pull-in track width, and barrier/block (rock rubble).

Rebuild 6 rock steps, rock armour all treads, and new stone-lined invert on extended tread in middle of steps.

Cut step into rock ledge at upper end (at least 700mm wide).

(Medium - for sustainability/impact issues, to contain track widening, and for passability issues)

Site ID: **NT – 5(H)**

Location: 338258 6260435 bottom (top of Site NT – 5(I))
338247 6260441 middle
338237 6260441 top

Bottom to top – rock ledge (top of Site NT – 5(I)); then compacted sand ledge for 6m at 2° gradient with protruding roots and embedded rocks, and drainage across, and displaced retaining logs downslope on low side; boulder at end and failed/displaced log waterbar; then 27m long section of track of rocky, loose and compacted sand and rubble, rising a total of 6m at 18° gradient steeply diagonally up/down slope with considerable flows down; ledge at 10m from top, angled/sloped boulder at bottom of next steeply sloped rocky section with 3 log waterbars in centre of slope (all failed, scour under to 400mm step off) then rock face/ledge along upslope side with minor rock platform below and paced rock steps a up/alongside rock face (some track widening/avoidance on downslope side); failed log waterbar at top then large roots from dead/cut tree retaining track as steps; embedded and loose rocks above to crest/top.

Works:

Install FRP boardwalk along lower ledge with handrail on downslope side.

Install FRP steps, step-run and landings for climb, steeply angled across and up/down slope – total rise of 5.5m of steps/step-and-runs requiring 50-60 treads, and potential anchor points onto rock ledges and large boulders. May need 8m of handrail on ledge 10m from the top (depending on final height of FRP structure.

Possible break in FRP steps at rock ledge 10m from top of slope, with 2 rock steps (at least 700mm wide) cut into ledge 10m from top (400-500mm wide) –.

Install at least 2 or 3 large stone-lined inverts (or large stone gutters, or stone walls) to divert flows off existing alignment and away from under FRP structure (mainly on upper two thirds of section).

Level upper approach/landing above FRP structure, remove protruding rock and roots.

(HIGH – for passability/safety and sustainability/impact issues)

Site ID: **NT – 5(I)**

Location: 338234 6260449 Gap between outcrop and sloping boulder, roots in gap, 300mm step off sloping boulder then embedded large rock/boulder with widening track, drainage flows across track.

Works:

Armour gap and level to match adjacent rocks and square.

Relocate embedded large rock/boulder to form informal rock step (with rocks upslope), rock armour landing as stone-lined invert to channel flows across track. Remove roots.

(Medium)

Site ID: **NT – 5(J)**

Location: 338226 6260461 Sloped rounded boulder with track widening around both sides, with drainage and sediment off track downslope. Embedded roots then log waterbar/step (full of sediment and failed) with compacted sand retained above, also retaining log along low side of track. 4 placed rock steps in small "chute" between rock ledge and boulders, 400mm drop off lowest step. Another step placed above boulder between ledges. Drainage down/over all rock steps, steps scoured but stable. 12m of track with 14° gradient overall.

Works:

Build 2 rock steps off low side of rounded boulder and level top as tread, cut/level wider tread on upslope side of boulder.

Pull-in track and block/barrier (with rock rubble) avoidance paths around each side of rounded boulder.

Install stone lined invert above (over or remove roots), and pull-in track and block/barrier (with rock rubble).

Remove logs and build step-and-run with extended tread upslope/above, box/retain tread on low side and rock armour/flag tread to prevent scouring from continued drainage from above (little chance to direct drainage way due to upslope gutter – Site NT – 5(K)).

Install extra stone step at base of existing bottom step.

Install stone-lined invert, with another stone step off low side, to direct drainage into gap between ledges/boulders (beside steps).

Monitor existing rock steps for stability.

(Medium)

Site ID: **NT – 5(K)**

Location: 338225 6260468 Gutter between two rock ledges.

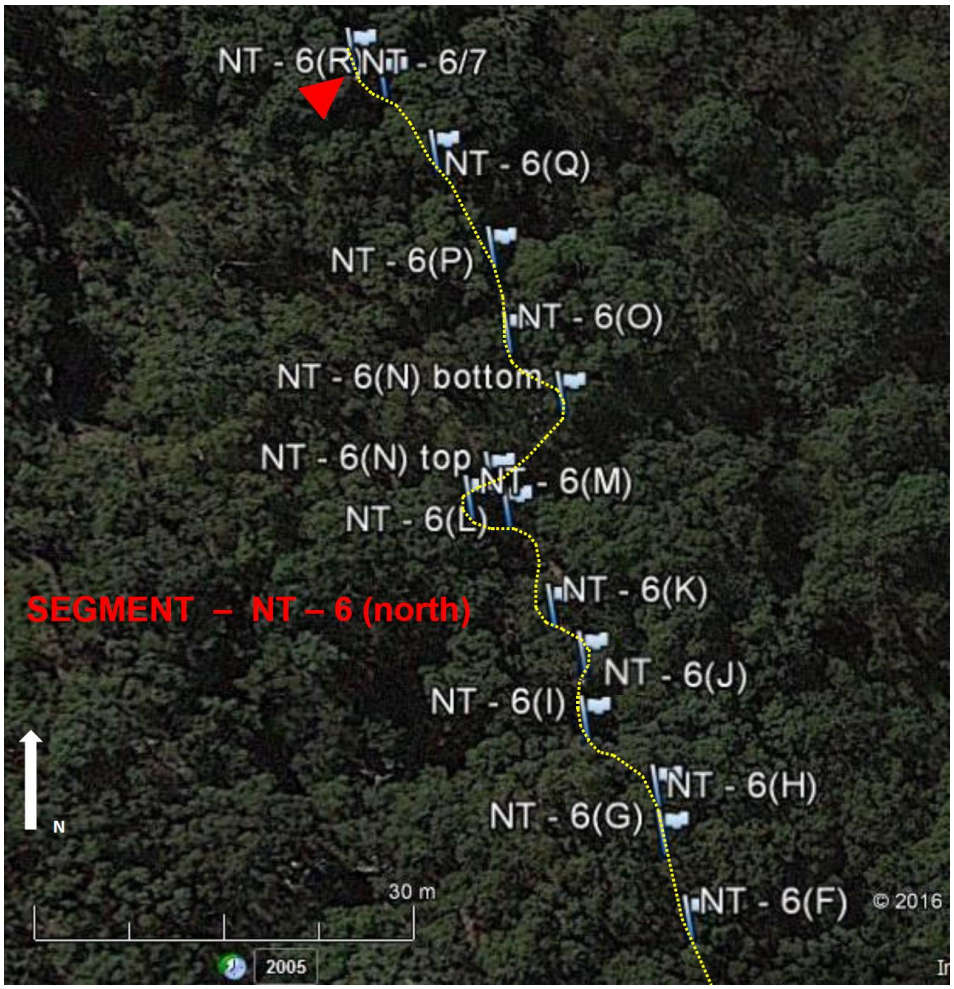
Works:

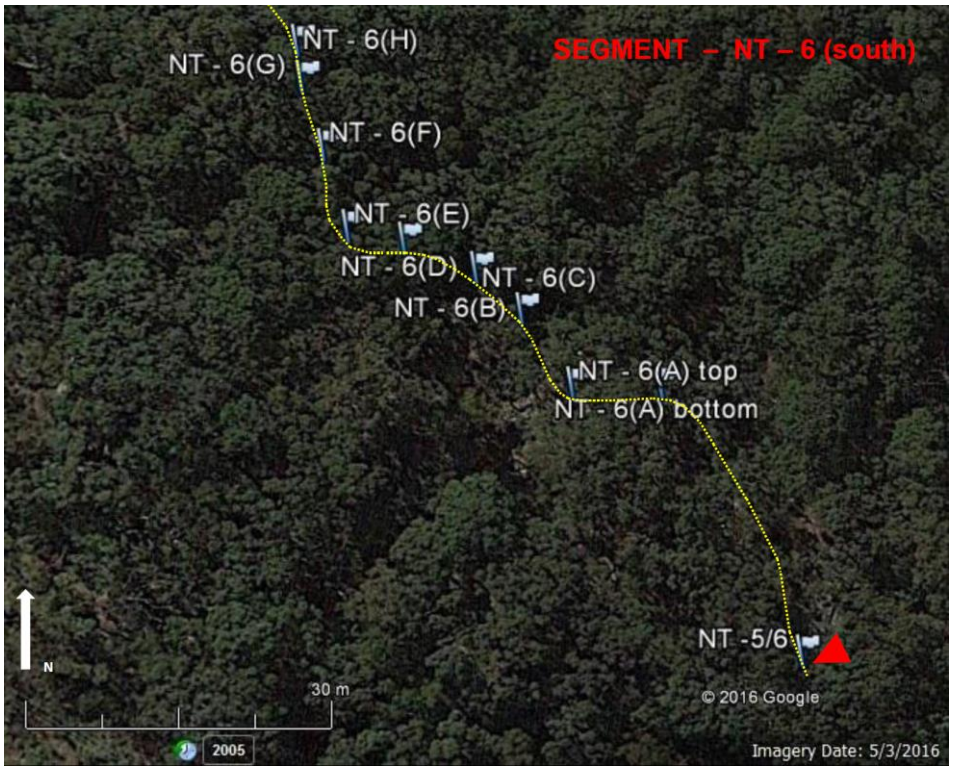
Cut/level tread up onto high side ledge at high point (at embedded rocks in gutter, before dip to SE).

Clear vegetation back to widen path along upper ledge, for 2.5-3m.

(low)

SEGMENT NATURE TRAIL - 6





SEGMENT: NT - 6	
Start Point: 338226 6260470	**End Point: 338127 6260623**

General Description and Condition: Well defined rocky track (170m approx.), mostly along contour but with several moderately sloped undulating sections, across mid-slope through open Eucalypt and Angophora forest with a medium understory downslope and an open understorey upslope, and below a line of rock ledges/cliffs upslope in places. Several short steep and eroded rocky sections. Few track treatments. Generally fair condition only.

Tread Width (mm): Mostly 600-1,00mm, but several sections of widening and braiding on steeper sections to 1,800mm.

Track Surface: Compacted sand and sandy/clay with very frequent embedded and protruding rock, rock outcrops and boulders, and regular rock ledges adjacent to track. Some rock pavement, mainly at S end. Regular loose rock and protruding roots, areas of dished track and frequent drainage capture (chiefly on more sloping sections). Benched to 400mm on upslope side of track in places, but more usually 100-200mm.

Gradient (degrees): Mostly gentle to gentle moderate slopes (1° to 5° gradients), with some short flat runs and some moderate slopes (mostly to 10° gradients) on short rocky slopes (and a few steep sections to 19° gradient over rock ledges).

Alignment: Mostly winding across slope, but with minor sharp curving sections up/down short steeper rocky slopes.

Terrain: Mid to upper hillslope.

Soil: Hawkesbury (Colluvial) – rugged, rolling to very steep hills on Hawkesbury Sandstone.

Vegetation: Bloodwood-Scribbly Gum Woodland (part of Sydney Coastal Dry Sclerophyll Forest).

Track Works and Improvements: Several placed rock steps on steeper sections (regularly avoided and widened/braided track), and occasional log waterbars (most full of sediment and failed, or only part-way across track).

Signs and Wayfinding: Occasional metal directional arrows on rocks. 4 older style small interpretation panels (poor condition).

User Experience: Pleasant walking through open forest with filtered views to the Allambie skyline/housing and dam, but requiring caution to watch footing on short steep and/or rocky section. Attractive boulders and rock overhangs along upslope side of track in places, and interesting line of rock ledges/cliffs upslope for part of segment.

Key Issues: Continued drainage capture and scour, and undercutting of rock steps. Unstable rocky sections. Track widening/braiding to avoid obstacles and steps, and associated environmental impacts. Moderate maintenance section. Major stormwater inflow from upslope drainage path, and informal dis-used track, at Sites NT - 6(A) and NT - 6(B).

Recommended Works – Overall

- Remove/level protruding rocks, roots and stumps.
- Remove loose rocks.
- Clean-out steps and waterbars, and maintenance/cleaning of drainage treatments.
- Monitor for scour over/around track treatments and stability of rock steps – with adaptive management/remediation as/if required.
- Monitor for track widening and step/treatment avoidance – with adaptive management/remediation as/if required.
- Open windrows to minimise drainage and seepage capture/ponding.

Recommended Works – Site-specific (Priority)

Site ID: **NT - 6(A)**

Location: 338197 6260503 15m, 12° gradient to crest, rock outcrops at bottom with widened/avoidance track low side, then 6 placed rock steps (to 400mm high, some sloped and worn) set among embedded rocks and compacted sand, retaining/protruding roots. Rock ledge adjacent on high side. Drainage down track, with some scouring. Inflows to track at crest from stormwater path and old/dis-used track from upslope (links to Bangaroo St), blocked by fallen/placed branches but considerable drainage onto track and eroded on high side to 500mm below NSL. Old interpretation panel at crest (poor condition). Protruding roots on eroded crest, informal rock step 1.5m beyond crest.

Works:

Cut/level tread in lower rock outcrop.

Pull-in track, barrier/block (rock rubble) low side to make outcrop and rock pavement/ledge the main alignment.

Stone-lined invert below tree, cut extended discharge outlet if needed.

Build 2 stone steps, anchor onto in-situ pavement/outcrop.

Extend rock outcrops, and repair existing stone steps (where stable), plus new stone steps (x 2) to give run of 7-8 stone steps up to crest, and armour all treads (to protect against continued drainage down/over).

Pull-in track, barrier/block (rock rubble) low side.

Remove protruding roots on crest, new stone step, and rock armour/flag track surface (to protect against continued drainage from upslope).

Square off and extended informal rock step over crest, remove protruding roots below.

Install rock wall between boulders/outcrops 8m upslope of track at crest, to redirect stormwater channel/flow to NW (to low point on track, Site NT – 6(B)), monitor for drainage overflow/breakout.

Disguise/rehabilitate informal track upslope.

(Medium – for sustainability/impact and passability issues)

Site ID: **NT - 6(B)**

Location: 338190 6260512 Low point with stormwater flows across track. Angled rock outcrop and protruding rocks with gap between on W side of dip, then old log waterbar halfway across track on uneven rock outcrops.

Works:

Rock armour a wide channel/invert at stormwater crossing point (will also receive redirected flows from works upslope of Site NT - 6(A)). Define/retain low edge of channel, to avoid undercutting.

Level angled outcrop and protruding rock and rock infill gap to match levels, as informal step.

Remove old log waterbar and level protruding/angular rock outcrops.

(Medium – for sustainability/impact and passability issues)

Site ID: **NT - 6(C)**

Location: 338185 6260518 Failed log waterbar at base of slope of compacted sand with embedded and protruding rocks, 11° gradient.

Works:

Replace waterbar.

2 new waterbars spaced up slope, built onto in-situ outcrops and larger embedded rocks. Remove protruding roots.

(low)

Site ID: **NT - 6(D)**

Location: 338176 6260521
Considerable embedded rock and outcrops/boulders in compacted sand, possibly 2 placed stone steps at upper end, some loose rock and protruding roots. Curved alignment, 9m long, 19° gradient, 1.9m total rise. Drainage down with scouring to 400mm below NSL.

Works:

Boxed step at bottom (retain along lower edge), fill compact tread.

Build 2 stone steps onto in-situ outcrops/boulders below tree and rock armour/flag tread above, barrier/block (rock rubble) outside of curve.

7 rock steps upslope of tree – 3 as extension/shaping of in-situ outcrops, and 4 new/built steps, rock armour treads.

Stone-lined invert on wider tread near upper end.

Build rock waterbar onto/between in-situ rocks at top of site, to divert flows from Site NT – 6(E) above.

Level top of large rounded boulder at top of site (to allow turn onto lower route at next Site NT – 6(E) above).

(Medium – for sustainability/impact and passability issues)

Site ID: **NT - 6(E)**

Location: 338170 6260522 6m of dual/parallel track, upslope alignment is rockier and less used, downslope alignment is on same level of preceding/downslope site with flatter surface and only minor embedded/protruding rock.

Works:

Block and disguise upper alignment.

Level/remove protruding rock on lower alignment.

(low)

Site ID: **NT - 6(F)**

Location: 338167 6260532 Embedded angled rocks on crest, track benched-in to 300mm below NSL on high side and boulder upslope.

Works:

Remove/level protruding rocks on crest.

Build informal rock step using in-situ outcrops, and rock waterbar or small gutter below.

(low)

Site ID: **NT - 6(G)**

Location: 338163 6260540 Large flat boulder sloping off low side of track, at top of 11.5° gradient slope, embedded and protruding rocks in compacted sand.

Works:

Build waterbar off high side of boulder.

(Medium - to divert flows before following Site NT - 6(G) and protect proposed downslope treatments)

Site ID: **NT - 6(H)**

Location: 338163 6260545 11.5° gradient slope of embedded and protruding rocks in compacted sand, some loose rocks, large rock ledge/shelf upslope beside track, large boulder midway with placed rock step on high side but track braids to low side w to 1700mm wide with drainage flows and scour.

Works:

Remove point of rock ledge/shelf at head height above track's preferred high alignment (possible hazard) for taller walkers.

Build waterbar off high side of large midway boulder, extend upslope to base of rock ledge/shelf collect drainage from both alignments.

Barrier/block (rock rubble) low side alignment and disguise (will also protect trackside Angophoras).

Build stone step-and-run below existing rock step, 1.5m long tread filled and compacted, built onto rock outcrop on high side and box/retain along low side, pull in track and barrier/block (rock rubble) low side below large midway boulder.

(Medium)

Site ID: **NT - 6(I)**

Location: 338155 6260552 Flat angled rock outcrop (attractive boulder and rock overhang upslope off track)

Works:

Build waterbar off high side of flat rock outcrop.

(Medium - to divert flows before following Site NT - 6(J) and protect proposed downslope treatments)

Site ID: **NT - 6(J)**

Location: 338153 6260558 Small rocky slope 5m long, 12° gradient, 800mm level change overall, 3 placed stone steps among embedded rocks and boulders high side and large angled outcrops low side, uppermost step is undercut, drainage down track with scour to 150mm below NSL. Old interpretation panel high side of track (poor condition).

Works:

Build waterbar off high side of uppermost angled outcrop.

Build additional stone step at top, anchored to in-situ large angled outcrop.

Reinforce, or replace, uppermost existing step and build additional stone step blow. Reinforce, or replace, existing 2 lower steps.

(Medium – for passability issues)

Site ID: **NT - 6(K)**

Location: 338151 6260563 Large Banksia root at top, then sloped rounded rock ledge (4.5m 600mm wide) with narrow footpad along low side, ledge steepens at NW end, curve downslope 16° gradient with 3 small boulders in compacted sand/clay with embedded rocks and 1 or 2 (?) placed rock steps (including brick waste), track braids/widens each side of small boulders, drainage down track with scour to 200mm below NSL, 10m and 10° gradient overall.

Works:

Rock armour/flagging on footpad on low side of rock ledge (to match level of ledge), and clear rocks from high side of ledge.

Cut a broad shallow cross drain at NW end of rock ledge (above steeper section, at existing drainage crossing point) with stone-lined invert as extended outflow channel.

Cut/level 3-4 treads into NW half of rock ledge, more closely spaced on steeper end.

Reposition outcrops/boulders incorporate into 6 new stone steps, with armoured treads (to protect against continued drainage from upslope), block/barrier sides and/or offset alternate steps to break up flows down side and reduce scour risk.

Pull in track and barrier/block (rock rubble), especially outside of curve on low side.

(Medium – for sustainability/impact and passability issues)

Site ID: **NT - 6(L)**

Location: 338146 6260574 9° gradient over 5m, failed log waterbar at bottom, 2 placed stone steps and “natural” step on rock outcrop, loose/placed rocks and embedded rocks at top, flows down track but little scour, 2 large boulders high side.

Works:

New stone step at top, with stone-lined invert above, and stabilise loose rock.

Extend and “square off” outcrop, as formed step, and abut to low side angled boulder.

Replace waterbar, and extend/upgrade lower rock step to abut adjacent boulders.

(low)

Site ID: **NT - 6(M)**

Location: 338142 6260574 Dual track, line of placed rocks offset from base of rock face/ledge as upslope alignment is rockier and less used, compacted sand and embedded rocks plus roots at NW end on undulating downslope alignment (less well used). Alignments re-join at NW end at embedded/protruding rocks and boulder.

Works:

Remove last/NW rock in line of placed rocks and level (to widen track).

Build rock step at NW end, onto in-situ rocks. Boulder (level or "square-off" boulder as needed) with armoured tread above.

Block and disguise upper alignment.

(low)

Site ID: **NT - 6(N)**

Location: 338143 6260577 top
338142 6260581 bottom

14m section of rocky slope with boulders and large embedded rocks (including "pedestal" rock) in compacted sand, roots, rockier on upslope section with 500mm steps off larger rocks/boulders and 2 placed stone steps, some loose rock. 16° gradient overall (more gently sloped central section), 3.6m overall elevation change. Drainage flows down track and track braiding or widening at obstacles. Old interpretation panel high side of track (poor condition).

Works:

Level/cut tread in top outcrop.

Build 2 stone steps below existing top step.

Stone lined invert below/downslope of 2 new stone steps.

Build 2 stone steps, anchored to outcrop on upslope side and boulder on low side.

Stone lined invert below/downslope of new steps (above "pedestal" rock), extend upslope to intercept higher drainage path. Build stone step off low side of invert.

Pull in both sides of track and barrier/block (rock rubble).

2 boxed step-and-runs, with filled/compacted treads, across central flatter area upslope of large boulder.

Rock armour/flag landing off lower step – at top of sloped rock outcrops (to protect against continued drainage from upslope).

Cut step (at least 700mm wide) into sloped rock outcrop and build stone step below - align to N/NE (not higher alignment to NW).

Stone lined invert below/downslope of outcrop/step, extend upslope (as rock wall or stone waterbar) to intercept higher/secondary drainage path and extend outlet to discharge through/past downslope boulders. Build stone step off low side of invert (anchored onto laterite outcrop), and cut/level landing into outcrop as needed.

Rock armour/flagging below laterite outcrop.

Build boxed step onto lowest boulder/outcrop

Pull in track and barrier/block (rock rubble), especially inside of curve/high side.

(Medium – for sustainability/impact and passability issues)

Site ID: **NT - 6(O)**

Location: 338144 6260592 Leaning Banksia (head/neck height), exposed/protruding roots and stump, track widening downslope of tree.

Works:

Boxed step over root, with filled and compacted tread, align lower than exiting track and retain downslope edge.

Mark tree as “height hazard”.

(Medium – for safety issues and sustainability/impact issues, to limit track widening)

Site ID: **NT - 6(P)**

Location: 338142 6260602 9m slope at 9° gradient, up and around boulder at top/crest and benched in to 300mm below NSL, then braids each side of “pedestal” rock, widening track of embedded and loose rocks on sandy/clay slope with drainage flows down entire length.

Works:

Move “pedestal” rock to define low side of track (below crest boulder).

Waterbar on top third of slope, open window and downslope mound to allow discharge, and level tread below.

Step-and-run anchored onto in-situ rock, with filled/compacted tread, box/retain along low side.

Rock infill and square-off between existing embedded rocks and outcrop at low end, to form informal step.

Pull in track and barrier/block (rock rubble) low side.

(low)

Site ID: **NT - 6(Q)**

Location: 338137 6260612 5m slope at 4° gradient, roots and low side boulder at bottom, embedded/vertical outcrops and embedded rocks at top, compacted sand and loose rocks.

Works:

Step-and-run anchored onto lower boulder, with filled/compacted tread over roots, box/retain along low side. Pull in track and barrier/block (rock rubble) low side.

Build stone step below/onto embedded rocks at top, with armoured tread above.

Stone-lined invert above top step, discharging low side of Angophora.

(low)

Site ID: **NT - 6(R)**

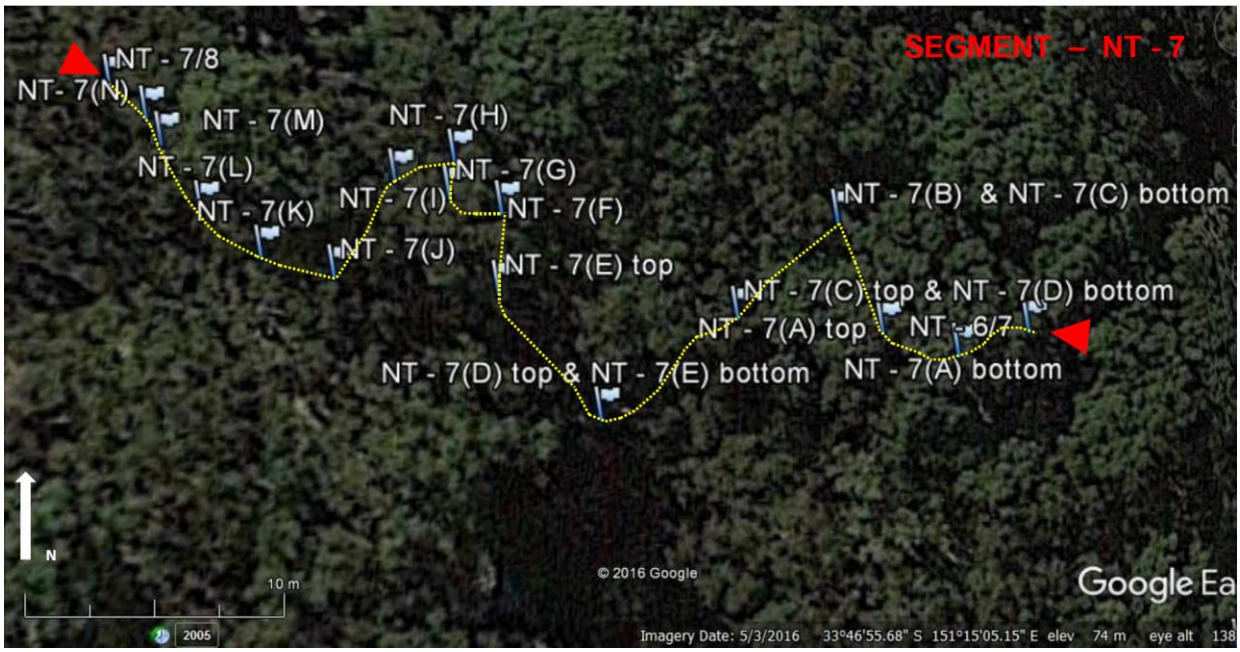
Location: 338130 6260620 Exposed roots in dished track of compacted sand and loose rocks.

Works:

Waterbar/step, filled and compacted upslope/above over roots.

(low)

SEGMENT NATURE TRAIL - 7



SEGMENT: NT - 7	
Start Point: 338127 6260623	**End Point: 338075 6260635**

General Description and Condition: Short (90m approx.) section of rocky track climbing sharply up/down steep hillslope with ephemeral drainage lines and cliffline at top, several sections of track on steep rocky hillslope are in poor condition only, but section up/down cliffline is fair to good condition (although some hazard points/issues). Through open Eucalypt and Angophora forest with an open to medium low understory.

Tread Width (mm): Variable - 400-900mm wide on rock steps up/down cliffline and rock ledges, 600-1,000mm on minor flatter compacted sand sections, widening/braiding to 1,700mm on rocky slopes and avoiding steps/obstacles.

Track Surface: Considerable embedded and protruding rock, outcrops and boulders set in compacted sand and sandy/clay. Areas of hardened track with built stone steps and rock ledges. Minor sections of dished or benched track, benched-in to 250mm on high side. Frequent drainage capture and flows down track, with scour to 300-400mm below NSL. Frequent protruding roots. Track intersects and "captures" flow from ephemeral drainage line at one point (Site NT - 7(D)).

Gradient (degrees): Mostly moderate to steep (11° to 17° gradient) with several short steep or very steep sections at stone steps at cliffline and rock ledges (25° to 32° gradient). Minor short flat/gentle runs between steeper track sections.

Alignment: Tightly curving track winding up/down steep rocky slope and cliffline at top, includes several 90° (or tighter) turns.

Terrain: Upper hillslope and summit cliffline.

Soil: Hawkesbury (Colluvial) – rugged, rolling to very steep hills on Hawkesbury Sandstone.

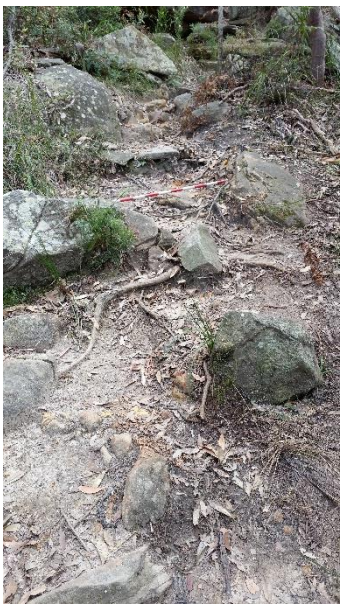
Vegetation: Bloodwood-Scribbly Gum Woodland (part of Sydney Coastal Dry Sclerophyll Forest).

Track Works and Improvements: Multiple track treatments – 25-30 stone steps (some avoided/detoured), 6 sleeper steps, and 4 log waterbars (all failed).

Signs and Wayfinding: Temporary signposting (*laminated paper signs)* at informal track junction at Site NT - 7(B) - *signposted "TRACK CLOSED" on dislodged thin timber post, and "NATURE TRAIL" sign (with directional arrow) on ground nearby held in place by rock.* Old metal (with perspex cover) warning sign "CLIFFLINE IN VICINITY OF TRACK" on tall metal post at base of cliff at Site NT - 7(H), poor condition and not easily legible. Several small metal directional arrows on ledges. Unmarked junctions with informal tracks at Site NT - 7(F) and Site NT - 7(H). Small old style interpretation panel beside track at Site NT - 7(A), in poor condition.

User Experience: Short but challenging climb/descent requiring caution on steeper sections and steps, including some hazardous drops/edges, and loose footing in several locations. Cliffline and rock ledges add interest at upper end, but require care (old warning signposting), and filtered views to the Allambie skyline/housing at upper end. Possible confusion at unmarked track junctions.

Key Issues: Continued drainage capture and scour, and undercutting of rock steps. Unstable rocky sections. Track widening/braiding to avoid obstacles and steps, and associated environmental impacts. Unmarked junctions with informal tracks, and enforcing informal track closures. High/moderate maintenance section. Track intersects and "captures" flow from ephemeral drainage line at Site NT - 7(D).



Recommended Works – Overall

- Close, disguise and rehabilitate unapproved tracks.
- Upgrade wayfinding signage.
- Remove/level protruding rocks, roots and stumps.
- Remove loose rocks.
- Clean-out steps and waterbars, and maintenance/cleaning of drainage treatments.
- Monitor for drainage capture – with adaptive management/remediation as/if required.
- Monitor for scour over/around track treatments and stability of rock steps – with adaptive management/remediation as/if required.
- Monitor for track widening and step/treatment avoidance – with adaptive management/remediation as/if required.

Recommended Works – Site-specific (Priority)

Site ID: **NT - 7(A)**

Location: 338122 6260621 bottom
338117 6260622 top

Short steep curving track on rocky slope and crossing ephemeral drainage line, 14m long, 14° gradient overall (E end at 16° gradient). Embedded rocks at bottom of E end then steep slope of large outcrops/boulders with gap/gutter to 400mm deep, tangle of exposed roots in gap and across track above. 1.7m total rise on E side of drainage line. Track curves across slope (at Angophora, old interpretation panel beside track in poor condition), crosses ephemeral drainage line via sloping outcrop, larger flows "captured" or diverted to run onto/down track to E. Step on W side of drainage over old root and large burnt stump, stormwater from upslope track to W flows into ephemeral drainage line.

Works:

Build stone step onto in-situ embedded rocks and armour tread upslope.

Build 5-6 stone steps, with armoured treads, into gap between outcrops/boulders, cut steps into flanking rocks to match built steps (if needed).

3 steps and/or short step-and-runs over roots above outcrops/boulders (preferably in stone), box/retain on lower side, a rock armour/flag all treads (to protect against continued drainage line overflows and flows from upslope).

Rock infill/tread anchored to rock outcrops on E side of drainage line, with steps off onto sloping outcrop forming drainage line bed (cut/level tread off, if needed) – to prevent larger flows diverting onto track.

Cut/level treads into sloping outcrop of ephemeral drainage line bed.

Cut/level tread into rock outcrop on W side of drainage line, and level top of outcrop.

New waterbar upslope of stump.

(HIGH - for sustainability/impact and passability issues)

Site ID: **NT - 7(B)**

Location: 338113 6260630 Junction with large track to NW. Track closed and blocked with placed branches, signposted "TRACK CLOSED" on dislodged thin wooden post, and "NATURE TRAIL" sign (with directional arrow) on ground nearby and held in place by rock – both temporary laminated paper signs. Nature Trail turns +90° upslope.

Works:

Install more durable/permanent wayfinding signage.

Reinforce physical closure, and rehabilitate initial section, of closed track.

(Medium – for wayfinding/safety issues)

Site ID: **NT - 7(C)**

Location: 338113 6260630 bottom (at Site NT – 7(B))
338108 6260623 top

Remains of old sleeper step at bottom, 350mm step off and avoided with track widening at junction. Then 4 failed log waterbars/steps, some burnt and /or only partially across track, drainage flows over/down and scour, steps of >300mm. Track of eroded compacted sand/clay, protruding roots, benched-in to 250mm on high side, 10m and 11° gradient overall.

Works:

Replace 3 upper failed treatments with longer waterbars/steps, extending well off track both sides.

Replace lowest waterbar/step with 2 boxed steps and/or step-and-runs, with filled/compacted treads.

2 boxed steps at bottom, with filled/compacted treads.

Pull-in track and block/barrier (rock rubble and branches) inside corner of bottom junction.

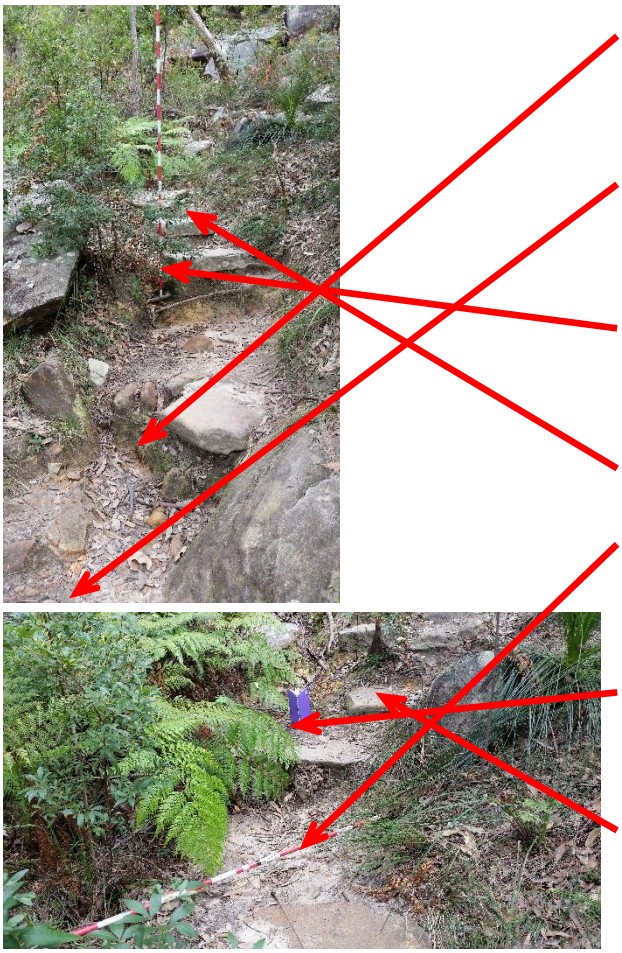
Monitor for avoidance/widening.

(Medium)

Site ID: **NT - 7(D)**

Location: 338108 6260623 bottom
338103 6260620 top

9m section up/down and steeply across slope, 11° gradient, 6 placed rock steps but lower 2 steps deeply scoured by flows over/around (with step heights of 400mm and 500mm). Major flows down track, due to intersecting ephemeral drainage line at upper end and flows being "captured" or diverted onto track, with considerable erosion resulting.



Works:

- Widen lowest rock step and butt to embedded angled rock on low side. Build 2 new stone steps below, with armoured treads.
- Stone-lined invert below lowest step and new steps (to divert flows and protect proposed downslope treatments at site NT – 7(C)).
- Widen second lowest rock step to infill scour on low side and rock armour adjacent bench/bank. Build 2 new stone steps below, with armoured treads.
- Widen 3rd and 4th steps (from bottom), with rock infill both sides.
- Stone-lined invert on wider tread/flat above 4th rock step (to catch/divert overflows from ephemeral drainage line and protect proposed downslope treatments).
- Build low rock wall along low side edge of track between 5th and 6th steps (top steps), to prevent flows in ephemeral drainage line to diverting onto track.
- Widen 6th (top) step, with rock infill and butt onto adjacent boulder.
- Monitor for scouring and destabilisation of steps, and avoidance/widening.

(HIGH - for sustainability/impact and passability issues)

Site ID: **NT - 7(E)**

Location: 338103 6260620 bottom
338095 6260625 top

11m section up/down and very sharply across steep slope, 17° gradient and 2.2m total rise. Large embedded rocks and outcrops/boulders in compacted and loose sand, large rock slab/step at top. Placed rock step midway, undercut, and large flat rock slab/step at top (but avoided). Widening/braiding to 1,600mm wide around protruding rocks and obstacles. Considerable drainage flow down track with scour to 300mm below NSL, flows into ephemeral drainage line at bottom (via Site NT – 7(D)).

Works:

Requires detailed on-site selection and location of track treatments. Approximate requirements –

- Build 10-11 stone steps and/or step-and-runs over entire site/slope, incorporate or build onto in-situ outcrops where possible (approx. 4-5 steps), armour all step treads and fill/compact all step-and-run treads (monitor for need to armour).
- Stone-lined invert (or waterbar) on lower third, location dependent on siting of steps/step-and-runs and suitably wide tread (for safety).
- Stone-lined invert midway, upslope of large pointed boulder (discharging into channel to ephemeral drainage line).
- Stone-lined invert (or waterbar) on upper third (at break in slope), extend upslope off track to catch flows from slope above (2 stone steps required on low side of invert, at head of slope).
- Pull-in track and block/barrier (rock rubble) both sides, over most of site/slope.
- Move large flat rock slab/step at top onto track alignment and position as a step, rock armour landing below. Block/barrier (rock rubble) higher/dis-used alignment onto rock bench.
- Monitor for scouring and destabilisation of steps and drainage treatments, and for avoidance/widening.

(HIGH - for sustainability/impact and passability issues)

Site ID: **NT - 7(F)**

Location: 338094 6260629 Junction with regularly used but unmarked track to NW along contour below boulders/rockface, indistinct after 30m. Nature Trail turns +90° upslope over flat rock ledge, small metal directional arrows (x 2) on rock ledge.

Works:

Close, disguise and rehabilitate unmarked/informal track.

Install wayfinding signage.

(Medium – for wayfinding/safety issues)

Site ID: **NT - 7(G)**

Location: 338092 6260630 Rock ledge with large placed flat rock at end, 550mm step height from compacted sand track below (Site NT – 7(F), 2 small metal directional arrows on ledge. 5 stone steps between boulders (350mm riser on lowest step, and 3rd step loose) curving low side of Angophora and boulder at top, large root is additional step (placed rock adjacent), drainage flows over/down steps (hard to redirect due to containing boulders). 8m at 30° gradient. Trample track (loose sand) at 2m above steps, up/down slope to informal track/junction below (Site NT – 7(F)).

Works:

Build 3 stone steps onto bottom rock ledge, butt onto/between ledge and adjacent large angled boulder (block/barrier (rock rubble) alignment E along rock ledge to square-up junction and prevent short-cutting).

Build additional stone step below lowest existing step, with armoured tread (connecting to new steps to rock ledge).

Stabilise, or replace, 3rd step.

Monitor root step for trip hazard (from scouring of adjacent treads) or rot/decay.

Infill gap at 5th step, butt to adjacent rock.

Build waterbar onto top corner of outcrop upslope of track, running upslope of Angophora to discharge well off track (to prevent inflows onto track from above).

Boxed step, with filled/compacted tread, over root at top of steps, retain lower edge.

Retain lower edge of track at shortcut and infill/compact track, new waterbar upslope.

Block/disguise shortcut.

(HIGH - for passability/safety issues)

Site ID: **NT - 7(H)**

Location: 338092 6260632 Track turns 90° upslope at base of cliff, onto rounded/sloped rock outcrop between cliffline and boulder, 4 built rock steps on inside of bend, upper 2 steps are undercut, all are avoided (with main alignment lower/below as widened track, to 1,400mm, of embedded and loose rocks with drainage flows down/across from upslope). Metal directional arrow on rock face. Old metal (with perspex cover) warning sign "CLIFFLINE IN VICINITY OF TRACK" on tall metal post at base of cliff, poor condition and not easily legible. Junction with regularly used, but unmarked, track to NW along contour at base of cliffline.

Works:

Build 3 stone steps with armoured treads on approach to 90° turn, reduce step width from wide at base narrowing upslope to match into largest step at base of rounded/sloped rock outcrop (re-use flat stones from lower 2 existing detoured steps, if possible).

Waterbar on low side of steps at base of rounded/sloped rock outcrop (to divert flows from track upslope and informal track to NW, and protect track/treatments below).

Block/barrier (rock rubble and branches) track immediately downslope of steps and rounded/sloped rock outcrop (monitor for effectiveness, may need "directional railing" as alternative to guide wakers at base of 90° turn and avoid track widening).

Widen existing 2 large steps onto base of rounded/sloped rock outcrop, retain/wall on sides for extra support (especially low/downslope sides).

Cut/level 2 treads into rounded/sloped rock outcrop, with rock infill on lower side (abutting boulder) to match and widen/level treads.

Replace unserviceable warning sign with new style sign or totem.

Close, disguise and rehabilitate unmarked/informal track.

Install wayfinding signage.

(HIGH - for safety issues [new warning sign], and passability issues, and sustainability/impact issues [to control track widening and close informal track])

Site ID: **NT - 7(I)**

Location: 338089 6260629 Upper edge of rounded/sloped rock outcrop with drainage down from upslope and from old track alignment along base of cliffline to NW. Retaining root/step 250mm high above, with protruding and embedded rock in compacted sandy clay upslope to large boulder (Site NT – 7(J)), 3m at 14° gradient.

Works:

Build 2 stone steps at top edge of rounded/sloped rock outcrop, butt onto boulder on low side (match with works at Site NT – 7(H) immediately below).

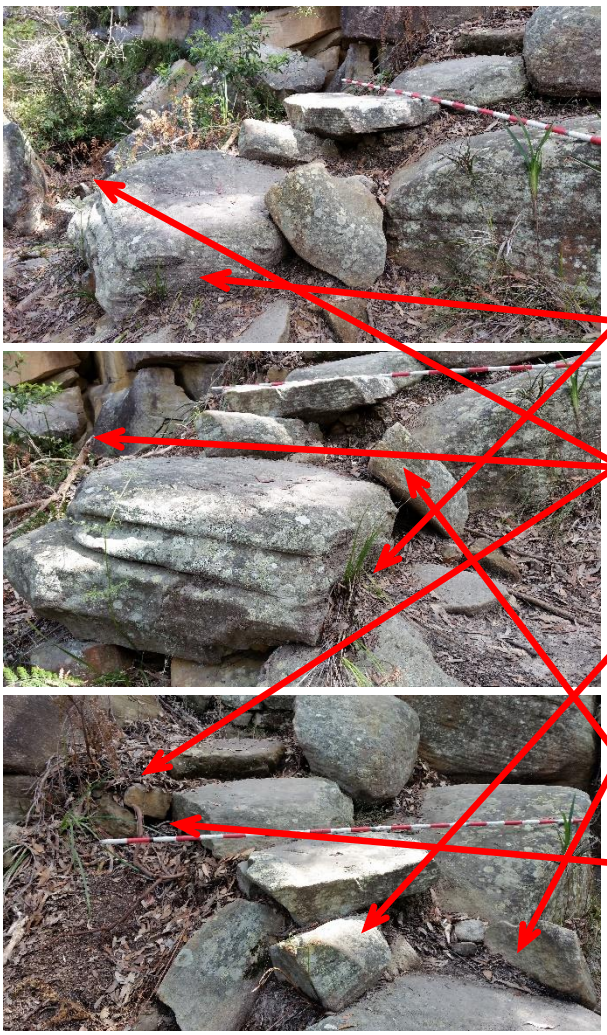
Build rock along high side of track above/NW of top of rounded/sloped rock outcrop, to catch/divert drainage from upslope (off old alignment and cliffline) and direct to new stone-lined invert.

Stone-lined invert upslope of protruding rock (high side) to channel flows across track and discharge past/above boulder (low side).

Leave protruding rock (high side) to define track edge.

Build rock step off upslope side of invert and rock armour tread above/upslope to below large boulder (Site NT – 7(J)).

(Medium - for passability/safety issues)



Site ID: **NT - 7(J)**

Location: 338087 6260625 Large flat topped/square boulder, step off 350mm on NE side (to track below, site NT – 7(I)) and 800mm sheer drop off SE side to steep boulder slope and rock ledges (fall hazard), 600mm off SW side. 90° turn at flat/square boulder upslope to 3 large placed flat stone to base of cliffline (links to stone steps in "chute above), steps 700-900mm wide, 300-400mm drop off outer/low side of steps with drainage flows down/alongside steps. Lowest step 350mm high with additional partial step (supporting rock) under outer corner. Protruding/angled rock at rear inside corner of flat/square boulder, trip hazard but retains sand/fill above. 5m at 31° gradient, drainage over/down steps but limited scour.

Works:

Build stone step off NE side of bottom flat topped/square boulder at 90° turn (match with works at Site NT – 7(I) immediately below).

Install safety railing across lower/SE side of bottom boulder, extend to NE (to stone lined invert below (Site NT – 7(I)) and extend upslope/NW along lower/outer side of steps above and anchor to base of cliffline.

Widen/extend partial step below bottom step to full width, and build onto boulder below.

Remove protruding/angled rock at rear of bottom boulder and rock armour (match to new/widened step at rear of boulder).

Add stone "wing" to outer/low side of middle rock step to divert flows down side of steps.

Monitor for scour/undercutting and stability of steps.

(HIGH - for passability/safety issues)

Site ID: **NT - 7(K)**

Location: 338083 6260626 10 stone steps in “chute” in cliffline, 400-900mm wide, 250-300mm risers, drainage flows down/over steps but little scour.

Works:

Build extra stone step off lowest existing step (onto top of site NT – 7(J) immediately below).

Monitor for scour/undercutting and stability of steps.

(low, and monitor for scour/undercutting and stability of steps.)

Site ID: **NT - 7(L)**

Location: 338081 6260629 6 timber sleeper steps in “bowl” at top of cliffline with rock faces/ledges both sides, 600-800mm wide, 5 upper steps older and rotting at exposed/SW ends and in fair/poor condition, lowest step a newer scored sleeper in good condition, compacted sand treads and slope, drainage flows down and erosion along SW side of steps below steep slope to rockface above, 6m at 25° gradient.

Works:

Replace 5 old sleeper steps with new steps boxed/retained on SW edge, with filled/compacted treads.

Extended/double waterbar diagonally across slope above/SW of steps, running from upper step across slope to discharge below lowest step (and beyond top of “chute” downslope) – will require extended outlet.

Waterbar, or low rock catch/diversion wall, above NE side of steps, from top of rock outcrop above/NE of top step then across slope and under rock ledge - to divert flows from upslope away from sleeper steps and “chute” below.

(Medium)

Site ID: **NT - 7(M)**

Location: 338079 6260631 5 rock steps in narrow cleft between rock face/ledge and large boulder at top of cliffline, 300-400mm wide, drainage flows down and some scour over/beside lowest step, embedded rocks and protruding roots at top of above steps with scour to 200mm below NSL (trip hazard), 6m at 32° gradient, major drainage path to NE/above steps on high side of boulder also receives some walker use (to avoid steps).

Works:

Block/barrier drainage path to NE/above steps, to prevent access.

Monitor stability of lowest step.

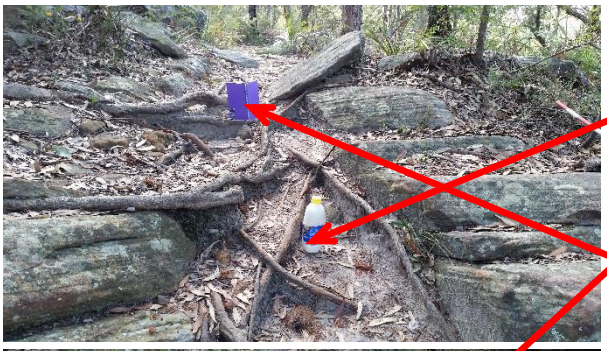
Extend top step and butt to top of boulder, cut/level top edge of boulder. Remove stump.

Build boxed rock step-and-run upslope/above top step, fill and armour tread over roots, build/butt onto rock ledge to SW.

Build 2 boxed rock steps, extending between rock face on upslope side and top corner of boulder/ledge on downslope side, armour tread above (back to stone-lined invert upslope).

Stone-lined invert above steps (and below end of squared outcrop on downslope side), with extended outlet to discharge well off track (beyond slope back to track, to prevent backflows), excavate outlet gutter if needed.

(HIGH - for passability/safety issues)



Site ID: **NT - 7(N)**

Location: 338078 6260633 Gutter to 250mm deep between rock outcrops, 600-800mm wide, multiple exposed and protruding roots to 300mm high, drainage flows down track from crest at top.

Works:

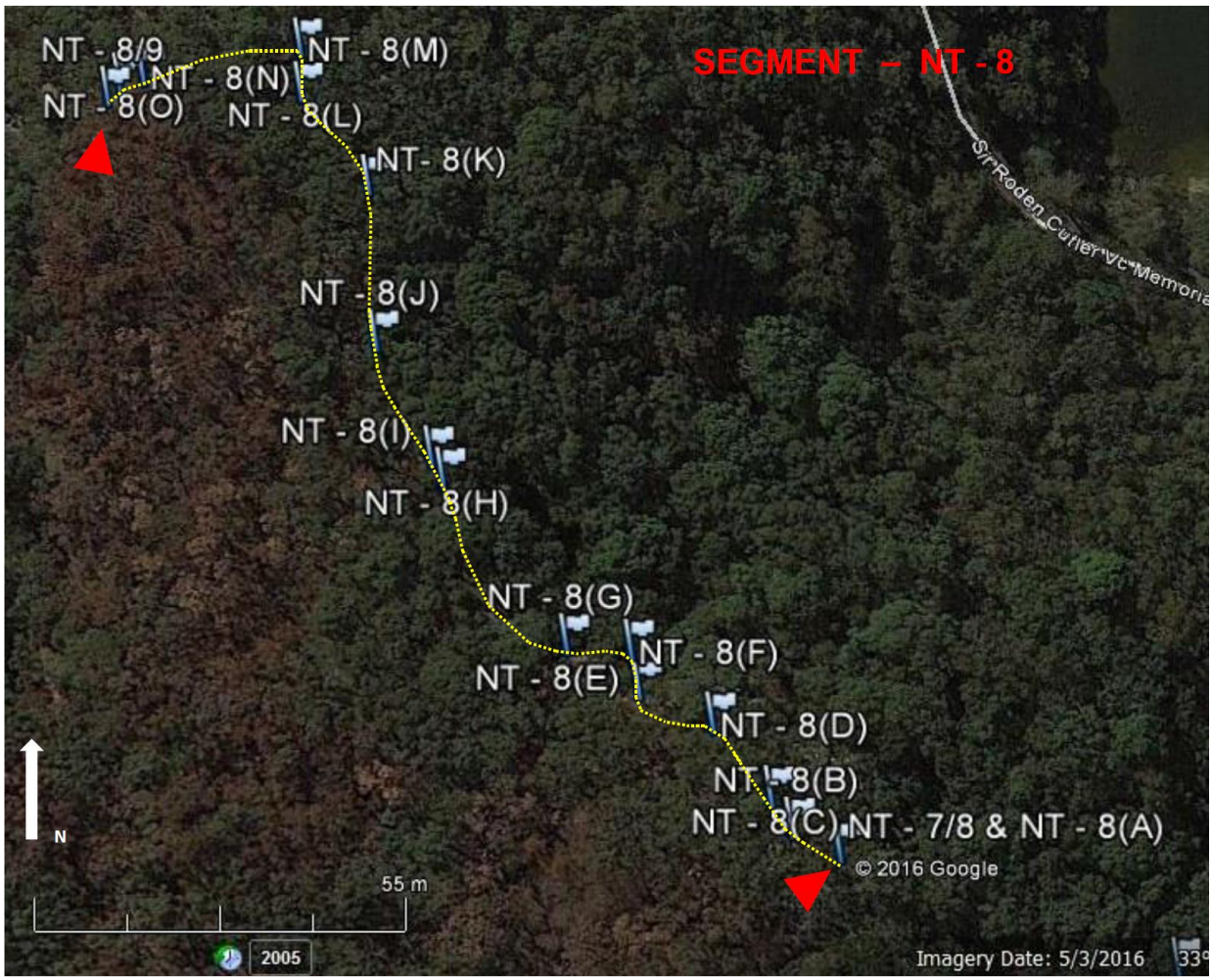
2 timber steps at lower end of gutter butted to adjacent outcrops, with extended filled/compacted tread upslope/above over roots (to step over crest).

Raised tread over crest (past angled boulder on low side of track) with timber step each end (SE and NW), box high side edge of tread and steps to retain, fill and compact tread over roots (remove highest root on crest).

Upper step on crest (facing NW) will catch/block drainage flows down track from upslope, install waterbar and/or cut outlet gutter off corner of steps to discharge flows past/above rock outcrops on low side.

(Medium - for passability and sustainability/impact issues)

SEGMENT NATURE TRAIL - 8



SEGMENT: NT - 8	
Start Point: 338075 6260635	**End Point: 337943 6260763**
General Description and Condition: Well-defined section of gently winding and gently undulating track (235m approx.) along ridgeline, through open Eucalypt and Angophora forest with an open mixed understory downslope and very open fire-impacted understorey upslope. Good condition. *Tread Width (mm):* 600-1,000mm. *Track Surface:* Mostly compacted sand with some gravels, often slightly dished with small windrows on low side, seepage and minor ponding in places, regular low often angled rock outcrops, mainly in SE, with occasional outcrop or rock bar in NW. Occasional protruding roots (minor). *Gradient (degrees):* Mix of gently sloped of flat (<1° to 3° gradient) section with occasional gentle/moderate shorter slopes (4° to 6° gradient). *Alignment:* Gently curving track along edge of hilltop/ridgeline, above cliffline to NE (at SE end). *Terrain:* Hilltop/ridgeline. *Soil:* Hawkesbury (Colluvial) – rugged, rolling to very steep hills on Hawkesbury Sandstone.	

Vegetation: Bloodwood-Scribbly Gum Woodland (part of Sydney Coastal Dry Sclerophyll Forest).

Track Works and Improvements: Minimal - a few placed rock steps/flagging among rock ledges, and stepstones in ponding areas.

Signs and Wayfinding: Log post with 2 small metal directional arrows, but no signposting, at junction with well-used track to S (to APZ behind, N of, Warringah Street) at NW end. Several small metal directional arrows en-route (on rocks, trees and stumps). 3 older style small interpretation panels, 1 dislodged.

User Experience: Easy pleasant walking with good views through trees to Allambie skyline and dam below, cliffline adds extra interest at SE end (but also a hazard). Burnt area upslope may detract from experience for some walkers (but temporary only). Possible Aboriginal engraving (if genuine) is an additional feature of interest. Possible confusion at unmarked track junctions.

Key Issues: Cliffline hazard at SE end. Management and presentation of Aboriginal engraving (if genuine). Track widening/braiding to avoid rock ledges and loose surfaces, and associated environmental impacts. Areas of ponding and seepage. Unmarked junctions with informal tracks. Major track junction at NW end, not signposted.

Recommended Works – Overall

- Improved safety signage along cliff edge where close to track.
- Remove/level protruding rocks and roots, level “lips” on angled rock outcrops (if/where significant trip hazards).
- Open windrows to minimise drainage and seepage capture/ponding.
- Maintenance/cleaning of drainage treatments.
- Monitor for track widening at protruding rock ledges or loose rocky section – with adaptive management/remediation as/if required.

Recommended Works – Site-specific (Priority)

Site ID: **NT - 8(A)**

Location: 3389075 6260035 (segment start point) Exploratory track leading 8m to cliff edge, partly screened edge with high cliff face/drop.

Works:

Close and disguise exploratory track, and physically block if necessary (or install warning sign before approach to cliff edge, but not visible from main Nature Trail so as not to attract attention).

Install caution/warning sign at top of cliff descent (similar style to new warning sign at Site NT – 7(H)).

(HIGH – safety issue)

Site ID: **NT - 8(B)**

Location: 338068 6260639 Well-used track joins from upslope (from S/SE), splits around large outcrop and boulders on upslope side of trail, 2 small metal directional arrows on rock (indicating Nature Trail running NW-SE). Track leads up to end of Bangaroo Street.

Works:

Close and disguise final section of "Bangaroo St Track" visible from Nature Trail - if no longer required.

Install waterbar on W braid of "Bangaroo St Track" to catch/divert flows from informal track and upslope before reaching trail.

(low)

Site ID: **NT - 8(C)**

Location: 338064 6260644 Sloped angled low rock outcrops and embedded rock on 7m slope, 9° gradient, loose sands, drainage flows down from informal track junction upslope.

Works:

Waterbar at top to divert flows from informal track junction upslope.

Remove/level angled embedded rocks (can re-use for rock armouring/fagging).

Fill/level gap between rock outcrops.

Cut/level 2 treads into lower outcrop.

(low)

Site ID: **NT - 8(D)**

Location: 338054 6260656 Sloped outcrop, angled rock bars/outcrops, ephemeral drainage line flowing across track (at 2 points) then over cliff edge 2.2.5m below track, drop of 8-10m over cliff (hazard). Cliffline close to low side of track (within 3m) for approximately 25m section to NW.

Works:

Install caution/warning re cliff edge on low side of track (similar style to new warning sign at Site NT – 7(H), or simpler totem style warning).

Cut/level 2 treads into sloped outcrops on SE side.

Cut/level treads into rounded and angled outcrops on NW side (cut "lips" back and level other angled outcrops if needed).

Rock armour, as inverts, both drainage line crossing points, ensure sufficient cross-fall to prevent ponding (and walker detouring/avoidance close to cliff edge).

(HIGH – safety issue, and for passability)

Site ID: **NT - 8(E)**

Location: 338041 6260662 Angled rock outcrops, with gap and protruding root.

Works:

Waterbar, built onto-in-situ outcrop.

Rock fill and level gap (remove root), to match outcrops.

(low)

Site ID: **NT - 8(F)**

Location: 338039 6260668 Rock slab and angled boulder upslope, and rounded outcrop below with fish "engraving" and carved graffiti (under "fish" and elsewhere. Older style small interpretation panel re Aboriginal Engravings, dislodged. Walker traffic over, or close, to engraving. Cliffline with sloping edge to 8m drop only 2m off track on low side (hazard), some evidence of walkers detouring around rock slab/outcrops closer to cliff edge (following drainage path), also attracted by views to sculpted overhang in cliff face nearby. Small metal directional arrow on tree stump.

Works:

Install caution/warning re cliff edge on low side of track (similar style to new warning sign at Site NT – 7(H), or simpler totem style warning).

If fish "engraving" is not genuine, then remove (track alignment and walker traffic over an unprotected Aboriginal cultural heritage sites sends inappropriate message re site protection/management) and cut/level tread in rounded outcrop.

If fish "engraving" is genuine, then realign track to below engraving with rock armouring/flagging to provide track and viewing area below art site, barrier/protect site from walkers/damage and remove graffiti as appropriate . May need barrier or safety railing on low side of track at viewing area (to prevent "distracted" visitors wandering too close to cliff edge while focused on site).

Level SE approach to rock slab (relocate flat rocks on high side, to define track edge).

Build small step off low edge of rock slab.

Block/barrier (rock rubble) drainage path on low side of rock slab, to not "read" as a detour and prevent walkers detouring too close to cliff edge.

(HIGH – for safety issues and Aboriginal cultural heritage site management).

Site ID: **NT - 8(G)**

Location: 3380-28 6260669 Dip to small drainage line with regular flows, rock outcrops and "natural" steps to SE and large rock outcrop to NW, large flat flagstone placed (?) in centre of bed. Cliffline close to low side of track, and start of section of track (running for approximately 25-30m to SE) where cliff is in close proximity to track.

Works:

Install caution/warning sign re cliff edge on low side of track, start of track section close to cliffline when heading SE (similar style to new warning sign at Site NT – 7(H).

Waterbar at top of SE approach.

Rock infill/armour and level gaps between outcrops on SE side.

Remove angled rocks (use as additional flagstones/stepstones in bed, if flat), cut step into outcrop on NW side and level top.

(HIGH – for safety issues)

Site ID: **NT - 8(H)**

Location: 338006 6260697 Damp sand slope with multiple small protruding roots, 9m long at 8° gradient, 600-900mm wide, angled track surface and outcrop at top, flat rock outcrops at bottom where drainage/seepage flows off low side of track.

Works:

Waterbar at top of slope.

Boxed step-and-run over roots on upper third, with filled/compacted tread.

Boxed step-and-run with extended run/tread over roots on lower upper third, with filled/compacted tread.

Monitor boxed step-and-runs for drainage flows and scour down sides, and need for wings to divert flows.

Define low side track edge at bottom drainage/seepage outlet point.

(low)

Site ID: **NT - 8(I)**

Location: 338005 6260701 Widened track, to 1,800mm, on sloping curve with protruding and loose rocks, drainage flows down inside of curve and walkers detouring/widening on outside of curve, rock outcrops on inside of curve and sloped rock outcrops at top of curve.

Works:

Waterbar at top.

1 or 2 step-and-runs in centre, boxed/retained on outer/low side and filled/compacted treads. Top tread extends to upper rock outcrops.

Build rock step onto in-situ outcrops at bottom of slope.

Pull-in track (both sides) and define outer/low edge, and block/barrier (rock rubble).

(low)

Site ID: **NT - 8(J)**

Location: 337994 6260720 Seepage/ponding area, 6m long, in dip between low rock outcrops.

Works:

Wide (at least 1.5m across) stone-lined invert at SE end (wettest area), built off in-situ outcrop.

4 or 5 large flat stepstones set into track for remainder of seepage/ponding area. Monitor for avoidance, or subsidence, of stepstones.

Open windrow on low side.

(Medium – for sustainability/impact issues [to control track widening])

Site ID: **NT - 8(K)**

Location: 337990 6260748 Rock ledge (low side) and large boulder (high side) at top of short 6m slope at 9° gradient, gap/gutter between ledge and boulders with protruding roots and drainage flows down track, rounded embedded boulders at bottom of slope.

Works:

Waterbar at top (above exposed root), discharging onto/across rock ledge.

Build 2 step-and-runs in gap/gutter, with filled/compacted treads.

Build 2 stone steps onto rounded embedded boulders, butt onto large outcrop on high side of track, and cut/level treads into boulders to match steps (if needed).

Fill/compact tread above upper step, upslope to start of gap.

Block/barrier (rock rubble) low/outer side of boulders.

(Medium – for passability issues)

Site ID: **NT - 8(L)**

Location: 337977 6260765 Large rounded rock outcrop, 450mm step off front of outcrop and with detouring and track widening to high side.

Works:

Cut wide step into face (SE side) of outcrop.

Extended /level in-situ embedded rock below, as tread off new step.

Block/barrier (rock rubble) low/outer side of boulders.

(low)

Site ID: **NT - 8(M)**

Location: 337976 6260773 Track curves sharply to W with 2 small metal directional arrows on rock pavement and small metal directional arrow on tree, well-used trample track to NE to rock ledge and top of steep rocky slope (with filtered views to dam).

Works:

Improve wayfinding signage.

(low)

Site ID: **NT - 8(N)**

Location: 337949 6260767 Compacted sand/gravel track, slightly dished, with low rock outcrops.

Works:

Waterbar, built onto in-situ outcrops (to divert flows off track before slope to track junction downslope)

(low)

Site ID: **NT - 8(O)**

Location: 337947 6260766 Protruding rocks and rock outcrop (and placed rocks along high side of track) upslope of track junction, with drainage flows down track. Older style small interpretation panel on high side of track.

Works:

Build rock step between in-situ outcrops at top, fill/compact tread above/upslope.

Remove mid-track protruding rock, and rock armour/flag track to new step below.

Remove large central protruding rock and build rock step onto outcrop beneath, armour tread below step (as safe approach to track junction immediately below).

(Medium – for passability/safety issues [on approach to track junction])

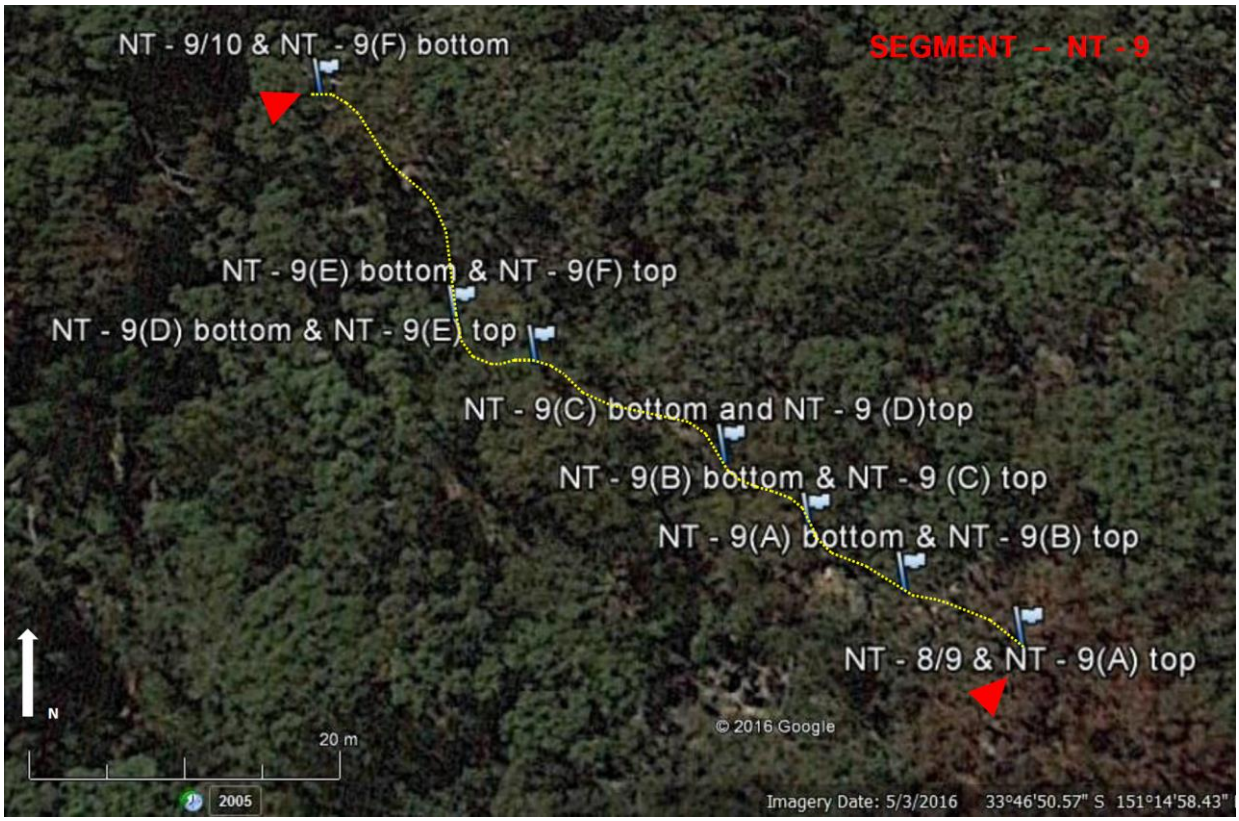
Site ID: Junction Segments 8 and 9 (and junction with track to S)

Location: 337943 6260763 90° junction between Segment 8 (on ridge) and Segment 9 (downslope to W/NW). Junction with un-marked but well-used track to S (to APZ behind, N of, Warringah Street). Junction is in dip at top of "chute" in rock ledges downslope with considerable drainage inflow from both tracks above. Log post with 2 small metal directional arrows, but no signposting.

Works:

See Segment NT-9 below.

SEGMENT NATURE TRAIL - 9



SEGMENT: NT - 9	
Start Point: 337943 6260763	**End Point: 337895 6260799**

General Description and Condition: Short steep rocky track (85m approx.) sharply up/down a steep rocky slope with significant drainage and erosion issues, track markedly widened/braided in places, rock ledges and scarp at top end, through mixed Eucalypt and Angophora forest and medium understory. Poor condition on upper two thirds with no track treatments, fair to good condition on lower third with frequent track treatments on less aggressive slope.

Tread Width (mm): Very varied, from 500mm at narrow steps/gutters to 2,100mm around large embedded and protruding boulders/rocks and outcrops.

Track Surface: Rocky - embedded and protruding rocks, several "pedestal" rocks, large boulders, large rock ledges and rock faces (mainly in upper half), considerable areas of exposed/protruding and retaining roots throughout, compacted sand/clay, loose stones and gravels. Drainage down track across the entire segment, with gutters or entrenched track to 500mm below NSL in places (more usually 350-400mm deep).

Gradient (degrees): Steep, overall 21° gradient (slopes vary from 16° to 27° gradients), very little gently sloped track.

Alignment: Almost directly up/down steep rocky slope with rock ledges/scarp in upper third.

Terrain: Upper hillslope, and rock ledges along edge of ridgeline above.

Soil: Hawkesbury (Colluvial) – rugged, rolling to very steep hills on Hawkesbury Sandstone.

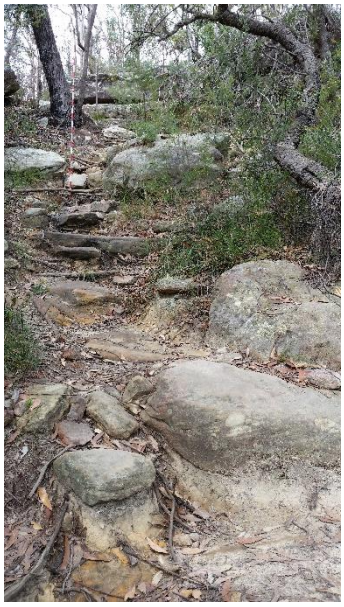
Vegetation: Bloodwood-Scribbly Gum Woodland (part of Sydney Coastal Dry Sclerophyll Forest).

Track Works and Improvements: 26 scored timber step-and-runs and steps (10 with drainage/scour around end/s) and 1 log waterbar – all on lower slope.

Signs and Wayfinding: Log post with 2 small metal directional arrows, but no signposting, at top (junction with un-marked but well-used track to S to APZ behind, N of, Warringah Street). Log post with small metal directional arrow at bottom of slope. Old tall metal post near top of segment (no sign attached).

User Experience: Short but challenging climb/descent requiring caution on steeper rocky sections in upper two thirds and loose footing in several locations (easier on lower third with timber step-and-runs and steps), care required. Rock ledges and scarp add interest at upper third. Possible confusion due to poor signposting.

Key Issues: Continued drainage capture and erosion, considerable drainage inflows from track junction/tracks at top of segment and flows also funnelled/contained on alignment by local topography. Loose or unstable rocky sections. Track widening/braiding to avoid obstacles and steps, and associated environmental impacts. Poorly signposted track junction at top of segment. High maintenance section.



Recommended Works – Overall

- Remove/level protruding rocks and roots.
- Remove (or compact/stabilise) loose rocks and gravel.
- Clean-out steps and waterbars, and maintenance/cleaning of drainage treatments.
- Monitor for effectiveness of drainage treatments proposed (especially drainage discharge off track, with no “return” flows) and on-going drainage capture – with adaptive management/remediation as/if required.
- Monitor for scour over/around track treatments and stability of rock steps – with adaptive management/remediation as/if required.

- Monitor for track widening and step/treatment avoidance – with adaptive management/remediation as/if required.
- Upgrade signage at top junction as per Manly Dam Sign Location Plan.

Recommended Works – Site-specific (Priority)

Site ID: Junction Segments 8 and 9 (and junction with track to S)

Location: 337943 6260763 90° junction between Segment 8 (on ridge) and Segment 9 (downslope to W/NW). Junction with un-marked but well-used track to S (to APZ behind, N of, Warringah Street). Junction is in dip at top of "chute" in rock ledges downslope with considerable drainage inflow from both tracks above. Log post with 2 small metal directional arrows, but no signposting.

Works:

Upgrade signage at junction as per Manly Dam Sign Location Plan.

Waterbar on final sloped section of un-marked track joining junction from S - to divert flows before junction (upper landing) and reduce volume of drainage into/down Segment 9.

See Site NT – 9(A) below for track works (fibreglass reinforced plastic landing/steps) at junction.

(Medium – for wayfinding and sustainability/impact issues)

Site ID: **NT – 9(A)**

Location: 337943 6260763 top (top of Segment, junction with Segment 8 and un-marked track to S)
337937 6260766 bottom

Large embedded rocks above (downslope from junction), to "chute" between rock ledges with sloped boulders and narrow gap alongside (ankle hazard), embedded rocks and roots below with 700mm drop/scarp to compacted sand/clay bench with embedded rocks and outcrops at bottom of site.
Lower rock ledge runs to S, below main rock face, at bottom of "chute" with 1,300mm drop to sand/rock bench at bottom of site. Old tall metal post on lower bench, no sign attached. 13m long, 20° gradient overall (27° gradient over "chute" and lower ledge/scarp) total level change of 3.2m (2.2m level change over "chute" and lower ledge/scarp). Substantial drainage capture and flows down, eroded 200-500mm below NSL (deeper at bottom of site).

Works:

Install FRP steps, step-and-runs and landings over entire length of site:

- concrete pad (anchor point) and FRP landing at upper track junction;
- FRP steps and/or step-and-runs from junction landing to top of ""chute";
- FRP steps through "chute";
- landing and turn to S onto/along lower rock ledge (anchor point), with safety railing across low side of steps and landing (due to fall height); and
- FRP steps off lower rock ledge to concrete pad (anchor point) on sand/rock bench at bottom of site, safety railing on upper third on both sides (due to fall height); and

Divert drainage flows away from under FRP structure (and to protect track/treatments downslope in Site NT – 9(B)) at bottom of chute – by low rock wall butted onto N end of lower rock ledge and running NW across bottom of "chute" and extending at least 5m to NW on slope below ledge/outcrop (as rock wall/rock gutter, or waterbar) to discharge well off track.

Remove old metal post.

(HIGH – for passability/safety and sustainability/impact issues)

Site ID: **NT – 9(B)**

Location: 337937 6260766 top
337930 6260770 bottom

9m rocky slope at 17° gradient, 2.1m total level change, widened/braided track to1,000 to 2,100mm around large embedded and protruding boulders/rocks and outcrops, compacted sand and loose rocks/gravel (slip hazard), numerous protruding/retaining roots on lower third, considerable drainage down track from “chute” and rock ledges upslope.

Works:

Level and rock armour/flagging on upper end, as landing below FRP steps above (Site NT – 9(A)).

Build 8-9 boxed rock steps or boxed step-and-runs on upper two-thirds of site (upslope from bottom of large angular boulder on N side of track), build onto in-situ outcrops and boulders as far as possible for stability (exact layout/configuration will require on-site design). Rock armour all treads (to protect against continued drainage down/over). Box/wall side of steps or step-and-runs to protect against scour and undercutting, include regular wings to divert flow from down sides.

Wide stone-lined invert, on wider tread in step-and-run upslope of large angular boulder, with extended outlet to NE to discharge well off track (important drainage feature due to difficulty in draining track “chute “ upslope above).

Level and rock armour/flagging on small flatter areas downslope of large angular boulder.

Build 3 rock steps over roots, rock armour all treads (to protect against continued drainage down/over), box/wall side of steps or step-and-runs to protect against scour and undercutting

Level and rock armour/flagging on lower end (built onto large flat rock ledge below (as landing above FRP steps above (Site NT – 9(A)).

(HIGH – for passability/safety and sustainability/impact issues)

Site ID: **NT – 9(C)**

Location: 337930 6260770 top
337924 6260774 bottom

15m rocky slope at 23° gradient overall (steeper at top 23° gradient, 17° gradient on lower half), 3.9m total level change, series of rock ledges and outcrops on lower two-thirds, upper third half curves up onto large flat/rounded rock ledge, multiple "natural" steps formed by embedded and protruding boulders/rocks and outcrops (to 400mm high), 500-1,000 mm wide, considerable drainage down track with scour to 300-400mm below NSL, flows braid around upper large flat/rounded rock ledge, some loose stone (slip hazard).

Works:

Install FRP steps and step-and-runs over entire length of site, mainly steps on upper half with more step-and-runs on lower half.

FRP steps curving at top to anchor to large flat/rounded rock ledge.

Anchor bottom end of FRP step-and-runs to large flat boulder (reinforce with concrete pad if required).

Divert drainage flows away from under FRP structure at top – by low rock wall at narrow point between two large boulders, extended outlet to discharge well off track.

Additional rock wall or gutter under FRP structure at suitable point midway on slope.

(HIGH – for passability issues)

Site ID: **NT – 9(D)**

Location: 337924 6260774 top
337911 6260780 bottom

17m rocky slope at 16° gradient overall, boulders and rock outcrop on upper part including "pedestal" rocks to 300-400mm (one at 500mm) above eroded track surface below, 1.5m overall rise over 5m at upper end (but also entrenched to 500mm below NSL), embedded rocks on middle/lower part (1.1m overall rise over 5.5m), frequent protruding/retaining roots throughout, 600-1,500mm wide, compacted sand and loose sand/rocks/gravel (slip hazard), considerable drainage down track with scour to 300-400mm below NSL.

Works:

Infill/level and rock armour/flagging at upper end, as landing below FRP steps above (Site NT – 9(C)) with slight fall to N for drainage with outlet gutter to N/NE (or stone-lined invert if there is space to install safely between FRP above and rock steps below).

Build 7 stone steps (upslope) and/or step-and-runs (downslope) at upper end of site, fill entrenched top section (re-use "pedestal" rocks if suitable), rock armour all treads (to protect against continued drainage down/over). Save grass tree (if possible).

5-6 step-and-runs over 5.5 m, anchored onto in-situ rock where possible (at midway and bottom end), filled and compacted treads, extend a selected upper tread and rock armour/flag and include stone-lined invert. Box/retain low side (outside of slight bend), and include 2-3 wings to divert flow from down sides and avoid scour/undercutting. Block/barrier (rock rubble) dis-used track sections.

Build 2 rock steps onto/incorporating in-situ outcrop, armour tread above/upslope to butt into in-situ outcrop/pavement.

Stone-lined invert, above/upslope of in-situ outcrops and embedded rocks.

3 step-and-runs with filled and compacted treads, over roots at lower end of site, box/retain low side. Pull-in track and block/barrier (rock rubble) dis-used track section.

(HIGH – for passability and sustainability/impact issues)

Site ID: **NT – 9(D)**

Location: 337911 6260780 top
337906 6260783 bottom

Rounded rock ledge 1.1m high, and gently sloping 1.8m wide above, at top of site. Walkers detour around SW end of ledge on sloping compacted sand track with embedded boulders and small step (at horizontal "cleft" in rock ledge) and drainage down track. Steep sloping compacted sand track with boulders, embedded rocks and protruding roots across bottom of rock ledge, some loose stone and gravel, 900-1,500mm wide, drainage down track (and from over ledge above) with erosion to 300mm below NSL. 21° gradient overall (17° gradient on track below rock ledge).

Works:

Stone-lined invert above/upslope of top of rock ledge, open mound beside track and cut extended outlet to discharge well off track (into small gully to NE) (build low rock wall as an alternative treatment, if insufficient depth for invert).

Cut 5-6 wide steps (at least 700mm wide) into upper face of rock ledge.

Cut/level tread into (or build extra stone step onto) lower "bench" of rock ledge.

Infill/level and rock armour/flag landing at base of rock ledge, match into in-situ boulder (level top of boulder to match landing, if required).

Build waterbar off base of rock ledge upslope of new landing and across existing "used" alignment, to divert drainage and protect new treatments on track downslope/below. Close and block/barrier (rock rubble) existing "used" alignment around end of rock ledge.

5 steps and /or step-and-runs (rock preferably) on steeper lower section of existing track, anchored onto in-situ rock where possible, filled and compacted treads, box/retain low side, and include 2-3 wings to divert flow from down side to avoid scour/undercutting.

(HIGH – for passability and sustainability/impact issues [to prevent track widening and environmental impacts])

Site ID: **NT – 9(F)**

Location: 337906 6260783 top
337895 6260799 bottom (and bottom of Segment)

24m slope at 15° gradient overall, 26 scored timber step-and-runs and steps (10 with drainage/scour around end [mostly on upper half of slope], 1 with a log extension), 1 log waterbar above bottom step, 800-1,200mm wide, track from NSL to 250-300mm below NSL in places, runs/treads of compacted sand and loose stone/gravel, loose/deposited sand at bottom of slope, drainage over all steps but little scour. Log post with small metal directional arrow at bottom of slope (90° turn at bottom, into Segment 10).

Works:

Stone-lined invert on wider run/tread near top of slope.

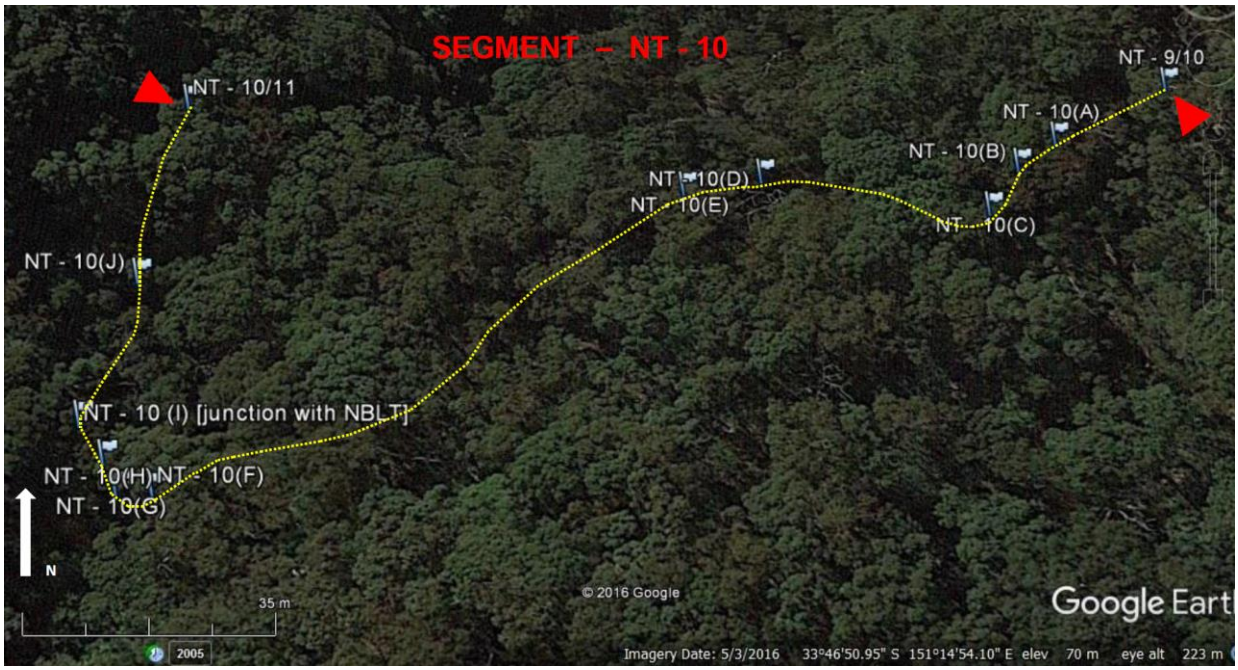
Extend or block (with embedded rock) existing timber steps (x 6), to catch flows and prevent scour around ends.

Level uneven treads and compact or remove loose stone/gravel – as/where needed.

Extend/realign 4 existing timber steps as waterbars/steps.

(low)

SEGMENT NATURE TRAIL – 10



SEGMENT: NT – 10	
Start Point: 337895 6260799	**End Point: 337754 6260791**

General Description and Condition: Well defined section of track (255m approx.) in good condition with few issues/obstacles, along contour on the slopes of a small broad valley. Large tributary crossing and signposted track junction (with the North Balgowlah Link Track) in the SW. Through mixed Eucalypt and Angophora forest, with occasional Casuarinas, and a medium/dense understorey.

Tread Width (mm): Mostly 500-900mm, occasionally to 1,200mm for short sections.

Track Surface: Chiefly compacted sand with occasional embedded rock and protruding roots, occasional laterite gravel. Frequently slightly dished track surface to 75mm, minor windrows low side and benched to 50-75mm on high side in places, but drainage capture only a localised/occasional issue. Area of loose/deposited sand at NE end (run-on area below Site NT -9(E)). Occasional faint trample tracks low side in E middle third of segment to low rock outcrops above small broad valley, and in NW third to small creekline and "wet" gully downslope.

Gradient (degrees): Predominantly gently sloping (<3-4° gradient), occasional short sections to 5° to 8° gradient.

Alignment: Very gently curving alignment, largely along contour across a moderate hillslope and around the head of a small broad valley.

Terrain: Mid hillslope, along sides of small broad valley.

Soil: Mostly Lambert (Erosional) – undulating to rolling low hills on Hawkesbury Sandstone. Area of Hawkesbury (Colluvial) – rugged, rolling to very steep hills on Hawkesbury Sandstone – at E end.

Vegetation: Bloodwood-Scribbly Gum Woodland in E (until just E of larger drainage line) and Sclerophyll Forest Peppermint Angophora Forest in W – both part of Sydney Coastal Dry Sclerophyll Forest.

Track Works and Improvements: 1 timber sleeper step at junction with North Balgowlah Link Track.

Signs and Wayfinding: 2 routered timber track identification and directional signs at junction with North Balgowlah Link Track - "NORTH BALGOWLAH" sign good condition, "NATURE TRAIL " sign fair condition only. No other wayfinding en-route. 3 old style small interpretation panels (fair condition only).

User Experience: Easy pleasant walking through attractive enclosed bushland in small broad and well vegetated valley (no views).

Key Issues: Overhanging/intruding vegetation. "Wet" drainage line crossing. Minor drainage capture.

Recommended Works – Overall

- Maintenance and cleaning of waterbars, waterbars/steps and other drainage treatments.
- Open windrows to minimise drainage/seepage capture and ponding.
- Remove/level protruding rocks and remove protruding roots.
- Regular vegetation trimming/clearance.
- Upgrade signage at junction with North Balgowlah Link Track (Site NT – 10(I)).

Recommended Works – Site-specific (Priority)

Site ID: **NT – 10(A)**

Location: 337878 56260790 Compacted sand track, 700mm wide, dished to 50mm, on 4° gradient.

Works:

Waterbar.

(low)

Site ID: **NT – 10(B)**

Location: 337873 6260786 Ephemeral drainage line in dip (1.5m wide flow path), seepage/ponding area withy pool on downslope side off track. and

Works:

Monitor for track widening (wet area avoidance) and need for stepstones

(monitor)

Site ID: **NT – 10(C)**

Location: 37868 6260779 Compacted sand track, 700mm wide, dished to 50mm, on 6° gradient.

Works:

Waterbar/step.

(low)

Site ID: **NT – 10(D)**

Location: 337836 6260783 Embedded small rounded boulders with gap between, 300mm wide and 300mm deep.

Works:

Rock infill gap and level top to form informal step (and act as waterbar), infill and compact tread above/upslope to half height of boulders.

Open low side windrow above/upslope of boulders to allow drainage flows off track.

(low)

Site ID: **NT – 10(E)**

Location: 338724 6260781 10m at 9° gradient. Protruding roots, and junction with trample track from N (leads to rock outcrop above slope into gully). Rock outcrop high side of track, with track guttered adjacent (to 100mm below NSL) over embedded rocks and protruding roots. Eroded track on slope above, with 2 large retaining/protruding roots, drainage flows down track.

Works:

Remove lower protruding roots.

Build 2 rock steps onto in-situ rock outcrop and embedded rocks in gutter, rock armour/flag tread above upper step upslope to stone-lined invert above.

Stone-lined invert above in-situ rock outcrop (and rock steps), remove roots, build rock step on upslope side of invert with extended tread above filled and compacted over roots.

Waterbar/step below roots at top of slope, fill and compact above/upslope over roots (box/retain on low side if needed).

(low)

Site ID: **NT – 10(F)**

Location: 337755 6260738 Slope to larger drainage line crossing, 5m at 6° gradient and 1.2 change in level overall, compacted a sand/clay at top of slope benched-in to 200mm on high side and retaining/step roots with 300mm face, flat embedded rock and protruding roots on slope below, moist sand/loam on edge of drainage line (with rock pavement bed). Old style small interpretation panel beside drainage line.

Works:

3 steps at top, boxed/retained on low side, with filled/compacted treads. Top step angled to also act as waterbar (but leaving sufficient tread width below for a safe step).

2 steps, built onto in-situ rock, boxed/retained on low side, with extended tread (retained on low side, and filled and compacted over roots upslope) above upper step.

Pull-in track width on approach to drainage line crossing and barrier/block (rock rubble).

(Medium)

Site ID: **NT – 10(G)**

Location: 337750 6260738 Larger drainage line crossing, wet/flowing with rock pavement bed/crossing, 1.8m wide, moist sand/loam on SE bank, flat rock outcrop on NW bank.

Works:

Boxed rock step on SE bank (deeply/well anchored into bank to prevent undercutting and instability), rock armour tread (to protect during larger flows).

Set stepstone onto pavement in middle of bed.

