# Attachment 2

# ITEM 12.2

# Appendix - Citizens' Advisory Panel and Association Streams Report

UNDER SEPARATE COVER

# Appendix 1

**REDLAND CITY COUNCIL CANAL AND LAKE ENGAGEMENT – Stakeholder Solution Submissions**

**ORGANISATION:**

**ORGANISATION CONTACT:**

**CONTACT PHONE NUMBER:**

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*What is your proposed solution for the funding and maintenance of Redland's Canal and Lakes?*

*Does your solution relate to the canals and waterways, to the revetment walls or to both?*

*How would your solution be applied?*

*What would the impact of your solution be on different groups within the Redlands community – i.e. ratepayers in different areas of the city, council, business owners, transport operators etc.*

*What is the rationale or principles used in drafting this solution.*

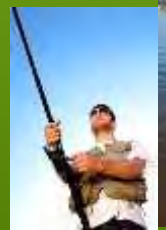
# Appendix 2

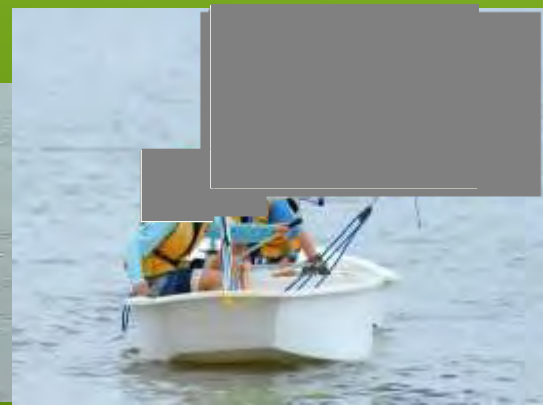
# REDLAND CITY COUNCIL
# CANAL AND LAKE ENGAGEMENT

## SOVEREIGN WATERS ESTATE
## STAKEHOLDER SOLUTION SUBMISSION

10 February 2018

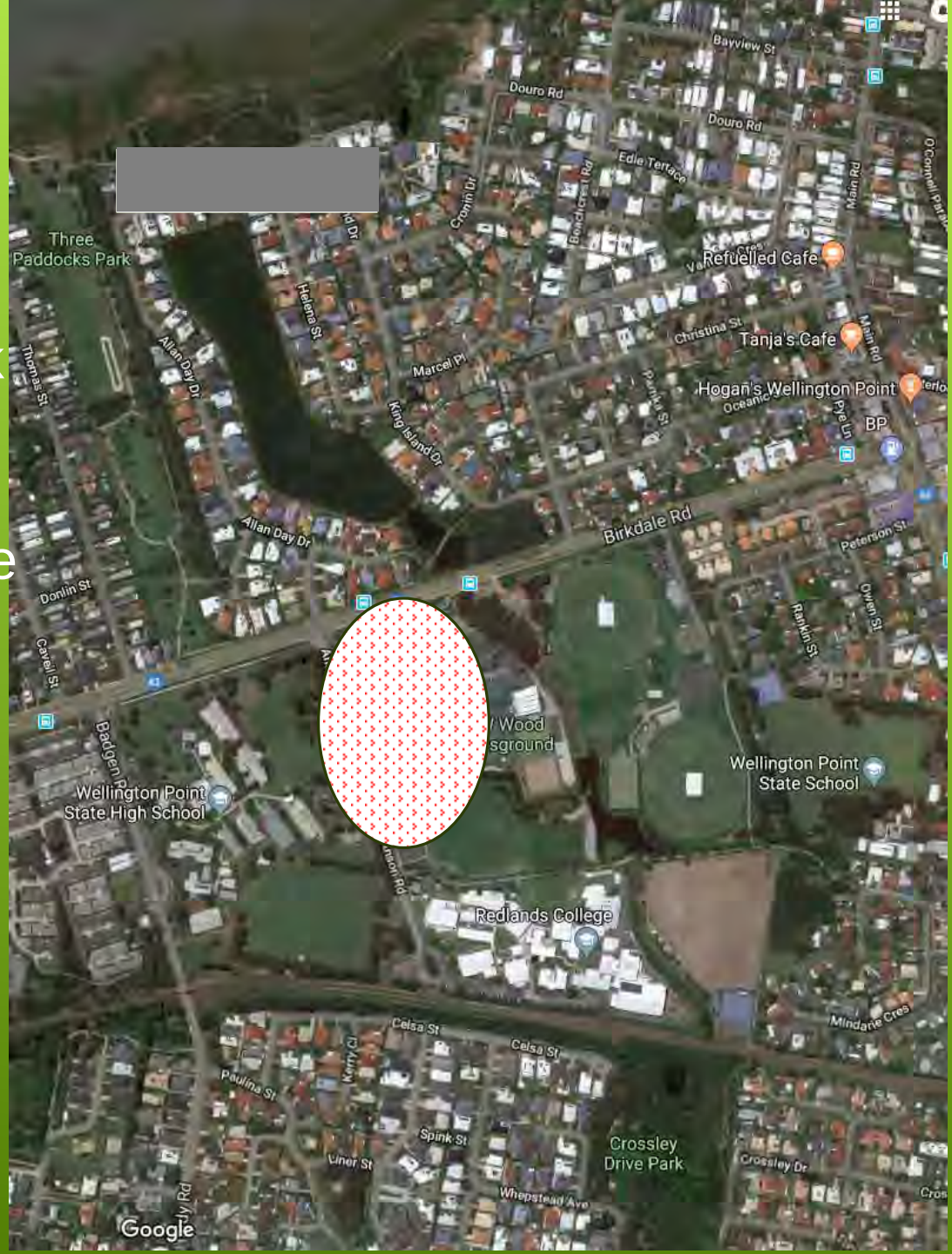
Version: 6




Beth Boyd Park
John St
Thorneside Rd
Queens Esplanade
Aquatic Paradise Park West
Thorneside
William Taylor Memorial Sportsground
Mary Pleasant Dr
Tarradarrapin Creek
Hogan's Wellington Point
Wellington Point
EGW Wood Sportsground
Wellington Point State School
Wellington Point State High School
Barry Rd
Redlands College
Birkdale
Birkdale station
Tarradarrapin Creek
Hardy Rd
Crossley Drive Park
Wellington Point station
Collingwood Rd
Collingwood Rd
Marlborough Rd
Marlborough Rd
Duncan St
Tarradarrapin Cr
Pitt Rd
Sunnybay Drive Park
Nelson Rd
3D

**Today's sediment and** pollutant problem is enhanced due to lack of maintenance in the park land and conservation foreshore area by Council. The Council volunteer Bushcare team has continually requested maintenance in this area to no avail.




Indicates:
Flow of water and sediments and pollutants during heavy rains

Indicates:
Leaves and debri has been allowed to build up, inhibiting the flood waters to reach the bay as designed by BMD in 2000

Indicates:
Anson Rd and Cricket oval flooding

# Lake Attributes

Location

- Wellington Point, Queensland

Developer

- BMD/Wellington Point Developments

Commencement Date

- August 1998

Completion Date

- August 2000

Contract Value

- $6.9 million

169 Blocks

- 55 wet blocks

"I was there toasting champagne with the mayor when the lake inlet valve was opened for the first time."

# Agenda

- About Me
- Introduction
- Lake Attributes
- Who Benefits?
- Who Pays?
- Asset Management Guidelines
- How is the Lake Managed?
- Is this Equitable?
- Recommendations
- Conclusion
- Related Issues

# Introduction

- There should be no Special Charges Levy
  - Mud
  - Money
  - Mitigation
  - Management
  - Many Non Resident Users

# Mud

- It is not our mud!
- The 2013 Report showed the mud & sediment was mainly from upstream with some coming from the bay. Why are residents paying for someone else's mud to be removed?
- BMD planned for the lake to be dredged in 2008. The study in 2013 analysed that dredging is not required until after 2050, why is a Special Charges levy still required?
- Up stream water is contaminated, what is Council doing about that, why should Sovereign residents pay for that?
- Why is lake water quality monitored so regularly? Is Council concerned about these up stream contaminants?
- Tarradarrapin Creek is known to have leachate leakage from the waste transfer station and land fill site. In heavy rains this flows through to the lake.
- Up stream water come through Redlands tip and previous industrial area that was known by locals at the back of Redland College to car battery acid and lead contaminants, why are Sovereign residents paying for this?
- Sediment in the Bay is a general problem for all Waterloo bayside residents, this should be a State EPA matter, not Sovereign Lake residents cost.


ROAD
CLOSED
NO
ENTRY
DUE TO FLOODING


ROAD
CLOSED
NO
ENTRY
DUE TO FLOODING


ROAD
CLOSED
NO
ENTRY
DUE TO FLOODING

# Community Bushcare

## Sovereign Bushcare Group

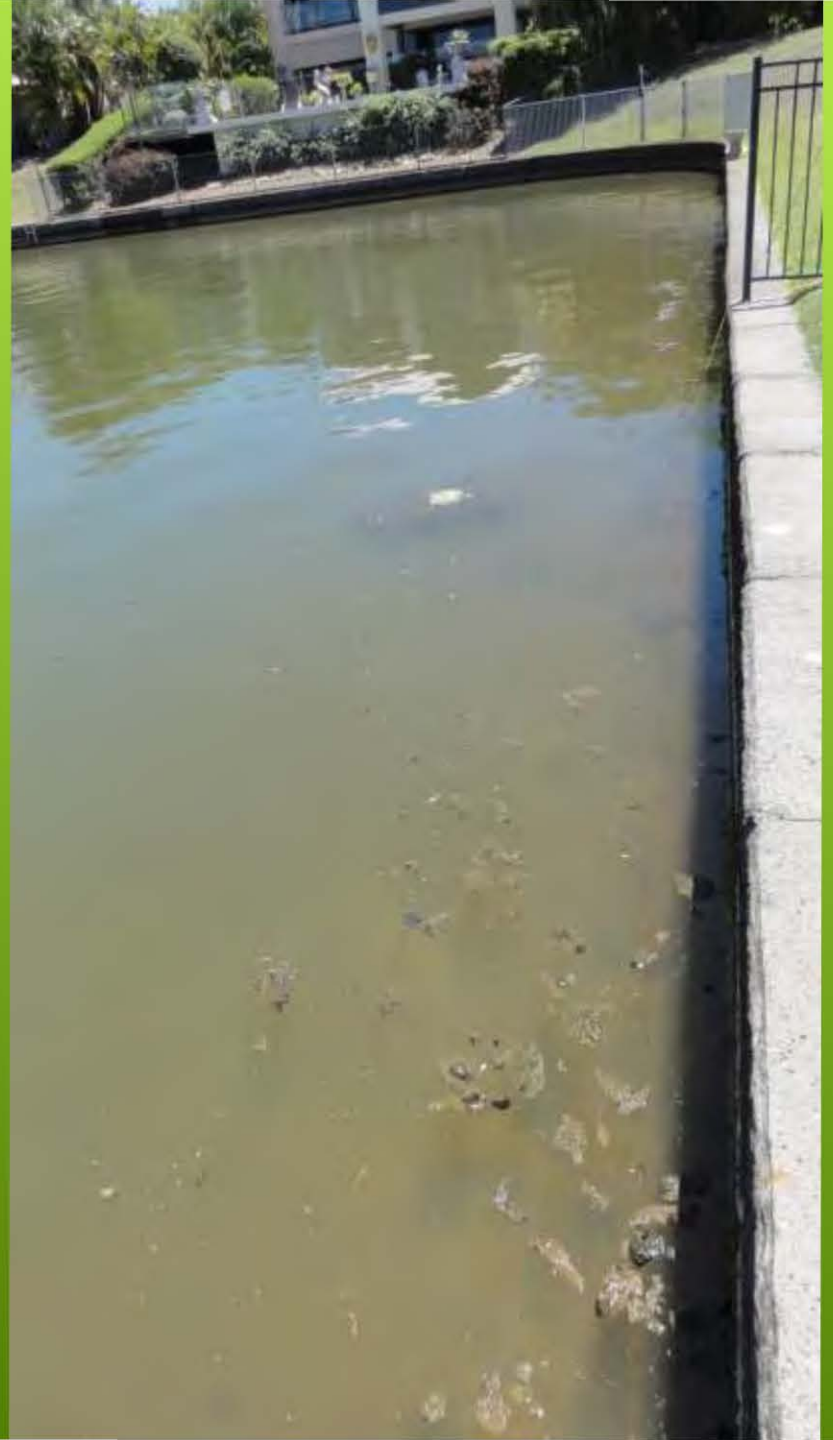
Coastal vegetation is important for bank protection and provides important wildlife habitat. This site is an important foreshore wildlife corridor. The Sovereign Bushcare Group is working to conserve the natural and aesthetic significance of this site.

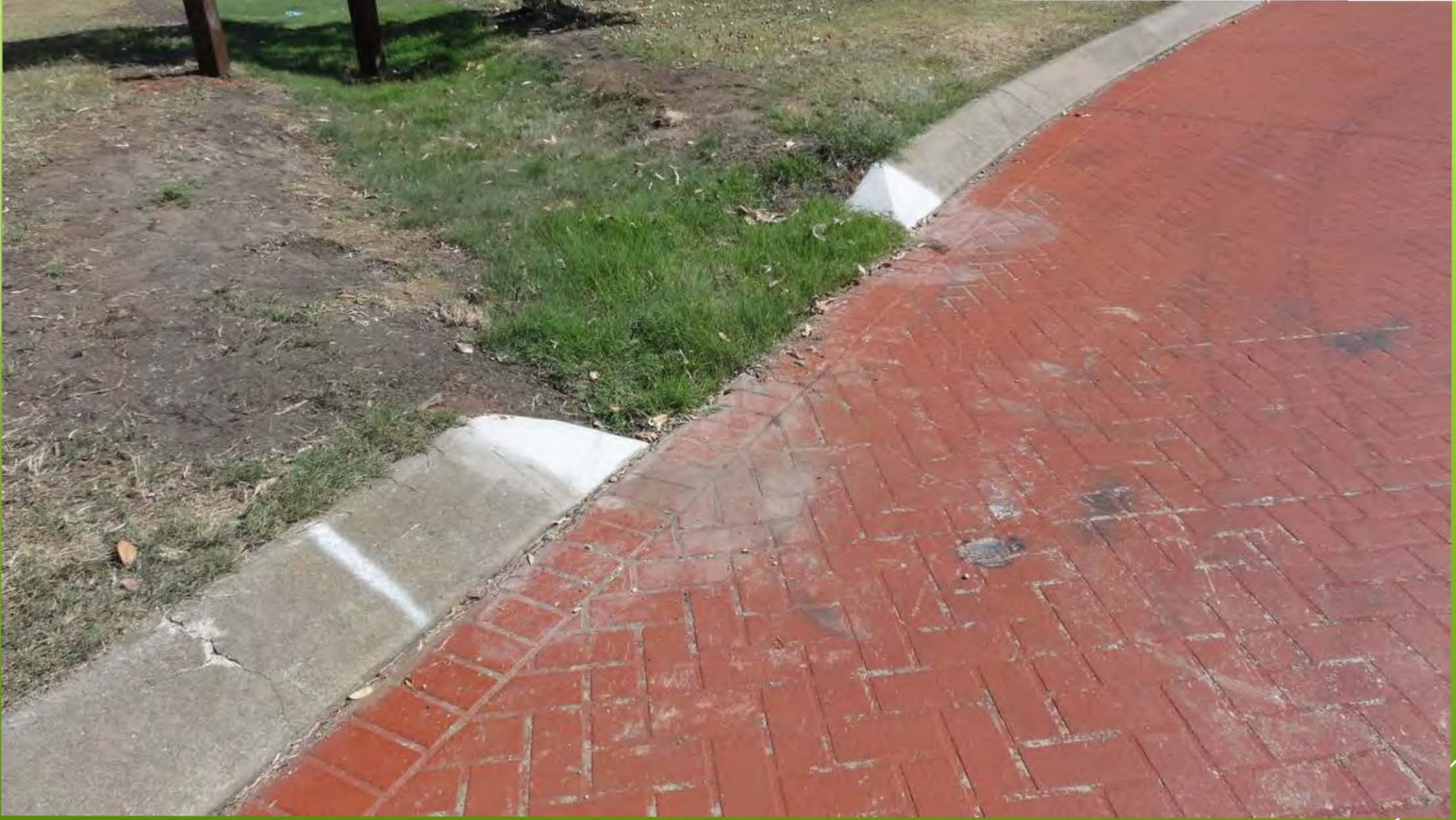
Volunteers meet once a month for around two hours to participate in activities such as tree planting, weed removal and rubbish collection.

For more information, contact the Redlands IndigiScapes Centre on 3824 8611 or visit the IndigiScapes website at www.indigiscapes.com.au.

Whistling kite

Redland CITY COUNCIL






Sovereign Waters Lake
Secondary Contact Recreation Lake
Suggested Activities
Warnings
www.redland.qld.gov.au
RAMP MAY BE SLIPPERY


Sovereign Waters Lake
This lake is a Secondary Contact Recreation Lake
What does this mean?
Suggested Activities
Warnings
www.redland.qld.gov.au
Redland
RAMP MAY BE SLIPPERY

# Many Non Resident Users

- Why should 55 wet block residents pay a Special Levy when there are many non-residents using the lake annually?

- Paddle boarders
- Fishing - individuals/families/groups/clubs
- Swimmers
- Model sail boat groups
- Scuba divers
- Surf skiers/ canoeists
- Triathletes

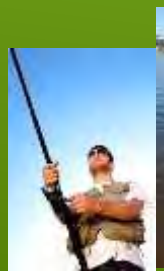
- Dog swimmers
- Sailors
- Nature lovers (pelicans/black swans/ducks/fish/cra
- Picnickers
- Xmas celebrations
- Wedding parties
- Thieves & thugs

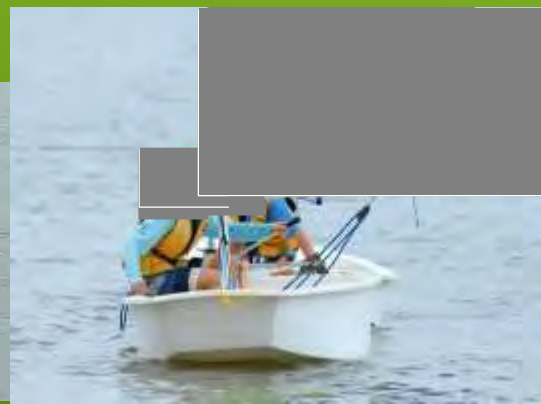
# REDLAND CITY COUNCIL
# CANAL AND LAKE ENGAGEMENT

SOVEREIGN WATERS ESTATE

STAKEHOLDER SOLUTION SUBMISSION

# QUESTIONS



# Money

- Council has made NO capital investment – all covered by developer
- Residents have already paid infrastructure charges when buying the block
- Using differential rating system residents are payer higher rates to cover ongoing maintenance
- Any increase in the general rate percentage will also mean that we will contribute more dollars of the increase than most other residents
- Why are residents funding sediment removal and wetland rehabilitation? The damage is caused by up stream water damage during heavy rains not the lake.
- Why should residents pay for water monitoring of up stream contaminants and bay sediments
- What is Council's justification for Sovereign Lake Special Charges. What have other Councils done around Queensland?
- Southern Moreton Island having $14m spent out of General Rates, also a $3.2m car park built on main-land out of General Rates – why no Special Charges?
- Residents given no transparency (canal developments receive quarterly reports)
- Maintenance costs appear over charged ($480 for 20 minutes for ramp cleaning!). This should be investigated.
- The cost of the general maintenance appears not "value for money"
- Triathlete clubs pay big fees at Raby Bay, why not at Sovereign Lake?

# Mitigation

- Sovereign Lake resolves previous low lying flood issues for the Council at the developer and residents cost
- Sovereign Lake with water treatment and catchment management mitigates bay contamination, bay sedimentation and flood run-off
- Every time there is heavy rain, sediment flows through the lake out to the Bay, the colour of the water clearly shows the up stream sediments flowing through.

# Management

- Council has not been transparent in providing Asset Management Plans, 5 year forecasting, annual budgets, maintenance schedules annual expenditures to residents
- If Council does produce reports why have these not been more openly shared?
- There is no residents group, residents did not expect one was necessary
- Wellington Point Local Councillors have not shared Raby Bay and Aquatic action groups, nor encouraged a local group, information has been at best adhoc.
- Recently Council is presenting complex reporting via the website, refunds to residents but not explaining why all unused funding have not been returned), even retired accountants could understand the complex reports.
- Council appears to be intentionally keeping Raby Bay, Sovereign and Aquatic residents apart and discouraging openness and collaboration

# Lake Attributes

- BMD provided RCC with a superior design that reduced anticipated maintenance costs.
- Situated on the shores of Moreton Bay, Sovereign Waters borders wetlands that are protected by international treaties and visited by many.
- 42,000m2 saltwater lake, which at the time of construction was the largest of its kind in Brisbane.
- Potential environmental impacts were managed through a number of environmental initiatives including
  - maintenance of vegetated buffer zones
  - water quality monitoring
  - monitoring and staging of earthworks and drainage to ensure controlled water run-off.
  - BMD handed over all plans to RCC (where are they now?)_

# Lake Attributes

- 169 lot estate featuring excavation of 120,000m3 of material forming the lake featuring;
- Construction of 1,000m of precast concrete revetment wall owned by residents around lake;
- Installation of five major underground gross pollutant traps;
- Construction of storm water drainage control to provide saltwater recirculation throughout the lake;
- Internal roadworks, drainage, water supply and sewerage; and
- External roadworks providing a four lane carriageway past the estate entry.
- A superior design of the lake system that reduces anticipated high maintenance costs associated with the approved design under the DA application. The design ensures the lake is flushed daily by incoming tides, resulting in a 23 day turnover of water.
- The artificial wetlands, which includes
  - Two large ponds of approximately 2,000m2 each, provides water quality polishing of the upstream catchment runoff.
  - The lake is in full compliance with the stringent EPA and Redlands Shire Council environmental regulations.

# Who Benefits?

- Those who have access to the lake
- Those who have a view of the lake
- Commercial operators who rely on the lake (paddle boarders, sailing clubs, swimming clubs, fishing clubs, triathlete teams, model sailing boat clubs)
- Cyclists, runners who meet and rest by the lake shore
- Retail and Hospitality near the lake (Redlands Sporting Club)
- Retail and Hospitality in Wellington Point Village
- All ratepayers in the Redlands
- Non-ratepayers and tourists who visit and use the lake

# Who Benefits?

- Paddle boarders
- Fishing - individuals/families/groups/clubs
- Swimmers
- Model sail boat group
- Scuba divers
- Surf skiers/ canoeists
- Triathletes
- Dog swimmers
- Sailers
- Nature lovers (pelicans/black swans/ducks/fish/crabs)
- Picnickers
- Xmas celebrations
- Wedding parties
- Thieves & thugs

# Asset Management Guidelines*

- Transparent and effective processes, and decision-making in the public interest; and
- Sustainable development and management of assets and infrastructure, and delivery of effective services; and
- Democratic representation, social inclusion and meaningful community engagement; and
- Good governance of, and by, local government; and
- Ethical and legal behaviour of councillors and local government employees
- Funds raised by Special Charge must be spent on the works/services/infrastructure that the levy is raised for – and before making the levy, the Council must have passed a resolution adopting a plan of works and a plan of the benefitting area, the estimated cost of the works and timeframe for doing the works.

- * As presented by Mark Leyland, LGAQ

# How is the Asset Managed?

Currently no transparency of:

- Corporate Plan – 5 year plan
- Operational Plan – 1 year plan
- Budget – 1 year plan to make funds available necessary to implement the Operational Plan
- Maintenance excessively priced
- 10 year Financial Plan/ Forecast – a sophisticated model of finances ensuring today's decisions do not impact future financial sustainability
- Asset Management Plan – a sophisticated record and management tool for the substantial , valuable and extensive assets under Council's control – used to ensure Council plans for replacement at the right time.

# Is this equitable?

- Rumours Council wants to reduce their contribution
- No bench marking with other lake estates
- How much has been paid?
- How much has been spent?
- What was it spent on?
- What are the 1, 5, 10, longer term plans and finances?
- What is fair for lake residents to pay?
- Findings show lake drainage not 2008, now 2050, what is the impact on finances?
- Recent Special Charges refund ($110) and attached report was incomprehensible
  - Retired accountants , real estate agents, residents could not make heads or tails of the poorly presented report
    - Is this legal?
    - Was there a coverup?
    - Was this intentional?
    - Was this incompetence?
    - Was this just lack of care, lack of responsibility or lack of operational expertise and professionalism?
    - Is this now "butt covering" given what is reaching the media?

EITHER WAY - IT IS NOT EQUITABLE !

# Recommendations

- Uncover, re-register and use the plans and documentation given to Council by BMD. After 5/6 years of BMD maintenance, BMD handed over maintenance to Council and the area went downhill from there.
- Carryout maintenance as per BMD handover documentation.
- Ensure property drainage is as per origi9nal DA approval. - House storm water drainage used for our building application not used for neighbouring applications, Council had no awareness of these drains – ensure designed drainage is used as approved in Lake DA application.
- Provide regular and accurate finance statements to residents:
  - Corporate Plan – 5 year plan
  - Operational Plan – 1 year plan
  - Budget – 1 year plan to make funds available necessary to implement the Operational Plan
  - 10 year Financial Plan/ Forecast – a sophisticated model of finances ensuring today's decisions do not impact future financial sustainability
  - Asset Management Plan
  - Local Councillor to initiate and present on a quarterly basis to residents

# Recommendations

- Provide transparent Special Charges – Lake Levy Expenditure Reports
- "Bank credit card style statement: of:
  - Budget
    - What residents have paid
    - What Council has paid
    - What has been spent
    - What is remaining
  - Asset Management
    - What has been achieved for the financial year
    - What is planned for the next financial year
    - What is planned in coming years
    - Emerging risks, issues, items of interest

# Recommendations

1. Engineering re-assessment of the lake maintenance requirements and funding model, this should be included in a sophisticated and detailed Asset Management Plan for the lake and shared with residents.
2. Benchmarking with similar lakes throughout Australia
3. Investigation of Alternative Funding Approaches
4. Consideration of Special Charges removal – pay out of General Rates
5. Property owners pay for upkeep of their own revetment wall
6. Variation of Existing Arrangement, but one which is based on fair and equitable contributions from ALL who benefit. Council to contribute more due to non-residents benefiting, lake residents to contribute less.
7. Handover to another body (State Government)
   - For example, the Gold Coast Waterways Authority, which is State Government funded, properly staffed and equipped to effectively manage public waterways.*

- * As presented by [redacted] Raby Bay Quays Body Corporate Committee

# Recommendations (cont)

1. Determine ongoing lake maintenance requirements, given recent report suggesting 2050 as a time for lake drainage and replenishment.
2. Notify all residents of what maintenance work is carried out each year.
3. Confirm in writing with residents ownership of lake revetment wall and maintenance expectations and plans.
4. Ensure up stream water catchments meet all environmental regulations
5. Develop and communicate routine maintenance plans for up stream water catchments
6. Re-establish the flood path levels for the northern floodway to ensure the regular flooding of Allan Day Drive does not occur as this is a life threatening risk for Council as children play in the flood waters competing with fast travelling vehicles. The [redacted] has made numerous recommendations to resolve this issue.

# Conclusion

- The report in 2013 determined that the lake does not require dredging in 2008 and most likely beyond 2050. This in itself is sufficient to remove the Special Charges/Levy. (Please note the upstream sediments must be stopped).
- Council and residents strongly benefit from Sovereign Lake being built
  - Direct benefits from the construction of Sovereign Lake including additional high rates
  - Indirect benefits of Sovereign Lake include providing significant flood mitigation for the area. There is a huge amount of "contaminated up stream" water feeding into our lake. This must be stopped.
  - Indirect benefits also come from the thousands of non residents using the lake recreationally. In principle, user pays suggests non-residents should be paying each time they use the lake!
- Residents put up with a lot on non residential use:
  - Fishing after dark/ before light
  - Rubbish left in the area
  - Strangers peering into homes at very close proximity

## Conclusion

- The silt coming into the lake is from up stream or from the Bay. Either way, it is not our mud we should not bear the cost to monitor or remove the mud.
- Council should remove the Special Charges/Levy
- Council should
  - Not try to "pit rich versus poor"
  - Reduce costs by removing the Sovereign Lake Special Charges/Levy
  - Be transparent, develop and communicate a lake Asset Management
  - Communicate quarterly expenditure to residents
  - Fund the lake water quality monitoring as it is monitoring upstream contaminants
- Council should provide rubbish bins in public parks
- Council should close the adjacent parks during dark to improve security and safety

# Related Issues

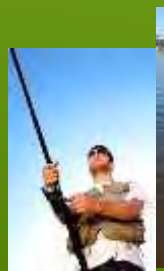
- For many years, residents have complained about lack of professional maintenance of the Sovereign Waters Estate
  - Reserves/park lands have not been mown as per contracts
  - Wetlands are not maintained causing visual and environmental issues AND continual flooding during rain events
  - Conservation areas are not maintained and are security risks
  - Weed eradication contractors sit in the shade and play on their smartphones
  - Requests for extra rubbish bin falls on deaf ears
  - Allan Day Drive floods regularly now due to increase of vegetation debris in conservation area
  - Child safety is at risk as Council refuses to correct regular Allan Day Drive flood issues
  - Residents forced to formulate the Sovereign Bushcare group (in its 8-9th year) to perform Council's maintenance work which was not getting done
  - Residents putting personal rubbish bins in public area to minimise rubbish and then being told by Council to remove them (a current unresolved issue that should have been resolved weeks ago)
  - Council destroying high side of road kerb in an attempt to reduce flooding!
  - Council not following up resident complaints

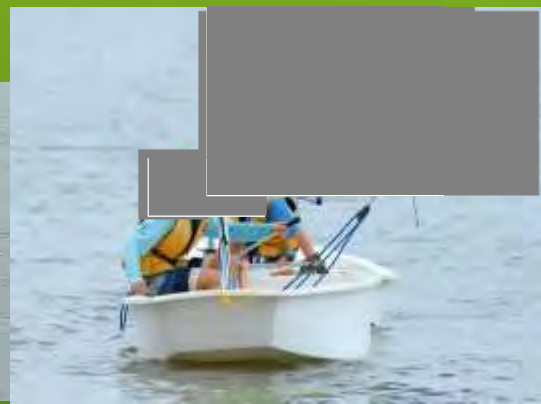
# REDLAND CITY COUNCIL CANAL AND LAKE ENGAGEMENT

SOVEREIGN WATERS ESTATE

STAKEHOLDER SOLUTION SUBMISSION

# QUESTIONS



Council received approval to include the Aquatic Paradise Residents' Association presentation in the consulation report via email on 25 May 2018.

# AQUATIC PARADISE RESIDENTS' ASSOCIATION Inc

"WITHOUT PREJUDICE TO OUR LEGAL RIGHTS"

# FLOODING LOWLANDS

# to

# AQUATIC PARADISE

10th February 2018

Our Presentation will show

# THE DECISION TO DEVELOP AQUATIC PARADISE IS ONE OF THE BEST MADE BY REDLANDS SHIRE

WE WILL GIVE YOU THE INFORMATION TO UNDERSTAND THIS AND DEVELOP THE BUSINESS CASE

# WE WILL :

- EXPLAIN BIG PICTURE
- CORRECT RCC $ MISTAKES
- PROVIDE $$$ NEEDED FOR YOU TO DO THE BUSINESS CASE
- PROVIDE THE HISTORY – PATRICK
- SUGGEST WAYS FORWARD
- ANSWER QUESTIONS

# ALL 3 ESTATES ARE DIFFERENT

- CANNOT JUST LOOK AT TOTAL
- NEED TO LOOK AT EACH ESTATE SEPARATELY
- AQUATIC – LOW LYING FARMLAND
- SOVEREIGN – SWAMP
- DEVELOPED FOR FLOOD MITIGATION
- WATER IN – NOT LAND IN
- HOUSES AND CANALS ON SOLID BASE
- RABY BAY – QUITE DIFFERENT
- OUR PRESENTATION IS ONLY ON AQUATIC

# AQUATIC $$$ OVERVIEW

- ALL AQUATIC RESIDENTS PAID FOR INFRATRUCTURE

  TODAY IT WOULD COST $80 Million +

- ALL AQUATIC RESIDENTS PAID FOR MAIN CANAL

  TODAY IT WOULD COST $12 Million +

- ALL RESIDENTS PAY HIGH RATES
- WET BLOCK OWNERS PAY

  6 TIMES MINIMUM RATE

  (3x GENERAL & 3x CANAL LEVY)

  4 TIMES AQUATIC DRY BLOCK RATE

  (2 x GENERAL & 2x CANAL LEVY)

- NOT FAIR - LEVY MUST BE ABOLISHED

# AQUATIC – MAIN ISSUES

- **MONEY**

- **FLOOD MITIGATION**

- **MUD**

- **FAIRNESS**

- **NON ISSUE FOR AQUATIC**

  **REVETMENT WALLS – NO FAILURES**

# RCC – $$$ INFORMATION – CAMPAIGN

- HERE TO SOLVE RCC $$$ PROBLEMS
    - NEED MONEY
    - RCC EMPHASISING PROCESS NOT $$$
- POLITICAL/FINANCIAL STATEMENT
    - $54.03 PER PROPERTY (2018 BUDGET)
    - THIS IS WRONG
- "PUNTERS" CONCLUSION - "SHOULD NOT HAVE BUILT ESTATES"
- OTHER REDLANDS PROPERTIES – "SHOULD NOT SUBSIDIZE"
- WHOLE PROCESS CRUMBLES "LIKE A PACK OF CARDS"
  AS $54.03 IS WRONG

# RCC POLICITAL/FINANCIALS – 2018

- **IGNORES GENERAL RATES**

| | BUDGETED SPEND | COUNCIL TOTAL CONTRIBUTION | ANNUAL COST FOR REST OF REDLANDS | |
|---|---|---|---|---|
| | $000 | $000 | $ | |
| AQUATIC | 1,663 | 1,052 | $15.85 | |
| SOVEREIGN | 464 | 427 | $ 6.44 | |
| Subtotal | 2,127 | 1,479 | $22.29 | |
| RABY BAY | 4,330 | 2,087 | $31.45 | |
| TOTAL | 6,457 | 3,566 | $53.74 | RCC $54.03 |

**CONCLUSION – CANALS SHOULD NOT HAVE BEEN BUILT**

# RCC POLICITAL/FINANCIALS INFO ERRORS

- **IGNORES GENERAL RATES**

| | | | |
|---|---|---|---|
| | | | **$000** |
| **RCC TOTAL CONTRIBUTION** | | | **1,052 ($15.85)** |
| **LESS BUDGET UNDERSPEND** | | | |
| **BUDGET** | **$1,663k** | | |
| **END DEC 2017 SPEND** | **-$1,019** | | |
| **STILL TO PROCESS ??** | **-$ 200** | | |
| **POSSIBLE UNDERSPEND** | | | **444** |
| **RCC TOTAL AFTER UNDERSPEND** | | | **$ 608** |
| **LESS BALANCE OF "FROZEN" RESERVE** | | | **$ 774** |
| | | **SURPLUS** | **$166k** |

**NO SUBSIDY FROM REST OF REDLANDS TO AQUATIC IN 2018**

# AQUATIC PARADISE $$$

- HAVE RCC PROVIDED A FULL BUSINESS CASE?
- HAVE RCC PROVIDED THE PROPOSAL BRIEF?
- HAVE RCC PROVIDED :
    - RATE INFO – WET & DRY BLOCKS?
    - TOTAL RCC INCOME FROM AQUATIC?
    - ACTUAL $ SPEND ON CANALS?
    - MULTIPLE YEARS FOR ABOVE?
- THESE ARE THE MINIMUM TO DO YOUR JOB AND DEVELOP A BUSINESS CASE

# "CANAL BLOCKS SHOULD PAY MORE"

## COMPARED TO MINIMUM RATE

| | $ |
|---|---|
| MINIMUM RCC RATE PER YEAR | 926 |
| AVERAGE AQUATIC WET BLOCK RATE | |
| ○ GENERAL RATE | 2,750 or 3 x MINIMUM |
| ○ CANAL LEVY | 2,806 or 3 x MINIMUM |
| TOTAL FOR WET BLOCK | 5,556 or 6 x MINIMUM |

**CONCLUSION – 6 TIMES IS TOO MUCH MORE**

**3 TIMES IS OK BASED ON GENERAL RATE**

# "CANAL BLOCKS SHOULD PAY MORE"

## COMPARED TO AQUATIC DRY BLOCKS ESTIMATED RATE

HOUSES IN THE SAME STREET

| | $ |
|---|---|
| AVERAGE AQUATIC DRY BLOCK RATE | 1,500 EST. |
| o GENERAL RATE | 2,750 or NEARLY 2 X |
| o CANAL LEVY | 2,806 or NEARLY 2 X |
| TOTAL FOR WET BLOCK | 5,556 or 3.7 TIMES |
| | (IF $1,400 = 4 TIMES) |

- **3.7 or 4 TIMES IS TOO MUCH MORE**
- **1.8 or 2 TIMES FROM GENERAL RATES IS OK**

# EXPLANATION OF A WET BLOCK RATE NOTICE – MARCH 2018

| | | QUARTER | | YEAR | AVERAGE USED IN PRES'N |
|---|---|---|---|---|---|
| | | $ | | $ | $ |
| **GENERAL RATES** | | **722.41** | | **2,889.64** | 2,750.00 |
| **CANAL CHARGE** | | **701.57** | | **2,806.28** | 2,806.00 |
| | | **1,423.98** | | **5,695.92** | |
| ENVIRONMENT/ | | | | | |
| LANDFILL/SES | $ 39.01 | | | | |
| UTILITY CHARGE | $ 89.12 | | | | |
| LOCAL GOVT WATER | $264.92 | **393.05** | } | | |
| | | | } | **2,304.84** | |
| STATE GOVT | | | } | | |
| EMERG MGMT. | $ 52.55 | | } | | |
| BULK WATER | $130.61 | **$ 183.16** | } | | |
| **TOTAL RATE NOTICE** | | **$2,000.19** | | **$8,000.76** | |

# TOTAL RCC INCOME FROM AQUATIC – BUDGET 2017/18

| | WET BLOCKS $000 | DRY BLOCKS $000 | TOTAL $000 |
|---|---|---|---|
| **RATES** | | | |
| **WET BLOCKS** | | | |
| 202 x $2750 (A) | 556 | | 556 |
| **DRY BLOCKS** | | | |
| 198 x $1,500 (E) | | 297 | 297 (E) |
| | | | 853 |
| **CANAL LEVY** | | | |
| **WET BLOCKS** | | | |
| 202 x $2,806 (A) | 567 | | 567 |
| **MARINA** | | | |
| 16 x $2,806 (A) | | 45 | 45 |
| | 1,122 | 342 | 1,464k |
| MUCH MORE THAN RESIDENT CONRIBUTION ON RCC SHEET | | | - 612 |
| DIFFERENCE $852k plus 140% | | | 852k |

# SUPPOSED SPECIAL BENEFITS

"S.94 in 2012 GOVERNMENT REGULATIONS

**ALLOW COUNCILS TO MAKE AND LEVY A SPECIAL CHARGE ON RATEABLE LAND IDENTIFIED AS ENJOYING A "SPECIAL BENEFIT"**

- SOUNDS GOOD AT FIRST
- **WHAT ARE YOUR SPECIAL BENEFITS AT YOUR PLACE?**
    - CLOSE TO
        - SCHOOLS
        - SHOPPING CENTRES
        - TRANSPORT
        - PARKLAND
        - WATER/BEACH
        - BUSH
        - BAY ACCESS
        - GOOD NEIGHBOURHOOD
- **BUT ALL THESE ARE INCLUDED IN PROPERTY VALUES USED FOR GENERAL RATE CALCULATION**
- **NO SPECIAL BENEFITS NOT INCLUDED IN SITE VALUE.**

# SPECIAL BENEFITS/CANAL LEVY

- ALL SPECIAL BENEFITS INCLUDED IN SITE VALUE
- NO ADDITIONAL SPECIAL BENEFIT
  - NO ADDITIONAL VALUE TO TAX
  - NO BASIS FOR CANAL LEVY
- RCC IS DOUBLE TAXING THE SITE VALUE

| | **GENERAL RATES $000** | **SPECIAL CHARGE $000** | **TOTAL $000** |
|---|---|---|---|
| PROPERTY SITE VALUE | 900 | | 900 |
| SPECIAL CHARGE VALUE | | 900 | 900 |
| IMPROVEMENTS | 600 | ___ | 600 |
| MARKET VALUE | 1,500 | 900 | 2,400 |

**-RCC IS FALSELY STATING PROPERTY IS WORTH $2.4M NOT THE $1.5M MARKET PRICE.**

# WHAT HAS BEEN SPENT ON AQUATIC?

| FIN YEAR | SPENDING | RESERVE BALANCE |
|---|---|---|
| | $000 | $000 |
| 2010 | 377 | 104 |
| 2011 | 72 | 566 |
| 2012 | 33 | 1,099 |
| 2013 | 59 | 1,560 |
| 2014 | 67 | 2,163 |
| 2015 | 228 | 2,834 |
| 2016 | 59 | 3,685 |
| 2017 | 1,781 | 2,583 |
| 2018 | 1,300 (E) | 348 (E) |
| **TOTAL** | **3,976** | - |

**AVERAGE SPEND $442k**

# MUD – 165,000 m3 TO BE REMOVED - 5 YEARS

- 165,000 m3 AS PER DREDGE PROGRAM
- "NOT OUR MUD"
- COMES FROM RCC & MORETON BAY
- INTO RCC OWNED CANALS AND NAVIGATION CHANNELS
- WE PAID TO DEVELOP CANALS +/OR FIRST DREDGE
- RCC AGREED TO MAINTAIN – **KEEP YOUR WORD**!
- "NOT OUR MUD"–WE SHOULD NOT BE PAYING LEVY TO REMOVE IT

# A GIGANTIC LOT OF MUD

165,000 m3 = 16,500 x 10m3 TRUCKS or

= 206 m DEEP ON AN 800 m2 BLOCK

IS IT FAIR IF:

- IT WAS DUMPED ON YOUR PROPERTY?
- YOU HAD TO PAY FOR ITS REMOVAL?

**THAT IS LIKE WHAT RCC IS DOING TO WET BLOCK OWNERS**

# MUD – 165,000 m3 TO BE REMOVED

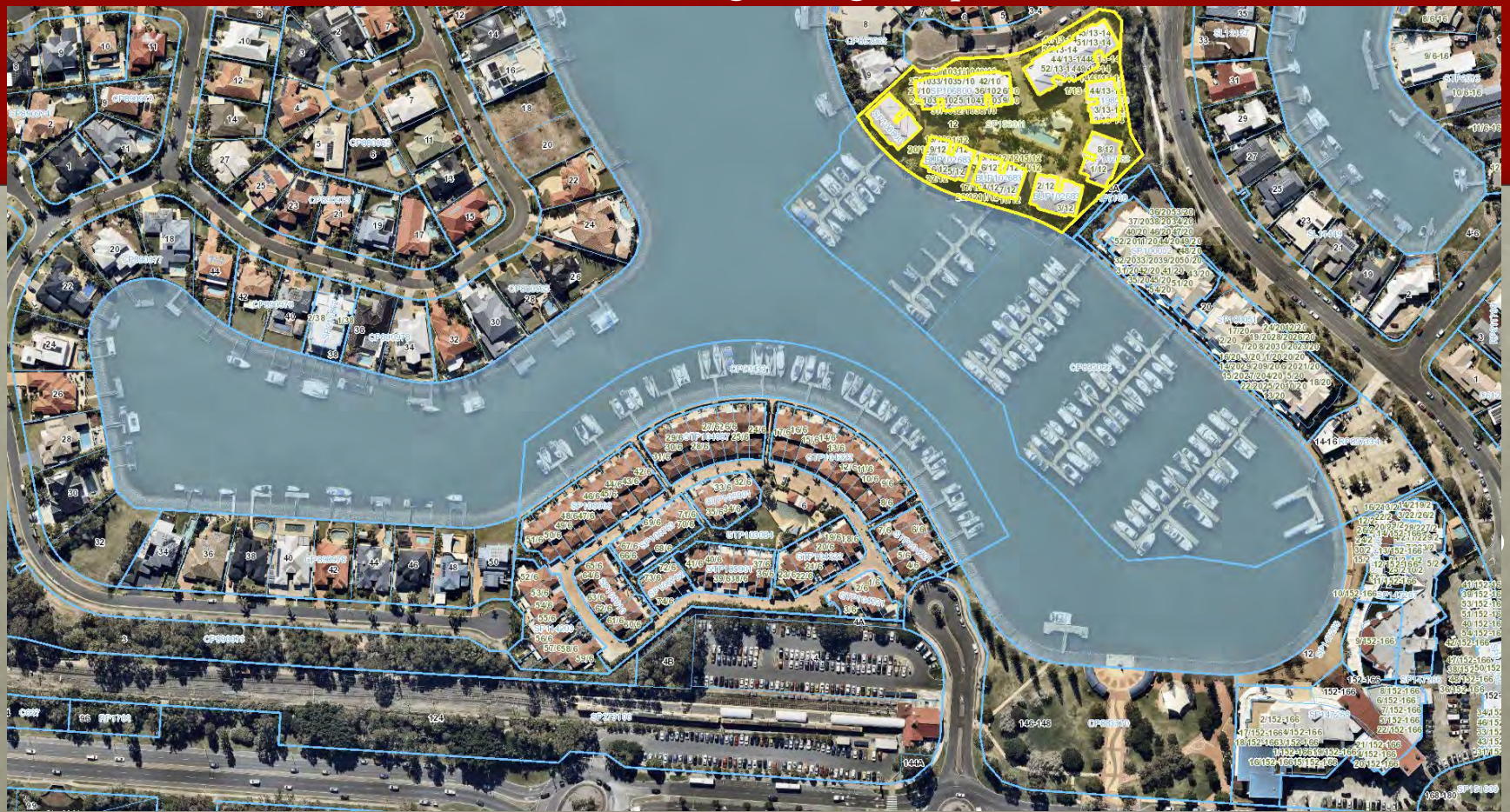
KBR REPORT 14th MAY 2015 PAGE 6-6 TABLE 6.2

| F.Y | VOLUME m3 | RCC FEB COMMUNITY 2011 STUDY | DIFFERENCE |
|---|---|---|---|
| 16 | 42,650 | | |
| 17 | 31,350 | | |
| 18 | 38,500 | | |
| 19 | 17,810 | | |
| 20 | 34,900 | | |
| **5 YR TOTAL** | **165,201** | **51,000** | **114,210** |
| **AVERAGE** | **33,042** | **10,200** | 22,842 |

- 2011 STUDY
- **DREDGE WORKING PAPERS BETTER SOURCE**
- RCC FIGURE 30% OF KBR DREDGE FIGURES

# Raby Bay Quays Body Corporate Committee. Representing:

CTS Schemes being charged Special Levy



# Benefits

- Planning and dredging to keep navigable
- Maintaining revetment walls assists in retaining land
- Monitoring can
  walls.
- Maintain the ov
- **Special amenity**
  - structure
  - recreational
  - social
  - health and
  - visual element
- **"Special Access**

# Who Benefits?

- Those who have access to the Canals
- Those who have a view of the canals
- Commercial operators who rely on the canals
- Retail and Hospitality on or near the canals
- Retail and Hospitality in Cleveland
- All ratepayers in the Redlands
- Non-ratepayers and tourists who visit

# Who Pays?



# Is this really Fair and Equitable ? ....




**$0**

## Canal Activities:

- Regular Triathlons
- Stradbroke Island Passenger Ferries
- Bay Charter Tours
- Recreational Fishing
- Markets and Festivals
- General Recreation



# CTS Equity and fairness

**Cost?** ✗400% more than anyone else!

**Benefits?** ✗Don't Receive the Benefits!

**Fair?** ✗Those with more benefit not charg

# Equitable?

Raby Bay Quays and Edgewater are not the only inequities....

Under the current Council Scheme these 2 “Standard Lots” each pay $2,354pa Canal Levy!


Possible Pontoon Length

Revetment Wall

Any Special Charge, should be based on Quayline Length...

# Alternative Approach Options

1. No Levy – Pay out of General Rate
2. Property owners pay for upkeep of their own wall.
3. Variation of Existing Arrangement, but one which is based on fair and equitable contribution from ALL who benefit.
4. Hand over to someone else (State Govt.?) *For example, the Gold Coast Waterways Authority, which is State Govt funded, properly staffed and equipped to effectively manage public waterways*

# Option 1:
# Impact to General Rates

| Year | Number of RCC Ratepayers | Special Levy Total | RCC Contribution | Total Expenditure |
|---|---|---|---|---|
| 1996 to 2017 (22 yrs) | 53,000 | $20,154,139 | $3,642,033 | $19,219,103 |
| Per Ratepayer / year | | | $3.12 | $16 |
| 2011 to 2017 (6 yrs) | 60,000 | $10,221,063 | $2,688,295 | $8,138,560 |
| Per Ratepayer / year | | | $7.47 | $23 |

# RCC Rates Calculation

## Redland City Council
### Rates & Charges 2017/2018

Redland CITY COUNCIL

*(Please Note: These Rates & Charges are for general information purposes only)*

| *GENERAL RATE (Annual Charge)* | Minimum Threshold | Minimum General Rate | Rate in $ | Description (for office use only) |
|---|---|---|---|---|
| ***1a*** ***$0 – $350,000*** | $ 228,164 | $ 926 | **0.00405848** | ***Residential - Principal place of residence*** ***GR20*** |
| ***1b*** ***$350,001 or greater*** | $ 432,732 | $ 1,405 | **0.00324681** | ***Residential - Principal place of residence*** ***GR20*** |
| ***2a*** ***$0 – $350,000*** | $ 207,608 | $ 1,019 | **0.00490828** | ***Residential - Non-principal place of residence*** ***GR25*** |
| ***2b*** ***$350,001 or greater*** | $ 407,230 | $ 1,699 | **0.00417209** | ***Residential - Non-principal place of residence*** ***GR25*** |

# Questions and Discussion

# Short History of Raby Bay

**Items to be covered:**

- **Canals built in stages over many years with Developer carrying out repairs whilst on site.**
- **Council commissioned several geotechnical reports over the years and ignored the warnings.**
- **Council abrogating their responsibilities to the residents.**

**Council welcomed the prospect of two Canal estates (Aquatic Paradise and Raby Bay) in the Redlands because of the higher rating capacity created by the increased value of waterfront land.**


**Built in 16 Stages between 1983 and 1998**

**When the canals were being constructed, there was considerable concern by people in the area about the method of construction.**

**There are lessons to be learnt here that councillors should heed. Raby Bay was created with the enthusiasm of generating something special for Cleveland, perhaps without a full understanding of the engineering challenges.**

**That means no infrastructure cost breaks for developers. Raby Bay has become a problem for the council and it must be vigilant to ensure that obligations on developers to meet roads, sewerage, water, lighting and other requirements are fully funded to ensure that when they walk away from the completed project, it does not become an ongoing burden for ratepayers.**

**Because of these concerns, the then Redland Shire Council (RSC) commissioned several studies by reputable consultants. Some of the resulting reports have since come to our attention and contain information and advice raising very serious concerns about the construction methodologies.**

**These reports outline that the method of construction used was not recommended for canal construction due to the associated risks of possible failure.**

**Revetment failures that occurred during construction were referred to the developer on site to be rectified at their cost.**

**During 1996, there was considerable concern expressed by RSC about revetment failures and questions raised as to who was responsible for future failures.**

**Redland Times 1st March 1996**

## Property owners sue over land subsidence

# Raby Bay writs

THIRTEEN Raby Bay Canal Estate property owners have issued Supreme Court Writs against the canal estate developers and Redland Shire Council relating to land subsidence.

The existence of the writs, which seek unspecified damages for alleged negligence, was confirmed yesterday by Redland Mayor Eddie Santagiuliana.

The writs have been lodged in the Brisbane Supreme Court by 13 Mainroyal Court homeowners.

Cr Santagiuliana said the homeowners were suing developers Civic Projects (Raby Bay P/L) and had co-joined Council as supervising authority for the development.

"We are taking the matter extremely seriously and will be strenuously defending our position," the Mayor said.

Cr Santagiuliana said Council believed it had undertaken the best possible supervision and had used the best possible engineering practices of the day.

Civic Projects general manager Gillian Lock said the company would "vigorously defend the action that has been brought against it."

"The company believes it was in no way negligent in the construction of the area of land in question, or in its conduct in relation to purchasers of that land," Mrs Lock said.

"Each step taken in the development process has been done with due care and in line with appropriate standards. Recognised consultants with considerable experience have been involved in the project.

"At this stage no full statement of claim outlining the details of the writs has been forthcoming from the issuing parties. This limits the comment the company can make, other than to say again, the writs will be vigorously defended by Civic Projects," Mrs Lock said.

Cr Santagiuliana said the canal development was begun under a previous Council administration.

The present Council initiated a major technical study of the canal development last year.

Cr Santagiuliana said it revealed subsidence had taken place in some areas, particularly revetment walls.

"Council undertook the study because of problems which had arisen," Cr Santagiuliana said.

At Wednesday night's general meeting, Council deferred further discussion on the Raby Bay problems but will consider making provision for the expenditure of $1.5 million over a 10-year period for the repair and restoration of revetments at Raby Bay Canal Estate.

In a recent letter circulated to Raby Bay homeowners by the Raby Bay Ratepayers Association, chairman Vince Halsall warned residents of potential costly problems.

The letter said: "An innocent and unknowing homeowner could face six-figure costs in repairs unless you become very active now."

Mr Halsall said the geotechnical survey predicted additional failures would occur.

"And I would not be surprised if more writs are issued.

"This has caused immense distress to families. The writs represent people in a state of desperation.

"They will not stand idly by and see Civic Projects wind up without some form of redress being made available to them."

Mr Halsall said the $1.5 million figure being considered by Council was probably less than 25 percent of the actual costs involved in repairs.

A request by *The Redland Times*, under Freedom of Information, for access to documents "Review of Revetment Stability — Raby Bay Canal Estate" has been denied by Redland Shire Council. The newspaper has lodged an appeal.

**In order to appease these residents, RSC introduced a levy of $100 per year per wet block.**

**Ultimately, RSC resolved these concerns by giving approval for the construction company to leave the site.**

**Suffice to say that the predicted failures did eventuate.**

**In an attempt to resolve the situation in 2012, RCC spent almost $1M of Canal Levy reserve funds to investigate the cause of failures in the canal revetments.**

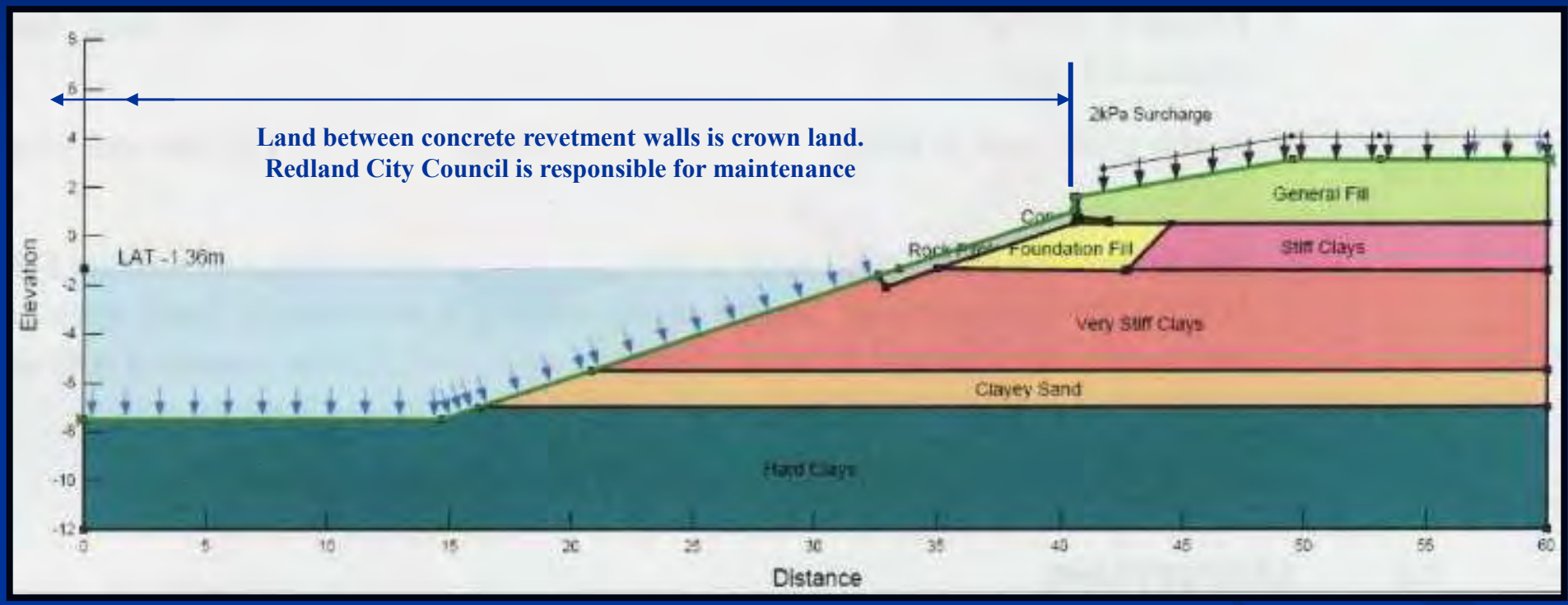
**We believe RSC was negligent in its original decision-making at the time of construction and should be held accountable, we also believe the current RCC has no right to levy current canal estate ratepayers through a dubious Special Charge.**

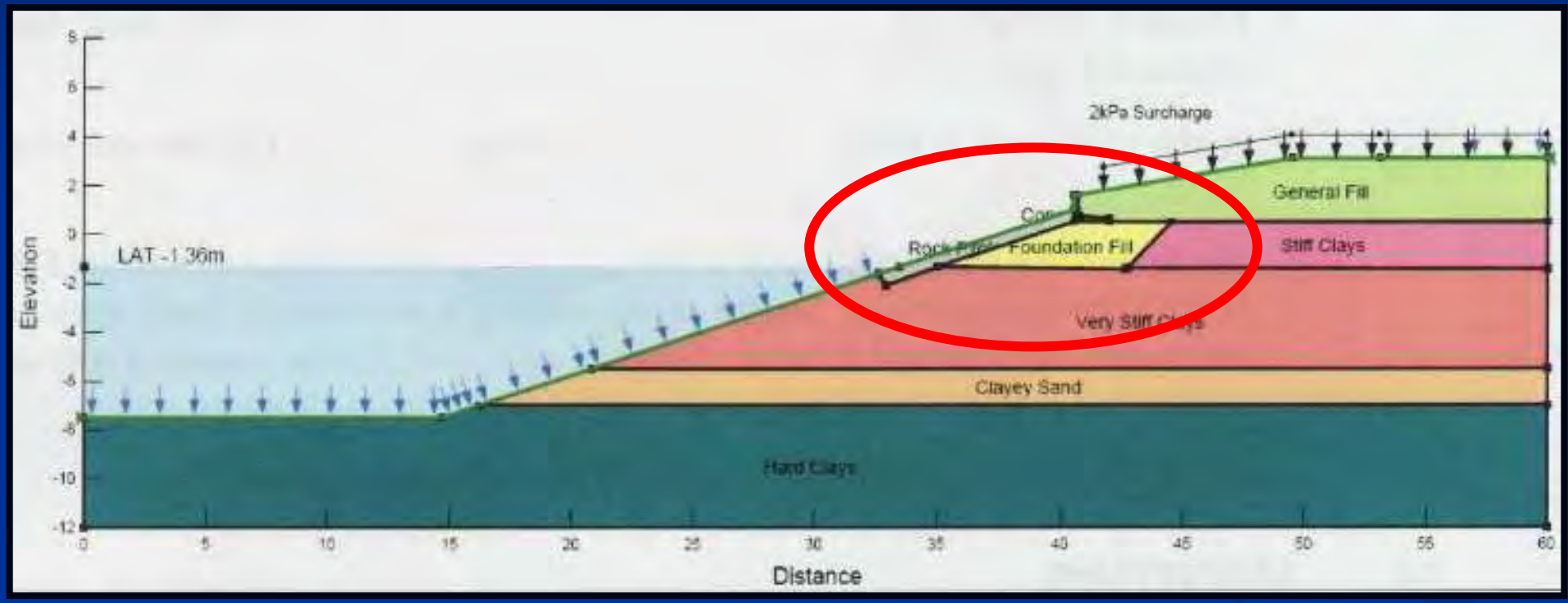
**This Special Charge is charged for costs for which the land owner is neither responsible nor which the land owner should be contributing.**

**The final Geotechnical Report, dated 24 June 2013, states:**

***"in order to build the rock armour and concrete wall, the fill in this area had to be brought up to profile…***

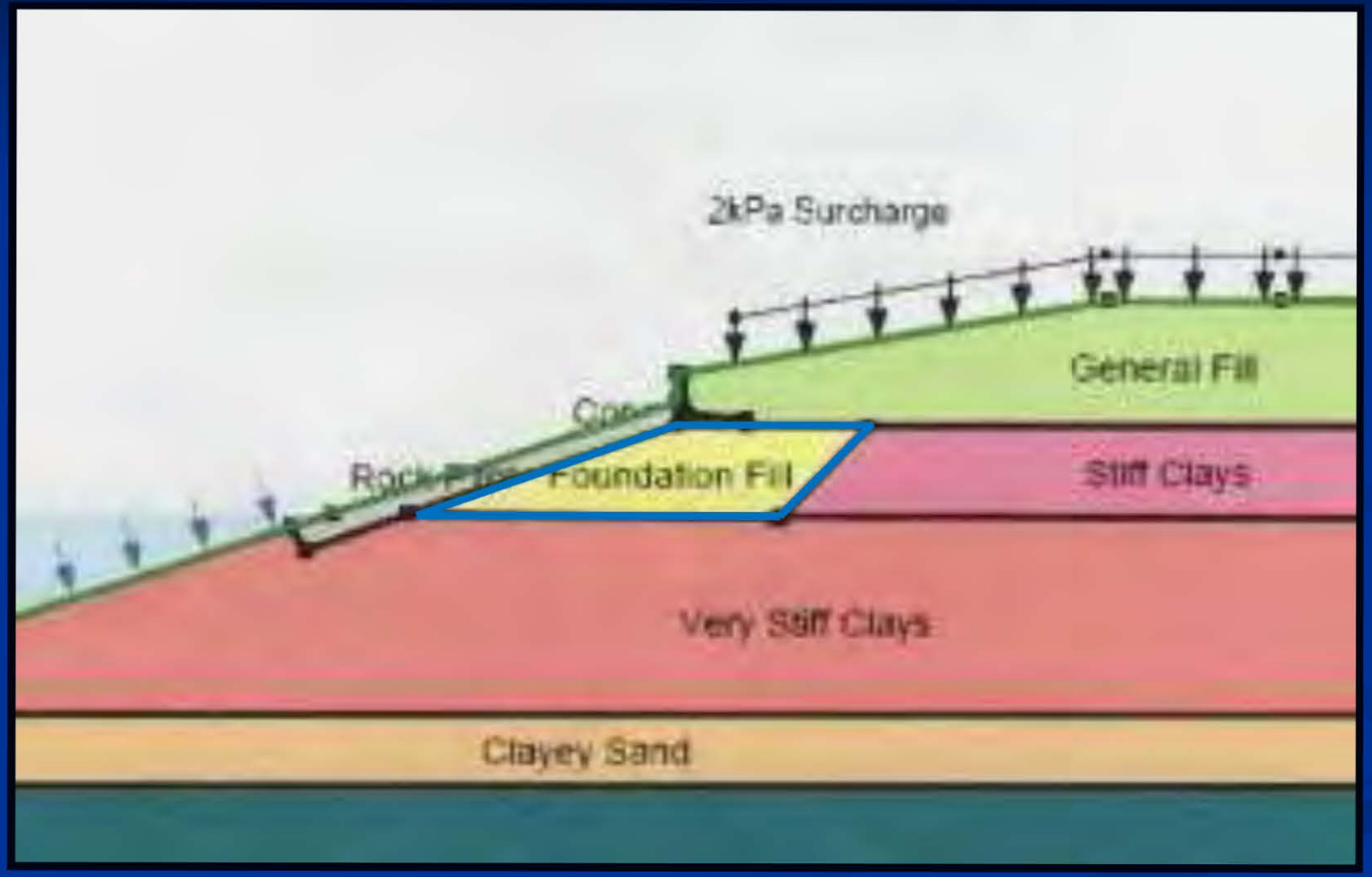
***…Instead it appears that 'foundation fill' was pushed into the 'wedge' between the 'stiff clay' batter and the design profile and not compacted (i.e. left loose)."***


Land between concrete revetment walls is crown land.
Redland City Council is responsible for maintenance
2kPa Surcharge
General Fill
Foundation Fill
Stiff Clays
Very Stiff Clays
Clayey Sand
Hard Clays
LAT -1.36m
Elevation
Distance




**Geotechnical Report, dated 24 June 2013, states:**

***"It appears many Raby Bay canal frontages have an uncompacted fill wedge under the rock protection and concrete wall."***


2kPa Surcharge
General Fill
Foundation Fill
Stiff Clays
Very Stiff Clays
Clayey Sand

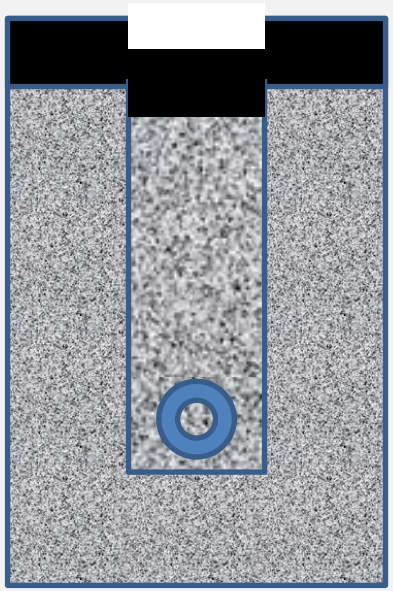
**For many years prior to the construction of the canals and indeed currently, construction methods requiring fill or back fill materials were required to be compacted to provide stability to the areas.**

**What reason could Council give to declare that compaction was not required behind the rock protection and under the concrete revetment walls?**

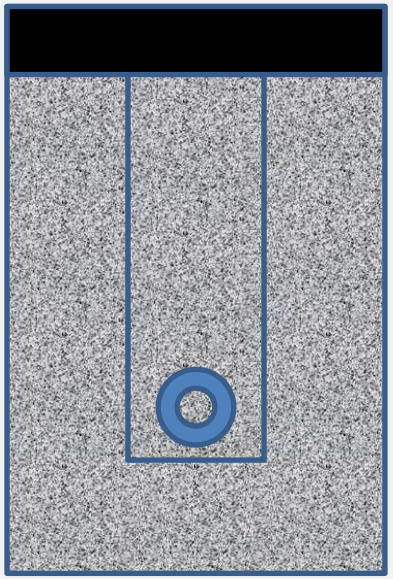
**Council would certainly not allow developers to construct roads on housing estates without ensuring compaction was carried out to National and International Standards.**

# Road Compaction

**Road Construction to a Standard**



**Road Opening Poor Consolidation**



**Road Opening Good Consolidation Or Lean Mix Fill**

**The RSC demanded a $1.5M bond from the developer for future maintenance and given the RSC decision to take the canals under maintenance, the developer left the site and disbanded the company.**

**Clearly this amount of bond was insufficient as it was consumed within one year.**

**While Council was in possession of advice that the construction methodology was flawed, continued with its approvals.**

**The Council has never pointed out to potential landowners in these areas that the works were deficient and have never negotiated with affected land owners about a levy.**

**Does Council believe that it has no responsibility for the ongoing maintenance given they were the body that gave full approval?**

**Council sets a very dangerous precedent by passing responsibility for its past decisions to existing and future residents.**

**Common law has a number of principles that deal with a situation such as this where affected parties to flawed or incorrect decision-making by another entity hold certain rights under the law.**

**The residents are very keen to resolve the situation and amend the unjust levy through negotiation and in good faith, Council continues to ignore their concerns and avoid sensible consultation and engagement.**

**Residents of the canal estates have exhausted all attempts at reaching a position of mutual understanding with the Redland City Council as the problems get repeated every time a new Council is elected.**

**As stated previously, every time new Councillors or senior staff change positions, we have to go through the whole process all over. This effectively delays any actions because of changes within the Council structure.**

**Council sets a very dangerous precedent by passing responsibility for its past decisions to existing and future residents.**

***We believe there is a public interest issue here - namely that local government bodies are not entitled to charge a minority of the population for its mistakes, particularly where the subject of the failure is a public facility benefiting the community as a whole.***

# Discussion

***The allowance of unconsolidated or compacted fill in the area beneath the revetment walls was against normal construction practices.***

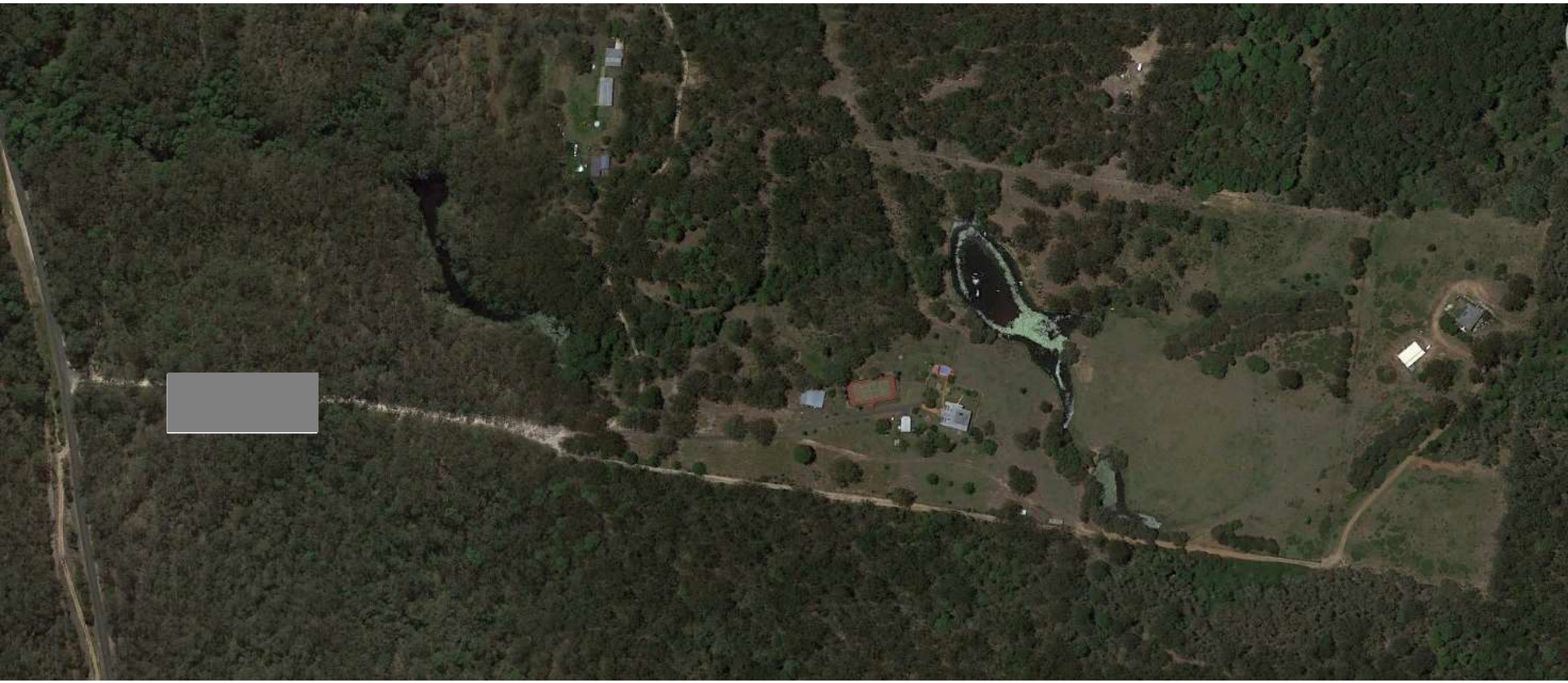
***This was obviously accepted by Council engineers to allow the developer to leave the site on completion.***

**Approx. 800 people live in the area to the right**

**If the bridge were to wash away or fail –Would you expect those people to pay for the rebuilding of the bridge?**


**Performing Arts Centre – Cost over $12M**

**Costs Over $2M / Year to maintain – Rate Payers Fund**



[redacted] has been constructed by Council – 900 metres

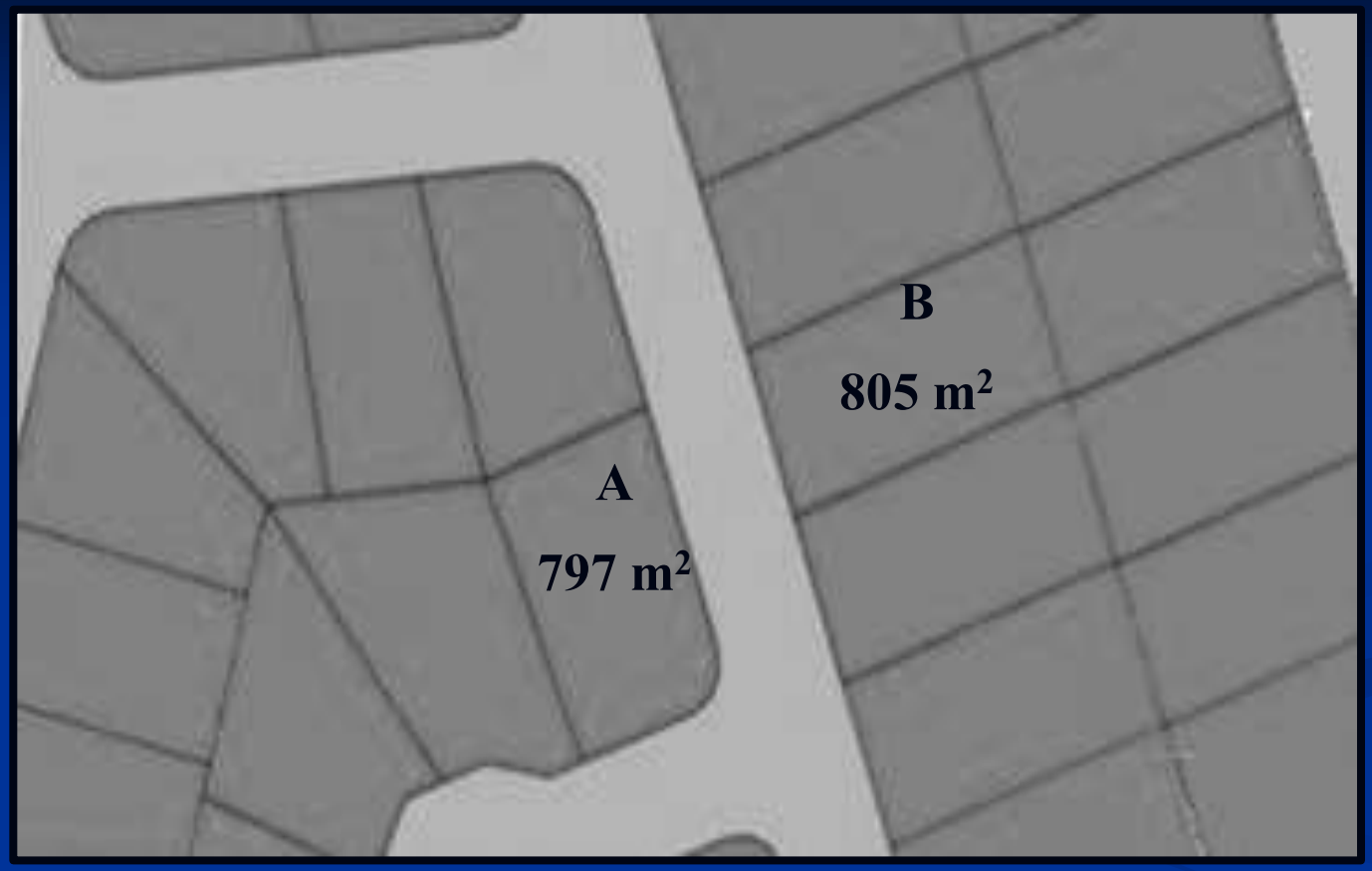
**The road services two homes [redacted] and being a dead end road – does not get very much traffic.**

**Should this have been a user pays road?**

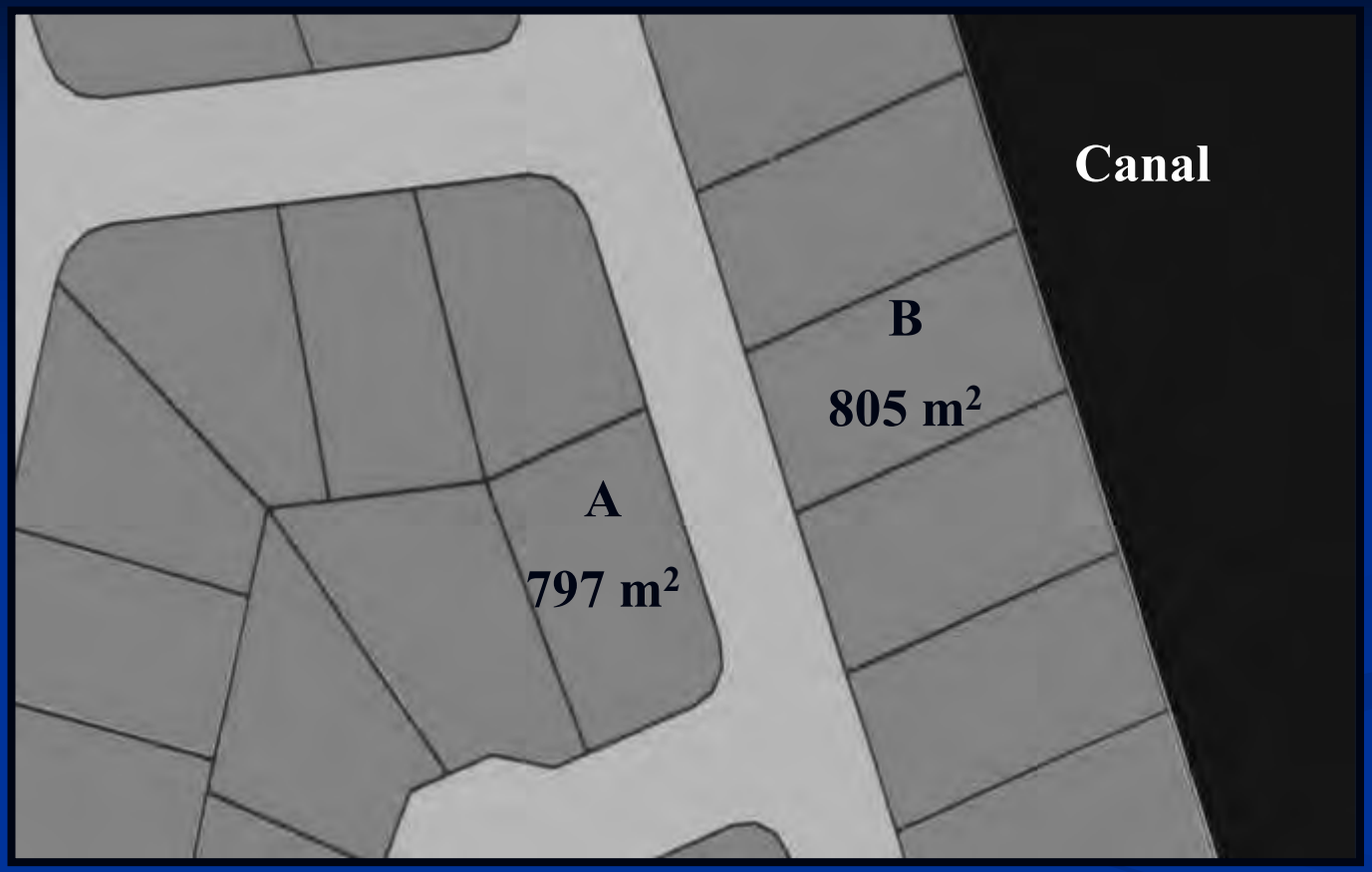
**It has been agreed the three influences on rates should be:**

- **Equity**
- **Fairness and**
- **Transparency**

# Wet Block Vs Dry Blocks




| | Tariff | S V | RID | Gen. Rate | Levies | Total |
|---|---|---|---|---|---|---|
| A & B | 1b | $420,000 | 0.00324681 | 1,363.66 | 361.52 | 1,725.18 |




| | Tariff | S V | RID | Gen. Rate | Levies | Total |
|---|---|---|---|---|---|---|
| A | 1b | $420,000 | 0.00324681 | 1,363.66 | 361.52 | 1,725.18 |
| B | 1b | $1,000,000 | 0.00324681 | 3,246.81 | 2,715.80 | 5,962.61 |
| | | | | | Diff. | 4,237.43 |

**This shows that property B which is directly over the road from property A is paying:**

- **238% more in General Rates ($1,883.15)**
- **751% more in levies ($2,354.28)**
- **346% more in combined rates and levies ($4,237.43)**

# If these properties were to be rated in Category 1b and no extra levies, then this table shows the differences.

| | Tariff | S V | RID | Gen. Rate | Levies | Total |
|---|---|---|---|---|---|---|
| A | 1b | $420,000 | 0.00324681 | 1,363.66 | 361.52 | 1,725.18 |
| B | 1b | $1,000,000 | 0.00324681 | 3,246.81 | 361.52 | 3,608.33 |
| | | | | | Diff. | 1,883.15 |

| | Tariff | S V | RID | Gen. Rate | Levies | Total |
|---|---|---|---|---|---|---|
| A | 1b | $420,000 | 0.00324681 | 1,363.66 | 361.52 | 1,725.18 |
| B | 1b | $1,000,000 | 0.00324681 | 3,246.81 | 2,715.80 | 5,962.61 |
| | | | | | Diff. | 4,237.43 |

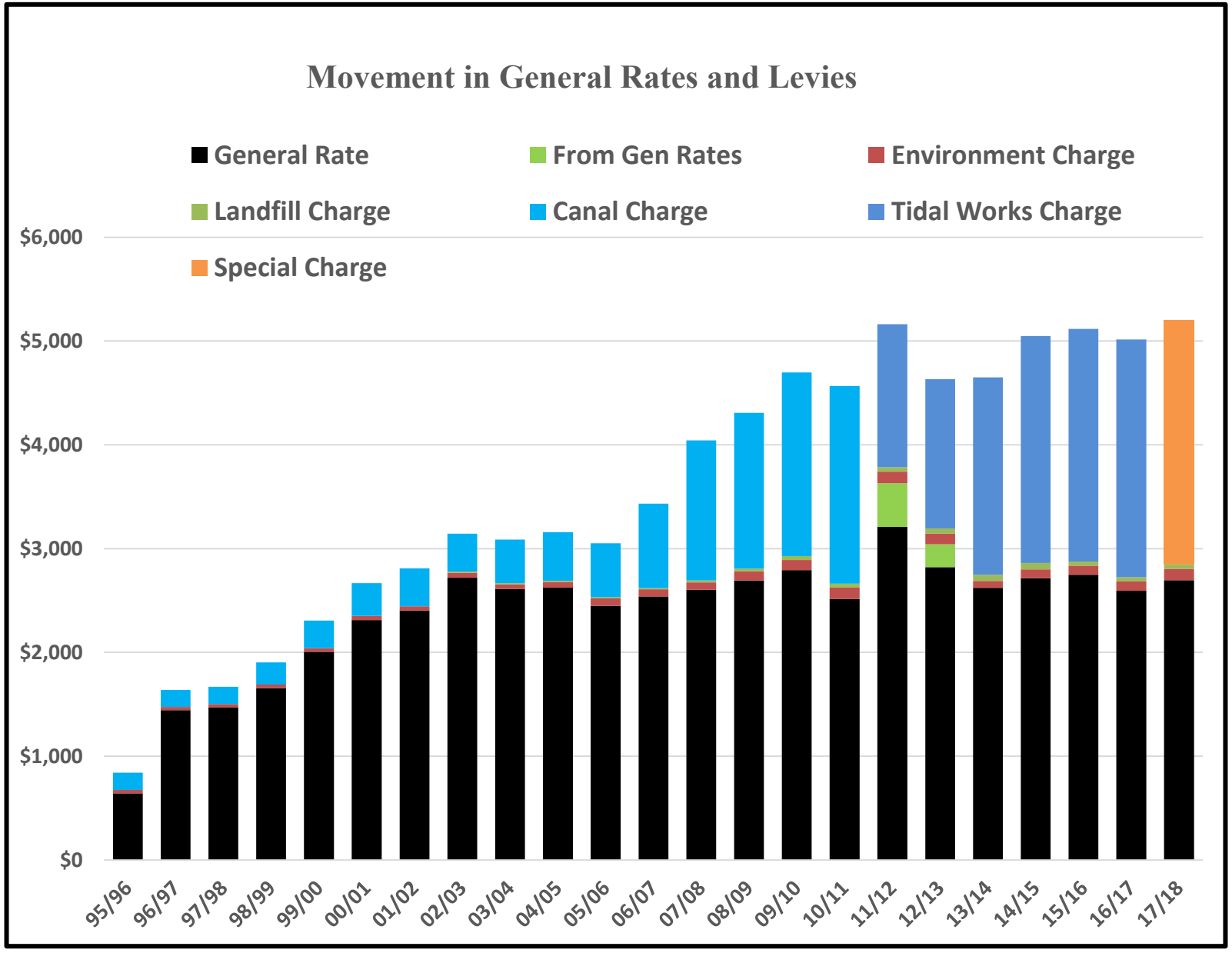
**This shows that property B which is directly over the road from property A is paying:**

- **238% more in rates and levies ($1,883.15)**

**Paradox - the fact that canal properties pay ~$1,900 more than dry blocks is showing that canal properties are in fact already paying for the maintenance of their canal fronts in their General Rate, the value of which is derived in the first place by being a canal front property!**

**Local government bodies are not entitled to charge a minority of the population for its mistakes.**

**Our position is that these costs should be absorbed out of the General Rate funds and the presentation of these Charges clearly shows these properties are already contributing more than their fair share.**


Movement in General Rates and Levies
General Rate
From Gen Rates
Environment Charge
Landfill Charge
Canal Charge
Tidal Works Charge
Special Charge
$6,000
$5,000
$4,000
$3,000
$2,000
$1,000
$0
95/96
96/97
97/98
98/99
99/00
00/01
01/02
02/03
03/04
04/05
05/06
06/07
07/08
08/09
09/10
10/11
11/12
12/13
13/14
14/15
15/16
16/17
17/18

**These canal estates are not purely for the benefit of the Raby Bay residents:**

- Council promotes the benefits of the waterfront;
- businesses are sited on the waterfront;
- commercial vessels are moored in the canals;
- Government bodies use the canals for educational purpose;
- commercial vessels embark and disembark paying passengers at the public jetties;
- marine refuelling facilities are available;
- sightseeing visitors travel around the canals;
- drainage of creeks and storm water pipes;
- fishermen use the canals to fish from their boats or from the shore;
- triathlons are held regularly;
- many other non-resident activities take place;
- visitors even live on their vessels; and,
- parklands are provided so that visitors can come and enjoy the water – not only the residents.

**Clearly <u>all</u> of the canals are used extensively by the general public.**

# Discussion

Council is double dipping.

Properties already are rated much higher because of their position.

# Thank You

# RABY BAY RATEPAYERS ASSOCIATION INC.

## FALLING STANDARDS IN DEVELOPMENT APPROVALS

## RABY BAY RATEPAYERS ASSOCIATION INC.

- **By far the most important concern of Raby Bay residents is the proliferation of massive buildings being constructed, many on tiny subdivided lots. This is creating considerable danger to the revetment wall and increased cost for remediation.**

- **The Canal and Lakeside Structures Overlay must be considerably strengthened and reinstated. Approvals of new construction on Raby Bay waterfront lots must become impact assessable**

RABY BAY RATEPAYERS ASSOCIATION INC.

# FALLING STANDARDS IN DEVELOPMENT APPROVALS

## What has happened?

- Original Covenant
- Adopted by Redland Shire Council
- Private Certifiers
- Waterfront Structures Policy
- Rewritten Planning Scheme
- Canal and Lakeside Structures Overlay

# Problems

- Requires clearance from wall
- No definition of structures
- Too much reliance on paperwork
- Overhanging Decks

RABY BAY RATEPAYERS ASSOCIATION INC.

# 2016 Draft City Plan

- Currently awaiting approval
- Overlay will disappear
- Replaced by an “Editor’s Note”
- Is it a “building” matter?
- Anything goes?

RABY BAY RATEPAYERS ASSOCIATION INC.

# What if there is a catastrophe?

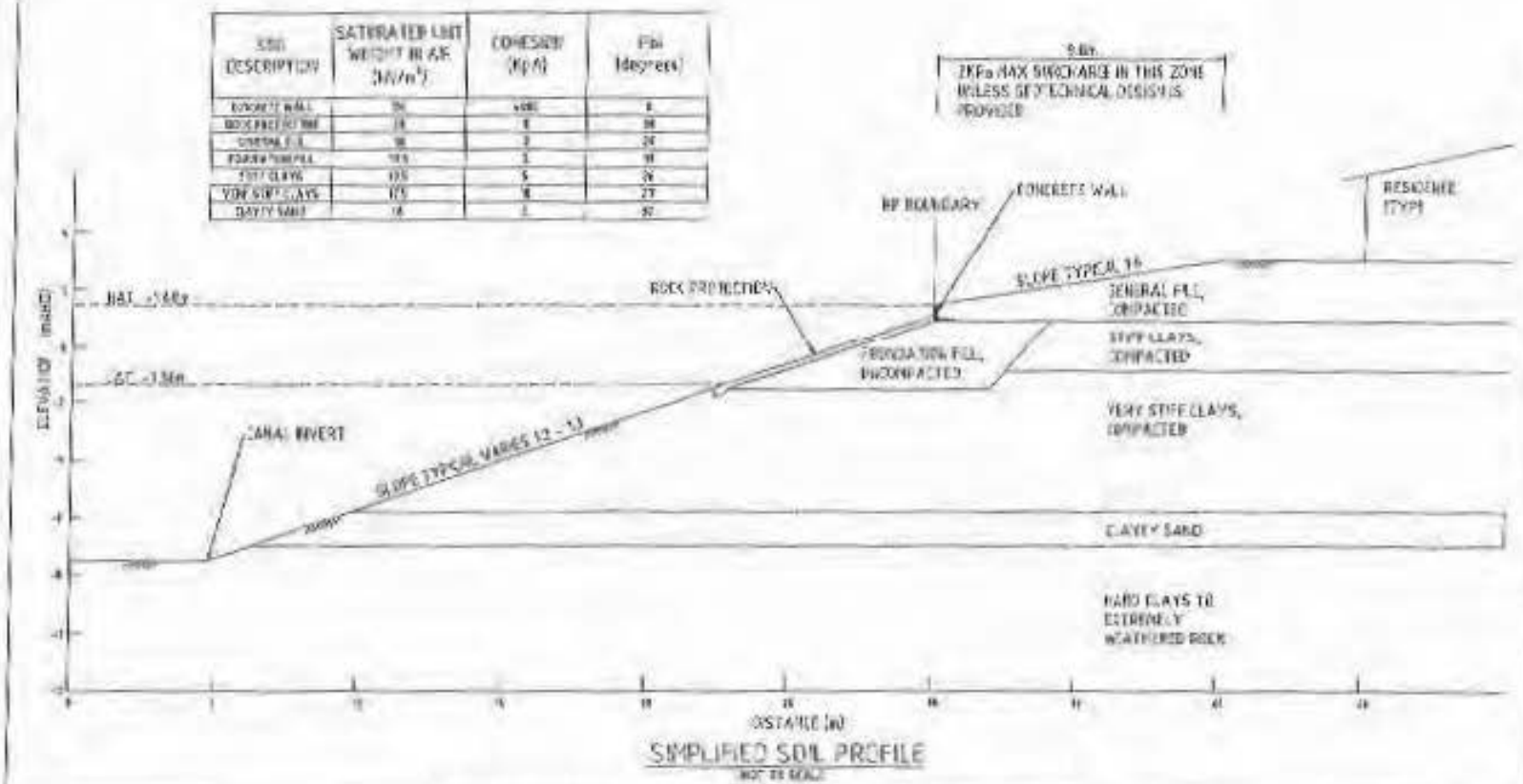
# Canal Revetment Remediation Works

**In 1996 Redland Shire Council obtained a $1.5 million bond from the developer and took over responsibility for canal bank and wall failures occurring in the future. Repairs were funded from general rates after the bond was exhausted. Some years later the Council decided to levy those ratepayers who had frontage to the canals.**

# Current Problems

- Constructed on reactive clay
- Lots compacted but not the canal banks
- Concrete revetment walls subject to movement
- Protective rocks slip or fall when canal bank fails

| SOIL DESCRIPTION | SATURATED UNIT WEIGHT IN kN/m³ | COHESION (kPa) | Φ (degrees) |
|---|---|---|---|
| CONCRETE WALL | 24 | 1000 | 0 |
| ROCK PROTECTION | 24 | 0 | 38 |
| GENERAL FILL | 18 | 0 | 28 |
| FOUNDATION FILL | 18 | 0 | 28 |
| STIFF CLAYS | 19 | 5 | 24 |
| VERY STIFF CLAYS | 19 | 10 | 27 |
| CLAYEY SAND | 18 | 0 | 32 |




SIMPLIFIED SOIL PROFILE

NOT TO SCALE



Redland CITY COUNCIL

TYPICAL CANAL WALL CROSS SECTION WITH TYPICAL GEOTECHNICAL PARAMETERS

MANUAL: Standard Drawing

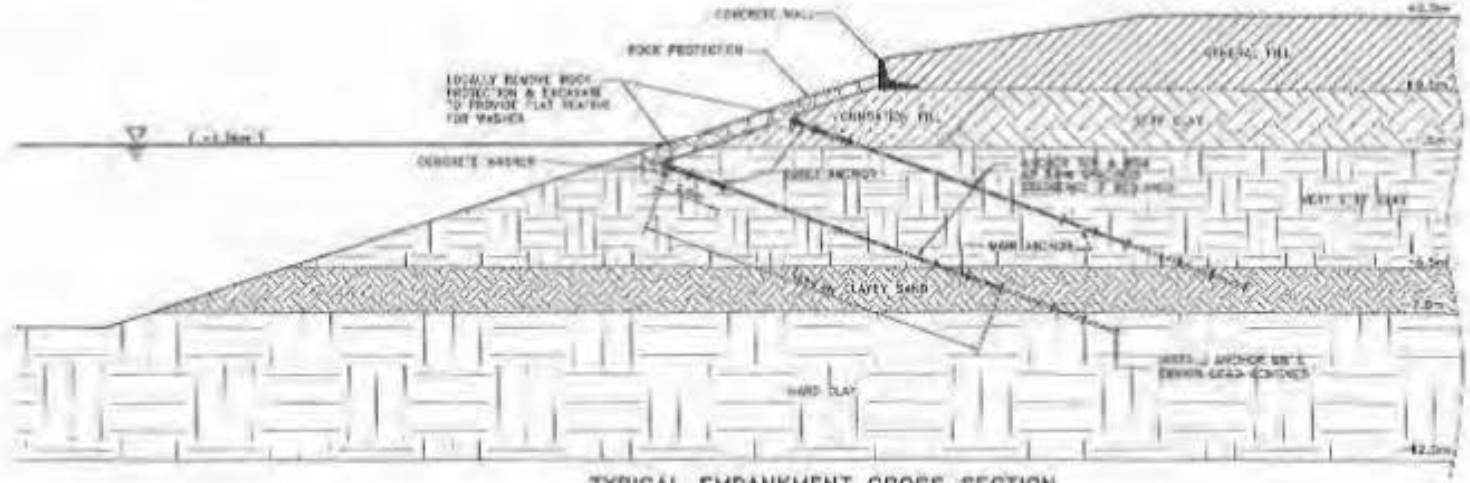
M-REC-E061

# Past Repairs

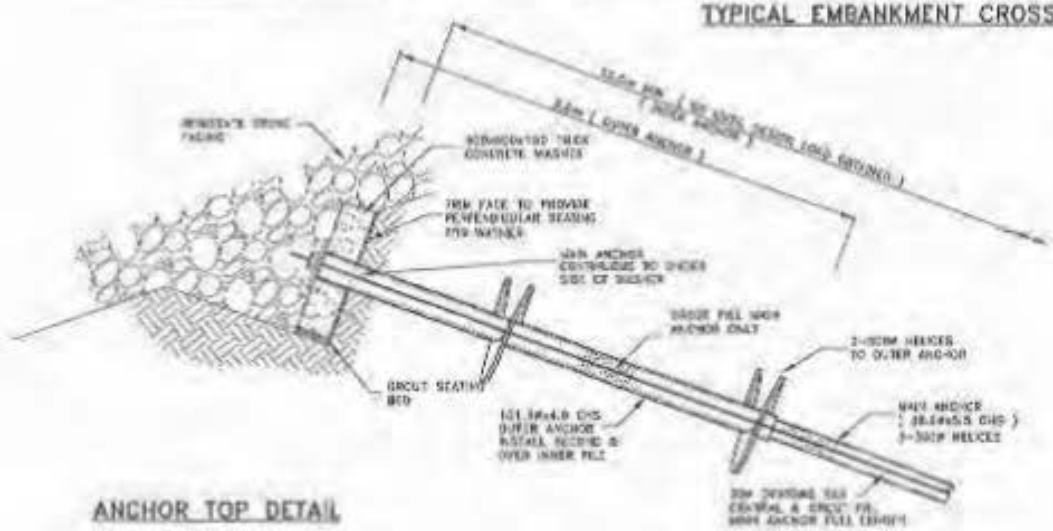
- Very high remediation costs – up to $30,000 per metre
- Many studies undertaken and reports prepared
- One still in use today
- Failures complex and difficult to predict
- Main cause – interaction of water on uncompacted reactive clay
- Important note – only 10% or 2 kilometres of wall  is affected

# Possible Solutions

- RBRA lobbied to seek lower cost solutions
- After 4 years delay tenders were called for grout injection trials
- This year three different remediation methods trialled
- Ongoing monitoring will determine success or failure\
- Costs were:
  - Resin injection - $6,550 per metre
  - Screw anchors- $11,500 per metre
  - Cement/lay mix - $12,000 per metre




TYPICAL EMBANKMENT CROSS SECTION




ANCHOR TOP DETAIL

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| DATE | ISSUED TO | NO | DATE | ISSUED TO | NO | | |
| DATE | REVISION | | | | | | |

[redacted]
CONSULTING ENGINEERS
[redacted]

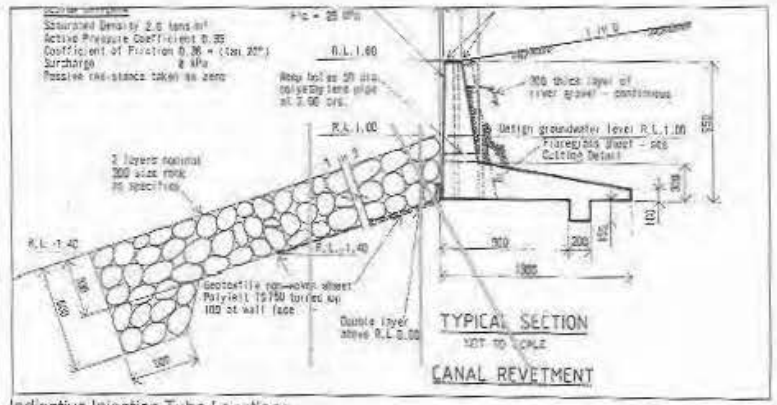
CLIENT [redacted]

PROJECT
RABY BAY CANAL
ESTATE QLD

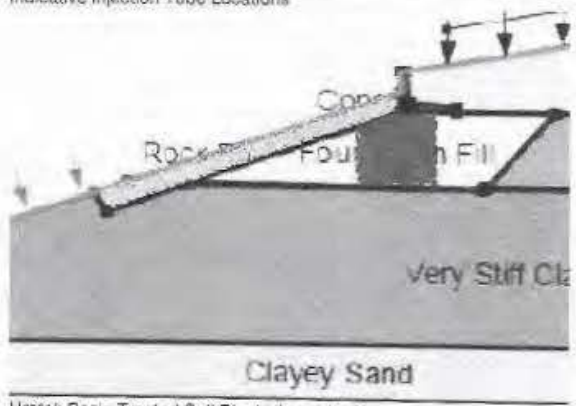
| | | | | |
|---|---|---|---|---|
| DRAWN | RH | JOB No. | 22473 | ISSUE PRELIMINARY NOT FOR CONSTRUCTION |
| CHECKED | | SHEET | S1 of 1 | DRAWING REMEDIAL WORKS CONCEPT |
| SCALE | 1:150 @ A3 | DATE | JULY 16 | DRW No. 1 A3 |

## Attachment N Concept Design

Uretek Resin, an expanding structural geopolymer, will be injected into the poorly compacted soil below the revetment wall at depth to improve ground strength. The treated soil block will resist and reduce the lateral spread of the canal slope. The extent of reduction in spread will be able to be determined by the current inclinometer survey being undertaken by Council during the trial period.




Indicative Injection Tube Locations




Uretek Resin Treated Soil Block shown in Blue

# Appendix 3

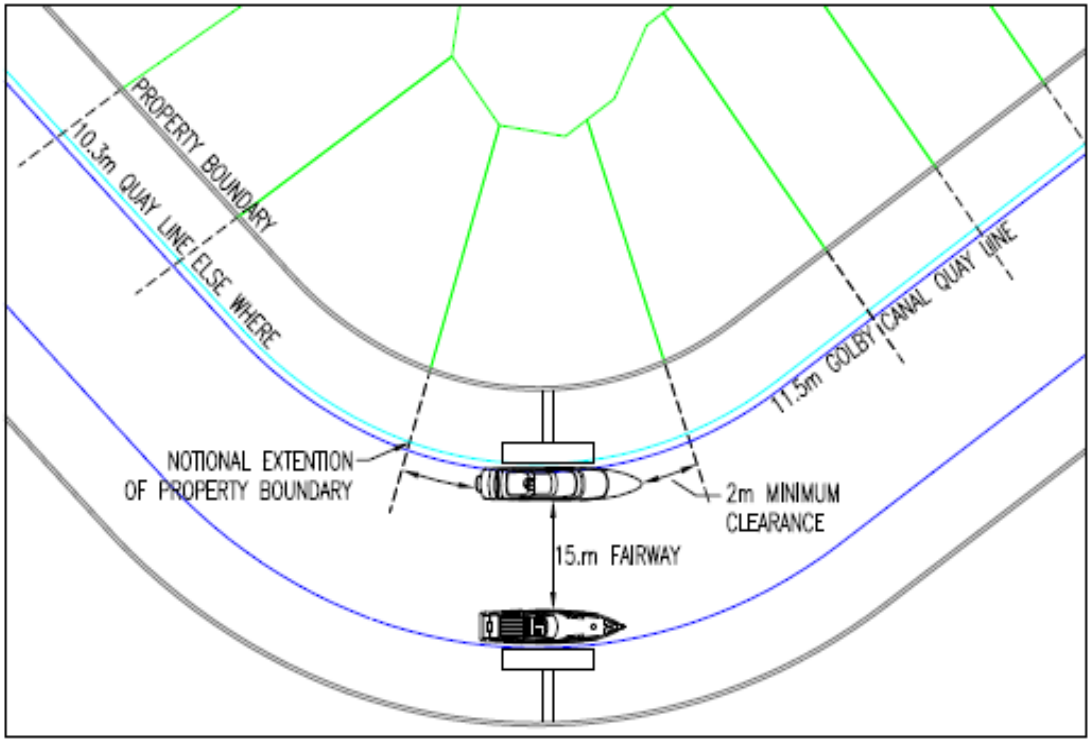
MAKE A DIFFERENCE MAKE IT COUNT

# What is Council doing to manage/maintain the Canals?

- Cleaning
- Mangrove removal
- Water Quality Monitoring
- Dredging
- Revetment Wall Monitoring
- Revetment Wall Repairs

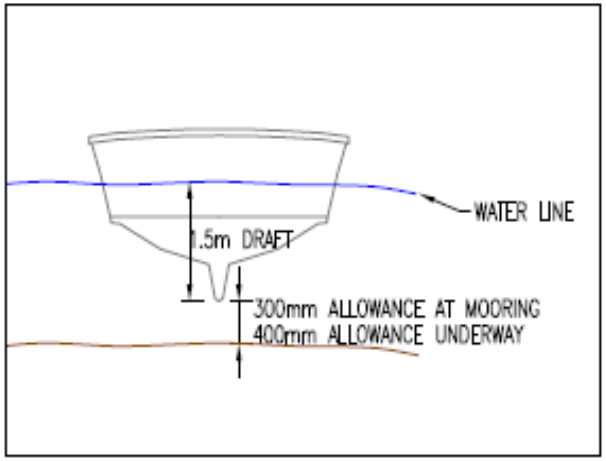
Redland CITY COUNCIL

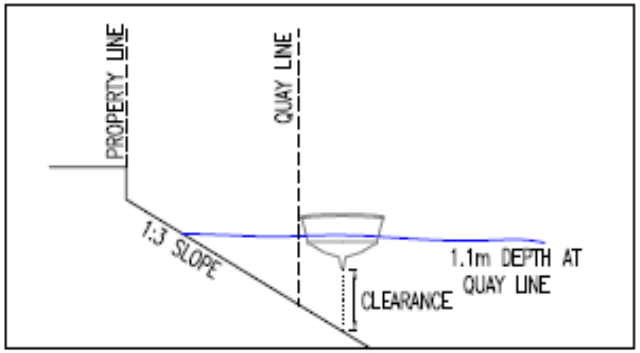
# Canal Estate Design Standards - Controlled By MSQ




NOTES:

- MINIMUM 15m "FAIRWAY" TO ALLOW THE VESSEL TO MOVE THROUGH
- PONTOON CANNOT EXTEND BEYOND QUAY LINE
- 1.9m IS NOMINAL DEPTH OF CANAL
- ALL DEPTHS AND CLEARANCES AT L.A.T




| | LENGTH | BEAM | DRAFT | MOORING CENTRE | MOORING DEPTH | MOORING CLEARANCE |
|---|---|---|---|---|---|---|
| YACHT | 8.0m | 5.4 | 1.5 | 1.7 | 1.61 | 0.11 |
| POWER | 20.0m | 5.7 | 1.5 | 2.85 | 1.9 | 0.4 |

| REV | DATE | DESCRIPTION | BY | CHECKED |
|---|---|---|---|---|
| A | 14.05.09 | FOR APPROVAL | WD | LG |

LOT No: NA
PLAN No: NA
PARISH OF: NA

Infrastructure Planning Group
RedLand CITY COUNCIL
TRANSPORT AND INFRASTRUCTURE TEAM
DESIGN SERVICES

Project:
CANAL ESTATE
DESIGN STANDARDS

DESIGN SERVICES DWG 0000-00 REV A
PLAN 1 OF 1 A3
RSC DWG No:

# Cleaning and Mangrove Removal

## The Sovereign Water Lake and Wetlands

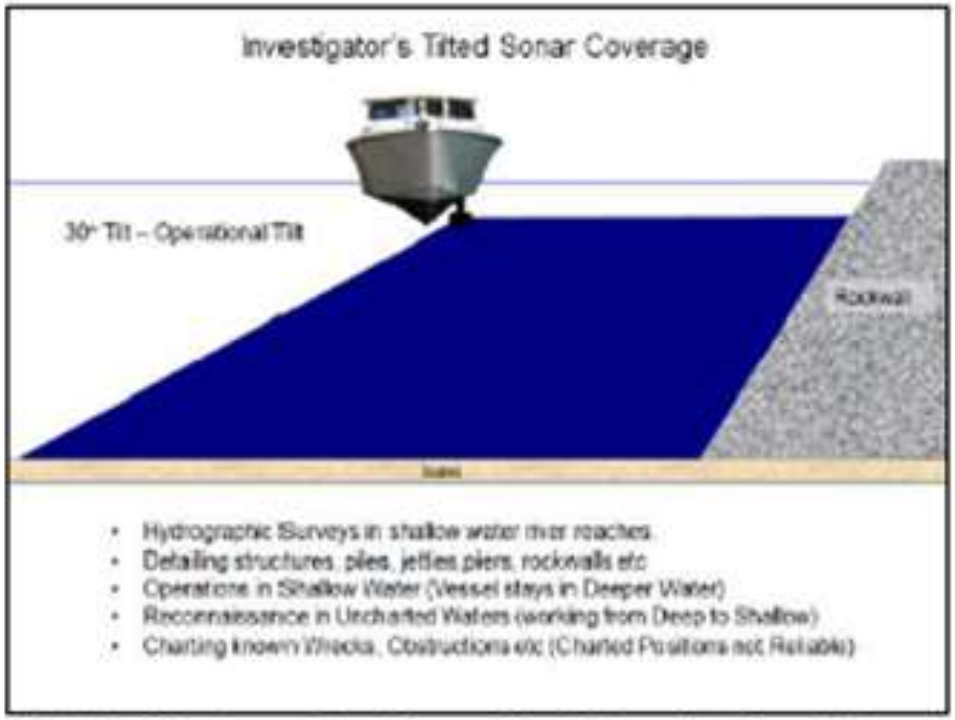
Sovereign Waters treatment measures consist of one Trash Rack, two x Wetlands, a Lake and Five GPTs (Gross Pollutant Traps)

# Ground Surveys

# Visual Inspections


- Benefits of early detection via monitoring
- Current systems
- Aerial monitoring
- Danger of early detection – mistaking rotational slip for clay expansion & contraction.

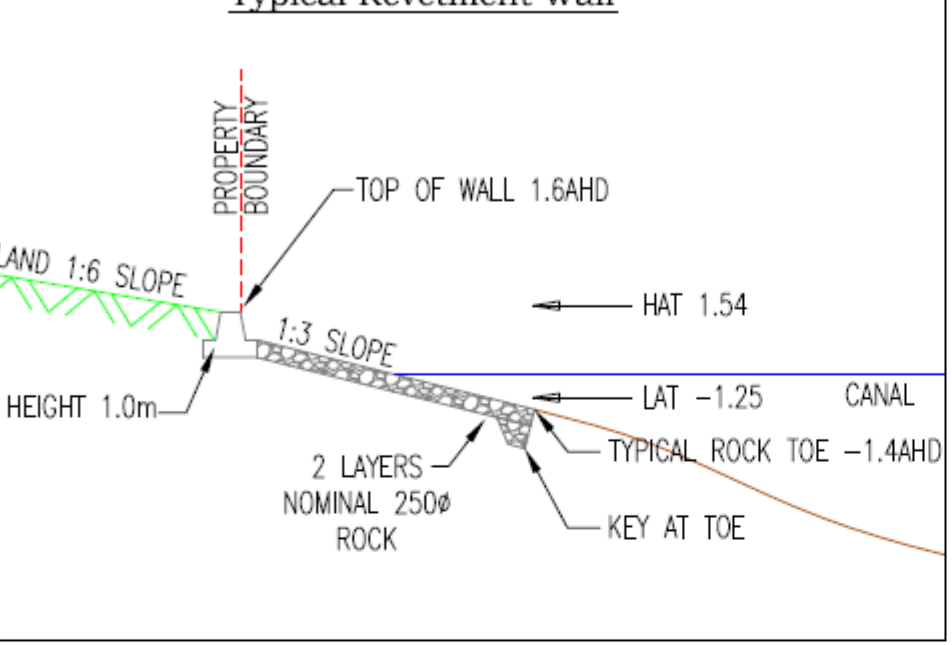
The precise positioning of all soundings is achieved by using a very high military specification inertial position and motion sensor system. Measurements of vessel heave, roll, pitch and yaw in addition to speed of sound in water are computed up to 200 times a second to deliver high resolution accurate soundings.

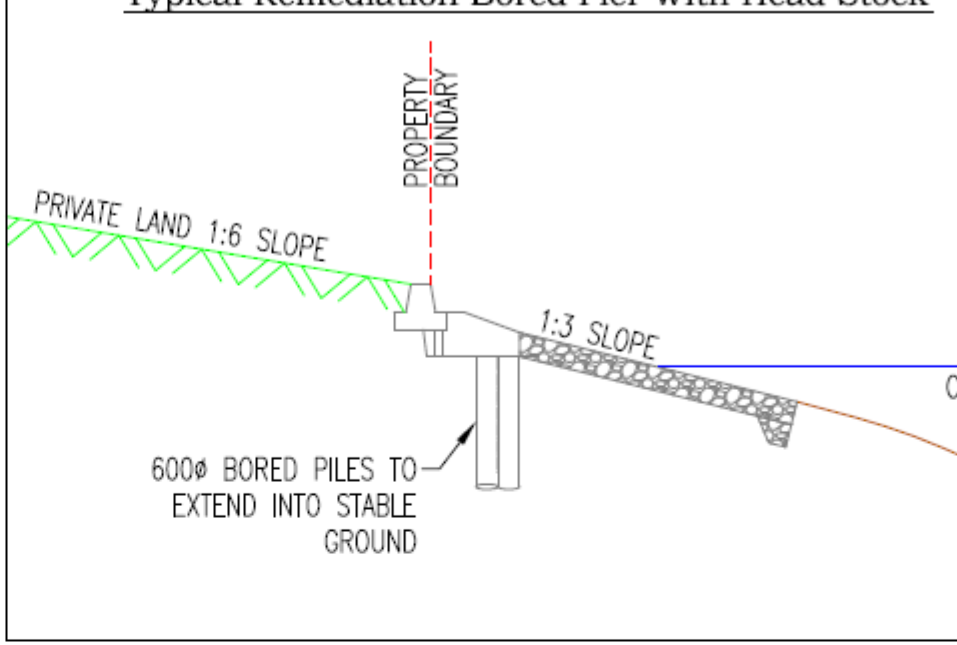



(Image No.31) The Navigator's sideward looking tilted multibeam capability

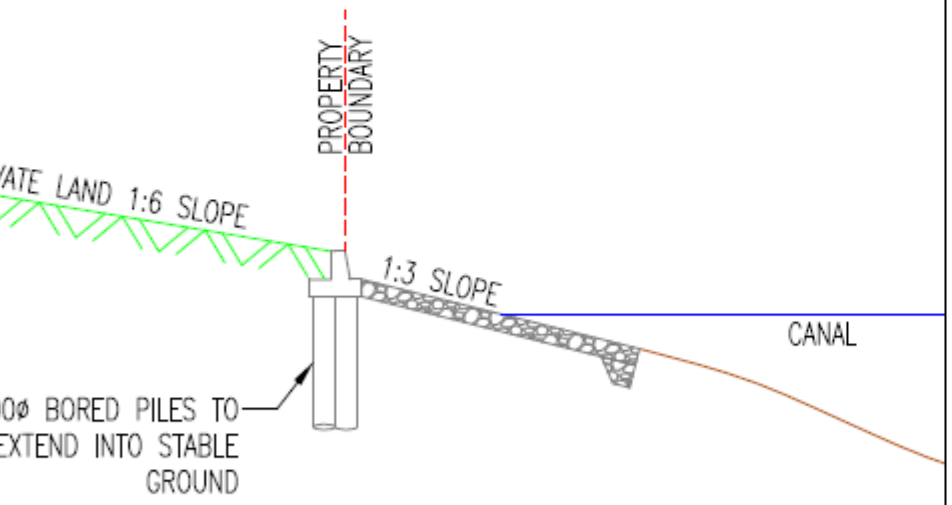
# Data Base


Legend
House/Unit Numbers
Remediated Revetment Walls
Prioritised Revetment Walls
4 - Highest
3 - High
2 - Medium
1 - Low
Current Land
Middle Street
Remediation Plan
for
Raby Bay
Redland
0 55 110 220
Meters

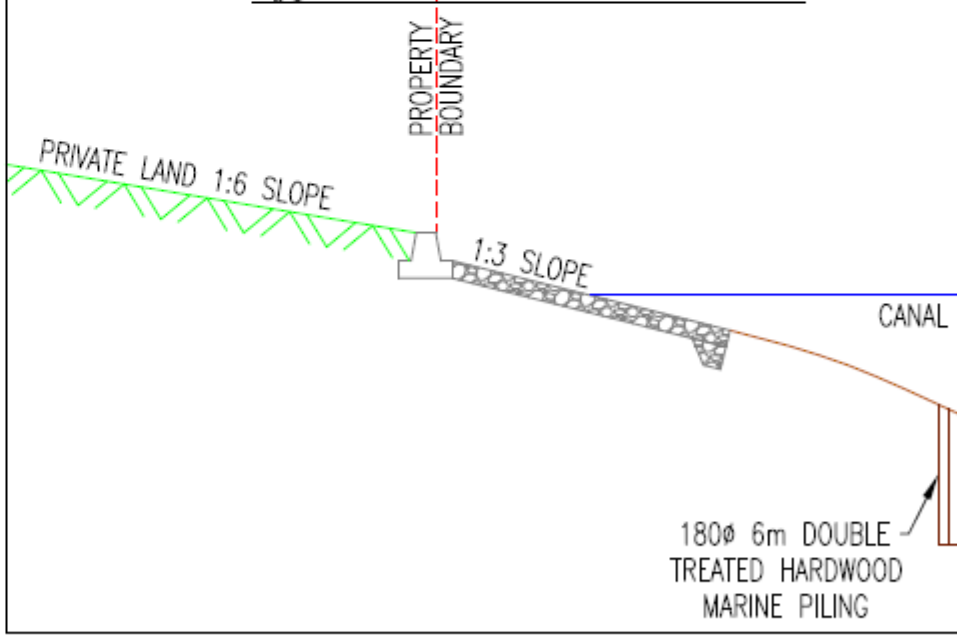



Typical Remediation Bored Pier Without Head Stock




Typical Remediation Timber Piles




LOT No: N/A

Infrastructure Planning Group

TITLE:

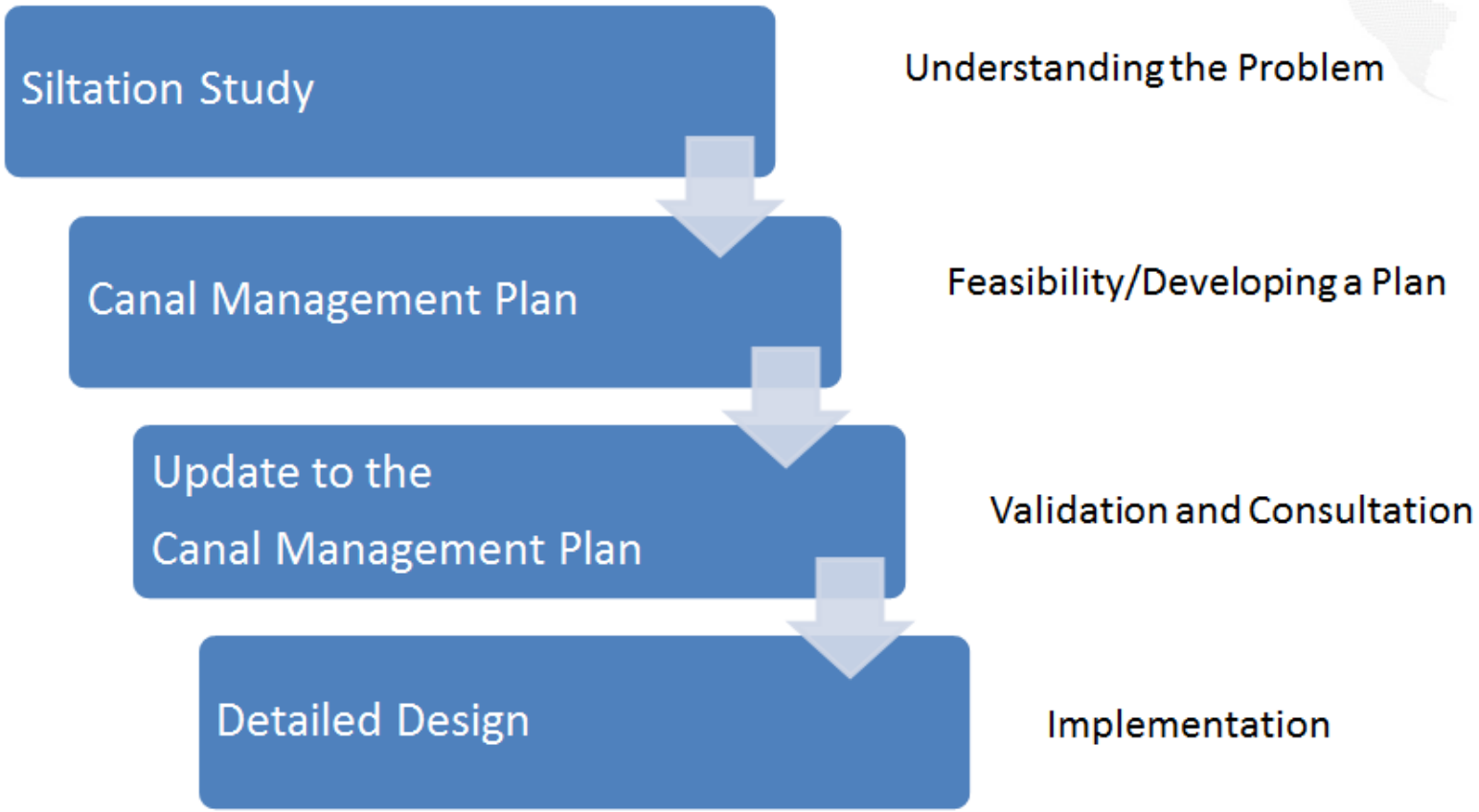
DESIGN SERV

# Failure

# Current Repair methods (increases the shear strength of the slip circle)

- Bored Piles at top
- Driven timber piles at bottom of slip
- Reconstruction of Revetment wall and tie into piles.
- Reconstruct pools, jetties, jetty piles, landscaping, access routes, reconnect power and water to jetties.
- PDG are currently improving the system by providing quicker response, lowering the factor of safety and standard designs.

# Steps to Developing the CMP



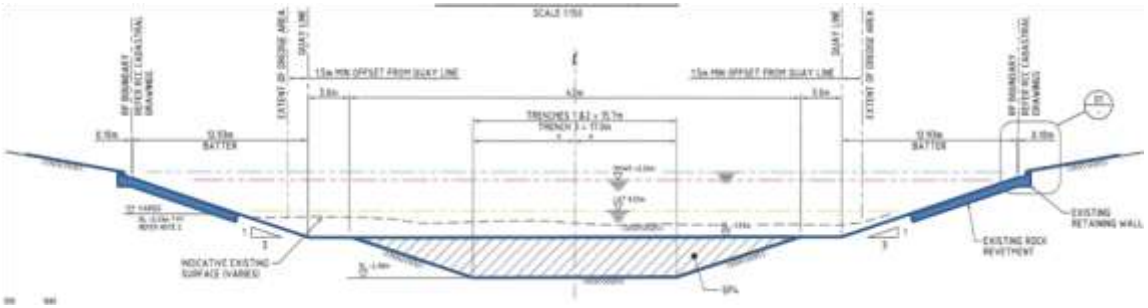
# Constraints

- high levels of accumulated siltation and a relatively high annual siltation rate
- limited pool of funding
- relatively small number of residents which the system services
- limited spoil disposal options
- limited accessibility
- Approvals

# Implementation


- Council tendered the five years of works as a single package
- All key stakeholders were involved throughout the tender process
- Considerable budget savings – up to 50% of the original estimated budget

# Silt Storage Trap Concept

# QUESTIONS?

Aquatic Paradise Maintenance Dredging Strategy

# General Rates and Special Charges Overview

Redland City Council

# Adopted Policy Position

- Council will draw from various revenue sources to fund special needs including (but necessarily limited to)
  - Separate rates or charges for whole of community programs
    - i.e. the cost to deliver services, activities and facilities that benefit the whole community generally
  - Special rates or charges for recovery of costs from beneficiaries
    - i.e. the cost to deliver services, activities and facilities that benefit specific rateable land or owners of such land
  - Utility charges for specific services based generally on usage
  - Statutory fees and charges in accordance with legislation, regulation or local laws
  - Commercial fees and charges where users can clearly be identified
  - Where practicable recovering credit card fees through a surcharge on credit card transactions

# Special Charges – Beneficiary principle


- Land owners who benefit more from the provision of certain services should pay according to the benefits they receive where it is possible for a user charge to apply.
- In the case of Special charges it is for services, facilities or activities that specially benefit the land or the owner or occupier of the land.

# Canal and Lake Special Levies First Adopted

- Raby Bay and Aquatic Paradise canal estates
  - Adopted 4 Aug 1986 — 0.0020 cents in the $
- Sovereign Lake Special Charge
  - Adopted 12 July 2000 — $500 per lot

# 2017/18 Canal & Lake Levies


- Aquatic Paradise (standard lot) $2,806.28
- Aquatic Paradise (marina berth) $2,806.28
- Raby Bay (standard lot) $2,354.28
- Raby Bay (unit) $1,364.24
- Raby Bay (marina berth) $1,189.96
- Sovereign Waters (standard lot) $ 723.60

# General Rate

- Real property is a stable base upon which to impose a tax
- Ad valorem principle - according to value
  - The tax is levied in proportion to the determined value set by the Queensland Valuer-General.
- Two other principles involved
  - Fairness
  - Equity

# General Rate - Fairness

- Legislation provides a platform of fairness
  - whether types of property may be taxed at different rates, or whether different groups are given preferential treatment (e.g. rebates or exemptions)
  - valuations are carried out by an independent central government body (Department of Natural Resources & Mines)

# General Rate - Equity

- Equity is maintained by the re-assessment of values, in line with market price movements
- 2 types of Equity
  - Horizontal equity – two identical properties having the same value
  - Vertical equity – a property having twice the value of another property should have twice the assessed amount. Inferred — greater economic capacity to pay more.
- Vertical Equity can be Regressive or Progressive
  - Regressive – high value properties are under assessed or under rated
  - Progressive – high value properties are over assessed or over rated

# General Rate - Equity

- Over or under assessment of land value
  - s105(1) Land Valuation Act 2010, an owner may object to the land valuation

- RCC residential General rate model creates artificial regressive equity – the return from high valued properties is discounted by 20%

# General Rate

- Impact of 20% discount

| Model | Value | Rate in the Dollar | Calculated Amount |
|---|---|---|---|
| 2017-18 category 1a | $300,000 | .00405848 | $1,218 |
| Single rate in the dollar | $300,000 | *.00377887 | $1,134 |
| | | | $84 |
| | | | |
| 2017-18 category 1b | 950,000 | .00324681 | $3,084 |
| Single rate in the dollar | 950,000 | *.00377887 | $3,590 |
| | | | -$506 |

* Based on modelling assumptions

# Increasing the General Rate Revenue Take

# If Canal and Lake Expenditure was Funded through the General Rate

| | |
|---|---|
| 17/18 General Rate revenue | $91,688,000 |
| 17/18 Canal & Lake Expenditure | $ 5,618,734 |
| | $97,306,734 |

# Comparison

(Based on modelling assumptions – 9.9% increase)

| Property Type | 2017-18 Revenue $91,688,000 | Model Revenue $97,306,734 | $ Variance to 2017-2018 |
|---|---|---|---|
| Residential owner occupied | | | |
| Bay water frontage | $4,870 | $5,350 | $480 |
| Canal frontage | $2,662 | $2,925 | $262 |
| Land value $300,000 | $1,218 | $1,338 | $120 |
| Strata Title Unit | $926 | $926 | $0 |
| Residential non owner occupied | | | |
| Bay water frontage | $6,258 | $6,875 | $617 |
| Canal frontage | $3,421 | $3,758 | $337 |
| Land value $300,000 | $1,472 | $1,618 | $145 |
| Strata Title Unit | $1,019 | $1,019 | $0 |
| Nursing Home | $12,516 | $13,750 | $1,234 |
| Retirement Village | $54,701 | $60,093 | $5,393 |
| Major Shopping Centre | $243,509 | $267,515 | $24,006 |
| Commercial business | $23,803 | $33,838 | $10,035 |
| Quarry | $141,600 | $155,559 | $13,960 |


# Questions?

# Appendix 4

# REDLAND CITY COUNCIL

## Canal and Lake Estates Special Charges Review

2 DECEMBERT 2017

# Project Background

Redland City has two canal estates and one lake estate

Aquatic Paradise  - approved 1971

Sovereign Waters – approved 1998

Raby Bay – approved 1979

# The issue

To maintain these estates, Council:

1. Dredges the waterways so they remain navigable

2. Repairs revetment walls that protect private and public properties from erosion.

Redland City Council is reviewing how it maintains its canal and lake estates and how this maintenance should be funded.

Maintaining these estates is expensive and how it is funded is a decision that financially impacts all Redlands' residents.

# Engagement Program

Council is engaging the community through three parallel streams of activity.

1) A whole of city engagement program

2) A Citizen's Advisory Panel

3) Direct engagement with residents' groups from Raby Bay, Aquatic Paradise and Sovereign Waters

# What is the Citizen's Advisory Panel being asked to do?

Redland City Council is asking the Citizen's Advisory Panel to answer the following questions:

- How should Redland City Council manage canal and lake maintenance activities such as dredging and bed-levelling to ensure the canals and lake can be navigated and how should these activities be paid for?

- How should the upgrade, maintenance and monitoring of revetment walls of properties on the canals and lake be managed and how should this be paid for?

# Considerations

When discussing these decisions Council is asking the panel to consider:

- What value and amenity does Redland City gain from the canal and lake estates?

- How do people use the canal and lake estates, and the waterways?

- What activities do people like to do in the popular canal and lake estate parks?

# Outcomes of this process

At the conclusion of this process a final report will be presented to Council that includes:

- The outcomes of all three streams of community engagement
- The Citizen's Advisory Panel's recommended direction to Council on both the management and funding of canal / lake infrastructure

# Why a citizen's panel?

Citizen's Advisory Panels such as this have been found to provide impartial and thoughtful advice to government.

They tell government what most everyday citizens would support, or advise, if they had:

- Access to sound information
- A variety of perspectives
- Time to think about it
- Opportunity discuss their thoughts with their fellow citizens

www.articulous.com.au

ABN 46 159 342 373

# Legislative Context

**Why is Council repairing revetment walls and dredging canals - under what legislation (if any) does this occur?**

Section 121 of the *Coastal Protection and Management Act 1995* (Coastal Act) states that a local government must maintain and keep clean each:

*a) canal in its area; and*

*b) access channel for a canal mentioned in paragraph (a), whether or not the access channel is in its area.*

This section of the Coastal Act was a continuation of provisions under the repealed *Canals Act 1958* which also required the local government to "preserve, maintain and keep clean any canal within its area". The *Canals Act 1958* also contained provisions for a local government to apply a special rate levied under the Local Government Act to provide for canal maintenance.

Sect 92 of the *Local Government Act 2009* allows local government to apply special rates and charges, "for services, facilities and activities that have a special association with particular land". This provision is often used by local governments to fund maintenance (e.g. maintenance dredging) of canals. In relation to the maintenance of revetment walls it is understood that Gold Coast City Council have determined that the revetment walls are within the private property boundaries and therefore maintenance is the responsibility of the landowner.

**How were the canal estates (especially Raby Bay estate) approved?**

These estates were approved under the provisions of the *Canals Act 1958* which required provisional and final approval of the estate. This legislation was repealed in 2003 and replaced with amendments to the *Coastal Protection and Management Act 1995*.

**Any engineering/building standards that were applicable to their construction**

We would need to check the file records to determine the engineering standards that applied at the time of the approval.

**What were the transfer conditions for Redlands when the State delegated their management to Local Government**

The transfer of the canal waterway was undertaken following the issue of a final approval under the Canals Act 1958.

***Senior Spokesperson from the Department of Environment and Science***

***Coastal and Marine Assessment | Environmental Service and Regulation***

# Redland City Council Special Charges Review

Mark Leyland
Principal Advisor Finance and Governance

# I’ve been asked to provide you with an independent perspective on these topics:

- How are Local Governments allowed to raise money?
- When can Local Governments use these methods to raise money and how do they work?
- What are the key principles that underpin each of these methods?
- What are the advantages/ disadvantages for the community associated with each method?
- What other methods can LGs use to reduce expense?

# How are Local Governments allowed to raise money?

Council's Rating Powers:

- Local Government General Rates are a tax based on "ability to pay"
- Property value is a long accepted indicator of a property owner's "ability to pay" an equitable share of the cost of services provided by the Council for its community.
- The statutory indicator of "ability to pay" is the unimproved or site land value
- A Local Government must charge a general rate based on the unimproved or site value as issued by the Valuer General.

And a couple of Myths:

- General rates should relate to the services used by the property (It's a TAX!)
- An increase in property valuation equals a similar increase in rates

# How are Local Governments allowed to raise money?

There are six main ways that local governments raise money to provide infrastructure and services to communities:

- rates and charges
- fees
- profit from council-owned businesses including child care centres, public housing, caravan parks and camping grounds, quarries and the like
- grants and subsidies
- loans
- developer contributions and infrastructure charges levied on land being developed to pay for water supply, sewerage and drainage, roads and pathways and public recreation.

Councils are required to document the processes used to raise revenue. These documents are publicly available and include the corporate plan, operational plan, revenue policy, revenue statement and budget.

# When can Local Governments use these methods to raise money and how do they work?

Each of the 77 Councils in Queensland can autonomously decide what mix of revenue sources will be used to fund operations, infrastructure and delivery of services to their communities.

Large urbanised councils will rely heavily on “own source revenues” from rates and charges, fees and profits from council owned businesses. They fund operations, maintenance and some capital projects.

Developer contributions, loans and grants and subsidies are mainly used for particular capital works projects and infrastructure.

*Queensland Councils have the most flexible rating powers of any local governments in Australia!*

# What are the key principles that underpin each of these methods?

Section 4 of the Local Government Act 2009 requires everyone involved in local government to comply with these local government principles —

(a) transparent and effective processes, and **decision-making in the public interest**; and

(b) **sustainable development and management of assets and infrastructure**, and delivery of effective services; and

(c) democratic representation, social inclusion and **meaningful community engagement;** and

(d) **good governance** of, and by, local government; and

(e) **ethical and legal behaviour** of councillors and local government employees

# What are the advantages/ disadvantages for the community associated with each method?

## Let's define what each rating term means:

| | |
|---|---|
| General Rates | A rate levied equally on the unimproved value of the land and is expressed as a number of cents per dollar of valuation. It is the same rate in the dollar for all rateable land in the local government area. |
| Differential General Rates | A rate levied where it would be inequitable and unfair to levy a single general rate on all land in a council's area. Councils may determine different categories of rateable land based on land use, access or consumption of council services. A council may levy a different rate in the dollar for each category. (Redland City has 14 Differential Rating categories) |
| Minimum General Rates | The minimum amount payable of a general rate or differential general rate determined by council, irrespective of valuation. |

# What are the advantages/ disadvantages for the community associated with each method?

## Let's define what each rating term means:

| | |
|---|---|
| **Separate Rates and Charges** | A rate or charge levied equally on all rateable land in the local government area to fund a particular service, facility or activity that benefits the entire community. For example, an environment levy, waste management levy, or bushland preservation levy. (See Redland City Separate Charges list later in the presentation) |
| **Special Rates and Charges** | A levy on specific land which receives a special benefit from the provision of a service, facility or activity e.g. road maintenance. (See Redland City Special Charges list later in the presentation) |

**Important note:**

*Funds raised by the levy of a Special Rate and Charge must be spent on the works/services/infrastructure that the levy is raised for – and before making the levy, the Council must have passed a resolution adopting a plan of works and a plan of the benefitting area, the estimated cost of the works and timeframe for doing the works.*

# What are the advantages/ disadvantages for the community associated with each method?

## Let's define what each rating term means:

| | |
|---|---|
| **Utility Charges** | A charge for the provision of water, gas, sewerage or refuse collection services. Water charges may have a two-part charge for access and consumption. |
| **Fees and Charges** | Cost recovery fees are used to fund regulatory and other operations Council is responsible for - e.g. animal control or development assessment etc. |

# What are the advantages/ disadvantages for the community associated with each method?

## Redland City Differential General Rates

Redland City Council has adopted a differential rating scheme for the 2017-18 financial year that is guided by the principles of sustainable financial management, fairness, and Council's policy objectives for various segments of our community.

The differential rating scheme for 2017-18 has 14 rating categories of land

# Redland City Charges

Below is a list of all council charges that can be included in a rate notice. Not all charges are applicable to everyone.

- Environment levy (Separate Charge)
- Landfill remediation levy (Separate Charge)
- Waste and recycling charges (Utility)
- Water charges: (Utility)
  - Fixed access water charges
  - Water consumption charge
- Wastewater charges (Utility)
- Trade waste charges (Utility)
- Rural Fire Brigade special charge (Special Charge)
- Special charges, only applicable for those in the benefit area:
  - **Raby Bay Canal Estate Special Charge** (Special Charge)
  - **Aquatic Paradise Canal Estate Special Charge** (Special Charge)
  - **Sovereign Waters Lake Estate Special Charge** (Special Charge)
  - Southern Moreton Bay Islands Translink operations special charge (Special Charge)

# What other methods can LGs use to reduce expense?

I have worked in local government for over 44 years, and have been exposed every one of those years to the pressures faced by councils in balancing their genuine desire to improve the amenity, lifestyle and standard of living for their community against the severe financial constraints caused by:

- ever increasing costs of providing base services,
- Growth or decline in population
- cost shifting by other levels of government,
- ever increasing community expectations
- technological advances Vs outdated (expensive) operations
- Pressure to reduce or maintain rates
- Severe reduction in grants and subsidies form State and Federal Government

My personal experience is that Councils are always looking for ways to reduce expense or be more efficient and productive with limited (albeit extensive human and physical) resources.

