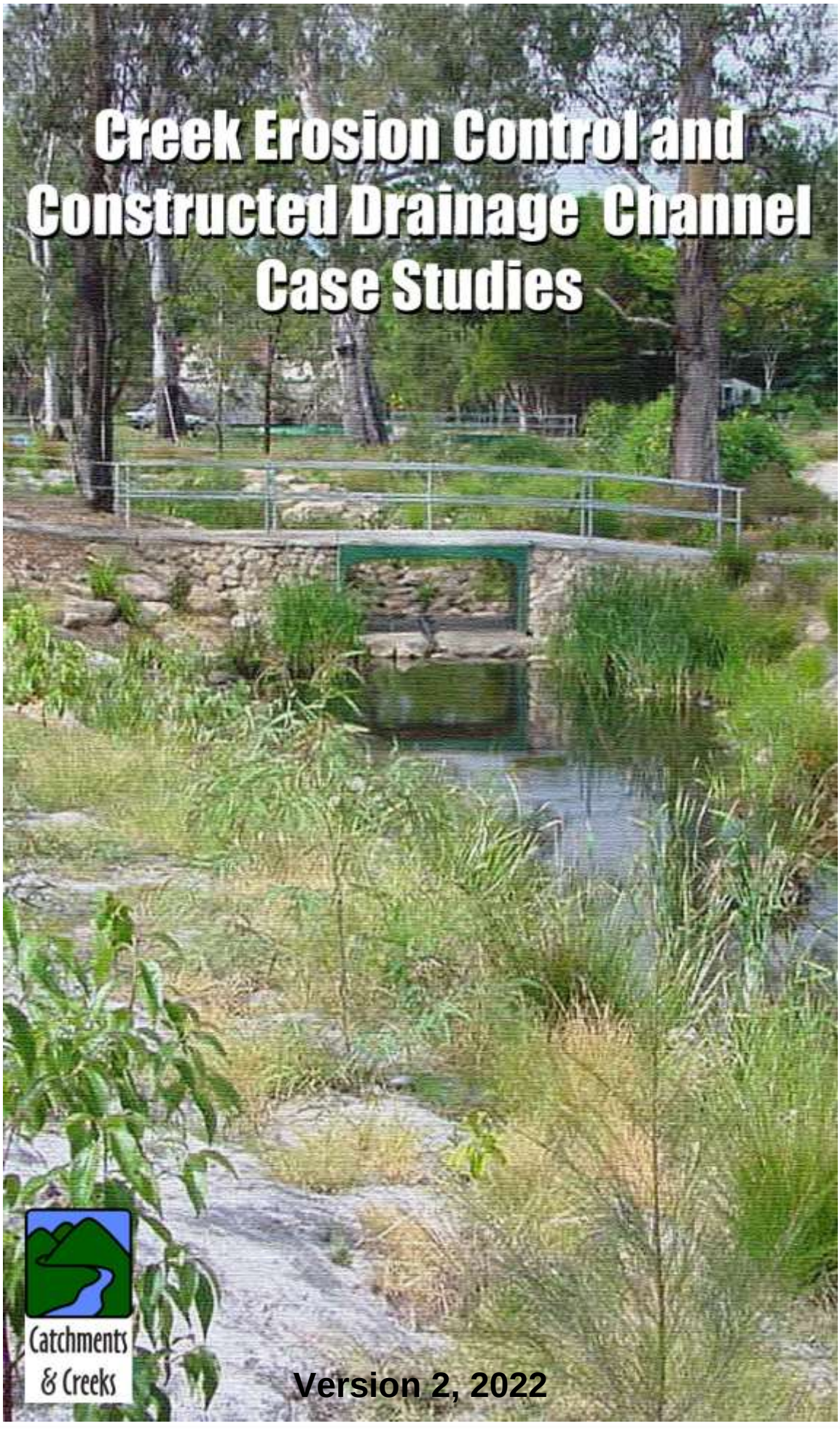
Creek Erosion Control and Constructed Drainage Channel Case Studies



Catchments & Creeks

Version 2, 2022

Creek Erosion Control and Constructed Drainage Channel Case Studies

Version 2, September 2022

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Published by: Catchments and Creeks Pty Ltd

Diagrams by: Grant Witheridge, Catchments and Creeks Pty Ltd, and Google imagery

Photos by: Catchments and Creeks Pty Ltd, Google imagery

This document should be referenced as:

Witheridge 2022, *Creek Erosion Control and Constructed Drainage Channel Case Studies*. Catchments and Creeks Pty Ltd., Brisbane, Queensland

Key words: creeks, creek rehabilitation, creek erosion control, natural channel design, constructed drainage channels, problematic drainage channels

Copies of this document may be downloaded from: www.catchmentsandcreeks.com.au

Cover: Bowman Park, Bardon, Brisbane, Queensland, 2001

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The commentary presented within this publication, and the results displayed within the case studies, are site specific. The author cannot, and does not, claim that the case study results or the associated commentary can be directly applied to other sites without appropriate consideration of local conditions and site constraints.

Application of the principles presented within this document requires experienced judgement to ensure the principles are appropriately adapted to the local conditions. The document is not a recipe book for persons acting outside their field of competence or experience. Therefore, readers must make informed decisions regarding the extent to which the commentary can be applied to a given situation, including appropriate consideration of local statutory regulations.

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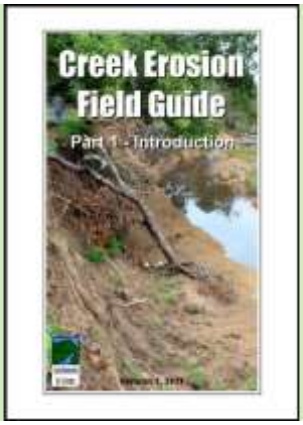
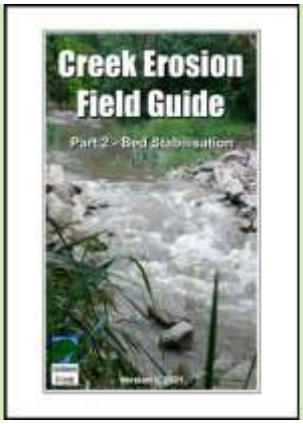
Related document: *'Creek Erosion Field Guide'*



Creek Erosion Field Guide – Part 1

Part 1 – Types of waterways and causes of waterway erosion

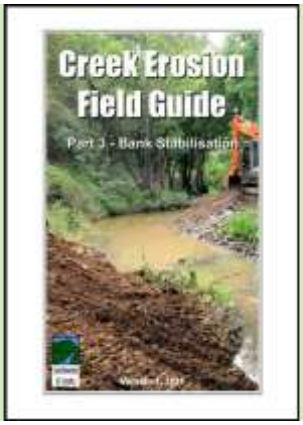
- Designing the appropriate treatment measures for creek erosion depends on knowing:
  - the type of watercourse
  - the type of erosion, and
  - the likely causes of the erosion.
- Part 1 discusses each of these issues, as well as presenting an introduction to creek engineering and fluid mechanics.



Creek Erosion Field Guide – Part 2

Part 2 – Bed stabilisation

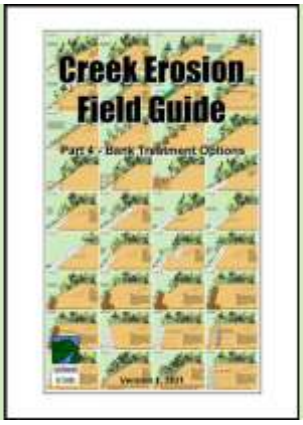
- Prior to presenting detailed information on bed stabilisation techniques, discussion is presented on the following topics:
  - fish-friendly waterways
  - common properties of rock
  - hydraulics of bed structures.
- Information on the treatment of bed erosion is then grouped into two chapters:
  - fish-friendly options
  - non fish-friendly options.



Creek Erosion Field Guide – Part 3

Part 3 – Bank stabilisation

- The treatment of bank erosion has been grouped into:
  - soft engineering options
  - hard engineering options
  - management of dispersive soils
  - management of lateral bank erosion
  - flow diversion techniques.
- Part 3 ends with a discussion on how vegetation can be incorporated into the various bank stabilisation measures.