Set rock onto pavement/outcrop on NW edge, to “square-off” step in/out of drainage line.

(low – and monitor for bank erosion and undercutting of track treatments after high flows)

Site ID: **NT – 10(H)**

Location: 337747 6260742 Guttered compacted sand track to 250mm below NSL, 600mm wide, retaining roots at top of slope, drainage flows down track from junction with North Balgowlah Link Track above.

Works:

Remove existing root at top of slope and replace with waterbar, extend waterbar upslope (beyond track edge) to catch/divert drainage from end of lowest step on North Balgowlah Link Track above.

Step below waterbar (at least one pace below) with filled compacted tread above.

2 step-and-runs on guttered track, with filled and compacted tread, box/retain low side if needed.

(Medium – for sustainability issues [to limit sediment inflows to drainage line below])

Site ID: **NT – 10(I)**

Location: 337745 6260746 Junction with North Balgowlah Link Track from upslope to SW, 90° turn in Nature Trail to NE, 2 routered timber track identification and directional signs (“NATURE TRAIL“ sign fair condition only, “NORTH BALGOWLAH” sign good condition). Timber step/waterbar at top of slope to Nature Trail to SE (Site NT – 10(H)), full of sediment with drainage flows over and down track. Old style small interpretation panel (fair condition only).

Works:

Upgrade signage at top junction as per Manly Dam Sign Location Plan.

Clean out step/waterbar, and extend outlet to discharge well off track (and prevent backflow onto track below)

(low)

Site ID: **NT – 10(J)**

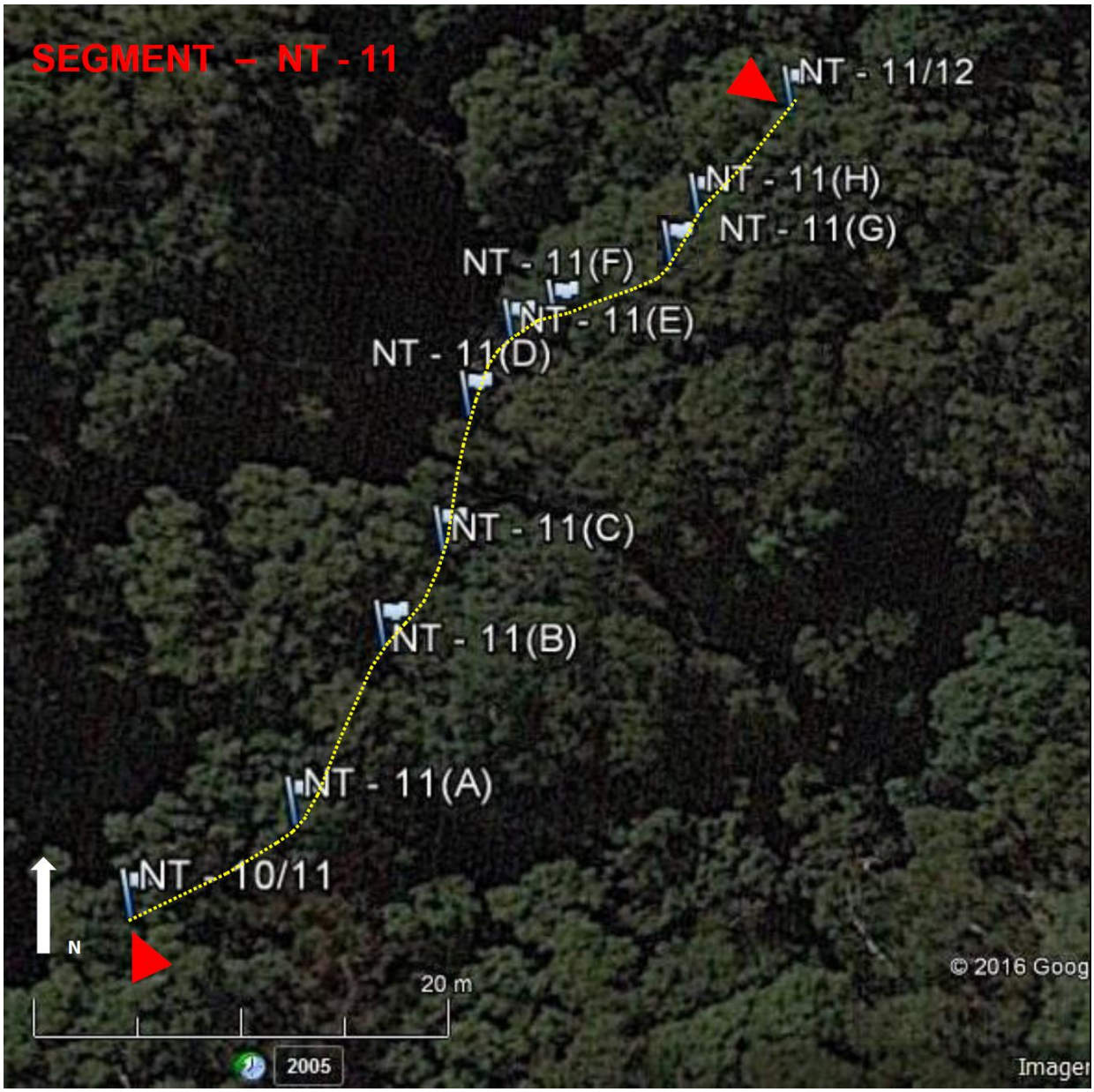
Location: 337748 6260767 Compacted sand and gravel track on 3.5° gradient and drainage flows, 700mm wide, dished to 75mm.

Works:

Waterbar.

(low)

SEGMENT NATURE TRAIL - 11



SEGMENT: NT - 11	
Start Point: 337754 6260791	**End Point: 337786 6260835**
General Description and Condition: Well-defined track (70m approx.) featuring an almost continuous run of steps and steps/waterbars angling across contour up/down a moderate hillslope on the W side of a small broad valley, through Eucalypt and Casuarina forest with a mixed open understorey (including ferns on downslope side towards creek). Good condition overall (with isolated fair or poor condition sites where treatments missing or failed). *Tread Width (mm):* 900-1,600mm. *Track Surface:* Compacted sand with some embedded stone and gravel, predominately as tread between sleeper steps. Track surface benched-in (sloping) on high side, usually to 75-100mm high but occasionally to 200mm high, and usually boxed/retained on low side of track between steps. Occasional embedded rock, and some protruding rocks, mainly on	

upper third. Drainage down over steps, but little scour due to frequent spacing of treatments (and many steps having some “freeboard” i.e. not full of sediment).

Gradient (degrees): Mainly gentle and gentle/moderate slope (7° to 15° gradient) with shorter steep sections (16° to 19° gradient).

Alignment: Very gently curving alignment angled across contour up/down a moderate hillslope, with only short landings/benching between more sloping sections.

Terrain: Mid to lower hillslope, along W side of small broad valley.

Soil: Lambert (Erosional) – undulating to rolling low hills on Hawkesbury Sandstone.

Vegetation: Sclerophyll Forest Peppermint Angophora Forest.

Track Works and Improvements: More or less continuous run of approximately 65 sleeper steps – 30 steps (including 4 rotten/rotting) and 33 wider steps/waterbars or elongated steps acting as waterbars (including 4 rotten/rotting), most boxed/retained on low side of track, some butted onto embedded rock or with “blocking” rocks containing flows around their downslope ends, many have some “freeboard”. Usually arranged as step-and-runs, and more closely spaced as steps on steeper slopes. 3 missing steps (Sites NT - 11(C), 11(E) and 11(G)).

Signs and Wayfinding: No wayfinding. Old style interpretation panel beside track (good condition).

User Experience: Relatively easy climb or decent, but care required at failed/missing treatments, through attractive enclosed bushland in small broad and well vegetated valley (no views).

Key Issues: Rotting sleeper track treatments. Potential for scour over and around sleeper steps/waterbars. Minor drainage capture. Boxing/retaining preventing drainage discharge from behind boxed steps.

Recommended Works – Overall

- Clean-out steps and steps/waterbars, and maintenance/cleaning of drainage treatments (including cutting slot in low side edge boxing/retaining behind boxed steps).
- Open windrows to minimise drainage and seepage capture/ponding.
- Monitor for rotting of timber sleepers (replace as/if required) and scour over and around steps and steps/waterbars – with adaptive management/remediation as/if required.

Recommended Works – Site-specific (Priority)

Site ID: **NT – 11(A)**

Location: 337761 6260795 Wide sleeper step with drainage flows over.

Works:

Realign as waterbar/step (for extra drainage protection at top of slope) and cleanout.

(Medium – for sustainability issues [to catch/divert flows at top of extended slope below])

Site ID: **NT – 11(B)**

Location: 337764 6260803 Rotten/buried sleeper step, with embedded rounded rocks above on sloping tread.

Works:

Replace sleeper step, and fill/compact tread above (over rocks) to step above.

(low)

Site ID: **NT – 11(C)**

Location: 337767 6260809
Rotted/missing sleeper step with protruding reinforcing rod remaining (trip hazard), rounded embedded boulder below on high side.

Works:

Build waterbar/step onto embedded boulder and fill/compact tread above ((box/retain on low side if needed – leaving outlet slot for drainage discharge).

Remove old reinforcing rod.

(Medium – safety issues [trip hazard])

Site ID: **NT – 11(D)**

Location: 337769 6260818 2 rotting sleeper steps (rotting from underside), and rotten retaining timber edge to tread.

Works:

Monitor for failure of sleeper steps and collapse/erosion of edge of track, replace as/when needed.

(monitor)

Site ID: **NT – 11(E)**

Location: 337771 6260821 Missing rotted sleeper step. Protruding log from high side of track, rotting sleeper step (rotting of downslope face) above/downslope.

Works:

Replace sleeper step, and fill/compact tread above (box/retain along low edge if needed).

Remove log.

Monitor for failure of sleeper step, replace as/when needed.

(low)

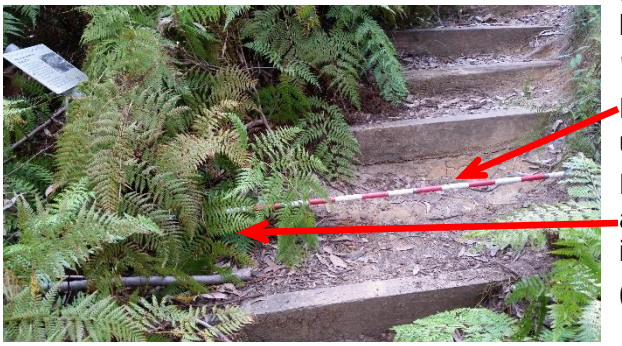
Site ID: **NT – 11(F)**

Location: 337772 6260822 Rotting sleeper step above, worn sleeper step below.

Works:

Monitor for failure of sleeper steps, replace as/when needed.

(monitor)



Site ID: **NT – 11(G)**

Location: 337778 6260825 Missing angled step (in longer run of sleeper steps on steep slope, 19° gradient), 250mm drop off step above/upslope, compacted sand/clay tread, old style interpretation panel beside track (good condition).

Works:

Build timber step against/below existing step upslope (with sufficient/safe tread width).

Box/retain low side of tread below new step, and level tread (as stopping/reading area for interpretive panel).

(low)

Site ID: **NT – 11(H)**

Location: 337781 6260829 2 rotten and failed wide sleeper steps/waterbars – upper step loose and sticking up, lower step broken and loose (hazard) – in longer run of sleeper steps on steep slope, 19° gradient. 350mm step off lowest wide step/waterbar onto eroded track with embedded rock. Drainage flows down.

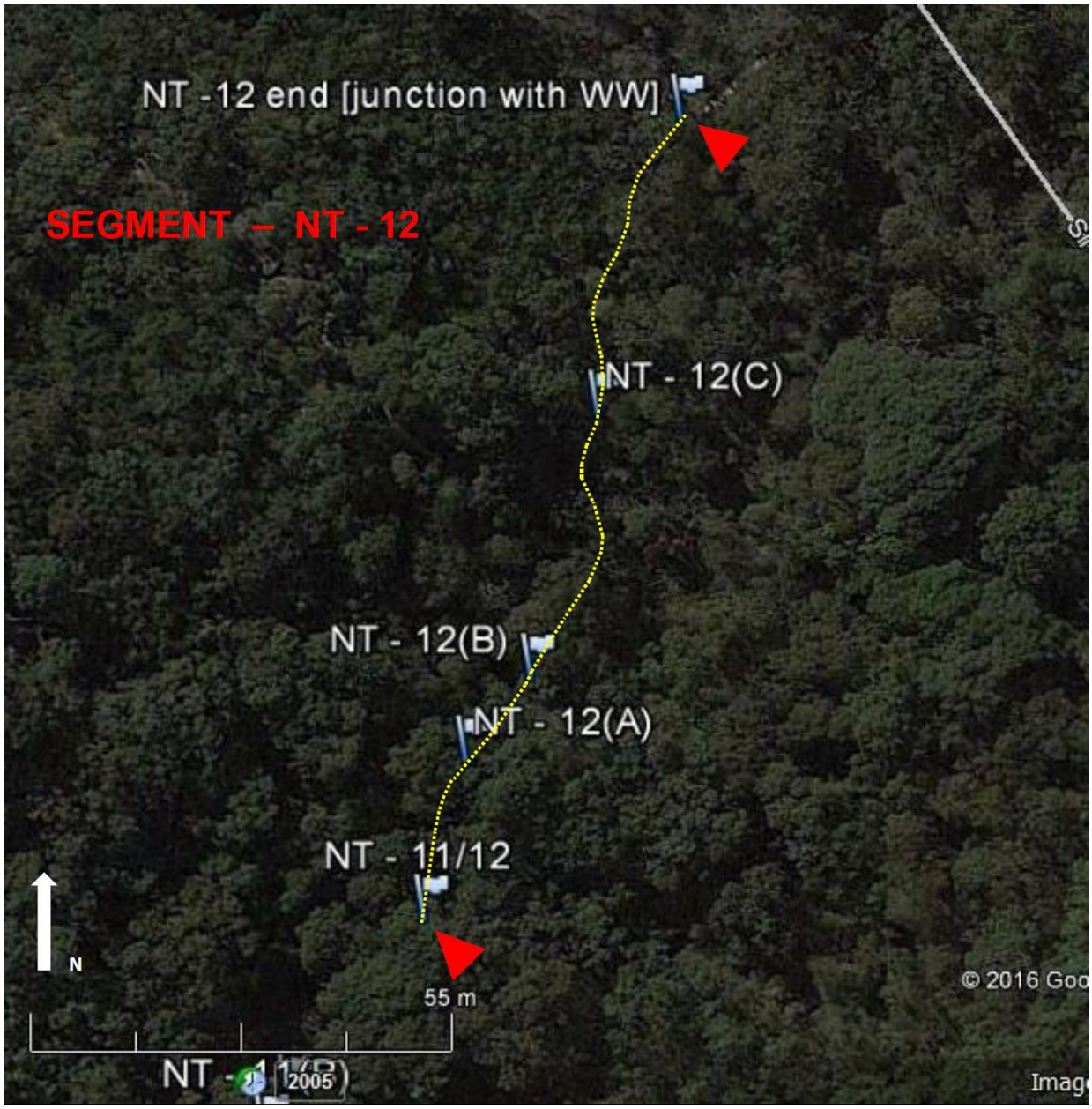
Works:

Replace 2 rotten/failed/broken steps/waterbars, and fill/compact treads above (box/retain along low edge if needed).

Build step onto in-situ rocks 1m below/downslope of existing bottom step, fill/compact tread above back to bottom step (box/retain along low edge if needed).

(HIGH – for safety issues [to remove trip hazard on steep run of steps])

SEGMENT NATURE TRAIL - 12



SEGMENT: NT - 12	
Start Point: 337786 6260835	**End Point: 337819 6260958**
General Description and Condition: Well-defined gently undulating track (145m approx.) gently curving along contour across a gentle/moderate lower hillslope on W side of broad open valley, through mixed open forest with an open understorey (including ferns on downslope side towards creekline), vegetation becoming lower and more open from S to N. Good condition. Joins Wildflower Walk at N end. *Tread Width (mm):* Mostly 900-1,400mm, short section only 600mm wide near middle of segment. *Track Surface:* Predominately compacted sand (tending to compacted sand/clay at N end), often with laterite gravel, and occasional embedded rock/outcrops and roots. Some areas of	

loose stone. Track surface benched-in (sloping) on high side, usually to 150mm high. Slightly dished track in places with some drainage flows down track, but no scour.

Gradient (degrees): Mostly flat to gently sloped (<1° to 3° gradient), short sections of gentle/moderate slope (4° to 6° gradient).

Alignment: Gently curving along contour across a gentle/moderate lower hillslope.

Terrain: Lower hillslope.

Soil: Lambert (Erosional) – undulating to rolling low hills on Hawkesbury Sandstone.

Vegetation: Sclerophyll Forest Peppermint Angophora Forest in S third, and Bloodwood-Scribbly Gum Woodland in N two-thirds – both part of Sydney Coastal Dry Sclerophyll Forest.

Track Works and Improvements: 25 wide sleeper steps (clustered on steeper track sections), 1 buried non-functional sleeper step/waterbar (Site NT – 12(B)), 2 old log waterbars, short timber cover (likely former drain cover) over small sediment filled gutter (Site NT – 12(A)).

Signs and Wayfinding: Routered timber track identification and directional sign at junction with Wildflower Walk ("NATURE TRAIL AND NTH BALGOWLAH" and "WILDFLOWER WALK") in fair condition. No other wayfinding en-route. Old style interpretation panel upslope side of track near N end, fair condition).

User Experience: Easy walking, through varied bushland (less attractive towards N end) and within earshot of park access road at N end.

Key Issues: Minor drainage capture. Potential for scour over and around timber steps/waterbars.

Recommended Works – Overall

- Maintenance and cleaning of waterbars, steps/waterbars and other drainage treatments.
- Open windrows to minimise drainage capture/ponding.
- Remove protruding rock and roots.
- Monitor for scour over drainage treatments and rotting of timbers sleepers (replace as/if required) – with adaptive management/remediation as/if required.

Recommended Works – Site-specific (Priority)

Site ID: **NT- 12(A)**

Location: 337791 6260858 Small timber cover (former drain cover ?), 800mm long, over small former gutter (now filled with sediment and non-functional)

Works:

Monitor for rotting of timber planks and trip hazard, or for erosion due to blocked gutter, or for avoidance and track widening – and need for adaptive management/remediation as/if required.

(monitor)

Site ID: **NT- 12(B)**

Location: 337799 6260871 Buried and non-functional step/waterbar, rotting at exposed end off low side of track.

Works:

Replace step/waterbar.

(low)

Site ID: **NT- 12(C)**

Location: 337809 6260911 Dished track on compacted sand with laterite gravel, 2 steps/waterbars rotting from underside.

Works:

Replace 2 steps/waterbars.

(low)

Site ID: **End of Segment NT - 12, at junction with Wildflower Walk**

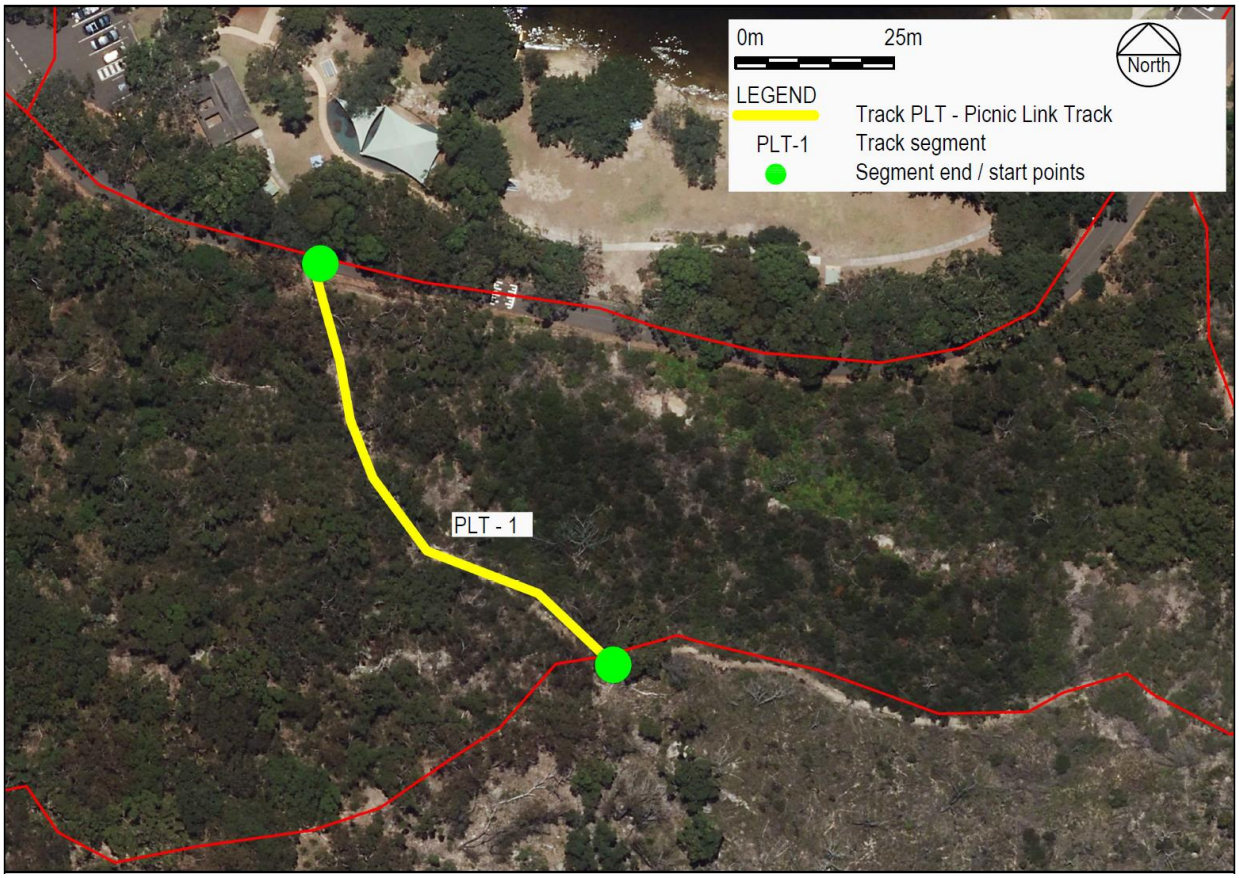
Location: 337819 6260958 Junction with Wildflower Walk, wide boxed landing/junction of compacted sand with retaining sleeper steps to both tracks. Routered timber track identification and directional sign ("NATURE TRAIL AND NTH BALGOWLAH" and "WILDFLOWER WALK") in fair condition. *Works:*

Upgrade signage at junction, as per Manly Dam Sign Location Plan.

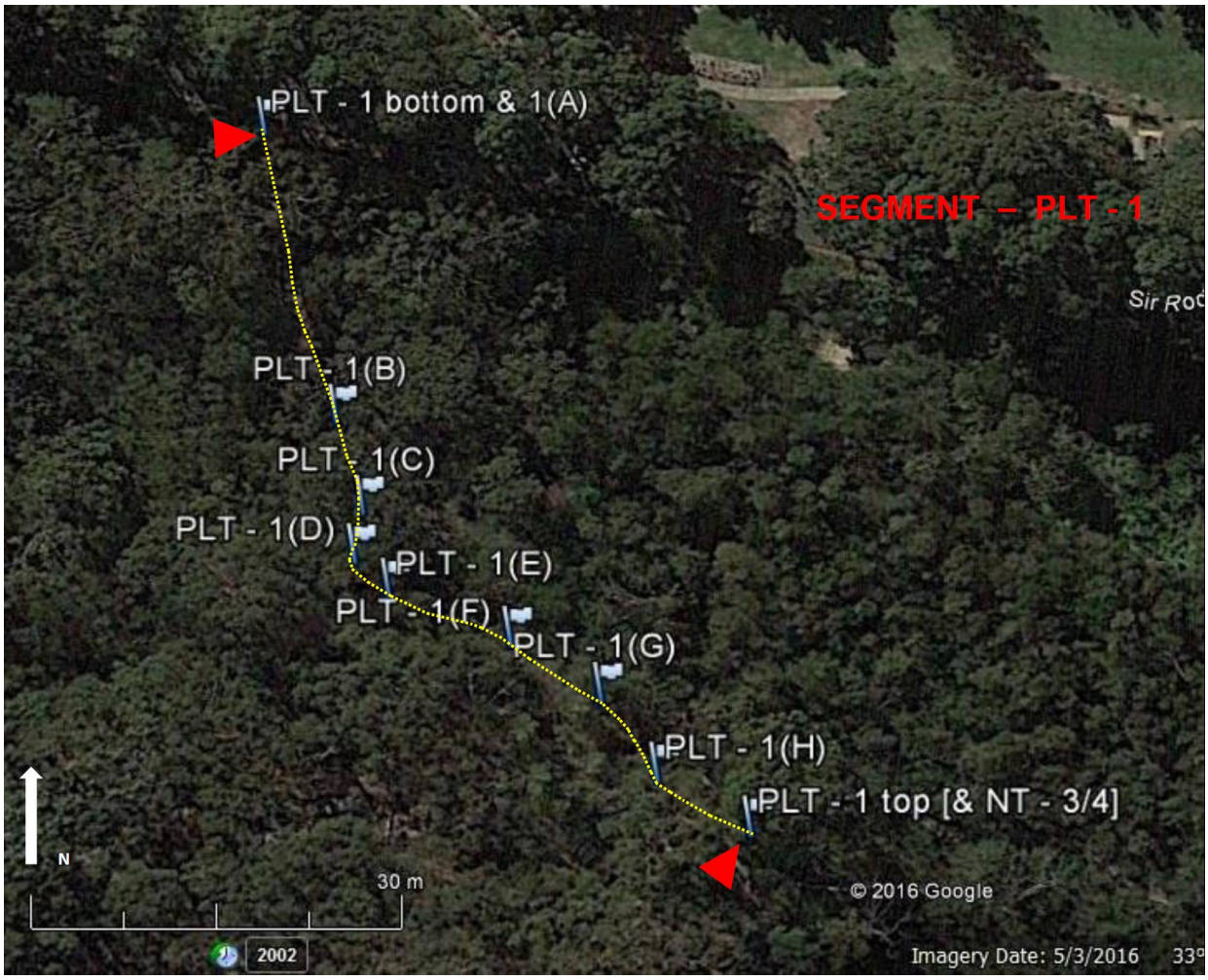
Clean-out upside of steps.

(low)

PICNIC LINK TRACK – SEGMENT 1 (ONLY)



SEGMENT PICNIC LINK TRACK - 1



SEGMENT: PLT -1	
Start Point: 338343 6260505 (trackhead at Sir Roden Cutler Drive)	**End Point: 338390 6260443 (junction with Nature Trail, NT-3 and NT-4)**
General Description and Condition: Wide and very well-defined short link track (95m approx.) with multiple sleeper step-and runs gently curving across and up/down slope through open Eucalypt forest with some Casuarina, over medium/dense mixed understorey. Good condition overall. *Tread Width (mm):* Main tread typically 900-1,400mm wide, but constructed track varies from 800mm to 2.2m wide. *Track Surface:* Mostly compacted sand with gravels, some areas of loose/deposited sand, occasional roots, 3 areas of exposed rock outcrops and small ledges in centre. Some imported sand and fill (rounded gravel) on lower section (possibly washed own form upslope). *Gradient (degrees):* Gentle/moderate – 4°-5° on upper and lower sections, up to 8.5° over sloped rock outcrops in centre. *Alignment:* Very gently curving across and up/down slope.	

Terrain: Mid to lower hillslope.

Soil: Hawkesbury (Colluvial) – rugged, rolling to very steep hills on Hawkesbury Sandstone.

Vegetation: Bloodwood-Scribbly Gum Woodland (part of Sydney Coastal Dry Sclerophyll Forest).

Track Works and Improvements: Numerous treatments – 29 sleeper step-and-runs (14 on upper half, and 15 on lower half including 3 boxed on lower edge) and 5 sleeper waterbars. All step-and-runs and waterbars are full of sediment and failed, with drainage flows over and some downside scour in places. Several sleeper treatments are rotted or decaying or worn along the upper tread/edge. Logs placed alongside track in upper section to define edge and prevent widening.

Signs and Wayfinding: New routered timber sign (track identification and orientation, "NATURE TRAIL") in good condition, log post with 2 pictograms ("walkers" and "no bikes") in good/fair condition, and adjacent routered timber sign ("WILDFLOWER PROTECTED AREA") in good condition at S trackhead/entry off park access road. Log post with larger "Dogs Prohibited" text and pictogram, facing upslope, 30m S of trackhead. Small routered timber sign for "NATURE TRAIL" at top/S of segment - dislodged (leaning against tree stump) and in poor condition - but no sign for link track or directional information to picnic area downslope. No wayfinding en-route.

User Experience: Easy walking, with steady climb, through pleasant open forest on edge of (and within earshot of) developed/facilities area.

Key Issues: Scour over and around timber steps/waterbars. Rotting, decaying and wear of sleeper treatments. Minor tree clearance issues (low or leaning intruding branches). Track widening. Absence of signposting at junction with Nature Trail.

Recommended Works – Overall

- Remove or mark hazardous branches.
- Maintenance and cleaning of steps, step-and-ruins, step/waterbars and other drainage treatments.
- Monitor for scour over drainage treatments and rotting of timbers sleepers (replace as/if required) – with adaptive management/remediation as/if required.
- Monitor for excessive track widening scour, with track edge definition and barriers as/if required.
- Upgrade signage, as per Manly Dam Sign Location Plan.

Recommended Works – Site-specific (Priority)

Site ID: **PLT - 1(A)**

Location: 338343 6260505 Trackhead at park access road (Sir Roden Cutler VC Memorial Drive) opposite playground with interpretation shelter and toilets, new routered timber sign (track identification and orientation, "NATURE TRAIL") in good condition, log post with 2 pictograms ("walkers" and "no bikes") in good/fair condition, adjacent routered timber sign ("WILDFLOWER PROTECTED AREA") in good condition, roadside drain crosses start track.

Works:

Monitor for muddiness and need to rock armour or install a stone lined invert at drain crossing.

(monitor)

Site ID: **PLT - 1(B)**

Location: 338351 6260478 Sleeper step with drainage flows over and scouring above angled rock outcrop, then sleeper step/waterbar with angled rock outcrop and embedded rock below. Log post with larger "Dogs Prohibited" text and pictogram, facing upslope, 30m S of trackhead.

Works:

Leave sloped rock faces as a "filter" so track will not be appealing to less capable/mobile walkers or poorly prepared (e.g. wrong footwear).

Install stone-lined invert below upper sloped outcrop, including infill and rock armour/flagging below upper scoured step.

Clean out waterbar.

(low)

Site ID: **PLT - 1(C)**

Location: 338355 6260471 2 sleeper steps (lower step shaped to fit rock outcrop below), then uneven rock outcrop with sloped/angled rockface below, drainage flows down, protruding root on compacted sand flat then angled outcrop/ledge (250mm step-off) below, waterbar downslope. Low Eucalypt branch at top/W of site

Works:

Level upper part of rock outcrop, with level tread or small step.

Cut 3 steps into sloped/angled rockface ledge (at least 700mm wide).

Remove protruding root and rock armour/flagging landing.

Cut step in lower outcrop (at least 700mm wide), and rock armour/flag landing below.

Clean-out waterbar below.

Hazard mark low branch (or drop).

(Medium – for passability issues, as is close to picnic area)

Site ID: **PLT - 1(D)**

Location: 338354 6260466 4m wide tread with protruding roots and some embedded rock

Works:

Install stone-lined invert with extended outlet discharging to W.

Remove protruding root, and rock armour/flagging below sleeper step upslope.

(low)

Site ID: **PLT - 1(E)**

Location: 338358 6260463 3m sloped rock outcrop and 1m rock outcrop above with gap/channel down E edge, small cross-sloping gap of compacted sand in between outcrops, some avoidance and track widening to NE (short logs placed to block access), sleepers on NW side (not fixed), drainage flows down, overall drop of 1.1m over 5.5m.

Works:

Install waterbar above.

Infill gap beside upper outcrop and level (rock armour/flagging if required).

Cut 4 level treads into lower larger sloped outcrop (at least 700mm wide).

Block/barrier (rock rubble) track to NE, to prevent avoidance/widening.

(Medium – for passability issues, as is close to picnic area)

Site ID: **PLT - 1(F)**

Location: 338368 6260459 Small rock outcrop above and larger flat but sloping outcrop, with angled Casuarina branch intruding onto track above, drainage flows over/down.

Works:

Remove overhanging Casuarina branch.

Install stone-lined invert above larger outcrop, flagging to extend rock outcrops to match with invert as needed (required to divert flows off track before larger rock slope below (Site PLT - 1(E)).

(low)

Site ID: **PLT - 1(G)**

Location: 338377 6260454 1,100mm wide compacted sand tread between sleeper step-and-runs, slightly dished, rock outcrop adjacent to W on edge of track.

Works:

Install additional waterbar, built onto in-situ outcrop.

(low)

Site ID: **PLT - 1(H)**

Location: 338382 6260448 2m wide compacted sand tread between sleeper step-and-runs just downslope of junction with Nature Trail. Overhanging Scribbly Gum branch.

Works:

Install wide stone-lined invert, replace sleeper step below with new sleeper waterbar

Trim overhanging Scribbly Gum branch.

(Medium – effective drainage diversion necessary to direct flows, from Nature Trail junction upslope, off track at top of this segment)

Site ID: Junction with Nature Trail (NT-3 to E, and NT-4 upslope to W)

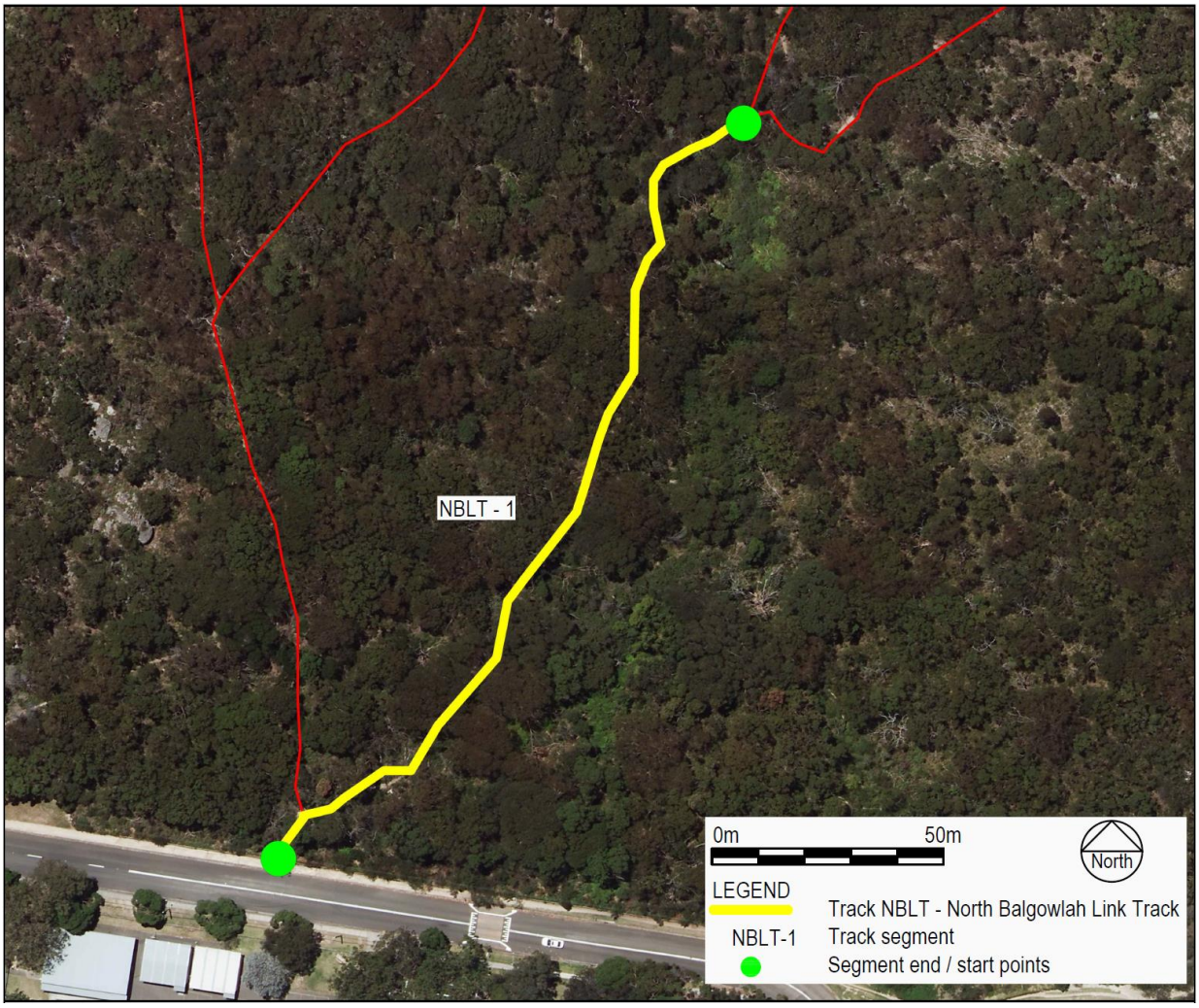
Location: 338390 6260443 Small routered timber sign for "NATURE TRAIL", with "MCCOMB HILL" and "Section 3" both with directional arrows. Dislodged (leaning against tree stump) and in poor condition.

Works:

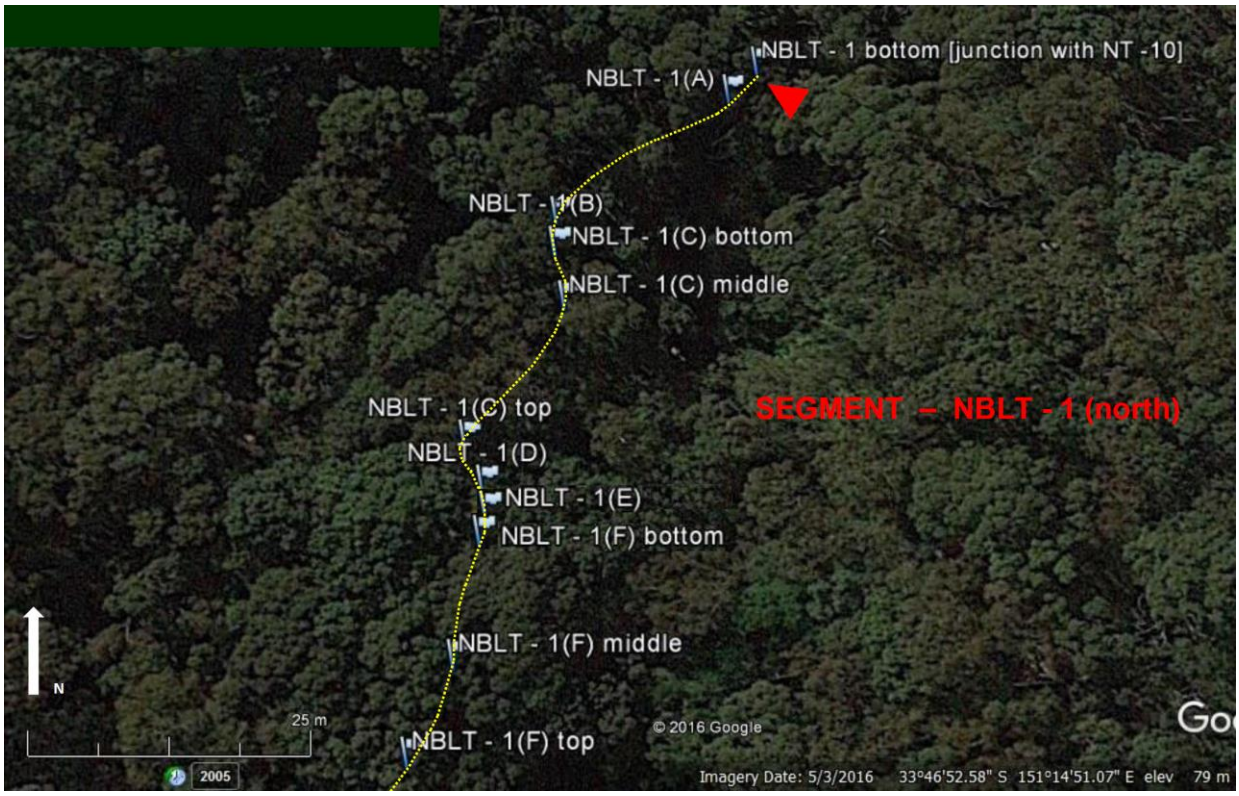
Upgrade signage at junction as per Manly Dam Sign Location Plan.

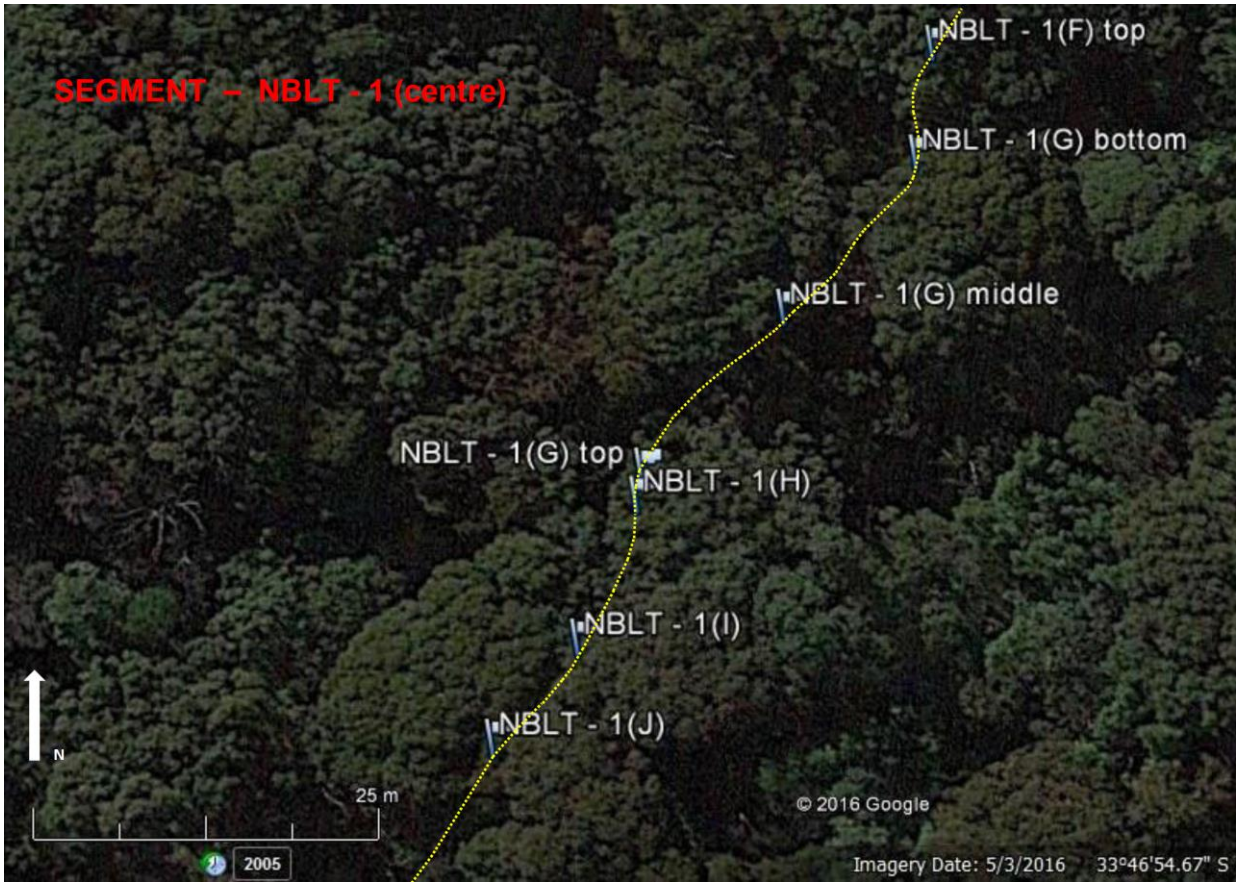
(Medium)

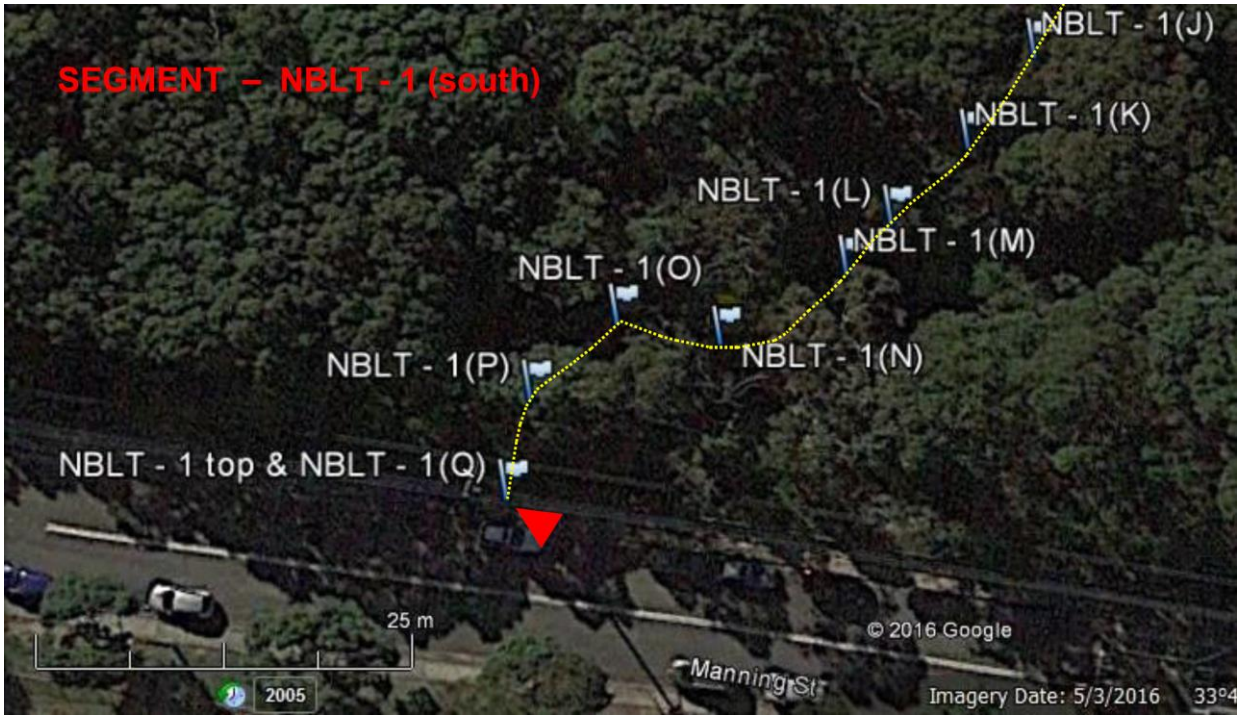
NORTH BALGOWLAH LINK TRACK - SEGMENT 1 ONLY



SEGMENT NBLT - 1







SEGMENT: NBLT – 1	
Start Point: 337745 6260746 **(junction with Nature Trail - 10)**	**End Point: 337640 6260588** **(park boundary at Manning Street footpath)**

General Description and Condition: Well-defined track (245m approx.) with a large number of timber track treatments (steps and step-and-runs) running up/down the W side of a small steep-sided valley, lower two thirds is a series of steeper steps/step-and-runs sharply up/down and across contour with minor more gently sloped section of track, upper third has fewer treatments and is more gently/moderately sloped to the trackhead on Manning Street. Through an attractive mixed Eucalypt/Angophora/Casuarina forest with dense fern understory downslope and a mixed understory upslope. Generally good/fair condition, but numerous missing and rotten treatments.

Tread Width (mm): 700-1,600mm on lower two-thirds dominated by sleeper steps and step-and-runs, 400-1,000mm (mostly 600-900mm) on upper third.

Track Surface: Mostly compacted sand, occasional embedded rock, regular laterite gravel and frequent roots (mostly on upper third). Drainage flows down most of track, but little scour on lower two-thirds due to spacing/frequency of sleeper steps and step-and-runs (scour wash around end of treatments), however track dished for most of third to 150mm below NSL and occasional scour.

Gradient (degrees): Moderate to steep (from usually 10° to 18°, short section to 23°) with minor flatter areas on lower two-thirds - dominated by sleeper steps and step-and-runs). Gentle/moderate slope on upper third (4° to 10°)

Alignment: Gently curving up/down and across a moderate to steep valley side slope, especially on the lower/N two-thirds.

Terrain: Mid to upper hillslope

Soil: Lambert (Erosional), undulating to rolling low hills on Hawkesbury Sandstone.

Vegetation: Predominantly Duffys Forest (Silverback Ash – Brown Stringybark Forest), with minor area of Peppermint Angophora Forest (part of Sydney Coastal Dry Sclerophyll Forest) at N end.

Track Works and Improvements: 100+ timber treatments on lower/N two-thirds mainly as step-and-runs, steps and waterbars - often boxed/edged along low side and several sites where former treatments rotted away or missing/removed. 16 timber treatments on upper/S third, mostly older log waterbars. Low level (floating ?) timber boardwalk, *7.*5m long and 900mm wide - Site NBLT-1(H). 3 un-used log posts around informal track junction just S of Manning Street.

Signs and Wayfinding: Routered timber sign ("NORTH BALGOWLAH") at junction with Nature Trail, good condition (but one post rotting from top). Older-style routered timber directional sign ("WAKEHURST GOLF CLUB" and "PICNIC AREAS") in fair condition only, and log post with "Walkers" and "No Bikes" pictograms in good condition, at informal track junction just S of Manning Street. No other wayfinding signage en-route.

User Experience: Slightly challenging ascent/descent but made easier by abundance of track treatments, well-defined track, and attractive mixed forest vegetation with views into/.across valley and creekline. Far S end is within earshot of Manning Street and public school.

Key Issues: Rotting/missing sleeper track treatments. Potential for scour over and around sleeper track treatments. Minor drainage capture. Boxing/edging on low side of steps/step-and-runs prevents drainage discharge from behind treatments in places.

Recommended Works – Overall

- Clean-out steps, step-and-runs and steps/waterbars.
- Open windrows to minimise drainage.
- Remove protruding roots.
- Maintenance/cleaning of drainage treatments (including cutting slot in low side boxing/edging).
- Monitor for rotting of timber sleepers (replace as/if required) and scour over and around steps and steps/waterbars – with adaptive management/remediation as/if required.

Recommended Works – Site-specific (Priority)

Site ID: **Junction with Nature Trail (NT-10)**

Location: 337745 6260746 Junction of North Balgowlah Link Track (upslope) and Nature Trail (Segment 10). Routered timber sign ("NORTH BALGOWLAH"), good condition (but one post rotting from top). Elongated timber step/waterbar at bottom of top of North Balgowlah Link Track, full of sediment with drainage flows over and down/E on Nature Trail.

Works:

Upgrade signage as per Manly Dam Sign Location Plan.

Clean out long/bottom step/waterbar, and extend outlet to discharge well off track (and prevent backflow onto Nature Trail below)

(low)

Site ID: **NBLT – 1(A)**

Location: 337741 6260744 (midpoint) Run of 14 timber steps/step-and-runs (6 boxed at upper end) in good/fair condition, over 15m length at 14°, 700-1,500mm wide, 2 steps extended as waterbar, 2 rotting treatments (worst at upper end of site), most treatments are full of sediment and failed with drainage flows down/over but little scour or washed out ends.

Works:

Clean out waterbars.

Replace rotting treatments.

(low)

Site ID: **NBLT – 1(B)**

Location: 337721 6260732 Drainage line captured by track (bank and log 300mm opposite where tributary meets track deflects flows down track) with ephemeral flows along track for 5-6m to NE, moist compacted sand and seepage. Boxed step with 350mm drop off above junction with drainage line, with double step/waterbar above. Trample tracks upslope from lower/N end of site.

Works:

Open low-side windrow beside step/windrow upslope.

Open mound for 2 - 3m opposite tributary. Build stone lined channel/invert to carry tributary across track.

5+m of low FRP boardwalk over crossing, butting into existing boxed step.

Monitor for repeated blocking/diversion of drainage line.

(Medium – for passability)

Site ID: **NBLT – 1(C)**

Location: 337723 6260730 *(bottom = top of Site NBLT-1(B))*
337725 6260722 *(midpoint)*
337716 6260707 *(top)*

Run of 35 timber sleeper steps/step-and-runs and waterbars, comprising - 20 steps/step-and-runs (several edged or with rotten edges), 4 with wash/scour around end, 10 steps extended/acting as waterbars, and 1 rotten step. 32m long, 18° overall (variously 13°, 11° and 18°), compacted sand between treatments, 700-1,600mm wide. Most treatments are full of sediment with flows over, but limited scour. Rotted/missing steps. Rotted out or missing treatments at 3 points. Generally fair/good condition

Works:

Replace 4 missing or rotten steps/waterbars.

Block (with embedded rock) 4 end wash arounds.

Replace 3 rotten edging/boxing.

Clean out waterbars.

Monitor for further rotting and treatment failure.

(low)

Site ID: **NBLT – 1(D)**

Location: 337717 6260703 6m section of compacted sand and embedded rock, 900-1,200mm wide, 23°. Run of 7 sleeper steps – 1 rotten/missing, 1 with rotten end and flows/wash around end, all full of sediment and failed with flow over but no serious scour. Old edging/boxing, but rotten. Overhanging/intruding vegetation.

Works:

Replace 2 failed/rotten steps as extended steps/waterbars (to discharge well off track).

Clear / trim overhanging vegetation.

Monitor for further rotting and treatment failure.

(low)

Site ID: **NBLT – 1(E)**

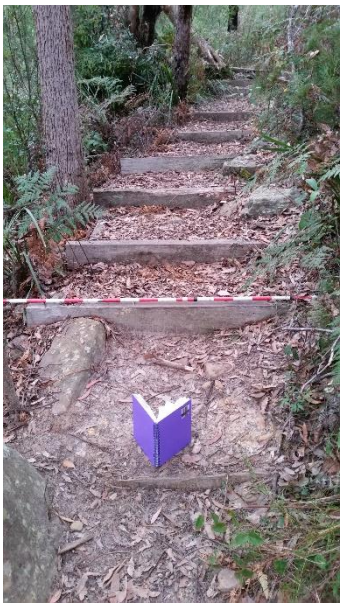
Location: 337716 6260700 Sloped boulders/outcrop with 2 placed stone steps in between. Timber step above, part rotten on upper edge.

Works:

Cut level treads into sloped outcrop beside placed stone steps (especially lower step), add/extend stone steps to match levels and provide sider steps.

Monitor timber step for replacement.

(low)



Site ID: **NBLT – 1(F)**

Location: 337717 6260699 *(bottom = top of Site NBLT-1(E))*
337715 6260686 *(midpoint)*
337710 6260677 *(top)*

Run of 23 timber steps, step-and-runs and waterbars, most boxed/edged, most full of sediment and failed with flows over but only occasional limited scour, comprising - 13 steps/step-and-runs, 4 rotting steps (1 uprooted by fallen tree, trip hazard), and 6 steps/waterbars. 29m section, *9*00–1500mm wide, 9° lower section then 15° upper section. Also 1 missing/rotted treatment and 1 old log waterbar (now buried and non-functional). Treatments generally good length, no wash arounds.

Works:

Replace uprooted rotten step, and box/edge above along low side.

Replace missing / rotten steps.

Clean out waterbars.

Monitor for further rotting and treatment failure.

(Medium - safety issue [trip hazard] at uprooted step - otherwise low)

Site ID: **NBLT – 1(G)**

Location: 337709 6260667 *(bottom)*
337699 6260654 *(midpoint)*
337688 6260641 *(top)*

Run of 19 timber steps, step-and-runs and waterbars, 900-1,400 mm wide, comprising - 12 steps (2 with wash around end), 3 rotten/rotting steps, and 4 steps acting as waterbars (most treatments boxed/edged along low side, but edging usually buried) - benched into slope 50-75mm along high side. All full of sediment and failed with flows over, but limited scour. Treads of compacted sand, with occasional roots plus embedded rock and gravel. 1 missing (rotted) step/waterbar. Large embedded rock with natural step up (200mm high sloped) about half way, with sloping rock slab above, and shallow gap/gutter along upslope side with drainage down (but no scour). Flat embedded pavement above.

Works:

Replace rotten or missing waterbars and steps.

Block (with embedded rock) ends of steps with wash arounds.

Build rock waterbar on top edge of sloping rock slab half-way up site.

Rock infill/armour gap to upslope of sloped slab, with level treads (match to adjacent rock).

Monitor for further rotting and treatment failure, including boxed edges.

(low)

Site ID: **NBLT – 1(H)**

Location: 337688 6260639 Low level (floating ?) timber boardwalk, *7.*5m long and 900mm wide slight kink in centre, over ephemeral drainage line with sedges and ferns. Good condition. Old disused and overgrown track angles to upslope at N end, but not used. Slightly tilted/angles deck at S end, possibly due to wash (and some deposition) from slope above (Site NBLT 1 (I)).

Works:

Monitor for boardwalk displacement.

Monitor for excess sediment cover at S end.

(monitor)

Site ID: **NBLT – 1(I)**

Location: 337683 6260628 3 timber steps/waterbars at bottom end and 3 timber steps at top end, over 9m site with 10° slope, all full of sediment and failed with drainage over but no scour, gravel/sand deposition on lower treads. Top step being detoured, only half of tread in use, with shallow gutter and roots above. Middle step has wash around end (high side).

Works:

Clean out all steps/waterbars.

Build additional step/waterbar above existing top step, and fill and level/compact above.

Reinstate/replace existing top step as step/waterbar, extend/anchor well into upslope bank and extend outlet well off track on low side, fill and level/compact above (upslope to new step/waterbar).

Block (with embedded rock) wash around at high end of middle step.

(low)

Site ID: **NBLT – 1(J)**

Location: 337677 6260620 Entrenched track to 150mm below NLS on high side, 6m long site, 700-900mm wide, 8° slope, compacted sand and loose sediment/gravel and regular protruding roots. 2 log waterbars - lower log detoured (worn path runs high side of log over root as “natural” step), upper waterbar full of sediment and failed, drainage over and wash around end.

Works:

Replace and extend upper waterbar/step above.

New step/waterbar /midway between existing, fill and level/compact above (box low side edge if need to).

Replace lower log with new waterbar/step for full width (remove root or install waterbar below it and backfill/level).

Remove any protruding roots remaining.

(Medium – for sustainability to divert drainage off track)

Site ID: **NBLT – 1(K)**

Location: 337672 6260614 Dished track, generally 50mm (but to 150mm below NSL for short sections), 11m long, 400-700mm wide, 5.5° with drainage flows downs, compacted sand and embedded lateritic stones and gravel, occasional roots, 3 angled log waterbars/steps, all full of sediment and failed with flows over at low end but little scour (other than overall track dishing/entrenching).

Works:

Reinstate and extend waterbars/steps (reuse in-situ logs if possible).

Install extra sleeper step and in deeper dished track below middle log waterbar, fill/compact above.

Build additional waterbar in lower half of site.

(low)

Site ID: **NBLT – 1(L)**

Location: 337667 6260608 Compacted sand and loose sediment (from upslope), 600-800mm wide. Lower sleeper step/waterbar, full of sediment and failed with flows of over and scoured step off 350mm high. Upper sleeper step, full of sediment and failed, log/root above with considerable sediment deposited from upslope.

Works:

Install new waterbar above upper step, with extended outlet to SE to discharge well off track.

Clean out lower step/waterbar.

Install extra sleeper step below lower step/waterbar, fill/compact above to in-situ step.

(Medium – for sustainability, as last chance to more easily divert water off track before track enters wide/shallow dished section downslope)

Site ID: **NBLT – 1(M)**

Location: 337663 6260604 10m section of compacted sand with embedded laterite gravel with multiple protruding roots on slope creating an uneven surface, 600-1,000mm wide, 10° slope overall (steepest over rots in lower half), drainage down entire site and dished to 100-150mm below NSL. 3 log waterbars/steps but all detoured with worn path and drainage down on high side.

Works:

Build 4 boxed step-and-runs on lower (protruding roots) section of site, fill and compact over roots

Angled and extended middle step (of 4 boxed steps) as waterbar.

Build new waterbar upslope of step-and-runs.

Replace in-situ retaining root with new step/waterbar.

Reinstate/replace uppermost log step/waterbar and extend/anchor well into upslope bank.

Extended outlets on all waterbars to discharge well off track, but extend to different lengths to avoid concentrating outflows downslope beside/offset from track.

(Medium – for passability and sustainability)

Site ID: **NBLT – 1(N)**

Location: 337654 6260599 Compacted sand/clay and embedded laterite gravel, 11m long with 9° slope, track dished to 75mm below NSL with considerable drainage flows down (from track and junction at upslope end), regular roots with drainage flows over and scour to 75mm deep. Older log waterbars/steps, 2 at top end and 1 at bottom end, all are detoured and now well off track and overgrown.

Works:

Build new waterbar at top (just below track junction) with extended outlet to discharge well off track.

Relocate/reinstate upper 2 log waterbars/steps.

Relocate/reinstate lowest log waterbar and install new sleeper step/waterbar below eroding "knick point" downslope, fill behind and level/compact.

Vary waterbar discharge lengths to avoid concentrating outflows downslope beside/offset from track.

Remove protruding roots.

(Medium – for sustainability, to divert flows early on upper slope)

Site ID: **NBLT – 1(O)**

Location: 337647 6260600 Track junction, older-style routered timber directional sign ("WAKEHURST GOLF CLUB" and "PICNIC AREAS"), fair condition only, old tall log post behind (but nothing on it). Newer log post 3m to S towards road with "Walkers" and "No Bikes" pictograms. 2.5m S/SW to another 2 low log posts (1 each side of track, but nothing on either). North Balgowlah Link Track turns 90° S at junction towards Manning Street (from E/downslope), but very well defined/used track heads cross-slope to N/NW (not assessed). Track slightly upslope/S from junction, 600-700mm wide, has loose sediment/fill deposited from Manning Street trackhead 14m away.

Works:

Upgrade orientation/wayfinding, include park identification and regulatory signage to inform users entering from Manning Street.

Remove redundant posts.

(low)

Site ID: **NBLT – 1(P)**

Location: 337642 6260595 Compacted and loose sand and imported/loose fill, 600mm wide, 4° slope with drainage down track from Manning Street trackhead 6-7m away, no scour and track only slightly dished. Old burnt sign off to NW side of track, partly screened by vegetation

Works:

Install waterbar with extended outlet (to reinforce drainage works proposed at trackhead - Site NBLT-1(Q)).

Remove redundant burnt sign.

(low)

Site ID: **NBLT – 1(Q) (Manning Street trackhead)**

Location: 337640 6260588 Post-and-rail and chainmesh fence along park boundary beside Manning Street, power pole nearby. Cement-stabilised decomposed granite footpath on slope along Manning Street with sleeper bulkheads/blocks – eroding and breaking up at trackhead with 250mm step down to track, with drainage capture from footpath and flows onto/down track. Dished track to 150mm below NSL, 600mm wide, compacted clay sand and embedded stone and imported fill. No park identification or orientation/wayfinding signage at footpath/boundary.

Works:

Reinstate footpath edge to fenceline.

Build rollover/mound along fenceline to prevent drainage flows/capture onto track.

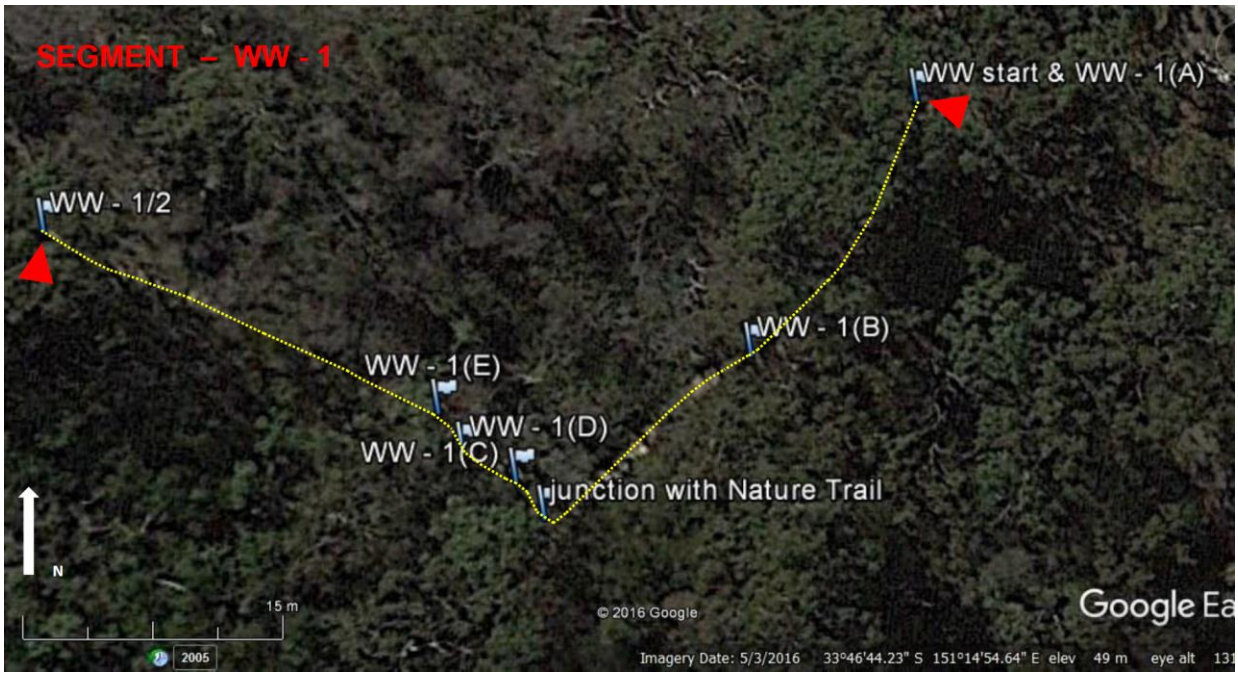
Build boxed step below fenceline at top of track, with step-and-run below for 1m with rock armoured tread.

(Signage addressed at Site NBLT-1(0) above.)

(Medium – for passability/safety and sustainability issues)

WILDFLOWER WALK - SEGMENTS 1 to 3

SEGMENT WW - 1



SEGMENT: WW - 1	
Start Point: 337847 6260988 **Trackhead (East), at park access road (Sir Roden Cutler VC Memorial Drive)**	**End Point: 337787 6260977**

General Description and Condition: Short (90m approx.) section of very well-defined track, from trackhead at the park access road and parking area, very gently curving up then across a gentle slope of low open woodland (burnt to W and N with grass/sedge regeneration beneath, and intact low open woodland to S and E with mixed medium understorey). Good condition overall.

Tread Width (mm): 1,500mm on lower section, 700-1,200 wide on upper section (after junction with Nature Trail)

Track Surface: Loose laterite gravel over compacted sand on lower section and upslope of junction with Nature Trail, some loose sands just upslope of junction with Nature Trail, compacted sand and gravels with occasional embedded/protruding rocks and protruding roots at upper end.

Gradient (degrees): Gentle/moderate - 4° then 8.5° to junction with Nature Trail, consistent 8° above junction.

Alignment: Gently curving up low slope, and then up/down and across slope (gently across contour).

Terrain: Lower hillslope.

Soil: Lambert (Erosional) – undulating to rolling low hills on Hawkesbury Sandstone.

Vegetation: Bloodwood-Scribbly Gum Woodland (part of Sydney Coastal Dry Sclerophyll Forest).

Track Works and Improvements: Run of 15 wide sleeper step-and-runs (also acting as waterbars) 1,400-1,700mm wide, all boxed on low side, on lower section - most with drainage flows over but no problematic scour. Run of 27 steps, and some step-and-runs, on upper section (after junction with Nature Trail) 700-1,200mm wide, some boxed on low edge

in upper section, some steps extended as waterbars - most steps with drainage flows over but no problematic scour due to close spacing of treatments. Occasional old log waterbar remaining beside upslope edge of track in upper section (remains of former alignment).

Signs and Wayfinding: 3-panel routered timber sign (track identification and orientation for NATURE TRAIL and WILDFLOWER WALK, and to NORTH BALGOWLAH) in good condition, and log post with 2 pictograms ("walkers" and "no bikes"), at trackhead. Log post with larger "Dogs Prohibited" text and pictogram, facing upslope, S of trackhead. Routered timber track identification and directional sign ("NATURE TRAIL AND NTH BALGOWLAH" and "WILDFLOWER WALK"), at junction with Nature Trail, in fair condition. No other wayfinding en-route.

User Experience: Easy walking on gentle slope close to (and within earshot of) developed/facilities area. Open/burnt adjacent vegetation detracts slightly from setting.

Key Issues: Several dead trees along edge of track (potential hazards). Potential for scour over and around timber steps/waterbars.

Recommended Works – Overall

- Remove hazardous trees, and monitor for future tree safety issues.
- Maintenance and cleaning of waterbars, steps/waterbars and other drainage treatments.
- Remove protruding rock and roots.
- Monitor for scour over drainage treatments and rotting of timbers sleepers (replace as/if required) – with adaptive management/remediation as/if required.
- Upgrade signage at trackhead and junction, as per Manly Dam Sign Location Plan.

Recommended Works – Site-specific (Priority)

Site ID: **WW – 1(A)**

Location: 337847 6260988 Eastern trackhead at park access road (Sir Roden Cutler VC Memorial Drive), 3 large boulders as vehicle barriers along edge of road at track entry, 6m wide entrance funnelling down to 1,500mm after 6m, compacted sand and loose sediment/stones (but stable track surface), some drainage down track into roadside drain, 3-panel routered timber sign (track identification and orientation for NATURE TRAIL and WILDFLOWER WALK, and to NORTH BALGOWLAH) in good condition, and log post with 2 pictograms ("walkers" and "no bikes").

Works:

Upgrade signage at junction, as per Manly Dam Sign Location Plan.

Routine maintenance only.

(low)

Site ID: **WW – 1(B)**

Location: 337834 6260969 Wide sleeper step, worn on face with protruding anchor rod (steel reinforcing bar) on edge of track, painted yellow.

Works:

Monitor for increased safety hazard at protruding anchor rod.

Monitor for rot/wear and need to replace sleeper step.

(monitor)

Site ID: **Junction with Nature Trail (at end of Segment NT – 12)**

Location: 337819 6260958 Junction with Nature Trail, wide boxed landing/junction of compacted sand with retaining sleeper steps to both tracks. Routered timber track identification and directional sign ("NATURE TRAIL AND NTH BALGOWLAH" and "WILDFLOWER WALK") in fair condition.

Works:

Upgrade signage at junction, as per Manly Dam Sign Location Plan.

(low)

Site ID: **WW – 1(C)**

Location: 337818 6260960 Rotted and loose sleeper step (hazard), dead tree (200mm DBH) on low side of track (leaning over track).

Works:

Replace sleeper step and angle (with extension, if required) to also act as waterbar, compact track surface upslope.

Fall dead tree leaning over track (potential hazard).

(HIGH – tree safety issue)

Site ID: **WW – 1(D)**

Location: 337814 6260962 2 rotten sleeper steps, upper one is also loose. 2 dead trees, greater than 200mm DBH, on low side of track – upslope tree has limb and trunk over track (potential hazard).

Works:

Fall dead trees.

Replace sleeper steps, compact track surface upslope.

(HIGH – tree safety issue)

Site ID: **WW – 1(E)**

Location: 337813 6260965 Rotten/loose sleeper (root ?) step.

Works:

Replace sleeper step, compact track surface upslope.

(Medium)

SEGMENT WW - 2

SEGMENT: WW - 2	
Start Point: 337787 6260977	**End Point: 337702 6261078**

General Description and Condition: Short (155m approx.) section of very well-defined narrow track, gently curving and undulating across slope largely along contour, with a short steeper rocky section up/down slope, through low open woodland (burnt downslope with grass/sedge regeneration beneath and extremely open in W, and intact but sparse woodland upslope with tall mixed understorey). Good condition overall.

Tread Width (mm): Mostly 500-800mm, 800-1,000mm at sleeper steps.

Track Surface: Compacted sand with considerable laterite gravel, regular embedded (mostly laterite) rocks, regular protruding roots, occasional flat/rounded sandstone embedded rocks, mostly dished (from gently dished to 75mm deep), short rocky section of outcrops and boulders up/down slope at W third (with minor run-on/deposition area of loose sand below).

Gradient (degrees): Gentle, mostly flat to 4° undulating along contour, short rocky section at 11-13°.

Alignment: Gently curving across slope, with a short steeper rocky section up/down slope.

Terrain: Lower hillslope.

Soil: Lambert (Erosional) – undulating to rolling low hills on Hawkesbury Sandstone.

Vegetation: Bloodwood-Scribbly Gum Woodland (part of Sydney Coastal Dry Sclerophyll Forest).

Track Works and Improvements: 2 log waterbars/steps, 3 sleeper step (2 and 1) and unusual sleeper "pen" arrangement across track at bottom of slope (Site WW-2(E)) in W third.

Signs and Wayfinding: Nil.

User Experience: Easy walking on gentle slope, views N to Heath Track summit area and part of Allambie Heights skyline (a few houses visible), open/burnt adjacent vegetation detracts from setting and within earshot of nearby golf course.

Key Issues: Several small dead (burnt) tress beside track (all less than 150mm DBH) (potential hazards). Potential for scour over and around timber steps/waterbars. Continued erosion on short steep section up/down slope. Minor drainage capture and ponding.

Recommended Works – Overall

- Remove hazardous trees, and monitor for future tree safety issues.
- Remove protruding rocks and roots.
- Open windrows to minimise drainage capture and ponding.
- Maintenance and cleaning of waterbars, steps/waterbars and other drainage treatments.

Recommended Works – Site-specific (Priority)

***Site ID:* WW – 2(A)**

Location: 337762 6261011 Above – sandstone outcrop as angled natural step, with embedded rocks below on high side, flows down. Below – gutter 75-100mm deep 500mm wide for 2.5m with sandstone boulder/outcrop on high side at lower end (track narrows to 400mm).

Works:

Build waterbar 1m above upper outcrop to catch/divert flows.

Infill upper outcrop to squared off as stone step, build new stone step below (save Xanthorrhoea if possible)

Build stone step onto low end of bottom boulder/outcrop.

Fill/compact gutter above for at least 2m back to new steps (obtain fill from run on / deposition area below). Block/barrier (rock rubble) beside steps to prevent avoidance/widening.

(low)

***Site ID:* WW – 2(B)**

Location: 337755 6261020 Sleeper step, with drainage flows over.

Works:

Extend high and low sides and realign to better function as waterbar.

(low)

***Site ID:* WW – 2(C)**

Location: 337750 6261020 Compacted sand and exposed roots on laterite slope, gently dished, 700mm wide, 3° with drainage flows down,.

Works:

Build waterbar and fill/compact above to level of roots.

(low)

***Site ID:* WW – 2(D)**

Location: 337726 6261043 Old log waterbar part way across track, track dished to 50mm with embedded lateritic rocks and gravels, 6° with drainage flows down.

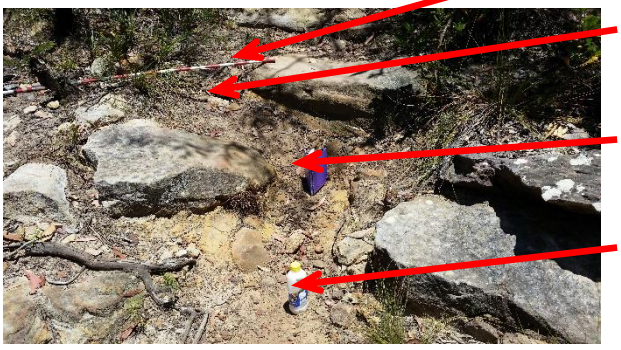
Works:

Build waterbar onto in situ embedded rock (upslope).

Extend/relocate in situ log waterbar over track, or replace with new waterbar.

Remove protruding roots.

(low)



Site ID: **WW – 2(E)**

Location: 337717 6261053 top

337719 6261065 bottom

14m long slope at 11-13° of outcrops and embedded/protruding rocks set in dished/guttered compacted sand and loose rocks/stones with loose laterite gravel, large sloping boulder across most of track midway with drainage gutter along W edge, drainage flows down entire section with scour over/round rocks and eroded steps of 350-400mm off rocks (often onto sloped track sections), track width from 600mm (between rocks) to 1,200mm, sleeper waterbar at base with drainage flows over.

Works:

Build waterbar onto in-situ rocks at top.

Level/armour tread at top of slope.

Build 2-3 rock steps onto upper outcrops and embedded rocks.

Build waterbar onto embedded rock below steps and open discharge outlet to NE, backfill/compact tread above.

Cut upper lip off sloped boulder and rock armour track beside/upslope.

Cut level tread into sloped boulder and match to new built rock step along upslope W/SW side to block/infill gutter (extend rock step along track to align with lower edge of boulder and square-off).

Level off low edge of sloped boulder as tread/step, and rock armour to W/SW.

Rock armour tread and build small rock step (onto in-situ outcrops) downslope of boulder, especially to NE (flow) side.

Build waterbar onto E end of flat boulder/outcrop (discharge to NE).

Block/level gap at E end of flat boulder/outcrop (below new waterbar) and rock armour slope below.

Build rock step onto SW side of outcrop, fill and armour tread above to natural step off flat boulder/outcrop.

Build rock step between lower outcrops, fill and armour tread back to new step above.

Pull-in, block/barrier (rock rubble) margins.

Build boxed step onto in situ rock below lower sleeper step, fill/compact above.

(Medium – for passability and sustainability/impact issues)

Site ID: **WW – 2(F)**

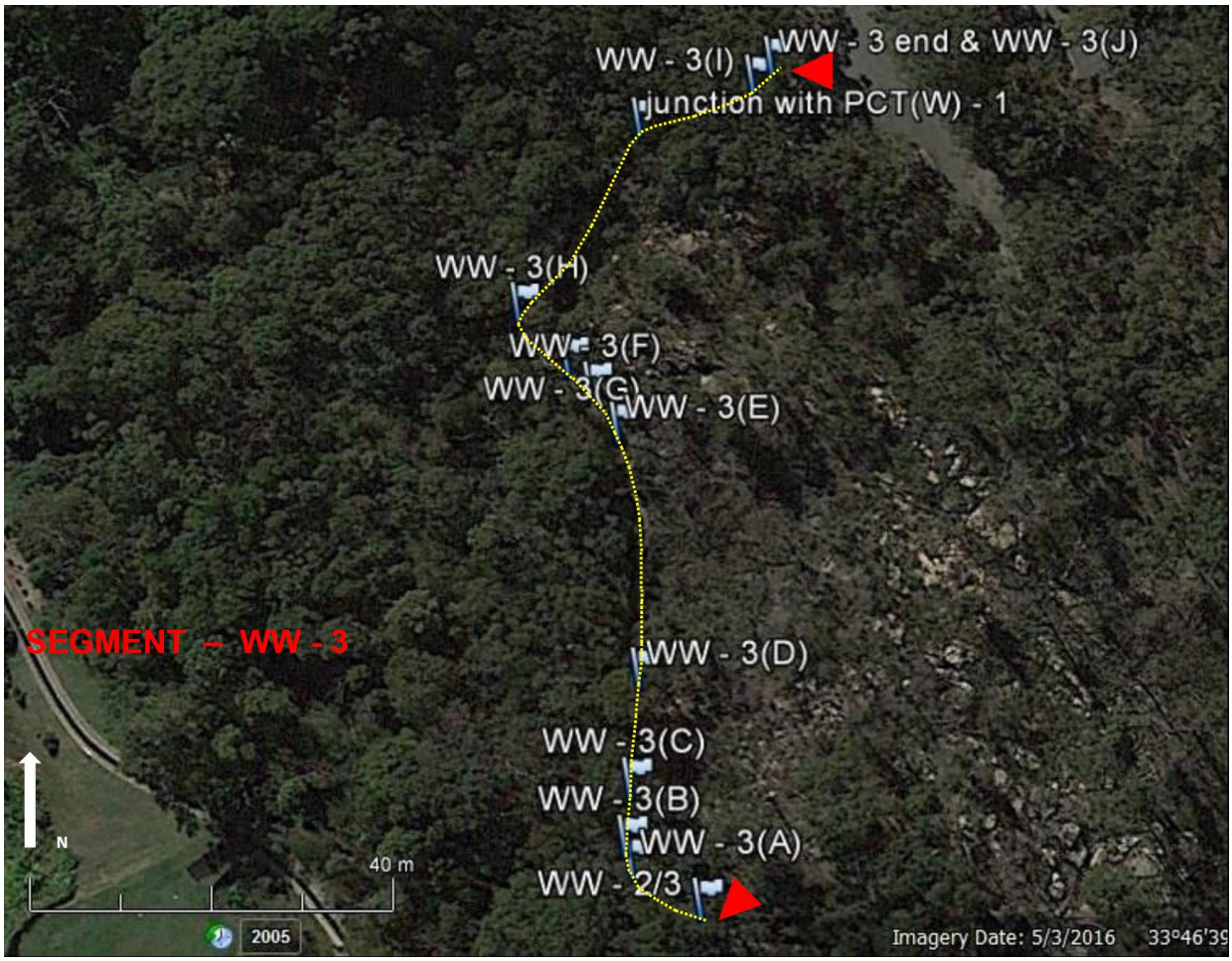
Location: 337720 6261071 Remains of old (rotten/burnt) timber waterbar.

Works:

Replace with new waterbar.

(low)

SEGMENT WW - 3



SEGMENT: WW - 3	
Start Point: 337702 6261078	**End Point: 337707 6261166** **Trackhead (West), at carpark and park access road (Sir Roden Cutler VC Memorial Drive)**
General Description and Condition: Short (120m approx.) section of very well-defined track with multiple treatments, gently curving across and up/down slope (across contour) before turning to run more sharply up/down slope to trackhead, through low woodland (burnt downslope/E with grass/sedge regeneration beneath, and intact but low woodland upslope with tall understorey). Good condition overall. *Tread Width (mm):* Mostly 800-1,400mm, minor sections narrow to 600mm and 1500-1700mm at N end approaching junction with Park Circuit Track (West) and NE trackhead. *Track Surface:* Mostly compacted sand with some laterite gravel, occasional embedded rock and rock pavement/outcrop, gently dished in places (especially at NE end), large benched rock ledge in centre of segment, minor loose sand at N end approaching junction with Park Circuit Track (West). *Gradient (degrees):* Gentle/moderate, 4°to 8°. *Alignment:* Gently curving across slope in E (across and along contour), before turning to NE and running more sharply up/down slope to trackhead.	

Terrain: Lower hillslope.

Soil: Lambert (Erosional) – undulating to rolling low hills on Hawkesbury Sandstone.

Vegetation: Bloodwood-Scribbly Gum Woodland (part of Sydney Coastal Dry Sclerophyll Forest).

Track Works and Improvements: Range of track treatment – 18 wide sleeper steps (3 and 1 and run of 14 at NE end (run of 14 includes some with minor rot, 2 with angled extensions at low ends, and 6 with shorter timber pieces/insets as buried tread below centreline of step [possible ponding or wear zones ?]), 14 sleeper steps 6 1 2 (6 and 1 [with "wing"] and 2 and 5), 3 boxed sleeper steps (2 and 1), 2 rock steps, 1 sleeper waterbar, 1 large log/pole waterbar, and 1 old log waterbar. A number of rotted/missing steps, and drainage flows over/down steps, but little scour, some steps/waterbars have 50mm freeboard along upslope edge. Large timber plank (sleeper) bridge 3.5 m long, 1,800mm wide with 200mm wide toe-boards along edges, on large square beams, across drain along road edge (1m drop off each side of bridge). Sleeper step off S end (200mm high), plank missing on N end with exposed beams (trip hazard) and 400mm step off. Posts for slip-rail gate located either side of bridge (but no rail).

Signs and Wayfinding: Older style 3 panel routered timber tack identification and directional sign ("WILDFLOWER WALK", "PARK CIRCUIT TRACK" and "WAKEHURST GOLF CLUB") at junction with Park Circuit Track (West) – fair/poor condition. Old low post with 2 metal directional arrows at junction with informal track to golf course – fair condition. Log post with larger "Dogs Prohibited" text and pictogram, just downslope of junction with informal track to golf course). Old metal directional arrow on rock pavement. No track identification or orientation signage at NE end/trackhead.

User Experience: Easy walking on gentler slope close to (and within earshot of) developed/facilities area. Glimpses to dam through open bushland in plces, but open/burnt adjacent vegetation detracts slightly from setting. Possible confusion at poorly signposted junction, and risk of walkers wandering onto golf course.

Key Issues: Potential for scour over and around timber steps/waterbars. Possible ponding/erosion at, or around, short timber pieces/insets (buried as tread below centreline of steps in N). Missing and rotting steps/waterbars. Minor drainage capture and ponding. Poor wayfinding at informal junction, and lack of signage at trackhead.

Recommended Works – Overall

- Open windrows to minimise drainage capture and ponding.
- Maintenance and cleaning of waterbars, steps/waterbars and other drainage treatments.
- Monitor for scour over drainage treatments and rotting of timbers sleepers (replace as/if required) – with adaptive management/remediation as/if required.
- Upgrade signage at trackhead and junction, as per Manly Dam Sign Location Plan.

Recommended Works – Site-specific (Priority)

Site ID: **WW – 3(A)**

Location: 337696 6261082 Old log waterbar off W side of rock pavement – full and failed.

Works:

Build new stone waterbar off upper/W lip of pavement.

Pull-in and block/barrier (rock rubble) flow path to W side of pavement.

(low)

Site ID: **WW – 3(B)**

Location: 337694 6261084 Upper rock pavement with roots on step-off below. Lower rock pavement with curved gap/dip in W side of outcrop.

Works:

Remove roots, fill/compact track surface (rock armour if needed).

Rock armour gap beside lower pavement to square-off. Define W edge of track (rock rubble/barrier).

(low)

Site ID: **WW – 3(C)**

Location: 337694 6261089 Low branch, 1400mm high, over W side of track (hazard).

Works:

Mark as hazard.

(low)

Site ID: **WW – 3(D)**

Location: 337695 6261100 Rotted/missing timber step, protruding stumps above (trip hazard).

Works:

Replace sleep step, angled as waterbar.

Remove small stumps.

(low)

Site ID: **WW – 3(E)**

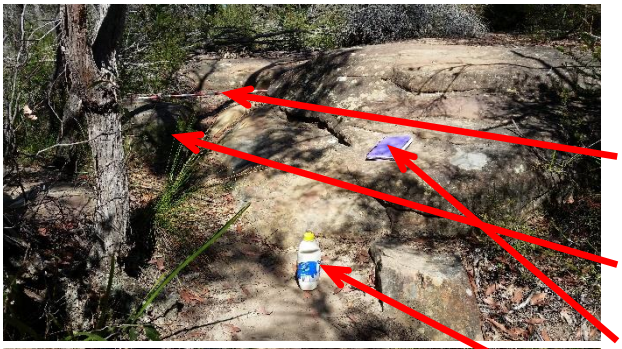
Location: 337693 6261125 Broken lower edge of rock pavement and embedded rock, drainage flows down.

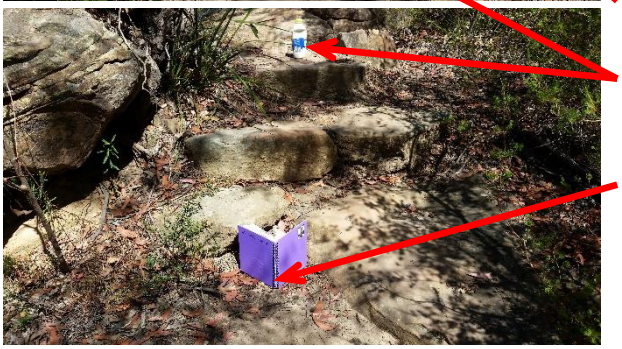
Works:

Build rock waterbar onto in-situ rock with extended discharge to NE (may need sleepers to extend/direct outflows to empty past rock ledge downslope and avoid backflow.

Rock armour/flag above waterbar to match level of in-situ to rock pavement.

(Medium – to protect track/treatments downslope in Site WW – 2(F))





Site ID: **WW – 3(F)**

Location: 337689 6261130 Large sloped rock ledge with dual routes. "High" SW route over stepped rock ledge, 2 ledges 250-300mm high and squared/angular placed rock at base of ledge. "Low" NE route off NE side of outcrop along flatter drainage line (fed by flows off rock ledge and from gutter along ledge's upper/SE edge between embedded rock outcrops). Routes rejoin at NE base of ledge, then placed rock step (700mm wide and 250 step-off) and double rock step below (1,100mm wide and 2 300 step-off), then flat rock outcrop (100-200mm step-off) to boxed sleeper step with compacted sand tread built onto lower side of flat outcrop. 18° over 9m (on direct route over ledge).

Works:

Build rock wall across top of lowside/NE gutter above rock ledge to divert flow off track and downslope to NE.

Infill gutter with rubble to block off as alternative route.

Cut three level treads, at least 700mm wide, into sloped/benched face of ledge.

Build extra rock step off bottom edge of ledge (butt onto in-situ squared/angular placed rock [or step ?]).

Rock flagging/armour to NE side of lower flat outcrop, to square-off (and as low step if required).

(Medium - for passability and sustainability/impact issues)

Site ID: **WW – 3(G)**

Location: 337686 6261133 Missing/rotted step/waterbar, protruding anchor rod (steel reinforcing bar) on N side (trip hazard), large log upslope and downslope either side.

Works:

Build new step/waterbar (wide), and remove old logs adjacent.

Remove steel reinforcing bar.

