GRAMPIANS PEAKS TRAIL®

Walking Trail Infrastructure
Design Manual
Grampians National Park
June 2012

siteoffice

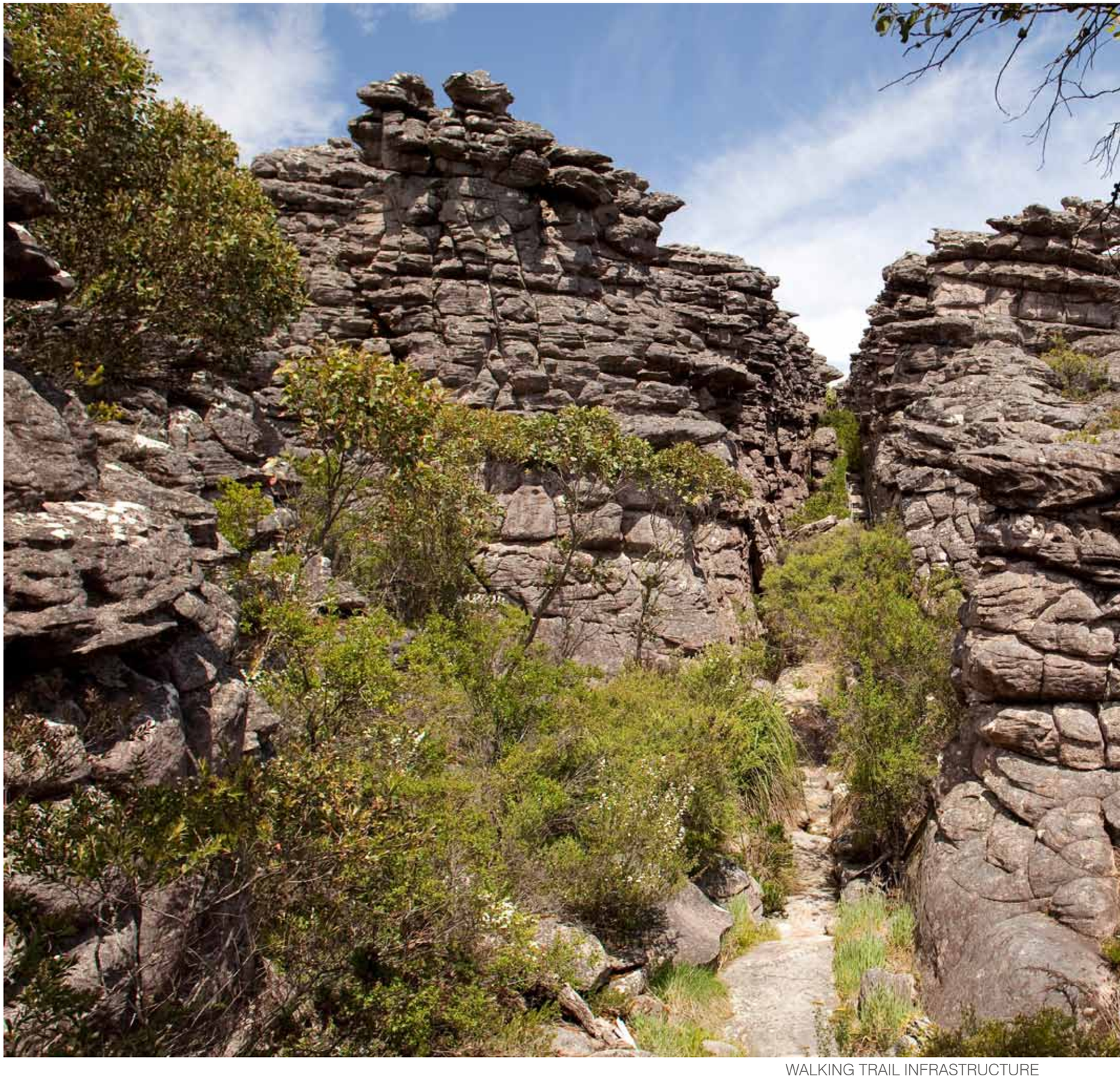
GPT INTRODUCTION:

PURPOSE OF THIS DOCUMENT:
The purpose of this document is to guide Parks Victoria staff involved in the design and construction of the Grampians Peaks Trail (GPT). It sets out the guiding principles for infrastructure design along with detailed guidelines. This document should be used in conjunction with the design work for the hiker camps, track marking, directional signage, and information and interpretive signage.

VISION:
The GPT will be “one of Victoria’s outstanding long distance walking experiences, showcasing Gariwerd’s natural and cultural values. The trail will be managed in a coordinated and sustainable manner that provides benefits to the community and the region”.

The trail will offer a range of experiences encompassing independent walking using public camp sites, day walks close to Halls Gap, Mt Zero and Dunkeld, commercial guided walking using standing camp sites, and the potential to link to off-park accommodation.

Rock formation, Wonderland, 2011



GRAMPIANS PEAKS TRAIL

Silent Street, Wonderland, 2011

Venus Baths, Wonderland, 2011

ROUTE:

- To traverse the Grampians from Mt Zero (Mura Mura) in the north to Dunkeld at the southern tip of the National Park
- Primarily through the Grampians National Park – the only exceptions being some road reserves close to Dunkeld and the Lake Wartook (Werdug) area, managed by Grampians Wimmera Mallee Water

INFRASTRUCTURE REQUIREMENTS:

Hiker camps -

- Located at approx. 10km intervals
- Include water supply, shelter, toilet facilities (type to be determined)
- Include allocated campsites and elevated structures
- Natural qualities, sense of remoteness
- Provide access for independent walkers, commercial users and groups

Track marking and directional signs -

- Consistent track marking system
- Good track definition
- Standardised trail head signage
- Information boards at key access nodes
- Markers and interpretive signs where required
- Distance confirmation markers along the trail
- Trail head orientation to walking tracks and links to the GPT

Information and interpretive signage -

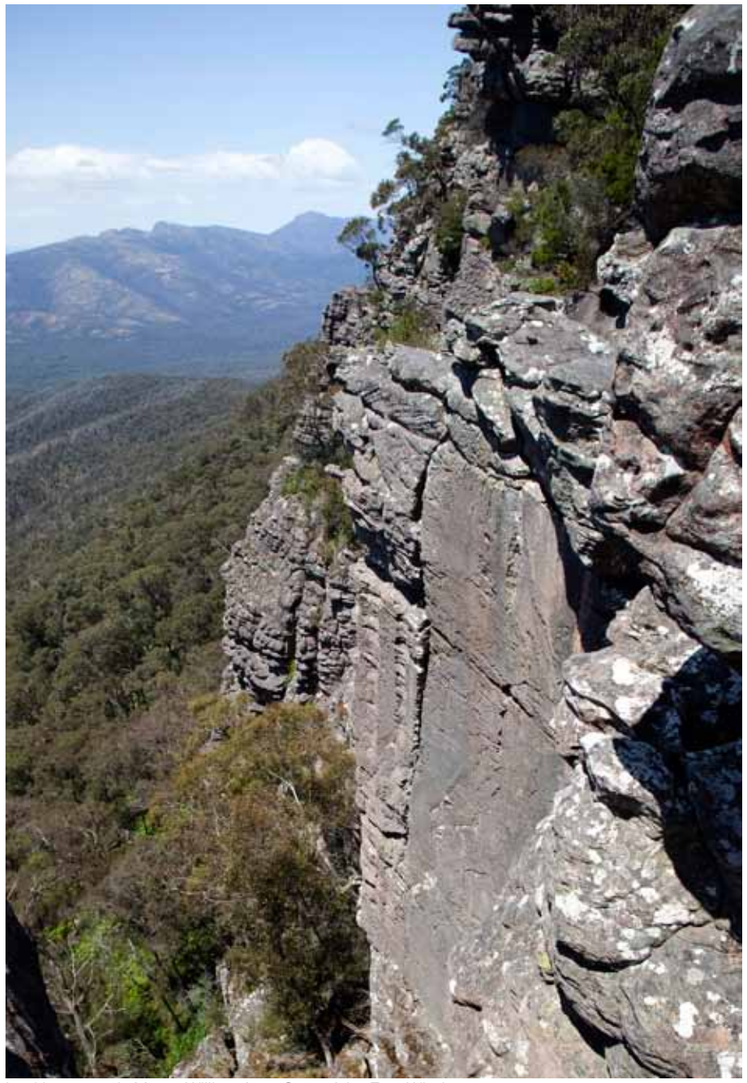
- Placed at major sites and places where the trail overlaps with shorter walks
- Provide detailed interpretive information on local features and track sections
- Provide safe walking information

Walking track infrastructure-

- Consistent with Australian Standard (AS) 2156.1-2001 walking track class three standard
- Tracks, track drainage, water crossings, handrails, lookouts, all trail head information, shelters, bridges, decking
- Boardwalks and steps
- High quality trail infrastructure
- Minimal impact through appropriate low maintenance materials (e.g. local sandstone) where possible, carefully blended into the immediate environment
- Designs to help distinguish the GPT from other Victorian nature-based walks

GPT PHILOSOPHY:

GUIDING PRINCIPLES:
Four key considerations should underpin the planning, design, implementation and maintenance of the GPT:



Looking towards Mount William from Gate of the East Winds, 2011

1. THE TRAIL AS LANDSCAPE

The design of the GPT should be informed by the diversity of landscapes within the Grampians National Park, contributing to a unique and site-specific walking experience. The design should protect and enhance the important and unique qualities of the landscape. Intrusion on or alteration of the existing landscape and unnecessary infrastructure should be avoided. Local geology and natural patterns should be reflected in the design as well as in the choice of materials (i.e. utilise local materials where possible). The design should protect and respect important indigenous and post-settlement cultural heritage (including through consultation with the traditional owners of Gariwerd).

Consideration should be given to:

- geology and landform
- weather/rainfall/climate
- flora
- significant trees and features
- fauna
- indigenous cultural heritage
- post-colonial cultural heritage
- views and vistas
- vantage points and aspect

2. THE TRAIL AS EXPERIENCE

The GPT should be designed to help the walker develop an understanding and connection to the landscape they are in. Locations where higher visitation is expected should be designed to accommodate this. The design should aim to enhance the whole walking experience - from booking through to arrival, outfitting, the walk itself and departure.

Consideration should be given to:

- promoting a sense of adventure
- providing a ‘wilderness’
- user groups
- walk sequence (arrival, outfitting, walking and completion)
- volumes of people
- support access
- interpretation and signage
- different walks
- track grading
- danger and concepts of risk
- time of year visiting (the seasons)
- maps and visual representations
- the social experience gained by long distance walking (i.e. meeting other hikers at intermittent intervals, arriving at hiker camps to no-one or many people etc.)

3. THE TRAIL AS MATERIAL

Contractor Site Office assessed and selected a range of materials for performance and durability, life cycle cost, availability, logistics, aesthetics, ability to work on site, salvageability, maintenance, sustainability and pre-fabrication.

The material evaluated include steel (galvanised, stainless, aluminium), steel mesh, timber (hardwoods, treated pine), stone, gravel, concrete, composite timber, and composite fibreglass.

In selecting materials, consideration should be given to:

- Durability and fitness for purpose – i.e. able to withstand frequent storms and bush fires
- The life cycle cost rather than up-front costs
- Required maintenance (reduction rather than increase over time is preferred)
- Use of local materials from within the National Park or local area that can be salvaged, recycled or reused
- Ease of transport to the site
- Ease of working with the materials on site
- Capacity to visually integrate with the landscape – sympathetic in colour and texture
- Level of environmental stewardship (high levels preferred), with lower levels of embodied energy
- Minimising (preferably avoiding) residue or material trace left on the site
- Whether the materials can be fabricated off-site (preferred)

4. THE TRAIL AS ART

The GPT design should be based on a consistent suite of design details that reinforces the unique identity and experience of the trail; can be deployed easily across a variety of different conditions; and allows for components to be replaced.

The highest level of craftsmanship and quality should be sought, along with construction techniques that suit the environment. A ‘light touch’ should be evident – i.e. avoid heavily engineered or over-designed solutions (e.g. large footings) and unnecessary additions (handrails, steps and balustrades). The trail should match the surrounding environment, be aligned along existing natural patterns within the landscape and integrate existing landscape elements and obstacles.

The Pinnacle, 2011

GPT PROCESS:

RELEVANT STANDARDS AND RELATED DOCUMENTS:

- Elevated Park Structures – Design Guidelines, Sinclair Knight Merz (2000)
- Draft AS2156.2 Walking Tracks: Infrastructure Design
- Facilities Design Manual, Parks Victoria

Note: No published Australian Standard directly applicable to this type of structure currently exists.

GPT TRAIL CLASSIFICATION:

Generally the GPT is rated a class 04 Trail under the AS2156.2 Walking Tracks: Infrastructure Design. However, a number of other track classifications exist along the length of the track, based on some segments being high-use (e.g. the track from Halls Gap to the Pinnacle).

RISK ASSESSMENT PROCEDURE:

Applicable published and draft codes are as follows:

- AS1170.1 Dead and Live Loads and Combinations
- Draft AS2156.1 Walking Tracks: Signage
- Draft AS2156.2 Walking Tracks: Infrastructure Design
- AS1657 Walkways, Stairs and Ladders
- Austroads Bridge Design Code

The intended application is confined to small bridges, platforms, etc. Note that the draft Parks Victoria publication Facilities Design Manual also has some guidance in these areas, but may be influenced by the guidelines agreed to as part of the GPT construction process.

CONSTRUCTION METHODS:

The following applies to construction throughout the GPT:

1. Use a modular suite of details with a standard range of simple, uncomplicated and robust components, able to be assembled on a range of differing sites
2. Details consisting of multiple components (e.g. ladders) can either be assembled off-site (prefabricated) and delivered as a whole unit, or brought to site as a series of components and then assembled
3. Individual components to utilise a standard range of materials and material dimensions (e.g. all timber boards to be 800 x 150 x 50mm)
4. Individual components to be fabricated off-site to ensure a higher quality of finish
5. Individual components can be pre-ordered and stored in readiness for rapid deployment when required
6. Individual components can either be welded or bolted together depending on the location and circumstance
7. A variety of different connection components should be provided to account for different installation conditions (e.g. handrail connection to stone, soil or steel frame)
8. Use durable steel structural components (e.g. bearers, steel frames and footings) that can withstand periodic fires
9. Ensure all steel components have a dull, matt finish to avoid being too bright and reflective
10. Provide timber as the finished, visible surface where possible – keep any steel structural componentry hidden from view (requiring the replacement of the timber surface only in the case of bush fire)
11. Cut the timber elements to fit into the surrounding landscape
12. Use larger, thicker class 01 timber components (e.g. thickness greater than 50mm) to provide greater fire resistance (refer materials section for further information on appropriate timber species)
13. Minimise the number of connection points where the detail meets the landscape (i.e. footings)
14. Use materials of smaller, thicker dimensions to achieve strength and reduce bulk (as opposed to materials of larger, thinner dimensions)

TRAIL ELEMENTS:

This document outlines a variety of concepts for the following elements-

A. Trail general design
B. Trail grade dip / grade reversal
C. Trail water bars
D. Trail switchback
E. Trail across landslip
F. Steps - stone
G. Water crossing - stone
H. Steps - cliff
I. Boardwalk - timber
J. Boardwalk - steel
K. Water crossing - short bridge
L. Water crossing - longer bridge
M. Handrail
N. Lookout rail
O. Trail head/collection point
P. Furniture/seating
Q. Trail signage
R. Directional markers
S. Trail maps

A. TRAIL GENERAL DESIGN

The following applies to the design of the length of the GPT:

01 Align the trail along existing contour lines where possible, to ensure gradients are shallower (refer IMG 1778).

02 Align the trail along existing site features, such as ‘snig’ lines that may provide for shallower gradients.

03 Align the trail to avoid significant existing trees or fragile vegetation.

04 Align the trail on the up-hill side of large trees to protect the root system from unnecessary compaction and erosion.

05 Align the trail to minimise water crossings.

06 Align the trail to integrate (rather than remove) existing site features, such as significant rocks and trees (e.g. some obstacles along may be useful for rest areas/marker/track protection).

07 Align the trail to reflect walker desire lines (to avoid off-track ‘goat’ paths developing).

08 Ensure the trail is always clearly visible to the walker and use existing fallen tree branches and/or loose stones to clearly mark the direction and edge of the trail (ensure they don’t impede drainage).

09 Align the trail to avoid existing constructed features, such as roadways and carparks.

10 Provide side tracks in and out of the hiker camps (i.e. avoid the need for backtracking and keep hiker camps separate from the main walking track).

11 Clear low overhanging tree limbs to a height of 1500mm.

12 Keep the trail as narrow as possible to minimise intrusion into the landscape, as well as to minimise works required to build and maintain the trail.

13 Narrow trails of 600mm width are preferable although wider trails may be required along higher traffic routes.

14 Provide a cross fall to the trail of 1:30 at all times, to ensure that water flows across (not along) the path.

15 Ensure no raised edges or other obstacles that may prevent water draining from trail.

16 Avoid the use of gutters to the trail wherever possible (they tend to increase water volumes and velocities that may lead to erosion and drainage problems).

17 Avoid trail gradients steeper than 1:10 (to avoid the possibility of erosion and drainage problems).

18 Provide grade dips at regular intervals to remove surface water and assist drainage.

19 Where gradients are steeper than 1:10, consider introduction of steps and other details to avoid drainage and erosion problems, and re-routing the trail to make the gradient shallower.

20 Where steep gradients are unavoidable, they should be as short as possible and not exceed 20m in length.

21 Use a clinometer or suitable surveying equipment when constructing new trail alignments to ensure the gradients are not too steep.

22 In higher use areas (closer to carparks), additional gravel may be applied as a top surface to the trail to make a more compacted and durable surface (refer materials section).

23 Do not use raised stone edging to define paths (over-emphasises the path and prevents adequate water drainage).

24 Use existing site rock to bench out the trail. Preference to be given to fully-benched pathway, as this is more durable than partial benching and/or use of retaining walls.

25 Where no stone is available, the trail surface will be largely made up of the indigenous compacted gravels, soils and/or mulched vegetation chipped onto track (remove existing humus layer and vegetation and form 600mm wide path into subsoil. Place excavated material on low side of trail).

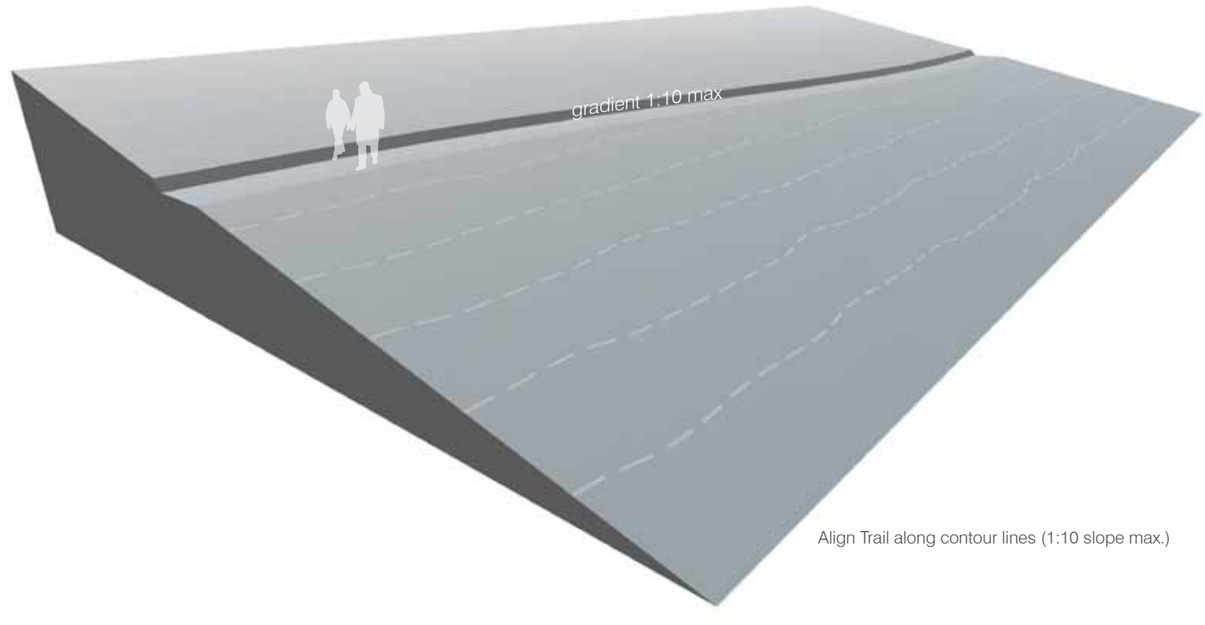
26 Where the trail passes through areas of soft soil (and no stone), consider the use of an elevated boardwalk to protect the trail from trenching and erosion.

27 Angle rock edging to reflect the larger angle of Grampians geology.

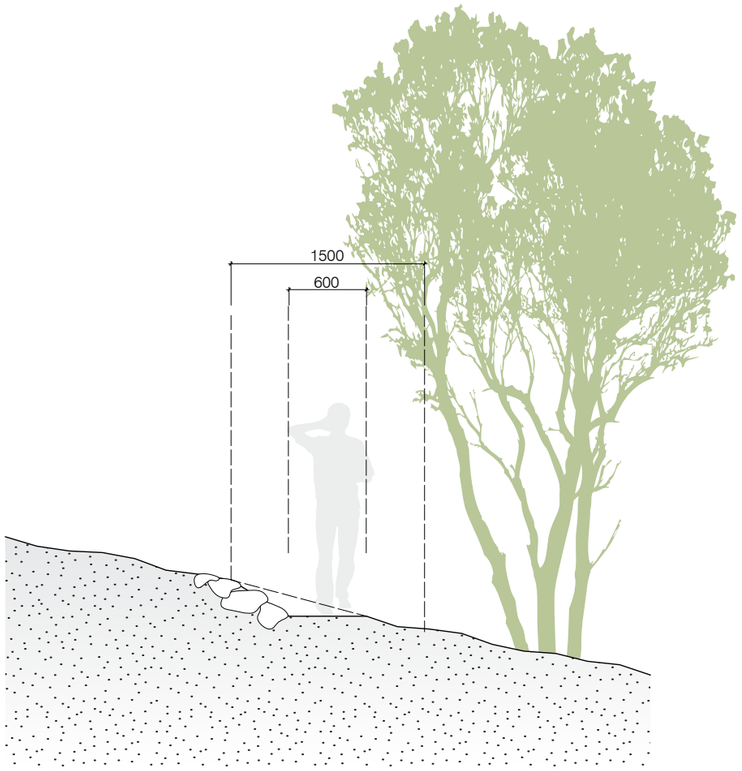
28 Avoid use of gabion cages to create downhill slope support (refer IMG 1682).

29 Avoid long, continuous sections of trail that may look out of place (maximum 15m in a straight line).

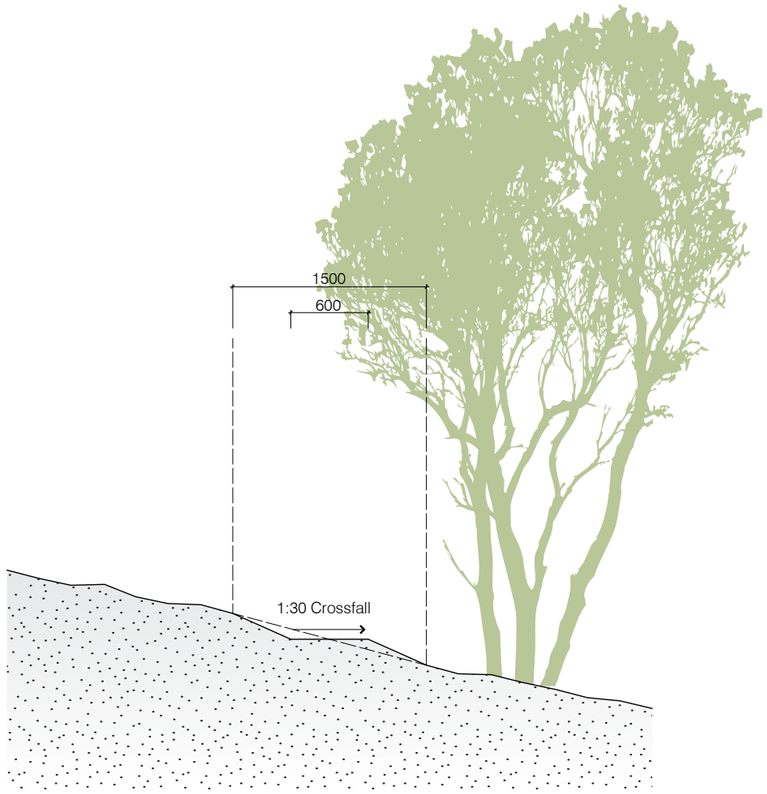
30 Align trail along contour lines (1:10 slope max.).



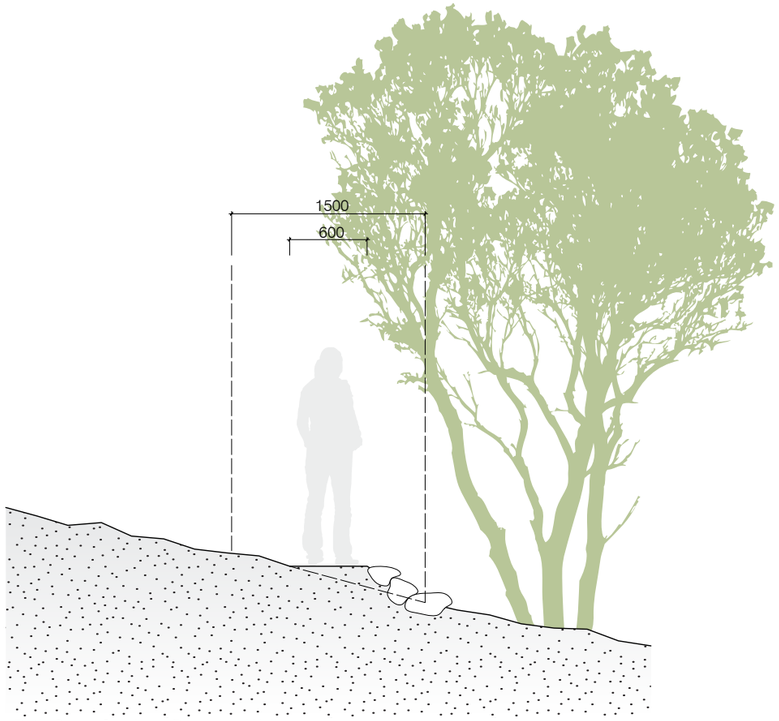
Align Trail along contour lines (1:10 slope max.)



Path Cross Section - Full Bench



Path Cross Section - Half Bench



Path Cross Section - Retaining Wall

IMG 6652 - Off track goat path around stone step

IMG 1522 - Trail erosion due to poor drainage

IMG 1598 - Erosion due to proximity to creek

IMG 5826 - Poor drainage during rain storm

Benched trail, Otways NP (Courtesy TTMS)

Benched trail, Otways NP (Courtesy TTMS)

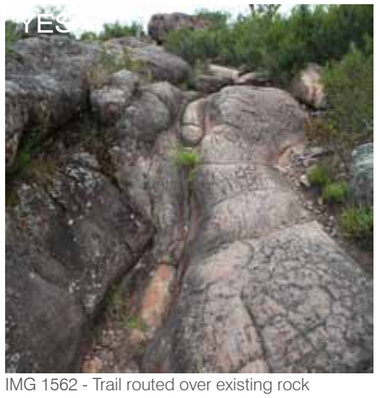
IMG 1778 - Route path along contours

IMG 1530 - Route path to high side of tree

IMG 1683

IMG 2959 Frecinet Tasmania

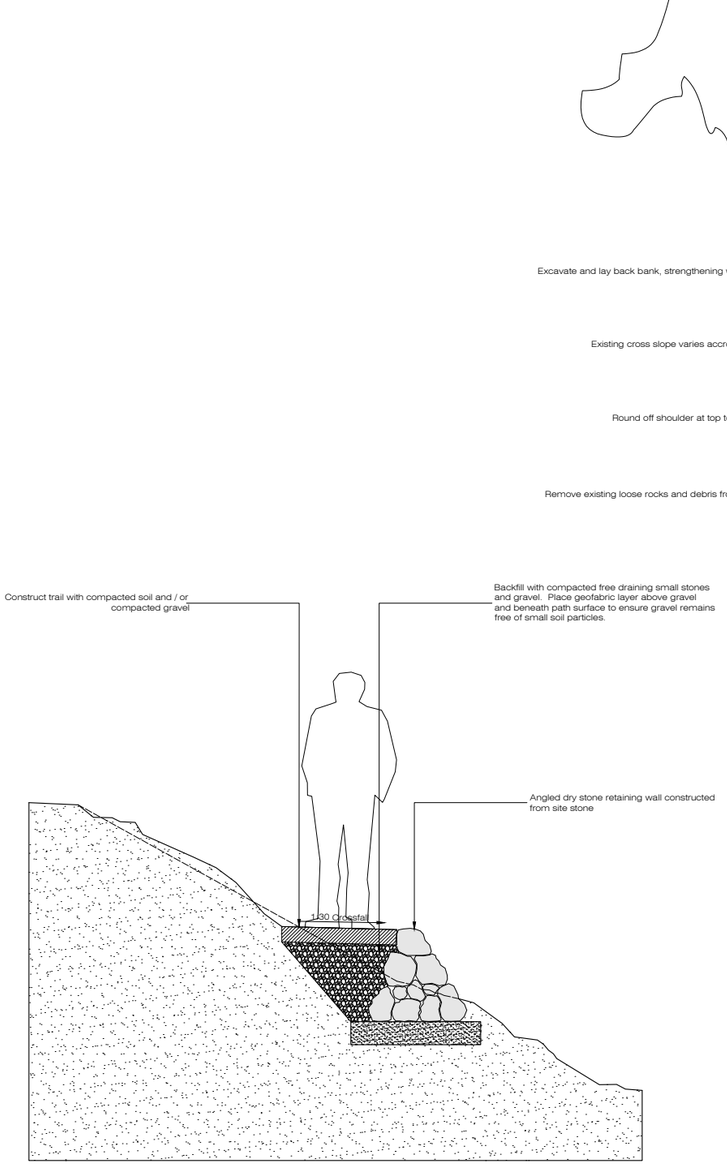
IMG 1767



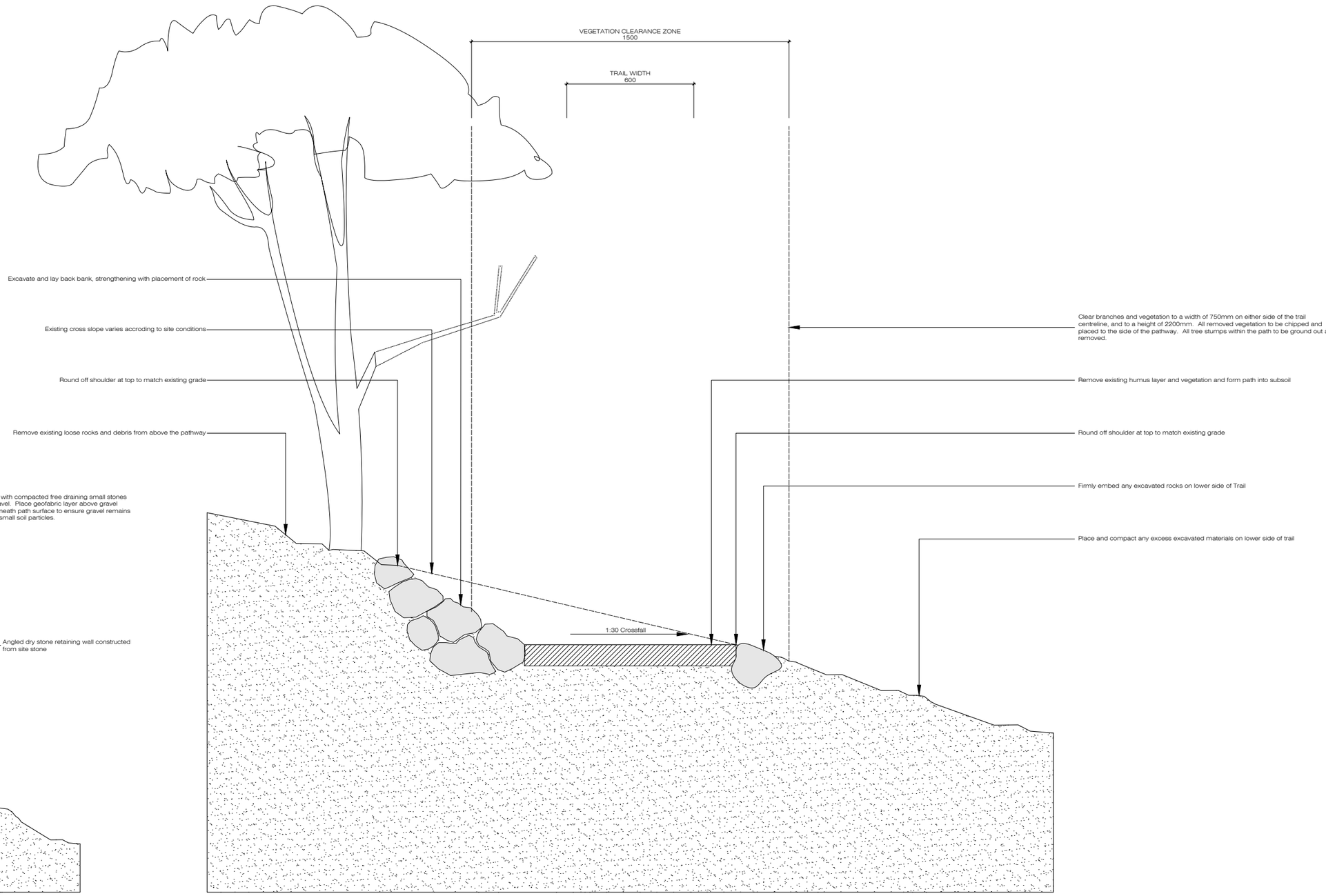
IMG 1562 - Trail routed over existing rock

GENERAL PATHWAY NOTES:

1. The first 100 metres of constructed trail will form the benchmark for all subsequent works. This first section of trail must be approved by the Superintendant prior to commencement of remaining works.
2. Generally, the full bench is preferable to the partial bench or partial bench with retaining wall.
3. All removed vegetation to be chipped and placed to the side of the pathway.
4. All tree stumps within the path cross section to be ground out and removed.
5. Ground depth and compaction rates to match the particular location.
6. Utilise local rock / gravel for path profile where available.
7. In locations where the trail is subject to water escape from the slope above, discharge the water across the trail using grade dips and / or water bars.



01 LA301 Retained Trail Section
1:20 (A1)



02 LA300 Fully Benched Trail Cross Section
1:10 (A1)

ISSUED FOR FINAL REVIEW

GRAMPIANS PEAKS TRAIL
Walk Victoria's Icons

NO.	DATE:	DESCRIPTION:	BY:	CHK:
01	07.05.2012	Issued for Information	cs	sk
02	04.06.2012	Issued For Final Review	cs	sk

Project Design:
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Client: Parks Victoria
Client Check:
Internal Check: cs
Drawing Scale: As Shown

GRAMPIANS PEAKS TRAIL

Landscape Details
Typical Trail Cross Sections

Date: 04.06.2012
Drawing Number: 1107 LA300
Revision: 02

B. TRAIL GRADE DIP / GRADE REVERSAL

01 Grade dips require less maintenance than water bars and are preferable.

02 Provide grade dips/grade reversals at periodic intervals along a sloping section of trail to remove excess surface water from the surface of the track. (Typically the gradient is reversed for a distance of 3 to 5m before the descent is continued).

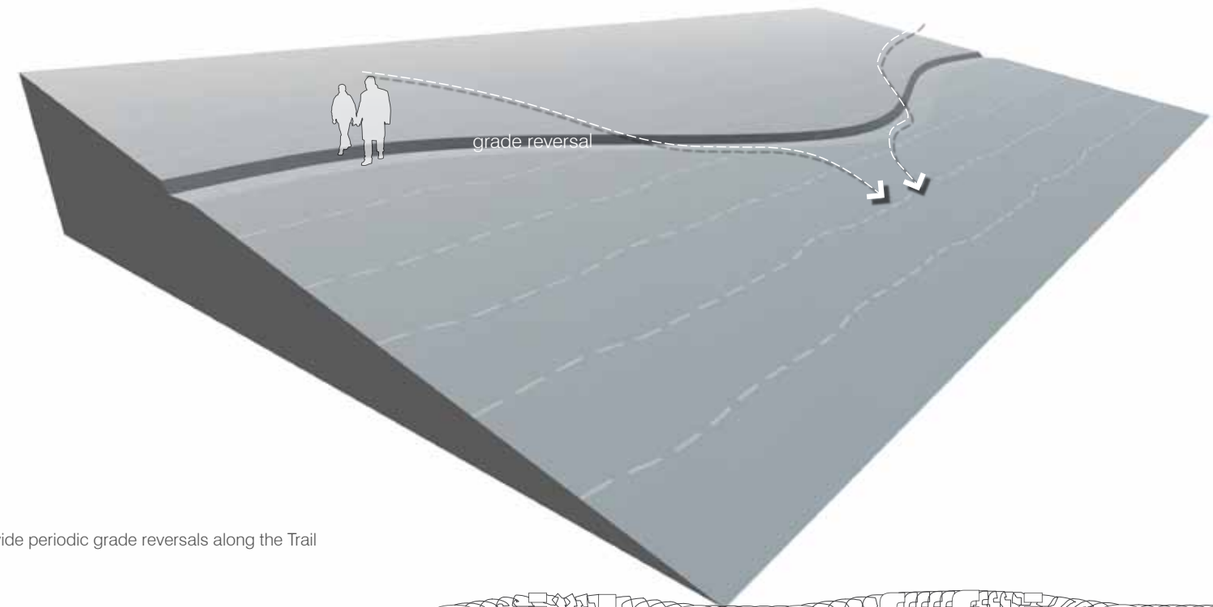
03 Build grade dips at regular intervals as determined by the site. (Steeper slopes may require grade dips every 10 to 15m).