# What other methods can LGs use to reduce expense?

The process taken by a Council in determining the rate in the dollar of land value firstly requires the Council to decide the cost of services and capital works to be provided in the budget year.

Councils continually review the way they deliver services (and what services that are appropriate for the council area) to ensure the principle of *"(b) sustainable development and management of assets and infrastructure, and delivery of effective services"* is met.

Then the Council determines what income it will receive from other sources like government grants and fees and charges etc. from council activities.

Finally the costs not met by those other sources have to be levied equitably over the ratepayers.

Council has to decide "equitability" for ratepayers and uses the land valuation of each property, and the rating tools to spread those costs either across the whole area, using differential general rates and separate rates or charges OR, where only a definable part of the area will benefit, to those defined areas, using special rates and charges.

# What other methods can LGs use to reduce expense?

Council will use several statutory documents to decide what services, operations, maintenance and infrastructure will be provided to its community:

- Corporate Plan – 5 year plan developed, usually with engagement of the community about its vision for standards of services and ability to pay.
- Operational Plan – 1 year plan of what council intends to do to implement the Corporate Plan
- Budget – 1 year plan to provide funds necessary to implement the Operational Plan
- 10 year Financial Plan/forecast – a sophisticated model of Council's finances through which scenarios can be modelled to ensure today's decisions will not adversely impact future financial sustainability
- Asset Management Plan – a sophisticated record and management tool for the substantial, valuable and extensive assets under council's control – used to ensure council plans for replacement at the right time.

# What other methods can LGs use to reduce expense?

Council's develop these documents and tools to help them decide the extent of services and infrastructure to be provided to its community – and ensure that doing so will be sustainable in the long term – for future generations of community ratepayers and residents.

Each year, careful effort and diligence is applied to the Operational Plan and Budget development – and local government has a proud and long record of continually delivering essential services to their communities, efficiently and cost effectively – and responding flexibly to changes in society, technology and available resources.

Effective councils will continuously engage with and listen to their communities – revisiting "needs, wants and essentials" of service delivery.

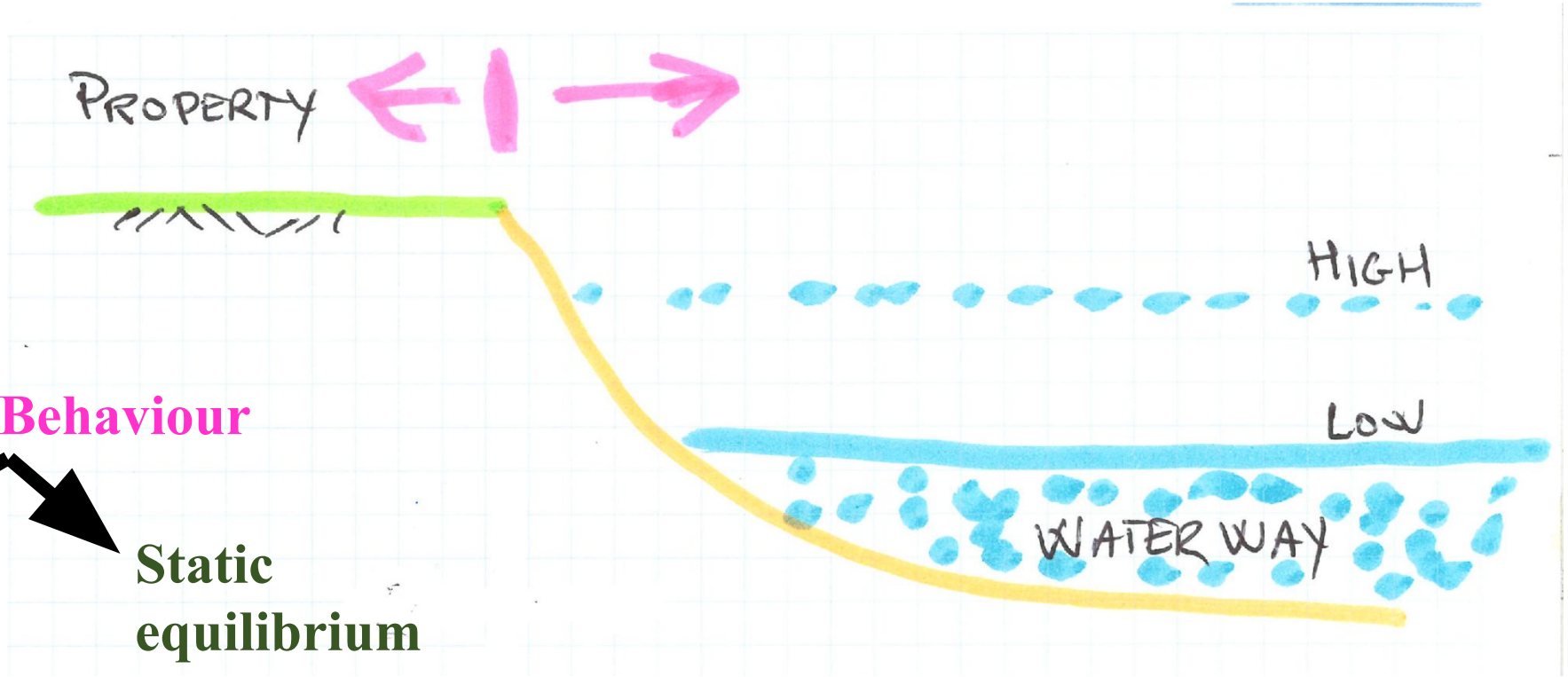
Redland City Council's Citizen Jury is a great example of a Council engaging and listening to its community!

# Redland City Council Special Charges Review

## Questions?

Mark Leyland
Principal Advisor Finance and Governance

# Why used revetment walls




**Natural Behaviour**

**Dynamic equilibrium**

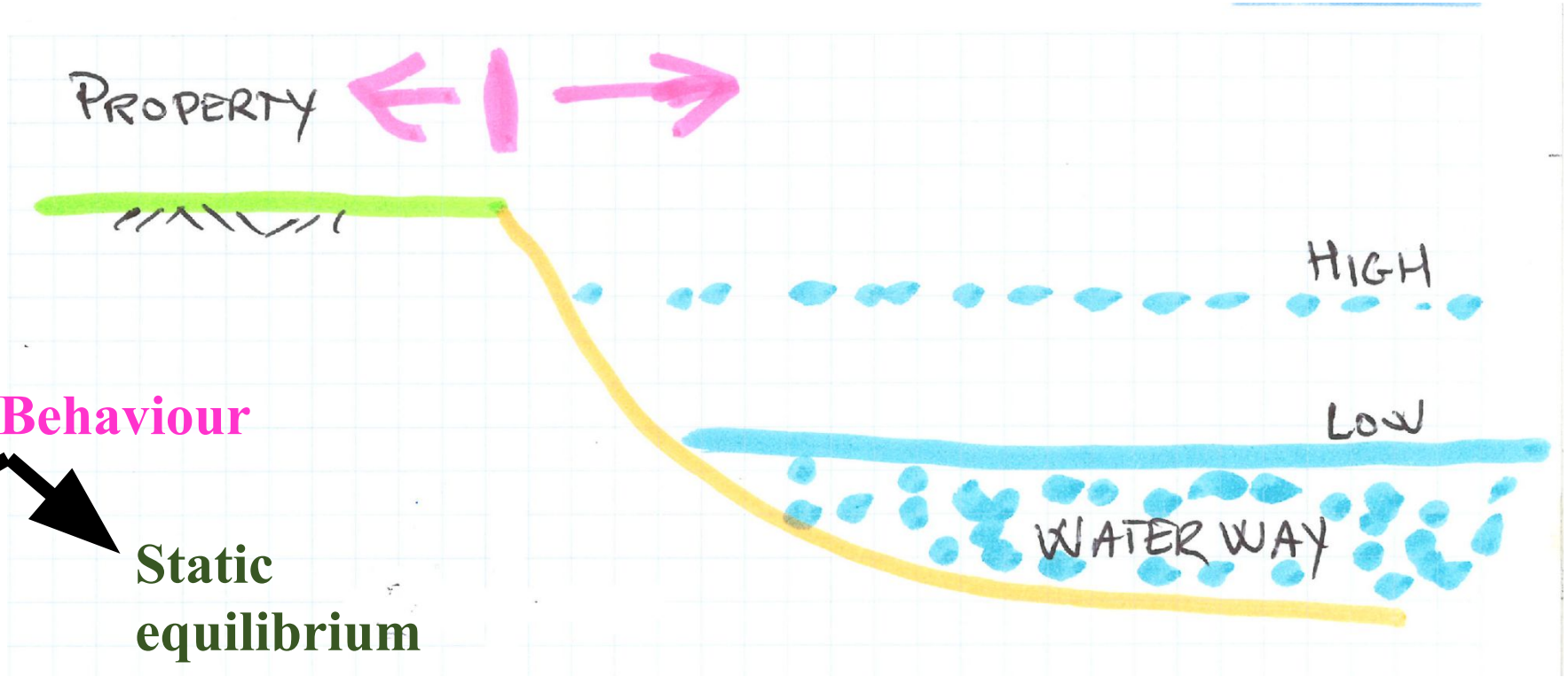
**Static equilibrium**

Movement likely if …

flow/waterway <u>out of equilibrium</u> to start with

system is in <u>dynamic equilibrium</u>

# Why used revetment walls




**Natural Behaviour**

**Dynamic equilibrium**

**Static equilibrium**

Movement likely if …

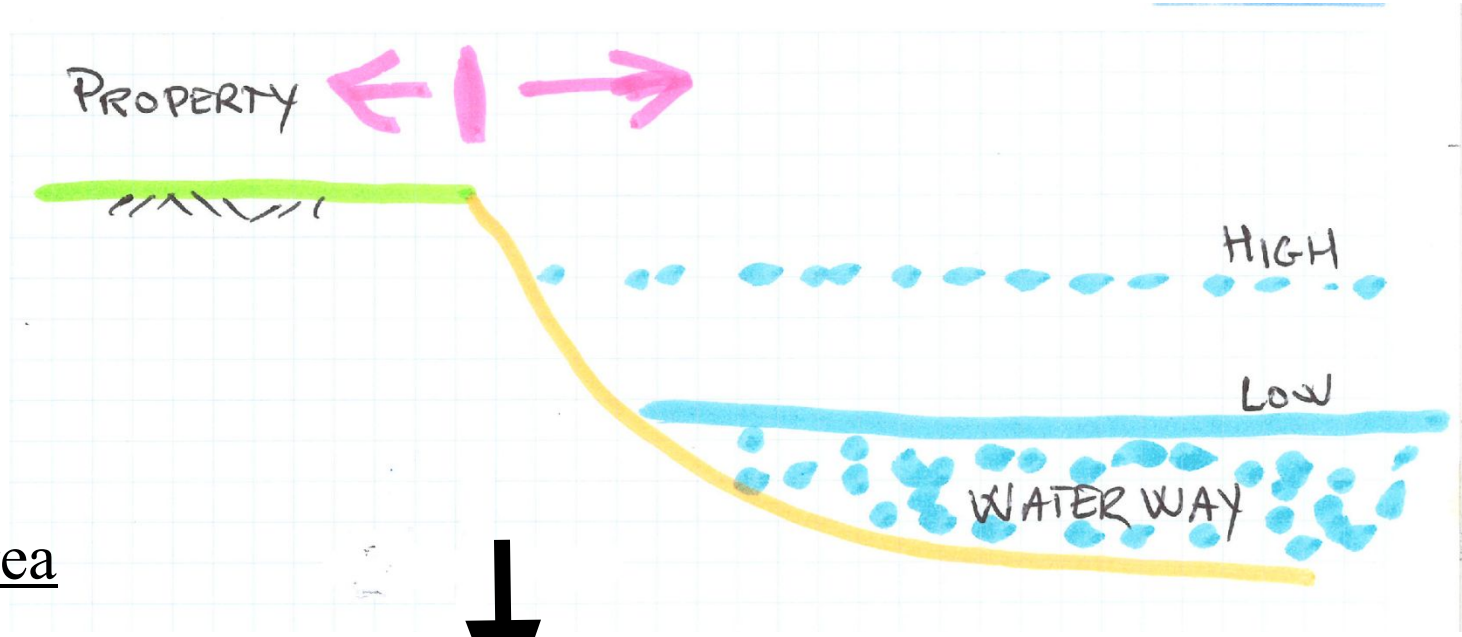
flow/waterway <u>out of equilibrium</u> to start with

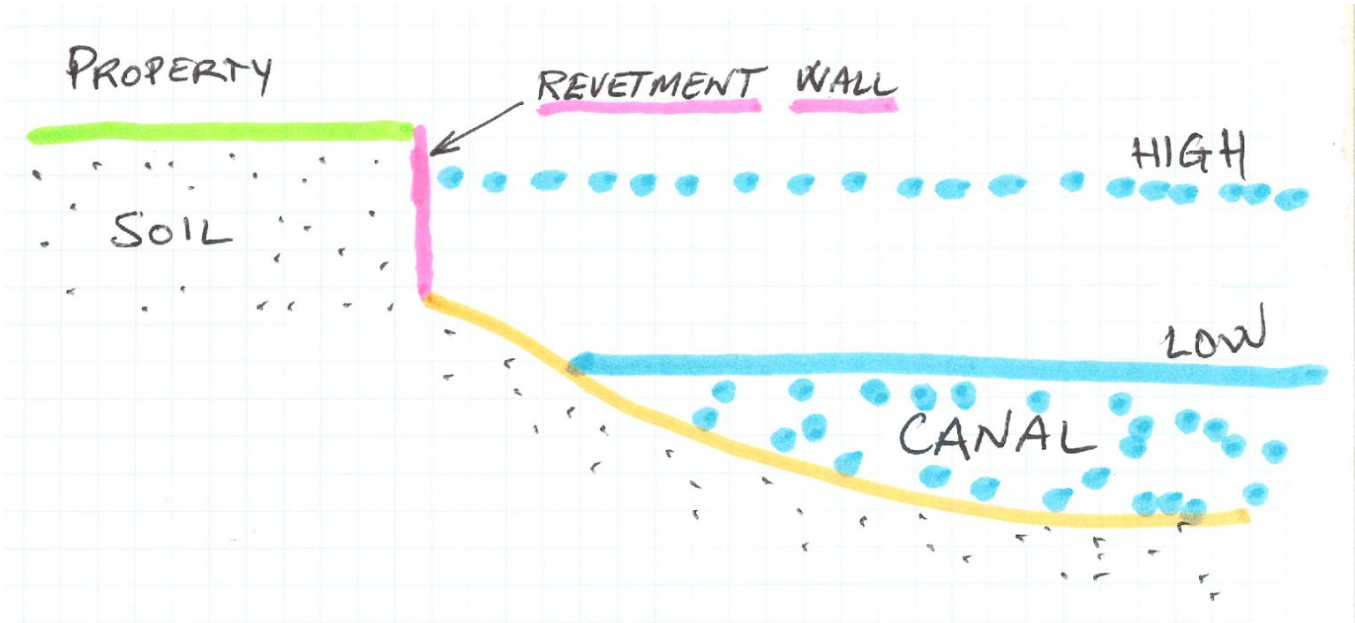
system is in <u>dynamic equilibrium</u>

artificial waterways (canals)

# Canals and revetment walls

- shapes (plan and section)
- require stabilisation
- properties neither gain nor loss area



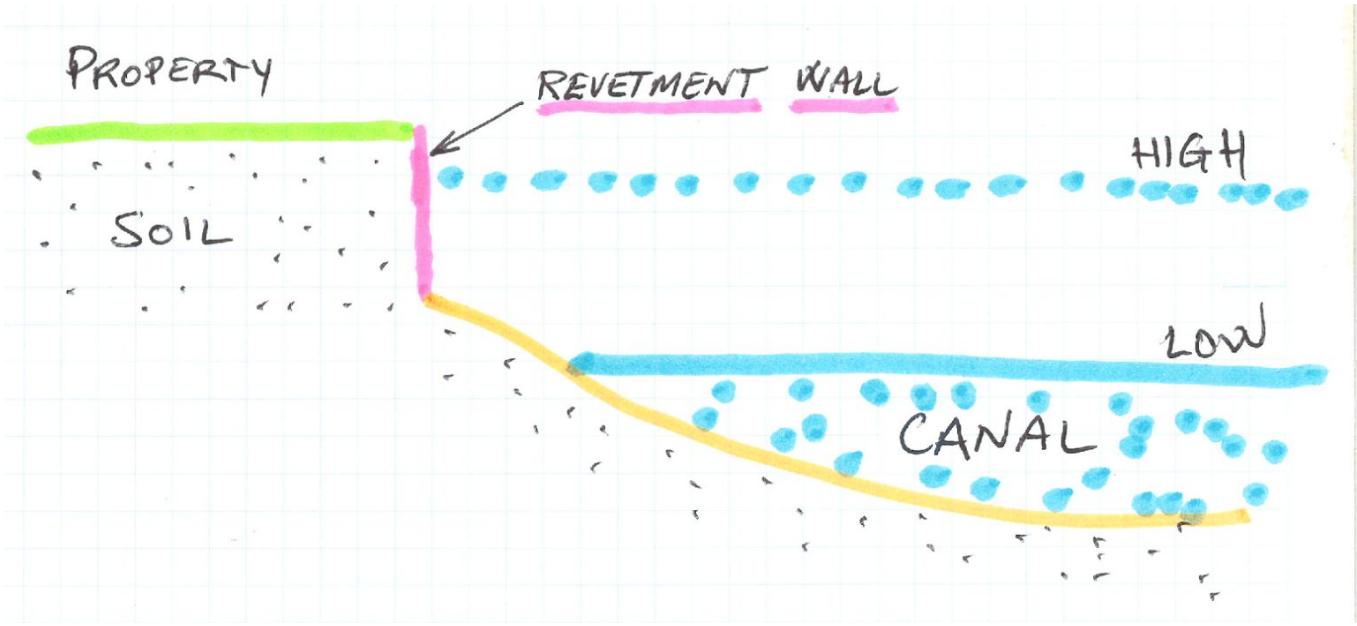



# Canals and revetment walls

Stabilisation

**horizontal** and **vertical**

earth **movement**




allow on land

source: homestratosphere.com

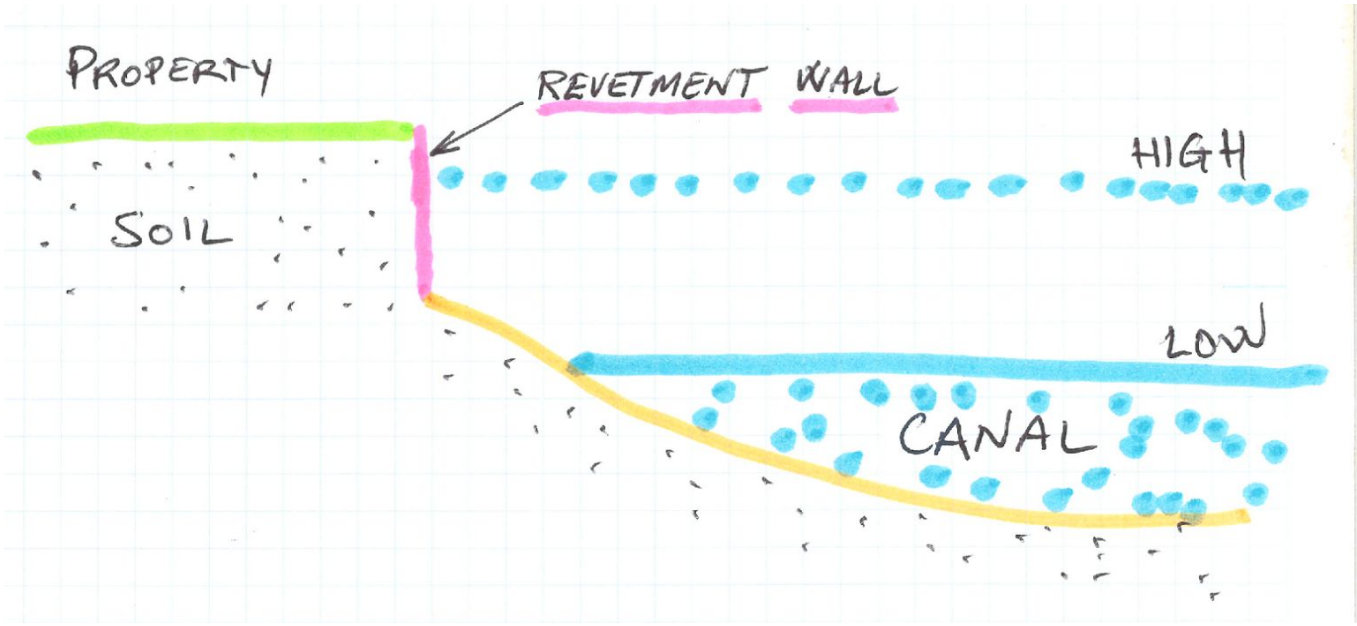
source: houzz.com.au

allow on water

source: superiorjetties.com

.....

# Revetment wall forces




"static" Forces

soil, canal water, ground water
(potentially changing over time with
sea level rise and climate change)

"dynamic" Forces

wind waves, **vessel waves**, **tidal currents**, rainfall flood currents,
storm surge currents, …

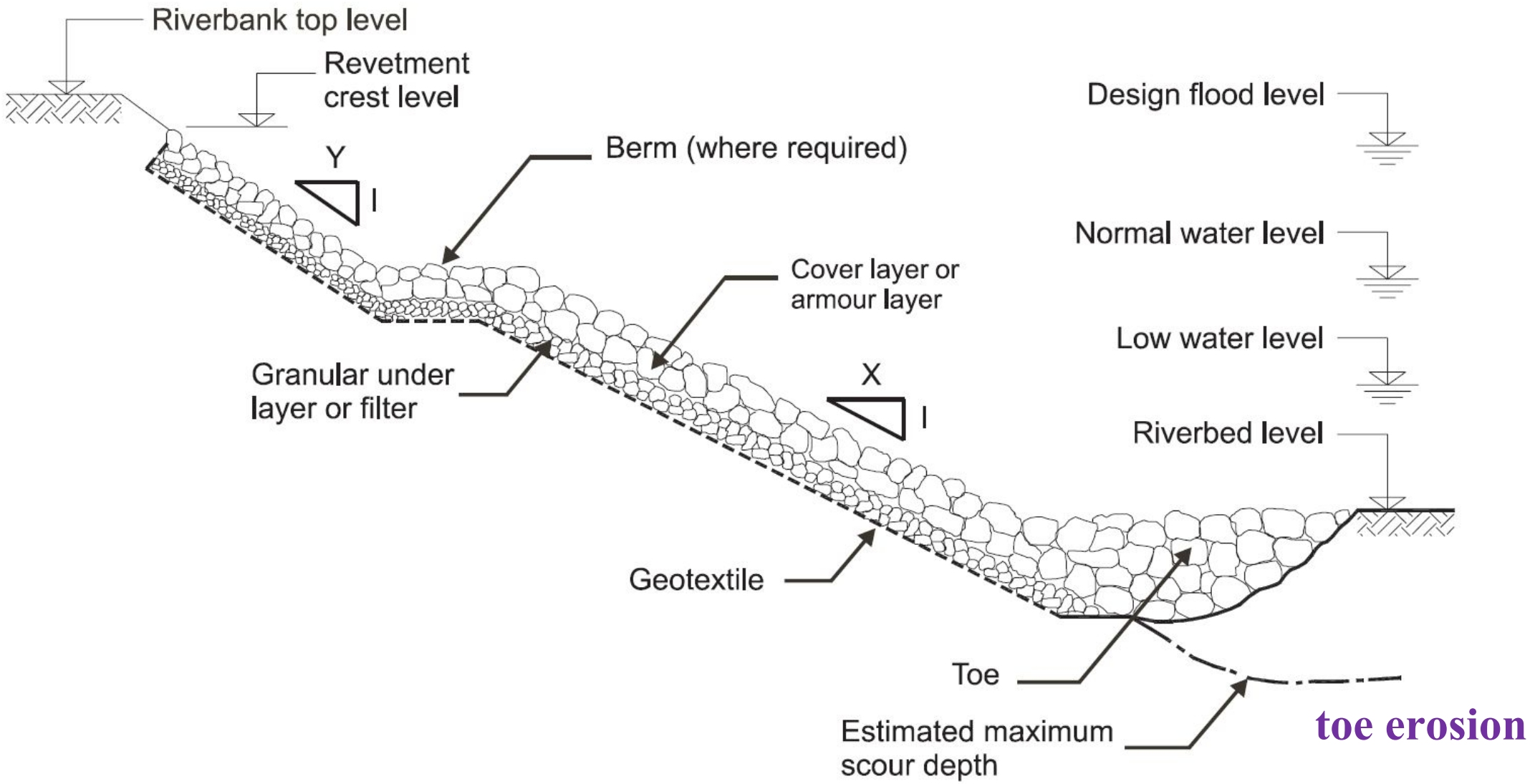
"Secondary" Forces

**pools**, trees, vegetation, pontoons, light structures

"Feedback" Forces

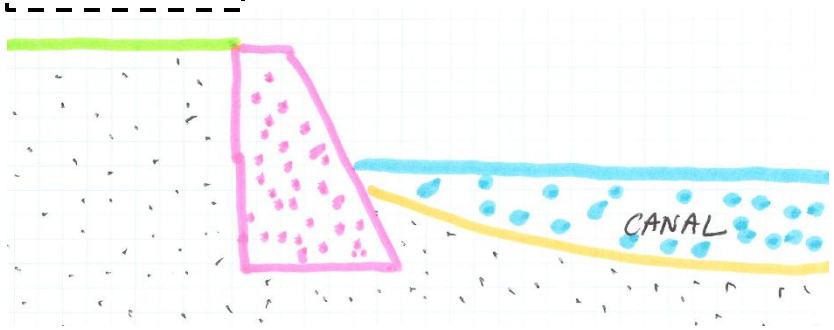
**toe erosion**, **ground water build up, isolated failures**

# Revetment wall best type…

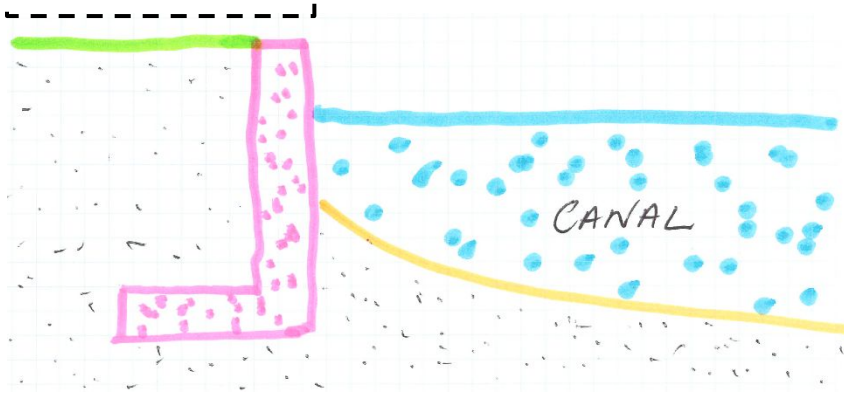


**Revetment wall best type bring in aesthetics and developable land…**

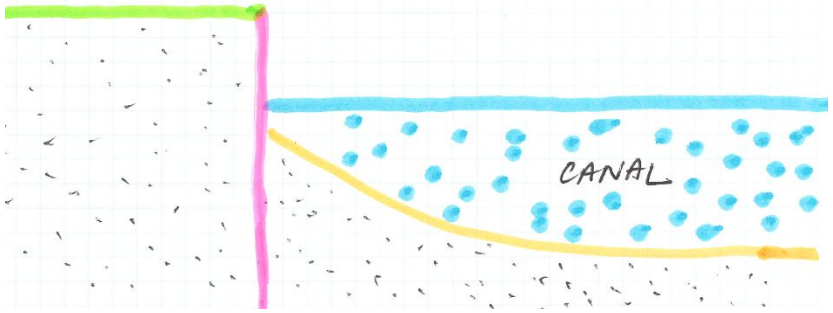
Gravity



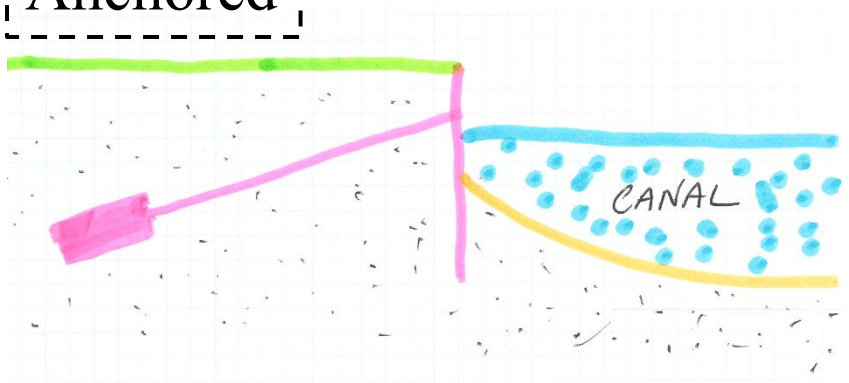

Cantilever




Pile




Anchored



# Revetment wall construction…

Best practice

Geotechnical investigation → **spatial** soil strength information

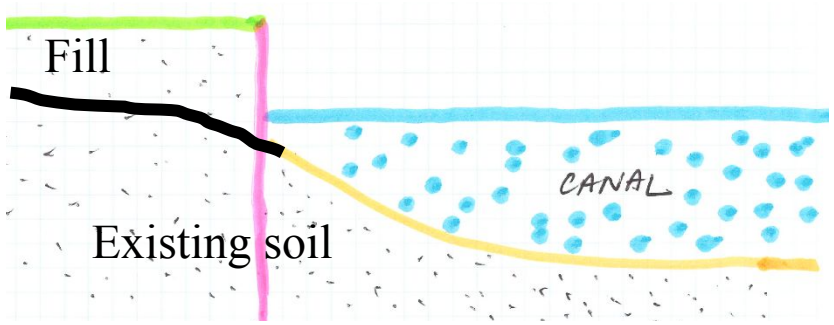
Specify **spatial** compaction when required

Revetment wall design varies **spatially** with soil strength

If working in fill or reclaimed land

**Foundations** located **below fill** and into **proven** dense and **stable** soil

For example, drive the pile well into material below fill



**Revetment wall construction…**

Best practice

Geotechnical investigation → **spatial** soil strength information

Specify **spatial** compaction when required

Revetment wall design varies **spatially** with soil strength

If working in fill or reclaimed land

**Foundations** located **below fill** and into **proven** density and **stable** soil

Reclaimed land built by **hydraulic placement of sand**

generally high density

strength and density confirmed by measurements

**River mouth within Moreton Bay**

Sediment in Moreton Bay from catchment, transported during rainfall floods

Wind waves and tidal currents keep this material available for transport

Tidal currents into river/estuaries/canals transports the finer fraction

If the waterway area is narrow enough to limit wind wave generation, material settles out

Accumulation occurs if rainfall flood current are not large enough to transport material back into Moreton Bay

# Appendix 5

# AQUATIC BUSINESS CASE

- WILL DRAW TOGETHER EARLIER FIGURES
  - BENEFITS
  - LESS COSTS
  - EQUALS SURPLUS OR NET BENEFIT
- NORMALLY WOULD DO FOR MANY YEARS
- WILL USE AVERAGES CALCULATED EARLIER
- DO FOR REDLAND SHIRE AS PER DICK WOOD (SHIRE CHAIRMAN)
- DISCUSS BENEFITS AND COSTS
- THEN PUT THE FIGURES TOGETHER
- THIS IS THE RIGHT PROCESS
  - THE FIGURES CAN BE IMPROVED

# DICK WOOD'S AQUATIC BUSINESS CASE - NO LEVY

## GENERAL

- DRAIN THE LOW LYING FARM LAND
- FLOOD MITIGATION INFRASTRUCTURE FREE TO REDLANDS SHIRE

## ANNUAL BENEFITS

- SAVE FLOOD DAMAGE REPAIRS
- EXTRA RATES FROM
    - AQUATIC
    - SURROUNDING AREAS
    - NEW UPSTREAM ESTATES
- PUBLIC USE OF AQUATIC PARKS/CANALS
- PUBLIC USE OF MORETON BAY CHANNELS, ETC.
- OTHER

# DICK WOOD'S AQUATIC BUSINESS CASE – NO LEVY

## CAPITAL COST

- HIGH - BUT PAID BY ALL AQUATIC RESIDENTS
- FREE TO REDLANDS SHIRE

## ANNUAL COSTS

- DREDGING ETC. OF CANALS AND CHANNELS
- MAINTENANCE OF REVETMENT WALLS
- MAINTENANCE OF ROADS/PARKS, ETC.

## NET BENEFIT

# DICK WOOD'S AQUATIC BUSINESS CASE (Draft)

| ANNUAL BENEFITS | $000 | $000 |
|---|---|---|
| - SAVE FLOOD DAMAGE REPAIR | 200 | |
| - EXTRA RATES | | |
| ○ AQUATIC | 853 | |
| ○ SURROUNDING AREAS | 100 | |
| ○ UPSTREAM ESTATES | 1,000 | |
| - PUBLIC USE OF AQUATIC PARKS AND WATERWAYS | 100 | |
| - PUBLIC USE OF MORETON BAY CHANNELS ETC. | 50 | |
| - OTHER | - | 2,303 |
| ANNUAL COSTS | | |
| - CANAL DREDGING ETC. | 442 | |
| - REVETMENT WALL REPAIRS | 0 | |
| - ROAD & OTHER MAINTENANCE | 200 | |
| - OTHER | - | 642 |
| ANNUAL NET BENEFIT | | 1,661k |

OVER 25 YEARS = $41M

# SUGGESTED OUTCOMES

-ABOLISH THE CANAL LEVY

-"UNFREEZE" CURRENT AQUATIC RESERVE $774K

-RCC TO REDUCE COST OF MUD INTO/OUT OF CANALS

-RCC TO SEEK $$$ FROM STATE GOVT. FOR BAY SILT COSTS

-ANY EXTRA MONIES TO BE RAISED FROM BROAD RATE BASE

-NO NEW RATE CATEGORY TO REPLACE LEVY

-PANEL TO QUERY - "PROBLEM"/PROCESS/LACK OF $$$ INFO

-RCC SENIOR CULTURE – LOSING TRUST OF GOOD RESIDENTS

# RECAP

**YOU NOW KNOW:**

- EACH ESTATE IS DIFFERENT
- NEED TO LOOK AT EACH NOT THE TOTAL
- AQUATIC $'s ARE REALLY ABOUT FREE FLOOD MITIGATION TO RCC
- NEW STORM WATER PIPES – NEW ESTATES – EXTRA RATES
- EXTRA AQUATIC RATES MORE THAN PAY FOR THE DREDGING
- IT IS NOT OUR MUD–WE SHOULD NOT BE CHARGED TO REMOVE IT
- NO BASIS FOR CANAL LEVY–ALL "SPECIAL BENEFITS" IN SITE VALUE
- HOW TO DO A BUSINESS CASE
- THE RCC FIGURES – WRONG AND MISLEADING

**THANK YOU FOR LISTENING, WE HOPE WE HAVE HELPED YOU**

**ANY QUESTIONS ?**

## History of transfers to and from AQUATIC PARADISE CANAL RESERVE

| | | | Transfers to Reserve | | | | Transfers from Reserve | |
|---|---|---|---|---|---|---|---|---|
| | Year | Opening Balance | Canal Special Charge | Council Contribution | Interest Income | General Rate | Other | Expenditure | Closing Balance |
| | Note: There was only one reserve for both Raby Bay & Aquatic Paradise Canals prior to 1995/96 | | | | | | | | |
| | 1995/1996 | $357,989.60 | $128,009.71 | $0.00 | $20,211.08 | | | $15,679.88 | $490,530.51 |
| | 1996/1997 | $490,530.51 | $136,957.60 | $0.00 | $26,798.00 | | | $10,335.59 | $643,950.52 |
| | 1997/1998 | $643,950.52 | $136,959.94 | $0.00 | $33,993.00 | | | $29,608.52 | $785,294.94 |
| | 1998/1999 | $785,294.94 | $179,759.85 | $0.00 | $40,923.14 | | | $111,964.50 | $894,013.43 |
| * | 1999/2000 | $894,013.43 | $226,833.71 | $0.00 | $7,398.04 | | $105,551.98 | $1,233,797.16 | $0.00 |
| | 2000/2001 | $0.00 | $249,083.94 | $0.00 | $6,854.68 | | | $54,070.42 | $201,868.20 |
| | 2001/2002 | $201,868.20 | $259,795.44 | $0.00 | $13,650.27 | | | $32,679.04 | $442,634.87 |
| | 2002/2003 | $442,634.87 | $259,796.00 | $0.00 | $29,033.89 | | | $35,053.99 | $696,410.77 |
| | 2003/2004 | $696,410.77 | $253,076.40 | $28,119.60 | $42,806.05 | | | $23,467.17 | $996,945.65 |
| | 2004/2005 | $996,945.65 | $263,776.40 | $0.00 | $63,140.62 | | | $34,331.91 | $1,289,530.76 |
| | 2005/2006 | $1,289,530.76 | $274,476.40 | $30,497.40 | $81,930.80 | | | $49,657.10 | $1,626,778.26 |
| | 2006/2007 | $1,626,778.26 | $291,601.34 | $32,400.18 | $110,787.67 | | | $31,497.06 | $2,030,070.39 |
| | 2007/2008 | $2,030,070.39 | $303,255.44 | $33,695.04 | $135,342.78 | | | $106,545.21 | $2,395,818.44 |
| ** | 2008/2009 | $2,395,818.44 | $327,608.32 | $36,400.92 | $143,232.81 | | $335,684.08 | $3,238,744.57 | $0.00 |
| | 2009/2010 | $0.00 | $431,913.04 | $47,990.34 | $1,628.08 | | | $377,058.25 | $104,473.21 |
| | 2010/2011 | $104,473.21 | $460,040.00 | $51,115.56 | $22,494.67 | | | $72,157.75 | $565,965.69 |
| | 2011/2012 | $565,965.69 | $20,905.44 | $158,283.00 | $24,606.58 | $362,344.45 | | $32,991.22 | $1,099,113.94 |
| *** | 2012/2013 | $1,099,113.94 | $21,846.24 | $126,982.68 | $50,941.61 | $274,443.00 | $45,330.73 | $59,043.09 | $1,559,615.11 |
| | 2013/2014 | $1,559,615.11 | $434,602.64 | $186,258.28 | $49,098.17 | | | $66,911.18 | $2,162,663.02 |
| | 2014/2015 | $2,162,663.02 | $587,614.64 | $251,834.84 | $59,697.51 | | | $227,674.97 | $2,834,135.04 |
| | 2015/2016 | $2,834,135.04 | $595,091.84 | $255,039.38 | $60,008.81 | | | $58,890.47 | $3,685,384.60 |
| | 2016/2017 (to P9) | $3,685,384.60 | $446,636.22 | $191,415.54 | $41,193.68 | | | $1,781,105.53 | $2,583,524.51 |

* Due to insufficient funds in Reserve, expenditure of $105,552 was funded by a loan from RSC and repaid over 6 years.

** Due to insufficient funds in Reserve, expenditure of $335,684.08 was funded by a loan from RCC and repaid in the 2009/10 financial year.

*** Amount of $45,330.73 reimbursed to the reserve for a prior year expenditure adjustment.

In 2011/12 Council resolved to create an additional 2 Aquatic Paradise reserves and deplete and close the balance of the Aquatic Paradise Canal reserve.
In 2013/14 Council resolved to re-instate the Aquatic Paradise Canal reserve and close and transfer the funds from the other 2 Aquatic Paradise reserves.

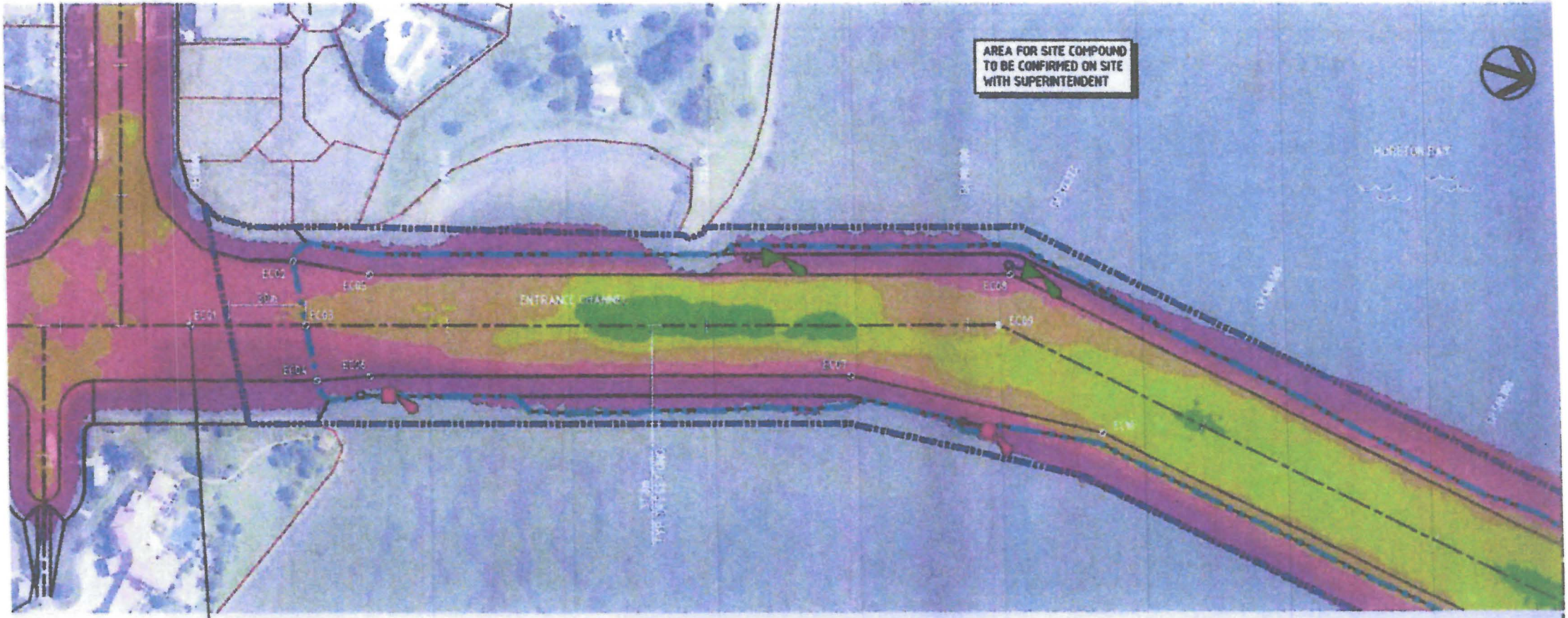
***Note: Transfers from reserve are done up to the $ value identified in the adopted budget.***

**NOTES:**

1. REFER DRG No. BEJ456-DW-CV-GEN-0100 STANDARD NOTES.
2. REFER DRG No. BEJ456-DW-CV-GEN-1001 STAGING SUMMARY PLAN.
3. REFER DRG No's. BEJ456-DW-CV-GEN-10[illegible] CANAL SETOUT CO-ORDINATES.

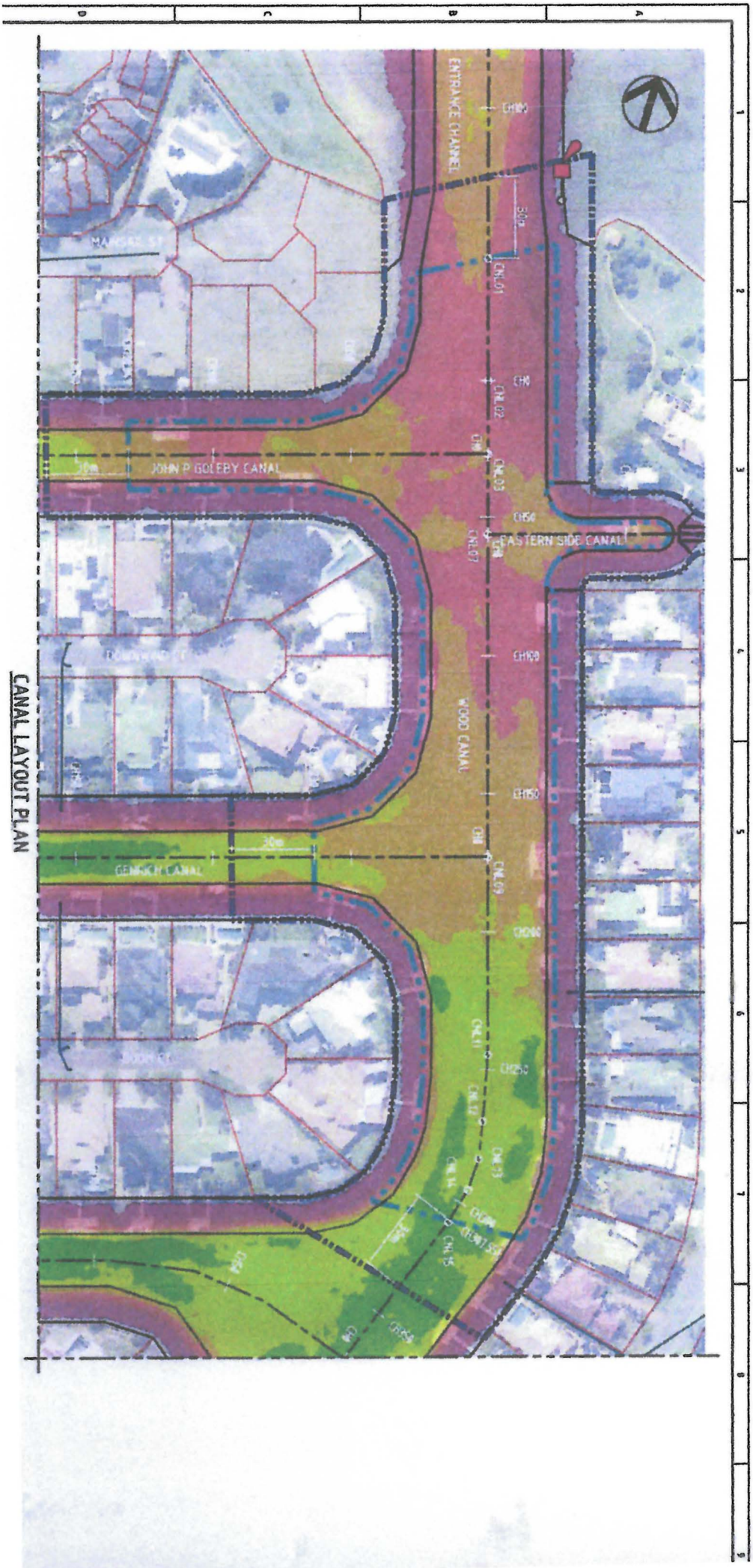
**BED LEVELS (m LAT):**
(PBPL 2014 SURVEY)

-0.25 -0.50 -0.75 -1.00 -1.25 -1.50 -1.75 -2.00 -2.25 -2.50




## ENTRANCE CHANNEL LAYOUT PLAN - PART A

SCALE 1:1000



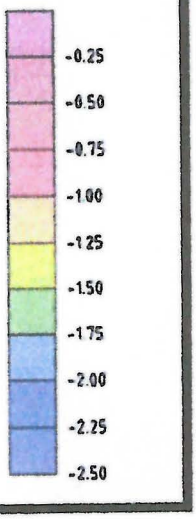

CANAL LAYOUT PLAN

## NOTES:

1. REFER DRG No. BEJ456-DW-CV-GEN-0100 FI STANDARD NOTES.
2. REFER DRG No. BEJ456-DW-CV-GEN-1001 FC STAGING SUMMARY PLAN.
3. REFER DRG No's. BEJ456-DW-CV-GEN-1003 CANAL SETOUT CO-ORDINATES.

## BED LEVELS (m LAT):

(PBPL 2014 SURVEY)




# Raby Roar

## ABOUT THIS ISSUE

**A bumper issue this time as there's so much to tell you! RCC has done the 'right thing' for Raby Bay ratepayers with the coming rate refunds – but at what cost!**

**RCC's actions causing extreme concern – RCC Planners have given up! We must get them back to work! If hazardous, unsafe development is allowed the result will be high unplanned costs, legal fights and inability to properly look after the wall. RCC has even suggested handing over responsibility for fixing the wall to individual landowners!**

**It's time that all of us who are directly affected had an actual say in how and when our money is being spent. Please phone or email to let us know your views, or better still come along to our next meeting below!**

## AN RCC CAUSED DEBACLE

**Six years ago, Redland City Council made a monumental mistake when developing its Implementation Plan for the Raby Bay canals. These are strictly regulated because they give Councils power to force some ratepayers to pay special charges over and above everyone else.**

**And there is evidence that RCC officers and the then Mayor and Councillors knew about this mistake when the Implementation Plan was approved! Either that or they messed up both the old and the new Plan!**

***Minutes: Meeting April 2011 between CEO and General Manager Corporate Services with canal and lake representatives. Minutes distributed to Mayor and all Councillors.***
***"The current special levy appears to be non-compliant and council may need to abandon special charges. This may result in the accumulated funds that are held in trust being paid back to rate payers…"***

*Observing the 9 metre rule?* *How would this wall ever be repaired?*

*Come, if you can, to our General Meeting at the VMR Base, William Street, Cleveland on Monday 20 November at 7:30 pm*

*Oops! RCC forgot about the wall & amenity!*

*Oops! RCC forgot this wall already needs repair!*

**Yet RCC went ahead! And weathered years of unrelenting attacks from this Association accusing it of collecting money illegally! Appeals to prominent lawyers, to the Queensland Ombudsman, to the Minister were all to no avail – all declared that Council was doing the right thing.**

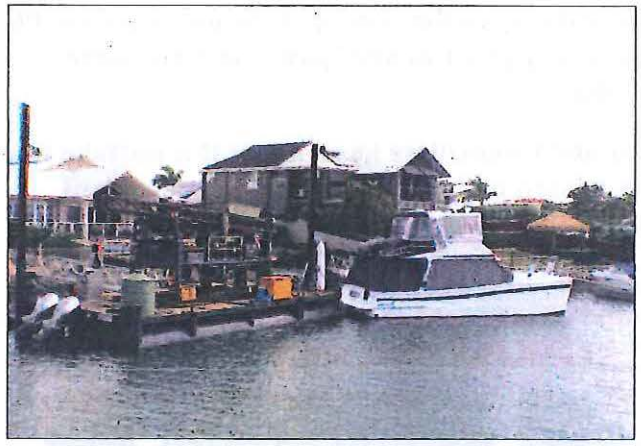
**Suddenly, after a couple of years of beavering away and raising question after question we've been told that RCC did make a mistake and was cancelling the Plan. Surprise surprise!**

***When you make a mistake that has affected someone else, what's the right thing to do? Silly question! Of course, you go to those who have suffered, sit down, apologize and together agree on how to make amends.***

**But, oh dear – not the Redland City Council! They are far too important for that! So, they called in expensive lawyers and accountants to work out a plan. And a very complicated one at that! It's taken BDO and the lawyers six months of work to produce some forty pages of calculations to tell RCC how to refund the money!**

**And the cost of employing those high priced city lawyers and accountants? We doubt there will be much change from a million dollars of ratepayers' money! Had they condescended to actually talk to canal ratepayers and their representatives they could have worked out a better deal and saved all those costs!**

**Redland City Bulletin calls it a "SNAFU" – Situation Normal. All F..... Up!**



***Revetment wall contractors need lots of space!***


**Our working group members try to ensure works are started and completed on time and on budget but are we going 1 step forward and 2 steps back? Start dates postponed, jobs delayed! And recent inspections produced more surprises!**

# *RCC PLANNING - A MUCH **BIGGER** SNAFU!*

**This piece contains some well-deserved criticism of RCC. It is about recent building construction.**

***It's directed solely at RCC and certainly <u>NOT</u> at associated owners, architects and engineers who have acted properly in their own best interests and in accordance with the law. It's not their fault that RCC has thrown away the rule book!***

**We've been talking to RCC about construction in Raby Bay that goes against original requirements about setbacks from the revetment wall.**

**Some of these walls have been constructed on uncompacted clay and have a bad habit of moving around. Resulting in much anxiety and expensive remediation!**

**On payment of a bond from the developers RCC agreed to take over this task. RCC has been doing this for the past twenty odd years and passing on the bulk of the cost to Raby Bay ratepayers.**

**The original covenants contained strict rules prohibiting major structures from being built closer than NINE (9) metres from the revetment wall. RCC continued these rules with its own Waterfront Structures Policy. But the 2006 rewritten Policy had drafting errors making in unenforceable.**

**Eventually – after nine years – this problem was fixed when the current *Canal and Lakeside Structures Overlay* was introduced.**

**But RCC assessing officers have been ignoring the amenity rules and overlooking the need to ensure that the revetment wall is clear of other structures. Some twenty years of looking after these walls must have given Council some idea that large excavators and other machinery need space to operate – but that's not the province of the assessing officers and they don't talk to the engineers!**

**Recently we found that a massive new home is being built too close to the wall and has a deck actually overhanging it. This very same wall has failed and is slated for well over half a million dollars' worth of remediation work!**

**We complained to RCC. The response from the Group Manager:**

***"The Council policy and assessment criteria for development in proximity to revetment walls is established by the Canal and Lakeside Overlay Code in the Redlands Planning Scheme ..... referral to the Marine Infrastructure Group was not required if the development is in accordance with the planning scheme as noted previously."***

**That's worthy of "Yes, Minister"! Never mind that massive construction is occurring with Council's full knowledge over a wall needing remediation. If the rules allow it – nothing else matters!**

**At the time he didn't bother to tell us that the Planning and Lakeside Overlay Code was to be consigned to history!**

**Massive structures are being built right up against the wall. The additional cost to remediate, which could involve demolition and reconstruction, ignored. The need for adequate setbacks ignored. Amenity rules overlooked. Massive future costs left for others to worry about.**

**We recently had a meeting with the senior officers of the Planning and Assessment Group. We put all our worries and concerns to them. We had a long conversation about the need to strengthen the rules in the Overlay to ensure that adequate space is available for machinery to work on the wall, to ensure that amenity rules are obeyed, to ensure that adequate setbacks are enforced and massive structures are not allowed.**

**The result? As the meeting was concluding, David Jeanes, the Group Manager, informed us that the Canal and Lakeside Structures Overlay is to be withdrawn. That Raby Bay lots are to be zoned Low Density Residential - similar to the bulk of other lots in the City. That the new City Plan will contain an 'Editor's Note' advising the need to obtain an engineer's certificate.**

**Great! No more headaches for RCC staff! They can just tick off everything that's put to them!**

**The excuse? Building structures are regulated under the State Building Code so there is no need to include rules in the City Plan! But there are no rules in the State Building Code about building on canal front properties! So, the situation now stands that .....**

**THIS IS VERY SERIOUS, AND WE NEED TO FIGHT IT RIGHT NOW!**

- **RCC is correcting the errors in its rules and their administrative failures by tearing up the rule book!**
- **We can expect huge problems in the future. These massive structures will need partial demolition to fix wall problems. Who will pay for that?**
- **Already there is an example of movement in a swimming pool following revetment wall remediation nearby - it will be a lawyers' picnic to determine who is responsible. If Council's present attitude persists we can expect much more of this in the years to come and we the ratepayers will have to foot the bill!**
- **Throughout the Raby Bay estate there is continuing need to rebuild the rock armour as these rocks are just sitting there and they tend to slip. It seems our Council has given no thought to how it can do this when people are allowed to build decks over the rocks let alone how they can remediate the wall if this becomes necessary.**

*RCC has spurned its responsibility to professionally oversee structures on Raby Bay*

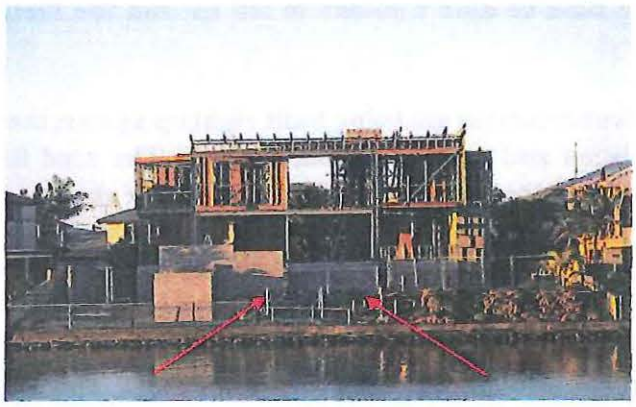
*It wants out!*

*Assessing these as building, not planning applications nicely transfers responsibility from RCC to the State!*

*But the State Building Code contains no rules about canal front properties!*

*Anything goes!*

*Massive costs will be incurred in the future!*



*Let's not even worry about wall stability or amenity – anything goes!!*

# IT'S TIME FOR A CHANGE!

**YES, IT'S TIME: to overcome the mistakes of the past, it's time to forget about the sensibilities of our Mayor, our Councillors and the legions of Council bureaucrats who make decisions without knowing what's really going on!**

**YES, IT'S TIME: to let go of the angry criticism of Council employees who must accept it with a smile and cannot answer back! Who then fall back into the bureaucratic practices of non-answers and obscurantism.**

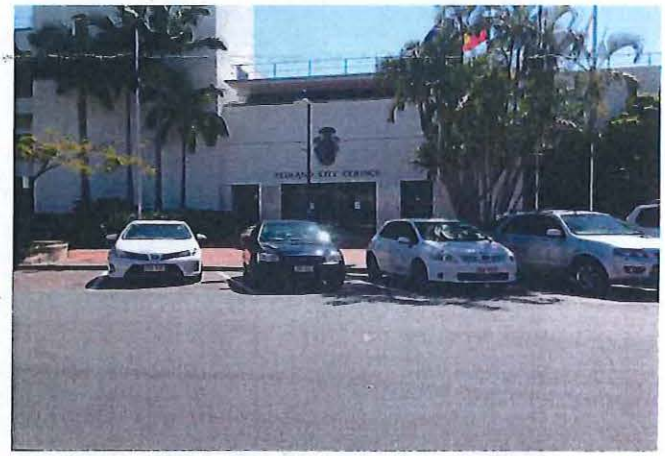
**YES, IT'S TIME: to set up a new organisation that is directly accountable to *those who are actually paying the bills*. An organisation that will not be bound by the excessive protocols and red tape of local government. An organisation which will concentrate on competence and value for money, which will not spend upwards of a million dollars to avoid talking to people.**

**YES, IT'S TIME: Our residents are sick and tired of the delays and over budgeting, of paying levies and waiting for years for the work to be done, of reporting wall movements and similar problems and waiting years for Council to get around to doing something. Of receiving high cost consultants' advice about better ways of doing things and waiting four years for action!**

**ES, IT'S TIME: Our residents are sick and tired of paying huge costs for overseeing straight forward contracts, either by Council's Project Delivery Group or by outside consultants who are more interested in collecting excessive fees for contract variations than actually getting the job done!**

**YES, IT'S TIME: In getting any action through the Council we have to deal with endless departments and managers who seldom communicate with each other for a fear of losing control of their empires.**

- **Organisational Services Department**
- **Financial Services Department**
- **City Planning and Assessment Group**
- **General Counsel Department**
- **Chief Executive Officer**
- **Mayor's Office**
- **Councillors Office**
- **Project Delivery Group - Infrastructure and Operations Department**
- **City Infrastructure Group - Infrastructure and Operations Department**
- **Communications, Engagement and Tourism Group**



**So, we strongly put a proposition to Council to establish a new corporation that would be specifically responsible for the management of the Raby Bay canals with its own engineering manager and office. The response?**

***Council:*** **"We'll set up a Community Consultation!"**

***RPRA:*** **"And who will run this?"**

***Council:*** **"Why Council's Communications, Engagement and Tourism Group of course!"**

**Now this Council department is full of lovely people and experts in their field of public relations, but they know nothing about engineering, finance, corporation law and all the facets of how best to operate the vital task of competent management of the canals and revetments.**

**And we asked further: Why involve the total Redlands community with another costly and needless survey when only Raby Bay residents pay the canal levy? The response to this reasonable question?**

***Council:*** ***"We were told that "you wanted more money so we have to consult the entire community!"***

**It's not more money we want! It's the need for economy and efficiency and getting the jobs managed and done quickly which is something RCC simply have not been able do and which could actually save the Council some money. It is their endless layers of bureaucratic administration, of too many departments who just don't want to talk to each other.**

**RBRPA's involvement in the RCC's Technical Working Group has seen many improvements with direct communication with the staff who actually maintain and repair the canals. We see this new corporation as a joint responsibility between the elected Councillors, Council staff and those who are actually paying, you the Raby Bay Ratepayers.**

**YES, IT'S TIME: For you, the ratepayers who are directly affected to have a say in how and when your money is being spent.**

## *IT'S TIME FOR A CHANGE!*

***Can you just imagine the consequences if this massive home that is almost on top of the revetment wall were to fail in some way in the future?***

**..... AND WHO WILL HAVE TO PAY FOR THE REBUILD?**

**RABY BAY RATEPAYERS ASSOCIATION INC.**

[redacted]

**President:** [redacted]

**Secretary:** [redacted]

20 January, 2018

# Raby Bay Ratepayers Association Inc.

[redacted]

President: [redacted]
Secretary: [redacted]

## Information to the Participants of the Community Consultation - Citizen Advisory Panel

**The Raby Bay Ratepayers Association (RBRA) is a voluntary organization that was established to be the RCC recognized Association to represent the residents and ratepayers on the Raby Bay canal estate. Following the initial advisory panel meeting in December, the RBRA became aware that a lot of the information being supplied by the Redlands City Council (RCC) to the general public and panel participants was very selective in that it specifically refers to the 2017/18 financial year only which is totally unrepresentative of the previous 22 year history of canal repairs and maintenance. The following information is based on historical financial data provided by the RCC for the 22 year recorded history of the Raby Bay Canal Reserve.**

**The RBRA greatly appreciate the time and effort put in by the 40 member Citizen Advisory Panel in seeking a fair and equitable solution to the future funding and management of the Redlands City canal estates and looks forward to receiving your final recommendations and suggestions.**

- Redland City Council (RCC) has engaged the services of **Articulous Communications** to conduct the citizen advisory panel engagement process. The RCC states that this company is **'an independent specialist community engagement consultancy'.** Articulous Communications and their appointed Project Manager, Bernard Houston, have previously been engaged by the RCC on numerous RCC projects and Bernard Houston was a previous employee of the RCC. The RBRA considers that because of the close association of this company with the RCC and in particular the appointed Project Manager, their independence and impartially cannot be guaranteed.

- A prominent catch-phrase used by the RCC in information sheets, newspaper advertising and on their website asks the general public "**You pay, Do you Play?"** Our Association considers that this statement, is a deliberate attempt on the part of RCC to mislead the public and provoke a negative response towards the ratepayers of the canal estates. We suggest that the RCC hopes the reader will assume there is significant cost and little benefit to them…..These facts have been presented in a very biased manner in an attempt to manipulate public opinion, suggesting to the public and panel participants that the canal estates are a benefited playground only for the residents that specifically live on them and as such this contemptuous statement unfairly discriminates against them. The real costs and genuine benefits to the whole community are not properly communicated.

- Prominently displayed for panel participants is a placard prepared by the RCC stating that each RCC ratepayer pays **$54.03 for canal works for the 2017/18 financial year.** The figures quoted are very selective and grossly misleading in that they refer specifically to the current financial year only, which is totally unrepresentative of the previous 22 year history. In detailed financial information provided by the RCC, in the 22 prior years all RCC ratepayers contributed a total of **$4,143,912 which equates to approximately $3.40 per property.** In the previous 6 years all RCC ratepayers contributed a total of $**3,190,174 to the Raby Bay canals which equates to around $8.60 per property**
  **– <u>LESS THAN 2 CUPS OF COFFEE PER YEAR!</u>**

- In the RCC Q&A information material supplied to the general public, the RCC asks the question **'How much does each other Redland ratepayer contribute to canal, lake and revetment wall maintenance each year?'** The answer supplied by the RCC refers only to the 2017/18 financial year and specifically states **'in the 17/18 financial year, works costing a total of $6,457,158 are scheduled' and further states 'in 17/18 the cost of the works required exceeded the money raised'** The <u>RCC has never spent this sort of money in the past</u> and there is no likelihood of it doing so this year. Annual expenditure on the Raby Bay canals has averaged only $**1.511 million over the past 7 years and on all waterways $1.9 million per year.** RCC expenditure on Raby Bay canals to date in 17/18 is $1.29 million.

- In the Q&A information material supplied to the general public, the RCC, in answer to the question **'Are general rates paid by canal or lake property owners higher than those paid by canal estate ratepayers not on waterfront properties?'**

The answer supplied states 'all other things being equal an owner of a canal, or lakefront property ***might pay*** a higher general rate than an owner of property without canal or lake frontage". This is a deliberate attempt on the part of RCC to cover up the facts. The RCC knows EXACTLY what the rating differences are across all properties in Redlands. The truth is that the property valuation of a canal or lakefront property is likely to be more than double the value of an equivalent 'dry' property in Redlands and as such they pay **approximately double the general rates of an equivalent 'dry' property.** Typically, this equates to paying about $2500/yr in additional rates compared to other ratepayers. (This is NOT including any additional canal levies which are additional to this amount)

- In the Q&A information material supplied to the general public, the RCC, in answer to the question of what proportion of walls are on public (Council) land states that **'8.37% of Raby Bay walls are on Council land'.** The 'wall' consists of the concrete revetment wall plus the rock armour wall in front which is not explained in the material. In the case of Raby Bay the Queensland Government/RCC owns 100% of the rock armour wall and 8.37% of the concrete revetment walls are on RCC property. Many of the wall failures occur under the rock armour wall which can cause the concrete wall to also fail. Under the Queensland Coastal Protection and Management Act (CPMA) **the RCC 'must maintain and keep clean'** each canal which includes cleaning, dredging and repair of the rock armour wall.

- Council has budgeted to spend $82million on capital works this year. We question why it can happily spend this amount without public consultation but must "consult" with the wider community only on the spending approx 2% of its budget on the canal estates which historically has predominately been paid by the property owners in the estates. **On current indications, it could spend more this year on 'community engagement' than on its contribution to actual canal repairs and maintenance!!**

- The RBRA is trying very hard to work with council and the community and it is vital that ALL the facts are properly represented. We have been denied further opportunities to present to the panel (after being promised 3 time-slots, the invitation has been withdrawn) so we hope this information sheet is useful to you.

# Raby Bay Ratepayers Association Inc.

**For information of Panel members**

The Redland Shire Council approved the construction of Raby Bay and supervised its construction. The Simmons Report noted that the Raby Bay Canal Estate "is unusual for a canal development in being built predominantly in clays of potentially high reactivity" This should have put the Council and its engineers (both employed and contracted) on notice as the need for special care both in the initial approval of the development and subsequently in the supervision of the construction.

The Council entered the Deed at a time when it and the developer were being sued in the Supreme Court by 13 separate landowners for land subsidence. Clause 7 of the Deed specifically deals with the end of the agreement after 5 years. The agreement was supposed to last until 27 September 2001, however the developer was wound up and deregistered on 15 May 1999. Thereafter the Council continued the arrangement without the participation of the developer.

Until the execution of the Deed, the payment of the bond and the commitments made by the Council in 1996, the residents' primary avenue of recourse for canal wall failure lay against the developer. The Deed of Agreement set up a regime whereby the Council became the primary source of assistance, which allowed the developer to withdraw upon completion of the estate apparently without leaving any provision for future repairs beyond the 5 year period. It also created the understanding among residents upon which they have relied ever since that the Council would take care of future failures. This situation has continued for 22 years, albeit with the introduction of a canal levy in more recent years.

It can be seen that, but for this action by Council, the developer would have been held directly responsible for repairing canal bank failures. However, by intervening in this way, Council allowed the developer to complete the estate and deregister its Australian company during the period of the bond on 15 July 1999. The company, a Hong Kong based corporation, was able to withdraw from Australia without leaving any further provision for future canal bank failures.

The Association believes that the Council has made a representation of fact to the ratepayers of Raby Bay, initially through that legal agreement under deed with the developer, Civic Projects (Raby Bay) Pty Ltd in 1996, but thereafter, by continuing to follow the process set forth in the deed after the construction was completed and the development company was wound up and deregistered, that it would continue to be primarily responsible for the maintenance and repair of the canal banks and walls.

The Council, initially by words (the legal agreement under deed), and later by acts or conduct (maintaining the process for a further 17 years to the present time after the expiration of the deed), with the intention (actual or presumptive) and with the result of inducing the individual Raby Bay ratepayer on the faith of such representation to alter his/her detriment, that is, to look to the relationship (if he/she purchased from the developer) or, for subsequent purchasers, under fort law liability for negligent construction.

It would be totally unfair and perhaps contrary to law for the Council to now go back on that arrangement.

These documents were made available under RTI rules as a result of a successful appeal by the then Redland Times when Redland Council refused to make it available.

# Raby Bay Ratepayers Association

## ***GREETINGS TO ALL PANEL MEMBERS!***

Our **Vice-President**, [redacted] and **Secretary**, [redacted], were grateful to be given the opportunity to talk with some of you at the December Panel session. Unfortunately we missed the extra session for newcomers as the three hour notice we were given was just too short for us.

We had been advised in writing that we would be addressing all sessions and had prepared on that basis. It was quite a shock to be told that this wasn't going to happen! Our members have made lifetime decisions on the current state of affairs which may be changed despite those affected having virtually no say.

We very much appreciate the opportunity to put the rest of our presentations in a form that can be sent to Panel members. We have been told that these will be distributed to you electronically well before the next session.

Unfortunately, ***as we are not allowed to be present at that session***, we cannot participate in a very important Question and Answer segment. So please email the Secretary, [redacted] at: [redacted] if you have any questions or need any further information.

***One of Raby Bay's popular Triathlon Events Dec 2017***

In the accompanying pages you will find that we have been critical of some of Council's actions and decisions. We regret having to do this as Council officers have quite a difficult job to do. They are often criticised but cannot answer back. But they are dealing with other people's property and must be answerable.

Our Association has existed from the very beginning. It was there during construction and has operated continually ever since. There is evidence that there was close cooperation between Council and the Association in the early days. As there was until a year or so ago when contact with the Mayor and CEO seemed to shut down. Correspondence continued of course but little else. We were concerned. Did Council have plans afoot?

If Council persists in making decisions which have a serious impact on its citizens, and refuses to discuss them or listen to alternative arguments it must accept the inevitable result.

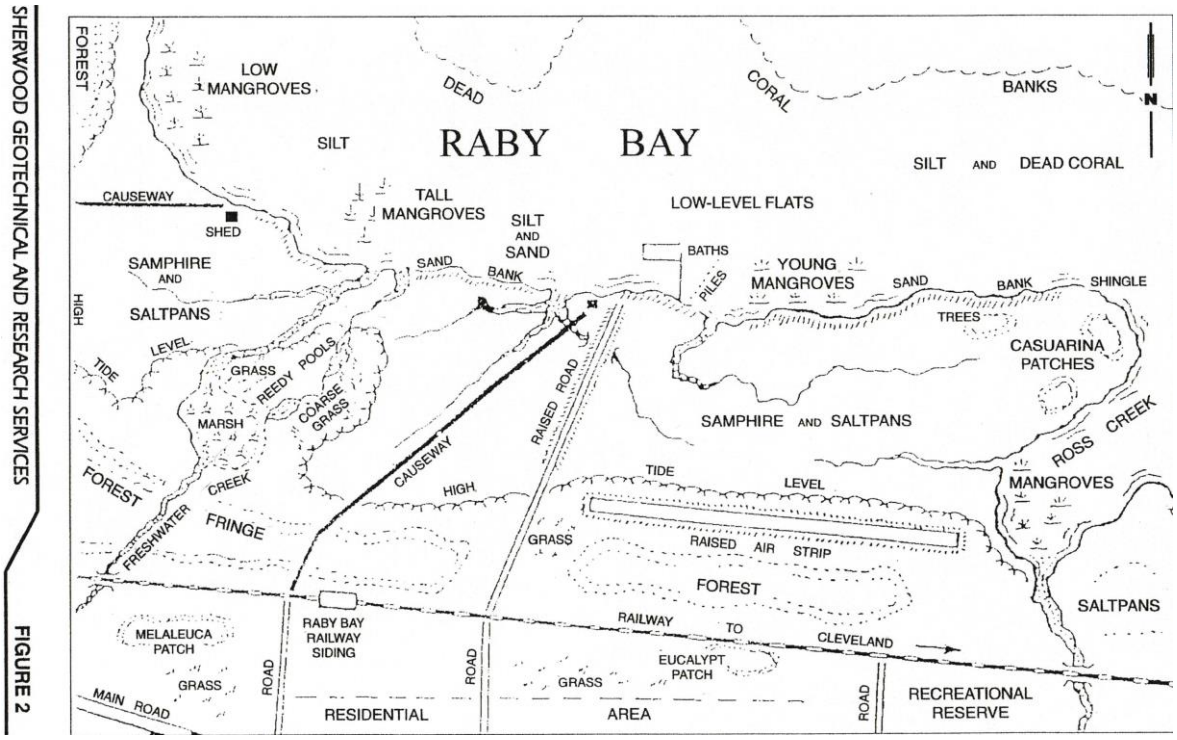
Council has expended substantial ratepayer funds on legal and accounting advice, on shutting down the Plan, on creating this Community Consultation. It has also given many of its citizens huge workloads. What for? We suspect Council has a predetermined result in mind.

**But perhaps it has inadvertently put itself on trial!**

# Raby Bay Ratepayers Association

## *LET'S LOOK AT THE HISTORY*

**This is what Raby Bay was like before 1983 when construction commenced.**




Mud flats, with fringing dead coral reefs being mined for cement, a bit of ground available for a small air strip, a railway siding and a raised road out to the shoreline, mangroves and salt pans.

Construction was undertaken in 16 stages. Lots were progressively sold as each stage was completed. The developer was a specially formed company, Civil Projects (Raby Bay) Pty Ltd, and it was supervised and approved by Redland Shire.

As construction proceeded, problems arose. Some canal banks slipped and walls had to be rebuilt. During construction these were fixed by the developer. News filtered out and prospective buyers became concerned. Our Association was established and became closely involved in discussions with Council

John Simmons, an independent and highly respected geophysicist was brought in to advise. He found the cause and submitted his report. Much of the walls were OK but those which were in doubt would have to wait until they actually failed. This could take many years.

But construction was near completion and the developer wanted out. Prospective buyers had to be assured that they would not be caught with unexpected costs. News of the problems was getting out, a number of residents had taken Supreme Court action against the developer. Things weren't looking too good.

Council had a vested interest in seeing this magnificent project come to a successful conclusion. So, in 1996, the deal was done. The developer provided a $1.5 million bond. Council undertook to fix and pay for all future repairs.

Initially the cost of those repairs was repaid out of the bond proceeds. When that was exhausted, Council took what it needed from the Canal Reserve, then over the years increased the levies to pay for increasing costs of repairs.

# Raby Bay Ratepayers Association

## *MORE ON THE HISTORY*

***Did Council do the right thing?***

Was the Redland Council's action in accepting money from the developer and agreeing to fix the walls into the future the right thing to do?

There was a problem that needed fixing. The money offered appeared to be generous. Council would have no immediate unrecoverable costs. Council, no doubt, would have been very keen to see this important project reach a happy conclusion with lots more revenue from rates. *(Today, Raby Bay ratepayers pay over $3 million yearly in general rates apart from their levies and other charges)*

And, in the 22 years since then, houses and units on Raby Bay have been purchased and sold on the clear basis that, while they had to pay an annual levy, there was never going to be a sudden unaffordable cost to repair a failed wall. There was never going to be legal fights between neighbours because one accused the other of causing the problem, or of legal action by the Council forcing someone to fix a wall when he can't afford it

In these 22 years the area has gone from a little used area of dead coral reefs, a few mangroves, salt pans and sand hills.

***TO THIS……***

And what has Council contributed? It paid nothing up front, it collects around $5,000 in rates and levies from each Raby Bay resident – about four times what it collects from an equivalent 'dry property' ratepayer. Over $5 million is collected yearly and RCC contributes around $500k annually into the Reserve Fund.

***So, who is on a good thing?***

# Raby Bay Ratepayers Association

## *MANAGEMENT - PLANNING*

***Does Council comply with its existing obligations?***

A 16 page Canal and Lakeside Structures Overlay was included in the 2016 City Plan. It requires – for structures within 9 metres from the wall:

- *That buildings or structures must be supported by design certificates proving the works will not cause any movement or damage to the wall and frontage ensuring visual amenity and aesthetics of the canal and revetment frontage,* and
- *That buildings or structures maintain set back consistent with those adjoining, and*
- *That they not dominate or detract from the build form, waterway and landscape setting.*

**Let's see – here's some examples of recent RCC approved construction!**

We complained strongly about this. We were told that the 16 page Overlay has been withdrawn and replaced by a one paragraph "Editor's Note"! That's in the new Plan which has gone to the Minister for approval.

After more complaints and representations we are now told that it is being looked at with a view to reinstalling a stricter Overlay. Fingers crossed! **In the meantime beautiful Raby Bay is being compromised and the revetment walls put in grave danger.**

***How long has the problem been known to Council?***

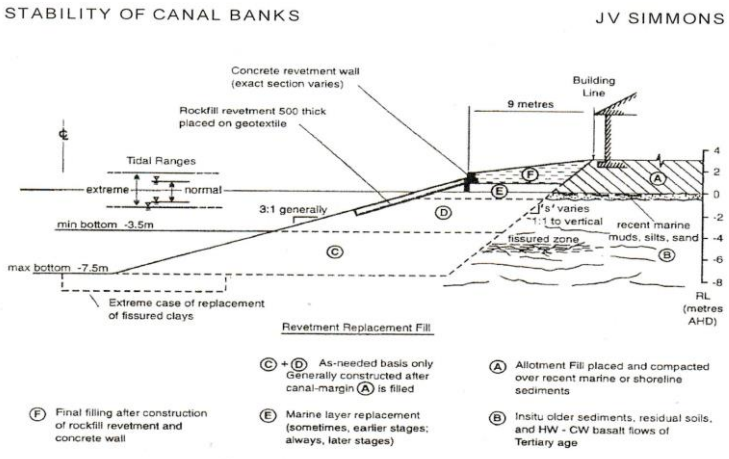



Figure 1 : Typical Raby Bay Canal Bank Profile

**This diagram is from the Simmons Report provided to Council in 1995!**

**In a later published article, Mr Simmons wrote:**

*"Slope failures have developed in many stages of the (Raby Bay) estate, after periods ranging from a few months to several years…After detailed examination (in 1995) it became apparent that these failures had developed in clay fill, in some cases near the interface with natural clay!"*

# Raby Bay Ratepayers Association

## MANAGEMENT - PLANNING

In his 1995 report to the Council Mr Simmons recommended:

- *Council should take steps to notify residents and developers that the site is a highly reactive clay site (9.1)*
- *Council should facilitate the awareness of residents about reactive clays, landscaping and moisture changes, and steps to minimise the visual impact of ground movements on landscaping. (9.1)*
- *All parts of Raby Bay Canal Estate should be considered as P sites in accordance with AS 2870 (9.1) (Note: The P classification is a "warning bell" to footing and slab designers.)*
- *Council must establish a data base of wall positions as a matter of urgency (9.1)*
- *Council should respond to loss of rock fill without delay or excessive deliberation (9.2)*
- *Pools and pipework connections to be properly engineered with respect to the likely fill profile and reactive ground movements.(9.3)*

***We strongly doubt that Council has complied with any of these recommendations!***

In his 1995 report Mr Simmons noted that

- *There is a building set-back line 9m from the concrete revetment wall. Within this set-back zone there are restrictions on development, including landscaping and swimming pool installations. The main residence structure is not permitted within this setback zone. (8.4)*

Mr Simmons accepted that this rule *is satisfactory, provided that the foundations for the residential structure have been adequately designed for each site on its merits. (8.4)*

***Little did he know that in later years this vital requirement would be regarded by Council with disdain!***

# Raby Bay Ratepayers Association

## FUNDING FOR CANAL MAINTENANCE

Local Government bodies have very strong powers to collect rates, levies, fines and charges from residents. But, in doing so, they must meticulously follow the laws and regulations which give them those powers.

**Has RCC done so?**

- Council's own history chart shows the Canal Reserve existed in 1995/96, apparently funded by levies.
- Were these levies for the revetment walls? Or just for normal canal maintenance?
- In 1988/89 Council took $693k from the Reserve to fund a shortfall of wall repair costs. (It had spent all the money paid by the developer)
- It continued collecting levies and paying for wall repairs through the Reserve each year since.
- In early 2011 it decided to set up a new "Implementation Plan" following advice from the then CEO that there were problems with the existing Plan and Council may have to refund the levies. (It made no refunds)
- At the end of 2011/12 Council borrowed $4.5 million as part of a plan to "fast track a solution" involving total borrowing of $15 million.
- That borrowing may not have been authorised by the Plan
- Over the years numerous questions were raised by this Association about apparent problems or errors. Some were answered, some not
- In March 2017 Council cancelled the Plan without consultation with this Association or residents and eventually refunded unspent levies to those who paid them. This was not in accord with the legislation but was done on "legal advice."
- Council has admitted that the Plan adopted in 2011 "contained a number of deficiencies," and that "they failed to provide an estimated cost for carrying out the overall plan and timeframe."

**So, we have a situation that Council, by its own admission:**

- **made significant errors in the Plan for these special charges in 2011, and**
- **made significant errors in the Plan before that, and**
- **probably made errors in the original Plan!**

**What does Council want you to do?**

By mischievously suggesting that you shouldn't have to "Pay" unless you "Play", misrepresenting Council's contributions, wrongly applying that to individual ratepayers, and distributing fact sheets indicating that some surrounding Councils require owners to repair their own walls, we can conclude that Council wants you to vote that way. But it has failed to disclose that:

- Surrounding Council's walls are built on sand, not uncompacted reactive clay and are sound
- Gold Coast Council provides in writing an estimate of repair costs of up to $1,600 per metre. Experience at Raby Bay indicates repair costs of between $12,000 and $30,000 per metre!

Redland City Council is obliged to apply fairness under its own Mission and Values Statement (*be professional and ethical*) and under the Judicial Review Act (*follow the rules of natural justice).*

**Has it done so?**

- Raby Bay actually has not one, but three Plans – one to cover the marina berths, one to cover community title (CTS) units that the last to cover housing lots. It calculates total costs and divides those into three using a formula no one has been able to explain.
- The result is that levies for CTS units and marina berths are about half the levies for housing lots. This smacks of a decision about "what they will accept." Or was it just guesswork?
- CTS units, marina berths and house lots are counted and the total amount allocated to each of the three categories divided equally amount the owners.
- But all of the waterfront restaurants, shops, offices, units, on the harbourside, and the marina berths alongside Edgewater pay nothing! Those magnificent homes with private bayfront beaches pay nothing for their homes but a smaller levy for their berths. Yet perhaps they enjoy the greatest benefit!
- All levies for each category pay the same amount. That's easy! But it omits the fact that some unit owners actually don't have a waterfront! Some housing lots have a 50 metre revetment wall, others as small as 10 metres!

**Complaints about this illogical and unfair treatment have been made on numerous occasions. Council officers refuse to discuss, saying it is a "Council decision!"**

**Where to from here?**

Council budgeted its capital expenditure for 2017/18 at $82 million. This includes $10 million to be spent on the islands and mainland foreshore which is not subject to any levies. It is possible Council may want to continue carving out a small minority of its residents to pay for capital works.

If there is to be a levy to maintain structures then it must apply to those who benefit. Everyone in the Redlands benefit from our waterways to a greater or lesser extent. Look at the benefits, the bayfront parklands with their beaches - whose very existence depends on the canals, the swimmers, the boaters, the paddle boarders, those who fish along the banks those who enjoy the views, the atmosphere, the charter boats, the businesses who are thriving with ever increasing customers.

In lieu of Raby Bay there could have been a massive yacht squadron as at Manly. How much better for the town that we have the canals and the homes, the parks, the facilities and all the people living in, shopping, financially and personally contributing to the Redlands! Would you really have preferred to have a huge bunch of moored yachts and their absentee owners?

But how to ensure that the levy payers are treated fairly? Now, due to site valuations, they are paying double. Then double again due to the levies.

If there is to be a levy, then it should be applied properly and fairly. Council should put more effort into working out who benefits and take note that the charges may be different among ratepayers. (Regulation 94(12)

# Raby Bay Ratepayers Association

## MANAGEMENT – CANAL REVETMENTS

By its agreement with the developer in 1996 Council took over responsibility for maintaining revetment walls into the future. From 1999 it has been levying canal front land owners to meet most of the costs of this work but it has retained full management responsibilities. It must carry out this work in accordance with law and its Mission and Values Statement

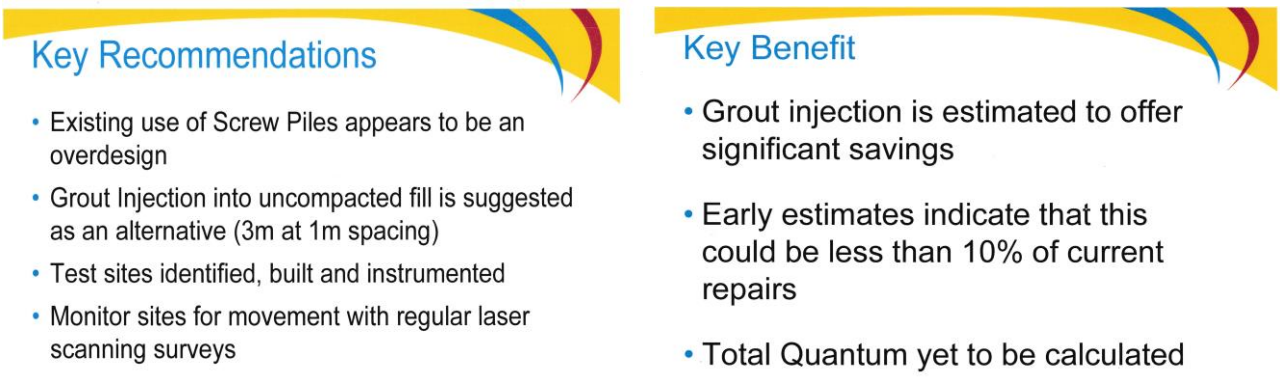
**Has it done so?**

**Firstly – a story of consistent delays:**

- **2011/12:** Budgeted to spend over $4 million for repairs at Seahaven and Seacrest Courts and Raby Bay Boulevarde. That year it spent less than $500k!
- **2012/13:** Budgeted to spend $3 million on Seahaven and Seacrest Courts which didn't get started in the prior year. But didn't complete either job until the next year
- **2013/14:** Budgeted to spend over $1 million on Voyagers Court but didn't do that job until the next year. Budgeted to spend $2 million on Mainroyal Court but didn't finish this job until the next year
- **2014/15:** Budgeted to spend $3 million on Beaufort Court but didn't start that job until the next year.
- **2015/16:** Completed the Beaufort Court job
- **2016/17:** Budgeted to spend $1 million on Seacrest Court and Marram Court but didn't start either job. Also budgeted to spend $1 million on new repair trials which was well under way by end of the year.

***When there are significant delays in repairing failed walls there are grave possibilities of this causing failures in adjacent walls and multiplying the problem.***

**Secondly – an example of inexcusable delays for cost saving processes:**




*These are power point slides presented to an RBRA meeting by RCC Marine Department on 8 October 2012. This work was eventually started in 2016 – **four years later!***

**Thirdly – spending substantial sums on consultants' reports and recommendations but failing to follow them.**

- There is little evidence available to show that Council has properly followed the recommendations provided by consultants.
- The 9 metre setback initiated by the developers and approved by Council's independent expert has been virtually ignored.
- Planning Unit approved construction of a substantial building too close to a failing wall and with an overhanging deck. On complaint we received a typical 'Yes!'

Minister' response – *"Council procedures were followed…the applicant demonstrated compliance with the code…the application did not need to be referred to the Marine Unit."*

***Note:*** *Council has since advised verbally that there will be communication between Marine and Planning Units in future but we have no written assurance of that!*

**<u>Fourthly</u> – while RBRA is represented on the Technical Working Group and there is a good relationship and a little influence, there is no control over Planning decisions, nor over the calling of tenders nor the appointment of contractors. This relatively small operation is hamstrung by too many bureaucratic procedures and oversight by senior officers without relevant experience.**

**Efficiency and economy is sadly lacking. This can only be achieved for an enterprise involving specialised tasks by the appointment of a separate corporation or Council unit under governance by those with appropriate experience and knowledge.**

**It is unfortunate indeed that Council is experiencing rapid turnover of senior officers. There can be no proper oversight of a specialised marine unit by people lacking knowledge and experience.**

***Marine unit staff have a difficult job to do but they are constrained. Very few people on Council's staff have the knowledge or experience needed to successfully operate a specialised marine engineering unit, perhaps none of the newly appointed senior staff. It is imperative that this fact be acknowledged and a separate corporation or unit be established and appropriately governed to ensure the litany of past errors and delays is ended.***

# Appendix 6

February 2018

# Aquatic Paradise canals
## Community update

## Updating residents of Aquatic Paradise on issues relating to canals

### You pay – have your say

Redland City Council maintains the Aquatic Paradise and Raby Bay canals and the Sovereign Waters lake. Activities include dredging the waterways so they remain navigable and repairing the revetment walls. Those who own canal or lake waterfront property pay the most for maintenance but all ratepayers contribute to some degree through general rates.

Council is undertaking citywide community engagement to find the best way to fund and manage the maintenance required for our city's canals and lake, and wants to hear from you. A survey on the use of the canals and lake waterways and parks is available online at **yoursay.redland.qld.gov.au/canal-and-lake-waterways**

### Funding and managing our canal and lake estates into the future

Redland City Council's community consultation on the funding and maintenance of the city's canal and lake waterways and revetment walls is proceeding well.

#### Ratepayer association meetings

A series of meetings with canal and lake ratepayer associations, or ratepayers where no association exists, is well under way. Ratepayers from our city's canal and lake estates, and their representatives, have been involved in meetings with the consultants, Articulous Communications. At the conclusion of the consultation process, a report on the outcomes of these meetings will be presented to Council as it decides how the city's canals and lake infrastructure will be funded and managed into the future.

#### Citizens' Advisory Panel

A mini representation of the Redlands, the Citizens' Advisory Panel will present to Council a report of its suggestions on ways to fund and manage the maintenance activities at our canals and lake estates. The panel does not have a decision-making role. Rather, the panel is acting in an advisory capacity, with meetings staged over a period of time, giving panel members the time and information they need to become familiar with the history and issues of this complex matter. Following the panel process, market research will be undertaken to test the panel's suggestions against the wider community. This will be conducted by an independent, specialist market research firm and the findings, along with the Citizens' Advisory Panel's outcomes, will be made available in a public report.

The first meeting of the Citizens' Advisory Panel on the funding and management of Redlands' canals and lake estates was held on Saturday, December 2 and the second meeting on Saturday, January 20. Panellists have heard from canal residents, Council officers, engineering and legal experts, as well as a representative from the Local Government Association of Queensland. They also took a bus tour of the canal and lake estates.

Not all panel members were able to attend the first meeting, so another meeting to adequately inform the extra members was held on Friday, January 19. The panel members at that meeting received the same presentations as those at the meeting on December 2, with the exception of the bus tour. However, they viewed drone footage of the canal and lake estates, with an explanation of Council's maintenance activities given by a Council officer. The drone footage can be viewed on Council's website at: **yoursay.redland.qld.gov.au/canal-and-lake-waterways**

The consultation's timeframe allows for the sharing of key ideas and outcomes with the wider community – a process that Council is committed to. Council has not yet made a decision on how the canal and lake waterways will be funded and maintained into the future. As part of the decision-making process, Council will receive reports on the outcomes of the Citizens' Advisory Panel deliberations, the ratepayer and ratepayer association meetings and the wider community consultation, including the market research.

For further information on the community consultation, and answers to questions about the Citizens' Advisory Panel process, visit **yoursay.redland.qld.gov.au/canal-and-lake-waterways**

#### Citywide engagement

As Council is committed to holding a citywide conversation about the funding and maintenance of the city's canal and lake estates, opportunities to access further information are being provided to all community members. A series of pop-up stands has been held in shopping centres across the city and, in addition to information available online, Council is also holding information displays at the following locations:

- **Victoria Point Library – February 12 to 16**
- **Capalaba Library – February 19 to 23**

**For more information visit Council's website:**
**www.redland.qld.gov.au**

Redland CITY COUNCIL

# Aquatic Paradise canals
**Community update February 2018**

## Maintenance activities

The 2017-18 stage of the dredging has been successfully completed and is finished for this financial year. The next stage of the dredging is estimated to start early in the 2018-19 financial year. Minor revetment wall maintenance at two properties in the estate has recently been completed. A revetment wall rock restacking program is currently being developed and is scheduled to soon go out for tender.

## Siltation

In regard to questions from the community about siltation at Aquatic Paradise, a study carried out in 2011 as part of the canal management plan found that siltation within the Aquatic Paradise Canal Estate and entrance channel, from 2000 to 2011, came from two main sources:

- Waterloo Bay (approximately 10,157m3/annum, or 99.6 per cent v/v long-term average).
- The stormwater outlets, including Tarradarrapin Creek (approximately 43m3/annum, or 0.4 per cent v/v long-term average).

The outlets of Tarradarrapin Creek, and other stormwater sources in the canals, are dredged by Council **separate to the special charge account** in recognition of the probable source of this sedimentation. The cost of this is borne by all residents in the city as it comes out of the general rate. The siltation study can be found on Council's website at: **yoursay.redland.qld.gov.au/canal-and-lake-waterways**

## Special charges

In the ongoing consultation, Council has been asked about the special charges levied to owners of canal and lakefront properties. Section 94 of the *Local Government Regulation 2012* allows councils to make and levy a special charge on rateable land identified as enjoying special benefit to fund the maintenance, construction or renewal of that benefit. This regulation allows Council to collect money to pay for the significant works required to maintain the canal and lake walls and waterways, from those who get a special benefit from them. Special charges are not unique to the Redlands – other councils also levy them – and, in Redland City, they are not unique to canal and lakefront properties.

Further explanation of general rates for canal and lake waterfront properties and the special charge is available in the Q&A documents online at **yoursay.redland.qld.gov.au/canal-and-lake-waterways**

## Canal and lake refunds

Council announced in March last year it would refund unspent monies levied for canal and lake maintenance and repairs from July 1, 2011 to March 31, 2017.

Refunds commenced to current and former property owners in October 2017.

At the end of November 2017 Council had processed more than 94 per cent of the refunds. Further information and a list of properties to which outstanding refunds apply can be found at **yoursay.redland.qld.gov.au/canal-and-lake-waterways**

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**For more information visit Council's website:**
**www.redland.qld.gov.au**

Redland CITY COUNCIL

December 2017

# Aquatic Paradise canals
## Community update

## Updating residents of Aquatic Paradise on issues relating to canals

### Canal and lake refunds

A public meeting was held on 20 November 2017 at the Redland Performing Arts Centre, where BDO, the accounting company appointed to calculate and manage the refund, answered residents' questions in relation to refunds.

Reserve fund balances, calculation methodology and the refund process itself were some of the topics discussed, to clarify how the canal and lake levy refunds were calculated.

Questions asked included queries about the interest paid back to property owners and the link between the reserve balances and refund project.

BDO representatives and Council officers talked through the approach taken, explained how the refunds were generated and referred to the range of material on the website where all community members can review the process.

The distinction between the reserves and the refund project was explained. In some years Council spent more than was raised through the levies in that year, while in other years Council spent less. Based on Council's external legal and financial advice, Council refunded the unspent special charges.

Attendees also heard how Council chose to apply interest to the refund amounts that was significantly higher than the interest revenue earned by Council and transferred to the reserve over the six financial years, and higher than standard commercial rates of around 3 per cent. It was actually based on rates from the Queensland Law Society and ranged from 9% to 11%.

The vast majority of ratepayers have now received their individual refunds from Council. Council took the proactive step to refund the unspent charges, following a review of relevant legislation.

A copy of the BDO report, its summary, and Q&A's from the meeting are on the Council's website. They are also available at the Cleveland Customer Contact Centre for those without easy access to a computer and/or the internet.

If you cannot access these online documents please call Council on: 07 3829 8999. It is also on Council's website: **www.redland.qld.gov.au**


**On 20 November, residents asked their refund queries of Council and BDO.**

### Have your say

Redland City Council maintains the canals at Raby Bay and Aquatic Paradise and the lake at Sovereign Waters. Activities include dredging the waterways so they remain navigable and repairing the revetment walls. Those who own canal or lake waterfront property pay the most for maintenance, however all ratepayers contribute to some degree through general rates.

Council is undertaking citywide community engagement to find the best way to manage and fund the maintenance required for our city's canals and lake.

Meetings have been held with ratepayer associations and estate ratepayers. Other community feedback opportunities will include open house displays, pop-up stands at local events, library displays, and telephone surveys. A survey on the use of the canals and lakes is available at **www.yoursay.redland.qld.gov.au/canal-and-lake-waterways**.

In addition, a Citizen's Advisory Panel is being coordinated and comprises 40 randomly selected and independently recruited residents from Redlands. The panel includes 10 canal and lakefront residents, 10 coastal residents, 10 island residents, and 10 from the broader ratepayer group.

The Panel will hear from experts and local residents, when they meet over the next few months until February 2018, to carry out detailed deliberations and make recommendations to Council.

For more details visit: **yoursay.redland.qld.gov.au**

Redland CITY COUNCIL

KBR | We Deliver

# AQUATIC PARADISE CANAL MANAGEMENT

## Maintenance Model Update

# AQUATIC PARADISE CANAL MANAGEMENT

## Maintenance Model Update

*Prepared for:*

**REDLAND CITY COUNCIL**
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*Prepared by:*

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**19 June 2015**

BEJ456-TD-MN-REP-0001 Rev. 0

**Acknowledgments**

Cadastral Data dn Aeirla photography supplied by the Department of Environment and Resource Mangement (DERM).

Information and data supplied by Redland City Council.

**Limitations Statement**

The sole purpose of this report and the associated services performed by Kellogg Brown & Root Pty Ltd (KBR) is to provide a canal mainteancne plan in accordance with the scope of services set out in the contract between KBR and Redland City Council ('the Client'). That scope of services was defined by the requests of the Client, by the time and budgetary constraints imposed by the Client, and by the availability of access to the site.

KBR derived the data in this report primarily from hydrographic survey data, visual inspections, examination of records in the public domain and interviews with individuals about the site. The passage of time, manifestation of latent conditions or impacts of future events may require further exploration at the site and subsequent data analysis, and re-evaluation of the findings, observations and conclusions expressed in this report.

In preparing this report, KBR has relied upon and presumed accurate certain information (or absence thereof) relative to waterway system provided by government officials and authorities, the Client and others identified herein. Except as otherwise stated in the report, KBR has not attempted to verify the accuracy or completeness of any such information.

The findings, observations and conclusions expressed by KBR in this report are not, and should not be considered, an opinion concerning the correctness of hydrographic survey data and the sutiable or otherwise of the design of Aquatic Pardise. No warranty or guarantee, whether express or implied, is made with respect to the data reported or to the findings, observations and conclusions expressed in this report. Further, such data, findings, observations and conclusions are based solely upon site conditions, information, data and drawings supplied by the Client in existence at the time of the investigation.

This report has been prepared on behalf of and for the exclusive use of the Client, and is subject to and issued in connection with the provisions of the agreement between KBR and the Client. KBR accepts no liability or responsibility whatsoever for or in respect of any use of or reliance upon this report by any third party.

Revision History

| Revision | Date | Comment | Signatures | | |
|---|---|---|---|---|---|
| | | | Originated by | Checked by | Approved by |
| A | 03/2/15 | Issued to client for review | K. Stemm | P. Cummings | P. Bayliss |
| B | 31/3/15 | Issued to client for review | K. Stemm | P. Cummings | P. Bayliss |
| C | 14/5/2015 | Issues to client for further review | K. Stemm | P. Cummings | K. Stemm |
| 0 | 19/6/2015 | Issued for Use | K. Stemm | P. Cummings | K. Stemm |

# CONTENTS

# 1 Introduction

## 1.1 PURPOSE

Kellogg Brown & Root Pty Ltd (KBR) has been commissioned by Redland City Council (RCC) to prepare a long-term maintenance strategy to improve and maintain the navigability of the canal estate and entrance channel at the Aquatic Paradise Canal Estate, Birkdale.

This report expands on previous studies undertaken by KBR following the receipt of more recent geotechnical and survey investigations. Previously, KBR undertook a Siltation Study and prepared a Canal Management Plan for Redland City Council (RCC) in 2012. Since the development of the Canal Management Plan (CMP) (KBR, 2012) RCC has undertaken a survey of the Aquatic Paradise canals and 800 m of the entrance channel in March 2014. To inform the Canal Management Plan and detailed design of dredging works, a geotechnical investigation was undertaken in October–November 2014. The purpose of this report is to summarise the feasibility of the Canal Management Plan (KBR, 2012) and provide an update to the Maintenance Model based on the most recent information. This report will inform the proposed capital and maintenance dredging detailed design and statutory approvals procurement.

## 1.2 SCOPE

The scope of this report is to bring together previous studies and incorporate recent information to produce an updated long-term canal management plan. This report:

- summarises the project background
- revises siltation rates estimates to include the latest survey data
- updates the Maintenance Model.

## 1.3 REPORT STATUS

This report is prepared for the purposes of revising the CMP (KBR 2012b) as described in Section 6 of this report. The CMP is considered a living document which requires continual updating as new information comes to hand. This is particularly important as the measured annual siltation volumes and dredging costs will vary from year to year in response to natural fluctuations in the environment and annual dredging works.

# 2 Project background

## 2.1 SITE LOCATION AND DESCRIPTION

The location of the Aquatic Paradise canal system is shown in Figure 2.1.

The canal system is located in Birkdale on the southern side of Waterloo Bay, with access to the greater Moreton Bay via an entrance channel. The estate comprises approximately 3,000 m of inshore canals with a 2,800 m access channel extending north into Waterloo Bay.

The system was constructed in 1987–88. The canals were constructed over existing creeks, and excavated out of dry land, prior to fully opening the canals to the sea. The entrance channel was formed using a cutter suction dredge.

### 2.1.1 Previous studies

In 2012, KBR undertook a Siltation Study (KBR, 2012a) and developed a Canal Management Plan (CMP) (KBR, 2012b) for RCC.

The Siltation Study (KBR, 2012a) provided an assessment of the siltation rates and volumes within the Aquatic Paradise canals and entrance channel based on historic surveys and information from previous dredging campaigns.

The CMP (KBR, 2012b) recommended that both bed levelling and grab dredging with disposal at Mud Island be employed to manage siltation, based on suggestions from the Port of Brisbane (PBPL). The plan was based on mechanical dredging using grab or excavator dredging of Wood Canal and the Entrance Canal, with sub-sea disposal of the spoil at the Mud Island disposal grounds in Moreton Bay. Hydraulic dredging using a cutter suction dredge cannot be economically employed due to the apparent absence of a dredged mud slurry settling pond site. As the grab/excavator dredge and hopper barges cannot access the side canals due to the narrow width of these canals, the plan proposes ‘bed levelling’ of silt from these canals into silt traps dug into the inverts of Wood and Wood Gate Canals (Figure 2.2). This plan includes the creation of new ‘trench blocks’ within the canals and deepening of the existing silt trap at the entrance to increase the capacity to receive sediment deposited by the bed levelling operations. The CMP report presented a 17 year maintenance model based on two phases of dredging. Phase 1 involves planning, capital works and removal of existing accumulated sediment. Phase 2 reverts to ongoing maintenance with bed levelling and maintenance dredging campaigns undertaken over a repeating 14 year cycle.


**Figure 2.1**
**LOCATION PLAN**


**Figure 2.2**
**CANALS LAYOUT**

## 2.2 DESIGN, SERVICE AND DREDGING TRIGGER LEVELS

### 2.2.1 Tidal planes and datum

The tidal planes and datum levels are used for the assessment of survey data and dredge trigger levels.

The tidal plane for Wellington Point, as published by the Department of Transport and Main Roads (Maritime Safety Queensland) (2015) is described in Table 2.1.

**Table 2.1 Wellington Point Tide Plane (MSQ 2015)**

| | | To LAT Datum (m) |
|---|---|---|
| Highest Astronomical Tide | HAT | 2.84 |
| Mean High Water Springs | MHWS | 2.26 |
| Mean High Water Neaps | MHWN | 1.85 |
| Mean Sea Level | MSL | 1.26 |
| Australian Height Datum | AHD | 1.33 |
| Mean Low Water Neaps | MLWN | 0.79 |
| Mean Low Water Springs | MLWS | 0.38 |
| Lowest Astronomical Tide | LAT | 0.00 |

The survey datum stated in the PBPL hydrographic surveys is referenced to an LAT datum based on survey benchmark PSM 100542 (at 4.854 mLAT). The stated conversion factor from AHD to LAT for the surveys is 1.31 m and is consistent with historical surveys provided by RCC and Port of Brisbane Pty Ltd. For consistency, the referenced LAT datum in this report, and in the detailed dredge designs, will be taken to be –1.31 m LAT; not the –1.33 m LAT as advised in Table 2.1.

### 2.2.2 Design levels and service levels

Design levels of the Canals and Entrance Channel are provided in Appendix A and summarised in Table 2.2.

**Table 2.2 Design Levels**

| | To AHD Datum (m)[1] | To LAT Datum (m)[2] |
|---|---|---|
| Entrance channel | –3.24 | –1.93 |
| Entrance channel silt trap | –3.84 | –2.53 |
| Canals | –3.24 | –1.93 |

*[1] Based on Burchill & Partners Pty. Ltd. Design drawings supplied by RCC*

*[2] Converted using 1.31m AHD to LAT conversion (Section 2.2.1)*

The Maintenance Model is based on regularly removing siltation back to the original design levels in order to meet the original intended level of service.

### 2.2.3 Dredging trigger level

The trigger for the need for immediate dredging to restore the bed levels to design levels is based on:

- The maximum draft for boats entering Aquatic Paradise as stated in the 'Properties on Redland City Canals' Fact Sheet (RCC, 2011) being 1.5 m.
- A 100 mm allowance is included for survey accuracy, vessel squat and trim, and underkeel clearance.
- As LAT events occur very rarely the probability of a maximum draft vessel (1.5 m) navigating at an LAT event coinciding with maximum bed levels is very low.

Based on these considerations, the adopted dredge trigger level is: Zero mLAT – 1.5 m – 0.1 m = –1.6 mLAT.

It is anticipated that sea level rise will have no effect on the function of the canal system over the timeframe of the CMP (20 years). Ultimately the trigger level for dredging could be revised upwards if sea level rise has a significant effect over the long-term—beyond the CMP timeframe.

# 3 Siltation rates

## 3.1 INTRODUCTION

Siltation patterns and rates were previously examined by KBR and the findings and recommendations were summarised in the Siltation Study (KBR, 2012a). The development of the Canal Management Plan (CMP) (KBR, 2012b) was based on findings from the Siltation Study (2012a), in particular the 2000 to 2011 averaged siltation rates and the total accumulated siltation as of June 2011. As stated in the CMP (KBR, 2012b) it is recommended that the siltation rate is continually reviewed following receipt of new survey data.

Siltation rates and accumulated sediment volumes have been analysed based on the 2014 survey in comparison with the 2011 survey. This information is considered the most reliable to date due to:

- The most recent investigations provide the most up-to-date information on the condition of the canal system.
- Improved surveying technology: use of smaller survey grid sizes plus technological advancements, such as the use of multi-beam over single-beam echo-sounders have allowed the production of higher resolution and more complete surveys compared with earlier investigations.

The updated estimates of siltation accumulations and rates to be adopted for the update of the maintenance model are described below. Whilst the reliability of the survey is greatest for the most recent survey investigations, indicated values still need to be considered in the context of survey accuracy and potential errors introduced through instrumentation and data collection. Information on the accuracy of the survey data is provided in the following sections.

## 3.2 SURVEY DATA

RCC provided a 'General Investigative Survey' that was undertaken by Port of Brisbane Pty Ltd in March, 2014. The survey information provided is to a 95% level of confidence and details of the survey and level of accuracy is summarised in Table 3.1.

**Table 3.1 Survey data**

| Date | Title and Plan Number(s) | Sonar Beam | Grid Size | Class | Vertical and Horizontal Tolerances | Data Format Received | Datum |
|---|---|---|---|---|---|---|---|
| 20-21 March 2014 | Hydrographic Survey 129450 | Multi Beam | 0.5m x 0.5m | A | Vertical = ±0.15<br>Horizontal = ±0.5 | XYZ points (.PTS) file & PDF plans | LAT (–1.31mAHD) |

A bed-level Digital Terrain Model (DTM) from the March 2014 survey is included in Appendix A.

## 3.3 2011 TO 2014 SILTATION RATES AND VOLUMES

Siltation rates and accumulated siltation volumes were calculated using the same analysis methodology as described in KBR 2012a.

Siltation estimates were prepared for 11 dredge zones as shown in Figure 3.1. These dredge zones are based on observed siltation patterns and are consistent with the zonings proposed in the CMP (2012b). The findings are summarised in Table 3.2 and are based on annual siltation rates and accumulated siltation above design DTMs presented in Appendix A. Year 2000 to 2011 siltation estimates used to develop the CMP are included for comparison.

**Table 3.2 Calculated annual siltation volumes and accumulated volume above design**

| | Average Annual siltation rate ($m^3/a$) | | Accumulated siltation volume ($m^3$) | |
|---|---|---|---|---|
| | 2000 to 2011 | 2011 to 2014 | As of June 2011 | As of March 2014 |
| Dredge Zone 1 | 555 | 340 | 430 | 380 |
| Dredge Zone 2 | 4,150 | 2,510 | 9,060 | 13,850 |
| Dredge Zone 3 | 1,205 | 1,280 | 7,460 | 10,630 |
| Dredge Zone 4 | 2,060 | 2,780 | 16,130 | 23,870 |
| Dredge Zone 5 | 415 | 740 | 5,770 | 8,120 |
| Dredge Zone 6 | 1,225 | 1,740 | 12,930 | 17,750 |
| Dredge Zone 7 | 350 | 610 | 4,060 | 5,640 |
| Dredge Zone 8 | 125 | 350 | 1,870 | 2,730 |
| Dredge Zone 9 | 160 | 470 | 1,830 | 2,970 |
| Dredge Zone 10 | 260 | 460 | 2,340 | 3,510 |
| Dredge Zone 11 | 200 | 490 | 3,810 | 5,030 |
| Canals | 2,735 | 4,860 | 32,610 | 45,750 |
| Entrance Channel | 7,970 | 6,910 | 33,080 | 48,730 |
| **Canal System and Entrance Channel** | **10,705** | **11,770** | **65,690** | **94,480** |

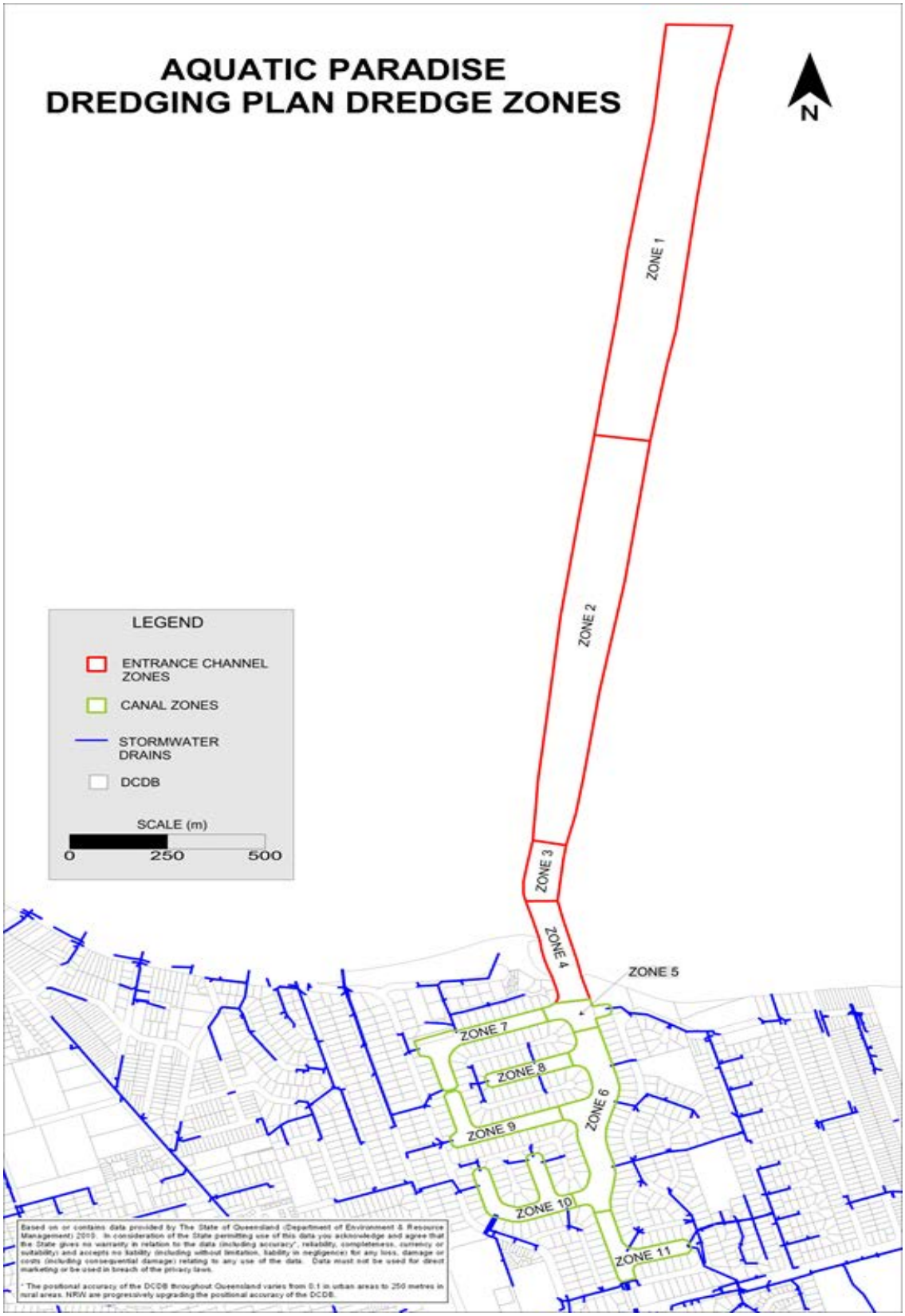



**Figure 3.1**
**PLAN OF DREDGE ZONES**

## 3.4 SILTATION PATTERNS

A comparison of siltation rates calculated for 2000–2011 compared with those calculated for 2011–2014 indicates similar siltation rates and distributions. Indicated siltation rates remain the highest within the inner entrance channel and at the canal intersections (Zones 2 to 6), particularly the Wood and John Goleby intersection, which remains the most silted area. Similarly, indicated siltation rates are generally lower in the upstream canal reaches (Zones 7 to 11).

Over the 2011 to 2014 period there is a noticeable increase in the observed average annual siltation rate in the upper canal reaches which may be due to the accumulation in the entrance canal. Potentially, increased tidal velocities due to this siltation have reduced the amount of silt trapped at the entrance, promoting increased sediment transport into the canal system on the rising tide. The observed increases in siltation rates are not expected to greatly influence the existing proposed CMP as it is proposed that the accumulations at the entrance will be removed in the first two dredging campaigns, and the overall average siltation rate is comparable to the previous siltation study.

It is noted that future siltation patterns will vary from year to year in response to natural fluctuations in environmental conditions and annual dredging works. Nevertheless, this most recent analysis indicates siltation patterns and rates that are similar to those expected in the entrance and canal system in the future.

## 3.5 RECOMMEND RATES AND VOLUMES TO BE ADOPTED

The analysis of the 2014 survey data indicates similar siltation rates for the 2011 to 2014 period compared to the 2000 to 2011 period, which was previously analysed in the CMP (2012b).

Average annual net siltation volumes are:

- 2000 to 2011: 10,705 $m^3$/a
- 2011 to 2014: 11,770 $m^3$/a.

Average annual siltation depth rates are:

- 2000 to 2011: 32 mm/a
- 2011 to 2014: 36 mm/a.

The 2011 to 2014 volumes and rates are considered to be the more reliable estimates of the siltation because:

- The 2000 to 2011 siltation volumes and rates are based on partial survey data and adjusted to account for dredge campaigns.
- The 2011 to 2014 surveys both cover most of the canal estate and entrance channel, and there have been no dredging events between these two surveys.

Therefore it is proposed that the 2011 to 2014 volumes and rates in Table 3.3 be adopted for the purposes of updating the Maintenance Model.

**Table 3.3 Calculated annual siltation volumes and accumulated volume above design recommended for use in the updated Maintenance Model**

| | Average Annual siltation rate ($m^3$/annum) | Accumulated siltation volume ($m^3$) |
|---|---|---|
| | 2011 to 2014 | As of March 2014 |
| Dredge Zone 1 | 340 | 380 |
| Dredge Zone 2 | 2,510 | 13,850 |
| Dredge Zone 3 | 1,280 | 10,630 |
| Dredge Zone 4 | 2,780 | 23,870 |
| Dredge Zone 5 | 740 | 8,120 |
| Dredge Zone 6 | 1,740 | 17,750 |
| Dredge Zone 7 | 610 | 5,640 |
| Dredge Zone 8 | 350 | 2,730 |
| Dredge Zone 9 | 470 | 2,970 |
| Dredge Zone 10 | 460 | 3,510 |
| Dredge Zone 11 | 490 | 5,030 |
| Canals | 4,860 | 45,750 |
| Entrance Channel | 6,910 | 48,730 |
| **Canal System and Entrance Channel** | **11,770** | **94,480** |

# 4 Geotechnical investigation

## 4.1 INTRODUCTION

In order to prepare the detailed design of the trench block capital dredging works, geotechnical investigations and assessments are required to confirm the stability of the channel/canal banks and the feasibility of dredging the proposed trenches and traps. The achievable subsurface profiles of the proposed trenches and traps also influence the feasibility of the proposed Canal Management Plan (CMP).

## 4.2 GEOTECHNICAL INVESTIGATIONS

### 4.2.1 Previous investigation

During the initial phases of developing the CMP (2012b), limited geotechnical information was available. Previous information provided by Council included a plan and longitudinal section of a geotechnical investigation which was undertaken in 1985 (Burchill & Partners Pty Ltd Drawing No C1338:02E:18B). The investigation included 14 borehole profiles along the entrance channel alignment. No information was provided within the canals which is the main area of interest in terms of the geotechnical characteristics. Materials typically encountered below the existing design surface included Very Stiff Clay and Extremely Weathered Sandstone. Whilst this information provides some insight into the potential dredge material that could be encountered, more detailed information was required to assess the bed in the trench blocks.

### 4.2.2 October – November 2014 investigation

A geotechnical investigation was carried out in October and November 2014 by Soil Surveys Engineering Pty Ltd to confirm the feasibility of dredging the proposed trenches and traps and to analyse the slope stability. A copy of this report is provided in Appendix E. Concurrently, Soil Surveys provided soil samples to KBR for testing, which was undertaken to support the environmental approvals process.

The investigation included the drilling of 12 boreholes at strategic locations within the extents of the proposed silt trap and trench blocks (Figure 4.1). Boreholes were drilled to depths of between 4.5 m and 6.5 m. Standard Penetrometer Testing (SPT) was undertaken at regular test intervals and recovery of undisturbed and disturbed soil samples was carried out at the test locations. In instances where rock was encountered, NMLC core drilling was undertaken for identification and strength testing. Piston samples of surficial sediments were collected to assess the sediment characteristics of the potential dredge material for use in obtaining environmental approvals for dredging and disposal. Details of the methodology and results of sediment sampling are outlined in the Sediment Sampling and Analysis Result Report (KBR 2015).


**Figure 4.1**
**GEOTECHNICAL INVESTIGATION—BOREHOLE LOCATIONS (Refer Appendix E) (Note deletion of Trench Block 4)**

## 4.3 GEOTECHNICAL RESULTS

Details of the geotechnical investigation and results are provided in Soil Surveys Geotechnical Investigation Report (Soil Surveys 2015) prepared for RCC (provided in Appendix E). A brief summary of the soil strata encountered is as follows:

- The surficial sediments encountered are very soft (weak) silts with thicknesses typically ranging from 0.5 m to 1.6 m within the canals. At the inner entrance channel and entrance to the canal, where the deeper silt trap is located, the weak silt layer is the thickest; with boreholes indicating soft silts encountered to depths of 2.4 m to 3.6 m below the existing bed level. An exception to these observations is Borehole 9 (Appendix E) where very weak silty sand material was encountered to the full depth of the borehole (RL -9.1 m AHD). This observation probably indicates a silt-filled Terradarrapin Creek paleo channel.
- Underlying the soft silt layer, silty or sandy clay was typically encountered. This material is generally classed as stiff, very stiff and hard clays. This clay is potentially a 'residual soil' from when the sea was lower in the ice ages.
- Weathered rock was encountered within the proposed locations of Trench Block 3 and in the inner entrance of the silt trap and Trench Block 1.

## 4.4 IMPLICATIONS ON THE MANAGEMENT PLAN

Materials encountered within the proposed dredge areas range from very soft silts to hard clays and very small amounts of weathered rock.

Soft silts will be mostly removed by the maintenance dredging operations. The trenches will therefore be mostly cut in to the stiff to hard clay. The geotechnical investigation provides details of the engineering characteristics of the material needed for the detailed design of the trench block excavations.

Some rock has been identified within the proposed depths of excavation for the trench blocks and silt traps. Due to the extremely high cost of dredging rock, where rock is identified within the trench/trap excavation, it is not proposed to dredge it, with the depth of the proposed trench blocks and silt traps adjusted upwards to avoid rock dredging. Given that the amount of rock encountered within the proposed trenches is minimal (only up to 60 mm thickness above the design invert level), the design implications are minor. It should be noted however that geological deposits could vary in height between the boreholes.

In consultation with the Port of Brisbane, it has been confirmed that dredging the trenches/traps in the stiff to hard clay layers is achievable using the proposed grab dredging method. It should be noted however that stiff to hard clays will be classed as 'hard dredging' and attract a significantly higher dredging rate due to the lower productivity when compared to dredging soft silt. This has a financial impact on the excavation of some trench blocks and consequently will extend the proposed duration of Phase 1 works.

# 5 Feasibility

## 5.1 INTRODUCTION

The CMP (KBR 2012b) assessed the feasibility of the following dredging and disposal options:

1. Do Nothing
2. Cutter Suction Dredging (CSD) and landfill disposal
3. Grab dredging and Mud Island disposal
4. Backhoe dredging and Mud Island disposal
5. Bed levelling

The performance of these options were compared against the following criteria: costs, legislation and approvals requirements and other dredging requirements such material dredge-ability, spoil disposal/treatments, accessibility for dredging plant and equipment; and the benefits/constraints of different types of dredging equipment. Based on the outcomes of this feasibility assessment, it is proposed to utilise a combination of grab dredging and bed levelling given that:

- Costs of bed levelling are low compared to dredging.
- Bed levelling has the potential to prolong the time between dredging campaigns.
- Grab dredging is has limited access to the narrow side canals – bed levelling can therefore redistribute siltation to more easily accessible locations.
- Hydraulic dredging using a cutter suction dredge cannot be economically employed, due to the apparent absence of a dredged mud slurry settling pond site.

## 5.2 REVIEW OF DREDGING METHODOLOGY

Considering the recent available information, the plan to use bed levelling in conjunction with grab dredging to a barge for offshore disposal at Mud Island disposal grounds is still the preferred disposal option.

A key component of the proposed CMP is the capital dredging of trenches and the deepening of the silt trap. The proposed location, dimensions and design depths of the trenches as per CMP (KBR,2012) are shown in Figure 5.1 and are based on Port of Brisbane (PoB) proposals to RCC in October 2011. The detailed design of this option is dependent on the following:

- dredgeability of the trenches and traps
- stability of the trench batters
- dredge accessibility to the trench location.

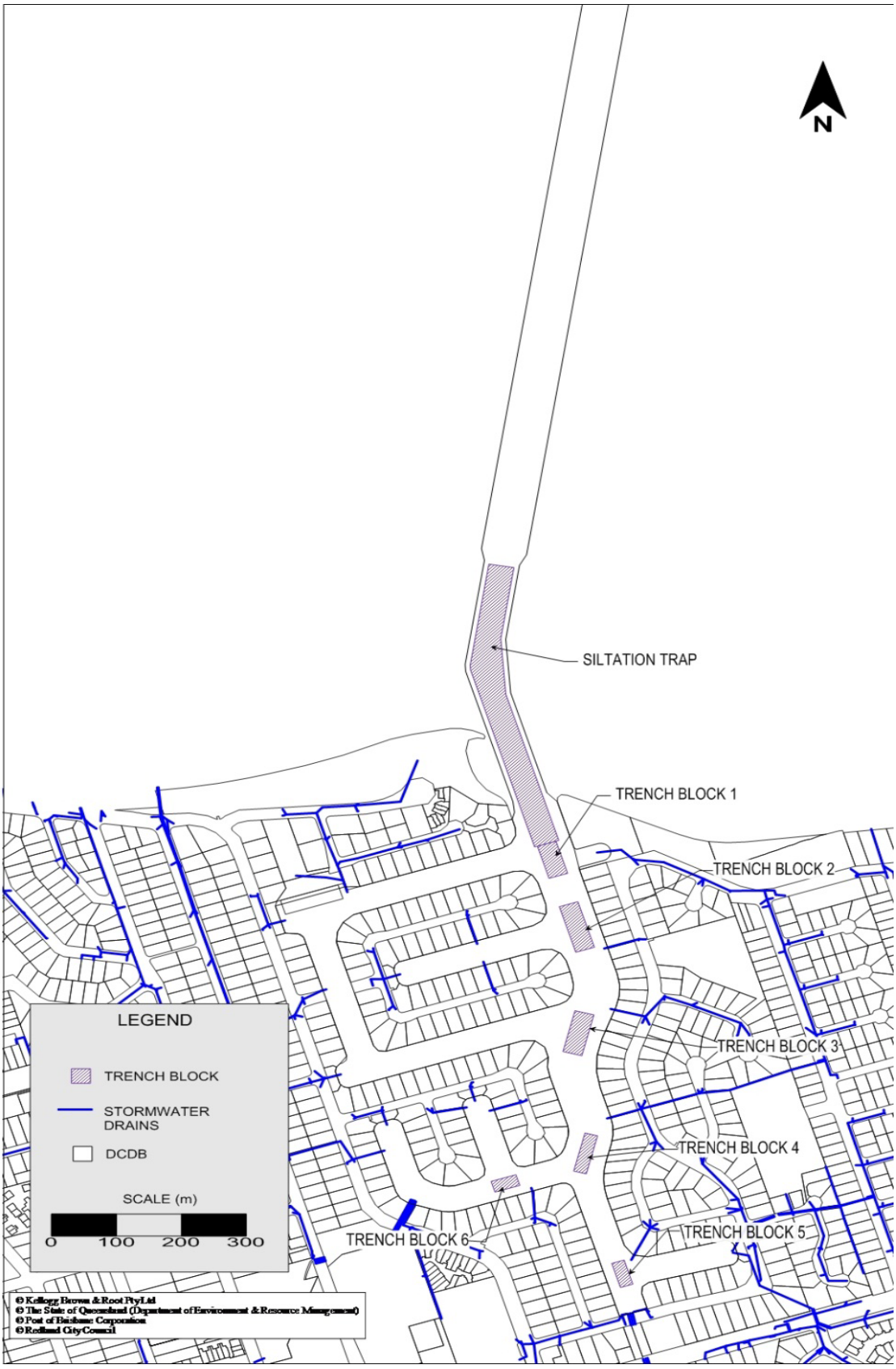



**Figure 5.1**
**PLAN OF PROPOSED SILT TRAP AND TRENCH BLOCKS (Trench blocks are indicative, based on proposed locations from CMP (KBR, 2012). Trench Block 4 deleted)**

The review of the 2014 hydrographic survey when compared with the 2011 survey indicates minimal change in the overall gross siltation rate of the entrance channel and canal system. Therefore the existing maintenance schedule appears to be most feasible option. The Phase 2 maintenance schedule proposed in the CMP (KBR 2012b) will form the maintenance schedule for the revised maintenance plan described herein. Based on the observed siltation patterns in the canal system, and the high levels of accumulation at the entrance, it is expected that removing silt at the entrance to the canals will somewhat reduce the rate of incoming siltation in the upper reaches of the canal.

Findings presented in Soil Survey's geotechnical investigation report, in conjunction with consultation with Port of Brisbane have confirmed that the proposed design of the trench blocks and silt traps is achievable using the grab/backhoe dredging method with minor trench block depth adjustments where rock is encountered.

The report also provides recommendations on the safe batter angles and benching required for maintaining satisfactory long-term factors of safety for the trench block and silt trap excavation. Adjustments to the proposed design have included the deletion of trench block 4 due to the presence of deep layers of very soft silty sand. A deep excavation into this material might cause localised canal batter movement.

# 6 Maintenance model

## 6.1 INTRODUCTION

The maintenance model is based on the average siltation rates and accumulated siltation observed from the 2011 to 2014 surveys as discussed in Section 3.

The plan is based on the two phase approach proposed in the CMP (KBR 2012b). Phase 1 involves the removal of existing accumulated sediment using grab dredging and bed levelling plus the capital dredging of the six (now five) trench blocks and deepening of the existing entrance silt trap. Phase 2 consists of ongoing maintenance with bed levelling and maintenance dredging campaigns undertaken over a repeating 14 year cycle. The plan assumes dredged material disposal at the Mud Island disposal grounds over the timeframe of this plan.

The modifications to the CMP consist of performing the Phase 1 works over five years, not three years due to:

- residents' prioritising the removal of the accumulated siltation over the creation of silt traps
- limited funding
- lack of available water depth due to siltation means that the dredge will have to 'dredge its way in' from the north. It cannot access the most silted areas until it has dredged its way in.

## 6.2 NAVIGATION PRIORITIES

The 2014 survey indicates an immediate need for dredging to be undertaken to remove the accumulated sediment to restore navigability to the canal estate; especially in heavily silted areas including the inner entrance channel and the intersection of Wood and John Goleby Canals (Zones 3 to 6). Through RCC, the Aquatic Paradise Residents' Association (APRA) advised a list of short-term priorities based on the need to dredge these heavily accumulated areas. These priorities are:

1. Dredge the shallow areas at the entrance to the canal estate (Zone 5 and the first half of Zone 6) to the design level
2. Dredge the siltation trap in the inner entrance channel (Zone 3 and 4) to the design level
3. Dredge siltation at the locations where the creeks enter the canal system
4. Dredge the entrance channel (Zone 2) to design levels (–1.93 mLAT) starting from the Southern (inner) end of the channel.

Unfortunately, these priorities cannot be exactly followed due to shallow water preventing dredge access.

At present, bed levels within the entrance channel (based on 2014 hydrographic survey) are:

- Zone 2: –2.0 to –1.3 mLAT
- Zone 3: –1.3 to –1.2 mLAT
- Zone 4: –1.2 to –0.6 mLAT.

Based on consultation with the Port of Brisbane, the proposed dredging equipment draws the following water:

- 1.9 m draft for grab dredge (Ken Harvey Grab Dredge)
- 2.0 m (max) draft for the two split hopper barges (Hercules and Sampson).

Generally, assisting tugs and the barges can time operations with the tides in order to avoid low tide. This, however, is not possible with the grab dredge. The operating depth of the grab dredge will therefore dictate the depth at which dredging operations can be undertaken.

The probability of the dredging campaign coinciding with Lowest Astronomical Tide (Zero mLAT) is low and not many tides occur below +0.3 mLAT (i.e. near MLWS). It is not acceptable for the dredge to ground at low tide as this will damage its hull. The grab dredge requires an underkeel clearance of 0.3 m. Therefore the highest acceptable bed elevation for safe operation is RL +0.3 mLAT – 0.3–1.9 m = RL –1.9 mLAT. This depth of –1.9 mLAT is therefore considered the critical operating depth. It will be necessary to dredge the channel and canal system to this depth to provide access for the dredging equipment. It should be noted that this advice is indicative only and must be confirmed via further consultations with the industry during the tender phase. Figure 6.1 shows the areas above –1.9 mLAT as per the current 2014 hydrographic survey which highlights the areas which have limited accessibility (in red).

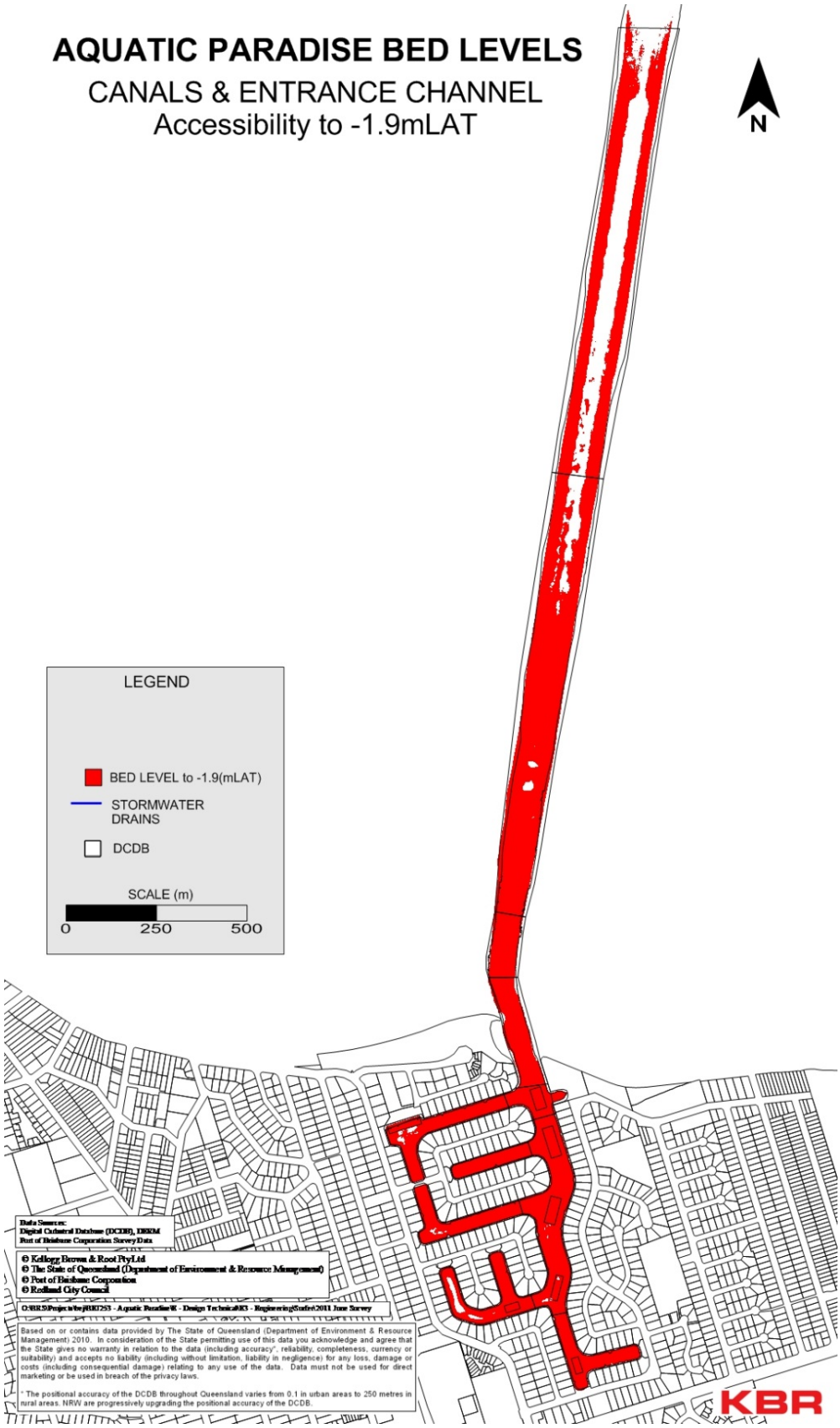



**Figure 6.1**
**AREAS OF LIMITED DREDGE ACCESSIBILITY (Trench Block 4 deleted)**

## 6.3 YEAR ONE CAMPAIGN

The year one campaign consists of dredging southwards along the entrance channel to the design level as far as funds allow. Council advised that $2.5 M in funding has been allocated to undertake the Year 1 works. The aim is for this dredging works to be undertaken in the 2015/16 financial year.

The previously proposed 'Year 1' campaign in the CMP (KBR 2012b) included dredging of accumulated siltation in the main entrance channel (Zone 2) and silt trap, plus capital dredging of the six (now five) trench blocks. Capital dredging works were proposed early in the program to facilitate bed levelling of the accumulated siltation in the remaining areas in the subsequent years.

Considering the dredging priorities outlined by APRA, and given the limited dredge access to the canals due to the levels of silt accumulation, the proposed Year 1 works will now incorporate dredging of the main entrance channel (Zone 2), outer (existing) silt trap (Zone 3) and part of inner (existing) silt trap (Zone 4) to the existing design levels. No capital works are proposed for the Year 1 campaign. A total volume of approximately 42,700$m^3$ is expected to be removed in this campaign. Dredging these areas will allow the subsequent dredging of priority areas 1 and 2 in Year 2 (i.e. the remainder of Zone 4, Zone 5 and first half of Zone 6). The originally proposed Year 1 works will now be undertaken over a 5 year period in the revised program.

## 6.4 CANAL MANAGEMENT PLAN REVISION

The revised CMP is in Appendix B. The staging diagrams are in Appendix D. Table 6.1 has a breakdown of the annual dredging operations and estimated costs.