(Medium – safety issue)

Site ID: **WW – 3(H)**

Location: 337681 6261139 Junction with informal, but well-used, track W/NW to golf course – as compacted and landing, at 90° bend in track to NE, with edging/retaining sleepers along high side and sleeper step across track downslope. Old log waterbar remaining inside 90° bend (remains of former alignment). Old low post with 2 directional arrows – fair condition. Downslope/NE to long sleeper waterbar (with extension) rotten at W end and loose (when trodden on) just NE/downslope of track junction, and log post with larger "Dogs Prohibited" text and pictogram adjacent (facing upslope to track junction) – fair condition.

Works:

Improve wayfinding signage.

Replace waterbar downslope of junction, and clean out.

(low)

Site ID: **Junction with Park Circuit Track (West)**

Location: 337693 6261159 Junction with Park Circuit Track (West), older style 3 panel routered timber tack identification and directional sign ("WILDFLOWER WALK", "PARK CIRCUIT TRACK" and "WAKEHURST GOLF CLUB") - in fair/poor condition. Large boulder, as informal seat. 15m S of bridge, and 23m S of trackhead (but signage not easily visible from trackhead).

Works:

Upgrade signage at junction, as per Manly Dam Sign Location Plan.

(low)

Site ID: **WW – 3(I)**

Location: 337705 6261164 Timber plank (sleeper) bridge 1,800mm wide with 200mm wide toe-boards along edges, on large square beams, across drain along road edge (1m drop off each side of bridge). Sleeper step off S end (200mm high), plank missing on N end with exposed beams (trip hazard) and 400mm step off. Log post with 2 pictograms ("walkers" and "no bikes") at NW end of bridge.

Works:

Replace missing plank, and add step off, N end of bridge.

(low)

Site ID: **WW – 3(J)**

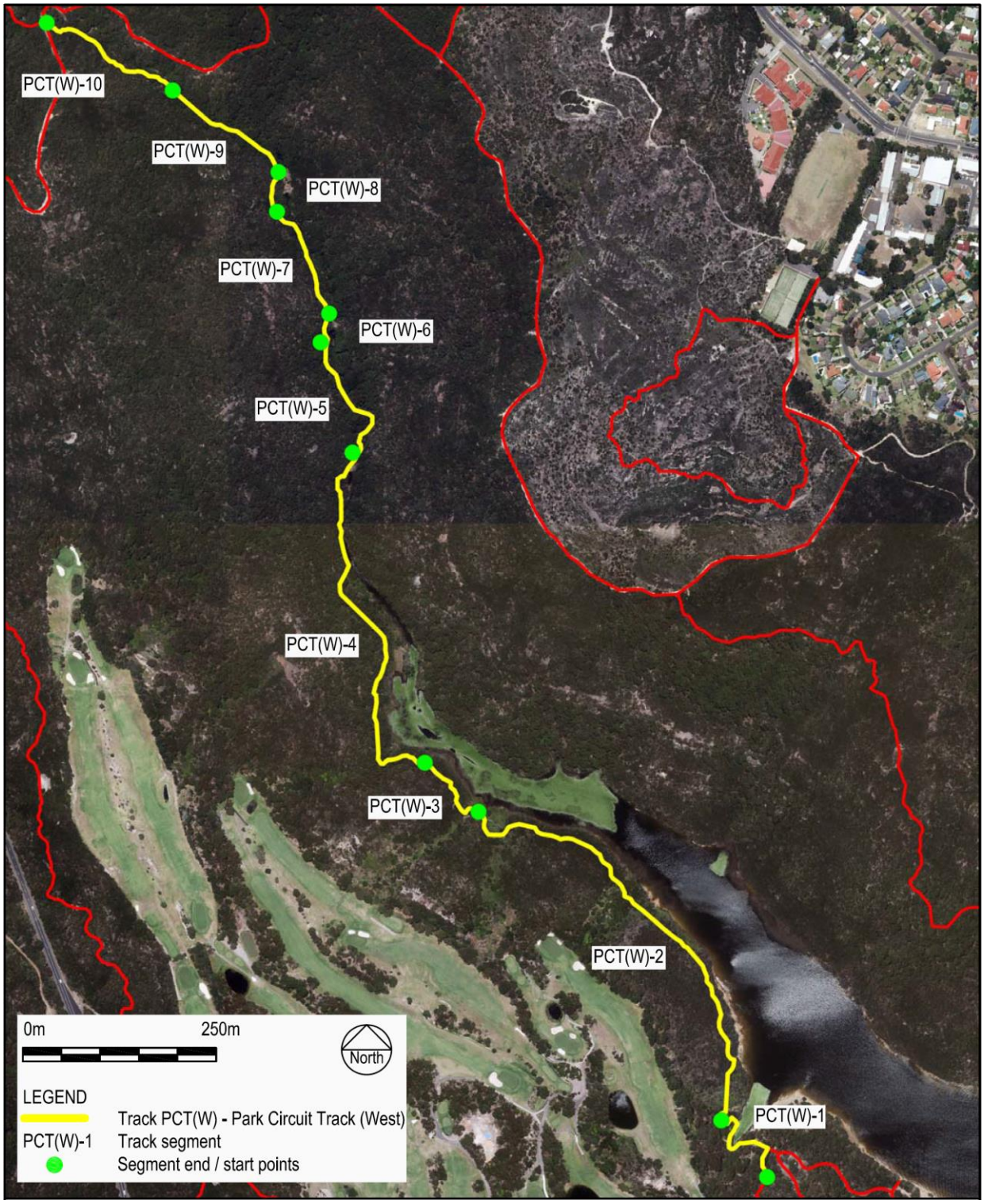
Location: 337707 6261166 Western trackhead at carpark and park access road (Sir Roden Cutler VC Memorial Drive) – no signage. Posts for slip-rail gate located either side of bridge (but no rail). No track identification or orientation information.

Works:

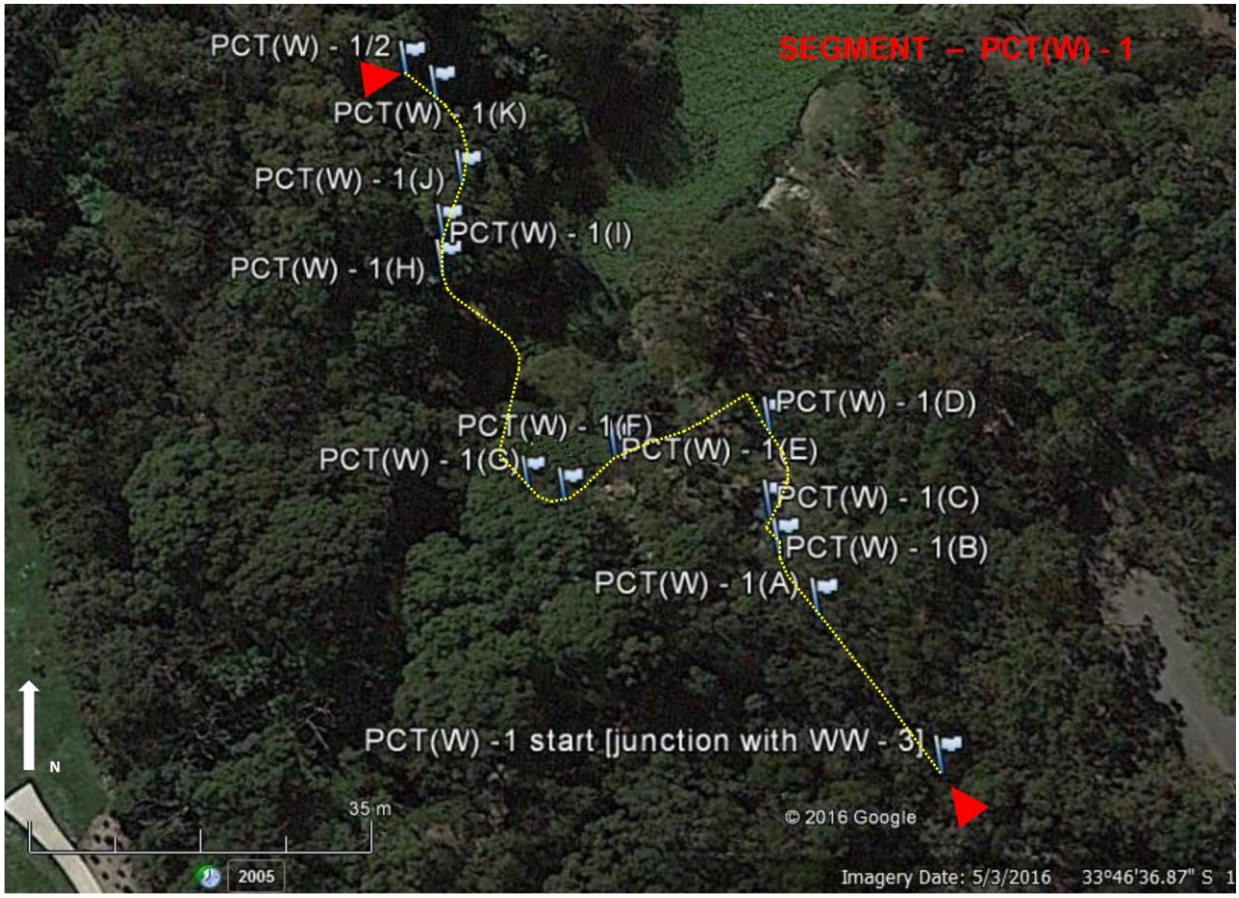
Provide signage at junction, as per Manly Dam Sign Location Plan.

(Medium)

PARK CIRCUIT TRACK (WEST) - SEGMENTS 1 to 10



SEGMENT PARK CIRCUIT TRACK (WEST) - 1



SEGMENT: PCT(W) - 1	
Start Point: 337693 6261159 (junction with Wildflower Walk)	**End Point: 337634 6261232**
General Description and Condition: Short section (130m approx.) of well-defined track, with multiple and varied track treatments, winding past a picnic site and around the head of small creek/inkle and along the dam edge, subject to higher levels of use. Attractive section through low open Eucalypt/Angophora forest over a tall mixed understorey at E end, then an open understorey with few trees and new plantings past the picnic site, then fern banks and tree ferns around the creek/inlet margins, and an open Eucalypt/Angophora forest over moist understory species grading to ow open understory on gentle rocky slopes at W end. Generally good condition, but some sections and older treatments good/fair condition. *Tread Width (mm):* Mostly 600-1,000, some sections to 1,200mm. *Track Surface:* Varied. Mostly compacted sand with regular exposed/protruding roots (abundant/dense in places). Regular flat outcrops or minor pavement, and larger outcrops/boulders. Larger rock ledge at Site PCT(W)-1(C) and rock shelfs N of low boardwalk along dam edge. Drainage flows down numerous sections of track and some ponding areas. *Gradient (degrees):* Mostly flat to 2°, short steeper sections over rock ledges (Site PCT(W)-1(D) to 24°) and occasional sandy slopes to 9°. *Alignment:* Winding down rock ledge and past a picnic site, then around the head (SW) of a small creek/inkle and along the dam edge gently curving up a gentle slope to the N.	

Terrain: Lower hillslope and dam margin.

Soil: Lambert (Erosional) undulating to rolling low hills on Hawkesbury Sandstone (and deposition/alluvial areas along dam margin).

Vegetation: Varied. Bloodwood-Scribbly Gum Woodland at S end and minor area of Peppermint Angophora Forest at head of creek/inlet (both part of Sydney Coastal Dry Sclerophyll Forest), large areas mapped as "disturbed' vegetation.

Track Works and Improvements:

Multiple improvements.

- Small sandstone squared bench, with concrete top (split/cracked) near at E end/junction with Wildflower Walk - fair condition only.
- Stone and sleeper steps down rock ledge at Site PCT(W)-1(C) – 2 cut rock steps, 7 built rock steps, 3 rock or concrete landings/ramps, and 4 sleeper steps.
- Short low FRP boardwalk, in truncated "T junction" layout below Site PCT(W)-1(D), provides access to/from picnic site to N/NE and PCT(W) continues to SW (337672 6261197 midpoint), 8.5 m long and 900mm wide with step on SW arm, timber boxed steps off each end with FRP treads, some drainage flows beneath but no scour, minor sediment deposition over leg of "T" from upslope.
- Picnic site (with picnic table, stone BBQ and former large stone fire ring), with regeneration/amenity plantings and short vehicle track adjacent to site E to carpark to N/NE of Site PCT(W)-1(D).
- 4 log steps, as older style "ladder-steps", fair condition – Site PCT(W)-1(F).
- Short timber bridge, 4m long 1.1m wide, good/fair condition - Site PCT(W)-1(G).
- Low FRP boardwalk angling closely along NW side of creek/inlet (SE end 337646 6261190, NW end 337646 6261202), 13.5m long 900mm wide, >1m from top of low steep bank to water at SE end, large placed/stable stone step off at NW end onto rock shelf.
- 7 sleeper steps (3 boxed) and sleeper waterbar at top – Site PCT(W)-1(K).

Signs and Wayfinding:

- Older style 3 panel routered timber tack identification and directional sign at E end/junction with Wildflower Walk ("WILDFLOWER WALK", "PARK CIRCUIT TRACK" and "WAKEHURST GOLF CLUB") - fair/poor condition.
- Newer 3 plank routered timber sign at entry to PCT(W) from picnic site beside low truncated "T" FRP boardwalk ("PARK CIRCUIT TRACK", "WATERFALL WAKEHURST PARKWAY" and " ALLAMBIE HEIGHTS NYRANG RD CARPARK" with distance/time and orientation information, but no map) – good condition.
- Older style, larger, "Track Closed to Bikes" sign on log post (SW of picnic site), under clouded perspex and graffitied - fair condition.
- Log post with large "Dogs Prohibited" sign at N end of segment, faces N – good condition.
- No other waymarking en-route.

User Experience: Attractive section of easily traversed track around creek/inlet adjacent to picnic site; views past picnic site to dam and appealing low-level views across dam and over lily filled creek/inlet; access to dam edge from rock shelf and small sandy beach on N side of inlet; surrounding attractive fern banks, tree ferns and moist vegetation backed by Eucalypt/Angophora forest.

Key Issues: Ponding and drainage capture with some scour. Some older style track improvements. Numerous trample tracks to creek/inlet and large well-used trample track to dam edge at N end of segment. High use zone - attractive section of track adjacent to vehicle access and facilities, including use by unsupervised children (exploration/play) and disability groups – warranting higher track/safety standards.







Recommended Works – Overall

- Open windrows to minimise drainage capture/ponding.
- Remove/level protruding roots and rocks.
- Maintenance/cleaning of drainage and other track treatments.
- Upgrade signage at head of creek/inlet as per Manly Dam Sign Location Plan.
- More frequent safety/condition monitoring due to higher use levels and proximity to picnic facilities.
- Monitor for degradation/failure of older track treatments, and repair/replace as required.
- Adaptive management of trample tracks to dam margin, closure or formalisation as/where warranted.
- Monitor for drainage flows beneath, and sediment deposition onto, low truncated “T” FRP boardwalk.

Recommended Works – Site-specific (Priority)

Site ID: **Junction with Wildflower Walk (E end of PCT(W))**

Location: 337693 6261159 Junction with Wildflower Walk, older style 3 panel routered timber tack identification and directional sign ("WILDFLOWER WALK", "PARK CIRCUIT TRACK" and "WAKEHURST GOLF CLUB") - in fair/poor condition. Large boulder, as informal seat, at junction. Start of track 600-800mm wide, compacted sand and embedded gravel, small sandstone squared bench, with concrete top (split/cracked) at 5m down track, fair condition only.

Works:

Upgrade signage at junction, as per Manly Dam Sign Location Plan.

Monitor condition of bench, repair as/when required.

(low, and monitor)

Site ID: **PCT(W) – 1(A)**

Location: 337680 6261175 Rounded outcrop with compacted sand, dip upslope, ponding and natural discharge area.

Works:

Build stone waterbar onto in situ outcrop.

Open windrow along low edge.

(low)

Site ID: **PCT(W) – 1(B)**

Location: 337675 6261181 Rounded top of rock ledge, compacted sand and gravel with ponding area adjacent on low side.

Works:

Build stone waterbar onto in-situ outcrop, discharge N over sloped rock ledge

(Medium – to prevent flow down rock steps below, Site PCT(W) – 3(C)).

Site ID: **PCT(W) – 1(C)**

Location: 337675 6261185 Split rock ledge – ledge above, large boulders (squared) below. "S" bend of well-constructed rock steps cut into and built onto face of ledge and over/between boulders, 24° and 3m height difference overall. Wide stone flagged landing at top of ledge, then 2 steps (700mm wide) cut into upper slope of ledge, curving 90° to a concrete landing/ramp below, then curving 90° to a 300mm high step off to 4 stone flagged steps cut/set into lower part of ledge (900mm wide, 150-200mm risers), then short flagged landing at top of boulders and finally 3 stone flagged steps between boulders (800-1,000mm wide, 150-200mm risers) and 2 sleeper steps off bottom (2 more sleeper steps 2.5m downslope, with drainage flows over but no scour) 1.2m drop off side of upper landing, over steeply sloped/rounded edge of ledge onto steps and rock below. Drainage flows down entire site but well-built/stable and no scour.

Works:

Install safety railing along low side of upper landing, for at least 2.5m.

(Medium – for safety, high use area adjacent to picnic sites)

Site ID: **PCT(W) – 1(D)**

Location: 337674 6261194
Dished/eroded track on sandy 9° slope with flows down, eroded to 150mm below NSL, 1,200mm wide with occasional roots. Old alignment runs up/down slope to W with 5 log waterbars in disturbed vegetation with re-plantings.

Works:

Build 3 (or 4) waterbars/steps with compacted fill upslope/above (fill can be delivered to site from nearby picnic area and vehicle access).

Define track edges and block/barrier if required.

(Medium – to improve track presentation adjacent to picnic sites)

Site ID: **PCT(W) – 1(E)**

Location: 337657 6261191 Large flat outcrop/boulder with eroded gutter adjacent 500mm wide 300mm deep with exposed roots and flows down. Compacted sand track surface v below/downslope with 2 large protruding Angophora roots and sloped rock outcrops below.

Works:

Build stone waterbar onto high side of in-situ outcrop.

Rock infill and block gutter, level surface and match to adjacent flat outcrop.

Wide boxed step over roots, build/anchor onto flat outcrops at low end and fill/compact tread, block (rubble barrier) high side.

Rock flagging/infills and /or cut level landings onto lower outcrop.

(Medium – for passability and sustainability issues, and high traffic area adjacent to picnic sites)

Site ID: **PCT(W) – 1(F)**

Location: 337652 6261189 Older style "ladder-steps", angling into/across slope at top, 900mm wide, 4 steps with 150-250mm risers, drainage down but no scour, fair condition.

Works:

Monitor for condition and scour and need to replace or install drainage protection upslope.

(monitor)

Site ID: **PCT(W) – 1(G)**

Location: 337650 6261189 4m long timber bridge, 1.1m wide on poles as beams, log hand rails both sides but only 700 mm high, then 1.5-1.6m drop to rock creek bed with fern beds and Lomandra. Flagged landing at W end with 90° turn onto low FRP boardwalk. Good/fair condition. Attractive area but impacted.

Works:

Increase safety rail height to 1-1.1m (or BCA standard) both sides, as is a high use area.

(Medium – safety issue, high traffic area close to picnic sites)

Site ID: **PCT(W) – 1(H)**

Location: 337638 6261210 Damp sand over rock platform beside drainage line (running more or less permanently from golf course upslope), 3m long and 1,200-1,400mm wide with grassy bank adjacent. Square angled rock on SE side of drainage line, 350mm step up from damp sand area, slopes towards drainage line (and split on sloped face) with 150mm face to drainage line. Small placed step stone in drainage line, loose and wobbly – also branch/log placed in drainage line by users – to assist crossing. Drainage line 550-600mm wide. Flat large outcrop on NW side of drainage line, 550mm step up on outcrop. Walkers have to step across and up (or down and across) – challenging, especially for younger or mobility impaired users – and slip hazard. Ledge and waterfall upslope 5m away – attractive, but poor water quality.

Works:

Short FRP bridge over drainage line, set at top level of higher/NW outcrop to give high flow clearance underneath, step off SE end on to SE outcrop.

Build rock step off SE outcrop, or extend FRP steps down/past outcrop to concrete pad in damp sand area.

Monitor damp sand area for need to rock wall along N edge to protect from creek flows (but drainage from high side and larger flows over sand flat may be an issue), ultimately extend FRP boardwalk if required.

(Medium – for safety/passability issues, high traffic area)

Site ID: **PCT(W) – 1(I)**

Location: 337638 6261214 Large area of exposed roots, up to 100-200 mm high and gaps beneath, trip hazard, in compacted sand track 1,000-1,200mm wide.

Works:

Boxed step with compacted fill above. Waterbar, at least 1 pace above boxed step, to divert flows to protect FRP bridge and step downslope.

(Medium – for safety/passability issues on approach to bridge, high traffic area)

Site ID: **PCT(W) – 1(J)**

Location: 337639 6261220 Large dead Banksia beside track, trunk bends over track, and trip hazard at base.

Works:

Fall dead Banksia, remove roots and level track.

(HIGH – safety issue, high traffic area)

Site ID: **PCT(W) – 1(K)**

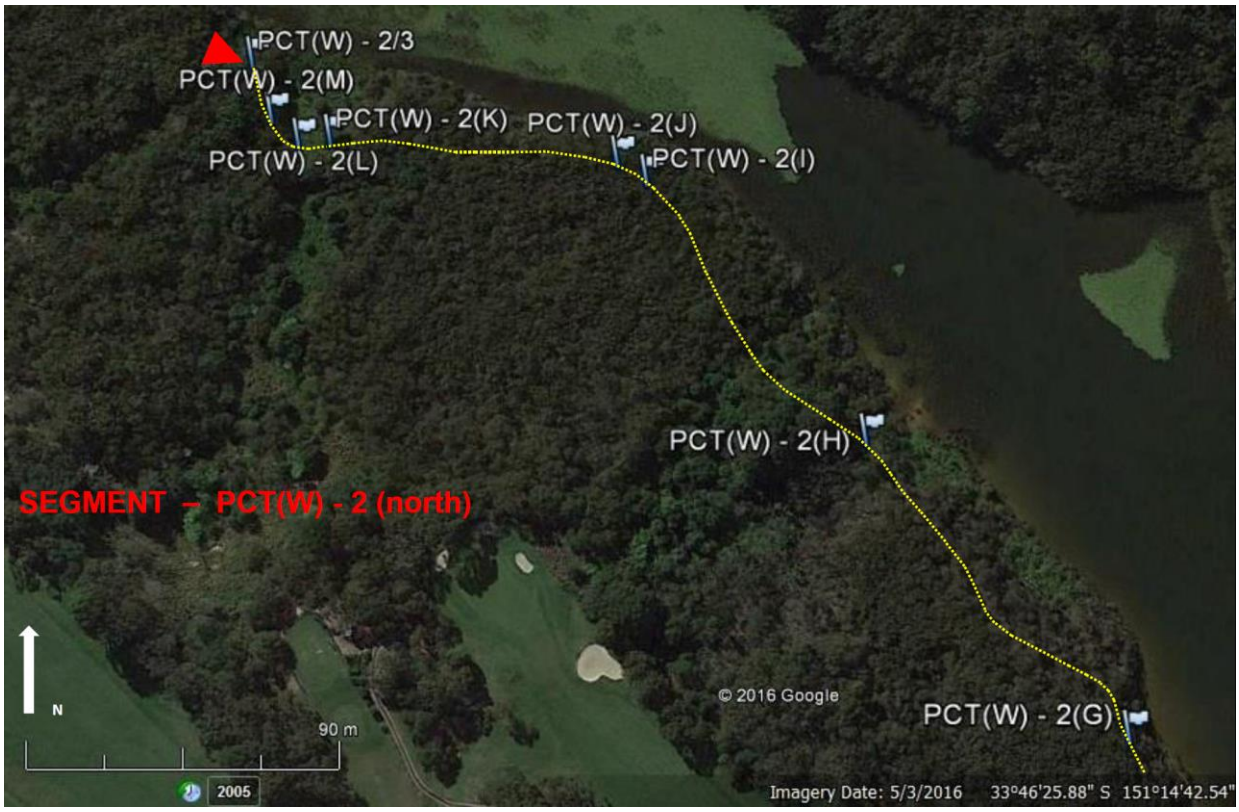
Location: 337636 6261229 (midpoint) Run of 7 sleeper steps, 3 boxed, 1,100mm wide and 100–200mm risers, through fern banks, good condition. Drainage flows over/down but minor scour only, compacted sand treads. Sleeper waterbar at top, full of sediment and failed. Log post with large "Dogs Prohibited" sign at top of steps, facing N – good condition.

Works:

Clean out and reinstate/relocate waterbar.

(low)

SEGMENT PARK CIRCUIT TRACK (WEST) - 2



SEGMENT: PCT(W) - 2	
Start Point: 337634 6261232	**End Point: 337322 6261629**

General Description and Condition: Extended section (640m approx.) of very well-defined and wide track very gently curving along the dam margin, with frequent minor track treatments as well as sections of low boardwalk. Through open Casuarina heath and tall/open Casuarina/Banksia heath, ferns beds in places (both open fern beds, and under Eucalypts and Casuarinas at S end). Good condition.

Tread Width (mm): Mostly 800-1,400mm, but many wider areas to 1,800-2,000mm, narrows to 700 at far S end and to 700-1,000mm (occasionally 1,200) at shorter rocky sections.

Track Surface: Predominantly compacted sand, flat to gently dished (to 50mm deep, minor location to 100mm deep mainly at S end), some areas of moist sand, very occasional embedded rock and laterite gravel, short section of embedded ironstone with laterite gravels and short section of embedded rock (some slightly protruding and squarish) and flat pavement/outcrop, occasional protruding roots (especially in rockier sections),

Gradient (degrees): Predominantly flat or <1° to <2°, short sections to 3° and 3.5° over minor rocky areas.

Alignment: Very gently curving along dam margin, with extended straight sections.

Terrain: Dam margin and alluvial flat along lower hillslope.

Soil: Lambert (Erosional) undulating to rolling low hills on Hawkesbury Sandstone (and deposition/alluvial areas along dam margin and at drainage line/marshy flat).

Vegetation: Mostly Bloodwood-Scribbly Gum Woodland (part of Sydney Coastal Dry Sclerophyll Forest), with a 90-100mm section (near centre of segment, across drainage line/marshy flat) mapped as “disturbed” vegetation.

Track Works and Improvements:

Multiple treatments regularly spaced along segment.

- Scored sleeper waterbars – x2, x2 (short on of upslope/W edge of track).
- Log waterbars – x4, x1 (rotted)
- Log steps – x3
- “Short” waterbars/steps (across half track width or more) – x8 logs, x3 scored sleepers.
- “Off-track” waterbars/steps (less than half track width, or only on track edge) – x3 scored sleepers.
- Extended log and scored sleeper waterbar – x1
- Low boardwalk (floating ?) of newer FRP for 19m in N and older timber for 28m in S (N end 337642 6261283, S end 337635 6261 242), 900mm wide, curving, FRP step on ground at N end, fern banks both side (with emergent small dead Banksias and Casuarinas beside boardwalk in N third) – FRP section in good condition, timber section in fair condition (several replaced planks).
- Low FRP boardwalk (floating ?) curving with 5 single steps (N end 337648 6261311, S end 337644 6261294), 23m long 900mm wide, curves away from dam through tall Casuarina heath with fern bank along low side – good condition. Old log post with 2 bolts at N end (but nothing on it).
- Low timber boardwalk (floating ?) with 5 single steps (N end 337494 6261542, S end 337546 6261490), 85m long and 900mm wide, ferns/sedges under Ti-tree and Casuarinas in N third with open woodland and bracken fern in S two-thirds, gently curving in S end – good/fair condition (several recently replaced planks).

Signs and Wayfinding: Log post with old meatal directional arrow near S end, but 1m off track and obscured by vegetation. Log post with 2 pictograms (“walkers” and “no bikes”) near S end of southernmost (FRP/timber) boardwalk – fair/good condition. No other waymarking en-route.

User Experience: Very easy pleasant walking on a wide well-defined track, often through an overarching canopy or ”tunnel” of tall Casuarina/ Banksia heath and attractive fern banks along the dam edge in places, open and filtered low-level views to dam and multiple water access points. Only minor uneven areas and occasional damp/degraded track sections.

Key Issues:

Track widening and avoidance of treatments (and resulting ineffectiveness) frequent along segment.

Multiple trample tracks:

- well-used track near S end (337632 6261234) leading upslope through open vegetation to golf course, no signposting (but log post with old meatal directional arrow near junction).
- well-used trample track to “green block shed” near S end of southernmost (FRP/timber) boardwalk.
- well-used trample track to rock pavement beside dam (8m off) at N end of middle (FRP) boardwalk.
- trample track to dam off S end of northernmost (timber) boardwalk.
- numerous trample tracks to dam margin, varying levels of use/establishment

Rotting/failure of planks on timber boardwalks, and floating boardwalk displacement.

Drainage/seepage capture and ponding.

Poor wayfinding at junction with golf course track at S end.

Several smaller dead trees beside track (potential hazards)




Recommended Works – Overall

- Maintenance/cleaning of waterbars and other drainage treatments.
- Open windrows to minimise drainage capture/ponding.
- Remove protruding roots and stumps.
- Remove/level occasional protruding/lipped rocks
- Monitor low boardwalks for plank rotting/failure (and movement), and repair/replace as required.
- Improve wayfinding at junction with golf course track (at S end).
- Fall smaller dead trees beside track.
- Adaptive management of trample tracks to dam margin, closure or formalisation as/where warranted.

Recommended Works – Site-specific (Priority)

Site ID: **PCT(W) – 2(A)**

Location: 337644 6261287 Old log waterbar, short with drainage flows around NE end, compacted sand track 1,100mm wide, 3° slope.

Works:

Replace or extend waterbar.

(low)

Site ID: **PCT(W) – 2(B)**

Location: 337644 6261294 Embedded log at S end of low FRP boardwalk, with ponding/run-on areas above/upslope and track widening (avoiding puddle/mud).

Works:

Clean-out waterbar and open outlet at E end.

Open windrow along low side of track.

(low)

Site ID: **PCT(W) – 2(C)**

Location: 337648 6261314 Rotted log waterbar/step, very wide track 1,500-2,000mm of compacted sand track, 3° slope.

Works:

New waterbar (or dual, extra-long, waterbar).

Pull in track and define/barrier edges on both sides (can use fallen/cut branches – abundant in surrounding area).

(low)

Site ID: **PCT(W) – 2(D)**

Location: 337644 6261318 Log step, short (half-track width) and being avoided with track widening. Scored steeper step upslope, drainage flows around end near small tree with exposed roots. Compacted sand 1,800-2,000mm wide, 3° slope. Track widening and braiding around small tree on inside of curve.

Works:

Extend upper sleeper step.

Extend/replace lower step and realign as waterbar.

Block/barrier braided track, and pull in track and define/barrier edges on both sides, mainly lower/E side (can use fallen/cut branches – abundant in surrounding area).

(low)

Site ID: **PCT(W) – 2(E)**

Location: 337645 6261335 Track curving down slight slope/dip with considerable ponding (drainage flows in each side, N and S), ponding partly retained by loosely placed logs along low edge. Scored sleeper steps at both ends and post laid at SE end along low side. Lots of laid branches beside low side (to contain track prevent detour, or provide a drier walking surface), 900–1,200mm wide with track widening on both approaches. Unsightly.

Works:

Timber or FRP low boardwalk, 10m long, with waterbar (or wide gutter) under each end. Barrier track alongside boardwalk (can use fallen/cut branches – abundant in surrounding area) to prevent avoidance.

(Medium – for passability and impact issues, to stop track widening and vegetation disturbance)

Site ID: **PCT(W) – 2(F)**

Location: 337634 6261369 Low rock outcrop on higher/W half of track on 3° slope with drainage flows down track, trample track to nearby dam edge.

Works:

Build rock waterbar onto in-situ outcrop (save Xanthorrhoea).

(low)

Site ID: **PCT(W) – 2(G)**

Location: 337621 6261408 Rock pavement and flat outcrops on higher/W half of track on 3° slope, small trench between rocks, drainage flows down track.

Works:

Build rock waterbar onto in-situ outcrop.

Rock infill and flagging along lower/E side of outcrops/pavement, match levels to existing, low step at end if needed.

Monitor for avoidance and track widening, and need for edge barrier.

(low, and monitor)

Site ID: **PCT(W) – 2(H)**

Location: 337537 6261501 One plank marked yellow on low timber boardwalk, split/rotting and lifting/split – trip hazard. Small dead tree on low side of boardwalk nearby.

Works:

Replace plank.

Fall small dead tree.

(Medium – safety issues)

Site ID: **PCT(W) – 2(I)**

Location: 337461 6261588 Dead Eucalypt, 300mm dbh, on high/W side and leaning over track.

Works:

Fall tree.

(HIGH – safety issue)

Site ID: **PCT(W) – 2(J)**

Location: 337450 6261594 Dead Eucalypt, 300mm dbh, on high/W side with 3 large branches over track.

Works:

Fall tree.

(HIGH – safety issue)

Site ID: **PCT(W) – 2(K)**

Location: 337353 6261600 Rotted plank on low timber boardwalk (angled/cut plank on curve), outlined yellow but faded - trip hazard. Near old dam/wall.

Works:

Replace plank.

(HIGH – safety issue)

Site ID: **PCT(W) – 2(L)**

Location: 337342 6261599 Rotten plank, broken and collapsed, on low timber boardwalk. Not hazard marked.

Works:

Replace plank.

(HIGH – safety issue)

Site ID: **PCT(W) – 2(M)**

Location: 337331 6261608 Large leaning overhanging Banksia, only 1.5m clearance on high/SW side of track.

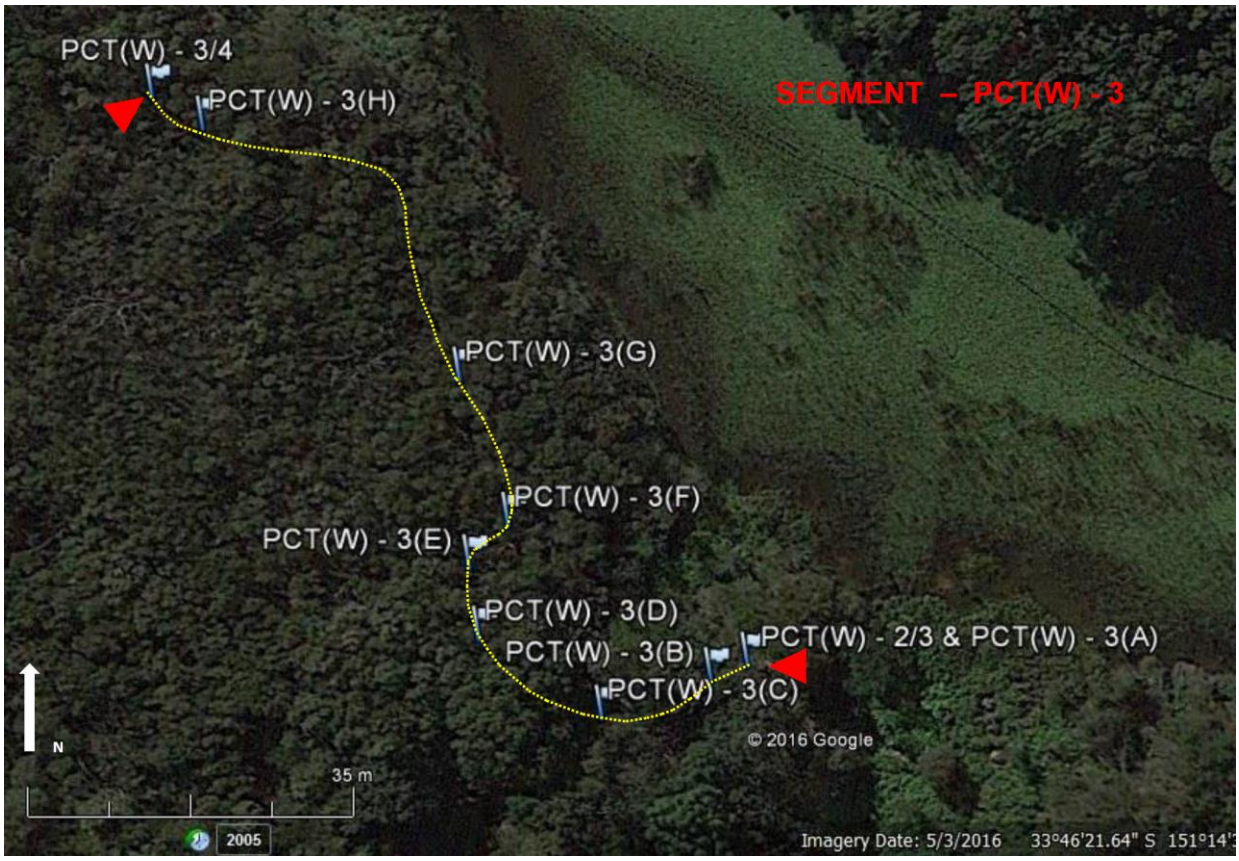
Works:

Mark as hazard, on both sides of trunk.

Monitor tree heath, for tree fall hazard.

(low)

SEGMENT PARK CIRCUIT TRACK (WEST) - 3



SEGMENT: PCT(W) - 3	
Start Point: 337322 6261629	**End Point: 337253 6261692**

General Description and Condition: Very well-defined track (140m approx.) gently winding across lower hillslope slightly up from dam margin, mostly flat with minor undulations, low timber boardwalk at E/SE end but very few other treatments, through tall Casuarina and Casuarina/Banksia heath over grasses/sedges. Good condition, mostly.

Tread Width (mm): Mostly 800-1,100 mm, occasional wider areas to 1,500mm (1,700mm maximum).

Track Surface: Predominantly compacted sand, mostly dished, entrenched to 250mm in places with drainage flows down/along many areas, regular protruding roots (often acting as steps), minor gravels.

Gradient (degrees): Mostly flat in S but gently undulating section in N two-thirds, to 3° for short sections.

Alignment: Gently winding across lower hillslope (slightly up from dam margin).

Terrain: Lower hillslope.

Soil: Lambert (Erosional) undulating to rolling low hills on Hawkesbury Sandstone.

Vegetation: Mostly Bloodwood-Scribbly Gum Woodland (part of Sydney Coastal Dry Sclerophyll Forest), SE end mapped as “disturbed” vegetation (drainage line/marshy flat).

Track Works and Improvements: Section of low timber (floating ?) boardwalk at E/SE end, 900mm wide, 16m long (approx.), 1x sleeper waterbar, and 1x scored sleeper step.

Signs and Wayfinding: Nil

User Experience: Easy pleasant walking on a well-defined track through mixed vegetation (moist in S, tall Casuarina heath in N), only minor uneven sections.

Key Issues: Continued scour on short sloped sections. Drainage/seepage capture and ponding. Rotting/failure of planks on timber boardwalk, and floating boardwalk displacement. Protruding roots.

Recommended Works – Overall

- Open windrows to minimise drainage capture and ponding.
- Remove protruding roots.
- Maintenance and cleaning of waterbars, steps/waterbars and other drainage treatments.
- Monitor low boardwalk for plank rotting/failure (and movement), and repair/replace as required.

Recommended Works – Site-specific (Priority)

Site ID: **PCT(W) – 3(A)**

Location: 337322 6261629 Two old star pickets beside track to N at bend (minor hazard).

Works:

Remove star pickets.

(low)

Site ID: **PCT(W) – 3(B)**

Location: 337318 6261627 800mm wide compacted sand track with 2 protruding roots acting as steps (75mm and 100mm high), entrenched track 250mm face on high/S side and 150mm slope on lower/N, drainage down and over roots.

Works:

Boxed step, fill and compact upslope/above over roots.

Waterbar above boxed step (at least 1 pace upslope).

(low)

Site ID: **PCT(W) – 3(C)**

Location: 337306 6261623 E/SE end of low timber boardwalk with 400mm step off, avoidance track to SW into adjacent sedges.

Works:

Build extra step off end of boardwalk.

Block/barrier avoidance trample track and rehabilitate.

(Medium – for passability and impact issues)

Site ID: **PCT(W) – 3(D)**

Location: 337293 6261632 800mm wide compacted sand track with 2.5° slope with protruding root acting as step 150mm high. Slightly entrenched track 150mm face on high/S side and 100mm slope on lower/N side, drainage down and over roots.

Works:

Install sleeper step below root, and fill/compact upslope behind (remove root if still protruding).

(low)

Site ID: **PCT(W) – 3(E)**

Location: 337290 6261639 Curving track of compacted sand 900-1,100mm wide on 3° slope, steeply dished to 200mm below NSL at top below protruding 150mm high root/step, angled root/step 200mm high downslope at bottom, entrenched track 200mm face on high side and 100mm slope on lower side.

Works:

Install sleeper step 1.5-2m below upper protruding root/step, fill and compact upslope behind.

Waterbar midway, with extended discharge channel.

Install sleeper step below lower angled root/step, fill and compact upslope behind.

Remove roots if still above infilled treads.

(low)

Site ID: **PCT(W) – 3(F)**

Location: 337295 6261644 Scored sleeper waterbar, full of sediment and failed with scour over and around higher end, 350mm step off and entrenched track to 300mm below NSL. Track 1700mm wide of compacted sand downslope, narrows to 800mm after 2m, entrenched to 150mm below NSL.

Works:

Raise and clean out in-situ waterbar.

Install sleeper step below 1.5m below existing waterbar, fill and compact behind back to existing waterbar (will reduce height of step off).

Pull-in track width, define/barrier edge (with branches).

(low)

Site ID: **PCT(W) – 3(G)**

Location: 337289 6261661 Curve on 2.5° slope (with a long gently sloped track above providing a large catchment), track of compacted sand and gravels and some embedded rock, 800-1200mm wide, dished to 250mm below NSL (on high side). Scored sleeper step, 300mm step off, only two thirds across track with deep gutter and drainage flows down/around end with gutter to 300mm deep.

Works:

Waterbar above, before curve on slope with extended discharge.

Replace sleeper with new waterbar/step extending across entire track (including gutter), fill and compact above/upslope (obtain fill from deposition area downslope).

Pull-in track width, define/barrier edge (with branches).

(low)

Site ID: **PCT(W) – 3(H)**

Location: 337259 6261689 Dead tree with branch 150mm diameter hanging over track. Second dead tree (with 2 trunks) 5m to SW off track.

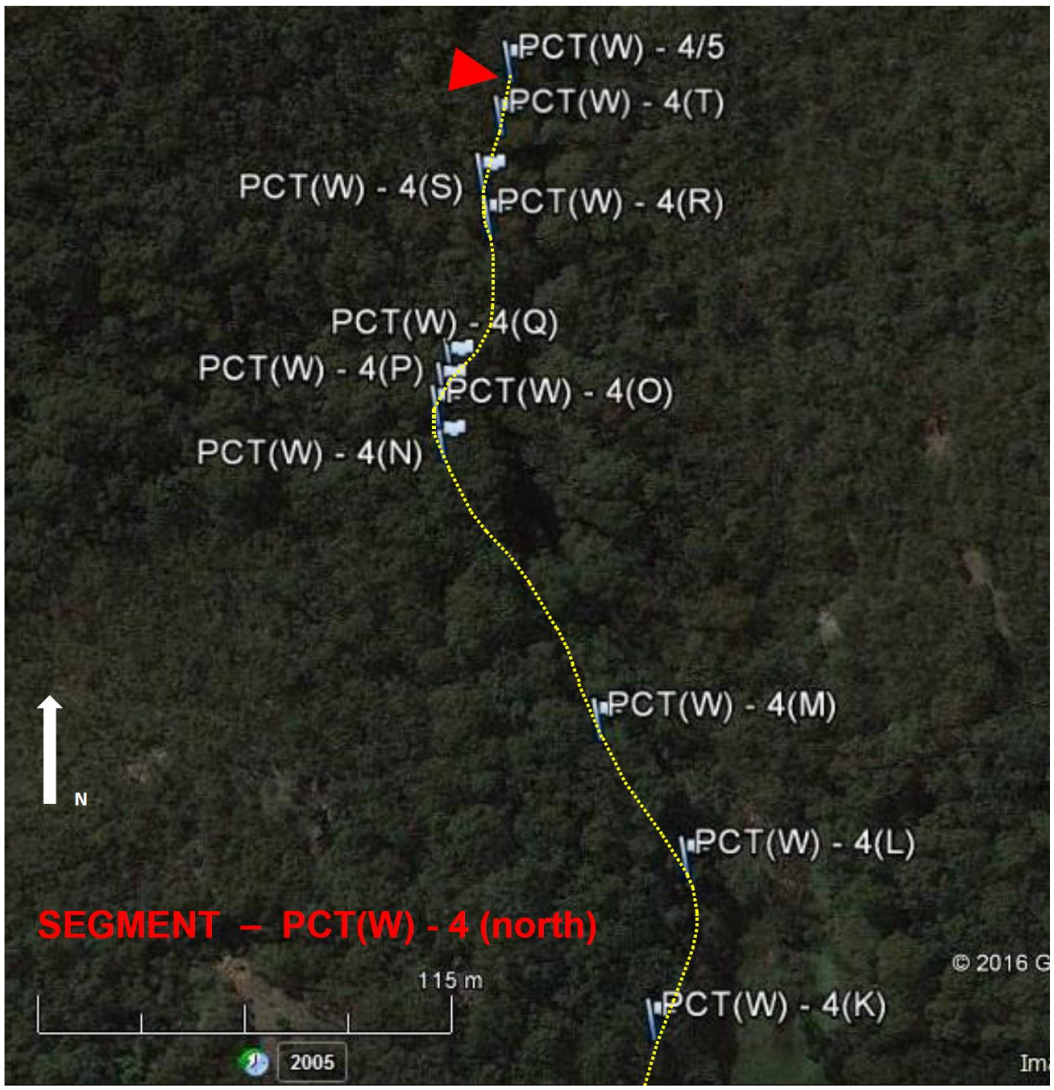
Works:

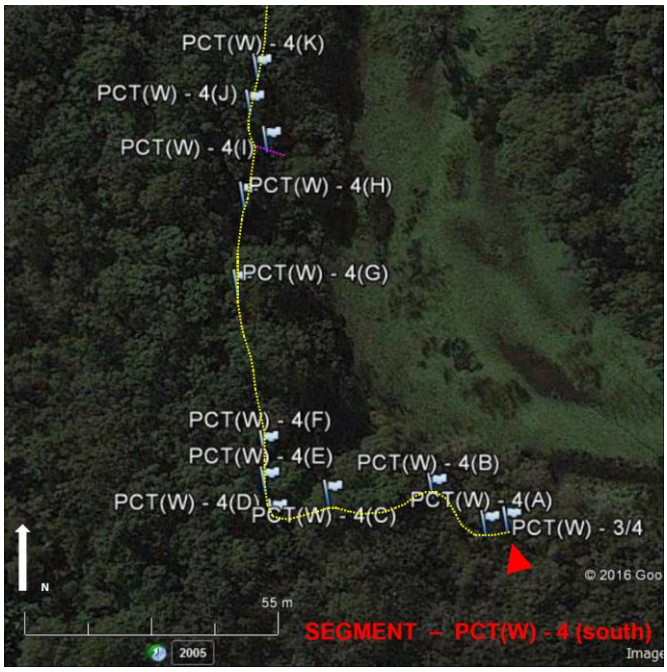
Drop dead limbs over track.

Fall dead tree (both trunks) to SW.

(HIGH – safety hazard)

SEGMENT PARK CIRCUIT TRACK (WEST) - 4





SEGMENT: PCT(W) - 4	
Start Point: 337253 6261692	**End Point: 337148 6262091**

General Description and Condition: Extended section (515 m approx.) of well-defined track with regular (mixed) track treatments, running from upper end of dam to lower end of Curl Curl Creek. Gently undulating and curving along contour across bottom of hillslope and over minor low spur alongside dam and creek, several tributary crossings. Major track junction, with side-track to E accessing upper reaches of dam/flats, at S third of segment. Runs alongside Curl Curl Creek for N third of segment with numerous creek access points. Through open Eucalypt forest with Banksias with usually medium understorey, as well as sedges/Lomandra and numerous grass trees in centre of section, and understorey vegetation becoming denser alongside creek on low side of track in N third. Good condition.

Tread Width (mm): Mostly 600-1,200mm.

Track Surface: Predominantly compacted sand, frequently dished and some short entrenched sections >300mm deep, drainage capture and flows down track common, regular exposed/protruding roots, regular areas of loose/deposited sand, minor sand/clay sections, occasional embedded rock

Gradient (degrees): Mostly flat to gentle 3°slope, gently undulating especially in N, a number of very short gentle/moderate to steep sections from 5° to 11°.

Alignment: Mostly very gently curving along contour across bottom of hillslope, more curving alignment at S end up/around minor drainage line.

Terrain: Lower hillslope.

Soil: Lambert (Erosional), undulating to rolling low hills on Hawkesbury Sandstone.

Vegetation: Predominantly Peppermint Angophora Forest, and small area of Bloodwood-Scribbly Gum Woodland in far SE and just touching track far N end (both part of Sydney Coastal Dry Sclerophyll Forest). Runs along boundary of Peppermint Angophora Forest and "artificial wetland" along dam margin in places though N half.

Track Works and Improvements:

Numerous and regularly spaced track treatments.

- Frequent, regularly spaced, waterbars and waterbars/steps – both older logs and newer scored sleepers, some short, usually with drainage flows over and often around ends.
- Short timber boardwalk/bridge over minor tributary, 2.6m long and 900mm wide - Site PCT(W)-4(D) – good/fair condition.
- Low timber boardwalk (floating ?) with 2 low steps (S end 337192 6261770, N end 337189 6261777), 12.5m long and 900mm wide, several recently replaced planks – good condition.
- Low timber boardwalk (floating ?) with 3 low steps (S end 337153 6261902, N end 337144 6261914), 19m long and 900mm wide, curving through ephemeral drainage line at S end (1 low step each side of drainage line), some sediment and leaf litter over N end – good condition.
- Short timber bridge over larger tributary – 5.5m long and 1.2m wide, some new planks, good condition. Double galvanised railing W side, no railing E side and 1,250mm drop to rock creek bed. Timber deck landings off both ends. Good condition but needs additional safety railing (see Site PCT(W)-4(O)).

Signs and Wayfinding: Single old metal directional arrow nailed to tree adjacent to track in N quarter of segment. No other wayfinding en-route. "Gulgadya Muru" Aboriginal self-guided walk interpretive panel (x 1) in N third - good condition.

User Experience: Easy and very pleasant walking through attractive vegetation, including a scenic area of grass trees. Views into adjacent creek in N third, and several access points to attractive creekline of sloping rock shelves, boulders, cascades/riffles, rockpools and larger pools.

Key Issues: Ponding and drainage capture with some scour/entrenchment. Several older style track improvements (especially short log waterbars). Rotting/failure of planks on timber boardwalks, sediment covering boardwalk ends (speeding rot), and floating boardwalk displacement. Several trample tracks to adjacent creek in N quarter.






Recommended Works – Overall

- Maintenance/cleaning of waterbars and other drainage treatments.
- Open windrows to minimise drainage capture/ponding.
- Remove/level protruding roots and rocks.
- Monitor low boardwalks for plank rotting/failure (and movement), and repair/replace as required.
- Adaptive management of trample tracks to dam margin and creek, closure or formalisation as/where warranted.
- Improved (reassurance) wayfinding – including at junction with side-track to upper dam margin.

Recommended Works – Site-specific (Priority)

Site ID: **PCT(W) – 4(A)**

Location: 337248 6261691 Scored sleeper waterbar, full of sediment and failed with flows over and scour with 350mm step off, and flows/gutter around low end. 2 scored sleeper steps, only two-thirds across track with flows/gutter around low ends. Scored sleeper waterbar, only two-thirds across track, flows around low end, mostly buried and ineffective. Compacted sand 1,000-1,300mm wide and dished to 200mm, with scarp/face on high side to 350mm near top waterbar, 2.5° overall. Dead tree 150mm dbh on low side of track.

Works:

Extra waterbar upslope/above, at least 1 pace above top waterbar.

Reinstate, raise and extend top waterbar – extend discharge if needed.

Two boxed step-and runs below existing top waterbar, fill and compact treads.

Pull-in track width (especially beside 2 middle steps and below), define edge and block/barrier (with branches).

Replace lower waterbar with sleeper step.

Fall dead tree.

(Medium)

Site ID: **PCT(W) – 4(B)**

Location: 337235 6261700 Compacted sand, 900mm wide, dished to 75mm, 2.5° slope with drainage flows down and roots exposed upslope.

Works:

Install waterbar below roots with extended outlet to discharge well off track, fill/compact track surface over roots (remove roots if still protruding).

(low)

Site ID: **PCT(W) – 4(C)**

Location: 337211 6261698 Compacted sand, 800-1,000mm wide, dished to 200mm, 5° slope with drainage flows down, exposed roots.

Works:

Install waterbar below roots, fill/compact track surface upslope/above over roots (box/tertian on low side if required).

(low)

Site ID: **PCT(W) – 4(D)**

Location: 337198 6261694 Short timber boardwalk/bridge over ephemeral tributary, 2.6m long and 900mm wide, 800mm drop to creekbed, sand and leaf litter covering 600mm at W end (but not rotting as yet).

Works:

Monitor for rot at SW end.

(monitor)

(waterbars proposed upslope on each side, Sites PCT(W)-4(C) and PCT(W)-4(E), will help minimise sediment deposition over each end of bridge)

Site ID: **PCT(W) – 4(E)**

Location: 337197 6261701 Compacted sand, 1000mm wide, gently dished to 75mm below NSL, 1.5° slope with considerable drainage flows down from steps/slope 6m upslope to N/NW (Site PCT(W)-4(F)).

Works:

Sleeper waterbar, cut outlet through windrow for free discharge.

(low)

Site ID: **PCT(W) – 4(F)**

Location: 337197 6261710 Log waterbar at top of 6° slope, full of sediment and failed with flows over but no scour. 3 scored sleeper steps downslope/below – upper step one has drainage flows around short (low) end but no scour (also bent over steel reinforcing/fixing rod is a tip hazard). Track of compacted sand and some laterite gravel upslope of log waterbar 1,000-1,400mm wide, dished to 100-150mm and to 300mm in places below NSL and protruding root down centre of track.

Works:

Install extra waterbar 7-8m above/upslope of top log waterbar (deeply dished track, to 300mm deep, and wide side mounds prevents waterbars closer to top of steps).

Install extra waterbar 1.5-2m above/upslope of top log waterbar.

Clean out and reinstate top log waterbar.

Extend upper step, and remove or paint steel reinforcing/fixing rod trip hazard.

(low)

Site ID: **PCT(W) – 4(G)**

Location: 337190 6261747 Compacted sand track, 1,200-1,500mm, with some embedded rock (a few protruding), 7° slope with drainage flows down track to compacted sand flat at bottom with drainage off track to NE. 2 scored sleeper waterbars, both full of sediment and failed with drainage flows over but no scour. 2 short log steps (1 above upper waterbar and 1 between waterbars) with drainage flows around ends of both.

Works:

Clean-out both waterbars.

Extend upper log step.

Replace middle log step with sleeper waterbar/step.

Extend lower waterbar.

Install extra waterbar 4m below lower waterbar (above run-on area) and pull-in track width, define edge and block/barrier.

Remove / level protruding rocks and roots.

(low)

Site ID: **PCT(W) – 4(H)**

Location: 337189 6261768 Old log waterbar 2m off S end of low timber boardwalk, only extends half way across track and being detoured – ineffective.

Works:

Remove redundant waterbar.

Open windrow low side.

(low)

Site ID: **PCT(W) – 4(I) (on side-track)**

Location: 337194 6261781 Short track downslope/E to flat area on upper end of dam, from junction at N end of boardwalk and angled embedded/retaining sleepers (main PCT(W) continues upslope to NW at junction). 5 scored sleeper steps and step-and-runs over 6m length on a 10° slope, entrenched to 300mm below NSL in bank of white clay/sand, treads of compacted/deposited sand and some embedded rock 900-1,200mm wide, very considerable flows down from upslope track/steps and slope above wit ponding on treads and scour to 350mm high over steps. Heavily used as access to dam margin and flat alluvial fan.

Works:

Assuming track to be retained as access to upper dam margin. Drainage works and other treatment proposed for site upslope, Site PCT(W)-4(J), will divert drainage away from top of this track section, only local inflows likely from adjacent banks/slopes.

Install wide built step, off lower/NE edge of proposed extended section of timber boardwalk across junction at top of site, to provide access from remodelled junction (refer to Site PCT(W)-4(J)), and realign existing retaining sleeper step and top step(s) as required.

Rock armour landing below new step (at top of existing steps).

Rock armour all treads – to reduce step height, improve surface stability, and protect against any possible continued drainage flows down track.

(Medium – for passability issues)

(proposed high priority works upslope, Site PCT(W)-4(J), will also protect this site)

Site ID: **PCT(W) – 4(J)**

Location: 337190 6261790 (midpoint)
Angled embedded/retaining sleepers off N end of boardwalk (track junction downslope to E), full of sediment with flows over. Upslope NW to long sleeper step (full of sediment with flows over) and protruding embedded/placed fat rock in tread and boulder at S end, then 4 boxed sleeper steps with compacted sand treads and sleepers retaining high/NE bank. Large protruding stump (450mm high) and roots in track above top step, compacted sand and embedded gravel track 1,800mm wide entrenched to 250mm below NSL, to scored sleeper step/waterbar full of sediment and failed with flows over and scour to 250mm, and buried log waterbar/step above. Overall slope of 8° (10° to top of boxed steps). Wide (600mm) gutter on low/SW side of boxed steps, with sleeper and log bars/bulkheads and protruding roots. Considerable drainage flows down from upslope, and well-used trample track, up adjacent slope to W to rock ledge and clearing above (fallen log acting as temporary waterbar). Flows down side gutter continue downslope (through track junction) and over/under end of boardwalk.

Works:

Extend low timber boardwalk at an angle to NW (including 1 step) to match level of, and join to, first sleeper step - but leave small gap between sleeper step and end of boardwalk for drainage outlet.

Replace tread off end of boardwalk (above/behind embedded/retaining sleepers) with a wide stone-lined gutter as “catch-drain”, extend gutter to S along high/W side of first 1-1.5m of boardwalk, to discharge flows downslope under boardwalk.

Stone headwall in bank at N end of gutter.

Leave N end of gutter rough/uneven to prevent use/shortcutting (especially if track downslope/E retained – Site PCT(W)-4(I)).

Level treads of lowest step and bottom boxed step and rock armour.

Realign/extend first boxed step to better align with centreline of extended boardwalk.

Rock armour lower/E end of side gutter, and trim outlet in lowest sleeper step to allow discharge into new “catch-drain”.

Rubble armour side gutter (fur full length to upslope of top boxed step), clean-out bars/bulkheads and reposition if required.

Install new extended flow deflection “wing” across slope off edge of top boxed step. Block/barrier top of side gutter, to prevent detouring.

Clean-out and realign upper waterbar/step.

New boxed step below upper waterbar/step, fill and compact tread above/behind.

Remove stump and protruding roots, level and compact track surface.

On slope above track to W:

- install extended waterbar across trample track (sited below fallen log, and butting into rock ledge at upslope end) and running across slope to catch/divert flows to S/SE away from side gutter (discharging upslope of N end of boardwalk);
- cut gutter in upper edge of rock outcrop above, to catch/divert flows away from trample track; and
- close/block and disguise trample track.

(HIGH - for sustainability/impact and passability issues)

Site ID: **PCT(W) – 4(K)**

Location: 337193 6261798 Compacted sand 1,200-1,600mm wide. Short log waterbar above, with flows around both ends. Scored sleeper waterbar below, with log extension low end, full of sediment and failed with flows over and scoured step off 350mm high and deeply dished track 350-500mm below NSL for short distance below waterbar.

Works:

Replace log with longer sleeper waterbar.

Clean-out lower waterbar.

Install step below, with compacted fill behind/above to reduce step height.

(low)

Site ID: **PCT(W) – 4(L)**

Location: 337202 6261847 Compacted and loose sand 700-800mm wide, 2.5° slope with drainage flows down track. Dead trunk/stem (250mm dbh) in tree on high side of track.

Works:

Install waterbar.

Fall dead stem on tree on high side.

(Medium – safety issue)

(waterbar alone would only be **low** priority)

Site ID: **PCT(W) – 4(M)**

Location: 337176 6261889 Dead tree on low side of track, 300mm dbh.

Works:

Fall tree.

(HIGH – safety issue)

Site ID: **PCT(W) – 4(N)**

Location: 337128 6261975 Compacted sand 1200mm, deeply dished track 200-250mm below NSL. Short log waterbar, full of sediment and failed, with flows round both ends (located at less incised point on track).

Works:

Replace with new waterbar just upslope of existing (with extended outlet to discharge well off track if needed).

(low)

Site ID: **PCT(W) – 4(O)**

Location: 337126 6261985 (midpoint) Short timber bridge over larger tributary – 5.5m long and 1.2m wide, some new planks, good condition. Double galvanised railing W side, no railing E side and 1,250mm drop to rock creek bed. Timber deck landings off both ends – same width as bridge – for 90° turns on/off bridge. S landing has step (2 planks wide) to E and then older/buried sleepers and logs in rectangle E of this beside tributary bank (trip hazard and invites access to sloping mossy rocks in tributary).

Works:

Install handrail on E side of bridge.

Widen (at least double) existing approach step on S end, as a second lower landing.

Replace rotten log between existing step and landing (S end).

Remove old/disused timbers in ground at S end, block/barrier trample track to tributary.

(HIGH – fall safety issues)

Site ID: **PCT(W) – 4(P)**

Location: 337129 6261992 Compacted sand track, flat, 900mm wide. Short (1m) log along/retaining low side of track with sandy bank sloping down to tributary, scour on bank starting to eat into track W of log. Trample tracks to tributary.

Works:

Replace log with longer sleeper to better retain track edge.

Monitor for further scour along track edge.

(low, and monitor)

Site ID: **PCT(W) – 4(Q)**

Location: 337130 6262000 Compacted sand/clay 1,200-1,400mm wide, 11° slope, benched track with 300mm scrap along high side. 2 double/extended log waterbars, both full of sediment and failed, drainage flows over (and around upper end of lower waterbar), scour below upper waterbar with 300mm step off.

Works:

Replace both logs with new (long) sleeper waterbars.

Sleeper step below upper waterbar (at least 1 pace below), boxed on low end and filled/compacted tread above.

Pull-in track width on low side, define and barrier/block edge.

(low)

Site ID: **PCT(W) – 4(R)**

Location: 337142 6262043 Compacted and loose sand track 1,000-1,200mm wide, benched/sloping to 300mm on high side.. Log waterbar above with drainage flows around lower end, then scored sleeper waterbar below with drainage flows around end and over with scour 250-300mm high and roots below.

Works:

Remove log waterbar.

Reinstate/extend existing sleeper waterbar.

Install new sleeper waterbar 1.5-2m below existing and fill/compact above/behind over roots.

(low)

Site ID: **PCT(W) – 4(S)**

Location: 337140 6262056 Dead tree low side of track, >300mm dbh. Large well-used trample track to adjacent creekline – sloping rock shelves to cascades/riffles and large pool below. Trample track acts as drainage discharge points from main track, but is over rock outcrop/sloped pavement so no scour issues.

Works:

Fall tree.

(HIGH – safety issue)

Site ID: **PCT(W) – 4(T)**

Location: 337147 6262086 Compacted sand and roots, 6m long, 900-1,200mm wide, 3° slope, benched to 250mm on high side. Side/edging log and two short buried log waterbars (both angled wrong way and ineffective).

Works:

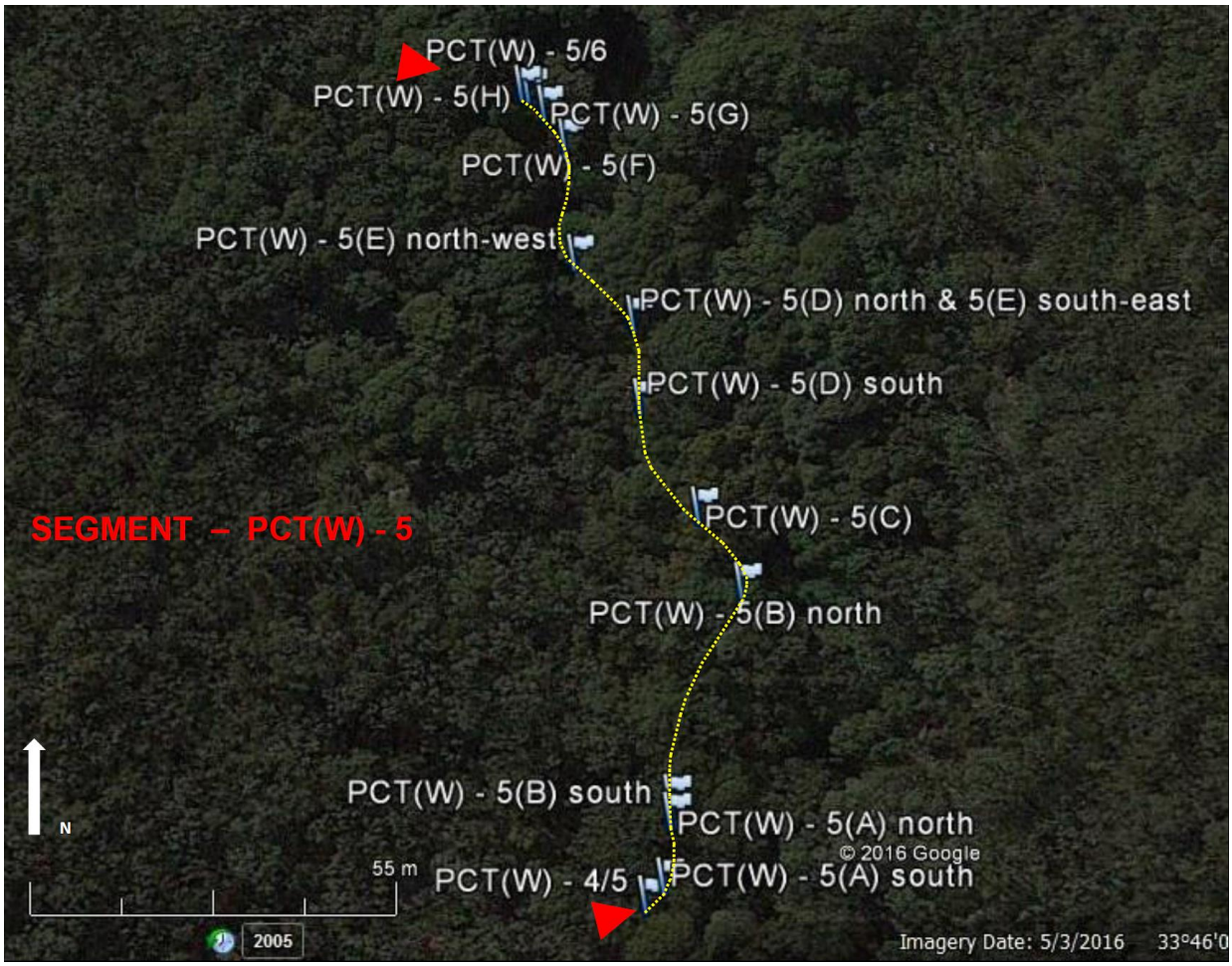
Remove existing waterbars and install 2 new long sleeper waterbars/steps.

Remove protruding root (acting as step) at top of site, and replace with sleeper waterbar/step.

Pull-in track width on low side, define and barrier/block edge.

(low)

SEGMENT PARK CIRCUIT TRACK (WEST) - 5



SEGMENT: PCT(W) - 5	
Start Point: 337148 6262091	**End Point: 337119 6262233**

General Description and Condition: Well-defined track (180m approx.) winding along contour across bottom of hillslope and along flood terrace beside creekline, drops into flood zone in places in N half (some sections flood impacted or liable), accesses waterfall at N end. Short section of boardwalk but few other track treatments. Through open Eucalypt forest, frequent fern beds and open understorey. Good/fair condition.

Tread Width (mm): Mostly 600-1,100mm, but several sections of widened/braided track to 1,8900mm.

Track Surface: Predominantly compacted sand, also areas of moist/wet sand from ponding or drainage "run-on" areas, overflow/flood channel adjacent in N half (flood debris over track in places), flood terrace mainly in N half and sandy bank at N end near waterfall, areas of loose sand, often dished to 100mm (occasionally 200mm deep), frequently benched on high side (100-150mm, occasionally 400 mm deep) manly in S half, drainage flows down several areas (mainly in S half), occasional roots, very occasional embedded rock.

Gradient (degrees): Mostly gently sloping – flat to 3°, slightly undulating in places, isolated short gentle/moderate slopes (4° and 8°).

Alignment: Winding along contour across bottom of hillslope and along flood terrace beside creekline.

Terrain: Lower hillslope and creekline.

Soil: Lambert (Erosional), undulating to rolling low hills on Hawkesbury Sandstone.

Vegetation: Peppermint Angophora Forest (part of Sydney Coastal Dry Sclerophyll Forest).

Track Works and Improvements:

A few scattered waterbars a run of short sleeper steps at N end near waterfall. Low timber boardwalk, 16 m long 900mm wide, some new planks – good/fair condition (Site PCT(W)-5(D)).

Signs and Wayfinding: Nil

User Experience: Easy and pleasant walking through attractive creekside vegetation, parallels creek (but not always visible) and accesses waterfall and sandy beach at N end.

Key Issues: Ponding and drainage capture and "run-on". Track widening/braiding around wet areas. Unstable track sections across flood terraces. Potential for flood/high flow impacts, especially at N end. Rotting/failure of planks on timber boardwalk and boardwalk displacement/damage by floods. Several trample track accessing creek, mainly in N

Recommended Works – Overall

- Maintenance/cleaning of waterbars and other drainage treatments.
- Open windrows to minimise drainage capture/ponding.
- Monitor low boardwalk(s) for plank rotting/failure, movement and flood damage – and repair/replace as required.
- Monitor for need for additional drainage protection requirements, and monitoring and responsive management for track widening.
- Adaptive management of trample tracks to creek margin, closure or formalisation as/where warranted.
- Install wayfinding/reassurance signage - as per Manly Dam Sign Location Plan.
- Possible alternative (more stable/sustainable, and safer, route around W/SW side of waterfall (see Site PCT(W) – 5(G).

Recommended Works – Site-specific (Priority)

Site ID: **PCT(W) – 5(A)**

Location: 337152 6262105 S end
337151 6262094 N end

Sandy dip and drainage "run-on" area, braided track at S end to 1,700mm wide and split level (low side possibly wet at times ?). Loose sand in centre with two logs (old buried waterbar and displaced side log) to 1,800mm wide on bend. Dip/ponding area to N below exposed Angophora roots. 14m total, on gentle bend.

Works:

Install low FRP boardwalk, 14m (approx.).

Pull-in track edges and block/barrier to prevent avoidance, rehabilitate.

Monitor after flood/high flows for possible damage/displacement.

(Medium – for passability [in wet] and sustainability/impact issues [to prevent trail widening and vegetation impacts] – and monitor)

Site ID: **PCT(W) – 5(B)**

Location: 337152 6262108 S end
337163 6262144 N end

Long run of compacted sand (and some clay) track, 600-700mm wide, 39m long, benched to 400mm high side and wide sand/fern mound on low/creek side, 1.5-2° slope with drainage flows down entire length and discharging into dip at S end (Site PCT(W)-5(A)).

Works:

Build waterbar at W end (before sand/fern mound low side) with extended outlet gutter to discharge well off track.

Install at least 3 waterbars spaced along whole length, where low side mound height allows (greater more chance to N).

New sleeper step at S end below root to "lock off" this end of track above boardwalk downslope/below (Site PCT(W)-5(A)).

(low)

Site ID: **PCT(W) – 5(C)**

Location: 337155 6262157 Paired log waterbars with root below, full of sediment and failed, drainage flows over and scoured with 350mm step off, also flows around high end. Compacted sand, 900-1,100mm wide, benched to 300mm high side. 4° slope.

Works:

Install new waterbar above existing and remove.

New sleeper step below existing waterbar, box on low side, fill and compacted tread above/behind.

(low)

Site ID: **PCT(W) – 5(D)**

Location: 337142 6262191 SE end (end of existing boardwalk)
337131 6262202 NW end

Low timber boardwalk, 16 m long 900mm wide, some new planks – good/fair condition. Extended long waterbar at S end, full of sediment and failed. Step off N end to rounded slightly angled embedded rock. In flood zone with debris against boardwalk, especially at N end.

Works:

Clean out water bar at s end.

Monitor after flood/high flows for possible damage/displacement.

(low, and monitor)

Site ID: **PCT(W) – 5(E)**

Location: 337144 6262176 S end
337142 6262191 N end

Compacted sand and roots, wet area with overflow from adjacent flood/overflow channel to E, 14m long, 900-1,100mm wide, track widening/braiding on high side to avoid wet patches, 2° slope, guttered to 150mm deep at NW end, runs beside adjacent flood/overflow channel to E for 7m with flood debris beside track at S end, some embedded and outcropping flat rock in S end to boardwalk (Site PCT(W)-5(E)).

Works:

Build low boardwalk (FRP or timber) for 14m linking to existing boardwalk to S (Site PCT(W)-5(E)) - preferably on piles (not floating, due to likely flood pressures). Provide flood protection along overflow/flood channel edge with embedded boulders (if locally available).

Block and rehabilitate braided/widened track sections.

Install waterbar 1m upslope of N\W end. Monitor after flood/high flows for possible damage/displacement.

(Medium – for passability [in wet] and sustainability/impact issues [to prevent trail widening and vegetation impacts] – and monitor)

Site ID: **PCT(W) – 5(F)**

Location: 337128 6262224 6 scored sleeper steps down loose sand bank to flood terrace downstream of waterfall, loose sand treads, edging/retaining sleeper off base of steps (at 90° to bottom step). Flood/overflow channel adjacent. Access straight ahead from bottom of steps to sandy beach and pool – receives high levels of use.

Works:

Install waterbar 1.5m above steps.

Monitor after flood/high flows for possible damage.

(low, and monitor)

Site ID: **PCT(W) – 5(G)**

Location: 337124 6262230 Sandy flood terrace behind waterfall beach, regularly flood impacted. Track extends 8m along top of flood terrace (after 90° bend from bottom of Site PCT(W)-5(F)), first 5m is loose sand merging to compacted sand to NW. Large senescent Eucalypt leaning over track.

Works:

Monitor health and safety risks posed by senescent Eucalypt and stability after flood/high flows (high use zone.

Monitor for passability and hazards after flood/high flows.

(Medium - monitor only, but high use zone)

Note: An alternative approach to track alignment around the waterfall site would be to establish a new track linking between a point above the existing steps down to the sandy beach (Site PCT(W)-5(F)), across a higher terrace just to the W of the waterfall (approx. 8-10m W of the current track), and rejoining the main track the base of the existing steps climbing the rock slope NW of the waterfall (Site PCT(W)-6(A)). A short side track (T-junction) would still provide access to the beach/waterfall.

Site ID: **PCT(W) – 5(H)**

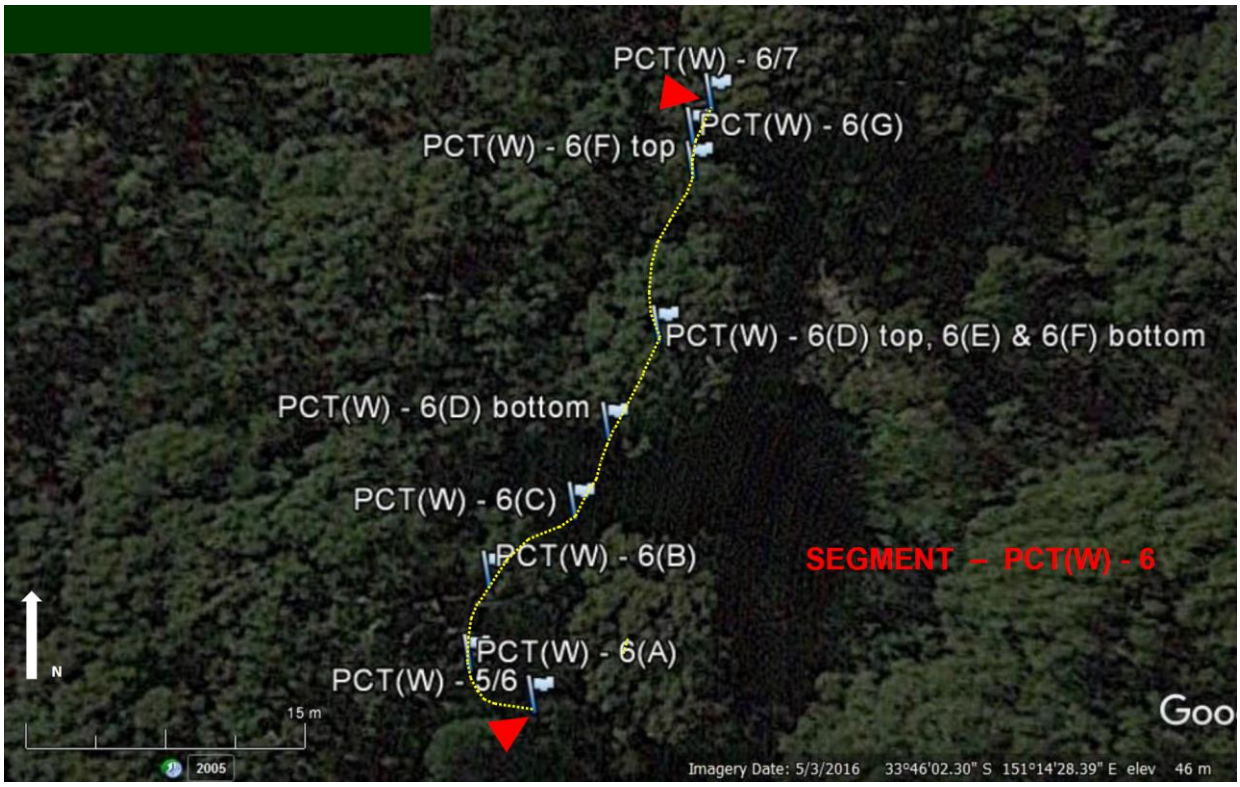
Location: 337121 6262235 Compacted sand track, 700-900mm wide, 8° slope with drainage flows down track (from steps above, next segment).

Works:

Install waterbar.

(low)

SEGMENT PARK CIRCUIT TRACK (WEST) - 6



SEGMENT: PCT(W) - 6	
Start Point: 337119 6262233	**End Point: 337130 6262270**

General Description and Condition: Short (50m approx.) section of steep track up/down rocky slope with adjacent rock faces/ledges on W side of waterfall, rough uneven/rocky surface and wide in places with "rock hopping" and large rises/lips, handrail above steep slope/cliffline to pool below. Fair condition only, with some hazards.

Tread Width (mm): Varies - from 700mm on narrow benches to 2,400mm around boulders and rock ledges.

Track Surface: Compacted sand and sand/clay among extensive areas of large boulders and rock ledges, embedded rocks, areas of loose sand, abundant protruding roots including large roots running down and across track in several places, drainage down much of segment with frequent scour.

Gradient (degrees): Steep 15-20° with short flat or more gently benches.

Alignment: Sharp curve at bottom/S end, then winding sharply up/down rocky slope on W side of waterfall.

Terrain: Lower to mid hillslope, W side of waterfall.

Soil: Lambert (Erosional), undulating to rolling low hills on Hawkesbury Sandstone.

Vegetation: Peppermint Angophora Forest (part of Sydney Coastal Dry Sclerophyll Forest).

Track Works and Improvements: 5 old (short) sleeper steps at bottom/S end and 2 old sleeper steps on high side of central landing. Double safety railing (galvanised pipe) along low side of track 9m long (5m flat bench, then 4m on slope) 700-1,000mm high - Site PCT(W)-6(C).

Signs and Wayfinding: "Gulgadya Muru" Aboriginal self-guided walk interpretive panel (x 1) at central landing. No wayfinding signage.

User Experience: Steep challenging but short section, requires care and some users hazards, but attractive views of waterfall and pool and access midway to scenic area of undulating rock pavement/shelf with riffles and rock pools.

Key Issues: Unsafe edges and fall hazards. Uneven track surface and high rises/steps. Drainage capture and flows down track, with on-going scour. Limited options for track works or realignment. Protruding roots.




Recommended Works – Overall

- See site-specific works.
- Monitor for drainage impacts and condition/serviceability of track treatments (especially safety features) - with repair/ remediation and adaptive management as/if required.
- Remove protruding roots.

Recommended Works – Site-specific (Priority)

Site ID: **PCT(W) – 6(A)**

Location: 337116 6262236 Compacted sand, 700-1,000mm wide, 8m curving track up 20° slope with 2.4m total height change. 5 old (short) sleeper steps, drainage flow and scour down both sides of steps with compacted and loose sand. Trip hazards – exposed protruding pieces of pipe. Flat rock outcrop and embedded rocks on sandy slope at base of steps/slope. Exposed roots with 200mm step up to compacted sand bench at top of steps/slope. Boulders/rock on inside of bend and embedded rocks at top of slope.

Works:

Build 11 boxed sleeper steps curving upslope to replace existing (becoming step-and-runs towards low end). Anchor to in-situ boulder/rock where possible. Add "wings" to side of steps to divert flows down and ways from sides and minimise side scour.

Build waterbar at top, butt onto boulder high side (at least 1m above top step).

(Medium – for passability and sustainability issues)

Site ID: **PCT(W) – 6(B)**

Location: 337117 6262241 Compacted sand track along bench, 700mm wide and benched in to 250mm high side. Eroding/washed-out on lower side, cutting into track for 1.2m length, at top of steep loose slope to boulders/pool below – hazard. Roots and embedded rock. Site is off SW end of safety railing, galvanised pipe, at next Site (Site PCT(W)-6(B)).

Works:

Retain track edge with rock//block edging and fill/compact track surface (monitor if further need to rock armour track surface).

Extend galvanised pipe safety railing from next Site (Site PCT(W)-6(B)) 3m to SW, to secure top of slope and eroding edge.

(HIGH – safety issue)

Site ID: **PCT(W) – 6(C)**

Location: 337122 6262245 (midpoint of safety railing)

Track of loose sand 700mm wide along narrow bench, with rock ledge on high side and steep/sheer drop to boulders/pool below on low side. Galvanised pipe, double safety railing, along low side of track - low only 700mm high for 4m at bend (due to sediment/fill from upslope raising track level) elsewhere to 1,000-1,00mm high.

Works:

Raise railing (or preferably remove fill and lower track – as will stop rust at base of galvanised posts as well).

(Medium – safety issue)

Site ID: **PCT(W) – 6(D)**

Location: 337124 6262250 bottom
337127 6262256 top (landing at "Gulgadya Muru" interpretive panel and access to top of waterfall)

12m at 17° slope (overall) and 3.1m total height change, large angled boulders and embedded rock among smaller patches of compacted/loose sand, large roots running down and across track, width from 900mm (at top) to 2,400mm around boulders, step height onto/around rocks of 300-500mm on lower half and 200-300mm on upper half, large stump near top of site, drainage down entire site with scour in sandy patches. Lower 5m of site has steep slope (partially covered/screened by leaf litter) only 1.5- 2m off edge of track, with very steep drop to pool/boulders below, and trample track to waterfall lip off track midway. Angled galvanised pipe, double safety railing, along low side of track for bottom 2m of site only.

Works:

Construct FRP steps for entire 12m length – likely to need 12-13 steps or small step-and-runs (but will require design on-site relative to anchor/pad points and "floaters"). Include gutters or diversion rock walls under FRP steps to direct drainage flows off track.

Extend existing safety railing for at least 6m upslope, to block off hazardous cliff edge and trample track to waterfall lip.

(HIGH – for passability and sustainability issues, and to enhance presentation of Aboriginal site)

Site ID: **PCT(W) – 6(E)**

Location: 337127 6262256 Compacted sand "landing" 1,600mm wide and 2,400mm long, largely level with roots at rear. "Gulgadya Muru" interpretive panel (grinding grooves). Sloped rock ledge leading E/NE to creek (with natural arch over channel) then undulating rock pavement/shelf with rock pools. Waterfall lip 5m to S/SE - hazard.

Works:

Stone flag landing to increase resilience (and protect from drainage off rock slope/steps upslope), save Xanthorrhoea if possible.

Install warning sign regarding safety at waterfall edge (and need to watch children), and message re respect for Aboriginal site – using pictograms where possible to avoid signage "clutter" at attractive location.

Do not cut steps in sloped rock outcrop to creek line, or other measures to make access to creek and rock shelves/pools more inviting/easier.

(Medium)

Site ID: **PCT(W) – 6(F)**

Location: 337127 6262256 bottom
337129 6262266 top

Rock ledges and embedded/protruding rocks with compacted sand and clay in between, 900-1,800mm wide and 12.5m long, 15° slope overall (but slightly lower 12° slope through middle of site, with larger rises at top and bottom), total height change of 2.6m. 2 old sleeper steps at bottom, from rear of landing at "Gulgadya Muru" interpretive panel (Site PCT(W)-6(E)) then rock ledges 300mm and 100mm and 400mm high, Banksia roots acting as steps 500mm high then embedded rocks above. Middle of site is angled embedded rocks and roots 350mm high, then mass of roots protruding up to 200mm. Large boulder at top, 350mm high downslope face, then rounded/knobby top, and slope off upper side to compacted sand track at top of site. Drop of 1,700mm into crevice 1.5-2m off NE edge of track at top of site.

Works:

Construct FRP steps and step-and-runs from above existing sleeper steps at bottom end to large boulder at top of site (as anchor point). More steps on lower half, and more step-and-runs on upper half. Include gutters or diversion rock walls under FRP steps to direct drainage flows off track. Remove Banksia, but save Xanthorrhoeas if possible.

Replace sleeper steps off rear of landing at "Gulgadya Muru" interpretive panel (Site PCT(W)-6(E)) – or continue FRP steps (if this will not significantly intrude into usable area of landing).

Cut/level tread across top of upper boulder (off top end of FRP steps) and build 2 wide rock steps (same width as FRP steps) off high side of boulder (align top end of FRP steps and track over boulder to SW, away from drop to crevice to NW).

Monitor for need to block/barrier track edges – if avoidance becomes an issue.

(HIGH – for passability and sustainability issues, and to enhance presentation of Aboriginal site)

Site ID: **PCT(W) – 6(G)**

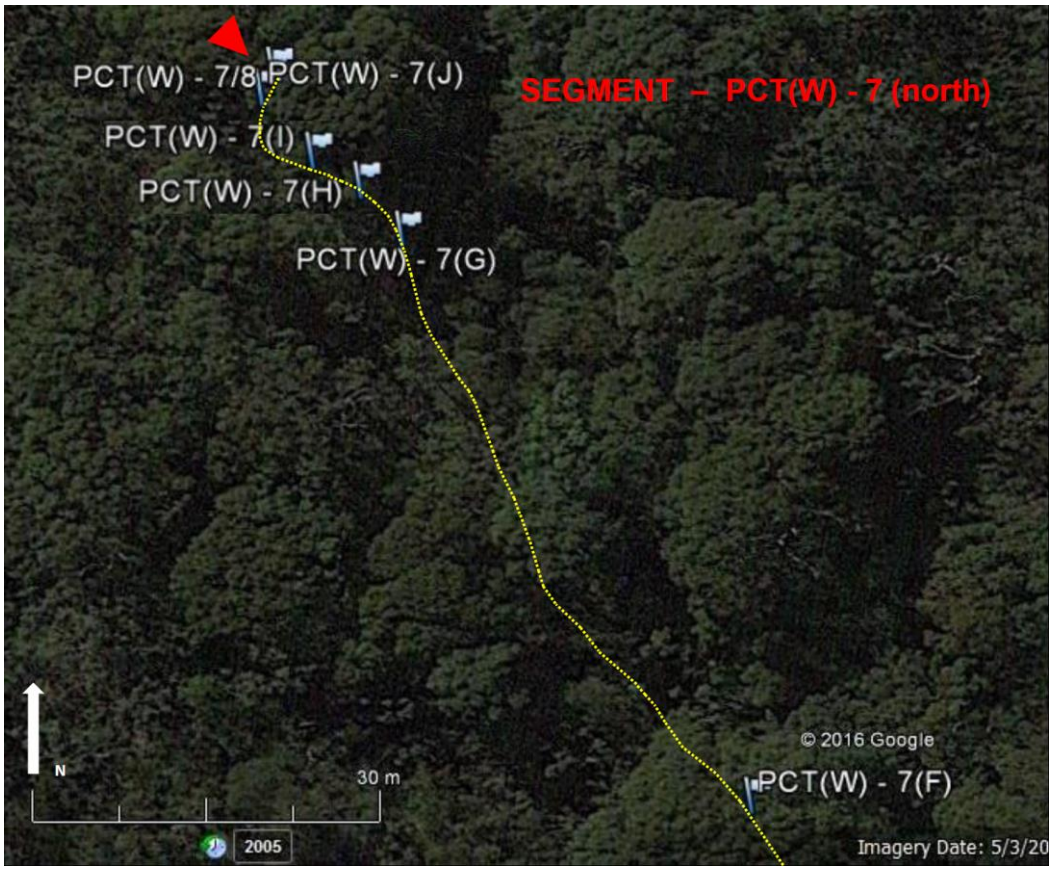
Location: 337129 6262268 Large protruding root to 100mm high along and across track, partly rotten - trip hazard (and >1.5m high rock ledge through vegetation off NE side of track).

Works:

Remove root and level track surface.

(Medium)

SEGMENT PARK CIRCUIT TRACK (WEST) - 7



SEGMENT: PCT(W) - 7	
Start Point: 337130 6262270	**End Point: 337063 6262401**

General Description and Condition: Well-defined section of largely flat track (190m approx.), straight to very gently winding on benches and flood terraces 5-10m off scenic creekline, with an extended section of boardwalk but few other track treatments, through open Eucalypt forest and medium understorey (including sedges and moist species). Good condition.