04 Use existing site control features, such as trees or rocks, to control where the grade dip occurs. Work with the existing terrain in the placement of the dip.

05 Grade dips should be installed either before or after steeper sections of trail where water volumes and speed can increase.

06 Ensure grade dips are built as part of the initial trail construction (retrofitting is difficult).

benched path with grade dips (Courtesy TTMS)



Provide periodic grade reversals along the Trail

C. TRAIL WATER BARS

01 Use shallow path gradients and grade dips instead of water bars where possible.

02 Where a sloping trail already exists and grade dips are difficult to incorporate, locate water bars at regular intervals along the trail.

03 The steeper the trail, the more frequent the water bar. (Generally locate every 10m, or where a suitable trough exists).

04 Should also be located to trap surface run-off at the top of slopes before erosion can occur.

05 Should be angled between 30 and 45 degrees to the path of travel.

06 Use stone sourced from the immediate site where available.

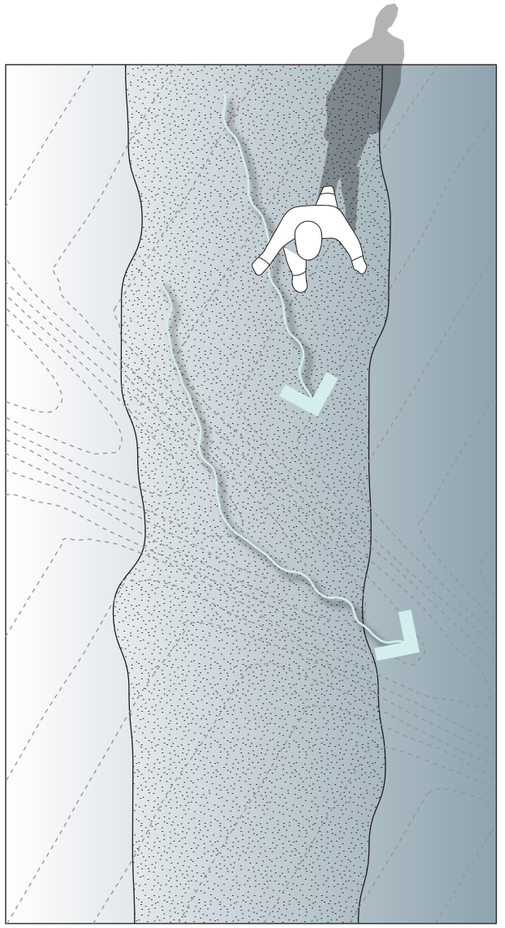
07 Stones to be set on a stable base course of fine crushed rock and/ or compacted or stabilised sub-grade.

08 Set high side stones flush into ground, and low side stones a maximum 100mm above the surface.

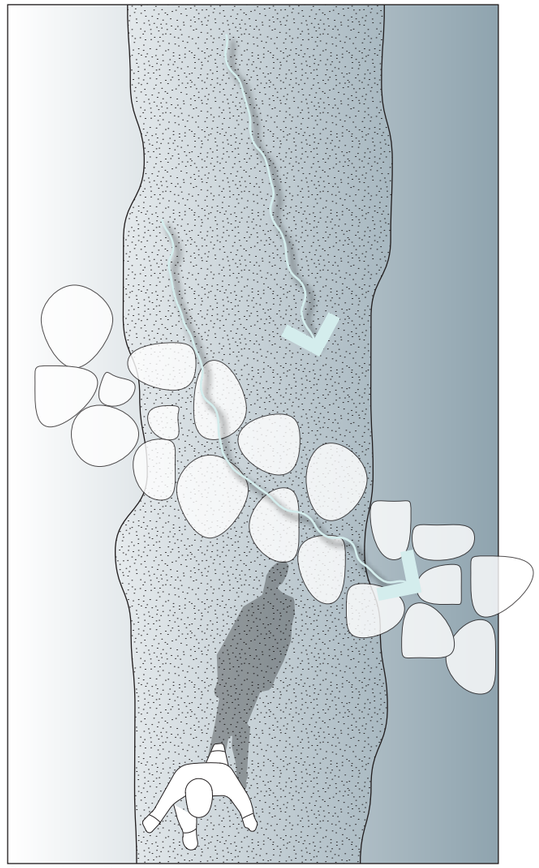
09 Extend the water bar 1m beyond the edge of the trail on the downhill side of the trail to help disperse water.

10 Incorporate rock work to stabilise soil and mitigate erosion. (Where no stone is available, construct the water bar with compacted earth, preferably sourced from the site).

11 Locate at the top of steps where ever possible.



Compacted Earth Water Bar (nts)



Stone Water Bar (nts)

IMG 6623 - Compacted earth water bar

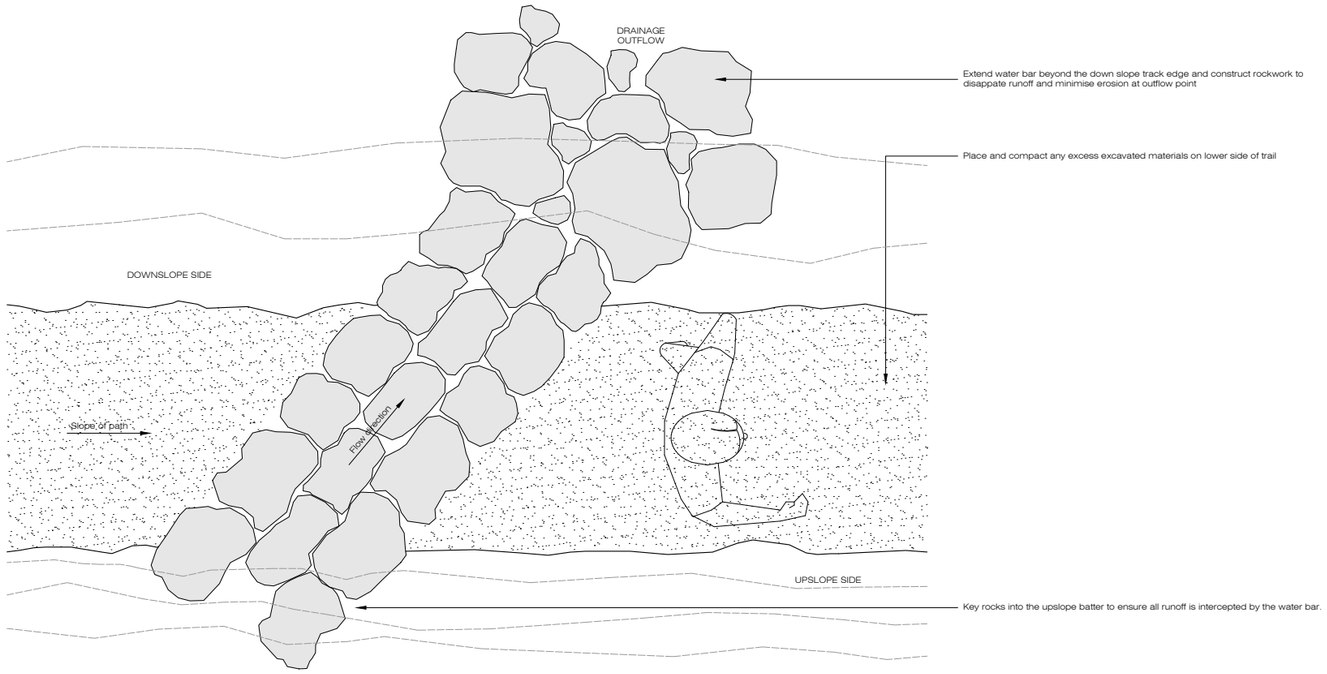
IMG 6686 - Compacted earth water bar

IMG 6669 - Compacted earth water bar

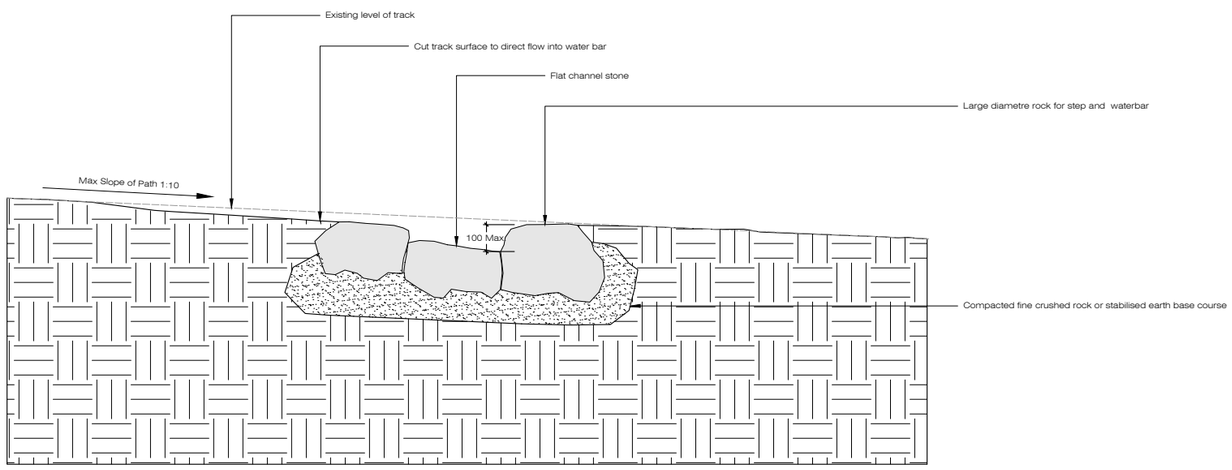
IMG 6676 - Compacted earth water bar

Stone water bar, Mount Buffalo (Courtesy TTMS)

Stone water bar, Mt Warning (Courtesy TTMS)



01 LA301 Stone Water Bar Plan
1:10 (A1)



01 LA301 Stone Water Bar Section
1:10 (A1)

TYPICAL WATER BAR NOTES:

1. The spacing of water bars may vary along the length of the track according to site and drainage conditions.
2. Position water bars at the top of track slopes and stone steps to trap runoff before erosion can occur.
3. Position water bars in natural depressions in the track alignment.
4. Minor cutting of the track may be required upslope of the drain to guide water into the flat channel stone / culvert.
5. Minimise the height of water bar to avoid trip hazards.
6. Utilise stone sourced from the immediate site to construct the water bar where available.

GRAMPIANS PEAKS TRAIL
Walk Victoria's Icons

ISSUED FOR FINAL REVIEW

NO.	DATE:	DESCRIPTION:	BY:	CHK:
01	07.05.2012	Issued for Information	cs	sk
02	04.06.2012	Issued For Final Review	cs	sk

Project Design:
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Client: Parks Victoria
Client Check:
Internal Check: cs
Drawing Scale: As Shown

GRAMPIANS PEAKS TRAIL

Landscape Details
Typical Stone Water Bar

Date: 04.06.2012
Drawing Number: 1107 LA301
Revision: 02

D. TRAIL SWITCHBACK

01 Avoid switchbacks possible, due to the likelihood of steep and tricky gradients and cross falls (refer IMG 1956).

02 Use existing site features, such as large stones and fallen timbers, to block short cuts.

03 Align the trail over the available hillside, rather than ‘stacking’ multiple switchbacks.

04 Maintain a constant gradient and cross fall through the turn section. (Avoid gradients in excess of 1:10).

05 Where switchbacks are unavoidable, consider realigning the trail to make shallower switchbacks, thereby reducing the potential for erosion.

06 Where available, consider the use of stone steps and rock armouring at the apex of the switchback, and where the gradients are steeper (refer IMG 1760).


Rock armouring on switrchback (Courtesy TTMS)


Rock armouring on switrchback (Courtesy TTMS)

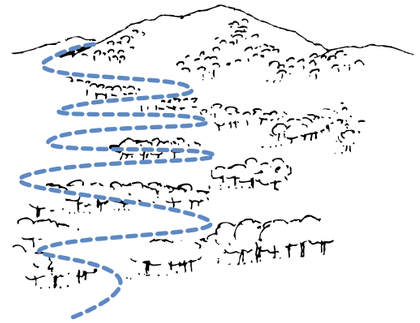
IMG 1956 - Switchback too steep

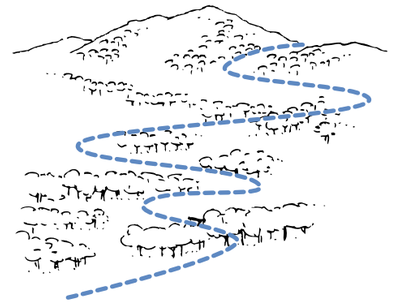
Rock armouring on switrchback (Courtesy TTMS)

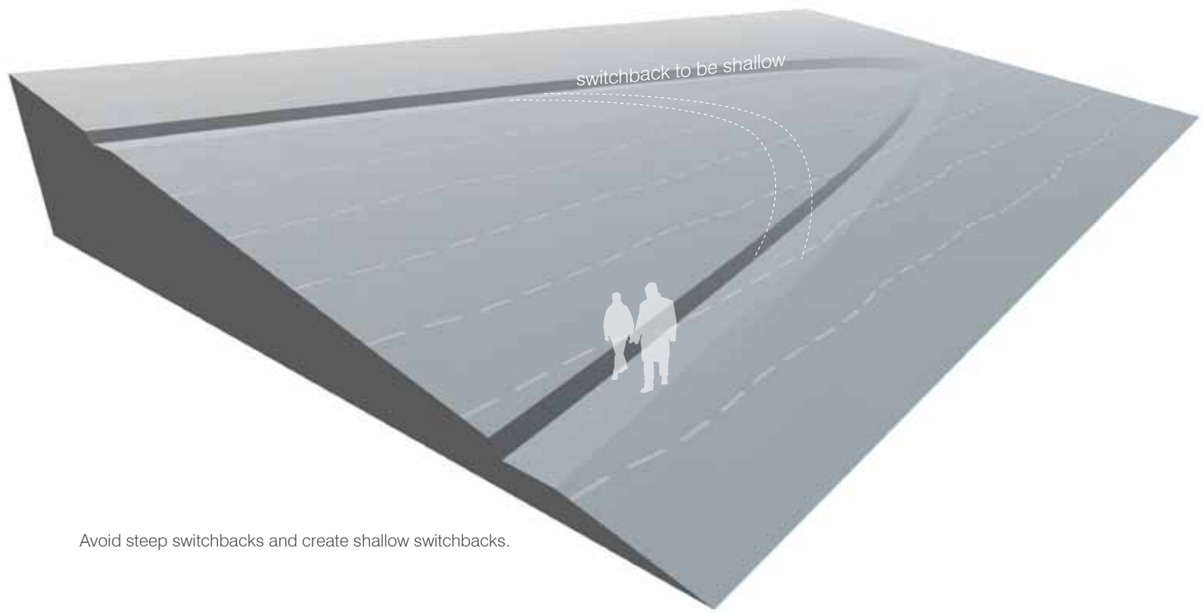
IMG 1760 - Switchback incorporating steps

IMG 1761 - Switchback aligned with features

Rock armouring on switrchback (Courtesy TTMS)


Avoid stacked switchbacks


Use available hillside



Avoid steep switchbacks and create shallow switchbacks.

E. TRAIL ACROSS LANDSLIP

01 Where landslips have occurred, consider realignments to avoid the affected area.

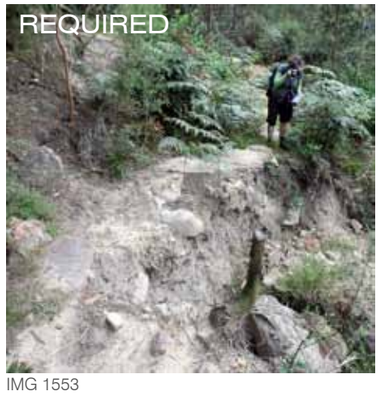
02 Confirm the integrity and safety of the landslip slope prior to construction.

03 Align the trail across sections of the landslip where there is stable exposed bedrock and/or larger rock shelves and ledges (refer IMG 1570).

04 Ensure loose stones and rocks above the pathway have been cleared.

05 Where the landslip follows a stream or drainage line, consider the use of the stone crossing detail.

06 Place additional stone at either end of the new trail to avoid erosion at the junction between the existing trail and the new slip path.

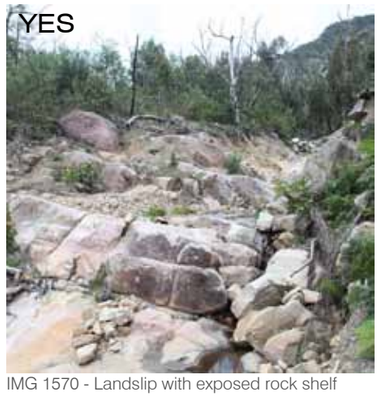


IMG 1553

IMG 1958

IMG 1959

IMG 1960



IMG 1570 - Landslip with exposed rock shelf

Lamington Nation Park (Courtesy TTMS)

Lamington Nation Park (Courtesy TTMS)

Lamington Nation Park (Courtesy TTMS)

F. STEPS - STONE

01 Minimise the need for steps where possible by following contour lines and using shallower gradients.

02 Use natural stone steps (an important component of the GPT experience) rather than artificial steps and ladders.

03 Use existing site features, such as large rocks and rocky outcrops, to help construct and anchor steps into the landscape (refer IMG 1618, 1762).

04 Avoid steps that appear too regular, constructed or artificial (refer IMG 5806).

05 Do not use raised stone edging to steps (it hinders water drainage) (refer IMG 1622).

06 Construct steps from stone sourced from the site where possible.

07 Drill and split existing site stone to create flatter steps (refer IMG 1671, IMG 1673) where other suitable stone is unavailable.

08 Where no site stone is available, consider importing Grampians sandstone to the site where feasible (typically on lower valley floors which are more accessible).

09 Use larger, monolithic, single stones that are held in place by their mass, position and embedment. Do not use mortar to hold together smaller stones (it is subject to damage during bushfires).

10 Always construct steps with stone landings/base stones at the top and base, to avoid erosion and compaction (refer IMG 1568, 1569).

11 Construct stone water bar above steps where possible.

12 Keep the step riser and tread relationship as even and humanly-scaled as possible, without being too repetitive. Risers generally between 150 and 250mm are acceptable.

13 Multiple steps with different height risers are acceptable in higher-use areas where more children may access the trail (refer IMG 2973).

14 Where the trail is aligned over stone with a steep cross fall, it may be appropriate to selectively remove segments of stone to create a flatter path. (Only consider where no other alignment and step options are available).

15 Use handrails and balustrades only when the fall heights exceed 1500mm. (Refer handrail detail).

16 Use stone steps in preference to timber steps where possible, as the base of steps can erode if not installed correctly (refer IMG 1974, IMG 1765).

IMG 1677 - Shallow steps

IMG 1671

IMG 1762 - Utilise existing site features

IMG 1974 - Timber steps with erosion

IMG 1765 - Timber steps with erosion

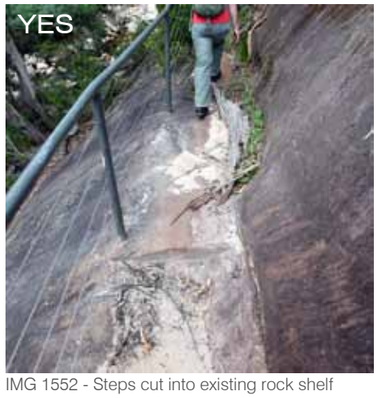
IMG 5806 - Steps appear too regular

IMG 1622 - Avoid stone edging to main steps

IMG 1569 - Erosion at foot of step

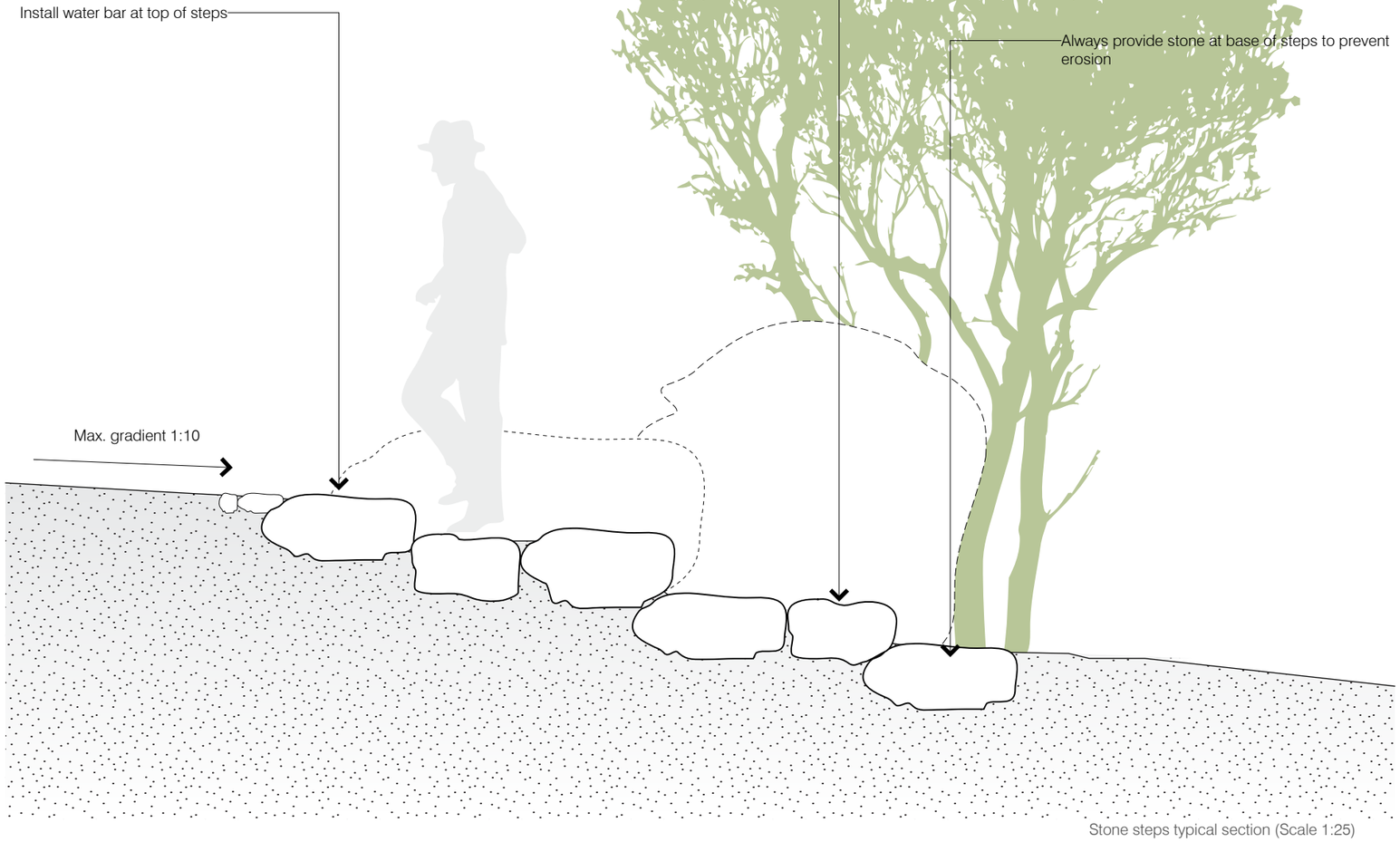
IMG 1653

IMG 1672



IMG 1552 - Steps cut into existing rock shelf

IMG 1618 - Utilise existing site features



Stone steps typical section (Scale 1:25)

IMG 1698 - Utilise adjacent stones

IMG 1753

IMG 1693

IMG 1752

IMG 2973 - Varying step risers freycinet

IMG 1747 - Use of large stones to bridge height

G. WATER CROSSING - STONE

01 Stone water crossings should only be used to ford slow moving, small and narrow water courses. For larger/longer water crossings, boardwalks and bridges may need to be considered where stone crossings are impractical or not possible.

02 Align the trail to minimise the need for water crossings and to avoid low-lying boggy areas.

03 Align the trail to make use of existing stone features and rock outcrops that may provide assistance with crossing and reduce the need for intervention.

04 Allow the water course to continue unimpeded. Do not use pipes or enclosed culverts beneath the trail, as these tend to quickly clog and require excessive maintenance (refer IMG 1524, IMG 5836).

05 Create stepping stones across the water course with larger stones, allowing water to continue to move freely past them without obstruction.

06 Locate stone across the natural desire line for walkers and ensure there are no easier crossing options elsewhere (refer IMG 1806).

07 Selectively remove vegetation from the immediate vicinity of the crossing where the location of the crossing is obscured by vegetation.

08 Ensure the crossing is tied back to the trail by providing additional stones at either end of the water crossing to help avoid erosion in the damper soils close to the water.

09 Where larger stones are available, these can be moved to create a ‘clapper’ bridge over the water course (refer IMG 1756). (Ensure the gap beneath the stone is sufficiently large to minimise the potential for clogging).

10 Do not place compacted earth over the crossing as a finished surface, as this tends to make the crossing less obvious and diminish the experience (refer IMG 0442).

11 With wider water crossings, infill existing stones with additional stones to create a series of stepping stones across the water.

12 Where no site stone is available, consider importing Grampians sandstone to the site if feasible. Where not feasible, consider the use of the timber boardwalk detail. Avoid low timber crossings that are likely to get clogged (refer IMG 1579, IMG 1836).

13 Where water seeps underneath or across the trail, elevate the trail on a porous bed of larger rock to allow water to freely drain beneath it (refer IMG 1678). (This detail to only be used where stone is available and where the trail cannot be realigned to avoid the water).

Stepping stones, Mt Warning (Courtesy TTMS)

Clapper Bridge, Mt Wellington (Source: Hobart CC)

IMG 1524 - Do not use pipe or culvert

IMG 5836 - Water bypassing culvert

IMG 1806 - development of goat track

IMG 1807 - development of goat track

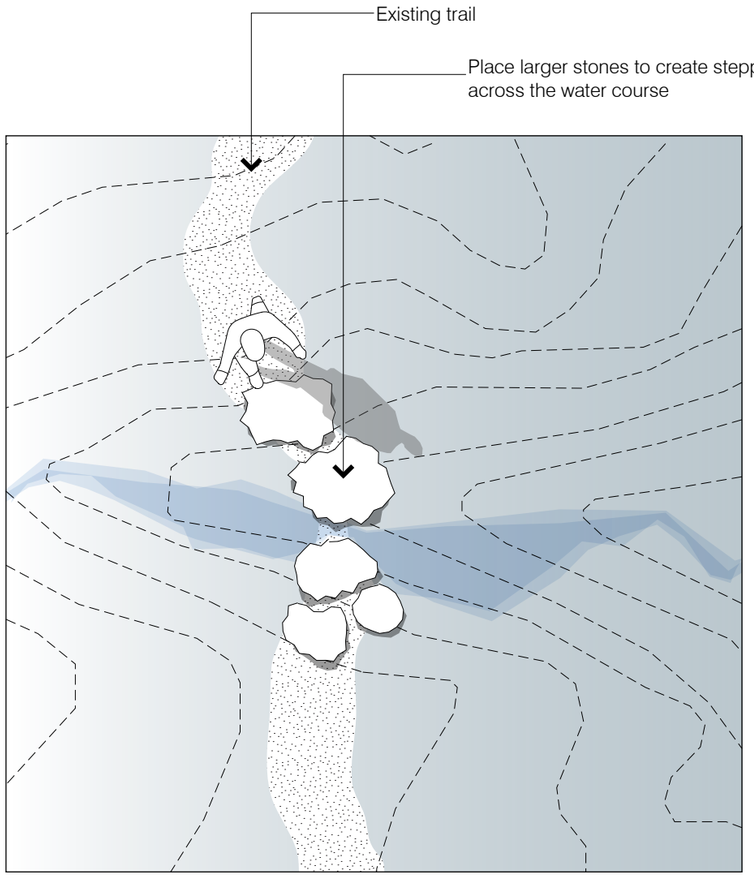
IMG 1579 - Crossing likely to get blocked

Stepping stones (Courtesy TTMS)

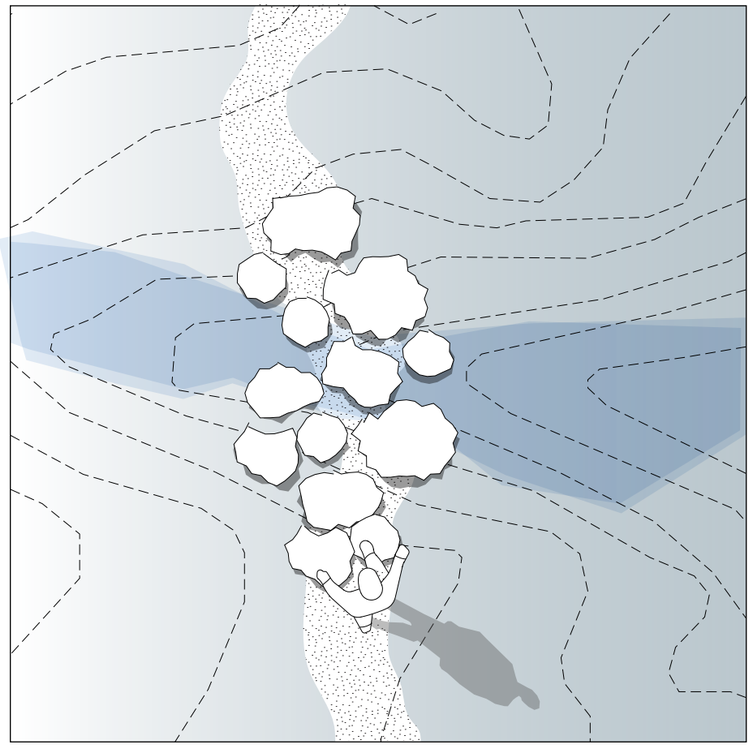
IMG 1738

IMG 1739

Stone bridge, Lamington NP (Courtesy TTMS)



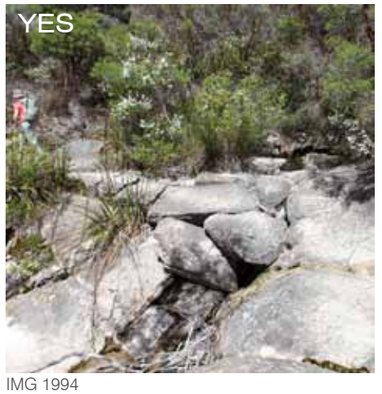
Typical smaller stone water crossing


Typical larger stone water crossing

IMG 1590

IMG 1756 - Stone as bridge

IMG 1684



IMG 1994

IMG 1813

IMG 1678

H. STEPS - CLIFF

01 Align the trail to avoid the need for cliff steps and ladders where possible.

02 Cliff steps and ladders are to be used to traverse steep cliffs and rocks in circumstances where there are no other trail alignments available.

03 Ensure all cliff steps and ladders are a maximum of 800mm wide (designed for single file use only).

04 Ensure cliff steps and ladders are not constructed in single runs longer than 20 steps without a break or a landing.

05 Landings should be provided on existing rock shelves, recesses and natural flat points where possible. Constructed landings should be avoided.

06 Use standard timber treads which can be cut to suit the particular conditions (refer IMG 1723, IMG 1714). (Do not use steel treads).

07 Locate the structural steel frame beneath the timber treads (rather than on the side as typically occurs) to make the structure as unobtrusive and narrow as possible (refer IMG 1713).

08 Use a modular structural steel framing system that allows for on-site adjustment and avoids the need for highly accurate site measurements (refer IMG 1611).

09 Use a modular structural steel framing system that allows for different assembly methods depending on the location, including bolt assembly (where access is difficult), on-site welded assembly (where access is good), or prefabricated assembly off-site (in remote locations).

10 Provide for a range of different connection and footing types to accommodate different and highly variable site conditions.

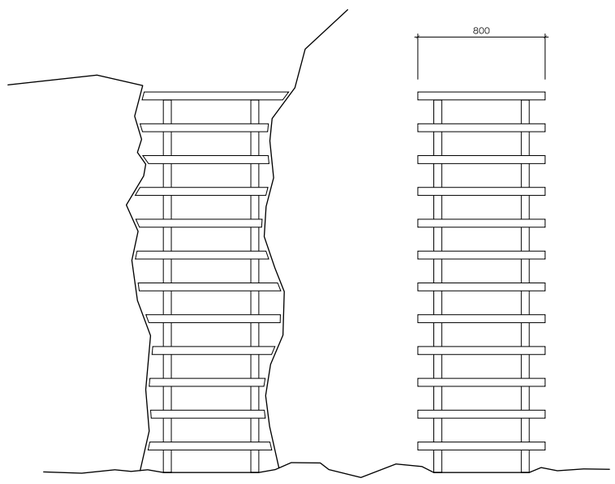
11 Minimise the number of connection footings and bolts into the landscape.

12 Provide a handrail only where fall heights exceed 1500mm.

13 Provide in-fill wire balustrading only where fall heights exceed 3000mm.

14 Provide a handrail that fully returns to the last stanchion. (This provides additional strength to the handrail, and avoids dangerous handrail extensions - refer handrail detail).

15 Ensure the base of cliff steps and ladders are located on stone, to avoid erosion.



Timber treads cut to suit to fit

Timber treads straight

IMG 3671 - Too constructed, dissimilar materials

IMG 1714 - Slient Street steps

IMG 1713 - Slient Street steps

IMG 1723 - Timber steps cut to suit

IMG 1611 - Large concrete plinth required

IMG 1644 - Excessive visible steel - too foreign

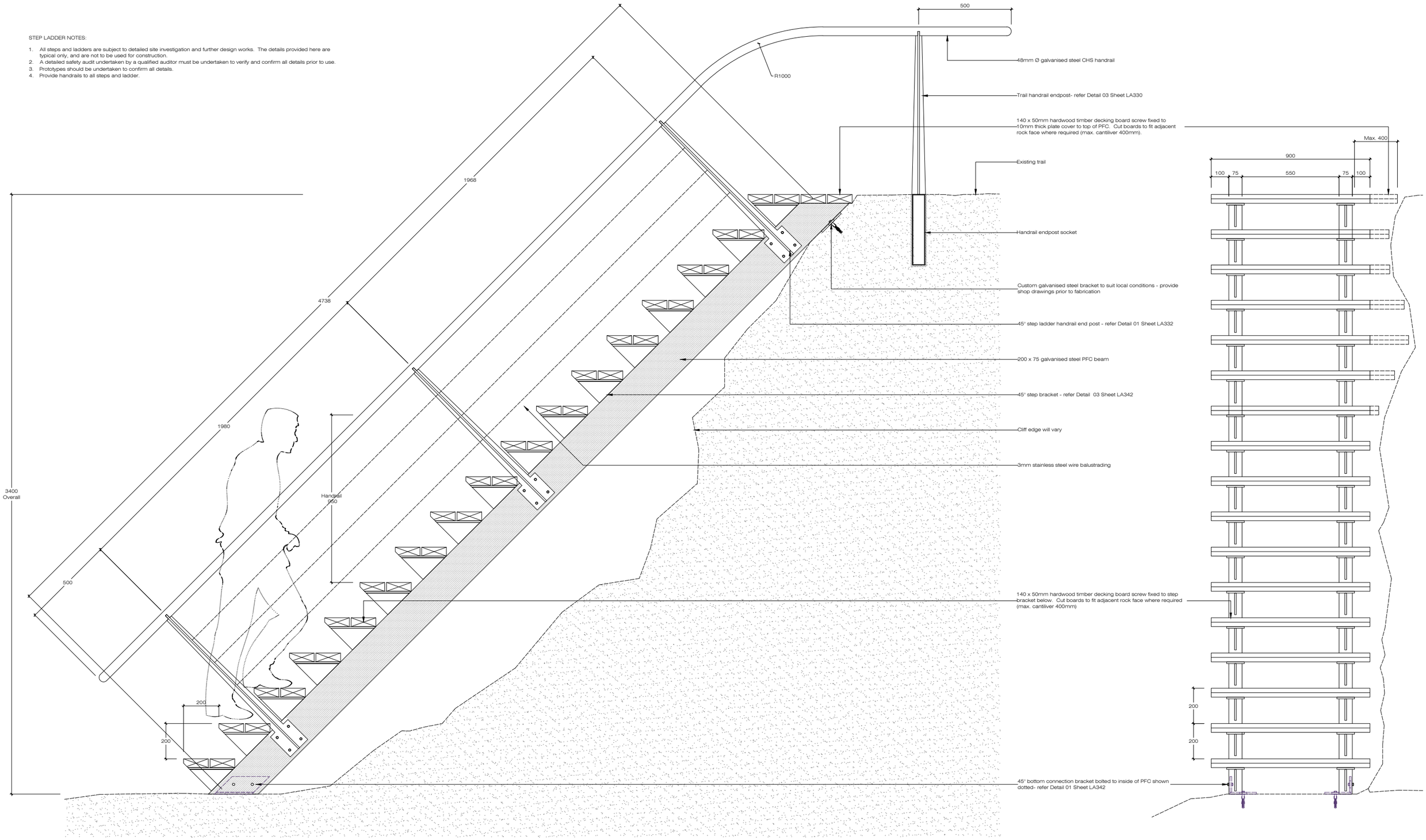
IMG 1647 - Detracts from wilderness experience

IMG 1650 - Excessive use of steel

IMG 1606 - Stone plinth at base is good

STEP LADDER NOTES:

1. All steps and ladders are subject to detailed site investigation and further design works. The details provided here are typical only, and are not to be used for construction.
2. A detailed safety audit undertaken by a qualified auditor must be undertaken to verify and confirm all details prior to use.
3. Prototypes should be undertaken to confirm all details.
4. Provide handrails to all steps and ladder.