**Table 6.1 Proposed dredging operations work breakdown structure**

| Phase | Phase Description | Financial Year | Activity | Dredging Cost Allocation (excl. GST) (2015$) |
|---|---|---|---|---|
| 1 | Planning, Design and Approvals<br>Removal of Existing Accumulated Siltation<br>Capital Dredging | 2015-16 | Maintenance Plan update and detailed design of the year one works | |
| | | | Dredge priority 4 - Removal of accumulated siltation in Zones 2 and 3 and the outer half of Zone 4 | $2,400,000 |
| | | 2016-17 | Obtain approvals for the capital dredging of the trenches inside the canal system and silt trap (Partly in the Marine Park) | $350,000 |
| | | | Dredge priorities 1 and 2 - Removal of accumulated siltation in Zone 4 (remaining), Zone 5 and half of Zone 6 | $1,650,000 |
| | | 2017-18 | Removal of accumulated siltation in remainder of Zone 6 and ; | $700,000 |
| | | | Capital dredging of Trench Blocks 1, 2& 3 | $3,500,000 |
| | | 2018-19 | Dredge priority 3 - Bed level accumulations in Zones 10 and 11 to Trenches 3 plus | $13,000 |
| | | | capital dredge Trench Blocks 5 and 6 and capital dredging of silt trap | $1,400,000 |
| | | 2019-20 | Bed levelling of accumulations in remaining areas (Zone 7, 8 and 9) plus distribution of siltation in Zone 6 | $2,000,000 |
| | | | Subsequent maintenance dredging of all Trench Blocks to empty. | |
| REVERSION TO MAINTENANCE DREDGE PLAN AS PER CMP (KBR 2012B) – 14 YEAR CYCLE | | | | |
| 2 | Maintenance Dredging | 2020-21 | Regular maintenance dredging schedule commences | |
| | | 2025-26 | Maintenance bed levelling all zones except Zones 1, 2 and Silt Trap. Undertaken every 7 years to prevent bed levels exceeding canal trigger levels | $72,000 |
| | | 2026-27 | Maintenance Grab Dredging Silt Trap, Zone 2 and Trench 6 | $3,000,000 |
| | | 2013-32 | Maintenance bed levelling all zones except Zones 1, 2 and Silt Trap. | $72,000 |
| | | 2032-33 | Maintenance Grab Dredging Silt Trap, Zone 2 and all trenches | $5,800,000 |

Disposal of dredged material at the Mud Island disposal grounds is a key component of the works as it provides a solution to the otherwise complex and expensive issue of spoil disposal. Constraints and benefits of different disposal options were considered in the CMP (KBR 2012b), with Mud Island disposal being the preferred option. The projected disposal volumes over the 18 year life of the management plan are in Table 6.2.

**Table 6.2 Estimated volumes of dredge material for disposal at Mud Island**

| Financial Year | Volume (m3) |
|---|---|
| 2015/16 | 42,650 |
| 2016/17 | 31,350 |
| 2017/18 | 38,500 |
| 2018/19 | 17,810 |
| 2019/20 | 34,900 |
| 2026/27 | 52,920 |
| 2032/33 | 106,680 |

*Notes:*

1. *Based on the Dredging Plan in Appendix B*
2. *Calculated volumes are insitu volumes based on 2014 hydrographic survey*
3. *Over-dredging is not included*
4. *A siltation allowance has been included*
5. *Actual volumes may vary. To be confirmed with a Pre-dredge survey*

## 6.5 FINANCIAL MODEL

The financial model has been developed using the methodologies and assumptions described in the CMP (KBR 2012b), and is provided in Appendix C. The financial model covers the period from 2015/16 to 2032/33 Financial Years (18 years) to incorporate the Phase 1 campaign and one full cycle of the Phase 2 campaign. Costed items listed in the CMP (KBR 2012b) were used to estimate the overall maintenance costs. These costed items include dredging and disposal, general maintenance, engineering and administration; and environmental approval and monitoring costs. In addition to dredging and disposal costs, provisions have also been made for 'hard material dredging' of the trench blocks and silt traps. The overall financial model and explanatory notes are provided in Appendix C.

Council advised that approximately $2.4 M in funding has been allocated to undertake the Year 1 works. This has informed the Year 1 works plan.

Overall, the Phase 1 works are estimated to cost approximately $12.5 M in 2015 dollars which includes the removal of the accumulated siltation from the entrance channel and canal system plus the capital dredging of trenches and silt traps (with provision for some hard dredging material works). The estimated average annual maintenance costs over the Phase 1 campaign is estimated to be $2,500,000 per year averaged over 5 years. The cost of the works in each financial year varies between $1,500,000 and $4,400,000. There are potential cost savings in combining campaigns, however, if there is a desire to reduce the timeframe of the Phase 1 program of works, summing the grand total of each yearly campaign is considered a reasonable combined campaign estimate. A full breakdown of costs is provided in Appendix C. The cost estimates include dredging of the siltation that occurs over the period of the CMP. It should be noted that all costs are in 2015 dollars.

Some estimates for the Phase 1 works in the revised CMP are increased from the original maintenance strategy due to:

- The 2014 hydrographic survey indicates slightly higher siltation rates compared with previous surveys; with a 10% increase in average annual siltation of the Canal and Entrance channel since the 2011 hydrographic survey.
- The revised financial model incorporates 'hard material dredging rates' for some capital dredging works in trenches/traps.
- Adjustments to the dredging schedule due to the inclusion of the priority areas and accessibility requirements which were not considered in the original management strategy.

Starting in the 2020/21 financial year, the schedule reverts to Phase 2 with an estimated average annual maintenance cost of around $700,000 which is consistent with the maintenance strategy proposed in the CMP (2012b).

# 7 Conclusion

At present, the Aquatic Paradise inner entrance channel and canal system is heavily silted.

The long-term maintenance approach proposed by the Port of Brisbane forms the basis for this revised Canal Management Plan (CMP). This plan is a combined methodology, with bed levelling supplemented by periodic grab dredging of silt from trenches and a deepened silt trap to remove accumulated siltation. As proposed in the CMP, disposal of the dredge spoil at the Mud Island disposal grounds remains the preferred option. The critical component for implementing this strategy is the excavation of trenches and the deepening of the existing silt trap below the existing design levels.

Grab dredging and bed levelling is still considered the preferred option. An 18 year maintenance plan has been developed as a revision to the previous CMP (KBR 2012b) using recently received geotechnical and survey data.

Based on adjustments to the dredging priorities, budgetary requirements and the results of the latest siltation and geotechnical investigations, the previously proposed 'Phase 1' works will now be extended. This extends the Phase 1 works from 3 years, as originally proposed, to 5 years, from the 2015/16 financial year campaign to the 2019/20 financial year campaign. After this, the plan will revert to the previously proposed 14 year maintenance strategy cycle starting in 2020/21 financial year.

The Year 1 campaign will focus on dredging the entrance channel to provide access for dredging and equipment to the highest priority areas in Zones 3 – 6. The Year 1 campaign will therefore include dredging of the accumulated siltation in Zones 2, 3 and 4 to provide dredge access to the canal system. The estimated cost of the Year 1 works is approximately $2.4 M.

Year 2 will focus on the highest dredging priority areas: Zones 4, 5 and the northern half of Zone 6, in order to address the main priorities (1 and 2) as advised by APRA.

Overall, the Phase 1 works are estimated to cost $12.5 M over a 5 year period. This equates to approximately $2.5 M per year, averaged over 5 years from 2015/16 financial year to 2019/20 financial year in 2015 dollars.

# 8 References

KBR (2012a) *Aquatic Paradise Canal Estate: Siltation Study (BEJ253-TD-MN-REP-0001 Rev. 1)* prepared for Redland City Council

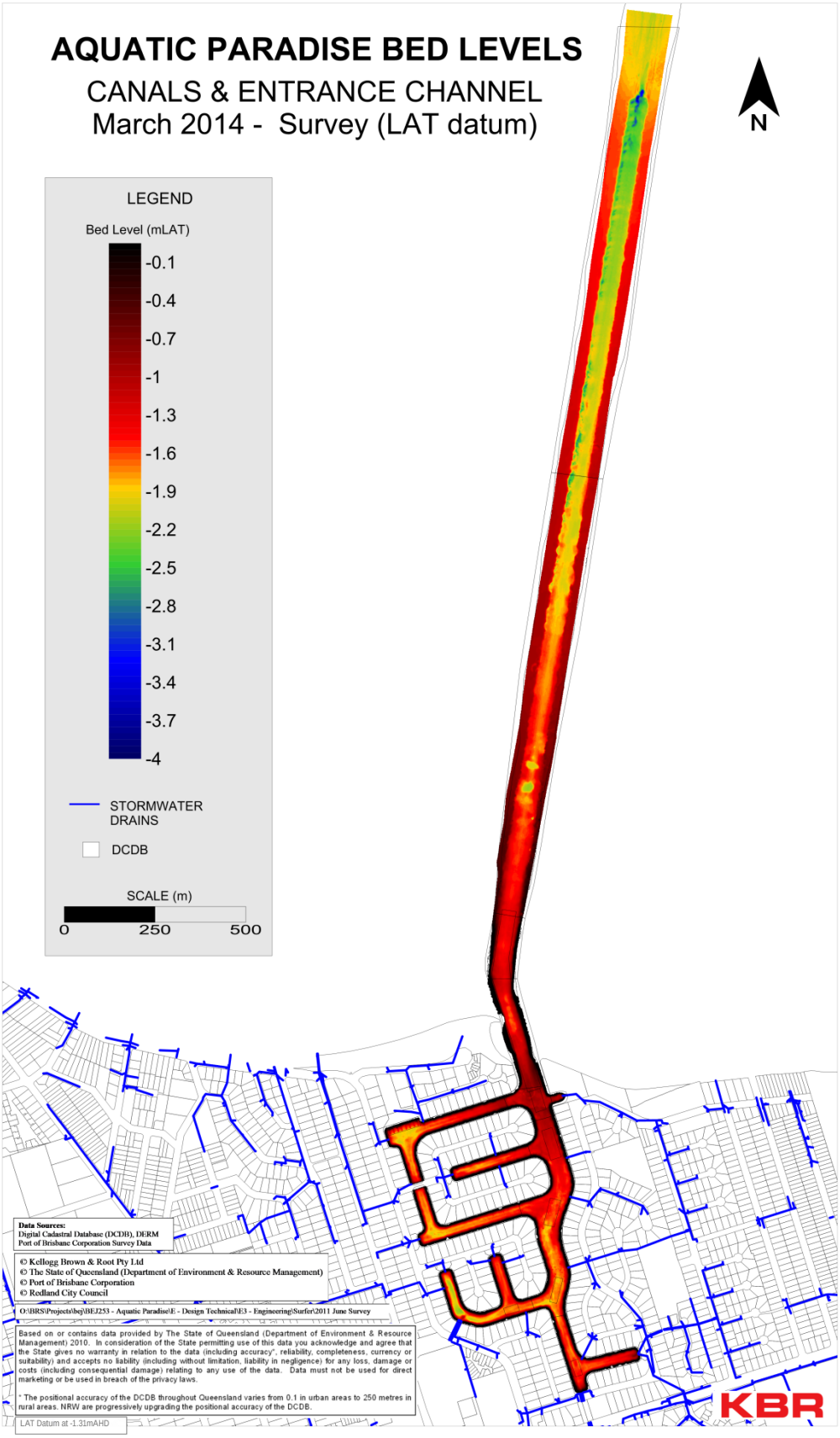
KBR (2012b) *Aquatic Paradise Canal System: Canal Management Plan (BEJ253-TD-MN-REP-0002 Rev. 0)* prepared for Redland City Council

KBR (2015) *Aquatic Paradise Canal Estate: Sediment Sampling and Analysis Results Report (BEJ456-TD-EV-REP-001)* prepared for Redland City Council

Soil Surveys Engineering Pty Ltd (2015) *Geotechnical Investigation: Canal Estate and Entrance Channel Dredging, Aquatic Paradise Canal Estate, Birkdale (1-16581, 2014-11-21 BR F VER 3)* prepared for Redland City Council (See Appendix E)

*Appendix A*

# CANAL SURVEYS AND ISOPACHS


AQUATIC PARADISE BED LEVELS
CANALS & ENTRANCE CHANNEL
March 2014 - Survey (LAT datum)
N
LEGEND
Bed Level (mLAT)
-0.1
-0.4
-0.7
-1
-1.3
-1.6
-1.9
-2.2
-2.5
-2.8
-3.1
-3.4
-3.7
-4
STORMWATER DRAINS
DCDB
SCALE (m)
0
250
500
Data Sources:
Digital Cadastral Database (DCDB), DERM
Port of Brisbane Corporation Survey Data
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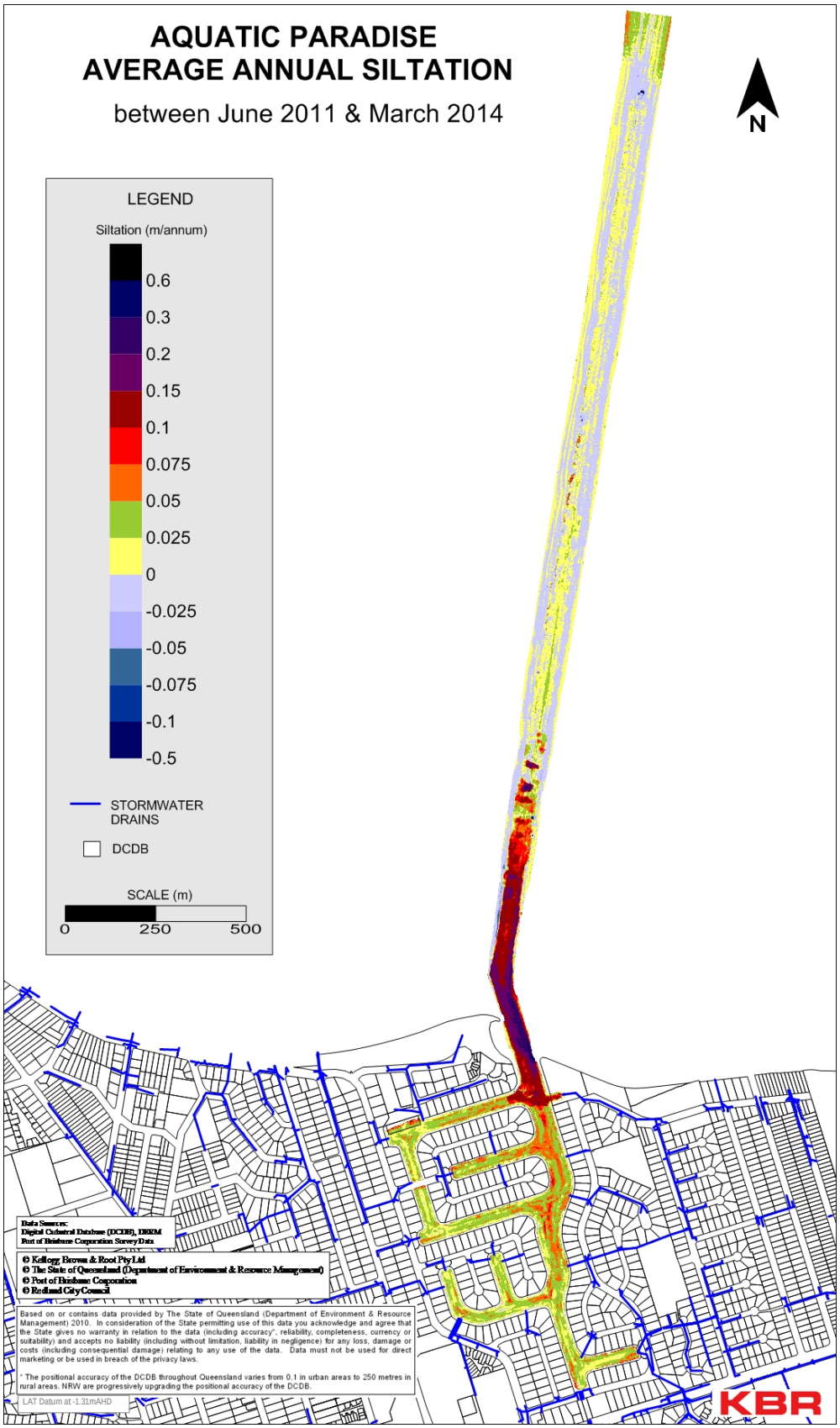
© The State of Queensland (Department of Environment & Resource Management)
© Port of Brisbane Corporation
© Redland City Council
O:\BRS\Projects\bej\BEJ253 - Aquatic Paradise\E - Design Technical\E3 - Engineering\Surfer\2011 June Survey
Based on or contains data provided by The State of Queensland (Department of Environment & Resource Management) 2010. In consideration of the State permitting use of this data you acknowledge and agree that the State gives no warranty in relation to the data (including accuracy*, reliability, completeness, currency or suitability) and accepts no liability (including without limitation, liability in negligence) for any loss, damage or costs (including consequential damage) relating to any use of the data. Data must not be used for direct marketing or be used in breach of the privacy laws.
* The positional accuracy of the DCDB throughout Queensland varies from 0.1 in urban areas to 250 metres in rural areas. NRW are progressively upgrading the positional accuracy of the DCDB.
LAT Datum at -1.31mAHD
KBR


AQUATIC PARADISE
AVERAGE ANNUAL SILTATION
between June 2011 & March 2014
N
LEGEND
Siltation (m/annum)
0.6
0.3
0.2
0.15
0.1
0.075
0.05
0.025
0
-0.025
-0.05
-0.075
-0.1
-0.5
STORMWATER DRAINS
DCDB
SCALE (m)
0
250
500
Data Sources:
Digital Cadastral Database (DCDB), DERM
Port of Brisbane Corporation Survey Data
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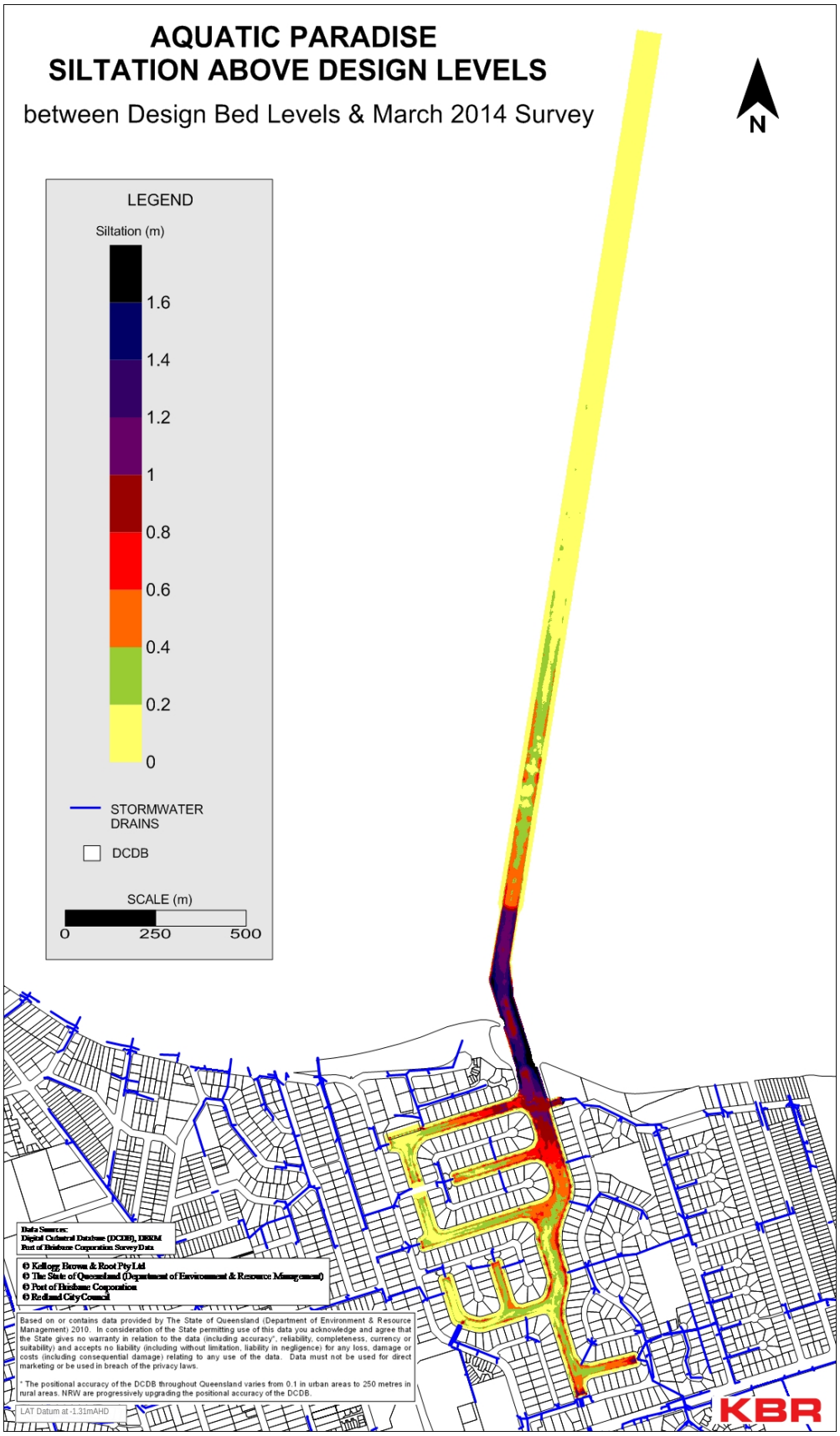
* The positional accuracy of the DCDB throughout Queensland varies from 0.1 in urban areas to 250 metres in rural areas. NRW are progressively upgrading the positional accuracy of the DCDB.
LAT Datum at -1.31mAHD
KBR


AQUATIC PARADISE
SILTATION ABOVE DESIGN LEVELS
between Design Bed Levels & March 2014 Survey
N
LEGEND
Siltation (m)
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
STORMWATER DRAINS
DCDB
SCALE (m)
0
250
500
Data Sources:
Digital Cadastral Database (DCDB), DRKM
Port of Brisbane Corporation Survey Data
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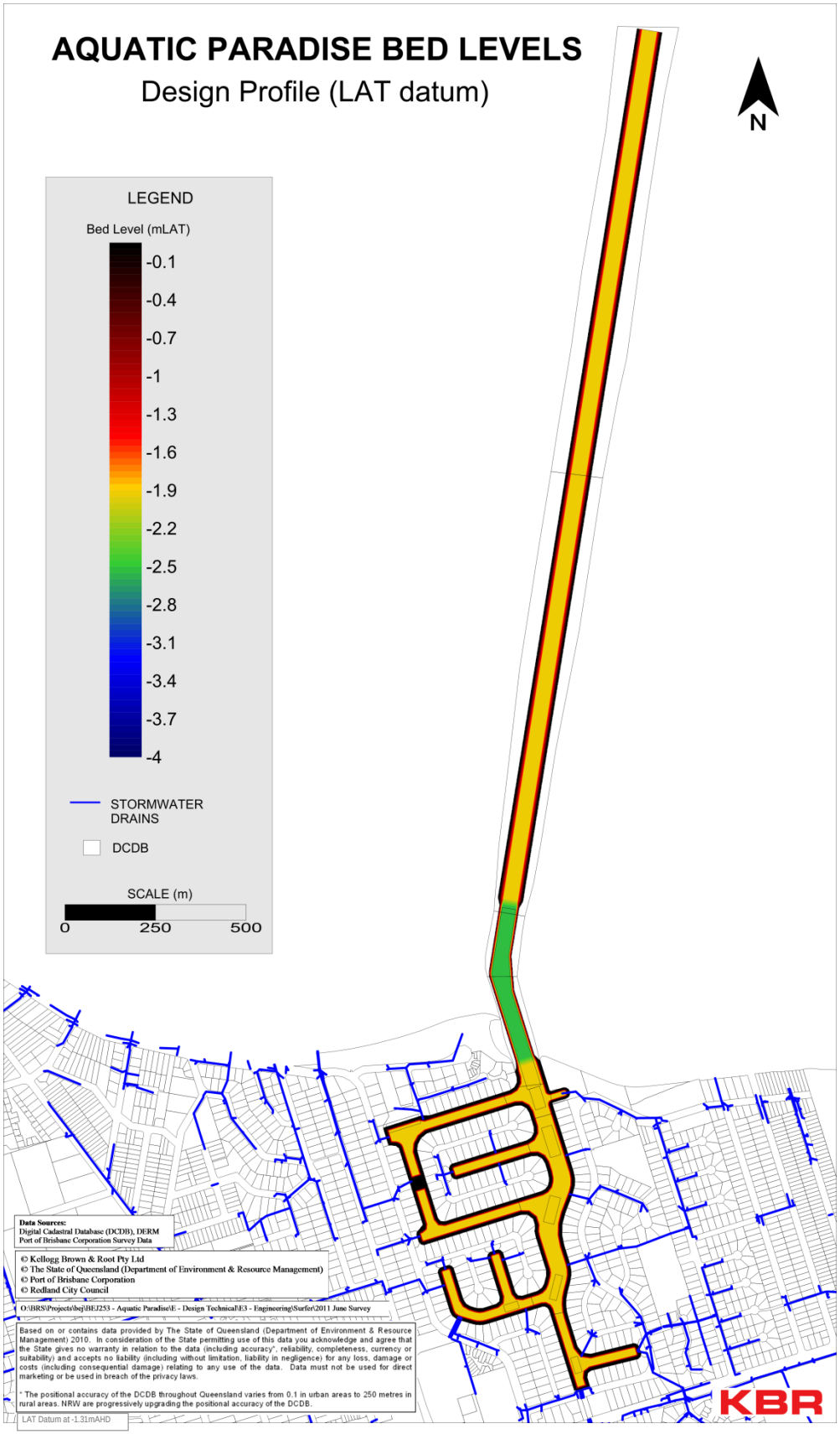
* The positional accuracy of the DCDB throughout Queensland varies from 0.1 in urban areas to 250 metres in rural areas. NRW are progressively upgrading the positional accuracy of the DCDB.
LAT Datum at -1.31mAHD
KBR


AQUATIC PARADISE BED LEVELS
Design Profile (LAT datum)
N
LEGEND
Bed Level (mLAT)
-0.1
-0.4
-0.7
-1
-1.3
-1.6
-1.9
-2.2
-2.5
-2.8
-3.1
-3.4
-3.7
-4
STORMWATER DRAINS
DCDB
SCALE (m)
0
250
500
Data Sources:
Digital Cadastral Database (DCDB), DERM
Port of Brisbane Corporation Survey Data
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* The positional accuracy of the DCDB throughout Queensland varies from 0.1 in urban areas to 250 metres in rural areas. NRW are progressively upgrading the positional accuracy of the DCDB.
LAT Datum at -1.31mAHD
KBR

*Appendix B*

# CANAL MANAGEMENT PLAN

**PROPOSED DREDGE PLAN - AQUATIC PARADISE**

| Index | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | Grab Dredge Volumes ($m^3$) Insitu | | Bed Leveling Volumes (m3) Insitu |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Canal | Outer Entrance Channel | Middle Entrance Channel | Slit Trap (outer half) | Slit Trap (inner half) | Wood & John Goleby Intersection | Wood (Main) | John Goleby | Genrich | Clauson | Wood Gate | Laidlaw & Wood (end) | Slit Trap | Trench 1 | Trench 2 | Trench 3 | Trench 4 | Trench 5 | Trench 6 | | | |
| Zone | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | - | - | - | - | - | - | - | Accumulations | Capital | |
| Campaign (Year) | | | | | | | | | | | | | | | | | | | | | |
| 1 | | 1 | 1 | 1 | | | | | | | | | | | | | | | 42650 | | |
| 2 | | | | 1 | 1 | 1 | | | | | | | | | | | | | 31350 | | |
| 3 | | | | | | 1 | | | | | | | 1 | 1 | 1 | 1 | | | 12380 | 26100 | |
| 4 | | | | | | | | | | 1 | 1 | 1 | | | | | 1 | 1 | | 18810 | 11410 |
| 5 | | | | | | 1 | 1 | 1 | 1 | | | | 1 | 1 | 1 | 1 | 1 | 1 | 34900 | | 19350 |
| 6 | | | | | | | | | | | | | | | | | | | | | |
| 7 | | | | | | | | | | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | | | | | | | | |
| 11 | | | | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | | | | | | | | | 35560 |
| 12 | | 1 | | | | | | | | | | 1 | | | | | | 1 | 52920 | | |
| 13 | | | | | | | | | | | | | | | | | | | | | |
| 14 | | | | | | | | | | | | | | | | | | | | | |
| 15 | | | | | | | | | | | | | | | | | | | | | |
| 16 | | | | | | | | | | | | | | | | | | | | | |
| 17 | | | | | | | | | | | | | | | | | | | | | |
| 18 | | | | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | | | | | | | | | 35560 |
| 19 | | 1 | | | | | | | | | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 106680 | | |

| Legend |
|---|
| Capital Grab Dredging |
| Accumulated Grab Dredging |
| Partial Accumulated Grab Dredging |
| Maintenance Grab Dredging |
| Accumulated Bed Levelling |
| Maintenance Bed Levelling |

| DREDGE & BED LEVELLING VOLUMES | | | | | | | | | | | | | | | | | | | TOTALS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Initial accumulated siltation ($m^3$) - 2014 Survey | | 13860 | 10630 | 23870 | 8120 | 17750 | 5640 | 2730 | 2980 | 3520 | 5030 | | | | | | | | 94130 |
| Annual Siltation ($m^3$) | | 2511 | 1279 | 2777 | 733 | 1740 | 609 | 344 | 472 | 463 | 488 | | | | | | | | 11420 |
| Estimated accumulated siltation (m3) - 2015 | | | | | 8853 | 19490 | 6249 | 3074 | 3452 | 3983 | 5518 | | | | | | | | 50620 |
| Annual siltation allocation to traps & trenches ($m^3$/yr) | | | | | | | | | | | | 4750 | 730 | 1040 | 990 | 840 | 240 | 300 | 8890 |
| Capital dredge trenches & maintenance dredge trap & zone 2 ($m^3$) | | 13860 | | | | | | | | | | 34500 | 7180 | 9580 | 7540 | 6540 | 1500 | 1220 | 81920 |
| Annual siltation allowance ($m^3$) | | 2511 | | | | | | | | | | 3244 | 209 | 134 | 121 | 54 | 30 | 17 | 3810 |
| 2014 to 2015 siltation volume, 1 yrs ($m^3$) | | 2511 | | | | | | | | | | 3244.177 | 209.158 | 134.214 | 120.547 | 54.473 | 30.101 | 17.395 | 3810 |
| Accumulated siltation removed in 2014 operation (capital trenches & maintenance trap & Z2) ($m^3$) | | 13860 | 10630 | 23870 | | | | | | | | | | | | | | | 48360 |
| Bed levelling vols to move accumulated siltation to traps & trenches ($m^3$) | | | | | | | | | | | | 16150 | 7070 | 6990 | 8510 | 7010 | 1870 | 1800 | 49400 |
| Capital dredging volumes (below current design levels) ($m^3$) | | | | | | | | | | | | 10125 | 5,400 | 7,650 | 6,750 | 6,300 | 1,160 | 1,030 | 38420 |

Notes & Assumptions

1. It is assumed that siltation which settles in the trap or trenches do not need to be bed levelled
2. Annual Siltation Volumes in each trap/trench are included in the annual siltation volume of the dredge zone to which the trap/trench lies within
3. Bed leveling occurs every 7 years to ensure seabed levels do not exceed the trigger level of -1.6mLAT based on the 2000 to 2011 rates of siltation accumulation
4. Due to the observed siltation patterns and rates in zone 1 it is predicted that it may not need dredging in the timeframe of this plan. Hence its siltation has been ommitted from this plan
5. Volumes from zone 2 will be grab dredged from their current locations and won't be bed levelled into the silt trap
6. See Figure 4-1 in Canal Management Plan Report for predicted % of zone allocation
7. Bed levelling of sediment into traps and trenches does not increase its bulk density. The material remains saturated and compacts to similar levels

*Appendix C*

# FINANCIAL MODEL

## AQUATIC PARADISE MAINTENANCE MODEL

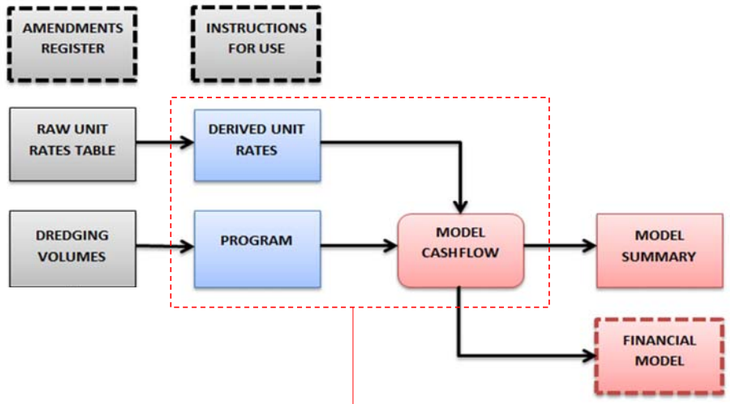
## AMENDMENTS REGISTER

| DATE | REV No. | BY | DETAILS |
|---|---|---|---|
| 2/02/2015 | A | KBR | Document issued for review for RCC |
| 18/02/2015 | B | KBR | Document issued for review for RCC |
| 31/03/2015 | C | KBR | Document issued for review for RCC |
| 4/05/2015 | D | KBR | Document issued for review for RCC |

# AQUATIC PARADISE MAINTENANCE MODEL

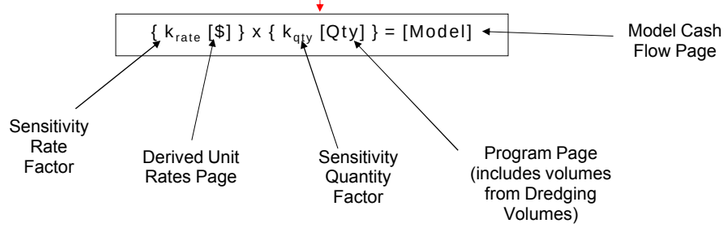
## Guidelines on the Use of this Model

**Worksheet Data Flow**




**Note: Worksheet is ordered such that data flows from RIGHT to LEFT. This results in the SUMMARY data being on tabs to the LEFT and INPUT data on tabs to the RIGHT**

**Governing Equation**




**Instructions For Use**

**Prepare the Model and Data Entry**

The Spreadsheet is structured so that general input occurs on **RAW UNIT RATES TABLE** and **PROGRAM** pages. Additionally, the **DERIVED UNIT RATES** and **DREDGING VOLUMES** page has adjustable sensitivity factors to model the change of costs and quantities. Otherwise, worksheets show output.

Review **PROGRAM** and **RAW UNIT RATES TABLE** and populate with relevant schedule and costing data respectively. When using the **PROGRAM** worksheet **please note the units** for each item. Only unitless items may be entered here, as volumes ($m^3$) and hours (hrs) are linked to **DREDGING VOLUMES.**

**DREDGING VOLUMES** contains information with regards to the major cost item of dredging and spoil disposal. These pages should not be edited without additional geotechnical information, a new dredging schedule, or new spoil disposal systems (except where shown).

**Run & Refine Model**

The **MODEL CASH FLOW** page is essentially **DERIVED UNIT RATES x PROGRAM** (2013-2034), with the addition of subtotals for each section.

The Model may be refined by breaking sections down further or adding new cost items. **This must be done with the care** as data is linked across multiple worksheets to provide relevant output.

Use adjustable sensitivity factor on **DERIVED UNIT RATES** and **DREDGING VOLUMES** pages

Update **AMENDMENTS REGISTER** upon updating model.

**Output**

**MODEL CASH FLOW** and **MODEL SUMMARY** pages are output pages, showing a breakdown of costs for given cost items.

It should be noted that all costs shown are 2012 dollars, with no consideration given for inflation

**Financial Model Instructions**

**Instructions for the use of this section are to be written by RCC as it is developed**

**Assumptions**

**Dredging Volumes**

Rev A data has been input from the dredging plan presented in the Canal Estate Management Plan Draft Report (KBR, 2012).
This plan covers the period 2013 to 2034.

The plan produced in the referenced report is based upon a number of important assumptions, most notably the siltation rates within the canals. The analysis of siltation rates within the canals indicates that siltation in Aquatic Paradise is variable in both space and time. As such, it is critical that the siltation be continually assessed using hydrographic surveys (collected as part of dredging campaigns) to ensure that the actual siltation rates within the canals are comparable to those assumed in the dredging plan. If the siltation rates are found to vary appreciably from those assumed for the proposed schedule (whether higher or lower) then an update of the schedule will be necessary.

Allowance can be made for the possibility of increased or reduced siltation. This is implemented via an increase or reduction in dredging volumes across all years (using the increased/reduced siltation check box in the dredging volumes worksheet), or in individual years by altering the dredge volumes sensitivity cells at the top of the worksheet.

**Raw Unit Rates**

Key assumptions with regards to the spoil disposal system include:

- The user selects their 'confidence percentage' preference; however as default it is set to 50% - that is there is a 50% probability that the costs will be exceeded.
- Costs sourced from the 'Aquatic Paradise Transactions Ledger' provided by RCC are indicative of future costs for comparable items.

**Program**

Some key events have been assumed and inserted into the model. These include:

- Capital dredging works feasibility study and detailed design occurring in 2013
- Attaining capital dredging approvals for the silt trap (in the Moreton Bay Marine Park) and the trench blocks (in the canals) in 2014
- Commencement of capital works grab dredging in 2015 with spoil disposed at Mud Island
- The model reverts to regular and timely maintenance dredging pattern from 2018 onwards
- Review of maintenance model – commencing in 2016 and again in 2019, then every 4 years thereafter.
- Each dredging / bed levelling operation has 2 surveys - pre and post dredging
- Sediment sampling and analysis is undertaken prior to grab dredging to assess spoils suitability to dispose offshore at Mud Island.

**Assumptions for this section are to be entered by RCC**

**Derived Unit Rates**

No Assumptions made

**Model Cash Flow / Model Summary**

No Assumptions made

**Finance Model**

**Assumptions for this section are to be written by RCC as it is developed**

**AQUATIC PARADISE MAINTENANCE MODEL**

**FINANCE MODEL**

**To be completed by RCC**

# AQUATIC PARADISE MAINTENANCE MODEL

## MODEL SUMMARY

| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|---|
| Budget No. | Component No. | ITEM / DESCRIPTON | 2015-16 | 2016-17 | 2017-18 | 2018-19 | 2019-20 | 2020-21 | 2021-22 | 2022-23 |
| | | 1.1 Dredging & Disposal | $ 2,431,125.00 | $ 2,008,875.00 | $ 4,255,125.00 | $ 1,410,989.75 | $ 2,045,854.28 | $ - | $ - | $ - |
| | | 1.2 General Maintenance | $ 31,500.00 | $ 31,500.00 | $ 31,500.00 | $ 31,500.00 | $ 31,500.00 | $ 31,500.00 | $ 31,500.00 | $ 31,500.00 |
| | | 1.3 Environmental | $ 32,250.00 | $ - | $ 32,250.00 | $ 32,250.00 | $ 32,250.00 | $ - | $ - | $ - |
| | | 1.4 Admininstration | $ 46,716.93 | $ 14,466.93 | $ 14,466.93 | $ 46,716.93 | $ 14,466.93 | $ 14,466.93 | $ 14,466.93 | $ 14,466.93 |
| | | GRAND TOTAL | $ 2,541,591.93 | $ 2,054,841.93 | $ 4,333,341.93 | $ 1,521,456.68 | $ 2,124,071.21 | $ 45,966.93 | $ 45,966.93 | $ 45,966.93 |
| | | ACCUMULATIVE TOTAL | $ 2,541,591.93 | $ 4,596,433.86 | $ 8,929,775.79 | $ 10,451,232.47 | $ 12,575,303.68 | $ 12,621,270.61 | $ 12,667,237.54 | $ 12,713,204.47 |
| | | RUNNING AVERAGE FROM 2014/15 FY | $ 2,541,591.93 | $ 2,298,216.93 | $ 2,976,591.93 | $ 2,612,808.12 | $ 2,515,060.74 | $ 2,103,545.10 | $ 1,809,605.36 | $ 1,589,150.56 |

**Instructions for Model Summary Worksheet**

DO NOT MODIFY CELL CONTENTS DIRECTLY
MODIFY RAW UNIT RATES AND PROGRAM SHEETS TO UPDATE DATA.
TO SIMULATE EFFECTS OF COST VARIATION, USE SENSITIVITY FACTORS ON DERIVED UNIT RATES AND DREDGING VOLUMES PAGES (FOR RATES AND QUANTITIES RESPECTIVELY)

Note:

* No downward adjustment in model for the deletion of Trench Block 4 Capital works

# AQUATIC PARADISE MAINTENANCE MODEL

## MODEL SUMMARY

| | | | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
|---|---|---|---|---|---|---|---|---|---|---|
| Budget No. | Component No. | ITEM / DESCRIPTON | 2023-24 | 2024-25 | 2025-26 | 2026-27 | 2027-28 | 2028-29 | 2029-30 | 2030-31 |
| | | 1.1 Dredging & Disposal | $ - | $ - | $ 71,952.74 | $ 2,970,300.00 | $ - | $ - | $ - | $ - |
| | | 1.2 General Maintenance | $ 31,500.00 | $ 31,500.00 | $ 31,500.00 | $ 31,500.00 | $ 31,500.00 | $ 31,500.00 | $ 31,500.00 | $ 31,500.00 |
| | | 1.3 Environmental | $ - | $ - | $ - | $ 32,250.00 | $ - | $ - | $ - | $ - |
| | | 1.4 Admininstration | $ 14,466.93 | $ 46,716.93 | $ 14,466.93 | $ 14,466.93 | $ 14,466.93 | $ 14,466.93 | $ 14,466.93 | $ 14,466.93 |
| | | GRAND TOTAL | $ 45,966.93 | $ 78,216.93 | $ 117,919.67 | $ 3,048,516.93 | $ 45,966.93 | $ 45,966.93 | $ 45,966.93 | $ 45,966.93 |
| | | ACCUMULATIVE TOTAL | $ 12,759,171.40 | $ 12,837,388.33 | $ 12,955,308.00 | $ 16,003,824.93 | $ 16,049,791.86 | $ 16,095,758.79 | $ 16,141,725.72 | $ 16,187,692.65 |
| | | RUNNING AVERAGE FROM 2014/15 FY | $ 1,417,685.71 | $ 1,283,738.83 | $ 1,177,755.27 | $ 1,333,652.08 | $ 1,234,599.37 | $ 1,149,697.06 | $ 1,076,115.05 | $ 1,011,730.79 |

**Instructions for Model Summary Worksheet**

DO NOT MODIFY CELL CONTENTS DIRECTLY

MODIFY RAW UNIT RATES AND PROGRAM SHEETS TO UPDATE DATA.

TO SIMULATE EFFECTS OF COST VARIATION, USE SENSITIVITY FACTORS ON DERIVED UNIT RATES AND DREDGING VOLUMES PAGES (FOR RATES AND QUANTITIES RESPECTIVELY)

# AQUATIC PARADISE MAINTENANCE MODEL

## MODEL SUMMARY

| | | | 17 | 18 |
|---|---|---|---|---|
| Budget No. | Component No. | ITEM / DESCRIPTON | 2031-32 | 2032-33 |
| | | 1.1 Dredging & Disposal | $ 71,952.74 | $ 5,792,700.00 |
| | | 1.2 General Maintenance | $ 31,500.00 | $ 31,500.00 |
| | | 1.3 Environmental | $ - | $ 32,250.00 |
| | | 1.4 Admininstration | $ 14,466.93 | $ 14,466.93 |
| | | GRAND TOTAL | $ 117,919.67 | $ 5,870,916.93 |
| | | ACCUMULATIVE TOTAL | $ 16,305,612.32 | $ 22,176,529.25 |
| | | RUNNING AVERAGE FROM 2014/15 FY | $ 959,153.67 | $ 1,232,029.40 |

**Instructions for Model Summary Worksheet**

DO NOT MODIFY CELL CONTENTS DIRECTLY

MODIFY RAW UNIT RATES AND PROGRAM SHEETS TO UPDATE DATA.

TO SIMULATE EFFECTS OF COST VARIATION, USE SENSITIVITY FACTORS ON DERIVED UNIT RATES AND DREDGING VOLUMES PAGES (FOR RATES AND QUANTITIES RESPECTIVELY)

## AQUATIC PARADISE MAINTENANCE MODEL

## MAINTENANCE MODEL CASH FLOW

| ITEM / DESCRIPTION | 2015-16 | 2016-17 | 2017-18 | 2018-19 | 2019-20 | 2020-21 | 2021-22 | 2022-23 | 2023-24 | 2024-25 | 2025-26 | 2026-27 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1.1 Dredging & Disposal** | | | | | | | | | | | | |
| Mob/Demob - Grab Dredge & Barges | $ 63,000.00 | $ - | $ 63,000.00 | $ 63,000.00 | $ 63,000.00 | $ - | $ - | $ - | $ - | $ - | $ - | $ 63,000.00 |
| Grab Dredging to Barge & Haul to Dispose at Mud Island - *Standard Rate* | $ 2,239,125.00 | $ 1,645,875.00 | $ 1,068,375.00 | $ 808,500.00 | $ 1,832,250.00 | $ - | $ - | $ - | $ - | $ - | $ - | $ 2,778,300.00 |
| Grab Dredging to Barge & Haul to Dispose at Mud Island - *Hard Dredging Rate* | $ - | $ - | $ 2,994,750.00 | $ 397,650.00 | $ - | $ - | $ - | $ - | $ - | $ - | $ - | $ - |
| Bed Levelling Service | $ - | $ - | $ - | $ 12,839.75 | $ 21,604.28 | $ - | $ - | $ - | $ - | $ - | $ 39,702.74 | $ - |
| Hydrographic Survey (pre & post) | $ 32,250.00 | $ - | $ 32,250.00 | $ 32,250.00 | $ 32,250.00 | $ - | $ - | $ - | $ - | $ - | $ 32,250.00 | $ 32,250.00 |
| Grab Dredging Design, Approvals & Monitoring | $ 96,750.00 | $ - | $ 96,750.00 | $ 96,750.00 | $ 96,750.00 | $ - | $ - | $ - | $ - | $ - | $ - | $ 96,750.00 |
| Capital Dredging Works Feasability Study and Detailed Design | $ - | $ 55,000.00 | $ - | $ - | $ - | $ - | $ - | $ - | $ - | $ - | $ - | $ - |
| Capital Dredging Approvals (silt trap - partly in Marine Park) | $ - | $ 220,000.00 | $ - | $ - | $ - | $ - | $ - | $ - | $ - | $ - | $ - | $ - |
| Capital Dredging Approvals (trenches in canals) | $ - | $ 88,000.00 | $ - | $ - | $ - | $ - | $ - | $ - | $ - | $ - | $ - | $ - |
| **Sub Total - Maintenance** | $ 2,431,125.00 | $ 1,645,875.00 | $ 712,838.96 | $ 12,839.75 | $ 2,045,854.28 | $ - | $ - | $ - | $ - | $ - | $ 71,952.74 | $ 2,970,300.00 |
| **Sub Total - Capital** | $ - | $ 363,000.00 | $ 3,542,286.04 | $ 1,398,150.00 | $ - | $ - | $ - | $ - | $ - | $ - | $ - | $ - |
| **TOTAL** | $ 2,431,125.00 | $ 2,008,875.00 | $ 4,255,125.00 | $ 1,410,989.75 | $ 2,045,854.28 | $ - | $ - | $ - | $ - | $ - | $ 71,952.74 | $ 2,970,300.00 |
| **1.2 General Maintenance** | | | | | | | | | | | | |
| Miscellaneous Items | $ 8,925.00 | $ 8,925.00 | $ 8,925.00 | $ 8,925.00 | $ 8,925.00 | $ 8,925.00 | $ 8,925.00 | $ 8,925.00 | $ 8,925.00 | $ 8,925.00 | $ 8,925.00 | $ 8,925.00 |
| Litter collection | $ 2,100.00 | $ 2,100.00 | $ 2,100.00 | $ 2,100.00 | $ 2,100.00 | $ 2,100.00 | $ 2,100.00 | $ 2,100.00 | $ 2,100.00 | $ 2,100.00 | $ 2,100.00 | $ 2,100.00 |
| Navigation Aid maintenance | $ 12,075.00 | $ 12,075.00 | $ 12,075.00 | $ 12,075.00 | $ 12,075.00 | $ 12,075.00 | $ 12,075.00 | $ 12,075.00 | $ 12,075.00 | $ 12,075.00 | $ 12,075.00 | $ 12,075.00 |
| Signage maintenance | $ 1,050.00 | $ 1,050.00 | $ 1,050.00 | $ 1,050.00 | $ 1,050.00 | $ 1,050.00 | $ 1,050.00 | $ 1,050.00 | $ 1,050.00 | $ 1,050.00 | $ 1,050.00 | $ 1,050.00 |
| Vegetation removal | $ 2,100.00 | $ 2,100.00 | $ 2,100.00 | $ 2,100.00 | $ 2,100.00 | $ 2,100.00 | $ 2,100.00 | $ 2,100.00 | $ 2,100.00 | $ 2,100.00 | $ 2,100.00 | $ 2,100.00 |
| Routine canal batter maintenance | $ 5,250.00 | $ 5,250.00 | $ 5,250.00 | $ 5,250.00 | $ 5,250.00 | $ 5,250.00 | $ 5,250.00 | $ 5,250.00 | $ 5,250.00 | $ 5,250.00 | $ 5,250.00 | $ 5,250.00 |
| **TOTAL** | $ 31,500.00 | $ 31,500.00 | $ 31,500.00 | $ 31,500.00 | $ 31,500.00 | $ 31,500.00 | $ 31,500.00 | $ 31,500.00 | $ 31,500.00 | $ 31,500.00 | $ 31,500.00 | $ 31,500.00 |
| **1.3 Environmental** | | | | | | | | | | | | |
| Sediment Sampling & Analysis (proir to grab dredging) | $ 32,250.00 | $ - | $ 32,250.00 | $ 32,250.00 | $ 32,250.00 | $ - | $ - | $ - | $ - | $ - | $ - | $ 32,250.00 |
| **TOTAL** | $ 32,250.00 | $ - | $ 32,250.00 | $ 32,250.00 | $ 32,250.00 | $ - | $ - | $ - | $ - | $ - | $ - | $ 32,250.00 |
| **1.4 Administration** | | | | | | | | | | | | |
| Review of Maintenance Model (Siltation Rates, Dredging Volumes & Costs) | $ 32,250.00 | $ - | $ - | $ 32,250.00 | $ - | $ - | $ - | $ - | $ - | $ 32,250.00 | $ - | $ - |
| RCC Administration | $ 10,750.00 | $ 10,750.00 | $ 10,750.00 | $ 10,750.00 | $ 10,750.00 | $ 10,750.00 | $ 10,750.00 | $ 10,750.00 | $ 10,750.00 | $ 10,750.00 | $ 10,750.00 | $ 10,750.00 |
| Annual ERA Holding Fee | $ 3,716.93 | $ 3,716.93 | $ 3,716.93 | $ 3,716.93 | $ 3,716.93 | $ 3,716.93 | $ 3,716.93 | $ 3,716.93 | $ 3,716.93 | $ 3,716.93 | $ 3,716.93 | $ 3,716.93 |
| **TOTAL** | $ 46,716.93 | $ 14,466.93 | $ 14,466.93 | $ 46,716.93 | $ 14,466.93 | $ 14,466.93 | $ 14,466.93 | $ 14,466.93 | $ 14,466.93 | $ 46,716.93 | $ 14,466.93 | $ 14,466.93 |
| **GRAND TOTAL** | $ 2,541,591.93 | $ 2,054,841.93 | $ 4,333,341.93 | $ 1,521,456.68 | $ 2,124,071.21 | $ 45,966.93 | $ 45,966.93 | $ 45,966.93 | $ 45,966.93 | $ 78,216.93 | $ 117,919.67 | $ 3,048,516.93 |
| **CUMULATIVE TOTAL** | $ 2,541,591.93 | $ 4,596,433.86 | $ 8,929,775.79 | $ 10,451,232.47 | $ 12,575,303.68 | $ 12,621,270.61 | $ 12,667,237.54 | $ 12,713,204.47 | $ 12,759,171.40 | $ 12,837,388.33 | $ 12,955,308.00 | $ 16,003,824.93 |
| **ANNUAL AVERAGE - BY PHASE** | | | | | $ 2,515,060.74 | | | | | | | |

**Instructions for Model Cash Flow Worksheet**
DO NOT MODIFY CELL CONTENTS DIRECTLY
MODIFY UNIT RATES AND PROGRAM SHEETS TO UPDATE DATA.
TO SIMULATE EFFECTS OF COST VARIATION, USE SENSITIVITY FACTORS
ON DERIVED UNIT RATES AND DREDGING VOLUMES PAGES
(FOR RATES AND QUANTITIES RESPECTIVELY)

Note:

* Provisions for *mobilisation/demobilisation* , *hydrographic survey* and *maintenance dredging/bed levelling design, approvals and monitoring* have been excluced from the 2015/16 program due to a combined campaign across 2015/16 and 2016/17 FY funding

* No downward adjustment in model for the deletion of Trench Block 4 Capital works

## AQUATIC PARADISE MAINTENANCE MODEL

## MAINTENANCE MODEL CASH FLOW

| ITEM / DESCRIPTION | 2027-28 | 2028-29 | 2029-30 | 2030-31 | 2031-32 | 2032-33 |
|---|---|---|---|---|---|---|
| **1.1 Dredging & Disposal** | | | | | | |
| Mob/Demob - Grab Dredge & Barges | $ - | $ - | $ - | $ - | $ - | $ 63,000.00 |
| Grab Dredging to Barge & Haul to Dispose at Mud Island - *Standard Rate* | $ - | $ - | $ - | $ - | $ - | $ 5,600,700.00 |
| Grab Dredging to Barge & Haul to Dispose at Mud Island - *Hard Dredging Rate* | $ - | $ - | $ - | $ - | $ - | $ - |
| Bed Levelling Service | $ - | $ - | $ - | $ - | $ 39,702.74 | $ - |
| Hydrographic Survey (pre & post) | $ - | $ - | $ - | $ - | $ 32,250.00 | $ 32,250.00 |
| Grab Dredging Design, Approvals & Monitoring | $ - | $ - | $ - | $ - | $ - | $ 96,750.00 |
| Capital Dredging Works Feasability Study and Detailed Design | $ - | $ - | $ - | $ - | $ - | $ - |
| Capital Dredging Approvals (silt trap - partly in Marine Park) | $ - | $ - | $ - | $ - | $ - | $ - |
| Capital Dredging Approvals (trenches in canals) | $ - | $ - | $ - | $ - | $ - | $ - |
| **Sub Total - Maintenance** | $ - | $ - | $ - | $ - | $ 71,952.74 | $ 5,792,700.00 |
| **Sub Total - Capital** | $ - | $ - | $ - | $ - | $ - | $ - |
| **TOTAL** | $ - | $ - | $ - | $ - | $ 71,952.74 | $ 5,792,700.00 |
| **1.2 General Maintenance** | | | | | | |
| Miscellaneous Items | $ 8,925.00 | $ 8,925.00 | $ 8,925.00 | $ 8,925.00 | $ 8,925.00 | $ 8,925.00 |
| Litter collection | $ 2,100.00 | $ 2,100.00 | $ 2,100.00 | $ 2,100.00 | $ 2,100.00 | $ 2,100.00 |
| Navigation Aid maintenance | $ 12,075.00 | $ 12,075.00 | $ 12,075.00 | $ 12,075.00 | $ 12,075.00 | $ 12,075.00 |
| Signage maintenance | $ 1,050.00 | $ 1,050.00 | $ 1,050.00 | $ 1,050.00 | $ 1,050.00 | $ 1,050.00 |
| Vegetation removal | $ 2,100.00 | $ 2,100.00 | $ 2,100.00 | $ 2,100.00 | $ 2,100.00 | $ 2,100.00 |
| Routine canal batter maintenance | $ 5,250.00 | $ 5,250.00 | $ 5,250.00 | $ 5,250.00 | $ 5,250.00 | $ 5,250.00 |
| **TOTAL** | $ 31,500.00 | $ 31,500.00 | $ 31,500.00 | $ 31,500.00 | $ 31,500.00 | $ 31,500.00 |
| **1.3 Environmental** | | | | | | |
| Sediment Sampling & Analysis (proir to grab dredging) | $ - | $ - | $ - | $ - | $ - | $ 32,250.00 |
| **TOTAL** | $ - | $ - | $ - | $ - | $ - | $ 32,250.00 |
| **1.4 Administration** | | | | | | |
| Review of Maintenance Model (Siltation Rates, Dredging Volumes & Costs) | $ - | $ - | $ - | $ - | $ - | $ - |
| RCC Administration | $ 10,750.00 | $ 10,750.00 | $ 10,750.00 | $ 10,750.00 | $ 10,750.00 | $ 10,750.00 |
| Annual ERA Holding Fee | $ 3,716.93 | $ 3,716.93 | $ 3,716.93 | $ 3,716.93 | $ 3,716.93 | $ 3,716.93 |
| **TOTAL** | $ 14,466.93 | $ 14,466.93 | $ 14,466.93 | $ 14,466.93 | $ 14,466.93 | $ 14,466.93 |
| **GRAND TOTAL** | $ 45,966.93 | $ 45,966.93 | $ 45,966.93 | $ 45,966.93 | $ 117,919.67 | $ 5,870,916.93 |
| **CUMULATIVE TOTAL** | $ 16,049,791.86 | $ 16,095,758.79 | $ 16,141,725.72 | $ 16,187,692.65 | $ 16,305,612.32 | $ 22,176,529.25 |
| **ANNUAL AVERAGE - BY PHASE** | | | | | | $ 738,555.81 |

**Instructions for Model Cash Flow Worksheet**

DO NOT MODIFY CELL CONTENTS DIRECTLY
MODIFY UNIT RATES AND PROGRAM SHEETS TO UPDATE DATA.
TO SIMULATE EFFECTS OF COST VARIATION, USE SENSITIVITY FACTORS
ON DERIVED UNIT RATES AND DREDGING VOLUMES PAGES
(FOR RATES AND QUANTITIES RESPECTIVELY)

## AQUATIC PARADISE MAINTENANCE MODEL

## MAINTENANCE MODEL DERIVED UNIT RATES

| ITEM / DESCRIPTION | Source | Units | RATE | SENSITIVITY: RATE FACTOR | COMMENT |
|---|---|---|---|---|---|
| **1.1 Dredging & Disposal** | | | | | |
| Mob/Demob - Grab Dredge & Barges | i | $ | $ 63,000.00 | 1 | Derived Rate = Sensitivity Rate Factor * [ Raw Unit Rate i * ( 1 + Adopted Confidence Percentage ) ] |
| Grab Dredging to Barge & Haul to Dispose at Mud Island | | | | | |
| *- Standard dredging rate* | ii | $/m$^3$ | $ 52.50 | 1 | Derived Rate = Sensitivity Rate Factor * [ Raw Unit Rate ii * ( 1 + Adopted Confidence Percentage ) ] |
| *- Hard dredging rate* | iii | $/m$^3$ | $ 165.00 | 1 | Derived Rate = Sensitivity Rate Factor * [ Raw Unit Rate iii * ( 1 + Adopted Confidence Percentage ) ] |
| Bed Levelling Service | iv | $/hr | $ 558.25 | 1 | Derived Rate = Sensitivity Rate Factor * [ Raw Unit Rate iv * ( 1 + Adopted Confidence Percentage ) ] |
| Hydrographic Survey (pre & post) | v | $ | $ 16,125.00 | 1 | Derived Rate = Sensitivity Rate Factor * [ Raw Unit Rate v * ( 1 + Adopted Confidence Percentage ) ] |
| Maintenance Grab Dredging / Bed Levelling Design, Approvals & Monitoring | vi | $ | $ 96,750.00 | 1 | Derived Rate = Sensitivity Rate Factor * [ Raw Unit Rate vi * ( 1 + Adopted Confidence Percentage ) ] |
| Capital Dredging Works Feasability Study and Detailed Design | vii | $ | $ 55,000.00 | 1 | Derived Rate = Sensitivity Rate Factor * [ Raw Unit Rate vii * ( 1 + Adopted Confidence Percentage ) ] |
| Capital Dredging Approvals (silt trap - partly in Marine Park) | viii | $ | $ 220,000.00 | 1 | Derived Rate = Sensitivity Rate Factor * [ Raw Unit Rate viii * ( 1 + Adopted Confidence Percentage ) ] |
| Capital Dredging Approvals (trenches in canals) | ix | $ | $ 88,000.00 | 1 | Derived Rate = Sensitivity Rate Factor * [ Raw Unit Rate ix * ( 1 + Adopted Confidence Percentage ) ] |
| **1.2 General Maintenance** | | | | | |
| Miscellaneous Items | x | $/annum | $ 8,925.00 | 1 | Derived Rate = Sensitivity Rate Factor * [ Raw Unit Rate x * ( 1 + Adopted Confidence Percentage ) ] |
| Litter collection | xi | $/annum | $ 2,100.00 | 1 | Derived Rate = Sensitivity Rate Factor * [ Raw Unit Rate xi * ( 1 + Adopted Confidence Percentage ) ] |
| Navigation Aid maintenance | xii | $/annum | $ 12,075.00 | 1 | Derived Rate = Sensitivity Rate Factor * [ Raw Unit Rate xii * ( 1 + Adopted Confidence Percentage ) ] |
| Signage maintenance | xiii | $/annum | $ 1,050.00 | 1 | Derived Rate = Sensitivity Rate Factor * [ Raw Unit Rate xiii * ( 1 + Adopted Confidence Percentage ) ] |
| Vegetation removal | xiv | $/annum | $ 2,100.00 | 1 | Derived Rate = Sensitivity Rate Factor * [ Raw Unit Rate xiv * ( 1 + Adopted Confidence Percentage ) ] |
| Routine canal batter maintenance | xv | $/annum | $ 5,250.00 | 1 | Derived Rate = Sensitivity Rate Factor * [ Raw Unit Rate xv * ( 1 + Adopted Confidence Percentage ) ] |
| **1.3 Environmental** | | | | | |
| Sediment Sampling & Analysis (proir to grab dredging) | xvi | $/annum | $ 32,250.00 | 1 | Derived Rate = Sensitivity Rate Factor * [ Raw Unit Rate xvi * ( 1 + Adopted Confidence Percentage ) ] |
| **1.4 Administration** | | | | | |
| Review of Maintenance Model (Siltation Rates, Dredging Volumes & Costs) | xvii | $/annum | $ 32,250.00 | 1 | Derived Rate = Sensitivity Rate Factor * [ Raw Unit Rate xvii * ( 1 + Adopted Confidence Percentage ) ] |
| RCC Administration | xviii | $/annum | $ 10,750.00 | 1 | Derived Rate = Sensitivity Rate Factor * [ Raw Unit Rate xviii * ( 1 + Adopted Confidence Percentage ) ] |
| Annual ERA Holding Fee | xix | $/annum | $ 3,716.93 | 1 | Derived Rate = Sensitivity Rate Factor * [ Raw Unit Rate xix * ( 1 + Adopted Confidence Percentage ) ] |

**MAINTENANCE MODEL DERIVED UNIT RATES**
USER MODIFY CELLS IN RED FONT
DO NOT MODIFY RATE CELLS DIRECTLY AS THESE ARE LINKED TO RAW UNIT RATES
COSTS SHOWN ARE UNIT RATES WITH CERTAINTY FACTOR APPLIED

**Instructions for Model Sensitivity Worksheet**
1 . Use the coloured cells to apply a factor to the adjacent item.
2. Unchanged cells (=1.0) will be displaced as light green, while cells with a factor applied will be displaced as light brown

## AQUATIC PARADISE MAINTENANCE MODEL

## MAINTENANCE MODEL PROGRAM (QUANTITIES TIME SERIES)

| ITEM / DESCRIPTION | Units | 2015-16 | 2016-17* | 2017-18 | 2018-19 | 2019-20 | 2020-21 | 2021-22 | 2022-23 | 2023-24 | 2024-25 | 2025-26 | 2026-27 | 2027-28 | 2028-29 | 2029-30 | 2030-31 | 2031-32 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1.1 Dredging & Disposal** | | | | | | | | | | | | | | | | | | |
| Mob/Demob - Grab Dredge & Barges | (-) | 1 | - | 1 | 1 | 1 | - | - | - | - | - | - | 1 | - | - | - | - | - |
| Grab Dredging to Barge & Haul to Dispose at Mud Island | | | | | | | | | | | | | | | | | | |
| *- Standard Dredging Rate* | $m^3$ | 42,650 | 31,350 | 20,350 | 15,400 | 34,900 | - | - | - | - | - | - | 52,920 | - | - | - | - | - |
| *- Hard Dredging Rate* | $m^3$ | - | - | 18,150 | 2,410 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Bed Levelling Service | hrs | - | - | - | 23 | 39 | - | - | - | - | - | 71 | - | - | - | - | - | 71 |
| Hydrographic Survey (pre & post) | (-) | 2 | - | 2 | 2 | 2 | - | - | - | - | - | 2 | 2 | - | - | - | - | 2 |
| Maintenance Dredging / Bed Levelling Design, Approvals & Monitoring | (-) | 1 | - | 1 | 1 | 1 | - | - | - | - | - | - | 1 | - | - | - | - | - |
| Capital Dredging Works Feasability Study and Detailed Design | (-) | | 1 | | | | | | | | | | | | | | | |
| Capital Dredging Approvals (silt trap - partly in Marine Park) | (-) | | 1 | | | | | | | | | | | | | | | |
| Capital Dredging Approvals (trenches in canals) | (-) | | 1 | | | | | | | | | | | | | | | |
| **1.2 General Maintenance** | | | | | | | | | | | | | | | | | | |
| Miscellaneous Items | (-) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Litter collection | (-) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Navigation Aid maintenance | (-) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Signage maintenance | (-) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Vegetation removal | (-) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Routine canal batter maintenance | (-) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| **1.3 Environmental** | | | | | | | | | | | | | | | | | | |
| Sediment Sampling & Analysis (proir to grab dredging) | (-) | 1 | - | 1 | 1 | 1 | - | - | - | - | - | - | 1 | - | - | - | - | - |
| **1.4 Administration** | | | | | | | | | | | | | | | | | | |
| Review of Maintenance Model (Siltation Rates, Dredging Volumes & Costs) | (-) | 1 | | | 1 | | | | | | 1 | | | | | | | |
| RCC Administration | (-) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Annual ERA Holding Fee | (-) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

**Instructions for Model Sensitivity Worksheet**
MODIFY DIMENSIONLESS EVENTS BY INSERTING THE NUMBER OF EVENTS FOR THAT YEAR.
DO NOT MODIFY CELLS IN THIS SPREADSHEET WHICH APPEAR IN BROWN, AS THEY ARE LINKED TO DREDGING VOLUMES WORKSHEETS. MODIFY BLUE CELLS.
THIS WORKSHEET IS THEN MULTIPLIED BY THE COSTS WORKSHEET TO PRODUCE COSTS FOR EACH ITEM.
IN EVENT THAT COSTS ITEMS ARE SHARED BETWEEN SECTIONS,
PLACE A FRACTION IN EACH CELL FOR DISTRIBUTION OF COSTS (TO SUM TO 1).

Note:
* Provisions for *mobilisation/demobilisation*, *hydrographic survey* and *maintenance dredging/bed levelling design, approvals and monitoring* have been excluced from the 2016/17 program due to a combined campaign across 2015/16 and 2016/17 FY funding

## AQUATIC PARADISE MAINTENANCE MODEL

## RAW UNIT RATES TABLE

| REF NO. | ITEM | UNIT | RATE | CONFIDENCE LEVEL | ORIGIN / REFERENCE / DATE |
|---|---|---|---|---|---|
| | **Dredge & Disposal** | | | | |
| i | Mob/Demob Grab Dredge and Barges | $ | 60,000.00 | 2 | KBR rates estimate - based on previous tenders |
| ii | Standard rate for Grab Dredging to Barge & Haul to Dispose at Mud Island | $/m$^3$ | 50.00 | 2 | KBR rates estimate - based on previous tenders |
| iii | "Hard Dredging" rate for Grab Dredging to Barge & Haul to Dispose at Mud Island | $/m$^3$ | 150.00 | 4 | Estimate based on productivity rates - POB preliminary estimate |
| iv | Bed Levelling Service | $/hr | 550.00 | 0 | POB rates estimate (phone conversation) |
| v | Dredge survey | $ | 15,000.00 | 3 | KBR Estimate, partial survey only |
| vi | Maintenance Grab Dredging / Bed Levelling Design, Approvals & Monitoring | $ | 90,000.00 | 3 | BEJ009 - Unit Cost Estimate - doc #: TD-MN-CAL-0001 + extra monitoring $30,000 |
| vii | Capital Dredging Works Feasability Study and Detailed Design | $ | 50,000.00 | 4 | KBR Estimate |
| viii | Capital Dredging Approvals (Silt Trap in Marine Park) | $ | 200,000.00 | 4 | KBR Estimate based on Newport Canals Works |
| ix | Capital Dredging Approvals (Trenches in Canals) | $ | 80,000.00 | 4 | KBR Estimate based on Newport Canals Works |
| | **General Canal Maintenance*** | | | | |
| x | Miscellaneous Items | $/annum | 8,500.00 | 2 | KBR estimate with input from previous similar projects |
| xi | Litter Collection | $/annum | 2,000.00 | 2 | KBR estimate with input from previous similar projects |
| xii | Nav Aid Maintenance & Replacement | $/annum | 11,500.00 | 2 | KBR estimate in combination with previous costs based on Aquatic Paradise Ledger - by RCC |
| xiii | Signage Maintenance | $/annum | 1,000.00 | 2 | KBR estimate with input from RCC |
| xiv | Vegetation Removal | $/annum | 2,000.00 | 2 | KBR estimate with input from RCC |
| xv | Routine canal batter maintenance | $/annum | 5,000.00 | 2 | KBR estimate with input from RCC |
| | **Canals Environmental** | | | | |
| xvi | Sediment Sampling & Analysis (proir to grab dredging) | $ | 30,000.00 | 3 | KBR estimate in combination with previous costs based on Aquatic Paradise Ledger - by RCC |
| | **Administration** | | | | |
| xvii | Review of Maintenance Model (Siltation Rates, Dredging Volumes & Costs) | $ | 30,000.00 | 3 | KBR Estimate |
| xviii | RCC Management, Administration& Staff Costs* | $/annum | 10,000.00 | 3 | Aquatic Paradise Ledger - by RCC |
| xix | Annual ERA Holding Fee | $/annum | 3,662.00 | 0 | Provided by RCC CMP Report review comments (24/10/2012) |
| xx | | | | | |

*costs averaged to an annual basis

| CONFIDENCE | | Optimistic (P10) | Pessimistic (P90) | Adopted Confidence | Indicative Situation |
|---|---|---|---|---|---|
| Very High | 0 | -2% | 5% | **2%** | Clear, concise scope supported by fixed quotes & labour rates, etc. |
| High | 1 | -5% | 10% | **3%** | Some minor uncertainty exists regarding scope and/or estimate process, etc. |
| Moderate | 2 | -10% | 20% | **5%** | Scope moderately clear, estimate based on mix of quotes & prices from similar jobs. |
| Low | 3 | -15% | 30% | **8%** | Low scope confidence. Estimate based on factoring from other non-identical jobs. |
| Very Low | 4 | -20% | 40% | **10%** | Vague / uncertain scope, prices factored from other similar (not identical) projects. |
| Order of Magnitude | 5 | -25% | 50% | **13%** | Based on the best guess of experienced employees or similar methods. |

| DEFINITION |
|---|
| Optimistic - P10 = 90% Probability of exceedance |
| Pessimistic - P90 = 10% Probability of exceedance |

| CONFIDENCE FACTOR ADJUSTMENT | | | | |
|---|---|---|---|---|
| **Optimistic** | · | | · | **Pessimistic** |

## AQUATIC PARADISE MAINTENANCE MODEL

## ANNUAL TOTAL DREDGE VOLUMES

**Proposed Dredging Schedule Based on Assumed Siltation Forecast**

| ITEM / DESCRIPTION | Units | 2015-16 | 2016-17 | 2017-18 | 2018-19 | 2019-20 | 2020-21 | 2021-22 | 2022-23 | 2023-24 | 2024-25 | 2025-26 | 2026-27 | 2027-28 | 2028-29 | 2029-30 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **SENSITIVITY: QUANTITIES FACTOR** | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| **DREDGE/BED LEVELLING VOLUMES TOTAL (INSITU)** | ($m^3$) | **42,650** | **31,350** | **38,500** | **29,310** | **54,250** | **-** | **-** | **-** | **-** | **-** | **35,560** | **52,920** | **-** | **-** | **-** |
| **DREDGING METHOD & CORRESPONDING VOLUMES** | | | | | | | | | | | | | | | | |
| **GRAB DREDGE VOLUMES - Standard Dredging Rate** | ($m^3$) | 42,650 | 31,350 | 20,350 | 15,400 | 34,900 | - | - | - | - | - | - | 52,920 | - | - | - |
| **GRAB DREDGE VOLUMES - Hard Dredging** | ($m^3$) | - | - | 18,150 | 2,410 | - | - | - | - | - | - | - | - | - | - | - |
| **BED LEVELLING VOLUMES** | ($m^3$) | - | - | - | 11,500 | 19,350 | - | - | - | - | - | 35,560 | - | - | - | - |
| **ESTIMATED REQUIRED BED LEVELLING HOURS*** | hrs | - | - | - | 23 | 39 | - | - | - | - | - | 71 | - | - | - | - |
| **DREDGE VOLUMES PROPORTION SILTATION** | % | 100% | 100% | 32% | 0% | 64% | 0% | 0% | 0% | 0% | 0% | 0% | 100% | 0% | 0% | 0% |
| **DREDGE VOLUMES PROPORTION TRENCH BLOCKS** | | 0% | 0% | 68% | 61% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| - STANDARD RATE | % | 0% | 0% | 21% | 53% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| - HARD DREDGING | | 0% | 0% | 47% | 8% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| **BED LEVELLING VOLUMES PROPORTION** | % | 0% | 0% | 0% | 39% | 36% | 0% | 0% | 0% | 0% | 0% | 100% | 0% | 0% | 0% | 0% |
| **INCREASED OR REDUCED SILTATION** | | | | | | | | | | | | | | | | |
| ☐ INCREASED/REDUCED SILTATION - factored by: | ($m^3$) | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **TOTAL FACTORED DREDGE VOLUMES (INSITU)** | ($m^3$) | 42,650 | 31,350 | 38,500 | 29,310 | 54,250 | - | - | - | - | - | 35,560 | 52,920 | - | - | - |
| DREDGE VOLUMES PROPORTION SILT TRAP | ($m^3$) | 42,650 | 31,350 | 12,400 | - | 34,900 | - | - | - | - | - | - | 52,920 | - | - | - |
| DREDGE VOLUMES PROPORTION TRENCH BLOCKS - Hard Dredging | ($m^3$) | - | - | 7,950 | 15,400 | - | - | - | - | - | - | - | - | - | - | - |
| DREDGE VOLUMES PROPORTION TRENCH BLOCKS | ($m^3$) | - | - | 18,150 | 2,410 | - | - | - | - | - | - | - | - | - | - | - |
| AVAILABLE BED LEVELLING VOLUMES | ($m^3$) | - | - | - | 11,500 | 19,350 | - | - | - | - | - | 35,560 | - | - | - | - |
| **DISPOSAL** | | | | | | | | | | | | | | | | |
| **TOTAL SPOIL DISPOSED AT MUD ISLAND** | ($m^3$) | 42,650 | 31,350 | 38,500 | 17,810 | 34,900 | - | - | - | - | - | - | 52,920 | - | - | - |
| Silt Trap Volumes | ($m^3$) | 42,650 | 31,350 | 12,400 | - | 34,900 | - | - | - | - | - | - | 52,920 | - | - | - |
| Trench Block Volumes | ($m^3$) | - | - | 18,150 | 2,410 | - | - | - | - | - | - | - | - | - | - | - |

### DREDGING VOLUMES INPUT

| | Units | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Total** | ($m^3$) | 42,650 | 31,350 | 38,500 | 29,310 | 54,250 | - | - | - | - | - | 35,560 | 52,920 | - | - | - |
| **Grab Dredge Siltation** | ($m^3$) | **42,650** | **31,350** | **12,400** | | **34,900** | | | | | | | **52,920** | | | |
| **Grab Dredge Trench Blocks (Standard Rate)** | ($m^3$) | | | **7,950** | **15,400** | | | | | | | | | | | |
| **Grab Dredge Trench Blocks (Hard Dredging Rate)** | ($m^3$) | | | **18,150** | **2,410** | | | | | | | | | | | |
| **Bed Levelling** | ($m^3$) | | | | **11,500** | **19,350** | | | | | | **35,560** | | | | |

**Instructions for Dredging Details Worksheet**
DREDGING VOLUMES INPUT TABLE IS BASED ON DREDGING PLAN - VALUES CAN ALSO BE MANUALLY MANIPULATED (CELLS SHOWN IN BOLD BLUE FONT AND GREEN SHADING. MANUAL MANIPULATION IS ONLY ADVISABLE IF THE USER HAS A KNOWLEDGE OF THE DREDGINGPLAN AND DREDGING AND DISPOSAL CONSTRAINTS.
SPOIL VOLUMES DIRECTLY INFORMS THE PROGRAM SHEET, AND THEREFORE AFFECTS COSTS.

Note:
* Based on estimate of being able to bed level approximately 500m3 per hour once operational
Allowances will need to be made for availability of times to bed levelling depending on tide height - e.g: POB bed leveller requires at least 1.8m of water to operate
Allocation of 10 hours per bed levelling operation to navigate to Aquatic Paradise, set up and return to Brisbane Port
Required hours for bed levelling to be review once the first operation is undertaken due to the uncertaintly surronding this dredging method
* No downward adjustment in modelled volumes for the deletion of Trench Block 4 Capital dredging works for conservatism.
Some volume adjustments to remaining trench blocks may offset the reduction in Trench Block 4 volumes.

## AQUATIC PARADISE MAINTENANCE MODEL

## ANNUAL TOTAL DREDGE VOLUMES

**Proposed Dredging Schedule Based on Assumed Siltation Forecast**

| ITEM / DESCRIPTION | Units | 2030-31 | 2031-32 | 2032-33 |
|---|---|---|---|---|
| **SENSITIVITY: QUANTITIES FACTOR** | | 1 | 1 | 1 |
| **DREDGE/BED LEVELLING VOLUMES TOTAL (INSITU)** | ($m^3$) | **-** | **35,560** | **106,680** |
| **DREDGING METHOD & CORRESPONDING VOLUMES** | | | | |
| **GRAB DREDGE VOLUMES - Standard Dredging Rate** | ($m^3$) | - | - | 106,680 |
| **GRAB DREDGE VOLUMES - Hard Dredging** | ($m^3$) | - | - | - |
| **BED LEVELLING VOLUMES** | ($m^3$) | - | 35,560 | - |
| **ESTIMATED REQUIRED BED LEVELLING HOURS*** | hrs | - | 71 | - |
| **DREDGE VOLUMES PROPORTION SILTATION** | % | 0% | 0% | 100% |
| **DREDGE VOLUMES PROPORTION TRENCH BLOCKS** | | 0% | 0% | 0% |
| - STANDARD RATE | % | 0% | 0% | 0% |
| - HARD DREDGING | | 0% | 0% | 0% |
| **BED LEVELLING VOLUMES PROPORTION** | % | 0% | 100% | 0% |
| **INCREASED OR REDUCED SILTATION** | | | | |
| ☐ INCREASED/REDUCED SILTATION - factored by: | ($m^3$) | - | - | - |
| **TOTAL FACTORED DREDGE VOLUMES (INSITU)** | ($m^3$) | - | 35,560 | 106,680 |
| DREDGE VOLUMES PROPORTION SILT TRAP | ($m^3$) | - | - | 106,680 |
| DREDGE VOLUMES PROPORTION TRENCH BLOCKS - Hard Dredging | ($m^3$) | - | - | - |
| DREDGE VOLUMES PROPORTION TRENCH BLOCKS | ($m^3$) | - | - | - |
| AVAILABLE BED LEVELLING VOLUMES | ($m^3$) | - | 35,560 | - |
| **DISPOSAL** | | | | |
| **TOTAL SPOIL DISPOSED AT MUD ISLAND** | ($m^3$) | - | - | 106,680 |
| Silt Trap Volumes | ($m^3$) | - | - | 106,680 |
| Trench Block Volumes | ($m^3$) | - | - | - |

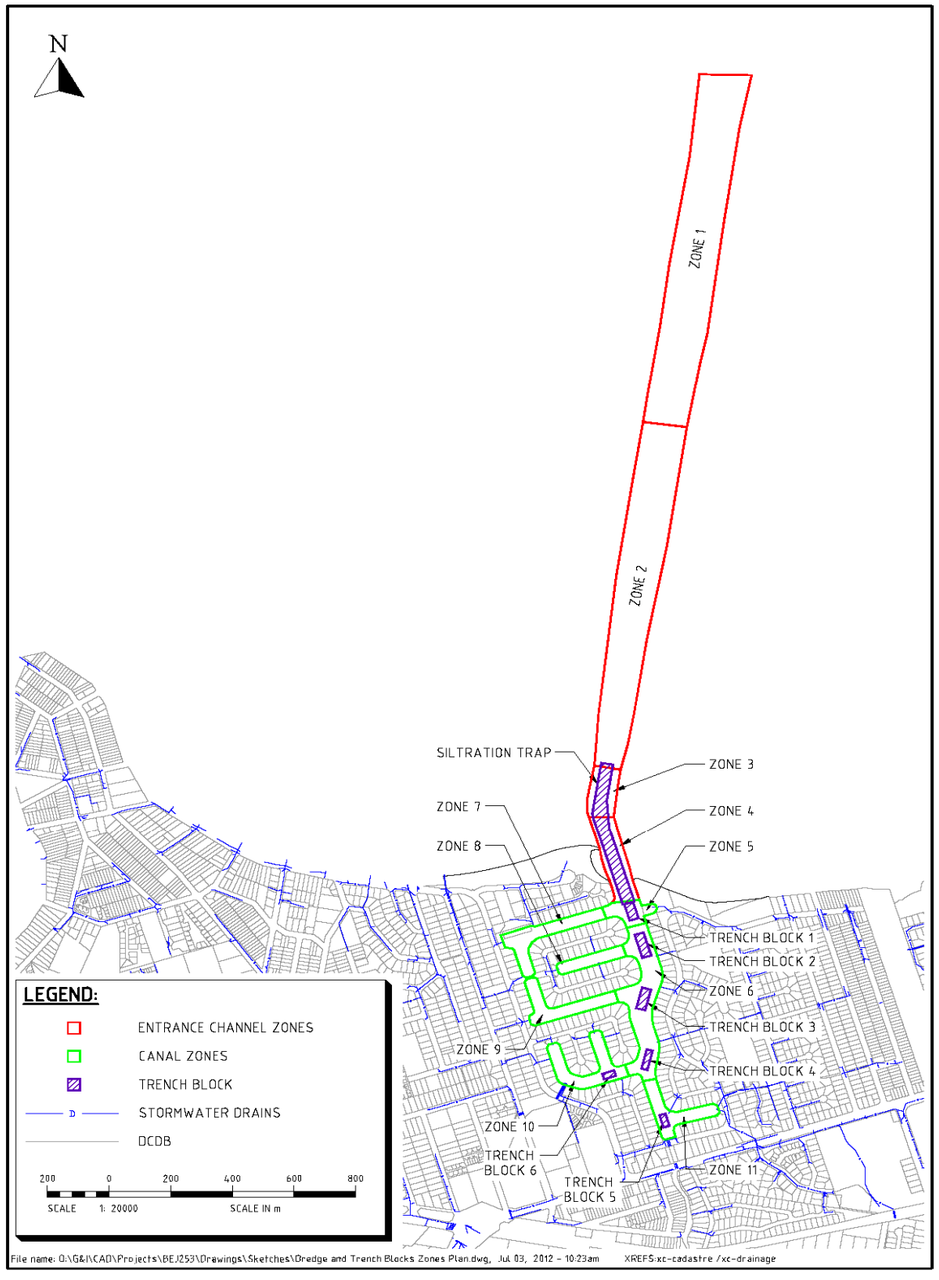
### DREDGING VOLUMES INPUT

| | | 2030 | 2031 | 2032 | Total |
|---|---|---|---|---|---|
| **Total** | ($m^3$) | - | 35,560 | 106,680 | 426,780 |
| **Grab Dredge Siltation** | ($m^3$) | | | **106,680** | 280,900 |
| **Grab Dredge Trench Blocks (Standard Rate)** | ($m^3$) | | | | 23,350 |
| **Grab Dredge Trench Blocks (Hard Dredging Rate)** | ($m^3$) | | | | 20,560 |
| **Bed Levelling** | ($m^3$) | | **35,560** | | 101,970 |

**Instructions for Dredging Details Worksheet**
DREDGING VOLUMES INPUT TABLE IS BASED ON DREDGING PLAN - VALUES CAN ALSO BE MANUALLY MANIPULATED (CELLS SHOWN IN BOLD BLUE FONT AND GREEN SHADING. MANUAL MANIPULATION IS ONLY ADVISABLE IF THE USER HAS A KNOWLEDGE OF THE DREDGINGPLAN AND DREDGING AND DISPOSAL CONSTRAINTS.
SPOIL VOLUMES DIRECTLY INFORMS THE PROGRAM SHEET, AND THEREFORE AFFECTS COSTS.

ZONE MAP

**AQUATIC PARADISE**
**DREDGE ZONES AND TRENCH BLOCKS PLAN**



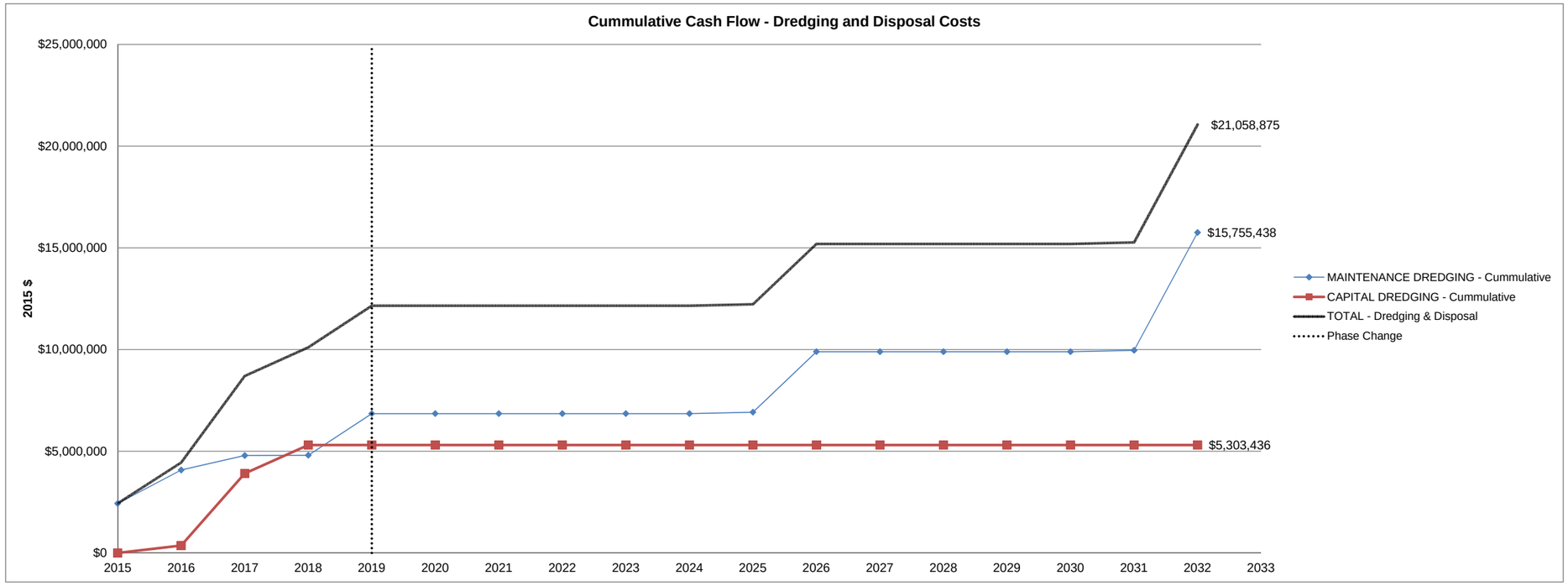

Note:

* Trench blocks are indicative, based on proposed locations in CMP (KBR, 2012)
Trench Block 4 deleted

## AQUATIC PARADISE MAINTENANCE MODEL

## CUMMULATIVE CASH FLOW

| ITEM / DESCRIPTION | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1.1 Dredging & Disposal** | | | | | | | | | | | | | | | | | | |
| **Sub Total - Maintenance - Cummulative** | $2,431,125 | $4,077,000 | $4,789,839 | $4,802,679 | $6,848,533 | $6,848,533 | $6,848,533 | $6,848,533 | $6,848,533 | $6,848,533 | $6,920,486 | $9,890,786 | $9,890,786 | $9,890,786 | $9,890,786 | $9,890,786 | $9,962,738 | $15,755,438 |
| **Sub Total - Capital - Cummulative** | $0 | $363,000 | $3,905,286 | $5,303,436 | $5,303,436 | $5,303,436 | $5,303,436 | $5,303,436 | $5,303,436 | $5,303,436 | $5,303,436 | $5,303,436 | $5,303,436 | $5,303,436 | $5,303,436 | $5,303,436 | $5,303,436 | $5,303,436 |
| **TOTAL** | $ 2,431,125 | $ 4,440,000 | $ 8,695,125 | $ 10,106,115 | $ 12,151,969 | $ 12,151,969 | $ 12,151,969 | $ 12,151,969 | $ 12,151,969 | $ 12,151,969 | $ 12,223,922 | $ 15,194,222 | $ 15,194,222 | $ 15,194,222 | $ 15,194,222 | $ 15,194,222 | $ 15,266,175 | $ 21,058,875 |
| **1.2 General Maintenance** | $31,500 | $63,000 | $94,500 | $126,000 | $157,500 | $189,000 | $220,500 | $252,000 | $283,500 | $315,000 | $346,500 | $378,000 | $409,500 | $441,000 | $472,500 | $504,000 | $535,500 | $567,000 |
| **1.3 Environmental** | $32,250 | $32,250 | $64,500 | $96,750 | $129,000 | $129,000 | $129,000 | $129,000 | $129,000 | $129,000 | $129,000 | $161,250 | $161,250 | $161,250 | $161,250 | $161,250 | $161,250 | $193,500 |
| **1.4 Administration** | $46,717 | $61,184 | $75,651 | $122,368 | $136,835 | $151,302 | $165,769 | $180,235 | $194,702 | $241,419 | $255,886 | $270,353 | $284,820 | $299,287 | $313,754 | $328,221 | $342,688 | $357,155 |
| **CUMMULATIVE GRAND TOTAL** | $ 2,541,592 | $ 4,596,434 | $ 8,929,776 | $ 10,451,232 | $ 12,575,304 | $ 12,621,271 | $ 12,667,238 | $ 12,713,204 | $ 12,759,171 | $ 12,837,388 | $ 12,955,308 | $ 16,003,825 | $ 16,049,792 | $ 16,095,759 | $ 16,141,726 | $ 16,187,693 | $ 16,305,612 | $ 22,176,529 |

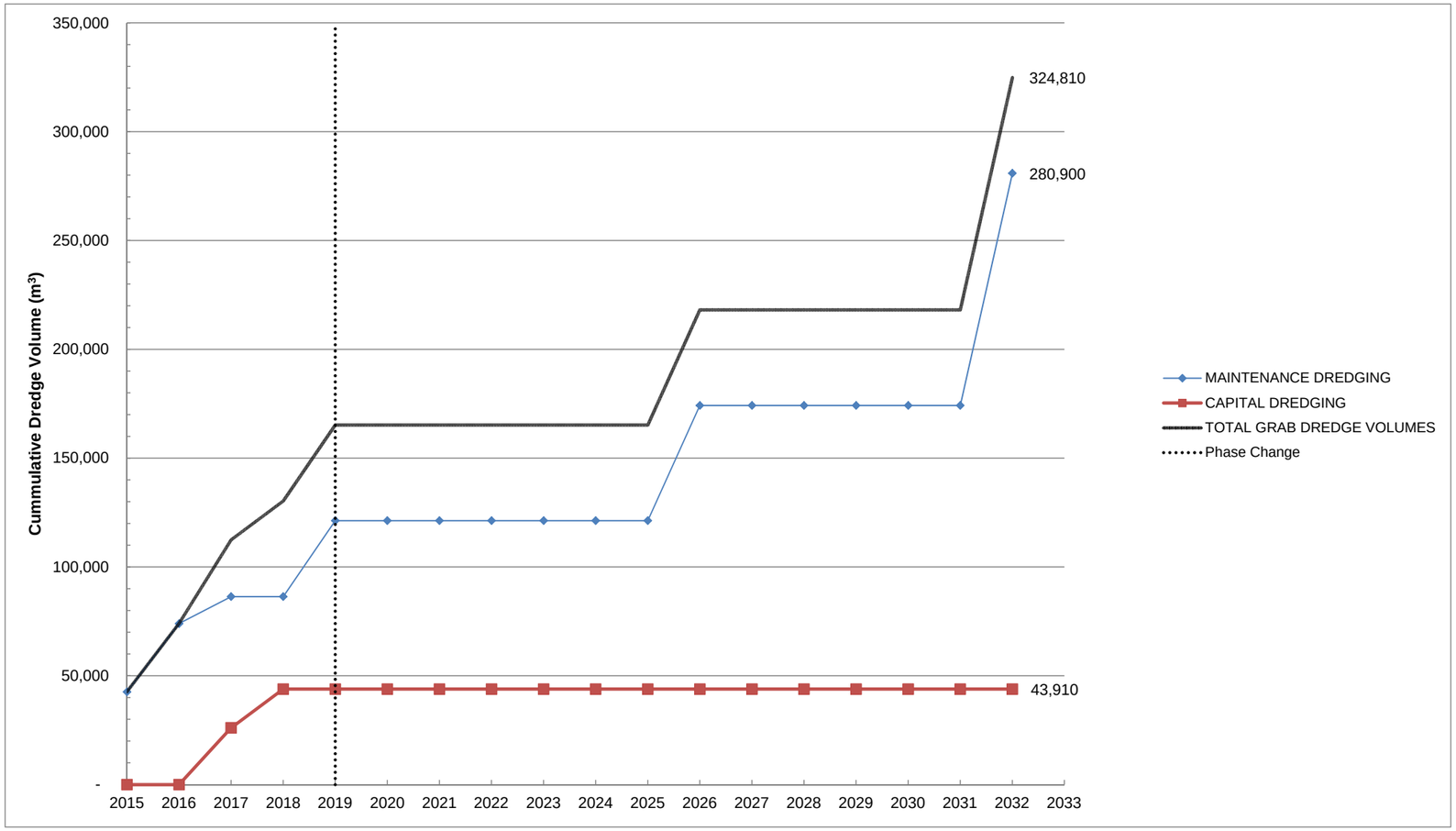


## AQUATIC PARADISE MAINTENANCE MODEL

## CUMMULATIVE DREDGE VOLUMES

**Cummulative Dredge Volumes Based on Proposed Dredging Plan**

| | | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TOTAL GRAB DREDGE VOLUMES | (m3) | 42,650 | 74,000 | 112,500 | 130,310 | 165,210 | 165,210 | 165,210 | 165,210 | 165,210 | 165,210 | 165,210 | 218,130 | 218,130 | 218,130 | 218,130 | 218,130 | 218,130 | 324,810 | **324,810** |
| MAINTENANCE DREDGING - Cummulative Volume | (m3) | 42,650 | 74,000 | 86,400 | 86,400 | 121,300 | 121,300 | 121,300 | 121,300 | 121,300 | 121,300 | 121,300 | 174,220 | 174,220 | 174,220 | 174,220 | 174,220 | 174,220 | 280,900 | **280,900** |
| CAPITAL DREDGING - Cummulative Volume | (m3) | - | - | 26,100 | 43,910 | 43,910 | 43,910 | 43,910 | 43,910 | 43,910 | 43,910 | 43,910 | 43,910 | 43,910 | 43,910 | 43,910 | 43,910 | 43,910 | 43,910 | **43,910** |

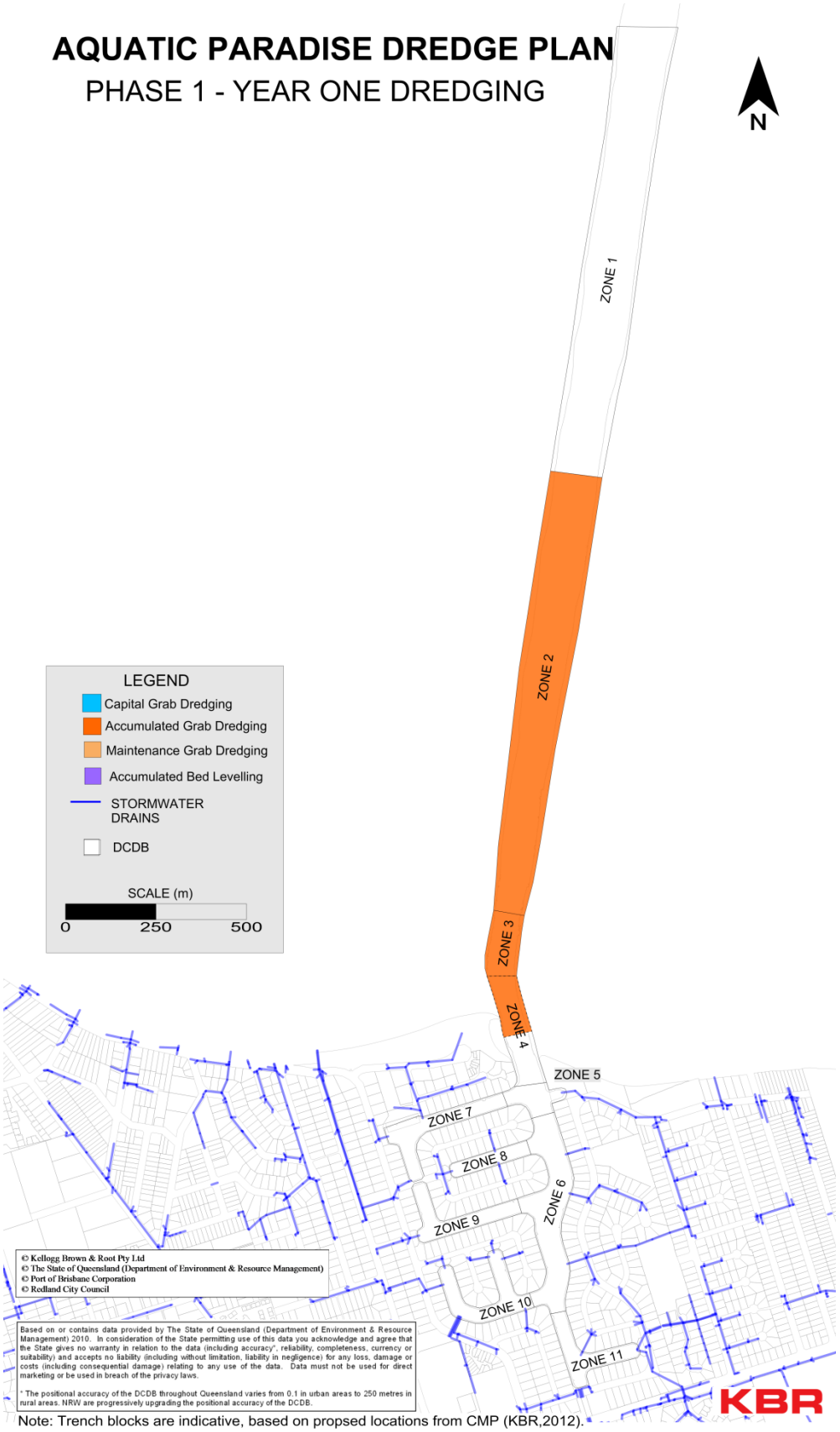


*Appendix D*

# CANAL MANAGEMENT PLAN – STAGING DIAGRAMS

# AQUATIC PARADISE DREDGE PLAN

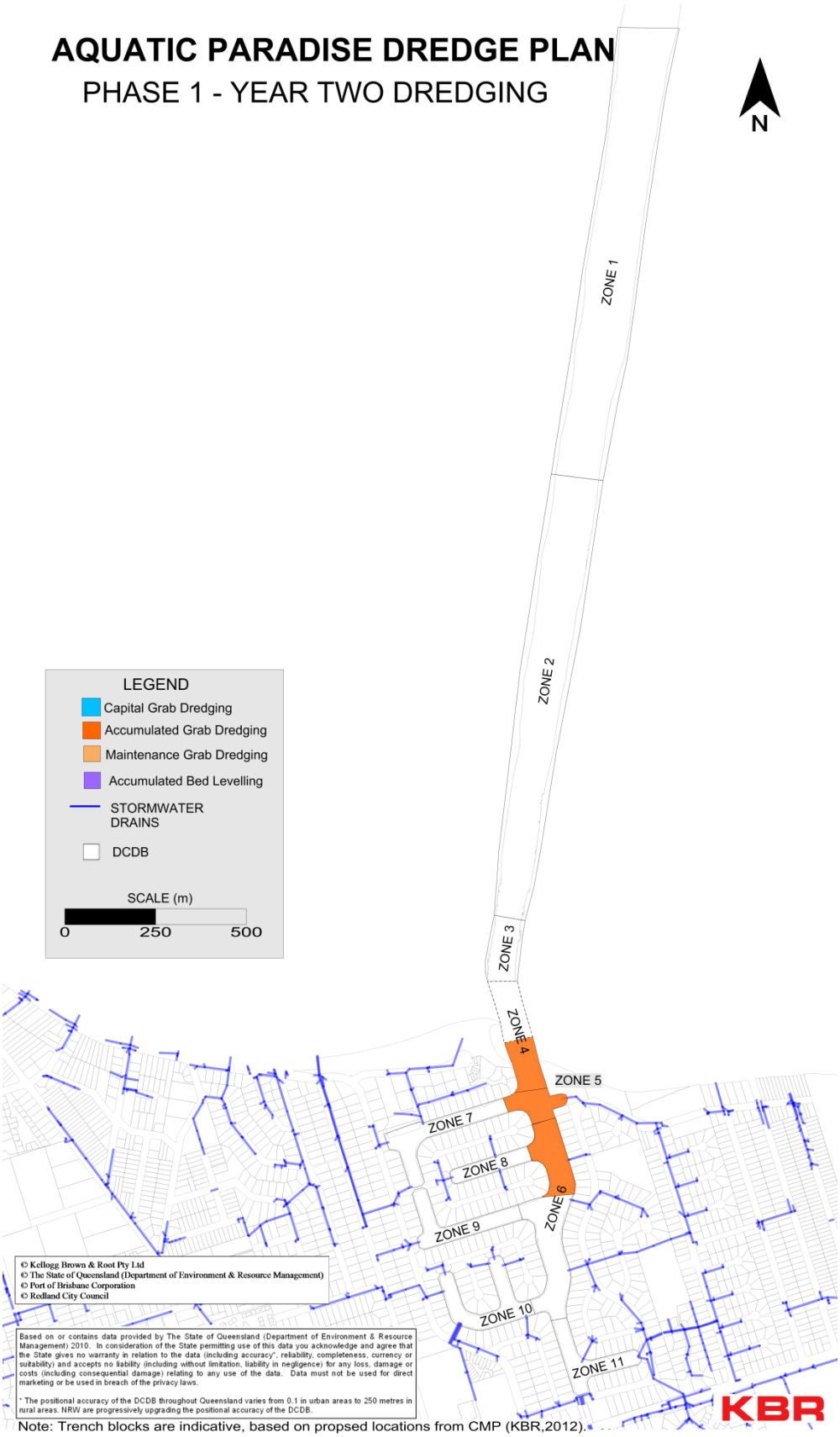
## PHASE 1 - YEAR ONE DREDGING




Note: Trench blocks are indicative, based on propsed locations from CMP (KBR,2012).

# AQUATIC PARADISE DREDGE PLAN

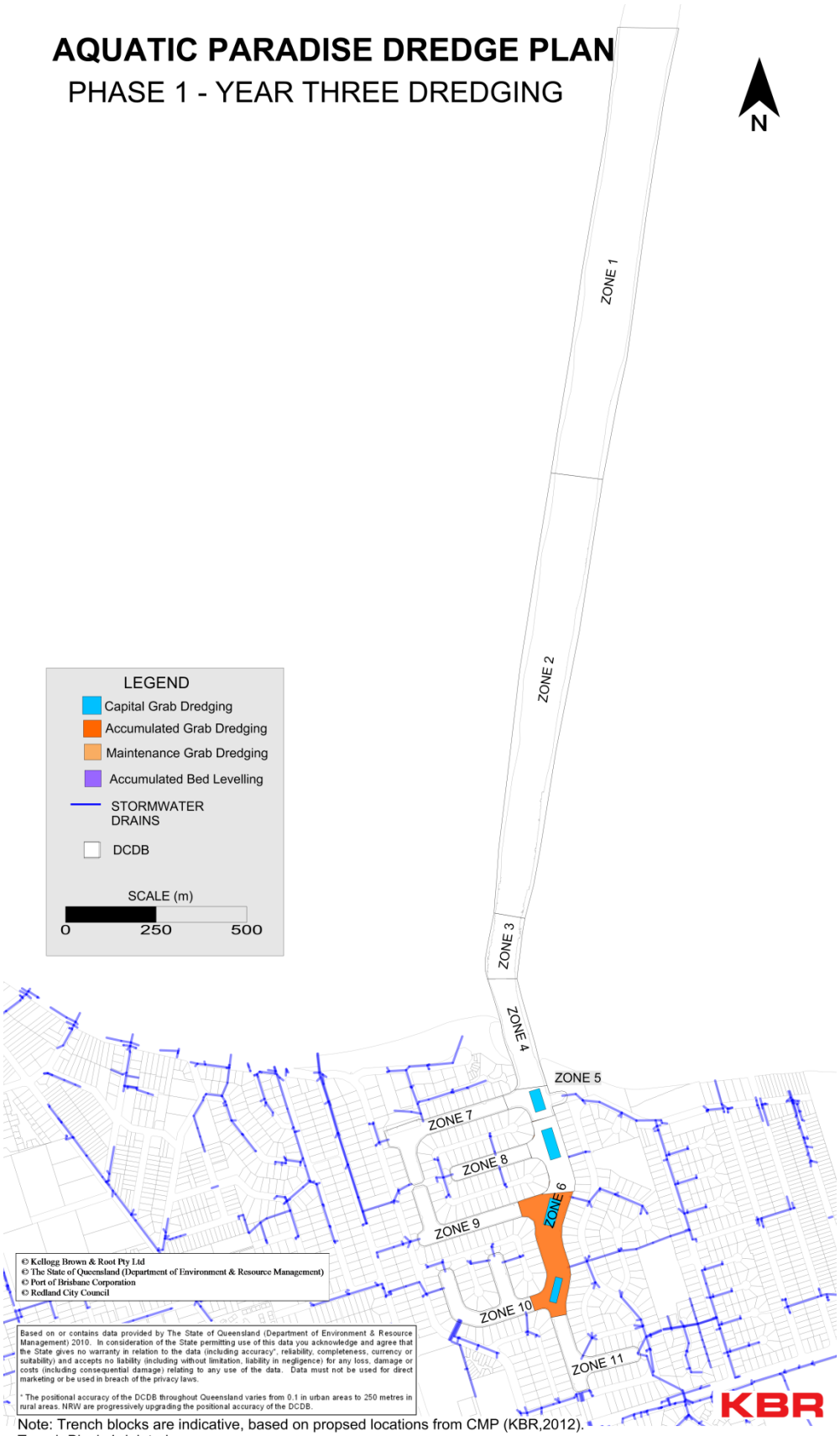
## PHASE 1 - YEAR TWO DREDGING




Note: Trench blocks are indicative, based on propsed locations from CMP (KBR,2012).

# AQUATIC PARADISE DREDGE PLAN

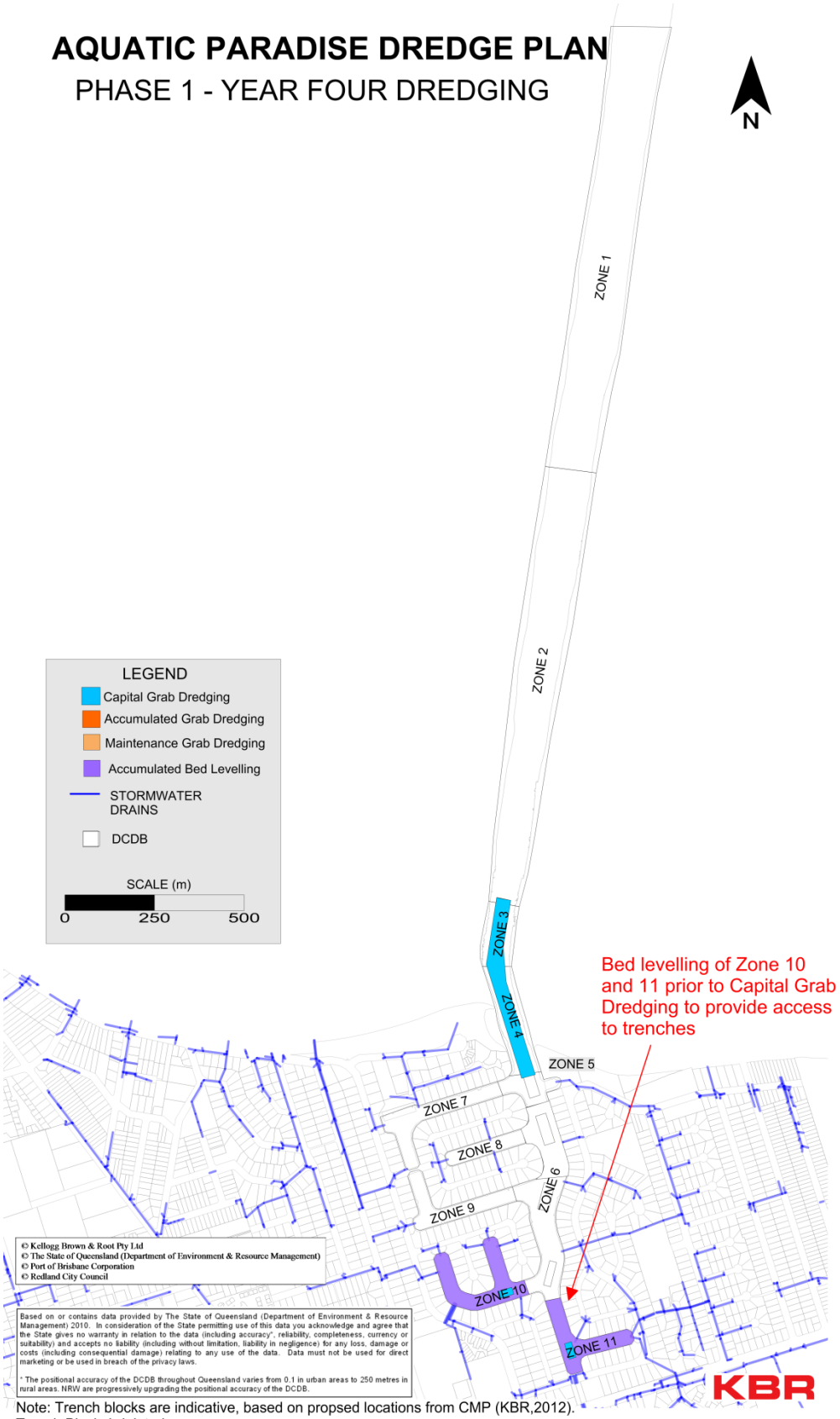
## PHASE 1 - YEAR THREE DREDGING




Note: Trench blocks are indicative, based on propsed locations from CMP (KBR,2012).
Trench Block 4 deleted.

# AQUATIC PARADISE DREDGE PLAN

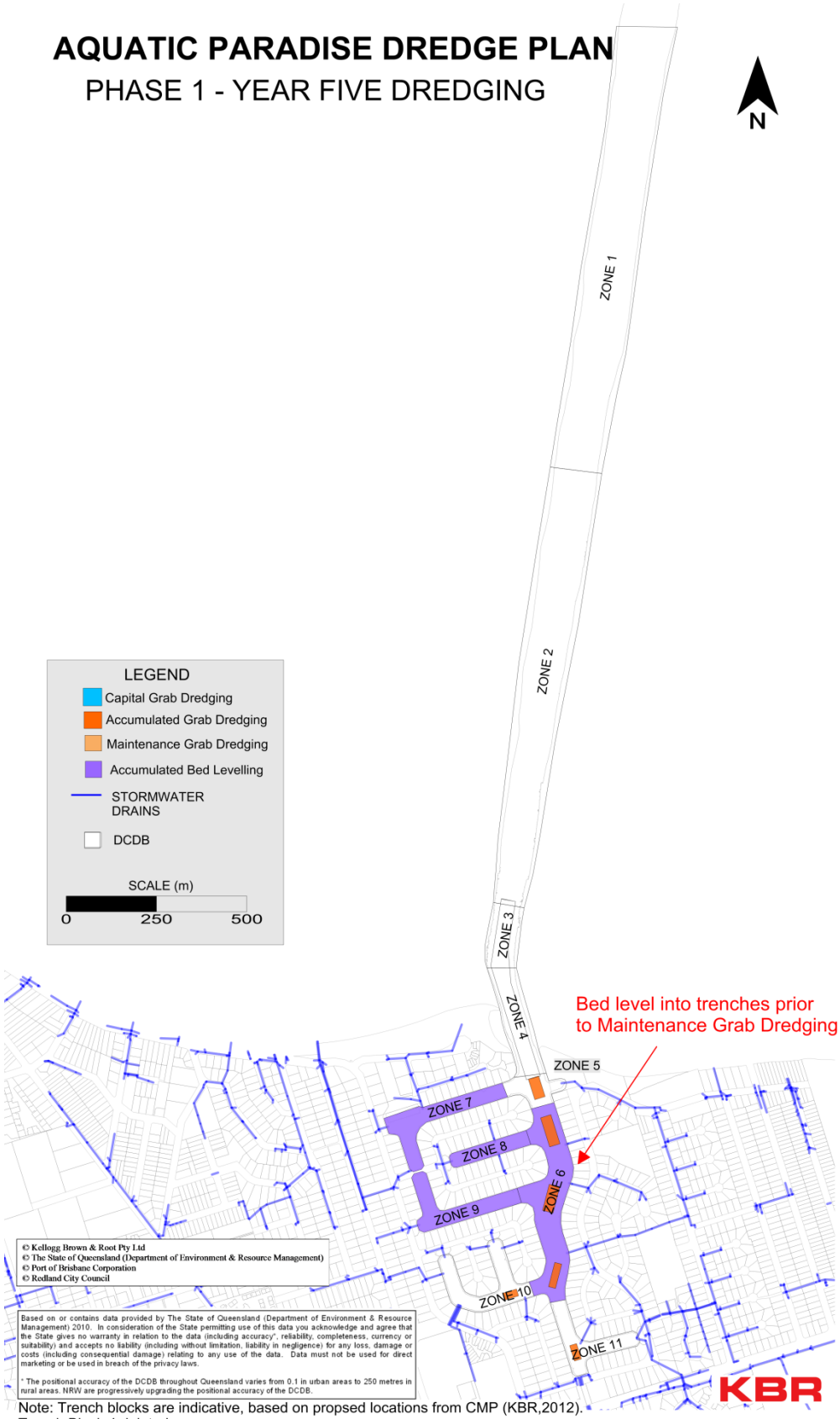
## PHASE 1 - YEAR FOUR DREDGING




Note: Trench blocks are indicative, based on propsed locations from CMP (KBR,2012).
Trench Block 4 deleted.

# AQUATIC PARADISE DREDGE PLAN

## PHASE 1 - YEAR FIVE DREDGING




Note: Trench blocks are indicative, based on propsed locations from CMP (KBR,2012).
Trench Block 4 deleted.

*Appendix E*

# GEOTECHNICAL REPORT

SOIL SURVEYS

PROJECT NO. 114-16581

JANUARY 2015

**REDLAND CITY COUNCIL**

GEOTECHNICAL INVESTIGATION

VERSION 3

CANAL ESTATE AND ENTRANCE CHANNEL DREDGING

AQUATIC PARADISE CANAL ESTATE

BIRKDALE

Soil Surveys Engineering Pty Limited
Specialists in Applied Geotechnics
A.B.N. 70 054 043 631

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Associates
CP Johnson BEng(Civil) RPEQ

Gold Coast Office
Job No: 114-16581
Ref: 1-16581, 2014-11-21, BR F VER 3
Author: Peter Elkington

9th January 2015

Redland City Council
PO Box 21
Cleveland QLD 4163
Email: Rodney.powell@redland.qld.gov.au

**ATTENTION: RODNEY POWELL**

Dear Sir,

**RE: GEOTECHNICAL INVESTIGATION – CANAL ESTATE AND ENTRANCE CHANNEL DREDGING - AQUATIC PARADISE CANAL ESTATE, BIRKDALE**

Enclosed is an updated copy of our geotechnical report for the above project dated January 2015. An electronic copy of the report has been issued.

Authority to proceed with the investigation was received from Murray Erbs on behalf of Redland City Council dated 13th October 2014.

Should you have any queries regarding this report, please do not hesitate to contact Peter Elkington at our Gold Coast office.

Yours faithfully,

**P. ELKINGTON (RPEQ 7226)**

for and on behalf of

**SOIL SURVEYS ENGINEERING PTY LIMITED**

Cc Kellogg Brown & Root
Attention: Emily Whitehill
Email: Emily.whitehill@kbr.com

# TABLE OF CONTENTS



## *Appendices*

## 1.0 INTRODUCTION

This report presents the results of the geotechnical investigation carried out by Soil Surveys Engineering Pty Limited in October and November 2014 for the canal estate and entrance channel dredging at the Aquatic Paradise Canal Estate, Birkdale.

The objectives of this investigation were to assess subsurface conditions at the site in accordance with the Scope of Services detailed in Section 2.0.

## 2.0 SCOPE OF GEOTECHNICAL SERVICES

The scope of geotechnical services provided by Soil Surveys Engineering Pty Limited was directed towards evaluating the following items as detailed in our proposed methodology, included in our tender submission for the project (Quotation No. 30448-2014).

- Investigate the soil profile to determine the feasibility of dredging the proposed trenches and traps
- Provide samples to KBR to support the environmental approvals process
- Analyse stability of the trenches and traps and material re-usage.

## 3.0 PROPOSED DEVELOPMENT

It is understood that a series of silt traps are to be excavated through the bed of the existing canal system at Aquatic Paradise Canal Estate, Birkdale.

The approximate locations of the proposed silt straps are indicated in the below Figure.

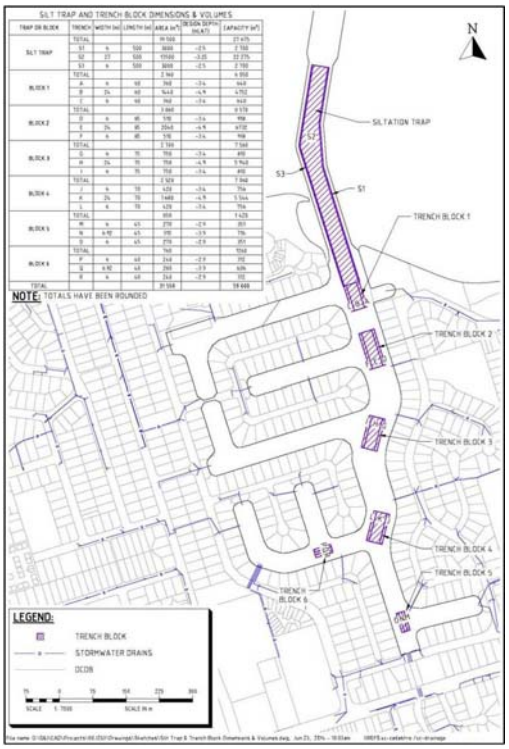



**FIGURE 1**

The silt traps are to involve excavations of up to 2m with a total volume of material to be excavated in the order of 60,000m$^3$ proposed over an area of approximately 31,500m$^2$.

# 4.0 GEOTECHNICAL INVESTIGATION

## *4.1 Field Investigation*

The following field investigation was undertaken in order to investigate the subsurface conditions at the site:-

- Drill 12 boreholes to depths of between 4.5m and 6.5m using our EVH2100 drilling rig mounted on a 40 foot spud legged barge. SPT testing, undisturbed samples (u50's) and disturbed samples were recovered from the boreholes. NMLC coring was undertaken when competent rock was encountered.
- Piston sampling of the surficial sediment was undertaken at each test location, to allow collection of the sediments for environmental testing. These samples were delivered directly to KBR for testing.
- All test locations were surveyed with differential GPS equipment with a nominal accuracy of +/- 150mm, and vertical levels confirmed with survey from an on shore datam.

The soil classification descriptions, field and laboratory testing were carried out in general accordance with Australian Standards.

| | |
|---|---|
| AS.1726 - 1993 | Geotechnical Site Investigations |
| AS.1289 | Methods of Testing Soils for Engineering Purposes |

Notes relating to this report, borehole records and a site plan showing the location of the boreholes are included in the Appendices.

The equipment utilised for the investigation is indicated below:

### *4.2 Site Description*

The site of the canal estate and entrance channel dredging is located at Aquatic Paradise Canal Estate, Birkdale.

The area of the development is indicated in the below Figure.

**FIGURE 2**

## 5.0 GEOTECHNICAL MODEL

### *5.1 Regional Geology*

The regional geology of the site comprises surficial Quarternary sequence alluvial soils overlying mainly Basaltic flows.

The canal estate has been generally excavated through the alluvial soils and into the residual soils and with the canals based in the basalts at some locations through the canal network.

### *5.2 Subsurface Profile*

The subsurface profile varied significantly along the length of the site. At all borehole locations, a surficial layer of very weak silts were encountered at the bed of the canal. The silt thicknesses were typically noted at depths of between 0.5m and 1.6m at most test locations. At the location of Borehole 1 and 2, the silt thickness was noted at 2.4m and 3.6m.

Underlying the silts, the subsurface profile generally consisted of a silty or sandy clay material. At the southern extent of the area (Boreholes 7 to 12) and at Borehole 4, a clayey sand or sandy gravel was encountered under the clays.

The clays were typically described as stiff to hard in strength, however, at Boreholes 8 and 9, a significantly weaker clay was noted under the sediment/silt. These soft to firm clays were noted to depths of 2.7m at each location.

At Borehole 9, the sands encountered under the clays were very loose and continued to the termination of testing.

Weathered rock was noted in Boreholes 3, 7 and 8. The rock type and strengths varied between locations but at all three locations, rock was encountered above the proposed excavation depths for that point.

A summary of the subsurface profile is presented in Table 1, with detailed borehole record sheets included in Appendix B.

**TABLE 1 SUBSURFACE PROFILE SUMMARY**

| Borehole No. | Bed RL | Silts | Silty/Sandy Clay | | | Clayey Sand | Sandy Gravel | Siltstone/ Basalt | TD |
|---|---|---|---|---|---|---|---|---|---|
| | | | Stiff | Very stiff | Hard | | | | |
| BH01 | -2.8 | 0.0-2.4 | NE | 2.4-3.3 | 3.3-TD | NE | NE | NE | 4.5 |
| BH02 | -2.9 | 0.0-3.6 | 3.6-4.1 | NE | 4.1-TD | NE | NE | NE | 4.5 |
| BH03 | -2.1 | 0.0-1.4 | 1.4-1.9 | 1.9-2.4 | NE | NE | NE | 2.4-TD | 6.0 |
| BH04 | -2.2 | 0.0-1.3 | NE | NE | 1.3-4.4 | 4.4-TD | NE | NE | 6.0 |
| BH05 | -2.4 | 0.0-1.15 | NE | NE | 1.15-TD | NE | NE | NE | 6.5 |
| BH06 | -2.7 | 0.0-1.3 | NE | 1.3-1.5 | 1.5-TD | NE | NE | NE | 6.0 |
| BH07 | -3.0 | 0.0-0.7 | NE | NE | 0.7-4.7 | NE | NE | 4.7-TD | 6.0 |
| BH08 | -3.0 | 0.0-1.25 | 1.25-2.7[4)] | NE | NE | NE | 2.7-3.15 | 3.15-TD | 6.0 |
| BH09 | -3.1 | 0.0-1.6 | 1.6-2.7 [5)] | NE | NE | 3.5-TD[3)] | NE | NE | 6.0 |
| BH10 | -3.1 | 0.0-1.1 | NE | NE | 1.2-4.5<br>5.0-TD | 1.1-1.2<br>4.5-5.0 | NE | NE | 6.0 |
| BH11 | -2.95 | 0.0-0.8 | NE | 0.8-3.7 | NE | 3.7-TD | NE | NE | 5.0 |
| BH12 | -3.1 | 0.0-0.5 | NE | NE | NE | 2.0-TD | 0.5-2.0 | NE | 4.5 |

Notes:
1. All depths in metres below bed level at time of investigation.
2. NE - Not Encountered; TD - Termination Depth
3. Very Loose - interbedded with Silty Clay.
4. Firm clay noted from 2.0-2.7m
5. Noted as soft in strength.

Significant variation was noted in the subsurface profile, with the depth to rock varying across the site and only encountered at three test locations. This variation is consistent with the site being located on the boundary of a residual basaltic clays/alluvial soil interface.

### *5.3 Laboratory Testing*

Laboratory testing was carried out on selected samples retrieved from the site investigation program and was directed towards assessing the reactivity, strength and subgrade characteristics of the subsurface material.

Laboratory testing included:-

- Moisture Content testing
- Atterberg Limits testing
- Particle Size Distribution testing
- Unit Weight / Bulk Density testing
- Triaxial testing
- Point Load testing

The results of the laboratory testing are outlined in the following Tables, with test certificates contained in Appendix C.

## TABLE 2 A LABORATORY TEST RESULTS SUMMARY

| Borehole 2 | | |
|---|---|---|
| **Depth, Sample Type, & Classification** | **Test** | **Test Result** |
| 0.0 - 0.4<br>U50<br>Silty CLAY (CH) | Moisture Content | MC = 121 % |
| | Atterberg Limits | LS = 23 %<br>LL = 96 %<br>PI = 59 % |
| | Particle Size Distribution | Percent passing 0.075mm = 73 % |
| | Unit Weight | Unit Weight = 1.3 t/m$^3$ |
| 1.0 - 1.4<br>U50<br>Silty CLAY (CH) | Moisture Content | MC = 121 % |
| | Atterberg Limits | LS = 23 %<br>LL = 100 %<br>PI = 72 % |
| | Particle Size Distribution | Percent passing 0.075mm = 86 % |
| | Unit Weight | Unit Weight = 1.36 t/m$^3$ |
| 2.0 - 2.4<br>U50<br>Silty CLAY (CH) | Moisture Content | MC = 100 % |
| | Atterberg Limits | LS = 24 %<br>LL = 100 %<br>PI = 73 % |
| | Particle Size Distribution | Percent passing 0.075mm = 91 % |
| | Unit Weight | Unit Weight = 1.47 t/m$^3$ |
| 3.0 - 3.4<br>U50<br>Silty CLAY (CH) | Moisture Content | MC = 48.8 % |
| | Atterberg Limits | LS = 21 %<br>LL = 88 %<br>PI = 61 % |
| | Particle Size Distribution | Percent passing 0.075mm = 71 % |
| | Unit Weight | Unit Weight = 1.87 t/m$^3$ |
| | Triaxial (3.0-3.1m) | C' = 0.3 kPa<br>$\phi$' = 24.5 ° |
| 3.5 - 3.98<br>U50<br>Silty CLAY (CH) | Moisture Content | MC = 35.3 % |
| | Atterberg Limits | LS = 14 %<br>LL = 54 %<br>PI = 29 % |
| | Particle Size Distribution | Percent passing 0.075mm = 68 % |
| | Unit Weight | Unit Weight = 1.89 t/m$^3$ |
| | Triaxial (3.5-3.6m) | C' = 0.7 kPa<br>$\phi$' = 25.2 ° |
| 4.0 - 4.45<br>SPT<br>Sandy CLAY (CH) | Moisture Content | MC = 51.5 % |
| | Atterberg Limits | LS = 11.5 %<br>LL = 64 %<br>PI = 25 % |
| | Particle Size Distribution | Percent passing 0.075mm = 75 % |
| | Unit Weight | Unit Weight = 1.75 t/m$^3$ |

## TABLE 2 B

| Borehole 3 | | |
|---|---|---|
| **Depth, Sample Type, & Classification** | **Test** | **Test Result** |
| 3.4<br>NMLC<br>Sandstone (DW) | Point Load | $I_S$ 50 = 1.69 MPa |
| 4.9<br>NMLC<br>Sandstone (DW) | Point Load | $I_S$ 50 = 0.47 MPa |
| 5.5<br>NMLC<br>Sandstone (DW) | Point Load | $I_S$ 50 = 1.11 MPa |

## TABLE 2 C

| Borehole 6 | | |
|---|---|---|
| **Depth, Sample Type, & Classification** | **Test** | **Test Result** |
| 1.0 - 1.3<br>U50<br>Silty CLAY (CH) | Moisture Content | MC = 132 % |
| | Atterberg Limits | LS = 22 %<br>LL = 122 %<br>PI = 90 % |
| | Particle Size Distribution | Percent passing 0.075mm = 91 % |
| | Unit Weight | Unit Weight = 1.40 t/m$^3$ |
| 2.0 - 2.45<br>SPT<br>Sandy CLAY (CH) | Moisture Content | MC = 53 % |
| | Atterberg Limits | LS = 18 %<br>LL = 83 %<br>PI = 45 % |
| | Particle Size Distribution | Percent passing 0.075mm = 91 % |
| | Unit Weight | Unit Weight = 1.66 t/m$^3$ |
| 3.0 - 3.45<br>SPT<br>Silty Sandy CLAY (CH) | Moisture Content | MC = 59.5 % |
| | Atterberg Limits | LS = 26 %<br>LL = 103 %<br>PI = 54 % |
| | Particle Size Distribution | Percent passing 0.075mm = 95 % |
| | Unit Weight | Unit Weight = 1.64 t/m$^3$ |
| 4.0 - 4.45<br>SPT<br>Silty Sandy CLAY (CH) | Moisture Content | MC = 67.5 % |
| | Atterberg Limits | LS = 17 %<br>LL = 74 %<br>PI = 27 % |
| | Particle Size Distribution | Percent passing 0.075mm = 73 % |
| | Unit Weight | Unit Weight = 1.69 t/m$^3$ |
| 5.0-5.45<br>SPT<br>Silty Sandy CLAY (CH) | Moisture Content | MC = 65.5 % |
| | Atterberg Limits | LS = 20.5 %<br>LL = 77 %<br>PI = 36 % |
| | Particle Size Distribution | Percent passing 0.075mm = 81 % |
| | Unit Weight | Unit Weight = 1.65 t/m$^3$ |

## TABLE 2 D

| Borehole 8 | | |
|---|---|---|
| **Depth, Sample Type, & Classification** | **Test** | **Test Result** |
| 3.6<br>NMLC<br>Basalt (DW) | Point Load | $I_S$ 50 = 1.81 MPa |
| 4.6<br>NMLC<br>Basalt (DW) | Point Load | $I_S$ 50 = 1.20 MPa |
| 5.9<br>NMLC<br>Basalt (DW) | Point Load | $I_S$ 50 = 1.45 MPa |

## TABLE 2 E

| Borehole 10 | | |
|---|---|---|
| **Depth, Sample Type, & Classification** | **Test** | **Test Result** |
| 1.0 - 1.45<br>SPT<br>Silty Clayey SAND (SC) | Moisture Content | MC = 39.2 % |
| | Atterberg Limits | LS = 16.5 %<br>LL = 49 %<br>PI = 31 % |
| | Particle Size Distribution | Percent passing 0.075mm = 54 % |
| | Unit Weight | Unit Weight = 2.14 t/m$^3$ |
| 2.0 - 2.45<br>SPT<br>Silty CLAY (CH) | Moisture Content | MC = 59 % |
| | Atterberg Limits | LS = 30.5 %<br>LL = 154 %<br>PI = 118 % |
| | Particle Size Distribution | Percent passing 0.075mm = 97 % |
| | Unit Weight | Unit Weight = 1.62 t/m$^3$ |
| 3.0 - 3.45<br>SPT<br>Silty CLAY (CH) | Moisture Content | MC = 60 % |
| | Atterberg Limits | LS = 29.5 %<br>LL = 138 %<br>PI = 99 % |
| | Particle Size Distribution | Percent passing 0.075mm = 96 % |
| | Unit Weight | Unit Weight = 1.60 t/m$^3$ |
| 4.0 - 4.4<br>U50<br>Silty CLAY (CH) | Moisture Content | MC = 62 % |
| | Atterberg Limits | LS = 29 %<br>LL = 118 %<br>PI = 91 % |
| | Particle Size Distribution | Percent passing 0.075mm = 92 % |
| | Unit Weight | Unit Weight = 1.63 t/m$^3$ |
| | Triaxial (4.3-4.4m) | C' = 2.7 kPa<br>$\phi$' = 23.0 ° |
| 5.0 - 5.45<br>SPT<br>Silty Sandy CLAY (CH) | Moisture Content | MC = 50.5 % |
| | Atterberg Limits | LS = 16.5 %<br>LL = 77 %<br>PI = 31 % |
| | Particle Size Distribution | Percent passing 0.075mm = 63 % |
| | Unit Weight | Unit Weight = 1.64 t/m$^3$ |
| 6.0 - 6.45<br>SPT | Moisture Content | MC = 58 % |
| | Atterberg Limits | LS = 17.5 %<br>LL = 84 %<br>PI = 35 % |
| | Particle Size Distribution | Percent passing 0.075mm = 68 % |
| | Unit Weight | Unit Weight = 1.62 t/m$^3$ |

# 6.0 ENGINEERING ASSESSMENT

## *6.1 Dredging Assessment*

The various materials encountered that are proposed to be dredged vary from very soft silts, through clays ranging from soft to hard in strength, sands and gravels of variable consistency to weathered rock ranging in strength from very weak and extremely weathered to high strength and distinctly weathered.

Generally, the surficial silts and soft and firm clays, and very loose sands will be easily removed using small suction dredgers.

The very stiff to hard clays and dense sands and gravels, and possibly the weak siltstone, will require a cutter/suction dredge, or need to be excavated using conventional excavator equipment.

The rock is likely to prevent cost effective excavation using small sized dredgers.

The sandstone encountered in Borehole 3 is likely to require large excavators to facilitate its removal.

The basalt encountered in Borehole 8 is likely to be difficult to excavate without specialised rock removal equipment and may prove uneconomical to excavate to the design depths at this location.

## *6.2 Material Re-usage*

### *6.2.1 Materials*

The soil types excavated and the materials present at excavation level will vary across the site.

Typically, the materials likely to be encountered will comprise existing weak sediments, firm to hard clays, clayey sands and some isolated sandy gravels. Some areas of weathered rock are likely to be encountered.

Clays, clayey sands and gravels are generally considered suitable for use as fill for allotment filling and pavement areas, provided suitable moisture conditioning (and treatment for acid sulfate soils, if required) are undertaken. Care should be taken in the materials handling to utilize less reactive material in the upper fill layers of the allotments.

The existing silt sediment is unlikely to produce a material suitable for re-use, even with moisture conditioning.

Dredging may also result in some material "loss" due to loss of fines. The loss of volume from the dredging operations is estimated at approximately 5% to 10%. This loss must be considered in calculation of earthworks volumes.

Potential problems exist with the disposal of silt and clay fines tailings from the dredging operation. Tailings cannot be allowed to pond in areas of the proposed filling, as this could lead to potential settlement if tailings are allowed to accumulate. If the collection of tailings in structural areas cannot be avoided, their locations should be carefully monitored and they should be fully removed, following the completion of the dredging operations.

### *6.2.2 Reclamation in Clay*

Stiff to hard clay and sandy clay material is likely to be encountered during excavation of the canals. This material is considered suitable for use as structural fill, with appropriate moisture conditioning.

Pre-treatment in the form of drying will be required for the clay material prior to placement and compaction. Typically moisture loss of 10% to 25% from the field moisture content to achieve optimum moisture content will be required.

Volumes for quantity calculations can be based on the following:-

- Bank volume of stiff clay 1.00
- Dried and compacted volume 0.90
- Other losses <0.05
- Compaction factor = $\frac{\text{Compacted Volume}}{\text{Bank Volume}}$ 0.85 to 0.9

### *6.2.3 Reclamation in Clayey Sand*

Very loose to medium dense clayey sand material is considered suitable for use as structural fill provided moisture conditioning is undertaken. Clayey sands and silty sand material may typically have a fines content greater than 12% and less than 50% and therefore are not as free draining as clean sands.

Pre-treatment in the form of drying will be required for the clayey sand material prior to placement and compaction. Typically moisture loss of 15% to 20% from the field moisture content to achieve optimum moisture content will be required.

Significant effort should be made in maintaining appropriate moisture content within the clayey sand material. It is likely that moisture conditioning to within +/- 2% of optimum moisture content will be required to allow suitable compaction of the clayey sand material to be achieved.

Additionally, difficulties in "sealing off" both the compacted and stockpiled clayey sand is likely to be experienced. This may result in unacceptable increases in moisture content of those material following periods of rainfall.