Tread Width (mm): Mostly 900-1,200mm, some sections of widened (and avoidance) track to 1,500-1,700mm wide.

Track Surface: Predominantly compacted sand, usually slightly dished, regular protruding roots and embedded rock, occasional boulders, large rock ledges at S end, occasional laterite gravel (mainly at N end). Regular drainage ponding and seepage, occasional drainage capture.

Gradient (degrees): Predominantly flat to gentle <3°slope, track very gently undulates alongside creek.

Alignment: Very gently winding on creek flats or along contour paralleling creekline to E.

Terrain: Creek corridor – creek flats and flood terraces, in broad midslope valley.

Soil: Lambert (Erosional), undulating to rolling low hills on Hawkesbury Sandstone.

Vegetation: Predominantly Peppermint Angophora Forest and passes through an area of Bloodwood-Scribbly Gum Woodland in N third (both part of Sydney Coastal Dry Sclerophyll Forest). Enters Sandstone Heath at N end.

Track Works and Improvements: Occasional waterbars and some waterbars/steps, usually older style log treatments, many some short, usually with drainage flows over and around ends but limited scour. Low timber boardwalk (floating ?) with 3 steps at S end (S end 337101 6262345, N end 3371075 6262386), 56m long and 900mm wide, angling through mixed understory/groundstorey, crosses ephemeral drainage line at S end, some sediment and leaf litter deposited over N end, several new/replaced planks – good condition.

Signs and Wayfinding: Nil

User Experience: Easy and pleasant walking along creek corridor through attractive tall open Eucalypt forest with mixed medium understorey and an area of large Eucalypts and an open understorey of sedges. Parallels scenic creekline - usually 5-10m off track - with rock pools, riffles and rock ledges/shelves – attractive and creek sounds can be heard from most sections of track.

Key Issues: Ponding and drainage capture. Several older style track improvements (especially short log waterbars). Track widening/braiding around perceived obstacles or wet areas. Regular trample tracks to adjacent creek. Rotting/failure of planks on timber boardwalk, sediment covering boardwalk ends (speeding rot), and floating boardwalk displacement.




Recommended Works – Overall

- Open windrows to minimise drainage and seepage capture/ponding.
- Remove/level protruding rocks, roots and stumps.
- Maintenance/cleaning of waterbars and other drainage treatments.
- Monitoring and responsive management for track widening
- Adaptive management of trample tracks to creek, closure or formalisation as/where warranted.
- Monitor low boardwalk for plank rotting/failure (and movement), and repair/replace as required.

Recommended Works – Site-specific (Priority)

***Site ID*: PCT(W) – 7(A)**

Location: 337130 6262270 S end
337134 6262278 N end

8m long rock shelf with 1.8-2.1m drop off sheer edge to rocky creekbed, track (wear path) only 500mm from edge of drop at closest point (1-1.5m elsewhere) – fall hazard.

Works:

Install simple totem style caution/warning signs at each end of rock shelf (or single sign in centre of shelf on creekside).

(HIGH – safety issue)

***Site ID:* PCT(W) – 7(B)**

Location: 337131 6262282 Angled and sloped rock ledges with central crevice/gap, steep edge of ledge 700mm high, rock ledge narrows to N to 600-700mm wide and increasing sloped (with second low ledge above) then compacted sand (flood terrace) beyond to N.

Works:

FRP boardwalk 5-6m long, anchored to rock ledges at each end and passing over central crevice/gap (drop <1m to sand so no requirement for a handrail, but check fall height after installation).

FRP step off N end of boardwalk, with large adjacent rock (bedded in) to protect boardwalk from possible flood flows.

(Medium – for passability issues)

***Site ID:* PCT(W) – 7(C)**

Location: 337127 6262290 Boulder low side of track, long embedded rock with drainage Trample track to adjacent creek.

Works:

Infill/level with rock armouring, and square off S end as low rock step (retain along low/E side if required)

(low)

Site ID: **PCT(W) – 7(D)**

Location: 337124 6262307 Large rock outcrop with uneven/lumpy top, avoidance track along creek side 400mm wide and up/around Eucalypt upslope.

Works:

Level top of boulder (as step off/on), and build rock step onto low/E side of boulder (to square off step).

Block/barrier avoidance path beside boulder.

(low)

Site ID: **PCT(W) – 7(E)**

Location: 337119 6262324 Sloped flat embedded rock with drainage flows down and scour on outside of bend.

Works:

Build waterbar onto existing rock, with extended outlet to discharge well off track.

Pull-in track width and barrier/block edge to prevent avoidance.

(low)

Site ID: **PCT(W) – 7(F)**

Location: 337109 6262333 Compacted sand track 1,500mm wide. Old log waterbar full of sediment and failed with drainage flows over and discharge/outlet blocked by windrow. Large protruding root below waterbar. Then angled rounded outcrop 2m downslope, extending across three quarters of track on high-side.

Works:

Reinstate waterbar with extended outlet (open windrow and/or cut outlet gutter) to discharge well off track.

Build rock step onto lower in-situ outcrop, extend and square up. Fill/compact tread above step, with boxing to retain on low side.

(low)

Site ID: **PCT(W) – 7(G)**

Location: 337078 6262388 Root acting as step 250mm high, 1.5m off N end of low timber boardwalk, dished track.

Works:

Install waterbar and fill/compacted above/behind over roots, cut outlet channel to discharge over adjacent rock pavement in drainage gutter.

(low)

Site ID: **PCT(W) – 7(H)**

Location: 337071 6262391 Short log waterbar (extended off low side of track), full of sediment and failed with drainage flows over and flow/scour around high end at protruding roots.

Works:

Replace with new waterbar, across entire track.

(Medium – to divert flows and protect timber boardwalk below to S)

Site ID: **PCT(W) – 7(I)**

Location: 337066 6262394 Old log waterbar butted to in-situ rock, off alignment, and avoided due to track widening. *Works:*

New waterbar, butted to in-situ rock and extending across low side of widened track.

Pull-in track width (high side) and barrier/block edge.

(low)

Site ID: **PCT(W) – 7(J)**

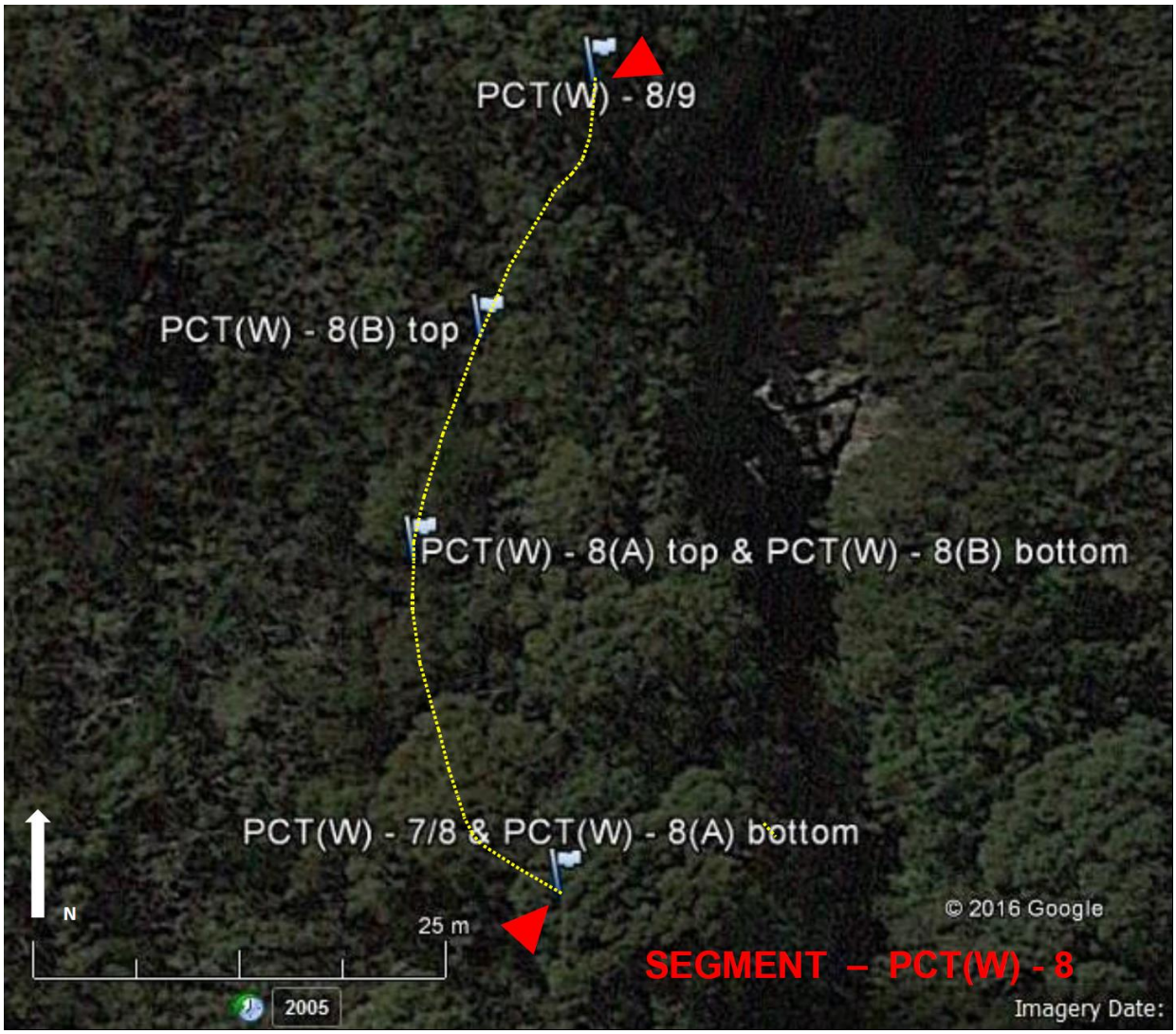
Location: 337062 6262399 Angled rock outcrop and root (at bottom of slope).

Works:

Build waterbar, butted to in-situ rock.

(low)

SEGMENT PARK CIRCUIT TRACK (WEST) - 8



SEGMENT: PCT(W) - 8	
Start Point: 337063 6262401	**End Point: 337065 6262452**
General Description and Condition: Short (65m approx.) section of well-defined, but rocky and uneven, track gently curving up/down a gentle/moderate slope, curves away from creek at S end but adjacent to creek at N end, through scattered Eucalypts with mixed understory. Fair condition. *Tread Width (mm):* 900-1,500mm. *Track Surface:* Extensive rocky areas – large rock shelves, ledges, boulders/outcrops and embedded rock – as well as loose rock. Large/wide rock shelf at N end beside creek (stepped access to creek). Compacted sand between rock - with areas of loose sand, minor clays, and occasional laterite gravel. Regular protruding roots. Drainage down most of segment, with frequent scour. *Gradient (degrees):* Mostly gentle/moderate slope of 6-7° (lower three-quarters of segment) with flat track at N end.	

Alignment: Predominantly a gently sweeping curve aligned sharply up/down a gentle/moderate slope.

Terrain: Mid hillslope, between benches/levels in creek corridor.

Soil: Lambert (Erosional), undulating to rolling low hills on Hawkesbury Sandstone.

Vegetation: Sandstone Heath in S half, and Bloodwood-Scribbly Gum Woodland (part of Sydney Coastal Dry Sclerophyll Forest) in N half.

Track Works and Improvements: Older log waterbars x4 (including 1 paired/extended), all full of sediment and failed with drainage flows over and/or around ends, and 2 log steps.

Signs and Wayfinding: Nil

User Experience: Short easy ascent/descent, but care required on section of uneven and loose track surface. Attractive creekline – rock shelves, riffles/cascades and rock pool – adjacent top track at N end and accessible from lower third.

Key Issues: Continued drainage capture and scour. Uneven track surface and loose rocks. Older style track improvements (short log waterbars). Well-used trample track to creek.

Recommended Works – Overall

- Remove/level protruding rocks and roots.
- Maintenance/cleaning of waterbars and other drainage treatments.
- Install wayfinding/reassurance signage - as per Manly Dam Sign Location Plan.
- Monitoring and responsive management for track widening.
- Adaptive management of trample tracks to creek, closure or formalisation as/where warranted.

Recommended Works – Site-specific (Priority)

Site ID: **PCT(W) – 8(A)**

Location: 337063 6262401 bottom (start of segment)
337054 6262422 top

27m section or track with 6-7° slope, mainly embedded/protruding rocks, and loose rocks, in compacted and loose sand plus some clay and laterite gravel, with considerable drainage flows down track and continuing scour. Bottom to top:

- paired/extended log waterbar, full of sediment and failed, then log step butted to rock at low end, track 1200mm wide benched to 500mm on high side;
- rock outcrop, 350mm face as "natural" step, with root/step high side;
- embedded flat rock, log step butted to high side, 900mm wide track dished to 150mm;
- rock ledge/shelf high side and long narrow protruding rock low side, 400mm wide gutter in between to 300mm below NSL;
- embedded flat-top rock, 250mm face;
- well used trample track E to creek (cascades and rock pools);
- short flat compacted sand area with protruding roots, 1,200-1,400mm wide;
- cluster of flat-topped embedded rocks and rock outcrops, mainly on high side of track, 100-300mm faces, gutter and drainage flows down low side,
- log waterbar above embedded rocks, full of sediment and failed flows over/around low end;
- angled embedded boulder and smaller loose rocks below on high side of track, drainage flows on low side with small gutter;
- log waterbar full of sediment and failed, flows over with scour to 300mm below; and
- log waterbar full of sediment and failed, flows over.

Works:

Square-up "natural" rock step with well-anchored infill rocks

Build extra rock step below (anchored onto lower rock outcrop) fill and rock armour tread.

Pull-in and barrier/block inside of bend.

Build 2 rock steps off rock ledge/shelf on high side of track, retain/box on low/outer side, then fill above/upslope and compact extended level tread to proposed waterbar above, pull-in track width on low side and barrier/block edge to prevent avoidance.

Build waterbar butting onto in-situ flat topped rock on high side, with extended outlet to discharge well off track (downslope of trample track to creek).

Formalise 2-3 stone steps (lower one may be step-and-run), built onto and incorporating in-situ outcrops and embedded rock), rock armour treads and infill/level between in-situ rocks, pull-in track width on low side and barrier/block edge to prevent avoidance.

Replace log waterbar with stone-lined invert, butted to high side in-situ rock.

Level sloped boulder, rock armour and level gutter along low side to match, square-off off as low rock step.

Replace waterbar, build new boxed step below with filled/compacted tread above/behind.

Replace top waterbar, with extended outlet to discharge well off track.

Clean out all waterbars, where not replaced.

Remove protruding roots, and reinstate/level track.

Monitor for additional rock armouring of treads and track surface.

(Medium – for both sustainability/impact issues and passability – and monitor)

Site ID: **PCT(W) – 8(B)**

Location: 337054 6262422 bottom (top of site PCT(W)-8(A))
337058 6262436 top

13m section of rocky track with 7° slope, degrees overall. 900mm wide dished compacted sand at bottom with protruding roots, then large rock shelf/ledge along high side of track for 7m with 350mm face along centreline of track, sloping compacted sand with outcropping/embedded rock and protruding roots on lower half of track alongside rock shelf/ledge at bottom/S with root/step below, and lower concave rock ledge/outcrop on lower side of track alongside rock shelf/ledge at top/N.

Works:

New waterbar above top of site, and remove surrounding roots.

Rock infill and level gap between high side rock shelf/ledge and adjacent low side rock ledge/outcrop at top of site as a level landing/tread.

Cut 3 rock steps into lower rock ledge/outcrop

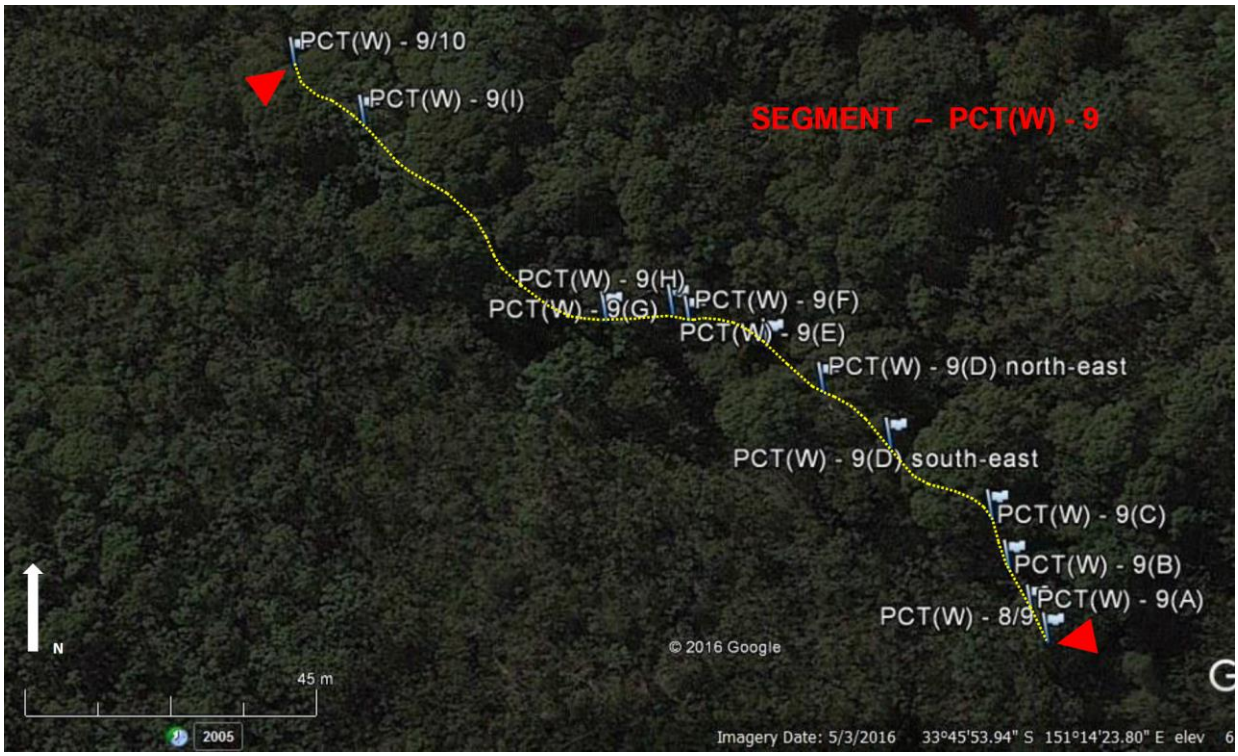
Rock armour/flagging across sloping area below low side rock ledge/outcrop.

Build 2 rock step-and-runs, anchored onto in-situ rock, with filled and rock armoured treads. Rock armour and level landing off lower step-and-run.

Replace lower root/step with sleeper step.

(Medium – for passability issues)

SEGMENT PARK CIRCUIT TRACK (WEST) - 9



SEGMENT: PCT(W) - 9	
Start Point: 337065 6262452	**End Point: 336929 6262557**

General Description and Condition: Very-well defined section (200m approx.) of mostly flat sandy track, very gently winding along the creek bank and flood terrace for most of segment, with one section of boardwalk but few other track treatments, through attractive Eucalypts with a mixed understorey and creekside fern beds as well as views to cascades and pools along creek, sections off track subject to flooding/inundation. Good/fair condition.

Tread Width (mm): 700-1200mm, but regular wider areas to 1,800mm (and some track braiding)

Track Surface: Predominantly compacted sand, moist/wet in places, frequently dished (sometimes deeply dished, often closer to creek channel), regular exposed roots (some protruding to 300mm, and exposed by flooding/scour), flood levees of sand along creekside of track in places (mainly S half), occasional boulders or outcrops and embedded rock, small area of angled rock slabs/outcrops midway, and large/wide rock shelf at S end beside creek (stepped access to creek). Drainage down much of track with frequent ponding areas and capture/ponding of high flows/flooding in adjacent creek.

Gradient (degrees): Mostly flat to <2, very short sections to 4-5°.

Alignment: Very gently winding along the creek bank and flood terrace for S two-thirds of segment, winds to/from creek side in N third before leaving creek channel/flood terrace at N end (at small knoll).

Terrain: Creek corridor – creek bank/flats and flood terrace, in broad midslope valley.

Soil: Lambert (Erosional), undulating to rolling low hills on Hawkesbury Sandstone.

Vegetation: Predominantly Peppermint Angophora Forest and entering Bloodwood-Scribbly Gum Woodland in far NW end (both part of Sydney Coastal Dry Sclerophyll Forest).

Track Works and Improvements: Low timber boardwalk, 26m long and 900mm wide (S end 337055 6262474, N end 337037 6262487), step off to landing at E end, ramp down to ground level at W end (for flood protection ?), several new planks - good condition. Very few other treatments – occasional scattered older style log waterbars.

Signs and Wayfinding: Nil

User Experience: Easy pleasant walking alongside creek through scattered Eucalypts and mixed understorey, including an attractive area of very large/older Eucalypts with an open mixed shrub storey a well as creekside fern beds. Parallels scenic creekline for most of segment (very close in places) with rock pools, riffles/cascades, rock pools and sandy pools –creek sounds can be heard from most sections of track. Trak width and sandy surface minor detracting elements.

Key Issues: Many areas subject to inundation, including flows down track, and damage during high flows/floods in adjacent creek – flood debris on both sides of track in places. Ponding and drainage capture. Track widening/braiding around perceived obstacles or wet areas. Regular trample tracks to adjacent creek. Rotting/failure of planks on timber boardwalk, and boardwalk displacement.

Recommended Works – Overall

- Monitor for damage to track or user hazards after high flows/floods, and repair/replace or remediate as required (adaptive management, including additional treatments or possible realignment at sections subject to repeated issues).
- Advising users of potential flood hazards -in off-site and on-site orientation/information.
- Open windrows to minimise drainage and seepage capture/ponding.

- Remove/level protruding roots and rocks.
- Maintenance/cleaning of waterbars and other drainage treatments.
- Monitor and responsive management for track widening/braiding and obstacle or treatment avoidance.
- Monitor low boardwalk for plank rotting/failure (and movement), and repair/replace as required.

Recommended Works – Site-specific (Priority)

Site ID: **PCT(W) – 9(A)**

Location: 337062 6262457 Deeply dished track, 450mm bellow NSL on high side to 200mm on low side, of wet sand 1,200-1,400mm wide, flat and angled rock outcrops with dip/ponding area between ('run-on" area from track upslope).

Works:

Infill and rock armour dip (3m long and 400-900mm wide) to match level of in-situ rocks and provide stable footing - as will continue to be a run-on area with drainage inflows, and potential for inundation in high creek flows.

Monitor for avoidance/widening (especially high side) and requirement to define/barrier track edge.

(low)

Site ID: **PCT(W) – 9(B)**

Location: 337058 6262465 Large flat boulder/pavement with 200mm step off ledge at lower end, onto protruding roots below.

Works:

Build boxed step off low side of boulder/pavement and fill/compact above/behind over root.

Open windrow and cut outlet gutter (on low/creek side) to discharge drainage flows off track (will address small discharges, but larger flows - high creek flows or flooding - likely to come back onto track below boulder/pavement).

(low)

Site ID: **PCT(W) – 9(C)**

Location: 337055 6262474 Cleared area, or wide track braiding, around old Scribbly Gum with rotting trunks at S end of low timber boardwalk (with low step/landing off boardwalk end), beside large deep pool in creek immediately to E (attractive).

Works:

Monitor condition of Scribbly Gum for safety risk near feature of interest.

(monitor – safety issue)

Site ID: **PCT(W) – 9(D)**

Location: 337037 6262487 SE end (at NW end of low timber boardwalk, ramped down)
337031 6262492 midpoint
337025 6262497 NW end

SE two-thirds (off end of low timber boardwalk) is compacted and loose sand and exposed roots, 1,200mm wide, flat, deeply dished with flood levee (sand) along low side and creek channel only 3-4m away to E off – inundated during high flows or floods. NW third is large area (4m long) of exposed/protruding roots, some over rock, then large angled rock slabs/outcrops with deep gaps/channels and some roots in between, NW third has 5° slope overall.

Works:

Extend existing boardwalk (from SE end) as new FRP or timber boardwalk for 16m in total, preferably on piles (not floating, due to likely flood pressures), anchor to large rock outcrops at NW end, include step-and-runs at NW end up slight rise to outcrops, and use uppermost large flat outcrop as landing/step-off boardwalk end. Remove higher roots as necessary.

Build rock diversion wall under NW end of boardwalk, off rock outcrop, to divert drainage flows.

Block/barrier redundant track width/edges to prevent avoidance, and rehabilitate.

(Medium – for passability issues)

Site ID: **PCT(W) – 9(E)**

Location: 337015 6262505 Compacted and wet sand, 1,500-1,800mm wide, slight crossfall towards low side/E, flood levee (sand) along low side and creek channel (with riffles/cascades) only 5m away. Existing log waterbar at top of slight slope.

Works:

Install additional waterbar (to support log waterbar upslope), extended length or cut outlet gutter.

Define and block/barrier track edge on high side to prevent avoidance/widening.

(low)

Site ID: **PCT(W) – 9(F)**

Location: 337001 6262509 Log step with roots below, drainage flows over flows over, 800mm wide track below steps in cleft between ledge on high side and boulder on low side.

Works:

Replace log steps with two stone steps anchored to in-situ ledge and boulder (for additional protection from flooding/inundation and continued drainage flows down/over).

(low)

Site ID: **PCT(W) – 9(G)**

Location: 336998 6262511 Rock pavement/outcrop and embedded rock in compacted sand. Small dead tree (rotten), 100mm dbh, below.

Works:

Fall small tree.

Build rock waterbar butted onto in situ material.

(Medium – safety issue)

Site ID: **PCT(W) – 9(H)**

Location: 336986 6262510 Compacted sand 900mm wide, with occasional embedded rock, for 11m on 4° slope.

Works:

Install waterbar midway on slope, butt off in-situ material on high side.

Cut level tread in outcrop at top to prevent avoidance/widening.

(low)

Site ID: **PCT(W) – 9(l)**

Location: 336942 6262546 Compacted sand 1,000-1,200mm wide on 5° slope, curving up and around large Angophora for 8m, with exposed/protruding roots some up to 300mm step off, drainage flows down track.

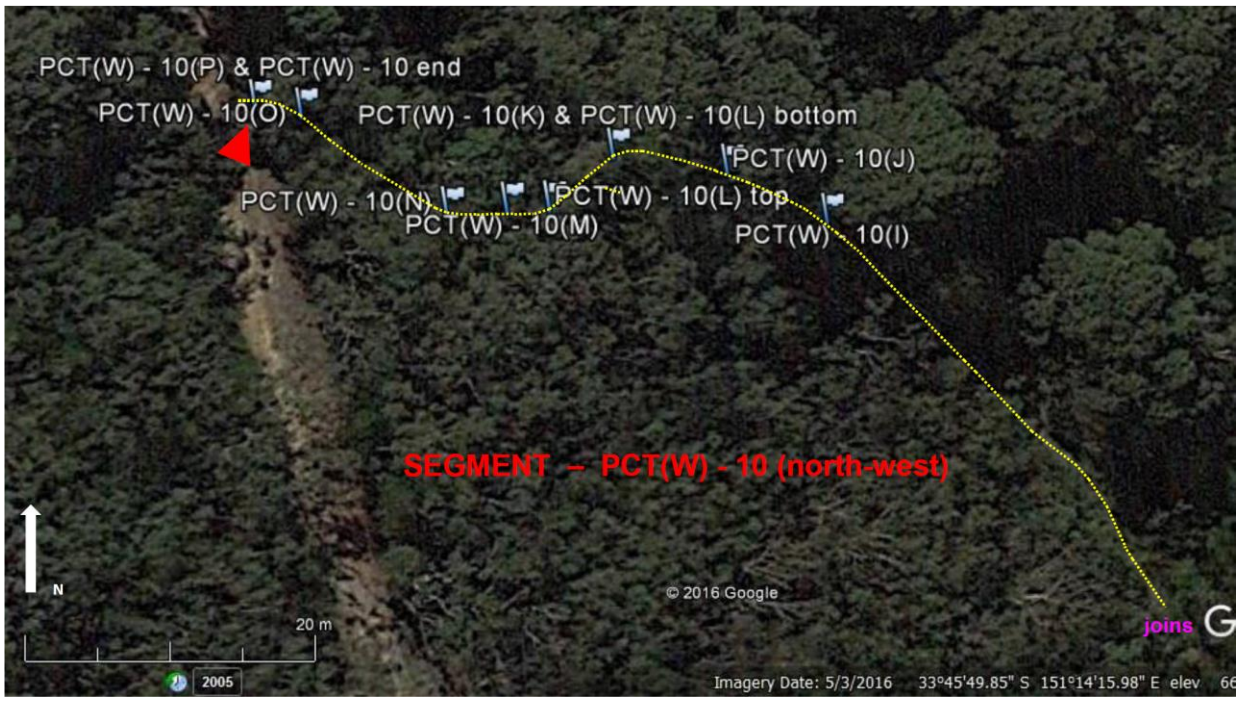
Works:

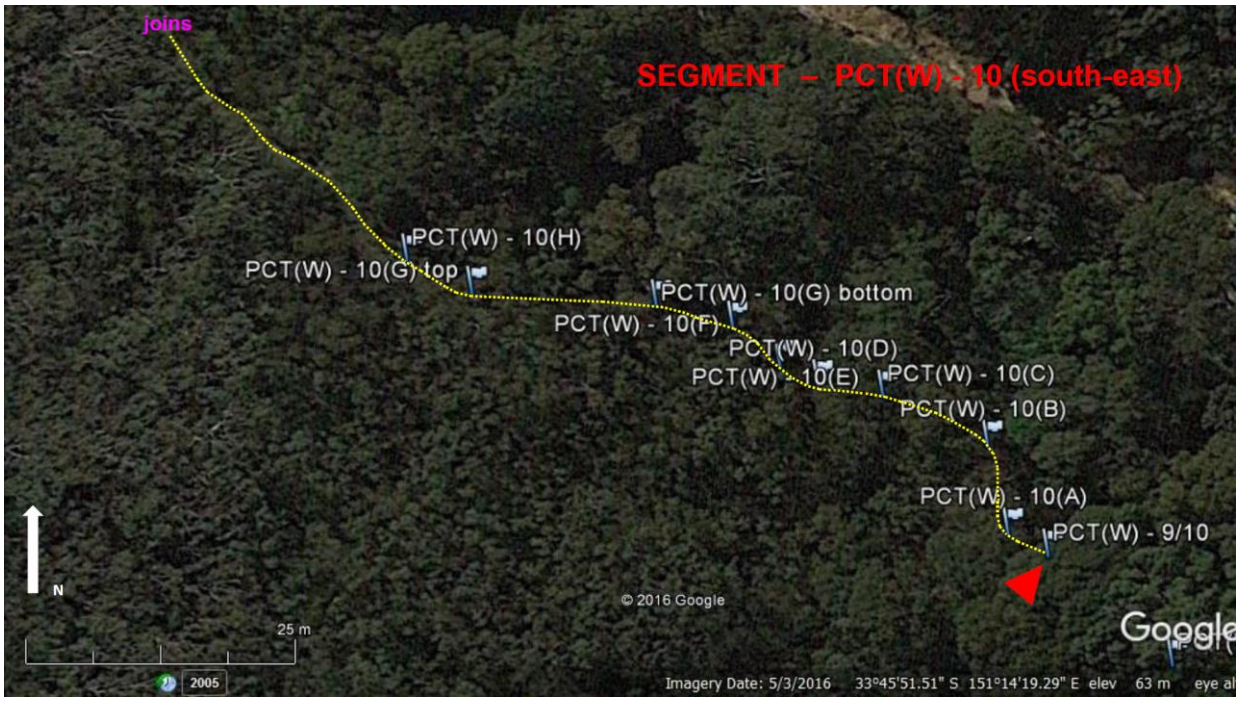
Install waterbar at top of site, discharging above/N of tree.

Build 5 boxed steps and /or step-and-runs with filled and compacted tread, include diversion “wing(s)” on high side to divert flows and prevent side scour.

(low)

SEGMENT PARK CIRCUIT TRACK (WEST) - 10





SEGMENT: PCT(W) - 10	
Start Point: 336929 6262557	**End Point: 336767 6262644** **(Perimeter Fire Trail and Shared Path, just SW of creek crossing, and opposite S trackhead of Curl Curl Track)**

General Description and Condition: Well-defined track (220m approx.) leaving creek flat at SE end to climb over low rounded spur in centre of segment running upslope of rocky creekline. Re-joins creek flat in NW, in area subject to inundation in flood/high flows, before climbing short slope to junction with Perimeter Fire Trail. Runs along narrow benches (creekbank or on steep side-slopes) in places. Long timber boardwalk and short FRP steps, but few other track treatments. Through open tall Eucalypt woodland with medium mixed understorey, ferns/sedges along creek and wet species/shrubs, and perched swamp on spur. Fair/good condition.

Tread Width (mm): Mostly 600-1,200mm, but numerous wider sections to 1,500-1,800mm (including avoidance and braiding).

Track Surface: Mostly compacted sand, regular rock ledges and outcrops and embedded rocks, frequent protruding roots, areas of laterite gravel (mainly in NE), several wet areas, dished and guttered in places with drainage flows down most sloped sections.

Gradient (degrees): Varies - track steps across/up-down slope in series of flat or gently sloped sections interspersed with runs of gentle/moderate slopes 6-8°, some short steeper sections (12°, 14.5° and 17.5°) over rock outcrop/ledges or larger boulders.

Alignment: Curving across/up-down slopes at SE and NW ends, more gently curving across low rounded spur in centre of segment.

Terrain: Midslope, in broad valley, partly along and partly above creek corridor.

Soil: Lambert (Erosional), undulating to rolling low hills on Hawkesbury Sandstone.

Vegetation: Bloodwood-Scribbly Gum Woodland (part of Sydney Coastal Dry Sclerophyll Forest) in E half, and Sandstone Heath in W half.

Track Works and Improvements: 5 older style log waterbars (over 3 sites). Run of FRP low steps (x15) and step-and-runs (x3) plus step-off, 900mm wide (E end 336888 6262582, W end 336869 6262583 – Site PCT(W)-10(G)) – good condition. Long low timber boardwalk (SE end 336842 6262603, NW end 336811 6262634), 48m long 900mm wide, mostly straight in SE and gently curving in NW, 13 long low step-and-runs down to NW end (onto large rounded rock outcrop – Site PCT(W)-10(I)), ramped down at SE end onto rock pavement (with seepage across), through perched swamp of sedges and Ti-tree, some new planks (but several with signs of rot) – good/fair condition.

Signs and Wayfinding: Old post with two metal directional arrows at NW end beside creekline. Post with two pictograms (“walkers” and “no bikes”) on side track at NW end – adjacent to creek edge facing upstream/W. New totem signpost at NW junction/trailhead with Perimeter Fire Trail, well signed - but no distance, time or difficulty information. No other wayfinding en-route.

User Experience: Relatively easy walking overall but short climbs/descents require slightly more exertion and care needed on loose, wet/slippery or uneven track section. Through a mix of vegetation types with attractive views into rocky/boulder creek channel and alongside attractive creek section (pools, rock ledges and riffles) at NW end.

Key Issues: Section of low-level track adjacent to creekline subject to inundation (and possible undercutting and erosion) during foods/high flows. Ponding and drainage capture with some scour. Protruding rocks and roots. Slippery wet rock pavements/ledges, especially where sloping. Track widening/avoidance along low side of rock ledges/pavements. Several older style track improvements (especially short log waterbars). Rotting/failure of planks on timber boardwalk. Trample track to elevated viewing point over boulder/rocky creekline. Vegetation overhanging boardwalks/steps, forcing off-track detour/avoidance.

Recommended Works – Overall

- Monitor for damage to track or user hazards after high flows/floods, and repair/replace or remediate as required (adaptive management, including additional treatments or possible realignment at sections subject to repeated issues).
- Advising users of potential flood hazards -in off-site and on-site orientation/information.
- Remove/level protruding roots and rocks.
- Maintenance/cleaning of waterbars and other drainage treatments.
- Open windrows to minimise drainage capture/ponding.
- Vegetation trimming/clearance.
- Monitoring of slip/fall hazard due to seepage and wet/slippery track surface, responsive management (additional drainage) as required.

- Monitor for track widening (avoidance/braiding) along low side of rock ledges/pavements – responsive management as required (including additional track treatments or minor re-alignment for persistent issues).
- Monitor low timber boardwalk for plank rotting/failure, and repair/replace as required.
- Monitor for track widening (avoidance/braiding) along low side of rock ledges/pavements – responsive management as required (including additional track treatments or minor re-alignment for persistent issues).
- Adaptive management of trample tracks to creek margin or vantage points, closure or formalisation as/where warranted (especially is safety issues emerge).

Recommended Works – Site-specific (Priority)

Site ID: **PCT(W) – 10(A)**

Location: 336925 6262559 (mid/high point)

Rock outcrop/ledge at base of compacted sand slope, 1,500mm wide, running up to root mass at base of tree with 7° slope overall, buried log waterbar off bottom of outcrop and angled log waterbar off top points of outcrop, both full of sediment and failed with drainage flows over and round low ends. 10m from bottom of slope to crest on N side. Track curves around top side of tree as crest, 350mm step off roots on S side and 150-200mm high roots on N side, tangle of exposed/protruding roots over top of crest (especially in S, becoming less dense to N). 4m compacted sand track slope N from crest (downslope), 800mm wide, 8° slope, boulder along low at bottom of slope but full of sediment and failed with drainage flows over and around low end.

Works:

Clean-out lower waterbar, replace if necessary.

Replace upper waterbar, butted (tightly) onto lodge on high.

Build boxed step-and-run abusive rock outcrop, fill and compacted tread above/upslope (to proposed steps), include diversion “wing(s)” on low side to divert flows and prevent side scour.

Build 3 or 4 boxed steps on steeper upper section of slope (over roots) on S side.

Pull-in and define and block/barrier outer/lower track edge on S (curved) slope.

Level track over crest (upslope of tree), over roots, box/retain along low side as needed.

Build 3 boxed steps and/or step-and-runs on N side slope.

Replace log waterbar on N side with longer waterbar, discharging below boulder.

(Medium – for passability issues)

Site ID: **PCT(W) – 10(B)**

Location: 336923 6262568 Track retained on low side at SE end by small log above sandy loose slope >1m high. 2 large elongated rounded rock outcrops running longitudinally along track, with lower outcrop/ledge as well as embedded and broken rocks in compacted (wet) sand, track runs both above (higher alignment) and below (lower line) these central outcrops, 4m long at 6° slope. Compacted wet sand track NW of outcrops, 1,500mm wide, small drainage line crosses track for 2.5-3m with ponding and muddy areas on track, then protruding curved root and end of sloped rock ledge to NW.

Works:

Square off SE end of lower outcrop/ledge as step. Angle step (and step-and-runs) to align track along upslope side of existing width and away from top of steep sandy slope at SE end.

Block/barrier track above steep slope.

Remove long central outcrops and build two stone step-and-runs anchored onto rock outcrop (exposed) beneath, box/retain along low side, fill and compact treads.

Wide stone-lined invert at NW end to carry drainage line across track, box/retain on low side if required for stability. Remove protruding root.

(Medium – for passability/safety issues)

Site ID: **PCT(W) – 10(C)**

Location: 336912 6262573 Compacted sand track along low side of long rock ledge/shelf. Sloping and stepped rock ledges at NW end with drainage flows and small gutter down outer/lower side. Well-used trample track to NE, to nearby rock ledge overlooking scenic boulder strewn creekbed.

Works:

Infill and rock armour (as low steps) drainage wash/gutter along low side of ledge, and cut 2-3 treads into adjacent ledge matched to same levels (to create wide low steps up/down NE end of ledge).

Cut wide shallow gutter into sloped rock at top of ledge, and extend as short stone-lined gutter (discharging below trample track).

(low)

Site ID: **PCT(W) – 10(D)**

Location: 336905 6262574 Short log waterbar at top of rock outcrop, full of sediment and failed, flows around low end and over with scour 300mm high to broken rocks below.

Works:

Install new, longer, waterbar/step and butt tightly onto rock outcrop (or align upslope/above outcrop).

Build rock step below new waterbar, anchor onto in-situ outcrop and fill/compact tread above (box/retain low side if required).

(low)

Site ID: **PCT(W) – 10(E)**

Location: 336901 6262576 Compacted sand and laterite gravel, 600-700mm wide, 5m long at 8° slope, embedded rocks and roots at bottom of site. Sloping rock outcrop at top of site with protruding roots below to 250mm high, track curves upslope of tree above outcrop. Drainage flows down entire site.

Works:

Install waterbar on lower third of slope, above embedded rocks.

Rock infill/square-up lower embedded rocks as small rock step (ensure stability, as landing below waterbar).

Build 3 low step-and runs anchored into outcrop at top, box/retain on low side of bottom step(s) if required, fill and compact tread over roots (remove roots as required).

Install waterbar at top of site, discharging upslope/NW of tree.

(low)

Site ID: **PCT(W) – 10(F)**

Location: 336896 6262580 Compacted sand with considerable laterite gravel, 800mm wide, on 4.5° slope.

Works:

Install waterbar midway on long sloping track section.

(low)

Site ID: **PCT(W) – 10(G)**

Location: 336888 6262582 E end
336869 6262583 W end

15 FRP low steps and 3 FRP step-and-runs at low/E end plus step-off, 900mm wide.

Works:

Trim overhanging vegetation away from steps to prevent avoidance.

Monitor for scour down sides or avoidance.

(low, and monitor)

Site ID: **PCT(W) – 10(H)**

Location: 336863 6262586 Angled sloping pavement high side of track, 4-5m long and 700-1,000mm wide, with drainage flow and narrow compacted sand "tread" on low side (receives some use), 200mm step off pavement to low side. Drainage flows and shallow gutter along outer/low edge of pavement curving/exposed upslope. Compacted sand slope above W end of pavement, 1,000mm wide, dished (angular) with drainage flows down. 3 embedded boulders at top of slope/crest with gap 300-400mm wide between lower/larger 2 boulders on E side. Compacted sand and embedded gravel/stone then embedded rocks on W side of crest.

Works:

Build stone waterbar off pavement, midway up outer/low edge of W end of pavement (curving/exposed upslope).

Cut level tread in more angular upper third of W end of pavement.

Build boxed step above top of pavement (anchor to pavement if near-surface) and infill/compact tread upslope/above (back to first boulder on crest).

Rock infill gap between boulders and level top as step. Level topside of large boulder on downslope side at crest.

Remove smaller/flatter boulder on W side of crest and rock armour track (as W landing off step over crest).

Monitor for trail widening – avoiding angled pavement and/or steps on crest.

(low)

Site ID: **PCT(W) – 10(I)**

Location: 336811 6262635 Large rounded outcrop 6m off W end of timber boardwalk (angled/sloping rock ledge straight off boardwalk end then main outcrop is concave at top with only a narrow (500mm wide) and slightly rounded walking route along crest with "lump" at W end. W face of outcrop slopes down to sandy creekbank (and track) hard along channel/pool edge, only 800-900mm above water level (subject to high/flood flows). W face is 3.5m long, overall 14.5° slope and total height difference of 1.5m (to "lump"). Seepage/drainage over upper concave/scalloped section, and steep W face, are both slip hazards. Small broken tree (75mm dbh), creekside at bottom of outcrop points back up W face - broken off handhold (?), now a hazard ("spear"). Section of PVC pipe, with drilled holes, exposed at bottom/W end of outcrop. Attractive views into creek adjacent below, when walking E to W, may distract users from watching their footing over outcrop.

Works:

Extend low timber boardwalk as FRP boardwalk curving across ledges and around high (more level) upper edge of boulder/outcrop (upslope of deeper scallop face - alternative alignment would be to drop into/below scalloped area but this would take track closer to steep higher edge/drop to creek). Extend boardwalk for approximately 5.5m to "lump" at top of W face of slope, some vegetation trimming required.

Level "lump" as tread (landing).

Install 7 individual FRP treads set down W face of boulder/outcrop as steps, aligned along higher/S edge – lower treads/steps subject to flood flows so anchor well.

Install wide stone-lined invert at bottom of boulder/outcrop, embed retaining blocks along lower end along creek edge to protect against undercutting during high/flood flows.

Remove stump (spear) facing upslope at base of W face beside creek edge.

(Close to Perimeter Fire Trail for importing materials.)

(HIGH – safety issue for stump ("spear") removal. Medium – for passability and safety issues)

Site ID: **PCT(W) – 10(J)**

Location: 336804 6262640 Compacted sand, 900-1,200mm wide flat but benched-in to 150mm on high side, some embedded gravel and a few protruding roots. Extends 8m long bench immediately beside creek channel and only 800-900mm above water level. Subject to inundation in high flows/floods, and also in direct line from main channel over cascade/ledge 5m so would be impacted during floods or high flows – but no sign of significant erosion. However creekbank (and track edge) along W end of site is retained by logs for 3m above large boulder sloping into creek (also an old agricultural drain under at E end of logs). Large stones placed as step at W end, but gap at S end, with root above. Old post with two metal directional arrows at W end of site. (Can see Perimeter Fire Trail and shared mountain bike circuit crossing Curl Curl Creek 30m upstream.)

Works:

Replace edge logs with large rock retaining wall in W half of site.

Rock armour/flag track surface with slight cross fall to creek, and an invert midway if necessary, to protect track surface from scour during high/flood flows.

Rock edge/wall along high side of track (away from creek) where benched in >100mm – to retain bank and stop scour/erosion in during high/flood flows.

Infill stone step at W end of existing placed stone step at W end of site.

Upgrade/new wayfinding sign

Monitor for damage after high/flood flows.

(Close to Perimeter Fire Trail for importing materials.)

(Medium – for passability and track stability issues)

Site ID: **PCT(W) – 10(K) (and side track)**

Location: 336795 6262641 E junction with well-used track to NW along creek bank for 8m, the curving for 2m over roots to creek edge of gravel and rock with 400mm step over roots into creek bed of mossy rock and pavement (slippery when wet, or moss is "green"). Post with two pictograms ("walkers" and "no bikes") facing upstream/W where track drops into creek. (Possible grinding groove on boulder beside drop into creek ?). Wide rock pavement in creekbed extends W to Perimeter Fire Trail and shared mountain bike circuit crossing of Curl Curl Creek.

Works:

Close, disguise and rehabilitate track.

Install signage to direct walkers (coming from creekline/W) to main track junction with Perimeter Fire Trail only 25-30m upslope to SW - to avoid possible grinding grooves site(s).

(Medium – for cultural heritage issues)

Site ID: **PCT(W) – 10(L)**

Location: 336795 6262641 bottom (at junction with well-used track to NW along creek bank)
336790 6262636 top

Embedded rounded rocks and compacted sand and gravel track, gently sloped at bottom of site (above junction with track to NW along creek bank (Site PCT(W)-10(K)). 2 log waterbars, butted to embedded rock at NW end but flows around lower/SE end. Large sloped boulder with drainage flows down/over. Compacted and loose sand and laterite gravel track above boulder, 1,800mm wide, only slightly sloped but loose gravel (and sand) washed from upslope makes surface slippery. Log waterbar above full of sediment and failed with flows over and around low/NW end. Partly rotten tree beside track. Site 9m total length, 17.5° slope overall (but steepest over boulder face, more gently sloped track above and below) and total height difference of 2.0m.

Works:

Rock armour lower landing (at junction with track to NW along creek bank (Site PCT(W)-10(K)) and level embedded rocks, butt into placed stone step below – to protect from floods/high flows and continued drainage from boulder upslope.

Replace 2 log sleepers with 2 or 3 stone steps with armoured treads, and cut tread/step into lower lip of sloped boulder above.

Cut three level treads, at least 700mm wide, into face of sloped boulder (armour infill to level if required).

New rock waterbar built off top edge of boulder, with stone-lined invert above/upslope (remove log waterbar).

Pull-in track width upslope of boulder, define and block/barrier edges.

Monitor partly rotten tree beside track for need to remove (for safety) if risk increases.

(Medium – for passability and safety issues – and monitor)

Site ID: **PCT(W) – 10(M)**

Location: 36787 6262636 Compacted sand and loose laterite gravel, 1,000-1,200mm wide on 8° slope, 2 points with exposed roots and embedded rocks retaining track surface and acting as small steps with 250mm rise/face, low sloping rock ledge/pavement at top of site, drainage flows down low side of ledge/pavement in shallow gutter and down remainder of site below.

Works:

Build 2 step-and-runs over roots and embedded rocks, boxed/retained on low side with filled and compacted treads.

Build rock waterbar butting onto top of upper rock pavement, and rock armour/flag shallow gutter below to match level with ledge/pavement.

(low)

Site ID: **PCT(W) – 10(N)**

Location: 336782 6262636 Compacted sand and loose laterite gravel, 3m with 12° slope (steeper on high side of track), sloping rock outcrop with drainage wash down low side, embedded flat rock above.

Works:

Build waterbar butting off flat embedded rock at top of site.

Cut/level 3 level treads into lower side of sloped outcrop, and rock armour/flag adjacent wash zone as 3 low steps to match levels with outcrop.

(Medium – to divert flows and protect downslope works)

Site ID: **PCT(W) – 10(O)**

Location: 336771 6262644 Loose deposited sand and laterite gravel – “run on” deposition area from Perimeter Fire Trail and shared mountain bike circuit 4m upslope (along track) to W.

Works:

Install waterbar.

(low)

Site ID: **PCT(W) – 10(P) and junction with Perimeter Fire Trail**

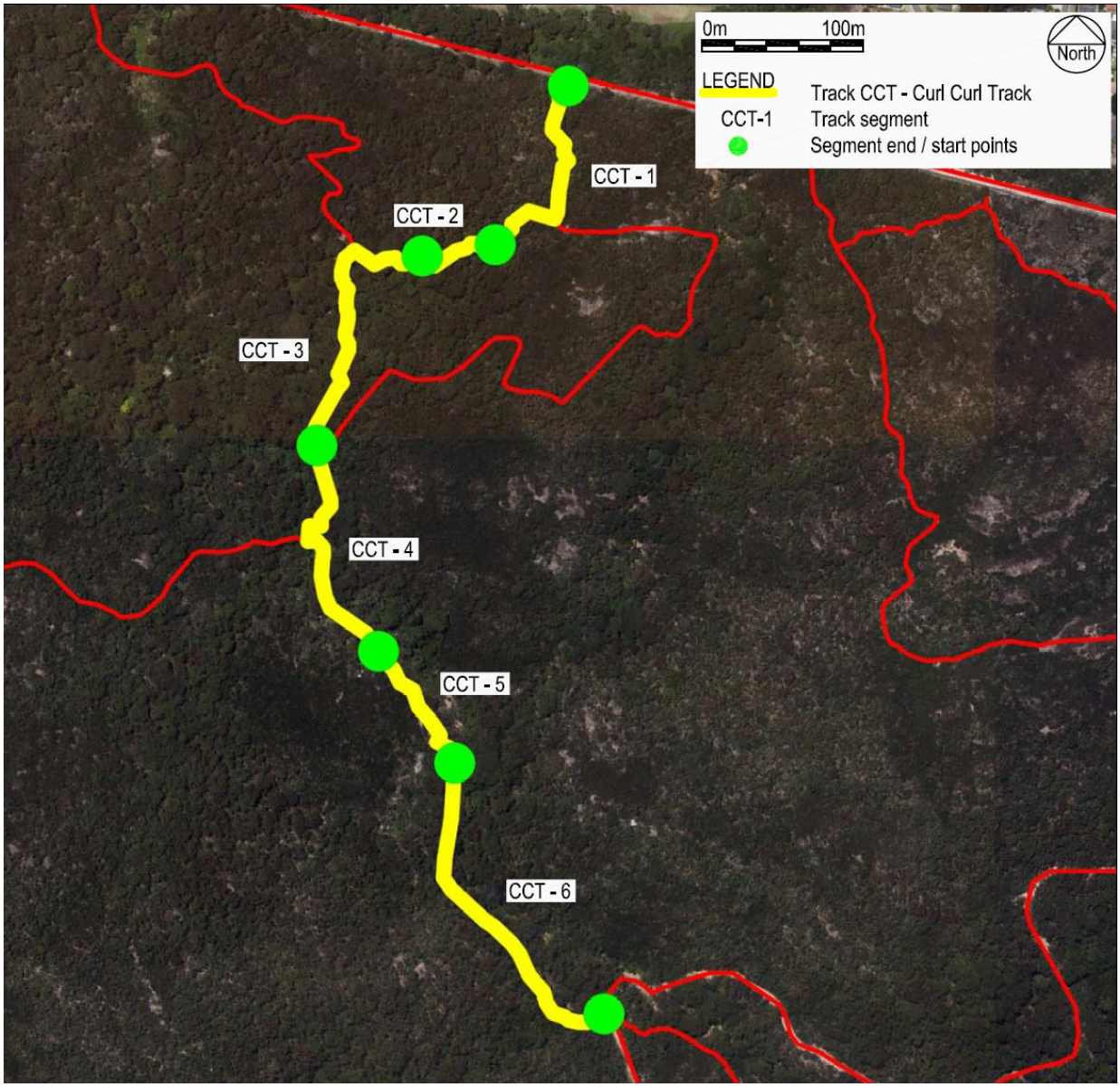
Location: 336767 6262644

Junction/trailhead with Perimeter Fire Trail and shared mountain bike circuit, 2.6m wide splayed “fish-tail” entry off fire trail. New totem sign, well signed - but no distance, time or difficulty information. Potential for conflicts with mountain bikes on fire trail, but caution pictogram and message on totem. Curl Curl Track S trailhead on directly opposite side of fire trail.

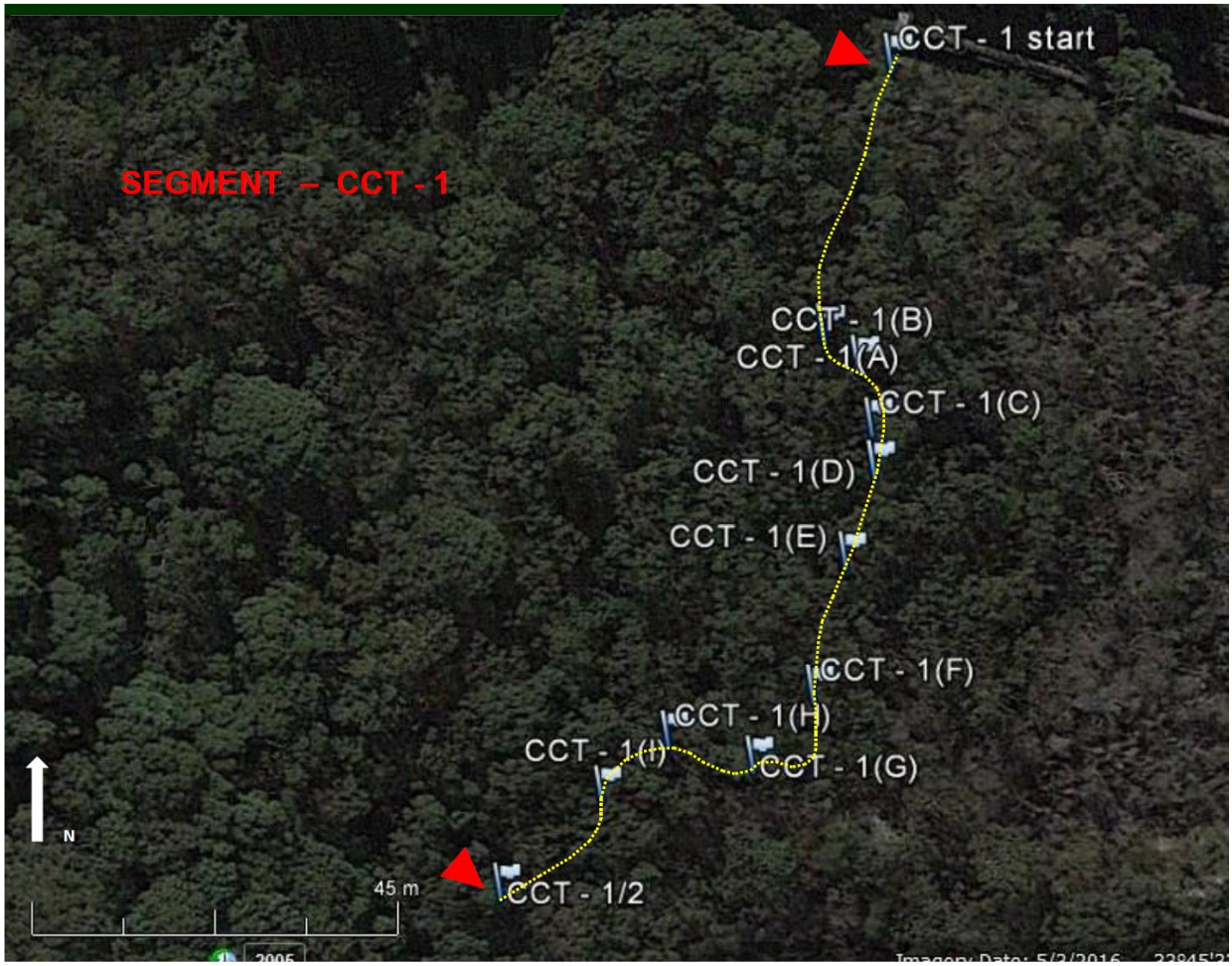
Works:

Nil

CURL CURL TRACK - SEGMENTS 1 to 6



SEGMENT CURL CURL TRACK - 1



SEGMENT: CCT - 1	
Start Point: 336737 6263218 (S side of pipeline)	**End Point: 336692 6263120**

General Description and Condition: Well-defined section of track (145m approx.) with regular track treatments curving up/down a gentle/moderate hillslope with occasional rocky sections, through tall open Eucalypt forest with a moderate dense understorey(more sparse, previously burnt, on high side on lower sloe). Junction with old/dis-used loop track partially disguised, or not obvious, on lower slope - at 336726 6263138. Good condition (overall).

Tread Width (mm): Mostly 600-900mm.

Track Surface: Compacted sand with regular rock outcrops, embedded rock and occasional ledges. Protruding roots in places. Drainage capture on many sections with track surface entrenched 100-300mm below NSL, and flows over waterbars and steps, but little downside scour. Erosion potential reduced due to by regular rocky sections and waterbars/steps, as well as curved alignment.

Gradient (degrees): Generally gentle to gentle/moderate gradients of 2-6°, short steep sections over rock ledges have moderate to steep slopes of 17-23° gradients.,

Alignment: Gently curved up/down gentle/moderate hillslope with rocky ledges, more tightly curving on lower section, only short sections across/along contours.

Terrain: Upper hillslope.

Soil: Disturbed terrain at N end, grading into Lambert (Erosional) – undulating to rolling low hills on Hawkesbury Sandstone on S half.

Vegetation: Predominantly Bloodwood-Scribbly Gum Woodland, with area of Sandstone Heath at top/N end plus minor patch towards S end.

Track Works and Improvements: Scored timber sleeper waterbars and steps, in 3 main runs/groupings. Most full of sediment, with flows over and occasionally around ends, but little downside scour (usually less than 250mm high risers).

Signs and Wayfinding: Log post with 2 pictograms ("walkers" and "no bikes") at N trackhead/entry, but no track identification and orientation information. Metal directional arrows on rock ledge (at junction with old/dis-used loop track).

User Experience: Relatively easy climb or decent, with short section requiring slightly more exertion, but generally a well-defined and maintained track through attractive tall open Eucalypt forest on a occasionally rocky hillslope Traffic noise from Wakehurst Parkway is intrusive in places.

Key Issues: Drainage capture, potential for scour over and around timber waterbars/steps, protruding roots (trip hazards), track (and Park) identification and regulatory signage an N trackhead/entry, excluding bikes/mountain bikes entry from pipeline service track, and junction with old/dis-used loop track.

Recommended Works – Overall

- Open windrows to minimise drainage capture/ponding.
- Maintenance and cleaning of waterbars, waterbars/steps and other drainage treatments.

- Monitor scour over waterbars and waterbars/steps for need for adaptive management/remediation.
- Remove/level protruding roots (trip hazards).
- Continued bikes/mountain bikes exclusion enforcement (consider stile or “kissing gate” at suitable “defensible” site early in N end segment).
- Upgrade signage at N trackhead/entry as per Manly Dam Sign Location Plan.
- Disguise entry to old/disused track (if loop/link is no longer required as part of track network).

Recommended Works – Site-specific (Priority)

Site ID: **N entry/trackhead (at pipeline)**

Location: 336737 6263218 Trackhead on S side of pipeline, access via A-frame free-standing aluminium ladder (with handrails) over pipeline, concrete pad on S side with 2 boxed timber steps off. Log post with 2 pictograms (“walkers” and “no bikes”) at start of track, but no track identification and orientation information.

Works:

Upgrade signage as per Manly Dam Sign Location Plan, including Park identification and regulatory signage.

(Medium)

Site ID: **CCT – 1(A)**

Location: 336730 6263187 Rock outcrop above, with angled embedded rock with step off onto sloping rock and roots.

Works:

Install water bar, or stone-lined invert, above (discharge to SW with extended outlet to discharge past hump in rock ledge and prevent backflow onto track and downslope works).

Rock flagging/infills, to level angled rock above and infill / level tread below

(low)

Site ID: **CCT – 1(B)**

Location: 336734 6263184 Sloped "chute" between rock ledge and large boulder, 400mm deep, 700-900mm wide with roots and embedded rock, minor trip hazards in top half (including protruding cut stump at top), metal directional arrows on rock, Angophora roots, large sloping outcrop and angled embedded rocks at bottom end of s chute and bend downslope, 17° gradient overall. Faint trample track from bottom of chute running to W along base of rock ledge.

Works:

Monitor need for waterbar above top of chute to prevent inflow down (if installed would need to cut step in rock ledge above).

Cut off protruding stump.

Build rock step off rock ledge into top of chute.

Install stone flagging between/over roots on upper aprt of chute.

Rock armour flagging over and around roots off bottom end of chute.

Build 2 steps boxed stone steps onto in-situ rocks on slope (below chute) with compacted treads, pull-in track width with edge definition and containment/barrier (rock rubble) but retain Grass Tree if possible.

Waterbar on slope below steps, discharging to E.

Disguise/block faint trample track

(low)

Site ID: **CCT – 1(C)**

Location: 336736 6263177 6 cut steps in sloped rock outcrop, 500-700mm wide, 150-200mm riser (mostly), 23° overall gradient on rock outcrop.

Works:

Level protruding/angled embedded rock and remove roots (or flagging/armour rocks over roots) to minimise trip hazard at top approach.

(low)

Site ID: **CCT – 1(D)**

Location: 336736 6263172 Large embedded boulders upslope (variously rounded, flat and angled) and rock outcrop below, compacted sand with drainage down.

Works:

Build waterbar at top, off in-situ rock, discharging to SE.

Rock armour/flagging on low side of central boulders, build-up to level and box/retain if required (retain Grass Trees). Pull-in and block (rock rubble) route upslope of boulders.

Build waterbar at bottom, onto in-situ rock.

(low)

Site ID: **CCT – 1(E)**

Location: 336733 6263162 600-900mm wide compacted sand and roots with scored timber sleeper steps and waterbars, drainage down, some scour over steps/waterbars up to 250mm depth, waterbars full of sediment, 6° gradient.

Works:

Extend or block (with embedded rock) existing waterbars or waterbars/steps, to catch flows and minimise erosion around ends. (x 2 on upper section).

Clean out waterbar (x 1) and cut discharge channel and/or extend or block (with embedded rock) at lower end.

(low)

Site ID: **CCT – 1(F)**

Location: 336729 6263145 Scored timber sleeper step, with roots below

Works:

Clean out waterbar (x 1) and extend or block (with embedded rock) at lower end.

Extended step-and-run with filled/compacted tread (and boxed edges where necessary for containment) for 2m below waterbar/step over roots.

(low)

Site ID: **Junction with old/disused loop and waterfall access**

Location: 336726 6263138 Rock ledge with old/disused loop and waterfall access joining Curl Curl Track from SE, on bend at E end of rock ledge. Metal directional arrows on bend in main track. Rock ledge slopes off to S/SE then continues at lower level to E (another set of metal directional arrows 10m away on rock shelf on old track, but not easily visible from main track). Entry to old/disused loop is partially blocked by overhanging vegetation and appear very little used.

Works:

Disguise entry to old/disused track and remove first set of metal directional arrows (if loop/link is no longer required as part of track network, or as a "there-and-back" spur access to creek and waterfall).

(low)

Site ID: **CCT – 1(G)**

Location: 336722 6263137 Rock ledge with 5 steps cut into boulders below/off ledge, 550mm drop off upper ledge (and 300mm above top of adjacent boulder) with gap/trench 400mm wide, 3 steps cut in upper boulder and 2 in lower boulder (steps 500-900mm wide with 150-200mm risers) then large slightly sloped rock, 8° gradient overall.

Works:

Open windrow on ledge above (to SE) to allow drainage off (over ledge) before cut steps.

Cut step into upper ledge (for easier step to/from upper boulder and existing cut steps)

Monitor tread between boulders and off bottom rock for wear away and need for armouring

(low)

Site ID: **CCT – 1(H)**

Location: 336712 6263139 Failed/full cross drain, of parallel scored timber sleepers, with track detouring to low side.

Works:

Extend failed cross drain as waterbar (can re-use one in-situ timber sleeper).

(low)

Site ID: **CCT – 1(l)**

Location: 336704 6263132 Compacted sand track 700-900mm wide with roots, entrenched 1 to 3mm deep in places, 6 scored timber sleeper steps with flows down/over, upper 4 steps are scoured on low side of risers 250-300mm deep.

Works:

Stone lined invert at top, above steps, to catch and divert flows.

Build additional step between the existing upper steps (on bend at the base of the slope), fill/compact tread above to cover roots with boxed edge on low side to retain if necessary (obtain fill from downslope deposition site)

(low)

SEGMENT CURL CURL TRACK - 2

SEGMENT: CCT - 2	
Start Point: 336692 6263120	**End Point: 336647 6263113**

General Description and Condition: Short (50m approx.) section of well-defined compacted sand track across slope offering easy walking through attractive Eucalypt and Angophora forest with low sparse understorey. Good condition.

Tread Width (mm): 700-900mm wide, with very minor bench on high side (<75mm).

Track Surface: Compacted sand, occasional embedded rock and patches of laterite gravel. Gently dished in places, but no drainage capture.

Gradient (degrees): Predominantly flat to gently sloped with 1-4° gradients, occasionally short sections at 6° gradient

Alignment: Across the slope on contour, occasionally minor gently sloping sections.

Terrain: Bench on upper hillslope.

Soil: Lambert (Erosional) – undulating to rolling low hills on Hawkesbury Sandstone.

Vegetation: Bloodwood-Scribbly Gum Woodland.

Track Works and Improvements: Single scored timber waterbar.

Signs and Wayfinding: Nil.

User Experience: Easy cross-slope along contour walking through attractive tall open Eucalypt and Angophora forest, but traffic noise from Wakehurst Parkway can be intrusive.

Key Issues: Windrows retaining surface flows in places.

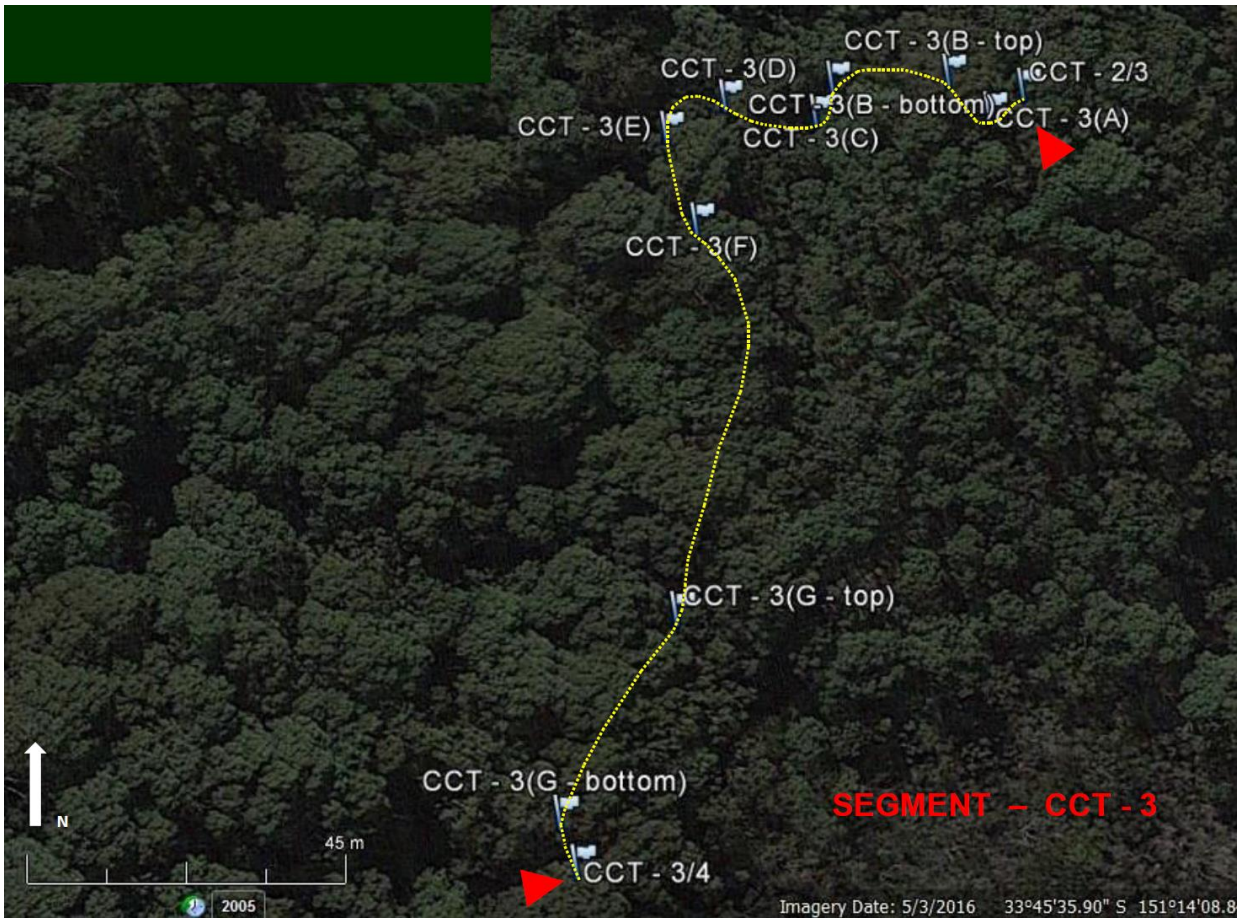
Recommended Works – Overall

- Open windrows to minimise drainage capture/ponding.

Recommended Works – Site-specific (Priority)

Nil

SEGMENT CURL CURL TRACK - 3



SEGMENT: CCT - 3	
Start Point: 336647 6263113	**End Point: 336582 6262996**
General Description and Condition: Well-defined section of track (185m approx.) winding up/down and across moderate slopes on upper third, including two drainage line crossings, and more undulating along contour and obliquely up/down gentle/moderate slopes on lower two-thirds (along E side of valley slope with creekline below to W). Through attractive open Eucalypt and Angophora forest with low sparse understorey upslope, and medium understory in valley below track. Junction with old/disused loop track, very obvious, at S end - at 336580 6263001. Good condition, with curving alignment with regular and effective track treatments on steeper slopes. *Tread Width (mm):* Mostly 700-1,000mm wide, some sections narrow to 400mm for a short distances but more often widen to 1,200mm in places. *Track Surface:* Compacted sand, with occasional embedded rocks or rock outcrops, and a few larger boulders, occasional laterite gravels. Frequent drainage down more sloping sections of track but no major erosion/scour issues due to curving alignment (spills flows off track) and frequent spacing of steps and waterbars (catches sediment and slows flow), well aligned on slopes. Minor benching on high side of track (where across slopes), only occasional sections of dished track, and minor entrenched track.	

Gradient (degrees): Mix of gentle/moderate slopes (6-8° gradients) and moderate slopes (10°, 12° and 14° gradients), with occasional short steep sections (17° gradients). Generally steeper in upslope N third.

Alignment: Winding route up/down and across moderate slopes on upper third, gently curved alignment on lower two-thirds along undulating along contour and obliquely up/down gentle/moderate slopes.

Terrain: Upper hillslope in N, grading into creek valley on midslope in S.

Soil: Lambert (Erosional) – undulating to rolling low hills on Hawkesbury Sandstone.

Vegetation: Predominantly Peppermint Angophora Forest, with Bloodwood-Scribbly Gum Woodland at far N/NE end.

Track Works and Improvements: Three long runs of timber sleeper steps and occasional waterbars - Sites CCT – 3(B), CCT – 3(E) and CCT – 3(B) - effective in slowing flows and minimising erosion/scour. All waterbars largely full of sediment.

Signs and Wayfinding: Small routered timber sign ("Curl Curl Track" with arrow to N) on galvanised metal posts on main Curl Curl Track (good condition). No wayfinding en-route.

User Experience: Relatively easy extended climb or decent, with short sections requiring some exertion, but generally a well-defined and maintained track through attractive tall open Eucalypt and Angophora forest on a occasionally rocky hillslope (in upper section) and with adjacent attractive well vegetated creek in valley below (in lower section). Traffic noise from Wakehurst Parkway is intrusive in places.

Key Issues: Potential for drainage capture, potential for scour over and around timber waterbars/steps, protruding roots (trip hazards), junction with old/disused loop track.

Recommended Works – Overall

- Maintenance and cleaning of waterbars, waterbars/steps and other drainage treatments.
- Monitor scour over and around ends of waterbars and waterbars/steps for need for adaptive management/remediation.
- Remove/level protruding roots (trip hazards).
- Disguise entry to old/disused track (if loop/link is no longer required as part of track network).

Recommended Works – Site-specific (Priority)

Site ID: **CCT – 3(A)**

Location: 336642 6263110 Laterite embedded rocks and occasional roots on slightly dished track curving on slope at 9° gradient, drainage flows down track.

Works:

Install 3 waterbars/steps on bend (at top of slope, to divert flows before long run of scored timber sleeper steps and waterbars downslope). Build centre waterbar off in-situ laterite rock.

(low)

Site ID: **CCT – 3(B)**

Location:

Top 336636 6263116

Bottom 336618 6263115

"S" curve downslope of 26 steps and 2 waterbars (both full of sediment) all of scored timber sleepers, compacted sand and laterite gravel between steps (on treads and sloped track), 800-1000mm wide, 10-14° gradient, drainage flows down but little erosion or dishing due to curved alignment to spill flows off track and frequent spacing of steps catches sediment and slows flow, good alignment and good condition, minor drainage line at bottom with thick ferns (Site CCT – 3(C)).

Works:

Extend or block (with embedded rock) existing timber steps (5 on upper curve, 1 mid curve and 3 lower curve) to catch flows and minimise erosion around ends.

Clean out waterbars (x 2)

(low)

Site ID: **CCT – 3(C)**

Location: 336616 6263109 Placed stepping stones across minor drainage line/tributary crossing, stones detoured and track widened.

Works:

Relocate and widen drainage line crossing with extra step stones/flagging. Monitor for need for edge definition and containment/barrier (rock rubble).

(low)

Site ID: **CCT – 3(D)**

Location: 336602 6263115 Compacted sandy/clay track 400-700mm wide, directly up/down slope curving between sandstone boulders, occasional roots at top, drainage down track and eroded to 300mm below NSL (at top), , 12° gradient with 2.4m change in level overall over 9m length (on W side of minor drainage line - Site CCT – 3(C)).

Works:

Waterbar at top of slope, built onto in-situ rocks, discharging to SE.

2 step-and runs in upper eroded section of track, fill/compact treads, anchor lower step onto large in-situ boulder.

Waterbar/step built off in-situ boulder, discharging to S/SW, level/fill above to cover protruding root.

4 step-and runs built onto lower outcrop (above drainage line) on inside of curve and boxed on outer side for containment, fill/compact treads, with “wing” on outside of upper tread to prevent/divert flows down/around sides.

(Medium - for passability and sustainability/impact issues)

Site ID: **CCT – 3(E)**

Location: 336592 6263107 15 steps and 2 waterbars (both full of sediment), all of scored timber sleepers across (up/down) across a 17° gradient slope over 14m length, 800-1200mm wide, compacted sand treads, minor drainage flows down but no scour, lower steps edged or end barriered with rock on outer side, good alignment and good condition.

Works:

Clean out waterbars.

Extend or block (with embedded rock) existing timber steps to catch flows and minimise erosion around ends. (4 steps, mainly inside ends on lower half of site)

(low)

Site ID: **CCT – 3(F)**

Location: 336597 6263092 Drainage crossing, 3 scored timber sleeper steps on NW approach (12° gradient) with timber waterbar above and 6m upslope to NW (both full of sediment), 1 large step stone in drainage line (low side), SE approach is compacted sand with minor cross-slope (8° gradient).

Works:

Clean-out waterbars on NW side (x 2).

Cut/level tread in rock outcrop belowe sleepoer steps on NW side (for safer more stable entry/exit).

Replace lower/last sleeper waterbar/step on NW side of channel (partially buried) with large stone step, anchored to in-situ outcrop (more durable and less susceptible to erosion during flows).

2 waterabrs on SW side, at 4m and 10m from drainage line (build onot in-situ outcrop on high siode of track).

Monitor track on SW beside drainage line for undercutting/ersosion from larger flows, and possible need to armour.

(Medium - for passability issues)

Site ID: **CCT – 3(G)**

Location: 336596 6263032 top

336580 6263003 bottom

42m long section up/down slope, 9° gradient overall, 14 steps/risers (some steps with end rock blocks/barriers) and 3 waters (all full of sediment), steps and waterbars mostly of scored timber sleepers but a few older logs as well, generally in good condition despite drainage flows down, compacted sand track 800-1200mm wide, occasional roots, dished to 250mm below NSL on upper section, embedded rocks on lower end.

Works:

Clean out waterbars (x 3)

Extend or block (with embedded rock) existing timber steps to catch flows and minimise erosion around ends. (x 3).

4 steps, mainly inside ends on lower half of site)

Extend lowest waterbar on slope, and install additional step below, with fill/level above over angled broken rock and roots.

(low)

Site ID: **Junction with old/disused loop track**

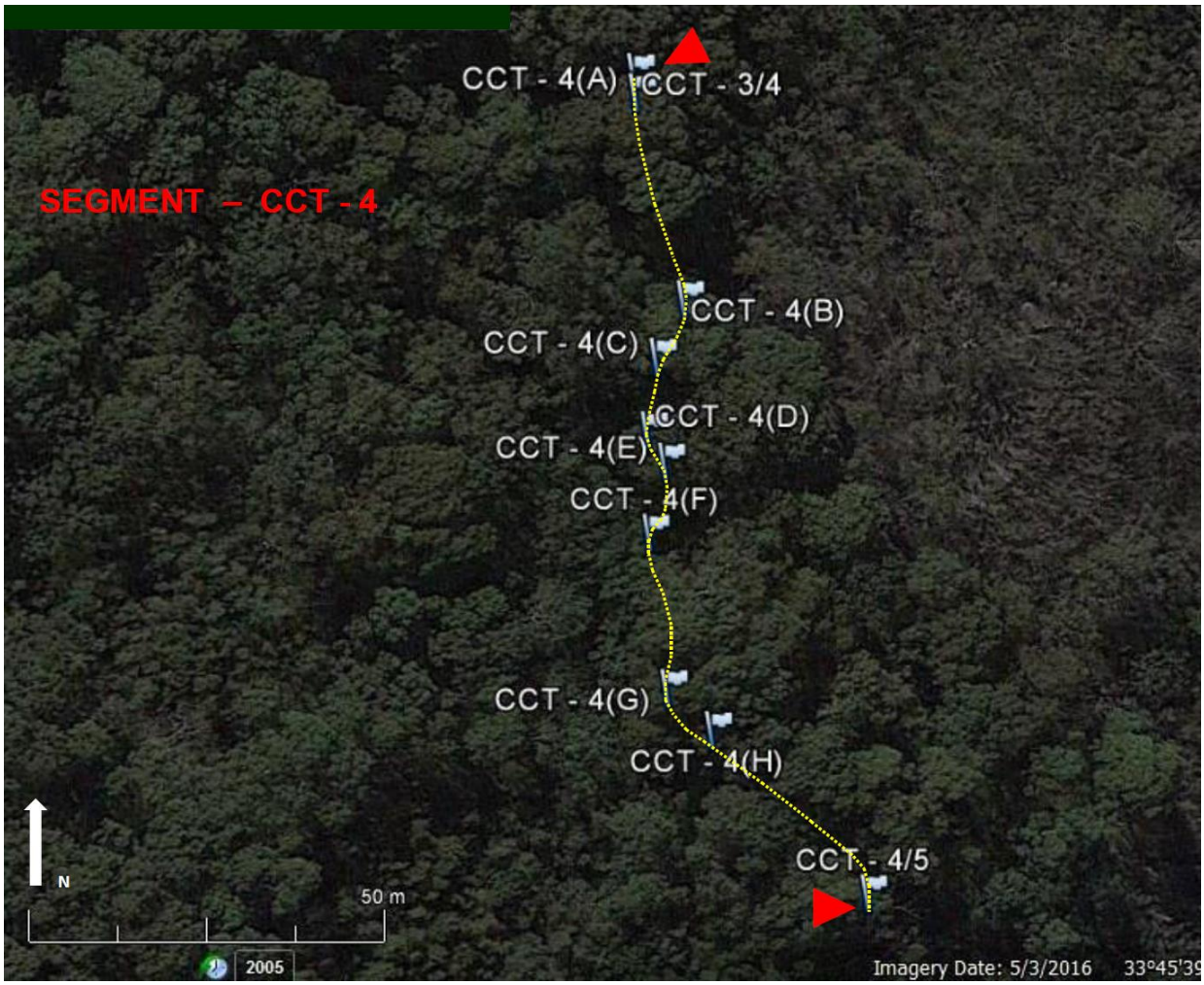
Location: 336580 6263001 Old/disused track joins (via T junction) from E/NE on gentle/moderate slope. Small routered timber sign ("Curl Curl Track" with arrow to N) on galvanised metal posts on main Curl Curl Track (good condition). Drainage flows down old/disused track onto main route (and into next Segment CCT-4). Old/disused track has very little sign of use, despite being very obvious.

Works:

Close, disguise and rehabilitate disused track (if loop/link is no longer required as part of track network), including informal waterbar to divert flows before reaching Curl Curl Track.

(Medium)

SEGMENT CURL CURL TRACK - 4



SEGMENT: CCT - 4	
Start Point: 336582 6262996	**End Point: 336620 6262869**

General Description and Condition: Well-defined section of track (155m approx.) gently winding along upper reaches of valley, with mainly gentle to gentle moderate slopes and becoming more open to S. Track parallels creekline, crossing it midway along this segment, with several sections running close to or just above the creek corridor (especially in the S half) – flooding during high flows likely to occur at some sites. Through attractive open Eucalypt and Angophora forest with low sparse understorey upslope (previously burnt in places), and thick creekside vegetation of sedges and ferns downslope of track. Good condition overall, but occasional sections fair only.

Tread Width (mm): Mostly 600-1,000mm wide on upper/N and central sections, and 400-700mm wide on lower/S benched cross-slope section. Widens to 1,200-1,400mm in places.

Track Surface: Compacted sand with regular exposed/protruding roots (some to 200-300mm above track surface) and embedded rocks, track surface mostly dished 50-75mm below NSL and benched-in 50-75mm on highside along lower/S cross-slope section, occasional boulders and rock pavements.

Gradient (degrees): Undulating across and up/down mostly gentle and gentle/moderate slopes (1-4° gradients), occasional short sections at 8-9° gradients over rock ledges/outcrops.

Alignment: Gently curving alignment, initially along E side of valley in upper/N half then crossing creek to run along W side of creek (lower down valley slope and closer to creek) in lower/S half. Mostly 5-10m away from creekline (but closer in places – notably Site CCT - 4(E). Some sections in central and S half (and creek crossing) likely to be impacted by high creek flows.

Terrain: Creek valley on mid hillslope.

Soil: Lambert (Erosional) – undulating to rolling low hills on Hawkesbury Sandstone.

Vegetation: Peppermint Angophora Forest.

Track Works and Improvements: Creek crossing improved with placed rocks on banks and central stepping stone, narrow tread cut into boulder/outcrop, and 3 timber sleeper waterbars.

Signs and Wayfinding: 2 metal directional arrows on rock pavement/ledge.

User Experience: Easy and pleasant walking on generally well-defined and maintained track in a varied valley setting with attractive tall open Eucalypt and Angophora forest and dense creekside vegetation. Regular views into creek, including rocky cascades and pools and grassy banks in places. Creek sounds can be heard from most sections of track, but traffic noise from Wakehurst Parkway is also intrusive in places.

Key Issues: Potential for flooding of track by adjacent creek in places, potential for undercutting and erosion damage by high creek flows in places, protruding roots (trip hazards), and drainage capture.

Recommended Works – Overall

- Open windrows to minimise drainage capture/ponding.
- Maintenance and cleaning of waterbars, waterbars/steps and other drainage treatments.
- Remove/level protruding roots (trip hazards).
- Monitor for track damage and safety issues after high creek flows and flooding, and need for maintenance/repair or adaptive management (such as improved treatments or re-routing).
- Monitor for slip hazards on rock pavements/outcrops adjacent to creek, and need for adaptive management/remediation.
- Monitor for "avoidance" and track widening/braiding at steps or step-and-runs, and need for adaptive management/remediation (such as edge definition/barriers).

Recommended Works – Site-specific (Priority)

Site ID: **CCT – 4(A)**

Location: 336582 6262993 Exposed/ protruding roots (some to 250mm high) on 7m length of compacted sand track with 6° gradient, 800-1200mm wide, drainage flows down (including run-on from old track at bottom/S end of Segment CCT-3).

Works:

Waterbar, or stone-lined invert, at top to catch/divert flows.

Step (x 1) and step-and run (x 1) with boxed low-side (W) edges for containment and filled/compacted treads, over upper protruding roots.

Step (x 1) and step-and run (x 1) with boxed low-side (W) edges for containment and filled/compacted treads, over lower protruding roots.

Pull-in track width, disguise/rehabilitate and block/barrier (such as with rock rubble).

(Medium - for passability and sustainability/impact issues)

Site ID: **CCT – 4(B)**

Location: 336591 6262962 Narrow track over and around two large angled/sculpted boulders at minor crest, gap between boulders with exposed roots, eroded/benched track on downslope/S side with 300mm high benching-in on high side, track surface dished to 50-75mm below NSL.

Works:

Cut/level tread (reinforce section that is almost flat at present) across upper boulder. Cut step off S/SE end of upper boulder, with rock armour/flagging below step off.

Stone step built off/between lower boulder and embedded rock on high side of track, fill and compact above step.

Step/waterbar on compacted sand slope below lower boulder, stone-lined invert above with cut channel (or formed/lined gutter) to discharge between adjacent rocks towards creek (required to divert drainage to protect existing and proposed downslope track treatments).

(low)

Site ID: **CCT – 4(C)**

Location: 336586 6262953 Two sloped rock pavements with large exposed root between, loose rocks placed at base of lower steeper pavement as informal step, drainage flows down track, 9° gradient overall.

Works:

Boxed stone step-and-run off lower edge of upper pavement (below root), backfill over root and rock armour extended tread (anchoring tread onto lip of rock pavement) with stone-lined invert on tread (discharging to W, with extended extend outlet to prevent backflow onto track). Boxed stone step at low end/below step-and-run, onto rock pavement.

Cut/level 2 steps into lower/steeper rock pavement.

Move loose rocks and rock armour/flagging tread off lower end egde of pavement.

(low)

Site ID: **CCT – 4(D)**

Location: 336585 6262942 Upper - large angled root retaining compacted sand track above, with 300mm step off onto embedded rock then rock outcrop/pavement, drainage flows over/down. Lower - oots retaining dished compacted sand track, with 150mm step off witjh ponding area, then gently sloped pavement (track may be subject to flood flows from adjacent creek). 7m length overall.

Works:

Waterbar above upper angled root.

2 boxed stone steps anchored onto rock pavement below large angled root, backfill over root and fill/compact treads.

Boxed stone step-and run (above) and step (below) anchored onto rock pavement below root, backfill over root and fill/compact both treads, rock armour/flagging on both tread (to protect from scour during possible flooding by creek flows).

(Medium – for passability and sustainability/impact issues, to protect track against creek flows)

Site ID: **CCT – 4(E)**

Location: 336587 6262937 Upper - gently sloped rock ledges above (with short track to creek cascade) with lip and 250-300mm step off to pavement outcrop, 2 metal directional arrows on rock, likely to be subject to creek flows diverted onto/down the track in medium flows (creek is only 2m to W of track and at almost the same level). Lower - rounded boulder/outcrop, minor tread (approx. 200mm wide) cut into highest part of outcrop, but slopes off to S and evidence of walkers (and creek flows) along low side of outcrop.

Works:

Monitor upper rock ledges for moss and slippery conditions, may need to cut/level treads (or build stone step) if becomes a safety issue.

Widen tread on lower rounded boulder/outcrop, and cut 2 steps off lower/S end.

Rock wall/barrier built onto upper corner of lower rounded boulder/outcrop, to force overflows back towards creek (to prevent erosion down side of outcrop and track widening)

(Low, and monitor for flooding and safety issues adjacent to creek)

Site ID: **CCT – 4(F)**

Location: 336585 6262926 Creek crossing, 2.5m wide, large embedded rock on S bank and 2 smaller rocks embedded on N bank (plus sediment fan and 2 other smaller loose rocks), large loose rounded rock (stepping stone ?) in middle of channel , compacted sand track both sides with roots on N approach (and grassy bank) with 4° gradient, flood debris piled to 700mm high against tree indicates site subject to substantial creek flows.

Works:

Waterbar/step on N approach.