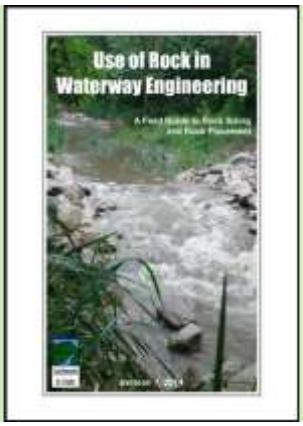


Creek Erosion Field Guide – Part 4

Part 4 – Bank stabilisation

- Part 4 starts with an overview of the various recommendations presented in Part 3 on the stabilisation of creek banks.
- The main focus of Part 4 is the presentation of a pictorial guide to the selection of bank stabilisation options—starting with the lower gradient options, and moving onto the steeper bank options.
- A glossary of technical terms is presented at the end of the document.

Other related field guides



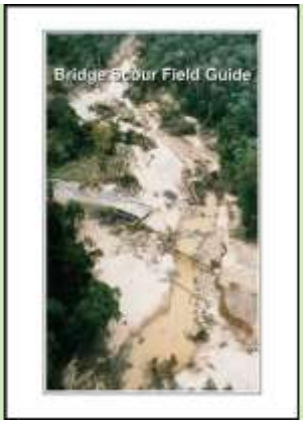
Use of Rock in Waterway Engineering

Use of Rock in Waterway Engineering

Catchments and Creeks Pty Ltd, Bargara, Queensland

Free PDF download from the C&C website.

First published in 2014, with regular updates being produced since then.



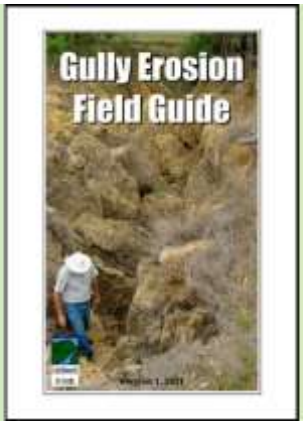
Bridge Scour Field Guide

Bridge Scour Field Guide

Catchments and Creeks Pty Ltd, Bargara, Queensland

Free PDF document from the C&C website.

First published in 2020, this document provides a summary of the AustRoads and Queensland Main Roads guidelines.



Gully Erosion Field Guide

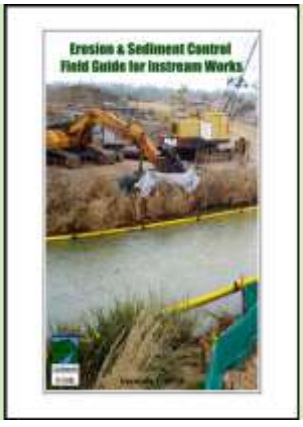
Gully Erosion Field Guide

Catchments and Creeks Pty Ltd, Bargara, Queensland

At the time of first publishment of the Creek Erosion Field Guide, this gully erosion field guide had not been completed.

Free PDF document from the C&C website.

This is a 3-part field guide first released in 2021, which complements the Creek Erosion Field Guides.



ESC Field Guide for Instream Works

Erosion and Sediment Control Field Guide for Instream Works

Catchments and Creeks Pty Ltd, Bargara, Queensland

Free PDF document from the C&C website.

First published early 2020, then updated late 2020.

This field guide addresses the erosion and sediment control issues that need to be managed during the construction phase of creek erosion control measures.

Contents

Purpose of document

This document has been prepared specifically to:

- provide a brief pictorial overview of various creek engineering and erosion control projects
- provide a brief pictorial overview of various vegetated drainage channel projects
- provide brief commentary on the projects where such information is available to the author
- provide a location map of creek engineering sites so interested person can visit the sites
- aid in the advancement and promotion of Natural Channel Design projects.

The images presented within this document are intended to represent the current topic being discussed. These images are presented for the purpose of depicting an actual site condition or outcome. In some cases the images may not represent current best practice, but a response to the site conditions or the state of knowledge known at the time of the project's design.

The caption and/or associated discussion should **not** imply that the images necessarily represent either good or bad practice. The actual circumstances, site conditions and history of the site may not be fully known by the author. This means that there may be a valid site-specific reason why the designer chose the layout and channel features depicted in the photo.

About the author

Grant Witheridge is a retired civil engineer with both Bachelor and Masters degrees from the University of NSW (UNSW). He has some 40 years experience in the fields of hydraulics, creek engineering and erosion & sediment control, during which time he has worked for a variety of Federal, state, local government and private organisations.

He commenced his career at the UNSW Water Research Laboratory operating physical flood models of river floodplains. He later worked for Brisbane City Council on creek engineering and stormwater management issues. He currently works on the production of various Field Guides through his own company Catchments and Creeks Pty Ltd.

Introduction

This document presents only a small sample of the creek erosion control and Natural Channel Design projects completed in and around Brisbane. The inclusion of sites in this document primarily depended on whether the author had access to sufficient photos to describe the site. Many good creek erosion control projects have not been included simply because the author did not have early site images that would allow a good comparison with current site conditions.

Creek engineering and Natural Channel Design are not exact sciences. Creek engineering practices are still very much in their infancy. At this point in time our knowledge base still originates from real life case studies such as these, rather than from text books.

Hindsight is a wonderful thing in creek engineering. The approaches taken within many of the following case studies may well be different if they were based on current practices and the knowledge gained over the past 20 years.

The designers and practitioners associated with each of these case studies should not be criticised for decisions made in the past, but praised for the part they played in the development of our current knowledge base, and for their leadership in the promotion of ever-improving urban waterway and drainage design practices.

Natural Channel Design (NCD) may be looked upon as a branch of creek engineering that involves the planning, design, construction and maintenance of waterway channels that are compatible with current and future hydrological, ecological and human requirements of the drainage catchment.

The principles of Natural Channel Design are based on providing the required hydraulic conveyance of a drainage channel and floodway, while maximising its potential environmental values. This holistic approach combines the disciplines of hydraulic engineering, fluvial geomorphology, and in-stream and riparian ecology.

These NCD principle may be applied to the rehabilitation of natural waterways and the construction of new drainage channels in locations where no waterway previously existed.

Introduction

Severe bank erosion, Inala, Qld

Creek erosion projects

- The focus of these projects is on stabilising bed or bank erosion without the need for major channel reconstruction.
- These projects usually incorporate the regeneration of the adjacent riparian zones.

A 'before' and 'after' split image

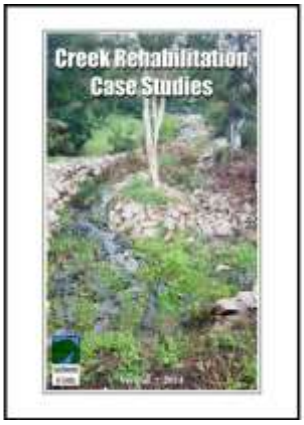
Constructed drainage channels

- These projects usually involve either the reconstruction of old drainage channels, or the construction of new drainage channels within new land developments.
- The principles of *Natural Channel Design* form the basis of many of these projects.

Formed channel with concrete low-flow

Problematic drainage channels

- These case studies represent just a few examples of the style of drainage channel design typically built during the latter stages of the twentieth century.
- The short descriptions are provided on the types of operational problems commonly associated with these now largely out-dated drainage designs.