Volumes for quantity calculations can be based on the following:-

- Bank volume of clayey sand 1.00
- Dried and compacted volume 0.83 - 0.85
- Other losses 0.03
- Compaction factor = $\frac{\text{Compacted Volume}}{\text{Bank Volume}}$ 0.80 - 0.85

### *6.2.4 Reclamation in Soft Sediment*

Soft sediment material encountered across the base of the canals is unlikely to be suitable for reuse as structural fill, and will require excavation. This material and other soft and firm clay material may be suitable for non-structural fill, provided that spreading and drying is carried out to reduce the moisture content to a value close to optimum for compaction, but long term difficulties with material usage may be encountered.

Volume losses up to 45% can be assumed from loss of water and compaction. Volumes for quantity calculations may be based on the following:-

- Bank volume of soft clay 1.00
- Dried and compacted volume 0.70 - 0.75
- Other losses 0.05
- Compaction factor = $\frac{\text{Compacted Volume}}{\text{Bank Volume}}$ 0.65 - 0.70

## 6.3 Batter Slopes

### *6.3.1 Material Parameters*

The following material parameters have been developed based on the interpretation of the results of the field and laboratory testing from this investigation and the results of earlier investigations across the site and in the immediate area.

Parameters for effective stress analysis are based on results of consolidated undrained triaxial tests with pore water measurement carried out as part of this investigation.

Table 3 presents the strength parameters initially adopted for stability analysis.

**TABLE 3 STRENGTH PROFILE**

| Material | Total Stress | | Effective Stress | |
|---|---|---|---|---|
| | Cu (kPa) | Ø (°) | C' (kPa) | Ø' (°) |
| Very Soft / Soft Silt | <5 | 0 | 0 | 18 |
| Stiff Clay | 50 | 0 | 2 | 24 |
| Very Stiff to Hard Clay | 100 | 0 | 5 | 26 |
| Very Loose Clayey Sand | - | 28 | 0 | 28 |
| Medium Dense Clayey Sand | - | 32 | 0 | 32 |

It is understood that batters to up to 2m in height will be formed as part of the works.

Considering the proposed excavation depths, the following maximum batter angles are recommended.

**BATTER ANGLES**

| Material | Long Term |
|---|---|
| Silt/Sediments | Not Recommended |
| Clay Soils | 18 degrees |
| Clayey Sands | 14 degrees |
| Weathered Rock | 30 degrees |

It has been assumed that the very soft and soft silty clays are sediments that have recently settled across the canal beds and previous sediment traps excavated across the site.

It has been assumed that all these weak recent sediments will be removed from the canal as part of the dredging operation and will not form part of the long term batter slopes of the proposed silt traps.

It is suggested that the excavations are not undertaken immediately adjacent to the existing revetment slopes. A minimum bench width of 5m is suggested at the toe of the batters. This will allow for possible lack of control during the excavation operation.

If careful control of the excavation operation can be maintained, this recommendation would not be required. However, it should be noted that if the batters are over-excavated, then a reduction in the factor of safety will result.

The batter slopes outlined above are considered conservative and will maintain a satisfactory long term factor of safety for the excavation.

Less conservative batter slopes could be assessed when more detailed designs of the traps have been developed.

## 7.0 LIMITATIONS

We have prepared this report for the use of **REDLAND CITY COUNCIL**, for design purposes in accordance with generally accepted geotechnical engineering practices. No other warranty, expressed or implied, is made as to the professional advice included in this report. This report has not been prepared for use by parties other than **REDLAND CITY COUNCIL**. It may not contain sufficient information for purposes of other parties or for other uses.

Your attention is drawn to 'Appendix A', 'Notes Relating to this Report'. Interpretation of factual data given in this report is based on judgement, not a greater knowledge of facts other than those reported.

Interpretation of the information shown on the logs, and its application to design and construction, should therefore take into account the spacing of boreholes, the method of drilling, the frequency of sampling and testing and the possibility of other than "straight line" variations between the boreholes. Subsurface conditions between boreholes may vary significantly from conditions encountered at the borehole locations.

In the event that conditions encountered on site during construction appear to vary from those expected from the information contained in the report, the Company requests that it immediately be notified. Most problems are more readily resolved when conditions are exposed than at some later stage, after the event.

Soil Surveys Engineering consider that a documentation review service (during the design phase and prior to construction) to verify that the intent of geotechnical recommendations is properly reflected in the design, along with construction inspections, forms a very important component of the geotechnical engineering design service/process.

This statement is not intended to reduce the level of responsibility accepted by Soil Surveys Engineering in accordance with our commission, but rather to ensure that all parties who may rely on this report are aware of the responsibilities each assumes in doing so and the risks they accept should they decline to have Soil Surveys Engineering carry out a geotechnical documentation review and geotechnical construction inspections.

The geotechnical review ensures geotechnical risks to our Client and their project are minimised at the design and tender stage of the project. Further, with Soil Surveys Engineering being commissioned to carry out geotechnical construction inspections, an opportunity becomes available at the time of construction to confirm any assumptions made in the preparation of the report and allow the effect of any normally occurring variation in ground conditions to be assessed with respect to construction.

**P. ELKINGTON (RPEQ 7226)**

For and on behalf of
**SOIL SURVEYS ENGINEERING PTY LIMITED**

# APPENDICES

# APPENDIX A

# NOTES RELATING TO THIS REPORT

***INTRODUCTION***

These notes are provided by Soil Surveys Engineering Pty Limited (the Company) to complement the geotechnical report in regard to classification methods and field procedures. Not all notes are necessarily relevant to all reports.

The ground is a product of continuing natural and man-made processes and therefore exhibits a variety of characteristics and properties which vary from place to place and can change with time. Geotechnical engineering involves gathering and assimilating limited information about these characteristics and properties in order to understand or predict the behaviour of the ground on a particular site under certain conditions. This report may contain such information obtained by inspection, excavation, probing, sampling, testing or other means of investigation. If so, they are directly relevant only to the ground at the place where and at the time when the investigation was carried out.

***DESCRIPTION AND CLASSIFICATION METHODS***

Soils - The methods of description and classification of soils and rocks used in this report are based on Australian Standard 1726-1993 (Geotechnical Site Investigations), where appropriate. In general, descriptions cover the following properties - soil or rock type, colour, structure, strength or density, and inclusions. Identification and classification of soil and rock involves judgement and the Company infers accuracy only to the extent that is common in current geotechnical practice.

Soil types are described according to the dominant particle size and behaviour as set out in AS 1726-1993.

Cohesive soils are classified on the basis of strength (consistency) either by use of hand penetrometer, shear vane, laboratory testing or engineering examination. The strength terms are defined in AS1726-1993 Table A4.

Non-cohesive soils are classified on the basis of relative density usually based on insitu testing or engineering examination (see AS1726-1993 Table A5).

Rocks - Rock types are classified by their geological names (AS1726-1993 Table A6), together with descriptive terms regarding weathering (AS1726-1993 Table A9), strength (refer Table 1 below), defects (AS1726-1993 Table A10), etc. Where strength testing (ie Point Loads) is carried out, AS1726-1993 Table A8 is used. Where relevant, further information regarding rock classification is attached.

Table 1 Estimated strength descriptions given to rock based on engineering examination

| Strength Term | Approximate Qu (MPa) |
|---|---|
| Extremely Weak | < 1.0 |
| Very Weak | 1.0 - 5.0 |
| Weak | 5.0 - 25 |
| Medium Strong | 25 - 50 |
| Strong | 50 - 100 |
| Very Strong | 100 - 250 |
| Extremely Strong | > 250 |

Ref ISRM "Suggested Methods for the Quantitative Description of Discontinuities in Rock Masses"

***SAMPLING***

Sampling is carried out during drilling or from other excavations to allow engineering examination (and laboratory testing where required) of the soil or rock.

Disturbed samples taken during drilling provide information on plasticity, grain size, colour, moisture content, minor constituents and, depending upon sample disturbance, (information on strength and structure).

Undisturbed samples are taken by pushing a thin walled sample tube, usually 50mm diameter (U50), into the soil and withdrawing it with a sample of the soil contained in a relatively undisturbed state. Such samples yield information on structure and strength, and are necessary for laboratory determination of shear strength, volume change potential and compressibility. Undisturbed sampling is generally effective only in cohesive soils.

Details of the type and method of sampling used are given on the attached logs.

***TEST LOCATIONS***

Test locations (e.g. boreholes, CPT's, test pits etc.) were based on available access at the time of testing (access may need to be provided "by others"). Test locations may have been shifted if access was not suitable.

Unless noted otherwise, accuracy of test locations are to the accuracy of hand held GPS equipment.

***INVESTIGATION METHODS***

The following is a brief summary of investigation methods currently adopted by the Company and some comments on their use and application.

**Test Pits -** These are normally excavated with a backhoe or a tracked excavator, allowing close examination of the insitu soils if it is safe to descend into the pit. The depth of penetration is limited to about 3m for a backhoe and up to 6m for an excavator. Limitations of test pits are the problems associated with disturbance and difficulty of reinstatement and the consequent effects on close-by structures. Care must be taken if construction is to be carried out near test pit locations to either properly recompact the backfill during construction or to design and construct the structure so as not to be adversely affected by poorly compacted backfill at the test pit location.

**Hand Auger Drilling -** A borehole of 50 to 100mm diameter is advanced by manually operated equipment. Refusal of the augers can occur on a variety of materials such as hard clay, gravel or rock fragments and does not necessarily indicate rock level.

**Continuous Spiral Flight Augers -** The borehole is advanced using 75 to 300 mm diameter continuous spiral flight augers, which are withdrawn at intervals to allow sampling or insitu testing. This is a relatively economical means of drilling in clays and in sands above the water table. Samples are returned to the surface by the flights or may be collected after withdrawal of the augers. Information from the drilling (as distinct from specific sampling) is of relatively lower reliability due to remoulding, inclusion of cuttings from above or softening of samples by groundwater, or uncertainties as to the original depth of the samples. Augering below the groundwater table has a lower reliability than augering above the water table. Various drill bits are attached to the base of the augers during the drilling. The depth of refusal of the different bit types can provide information as to the strength of the material encountered. Generally two different bit types are used. The 'V' bit is a V shaped steel bit and the 'TC' bit is a tungsten carbide tipped screw type bit.

**Wash Boring -** The borehole is usually advanced by a rotary bit with water or fluid pumped down the hollow drill rods and returned up in the space between the rods and the soil or casing, carrying the drill cuttings. Only major changes in stratification can be determined from the cuttings, together with some information from "feel" and rate of penetration. More accurate information on soil strata is gained by regular testing and sampling using the Standard Penetration Test (SPT) and undisturbed thin walled tube samples (U50).

**Mud Stabilized Drilling -** Either Wash Boring or Continuous Core Drilling can use drilling mud as a circulating fluid to stabilize the borehole. The term "mud" encompasses a range of products ranging from bentonite to polymers such as Revert or Biogel. The mud tends to mask the cuttings and reliable identification is only possible from regular intact sampling (eg. from SPT and U50 samples) or from rock coring, etc.

**Continuous Core Drilling -** A continuous core sample is obtained using a diamond or tungsten carbide tipped core barrel. Provided full core recovery is achieved (which is not always possible in very weak rocks and granular soils), this technique provides a very reliable method of investigation. In rocks, NMLC coring (nominal 52 mm diameter) is usually used with water flush. The length of core recovered is compared to the length drilled and any length not recovered is shown as CORE LOSS. The location of losses is determined on site by the supervisor. If the location of the loss is uncertain, it is placed at the top end of the run, when the core is placed in a storage tray and recorded on the log.

**Standard Penetration Tests -** Standard Penetration Tests (SPT) are used mainly in non-cohesive soils, but can also be used in cohesive soils, as a means of indicating density or strength. The test procedure is described in Australian Standard 1289, "Methods of Testing Soils for Engineering Purposes" - Test 6.3.1.

The test is carried out in a borehole by driving a 50mm diameter split sample tube with a tapered shoe, under the impact of a 63 kg hammer with a free fall of 760 mm. It is normal for the tube to be driven in three successive 150 mm increments and the 'N' value is taken as the number of blows for the last 300 mm, the upper 150 mm being neglected due to possible disturbance from the drilling method. In dense sands, very hard clays or weak rock, the full 450 mm penetration may not be practicable and the test is discontinued at a reduced penetration.

In the case where full penetration is obtained with successive blow counts for each 150 mm of, say 4, 6 and 7 blows, the record shows,

4, 6, 7 N = 13

In a case where the test is discontinued short of full penetration, say after 15 blows for the first 150 mm and 30 blows for the next 40 mm, the record shows:

15, 30/40mm

The results of the test can be related empirically to the engineering properties of the soil.

Occasionally, the drop hammer is used to drive 50mm diameter thin walled sample tubes (U50) in clays. In such circumstances, it is noted on the borehole logs.

A modification to the SPT test is where the same driving system is used with a solid $60^0$ tipped steel cone of the same diameter as the SPT hollow sampler. The solid cone can be continuously driven for some distance in soft clays or loose sands, or may be used where damage would otherwise occur to the SPT. The results of this Solid SPT are shown as "$N_c$" on the borehole logs, together with the number of blows per 150 mm penetration.

**Cone Penetration Tests -** Test Method - Cone Penetration Tests (CPT) are carried out in accordance with AS 1289 Test 6.5.1-1977, using an electrical friction-cone penetrometer.

The test essentially comprises the measurement of resistance to penetration of a cone of 35.7 mm diameter pushed into the soil at a rate of 10-20 mm per second by hydraulic force. The resistance to penetration is recorded in terms of pressure on the end area of the cone (cone resistance, $q_c$, in MPa) and friction on the side of the 135 mm long sleeve immediately above the top of the cone (friction resistance, $f_s$, in kPa). These forces are measured by electrical transducers (strain gauges) within the cone device. The ratio between friction resistance and cone resistance is also calculated as a percentage, ie.-

$$Friction\ Ratio\ (FR) = \frac{Friction\ Resistance, f_s\ (kPa) \times 100}{cone\ resistance,\ q_c\ (kPa)}$$

The friction ratio, FR, is generally low in sands (less than 1% or 2%) and generally higher in clays (say 3% or more). The interpretation of sandy clays, clayey sands and material with a high silt content is more difficult, but intermediate values (between 1% and 3%) would be expected. Highly organic clays and peats generally have a friction ratio in excess of 5%.

Static cone data is recorded in the field on disc for later presentation using computer aided drafting.

The equipment can be operated from any conventional drill rig. A total applied load in the range of 4 to 10 tonnes is required for practical purposes, although lighter loads may be used. The cone penetrometers are available with various capacities of cone resistance ranging up to 100 MPa for general purpose investigations, while a range of 0 to 10 MPa can be used where more sensitive investigations of soft clay are required.

The cone resistance value provides a continuous measure of soil strength or density, and together with the friction ratio, provide very useful indications of the presence of narrow bands of geotechnically significant layers such as thin, soft clay layers or lenses of sand which might otherwise be missed using conventional drilling methods.

The lithology of the encountered soils is interpreted from static cone data and is generally presented on the static cone log sheets.

It is important to note that the lithology is interpreted information and is based on research by Schmertmann (1970), Sanglerat (1972), Robinson and Campinalli (1986), modified to suit local conditions as indicated by borehole information and laboratory testing.

As soils generally change gradually it is sometimes difficult to accurately describe depths of strata changes, although greater accuracy is obtained with the static cone compared with conventional drilling. In addition, friction ratios decrease in accuracy with low cone resistance values, and in desiccated soils. As a result, some overlap and minor discrepancies may

exist between static cone and nearby borehole information.

**Portable Dynamic Cone Penetrometers -** Portable Dynamic Cone Penetrometer (DCP) tests are carried out by driving a rod into the ground with a falling weight hammer and measuring the blows for successive 100mm increments of penetration.

The DCP comprises a Cone of 20 mm diameter with 30 degree taper attached to steel rods of smaller section.

The cone end is driven with a 9 kg hammer falling 510 mm (AS. 1289 Test 6.3.2). The test was developed initially for pavement subgrade investigations, and empirical correlations of the test results with California Bearing Ratio have been published by various Road Authorities. The Company has developed their own correlations with Standard Penetration tests and Density Index tests in sands.

***LOGS***

The borehole or test pit logs presented herein are an engineering and/or geological interpretation of the subsurface conditions, and their reliability will depend to some extent on the frequency of sampling and the method of drilling or excavation. Ideally, continuous undisturbed sampling or core drilling will enable the most reliable assessment but is not always practicable or possible to justify on economic grounds. In any case, the boreholes or test pits represent only a very small sample of the total subsurface conditions.

The attached explanatory notes define the terms and symbols used in preparation of the logs.

Interpretation of the information shown on the logs, and its application to design and construction, should therefore take into account the spacing of boreholes or test pits, the method of drilling or excavation, the frequency of sampling and testing and the possibility of other than "straight line" variations between the boreholes or test pits. Subsurface conditions between boreholes or test pits may vary significantly from conditions encountered at the borehole or test pit locations.

***GROUNDWATER***

Where groundwater levels are measured in boreholes, there are several potential problems.

- Although groundwater may be present in lower permeability soils, it may enter the hole slowly or perhaps not at all during the time the hole is open.
- A localized perched water table may lead to an erroneous indication of the true water table.
- Water table levels will vary from time to time with seasons or recent weather changes and may not be the same at the time of construction.
- The use of water or mud as a drilling fluid will mask any groundwater inflow. Water has to be bailed out of the bore and mud must be washed out of the hole or "reverted" if water observations are to be made.

More reliable measurements can be made by use of standpipes which are read after stabilizing at periods ranging from several days to perhaps weeks for low permeability soils. Piezometers, sealed in a particular stratum, may be advisable in low permeability soils or where there may be interference from perched water tables or surface water.

***FILL***

The presence of fill materials can often be determined only by the inclusion of foreign objects (eg. bricks, steel, etc.) or by distinctly unusual colour, texture or fabric. Identification of the extent of fill materials will also depend on investigation methods and frequency. Where natural soils similar to those at the site are used for fill, it may be difficult with limited testing and sampling to reliably determine the extent of the fill.

The presence of fill materials is usually regarded with caution as the possible variation in density, strength and material type is much greater than with natural soil deposits. Consequently, there is an increased risk of adverse engineering characteristics or behaviour. If the volume and quality of fill is important to a project, then frequent test pit excavations are preferable to boreholes.

***LABORATORY TESTING***

Laboratory testing is normally carried out in accordance with Australian Standard 1289 "Methods of Testing Soil for Engineering Purposes". Details of the test procedure used are given on the individual report forms and the attached explanatory notes summarize important aspects of the Laboratory Test Procedures adopted.

***ENGINEERING REPORTS***

Engineering reports are prepared by qualified personnel and are based on the information obtained and on current engineering standards of interpretation and analysis. The information provided in Soil Surveys Engineering reports is opinion and interpretation and not factual. The client/contractor increases their risk by not retaining the person who authored the geotechnical report, to carry out site inspection and review (overseeing role) during construction, to confirm opinion and interpretation expressed in the report is accurate. Where the report has been prepared for a specific design proposal the information and interpretation may not be relevant if the design proposal is changed. If this happens, the Company will be pleased to review the report and the sufficiency of the investigation work.

Every care is taken with the report as it relates to interpretation of subsurface conditions, discussion of geotechnical aspects and recommendations or suggestions for design and construction. Since the test sites in any exploration represent a very small proportion of the total site and since the exploration only identifies actual ground conditions at the test sites, even under the best circumstances actual conditions may vary from those inferred to exist. No responsibility is taken for:-

- Unexpected variations in ground and/or groundwater conditions.
- Changes in policy or interpretation of policy by statutory authorities.
- The actions of other persons.
- Any work where the company is not given the opportunity to supervise the construction using the Companies designs/recommendations.

If differences occur, the Company will be pleased to assist with investigation or advice to resolve any problems occurring.

***SITE ANOMALIES***

In the event that conditions encountered on site during construction appear to vary from those expected from the information contained in the report, the Company requests that it immediately be notified. Most problems are more readily resolved when conditions are exposed than at some later stage, well after the event.

Extreme events including but not limited to the results of climate change, eg. flood levels above previously identified levels, beach scour or erosion beyond normal expectations (as identified by local authorities) extreme rainfall events, war, espionage, sabotage may result in different conditions between time of investigation and time of construction.

***REPRODUCTION OF INFORMATION FOR CONTRACTUAL PURPOSES***

Attention is drawn to the document “Guidelines for the Provision of Geotechnical Information in Construction Contracts (1987)”, published by the Institution of Engineers, Australia. Where information obtained from this investigation is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances, where the discussion or comments section is not relevant to the contractual situation, it may be appropriate to prepare a specially edited document. The Company would be pleased to assist in this regard and/or to make additional report copies available for contract purposes at a nominal charge.

***REVIEW OF DESIGN***

Where major civil or structural developments are proposed or where only a limited investigation has been completed or where the geotechnical conditions/ constraints are quite complex, it is prudent to have a joint design review which involves a senior geotechnical engineer. We would be happy to assist in this regard as an extension of our investigation commission. Construction drawings should be reviewed by Soil Surveys Engineering, with sufficient time to allow changes if required, prior to inspections.

Otherwise Soil Surveys Engineering reserves the right to refuse to carry out inspections.

***SITE INSPECTION***

The Company will always be pleased to provide engineering inspection services for geotechnical aspects of work to which this report is related.

i) Site visits during construction to confirm reported ground conditions

ii) Site visits to assist the contractor or other site personnel in identifying various soil/rock types such as appropriate footing or pier founding depths, the stability of a filled or excavated slope; or

iii) Full-time engineering presence on site.

In the vast majority of cases it is advantageous to the principal for the geotechnical engineer who wrote the investigation report to be involved in the construction stage of the project.

The geotechnical engineer cannot take responsibility for variations in encountered conditions, where he is not given the opportunity to review plans for the proposed development with sufficient time to allow review and make changes to the proposed development if required, and where he is not given the opportunity to inspect the site and oversee construction methods with regard to site conditions with sufficient time to observe all relevant site conditions and operations.

***RESPONSIBLE USE OF GEOTECHNICAL INFORMATION***

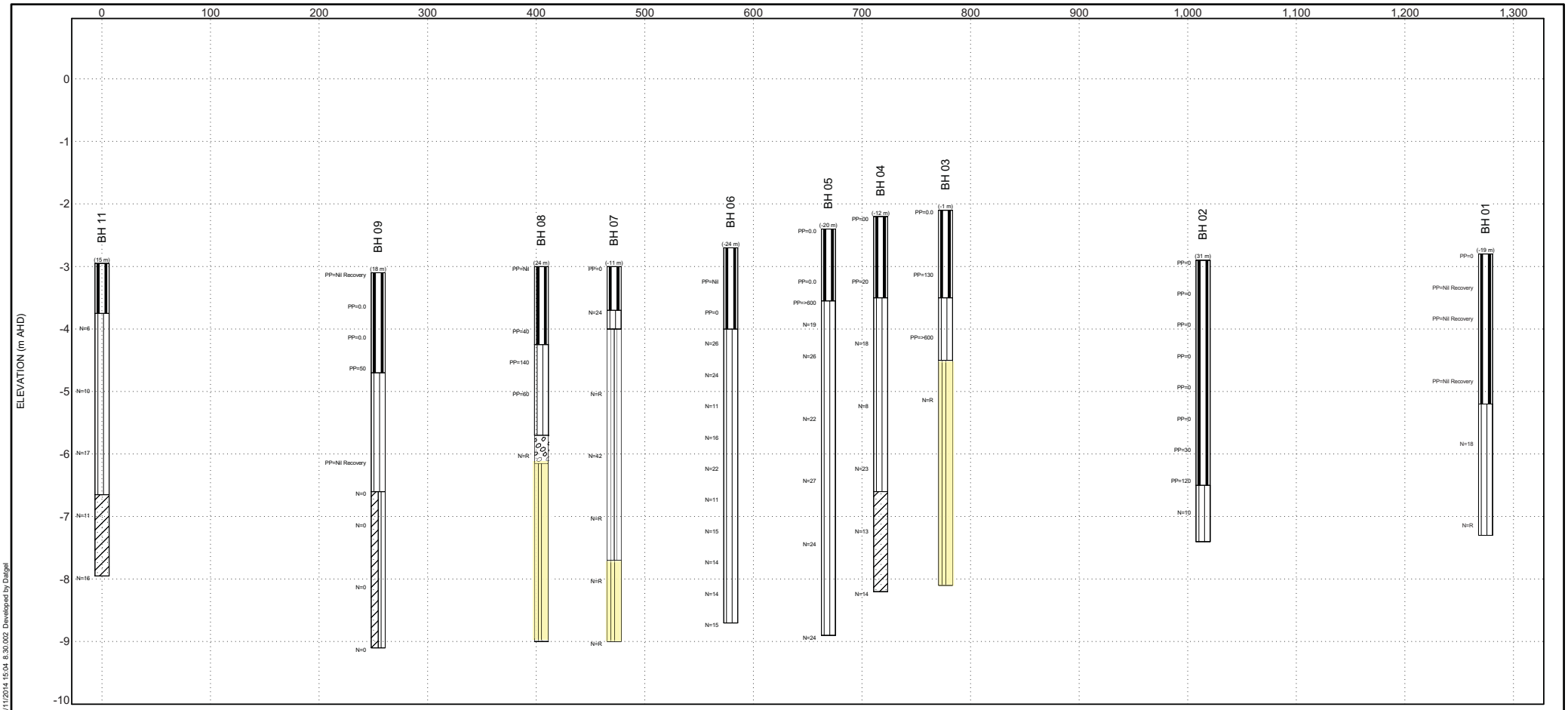
Recommendations in our report are for design purposes only and provided on the basis that inspections are carried out to allow finalisation of opinions and recommendations contained in our report.

The geotechnical investigation consisting of field and laboratory testing has been carried out to indicate typical conditions by indicating conditions and parameters at the specific locations of boreholes/test pits. Subsurface conditions are indicated at these locations only and the inference of conditions between or away from these locations (interpolation and extrapolation) involves a certain degree of risk. Persons inferring such conditions or carrying out such inferences should do so with a degree of caution and conservatism which is commensurate with the consequences of the risk of error.

Estimates of volumes based on our findings require interpolation and extrapolation between test locations and as such may be significantly different from actual volumes.

# APPENDIX B

# BOREHOLE RECORD SHEETS

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SCALE V 1:65 H 1:3714 (0 m – 3.2 m; 0 m – 185.7 m)

REFERENCE Q:\DOCS\MILTONS DOCUMENTS\1-16000-1-16999\1-16500-1-16599\1-16581\\Graphics\114-16581-AA.pdf

A3 | DRW. NO. 114-16581-AA | Date : 24/11/14 | Checked:

PROJECT

# CROSS SECTION

## Sediment Basin Assessment

CLIENT
Redland City Council

LOCATION
Aquatic Paradise Canal Estate


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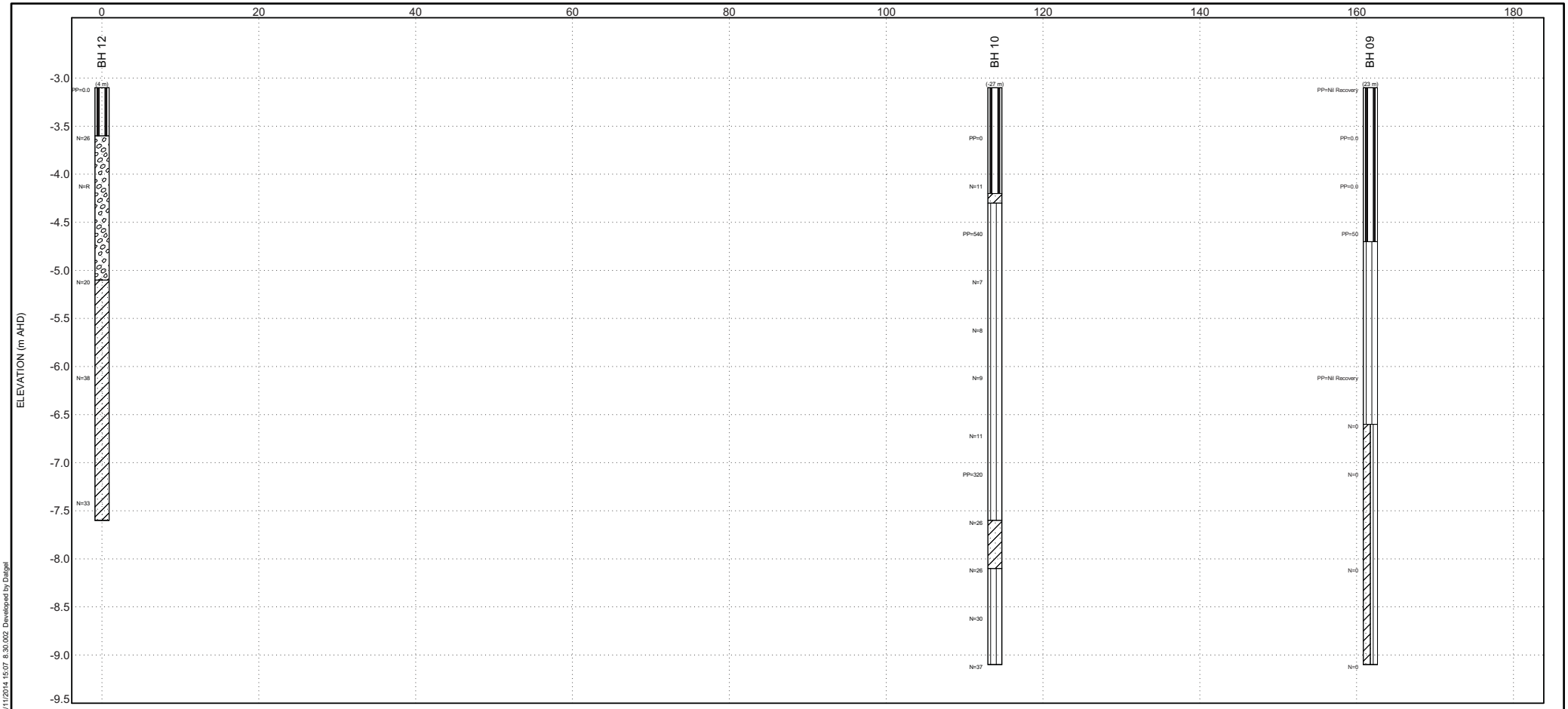
SOIL SURVEYS




**MATERIAL GRAPHIC**

Silt
Gravel
Clay
Sand

This sheet may be prepared using colour and may be incomplete if copied

SCALE
V 1:42
H 1:514
0 m 2.1 m
0 m 25.7 m

REFERENCE
Q:\DOCS\MILTONS DOCUMENTS\1-16000-1-16999\1-16500-1-16599\1-16581\\Graphics\114-16581-BB.pdf

A3 | DRW. NO. 114-16581-BB | Date : 24/11/14 | Checked:

PROJECT
# CROSS SECTION
## Sediment Basin Assessment

CLIENT
Redland City Council

LOCATION
Aquatic Paradise Canal Estate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# BOREHOLE RECORD SHEET

**Location Number: BH 01**

Project Number: 114-16581
Project Name: Sediment Basin Assessment
Location: Aquatic Paradise Canal Estate
Client: Redland City Council
Date: 06/11/2014



Easting: 521598 Northing: 6960518 RL: -2.8 m
Logger: MD Operator: MD Machine: EVH2100

| Drilling Method (TC / WB / RR / NMLC / Casing) | Depth | Graphic | Description | Samples and Remarks |
|---|---|---|---|---|
| WB | 0.0 | | Silty CLAY (CH) Very soft, high plasticity, dark grey. | U50 PP=0 |
| | 1.0 | | | U50 PP=Nil Recovery |
| | | | | U50 PP=Nil Recovery |
| | 2.0 | | | |
| | 2.40 | | | U50 PP=Nil Recovery |
| | | | Sandy CLAY (CH) Very stiff, high plasticity, orange brown mottled grey and red brown, fine to coarse grained sand, moist. | |
| | 3.0 | | | |
| | 3.30 | | | SPT 2, 2, 16 N=18 |
| | | | Sandy CLAY (CH) Hard, high plasticity, orange brown mottled grey and red brown, fine to coarse grained sand, moist. | |
| | 4.0 | | | |
| | 4.50 | | | SPT 30/145mm |
| | | | BOREHOLE BH 01 TERMINATED AT 4.50 m | |
| | 5.0 | | | |
| | 6.0 | | | |
| | 7.0 | | | |
| | 8.0 | | | |
| | 9.0 | | | |
| | 10.0 | | | |

Comments:
1) Drilled off barge.

Water First Noted  Water Steady Level

**Weathering Grades**
RS - Residual Soil
XW - Extremely weathered
DW - Distinctly weathered
SW - Slightly weathered
FR - Fresh

**Rock Strength**
VW - Very weak
W - Weak
MS - Medium strong
S - Strong
VS - Very strong
ES - Extremely strong

**Samples**
U50
SPT
Disturbed Sample

Approved:
Date:

# PHOTO LOG - SPT SAMPLES

**Borehole No:** **BH01**
Date Sampled: 06/11/2014

| DEPTH | Recovered Length | SPT | Sample Photo |
|---|---|---|---|
| 3.0 | 450mm | 2, 2, 16 N = 18 |  |
| 4.3 | 145mm | 30/145mm |  |

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SOIL SURVEYS

# BOREHOLE RECORD SHEET

**Location Number: BH 02**

Project Number: 114-16581
Project Name: Sediment Basin Assessment
Location: Aquatic Paradise Canal Estate
Client: Redland City Council
Date: 21/10/2014



Easting: 521593 Northing: 6960253 RL: -2.9 m
Logger: MD Operator: MD Machine: EVH2100

| Drilling Method (TC / WB / RR / NMLC / Casing) | Depth | Graphic | Description | Samples and Remarks |
|---|---|---|---|---|
| | 0.0 | | Silty CLAY (CH) Very soft, high plasticity, dark grey, with fine to medium grained sand. | ENVIRO U50 PP=0 |
| | 1.0 | | | ENVIRO U50 PP=0 |
| | 2.0 | | | ENVIRO U50 PP=0 |
| | | | | ENVIRO U50 PP=0 |
| | | | | ENVIRO U50 PP=0 |
| | 2.80 | | | ENVIRO U50 PP=0 |
| | 3.0 | | Silty CLAY (CH) Soft, high plasticity, dark grey, with fine to medium grained sand, with clayey sand bands throughout, shell. | U50 PP=30 |
| | 3.60 | | Silty CLAY (CH) Stiff, high plasticity, grey, with fine to medium grained sand. | U50 PP=120 |
| | 4.0 | | | |
| | 4.10 | | Sandy CLAY (CH) Hard, high plasticity, grey mottled orange brown, fine to medium grained sand. | SPT 3, 4, 6 N=10 |
| | 4.50 | | BOREHOLE BH 02 TERMINATED AT 4.50 m | |
| | 5.0 | | | |
| | 6.0 | | | |
| | 7.0 | | | |
| | 8.0 | | | |
| | 9.0 | | | |
| | 10.0 | | | |

Comments:
1) Drilled off barge.

Water First Noted  Water Steady Level

**Weathering Grades**
RS - Residual Soil
XW - Extremely weathered
DW - Distinctly weathered
SW - Slightly weathered
FR - Fresh

**Rock Strength**
VW - Very weak
W - Weak
MS - Medium strong
S - Strong
VS - Very strong
ES - Extremely strong

**Samples**
U50
SPT
Disturbed Sample

Approved:
Date:

# PHOTO LOG - SPT SAMPLES

**Borehole No:** **BH02**
Date Sampled: 21/10/2014

| DEPTH | Recovered Length | SPT | Sample Photo |
|---|---|---|---|
| 4.0m | 450mm | 3, 4, 6 N = 10 | No photo |

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# *BOREHOLE RECORD SHEET*

**Location Number: BH 03**

Project Number: 114-16581
Project Name: Sediment Basin Assessment
Location: Aquatic Paradise Canal Estate
Client: Redland City Council
Date: 22/10/2014



Easting: 521666 Northing: 6960025 RL: -2.1 m
Logger: MD Operator: MD Machine: EVH2100

| Drilling Method (TC / WB / RR / NMLC / Casing) | Depth | Graphic | Description | Weathering | Strength (Estimated: RS/VW/W/MS/S/VS/ES) | Defect Spacing (20 60 200 600) | Rec (%) | RQD | Samples and Remarks |
|---|---|---|---|---|---|---|---|---|---|
| WB | 0.00 | | Silty CLAY (CH) Very soft, high plasticity, dark grey, trace of fine to medium grained sand. | | | | | | U50 PP=0.0 |
| WB | 1.0 | | | | | | | | |
| WB | 1.40 | | Silty CLAY (CH) Stiff, high plasticity, grey mottled orange brown. | | | | | | U50 PP=130 |
| WB | 1.90 | | Silty CLAY (CH) Very stiff to hard, high plasticity, grey mottled orange brown. | | | | | | |
| WB | 2.0 | | | | | | | | U50 PP=>600 |
| WB | 2.40 | | SANDSTONE (XW) Extremely weathered, weak, light grey mottled brown. | | | | | | |
| WB | 3.0 | | | | | | | | |
| WB | 3.00 | | SANDSTONE (DW) Distinctly weathered, weak to moderately strong, fine grained, light grey and orange brown, fractured. | DW | | | 100 | 0 | SPT 30/60mm |
| WB | 4.0 | | | | | | 100 | 0 | |
| WB | 4.10 | | CORE LOSS 0.40m (4.10-4.50) | | | | | | |
| WB | 4.50 | | SANDSTONE (DW) Distinctly weathered, weak to moderately strong, fine grained, light grey and orange brown, fractured. | DW | | | 80 | 12 | |
| WB | 5.0 | | | | | | | | |
| WB | 6.0 | | | | | | | | |
| WB | 6.00 | | BOREHOLE BH 03 TERMINATED AT 6.00 m | | | | | | |
| WB | 7.0 | | | | | | | | |
| WB | 8.0 | | | | | | | | |
| WB | 9.0 | | | | | | | | |
| WB | 10.0 | | | | | | | | |

Comments:
1) Drilled off barge.

Chainage :m Offset : m
Water First Noted Water Steady Level

**Defects - 1.54m : F,60°,P,R,O,C**

Depth (m) | Type: B - Bedding, C - Clay seam, F - Foliation, H - Schistosity, J - Joint, L - Cleavage, R - Fracture, S - Shear zone, T - Contact, V - Vein, Z - Decomposed Zone, DI - Drilling Induced break | Dip (deg) | Planarity: C - Curvilinear, D - Discontinuous, P - Planar, S - Subplanar, T - Stepped, U - Undulating | Roughness: L - Slickensides, P - Polished, R - Rough, S - Smooth, V - Very rough | Aperature: C - Closed, F - Filled, N - Clean, O - Open, S - Stain | Infill: C - Clay, F - Iron Oxide, K - Calcite, L - Limonite, Q - Quartz, S- Secondary mineral, U - Unidentified mineral, W - Weathered rock, X - Carbonaceous, Z - Clean

**Weathering Grades**
RS - Residual Soil
XW - Extremely weathered
DW - Distinctly weathered
SW - Slightly weathered
FR - Fresh

**Rock Strength**
VW - Very weak
W - Weak
MS - Medium strong
S - Strong
VS - Very strong
ES - Extremely strong

**Samples**
U50
SPT
Disturbed Sample

Approved:
Date:

# PHOTO LOG - SPT SAMPLES

**Borehole No:** **BH03**
Date Sampled: 22/10/2014

| DEPTH | Recovered Length | SPT | Sample Photo |
|---|---|---|---|
| 3.0m | 0.6mm | 30/60mm |  |

Project No. 1-16581
Client: Redland City Council
Project: Sediment Basin Assessment
Site: Aquatic Paradise Canal Estate - Birkdale

**Borehole 3 - Core box 1 of 1**
**3m - 6m.**

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# BOREHOLE RECORD SHEET

**Location Number: BH 04**

Project Number: 114-16581
Project Name: Sediment Basin Assessment
Location: Aquatic Paradise Canal Estate
Client: Redland City Council
Date: 17/10/2014



Easting: 521687 Northing: 6959968 RL: -2.2 m
Logger: MD Operator: MD Machine: EVH2100

| Drilling Method (TC / WB / RR / NMLC / Casing) | Depth | Graphic | Description | Samples and Remarks |
|---|---|---|---|---|
| WB | 0.00 | | Silty CLAY (CH) Very soft, high plasticity, dark grey, wet. | U50 PP=00 |
| | 1.0 | | | |
| | 1.30 | | | U50 PP=20 |
| | 1.50 | | Sandy CLAY (CH) Hard, high plasticity, grey mottled orange brown, fine to medium grained sand, moist. | |
| | 2.0 | | CLAY (CH) Hard, high plasticity, grey mottled orange brown, with fine to coarse grained sand, moist. | SPT 6, 8, 10 N=18 |
| | 2.60 | | CLAY (CH) Hard, high plasticity, grey mottled orange brown, with fine to coarse grained sand, with sandy clay bands throughout, moist. | |
| | 3.0 | | | SPT 4, 4, 4 N=8 |
| | 4.0 | | | SPT 6, 11, 12 N=23 |
| | 4.40 | | Clayey Gravelly SAND (SC) Medium dense, fine to coarse grained, grey mottled brown and yellow, fine sized gravel, low to medium plasticity clay fines, bands of possible weathered rock noted throughout. | |
| | 5.0 | | | SPT 4, 6, 7 N=13 |
| | 6.0 | | | |
| | 6.00 | | BOREHOLE BH 04 TERMINATED AT 6.00 m | SPT 4, 6, 8 N=14 |
| | 7.0 | | | |
| | 8.0 | | | |
| | 9.0 | | | |
| | 10.0 | | | |

Comments:
1) Drilled off barge.

Water First Noted  Water Steady Level

**Weathering Grades**
RS - Residual Soil
XW - Extremely weathered
DW - Distinctly weathered
SW - Slightly weathered
FR - Fresh

**Rock Strength**
VW - Very weak
W - Weak
MS - Medium strong
S - Strong
VS - Very strong
ES - Extremely strong

**Samples**
U50
SPT
Disturbed Sample

Approved:
Date:

# PHOTO LOG - SPT SAMPLES

**Borehole No:** **BH04**
Date Sampled: 17/10/2014

| DEPTH | Recovered Length | SPT | Sample Photo |
|---|---|---|---|
| 2.0m | 450mm | 6, 8, 10 N = 18 |  |
| 3.0m | 450mm | 4, 4, 4 N = 8 |  |
| 4.0m | 450mm | 6, 11, 12 N = 23 |  |
| 5.0m | 450mm | 4, 6, 7 N = 13 |  |
| 6.0m | 450mm | 4, 6, 8 N = 14 |  |

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# BOREHOLE RECORD SHEET

**Location Number: BH 05**

Project Number: 114-16581
Project Name: Sediment Basin Assessment
Location: Aquatic Paradise Canal Estate
Client: Redland City Council
Date: 22/10/2014



Easting: 521703 Northing: 6959922 RL: -2.4 m
Logger: MD Operator: MD Machine: EVH2100

| Drilling Method TC | WB | RR | NMLC | Casing | Depth | Graphic | Description | Samples and Remarks |
|---|---|---|---|---|---|---|---|---|
| | | | | | 0.0 | | Silty CLAY (CH) Very soft, high plasticity, dark grey. | U50 PP=0.0 |
| | | | | | 1.15 | | Silty CLAY (CH) Hard, high plasticity, light grey, mottled orange brown. | U50 PP=0.0 |
| | | | | | 1.45 | | Sandy Silty CLAY (CH) Hard, high plasticity, red brown and grey and orange brown mottled, fine to medium grained sand, moist. | U50 PP=>600<br>SPT 9, 8, 11 N=19 |
| | | | | | 2.60 | | Sandy CLAY (CH) Hard, high plasticity, grey mottled light yellow and grey, fine to medium grained sand, thin bands of very weak siltstone. | SPT 16, 12, 14 N=26<br>SPT 5, 12, 10 N=22<br>SPT 11, 11, 16 N=27<br>SPT 10, 11, 13 N=24 |
| | | | | | 6.50 | | BOREHOLE BH 05 TERMINATED AT 6.50 m | SPT 5, 9, 15 N=24 |

Comments:
1) Drilled off barge.

Water First Noted Water Steady Level

**Weathering Grades**
RS - Residual Soil
XW - Extremely weathered
DW - Distinctly weathered
SW - Slightly weathered
FR - Fresh

**Rock Strength**
VW - Very weak
W - Weak
MS - Medium strong
S - Strong
VS - Very strong
ES - Extremely strong

**Samples**
U50
SPT
Disturbed Sample

Approved:
Date:

# PHOTO LOG - SPT SAMPLES

**Borehole No:** **BH05**
Date Sampled: 22/10/2014

| DEPTH | Recovered Length | SPT | Sample Photo |
|---|---|---|---|
| 1.5m | 450mm | 9, 8, 11 N = 19 |  |
| 2.0m | 450mm | 16, 12, 14 N = 26 |  |
| 3.0m | 450mm | 5, 12, 10 N = 22 |  |
| 4.0m | 450mm | 11, 11, 16 N = 27 |  |
| 5.0m | 450mm | 10, 11, 13 N = 24 |  |
| 6.5m | 450mm | 5, 9, 15 N = 24 |  |

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# BOREHOLE RECORD SHEET

**Location Number: BH 06**

Project Number: 114-16581
Project Name: Sediment Basin Assessment
Location: Aquatic Paradise Canal Estate
Client: Redland City Council
Date: 23/10/2014



Easting: 521722 Northing: 6959834 RL: -2.7 m
Logger: MD Operator: MD Machine: EVH2100

| Drilling Method (TC / WB / RR / NMLC / Casing) | Depth | Graphic | Description | Samples and Remarks |
|---|---|---|---|---|
| WB | 0.0 | | Silty CLAY (CH) Very soft, high plasticity, dark grey, trace of fine to medium grained sand. | U50 PP=Nil; U50 PP=0 |
| WB | 1.30 | | | |
| WB | 1.50 | | Silty CLAY (CH) Very stiff, high plasticity, light grey mottled green grey, with fine to coarse grained sand, moist. | ENVIRO SPT 10, 13, 13 N=26 |
| WB | 2.0 | | Sandy CLAY (CH) Hard, high plasticity, orange brown and red brown and grey mottling, fine to medium grained sand, moist. | ENVIRO SPT 7, 11, 13 N=24; ENVIRO SPT 7, 5, 6 N=11 |
| WB | 3.00 | | Sandy Silty CLAY (CH) Hard, high plasticity, light grey mottled orange brown, fine to medium grained sand, with coarse grained sand. | ENVIRO SPT 5, 7, 9 N=16; ENVIRO SPT 8, 10, 12 N=22; SPT 4, 5, 6 N=11; SPT 5, 7, 8 N=15; ENVIRO SPT 5, 7, 7 N=14; SPT 5, 6, 8 N=14 |
| WB | 6.00 | | BOREHOLE BH 06 TERMINATED AT 6.00 m | ENVIRO SPT 6, 6, 9 N=15 |

Comments:
1) Drilled off barge.

Water First Noted  Water Steady Level

**Weathering Grades**
RS - Residual Soil
XW - Extremely weathered
DW - Distinctly weathered
SW - Slightly weathered
FR - Fresh

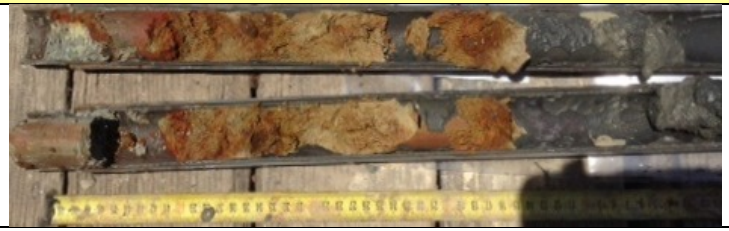
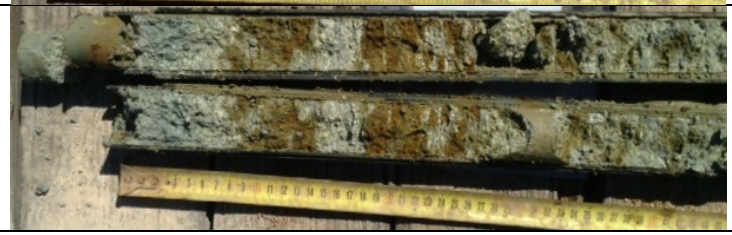
**Rock Strength**
VW - Very weak
W - Weak
MS - Medium strong
S - Strong
VS - Very strong
ES - Extremely strong

**Samples**
U50
SPT
Disturbed Sample

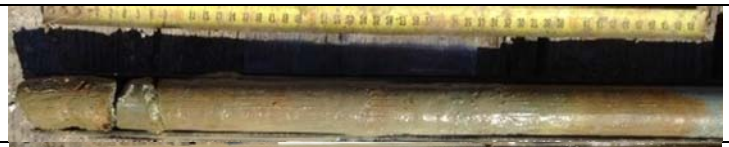
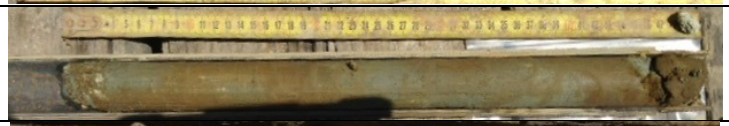
Approved:
Date:

# PHOTO LOG - SPT SAMPLES

**Borehole No:** **BH06**
Date Sampled: 23/10/2014

| DEPTH | Recovered Length | SPT | Sample Photo |
|---|---|---|---|
| 1.5m | 450mm | 10, 13, 13 N = 26 |  |
| 2.0m | 450mm | 7, 11, 13 N = 24 |  |
| 2.5m | 450mm | 7, 5, 6 N = 11 |  |
| 3.0m | 450mm | 5, 7, 9 N = 16 |  |
| 3.5m | 450mm | 8, 10, 12 N = 22 |  |

# PHOTO LOG - SPT SAMPLES

| | | | | |
|---|---|---|---|---|
| 4.0m | 450mm | 4, 5, 6, N = 11 | |  |
| 4.5m | 450mm | 5, 7, 8 N = 15 | |  |
| 5.0m | 450mm | 5, 7, 7, N = 14 | |  |
| 5.5m | 450mm | 5, 6, 8 N = 14 | |  |
| 6.0m | 450mm | 6, 6, 9 N = 15 | |  |

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# BOREHOLE RECORD SHEET

**Location Number: BH 07**

Project Number: 114-16581
Project Name: Sediment Basin Assessment
Location: Aquatic Paradise Canal Estate
Client: Redland City Council
Date: 24/10/2014



Easting: 521728 Northing: 6959726 RL: -3.0 m
Logger: MD Operator: MD Machine: EVH2100

| Drilling Method (TC / WB / RR / NMLC / Casing) | Depth | Graphic | Description | Samples and Remarks |
|---|---|---|---|---|
| | | | Silty CLAY (CH) Very soft, high plasticity, dark grey. | U50 PP=0 |
| | 0.70 | | | |
| | 1.0 1.00 | | Sandy Silty CLAY (CH) Hard, high plasticity, grey and light grey, fine to medium grained sand, moist. | SPT 7, 7, 17 N=24 |
| | | | Sandy Silty CLAY (CH) Hard, high plasticity, fine to medium grained sand, with some Siltstone bands, moist. | |
| | 2.0 | | | SPT 18, 30/150mm |
| | 3.0 | | | SPT 16, 15, 27 N=42 |
| | 4.0 | | | SPT 18, 30/130mm |
| | 4.70 | | SILTSTONE (XW) Extremely weathered, grey and light grey, with some bands of hard clay. | |
| | 5.0 | | | SPT 30/135mm |
| | 5.30 | | SILTSTONE (XW-DW) Extremely to distinctly weathered, weak grey mottled red brown. | |
| | 6.0 6.00 | | | |
| | | | BOREHOLE BH 07 TERMINATED AT 6.00 m | SPT 30/80mm |
| | 7.0 | | | |
| | 8.0 | | | |
| | 9.0 | | | |
| | 10.0 | | | |

Comments:
1) Drilled off barge.

Water First Noted  Water Steady Level

**Weathering Grades**
RS - Residual Soil
XW - Extremely weathered
DW - Distinctly weathered
SW - Slightly weathered
FR - Fresh

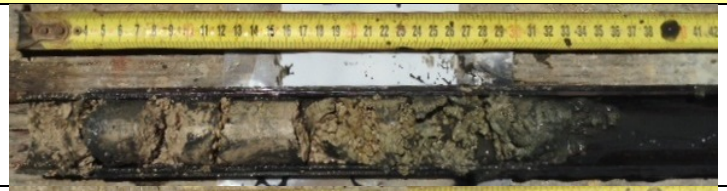
**Rock Strength**
VW - Very weak
W - Weak
MS - Medium strong
S - Strong
VS - Very strong
ES - Extremely strong

**Samples**
U50
SPT
Disturbed Sample

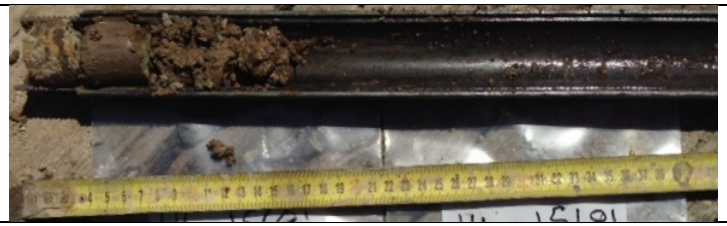
Approved:
Date:

# PHOTO LOG - SPT SAMPLES

**Borehole No:** **BH07**
Date Sampled: 24/10/2014

| DEPTH | Recovered Length | SPT | Sample Photo |
|---|---|---|---|
| 0.7m | 450mm | 7, 7, 17 N = 24 |  |
| 2.0m | 300mm | 18, 30/150mm |  |
| 3.0m | 450mm | 16, 15, 27 N = 42 |  |
| 4.0m | 280mm | 18, 30/130mm |  |
| 5.0m | 135mm | 30/135mm |  |

# PHOTO LOG - SPT SAMPLES

| | | | | | |
|---|---|---|---|---|---|
| 6.0m | 80mm | 30/80mm | |  | |

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# BOREHOLE RECORD SHEET

**Location Number: BH 08**

Project Number: 114-16581
Project Name: Sediment Basin Assessment
Location: Aquatic Paradise Canal Estate
Client: Redland City Council
Date: 24/10/2014



Easting: 521705 Northing: 6959654 RL: -3.0 m
Logger: MD Operator: MD Machine: EVH2100

| Drilling Method (TC / WB / RR / NMLC / Casing) | Depth | Graphic | Description | Weathering | Strength (Estimated: RS/XW/W/MS/S/VS/ES) | Defect Spacing (20 60 200 600) | Rec (%) | RQD | Samples and Remarks |
|---|---|---|---|---|---|---|---|---|---|
| | 0.0 | | Silty CLAY (CH) Very soft, high plasticity, dark grey. | | | | | | U50 PP=Nil |
| | 1.0 | | | | | | | | |
| | 1.25 | | Silty CLAY (CH) Stiff, high plasticity, grey and light grey mottled orange brown, with fine to coarse grained sand, moist. | | | | | | U50 PP=40 |
| | 2.0 | | | | | | | | U50 PP=140 |
| | 2.00 | | Silty CLAY (CH) Firm, high plasticity, grey and light grey mottled orange brown, with fine to coarse grained sand, moist. | | | | | | U50 PP=60 |
| | 2.70 | | | | | | | | |
| | 3.0 | | Sandy GRAVEL (GS) Medium dense, fine to medium sized gravel, grey mottled orange brown, fine to coarse grained sand, moist. | | | | | | SPT 6, 30/50mm |
| | 3.15 | | BASALT (XW) Extremely weathered, very weak to weak, red brown with yellow brown. | | | | | | |
| | 3.60 | | | | | | | | |
| | 4.0 | | BASALT (DW) Distinctly weathered, weak to moderately strong, red brown, fractured vesicles, some clay infill. | DW | | | 100 | 14 | |
| | 5.0 | | | | | | | | |
| | 6.0 | | | | | | 100 | 0 | |
| | 6.00 | | BOREHOLE BH 08 TERMINATED AT 6.00 m | | | | | | |
| | 7.0 | | | | | | | | |
| | 8.0 | | | | | | | | |
| | 9.0 | | | | | | | | |
| | 10.0 | | | | | | | | |

Comments:
1) Drilled off barge.

Chainage :m Offset : m
Water First Noted Water Steady Level

**Defects - 1.54m : F,60°,P,R,O,C**

Depth (m) | Type | Dip (deg) | Planarity | Roughness | Aperature | Infill

Type: B - Bedding; C - Clay seam; F - Foliation; H - Schistosity; J - Joint; L - Cleavage; R - Fracture; S - Shear zone; T - Contact; V - Vein; Z - Decomposed Zone; DI - Drilling Induced break
Planarity: C - Curvilinear; D - Discontinuous; P - Planar; S - Subplanar; T - Stepped; U - Undulating
Roughness: L - Slickensides; P - Polished; R - Rough; S - Smooth; V - Very rough
Aperature: C - Closed; F - Filled; N - Clean; O - Open; S - Stain
Infill: C - Clay; F - Iron Oxide; K - Calcite; L - Limonite; Q - Quartz; S- Secondary mineral; U - Unidentified mineral; W - Weathered rock; X - Carbonaceous; Z - Clean

**Weathering Grades**
RS - Residual Soil
XW - Extremely weathered
DW - Distinctly weathered
SW - Slightly weathered
FR - Fresh

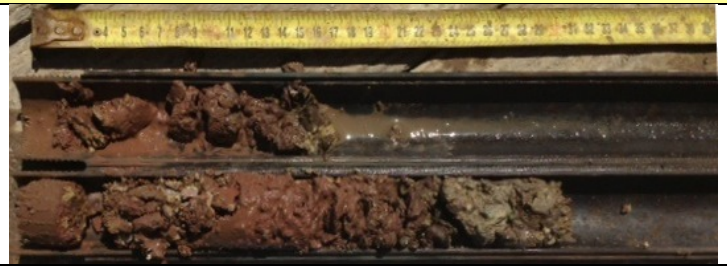
**Rock Strength**
VW - Very weak
W - Weak
MS - Medium strong
S - Strong
VS - Very strong
ES - Extremely strong

**Samples**
U50
SPT
Disturbed Sample

Approved:
Date:

# PHOTO LOG - SPT SAMPLES

**Borehole No:** **BH08**
Date Sampled: 24/10/2014

| DEPTH | Recovered Length | SPT | Sample Photo |
|---|---|---|---|
| 3.0m | 200mm | 6, 30/50mm |  |

Project No. 1-16581
Client: Redland City Council
Project: Sediment Basin Assessment
Site: Aquatic Paradise Canal Estate - Birkdale

**Borehole 8 - Core box 1 of 1**
**3.6m - 6m.**

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SOIL SURVEYS

# BOREHOLE RECORD SHEET

**Location Number: BH 09**

Project Number: 114-16581
Project Name: Sediment Basin Assessment
Location: Aquatic Paradise Canal Estate
Client: Redland City Council
Date: 06/11/2014



Easting: 521737 Northing: 6959507 RL: -3.1 m
Logger: MD Operator: MD Machine: EVH2100

| Drilling Method (TC / WB / RR / NMLC / Casing) | Depth | Graphic | Description | Samples and Remarks |
|---|---|---|---|---|
| WB | 0.0 | | Silty CLAY (CH) Very soft, high plasticity, dark grey. | U50 PP=Nil Recovery |
| WB | 1.0 | | | U50 PP=0.0 |
| WB | 1.60 | | | U50 PP=0.0 |
| WB | 2.0 | | Sandy Silty CLAY (CH) Firm, high plasticity, grey mottled orange brown, fine to coarse grained sand, moist. | U50 PP=50 |
| WB | 2.00 | | Sandy Silty CLAY (CH) Soft, high plasticity, grey, fine to medium grained sand, with shell, moist. | |
| WB | 3.0 | | | U50 PP=Nil Recovery |
| WB | 3.50 | | Silty Clayey SAND (SC) Very loose, fine to medium grained, grey, high plasticity clay fines, with shell, interbedded layers of soft Sandy Clay. | SPT 0, 0, 0 N=0 |
| WB | 4.0 | | | SPT 0, 0, 0 N=0 |
| WB | 5.0 | | | SPT 0, 0, 0 N=0 |
| WB | 6.0 | | | |
| WB | 6.00 | | BOREHOLE BH 09 TERMINATED AT 6.00 m | SPT 0, 0, 0 N=0 |
| | 7.0 | | | |
| | 8.0 | | | |
| | 9.0 | | | |
| | 10.0 | | | |

Comments:
1) Drilled off barge.

Water First Noted  Water Steady Level

**Weathering Grades**
RS - Residual Soil
XW - Extremely weathered
DW - Distinctly weathered
SW - Slightly weathered
FR - Fresh

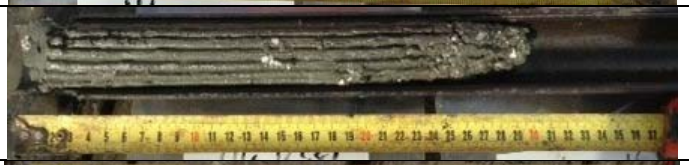
**Rock Strength**
VW - Very weak
W - Weak
MS - Medium strong
S - Strong
VS - Very strong
ES - Extremely strong

**Samples**
U50
SPT
Disturbed Sample

Approved:
Date:

# PHOTO LOG - SPT SAMPLES

**Borehole No:** **BH09**
Date Sampled: 06/11/2014

| DEPTH | Recovered Length | SPT | Sample Photo |
|---|---|---|---|
| 3.5m | 450mm | 0, 0, 0 N = 0 |  |
| 4.0m | 450mm | 0, 0, 0 N = 0 |  |
| 5.0m | 450mm | 0, 0, 0 N = 0 |  |
| 6.0m | 450mm | 0, 0, 0 N = 0 |  |

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# BOREHOLE RECORD SHEET

**Location Number: BH 10**

Project Number: 114-16581
Project Name: Sediment Basin Assessment
Location: Aquatic Paradise Canal Estate
Client: Redland City Council
Date: 28/10/2014



Easting: 521716 Northing: 6959441 RL: -3.1 m
Logger: MD Operator: MD Machine: EVH2100

| Drilling Method (TC / WB / RR / NMLC / Casing) | Depth | Graphic | Description | Samples and Remarks |
|---|---|---|---|---|
| | 0.0 | | Silty CLAY (CH) Very soft, high plasticity, dark grey. | U50 PP=0 |
| | 1.0 | | | |
| | 1.10 | | | |
| | 1.20 | | Silty Clayey SAND (SC) Medium dense, fine to medium grained sand, grey mottled orange brown, high plasticity clay and silt fines, moist. | SPT 5, 7, 4 N=11 |
| | | | Silty CLAY (CH) Very stiff, high plasticity, grey mottled red and orange brown, trace of fine to medium grained sand, moist. | |
| | 2.0 | | | SPT 3, 3, 4 N=7 |
| | 2.50 | | Silty CLAY (CH) Hard, high plasticity, grey mottled red and orange brown, trace of fine to medium grained sand, with fine to coarse grained sand, moist. | SPT 3, 4, 4 N=8 |
| | 3.0 | | | SPT 3, 3, 6 N=9 |
| | 4.0 | | | SPT 3, 4, 7 N=11 |
| | | | | U50 PP=320 |
| | 4.50 | | Clayey SAND (SC) Medium dense, fine to medium grained sand, grey mottled orange brown, high plasticity clay fines, moist. | SPT 7, 13, 13 N=26 |
| | 5.0 | | | |
| | 5.00 | | Sandy Silty CLAY (CH) Hard, high plasticity, light grey green mottled red and orange brown, fine to medium grained sand, moist. | SPT 7, 10, 16 N=26 |
| | | | | SPT 6, 10, 20 N=30 |
| | 6.0 | | | |
| | 6.00 | | BOREHOLE BH 10 TERMINATED AT 6.00 m | SPT 10, 12, 25 N=37 |
| | 7.0 | | | |
| | 8.0 | | | |
| | 9.0 | | | |
| | 10.0 | | | |

Comments:
1) Drilled off barge.

Water First Noted  Water Steady Level

**Weathering Grades**
RS - Residual Soil
XW - Extremely weathered
DW - Distinctly weathered
SW - Slightly weathered
FR - Fresh

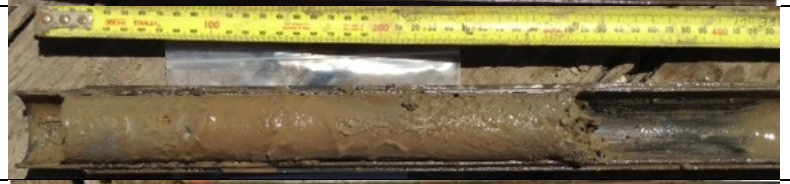
**Rock Strength**
VW - Very weak
W - Weak
MS - Medium strong
S - Strong
VS - Very strong
ES - Extremely strong

**Samples**
U50
SPT
Disturbed Sample

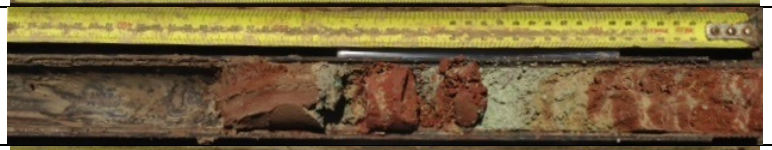
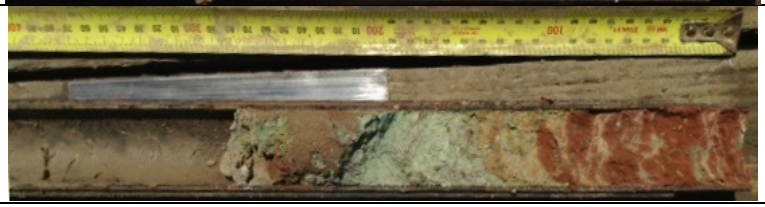
Approved:
Date:

# PHOTO LOG - SPT SAMPLES

**Borehole No:** **BH10**
Date Sampled: 28/10/2014

| DEPTH | Recovered Length | SPT | Sample Photo |
|---|---|---|---|
| 1.0m | 450mm | 5, 7, 4 N = 11 |  |
| 2.0m | 450mm | 3, 3, 4 N = 7 |  |
| 2.5m | 450mm | 3, 4, 4 N = 8 |  |
| 3.0m | 450mm | 3, 3, 6 N = 9 |  |
| 3.6m | 450mm | 3, 4, 7 N = 11 |  |
| 4.5m | 450mm | 7, 13, 13 N = 26 |  |

# PHOTO LOG - SPT SAMPLES

| | | | | |
|---|---|---|---|---|
| 5.0m | 450mm | 7, 10, 16 N = 26 | |  |
| 5.5m | 450mm | 6, 10, 20 N = 30 | |  |
| 6.0m | 450mm | 10, 12, 25 N = 37 | |  |

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# BOREHOLE RECORD SHEET

**Location Number: BH 11**

Project Number: 114-16581
Project Name: Sediment Basin Assessment
Location: Aquatic Paradise Canal Estate
Client: Redland City Council
Date: 28/10/2014



Easting: 521784 Northing: 6959257 RL: -2.95 m
Logger: MD Operator: MD Machine: EVH2100

| Drilling Method (TC / WB / RR / NMLC / Casing) | Depth | Graphic | Description | Samples and Remarks |
|---|---|---|---|---|
| WB | 0.80 | | Silty CLAY (CH) Very soft, high plasticity, dark grey. | |
| WB | 1.20 | | Sandy Silty CLAY (CH) Very stiff, high plasticity, grey mottled light grey, fine to coarse grained sand, moist. | SPT 2, 2, 4 N=6 |
| WB | 3.70 | | Sandy Silty CLAY (CH) Very stiff, high plasticity, grey mottled orange brown, fine to coarse grained sand, moist. | SPT 4, 4, 6 N=10<br>SPT 4, 8, 9 N=17 |
| WB | 5.00 | | Clayey SAND (SC) Medium dense, fine to medium grained sand, grey mottled orange brown, medium plasticity clay fines, moist. | SPT 3, 4, 7 N=11 |
| | | | BOREHOLE BH 11 TERMINATED AT 5.00 m | SPT 5, 7, 9 N=16 |

Comments:
1) Drilled off barge.

Water First Noted  Water Steady Level

**Weathering Grades**
RS - Residual Soil
XW - Extremely weathered
DW - Distinctly weathered
SW - Slightly weathered
FR - Fresh

**Rock Strength**
VW - Very weak
W - Weak
MS - Medium strong
S - Strong
VS - Very strong
ES - Extremely strong

**Samples**
U50
SPT
Disturbed Sample

Approved:
Date:

# PHOTO LOG - SPT SAMPLES

**Borehole No:** **BH11**
Date Sampled: 28/10/2014

| DEPTH | Recovered Length | SPT | Sample Photo |
|---|---|---|---|
| 1.0m | 450mm | 2, 2, 4 N = 6 |  |
| 2.0m | 450mm | 4, 4, 6 N = 10 |  |
| 3.0m | 450mm | 4, 8, 9 N = 17 |  |
| 4.0m | 450mm | 3, 4, 7 N = 11 |  |
| 5.0m | 450mm | 5, 7, 9 N = 16 |   |

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SOIL SURVEYS

# BOREHOLE RECORD SHEET

**Location Number: BH 12**

Project Number: 114-16581
Project Name: Sediment Basin Assessment
Location: Aquatic Paradise Canal Estate
Client: Redland City Council
Date: 29/10/2014



Easting: 521600 Northing: 6959419 RL: -3.1 m
Logger: MD Operator: MD Machine: EVH2100

| Drilling Method (TC / WB / RR / NMLC / Casing) | Depth | Graphic | Description | Samples and Remarks |
|---|---|---|---|---|
| WB | 0.00 | | Silty CLAY (CH) Very soft, high plasticity, dark grey. | U50 PP=0.0 |
| WB | 0.50 | | Clayey Sandy GRAVEL (GP) Medium dense, fine sized gravel, grey mottled orange brown, fine to coarse grained sand, high plasticity clay fines, moist. | SPT 6, 10, 16 N=26 |
| WB | 1.0 | | | SPT 7, 30/145mm |
| WB | 2.00 | | Clayey SAND (SC) Medium dense, fine to coarse grained, grey mottled orange brown, high plasticity clay fines, moist. | SPT 7, 10, 10 N=20 |
| WB | 3.0 | | | SPT 19, 19, 19 N=38 |
| WB | 3.50 | | Clayey SAND (SC) Medium dense, fine to coarse grained, grey mottled red brown, high plasticity clay fines, moist. | |
| WB | 4.0 | | | |
| WB | 4.50 | | BOREHOLE BH 12 TERMINATED AT 4.50 m | SPT 15, 16, 17 N=33 |
| | 5.0 | | | |
| | 6.0 | | | |
| | 7.0 | | | |
| | 8.0 | | | |
| | 9.0 | | | |
| | 10.0 | | | |

Comments:
1) Drilled off barge.

Water First Noted Water Steady Level

**Weathering Grades**
RS - Residual Soil
XW - Extremely weathered
DW - Distinctly weathered
SW - Slightly weathered
FR - Fresh

**Rock Strength**
VW - Very weak
W - Weak
MS - Medium strong
S - Strong
VS - Very strong
ES - Extremely strong

**Samples**
U50
SPT
Disturbed Sample

Approved:
Date:

# PHOTO LOG - SPT SAMPLES

**Borehole No:** **BH12**
Date Sampled: 29/10/2014

| DEPTH | Recovered Length | SPT | Sample Photo |
|---|---|---|---|
| 0.5m | 450mm | 6, 10, 16 N = 26 |  |
| 1.0m | 295mm | 7, 30/145mm | No Photo |
| 2.0m | 450mm | 7, 10, 10 N = 20 |  |
| 3.0m | 450mm | 19, 19, 19 N = 38 |  |
| 4.3m | 450mm | 15, 16, 17 N = 33 |  |

# APPENDIX C

# LABORATORY TEST CERTIFICATES

**Helensvale Lab**
**Gold Coast**
Unit 8, 140 Millaroo Drive
Helensvale QLD 4212
Australia
Ph:+61 7 5502 6795
Fax:+61 7 5502 6724

SOIL SURVEYS

# Material Test Report

**Report No: MAT:WHL14-1507-S1**
**Issue No: 1**

**Client:** Redland City Council
C/O 2/19 Finchley Street
Milton QLD 4064

**Project:** Revetment Wall Investigation

**Project Location:** Aquatic Paradise Canal Estate

**Project Number:** 1-16581

This document is issued in accordance with NATA's accreditation requirements.

NATA Accredited Laboratory Number: 15301

Approved Signatory: C.Ferguson-Hannah (Senior Technician)
Date of Issue: 24/11/2014



## Sample Details

**Sample ID:** WHL14-1507-S1
**Field Sample ID:**
**Date Sampled:** 21/10/2014
**Source:** Borehole
**Material:**
**Specification:** Grading
**Sampling Method:** As Supplied
**Soil Description:**
**Sampled By:** SSE
**Location Description:** BH2
0.0m

## Other Test Results

| Description | Method | Result | Limits |
|---|---|---|---|
| Moisture Content [AS 1289.2.1.1] | | | |
| Moisture Content (%) | | 121 | |
| Date Tested | | 13/11/2014 | |
| Atterberg Limits Casagrande [AS 1289.3.1.2, AS 1289.3.2.1, AS 1289.3.3.1, AS 1289.3.4.1] | | | |
| Sample History | AS 1289.1.1 | Air-dried | |
| Preparation | AS 1289.1.1 | Dry Sieved | |
| Linear Shrinkage (%) | AS 1289.3.4.1 | 23.0 | |
| Mould Length (mm) | | 125.3 | |
| Crumbling | | No | |
| Curling | | No | |
| Liquid Limit (%) | AS 1289.3.1.2 | 96 | |
| Method | | One Point | |
| Plastic Limit (%) | AS 1289.3.2.1 | 37 | |
| Plasticity Index (%) | AS 1289.3.3.1 | 59 | |
| Date Tested | | 18/11/2014 | |

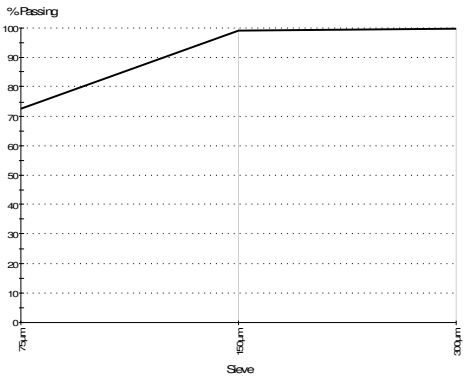
## Particle Size Distribution

**Method:** Grading [AS 1289.3.6.1]

**Date Tested:** 20/11/2014
**Note:** Sample Washed

| Sieve Size | % Passing | Limits |
|---|---|---|
| 300µm | 100 | |
| 150µm | 99 | |
| 75µm | 73 | |

## Chart




## Comments

DESCRIPTION: SANDY CLAY(CH) DARK GREY
UNIT WEIGHT: 1.30 t/m3
BULK DENSITY: 0.54 t/m3

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SOIL SURVEYS

# Material Test Report

Report No: MAT:WHL14-1507-S2
Issue No: 1

Client: Redland City Council
C/O 2/19 Finchley Street
Milton QLD 4064

Project: Revetment Wall Investigation

Project Location: Aquatic Paradise Canal Estate

Project Number: 1-16581

This document is issued in accordance with NATA's accreditation requirements.

NATA Accredited Laboratory Number: 15301

Approved Signatory: C.Ferguson-Hannah (Senior Technician)
Date of Issue: 24/11/2014



## Sample Details

| | |
|---|---|
| Sample ID: | WHL14-1507-S2 |
| Field Sample ID: | |
| Date Sampled: | 21/10/2014 |
| Source: | Borehole |
| Material: | |
| Specification: | Grading |
| Sampling Method: | As Supplied |
| Soil Description: | |
| Sampled By: | SSE |
| Location Description: | BH2 |
| | 1.0m |

## Other Test Results

| Description | Method | Result | Limits |
|---|---|---|---|
| Moisture Content [AS 1289.2.1.1] | | | |
| Moisture Content (%) | | 121 | |
| Date Tested | | 13/11/2014 | |
| Atterberg Limits Casagrande [AS 1289.3.1.2, AS 1289.3.2.1, AS 1289.3.3.1, AS 1289.3.4.1] | | | |
| Sample History | AS 1289.1.1 | Air-dried | |
| Preparation | AS 1289.1.1 | Dry Sieved | |
| Linear Shrinkage (%) | AS 1289.3.4.1 | 23.0 | |
| Mould Length (mm) | | 124.9 | |
| Crumbling | | No | |
| Curling | | No | |
| Liquid Limit (%) | AS 1289.3.1.2 | 100 | |
| Method | | One Point | |
| Plastic Limit (%) | AS 1289.3.2.1 | 28 | |
| Plasticity Index (%) | AS 1289.3.3.1 | 72 | |
| Date Tested | | 18/11/2014 | |

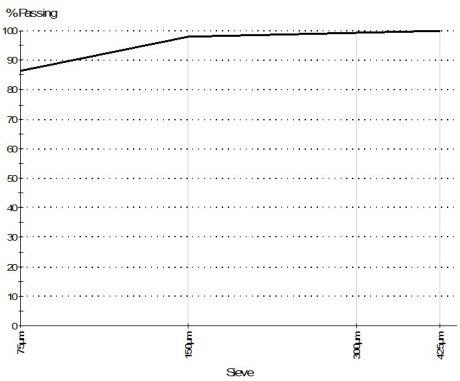
## Particle Size Distribution

Method: Grading [AS 1289.3.6.1]

Date Tested: 20/11/2014
Note: Sample Washed

| Sieve Size | % Passing | Limits |
|---|---|---|
| 425µm | 100 | |
| 300µm | 99 | |
| 150µm | 98 | |
| 75µm | 86 | |

## Chart




## Comments

DESCRIPTION: SANDY CLAY(CH) DARK GREY
UNIT WEIGHT: 1.36 t/m3
BULK DENSITY: 0.66 t/m3

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SOIL SURVEYS

# Material Test Report

Report No: MAT:WHL14-1507-S3
Issue No: 1

Client: Redland City Council
C/O 2/19 Finchley Street
Milton QLD 4064

Project: Revetment Wall Investigation

Project Location: Aquatic Paradise Canal Estate

Project Number: 1-16581

This document is issued in accordance with NATA's accreditation requirements.

NATA Accredited Laboratory Number: 15301

Approved Signatory: C.Ferguson-Hannah
(Senior Technician)
Date of Issue: 24/11/2014



## Sample Details

| | |
|---|---|
| Sample ID: | WHL14-1507-S3 |
| Field Sample ID: | |
| Date Sampled: | 21/10/2014 |
| Source: | Borehole |
| Material: | |
| Specification: | Grading |
| Sampling Method: | As Supplied |
| Soil Description: | |
| Sampled By: | SSE |
| Location Description: | BH2 2.0m |

## Other Test Results

| Description | Method | Result | Limits |
|---|---|---|---|
| Moisture Content [AS 1289.2.1.1] | | | |
| Moisture Content (%) | | 100.0 | |
| Date Tested | | 13/11/2014 | |
| Atterberg Limits Casagrande [AS 1289.3.1.2, AS 1289.3.2.1, AS 1289.3.3.1, AS 1289.3.4.1] | | | |
| Sample History | AS 1289.1.1 | Air-dried | |
| Preparation | AS 1289.1.1 | Dry Sieved | |
| Linear Shrinkage (%) | AS 1289.3.4.1 | 24.0 | |
| Mould Length (mm) | | 125 | |
| Crumbling | | No | |
| Curling | | No | |
| Liquid Limit (%) | AS 1289.3.1.2 | 100 | |
| Method | | One Point | |
| Plastic Limit (%) | AS 1289.3.2.1 | 27 | |
| Plasticity Index (%) | AS 1289.3.3.1 | 73 | |
| Date Tested | | 18/11/2014 | |

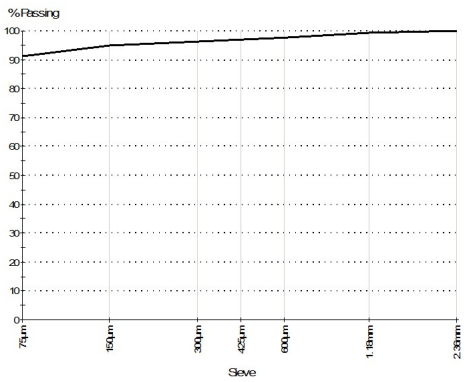
## Particle Size Distribution

Method: Grading [AS 1289.3.6.1]

Date Tested: 20/11/2014
Note: Sample Washed

| Sieve Size | % Passing | Limits |
|---|---|---|
| 2.36mm | 100 | |
| 1.18mm | 99 | |
| 600µm | 98 | |
| 425µm | 97 | |
| 300µm | 96 | |
| 150µm | 95 | |
| 75µm | 91 | |

## Chart




## Comments

DESCRIPTION: CLAY(CH) DARK GREY, SOME SAND
UNIT WEIGHT: 1.47 t/m3
BULK DENSITY: 0.75 t/m3

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SOIL SURVEYS

# Material Test Report

Report No: MAT:WHL14-1507-S4
Issue No: 1

Client: Redland City Council
C/O 2/19 Finchley Street
Milton QLD 4064

Project: Revetment Wall Investigation

Project Location: Aquatic Paradise Canal Estate

Project Number: 1-16581

This document is issued in accordance with NATA's accreditation requirements.

NATA Accredited Laboratory Number: 15301

Approved Signatory: C.Ferguson-Hannah (Senior Technician)
Date of Issue: 24/11/2014



## Sample Details

| | |
|---|---|
| Sample ID: | WHL14-1507-S4 |
| Field Sample ID: | |
| Date Sampled: | 21/10/2014 |
| Source: | Borehole |
| Material: | |
| Specification: | Grading |
| Sampling Method: | As Supplied |
| Soil Description: | |
| Sampled By: | SSE |
| Location Description: | BH2 3.0m |

## Other Test Results

| Description | Method | Result | Limits |
|---|---|---|---|
| Moisture Content [AS 1289.2.1.1] | | | |
| Moisture Content (%) | | 48.8 | |
| Date Tested | | 17/11/2014 | |
| Atterberg Limits Casagrande [AS 1289.3.1.2, AS 1289.3.2.1, AS 1289.3.3.1, AS 1289.3.4.1] | | | |
| Sample History | AS 1289.1.1 | Air-dried | |
| Preparation | AS 1289.1.1 | Dry Sieved | |
| Linear Shrinkage (%) | AS 1289.3.4.1 | 21.0 | |
| Mould Length (mm) | | 125.2 | |
| Crumbling | | No | |
| Curling | | No | |
| Liquid Limit (%) | AS 1289.3.1.2 | 88 | |
| Method | | One Point | |
| Plastic Limit (%) | AS 1289.3.2.1 | 27 | |
| Plasticity Index (%) | AS 1289.3.3.1 | 61 | |
| Date Tested | | 18/11/2014 | |

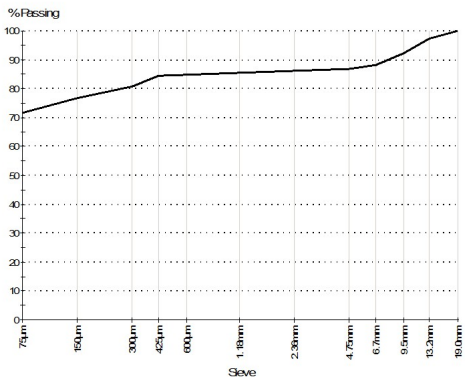
## Particle Size Distribution

Method: Grading [AS 1289.3.6.1]

Date Tested: 20/11/2014
Note: Sample Washed

| Sieve Size | % Passing | Limits |
|---|---|---|
| 19.0mm | 100 | |
| 13.2mm | 97 | |
| 9.5mm | 92 | |
| 6.7mm | 88 | |
| 4.75mm | 87 | |
| 2.36mm | 86 | |
| 1.18mm | 86 | |
| 600µm | 85 | |
| 425µm | 84 | |
| 300µm | 81 | |
| 150µm | 77 | |
| 75µm | 71 | |

## Chart




## Comments

DESCRIPTION: SILTY CLAY(CH) GREY, SOME SAND AND GRAVEL
UNIT WEIGHT: 1.87 t/m3
BULK DENSITY: 1.26 t/m3

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**Unit 8, 140 Millaroo Drive**
**HELENSVALE QLD 4212**
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FAX 07 55026724

SOIL SURVEYS

# TRIAXIAL TEST REPORT

| | | | |
|---|---|---|---|
| Client: | **Redland City Council** | Report Number: | WHL14-1507-S4 TRI |
| Address: | **C/O 2/19 Finchley Street, Milton, QLD, 4064** | Report Date: | 19/11/2014 |
| Job Number: | **1-16581** | Order Number: | |
| Project: | **Revetment Wall Investigation** | Test Methods: | AS1289 6.4.2, 2.1.1 |
| Location: | **Aquatic Paradise Canal Estate** | | |

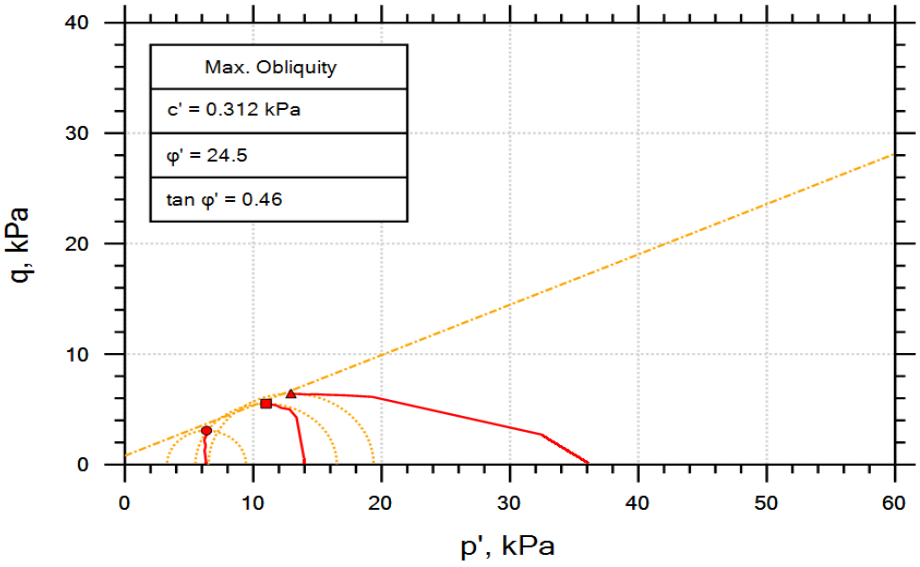


| | | |
|---|---|---|
| Lab Number: | S4 | Sample Identification |
| Date Sampled: | 21/10/2014 | LOCATION: BH2 |
| Date Tested: | 17/11/2014 | |
| Sampling Method: | U50 | DEPTH: 3.0-3.1m |
| Description: | SILTY CLAY(CH) GREY, SOME SAND AND GRAVEL | |

**SAMPLE DETAILS**

| | | | | | |
|---|---|---|---|---|---|
| Initial Height(mm): | 100.0 | Initial Moisture Content(%): | 48.9 | Rate of Strain(%/min): | 0.10 |
| Initial Diameter(mm): | 47.5 | Final Moisture Content(%): | 48.4 | B Value: | 0.99 |
| D/L Ratio: | 2:1 | Wet Density(t/m$^3$): | 1.87 | Failure Criteria: | Peak Principle Stress Ratio |
| | | Dry Density(t/m$^3$): | 1.26 | | |

**Mohr Circle Diagram**




**Cohesion C' (kPa): 0.3**

**Angle of Shear Resistance ϕ' (Degrees): 24.5**

Remarks: PP 0-10

SOIL SURVEYS



Approved Signatory

C.Ferguson-Hannah

Form Number

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SOIL SURVEYS

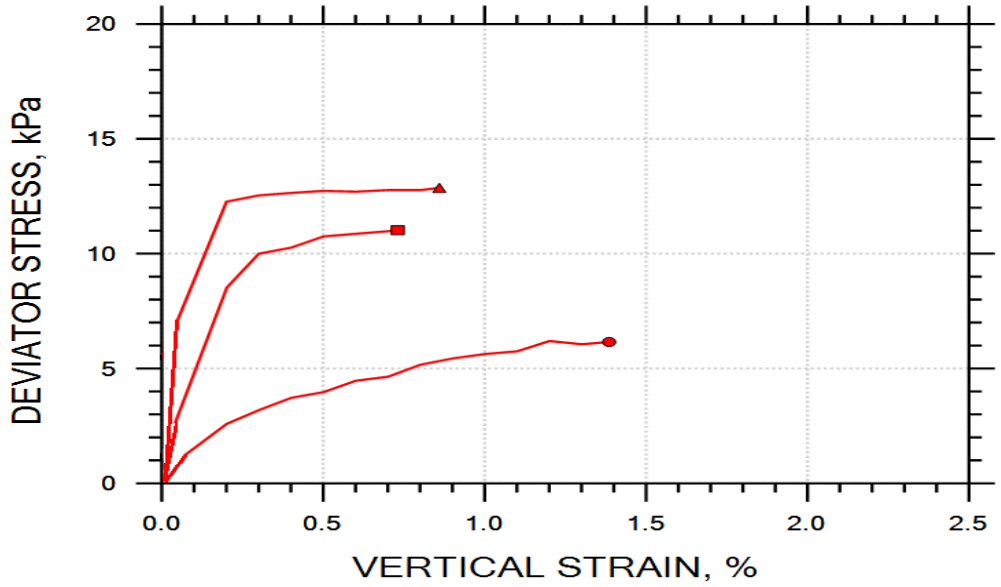
# TRIAXIAL TEST REPORT

| | | | |
|---|---|---|---|
| Client: | **Redland City Council** | Report Number: | WHL14-1507-S4 TRI |
| Address: | **C/O 2/19 Finchley Street, Milton, QLD, 4064** | Report Date: | 19/11/2014 |
| Job Number: | **1-16581** | Order Number: | |
| Project: | **Revetment Wall Investigation** | Test Methods: | AS1289 6.4.2, 2.1.1 |
| Location: | **Aquatic Paradise Canal Estate** | | |



| | | |
|---|---|---|
| Lab Number: | S4 | Sample Identification |
| Date Sampled: | 21/10/2014 | LOCATION: BH2 |
| Date Tested: | 17/11/2014 | |
| Sampling Method: | U50 | DEPTH: 3.0-3.1m |
| Description: | SILTY CLAY(CH) GREY, SOME SAND AND GRAVEL | |

**Stress / Strain Diagram**




| Stage: | Confining Pressure(kPa): | Failure Pore Pressure(kPa): | Principal Effective stresses(kPa): σ' 1 | Principal Effective stresses(kPa): σ' 3 | deviator Stress(kPa): | Strain(%) |
|---|---|---|---|---|---|---|
| 1 | 6.5 | 35 | 9 | 3 | 6 | 1.39 |
| 2 | 14 | 44 | 16 | 5 | 11 | 0.73 |
| 3 | 36 | 64 | 19 | 6 | 13 | 0.86 |

Remarks: PP 0-10



Approved Signatory

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Form Number

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SOIL SURVEYS

# TRIAXIAL TEST REPORT

| | | | |
|---|---|---|---|
| Client: | **Redland City Council** | Report Number: | WHL14-1507-S4 TRI |
| Address: | **C/O 2/19 Finchley Street, Milton, QLD, 4064** | Report Date: | 19/11/2014 |
| Job Number: | **1-16581** | Order Number: | |
| Project: | **Revetment Wall Investigation** | Test Methods: | AS1289 6.4.2, 2.1.1 |
| Location: | **Aquatic Paradise Canal Estate** | | |



| | | |
|---|---|---|
| Lab Number: | S4 | Sample Identification |
| Date Sampled: | 28/10/2014 | LOCATION: BH2 |
| Date Tested: | 17/11/2014 | |
| Sampling Method: | U50 | DEPTH: 3.0-3.1m |
| Description: | SILTY CLAY(CH)GREY SOME SAND AND GRAVEL | |

Remarks: PP 0-10



Approved Signatory

C.Ferguson-Hannah

Form Number

REP-TRI-01

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SOIL SURVEYS

# Material Test Report

Report No: MAT:WHL14-1507-S5
Issue No: 1

Client: Redland City Council
C/O 2/19 Finchley Street
Milton QLD 4064

Project: Revetment Wall Investigation

Project Location: Aquatic Paradise Canal Estate

Project Number: 1-16581

This document is issued in accordance with NATA's accreditation requirements.

NATA Accredited Laboratory Number: 15301

Approved Signatory: C.Ferguson-Hannah (Senior Technician)
Date of Issue: 24/11/2014



## Sample Details

| | |
|---|---|
| Sample ID: | WHL14-1507-S5 |
| Field Sample ID: | |
| Date Sampled: | 21/10/2014 |
| Source: | Borehole |
| Material: | |
| Specification: | Grading |
| Sampling Method: | As Supplied |
| Soil Description: | |
| Sampled By: | SSE |
| Location Description: | BH2 3.5m |

## Other Test Results

| Description | Method | Result | Limits |
|---|---|---|---|
| Moisture Content [AS 1289.2.1.1] | | | |
| Moisture Content (%) | | 35.3 | |
| Date Tested | | 18/11/2014 | |
| Atterberg Limits Casagrande [AS 1289.3.1.2, AS 1289.3.2.1, AS 1289.3.3.1, AS 1289.3.4.1] | | | |
| Sample History | AS 1289.1.1 | Air-dried | |
| Preparation | AS 1289.1.1 | Dry Sieved | |
| Linear Shrinkage (%) | AS 1289.3.4.1 | 14.0 | |
| Mould Length (mm) | | 125.3 | |
| Crumbling | | No | |
| Curling | | No | |
| Liquid Limit (%) | AS 1289.3.1.2 | 54 | |
| Method | | One Point | |
| Plastic Limit (%) | AS 1289.3.2.1 | 25 | |
| Plasticity Index (%) | AS 1289.3.3.1 | 29 | |
| Date Tested | | 22/11/2014 | |

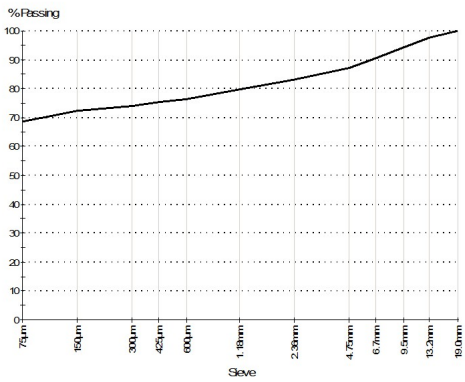
## Particle Size Distribution

Method: Grading [AS 1289.3.6.1]

Date Tested: 19/11/2014
Note: Sample Washed

| Sieve Size | % Passing | Limits |
|---|---|---|
| 19.0mm | 100 | |
| 13.2mm | 98 | |
| 9.5mm | 94 | |
| 6.7mm | 90 | |
| 4.75mm | 87 | |
| 2.36mm | 83 | |
| 1.18mm | 80 | |
| 600µm | 77 | |
| 425µm | 75 | |
| 300µm | 74 | |
| 150µm | 72 | |
| 75µm | 68 | |

## Chart




## Comments

DESCRIPTION: SILTY CLAY(CH) GREY BROWN, RED MOTTLE, SOME SAND AND GRAVEL
UNIT WEIGHT: 1.89 t/m3
BULK DENSITY: 1.40 t/m3

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**Unit 8, 140 Millaroo Drive**
**HELENSVALE QLD 4212**
**PHONE 07 55026795**
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SOIL SURVEYS

# TRIAXIAL TEST REPORT

| | | | |
|---|---|---|---|
| Client: | **Redland City Council** | Report Number: | WHL14-1507-S5 TRI |
| Address: | **C/O 2/19 Finchley Street, Milton, QLD, 4064** | Report Date: | 19/11/2014 |
| Job Number: | **1-16581** | Order Number: | |
| Project: | **Revetment Wall Investigation** | Test Methods: | AS1289 6.4.2, 2.1.1 |
| Location: | **Aquatic Paradise Canal Estate** | | |

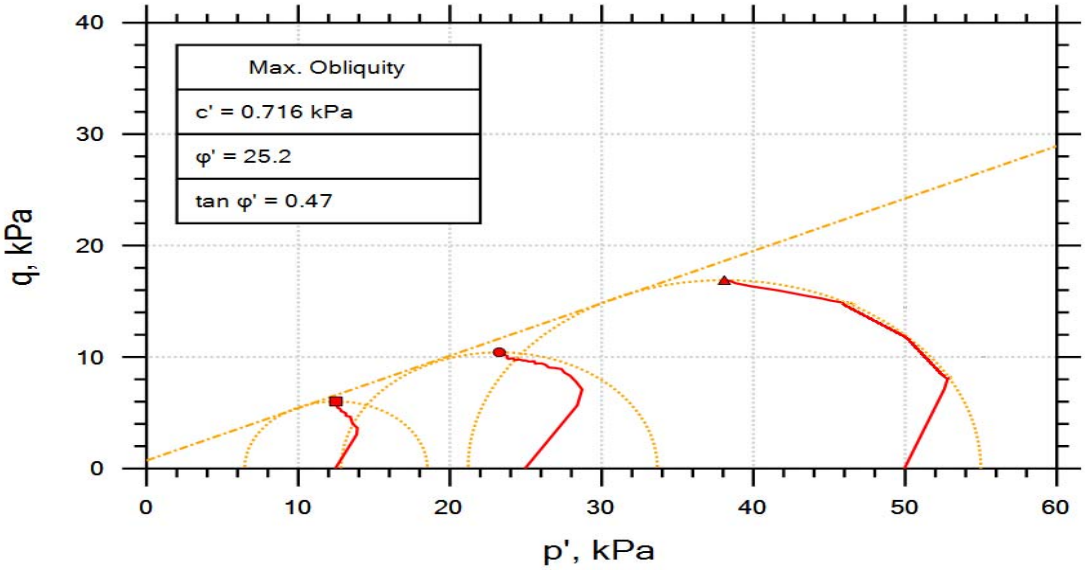


| | | |
|---|---|---|
| Lab Number: | S5 | Sample Identification |
| Date Sampled: | 21/10/2014 | LOCATION: BH2 |
| Date Tested: | 18/11/2014 | |
| Sampling Method: | U50 | DEPTH: 3.5-3.6m |
| Description: | SILTY CLAY(CH) GREY BROWN, RED MOTTLE, SOME SAND AND GRAVEL | |

**SAMPLE DETAILS**

| | | | | | |
|---|---|---|---|---|---|
| Initial Height(mm): | 100.0 | Initial Moisture Content(%): | 35.4 | Rate of Strain(%/min): | 0.08 |
| Initial Diameter(mm): | 47.5 | Final Moisture Content(%): | 33.5 | B Value: | 1.00 |
| D/L Ratio: | 2:1 | Wet Density(t/m$^3$): | 1.89 | Failure Criteria: | Peak Principle Stress Ratio |
| | | Dry Density(t/m$^3$): | 1.40 | | |

**Mohr Circle Diagram**




**Cohesion C' (kPa): 0.7**

**Angle of Shear Resistance ϕ' (Degrees): 25.2**

Remarks: PP 10-20

SOIL SURVEYS



Approved Signatory

C.Ferguson-Hannah

Form Number

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SOIL SURVEYS

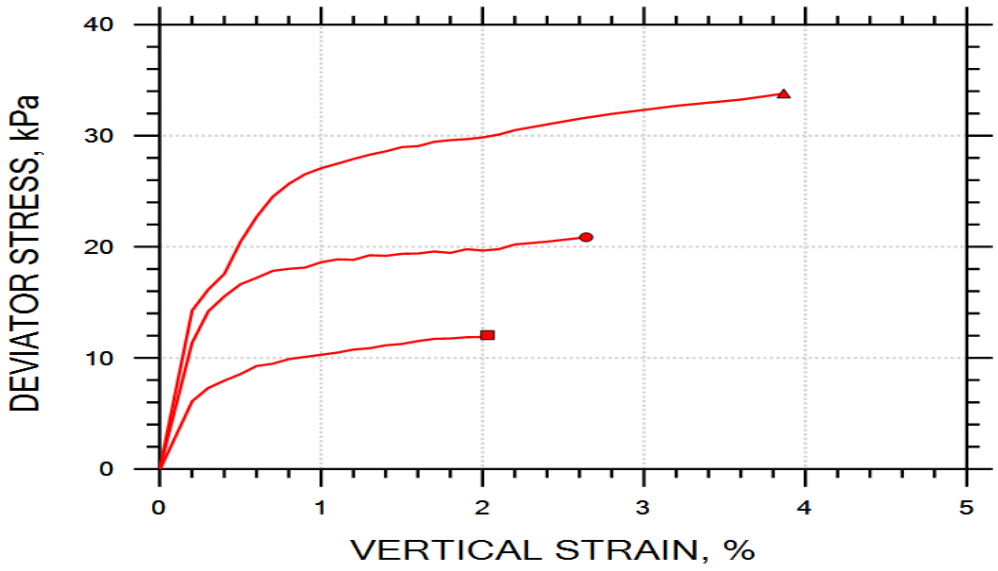
# TRIAXIAL TEST REPORT

| | | | |
|---|---|---|---|
| Client: | **Redland City Council** | Report Number: | WHL14-1507-S5 TRI |
| Address: | **C/O 2/19 Finchley Street, Milton, QLD, 4064** | Report Date: | 19/11/2014 |
| Job Number: | **1-16581** | Order Number: | |
| Project: | **Revetment Wall Investigation** | Test Methods: | AS1289 6.4.2, 2.1.1 |
| Location: | **Aquatic Paradise Canal Estate** | | |



| | | |
|---|---|---|
| Lab Number: | S5 | Sample Identification |
| Date Sampled: | 21/10/2014 | LOCATION: BH2 |
| Date Tested: | 18/11/2014 | |
| Sampling Method: | U50 | DEPTH: 3.5-3.6m |
| Description: | SILTY CLAY(CH) GREY BROWN, RED MOTTLE, SOME SAND AND GRAVEL | |

**Stress / Strain Diagram**




| Stage: | Confining Pressure(kPa): | Failure Pore Pressure(kPa): | Principal Effective stresses(kPa): σ' 1 | Principal Effective stresses(kPa): σ' 3 | deviator Stress(kPa): | Strain(%) |
|---|---|---|---|---|---|---|
| 1 | 12.5 | 42 | 19 | 7 | 12 | 2.03 |
| 2 | 25 | 54 | 34 | 13 | 21 | 2.64 |
| 3 | 50 | 83 | 55 | 21 | 34 | 3.87 |

Remarks: PP 10-20



Approved Signatory

C.Ferguson-Hannah

Form Number

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SOIL SURVEYS

# TRIAXIAL TEST REPORT

| | | | |
|---|---|---|---|
| Client: | **Redland City Council** | Report Number: | WHL14-1507-S5 TRI |
| Address: | **C/O 2/19 Finchley Street, Milton, QLD, 4064** | Report Date: | 19/11/2014 |
| Job Number: | **1-16581** | Order Number: | |
| Project: | **Revetment Wall Investigation** | Test Methods: | AS1289 6.4.2, 2.1.1 |
| Location: | **Aquatic Paradise Canal Estate** | | |



| | | |
|---|---|---|
| Lab Number: | S5 | Sample Identification |
| Date Sampled: | 21/10/2014 | LOCATION: BH2 |
| Date Tested: | 18/11/2014 | |
| Sampling Method: | U50 | DEPTH: 3.5-3.6m |
| Description: | SILTY CLAY(CH) GREY BROWN, RED MOTTLE, SOME SAND AND GRAVEL | |

Remarks: PP 10-20



Approved Signatory

C.Ferguson-Hannah

Form Number

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SOIL SURVEYS

# Material Test Report

Report No: MAT:WHL14-1507-S6
Issue No: 1

Client: Redland City Council
C/O 2/19 Finchley Street
Milton QLD 4064

Project: Revetment Wall Investigation

Project Location: Aquatic Paradise Canal Estate

Project Number: 1-16581

This document is issued in accordance with NATA's accreditation requirements.

NATA Accredited Laboratory Number: 15301

Approved Signatory: C.Ferguson-Hannah (Senior Technician)
Date of Issue: 24/11/2014



## Sample Details

| | |
|---|---|
| Sample ID: | WHL14-1507-S6 |
| Field Sample ID: | |
| Date Sampled: | 21/10/2014 |
| Source: | Borehole |
| Material: | |
| Specification: | Grading |
| Sampling Method: | As Supplied |
| Soil Description: | |
| Sampled By: | SSE |
| Location Description: | BH2 4.0m |

## Other Test Results

| Description | Method | Result | Limits |
|---|---|---|---|
| Moisture Content [AS 1289.2.1.1] | | | |
| Moisture Content (%) | | 51.5 | |
| Date Tested | | 13/11/2014 | |
| Atterberg Limits Casagrande [AS 1289.3.1.2, AS 1289.3.2.1, AS 1289.3.3.1, AS 1289.3.4.1] | | | |
| Sample History | AS 1289.1.1 | Air-dried | |
| Preparation | AS 1289.1.1 | Dry Sieved | |
| Linear Shrinkage (%) | AS 1289.3.4.1 | 11.5 | |
| Mould Length (mm) | | 125.2 | |
| Crumbling | | No | |
| Curling | | No | |
| Liquid Limit (%) | AS 1289.3.1.2 | 64 | |
| Method | | One Point | |
| Plastic Limit (%) | AS 1289.3.2.1 | 39 | |
| Plasticity Index (%) | AS 1289.3.3.1 | 25 | |
| Date Tested | | 20/11/2014 | |

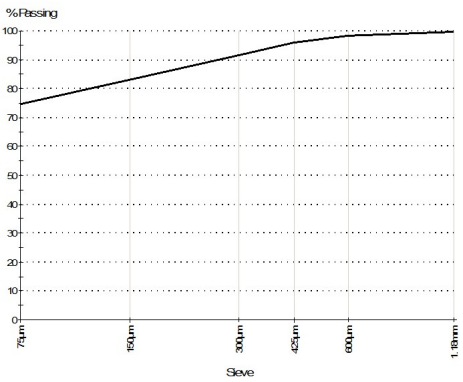
## Particle Size Distribution

Method: Grading [AS 1289.3.6.1]

Date Tested: 20/11/2014
Note: Sample Washed

| Sieve Size | % Passing | Limits |
|---|---|---|
| 1.18mm | 100 | |
| 600µm | 98 | |
| 425µm | 96 | |
| 300µm | 92 | |
| 150µm | 83 | |
| 75µm | 75 | |

## Chart




## Comments

DESCRIPTION: SANDY SILTY CLAY(CH) PALE BROWN
UNIT WEIGHT: 1.75 t/m3
BULK DENSITY: 1.15 t/m3

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SOIL SURVEYS

# Material Test Report

Report No: MAT:WHL14-1507-S7
Issue No: 1

Client: Redland City Council
C/O 2/19 Finchley Street
Milton QLD 4064

Project: Revetment Wall Investigation

Project Location: Aquatic Paradise Canal Estate

Project Number: 1-16581

This document is issued in accordance with NATA's accreditation requirements.

NATA Accredited Laboratory Number: 15301

Approved Signatory: C.Ferguson-Hannah (Senior Technician)
Date of Issue: 24/11/2014



## Sample Details

| | |
|---|---|
| Sample ID: | WHL14-1507-S7 |
| Field Sample ID: | |
| Date Sampled: | 23/10/2014 |
| Source: | Borehole |
| Material: | |
| Specification: | Grading |
| Sampling Method: | As Supplied |
| Soil Description: | |
| Sampled By: | SSE |
| Location Description: | BH6 |
| | 1.0m |

## Other Test Results

| Description | Method | Result | Limits |
|---|---|---|---|
| Moisture Content [AS 1289.2.1.1] | | | |
| Moisture Content (%) | | 132 | |
| Date Tested | | 13/11/2014 | |
| Atterberg Limits Casagrande [AS 1289.3.1.2, AS 1289.3.2.1, AS 1289.3.3.1, AS 1289.3.4.1] | | | |
| Sample History | AS 1289.1.1 | Air-dried | |
| Preparation | AS 1289.1.1 | Dry Sieved | |
| Linear Shrinkage (%) | AS 1289.3.4.1 | 22.0 | |
| Mould Length (mm) | | 125 | |
| Crumbling | | No | |
| Curling | | No | |
| Liquid Limit (%) | AS 1289.3.1.2 | 122 | |
| Method | | One Point | |
| Plastic Limit (%) | AS 1289.3.2.1 | 32 | |
| Plasticity Index (%) | AS 1289.3.3.1 | 90 | |
| Date Tested | | 18/11/2014 | |

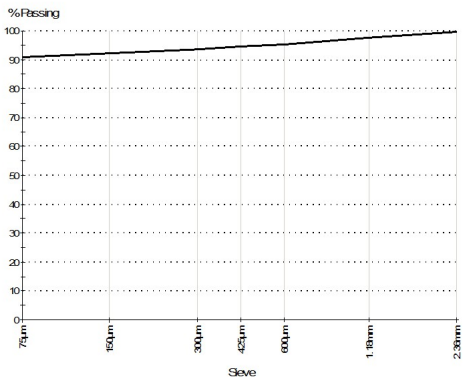
## Particle Size Distribution

Method: Grading [AS 1289.3.6.1]

Date Tested: 20/11/2014
Note: Sample Washed

| Sieve Size | % Passing | Limits |
|---|---|---|
| 2.36mm | 100 | |
| 1.18mm | 98 | |
| 600µm | 95 | |
| 425µm | 94 | |
| 300µm | 94 | |
| 150µm | 92 | |
| 75µm | 91 | |

## Chart




## Comments

DESCRIPTION: CLAY(CH) DARK GREY, SOME SAND
UNIT WEIGHT: 1.40 t/m3
BULK DENSITY: 0.61 t/m3

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SOIL SURVEYS

# Material Test Report

Report No: MAT:WHL14-1507-S8
Issue No: 1

Client: Redland City Council
C/O 2/19 Finchley Street
Milton QLD 4064

Project: Revetment Wall Investigation

Project Location: Aquatic Paradise Canal Estate

Project Number: 1-16581

This document is issued in accordance with NATA's accreditation requirements.

NATA Accredited Laboratory Number: 15301

Approved Signatory: C.Ferguson-Hannah (Senior Technician)
Date of Issue: 24/11/2014



## Sample Details

| | |
|---|---|
| Sample ID: | WHL14-1507-S8 |
| Field Sample ID: | |
| Date Sampled: | 23/10/2014 |
| Source: | Borehole |
| Material: | |
| Specification: | Grading |
| Sampling Method: | As Supplied |
| Soil Description: | |
| Sampled By: | SSE |
| Location Description: | BH6 2.0m |

## Other Test Results

| Description | Method | Result | Limits |
|---|---|---|---|
| Moisture Content [AS 1289.2.1.1] | | | |
| Moisture Content (%) | | 53.0 | |
| Date Tested | | 13/11/2014 | |
| Atterberg Limits Casagrande [AS 1289.3.1.2, AS 1289.3.2.1, AS 1289.3.3.1, AS 1289.3.4.1] | | | |
| Sample History | AS 1289.1.1 | Air-dried | |
| Preparation | AS 1289.1.1 | Dry Sieved | |
| Linear Shrinkage (%) | AS 1289.3.4.1 | 18.0 | |
| Mould Length (mm) | | 125.2 | |
| Crumbling | | No | |
| Curling | | No | |
| Liquid Limit (%) | AS 1289.3.1.2 | 83 | |
| Method | | One Point | |
| Plastic Limit (%) | AS 1289.3.2.1 | 38 | |
| Plasticity Index (%) | AS 1289.3.3.1 | 45 | |
| Date Tested | | 21/11/2014 | |

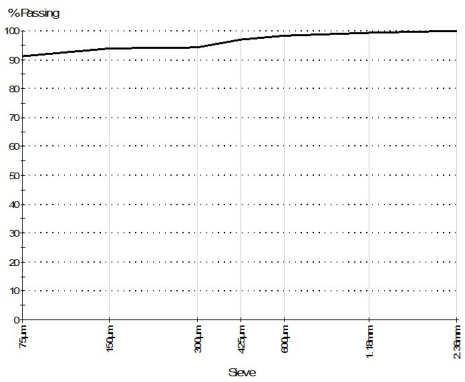
## Particle Size Distribution

Method: Grading [AS 1289.3.6.1]

Date Tested: 18/11/2014
Note: Sample Washed

| Sieve Size | % Passing | Limits |
|---|---|---|
| 2.36mm | 100 | |
| 1.18mm | 99 | |
| 600µm | 98 | |
| 425µm | 97 | |
| 300µm | 94 | |
| 150µm | 94 | |
| 75µm | 91 | |

## Chart




## Comments

DESCRIPTION: SILTY CLAY(CH) GREY, BROWN MOTTLE, SOME SAND
UNIT WEIGHT: 1.66 t/m3
BULK DENSITY: 1.08 t/m3

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SOIL SURVEYS

# Material Test Report

Report No: MAT:WHL14-1507-S9
Issue No: 1

Client: Redland City Council
C/O 2/19 Finchley Street
Milton QLD 4064

Project: Revetment Wall Investigation

Project Location: Aquatic Paradise Canal Estate

Project Number: 1-16581

This document is issued in accordance with NATA's accreditation requirements.

NATA Accredited Laboratory Number: 15301

Approved Signatory: C.Ferguson-Hannah (Senior Technician)
Date of Issue: 24/11/2014



## Sample Details

| | |
|---|---|
| Sample ID: | WHL14-1507-S9 |
| Field Sample ID: | |
| Date Sampled: | 23/10/2014 |
| Source: | Borehole |
| Material: | |
| Specification: | Grading |
| Sampling Method: | As Supplied |
| Soil Description: | |
| Sampled By: | SSE |
| Location Description: | BH6 |
| | 3.0m |

## Other Test Results

| Description | Method | Result | Limits |
|---|---|---|---|
| Moisture Content [AS 1289.2.1.1] | | | |
| Moisture Content (%) | | 59.5 | |
| Date Tested | | 13/11/2014 | |
| Atterberg Limits Casagrande [AS 1289.3.1.2, AS 1289.3.2.1, AS 1289.3.3.1, AS 1289.3.4.1] | | | |
| Sample History | AS 1289.1.1 | Air-dried | |
| Preparation | AS 1289.1.1 | Dry Sieved | |
| Linear Shrinkage (%) | AS 1289.3.4.1 | 26.0 | |
| Mould Length (mm) | | 125.3 | |
| Crumbling | | No | |
| Curling | | No | |
| Liquid Limit (%) | AS 1289.3.1.2 | 103 | |
| Method | | One Point | |
| Plastic Limit (%) | AS 1289.3.2.1 | 49 | |
| Plasticity Index (%) | AS 1289.3.3.1 | 54 | |
| Date Tested | | 22/11/2014 | |

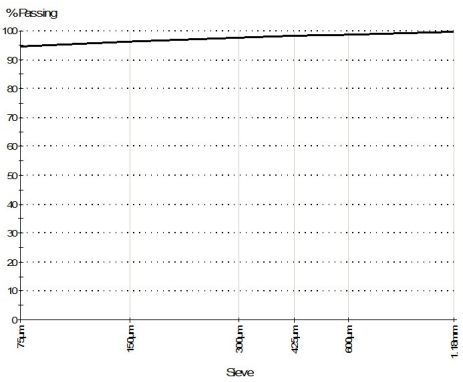
## Particle Size Distribution

Method: Grading [AS 1289.3.6.1]

Date Tested: 20/11/2014
Note: Sample Washed

| Sieve Size | % Passing | Limits |
|---|---|---|
| 1.18mm | 100 | |
| 600µm | 99 | |
| 425µm | 98 | |
| 300µm | 97 | |
| 150µm | 96 | |
| 75µm | 95 | |

## Chart




## Comments

DESCRIPTION: SILTY CLAY(CH) GREY, SOME SAND
UNIT WEIGHT: 1.64 t/m3
BULK DENSITY: 1.03 t/m3

Helensvale Lab
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SOIL SURVEYS

# Material Test Report

Report No: MAT:WHL14-1507-S10
Issue No: 1

Client: Redland City Council
C/O 2/19 Finchley Street
Milton QLD 4064

Project: Revetment Wall Investigation

Project Location: Aquatic Paradise Canal Estate

Project Number: 1-16581

This document is issued in accordance with NATA's accreditation requirements.

NATA Accredited Laboratory Number: 15301

Approved Signatory: C.Ferguson-Hannah (Senior Technician)
Date of Issue: 24/11/2014



## Sample Details

| | |
|---|---|
| Sample ID: | WHL14-1507-S10 |
| Field Sample ID: | |
| Date Sampled: | 23/10/2014 |
| Source: | Borehole |
| Material: | |
| Specification: | Grading |
| Sampling Method: | As Supplied |
| Soil Description: | |
| Sampled By: | SSE |
| Location Description: | BH6 4.0m |

## Other Test Results

| Description | Method | Result | Limits |
|---|---|---|---|
| Moisture Content [AS 1289.2.1.1] | | | |
| Moisture Content (%) | | 67.5 | |
| Date Tested | | 13/11/2014 | |
| Atterberg Limits Casagrande [AS 1289.3.1.2, AS 1289.3.2.1, AS 1289.3.3.1, AS 1289.3.4.1] | | | |
| Sample History | AS 1289.1.1 | Air-dried | |
| Preparation | AS 1289.1.1 | Dry Sieved | |
| Linear Shrinkage (%) | AS 1289.3.4.1 | 17.0 | |
| Mould Length (mm) | | 125 | |
| Crumbling | | No | |
| Curling | | No | |
| Liquid Limit (%) | AS 1289.3.1.2 | 74 | |
| Method | | One Point | |
| Plastic Limit (%) | AS 1289.3.2.1 | 47 | |
| Plasticity Index (%) | AS 1289.3.3.1 | 27 | |
| Date Tested | | 22/11/2014 | |

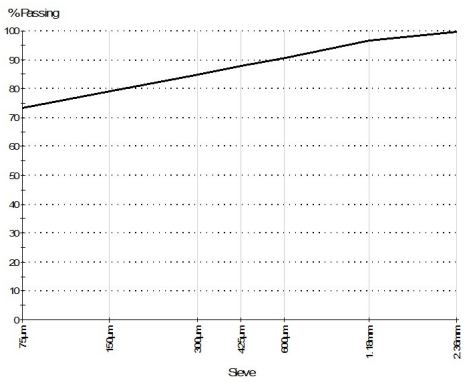
## Particle Size Distribution

Method: Grading [AS 1289.3.6.1]

Date Tested: 20/11/2014
Note: Sample Washed

| Sieve Size | % Passing | Limits |
|---|---|---|
| 2.36mm | 100 | |
| 1.18mm | 97 | |
| 600µm | 91 | |
| 425µm | 88 | |
| 300µm | 85 | |
| 150µm | 79 | |
| 75µm | 73 | |

## Chart




## Comments

DESCRIPTION: SANDY SILTY CLAY(CH) GREY, BROWN MOTTLE
UNIT WEIGHT: 1.69 t/m3
BULK DENSITY: 1.01 t/m3

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Unit 8, 140 Millaroo Drive
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SOIL SURVEYS

# Material Test Report

Report No: MAT:WHL14-1507-S11
Issue No: 1

Client: Redland City Council
C/O 2/19 Finchley Street
Milton QLD 4064

Project: Revetment Wall Investigation

Project Location: Aquatic Paradise Canal Estate

Project Number: 1-16581

This document is issued in accordance with NATA's accreditation requirements.

NATA Accredited Laboratory Number: 15301

Approved Signatory: C.Ferguson-Hannah (Senior Technician)
Date of Issue: 24/11/2014



## Sample Details

| | |
|---|---|
| Sample ID: | WHL14-1507-S11 |
| Field Sample ID: | |
| Date Sampled: | 23/10/2014 |
| Source: | Borehole |
| Material: | |
| Specification: | Grading |
| Sampling Method: | As Supplied |
| Soil Description: | |
| Sampled By: | SSE |
| Location Description: | BH6 5.0m |

## Other Test Results

| Description | Method | Result | Limits |
|---|---|---|---|
| Moisture Content [AS 1289.2.1.1] | | | |
| Moisture Content (%) | | 65.5 | |
| Date Tested | | 13/11/2014 | |
| Atterberg Limits Casagrande [AS 1289.3.1.2, AS 1289.3.2.1, AS 1289.3.3.1, AS 1289.3.4.1] | | | |
| Sample History | AS 1289.1.1 | Air-dried | |
| Preparation | AS 1289.1.1 | Dry Sieved | |
| Linear Shrinkage (%) | AS 1289.3.4.1 | 20.5 | |
| Mould Length (mm) | | 125.2 | |
| Crumbling | | No | |
| Curling | | No | |
| Liquid Limit (%) | AS 1289.3.1.2 | 77 | |
| Method | | One Point | |
| Plastic Limit (%) | AS 1289.3.2.1 | 41 | |
| Plasticity Index (%) | AS 1289.3.3.1 | 36 | |
| Date Tested | | 22/11/2014 | |

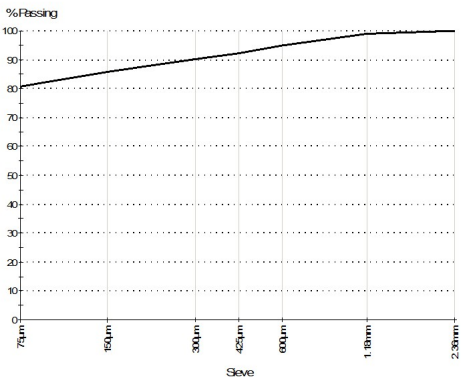
## Particle Size Distribution

Method: Grading [AS 1289.3.6.1]

Date Tested: 20/11/2014
Note: Sample Washed

| Sieve Size | % Passing | Limits |
|---|---|---|
| 2.36mm | 100 | |
| 1.18mm | 99 | |
| 600µm | 95 | |
| 425µm | 92 | |
| 300µm | 90 | |
| 150µm | 86 | |
| 75µm | 81 | |

## Chart




## Comments

DESCRIPTION: SANDY SILTY CLAY(CH) GREY, BROWN MOTTLE
UNIT WEIGHT: 1.65 t/m3
BULK DENSITY: 1.00 t/m3

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SOIL SURVEYS

# Material Test Report

Report No: MAT:WHL14-1507-S12
Issue No: 1

Client: Redland City Council
C/O 2/19 Finchley Street
Milton QLD 4064

Project: Revetment Wall Investigation

Project Location: Aquatic Paradise Canal Estate

Project Number: 1-16581

This document is issued in accordance with NATA's accreditation requirements.

NATA Accredited Laboratory Number: 15301

Approved Signatory: C.Ferguson-Hannah (Senior Technician)
Date of Issue: 24/11/2014



## Sample Details

| | |
|---|---|
| Sample ID: | WHL14-1507-S12 |
| Field Sample ID: | |
| Date Sampled: | 28/10/2014 |
| Source: | Borehole |
| Material: | |
| Specification: | Grading |
| Sampling Method: | As Supplied |
| Soil Description: | |
| Sampled By: | SSE |
| Location Description: | BH10 |
| | 1.0m |

## Other Test Results

| Description | Method | Result | Limits |
|---|---|---|---|
| Moisture Content [AS 1289.2.1.1] | | | |
| Moisture Content (%) | | 39.2 | |
| Date Tested | | 13/11/2014 | |
| Atterberg Limits Casagrande [AS 1289.3.1.2, AS 1289.3.2.1, AS 1289.3.3.1, AS 1289.3.4.1] | | | |
| Sample History | AS 1289.1.1 | Air-dried | |
| Preparation | AS 1289.1.1 | Dry Sieved | |
| Linear Shrinkage (%) | AS 1289.3.4.1 | 16.5 | |
| Mould Length (mm) | | 125.1 | |
| Crumbling | | No | |
| Curling | | No | |
| Liquid Limit (%) | AS 1289.3.1.2 | 49 | |
| Method | | One Point | |
| Plastic Limit (%) | AS 1289.3.2.1 | 18 | |
| Plasticity Index (%) | AS 1289.3.3.1 | 31 | |
| Date Tested | | 21/11/2014 | |

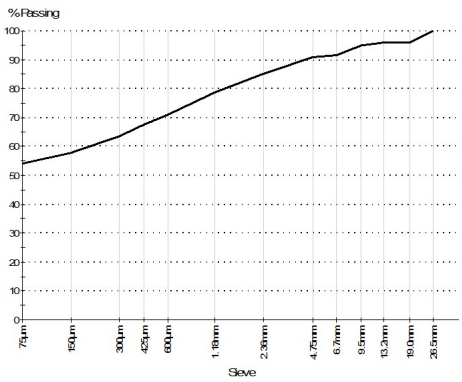
## Particle Size Distribution

Method: Grading [AS 1289.3.6.1]

Date Tested: 20/11/2014
Note: Sample Washed

| Sieve Size | % Passing | Limits |
|---|---|---|
| 26.5mm | 100 | |
| 19.0mm | 96 | |
| 13.2mm | 96 | |
| 9.5mm | 95 | |
| 6.7mm | 92 | |
| 4.75mm | 91 | |
| 2.36mm | 85 | |
| 1.18mm | 79 | |
| 600µm | 71 | |
| 425µm | 68 | |
| 300µm | 64 | |
| 150µm | 58 | |
| 75µm | 54 | |

## Chart




## Comments

DESCRIPTION: SANDY GRAVELLY CLAY(CI) PALE BROWN
UNIT WEIGHT: 2.14 t/m3
BULK DENSITY: 1.54 t/m3

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SOIL SURVEYS

# Material Test Report

Report No: MAT:WHL14-1507-S13
Issue No: 1

Client: Redland City Council
C/O 2/19 Finchley Street
Milton QLD 4064

Project: Revetment Wall Investigation

Project Location: Aquatic Paradise Canal Estate

Project Number: 1-16581

This document is issued in accordance with NATA's accreditation requirements.

NATA Accredited Laboratory Number: 15301

Approved Signatory: C.Ferguson-Hannah (Senior Technician)
Date of Issue: 24/11/2014



## Sample Details

| | |
|---|---|
| Sample ID: | WHL14-1507-S13 |
| Field Sample ID: | |
| Date Sampled: | 28/10/2014 |
| Source: | Borehole |
| Material: | |
| Specification: | Grading |
| Sampling Method: | As Supplied |
| Soil Description: | |
| Sampled By: | SSE |
| Location Description: | BH10 |
| | 2.0m |

## Other Test Results

| Description | Method | Result | Limits |
|---|---|---|---|
| Moisture Content [AS 1289.2.1.1] | | | |
| Moisture Content (%) | | 59.0 | |
| Date Tested | | 13/11/2014 | |
| Atterberg Limits Casagrande [AS 1289.3.1.2, AS 1289.3.2.1, AS 1289.3.3.1, AS 1289.3.4.1] | | | |
| Sample History | AS 1289.1.1 | Air-dried | |
| Preparation | AS 1289.1.1 | Dry Sieved | |
| Linear Shrinkage (%) | AS 1289.3.4.1 | 30.5 | |
| Mould Length (mm) | | 125.1 | |
| Crumbling | | No | |
| Curling | | No | |
| Liquid Limit (%) | AS 1289.3.1.2 | 154 | |
| Method | | One Point | |
| Plastic Limit (%) | AS 1289.3.2.1 | 36 | |
| Plasticity Index (%) | AS 1289.3.3.1 | 118 | |
| Date Tested | | 19/11/2014 | |

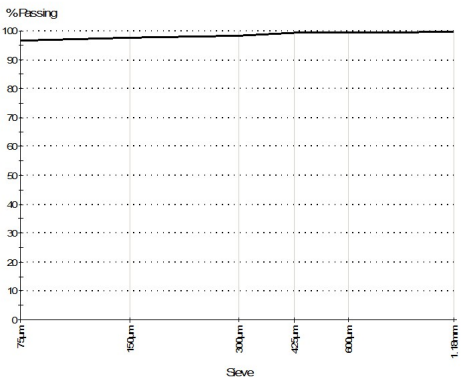
## Particle Size Distribution

Method: Grading [AS 1289.3.6.1]

Date Tested: 20/11/2014
Note: Sample Washed

| Sieve Size | % Passing | Limits |
|---|---|---|
| 1.18mm | 100 | |
| 600µm | 99 | |
| 425µm | 99 | |
| 300µm | 98 | |
| 150µm | 98 | |
| 75µm | 97 | |

## Chart




## Comments

DESCRIPTION: SILTY CLAY(CH) TRACE OF SAND
UNIT WEIGHT: 1.62 t/m3
BULK DENSITY: 1.02 t/m3

SOIL SURVEYS

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# Material Test Report

Report No: MAT:WHL14-1507-S14
Issue No: 1

Client: Redland City Council
C/O 2/19 Finchley Street
Milton QLD 4064

Project: Revetment Wall Investigation

Project Location: Aquatic Paradise Canal Estate

Project Number: 1-16581

This document is issued in accordance with NATA's accreditation requirements.

NATA Accredited Laboratory Number: 15301

Approved Signatory: C.Ferguson-Hannah (Senior Technician)
Date of Issue: 24/11/2014



## Sample Details

| | |
|---|---|
| Sample ID: | WHL14-1507-S14 |
| Field Sample ID: | |
| Date Sampled: | 28/10/2014 |
| Source: | Borehole |
| Material: | |
| Specification: | Grading |
| Sampling Method: | As Supplied |
| Soil Description: | |
| Sampled By: | SSE |
| Location Description: | BH10 3.0m |

## Other Test Results

| Description | Method | Result | Limits |
|---|---|---|---|
| Moisture Content [AS 1289.2.1.1] | | | |
| Moisture Content (%) | | 60.0 | |
| Date Tested | | 13/11/2014 | |
| Atterberg Limits Casagrande [AS 1289.3.1.2, AS 1289.3.2.1, AS 1289.3.3.1, AS 1289.3.4.1] | | | |
| Sample History | AS 1289.1.1 | Air-dried | |
| Preparation | AS 1289.1.1 | Dry Sieved | |
| Linear Shrinkage (%) | AS 1289.3.4.1 | 29.5 | |
| Mould Length (mm) | | 125.1 | |
| Crumbling | | No | |
| Curling | | No | |
| Liquid Limit (%) | AS 1289.3.1.2 | 138 | |
| Method | | One Point | |
| Plastic Limit (%) | AS 1289.3.2.1 | 39 | |
| Plasticity Index (%) | AS 1289.3.3.1 | 99 | |
| Date Tested | | 22/11/2014 | |

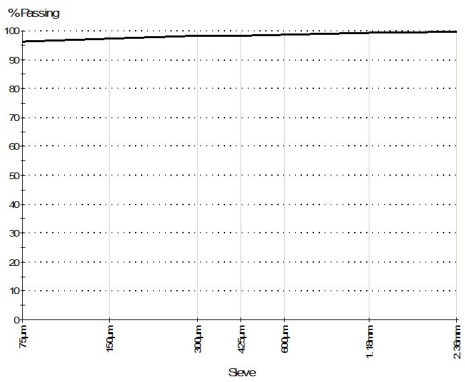
## Particle Size Distribution

Method: Grading [AS 1289.3.6.1]

Date Tested: 18/11/2014
Note: Sample Washed

| Sieve Size | % Passing | Limits |
|---|---|---|
| 2.36mm | 100 | |
| 1.18mm | 99 | |
| 600µm | 99 | |
| 425µm | 98 | |
| 300µm | 98 | |
| 150µm | 97 | |
| 75µm | 96 | |

## Chart




## Comments

DESCRIPTION: SILTY CLAY(CH) GREY, TRACE OF SAND
UNIT WEIGHT: 1.60 t/m3
BULK DENSITY: 1.00 t/m3

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Unit 8, 140 Millaroo Drive
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SOIL SURVEYS

# Material Test Report

Report No: MAT:WHL14-1507-S15
Issue No: 1

Client: Redland City Council
C/O 2/19 Finchley Street
Milton QLD 4064

Project: Revetment Wall Investigation

Project Location: Aquatic Paradise Canal Estate

Project Number: 1-16581

This document is issued in accordance with NATA's accreditation requirements.