Replace N side edge rocks with larger rocks more stably set into bank.

Centre and firmly set step stone in middle of channel, and cut/level tread on top side.stone tops

Monitor for flood damage and need for post-flood maintenance/repair.

(High - for passability/safety issues and to protect track against creek flows, and monitor for flood damage and need for post-flood maintenance/repair)

Site ID: **CCT – 4(G)**

Location: 336588 6262901 Minor/ephemeral drainage line flowing onto track from upslope then “captured” to flow down/along track for 9m before discharging to E at low point, eroded/exposed roots and track widening to 1.4m.

Works:

Large stone-lined invert or gutter where drainage line meets track (above tree) to carry flows across the track, extend invert/gutter or outlet through mound to NE side of track (for 1-1.2m) to ensure discharge off/across track.

Waterbar to S, downslope of tree to divert any overflows from uplsope invert/gutter, with extended outlet to prevent backflow onto track.

Pull in track width (away from roots on high side) with edge containment/definition (both sides).

(Medium – for sustainability/impact issues issues)

Site ID: **CCT – 4(H)**

Location: 336595 6262895 Angled rock outcrop and protruding embedded rocks on track and on high side, track 1,000-1200mm wide, large Eucalypt adjacent low side with roots running over the outcropping rocks, creekside of track retained by fallen branch with 400mm slope down/off, drainage flows down track. Track on bend below/SE runs beside creek, 8-10m section has steep slope (+1m high) to flood bench below, with potential for undercutting/erosion during high flows.

Works:

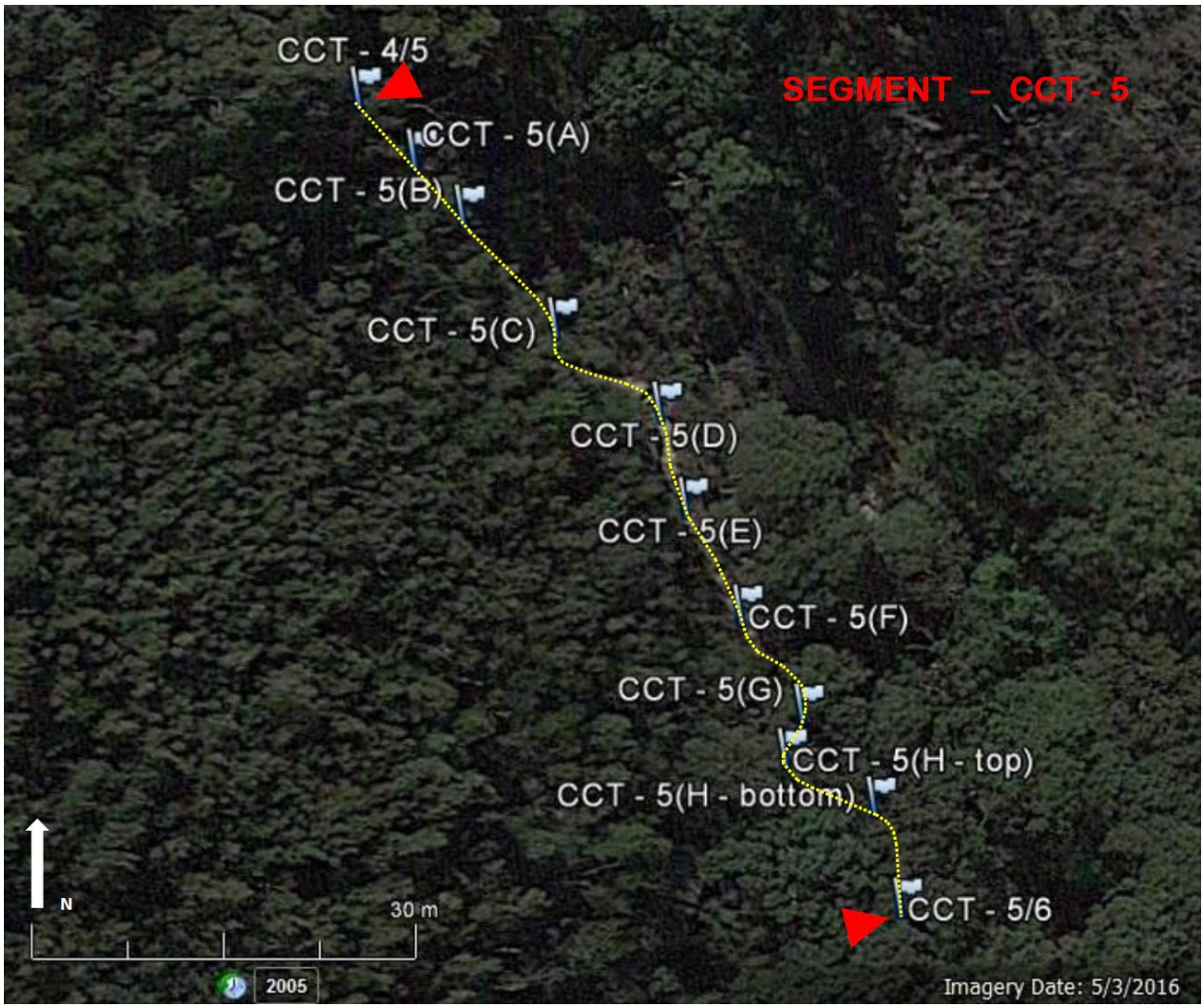
Waterbar upslope to catch/divert flows.

Remove fallen branch and build extended tread/step-and-run with 2 steps off lower end, box lower creekside edge for contianmemnt and fill tread (over outcrops and roots), rock armour/flagging on all treads (to protect from scour during possible flooding by creek flows).

Monitor track below/SE for flood erosion and track undercutting or narrowing (potential safety issues).

(Mediuym - for passability/safety issues, and monitor for flood damage and need for post-flood maintenance/repair)

SEGMENT CURL CURL TRACK - 5



SEGMENT: CCT - 5	
Start Point: 336620 6262869	**End Point: 3366667 6262800**
General Description and Condition: Well-defined section of track (95m approx.) gently winding along SW slope of broad open valley above, and paralleling, creekline. Track runs closer to creek corridor towards SE with views to rocky bed, pools and cascades before a short steep slope to join the flood terrace below a small waterfall – flooding during high flows likely to occur at SE end. Mostly through low open woodland with sparse to medium understorey, and slightly thicker vegetation long creekline – evidence of past fires. Good condition overall, but occasional sections fair only (especially rocky or steeper sections). *Tread Width (mm):* Mostly 400-900mm, widening to 1,200mm around obstacles or over rocky sections. *Track Surface:* Compacted sand (and some sandy clay) with regular embedded rocks and boulders as well as occasional rock ledges and pavements, occasional loose stone and gravel, occasional patches of loose/deposited sand, regular protruding roots (especially at SE end). Mostly slightly dished to 50mm below NSL, and benched-in 50-100mm on	

highside in some places. Drainage flows down the more sloping sections of track (and over rocky sections) with some minor areas of erosion to 400mm below NSL

Gradient (degrees): Undulating across slope with gentle to gentle/moderate 2-6° gradients, short sections at 8-9° gradients over rock ledges/outcrops. Steeper section at SE end directly up/down a steep rocky slope to creekline (18° gradient).

Alignment: Very gently curving alignment across/along a mostly gentle valley side slope (mostly along contour) on W side of broad valley with views into creek corridor, dropping down rocky slope to flood terrace beside creek at SE end (likely to be impacted by high creek flows).

Terrain: Broad valley on mid hillslope.

Soil: Lambert (Erosional) – undulating to rolling low hills on Hawkesbury Sandstone.

Vegetation: Predominantly Sandstone Heath, with Peppermint Angophora Forest at far NW end.

Track Works and Improvements: Occasional scored timber sleeper steps/waterbars on most of segment. Run of scored timber sleeper steps and waterbars (x 6) and placed rock steps (x 16) on steep rocky slope to creekline at SE end

Signs and Wayfinding: Metal directional arrows on rock outcrop midway along segment.

User Experience: Mostly easy and pleasant walking on generally well-defined and maintained track in an open valley setting with regular views into creek – including rocky bed, pools, cascades and a small waterfall at SE end (all easily accessed from track). Large boulders and steeper slope at SE require caution for less experienced walkers (some rock scrambling off S face). Vegetation less enclosed, and attractive, than upslope segments of Curl Curl Track to N, and traffic noise from Wakehurst Parkway is intrusive in places.

Key Issues: Potential for flooding and undercutting or erosion damage by adjacent creek at SE end, protruding roots (trip hazards), and drainage capture.

Recommended Works – Overall

- Open windrows to minimise drainage capture/ponding.
- Maintenance and cleaning of waterbars, waterbars/steps and other drainage treatments.
- Remove/level protruding roots (trip hazards).

- Monitor SE end of track for damage and safety issues after high creek flows and flooding, and need for maintenance/repair or adaptive management.
- Monitor for, and manage, trample tracks to creek features.

Recommended Works – Site-specific (Priority)

Site ID: **CCT – 5(A)**

Location: 336625 6262864 Angled rock outcrops and embedded rocks.

Works:

Cut/level tread on upper angled outcrop, rock armour/flagging on downslope side to same level, anchor armour/flagging well in to retain/contain (due to slope away from track edge) and barrier/block below (with rock rubble or similar) to prevent "avoidance" and track widening.

Waterbar, built onto in-situ situ outcrop.

Rock infill and armour gap bewteeen, and to same level as, embedded rocks to form small stone step.

(low)

Site ID: **CCT – 5(B)**

Location: 336629 6262859 Boulders/outcrops upslope with compacted sand track and loose stones/gravel, scored timber sleeper waterbar/step (full of sediment and scour over) at lower end (below dead tree), 8° gradient overall.

Works:

Stone step built onto upper flat boulder to "square-up" step off, fill and compact tread above.

Waterbar, built onto lower outcrop

Clean out existing waterbar/step, and build short step-and-run below step (extending 1m) and fill and compact tread back to existing waterbar/step (box low side if necessary for containment).

(low)

Site ID: **CCT – 5(C)**

Location: 336637 6262850 Waterbar (full of sediment and failed, with scour over) upslope of eroded gutter on bend (150mm deep and opening to 400-500mm wide at low end), with deposited sediment below), drainage flows down track, 5° gradient overall.

Works:

Clean out and extend existing waterbar.

Step at low end of gutter, fill and compact gutter to adjacent track level with waterbar "one pace" (at least 600mm) upslope of step (waterbar to also protect proposed downslope track treatments at Site CCT-5(D)).

(Medium)

Site ID: **CCT – 5(D)**

Location: 336644 6262843 Large rock ledge above (flat/rounded, slippery due to loose sand from upslope) with 450mm step off to compacted sand bench/gap (400mm wide) with exposed roots on downslope edge (from adjacent multi-stem tree), then boulder on high side of track with root and flat rock pavement (at NSL) extending down track on low side, most walkers use route on low side of rocks, drainage flows over and around rocks with some surface erosion, 13° gradient and 900mm drop overall, metal directional arrows on upper ledge.

Works:

Waterbar in shallow sandy area at rear of upper ledge (if insufficient depth to instlal timber sleeper waterbar may need to excavate broad shallow drainage channel into upper side of ledge).

Cut 2 steps into lower face of upper ledge.

Rock armour/flagging in gap below legde, to fill and level gap bewtween ledge and boulder.

Level top of boulder as flat tread

Stone step-and-run off low side of boulder with 2 steps at end anchored onto lower flat rock pavement, boxed on low side for containment, fill and rock armour all treads (to protect against likely continued drainage over site from adjacent slope).

	Pull-in track width with edge definition and containment/barrier (rock rubble) to prevent "avoidance" and widening. **(Medium - for passability/safety issues)**
	***Site ID:*** **CCT – 5(E)** *Location:* 336647 6262838 Tangle of exposed/protruding roots in compacted and loose sand, some embedded rock, drainage flows down track, rock ledges on upslope side, 3° gradient overall. *Works:* 2 steps built onto embedded rock and outcrop on high side of track, boxed on low side for containment with retaining/edging extending back upslope along low side of track, fill above steps (over roots) and compact, include stone-lined invert butted onto adjacent/upslope rock ledge. Waterbar/step, fill above (over roots) back upslope to steps above, retaining/edging on low side if required. **(low)**
 	***Site ID:*** **CCT – 5(F)** *Location:* 336652 6262826 13m length of compacted sand track, around low side of large flat rock outcrop at top (dead tree adjacent), then over embedded rocks and cluster of exposed/retaining roots (beside dead tree) with 400mm step off, larger exposed/retaining roots with 300mm step off, drainage capture and flows down track, 10° gradient overall. *Works:* Remove 2 dead trees (safety issue). Waterbar at top of site, before slope and above large flat rock outcrop. 2 stone steps built onto embedded rocks, boxed on low side for containment, fill and compact uplsope, with stone-lined invert above. 3 stone steps below upper/clustered roots, backfill above (over roots) and compact/level. 2 stone steps below lower roots, built onto upper end of rock outcrop below, boxed on low side for containment, backfill behind (over roots) and compact/level. **(Medium - for passability/safety issues, remove dead trees as minimum treatment)**

Site ID: **CCT – 5(G)**

Location: 336655 6262816 Large flat angled rock slab/boulder at top, with step off to sloping gap/channel of loose sand (200mm wide), then onto very large angled and sloping boulder with 500mm high angular face on low side – 1,700mm drop overall over 3m length. Broken rock slabs on low side of track above moderately steep sandy slope. Below angled/sloping boulder is compacted sand track with smaller boulders along upslope edge and some embedded rocks and protruding roots, entrenched 200-400mm below NSL, extends 2.5 m to placed rocks at top of next site (CCT-5(H)), large tree (with trunk cavity/deadwood facing track) on low side of track. 9m total length, 17° gradient overall.

Works:

Waterbar above top of site.

Cut 2 steps into upper rock slab/boulder with level tread above (may need to build rock steps if slab is too for cutting steps).

Enlarge and stone-line/armour existing gap between slab and boulder, extend and armour downslope outlet to discharge past and away from large tree (to avoid destabilising).

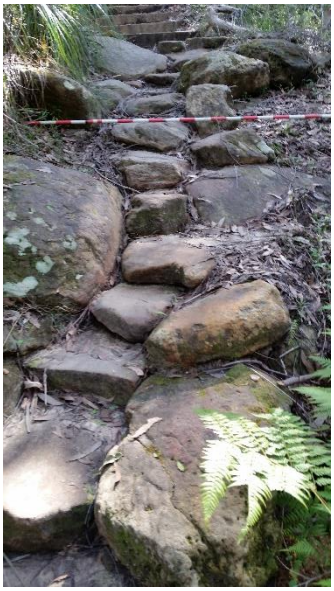
Edge definition and containment/barrier (rock rubble) on lower side of slab and boulder to prevent “avoidance” and keep walkers away from top of sandy slope.

Cut/level landing onto top of large angled/sloping boulder.

Cut 4 steps, in a gentle curve, along higher side of angled/sloping boulder (to avoid crack on low side while minimising cut depth, and away from steep sandy slope).

Run of 8-9 fibreglass reinforced plastic steps and short landings (1.3m drop over 3.8m), anchored onto large angled/sloping boulder at upper end (above steep face/drop), and extending past (upslope) of large tree, to bottom landing at existing track level and anchored onto concrete pad or footings (bottom landing is at top of following site (CCT-5(H), with extra step off E side of landing to line up for existing steps in CCT-5(H) if required). Avoid excavations or loadings that may compromise roots or stability of large tree (avoid falling/uprooting that would damage track treatments).

(HIGH – for passability/safety issues)



Site ID: **CCT – 5(H)**

Location: 336656 6262813 top
336664 6262809 bottom

Extended run of steps for 16m directly up/down an 18° gradient slope above creekline. Waterbar at top (at bottom of Site CCT-5(G) above), full of sediment and failed with gap at N end, with retaining root forming a step and embedded/broken rocks below. Then 3 scored timber sleeper steps and 1 step-and-run on top third of slope (eroded to 250mm deep at/around lower ends), and 16 built/placed stone steps on lower two-thirds (built onto and around in-situ small boulders on slope) 300-800mm wide, most in fair to good condition and stable/secure. Drainage flows down all stone steps, but little erosion/scour. Large step off lowest rock step to compacted sand track on flood terrace beside creek (appears regularly inundated), with trample track to NE to creek. Waterbar at base beside creek (track along flood terrace).

Works:

Clean-out uppermost waterbar and extend upslope to N, towards and butting into base of tree above.

Secondary waterbar/barrier (“side bar” located off track, angled below upslope tree) to catch/divert flows from track upslope above (Site CCT-5(G)) and prevent flows onto steps downslope.

Remove roots and broken rock, replace with 2 boxed stone steps with armoured treads. Pull in track width and edge barrier (rock rubble) to prevent “avoidance”.

Extend or block (with embedded rock) S ends of 3 existing timber steps, to catch flows and minimise erosion around ends, infill and level behind blocks to widen steps.

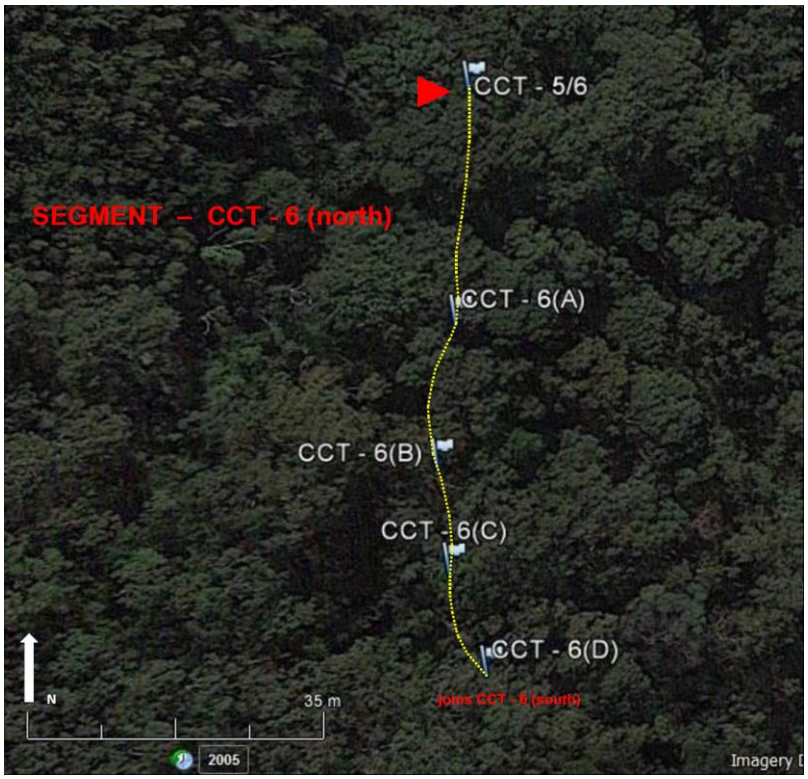
Stone-lined invert below existing step-and-run (before stone steps below), butt onto boulder on upslope side, with extended outlet to discharge well off track.

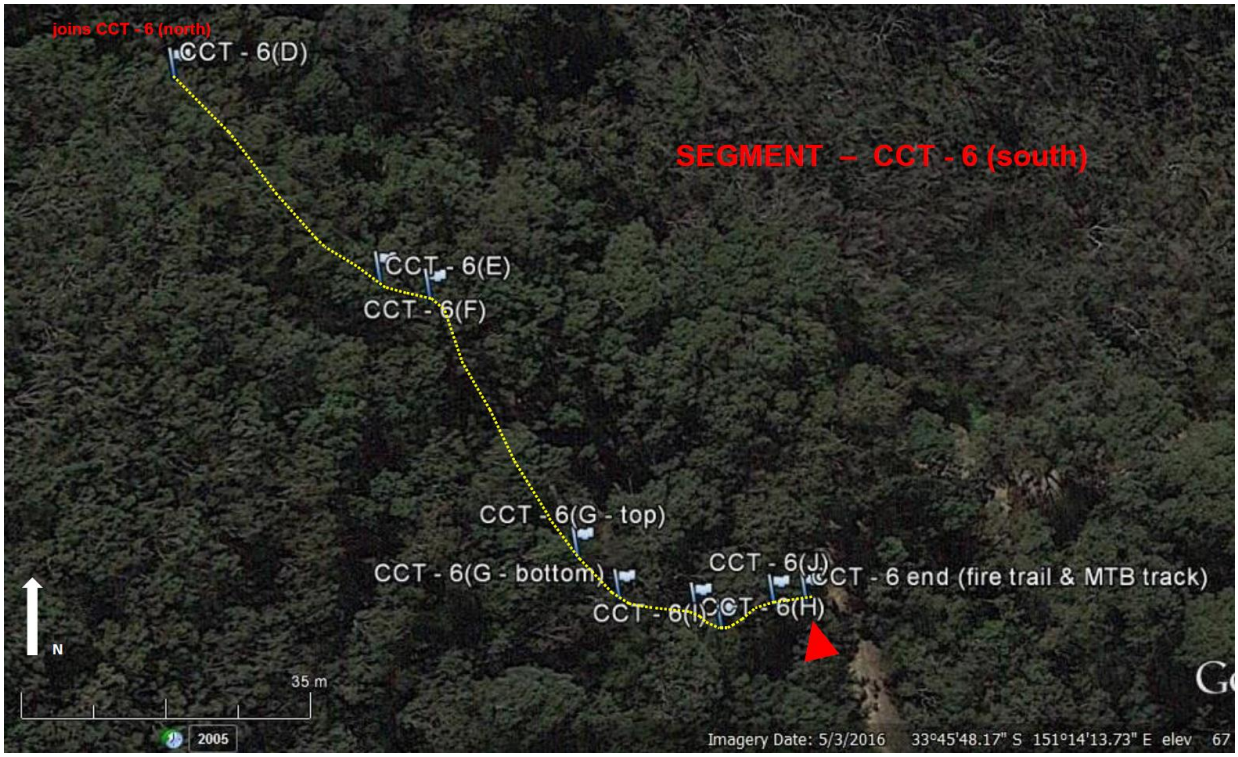
Single large stone step embedded below lowest rock step, set firmly into track to resist flooding and potential undercutting/scour (or boxed and armoured stone step as an alternative).

Extend creekside waterbar at bottom of site.

(Medium – for passability and sustainability/impact issues)

SEGMENT CURL CURL TRACK - 6





SEGMENT: CCT - 6	
Start Point: 3366667 6262800	**End Point: 336759 6262645** **(Perimeter Fire Trail and Shared Path, just SW of creek crossing, and opposite N trackhead of Park Circuit Track -West)**

General Description and Condition:

Well-defined section of track (185m approx.) gently winding along contour on W and SW slope of broad open valley above, and paralleling, creekline for most of segment with views to rock pool and small cascades from central section. Flood terrace at far N end, and crosses small (wet) tributary in SE third. Mostly through open mixed Eucalypt woodland (with evidence of past fire) and open understorey (including sedges) in N and medium more mixed understorey towards SE. Joins Perimeter Fire Trail and mountain bike/shared path at SE end, with connection to N end of Park Circuit Track (West) opposite. Good condition overall.

Tread Width (mm): Mostly 600-1,00mm, some narrow section at 300-400mm for short distances (such as narrow benched track past obstacles on side-slopes) or wider section to 1,200mm around obstacles.

Track Surface: Compacted sand with regular embedded rocks and rock outcrops/boulders (typically low or flat outcrops), occasional stones and laterite gravel, frequent exposed/protruding roots and occasional stump (some up to 250mm high in places). Track frequently dished 50-100mm below NSL, and drainage flows down in many places with occasional deeper gutters (to 300-350mm below NSL). Benched-in 50-200mm on highside in places (depending on degree of side-slope). Areas of sandy loam close to creek along flood terrace at N end, and increasing amounts of sandy clay in SE third.

Gradient (degrees): Undulating across slope with mainly gentle <1-2.5° gradients and some gentle/moderate slopes (5-7.5° gradients) including over rock ledges/outcrops.

Alignment: Short section along flood terrace (beside creekline - likely to be impacted by high creek flows)) at N end, then climbing slightly to run in a very gently curving alignment across/along a mostly gentle valley side slope (mostly along contour) on W side of open valley, with views into creek corridor, gradually dropping down to S.

Terrain: Valley on lower hillslope.

Soil: Lambert (Erosional) – undulating to rolling low hills on Hawkesbury Sandstone.

Vegetation: N third of track runs along boundary of Peppermint Angophora Forest and Bloodwood-Scribbly Gum Woodland, S two-thirds of track runs along boundary of Peppermint Angophora Forest and Sandstone Heath.

Track Works and Improvements: Occasional scored timber sleeper steps/waterbars scattered along most of segment, more frequent and loosely grouped in SE third.

Signs and Wayfinding: New signage/directional totem at SE junction with Perimeter Fire Trail / shared path (opposite N trackhead of Park Circuit Track –West). Totem identifies Mountain Bike Circuit (and Fire Trail) and Park Circuit Track (West) to S, but no identification or orientation information for Curl Curl Track. No wayfinding en-route.

User Experience: Easy walking on well-defined and maintained track in a broad valley setting with mostly open vegetation. Regular views into creek – including creek in close proximity at N end and attractive views to pools and riffles/shelves along creekline (10-20m below track) in N and central sections. Vegetation less enclosed, and attractive, than upslope segments of Curl Curl Track to N. Moderate slope below track in places but minor/low hazard only (mainly when track narrows to 300-400mm wide).

Key Issues: Potential for flooding and undercutting or erosion damage by adjacent creek at N end, protruding roots (trip hazards), drainage capture, erosion/guttering, scour over and

around end of some waterbars/steps, and moderate slope below track in places (but minor/low hazard only).



Recommended Works – Overall

- Open windrows to minimise drainage capture/ponding.
- Remove/level protruding roots (trip hazards).
- Improved track identification and orientation signage at SE trackhead (on Perimeter Fire Trail).
- Maintenance and cleaning of waterbars, waterbars/steps and other drainage treatments.
- Monitor N end of track for damage and safety issues after high creek flows and flooding, and need for maintenance/repair or adaptive management.
- Monitor for, and manage, trample tracks to creek features.

Recommended Works – Site-specific (Priority)

Site ID: **CCT – 6(A)**

Location: 336665 6262766 Tributary crossing with 2 boxed scored timber sleeper steps on N side, large central rock/step stone (stable but rounded top), small rock off S bank (loose), embedded rock on S bank and gentle compacted sand track on S approach.

Works:

Cut/level flat tread in top of central stepping stone (check/ensure stability after works).

Secure/anchor smaller rock off S bank, or replace with 2 with larger stable stepping stones

(Medium – for passability/safety issues)

Site ID: **CCT – 6(B)**

Location: 336663 6262746 Outcrops and embedded rocks and roots, gap 400mm wide between rock, with drainage flows down/between.

Works:

Rock infill to gap, anchor to in-situ outctrop, and level top as small step.

Remove protruding roots and level embedded rocks below, and rock armour/flaggin step off below.

Waterbar downslope, built onto in-situ embedded rocks.

(low)

Site ID: **CCT – 6(C)**

Location: 336664 6262731 Track detouring around protruding flat boulders with 200-300mm faces, eroding into upslope side of track to 400mm below NSL, minor crest (and watershed).

Works:

Cut edge of upper boulder (potentially using exisitng fracture line) and straighten track (use excess stone at previous site – CCT -6 (B) – if intact).

(low)

Site ID: **CCT – 6(D)**

Location: 336669 6262716 Low uneven rock outcrop forcing narrow track to widen along downslope side (as walkers avoid outcrop) above moderate slope away from track, embedded rocks

Works:

Level uneven outcrop and remove/level protruding embedded rock. Close and block/barrier (rock rubble) “avoidance” alignment along lower side.

(low)

Site ID: **CCT – 6(E)**

Location: 336699 6262689 Angled outcropping/embedded rocks (x 2) with S outcrop forcing narrow track to widen along downslope side (as walkers avoid outcrop). "Avoidance" alignment is very narrow (<200mm tread width) above moderate slope away from track.

Works:

Level or remove S outcrop, and close and block/barrier (rock rubble) "avoidance" alignment along lower side (or build a rock bench onto low side of this angled outcrop with rock step at N end).

(low)

Site ID: **CCT – 6(F)**

Location: 336705 6262687 Sloped rock ledge with broken slab downslope, current track aligned via gap between ledge and slab with 2 placed/embedded rocks as informal steps (flat upper rock, angled lower rock) then natural rock steps/ledges above, drainage flows down/over ledges.

Works:

2 stone steps in gap between ledge and slab, formalise and upgrade/widen existing steps to fill entire gap.

Stone-lined invert uplslope, in small sandy flat between lower and upper ledges.

(low)

Site ID: **CCT – 6(G)**

Location: 336726 6262651 top/N
336733 626245 bottom/S

Dished/entrenched track 50-150mm below NSL above timber sleeper step/waterbar, full of sediment and failed with scour over. Deeply entrenched track below, 300-350mm below NSL, in compacted sandy/clay. Then 2 angled timber sleeper steps with muddy track below, for 1.5-1.7m, then sloping rock pavement to tributary. S side of tributary has a well embedded large step stone. Total length 14m, 7° gradient overall.

Works:

Waterbar at top of site, to catch and divert flows.

Step-and-run 2-2.5m below existing step/waterbar, fill and compact behind (back to existing step/waterbar - fill could be delivered via nearby Perimeter Fire Trail), with stone-lined invert “one pace” (at least 600mm) upslope of new step (cut extended outlet channel to NE to allow for open discharge and prevent backflow onot track).

Monitor muddy area below 2 existing steps, (may need to rock armour/flagging if still muddy after stone-lined invert is installed upslope).

Cut/level 2 treads into sloped rock pavement on N side of tributary.

(Medium – for sustainability/impact issues[to prevent sediment inflow to tributary)

Site ID: **CCT – 6(H)**

Location: 336744 6262643 Scored timber step, drainage flows and eroded around E end and flows down track.

Works:

Replace with extended waterbar/step.

(low)

Site ID: **CCT – 6(I)**

Location: 336747 6262642 Scored timber sleeper step, full of sediment and failed, with drainage flows around ends and flows over, scoured to 350mm over step then entrenched track 300-150mm below NSL for 2m deep

Works:

Replace with extended waterbar/step.

Step-and-run 1m below new waterbar/step and fill/compact behind (fill could be delivered via nearby Perimeter Fire Trail).

(low)

Site ID: **CCT – 6(J)**

Location: 336754 6262645 Scored timber sleeper steps/waterbars (x 2), both full of sediment and failed, flows over upper step and around end of lower step. Downslope to retaining roots forming a step in compacted sand/clay, then gutter to 300mm below NSL for 2m to sculpted rock outcrops (near Perimeter Fire trail junction), with track widening on N side to avoid.

Works:

Clean-out upper step/waterbar.

Replace or extend lower step/waterbar, and clean-out.

Build 2 steps onto scultped rock outcrop (at end of gutter) and fill/compact to level of adjacent track and over roots back to step/waterbar (box low side if necessary for containment).

Pull-in track width with edge definition and containment/barrier (rock rubble).

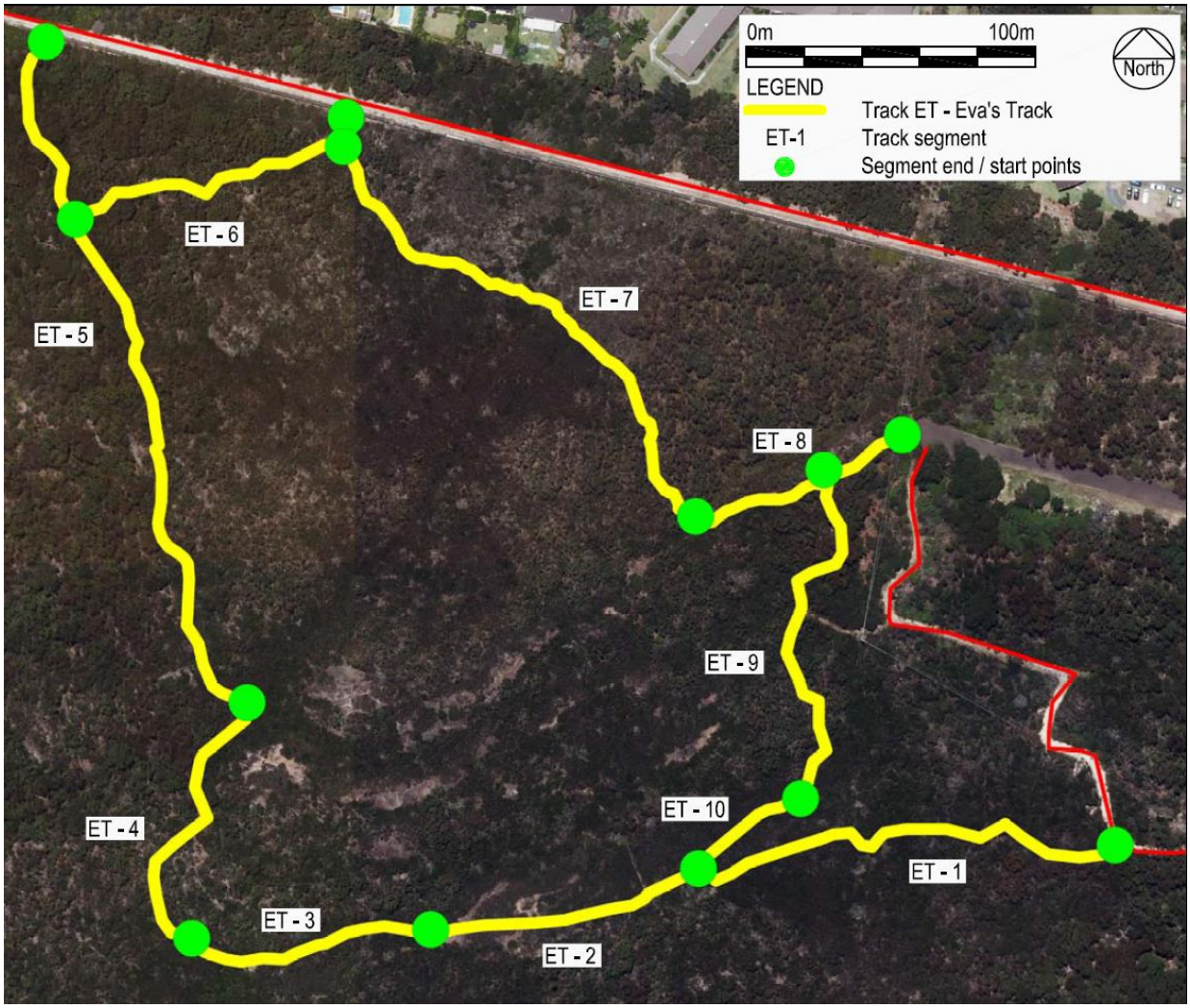
(low)

Site ID: **Trackhead at Perimeter Fire Trail (S end of Curl Curl Track)**

Location: 336759 6262645 Junction of Curl Curl Track and Perimeter Fire Trail / Shared Path (and N trackhead of Park Circuit Track (West) opposite). New signage/directional totem – identifies Mountain Bike Circuit (and Fire Trail) and Park Circuit Track (West) to S, but no identification or orientation information for Curl Curl Track. Drainage and loose sand out onto Perimeter Fire Trail. Potential for walkers exiting Curl Curl Track to encounter high-speed (downhill) mountain bikers on Perimeter Fire Trail / Shared Path

	Works: Additional identification or orientation signage/information for Curl Curl Track. Mountain bike caution/warning sign on Curl Curl Track just prior to junction. **(Medium)**

EVA'S TRACK - SEGMENTS 1 to 10



SEGMENT EVA'S TRACK - 1

SEGMENT: ET - 1	
Start Point: 337261 6262903 **(junction with North-western Fire Trail)**	**End Point: 337118 6262895** **(junction with ET - 2 to W, and ET - 10 to E)**

General Description and Condition: Well-defined but lower standard track (160m approx.) gently winding across and up/down a gentle/gentle-moderate slope, with frequent wet/ponded and seepage areas for long periods after rain, and several guttered/eroded sections. Through Banksia and Casuarina heath, burnt and fallen for much of segment. Accesses main Eva's Track "loop" at W end via a T junction (ET-2 to W and ET-10 to E). Poor condition on lower/E half, and fair condition on upper/W half.

Tread Width (mm): Typically 600-1,200mm, but track widening and ponding or wet area avoidance common (especially on lower/E section) to 2,000mm wide.

Track Surface: Compacted sand and sandy/clay with frequent rock outcrops and sections of track along rock ledges, benched into side slope up to 250mm in places, windrows on downslope track edge are common resulting in ponding and track widening/avoidance, considerable drainage capture and flows down track including extensive intercepted seepage from upslope side of track (track acts as "catch drain", and sub-surface flows also "pushed" to surface by shallow rock shelves and pavements) for long periods after rain, guttering to 700mm below NSL in places.

Gradient (degrees): Ranges from undulating at <1° gradient to 3-4° gradient mostly, short sections 6-7° gradient.

Alignment: Gently winding across and up/down slope.

Terrain: Mid to upper hillslope, break in slope at rock ledge at W end of segment.

Soil: Lambert (Erosional) undulating to rolling low hills on Hawkesbury Sandstone.

Vegetation: Sandstone Heath.

Track Works and Improvements: 2 large placed stone steps at W end (at junction with ET-2 to W and ET-10 to E).

Signs and Wayfinding: Eastern end (junction with North-western Fire Trail) - small routered timber identification and wayfinding sign (good/fair condition – damaged), but arrow points SE down fire trail not along track, and post with "walkers" pictogram (good condition). Western end (junction with ET-2 to W and ET-10 to E) - 2 small routered timber identification

and wayfinding signs (1 in good condition, 1 in fair/poor condition – previously burnt). Single metal directional arrow on rock ledge halfway along segment.

User Experience: Relatively easy walking, but compromised by very wet areas and less attractive due to current burnt/degraded condition of surrounding vegetation.

Key Issues: Drainage and seepage capture with wet areas for long periods after rain, track widening/braiding to avoid wet areas, excluding bikes/mountain bikes, guttering/erosion on short steeper sections, potential for slippery areas on rock ledges.

Recommended Works – Overall

- Open windrows to minimise drainage capture/ponding.
- Maintenance and cleaning of drainage treatments.
- Continued bikes/mountain bikes exclusion enforcement (consider stile or "kissing gate" at suitable "defensible" site early in segment).
- Upgrade signage - at E end (junction with fire trail) and W end (junction with ET-2 to W and ET-10 to E) - as per Manly Dam Sign Location Plan.
- Monitor for need for additional drainage protection, waterbars or stepping stones if track section are still wet/muddy.
- Monitoring and responsive management for track widening especially at ponding areas and other obstacles/challenges.
- Monitoring of slip/fall hazard due to seepage and wet/slippery track surface, responsive management (additional drainage) as required.

Recommended Works – Site-specific (Priority)

Site ID: **ET – 1(A), and eastern end of segment**

Location: 337261 6262903 Junction with North-western Fire Trail

Works:

Install rollover drain across start of track (at junction, along edge of fire trail) to prevent drainage inflows from upslope section off fire trail to NW.

(low)

Site ID: **ET – 1(B)**

Location: 337238 6262899 Deep central gutter, 400-500mm wide eroded to 600-7000mm below NSL, in sandy/clay track and exposed rock shelves and flat outcrops, drainage capture and considerable flows down, track widening around/past gutter.

Works:

Stone-lined invert below upper rock outcrop, with excavated discharge channel to allow free outflows. Add waterbar downslope of invert for added drainage protection/security.

Fill gutter to NSL for approx. 6 m (fill can be delivered to site from nearby fire trail, 25m to E) and compact, box edges for containment (with regular "wings" to prevent/divert flows down/around sides). Build 2 boxed steps off lower end to existing track level.

Pull-in track width with edge definition and containment/barrier (rock rubble).

Open windrows on low side of site, on flatter section of track E to fire trail.

(Medium - for passability and sustainability/impact issues)

Site ID: **ET – 1(C)**

Location: 337232 6262905 Wide eroded track to 300mm below NSL for full width 1,200-1,600mm wide, eroded to rock pavement/outcrop, with eroded "plunge pool;" off lower side of outcrop, obstructed by fallen shrubs/debris, drainage capture (including from rock ledge/outcrop off/beside track upslope) and considerable flows down, to 200-300mm deep, 6° gradient, track widening/detour formed on inside/S of track (upslope to bend) above.

Works:

Long waterbar just below bend 3-4m upslope of site, extend/excavate outlet to discharge well off track and avoid backflows.

Long waterbar on upslope side of site, tied onto rock ledge/outcrop on high side, extend/excavate outlet to discharge well off track and avoid backflows.

Build 2 step-and-runs above central rock outcrop, filled and compacted treads with rock armour/flagging for extra stability (if required), step off lower end onto rock outcrop.

Fill eroded plunge pool and track below central rock outcrop, box edges for containment and build 2 boxed steps off lower end to existing track level, filled and compacted treads with rock armour/flagging for extra stability (if required), tie onto outcrop at upslope end.

Include regular "wings" on all boxed runs/treads and steps to prevent/divert flows down/around sides.

Pull-in track width with edge definition and containment/barrier (rock rubble).

(Fill can be delivered to site from nearby fire trail, to E.)

(Medium - for sustainability/impact issues, including to divert surface flow and protect sites/treatments downslope at site ET – 1(B), and passability issues)

Site ID: **ET – 1(D)**

Location: 337223 6262910 Wide muddy track above bend, with drainage run-on from upslope track and seepage from adjacent rock shelf upslope, 1° gradient.

Works:

Long waterbar, extend/excavate outlet to discharge well off track.

Pull-in and define/contain track edges (branch barrier bundles – using lots of dead/fallen shrubs available in surrounding area).

(Medium - for sustainability/impact issues, including to divert surface flow and protect treatments downslope at site ET – 1(C))

Site ID: **ET – 1(E)**

Location: 337218 6262909 Flat rock outcrop with drainage run-on from upslope track and intercepted seepage from upslope side of track (track acts as "catch drain", and sub-surface flows also "pushed" to surface by shallow rock shelves and pavements).

Works:

Cut broad shallow invert/spoon drain across rock outcrop and reinforce with low built rock waterbar onto outcrop on downslope side, extend/excavate outlet to discharge well off track.

(Medium - for passability issues)

Site ID: **ET – 1(F)**

Location: 337170 6262905 Large rounded/rough rock outcrops with central gap/channel with drainage flows down, low rock ledge upslope above, 7° gradient overall.

Works:

Rock armour /flagging on upper sand flat and build single rock step off/onto low rock ledge above.

Block head of channel on upper sand flat on SW side (below rock ledge), with low rock waterbar built onto high side of outcrop below). Open windrow on low side, and excavate discharge channel to allow free outflows (if required).

Reinforce in-situ gap across rock outcrop in SW, with low built rock waterbar on downslope side and built onto higher outcrop on NW side.

Rock infill and level gap/channel between lower outcrops, with rock step off and armoured/flagged tread below.

(Medium - for passability and sustainability/impact issues)

Site ID: **ET – 1(G)**

Location: 337137 6262899 Angled edge of low rock ledge, with gap/channel along high side, 900-1,100 mm wide, former track runs along base of ledge but wet/seepage and blocked (closed ?) by small fallen branches, angled ledge is current “used” alignment.

Works:

Cut/level rock ledge on approaches to central (most angled/sloped) section of ledge, especially in E.

Widen tread along top of central (most angled/sloped) section by stripping back vegetation on high side to expose rock pavement, and infill/level gap/channel.

Block/barrier former, disused, alignment below ledge.

(low – and monitor for slip hazard and possible need to increase to medium priority works)

Site ID: **ET – 1(H)**

Location: 337122 6262894 Compacted sand/clay below/downslope of track junction at rock ledges, above bend to E, slightly dished with drainage flows down from rock ledges above.

Works:

Waterbar, 2.5m below track junction (rock ledges) and above bend to E, discharging to SW.

(Medium - to divert surface flow and protect sites/treatments downslope on ET – 1)

Site ID: **W end of Segment**

Location: 337118 6262895 Rounded rock ledge at junction with ET-2 to W, and ET-10 to E. Large placed stone steps on E side but main "used" alignment cuts corner to W to step 500-600mm up onto split rock ledge and bench, ponding below and 2 routered timber signs.

Works:

Extend stone steps for at another 1m wide to W to widen junction with rock ledge, rock armour/flagging tread (ponding area) off/below all steps.

Pull-in track width with edge definition and containment/barrier (rock rubble) to define T junction", mainly on W side.

(low)

SEGMENT EVA'S TRACK - 2

SEGMENT: ET - 2	
Start Point: 337118 6262895 (junction with ET-1 to SE, and ET-10 to E)	**End Point: 337026 6262874**

General Description and Condition: Well-defined and easy walking track, mostly along rock "pavement", along contour across slope following the lower edge of a low rock ledge/shelf (95m approx.), through burnt Banksia and Casuarina heath for majority of segment. At E end connected to both ET-1 to SE and to ET-10 to E. Good condition.

Tread Width (mm): 600-1,200mm (undefined over wide rock shelf towards W end).

Track Surface: Rolling rock ledge for E two-thirds, section of compacted sand and gravels in W half, and wide rolling rock outcrop at W end.

Gradient (degrees): Flat to gently undulating, generally <1° gradient.

Alignment: Largely straight along edge of low rock ledge/shelf.

Terrain: Mid to upper hillslope, segment aligned along break in slope at rock ledge.

Soil: Lambert (Erosional) undulating to rolling low hills on Hawkesbury Sandstone for majority of track in E, grading into Hawkesbury (Colluvial) rugged rolling to very steep hills on Hawkesbury Sandstone in W end.

Vegetation: Sandstone Heath.

Track Works and Improvements: Nil.

Signs and Wayfinding: 2 small routered timber identification and wayfinding signs at E end (junction with ET-2 to W and ET-10 to E) – see Segment ET - 1 above. Single metal directional arrow on rock shelf at towards W end.

User Experience: Easy walking on rock "pavement" along edge of low rock shelf/ledge, but mostly surrounded by unattractive currently burnt/degraded vegetation.

Key Issues: Excluding bikes/mountain bikes, potential for slippery drainage/seepage areas on edge of rock shelf/ledge.

Recommended Works – Overall

- Continued bikes/mountain bikes exclusion enforcement.
- Upgrade signage - at E end (junction with ET-2 to W and ET-10 to E) - as per Manly Dam Sign Location Plan.
- Monitoring of slip/fall hazard due to seepage and wet/slippery track surface, responsive management (additional drainage) as required.

Recommended Works – Site-specific (Priority)

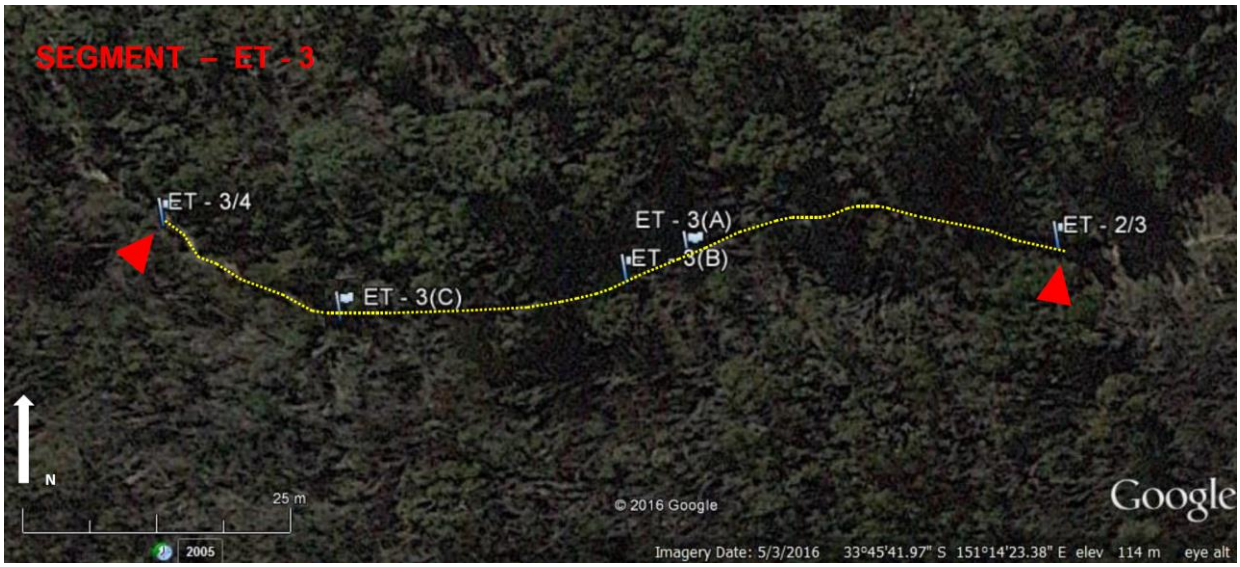
Site ID: **E end of Segment**

Location: 337118 6262895

Works:

See Segment ET - 1 above.

SEGMENT EVA'S TRACK - 3



SEGMENT: ET - 3	
Start Point: 337026 6262874	**End Point: 336944 6262871**

General Description and Condition: Short (85m approx.) section of well-defined track undulating across slope, through mixed heath and low open woodland long contour, erosion of steeper section and large run-on sediment deposition area at W end. Fair condition overall.

Tread Width (mm): 400-600mm at E end, 600-1,200mm at W end.

Track Surface: Compacted sand and sand/clay, slightly dished to 50mm over most of segment with erosion gutters on gentle/moderate slopes section where drainage (and seepage) is more concentrated, some laterite gravels on higher areas and large area of sediment on lower section at W end, occasional embedded rock (mainly in E) and flat rock outcrops (mainly in W).

Gradient (degrees): Undulating across slope, mostly 1-3° gradient, short section at 7° gradient.

Alignment: Gently winding across slope.

Terrain: Mid to upper hillslope, higher in E to lower in W.

Soil: Hawkesbury (Colluvial) rugged rolling to very steep hills on Hawkesbury Sandstone.

Vegetation: Sandstone Heath, enters Bloodwood-Scribbly Gum Woodland at far W end.

Track Works and Improvements: Nil.

Signs and Wayfinding: Nil.

User Experience: Easy walking through mixed vegetation.

Key Issues: Drainage and seepage capture, sediment deposition and overflow into adjacent bushland.



Recommended Works – Overall

- Open windrows to minimise drainage capture/ponding.
- Maintenance and cleaning of drainage treatments.
- Continued bikes/mountain bikes exclusion enforcement.

Recommended Works – Site-specific (Priority)

Site ID: **ET – 3(A)**

Location: 336992 6262871 Compacted sand and laterite gravels with squared gutter 200-300mm deep on 7° gradient slope.

Works:

Waterbar at head of gutter.

Waterbar/step, 1.5-2m below upper waterbar, with infilled and compacted tread.

(low)

Site ID: **ET – 3(B)**

Location: 336987 6262868 Wide gutter eroding into 7° gradient clay/sand slope, eroded to 400mm below NSL.

Works:

Waterbar at head of gutter to catch/divert flows, extend/excavate outlet to ensure outflow.

Infill gutter (for at least 2m) and compact to adjacent track level (NSL), retain fill at lower end with 2 boxed steps (or boxed step-and run midway if slope dictates), fill could be sourced from large deposition area downslope at Site ET – 39(C).

Open windrow on low side edge of track downslope.

(Medium - for sustainability/impact issues - to divert surface flow and prevent erosion, and sediment source, for large deposition area downslope at Site ET – 3(C))

Site ID: **ET – 3(C)**

Location: 336961 6262863 Low point and large sand/sediment deposition area, from erosion off adjacent upslope sites to E and NW (Site ET - 3(B) to NE and Site ET - 4(A) to NW), extends 16m along track 800-1,200mm wide. Sediment spilling off low side of track 5m into surrounding bushland (arrowed).

Works:

Deny sediment source by works at adjacent upslope sites to NE and NE – see Site ET - 3(B) and Site ET - 4(A).

Sediment could be used as a source of fill for track treatments at adjacent/nearby sites.

SEGMENT EVA'S TRACK - 4

SEGMENT: ET - 4	
Start Point: 336944 6262871	**End Point: 336963 6262952**

General Description and Condition: Short (120m approx.) section of rocky and deeply eroded track up/down hillslope with a gentle/moderate gradient overall, through low open Eucalypt woodland with burnt/dead understorey on lower slope and dead tall Banksia/Casuarina heath on upper section. Poor condition.

Tread Width (mm): 600-1,800mm, track widening around obstacles is very common.

Track Surface: Mix of compacted sand/clay, embedded rock, rock outcrops or ledges, and areas of loose/depositional sand. Deeply eroded in many places, especially on sections directly up/down steeper slopes (ET-4(A) and ET- 4(D), to 700mm below NSL, with continued drainage capture and substantial flows down track.

Gradient (degrees): Mostly gentle/moderate slopes at 6-8° gradient.

Alignment: Sharply up/down a gentle/moderate rocky hillslope.

Terrain: Transition from mid to upper hillslope.

Soil: Hawkesbury (Colluvial) rugged rolling to very steep hills on Hawkesbury Sandstone for most of section, enters Lambert (Erosional) undulating to rolling low hills on Hawkesbury Sandstone at upper/N end.

Vegetation: Bloodwood-Scribbly Gum Woodland on lower/S half, Sandstone Heath on upper/N half.

Track Works and Improvements: Several failed log waterbars and waterbars/steps – mainly on upper section in and ET- 4(C), all failed (full of sediment, flows over and scouring, end erosion/flows and track widening, displaced - and some older burnt treatments).

Signs and Wayfinding: Nil

User Experience: Relatively easy climb or decent, but care required on rocky sections, and less appealing due to eroded/wet section, loose sands and damaged track works.

Key Issues: Drainage (and seepage) capture and on-going erosion/guttering, damaged and non-functional track works, alignment almost directly up/down slope, track widening/braiding to avoid gutters or wet areas and damaged infrastructure, excluding bikes/mountain bikes.



Recommended Works – Overall

- Open windrows to minimise drainage capture/ponding.
- Remove protruding roots.
- Maintenance and cleaning of drainage treatments.
- Monitor for need for additional drainage protection, waterbars or rock armour/flagging.
- Monitoring and responsive management for track widening especially at track treatments and obstacles/challenges, and install edge definition and containment/barriers where required.
- Continued bikes/mountain bikes exclusion enforcement.

Recommended Works – Site-specific (Priority)

Site ID: **ET – 4(A)**

Location: 336938 6262876 bottom/S
336938 6262906 top/N

40m section very gently curved up/down 8° gradient slope (with flat to gently sloped middle section), embedded rocks and rock ledges in compacted sand/clay, flanking rock outcrops beside track, occasional protruding roots, 600-1,800mm wide, drainage capture and flows down, eroded to 400mm below NSL on upper and lower steeper sections and 50mm on middle flat, 1 log waterbar on lower section full/failed with flows over, loose depositional sands over rock outcrops/pavement on lower slope.

Works:

Waterbar above upper rock ledge/outcrop.

Cut channel into bench on upper rock ledge and extend to NW/W to discharge well off track (rock waterbar built onto ledge as an alternative, or as an addition to reinforce cut channel, if not an unacceptable trip hazard).

"Catch" waterbar off base, W side, of upper rock ledge - with "natural" step to E.

(Upper 2 waterbars are important treatments to divert flows from slope/treatments below.)

2 rock steps built off in-situ outcrops with boxed/edge tread, filled and compacted, above to level over roots and rocks.

Stone-lined invert, or waterbar, above rock ledge and "natural" step.

2 waterbars on middle flatter section, built onto pavement/outcrops (and/or reinforce natural channels).

2 rock steps built off in-situ outcrops with boxed/edge tread, filled and compacted, above to level over roots and rocks.

Stone-lined invert, or waterbar, on compacted sand/clay bench below steps

2-3 step-and runs with filled/compacted treads, boxed edges for containment, and with regular "wings" to prevent/divert flows down/around sides.

Replace failed waterbar.

2 step-and runs with filled/compacted treads, boxed edges for containment, below.

Pull-in track width where needed, with edge

	definition and containment/barrier (rock rubble). **(Medium - for sustainability/impact issues - to divert surface flow and prevent erosion, and sediment source, for large deposition area downslope at Site ET – 3(C) to SE)**
	***Site ID:*** **ET – 4(B)** *Location:* 336948 6262915 Bend with considerable drainage down wide track of compacted sand and loose rocks, some embedded rock and pavement below. *Works:* Waterbar on bend, with extended outlet to discharge well off track and avoid backflow to track downslope. **(Medium - to divert surface flow and protect sites/treatments downslope at ET – 4(A))**
	***Site ID:*** **ET – 4(C)** *Location:* 336946 6262920 Compacted sand 1,100mm wide with central "V" shaped shallow gutter and considerable drainage down (from Site ET - 4(D) upslope). *Works:* Waterbar, with extended outlet to discharge well off track.
	***Site ID:*** **ET – 4(D)** *Location:* 336947 6262928 bottom/SW 336962 6262953 top/NE \ (and segment junction) 33m section of deeply eroded track up/down 6-7° gradient slope, compacted sand on lower half (including loose/deposited sands) and compacted sand/clay and rock outcrops on upper half, drainage capture and considerable flows downs (with some ponding in scour pools), central gutter 300-700mm deep within wider deeply dished track 900-1,800mm wide, 3 sets of failed log waterbars and steps (upper, middle and lower) full/failed and some also burnt/replaced most with flows/scour over), upper set of steps previously boxed, step 500mm up onto rock ledge at top of site, incised track also intercepts seepage (especially at top).

Works:

Throughout - use in-situ benches/risers around failed waterbars/steps, and in-situ rocks in middle section, as basis for replacement/upgraded treatments.

Rock step, built onto rear of upper rock ledge, and compacted/filled tread upslope back to track level with boxed/edged for containment, and waterbar above.

Wide rock step built off upper rock ledge, with stone-lined invert on bench below (also serves as armoured tread) with extended outlet to discharge well off track.

Stone-lined invert or waterbar on bench above step-and runs, with extended outlet to discharge well off track (if needed).

2-3 step-and runs with filled/compacted treads, boxed edges for containment, and with regular “wings” to prevent/divert flows down/around sides.

Replace failed treatments with 4 step-and runs (900mm overall drop) with filled/compacted and rock armoured/flagging treads, boxed edges for containment, with regular “wings” to prevent/divert flows down/around sides and upper step enlarged as waterbar (or separate waterbar set back upslope above).

Build rock waterbar onto upslope edge of rock outcrop, with extended outlet to discharge well off track.

Backfill head of gutter and build 3 rock steps (boxed edges for containment if required) with rock armoured treads, rock armour/flagging off lower step.

Replace failed treatments with 3 wide step-and runs with filled and compacted treads, boxed edges for containment, with regular "wings" to prevent/divert flows down/around sides and upper step enlarged as waterbar (or separate waterbar set back upslope above), with excacated discharge channel to match NSL and allow free outflows.

Waterbar/step at bottom end of site, and backfill/level to roots above.

Throughout - pull-in track width with edge definition and containment/barrier (rock rubble) where required - especially on lower section and where widened around failed treatments and obstacles,

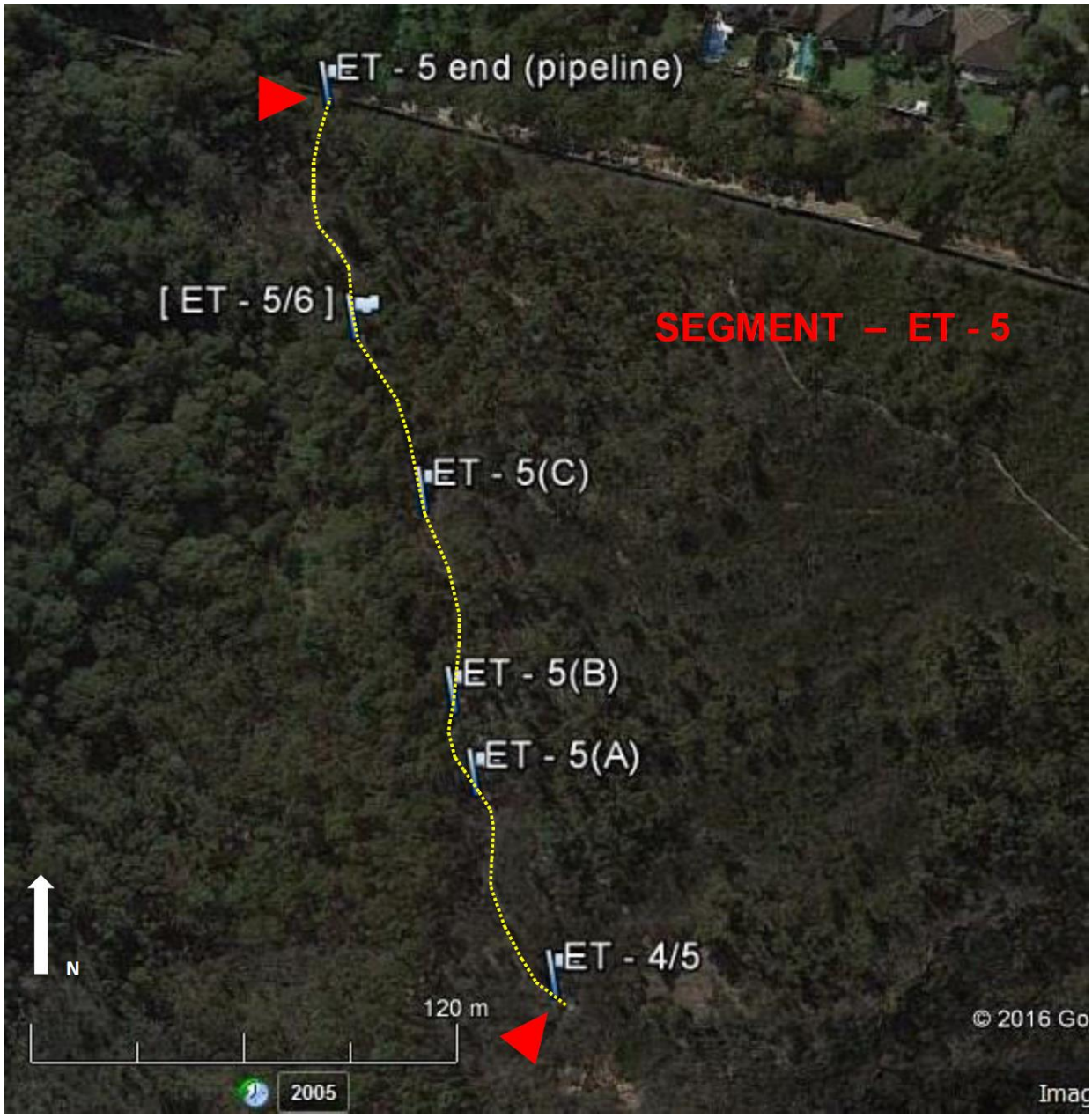
Fill for track treatments could be sourced from deposition area on track downslope of this site.

Note: An alternative approach to treatment of this site would be to close and rehabilitate this entire section of track and establish a new alignment to the W (contoured into slope with one or more sweeping switchbacks and drainage protection) to re-join this alignment below the upper rock ledge.

(HIGH - for both passability issues and sustainability/impact issues)

(Monitor tread and benches/flats for need for additional rock armour/flagging)

SEGMENT EVA'S TRACK - 5



SEGMENT: ET - 5	
Start Point: 336963 6262952	**End Point: 336894 6263179 (S side of pipeline)**
General Description and Condition: Long section of well-defined track (290m approx.) across and around slope, mostly undulating along contour on gentle gradients, through tall heath (mostly burnt/dead) and occasional Eucalypts for most part with open Eucalypt forest in N. Junction in N end with link track (ET – 6), at 336904 6263118, connecting to N arm of Eva's Track loop. Good condition (overall). *Tread Width (mm):* 600-1,000mm, occasional wider sections at rock ledges/obstacles. *Track Surface:* Compacted sand with occasional laterite gravels, often dished or benched into upslope side to 50-100mm, drainage capture in places and considerable seepage from	

upslope, regular ponding and cross-track seepage, frequent sections of rock pavements and angled rock outcrops, occasional "natural" rock steps, and occasional roots/stumps.

Gradient (degrees): Predominantly gently undulating track, flat to 4° gradient, few short steeper sections (to 10° gradient) at rock outcrops.

Alignment: Gently curving across/around slope, largely along contour with occasional dips or slopes.

Terrain: Upper hillslope and bench.

Soil: Lambert (Erosional) undulating to rolling low hills on Hawkesbury Sandstone.

Vegetation: Sandstone Heath at S end, but mostly Bloodwood-Scribbly Gum Woodland.

Track Works and Improvements: Occasional sleeper steps (and small piles of old/discarded sleepers beside track at N end of segment).

Signs and Wayfinding: Log post with 2 pictograms ("walkers" and "no bikes") (good condition) but no track identification and orientation information at N trackhead/entry. Small paired routered timber identification and wayfinding signs at T-junction with ET – 6 (very poor condition, unserviceable – burnt, missing posts and grafittied).

User Experience: Easy walking across slope with views N into forested valley in N end, but current condition of vegetation in S is unappealing.

Key Issues: Drainage and seepage capture, ponding and track widening/avoidance, access at N end via crawl/crouch under pipeline and lack of signposting/identification at N trackhead (on either side of pipeline), excluding bikes/mountain bikes entry from pipeline service track.

Recommended Works – Overall

- Open windrows to minimise drainage and seepage capture/ponding.
- Upgrade signage - at N trackhead/entry and junction with ET – 6 - as per Manly Dam Sign Location Plan.
- Continued bikes/mountain bikes exclusion enforcement (consider stile or "kissing gate" at suitable "defensible" site early in segment).
- Maintenance and cleaning of drainage treatments.
- Remove protruding roots.
- Relocate/re-use old/discarded sleepers beside track at N end of segment.

Recommended Works – Site-specific (Priority)

Site ID: **ET - 5(A)**

Location: 336942 6263002 900mm wide sandy/clay track eroded to 75mm below NSL with flows down track, and outcropping rocks.

Works:

Waterbar at head of slope/erosion.

Build rock step on in-situ outcrop, and fill/compact above.

(low)

Site ID: **ET - 5(B)**

Location: 336935 6263022 3 sleeper steps and track edging (good condition) below, then steep faced rock outcrop 400-500mm high face (covering 90% of track) with gap to tree on downslope side, sloped rock outcrop 400mm high (covering 90% of track) with tree and small "natural" step on downslope side, compacted and loose sand and tree roots, 10° gradient overall.

Works:

Build rock step onto lower rock outcrop, rock infill and level gap on lower outcrop (to match adjacent step and rock outcrop).

Stone-lined invert on bench between rock outcrops, remove protruding roots.

Build rock step onto upper rock outcrop, squaring-off crumbling lower edge of outcrop.

Stone-lined invert on bench above upper rock outcrop, with extended outlet to avoid backflows down outcrops.

(low)

Site ID: **ET - 5(C)**

Location: 336925 6263073 1,000mm wide dished track with seepage form hillslope and upslope rock pavement and sloped outcrops.

Works:

Waterbar, built onto in-situ rock.

(low)

Site ID: **Junction of ET - 5 and ET - 6**

Location: 336904 6263118 T-junction with small paired routered timber identification and wayfinding signs (very poor condition, unserviceable – burnt, missing posts and grafittied).

Works:

See Segment ET - 6 below.

Site ID: **N end of Segment (at pipeline)**

Location: 336894 6263179 Trackhead on S side of pipeline (access via crawl/crouch under pipeline), log post with 2 pictograms (“walkers” and “no bikes”) but no track identification and orientation information, sleeper step.

Works:

Upgrade signage as per Manly Dam Sign Location Plan, including Park identification and regulatory signage.

(Medium)

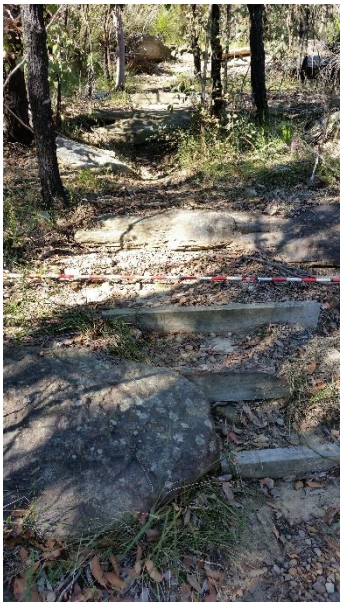
SEGMENT EVA'S TRACK - 6

SEGMENT: ET - 6	
Start Point: 336904 6263118 (junction with ET - 5)	**End Point: 336996 6263143 (junction with ET - 7)**
General Description and Condition: Reasonably well-defined, but less frequently maintained, short (120m approx.) section of track sharply up/down a gentle to gentle/moderate rocky slope between the W and E arms of the Eva's Track "loop" (between ET – 5 in the W, and ET – 7 in the E) – used as an alternative to the pipeline service access – through open Eucalypt woodland. Fair condition. *Tread Width (mm):* Mostly 400-800mm wide, some sections to 1,300mm on rocky slopes. *Track Surface:* Compacted sand, slightly dished in places, with some laterite gravel and embedded rock, occasional larger rock outcrops and ledges, more embedded rocks and gravels on upper/E section, drainage capture and flows downs track but areas of erosion and guttering only on steeper slopes in middle section (timber waterbars/steps limit erosion elsewhere, even where full/failed). *Gradient (degrees):* Gentle/moderate slope in lower/W (5-9° gradient) and upper/E (9° gradient) sections, with moderate slope (14° gradient) in middle section. *Alignment:* Slightly curving up/down rocky hillslope. *Terrain:* Upper hillslope. *Soil:* Lambert (Erosional) undulating to rolling low hills on Hawkesbury Sandstone. *Vegetation:* Bloodwood-Scribbly Gum Woodland. *Track Works and Improvements:* 15 timber sleeper waterbars/steps and waterbars, all full of sediment and failed with flows over but only limited downside scouring, some older log waterbars/steps most burnt/unserviceable (and some log treatments located off track - former alignment ?).	

Signs and Wayfinding: Small paired routered timber identification and wayfinding signs at T-junction with Segment ET – 5 in W (very poor condition, unserviceable – burnt, missing posts and grafittied). No identification or orientation/wayfinding signage at junction with ET – 7 in E.

User Experience: Relatively easy up or down slope walking, as an alternative to exiting onto the pipeline service access to "link" the N ends of Eva's Track.

Key Issues: Track status is unclear (not shown on all available "Tracks & Trails" maps of the park), excluding bikes/mountain bikes, drainage capture and erosion, loose rocky slopes.


Recommended Works – Overall

- Retain, and manage/maintain, as formal part of the track network, as a link in the N section of Eva's Track (and clarify/harmonise visitor information mapping).
- Upgrade signage at W junction with ET – 5 (as per Manly Dam Sign Location Plan) and E junction with ET – 7.
- Clean out existing waterbars and waterbars/steps.
- Continued bikes/mountain bikes exclusion enforcement (in conjunction with possible stile or "kissing gate" at suitable "defensible" sites at the N end of Segments ET – 5 and ET – 7 to prevent bike entry off the pipeline service access).
- Maintenance and cleaning of drainage treatments.
- Monitor for need for additional drainage protection requirements, and monitoring and responsive management for track widening.
- Also see "Entire Segment" recommended works bellow.

Recommended Works – Site-specific (Priority)

Site ID: **Entire segment**

Location: Entire segment, principally more gentle/moderate sloped sections in W/lower and E/upper.

Works:

Replace burnt/failed waterbars/steps (approx. 2 over whole segment).

Extend or block (with embedded rock) existing timber waterbars or waterbars/steps, to catch flows and minimise erosion around ends (approx. 4 over whole segment).

Additional timber waterbars at 10m spacings on in W/lower and E/upper sections (approx. 4 extra on upper/E section and 2 extra on lower/W section), build onto in-situ rock outcrops where possible.

(low)

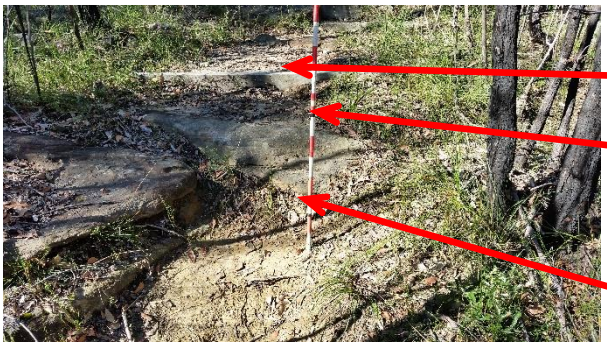
Site ID: **Junction with ET – 5 (W end of segment)**

Location: 336904 6263118 T-junction with Segment ET – 5, with small paired routered timber identification and wayfinding signs (very poor condition, unserviceable – burnt, missing posts and grafittied).

Works:

Replace/upgrade signage as per Manly Dam Sign Location Plan.

(Medium)



Site ID: **ET – 6(A)**

Location: 336928 6263132 Sloped rock outcrop 500mm high.

Works:

Clean out existing sleeper waterbar upslope above.

Stone-lined invert immediately above outcrop, and build rock waterbar on S side of outcrop extending to S as waterbar to discharge well off track.

Build rock step onto sloped rock outcrop.

(low)

Site ID: **ET – 6(B)**

Location: 336936 6263131 Angled and sloped rock ledge 800mm off with drainage over and scoured track below, embedded boulder to N side of track.

Works:

Build rock step onto rock ledge, and cut level upper tread on ledge (if still required after step constructed).

Infill scour as step-and-run built onto embedded boulder with rock step off end (and boxed lower/S edge for containment, if required) and rock armour/flagging tread, include invert/dip on tread surface to discharge to S (cut outlet channel to discharge well off track).

(low)

Site ID: **ET – 6(C)**

Location: 336945 6263128 Rubbly loose rocky slope, with occasional outcrops and embedded rock, between boulders and rock ledges, existing sleeper waterbars/steps above and below site.

Works:

4 step-and runs built onto in-situ outcrops where possible, with filled/compacted and rock armoured/flagging treads, boxed edges for containment, and with regular “wings” to prevent/divert flows down/around sides. Extended middle tread between 2 upper and 2 lower steps and include invert/dip on tread surface to discharge to S.

Pull-in track width with edge definition and containment/barrier (rock rubble).

Clean out existing sleeper waterbars/steps.

(Medium - for passability issues)

Site ID: **ET – 6(D)**

Location: 336952 6263129 Angled rock outcrop/ledge with erosion gutter to 300mm below NSL angled across track, drainage capture and flows down from rock pavement and track upslope.

Works:

Stone lined invert between rock ledges/gutter and upslope pavement.

Extend in-situ outcrop as single rock step, infill/compact above (with boxed edge for containment, if required) with rock armour/flagging matching back to stone-lined invert.

Rock infill and level gutter, build onto and match adjacent rock outcrop, with rock step off lower end and armour/flagging tread off/below step.

(Medium - for both passability issues and sustainability/impact issues)

Site ID: **Junction with ET – 7 (E end of segment)**

Location: 336996 6263143 Slightly angled T-junction with Segment ET – 7, slightly dished compacted sand and loose stones track 700-900mm wide with drainage down from N to S track (ET – 7) above, no identification or orientation/wayfinding signage.

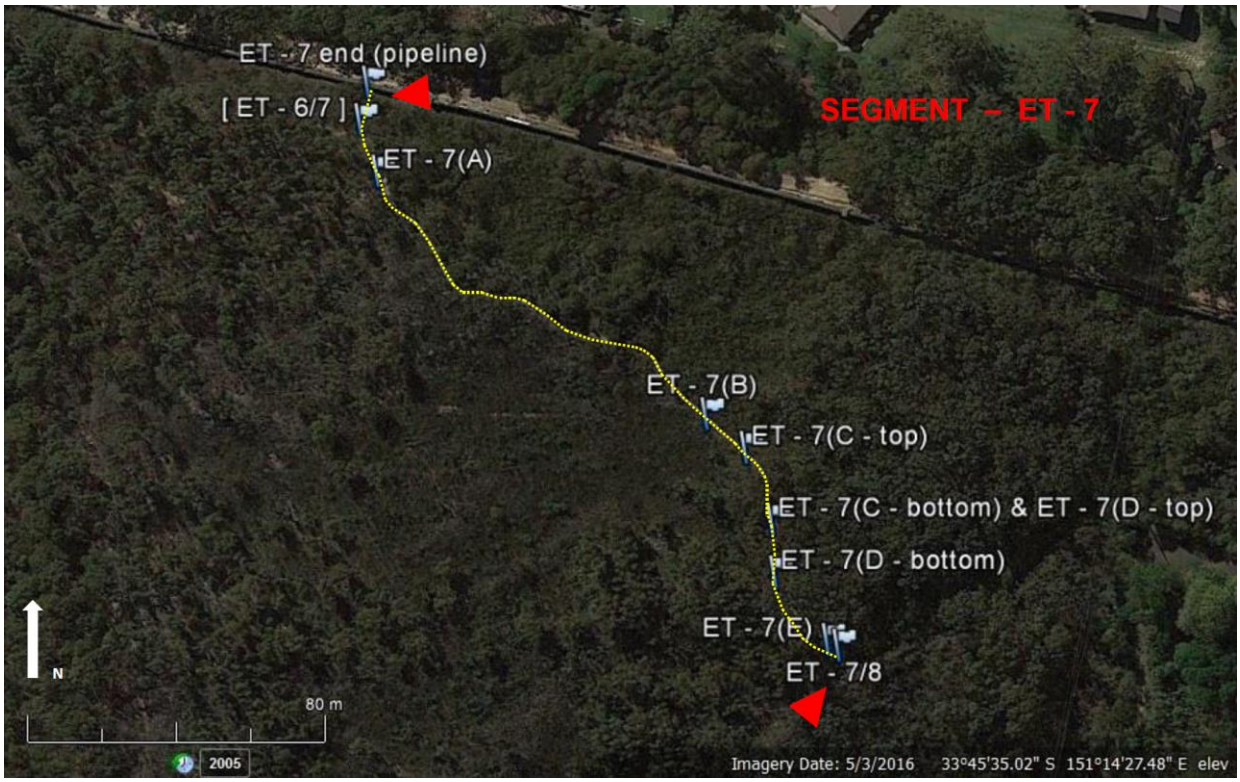
Works:

Low-key identification and orientation or wayfinding signage, and “no bikes” regulatory signage.

Waterbar 2-3m downslope of junction to divert captured flows off track ET – 7 upslope.

(Medium)

SEGMENT EVA'S TRACK - 7



SEGMENT: ET - 7	
Start Point: 336997 6263153 **(S side of pipeline)**	**End Point: 337117 6263016**

General Description and Condition: Extended section (215m approx.) of well-defined track over flat ridgeline/hilltop with gentle/moderate slopes at each end, through low heath across the ridgeline and Eucalypt woodland on slopes at each end. Good condition.

Tread Width (mm): Mostly 400-800mm, to 1,500mm on rocky slopes and at track widening/detouring around obstructions (including bypassing waterbars), and 2 locations of braided track at SE end.

Track Surface: Mostly compacted sand, some laterite gravels and areas of loose sand, dished track surface and some flows down track with scouring on sloped sections (especially at SE end), frequent roots at SE end, occasional and rock outcrops (mainly at NW end).

Gradient (degrees): Mostly flat to 2-3° gradient across ridgeline/hilltop, gentle/moderate slopes at each end (4-10° gradients in NW, and 5-7° gradients in SE).

Alignment: Straight to gently curving across ridgeline/hilltop and winding across/up-down slopes at each end.

Terrain: Hill top and wide ridge/bench.

Soil: Lambert (Erosional) undulating to rolling low hills on Hawkesbury Sandstone.

Vegetation: Mostly Sandstone Heath for NW two-thirds, enters Bloodwood-Scribbly Gum Woodland at NW end (past burnt area to SW of track).

Track Works and Improvements: Occasional log waterbars, mainly on slope at SE end, all full/failed, some burnt and non-functional, some bypassed or located on dis-used or detoured track sections.

Signs and Wayfinding: Log post with “no bikes” pictogram (good condition) (but no Park identification or track identification and orientation/wayfinding signage) at N trackhead/entry. No signs at T-junction with Segment ET – 6. Directional arrows on old post (x1) and trees.

User Experience: Easy walking across ridge/hill top, good views to City skyline from NW end of ridge/hill top.

Key Issues: Track widening/detouring around waterbars, drainage capture and erosion, excluding bikes/mountain bikes.

Recommended Works – Overall

- Upgrade signage at N trackhead/entry, and install signage at junction with ET – 6.
- Clean out existing waterbars and waterbars/steps (where serviceable).
- Continued bikes/mountain bikes exclusion enforcement (possible stile or “kissing gate” at suitable “defensible” sites at the N end of segment to prevent bike entry off the pipeline service access).
- Maintenance and cleaning of drainage treatments.
- Monitoring and responsive management for track widening.

Recommended Works – Site-specific (Priority)

Site ID: **N end of Segment (at pipeline)**

Location: 336997 6263153 Trackhead on S side of pipeline midway up hill (access via crawl/crouch under pipe), log post with “no bikes” pictogram (good condition), dis-used/discarded timber sleepers beside track. No Park identification, or track name and orientation/wayfinding, signs.

Works:

Park identification and regulatory signage.

Track identification and orientation or wayfinding signage.

Relocate/re-use old/discarded sleepers.

(Medium)

Site ID: **Junction with ET – 6**

Location: 336996 6263143 Slightly angled T-junction with Segment ET – 6 (to downslope/W), no identification or orientation/wayfinding signage.

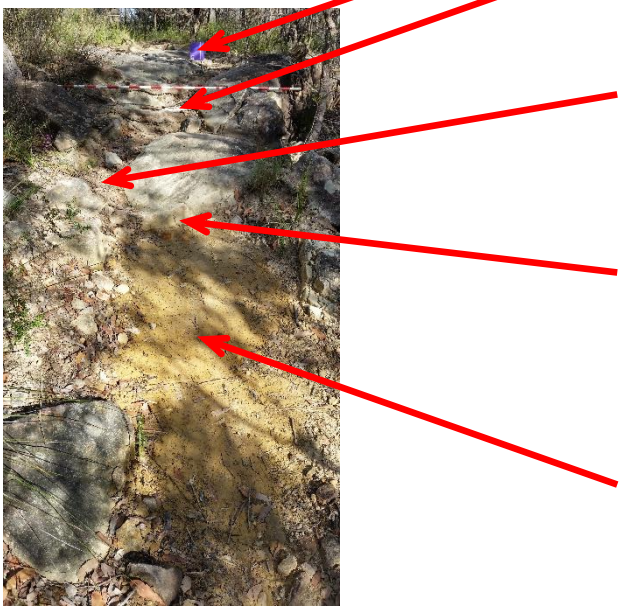
Works:

See Segment ET - 6 above.

Site ID: **ET – 7(A)**

Location: 337002 6263130 Compacted sand/clay and stoney track below/downslope with large rock outcrop, then broken rock outcrop and embedded rocks with large Banksia roots and uneven steps to 300mm, rock ledge flanks W side of track, and uneven rock pavement above/upslope, 7-10° gradient, drainage capture and flows down with erosion to 300mm below NSL.

Works:



Build rock waterbar on upper pavement.

2 boxed rock steps below broken rock edge and Banksia roots, infill/compact above (with edge containment) and rock armour tread back to meet upper rock pavement.

Infill, level and rock armour/flagging channel beside large rock outcrop, build onto outcrop and flanking embedded rocks, rock step off lower end if required, cut level tread on outcrop to match.

Stone-lined invert off lower edge of large rock outcrop, move embedded rocks adjacent to low/W side of track to allow outflow and construct outflow channel if required (removed rocks can be re-used for stonework at this site).

2 boxed rock steps at downslope end of site, with extended (2m) tread above running back to meet stone-lined invert below large rock outcrop (tread filled and compacted, with boxed/edges built onto adjacent in-situ embedded rocks if required).

Pull-in track width with edge definition and containment/barrier (rock rubble), where required after treatments installed.

(low)

Site ID: **ET – 7(B)**

Location: 337085 6263072 Old log waterbar/step, bypassed with track widening.

Works:

Replace or extend waterbar/step, and clean out.

Block/disguise widening track (with branch barrier bundles) and rehabilitate.

(low)

Site ID: **ET – 7(C)**

Location: 337094 6263064 top/NW
337100 6263047 bottom/S

20m section of deeply dished track, to 150mm below NSL, in compacted sand with considerable flows down track, 7° gradient, multiple eroding “knick points” and roots retaining track surface, 600-900mm wide, 4 log waterbars (2 burnt out and 2 failed/full, lowest waterbar on slope has 300mm drop off).

Works:

Extend 2 in-situ (functional) waterbars, and clean out.

Build timber step and backfill/compact below lower (functional) waterbar.

Replace 2 burnt (non-functional) waterbars. 2 new waterbars, spaced between burnt (non-functional) waterbars.

(low)

Site ID: **ET – 7(D)**

Location: 337100 6263047 top/N

337102 6263034 bottom/S

15m section of braided/dual track, older alignment to W (partly revegetated) and current "in-use" alignment to E on 7° gradient slope, "in-use" alignment is 400-600mm wide with dished surface in compacted sand 50-150mm below NSL with flows down and continuing scour, roots retaining track surface, 2 log waterbars on old alignment to W.

Works:

Close, disguise and rehabilitate old alignment to W.

Install 3 waterbars on new alignment (relocate/reuse log waterbars already on site).

(low)

Site ID: **ET – 7(E)**

Location: 337115 6263017 2 failed/full log waterbars with track widened/detoured past ends, short steep scoured sand/clay slope (slippery) below lower waterbar onto rock pavement below, drainage capture and considerable flows down track and ponding at lower end.

Works:

Replace/reinstate waterbars.

Close/block widened/detoured track and disguise (such as with branch barrier bundles), and rehabilitate – avoid impacting in-situ Grass Trees.

3 boxed rock steps on lower sand/clay slope (below waterbar) with rock armoured treads, pull-in and contain/barrier (rock rubble) adjacent widened/detoured track.

(Medium - for both passability issues and sustainability/impact issues)

SEGMENT EVA'S TRACK - 8

SEGMENT: ET - 8	
Start Point: 337117 6263016	**End Point: 337188 6263044 (trackhead at end of private road)**

General Description and Condition: Short section (85m approx.) of well-defined track along low rock ledge or on contour across hillside at break in slope, occasional wet area mainly in W, through pockets of low open Eucalypt woodland with low heath upslope and mixed tall heath with Eucalypts downslope. Junction with ET – 9 (downslope) midway, and trackhead/entry at E end (at end of private road). Good/fair condition.

Tread Width (mm): 600-900mm.

Track Surface: Predominantly uneven rock pavement along low ledge in W (to junction with ET – 9) with pockets of compacted sand in hollows and frequent flows/seepage across rock ledge and ponding areas, then mostly compacted sand in E slightly dished in places. Minor section of dual/braided track near centre of segment.

Gradient (degrees): Flat or very gently undulating/uneven to gentle slopes (2-3° gradients).

Alignment: Along contour across/around slope, along low rock ledge at break in slope in W.

Terrain: Mid to upper hill slope.

Soil: Lambert (Erosional) undulating to rolling low hills on Hawkesbury Sandstone.

Vegetation: Sandstone Heath in W half and Bloodwood-Scribbly Gum Woodland in E half, with are of unmapped/disturbed vegetation at E end.

Track Works and Improvements: Rough concrete dish drain at E trackhead/entry.

Signs and Wayfinding: Small routered timber identification and wayfinding sign (old, fair condition) at T-junction with Segment ET – 9. Log post with "walker" and "no bikes" pictograms but post dislodged (poor condition – damaged) at E trackhead/entry from private road - but Park identification, or track name and orientation/wayfinding, signage.

User Experience: Easy walking across slope on rock pavement and along contour, potential confusion at E trackhead/entry where track exits to private road (signposted as "EXIT" on signage at junction with ET – 9).

Key Issues: Drainage/seepage capture and ponding, track braiding to avoid wet areas, potential for slippery areas on rock ledges, excluding bikes/mountain bikes.

Recommended Works – Overall

- Upgrade signage at junction with ET – 9 and at E trackhead/entry, as per Manly Dam Sign Location Plan.
- Clarify public access/transit status along private road at E trackhead/entry.
- Continued bikes/mountain bikes exclusion enforcement (possible stile or "kissing gate" at suitable "defensible" sites at the E end of segment to prevent bike entry off private road).
- Maintenance and cleaning of drainage treatments.
- Open windrows to minimise drainage capture/ponding.
- Monitoring of slip/fall hazard due to seepage and wet/slippery track surface, responsive management (additional drainage) as required.
- Monitoring and responsive management for track widening.

Recommended Works – Site-specific (Priority)

Site ID: **ET – 8(A)**

Location: 337149 6263024 10m section of dual/braided track, high/N alignment on dished compacted sand with seepage, low/S alignment along edge of low rock ledge/shelf with intercepted seepage and frequent ponding.

Works:

Close/block and disguise low/S alignment.

Rock waterbar (or broad cut channel) at E end of site, across both alignments, on rock ledge/pavement and discharging to SE over ledge.

(Medium - for sustainability/impact issues, and to divert flows to protect downslope treatments at ET – 8(B))

Site ID: **ET – 8(B)**

Location: 337156 6263027 600mm drop off rounded rock ledge with flows/seepage over edge.

Works:

Build 2 rock steps off edge of ledge, boxed/contained on low side and built into continuation of ledge on high side – armour treads, and tread off lowest step, to protect against continued flows/seepage over steps.

Close/block and disguise continuation of ledge to E (on high/N side) no used as alternative alignment to junction with ET- 9.

(Medium - for passability issues)

Site ID: **Junction with ET – 9**

Location: 337161 6263032 T-junction with Segment ET – 9 (off rock ledge downslope/W), small routered timber identification and wayfinding sign (old, fair condition).

Works:

See Segment ET - 9 below.