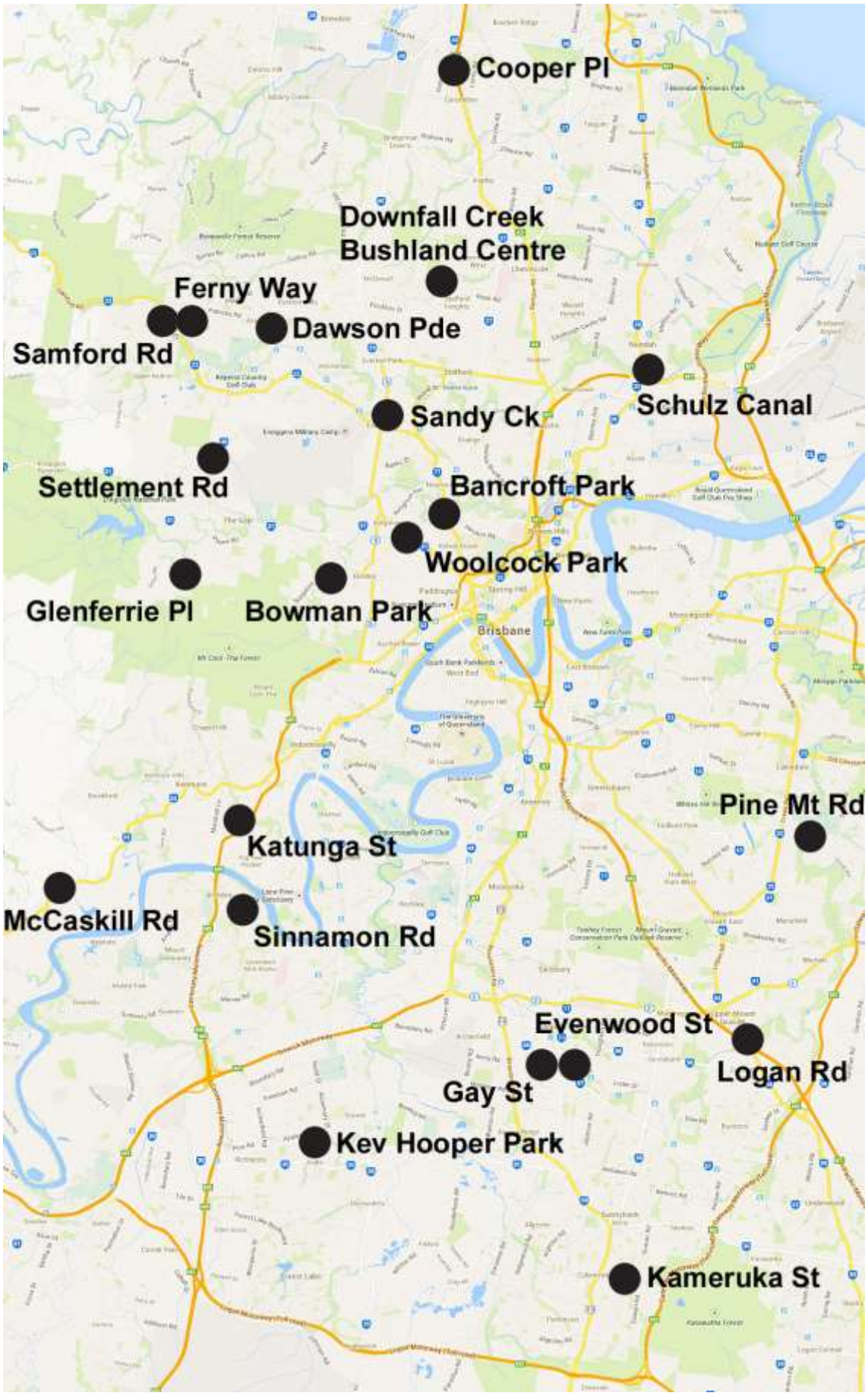


Creek Rehabilitation Case Studies (2014)

Creek and riparian rehabilitation projects

- Case studies for creek and riparian rehabilitation projects can be found in the *Catchments & Creeks* document *'Creek Rehabilitation Case Studies'*.
- Presented within this document are projects that focus on the rehabilitation of riparian areas without the need for major earthworks.
- Many of the projects are centred around community-based bushcare teams assisted by expert bushcare officers.

Location map



Location of Brisbane sites

Creek Erosion Projects

Boss Creek, Kev Hooper Park, Inala, Qld

Location map (north to the top of image)

Aerial image of the site

Bank erosion looking upstream (1993)

Site history

- This creek passes through a region of highly erodible dispersive subsoils.
- The creek had largely been cleared of riparian vegetation resulting in a weedy, open canopy waterway.
- In the past, parts of the creek had been stabilised with grouted rock, which is now failing largely due to the highly erodible underlying soils.

Repaired creek bank on right (1995)

The project

- The project consisted of stabilising the creek bank in order to prevent the loss of four mature trees located on the southern bank (visible on the right in this photo).
- Initially non dispersive soil was used to extend the bank away from the base of the trees.
- The lower half of the new creek bank was then stabilised with rock and planted.

Early plant establishment (1996)

Key feature of project

- The key feature of this project was the matching of the rehabilitated bank with the existing aesthetics of the creek.
- Covering the rocks with vegetation has helped to remove the ‘constructed’ appearance of the creek bank.
- In time the bank will be planted with natives in association with riparian restoration along the opposite bank.

Boss Creek, Kev Hooper Park, Inala – plant establishment

Looking d/s with works on right (1995)

Year 1995

- Most of the rock stabilisation was covered with soil and planted.

Looking d/s with works on right (1996)

Year 1996

- Weeds and grasses dominate the bank revegetation; however, these plants help the new bank to blend with the rest of the creek.

Looking d/s with works on right (2004)

Year 2004

- Significant loss of middle and upper-storey natives is obvious.
- Grasses dominate along the bank.

Looking d/s with works on right (2014)

Year 2014

- Grasses still dominate the bank vegetation, but the bank remains erosion-free and very stable.

Bulimba Creek, Pine Mountain Road, Carindale, Qld

Location map (north to the top of image)

Aerial image of the site

Looking upstream from bridge (1995)

Site history

- In 1995 a bridge was constructed over Bulimba Creek joining the east and west sections of Pine Mountain Road.
- The bridge was located on a small meander (S-bend) of the creek.
- To prevent the creek from eroding into the foundations of the bridge's eastern abutment, the creek bank was stabilised with a gabion wall.

Looking upstream from bridge (1996)

The problem

- The problem caused by the placement of the gabion wall on the outside of a significant channel bend was that it induced high flow velocities to exist along the face of the gabion wall.
- As a result of this, high flow velocities also existed adjacent the creek bed causing a scour hole to form at the base of the gabion wall.
- Consequently, the gabion wall started to slide (slump) into the creek bed.

Looking upstream from bridge (2000)

Year 2000

- One of the main problems associated with gabion structures in Brisbane waterways is their propensity to attract non-native vines.
- Once established within the gabions, these vines can then move into the adjacent riparian zone.
- By the year 2000, vines had already established along the gabion wall.

Bulimba Creek, Pine Mountain Road, Carindale

Looking upstream from bridge (2001)

Year 2001

- Maintenance work had cleared the gabions of the vines.
- The gabion wall continues to slump into the creek bed.

Looking upstream from bridge (2008)

Year 2008

- The gabion wall is now heavily vegetated, mainly with weed species.

Looking upstream from bridge (2014)

Year (early) 2014

- The ongoing slumping of the creek bank has allowed a lower bench to form at the base of the bank.
- The formation of this bench, and the ongoing establishment of woody species should see the creek bank achieve a more ‘natural’ profile and stability.

Looking upstream from bridge (2014)

Year (late) 2014

- No visible indications left of the gabion wall.
- Weeds still dominate the bank vegetation.

Cubberla Creek, Katunga Street, Kenmore, Qld

Location map (north to the top of image)

Aerial image of the site

Looking u/s from footbridge (1996)

The site

- A common problem in the Brisbane region is the occurrence of bank erosion on the northern (shaded) banks of streams.
- This particular bank erosion problem occurred immediately upstream of the Katunga Street footbridge.
- Similar bank erosion problems also existed immediately downstream of the footbridge.

Looking d/s from footbridge (1995)

The project

- In the mid 1990s Brisbane City Council decided to construct a bikeway adjacent to the creek; however, there was limited room between the adjacent sports ovals and the creek bank.
- It was decided that rock stabilisation was needed to be placed on the creek bank to prevent the creek bank from undermining the new bikeway.

Downstream of footbridge (1997)

The problem

- In the absence of vegetation, rock-lined banks can induce high flow velocities to occur adjacent the rock-lined surface.
- These same high velocities can also exist adjacent the unprotected creek bed causing bed scour.
- Toe erosion at the base of the rock-lined bank, and the existence of a smooth filter cloth underlay, caused the rocks to slide down the face of the bank into the creek.