01 LA340 45° Step Ladder Side Elevation
1:10 (A1)

02 LA340 45° Step Ladder Front Elevation
1:10 (A1)

ISSUED FOR FINAL REVIEW

GRAMPIANS PEAKS TRAIL
Walk Victoria's Icons

NO.	DATE:	DESCRIPTION:	BY:	CHK:
01	07.05.2012	Issued for Information	cs	sk
02	04.06.2012	Issued For Final Review	cs	sk

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Client: Parks Victoria
Client Check:
Internal Check: cs
Drawing Scale: As Shown

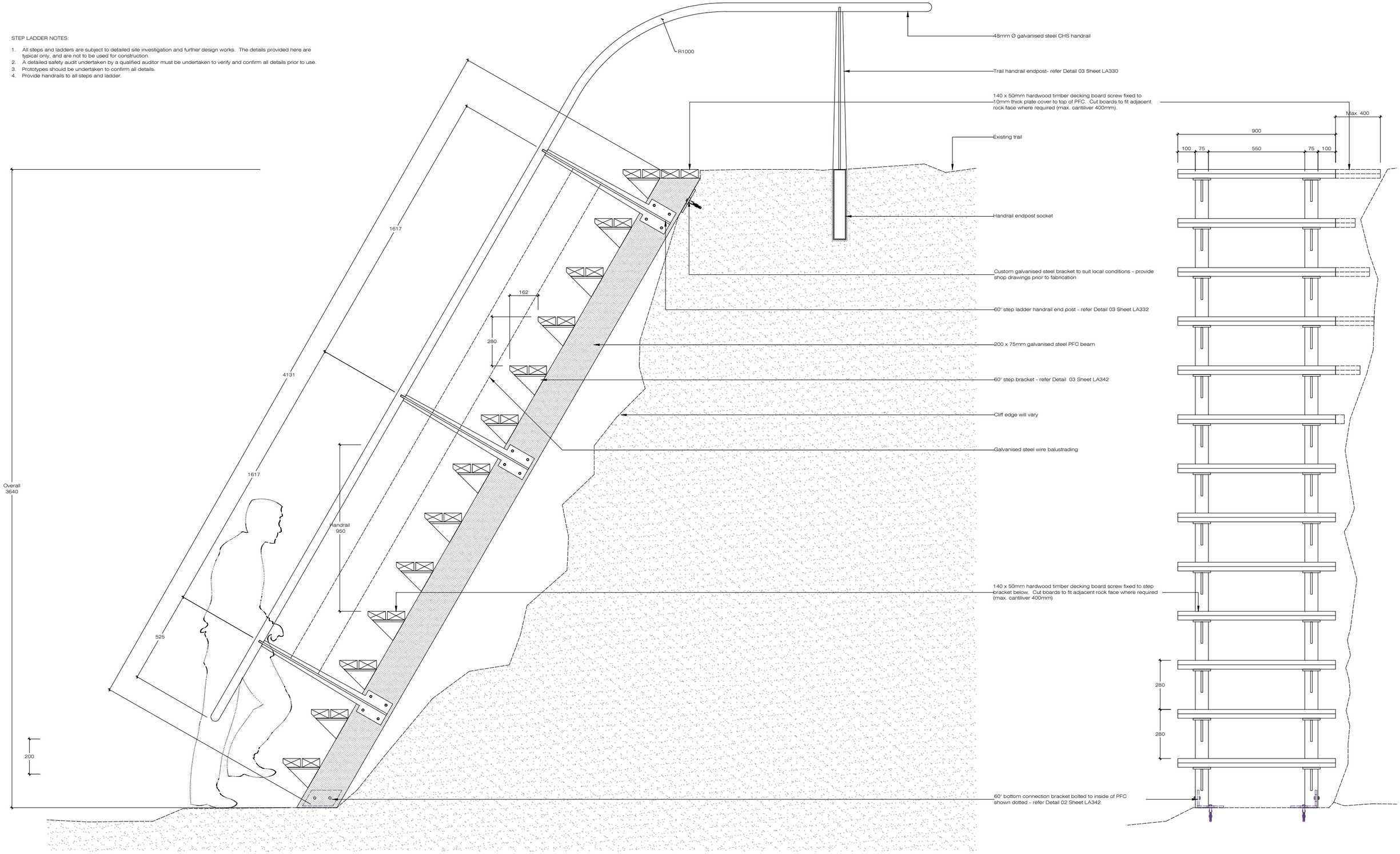
GRAMPIANS PEAKS TRAIL

Landscape Details
Typical 45°Step Ladder

Date: 04.06.2012
Drawing Number: 1107 LA340
Revision: 02

STEP LADDER NOTES:

1. All steps and ladders are subject to detailed site investigation and further design works. The details provided here are typical only, and are not to be used for construction.
2. A detailed safety audit undertaken by a qualified auditor must be undertaken to verify and confirm all details prior to use.
3. Prototypes should be undertaken to confirm all details.
4. Provide handrails to all steps and ladder.



01 LA341 60° Step Ladder Side Elevation
1:10 (A1)

02 LA341 60° Step Ladder Front Elevation
1:10 (A1)

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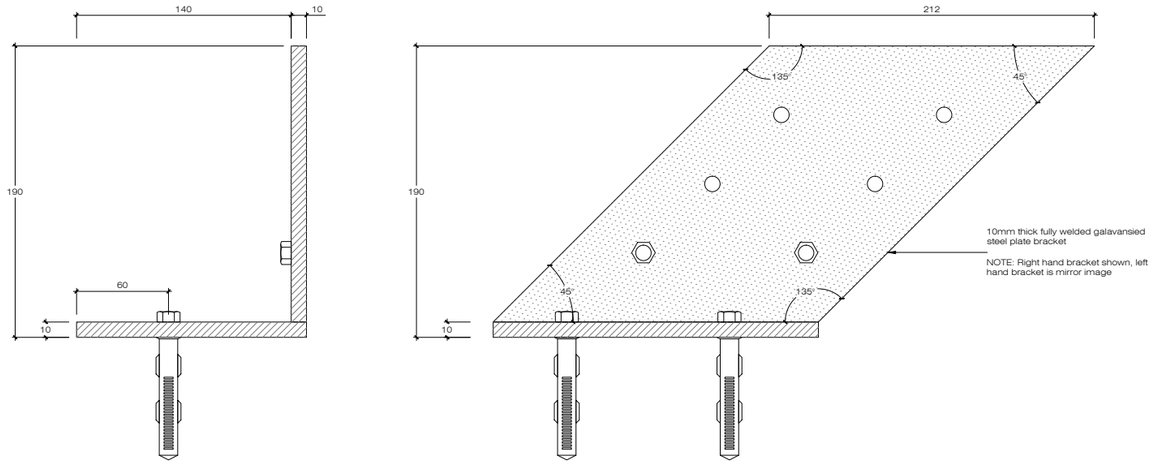
Internal Check: cs
Drawing Scale: As Shown

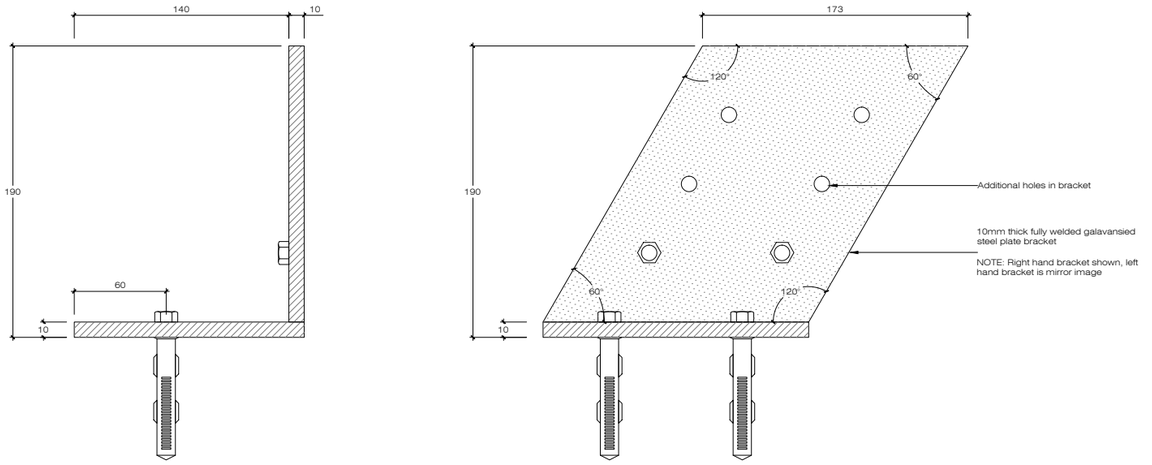
GRAMPIANS PEAKS TRAIL

Landscape Details
Typical 60° Step Ladder

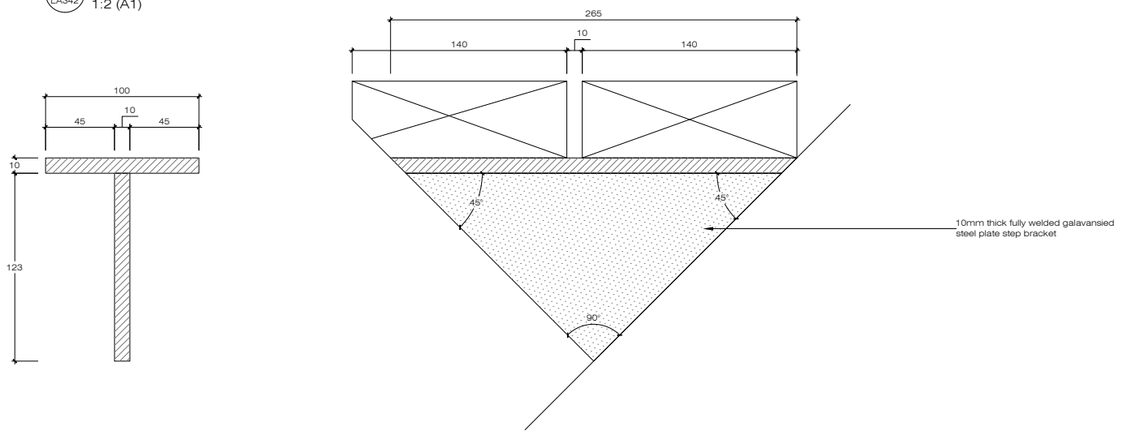
Date: 04.06.2012
Drawing Number: 1107 LA341
Revision: 02



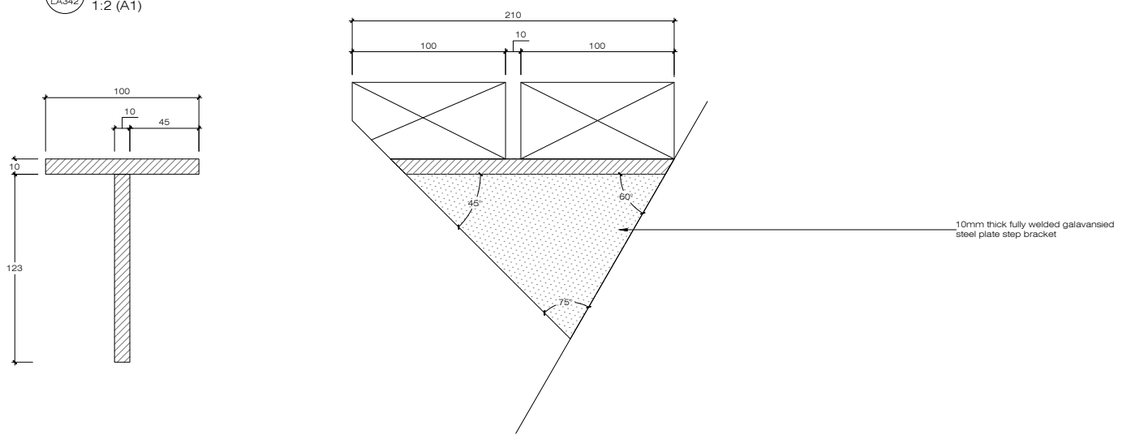
01 LA342 45° Bottom Connection Bracket
1:2 (A1)



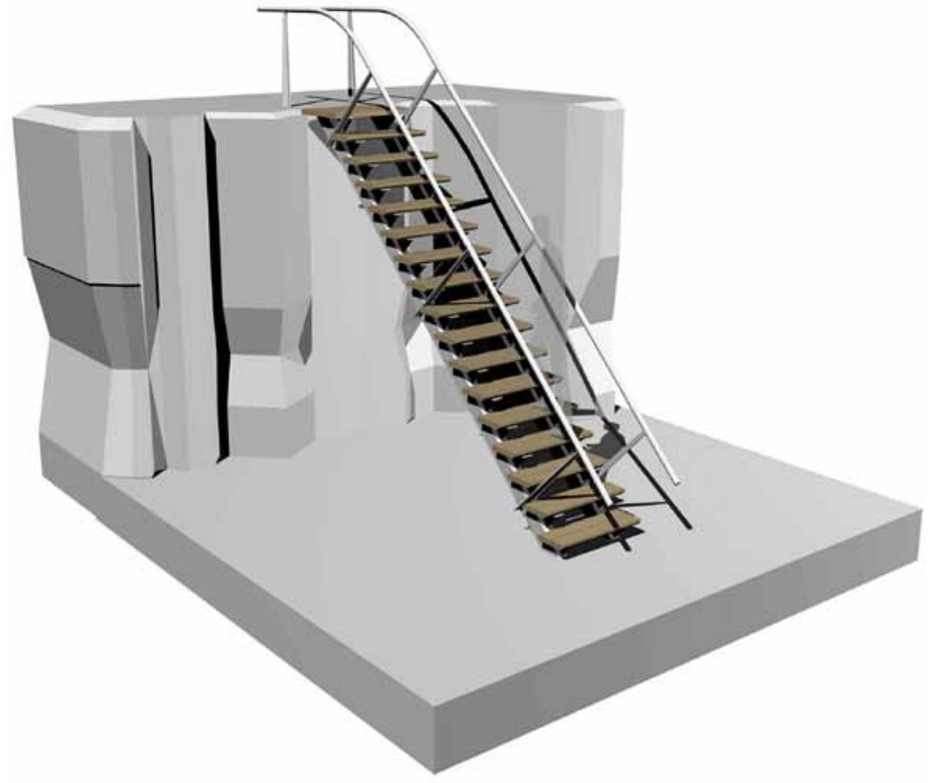
02 LA342 60° Bottom Connection Bracket
1:2 (A1)



03 LA342 45° Step Bracket
1:2 (A1)



04 LA342 60° Step Bracket
1:2 (A1)



05 LA342 45° Step Ladder - Indicative Perspective
n/a

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GRAMPIANS PEAKS TRAIL
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Client Check:
Internal Check: cs
Drawing Scale: As Shown

GRAMPIANS PEAKS TRAIL

Landscape Details
Typical Step Ladder Connections

Date: 04.06.2012
Drawing Number: 1107 LA342
Revision: 02

I. BOARDWALK - TIMBER

01 Provide timber boardwalks over soft, delicate, moist or boggy soils or ground that is prone to erosion and trenching, and where no other alignment options exist.

02 Provide boardwalks where boggy ground conditions extend over longer lengths (>10m) and where stone crossings are not appropriate or possible.

03 Ensure the boardwalk continues well beyond the end of the affected area to help avoid erosion in the damper soils and to tie the crossing back into the trail.

04 Boardwalks can also be used to ford smaller water crossings in circumstances where no site stone is available.

05 All timber boardwalks to be a maximum width of 800mm.

06 The timber boardwalk system consists of two standard modules: a straight module and a curved module. (The combination of these two modules allows the boardwalk to be placed accurately within the landscape and to avoid existing site obstacles, as well as to create a more engaging 'wriggling' line across the landscape).

07 Do not use timber boardwalk in straight runs longer than four modules (10m) in length (refer IMG 1661).

08 Maximum slope/gradient of boardwalk is 1:14 before the introduction of steps. (Steps to typically provide a maximum riser of 200mm).

09 Use a modular steel framing system that is easy to install, and allows for either bolt-together or welded assembly, depending on the site location and conditions.

10 Use larger format, durable hardwood timber boards (150mm wide x 50mm deep) to allow easy replacement following fire, wear or damage. (Refer materials assessment).

11 Ensure a flush edge between the trail and the boardwalk to avoid the potential for tripping (refer IMG 1582).

12 Provide a timber plinth end board to the boardwalk to avoid erosion of the trail at the transition.

13 Where site stone is available, consider providing a large stone at the beginning and end to emphasis the transition from trail to boardwalk, and help avoid erosion.

14 Do not use a handrail with this detail, as fall zones will not exceed 1500mm.

Boardwalk required due to periodic inundation

IMG 1829 - Required due to trenching

Boardwalk required due to boggy ground

IMG 1582 - Poor edge interface with Trail

IMG 1814 - Low boardwalk

IMG 1661 - Walkway too long and straight

IMG 1763 - Awkward interface

Curved boardwalk (Courtesy TTMS)

South Coast Trail Tasmania

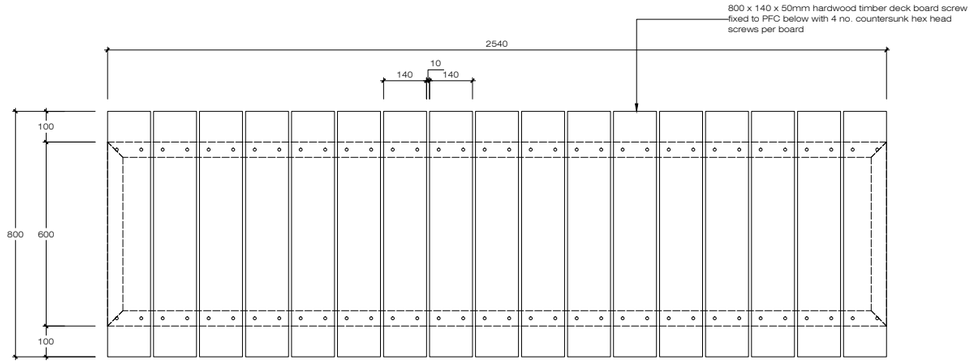
IMG 3139 - Cradle Mountain curved boardwalk

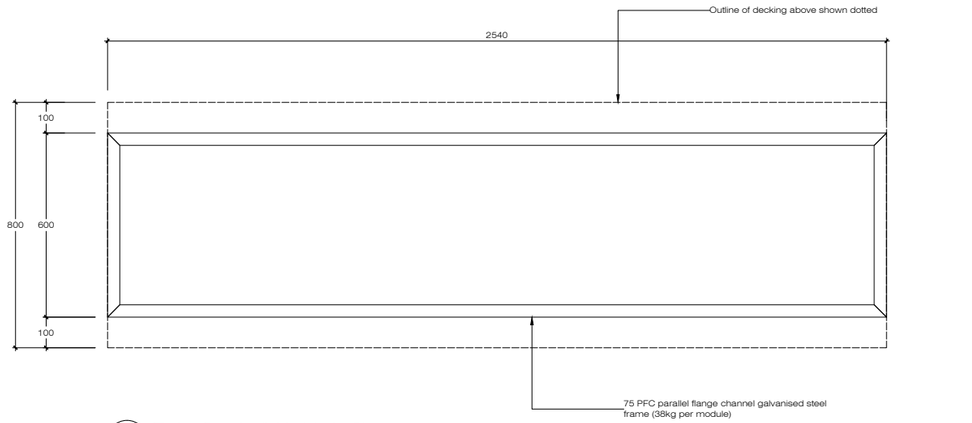
Overland Track Tasmania - vegetated edge

IMG 3137 - Cradle Mountain - winding boardwalk

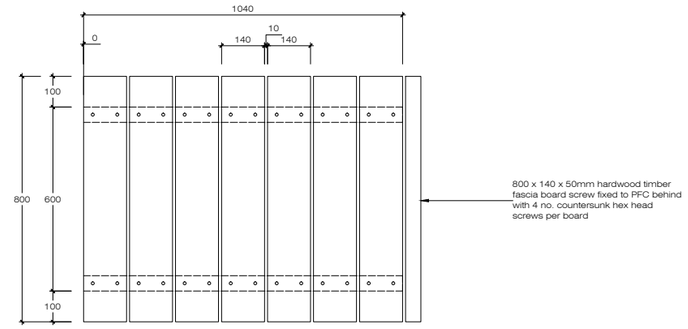
Boardwalk, Otway NP (Courtesy TTMS)

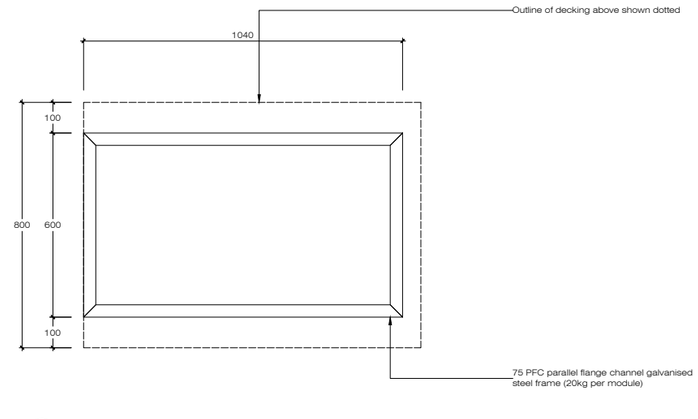
Boardwalk, Mt Cole (Courtesy TTMS)



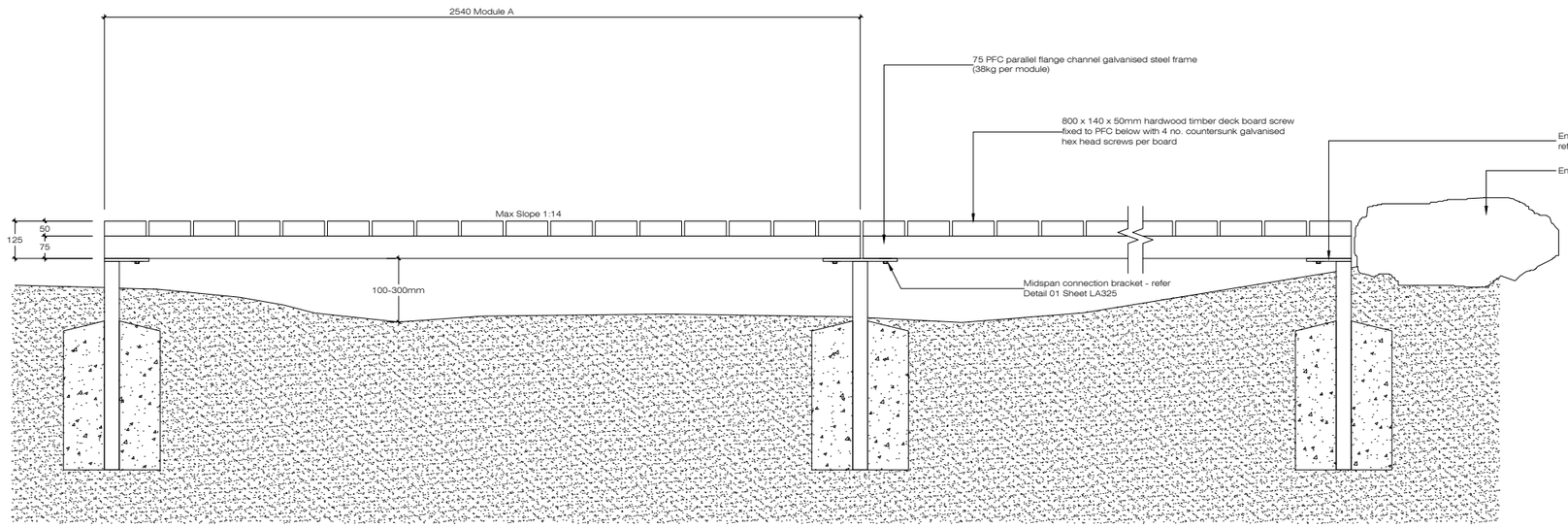


01 LA320 Timber Boardwalk Module A - Plan
1:10 (A1)

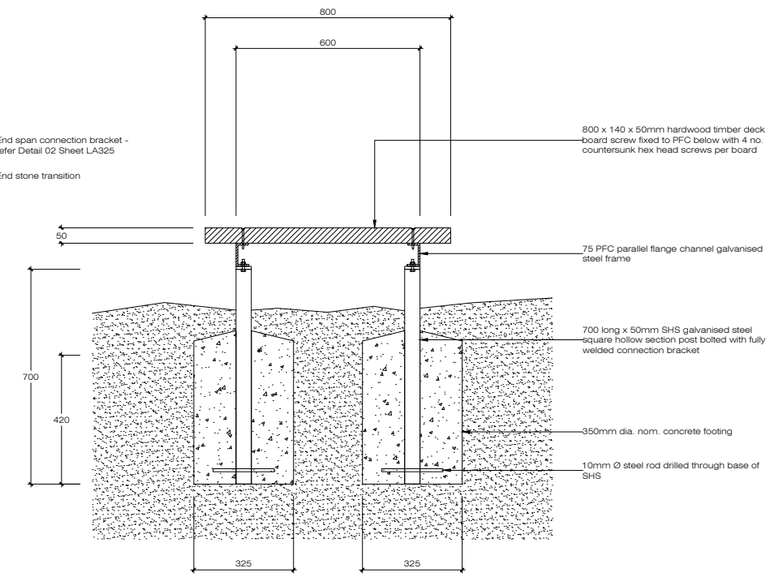




02 LA320 Timber Boardwalk Module B - Plan
1:10 (A1)



03 LA320 Timber Boardwalk Elevation
1:10 (A1)



04 LA320 Timber Boardwalk Section
1:10 (A1)

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01	07.05.2012	Issued for Information	cs	sk
02	04.06.2012	Issued For Final Review	cs	sk

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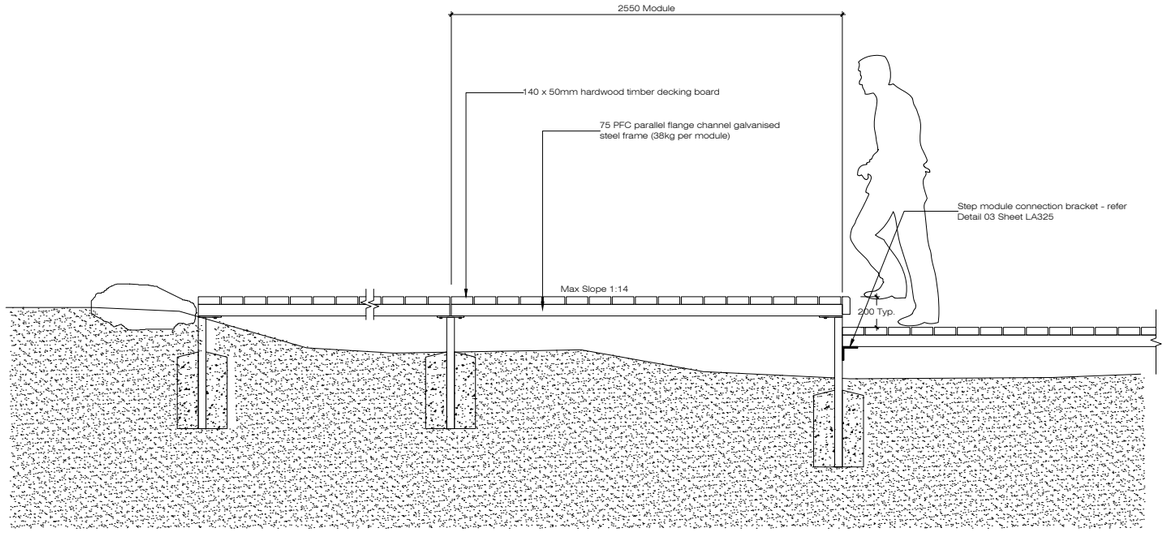
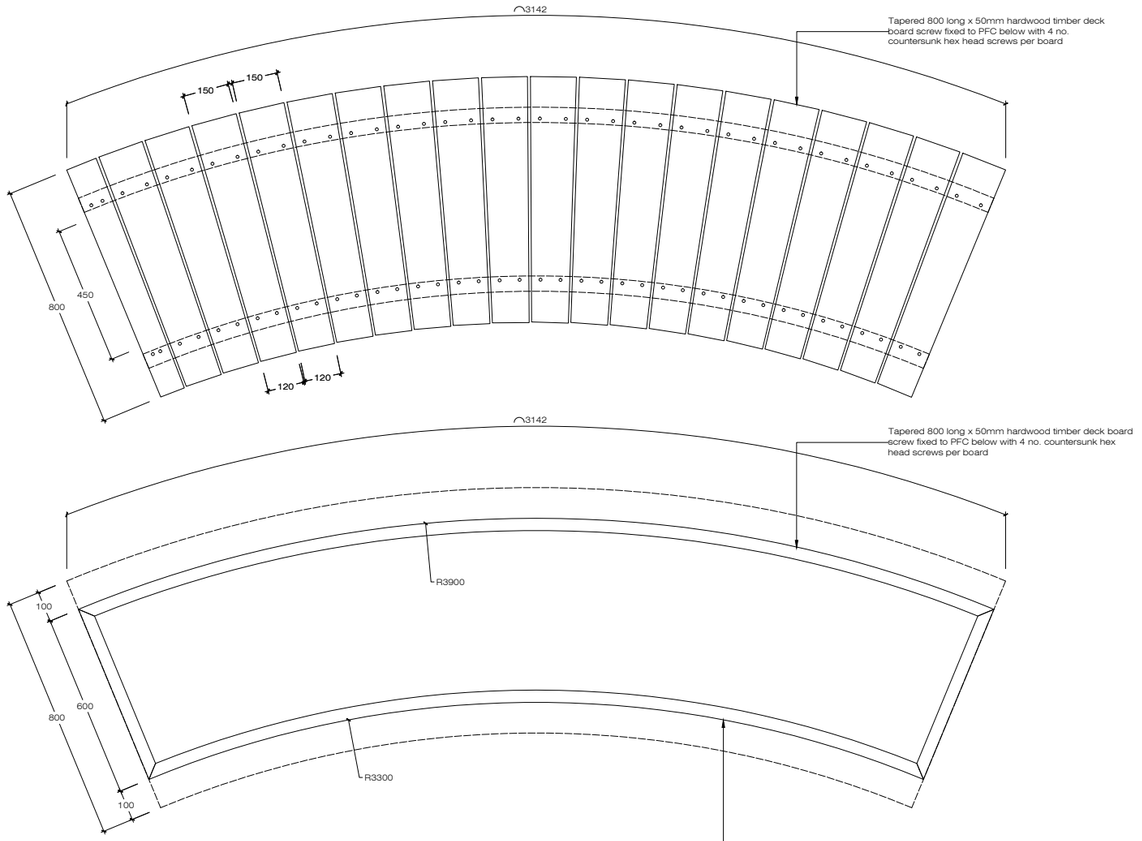
GRAMPIANS PEAKS TRAIL

Landscape Details
Typical Timber Boardwalk

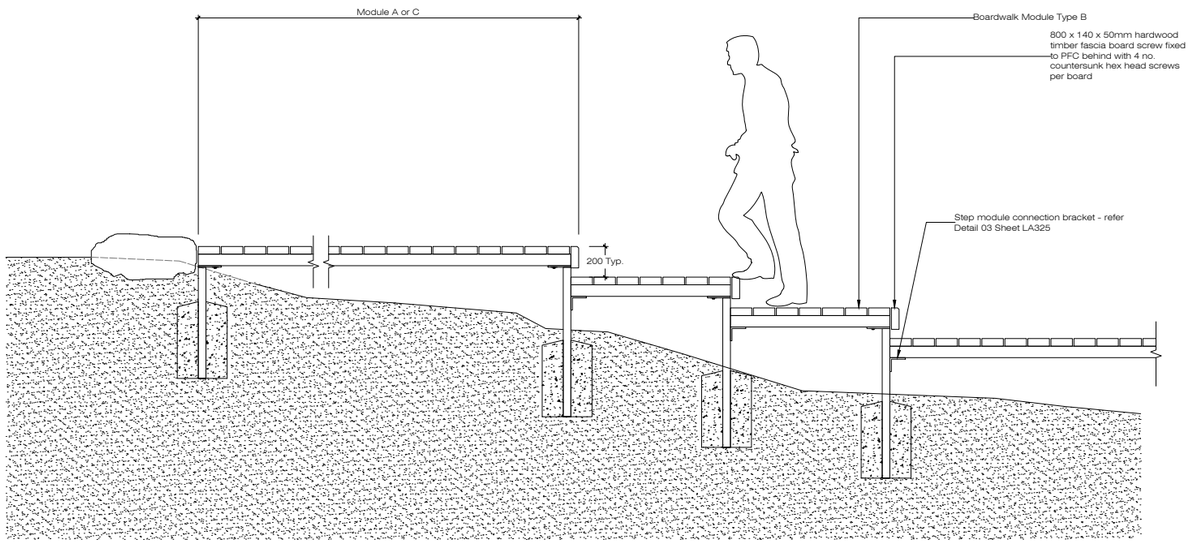
Date: 04.06.2012
Drawing Number: 1107 LA320
Revision: 02



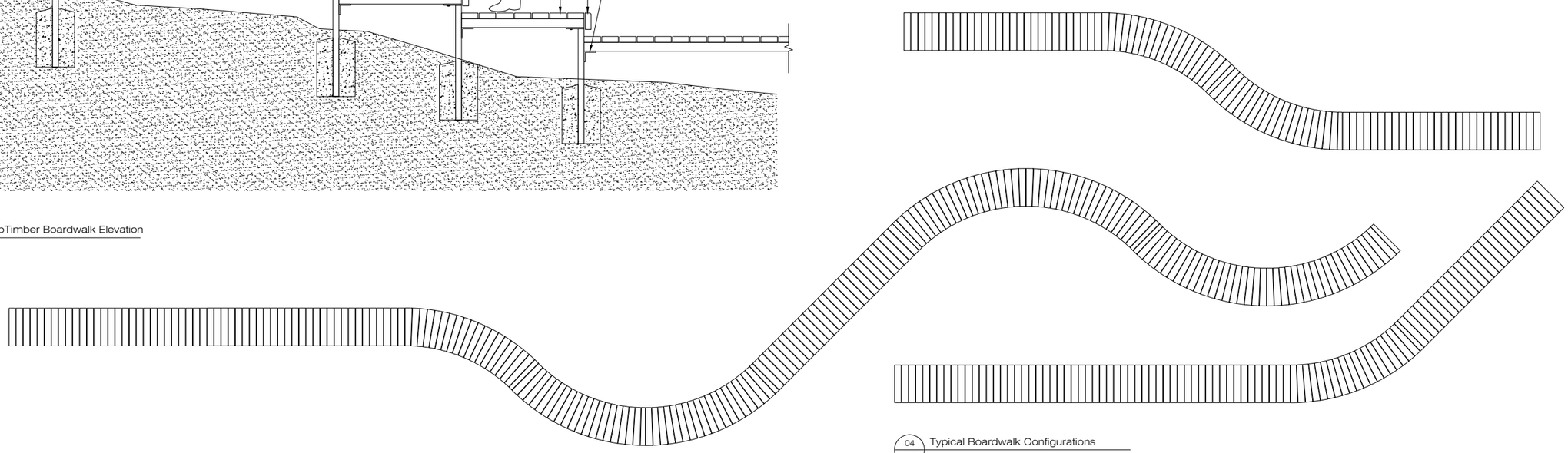
01 LA322 Single Step Timber Boardwalk Elevation
1:20 (A1)



03 LA322 Timber Boardwalk Module C - Plan
1:10 (A1)



02 LA322 Multiple StepTimber Boardwalk Elevation
1:20 (A1)



04 LA322 Typical Boardwalk Configurations
1:50 (A1)

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Internal Check: cs
Drawing Scale: As Shown

GRAMPIANS PEAKS TRAIL

Landscape Details
Typical Timber Boardwalk Step

Date: 04.06.2012
Drawing Number: 1107 LA322
Revision: 02

J. BOARDWALK - STEEL

01 Provide steel mesh boardwalks over soft, delicate, moist or boggy soils or ground that is prone to erosion and trenching in remote locations where access is limited and maintenance and repairs difficult to undertake (for example the Major Mitchell plateau).

02 Provide steel boardwalks at hiker camps.

03 Provide boardwalks where the boggy ground conditions extend over longer lengths (>10m) and where stone crossings are not appropriate or possible.

04 Ensure the boardwalk continues well beyond the end of the affected area to help avoid erosion in the damper soils and to tie the crossing back into the trail.

05 Boardwalks can also be used to ford smaller water crossings in circumstances where there is no site stone available.

06 All steel boardwalks to be a maximum width of 800mm.

07 The steel boardwalk system consists of two standard modules: a straight module and a curved module. (The combination of these two modules allows the boardwalk to be placed accurately within the landscape and to avoid existing site obstacles, as well as to create a more engaging 'wriggling' line across the landscape).

08 Do not use steel boardwalk in straight runs longer than four modules (10m) in length (refer IMG 1661).

09 Maximum slope/gradient of boardwalk is 1:14 before the introduction of stepped modules. Stepped modules to typically provide a maximum riser of 200mm. Multiple modules can be stepped where required.