Site ID: **ET – 8(C) and trackhead/entry**

Location: 337188 6263044 Short slopes of compacted sand, embedded rock and loose stone and rubble down to rough concrete dish drain, flows down both slopes, steeper/higher E bank also receives run-off from adjacent private road and is more deeply dished also with scouring off end of road pavement and protruding roots. Log post with "walker" and "no bikes" pictograms at entry to track from private road, but post dislodged (poor condition – damaged). No Park identification, or track name and orientation/wayfinding, signs.

Works:

Repair existing trackhead signage.

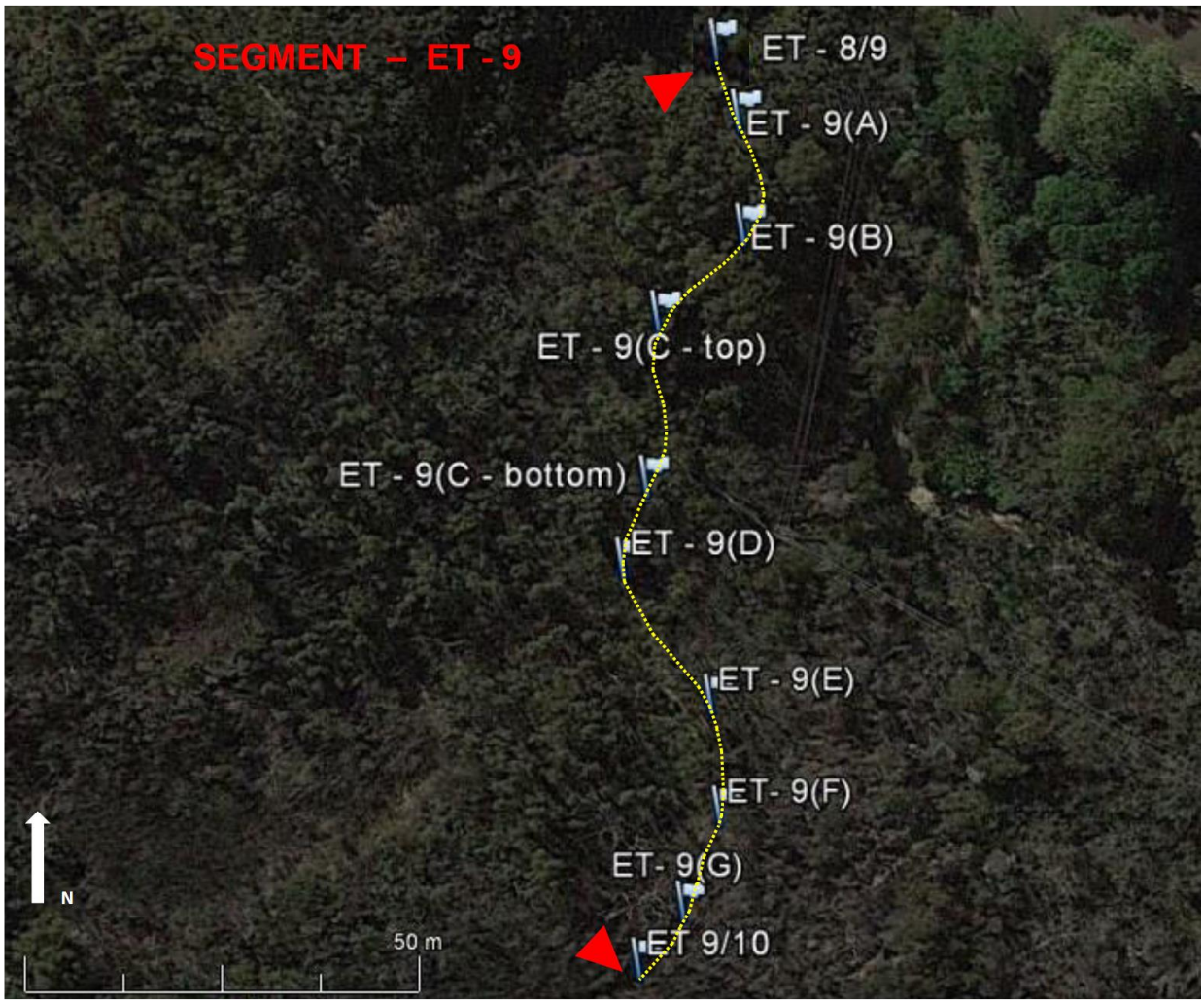
3 rock steps, with boxed edges and armoured treads (to protect against continued flows from road), on E bank from road to concrete drain and contain/barrier track (rock rubble) to prevent step avoidance and widening.

Build rock step onto in-situ embedded rock on W side of concrete drain.

Upgrade signage as per Manly Dam Sign Location Plan.

(low – not a trackhead/entry accessible to the general public)

SEGMENT EVA'S TRACK - 9



SEGMENT: ET - 9	
Start Point: 337161 6263032	**End Point: 337153 6262920**
General Description and Condition: Steeper section of track (140m approx.) winding abruptly up/down hillslope mostly with a gentle/moderate or moderate grade, upper two-thirds is a rocky slope with regular rock ledges and outcrop areas while lower third is slippery clay/sand on a more gentle/moderate sloped bench, drainage capture and erosion are common throughout, runs through low open Eucalypt woodland with open shrub understorey at upper end and recently burnt areas of tall heath at lower end. Trample track connecting E-W to fire trail at bottom of upper rocky slope section. Poor condition overall. *Tread Width (mm):* 600-1,800mm, wider sections are typically on/over rocky slopes and at obstacles, short section of dual/split track on lower end. *Track Surface:* Rocky outcrops and ledges with intervening compacted sands with drainage capture and localised erosion/guttering and ponding on upper two-thirds, compacted clay/sand and areas of loose sand on lower third with drainage capture and considerable flows down track plus deep guttering/erosion and ponding, slippery when damp.	

Gradient (degrees): Mostly gentle/moderate (6-8° gradients) to moderate (9-10° gradients) abruptly up/down contour overall, some short sections of more gentle slopes (3° gradient) along or across contour.

Alignment: Winding abruptly up/down moderate rocky slope with minor sections across/along small benches on upper two-thirds, and gently curved but also aligned sharply up/down gentle/moderate slope on lower third.

Terrain: Midslope.

Soil: Lambert (Erosional) undulating to rolling low hills on Hawkesbury Sandstone.

Vegetation: Predominantly Bloodwood-Scribbly Gum Woodland, with minor intervening areas of Sandstone Heath.

Track Works and Improvements: Single log waterbar at upper end and 1 placed rock step on rocky ledge (and minor old remains of possible former track treatments).

Signs and Wayfinding: Small routered timber identification and wayfinding sign (old, fair condition) at T-junction with Segment ET – 8. Metal directional arrow on large sloping rounded rock outcrop/boulder in upper third. No wayfinding at junction with informal trample track to fire trail, below Site ET – 9(C).

User Experience: Relatively easy climb or decent, but care required on rocky areas in upper section and eroded slippery areas on lower section, and less appealing due to eroded/wet sections as well as currently burnt flanking vegetation.

Key Issues: Drainage (and seepage) capture and on-going erosion/guttering, alignment almost directly up/down slope in several places, track widening/braiding to avoid gutters or wet areas and other obstacles, excluding bikes/mountain bikes, wayfinding at junction with trample track to fire trail.

Recommended Works – Overall

- Upgrade signage at junction with ET – 8 as per Manly Dam Sign Location Plan, and install low-key wayfinding at junction with trample track to fire trail.
- Open windrows to minimise drainage capture/ponding.
- Maintenance and cleaning of drainage treatments.
- Remove protruding roots.
- Monitor for need for additional drainage protection, waterbars or rock armour/flagging.
- Monitoring and responsive management for track widening especially at track treatments and obstacles/challenges, and install edge definition and containment/barriers where required.
- Continued bikes/mountain bikes exclusion enforcement.

Recommended Works – Site-specific (Priority)

Site ID: **Junction with ET – 8**

Location: 337161 6263032 400mm high rock ledge and track widened to 1,800mm at T-junction with Segment ET – 8 (along top of rock ledge), wide compacted sand track below with drainage off ledge, small routered timber identification and wayfinding sign (old, fair condition).

Works:

Install wide rock step on low side of ledge, and rock armour/flagging tread (possible wet/ponding area) off/below step.

Pull-in track width with edge definition and containment/barrier (rock rubble) to define T junction and prevent widening ("fishtailing").

Upgrade signage as per Manly Dam Sign Location Plan.

(Medium)

Site ID: **ET – 9(A)**

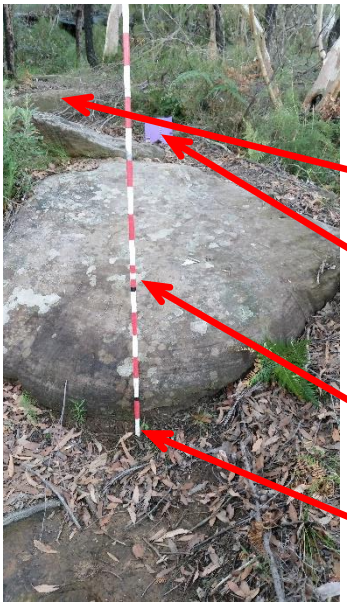
Location: 337164 6263026 Log waterbar/step, full/failed with flows over.

Works:

Reinstate/replace existing waterbar/step and extend outlet to discharge well off track.

Additional waterbar 2-2.5m downslope, with extended outlet to discharge well off track.

(low)



Site ID: **ET – 9(B)**

Location: 337164 6263012 10-12m track section curved up/down slope over rock ledge and outcrops/boulders, 8° gradient overall. Low squared rock ledge, 400mm high, at upslope end. Then track runs along upslope side of angled rock outcrop/boulder with drainage flows down track. Large sloping rounded rock outcrop/boulder downslope (with metal directional arrow). Sloped compacted sand track with drainage flows down, and exposed roots and embedded rocks, for 4-5m at bottom of site below rounded rock outcrop/boulder.

Works:

Build rock step off upper squared rock ledge with edge containment/barrier (rock rubble) to prevent avoidance (or cut single step into rock, and may not require avoidance barrier).

Build rock waterbar off lower end of angled rock outcrop/boulder, with extended outlet to discharge well off track and prevent backflow.

Cut 2 level treads into large sloping rounded rock outcrop/boulder.

Build rock step off bottom edge of lower rounded boulder, with track edge definition and containment/barrier (rock rubble) to direct walkers onto step/treads up/down boulder and prevent avoidance/detouring.

Build 2 rock steps onto in-situ embedded rocks (box low side to retain), with extended (3m) filled/compacted tread above over roots (edged on low side for containment).

Waterbar (or stone-lined invert) at upslope end of tread.

(Medium - for passability issues)

Site ID: **ET – 9(C)**

Location: 337154 6263001 top/N

337152 6262980 bottom/S

22m section of track curving up/down rocky slope in broad "S" bend, 9° gradient overall but some short steeper sections – large (5m long) widened ponded area at upslope end (with drainage run-on from upslope track and seepage, retained by rock shelf/outcrop) then long (17m) run of rounded and sloped/angled rock outcrops and embedded rocks with minor areas of compacted sand, larger ledges and rocks in upper section (500mm face on upper rock ledge with placed rock step) and smaller or more varied in lower section (with several "natural" steps), drainage capture and flows down (but rockiness limits guttering), several protruding roots (from adjacent Banksia) in upper section. Wire rope stay from power pole (sited E of track) anchored to rock in centre of track at lower end of site. Trample track links SE and E to fire trail (via power pole), from lower end of rock slope, also discharge route for drainage from this site. Rounded rock outcrops in compacted sand at low end of site.

Works:

Waterbar upslope of ponding/boggy area – to divert inflows.

Open low side windrow for length of ponding/boggy area, and profile track surface to angle cross-slope (to ensure flows off track), pull in track width.

Upper rock shelf/outcrop:

- cut 2 level treads in upper slope;
- cut catch drain along upper/W side to catch drainage/seepage and divert to waterbar; and
- build rock waterbar across outcrop.

Cut step into upper rock ledge.

Build rock step onto small rock ledge, and raise/fill track upslope over roots (edged on low side for containment) with rock armoured/flagged tread (to protect against continued surface flows), extend back to upper rock ledge.

Rock armour/flagging to infill/level track surface between embedded rock and outcrops.

Build rock waterbar onto in-situ outcrop (discharge to SE, with extended outlet to

discharge well off track and prevent backflow if required).

Rock armour/flagging to infill/level track surface between embedded rocks, and/or to reinforce “natural” steps – where required.

Install marker post at power pole stay wire pole – to highlight as trip hazard.

Set infill rock onto outcrop on downslope side of stay wire anchor point to square off as step (levelled to adjacent in-situ rocks).

Open/reinforce gap between outcrops, to “catch” and redirect surface flow, and rock armour/flagging for protection.

Build rock waterbar off high side of lower rock outcrop, discharging to SE.

Build rock step off lower side of rock outcrop, below waterbar, and match to rock outcrop, rock armour tread off step.

(Medium - for passability issues - and monitor for need for additional drainage works, adequacy of “natural” steps and track widening/avoidance)

Site ID: **Trample track to fire trail via power pole**

Location: 337152 6262984
W end, at Eva’s Track
337185 6262982
e end, at fire trail

Well-used trample track, and drainage/discharge line, E from Eva’s Track linking though to fire trail (at bend), widens at E end as service access to power pole, wet boggy dip in centre of link.

Site ID: **ET – 9(D)**

Location: 337150 6262970 Clay/sandy track, retaining roots at top and dual/split track on slope with ponding at bottom, 1,200mm wide, drainage capture and flows down, ongoing erosion, slippery when wet.

Works:

Waterbar above to catch/divert flows, discharging to E.

Waterbar upslope of main eroded slope to catch/divert flows, discharging to E.

3 step-and runs with filled/compacted treads, boxed edges for containment, and with regular "wings" to prevent/divert flows down/around sides. Pull-in track width, disguise/rehabilitate and block/barrier (such as with rock rubble) redundant track.

(Medium - for both passability issues and sustainability/impact issues)

Site ID: **ET – 9(E)**

Location: 337160 6262952 Compacted clay/sand 1,00mm wide on bend, drainage capture and sheet flows down track.

Works:

Waterbar on bend.

(low)

Site ID: **ET – 9(F)**

Location: 337162 6262938 Slope of deposited/loose sand and buried stones/rocks with central gutter 600mm wide eroded 200-300mm below NSL, 2 knick points, or "cascades", into eroded plunge pools, area of loose/depositional sand on bend downslope below.

Works:

Waterbar above to catch/divert flows, discharging to E.

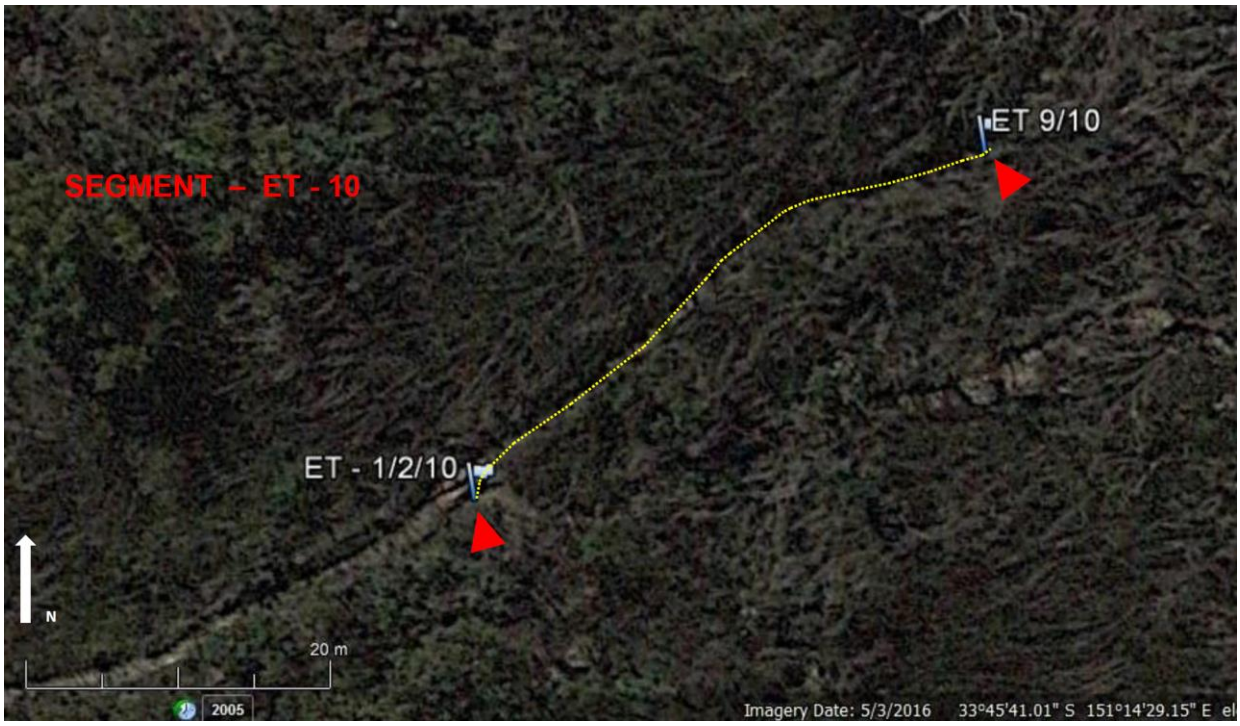
2 boxed steps on upper erosion slope.

1-2 boxed steps on lower erosion slope, with infilled/compacted tread above (extending upslope back to upper steps, and infilling upper plunge pool) boxed for edge containment) with "wings" to prevent/divert flows down/around sides.

Short boxed step-and-run below lower plunge pool.

	Pull-in track width, disguise/rehabilitate and block/barrier (such as with rock rubble) redundant track surface. Waterbar on bend below (to divert flows and protect treatments at downslope site ET – 9(G). **(Medium - for both passability issues and sustainability/impact issues – and monitor for need for rock armouring/flagging on extended treads, if drainage issues persist and compaction is problematic)**
	***Site ID:*** **ET – 9(G)** *Location:* 337157 6262925 Steep 700mm high slope eroding into a lobe of clay and stones onto exposed rock outcrop/pavement below, eroded to 400mm below NSL, drainage capture and considerable flows down, remains of galvanised pipe (former waterbar/step ?). *Works:* Waterbar above to catch/divert flows, discharging to S. 4 rock steps on erosion slope, anchored onto rock pavement below. Open low side windrow below steps, to allow free drainage off rock pavement. Disguise and stabilise/rehabilitate redundant track surface on slope, and block/barrier (such as with rock rubble) to prevent avoidance/detouring. **(Medium - for both passability issues and sustainability/impact issues)**

SEGMENT EVA'S TRACK - 10



SEGMENT: ET - 10	
Start Point: 337153 6262920	**End Point: 337118 6262895 (junction with ET- 1 to E/SE and ET- 2 to SW)**

General Description and Condition: Well-defined and easy walking track, mostly along rock "pavement", along contour across slope following the lower edge of a low rock ledge/shelf (45m approx.), through burnt Banksia and Casuarina heath for majority of segment. At W end connected to both ET - 1 to E/SE and to ET - 2 to SW. Good condition.

Tread Width (mm): 600-900mm.

Track Surface: Rounded rock ledge, rolling in places with frequent seepage across ledge and occasional ponding, a few pockets of laterite gravel, some run-on/ponding and loose stones/gravel at E end (from upslope Segment ET – 9).

Gradient (degrees): Flat to gently undulating, generally <2° gradient.

Alignment: Gently curving along edge of low rock ledge/shelf.

Terrain: Mid to upper hillslope, segment aligned along break in slope at rock ledge.

Soil: Lambert (Erosional) undulating to rolling low hills on Hawkesbury Sandstone.

Vegetation: Sandstone Heath.

Track Works and Improvements: Nil.

Signs and Wayfinding: Single metal directional arrow on rock ledge.

User Experience: Easy walking on rock "pavement" along edge of low rock shelf/ledge, but mostly surrounded by unattractive currently burnt/degraded vegetation.

Key Issues: Excluding bikes/mountain bikes, potential for slippery drainage/seepage areas on edge of rock shelf/ledge.

Recommended Works – Overall

- Continued bikes/mountain bikes exclusion enforcement.
- Upgrade signage - at W end (junction with ET – 1 to E/SE and ET – 2 to SW) - as per Manly Dam Sign Location Plan.
- Monitoring of slip/fall hazard due to seepage and wet/slippery track surface, responsive management (additional drainage) as required.

Recommended Works – Site-specific (Priority)

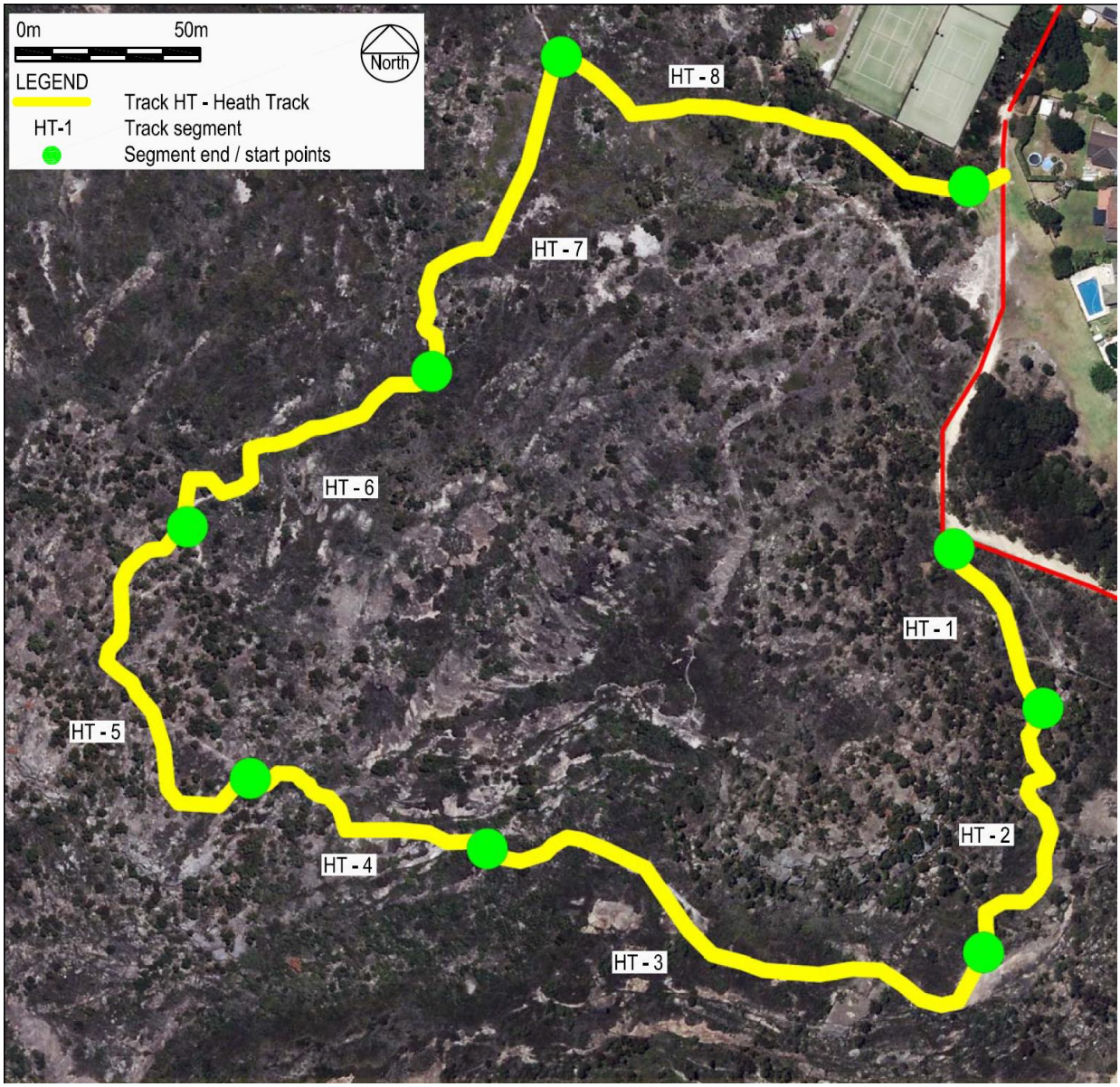
Site ID: ***W* end of Segment**

Location: 337118 6262895

Works:

See Segment ET - 1 above.

HEATH TRACK - SEGMENTS 1 to 8



SEGMENT HEATH TRACK - 1

SEGMENT: HT - 1	
Start Point: 337718 6262143 **(junction with Allambie Heights management track)**	**End Point: 337740 6262100**

General Description and Condition: A short section (55m approx.) section of wide flat to gently sloped very well-defined track on ridgetop, through heath and scattered Eucalypts (also used as a service/maintenance access to power pole). Minor sheet drainage down track (N to S) in places, and edge gutters. Good condition.

Tread Width (mm): 1,100-1,300mm cleared track surface - with maintained grass strips each side, and edge gutters in places.

Track Surface: Compacted sand, some loose sand at S end (run-on/deposition area).

Gradient (degrees): Flat to gently sloped, 0-1° gradient.

Alignment: Very gently curved.

Terrain: Hilltop, adjacent to rocky knoll/crest.

Soil: Lambert (Erosional) undulating to rolling low hills on Hawkesbury Sandstone.

Vegetation: Sandstone Heath.

Track Works and Improvements: Edge gutters in places, maintained service/maintenance access. Nil track treatments.

Signs and Wayfinding: Large routered timber identification and wayfinding sign (fair condition - vandalised/graffitied), and post with “walkers” and “no bikes” pictograms (good condition) and “Track Closed to Bikes” regulatory sign (poor condition only - vandalised/graffitied and partly illegible), at trackhead/entry off Allambie Heights management track. No wayfinding en-route.

User Experience: Easy open walking on hilltop, occasional filtered views SE to Manly and ocean at S end.

Key Issues: Signposting.

Recommended Works – Overall

- Upgrade signage (at N end, south-eastern trackhead) as per Manly Dam Sign Location Plan.
- Routine service trail maintenance.
- Open windrows at S end, and install roil-over drain at appropriate point S half (low priority, as part of routine service trail maintenance).

Recommended Works – Site-specific (Priority)

Site ID: **Segment start, south-eastern trackhead**

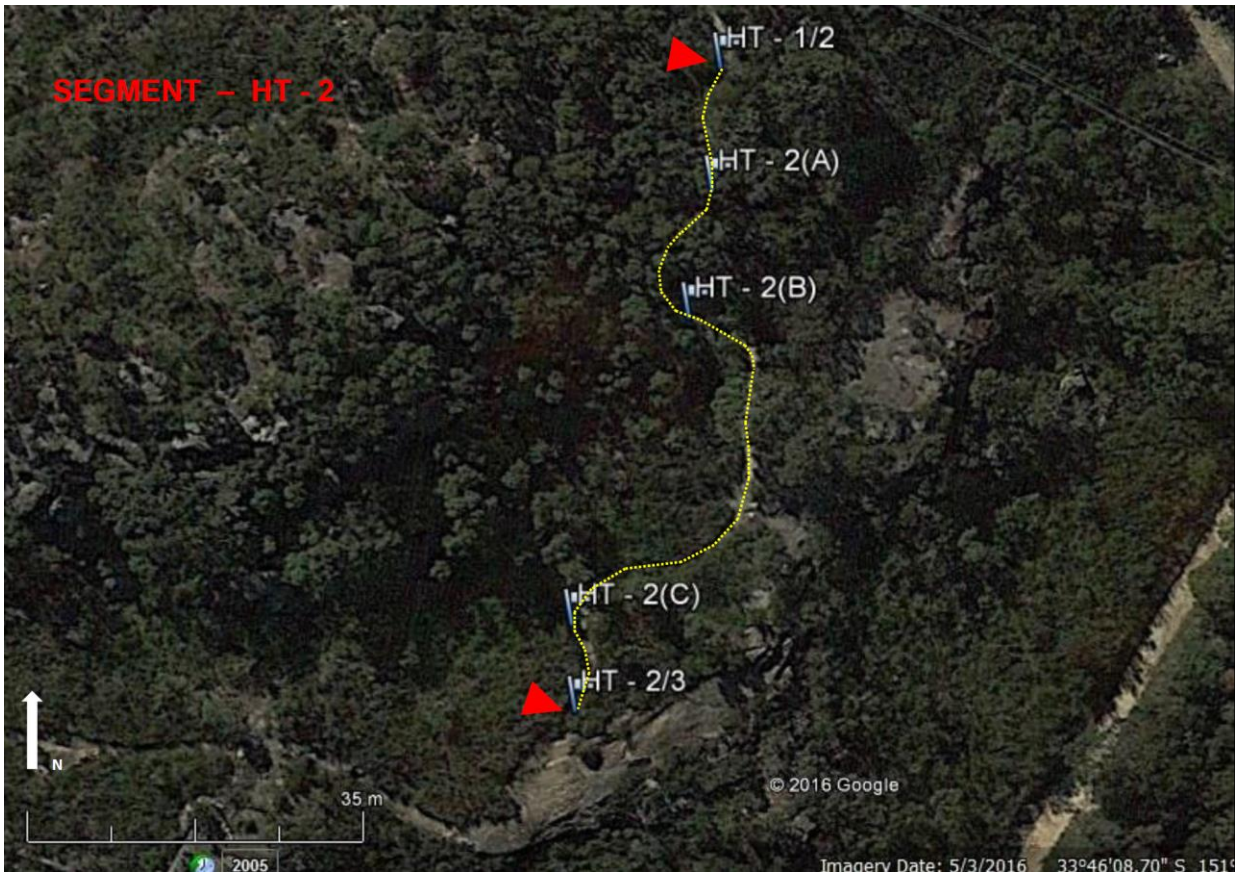
Location: 337718 6262143 Large routered timber identification and wayfinding sign (fair condition - vandalised/graffitied), and post with “walkers” and “no bikes” pictograms (good condition) and “Track Closed to Bikes” regulatory sign (poor condition only - vandalised/graffitied and partly illegible). No orientation information.

Works:

Upgrade signage – as per Manly Dam Sign Location Plan.

(Medium)

SEGMENT HEATH TRACK - 2



SEGMENT: HT - 2	
Start Point: 337740 6262100	**End Point: 337726 6262034**

General Description and Condition: 80m (approx.) section of well-defined open track undulating around the lower slope of rocky knoll/crest and over a series of rock ledges, through low open heath with scattered Eucalypts. Good condition overall, short sections up/down rocky ledges in fair condition only.

Tread Width (mm): 600-1,000mm.

Track Surface: Compacted sand, slightly dished to 50-100mm with minor seepage/drainage capture in places, occasional embedded rocks and protruding roots, rock ledges and larger rock outcrops on short steeper sections, and small areas of rock pavement.

Gradient (degrees): Mostly gentle to gentle/moderate (1-4.5°) with some flat/undulating sections, short sections over rock ledges at 8-10°.

Alignment: Curving around lower slope of rocky knoll/crest, sharper bends over rock ledges.

Terrain: Hilltop, adjacent to rocky knoll/crest.

Soil: Lambert (Erosional) undulating to rolling low hills on Hawkesbury Sandstone.

Vegetation: Sandstone Heath.

Track Works and Improvements: Nil

Signs and Wayfinding: Pair of metal arrows on rock pavement.

User Experience: Easy open walking on hilltop with good views SE to Manly, North Head and ocean in many places.

Key Issues: Excluding bikes/mountain bikes, drainage capture, erosion on short steep sections over rock ledges/outcrops.

Recommended Works – Overall

- Open windrows to minimise drainage capture/ponding.
- Monitoring and responsive management for drainage capture and erosion on short sections over rock ledges/outcrops.
- Continued bikes/mountain bikes exclusion enforcement (consider stile or "kissing gate" at suitable "defensible" site early in segment.

Recommended Works – Site-specific (Priority)

Site ID: **HT – 2(A)**

Location: 337741 6262087 Embedded rocks and tree roots at bottom of sloped rock outcrop, with drainage capture and flows down.

Works:

Infill/extend and level in-situ rock outcrops to create rock step, and fill/compact tread above to level /cover roots (with boxed edges if required for containment).

Stone-lined invert below new rock step, sloping/discharging to E.

(low)

Site ID: **HT – 2(B)**

Location: 337738 6262075 Sloped rock outcrop and large embedded protruding/rounded rocks, gutter between rocks with drainage capture and flows down, broken outcropping rock below, rock pavement with "natural" step above (before bend downslope), 13m and 8° gradient overall.

Works:

Waterbar, or stone-lined invert, above rock pavement to divert flows before site/slope.

Rock armour landing/tread below "natural" rock step off pavement.

Infill/extend and level in-situ rock outcrops to fill/block gutter, create level treads.

Cut/level rock step onto lower sloped rock outcrop, and extend with adjacent built stone step (infilling gutter), and rock armour landing/tread below.

Waterbar, built onto in-situ rock outcrop, 2.5m downslope of sloped rock outcrop (lowest step).

(low)

Site ID: **HT – 2(C)**

Location: 337726 6262043 Rock pavement above sloped curve, 10° gradient, with rock outcrops/boulders and embedded protruding/rounded rocks, compacted sand, drainage capture and flows down, 6m overall.

Works:

Stone-lined invert above rock pavement (or rock waterbar built off pavement edge) to divert flows before site/slope, extended discharge channel may be required past Banksia.

Block/infill gutter with rock and finish level and matched to adjacent outcrops.

Cut/level rock step on upper (angled) rock outcrop, and extend with adjacent built stone step (gutter infill, as above) with boxed edge on low side for containment.

Build rock step off rounded lower outcrop/boulder, with boxed edge on low side for containment, and rock armour landing/tread below.

(low)

SEGMENT HEATH TRACK - 3

SEGMENT: HT - 3	
Start Point: 337726 6262034	**End Point: 337591 6262063**

General Description and Condition: Scenic section of open track (195m approx.) along lower edge of rock ledge or low cliffline in E and across rocky slope/bench in W, open/exposed track with very good views over park and beyond, through low heath in E and low heath with occasional low eucalypts in W. Good condition (and resilient).

Tread Width (mm): 600-1,000mm, with some wider sections around obstacles (or step avoidance)

Track Surface: Mainly flat to rounded/rolling rock pavement and outcrop with some rough surfaces (but readily passable and resilient walking surface), intervening sections of compacted sand slightly dished (mainly in W), seepage from rock ledge and slope above in many places with ponding where retained by uneven rock pavement rock or windrows.

Gradient (degrees): Mostly flat to gently undulating (1-3° gradients), with some steepers sections over rounded/sloped rock outcrops (7-15° gradients).

Alignment: Gently curving, along edge of rock ledge/low cliffline in E and across rocky slope/bench in W. Majority of track is set a safe distance back from edge of rock ledge (apart from site HT -3(A) below).

Terrain: Hilltop, along rock ledge at break in slope, rocky knoll/crest upslope above.

Soil: Lambert (Erosional) undulating to rolling low hills on Hawkesbury Sandstone.

Vegetation: Sandstone Heath.

Track Works and Improvements: Nil

Signs and Wayfinding: Metal directional arrow on rock pavement in E.

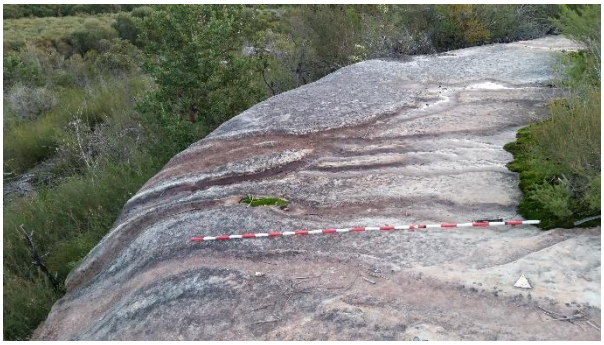
User Experience: Easy open scenic walking along rock ledge with very good views S and SE over park/dam, to Manly and North Head and ocean, and to City skyline (best views

mainly in E half) and also scenic broken cliffline upslope to S. Rock ledges/outcrops and tessellated pavement are additional features of interest.

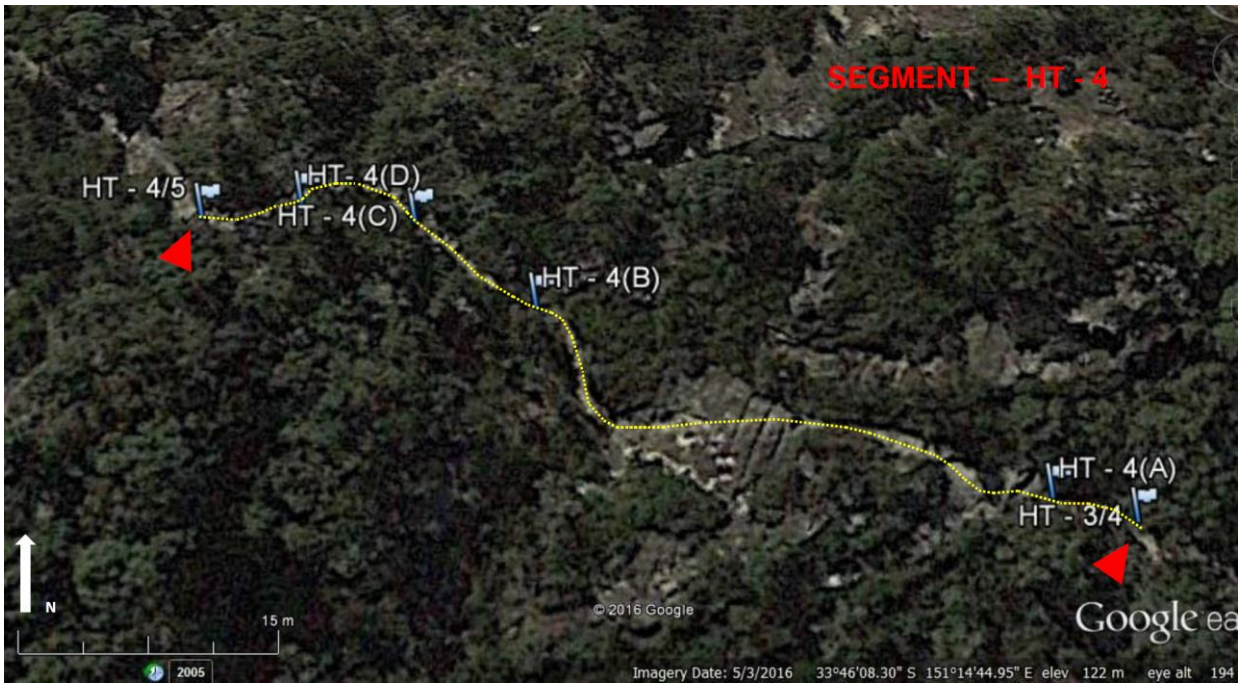
Key Issues: Walkers safety, excluding bikes/mountain bikes, seepage/drainage capture and ponding, track widening.

Recommended Works – Overall

- Open windrows to minimise seepage drainage capture and ponding.
- Monitor for track widening.
- Continued bikes/mountain bikes exclusion enforcement.

Recommended Works – Site-specific (Priority)	
	***Site ID:*** **HT – 3(A)** *Location:* 337722 6262021 Rock ledge/pavement with drainage channels (with seepage at many times) and slightly sloped uneven surface, adjacent to edge with drop of +2m, directional arrow on pavement, moss and low heath over pavement on upslope side. *Works:* Edge/fall hazard warning signs (low-key pictogram style) required on approaches from both sides. **(HIGH – safety issue)**
	***Site ID:*** **HT – 3(B)** *Location:* 337704 6262028 Abrupt rock ledge 900mm high with 2 placed rock steps/pedestals, but track widening thro0hgh step avoidance. *Works:* Build 4 rock steps onto ledge (steps at least 900mm wide) (built steps are preferred to cutting steps into rock ledge, as rock ledges/pavement are a feature of this segment). Install edge definition and containment/barrier (rock rubble) to track to prevent avoidance/widening. **(Medium – for both passability issue and sustainability/impact issues)**
	***Site ID:*** **HT – 3(C)** *Location:* 337649 6262038 Sloped rock outcrop/ledge (15° gradient) with 400mm step off bottom edge, track below benched into slope to 200mm deep on high side with ponding of flows off rock ledge. *Works:* Build 1 rock step onto base of outcrop/ledge (step at least 900mm wide) (built steps are preferred to cutting steps into rock ledge, as rock ledges/pavement are a feature of this segment). Fill and rock armour/flagging on track below/off step. Install edge definition and containment/barrier (rock rubble) to track to prevent avoidance/widening. **(low)**

SEGMENT HEATH TRACK - 4



SEGMENT: HT - 4	
Start Point: 337591 6262063	**End Point: 337528 6262081**

General Description and Condition: Short section of rocky track (75m approx.) across and up/down a gentle/moderate gradient rocky slope mainly in W (to crest) and a large area of rock pavement on lower/E section, through low mixed heath. Good condition overall, short sections up/down rocky outcrops/ledges in fair condition only.

Tread Width (mm): 600-1,200mm, with wider sections to 2,000mm around obstacles (or step avoidance)

Track Surface: Rock outcrops and embedded rocks as well as regular ledges, compacted (and some loose) sand between rocky sections, occasional protruding roots, large area of rock pavement on lower/E section, considerable drainage capture and flows down (especially at short steeper rocky outcrops/ledges).

Gradient (degrees): Undulating to gently sloped in E and gentle/moderate slope up/down rocky hillside to crest at W end, short rocky outcrops/ledges at moderate slopes (9-11° gradients).

Alignment: Gently curving on lower/E section, curving up/down rocky hillside in W.

Terrain: Upper hillslope, and ridge/crest in W.

Soil: Lambert (Erosional) undulating to rolling low hills on Hawkesbury Sandstone.

Vegetation: Sandstone Heath in lower/E end, Bloodwood-Scribbly Gum Woodland in higher/W end.

Track Works and Improvements: Nil

Signs and Wayfinding: Metal directional arrow on rock pavement.

User Experience: Relatively easy walking up/down hillside with 3 short steeper rocky sections requiring some walker care, good views SE and S (park/dam, Manly, North Head and ocean).

Key Issues: Excluding bikes/mountain bikes, drainage capture, erosion on short steep sections over rock ledges/outcrops.

Recommended Works – Overall

- Monitoring and responsive management for drainage capture and erosion on short steep sections over rock ledges/outcrops.
- Maintenance and cleaning of drainage treatments.
- Monitor for track widening, especially at steps/challenges.
- Continued bikes/mountain bikes exclusion enforcement.

Recommended Works – Site-specific (Priority)

Site ID: **HT - 4(A)**

Location: 337584 6262064 Drainage down/over rock outcrop and crumbly embedded rock, compacted sand track and rock pavement for 3m upslope to a steeply sloped rock ledge 1,200mm high and 2,400mm wide (walkers grab adjacent small Eucalypt to assist them up/down ledge, steep and slippery due to film of dry sand), low rock ledge and high "natural;" step above.

Works:

Rock step built onto in-situ rock, fill compact above step and retain/edge along downslope side.

Stone-lined invert above embedded rock.

Build wide rock step off base of sloped ledge, install edge definition and containment/barrier (rock rubble) to track to prevent alternative routes up ledge, widening and step avoidance.

Cut 4 wide steps into sloped face of ledge, above built step.

Build wide rock step off upper rock ledge.

(Medium – for passability and safety issues)

Site ID: **HT - 4(B)**

Location: 337551 6262076 Angled sloping rock outcrops and small ledges plus embedded rocks, protruding roots, drainage capture and flows down, 11° gradient overall.

Works:

Waterbar/step on lower roots/nick-point.

Build 4 rock steps onto in-situ rocks, with and armoured treads and boxed edge for containment (where required), cut/level adjacent in-situ rocks to extend step treads, and install edge containment/barrier (rock rubble) in inside of bend to prevent step avoidance and short-cutting.

Stone-lined invert above upper rock outcrop (or waterbar built onto upslope edge of in-situ outcrop).

(low)

Site ID: **HT - 4(C)**

Location: 337543 6262082 Abrupt faced rock ledge/outcrop with roots retaining ”natural” steps at base, 1,000mm high, drainage capture and flows down, embedded rock on track 1.6m below base of ledge form “natural” step (appears stable and not eroding).

Works:

Build 2 rock steps (or 1 step and 1 step-and-run) at base of outcrop and fill over roots, rock armour treads, and boxed edge on lower step if required.

Cut/level and build 3 rock step in main rock ledge above.

Install edge definition and containment/barrier (rock rubble) to track to prevent alternative routes up ledge, widening and step avoidance.

Waterbar abutting off low rock outcrop beside track 2.5m above/upslope of main rock ledge (also to catch divert flows from next site HT – 4(D) upslope).

(Medium – for both passability issue and sustainability/impact issues)

Site ID: **HT - 4(D)**

Location: 337534 6262082 Series of rock ledges/outcrops over 11m on a slope of 9° gradient, 2 large lower ledges with central channel and placed stone step below then roots retaining slope/step of compacted sands below, considerable drainage capture and flows down, upper area of large embedded ricks with rock bench/pavement above with drainage capture and flows down from pavement (track bends to N/NW on crest).

Works:

Boxed step-and-run over lower slope and roots, fill and compact tread, include “wings” to prevent/divert flows down/around sides of step.

Install edge definition and containment/barrier (rock rubble) to track to prevent step avoidance and track widening, and to align track for steps upslope.

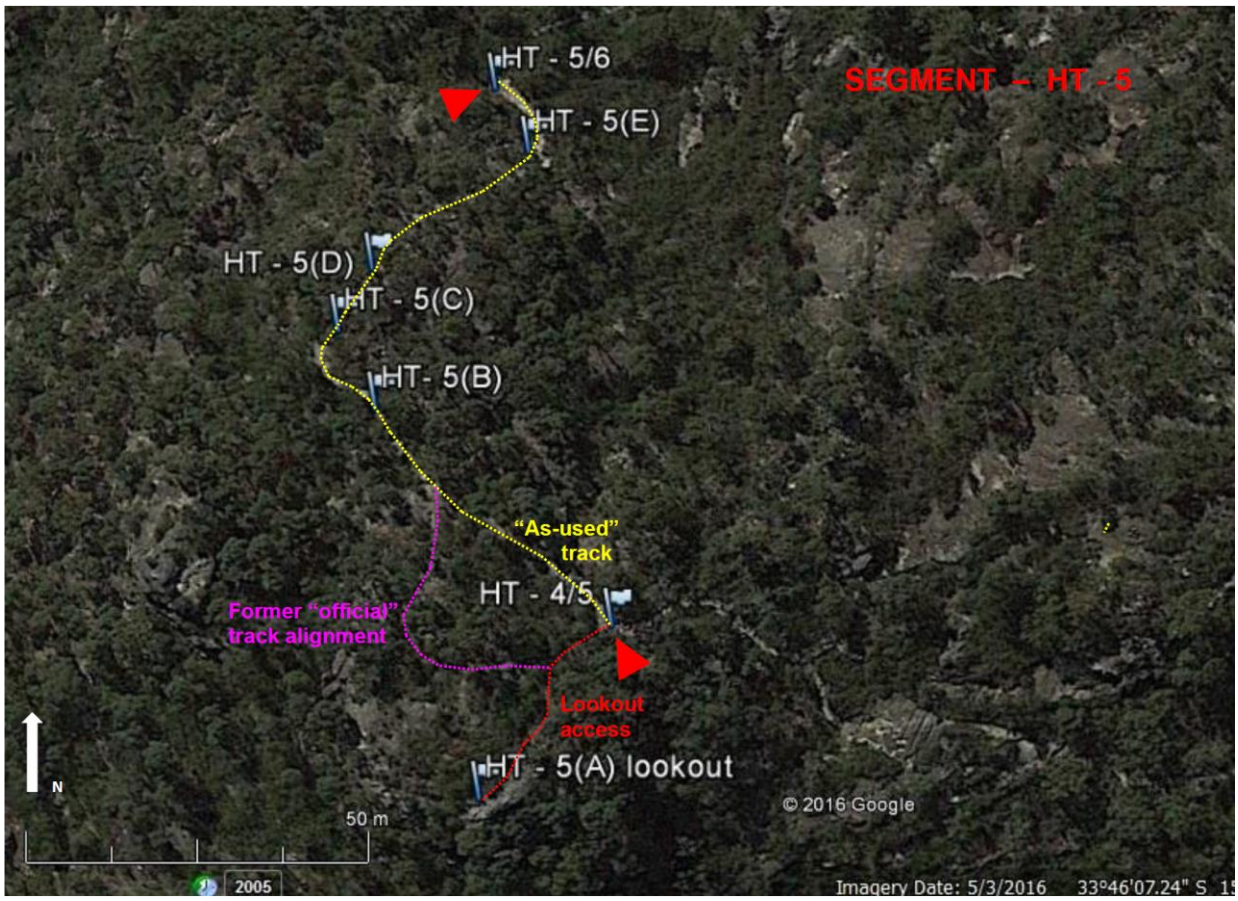
Reinforce existing rock step, and infill level gutter with 2 new rock steps and armoured treads (to harden steps against continued flows over ledges), cut/level adjacent ledges as required to widen/extend steps.

Stone-lined invert in gap in upper embedded rocks, infill/block gap between in-situ rocks on downslope edge to reinforce effectiveness, extend drain with waterbar or low rock wall at least 2.5m to SE to discharge above nick-point in rock ledge (to avoid backflow onto track).

Level/reinforce “natural” rock step on upper bench pavement.

(low)

SEGMENT HEATH TRACK - 5



SEGMENT: HT - 5	
Start Point: 337528 6262081	**End Point: 337511 6262149**

General Description and Condition: Section of mainly rocky track (120m approx.) up/down and across a gentle/moderate gradient rocky slope off N side of rocky knoll, passes below rock ledge at N end. Good condition overall, short sections up/down rocky outcrops/ledges in fair condition only. Former alignment of Heath Track, now largely dis-used, off S end of segment looping over top of crest on rocky knoll.

Tread Width (mm): 700-1,200mm, with wider sections to 1,800mm around obstacles (or step avoidance).

Track Surface: Extensive rock outcrops and pavement especially in S, frequent "natural" rock steps, sections of compacted sand and occasional roots more frequent in N. Regular drainage capture and flows down track, but limited erosion due to surface rockiness.

Gradient (degrees): Gentle/moderate gradient overall (3-5° gradients) but short rocky outcrops/ledges at moderate slopes (10-11° gradients). Flatter section in N where track runs below base of rock ledge.

Alignment: Mostly straight up/down slope in upper S section, curving up/down rocky hillside in lower N section.

Terrain: Upper hillslope, and ridge/crest in S.

Soil: Lambert (Erosional) undulating to rolling low hills on Hawkesbury Sandstone.

Vegetation: Mostly Bloodwood-Scribbly Gum Woodland, enters Sandstone Heath at N end.

Track Works and Improvements: No formal works, stone steps placed by users (but irregularly shaped and loose/unstable).

Signs and Wayfinding: Metal directional arrows on rock pavement at S end (junction) and N end (bend) (and on dis-used section of Heath Track over knoll).

User Experience: Relatively easy walking up/down hillside with short steeper rocky sections requiring some walker care, potential for spur track to lookout at S end offering very good views SE to SW (park/dam, Manly, North Head and ocean, City high skyline, and Chatswood CBD).

Key Issues: Orientation at S end (junction with former Heath Track alignment), drainage capture, erosion and track widening on short steep sections over rock ledges/outcrops, excluding bikes/mountain bikes.

Recommended Works – Overall

- Monitoring and responsive management for drainage capture and erosion on short steep sections over rock ledges/outcrops.
- Maintenance and cleaning of drainage treatments.
- Management of dis-used tracks.
- Monitor for track widening, especially at steps/challenges.
- Continued bikes/mountain bikes exclusion enforcement.

Recommended Works – Site-specific (Priority)

Site ID: **Segment 4/5 junction on crest**

Location: 337528 6262081 Segment start/end point at track junction on crest and rock pavement. Directional arrow on rock pavement indicates SW to former "official" track alignment onto/around low rocky knoll, but far more heavily used (and more apparent/logical) track leads NW along rock pavement and down rock ledges and "natural" rock steps to NW. Former "official" track heads SW from junction to curve around rocky knoll, but is indistinct in places and not well-used, to rejoin the NW "as-used" track (at 337505 6262098) on NE slope of knoll.

Works:

Remove arrow at junction (and replace with directional sign to SW track as "lookout access" – see Site HT - 5(A) below).

Close, disguise and rehabilitate former "official" track over knoll (excluding section

	used for “lookout access” – see Site HT - 5(A) below). **(Medium)**
	***Site ID:*** **HT – 5(A) lookout** *Location:* Informal track to lookout point, SW from start of Segment 5 (337528 6262081) (first 10m approx. is part of former “official” track alignment) to lookout on end of rocky point (337512 6262059). Informal track is predominantly along edge of level/undulating rock ledge (face of ledge is stepped, so negligible fall hazard) to lookout offering very good views SE to SW – over park/dam, Manly, ocean and North Head, City high skyline, and Chatswood CBD). *Works:* Formalise track from junction to lookout point, as a short spur (dead-end) track. Install directional sign to lookout/track at junction with main Heath Track. **(Medium)**
	***Site ID:*** **HT – 5(B)** *Location:* 337497 6262107 Rock outcrop with broken/crumbly lower edge. *Works:* Formalise lower edge of outcrop as a rock step, with wide stone-lined invert below step (to catch/divert flows prior to next site HT – 5(C) downslope). **(low)**

Site ID: **HT – 5(C)**

Location: 337492 6262117 Rock outcrops and sloped/rounded pavement on 90 °corner in track (on 3° gradient slope), 2 natural narrow channels run across outcrops/pavements on bend (with 90 ° bend in rock channel on inside of corner), 200-300mm drop off downslope edge of lower outcrop with drainage down adjacent gutter, lower outcrop also cut by a small ledge and partial channel halfway down, compacted/loose sand with embedded rocks on slope below with roots and protruding stump.

Works:

Reinforce natural channels across outcrops/pavements with:

- rock wall/deflectors on 90 ° bend on upper/inside of corner;
- rock wall/block at lower end of channel to extend gutter to discharge off track downslope (rather than into gutter alongside lower outcrop); and
- rock wall/block at upper end of channel across middle of lower outcrop (to catch/divert flows along upper edge of outcrops).

Rock infill and level gutter alongside lower outcrop (to match adjacent rock outcrop), include invert to extend channel across middle of lower outcrop to discharge off track downslope

Formalise rock step off lower outcrop, and rock armour tread below.

Pull-in track width with edge definition and containment/barrier (rock rubble), and remove protruding tree stump (if still part of alignment).

(low)

Site ID: **HT – 5(D)**

Location: 337497 6262125 Sloping tessellated rock outcrop with 400mm step off, with placed rock step but irregularly shaped and loose/unstable. Old dis-used track runs N/NW off lower side of outcrop and continues downslope below, and also acts as (and appears as) a drainage discharge.

Works:

Rock wall or waterbar off outcrop (upslope of step) to reinforce existing drainage path off outcrop, extend outlet to prevent backflow onto track.

Close, disguise and rehabilitate dis-used track (retain as drainage outlet, as above).

Formalise and widen rock step off lower outcrop.

(Medium)

Site ID: **HT – 5(E)**

Location: 337515 6262140 2 large sloped/smooth rock outcrops on bend with moderate slope, compacted sand slope with rubble and roots between outcrops large boulder and grass tree to E of bend, embedded rocks then compacted sand track at base, drainage capture and flows down.

Works:

Rock waterbar, and/or stone-lined invert, at upper edge of top outcrop - extended outlet/channel, above boulder and grass tree, to discharge to at least 2.5m to E and prevent backflow onto track.

Build 2-3 boxed steps (preferably rock) on upper edge of lower outcrop, backfill over roots and sand slope onto upper ledge (with edge containment) and armour tread.

Cut/level tread into lower outcrop.

Build 1-2 wide rock steps onto bottom edge of lower outcrop, armour tread below.

Install edge definition and containment/barrier (rock rubble) to track to prevent avoidance/widening

(Medium – for passability issues)

Site ID: **Segment end**

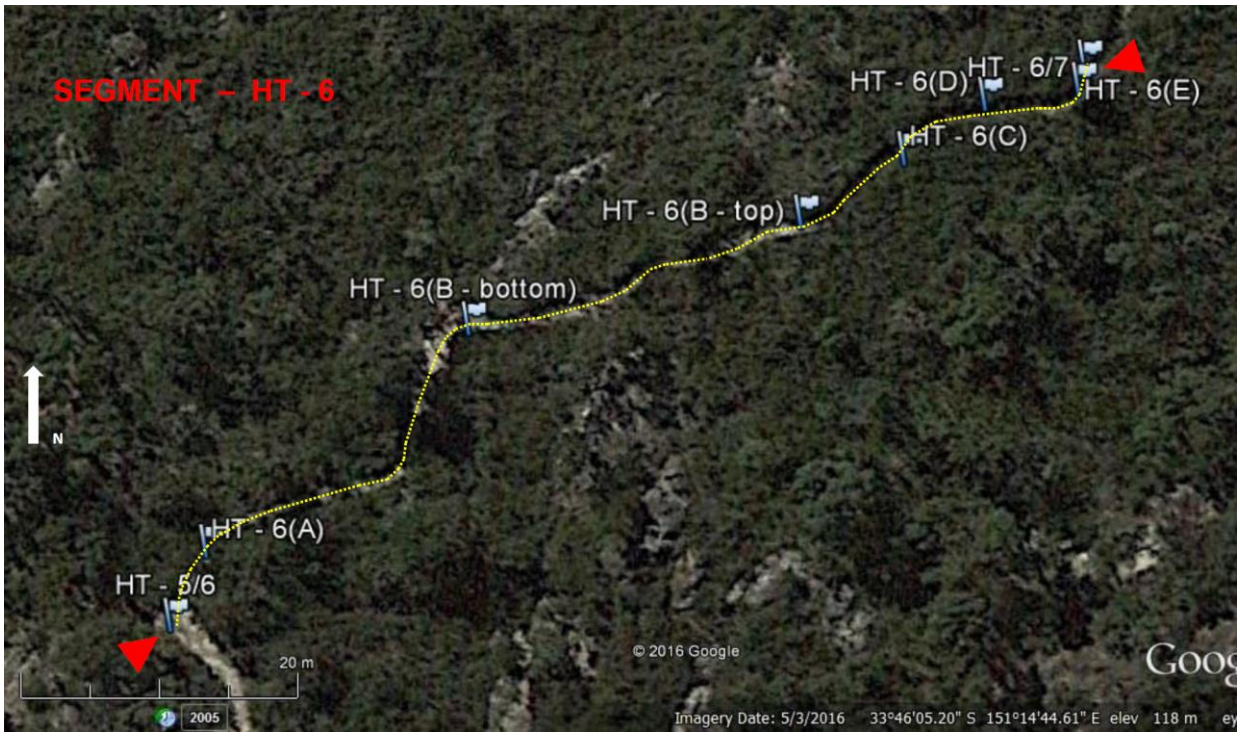
Location: 337511 6262149 Faint little used track joins main Heath Track from W - links back to site HT – 5(D), metal directional arrow on rock pavement (indicating bend in Hearth Track), evidence of previous attempt to block/disguise faint track.

Works:

Close, disguise and rehabilitate little used track.

(Medium – to avoid walker confusion)

SEGMENT HEATH TRACK - 6



SEGMENT: HT - 6	
Start Point: 337511 6262149	**End Point: 337577 6262191**

General Description and Condition: Well-defined track along/across contour on gentle slope of low heath (90m approx.), with central rocky/eroded section and upper two-thirds of track entrenched/guttered, considerable areas with drainage/seepage and ponding issues. Fair condition only, due to drainage/seepage issues.

Tread Width (mm): 700-900mm, but to 1,600mm wide at obstacles.

Track Surface: Compacted sand slightly dished in lower third, with areas of loose/deposited sand. Central section of low rock ledges/outcrops with eroded/guttered sandy track between outcrops, and frequent roots. Upper third is entrenched track in compacted sand with occasional roots and rock pavement/outcrops, 100 to 400mm below NSL. Major drainage capture, including intercepted seepage from upslope side of track (track acts as "catch drain", and sub-surface flows also "pushed" to surface by shallow rock shelves and pavements), on central and upper sections of track with numerous areas of ponding.

Gradient (degrees): Gentle 1-4° gradient overall.

Alignment: Gently curving up/across slope.

Terrain: Gentle slope and sloping bench, on upper hillslope.

Soil: Lambert (Erosional) undulating to rolling low hills on Hawkesbury Sandstone.

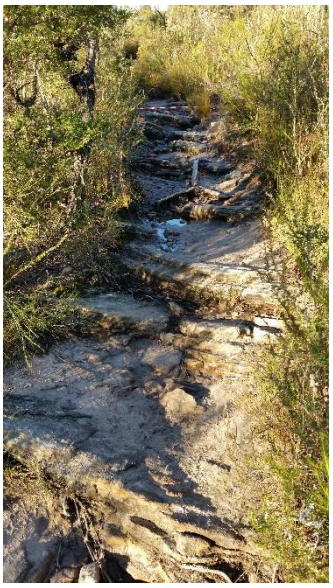
Vegetation: Sandstone Heath.

Track Works and Improvements: Nil.

Signs and Wayfinding: Nil.

User Experience: Easy walking in open terrain, but wet/ponding areas and broken rock ledges are regular obstacles.

Key Issues: Drainage and seepage capture, continued erosion/entrenchment, track widening as users seek to avoid ponding and obstacles, excluding bikes/mountain bikes.



Recommended Works – Overall

- Monitoring and responsive management for track widening especially at ponding, steps and other obstacles/challenges.
- Monitor for requirement for additional step/waterbar combinations, similar to Sites HT-6(C) and HT 6 – (D), at drainage/seepage and ponding sites.
- Maintenance and cleaning of drainage treatments.
- Continued bikes/mountain bikes exclusion enforcement.

Recommended Works – Site-specific (Priority)

Site ID: **HT – 6(A)**

Location: 337513 6262154 Low rock outcrop in dished track of compacted sand, considerable flows down track from segment HT - 5 upslope.

Works:

Wide stone-lined invert above in-situ rock outcrop.

(low)

Site ID: **HT – 6(B)**

Location: 338278 6261587 bottom/SW
338276 6261578 top/NE

27m section of guttered track with series of angled and sloping low rock ledges, exposed/protruding roots, embedded/loose rocks and intervening areas of compacted and loose sand - 800-1,400mm wide. Extensive drainage capture (including intercepted seepage from upslope side of track) and flows down track, erosion and nick-point scouring with gutters to 300-400mm below NSL, considerable ponding. Lower/SW 16m, and upper/NE 6m, are worst. Area of loose/deposited sand below.

Works:

Requires detailed on-site selection and location of track treatments. Approximate requirements –

- At retaining roots midway - install 2 rock steps, fill/compact track above as a stone-lined invert to discharge surface flows, fill ponding area below and rock armour/flagging.
- At upper rock ledges – build wide rock step off upper ledge, fill and rock armour central bench with stone-lined invert to discharge surface flows (extend outlet to discharge well off track and prevent backflows), square off point of lower ledge, build 2 wide rock steps onto/off lower ledge and armour tread below.
- Build rock waterbar off in-situ rounded pavements at top/NE of site (extend outlet to discharge well off track and prevent backflows).
- At 2 locations where NSL is most suitable (preferably mid-point and upper third) install 2 rock steps and fill/compact track above (to NSL) as an extended tread including a stone-lined invert to discharge surface flows (additional step may be required above invert, depending on levels).
- Infill and level, with rock armouring/flagging, in-situ rock ledges that can be adapted to be “natural” steps.
- Install edge definition and containment/barrier (rock rubble) to track to prevent avoidance/widening
- Remove protruding roots.

(HIGH - for both passability/safety issues and sustainability/impact issues)

Site ID: **HT – 6(C)**

Location: 337564 6262184 "Shallow" point (250mm below NSL on upper side, 150mm on low side) on entrenched section of track with drainage capture (including intercepted seepage from upslope side of track), very gentle slope, flows down track and extensive ponding.

Works:

If fill can be sourced/delivered to site – install rock step/bulkhead with armoured tread below, fill/compact track above as extended tread grading back to entrenched track surface over at least 2m and install timber waterbar approx. 500mm upslope of step midway on tread (extend waterbar and excavate discharge channel to match NSL and allow free outlfows) and stone armour/flagging (if required) between waterbar and step.

Alternative treatment, if fill cannot be provided to site – install timber waterbar at shallow point, extend waterbar and excavate discharge channel to match NSL and allow free outlfows (waterbar acts as a holdpoint for progressive sediment infilling of erosion gutter above, but is also a minor trip hazard until filled).

(Medium – for passability and sustainability/impact issues)

(Note: Alternative treatment could be repeated at other, deeper, sites on this entrenched length of track – as is less dependent on "shallow" locations.)

Site ID: **HT – 6(D)**

Location: 337569 6262188 Root angled across track eroded to 150mm below NSL, eroding nick-point and ponding downslope to 400mm below NSL. Smaller retaining root and ponding area 1.5 m upslope.

Works:

Install waterbar upslope of root.

Build 2 rock steps below root and fill/compact track above back to waterbar, infill ponded area and rock armour tread off steps.

Same waterbar and step treatment at root/ponding site 1.5m upslope – but with single rock step only.

(Medium – for passability issues)

Site ID: **HT – 6(D)**

Location: 337577 6262189 Rounded rock pavements with ponding area below on bend, to 150mm below NSL.

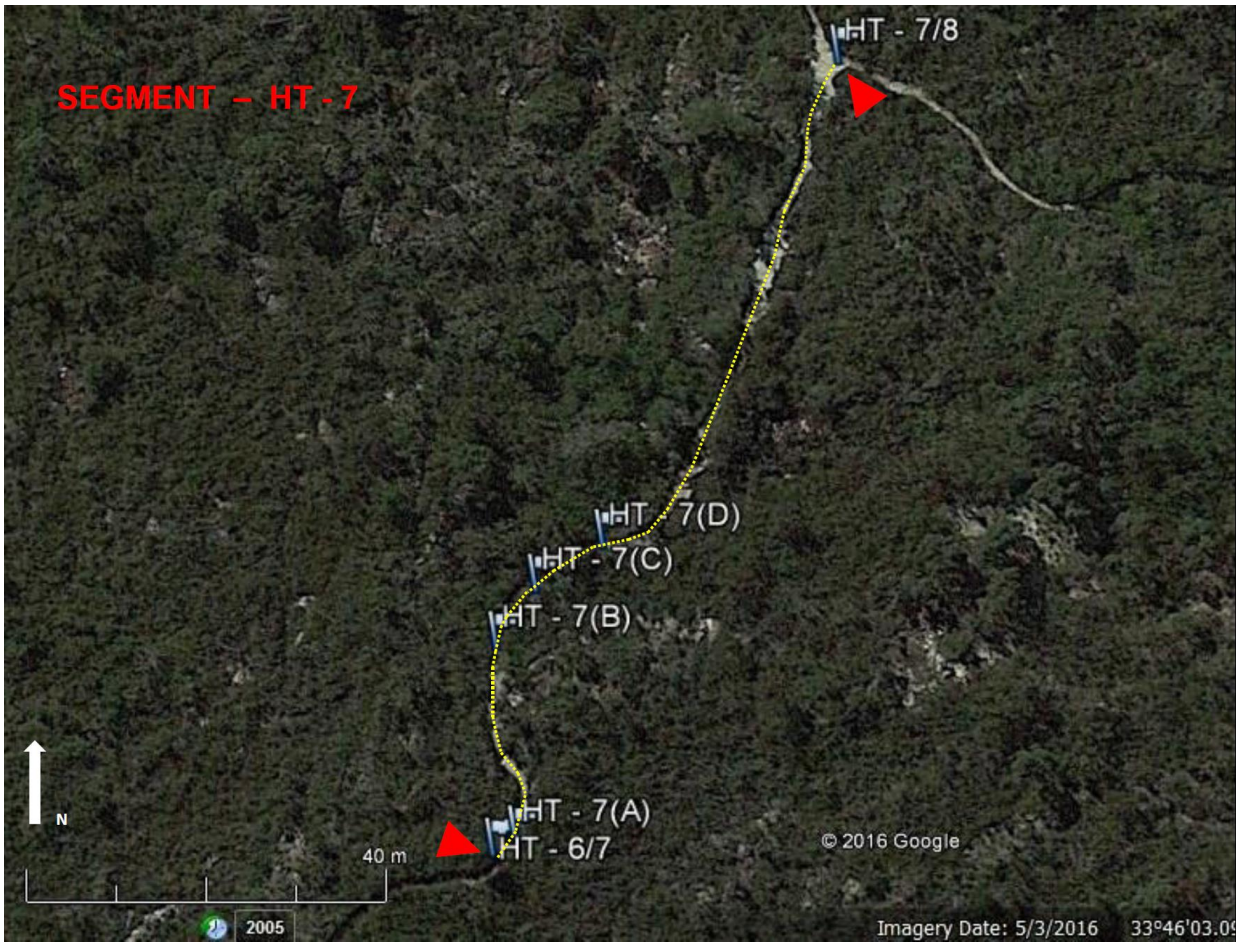
Works:

Build rock waterbar onto rock pavement (reinforce in-situ channel/gap if practical) and extend waterbar and/or excavate discharge channel to match NSL and allow free outlfows.

Square-off and build rock step off bottom end of lower pavement, infill ponding area below and rock armour tread off step.

(Medium – for passability issues, and to divert surface flows and seepage before entrenched section of track and sites downslope)

SEGMENT HEATH TRACK - 7



SEGMENT: HT - 7	
Start Point: 337577 6262191	**End Point: 337612 6262276**

General Description and Condition: Well-defined track along contour across gentle slope (105m approx.) through low heath and scattered low Eucalypts, mostly along rock pavement with considerable seepage across track and occasional minor rocky ledges, eroded or ponding areas. Good condition, overall.

Tread Width (mm): 600-1,800mm (track wider and ill-defined over wider rock pavements).

Track Surface: Predominantly undulating rock pavement and occasional ledges, smaller areas of compacted sand (usually dished). Considerable surface flows across pavement from intercepted seepage from upslope side of track (track acts as "catch drain", and sub-surface flows also "pushed" to surface by shallow rock shelves and pavements), also drainage capture in places, and occasional areas of water ponding.

Gradient (degrees): Mostly flat to very gently sloped (<1 to 3° gradients), short sections at 4° gradient in S.

Alignment: Along contour across gentle slope, gently curved in S and straight in N.

Terrain: Gentle slope and sloping bench, on upper hillslope.

Soil: Lambert (Erosional) undulating to rolling low hills on Hawkesbury Sandstone.

Vegetation: Sandstone Heath.

Track Works and Improvements: Nil (possible imported fill/bricks as fill at Site HT – 7(D).

Signs and Wayfinding: Double directional arrows at N end (track junction).

User Experience: Easy walking in open terrain, wet/ponding areas are occasional obstacles, noise from tennis courts and urban area upslope to NE.

Key Issues: Seepage and drainage and capture, track widening as users seek to avoid ponding and obstacles, excluding bikes/mountain bikes, wayfinding at S end (junction with un-marked but well-used track to N/NW).

Recommended Works – Overall

- Monitoring of slip/fall hazard due to seepage and wet/slippery track surface, responsive management (additional drainage) as required.
- Monitoring and responsive management for track widening especially at ponding areas and other obstacles/challenges.
- Open windrow along downslope edge of track.
- Maintenance and cleaning of drainage treatments.
- Continued bikes/mountain bikes exclusion enforcement.

Recommended Works – Site-specific (Priority)

Site ID: **HT – 7(A)**

Location: 337579 6262192 Rock pavements with natural channel/gutter across track.

Works:

Reinforce natural channel as cross/catch drain, raise downslope edge of channel with rock waterbar and excavate discharge channel (or extend waterbar) to allow free outlfows and prevent backflow onto next/lower section of track (around bend in Segment 6).

(Medium –to divert surface flows and seepage before entrenched section of track and sites downslope)

Site ID: **HT – 7(B)**

Location: 337577 6262213 Angled rock ledges (x2) diagonally across track, 300mm drop off middle ledge. Ponding on track past/downslope of ledges.

Works:

Cut wide level tread in middle ledge and wide rock step off middle ledge (built off or cut into ledge, and squared-up)

Open windrows on low side of track past/downslope of ledges.

(low)

Site ID: **HT – 7(C)**

Location: 337582 6262219 16m section of flat compacted sand track, dished with windrow low side, drainage along track form both ends of site, extensive ponding.

Works:

Open windrow on low side.

(low)

Site ID: **HT – 7(D)**

Location: 337588 6262224 3 stepped rock ledges (upper 2 edge form ”natural “ rock steps), embedded and placed rocks (and bricks) below in wet compacted sand/clay, and then large ponding area to 150mm deep at bottom. Large rock pavement upslope of site (around bend). Drainage capture off pavement above, and flows down site (plus seepage) – eroded to 300mm below NSL and eroding lower edge of embedded/placed rocks.

Works:

Cut 2 broad shallow invert/spoon drains in rock pavement above site, at 2m and 4.5m above upper ledge (caution required in cutting inverts across pavement to avoid trip hazard).

Build wide rock step onto middle ledge (additional to “natural” rock step).

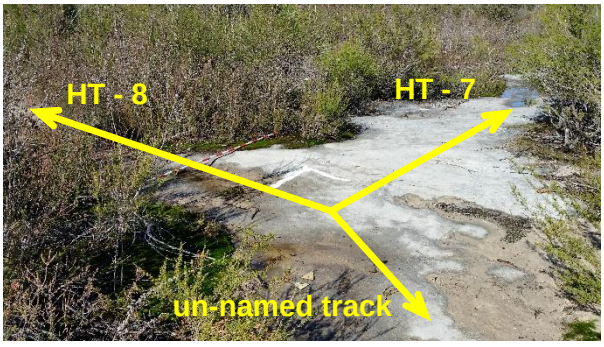
Build 2 wide rock steps off lower ledge (square-up ledge as required).

Armour compacted sand and rocks as an extended tread/run, square-up eroding edge of embedded/placed rocks and build 2 rock steps off (box edges, for containment, as required).

Install edge definition and containment/barrier (rock rubble) to track to prevent avoidance/widening

Open windrow on low side of track to drain ponding area (infill and compact if required after windrow opening) and armour tread off last built step.

(Medium – for passability issues)



Site ID: **Segment junction (7/8), and un-named track junction**

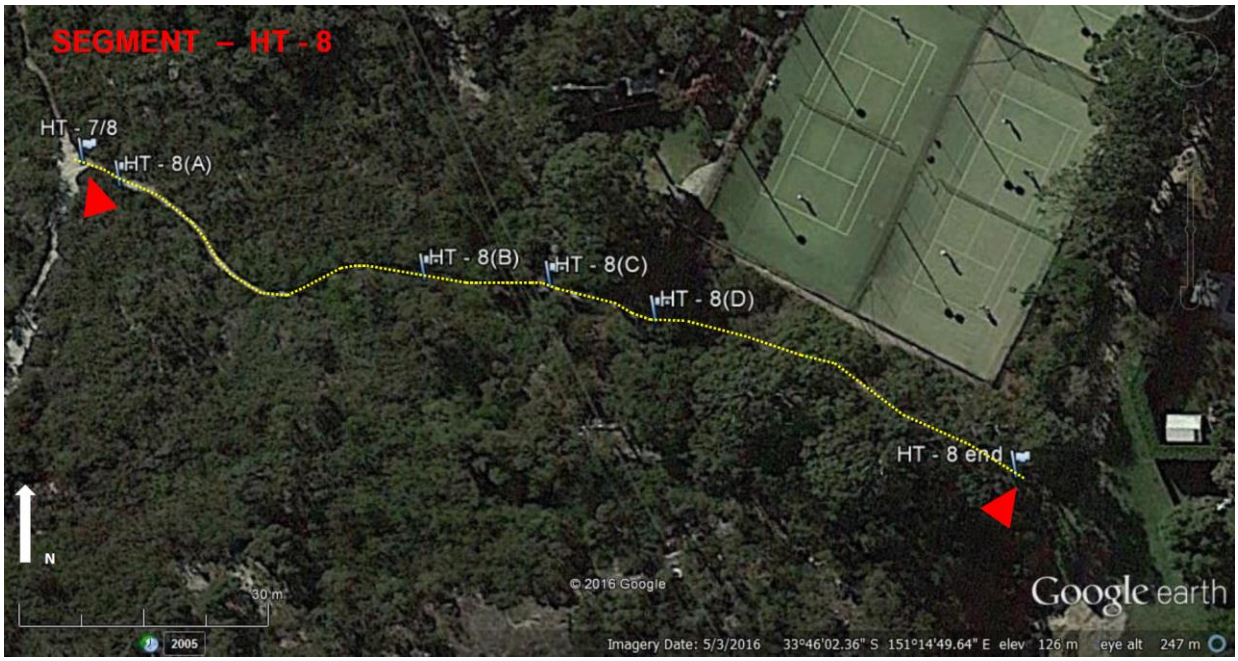
Location: 337612 6262276 Track junction on wide rock pavement, Heath Track turns +90° runs S/SW to SE, and well-used un-named track joins from N/NW. Heath Track route (bend) marked by 2 directional arrows on pavement.

Works:

Upgrade wayfinding signage at junction.

(low)

SEGMENT HEATH TRACK - 8



SEGMENT: HT - 8	
Start Point: 337612 6262276	**End Point: 337722 6262241 (junction with Allambie Heights management track)**

General Description and Condition: Well-defined track (120m approx.) gently curving up/down slope and running across ridgetop at rear of tennis courts to northern trackhead, few obstacles or issues but several un-named/unmarked track coming off main route (due to proximity to urban area). Passes through changing vegetation – from low heath occasional small Eucalypts in lower/W section, grading through tall heath, to tall open forest with mixed open understory in on higher section in E. Good condition, overall.

Tread Width (mm): 600-1,500mm, wider sections mainly in E behind (S of) tennis courts.

Track Surface: Mostly compacted sand, with shallow rock and rock pavements in W and increasing sand/clay in E, frequently dished with drainage capture and flows down (but only occasional erosion/guttering and ponding).

Gradient (degrees): Gentle to gentle/moderate slope (1-5° gradient) in W, and gently undulating across ridgetop in E

Alignment: Gently curved then mostly straight alignment up/down gentle to gentle/moderate slope in W, then largely straight track on along S side of tennis courts in E.

Terrain: Upper hillslope and ridge

Soil: Lambert (Erosional) undulating to rolling low hills on Hawkesbury Sandstone.

Vegetation: Sandstone Heath for W two-thirds, unmapped and disturbed at E end.

Track Works and Improvements: Series of log waterbars on upper section of hillslope, all full of sediment.

Signs and Wayfinding: Timber post with “walkers” and “no bikes” pictograms and “Track Closed to Bikes” regulatory sign at trackhead (good condition). No wayfinding en-route, despite well-used track joining at SW corner of tennis courts and several faint trample track off track behind (S of) tennis courts.

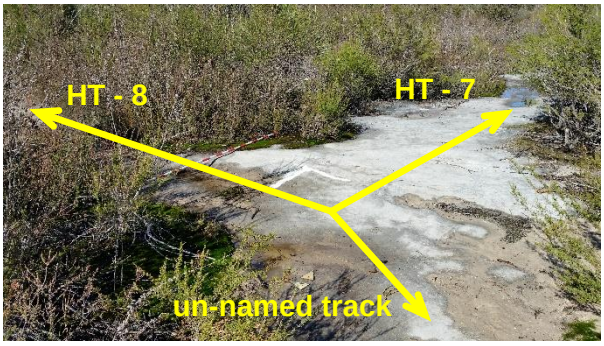
User Experience: Relatively easy walking with no major challenges, changing vegetation adds interest but noise from tennis courts and urban area increasingly detracts for bush setting heading E (track runs only 5-6 off rear fence of tennis courts in places so "full" bush/park experience does not start until SW corner).

Key Issues: Excluding bikes/mountain bikes and other urban disturbances, track widening, orientation at N trackhead (at E end of segment), wayfinding at un-named informal tracks (especially track junction at SW corner of tennis courts).

Recommended Works – Overall

- Upgrade signage at N trackhead (E end of segment) as per Manly Dam Sign Location Plan.
- Continued bikes/mountain bikes exclusion enforcement – consider stile or "kissing gate" at suitable "defensible" site early in segment, possibly at Site HT – 8 (C).
- Monitoring and responsive management of informal track creation.
- Monitoring and responsive management of track widening.
- Maintenance and cleaning of drainage treatments.

Recommended Works – Site-specific (Priority)



Site ID: **Segment junction (7/8), and un-named track junction**

Location: 337612 6262276 Track junction on wide rock pavement, Heath Track turns +90° runs S/SW to SE, and well-used un-named track joins from N/NW. Heath Track route (bend) marked by 2 directional arrows on pavement.

Works:

Upgrade wayfinding signage at junction.

(low)

Site ID: **HT – 8(A)**

Location: 337617 6262273 Outcropping and embedded rocks with broken/uneven edges and surfaces, 3° gradient with drainage/flows down and minor ponding, track widening to 1,500mm.

Works:

Stone-lined invert on compacted sand area upslope of upper outcrop to catch/divert flows.

Square-up and build rock step on upper rock outcrop, infill/level tread on outcrop above.

Build rock step on lower rock outcrop, and fill/compact and rock armour/fagging tread above to upper outcrop (box edges for containment).

Install edge containment/barrier (rock rubble) to track to prevent avoidance/widening.

(low)

Site ID: **HT – 8(B)**

Location: 337654 6262263 Run of log steps on 5° gradient, all full/failed with drainage over and flows down track, lowest log step has a 400mm drop off low side and dished track below to 200-300mm below NSL.

Works:

Clean-out all steps.

Extend/reinstate 2 upper steps as waterbars.

Rebuild lowest step as water above with small step-and-run bellow with filled/compacted tread (use sediment removed from upslope steps for fill).

(low)

Site ID: **HT – 8(C)**

Location: 337668 6262262 Stepped rock outcrop with slight slope, and rock pavement with low ledges above. Located off SW corner of tennis courts, informal well-used track joins from N/NW and runs along W side of courts.

Works:

Waterbar or stone lined invert upslope of stepped low ledges, extend outlet to prevent backflow onto track.

Cut wide level tread in sloped rock outcrop. Wayfinding signage, and regulatory signage ("No Bikes") for users heading west (possible site for stile or "kissing gate").

(low)

Site ID: **HT – 8(D)**

Location: 337681 6262258 Dished track of compacted sand/clay, roots and embed rock on 5° gradient, drainage flows down.

Works:

Waterbar above slope to catch/divert flows.

2 long step-and-runs (2m and 2.5m treads) with filled and compacted treads, boxed for edge containment and with "wings" to prevent/divert flows down sides ((fill could be delivered via nearby fire/service trail and trackhead).

Install edge containment/barrier (rock rubble) to track to prevent avoidance/widening

(low)

Site ID: **Segment end, northern trackhead**

Location: 337722 6262241 Trackhead off Allambie Heights management track (from Roosevelt Avenue) at SE corner of tennis courts, track surface of compacted sand and stepped roots with grass to service trail in E. Post with "walkers" and "no bikes" pictograms and "Track Closed to Bikes" regulatory sign (good condition). No track name/identification or orientation information.

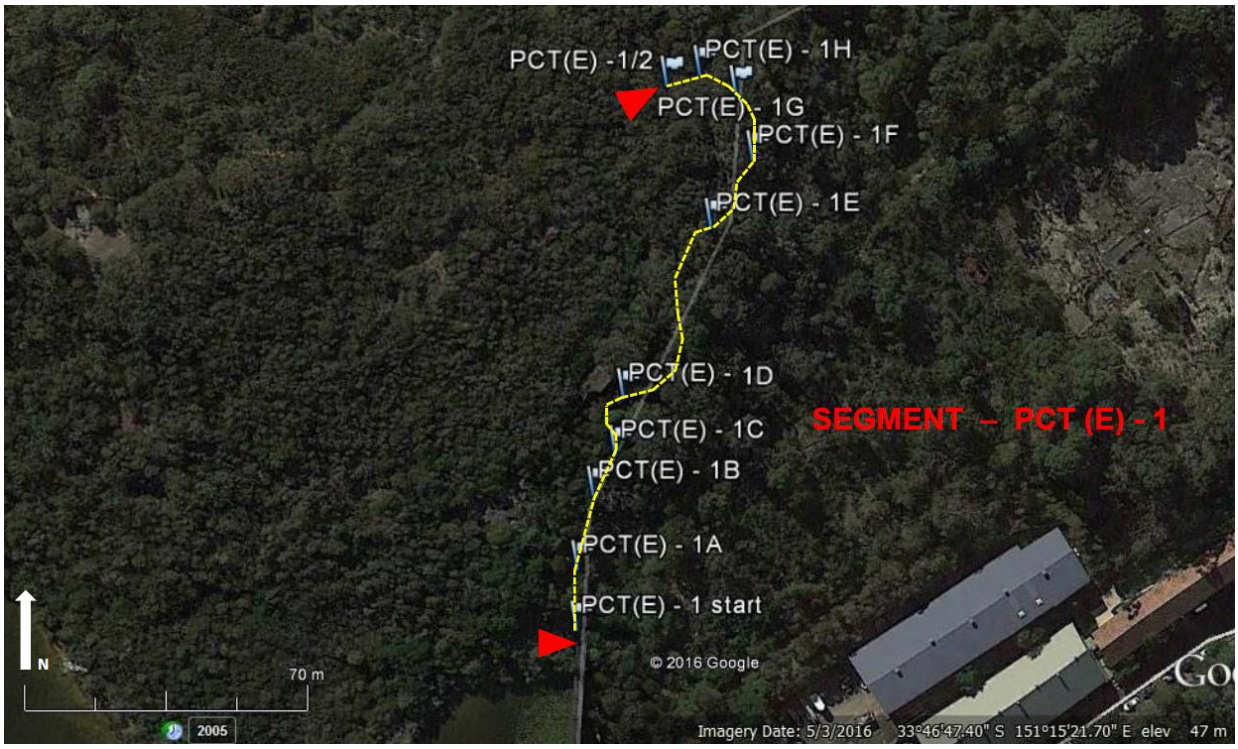
Works:

Upgrade signage – track name/identification or orientation – as per Manly Dam Sign Location Plan.

(Medium)

PARK CIRCUIT TRACK (EAST) - SEGMENTS 1 to 16

SEGMENT PARK CIRCUIT TRACK (EAST) - 1



SEGMENT: PCT(E) - 1	
Start Point: 338496 6260815 **(NE end of dam wall)**	**End Point: 338516 6260943**

General Description and Condition: Short section (165m approx.) of track curving across and up a moderate slope, with numerous rock ledges/outcrops, through woodland. Fair to good condition, but some poor sections of steeper gradients over rock ledges/outcrops.

Tread Width (mm): 700-1,200mm, track widening on rock slopes to 2,200mm.

Track Surface: Slightly concave, compacted sand with embedded/outcropping rocks and exposed roots, several short rocky sections over larger ledges/outcrops.

Gradient (degrees): Varies, flat sections along contours to steep rocky slopes and stairs/steps up to 22.5°.

Alignment: Curving across and up a moderate slope, sections along contour or benches between short steep sections upslope on rock lodges/outcrops.

Terrain: Hillslope, dam margin to just below ridgeline.

Soil: Lambert (Erosional) – undulating to rolling low hills on Hawkesbury Sandstone.

Vegetation: On the margin between Bloodwood Scribbly Gum Woodland (upslope side) and Sandstone Heath (downslope side), with an area mapped as “disturbed vegetation” closer to the dam margins/wall.

Track Works and Improvements: Timber stairs and steps at site PCT(E) - 1A, fair to good condition.

Signs and Wayfinding: Occasional metal arrows on rock outcrop and pavements. Several trample tracks and side tracks not signposted. . Log post with small pictograms (”walkers” and “no bikes”) at NE end of dam wall at start of segment.

User Experience: Easy to medium walk on moderate slope, with flatter/easier sections of track along contour or benches between short steeper sections over rock lodges and outcrops, in woodland setting with open understory on upper slopes and denser understorey in gullies and closer to dam. Access across dam wall at S end of segment.

Key Issues: Hazardous locations/features. Drainage capture and erosion on steeper slopes. Wayfinding at trample/side tracks.

Recommended Works – Overall

- Cleanout and maintain waterbars.
- Upgrade signage as per Manly Dam Sign Location Plan

Recommended Works – Site-specific (Priority)

Site ID: **PCT(E) – 1A**

Location: 338496 6260830 11 timber stairs off-ground, 1,200mm wide - fair/good condition but upper landing undercut on low side. 19 timber steps, most boxed but some open-sided, 900-1,200mm wide – fair condition. 3 log waterbars, all full and ineffective. Flows over/down steps, some side scour, and washout of some open-ended steps. Steep 20.5° gradient. Log post with small pictograms (”walkers” and “no bikes”) at base of steps. Three well-used trample tracks radiate from base of steps – NW to dam shore, SE to below dam wall (semi-formal track), and E/NE along contour then gradually upslope. None signposted.

Works:

Waterbar 4m above top of stairs as additional drainage protection for stairs and steps (can use excess rock from nearby quarry site – if no heritage constraints).

Replace undercut log edge to upper landing with rock retaining wall and armour landing (**safety issue**). Timber “wing” at base of stairs to divert flows down along/side.

Box in eroded open-ended steps with rock or timber, fill/level and compact. Timber “wings” off side of steps to divert side flows/scour – at least 2 wings on upper, and 2 on lower, run of steps. Extend and fill lower 3 steps.

(HIGH)

Site ID: **PCT(E) – 1B**

Location: 338499 6260848

Works: Waterbar (can use excess rock from nearby quarry site – if no heritage constraints)

(Medium – for additional drainage protection for stairs and steps at site PCT(E) – 1A downslope)

Site ID: **PCT(E) – 1C**

Location: 338504 6260859

Works: Waterbar (can use excess rock from nearby quarry site – if no heritage constraints).