Cubberla Creek, Katunga Street – 'upstream' of footbridge

Upstream of footbridge (1995)

Year 1995

- In the absence of other controlling factors, there is a greater tendency for bank erosion to occur predominantly on the more-shaded northern banks of streams.
- This problem becomes less significant north of the Tropic of Capricorn.
- This 1995 photo shows the steep northern bank (right) and the heavily vegetated, more gradual southern bank (left) prior to the initiation of the bank erosion.

Upstream of footbridge (1996)

Year 1996

- Significant rainfall and flooding occurred in Brisbane during May 1996.
- This image shows the eroded northern bank of the creek after the May 1996 storm.
- Note that the eroded bank is in shade.
- Note also, the limited amount of erosion experienced on the more substantially vegetated southern bank.

Upstream of footbridge (1997)

Year 1997

- Rock stabilisation was placed against the bank in 1996 and sediment and grasses were allowed to establish within the rock voids.

Upstream of footbridge (2014)

Year 2014

- The rock stabilisation is now completely covered with grasses.
- This section of Cubberla Creek is yet to be rehabilitated with respect to the establishment of native riparian vegetation.
- Similar to other creeks in Brisbane, major creek restoration initially occurs within the upper reaches, then slowly moves down towards the lower reaches.

Cubberla Creek, Katunga Street – 'downstream' of footbridge

Downstream of footbridge (1992)

Year 1992

- Creek bank prior to construction of bikeway.

Year 1995

- Placement of rock over a geotextile mat.

Year 1996

- Bed scour adjacent the rock-stabilised bank has undermined the creek bank.
- Having been placed on a 'smooth' geotextile mat, the rock simply slipped down the bank onto the creek bed.

Downstream of footbridge (1995)

Downstream of footbridge (1996)

Downstream of footbridge (1997)

Year 1997

- Almost all the rocks have now slipped onto the creek bed.
- The exposed geotextile filter cloth can be seen.

Year 2000

- Plants have now established within the deteriorating filter cloth.

Year 2014

- Weeds still dominate, however, this section of Cubberla Creek is yet to be rehabilitated.

Downstream of footbridge (2000)

Downstream of footbridge (2014)

Downfall Creek Bushland Centre, Chermside West, Qld

Location map (north to the top of image)

Aerial image of the site

Downfall Creek education centre

Site history

- The Downfall Creek Bushland Centre is located on Rode Road, Chermside West.
- The community education centre was established by Brisbane City Council in 1988 and was initially operated by Greening Australia.
- The facility was established as a community education centre focused on nature conservation and ecologically sustainable urban living.

Eroded, dispersive soil bank (1991)

The problem

- Downfall Creek contains some of the most erodible soils in Brisbane.
- The subsoils found at the community centre are largely dispersive, meaning the soils contain a significant (>6%) quantity of sodium, which causes the soil to be unstable and disperse in water.
- A small tributary to the creek flows through the Bushland Centre and this tributary was experiencing significant bank erosion as a result of the exposure of these dispersive subsoils.

JUTEMASTER sales brochure (1991)

Demonstration of new products

- Rehabilitation of the eroded creek bank became a demonstration project for the use of a new (in 1991) erosion control product, ‘jute matting’.
- The eroded bank was re-profiled, stabilised with rock along the toe of the bank, seeded with grass, then covered with ‘thin’ jute matting.
- The bank was initially stabilised with grass before native plants were introduced to the stable bank over the following years.

Downfall Creek Bushland Centre – tributary north bank

Tributary, looking upstream (1991)

August 1991

- The exposed sodic subsoil on the northern bank experienced significant vertical rilling known as 'fluting'.
- Tunnels had formed in the soil (tunnel erosion) passing from the base of the eroded bank up through the soil into the adjacent bushland.
- In a 'misguided' attempt to stop this tunnel erosion (the author's error!), plastic sheeting was placed against the subsoil prior to placing the earth fill, rock and the jute matting.

Placement of jute matting (1991)

Year 1991

- The eroded bank was first stabilised in 1991 as part of a demonstration field test of jute matting (a new product in 1991).
- The eroded bank was re-profiled, grass seeded, then covered with *'Jutemaster'* jute matting.
- The demonstration project involved people from Queensland DPI, Brisbane City Council, Landplan and Greening Australia.

Tributary, looking upstream (1991)

December 1991

- Native plants were initially established within the grassed bank.

Tributary, looking downstream (1994)

January 1994

- Some die-back of the grass is beginning to occur.
- Newly established native trees are clearly visible above the grass.
- Grasses have established within the rock-stabilised creek bed.

Downfall Creek Bushland Centre – tributary north bank

Tributary, looking downstream (1996)

April 1996

- Thick weed (grass) cover exists over the bed and banks of the tributary.

September 2001

- Some minor bed erosion is visible at the downstream end of the tributary at the point where the tributary spills into the main Downfall Creek channel (see photo below).

Tributary, looking <u>downstream</u> (2001)

Tributary, looking <u>upstream</u> (2001)

Tributary, looking upstream (2012)

September 2012

- Bed erosion has migrated up the tributary exposing parts of the buried black plastic sheeting.
- The bank has now slumped forming a low bench.

August 2014

- Increased shading from the established canopy cover, and the extensive work of the local bushcare group, has reduced the grass cover and increased the dominance of native species.

Tributary, looking downstream with northern bank on the left (2014)

Downfall Creek Bushland Centre – tributary south bank

Storm flow 11 October 2010

Southern bank of the tributary

- On the southern bank of the tributary (opposite the eroded, dispersive soil bank) the soils are more stable, but high velocity flows discharging from the upstream culvert had caused significant toe erosion.
- The toe of the bank was stabilised with jute logs and planted with *Lomandra*.
- Both the jute log stabilisation of the *Lomandra* plants proved successful in stabilising the toe of the bank.

Bank erosion (2012)

Toe stabilisation with jute logs (2012)

Toe stabilisation (Sept 2012)

Toe stabilisation (May 2013)

Tributary, looking downstream with the southern bank on the right (2014)

Downfall Creek Bushland Centre – Downfall Creek

Synthetic matting placed on bank (1991)

August 1991

- In 1991, the western bank of the main Downfall Creek channel was cleared of weeds and stabilised with synthetic reinforced erosion control matting.
- Use of this synthetic reinforced matting proved most unsatisfactory in a bushland setting because native reptiles were found to become entangled in the plastic mesh.
- Preference is now given to the use of jute and coir mesh in creek and bushland settings.

Looking downstream from Rode Rd (1997)

September 1997

- With the weeds removed, and with the failed establishment of an effective native plant cover, the western bank (shown here to the left of the channel) experienced significant erosion (just visible in this 1997 image).
- Significant weed establishment along the bed of the creek also increased the erosion stress on the creek bank.

Looking downstream from Rode Rd (2001)

September 2001

- The western bank was stabilised with rock boulders set against a bench.
- The bank was ‘benched’ in order to provide access for the heavy machinery required to place the rock—thus avoiding the loss of mature riparian trees.
- At the same time the bed of the creek was de-silted and cleared of weeds.

Looking downstream from Rode Rd (2013)

May 2013

- Stable bank conditions have led to thick vegetation establishment along the creek.

Downfall Creek, Rode Road, Chermside West

Looking downstream from Rode Rd (1997)

Looking downstream from Rode Rd (2014)

Enoggera Creek, Bancroft Park, Kelvin Grove, Qld

Location map (north to the top of image)

Aerial image of the site

Looking downstream towards weir (1993)

March 1993

- The Enoggera Creek weir is located at the creek bend just visible in the background of this 1993 image.
- The State Government's stream gauging station tower can be seen at the top of the creek bank adjacent the weir.
- Ongoing bank erosion had caused the formation of an unstable, steep creek bank that was seen as a safety risk to children playing in the adjacent park.

Looking downstream towards weir (1993)

December 1993

- In 1993 the creek bank was battered at approximately a 1 in 2 gradient.
- The bank was covered with a jute blanket and planted with various native shrubs and trees.
- In general, it is not desirable for highly flexible, non-woody, ground covers to dominate on the outside bank of channel bends; instead, woody species are preferred in order to reduce flow velocities adjacent to the bed and bank.