10 Use a modular steel framing system that is easy to install, and allows for either bolt-together or welded assembly, depending on the site location and conditions.

11 Mesh panels to be mild steel grating, and not expanded metal grating.

12 Ensure a flush edge between the trail and the boardwalk to avoid the potential for tripping.

13 Where site stone is available, consider providing a large stone at the beginning and end to emphasis the transition from trail to boardwalk, and to help avoid erosion to the trail.

14 Do not use a handrail with this detail, as fall zones will not exceed 1500mm.

15 Do not provide seating along the steel boardwalk.

Streel grating prefeable (tie into Hiker camps)

Streel grating

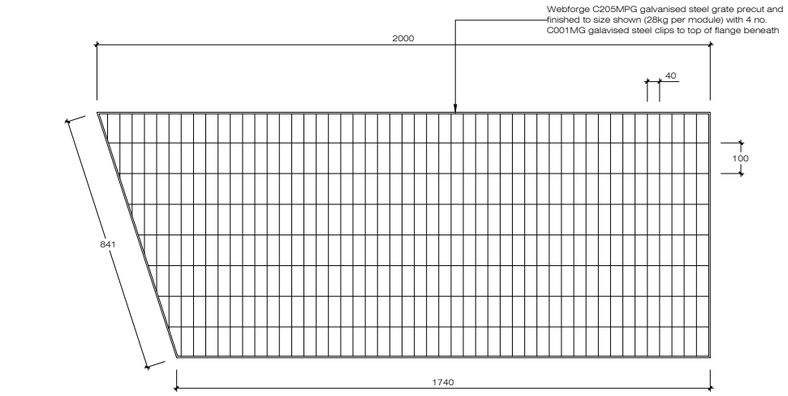
IMG 1661 - Runway too long and straight

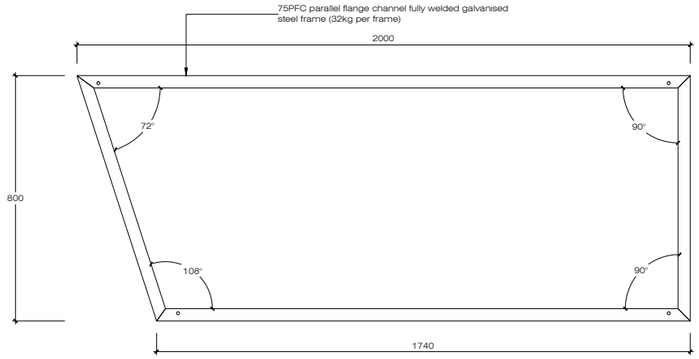
IMG 1667 - Seat too constructed / out of place

Expanded mesh too harsh / industrial

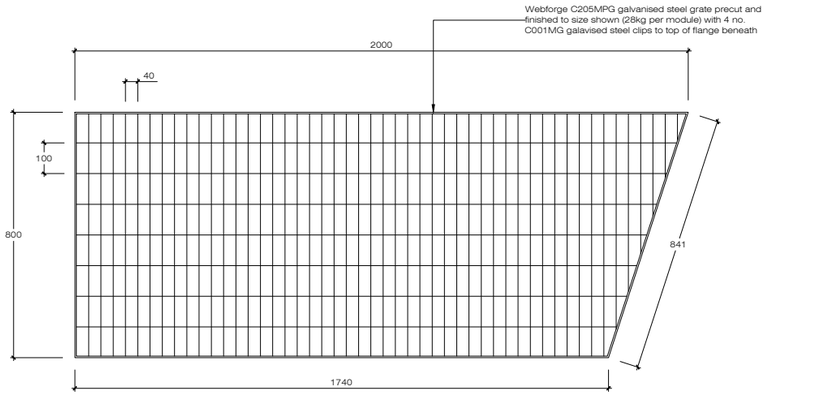
Material junctions too complicated

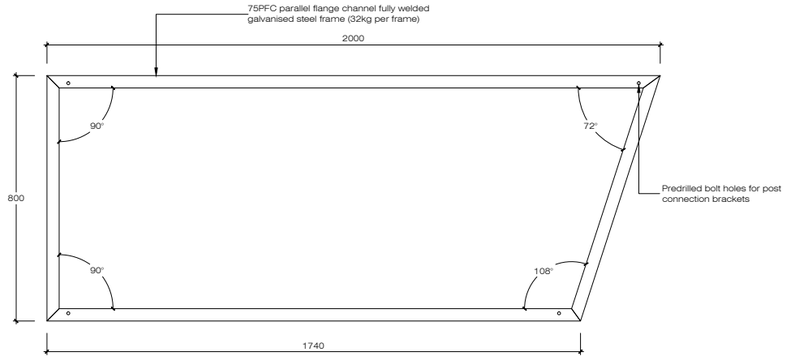
Streel grating



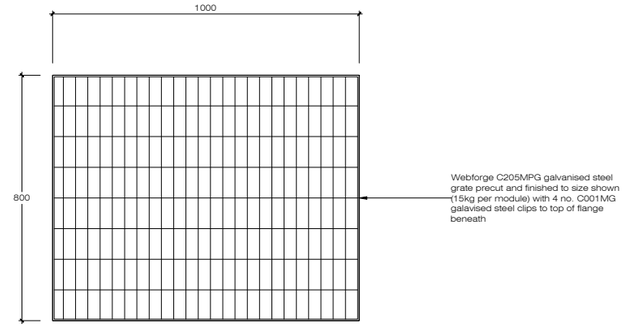


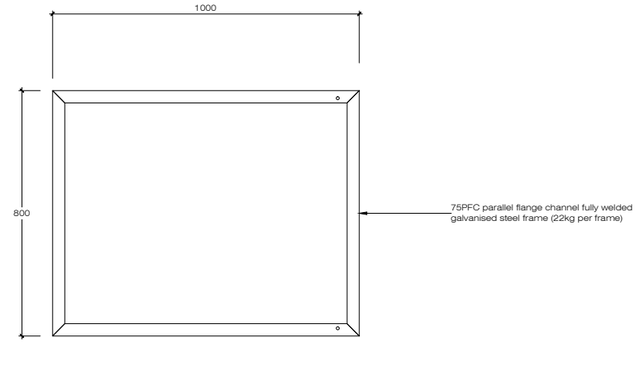
01 LA323 Steel Boardwalk Module A
1:10



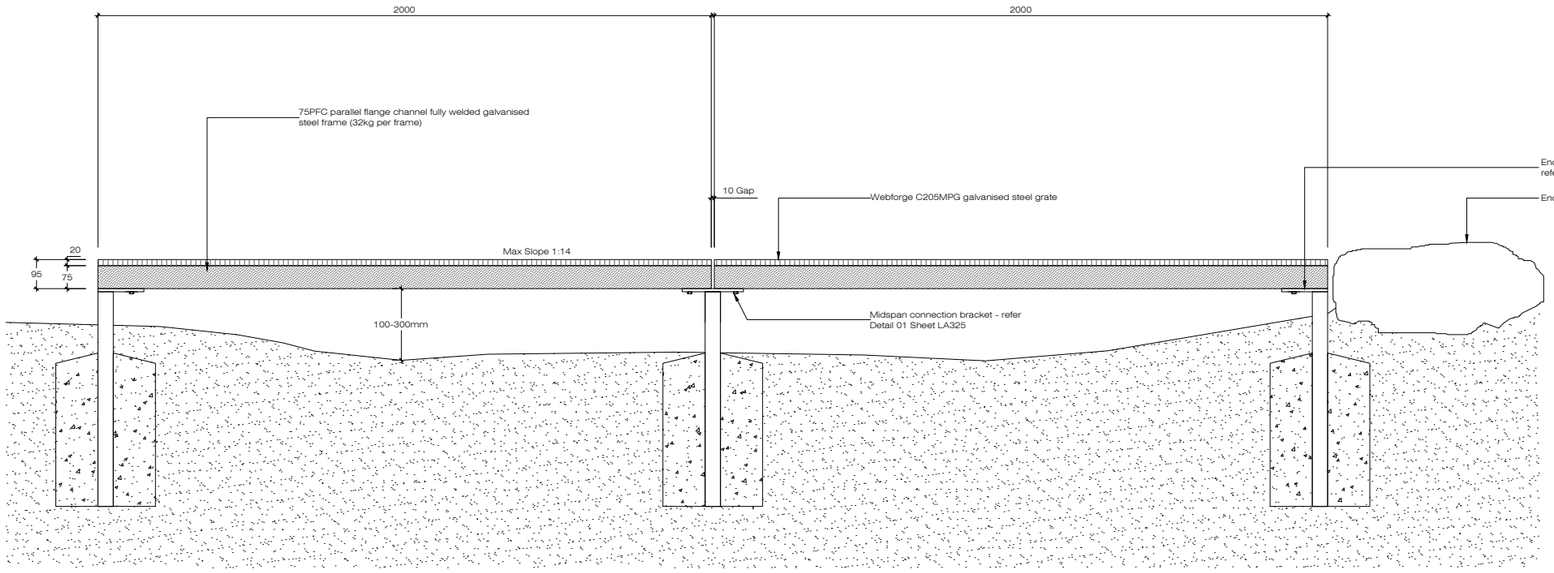


02 LA323 Steel Boardwalk Module B
1:10 (A1)

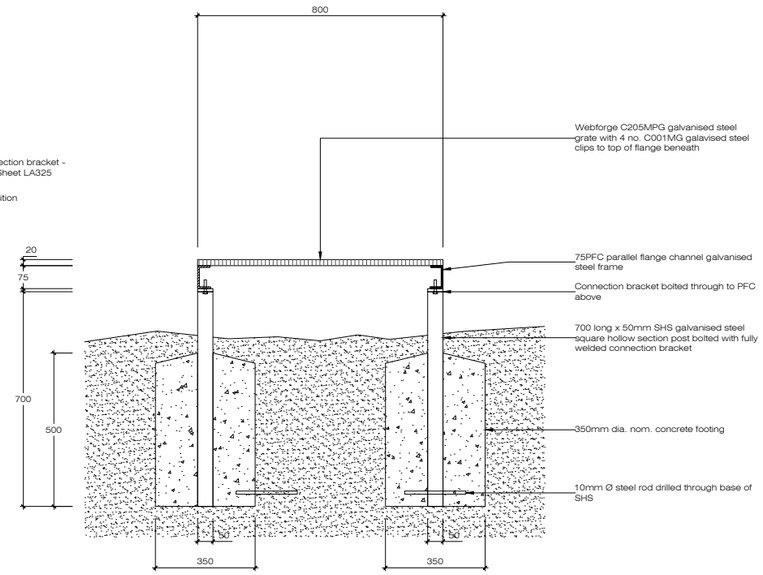




03 LA323 Steel Boardwalk Module C
1:10



03 LA323 Steel Boardwalk Elevation
1:10 (A1)



04 LA323 Steel Boardwalk Section
1:10 (A1)

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Walk Victoria's Icons

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Client: Parks Victoria
Client Check:
Internal Check: cs
Drawing Scale: n/a

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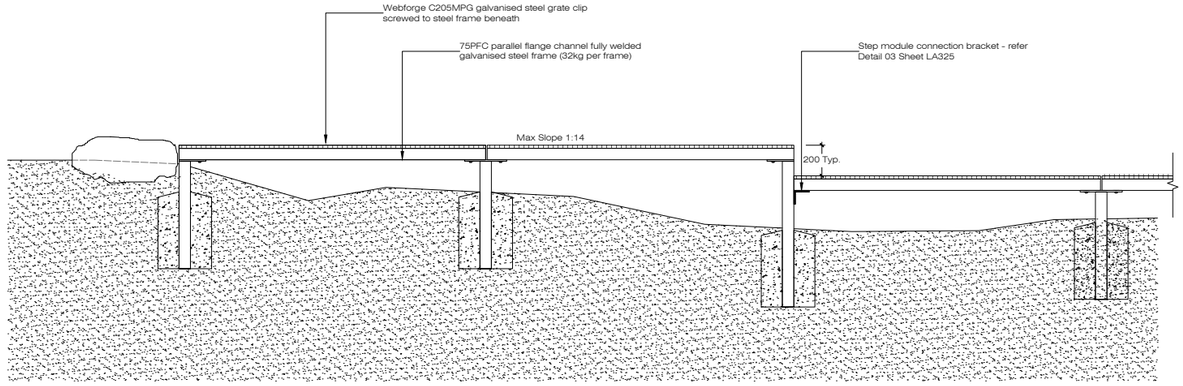
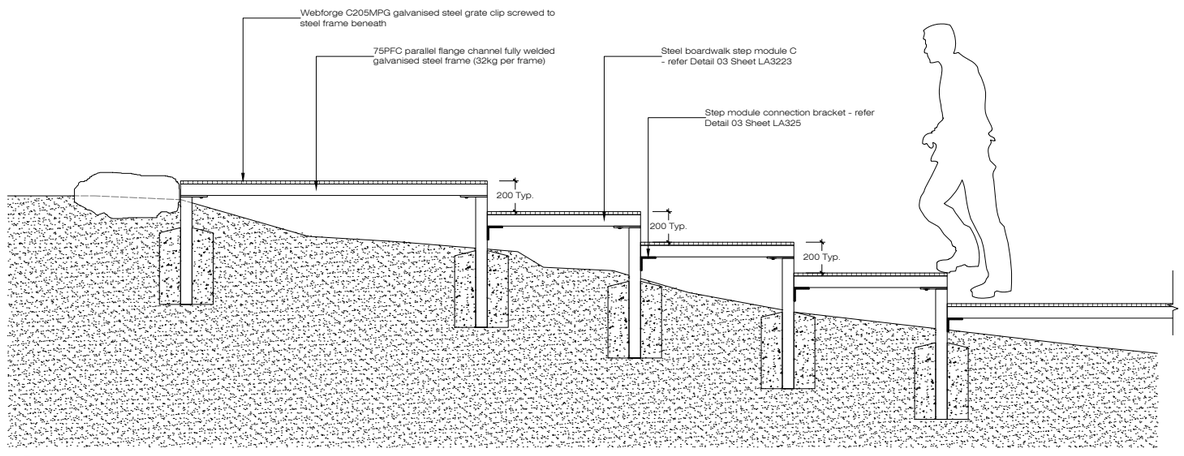
Landscape Details
Typical Steel Boardwalk

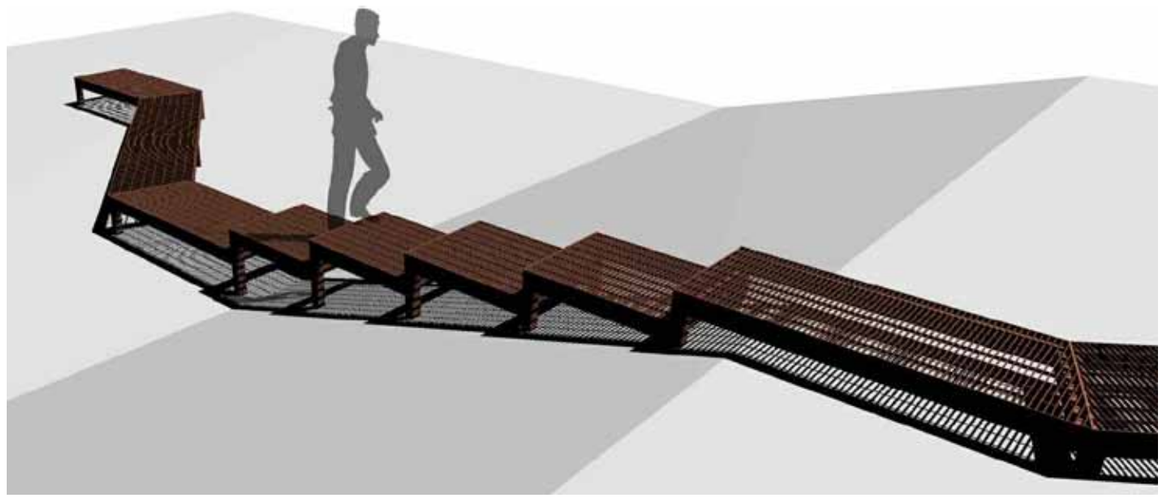
Date: 04.06.2012
Drawing Number: 1107 LA323
Revision: 02



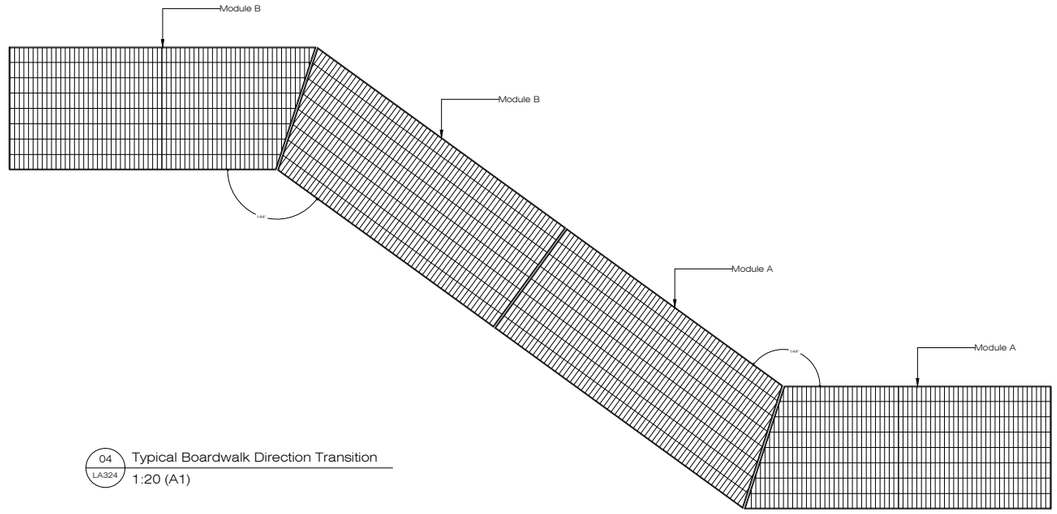
01 LA324 Single Step Steel Boardwalk Elevation
1:20 (A1)



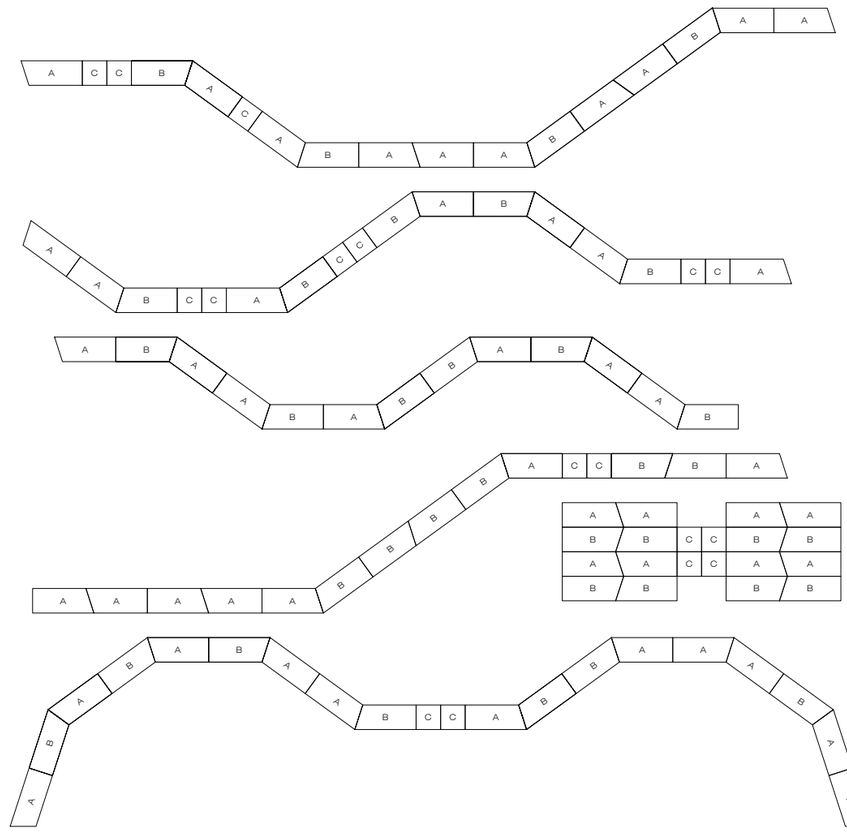
02 LA324 Multiple Step Steel Boardwalk Elevation
1:20 (A1)



03 LA324 Typical Boardwalk Perspctive
n/a



04 LA324 Typical Boardwalk Direction Transition
1:20 (A1)



05 LA324 Steel Boordwalk Configurations
1:100

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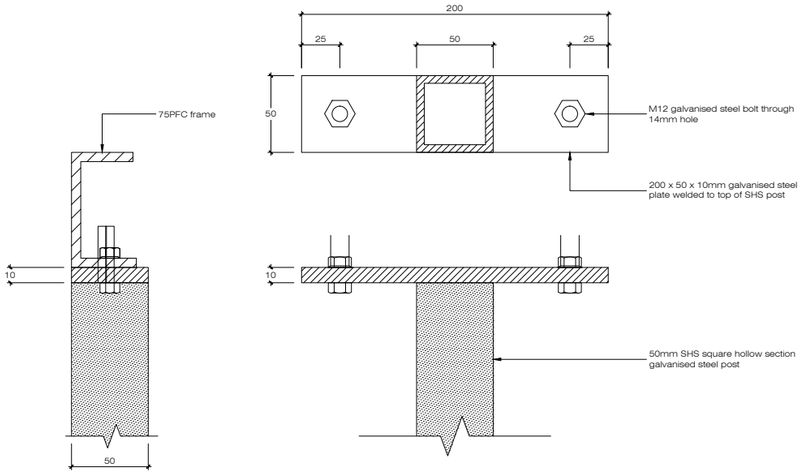
Internal Check: cs
Drawing Scale: n/a

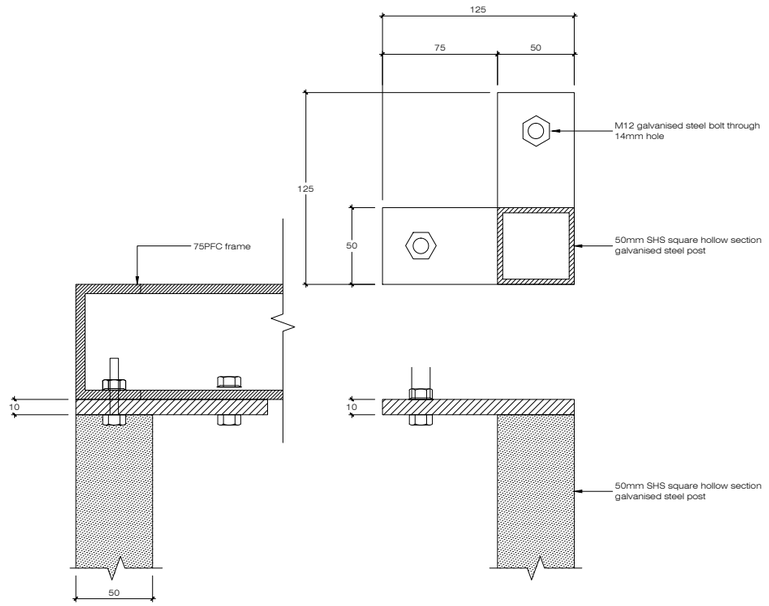
GRAMPIANS PEAKS TRAIL

Landscape Details
Typical Steel Boardwalk Step

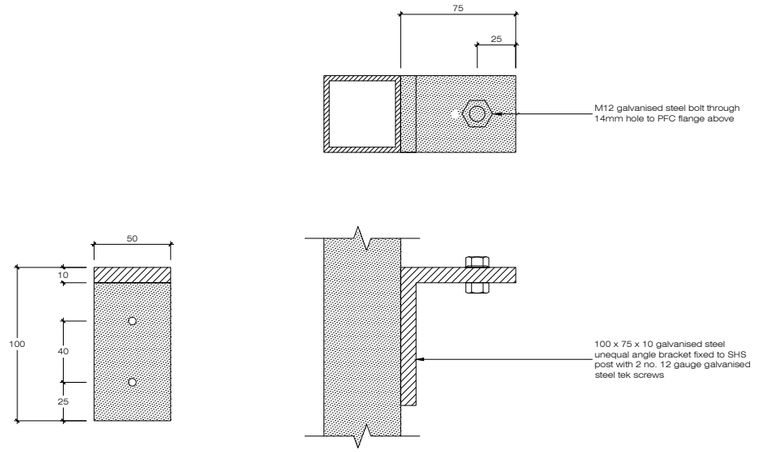
Date:	Drawing Number:	Revision:
04.06.2012	1107 LA324	02



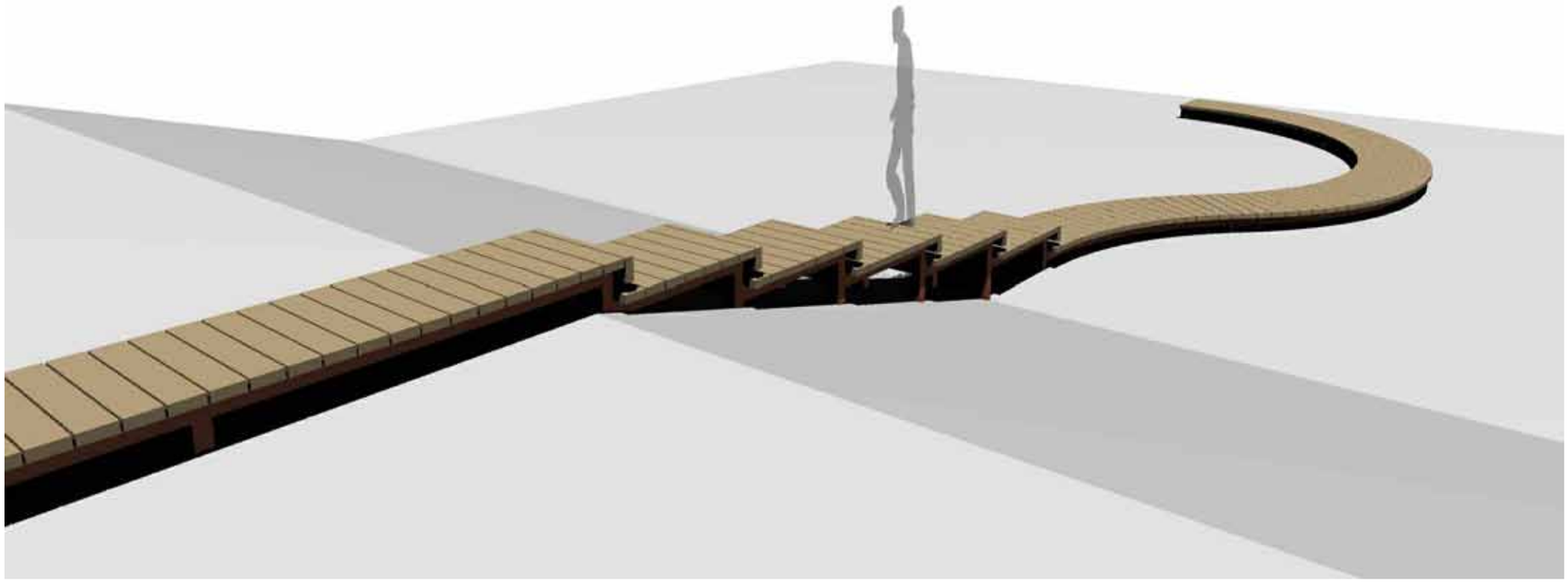
01 LA325 Boardwalk Mid Span Connection Bracket
1:2 (A1)



02 LA325 Boardwalk Endspan Connection Bracket
1:2 (A1)



03 LA325 Boardwalk Step Module Connection Bracket
1:2 (A1)



04 LA325 Typical Timber Boardwalk Perspective
n/a

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02	04.06.2012	Issued For Final Review	cs	sk

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Drawing Scale: As Shown

GRAMPIANS PEAKS TRAIL

Landscape Details
Typical Boardwalk Connections

Date: 04.06.2012
Drawing Number: 1107 LA325
Revision: 02

K. WATER CROSSING - SHORT BRIDGE

01 Water crossings are an exciting and integral component of the walking experience along the trail and should be celebrated.

02 Short bridges should be used to cross small rivers and creeks.

03 Align the trail to minimise the need for creek crossings.

04 Where short bridges are required, align the trail to the most appropriate crossing point, using existing site features to best locate the bridge.

05 This detail can also be used to bridge short rock chasms or gullies, or to connect rock shelves (for example, Gate of the East Wind).

06 The short bridge is designed to be low in height and short in length, minimising its bulk within the landscape.

07 Ensure bridge crossings are tied back into the landscape beyond the edge of the creek, to avoid erosion. (Where required, more than one bridge module can be used together).

08 Maximum width of the bridge module is 1200mm.

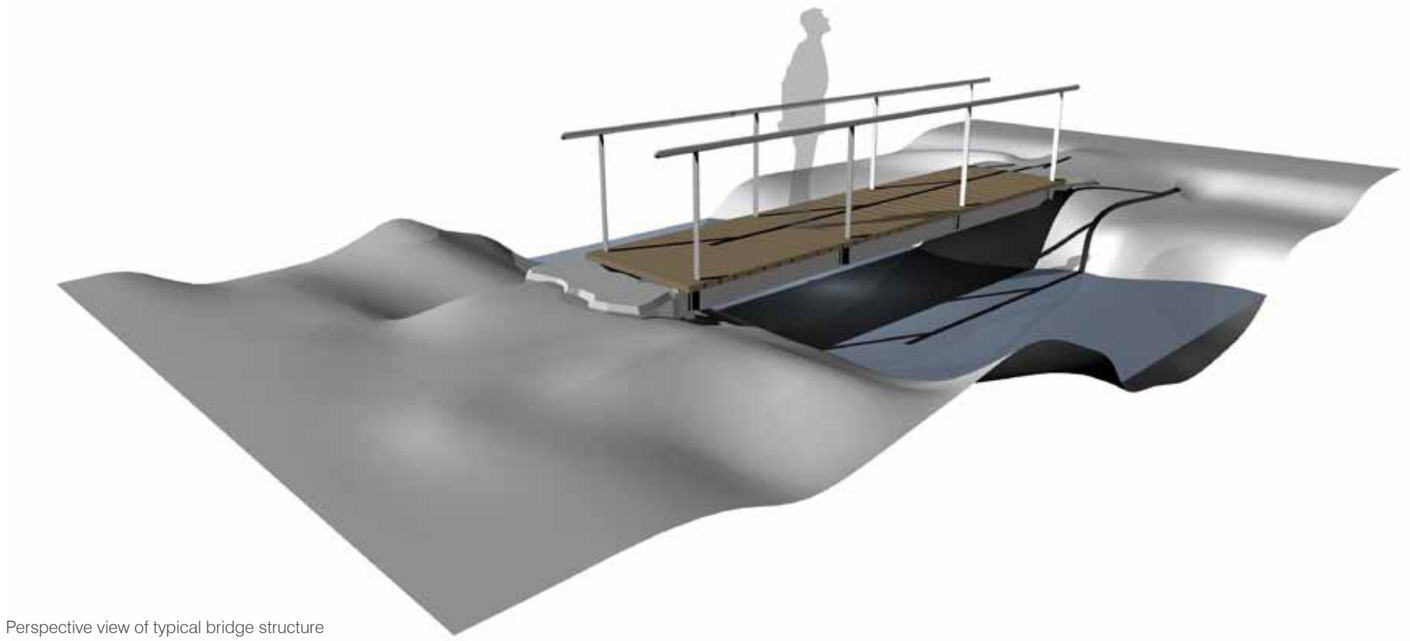
09 The shorter bridge module should have a maximum span length of 5m.

10 Bridge modules should be installed flat or with a minimum gradient where possible. Where the bridge module is used to connect rock shelves, the maximum longitudinal slope cannot exceed 1:14.

11 Use a modular steel framing system that is easy to install and allows for either bolt-together or welded assembly, depending on the site location and conditions.

12 Handrails should only be provided where fall heights exceed 1500mm or where there is fast-flowing and/or dangerous water. (Refer handrail detail).

13 The short bridge module can be used in conjunction with the longer bridge module to cross larger creeks and water bodies.