NATA Accredited Laboratory Number: 15301

Approved Signatory: C.Ferguson-Hannah (Senior Technician)
Date of Issue: 24/11/2014



## Sample Details

| | |
|---|---|
| Sample ID: | WHL14-1507-S15 |
| Field Sample ID: | |
| Date Sampled: | 28/10/2014 |
| Source: | Borehole |
| Material: | |
| Specification: | Grading |
| Sampling Method: | As Supplied |
| Soil Description: | |
| Sampled By: | SSE |
| Location Description: | BH10 4.0m |

## Other Test Results

| Description | Method | Result | Limits |
|---|---|---|---|
| Moisture Content [AS 1289.2.1.1] | | | |
| Moisture Content (%) | | 62.0 | |
| Date Tested | | 12/11/2014 | |
| Atterberg Limits Casagrande [AS 1289.3.1.2, AS 1289.3.2.1, AS 1289.3.3.1, AS 1289.3.4.1] | | | |
| Sample History | AS 1289.1.1 | Air-dried | |
| Preparation | AS 1289.1.1 | Dry Sieved | |
| Linear Shrinkage (%) | AS 1289.3.4.1 | 29.0 | |
| Mould Length (mm) | | 125.7 | |
| Crumbling | | No | |
| Curling | | No | |
| Liquid Limit (%) | AS 1289.3.1.2 | 118 | |
| Method | | One Point | |
| Plastic Limit (%) | AS 1289.3.2.1 | 27 | |
| Plasticity Index (%) | AS 1289.3.3.1 | 91 | |
| Date Tested | | 21/11/2014 | |

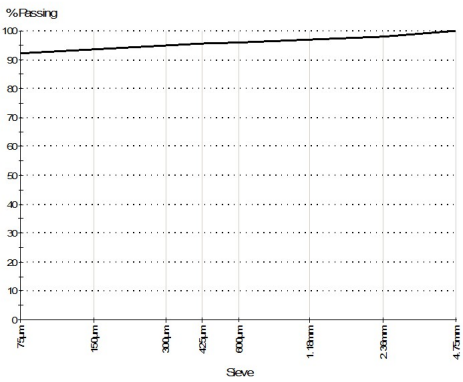
## Particle Size Distribution

Method: Grading [AS 1289.3.6.1]

Date Tested: 19/11/2014
Note: Sample Washed

| Sieve Size | % Passing | Limits |
|---|---|---|
| 4.75mm | 100 | |
| 2.36mm | 98 | |
| 1.18mm | 97 | |
| 600µm | 96 | |
| 425µm | 95 | |
| 300µm | 95 | |
| 150µm | 93 | |
| 75µm | 92 | |

## Chart




## Comments

DESCRIPTION: SILTY CLAY(CH) GREY, ORANGE MOTTLE, TRACE OF SAND AND GRAVEL
UNIT WEIGHT: 1.63 t/m3
BULK DENSITY: 1.01 t/m3

***SOIL SURVEYS ENGINEERING P/L***
**Unit 8, 140 Millaroo Drive**
**HELENSVALE QLD 4212**
**PHONE 07 55026795**
FAX 07 55026724

SOIL SURVEYS

# TRIAXIAL TEST REPORT

| | | | |
|---|---|---|---|
| Client: | **Redland City Council** | Report Number: | WHL14-1507-S15 TRI |
| Address: | **C/O 2/19 Finchley Street, Milton, QLD, 4064** | Report Date: | 14/11/2014 |
| Job Number: | **1-16581** | Order Number: | |
| Project: | **Revetment Wall Investigation** | Test Methods: | AS1289 6.4.2, 2.1.1 |
| Location: | **Aquatic Paradise Canal Estate** | | |

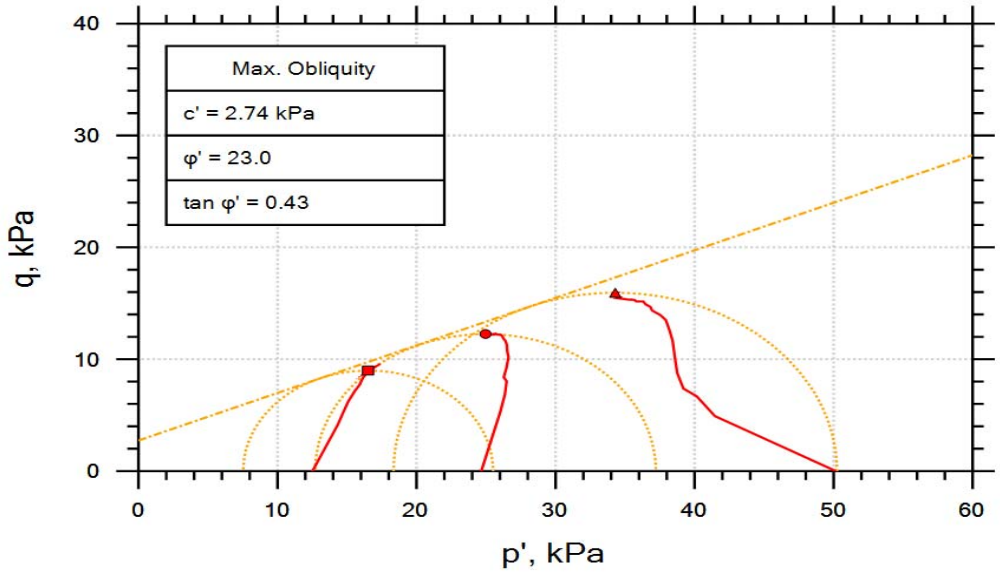


| | | |
|---|---|---|
| Lab Number: | S15 | Sample Identification |
| Date Sampled: | 28/10/2014 | LOCATION: BH10 |
| Date Tested: | 12/11/2014 | |
| Sampling Method: | U50 | DEPTH: 4.3-4.4m |
| Description: | SILTY CLAY(CH) GREY, ORANGE MOTTLE, TRACE OF SAND AND GRAVEL | |

**SAMPLE DETAILS**

| | | | | | |
|---|---|---|---|---|---|
| Initial Height(mm): | 97.3 | Initial Moisture Content(%): | 61.8 | Rate of Strain(%/min): | 0.10 |
| Initial Diameter(mm): | 47.7 | Final Moisture Content(%): | 62.3 | B Value: | 0.99 |
| D/L Ratio: | 2:1 | Wet Density(t/m$^3$): | 1.63 | Failure Criteria: | Peak Principle Stress Ratio |
| | | Dry Density(t/m$^3$): | 1.01 | | |

**Mohr Circle Diagram**




**Cohesion C' (kPa): 2.7**

**Angle of Shear Resistance ϕ' (Degrees): 23.0**

Remarks: PP 30-50

SOIL SURVEYS



Approved Signatory

C.Ferguson-Hannah

Form Number

REP-TRI-01

**SOIL SURVEYS ENGINEERING P/L**
**Unit 8, 140 Millaroo Drive**
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**PHONE 07 55026795**
**FAX 07 55026724**

SOIL SURVEYS

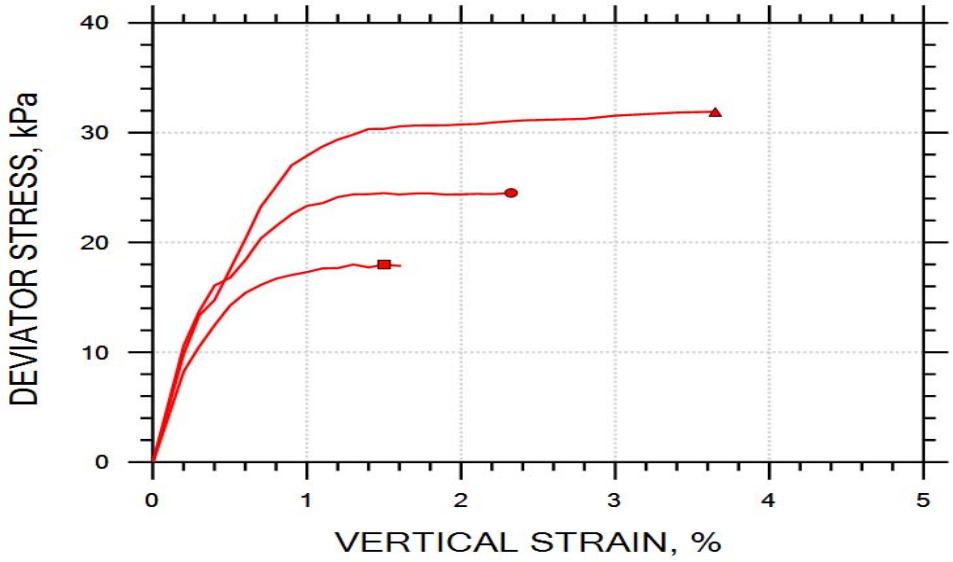
# TRIAXIAL TEST REPORT

| | | | |
|---|---|---|---|
| Client: | **Redland City Council** | Report Number: | WHL14-1507-S15 TRI |
| Address: | **C/O 2/19 Finchley Street, Milton, QLD, 4064** | Report Date: | 14/11/2014 |
| Job Number: | **1-16581** | Order Number: | |
| Project: | **Revetment Wall Investigation** | Test Methods: | AS1289 6.4.2, 2.1.1 |
| Location: | **Aquatic Paradise Canal Estate** | | |



| | | |
|---|---|---|
| Lab Number: | S15 | Sample Identification |
| Date Sampled: | 28/10/2014 | LOCATION: BH10 |
| Date Tested: | 12/11/2014 | |
| Sampling Method: | U50 | DEPTH: 4.3-4.4m |
| Description: | SILTY CLAY(CH) GREY, ORANGE MOTTLE, TRACE OF SAND AND GRAVEL | |

**Stress / Strain Diagram**




| Stage: | Confining Pressure(kPa): | Failure Pore Pressure(kPa): | Principal Effective stresses(kPa): σ' 1 | Principal Effective stresses(kPa): σ' 3 | deviator Stress(kPa): | Strain(%) |
|---|---|---|---|---|---|---|
| 1 | 12.5 | 74 | 26 | 8 | 18 | 1.50 |
| 2 | 25 | 86 | 38 | 13 | 25 | 2.32 |
| 3 | 50 | 118 | 50 | 18 | 32 | 3.65 |

Remarks: PP 30-50



Approved Signatory

C.Ferguson-Hannah

Form Number

REP-TRI-01

**SOIL SURVEYS ENGINEERING P/L**
**Unit 8, 140 Millaroo Drive**
**HELENSVALE QLD 4212**
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FAX 07 55026724

SOIL SURVEYS

# TRIAXIAL TEST REPORT

| | | | |
|---|---|---|---|
| Client: | **Redland City Council** | Report Number: | WHL14-1507-S15 TRI |
| Address: | **C/O 2/19 Finchley Street, Milton, QLD, 4064** | Report Date: | 14/11/2014 |
| Job Number: | **1-16581** | Order Number: | |
| Project: | **Revetment Wall Investigation** | Test Methods: | AS1289 6.4.2, 2.1.1 |
| Location: | **Aquatic Paradise Canal Estate** | | |



| | | |
|---|---|---|
| Lab Number: | S15 | Sample Identification |
| Date Sampled: | 28/10/2014 | LOCATION: BH10 |
| Date Tested: | 12/11/2014 | |
| Sampling Method: | U50 | DEPTH: 4.3-4.4m |
| Description: | SILTY CLAY(CH) GREY, ORANGE MOTTLE, TRACE OF SAND AND GRAVEL | |

Remarks: PP 30-50



Approved Signatory

C.Ferguson-Hannah

Form Number

REP-TRI-01

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SOIL SURVEYS

# Material Test Report

Report No: MAT:WHL14-1507-S16
Issue No: 1

Client: Redland City Council
C/O 2/19 Finchley Street
Milton QLD 4064

Project: Revetment Wall Investigation

Project Location: Aquatic Paradise Canal Estate

Project Number: 1-16581

This document is issued in accordance with NATA's accreditation requirements.

NATA Accredited Laboratory Number: 15301

Approved Signatory: C.Ferguson-Hannah (Senior Technician)
Date of Issue: 24/11/2014



## Sample Details

| | |
|---|---|
| Sample ID: | WHL14-1507-S16 |
| Field Sample ID: | |
| Date Sampled: | 28/10/2014 |
| Source: | Borehole |
| Material: | |
| Specification: | Grading |
| Sampling Method: | As Supplied |
| Soil Description: | |
| Sampled By: | SSE |
| Location Description: | BH10 |
| | 5.0m |

## Other Test Results

| Description | Method | Result | Limits |
|---|---|---|---|
| Moisture Content [AS 1289.2.1.1] | | | |
| Moisture Content (%) | | 50.5 | |
| Date Tested | | 13/11/2014 | |
| Atterberg Limits Casagrande [AS 1289.3.1.2, AS 1289.3.2.1, AS 1289.3.3.1, AS 1289.3.4.1] | | | |
| Sample History | AS 1289.1.1 | Air-dried | |
| Preparation | AS 1289.1.1 | Dry Sieved | |
| Linear Shrinkage (%) | AS 1289.3.4.1 | 16.5 | |
| Mould Length (mm) | | 125 | |
| Crumbling | | No | |
| Curling | | No | |
| Liquid Limit (%) | AS 1289.3.1.2 | 77 | |
| Method | | One Point | |
| Plastic Limit (%) | AS 1289.3.2.1 | 46 | |
| Plasticity Index (%) | AS 1289.3.3.1 | 31 | |
| Date Tested | | 22/11/2014 | |

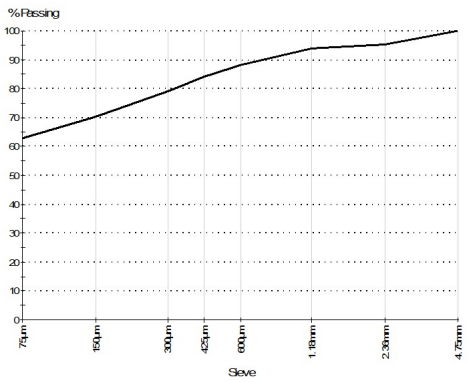
## Particle Size Distribution

Method: Grading [AS 1289.3.6.1]

Date Tested: 19/11/2014
Note: Sample Washed

| Sieve Size | % Passing | Limits |
|---|---|---|
| 4.75mm | 100 | |
| 2.36mm | 95 | |
| 1.18mm | 94 | |
| 600µm | 88 | |
| 425µm | 84 | |
| 300µm | 79 | |
| 150µm | 70 | |
| 75µm | 63 | |

## Chart




## Comments

DESCRIPTION: SANDY SILTY CLAY(CH) PALE BROWN, TRACE OF GRAVEL
UNIT WEIGHT: 1.64 t/m3
BULK DENSITY: 1.09 t/m3

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Australia
Ph:+61 7 5502 6795
Fax:+61 7 5502 6724

SOIL SURVEYS

# Material Test Report

Report No: MAT:WHL14-1507-S17
Issue No: 1

Client: Redland City Council
C/O 2/19 Finchley Street
Milton QLD 4064

Project: Revetment Wall Investigation

Project Location: Aquatic Paradise Canal Estate

Project Number: 1-16581

This document is issued in accordance with NATA's accreditation requirements.

NATA Accredited Laboratory Number: 15301

Approved Signatory: C.Ferguson-Hannah (Senior Technician)
Date of Issue: 24/11/2014



## Sample Details

| | |
|---|---|
| Sample ID: | WHL14-1507-S17 |
| Field Sample ID: | |
| Date Sampled: | 28/10/2014 |
| Source: | Borehole |
| Material: | |
| Specification: | Grading |
| Sampling Method: | As Supplied |
| Soil Description: | |
| Sampled By: | SSE |
| Location Description: | BH10 |
| | 6.0m |

## Other Test Results

| Description | Method | Result | Limits |
|---|---|---|---|
| Moisture Content [AS 1289.2.1.1] | | | |
| Moisture Content (%) | | 58.0 | |
| Date Tested | | 13/11/2014 | |
| Atterberg Limits Casagrande [AS 1289.3.1.2, AS 1289.3.2.1, AS 1289.3.3.1, AS 1289.3.4.1] | | | |
| Sample History | AS 1289.1.1 | Air-dried | |
| Preparation | AS 1289.1.1 | Dry Sieved | |
| Linear Shrinkage (%) | AS 1289.3.4.1 | 17.5 | |
| Mould Length (mm) | | 125.2 | |
| Crumbling | | No | |
| Curling | | No | |
| Liquid Limit (%) | AS 1289.3.1.2 | 84 | |
| Method | | One Point | |
| Plastic Limit (%) | AS 1289.3.2.1 | 49 | |
| Plasticity Index (%) | AS 1289.3.3.1 | 35 | |
| Date Tested | | 20/11/2014 | |

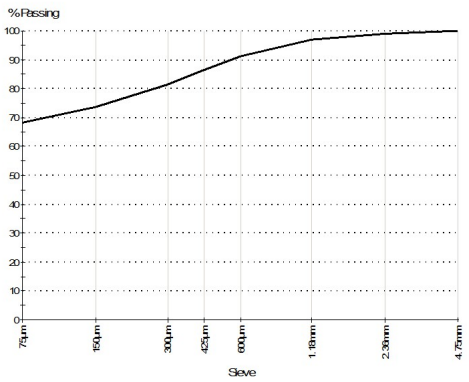
## Particle Size Distribution

Method: Grading [AS 1289.3.6.1]

Date Tested: 20/11/2014
Note: Sample Washed

| Sieve Size | % Passing | Limits |
|---|---|---|
| 4.75mm | 100 | |
| 2.36mm | 99 | |
| 1.18mm | 97 | |
| 600µm | 91 | |
| 425µm | 86 | |
| 300µm | 81 | |
| 150µm | 74 | |
| 75µm | 68 | |

## Chart




## Comments

DESCRIPTION: SANDY SILTY CLAY(CH) GREY BROWN
UNIT WEIGHT: 1.62 t/m3
BULK DENSITY: 1.02 t/m3

*SOIL SURVEYS*
*ENGINEERING PTY LTD*

***GOLD COAST***
Unit 8, 140 Millarroo Drive
HELENSVALE QLD 4212
PH:07 55026795 FAX:0755026724
EMAIL: gclab1@soilsurveys.com.au

SOIL SURVEYS

# POINT LOAD STRENGTH INDEX RESULTS TABLE

| | |
|---|---|
| Client | Redland City Council |
| Job Number | 1-16581 |
| Project | Sediment Basin Assessment |
| Location | Aquatic Paradise Canal Estate |

| | |
|---|---|
| Report Number | 1-16581 |
| Report Date | 28/11/2014 |
| Test Method | AS 4133.4.1 - 2007 |

| Borehole | Depth | Density (t/m$^3$) | Test Method | Diametral D (mm) | L (mm) | Failure Type | Failure Load (kN) | Is (MPa) | Is(50) (MPa) | Classification |
|---|---|---|---|---|---|---|---|---|---|---|
| BH 8 | 3.80 | 2.06 | Diametral | 52 | 53.1 | Shear | 4.80 | 1.78 | 1.81 | High |
| BH 8 | 4.60 | 2.11 | Diametral | 52 | 60.5 | Through healed joint | 3.20 | 1.18 | 1.20 | High |
| BH 8 | 5.90 | 1.99 | Diametral | 52 | 60.0 | Through healed joint | 3.85 | 1.42 | 1.45 | High |
| BH 3 | 3.40 | 2.37 | Diametral | 52 | 56.0 | Shear | 4.50 | 1.66 | 1.69 | High |
| BH 3 | 4.90 | 2.40 | Diametral | 52 | 96.2 | Through healed joint | 1.25 | 0.46 | 0.47 | Medium |
| BH 3 | 5.50 | 2.47 | Diametral | 52 | 99.3 | Through healed joint | 2.95 | 1.09 | 1.11 | High |

# APPENDIX D

# SITE PLAN

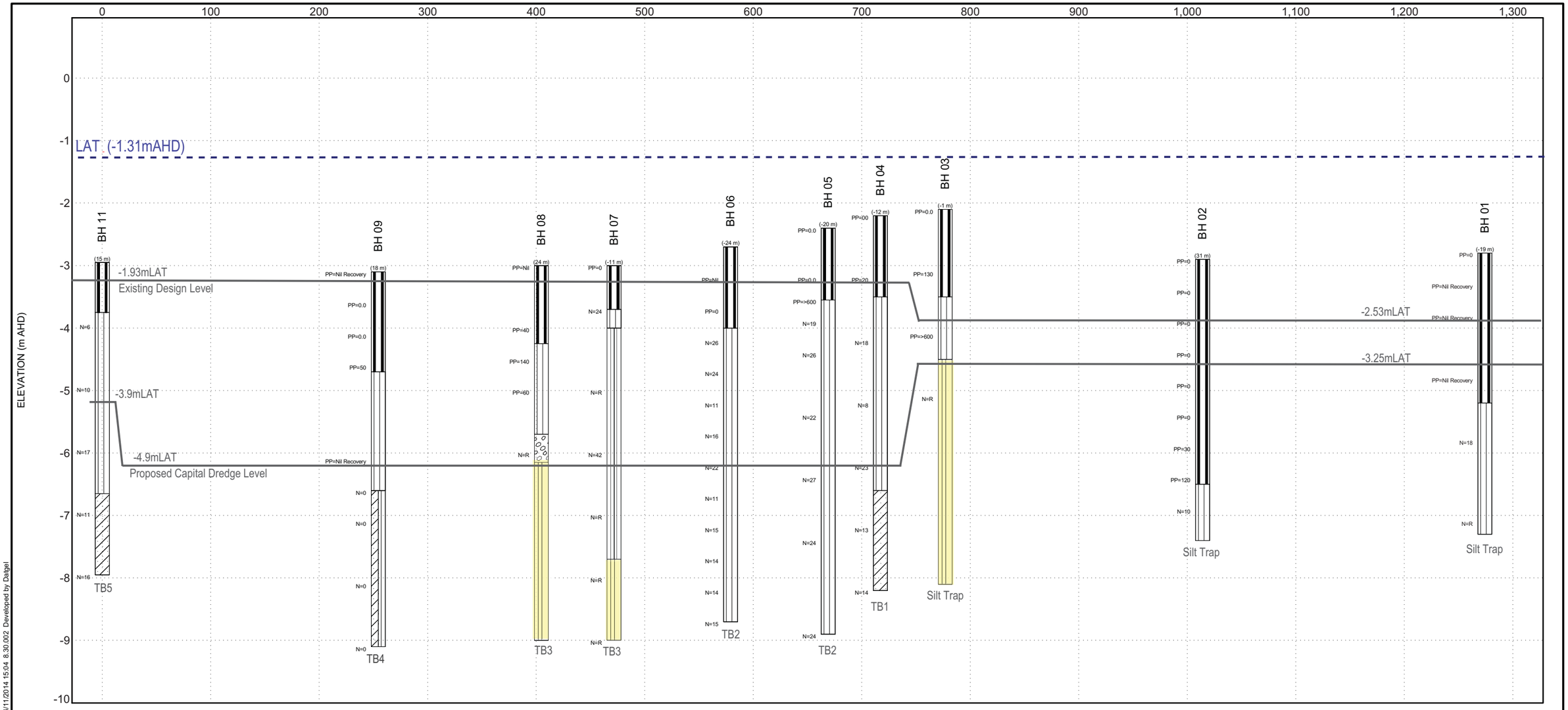

**SOIL SURVEYS ENGINEERING PTY LIMITED**
A.C.N. 054 043 631
Consulting Geotechnical Engineers

| | | | | |
|---|---|---|---|---|
| **Drawn** AB | **Project:** | **Sediment Basement Assessment** | **Drawing No.** 1-16581 | **A4** |
| **Date** Nov 2014 | **Location:** | **Aquatic Paradise Canal Estate - Birkdale** | | |
| **Checked** | **Client:** | **Redland City Council** | | |

*Appendix F*

# BOREHOLE REFERENCE LEVELS

## (For Information)




**MATERIAL GRAPHIC**

- Silt
- Sand
- Clay
- Gravel
- Rock

This sheet may be prepared using colour and may be incomplete if copied

SCALE V 1:65 H 1:3714 (0 m – 3.2 m; 0 m – 185.7 m)

REFERENCE Q:\DOCS\MILTONS DOCUMENTS\1-16000-1-16999\1-16500-1-16599\1-16581\\Graphics\114-16581-AA.pdf

A3 | DRW. NO. 114-16581-AA | Date : 24/11/14 | Checked:

PROJECT

# CROSS SECTION

## Sediment Basin Assessment

CLIENT
Redland City Council

LOCATION
Aquatic Paradise Canal Estate


*Soil Surveys Engineering Pty. Limited*
*Specialist in Applied Geotechnics*
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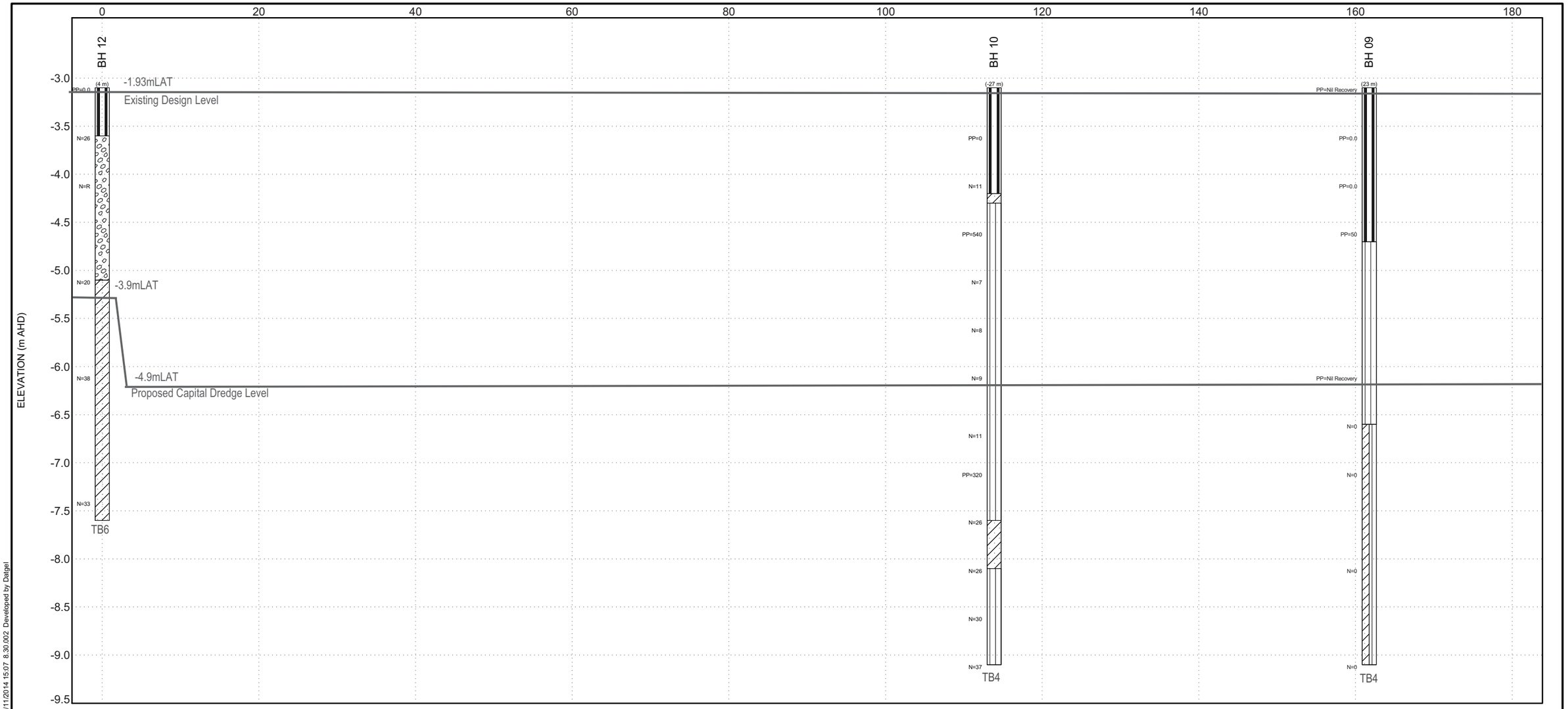
Sunshine Coast: ph +61 7 5493 1980 sunshinecoast@soilsurveys.com.au
Northern Rivers: ph +61 7 5523 4577 northernrivers@soilsurveys.com.au
SOIL SURVEYS




**MATERIAL GRAPHIC**

Silt
Clay
Sand
Gravel

This sheet may be prepared using colour and may be incomplete if copied

SCALE
V 1:42
H 1:514
0 m 2.1 m
0 m 25.7 m

REFERENCE
Q:\DOCS\MILTONS DOCUMENTS\1-16000-1-16999\1-16500-1-16599\1-16581\\Graphics\114-16581-BB.pdf

A3 | DRW. NO. 114-16581-BB | Date : 24/11/14 | Checked:

PROJECT
# CROSS SECTION
## Sediment Basin Assessment

CLIENT
Redland City Council

LOCATION
Aquatic Paradise Canal Estate


*Soil Surveys Engineering Pty. Limited*
*Specialist in Applied Geotechnics*
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SOIL SURVEYS

Kellogg Brown & Root Pty Ltd | ABN 91 007 660 317

# AQUATIC PARADISE CANAL ESTATE

## Siltation Study

*Prepared for:*

**REDLAND CITY COUNCIL**
PO Box 21
CLEVELAND QLD 4163

*Prepared by:*

**Kellogg Brown & Root Pty Ltd**
ABN 91 007 660 317
Level 11, 199 Grey Street, South Bank, Queensland 4101
Telephone (07) 3721 6555, Facsimile (07) 3721 6500

**13 December 2012**

BEJ253-TD-MN-REP-0001 Rev. 1

**Acknowledgments**

Hydrographic Survey Data supplied by Port of Brisbane Corporation (POB)

Cadastral Data supplied by the Department of Environment and Resource Management (DERM)

Information and data supplied by Redland City Council (RCC)

**Limitations Statement**

The sole purpose of this report and the associated services performed by Kellogg Brown & Root Pty Ltd (KBR) is to provide a siltation study in accordance with the scope of services set out in the contract between KBR and Redland City Council (RCC). That scope of services was defined by the requests of the Client, by the time and budgetary constraints imposed by the Client, and by the availability of access to the site.

KBR derived the data in this report primarily from hydrographic survey data, visual inspections, examination of records in the public domain, interviews with individuals with information about the site and a limited amount of sub-surface explorations made on the dates indicated. The passage of time, manifestation of latent conditions or impact ts of future events may require further exploration at the site and subsequent data analysis, and re-evaluation of the findings, observations and conclusions expressed in this report.

In preparing this report, KBR has relied upon and presumed accurate certain information (or absence thereof) relative to the waterway system and local catchment provided by government officials and authorities, the Client and others identified herein. Except as otherwise stated in the report, KBR has not attempted to verify the accuracy or completeness of any such information.

The findings, observations and conclusions expressed by KBR in this report are not, and should not be considered, an opinion concerning the correctness of the past hydrographic survey data and the suitability or otherwise of the design of Aquatic Paradise. No warranty or guarantee, whether express or implied, is made with respect to the data reported or to the findings, observations and conclusions expressed in this report. Further, such data, findings, observations and conclusions are based solely upon site conditions, information, data and drawings supplied by the Client in existence at the time of the investigation.

This report has been prepared on behalf of and for the exclusive use of the Client, and is subject to and issued in connection with the provisions of the agreement between KBR and the Client. KBR accepts no liability or responsibility whatsoever for or in respect of any use of or reliance upon this report by any third party.

Revision History

| Revision | Date | Comment | Signatures | | |
|---|---|---|---|---|---|
| | | | Originated by | Checked by | Approved by |
| A | 26/06/2012 | First issue for review and comment | P. Bayliss | P. Cummings | S. Ciner |
| 0 | 01/08/2012 | Issued to client for use | P.Bayliss | P. Cummings | S. Ciner |
| 1 | 13/12/12 | Issue for Use with updated survey information | [redacted] | | |

# CONTENTS

# Summary

Kellogg Brown & Root Pty Ltd (KBR) was commissioned by Redland City Council (RCC) on 2 May 2012 to carry out a siltation study and develop a canal management plan for the Aquatic Paradise Canal System at Birkdale, Queensland.

This document provides an assessment of siltation in the canals and entrance channel by estimating siltation rates and volumes and identifying sources and processes of siltation.

The scope of works for the siltation study requested by RCC includes:

- a literature review of existing reports and studies on Aquatic Paradise
- identification of sources and processes of siltation
- estimation of siltation rates.

KBR assessed siltation rates using historical hydrographic survey data collected within the canals and entrance channel. Digital Terrain Models (DTMs) were developed to attain rates and volumes of siltation and quantify the volume of accumulated sediment in the canals. These DTMs were also used to identify siltation patterns, potential siltation sources and processes and assess the effectiveness of the siltation trap at the canal entrance. Sediment sampling was also undertaken at key locations in the canal system to broadly categorise the bed sediments and to gain an understanding of the possible sediment origins and processes.

The siltation study indicated an estimated average annual siltation rate of 32mm/annum and average annual net siltation volume of 10,200 $m^3$/annum between 2000 and 2011. The estimated current siltation above design levels as of June 2011 is 65,400 $m^3$.

This annual siltation within the Aquatic Paradise Canal Estate and entrance channel between 2000 and 2011 is attributable to two main sources:

- Waterloo Bay approximately 10,157 $m^3$/annum = 99.6%.
- Stormwater outlets including Tarradarrapin Creek approximately 43 $m^3$/annum = 0.4%.

Sediment sampling identified typical marine clays at sites throughout the canals and towards the canal entrance. Organic matter, apparently from upland sources, was also found in deposits

close to stormwater drain and creek inflow points. Interpretation of the DTMs indicates the highest level of siltation to be at the entrance to the canal system and around the first junction entering the canals (junction of John Goleby and Wood Canals). The analysis indicates that the siltation trap in a dredged condition is effective in reducing siltation in the canals.

The outcomes of this siltation study will inform the development of the canal management plan.

# 1 Introduction

## 1.1 PURPOSE

Kellogg Brown & Root Pty Ltd (KBR) was commissioned by Redland City Council (RCC) on 2 May 2012 to carry out a siltation study and develop a canal management plan for the Aquatic Paradise Canal System at Birkdale, Queensland.

Siltation has been occurring within the canals and entrance channel since its construction in 1987–88. There have been a number of dredging campaigns in various parts of the canal and entrance channel system since its construction. This dredging has formed a large part of the maintenance costs of the canal system.

This document provides an estimate of the siltation rates in the canals and entrance channel via analysis of past surveys. These rates are compared to sediment core sample stratigraphy. The nature of the sediment in the samples plus the siltation spatial pattern is also used to estimate the volumes of siltation from various sources (e.g. Waterloo Bay, Tarradarrapin Creek catchment).

This siltation study will inform the subsequent development of the canal management plan (CMP).

## 1.2 SCOPE

The scope of works for the siltation study requested by RCC includes:

- a literature review of existing reports and studies on Aquatic Paradise
- identification of sources and causes of siltation
- estimation of siltation rates.

To complete the scope of works KBR utilised an array of resources and tools. This included 3D mapping software to model siltation and a site visit to undertake sediment sampling.

Due to the nature of the study, the outcomes and findings do have limitations. The siltation rate estimate is reliant on the accuracy of the survey data provided to KBR. Silt origin estimates are reliant on the visual appearance of the silt (e.g. brown and organic for catchment derived and grey for bay derived) and the observed siltation pattern (e.g. deposits near culvert outlets → catchment derived).

More definitive silt origin studies require expensive and time consuming x-ray crystallography and/or trace element studies that have not been performed as part of this study.

Notwithstanding this, the completed analyses and the findings are considered appropriate for the forecasting and planning of the future dredging requirements required for the development of the CMP.

# 2 Project background

## 2.1 SITE LOCATION AND DESCRIPTION

The location of the Aquatic Paradise canal system is shown in Figure 2.1. This aerial image displays the canals and entrance channel with the canal estates broader locality being shown on the key map.

The canal system is located in Birkdale on the southern side of Waterloo Bay, which forms part of the greater Moreton Bay. The estate comprises approximately 3,000 m of inshore canals with a 2,950 m long access channel extending north into Waterloo Bay.

The system was constructed in 1987–88. The canals were excavated from dry land and the entrance channel was formed using a cutter suction dredge. The main and side canals have a design bed level of –1.9 mLAT; the entrance channel between the canal entrance at chainage 0 m (start) and 500 m a level of –2.5 mLAT, and between chainage 500 m and 2,950 m (end) a level of –1.9 mLAT. These typical design levels are contained in the design drawings contained in Appendix D. The maximum draught for boats entering Aquatic Paradise is defined by RCC to be 1.5 m. It appears that the canals and entrance channel were built close to the design levels.

Figure 2.2 is a close-up aerial image showing the layout of the canal system. There is only one entry/exit point for boat traffic, but there are a number of stormwater inflow points. The main source of runoff into the canals is Tarradarrapin Creek, which flows into the system at the southern end of Wood Canal. The canal estate has a total catchment area of approximately 4.5 $km^2$, of which approximately 85% is suburban development, 5% is playing fields and parks, and the remainder is bush and wetland. In addition to Tarradarrapin Creek there are also three relatively large culverts which discharge into Wood Gate Canal, from William Taylor Park and the nearby cricket ground. Various other minor stormwater outlets also drain into the canals at locations throughout the system. In recent years RCC has installed sediment traps on some stormwater drains which flow into the canal system as a trial program.


**Figure 2.1**
**LOCATION**


**Figure 2.2**
**CANALS LAYOUT**

## 2.2 BACKGROUND INFORMATION

### 2.2.1 Constructed levels

The as-built survey drawings supplied by RCC describe 'as constructed' levels in the canals in comparison to the design profiles. It appears that most of the system was constructed at or just below the design levels, except for a couple of sections around the western end of Wood Gate Canal and in John Goleby Canal. These areas were excavated deeper than design levels, possibly to source fill.

### 2.2.2 Tide planes

Tide planes and datum levels play a crucial role in assessing the survey data and for understanding navigation in the area.

The most up-to-date tide planes for Wellington Point are provided in Table 2.1.

**Table 2.1 Wellington Point Tide Planes (MSQ 2012)**

| | | To LAT Datum (m) | To AHD Datum (m) |
|---|---|---|---|
| Highest Astronomical Tide | HAT | 2.84 | 1.51 |
| Mean High Water Springs | MHWS | 2.26 | 0.93 |
| Mean High Water Neaps | MHWN | 1.85 | 0.52 |
| Australian Height Datum | AHD | 1.33 | –0.00 |
| Mean Sea Level | MSL | 1.26 | –0.07 |
| Mean Low Water Neaps | MLWN | 0.79 | –0.54 |
| Mean Low Water Springs | MLWS | 0.38 | –0.95 |
| Lowest Astronomical Tide | LAT | 0.00 | –1.33 |

The survey datum stated in the hydrographic surveys provided to KBR is to LAT. This equates to –1.33 mAHD. This LAT datum has been adopted for all survey modelling and use in this report.

### 2.2.3 Dredging and surveying history

Since the canal system's construction in 1987–88 there have been various surveys and dredging campaigns undertaken. In order to assess siltation, KBR needed to identify and quantify dredging campaigns between surveys. The timeline set out below indicates times when KBR has information that dredging and surveying has occurred. Dredging is shown in red text and surveying in blue.

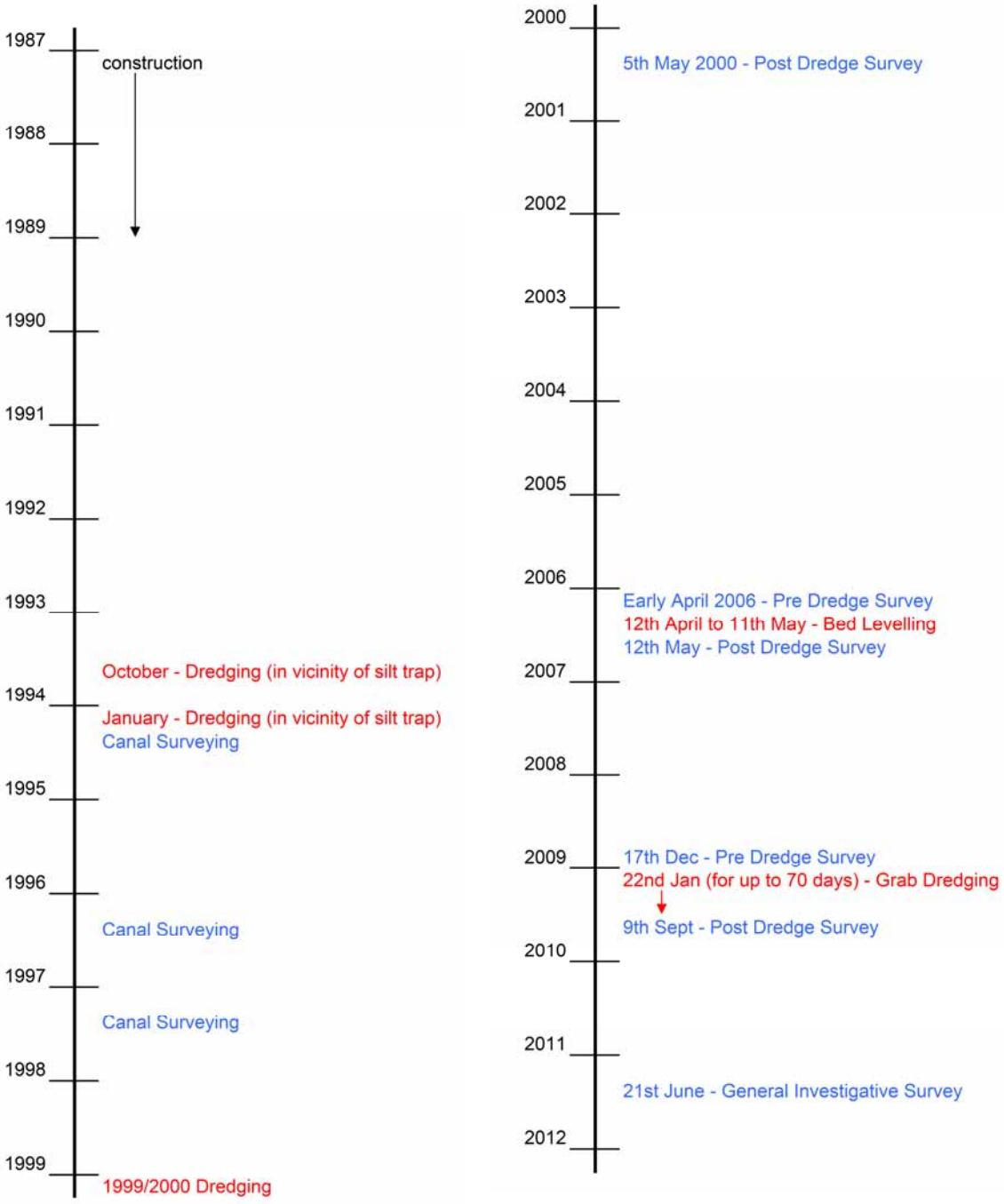



**Figure 2.3**
**SURVEYS AND DREDGING OCCURRENCES**

*Note: The 'silt trap' is located between chainage 0m and 500m. These chainages of the inner entrance channel are shown in Appendix D.*

KBR has been provided with survey data from the year 2000 onwards, hence this period will be used to estimate siltation rates. Dredging operations during this time are briefly summarised as follows.

**Bed levelling**

- occurred over three days between 12 April and 11 May 2006
- undertaken by 'Port of Brisbane Corporation'
- undertaken around silt trap/entrance to canals.

**Grab dredging**

- contracted dredging commencement date of 22 January 2009
- practical completion within 70 days of commencement date
- undertaken by 'Coastal Dredging & Construction Pty Ltd
- dredging extent:
  - Wood Channel Chainage –50 m to 300 m to depth –2.4 mLAT. Estimated insitu dredge volume of 19,885 $m^3$ (as at June 2006)
  - Wood Channel Chainage 300 m to 1,000 m to depth –1.9 mLAT. Estimated in situ dredge volume of 22,765 $m^3$ (as at June 2006)
- dredged material disposed at Mud Island via barge.

### 2.2.4 Existing reports and studies

The following reports and studies on the entrance channel and canal system were examined:

- 'Aquatic Paradise Canal Estate Siltation Study' November 1997 by Kinhill Pty Ltd: This report presents the findings of a siltation study on the canal system. The objective of the study was to examine possible sources of siltation, long term maintenance dredging requirements and costs, and the nature of any measures that could be employed to mitigate the costs of dredging. This report is a useful source of background information in developing this current report.
- University of New South Wales Water Research Laboratory (WRL) Study: This study was undertaken with the aim of understanding the sedimentation dynamics of Waterloo Bay. The Kinhill report summarised this study as '*the WRL report provides a reasonable insight into the future sedimentation behaviour of the development. While the predicted sedimentation volumes were extremely broad, the results are within the accepted accuracy ranges of the sedimentation prediction theories available at the time'.*
- Riedel & Byrne (R&B) Engineers Field Studies: During 1988 and 1989 R&B undertook field measurements and performed calculations aimed at estimating the likely siltation characteristics of the proposed Aquatic Paradise entrance channel. An important finding from this study was that during periods of observed heavy rain observed the suspended sediment levels in Waterloo Bay did not increase significantly..

# 3 Input data

## 3.1 SURVEY DATA

Siltation rates were estimated by comparing historical surveys after allowing for dredging. Survey data was provided by RCC and Port of Brisbane Pty Ltd. A summary of the survey data is provided in Table 3.1. All surveys were undertaken by the Port of Brisbane Pty Ltd.

**Table 3.1 Survey data**

| Date | Title and Plan Number(s) | Sonar Beam | Grid Size | Class | Vertical and Horizontal Tolerances | Data Type Received | Datum |
|---|---|---|---|---|---|---|---|
| 5 May 2000 | Post Dredge 101383 101384 101514 | Single Beam | 5 m x 5 m | – | – | XYZ points (.TXT) file & PDF plans | LAT |
| 12 April 2006 | Pre Dredge | Single Beam | 5 m x 5 m | C | Vertical = ± 0.10m Horizontal = ± 1.5m | XYZ points (.TXT) file | LAT (–1.31 mAHD) |
| 12 May 2006 | Post Dredge 113760 | Single Beam | 5 m x 5 m | C | Vertical = ± 0.10m Horizontal = ± 1.5m | XYZ points (.TXT) file & PDF plans | LAT (–1.31 mAHD) |
| 17 Dec 2008 | Pre Dredge | Multi Beam | 0.2 m x 0.2 m | A | Vertical = ± 0.15m Horizontal = ± 0.5m | XYZ points (.PTS) file | LAT |
| 9–11 Sept 2009 | Post Dredge 122160 | Multi Beam | 0.2 m x 0.2 m | A | Vertical = ± 0.15m Horizontal = ± 0.5m | XYZ points (.PTS) file & PDF plans | LAT |
| 21–22 June 2011 | General Investigative 125528 | Multi Beam | 0.2 m x 0.2 m | A | Vertical = ± 0.15m Horizontal = ± 0.5m | XYZ points (.PTS) file | LAT (–1.31 mAHD) |

# 4 Siltation modelling methodology

## 4.1 SURVEY DATA PROCESSING

The survey datasets were plotted for a rough check of their validity and verified against survey notes and datum levels. They were then converted from XYZ points to a DTM of the canal using 3D mapping and modelling software. This process facilitates subtraction of surveys to obtain siltation isopachs. The bed level DTMs are provided in Appendix A.

## 4.2 ESTIMATING SILTATION

Sequential bed level DTMs were overlayed to find the difference in height to estimate annual siltation rates and the current volume of siltation above design levels. This process is outlined below:

- Annual siltation rate (for a particular period) = newer survey minus older survey; then divided by the time (in years) between the two surveys.
- Current accumulated siltation above design levels = most current survey minus canal design levels.

All known dredging and bed levelling campaigns are also taken into account. This was done by estimating the dredged volumes using the pre and post dredge surveys and then adding this volume to the appropriate time period and areas as ‘siltation’.

Proposed dredge zones are based on observed siltation patterns; regions exhibiting similar siltation rates are grouped together with the intention that zone specific siltation volumes may be used to inform future dredge campaigns. The dredge zones are shown in Figure 4.1. Zones 1, 2 and 3 make up the entrance channel and Zones 4, 5, 6, 7, 8 and 9 make up the canals.

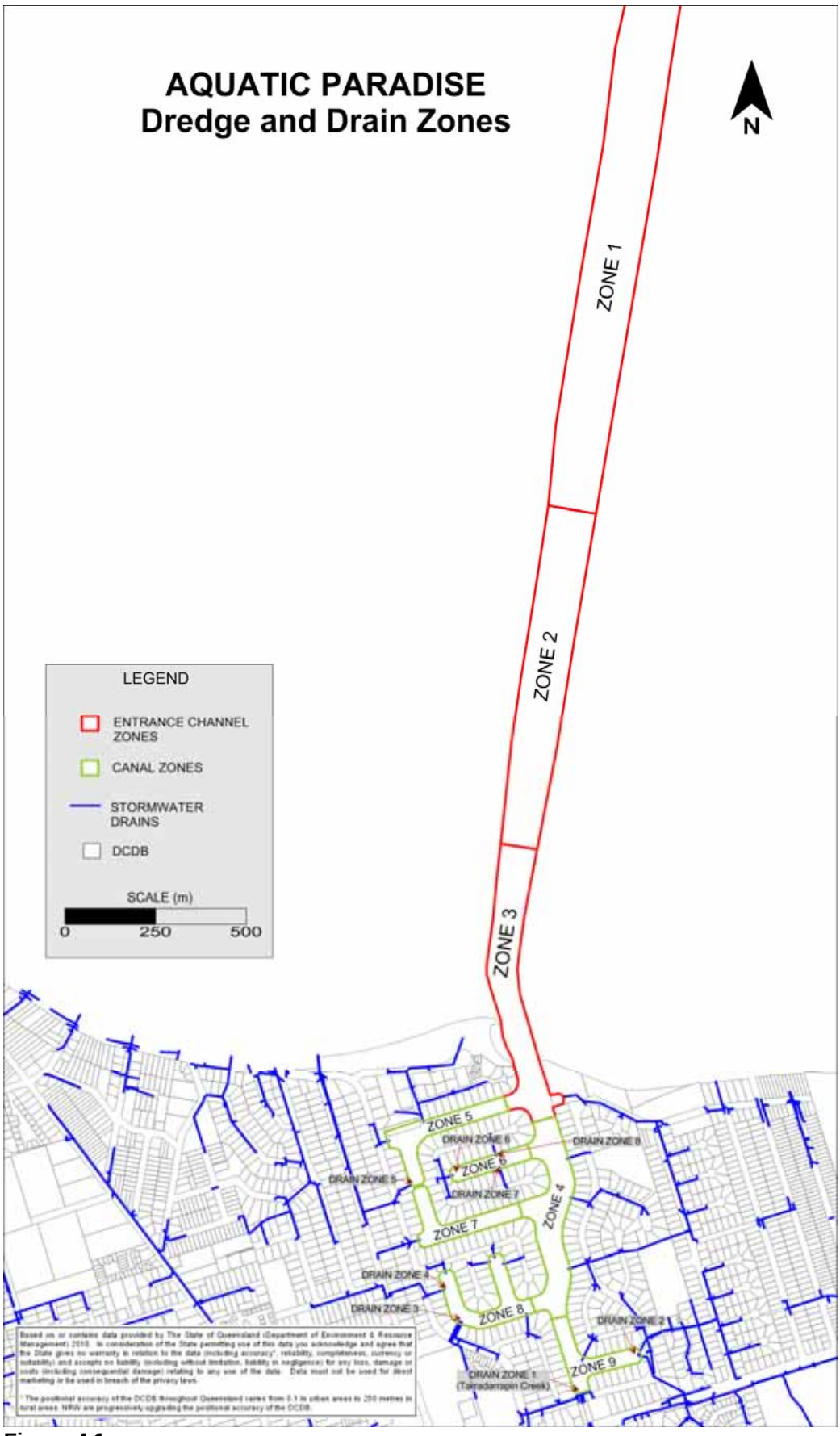



**Figure 4.1**
**DREDGE ZONES**

# 5 Siltation rates

## 5.1 ANNUAL SILTATION

This section details the estimated annual siltation across four time periods:

- May 2000 to May 2006 (partial extent model*).
- May 2006 to September 2009 (full extent overlayed model*).
- September 2009 to June 2011 (full extent model*).
- May 2000 to June 2011 (full extent model*).

* *'partial extent model' means that the hydrographic surveys were incomplete. 'Full extent model' means that the hydrographic surveys covered the entire canal estate and entrance channel. Whilst the 'full extent overlayed model' means that siltation was estimated by overlaying partially complete surveys to achieve a full extent model.*

Each of these siltation maps are presented in Appendix B.

By applying a range of area and volume calculation functions to the annual siltation DTMs, the annual siltation rates have been estimated for each of the dredge zones. They are outlined in Table 5.1.

**Table 5.1 Estimated average annual siltation rates**

| | Average annual siltation rate (mm/annum) | | | |
|---|---|---|---|---|
| | 2000 to 2006 | 2006 to 2009 | 2009 to 2011 | 2000 to 2011 |
| Entire Canal System | 11 | 15 | –8 | 32 |
| Dredge Zone 1 | – | –6 | –20 | 4 |
| Dredge Zone 2 | 8 | 15 | –3 | 37 |
| Dredge Zone 3 | 14 | 43 | 42 | 84 |
| Dredge Zone 4 | 5 | 48 | –11 | 41 |
| Dredge Zone 5 | 5 | 36 | –28 | 31 |
| Dredge Zone 6 | 5 | 18 | –22 | 31 |
| Dredge Zone 7 | – | –18 | –30 | 20 |
| Dredge Zone 8 | – | 11 | –24 | 24 |
| Dredge Zone 9 | – | 30 | –35 | 25 |

*Note: Negative values represent areas where the indicated rate of siltation is negative, i.e. 'erosion'. The indicated 'erosion' in the period 2009–2011 is due to apparent small changes in bed levels over large areas, these apparent level changes are within normal survey accuracy bounds.*

*Values represented by a '–' are due to partial survey coverage and hence data was not available for those time periods in those zones.*

The same process was also undertaken to estimate the average annual siltation volumes. They are outlined below in Table 5.2. These volumes represent the net

siltation which is the siltation volume minus how much has eroded. However this net siltation is not necessarily the volume which should be dredged from the canals, since this also needs to consider where and how the siltation is deposited.

**Table 5.2 Estimated average annual siltation volumes**

| | Annual siltation volume ($m^3$/annum) | | | |
|---|---|---|---|---|
| | 2000 to 2006 | 2006 to 2009 | 2009 to 2011 | 2000 to 2011 |
| Entire Canal System | 9,850 | 4,430 | –3,200 | 10,200 |
| Dredge Zone 1 | – | –690 | –3110 | 430 |
| Dredge Zone 2 | 2,480 | 1,090 | –250 | 2,710 |
| Dredge Zone 3 | 6,660 | 2,230 | 2,180 | 4,760 |
| Dredge Zone 4 | 450 | 1,320 | –390 | 1,220 |
| Dredge Zone 5 | 140 | 260 | –410 | 340 |
| Dredge Zone 6 | 120 | 50 | –140 | 120 |
| Dredge Zone 7 | – | –130 | –360 | 160 |
| Dredge Zone 8 | – | 100 | –340 | 260 |
| Dredge Zone 9 | – | 200 | –380 | 200 |
| Canals | 710 | 1,800 | –2,020 | 2,300 |
| Entrance Channel | 9,140 | 2,630 | –1,180 | 7,900 |

*Note: Negative values represent areas where the indicated volume of siltation is reducing, i.e. 'erosion'. The indicated 'erosion' in the period 2009–2011 is due to apparent small changes in bed levels over large areas, these apparent level changes are within normal survey accuracy bounds.*

## 5.2 CURRENT SILTATION ABOVE DESIGN LEVELS

This section describes the current estimated accumulated siltation above the canal system's design levels.

The resulting estimated volumes are outlined in Table 5.3. As various dredging operations have taken place during the time period between 1987/88 and the June 2011 survey, these volumes do not represent the total amount of siltation that has accumulated since construction; they simply show how much accumulated present in the canals above the design levels as of June 2011.

**Table 5.3 Estimated accumulated siltation volumes**

| Canal Area | Accumulated siltation volume ($m^3$) (as of June 2011) |
|---|---|
| Entire Canal System | 65,400 |
| Dredge Zone 1 | 500 |
| Dredge Zone 2 | 6,800 |
| Dredge Zone 3 | 31,300 |
| Dredge Zone 4 | 12,900 |
| Dredge Zone 5 | 4,100 |
| Dredge Zone 6 | 1,900 |
| Dredge Zone 7 | 1,800 |
| Dredge Zone 8 | 2,300 |
| Dredge Zone 9 | 3,800 |
| Entrance Channel (total) | 38,600 |
| Canals (total) | 26,800 |

## 5.3 SILTATION DUE TO STORMWATER DRAIN DISCHARGES

The DTMs show isolated mounds of siltation at some locations where stormwater drains flow into the canals. A zoomed image showing a couple of these 'stormwater drain siltation mounds' from the 2009 to 2011 annual siltation DTM is shown in Figure 5.1.

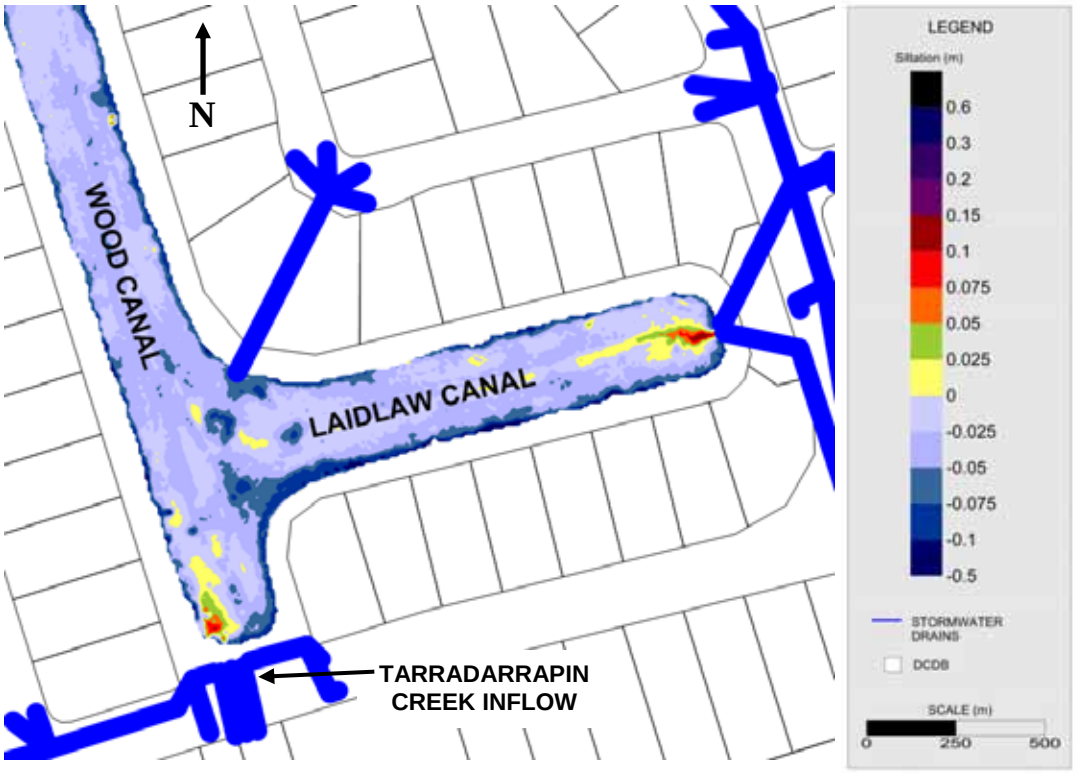



**Figure 5.1**
**SILTATION MOUNDS (LAIDLAW AND WOOD CANALS)**

Based on the 2000 to 2011 annual siltation DTM, each year approximately 43 $m^3$ of sediment accumulates in the canals each year as a result of sediment and debris coming from stormwater drains. This represents approximately 0.4% of the total average annual siltation of 10,200 $m^3$.

Table 5.4 outlines the estimated annual siltation at stormwater drain outlets over several surveyed time periods.

**Table 5.4 Estimated annual siltation at stormwater drain outlets**

| | 2006 to 2009 Annual siltation volume ($m^3$/annum) | 2009 to 2011 Annual siltation volume ($m^3$/annum) | 2000 to 2011 Annual siltation volume ($m^3$/annum) |
|---|---|---|---|
| Drain Outlet Zone 1 | 16.5 | 4.5 | 6 |
| Drain Outlet Zone 2 | 12.5 | 6.5 | 16 |
| Drain Outlet Zone 3 | 2 | 4 | 16 |
| Drain Outlet Zone 4 | 0.5 | 0.5 | 2 |
| Drain Outlet Zone 5 | 1 | 0.5 | – |
| Drain Outlet Zone 6 | 5.5 | 5.5 | 1 |
| Drain Outlet Zone 7 | 0.5 | – | – |
| Drain Outlet Zone 8 | 2.5 | – | 2 |
| **Total** | **41** | **21.5** | **43** |

The location of the drain zones is shown in Figure 4.1. Siltation volumes have been estimated only for stormwater drains that display an identifiable sediment deposit.

These results indicate a declining annual volume of silt depositing at stormwater drain outlets from 2006–2009 to 2009–2011.

Sediment samples taken from the deposits shown in Figure 5.1 show that these samples have a significant organic content, unlike other samples, confirming the hypothesis that these deposits have a significant catchment origin (refer Section 6).

## 5.4 DISCUSSION

Siltation is known to vary over space and time and this is reflected in the variation of the observed rates across the different dredge zones and time periods. Different factors could contribute to this rate deviation, including variation in rainfall events, turbidity levels, wind and wave action and direction, catchment runoff, tidal movements, survey accuracy, the depth of silt in the trap and an array of other factors, some of which are dependent upon each other.

KBR recommends that the 2000 to 2011 survey period is the most useful for analysing siltation patterns and identifying siltation sources and volumes. This is primarily due to its greater coverage and being over the longest time period, hence producing the most reliable long term siltation pattern estimate. The three other siltation periods (which fall in the 2000 to 2011 period) are still useful in assessing siltation patterns and origins in and between their respective time steps, however partial survey coverage, potential survey inaccuracies and shorter time frames means they were not adopted for KBR's assessment of siltation rates and volumes.

The consolidated average annual net siltation depths and volumes for the 2000 to 2011 period shown in Table 5.5:

**Table 5.5 Consolidated average annual net siltation depths and volumes**

| | Annual siltation depths (mm/annum) | Annual siltation volume ($m^3$/annum) |
|---|---|---|
| | 2000 to 2011 | 2000 to 2011 |
| Entire Canal System | 32 | 10,200 |
| Canals | 42 | 2,300 |
| Entrance Channel | 29 | 7,900 |

The estimated volume of accumulated siltation above design levels as of June 2011 is:

- Entrance channel = 38,600 $m^3$.
- Canals = 26,800 $m^3$.
- Entire Canal System = 65,400 $m^3$.

The estimated annual siltation at stormwater drain outlets is:

- 2006 to 2009 = 41 $m^3$/a
- 2009 to 2011 = 21.5 $m^3$/a
- 2000 to 2011 = 43 $m^3$/a.

The average annual siltation depths and volumes temporal and spatial patterns have the following features:

- Greatest proportion of siltation is depositing in the inner entrance channel, silt trap and canal junction nearest the canal entrance. This volume is in the order of approximately 73% of the total annual siltation (2000–2011 survey).
- Over the 2000 to 2011 period the greatest rate of annual siltation accumulation is in the siltation trap and inner entrance channel.
- Much lower observed canal siltation after the Zone 3 'silt trap' had been dredged (e.g. 2009–2011).
- A declining trend in siltation, possibly due to stabilisation of the areas surrounding the entrance channel. In theory, shallowing of canal bed levels may also result in declining siltation due to increased current flow and greater boat propeller jet action.
- Negative correlation with rainfall (2006–2009 which was dry has a higher siltation rate than the wet 2009–2011 period).
- Widespread and apparently even minor 'erosion' areas (negative siltation) indicated in the 2009 to 2011 survey are within the survey equipment error band [this survey period has a ±0.15 m vertical tolerance, to a 95% confidence (Port of Brisbane survey plots; drawing 122160 1 to 4 and 125528 1 to 4).

Dredging volumes and siltation volumes are related but not the same. Areas of low accretion rates can be allowed to accrete for many years without causing navigation problems. Localised high areas may require dredging even if the entire estate has minimal net average siltation. Note that 'siltation' refers to sediment accumulation of all types – gravel, sand, silt, clay and debris (organic matter).

# 6 Sediment sampling

## 6.1 INTRODUCTION

On 1 June 2012 KBR undertook preliminary sediment sampling in the Aquatic Paradise Canal System using a piston sampler. The purpose of this preliminary sampling was to qualitatively characterise the sediment and gain an understanding of the possible sediment origins and processes. No quantitative tests have been performed.

## 6.2 SAMPLING PROCESS AND LOCATIONS

A manual piston sampler was used to extract the sediments. This piston sampler consists of a metal tube with an inner plunger attached to a rope. The sampler is lowered down to the canal bed level (sediment surface) and the metal tube is pushed into the sediment. Whilst pushing the sampler down into the sediment the rope is held up, thus extracting a sediment core into the tube. Several metal pipes can be screwed together on top of the sampler to allow use in water of varied depths. As the sampler is non-mechanised the depth of this sediment core is determined by how far the user can push the piston into the sediment.

Each sample site was identified using a GPS. Sediment samples were extruded, photographed and some of the sediment was bagged for further inspection. This process was undertaken at six sediment sampling locations within the Aquatic Paradise canal system.

The sediment sampling locations were chosen based on analysis of the hydrographic surveys. These locations were at points of high sedimentation identified in the 2009 to 2011 Annual Siltation DTM. The sediment sampling locations can be seen in Figure 6.1. Sediment sample sites 1, 2 and 3 are at locations of high sedimentation which is expectedly due to sedimentation process from Moreton Bay. Whilst sample sites 4, 5 and 6 are at identified locations of localised sedimentation where stormwater drains enter the canal system.

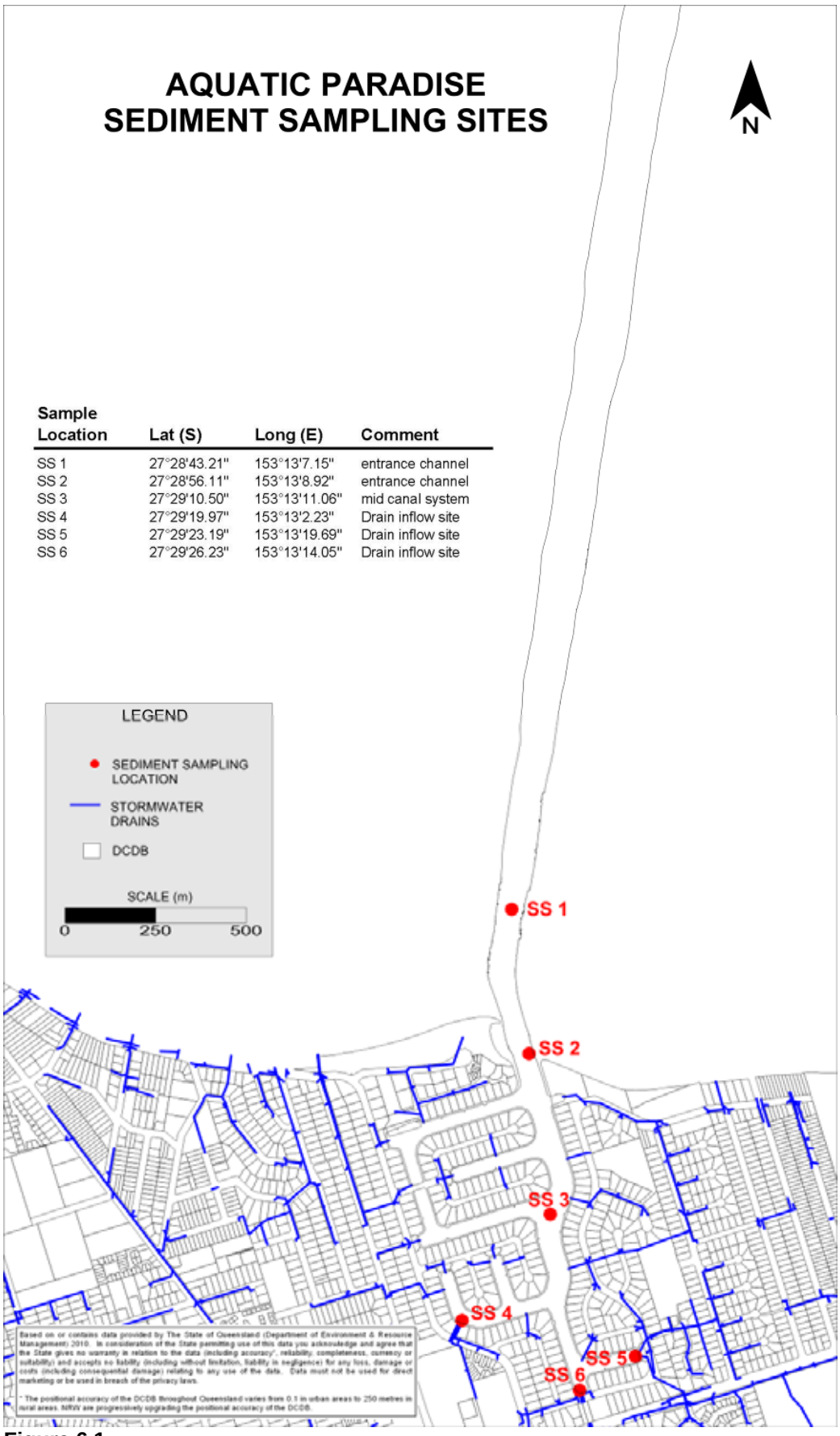



**Figure 6.1**
**SEDIMENT SAMPLE SITES**

## 6.3 SUMMARY OF SAMPLING RESULTS

Analysis of the samples was limited to visual inspection only. The colour of the sediment was assessed using the Munsell Colour Chart. Colour might be a guide to the origin of the sediment.

Table 6.1 summarises the sediment sample cores taken in the Aquatic Paradise Canal System. The table outlines sediment core length, sediment layering, sediment colour classification based on the Munsell Chart and general descriptions and comments of the sediments. Photos of each of the sediment cores are included in Appendix C.

**Table 6.1 Sediment sample core summary**

| | Core Length (m) | Layers Separation (m) | Munsell Colour Description | Physical Descriptions/Comments |
|---|---|---|---|---|
| SS 1 (10:40am) | 0.9 | 0 – 0.1 | Gley 1 – 3/N (very dark grey) | Very fine marine clay<br>Not as cohesive as SS2, although still fairly cohesive |
| | | 0.1 – 0.75 | Gley 1 – 4/N (dark grey) | Fine marine clay<br>Cohesive |
| | | 0.75 – 0.9 | Gley 1 – 3/N (very dark grey) | Fine marine clay<br>Cohesive<br>Presence of granules (2–4 mm) and pebbles (up to 7mm) |
| SS 2 (10:15am) | 0.75 | 0 – 0.1 | Gley 1 – 2.5/N (black) | Fine marine clay<br>Cohesive |
| | | 0.1 – 0.75 | Gley 1 – 3/N (very dark grey) | Fine marine clay<br>cohesive |
| SS 3 (09:45am) | 0.75 | 0 – 0.1 | Gley 1 – 2.5/N (black) | Fine marine clay<br>Smooth texture and cohesive<br>Noticeable salty odour |
| | | 0.1 – 0.75 | Gley 1 – 4/1 10Y (dark greenish grey) | Fine marine clay<br>Smooth texture and cohesive<br>Noticeable salty odour<br>More greyish colour than top layer |
| SS 4 (09:15am) | 0.35 | 0 – 0.1 | NA | Coarse sand / gravel<br>2–4mm granules, sub angular<br>Very minimal fines, some quartz |
| | | 0.1 – 0.2 | NA | Pebbles (average 15–20mm)<br>Sub angular, no fines, some quartz |
| | | 0.2 – 0.35 | Gley 2 – 5PB2.5/1 (blueish black) | Coarse sand with some silt<br>Some organic matter and granules present (2–4mm) |
| SS 5 (08:40am) | 0.7 | 0 – 0.3 | Gley 2 – 5PB2.5/1 (blueish black) | Fine clayey silt<br>Strong odour (possibly due to decomposing organic matter)<br>Organic matter present – high level of leaves, sticks etc |
| | | 0.3 – 0.7 | Gley 2 – 5PB2.5/1 (blueish black) | Fine clayey silt<br>Slightly less odour than top layer<br>Organic matter present – although less than top layer<br>Gravel present (up to 10 mm, sub angular) |
| SS 6 (07:45am) | 0.75 | 0 – 0.3 | Gley 2 – 5PB2.5/1 (blueish black) | Fine clayey silt<br>Organic matter present |
| | | 0.3 – 0.75 | Gley 2 – 5PB2.5/1 (blueish black) | Fine clayey silt<br>Small pebbles throughout (up to 10 mm, sub-angular)<br>Vegetative debris and organic matter present |

## 6.4 INTERPRETATION

Sediment samples from locations 1 and 2 are typical marine clay, ex Waterloo Bay and transported into the estate by the tide.

Sediment samples from location 3 appear to be from a similar origin to Samples 1 and 2. These samples appear slightly greyer than 1 and 2 for an unknown reason.

Sediment samples from location 4 have significant gravel and pebble content, with just a very shallow layer of black coloured sedimentation on top. This location is close to a stormwater discharge point, therefore it is possible that this region experiences erosion during times of high runoff, alternating with sedimentation during low runoff periods.

Sediment samples from locations 5 and 6 are from localised sedimentation mounds where stormwater drains flow into the canal system (based on the hydrographic survey interpretation). These samples appear to be fine clayey silt, very dark in colour and displaying a high organic content. The sample from site 5 also had a very strong odour, possibly due to anaerobic decomposition of organic matter. The organic matter indicates that these localised sedimentation deposit could have catchment origin.

# 7 Siltation sources and processes

This section discussed potential siltation sources and processes based on the siltation rates and patterns identified in Section 5 and the sediment characterisations described in Chapter 6.

## 7.1 SILTATION SOURCES

The two main sources of siltation of the Aquatic Paradise canal system appear to be offshore from Moreton Bay and upland sediment entering the canals at inflow points.

### 7.1.1 Offshore

As described in the DERM Moreton Bay Healthy Waterways reports and other references, sediment in western Moreton Bay is ultimately derived from catchment erosion. Course sediments are deposited at the mouth of rivers, especially Fisherman Islands, Brisbane River whereas fine sediments circulate in the bay for long periods of time due to tides, winds, waves, currents and an array of coastal processes. Due to the sand islands and shoals, such as Stradbroke and Moreton Islands and predominant south-easterly wind and waves, a large portion of this fine sediment is trapped within the bay. This trapped sediment undergoes a process of being circulated, deposited and then re-circulated throughout the bay, especially along the western side.

This circulation process transports suspended sediment into the entrance channel and canal system. How and where this sediment may come out of suspension is discussed in Section 7.2 ‘Siltation Processes’.

As this sediment has generally been in Moreton Bay for a long period of time it undergoes a salt alteration process into ‘marine clay’. This type of sediment was sampled from the Aquatic Paradise Canals as discussed in Chapter 6 of this report.

### 7.1.2 Upland

Other sources of siltation are the Tarradarrapin Creek inflow, various stormwater drain inflows around the canals and general surface runoff into the canals from the local catchment. These sources bring sediment and debris, such as organic matter into the canal system where it can be deposited. There are various points in the canal system where ‘siltation mounds’ have been identified close to stormwater outlets and creek inflows, as discussed in Section 5.3. Sediment sampling of these mounds which is discussed in Section 6 tends to confirm an upland origin for these ‘mounds’.

## 7.2 SILTATION PROCESSES

Surveyed siltation patterns (shown in Appendix B), plus the sediment sampling are consolidated into a siltation conceptual model as follows.

Due to the greater water depth in the entrance channel the combined wave–current seabed shear stresses decline, facilitating sedimentation. Moving into the canal estate, wave action disappears and current velocities also decline especially at canal 'T' junctions. Due to the decline in bed shear stresses and sediment transport rates, flocculated clay particles in suspension settle onto the bed especially at 'T' junctions. It is also noted that even though the tidal prism in the canals is generally expected to be the same for a flood and ebb tide (except in times of flood), the bed shear force to deposit siltation is appreciably less to the bed shear force required to erode siltation.

Further into the canal system siltation is reduced because the water turbidity has declined, leaving behind unflocculated particles in suspension that have an extremely slow settling rate.

In addition there are small fluvial deposits close to stormwater drain discharges. This pattern can be seen at various locations on the bed level and siltation DTMs shown in Appendix A.

The Aquatic Paradise Canal System has a 'siltation trap'. This is the area from chainage 0 m to 500 m where the canal invert design level and hence re-dredge level is set at –2.5 mLAT, which is 0.6 m deeper than the rest of the canals and entrance channel. The purpose of this trap is for sediment to come out of suspension at this easy-to-dredge location, so that hard-to-dredge areas upstream of the trap experience less siltation. By comparing the 2006 to 2009 and 2009 to 2011 survey periods then the effectiveness of this siltation trap can be assessed as this trap was dredged between these two survey periods.

When the siltation trap was becoming full between 2006 and 2009, apparently more siltation accumulated throughout the entire canal system. Once the trap was dredged in 2009, then the 2009 to 2011 Annual Siltation DTM indicates less siltation throughout the canal system. The relevant DTMs can be found in Appendices A and B. It appears that a dredged silt trap is quite successful at reducing siltation throughout the canal system. Further investigations could also be undertaken to show potential benefits of dredging the siltation trap deeper than current design levels, and/or beam dragging sedimentation into the trap.

The apparent effectiveness of the siltation trap also reinforces the hypothesis that most siltation is coming from offshore. The DTMs show significant siltation upstream of the siltation trap when the trap is full, however there is generally much less siltation when it is empty. If the majority of siltation was coming from upland sources then significant siltation would be seen in both the 2006 to 2009 and 2009 to 2011 DTMs, which is not the case.

A possible influence on siltation processes within the canal system is suspected to be the Tarradarrapin Creek fresh water flow, especially during times of flood. In the absence of Tarradarrapin Creek flow it is expected that the flood and ebb tidal velocities in and out of the canals will be close to symmetric. Hence a fresh water outflow from Tarradarrapin Creek is expected to produce a net water flow out of the canal system into Moreton Bay. A net outward flow is expected to export sediment from the canal estate, or at least reduce the rate of siltation. This might partly explain the reduced rate of siltation and net erosion in the wet 2009–2011 period compared to the dryer 2006–2009. The indicated net erosion during the 2009 to 2011 period may

also be partly due to normal survey accuracy within the accepted tolerance levels, and hence may be less (or more) than in reality.

# 8 Conclusion

This Aquatic Paradise siltation study concludes that based on analysis of the 2000 to 2011 DTM there is an estimated average annual siltation rate of 32 mm/annum and average annual net siltation volume of 10,200 $m^3$/annum. The estimated current siltation above design levels as of June 2011 is 65,400 $m^3$.

Siltation within the Aquatic Paradise canal estate and entrance channel between 2000 and 2011 is attributed to two main sources; Waterloo Bay (approximately 10,157 $m^3$/annum = 99.6% v/v long-term average) and the stormwater outlets including Tarradarrapin Creek (approximately 43 $m^3$/a = 0.4% v/v long-term average).

For this 2000 to 2011 survey period approximately 73% of annual siltation by volume is depositing in the inner entrance channel, silt trap and canal junction nearest the canal entrance. The surveys indicate that a dredged siltation trap is effective at reducing siltation in the canals.

Sediment sampling identified typical marine clays at sites throughout the canals and towards the canal entrance and suggested sediments and organic matter found at stormwater drain and creek inflow points were from upland sources.

This siltation study informs the development of a CMP. This plan will guide the sustainable management of the canal system.

# 9 References


Kinhill Pty Ltd. 1997, *Aquatic Paradise Canal Estate Siltation Study – Final Report*, Ref: BC7905-001 Rev 0. 6 November 1997

Riedel & Byrne Consulting Engineers Pty Ltd. October 1989, *Waterloo Bay Canal Estate, Siltation Studies – Report*, ref: R350.

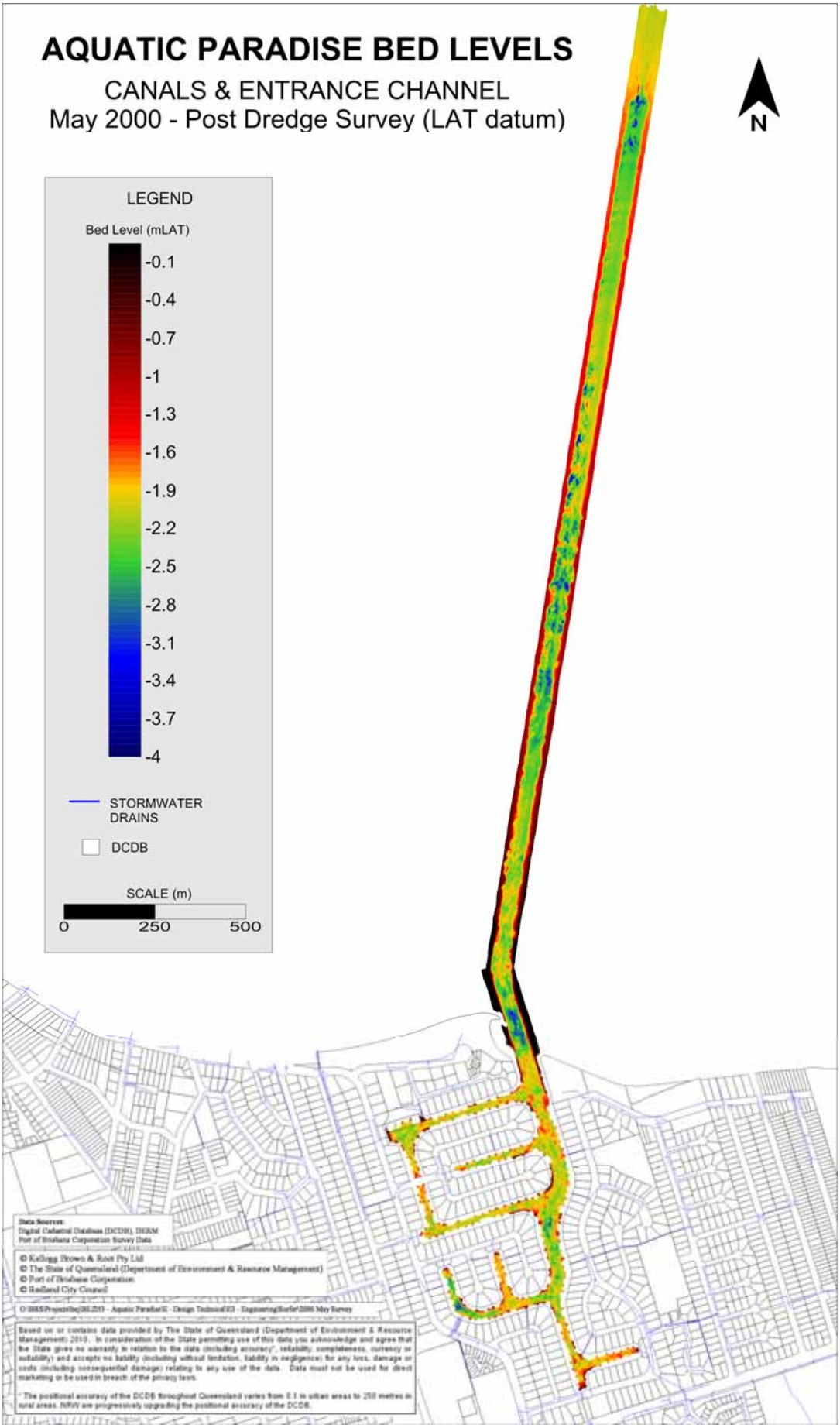
Riedel & Byrne Consulting Engineers Pty Ltd. June 1989, *Wellington Point Development – Channel Stability Studies Report*, ref: R324.

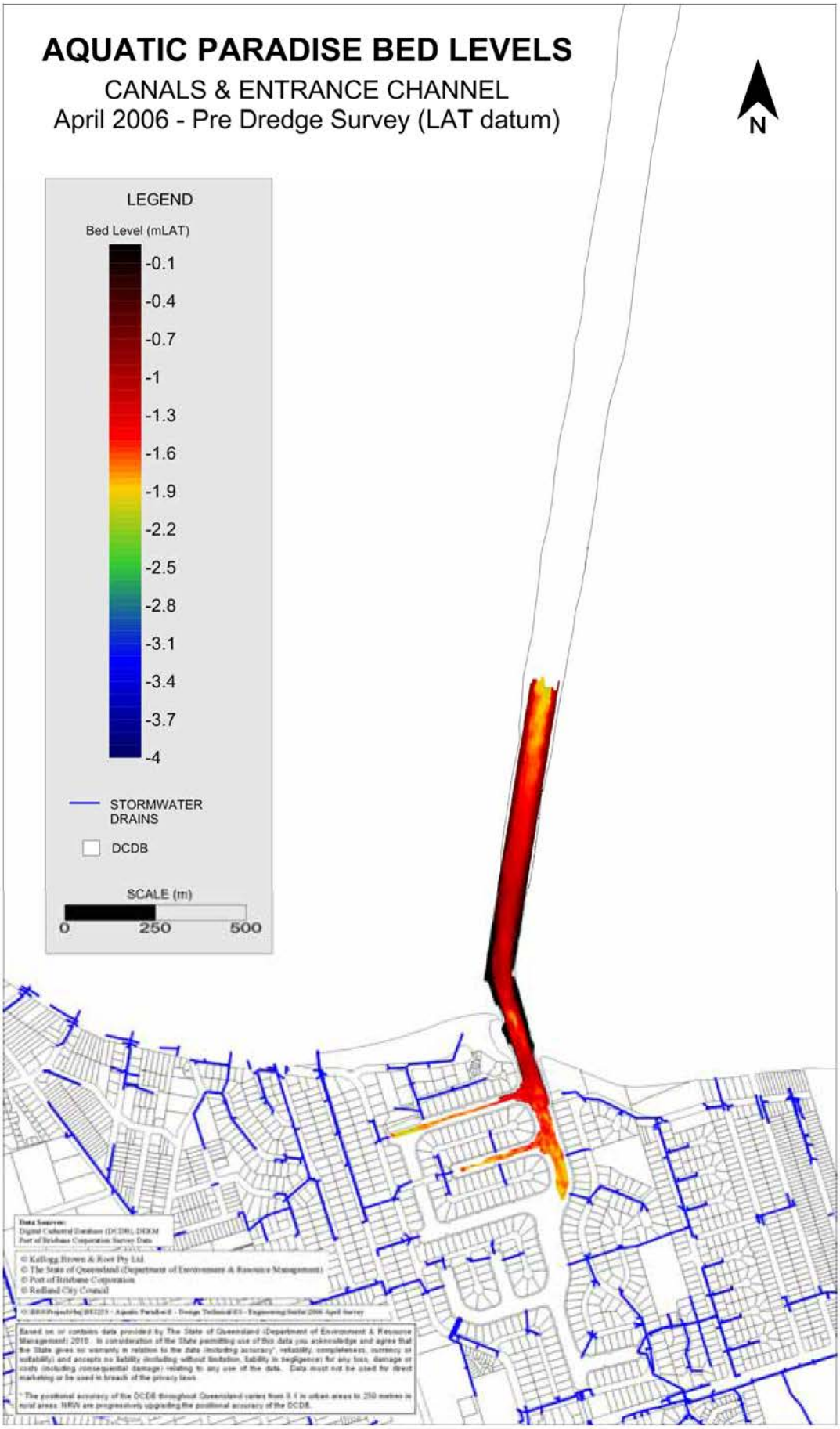
The State of Queensland (Department of Transport and Main Roads) 2011, Queensland Tide Tables 2012.

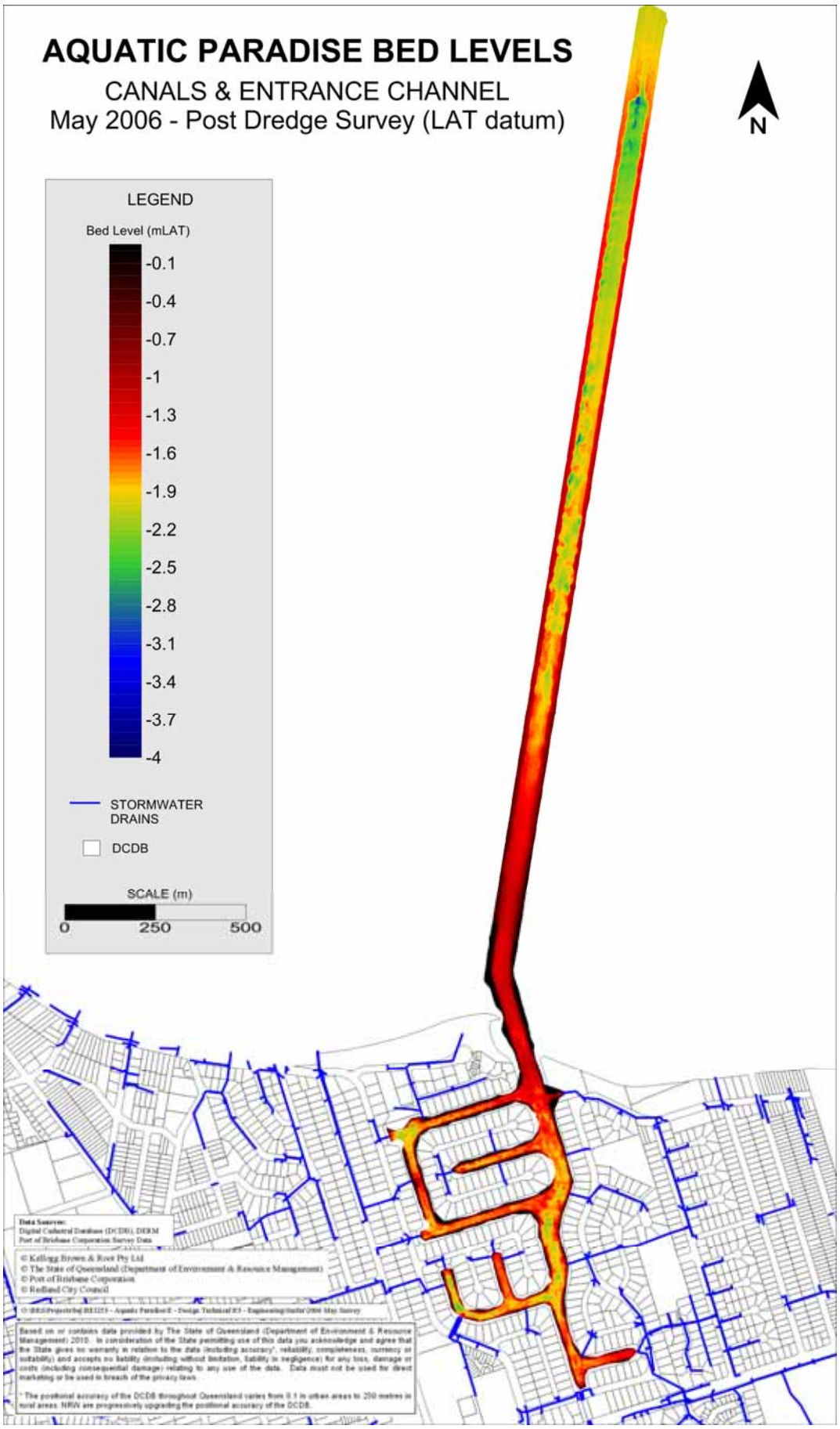
University of New South Wales Water Research Laboratory. 1982, *Sedimentation and Wave Penetration Studies for Aquatic Paradise Canal Estate Technical Report*, Ref: No, 82/21. November 1982.

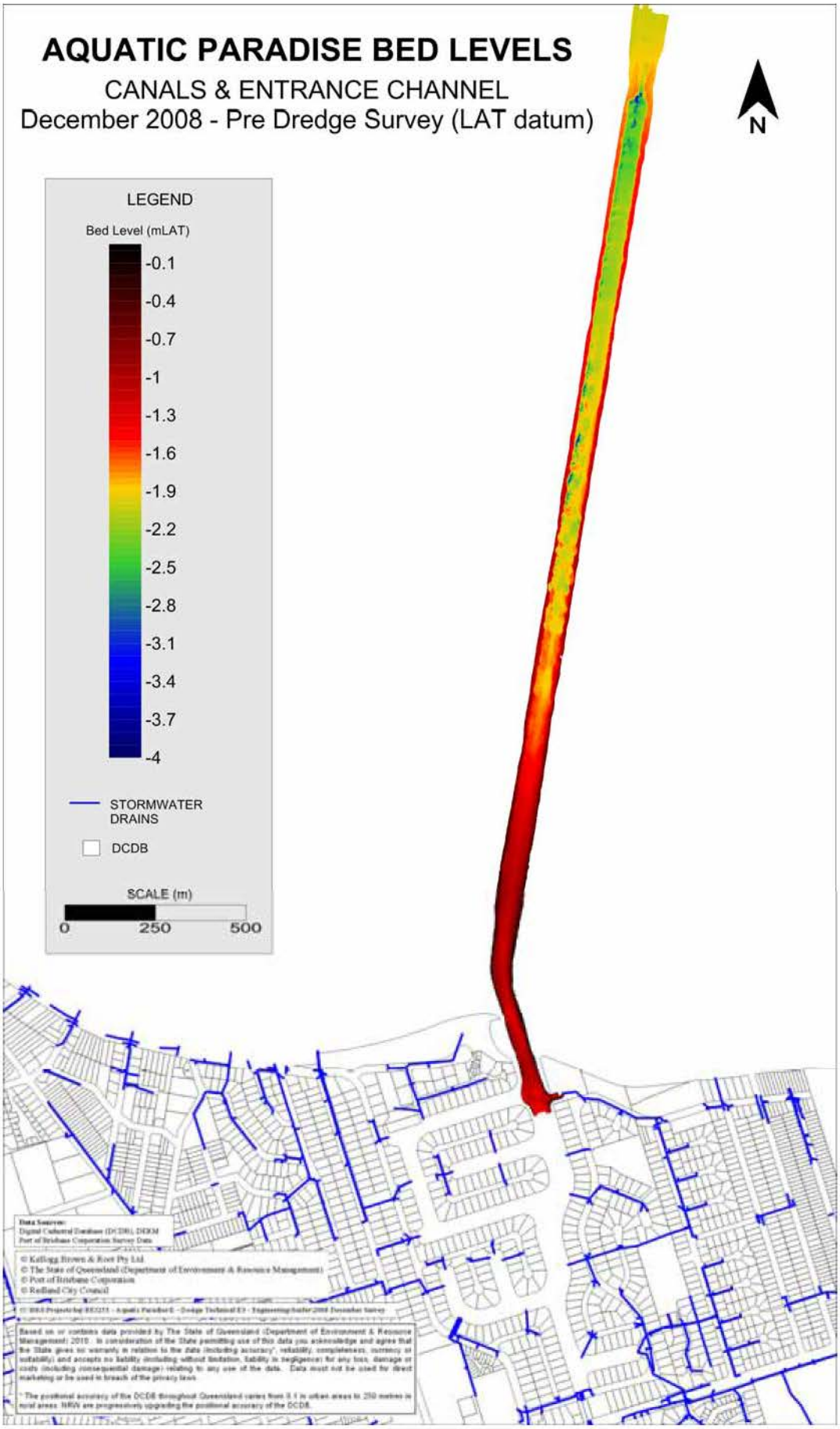
*Appendix A*

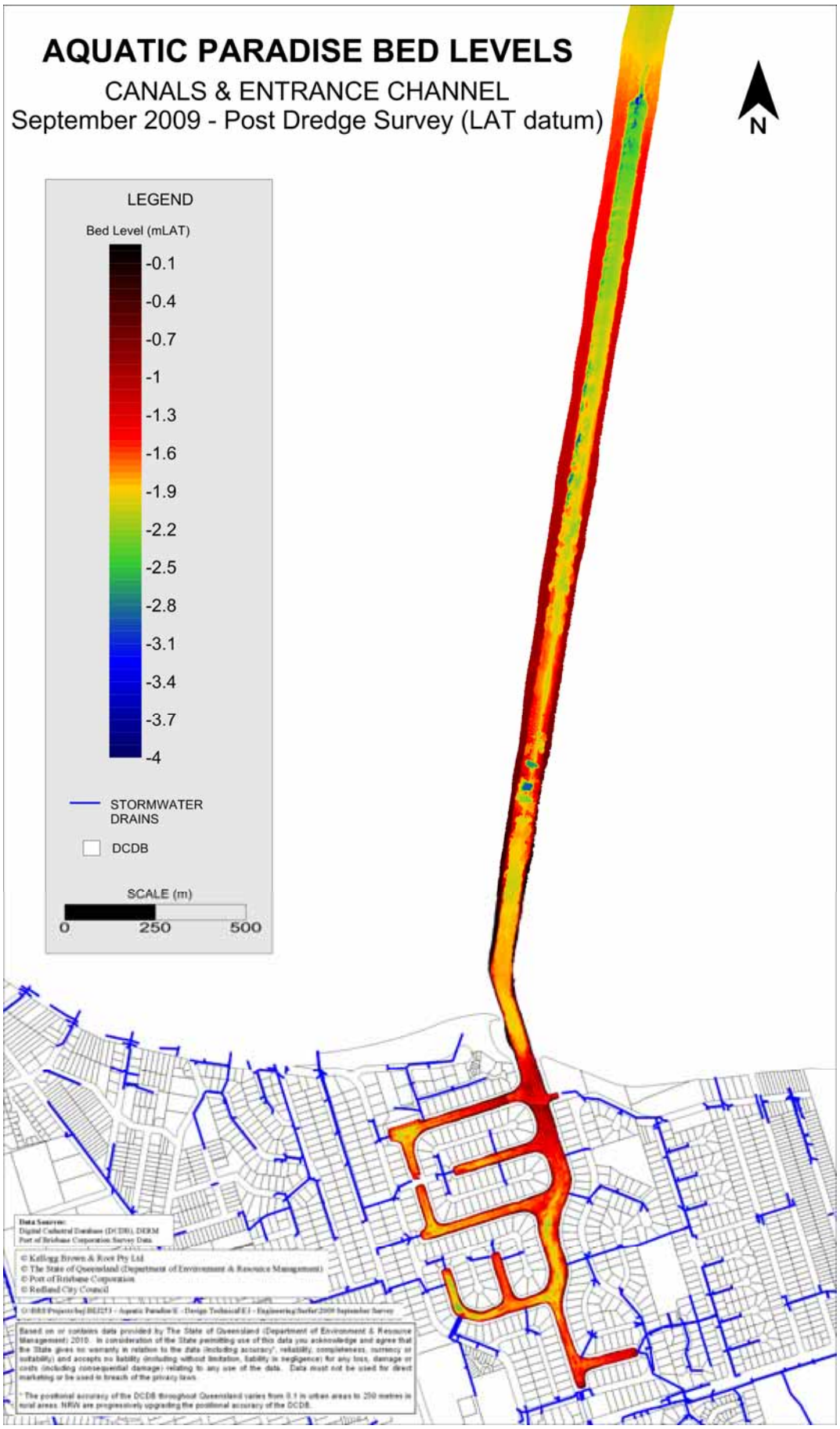
# BED LEVEL DIGITAL TERRAIN MODELS

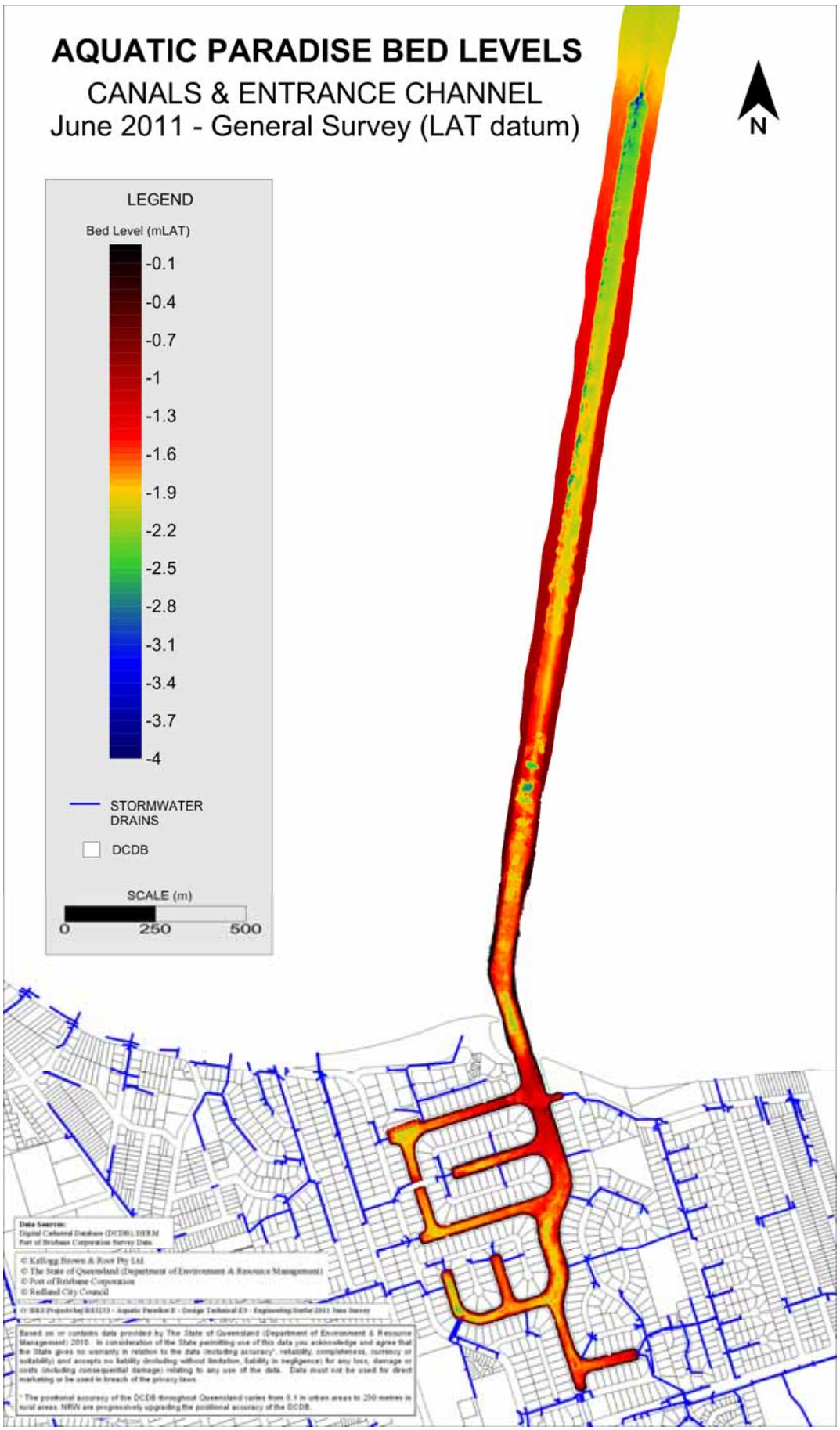

AQUATIC PARADISE BED LEVELS
CANALS & ENTRANCE CHANNEL
May 2000 - Post Dredge Survey (LAT datum)
N
LEGEND
Bed Level (mLAT)
-0.1
-0.4
-0.7
-1
-1.3
-1.6
-1.9
-2.2
-2.5
-2.8
-3.1
-3.4
-3.7
-4
STORMWATER DRAINS
DCDB
SCALE (m)
0
250
500


AQUATIC PARADISE BED LEVELS
CANALS & ENTRANCE CHANNEL
April 2006 - Pre Dredge Survey (LAT datum)
N
LEGEND
Bed Level (mLAT)
-0.1
-0.4
-0.7
-1
-1.3
-1.6
-1.9
-2.2
-2.5
-2.8
-3.1
-3.4
-3.7
-4
STORMWATER DRAINS
DCDB
SCALE (m)
0
250
500


AQUATIC PARADISE BED LEVELS
CANALS & ENTRANCE CHANNEL
May 2006 - Post Dredge Survey (LAT datum)
N
LEGEND
Bed Level (mLAT)
-0.1
-0.4
-0.7
-1
-1.3
-1.6
-1.9
-2.2
-2.5
-2.8
-3.1
-3.4
-3.7
-4
STORMWATER DRAINS
DCDB
SCALE (m)
0
250
500

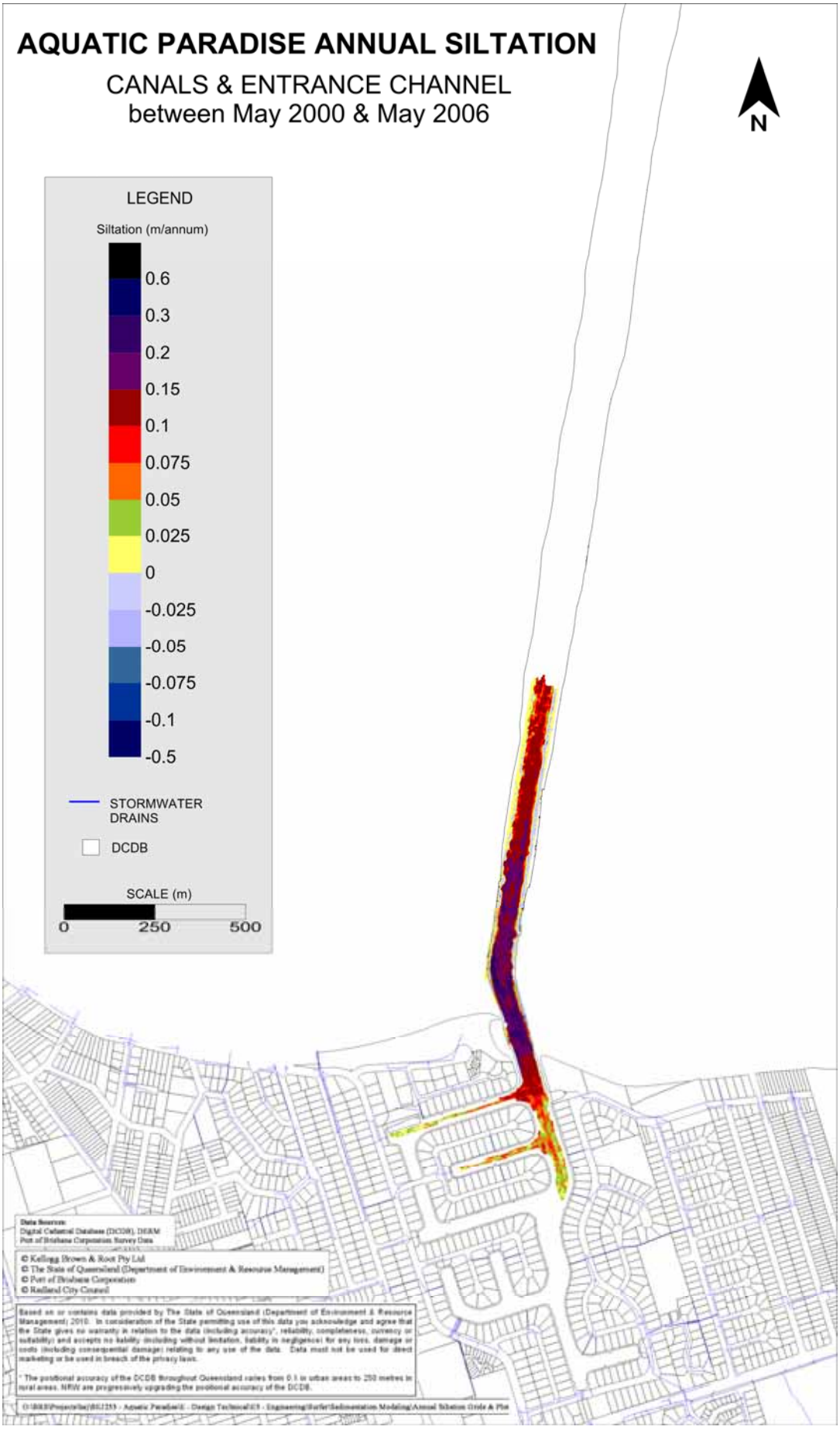

AQUATIC PARADISE BED LEVELS
CANALS & ENTRANCE CHANNEL
December 2008 - Pre Dredge Survey (LAT datum)
N
LEGEND
Bed Level (mLAT)
-0.1
-0.4
-0.7
-1
-1.3
-1.6
-1.9
-2.2
-2.5
-2.8
-3.1
-3.4
-3.7
-4
STORMWATER DRAINS
DCDB
SCALE (m)
0
250
500

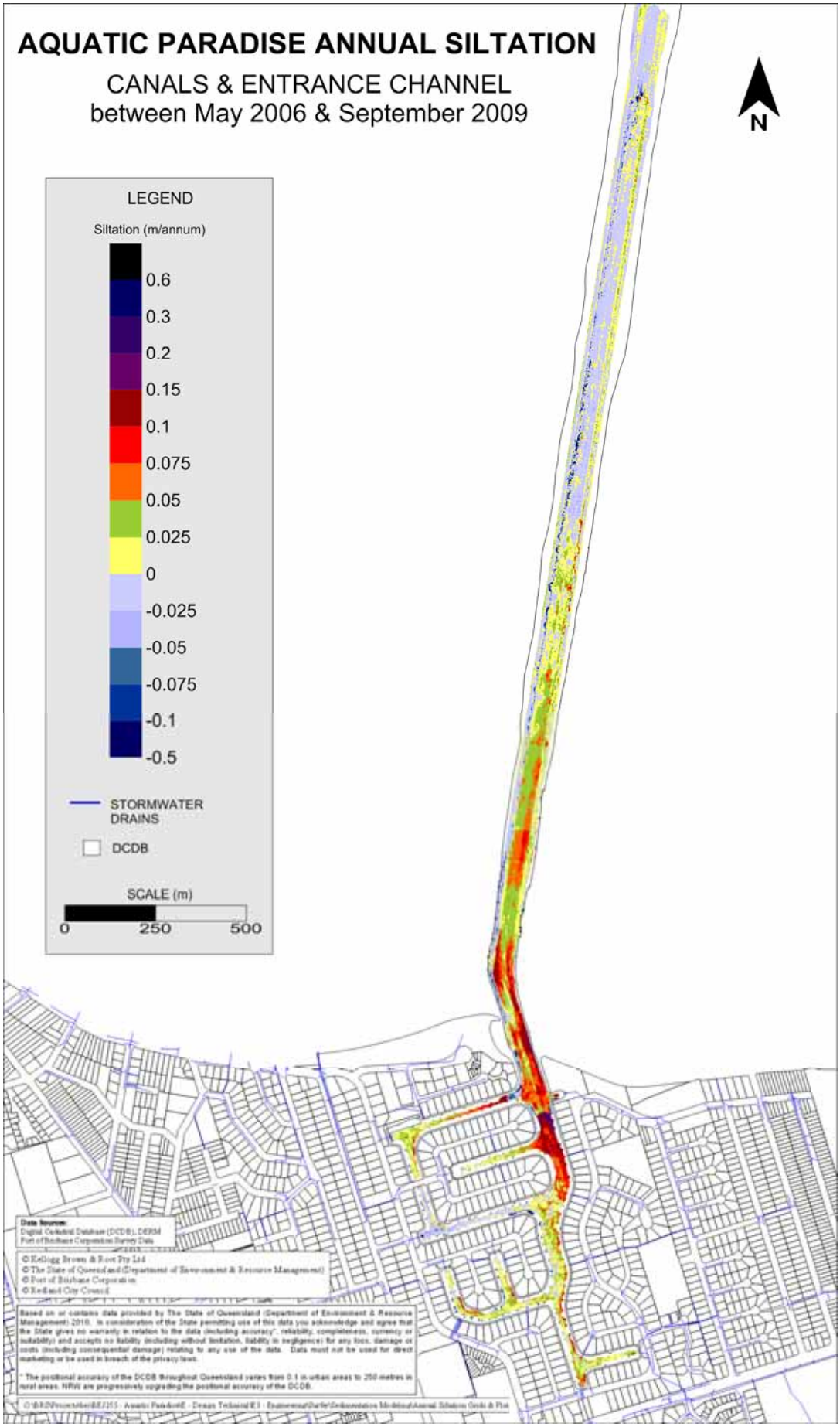

AQUATIC PARADISE BED LEVELS
CANALS & ENTRANCE CHANNEL
September 2009 - Post Dredge Survey (LAT datum)
N
LEGEND
Bed Level (mLAT)
-0.1
-0.4
-0.7
-1
-1.3
-1.6
-1.9
-2.2
-2.5
-2.8
-3.1
-3.4
-3.7
-4
STORMWATER DRAINS
DCDB
SCALE (m)
0
250
500

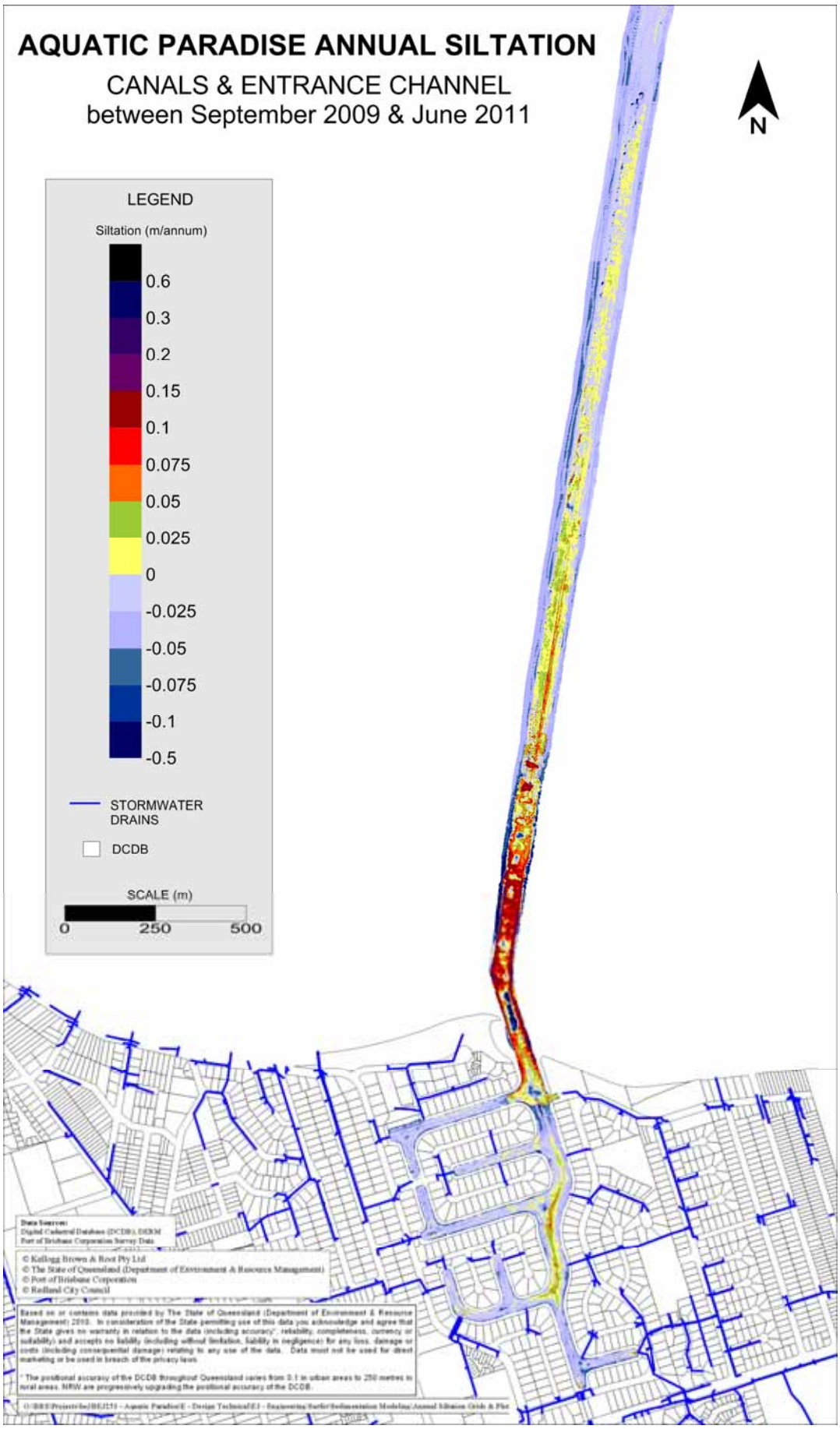

AQUATIC PARADISE BED LEVELS
CANALS & ENTRANCE CHANNEL
June 2011 - General Survey (LAT datum)
N
LEGEND
Bed Level (mLAT)
-0.1
-0.4
-0.7
-1
-1.3
-1.6
-1.9
-2.2
-2.5
-2.8
-3.1
-3.4
-3.7
-4
STORMWATER DRAINS
DCDB
SCALE (m)
0
250
500

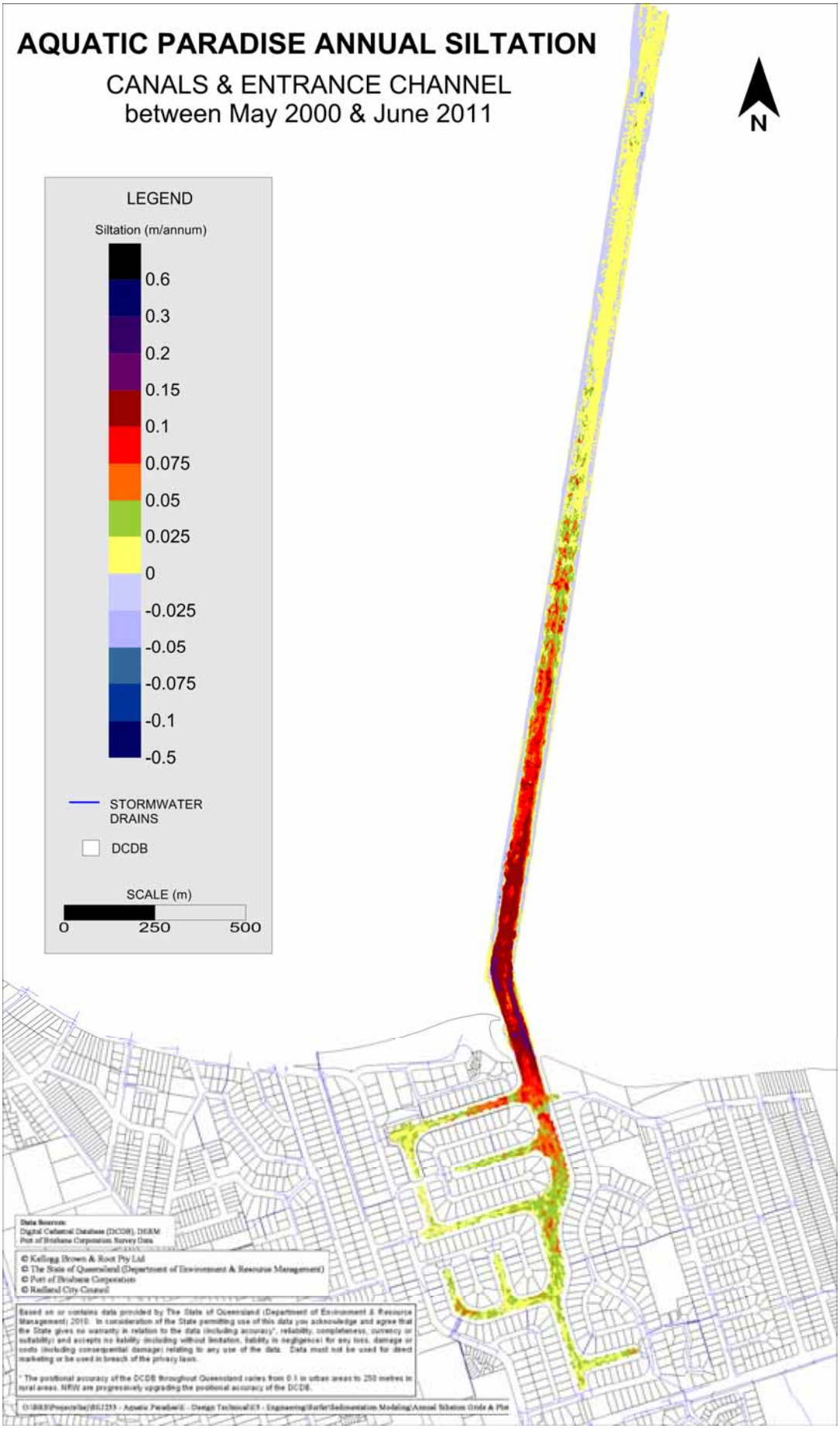
*Appendix B*

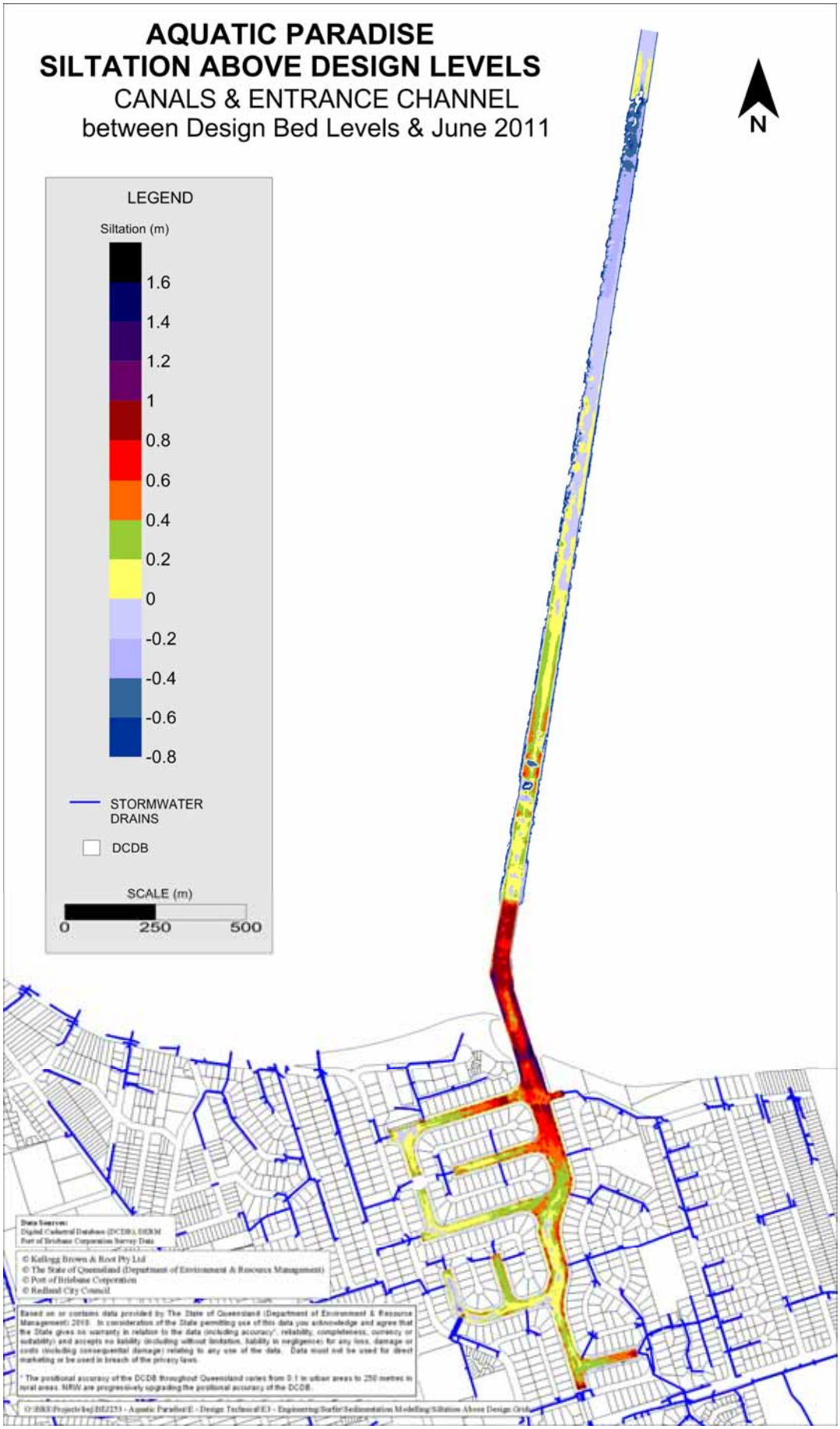
# SILTATION DIGITAL TERRAIN MODELS


AQUATIC PARADISE ANNUAL SILTATION
CANALS & ENTRANCE CHANNEL
between May 2000 & May 2006
N
LEGEND
Siltation (m/annum)
0.6
0.3
0.2
0.15
0.1
0.075
0.05
0.025
0
-0.025
-0.05
-0.075
-0.1
-0.5
STORMWATER DRAINS
DCDB
SCALE (m)
0
250
500


AQUATIC PARADISE ANNUAL SILTATION
CANALS & ENTRANCE CHANNEL
between May 2006 & September 2009
N
LEGEND
Siltation (m/annum)
0.6
0.3
0.2
0.15
0.1
0.075
0.05
0.025
0
-0.025
-0.05
-0.075
-0.1
-0.5
STORMWATER DRAINS
DCDB
SCALE (m)
0
250
500


AQUATIC PARADISE ANNUAL SILTATION
CANALS & ENTRANCE CHANNEL
between September 2009 & June 2011
N
LEGEND
Siltation (m/annum)
0.6
0.3
0.2
0.15
0.1
0.075
0.05
0.025
0
-0.025
-0.05
-0.075
-0.1
-0.5
STORMWATER DRAINS
DCDB
SCALE (m)
0
250
500


AQUATIC PARADISE ANNUAL SILTATION
CANALS & ENTRANCE CHANNEL
between May 2000 & June 2011
N
LEGEND
Siltation (m/annum)
0.6
0.3
0.2
0.15
0.1
0.075
0.05
0.025
0
-0.025
-0.05
-0.075
-0.1
-0.5
STORMWATER DRAINS
DCDB
SCALE (m)
0
250
500


AQUATIC PARADISE
SILTATION ABOVE DESIGN LEVELS
CANALS & ENTRANCE CHANNEL
between Design Bed Levels & June 2011
N
LEGEND
Siltation (m)
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
STORMWATER DRAINS
DCDB
SCALE (m)
0
250
500

*Appendix C*

# SEDIMENT SAMPLING PHOTOGRAPHS

*Appendix C*

# Aquatic Paradise Canals – 1 June 2012
# Piston sampling

## SAMPLE SITE 1


**Figure 1**
**SS 1 TOTAL CORE (0–0.9m)**


**Figure 2**
**SS 1 (1 of 6)**


**Figure 3**
**SS 1 (2 of 6)**

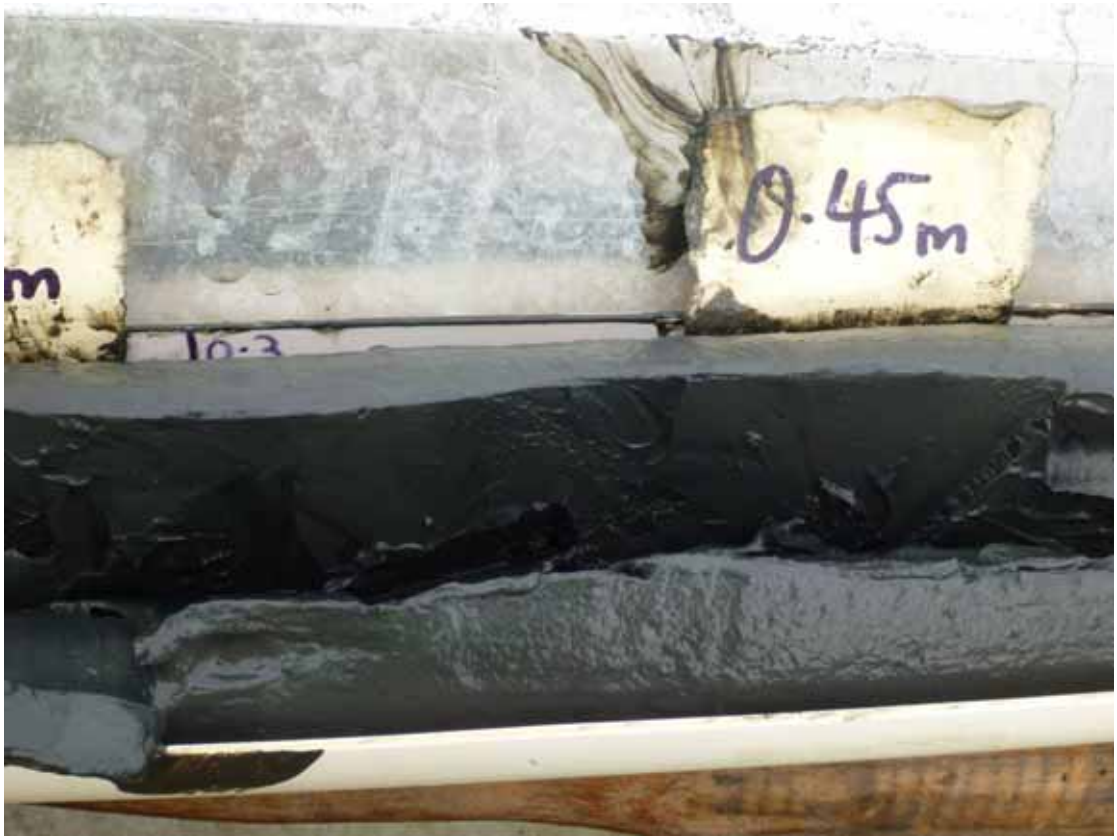



**Figure 4**
**SS 1 (3 of 6)**


**Figure 5**
**SS 1 (4 of 6)**


**Figure 6**
**SS 1 (5 of 6)**

**Figure 7**
**SS 1 (6 of 6)**

## SAMPLE SITE 2


**Figure 8**
**SS2 TOTAL CORE (0 - 0.75m)**


**Figure 9**
**SS 2 (1 0f 5)**

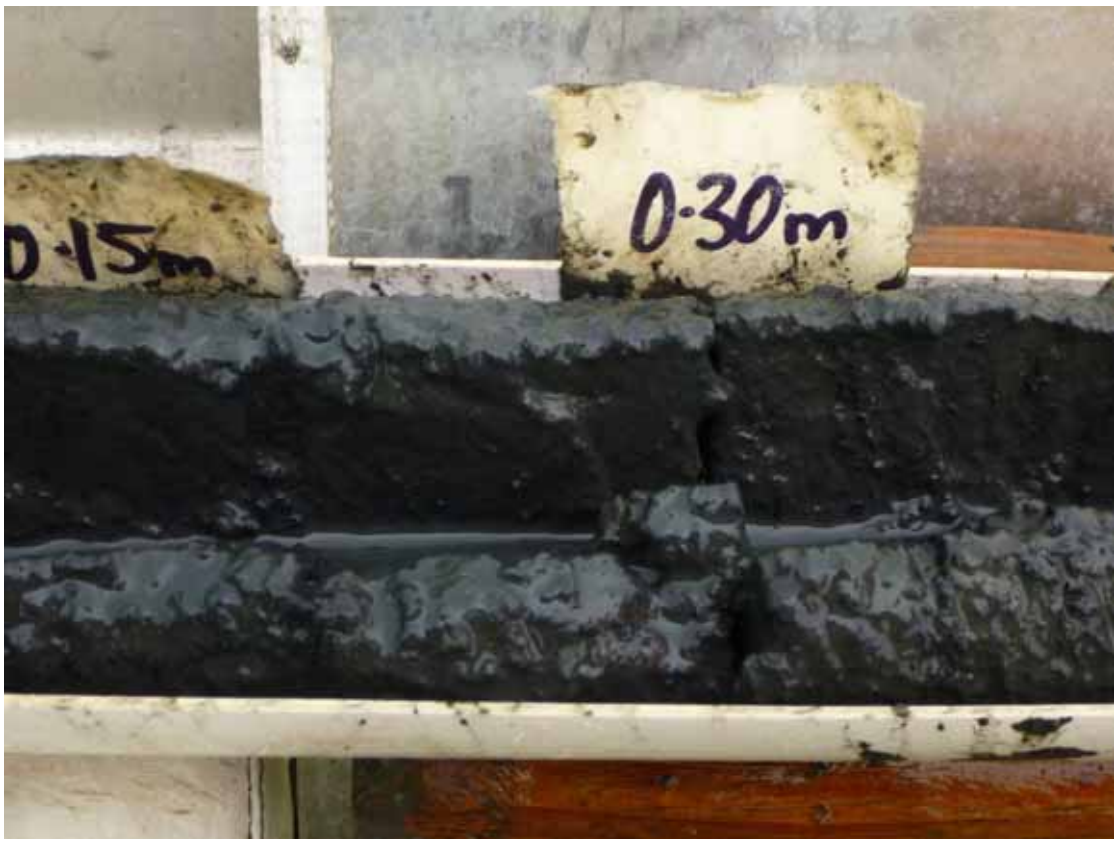



**Figure 10**
**SS 2 (2 0f 5)**

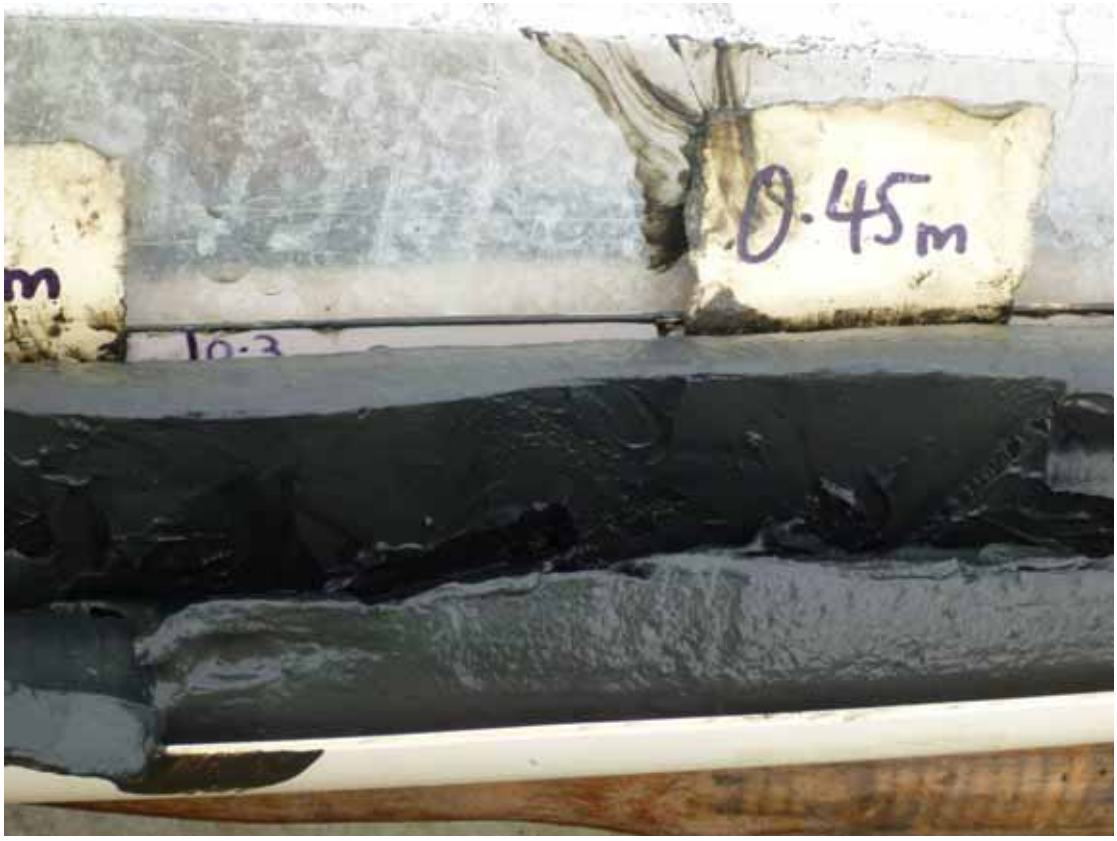



**Figure 11**
**SS 2 (3 0f 5)**

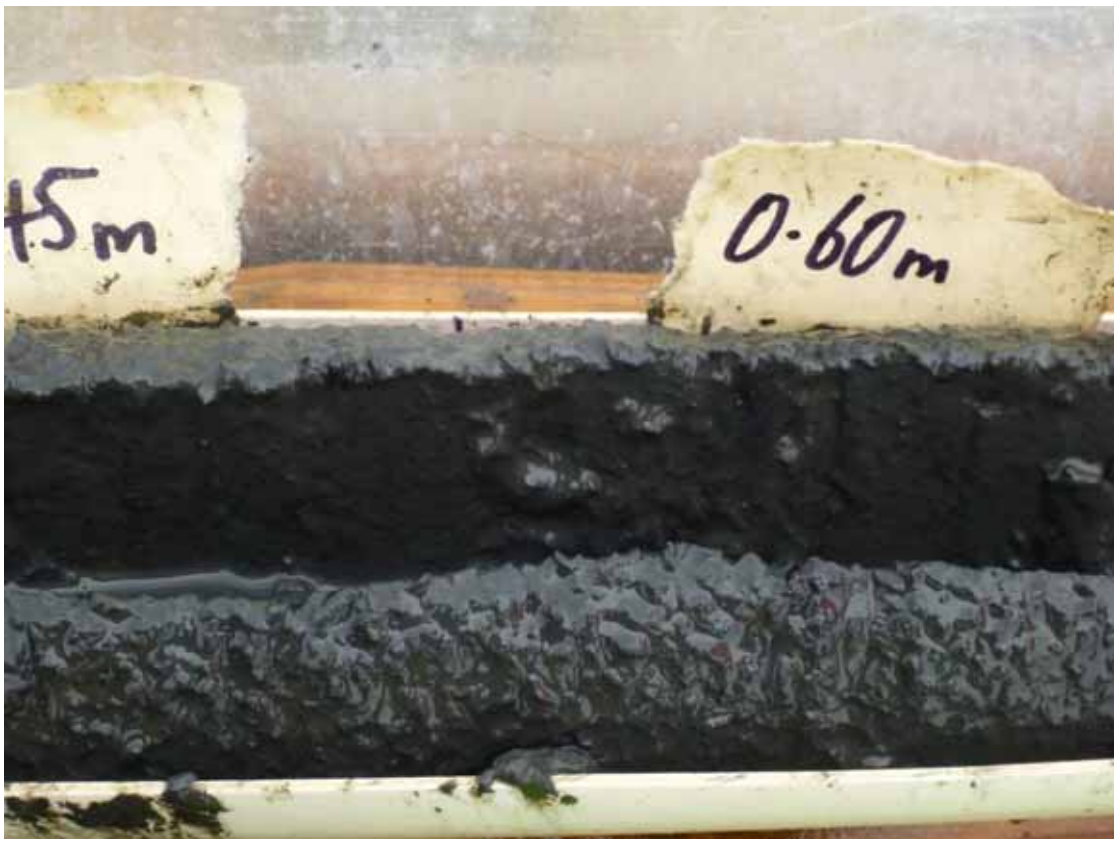



**Figure 12**
**SS 2 (4 0f 5)**


**Figure 13**
**SS 2 (5 0f 5)**

## SAMPLE SITE 3


**Figure 14**
**SS 3 TOTAL CORE (0 - 0.75m)**


**Figure 15**
**SS 3 (1 of 5)**


**Figure 16**
**SS 3 (2 of 5)**


**Figure 17**
**SS 3 (3 of 5)**

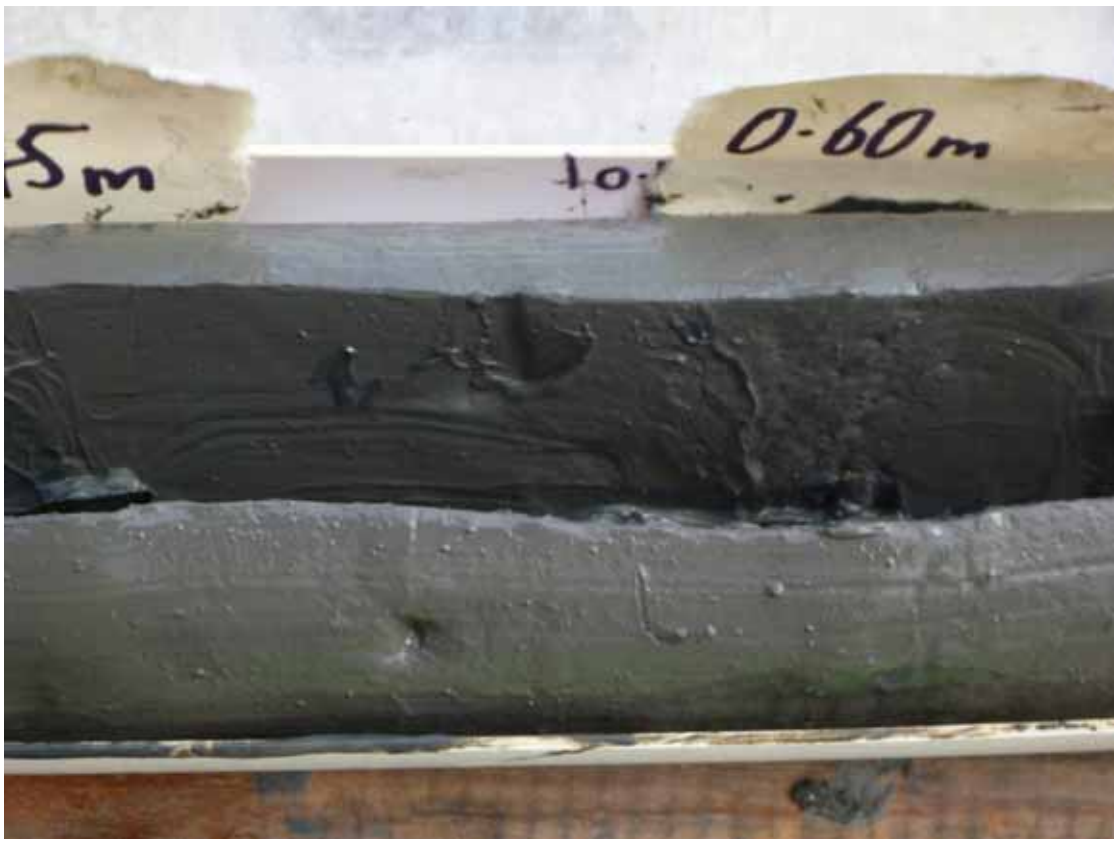



**Figure 18**
**SS 3 (4 of 5)**

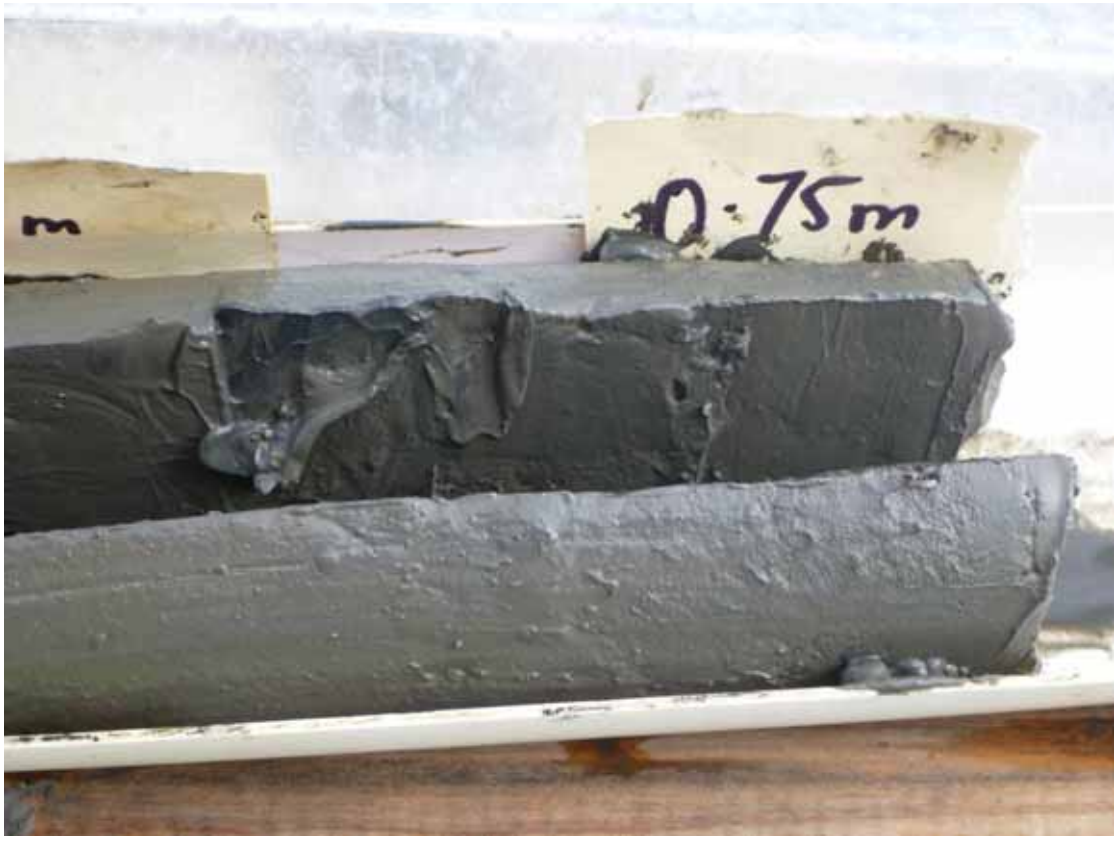



**Figure 19**
**SS 3 (5 of 5)**

## SAMPLE SITE 4

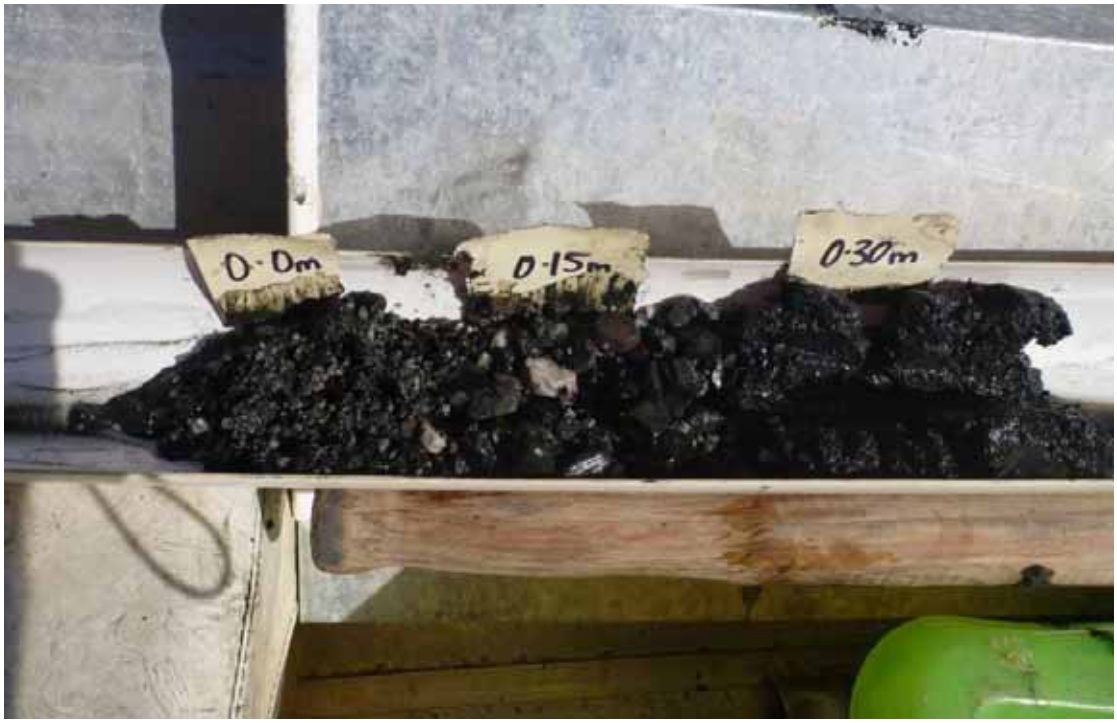



**Figure 20**
**SS 4 TOTAL CORE (0 - 0.35m)**


**Figure 21**
**SS 4 (1 of 3)**


**Figure 22**
**SS 4 (2 of 3)**


**Figure 23**
**SS 4 (3 of 3)**

## SAMPLE SITE 5


**Figure 24**
**SS 5 TOTAL CORE (0 - 0.7m)**


**Figure 25**
**SS 5 (1 of 5)**


**Figure 26**
**SS 5 (2 of 5)**


**Figure 27**
**SS 5 (3of 5)**


**Figure 28**
**SS 5 (4 of 5)**

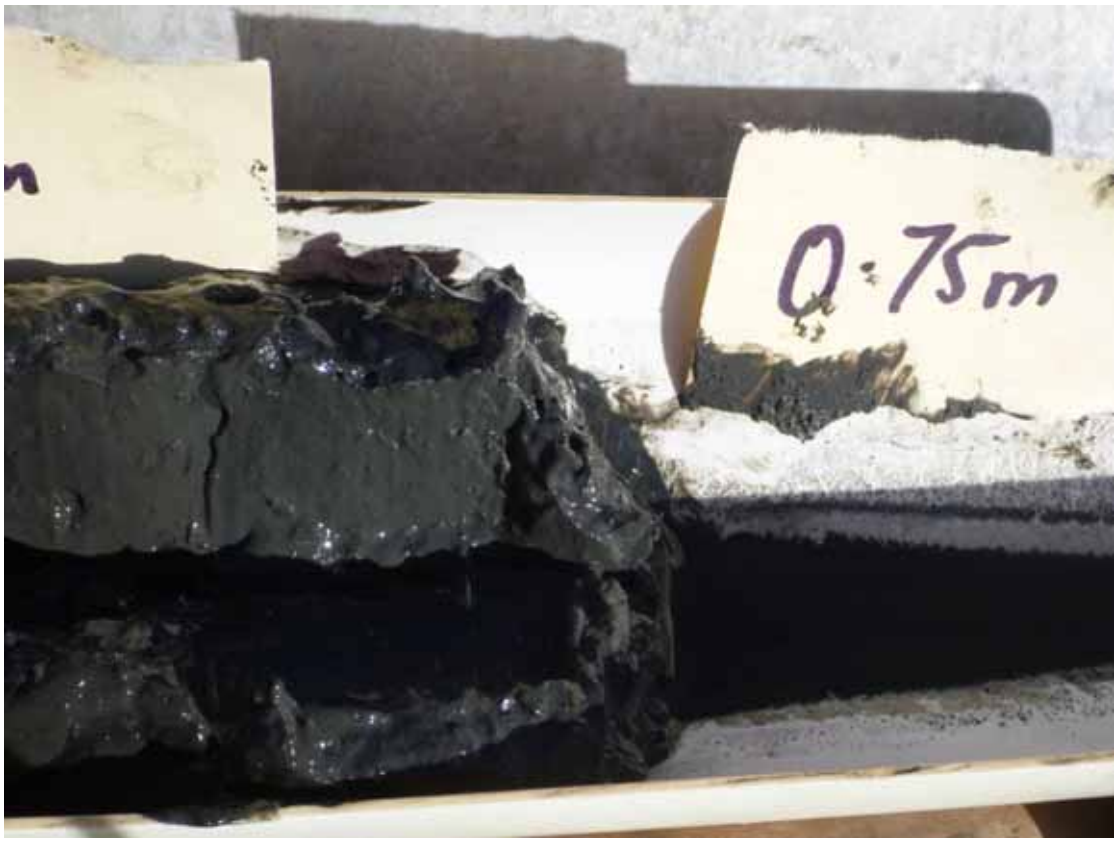



**Figure 29**
**SS 5 (5 of 5)**

## SAMPLE SITE 6


**Figure 30**
**SS 6 TOTAL CORE (0 - 0.75m)**


**Figure 31**
**SS 6 (1 of 5)**


**Figure 32**
**SS 6 (2 of 5)**

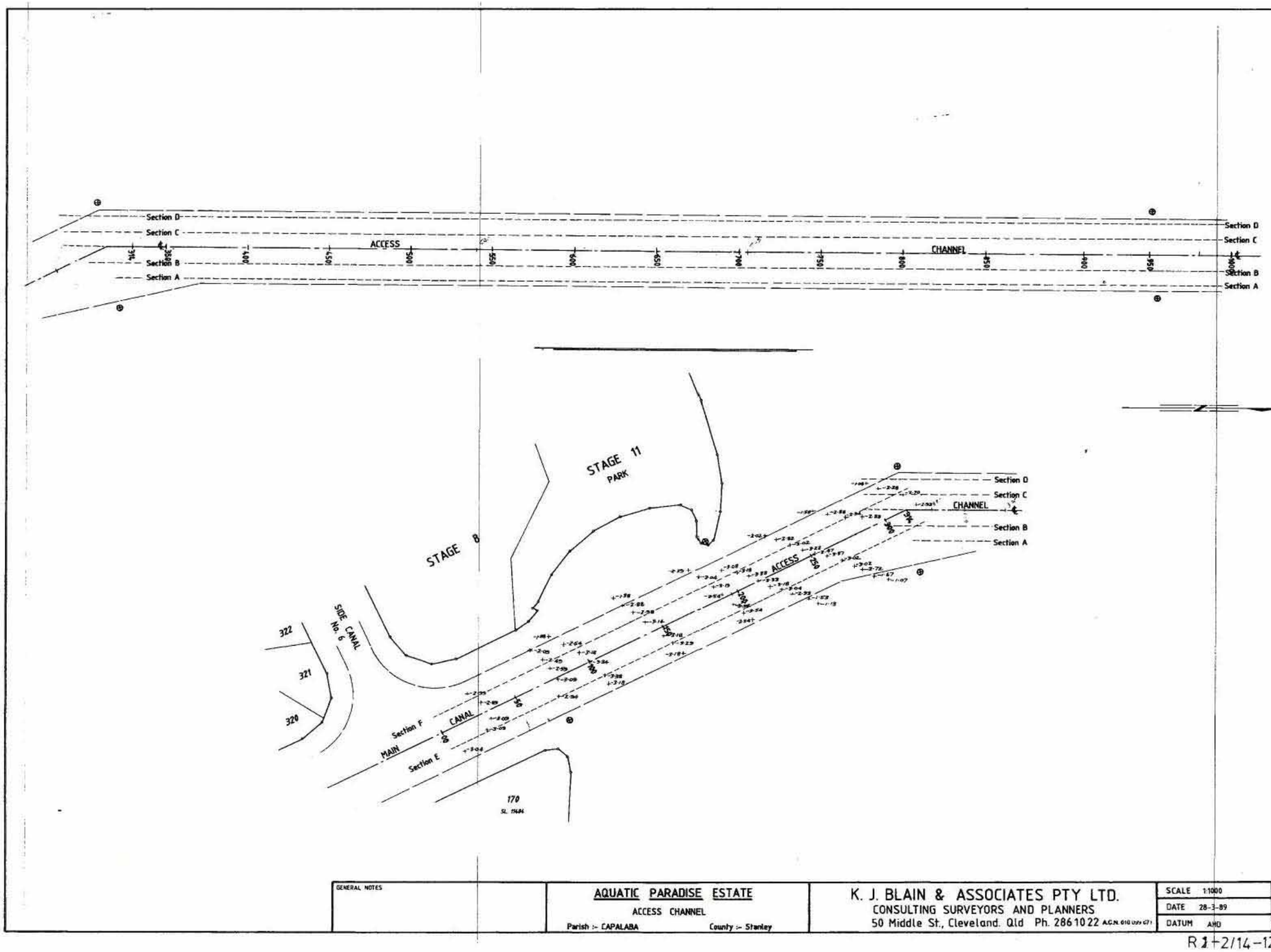

**Figure 33**
**SS 6 (3 of 5)**

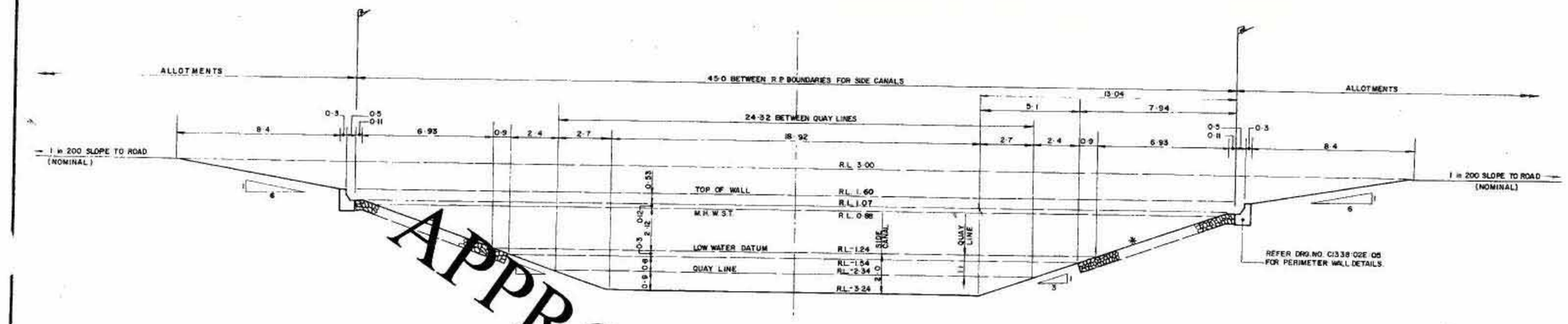

**Figure 34**
**SS 6 (4 of 5)**


**Figure 35**
**SS 6 (5 of 5)**

*Appendix D*

# DESIGN DRAWINGS

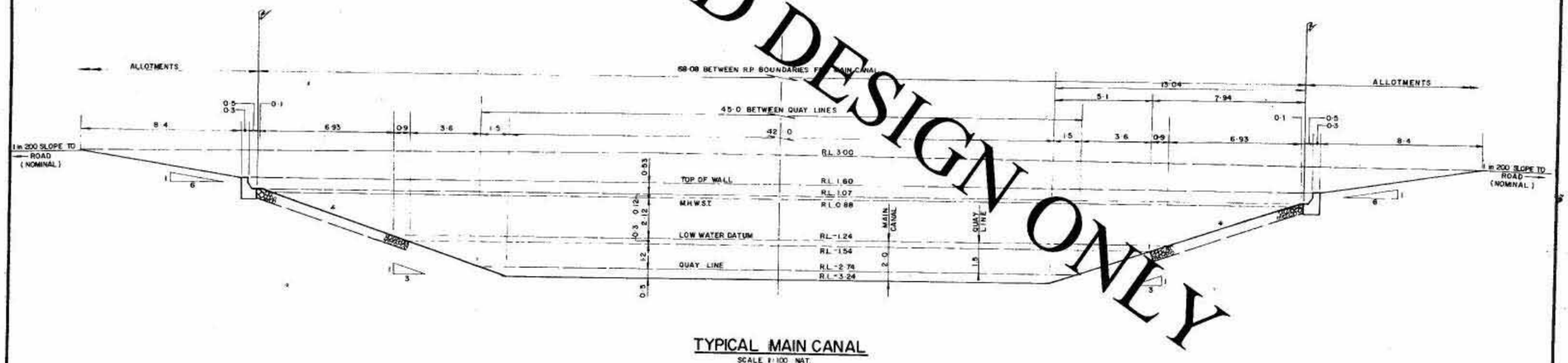

Section D
Section C
Section B
Section A
ACCESS
CHANNEL
STAGE 11
PARK
STAGE 8
SIDE CANAL No 6
MAIN CANAL
Section F
Section E
322
321
320
170
GENERAL NOTES
AQUATIC PARADISE ESTATE
ACCESS CHANNEL
Parish :- CAPALABA
County :- Stanley
K. J. BLAIN & ASSOCIATES PTY LTD.
CONSULTING SURVEYORS AND PLANNERS
50 Middle St., Cleveland. Qld Ph. 2861022
SCALE 1:1000
DATE 28-3-89
DATUM AHD
REF. NO.
AQ 001-98
D026155
R 1+2/14-129




TYPICAL SIDE CANAL

SCALE 1:100 NAT.