(low)

Site ID: **PCT(E) – 1D**

Location: 338507 6260871 Cut rock ledge 600-900mm wide, uneven, curved and sloping down to SW for 7m then large angled rock slab 2.5m long. Rock face and boulders on high side, drop 800-1000mm to cut/broken rock and bracken on low side. Cut boulders and 3 “natural” rock steps at S/SW end over 5m. Large rounded rock/ledge at NE end, steep 700mm face to track. Gentle/moderate 9.5° overall gradient.

Works:

Fibreglass reinforced plastic boardwalk, steps and landings.

3 steps between cut boulders at S/SW end.

Curving boardwalk with handrail on downslope (drop) with steps or level changes as necessary along cut rock ledge and slab (approx.. 9m).

4 steps off/down rock ledge at NE end.

(HIGH)

Probable former quarry site, possible interpretive interest.

Site ID: **PCT(E) – 1E**

Location: 338526 6260911 Braided track around tree and angled boulder (lower route more regularly used), then 5° slope over angled outcrops, and down 2 natural rock steps into small flat sandy drainage line.

Works:

Upper waterbar, built off in-situ boulder.

Lower waterbar, built off in-situ outcrop. Will require extended waterbar or invert/drain upslope to catch flows off higher (closed) track (on downslope side of tree, upslope side of rock outcrops).

Large flat stepping stone, set securely into drainage line.

Close/block and rehabilitate upper track (less used).

(low)

Site ID: **PCT(E) – 1F**

Location: 338536 6260927 Series of rounded rock ledges above (stepped to 900mm high), sloped rock pavements with embedded/broken rock and roots and loose sand, then lower rounded rock ledge 500mm high. 8° gradient, with considerable drainage capture and flows down track. Track width varies from 600 to 2,200mm.

Works:

Cut step into upper rock ledge, and level treads on 2 natural rock steps/ledges below.

3 step-and-runs (with compacted fill) built onto sloped/broken outcrop, with edge containment/definition to track. Fill upper tread to natural surface level and armour with stone-lined invert draining to E (or waterbar as alternative).

Rock armour track surface, with edge containment/definition to track, upslope of lower rock ledge.

Cut step into NW end of lower rock ledge.

Trample track (unsignposted) and drainage to SE from lower rock ledge – block to pond/slow flows and reduce erosion.

(Medium)

Remove star picket beside track below lower rock ledge.

(HIGH - safety issue).

Site ID: **PCT(E) – 1G**

Location: 0338532 6260942

Works: Waterbar (additional protection for works at site PCT(E) – 1F downslope).

(low)

Site ID: **PCT(E) – 1H**

Location: 338523 6260946 Sculpted upper rock outcrops, with embedded rocks and roots and flatter/rounded outcrops on slope below. 8° gradient, with considerable drainage capture and flows down track. Eroded to 300mm below NSL. Trample track heads E along rock shelf to APZ, not signposted.

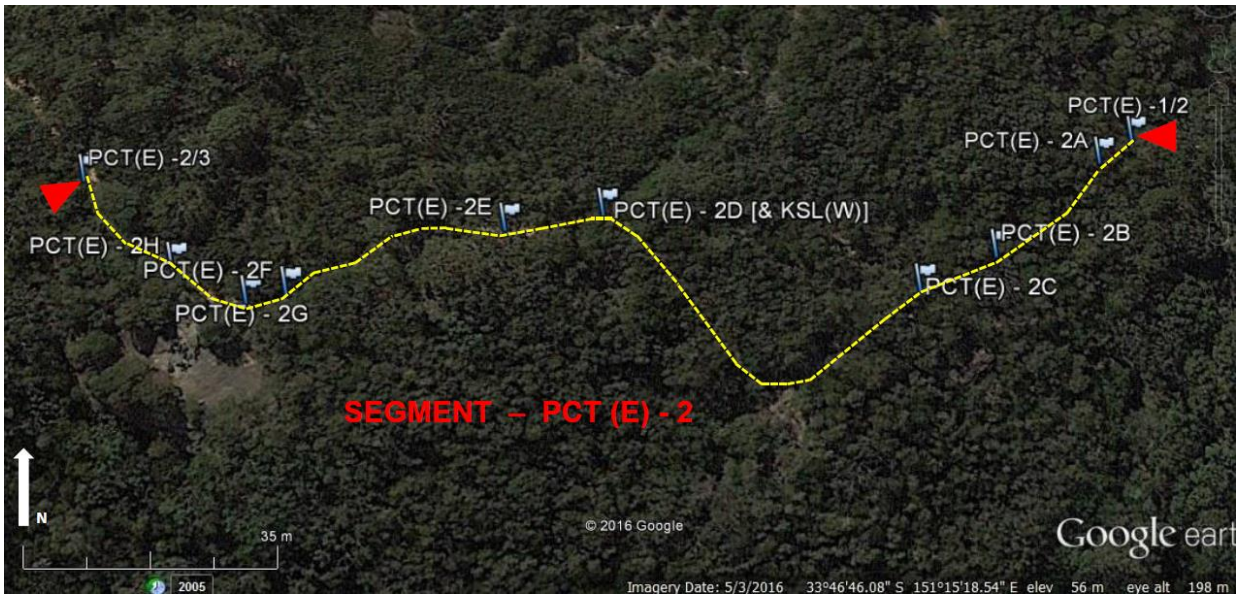
Waterbar above to catch/divert surface flows.

4-5 stone steps built onto in-situ outcrops on upper section, steps to fill/protect full width of gap between in-situ outcrops due to high likelihood of continued flows down track. Rock armour the slope below upper outcrops, with invert to catch/carry cross-slope flows over track, and edge containment/definition to track.

2 stone steps built onto flatter outcrops on lower section.

(Medium).

SEGMENT PARK CIRCUIT TRACK (EAST) - 2



SEGMENT: PCT(E) - 2	
Start Point: 338516 6260943	**End Point: 338364 6260934**

General Description and Condition: Gently curved undulating track on ridge through low open woodland or shrub storey (180m approx.). Generally good condition.

Tread Width (mm): 600-1,200mm, to 1,500mm wide on rock outcrops.

Track Surface: Mostly at natural surface levels with some sections slightly concave to 100mm deep, minor guttering to 150mm deep on slopes compacted sand, exposed roots, occasional embedded rock and laterite gravels, minor area of scalloped/uneven rock pavement, occasional rock outcrops/ledges.

Gradient (degrees): Low to gently undulating to 4°, rock ledges/outcrops 6-10°.

Alignment: Gently curving across ridgetop.

Terrain: Ridgetop.

Soil: Lambert (Erosional) – undulating to rolling low hills on Hawkesbury Sandstone.

Vegetation: Mainly Sandstone Heath with smaller areas of Bloodwood Scribbly Gum Woodland.

Track Works and Improvements: Nil.

Signs and Wayfinding: 2 routered timber signs at junction with track E to APZ “King St Link” - fair condition. Occasional metal arrows on rock pavements/outcrops. One log post with directional arrows.

User Experience: Easy ridgetop walking in open woodland or shrub storey setting, filtered glimpses of dam from W end.

Key Issues: Rock ledges/slopes, minor guttering on slopes, and minor surface unevenness on rock pavements.

Recommended Works – Overall

- Upgrade signage as per Manly Dam Sign Location Plan

Recommended Works – Site-specific (Priority)

Site ID: **PCT(E) - 2A**

Location: 338511 6260939

Works: Waterbar

(low)

Site ID: **PCT(E) – 2B**

Location: 338493 6260924 Angled rock outcrop, moderate slope at 10°, 1,500mm wide, broken/embedded rock at base, drainage capture and flows down track

Works:

Waterbar or stone-lined invert above outcrop to divert surface flow off track.

4 stone steps set onto sloped rock face, infill or level as required.

2 boxed step-and-runs, with compacted fill, over broken embedded rock at base of outcrop.

Edge containment/definition to track.

(low).

Site ID: **PCT(E) – 2C**

Location: 338482 6260919 Sloped rock outcrop, 1,200mm high

Works:

Stone-lined invert above outcrop to divert surface flow off track.

Cut 3 steps into sloped rock face, and build 3 stone steps onto base of outcrop with edge containment/definition to track.

(Medium)

Site ID: **PCT(E) – 2D**

Location: 338440 6260929 Track junction, “King St Link” track to APZ joins from NE. Two routered timber signs (1 - “PICNIC AREA VIA DAM WALL” upper line “PARK CIRCUIT TRACK TO PICNIC AREAS VIA WATERFALL ”LOWER LINE”, and 2 - “ALTERNATE TRACK TO PICNIC AREAS VIA KING STREET”) – fair condition.

Site ID: **PCT(E) – 2E**

Location: 338425 6260926 “Natural” embedded rock steps and angled outcrop, moderate 12° gradient, with flat rock outcrops above. Some drainage down track over rock steps/outcrops.

Works:

Stone-lined invert above rock outcrop/steps to divert surface flow off track.

Waterbar on S side of track above rock outcrop/steps to divert flows away from “natural” steps and into stone-lined invert.

Block/barrier (with embedded rock) ends of two in-situ “natural” rock steps.

(low)

Site ID: **PCT(E) – 2F**

Location: 338396 6260917 Entrenched track 100-150mm deep, 700-900mm wide with occasional roots, gentle/moderate 6° gradient.

Works:

Step (stone preferably, or timber) infilled with gravels and compacted fill upslope to NSL, and waterbar above.

(low)

Monitor step off sandstone pavement 7m upslope for future need for step.

(monitor)

Site ID: **PCT(E) – 2G**

Location: 338399 6260915 Embedded boulder with 400mm face to entrenched track surface to 250mm below NSL, Drainage over boulder, and down "chute" on S edge. Trample track to rock platform to S, with views over dam. Log post with directional arrows.

Works:

Waterbar, upslope (at old post), to catch/redirect flows off track onto rock platform to S.

Step-and-run below boulder with compacted gravel/fill.

Block chute to S of boulder with embedded rock to minimise erosion around side.

(low)

Site ID: **PCT(E) – 2H**

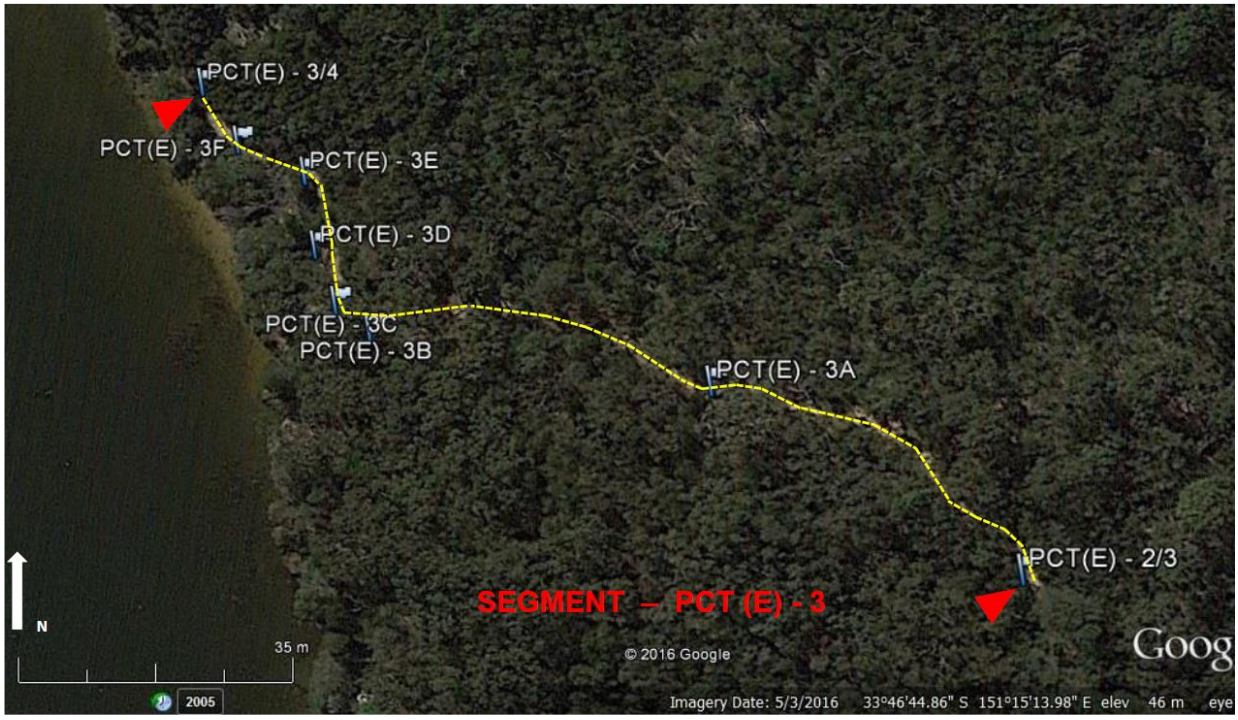
Location: 338378 6260920 Gutter 100-150mm deep through embedded rocks, and exposed rock pavement below, gentle/moderate 6° gradient.

Works:

2 step-and-runs (stone preferably, or timber) infilled with gravels and compacted fill upslope to NSL, and waterbar above.

(low)

SEGMENT PARK CIRCUIT TRACK (EAST) - 3



SEGMENT: PCT(E) - 3	
Start Point: 338364 6260934	**End Point: 338264 6260990**

General Description and Condition: Predominantly an eroded section of track up/down a moderate gradient hillslope, with more gently sloped section at bottom beside climbing up from the dam shoreline through open woodland with occasional views to dam. 125m approx. Major trample track joins to S at base of hill. Poor condition.

Tread Width (mm): Mostly 900-2,400mm on steeper hillslopes, 700-900mm on fewer more gently sloped sections.

Track Surface: Slightly concave in most parts with compacted sands and gravel. Rock ledges, outcrops/remnants and loose rock as well as exposed tree roots on eroded steeper hillslopes. Occasional rock pavement.

Gradient (degrees): Mostly 8-12°on moderate gradient hillslope, 3-5° on upper and lower ends.

Alignment: Gently curved alignment up/down hillslope, including some sections directly upslope.

Terrain: Hillslope, dam margin to ridgeline.

Soil: Lambert (Erosional) – undulating to rolling low hills on Hawkesbury Sandstone.

Vegetation: Mostly Bloodwood-Scribbly Gum Woodland with smaller area of Sandstone Heath on lower section beside dam.

Track Works and Improvements: Nil.

Signs and Wayfinding: A few metal directional arrows on rock outcrops/pavement.

User Experience: Short moderate difficulty climb/descent with occasional views to dam, loose track surface requires care in places.

Key Issues: Drainage capture, erosion, track widening and loose rock/gravels on steeper sloped sections.

Recommended Works – Overall

- Improved wayfinding at junction with major trample track.

Recommended Works – Site-specific (Priority)

Site ID: **PCT(E) – 3A**

Location: 338364 6260934 top
338328 6260954 mid-point
338288 6260959 bottom

Extended section of track directly up/down moderate slope (8-12°), with gentle/moderate slope at top (4-5°). Total length 96m (approx.). Eroded track 900-2,400mm wide over rock ledges/outcrops and embedded rocks, with compacted sandy/clay plus some laterite gravels and exposed roots. Significant drainage capture and flows down, erosion to 300mm below NSL in places with occasional remnant rock "pedestals" and smaller broken embedded rocks on upper section, with rock pavement at top. Approximate total change in elevation of 14m. No existing infrastructure or improvements (other than metal directional arrows on rock outcrop at base of slope).

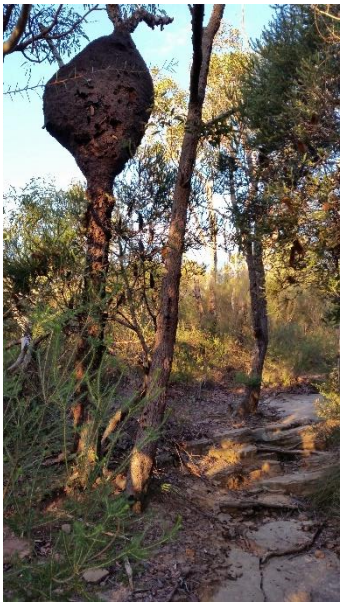
Works:

Requires detailed on-site selection and location of track treatments. Approximate requirements –

- 28 stone steps – built onto in-situ rock ledges/outcrops (3 steps could be cut into existing rock ledges);
- 17 stone steps – as stand-alone step/steps;
- 11 waterbars (some could be combined with the above stand-alone steps);
- 2 stone lined inverts;
- 2-3 block/fill side scour channels;
- rock armouring of sloped sections with loose stones/rocks (10m approx.); and
- pull-in wide/braided section of track and provide edge containment/definition, rehabilitate flanks where required.

Stone-lined invert built onto in-situ rock/pavement, at top of site.

(HIGH - for both passability/safety issues and sustainability/impact issues)



Site ID: **PCT(E) – 3A**

Location: 338328 6260954

mid-point on PCT(E) - 3

Large termite nest on unstable dead tree trunk beside track, at approx. midpoint on slope.

Works:

Requires immediate removal/felling.

(HIGH - safety issue)

Site ID: **PCT(E) – 3B**

Location: 338288 6260959 Well-used trample track joins from S, runs along rock ledge upslope of dam edge.

Site ID: PCT(E) – 3C

Location: 338282 6260962 Flat rock outcrops, sand and gravel/stone - with run on form site above (PCT (E) – 3A).

Works:

Waterbar, built off in-situ rock outcrops.

(low)

Site ID: **PCT(E) – 3D**

Location: 338280 6260969 Rounded flat rock outcrops with central gutter/trench 100-200mm deep.

Works:

Stone-lined invert upslope of rock outcrops.

Stone step at bottom of trench, between rock outcrops, an fill/compact trench above (rock armour if required).

(low)

Site ID: **PCT(E) – 3E**

Location: 338278 6260978 Dual, slightly-angled, rock ledges with broken embedded rock below to eroded/concave track surface. 1,100mm high in total.

Works:

Cut step into upper rock ledge.

3 boxed steps (stone preferably due to flows down, or timber) infilled with gravels and compacted fill, off lower ledge - with regular "wings" to prevent/divert flows down/around sides. Elongate bottom tread over eroded track section.

(Medium)

Site ID: **PCT(E) – 3F**

Location: 338269 6260982 Elongated sloped rock outcrops with large central gutter/trench.

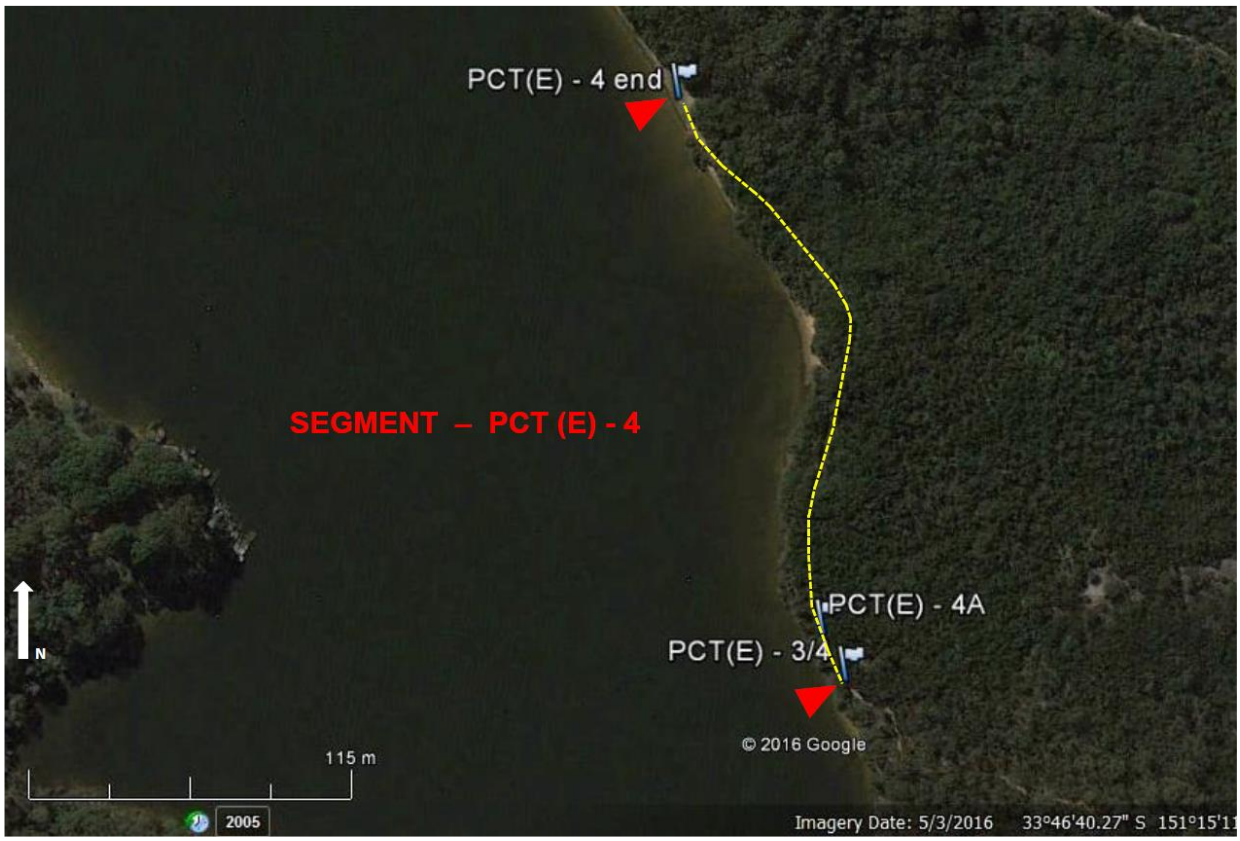
Works:

Stone-lined invert upslope of rock outcrops.

2 stone steps, midway and at bottom of trench, between rock outcrops and fill/compact trench above steps (rock armour if required) (fill could be sourced from nearby dam shoreline).

(low)

SEGMENT PARK CIRCUIT TRACK (EAST) - 4



SEGMENT: PCT (E) - 4	
Start Point: 338264 6260990	**End Point: 338201 6261197 (shoreline end of Nyrang Road Fire Trail)**
General Description and Condition: 240m (approx.) section of largely flat gently curving track just upslope from the dam shoreline through Banksia and Ti-tree heath, including 116m (approx.) of timber "floating" boardwalk. Joins to shoreline end of Nyrang Road Fire Trail at N end. Good condition (but section of boardwalk subsequently displaced/damaged in major rainfall event of 4-6 June 2016). *Tread Width (mm):* Track 600-900mm (widens to 1,200mm around roots/obstructions in places), boardwalk 900mm. *Track Surface:* Compacted sand, mostly gently concave/dished to 100mm deep (occasionally to 200mm below NSL), occasional exposed/protruding roots and stumps. Timber boardwalk. *Gradient (degrees):* Flat, to very gently undulating at N and S ends (0 to 1.5°). *Alignment:* Gently curving just upslope from the dam shoreline. *Terrain:* Flat to gentle side slope beside dam shoeline. *Soil:* Lambert (Erosional) – undulating to rolling low hills on Hawkesbury Sandstone. *Vegetation:* Sandstone Heath. *Track Works and Improvements:* Timber "floating" boardwalk 9oomm wide, gently curving, 37m long (approx.) at 338253 6261069 (approx. centre). Good condition (when originally assessed - but	

displaced/damaged in part following major rainfall event of 4-6 June 2016).

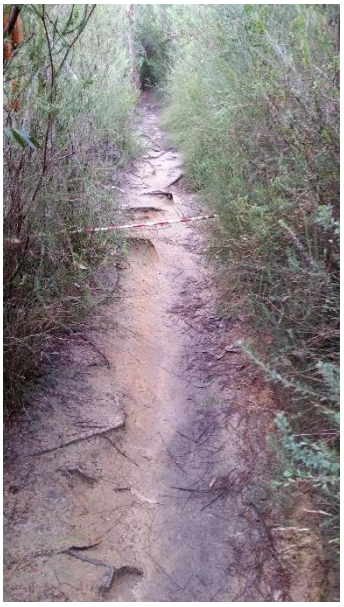
Timber “floating” boardwalk 900mm wide with occasional single step, gently curving, 79m long (approx.) at 338246 6261143 (approx centre). Good condition. Runs parallel to shoreline, approx. 3 to 12m off water’s edge, with several trample tracks to W to shore.

Backed seat on dam shoreline juts N of N end of segment.

Signs and Wayfinding: Old posts with directional arrows located in heath 1-1.5m off side of boardwalks (old track alignment), no other wayfinding (including at N end on shoreline). (Dam recreation/safety advisory and regulatory sign beside N end of track.)

User Experience: Easy walking with regular views to adjacent shoreline.

Key Issues: Ongoing stability of “floating” boardwalk. Drainage capture on compacted sand sections. Informal trample tracks to shoreline.



Recommended Works – Overall

- Repair displaced/damaged boardwalk after storm event (right). **(HIGH - passability/safety issues)**
- Upgrade signage/wayfinding as per Manly Dam Sign Location Plan.
- Monitor trample tracks to shorelines, for increased impacts and need to manage/close where necessary.

Recommended Works – Site-specific (Priority)

Site ID: **PCT(E) – 4A**

Location: 338256 6261006 Gutter to 250mm below NSL beside are of protruding roots (minor hazared), drainage capture and flows downs track and off W to dam. 1.5° gradient over 21m.

Works:

Step and waterbar in upper third of site with stone-lined invert to W towards shoreline. Infill gutter above, with gravels and compacted fill ((fill could be sourced from nearby dam shoreline).

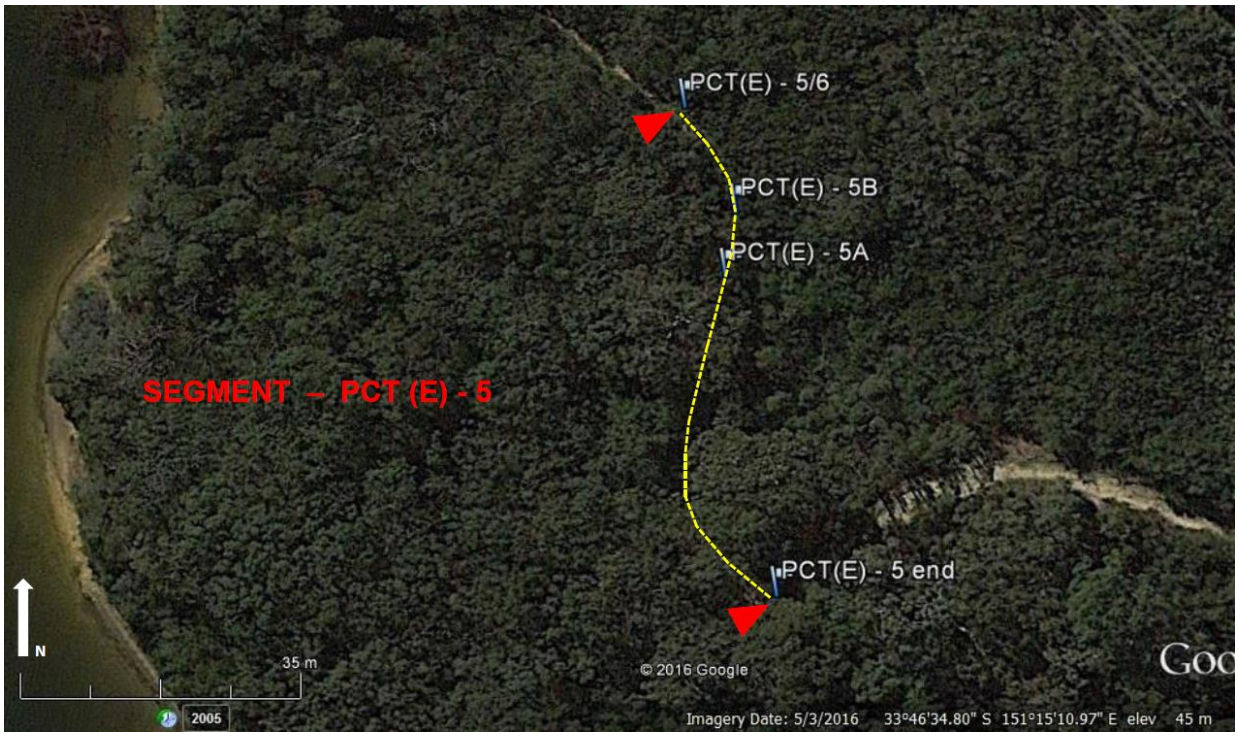
Stone lined invert discharging W to dam, in lower third of site.

Remove or cover protruding roots.

(Medium)

Note: PCT(E) - 4 connects NE to PCT(E) - 5 via the W end of the Nyrang Road Fire Trail (approx. link distance of 70 m). See NRFT Segment.

SEGMENT PARK CIRCUIT TRACK (EAST) - 5



SEGMENT: PCT(E) - 5	
Start Point: 0338252 6261240 **(junction with Nyrang Road Fire Trail)**	**End Point: 338240 6261299**
Note: PCT(E) - 5 connects SW to PCT(E) - 4 via the W end of the Nyrang Road Fire Trail (approx. link distance of 70 m). See "NRFT Segment".	
General Description and Condition: Short section (60m approx.) of gently curved track through open woodland and Banksia understorey. Good condition. *Tread Width (mm):* 700-900mm. *Track Surface:* Slightly concave with very minor benching on high side in places, compacted sand, exposed roots (especially on slopes), occasional embedded sandstone rocks and surface gravels. *Gradient (degrees):* Gentle, gently undulating, to 3.5°. *Alignment:* Gradually curving across and up gentle cross-slope. *Terrain:* Lower hillslope. *Soil:* Lambert (Erosional) – undulating to rolling low hills on Hawkesbury Sandstone. *Vegetation:* Sandstone Heath. *Track Works and Improvements:* Low timber boardwalk 900mm wide 4.7m over minor drainage line at 0338245 6261277 (site PCT(E) - 5A), in good condition *Signs and Wayfinding:* Old directional sign ("VIA WATERFALL" "VIA MANLY VALE" graffiti damaged) at S end at junction with Nyrang Rd fire trail, no wayfinding en-route *User Experience:* Easy walking in open woodland setting, close to fire trail and dam *Key Issues:* Signposting at junction with Nyrang Rd fire trail; closed/disused track downslope of timber bridge (site PCT(E) - 5A).	

Recommended Works – Overall

- Upgrade signage as per Manly Dam sign Location Plan.

Recommended Works – Site-specific (Priority)

Site ID: **PCT(E) – 5A**

Location: 0338245 6261277 Closed and disused old track along drainage line, downslope of low timber boardwalk (N end)

Works:

Block and disguise closed/disused track.

(low)

Site ID: **PCT(E) – 5B**

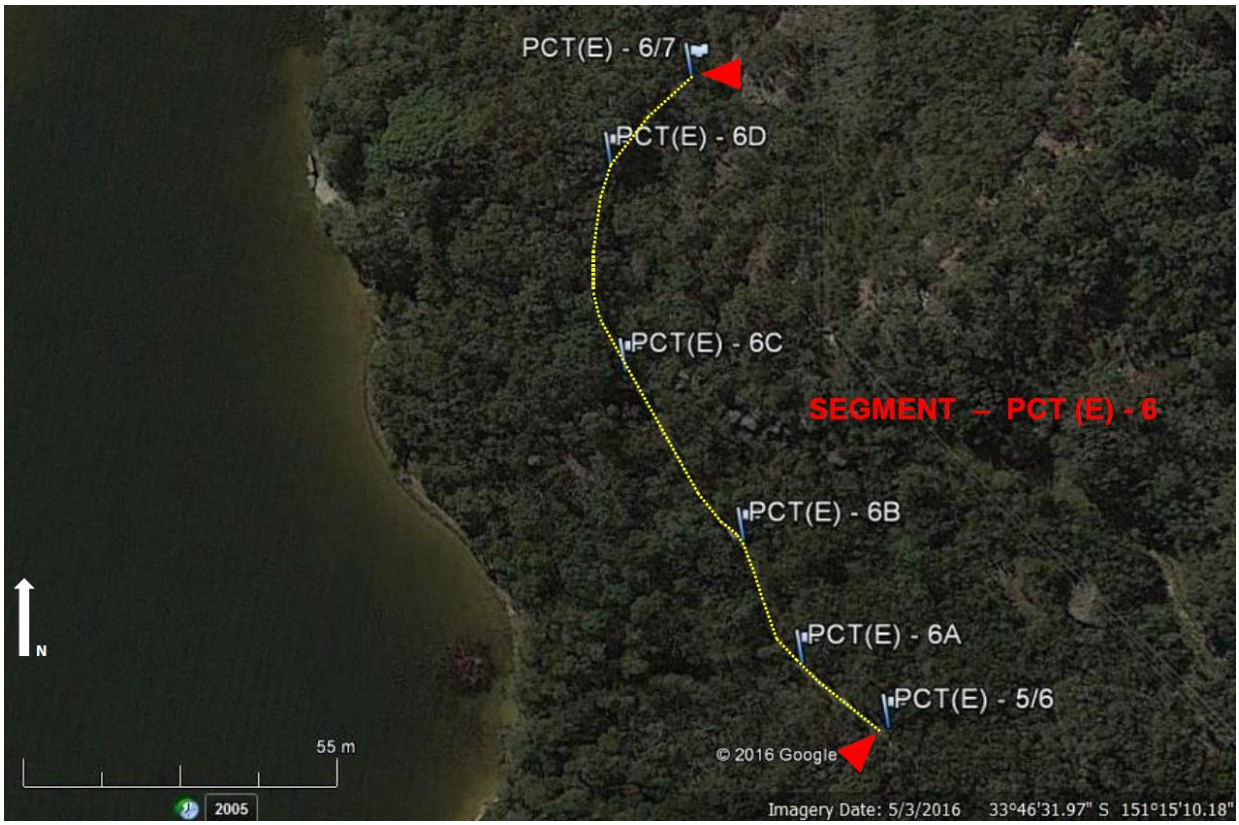
Location: 338247 6261285 (5m off N end of low timber boardwalk) Drainage capture down track

Works:

Waterbar to divert surface flow off track (to prevent surface erosion and guttering into drainage line at boardwalk, and prevent further track lowering at N step off boardwalk.

(low)

SEGMENT PARK CIRCUIT TRACK (EAST) - 6



SEGMENT: PCT(E) - 6	
Start Point: 338240 6261299	**End Point: 338204 6261409**

General Description and Condition: Mainly flat to undulating track along contour across a hillslope through open woodland and Banksia understorey – with a short rocky slope at S end, and curved route on gentle slope to higher contour at N end. 135 m approx. Several faint trample tracks upslope to power line and rock outcrops, and W/downslope to rock ledges with views of dam. Mostly good condition, sloped sections fair/good condition only.

Tread Width (mm): Mostly 700-900mm, up to 1400mm on eroded sloping sections.

Track Surface: Slightly concave in most parts with minor benching on high side in places, mainly compacted sand (minor areas of loose/deposited sand), some laterite gravels, exposed roots (especially on slopes), embedded sandstone boulders and exposed bedrock on slopes, patches of loose gravel on slopes.

Gradient (degrees): Mostly 2-3°, up to 6.5° on sloped sections

Alignment: Gentle to moderate slope at S end, then mostly straight track across slope before curving up a gentle slope at N end.

Terrain: Lower hillslope.

Soil: Lambert (Erosional) – undulating to rolling low hills on Hawkesbury Sandstone.

Vegetation: Track runs along boundary of vegetation communities - Sandstone Heath (upslope side) and Bloodwood Scribbly Gum Woodland (downslope side).

Track Works and Improvements: Occasional timber sleeper steps, one run of timber sleeper steps (site PCT(E) - 6B) and one run of timber sleeper step-and-run (site PCT(E) - 6D).

Signs and Wayfinding: Nil.

User Experience: Easy walking in open woodland setting, power lines visible and close by upslope.

Key Issues: Drainage capture, erosion and track widening on sloped sections – with dished and guttered channels 150-250mm deep. Trample track formation off main route.

Recommended Works – Overall

- Ongoing cleaning and maintenance of waterbars.
- Monitor trample track formation – E to power line and rock outcrops, and W to rock ledges overlooking dam.

Recommended Works – Site-specific (Priority)

Site ID: **PCT(E) – 6A**

Location: 338226 6261307 Gentle/moderate slope (6.5°) of sandstone outcrops and embedded boulders, 18m long, drainage capture and erosion to 200mm deep

Works:

Waterbar above to catch/divert surface flows.

Install stone armouring/steps between in-situ rocks to create irregular/informal steps, with additional waterbar halfway down slope.

(Medium)

Site ID: **PCT(E) – 6B**

Location: 338215 6261328 Five timber sleeper steps, eroding around W side

Works:

Extend/replace upper step as waterbar.

Extend or block (with embedded rock) the 3 timber steps below, to catch flows and minimise erosion around ends.

(low)

Site ID: PCT(E) – 6C

Location: 338195 6261357 Entrenched track 150-200mm deep, drainage capture, roots

Works:

Waterbar at head (top third) of trench to catch/divert surface flows.

(low)

Site ID: **PCT(E) – 6D**

Location: 338190 6261913 Series of timber sleeper set-and-runs, wide entrenched track to 1400mm wide and 150-250mm deep, roots, on gentle slope (4.5°)

Works:

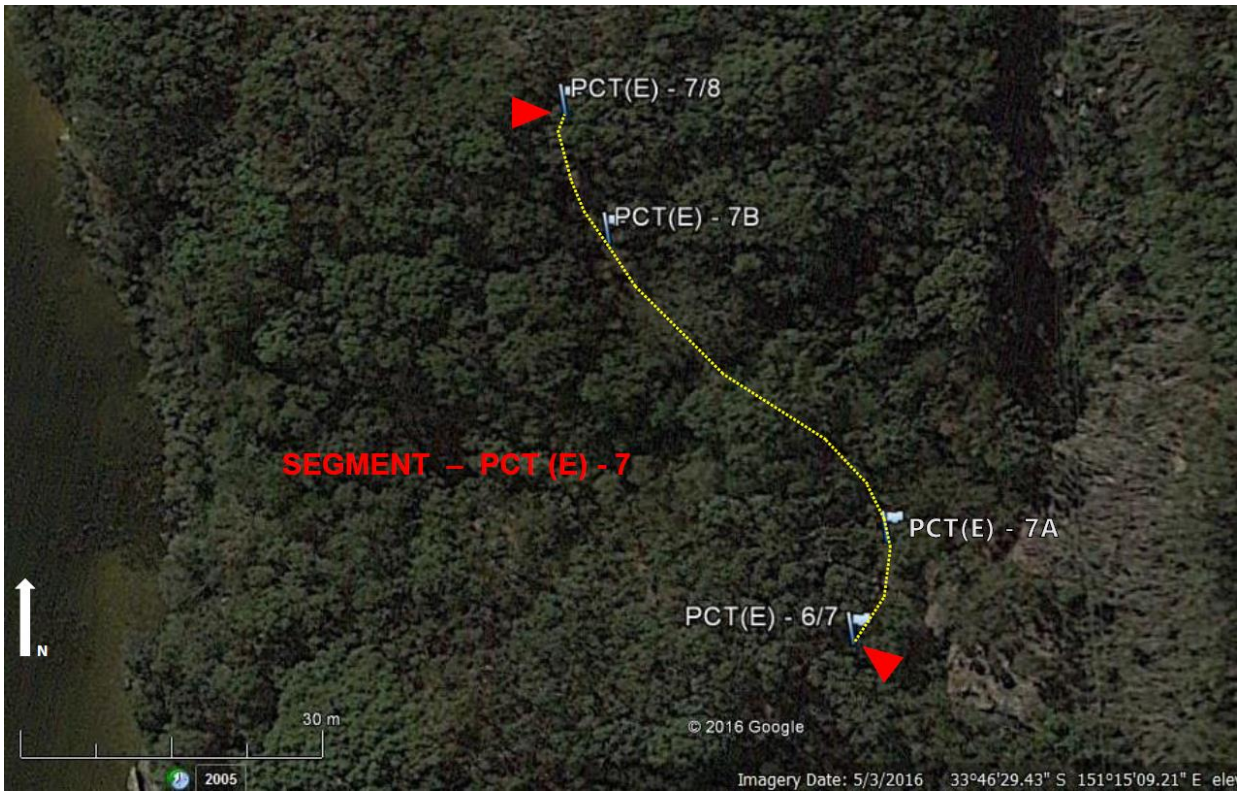
Remove hazardous protruding roots (minor safety issue).

Waterbar at head (top quarter) to catch/divert surface flows, and monitor for need for waterbar halfway down.

Extend or block (with embedded rock) lower timber steps to catch flows and minimise erosion around ends.

(low)

SEGMENT PARK CIRCUIT TRACK (EAST) - 7



SEGMENT: PCT(E) - 7	
Start Point: 338204 6261409	**End Point: 338177 6261459**

General Description and Condition: Short section (65m approx.) of track down and across a minor valley with an indistinct drainage line and damp flat. Central boardwalk good condition, sloped track sections fair condition.

Tread Width (mm): Track 800-1500mm, boardwalk 900mm.

Track Surface: Exposed sandstone bedrock and embedded rocks, compacted sandy clay and laterite gravels, roots.

Gradient (degrees): Moderate slopes (8° and 9°) each side of flat valley floor

Alignment: Curved approaches on slopes either side of flat and low (slightly kinked) boardwalk.

Terrain: Minor valley, flanked by moderate rocky slopes, with central flat wetter area and indistinct drainage line.

Soil: Lambert (Erosional) – undulating to rolling low hills on Hawkesbury Sandstone.

Vegetation: Sandstone Heath on valley floor and Bloodwood Scribbly Gum Woodland on slopes.

Track Works and Improvements: Fibreglass reinforced plastic mesh low boardwalk over drainage line and wet area 900mm wide and 22m long (at 338192 6261434), series of timber sleeper steps and step-and-runs (site PCT(E) – 7A) 16m long.

Signs and Wayfinding: Nil.

User Experience: Mostly easy walking dominated by more open vegetation of the central wetter area, eroded N slope requires some caution and brief effort.

Key Issues: Drainage capture, on-going erosion and track widening on sloped sections (worse on N side, site PCT(E) – 7B).

Recommended Works – Overall

- Ongoing cleaning and maintenance of waterbars.

Recommended Works – Site-specific (Priority)

Site ID: **PCT(E) – 7A (upper)**

Location: 338204 6261409 Timber step-and-runs on gentle/moderate (8°) slope, eroded to 200mm below NSL.

Works:

Waterbar at head to catch/divert surface flows.

Extend or block (with embedded rock) 2 lower timber steps to catch flows and minimise erosion around ends.

(low)

Site ID: **PCT(E) – 7A (lower)**

Location: 338206 6261418 Drainage capture/flows over log waterbar and 3 timber sleeper steps plus lower steep of log and rocks.

Works:

Waterbar above steps (mid-point flat of whole site) to catch/divert surface flows.

Stone armour and build-up landing tread below lowest sleeper step to reduce step height and unevenness.

(low)

Site ID: **PCT(E) – 7B**

Location: 338183 6261447 Moderate (9°) sloped eroded chute 16m long, drainage capture, eroded 200-400mm below NSL, sandstone bedrock and embedded rocks, failed log steps x2, roots retaining sandy/clay and acting as steps

Works:

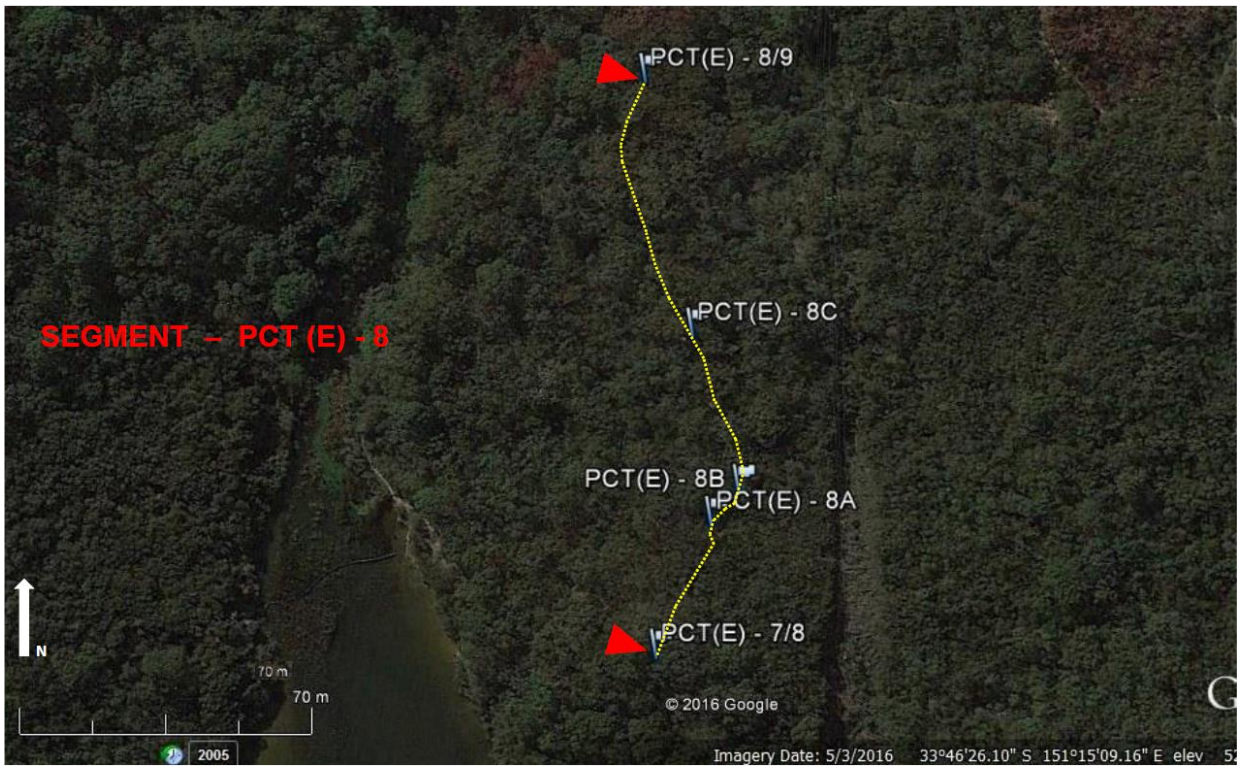
Waterbar above to catch/divert surface flows and protect works below.

Boxed steps (stone preferably, or timber) infilled with gravels and compacted fill, with regular “wings” to prevent/divert flows down/around sides.

Elongate and fill a selected tread midway down the slope, to raise track level above NSL, and install waterbar (midway on tread or at upside of step, whichever is safer and achieves effective outflows) – will likely require a double step off lower end.

(Medium).

SEGMENT PARK CIRCUIT TRACK (EAST) - 8



SEGMENT: PCT(E) - 8	
Start Point: 338177 6261459	**End Point: 338172 6261603**

General Description and Condition: Largely straight and mostly flat section of track (130m approx.) with gradual curves at both end, S end slightly sloped. N end passes between sandstone boulders and ends at minor drainage line crossing. Well-used, eroded, trample track joins from upslope (E) approximately halfway along segment (site PCT(E) – 8C).

Tread Width (mm): 800-1,000mm.

Track Surface: Compacted sand and sandy clay, areas of laterite stones/gravel, slightly concave in most parts (generally 100mm deep, approx.)

Gradient (degrees): Mostly flat to low gradients, minor gently sloped short section (site PCT(E) – 8A) at 4.5°

Alignment: Gently meandering, largely along contour, across hillslope.

Terrain: Lower hillslope.

Soil: Lambert (Erosional) – undulating to rolling low hills on Hawkesbury Sandstone.

Vegetation: Mainly Bloodwood Scribbly Gum Woodland, with smaller area of Sandstone Heath in S.

Track Works and Improvements: Single set of timber sleeper step-and-runs. Lateral timber log retaining low side of track at minor drainage line crossing at N end

Signs and Wayfinding: Nil.

User Experience: Easy walking through open woodland, sandstone boulders at N end provide local interest.

Key Issues: Localised drainage capture and erosion. Informal trample track junction and wayfinding.


Recommended Works – Overall

- Ongoing cleaning and maintenance of waterbars.
- Wayfinding at junction with well-used informal track from upslope/E (site PCT(E) – 8C).

Recommended Works – Site-specific (Priority)


Site ID: **PCT(E) – 8A**

Location: 338190 6261492 "S" curve on gentle slope (4.5°) with drainage capture (realigned from olde "straight" route), flows over/around timber sleeper step-and-runs, guttering downslope to 150mm deep

Works:

Waterbar above to catch/divert surface flows.

Extend or block (with embedded rock) 2 or 3 timber step-and-runs below to catch flows and minimise erosion around ends. Could extend/convert upper timber step as an additional waterbar if required (monitor only).

Waterbar across gutter 3-4m downslope of "S" bend, to contain further erosion/guttering, backfill with gravel/fill to raise level and for safety as required.

(low)

Site ID: **PCT(E) – 8B**

Location: 338196 6261501 *Drainage capture and guttering 100-250mm deep.*

Works:

Waterbar above to catch/divert surface flows.

(low)

Site ID: **PCT(E) – 8C**

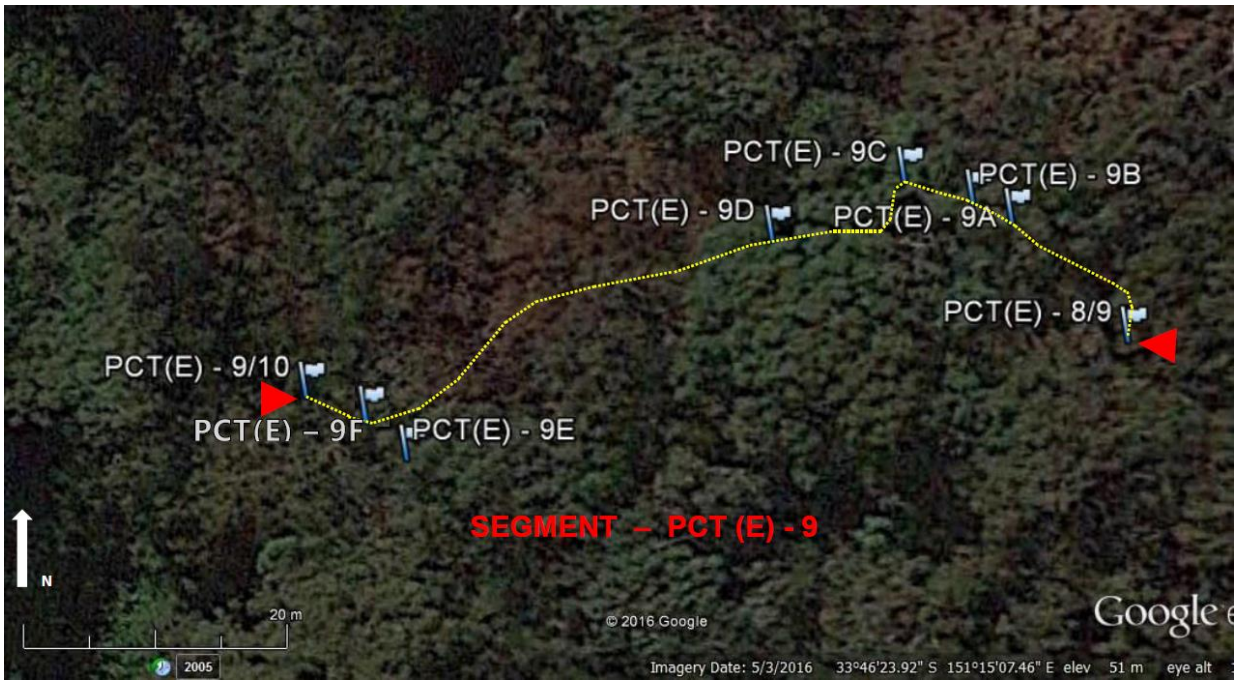
Location: 338184 6261538 Well-used informal track joins (at 90°) from upslope/E, drainage down trample track discharging onto/across main track. Old log post opposite junction (on main track) but no wayfinding or signage.

Works:

Install wayfinding or identification/orientation signage (if upslope track is retained).

(Medium)

SEGMENT PARK CIRCUIT TRACK (EAST) - 9



SEGMENT: PCT(E) - 9	
Start Point: 338172 6261603	**End Point: 338124 6261598** **(junction with Segment DSB - "Dam Shoreline Boardwalk")**
General Description and Condition: A 60m (approx.) section of track up/down a lower hillslope (from dam level) with two distinct sections - a short section of steep braided/dual track around rock outcrops and steep rocky chutes at the upper/E end, and a longer more moderate/gentle slope below. Junction with the "Dam Shoreline/Boardwalk" at the lower/W end. Trample track and eroded gutter joins from upslope (N-NE) above upper rocky section. *Tread Width (mm):* 700-1500mm (varies abruptly through upper rocky section). *Track Surface:* Moist sandy/loam and roots on upper section; then embedded sandstone boulders/rocks and outcrop/ledges with compacted sand and gravels on steep rocky section; to compacted and loose sand with occasional rocks on lower section. *Gradient (degrees):* Steep and very steep drops (+25°) over rock ledges and chutes on upper section (although overall grade is gentle/moderate, approx. 7-8.5°); and gentle grades (5°) on lower section. *Alignment:* Sharp turn downslope (W) from Segment 9 at top, then curving alignment on slope. *Terrain:* Lower hillslope beside drainage line. *Soil:* Lambert (Erosional) – undulating to rolling low hills on Hawkesbury Sandstone. *Vegetation:* Bloodwood Scribbly Gum Woodland. *Track Works and Improvements:* Long series of step-and runs on lower slope (mainly timber sleepers, some stone and logs). *Signs and Wayfinding:* Old directional arrows on log posts.	

User Experience: Moderate gradient track requiring caution on rocky upper section (short section of braided/dual track, but not a wayfinding issue). Adjacent drainage line and more rugged terrain (in upper section) provide local interest.

Key Issues: Braided/dual track around steep rocky slope/outcrops on upper section, with drainage capture and erosion. Informal trample track junction and wayfinding.

Recommended Works – Overall

- Ongoing cleaning and maintenance of waterbars.
- Wayfinding at junction with informal track from upslope/N-NE (at site PCT(E) – 9B).
- Monitor step-and-runs on lower slope for flow/erosion around shorter ends.

Recommended Works – Site-specific (Priority)

Site ID: PCT(E) – 9A

Location: 338164 6261607
Exposed/protruding roots and sandstone outcrop/step. Following higher (original/intended) track route not direct downslope route beside drainage line.

Works:

Reinforce sandstone outcrop with extra embedded rock to create informal step.

Box lower edge of track with timber, and fill/level track surface over roots - allow for cross-drainage from upslope (preferably via a stone lined invert.

(low)

***Site ID:* n/a braid below site PCT(E) – 9C**

Location: Lower/direct route (below site PCT(E) – 9C), beside drainage line.

Works:

Block track and rehabilitate – between site PCT(E) - 10A above and PCT(E) - 10C (FRP steps/boardwalk) below.

(HIGH - sustainability/impact issues)

Site ID: **PCT(E) – 9B**

Location: 338163 6261611 High point at junction with trample track and gutter from upslope (N-NE). Old directional arrows on log post.

Works:

Waterbar downslope of junction to catch/divert surface flows, and protect works below (at PCT(E) – 9C).

(Medium)

Site ID: **PCT(E) – 9C to PCT(E) – 9D**

Location:

- Top (PCT(E) – 9C) - 338157 6261615
- Bottom (PCT(E) – 9D) - 338153 6261608

Steep chute of sandstone boulders/rocks between outcrops, 1300mm high to rocky bench then 90° turn to second rock shelf/drop-off and moderate slope of large embedded sandstone rocks below, drainage capture from upslope

Works:

Waterbar above to catch/divert surface flows and protect works below, discharging to W, stone armouring of track if needed.

Fibreglass reinforced plastic steps and landings (approx. 12m long):

- steps down upper chute (with landing above if required);
- landing/low boardwalk on middle rocky bench;
- steps over second rock shelf/drop-off; and
- low boardwalk (with steps where needed) over rocky slope to below/W of *Angophora* (also for root protection).

(HIGH - passability/safety issues)

Site ID: **PCT(E) – 9E**

Location: 338130 6261595 Short cut linking Circuit Track and "Dam Shoreline/Boardwalk", surface flows from Circuit Track onto short link track.

Works:

Close short cut and modify to discharge/detention site. Additional waterbar (below existing) to catch/divert surface flows from Circuit Track for capture/dissipation on former short cut – will also protect track junction downslope.

(Medium)

Site ID: **PCT(E) – 9F**

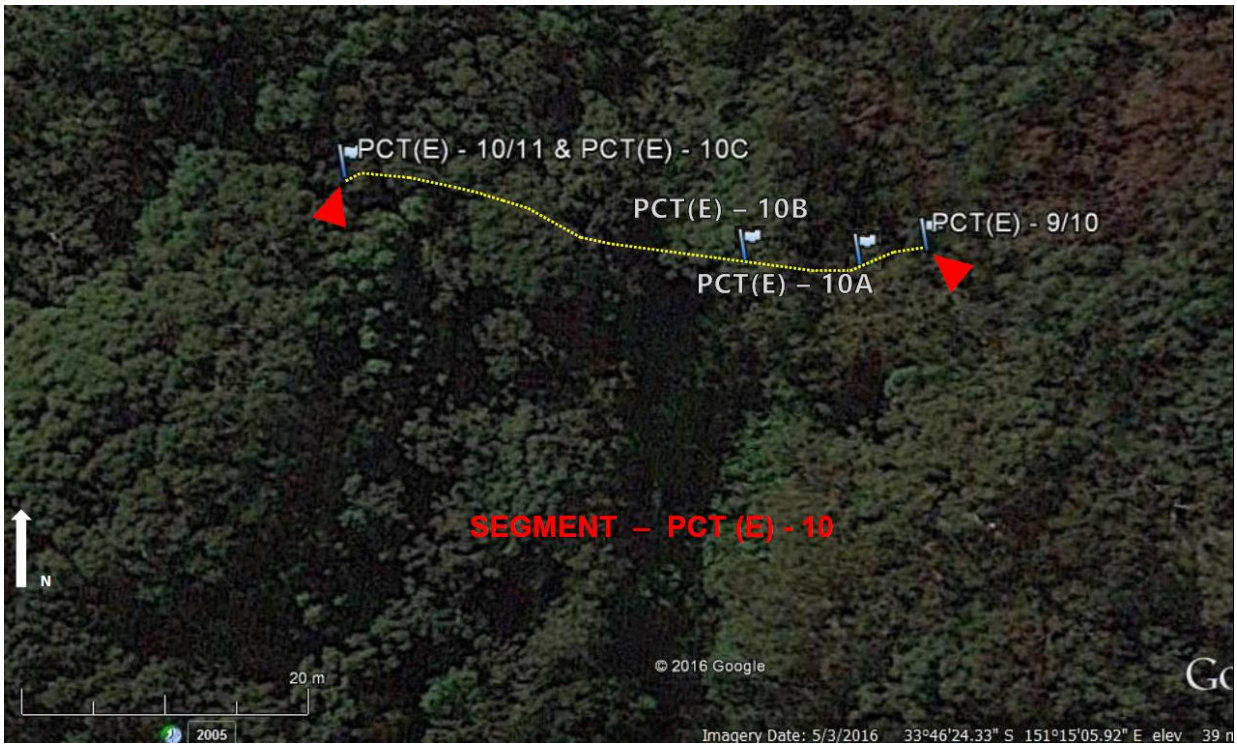
Location: 338127 6261598 Embedded/outcropping sandstone and timber sleeper steps upslope of track junction

Works:

Waterbar above track junction to catch/divert surface flows (direct to behind existing log and sleeper waterbar upslope/N of junction – would suit rock bar connecting to in-situ rock. (Alternatively upgrade existing timber sleeper waterbar 2m upslope.)

(low)

SEGMENT PARK CIRCUIT TRACK (EAST) - 10



SEGMENT: PCT(E) - 10	
Start Point: 338124 6261598 **(junction with Segment DSB - "Dam Shoreline Boardwalk")**	**End Point: 338078 6261603**

General Description and Condition: Short section of track (42m approx.) across a wide vegetated creek with gentle timbered slopes both sides.

Tread Width (mm): 1,000-1,200mm wide on E slope. Bridge 1,200mm wide. 700-1,000mm wide on W slope.

Track Surface: Fibreglass reinforced plastic low bridge. Sandy clay and embedded rock and occasional roots on E slope. Compacted, and some loose/deposited, sand on W slope.

Gradient (degrees): Gentle/moderate grade on both approach slopes, 7.5°.

Alignment: Largely straight, gently curved on W slope.

Terrain: Wide vegetated creek, in board gently sloped valley. ,with g

Soil: Lambert (Erosional) – undulating to rolling low hills on Hawkesbury Sandstone.

Vegetation: Bloodwood-Scribbly Gum Woodland on E slope, creek mapped as "Artificial Wetland", and Peppermint Angophora Forest on W slope.

Track Works and Improvements: Fibreglass reinforced plastic low bridge (no handrails) over wide weedy creek (braided channels), site PCT(E) - 10B, 1,200mm wide and 20m long (approx.) with drop to vegetated bed of +1m in places – good condition. Timber steps and waterbar on E approach to bridge – fair condition. Extended series of timber sleeper and log step-and-runs, with timber sleeper waterbar at top, on W approach to bridge – good/fair condition (entrenched to 400mm below NSL with flows down, but no active erosion).

Signs and Wayfinding: Log post with metal directional arrows at E end.

User Experience: Easy walking, open creek setting between timbered slopes (but no views to dam).

Key Issues: Potential for erosion on approach slopes to bridge. Fall height off bridge. Wayfinding at E end/junction.

Recommended Works – Overall

- Upgrade signage/wayfinding as per Manly Dam sign Location Plan.
- Ongoing cleaning and maintenance of waterbars.
- Monitor erosion on approach slopes to bridge, especially longer W slope.
- Monitor fall height off bridge with changes on creek bed profile.

Recommended Works – Site-specific (Priority)

Site ID: **PCT(E) – 10A**

Location: 338122 6261597 Slope to E end of bridge, with embedded stone, roots and 2 timber sleeper steps, 7.5° gradient. Concave to 200mm below NSL on upper section. Timber sleeper and log waterbar at top.

Works:

Step-and-run (stone preferably, or timber), built onto in-situ rock, infilled with gravels and compacted fill upslope to NSL.

(low)

Site ID: **PCT(E) – 10B**

Location: 338108 6261602 Fibreglass reinforced plastic low bridge (no handrails) over wide weedy creek (braided channels), 1,200mm wide and 20m long (approx.).

Site ID: **PCT(E) – 10C**

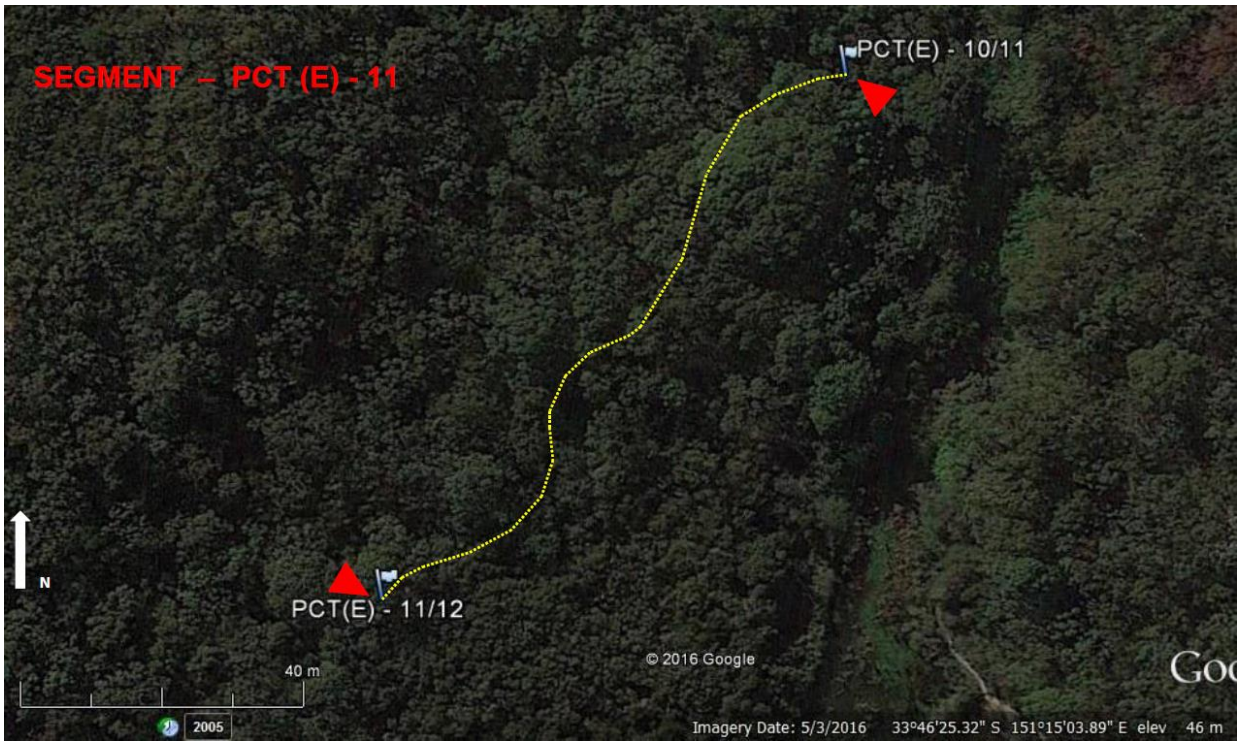
Location: 338078 6261603 Timber sleeper waterbar at top of W slope to bridge.

Works:

Extend waterbar to prevent flows around ends (1,000mm on low/discharge end, 500mm on high end).

(low)

SEGMENT PARK CIRCUIT TRACK (EAST) - 11



SEGMENT: PCT(E) - 11	
Start Point: 338078 6261603	**End Point: 338004 6261515**

General Description and Condition: Gently curving sandy track across, and slightly up/down, a bench and gentle/moderate side slope through and open Angophora forest and medium understorey (110m approx.). Good condition.

Tread Width (mm): 900-1,400mm.

Track Surface: Flat compacted sand, with minor areas of gravel and embedded sandstone.

Gradient (degrees): Gentle gradient, mostly 2, with minor sections to 4.5°.

Alignment: Gently curving across, and slightly up/down, a bench and gentle/moderate side slope.

Terrain: Mid-slope and bench.

Soil: Lambert (Erosional) – undulating to rolling low hills on Hawkesbury Sandstone.

Vegetation: Mostly Peppermint Angophora Forest, minor area of Bloodwood Scribbly Gum Woodland at SE end.

Track Works and Improvements: Regular timber sleeper (occasional log) steps and waterbars, and sections of timber sleeper step-and-runs on upper SE end. All waterbars full of sediment and ineffective, with flows over/around. Remains of former alignment visible beside present track in places.

Signs and Wayfinding: Nil.

User Experience: Easy pleasant walking in closed forest setting.

Key Issues: Waterbar maintenance and side flows/scour beside steps.

Recommended Works – Overall

- Ongoing cleaning and maintenance of waterbars.

Recommended Works – Site-specific (Priority)

Site ID: PCT(E) – 11 (entire segment)

Location:

- Bottom 338078 6261603
- Top 338004 6261515

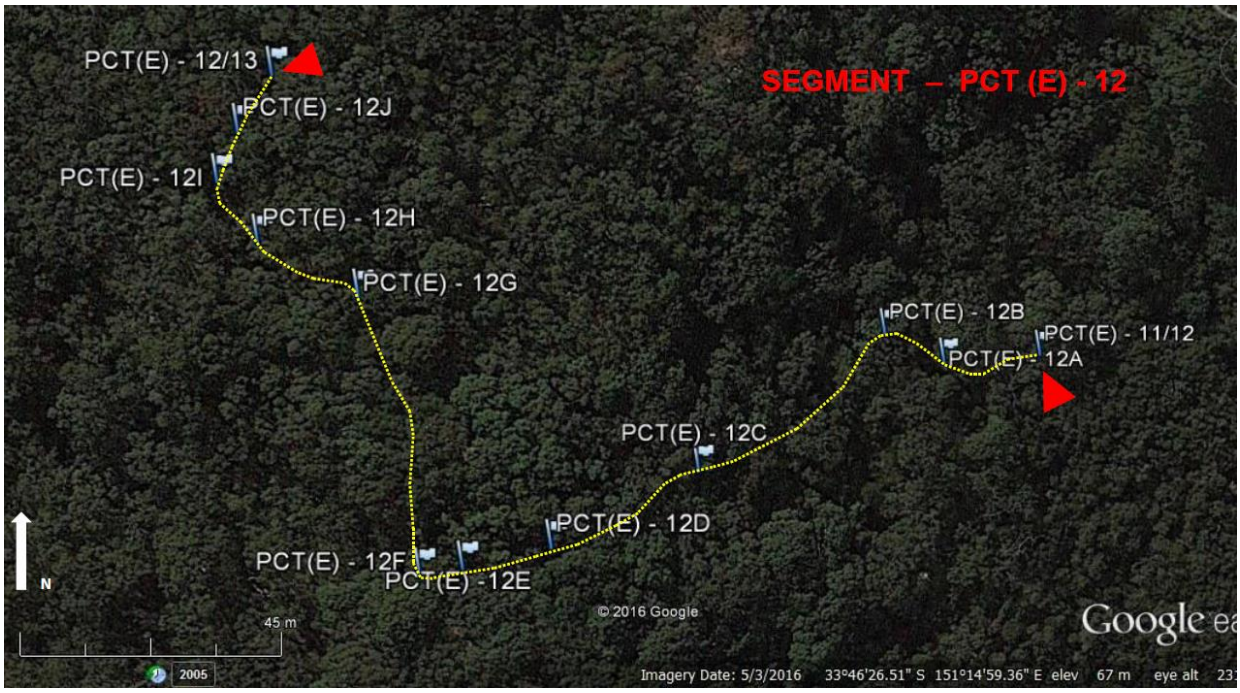
Works:

Extend existing waterbars, or extend upper timber sleeper step in a series as a waterbar (to divert flows before steps below), x 6 approx.

Extend or block (with embedded rock) lower timber steps to catch flows and minimise erosion around ends, x 6 approx.

(low)

SEGMENT PARK CIRCUIT TRACK (EAST) - 12



SEGMENT: PCT(E) - 12	
Start Point: 338004 6261515	**End Point: 337885 6261552**

General Description and Condition: Longer section of track (225m approx.) up/down gentle/moderate hillslope between lower slope and elevated bench, with some moderately steep sections, through open forest with a medium undestorey.

Tread Width (mm): Varies from 600-1,200mm, with braiding at several sites. Widens to +2m at site PCT(E) – 12J.

Track Surface: Compacted sand on benches and steeped slopes, with rock ledges/outcrops and embedded rocks as well as numerous protruding roots on steeper/eroded slopes.

Gradient (degrees): Varies from flat on benches and along contour, to 14.5° on steeper sections, stepped slopes typically 9-12°. Steeper sections concentrated more in upper S and W half.

Alignment: Winds up/down slope via sequence off across slope and up slope sections.

Terrain: Gentle/moderate hillslope with rock ledges/outcrops more common in upper S and W half.

Soil: Lambert (Erosional) on undulating to rolling low hills on Hawkesbury Sandstone on lower/E half. Hawkesbury (Colluvial) on rugged, rolling to very steep hills on Hawkesbury Sandstone in upper S and W half.

Vegetation: Bloodwood-Scribbly Gum Woodland.

Track Works and Improvements: Numerous timber steps and waterbars, mainly as extended runs of steps and step-and-runs as well as occasional isolated steps/waterbars.

Signs and Wayfinding: Occasional old metal directional arrows on rocks and trees.

User Experience: Mostly easy/medium walking with some moderate difficulty climbs/descents on moderate slopes, in attractive forest setting.

Key Issues: Drainage capture on slopes with potential for further erosion and damage to infrastructure and/or hazards. Waterbar cleaning and maintenance. Rehabilitations of former/disused track sections.



Recommended Works – Overall

- Ongoing cleaning and maintenance of waterbars.
- Monitor drainage capture/erosion and track condition on steeper slopes.

Recommended Works – Site-specific (Priority)

Site ID: **PCT(E) – 12A**

Location: 337987 6261513 Sloped rock outcrop and embedded rock, 1 timber sleeper step below and 2 above (curving upslope around rock ledge/outcrop and tree).

Works:

Cut 2 steps/tread in in-situ rock outcrops and armour/infill level sloped outcrop.

Extend timber sleeper steps as waterbars (especially upslope steps).

(low)

Site ID: **PCT(E) – 12B**

Location: 337977 6261518 Angled rock outcrop with protruding timber sleeper step above (flows/eroded around ends), track braided around Angophora. 2 large flat rock outcrops upslope, with 2 timber sleeper stapes onto lower outcrop and embedded (loose) rock above upper step.

Works:

Extend protruding timber step to also function as waterbar, with compacted/levelled fill above.

Block braided track/detour around Angophora.

Stone-lined invert above upper outcrop.

Cut step into larger upper outcrop.

Stabilise embedded rock above timber steps.

(Medium - for both passability issues and sustainability/impact issues)

Site ID: **PCT(E) – 12C**

Location: 337947 6261497 Failed timber sleeper steps/waterbars, considerable flow and erosion around downslope ends.

Works:

Extend steps/waterbars.

Stone-lined invert upslope of upper step.

(Medium – to protect downslope site PCT(E) – 12B, by diverting drainage off track)

Site ID: **PCT(E) – 12D**

Location: 337926 6261487 (centre of site)

Long run of timber sleeper steps and occasional waterbar and embedded rocks, 30m long (approx.). 11-15° gradient. Generally in fair/good condition for most aprt, little erosion despite some drainage down steps. Waterbars full of sediment and ineffective.

Former track adjacent to N. Largely unvegetated, but protected drainage blocked by regular timber sleepers and log waterbars plus occasional embedded rock (especially at top) and placed tree logs. Boundary between new and older track defined by placed rock on upper half.

Works:

Clean out and maintain waterbars.

Extend or block (with embedded rock) timber steps to catch flows and minimise erosion around ends, x 5 (approx.).

Extend some timber steps as waterbars, x 5 (approx.) – but avoid discharging drainage across former track.

Additional placed log barriers on former track.

(Medium – sustainability/impact issues)

Site ID: **PCT(E) – 12E**

Location: 337916 6261479 Shelved and angled rock ledges offering “natural” steps, and adjacent timber sleeper waterbar is undercut (also full of sediment and ineffective) and potentially hazardous, at top of site PCT(E) – 12D.

Works:

Level/cut and/or build up tread for 3-4 steps on in-situ rock ledges.

(Medium)

Support undercut waterbar, and clean out.

(HIGH – safety issue)

Site ID: **PCT(E) – 12F**

Location: *337908 6261483* Rounded rock outcrops and minor embedded rock on bend at top of slope of sites PCT(E) – 12D & 12E. Well-used trample track joins from S leading to rock platform with filtered views through Angophoras to dam. Faint trample track also join from W/SW.

Works:

Waterbar, built onto in-situ rock outcrops and embedded rocks.

(Medium – to protect downslope sites PCT(E) – 12D & 12E, by diverting drainage off track)

Site ID: **PCT(E) – 12G**

Location: 337898 6261522 (centre of site)

Entrenched track 200-400mm below NSL with protruding roots, embedded rocks and loose gravel – hazardous. Fallen tree trunk angled across track acting as waterbar. 16m long, more deeply entrenched at upper end, with undercut timber sleeper step (500mm high) and braided track around tree at top. 7° gradient

Works:

Support/stabilise undercut timber sleeper step, and close track (block braiding) around tree, at top end.

2-3 step-and-runs (stone preferably, or timber) infilled with compacted fill/gravel, below existing undercut top step. Build at least 1 tread to NSL and extended length to include stone-lined invert to discharge surface flows.

Step (stone preferably, or timber), infilled with compacted fill/grave above, over roots.

Retain fallen tree trunk as “natural” waterbar and step and build waterbar off end, with edge containment/definition to track.

(Medium - for both passability issues and sustainability/impact issues)

Site ID: **PCT(E) – 12H**

Location: 337883 6261529 (centre of site)

Run of timber sleeper steps 600-1,200mm wide up/down eroded "chute" - 150mm below NSL on lower apt and up to 350mm deep on upper part. 11° gradient. Between and contained by embed rock and boulders, especially on upper section. Drainage down. Fair condition.

Works:

Raise 6th timber step (from bottom) and build double step, and infill above/behind compacted fill/grave to NSL, stone armour if required. Include stone-lined invert on tread to discharge surface flows, may need to excavate discharge drain (stone-lined) if unable to match NSL. (Repeat at another suitable step, close to NSL, if necessary.)

Extend 2nd timber step as waterbar including excavated/extended outlet (to divert surface flows and protect downslope site PCT(E) – 12G).

Remove loose cobbles and stones from treads, rock armour where necessary

Monitor for future/continuing drainage capture and erosion.

(Medium)

Site ID: **PCT(E) – 12I**

Location: 337878 6261538 Track braids/widens, to +2m across, curving around sculpted rock outcrop and embedded rocks. Gutter and drainage beside rock outcrop, in centre of track. Poor condition. Long/dual timber waterbar above, full of sediment and ineffective.

Works:

Stone step built onto lower S/W end of in-situ outcrop, including raised/level stone tread below.

Level and stone armour track on outside of bend, built onto in-situ outcrop along inside edge.

Fill gutter and centre/inside of curve, block/barrier to prevent access.

Clean out existing timber waterbar. Install stone-lined invert, (with extended discharge/outlet, as extra drainage – and to protect downslope site PCT(E) – 12H).

(HIGH - for both passability issues and sustainability/impact issues, to protect downslope site PCT(E) – 12H by diverting flows off track)

Site ID: **PCT(E) – 12J**

Location: 337882 6261545 Low rock ledges/outcrops and embedded rocks, "natural" steps, drainage down on 8° gradient.

Works:

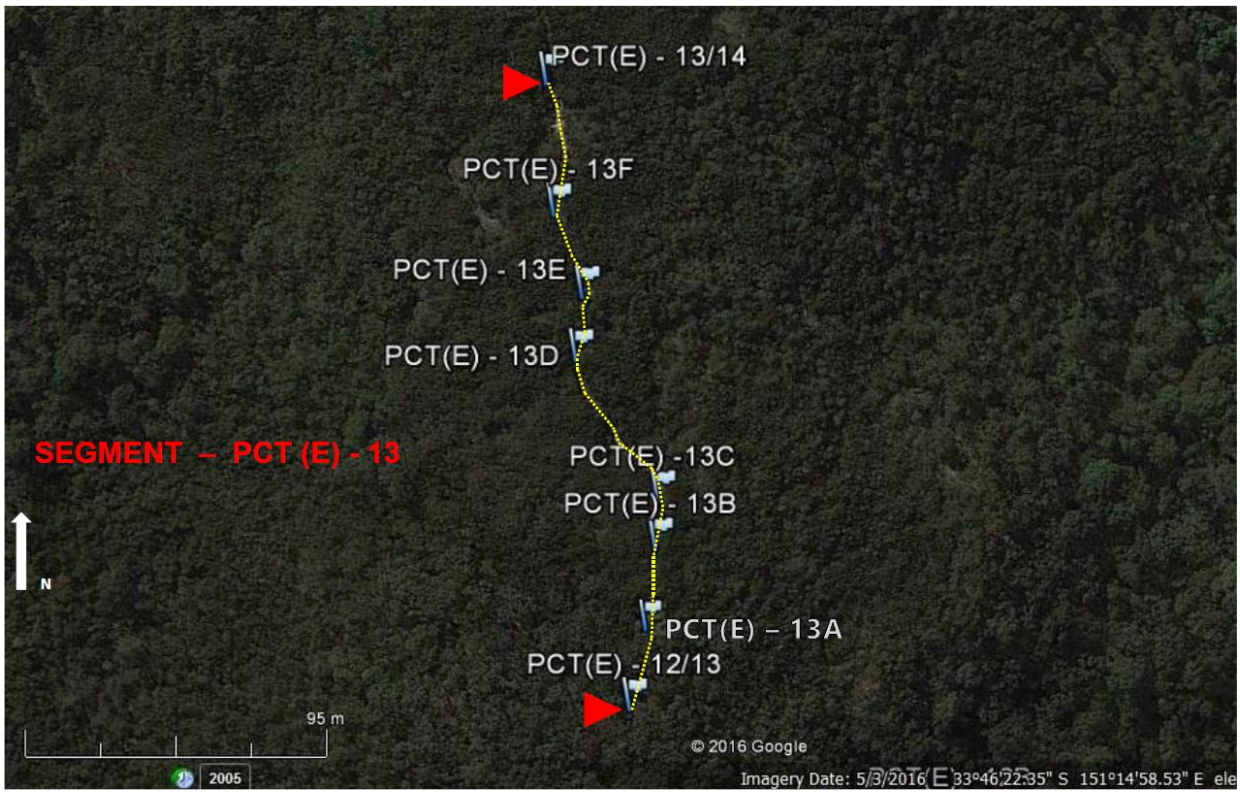
Use break in rock outcrops as basis for stone-lined invert (block off channel/chute downslope) in centre.

Edge containment/definition to track, preferably using placed stone.

Waterbar, or stone-lined invert, built onto in-situ rock at upper end.

(Medium – to protect downslope sites PCT(E) – 12I and PCT(E) – 12H by diverting flows off track)

SEGMENT PARK CIRCUIT TRACK (EAST) - 13



SEGMENT: PCT(E) - 13	
Start Point: 337885 6261552	**End Point: 337861 6261719**

General Description and Condition: Gently winding track, deeply dished in sections with drainage down alignment and occasional steps (waterbars), on a mostly gently sloped bench through tall Casuarina and Banksia heath - 205m long (approx.)

Tread Width (mm): 700-1,000mm

Track Surface: Mostly compacted sandy clay, with extended rock pavement/outcrops on lower sections and smaller ares of outcropping and embedded rock on upper half (mainly where exposed by erosion).

Gradient (degrees): 3-5°.

Alignment: Gently winding.

Terrain: Gently sloped bench, located on mid-slope.

Soil: Along boundary between Lambert (Erosional) on undulating to rolling low hills on Hawkesbury Sandstone to E and Hawkesbury (Colluvial) on rugged, rolling to very steep hills on Hawkesbury Sandstone to W.

Vegetation: Sandstone Heath.

Track Works and Improvements: Occasional timber waterbars/steps

Signs and Wayfinding: Nil.

User Experience: Easy but enclosed walking on gentle slope though tall heath, deeply concave/dished track surface and eroded step height at waterbars require awareness in places.

Key Issues: Continued drainage down track and on-going erosion/dishing. Cleaning/maintenance of waterbars.



Recommended Works – Overall

- Ongoing cleaning and maintenance of waterbars.
- Monitor on-going drainage capture/entrenchment and need for additional waterbars or inverts.

Recommended Works – Site-specific (Priority)

Site ID: **PCT(E) – 13A**

Location: 337889 6261576 (centre of site)

Drainage capture down concave/dished track with rounded/undulating rock pavement. 35m long (approx.) with gentle to gentle/moderate gradient (3-4°).

Works:

Waterbars on sandy flats (where NSWL suits) and built onto in-situ rock pavements, x4 approx. over whole length.

(low)

Site ID: **PCT(E) – 13B**

Location: 337892 6261595
Uneven/broken rock pavement and embedded rock, 4°gradient and 50-100mm drop off edge of pavement.

Works:

Rock armour and flagging/infill to level uneven rock surface.

Waterbar upslope of rock pavement, built onto in-situ rock.

(low)

Site ID: **PCT(E) – 13C**

Location: 337892 6261608

Works:

Extend timber waterbar on upslope side, clean out.

(low)

Site ID: **PCT(E) – 13D**

Location: 337870 6261645 (centre of site)

2 full/failed timber waterbars, with dished entrenched track between and below, eroded to 200-300mm below NSL with drainage down. 400mm drop over lower waterbar, 500mm drop at upper waterbar. Occasional outcropping and embedded rock. 15m overall (approx.) at 4°and 5° gradient.

Works:

Clean out existing waterbars.

Step-and-run below lower waterbar, infilled with gravels and compacted fill upslope to existing waterbar (and reduce step height).

Stone-lined invert upslope of lower waterbar.

1 or 2 step-and-runs below upper waterbar, infilled with gravels and compacted fill upslope (and reduce step height).

(low)

Site ID: **PCT(E) – 13E**

Location: 337871 6261662 (centre of site)

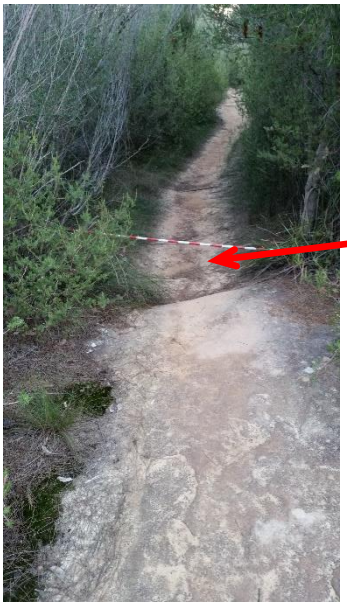
Dished entrenched track eroded to 100-500mm below NSL with drainage down. Full/failed timber waterbar at upper end, with 400mm drop over front. Sandy clay and embedded/broken rock 900-1,000mm wide. 18m overall (approx.) at 4°gradient.

Works:

Clean out existing waterbar.

2-3 step-and-runs below waterbar, infilled with gravels and compacted fill upslope (and upper tread butting into waterbar to reduce step height).

(low)



Site ID: **PCT(E) – 13F**

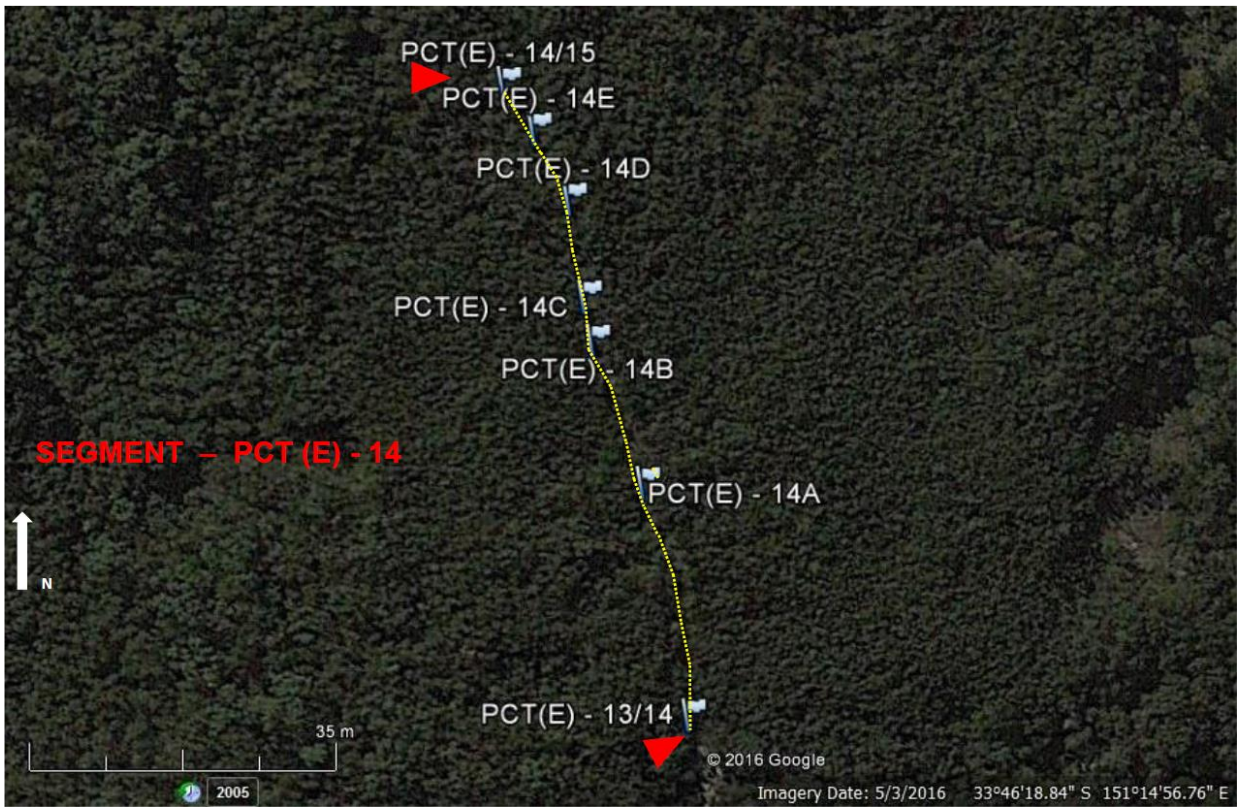
Location: 337863 6261684 Large sloped rock outcrop and rock ledge/pavement above.

Works:

Boxed step (stone preferably, or timber) off bottom of rock outcrop, infilled with gravels and compacted fill or stone armouring. Include stone-lined invert on tread to discharge surface flows and drainage off rock outcrop above (before flowing further along track).

(Medium - to divert flows off track and protect downslope works)

SEGMENT PARK CIRCUIT TRACK (EAST) - 14



SEGMENT: PCT(E) - 14	
Start Point: 337861 6261719	**End Point: 337841 6261782**

General Description and Condition: Largely straight short section of track (80m approx.) on a gently sloped bench through tall Casuarina heath. Distinguished by sections of deep concave channel (400-1,000mm wide) eroded into the centre of the track with continued drainage and erosion down the alignment.

Tread Width (mm): 900 -1,400mm.

Track Surface: Mostly compacted sandy clay. Occasional laterite gravel, loose deposited sand, exposed roots and embedded rock.

Gradient (degrees): Mostly 3-4°, short sections to 6°.

Alignment: Long straight to very gently curving sections.

Terrain: Gently sloped bench, located on mid-slope.

Soil: Along boundary between Lambert (Erosional) on undulating to rolling low hills on Hawkesbury Sandstone to E and Hawkesbury (Colluvial) on rugged, rolling to very steep hills on Hawkesbury Sandstone to W.