Perspective view of typical bridge structure

IMG 1534 - Handrails not required

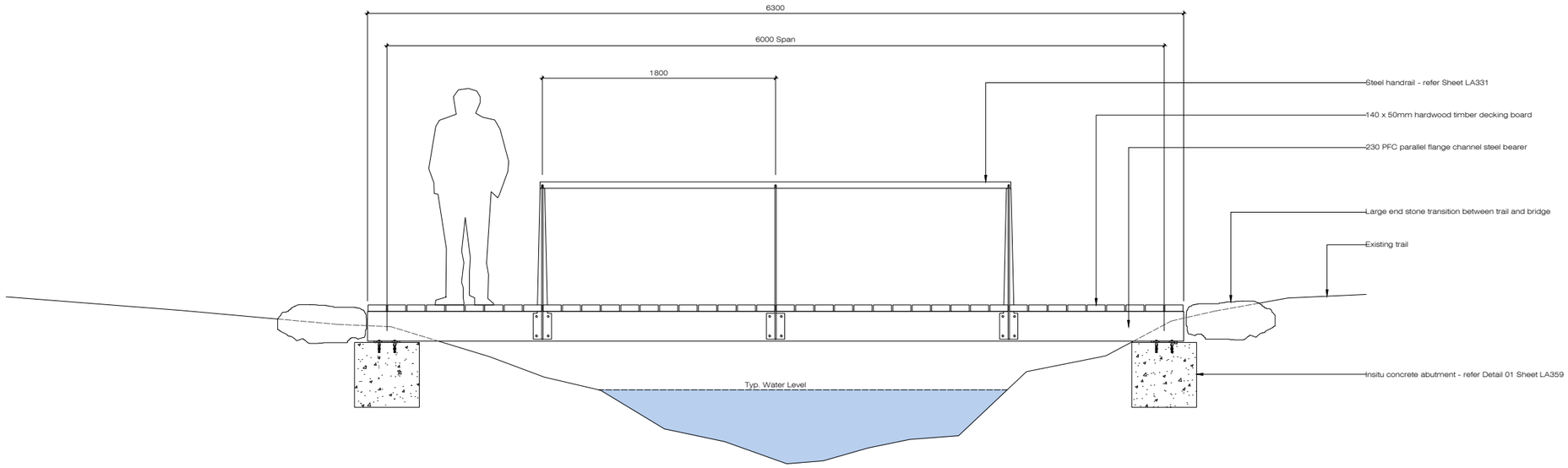
IMG 1633 Awkward trip hazard

IMG 1876 - Too bulky (fully prefabricated)

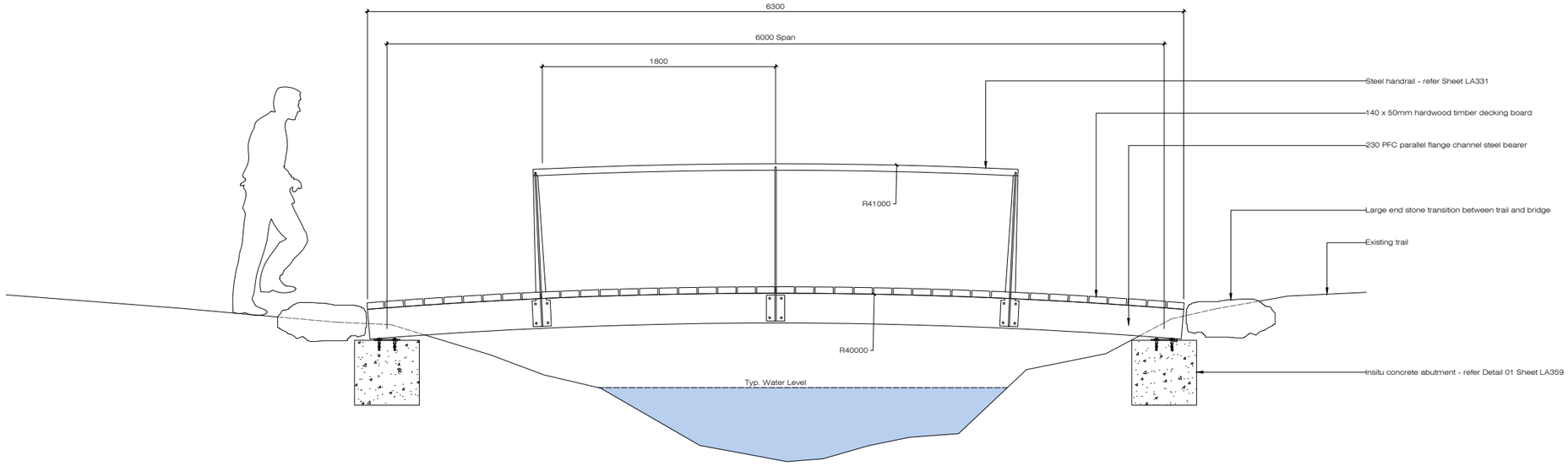
IMG 6595 - Timber is good

IMG 1979 - Middleton Creek crossing

IMG 1542 - Stony Creek crossing



01 LA350 6m Straight Bridge - Elevation
1:20 (A1)



02 LA350 6m Curved Bridge - Elevation
1:20 (A1)

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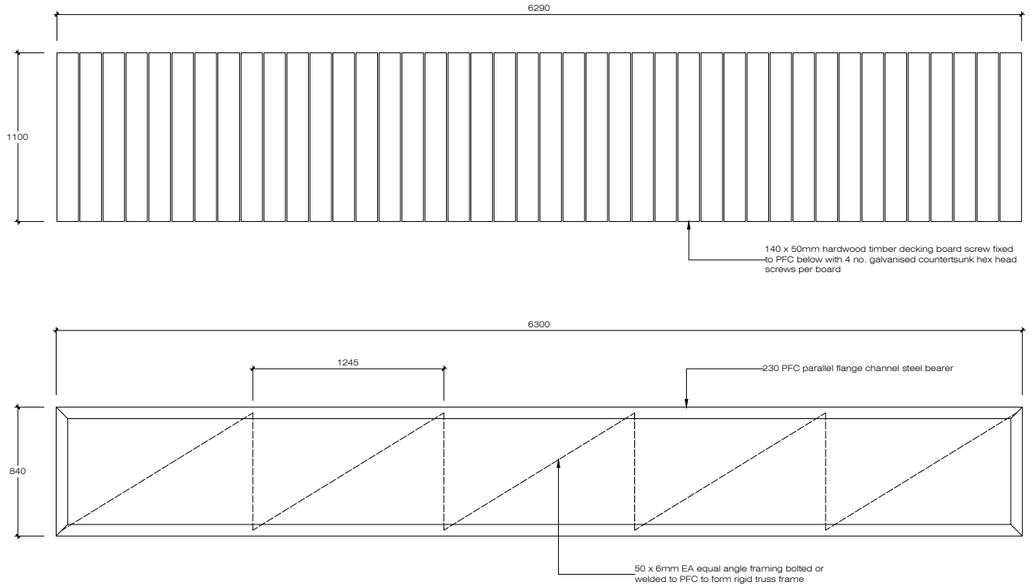
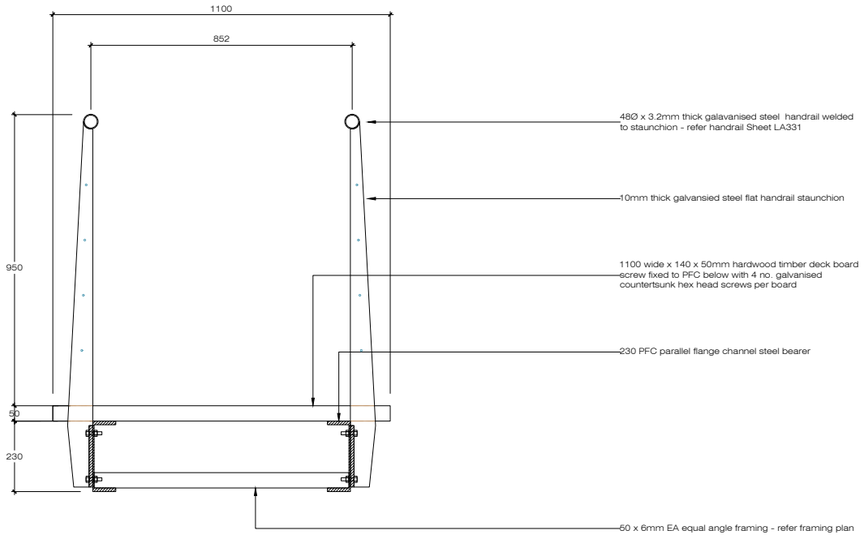
GRAMPIANS PEAKS TRAIL
Landscape Details
Typical 6m Bridge - Elevations

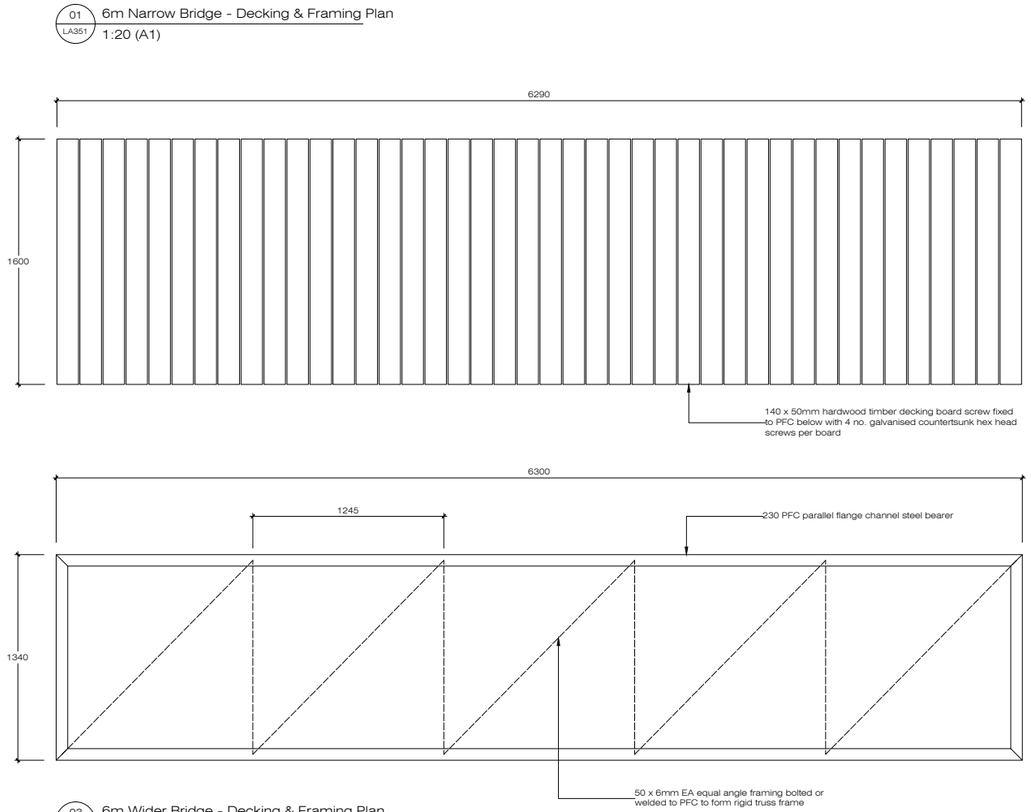
Date:	Drawing Number:	Revision:
04.06.2012	1107 LA350	02



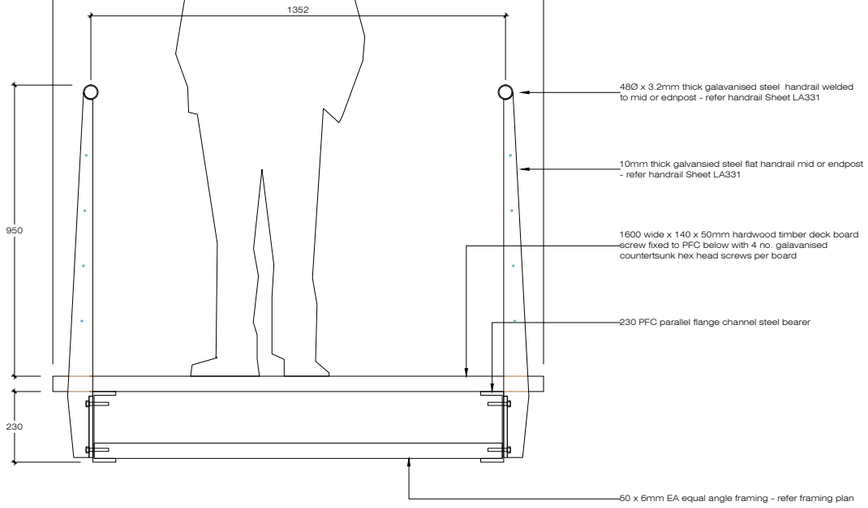
01 LA351 6m Narrow Bridge - Decking & Framing Plan
1:20 (A1)



02 LA351 6m Narrow Bridge - Section
1:10 (A1)



03 LA351 6m Wider Bridge - Decking & Framing Plan
1:20 (A1)



04 LA351 6m Wide Bridge - Section
1:10 (A1)

GRAMPIANS PEAKS TRAIL
Walk Victoria's Icons

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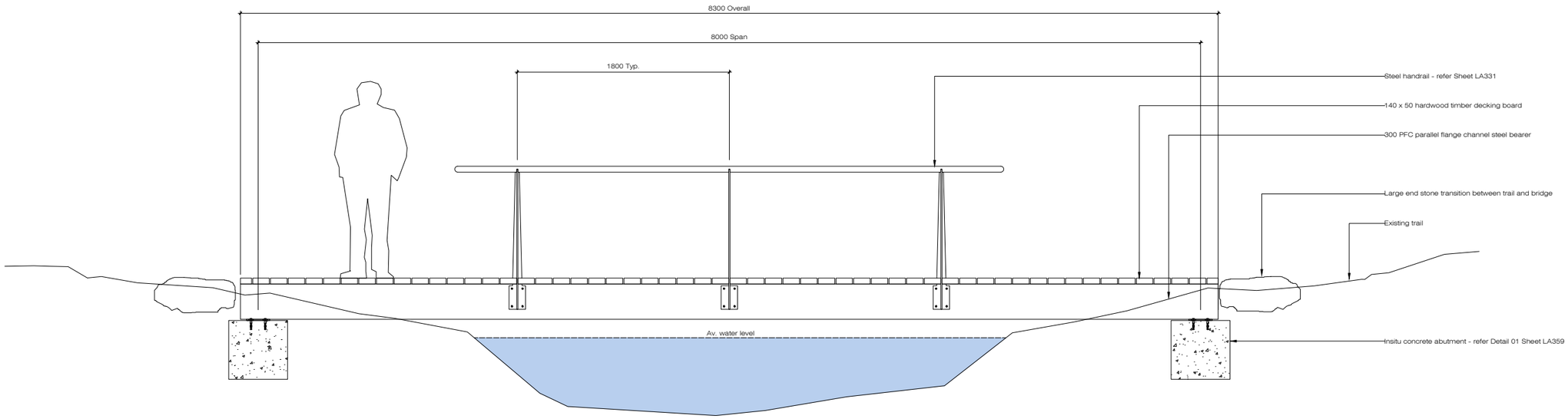
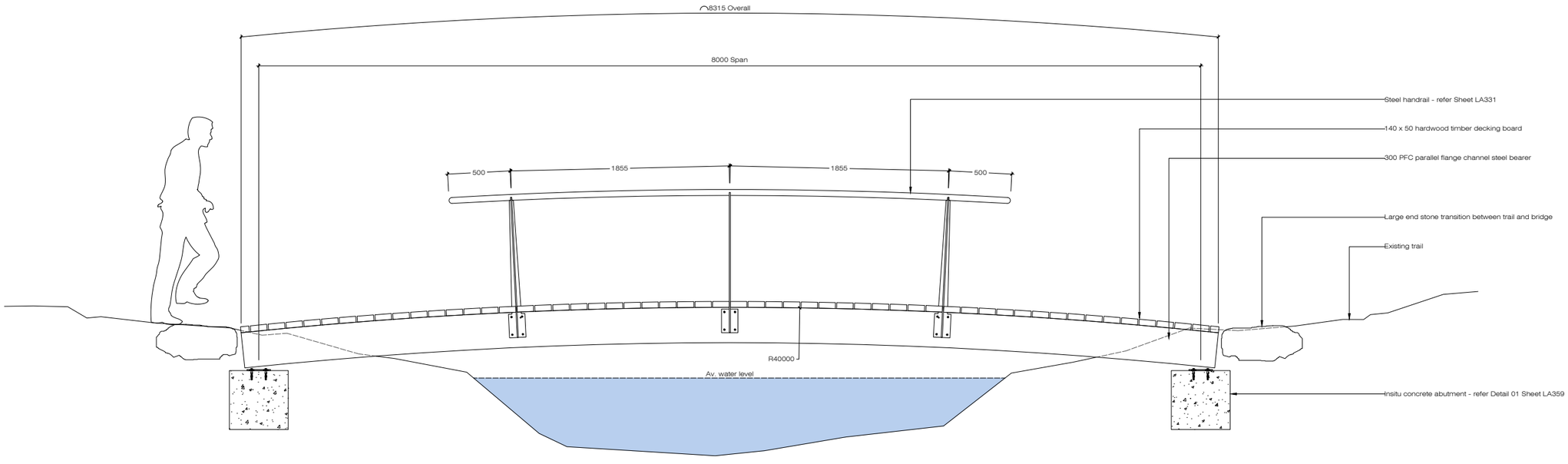
Landscape Details
Typical 6m Bridge - Plans & Sections

Date:	Drawing Number:	Revision:
04.06.2012	1107 LA351	02



01 LA352 8m Straight Bridge - Elevation
1:20 (A1)



02 LA352 8m Curved Bridge - Elevation
1:20 (A1)

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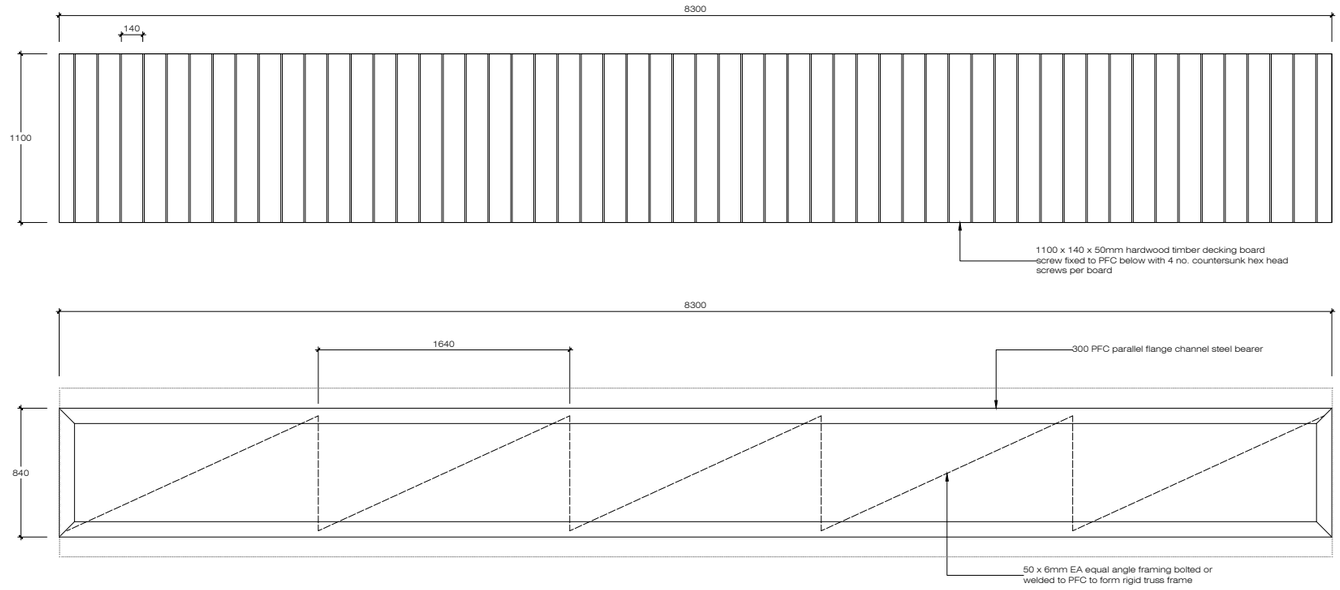
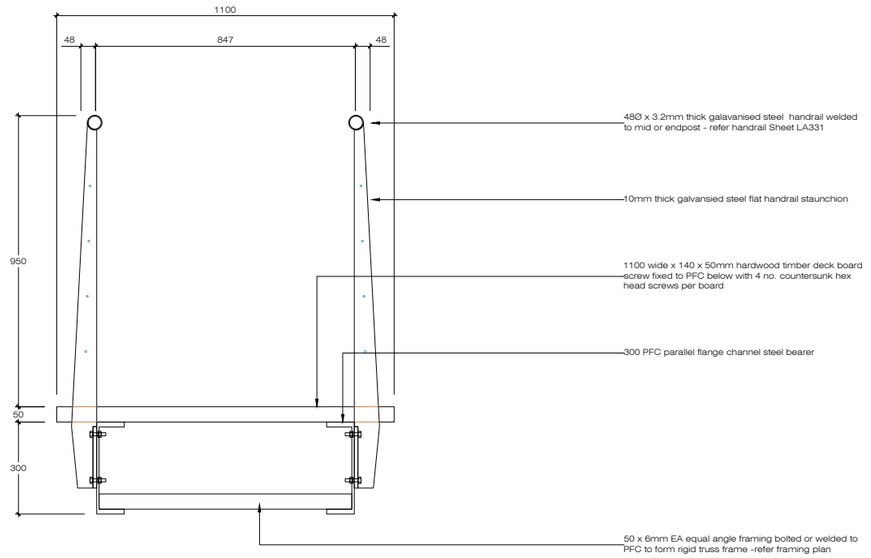
GRAMPIANS PEAKS TRAIL

Landscape Details
Typical 8m Bridge - Elevations

Date: 04.06.2012
Drawing Number: 1107 LA352
Revision: 02



01 LA353 8m Narrow Bridge - Decking & Framing Plan
1:20 (A1)



02 LA353 8m Narrow Bridge - Section
1:10 (A1)

03 LA353 8m Wide Bridge - Decking & Framing Plan
1:20 (A1)

04 LA353 8m Wide Bridge - Section
1:10 (A1)

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GRAMPIANS PEAKS TRAIL
Walk Victoria's Icons

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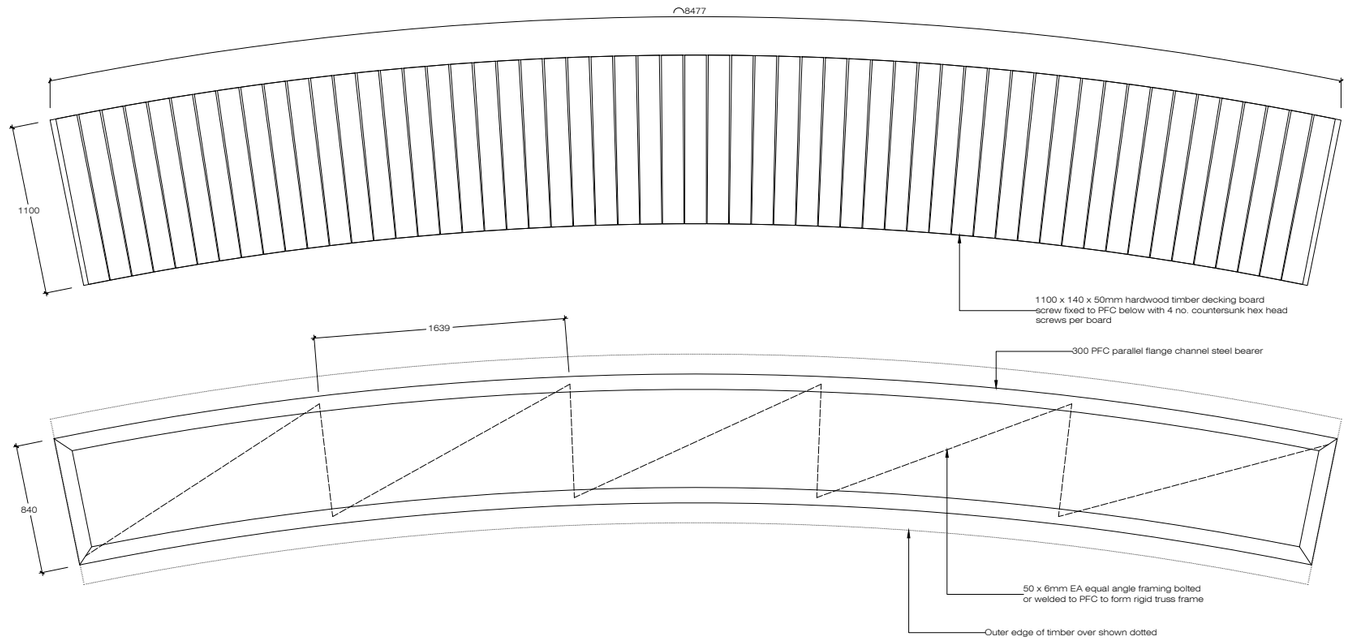
Internal Check: cs
Drawing Scale: As Shown

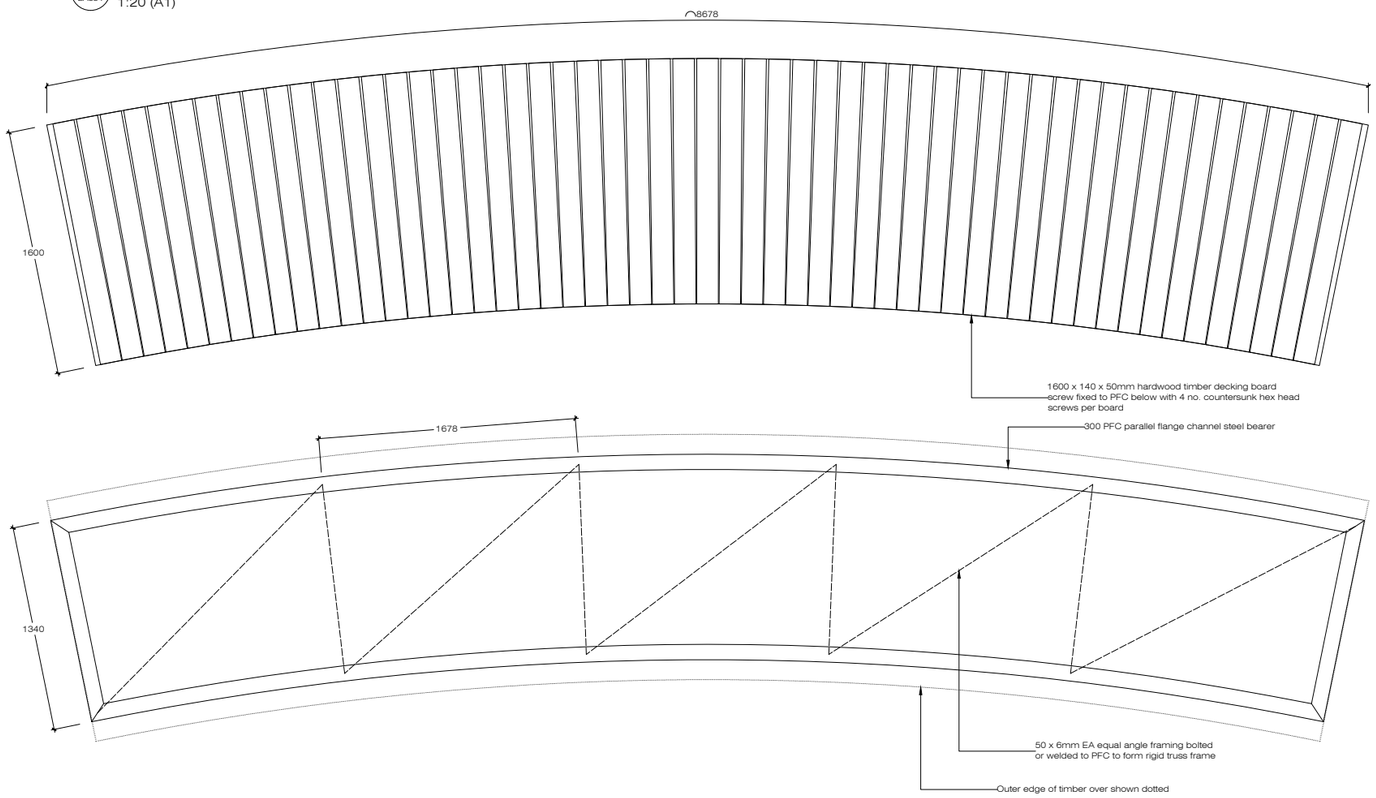
GRAMPIANS PEAKS TRAIL

Landscape Details
Typical 8m Bridge - Plans & Sections

Date: 04.06.2012
Drawing Number: 1107 LA353
Revision: 02



01 LA354 8m Narrow Curved Bridge - Decking & Framing Plan
1:20 (A1)



02 LA354 8m Wide Curved Bridge - Decking & Framing Plan
1:20 (A1)

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Walk Victoria's Icons

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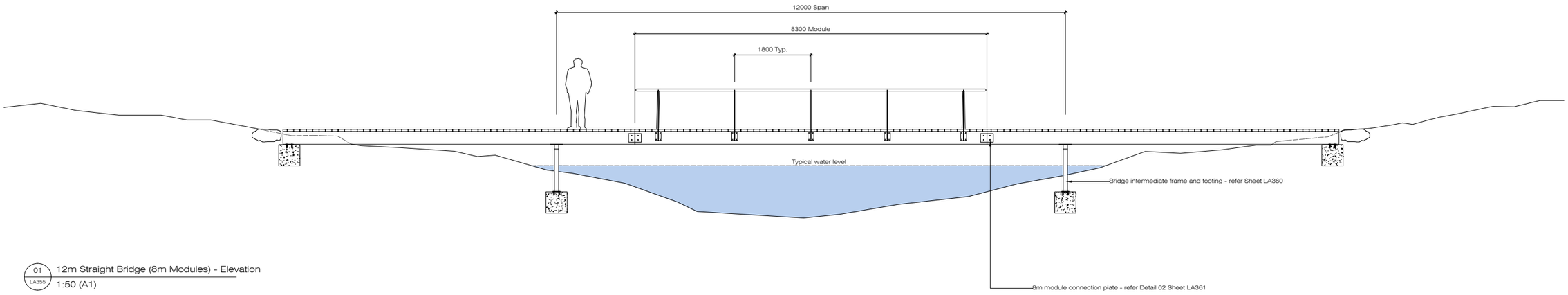
Client: Parks Victoria
Client Check:
Internal Check: cs
Drawing Scale: As Shown

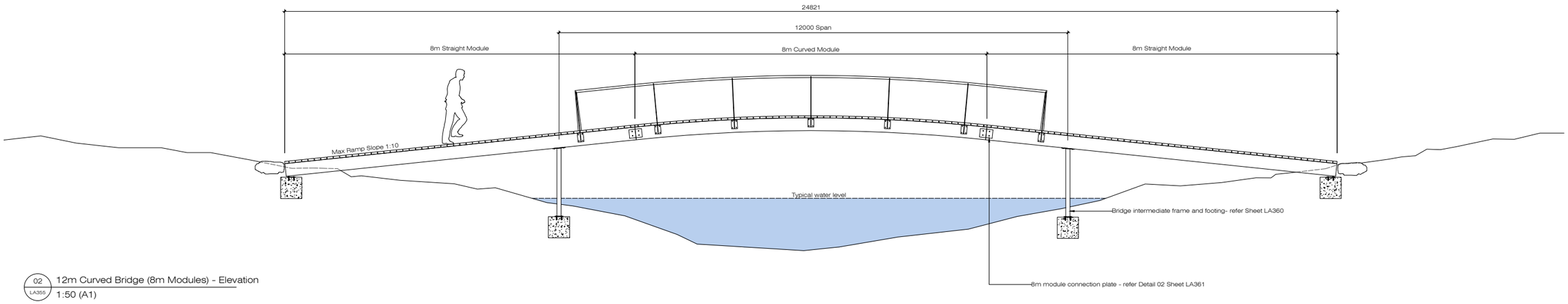
GRAMPIANS PEAKS TRAIL

Landscape Details
Typical 8m Curved Bridge - Plans & Sections

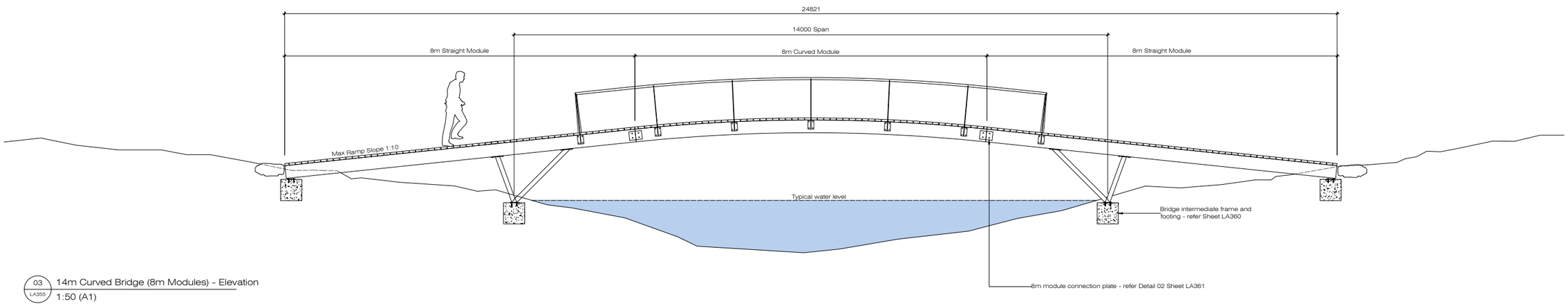
Date:	Drawing Number:	Revision:
04.06.2012	1107 LA354	02



01 LA355 12m Straight Bridge (8m Modules) - Elevation
1:50 (A1)



02 LA355 12m Curved Bridge (8m Modules) - Elevation
1:50 (A1)



03 LA355 14m Curved Bridge (8m Modules) - Elevation
1:50 (A1)

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GRAMPIANS PEAKS TRAIL
Walk Victoria's Icons

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Client: Parks Victoria
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Internal Check: cs
Drawing Scale: As Shown

GRAMPIANS PEAKS TRAIL

Landscape Details
Typical 8m Bridge Combo (12m Span) - Elevations

Date: 04.06.2012
Drawing Number: 1107 LA355
Revision: 02

L. WATER CROSSING - LONGER BRIDGE

01 Water crossings are an exciting and integral component of the walking experience along the trail and should be celebrated.

02 In a number of locations, longer bridges will be required to cross rivers and creeks, such as the Wannon River and Fyans Creek.

03 Align the trail to minimise the need for creek crossings.

04 Where longer bridges are required, align the trail to the most appropriate crossing point, using existing site features to best locate the bridge.

05 These elements will be subject to detailed design based on careful analysis of the site conditions.

06 The long bridge is designed to be low in height and short in length, minimising its bulk within the landscape.

07 A number of different modules exists for the longer bridge: flat and straight module; flat and curved module; straight and arced module. (The type of longer bridge module will depend on the site).

08 Ensure bridge crossings are tied back into the landscape beyond the edge of the creek to avoid erosion. (Where required, more than one bridge module can be used together).

09 Maximum width of the bridge module is 1600mm (to facilitate quad bike service access). Typical width 1200mm.

10 The longer bridge module should have a maximum span length of 12m. Avoid placing footings in the water. The bridge should be able to span the required distance.

11 Longer bridge loadings = quad bike access.

12 Use a modular steel framing system that is easy to install, and allows for either bolt-together or welded assembly, depending on the site location and conditions.

13 Where longer bridges are required, these should be constructed from multiple spans, using either the short or longer bridge modules (rather than larger, single span bridges).

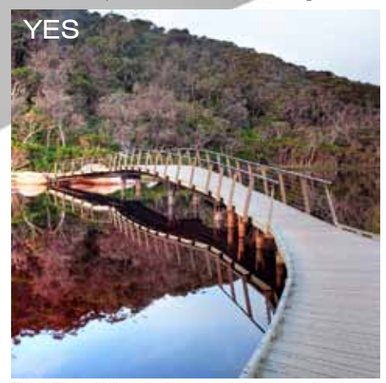
14 Ensure bridge crossings are tied back into landscape beyond the edge of the river, to avoid erosion. (Where required, more than one bridge module can be used together).

15 Handrails should only be provided where fall heights exceed 1500mm or where there is fast-flowing and/or dangerous water.

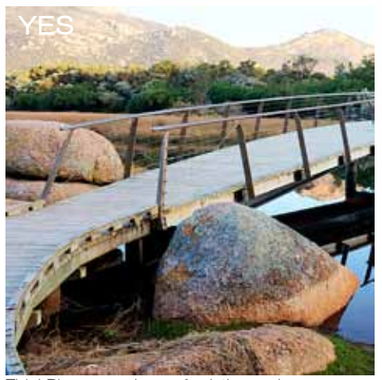
Perspective view of curved bridge module

IMG 5805 - Bridge too urban / constructed

IMG 5804 - Bridge too urban / constructed

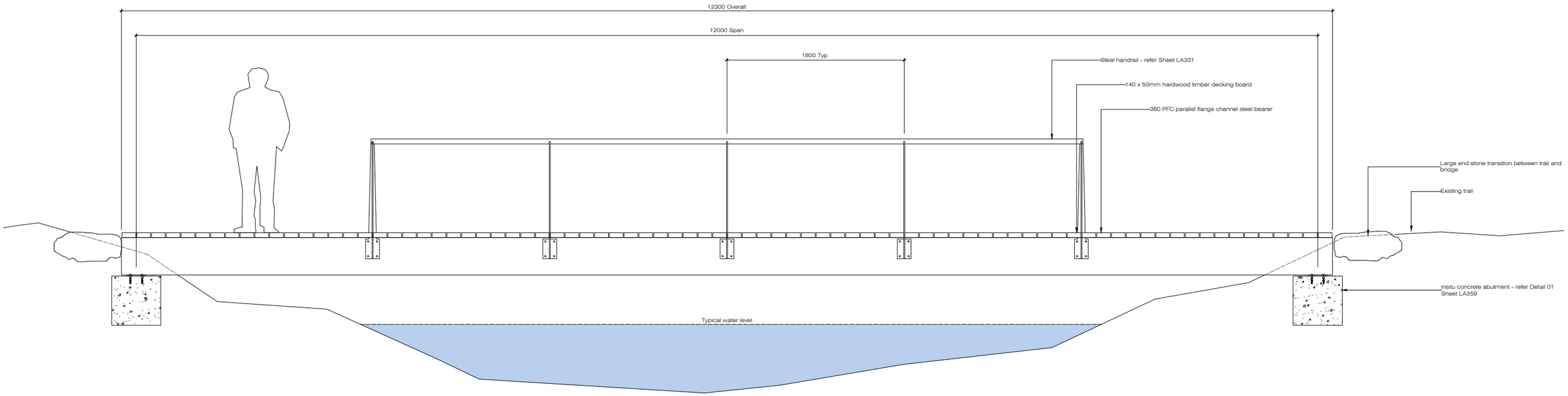


Tidal River, Wilson's Prom - slight curve, low

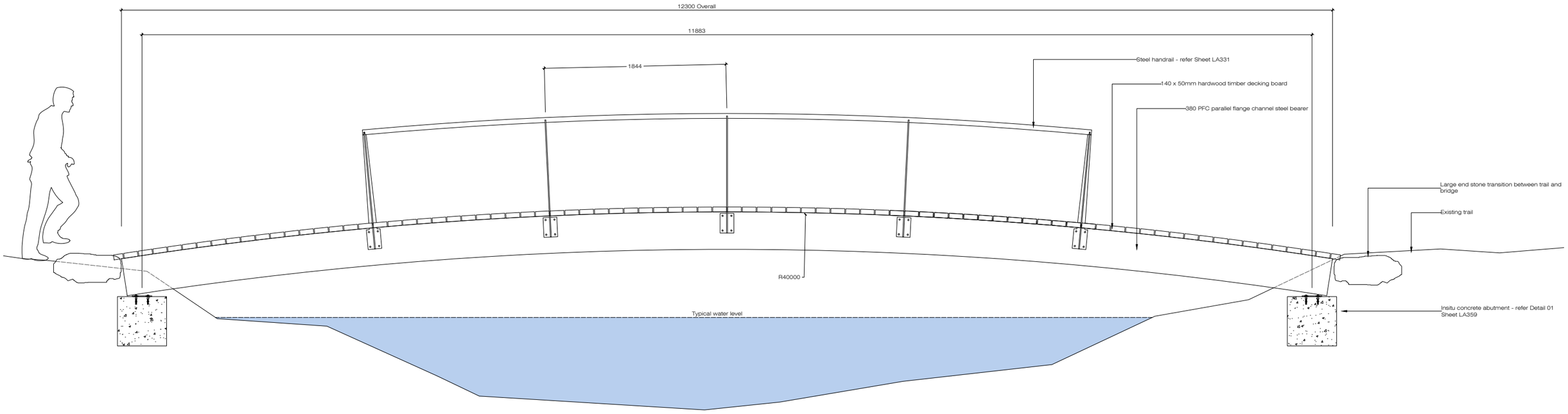


Tidal River - good use of existing rocks

Tidal River - good use of existing rocks



01 LA356 12m Straight Bridge - Elevation
1:20 (A1)



02 LA356 12m Curved Bridge - Elevation
1:20 (A1)

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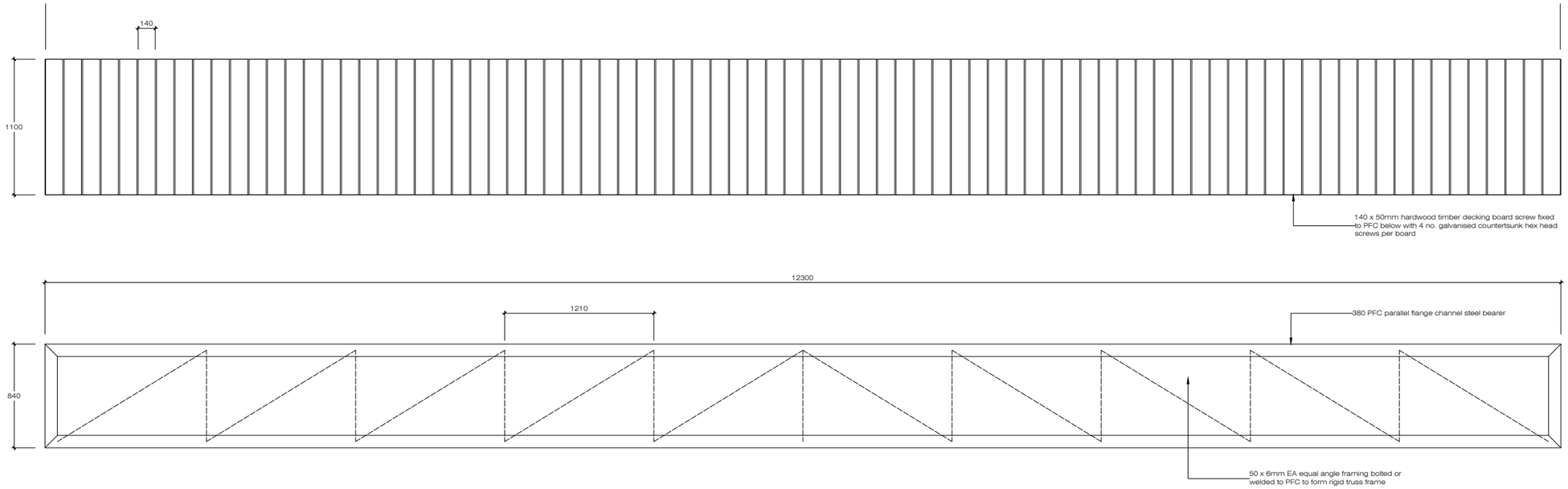
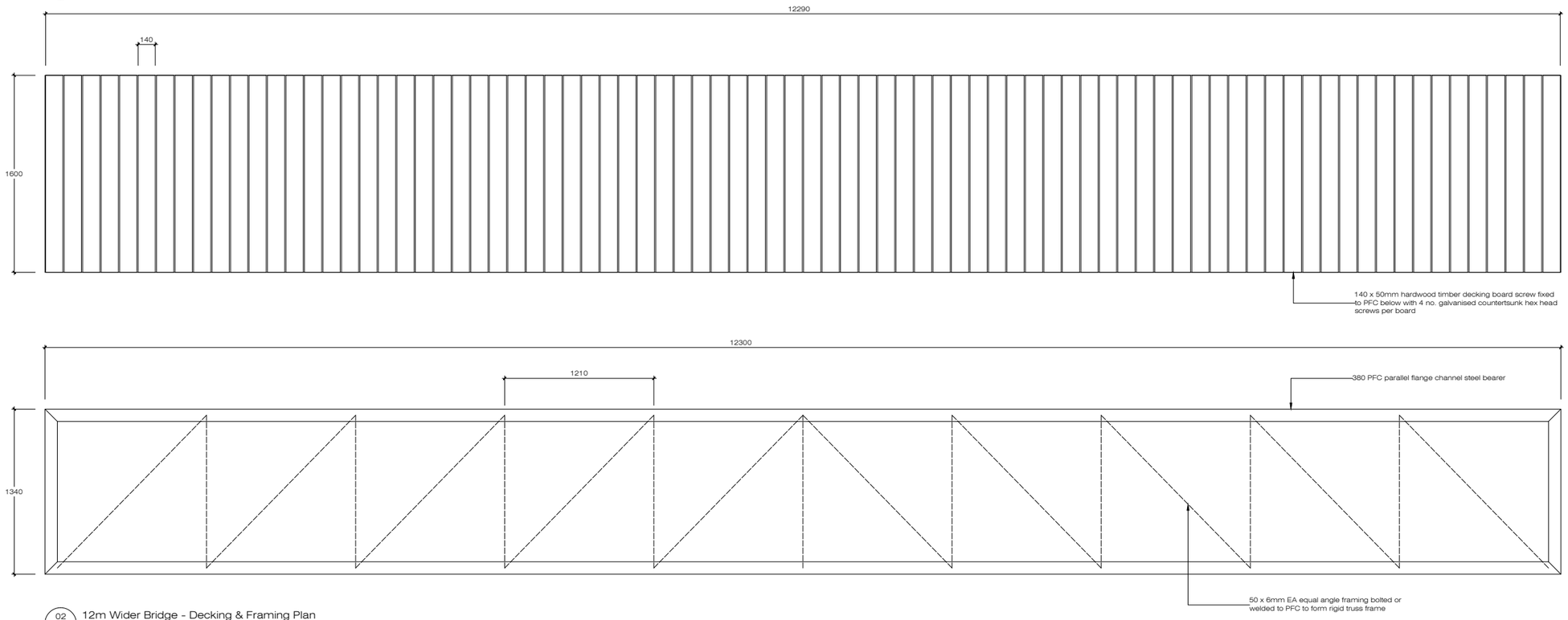
Drawing Scale: As Shown