Looking downstream towards weir (1996)

June 1996

- A good mix of ground covers, middle storey and upper storey plants was established along the creek bank.
- Significant bank erosion has occurred around the base of the abandoned stream gauging station tower (background).

Enoggera Creek, Bancroft Park, Kelvin Grove

Looking downstream towards weir (1996)

December 1996

- Significant loss of middle storey and upper storey plants has occurred.
- Non-woody ground cover grasses now dominate along the bank.
- Such a vegetation cover on the bank is likely to reintroduce high flow velocities along the toe of the bank, possibly leading to the return of bank erosion problems.

Looking downstream towards weir (2003)

Year 2003

- The decommissioned stream gauging station tower as been removed from adjacent to the weir.
- Increased vegetative roughness has returned to the creek bank; however, weeds still dominate.

Looking downstream towards weir (2011)

December 2011

- Native plants have increased in number, but the bank still lacks the required density of low woody branches that such a creek bank requires to prevent ongoing bank erosion.

Looking downstream towards weir (2014)

October 2014

- Rock stabilisation has now been applied to the creek bank just upstream of the weir (visible in the background of this image).

Enoggera Creek, Bancroft Park, Kelvin Grove

Looking downstream towards the weir (1993)

Looking downstream towards the weir (2014)

Ithaca Creek, Woolcock Park, Red Hill, Qld

Location map (north to the top of image)

Aerial image of the site

Looking downstream (1992)

Year 1992

- Erosion along the outer bank of this bend of Ithaca Creek was likely to have been initiated by the upstream concrete-lined channel works.
- The bank had previously been stabilised with rock, but appropriate vegetation had not been established within the rocks.

Looking downstream (1999)

Year 1999

- Woolcock Park had undergone significant enhancement by 1999, which had seen increased riparian planting both within the park and downstream of Waterworks Road.

Looking downstream (2014)

Year 2014

- Riparian planting is fully established along the northern bank (left), but only partly established within the park (right).
- The establishment of a canopy cover over the low-flow channel along the northern bank has helped to maintain an open water low-flow channel.

Kedron Brook, Dawson Parade, Keperra, Qld

Location map (north to the top of image)

Aerial image of the site

Looking u/s from Dawson Pde (pre 1991)

Site history

- After the 1974 flood, many of the creeks in Brisbane had undergone significant widening and channelisation.
- This section of Kedron Brook adjacent Arana Hills shopping centre had been modified into a wide, grass-lined trapezoidal channel.
- By the time of this photo, sedimentation had caused a low-flow channel to return to the bed of the creek.

Looking u/s from Dawson Pde (2012)

The issues

- Significant natural, community-based and council planting had seen a major change in the dynamics of the creek by 2012.
- However, bank erosion was occurring along the southern bank (just visible in the foreground, left).

Looking u/s from Dawson Pde (2014)

The project

- In 2012, rock stabilisation was placed against the southern bank (LHS looking upstream).
- The voids between the rocks were filled with soil and pocket planted, which has enhanced the establishment of vegetation on this bank.

Kedron Brook, Dawson Parade, Keperra

Eroded bank on left, 28/9/12

Establish flow diversion bund, 24/10/12

Placement of fill, 31/10/12

Instalment of sediment fence, 2/11/12

Final bank shaping, 7/11/12

Placement of rock, 20/11/12

Final rock placement, 30/11/12

Placement of jute mesh, 13/12/12

Kedron Brook, Dawson Parade, Keperra

Placement of jute mesh, 13/12/12

Pocket planting of rock stabilisation

- The aesthetics and stability of rock-stabilised waterway banks can be **significantly** enhanced through the active promotion of plant establishment within the rock voids.
- The placement of jute mesh over revegetated **earth banks** can significantly increase the short-term stability of the bank.
- However, the placement of jute mesh over rock-stabilised banks is questionable.

Damage by high bank stream flow, 8/2/13

Flood damage, 2013

- Moderate creek flooding in early 2013 caused the total loss of the jute mesh from the creek bank.
- However, the jute mesh remained in the over-bank area where the mesh was able to be adequately pinned into the soil.

Removal of jute mesh, 8/2/13

Flood damage, 2013

- Some soil was lost from the rock voids; however, significant quantities of soil remain.
- The adverse outcomes produced by the loss of soil from the bank during floods are considered to be out-weighed by the potential benefits gained by actively promoting early plant establishment over the creek bank.

Establishment of vegetation (2014)

Year 2014

- Early stages of plant establishment in 2014.

Kedron Brook, Dawson Parade, Keperra

Looking upstream from Dawson Parade bridge (pre 1991)

Looking upstream from Dawson Parade bridge (2014)

Kedron Brook, Samford Rd, Ferny Hills, Qld

Location map (north to the top of image)

Aerial image of the site

Overbank area looking upstream

Site history

- Sometime around 2006 the creek and over-bank riparian zone was cleared of weeds by the local council.
- The cleared area was heavily mulched and lightly planted in a manner that left the creek bank vulnerable to flood damage.

Looking upstream (2008)

The problem

- In 2008 a storm event caused significant bank erosion along the area previously cleared of weeds.
- Adding to the erosion problem was the fact that the eroded bank had a southern aspect resulting in the bank being heavily shaded once a near-vertical bank was formed through the creek erosion.
- The eroding creek bank progressively moved north towards the now established over-bank trees.

Looking upstream (2014)

The project

- In 2014 the bank was stabilised with rock at the same time the creek was de-silted.
- Final bank shaping consisted of exposed rock stabilisation in the lower third of the bank, with a vegetated upper two-thirds batter.
- The upper bank was initially stabilised with jute mesh prior to the establishment of plants.

Kedron Brook, Samford Rd, Ferny Hills

Looking upstream, November 2008

Year 2008

- Bank erosion commenced during the 2008 micro-storm that severely damaged the nearby suburb of The Gap.
- The top-of-bank is just 1 metre from the base of the tree (visible in top-right of image).

Looking upstream, November 2010

November 2010

- A low-flow channel has now formed at the base of the northern bank.
- Top-of-bank has now moved past the base of the tree.

Looking upstream, September 2014

September 2014

- Rock stabilisation has occurred along the lower third of bank with the voids filled with soil ready for planting.
- The upper two-thirds of the bank will be stabilised with vegetation.
- Initial upper bank stabilisation consists of pegged jute mesh.

Looking upstream, December 2014

December 2014

- Plants established within the erosion control mesh.
- This site has already experienced a near bankful event since September with no significant damage.

Kedron Brook, Samford Rd, Ferny Hills

Looking upstream following removal of weeds from creek bank, November 2008

Looking upstream after bank rehabilitation, December 2014

Kedron Brook, upstream of Ferny Way, Ferny Hills, Qld

Location map (north to the top of image)

Aerial image of the site

Previous stormwater outlet (1997)

Site history

- Prior to 2004, a stormwater pipe from Olankuna Crescent discharged directly into Kedron Brook at the park.
- In 2004 a stormwater treatment wetland was constructed at this outlet.
- Over the period 2009 to 2011 the creek experienced several near-bankful flows that caused erosion along the embankment that separated the stormwater treatment wetland from Kedron Brook.

Construction of stormwater treatment wetland upstream of Ferny Way culvert (2004)

Stormwater treatment wetland with Kedron Brook in background (2014)

Kedron Brook, upstream of Ferny Way – the problem

Flood spill-through (11 Oct 2010)

The problem

- On the 11 October 2010, flood waters passing down Kedron Brook reached and held a height of 'bankful flow' for an extended period of time.
- Floodwaters spilt from the main Kedron Brook channel into the stormwater treatment wetland causing significant damage to the connecting embankment.
- Floods during 2009, 2010, and 2011 had also caused significant erosion along the northern bank of Kedron Brook just upstream (to right) of the wetland.

Over-bank spill-through on 11 October 2010 (Ferny Way culvert to left)

Kedron Brook looking downstream (2010)

Kedron Brook looking upstream (2010)

Bank erosion (28 January 2011)

Looking upstream (16 August 2010)

Kedron Brook, upstream of Ferny Way – the project

Post flood bank erosion (October, 2010)

The project

- As a result of the extensive bank damage caused during 2010 and 2011, the northern creek bank (the outside bank of a sweeping channel bend) was stabilised with rock as part of the emergency, post-2011 flood works.
- The bank was lined with rock, all voids filled with soil, covered with jute mesh, and pocket planted with natives.
- The chosen native plants have low woody branches, which will add bank roughness.