Vegetation: Sandstone Heath.

Track Works and Improvements: 4 timber waterbars/steps.

Signs and Wayfinding: Nil.

User Experience: Easy walking, but deeply eroded track detracts from setting/experience and may require care for some users.

Key Issues: Continued drainage down track and on-going erosion/dishing. Cleaning/maintenance of waterbars.


Recommended Works – Overall

- Ongoing cleaning and maintenance of waterbars.
- Monitor on-going drainage capture/entrenchment and need for additional waterbars or inverts.

Recommended Works – Site-specific (Priority)

Site ID: **PCT(E) – 14A**

Location: 337855 6261743
Concave/dished erosion channel, 150 below NSL.

Works:

Waterbar/step at shallow point in channel. Extend waterbar and excavate discharge channel to match NSL and allow free outlfows. (Fill and compact behind/upslope of waterbar/step, if fill can be sourced, to minimise step/trip hazard).

(low)

Site ID: **PCT(E) – 14B**

Location: 337850 6261757 Eroded channel, 200 below NSL.

Works:

Waterbar/step at shallower point in long eroded channel. Extend waterbar and excavate discharge channel to match NSL and allow free outlfows. (Fill and compact behind/upslope of waterbar/step, if fill can be sourced, to minimise step/trip hazard).

(Medium – for passability and sustainability/impact issues, as a hold point for progressive sediment infilling of erosion gutter above)

Site ID: **PCT(E) – 14C**

Location: 337850 6261762 Timber waterbar/step, full/failed.

Works:

Clean out existing waterbar/step. and discharge channel to allow free outlfows.

Additional waterbar/step 1m below existing, and backfill tread with compacted gravel/fill (butting into waterbar to reduce step height). Extend waterbar and excavate discharge channel to match NSL and allow free outlfows.

(low)

Site ID: **PCT(E) – 14D**

Location: 337849 6261771 Head of concave/dished erosion channel down centre of track.

Works:

Waterbar/step just downslope from head of channel. Extend waterbar and excavate discharge channel to match NSL and allow free outlfows.

(low)

Site ID: **PCT(E) – 14E**

Location: 337485 6261778 Timber waterbar/step above pair of sloping embedded rocks. Upslope of concave/dished erosion channel down centre of track.

Works:

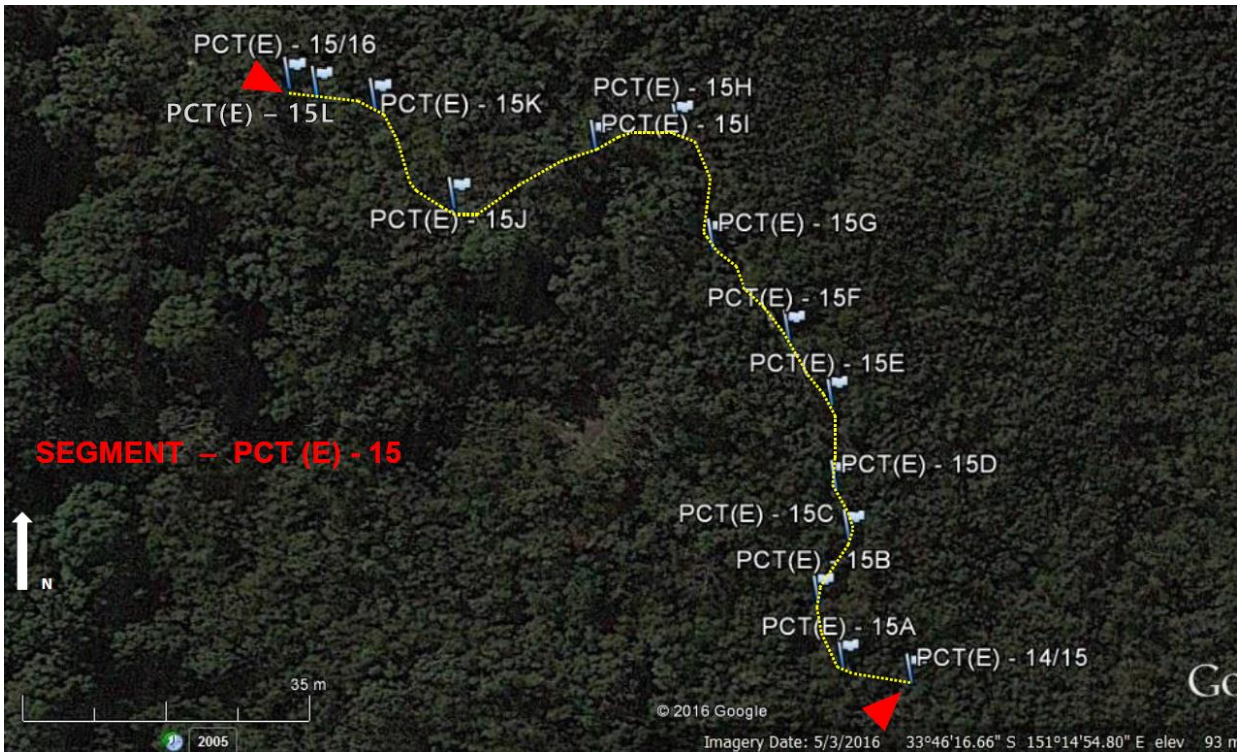
Replace or extend waterbar/step.

Stone-lined invert below waterbar/step and above in-situ rock, excavate extended discharge drain (stone-lined) allow free outlfows.

Additional waterbar/step below in-situ embedded rocks, and backfill tread with compacted gravel/fill butting onto rocks. Box sides to contain fill if required.

(Medium – to divert flows off track reducing downslope flows and erosion)

SEGMENT PARK CIRCUIT TRACK (EAST) - 15



SEGMENT: PCT(E) - 15	
Start Point: 337841 6261782	**End Point: 337769 6261850**

General Description and Condition: Generally eroded track winding up/down hillslope with multiple rock/ledge sections and (145m with 18m change in elations approx.) through open woodland and heath. Continued drainage capture and erosion. Fair condition only.

Tread Width (mm): Varies markedly,700-1,800 mm, with widening at rock ledges or rocky slopes and other obstacles.

Track Surface: Concave/dished compacted sand and some laterite gravels on more gently sloped sections, with loose/deposited sand downslope of active erosion slopes. Loose and protruding rock, exposed/protruding roots, and rock outcrops/ledges on steeper sections. Some flatter rock pavements.

Gradient (degrees): Some gentle sloped sections 1-2°, more commonly gentle/moderate and occasionally moderate slopes 4-10° with some short grades to 14° over rock ledge sections.

Alignment: Gently winding on lower section, curving on upper section with several sharper bends.

Terrain: Hillslope above midslope bench.

Soil: Lambert (Erosional) on undulating to rolling low hills on Hawkesbury Sandstone on gentler lower section, and Hawkesbury (Colluvial) on rugged, rolling to very steep hills on Hawkesbury Sandstone on steeper upper section.

Vegetation: Sandstone Heath

Track Works and Improvements: Occasional log waterbars and timber steps on lower section. No improvements on steeper upper section.

Signs and Wayfinding: Occasional metal arrows on rocks.

User Experience: Moderately difficult section with minor hazards at rock ledges and loose rocky slopes, care required. Eroded track, and sewer line, detracts from setting/experience.

Key Issues: Continued drainage capture and erosion and track widening around obstacles or difficult sections. Cleaning/maintenance of waterbars.

Recommended Works – Overall

- Ongoing cleaning and maintenance of waterbars.
- Monitor on-going drainage capture/entrenchment and need for additional waterbars.
- Monitor on-going track widening and need for containment.

Recommended Works – Site-specific (Priority)

Site ID: **PCT(E) - 15A**

Location: 337833 6261784

2 flat/rounded rock outcrops forming "natural;" steps, with (gap/channel in upper step), then embedded rocks above. 4 timber steps below (flows/erosion around the ends of 2 steps). 9° gradient.

Works:

Waterbar or stone-lined invert above.

Rock fill/armour and level gap in upper "natural;" step.

Extend or block (with embedded rock) lower timber steps to catch flows and minimise erosion around ends.

(low)

Site ID: **PCT(E) – 15B**

Location: 337829 6261792 Squared eroded channel 200mm deep by 300mm wide, within wider concave/eroded track to 400mm below NSL - in sandy clay and loose/deposited sands.

Works:

Waterbar/step, and backfill/level behind/ (above/upslope) with compacted gravel/fill (deposited sand on this section of track could be used for fill, if suitably stabilised and compacted). Extend waterbar and excavate discharge channel to match NSL and allow free outlfows.

(low)

Site ID: **PCT(E) – 15C**

Location: 337833 6261800 Broken rock outcrops and embedded rock, including central gap/gutter. Protruding roots retaining loose sands above. 9m long (approx.) and 5° gradient.

Works:

Waterbar/step at top end below roots, and backfill/level behind (above/upslope, to cover roots) with compacted gravel/fill (deposited sand on this section of track could be used for fill, if suitably stabilised and compacted).

Waterbar, built onto in-situ rock outcrops.

Rock fill/armour and level gap in lower sloped rock outcrops.

(Medium)

Site ID: **PCT(E) – 15D**

Location: 337832 6261805 4 timber steps 1,200mm wide off sloped rock ledge in fair/good condition, 14° gradient. Flow/scour down NE side of steps

Works:

Rubble fill and block wash/scour path beside steps.

Monitor rock ledge above steps for sand deposition and resulting slip hazard, may need to cut 1-2 level treads into rock surface.

(low)

Site ID: **PCT(E) – 15E**

Location: 337830 6261816 End of rock ledge, N of site PCT(E) – 15D.

Works:

Waterbar, to divert flows off track before rock ledge and protect steps at downslope site PCT(E) – 15D.

(low)

Site ID: **PCT(E) – 15F**

Location: 337826 6261823 Rock pavement and ledge above, with 600mm drop off, to sloped rock outcrop/pavement flanked by boulders in centre. Uneven/broken rock outcrop, with occasional roots and deposited sand, below then step off to compacted sand track. "S" curve and 10° gradient over whole site, drainage down, 15m long (approx.).

Works:

Waterbar above, approx. 4m upslope of edge of upper rock ledge.

Cut level tread into edge of rock ledge and build 2 steps (preferably stone steps), onto face of rock ledge.

Cut level tread into angled rock pavement, and build step (stone preferably) off pavement – adjacent to roots/boulders.

Waterbar, built onto in-situ rock, discharge to E, extend discharge if necessary to allow free outlfow.

Armour tread at step off lower rock outcrop (protect compacted sand track).

(Medium)

Site ID: **PCT(E) – 15G**

Location: 337816 6261833 2 full/failed log waterbars and 1 failed log waterbar with flow/erosion around end and widened track, 4° gradient, compacted and loose/deposited sand.

Works:

Clean-out 2 upper waterbars, extend lower waterbar and clean-out. Pull in and edge containment/definition to track at lower waterbar.

(Medium – to prevent further track widening and sustainability/impact issues)

Site ID: **PCT(E) – 15H**

Location: 337812 6261847 Flat/ledged rock outcrop stepped down to embedded and broken rocks and above a 90° bed with exposed/eroded boulders both sides and exposed/retaining roots, drainage down/over and eroded to 400mm below NSL, sloped rock outcrop/pavement below and concave/dished track to 100mm deep, 800-1,600mm wide, 15m long at 12° grade on upper section (bend) and 7° grade below.

Works:

(Waterbar at site just upslope [PCT(E) – 15I] provides drainage protection/diversion before this site.)

Stone armour/flagging above “natural” rock step above bend.

Infill and compact eroded gutter on bend and 2 stone steps, with armoured tread above, between boulders on bend.

1 stone step-and-run below bend/boulders, extending downslope to anchor step onto top of sloped rock outcrop below. Stone armour/flagging on run (due to likely continued flows down). Cut level tread on top of sloped rock outcrop below step.

Stone-lined invert on gap between lower rock outcrops at bottom end of site.

Stone infill (armour/flagging) top E side of lowest rock outcrop to “square-off” as low step to track downslope.

(Medium - for both passability/safety issues and sustainability/impact issues)

Site ID: **PCT(E) – 15I**

Location: 337803 6261847

Works:

Waterbar - to divert flows prior to major site downslope PCT(E) – 15H.

Open/remove low mound on low side of track to allow outflows, excavate broad shallow drain if necessary.

(Medium - low)

Site ID: **PCT(E) – 15J**

Location: 337787 6261837 Rock outcrop/ledge with 600mm face, exposed/protruding roots beside and below, protruding/embedded and loose rock on slope below eroded to 400mm below NSL on upper section with drainage down, curve with compacted sand and loose/embedded rock, to sewer lid with concrete base 100mm above track level. 9m overall, 6° gradient, 1,200-1,800mm wide.

Works:

Waterbar 2,5m upslope of upper rock ledge – beside boulder.

2 stone steps built out/off rock outcrop/ledge to cover roots, and armour lower landing/tread. Edge containment/definition to track.

Remove protruding rock on slope and build 1 or 2 step-and-runs on steeper/rockier part of slope. Edge containment/definition to track.

Embed/fix stone armouring at angle on protruding (trackside) edge of sewer access lid to reduce trip hazard.

(Medium - for both passability/safety issues and sustainability/impact issues)

Site ID: **PCT(E) – 15K**

Location: 337778 6261848 Sloped/rounded rock ledge with dip/hollows on N side below rounded rock face.

Works:

Fix stone to armour/level dip/hollow.

Cut step and level tread into sloped rock face below.

(low)

Site ID: **PCT(E) – 15L**

Location: 337771 6261850

Rounded/uneven rock outcrops with central gap and drainage down/between.

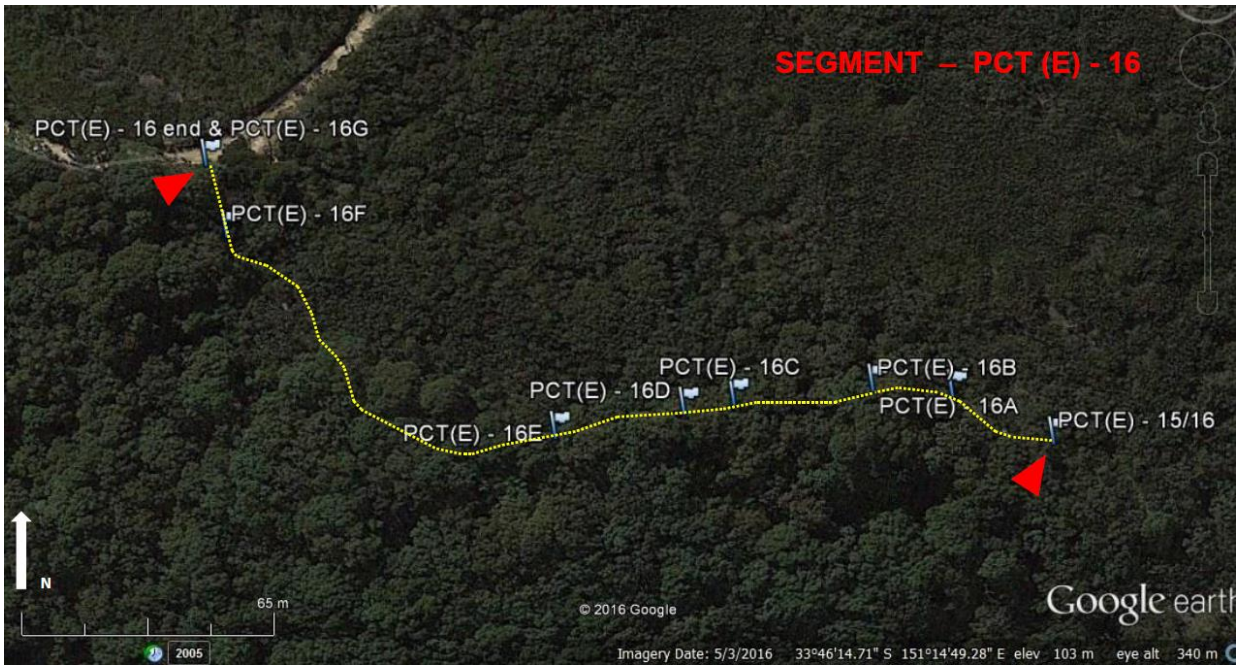
Works:

Stone infill and level central gap.

Waterbar above.

(low)

SEGMENT PARK CIRCUIT TRACK (EAST) - 16



SEGMENT: PCT(E) - 16	
Start Point: 337769 6261850	**End Point: 337579 6261908 (Perimeter Fire Trail and Shared Path)**

General Description and Condition: Mostly flat to gently undulating track (260m approx.), largely along contour across an upper hillslope with several on-ground or low boardwalks sections, though attractive Angophora forest. Junction with Perimeter Fire Trail and Shared Path at NW end.

Tread Width (mm): 600-1,200mm.

Track Surface: Mostly compacted sand and rock pavements, with occasional roots and embedded rocks. 65m (approx.) of boardwalk in 4 sections – 3 as on-ground timber boardwalk 1,200mm wide (fair to good condition), and 1 section of new fibreglass reinforced plastic boardwalk 900mm wide at NW end (good condition). Frequent seepage onto/across track with occasional ponding. Occasional concrete waste from adjacent sewer line.

Gradient (degrees): Flat to 3°.

Alignment: Very gently curving, with bend to junction with Perimeter Fire Trail and Shared Path at NW end.

Terrain: Upper hillslope, along break in slope or gentle/moderate cross slope, with steeper drop off track at one location (PCT(E) – 16C).

Soil: Hawkesbury (Colluvial) on rugged, rolling to very steep hills on Hawkesbury Sandstone.

Vegetation: Along boundary of Peppermint Angophora Forest downslope and Sandstone Heath upslope for E two-thirds, and Sandstone Heath at W end.

Track Works and Improvements: 4 sections of boardwalk (total 65m approx.) – 3 on-ground timber boardwalk, and 1 section of new fibreglass reinforced plastic boardwalk (with single steps) at NW end. Occasional log waterbar.

Signs and Wayfinding: New signage/directional totem at NW end, at junction with Perimeter Fire Trail and Shared Path.

User Experience: Easy pleasant walking, mostly through scenic Angophora forest with occasional filtered views to dam. Adjacent sewer line is a detracting element in places.

Key Issues: Boardwalk maintenance – especially older timber on-ground boardwalks. Management of seepage and ponding.

Recommended Works – Overall

- On-going condition monitoring and repair of older timber boardwalks.
- Open windrows on downslope margins of track.

Recommended Works – Site-specific (Priority)

Site ID: **PCT(E) – 16A**

Location: 337746 6261860 Squared rock outcrops with "natural " steps, and drainage down gutter along downslope side of outcrops.

Works:

Waterbar upslope of outcrops (will also divert flows before major downslope site (PCT(E) – 16B).

Stone flagging/fill in gutter - flat and level with adjacent rock outcrops.

(low)

Site ID: **PCT(E) – 16B**

Location: 337728 6261861 Bend with erosion scarp over large roots, drop of 500mm with drainage capture, embedded rocks and protruding roots below with water ponding. Track downslope 1,200-1,400 wide, eroded d to 300 below NSWL with protruding roots, and embedded rocks on upper section dropping to protruding roots on lower section. 10m long (approx.) and 5° gradient with drainage down entire site. 6m section upslope of tree/bend, compacted sand and rock outcrop.

Works:

Waterbar, 6m upslope of bend/tree, built onto in-situ rock outcrop on high side.

3 stone steps over tree roots and upper drop, fill/compact above/upslope to cover roots.

Central section of site - step-and-run, with 2 steps (stone preferably) off at lower end built on in-situ embedded rocks, and backfill/level the extended tread behind (above/upslope, to cover roots) with compacted gravel/fill back (or rock armouring/flagging for drainage/flows resistance) upslope to butt to steps above.

Lower section of site – 2 single step-and-runs, backfill/level behind (above/upslope, to cover roots) with compacted gravel/fill. Box-in downslope edges of runs/treads, if required.

Pull-in track width and provide edge definition/containment as required.

(Medium)

Site ID: **PCT(E) – 16C**

Location: 337698 6261857 On-ground timber boardwalk 12m long (approx.) and 1,200mm wide, +2m drop along much of boardwalk's length with only a narrow leaf-litter covered slope above – potential hazard. Jutting board approx. halfway (painted "hazard" yellow). Full /failed timber waterbar off E end of boardwalk.

Works:

Handrail along low side of boardwalk.

Clean out existing E waterbar.

Monitor boardwalk deck for repair and hazard management requirements.

(HIGH – safety issue, and monitor)

Site ID: **PCT(E) – 16D**

Location: 337686 6261855 Elongated narrow rock bar/outcrop directing flows and seepage onto timber boardwalk to E.

Works:

Waterbar at W end (above) in-situ rock bar (build onto rock bar if feasible).

Infill and level (rock armour preferably) gutter on high side of rock bar to level track.

(low)

Site ID: **PCT(E) – 16E**

Location: 337659 6261849 On-ground timber boardwalk, curved 19.5 m long (approx.) and 1,200mm wide, fair condition only - with jutting board (painted “hazard” yellow) and some decaying boards.

Works:

Monitor for repair and hazard management requirements.

(monitor)

Site ID: **PCT(E) – 16F**

Location: 337585 6261892 Sediment deposition under fibreglass reinforced plastic boardwalk and over/covering on-ground timber boardwalk, and sediment fan in bushland downslope – from spoon drain discharge off Perimeter Fire Trail upslope (just E of entry to Park Circuit Track)

Works:

Retention bank and larger stilling pond at end of spoon drain – off track but required to effectively prevent sediment outflow over track and bushland.

Large stone lined gutter under W end of on-ground timber boardwalk to carry flows (from spoon drain) under boardwalk (alternatively drain/gutter under S end of fibreglass reinforced plastic boardwalk to catch and divert flows away from on-pound boardwalk).

(Medium - sustainability/impact issues)

Site ID: **PCT(E) – 16G**

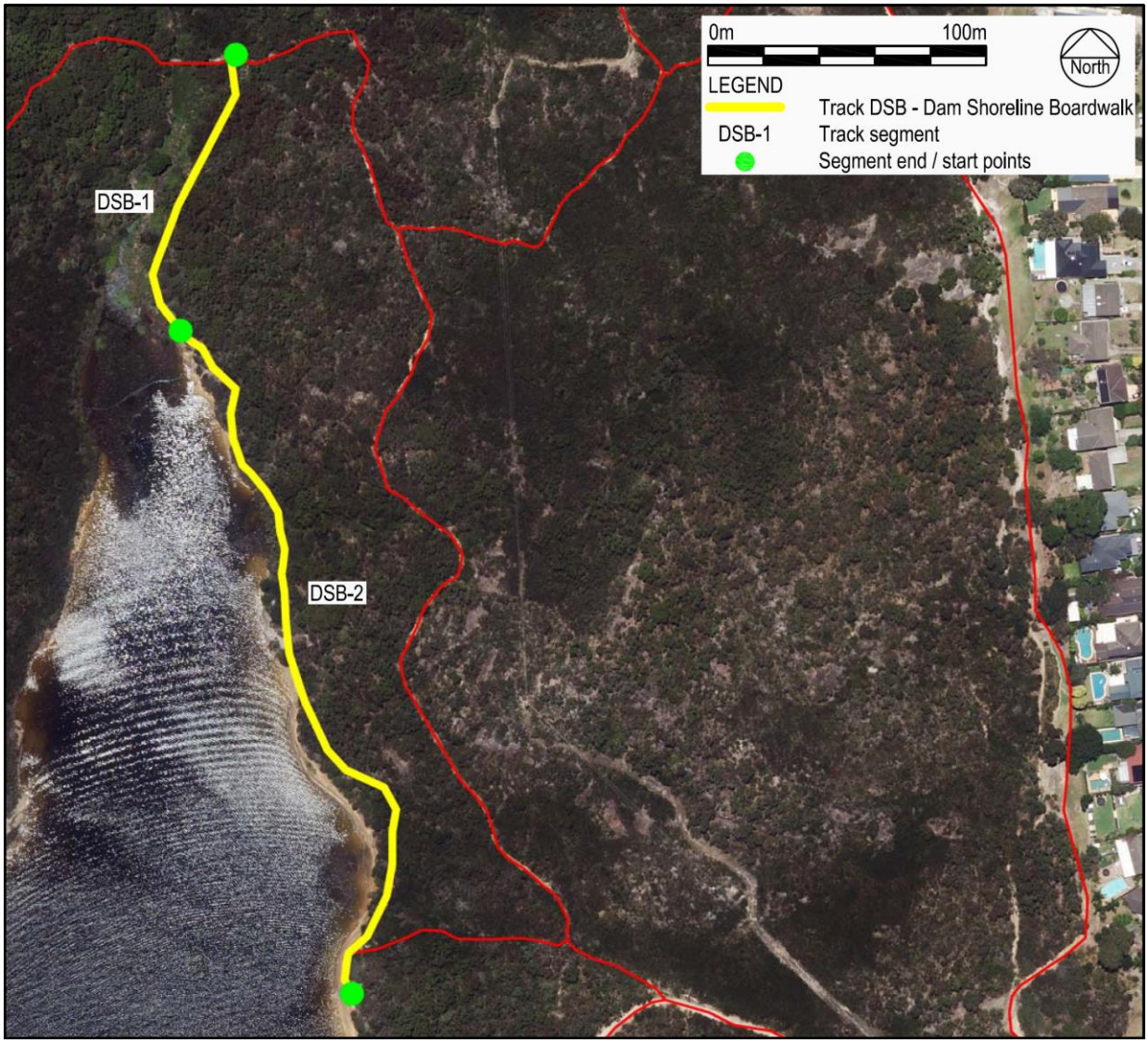
Location: 337579 6261908 Junction of Park Circuit Track and Perimeter FireTrail / Shared Path. New signage/directional totem. Drainage from fire trail onto start of Park Circuit Track.

Works:

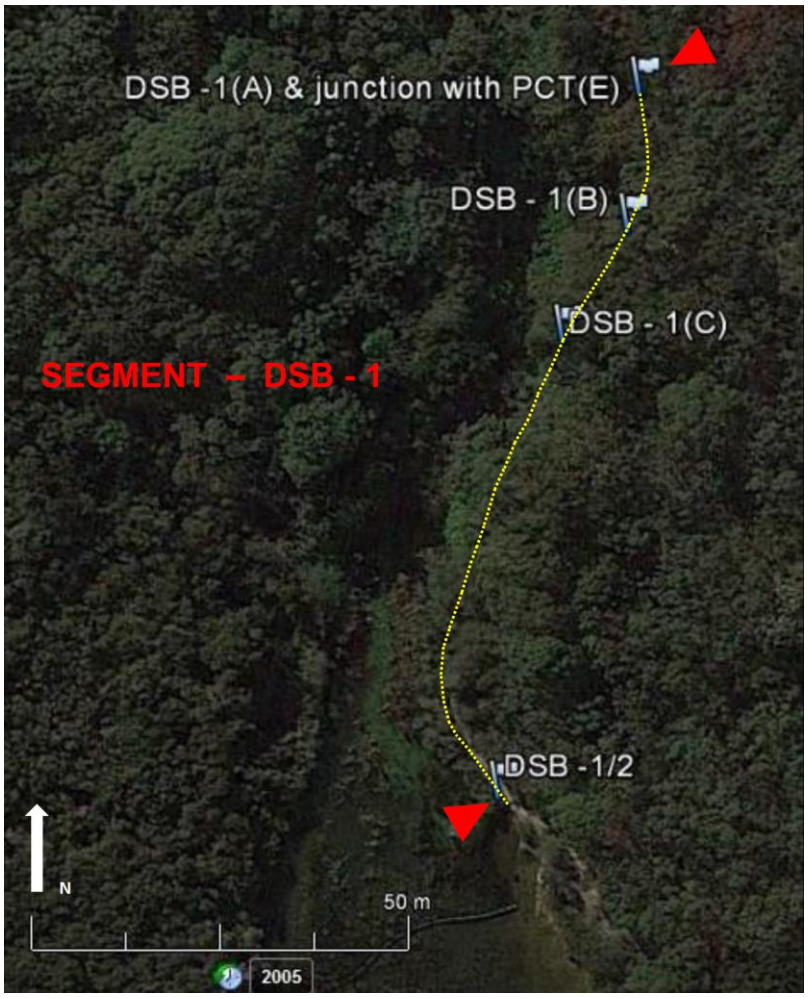
Mound or small roll-over along S edge of fire trail at start of Park Circuit Track, to prevent drainage entry.

(low)

DAM SHORELINE BOARDWALK - SEGMENTS 1 to 2



SEGMENT DAM SHORELINE BOARDWALK - 1



SEGMENT: DSB - 1	
Start Point: 338124 6261598 **(junction with Park Circuit Track (East) at end of PCT(E) - 9 and start of PCT(E) – 10)**	**End Point: 338104 6261498** **(at dam margin)**
General Description and Condition: Section of gently curving track (110m approx.) leading S to dam margin, N third is natural surfaced track and S two-thirds is timber and FRP boardwalk, through open woodland in N and ferns, sedges and Ti-tree heath in S. Mainly in good condition, short section only good to fair condition. *Tread Width (mm):* 900-1,200mm on sandy section in N, 900mm on low boardwalk. *Track Surface:* Compacted sand with some sand/clay and occasional rocks/roots, and some areas of dished and eroded track, in N third (natural surfaced track). Timber and FRP boardwalk for S two-thirds. *Gradient (degrees):* Mostly flat boardwalk, short section at 3-5° at natural surfaced N end. *Alignment:* Junction with PCT(E) at N end. Gently curving natural surfaced track in N end and gently curving low timber boardwalk for S two-thirds. *Terrain:* Lower hillslope and dam margin. *Soil:* Lambert (Erosional) – undulating to rolling low hills on Hawkesbury Sandstone.	

Vegetation: Bloodwood-Scribbly Gum Woodland (part of Sydney Coastal Dry Sclerophyll Forest) in N half, mapped as “artificial wetland” in S half closer to dam.

Track Works and Improvements: Low boardwalk (floating ?) mainly timber with newer central section of FRP (N end at 338112 6261564, S end [and segment end] at 338104 6261498). 80m length in total, from N – 45m of timber boardwalk, mostly in good condition, occasional single or double step-and-run; then 11m of newer FRP boardwalk; then 24m of timber boardwalk, fair condition only with some rotting planks and uneven/lifting sections. Step off S end of boardwalk onto sandstone outcrops/rocks at dam margin.

Signs and Wayfinding: Small log post with two metal directional arrows (indicating PCT(E), DSB not signposted), and taller timber post/stake behind log post but no signage, at N end of segment (junction with PCT(E)). “Gulgadya Muru” Aboriginal self-guided walk interpretive panel (x 1) beside N half of boardwalk - good condition.

User Experience: Easy walking with access to dam at S end.

Key Issues: Signposting at junction with PCT(E). Deposition over N end of boardwalk and potential for rot/decay. Maintenance of boardwalk. Minor drainage capture at N end.

Recommended Works – Overall

- Upgrade signage as per Manly Dam Sign Location Plan.

- Monitor boardwalk for plank rotting/failure (and movement), and repair/replace as required.

Recommended Works – Site-specific (Priority)

Site ID: **DSB – 1(A) (junction with Park Circuit Track (East) – 9/10)**

Location: 338124 6261598 Track junction (DSB-1 to S, PCT(E)-9 to E and PCT(E)-10 to W) with stone pavement/outcrops as "natural" steps above, and scored sleeper steps below with compacted sandy loam treads and end rocks. Log waterbar/step angled to NW off stone pavement/outcrops, and extended with scored sleeper waterbar. Small log post with two metal directional arrows (indicating PCT(E), DSB not signposted), taller timber post/stake behind log post but no signage. Drainage flows down/through junction, but little scour. Start of DWB to S is compacted sand/loam with occasional embedded rocks and large root (as step), 900-1,100mm wide, slightly dished to 100-150mm deep.

Works:

Upgrade signage as per Manly Dam Sign Location Plan.

(Medium)

Site ID: **DSB – 1(B)**

Location: 338123 6261579 (midpoint) Compacted sand and some sandy/clay track, 900-1,200mm wide, 3-5° gradient (gentler at top, steeper gradient is in S on slope to dam/boardwalk), dished to deeply dished in places up to 300mm below NSL with drainage down, occasional protruding roots, embedded rock/outcrops (ironstone) at lower/S end (downslope of last/lowest waterbar). 4 log waterbars or waterbars/steps over 20m approx. total distance – 2 middle log waterbars failed with wash around lower ends, and 350mm step-off last/lowest waterbar/step to uneven embedded rock. Short cut track from PCT(E)-9 joins at upper part of site.

Works:

New sleeper waterbar at top of slope to dam/boardwalk (between upper and second existing waterbars) with extended outlet to discharge well off track. Locate at least 1 pace above/upslope of existing downslope water (to be extended).

Extend (or replace) 2 middle waterbars, to prevent wash around.

Boxed sleeper step-and run, with filled/compacted tread, 1.5m downslope of last/lowest waterbar/step anchored onto embedded rock. Extend/butt tread to existing waterbar/step to reduce step height. Pull in track width and block/barrier (with rock rubble) to prevent avoidance

(low)

(see PCT(E) – 9E for closure of short cut track at top of site)

Site ID: **DSB – 1(C)**

Location: 338112 6261564 Compacted and deposited sand track, 900-1,200mm wide. Gentle gradient, but drainage down from upslope, with loose/deposited sand and leaf litter over first 1.5m of timber boardwalk (potential for rotting/decay).

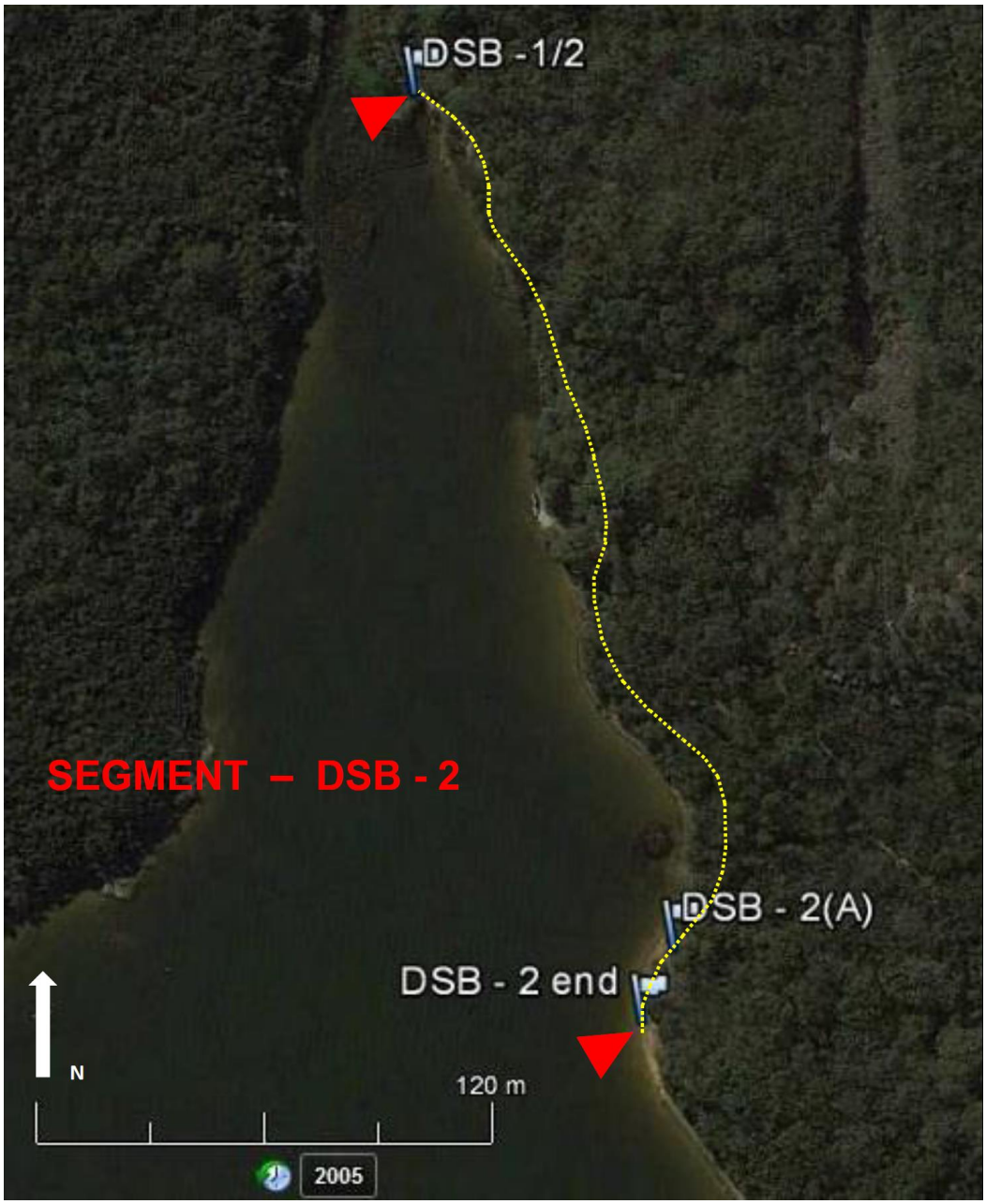
Works:

Low mound (or sleeper waterbar), 2m long, butt to top bank to E to catch and divert all flows (discharge to W) before boardwalk.

Clear off N end of boardwalk.

(low, and monitor)

SEGMENT DAM SHORELINE BOARDWALK - 2



SEGMENT: DSB - 2	
Start Point: 338104 6261498	**End Point: 338166 6261258**
General Description and Condition: Gently curved and slightly undulating informal/trample track along dam shoreline linking water access point, informal track (not part of the official track network) but well-used and easily visible/followed on-ground. Extends for approximately 270m, S from end of boardwalk (DSB-1) to terminate on dam shoreline approximately 75m N of lower/dam (W) end of Nyrang Road Fire Trail (connection possible along gravelly shoreline, unless the dam is very high, and appears regularly used). Through mixed heath over sedges and open dam shoreline. Unmanaged /unmaintained route in generally fair to good condition.	

Tread Width (mm): Mainly 600-800mm, minor sections to 1,200mm.

Track Surface: Mostly compacted (often damp) sand, areas of compacted sand/clay and embedded rocks and laterite gravels (more common towards S end), embedded roots in many places. Frequently dished (usually only slightly) but only minor drainage capture and minor occasional erosion/scour over rocks and roots. Sections possibly occasionally inundated. Stone outcrops and minor ledges where track curves inland away from dam margin.

Gradient (degrees): Flat to gently undulating, short sections to 3° (mainly when curving up/away from dam margin and over/around minor rock outcrops).

Alignment: Gently meandering along dam edge, occasionally curving upslope around rock outcrops or minor drainage features to 10-15m off waterline.

Terrain: Dam margin.

Soil: Lambert (Erosional) – undulating to rolling low hills on Hawkesbury Sandstone.

Vegetation: Mostly Bloodwood-Scribbly Gum Woodland with smaller areas of Sandstone Heath in the centre and S (both part of Sydney Coastal Dry Sclerophyll Forest).

Track Works and Improvements: Nil (well-used but not maintained/constructed informal track).

Signs and Wayfinding: No wayfinding on DSB-2 informal track. Short (old) log post with 2 metal directional arrows at junction with disused track near S end (DSB-2(A)).

User Experience: Easy pleasant walking along dam margin with constant views of dam and regular access to water edge.

Key Issues: Informal and unmaintained track, not part of the official track network. Several faint trample tracks upslope into adjoining bushland (usually to "toilet" areas) and downslope to dam margin. Potential for inundation in places.

Recommended Works – Overall (if track is to be retained/formalised)

- Closure of disused track near S end.
- Provide wayfinding, especially at S end and for shoreline link to Nyrang Road Fire Trail.
- Management of trample tracks.
- Monitoring, and possible realignment, of sections subject to inundation.

Recommended Works – Site-specific (Priority)

Site ID: **DSB – 2(A)**

Location: 338173 6261277 Overgrown and deeply eroded disused track from E/upslope, over sleeper step/waterbar undercut/scoured on downslope side. Eroded sand/clay, 1,400mm wide, with drainage down disused track onto/across informal DSB track. Short (old) log post with 2 metal directional arrows. Informal DSB track of compacted sand/clay with roots and occasional laterite gravel. (Disused track ruins directly upslope to join PCT(E)-5A.)

Works:

Remove log post and directional arrow.

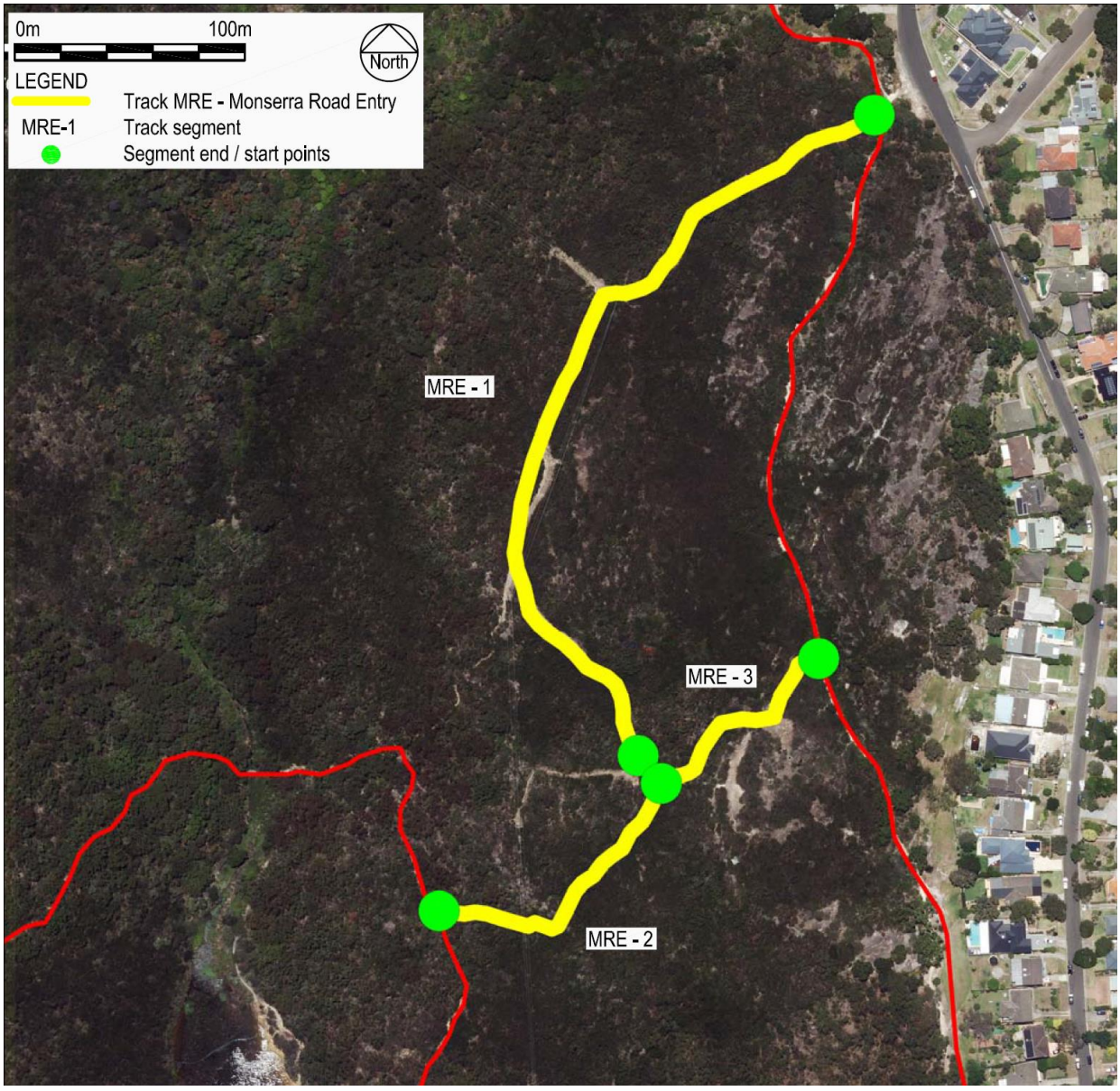
Remove existing step/waterbar and re-contour junction.

Additional waterbars x 2 (re-use existing/removed sleeper), or low mound(s), on lower section of disused track to divert drainage before junction.

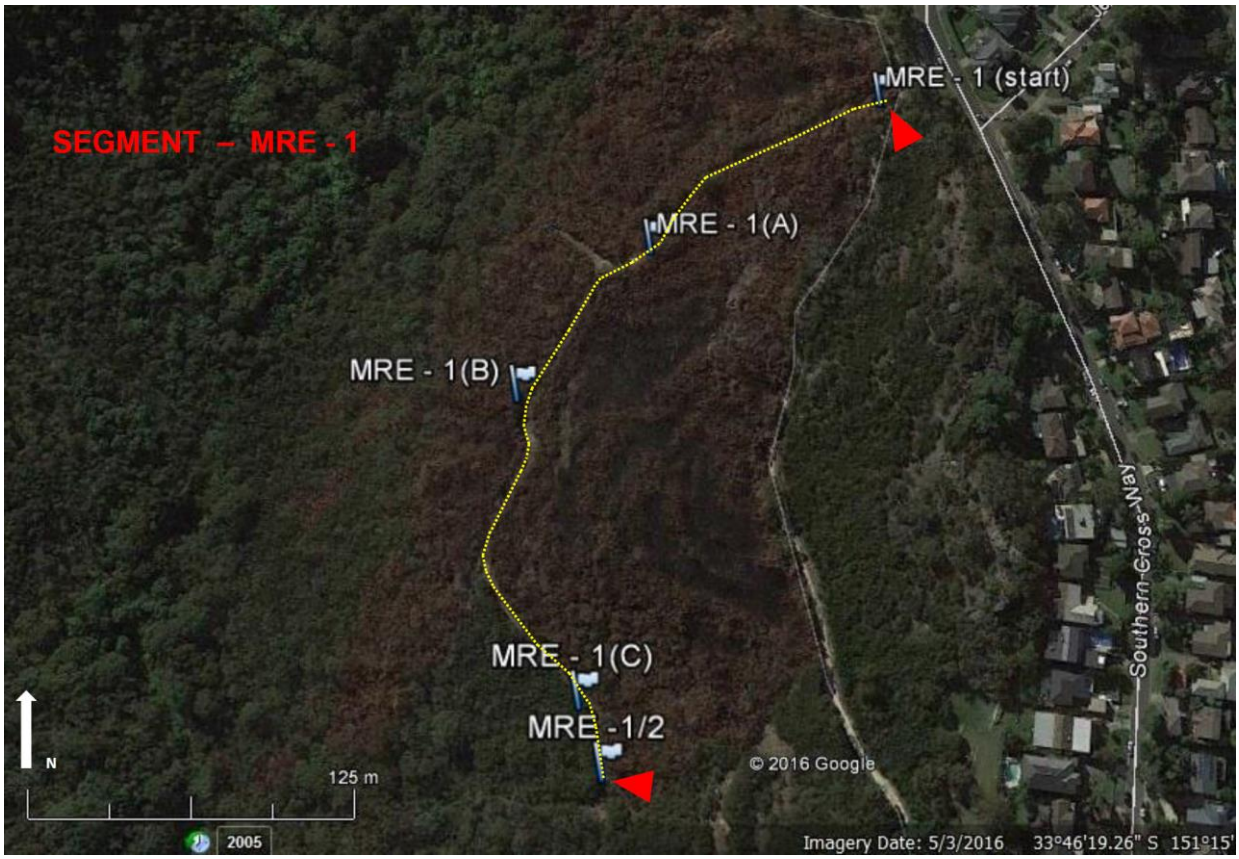
Close, disguise and rehabilitate disused track.

(low)

MONSERRA ROAD ENTRY - SEGMENTS 1 to 3



SEGMENT MONSERRA ROAD ENTRY - 1



SEGMENT: MRE - 1	
Start Point: 338371 6261880 **(junction with Perimeter Fire Trail and MTB Track, beside Monserra Road)**	**End Point: 338269 6261603**
General Description and Condition: Maintained fire trail (410m approx.) up/down and across a gentle to gentle/moderate slope through tall Casuarina heath and Casuarina- Banksia heath with scattered Eucalypts on lower section. Lower two-thirds is under or parallels power line. Good condition. *Tread Width (mm):* 2,000-2,600mm. *Track Surface:* Level to uneven compacted sand/sandy-clays and gravels, some embedded rock, areas of rock pavement/outcrops (mainly on upper section) and minor areas of sand deposition and ponding (mainly on lower section). Slight cross-slope in many places, side gutters in places. *Gradient (degrees):* Mainly gently sloped (1° to 3.5°) with some gentle/moderate slopes (4° to 6°) on E/upper section. *Alignment:* Up/down slope from E entry then Gradually curving across gentle cross-slope. *Terrain:* Upper hillslope. *Soil:* Lambert (Erosional) undulating to rolling low hills on Hawkesbury Sandstone, on E/upper section. Hawkesbury (Colluvial) rugged, rolling to very steep hills on Hawkesbury Sandstone, on lower section across slope. *Vegetation:* Mostly Sandstone Heath, minor areas of Bloodwood-Scribbly Gum Woodland.	

Track Works and Improvements: Maintained fire trail (and power line service access) in good condition. Post and slip-rail gate at E entry.

Signs and Wayfinding: Large routered timber wayfinding sign (fair condition) and "walkers" pictogram (on gate post, good condition) at E entry. Old post and metal direction arrow at lower end (fair/poor condition). No wayfinding at lower end where fire/service trails diverge/terminate.

User Experience: Easy walking, but less appealing fire trail setting. Possible interaction with mountain bike traffic at E end/entry.

Key Issues: Fire/service trail maintenance and minor drainage capture. Signposting at lower end, and upper E/entry (junction with Perimeter Fire Trail and MTB Track).

Recommended Works – Overall

- Routine fire trail maintenance.
- Upgrade signage at E/entry and lower end (where fire/service trails diverge/terminate).

Recommended Works – Site-specific (Priority)

Site ID: **MRE – 1(A)**

Location: 338277 6261811 Wide shallow gutter on N side of sweeping downslope "S" bend fire trail, 3° gradient.

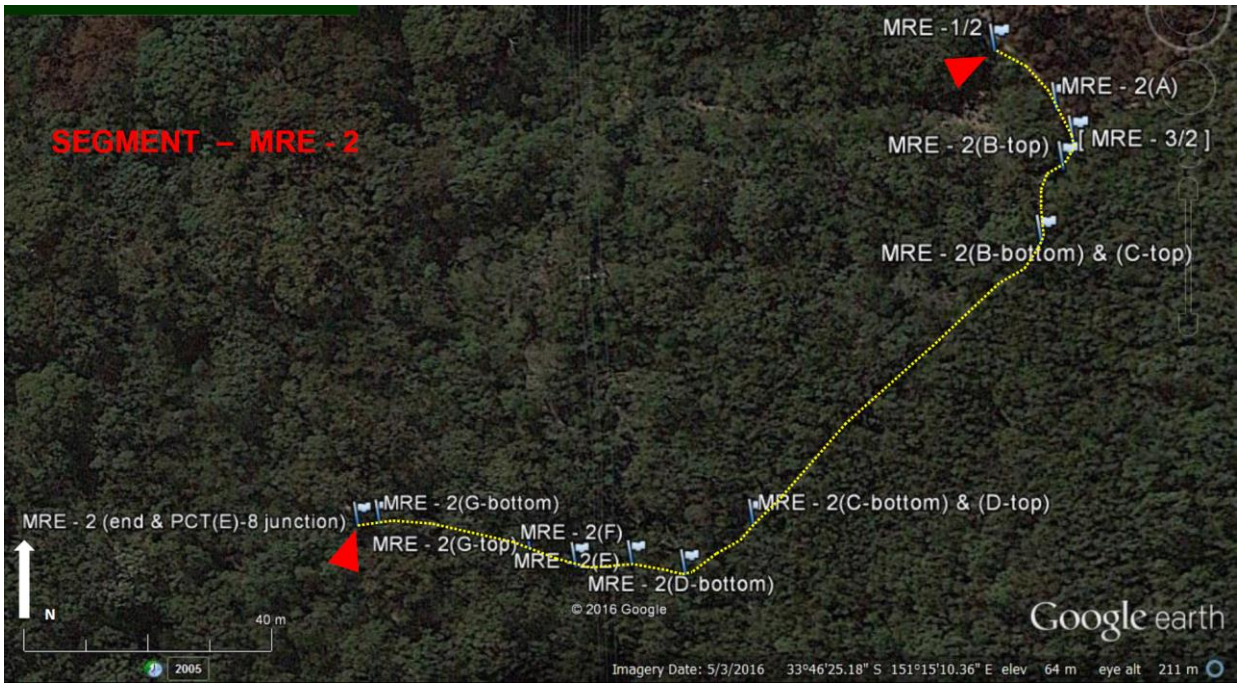
Works:

Rollover drain upslope.

(low)

	***Site ID:*** **MRE – 2(B)** *Location:* 338227 6261745 Seepage ponding on low point/kink on fire trail. *Works:* Open windrow along downslope edge of trail, excavate broad shallow invert along downslope edge of trail if problem recurs. **(low)**
	***Site ID:*** **MRE – 2(C)** *Location:* 338261 6261628 Concentrated overland flow across /along fire trail. *Works:* Broad invert (or double rollovers) to contain and direct surface/sheet flows across fire trail. **(low)**

SEGMENT MONSERRA ROAD ENTRY - 2



SEGMENT: MRE - 2	
Start Point: 338269 6261603	**End Point: 338183 6261536 (junction with Park Circuit Track (East) - 8)**
General Description and Condition: Short but steep and degraded section of narrow track running 155 m (approx.) up/down a moderate slope, especially on upper section with more up/down/across contour on lower section. Multiple failed waterbars and several steep rocky sections. Deeply eroded in many parts with continued drainage capture and guttering. Mixed Banksia and Casuarina heath on upper section, grading to low open woodland on lower section. Passes under power line in centre, and joins Park Circuit Track (East) -8 at bottom end. Poor to very poor condition. *Tread Width (mm):* Mostly 400-800mm, up to 1,200mm in places. *Track Surface:* Deeply eroded/guttered in most parts, up to 500mm below NSL, where not over exposed or embedded rock. Mostly compacted sand/clay. Sections of rock "chutes". *Gradient (degrees):* Mostly 10-15° on steeper central section (majority), 2-5° on more gently sloped upper and lower ends. *Alignment:* Mostly acutely angled up/down slope with few bends, lower section curves away to a slightly more across contour alignment. *Terrain:* Mid to lower hillslope, track encompasses break in slope. *Soil:* Hawkesbury (Colluvial) rugged, rolling to very steep hills on Hawkesbury Sandstone, on upper section. Lambert (Erosional) undulating to rolling low hills on Hawkesbury Sandstone, on lower section. *Vegetation:* Mostly Sandstone Heath, minor area of Bloodwood-Scribbly Gum Woodland in centre of section.	

Track Works and Improvements: Long run of log steps and waterbars on upper section, scattered single log waterbars on lower section – most full/failed with flows/scour around ends, and several rotted. Several placed stone steps at central rock "chute".

Signs and Wayfinding: Nil. Remains of log post (possibly former sign) opposite lower end of track at junction with Park Circuit Track (East) - 8. No wayfinding at junction with MRE-3 or junction with Park Circuit Track (East) - 8.

User Experience: More challenging walking requiring care on steep, uneven and rocky slopes. Numerous trip hazards. Power lines visible overhead.

Key Issues: Drainage capture and ongoing erosion with channels to 400-500mm deep. Steep section with high steps and trip hazards.

Recommended Works – Overall

- Identification and directional/wayfinding signage at junction with Park Circuit Track (East) – 8.
- Ongoing cleaning and maintenance of waterbars and drainage treatments.
- Monitor for ongoing drainage capture and erosion problems
- Potential for re-routing of problem sections and closure/rehabilitation of failed track – as detailed below.

Recommended Works – Site-specific (Priority)

Site ID: **MRE – 2(A)**

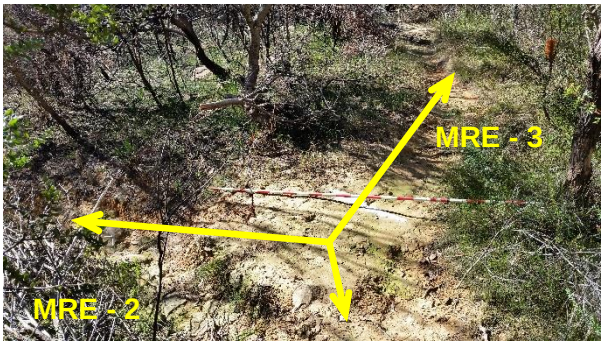
Location: 338277 6261603 Guttered track to 400mm below NSL over rock outcrops and embedded rocks, compacted sandy/clay and roots, 600-800mm wide.

Works:

Waterbar above to catch/divert surface flows.

Install 5-6 step-and-runs (steps may be needed in upper section) with filled and compacted treads (fill could be delivered via nearby fire/service trail), extend a suitable tread midway down series to include waterbar.

(Medium)



Site ID: **MRE – 2/3 (junction)**

Location: 338279 6261591 Junction with segment MRE – 3, from upslope. No wayfinding.

Site ID: **MRE – 2(B)**

Location: 338278 6261587 top

338276 6261578 bottom

Guttered track 50-150mm below NSL in compacted sandy clay, drainage down track form junction upslope, failed/rotted waterbar with wash/tracking around end, roots retaining track surface, 2.5 ° to 4° gradient.

Works:

Replace upper waterbar.

New waterbar/step in lower section.

(low)

Site ID: **MRE – 2(C)**

Location: 338276 6261578 top

……338240 6261540 bottom

Extended run of entrenched track 600-1,100mm wide up/down moderate slope (11° to 15°) with total elevation change of 11-12m, guttered 100-400mm below NSL with drainage capture and flows down, compacted clay/sand with embedded rock and roots with some rock outcrops/ledges on lower section, areas of gravel and loose/deposited sand, 12 existing log steps and 4 log waterbars (all full/failed, several with wash/erosion around end).

Works:

Major works required (approx. counts only):

- waterbars (timber) – new waterbar at top, replace/reinstate 2 existing waterbars, 6 new waterbars (2 built onto/off in-situ rock), retain and clean-out 2 existing waterbars;
- steps (timber) – replace/reinstate 8 existing steps, 11 new steps, retain 1 existing step;
- 7 new rock steps, built onto/off in-situ rocks; and
- 5 new rock steps – infill/extend and level in-situ rock outcrops to create rock step.

Extend all new or reinstated steps well into adjacent natural ground.

(**Note:** Alternative approach would be to close and rehabilitate this entire section of track (running straight up/down slope) and establish a new track, to NW, contoured into

slope with sweeping switchback and drainage protection.)

(HIGH - for both passability issues and sustainability/impact issues)

Site ID: **MRE – 2(D)**

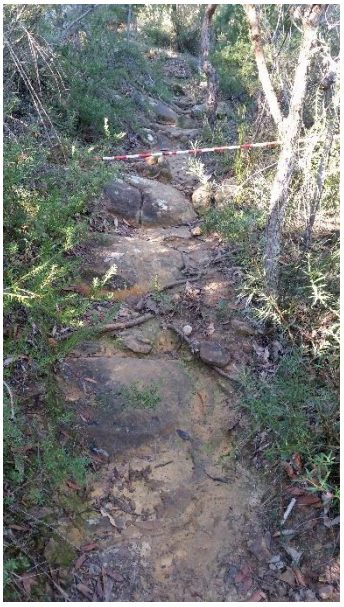
Location: 338240 6261540 top
338231 6261532 bottom

Rock "chute" over/between large rock ledges. Sloped rock outcrop on upper section, 600-900mm wide, 18° gradient over 11m (total vertical drop of 2.5m). Lower section 25° over 5.5m (total vertical drop of 2.6m), 400-900mm wide, in-situ ledges and 5 placed rock steps plus 2 log steps at base (some steps to 400mm high). Drainage capture and major flows down track.

Works:

Major works required, detailed on-site selection and location of track treatments necessary. Approximate requirements only:

- large waterbar at top of site, with extended discharge (2.5-3m) to spill beyond upper rock ledge avoiding backflow onto track;
- 5 rock steps on upper section (above sloped outcrop) with rock armoured treads (due to likely flows down track);
- cut 6 rock steps into sloped rock outcrop, with infill/levelling where required (if surface unstable/broken);
- reinforce/reinstate 5 existing rock steps at top of lower section (lower 2 in-situ rock steps may need full rebuild);
- replace upper log step with 2 rock steps or short step-and-runs (with rock armoured treads); and
- replace lower log step with 2 rock steps and armour tread off/below.

	(HIGH - for both passability and safety issues and sustainability/impact issues)
	***Site ID:*** **MRE – 2(E)** *Location:* 338223 6261533 Failed log waterbar on 13° gradient, benched/guttered track to 150mm deep and 600-800mm wide, compacted sandy clay, embedded rocks (some sloping) and roots, drainage capture/flows down. *Works:* Replace and extend waterbar. 2 new boxed step-and-runs below, with filled/compacted tread. **(Medium - for passability and safety)**
	***Site ID:*** **MRE – 2(F)** *Location:* 338216 6261532 slope of embedded and protruding rocks in compacted sand/clay, 600-800mm wide, 10° gradient with drainage capture/flows down. *Works:* 5 rock steps or step-and-runs variously cut into or built onto in-situ rocks, box/retain lower side as required, and extend a suitable tread midway down series to include stone-lined invert. **(Medium - for both passability issues and sustainability/impact issues)**

Site ID: **MRE – 2(G)**

Location: 338209 6261534 top

……338185 6261537 bottom

Eroded (28m) section of entrenched track up/down and angled across slope, 12° gradient overall, some steeper sections on upper part and gentler on lower part (above junction with PCT(E) – 8), compacted clay/sand guttered 100-500mm below NSL and 300-400mm wide and drainage capture/flows down, sloped embedded rocks and rock outcrops, stumps and protruding roots, failed log waterbars.

Works:

Replace failed water bar at top.

Build 4 rock steps or step-and-runs onto in-situ rock outcrops, box/retain lower side as required, and extend a suitable tread midway down series to include stone-lined invert or waterbar.

Replace failed waterbar and build 2 boxed steps, or 1 step and 1 step-and-run, with filled/compacted tread below.

Fill and level in-situ rock outcrops to form rock steps, with 2 boxed stone steps below.

Reinstate/replace waterbar with 2 steps or step-and-runs, with filled/compacted tread, below.

1 step-and-run, with filled/compacted tread, on extended gutter at lower end.

(HIGH - for both passability and safety issues and sustainability/impact issues)

Site ID: **junction with Park Circuit Track (East) -8**

Location: 338183 6261536

Note: An alternative approach to treatment of the lower section of this segment, from the bottom of Site MRE – 3(D), would be to close and rehabilitate this entire section of track and establish a new alignment to the S (contoured into slope with one or more sweeping switchbacks and drainage protection) linking across and down slope to a more southerly intersection with the Park Circuit Track (East).

SEGMENT MONSERRA ROAD ENTRY - 3

SEGMENT: MRE - 3	
Start Point: 338347 6261645 (junction with Perimeter Fire Trail and MTB Track)	**End Point: 338279 6261591 (junction with Monserra Road Entry – 2)**
General Description and Condition: Short 95m section of linking track with no treatments and limited (if any) maintenance. Upper/E 35m off Perimeter Fire Trail is gently sloped, slightly dished, track in fair condition leading through tall Casuarina and Banksia heath to a large rock bench/pavement. Track then runs acutely up/down a moderate slope with significant drainage capture/flows and guttering to 500mm below NSL - poor to very poor condition. *Tread Width (mm):* Mostly 400-800mm, up to 1,100mm in places. *Track Surface:* Mostly compacted clay/sand (slippery in places), with rock outcrops/ledges and embedded rocks, and an area of rock bench/pavement at break in slope. Frequent exposed roots due to guttering. *Gradient (degrees):* Gentle slope on upper/E end 1.5-2.5°, mostly moderate slopes on majority of track below break in slope b (10 to 13°). *Alignment:* Mostly acutely angled up/down slope, upper/E and lower/W ends are aligned slightly more across contour. *Terrain:* Upper to mid hillslope, track encompasses break in slope over edge of rock benches/pavement. *Soil:* Mostly Lambert (Erosional), undulating to rolling low hills on Hawkesbury Sandstone. *Vegetation:* Sandstone Heath on upper/E section above break in slope, Bloodwood Scribbly Gum Woodland on moderate slope in W. *Track Works and Improvements:* Nil.	

Signs and Wayfinding: Nil. No wayfinding at junction with Perimeter Fire Trail in E or with MRE-2 in W.

User Experience: More challenging walking requiring care on eroded slippery sections and steeper slopes. Numerous trip hazards and areas of ponding.

Key Issues: Informal link track that receives regular use, but would require considerable treatments if to be retained. Drainage capture and ongoing erosion with channels to 500mm deep. Steep sections with slippery gutter and trip hazards.

- **Recommended Works – Overall (i**f track is to be retained/formalised)
- Identification and directional/wayfinding signage at junction with Perimeter Fire Trail in E or with MRE-2.
- Ongoing cleaning and maintenance of waterbars and drainage treatments.
- Monitor for ongoing drainage capture and erosion problems
- Potential for re-routing of problem sections and closure/rehabilitation of failed track – as detailed below.

Recommended Works – Site-specific (Priority)

Site ID: **MRE – 3(A)**

Location: 338322 6261618 Lower NW edge of large rock bench/pavement (track crosses NW corner of bench) with flows concentrated off pavement down track.

Works:

Cut broad shallow invert/spoon drain across drainage path over bench, discharging N away from track below (discharge area may need reinforcing with waterbar, or cut outlet drain, to ensure outflow is well clear of track below). Caution required in cutting invert across bench to avoid trip hazard and detracting from appearance of site.

(Medium – for sustainability/impact issues, to divert surface flow and

protect sites/treatments downslope on track)

Site ID: **MRE – 3(B)**

Location: 338314 6261619 Series of rock ledges/outcrops and "natural steps" up to 500mm high over 13m section, some rounded/angled and slippery, 600-1,100mm wide compacted clay/sand, 13° gradient with drainage capture/flows down.

Works:

Level treads and cut steps into in-situ ledges, armour clay/sand benches/treads where required.

Build stone step onto large (500mm high) ledge.

Infill gap between flat embedded rocks and level as step.

(Medium)

Site ID: **MRE – 3(C)**

Location: 338309 6261617 top

……338288 6261596 bottom

Upper section – 19m at 5-11° gradient with overall local relief of 3.5m (approx.), track is largely an eroded dished/semi-circular gutter 300-500mm below NSL with occasional ponds/dips and roots and rocks, drainage capture/flows down (and ponded water after rains), 400-700mm wide in clay/sand (slippery in places), intruding/overhanging vegetation.

Middle section – short 5m compacted sandy clay, flat to gently sloped (1°).

Lower section – gutter to 400mm below NSL over rocks/roots, 9m long 600-800mm wide, 10° gradient with drainage capture and flows, sloped rock outcrop at base.

Works:

Total rebuild of upper section with steps and step-and-runs with infilling and compaction of treads (approx. 12-14 steps/risers needed overall), waterbar at top and at least 5 waterbars or stone-lined inverts on elongated treads midslope where practical (fill could be delivered via Perimeter Fire Trail upslope). Alternative treatment would be fibreglass reinforced plastic steps and landings, with existing gutter rubble filled and drainage inverts cut or blocked/walled underneath mesh at top and at least 2 points downslope).

Waterbar (rock) on central flatter section).

5 boxed step-and-runs (over 2m section), with regular “wings” to prevent/divert flows down/along sides.

In-situ rock outcrop at bottom of site:

- cut or build-up stone-lined invert at top;
- level treads (x 2) into centre of outcrop; and
- build/formalise low stone step off lower end of outcrop.

(**Note:** An alternative approach would to close and rehabilitate this entire 33m section of track (which largely runs straight up/down slope) and establish a new track, to N, contoured into slope with sweeping switchback [at rock ledge/outcrop on break in slope] and planned drainage protection.)

(HIGH - for both passability issues and sustainability/impact issues)

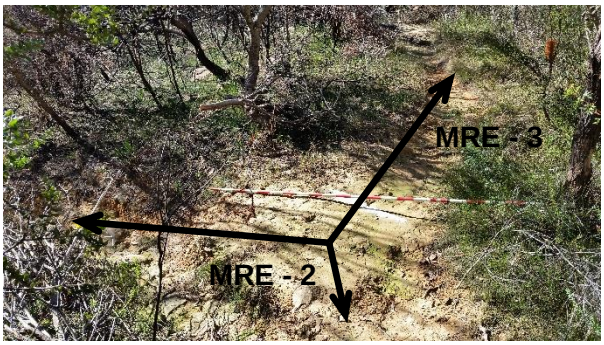
Site ID: **MRE – 3(D)**

Location: 338284 6261593 Dished track eroded 50-100mm below NSL, 400-600mm wide in compacted sandy clay with low embedded/outcropping rock, 4.5° gradient.

Works:

Rock waterbar built onto in-situ embedded/outcropping rock.

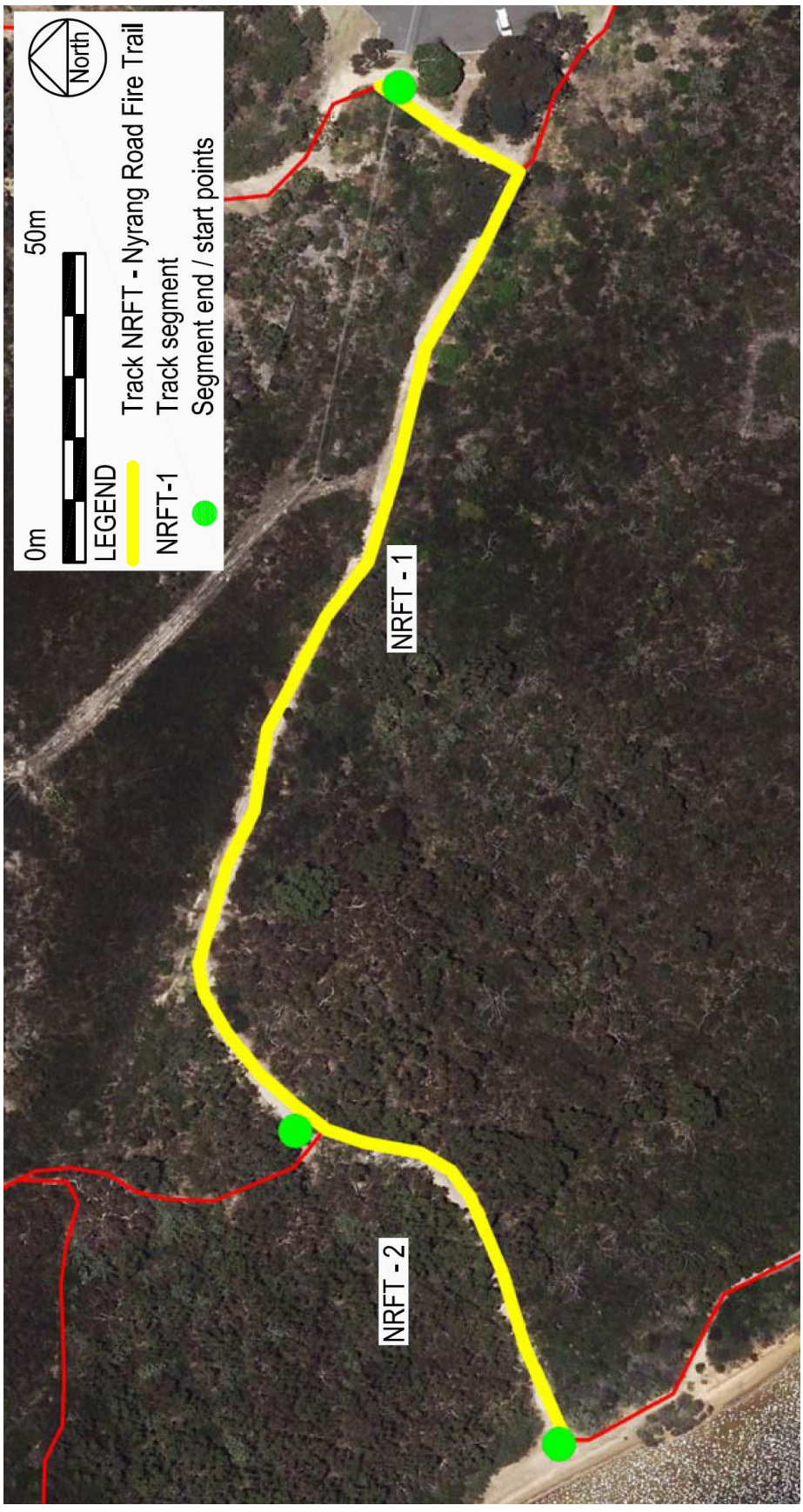
(Medium – for sustainability/impact issues, to divert surface flow and protect sites/treatments downslope on track in MSE-2)



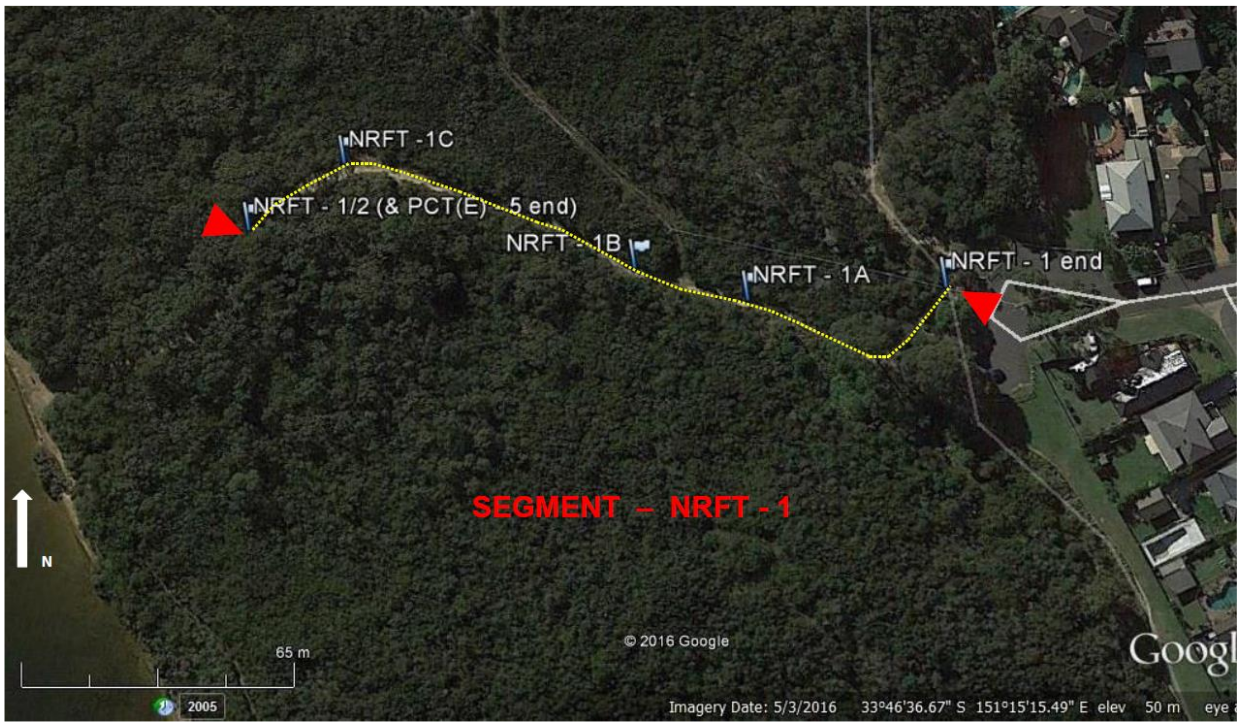
Site ID: **MRE – 3/2 (junction)**

Location: 338279 6261591 Junction with segment MRE – 2, joins at 80° bend. No wayfinding.

NYRANG ROAD FIRE TRAIL - SEGMENTS 1 AND 2



SEGMENT NYRANG ROAD FIRE TRAIL - 1



SEGMENT: NRFT - 1	
Start Point: 338422 6261223 **(Nyrang Road carpark)**	**End Point: 0338252 6261240** **(junction with Park Circuit Track (East) - 5)**

General Description and Condition: Maintained fire trail (180m approx.) up/down gentle/moderate slope through tall heath and scattered Eucapypts. Good condition.

Tread Width (mm): 2,000-2,800mm.

Track Surface: Level to uneven compacted sand and stone, (some imported crushed sandstone fill and other material) and occasional low rock outcrops. Side gutters in places.

Gradient (degrees): Gentle to gentle/moderate grades, 3 to 5.5°.

Alignment: Straight to gently curving up/down slope.

Terrain: Midslope.

Soil: Lambert (Erosional) – undulating to rolling low hills on Hawkesbury Sandstone.

Vegetation: Mostly Sandstone Heath, enters Bloodwood-Scribbly Gum Woodland at lower end. Vegetation is managed/slashed along trail margins, with grass and sedge regrowth.

Track Works and Improvements: Maintained fire trail in good condition.

Signs and Wayfinding: New signage/directional totem at E (carpark) end – good condition. Small pictograms ("walkers" and "no bikes") and "Dog Owners" advisory/regulatory warning sign on separate log posts at E end of fire trail – good/fair condition. Old directional signs ("VIA WATERFALL" "VIA MANLY VALE" graffiti damaged, and "NYRANG ROAD CAR PARK") at W end at junction with Park Circuit Track (East) – 5 – both poor condition.

User Experience: Easy walking, but less appealing fire trail setting. Possible interaction with mountain bike traffic at E end/entry.

Key Issues: Drainage capture and fire trail maintenance. Signposting at junction with Park Circuit Track (East) – 5.

Recommended Works – Overall

- Routine fire trail maintenance.
- Upgrade signage (at W end) as per Manly Dam sign Location Plan.

Recommended Works – Site-specific (Priority)

Site ID: **NRFT – 1A**

Location: 338377 6261220 Erosion to 150mm below NSL over and around flat/rounded rock outcrop.

Works:

Rollover drain upslope.

(low)

Site ID: **NRFT – 1B**

Location: 338349 6261229 Erosion guttering over knick points, with downslope loose sand and stone deposition. Drainage capture down track

Works:

Rollover drain upslope of erosion (downslope of power line service access gate).

(low)

Site ID: **NRFT – 1C**

Location: 338275 6261256 Erosion gutter 5m long and 50-250mm below NSL, running form centre of track to N side on bend, with loose rounded rocks. Drainage capture down trail.

Works:

Fill and compact gutter.

Rolllover drain upslope of erosion

(Medium - sustainability/impact issues (sediment deposition])

SEGMENT NYRANG ROAD FIRE TRAIL - 2

SEGMENT: NRFT - 2	
Start Point: 338252 6261240 **(junction with Park Circuit Track (East) -5)**	**End Point: 338201 6261197** **(dam shoreline, N end of Park Circuit Track (East) - 4)**
General Description and Condition: Short section of maintained fire trail (75m approx.) up/down gentle/moderate slope through Eucalypt woodland. Fair condition with considerable loose rounded rock (but deeply guttered/eroded, and loose rounded rock hazard exacerbated, by major rainfall event of 4-6 June 2016 – segment now in poor condition). Connects Park Circuit Track (East) - 4 on dam shoreline in W, and Park Circuit Track (East) -5 in E. *Tread Width (mm):* 2,400-2,800mm. *Track Surface:* Level to uneven compacted sand and stone (some imported crushed sandstone fill and other material), considerable loose rounded rock (tennis ball size, slip/fall hazard) on lower section. Side gutters in places. *Gradient (degrees):* Gentle/moderate grades, 4.5 to 5.5°. *Alignment:* Straight to gently curving up/down slope. *Terrain:* Lower slope to dam margin. *Soil:* Lambert (Erosional) – undulating to rolling low hills on Hawkesbury Sandstone. *Vegetation:* Mostly Bloodwood-Scribbly Gum Woodland, small area of Sandstone Heath at lower end (dam margin). Vegetation is managed/slashed along trail margins, with grass and sedge regrowth. *Track Works and Improvements:* Maintained fire trail in fair condition. Backed seat on dam shoreline juts N of W end of segment. *Signs and Wayfinding:* Old directional signs (“VIA WATERFALL” “VIA MANLY VALE” graffiti damaged, and “NYRANG ROAD CAR PARK”) at E end at junction with Park Circuit	

Track (East) – 5 – both poor condition. No other wayfinding (including at W end on shoreline). (Dam recreation/safety advisory and regulatory sign beside shoreline to S of W end of segment.)

User Experience: Careful walking required due to extended area of loose rock on slope (exacerbated by walkers looking to dam downslope, rather than checking footing/surface). Less appealing fire trail setting.

Key Issues: Loose rounded surface rocks and slip/fall hazard. Drainage capture and fire trail maintenance. Signposting at W end at junction with Park Circuit Track (East) – 4, and at E end at junction with Park Circuit Track (East) – 5.

Recommended Works – Overall

- Repair deeply guttered/eroded section (whole segment) and address exacerbated loose/rounded rock hazard (on lower section) after storm event (below right and left). **(HIGH – passability/safety issues, and sustainability/impact issues)**
- Upgrade signage/wayfinding as per Manly Dam Sign Location Plan.

Recommended Works – Site-specific (Priority)

Site ID: **NRFT – 2A**

Location: 338251 6261236 N side gutter spills out over Fire Trail and flows down trail with minor below junction with Park Circuit Track (East) -5.

Works:

Enlarge N side gutter and outflow, reinforce (with trailside mound) to prevent backflow onto Fire Trail.

(low)

Site ID: **NRFT – 2B**

Location: 338239 6261212 Top of 5° gradient directly downslope to dam, with existing scour and sheet erosion with loose rounded rocks. (Deeply guttered/eroded by later major rainfall event of 4-6 June 2016.)

Works:

Rolllover drain on upper section of slope to divert flows and reduce further erosion.

(Medium - passability/safety issues)

Site ID: **NRFT – 2C**

Location: 338225 6261205 Extended slope at gentle/moderate 5° gradient with considerable loose rounded rock (tennis ball size), slip/fall hazard, 38m overall (lower 28m in poor/hazardous condition, upper 10m in fair condition). (Deeply guttered/eroded, and loose rounded rock hazard exacerbated, by major rainfall event of 4-6 June 2016.)

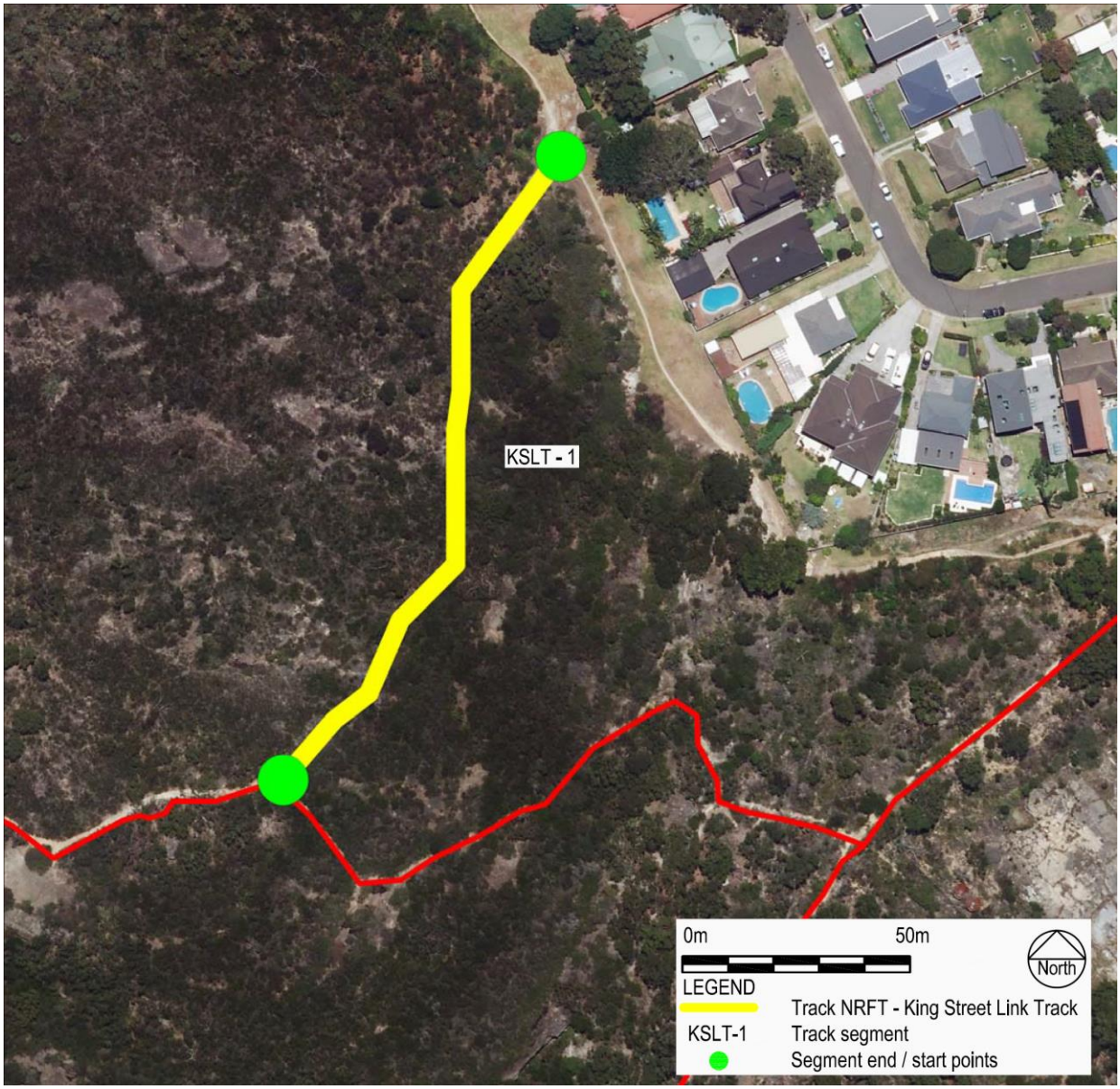
Works:

Remove and/or stabilise and compact loose rounded rocks.

Rolllover drain on mid/upper section of slope to divert flows.

(HIGH – safety issue, for passability/safety)

KING STREET LINK TRACK - SEGMENT 1 (ONLY)



KING STREET LINK TRACK - SEGMENT 1

SEGMENT: KSLT - 1	
Start Point: 338440 6260929 **(Junction with Park Circuit Track [East])**	**End Point: 338501 6261066** **(Asset Protection Zone behind Maroa Crescent)**
General Description and Condition: Short (150 approx.), narrow, gentle gradient track linking park boundary with Park Circuit Trak (East) through Ti-tree and Casuarina Heath and scattered Eucalypts. Good to fair condition. *Tread Width (mm):* 600-900mm *Track Surface:* Compacted sand with considerable laterite gravel and frequent flat/uneven rock outcrops. Slightly concave/dished with drainage down and minor erosion in places. *Gradient (degrees):* Mostly flat to 2°, minor short sections up to 5°. *Alignment:* Straight to gently winding. *Terrain:* Ridge/crest on mid-slope. *Soil:* Lambert (Erosional) – undulating to rolling low hills on Hawkesbury Sandstone. *Vegetation:* On the margin between Sandstone Heath and an area along boundary mapped as "disturbed vegetation", with Bloodwood Scribbly Gum Woodland around the junction with the Park Circuit Track (East). *Track Works and Improvements:* Logs placed along track edge at E (APZ) end for containment. *Signs and Wayfinding:* 2 routered timber signs at junction with Park Circuit Trak (East) – fair condition. New signage/directional totem at APZ end – good condition. One old log post with directional arrow – poor condition.	

User Experience: Easy walk along access/link track, narrow track with intruding vegetation and loose gravel in places requires awareness by users.

Key Issues: Continued drainage capture. Areas of loose gravel.

Recommended Works – Overall

- Open windrows.
- Trim vegetation.

Recommended Works – Site-specific (Priority)

Site ID: **KSLT(W), junction with Park Circuit Track (East)**

Location: 338440 6260929 Track junction, "King St Link" track to APZ head NE at sharp/90° bend in Park Circuit Track (East). Two routered timber signs (1 - "ALTERNATE TRACK TO PICNIC AREAS VIA KING STREET" and 2 - "PICNIC AREA VIA DAM WALL" upper line "PARK CIRCUIT TRACK TO PICNIC AREAS VIA WATERFALL "LOWER LINE") – fair condition.

Site ID: **KSLT – 1**

Location: 338450 6260941 Loose/deposited sand from junction with Park Circuit Track upslope (site PCT(E) – 2D).

Works:

Waterbar, with extended discharge/outlet well off track.

(low)

Site ID: **KSLT – 2**

Location: 338462 6260954 3 spaced rock outcrops, sloped with compacted sand and laterite gravel between, 4-5° gradient with drainage down track.

Works:

Waterbar between upper and middle rock outcrops.

Waterbar between middle and lower r9ck outcrops.

Stone infill and level gap/dip in lower rock outcrop.

(low)

Site ID: **KSLT - 3**

Location: 338473 6260974 Upslope of flat/uneven rock outcrops and small ledge/“natural” step on bend, exposed roots, 2.5 ° gradient.

Works:

Waterbar, to divert flows before rock outcrops.

(low)

Site ID: **KSLT - 4**

Location: 338479 6261001 Upslope of flat/uneven rock outcrops, with ledge/small “natural” step, 2.5 ° gradient.

Works:

Waterbar, to divert flows before rock outcrops.

(low)

Site ID: **KSLT – 5**

Location: 338480 6261042 Upslope of angled flat rock outcrops with drainage capture, 4 ° gradient

Works:

Waterbar, to divert flows before rock outcrops.

(low)

Site ID: **KSLT(E), east end of King Street Link Track, at APZ**

Location: 338480 6261042 New signage/directional totem at APZ.