GRAMPIANS PEAKS TRAIL
Landscape Details
Typical 12m Bridge - Elevations

Date: 04.06.2012
Drawing Number: 1107 LA356
Revision: 02



01 LA357 12m Narrow Bridge - Decking & Framing Plan
1:20 (A1)



02 LA357 12m Wider Bridge - Decking & Framing Plan
1:20 (A1)

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GRAMPIANS PEAKS TRAIL
Walk Victoria's Icons

NO.	DATE:	DESCRIPTION:	BY:	CHK:
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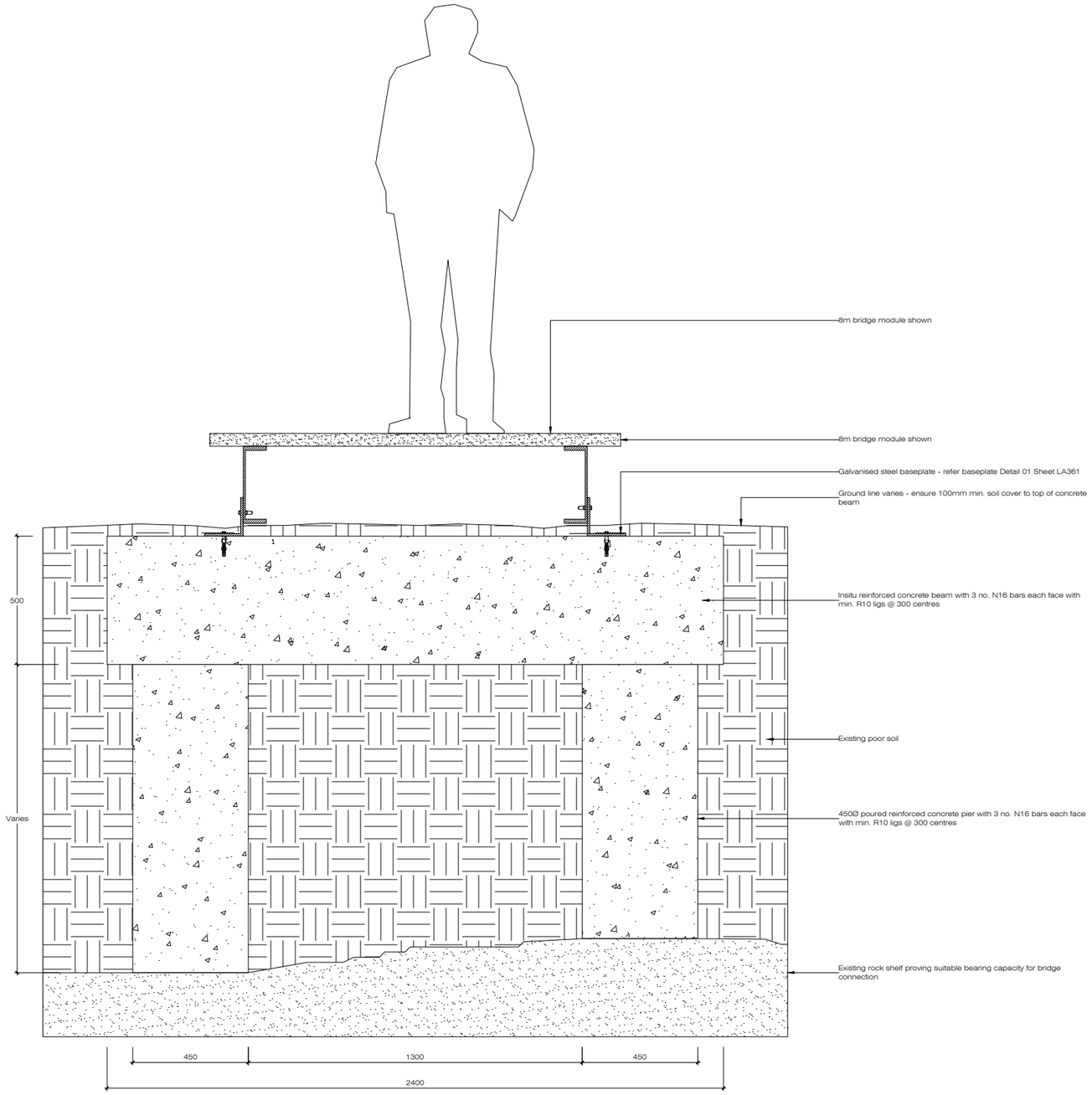
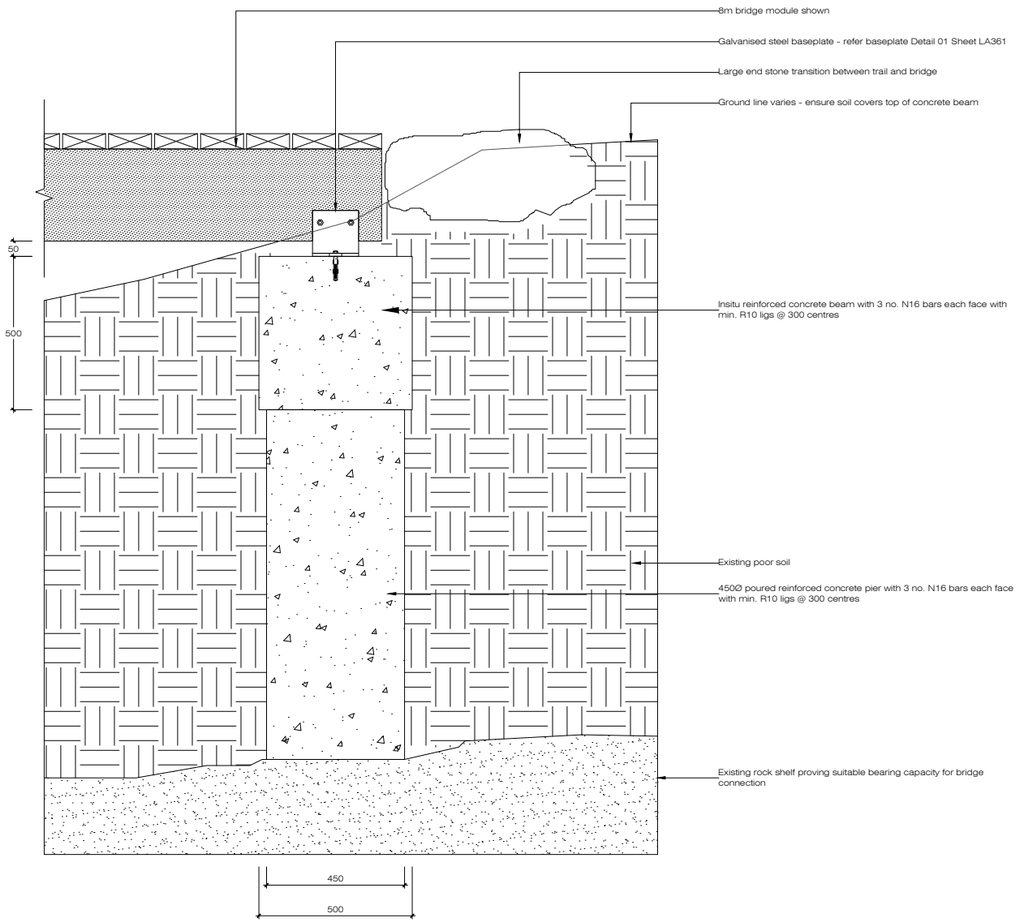
Client: Parks Victoria
Client Check:
Internal Check: cs
Drawing Scale: As Shown

GRAMPIANS PEAKS TRAIL
Landscape Details
Typical 12m Bridge - Plans & Sections

Date: 04.06.2012
Drawing Number: 1107 LA357
Revision: 02



01 LA358 Typical Bridge Abutment - Poor Soil
1:10 (A1)



02 LA358 Typical Bridge Abutment - Poor Soil
1:10 (A1)

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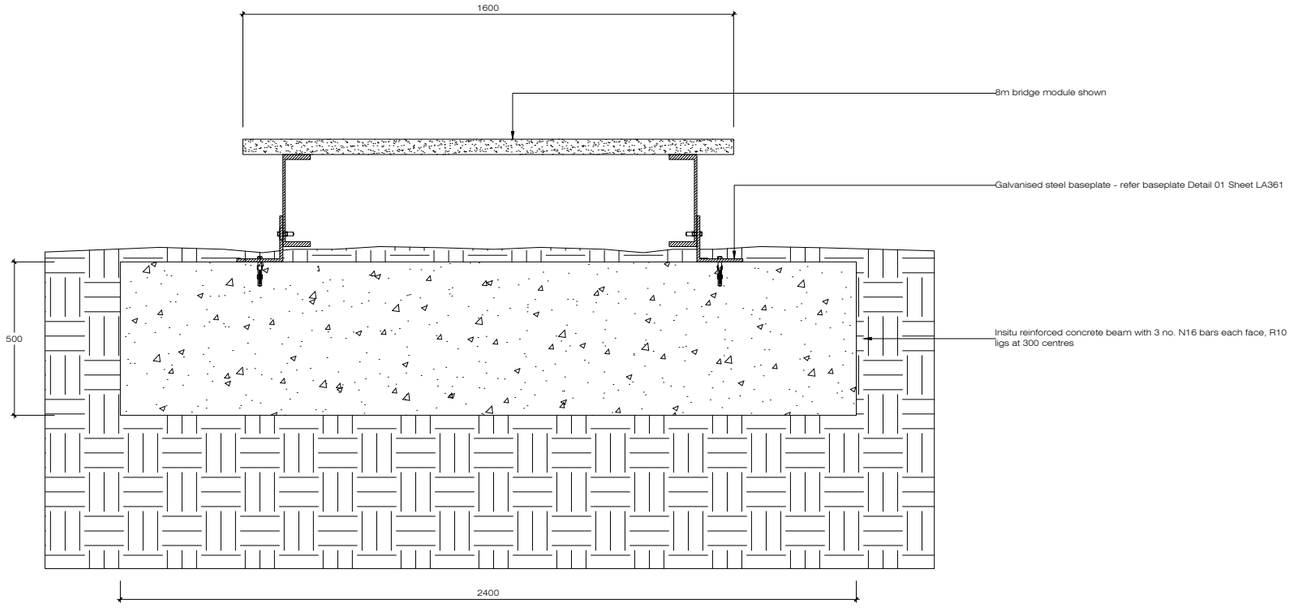
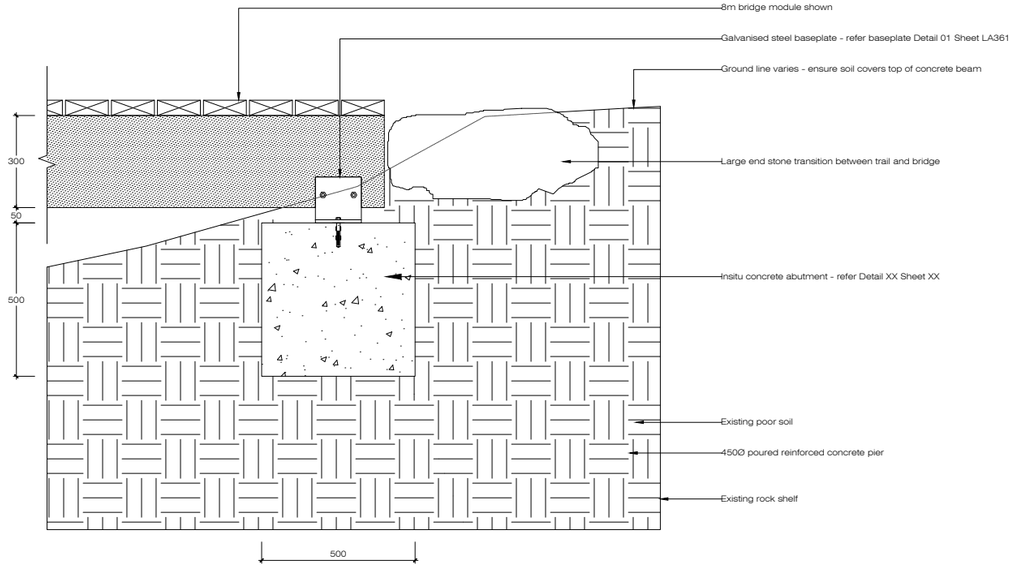
Landscape Details
Typical Bridge Abutment - Poor Soil

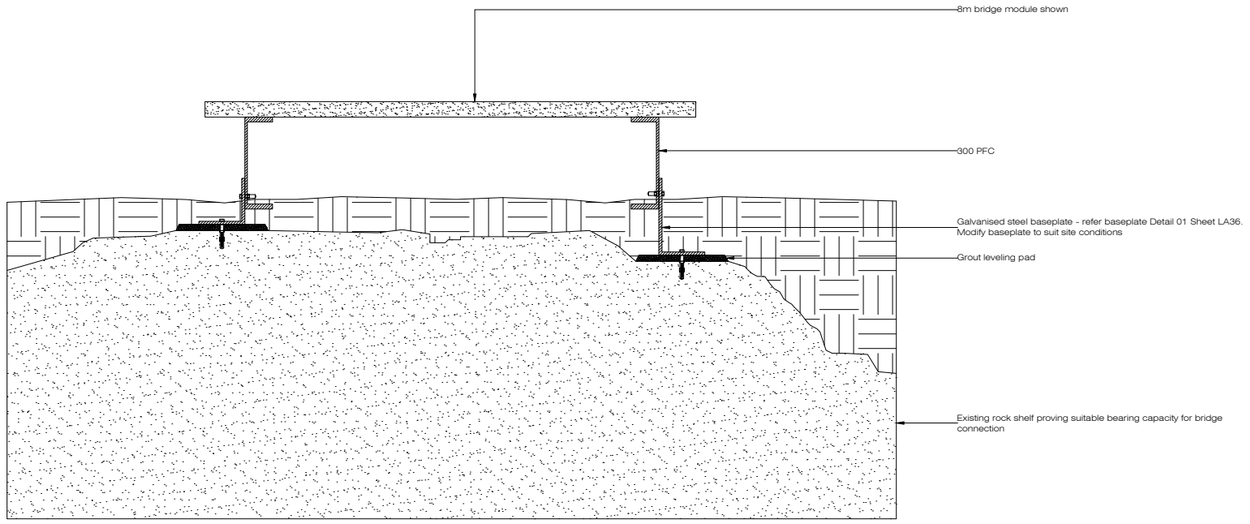
Date: 04.06.2012
Drawing Number: 1107 LA358
Revision: 02



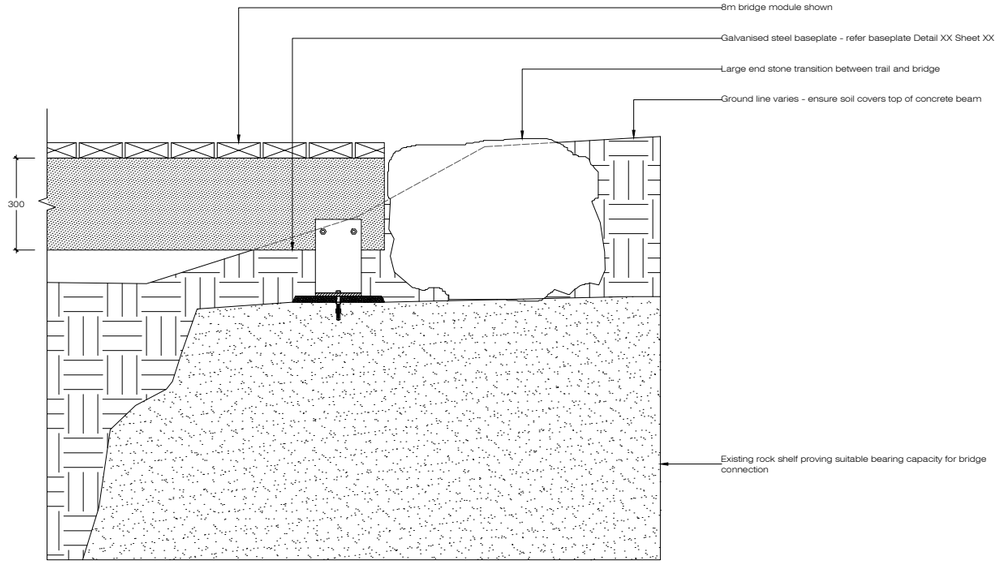
01 LA359 Typical Bridge Abutment Cross Section
1:10 (A1)



02 LA359 Typical Bridge Abutment Elevation
1:10 (A1)



03 LA359 Typical Bridge Abutment - Concrete Beam
1:10 (A1)



04 LA359 Typical Bridge Abutment - Poor Soil
1:10 (A1)

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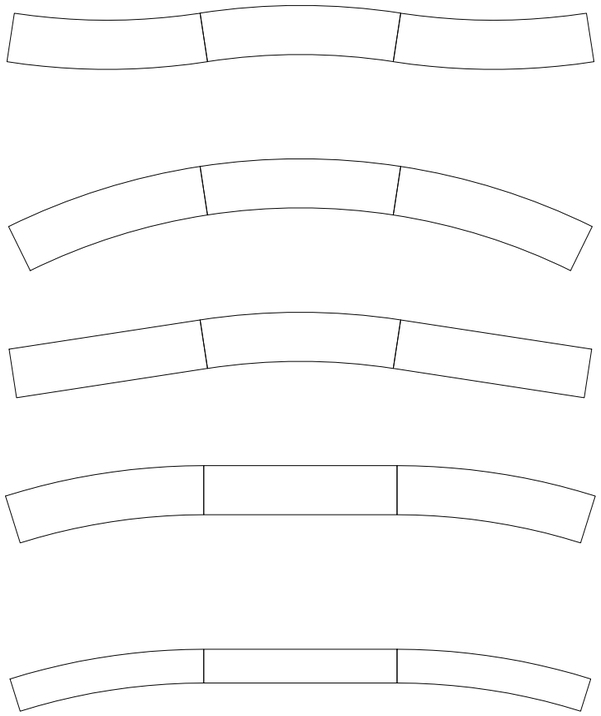
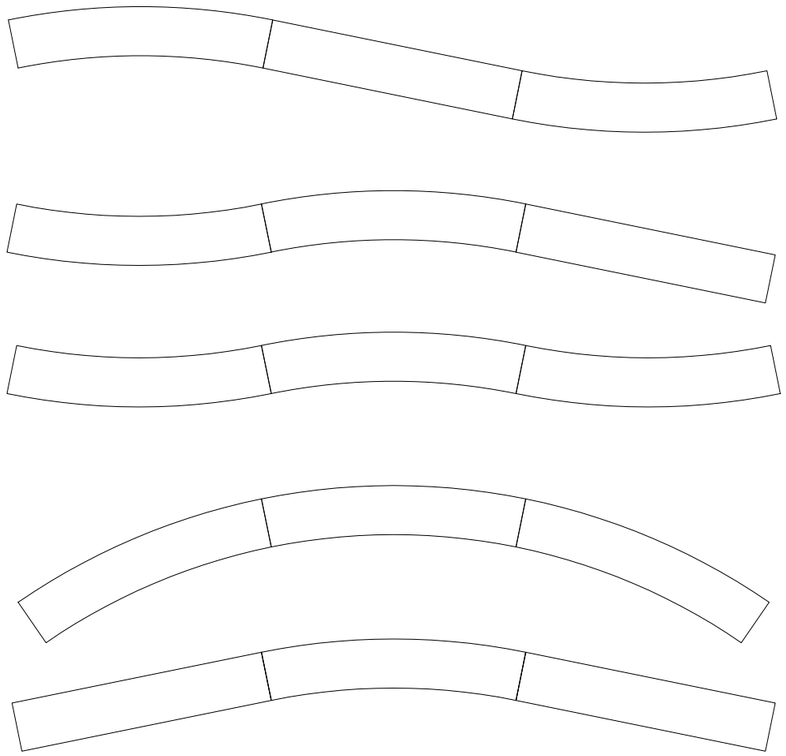
GRAMPIANS PEAKS TRAIL

Landscape Details
Typical Bridge Abutment - Poor Soil

Date: 04.06.2012
Drawing Number: 1107 LA359
Revision: 02



01 LA362 Typical 6m Bridge Configurations
1:100 (A1)



02 LA362 Typical 8m Bridge Configurations
1:100 (A1)

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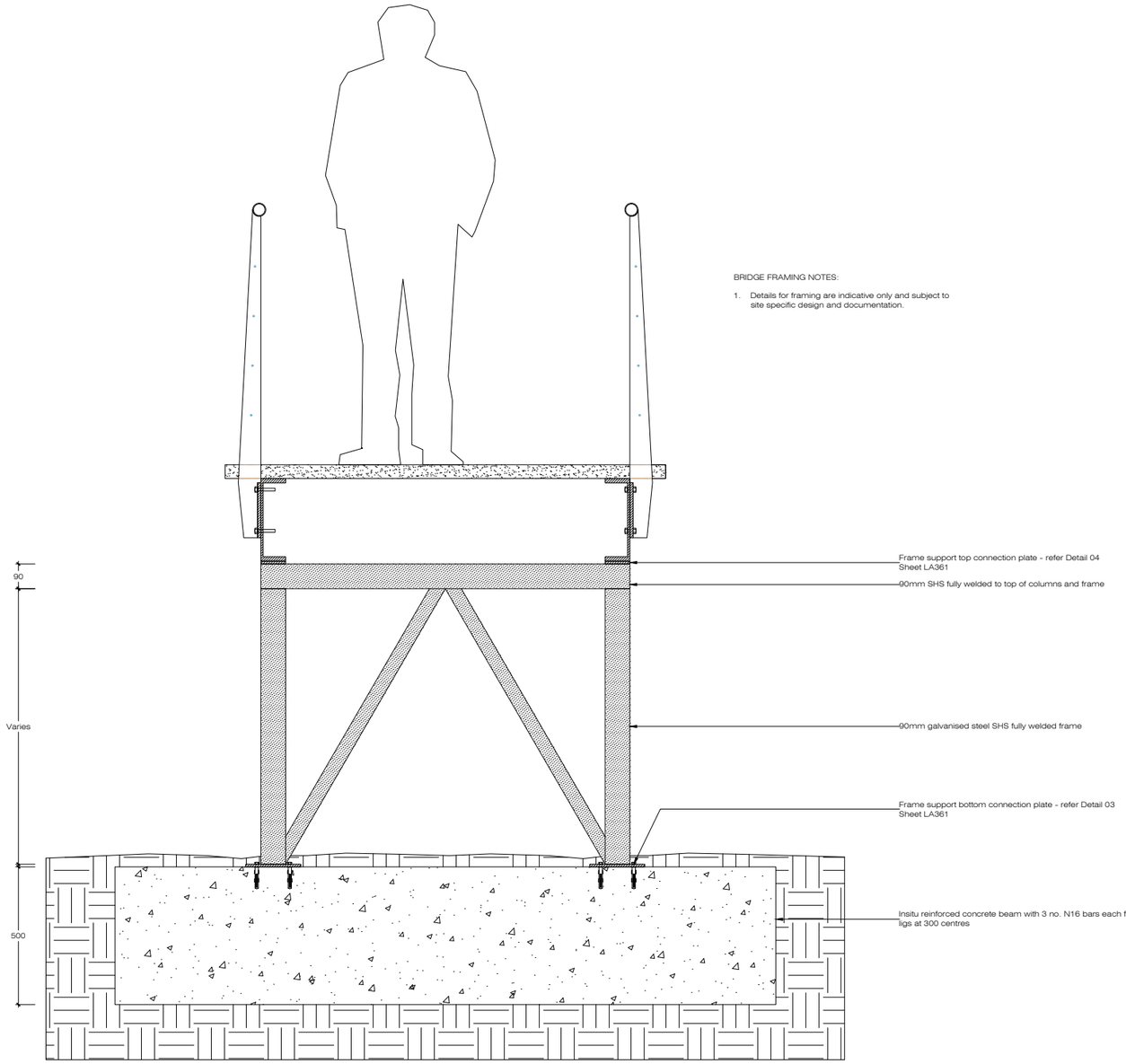
GRAMPIANS PEAKS TRAIL

Landscape Details
Typical Bridge Configurations

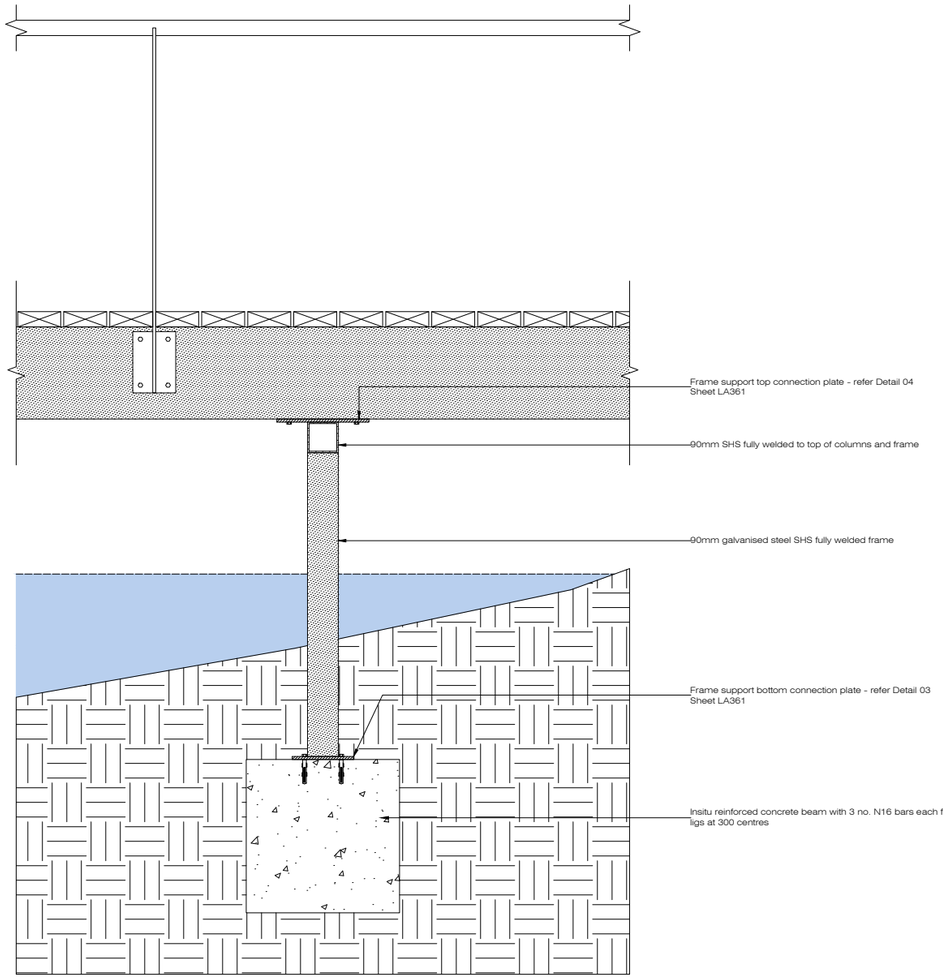
Date: 04.06.2012
Drawing Number: 1107 LA362
Revision: 02



BRIDGE FRAMING NOTES:

1. Details for framing are indicative only and subject to site specific design and documentation.

01 LA360 Typical Steel Framing (8m Module)
1:10 (A1)



02 LA360 Typical Steel Framing - Section
1:10 (A1)

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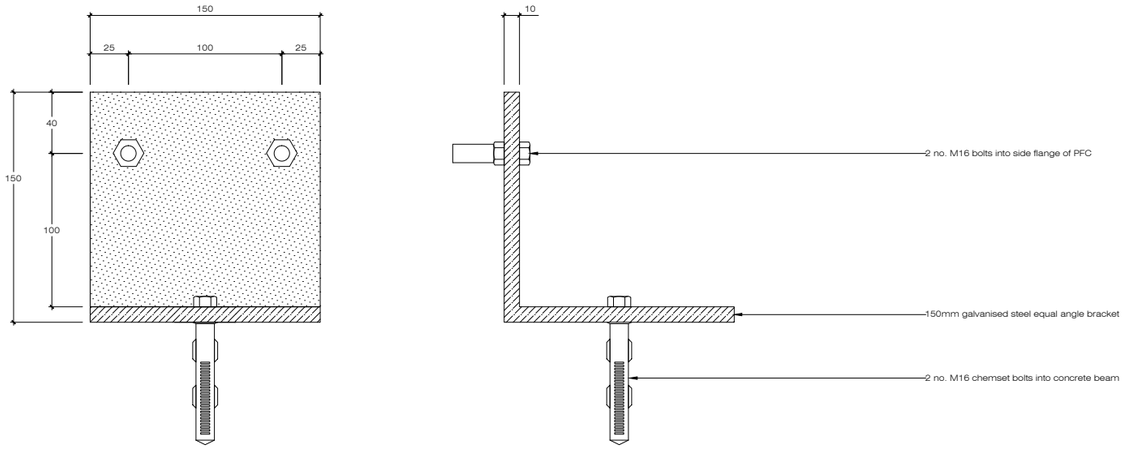
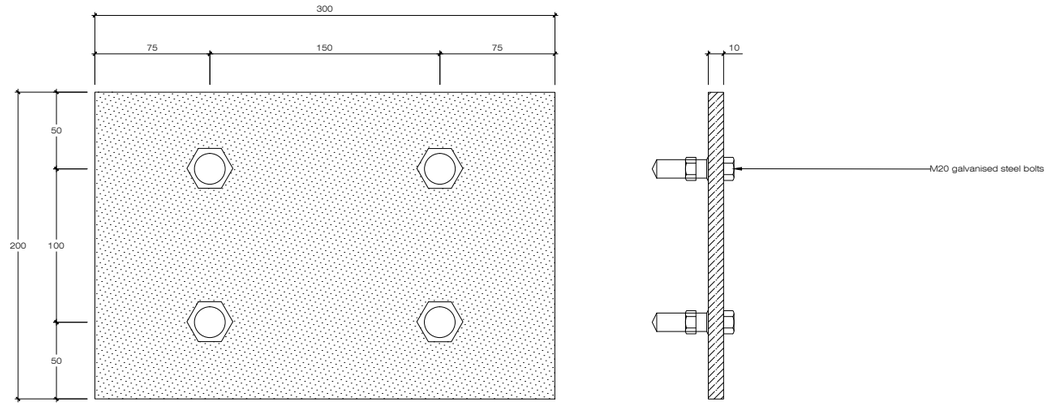
GRAMPIANS PEAKS TRAIL

Landscape Details
Typical Bridge Intermediate Frame

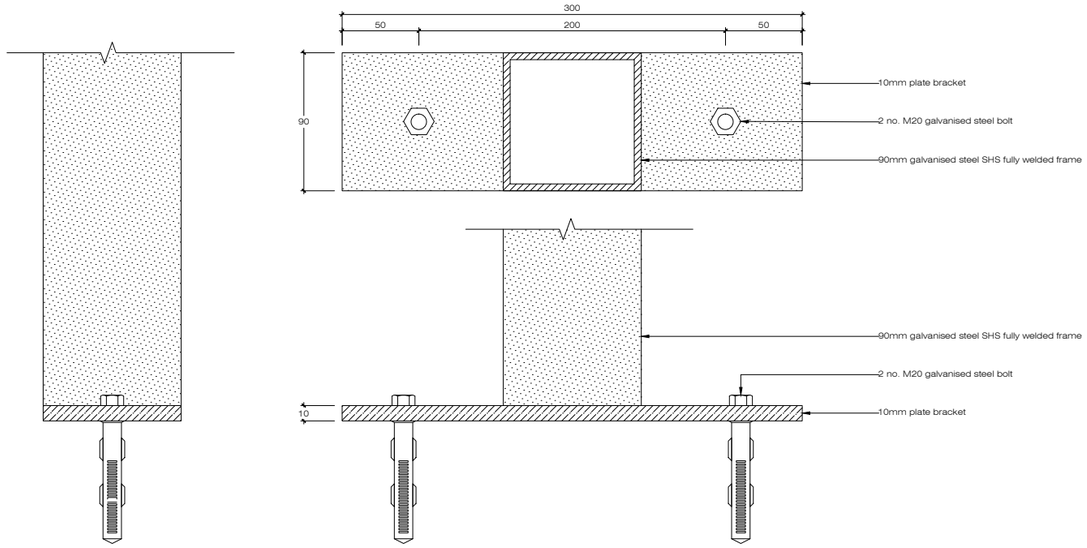
Date: 04.06.2012
Drawing Number: 1107 LA360
Revision: 02



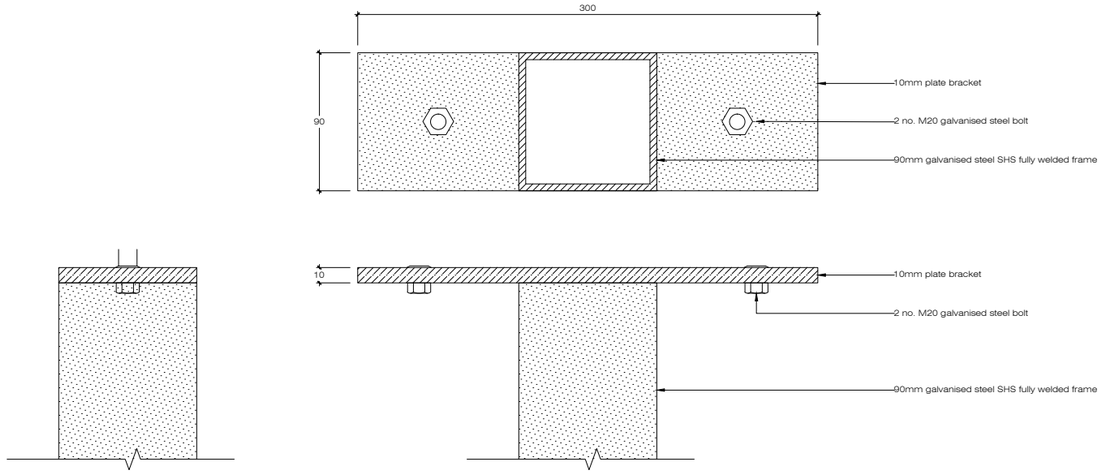
01 LA361 Typical Abutment Connection Plate
1:5 (A1)



02 LA361 Typical 8m Module Connection Plate
1:5 (A1)



03 LA361 Typical Bottom Frame Connection Plate
1:5 (A1)



04 LA361 Typical Top Frame Connection Plate
1:5 (A1)

ISSUED FOR FINAL REVIEW

GRAMPIANS PEAKS TRAIL
Walk Victoria's Icons

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Client: Parks Victoria
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Internal Check: cs
Drawing Scale: As Shown

GRAMPIANS PEAKS TRAIL

Landscape Details
Typical Bridge Abutment - Poor Soil

Date: 04.06.2012
Drawing Number: 1107 LA361
Revision: 02

M. HANDRAIL

01 The same handrail (or variant of it) should be used in all circumstances.

02 Align the trail to avoid the need for handrails (refer IMG 1534).

03 The handrail should only be used where fall heights exceed 1500mm; where assistance is required for the walker to traverse a steep incline or descent; or to help prevent danger to the walker.