NOTES:
1. LEVEL DATUM A.H.D.
2. ALL TIDAL VALUES BASED ON H.B.M.
   PROVISIONAL APPROVAL CONDITIONS OF 21/1/82
3. REFER EARTHWORKS LAYOUT PLANS FOR LIMITS OF CANAL PROFILES DRG NOS: C1338·02E : 06/07.




TYPICAL MAIN CANAL

SCALE 1:100 NAT.

* ROCK REVETMENT, TYPE 3
REFER DRG NO. C1338·02E·04



D036484

R1-2/14-209

aquatic paradise

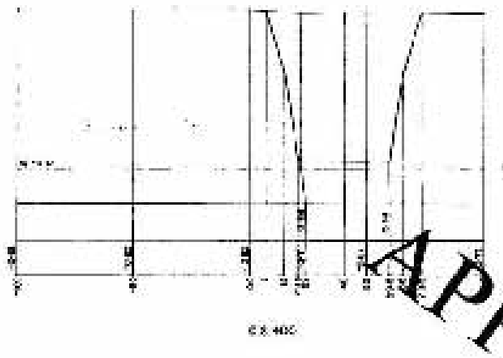
| DATE | AMENDMENT |
|---|---|
| 22·8·85 | D MAIN CANAL 1in3 BATTERS |
| 2·8·85 | C TOP OF WALL |
| 12·7·85 | B GENERAL |
| 25·6·85 | A SIDE CANAL |

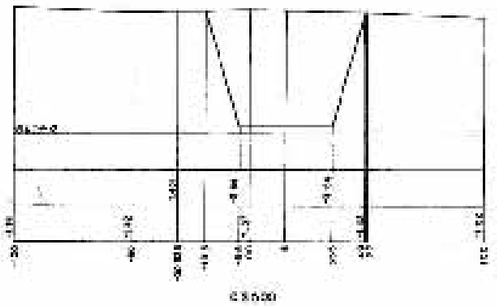
TYPICAL CANAL CROSS SECTIONS

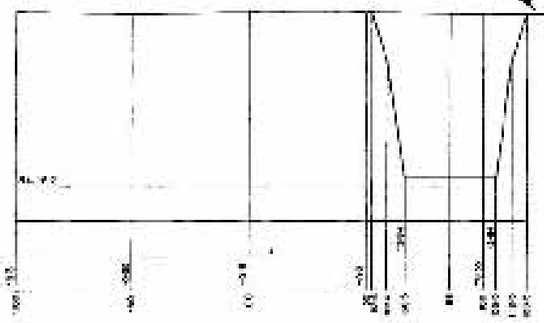
K.J BLAIN & ASSOC. PTY. LTD.
Survey Consultant
50 MIDDLE STREET
CLEVELAND Q.
Phone (07) 2861022

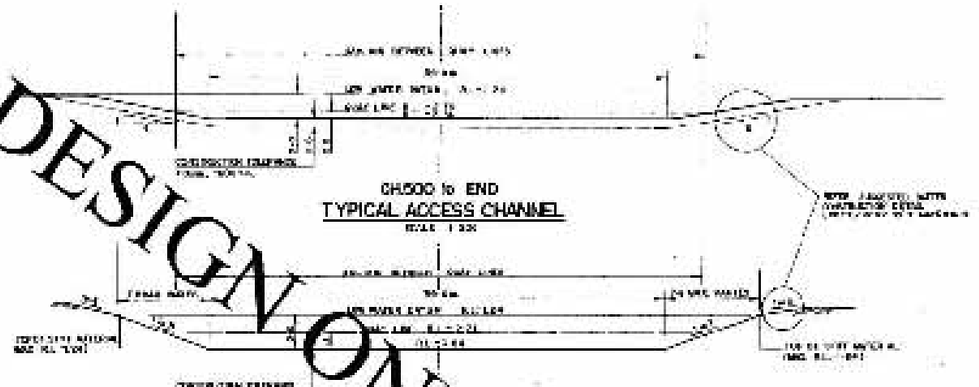
BURCHILL & PARTNERS PTY. LTD.
CONSULTING ENGINEERS: CIVIL, STRUCTURAL & PLANNERS
GOLD COAST BRISBANE

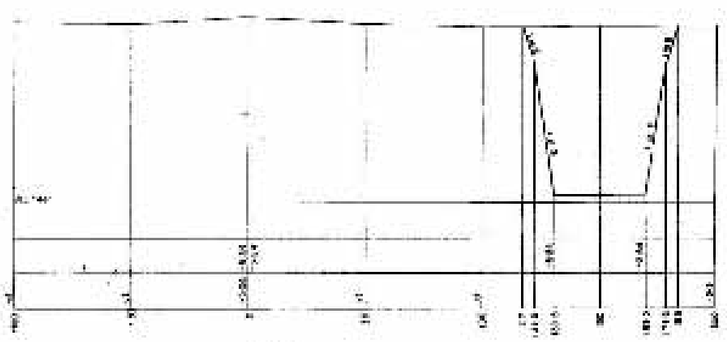
| DESIGNED | DRAWN | DRAWING NO. |
|---|---|---|
| D.N.D. | C.L.S. | C1338:02E:03D |
| CHECKED D.T.K. | DATE 9·5·85 | |
| APPROVED | | |

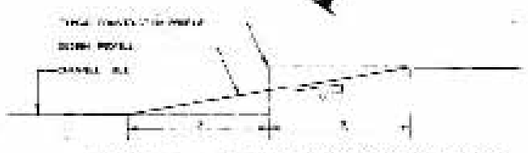













aquatic paradise

ACCESS CHANNEL
TYPICAL SECTIONS AND CROSS SECTIONS
CH 200 to CH 500

C.J. BLAIN & ASSOC. PTY. LTD.
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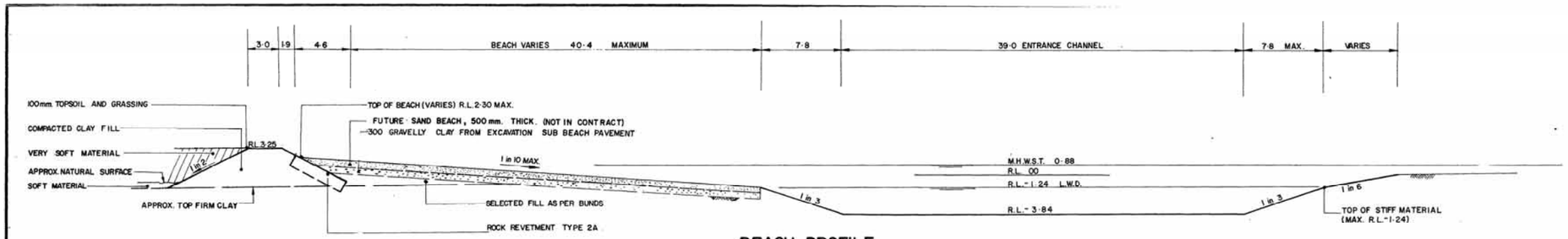
50 MIDDLE STREET
CLEVELAND Q 4
Phone (07) 3286022

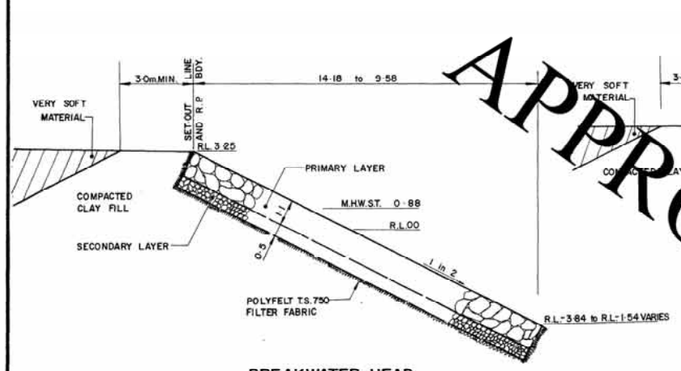
BURCHILL & PARTNERS PTY. LTD.
CONSULTING ENGINEERS · CIVIL STRUCTURAL & PLANNERS
GOLD COAST

C1338-02E 19




## BEACH PROFILE

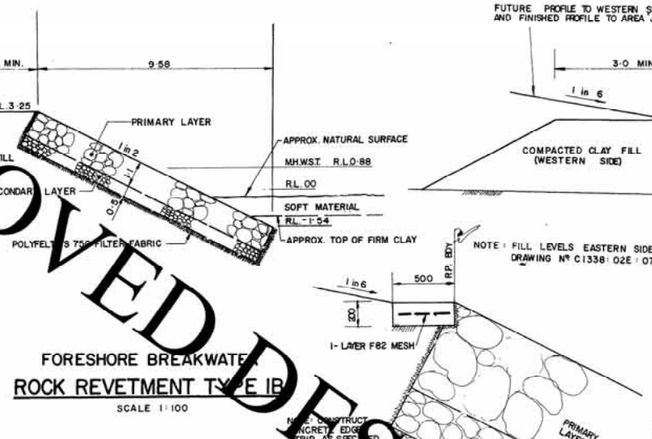
SCALE 1: 200




BREAKWATER HEAD

## ROCK REVETMENT TYPE 1A

SCALE 1:100




FORESHORE BREAKWATER

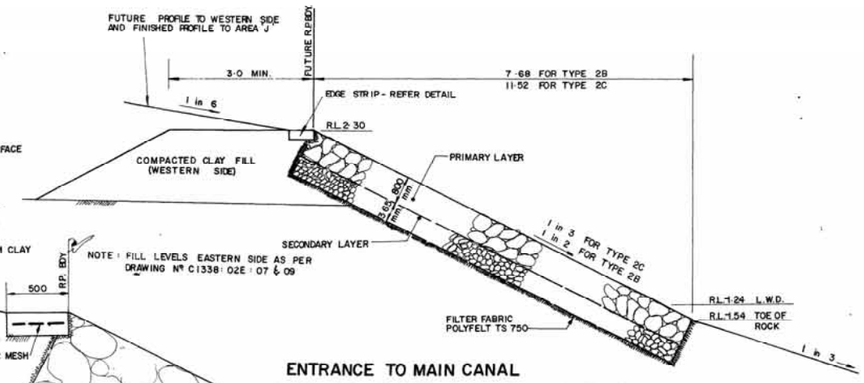
## ROCK REVETMENT TYPE 1B

SCALE 1:100




## EDGE STRIP DETAIL

SCALE 1:20

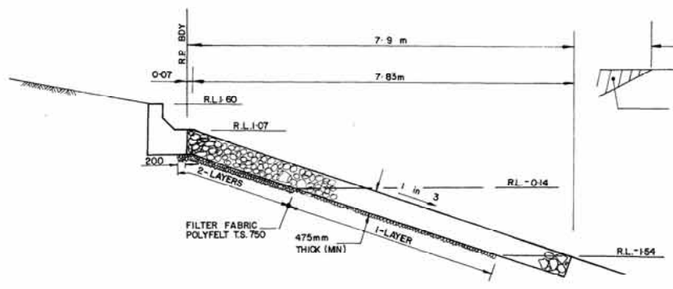



ENTRANCE TO MAIN CANAL

## ROCK REVETMENT TYPE 2B AND 2C

SCALE 1:50

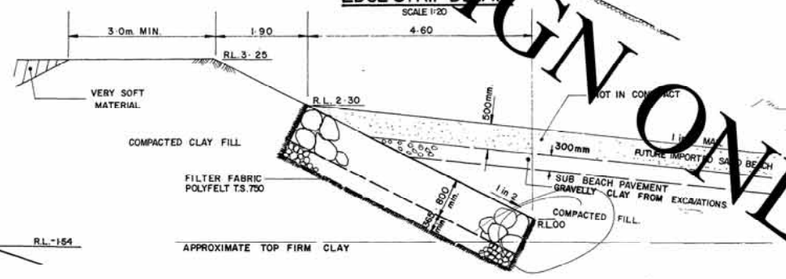
(TYPE 2A - TOE OF ROCK R.L. 0·0)




CANAL REVETMENT

## ROCK REVETMENT TYPE 3

SCALE 1:50




## ROCK REVETMENT TYPE 2A TO BEACH

SCALE 1:50

### ROCK REVETMENT SPECIFICATION

| ROCK REVETMENT. | PRIMARY LAYER | SECONDARY LAYER |
|---|---|---|
| TYPE IA AND IB | 'M' = 274 kg 'D' = 590mm.<br>75% 274 kg to 360 kg.<br>25% 190 kg to 274 kg | 'M' = 27 kg 'D' = 270mm.<br>75% 27kg. to 36 kg.<br>25% 19kg. to 27 kg. |
| TYPE 2A, 2B AND 2C | 'M' = 100 kg 'D' = 420mm.<br>75% 100 kg to 130 kg<br>25% 70 kg to 100 kg | 'M' = 10 kg 'D' = 195 mm.<br>75% 10kg. to 13 kg.<br>25% 7 kg to 10 kg. |

GRADING OF STONE (BASED ON REQUIRED D75 WEIGHT)

| | D100 | D85 | D75 | D50 | D15 | D0 |
|---|---|---|---|---|---|---|
| TYPE 3 'M' | 77·5 kg | 38 kg. | 23·5kg | 11·5 kg | 4·5 kg | 0·7 kg |
| TYPE 3 'D' | 385 mm. | 300mm. | 260mm. | 200mm. | 150mm. | 80mm. |

STONE SIZES BASED ON SPECIFIC WEIGHT OF STONE 2600 kg PER CUBIC METRE. D100, D85, D75 ETC. ARE THE SIZES OF SIEVE OR SCREEN OPENINGS PASSING 100%, 85%, 75% ETC. OF THE MATERIAL BY WEIGHT. D50 IS THE AV. SIZE.

'M' NOMINAL UNIT ARMOUR MASS
'D' EQUIVALENT SPHERICAL DIAMETER
AS DESCRIBED IN HUDSONS EQUATION
(BASED ON SPECIFIC GRAVITY OF ROCK 2·6 T/m³)

REFERENCE:- R.Y. HUDSON "LAB. INVESTIGATION OF RUBBLE MOUND BREAK WATERS" AM. SOC. CIVIL ENG. PAPER 2171 SEPTEMBER 1954

NOTE:
1. ALL FILL MATERIAL FOR ROCK REVETMENT CORE IS TO BE APPROVED BY THE SUPERINTENDENT AS SUITABLE INSITU OR COMPACTED CLAY FILL FROM CANAL EXCAVATION
2. ALL VERY SOFT MATERIAL BELOW ROCK REVETMENTS IS TO BE REMOVED PRIOR TO CONSTRUCTION OF ROCK REVETMENT.

R1-2/14-2016

D038486



aquatic paradise

| DATE | AMENDMENT |
|---|---|
| 9-9-85 | G. TYPE 2 |
| 5-9-85 | F. TYPE 3 |
| 4-9-85 | E. 2, 2A, 3 and SPECIFICATION |
| 23-8-85 | D. TYPE 2B, 3. REVET. |
| 2-8-85 | C. GENERAL |
| 12-7-85 | B. SUB BEACH PAVEMENT |
| 24-6-85 | GENERAL |

ROCK REVETMENT AND BEACH DETAILS

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BURCHILL & PARTNERS PTY. LTD.
CONSULTING ENGINEERS: CIVIL, STRUCTURAL & PLANNERS
GOLD COAST BRISBANE
HEAD OFFICE: Evandale Place, 142 Bundall Road, Surfers Paradise. 4217 phone (075) 383411
BRISBANE OFFICE: Fl. 17 City Mutual Bldg. 307 Queen Street, Brisbane. 4000 phone (07) 2216111

| DESIGNED | DRAWN | DRAWING Nº |
|---|---|---|
| D.N.D./J.B. | C.L.S. | C1338:02E:046 |
| CHECKED D.T.K. | DATE 22·3·85 | |
| APPROVED | | |

## Checking the facts

Throughout the series of Citizens' Advisory Panel meetings on the management and funding of Redland City's canal and lake maintenance activities, panel members have heard from a range of estate ratepayer associations, ratepayers themselves, experts and Council officers.

In the presentations, various individuals and association representatives have made claims with which Council does not necessarily agree. While this document does not address every claim, Council would like to state its position on the following points.

### RABY ROAR

The November, 2017 edition of *Raby Roar* – a newsletter produced by Raby Bay Ratepayers Association and distributed to panel members – contained a number of inaccuracies, particularly in regard to the impact of development on revetment walls.

Since this issue of the newsletter was produced, Council officers have met with Raby Bay Ratepayers Association and addressed these matters. However, as panellists also received a copy of the newsletter, the following points are clarified below for panellists' information:

- *The 9m setback*

  The original setback requirements for development from revetment walls in Raby Bay Canal Estate were achieved through building covenants that were imposed through contract of sales by the developer. The covenants restricted building work within 9m of the canal revetment wall to ensure consistent building setbacks and amenity along the canal frontages and to protect the structural integrity of the revetment walls. The covenants were not registered against title and, as land ownership changed, they were not passed on to subsequent owners.

  Council currently regulates the impacts of development on the structural integrity of revetment walls through the Canal and Lakeside Structure Overlay (CLSO), which forms part of the Redlands Planning Scheme 2006. However, during development of the new draft Redland City Plan, Council received advice from the State that such provisions would duplicate the Building Assessment Provisions (BAPs) and therefore could not be regulated by Council. Accordingly,

the draft City Plan does not currently include provisions that seek to protect the structural integrity of revetment walls.

In previous correspondence with the State, Council has expressed concern that the BAPs do not specifically deal with the impacts of development on the structural integrity of revetment walls. This has occurred through a formal submission to the State on the draft Queensland Housing Code, correspondence with officers from the Department of Housing and Public Works and direct representations to Kerry Doss, the Deputy Director-General of the Planning Group within the Department of State Development, Manufacturing, Infrastructure and Planning.

It is Council's position that to provide certainty, the BAPs should be amended to explicitly state that development adjacent to revetment walls must be considered and assessed as part of the building approval process. If the abovementioned changes are not implemented by the State Government prior to the commencement of the draft City Plan, Council officers will consider implementing a Temporary Local Planning Instrument to achieve the same end.

Despite the above, it should be noted that the draft City Plan will carry forward provisions from the CLSO that deal with the impacts of development on amenity in the canal and lakeside estates. In the City Plan, development proposed within 9m of a property boundary adjoining a canal wall, revetment wall or bank of an artificial water body will require approval by Council.

- *The newsletter suggests Council did not speak with canal ratepayers and their representatives in regard to the special charge refunds; and, had it done so, a "better deal" could have been found.*

  Council's former CEO personally met with the associations and key stakeholders to provide information on the review and why Council was refunding the money. Also, Council was not seeking a 'better deal' but to do the right thing by the community. The newsletter itself states at the outset that refunding was the right thing to do.

- *The newsletter suggests the cost for the legal and accounting management of the canal and lake refunds will be close to $1 million.*

  Those costs incurred by Council for this project are approximately $220,000.

- *The newsletter states that Council's canal and lake implementation plan provides Council with "… power to force some ratepayers to pay a special charge over and above everyone else".*

  Section 94 of the *Local Government Regulation 2012* allows councils to make and levy a special charge on rateable land identified as enjoying special benefit to fund the maintenance, construction, or renewal of that benefit. This regulation allows Council to collect money to pay for the significant works required to maintain the canal and lake waterways, from those who get a special benefit from them.

  Special charges are not unique to Redland City – other councils also levy them. Other Councils with canals also levy a special charge to canal residents.

**PRESENTATIONS AT PANEL MEETINGS**

- *Claims have been made that Council has a predetermined outcome it would like to achieve for the maintenance and funding of maintenance activities at the city's canal and lake estates.*

  Council has yet to adopt a position on, or to make a decision about, how these activities will be managed going forward. In resolving last year to consult with the entire community, Council sought to understand what principles the Redlands community believed should be applied to deciding how maintenance of infrastructure, canals and the lake is managed and paid for. Ultimately, the decision rests with Council.

- *Claims have been made that misinformation was given about how many times RBRA was invited to present to the panel, with the association stating it was invited in*

*writing to attend all three panel sessions, and was given only three hours' notice of the 'make up' workshop on January 19, 2018.*

An email sent to the association on November 29, 2017 invited a presentation at the first panel meeting, and specifically stated that if it was not possible for a member to attend, the presentation could be made at a later session. The email provided the dates for those sessions.

The association was also invited to present at the 'make up' workshop on January 19, 2018. The association confirmed in a meeting with the consultants on Wednesday, January 17 that members would present at the January 19 workshop, but at around 4.30pm on Friday, January 19, advice was received from the association that they would not be attending, citing short notice.

Across the three panel sessions, the association presented at the first session on December 2, 2017; a hard copy of that presentation and a copy of Raby Roar was given to panellists at the 'make up' workshop on January 19, 2018; a copy of a document produced by RBRA was distributed to panellists at the session on January 20; and another printed document from RBRA has been distributed to panellists for the third session on February 10.

Council has taken steps to provide panel members with as much information as possible, including from RBRA.

- *Claims have been made that Council failed to follow recommendations in consultant reports.*

  Council does not ignore properly commissioned reports. The canal and lake waterways at Raby Bay, Aquatic Paradise and Sovereign Waters are major structures in a marine environment. Some were constructed more than 30 years ago and require ongoing maintenance and repair.

- *Claims have been made that the then Redland Shire Council was negligent in its approval of the Raby Bay Canal Estate.*

  The State Government certified the estate in 1996 and was constructed and approved in accordance with the standards at the time.

- *Claims have been made that Council, by levying a special charge to canal and lake waterfront property owners, is "double-dipping".*

  Revenue raised through the canal and lake special charges is quarantined for maintenance activities at the canal and lake estates. As explained by LGAQ principal advisor finance and governance Mark Leyland at the panel meeting on January 20, Local Government general rates are a tax based on ability to pay, with property value the "indicator of the property owner's ability to pay an equitable share of the cost of services provided by the council for its community". This is a universal approach taken by all local governments within Australia and certainly in other countries as well.

  A local government must charge a general rate based on a property's unimproved site value as issued by the Valuer General. As general rates are a tax, they cannot relate to specific services used by a property. The special charge, however, can legally be levied specifically for a service (such as the significant works required to maintain the canal and lake walls and waterways) from those who get a special benefit from that service.

  In Redland City, revenue raised from special charges levied to property owners in any of the city's canal and lake estates is spent within that estate. For each estate, Council produces a quarterly report that details income and expenditure for canals and lake maintenance activities. Once produced, these reports are supplied to the estates' ratepayer associations.

  Council has the legal ability to levy the special charges in addition to the general rates. Section 94 subsection 12 of the *Local Government Regulation 2012* states that:

  *The amount of the special rates or charges for the particular rateable land may be different to the amount for other rateable land because, in the local government's opinion—*
  *(a) the land or its occupier—*
  *(i) specially benefits from the service, facility or activity; or*
  *(ii) has or will have special access to the service, facility or activity; or*

*(b) the land is or will be used in a way that specially contributes to the need for the service, facility or activity; or*
*(c) the occupier of the land specially contributes to the need for the service, facility or activity.*
*(13) For subsection (12), the local government may levy the special rates or charges on any basis the local government considers appropriate* (emphasis added).

- *A claim was made that properties at Raby Bay Quays did not receive a special benefit from the canals.*

  The units at Raby Bay Quays have special access to the canals by way of a walkway that is closed to the general public. The Raby Bay Quays is one entire lot. Council levies the charge to the units within the lot. The revetment wall prevents the land on which these units sit from erosion and the units in this complex especially benefit from the service provided by Council and the special access.

- *Various statements have been made in presentations about the costs of canal and lake estate maintenance activities.*

  The figure of $54.03 being the amount contributed by each non-canal and lakefront property in the current financial year, as quoted in Council fact sheets, is based on this financial year, and is a budget projection. As with any budget, actual costs will come to light as the year progresses. Council's publicly available fact sheet *Q&As – Maintenance Activities and Costs* provides the following detail outlining the actual income and expenditure across the three canal and lake estates over the past two financial years:

| 2015-16 | 2016-17 |
|---|---|
| Reserve: $9,126,600.74 | Reserve: $8,236,155.16 |
| Income: $3,710,721.11 | Income: $2,847,529.83* |
| Costs: $4,601,166.68 | Costs: $3,309,664.65 |
| Balance: $8,236,155.17 | Balance: $7,774,020.34 |

* special charge for three quarters only

The figures show that Council spent more than was raised in those years, thereby reducing the reserve. However, in those financial years, expenditure against the

amount that was budgeted for canal and lake maintenance indicates that Council did not spend the amount that was budgeted.

The figure of $54.03 applies to all three estates. The calculations for this can be found in the above-mentioned fact sheet.

# Canal and lake estates

## How some neighbouring councils manage their canals and lakes

Blessed with natural beauty from bushland to bay, the Redlands is also home to popular parks and waterways at Raby Bay, Aquatic Paradise and Sovereign Waters.

Across these three locations there are constructed canals, a lake and associated infrastructure, including 28.7kms of revetment walls that must be inspected and maintained.

Council's canal and lake maintenance activities include water dredging to ensure the waterways are clean and navigable, inspecting and renewing marine beacons, and inspection and upkeep of revetment walls.

**Historically, the cost of canal and lake maintenance at Raby Bay, Aquatic Paradise and Sovereign Waters has been covered jointly by the residents who own property on the canals and lakefront as well as a 20 to 30 per cent contribution by Council (or all ratepayers).**

How the canal and lake estates in the Redlands will be funded and managed into the future is still to be decided. However, our city is not unique in having canal and lake estates. A range of models for funding and managing canal and lake maintenance is used by councils around Australia, including these models in use by some of our closest neighbouring councils.

### City of Gold Coast

City of Gold Coast has numerous lakes and more than 400kms of constructed canals.

While this council conducts some cleaning and maintenance of lakes and canals, to ensure good water flow, property owners of waterfront land are responsible for the upkeep of revetment walls that benefit their property.

In community title developments, each Body Corporate is responsible for revetment walls that benefit the development.

Should a waterfront landowner detect issues with a revetment wall that benefits their property, the landowner is responsible for arranging for a suitably qualified, professional engineer to assess and report on the wall's structural integrity.

City of Gold Coast determines revetment walls to be part of the properties that benefit from them and places the onus for maintenance on the landowners.

### Moreton Bay Regional Council

Moreton Bay Regional Council levies a special charge to properties with canal frontage across three canal estates – Newport, Pacific Harbour and Bribie Gardens.

This includes marina complexes and residential units where the land has canal frontage.

Owners of residential units in the estates are levied the charge, not the Body Corporate.

The special charge varies, depending on the land use; and is for the funding of works to preserve, maintain and keep clean and navigable the canals and associated public infrastructure and the lock and weir at Bribie Gardens.

Landowners whose properties benefit from revetment walls are responsible for their maintenance.

### Noosa Council

Noosa Council has decided to implement an inspection, maintenance and future works program for the Noosa Waters estate, to ensure the long-term viability of the revetment walls.

The Noosa Waters Canal Maintenance Levy (a special charge) will apply to waterfront allotments on specified land in the Noosa Waters estate.

The council will contribute 8.5 per cent of the costs of the program, as approximately 8.5 per cent of the properties bordering the canals are owned by the council.

While no revenue will be collected in 2017/18, as the council considered there were sufficient reserve funds available (collected from previous years) to implement the overall plan during this financial year, Noosa Council anticipates applying a levy in future years as the maintenance program will be ongoing.

Redland CITY COUNCIL

**For more information and to have your say, visit yoursay.redland.qld.gov.au**

# Fast facts

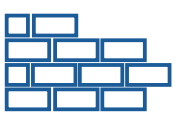
## Canals and lake waterways

**Raby Bay, Aquatic Paradise and Sovereign Waters are home to popular parks and waterways. But did you know that Council maintenance costs apply to these locations?**

### Council maintenance activities include

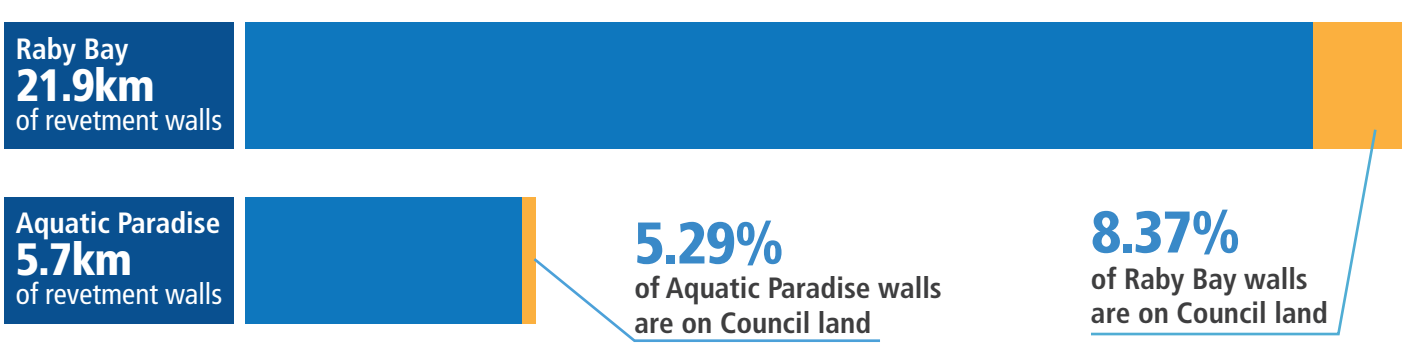
Water dredging ensures the waterways are navigable

Beacons must be renewed



Revetment walls are inspected and maintained

### The revetment walls line the estates' waterways

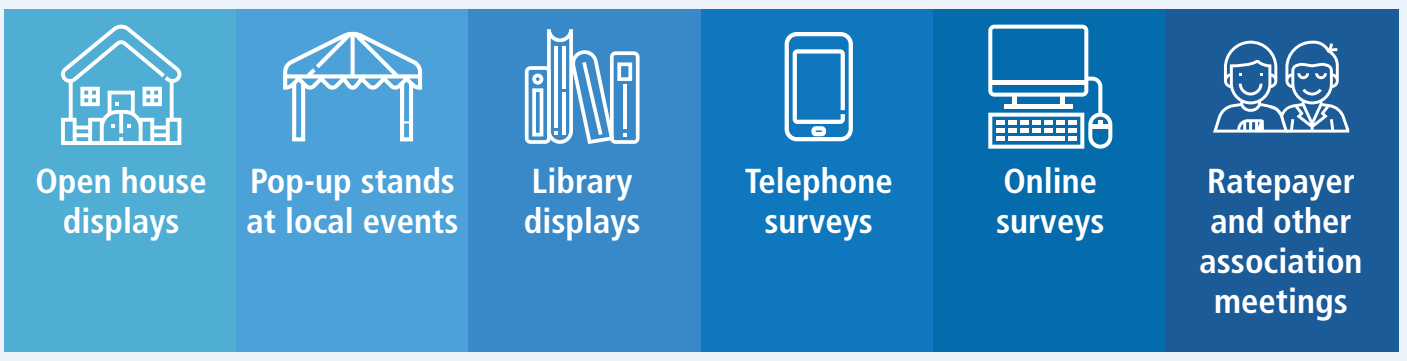



### The 17/18 budgeted financial year contribution towards the maintenance of canals, the lake and revetment walls


## Your opinion counts

**To ensure the fairest approach for all, Council is now consulting with the community to review its charges, which currently affect all ratepayers.**

### Your feedback opportunities




**You can also dive in and have your say at**
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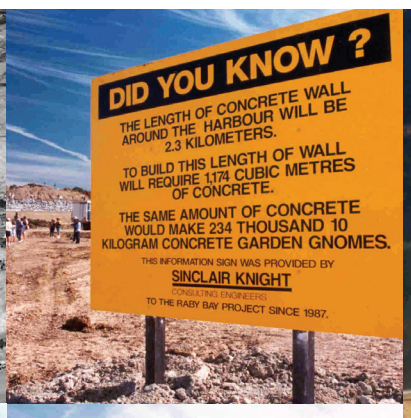
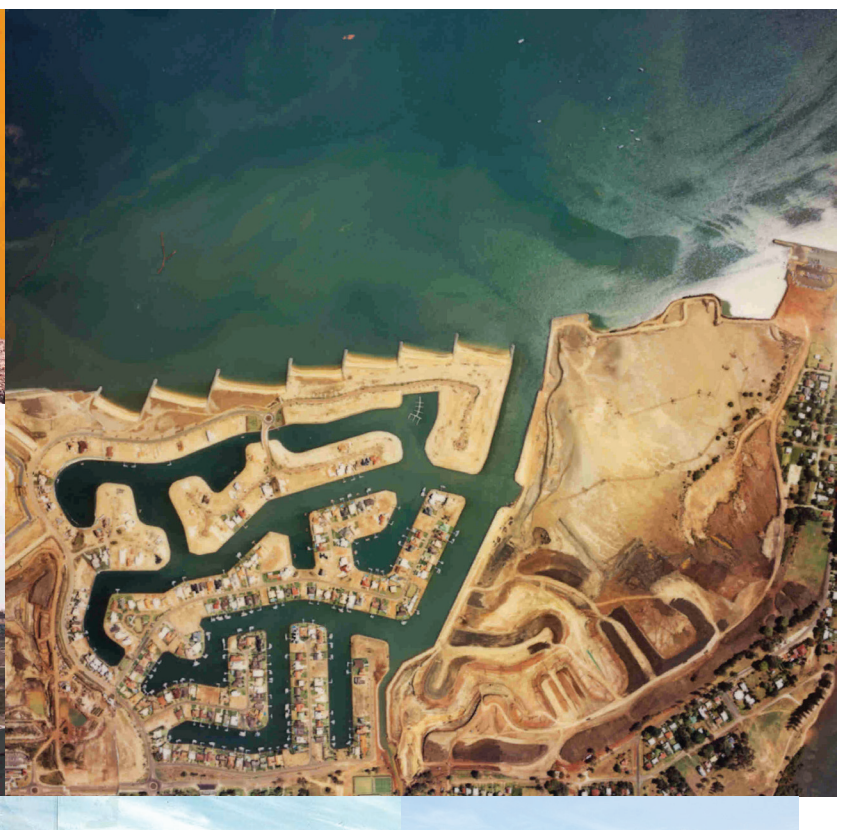
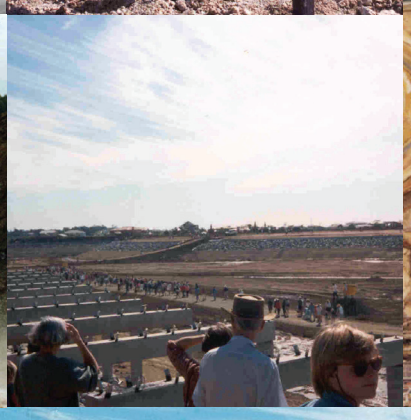
Redland CITY COUNCIL

# Historic snaps

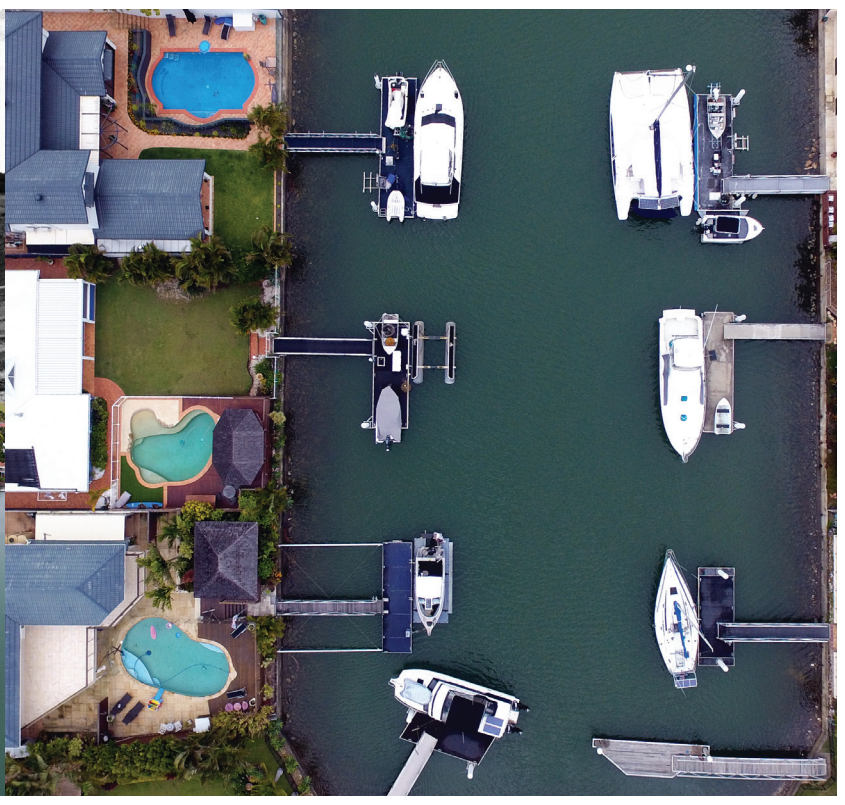
## Raby Bay
### 1980 - present day

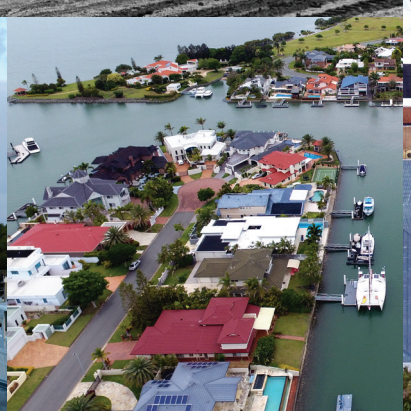




## Aquatic Paradise
### 1993 - present day





## Sovereign Waters
### 2000 - present day

Source for historic photos: Redland Library Local History and Heritage Collection

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Redland CITY COUNCIL

# Q&As – Background

- Funding of canals and lake waterways

January 2018

***Q. What is a revetment wall?***

**A.** A revetment wall is a permanent, engineered structure on a lake or canal front that acts as a protective covering on an embankment of earth. It is designed to maintain the slope and to protect it from erosion. It has a limited life and requires regular inspection and maintenance.

***Q What is a canal?***

**A.** A canal is an artificial waterway connected, or intended to be connected, to tidal water; and from which boating access to the tidal water is not hindered by a lock, weir or similar structure.

***Q. Where are the revetment walls in the Redlands?***

**A.** There are revetment walls on the canal and lake fronts at Raby Bay, Sovereign Waters and Aquatic Paradise.

***Q. How many properties pay a special charge for canal and revetment wall maintenance?***

**A.**
- The number of properties at Raby Bay paying a special charge is 815. The number of marinas is 3 (with 101 berths).
- The number of canal front properties at Aquatic Paradise paying a special charge is 202. The number of marinas is 1 (with 16 berths).
- The number of lakefront properties at Sovereign Waters paying a special charge is 50. There are also 134 units at Raby Bay that pay the special charge.

Note: these figures may change throughout the financial year if changes are made to the property database.

***Q. How many kilometres of revetment walls are there?***

**A.**
- Raby Bay has 21.9km of walls,
- Aquatic Paradise has 5.7km of walls, and
- Sovereign Waters has 1.1km of walls.

***Q. What proportion of walls are on public (Council) land?***

**A.**
- 8.37% of Raby Bay walls are on Council land,
- 5.29% of Aquatic Paradise walls are on Council land, and
- 13.07% of Sovereign Waters walls are on Council land

***Q. How much do property owners with a revetment wall on a canal or lake front property contribute towards these costs each year?***

**A.** Canal and lake front property owners currently contribute via a special charge in the 17/18 financial year as per the following schedule:

- $723.60 for a standard lot at Sovereign Waters
- $2,354.28 for a standard lot at Raby Bay Canal Estate (including lots 1 to 12 on GTP 2073)
- $1,364.24 for a unit in a Community Title Scheme at Raby Bay Canal Estate (excluding lots 1 to 12 on GTP 2073)
- $1,189.96 for a marina berth at Raby Bay Canal Estate
- $2,806.28 for a standard lot at Aquatic Paradise Canal Estate
- $2,806.28 for a marina berth at Aquatic Paradise Canal Estate

Note: These annual charges may change each FY.

***Q. What has Council been contributing?***

**A.** While percentage contributions have varied over time at the direction of Council, over the past several financial years Council has contributed 20% of the total reserve funding for Raby Bay, and 30% of the total reserve funding at Aquatic Paradise and Sovereign Waters.

# Q&As – Background

- Funding of canals and lake waterways

January 2018

Until the 17/18 financial year, Council established an annual implementation plan that calculated the annual estimated cost for operational and capital works (maintenance and repair), which was then apportioned to canal and lake estate property owners via the levy calculation.

## HISTORY OF REDLAND CANAL AND LAKE ESTATES

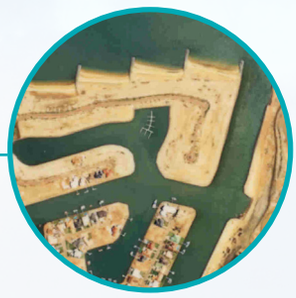
**1998**
Redland Shire Council agrees in principle to the lake development that became Sovereign Waters.

**1994**
Raby Bay Harbour is built.


**1984**
Stage 1 of Raby Bay canal development officially opens on November 23; land goes on sale in December.

**1979**
State Government approves in principle the Raby Bay canal development.

2000



**1997**
Final stage of Raby Bay development is complete; the last canal is flooded in December.

1995

**1985**
Aquatic Paradise canal development is underway.

1990

**1983**
Construction begins on Raby Bay development.

1985

**1971**
Redland Shire Council approves the Aquatic Paradise canal development.

1980

1975

00151 1/18

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Redland CITY COUNCIL

# Q&As – Community Consultation

- Funding of canals and lake waterways

January 2018

***Q. Why is community consultation occurring?***

**A.** Council wants to ensure the fairest funding approach for the maintenance of canal and lake waterways and revetment walls – a funding model which currently affects all ratepayers in Redland City, because all ratepayers help fund the maintenance.

***Q. When will the changes (to how activities are managed or paid for) take effect?***

**A.** Community consultation will inform how we do things going forward, and specifically consultation outcomes will inform budget planning processes. If we can complete city-wide consultation and any subsequent administrative, financial, legal or other work that might be identified as required, in advance of planning deadlines for the 17/18 FY, the changes identified through community consultation could take effect on the first of July 2018.

***Q. How will Council select participants for this engagement process?***

**A.** Participants will be randomly selected for a Citizen's Advisory Panel by an independent Market Research firm. The panel will comprise 40 participants. Recruitment of 10 panellists from each of the following areas will ensure geographic representation:

- 10 Canal and lake waterfront property ratepayers
- 10 City Coastal (excluding canal and lake estates) ratepayers
- 10 City Mainland ratepayers
- 10 City Islands ratepayers

As canal and lake waterfront ratepayers will be more directly impacted by consultation outcomes, this group is over-represented on the Citizen's Advisory Panel. The executives of the canal and lake estate ratepayer associations, and the broader population of the city will be engaged through other consultation processes.

***Q. How can Council assure the community that the panel engagement process will be independent and transparent?***

**A.**

- The Citizen's Advisory Panel of 40 people will be comprised exclusively from members of the public.
- The panel is being led by independent specialist community engagement consultancy, Articulous Communications, in partnership with Max Hardy Consulting.
- Those stakeholders most affected by the outcomes of the consultation will have their say on the draft consultation questions and to the extent possible given the conflict of interest, the draft consultation process.
- Consultation with the panel will be staged, giving participants the information they need to get across the issues more easily. The process will also run over an extended period, allowing more time to share key ideas and outcomes with the community – a process that Council has committed to.
- A final step will be a market research exercise. An independent, specialist market research firm will be appointed to test the findings/outcomes of this extended process with a randomly selected representative sample of the city's population.
- These findings, along with the Citizen's Advisory Board outcomes, will be made available in a public report.

***Q. Will Councillors (or their immediate families) be able to take part on the panel?***

**A.** No. Councillors and their immediate families will not be able to participate as panellists in the Citizen's Advisory Panel.

# Q&As – Community Consultation

- Funding of canals and lake waterways

January 2018

***Q. Will employees of Redland City Council be able to take part in the process?***

**A.** No. Employees of Redland City Council (RCC) and their immediate families will not be able to participate as panellists in the Citizen's Advisory Panel.

***Q. Will the panel participants be renumerated?***

**A.** The 40 panel participants will receive a small stipend to defray travel and other expenses, and compensate them to some extent for their time.

***Q. Who is conducting the panel engagement process?***

**A.** This engagement process is being led by independent specialist community engagement consultancy, Articulous Communications, in partnership with Max Hardy Consulting.

***Q. How were these companies selected to facilitate the process?***

**A.** Five leading national specialist community engagement consultancies were invited to provide a proposal for professional services. Articulous Communications and Max Hardy Consulting provided a joint response, and were ultimately successful in securing the contract for the project.

An evaluation team comprising representatives from RCC Procurement and Communications, Engagement and Tourism made the decision based on: the quality of the proposed solution; quality of the submission; and quality and experience of the project team (including their experience in planning and facilitating similarly complex local government community consultations).

***Q. What safeguards are in place to ensure the legitimacy of the panel process?***

**A.**

- Appointment of a leading, independent, specialist engagement consultant.
- Appointment of an independent specialist market research firm for panel recruitment.
- Appointment of an independent market research firm to test findings with the community.
- Inviting those most affected by consultation outcomes to have their say on the engagement questions and (to the extent possible given the conflict of interest) the engagement approach.
- An engagement process in which panel findings will be shared with the broader community, and outcomes from the final stage tested with a representative sample of the broader community through market research.
- An engagement process that will provide open access to all records (barring those where the privacy of participants might be compromised), information and expert testimony requested by the panel.

***Q. Will Council implement the recommendations of the panel participants?***

**A.** In making the final funding model decision, Council will operate transparently and take guidance from the panel recommendations.

***Q. Will the panel engagement meetings be open to the public?***

**A.** No. To protect the privacy of panellists, ensure the panel is not interrupted and has sufficient time to hear from technical experts (engineers, solicitors, accountants etc), and to cover everything the panel needs to know, the panel meetings will not be open to the public.

# Q&As – Community Consultation

- Funding of canals and lake waterways

January 2018

***Q. Will outcomes of panel deliberations be made publically available?***

**A.** Yes. A report detailing the deliberations of the group will be made public.

***Q. Hasn't Council already consulted the community about this matter?***

**A.** A 2010 survey, conducted on behalf of Council by an independent market research firm, sought feedback from ratepayers regarding the principles that should influence the way Council manages finances and calculates rates. That survey did not question ratepayers concerning:

- how to best manage maintenance activities in the canal and lake estates, or
- how to pay for those maintenance activities.

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Redland CITY COUNCIL

# Q&As – Development Applications

- Funding of canals and lake waterways

January 2018

***Q. Is Council approving works either adjacent to or hanging over revetment walls that may need additional work in the future?***

**A.** Council must assess works near or adjacent to revetment walls against the following:

- Works/structures on the landward side of revetment walls are regulated through the Redlands Planning Scheme 2006 (RPS 2006).
- Works/structures that extend over or beyond the revetment wall are regulated through the State Prescribed Tidal Works Code.

Queensland operates under a performance based planning system, which allows for a development application to be lodged and assessed on its merits, in accordance with the Planning Act 2016. For works on the land side of the revetment wall, Council must approve the development if an applicant can demonstrate the development is consistent with the provisions in the planning scheme.

At present, an application within 9 metres of a revetment wall in the canal estates must demonstrate that the development will not have an impact on the structural integrity of the wall, will maintain amenity and will not affect legal public access. In circumstances where these matters are addressed, Council would be satisfied that development would not unduly impact on the structural integrity of the revetment wall network.

Regulating the impacts of development in proximity to revetment walls is a complex issue, and Council agrees that all development near revetment walls must be effectively managed.

***Q. Who will pay in the event of a structural failure?***

**A.** Applications for works near revetment walls need to meet the structural, access and amenity requirements of the RPS 2006 and Building Code of Australia (BCA), mitigating the likelihood of adverse outcomes.

***Q. Will the canal overlay be removed and, if so, what will replace it?***

**A.** At present, the Redlands Planning Scheme 2006 includes an overlay called the 'Canal and Lakeside Structures Overlay', which triggers a planning application to be lodged for buildings and structures that are proposed within 9 metres of the revetment wall. This application is then assessed against the overlay code.

Draft City Plan takes a different approach by assessing it under a building application rather than a planning application. This approach still ensures the integrity of the revetment walls is taken into consideration by requiring the proposed structure to meet the requirements of the Building Code of Australia (BCA).

In order to highlight the significance of revetment walls the draft City Plan does include a note to emphasise to building certifiers that they (as always) should obtain appropriate engineering certification prior to approving any structures. The note reads: Applicants should also be aware that structures near a canal or revetment wall must maintain the structural integrity of the wall, in accordance with the Building Code of Australia. Any construction closer than 9m would need to be supported by the correct building structural design certificates which prove that any works within this distance will not cause any movement or damage to the existing revetment wall or bank which may have a limited capacity to withstand additional loadings. These matters are to be addressed in any application for building works.

The draft City Plan will continue to include provisions which address residential amenity. In particular the draft City Plan will trigger a requirement for new building applications located within 9m of the revetment wall to be submitted to Council for assessment. Currently under the existing Redlands Planning Scheme, Council considers the impact on residential development of new building applications located within 4.5m of canal revetment walls.

# Q&As – Development Applications

- Funding of canals and lake waterways

January 2018

***Q. Did council know about its canal fund being non-compliant as far back as 2011 and, if so, why was the issue not addressed sooner?***

**A.** No. Council did not know that new canal and lake levies introduced in 2011-12 were potentially non-compliant. The changes were made to the levy in 2011-12 as a result of changes to the Local Government Act in 2011.

It is important to note that the decision to refund unspent collected monies does not affect special charges collected for services or activities for other areas of the city, as the charges being refunded were collected from canal and lakefront property owners and reserved specifically for work on canals and the lake, such as dredging, cleaning and repairs to revetment walls

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Redland CITY COUNCIL

# Q&As – Engineering

- Funding of canals and lake waterways

January 2018

***Q. How are revetment walls designed?***

**A.** There are 14 different revetment wall designs, depending on the development stage for which they were designed and constructed.

***Q. What is the expected life of revetment walls?***

**A.** Revetment walls have a life expectancy of approximately 75 years.

***Q. How are revetment walls repaired?***

**A.** The type of repair required depends on the type of fault or failure, but often involves stabilising the ground supporting the wall's footing.

***Q. What did the 2016-2017 revetment wall trial involve?***

**A.** The trial involved the repair of 3 sections of revetment wall using 3 different methods, each of which typically involved stabilising the ground supporting the wall's footing. Council has installed monitoring devices and these will be monitored for 12 months. The goal behind these trials is to evaluate different methods for repairing the walls, which would deliver savings and efficiency in revetment wall repair, thereby allowing more proactive works which, over time, should result in fewer wall failures and even more savings.

***Q. What was the outcome of the revetment wall trial?***

**A.** The trial will be finalised after the post works monitoring period, over which trial sites are monitored for a year to assess performance of the different methods in stabilising the ground and revetment walls.

***Q. How are depths monitored?***

**A.** Depths are monitored through completion of Bathymetric Surveys (or high detail sonar scan) of the canal floor that typically occurs every 4 years, unless otherwise required.

***Q. How is it decided that repairs are required?***

**A.** A process (devised by consulting engineers involving trigger levels) dictates when walls need repair. The triggers and associated actions are:

- Movement of 0-50mm: Monitor
- Movement of 50-100mm: Proactive repair with revetment trial methods
- Movement of 100mm+: Full replacement, or revetment wall repair using screw piles

***Q. What would happen if revetment wall repair work was not carried out?***

**A.** The condition of the walls would deteriorate and significantly affect their expected life, and canals would silt up reducing service levels for customers.

***Q. What is the current condition of the canals and lake?***

**A.**

- The canals and lake depths and navigability are monitored in accordance with their design specifications, for which each estate is different:
- Aquatic Paradise is maintained for a maximum vessel draft of 1.5m.
- Raby Bay is maintained for a maximum vessel draft of 2.2m.
- Sovereign Waters Lake is not considered a navigable water way. Depths are maintained to ensure correct operation of the lake's water quality system.

***Q. How often is dredging and bed levelling required?***

**A.**

- Raby Bay dredging / bed-levelling is typically required and undertaken on a 4 year program,
- Once the current 5 year dredging program at Aquatic Paradise is finished, it is scheduled to be dredged at 4 year intervals.
- As no vessels use the lake at Sovereign Waters, there is no dredging cycle.

# Q&As – Engineering

- Funding of canals and lake waterways

January 2018

***Q. Where does the sediment come from?***

**A.** The main source of sediment is from Moreton Bay, with stormwater outlets and upstream catchments contributing minor amounts.

***Q. What would happen if ongoing maintenance work was substantially scaled back?***

**A.** Council is committed to maintaining technical service levels.

***Q. What is the environmental impact, if any, of repair and maintenance works?***

**A.** Council meets all environmental standards required under law and takes every precaution to ensure any works do not adversely affect the environment. Impacts are considered prior to works commencing and managed on a project by project basis to minimise and mitigate environmental impacts. eg turbidity is monitored during dredging works, and silt curtains often used during revetment wall repairs.

***Q. Will required works be completed?***

**A.** The completion dates are dependent on the nature of the maintenance work. Council will continue to undertake maintenance of the canals and lake in the 17/18 FY.

***Q. Who does the maintenance work?***

**A.** The maintenance work is completed by specialist external contractors. Council follows a stringent procurement process, typically involving an open tender and imposes strict standards on these contractors to deliver the works to a high standard.

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Redland CITY COUNCIL

# Q&As – Maintenance Activities and Costs

January 2018

- Funding of canals and lake waterways

***Q. What activities are involved in maintaining revetment walls?***

**A.** Council directed activities include revetment wall planning, monitoring, maintenance, and upgrades.

***Q. What is involved in maintaining the navigability of the canals and lakes?***

**A.** The activities include navigation beacon renewals, canal maintenance, canal monitoring, planning and dredging/ bed-levelling.

***Q. Where does siltation at Aquatic Paradise stem from?***

**A.** A siltation study carried out in 2011 as part of the canal management plan found that siltation within the Aquatic Paradise Canal Estate and entrance channel, from 2000 to 2011, came from two main sources:

- Waterloo Bay (approximately 10,157m3/annum, or 99.6 per cent v/v long-term average).
- The stormwater outlets, including Tarradarrapin Creek (approximately 43m3/annum, or 0.4 per cent v/v long-term average).

The outlets of Tarradarrapin Creek, and other stormwater sources in the canals, are dredged by Council separate to the special charge account in recognition of the probable source of this sedimentation.

The siltation study can be found on Council's website at **yoursay.redland.qld.gov.au**

***Q. How much does it cost each year for these activities?***

**A.** The required activities vary every year, but in the 17/18 financial year, works costing a total of $6,457,158 are scheduled.

***Q. How much do property owners with a revetment wall on a canal or lake front property contribute towards these costs each year?***

**A.** Canal and lake front property owners currently contribute as per the following schedule:

- $723.60 for a standard lot at Sovereign Waters
- $2,354.28 for a standard lot at Raby Bay Canal Estate (including lots 1 to 12 on Group Title Plans 2073)
- $1,364.24 for a unit in a Community Title Scheme at Raby Bay Canal Estate (excluding lots 1 to 12 on Group Title Plans 2073)
- $1,189.96 for a marina berth at Raby Bay Canal Estate
- $2,806.28 for a standard lot at Aquatic Paradise Canal Estate
- $2,806.28 for a marina berth at Aquatic Paradise Canal Estate

Note: These annual charges may change each FY.

***Q. What has Council been contributing?***

**A.** While percentage contributions have varied over time at the direction of Council, over the past several financial years Council has contributed 20% of the

total reserve funding for Raby Bay, and 30% of the total reserve funding at Aquatic Paradise and Sovereign Waters.

Until the 17/18 financial year, Council established an annual implementation plan that calculated the annual estimated cost for operational and capital works (maintenance and repair), which was then apportioned to canal and lake estate property owners via the levy calculation.

***Q. How much does every other Redland ratepayer contribute to canal, lake and revetment wall maintenance each year?***

**A.** Through their general rates, other Redland ratepayers contribute to the balance of the cost to ensure the canals and Sovereign Waters Lake can be navigated and revetment walls maintained. In 17/18 the total cost for canal and lake maintenance and revetment wall activities is expected to be distributed as follows:

*Raby Bay*

| | |
|---|---|
| Total cost of activities: | $4,330,105 |
| Resident contribution: | $2,242,921 |
| Council contribution (through ratepayers): (20% of total contribution) | $560,730 |
| Shortfall: | $1,526,454 |

*Aquatic Paradise*

| | |
|---|---|
| Total cost of activities: | $1,663,507 |
| Resident contribution: | $611,769 |
| Council contribution (through ratepayers): (30% of total contribution) | $262,187 |
| Shortfall: | $789,551 |

*Sovereign Waters*

| | |
|---|---|
| Total cost of activities: | $463,546 |
| Resident contribution: | $36,180 |
| Council contribution (through ratepayers): (30% of total contribution) | $15,506 |
| Shortfall: | $411,860 |

# Q&As – Maintenance Activities and Costs

January 2018

- Funding of canals and lake waterways

In the 17/18 FY the cost of the works required exceeded the money raised.

The shortfalls listed above will be funded by Council (from general rates), so in the case of Raby Bay, the actual contribution by Council (or other ratepayers), will be $2,087,184 (i.e. $560,730+1,526,454), which equates to 48% of the total contribution to the Raby Bay Reserve (not 20%) for FY 17-18.

In the case of Aquatic Paradise, in the 17/18 FY the contribution made by Council (or other ratepayers), will be $1,051,738, which equates to 63% of the total contribution to the Aquatic Paradise Reserve (not 30%) for FY 17-18.

In the case of Sovereign Waters, in the 17/18 FY the contribution made by Council (or other ratepayers), will be $427,366, which equates to 92% of the total contribution to the Sovereign Waters Reserve (not 30%) for FY 17-18.

In the case of the 17/18 financial year all other Redland ratepayers will contribute a total of $3,566,288 towards the maintenance of canals, the lake and revetment walls. With 66,356 properties not being on a canal or lakefront property, this equates to $54.03 per property.

***Q. How is this fee calculated?***

**A.** Until the current financial year, Council established an annual implementation plan that calculated the annual estimated cost for operational and capital works (maintenance and repair), which was then apportioned to canal and lake front estate property owners via the special charge calculation.

***Q. Why is there a shortfall this year in funding for canal, lake and revetment wall maintenance?***

**A.** For the first time, this financial year's cost of maintaining the city's canals and revetment walls shows a shortfall.

This is not reflective of previous years due to a change in the way Council is required to manage the special charges levied to canal and lakefront property owners.

In late 2016, Council decided to review the special charges after questions were raised within Council about the special charges' compliance with the requirements under State legislation.

While Council can certainly levy a special charge for the canal, lake and revetment wall maintenance, there were some potential technical deficiencies in the overall plans, including for example that they failed to provide an estimated cost and timeframe for carrying out the overall plan.

As a result of the review, Council took the position that the money collected from canal and lake special charges that had not been spent should be refunded to those who paid it.

This was done in 2017 and canal and lakefront property owners were not levied the special charge in their April 2017 rates notice.

Previously, funds for canal and revetment wall maintenance that were not used in any given financial year were carried over to the next, thereby offsetting any shortfalls.

In the past, this permitted a smoothed approach to setting the special charges based on a rolling, long term expenditure plan.

However, in view of the above, the 2017/18 financial year began with a $0 balance, with special charges set around a one-year plan.

Council reviews its rates and charges on an annual basis as part of the budget development process, and future approaches are yet to be determined and adopted but further shortfalls may arise where the special charges and Council's contribution are not set to match the planned expenditure each year.

In the past two financial years, Council raised and spent the following amounts across the three canal and lake estates:

| 2015/16 | | 2016/17 | |
|---|---|---|---|
| Reserve: | $9,126,600.74 | Reserve: | $8,236,155.16 |
| Income: | $3,710,721.11 | Income: | $2,847,529.83* |
| Costs: | $4,601,166.68 | Costs: | $3,309,664.65 |
| Balance: | $8,236,155.17 | Balance: | $7,774,020.34 |

*special charge for three quarters only

The figures show that Council spent more than was raised in those years, thereby reducing the reserve. However, in those financial years, expenditure against the amount that was budgeted for canal and lake maintenance indicates that Council did not spend the amount that was budgeted.

***Q. Are units without canal frontage charged the Special Levy?***

**A.** Yes, if they are in a Community Title Scheme (CTS) which has canal frontage.

***Q. Do the residential units above the commercial properties at Raby Bay Harbour pay the Special Charge, or only the commercial on the ground level?***

**A.** No, the Benefitted Area does not include these units.

# Q&As – Maintenance Activities and Costs

January 2018

## - Funding of canals and lake waterways

***Q. How much do those in Community Title Schemes pay each year?***

**A.** A unit in a Community Title Scheme at Raby Bay Canal Estate (excluding lots 1 to 12 on GTP 2073) is charged $1,364.24 per annum, in the 17/18 FY.

***Q. Are general rates paid by canal or lake waterfront property owners higher than those paid by canal estate ratepayers not on waterfront properties?***

**A.** General rates are based on a valuation calculated by the state government's Department of Natural Resources and Mines, and the Land Use Category of the rateable property (note, no categories are related to whether a property is on a canal or lakefront).

The Department of Natural Resources and Mines values all non-rural land in Queensland using the site value methodology, which reflects what the land would be expected to sell for in its current condition, and includes any work undertaken, or materials used, to improve the physical nature of the land to prepare it for development including 'reclaiming land by draining or filling, including retaining walls and other works for the reclamation'. This method of valuation also considers anything else which might improve the value of a property, such as access, size, shape, topography, elevation or views.

So, general rates do take site specifics into consideration, and all other things being equal an owner of a canal, or lakefront property might pay a higher general rate than an owner of property without canal or lake frontage.

Likewise, the owner of a large property would pay higher general rates than the owner of an otherwise comparable smaller property. This is relevant in that, while numerous factors affect valuation and consequently general rate, only some factors (such as maintenance of revetment walls) have high associated maintenance costs.

That is why Section 94 of the Local Government Regulation 2012 allows Councils to make and levy a special charge on rateable land identified as enjoying a special benefit to fund the maintenance, construction, or renewal of that benefit. This regulation allows Council to collect money to pay for the significant works required to maintain the canal and lake walls and waterways, from those who get a special benefit from them.

***Q. How were the percentage contributions decided?***

**A.** Rates were decided by Council resolution.

***Q. When were the percentage contributions decided?***

**A.** Annually, rates have been changed by Council resolution at a special budget meeting when the following years' budget was adopted.

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Redland CITY COUNCIL

# Q&As – Regulatory

- Funding of canals and lake waterways

December 2017

***Q. Who is responsible for maintaining the canals?***

**A.** Section 121 of the Coastal Protection and Management Act 1995 (the CPMA) says Council "must maintain and keep clean" each canal in its local government area (and each access channel for each canal). That obligation extends to the physical embankments and any structures forming part of the canal and applies even though land in a canal is owned by the State.

***Q. Who is responsible for maintaining revetment walls?***

**A.** Under ordinary principles of law the owner of the land on which any structure is located is responsible for the structure's maintenance. Therefore, if a revetment wall is within the boundary of freehold land that adjoins a canal, the registered owner of that land is responsible for the wall's maintenance.

Where a revetment wall is within the boundary of a canal, the wall forms (and is) part of the canal for the purposes of section 121 of the CPMA. Accordingly, Council's obligation to maintain canals within its local government area extends to revetment walls within a canal boundary.

However, section 124 of the CPMA may require a person who owns land adjoining a canal and who authorised the construction of a revetment wall in the canal to maintain the wall in a safe condition. Also, depending on when authority for construction of the revetment wall was given, section 124 may require a person who owns land above high-water mark to maintain a revetment wall in a safe condition if the person's land is connected to, or receives the benefit of, the wall.

Accordingly, the obligation of Council under section 121 of the CPMA to clean and maintain a canal may co-exist with an obligation on an adjoining landowner under section 124 of that Act to maintain a revetment wall in the canal in a safe condition.

***Q. Does Council enforce regulations ensuring the proper use of the canals and lakes?***

**A.** Maritime Safety Queensland (MSQ) is responsible for regulating marine safety in canals and lakes (such as speed restrictions) . Council works closely with MSQ them to ensure the canals and lakes are being used safely.

***Q. When did Redland City Council take over canal and lake maintenance activities at Raby Bay, Sovereign Waters and Aquatic Paradise?***

**A.** Council took these activities over when the estates were handed over from their developers (that is, when the lands in the canals were surrendered to the State).

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Redland CITY COUNCIL



# 2016 SOCIAL SCIENCE RESEARCH REPORT

DATE 11 OCTOBER 2016

**Prepared by**

**Dr Kim Johnston** and **Dr Amanda Beatson**
QUT Business School
Queensland University of Technology
Research Assistant - **Dr Ryan McAndrew**

# EXECUTIVE SUMMARY

Healthy Waterways produces an annual report card on environmental conditions and social impacts of the waterways across 18 catchment areas in South East Queensland (SEQ). Through evidence based reporting, Healthy Waterways aims to protect and enhance the condition of these waterways and influence the decisions and actions – including social lifestyle choices – of community members who interact with these waterways.

This research report documents the social component of evidence, specifically the attitudinal and behavioural components that underpin social expectations and actions towards valuing and using local and SEQ waterways in communities across the 18 catchment areas in Queensland. The study design and findings from the 2016 Healthy Waterways social study are provided

In 2016, two key research questions guided the research project. The research questions focused on waterway use and waterway condition. The questions investigated to what extent do people use local and SEQ waterways, and to what extent do the conditions of SEQ waterways impact the use and enjoyment of these waterways?

The items use to answer these questions were based on existing measures, but also included specific questions and issues used historically in the 2015 survey. A number of constructs or topic areas were identified for the survey that had previously rated survey items (i.e. they have been tested in previous research and found to have reliability and validity). Data for the study were collected through a self-administered 20 minute online survey developed from established scale items and modified for use. In addition, historical questions were used to provide comparative data based on previous surveys. The sample was adults living in the 18 catchment areas in South East Queensland (SEQ) recruited using panel data (n=3263).Data were analysed using the statistical packages SPSS (23). Quantitative analyses provided frequencies, mean statistics, correlations and regressions.

Similar to findings reported in the 2015 social science survey (Johnston & Beatson, 2015), respondents confirmed waterways as valuable and important to their lives, and get satisfaction from this use. Respondents most frequently used beaches with the Northern and Southern Gold Coast being the most frequently visited beaches followed by Southern Sunshine Coast. Across the sample, swimming and recreational activities such as walking, cycling, running, and picnics and barbeques, were the most popular activities on waterways, with fishing featuring more prominently in some catchments. Activities involving the use of craft on water, and those requiring sophisticated equipment– such as boating, sailing, water and jet-skiing, sailboarding and kayaking, and scuba diving – were undertaken less frequently. Activities more frequent at local level (within 15kms from their home) than across SEQ. The largest percentage of residents (26.8%) travel only up to 5kms to access their most frequently used waterway. In total however, nearly 40% travel between 11-50kms to access their most frequently used waterway. Respondents feel they get a lot of overall value from using their local waterway (5.13). Tallebudgera-Currumbin catchment recoded the highest level of overall perceived value (M6.15, SD 0.95) whereas Albert catchment was the lowest (M4.63, SD 1.53). Respondents also feel that local waterways give them a 'third place' to get away from home and work.

Conditions of waterways were found to influence intention or likeliness to use the waterway. Respondents indicated appearance of water and lack of amenities or infrastructure as important considerations. Waterway attributes that encourage usage are Cleanliness, local scenery and ease of access. Waterway attributes discouraging usage were weather and not enough time.

Recommendations are offered at the conclusion of the report, with opportunities for future research identified.

# Table of Contents

# 1.0 Introduction

Healthy Waterways is an independent, not-for-profit organisation that works with government, industry and the community to protect and improve South East Queensland's waterways. Healthy Waterways monitors and reports on the condition of these waterways and provides capacity building for water professionals and community groups. It advises on reforms to policy and planning, and conducts community education programs to motivate Queensland community members to value and protect Queensland waterways.
Underpinning these activities are four strategic objectives:

1) To understand and report on the condition of waterways
2) To educate people on the value of our waterways
3) To influence decisions, policy and actions to improve and maintain waterway health
4) To maximise member return on investment

# 2.0 Project Aims

Healthy Waterways aims to protect and enhance the condition of waterways across 18 catchment areas in Queensland. It does this by seeking to influence the decisions and actions – including social lifestyle choices – of community members who interact with these waterways. It then monitors the waterways in the 18 catchments to gauge the impact of these decisions and actions. Each year, Healthy Waterways produces a report card on its activities and their impact on the condition of the waterways they are monitoring. This research will contribute to understanding the social component of that report, specifically the attitudinal and behavioural components that underpin social expectations and actions towards protecting and supporting local waterways in communities across the 18 catchment areas in Queensland.

# 3.0 Guiding Research Questions

Two key research questions guide the research project. These focus on waterway use, values of waterways, and waterway condition:

1) **To what extent do people (across the 18 catchment areas in SEQ) use local and SEQ waterways?**
    a) Which waterways are used for recreation? (Location, type)
    b) Which activities, and how frequently, do residents undertake on or next to waterways?
    c) Do residents use their local waterways or travel to adjacent/distant waterways to undertake activities?

2) **To what extent do the conditions of SEQ waterways impact the use and enjoyment of these waterways?**
    a) How important are waterways to the SEQ community?
    b) To what extent do the conditions of waterways contribute to the use of these waterways?
    c) Which waterway attributes encourage or discourage people from using waterways?

# 4.0 Ethical Considerations and Funding

This research reported was granted ethics approval by the Queensland University of Technology (QUT) Human Ethics Committee (QUT approval number: **1500000402**) in line with standard ethical guidelines and the National Statement on Ethical Conduct in Human Research (Australian Government, 2007). This $60,000 research project was jointly funded by Healthy Waterways and QUT. Please see Appendix B for Participant Information Sheet.

# 5.0 Method

## 5.1 Instrument

A survey instrument, reflecting the key concepts and constructs forming the research questions, was developed from established scale items and modified for use. The construct map is provided in Appendix C. In addition, historical questions were used to provide comparative data based on previous surveys. Questions featured seven point Likert scale questions (*1 = Strongly Disagree to 7 = Strongly Agree* range was used), open text boxes, and distance pins on maps. The survey was administered through a 20-minute online survey hosted by QUT (Key Survey The survey is included in Appendix B.

**Pin Maps**

To identify the distance from home respondents travel to their two most frequently used waterways, respondents were asked to nominate the suburb they live in on a Google Map by 'dropping' a red marker. Following this, respondents were then asked to place the marker in the waterway they have visited the most in the past 12 months and to identify how often they have visited this waterway in the last 12 months (from almost every day to once a year – with an option for not having visited a waterways in the last 12 months). 20.25% of respondents indicate that they visit their most frequently visited waterway every six months, 19.56% state every month, and 18.73% state once a year. 16.53% state they have not visited a waterway in the last 12 months. For participants who indicated they had visited a waterway, a second map was offered. This placing of a pin was repeated for the second most visited waterway in the last 12 months.

## 5.2 Sampling and Procedure

The sample was adults (18+) living in the 19 catchment areas in South East Queensland (SEQ). Data were collected via an online survey using panel data as a recruitment strategy (n=3263). The catchment and postcode methodology was changed from the postcode distribution used in the 2015 research report with specific suburbs used to allow more accurate allocation of respondents to catchments. However this resulted in small numbers in three catchments (Mid Brisbane, Upper Brisbane and Stanley). Caution needs to be taken when interpreting these specific catchment results.

A soft launch was conducted with panel data on 23 August 2016 (n300) and refinements were made to some questions and the length of the survey was reduced due to respondent fatigue and drop out rates. The full launch was on 26th August 2016. The survey was hosted on a QUT web-based survey (Key Survey) with the link distributed to recruited panel members. The survey was closed out on 22 September 2016.

## 5.3 Analysis

Data were analysed using the statistical packages SPSS (23). Quantitative analyses provided frequencies, mean statistics, correlations and regressions.

## 5.4 Respondents – Demographic profiles

A total of 3263 surveys were completed. Of these respondents, 55.1 % were female, 44.8% male, and .1% of respondents elected not to disclose their gender. Figure 1 illustrates this mix.

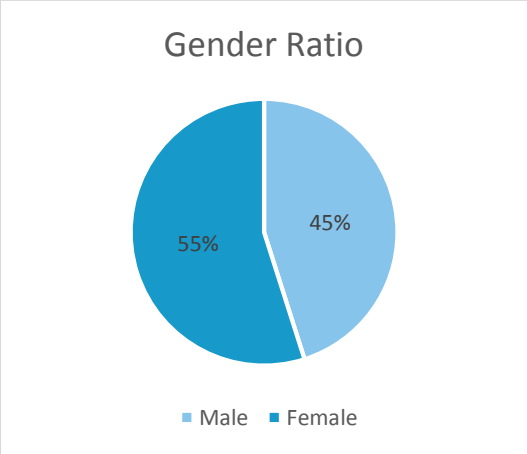



Figure 1: Gender ration- full sample

More than 74% of respondents have lived in Queensland more than 10 years. Just over 10.5% of respondents have lived in Queensland for up to 3 years.

The median age of respondents was 51 years old (M= 49.5 SD 16.81) with the youngest being 18 and the oldest 89 years old.

Education of respondents represented a normal distribution with 69.2% holding a post-secondary school qualification.

### 5.4.1 Employment

Nearly 31% of participants were in full time employment, with 17.5% part-time. 23.2% of participants were a carer, student or unemployed. Just over a quarter of the sample (28.6%) identified as retired.

| | Frequency | Percent |
|---|---|---|
| Retired | 932 | 28.6 |
| Carer | 110 | 3.4 |
| Full time student | 218 | 6.7 |
| Unemployed and not seeking work | 214 | 6.6 |
| Unemployed and seeking work | 211 | 6.5 |
| Part time employee | 571 | 17.5 |
| Full time work | 1007 | 30.9 |
| Total | 3263 | 100.0 |

### 5.4.2 Industry

Participants were asked what industry they currently work in, or recently worked in. While just over 16% identified as retired, other industries were represented. More than 8% of participants represented the retail, education and health sectors.

| | Frequency | Percent |
|---|---|---|
| Agriculture, Forestry and Fishing, | 56 | 1.7 |
| Mining | 36 | 1.1 |
| Manufacturing | 121 | 3.7 |
| Electricity, Gas and Water Supply | 38 | 1.2 |
| Construction and development | 121 | 3.7 |
| Wholesale Trade | 38 | 1.2 |
| Retail Trade | 282 | 8.6 |
| Hospitality and Tourism | 203 | 6.2 |
| Transport and Storage | 142 | 4.4 |
| Communication Services | 66 | 2.0 |
| Finance and Insurance | 119 | 3.6 |
| Property and Business Services | 73 | 2.2 |
| Government Administration and Defence | 185 | 5.7 |
| Education | 253 | 7.8 |
| Health and Community Services | 274 | 8.4 |
| Cultural and Recreational Services | 26 | .8 |
| Personal and Other Services | 102 | 3.1 |
| I have not worked | 218 | 6.7 |
| I am retired and do not identify with any of these industries | 529 | 16.2 |
| Other - please provide | 381 | 11.7 |
| Total | 3263 | 100.0 |

### 5.4.3 Length of time living in SEQ

Length of time living in SEQ suggests more familiarity with local and state wide waterways. For each catchment the majority of residents had lived in their current locations for more than 10 years, again indicating strong familiarity with their local waterways.

| | SEQ_LIVED How long have you lived in South East Queensland? | | | | | Total |
|---|---|---|---|---|---|---|
| | Less than a year | 1-3 years | 4-6 years | 7-10 years | More than 10 years | |
| Noosa | 1 | 13 | 5 | 2 | 59 | 80 |
| Maroochy | 4 | 7 | 9 | 12 | 85 | 117 |
| Mooloolah | 4 | 8 | 4 | 6 | 62 | 84 |
| Pumicestone | 5 | 12 | 7 | 5 | 83 | 112 |
| Caboolture | 3 | 9 | 8 | 15 | 103 | 138 |
| Pine | 4 | 17 | 22 | 24 | 176 | 243 |
| Lower Brisbane | 50 | 79 | 84 | 64 | 763 | 1040 |
| Redland | 2 | 6 | 16 | 9 | 124 | 157 |
| Logan | 3 | 12 | 17 | 34 | 232 | 298 |
| Albert | 2 | 4 | 1 | 3 | 45 | 55 |
| 12 Pimpama-Coomera | 6 | 16 | 21 | 17 | 122 | 182 |
| Nerang | 11 | 21 | 20 | 23 | 143 | 218 |
| Tallebudgera-Currumbin | 1 | 3 | 5 | 4 | 51 | 64 |
| Bremer | 1 | 9 | 8 | 12 | 78 | 108 |
| Lockyer | 2 | 8 | 3 | 9 | 99 | 121 |
| Mid Brisbane | 0 | 1 | 0 | 2 | 11 | 14 |
| Upper Brisbane | 2 | 0 | 4 | 1 | 19 | 26 |
| Stanley | 0 | 1 | 1 | 0 | 20 | 22 |
| **Total** | **101** | **226** | **235** | **242** | **2275** | **3079** |

### 5.4.4 Household Income

Participants were asked to provide an indication of their household income. More than 30% of participants earned between $50,000 and $100,000, while just over 30% earnt less than $50,000. Just over 7% earned more than $150,000. These data reflect ABS statistics for these representative areas. Nearly 16% of participants elected not to disclose their income.

| | Frequency | Percent |
|---|---|---|
| 1 Under $25,000 | 337 | 10.3 |
| 2 $25,001-$50,000 | 699 | 21.4 |
| 3 $50,001-$75,000 | 524 | 16.1 |
| 4 $75,001-$100,000 | 460 | 14.1 |
| 5 $100,001-$150,000 | 491 | 15.0 |
| 6 $150,001-$200,000 | 160 | 4.9 |
| 7 Over $200,000 | 75 | 2.3 |
| 8 Prefer not to say | 517 | 15.8 |
| Total | 3263 | 100.0 |

## 6.0 Catchment Areas

Respondents in Queensland postcodes spanning 18 SEQ waterway catchment areas were targeted with this research. See Appendix A for catchment allocated suburbs and associated postcodes.

| | Frequency | Percent | Valid Percent |
|---|---|---|---|
| Noosa | 80 | 2.5 | 2.6 |
| Maroochy | 117 | 3.6 | 3.8 |
| Mooloolah | 84 | 2.6 | 2.7 |
| Pumicestone | 112 | 3.4 | 3.6 |
| Caboolture | 138 | 4.2 | 4.5 |
| Pine | 243 | 7.4 | 7.9 |
| Lower Brisbane | 1040 | 31.9 | 33.8 |
| Redland | 157 | 4.8 | 5.1 |
| Logan | 298 | 9.1 | 9.7 |
| Albert | 55 | 1.7 | 1.8 |
| Pimpama-Coomera | 182 | 5.6 | 5.9 |
| Nerang | 218 | 6.7 | 7.1 |
| Tallebudgera-Currumbin | 64 | 2.0 | 2.1 |
| Bremer | 108 | 3.3 | 3.5 |
| Lockyer | 121 | 3.7 | 3.9 |
| Mid Brisbane | 14 | .4 | .5 |
| Upper Brisbane | 26 | .8 | .8 |
| Stanley | 22 | .7 | .7 |
| Total | 3079 | 94.4 | 100.0 |
| Missing | 184 | 5.6 | |
| **Total** | **3263** | **100.0** | |

# 7.0 Survey Constructs

The items in the survey were based on existing measures, but also included specific questions and issues used historically by Healthy Waterways. A number of constructs or topic areas were identified for the survey that had previously rated survey items (i.e. they have been tested in previous research and found to have reliability and validity). Wherever possible we have used these items, adapted if necessary to the specific context, to ensure reliability. The construct map is included in Appendix C. Means and Standard Deviations for each construct are summarised in Table 1.

The aim of each construct investigated is outlined below with the results of each construct including the average score across SEQ respondents and also the highest and the lowest scoring catchment per construct. The tables including all the data for the individual catchments can be found in Section 9.0.

**Table 1: Survey constructs - total sample**

1 = Strongly Disagree, 7 = Strongly Agree

| Construct | Mean | Standard Deviation |
|---|---|---|
| 1. Nature Relatedness | 4.81 | 1.33 |
| 2. Environmental Concern | 5.22 | 1.13 |
| 3. Environmental Belief | 5.18 | 1.17 |
| 4. Introjected Regulation | 3.38 | 1.44 |
| 5. Integrated Regulation | 3.89 | 1.54 |
| 6. External Regulation | 2.85 | 1.46 |
| 7. Identified Regulation | 4.25 | 1.33 |
| 8. Intrinsic Regulation | 4.92 | 1.38 |
| 9. Overall Satisfaction | 4.83 | 1.25 |
| 10. Overall Accessibility | 5.11 | 1.36 |
| 11. Overall Useability | 4.89 | 1.32 |
| 12. Overall Value | 5.13 | 1.39 |
| 13. Social Value | 4.68 | 1.41 |
| 14. Fascination | 4.54 | 1.34 |
| 15. Being away | 4.97 | 1.42 |
| 16. Compatibility | 4.38 | 1.46 |
| 17. Loyalty | 4.59 | 1.47 |
| 18. Industry Concern | 4.22 | 1.31 |

## Validity and Reliability

To assess the validity and reliability of the constructs exploratory factory analysis (EFA), Cronbach's alpha (α), and item-to-total correlation (ITC) tests were conducted.

| Test | SPSS steps | Thresholds |
|---|---|---|
| **Cronbach's Alpha, item-to-total correlation** | **Analyse → Scale → Reliability Analysis**<br>Add items<br>*Statistics* → Check Item, Scale, Scale if item delete → Cont.<br>OK | α ≥ 0.70 (or 0.60 in exploratory research)<br><br>ITC > 0.30 |
| **EFA** | **Analyse → Dimensions Reduction → Factor**<br>Add items<br>*Descriptives* → Check KMO/Bartlett<br>*Extractions* → Principal components<br>*Rotations* → Check Direct Oblimin<br>*Options* → Check Sorted by size, Supress small coefficients, chance value to 0.3<br>OK | KMO > 0.5<br><br>Bartlett's test < .05<br><br>Factor loadings > .5 |

The KMO and Bartlett's test were used to assess the suitability for factor analysis, with the KMO cut-off value being 0.5 and the Bartlett's test needing to be significant. Items with an item-to-total correlation below 0.30 (Field, 2009) were removed; items with a factor loading less than 0.50 were removed (Field, 2009). This research cautiously used the guidelines set out by Hair, Anderson, Tatham, & Black (1998), with 0.7 being the generally accepted lower limit for α, while it may decrease to 0.6 in exploratory research. A full list of steps and item results is available from the authors on request.

# 8.0 Results and Discussion

Results are presented by total sample in general section and by panel data only for individual catchment level (Section 9.0). To begin, the results are presented and discussed regarding access, usability and overall satisfaction toward the respondent's local waterway. Following this the results from the table are discussed relating to each construct. The questions first relate to using their local waterway and then move on to their connections with their waterways such as loyalty and feelings of value derived through their waterways.

| | |
|---|---|
| **Nature relatedness** | Nature relatedness - This scale was used in 2015 HWSSS. It measures how an individual's connection to the natural world (environment). In this construct we see a good connection with nature (M4.81, SD, 1.34). When respondents rate favourably on this construct they are more likely to also demonstrate greater happiness and environmental concern. Those respondents from Noosa catchment demonstrate the highest level of nature relatedness (M5.3, SD 1.28). This was the same as 2015. Those from Mid Brisbane demonstrate the lowest (M4.69, SD 1.73). |
| **Environmental Concern** | Environmental concern measures the level of apprehension the respondents have toward environmental damage on waterways and their concern about the state of waterways in general.–Respondents indicated that they are largely concerned about waterways (M5.22, SD 1.13). This was felt at the catchment level too. As above, Tallebudgera-Currumbin catchment recoded the highest level of environmental concern (M5.47, SD 0.96) whereas Mid Brisbane was the lowest (M4.90, SD 1.41). |
| **Environmental Belief** | Environmental beliefs measures the specific beliefs that consumers have about the relationship between people and how to look after their waterways including changing water protection laws and also altering their individual behaviour to help protect waterways. Respondents indicated that they largely have strong environmental beliefs. The mean was 5.17 (SD 1.17) indicating there was a great deal of agreement on this construct. At the catchment level we see that the highest environmental beliefs are seen in the Tallebudgera-Currumbin catchment (M5.46, SD 1.11) and the lowest are in the Upper Brisbane catchment (M4.83, SD 1.48). |
| **Self Determination Theory (SDT)** | Self-Determination Theory (SDT) is a theory of motivation. It is concerned with supporting our natural or intrinsic tendencies to behave in effective and healthy ways. SDT articulates a meta-theory for framing motivational studies, outlining internal and external sources of. SDT is a higher order construct with five dimensions of motivation; 1) intrinsic, 2) introjected, 3) integrated, 4) identified, and 5) extrinsic. |
| **SDT – 1) Intrinsic Regulation/ Motivation** | Intrinsic motivation occurs when individuals feel visiting waterways is inherently satisfying and enjoyable. The results indicate that respondents are reasonably intrinsically motivated to use waterways. The mean for the total sample was 4.99 (SD 1.38). Tallebudgera-Currumbin catchment had the highest level of intrinsic regulation (M5.73, SD 1.11) and Upper Brisbane catchment had the lowest (M4.23, SD1.52). |

| | |
|---|---|
| **SDT – 2) Introjected Regulation/ Motivation** | Introjected motivation describes internalisation of behaviours based on the provision of relatedness, such as visiting waterways to avoid the anxiety associated with disappointing loved ones. Respondents did not score this construct too highly demonstrating that while the connection with their self-concept was there, it was not too strong (M3.40, SD (1.44). Tallebudgera-Currumbin catchment showed the highest levels of integrated regulation (M4.00, SD 1.51) and Stanley catchment showed the lowest levels (M3.40, SD 1.44). |
| **SDT – 3) Integrated Regulation/ Motivation** | Integrated motivation occurs when motives for using waterways are fully in line with one's personal values and needs. Respondents did not score this construct too highly demonstrating that while the connection with their self-concept was there, it was not too strong (M3.90) and it had a reasonably wide SD (1.54) which shows spread in the answers to this question. Tallebudgera-Currumbin catchment showed the highest levels of integrated regulation (M5.05, SD 1.44) and Upper Brisbane showed the lowest levels (M3.18, SD 1.52). |
| **SDT – 4) Identified Regulation/ Motivation** | Identified motivation occurs when the goal of an activity is accepted as personally important, such as using waterways to build particular skills. The mean for the overall sample was 4.26 (SD 1.34). Tallebudgera-Currumbin catchment scored the highest indicating that respondents felt that it is important to use a waterway; they value the benefits of using the waterway and they feel using a waterway is a sensible thing to do. Respondents from Tallebudgera-Currumbin scored M5.15 out of 7 (SD 1.12) whereas those from Upper Brisbane scored M3.58 (SD 1.34). |
| **SDT 5) Extrinsic/ External Regulation /Motivation** | Extrinsic motivation refers to behaviours that are done to attain some outcome separate from what exists within an activity, such as visiting waterways to attain a positive feedback or to avoid punishment. The responses indicated that the use of waterways is not down to social pressure from friends and family. The overall sample mean was 2.86 (SD 1.47). Pimpama-Coomera showed the higher influence from others with their usage (M3.10, SD 1.55) whereas respondents from Stanley felt they used the waterways because of family/friends the least out of the total sample with M2.49 (SD 1.65) out of 7 with 7 indicating that respondents are influenced by trying to impress friends and family. This is still a very low number though suggesting that motives are not influenced a great deal in this manner. |
| **Overall Satisfaction** | Overall Satisfaction measures how satisfied overall the respondents are with their experiences when using or visiting their local waterways. It looks at whether respondents find these to be good experiences and whether they truly enjoyed these experiences. On average SEQ respondents responded generally favourably to this (4.84 SD 1.25). Those in the Tallebudgera-Currumbin catchment scored the highest levels of satisfaction with a mean of 5.79 (SD 0.96) with those in Albert being the least satisfied (4.34 SD 1.31). |
| **Overall Accessibility** | Overall accessibility explores whether the respondents feel they can access their local waterway easily. The average score across SEQ residents for this was 5.12 (1.36) indicating that on the whole respondents feel that accessing their local waterways is straight forward. Those respondents in Pumicestone felt that they had the best accessibility to their local waterway (5.81 SD1.10) whereas those in Bremer felt they had the lowest (4.50 SD 1.38). |

| | |
|---|---|
| **Overall Useability** | Overall Usability measured whether they respondents thought that their local waterways were usable and didn't take much effort to use. The average score across on this construct suggesting that respondents overall think that their local waterways are relatively easy to use was 4.90 (SD 1.32). Those in Tallebudgera-Currumbin catchment again thought their local waterways were the most usable (5.64 SD 0.95) whereas those respondents in Albert thought theirs were the least usable (4.26 SD 1.17). |
| **Overall Value** | Overall perceived value measures the assessment of the trade-off that respondents make based on inputs versus what they feel they get out of using their local waterways. These trade-offs include, money, time, and effort. Respondents indicated that they largely feel that they get value from using their waterways with the overall mean 5.13 (SD 1.39). Tallebudgera-Currumbin catchment recoded the highest level of overall perceived value (M6.15, SD 0.95) whereas Albert catchment was the lowest (M4.63, SD 1.53). |
| **Social Value** | Social value measures the level of value respondents receive from using waterway with their friends and others known to them. Respondents indicated general agreement with this. They are happy, and they find using waterways more interesting when they are using them with friends or as part of a group. The overall mean was 4.61 (SD 1.42). Those respondents in the Mid Brisbane catchment scored the highest level of social value (5.84 SD 1.08) and those in Bremer catchment scored the lowest (4.43 SD 1.59). |
| **Third Place** | Third Place (TP) represents a location where a person is able to restore themselves and often represents a setting central to someone's informal life away from home and work. Third places are often important in the social and psychological lives of people and may encapsulate natural settings, such as parks and gardens (Rosenbaum, 2009). The measurement of third place includes three dimensions; 1) Being Away, 2) Fascination and 3) Compatibility. |
| **TP 1) Being away** | TP 1) Being Away involves a "conceptual rather than a physical transformation" (Kaplan, 1995, p. 173) whereby a being in a location helps the person to relax, gives them a break from their routines and escape. Overall respondents thought of their local waterways as places to be away at. The mean was 4.97 (SD 1.43). Those respondents in the Tallebudgera-Currumbin catchment recorded the highest on this construct (5.79 SD 1.04) while those in Upper Brisbane scored the lowest (4.43 SD 1.48). |
| **TP 2) Fascination** | TP 2) Fascination is conceptualised as a location which provides an interest which is thoroughly absorbing. Examples can include fishing, bird watching or going for a walk. This construct taps into the person's awareness of interesting things to do at this location and that they want to spend more time on activities at this location. The average for all respondents was 4.55 (SD 1.34), with those in Tallebudgera-Currumbin again scoring the highest (5.18 SD 1.04) and those in Upper Brisbane the lowest (3.03, SD 1.28) |
| **TP 3) Compatibility** | TP 3) Compatibility focuses on what a person is doing and the fit with the surrounding environment. It focuses on the fact that the person can find something enjoyable to do at this location and that they have a sense of belonging at this place. The average for all SEQ residents on this construct was 4.38 (SD 1.46), with those in Tallebudgera- |

| | |
|---|---|
| | Currumbin scoring the highest (5.17 SD 1.18) and those in Albert scoring the lowest (3.67 SD 1.52). |
| **Loyalty** | Loyalty captures whether or not people are committed to re-patronising a location consistently in the future. It includes into whether people are willing to expend extra effort to return to their local waterway and whether they intend to go back to their local waterway in the future. The average for SEQ respondents was 4.59 (SD 1.47). Those in the Tallebudgera-Currumbin catchment scored the highest indicating they are loyal to their local waterways (5.45, SD 1.10) whereas those in Albert scored the lowest (3.88, SD 1.55). |
| **Industry Concern** | Industry concern tapped into whether or not the respondents felt the industry where they work is likely to have a negative impact on water quality, whether the roles and responsibilities around minimising negative impacts waterways, and whether they feel their industry does enough to manage its impact on waterways. The average for SEQ respondents was 4.21 (SD 1.31) suggesting that respondents thought on the whole their work industry is mindful of waterway quality. Those in Mid Brisbane scored the highest suggesting that they thought their industry is aware of their impact on water quality (4.61 SD 1.00) and those in Lockyer scored the lowest (4.09 SD 1.41). |
| **Aesthetic Value** | Aesthetic value measures the value the respondents derive from the way their local waterways look. The respondents form value assessments based on whether they think their local waterways look attractive, they like the scenery and they feel their local waterways looks picturesque. |

# 8.1 Local waterway accessibility, use and overall satisfaction

Respondents across the total sample were asked to consider their local waterway and rate their perceptions of access, use and overall satisfaction.

## 8.1.1 Local waterway accessibility

These questions asked how participants their perceptions about accessibility of their local waterway (– 1= not very, where 7= very). At a SEQ level, the mean was 5.12 (SD 1.36) suggesting respondents felt their local waterway tended to be very accessible. This is an improvement on 2015 levels. At the local catchment level, Tallebudgera-Currumbin (M 5.79 SD .97), Pumicestone (M 5.81 SD 1.10), and Mooloolah (M 5.57 SD 1.33) reported the highest levels of accessibility, while Albert (M 4.51 SD 1.22) and Bremer (M 4.50 SD 1.38) reported the lowest.

| Accessibility | Count | Mean | SD |
|---|---|---|---|
| 1 Noosa | 80 | 5.27 | 1.61 |
| 2 Maroochy | 117 | 5.19 | 1.28 |
| 3 Mooloolah | 84 | 5.57 | 1.33 |
| 4 Pumicestone | 112 | 5.81 | 1.10 |
| 5 Caboolture | 138 | 5.15 | 1.29 |
| 6 Pine | 243 | 5.38 | 1.31 |
| 7 Lower Brisbane | 1040 | 4.97 | 1.35 |
| 9 Redland | 157 | 5.34 | 1.31 |
| 10 Logan | 298 | 4.71 | 1.36 |
| 11 Albert | 55 | 4.51 | 1.22 |
| 12 Pimpama-Coomera | 182 | 5.45 | 1.22 |
| 13 Nerang | 218 | 5.44 | 1.25 |
| 14 Tallebudgera-Currumbin | 64 | 5.79 | 0.97 |
| 15 Bremer | 108 | 4.50 | 1.38 |
| 16 Lockyer | 121 | 4.83 | 1.48 |
| 17 Mid Brisbane | 14 | 5.29 | 1.40 |
| 18 Upper Brisbane | 26 | 4.75 | 1.19 |
| 19 Stanley | 22 | 5.24 | 1.46 |
| **SEQ** | **3079** | **5.12** | **1.36** |

### 8.1.2 Local waterway useability

These questions asked respondents to rate how useable their local waterway was, choosing from 1= not very, to 7= very. The SEQ mean was 4.90 (SD 1.32) suggesting respondents felt their local waterway tended to be useable. However this is a decrease from 2015 report card (M 5.07 SD 1.82) suggesting more participants felt their waterway wasn't as useable. Those respondents in Tallebudgera-Currumbin catchment (M 5.64 SD .96), Pumicestone (M 5.47 SD 1.03), and Mooloolah (M 5.33 SD 1.22) reported the highest levels of useability, while Albert (M 4.26 SD 1.17) and Bremer (M 4.35 SD 1.36) reported the lowest.

| Usability | Count | Mean | SD |
|---|---|---|---|
| 1 Noosa | 80 | 5.17 | 1.46 |
| 2 Maroochy | 117 | 4.97 | 1.24 |
| 3 Mooloolah | 84 | 5.33 | 1.22 |
| 4 Pumicestone | 112 | 5.47 | 1.03 |
| 5 Caboolture | 138 | 4.90 | 1.34 |
| 6 Pine | 243 | 5.04 | 1.31 |
| 7 Lower Brisbane | 1040 | 4.78 | 1.29 |
| 9 Redland | 157 | 5.06 | 1.28 |
| 10 Logan | 298 | 4.57 | 1.31 |
| 11 Albert | 55 | 4.26 | 1.17 |
| 12 Pimpama-Coomera | 182 | 5.18 | 1.27 |
| 13 Nerang | 218 | 5.20 | 1.27 |
| 14 Tallebudgera-Currumbin | 64 | 5.64 | 0.96 |
| 15 Bremer | 108 | 4.35 | 1.36 |
| 16 Lockyer | 121 | 4.62 | 1.51 |
| 17 Mid Brisbane | 14 | 5.18 | 1.30 |
| 18 Upper Brisbane | 26 | 4.35 | 1.22 |
| 19 Stanley | 22 | 5.07 | 1.36 |
| **SEQ** | **3079** | **4.90** | **1.32** |

### 8.1.3 Local waterway satisfaction

Finally, questions asked respondents to rate how satisfied they were with their local waterway, choosing from 1= not very, to 7= very. The SEQ Mean was 4.84 (SD 1.25) suggesting respondents felt generally satisfied with their local waterway. However this is a decrease on the 2015 report card measure (M 5.01 SD 1.66). ). Tallebudgera-Currumbin showed the highest levels of satisfaction with their local waterways (5.66, SD 0.95) while Albert catchment showed the lowest levels (4.34, SD 1.31).

| Satisfaction | N | Mean | SD |
|---|---|---|---|
| 1 Noosa | 80 | 5.07 | 1.44 |
| 2 Maroochy | 117 | 5.08 | 1.17 |
| 3 Mooloolah | 84 | 5.37 | 1.18 |
| 4 Pumicestone | 112 | 5.32 | 1.01 |
| 5 Caboolture | 138 | 4.82 | 1.12 |
| 6 Pine | 243 | 4.98 | 1.22 |
| 7 Lower Brisbane | 1040 | 4.70 | 1.22 |
| 9 Redland | 157 | 4.89 | 1.22 |
| 10 Logan | 298 | 4.42 | 1.28 |
| 11 Albert | 55 | 4.34 | 1.31 |
| 12 Pimpama-Coomera | 182 | 5.23 | 1.18 |
| 13 Nerang | 218 | 5.18 | 1.16 |
| 14 Tallebudgera-Currumbin | 64 | 5.66 | 0.95 |
| 15 Bremer | 108 | 4.22 | 1.30 |
| 16 Lockyer | 121 | 4.68 | 1.37 |
| 17 Mid Brisbane | 14 | 5.31 | 1.12 |
| 18 Upper Brisbane | 26 | 4.38 | 1.12 |
| 19 Stanley | 22 | 4.70 | 1.41 |
| SEQ | 3079 | 4.84 | 1.25 |

## 8.2 Aesthetic value

Aesthetic value measures the value the respondents derive from the way their local waterways look. The respondents form value assessments based on whether they think their local waterways look attractive, they like the scenery and they feel their local waterways looks picturesque. The overall mean was 4.91 (SD 1.40). Those respondents in the Tallebudgera-Currumbin catchment scored the highest level of aesthetic value (6.04 SD .88) and those in Bremer catchment scored the lowest (4.36 SD 1.48).

| | N | Mean | SD |
|---|---|---|---|
| Noosa | 80 | 5.36 | 1.64 |
| Maroochy | 117 | 5.16 | 1.32 |
| Mooloolah | 84 | 5.72 | 1.15 |
| Pumicestone | 112 | 5.58 | 1.14 |
| Caboolture | 138 | 4.96 | 1.32 |
| Pine | 243 | 5.04 | 1.47 |
| Lower Brisbane | 1040 | 4.66 | 1.35 |
| Redland | 157 | 5.05 | 1.45 |
| Logan | 298 | 4.47 | 1.40 |
| Albert | 55 | 4.56 | 1.45 |
| Pimpama-Coomera | 182 | 5.27 | 1.29 |
| Nerang | 218 | 5.25 | 1.28 |
| Tallebudgera-Currumbin | 64 | 6.04 | 0.88 |
| Bremer | 108 | 4.36 | 1.48 |
| Lockyer | 121 | 4.62 | 1.44 |
| Mid Brisbane | 14 | 5.46 | 1.52 |
| Upper Brisbane | 26 | 4.65 | 1.26 |
| Stanley | 22 | 5.78 | 0.90 |
| | | | |
| SEQ | 3079 | 4.91 | 1.40 |

## 8. 3 Waterway use and activities

Types of usage were captured across the total sample and by catchment. Across the sample, swimming and recreational activities such as walking, cycling, running, and picnics and barbeques, were the most popular activities on waterways, with fishing featuring more prominently in some catchments. Activities involving the use of craft on water, and those requiring sophisticated equipment– such as boating, sailing, water and jet-skiing, sailboarding and kayaking, and scuba diving – were undertaken less frequently.

| SEQ Useage | Never | Almost everyday | Every week | Every fortnight | Every month | Once or twice a year | Every few years |
|---|---|---|---|---|---|---|---|
| Boating, sailing | 64.5 | 0.6 | 1.7 | 2.4 | 5.7 | 16.3 | 8.8 |
| Jet skiing, Water skiing | 83.1 | 0.6 | 0.6 | 1.4 | 2.3 | 5.7 | 6.3 |
| Walking or running | 19.6 | 10.1 | 14.3 | 8.5 | 18.2 | 25.4 | 3.8 |
| Cycling | 66.3 | 1.6 | 4 | 3.9 | 7.4 | 11.5 | 5.2 |
| Picnics, BBQs | 21.5 | 0.7 | 3.2 | 6.6 | 20.5 | 40.9 | 6.6 |
| Recreational fishing | 56.7 | 0.7 | 2.9 | 4.3 | 8.2 | 19.2 | 8 |
| Rowing, kayaking, canoeing | 74.9 | 0.6 | 2 | 2.1 | 4.8 | 9.1 | 6.5 |
| Scuba diving, snorkelling | 83.3 | 0.5 | 1.1 | 1.4 | 2.2 | 5.6 | 5.9 |
| Surfing, kite-surfing, sail boarding | 83.9 | 0.8 | 1.5 | 1.7 | 3 | 5 | 4.1 |
| Swimming | 44.7 | 1.5 | 4.9 | 4.8 | 13.5 | 25.5 | 5 |
| Enjoying nature | 32.7 | 3.5 | 6.3 | 7 | 15.5 | 28.3 | 6.8 |
| Commuting or getting to work | 77.4 | 3.7 | 3.3 | 2.5 | 3.6 | 6.3 | 3.1 |

| Local Useage | Never | Almost everyday | Every week | Every fortnight | Every month | Once or twice a year | Every few years |
|---|---|---|---|---|---|---|---|
| Boating, sailing | 5.1 | 76.2 | 0.7 | 1.6 | 1.9 | 4.8 | 9.7 |
| Jet skiing, Water skiing | 3.8 | 86.9 | 0.5 | 0.9 | 1.6 | 2.1 | 4.2 |
| Walking or running | 2.6 | 29.6 | 10.1 | 13.5 | 8.3 | 14.9 | 21.0 |
| Cycling | 4.1 | 70.6 | 1.9 | 4.0 | 4.0 | 5.9 | 9.5 |
| Picnics, BBQs | 5.1 | 33.4 | 0.6 | 3.3 | 5.9 | 17.9 | 33.8 |
| Recreational fishing | 5.8 | 66.4 | 0.8 | 2.9 | 3.5 | 7.3 | 13.4 |
| Rowing, kayaking, canoeing | 4.6 | 80.3 | 0.7 | 1.7 | 2.0 | 4.3 | 6.4 |
| Scuba diving, snorkelling | 3.6 | 87.0 | 0.3 | 1.0 | 1.5 | 2.4 | 4.2 |
| Surfing, kite-surfing, sail boarding | 3.2 | 86.7 | 0.9 | 1.3 | 1.8 | 2.6 | 3.4 |
| Swimming | 3.8 | 58.4 | 1.3 | 4.2 | 4.6 | 9.4 | 18.1 |
| Enjoying nature | 4.6 | 41.9 | 4.1 | 6.6 | 6.3 | 13.6 | 23.0 |
| Commuting or getting to work | 2.9 | 79.6 | 3.6 | 3.0 | 2.5 | 3.4 | 5.0 |

## 8.3.1 Comparison - Local vs SEQ waterway use and activities

T-tests were conducted to show if there is a significant difference between the activities respondents undertake across SEQ waterways and the activities they undertake at their local waterways. As expected, results suggest people undertake activity more often in their local waterway (within 15 km of their home) than in waterways further away.

Results also suggest that there are lower mean scores for Local waterway activities than on all activities than for SEQ. Results show the **lower the Mean score the more frequent that activity** (1 = almost every day, up to 7 = Never). For all the activities, people are doing them more **frequently in their local waterway than in general for SEQ.** This means that for all the types of activities people undertook, these activities were all conducted in closer waterways. . The % difference column shows the difference between the means of Local and SEQ. For example, boating in the local waterway has a lower mean score than boating in SEQ, therefore boating in local waterways is more frequently done than boating in general SEQ waterways.

| | | Mean | SD | Sig. | % Difference |
|---|---|---|---|---|---|
| **Pair 1** | ACT_SEQ_1 Boating, sailing SEQ | 2.68 | 2.37 | | |
| | ACT_LCL_1 Boating, sailing LCL | 2.08 | 2.03 | 0.000 | 22.39% |
| **Pair 2** | ACT_SEQ_2 Jet skiing, Water skiing SEQ | 1.81 | 1.88 | | |
| | ACT_LCL_2 Jet skiing, Water skiing LCL | 1.60 | 1.61 | 0.000 | 11.60% |
| **Pair 3** | ACT_SEQ_3 Walking or running SEQ | 3.87 | 1.96 | | |
| | ACT_LCL_3 Walking or running LCL | 3.42 | 2.02 | 0.000 | 11.63% |
| **Pair 4** | ACT_SEQ_4 Cycling SEQ | 2.40 | 2.12 | | |
| | ACT_LCL_4 Cycling LCL | 2.18 | 1.99 | 0.000 | 9.17% |
| **Pair 5** | ACT_SEQ_5 Picnics, BBQs SEQ | 4.53 | 2.04 | | |
| | ACT_LCL_5 Picnics, BBQs LCL | 3.96 | 2.25 | 0.000 | 12.58% |
| **Pair 6** | ACT_SEQ_6 Recreational fishing SEQ | 2.96 | 2.38 | | |
| | ACT_LCL_6 Recreational fishing LCL | 2.48 | 2.20 | 0.000 | 16.22% |
| **Pair 7** | ACT_SEQ_7 Rowing, kayaking, canoeing SEQ | 2.15 | 2.09 | | |
| | ACT_LCL_7 Rowing, kayaking, canoeing LCL | 1.87 | 1.86 | 0.000 | 13.02% |
| **Pair 8** | ACT_SEQ_8 Scuba diving, snorkelling SEQ | 1.79 | 1.85 | | |
| | ACT_LCL_8 Scuba diving, snorkelling LCL | 1.59 | 1.60 | 0.000 | 11.17% |
| **Pair 9** | ACT_SEQ_9 Surfing, kite-surfing, sail boarding SEQ | 1.70 | 1.71 | | |
| | ACT_LCL_9 Surfing, kite-surfing, sail boarding LCL | 1.56 | 1.54 | 0.000 | 8.24% |
| **Pair 10** | ACT_SEQ_10 Swimming SEQ | 3.37 | 2.31 | | |
| | ACT_LCL_10 Swimming LCL | 2.75 | 2.23 | 0.000 | 18.40% |
| **Pair 11** | ACT_SEQ_11 Enjoying nature e.g. birdwatching, conservation, photography, camping SEQ | 3.81 | 2.24 | | |
| | ACT_LCL_11 Enjoying nature e.g. birdwatching, conservation, photography, camping LCL | 3.33 | 2.24 | 0.000 | 12.60% |
| **Pair 12** | ACT_SEQ_12 For commuting or getting to work SEQ | 1.82 | 1.73 | | |
| | ACT_LCL_12 For commuting or getting to work LCL | 1.73 | 1.64 | 0.000 | 4.95% |

## 8.4 Enablers to use

Enablers to use featured 17 items encompassing natural (weather, scenery), logistic (access), environmental (condition and colour of water; cleanliness), infrastructure (e.g.: toilets, pathways, shade), and social elements (family and friends, time).

Cleanliness at 59% (strongly agree/agree), local scenery (57.1%) and ease of access (54.9%) were the top three enablers for using or visiting waterways. The least regarded enablers (strongly disagree/ disagree) were allowing dogs (24.8%), playgrounds (33.4%), picnic areas (40.9%), being with family or friends (43.2%) suggesting that some participants didn't perceive these elements as being critical to them visiting their waterway. Of note, that allowing dogs was the only enabler that was equally spread across strongly disagree/disagree (26.2%) to strongly agree/agree (24.8%) suggesting a result that reflects dog ownership rates in SEQ.

| | Strongly disagree | Disagree | Slightly disagree | Neutral | Slightly agree | Agree | Strongly agree |
|---|---|---|---|---|---|---|---|
| Suitable weather | 1.7% | 1.7% | 3.4% | 16.4% | 21.8% | 28.6% | 26.3% |
| Condition of water - cleanliness | 1.5% | 1.9% | 4.5% | 16.7% | 22.6% | 27.5% | 25.3% |
| Colour of water | 1.8% | 2.4% | 6.1% | 20.1% | 25.1% | 25.7% | 18.9% |
| Peaceful/quiet | 1.5% | 1.4% | 3.6% | 15.7% | 25.0% | 29.3% | 23.5% |
| Local beauty/scenery | 1.3% | 1.2% | 3.3% | 13.6% | 23.4% | 31.4% | 25.7% |
| Not crowded | 1.4% | 2.0% | 4.2% | 17.0% | 24.9% | 29.2% | 21.3% |
| Allow dogs | 15.4% | 10.8% | 11.1% | 24.8% | 13.1% | 12.3% | 12.5% |
| Parks and playgrounds | 3.9% | 5.0% | 9.4% | 24.5% | 23.8% | 19.7% | 13.7% |
| Picnic areas | 2.9% | 2.9% | 6.3% | 20.9% | 26.0% | 24.7% | 16.2% |
| Paths and walkways | 2.0% | 2.4% | 4.9% | 16.2% | 24.1% | 29.1% | 21.3% |
| Easy to get to | 1.5% | 1.5% | 3.6% | 15.4% | 22.7% | 32.0% | 23.3% |
| Shelter and shade | 1.7% | 2.2% | 4.1% | 16.7% | 23.7% | 29.0% | 22.5% |
| Toilets | 2.2% | 2.9% | 4.7% | 16.8% | 21.6% | 26.0% | 25.8% |
| Cleanliness of surrounding area | 1.4% | 1.3% | 2.8% | 13.4% | 22.0% | 32.3% | 26.9% |
| Access to waterway | 1.7% | 1.6% | 4.1% | 17.1% | 24.1% | 30.2% | 21.1% |
| Time availability | 1.6% | 1.7% | 4.5% | 20.2% | 22.7% | 28.7% | 20.5% |
| With family or friends | 2.6% | 2.9% | 6.1% | 23.3% | 22.0% | 24.9% | 18.3% |

### 8.4.1 Enablers reported by sentiment (SEQ)

| Enablers by sentiment (SEQ) | Negative | Neutral | Positive |
|---|---|---|---|
| Suitable weather | 6.80% | 16.40% | 76.70% |
| Condition of water - cleanliness | 7.90% | 16.70% | 75.40% |
| Colour of water | 10.30% | 20.10% | 69.70% |
| Peaceful/quiet | 6.50% | 15.70% | 77.80% |
| Local beauty/scenery | 5.80% | 13.60% | 80.50% |
| Not crowded | 7.60% | 17.00% | 75.40% |
| Allow dogs | 37.30% | 24.80% | 37.90% |
| Parks and playgrounds | 18.30% | 24.50% | 57.20% |
| Picnic areas | 12.10% | 20.90% | 66.90% |
| Paths and walkways | 9.30% | 16.20% | 74.50% |
| Easy to get to | 6.60% | 15.40% | 78.00% |
| Shelter and shade | 8.00% | 16.70% | 75.20% |
| Toilets | 9.80% | 16.80% | 73.40% |
| Cleanliness of surrounding area | 5.50% | 13.40% | 81.20% |
| Access to waterway | 7.40% | 17.10% | 75.40% |
| Time availability | 7.80% | 20.20% | 71.90% |
| With family or friends | 11.60% | 23.30% | 65.20% |

## 8.5 Barriers to using or visiting waterways in SEQ

Not having enough time and poor weather were the two most important barriers in terms of stopping people from visiting their local waterways. While each of these barriers is incidental, the appearance of the water cleanliness, litter and pollution also presented as a key barrier. The barriers that have the least impact on stopping respondents from using or visiting waterways in SEQ were perceiving the waterway as a threat to their health and safety, not having enough information (e.g. where or how), a lack of natural vegetation, safety or security concerns, being in poor physical health, issues of personal finances, travel distance, and creatures that bite or sting.

| | Strongly disagree | Disagree | Slightly disagree | Neither agree nor disagree | Slightly agree | Agree | Strongly agree |
|---|---|---|---|---|---|---|---|
| 1 Not enough time | 9.40% | 7.80% | 10.50% | 22.20% | 20.30% | 16.30% | 13.50% |
| 2 It is polluted | 18.60% | 19.60% | 17.30% | 22.30% | 12% | 5.50% | 4.70% |
| 3 Appearance of water … | 15.90% | 16.50% | 16.60% | 23% | 13.80% | 8.20% | 6% |
| 4 Lack of infrastructure… | 17.40% | 18.20% | 17% | 24.10% | 12.50% | 6.30% | 4.60% |
| 5 Odour or smell of water | 22.30% | 20.50% | 17.20% | 21.30% | 9.10% | 5.50% | 4% |
| 6 Poor physical health | 34.10% | 17.20% | 11% | 17.50% | 8.50% | 6.10% | 5.50% |
| 7 Not enough information | 31.20% | 19.40% | 13.90% | 20.30% | 7.60% | 4.90% | 2.80% |
| 8 Litter | 21.40% | 20.40% | 16.80% | 21% | 10% | 6.20% | 4.20% |
| 9 Lack of natural vegetation | 24.70% | 23% | 16% | 20.90% | 8.60% | 4.20% | 2.50% |
| 10 Threat to my health and safety | 36% | 22.40% | 12.30% | 17.60% | 5.30% | 3.50% | 2.90% |
| 11 Creatures that bite or sting | 25.70% | 20.20% | 14.80% | 20.40% | 9.20% | 5.60% | 4% |
| 12 Lack of amenities… | 20.50% | 17.60% | 14.70% | 22.60% | 12.40% | 7.60% | 4.60% |
| 13 Weather | 13.50% | 12.50% | 12.50% | 25.50% | 14.70% | 13.10% | 8.30% |
| 14 Family or carer responsibilities | 27.90% | 16.70% | 11.60% | 20.60% | 10.80% | 7.40% | 4.90% |
| 15 Distance | 28.30% | 20.30% | 12.60% | 20.30% | 9.70% | 5.10% | 3.70% |
| 16 Safety or security concerns | 28.10% | 20.90% | 13.50% | 20.50% | 8.20% | 5.30% | 3.50% |
| 17 Personal finances | 31.70% | 18% | 11.70% | 20.20% | 7.80% | 6.40% | 4.20% |

### 8.5.1 Barriers reported by sentiment (SEQ)

| | Disagreement | Neutral | Agreement |
|---|---|---|---|
| 1 Not enough time | 27.70% | 22.20% | 50.10% |
| 2 It is polluted | 55.50% | 22.30% | 22.20% |
| 3 Appearance of water ie: looks brown | 49.00% | 23.00% | 28.00% |
| 4 Lack of infrastructure e.g. Carparks, paths, ramps, pontoons | 52.60% | 24.10% | 23.40% |
| 5 Odour or smell of water | 60.00% | 21.30% | 18.60% |
| 6 I have poor physical health | 62.30% | 17.50% | 20.10% |
| 7 I don't have enough information (e.g. where or how) | 64.50% | 20.30% | 15.30% |
| 8 Litter | 58.60% | 21.00% | 20.40% |
| 9 Lack of natural vegetation | 63.70% | 20.90% | 15.30% |
| 10 It is a threat to my health and safety | 70.70% | 17.60% | 11.70% |
| 11 Creatures that bite or sting | 60.70% | 20.40% | 18.80% |
| 12 Lack of amenities e.g. toilets, BBQs, shelter | 52.80% | 22.60% | 24.60% |
| 13 Weather | 38.50% | 25.50% | 36.10% |
| 14 Family or carer responsibilities | 56.20% | 20.60% | 23.10% |
| 15 Distance | 61.20% | 20.30% | 18.50% |
| 16 Safety or security concerns | 62.50% | 20.50% | 17.00% |
| 17 Personal finances | 61.40% | 20.20% | 18.40% |

## 8.6 Conditions

Respondents were asked how likely they were to visit or use a waterway when presented with the following conditions. The conditions were presented as incremental shifts in waterway condition.

- Water clarity : murky partly murky
- Water is polluted/some/none
- Water has many/no species of fish or water animals
- The waterway surrounds are in poor/moderate condition

| | WATER_MURKY Water clarity is murky or very murky | WATER_PART_MURKY Water clarity is partly murky |
|---|---|---|
| Likely | 38.2% | 43.5% |
| Unlikely | 61.7% | 56.5% |

Murkiness was found to influence likelihood to use. As Murkiness reduced, the likelihood of visiting or using increased.

| | WATER_POLLUTED Water is polluted | WATER_SOME_POLL Water has some pollution |
|---|---|---|
| Likely | 21.6% | 29.2% |
| Unlikely | 78.4% | 70.9% |

Pollution can be considered a strong predictor of waterway use. These results above suggest however, that moving from polluted to only some pollution improves visiting likelihood.

| | WATER_FISH Water has many species of fish or water animals | WATER_NOFISH Water has no evidence of fish or sea/water animals | WATER_RIGHTFISH Water has the amount of fish of sea/water animals I would expect |
|---|---|---|---|
| Likely | 81.2% | 46.9% | 81.5% |
| Unlikely | 18.7% | 53.1% | 18.6% |

The amount of sea live (fish or water animals) suggested little to no effect on likelihood of use. This may be due to knowledge levels around sea animals that can potentially harm, and that sea life is an indicator of a healthy waterway.

| | SURROUNDS_POOR The waterway surrounds (e.g., plant life, litter, erosion) are in poor condition | SURROUNDS_MOD The waterway surrounds (e.g., plant life, litter, erosion) are in moderate condition | SURROUNDS_GOOD The waterway surrounds (e.g., plant life, litter, erosion) are in good condition |
|---|---|---|---|
| Likely | 31.2% | 58.8% | 83.8% |
| Unlikely | 68.8% | 41.2% | 16.3% |

Surrounding conditions of a waterway was found to increase likelihood of waterway use. While 31.2% indicated they would still visit a waterway that had poor surrounds, the next increment improved the likelihood significantly. Therefore as the surrounds improve in condition, likelihood of use increases.

| | AMENITIES_POOR The waterway amenities (e.g., bbqs, toilets) are in poor condition | AMENITIES_MODERATE The waterway amenities (e.g., bbqs, toilets) are in moderate condition | AMENITIES_GOOD The waterway amenities (e.g., bbqs, toilets) are in good condition |
|---|---|---|---|
| Likely | 32% | 73.2% | 84.5% |
| Unlikely | 68% | 26.8% | 15.5% |

Amenities were a strong indicator of likelihood of use. While the difference between good and moderate amenities condition and use was not significant, there was a marked difference between poor and moderate. This suggests that waterways can have moderate condition amenities to encourage likelihood of use.

| | WATER_COL_NORM The water colour looks normal | WATER_COL_SLI_UNUSUAL The water colour looks slightly unusual | WATER_COL_UNUSUAL The water colour looks unusual | WATER_COL_SLI_UNNAT The water colour looks slightly unnatural | WATER_COL_UNNAT The water colour looks unnatural |
|---|---|---|---|---|---|
| Likely | 85% | 56.7% | 43.8% | 39.1% | 32.6% |
| Unlikely | 15% | 43.2% | 56.2% | 60.8% | 67.4% |

Water colour is a moderate indicator of use. As water colour moves to a “normal” colour, intention to use increases. However this is more marked when water colour looks “unnatural”. Unnatural water colour (slightly unnatural or unnatural) was consistent with more than two thirds of all respondents unlikely to use.