Re-construction of creek bank, January 2011 (Kedron Brook in background)

Looking downstream (January, 2011)

Looking upstream (January, 2011)

Looking downstream (June, 2011)

Looking upstream (June, 2011)

Kedron Brook, upstream of Ferny Way – plant establishment

Looking downstream (June, 2011)

Looking downstream (October, 2012)

Looking upstream (June, 2011)

Looking upstream (May, 2013)

Kedron Brook, upstream of Ferny Way, Ferny Hills

Looking u/s from Ferny Way culvert (1998)

Looking u/s from Ferny Way culvert (2001)

Looking u/s from Ferny Way (Nov, 2008)

Looking u/s from Ferny Way (Aug, 2010)

Looking u/s from Ferny Way (Oct, 2010)

Looking u/s from Ferny Way (Oct, 2010)

Looking u/s from Ferny Way (Nov, 2012)

Looking u/s from Ferny Way (Sept, 2014)

Kedron Brook, upstream of Ferny Way, Ferny Hills

Looking upstream from Ferny Way culvert (1998)

Looking upstream from Ferny Way culvert (2014)

Schulz Canal, Nundah, Qld

Location map (north to the top of image)

Aerial image of the site

Looking downstream (1996)

Site history

- Schulz Canal forms part of a major floodway diversion that directs floodwaters away from the Brisbane Airport precinct.
- This reach of Schulz Canal runs parallel to the Toombul Shopping Centre car park.
- The shaded northern bank (left) was subject to significant post-flood and post-king tide bank slumping.

Looking upstream (1996)

The natural solution

- The ‘natural’ solution to the bank slumping is the growth of mangroves, which can be observed growing naturally along the southern bank.
- The establishment of mangroves along both sides of the channel was initially resisted by the local creek maintenance team because they preferred to retain open access along the channel to allow ongoing de-silting activities.

Looking downstream (2014)

The project

- The creek banks were stabilised with rock as part of the Airport Tunnel construction project.
- Mangroves have already begun to establish within the rocks.

Schulz Canal, Nundah

Looking downstream towards the footbridge (1996)

Looking upstream (2001)

Year 2001

- Parts of the northern bank had been stabilised with rock.
- The best long-term solution would be to bench the bank and promote the establishment of mangroves.

Year 2010

- The channel was partially disturbed by the construction of the Airport Tunnel.

Year 2014

- Mangroves are beginning to establish within the rock-lined creek banks.

Looking upstream (2010)

Looking upstream (2014)

Looking downstream towards the footbridge (2014)

Stable Swamp Creek, Evenwood St, Coopers Plains, Qld

Location map (north to the top of image)

Aerial image of the site

Similar erosion u/s of works area (2000)

Site history

- Stable Swamp Creek has a long history of erosion control activities and major channel relocation and reconstruction projects.
- A significant proportion of the bank erosion problems exist within the shaded northern bank.

Looking upstream (2007)

The project

- At this site the eroding north bank is also the outside of a channel bend.
- The bank erosion was moving close to a bikeway and adjacent homes.
- The bank was stabilised with timber groynes, a channel alignment strategy.
- Open style timber fences are constructed in a manner that redirects channel flows away from the outer bank.
- Shrubs are then planted between the fences.

Looking upstream (2014)

Lessons

- The project is considered highly successful and the channel stability has allowed significant recovery of native plants.
- The timber fences are only temporary, and will eventually rot away.

Constructed Drainage Channels

Bowman Park, Bardon, Brisbane

Map location (north is to the right)

Aerial image showing vegetated channel

Bowman Park concept plan

Aerial image showing channel alignment

Original concrete drain (1998)

Rehabilitated drain (2000)

The proposal

- The original proposal for the ‘naturalisation’ of the concrete spoon drain was made by the local frog society.
- The proposal was based around the development of suitable frog habitats, with the aim of reducing frog mortality within the adjacent sports oval.
- The works were designed by Brisbane City Council and built in 2000.
- The estimated cost of construction in 2000 was just $170,000.

Site constraints

- The site benefited from the fact that it was a constructed drainage tributary to Ithaca Creek, and was not a formal part of the natural creek system.
- The drain also sat within a backwater region of the floodplain, and as such, the works did not increase local flood levels.
- However, the tributary was initially judged not to have sufficient trickle flows to maintain healthy water quality within the proposed pool-riffles system.

Bowman Park – before and after

Western tributary (1998)

Western tributary (2001)

Eastern tributary (1998)

Eastern tributary (2001)

Tributary junction (1998)

Tributary junction (2001)

Main channel (looking south, 1998)

Main channel (looking south, 2000)

Bowman Park – channel features

Pool-riffle system (2000)

Pool-riffle system

- In theory, pool-riffle systems should only be constructed within waterways that would normally contain such bed systems.
- The adjacent Ithaca Creek is a waterway that does contain natural pools and riffles.
- To maintain sufficient trickle flow through the pools, a clay lining was placed under the channel to minimise infiltration of stormwater runoff into the subsoil.
- The pool-riffle dimension were based on information gained from local waterways.

Anchored habitat logs (2000)

Roosting logs

- Several logs were anchored into the channel as habitat-enhancement to provide roosting for local wildlife, such as lizards.
- Such channel 'irregularities' can also provide shelter for aquatic life during high-velocity flood flows.
- The logs are placed in the channel such that they point downstream to minimise the risk of the log catching flood debris.

New footbridge (d/s of junction, 2000)

Public access

- Replacement of the grass and concrete-lined storm drain with a vegetated waterway meant that pedestrian access to the sports oval had to be enhanced.
- The rehabilitated park has become very popular with the local residents and children, as such, the pathways also provide valuable bikeways.

Stepping stone pathways (2008)

Stepping stones

- In a world of increasing public safety and risk assessment procedures, the days of constructing stepping stone crossings of waterways may quickly become a thing of the past.
- Fortunately, this channel rehabilitation project has incorporated numerous recreational features that can enhance a child's ability to access and explore the waterway.

Bowman Park – plant establishment

Main channel (looking south, 2000)

Year 2000

- Initial plant establishment within jute erosion and weed-control blankets.

Main channel (looking south, 2001)

Year 2001

- Fully open canopy.
- Channel enters initial ‘weedy’ phase.
- Pools are almost completely filled with invading reeds.

Main channel (looking south, 2005)

Year 2005

- Insufficient canopy cover still exists over the low-flow channel.
- Significant weed growth still exists within the channel.
- A dense cover of lower-storey native plants exists.

Main channel (looking south, 2010)

Year 2001

- Canopy has formed producing sufficient shade to thin plant density and allow the shading-out of weeds and the clearing of reeds from the pools.
- A pool is visible within the centre of the image.
- A riffle is also just visible in the foreground of the image.

Bowman Park – plant establishment

Looking u/s to footbridge (2000)

Looking u/s to footbridge (2008)

Looking down main channel (2000)

Looking down main channel (2008)

Stepping stones (2000)

Stepping stones (2008)

Pool-riffle system (2000)

Pool-riffle system (2008)

Bowman Park, Bardon, Brisbane

Original concrete drain looking upstream with sports oval to the right (1998)

Rehabilitated waterway looking upstream with sports oval to the right (2010)

Bulimba Creek, Logan Road, Upper Mt Gravatt, Qld

Looking upstream (1993)

Year 1993

- Creek channel was initially cleared and re-profiled as part of the Garden City Bus Depot construction.
- A non fish-friendly ‘drop inlet’ was formed at the inlet of the Logan Road culvert.

Looking upstream (1994)

Year 1994

- Channel revegetation as part of the bus depot development.

Looking upstream (2014)

Year 2014

- Fully established vegetation cover.