04 The use of handrails must be carefully assessed on a case-by-case basis.

05 Handrails should not be used as directional markers.

06 Don't have unnecessary structure (for example, Splitters Fall bridge IMG 1627).

07 All handrails to be constructed from stainless steel. Do not use galvanised steel due to leaching of contaminants (refer IMG 1604).

08 Handrail to be 50mm diameter stainless steel circular hollow section.

09 All stanchions to be 50 x 10mm thick stainless steel plate, and nominally spaced at 1650mm centres. (Exact spacing will depend on site conditions).

10 All handrails to be nominally 950mm above the ground. (This will not be possible in all locations, particularly where set in stone).

11 Handrails to be bent on-site to required angles and configurations. Aim for clean, simple handrail alignments.

12 Ensure the bend radius is consistent. Generally bend to one metre radius. Bends to be located mid-way between stanchions where possible.

13 Provide a variety of connection brackets and sockets to enable different methods of fixing the stanchion.

14 Provide a standard steel bracket fixing to steel beams (steps, ladders and bridges) and a socket fixing for embedment in stone.

15 Provide 3mm stainless steel wire in-fill balustrading at 150mm centres where fall heights exceed 3m.

16 Provide fully enclosed and welded circular ends to all handrails.

17 Do not leave handrail end exposed/uncapped (refer IMG 1584).

18 Provide 600mm handrail extension beyond last stanchion.

19 Where additional strength is required, or where there is a greater level of danger (for example, cliff steps, look-out balustrading), provide a handrail that returns fully to the last stanchion.

IMG 5808 - Too much steel work,

IMG1697 - Unnecessary handrail

IMG 1737 - Unnecessary handrail

IMG 6595 - Do not use solid steel mid rails

IMG 1534 - Handrail not required

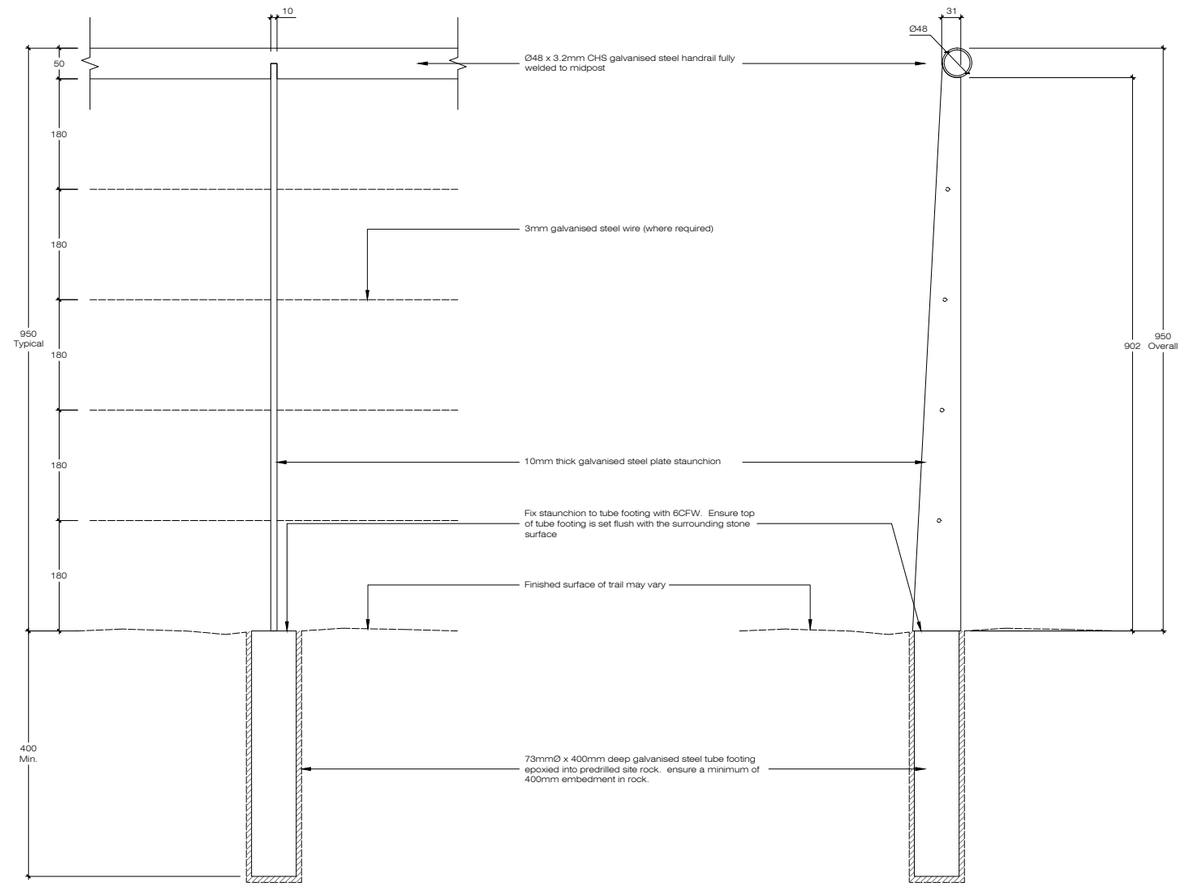
IMG1604 - Leaching from galvanised handrail

IMG 5831 - Excessive use of handrail

IMG 5805 - Handrail too heavy

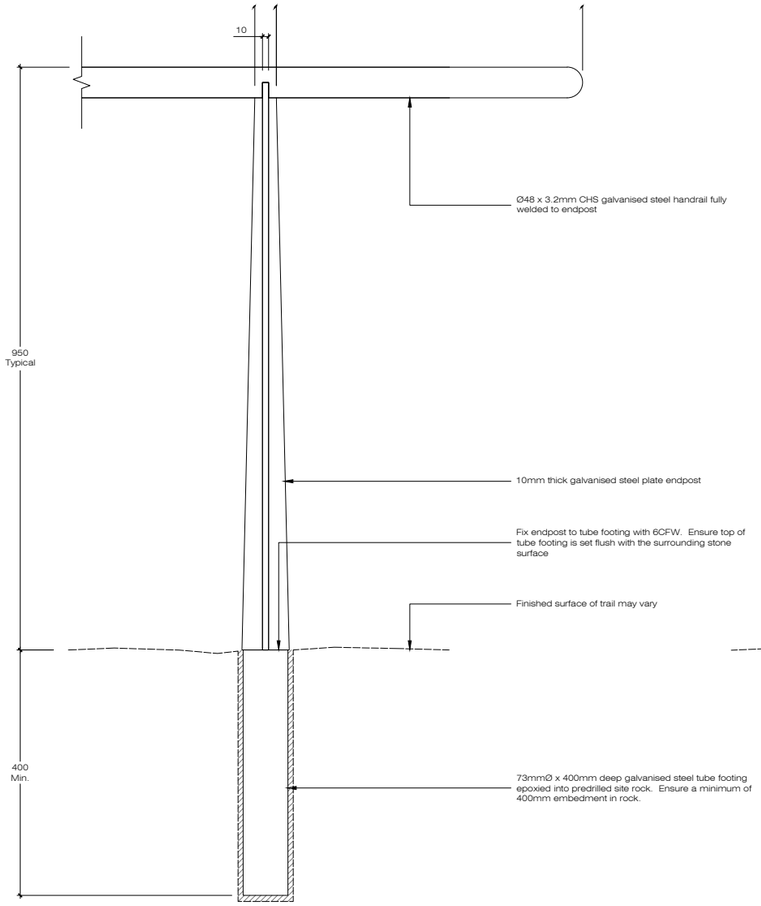
IMG1584 - Lack of end cap unappealing

IMG1558 - Directional handrail should not be used

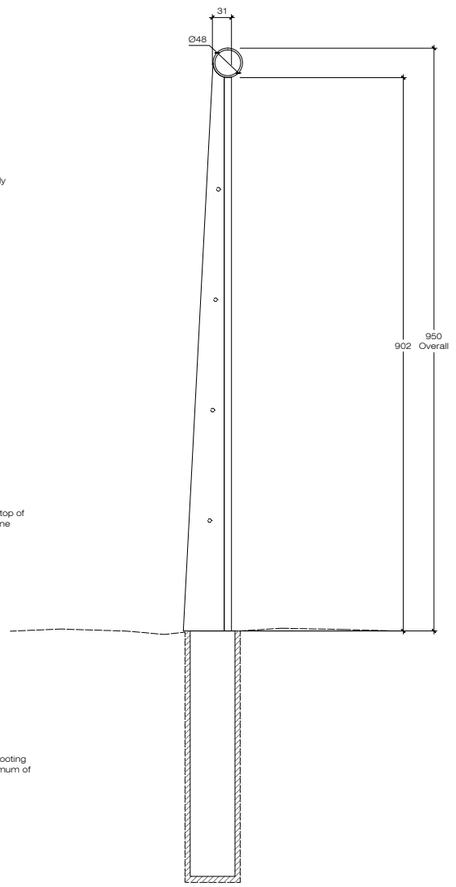


01 LA330 Trail Handrail Midpost - Front Elvation
1:05 (A1)

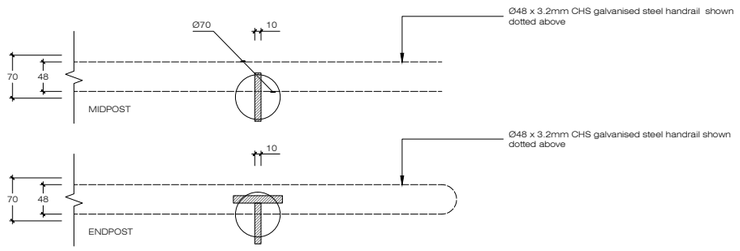
02 LA330 Trail Handrail Midpost - Side Elevation
1:5 (A1)



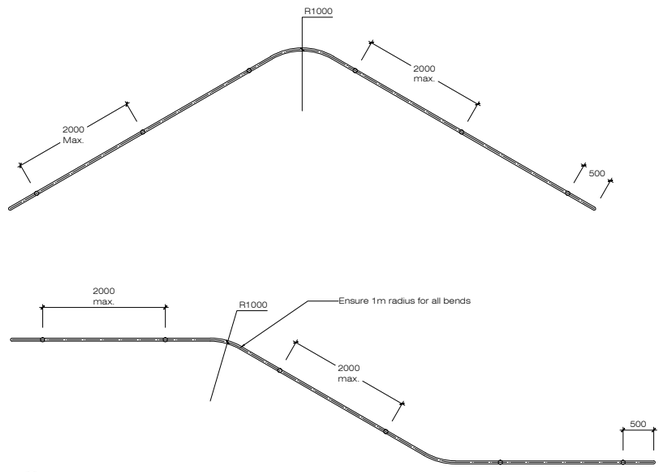
03 LA330 Trail Handrail Endpost - Front Elvation
1:5 (A1)



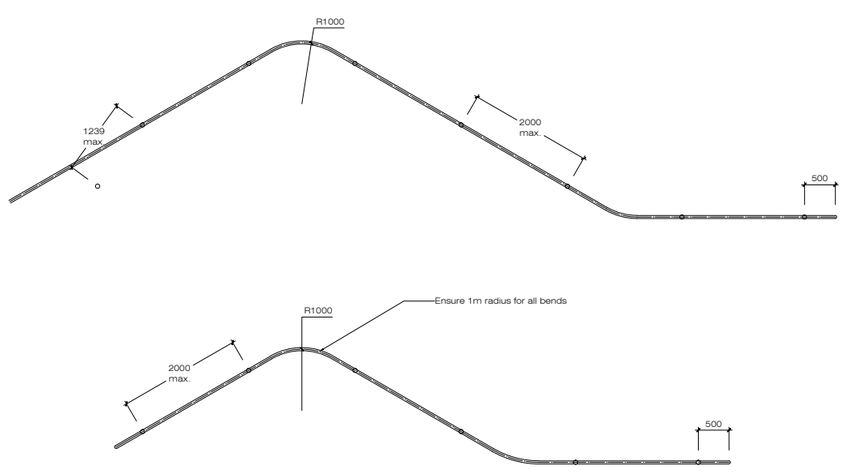
04 LA330 Trail Handrail Endpost - Side Elevation
1:5 (A1)



05 LA330 Trail Handrail - Plans
1:5 (A1)



06 LA330 Typical Trail Handrail Configurations
1:50 (A1)



GRAMPIANS PEAKS TRAIL
Walk Victoria's Icons

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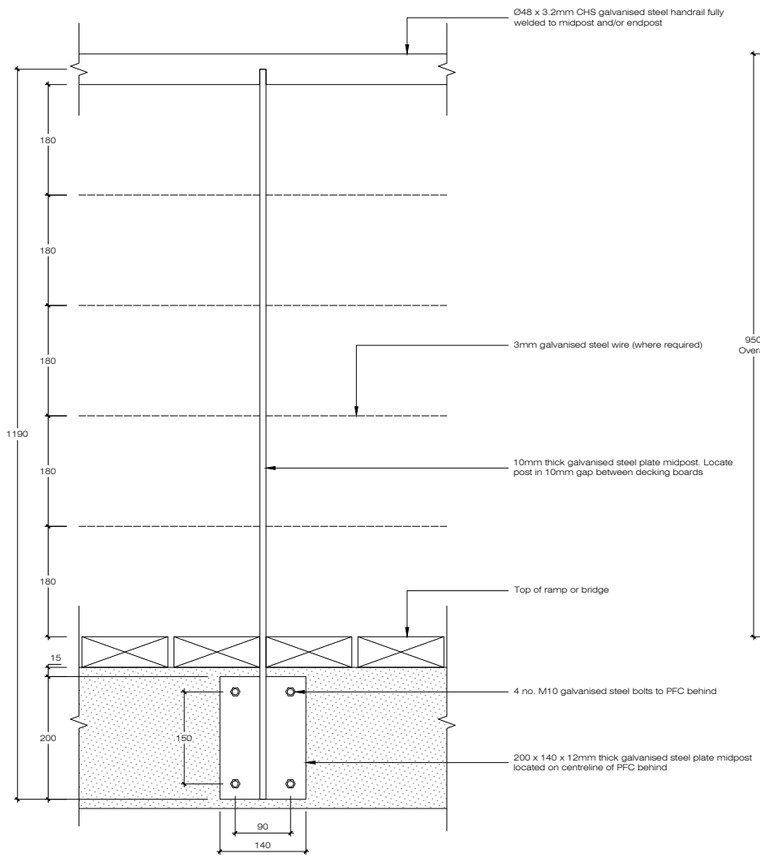
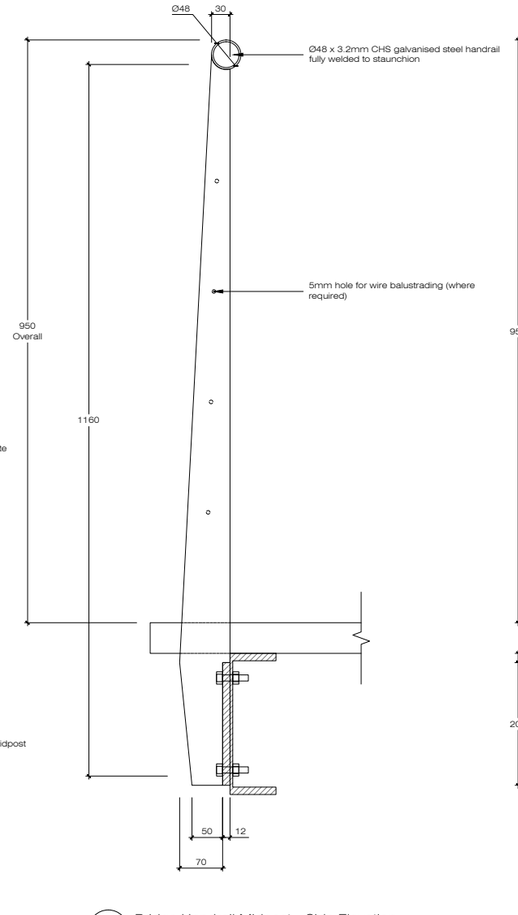
GRAMPIANS PEAKS TRAIL
Landscape Details
Typical Trail Handrail

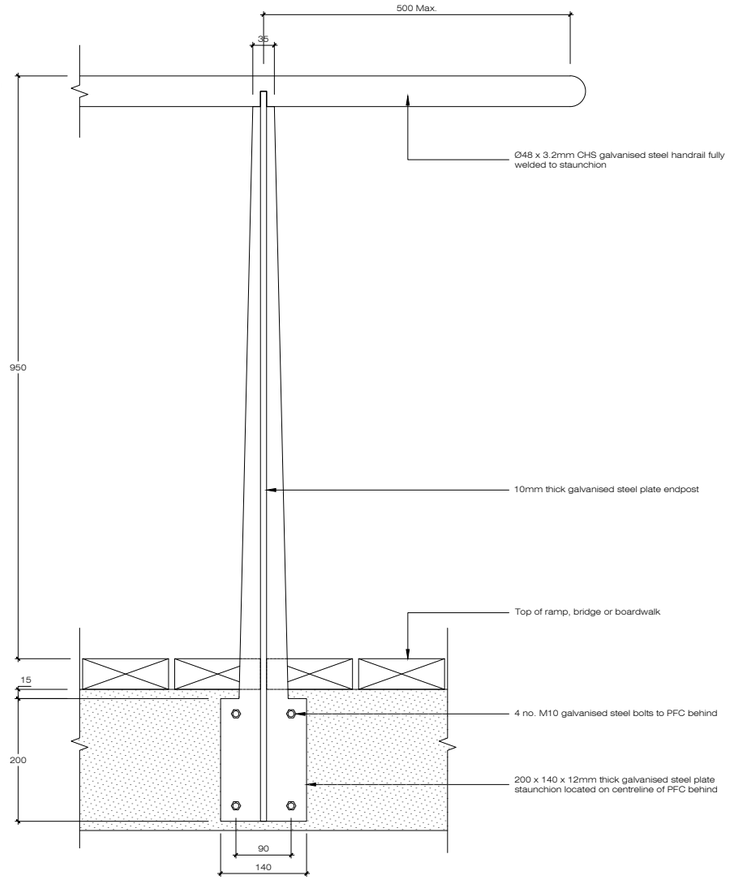
Drawing Number: 1107 LA330 Revision: 02
Date: 04.06.2012



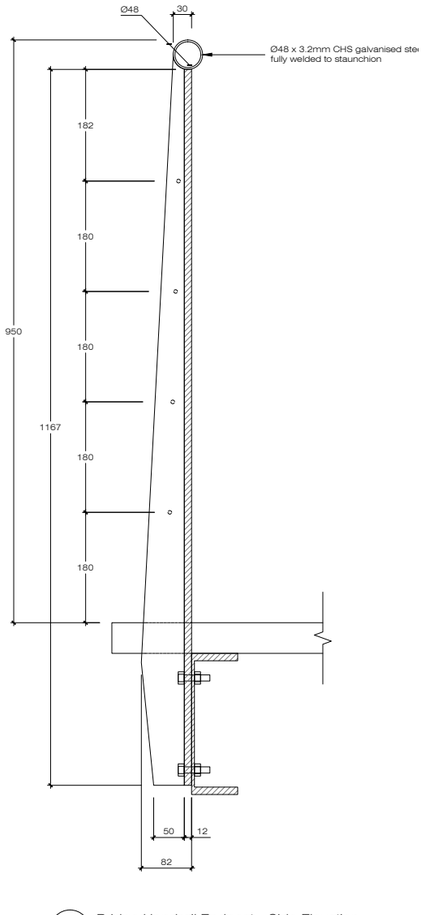
01 LA331 Bridge Handrail Midpost - Front Elevation
1:5 (A1)



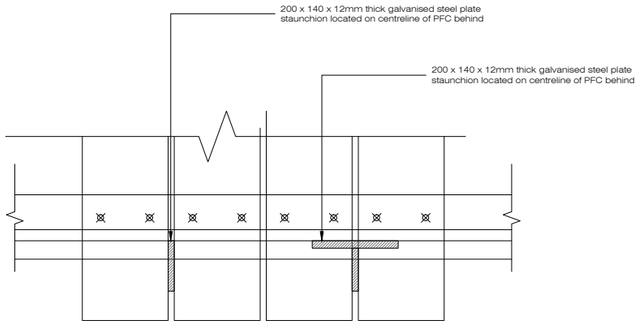
02 LA331 Bridge Handrail Midpost - Side Elevation
1:5 (A1)



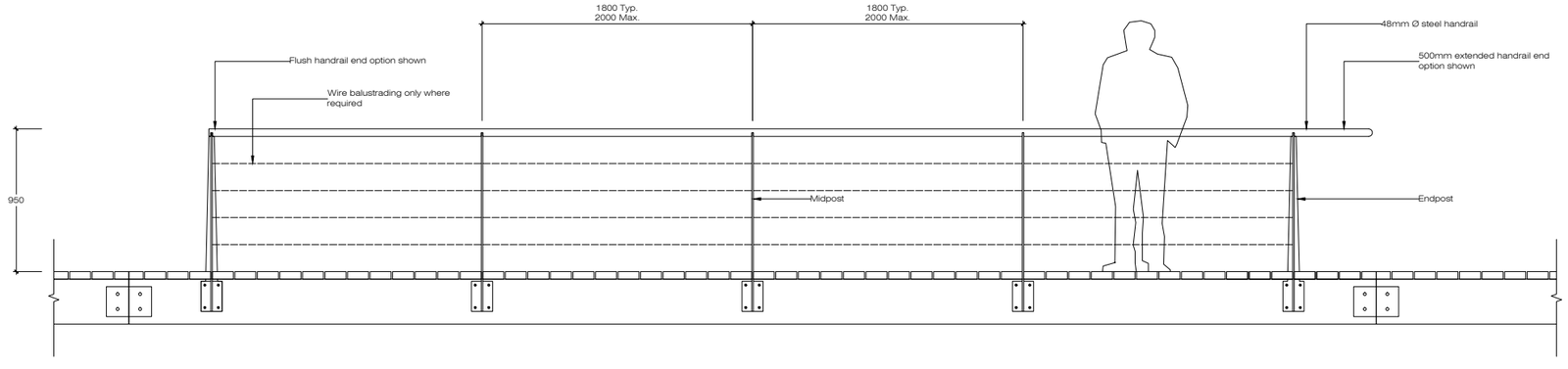
03 LA331 Bridge Handrail End Post - Front Elevation
1:5 (A1)



04 LA331 Bridge Handrail Endpost - Side Elevation
1:5 (A1)



05 LA331 Bridge Handrail Plan
1:5 (A1)



06 LA331 Typical Bridge Handrail Elevation
1:20 (A1)

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GRAMPIANS PEAKS TRAIL
Landscape Details
Typical Bridge Handrail

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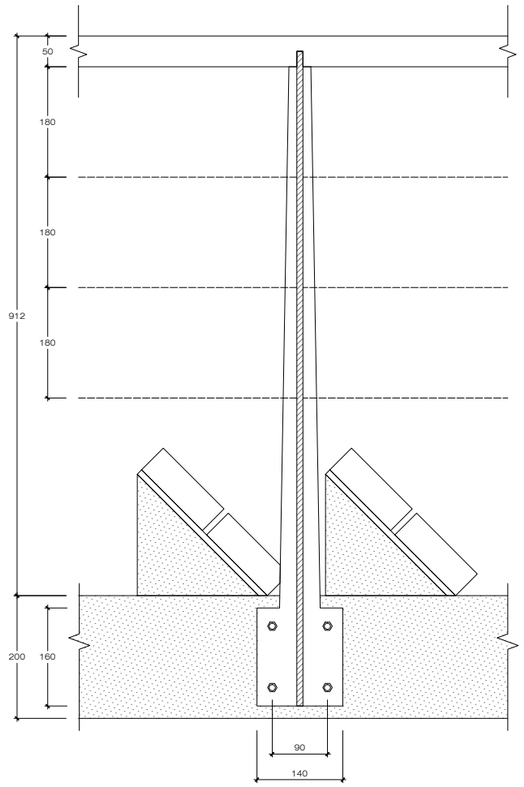
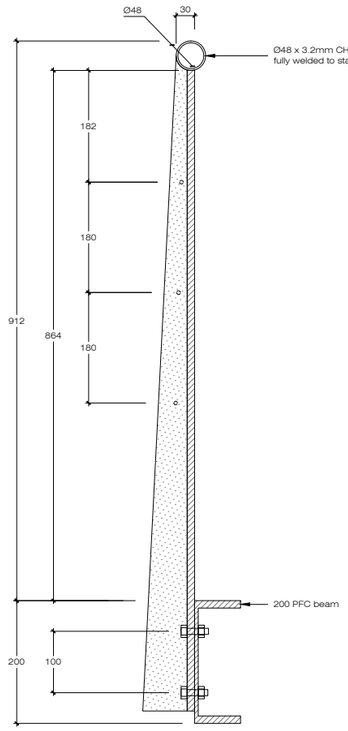
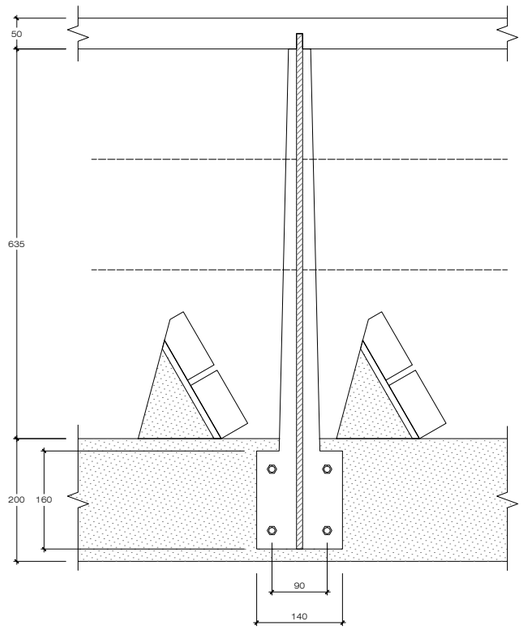
Revision: 02



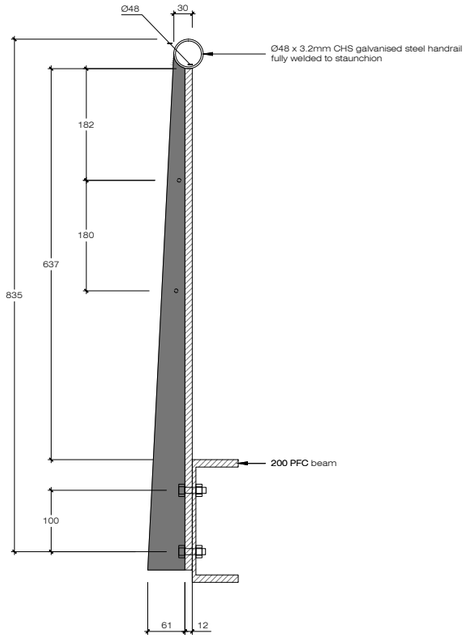
01 LA332 45° Step Ladder Handrail - Side Elevation
1:5 (A1)



02 LA332 45° Step Ladder Handrail - Front Elevation
1:5 (A1)



03 LA332 60° Step Ladder Handrail - Side Elevation
1:5 (A1)



04 LA332 60° Step Ladder Handrail - Front Elevation
1:5 (A1)

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GRAMPIANS PEAKS TRAIL

Landscape Details
Typical Step Ladder Handrail

Date: 04.06.2012
Drawing Number: 1107 LA332
Revision: 02

N. LOOKOUT RAIL

01 Provide look-out railing only at key destination points and look-outs where there is a clear ‘invitation’ to view and where the fall heights are great (for example at the Pinnacle and Mount Rosea – refer IMG 1718/1893).

02 Only provide look-out railing where strictly necessary (refer Reeds Look-out where there is excessive use of railing – IMG 1531).

03 Look-out railings to be based on a modified version of the handrail detail.

04 Look-out railings to have a top and a bottom rail constructed from 50mm diameter stainless steel circular hollow section.

05 Provide stainless steel wire mesh in-fill panels threaded to top and bottom rails with a nominal 40mm opening size.

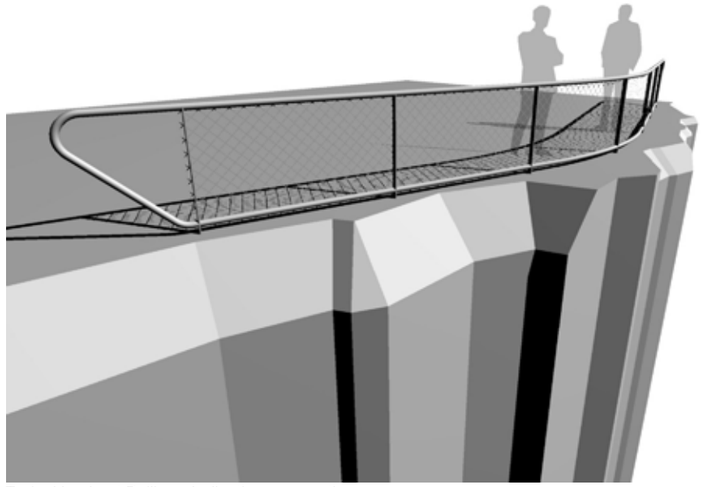
06 Bend look-out railings to suit the site conditions. Configurations should be simple, elegant and clean. Avoid boxy and angular designs.

07 Use existing stone and rock shelves to provide informal seating at the look-out (refer Reeds Look-out).

08 Consider placement of informal seating stones a short distance away from the look-out (and out of the wind) to provide gathering spaces where appropriate.

09 With the exception of direction and place compass (IMG 1892), do not include other constructed seating elements at the look-out.

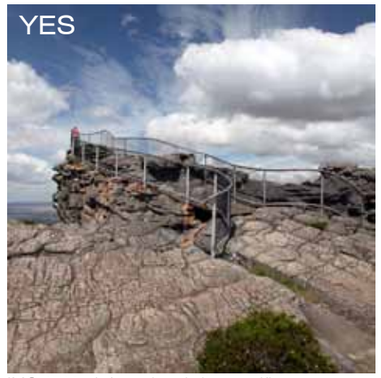
10 Where additional strength is required, or where there is a greater level of danger (for example, cliff steps, look-out balustrading), provide a handrail that returns fully to the last stanchion – alerting people to the end of the railing.



Typical Lookout Railing - Indicative perspective

IMG 1892 - Provide compass markers

Reeds Lookout - use of existing stone for seating



IMG 1718 - Informal and site specific

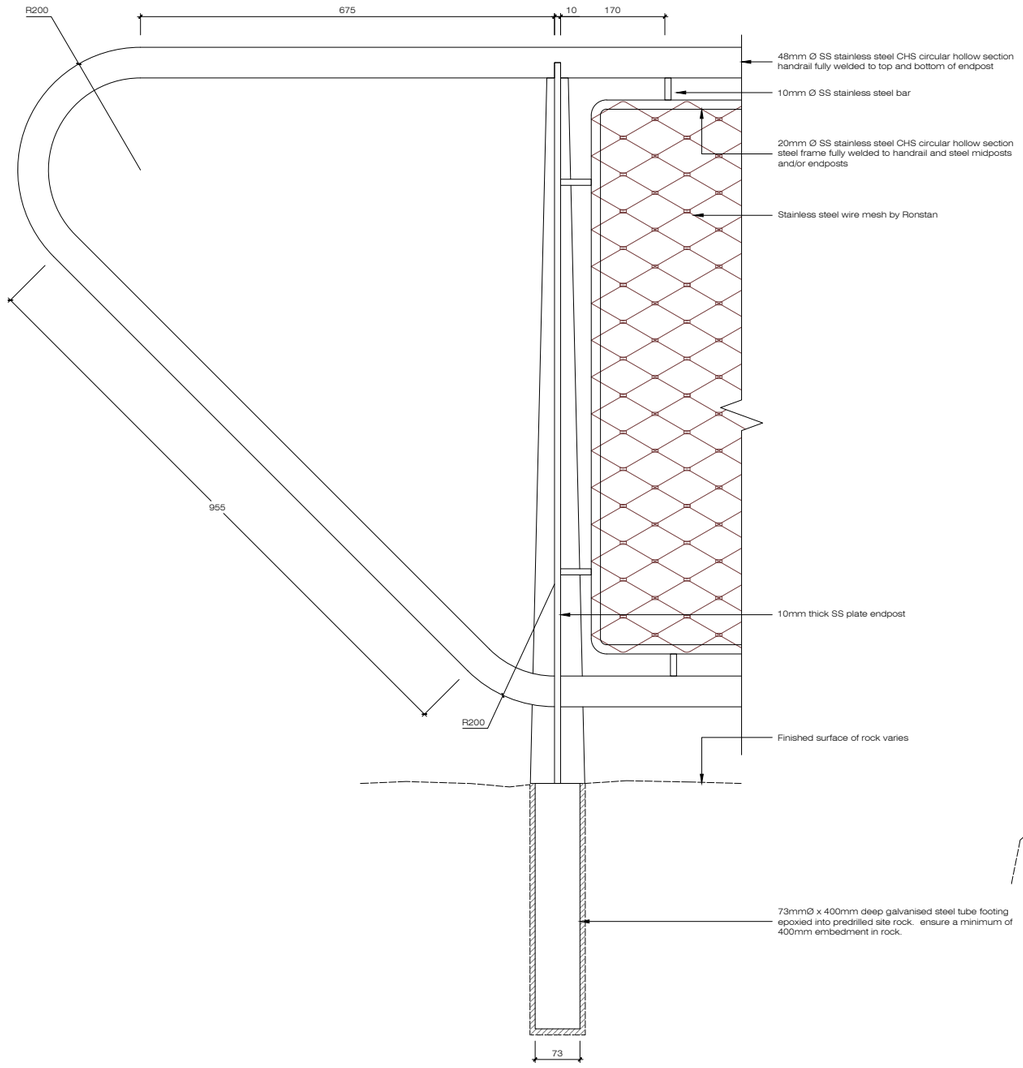
IMG 5830 - Excessive use of oversized railing

IMG 5843 - Lookout too angular and domestic

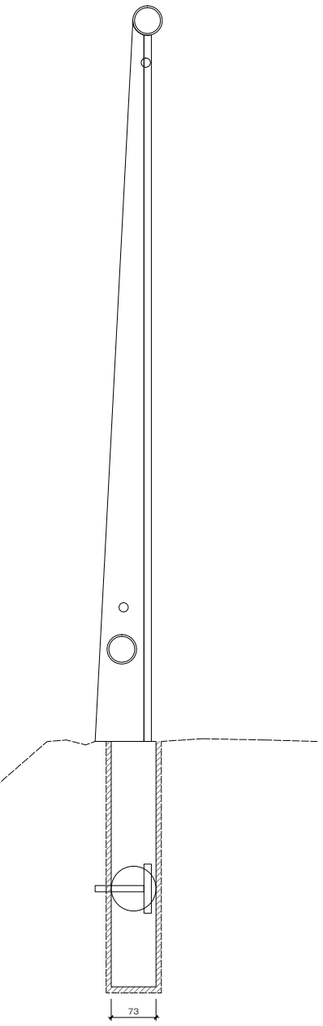
IMG 5848 MacKenzie Falls

IMG 1893 - Rust stains from galvanised steel

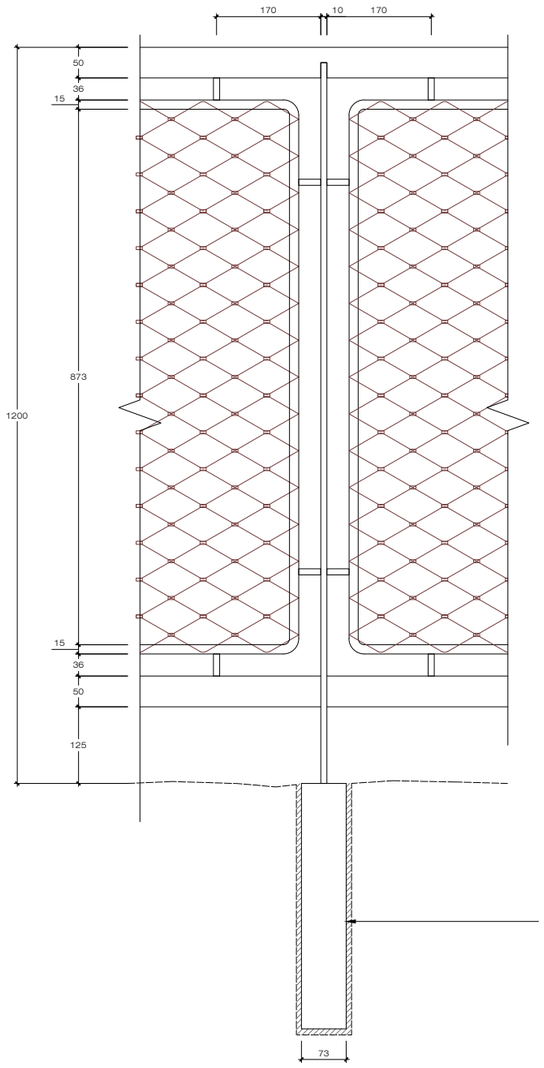
Reeds Lookout - use of existing stone for seating



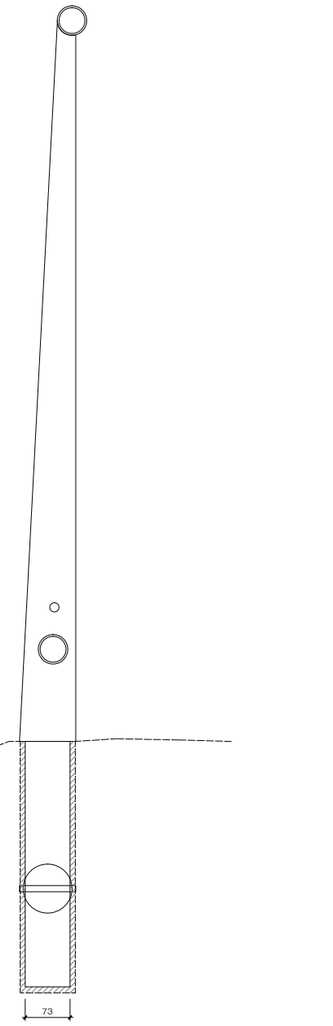
01 LA333 Balustrade End Post - Front Elevation
1:5 (A1)



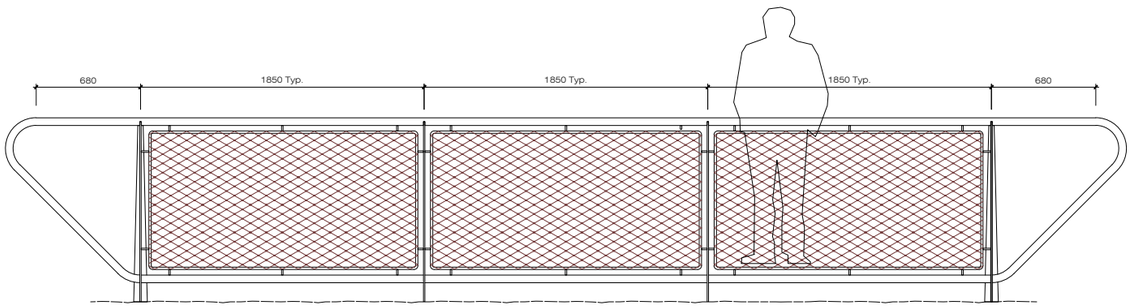
02 LA333 Balustrade Endpost - Side Elevation
1:5 (A1)



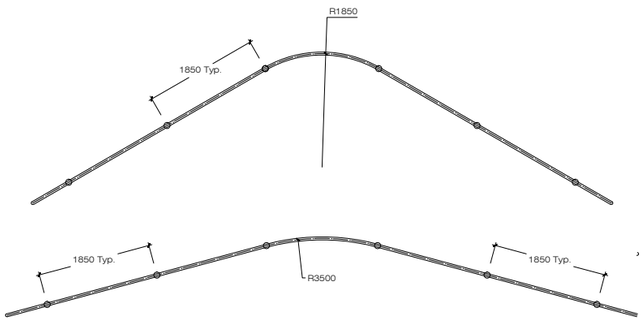
03 LA333 Balustrade Midpost - Front Elvation
1:5 (A1)



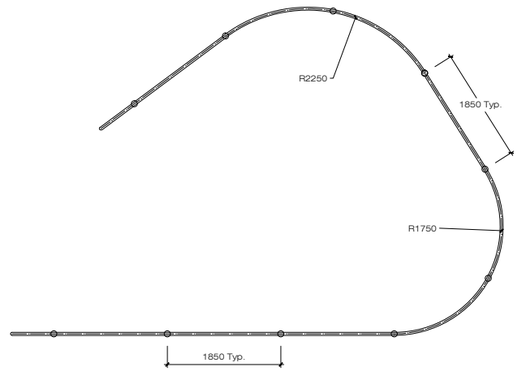
04 LA333 Balustrade Midpost - Side Elevation
1:5 (A1)



05 LA333 Typical Balustrade Lookout Elevation
1:20 (A1)



06 LA333 Typical Balustrade Configurations
1:50 (A1)



ISSUED FOR FINAL REVIEW

GRAMPIANS PEAKS TRAIL
Walk Victoria's Icons

NO.	DATE:	DESCRIPTION:	BY:	CHK:
01	07.05.2012	Issued for Information	cs	sk
02	04.06.2012	Issued For Final Review	cs	sk

Project Design:
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Client: Parks Victoria
Client Check:
Internal Check: cs
Drawing Scale: As Shown

GRAMPIANS PEAKS TRAIL
Landscape Details
Typical Lookout Balustrade

Date: 04.06.2012
Drawing Number: 1107 LA333
Revision: 02

O. TRAIL HEAD / COLLECTION POINT

01 Trail heads should be designed as beautiful, functional, memorable places and should not detract from the experience of the trail.