## 8.7 Water Literacy

Water literacy investigated participant knowledge of things that can affect waterways in SEQ. These included vegetation on banks, resident action, storm water and wastewater treatment, the use of pesticides by households and sediment runoff. Across the total sample (N3263), water literacy showed strong results but with a relatively high standard deviation suggesting that there are differences in opinion on this construct. In general, the respondents are indicating that they have relatively high water literacy; however literacy around the use of pesticides presents an opportunity for improvement. A more water literate group will be able to behave and support practices that protect and restore waterways.

| Item | M | SD |
|---|---|---|
| Planting native plants along a waterway's bank improves the health of the waterway | 5.56 | 1.368 |
| What individual residents do in their home and garden has consequences for the health of waterways and coastal bays | 5.31 | 1.430 |
| Storm water from roofs and roads is treated to remove pollutants before entering the waterways | 4.08 | 1.715 |
| Wastewater from domestic bathrooms and laundries receives little or no treatment before entering waterways | 4.04 | 1.701 |
| The pesticides that individual householders use in their garden have no negative impact on the health of waterways | 3.29 | 1.884 |
| Waterways cannot cope easily with large amounts of sediment (i.e., eroded soil suspended in the water) | 5.01 | 1.561 |

Water literacy questions were analysed by SEQ and by catchment based on correct scoring against these questions. . SEQ as a whole got 40.86% out of the possible 100% correct. Noosa (49.1%) and Stanley (51.95%) had the highest, with Maroochy (36.4%) having the lowest. This indicates that generally there is a lot of room for improvement of knowledge about impacts of behaviours on waterways.

| Catchments | % of correct answers |
|---|---|
| Noosa | 49.11% |
| Maroochy | 36.39% |
| Mooloolah | 42.69% |
| Pumicestone | 44.01% |
| Caboolture | 44.51% |
| Pine | 42.15% |
| Lower Brisbane | 39.15% |
| Redland | 44.59% |
| Logan | 37.54% |
| Albert | 41.30% |
| Pimpama-Coomera | 39.95% |
| Nerang | 39.78% |
| Tallebudgera-Currumbin | 44.42% |
| Bremer | 41.80% |
| Lockyer | 41.44% |
| Mid Brisbane | 38.78% |
| Upper Brisbane | 42.86% |
| Stanley | 51.95% |

Participants were also asked if they knew what a catchment was. Nearly 59% of participants correctly identified a catchment, indicating that there are still opportunities for further community education about catchments (meaning and consequences for waterways) which can be undertaken in the future.

| Understanding of a catchment | % |
|---|---|
| The area that retains water like a wetland or a marsh | 13.7 |
| All of the land area that drains to a specific river or waterway | 58.9 |
| Reservoir that serves as a water source | 17.3 |
| Small building where water is stored | .6 |
| None of these | 1.5 |
| Do not know | 8.0 |
| Total | 100.0 |

### 8.7.1 Understanding of a catchment - by catchment

Stanley (77.30%) and Noosa (77.50%) were the two catchments that showed the greatest correct knowledge about what a catchment is. Pimpama-Coomera (51.10%) and Nerang (52.80%) were the two catchments which had the least knowledge about what a catchment correctly is.

| | The area that retains water like a wetland or a marsh | All of the land area that drains to a specific river or waterway | Reservoir that serves as a water source | Small building where water is stored | None of these | Do not know |
|---|---|---|---|---|---|---|
| Noosa | 10.00% | 77.50% | 7.50% | 0.00% | 1.30% | 3.80% |
| Maroochy | 18.80% | 56.40% | 16.20% | 0.90% | 0.90% | 6.80% |
| Mooloolah | 15.50% | 57.10% | 17.90% | 1.20% | 1.20% | 7.10% |
| Pumicestone | 16.10% | 63.40% | 14.30% | 1.80% | 0.90% | 3.60% |
| Caboolture | 10.10% | 63.80% | 18.80% | 0.00% | 0.00% | 7.20% |
| Pine | 9.90% | 56.00% | 24.70% | 0.00% | 0.40% | 9.10% |
| Lower Brisbane | 14.70% | 56.90% | 15.80% | 0.80% | 2.40% | 9.40% |
| Redland | 9.60% | 67.50% | 10.80% | 0.60% | 1.90% | 9.60% |
| Logan | 16.40% | 55.00% | 16.80% | 0.00% | 1.30% | 10.40% |
| Albert | 9.10% | 67.30% | 20.00% | 0.00% | 0.00% | 3.60% |
| Pimpama-Coomera | 17.60% | 51.10% | 20.90% | 0.50% | 2.70% | 7.10% |
| Nerang | 18.80% | 52.80% | 21.60% | 0.50% | 0.90% | 5.50% |
| Tallebudgera-Currumbin | 6.30% | 65.60% | 23.40% | 0.00% | 1.60% | 3.10% |
| Bremer | 10.20% | 66.70% | 13.00% | 1.90% | 1.90% | 6.50% |
| Lockyer | 12.40% | 59.50% | 18.20% | 0.80% | 0.00% | 9.10% |
| Mid Brisbane | 7.10% | 71.40% | 14.30% | 0.00% | 0.00% | 7.10% |
| Upper Brisbane | 26.90% | 53.80% | 7.70% | 0.00% | 3.80% | 7.70% |
| Stanley | 0.00% | 77.30% | 18.20% | 0.00% | 0.00% | 4.50% |

# 8.8 Travel to waterways – distance and type preferences

This question asked respondents, in the past 12 months think about the waterway you visit or use the most in South East Queensland and indicate how far you typically travel to visit this preferred waterway. While 28.6 % travelled up to 5 km, nearly 40% of respondents travelled up to 50kms, and 16% travelled more than 50 kms. This suggests respondents are willing to undertake travel to reach a preferred destination in another catchment.

| Travel to waterways | Frequency | Percent |
|---|---|---|
| 0-5km | 933 | 28.6 |
| 6-10km | 508 | 15.6 |
| 11-20kn | 555 | 17.0 |
| 21-30km | 398 | 12.2 |
| 31-50km | 344 | 10.5 |
| 51-100km | 347 | 10.6 |
| More than 100km | 178 | 5.5 |
| Total | 3263 | 100.0 |

## 8.8.1 Pin Maps

To identify the distance from home respondents travel to their two most frequently used waterways, respondents were asked to nominate the suburb they live in on a Google Map by 'dropping' a red marker. Following this, respondents were then asked to place the marker in the waterway they have visited the most in the past 12 months and to identify how often they have visited this waterway in the last 12 months (from almost every day to once a year – with an option for not having visited a waterways in the last 12 months). 20.25% of respondents indicate that they visit their most frequently visited waterway every six months, 19.56% state every month, and 18.73% state once a year. 16.53% state they have not visited a waterway in the last 12 months. This placing of a pin is also repeated for the second most visited waterway in the last 12 months.

### 8.8.2 Distance travelled by catchment

At the catchment level, participants from coastal catchments, such as areas on the Sunshine Coast or Gold Coast, travelled less distance to their preferred waterway, while Brisbane and western catchments travelled more. Lockyer and Upper Brisbane did the most travelling to get to their most frequently used/visited waterway.

| | 0-5km | 6-10km | 11-20kn | 21-30km | 31-50km | 51-100km | More than 100km |
|---|---|---|---|---|---|---|---|
| Noosa | 37.50% | 20.00% | 15.00% | 3.80% | 6.30% | 7.50% | 10.00% |
| Maroochy | 31.60% | 23.90% | 19.70% | 11.10% | 7.70% | 3.40% | 2.60% |
| Mooloolah | 42.90% | 21.40% | 19.00% | 8.30% | 1.20% | 3.60% | 3.60% |
| Pumicestone | 50.00% | 14.30% | 12.50% | 7.10% | 8.90% | 6.30% | 0.90% |
| Caboolture | 19.60% | 7.20% | 23.90% | 21.00% | 18.80% | 8.70% | 0.70% |
| Pine | 25.90% | 16.90% | 21.80% | 14.40% | 8.60% | 8.60% | 3.70% |
| Lower Brisbane | 27.80% | 15.30% | 15.70% | 11.40% | 10.70% | 13.80% | 5.40% |
| Redland | 34.40% | 19.10% | 18.50% | 11.50% | 7.00% | 5.70% | 3.80% |
| Logan | 17.10% | 9.10% | 15.40% | 19.50% | 19.50% | 17.10% | 2.30% |
| Albert | 21.80% | 1.80% | 12.70% | 10.90% | 27.30% | 21.80% | 3.60% |
| Pimpama-Coomera | 29.10% | 17.60% | 30.20% | 15.40% | 6.60% | 0.00% | 1.10% |
| Nerang | 37.20% | 30.30% | 17.00% | 10.10% | 4.10% | 0.50% | 0.90% |
| Tallebudgera-Currumbin | 56.30% | 29.70% | 10.90% | 1.60% | 0.00% | 1.60% | 0.00% |
| Bremer | 19.40% | 12.00% | 12.00% | 13.90% | 13.90% | 19.40% | 9.30% |
| Lockyer | 16.50% | 4.10% | 8.30% | 9.90% | 11.60% | 15.70% | 33.90% |
| Mid Brisbane | 7.10% | 14.30% | 28.60% | 28.60% | 7.10% | 14.30% | 0.00% |
| Upper Brisbane | 7.70% | 0.00% | 19.20% | 15.40% | 15.40% | 23.10% | 19.20% |
| Stanley | 18.20% | 13.60% | 4.50% | 9.10% | 13.60% | 31.80% | 9.10% |

## 8.9 Type of preferred waterway to visit

This question asked respondents to identify the type and general location of waterway they visited in the last 12 months. Beaches were the most visited waterway with only 20.2% stating they didn't visit a beach; wetlands and dams and lakes were the least waterway visited with 69.87% not visiting a wetland in the past 12 months followed by 57.62% not visiting dams or lakes. The following tables display these results for each type of waterway.

| Beaches | Frequency | Percent |
|---|---|---|
| Didn't visit | 662 | 20.29% |
| Noosa | 650 | 19.92% |
| Northern Sunshine Coast | 551 | 16.89% |
| Southern Sunshine Coast | 813 | 24.92% |
| Bribie Island | 658 | 20.17% |
| Moreton Island | 186 | 5.70% |
| Stradbroke Islands | 279 | 8.55% |
| Northern Gold Coast | 861 | 26.39% |
| Southern Gold Coast | 942 | 28.87% |
| Other, please name the beach you visited or used | 353 | 10.82% |

| Fresh water creeks or waterholes | Frequency | Percent |
|---|---|---|
| Didn't visit | 1311 | 40.18% |
| Noosa Hinterland | 236 | 7.23% |
| Sunshine Coast Hinterland | 499 | 15.29% |
| Upper Caboolture/ Dayboro/Samford Valley | 253 | 7.75% |
| Upper Brisbane | 229 | 7.02% |
| Greater Brisbane (Urban) | 521 | 15.97% |
| Ipswich/Lockyer | 288 | 8.83% |
| Scenic Rim | 324 | 9.93% |
| Gold Coast Hinterland | 562 | 17.22% |
| Other | 189 | 5.79% |

| Dams or Lakes | Frequency | Percent |
|---|---|---|
| Didn't visit | 1880 | 57.62% |
| Lake Cooroibah | 118 | 3.62% |
| Lake Macdonald | 102 | 3.13% |
| Lake Weyba | 107 | 3.28% |
| Ewan Maddock Dam | 114 | 3.49% |
| Lake Wivenhoe/Somerset Dam | 586 | 17.96% |
| Lake Samsonvale | 165 | 5.06% |
| Lake Manchester | 65 | 1.99% |
| Enoggera Reservoir | 111 | 3.40% |
| Tingalpa Reservoir | 72 | 2.21% |
| Wyaralong Dam | 84 | 2.57% |
| Lake Moogerah | 223 | 6.83% |
| Advancetown Lake | 117 | 3.59% |
| Lake Maroon | 109 | 3.34% |
| Other | 255 | 7.82% |

| Sheltered Bays | Frequency | Percent |
|---|---|---|
| Didn't visit | 1680 | 51.49% |
| Pumicestone Passage | 522 | 16% |
| Northern Moreton Bay | 286 | 8.77% |
| Southern Moreton Bay | 290 | 8.89% |
| Western Moreton Island (Tangalooma) | 100 | 3.07% |
| Western North Stradbroke Island (Dunwich) | 130 | 3.98% |
| Gold Coast Broadwater | 730 | 22.37% |
| Other | 55 | 1.69% |

| Rivers or Estuaries | Frequency | Percent |
|---|---|---|
| Didn't visit | 1090 | 33.41% |
| Noosa | 435 | 13.33% |
| Maroochydore | 430 | 13.18% |
| Mooloolah | 205 | 6.28% |
| Caboolture River | 233 | 7.14% |
| Pine Rivers | 295 | 9.04% |
| Brisbane/Oxley/Bulimba | 707 | 21.67% |
| Bremer | 143 | 4.38% |
| Tingalpa Creek | 113 | 3.46% |
| Logan/Albert River | 222 | 6.80% |
| Coomera River | 233 | 7.14% |
| Nerang | 217 | 6.65% |
| Tallebudgera Creek | 321 | 9.84% |
| Currumbin Creek | 327 | 10.02% |
| Other | 101 | 3.10% |

| Wetlands | Frequency | Percent |
|---|---|---|
| Didn't visit | 2280 | 69.87% |
| Noosa Everglades | 138 | 4.23% |
| Maroochy Wetlands | 110 | 3.37% |
| Mooloolah River National Park | 71 | 2.18% |
| Pumicestone Passage Wetlands | 184 | 5.64% |
| Moreton Bay National Parks (Moreton Island, Stradbroke Island etc) | 140 | 4.29% |
| Tinchi Tamba Wetlands | 64 | 1.96% |
| Boondal Wetlands | 251 | 7.69% |
| North East Wetlands | 28 | 0.86% |
| Weinam Creek Wetland | 24 | 0.74% |
| Southern Moreton Bay/Northern Gold Coast Wetlands | 78 | 2.39% |
| Eagleby Wetlands | 59 | 1.81% |
| Coombabah Wetlands | 103 | 3.16% |
| Elanora Wetlands | 48 | 1.47% |
| Hope Island | 171 | 5.24% |
| Other | 45 | 1.38% |

## 8.10 Level of concern by industry sector

Employed or recently employed participants were asked to identify the industry where they work and their perception of this industry's impact on waterways (1-strongly agree to strongly disagree -7). The level of industry concern construct was made up of two sub-factors, one of pro-activeness measuring how pro-active their industry is in mitigating its impact on waterways, and one of "room for improvement" which assesses whether they feel their industry could do more to minimise its impact on waterways.

**Pro-activeness**

- My industry is aware of its potential for negative impacts for water quality
- Within my industry, roles and responsibilities for minimising negative impacts for waterways are clearly defined and understood
- My industry is proactive in improving practice and promoting responsible environmental behaviour
- My industry manages its impact on waterways to an acceptable degree

**Room for improvement**

- My industry could improve its performance in managing its impact on waterway
- My industry could manage its impact on waterways more effectively

Results suggest proactive and room for improvement factors are strongly related to each other. High proactive score led to high room for improvement score or vice versa. Construction, mining, and utilities industries reported the highest proactive scores. These results suggest that individuals employed in these industries believe their industry is being proactive in managing its impact on waterways. Retail and personal services reported the lowest levels of proactive factors. These results suggest that individuals employed in these industries believe their industry could be more proactive in managing its impact on waterways.

Room for improvement was most strongly represented in personal and other services, and wholesale trade (Mean 3.69 / 3.87) suggesting these industries could take more action to improve waterway impact management. Other industry results displaying higher means (4.5 plus) suggest employees felt their industry was managing their impact on waterways well, while those industries with mean scores from 4 to 4.45) suggest while generally regarded as acceptable, there is opportunity for these industries to take more action in managing their impact on waterways.

| Level of Concern by Industry | Proactive | | Room for improvement | |
|---|---|---|---|---|
| | Mean | SD | Mean | SD |
| Agriculture, Forestry and Fishing, | 5.13 | 1.36 | 4.55 | 1.53 |
| Mining | 5.92 | 1.37 | 4.89 | 1.59 |
| Manufacturing | 4.62 | 1.54 | 4.18 | 1.62 |
| Electricity, Gas and Water Supply | 5.94 | 0.98 | 4.17 | 1.70 |
| Construction and development | 5.01 | 1.38 | 4.66 | 1.53 |
| Wholesale Trade | 4.13 | 1.78 | 3.87 | 1.73 |
| Retail Trade | 3.78 | 1.56 | 4.24 | 1.65 |
| Hospitality and Tourism | 4.20 | 1.58 | 4.45 | 1.44 |
| Transport and Storage | 4.50 | 1.63 | 4.07 | 1.55 |
| Communication Services | 3.89 | 1.36 | 4.17 | 1.32 |
| Finance and Insurance | 3.49 | 1.36 | 4.00 | 1.49 |
| Property and Business Services | 3.96 | 1.39 | 3.90 | 1.49 |
| Government Administration and Defence | 4.39 | 1.64 | 4.20 | 1.52 |
| Education | 4.53 | 1.47 | 4.32 | 1.44 |
| Health and Community Services | 4.15 | 1.50 | 4.13 | 1.52 |
| Cultural and Recreational Services | 4.20 | 1.60 | 3.84 | 1.69 |
| Personal and Other Services | 3.72 | 1.21 | 3.69 | 1.31 |
| Other - please provide | 4.00 | 1.68 | 3.76 | 1.63 |
| **Overall** | **4.24** | **1.59** | **4.15** | **1.56** |

## 8.11 Economic indicators – Spend on activities

This question asked participants to indicate monthly spend on activities at the waterway they visit or use the most. No guidelines were given to participants about what to include in making their response (i.e.: fuel to get to the waterway). More than 26% indicated they spent between $10 and $50 per month, while 45% indicated they spent no money on activities. 3.7% indicated they spent more than $100 per month.

| | Frequency | Percent |
|---|---|---|
| I spend no money | 1468 | 45.0 |
| Less than $10 | 617 | 18.9 |
| $10-$30 | 526 | 16.1 |
| $31-$50 | 326 | 10.0 |
| $51-$100 | 204 | 6.3 |
| $100-$200 | 72 | 2.2 |
| More than $200 | 50 | 1.5 |
| Total | 3263 | 100.0 |

### Money Spend by Catchment - 2016

| | I spend no money | Less than $10 | $10-$30 | $31-$50 | $51-$100 | $100-$200 | More than $200 |
|---|---|---|---|---|---|---|---|
| Noosa | 37.50% | 21.30% | 23.80% | 11.30% | 3.80% | 1.30% | 1.30% |
| Maroochy | 46.20% | 23.10% | 14.50% | 12.80% | 3.40% | 0.00% | 0.00% |
| Mooloolah | 47.60% | 26.20% | 14.30% | 4.80% | 3.60% | 3.60% | 0.00% |
| Pumicestone | 44.60% | 17.90% | 17.00% | 10.70% | 7.10% | 2.70% | 0.00% |
| Caboolture | 42.00% | 17.40% | 17.40% | 13.80% | 8.70% | 0.70% | 0.00% |
| Pine | 45.70% | 19.80% | 14.80% | 11.90% | 2.90% | 2.90% | 2.10% |
| Lower Brisbane | 45.20% | 17.80% | 15.70% | 10.50% | 6.30% | 2.80% | 1.70% |
| Redland | 42.70% | 19.70% | 14.00% | 12.70% | 8.30% | 0.60% | 1.90% |
| Logan | 38.60% | 19.80% | 17.40% | 12.80% | 7.40% | 2.00% | 2.00% |
| Albert | 50.90% | 5.50% | 21.80% | 9.10% | 10.90% | 1.80% | 0.00% |
| Pimpama-Coomera | 47.30% | 17.60% | 14.30% | 10.40% | 7.10% | 1.60% | 1.60% |
| Nerang | 46.30% | 23.90% | 18.80% | 4.10% | 4.10% | 1.40% | 1.40% |
| Tallebudgera-Currumbin | 54.70% | 20.30% | 18.80% | 3.10% | 3.10% | 0.00% | 0.00% |
| Bremer | 55.60% | 11.10% | 17.60% | 6.50% | 6.50% | 0.90% | 1.90% |
| Lockyer | 36.40% | 17.40% | 14.90% | 5.80% | 12.40% | 8.30% | 5.00% |
| Mid Brisbane | 28.60% | 21.40% | 14.30% | 14.30% | 21.40% | 0.00% | 0.00% |
| Upper Brisbane | 42.30% | 15.40% | 15.40% | 11.50% | 11.50% | 0.00% | 3.80% |
| Stanley | 59.10% | 13.60% | 4.50% | 13.60% | 4.50% | 0.00% | 4.50% |

# 8.12 – Correlations

## 8.12.1 Satisfaction and nature relatedness

Correlations between overall satisfaction and nature relatedness showed a strong significant relationship in all but two of the catchments; however this relationship does differ between catchments. Mid Brisbane and Upper Brisbane (low sample size) do not show a relationship suggesting these overall satisfaction and nature relatedness are not related in these catchments. For the other catchments, i.e.: Tallebudgera-Currumbin (.446**), which has the highest score, there is a very strong nature relatedness to satisfaction relationship, and Albert (.322*) which has a low, but still significant relationship between satisfaction and nature relatedness. This suggests that those respondents who feel that nature is important to them are satisfied overall with their local waterway. This implies that to keep the satisfaction levels up for those people using waterways, the importance of nature to their lives should be reinforced. By making this strong association, people are reminded of the importance of nature in their lives and therefore can make the connection with how using the waterways can contribute towards this.

| Correlation of Nature Relatedness with Satisfaction by catchment | | |
|---|---|---|
| Noosa | .356** | |
| Maroochy | .520** | |
| Mooloolah | .401** | |
| Pumicestone | .412** | |
| Caboolture | .534** | |
| Pine | .460** | |
| Lower Brisbane | .448** | |
| Redland | .361** | |
| Logan | .366** | |
| Albert | .322* | |
| Pimpama-Coomera | .534** | |
| Nerang | .456** | |
| Tallebudgera-Currumbin | .446** | |
| Bremer | .392** | |
| Lockyer | .447** | |
| Mid Brisbane | | 0.365 |
| Upper Brisbane | | 0.282 |
| Stanley | .493* | |

Note: $p < .05$ = *, $p < .01$ = **

### 8.12.2 Correlation - Satisfaction and Use

Correlations between overall satisfaction and people's use of waterways (frequency and type) showed a clear and significant relationship for all catchment areas. All catchments are significant and are very high, with all but two being above .07 indicating very strong relationships ($p < .05$ = *, $p < .01$ = **). This suggests that South East Queensland waterways are able to satisfy a diverse range of users. Noosa catchment shows the highest amount of satisfaction to use relationship (.85) while Stanley showed the lowest (.46) however its significance indicates that those in the Stanley catchment still are satisfied with their use of their local waterways.

| Correlation Use and Satisfaction | |
|---|---|
| Noosa | .854** |
| Maroochy | .745** |
| Mooloolah | .766** |
| Pumicestone | .765** |
| Caboolture | .709** |
| Pine | .816** |
| Lower Brisbane | .812** |
| Redland | .742** |
| Logan | .785** |
| Albert | .682** |
| Pimpama-Coomera | .831** |
| Nerang | .776** |
| Tallebudgera-Currumbin | .784** |
| Bremer | .785** |
| Lockyer | .845** |
| Mid Brisbane | .897** |
| Upper Brisbane | .805** |
| Stanley | .456* |

Note: $p < .05$ = *, $p < .01$ = **

### 8.12.3 Satisfaction and water literacy

Correlations between overall satisfaction and water literacy showed there is a relationship between overall satisfaction levels relating to the respondent's local waterway and the value placed on knowledge and understanding of where our water comes from and how we use water and waterways with the view to protect local waterways. Seven catchments (Maroochy, Pumicestone, Pine, Caboolture, Lower Brisbane, Pimpama-Coomera and Nerang) all showed strong significant relationships. The remaining catchments did not show any relationship indicating these the satisfaction of these respondents with their local waterways is not affected by their water literacy.

| Water Literary and Satisfaction by Catchment | |
|---|---|
| Noosa | 0.185 |
| Maroochy | .396** |
| Mooloolah | 0.166 |
| Pumicestone | .399** |
| Caboolture | .219** |
| Pine | .336** |
| Lower Brisbane | .181** |
| Redland | 0.125 |
| Logan | 0.084 |
| Albert | 0.134 |
| Pimpama-Coomera | .403** |
| Nerang | .353** |
| Tallebudgera-Currumbin | 0.100 |
| Bremer | 0.011 |
| Lockyer | 0.074 |
| Mid Brisbane | -0.298 |
| Upper Brisbane | 0.047 |
| Stanley | 0.325 |
| Note: $p < .05$ = *, $p < .01$ = ** | |

## 8.12 – Regressions

Multiple regressions were performed for the main variables. Overall the Regression suggests third place variables to be the best predictors of loyalty and satisfaction (excluding compatibility) and intrinsic regulation on satisfaction, with all those scores being above 0.14. All the values had low scores (second decimal place).

For Third Place, both being away and fascination are important predictors of loyalty and satisfaction. Compatibility is important for loyalty to a waterway but not to satisfaction.
It should be noted compatibility is about feelings of belonging, which is a strong factor in loyalty in general, and being away is more about having a break from routine and fascination is about the fun stuff at a waterway.

Nature relatedness had no impact on loyalty but did so on satisfaction.
Environmental concern has no effect on satisfaction, but a negative sig. impact on loyalty. One explanation may be that people who are environmentally concerned don't like to visit too much because they think they are having a negative impact on the waterways. This requires further research. Enviro belief impacts loyalty positively and satisfaction negatively.

Self-Determination Theory. Introjected regulation as negative is not unsurprising as for satisfaction as these negative emotions go down satisfaction does up.
Integrated is similar to compatibility or belonging, so these results are also not surprising..
External Regulation, could be explained by friends have the ability to increase my satisfaction, but they don't affect loyalty. Identified are both significant and positive for each out variable.
Intrinsic is about fun and enjoyment so for satisfaction that results makes sense, unlike loyalty which I can't think of an explanation for.

| Topic | Variables | Loyalty | Satisfaction |
|---|---|---|---|
| Third Place | Being Away | 0.360*** | 0.244*** |
| | Compatibility | 0.405*** | 0.032 |
| | Fascination | 0.140*** | 0.318*** |
| Values and Attitudes towards the environment | Nature Relatedness | -0.019 | 0.051** |
| | Environment Concern | -0.053*** | 0.050 |
| | Environment Belief | 0.064*** | -0.092*** |
| Self-Determination Theory | Introjected Regulation | 0.032* | -0.101*** |
| | Integrated Regulation | 0.043** | -0.052 |
| | External Regulation | -0.014 | 0.048** |
| | Identified Regulation | 0.058** | 0.080* |
| | Intrinsic Regulation | -0.011 | 0.221*** |

# 9. Catchment Reporting

The following section contains analysis of individual catchment areas under investigation. While some catchment level reporting has been done in the main report (section 8), the following sections contain individual catchment analysis contains tables on the following items:

- Demographics
- Enablers to use
- Frequency of use

## 9.1 Noosa Catchment

**Demographics**

| Gender ratio | Frequency | Percent |
|---|---|---|
| Male | 35 | 43.8 |
| Female | 45 | 56.3 |
| Total | 80 | 100 |

**Education**

| | Frequency | Percent |
|---|---|---|
| High school | 26 | 32.5 |
| Diploma / Certificate or equivalent | 22 | 27.5 |
| Apprenticeship or trade certificate or equivalent | 6 | 7.5 |
| Bachelor degree or equivalent | 18 | 22.5 |
| Postgraduate degree or equivalent | 7 | 8.8 |
| Other | 1 | 1.3 |
| Total | 80 | 100 |

**Lived in SEQ**

| | Frequency | Percent |
|---|---|---|
| Less than a year | 1 | 1.3 |
| 1-3 years | 13 | 16.3 |
| 4-6 years | 5 | 6.3 |
| 7-10 years | 2 | 2.5 |
| More than 10 years | 59 | 73.8 |
| Total | 80 | 100 |

**Employment**

| | Frequency | Percent |
|---|---|---|
| Retired | 36 | 45 |
| Carer | 3 | 3.8 |
| Full time student | 2 | 2.5 |
| Unemployed and not seeking work | 8 | 10 |
| Unemployed and seeking work | 7 | 8.8 |
| Part time employee | 12 | 15 |
| Full time work | 12 | 15 |
| Total | 80 | 100 |

**Employment industry**

| | Frequency | Percent |
|---|---|---|
| Agriculture, Forestry and Fishing, | 5 | 6.3 |
| Manufacturing | 1 | 1.3 |
| Construction and development | 2 | 2.5 |
| Retail Trade | 7 | 8.8 |
| Hospitality and Tourism | 2 | 2.5 |
| Transport and Storage | 2 | 2.5 |
| Communication Services | 1 | 1.3 |
| Finance and Insurance | 2 | 2.5 |
| Property and Business Services | 4 | 5 |
| Government Administration and Defence | 5 | 6.3 |
| Education | 5 | 6.3 |
| Health and Community Services | 7 | 8.8 |
| 16 Cultural and Recreational Services | 2 | 2.5 |
| Personal and Other Services | 2 | 2.5 |
| I have not worked | 5 | 6.3 |
| I am retired and do not identify with any of these industries | 21 | 26.3 |
| Other - please provide | 7 | 8.8 |
| Total | 80 | 100 |

**Household Income**

| | Frequency | Percent |
|---|---|---|
| Under $25,000 | 9 | 11.3 |
| $25,001-$50,000 | 25 | 31.3 |
| $50,001-$75,000 | 15 | 18.8 |
| $75,001-$100,000 | 9 | 11.3 |
| $100,001-$150,000 | 11 | 13.8 |
| $150,001-$200,000 | 1 | 1.3 |
| Prefer not to say | 10 | 12.5 |
| Total | 80 | 100 |

**Enablers of use - Noosa**

| | Strongly disagree | Disagree | Slightly disagree | Neither agree nor disagree | Slightly agree | Agree | Strongly agree |
|---|---|---|---|---|---|---|---|
| ENABLE_1 Suitable weather | 2.50% | 1.30% | 0.00% | 7.50% | 15.00% | 35.00% | 38.80% |
| ENABLE_2 Condition of water - cleanliness | 1.30% | 1.30% | 0.00% | 8.80% | 21.30% | 33.80% | 33.80% |
| ENABLE_3 Colour of water | 1.30% | 1.30% | 3.80% | 15.00% | 31.30% | 26.30% | 21.30% |
| ENABLE_4 Peaceful/quiet | 2.50% | 2.50% | 1.30% | 10.00% | 18.80% | 25.00% | 40.00% |
| ENABLE_5 Local beauty/scenery | 2.50% | 1.30% | 0.00% | 7.50% | 15.00% | 31.30% | 42.50% |
| ENABLE_6 Not crowded | 2.50% | 2.50% | 1.30% | 10.00% | 18.80% | 32.50% | 32.50% |
| ENABLE_7 Allow dogs | 18.80% | 7.50% | 6.30% | 23.80% | 12.50% | 13.80% | 17.50% |
| ENABLE_8 Parks and playgrounds | 5.00% | 5.00% | 13.80% | 20.00% | 22.50% | 16.30% | 17.50% |
| ENABLE_9 Picnic areas | 3.80% | 2.50% | 11.30% | 18.80% | 23.80% | 22.50% | 17.50% |
| ENABLE_10 Paths and walkways | 2.50% | 3.80% | 2.50% | 16.30% | 16.30% | 35.00% | 23.80% |
| ENABLE_11 Easy to get to | 2.50% | 1.30% | 1.30% | 11.30% | 18.80% | 35.00% | 30.00% |
| ENABLE_12 Shelter and shade | 2.50% | 2.50% | 3.80% | 15.00% | 16.30% | 31.30% | 28.70% |
| ENABLE_13 Toilets | 3.80% | 3.80% | 7.50% | 10.00% | 13.80% | 28.70% | 32.50% |
| ENABLE_14 Cleanliness of surrounding area | 2.50% | 0.00% | 2.50% | 7.50% | 15.00% | 37.50% | 35.00% |
| ENABLE_15 Access to waterway | 2.50% | 1.30% | 1.30% | 8.80% | 16.30% | 36.30% | 33.80% |
| ENABLE_16 Time availability | 1.30% | 1.30% | 3.80% | 18.80% | 18.80% | 27.50% | 28.70% |
| ENABLE_17 With family or friends | 1.30% | 5.00% | 7.50% | 23.80% | 13.80% | 25.00% | 23.80% |

**Use and frequency of activities - Noosa**

| | Never | Almost everyday | Every week | Every fortnight | Every month | Once or twice a year | Every few years |
|---|---|---|---|---|---|---|---|
| Boating, sailing | 57.50% | 1.30% | 1.30% | 3.80% | 5.00% | 22.50% | 8.80% |
| Jet skiing, Water skiing | 90.00% | 0.00% | 0.00% | 1.30% | 1.30% | 0.00% | 7.50% |
| Walking or running | 13.80% | 10.00% | 13.80% | 5.00% | 18.80% | 31.30% | 7.50% |
| Cycling | 57.50% | 0.00% | 5.00% | 0.00% | 6.30% | 21.30% | 10.00% |
| Picnics, BBQs | 13.80% | 0.00% | 5.00% | 5.00% | 17.50% | 48.80% | 10.00% |
| Recreational fishing | 57.50% | 0.00% | 1.30% | 3.80% | 7.50% | 21.30% | 8.80% |
| Rowing, kayaking, canoeing | 77.50% | 0.00% | 0.00% | 1.30% | 3.80% | 7.50% | 10.00% |
| Scuba diving, snorkeling | 81.30% | 0.00% | 0.00% | 1.30% | 2.50% | 6.30% | 8.80% |
| Surfing, kite-surfing, sail boarding | 87.50% | 1.30% | 2.50% | 0.00% | 1.30% | 3.80% | 3.80% |
| Swimming | 32.50% | 1.30% | 10.00% | 3.80% | 16.30% | 27.50% | 8.80% |
| Enjoying nature e.g. birdwatching, conservation, photography, camping | 26.30% | 3.80% | 5.00% | 6.30% | 18.80% | 36.30% | 3.80% |
| For commuting or getting to work | 82.50% | 1.30% | 0.00% | 0.00% | 6.30% | 6.30% | 3.80% |

# 9.2 Maroochy Catchment

| Gender ratio | Frequency | Percent |
|---|---|---|
| Male | 40 | 34.2 |
| Female | 77 | 65.8 |
| Total | 117 | 100 |

### Education

| | Frequency | Percent |
|---|---|---|
| Primary school | 1 | 0.9 |
| High school | 30 | 25.6 |
| Diploma / Certificate or equivalent | 39 | 33.3 |
| Apprenticeship or trade certificate or equivalent | 13 | 11.1 |
| Bachelor degree or equivalent | 23 | 19.7 |
| Postgraduate degree or equivalent | 10 | 8.5 |
| Other | 1 | 0.9 |
| Total | 117 | 100 |

### Lived in SEQ

| | Frequency | Percent |
|---|---|---|
| Less than a year | 4 | 3.4 |
| 1-3 years | 7 | 6 |
| 4-6 years | 9 | 7.7 |
| 7-10 years | 12 | 10.3 |
| More than 10 years | 85 | 72.6 |
| Total | 117 | 100 |

### Employment

| | Frequency | Percent |
|---|---|---|
| Retired | 42 | 35.9 |
| Carer | 8 | 6.8 |
| Full time student | 2 | 1.7 |
| Unemployed and not seeking work | 8 | 6.8 |
| Unemployed and seeking work | 7 | 6 |
| Part time employee | 31 | 26.5 |
| Full time work | 19 | 16.2 |
| Total | 117 | 100 |

### Employment industry

| | Frequency | Percent |
|---|---|---|
| Agriculture, Forestry and Fishing, | 2 | 1.7 |
| Mining | 4 | 3.4 |

| | | |
|---|---|---|
| Manufacturing | 2 | 1.7 |
| Construction and development | 3 | 2.6 |
| Retail Trade | 10 | 8.5 |
| Hospitality and Tourism | 8 | 6.8 |
| Transport and Storage | 2 | 1.7 |
| Communication Services | 1 | 0.9 |
| Finance and Insurance | 5 | 4.3 |
| Property and Business Services | 3 | 2.6 |
| Government Administration and Defence | 2 | 1.7 |
| Education | 13 | 11.1 |
| Health and Community Services | 9 | 7.7 |
| 16 Cultural and Recreational Services | 1 | 0.9 |
| Personal and Other Services | 4 | 3.4 |
| I have not worked | 7 | 6 |
| I am retired and do not identify with any of these industries | 29 | 24.8 |
| Other - please provide | 12 | 10.3 |
| Total | 117 | 100 |

**Household Income**

| | Frequency | Percent |
|---|---|---|
| Under $25,000 | 9 | 7.7 |
| $25,001-$50,000 | 36 | 30.8 |
| $50,001-$75,000 | 17 | 14.5 |
| $75,001-$100,000 | 18 | 15.4 |
| $100,001-$150,000 | 10 | 8.5 |
| $150,001-$200,000 | 2 | 1.7 |
| $ Over $200,000 | 1 | 0.9 |
| Prefer not to say | 24 | 20.5 |
| Total | 117 | 100 |

**Maroochy**

| | Strongly disagree | Disagree | Slightly disagree | Neither agree nor disagree | Slightly agree | Agree | Strongly agree |
|---|---|---|---|---|---|---|---|
| ENABLE_1 Suitable weather | 4.30% | 0.90% | 2.60% | 21.40% | 20.50% | 26.50% | 23.90% |
| ENABLE_2 Condition of water - cleanliness | 4.30% | 1.70% | 2.60% | 22.20% | 19.70% | 22.20% | 27.40% |
| ENABLE_3 Colour of water | 2.60% | 2.60% | 8.50% | 25.60% | 25.60% | 16.20% | 18.80% |
| ENABLE_4 Peaceful/quiet | 3.40% | 0.90% | 1.70% | 23.10% | 24.80% | 23.90% | 22.20% |
| ENABLE_5 Local beauty/scenery | 3.40% | 0.00% | 1.70% | 23.90% | 23.10% | 25.60% | 22.20% |
| ENABLE_6 Not crowded | 3.40% | 1.70% | 4.30% | 22.20% | 21.40% | 25.60% | 21.40% |
| ENABLE_7 Allow dogs | 18.80% | 12.80% | 7.70% | 22.20% | 14.50% | 9.40% | 14.50% |
| ENABLE_8 Parks and playgrounds | 4.30% | 6.00% | 9.40% | 27.40% | 24.80% | 17.10% | 11.10% |
| ENABLE_9 Picnic areas | 3.40% | 1.70% | 5.10% | 32.50% | 22.20% | 23.90% | 11.10% |
| ENABLE_10 Paths and walkways | 3.40% | 2.60% | 1.70% | 24.80% | 24.80% | 24.80% | 17.90% |
| ENABLE_11 Easy to get to | 3.40% | 1.70% | 0.90% | 26.50% | 18.80% | 28.20% | 20.50% |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| ENABLE_12 Shelter and shade | 2.60% | 2.60% | 2.60% | 23.90% | 24.80% | 23.90% | 19.70% |
| ENABLE_13 Toilets | 3.40% | 1.70% | 5.10% | 26.50% | 17.10% | 23.90% | 22.20% |
| ENABLE_14 Cleanliness of surrounding area | 3.40% | 0.00% | 1.70% | 23.10% | 14.50% | 33.30% | 23.90% |
| ENABLE_15 Access to waterway | 3.40% | 1.70% | 4.30% | 23.90% | 17.90% | 26.50% | 22.20% |
| ENABLE_16 Time availability | 4.30% | 0.90% | 2.60% | 24.80% | 19.70% | 28.20% | 19.70% |
| ENABLE_17 With family or friends | 5.10% | 3.40% | 4.30% | 26.50% | 19.70% | 23.90% | 17.10% |

2 Maroochy

| | Never | Almost everyday | Every week | Every fortnight | Every month | Once or twice a year | Every few years |
|---|---|---|---|---|---|---|---|
| Boating, sailing | 66.70% | 0.00% | 2.60% | 2.60% | 6.00% | 13.70% | 8.50% |
| Jet skiing, Water skiing | 89.70% | 0.00% | 0.90% | 0.00% | 2.60% | 1.70% | 5.10% |
| Walking or running | 24.80% | 10.30% | 17.90% | 7.70% | 11.10% | 25.60% | 2.60% |
| Cycling | 74.40% | 0.90% | 3.40% | 4.30% | 2.60% | 8.50% | 6.00% |
| Picnics, BBQs | 31.60% | 0.00% | 4.30% | 7.70% | 18.80% | 31.60% | 6.00% |
| Recreational fishing | 58.10% | 0.00% | 2.60% | 2.60% | 10.30% | 14.50% | 12.00% |
| Rowing, kayaking, canoeing | 78.60% | 0.90% | 2.60% | 1.70% | 6.00% | 4.30% | 6.00% |
| Scuba diving, snorkeling | 88.90% | 0.00% | 0.90% | 1.70% | 2.60% | 1.70% | 4.30% |
| Surfing, kite-surfing, sail boarding | 84.60% | 0.00% | 4.30% | 1.70% | 0.90% | 3.40% | 5.10% |
| Swimming | 45.30% | 0.90% | 8.50% | 9.40% | 11.10% | 19.70% | 5.10% |
| Enjoying nature e.g. birdwatching, conservation, photography, camping | 34.20% | 3.40% | 12.00% | 6.00% | 13.70% | 23.90% | 6.80% |
| For commuting or getting to work | 77.80% | 3.40% | 5.10% | 3.40% | 3.40% | 2.60% | 4.30% |

# 9.3 Mooloolah Catchment

| Gender ratio | Frequency | Percent |
|---|---|---|
| Male | 33 | 39.3 |
| Female | 51 | 60.7 |
| Total | 117 | 100 |

**Education**

| | Frequency | Percent |
|---|---|---|
| Primary school | 2 | 2.4 |
| High school | 27 | 32.1 |
| Diploma / Certificate or equivalent | 22 | 26.2 |
| Apprenticeship or trade certificate or equivalent | 11 | 13.1 |
| Bachelor degree or equivalent | 14 | 16.7 |
| Postgraduate degree or equivalent | 7 | 8.3 |
| Other | 1 | 1.2 |
| Total | 84 | 100 |

**Lived in SEQ**

| | Frequency | Percent |
|---|---|---|
| Less than a year | 4 | 4.8 |
| 1-3 years | 8 | 9.5 |
| 4-6 years | 4 | 4.8 |
| 7-10 years | 6 | 7.1 |
| More than 10 years | 62 | 73.8 |
| Total | 84 | 100 |

**Employment**

| | Frequency | Percent |
|---|---|---|
| Retired | 30 | 35.7 |
| Carer | 3 | 3.6 |
| Full time student | 6 | 7.1 |
| Unemployed and not seeking work | 2 | 2.4 |
| Unemployed and seeking work | 6 | 7.1 |
| Part time employee | 19 | 22.6 |
| Full time work | 18 | 21.4 |
| Total | 84 | 100 |

**Employment industry**

| | Frequency | Percent |
|---|---|---|
| Agriculture, Forestry and Fishing, | 2 | 2.4 |
| Mining | 0 | 0 |
| Manufacturing | 6 | 7.1 |
| Construction and development | 1 | 1.2 |
| Retail Trade | 3 | 3.6 |
| Hospitality and Tourism | 8 | 9.5 |
| Transport and Storage | 4 | 4.8 |
| Communication Services | 1 | 1.2 |
| Finance and Insurance | 3 | 3.6 |
| Property and Business Services | 4 | 4.8 |

| | | |
|---|---|---|
| Government Administration and Defence | 1 | 1.2 |
| Education | 5 | 6 |
| Health and Community Services | 7 | 8.3 |
| Cultural and Recreational Services | 8 | 9.5 |
| Personal and Other Services | 4 | 4.8 |
| I have not worked | 2 | 2.4 |
| I am retired and do not identify with any of these industries | 16 | 19 |
| Other - please provide | 9 | 10.7 |
| Total | 84 | 100 |

**Household Income**

| | Frequency | Percent |
|---|---|---|
| Under $25,000 | 10 | 11.9 |
| $25,001-$50,000 | 24 | 28.6 |
| $50,001-$75,000 | 8 | 9.5 |
| $75,001-$100,000 | 13 | 15.5 |
| $100,001-$150,000 | 9 | 10.7 |
| $150,001-$200,000 | 4 | 4.8 |
| Over $200,000 | 1 | 1.2 |
| Prefer not to say | 15 | 17.9 |
| Total | 84 | 100 |

**Mooloolah**

| | Strongly disagree | Disagree | Slightly disagree | Neither agree nor disagree | Slightly agree | Agree | Strongly agree |
|---|---|---|---|---|---|---|---|
| ENABLE_1 Suitable weather | 1.20% | 1.20% | 1.20% | 11.90% | 21.40% | 32.10% | 31.00% |
| ENABLE_2 Condition of water - cleanliness | 1.20% | 1.20% | 1.20% | 11.90% | 26.20% | 32.10% | 26.20% |
| ENABLE_3 Colour of water | 1.20% | 1.20% | 3.60% | 14.30% | 29.80% | 32.10% | 17.90% |
| ENABLE_4 Peaceful/quiet | 1.20% | 1.20% | 1.20% | 13.10% | 23.80% | 33.30% | 26.20% |
| ENABLE_5 Local beauty/scenery | 1.20% | 2.40% | 0.00% | 8.30% | 25.00% | 35.70% | 27.40% |
| ENABLE_6 Not crowded | 1.20% | 2.40% | 0.00% | 16.70% | 27.40% | 33.30% | 19.00% |
| ENABLE_7 Allow dogs | 22.60% | 10.70% | 9.50% | 15.50% | 10.70% | 17.90% | 13.10% |
| ENABLE_8 Parks and playgrounds | 2.40% | 4.80% | 7.10% | 21.40% | 27.40% | 22.60% | 14.30% |
| ENABLE_9 Picnic areas | 2.40% | 2.40% | 6.00% | 20.20% | 21.40% | 29.80% | 17.90% |
| ENABLE_10 Paths and walkways | 2.40% | 2.40% | 6.00% | 6.00% | 20.20% | 40.50% | 22.60% |
| ENABLE_11 Easy to get to | 2.40% | 2.40% | 1.20% | 10.70% | 16.70% | 41.70% | 25.00% |
| ENABLE_12 Shelter and shade | 2.40% | 4.80% | 3.60% | 9.50% | 26.20% | 27.40% | 26.20% |
| ENABLE_13 Toilets | 2.40% | 3.60% | 4.80% | 14.30% | 17.90% | 29.80% | 27.40% |
| ENABLE_14 Cleanliness of surrounding area | 2.40% | 1.20% | 0.00% | 9.50% | 17.90% | 34.50% | 34.50% |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| ENABLE_15 Access to waterway | 1.20% | 1.20% | 2.40% | 9.50% | 27.40% | 32.10% | 26.20% |
| ENABLE_16 Time availability | 1.20% | 2.40% | 2.40% | 17.90% | 20.20% | 32.10% | 23.80% |
| ENABLE_17 With family or friends | 1.20% | 2.40% | 4.80% | 23.80% | 15.50% | 28.60% | 23.80% |

3 Mooloolah

| | Never | Almost everyday | Every week | Every fortnight | Every month | Once or twice a year | Every few years |
|---|---|---|---|---|---|---|---|
| Boating, sailing | 61.90% | 3.60% | 1.20% | 1.20% | 9.50% | 17.90% | 4.80% |
| Jet skiing, Water skiing | 86.90% | 0.00% | 0.00% | 1.20% | 2.40% | 4.80% | 4.80% |
| Walking or running | 13.10% | 17.90% | 27.40% | 3.60% | 26.20% | 10.70% | 1.20% |
| Cycling | 56.00% | 1.20% | 8.30% | 9.50% | 8.30% | 13.10% | 3.60% |
| Picnics, BBQs | 16.70% | 1.20% | 8.30% | 11.90% | 26.20% | 33.30% | 2.40% |
| Recreational fishing | 44.00% | 2.40% | 3.60% | 4.80% | 8.30% | 29.80% | 7.10% |
| Rowing, kayaking, canoeing | 71.40% | 1.20% | 2.40% | 6.00% | 3.60% | 7.10% | 8.30% |
| Scuba diving, snorkeling | 83.30% | 0.00% | 0.00% | 1.20% | 2.40% | 7.10% | 6.00% |
| Surfing, kite-surfing, sail boarding | 81.00% | 2.40% | 1.20% | 2.40% | 3.60% | 4.80% | 4.80% |
| Swimming | 36.90% | 7.10% | 9.50% | 10.70% | 19.00% | 15.50% | 1.20% |
| Enjoying nature e.g. birdwatching, conservation, photography, camping | 27.40% | 4.80% | 14.30% | 2.40% | 17.90% | 28.60% | 4.80% |
| For commuting or getting to work | 73.80% | 1.20% | 9.50% | 2.40% | 3.60% | 7.10% | 2.40% |

# 9.4 Pumicestone Catchment

| Gender ratio | Frequency | Percent |
|---|---|---|
| Male | 53 | 47.3 |
| Female | 59 | 52.7 |
| Total | 112 | 100 |

**Education**

| | Frequency | Percent |
|---|---|---|
| Primary school | 1 | 0.9 |
| High school | 31 | 27.7 |
| Diploma / Certificate or equivalent | 34 | 30.4 |
| Apprenticeship or trade certificate or equivalent | 16 | 14.3 |
| Bachelor degree or equivalent | 22 | 19.6 |
| Postgraduate degree or equivalent | 7 | 6.3 |
| Other | 1 | 0.9 |
| Total | 112 | 100 |

**Lived in SEQ**

| | Frequency | Percent |
|---|---|---|
| Less than a year | 5 | 4.5 |
| 1-3 years | 12 | 10.7 |
| 4-6 years | 7 | 6.3 |
| 7-10 years | 5 | 4.5 |
| More than 10 years | 83 | 74.1 |
| Total | 112 | 100 |

**Employment**

| | Frequency | Percent |
|---|---|---|
| Retired | 48 | 42.9 |
| Carer | 8 | 7.1 |
| Full time student | 7 | 6.3 |
| Unemployed and not seeking work | 9 | 8 |
| Unemployed and seeking work | 7 | 6.3 |
| Part time employee | 14 | 12.5 |
| Full time work | 19 | 17 |
| Total | 112 | 100 |

**Employment industry**

| | Frequency | Percent |
|---|---|---|
| Agriculture, Forestry and Fishing, | 2 | 1.8 |
| Mining | 0 | 0 |
| Manufacturing | 2 | 1.8 |
| Construction and development | 2 | 1.8 |
| Retail Trade | 2 | 1.8 |
| Hospitality and Tourism | 9 | 8 |
| Transport and Storage | 12 | 10.7 |
| Communication Services | 2 | 1.8 |
| Finance and Insurance | 6 | 5.4 |
| Property and Business Services | 2 | 1.8 |

| | | |
|---|---|---|
| Government Administration and Defence | 3 | 2.7 |
| Education | 6 | 5.4 |
| Health and Community Services | 8 | 7.1 |
| Cultural and Recreational Services | 0 | 0 |
| Personal and Other Services | 4 | 3.6 |
| I have not worked | 7 | 6.3 |
| I am retired and do not identify with any of these industries | 32 | 28.6 |
| Other - please provide | 13 | 11.6 |
| Total | 112 | 100 |

**Household Income**

| | Frequency | Percent |
|---|---|---|
| Under $25,000 | 16 | 14.3 |
| $25,001-$50,000 | 24 | 21.4 |
| $50,001-$75,000 | 20 | 17.9 |
| $75,001-$100,000 | 15 | 13.4 |
| $100,001-$150,000 | 14 | 12.5 |
| $150,001-$200,000 | 3 | 2.7 |
| Over $200,000 | 2 | 1.8 |
| Prefer not to say | 18 | 16.1 |
| Total | 112 | 100 |

Pumicestone

| | Strongly disagree | Disagree | Slightly disagree | Neither agree nor disagree | Slightly agree | Agree | Strongly agree |
|---|---|---|---|---|---|---|---|
| ENABLE_1 Suitable weather | 0.00% | 0.00% | 2.70% | 7.10% | 23.20% | 37.50% | 29.50% |
| ENABLE_2 Condition of water - cleanliness | 0.00% | 0.00% | 4.50% | 12.50% | 27.70% | 30.40% | 25.00% |
| ENABLE_3 Colour of water | 0.00% | 0.90% | 8.00% | 15.20% | 29.50% | 25.00% | 21.40% |
| ENABLE_4 Peaceful/quiet | 0.00% | 0.00% | 1.80% | 13.40% | 27.70% | 31.30% | 25.90% |
| ENABLE_5 Local beauty/scenery | 0.00% | 0.00% | 2.70% | 10.70% | 24.10% | 32.10% | 30.40% |
| ENABLE_6 Not crowded | 0.00% | 0.90% | 1.80% | 10.70% | 27.70% | 37.50% | 21.40% |
| ENABLE_7 Allow dogs | 9.80% | 11.60% | 14.30% | 23.20% | 17.00% | 12.50% | 11.60% |
| ENABLE_8 Parks and playgrounds | 1.80% | 7.10% | 9.80% | 20.50% | 28.60% | 17.00% | 15.20% |
| ENABLE_9 Picnic areas | 0.00% | 2.70% | 4.50% | 19.60% | 32.10% | 22.30% | 18.80% |
| ENABLE_10 Paths and walkways | 0.00% | 2.70% | 1.80% | 14.30% | 25.00% | 26.80% | 29.50% |
| ENABLE_11 Easy to get to | 0.90% | 0.00% | 4.50% | 6.30% | 25.90% | 33.00% | 29.50% |
| ENABLE_12 Shelter and shade | 1.80% | 2.70% | 1.80% | 11.60% | 26.80% | 29.50% | 25.90% |
| ENABLE_13 Toilets | 1.80% | 3.60% | 2.70% | 10.70% | 26.80% | 26.80% | 27.70% |
| ENABLE_14 Cleanliness of surrounding area | 0.90% | 0.00% | 0.90% | 7.10% | 24.10% | 37.50% | 29.50% |
| ENABLE_15 Access to waterway | 0.90% | 0.00% | 0.90% | 9.80% | 30.40% | 31.30% | 26.80% |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| ENABLE_16 Time availability | 0.00% | 0.00% | 0.90% | 15.20% | 29.50% | 33.90% | 20.50% |
| ENABLE_17 With family or friends | 0.00% | 0.00% | 3.60% | 23.20% | 30.40% | 25.00% | 17.90% |

Pumicestone

| | Never | Almost everyday | Every week | Every fortnight | Every month | Once or twice a year | Every few years |
|---|---|---|---|---|---|---|---|
| Boating, sailing | 63.40% | 0.00% | 4.50% | 2.70% | 9.80% | 11.60% | 8.00% |
| Jet skiing, Water skiing | 84.80% | 0.00% | 0.00% | 1.80% | 7.10% | 4.50% | 1.80% |
| Walking or running | 18.80% | 19.60% | 21.40% | 8.90% | 14.30% | 16.10% | 0.90% |
| Cycling | 59.80% | 3.60% | 10.70% | 3.60% | 10.70% | 8.90% | 2.70% |
| Picnics, BBQs | 17.00% | 1.80% | 3.60% | 8.90% | 29.50% | 35.70% | 3.60% |
| Recreational fishing | 52.70% | 1.80% | 4.50% | 7.10% | 13.40% | 17.90% | 2.70% |
| Rowing, kayaking, canoeing | 69.60% | 1.80% | 1.80% | 0.90% | 9.80% | 12.50% | 3.60% |
| Scuba diving, snorkeling | 82.10% | 0.00% | 0.90% | 1.80% | 5.40% | 8.00% | 1.80% |
| Surfing, kite-surfing, sail boarding | 79.50% | 3.60% | 2.70% | 1.80% | 7.10% | 3.60% | 1.80% |
| Swimming | 38.40% | 1.80% | 9.80% | 9.80% | 11.60% | 25.90% | 2.70% |
| Enjoying nature e.g. birdwatching, conservation, photography, camping | 25.00% | 9.80% | 10.70% | 5.40% | 19.60% | 27.70% | 1.80% |
| For commuting or getting to work | 82.10% | 3.60% | 1.80% | 1.80% | 6.30% | 2.70% | 1.80% |

# 9.5 Caboolture Catchment

| Gender ratio | Frequency | Percent |
|---|---|---|
| Male | 65 | 47.1 |
| Female | 73 | 52.9 |
| Total | 138 | 100 |

**Education**

| | Frequency | Percent |
|---|---|---|
| Primary school | 3 | 2.2 |
| High school | 47 | 34.1 |
| Diploma / Certificate or equivalent | 38 | 27.5 |
| Apprenticeship or trade certificate or equivalent | 21 | 15.2 |
| Bachelor degree or equivalent | 18 | 13 |
| Postgraduate degree or equivalent | 11 | 8 |
| Other | | |
| Total | 138 | 100 |

**Lived in SEQ**

| | Frequency | Percent |
|---|---|---|
| Less than a year | 3 | 2.2 |
| 1-3 years | 9 | 6.5 |
| 4-6 years | 8 | 5.8 |
| 7-10 years | 15 | 10.9 |
| More than 10 years | 103 | 74.6 |
| Total | 138 | 100 |

**Employment**

| | Frequency | Percent |
|---|---|---|
| Retired | 40 | 29 |
| Carer | 9 | 6.5 |
| Full time student | 6 | 4.3 |
| Unemployed and not seeking work | 12 | 8.7 |
| Unemployed and seeking work | 10 | 7.2 |
| Part time employee | 20 | 14.5 |
| Full time work | 41 | 29.7 |
| Total | 138 | 100 |

**Employment industry**

| | Frequency | Percent |
|---|---|---|
| 1. Agriculture, Forestry and Fishing, | 3 | 2.2 |
| 2. Mining | 4 | 2.9 |
| 3. Manufacturing | 4 | 2.9 |
| 4. Electricity Gas and Water Supply | 2 | 1.4 |
| 5. Construction and development | 8 | 5.8 |
| 6. Wholesale trade | 2 | 1.4 |
| 7. Retail Trade | 12 | 8.7 |
| 8. Hospitality and Tourism | 9 | 6.5 |
| 9. Transport and Storage | 4 | 2.9 |
| 10. Communication Services | 1 | 0.7 |
| 11. Finance and Insurance | 4 | 2.9 |
| 12. Property and Business Services | 3 | 2.2 |

| | | | |
|---|---|---|---|
| 13. | Government Administration and Defence | 9 | 6.5 |
| 14. | Education | 10 | 7.2 |
| 15. | Health and Community Services | 5 | 3.6 |
| 16. | Cultural and Recreational Services | 2 | 1.4 |
| 17. | Personal and Other Services | 2 | 1.4 |
| 18. | I have not worked | 8 | 5.8 |
| 19. | I am retired and do not identify with any of these industries | 24 | 17.4 |
| 20. | Other - please provide | 22 | 15.9 |
| Total | | 138 | 100 |

**Household Income**

| | Frequency | Percent |
|---|---|---|
| Under $25,000 | 20 | 14.5 |
| $25,001-$50,000 | 41 | 29.7 |
| $50,001-$75,000 | 23 | 16.7 |
| $75,001-$100,000 | 11 | 8 |
| $100,001-$150,000 | 15 | 10.9 |
| $150,001-$200,000 | 7 | 5.1 |
| Over $200,000 | 2 | 1.4 |
| Prefer not to say | 19 | 13.8 |
| Total | 138 | 100 |

Caboolture

| | Strongly disagree | Disagree | Slightly disagree | Neither agree nor disagree | Slightly agree | Agree | Strongly agree |
|---|---|---|---|---|---|---|---|
| ENABLE_1 Suitable weather | 2.20% | 0.70% | 2.20% | 11.60% | 26.10% | 29.70% | 27.50% |
| ENABLE_2 Condition of water - cleanliness | 2.20% | 2.20% | 5.10% | 16.70% | 19.60% | 23.20% | 31.20% |
| ENABLE_3 Colour of water | 2.90% | 2.90% | 8.00% | 16.70% | 23.20% | 22.50% | 23.90% |
| ENABLE_4 Peaceful/quiet | 2.20% | 0.00% | 4.30% | 12.30% | 23.90% | 29.70% | 27.50% |
| ENABLE_5 Local beauty/scenery | 2.20% | 0.00% | 2.20% | 16.70% | 23.20% | 29.00% | 26.80% |
| ENABLE_6 Not crowded | 1.40% | 2.90% | 5.10% | 18.80% | 13.80% | 31.20% | 26.80% |
| ENABLE_7 Allow dogs | 10.90% | 9.40% | 10.90% | 29.70% | 12.30% | 15.90% | 10.90% |
| ENABLE_8 Parks and playgrounds | 7.20% | 1.40% | 10.90% | 23.90% | 15.90% | 26.10% | 14.50% |
| ENABLE_9 Picnic areas | 4.30% | 2.20% | 2.90% | 20.30% | 21.00% | 30.40% | 18.80% |
| ENABLE_10 Paths and walkways | 2.90% | 0.70% | 5.80% | 15.90% | 16.70% | 31.20% | 26.80% |
| ENABLE_11 Easy to get to | 1.40% | 2.20% | 2.20% | 13.80% | 20.30% | 36.20% | 23.90% |
| ENABLE_12 Shelter and shade | 2.90% | 0.00% | 2.90% | 23.20% | 17.40% | 31.90% | 21.70% |
| ENABLE_13 Toilets | 2.90% | 1.40% | 2.20% | 19.60% | 22.50% | 23.90% | 27.50% |
| ENABLE_14 Cleanliness of surrounding area | 1.40% | 1.40% | 1.40% | 16.70% | 18.10% | 32.60% | 28.30% |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| ENABLE_15 Access to waterway | 1.40% | 0.70% | 3.60% | 15.90% | 20.30% | 35.50% | 22.50% |
| ENABLE_16 Time availability | 2.20% | 3.60% | 2.90% | 19.60% | 18.10% | 29.00% | 24.60% |
| ENABLE_17 With family or friends | 4.30% | 2.90% | 2.90% | 25.40% | 18.10% | 25.40% | 21.00% |

| | Never | Almost everyday | Every week | Every fortnight | Every month | Once or twice a year | Every few years |
|---|---|---|---|---|---|---|---|
| Boating, sailing | 79.00% | 0.00% | 0.00% | 2.20% | 7.20% | 8.00% | 3.60% |
| Jet skiing, Water skiing | 90.60% | 0.00% | 0.70% | 2.20% | 1.40% | 1.40% | 3.60% |
| Walking or running | 28.30% | 5.80% | 15.20% | 12.30% | 14.50% | 21.70% | 2.20% |
| Cycling | 78.30% | 1.40% | 2.20% | 4.30% | 2.90% | 8.70% | 2.20% |
| Picnics, BBQs | 33.30% | 0.70% | 2.90% | 5.80% | 18.80% | 34.80% | 3.60% |
| Recreational fishing | 62.30% | 0.00% | 3.60% | 6.50% | 8.70% | 15.20% | 3.60% |
| Rowing, kayaking, canoeing | 82.60% | 0.00% | 1.40% | 2.90% | 2.20% | 8.00% | 2.90% |
| Scuba diving, snorkeling | 92.00% | 0.00% | 0.00% | 2.20% | 1.40% | 2.90% | 1.40% |
| Surfing, kite-surfing, sail boarding | 93.50% | 0.00% | 0.70% | 0.70% | 2.20% | 1.40% | 1.40% |
| Swimming | 65.90% | 0.70% | 2.20% | 5.10% | 8.70% | 15.20% | 2.20% |
| Enjoying nature e.g. birdwatching, conservation, photography, camping | 37.00% | 3.60% | 8.00% | 10.10% | 15.20% | 22.50% | 3.60% |
| For commuting or getting to work | 87.70% | 2.20% | 1.40% | 3.60% | 1.40% | 1.40% | 2.20% |

# 9.6 Pine Catchment

| Gender ratio | Frequency | Percent |
|---|---|---|
| Male | 105 | 43.2 |
| Female | 138 | 56.8 |
| Total | 243 | 100 |

**Education**

| | Frequency | Percent |
|---|---|---|
| Primary school | 5 | 2.1 |
| High school | 77 | 31.7 |
| Diploma / Certificate or equivalent | 67 | 27.6 |
| Apprenticeship or trade certificate or equivalent | 25 | 10.3 |
| Bachelor degree or equivalent | 44 | 18.1 |
| Postgraduate degree or equivalent | 24 | 9.9 |
| Other | 1 | 0.4 |
| Total | 243 | 100 |

**Lived in SEQ**

| | Frequency | Percent |
|---|---|---|
| Less than a year | 4 | 1.6 |
| 1-3 years | 17 | 7 |
| 4-6 years | 22 | 9.1 |
| 7-10 years | 24 | 9.9 |
| More than 10 years | 176 | 72.4 |
| Total | 243 | 100 |

**Employment**

| | Frequency | Percent |
|---|---|---|
| Retired | 66 | 27.2 |
| Carer | 11 | 4.5 |
| Full time student | 13 | 5.3 |
| Unemployed and not seeking work | 11 | 4.5 |
| Unemployed and seeking work | 18 | 7.4 |
| Part time employee | 46 | 18.9 |
| Full time work | 78 | 32.1 |
| Total | 243 | 100 |

**Employment industry**

| | Frequency | Percent |
|---|---|---|
| 1. Agriculture, Forestry and Fishing, | 1 | 0.4 |
| 2. Mining | 4 | 1.6 |
| 3. Manufacturing | 7 | 2.9 |
| 4. Electricity Gas and Water Supply | 3 | 1.2 |
| 5. Construction and development | 13 | 5.3 |
| 6. Wholesale trade | 3 | 1.2 |
| 7. Retail Trade | 29 | 11.9 |
| 8. Hospitality and Tourism | 12 | 4.9 |
| 9. Transport and Storage | 19 | 7.8 |
| 10. Communication Services | 7 | 2.9 |
| 11. Finance and Insurance | 5 | 2.1 |
| 12. Property and Business Services | 5 | 2.1 |
| 13. Government Administration and Defence | 12 | 4.9 |
| 14. Education | 18 | 7.4 |
| 15. Health and Community Services | 20 | 8.2 |
| 16. Cultural and Recreational Services | 0 | 0 |
| 17. Personal and Other Services | 9 | 3.7 |
| 18. I have not worked | 14 | 5.8 |
| 19. I am retired and do not identify with any of these industries | 32 | 13.2 |
| 20. Other - please provide | 30 | 12.3 |
| Total | 243 | 100 |

**Household Income**

| | Frequency | Percent |
|---|---|---|
| Under $25,000 | 19 | 7.8 |
| $25,001-$50,000 | 53 | 21.8 |
| $50,001-$75,000 | 35 | 14.4 |
| $75,001-$100,000 | 35 | 14.4 |
| $100,001-$150,000 | 42 | 17.3 |
| $150,001-$200,000 | 19 | 7.8 |
| Over $200,000 | 5 | 2.1 |
| Prefer not to say | 35 | 14.4 |
| Total | 243 | 100 |

Pine

| | Strongly disagree | Disagree | Slightly disagree | Neither agree nor disagree | Slightly agree | Agree | Strongly agree |
|---|---|---|---|---|---|---|---|
| ENABLE_1 Suitable weather | 2.10% | 2.50% | 3.70% | 15.20% | 21.40% | 26.30% | 28.80% |
| ENABLE_2 Condition of water - cleanliness | 1.20% | 2.50% | 4.90% | 16.90% | 19.80% | 25.90% | 28.80% |
| ENABLE_3 Colour of water | 2.10% | 3.70% | 4.10% | 23.00% | 19.30% | 27.60% | 20.20% |
| ENABLE_4 Peaceful/quiet | 1.60% | 2.10% | 4.50% | 14.80% | 20.60% | 30.00% | 26.30% |
| ENABLE_5 Local beauty/scenery | 1.20% | 2.10% | 2.50% | 11.50% | 20.60% | 35.80% | 26.30% |
| ENABLE_6 Not crowded | 1.20% | 2.10% | 4.50% | 15.20% | 24.70% | 30.00% | 22.20% |
| ENABLE_7 Allow dogs | 16.90% | 13.60% | 8.20% | 23.00% | 9.10% | 14.40% | 14.80% |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| ENABLE_8 Parks and playgrounds | 4.90% | 6.20% | 8.20% | 25.10% | 18.90% | 20.60% | 16.00% |
| ENABLE_9 Picnic areas | 4.10% | 3.70% | 5.30% | 16.90% | 23.50% | 26.30% | 20.20% |
| ENABLE_10 Paths and walkways | 2.90% | 1.60% | 4.10% | 18.50% | 18.50% | 29.20% | 25.10% |
| ENABLE_11 Easy to get to | 1.60% | 1.60% | 4.50% | 14.40% | 21.00% | 31.30% | 25.50% |
| ENABLE_12 Shelter and shade | 1.60% | 2.90% | 4.10% | 15.60% | 18.10% | 28.40% | 29.20% |
| ENABLE_13 Toilets | 3.30% | 3.30% | 3.30% | 15.60% | 19.80% | 23.50% | 31.30% |
| ENABLE_14 Cleanliness of surrounding area | 1.20% | 2.10% | 2.90% | 11.90% | 18.90% | 35.80% | 27.20% |
| ENABLE_15 Access to waterway | 0.80% | 2.10% | 5.80% | 16.00% | 19.80% | 29.20% | 26.30% |
| ENABLE_16 Time availability | 0.80% | 2.50% | 3.70% | 17.30% | 21.80% | 28.40% | 25.50% |
| ENABLE_17 With family or friends | 2.10% | 4.90% | 4.90% | 25.10% | 18.90% | 22.60% | 21.40% |

6 Pine

| | Never | Almost everyday | Every week | Every fortnight | Every month | Once or twice a year | Every few years |
|---|---|---|---|---|---|---|---|
| Boating, sailing | 81.10% | 0.40% | 1.20% | 0.80% | 3.30% | 8.20% | 4.90% |
| Jet skiing, Water skiing | 86.40% | 1.20% | 0.40% | 1.60% | 2.50% | 3.30% | 4.50% |
| Walking or running | 26.30% | 11.90% | 13.20% | 7.00% | 18.90% | 21.00% | 1.60% |
| Cycling | 72.00% | 3.70% | 2.90% | 2.90% | 7.00% | 9.50% | 2.10% |
| Picnics, BBQs | 28.00% | 0.40% | 2.10% | 6.60% | 22.20% | 36.60% | 4.10% |
| Recreational fishing | 66.30% | 0.40% | 3.30% | 2.10% | 7.00% | 16.00% | 4.90% |
| Rowing, kayaking, canoeing | 83.10% | 2.10% | 0.40% | 1.20% | 3.30% | 4.50% | 5.30% |
| Scuba diving, snorkeling | 88.90% | 0.00% | 0.40% | 0.80% | 3.30% | 2.90% | 3.70% |
| Surfing, kite-surfing, sail boarding | 90.90% | 0.80% | 0.80% | 0.40% | 1.60% | 3.70% | 1.60% |
| Swimming | 55.60% | 0.80% | 3.30% | 3.70% | 9.50% | 24.70% | 2.50% |
| Enjoying nature e.g. birdwatching, conservation, photography, camping | 44.90% | 6.60% | 4.90% | 4.10% | 11.10% | 24.30% | 4.10% |
| For commuting or getting to work | 83.50% | 4.10% | 2.10% | 1.60% | 2.10% | 4.90% | 1.60% |

# 9.7 Lower Brisbane Catchment

| Gender ratio | Frequency | Percent |
|---|---|---|
| Male | 509 | 48.9 |
| Female | 528 | 50.8 |
| Non-disclosed | 3 | 0.3 |
| Total | 1040 | 100 |

**Education**

| | Frequency | Percent |
|---|---|---|
| Primary school | 7 | 0.7 |
| High school | 254 | 24.4 |
| Diploma / Certificate or equivalent | 220 | 21.2 |
| Apprenticeship or trade certificate or equivalent | 73 | 7 |
| Bachelor degree or equivalent | 330 | 31.7 |
| Postgraduate degree or equivalent | 145 | 13.9 |
| Other | 11 | 1.1 |
| Total | 1040 | 100 |

**Lived in SEQ**

| | Frequency | Percent |
|---|---|---|
| Less than a year | 50 | 4.8 |
| 1-3 years | 79 | 7.6 |
| 4-6 years | 84 | 8.1 |
| 7-10 years | 64 | 6.2 |
| More than 10 years | 763 | 73.4 |
| Total | 1040 | 100 |

**Employment**

| | Frequency | Percent |
|---|---|---|
| Retired | 237 | 22.8 |
| Carer | 23 | 2.2 |
| Full time student | 114 | 11 |
| Unemployed and not seeking work | 54 | 5.2 |
| Unemployed and seeking work | 53 | 5.1 |
| Part time employee | 176 | 16.9 |
| Full time work | 383 | 36.8 |
| Total | 1040 | 100 |

**Employment industry**

| | Frequency | Percent |
|---|---|---|
| 1. Agriculture, Forestry and Fishing, | 11 | 1.1 |
| 2. Mining | 13 | 1.3 |
| 3. Manufacturing | 33 | 3.2 |
| 4. Electricity Gas and Water Supply | 18 | 1.7 |
| 5. Construction and development | 35 | 3.4 |
| 6. Wholesale trade | 16 | 1.5 |
| 7. Retail Trade | 78 | 7.5 |
| 8. Hospitality and Tourism | 64 | 6.2 |
| 9. Transport and Storage | 51 | 4.9 |
| 10. Communication Services | 26 | 2.5 |

| | | |
|---|---|---|
| 11. Finance and Insurance | 46 | 4.4 |
| 12. Property and Business Services | 28 | 2.7 |
| 13. Government Administration and Defence | 61 | 5.9 |
| 14. Education | 83 | 8 |
| 15. Health and Community Services | 95 | 9.1 |
| 16. Cultural and Recreational Services | 14 | 1.3 |
| 17. Personal and Other Services | 39 | 3.8 |
| 18. I have not worked | 74 | 7.1 |
| 19. I am retired and do not identify with any of these industries | 124 | 11.9 |
| 20. Other - please provide | 131 | 12.6 |
| Total | 1040 | 100 |

**Household Income**

| | Frequency | Percent |
|---|---|---|
| Under $25,000 | 98 | 9.4 |
| $25,001-$50,000 | 167 | 16.1 |
| $50,001-$75,000 | 171 | 16.4 |
| $75,001-$100,000 | 152 | 14.6 |
| $100,001-$150,000 | 191 | 18.4 |
| $150,001-$200,000 | 55 | 5.3 |
| Over $200,000 | 36 | 3.5 |
| Prefer not to say | 170 | 16.3 |
| Total | 1040 | 100 |

**Lower Brisbane**

| | Strongly disagree | Disagree | Slightly disagree | Neither agree nor disagree | Slightly agree | Agree | Strongly agree |
|---|---|---|---|---|---|---|---|
| ENABLE_1 Suitable weather | 1.60% | 2.20% | 4.40% | 17.80% | 23.80% | 27.80% | 22.30% |
| ENABLE_2 Condition of water - cleanliness | 1.30% | 2.70% | 5.00% | 18.00% | 24.70% | 28.30% | 20.00% |
| ENABLE_3 Colour of water | 2.00% | 2.70% | 6.50% | 21.30% | 27.10% | 24.80% | 15.50% |
| ENABLE_4 Peaceful/quiet | 1.30% | 1.70% | 3.70% | 16.70% | 27.80% | 29.20% | 19.50% |
| ENABLE_5 Local beauty/scenery | 1.30% | 1.40% | 4.00% | 15.40% | 24.90% | 30.90% | 22.00% |
| ENABLE_6 Not crowded | 1.60% | 2.40% | 5.20% | 17.90% | 26.10% | 28.70% | 18.20% |
| ENABLE_7 Allow dogs | 14.90% | 11.30% | 13.20% | 25.40% | 12.80% | 11.50% | 10.90% |
| ENABLE_8 Parks and playgrounds | 3.90% | 5.20% | 8.80% | 25.40% | 24.10% | 21.00% | 11.60% |
| ENABLE_9 Picnic areas | 2.90% | 2.50% | 6.70% | 22.80% | 28.40% | 23.20% | 13.60% |
| ENABLE_10 Paths and walkways | 1.70% | 1.80% | 5.10% | 16.20% | 26.10% | 29.20% | 19.90% |
| ENABLE_11 Easy to get to | 1.30% | 2.00% | 3.00% | 16.40% | 23.10% | 32.50% | 21.60% |
| ENABLE_12 Shelter and shade | 1.70% | 2.20% | 4.10% | 17.10% | 25.10% | 29.90% | 19.80% |
| ENABLE_13 Toilets | 1.90% | 3.20% | 5.60% | 17.90% | 24.70% | 25.90% | 20.90% |
| ENABLE_14 Cleanliness of surrounding area | 1.30% | 1.80% | 3.80% | 14.10% | 24.40% | 30.90% | 23.80% |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| ENABLE_15 Access to waterway | 1.80% | 2.60% | 4.00% | 18.40% | 26.70% | 30.10% | 16.30% |
| ENABLE_16 Time availability | 1.40% | 2.10% | 4.80% | 21.30% | 24.50% | 28.50% | 17.30% |
| ENABLE_17 With family or friends | 2.50% | 3.80% | 6.90% | 23.50% | 23.10% | 23.80% | 16.50% |

| | Never | Almost everyday | Every week | Every fortnight | Every month | Once or twice a year | Every few years |
|---|---|---|---|---|---|---|---|
| Boating, sailing | 79.30% | 0.70% | 1.90% | 2.50% | 3.40% | 7.00% | 5.20% |
| Jet skiing, Water skiing | 85.00% | 0.60% | 1.30% | 2.80% | 2.00% | 4.30% | 3.90% |
| Walking or running | 29.50% | 8.80% | 14.20% | 9.60% | 15.00% | 20.30% | 2.50% |
| Cycling | 66.40% | 1.70% | 5.10% | 5.00% | 6.30% | 10.20% | 5.30% |
| Picnics, BBQs | 37.70% | 0.90% | 4.00% | 5.20% | 15.60% | 31.40% | 5.20% |
| Recreational fishing | 73.80% | 0.70% | 2.70% | 3.50% | 4.30% | 9.20% | 5.90% |
| Rowing, kayaking, canoeing | 81.10% | 0.50% | 2.00% | 2.50% | 3.80% | 5.40% | 4.70% |
| Scuba diving, snorkeling | 84.90% | 0.40% | 1.40% | 2.20% | 2.70% | 4.60% | 3.80% |
| Surfing, kite-surfing, sail boarding | 84.40% | 0.80% | 1.80% | 2.30% | 3.50% | 3.60% | 3.70% |
| Swimming | 67.80% | 1.00% | 3.50% | 3.30% | 6.90% | 13.90% | 3.70% |
| Enjoying nature e.g. birdwatching, conservation, photography, camping | 45.50% | 2.60% | 6.40% | 5.60% | 13.50% | 21.90% | 4.50% |
| For commuting or getting to work | 70.80% | 5.20% | 4.70% | 3.30% | 5.40% | 7.30% | 3.40% |

# 9.8 Redlands Catchment

| Gender ratio | Frequency | Percent |
|---|---|---|
| Male | 65 | 41.4 |
| Female | 92 | 58.6 |
| Total | 157 | 100 |

### Education

| | Frequency | Percent |
|---|---|---|
| Primary school | 1 | 0.6 |
| High school | 50 | 31.8 |
| Diploma / Certificate or equivalent | 43 | 27.4 |
| Apprenticeship or trade certificate or equivalent | 14 | 8.9 |
| Bachelor degree or equivalent | 35 | 22.3 |
| Postgraduate degree or equivalent | 14 | 8.9 |
| Other | | |
| Total | 157 | 100 |

### Lived in SEQ

| | Frequency | Percent |
|---|---|---|
| Less than a year | 2 | 1.3 |
| 1-3 years | 6 | 3.8 |
| 4-6 years | 16 | 10.2 |
| 7-10 years | 9 | 5.7 |
| More than 10 years | 124 | 79 |
| Total | 157 | 100 |

### Employment

| | Frequency | Percent |
|---|---|---|
| Retired | 43 | 27.4 |
| Carer | 5 | 3.2 |
| Full time student | 7 | 4.5 |
| Unemployed and not seeking work | 13 | 8.3 |
| Unemployed and seeking work | 11 | 7 |
| Part time employee | 30 | 19.1 |
| Full time work | 48 | 30.6 |
| Total | 157 | 100 |

| | Frequency | Percent |
|---|---|---|
| 1. Agriculture, Forestry and Fishing, | 3 | 1.9 |
| 2. Mining | 3 | 1.9 |
| 3. Manufacturing | 6 | 3.8 |
| 4. Electricity Gas and Water Supply | 2 | 1.3 |
| 5. Construction and development | 7 | 4.5 |
| 6. Wholesale trade | 2 | 1.3 |
| 7. Retail Trade | 15 | 9.6 |
| 8. Hospitality and Tourism | 7 | 4.5 |
| 9. Transport and Storage | 6 | 3.8 |
| 10. Communication Services | 4 | 2.5 |
| 11. Finance and Insurance | 7 | 4.5 |
| 12. Property and Business Services | 5 | 3.2 |
| 13. Government Administration and Defence | 13 | 8.3 |
| 14. Education | 13 | 8.3 |
| 15. Health and Community Services | 14 | 8.9 |
| 16. Cultural and Recreational Services | 1 | 0.6 |
| 17. Personal and Other Services | 2 | 1.3 |
| 18. I have not worked | 6 | 3.8 |
| 19. I am retired and do not identify with any of these industries | 27 | 17.2 |
| 20. Other - please provide | 14 | 8.9 |
| Total | 157 | 100 |

**Household Income**

| | Frequency | Percent |
|---|---|---|
| Under $25,000 | 6 | 3.8 |
| $25,001-$50,000 | 25 | 15.9 |
| $50,001-$75,000 | 30 | 19.1 |
| $75,001-$100,000 | 20 | 12.7 |
| $100,001-$150,000 | 36 | 22.9 |
| $150,001-$200,000 | 7 | 4.5 |
| Over $200,000 | 3 | 1.9 |
| Prefer not to say | 30 | 19.1 |
| Total | 157 | 100 |

9 Redland

| | Strongly disagree | Disagree | Slightly disagree | Neither agree nor disagree | Slightly agree | Agree | Strongly agree |
|---|---|---|---|---|---|---|---|
| ENABLE_1 Suitable weather | 1.30% | 1.30% | 2.50% | 13.40% | 16.60% | 36.30% | 28.70% |
| ENABLE_2 Condition of water - cleanliness | 0.60% | 0.60% | 6.40% | 15.30% | 22.30% | 27.40% | 27.40% |
| ENABLE_3 Colour of water | 0.60% | 3.20% | 7.00% | 17.20% | 24.80% | 28.70% | 18.50% |
| ENABLE_4 Peaceful/quiet | 1.30% | 1.90% | 3.20% | 15.30% | 25.50% | 30.60% | 22.30% |
| ENABLE_5 Local beauty/scenery | 0.00% | 1.90% | 3.20% | 11.50% | 24.20% | 38.20% | 21.00% |
| ENABLE_6 Not crowded | 0.00% | 3.20% | 3.20% | 15.30% | 24.80% | 33.80% | 19.70% |
| ENABLE_7 Allow dogs | 12.70% | 12.10% | 12.10% | 27.40% | 12.70% | 12.70% | 10.20% |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| ENABLE_8 Parks and playgrounds | 1.30% | 6.40% | 12.70% | 29.30% | 25.50% | 14.60% | 10.20% |
| ENABLE_9 Picnic areas | 0.60% | 5.10% | 7.60% | 21.70% | 25.50% | 25.50% | 14.00% |
| ENABLE_10 Paths and walkways | 0.60% | 3.80% | 4.50% | 14.60% | 28.00% | 32.50% | 15.90% |
| ENABLE_11 Easy to get to | 0.60% | 1.30% | 3.80% | 14.00% | 23.60% | 36.30% | 20.40% |
| ENABLE_12 Shelter and shade | 0.60% | 4.50% | 3.20% | 16.60% | 26.10% | 31.20% | 17.80% |
| ENABLE_13 Toilets | 1.90% | 3.20% | 2.50% | 19.70% | 20.40% | 31.20% | 21.00% |
| ENABLE_14 Cleanliness of surrounding area | 1.30% | 0.60% | 2.50% | 12.10% | 24.20% | 33.10% | 26.10% |
| ENABLE_15 Access to waterway | 1.30% | 0.60% | 3.80% | 17.80% | 22.30% | 35.00% | 19.10% |
| ENABLE_16 Time availability | 0.60% | 1.90% | 6.40% | 14.60% | 22.30% | 31.80% | 22.30% |
| ENABLE_17 With family or friends | 1.30% | 3.20% | 10.20% | 25.50% | 19.70% | 26.80% | 13.40% |

9 Redland

| | Never | Almost everyday | Every week | Every fortnight | Every month | Once or twice a year | Every few years |
|---|---|---|---|---|---|---|---|
| Boating, sailing | 70.10% | 0.00% | 1.30% | 2.50% | 8.90% | 11.50% | 5.70% |
| Jet skiing, Water skiing | 87.30% | 0.60% | 0.00% | 0.60% | 1.90% | 5.10% | 4.50% |
| Walking or running | 22.90% | 13.40% | 14.60% | 7.60% | 14.60% | 24.80% | 1.90% |
| Cycling | 68.80% | 1.90% | 3.20% | 3.80% | 7.00% | 12.70% | 2.50% |
| Picnics, BBQs | 26.10% | 0.00% | 4.50% | 3.80% | 19.10% | 38.20% | 8.30% |
| Recreational fishing | 59.90% | 1.90% | 0.60% | 3.80% | 8.90% | 15.90% | 8.90% |
| Rowing, kayaking, canoeing | 75.20% | 0.00% | 0.00% | 1.30% | 7.60% | 8.30% | 7.60% |
| Scuba diving, snorkeling | 87.30% | 0.00% | 0.60% | 0.00% | 0.60% | 7.00% | 4.50% |
| Surfing, kite-surfing, sail boarding | 89.20% | 0.60% | 0.00% | 1.90% | 1.30% | 3.20% | 3.80% |
| Swimming | 58.00% | 1.30% | 1.30% | 3.20% | 10.80% | 21.70% | 3.80% |
| Enjoying nature e.g. birdwatching, conservation, photography, camping | 40.10% | 3.20% | 9.60% | 8.90% | 12.70% | 19.70% | 5.70% |
| For commuting or getting to work | 82.20% | 0.60% | 3.20% | 1.30% | 2.50% | 6.40% | 3.80% |

# 9.9 Logan Catchment

| Gender ratio | Frequency | Percent |
|---|---|---|
| Male | 126 | 42.3 |
| Female | 172 | 57.7 |
| Total | 298 | 100 |

**Education**

| | Frequency | Percent |
|---|---|---|
| Primary school | 6 | 2 |
| High school | 104 | 34.9 |
| Diploma / Certificate or equivalent | 94 | 31.5 |
| Apprenticeship or trade certificate or equivalent | 29 | 9.7 |
| Bachelor degree or equivalent | 50 | 16.8 |
| Postgraduate degree or equivalent | 14 | 4.7 |
| Other | 1 | 0.3 |
| Total | 298 | 100 |

**Lived in SEQ**

| | Frequency | Percent |
|---|---|---|
| Less than a year | 3 | 1 |
| 1-3 years | 12 | 4 |
| 4-6 years | 17 | 5.7 |
| 7-10 years | 34 | 11.4 |
| More than 10 years | 232 | 77.9 |
| Total | 298 | 100 |

**Employment**

| | Frequency | Percent |
|---|---|---|
| Retired | 90 | 30.2 |
| Carer | 12 | 4 |
| Full time student | 17 | 5.7 |
| Unemployed and not seeking work | 24 | 8.1 |
| Unemployed and seeking work | 18 | 6 |
| Part time employee | 50 | 16.8 |
| Full time work | 87 | 29.2 |
| Total | 298 | 100 |

**Employment industry**

| | Frequency | Percent |
|---|---|---|
| 1. Agriculture, Forestry and Fishing, | 6 | 2 |
| 2. Mining | 2 | 0.7 |
| 3. Manufacturing | 21 | 7 |
| 4. Electricity Gas and Water Supply | 1 | 0.3 |
| 5. Construction and development | 14 | 4.7 |
| 6. Wholesale trade | 3 | 1 |
| 7. Retail Trade | 21 | 7 |
| 8. Hospitality and Tourism | 15 | 5 |
| 9. Transport and Storage | 14 | 4.7 |
| 10. Communication Services | 8 | 2.7 |
| 11. Finance and Insurance | 9 | 3 |
| 12. Property and Business Services | 5 | 1.7 |
| 13. Government Administration and Defence | 16 | 5.4 |
| 14. Education | 19 | 6.4 |
| 15. Health and Community Services | 20 | 6.7 |
| 16. Cultural and Recreational Services | 3 | 1 |
| 17. Personal and Other Services | 9 | 3 |
| 18. I have not worked | 36 | 12.1 |
| 19. I am retired and do not identify with any of these industries | 48 | 16.1 |
| 20. Other - please provide | 28 | 9.4 |
| Total | 298 | 100 |

**Household Income**

| | Frequency | Percent |
|---|---|---|
| Under $25,000 | 40 | 13.4 |
| $25,001-$50,000 | 61 | 20.5 |
| $50,001-$75,000 | 48 | 16.1 |
| $75,001-$100,000 | 43 | 14.4 |
| $100,001-$150,000 | 39 | 13.1 |
| $150,001-$200,000 | 17 | 5.7 |
| Over $200,000 | 5 | 1.7 |
| Prefer not to say | 45 | 15.1 |
| Total | 298 | 100 |

10 Logan

| | Strongly disagree | Disagree | Slightly disagree | Neither agree nor disagree | Slightly agree | Agree | Strongly agree |
|---|---|---|---|---|---|---|---|
| ENABLE_1 Suitable weather | 1.70% | 2.30% | 3.40% | 21.80% | 21.50% | 26.50% | 22.80% |
| ENABLE_2 Condition of water - cleanliness | 2.70% | 1.70% | 4.70% | 21.80% | 20.50% | 25.80% | 22.80% |
| ENABLE_3 Colour of water | 2.70% | 2.30% | 4.70% | 21.80% | 24.20% | 26.80% | 17.40% |
| ENABLE_4 Peaceful/quiet | 1.70% | 1.30% | 2.00% | 19.80% | 24.50% | 28.20% | 22.50% |
| ENABLE_5 Local beauty/scenery | 1.70% | 1.30% | 2.00% | 17.10% | 23.20% | 31.20% | 23.50% |
| ENABLE_6 Not crowded | 1.30% | 0.70% | 3.40% | 21.80% | 25.80% | 29.50% | 17.40% |
| ENABLE_7 Allow dogs | 16.40% | 7.40% | 11.40% | 29.50% | 11.70% | 12.10% | 11.40% |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| ENABLE_8 Parks and playgrounds | 3.00% | 4.00% | 8.70% | 25.80% | 20.80% | 22.80% | 14.80% |
| ENABLE_9 Picnic areas | 2.70% | 2.70% | 6.70% | 20.10% | 22.80% | 25.80% | 19.10% |
| ENABLE_10 Paths and walkways | 2.30% | 2.70% | 6.70% | 19.10% | 22.50% | 26.80% | 19.80% |
| ENABLE_11 Easy to get to | 2.00% | 1.00% | 5.00% | 20.10% | 23.50% | 26.50% | 21.80% |
| ENABLE_12 Shelter and shade | 1.70% | 1.70% | 4.00% | 19.80% | 23.20% | 28.90% | 20.80% |
| ENABLE_13 Toilets | 2.30% | 2.30% | 5.00% | 17.80% | 17.80% | 27.20% | 27.50% |
| ENABLE_14 Cleanliness of surrounding area | 1.30% | 1.00% | 2.70% | 15.40% | 21.50% | 30.90% | 27.20% |
| ENABLE_15 Access to waterway | 2.30% | 1.30% | 4.70% | 21.80% | 23.80% | 25.20% | 20.80% |
| ENABLE_16 Time availability | 2.30% | 0.70% | 4.70% | 25.80% | 21.50% | 27.20% | 17.80% |
| ENABLE_17 With family or friends | 3.00% | 1.70% | 4.70% | 24.50% | 22.50% | 25.80% | 17.80% |

10 Logan

| | Never | Almost everyday | Every week | Every fortnight | Every month | Once or twice a year | Every few years |
|---|---|---|---|---|---|---|---|
| Boating, sailing | 80.90% | 1.70% | 1.00% | 0.70% | 3.70% | 7.70% | 4.40% |
| Jet skiing, Water skiing | 88.90% | 0.30% | 0.30% | 0.30% | 1.30% | 5.00% | 3.70% |
| Walking or running | 46.00% | 3.00% | 5.40% | 6.00% | 11.40% | 24.20% | 4.00% |
| Cycling | 77.90% | 1.00% | 1.00% | 2.70% | 4.40% | 9.10% | 4.00% |
| Picnics, BBQs | 40.90% | 0.70% | 1.70% | 4.00% | 14.10% | 31.90% | 6.70% |
| Recreational fishing | 67.40% | 0.70% | 2.70% | 2.00% | 7.70% | 12.80% | 6.70% |
| Rowing, kayaking, canoeing | 85.20% | 0.30% | 1.30% | 0.00% | 3.40% | 6.00% | 3.70% |
| Scuba diving, snorkeling | 90.90% | 0.30% | 1.00% | 0.30% | 2.00% | 2.00% | 3.40% |
| Surfing, kite-surfing, sail boarding | 90.60% | 1.00% | 0.00% | 0.70% | 1.30% | 3.00% | 3.40% |
| Swimming | 65.80% | 0.30% | 2.70% | 3.00% | 6.70% | 15.40% | 6.00% |
| Enjoying nature e.g. birdwatching, conservation, photography, camping | 54.40% | 2.30% | 4.70% | 3.70% | 12.10% | 18.80% | 4.00% |
| For commuting or getting to work | 90.90% | 1.30% | 1.00% | 1.30% | 0.70% | 1.70% | 3.00% |

# 9.10 Albert Catchment

| Gender ratio | Frequency | Percent |
|---|---|---|
| Male | 28 | 50.9 |
| Female | 27 | 49.1 |
| Total | 55 | 100 |

**Education**

| | Frequency | Percent |
|---|---|---|
| Primary school | 0 | 0 |
| High school | 17 | 30.9 |
| Diploma / Certificate or equivalent | 12 | 21.8 |
| Apprenticeship or trade certificate or equivalent | 10 | 18.2 |
| Bachelor degree or equivalent | 14 | 25.5 |
| Postgraduate degree or equivalent | 2 | 3.6 |
| Other | 0 | 0 |
| Total | 55 | 100 |

**Lived in SEQ**

| | Frequency | Percent |
|---|---|---|
| Less than a year | 2 | 3.6 |
| 1-3 years | 4 | 7.3 |
| 4-6 years | 1 | 1.8 |
| 7-10 years | 3 | 5.5 |
| More than 10 years | 45 | 81.8 |
| Total | 55 | 100 |

**Employment**

| | Frequency | Percent |
|---|---|---|
| Retired | 18 | 32.7 |
| Carer | 3 | 5.5 |
| Full time student | 3 | 5.5 |
| Unemployed and not seeking work | 5 | 9.1 |
| Unemployed and seeking work | 4 | 7.3 |
| Part time employee | 11 | 20 |
| Full time work | 11 | 20 |
| Total | 55 | 100 |

**Employment industry**

| | Frequency | Percent |
|---|---|---|
| 1. Agriculture, Forestry and Fishing, | 2 | 3.6 |
| 2. Mining | | |
| 3. Manufacturing | 7 | 12.7 |
| 4. Electricity Gas and Water Supply | 1 | 1.8 |
| 5. Construction and development | 3 | 5.5 |
| 6. Wholesale trade | 1 | 1.8 |
| 7. Retail Trade | 3 | 5.5 |
| 8. Hospitality and Tourism | 3 | 5.5 |
| 9. Transport and Storage | 3 | 5.5 |
| 10. Communication Services | 1 | 1.8 |
| 11. Finance and Insurance | 2 | 3.6 |
| 12. Property and Business Services | | |
| 13. Government Administration and Defence | 3 | 5.5 |
| 14. Education | 4 | 7.3 |
| 15. Health and Community Services | 4 | 7.3 |
| 16. Cultural and Recreational Services | | |
| 17. Personal and Other Services | 1 | 1.8 |
| 18. I have not worked | 4 | 7.3 |
| 19. I am retired and do not identify with any of these industries | 9 | 16.4 |
| 20. Other - please provide | 4 | 7.3 |
| Total | 55 | 100 |

**Household Income**

| | Frequency | Percent |
|---|---|---|
| Under $25,000 | 5 | 9.1 |
| $25,001-$50,000 | 13 | 23.6 |
| $50,001-$75,000 | 8 | 14.5 |
| $75,001-$100,000 | 10 | 18.2 |
| $100,001-$150,000 | 6 | 10.9 |
| $150,001-$200,000 | 2 | 3.6 |
| Over $200,000 | 0 | 0 |
| Prefer not to say | 11 | 20 |
| Total | 55 | 100 |

| Albert | Strongly disagree | Disagree | Slightly disagree | Neither agree nor disagree | Slightly agree | Agree | Strongly agree |
|---|---|---|---|---|---|---|---|
| ENABLE_1 Suitable weather | 0.00% | 3.60% | 3.60% | 30.90% | 16.40% | 29.10% | 16.40% |
| ENABLE_2 Condition of water - cleanliness | 0.00% | 5.50% | 3.60% | 21.80% | 29.10% | 18.20% | 21.80% |
| ENABLE_3 Colour of water | 1.80% | 3.60% | 5.50% | 29.10% | 20.00% | 23.60% | 16.40% |
| ENABLE_4 Peaceful/quiet | 0.00% | 3.60% | 3.60% | 16.40% | 30.90% | 30.90% | 14.50% |
| ENABLE_5 Local beauty/scenery | 0.00% | 3.60% | 5.50% | 16.40% | 20.00% | 32.70% | 21.80% |
| ENABLE_6 Not crowded | 0.00% | 5.50% | 3.60% | 23.60% | 25.50% | 27.30% | 14.50% |
| ENABLE_7 Allow dogs | 14.50% | 7.30% | 12.70% | 30.90% | 16.40% | 10.90% | 7.30% |
| ENABLE_8 Parks and playgrounds | 1.80% | 10.90% | 10.90% | 27.30% | 23.60% | 16.40% | 9.10% |
| ENABLE_9 Picnic areas | 3.60% | 9.10% | 7.30% | 25.50% | 20.00% | 20.00% | 14.50% |
| ENABLE_10 Paths and walkways | 1.80% | 7.30% | 5.50% | 18.20% | 25.50% | 27.30% | 14.50% |
| ENABLE_11 Easy to get to | 1.80% | 5.50% | 5.50% | 14.50% | 25.50% | 30.90% | 16.40% |
| ENABLE_12 Shelter and shade | 0.00% | 1.80% | 3.60% | 20.00% | 25.50% | 32.70% | 16.40% |
| ENABLE_13 Toilets | 1.80% | 7.30% | 1.80% | 23.60% | 16.40% | 23.60% | 25.50% |
| ENABLE_14 Cleanliness of surrounding area | 0.00% | 3.60% | 3.60% | 18.20% | 23.60% | 27.30% | 23.60% |
| ENABLE_15 Access to waterway | 1.80% | 3.60% | 10.90% | 23.60% | 23.60% | 16.40% | 20.00% |
| ENABLE_16 Time availability | 1.80% | 5.50% | 5.50% | 21.80% | 23.60% | 20.00% | 21.80% |
| ENABLE_17 With family or friends | 3.60% | 5.50% | 3.60% | 23.60% | 25.50% | 21.80% | 16.40% |

| Albert Use | Never | Almost everyday | Every week | Every fortnight | Every month | Once or twice a year | Every few years |
|---|---|---|---|---|---|---|---|
| Boating, sailing | 81.80% | 0.00% | 0.00% | 1.80% | 3.60% | 10.90% | 1.80% |
| Jet skiing, Water skiing | 94.50% | 0.00% | 0.00% | 1.80% | 0.00% | 1.80% | 1.80% |
| Walking or running | 50.90% | 3.60% | 5.50% | 7.30% | 7.30% | 21.80% | 3.60% |
| Cycling | 80.00% | 0.00% | 3.60% | 3.60% | 3.60% | 7.30% | 1.80% |
| Picnics, BBQs | 50.90% | 0.00% | 0.00% | 7.30% | 9.10% | 30.90% | 1.80% |
| Recreational fishing | 65.50% | 1.80% | 0.00% | 3.60% | 10.90% | 14.50% | 3.60% |
| Rowing, kayaking, canoeing | 83.60% | 0.00% | 1.80% | 0.00% | 3.60% | 3.60% | 7.30% |
| Scuba diving, snorkeling | 92.70% | 0.00% | 1.80% | 0.00% | 1.80% | 0.00% | 3.60% |
| Surfing, kite-surfing, sail boarding | 94.50% | 0.00% | 0.00% | 3.60% | 0.00% | 0.00% | 1.80% |
| Swimming | 70.90% | 1.80% | 3.60% | 5.50% | 5.50% | 9.10% | 3.60% |
| Enjoying nature e.g. birdwatching, conservation, photography, camping | 58.20% | 0.00% | 3.60% | 5.50% | 9.10% | 18.20% | 5.50% |
| For commuting or getting to work | 92.70% | 0.00% | 1.80% | 1.80% | 0.00% | 0.00% | 3.60% |

# 9.11 Pimpama Coomera Catchment

| Gender ratio | Frequency | Percent |
|---|---|---|
| Male | 85 | 46.7 |
| Female | 97 | 53.3 |
| Total | 182 | 100 |

**Education**

| | Frequency | Percent |
|---|---|---|
| Primary school | 1 | 0.5 |
| High school | 60 | 33 |
| Diploma / Certificate or equivalent | 50 | 27.5 |
| Apprenticeship or trade certificate or equivalent | 17 | 9.3 |
| Bachelor degree or equivalent | 37 | 20.3 |
| Postgraduate degree or equivalent | 15 | 8.2 |
| Other | 2 | 1.1 |
| Total | 182 | 100 |

**Lived in SEQ**

| | Frequency | Percent |
|---|---|---|
| Less than a year | 6 | 3.3 |
| 1-3 years | 16 | 8.8 |
| 4-6 years | 21 | 11.5 |
| 7-10 years | 17 | 9.3 |
| More than 10 years | 122 | 67 |
| Total | 182 | 100 |

**Employment**

| | Frequency | Percent |
|---|---|---|
| Retired | 52 | 28.6 |
| Carer | 3 | 1.6 |
| Full time student | 6 | 3.3 |
| Unemployed and not seeking work | 13 | 7.1 |
| Unemployed and seeking work | 13 | 7.1 |
| Part time employee | 29 | 15.9 |
| Full time work | 66 | 36.3 |
| Total | 182 | 100 |

**Employment industry**

| | Frequency | Percent |
|---|---|---|
| Agriculture, Forestry and Fishing, | 0 | 0 |
| Mining | 1 | 0.5 |
| Manufacturing | 9 | 4.9 |
| Electricity Gas and Water Supply | 2 | 1.1 |
| Construction and development | 3 | 1.6 |
| Wholesale trade | 4 | 2.2 |
| Retail Trade | 22 | 12.1 |
| Hospitality and Tourism | 17 | 9.3 |
| Transport and Storage | 12 | 6.6 |
| Communication Services | 3 | 1.6 |
| Finance and Insurance | 5 | 2.7 |
| Property and Business Services | 2 | 1.1 |
| Government Administration and Defence | 9 | 4.9 |
| Education | 12 | 6.6 |
| Health and Community Services | 14 | 7.7 |
| Cultural and Recreational Services | 0 | 0 |
| Personal and Other Services | 2 | 1.1 |
| I have not worked | 12 | 6.6 |
| I am retired and do not identify with any of these industries | 32 | 17.6 |
| Other - please provide | 21 | 11.5 |
| Total | 182 | 100 |

**Household Income**

| | Frequency | Percent |
|---|---|---|
| Under $25,000 | 17 | 9.3 |
| $25,001-$50,000 | 46 | 25.3 |
| $50,001-$75,000 | 28 | 15.4 |
| $75,001-$100,000 | 20 | 11 |
| $100,001-$150,000 | 30 | 16.5 |
| $150,001-$200,000 | 11 | 6 |
| $ Over $200,000 | 6 | 3.3 |
| Prefer not to say | 24 | 13.2 |
| Total | 182 | 100 |

| Pimpama | Strongly disagree | Disagree | Slightly disagree | Neither agree nor disagree | Slightly agree | Agree | Strongly agree |
|---|---|---|---|---|---|---|---|
| ENABLE_1 Suitable weather | 1.60% | 0.50% | 5.50% | 13.70% | 17.00% | 29.70% | 31.90% |
| ENABLE_2 Condition of water - cleanliness | 1.60% | 0.50% | 4.40% | 13.70% | 21.40% | 26.90% | 31.30% |
| ENABLE_3 Colour of water | 1.60% | 0.50% | 6.00% | 19.20% | 22.50% | 25.30% | 24.70% |
| ENABLE_4 Peaceful/quiet | 1.60% | 0.50% | 4.90% | 12.10% | 24.20% | 29.70% | 26.90% |
| ENABLE_5 Local beauty/scenery | 1.60% | 0.50% | 4.40% | 9.30% | 20.30% | 34.60% | 29.10% |
| ENABLE_6 Not crowded | 1.60% | 0.50% | 3.80% | 12.60% | 22.50% | 30.80% | 28.00% |
| ENABLE_7 Allow dogs | 16.50% | 11.00% | 10.40% | 19.80% | 14.30% | 11.00% | 17.00% |
| ENABLE_8 Parks and playgrounds | 3.80% | 5.50% | 11.00% | 21.40% | 18.70% | 20.90% | 18.70% |
| ENABLE_9 Picnic areas | 2.20% | 2.70% | 6.60% | 17.60% | 25.80% | 27.50% | 17.60% |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| ENABLE_10 Paths and walkways | 1.60% | 1.10% | 6.00% | 14.30% | 22.50% | 31.30% | 23.10% |
| ENABLE_11 Easy to get to | 2.20% | 0.00% | 5.50% | 10.40% | 20.90% | 35.20% | 25.80% |
| ENABLE_12 Shelter and shade | 2.70% | 1.60% | 5.50% | 11.50% | 19.20% | 29.70% | 29.70% |
| ENABLE_13 Toilets | 2.20% | 1.10% | 4.90% | 12.10% | 15.40% | 28.00% | 36.30% |
| ENABLE_14 Cleanliness of surrounding area | 2.20% | 0.00% | 2.70% | 10.40% | 19.20% | 31.90% | 33.50% |
| ENABLE_15 Access to waterway | 2.20% | 1.10% | 3.80% | 15.40% | 19.20% | 34.10% | 24.20% |
| ENABLE_16 Time availability | 2.20% | 0.50% | 5.50% | 16.50% | 23.10% | 27.50% | 24.70% |
| ENABLE_17 With family or friends | 3.80% | 1.10% | 7.10% | 20.90% | 20.30% | 25.80% | 20.90% |

| Pimpama | Never | Almost everyday | Every week | Every fortnight | Every month | Once or twice a year | Every few years |
|---|---|---|---|---|---|---|---|
| Boating, sailing | 66.50% | 1.10% | 2.70% | 3.30% | 6.60% | 15.40% | 4.40% |
| Jet skiing, Water skiing | 80.80% | 1.60% | 1.60% | 1.60% | 3.30% | 7.70% | 3.30% |
| Walking or running | 19.80% | 13.70% | 18.70% | 6.00% | 20.30% | 18.70% | 2.70% |
| Cycling | 65.90% | 2.70% | 4.90% | 3.30% | 9.30% | 9.90% | 3.80% |
| Picnics, BBQs | 28.00% | 0.00% | 6.00% | 6.60% | 22.00% | 32.40% | 4.90% |
| Recreational fishing | 58.80% | 1.60% | 6.60% | 4.40% | 11.00% | 13.70% | 3.80% |
| Rowing, kayaking, canoeing | 76.90% | 0.50% | 4.40% | 2.70% | 4.90% | 6.00% | 4.40% |
| Scuba diving, snorkeling | 84.60% | 0.50% | 1.10% | 2.20% | 2.20% | 5.50% | 3.80% |
| Surfing, kite-surfing, sail boarding | 86.80% | 0.00% | 1.10% | 3.80% | 1.60% | 3.30% | 3.30% |
| Swimming | 45.10% | 1.10% | 3.30% | 8.20% | 13.70% | 25.30% | 3.30% |
| Enjoying nature e.g. birdwatching, conservation, photography, camping | 35.70% | 3.30% | 7.10% | 10.40% | 15.90% | 22.00% | 5.50% |
| For commuting or getting to work | 78.00% | 3.30% | 2.20% | 5.50% | 4.90% | 3.80% | 2.20% |

# 9.12 Nerang Catchment

| Gender ratio | Frequency | Percent |
|---|---|---|
| Male | 98 | 45 |
| Female | 120 | 55 |
| Total | 218 | 100 |

**Education**

| | Frequency | Percent |
|---|---|---|
| Primary school | 1 | 0.5 |
| High school | 55 | 25.2 |
| Diploma / Certificate or equivalent | 58 | 26.6 |
| Apprenticeship or trade certificate or equivalent | 24 | 11 |
| Bachelor degree or equivalent | 64 | 29.4 |
| Postgraduate degree or equivalent | 16 | 7.3 |
| Other | | |
| Total | 218 | 100 |

**Lived in SEQ**

| | Frequency | Percent |
|---|---|---|
| Less than a year | 11 | 5 |
| 1-3 years | 21 | 9.6 |
| 4-6 years | 20 | 9.2 |
| 7-10 years | 23 | 10.6 |
| More than 10 years | 143 | 65.6 |
| Total | 218 | 100 |

**Employment**

| | Frequency | Percent |
|---|---|---|
| Retired | 64 | 29.4 |
| Carer | 5 | 2.3 |
| Full time student | 9 | 4.1 |
| Unemployed and not seeking work | 12 | 5.5 |
| Unemployed and seeking work | 11 | 5 |
| Part time employee | 44 | 20.2 |
| Full time work | 73 | 33.5 |
| Total | 218 | 100 |

**Employment industry**

| | Frequency | Percent |
|---|---|---|
| Agriculture, Forestry and Fishing, | 2 | 0.9 |
| Mining | 3 | 1.4 |
| Manufacturing | 4 | 1.8 |
| Electricity Gas and Water Supply | 1 | 0.5 |
| Construction and development | 8 | 3.7 |
| Wholesale trade | 3 | 1.4 |
| Retail Trade | 24 | 11 |
| Hospitality and Tourism | 24 | 11 |
| Transport and Storage | 4 | 1.8 |
| Communication Services | 3 | 1.4 |
| Finance and Insurance | 8 | 3.7 |
| Property and Business Services | 6 | 2.8 |
| Government Administration and Defence | 10 | 4.6 |

| | | |
|---|---|---|
| Education | 18 | 8.3 |
| Health and Community Services | 17 | 7.8 |
| Cultural and Recreational Services | 2 | 0.9 |
| Personal and Other Services | 10 | 4.6 |
| I have not worked | 8 | 3.7 |
| I am retired and do not identify with any of these industries | 32 | 14.7 |
| Other - please provide | 31 | 14.2 |
| Total | 218 | 100 |

**Household Income**

| | Frequency | Percent |
|---|---|---|
| Under $25,000 | 21 | 9.6 |
| $25,001-$50,000 | 46 | 21.1 |
| $50,001-$75,000 | 36 | 16.5 |
| $75,001-$100,000 | 33 | 15.1 |
| $100,001-$150,000 | 33 | 15.1 |
| $150,001-$200,000 | 7 | 3.2 |
| $ Over $200,000 | 8 | 3.7 |
| Prefer not to say | 34 | 15.6 |
| Total | 218 | 100 |

| Nerang | Strongly disagree | Disagree | Slightly disagree | Neither agree nor disagree | Slightly agree | Agree | Strongly agree |
|---|---|---|---|---|---|---|---|
| ENABLE_1 Suitable weather | 2.80% | 2.30% | 2.30% | 11.50% | 21.60% | 25.70% | 33.90% |
| ENABLE_2 Condition of water - cleanliness | 2.30% | 0.90% | 5.50% | 10.10% | 20.60% | 30.70% | 29.80% |
| ENABLE_3 Colour of water | 2.30% | 2.30% | 5.50% | 15.60% | 24.30% | 26.60% | 23.40% |
| ENABLE_4 Peaceful/quiet | 2.80% | 1.80% | 5.50% | 12.80% | 21.10% | 32.60% | 23.40% |
| ENABLE_5 Local beauty/scenery | 1.80% | 1.80% | 4.10% | 9.20% | 22.90% | 28.00% | 32.10% |
| ENABLE_6 Not crowded | 2.30% | 2.30% | 3.70% | 16.50% | 26.10% | 25.70% | 23.40% |
| ENABLE_7 Allow dogs | 17.40% | 8.70% | 11.00% | 24.30% | 13.80% | 13.30% | 11.50% |
| ENABLE_8 Parks and playgrounds | 6.40% | 6.00% | 7.80% | 25.20% | 28.40% | 15.10% | 11.00% |
| ENABLE_9 Picnic areas | 5.00% | 3.20% | 6.40% | 18.80% | 30.30% | 22.90% | 13.30% |
| ENABLE_10 Paths and walkways | 2.80% | 3.20% | 4.60% | 13.30% | 26.60% | 27.10% | 22.50% |
| ENABLE_11 Easy to get to | 2.30% | 0.90% | 2.80% | 8.70% | 29.40% | 29.80% | 26.10% |
| ENABLE_12 Shelter and shade | 1.80% | 2.30% | 4.60% | 14.20% | 27.10% | 25.70% | 24.30% |
| ENABLE_13 Toilets | 2.30% | 1.80% | 6.40% | 15.10% | 21.60% | 27.10% | 25.70% |
| ENABLE_14 Cleanliness of surrounding area | 1.80% | 1.40% | 1.80% | 11.00% | 21.60% | 30.30% | 32.10% |
| ENABLE_15 Access to waterway | 2.30% | 0.90% | 4.60% | 14.20% | 25.20% | 28.90% | 23.90% |
| ENABLE_16 Time availability | 3.20% | 1.40% | 5.00% | 16.50% | 22.00% | 33.00% | 18.80% |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| ENABLE_17 With family or friends | 4.10% | 2.80% | 6.90% | 21.10% | 23.90% | 24.80% | 16.50% |

| Nerang | Never | Almost everyday | Every week | Every fortnight | Every month | Once or twice a year | Every few years |
|---|---|---|---|---|---|---|---|
| Boating, sailing | 67.90% | 1.40% | 1.80% | 1.80% | 7.30% | 15.10% | 4.60% |
| Jet skiing, Water skiing | 83.90% | 0.90% | 1.80% | 1.80% | 1.80% | 6.40% | 3.20% |
| Walking or running | 16.50% | 16.10% | 19.70% | 11.90% | 13.80% | 20.20% | 1.80% |
| Cycling | 67.90% | 4.10% | 4.10% | 6.40% | 4.10% | 9.60% | 3.70% |
| Picnics, BBQs | 25.70% | 0.90% | 3.70% | 7.80% | 18.30% | 40.40% | 3.20% |
| Recreational fishing | 65.10% | 0.90% | 5.00% | 5.00% | 7.80% | 11.50% | 4.60% |
| Rowing, kayaking, canoeing | 76.60% | 1.40% | 2.80% | 3.20% | 5.50% | 7.80% | 2.80% |
| Scuba diving, snorkeling | 81.70% | 1.40% | 1.80% | 2.80% | 2.80% | 6.90% | 2.80% |
| Surfing, kite-surfing, sail boarding | 78.40% | 1.80% | 1.80% | 4.10% | 3.20% | 6.00% | 4.60% |
| Swimming | 38.50% | 3.20% | 6.00% | 7.30% | 15.60% | 27.10% | 2.30% |
| Enjoying nature e.g. birdwatching, conservation, photography, camping | 32.60% | 6.90% | 8.70% | 7.30% | 13.80% | 26.60% | 4.10% |
| For commuting or getting to work | 79.40% | 6.00% | 0.90% | 2.30% | 2.30% | 6.00% | 3.20% |

# 9.13 Tallebudgera Catchment

| Gender ratio | Frequency | Percent |
|---|---|---|
| Male | 23 | 35.9 |
| Female | 41 | 64.1 |
| Total | 64 | 100 |

**Education**

| | Frequency | Percent |
|---|---|---|
| Primary school | 0 | 0 |
| High school | 21 | 32.8 |
| Diploma / Certificate or equivalent | 18 | 28.1 |
| Apprenticeship or trade certificate or equivalent | 5 | 7.8 |
| Bachelor degree or equivalent | 13 | 20.3 |
| Postgraduate degree or equivalent | 6 | 9.4 |
| Other | 1 | 1.6 |
| Total | 64 | 100 |

**Lived in SEQ**

| | Frequency | Percent |
|---|---|---|
| Less than a year | 1 | 1.6 |
| 1-3 years | 3 | 4.7 |
| 4-6 years | 5 | 7.8 |
| 7-10 years | 4 | 6.3 |
| More than 10 years | 51 | 79.7 |
| Total | 64 | 100 |

**Employment**

| | Frequency | Percent |
|---|---|---|
| Retired | 21 | 32.8 |
| Carer | 1 | 1.6 |
| Full time student | 2 | 3.1 |
| Unemployed and not seeking work | 5 | 7.8 |
| Unemployed and seeking work | 3 | 4.7 |
| Part time employee | 12 | 18.8 |
| Full time work | 20 | 31.3 |
| Total | 64 | 100 |

**Employment industry**

| | Frequency | Percent |
|---|---|---|
| Agriculture, Forestry and Fishing, Mining | 1 | 1.6 |
| Manufacturing<br>Electricity Gas and Water Supply<br>Construction and development | 7 | 10.9 |
| Wholesale trade<br>Retail Trade | 9 | 14.1 |
| Hospitality and Tourism | 5 | 7.8 |
| Transport and Storage | 1 | 1.6 |
| Communication Services | 2 | 3.1 |
| Finance and Insurance | 1 | 1.6 |

| | | |
|---|---|---|
| Property and Business Services | 1 | 1.6 |
| Government Administration and Defence | 4 | 6.3 |
| Education | 4 | 6.3 |
| Health and Community Services | 9 | 14.1 |
| Cultural and Recreational Services | | |
| Personal and Other Services | 1 | 1.6 |
| I have not worked | | |
| I am retired and do not identify with any of these industries | 14 | 21.9 |
| Other - please provide | 5 | 7.8 |
| Total | 64 | 100 |

**Household Income**

| | Frequency | Percent |
|---|---|---|
| Under $25,000 | 5 | 7.8 |
| $25,001-$50,000 | 15 | 23.4 |
| $50,001-$75,000 | 9 | 14.1 |
| $75,001-$100,000 | 11 | 17.2 |
| $100,001-$150,000 | 10 | 15.6 |
| $150,001-$200,000 | 4 | 6.3 |
| $ Over $200,000 | 0 | 0 |
| Prefer not to say | 10 | 15.6 |
| Total | 64 | 100 |

| Tallebudgera | Strongly disagree | Disagree | Slightly disagree | Neither agree nor disagree | Slightly agree | Agree | Strongly agree |
|---|---|---|---|---|---|---|---|
| ENABLE_1 Suitable weather | 3.10% | 1.60% | 0.00% | 6.30% | 23.40% | 29.70% | 35.90% |
| ENABLE_2 Condition of water - cleanliness | 0.00% | 1.60% | 0.00% | 7.80% | 15.60% | 37.50% | 37.50% |
| ENABLE_3 Colour of water | 0.00% | 1.60% | 1.60% | 14.10% | 20.30% | 32.80% | 29.70% |
| ENABLE_4 Peaceful/quiet | 0.00% | 0.00% | 0.00% | 9.40% | 31.30% | 28.10% | 31.30% |
| ENABLE_5 Local beauty/scenery | 0.00% | 0.00% | 0.00% | 4.70% | 17.20% | 39.10% | 39.10% |
| ENABLE_6 Not crowded | 0.00% | 0.00% | 3.10% | 17.20% | 23.40% | 21.90% | 34.40% |
| ENABLE_7 Allow dogs | 17.20% | 14.10% | 6.30% | 25.00% | 7.80% | 9.40% | 20.30% |
| ENABLE_8 Parks and playgrounds | 3.10% | 4.70% | 9.40% | 18.80% | 21.90% | 15.60% | 26.60% |
| ENABLE_9 Picnic areas | 1.60% | 3.10% | 3.10% | 15.60% | 26.60% | 21.90% | 28.10% |
| ENABLE_10 Paths and walkways | 1.60% | 3.10% | 1.60% | 7.80% | 20.30% | 32.80% | 32.80% |
| ENABLE_11 Easy to get to | 0.00% | 1.60% | 3.10% | 7.80% | 14.10% | 37.50% | 35.90% |
| ENABLE_12 Shelter and shade | 0.00% | 0.00% | 4.70% | 12.50% | 23.40% | 29.70% | 29.70% |
| ENABLE_13 Toilets | 0.00% | 1.60% | 1.60% | 17.20% | 18.80% | 26.60% | 34.40% |
| ENABLE_14 Cleanliness of surrounding area | 0.00% | 1.60% | 0.00% | 4.70% | 23.40% | 35.90% | 34.40% |
| ENABLE_15 Access to waterway | 0.00% | 1.60% | 1.60% | 7.80% | 15.60% | 45.30% | 28.10% |
| ENABLE_16 Time availability | 0.00% | 1.60% | 4.70% | 14.10% | 10.90% | 39.10% | 29.70% |
| ENABLE_17 With family or friends | 1.60% | 0.00% | 3.10% | 17.20% | 12.50% | 43.80% | 21.90% |

| Tallebudgera | Never | Almost everyday | Every week | Every fortnight | Every month | Once or twice a year | Every few years |
|---|---|---|---|---|---|---|---|
| Boating, sailing | 65.60% | 0.00% | 1.60% | 1.60% | 4.70% | 17.20% | 9.40% |
| Jet skiing, Water skiing | 84.40% | 0.00% | 1.60% | 0.00% | 3.10% | 4.70% | 6.30% |
| Walking or running | 9.40% | 28.10% | 23.40% | 14.10% | 7.80% | 15.60% | 1.60% |
| Cycling | 54.70% | 6.30% | 6.30% | 1.60% | 9.40% | 15.60% | 6.30% |
| Picnics, BBQs | 20.30% | 0.00% | 1.60% | 12.50% | 32.80% | 28.10% | 4.70% |
| Recreational fishing | 62.50% | 1.60% | 3.10% | 1.60% | 4.70% | 20.30% | 6.30% |
| Rowing, kayaking, canoeing | 71.90% | 0.00% | 6.30% | 3.10% | 4.70% | 9.40% | 4.70% |
| Scuba diving, snorkeling | 82.80% | 0.00% | 0.00% | 1.60% | 4.70% | 6.30% | 4.70% |
| Surfing, kite-surfing, sail boarding | 75.00% | 4.70% | 0.00% | 1.60% | 7.80% | 7.80% | 3.10% |
| Swimming | 23.40% | 7.80% | 14.10% | 4.70% | 25.00% | 18.80% | 6.30% |
| Enjoying nature e.g. birdwatching, conservation, photography, camping | 29.70% | 14.10% | 10.90% | 10.90% | 12.50% | 17.20% | 4.70% |
| For commuting or getting to work | 76.60% | 7.80% | 3.10% | 0.00% | 0.00% | 7.80% | 4.70% |

# 9.14 Bremer Catchment

| Gender ratio | Frequency | Percent |
|---|---|---|
| Male | 46 | 42.6 |
| Female | 62 | 57.4 |
| Total | 108 | 100 |

**Education**

| | Frequency | Percent |
|---|---|---|
| Primary school | 2 | 1.9 |
| High school | 36 | 33.3 |
| Diploma / Certificate or equivalent | 40 | 37 |
| Apprenticeship or trade certificate or equivalent | 10 | 9.3 |
| Bachelor degree or equivalent | 16 | 14.8 |
| Postgraduate degree or equivalent | 3 | 2.8 |
| Other | 1 | 0.9 |
| Total | 108 | 100 |

**Lived in SEQ**

| | Frequency | Percent |
|---|---|---|
| Less than a year | 1 | 0.9 |
| 1-3 years | 9 | 8.3 |
| 4-6 years | 8 | 7.4 |
| 7-10 years | 12 | 11.1 |
| More than 10 years | 78 | 72.2 |
| Total | 108 | 100 |

**Employment**

| | Frequency | Percent |
|---|---|---|
| Retired | 29 | 26.9 |
| Carer | 7 | 6.5 |
| Full time student | 5 | 4.6 |
| Unemployed and not seeking work | 14 | 13 |
| Unemployed and seeking work | 9 | 8.3 |
| Part time employee | 11 | 10.2 |
| Full time work | 33 | 30.6 |
| Total | 108 | 100 |

**Employment industry**

| | Frequency | Percent |
|---|---|---|
| 21. Agriculture, Forestry and Fishing, 22. Mining | 3 | 2.8 |
| 23. Manufacturing | 10 | 9.3 |
| 24. Electricity Gas and Water Supply 25. Construction and development | | |
| 26. Wholesale trade | 2 | 1.9 |
| 27. Retail Trade | 9 | 8.3 |
| 28. Hospitality and Tourism | 3 | 2.8 |
| 29. Transport and Storage | 7 | 6.5 |

| | | | |
|---|---|---|---|
| 30. | Communication Services | | |
| 31. | Finance and Insurance | 3 | 2.8 |
| 32. | Property and Business Services | 3 | 2.8 |
| 33. | Government Administration and Defence | 10 | 9.3 |
| 34. | Education | 7 | 6.5 |
| 35. | Health and Community Services | 8 | 7.4 |
| 36. | Cultural and Recreational Services | | |
| 37. | Personal and Other Services | 4 | 3.7 |
| 38. | I have not worked | 12 | 11.1 |
| 39. | I am retired and do not identify with any of these industries | 16 | 14.8 |
| 40. | Other - please provide | 11 | 10.2 |
| Total | | 108 | 100 |

**Household Income**

| | Frequency | Percent |
|---|---|---|
| Under $25,000 | 12 | 11.1 |
| $25,001-$50,000 | 27 | 25 |
| $50,001-$75,000 | 23 | 21.3 |
| $75,001-$100,000 | 22 | 20.4 |
| $100,001-$150,000 | 9 | 8.3 |
| $150,001-$200,000 | 3 | 2.8 |
| $ Over $200,000 | | |
| Prefer not to say | 12 | 11.1 |
| Total | 108 | 100 |

| Bremer | Strongly disagree | Disagree | Slightly disagree | Neither agree nor disagree | Slightly agree | Agree | Strongly agree |
|---|---|---|---|---|---|---|---|
| ENABLE_1 Suitable weather | 1.90% | 2.80% | 0.90% | 26.90% | 24.10% | 23.10% | 20.40% |
| ENABLE_2 Condition of water - cleanliness | 1.90% | 2.80% | 1.90% | 23.10% | 20.40% | 27.80% | 22.20% |
| ENABLE_3 Colour of water | 1.90% | 1.90% | 8.30% | 24.10% | 21.30% | 25.00% | 17.60% |
| ENABLE_4 Peaceful/quiet | 1.90% | 0.90% | 6.50% | 18.50% | 24.10% | 26.90% | 21.30% |
| ENABLE_5 Local beauty/scenery | 1.90% | 0.90% | 5.60% | 17.60% | 23.10% | 30.60% | 20.40% |
| ENABLE_6 Not crowded | 0.90% | 1.90% | 3.70% | 20.40% | 22.20% | 30.60% | 20.40% |
| ENABLE_7 Allow dogs | 11.10% | 13.90% | 12.00% | 25.00% | 21.30% | 6.50% | 10.20% |
| ENABLE_8 Parks and playgrounds | 2.80% | 5.60% | 10.20% | 28.70% | 23.10% | 17.60% | 12.00% |
| ENABLE_9 Picnic areas | 3.70% | 5.60% | 7.40% | 21.30% | 23.10% | 24.10% | 14.80% |
| ENABLE_10 Paths and walkways | 1.90% | 3.70% | 7.40% | 21.30% | 27.80% | 24.10% | 13.90% |
| ENABLE_11 Easy to get to | 0.90% | 1.90% | 3.70% | 26.90% | 24.10% | 25.90% | 16.70% |
| ENABLE_12 Shelter and shade | 1.90% | 2.80% | 7.40% | 23.10% | 22.20% | 24.10% | 18.50% |
| ENABLE_13 Toilets | 3.70% | 2.80% | 4.60% | 19.40% | 23.10% | 20.40% | 25.90% |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| ENABLE_14 Cleanliness of surrounding area | 0.90% | 1.90% | 4.60% | 21.30% | 20.40% | 31.50% | 19.40% |
| ENABLE_15 Access to waterway | 1.90% | 0.90% | 5.60% | 23.10% | 23.10% | 29.60% | 15.70% |
| ENABLE_16 Time availability | 0.90% | 1.90% | 3.70% | 25.90% | 25.90% | 25.90% | 15.70% |
| ENABLE_17 With family or friends | 4.60% | 1.90% | 5.60% | 26.90% | 29.60% | 17.60% | 13.90% |

| Bremer | Never | Almost everyday | Every week | Every fortnight | Every month | Once or twice a year | Every few years |
|---|---|---|---|---|---|---|---|
| Boating, sailing | 81.50% | 0.90% | 0.00% | 0.00% | 2.80% | 8.30% | 6.50% |
| Jet skiing, Water skiing | 87.00% | 0.00% | 0.90% | 0.00% | 0.90% | 4.60% | 6.50% |
| Walking or running | 47.20% | 3.70% | 3.70% | 3.70% | 9.30% | 25.00% | 7.40% |
| Cycling | 75.90% | 0.00% | 4.60% | 0.90% | 3.70% | 6.50% | 8.30% |
| Picnics, BBQs | 45.40% | 0.00% | 1.90% | 1.90% | 9.30% | 35.20% | 6.50% |
| Recreational fishing | 66.70% | 0.00% | 0.90% | 2.80% | 6.50% | 14.80% | 8.30% |
| Rowing, kayaking, canoeing | 78.70% | 1.90% | 0.90% | 1.90% | 2.80% | 7.40% | 6.50% |
| Scuba diving, snorkeling | 87.00% | 0.00% | 0.90% | 0.00% | 1.90% | 2.80% | 7.40% |
| Surfing, kite-surfing, sail boarding | 87.00% | 1.90% | 0.00% | 0.00% | 0.90% | 4.60% | 5.60% |
| Swimming | 66.70% | 0.00% | 2.80% | 2.80% | 7.40% | 13.90% | 6.50% |
| Enjoying nature e.g. birdwatching, conservation, photography, camping | 44.40% | 2.80% | 1.90% | 3.70% | 10.20% | 30.60% | 6.50% |
| For commuting or getting to work | 81.50% | 1.90% | 1.90% | 0.00% | 2.80% | 7.40% | 4.60% |

# 9.15 Lockyer Catchment

| Gender ratio | Frequency | Percent |
|---|---|---|
| Male | 52 | 43 |
| Female | 69 | 57 |
| Total | 121 | 100 |

**Education**

| | Frequency | Percent |
|---|---|---|
| Primary school | 6 | 5 |
| High school | 38 | 31.4 |
| Diploma / Certificate or equivalent | 33 | 27.3 |
| Apprenticeship or trade certificate or equivalent | 9 | 7.4 |
| Bachelor degree or equivalent | 21 | 17.4 |
| Postgraduate degree or equivalent | 13 | 10.7 |
| Other | 1 | 0.8 |
| Total | 121 | 100 |

**Lived in SEQ**

| | Frequency | Percent |
|---|---|---|
| Less than a year | 2 | 1.7 |
| 1-3 years | 8 | 6.6 |
| 4-6 years | 3 | 2.5 |
| 7-10 years | 9 | 7.4 |
| More than 10 years | 99 | 81.8 |
| Total | 121 | 100 |

**Employment**

| | Frequency | Percent |
|---|---|---|
| Retired | 32 | 26.4 |
| Carer | 1 | 0.8 |
| Full time student | 7 | 5.8 |
| Unemployed and not seeking work | 6 | 5 |
| Unemployed and seeking work | 12 | 9.9 |
| Part time employee | 22 | 18.2 |
| Full time work | 41 | 33.9 |
| Total | 121 | 100 |

**Employment industry**

| | Frequency | Percent |
|---|---|---|
| 41. Agriculture, Forestry and Fishing, | 4 | 3.3 |
| 42. Mining | 1 | 0.8 |
| 43. Manufacturing | 4 | 3.3 |
| 44. Electricity Gas and Water Supply | 2 | 1.7 |
| 45. Construction and development | 4 | 3.3 |
| 46. Wholesale trade | 1 | 0.8 |
| 47. Retail Trade | 8 | 6.6 |
| 48. Hospitality and Tourism | 7 | 5.8 |
| 49. Transport and Storage | 7 | 5.8 |
| 50. Communication Services | 1 | 0.8 |
| 51. Finance and Insurance | 4 | 3.3 |

| | | |
|---|---|---|
| 52. Property and Business Services | 3 | 2.5 |
| 53. Government Administration and Defence | 10 | 8.3 |
| 54. Education | 13 | 10.7 |
| 55. Health and Community Services | 15 | 12.4 |
| 56. Cultural and Recreational Services | | |
| 57. Personal and Other Services | 4 | 3.3 |
| 58. I have not worked | 8 | 6.6 |
| 59. I am retired and do not identify with any of these industries | 12 | 9.9 |
| 60. Other - please provide | 13 | 10.7 |
| Total | 121 | 100 |

**Household Income**

| | Frequency | Percent |
|---|---|---|
| Under $25,000 | 15 | 12.4 |
| $25,001-$50,000 | 29 | 24 |
| $50,001-$75,000 | 19 | 15.7 |
| $75,001-$100,000 | 16 | 13.2 |
| $100,001-$150,000 | 16 | 13.2 |
| $150,001-$200,000 | 8 | 6.6 |
| $ Over $200,000 | | |
| Prefer not to say | 18 | 14.9 |
| Total | 121 | 100 |

Lockyer

| Lockyer | Strongly disagree | Disagree | Slightly disagree | Neither agree nor disagree | Slightly agree | Agree | Strongly agree |
|---|---|---|---|---|---|---|---|
| ENABLE_1 Suitable weather | 1.70% | 1.70% | 5.00% | 19.00% | 18.20% | 25.60% | 28.90% |
| ENABLE_2 Condition of water - cleanliness | 1.70% | 0.80% | 7.40% | 14.90% | 24.00% | 24.80% | 26.40% |
| ENABLE_3 Colour of water | 1.70% | 0.80% | 6.60% | 20.70% | 29.80% | 24.00% | 16.50% |
| ENABLE_4 Peaceful/quiet | 1.70% | 0.80% | 5.80% | 14.00% | 21.50% | 27.30% | 28.90% |
| ENABLE_5 Local beauty/scenery | 1.70% | 0.00% | 5.80% | 10.70% | 22.30% | 30.60% | 28.90% |
| ENABLE_6 Not crowded | 1.70% | 0.00% | 5.80% | 17.40% | 25.60% | 28.90% | 20.70% |
| ENABLE_7 Allow dogs | 14.00% | 13.20% | 9.90% | 22.30% | 16.50% | 10.70% | 13.20% |
| ENABLE_8 Parks and playgrounds | 5.80% | 2.50% | 9.10% | 20.70% | 29.80% | 19.80% | 12.40% |
| ENABLE_9 Picnic areas | 4.10% | 1.70% | 5.80% | 14.90% | 25.60% | 30.60% | 17.40% |
| ENABLE_10 Paths and walkways | 3.30% | 3.30% | 5.00% | 15.70% | 28.90% | 28.90% | 14.90% |
| ENABLE_11 Easy to get to | 1.70% | 0.80% | 5.00% | 15.70% | 26.40% | 31.40% | 19.00% |
| ENABLE_12 Shelter and shade | 1.70% | 1.70% | 5.80% | 14.00% | 24.80% | 33.10% | 19.00% |
| ENABLE_13 Toilets | 3.30% | 1.70% | 5.00% | 11.60% | 24.80% | 25.60% | 28.10% |
| ENABLE_14 Cleanliness of surrounding area | 2.50% | 0.00% | 5.00% | 8.30% | 23.10% | 37.20% | 24.00% |
| ENABLE_15 Access to waterway | 2.50% | 0.00% | 6.60% | 14.90% | 21.50% | 32.20% | 22.30% |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| ENABLE_16 Time availability | 1.70% | 0.80% | 5.00% | 19.00% | 19.80% | 31.40% | 22.30% |
| ENABLE_17 With family or friends | 3.30% | 1.70% | 5.00% | 15.70% | 21.50% | 28.90% | 24.00% |

| Lockyer | Never | Almost everyday | Every week | Every fortnight | Every month | Once or twice a year | Every few years |
|---|---|---|---|---|---|---|---|
| Boating, sailing | 83.50% | 0.00% | 0.00% | 0.80% | 5.00% | 7.40% | 3.30% |
| Jet skiing, Water skiing | 92.60% | 0.00% | 0.00% | 0.80% | 2.50% | 1.70% | 2.50% |
| Walking or running | 50.40% | 6.60% | 5.00% | 3.30% | 9.90% | 22.30% | 2.50% |
| Cycling | 86.80% | 0.80% | 0.80% | 1.70% | 3.30% | 4.10% | 2.50% |
| Picnics, BBQs | 44.60% | 0.00% | 0.00% | 4.10% | 19.00% | 28.10% | 4.10% |
| Recreational fishing | 71.90% | 0.00% | 0.00% | 0.00% | 10.70% | 11.60% | 5.80% |
| Rowing, kayaking, canoeing | 83.50% | 0.00% | 0.00% | 0.00% | 4.10% | 9.10% | 3.30% |
| Scuba diving, snorkeling | 94.20% | 0.00% | 0.00% | 0.80% | 0.80% | 2.50% | 1.70% |
| Surfing, kite-surfing, sail boarding | 95.00% | 0.00% | 0.80% | 0.00% | 0.80% | 1.70% | 1.70% |
| Swimming | 74.40% | 0.80% | 0.80% | 2.50% | 5.80% | 12.40% | 3.30% |
| Enjoying nature e.g. birdwatching, conservation, photography, camping | 50.40% | 2.50% | 1.70% | 2.50% | 17.40% | 21.50% | 4.10% |
| For commuting or getting to work | 89.30% | 2.50% | 1.70% | 0.80% | 1.70% | 2.50% | 1.70% |