McCaskill Road, Pullenvale, Qld

Location map (north to the top of image)

Aerial image of the site

Looking downstream (January 2001)

Looking downstream (2014)

Looking upstream (August 2001)

Looking upstream (August 2014)

Looking upstream (August 2001)

Looking upstream (August 2014)

Sandy Creek, Enoggera, Qld

Location map (north to the top of image)

Aerial image of the site

Looking upstream from Magura St (1996)

Looking upstream from Magura St (1997)

Looking upstream from Wardel St (1997)

Site history

- Sandy Creek is a tributary of Kedron Brook with its source located within the training hills of Enoggera army barracks.
- The creek passes through the industrial precinct of Enoggera where motor vehicle parts and debris had been used to stabilise the eroding creek banks.
- Prior to the channel works, both the industrial area and upstream residential areas experience frequent flood inundation.

The project

- In 1997 the project consisted of:
  - new stormwater drainage pipe upstream of Pickering Street
  - enlarged earth channel between the Pickering St culvert and upstream end of the Pickering St industrial estate
  - a Q100-capacity concrete channel through the industrial estate joining an existing downstream concrete channel
  - a sediment trap and habitat pond between the old and new channels.

Natural channel design features

- Incorporated into the flood mitigation works was the significant (doubled in size) expansion of the open channel through the council parkland between the Pickering St culvert and upstream end of the Pickering St industrial estate.
- This project represented Brisbane City Council's first endeavour into the principles of *Natural Channel Design.*
- At was the case in 1997, the design was based on the principles of river morphology rather than creek engineering.

Sandy Creek, Enoggera – channel features

Log and sand bench (1997)

Habitat log and sand bench

- Two habitat (roosting) logs were anchored into the channel.
- These logs provide habitat and shelter (from flood flows) for aquatic wildlife, and sunning perches for reptiles.
- Washed sand was introduced to the inside of channel bends to mimic the channel feature commonly found in alluvial river systems (now viewed as inappropriate within urban creeks).

Maintenance access ramp (1997)

Maintenance access ramps

- Maintenance access ramps were installed into the channel both upstream and downstream of the Wardell Street culvert.
- These access ramps were formed from flexible geotextile/concrete mats (Humes *Flexmat*).
- Use of these mats allows vegetation (grasses) to grow between the concrete blocks to eventually hide the hard surfacing.

Grouted rock bed on concrete channel

Habitat pool and grouted rock roughness

- A deep sediment trap and habitat pool was established between the downstream end of the new concrete channel and the upstream end of the existing concrete channel, just upstream of the Magura Street footbridge.
- To enhance the environmental features of the concrete channel, rocks were grouted to the bed of the downstream end of the new concrete channel.
- The intent was to allow vegetation to establish over these rocks.

Tree planter boxes set into boulders

Planter cell in rock bank

- To help shade the habitat pool, tree planter boxes (concrete pipe segments) were installed in the boulder-lined southern bank of the creek adjacent the Magura Street footbridge.

Sandy Creek, Enoggera – plant establishment

Looking upstream from Wardell St (1997)

Year 1997, February

- Pre-planting site conditions.
- Jute erosion control blankets placed over exposed soil banks prior to planting.

Looking upstream from Wardell St (1997)

Year 1997, June

- Site conditions just after initial plant establishment.
- Heavy loose mulching of the upper banks and over-bank areas.
- Limited pocket planting within the rock voids.

Looking upstream from Wardell St (1998)

Year 1998, April

- Significant weed (grass) growth within the bank vegetation.
- Channel bed effectively remains free of significant weed (reed) growth.

Looking upstream from Wardell St (1999)

Year 1999, April

- Significant weed growth along the banks and on the channel bed.
- A low-flow channel is beginning to establish in the centre of the channel bed.

Sandy Creek, Enoggera – plant establishment

Looking upstream from Wardell St (2003)

Year 2003

- Upper-storey canopy trees are slowly beginning to shade the channel, but currently they are only controlling weeds on the banks.
- Dry-land grasses begin to invade the channel bed during the extended drought of 2000–2008.
- A well-defined low-flow channel still exists.

Looking upstream from Wardell St (2007)

Year 2007

- Riparian vegetation has thinned due to the past drought.
- Channel bed thick with weeds, mainly grasses.
- This image shows the channel just after a storm that caused the bed vegetation to fold in the direction of the flow.

Looking upstream from Wardell St (2011)

Year 2011

- Canopy trees are beginning to shade the channel bed and limit weed growth.
- The low-flow channel is now more pronounced.
- The original riffle rocks are now becoming exposed and forming a riffle.

Looking upstream from Wardell St (2014)

Year 2014

- The low-flow channel is well defined.
- Excessive sediment deposition is occurring on the inside of the channel bend, and this sediment is being stabilised by weeds.

Sandy Creek, Enoggera – plant establishment

Looking upstream Pickering St (1997)

Looking downstream Pickering St (1997)

Looking upstream Pickering St (2003)

Looking downstream Pickering St (1998)

Looking upstream Pickering St (2007)

Looking downstream Pickering St (1999)

Looking upstream Pickering St (2014)

Looking downstream Pickering St (2007)

Sandy Creek, Enoggera – plant establishment

Upstream of Wardell Street (1997)

Looking downstream Wardell St (1997)

Upstream of Wardell Street (2003)

Looking downstream Wardell St (1997)

Upstream of Wardell Street (2007)

Looking downstream Wardell St (2003)

Upstream of Wardell Street (2011)

Looking downstream Wardell St (2011)

Sandy Creek, Enoggera – sediment trap and habitat pond

Looking upstream Magura St (1998)

Year 1998

- A habitat pool was established between the downstream end of the new concrete channel and the upstream end of the existing concrete channel.
- This habitat pond also acted as a sediment trap for the upper drainage catchment.

Looking upstream Magura St (1999)

Year 1999

- The rising bed level of the pond (due to sediment deposition) is allowing reeds to establish adjacent to the boulder wall.

Looking upstream Magura St (2011)

Year 2011

- Significant sediment deposition has occurred within the habitat pond.

Looking upstream Magura St (2014)

Year 2014

- The habitat pond is now near-full of sediment resulting in the establishment of reeds and grasses across the full width of the pond.

Sandy Creek, Enoggera – habitat pond bank planting

Tree planter boxes (1997)

Year 1997

- Tree planter boxes consisting of concrete pipe segments were installed in the boulder-lined southern bank of the creek to help shade the habitat pool.

Looking upstream Magura St (2003)

Year 2003

- Canopy trees just beginning to appear above the weed-infested rock bank.

Looking upstream Magura St (2011)

Year 2011

- Substantial tree growth.

Looking upstream Magura St (2014)

Year 2014

- Limited shading is being provided over the habitat pond because sediment deposition has limited the extent (width) of the pond.

Sandy Creek, Enoggera – channel bed modifications

Looking d/s to Magura St footbridge

Year 1997

- At the request of a business located adjacent to the channel, 'ecological features' were designed into the concrete channel.
- These 'experimental' features included rocks being grouted to the channel floor.
- The intent was for vegetation to establish over these rocks to help establish a more-natural channel bed ecosystem.

Looking upstream (1999)

Year 1999

- Sediment has settled between the rocks and plants are now beginning to establish on the channel bed.
- A low-flow channel has formed through the planted rocks.

Looking upstream from footbridge (2011)

Year 2011

- Plants and an associated ecosystem have established on the bed of the grouted, rock-lined, concrete channel bed.
- The habitat pond is still visible in the foreground.

Looking upstream from footbridge (2014)

Year 1999

- Woody species (*Melaleuca*) are now becoming established within the rock-lined concrete channel.
- The growth of such woody species in the concrete channel would not be desirable from a flood control perspective, as well as there is the risk that the roots could dislodge the grouted rocks, which could result in all the plants being dislodged during the next flood.

Sandy Creek, Enoggera – upstream of Wardell Street

Looking upstream from Wardell Street culvert (1997)

Looking upstream from Wardell Street culvert (2014)

Sandy Creek, Enoggera – downstream of Wardell Street

Looking downstream from the Wardell Street off ramp (1997)

Looking downstream from the Wardell Street off ramp (2014)

Settlement Road, The Gap, Qld

Location map (north to the top of image)

Aerial image of the site

Constructed drainage channel

Modified creek channel u/s of Tilquin St

Existing creek upstream of the site (2012)

The site

- The site is located adjacent to Settlement Road, The Gap; between Kilbowie Street and Tilquin Street.
- The site is a new subdivision involving both drainage channel construction and creek engineering.