02 Because trail heads usually incorporate a range of elements (such as seating, signage, tables, car parking and toilets), they require a detailed design process that protects the trail experience. (The notes here outline a range of general design issues only).

03 Use stone to create a significant and identifiable beginning point.

04 Trail heads should provide a gathering space and informal seating to allow groups of walkers to gather prior to departure. (This should be located off the main path of travel – refer seating detail).

05 At major trail heads with high volumes of traffic (for example, trail heads that service multiple walks), consider the use of stone paving to provide a more durable, hard wearing surface (refer IMG 2958 Freycinet).

06 Trail heads should provide appropriate information about the section of trail, including a description, map, classification, advisory notes, warnings and other interpretive material (cultural, historic – refer signage details).

07 Align the trail to avoid car parking at trail heads (such as Wonderland carpark and Sundial carpark) to protect the wilderness walking experience (refer IMG 6673).

08 Design carparks to sit sensitively within the environment (refer IMG 5830).

09 Under GPT Stage 01, trail heads are located at Brambuk, Halls Gap, the Pinnacle, Sundial carpark, Mount Rosea carpark and Burrough Huts. (The current Stage 01 trail head behind the Halls Gap caravan park should be reconsidered in light of its significance as a departure point for the GPT).

IMG 1518 Poor Access to main Trail from town

IMG 1519 Poor trail head design

IMG 6673 - Poorly integrated car park Sundial

IMG 5830 - Poor interafce with carpark (Reeds)

Natural stone trailhead, Nga Keenatt, Grampians

IMG 5256 - Larger embedded stone

IMG 2958 - Trailhead Winegalss Bay walk

IMG 5841 - Trailhead MacKenzies Falls

P. FURNITURE / SEATING

01 Take advantage of existing site features that can be used for informal seating and resting, such as larger rocks and rock shelves.

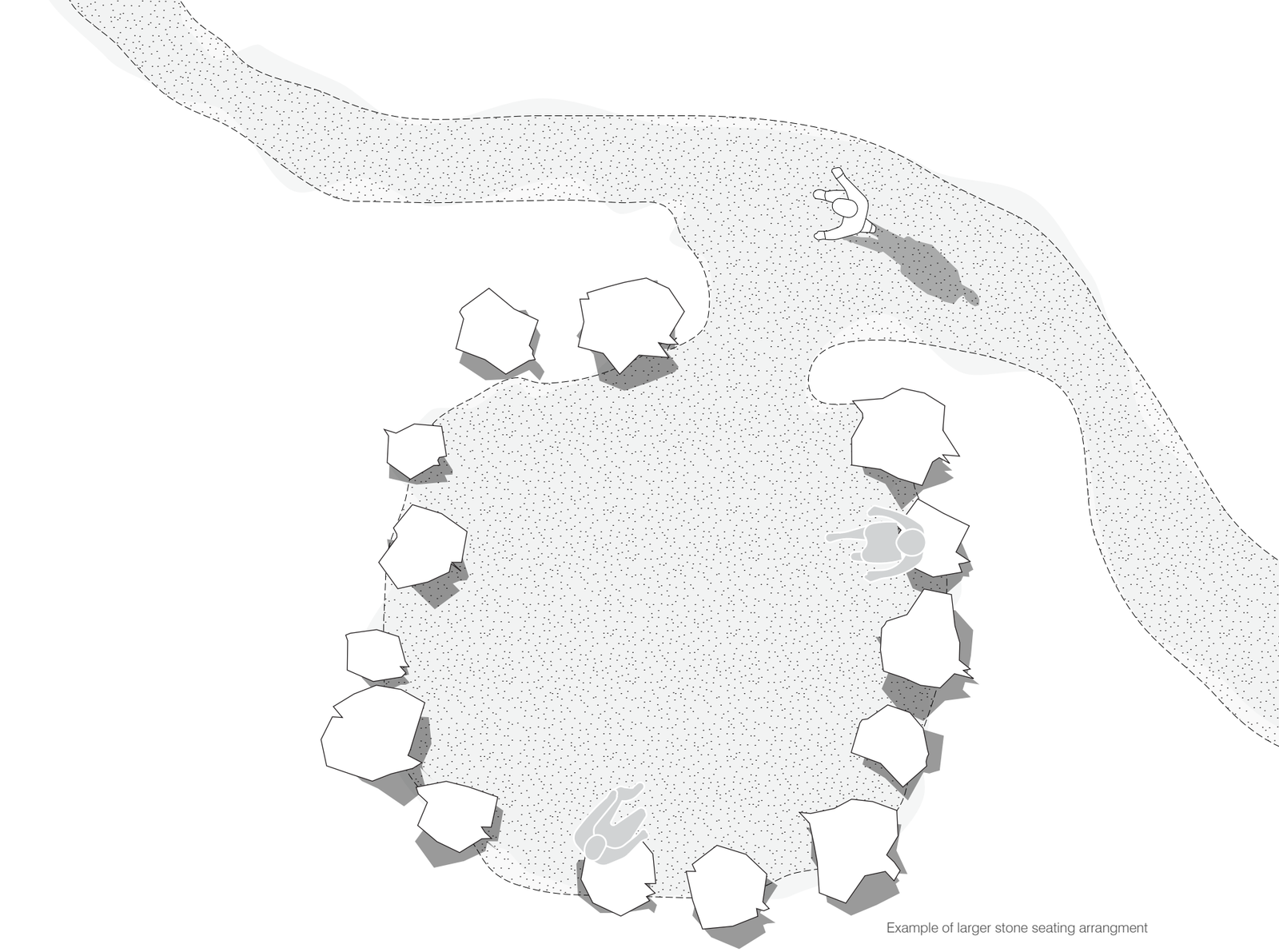
02 Provide informal stone seating at key destinations or resting places, using stone found from the site.

03 Seating areas should be located out of the direct path of travel.

04 Stone seating should be arranged in informal, circular clusters that promote group interaction and discussion, and consist of a variety of different sized stones (to suit different people).

05 Seating should be sited carefully to take advantage of existing site features such as shade, views and prevailing winds.

06 Do not install constructed, formal seating which detracts from the wilderness experience (refer IMG 1667, 5838).



Example of larger stone seating arrangment

IMG 1667 - Seat too constructed / out of place

IMG 5838 - Seat facing wrong direction

IMG 6619 - Utilise existing site features

IMG 1670 - Informal stone seating

IMG 2968 - Informal stone seat - Freycinet

IMG 3029 - Informal stone seat - Freycinet

IMG 2964 - Freycinet

Q. TRAIL SIGNAGE

01 Signage should be consistent, clear and attractive.

02 Ensure all signs are positioned where they can be easily seen and interpreted (refer IMG 6576).

03 Generally, major signage to be consolidated to trail heads and intersections.

04 Avoid use along the trail between trail heads and intersection.

05 Consolidate multiple signs to the one central location or board (refer IMG 6673).

06 Signage to conform to Australian Walking Track Grading system (DSE), as well as Australian Standard 2165.1 (2001) Walking Tracks - Classification and Signage.

07 Signage to conform to Parks Victoria's forthcoming signage manual (due for release in 2012), and include the GPT specific logo design.

08 Consider reintroducing point of interest names (such as the Fallen Giant and Nerve Test) as they contribute to the character of the experience, as well as help give the walker a sense of progress along the trail.

09 Where possible, use dual names Aboriginal and English (for example, Gariwerd/Grampians).

R. DIRECTIONAL MARKERS

01 Use directional markers where the trail is routed over stone and where the route is difficult to find.

02 Directional markers to be simple, clear and obviously located.

03 Where possible, locate the marker on a vertical or sloping stone face (refer IMG 1919) in the direction of travel.

04 Do not over-use directional markers (to preserve the walking experience of having to find the correct path to travel where the route becomes less clear).

05 Do not use handrails as directional or way-finding elements.

06 Directional markers to conform to Parks Victoria's forthcoming signage manual (due for release in 2012).

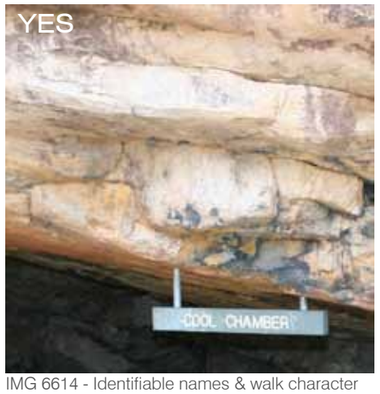
IMG 6673 - Need to consolidate signage

New PV signage strategy

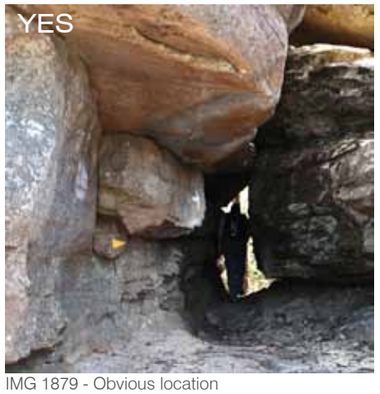
IMG 1919 - Obvious location

IMG 6576 - Locate signs in obvious positions

IMG 6637 - Identifiable names & walk character



IMG 6614 - Identifiable names & walk character



IMG 1879 - Obvious location

IMG 6581 - Clear and simple

S. TRAIL MAPS

01 The GPT provides an opportunity to prepare a series of exciting and informative walking maps.

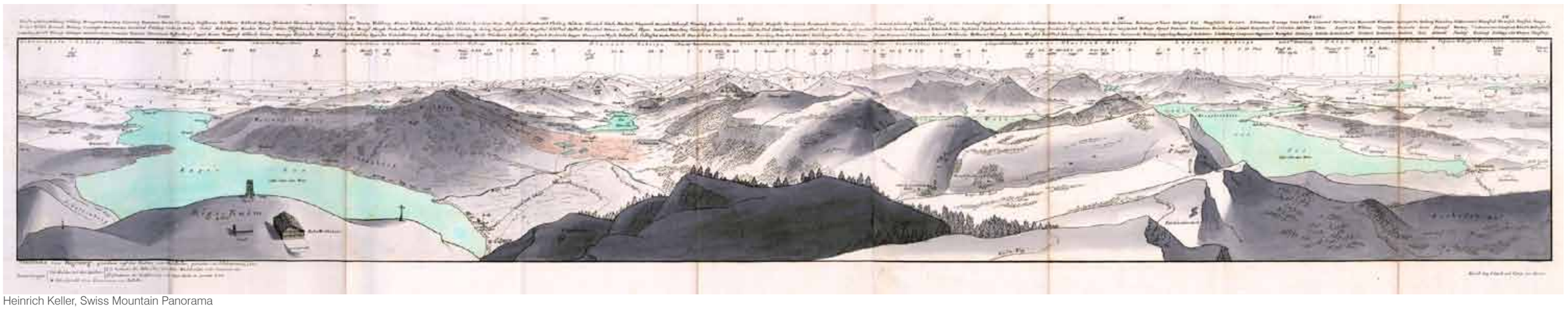
02 Consideration should be given to the use of panoramic map projections that better describe the terrain of the GPT than traditional cartographic maps.

03 These maps also have significant potential as a marketing tool.

Swiss panoramic map (H. Berann)

Swiss panoramic map (H. Berann)

Hiking Map Milford Sound



Heinrich Keller, Swiss Mountain Panorama

GRAMPIANS PEAKS TRAIL

LANDSCAPE DRAWING SCHEDULE

TYPE	NUMBER	DRAWING NAME	SCALE	SIZE	REV	REV DATE	REV TYPE
Schedules	LA 000	Landscape Title	N/A	A1	2	04.06.2012	Issued For Final Review
	LA 001	Landscape Drawing Schedule	N/A	A1	2	04.06.2012	Issued For Final Review
Trail	LA 300	Typical Trail Cross Section	As Shown	A1	2	04.06.2012	Issued For Final Review
	LA 301	Typical Stone Water Bar	As Shown	A1	2	04.06.2012	Issued For Final Review
Boardwalks	LA 320	Boardwalk Timber Straight	As Shown	A1	2	04.06.2012	Issued For Final Review
	LA 322	Boardwalk Timber Curved	As Shown	A1	2	04.06.2012	Issued For Final Review
	LA 323	Boardwalk Steel	As Shown	A1	2	04.06.2012	Issued For Final Review
	LA 324	Boardwalk Steel	As Shown	A1	2	04.06.2012	Issued For Final Review
	LA 325	Boardwalk Posts	As Shown	A1	2	04.06.2012	Issued For Final Review
Handrails	LA 330	Trail Handrail	As Shown	A1	2	04.06.2012	Issued For Final Review
	LA 331	Bridge Handrail	As Shown	A1	2	04.06.2012	Issued For Final Review
	LA 332	Ladder Handrail	As Shown	A1	2	04.06.2012	Issued For Final Review
	LA 333	Lookout Balustrade	As Shown	A1	2	04.06.2012	Issued For Final Review
	LA 334	Typical Handrail Perspectives	As Shown	A1	2	04.06.2012	Issued For Final Review
Step Ladders	LA 340	Step Ladder Type 01	As Shown	A1	2	04.06.2012	Issued For Final Review
	LA 341	Step Ladder Type 02	As Shown	A1	2	04.06.2012	Issued For Final Review
	LA 342	Ladder Connections	As Shown	A1	2	04.06.2012	Issued For Final Review
Bridges	LA 350	6m Bridge Elevations	As Shown	A1	2	04.06.2012	Issued For Final Review
	LA 351	6m Bridge Plans	As Shown	A1	2	04.06.2012	Issued For Final Review
	LA 352	8m Bridge Elevations	As Shown	A1	2	04.06.2012	Issued For Final Review
	LA 353	8m Bridge Plans	As Shown	A1	2	04.06.2012	Issued For Final Review
	LA 354	8m Bridge Curved Plans	As Shown	A1	2	04.06.2012	Issued For Final Review
	LA 355	8m Bridge (12m Span) Combination	As Shown	A1	2	04.06.2012	Issued For Final Review
	LA 356	12m Bridge Elevations	As Shown	A1	2	04.06.2012	Issued For Final Review
	LA 357	12m Bridge Plans	As Shown	A1	2	04.06.2012	Issued For Final Review
	LA 358	Typical Bridge Abutments	As Shown	A1	2	04.06.2012	Issued For Final Review
	LA 359	Typical Bridge Abutments	As Shown	A1	2	04.06.2012	Issued For Final Review
	LA 360	Typical Bridge Framing	As Shown	A1	2	04.06.2012	Issued For Final Review
	LA 361	Typical Bridge Connections	As Shown	A1	2	04.06.2012	Issued For Final Review
	LA 362	Bridge Configurations	As Shown	A1	2	04.06.2012	Issued For Final Review

GENERAL LANDSCAPE NOTES:

1. These drawings must be read in conjunction with the 'Walking Trail Infrastructure for the Grampians Peaks Trail' design manual.
2. If in doubt, Contractor must seek direction from Superintendent before proceeding.

LOADING INFORMATION:

3. All boardwalk modules have been designed to support a 3 kPa uniform distributed load (as outlined in the Parks Victoria 'Elevated Park Structures Design Guidelines' (SKM, 2000). 3 kPa = 300kg per m2. This equates to 3.75 no. 80kg people per m2.

PROTOTYPING:

4. Where possible, all details should be prototyped first, to refine the design and to test the detail on site.
5. Many of these details are typical details only, and will require additional work and amendment to suit particular site conditions.

SAFETY & COMPLIANCE:

6. All details should undergo a thorough safety audit and risk assessment to determine suitability in a particular location and circumstance.

DRAWINGS:

7. Where scales are indicated on the drawings, they always refer to A1 page size. If drawings are printed 50% at A3, double the scale.
8. Do not scale off drawings. Only use written dimensions.
9. All dimensions in millemetres unless otherwise noted.
10. Shop drawings must be provided for all steelwork. Do not proceed with fabrication and installation until all shop drawings have been approved.

GENERAL ENGINEERING NOTES:

11.

GRAMPIANS PEAKS TRAIL

Walk Victoria's Icons

ISSUED FOR FINAL REVIEW

NO.	DATE:	DESCRIPTION:	BY:	CHK:
01	07.05.2012	Issued for Information	cs	sk
02	04.06.2012	Issued For Final Review	cs	sk

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Client: Parks Victoria

Client Check:

Internal Check: cs

Drawing Scale: n/a

GRAMPIANS PEAKS TRAIL

Landscape Drawing Schedule & General Notes

Date: 04.06.2012

Drawing Number: 1107 LA001

Revision: 02

GPT PREFFED PALETTE:

PREFERED MATERIAL PALETTE:

A variety of different materials is appropriate for use along the GPT. For guidelines to assessing materials, see Appendix 1. For materials appropriate for use, see Appendix 2. For materials not recommended for use, see Appendix 3.

GRAMPIANS STONE:
The preferred material to construct the trail infrastructure elements is stone found on-site or in the surrounding landscape. While more costly and labour-intensive to install, stone is by far the most durable and site-appropriate material.

OXIDISED MILD STEEL:
Where structures are required, such as bridges, boardwalks and ladders, the structural elements can be constructed from mild steel that will oxidise in the environment. These elements should be robust enough to withstand bush fires.

HARDWOOD TIMBERS:
Where possible, elements that are seen or touched should be constructed from larger dimensioned, class 01 hardwood timbers, preferably salvaged or sourced from within the Park. These timbers are more resistant to fire and even in the event they do burn, they can be re-dressed or recycled. If destroyed, then the timber is easily reinstalled over the structural steel frame.

OXIDISED STEEL GRATING:
In more remote locations, oxidised steel grating can be used in lieu of hardwood timbers. All materials should develop a patina of age, and weather gracefully, thereby integrating visually into the surrounding landscape.


Grampians stone


Hardwood timbers

Corten Steel signage


Steel Grating

appendices -. materials

APPENDIX 01: GUIDELINES FOR ASSESSING MATERIALS

A material proposed for use on the GPT should be assessed based on consideration of the five stages of the material's life:

- Mining/extraction
- Manufacture
- Construction
- Use
- Demolition

The following criteria should also be used when assessing materials:

PERFORMANCE AND DURABILITY:
Consideration needs to be given to the frequency of bush fire and storm events, and the performance of the materials within extreme climatic variations.

LIFE CYCLE COST:
The life cycle cost of the materials should be considered (i.e. the cost over the entire life of the product), rather than up-front cost.

AVAILABILITY:
Preference should be given to materials that are readily available. Consideration should also be given to what materials can be found on site.

LOGISTICS:
Consideration should be given to the type of equipment and procedures necessary to delivery materials to the site, particularly in remote sections of the Trail.

AESTHETICS:
It is very important that the visual and emotive impact that different materials have is in keeping with the wilderness experience of the trail.

ABILITY TO WORK ON-SITE:
Ideally, materials should not rely on difficult, labour intensive or time consuming preparation or installation procedures. Prefabricated construction methods should be considered where appropriate.

SALVAGEABILITY:
Strong preference should be given to material that can be recycled or re-used – for example, after fire or flood.

MAINTENANCE:
Preference should be given to materials that do not require extensive or time-consuming ongoing maintenance. Applied surface finishes that degrade with time and require periodic renewal (such as paint) should be avoided.

SUSTAINABILITY:
Preference should be given to materials with low environmental impacts, with reference to the following -

- environmental damage during mining or harvesting of the basic material
- source, size, or renewability of the material
- recycled content of the material
- waste residue generated in production
- air pollution due to manufacture and production
- embodied energy (refer to Appendix 4)
- energy consumed during transport to site
- energy consumed on-site for erection or assembling
- packaging and on-site waste produced
- maintenance required during the life-cycle
- energy and effects associated with demolition/disposal at the end of the life-cycle

APPENDIX 02: MATERIALS AND WHERE/WHEN TO USE THEM

GALVANISED STEEL

Benefits:
- Easily available.
- Can be welded on site much more easily than stainless steel.
- Can be in kit form to bolt together (rather than weld).
- Easily repaired on site.
- Cheaper than stainless steel.

Issues:
- Clearly ‘artificial’ – difficult to integrate sensitively into the environment.
- an leach zinc and other trace metals into environment (refer stains found on adjacent rock).
- Can be highly reflective of sunlight when new.
- Higher embodied energy.
- More costly than timber.
- Requires more specialised welding skills.
- Not very tactile.

Lifespan:
- Longlife span (black mild steel min 8 mm thick – life span 20 yrs)
- Will rust over time and have a shorter life span than stainless steel.

Maintenance:
- Check every 5 years
- May require ‘touch up’ with galvanised paint.

Recommendations:
- Consider for use in structural elements only.
- Kit form recommended (to minimise welding).
- Try to minimise visibility.
- Avoid use where touch is required.

STAINLESS STEEL:

Benefits:
- Stronger and more durable than galvanized steel.
- Corrosion resistant.
- Aesthetically better than galvanised steel.

Issues:
- Clearly ‘artificial’ – difficult to integrate sensitively into the environment.
- Higher embodied energy.
- Can be highly reflective of sunlight.
- Requires specialised welding skills.
- Can only be welded onto/connect to stainless steel (not galvanised steel).
- Costly (two to four times as much as mild steel).

Lifespan:
- Highly durable - longer lasting than galvanized steel.

Maintenance:
- Lower maintenance than galvanized steel.

Recommendations:
- Use only where extreme durability and little maintenance is required (for example, damp and exposed locations, such as lookouts).
- Ensure matt satin finish, to minimise the reflectivity of material.
- Consider kit form / prefabrication to minimise welding on site.

Galvanised Steel (Mackenzie Falls)

Stainless steel - highly reflective

OXIDISED / WEATHERED STEEL (COR-TEN):

Benefits:
- Looks more ‘natural’.
- Non-reflective, so minimises problem of sunlight reflection common to steel.

Issues:
- High embodied energy
- Costly compared to galvanised steel.
- More difficult to source and would need to be pre-ordered and stored.
- Will leach oxides into environment (particularly if not pre-weathered), and can leave rust stains on adjacent materials.

Lifespan:
- Highly durable.

Maintenance:
- Lower maintenance than galvanised steel.
- Oxidation prevents further rusting and protects the steel (Note: can still rust if water doesn’t escape).

Recommendations:
- Consider for use in trail head signage.
- Consider where steel is required for durability but will be visible to the eye.

ALUMINIUM:

Benefits:
- Lightweight.
- Strong.
- Durable.
- Low maintenance.

Issues:
- Very high embodied energy.
- Looks artificial – stands out in the environment.
- Expensive.
- Difficult to weld – specialist equipment and skills required.

Lifespan:
- Highly durable.

Maintenance:
- Lower maintenance than galvanized steel.

Recommendations:
- Avoid use due to high embodied energy.
- If use, specify matt finish.
- Is used for signs in National Park already.


Corten Steel signage

Corten Steel signage


Aluminium (Gate of the East Wind) - very bright.

EXPANDED METAL MESH

Benefits:
- Strong.
- Durable.
- Good for use in bush fire prone areas.
- Allows plants to grow through; blurs edge of walkway.
- Can be fabricated in complete units and brought to site.

Issues:
- Can look harsh and industrial.
- Can be bright – better to use metal that can rust rather than galvanised mesh.
- Very heavy to lift in larger sections.
- Uncomfortable to walk on in bare feet and thongs.

Lifespan:
- Long life.

Maintenance:
- Requires checking to ensure no excessive rusting.
- Vegetation may need to be cut back if growing through mesh (although walkers tend to ‘prune’ this as they pass).

Recommendations:
- Consider using less industrial mesh systems, such as grating (rather than expanded mesh).
- Consider use of modular connection system.
- Consider how to implement over longer runs.
- Consider placement along less frequented sections of the trail (where user groups are more likely to be wearing appropriate footwear).

Notes:
1. Panel Sizes 1000 x 6000,1200 x 6000, 900 x 6000, 900 x 4000 span

METAL MESH / GRATING

Benefits:
- Strong.
- Durable.
- Good for use in bush fire prone areas.
- Allows plants to grow through – blurs edge of walkway.
- Can be fabricated in complete units and brought to site.
- Visually less harsh than expanded mesh.

Issues:
- Can look harsh and industrial.
- Can be bright – better to use metal that can rust rather than galvanised mesh.
- Very heavy to lift in larger sections.
- Uncomfortable to walk on in bare feet and thongs.

Lifespan:
- Long life.

Maintenance:
- Requires checking to ensure no excessive rusting.
- Vegetation may need to be cut back if growing through mesh (although walkers tend to ‘prune’ this as they pass).

Recommendations:
- Consider use of modular connection system.
- Consider how to implement over longer runs.

Notes:
- Panel Sizes 1000 x 6000,1200 x 6000, 900 x 6000, 900 x 4000 span


Streel grating


Rusted expanded metal - Major Mitchell plateau


Steel Grating

TIMBER TREATED PINE:

Benefits:
- Easily available.
- Low cost.
- Easy to work on site.
- Lightweight.

Issues
- Treatment is required to provide more durability, particularly for in-ground applications (e.g. stumps, footings etc.).
- Some treatments not environmentally or human-friendly.
- Can leach contaminants into the environment.
- Visually not that appealing.

Recommendation
- Do not use treated pine.

TIMBER HARDWOOD:

Benefits:
- Doesn't require additional treatment to make it suitable for use.
- Looks relatively 'natural'.
- Possibility of harvesting/salvaging/recycling some timbers on-site and/or from within the National Park (although these timbers may need to be cured/dried before use).
- Tactile and warm to touch..

Issues:
- Much more costly than treated pine.
- Heavier than treated pine.
- Slightly more difficult to work on on-site (for example, may need to pre-drill screw holes in dense/tightly grained timbers).
- Heavier than steel mesh (in a similar dimension).

Lifespan:
- Highly durable compared with treated pine, especially if using class 01 or 02 timber.

Maintenance:
- May need to be planed and dressed and/or replaced after a bushfire.

Recommendations:
- Use timbers that satisfy the definition of fire-retardant timber as specified in AS 3959 (1999) – see list below.
- Use in thicknesses greater than 18mm. (The thicker the timber, the more fire-resistant it will be).
- Use tight gaps between decking boards (to reduce fire risk).
- Ensure timber is sourced from sustainable locations.

Notes:
- Bush fire-resistant native timbers which meet AS 3959 include blackbutt, red ironbark, river red gum, silvertop ash, spotted gum and turpentine.


Treated Pine


Hardwood decking

COMPOSITE TIMBER (PLASTIC & TIMBER):

Benefits:
- Uses large portion of recycled material (often >60 per cent).
- Termite-resistant.
- Easy to work with conventional tools.
- Easily available.

Issues:
- Recognisable as an artificial product – doesn't have the same tactile, warm qualities as timber.
- Limited sizes available, particularly in larger formats.
- Not available in larger formats for stumps, bearers and joints (typically still need to use steel or timber for these elements).
- Not suitable for use in bush fire areas – it will burn.
- High embodied energy.

Recommendation:
- Do not use.

Maintenance:

FIBRE REINFORCED GRATING

Benefits:
- Easy to work with.
- Lightweight.
- Good slip resistance (if grit finish specified).
- Good corrosion resistance (will not rust).

Issues:
- Higher embodied energy.
- Not as strong or durable as steel mesh.
- Cannot achieve the same spans as steel mesh.
- May appear artificial in the natural environment.
- Strange material to walk on.
- Limited colour choice.
- Less fire-resistant than steel.

Lifespan:
- Durable.
- Flame-resistant resin (phenolic) available.

Maintenance:

Recommendations:
- Avoid use where possible – steel mesh preferable due to longer spans and greater durability.

Compsite timber structure

Fibre reinforced plastic (FRP) grating

GRAMPIANS SAND STONE:

Benefits:
- Can be sourced locally.
- Fits naturally into the environment.
- Very low embodied energy.
- Fire resistant.

Issues:
- Can be difficult to move and work (e.g. lifting equipment may be required).
- Requires craftsmanship to lay effectively.
- Labour-intensive.
- May require modification to the existing landscape.

Lifespan:
- Highly durable.
- Will not erode.
- Fire-resistant, although may fracture in bushfire.

Maintenance:
- Check after major storm and fire events.

Recommendations:
- Use wherever possible, practical and appropriate.

IMPORTED STONE:

Benefits:
- Fits very naturally into the environment.
- Highly durable.
- Will not erode.
- Fire resistant.
- Very low embodied energy.

Issues:
- Can be difficult to move and work (e.g. lifting equipment may be required).
- Requires craftsmanship to lay effectively.
- Labour-intensive.
- May require modification to the existing landscape.

Maintenance:
- Check after major storm and fire events.

Recommendations:
- Do not use, or use only where Grampians sandstone is unavailable (i.e. from Dunkeld sandstone quarry).


Stone steps (Silent Street)


Stone steps (Wonderland)

INSITU CONCRETE:

Benefits:
- Low embodied energy.
- Elements can be prefabricated (such as stumps and blocks).
- Easily worked and can solve a variety of issues.
- Can be coloured to suit the environment.

Issues:
- Requires water for construction, which may not be available in some locations.
- Needs to be mixed on-site (requires certain equipment).
- Can look very poor visually if poorly laid/constructed.
- Recognisable as an artificial product .

Lifespan:
- Durable and fire resistant, although may crack / fracture during fire.

Recommendations:
- May be required for footings, structural strength.
- Use stone instead where possible.
- Consider use in very high traffic areas (e.g. Mackenzie Falls).

GRAVEL:

Benefits:
- Can be found locally (i.e. Great Western Pit).
- Can fit naturally into the environment (highly site specific).

Issues:
- May require edge treatment to hold in place, otherwise can ‘escape’.
- Need to ensure appropriately-sized material is selected to allow better compaction.
- Susceptible to erosion.
- Can look out of place within the environment if not the correct colour, type of gravel for the landscape.
- Source gravel to be checked for cinnamon fungus.
- Quality of available gravel (from within the park) reducing.

Lifespan:
- Highly durable, although susceptible to flooding, particularly if not installed correctly.
- 100 per cent fire-resistant.

Maintenance:
- Level of maintenance relies on trail design and installation.
- May require periodic top-ups after storm events.
- May require periodic regrading.

Recommendations:
- Avoid use wherever possible.
- Wherever possible, source gravel from within the Park.
- Source gravel to be checked for cinnamon fungus.

Notes:
- Park and road networks use gravel sourced from 29 gravel pits within the park. Fourteen of these pits are known to be infected with cinnamon fungus. Eighteen active gravel pits will be reduced to 11. Must be tested and have the right plasticity.

GRANITIC SAND:

Recommendation:
- Do not use.

PAINT:

Recommendation:
- Do not use. (Note: does not apply to steel which requires a primer and galvanised touch up paint)

IMG 1772 - Imported “Great Western’ gravel

IMG 1766 - Local gravel from ‘Paddy Castle’

APPENDIX 04: EMBODIED ENERGY

EMBODIED ENERGY

Embodied energy is defined as the sum of energy inputs (fuels/power, materials, human resources etc.) used to make any product, from the point of extraction and refining materials, to bringing it to market, to the disposal/re-purposing of it.

Generally, the more highly processed a material is, the higher its embodied energy. Typical figures for some Australian materials are as follows (Source: Lawson Buildings, Materials, energy and the environment 1996).

MATERIAL PER EMBODIED ENERGY	MJ/kg
Kiln dried sawn softwood	3.4
Kiln dried sawn hardwood	2.0
Air dried sawn hardwood	0.5
Hardboard	24.2
Particleboard	8.0
MDF	11.3
Plywood	10.4
Glue-laminated timber	11.0
Laminated veneer lumber	11.0
Plastics – general	90
PVC	80.0
Synthetic rubber	110.0
Acrylic paint	61.5
Stabilised earth	0.7
Imported dimension granite	13.9
Local dimension granite	5.9
Gypsum plaster	2.9
Plasterboard	4.4
Fibre cement	4.8*
Cement	5.6
Insitu Concrete	1.9
Precast steam-cured concrete	2.0
Precast tilt-up concrete	1.9
Clay bricks	2.5
Concrete blocks	1.5
AAC	3.6
Glass	12.7
Aluminium	170
Copper	100
Galvanised steel	38
Stainless steel	51.5
Fibreglass	30