The project

- The project involved:
  - constructing a vegetated drainage channel in a location where no creek or concentrated flow path previously existed, and
  - modifying an existing creek channel upstream of Tilquin Street into which the constructed drainage channel discharges.
- This type of project is closely aligned with the principles of *Natural Channel Design*.

Existing (pre-2012) creek conditions

- The creek that passes through the subdivision is relatively steep.
- Prior to the modifications made during construction of the residential subdivision, the creek contained significant weed infestation and was subject to some ongoing bed and bank erosion.
- The developer was required to stabilise the creek and replace weeds with native plants.
- The site will be further monitored over the nest few years.

Settlement Road, The Gap

Looking d/s from Settlement Rd (2012)

Looking d/s from Settlement Rd (2012)

Looking downstream (February 2013)


Looking downstream (May 2013)

Looking d/s from Settlement Rd (2014)

Looking d/s from Settlement Rd (2014)

Looking d/s from Settlement Rd (2014)

Looking d/s from Settlement Rd (2014)

Settlement Road, The Gap

Looking upstream (2012)

Looking d/s to Tilquin St (2012)

Looking upstream (February 2013)

Looking d/s to Tilquin St (February 2013)

Looking upstream (May 2013)

Looking d/s to Tilquin St (May 2013)

Looking upstream (2014)

Looking d/s to Tilquin St (2014)

Sinnamon Road, Sinnamon Park, Qld

Location map (north to the top of image)

Aerial image of the site

Looking d/s from Sinnamon Rd (2000)

Looking d/s from Sinnamon Rd (2014)

Looking downstream to footbridge (2000)

Looking downstream to footbridge (2014)

Looking u/s towards s/w inflow (2000)

Looking u/s towards s/w inflow (2014)

Sinnamon Road, Sinnamon Park

Constructed waterway looking downstream from the Sinnamon Road culvert (2000)

Looking downstream from Sinnamon Road culvert (2014)

Stable Swamp Creek, Gay Street, Coopers Plains, Qld

Location map (north to the top of image)

Aerial image of the site

Looking upstream from drop structure

Looking downstream from culvert (2000)

Looking downstream from culvert (2014)

The project

- The primary objective of this project was a major relocation of the waterway to allow improved traffic conditions at a complex trail–road intersection, and to allow the construction of an industrial development.
- The channel relocation consisted of the formation of a grass-lined trapezoidal channel with two rock-lined drop structures.
- Upstream of the upper most drop structure (left) was an early Natural Channel Design project.

Upper reach channel works

- The channel works were constructed in 1999.
- Between the upper most drop structure (adjacent Gay St) and the Beenleigh Road culvert, a section of channel was formed that contained a meandering low-flow channel.
- This was one of the first examples of a meandering low-flow channel formed in a constructed waterway within Brisbane.

Lesson gained from this project

- As woody vegetation slowly established on either side of the low-flow channel, the hydraulic stresses placed on the low-flow channel during flood events increased.
- As a result of this increased shear stress, the low-flow channel suffered significant erosion problems until thick non-woody vegetation began to dominate along the banks of the low-flow channel.

Stable Swamp Creek, Gay Street, Coopers Plains

Looking downstream (2000)

Looking upstream (2001)

Looking downstream (2007)

Looking upstream (2007)

Looking d/s from drop structure (2010)

Looking upstream (2010)

Looking downstream (2014)

Looking upstream (2014)

Stable Swamp Creek, Gay Street, Coopers Plains

Looking downstream from Beenleigh Road (2000)

Looking downstream from Beenleigh Road (2014)

Stable Swamp Creek, Gay Street, Coopers Plains

Looking upstream from the Gay Street drop structure (2001)

Looking upstream from the Gay Street drop structure (2014)

Problematic Drainage Channels

The following examples of drainage channel design typically represent the style of constructed stormwater drainage systems accepted by Brisbane City Council in the 1980s and 1990s.

It would be wrong to simply judge these case studies as examples of ‘poor engineering’ because at the time of their construction they represented the style of drainage channel design typically built in and around Brisbane.

The following examples, however, do demonstrate poor aesthetic and ecological outcomes compared with today’s drainage systems that have largely been based on the principles of *Natural Channel Design* and *Water Sensitive Urban Design*.

These drainage channel design case studies have been provided solely to demonstrate some of the operational problems that can be experienced with such drainage channel designs, and how the aesthetics of these channels can change over time with increasing plant growth.

Glenferrie Place, The Gap, Qld

Location map (north to the top of image)

Aerial image of the site

Original landscaping (1995)

Damage to landscaping by storm (1996)

Looking downstream (1997)

The site

- The site consists of a steep overland flow path that discharges stormwater runoff from a drainage catchment that originates within Mount Coot-tha Park.
- The design of the drainage channel, which has a relatively steep gradient, was based on achieving slow, non-erosive flow velocity through the development of heavy vegetation cover either side of a low-flow channel.

The problem

- The basis problem was that it would take several years to achieve the required vegetation cover (channel roughness).
- In the mean time, excessive flow velocities caused gully erosion (head-cut) to migrate up through the channel.
- The early stages of this gully erosion can be seen here passing up the invert of the channel.

Channel stabilisation

- In 1997 the site was taken over by Brisbane City Council and a series of recessed rock check dams were installed across the steep overland flow path.
- The recessed check dams extend well into the banks; however, in this image they are only visible as they pass across the low-flow channel.
- The outer edges of the channel were planted with trees and shrubs, but most of these plants were lost through aggressive maintenance mowing.

Glenferrie Place, The Gap

Looking downstream from culvert (1997)

Looking upstream (1997)

Looking downstream from culvert (1998)

Looking upstream (1998)

Looking downstream from culvert (2001)

Looking upstream (2001)

Looking downstream from culvert (2014)

Looking upstream (2014)

Cooper Place, Carseldine, Qld

Location map (north to the top of image)

Aerial image of the site

Looking upstream from Gympie Rd (1995)

Looking upstream from Gympie Rd (1997)

Looking upstream from Gympie Rd (2014)

Site history

- This site consists of replacing a small natural creek with a partially vegetated drainage channel design to convey the estimated 1 in 100 year flow.
- The drainage channel passes around an industrial estate located on Gympie Road.
- At the time of construction, it was a requirement of the council that constructed drainage channels must incorporate a concrete low flow channel, but also have vegetated banks.

The problem

- The problem is that such drainage channels require regular maintenance mowing by the council, and the cost of this regular maintenance is considered an undesirable public expenditure.
- Without regular mowing, reeds and long grasses formed along the base of the channel.
- Also, during the summer ‘wet-season’ the channel base becomes saturated and impossible to mow.

Long-term outcome.

- The preferred long-term outcome would be to remove the concrete invert and establish a ‘natural’ low-flow channel.
- However, the main problem with such an outcome would be that the drainage channel would no longer be able of carrying the required 1 in 100 year design flow.
- Such example of undesirable outcomes are typical as councils transition from traditional drainage systems to systems based on Natural Channel Design.

Kameruka Street, Calamvale, Qld

Location map (north to the top of image)

Aerial image of the site

Looking u/s from Kameruka St (1993)

Year 1993

- This constructed stormwater channel is located within a 1990s residential subdivision.
- The channel was lined with rock-filled mattresses to cater for the expected high flow velocities.
- This type of drainage channel is highly susceptible to weed and reed infestation.
- The existence of the wire mattresses prevents normal channel maintenance and the easy removal of the weeds.

Looking u/s from Kameruka St (1994)

Year 1994

- Weed control along the channel is required to maintain the drainage channel's required flow capacity.
- Initially herbicides were used to knockdown the weeds and reeds.

Looking u/s from Kameruka St (2014)

Year 2014

- Establishment of a partial canopy cover over the channel, and the resulting shading of the channel, has reduced the density of the in-channel weeds.
- Limited vegetation establishment has occurred on the mattress-lined channel banks, possibly as a result of the maintenance control of weeds.
- In the long-term, appropriate ground covers will need to be established over all the rock-filled mattresses.