# 9.16 Mid Brisbane Catchment

*caution with interpretation as low numbers

| Gender ratio | Frequency | Percent |
|---|---|---|
| Male | 4 | 28.6 |
| Female | 10 | 71.4 |
| Total | 14 | 100 |

**Education**

| | Frequency | Percent |
|---|---|---|
| Primary school | | |
| High school | 6 | 42.9 |
| Diploma / Certificate or equivalent | 4 | 28.6 |
| Apprenticeship or trade certificate or equivalent | 2 | 14.3 |
| Bachelor degree or equivalent | 2 | 14.3 |
| Postgraduate degree or equivalent | | |
| Other | | |
| Total | 14 | 100 |

**Lived in SEQ**

| | Frequency | Percent |
|---|---|---|
| Less than a year | | |
| 1-3 years | 1 | 7.1 |
| 4-6 years | | |
| 7-10 years | 2 | 14.3 |
| More than 10 years | 11 | 78.6 |
| Total | 14 | 100 |

**Employment**

| | Frequency | Percent |
|---|---|---|
| Retired | 2 | 14.3 |
| Carer | 1 | 7.1 |
| Full time student | 1 | 7.1 |
| Unemployed and not seeking work | 1 | 7.1 |
| Unemployed and seeking work | 3 | 21.4 |
| Part time employee | 3 | 21.4 |
| Full time work | 3 | 21.4 |
| Total | 14 | 100 |

**Employment industry**

| | Frequency | Percent |
|---|---|---|
| Agriculture, Forestry and Fishing, Mining | | |
| Manufacturing | 2 | 14.3 |
| Electricity Gas and Water Supply | | |
| Construction and development | 1 | 7.1 |
| Wholesale trade | | |
| Retail Trade | | |
| Hospitality and Tourism | 1 | 7.1 |
| Transport and Storage | | |
| Communication Services | | |

| | | |
|---|---|---|
| Finance and Insurance | 1 | 7.1 |
| Property and Business Services | | |
| Government Administration and Defence | | |
| Education | 1 | 7.1 |
| Health and Community Services | 3 | 21.4 |
| Cultural and Recreational Services | | |
| Personal and Other Services | | |
| I have not worked | 2 | 14.3 |
| I am retired and do not identify with any of these industries | 1 | 7.1 |
| Other - please provide | 2 | 14.3 |
| Total | 14 | 100 |

**Household Income**

| | Frequency | Percent |
|---|---|---|
| Under $25,000 | 1 | 7.1 |
| $25,001-$50,000 | 3 | 21.4 |
| $50,001-$75,000 | 2 | 14.3 |
| $75,001-$100,000 | 2 | 14.3 |
| $100,001-$150,000 | 1 | 7.1 |
| $150,001-$200,000 | 1 | 7.1 |
| $ Over $200,000 | 1 | 7.1 |
| Prefer not to say | 3 | 21.4 |
| Total | 14 | 100 |

| Mid Brisbane | Strongly disagree | Disagree | Slightly disagree | Neither agree nor disagree | Slightly agree | Agree | Strongly agree |
|---|---|---|---|---|---|---|---|
| ENABLE_1 Suitable weather | 0.00% | 0.00% | 0.00% | 21.40% | 21.40% | 21.40% | 35.70% |
| ENABLE_2 Condition of water - cleanliness | 0.00% | 7.10% | 7.10% | 14.30% | 14.30% | 21.40% | 35.70% |
| ENABLE_3 Colour of water | 0.00% | 7.10% | 7.10% | 14.30% | 21.40% | 21.40% | 28.60% |
| ENABLE_4 Peaceful/quiet | 0.00% | 0.00% | 7.10% | 7.10% | 28.60% | 28.60% | 28.60% |
| ENABLE_5 Local beauty/scenery | 0.00% | 7.10% | 0.00% | 7.10% | 35.70% | 21.40% | 28.60% |
| ENABLE_6 Not crowded | 0.00% | 0.00% | 0.00% | 14.30% | 35.70% | 21.40% | 28.60% |
| ENABLE_7 Allow dogs | 14.30% | 0.00% | 14.30% | 28.60% | 0.00% | 28.60% | 14.30% |
| ENABLE_8 Parks and playgrounds | 0.00% | 7.10% | 7.10% | 7.10% | 28.60% | 28.60% | 21.40% |
| ENABLE_9 Picnic areas | 0.00% | 0.00% | 7.10% | 14.30% | 28.60% | 28.60% | 21.40% |
| ENABLE_10 Paths and walkways | 0.00% | 7.10% | 7.10% | 7.10% | 35.70% | 21.40% | 21.40% |
| ENABLE_11 Easy to get to | 0.00% | 0.00% | 14.30% | 0.00% | 35.70% | 21.40% | 28.60% |
| ENABLE_12 Shelter and shade | 0.00% | 0.00% | 0.00% | 14.30% | 35.70% | 21.40% | 28.60% |
| ENABLE_13 Toilets | 0.00% | 0.00% | 7.10% | 7.10% | 35.70% | 21.40% | 28.60% |
| ENABLE_14 Cleanliness of surrounding area | 0.00% | 0.00% | 0.00% | 7.10% | 42.90% | 28.60% | 21.40% |
| ENABLE_15 Access to waterway | 0.00% | 0.00% | 0.00% | 7.10% | 35.70% | 35.70% | 21.40% |
| ENABLE_16 Time availability | 0.00% | 0.00% | 7.10% | 7.10% | 35.70% | 14.30% | 35.70% |
| ENABLE_17 With family or friends | 0.00% | 0.00% | 0.00% | 14.30% | 28.60% | 21.40% | 35.70% |

| Mid Brisbane | Never | Almost everyday | Every week | Every fortnight | Every month | Once or twice a year | Every few years |
|---|---|---|---|---|---|---|---|
| Boating, sailing | 64.30% | 0.00% | 7.10% | 0.00% | 21.40% | 0.00% | 7.10% |
| Jet skiing, Water skiing | 78.60% | 0.00% | 7.10% | 0.00% | 7.10% | 7.10% | 0.00% |
| Walking or running | 35.70% | 0.00% | 7.10% | 7.10% | 21.40% | 28.60% | 0.00% |
| Cycling | 85.70% | 0.00% | 0.00% | 7.10% | 7.10% | 0.00% | 0.00% |
| Picnics, BBQs | 0.00% | 0.00% | 0.00% | 0.00% | 50.00% | 50.00% | 0.00% |
| Recreational fishing | 42.90% | 0.00% | 0.00% | 7.10% | 28.60% | 21.40% | 0.00% |
| Rowing, kayaking, canoeing | 71.40% | 0.00% | 0.00% | 0.00% | 21.40% | 7.10% | 0.00% |
| Scuba diving, snorkeling | 85.70% | 0.00% | 0.00% | 0.00% | 14.30% | 0.00% | 0.00% |
| Surfing, kite-surfing, sail boarding | 85.70% | 0.00% | 0.00% | 7.10% | 7.10% | 0.00% | 0.00% |
| Swimming | 42.90% | 0.00% | 7.10% | 7.10% | 21.40% | 21.40% | 0.00% |
| Enjoying nature e.g. birdwatching, conservation, photography, camping | 35.70% | 0.00% | 14.30% | 0.00% | 14.30% | 35.70% | 0.00% |
| For commuting or getting to work | 85.70% | 0.00% | 0.00% | 7.10% | 7.10% | 0.00% | 0.00% |

# 9.17 Upper Brisbane Catchment

* caution – low numbers

| Gender ratio | Frequency | Percent |
|---|---|---|
| Male | 10 | 38.5 |
| Female | 16 | 61.5 |
| Total | 26 | 100 |

**Education**

| | Frequency | Percent |
|---|---|---|
| Primary school | 1 | 3.8 |
| High school | 9 | 34.6 |
| Diploma / Certificate or equivalent | 7 | 26.9 |
| Apprenticeship or trade certificate or equivalent | 2 | 7.7 |
| Bachelor degree or equivalent | 4 | 15.4 |
| Postgraduate degree or equivalent | 2 | 7.7 |
| Other | 1 | 3.8 |
| Total | 26 | 100 |

**Lived in SEQ**

| | Frequency | Percent |
|---|---|---|
| Less than a year | 2 | 7.7 |
| 1-3 years | | |
| 4-6 years | 4 | 15.4 |
| 7-10 years | 1 | 3.8 |
| More than 10 years | 19 | 73.1 |
| Total | 26 | 100 |

**Employment**

| | Frequency | Percent |
|---|---|---|
| Retired | 6 | 23.1 |
| Carer | | |
| Full time student | | |
| Unemployed and not seeking work | 1 | 3.8 |
| Unemployed and seeking work | 5 | 19.2 |
| Part time employee | 8 | 30.8 |
| Full time work | 6 | 23.1 |
| Total | 26 | 100 |

**Employment industry**

| | Frequency | Percent |
|---|---|---|
| Agriculture, Forestry and Fishing, | 2 | 7.7 |
| Mining | | |
| Manufacturing | | |
| Electricity Gas and Water Supply | | |
| Construction and development | 1 | 3.8 |
| Wholesale trade | | |
| Retail Trade | 5 | 19.2 |
| Hospitality and Tourism | 1 | 3.8 |
| Transport and Storage | 1 | 3.8 |
| Communication Services | 1 | 3.8 |
| Finance and Insurance | | |
| Property and Business Services | 1 | 3.8 |
| Government Administration and Defence | | |
| Education | 4 | 15.4 |
| Health and Community Services | 1 | 3.8 |
| Cultural and Recreational Services | 1 | 3.8 |
| Personal and Other Services | | |
| I have not worked | 2 | 7.7 |
| I am retired and do not identify with any of these industries | 5 | 19.2 |
| Other - please provide | 1 | 3.8 |
| Total | 26 | 100 |

**Household Income**

| | Frequency | Percent |
|---|---|---|
| Under $25,000 | 3 | 11.5 |
| $25,001-$50,000 | 11 | 42.3 |
| $50,001-$75,000 | 4 | 15.4 |
| $75,001-$100,000 | 3 | 11.5 |
| $100,001-$150,000 | 2 | 7.7 |
| $150,001-$200,000 | | |
| $ Over $200,000 | | |
| Prefer not to say | 3 | 11.5 |
| Total | 26 | 100 |

Upper Brisbane

| | Strongly disagree | Disagree | Slightly disagree | Neither agree nor disagree | Slightly agree | Agree | Strongly agree |
|---|---|---|---|---|---|---|---|
| ENABLE_1 Suitable weather | 0.00% | 0.00% | 0.00% | 15.40% | 30.80% | 30.80% | 23.10% |
| ENABLE_2 Condition of water - cleanliness | 0.00% | 0.00% | 0.00% | 19.20% | 34.60% | 26.90% | 19.20% |
| ENABLE_3 Colour of water | 0.00% | 0.00% | 3.80% | 23.10% | 26.90% | 26.90% | 19.20% |
| ENABLE_4 Peaceful/quiet | 0.00% | 0.00% | 0.00% | 23.10% | 42.30% | 15.40% | 19.20% |
| ENABLE_5 Local beauty/scenery | 0.00% | 0.00% | 3.80% | 15.40% | 38.50% | 15.40% | 26.90% |
| ENABLE_6 Not crowded | 0.00% | 0.00% | 3.80% | 15.40% | 46.20% | 15.40% | 19.20% |
| ENABLE_7 Allow dogs | 19.20% | 3.80% | 7.70% | 19.20% | 15.40% | 15.40% | 19.20% |
| ENABLE_8 Parks and playgrounds | 0.00% | 7.70% | 11.50% | 19.20% | 34.60% | 11.50% | 15.40% |
| ENABLE_9 Picnic areas | 3.80% | 0.00% | 3.80% | 23.10% | 34.60% | 15.40% | 19.20% |
| ENABLE_10 Paths and walkways | 0.00% | 3.80% | 0.00% | 30.80% | 26.90% | 19.20% | 19.20% |
| ENABLE_11 Easy to get to | 0.00% | 0.00% | 0.00% | 23.10% | 19.20% | 30.80% | 26.90% |
| ENABLE_12 Shelter and shade | 0.00% | 0.00% | 3.80% | 19.20% | 34.60% | 23.10% | 19.20% |
| ENABLE_13 Toilets | 0.00% | 0.00% | 3.80% | 11.50% | 30.80% | 19.20% | 34.60% |
| ENABLE_14 Cleanliness of surrounding area | 0.00% | 0.00% | 3.80% | 15.40% | 26.90% | 30.80% | 23.10% |
| ENABLE_15 Access to waterway | 0.00% | 0.00% | 3.80% | 23.10% | 34.60% | 19.20% | 19.20% |
| ENABLE_16 Time availability | 0.00% | 3.80% | 3.80% | 30.80% | 15.40% | 30.80% | 15.40% |
| ENABLE_17 With family or friends | 0.00% | 3.80% | 3.80% | 23.10% | 15.40% | 34.60% | 19.20% |

Upper Brisbane

| | Never | Almost everyday | Every week | Every fortnight | Every month | Once or twice a year | Every few years |
|---|---|---|---|---|---|---|---|
| Boating, sailing | 88.50% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 11.50% |
| Jet skiing, Water skiing | 100.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| Walking or running | 53.80% | 3.80% | 3.80% | 3.80% | 19.20% | 11.50% | 3.80% |
| Cycling | 80.80% | 0.00% | 0.00% | 0.00% | 7.70% | 3.80% | 7.70% |
| Picnics, BBQs | 34.60% | 0.00% | 0.00% | 3.80% | 15.40% | 38.50% | 7.70% |
| Recreational fishing | 61.50% | 0.00% | 0.00% | 0.00% | 11.50% | 26.90% | 0.00% |
| Rowing, kayaking, canoeing | 80.80% | 0.00% | 0.00% | 0.00% | 7.70% | 7.70% | 3.80% |
| Scuba diving, snorkeling | 96.20% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 3.80% |
| Surfing, kite-surfing, sail boarding | 92.30% | 0.00% | 0.00% | 0.00% | 0.00% | 3.80% | 3.80% |
| Swimming | 61.50% | 0.00% | 0.00% | 3.80% | 7.70% | 15.40% | 11.50% |
| Enjoying nature e.g. birdwatching, conservation, photography, camping | 30.80% | 0.00% | 0.00% | 11.50% | 11.50% | 42.30% | 3.80% |
| For commuting or getting to work | 88.50% | 0.00% | 0.00% | 7.70% | 3.80% | 0.00% | 0.00% |

# 9.18 Stanley Catchment

* caution low numbers

| Gender ratio | Frequency | Percent |
|---|---|---|
| Male | 9 | 40.9 |
| Female | 13 | 59.1 |
| Total | 22 | 100 |

**Education**

| | Frequency | Percent |
|---|---|---|
| Primary school | | |
| High school | 10 | 45.5 |
| Diploma / Certificate or equivalent | 4 | 18.2 |
| Apprenticeship or trade certificate or equivalent | 1 | 4.5 |
| Bachelor degree or equivalent | 5 | 22.7 |
| Postgraduate degree or equivalent | 2 | 9.1 |
| Other | | |
| Total | 22 | 100 |

**Lived in SEQ**

| | Frequency | Percent |
|---|---|---|
| Less than a year | | |
| 1-3 years | 1 | 4.5 |
| 4-6 years | 1 | 4.5 |
| 7-10 years | | |
| More than 10 years | 20 | 90.9 |
| Total | 22 | 100 |

**Employment**

| | Frequency | Percent |
|---|---|---|
| Retired | 9 | 40.9 |
| Carer | | |
| Full time student | 1 | 4.5 |
| Unemployed and not seeking work | 2 | 9.1 |
| Unemployed and seeking work | 3 | 13.6 |
| Part time employee | 3 | 13.6 |
| Full time work | 4 | 18.2 |
| Total | 22 | 100 |

**Employment industry**

| | | |
|---|---|---|
| Agriculture, Forestry and Fishing, Mining | 3 | 13.6 |
| Manufacturing | | |
| Electricity Gas and Water Supply | | |
| Construction and development | 1 | 4.5 |
| Wholesale trade | | |
| Retail Trade | | |
| Hospitality and Tourism | | |
| Transport and Storage | | |

| | | |
|---|---|---|
| Communication Services | | |
| Finance and Insurance | | |
| Property and Business Services | | |
| Government Administration and Defence | 4 | 18.2 |
| Education | | |
| Health and Community Services | 2 | 9.1 |
| Cultural and Recreational Services | | |
| Personal and Other Services | | |
| I have not worked | 1 | 4.5 |
| I am retired and do not identify with any of these industries | 7 | 31.8 |
| Other - please provide | 4 | 18.2 |
| Total | 22 | 100 |

**Household Income**

| | Frequency | Percent |
|---|---|---|
| Under $25,000 | 4 | 18.2 |
| $25,001-$50,000 | 7 | 31.8 |
| $50,001-$75,000 | 1 | 4.5 |
| $75,001-$100,000 | 4 | 18.2 |
| $100,001-$150,000 | 1 | 4.5 |
| $150,001-$200,000 | 1 | 4.5 |
| $ Over $200,000 | 1 | 4.5 |
| Prefer not to say | 3 | 13.6 |
| Total | 22 | 100 |

Stanley

| | Strongly disagree | Disagree | Slightly disagree | Neither agree nor disagree | Slightly agree | Agree | Strongly agree |
|---|---|---|---|---|---|---|---|
| ENABLE_1 Suitable weather | 0.00% | 0.00% | 4.50% | 18.20% | 22.70% | 27.30% | 27.30% |
| ENABLE_2 Condition of water - cleanliness | 0.00% | 0.00% | 4.50% | 13.60% | 18.20% | 22.70% | 40.90% |
| ENABLE_3 Colour of water | 0.00% | 4.50% | 9.10% | 4.50% | 18.20% | 27.30% | 36.40% |
| ENABLE_4 Peaceful/quiet | 0.00% | 4.50% | 4.50% | 4.50% | 13.60% | 31.80% | 40.90% |
| ENABLE_5 Local beauty/scenery | 0.00% | 0.00% | 4.50% | 4.50% | 22.70% | 31.80% | 36.40% |
| ENABLE_6 Not crowded | 4.50% | 0.00% | 13.60% | 0.00% | 22.70% | 31.80% | 27.30% |
| ENABLE_7 Allow dogs | 18.20% | 22.70% | 4.50% | 9.10% | 9.10% | 18.20% | 18.20% |
| ENABLE_8 Parks and playgrounds | 9.10% | 0.00% | 13.60% | 9.10% | 22.70% | 22.70% | 22.70% |
| ENABLE_9 Picnic areas | 4.50% | 0.00% | 4.50% | 18.20% | 22.70% | 31.80% | 18.20% |
| ENABLE_10 Paths and walkways | 4.50% | 0.00% | 4.50% | 4.50% | 22.70% | 40.90% | 22.70% |
| ENABLE_11 Easy to get to | 0.00% | 4.50% | 4.50% | 4.50% | 13.60% | 54.50% | 18.20% |
| ENABLE_12 Shelter and shade | 4.50% | 0.00% | 0.00% | 9.10% | 18.20% | 40.90% | 27.30% |
| ENABLE_13 Toilets | 4.50% | 4.50% | 9.10% | 0.00% | 9.10% | 40.90% | 31.80% |
| ENABLE_14 Cleanliness of surrounding area | 0.00% | 0.00% | 4.50% | 9.10% | 13.60% | 40.90% | 31.80% |
| ENABLE_15 Access to waterway | 0.00% | 4.50% | 0.00% | 13.60% | 13.60% | 40.90% | 27.30% |
| ENABLE_16 Time availability | 0.00% | 0.00% | 4.50% | 27.30% | 13.60% | 31.80% | 22.70% |
| ENABLE_17 With family or friends | 0.00% | 4.50% | 4.50% | 27.30% | 4.50% | 27.30% | 31.80% |

Stanley

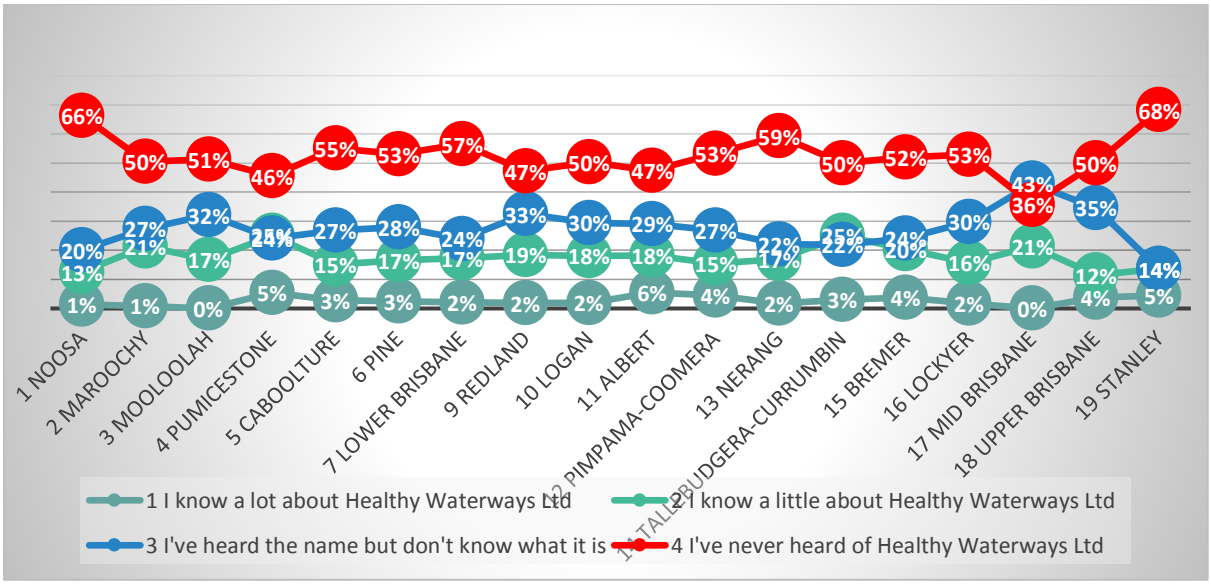
| | Never | Almost everyday | Every week | Every fortnight | Every month | Once or twice a year | Every few years |
|---|---|---|---|---|---|---|---|
| Boating, sailing | 86.40% | 4.50% | 0.00% | 4.50% | 0.00% | 4.50% | 0.00% |
| Jet skiing, Water skiing | 90.90% | 0.00% | 4.50% | 0.00% | 4.50% | 0.00% | 0.00% |
| Walking or running | 22.70% | 9.10% | 0.00% | 9.10% | 13.60% | 40.90% | 4.50% |
| Cycling | 81.80% | 0.00% | 4.50% | 0.00% | 0.00% | 13.60% | 0.00% |
| Picnics, BBQs | 36.40% | 0.00% | 0.00% | 0.00% | 9.10% | 50.00% | 4.50% |
| Recreational fishing | 72.70% | 0.00% | 0.00% | 0.00% | 9.10% | 9.10% | 9.10% |
| Rowing, kayaking, canoeing | 81.80% | 4.50% | 0.00% | 4.50% | 0.00% | 9.10% | 0.00% |
| Scuba diving, snorkeling | 90.90% | 0.00% | 0.00% | 0.00% | 0.00% | 4.50% | 4.50% |
| Surfing, kite-surfing, sail boarding | 86.40% | 0.00% | 0.00% | 0.00% | 4.50% | 4.50% | 4.50% |
| Swimming | 63.60% | 4.50% | 0.00% | 4.50% | 9.10% | 18.20% | 0.00% |
| Enjoying nature e.g. birdwatching, conservation, photography, camping | 27.30% | 13.60% | 0.00% | 4.50% | 13.60% | 27.30% | 13.60% |
| For commuting or getting to work | 95.50% | 0.00% | 0.00% | 0.00% | 0.00% | 4.50% | 0.00% |

# 10. Healthy Waterways – Brand Awareness – SEQ and by catchment

This question asked respondents how familiar they were with Healthy Waterways Ltd. Nearly 26% of respondents indicated they had heard of Healthy Waterways, however 54.3% indicated they had never heard of Healthy Waterways Ltd. This suggests an opportunity to increase brand awareness of Healthy Waterways and its associated programs in the future.

| | Frequency | Percent |
|---|---|---|
| I know a lot about Healthy Waterways Ltd | 77 | 2.4 |
| I know a little about Healthy Waterways Ltd | 571 | 17.5 |
| I've heard the name but don't know what it is | 844 | 25.9 |
| I've never heard of Healthy Waterways Ltd | 1771 | 54.3 |
| Total | 3263 | 100.0 |

At the catchment level, brand familiarity remained generally consistent, ranging from 36% (Mid Brisbane) to 68% (Stanley) never hearing of Healthy Waterways. While some brand familiarity ranged from 43% (Mid Brisbane) to 14% (Stanley).



# 11. Conclusion

The 2016 social impact report investigated the role of waterways in the lives of residents in SEQ, particularly their uses at a local and SEQ level, and the influence of condition on their views and values of waterways. Similar to findings reported in the 2015 social science survey (Johnston & Beatson, 2015), respondents confirmed waterways as valuable and important to their lives. Respondents particularly confirmed the importance of their local waterways, with the high levels of use in a range of activities. While variations across catchments were not surprising, the results were also consistent with relevant findings from 2015.

Based on the finding in this report a number of recommendations are offered. Further research and resources may be required to implement these recommendations:

- Work with key catchment areas to understand and improve on perceptions of satisfaction, accessibility and useability. While generally catchments overall reported fair to high levels of satisfaction, accessibility and useability, key catchments such as Bremer and Albert reported lower levels. This is consistent with the 2015 report card. A recommendation is that further research is conducted with this catchment to identify specific sources of these low levels to allow mitigating actions and improvement in these areas.
- Focus on local waterways across all catchments – the high levels of use of local waterways for a range of activities suggests strong endorsement and the ongoing requirement to maintain facilities (amenities) and conditions.
- Enablers and Barriers to use – the findings suggest that infrastructure (toilets, pathways, shade), access, and cleanliness were key enablers for waterway use. These three areas should be a priority for local waterway investment or ongoing maintenance.
- Waterway condition was found that by small increments in some conditions, influenced the likelihood of use. So for some waterways, slight improvements in surrounds, amenities, or water clarity will increase likelihood of use.
- Water literacy. While there were strong results suggesting relatively high literacy, the high standard deviation suggests there are wide differences in catchments. There is an opportunity, for example, for the use of pesticides, and information about how water is treated, to be the basis of an education campaign to improve literacy and knowledge of these impacts on waterways. Knowledge of a catchment found only 59% giving the correct answer. This presents a more immediate education need, given the associated impacts on key populated waterways.
- Waterway preference was dominated by beaches and freshwater creeks. It may be that wetlands are highlighted as an alternative destination through education campaigns.
- Level of concern by industry sector offers key opportunities in both areas. While employees in the mining, agriculture and resources areas believe their industry is proactive, opportunities within for example, finance and insurance and others, to conceptualise how these industries can tangibly contribute to waterway management is recommended.
- Third Place offers a way of communicating the value of waterways to locals to encourage them to ‘escape’ from their lives.
- Education about the importance of conditions for usage and an opportunity to educate residents about what to expect from different waterways and associated conditions.

# Appendix A – 2016 Catchment Postcodes

| Suburb | Catchment | Postcode |
|---|---|---|
| BRISBANE CITY, BRISBANE CITY | Lower Brisbane | 4000 |
| BOWEN HILLS, BRISBANE CITY | Lower Brisbane | 4000 |
| FORTITUDE VALLEY, BRISBANE CITY | Lower Brisbane | 4000 |
| MILTON, BRISBANE CITY | Lower Brisbane | 4000 |
| PADDINGTON, BRISBANE CITY | Lower Brisbane | 4000 |
| RED HILL, BRISBANE CITY | Lower Brisbane | 4000 |
| PETRIE TERRACE, BRISBANE CITY | Lower Brisbane | 4000 |
| KELVIN GROVE, BRISBANE CITY | Lower Brisbane | 4000 |
| SPRING HILL, BRISBANE CITY | Lower Brisbane | 4000 |
| FORTITUDE VALLEY, BRISBANE CITY | Lower Brisbane | 4005 |
| NEW FARM, BRISBANE CITY | Lower Brisbane | 4005 |
| TENERIFFE, BRISBANE CITY | Lower Brisbane | 4005 |
| ALBION, BRISBANE CITY | Lower Brisbane | 4006 |
| BRISBANE CITY, BRISBANE CITY | Lower Brisbane | 4006 |
| BOWEN HILLS, BRISBANE CITY | Lower Brisbane | 4006 |
| HERSTON, BRISBANE CITY | Lower Brisbane | 4006 |
| FORTITUDE VALLEY, BRISBANE CITY | Lower Brisbane | 4006 |
| NEW FARM, BRISBANE CITY | Lower Brisbane | 4006 |
| NEWSTEAD, BRISBANE CITY | Lower Brisbane | 4006 |
| KELVIN GROVE, BRISBANE CITY | Lower Brisbane | 4006 |
| WILSTON, BRISBANE CITY | Lower Brisbane | 4006 |
| SPRING HILL, BRISBANE CITY | Lower Brisbane | 4006 |
| WINDSOR, BRISBANE CITY | Lower Brisbane | 4006 |
| TENERIFFE, BRISBANE CITY | Lower Brisbane | 4006 |
| ALBION, BRISBANE CITY | Lower Brisbane | 4007 |
| ASCOT, BRISBANE CITY | Lower Brisbane | 4007 |
| CLAYFIELD, BRISBANE CITY | Lower Brisbane | 4007 |
| HENDRA, BRISBANE CITY | Lower Brisbane | 4007 |
| HAMILTON, BRISBANE CITY | Lower Brisbane | 4007 |
| EAGLE FARM, BRISBANE CITY | Lower Brisbane | 4007 |
| ASCOT, BRISBANE CITY | Lower Brisbane | 4008 |
| BANYO, BRISBANE CITY | Lower Brisbane | 4008 |
| BRISBANE AIRPORT, BRISBANE CITY | Lower Brisbane | 4008 |
| HENDRA, BRISBANE CITY | Lower Brisbane | 4008 |
| EAGLE FARM, BRISBANE CITY | Lower Brisbane | 4008 |
| NORTHGATE, BRISBANE CITY | Lower Brisbane | 4008 |
| PINKENBA, BRISBANE CITY | Lower Brisbane | 4008 |
| NUNDAH, BRISBANE CITY | Lower Brisbane | 4008 |
| NUDGEE BEACH, BRISBANE CITY | Lower Brisbane | 4008 |
| NUDGEE, BRISBANE CITY | Lower Brisbane | 4008 |
| ASCOT, BRISBANE CITY | Lower Brisbane | 4009 |
| BRISBANE AIRPORT, BRISBANE CITY | Lower Brisbane | 4009 |
| HAMILTON, BRISBANE CITY | Lower Brisbane | 4009 |

| | | |
|---|---|---|
| *EAGLE FARM, BRISBANE CITY* | Lower Brisbane | 4009 |
| *PINKENBA, BRISBANE CITY* | Lower Brisbane | 4009 |
| *ALBION, BRISBANE CITY* | Lower Brisbane | 4010 |
| *ASCOT, BRISBANE CITY* | Lower Brisbane | 4010 |
| *BOWEN HILLS, BRISBANE CITY* | Lower Brisbane | 4010 |
| *CLAYFIELD, BRISBANE CITY* | Lower Brisbane | 4010 |
| *HAMILTON, BRISBANE CITY* | Lower Brisbane | 4010 |
| *NEWSTEAD, BRISBANE CITY* | Lower Brisbane | 4010 |
| *WINDSOR, BRISBANE CITY* | Lower Brisbane | 4010 |
| *WOOLOOWIN, BRISBANE CITY* | Lower Brisbane | 4010 |
| *ALBION, BRISBANE CITY* | Lower Brisbane | 4011 |
| *ASCOT, BRISBANE CITY* | Lower Brisbane | 4011 |
| *CLAYFIELD, BRISBANE CITY* | Lower Brisbane | 4011 |
| *HENDRA, BRISBANE CITY* | Lower Brisbane | 4011 |
| *EAGLE FARM, BRISBANE CITY* | Lower Brisbane | 4011 |
| *NUNDAH, BRISBANE CITY* | Lower Brisbane | 4011 |
| *KALINGA, BRISBANE CITY* | Lower Brisbane | 4011 |
| *WOOLOOWIN, BRISBANE CITY* | Lower Brisbane | 4011 |
| *CHERMSIDE, BRISBANE CITY* | Lower Brisbane | 4012 |
| *CLAYFIELD, BRISBANE CITY* | Lower Brisbane | 4012 |
| *GEEBUNG, BRISBANE CITY* | Lower Brisbane | 4012 |
| *NORTHGATE, BRISBANE CITY* | Lower Brisbane | 4012 |
| *NUNDAH, BRISBANE CITY* | Lower Brisbane | 4012 |
| *KEDRON, BRISBANE CITY* | Lower Brisbane | 4012 |
| *KALINGA, BRISBANE CITY* | Lower Brisbane | 4012 |
| *VIRGINIA, BRISBANE CITY* | Lower Brisbane | 4012 |
| *WAVELL HEIGHTS, BRISBANE CITY* | Lower Brisbane | 4012 |
| *BANYO, BRISBANE CITY* | Lower Brisbane | 4013 |
| *NORTHGATE, BRISBANE CITY* | Lower Brisbane | 4013 |
| *NUNDAH, BRISBANE CITY* | Lower Brisbane | 4013 |
| *VIRGINIA, BRISBANE CITY* | Lower Brisbane | 4013 |
| *BANYO, BRISBANE CITY* | Lower Brisbane | 4014 |
| *BRISBANE AIRPORT, BRISBANE CITY* | Lower Brisbane | 4014 |
| *BOONDALL, BRISBANE CITY* | Lower Brisbane | 4014 |
| *GEEBUNG, BRISBANE CITY* | Lower Brisbane | 4014 |
| *NORTHGATE, BRISBANE CITY* | Lower Brisbane | 4014 |
| *NUDGEE BEACH, BRISBANE CITY* | Lower Brisbane | 4014 |
| *NUDGEE, BRISBANE CITY* | Lower Brisbane | 4014 |
| *VIRGINIA, BRISBANE CITY* | Lower Brisbane | 4014 |
| *WAVELL HEIGHTS, BRISBANE CITY* | Lower Brisbane | 4014 |
| *SHORNCLIFFE, BRISBANE CITY* | Lower Brisbane | 4014 |
| *BRACKEN RIDGE, BRISBANE CITY* | Lower Brisbane | 4017 |
| *BOONDALL, BRISBANE CITY* | Lower Brisbane | 4017 |
| *BRIGHTON, BRISBANE CITY* | Lower Brisbane | 4017 |
| *FITZGIBBON, BRISBANE CITY* | Lower Brisbane | 4017 |
| *DEAGON, BRISBANE CITY* | Lower Brisbane | 4017 |

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| *NUDGEE BEACH, BRISBANE CITY* | Lower Brisbane | 4017 |
| *TAIGUM, BRISBANE CITY* | Lower Brisbane | 4017 |
| *SHORNCLIFFE, BRISBANE CITY* | Lower Brisbane | 4017 |
| *SANDGATE, BRISBANE CITY* | Lower Brisbane | 4017 |
| *BALD HILLS, BRISBANE CITY* | Pine | 4017 |
| *BRACKEN RIDGE, BRISBANE CITY* | Pine | 4017 |
| *BRIGHTON, BRISBANE CITY* | Pine | 4017 |
| *GRIFFIN, MORETON BAY REGIONAL* | Pine | 4017 |
| *BALD HILLS, BRISBANE CITY* | Lower Brisbane | 4018 |
| *BRACKEN RIDGE, BRISBANE CITY* | Lower Brisbane | 4018 |
| *BOONDALL, BRISBANE CITY* | Lower Brisbane | 4018 |
| *CARSELDINE, BRISBANE CITY* | Lower Brisbane | 4018 |
| *FITZGIBBON, BRISBANE CITY* | Lower Brisbane | 4018 |
| *DEAGON, BRISBANE CITY* | Lower Brisbane | 4018 |
| *ZILLMERE, BRISBANE CITY* | Lower Brisbane | 4018 |
| *TAIGUM, BRISBANE CITY* | Lower Brisbane | 4018 |
| *BALD HILLS, BRISBANE CITY* | Pine | 4018 |
| *BRACKEN RIDGE, BRISBANE CITY* | Pine | 4018 |
| *FITZGIBBON, BRISBANE CITY* | Pine | 4018 |
| *CLONTARF, MORETON BAY REGIONAL* | Pine | 4019 |
| *REDCLIFFE, MORETON BAY REGIONAL* | Pine | 4019 |
| *MARGATE, MORETON BAY REGIONAL* | Pine | 4019 |
| *WOODY POINT, MORETON BAY REGIONAL* | Pine | 4019 |
| *NEWPORT, MORETON BAY REGIONAL* | Pine | 4020 |
| *REDCLIFFE, MORETON BAY REGIONAL* | Pine | 4020 |
| *KIPPA-RING, MORETON BAY REGIONAL* | Pine | 4020 |
| *MARGATE, MORETON BAY REGIONAL* | Pine | 4020 |
| *SCARBOROUGH, MORETON BAY REGIONAL* | Pine | 4020 |
| *CLONTARF, MORETON BAY REGIONAL* | Pine | 4021 |
| *NEWPORT, MORETON BAY REGIONAL* | Pine | 4021 |
| *REDCLIFFE, MORETON BAY REGIONAL* | Pine | 4021 |
| *KIPPA-RING, MORETON BAY REGIONAL* | Pine | 4021 |
| *MARGATE, MORETON BAY REGIONAL* | Pine | 4021 |
| *ROTHWELL, MORETON BAY REGIONAL* | Pine | 4021 |
| *CLONTARF, MORETON BAY REGIONAL* | Pine | 4022 |
| *DECEPTION BAY, MORETON BAY REGIONAL* | Pine | 4022 |
| *MANGO HILL, MORETON BAY REGIONAL* | Pine | 4022 |
| *KIPPA-RING, MORETON BAY REGIONAL* | Pine | 4022 |
| *NORTH LAKES, MORETON BAY REGIONAL* | Pine | 4022 |
| *ROTHWELL, MORETON BAY REGIONAL* | Pine | 4022 |
| *BULWER, BRISBANE CITY* | Moreton Island | 4025 |
| *COWAN, BRISBANE CITY* | Moreton Island | 4025 |
| *MORETON ISLAND, BRISBANE CITY* | Moreton Island | 4025 |
| *MORETON BAY, BRISBANE CITY* | Moreton Island | 4025 |
| *KOORINGAL, BRISBANE CITY* | Moreton Island | 4025 |
| *ALBION, BRISBANE CITY* | Lower Brisbane | 4030 |

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| *BOWEN HILLS, BRISBANE CITY* | Lower Brisbane | 4030 |
| *CLAYFIELD, BRISBANE CITY* | Lower Brisbane | 4030 |
| *HERSTON, BRISBANE CITY* | Lower Brisbane | 4030 |
| *LUTWYCHE, BRISBANE CITY* | Lower Brisbane | 4030 |
| *GORDON PARK, BRISBANE CITY* | Lower Brisbane | 4030 |
| *GRANGE, BRISBANE CITY* | Lower Brisbane | 4030 |
| *NUNDAH, BRISBANE CITY* | Lower Brisbane | 4030 |
| *KEDRON, BRISBANE CITY* | Lower Brisbane | 4030 |
| *KALINGA, BRISBANE CITY* | Lower Brisbane | 4030 |
| *WILSTON, BRISBANE CITY* | Lower Brisbane | 4030 |
| *WINDSOR, BRISBANE CITY* | Lower Brisbane | 4030 |
| *WOOLOOWIN, BRISBANE CITY* | Lower Brisbane | 4030 |
| *WAVELL HEIGHTS, BRISBANE CITY* | Lower Brisbane | 4030 |
| *CHERMSIDE, BRISBANE CITY* | Lower Brisbane | 4031 |
| *LUTWYCHE, BRISBANE CITY* | Lower Brisbane | 4031 |
| *GORDON PARK, BRISBANE CITY* | Lower Brisbane | 4031 |
| *GRANGE, BRISBANE CITY* | Lower Brisbane | 4031 |
| *KEDRON, BRISBANE CITY* | Lower Brisbane | 4031 |
| *KALINGA, BRISBANE CITY* | Lower Brisbane | 4031 |
| *WAVELL HEIGHTS, BRISBANE CITY* | Lower Brisbane | 4031 |
| *STAFFORD HEIGHTS, BRISBANE CITY* | Lower Brisbane | 4031 |
| *STAFFORD, BRISBANE CITY* | Lower Brisbane | 4031 |
| *ASPLEY, BRISBANE CITY* | Lower Brisbane | 4032 |
| *CHERMSIDE WEST, BRISBANE CITY* | Lower Brisbane | 4032 |
| *CHERMSIDE, BRISBANE CITY* | Lower Brisbane | 4032 |
| *MCDOWALL, BRISBANE CITY* | Lower Brisbane | 4032 |
| *WAVELL HEIGHTS, BRISBANE CITY* | Lower Brisbane | 4032 |
| *ASPLEY, BRISBANE CITY* | Lower Brisbane | 4034 |
| *BALD HILLS, BRISBANE CITY* | Lower Brisbane | 4034 |
| *BANYO, BRISBANE CITY* | Lower Brisbane | 4034 |
| *BOONDALL, BRISBANE CITY* | Lower Brisbane | 4034 |
| *BRIDGEMAN DOWNS, BRISBANE CITY* | Lower Brisbane | 4034 |
| *CARSELDINE, BRISBANE CITY* | Lower Brisbane | 4034 |
| *CHERMSIDE WEST, BRISBANE CITY* | Lower Brisbane | 4034 |
| *CHERMSIDE, BRISBANE CITY* | Lower Brisbane | 4034 |
| *GEEBUNG, BRISBANE CITY* | Lower Brisbane | 4034 |
| *FITZGIBBON, BRISBANE CITY* | Lower Brisbane | 4034 |
| *DEAGON, BRISBANE CITY* | Lower Brisbane | 4034 |
| *NUDGEE BEACH, BRISBANE CITY* | Lower Brisbane | 4034 |
| *NUDGEE, BRISBANE CITY* | Lower Brisbane | 4034 |
| *MCDOWALL, BRISBANE CITY* | Lower Brisbane | 4034 |
| *VIRGINIA, BRISBANE CITY* | Lower Brisbane | 4034 |
| *ZILLMERE, BRISBANE CITY* | Lower Brisbane | 4034 |
| *WAVELL HEIGHTS, BRISBANE CITY* | Lower Brisbane | 4034 |
| *TAIGUM, BRISBANE CITY* | Lower Brisbane | 4034 |
| *SHORNCLIFFE, BRISBANE CITY* | Lower Brisbane | 4034 |

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| *SANDGATE, BRISBANE CITY* | Lower Brisbane | 4034 |
| *BALD HILLS, BRISBANE CITY* | Pine | 4034 |
| *BRIDGEMAN DOWNS, BRISBANE CITY* | Pine | 4034 |
| *CARSELDINE, BRISBANE CITY* | Pine | 4034 |
| *ASPLEY, BRISBANE CITY* | Lower Brisbane | 4035 |
| *BALD HILLS, BRISBANE CITY* | Lower Brisbane | 4035 |
| *BRIDGEMAN DOWNS, BRISBANE CITY* | Lower Brisbane | 4035 |
| *CARSELDINE, BRISBANE CITY* | Lower Brisbane | 4035 |
| *MCDOWALL, BRISBANE CITY* | Lower Brisbane | 4035 |
| *ALBANY CREEK, MORETON BAY REGIONAL* | Pine | 4035 |
| *BALD HILLS, BRISBANE CITY* | Pine | 4035 |
| *BRIDGEMAN DOWNS, BRISBANE CITY* | Pine | 4035 |
| *BRENDALE, MORETON BAY REGIONAL* | Pine | 4035 |
| *BUNYA, MORETON BAY REGIONAL* | Pine | 4035 |
| *CARSELDINE, BRISBANE CITY* | Pine | 4035 |
| *EATONS HILL, MORETON BAY REGIONAL* | Pine | 4035 |
| *MCDOWALL, BRISBANE CITY* | Pine | 4035 |
| *BALD HILLS, BRISBANE CITY* | Lower Brisbane | 4036 |
| *CARSELDINE, BRISBANE CITY* | Lower Brisbane | 4036 |
| *BALD HILLS, BRISBANE CITY* | Pine | 4036 |
| *BRACKEN RIDGE, BRISBANE CITY* | Pine | 4036 |
| *BRIDGEMAN DOWNS, BRISBANE CITY* | Pine | 4036 |
| *BRIGHTON, BRISBANE CITY* | Pine | 4036 |
| *BRENDALE, MORETON BAY REGIONAL* | Pine | 4036 |
| *CARSELDINE, BRISBANE CITY* | Pine | 4036 |
| *GRIFFIN, MORETON BAY REGIONAL* | Pine | 4036 |
| *LAWNTON, MORETON BAY REGIONAL* | Pine | 4036 |
| *STRATHPINE, MORETON BAY REGIONAL* | Pine | 4036 |
| *ALBANY CREEK, MORETON BAY REGIONAL* | Pine | 4037 |
| *BUNYA, MORETON BAY REGIONAL* | Pine | 4037 |
| *CASHMERE, MORETON BAY REGIONAL* | Pine | 4037 |
| *CLEAR MOUNTAIN, MORETON BAY REGIONAL* | Pine | 4037 |
| *EATONS HILL, MORETON BAY REGIONAL* | Pine | 4037 |
| *DRAPER, MORETON BAY REGIONAL* | Pine | 4037 |
| *WARNER, MORETON BAY REGIONAL* | Pine | 4037 |
| *ALDERLEY, BRISBANE CITY* | Lower Brisbane | 4051 |
| *ASHGROVE, BRISBANE CITY* | Lower Brisbane | 4051 |
| *NEWMARKET, BRISBANE CITY* | Lower Brisbane | 4051 |
| *HERSTON, BRISBANE CITY* | Lower Brisbane | 4051 |
| *LUTWYCHE, BRISBANE CITY* | Lower Brisbane | 4051 |
| *GAYTHORNE, BRISBANE CITY* | Lower Brisbane | 4051 |
| *GORDON PARK, BRISBANE CITY* | Lower Brisbane | 4051 |
| *GRANGE, BRISBANE CITY* | Lower Brisbane | 4051 |
| *ENOGGERA, BRISBANE CITY* | Lower Brisbane | 4051 |
| *EVERTON PARK, BRISBANE CITY* | Lower Brisbane | 4051 |
| *RED HILL, BRISBANE CITY* | Lower Brisbane | 4051 |

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| *KELVIN GROVE, BRISBANE CITY* | Lower Brisbane | 4051 |
| *MITCHELTON, BRISBANE CITY* | Lower Brisbane | 4051 |
| *KEPERRA, BRISBANE CITY* | Lower Brisbane | 4051 |
| *WILSTON, BRISBANE CITY* | Lower Brisbane | 4051 |
| *WINDSOR, BRISBANE CITY* | Lower Brisbane | 4051 |
| *THE GAP, BRISBANE CITY* | Lower Brisbane | 4051 |
| *STAFFORD, BRISBANE CITY* | Lower Brisbane | 4051 |
| *ARANA HILLS, MORETON BAY REGIONAL* | Lower Brisbane | 4053 |
| *ALDERLEY, BRISBANE CITY* | Lower Brisbane | 4053 |
| *ASPLEY, BRISBANE CITY* | Lower Brisbane | 4053 |
| *BRIDGEMAN DOWNS, BRISBANE CITY* | Lower Brisbane | 4053 |
| *BUNYA, MORETON BAY REGIONAL* | Lower Brisbane | 4053 |
| *CHERMSIDE WEST, BRISBANE CITY* | Lower Brisbane | 4053 |
| *CHERMSIDE, BRISBANE CITY* | Lower Brisbane | 4053 |
| *GAYTHORNE, BRISBANE CITY* | Lower Brisbane | 4053 |
| *GORDON PARK, BRISBANE CITY* | Lower Brisbane | 4053 |
| *GRANGE, BRISBANE CITY* | Lower Brisbane | 4053 |
| *ENOGGERA, BRISBANE CITY* | Lower Brisbane | 4053 |
| *EVERTON HILLS, MORETON BAY REGIONAL* | Lower Brisbane | 4053 |
| *EVERTON PARK, BRISBANE CITY* | Lower Brisbane | 4053 |
| *KEDRON, BRISBANE CITY* | Lower Brisbane | 4053 |
| *MITCHELTON, BRISBANE CITY* | Lower Brisbane | 4053 |
| *KEPERRA, BRISBANE CITY* | Lower Brisbane | 4053 |
| *MCDOWALL, BRISBANE CITY* | Lower Brisbane | 4053 |
| *STAFFORD HEIGHTS, BRISBANE CITY* | Lower Brisbane | 4053 |
| *STAFFORD, BRISBANE CITY* | Lower Brisbane | 4053 |
| *ALBANY CREEK, MORETON BAY REGIONAL* | Pine | 4053 |
| *BRIDGEMAN DOWNS, BRISBANE CITY* | Pine | 4053 |
| *BUNYA, MORETON BAY REGIONAL* | Pine | 4053 |
| *EVERTON HILLS, MORETON BAY REGIONAL* | Pine | 4053 |
| *MCDOWALL, BRISBANE CITY* | Pine | 4053 |
| *ARANA HILLS, MORETON BAY REGIONAL* | Lower Brisbane | 4054 |
| *FERNY GROVE, BRISBANE CITY* | Lower Brisbane | 4054 |
| *ENOGGERA, BRISBANE CITY* | Lower Brisbane | 4054 |
| *EVERTON HILLS, MORETON BAY REGIONAL* | Lower Brisbane | 4054 |
| *FERNY HILLS, MORETON BAY REGIONAL* | Lower Brisbane | 4054 |
| *MITCHELTON, BRISBANE CITY* | Lower Brisbane | 4054 |
| *KEPERRA, BRISBANE CITY* | Lower Brisbane | 4054 |
| *THE GAP, BRISBANE CITY* | Lower Brisbane | 4054 |
| *UPPER KEDRON, BRISBANE CITY* | Lower Brisbane | 4054 |
| *ARANA HILLS, MORETON BAY REGIONAL* | Pine | 4054 |
| *BUNYA, MORETON BAY REGIONAL* | Pine | 4054 |
| *EVERTON HILLS, MORETON BAY REGIONAL* | Pine | 4054 |
| *FERNY HILLS, MORETON BAY REGIONAL* | Pine | 4054 |
| *ARANA HILLS, MORETON BAY REGIONAL* | Lower Brisbane | 4055 |
| *BUNYA, MORETON BAY REGIONAL* | Lower Brisbane | 4055 |

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| *CAMP MOUNTAIN, MORETON BAY REGIONAL* | Lower Brisbane | 4055 |
| *FERNY GROVE, BRISBANE CITY* | Lower Brisbane | 4055 |
| *ENOGGERA RESERVOIR, BRISBANE CITY* | Lower Brisbane | 4055 |
| *EVERTON HILLS, MORETON BAY REGIONAL* | Lower Brisbane | 4055 |
| *FERNY HILLS, MORETON BAY REGIONAL* | Lower Brisbane | 4055 |
| *KEPERRA, BRISBANE CITY* | Lower Brisbane | 4055 |
| *THE GAP, BRISBANE CITY* | Lower Brisbane | 4055 |
| *UPPER KEDRON, BRISBANE CITY* | Lower Brisbane | 4055 |
| *ARANA HILLS, MORETON BAY REGIONAL* | Pine | 4055 |
| *ALBANY CREEK, MORETON BAY REGIONAL* | Pine | 4055 |
| *BUNYA, MORETON BAY REGIONAL* | Pine | 4055 |
| *CAMP MOUNTAIN, MORETON BAY REGIONAL* | Pine | 4055 |
| *EATONS HILL, MORETON BAY REGIONAL* | Pine | 4055 |
| *DRAPER, MORETON BAY REGIONAL* | Pine | 4055 |
| *EVERTON HILLS, MORETON BAY REGIONAL* | Pine | 4055 |
| *FERNY HILLS, MORETON BAY REGIONAL* | Pine | 4055 |
| *SAMFORD VALLEY, MORETON BAY REGIONAL* | Pine | 4055 |
| *UPPER KEDRON, BRISBANE CITY* | Pine | 4055 |
| *ASHGROVE, BRISBANE CITY* | Lower Brisbane | 4059 |
| *BARDON, BRISBANE CITY* | Lower Brisbane | 4059 |
| *NEWMARKET, BRISBANE CITY* | Lower Brisbane | 4059 |
| *HERSTON, BRISBANE CITY* | Lower Brisbane | 4059 |
| *PADDINGTON, BRISBANE CITY* | Lower Brisbane | 4059 |
| *RED HILL, BRISBANE CITY* | Lower Brisbane | 4059 |
| *PETRIE TERRACE, BRISBANE CITY* | Lower Brisbane | 4059 |
| *KELVIN GROVE, BRISBANE CITY* | Lower Brisbane | 4059 |
| *WILSTON, BRISBANE CITY* | Lower Brisbane | 4059 |
| *SPRING HILL, BRISBANE CITY* | Lower Brisbane | 4059 |
| *ALDERLEY, BRISBANE CITY* | Lower Brisbane | 4060 |
| *ASHGROVE, BRISBANE CITY* | Lower Brisbane | 4060 |
| *BARDON, BRISBANE CITY* | Lower Brisbane | 4060 |
| *NEWMARKET, BRISBANE CITY* | Lower Brisbane | 4060 |
| *ENOGGERA, BRISBANE CITY* | Lower Brisbane | 4060 |
| *RED HILL, BRISBANE CITY* | Lower Brisbane | 4060 |
| *ASHGROVE, BRISBANE CITY* | Lower Brisbane | 4061 |
| *BARDON, BRISBANE CITY* | Lower Brisbane | 4061 |
| *BROOKFIELD, BRISBANE CITY* | Lower Brisbane | 4061 |
| *ENOGGERA RESERVOIR, BRISBANE CITY* | Lower Brisbane | 4061 |
| *ENOGGERA, BRISBANE CITY* | Lower Brisbane | 4061 |
| *MOUNT COOT-THA, BRISBANE CITY* | Lower Brisbane | 4061 |
| *KEPERRA, BRISBANE CITY* | Lower Brisbane | 4061 |
| *THE GAP, BRISBANE CITY* | Lower Brisbane | 4061 |
| *UPPER KEDRON, BRISBANE CITY* | Lower Brisbane | 4061 |
| *AUCHENFLOWER, BRISBANE CITY* | Lower Brisbane | 4064 |
| *BARDON, BRISBANE CITY* | Lower Brisbane | 4064 |
| *BRISBANE CITY, BRISBANE CITY* | Lower Brisbane | 4064 |

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| *MILTON, BRISBANE CITY* | Lower Brisbane | 4064 |
| *PADDINGTON, BRISBANE CITY* | Lower Brisbane | 4064 |
| *RED HILL, BRISBANE CITY* | Lower Brisbane | 4064 |
| *PETRIE TERRACE, BRISBANE CITY* | Lower Brisbane | 4064 |
| *ASHGROVE, BRISBANE CITY* | Lower Brisbane | 4065 |
| *AUCHENFLOWER, BRISBANE CITY* | Lower Brisbane | 4065 |
| *BARDON, BRISBANE CITY* | Lower Brisbane | 4065 |
| *PADDINGTON, BRISBANE CITY* | Lower Brisbane | 4065 |
| *MOUNT COOT-THA, BRISBANE CITY* | Lower Brisbane | 4065 |
| *THE GAP, BRISBANE CITY* | Lower Brisbane | 4065 |
| *TOOWONG, BRISBANE CITY* | Lower Brisbane | 4065 |
| *AUCHENFLOWER, BRISBANE CITY* | Lower Brisbane | 4066 |
| *BARDON, BRISBANE CITY* | Lower Brisbane | 4066 |
| *CHAPEL HILL, BRISBANE CITY* | Lower Brisbane | 4066 |
| *TARINGA, BRISBANE CITY* | Lower Brisbane | 4066 |
| *INDOOROOPILLY, BRISBANE CITY* | Lower Brisbane | 4066 |
| *MILTON, BRISBANE CITY* | Lower Brisbane | 4066 |
| *PADDINGTON, BRISBANE CITY* | Lower Brisbane | 4066 |
| *KENMORE HILLS, BRISBANE CITY* | Lower Brisbane | 4066 |
| *MOUNT COOT-THA, BRISBANE CITY* | Lower Brisbane | 4066 |
| *THE GAP, BRISBANE CITY* | Lower Brisbane | 4066 |
| *TOOWONG, BRISBANE CITY* | Lower Brisbane | 4066 |
| *TARINGA, BRISBANE CITY* | Lower Brisbane | 4067 |
| *TOOWONG, BRISBANE CITY* | Lower Brisbane | 4067 |
| *ST LUCIA, BRISBANE CITY* | Lower Brisbane | 4067 |
| *CHELMER, BRISBANE CITY* | Lower Brisbane | 4068 |
| *CHAPEL HILL, BRISBANE CITY* | Lower Brisbane | 4068 |
| *TARINGA, BRISBANE CITY* | Lower Brisbane | 4068 |
| *GRACEVILLE, BRISBANE CITY* | Lower Brisbane | 4068 |
| *INDOOROOPILLY, BRISBANE CITY* | Lower Brisbane | 4068 |
| *FIG TREE POCKET, BRISBANE CITY* | Lower Brisbane | 4068 |
| *MOUNT COOT-THA, BRISBANE CITY* | Lower Brisbane | 4068 |
| *TOOWONG, BRISBANE CITY* | Lower Brisbane | 4068 |
| *ST LUCIA, BRISBANE CITY* | Lower Brisbane | 4068 |
| *ANSTEAD, BRISBANE CITY* | Lower Brisbane | 4069 |
| *BELLBOWRIE, BRISBANE CITY* | Lower Brisbane | 4069 |
| *BROOKFIELD, BRISBANE CITY* | Lower Brisbane | 4069 |
| *CHAPEL HILL, BRISBANE CITY* | Lower Brisbane | 4069 |
| *LAKE MANCHESTER, BRISBANE CITY* | Lower Brisbane | 4069 |
| *KHOLO, BRISBANE CITY* | Lower Brisbane | 4069 |
| *INDOOROOPILLY, BRISBANE CITY* | Lower Brisbane | 4069 |
| *ENOGGERA RESERVOIR, BRISBANE CITY* | Lower Brisbane | 4069 |
| *FIG TREE POCKET, BRISBANE CITY* | Lower Brisbane | 4069 |
| *PINJARRA HILLS, BRISBANE CITY* | Lower Brisbane | 4069 |
| *PULLENVALE, BRISBANE CITY* | Lower Brisbane | 4069 |
| *KENMORE HILLS, BRISBANE CITY* | Lower Brisbane | 4069 |

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| *KENMORE, BRISBANE CITY* | Lower Brisbane | 4069 |
| *MOUNT COOT-THA, BRISBANE CITY* | Lower Brisbane | 4069 |
| *UPPER BROOKFIELD, BRISBANE CITY* | Lower Brisbane | 4069 |
| *THE GAP, BRISBANE CITY* | Lower Brisbane | 4069 |
| *LAKE MANCHESTER, BRISBANE CITY* | Mid Brisbane | 4069 |
| *UPPER BROOKFIELD, BRISBANE CITY* | Mid Brisbane | 4069 |
| *LAKE MANCHESTER, BRISBANE CITY* | Upper Brisbane | 4069 |
| *UPPER BROOKFIELD, BRISBANE CITY* | Upper Brisbane | 4069 |
| *ANSTEAD, BRISBANE CITY* | Lower Brisbane | 4070 |
| *BELLBOWRIE, BRISBANE CITY* | Lower Brisbane | 4070 |
| *KHOLO, BRISBANE CITY* | Lower Brisbane | 4070 |
| *PINJARRA HILLS, BRISBANE CITY* | Lower Brisbane | 4070 |
| *PULLENVALE, BRISBANE CITY* | Lower Brisbane | 4070 |
| *MOGGILL, BRISBANE CITY* | Lower Brisbane | 4070 |
| *MOUNT CROSBY, BRISBANE CITY* | Lower Brisbane | 4070 |
| *ST LUCIA, BRISBANE CITY* | Lower Brisbane | 4072 |
| *JINDALEE, BRISBANE CITY* | Lower Brisbane | 4073 |
| *DARRA, BRISBANE CITY* | Lower Brisbane | 4073 |
| *JAMBOREE HEIGHTS, BRISBANE CITY* | Lower Brisbane | 4073 |
| *OXLEY, BRISBANE CITY* | Lower Brisbane | 4073 |
| *MOUNT OMMANEY, BRISBANE CITY* | Lower Brisbane | 4073 |
| *SINNAMON PARK, BRISBANE CITY* | Lower Brisbane | 4073 |
| *SEVENTEEN MILE ROCKS, BRISBANE CITY* | Lower Brisbane | 4073 |
| *JINDALEE, BRISBANE CITY* | Lower Brisbane | 4074 |
| *MIDDLE PARK, BRISBANE CITY* | Lower Brisbane | 4074 |
| *DARRA, BRISBANE CITY* | Lower Brisbane | 4074 |
| *JAMBOREE HEIGHTS, BRISBANE CITY* | Lower Brisbane | 4074 |
| *MOUNT OMMANEY, BRISBANE CITY* | Lower Brisbane | 4074 |
| *RIVERHILLS, BRISBANE CITY* | Lower Brisbane | 4074 |
| *SUMNER, BRISBANE CITY* | Lower Brisbane | 4074 |
| *WACOL, BRISBANE CITY* | Lower Brisbane | 4074 |
| *WESTLAKE, BRISBANE CITY* | Lower Brisbane | 4074 |
| *CHELMER, BRISBANE CITY* | Lower Brisbane | 4075 |
| *CORINDA, BRISBANE CITY* | Lower Brisbane | 4075 |
| *GRACEVILLE, BRISBANE CITY* | Lower Brisbane | 4075 |
| *INALA, BRISBANE CITY* | Lower Brisbane | 4075 |
| *DARRA, BRISBANE CITY* | Lower Brisbane | 4075 |
| *DURACK, BRISBANE CITY* | Lower Brisbane | 4075 |
| *OXLEY, BRISBANE CITY* | Lower Brisbane | 4075 |
| *TENNYSON, BRISBANE CITY* | Lower Brisbane | 4075 |
| *WILLAWONG, BRISBANE CITY* | Lower Brisbane | 4075 |
| *SHERWOOD, BRISBANE CITY* | Lower Brisbane | 4075 |
| *SEVENTEEN MILE ROCKS, BRISBANE CITY* | Lower Brisbane | 4075 |
| *ROCKLEA, BRISBANE CITY* | Lower Brisbane | 4075 |
| *CAROLE PARK, IPSWICH CITY* | Lower Brisbane | 4076 |
| *GOODNA, IPSWICH CITY* | Lower Brisbane | 4076 |

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| *DARRA, BRISBANE CITY* | Lower Brisbane | 4076 |
| *JAMBOREE HEIGHTS, BRISBANE CITY* | Lower Brisbane | 4076 |
| *GAILES, IPSWICH CITY* | Lower Brisbane | 4076 |
| *ELLEN GROVE, BRISBANE CITY* | Lower Brisbane | 4076 |
| *OXLEY, BRISBANE CITY* | Lower Brisbane | 4076 |
| *RIVERHILLS, BRISBANE CITY* | Lower Brisbane | 4076 |
| *SINNAMON PARK, BRISBANE CITY* | Lower Brisbane | 4076 |
| *SUMNER, BRISBANE CITY* | Lower Brisbane | 4076 |
| *WACOL, BRISBANE CITY* | Lower Brisbane | 4076 |
| *SEVENTEEN MILE ROCKS, BRISBANE CITY* | Lower Brisbane | 4076 |
| *RICHLANDS, BRISBANE CITY* | Lower Brisbane | 4076 |
| *DOOLANDELLA, BRISBANE CITY* | Lower Brisbane | 4077 |
| *FOREST LAKE, BRISBANE CITY* | Lower Brisbane | 4077 |
| *INALA, BRISBANE CITY* | Lower Brisbane | 4077 |
| *HEATHWOOD, BRISBANE CITY* | Lower Brisbane | 4077 |
| *DARRA, BRISBANE CITY* | Lower Brisbane | 4077 |
| *PALLARA, BRISBANE CITY* | Lower Brisbane | 4077 |
| *DURACK, BRISBANE CITY* | Lower Brisbane | 4077 |
| *OXLEY, BRISBANE CITY* | Lower Brisbane | 4077 |
| *WACOL, BRISBANE CITY* | Lower Brisbane | 4077 |
| *WILLAWONG, BRISBANE CITY* | Lower Brisbane | 4077 |
| *RICHLANDS, BRISBANE CITY* | Lower Brisbane | 4077 |
| *CAROLE PARK, IPSWICH CITY* | Lower Brisbane | 4078 |
| *DOOLANDELLA, BRISBANE CITY* | Lower Brisbane | 4078 |
| *FOREST LAKE, BRISBANE CITY* | Lower Brisbane | 4078 |
| *GREENBANK, LOGAN CITY* | Lower Brisbane | 4078 |
| *INALA, BRISBANE CITY* | Lower Brisbane | 4078 |
| *HEATHWOOD, BRISBANE CITY* | Lower Brisbane | 4078 |
| *ELLEN GROVE, BRISBANE CITY* | Lower Brisbane | 4078 |
| *WACOL, BRISBANE CITY* | Lower Brisbane | 4078 |
| *RICHLANDS, BRISBANE CITY* | Lower Brisbane | 4078 |
| *HIGHGATE HILL, BRISBANE CITY* | Lower Brisbane | 4101 |
| *DUTTON PARK, BRISBANE CITY* | Lower Brisbane | 4101 |
| *KANGAROO POINT, BRISBANE CITY* | Lower Brisbane | 4101 |
| *WOOLLOONGABBA, BRISBANE CITY* | Lower Brisbane | 4101 |
| *WEST END, BRISBANE CITY* | Lower Brisbane | 4101 |
| *SOUTH BRISBANE, BRISBANE CITY* | Lower Brisbane | 4101 |
| *ANNERLEY, BRISBANE CITY* | Lower Brisbane | 4102 |
| *COORPAROO, BRISBANE CITY* | Lower Brisbane | 4102 |
| *GREENSLOPES, BRISBANE CITY* | Lower Brisbane | 4102 |
| *HIGHGATE HILL, BRISBANE CITY* | Lower Brisbane | 4102 |
| *DUTTON PARK, BRISBANE CITY* | Lower Brisbane | 4102 |
| *EAST BRISBANE, BRISBANE CITY* | Lower Brisbane | 4102 |
| *FAIRFIELD, BRISBANE CITY* | Lower Brisbane | 4102 |
| *KANGAROO POINT, BRISBANE CITY* | Lower Brisbane | 4102 |
| *WOOLLOONGABBA, BRISBANE CITY* | Lower Brisbane | 4102 |

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| *SOUTH BRISBANE, BRISBANE CITY* | Lower Brisbane | 4102 |
| *ANNERLEY, BRISBANE CITY* | Lower Brisbane | 4103 |
| *GREENSLOPES, BRISBANE CITY* | Lower Brisbane | 4103 |
| *DUTTON PARK, BRISBANE CITY* | Lower Brisbane | 4103 |
| *FAIRFIELD, BRISBANE CITY* | Lower Brisbane | 4103 |
| *MOOROOKA, BRISBANE CITY* | Lower Brisbane | 4103 |
| *TARRAGINDI, BRISBANE CITY* | Lower Brisbane | 4103 |
| *WOOLLOONGABBA, BRISBANE CITY* | Lower Brisbane | 4103 |
| *YERONGA, BRISBANE CITY* | Lower Brisbane | 4103 |
| *ANNERLEY, BRISBANE CITY* | Lower Brisbane | 4104 |
| *FAIRFIELD, BRISBANE CITY* | Lower Brisbane | 4104 |
| *YEERONGPILLY, BRISBANE CITY* | Lower Brisbane | 4104 |
| *TENNYSON, BRISBANE CITY* | Lower Brisbane | 4104 |
| *YERONGA, BRISBANE CITY* | Lower Brisbane | 4104 |
| *ANNERLEY, BRISBANE CITY* | Lower Brisbane | 4105 |
| *MOOROOKA, BRISBANE CITY* | Lower Brisbane | 4105 |
| *TARRAGINDI, BRISBANE CITY* | Lower Brisbane | 4105 |
| *YEERONGPILLY, BRISBANE CITY* | Lower Brisbane | 4105 |
| *TENNYSON, BRISBANE CITY* | Lower Brisbane | 4105 |
| *YERONGA, BRISBANE CITY* | Lower Brisbane | 4105 |
| *SALISBURY, BRISBANE CITY* | Lower Brisbane | 4105 |
| *ROCKLEA, BRISBANE CITY* | Lower Brisbane | 4105 |
| *ARCHERFIELD, BRISBANE CITY* | Lower Brisbane | 4106 |
| *COOPERS PLAINS, BRISBANE CITY* | Lower Brisbane | 4106 |
| *CORINDA, BRISBANE CITY* | Lower Brisbane | 4106 |
| *GRACEVILLE, BRISBANE CITY* | Lower Brisbane | 4106 |
| *OXLEY, BRISBANE CITY* | Lower Brisbane | 4106 |
| *MOOROOKA, BRISBANE CITY* | Lower Brisbane | 4106 |
| *YEERONGPILLY, BRISBANE CITY* | Lower Brisbane | 4106 |
| *TENNYSON, BRISBANE CITY* | Lower Brisbane | 4106 |
| *YERONGA, BRISBANE CITY* | Lower Brisbane | 4106 |
| *SALISBURY, BRISBANE CITY* | Lower Brisbane | 4106 |
| *SHERWOOD, BRISBANE CITY* | Lower Brisbane | 4106 |
| *ROCKLEA, BRISBANE CITY* | Lower Brisbane | 4106 |
| *COOPERS PLAINS, BRISBANE CITY* | Lower Brisbane | 4107 |
| *MOOROOKA, BRISBANE CITY* | Lower Brisbane | 4107 |
| *TARRAGINDI, BRISBANE CITY* | Lower Brisbane | 4107 |
| *NATHAN, BRISBANE CITY* | Lower Brisbane | 4107 |
| *SALISBURY, BRISBANE CITY* | Lower Brisbane | 4107 |
| *ROCKLEA, BRISBANE CITY* | Lower Brisbane | 4107 |
| *ACACIA RIDGE, BRISBANE CITY* | Lower Brisbane | 4108 |
| *ARCHERFIELD, BRISBANE CITY* | Lower Brisbane | 4108 |
| *COOPERS PLAINS, BRISBANE CITY* | Lower Brisbane | 4108 |
| *OXLEY, BRISBANE CITY* | Lower Brisbane | 4108 |
| *SALISBURY, BRISBANE CITY* | Lower Brisbane | 4108 |
| *WILLAWONG, BRISBANE CITY* | Lower Brisbane | 4108 |

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| *SUNNYBANK, BRISBANE CITY* | Lower Brisbane | 4108 |
| *ROCKLEA, BRISBANE CITY* | Lower Brisbane | 4108 |
| *ACACIA RIDGE, BRISBANE CITY* | Lower Brisbane | 4109 |
| *ALGESTER, BRISBANE CITY* | Lower Brisbane | 4109 |
| *CALAMVALE, BRISBANE CITY* | Lower Brisbane | 4109 |
| *COOPERS PLAINS, BRISBANE CITY* | Lower Brisbane | 4109 |
| *EIGHT MILE PLAINS, BRISBANE CITY* | Lower Brisbane | 4109 |
| *MACGREGOR, BRISBANE CITY* | Lower Brisbane | 4109 |
| *SUNNYBANK HILLS, BRISBANE CITY* | Lower Brisbane | 4109 |
| *SUNNYBANK, BRISBANE CITY* | Lower Brisbane | 4109 |
| *UPPER MOUNT GRAVATT, BRISBANE CITY* | Lower Brisbane | 4109 |
| *ROBERTSON, BRISBANE CITY* | Lower Brisbane | 4109 |
| *RUNCORN, BRISBANE CITY* | Lower Brisbane | 4109 |
| *ACACIA RIDGE, BRISBANE CITY* | Lower Brisbane | 4110 |
| *ALGESTER, BRISBANE CITY* | Lower Brisbane | 4110 |
| *ARCHERFIELD, BRISBANE CITY* | Lower Brisbane | 4110 |
| *COOPERS PLAINS, BRISBANE CITY* | Lower Brisbane | 4110 |
| *DOOLANDELLA, BRISBANE CITY* | Lower Brisbane | 4110 |
| *FOREST LAKE, BRISBANE CITY* | Lower Brisbane | 4110 |
| *GREENBANK, LOGAN CITY* | Lower Brisbane | 4110 |
| *HEATHWOOD, BRISBANE CITY* | Lower Brisbane | 4110 |
| *FORESTDALE, LOGAN CITY* | Lower Brisbane | 4110 |
| *PALLARA, BRISBANE CITY* | Lower Brisbane | 4110 |
| *DURACK, BRISBANE CITY* | Lower Brisbane | 4110 |
| *LARAPINTA, BRISBANE CITY* | Lower Brisbane | 4110 |
| *OXLEY, BRISBANE CITY* | Lower Brisbane | 4110 |
| *WILLAWONG, BRISBANE CITY* | Lower Brisbane | 4110 |
| *SUNNYBANK HILLS, BRISBANE CITY* | Lower Brisbane | 4110 |
| *SUNNYBANK, BRISBANE CITY* | Lower Brisbane | 4110 |
| *COOPERS PLAINS, BRISBANE CITY* | Lower Brisbane | 4111 |
| *HOLLAND PARK WEST, BRISBANE CITY* | Lower Brisbane | 4111 |
| *MOUNT GRAVATT, BRISBANE CITY* | Lower Brisbane | 4111 |
| *TARRAGINDI, BRISBANE CITY* | Lower Brisbane | 4111 |
| *MACGREGOR, BRISBANE CITY* | Lower Brisbane | 4111 |
| *NATHAN, BRISBANE CITY* | Lower Brisbane | 4111 |
| *SALISBURY, BRISBANE CITY* | Lower Brisbane | 4111 |
| *UPPER MOUNT GRAVATT, BRISBANE CITY* | Lower Brisbane | 4111 |
| *ROBERTSON, BRISBANE CITY* | Lower Brisbane | 4111 |
| *KARAWATHA, BRISBANE CITY* | Logan | 4112 |
| *KURABY, BRISBANE CITY* | Logan | 4112 |
| *STRETTON, BRISBANE CITY* | Logan | 4112 |
| *WOODRIDGE, LOGAN CITY* | Logan | 4112 |
| *UNDERWOOD, LOGAN CITY* | Logan | 4112 |
| *EIGHT MILE PLAINS, BRISBANE CITY* | Lower Brisbane | 4112 |
| *KURABY, BRISBANE CITY* | Lower Brisbane | 4112 |
| *RUNCORN, BRISBANE CITY* | Lower Brisbane | 4112 |

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| *KURABY, BRISBANE CITY* | Logan | 4113 |
| *STRETTON, BRISBANE CITY* | Logan | 4113 |
| *RUNCORN, BRISBANE CITY* | Logan | 4113 |
| *CALAMVALE, BRISBANE CITY* | Lower Brisbane | 4113 |
| *EIGHT MILE PLAINS, BRISBANE CITY* | Lower Brisbane | 4113 |
| *KURABY, BRISBANE CITY* | Lower Brisbane | 4113 |
| *MACGREGOR, BRISBANE CITY* | Lower Brisbane | 4113 |
| *STRETTON, BRISBANE CITY* | Lower Brisbane | 4113 |
| *WISHART, BRISBANE CITY* | Lower Brisbane | 4113 |
| *SUNNYBANK HILLS, BRISBANE CITY* | Lower Brisbane | 4113 |
| *SUNNYBANK, BRISBANE CITY* | Lower Brisbane | 4113 |
| *UNDERWOOD, LOGAN CITY* | Lower Brisbane | 4113 |
| *UPPER MOUNT GRAVATT, BRISBANE CITY* | Lower Brisbane | 4113 |
| *ROCHEDALE, BRISBANE CITY* | Lower Brisbane | 4113 |
| *RUNCORN, BRISBANE CITY* | Lower Brisbane | 4113 |
| *BERRINBA, LOGAN CITY* | Logan | 4114 |
| *LOGANLEA, LOGAN CITY* | Logan | 4114 |
| *KARAWATHA, BRISBANE CITY* | Logan | 4114 |
| *KINGSTON, LOGAN CITY* | Logan | 4114 |
| *MARSDEN, LOGAN CITY* | Logan | 4114 |
| *LOGAN CENTRAL, LOGAN CITY* | Logan | 4114 |
| *MEADOWBROOK, LOGAN CITY* | Logan | 4114 |
| *WOODRIDGE, LOGAN CITY* | Logan | 4114 |
| *SLACKS CREEK, LOGAN CITY* | Logan | 4114 |
| *BROWNS PLAINS, LOGAN CITY* | Logan | 4115 |
| *HILLCREST, LOGAN CITY* | Logan | 4115 |
| *DREWVALE, BRISBANE CITY* | Logan | 4115 |
| *PARKINSON, BRISBANE CITY* | Logan | 4115 |
| *ACACIA RIDGE, BRISBANE CITY* | Lower Brisbane | 4115 |
| *ALGESTER, BRISBANE CITY* | Lower Brisbane | 4115 |
| *CALAMVALE, BRISBANE CITY* | Lower Brisbane | 4115 |
| *HILLCREST, LOGAN CITY* | Lower Brisbane | 4115 |
| *FORESTDALE, LOGAN CITY* | Lower Brisbane | 4115 |
| *PALLARA, BRISBANE CITY* | Lower Brisbane | 4115 |
| *LARAPINTA, BRISBANE CITY* | Lower Brisbane | 4115 |
| *WILLAWONG, BRISBANE CITY* | Lower Brisbane | 4115 |
| *PARKINSON, BRISBANE CITY* | Lower Brisbane | 4115 |
| *BROWNS PLAINS, LOGAN CITY* | Logan | 4116 |
| *CALAMVALE, BRISBANE CITY* | Logan | 4116 |
| *KARAWATHA, BRISBANE CITY* | Logan | 4116 |
| *DREWVALE, BRISBANE CITY* | Logan | 4116 |
| *KURABY, BRISBANE CITY* | Logan | 4116 |
| *STRETTON, BRISBANE CITY* | Logan | 4116 |
| *PARKINSON, BRISBANE CITY* | Logan | 4116 |
| *RUNCORN, BRISBANE CITY* | Logan | 4116 |
| *ALGESTER, BRISBANE CITY* | Lower Brisbane | 4116 |

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|---|---|---|
| *CALAMVALE, BRISBANE CITY* | Lower Brisbane | 4116 |
| *DREWVALE, BRISBANE CITY* | Lower Brisbane | 4116 |
| *STRETTON, BRISBANE CITY* | Lower Brisbane | 4116 |
| *SUNNYBANK HILLS, BRISBANE CITY* | Lower Brisbane | 4116 |
| *PARKINSON, BRISBANE CITY* | Lower Brisbane | 4116 |
| *RUNCORN, BRISBANE CITY* | Lower Brisbane | 4116 |
| *BERRINBA, LOGAN CITY* | Logan | 4117 |
| *BROWNS PLAINS, LOGAN CITY* | Logan | 4117 |
| *KARAWATHA, BRISBANE CITY* | Logan | 4117 |
| *DREWVALE, BRISBANE CITY* | Logan | 4117 |
| *KINGSTON, LOGAN CITY* | Logan | 4117 |
| *MARSDEN, LOGAN CITY* | Logan | 4117 |
| *LOGAN CENTRAL, LOGAN CITY* | Logan | 4117 |
| *KURABY, BRISBANE CITY* | Logan | 4117 |
| *STRETTON, BRISBANE CITY* | Logan | 4117 |
| *WOODRIDGE, LOGAN CITY* | Logan | 4117 |
| *KARAWATHA, BRISBANE CITY* | Lower Brisbane | 4117 |
| *STRETTON, BRISBANE CITY* | Lower Brisbane | 4117 |
| *BERRINBA, LOGAN CITY* | Logan | 4118 |
| *BORONIA HEIGHTS, LOGAN CITY* | Logan | 4118 |
| *BROWNS PLAINS, LOGAN CITY* | Logan | 4118 |
| *HERITAGE PARK, LOGAN CITY* | Logan | 4118 |
| *HILLCREST, LOGAN CITY* | Logan | 4118 |
| *FORESTDALE, LOGAN CITY* | Logan | 4118 |
| *DREWVALE, BRISBANE CITY* | Logan | 4118 |
| *CRESTMEAD, LOGAN CITY* | Logan | 4118 |
| *MARSDEN, LOGAN CITY* | Logan | 4118 |
| *REGENTS PARK, LOGAN CITY* | Logan | 4118 |
| *PARK RIDGE, LOGAN CITY* | Logan | 4118 |
| *PARKINSON, BRISBANE CITY* | Logan | 4118 |
| *GREENBANK, LOGAN CITY* | Lower Brisbane | 4118 |
| *HILLCREST, LOGAN CITY* | Lower Brisbane | 4118 |
| *HEATHWOOD, BRISBANE CITY* | Lower Brisbane | 4118 |
| *FORESTDALE, LOGAN CITY* | Lower Brisbane | 4118 |
| *LARAPINTA, BRISBANE CITY* | Lower Brisbane | 4118 |
| *KURABY, BRISBANE CITY* | Logan | 4119 |
| *WOODRIDGE, LOGAN CITY* | Logan | 4119 |
| *UNDERWOOD, LOGAN CITY* | Logan | 4119 |
| *SLACKS CREEK, LOGAN CITY* | Logan | 4119 |
| *EIGHT MILE PLAINS, BRISBANE CITY* | Lower Brisbane | 4119 |
| *KURABY, BRISBANE CITY* | Lower Brisbane | 4119 |
| *UNDERWOOD, LOGAN CITY* | Lower Brisbane | 4119 |
| *ANNERLEY, BRISBANE CITY* | Lower Brisbane | 4120 |
| *COORPAROO, BRISBANE CITY* | Lower Brisbane | 4120 |
| *HOLLAND PARK WEST, BRISBANE CITY* | Lower Brisbane | 4120 |
| *GREENSLOPES, BRISBANE CITY* | Lower Brisbane | 4120 |

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| *WOOLLOONGABBA, BRISBANE CITY* | Lower Brisbane | 4120 |
| *ANNERLEY, BRISBANE CITY* | Lower Brisbane | 4121 |
| *CAMP HILL, BRISBANE CITY* | Lower Brisbane | 4121 |
| *CARINA HEIGHTS, BRISBANE CITY* | Lower Brisbane | 4121 |
| *COORPAROO, BRISBANE CITY* | Lower Brisbane | 4121 |
| *HOLLAND PARK WEST, BRISBANE CITY* | Lower Brisbane | 4121 |
| *HOLLAND PARK, BRISBANE CITY* | Lower Brisbane | 4121 |
| *GREENSLOPES, BRISBANE CITY* | Lower Brisbane | 4121 |
| *MOUNT GRAVATT EAST, BRISBANE CITY* | Lower Brisbane | 4121 |
| *MOUNT GRAVATT, BRISBANE CITY* | Lower Brisbane | 4121 |
| *MOOROOKA, BRISBANE CITY* | Lower Brisbane | 4121 |
| *TARRAGINDI, BRISBANE CITY* | Lower Brisbane | 4121 |
| *NATHAN, BRISBANE CITY* | Lower Brisbane | 4121 |
| *SALISBURY, BRISBANE CITY* | Lower Brisbane | 4121 |
| *CARINA HEIGHTS, BRISBANE CITY* | Lower Brisbane | 4122 |
| *CARINDALE, BRISBANE CITY* | Lower Brisbane | 4122 |
| *HOLLAND PARK WEST, BRISBANE CITY* | Lower Brisbane | 4122 |
| *HOLLAND PARK, BRISBANE CITY* | Lower Brisbane | 4122 |
| *EIGHT MILE PLAINS, BRISBANE CITY* | Lower Brisbane | 4122 |
| *MOUNT GRAVATT EAST, BRISBANE CITY* | Lower Brisbane | 4122 |
| *MOUNT GRAVATT, BRISBANE CITY* | Lower Brisbane | 4122 |
| *MANSFIELD, BRISBANE CITY* | Lower Brisbane | 4122 |
| *MACKENZIE, BRISBANE CITY* | Lower Brisbane | 4122 |
| *MACGREGOR, BRISBANE CITY* | Lower Brisbane | 4122 |
| *WISHART, BRISBANE CITY* | Lower Brisbane | 4122 |
| *UPPER MOUNT GRAVATT, BRISBANE CITY* | Lower Brisbane | 4122 |
| *ROCHEDALE, BRISBANE CITY* | Lower Brisbane | 4122 |
| *SPRINGWOOD, LOGAN CITY* | Logan | 4123 |
| *UNDERWOOD, LOGAN CITY* | Logan | 4123 |
| *ROCHEDALE SOUTH, LOGAN CITY* | Logan | 4123 |
| *EIGHT MILE PLAINS, BRISBANE CITY* | Lower Brisbane | 4123 |
| *MACKENZIE, BRISBANE CITY* | Lower Brisbane | 4123 |
| *WISHART, BRISBANE CITY* | Lower Brisbane | 4123 |
| *UNDERWOOD, LOGAN CITY* | Lower Brisbane | 4123 |
| *ROCHEDALE SOUTH, LOGAN CITY* | Lower Brisbane | 4123 |
| *ROCHEDALE, BRISBANE CITY* | Lower Brisbane | 4123 |
| *BURBANK, BRISBANE CITY* | Redland | 4123 |
| *MACKENZIE, BRISBANE CITY* | Redland | 4123 |
| *PRIESTDALE, LOGAN CITY* | Redland | 4123 |
| *SPRINGWOOD, LOGAN CITY* | Redland | 4123 |
| *ROCHEDALE SOUTH, LOGAN CITY* | Redland | 4123 |
| *ROCHEDALE, BRISBANE CITY* | Redland | 4123 |
| *BORONIA HEIGHTS, LOGAN CITY* | Logan | 4124 |
| *KAGARU, LOGAN CITY* | Logan | 4124 |
| *KAGARU, SCENIC RIM REGIONAL* | Logan | 4124 |
| *LYONS, LOGAN CITY* | Logan | 4124 |

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| *JIMBOOMBA, LOGAN CITY* | Logan | 4124 |
| *GREENBANK, LOGAN CITY* | Logan | 4124 |
| *HILLCREST, LOGAN CITY* | Logan | 4124 |
| *NEW BEITH, LOGAN CITY* | Logan | 4124 |
| *MUNRUBEN, LOGAN CITY* | Logan | 4124 |
| *NORTH MACLEAN, LOGAN CITY* | Logan | 4124 |
| *REGENTS PARK, LOGAN CITY* | Logan | 4124 |
| *UNDULLAH, LOGAN CITY* | Logan | 4124 |
| *PARK RIDGE SOUTH, LOGAN CITY* | Logan | 4124 |
| *PARK RIDGE, LOGAN CITY* | Logan | 4124 |
| *BORONIA HEIGHTS, LOGAN CITY* | Lower Brisbane | 4124 |
| *CAMIRA, IPSWICH CITY* | Lower Brisbane | 4124 |
| *CAROLE PARK, IPSWICH CITY* | Lower Brisbane | 4124 |
| *FOREST LAKE, BRISBANE CITY* | Lower Brisbane | 4124 |
| *LYONS, LOGAN CITY* | Lower Brisbane | 4124 |
| *GREENBANK, LOGAN CITY* | Lower Brisbane | 4124 |
| *HILLCREST, LOGAN CITY* | Lower Brisbane | 4124 |
| *FORESTDALE, LOGAN CITY* | Lower Brisbane | 4124 |
| *NEW BEITH, LOGAN CITY* | Lower Brisbane | 4124 |
| *SOUTH RIPLEY, IPSWICH CITY* | Lower Brisbane | 4124 |
| *SPRING MOUNTAIN, IPSWICH CITY* | Lower Brisbane | 4124 |
| *SPRINGFIELD LAKES, IPSWICH CITY* | Lower Brisbane | 4124 |
| *BORONIA HEIGHTS, LOGAN CITY* | Logan | 4125 |
| *CHAMBERS FLAT, LOGAN CITY* | Logan | 4125 |
| *HERITAGE PARK, LOGAN CITY* | Logan | 4125 |
| *GREENBANK, LOGAN CITY* | Logan | 4125 |
| *CRESTMEAD, LOGAN CITY* | Logan | 4125 |
| *MUNRUBEN, LOGAN CITY* | Logan | 4125 |
| *LOGAN RESERVE, LOGAN CITY* | Logan | 4125 |
| *NORTH MACLEAN, LOGAN CITY* | Logan | 4125 |
| *STOCKLEIGH, LOGAN CITY* | Logan | 4125 |
| *REGENTS PARK, LOGAN CITY* | Logan | 4125 |
| *PARK RIDGE SOUTH, LOGAN CITY* | Logan | 4125 |
| *PARK RIDGE, LOGAN CITY* | Logan | 4125 |
| *DAISY HILL, LOGAN CITY* | Logan | 4127 |
| *KINGSTON, LOGAN CITY* | Logan | 4127 |
| *MOUNT COTTON, REDLAND CITY* | Logan | 4127 |
| *MEADOWBROOK, LOGAN CITY* | Logan | 4127 |
| *TANAH MERAH, LOGAN CITY* | Logan | 4127 |
| *WOODRIDGE, LOGAN CITY* | Logan | 4127 |
| *SHAILER PARK, LOGAN CITY* | Logan | 4127 |
| *SPRINGWOOD, LOGAN CITY* | Logan | 4127 |
| *UNDERWOOD, LOGAN CITY* | Logan | 4127 |
| *ROCHEDALE SOUTH, LOGAN CITY* | Logan | 4127 |
| *SLACKS CREEK, LOGAN CITY* | Logan | 4127 |
| *BURBANK, BRISBANE CITY* | Redland | 4127 |

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| *DAISY HILL, LOGAN CITY* | Redland | 4127 |
| *MOUNT COTTON, REDLAND CITY* | Redland | 4127 |
| *PRIESTDALE, LOGAN CITY* | Redland | 4127 |
| *SPRINGWOOD, LOGAN CITY* | Redland | 4127 |
| *ROCHEDALE SOUTH, LOGAN CITY* | Redland | 4127 |
| *BETHANIA, LOGAN CITY* | Logan | 4128 |
| *CORNUBIA, LOGAN CITY* | Logan | 4128 |
| *DAISY HILL, LOGAN CITY* | Logan | 4128 |
| *LOGANHOLME, LOGAN CITY* | Logan | 4128 |
| *MEADOWBROOK, LOGAN CITY* | Logan | 4128 |
| *TANAH MERAH, LOGAN CITY* | Logan | 4128 |
| *SHAILER PARK, LOGAN CITY* | Logan | 4128 |
| *SLACKS CREEK, LOGAN CITY* | Logan | 4128 |
| *CORNUBIA, LOGAN CITY* | Redland | 4128 |
| *MOUNT COTTON, REDLAND CITY* | Redland | 4128 |
| *SHAILER PARK, LOGAN CITY* | Redland | 4128 |
| *BEENLEIGH, LOGAN CITY* | Logan | 4129 |
| *BETHANIA, LOGAN CITY* | Logan | 4129 |
| *CARBROOK, LOGAN CITY* | Logan | 4129 |
| *CORNUBIA, LOGAN CITY* | Logan | 4129 |
| *EAGLEBY, LOGAN CITY* | Logan | 4129 |
| *HOLMVIEW, LOGAN CITY* | Logan | 4129 |
| *EDENS LANDING, LOGAN CITY* | Logan | 4129 |
| *LOGANHOLME, LOGAN CITY* | Logan | 4129 |
| *TANAH MERAH, LOGAN CITY* | Logan | 4129 |
| *SHAILER PARK, LOGAN CITY* | Logan | 4129 |
| *ALBERTON, GOLD COAST CITY* | Logan | 4130 |
| *CARBROOK, LOGAN CITY* | Logan | 4130 |
| *CORNUBIA, LOGAN CITY* | Logan | 4130 |
| *EAGLEBY, LOGAN CITY* | Logan | 4130 |
| *REDLAND BAY, REDLAND CITY* | Logan | 4130 |
| *LOGANHOLME, LOGAN CITY* | Logan | 4130 |
| *MOUNT COTTON, REDLAND CITY* | Logan | 4130 |
| *SHAILER PARK, LOGAN CITY* | Logan | 4130 |
| *CORNUBIA, LOGAN CITY* | Redland | 4130 |
| *MOUNT COTTON, REDLAND CITY* | Redland | 4130 |
| *SHAILER PARK, LOGAN CITY* | Redland | 4130 |
| *BETHANIA, LOGAN CITY* | Logan | 4131 |
| *WATERFORD WEST, LOGAN CITY* | Logan | 4131 |
| *WATERFORD, LOGAN CITY* | Logan | 4131 |
| *LOGANLEA, LOGAN CITY* | Logan | 4131 |
| *KINGSTON, LOGAN CITY* | Logan | 4131 |
| *MEADOWBROOK, LOGAN CITY* | Logan | 4131 |
| *TANAH MERAH, LOGAN CITY* | Logan | 4131 |
| *SLACKS CREEK, LOGAN CITY* | Logan | 4131 |
| *BERRINBA, LOGAN CITY* | Logan | 4132 |

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| *HERITAGE PARK, LOGAN CITY* | Logan | 4132 |
| *WATERFORD WEST, LOGAN CITY* | Logan | 4132 |
| *LOGANLEA, LOGAN CITY* | Logan | 4132 |
| *CRESTMEAD, LOGAN CITY* | Logan | 4132 |
| *KINGSTON, LOGAN CITY* | Logan | 4132 |
| *MARSDEN, LOGAN CITY* | Logan | 4132 |
| *LOGAN RESERVE, LOGAN CITY* | Logan | 4132 |
| *PARK RIDGE, LOGAN CITY* | Logan | 4132 |
| *BAHRS SCRUB, LOGAN CITY* | Logan | 4133 |
| *BETHANIA, LOGAN CITY* | Logan | 4133 |
| *BUCCAN, LOGAN CITY* | Logan | 4133 |
| *CHAMBERS FLAT, LOGAN CITY* | Logan | 4133 |
| *WATERFORD WEST, LOGAN CITY* | Logan | 4133 |
| *WATERFORD, LOGAN CITY* | Logan | 4133 |
| *LOGANLEA, LOGAN CITY* | Logan | 4133 |
| *HOLMVIEW, LOGAN CITY* | Logan | 4133 |
| *EDENS LANDING, LOGAN CITY* | Logan | 4133 |
| *CRESTMEAD, LOGAN CITY* | Logan | 4133 |
| *MUNRUBEN, LOGAN CITY* | Logan | 4133 |
| *MARSDEN, LOGAN CITY* | Logan | 4133 |
| *LOGAN RESERVE, LOGAN CITY* | Logan | 4133 |
| *LOGAN VILLAGE, LOGAN CITY* | Logan | 4133 |
| *STOCKLEIGH, LOGAN CITY* | Logan | 4133 |
| *PARK RIDGE SOUTH, LOGAN CITY* | Logan | 4133 |
| *PARK RIDGE, LOGAN CITY* | Logan | 4133 |
| *CAMP HILL, BRISBANE CITY* | Lower Brisbane | 4151 |
| *COORPAROO, BRISBANE CITY* | Lower Brisbane | 4151 |
| *HOLLAND PARK, BRISBANE CITY* | Lower Brisbane | 4151 |
| *GREENSLOPES, BRISBANE CITY* | Lower Brisbane | 4151 |
| *EAST BRISBANE, BRISBANE CITY* | Lower Brisbane | 4151 |
| *NORMAN PARK, BRISBANE CITY* | Lower Brisbane | 4151 |
| *WOOLLOONGABBA, BRISBANE CITY* | Lower Brisbane | 4151 |
| *BELMONT, BRISBANE CITY* | Lower Brisbane | 4152 |
| *CAMP HILL, BRISBANE CITY* | Lower Brisbane | 4152 |
| *CANNON HILL, BRISBANE CITY* | Lower Brisbane | 4152 |
| *CARINA HEIGHTS, BRISBANE CITY* | Lower Brisbane | 4152 |
| *CARINA, BRISBANE CITY* | Lower Brisbane | 4152 |
| *CARINDALE, BRISBANE CITY* | Lower Brisbane | 4152 |
| *COORPAROO, BRISBANE CITY* | Lower Brisbane | 4152 |
| *HOLLAND PARK, BRISBANE CITY* | Lower Brisbane | 4152 |
| *MOUNT GRAVATT EAST, BRISBANE CITY* | Lower Brisbane | 4152 |
| *MANSFIELD, BRISBANE CITY* | Lower Brisbane | 4152 |
| *MORNINGSIDE, BRISBANE CITY* | Lower Brisbane | 4152 |
| *MACKENZIE, BRISBANE CITY* | Lower Brisbane | 4152 |
| *TINGALPA, BRISBANE CITY* | Lower Brisbane | 4152 |
| *SEVEN HILLS, BRISBANE CITY* | Lower Brisbane | 4152 |

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| *BELMONT, BRISBANE CITY* | Lower Brisbane | 4153 |
| *CHANDLER, BRISBANE CITY* | Lower Brisbane | 4153 |
| *GUMDALE, BRISBANE CITY* | Lower Brisbane | 4153 |
| *TINGALPA, BRISBANE CITY* | Lower Brisbane | 4153 |
| *BELMONT, BRISBANE CITY* | Redland | 4153 |
| *CHANDLER, BRISBANE CITY* | Redland | 4153 |
| *BELMONT, BRISBANE CITY* | Lower Brisbane | 4154 |
| *GUMDALE, BRISBANE CITY* | Lower Brisbane | 4154 |
| *MANLY WEST, BRISBANE CITY* | Lower Brisbane | 4154 |
| *WAKERLEY, BRISBANE CITY* | Lower Brisbane | 4154 |
| *TINGALPA, BRISBANE CITY* | Lower Brisbane | 4154 |
| *BELMONT, BRISBANE CITY* | Redland | 4154 |
| *BIRKDALE, REDLAND CITY* | Redland | 4154 |
| *CHANDLER, BRISBANE CITY* | Redland | 4154 |
| *GUMDALE, BRISBANE CITY* | Redland | 4154 |
| *MANLY WEST, BRISBANE CITY* | Redland | 4154 |
| *LOTA, BRISBANE CITY* | Redland | 4154 |
| *WAKERLEY, BRISBANE CITY* | Redland | 4154 |
| *RANSOME, BRISBANE CITY* | Redland | 4154 |
| *BELMONT, BRISBANE CITY* | Lower Brisbane | 4155 |
| *CHANDLER, BRISBANE CITY* | Lower Brisbane | 4155 |
| *BELMONT, BRISBANE CITY* | Redland | 4155 |
| *BURBANK, BRISBANE CITY* | Redland | 4155 |
| *CHANDLER, BRISBANE CITY* | Redland | 4155 |
| *BELMONT, BRISBANE CITY* | Lower Brisbane | 4156 |
| *MACKENZIE, BRISBANE CITY* | Lower Brisbane | 4156 |
| *ROCHEDALE, BRISBANE CITY* | Lower Brisbane | 4156 |
| *BELMONT, BRISBANE CITY* | Redland | 4156 |
| *BURBANK, BRISBANE CITY* | Redland | 4156 |
| *CAPALABA, REDLAND CITY* | Redland | 4156 |
| *CHANDLER, BRISBANE CITY* | Redland | 4156 |
| *MACKENZIE, BRISBANE CITY* | Redland | 4156 |
| *PRIESTDALE, LOGAN CITY* | Redland | 4156 |
| *ROCHEDALE, BRISBANE CITY* | Redland | 4156 |
| *SHELDON, REDLAND CITY* | Redland | 4156 |
| *ALEXANDRA HILLS, REDLAND CITY* | Redland | 4157 |
| *BIRKDALE, REDLAND CITY* | Redland | 4157 |
| *BURBANK, BRISBANE CITY* | Redland | 4157 |
| *CAPALABA, REDLAND CITY* | Redland | 4157 |
| *CHANDLER, BRISBANE CITY* | Redland | 4157 |
| *GUMDALE, BRISBANE CITY* | Redland | 4157 |
| *MOUNT COTTON, REDLAND CITY* | Redland | 4157 |
| *PRIESTDALE, LOGAN CITY* | Redland | 4157 |
| *THORNLANDS, REDLAND CITY* | Redland | 4157 |
| *SHELDON, REDLAND CITY* | Redland | 4157 |
| *RANSOME, BRISBANE CITY* | Redland | 4157 |

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| *BIRKDALE, REDLAND CITY* | Redland | 4158 |
| *THORNESIDE, REDLAND CITY* | Redland | 4158 |
| *ALEXANDRA HILLS, REDLAND CITY* | Redland | 4159 |
| *BIRKDALE, REDLAND CITY* | Redland | 4159 |
| *CAPALABA, REDLAND CITY* | Redland | 4159 |
| *CHANDLER, BRISBANE CITY* | Redland | 4159 |
| *WELLINGTON POINT, REDLAND CITY* | Redland | 4159 |
| *THORNESIDE, REDLAND CITY* | Redland | 4159 |
| *RANSOME, BRISBANE CITY* | Redland | 4159 |
| *ALEXANDRA HILLS, REDLAND CITY* | Redland | 4160 |
| *BIRKDALE, REDLAND CITY* | Redland | 4160 |
| *CLEVELAND, REDLAND CITY* | Redland | 4160 |
| *ORMISTON, REDLAND CITY* | Redland | 4160 |
| *MORETON BAY, REDLAND CITY* | Redland | 4160 |
| *WELLINGTON POINT, REDLAND CITY* | Redland | 4160 |
| *ALEXANDRA HILLS, REDLAND CITY* | Redland | 4161 |
| *BIRKDALE, REDLAND CITY* | Redland | 4161 |
| *CAPALABA, REDLAND CITY* | Redland | 4161 |
| *CLEVELAND, REDLAND CITY* | Redland | 4161 |
| *ORMISTON, REDLAND CITY* | Redland | 4161 |
| *WELLINGTON POINT, REDLAND CITY* | Redland | 4161 |
| *THORNLANDS, REDLAND CITY* | Redland | 4161 |
| *ALEXANDRA HILLS, REDLAND CITY* | Redland | 4163 |
| *CLEVELAND, REDLAND CITY* | Redland | 4163 |
| *ORMISTON, REDLAND CITY* | Redland | 4163 |
| *THORNLANDS, REDLAND CITY* | Redland | 4163 |
| *ALEXANDRA HILLS, REDLAND CITY* | Redland | 4164 |
| *CAPALABA, REDLAND CITY* | Redland | 4164 |
| *CLEVELAND, REDLAND CITY* | Redland | 4164 |
| *MOUNT COTTON, REDLAND CITY* | Redland | 4164 |
| *MORETON BAY, REDLAND CITY* | Redland | 4164 |
| *THORNLANDS, REDLAND CITY* | Redland | 4164 |
| *SHELDON, REDLAND CITY* | Redland | 4164 |
| *VICTORIA POINT, REDLAND CITY* | Redland | 4164 |
| *ALBERTON, GOLD COAST CITY* | Logan | 4165 |
| *CARBROOK, LOGAN CITY* | Logan | 4165 |
| *CORNUBIA, LOGAN CITY* | Logan | 4165 |
| *REDLAND BAY, REDLAND CITY* | Logan | 4165 |
| *MOUNT COTTON, REDLAND CITY* | Logan | 4165 |
| *SHAILER PARK, LOGAN CITY* | Logan | 4165 |
| *CORNUBIA, LOGAN CITY* | Redland | 4165 |
| *DAISY HILL, LOGAN CITY* | Redland | 4165 |
| *REDLAND BAY, REDLAND CITY* | Redland | 4165 |
| *MOUNT COTTON, REDLAND CITY* | Redland | 4165 |
| *MORETON BAY, REDLAND CITY* | Redland | 4165 |
| *PRIESTDALE, LOGAN CITY* | Redland | 4165 |

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| *THORNLANDS, REDLAND CITY* | Redland | 4165 |
| *SHAILER PARK, LOGAN CITY* | Redland | 4165 |
| *SHELDON, REDLAND CITY* | Redland | 4165 |
| *VICTORIA POINT, REDLAND CITY* | Redland | 4165 |
| *COORPAROO, BRISBANE CITY* | Lower Brisbane | 4169 |
| *EAST BRISBANE, BRISBANE CITY* | Lower Brisbane | 4169 |
| *KANGAROO POINT, BRISBANE CITY* | Lower Brisbane | 4169 |
| *NORMAN PARK, BRISBANE CITY* | Lower Brisbane | 4169 |
| *WOOLLOONGABBA, BRISBANE CITY* | Lower Brisbane | 4169 |
| *BALMORAL, BRISBANE CITY* | Lower Brisbane | 4170 |
| *BULIMBA, BRISBANE CITY* | Lower Brisbane | 4170 |
| *CAMP HILL, BRISBANE CITY* | Lower Brisbane | 4170 |
| *CANNON HILL, BRISBANE CITY* | Lower Brisbane | 4170 |
| *CARINA, BRISBANE CITY* | Lower Brisbane | 4170 |
| *COORPAROO, BRISBANE CITY* | Lower Brisbane | 4170 |
| *HAWTHORNE, BRISBANE CITY* | Lower Brisbane | 4170 |
| *EAST BRISBANE, BRISBANE CITY* | Lower Brisbane | 4170 |
| *MURARRIE, BRISBANE CITY* | Lower Brisbane | 4170 |
| *MORNINGSIDE, BRISBANE CITY* | Lower Brisbane | 4170 |
| *NORMAN PARK, BRISBANE CITY* | Lower Brisbane | 4170 |
| *TINGALPA, BRISBANE CITY* | Lower Brisbane | 4170 |
| *SEVEN HILLS, BRISBANE CITY* | Lower Brisbane | 4170 |
| *BALMORAL, BRISBANE CITY* | Lower Brisbane | 4171 |
| *BULIMBA, BRISBANE CITY* | Lower Brisbane | 4171 |
| *HAWTHORNE, BRISBANE CITY* | Lower Brisbane | 4171 |
| *MORNINGSIDE, BRISBANE CITY* | Lower Brisbane | 4171 |
| *NORMAN PARK, BRISBANE CITY* | Lower Brisbane | 4171 |
| *CANNON HILL, BRISBANE CITY* | Lower Brisbane | 4172 |
| *HEMMANT, BRISBANE CITY* | Lower Brisbane | 4172 |
| *MURARRIE, BRISBANE CITY* | Lower Brisbane | 4172 |
| *MORNINGSIDE, BRISBANE CITY* | Lower Brisbane | 4172 |
| *TINGALPA, BRISBANE CITY* | Lower Brisbane | 4172 |
| *BELMONT, BRISBANE CITY* | Lower Brisbane | 4173 |
| *CANNON HILL, BRISBANE CITY* | Lower Brisbane | 4173 |
| *CARINA, BRISBANE CITY* | Lower Brisbane | 4173 |
| *CARINDALE, BRISBANE CITY* | Lower Brisbane | 4173 |
| *GUMDALE, BRISBANE CITY* | Lower Brisbane | 4173 |
| *HEMMANT, BRISBANE CITY* | Lower Brisbane | 4173 |
| *MURARRIE, BRISBANE CITY* | Lower Brisbane | 4173 |
| *MANLY WEST, BRISBANE CITY* | Lower Brisbane | 4173 |
| *WYNNUM WEST, BRISBANE CITY* | Lower Brisbane | 4173 |
| *WAKERLEY, BRISBANE CITY* | Lower Brisbane | 4173 |
| *TINGALPA, BRISBANE CITY* | Lower Brisbane | 4173 |
| *LYTTON, BRISBANE CITY* | Lower Brisbane | 4174 |
| *HEMMANT, BRISBANE CITY* | Lower Brisbane | 4174 |
| *MURARRIE, BRISBANE CITY* | Lower Brisbane | 4174 |

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| *WYNNUM WEST, BRISBANE CITY* | Lower Brisbane | 4174 |
| *TINGALPA, BRISBANE CITY* | Lower Brisbane | 4174 |
| *MORETON BAY, BRISBANE CITY* | Green Island | 4178 |
| *LYTTON, BRISBANE CITY* | Lower Brisbane | 4178 |
| *HEMMANT, BRISBANE CITY* | Lower Brisbane | 4178 |
| *MANLY WEST, BRISBANE CITY* | Lower Brisbane | 4178 |
| *WYNNUM WEST, BRISBANE CITY* | Lower Brisbane | 4178 |
| *WYNNUM, BRISBANE CITY* | Lower Brisbane | 4178 |
| *TINGALPA, BRISBANE CITY* | Lower Brisbane | 4178 |
| *PORT OF BRISBANE, BRISBANE CITY* | Lower Brisbane | 4178 |
| *MORETON BAY, BRISBANE CITY* | Mud Island | 4178 |
| *PORT OF BRISBANE, BRISBANE CITY* | Port Expansion | 4178 |
| *MANLY WEST, BRISBANE CITY* | Redland | 4178 |
| *MANLY, BRISBANE CITY* | Redland | 4178 |
| *WYNNUM WEST, BRISBANE CITY* | Redland | 4178 |
| *WYNNUM, BRISBANE CITY* | Redland | 4178 |
| *MORETON BAY, BRISBANE CITY* | St Helena Island | 4178 |
| *MANLY WEST, BRISBANE CITY* | Lower Brisbane | 4179 |
| *WYNNUM WEST, BRISBANE CITY* | Lower Brisbane | 4179 |
| *WAKERLEY, BRISBANE CITY* | Lower Brisbane | 4179 |
| *TINGALPA, BRISBANE CITY* | Lower Brisbane | 4179 |
| *MANLY WEST, BRISBANE CITY* | Redland | 4179 |
| *MANLY, BRISBANE CITY* | Redland | 4179 |
| *MORETON BAY, BRISBANE CITY* | Redland | 4179 |
| *LOTA, BRISBANE CITY* | Redland | 4179 |
| *WYNNUM WEST, BRISBANE CITY* | Redland | 4179 |
| *WAKERLEY, BRISBANE CITY* | Redland | 4179 |
| *RANSOME, BRISBANE CITY* | Redland | 4179 |
| *AMITY, REDLAND CITY* | North Stradbroke Island | 4183 |
| *DUNWICH, REDLAND CITY* | North Stradbroke Island | 4183 |
| *RUSSELL ISLAND, REDLAND CITY* | North Stradbroke Island | 4183 |
| *MORETON BAY, BRISBANE CITY* | North Stradbroke Island | 4183 |
| *MORETON BAY, REDLAND CITY* | North Stradbroke Island | 4183 |
| *NORTH STRADBROKE ISLAND, REDLAND CITY* | North Stradbroke Island | 4183 |
| *POINT LOOKOUT, REDLAND CITY* | North Stradbroke Island | 4183 |
| *PEEL ISLAND, REDLAND CITY* | Peel Island | 4183 |
| *COOCHIEMUDLO ISLAND, REDLAND CITY* | Coochiemudlo Island | 4184 |
| *MACLEAY ISLAND, REDLAND CITY* | Macleay Island | 4184 |
| *RUSSELL ISLAND, REDLAND CITY* | Russell Island | 4184 |
| *NORTH STRADBROKE ISLAND, REDLAND CITY* | Russell Island | 4184 |
| *BETHANIA, LOGAN CITY* | Logan | 4205 |
| *WATERFORD, LOGAN CITY* | Logan | 4205 |
| *LOGANLEA, LOGAN CITY* | Logan | 4205 |
| *EDENS LANDING, LOGAN CITY* | Logan | 4205 |
| *LOGANHOLME, LOGAN CITY* | Logan | 4205 |
| *MEADOWBROOK, LOGAN CITY* | Logan | 4205 |

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| *TANAH MERAH, LOGAN CITY* | Logan | 4205 |
| *ALBERTON, GOLD COAST CITY* | Albert | 4207 |
| *BAHRS SCRUB, LOGAN CITY* | Albert | 4207 |
| *BANNOCKBURN, LOGAN CITY* | Albert | 4207 |
| *BEENLEIGH, LOGAN CITY* | Albert | 4207 |
| *BELIVAH, LOGAN CITY* | Albert | 4207 |
| *BUCCAN, LOGAN CITY* | Albert | 4207 |
| *CEDAR CREEK, GOLD COAST CITY* | Albert | 4207 |
| *CEDAR CREEK, LOGAN CITY* | Albert | 4207 |
| *LUSCOMBE, GOLD COAST CITY* | Albert | 4207 |
| *EAGLEBY, LOGAN CITY* | Albert | 4207 |
| *HOLMVIEW, LOGAN CITY* | Albert | 4207 |
| *MOUNT WARREN PARK, LOGAN CITY* | Albert | 4207 |
| *KINGSHOLME, GOLD COAST CITY* | Albert | 4207 |
| *ORMEAU HILLS, GOLD COAST CITY* | Albert | 4207 |
| *LOGAN VILLAGE, LOGAN CITY* | Albert | 4207 |
| *KAIRABAH, LOGAN CITY* | Albert | 4207 |
| *WOLFFDENE, LOGAN CITY* | Albert | 4207 |
| *YARRABILBA, LOGAN CITY* | Albert | 4207 |
| *YATALA, GOLD COAST CITY* | Albert | 4207 |
| *WINDAROO, LOGAN CITY* | Albert | 4207 |
| *WONGAWALLAN, GOLD COAST CITY* | Albert | 4207 |
| *STAPYLTON, GOLD COAST CITY* | Albert | 4207 |
| *TAMBORINE MOUNTAIN, SCENIC RIM REGIONAL* | Albert | 4207 |
| *TAMBORINE, LOGAN CITY* | Albert | 4207 |
| *TAMBORINE, SCENIC RIM REGIONAL* | Albert | 4207 |
| *SOUTHERN MORETON BAY ISLANDS, GOLD COAST* | Cobby Island | 4207 |
| *SOUTHERN MORETON BAY ISLANDS, GOLD COAST* | Crusoe Island | 4207 |
| *SOUTHERN MORETON BAY ISLANDS, GOLD COAST* | Eden Island | 4207 |
| *SOUTHERN MORETON BAY ISLANDS, GOLD COAST* | Island | 4207 |
| *SOUTHERN MORETON BAY ISLANDS, GOLD COAST* | Kangaroo Island | 4207 |
| *ALBERTON, GOLD COAST CITY* | Logan | 4207 |
| *BAHRS SCRUB, LOGAN CITY* | Logan | 4207 |
| *BEENLEIGH, LOGAN CITY* | Logan | 4207 |
| *BELIVAH, LOGAN CITY* | Logan | 4207 |
| *BETHANIA, LOGAN CITY* | Logan | 4207 |
| *BUCCAN, LOGAN CITY* | Logan | 4207 |
| *CARBROOK, LOGAN CITY* | Logan | 4207 |
| *CHAMBERS FLAT, LOGAN CITY* | Logan | 4207 |
| *CEDAR CREEK, LOGAN CITY* | Logan | 4207 |
| *CORNUBIA, LOGAN CITY* | Logan | 4207 |
| *GILBERTON, GOLD COAST CITY* | Logan | 4207 |
| *WATERFORD, LOGAN CITY* | Logan | 4207 |
| *JIMBOOMBA, LOGAN CITY* | Logan | 4207 |
| *LUSCOMBE, GOLD COAST CITY* | Logan | 4207 |
| *EAGLEBY, LOGAN CITY* | Logan | 4207 |

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| *HOLMVIEW, LOGAN CITY* | Logan | 4207 |
| *EDENS LANDING, LOGAN CITY* | Logan | 4207 |
| *MOUNT WARREN PARK, LOGAN CITY* | Logan | 4207 |
| *REDLAND BAY, REDLAND CITY* | Logan | 4207 |
| *ORMEAU HILLS, GOLD COAST CITY* | Logan | 4207 |
| *ORMEAU, GOLD COAST CITY* | Logan | 4207 |
| *LOGAN RESERVE, LOGAN CITY* | Logan | 4207 |
| *LOGAN VILLAGE, LOGAN CITY* | Logan | 4207 |
| *LOGANHOLME, LOGAN CITY* | Logan | 4207 |
| *KAIRABAH, LOGAN CITY* | Logan | 4207 |
| *WOLFFDENE, LOGAN CITY* | Logan | 4207 |
| *YARRABILBA, LOGAN CITY* | Logan | 4207 |
| *YATALA, GOLD COAST CITY* | Logan | 4207 |
| *WOONGOOLBA, GOLD COAST CITY* | Logan | 4207 |
| *STOCKLEIGH, LOGAN CITY* | Logan | 4207 |
| *STAPYLTON, GOLD COAST CITY* | Logan | 4207 |
| *TAMBORINE, LOGAN CITY* | Logan | 4207 |
| *STEIGLITZ, GOLD COAST CITY* | Logan | 4207 |
| *NORTH STRADBROKE ISLAND, REDLAND CITY* | North Stradbroke Island | 4207 |
| *CEDAR CREEK, GOLD COAST CITY* | Pimpama-Coomera | 4207 |
| *JACOBS WELL, GOLD COAST CITY* | Pimpama-Coomera | 4207 |
| *LUSCOMBE, GOLD COAST CITY* | Pimpama-Coomera | 4207 |
| *KINGSHOLME, GOLD COAST CITY* | Pimpama-Coomera | 4207 |
| *NORWELL, GOLD COAST CITY* | Pimpama-Coomera | 4207 |
| *ORMEAU HILLS, GOLD COAST CITY* | Pimpama-Coomera | 4207 |
| *ORMEAU, GOLD COAST CITY* | Pimpama-Coomera | 4207 |
| *WONGAWALLAN, GOLD COAST CITY* | Pimpama-Coomera | 4207 |
| *WOONGOOLBA, GOLD COAST CITY* | Pimpama-Coomera | 4207 |
| *SOUTHERN MORETON BAY ISLANDS, GOLD COAST* | Pimpama-Coomera | 4207 |
| *STEIGLITZ, GOLD COAST CITY* | Pimpama-Coomera | 4207 |
| *RUSSELL ISLAND, REDLAND CITY* | Russell Island | 4207 |
| *SOUTHERN MORETON BAY ISLANDS, GOLD COAST* | Short Island | 4207 |
| *SOUTH STRADBROKE, GOLD COAST CITY* | South Stradbroke Island | 4207 |
| *SOUTHERN MORETON BAY ISLANDS, GOLD COAST* | Tabby Island | 4207 |
| *CEDAR CREEK, GOLD COAST CITY* | Albert | 4208 |
| *LUSCOMBE, GOLD COAST CITY* | Albert | 4208 |
| *KINGSHOLME, GOLD COAST CITY* | Albert | 4208 |
| *SOUTHERN MORETON BAY ISLANDS, GOLD COAST* | Island | 4208 |
| *GILBERTON, GOLD COAST CITY* | Logan | 4208 |
| *LUSCOMBE, GOLD COAST CITY* | Logan | 4208 |
| *NORWELL, GOLD COAST CITY* | Logan | 4208 |
| *ORMEAU HILLS, GOLD COAST CITY* | Logan | 4208 |
| *ORMEAU, GOLD COAST CITY* | Logan | 4208 |
| *YATALA, GOLD COAST CITY* | Logan | 4208 |
| *WOONGOOLBA, GOLD COAST CITY* | Logan | 4208 |
| *STAPYLTON, GOLD COAST CITY* | Logan | 4208 |

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| *STEIGLITZ, GOLD COAST CITY* | Logan | 4208 |
| *CEDAR CREEK, GOLD COAST CITY* | Pimpama-Coomera | 4208 |
| *COOMERA, GOLD COAST CITY* | Pimpama-Coomera | 4208 |
| *GILBERTON, GOLD COAST CITY* | Pimpama-Coomera | 4208 |
| *JACOBS WELL, GOLD COAST CITY* | Pimpama-Coomera | 4208 |
| *LUSCOMBE, GOLD COAST CITY* | Pimpama-Coomera | 4208 |
| *KINGSHOLME, GOLD COAST CITY* | Pimpama-Coomera | 4208 |
| *NORWELL, GOLD COAST CITY* | Pimpama-Coomera | 4208 |
| *ORMEAU HILLS, GOLD COAST CITY* | Pimpama-Coomera | 4208 |
| *ORMEAU, GOLD COAST CITY* | Pimpama-Coomera | 4208 |
| *WONGAWALLAN, GOLD COAST CITY* | Pimpama-Coomera | 4208 |
| *WOONGOOLBA, GOLD COAST CITY* | Pimpama-Coomera | 4208 |
| *WILLOW VALE, GOLD COAST CITY* | Pimpama-Coomera | 4208 |
| *SOUTHERN MORETON BAY ISLANDS, GOLD COAST* | Pimpama-Coomera | 4208 |
| *STEIGLITZ, GOLD COAST CITY* | Pimpama-Coomera | 4208 |
| *PIMPAMA, GOLD COAST CITY* | Pimpama-Coomera | 4208 |
| *COOMERA, GOLD COAST CITY* | Pimpama-Coomera | 4209 |
| *GUANABA, GOLD COAST CITY* | Pimpama-Coomera | 4209 |
| *JACOBS WELL, GOLD COAST CITY* | Pimpama-Coomera | 4209 |
| *HOPE ISLAND, GOLD COAST CITY* | Pimpama-Coomera | 4209 |
| *HELENSVALE, GOLD COAST CITY* | Pimpama-Coomera | 4209 |
| *OXENFORD, GOLD COAST CITY* | Pimpama-Coomera | 4209 |
| *NORWELL, GOLD COAST CITY* | Pimpama-Coomera | 4209 |
| *ORMEAU, GOLD COAST CITY* | Pimpama-Coomera | 4209 |
| *MAUDSLAND, GOLD COAST CITY* | Pimpama-Coomera | 4209 |
| *UPPER COOMERA, GOLD COAST CITY* | Pimpama-Coomera | 4209 |
| *WONGAWALLAN, GOLD COAST CITY* | Pimpama-Coomera | 4209 |
| *WILLOW VALE, GOLD COAST CITY* | Pimpama-Coomera | 4209 |
| *SOUTHERN MORETON BAY ISLANDS, GOLD COAST* | Pimpama-Coomera | 4209 |
| *PIMPAMA, GOLD COAST CITY* | Pimpama-Coomera | 4209 |
| *CEDAR CREEK, GOLD COAST CITY* | Albert | 4210 |
| *WONGAWALLAN, GOLD COAST CITY* | Albert | 4210 |
| *TAMBORINE MOUNTAIN, SCENIC RIM REGIONAL* | Albert | 4210 |
| *CEDAR CREEK, GOLD COAST CITY* | Pimpama-Coomera | 4210 |
| *GUANABA, GOLD COAST CITY* | Pimpama-Coomera | 4210 |
| *HELENSVALE, GOLD COAST CITY* | Pimpama-Coomera | 4210 |
| *NERANG, GOLD COAST CITY* | Pimpama-Coomera | 4210 |
| *OXENFORD, GOLD COAST CITY* | Pimpama-Coomera | 4210 |
| *MOUNT NATHAN, GOLD COAST CITY* | Pimpama-Coomera | 4210 |
| *PACIFIC PINES, GOLD COAST CITY* | Pimpama-Coomera | 4210 |
| *KINGSHOLME, GOLD COAST CITY* | Pimpama-Coomera | 4210 |
| *MAUDSLAND, GOLD COAST CITY* | Pimpama-Coomera | 4210 |
| *UPPER COOMERA, GOLD COAST CITY* | Pimpama-Coomera | 4210 |
| *WONGAWALLAN, GOLD COAST CITY* | Pimpama-Coomera | 4210 |
| *WILLOW VALE, GOLD COAST CITY* | Pimpama-Coomera | 4210 |
| *TAMBORINE MOUNTAIN, SCENIC RIM REGIONAL* | Pimpama-Coomera | 4210 |

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| *ADVANCETOWN, GOLD COAST CITY* | Nerang | 4211 |
| *ASHMORE, GOLD COAST CITY* | Nerang | 4211 |
| *BEECHMONT, SCENIC RIM REGIONAL* | Nerang | 4211 |
| *BENOWA, GOLD COAST CITY* | Nerang | 4211 |
| *BINNA BURRA, SCENIC RIM REGIONAL* | Nerang | 4211 |
| *BROADBEACH WATERS, GOLD COAST CITY* | Nerang | 4211 |
| *CARRARA, GOLD COAST CITY* | Nerang | 4211 |
| *CLAGIRABA, GOLD COAST CITY* | Nerang | 4211 |
| *CLEAR ISLAND WATERS, GOLD COAST CITY* | Nerang | 4211 |
| *GILSTON, GOLD COAST CITY* | Nerang | 4211 |
| *HIGHLAND PARK, GOLD COAST CITY* | Nerang | 4211 |
| *GAVEN, GOLD COAST CITY* | Nerang | 4211 |
| *MUDGEERABA, GOLD COAST CITY* | Nerang | 4211 |
| *NERANG, GOLD COAST CITY* | Nerang | 4211 |
| *MOUNT NATHAN, GOLD COAST CITY* | Nerang | 4211 |
| *MOLENDINAR, GOLD COAST CITY* | Nerang | 4211 |
| *NUMINBAH VALLEY, GOLD COAST CITY* | Nerang | 4211 |
| *MERRIMAC, GOLD COAST CITY* | Nerang | 4211 |
| *LOWER BEECHMONT, GOLD COAST CITY* | Nerang | 4211 |
| *NATURAL BRIDGE, GOLD COAST CITY* | Nerang | 4211 |
| *TALLAI, GOLD COAST CITY* | Nerang | 4211 |
| *WORONGARY, GOLD COAST CITY* | Nerang | 4211 |
| *ADVANCETOWN, GOLD COAST CITY* | Pimpama-Coomera | 4211 |
| *ARUNDEL, GOLD COAST CITY* | Pimpama-Coomera | 4211 |
| *BEECHMONT, SCENIC RIM REGIONAL* | Pimpama-Coomera | 4211 |
| *BINNA BURRA, SCENIC RIM REGIONAL* | Pimpama-Coomera | 4211 |
| *CLAGIRABA, GOLD COAST CITY* | Pimpama-Coomera | 4211 |
| *GUANABA, GOLD COAST CITY* | Pimpama-Coomera | 4211 |
| *ILLINBAH, SCENIC RIM REGIONAL* | Pimpama-Coomera | 4211 |
| *GAVEN, GOLD COAST CITY* | Pimpama-Coomera | 4211 |
| *HELENSVALE, GOLD COAST CITY* | Pimpama-Coomera | 4211 |
| *FLYING FOX, SCENIC RIM REGIONAL* | Pimpama-Coomera | 4211 |
| *NERANG, GOLD COAST CITY* | Pimpama-Coomera | 4211 |
| *OXENFORD, GOLD COAST CITY* | Pimpama-Coomera | 4211 |
| *MOUNT NATHAN, GOLD COAST CITY* | Pimpama-Coomera | 4211 |
| *PACIFIC PINES, GOLD COAST CITY* | Pimpama-Coomera | 4211 |
| *MOLENDINAR, GOLD COAST CITY* | Pimpama-Coomera | 4211 |
| *NUMINBAH VALLEY, GOLD COAST CITY* | Pimpama-Coomera | 4211 |
| *MAUDSLAND, GOLD COAST CITY* | Pimpama-Coomera | 4211 |
| *LOWER BEECHMONT, GOLD COAST CITY* | Pimpama-Coomera | 4211 |
| *NATURAL BRIDGE, GOLD COAST CITY* | Pimpama-Coomera | 4211 |
| *WITHEREN, SCENIC RIM REGIONAL* | Pimpama-Coomera | 4211 |
| *TAMBORINE MOUNTAIN, SCENIC RIM REGIONAL* | Pimpama-Coomera | 4211 |
| *ARUNDEL, GOLD COAST CITY* | Pimpama-Coomera | 4212 |
| *COOMBABAH, GOLD COAST CITY* | Pimpama-Coomera | 4212 |
| *COOMERA, GOLD COAST CITY* | Pimpama-Coomera | 4212 |

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| *HOPE ISLAND, GOLD COAST CITY* | Pimpama-Coomera | 4212 |
| *HELENSVALE, GOLD COAST CITY* | Pimpama-Coomera | 4212 |
| *ADVANCETOWN, GOLD COAST CITY* | Nerang | 4213 |
| *AUSTINVILLE, GOLD COAST CITY* | Nerang | 4213 |
| *BONOGIN, GOLD COAST CITY* | Nerang | 4213 |
| *CARRARA, GOLD COAST CITY* | Nerang | 4213 |
| *VARSITY LAKES, GOLD COAST CITY* | Nerang | 4213 |
| *GILSTON, GOLD COAST CITY* | Nerang | 4213 |
| *HIGHLAND PARK, GOLD COAST CITY* | Nerang | 4213 |
| *MUDGEERABA, GOLD COAST CITY* | Nerang | 4213 |
| *NERANWOOD, GOLD COAST CITY* | Nerang | 4213 |
| *NUMINBAH VALLEY, GOLD COAST CITY* | Nerang | 4213 |
| *MERRIMAC, GOLD COAST CITY* | Nerang | 4213 |
| *NATURAL BRIDGE, GOLD COAST CITY* | Nerang | 4213 |
| *TALLAI, GOLD COAST CITY* | Nerang | 4213 |
| *TALLEBUDGERA VALLEY, GOLD COAST CITY* | Nerang | 4213 |
| *SPRINGBROOK, GOLD COAST CITY* | Nerang | 4213 |
| *REEDY CREEK, GOLD COAST CITY* | Nerang | 4213 |
| *WORONGARY, GOLD COAST CITY* | Nerang | 4213 |
| *ROBINA, GOLD COAST CITY* | Nerang | 4213 |
| *AUSTINVILLE, GOLD COAST CITY* | Tallebudgera-Currumbin | 4213 |
| *BONOGIN, GOLD COAST CITY* | Tallebudgera-Currumbin | 4213 |
| *TALLEBUDGERA VALLEY, GOLD COAST CITY* | Tallebudgera-Currumbin | 4213 |
| *SPRINGBROOK, GOLD COAST CITY* | Tallebudgera-Currumbin | 4213 |
| *ASHMORE, GOLD COAST CITY* | Nerang | 4214 |
| *BENOWA, GOLD COAST CITY* | Nerang | 4214 |
| *CARRARA, GOLD COAST CITY* | Nerang | 4214 |
| *GAVEN, GOLD COAST CITY* | Nerang | 4214 |
| *NERANG, GOLD COAST CITY* | Nerang | 4214 |
| *MOLENDINAR, GOLD COAST CITY* | Nerang | 4214 |
| *SOUTHPORT, GOLD COAST CITY* | Nerang | 4214 |
| *ARUNDEL, GOLD COAST CITY* | Pimpama-Coomera | 4214 |
| *ASHMORE, GOLD COAST CITY* | Pimpama-Coomera | 4214 |
| *BIGGERA WATERS, GOLD COAST CITY* | Pimpama-Coomera | 4214 |
| *COOMBABAH, GOLD COAST CITY* | Pimpama-Coomera | 4214 |
| *GAVEN, GOLD COAST CITY* | Pimpama-Coomera | 4214 |
| *HELENSVALE, GOLD COAST CITY* | Pimpama-Coomera | 4214 |
| *MOLENDINAR, GOLD COAST CITY* | Pimpama-Coomera | 4214 |
| *LABRADOR, GOLD COAST CITY* | Pimpama-Coomera | 4214 |
| *SOUTHPORT, GOLD COAST CITY* | Pimpama-Coomera | 4214 |
| *PARKWOOD, GOLD COAST CITY* | Pimpama-Coomera | 4214 |
| *ASHMORE, GOLD COAST CITY* | Nerang | 4215 |
| *BUNDALL, GOLD COAST CITY* | Nerang | 4215 |
| *SOUTHPORT, GOLD COAST CITY* | Nerang | 4215 |
| *ASHMORE, GOLD COAST CITY* | Pimpama-Coomera | 4215 |
| *BIGGERA WATERS, GOLD COAST CITY* | Pimpama-Coomera | 4215 |

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| *LABRADOR, GOLD COAST CITY* | Pimpama-Coomera | 4215 |
| *SOUTHPORT, GOLD COAST CITY* | Pimpama-Coomera | 4215 |
| *SOUTH STRADBROKE, GOLD COAST CITY* | Island | 4216 |
| *PARADISE POINT, GOLD COAST CITY* | Island | 4216 |
| *MAIN BEACH, GOLD COAST CITY* | Island | 4216 |
| *SOUTHERN MORETON BAY ISLANDS, GOLD COAST* | Island | 4216 |
| *RUNAWAY BAY, GOLD COAST CITY* | Island | 4216 |
| *ARUNDEL, GOLD COAST CITY* | Pimpama-Coomera | 4216 |
| *BIGGERA WATERS, GOLD COAST CITY* | Pimpama-Coomera | 4216 |
| *COOMBABAH, GOLD COAST CITY* | Pimpama-Coomera | 4216 |
| *HELENSVALE, GOLD COAST CITY* | Pimpama-Coomera | 4216 |
| *HOLLYWELL, GOLD COAST CITY* | Pimpama-Coomera | 4216 |
| *PARADISE POINT, GOLD COAST CITY* | Pimpama-Coomera | 4216 |
| *LABRADOR, GOLD COAST CITY* | Pimpama-Coomera | 4216 |
| *RUNAWAY BAY, GOLD COAST CITY* | Pimpama-Coomera | 4216 |
| *SOUTH STRADBROKE, GOLD COAST CITY* | South Stradbroke Island | 4216 |
| *ASHMORE, GOLD COAST CITY* | Nerang | 4217 |
| *BENOWA, GOLD COAST CITY* | Nerang | 4217 |
| *BROADBEACH WATERS, GOLD COAST CITY* | Nerang | 4217 |
| *BROADBEACH, GOLD COAST CITY* | Nerang | 4217 |
| *BUNDALL, GOLD COAST CITY* | Nerang | 4217 |
| *CARRARA, GOLD COAST CITY* | Nerang | 4217 |
| *MAIN BEACH, GOLD COAST CITY* | Nerang | 4217 |
| *SURFERS PARADISE, GOLD COAST CITY* | Nerang | 4217 |
| *SOUTHPORT, GOLD COAST CITY* | Nerang | 4217 |
| *BENOWA, GOLD COAST CITY* | Nerang | 4218 |
| *BROADBEACH WATERS, GOLD COAST CITY* | Nerang | 4218 |
| *BROADBEACH, GOLD COAST CITY* | Nerang | 4218 |
| *BUNDALL, GOLD COAST CITY* | Nerang | 4218 |
| *BURLEIGH WATERS, GOLD COAST CITY* | Nerang | 4218 |
| *CARRARA, GOLD COAST CITY* | Nerang | 4218 |
| *CLEAR ISLAND WATERS, GOLD COAST CITY* | Nerang | 4218 |
| *MIAMI, GOLD COAST CITY* | Nerang | 4218 |
| *MERMAID BEACH, GOLD COAST CITY* | Nerang | 4218 |
| *MERMAID WATERS, GOLD COAST CITY* | Nerang | 4218 |
| *SURFERS PARADISE, GOLD COAST CITY* | Nerang | 4218 |
| *BURLEIGH HEADS, GOLD COAST CITY* | Nerang | 4219 |
| *BURLEIGH HEADS, GOLD COAST CITY* | Tallebudgera-Currumbin | 4219 |
| *TALLEBUDGERA, GOLD COAST CITY* | Tallebudgera-Currumbin | 4219 |
| *BURLEIGH HEADS, GOLD COAST CITY* | Nerang | 4220 |
| *BURLEIGH WATERS, GOLD COAST CITY* | Nerang | 4220 |
| *MIAMI, GOLD COAST CITY* | Nerang | 4220 |
| *VARSITY LAKES, GOLD COAST CITY* | Nerang | 4220 |
| *MERMAID BEACH, GOLD COAST CITY* | Nerang | 4220 |
| *MERMAID WATERS, GOLD COAST CITY* | Nerang | 4220 |
| *BURLEIGH HEADS, GOLD COAST CITY* | Tallebudgera-Currumbin | 4220 |

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| *PALM BEACH, GOLD COAST CITY* | Tallebudgera-Currumbin | 4220 |
| *TALLEBUDGERA, GOLD COAST CITY* | Tallebudgera-Currumbin | 4220 |
| *BURLEIGH HEADS, GOLD COAST CITY* | Tallebudgera-Currumbin | 4221 |
| *ELANORA, GOLD COAST CITY* | Tallebudgera-Currumbin | 4221 |
| *PALM BEACH, GOLD COAST CITY* | Tallebudgera-Currumbin | 4221 |
| *CURRUMBIN, GOLD COAST CITY* | Tallebudgera-Currumbin | 4221 |
| *CURRUMBIN VALLEY, GOLD COAST CITY* | Tallebudgera-Currumbin | 4221 |
| *CURRUMBIN WATERS, GOLD COAST CITY* | Tallebudgera-Currumbin | 4221 |
| *TALLEBUDGERA, GOLD COAST CITY* | Tallebudgera-Currumbin | 4221 |
| *ELANORA, GOLD COAST CITY* | Tallebudgera-Currumbin | 4223 |
| *PALM BEACH, GOLD COAST CITY* | Tallebudgera-Currumbin | 4223 |
| *CURRUMBIN, GOLD COAST CITY* | Tallebudgera-Currumbin | 4223 |
| *CURRUMBIN VALLEY, GOLD COAST CITY* | Tallebudgera-Currumbin | 4223 |
| *CURRUMBIN WATERS, GOLD COAST CITY* | Tallebudgera-Currumbin | 4223 |
| *TALLEBUDGERA VALLEY, GOLD COAST CITY* | Tallebudgera-Currumbin | 4223 |
| *TUGUN, GOLD COAST CITY* | Tallebudgera-Currumbin | 4223 |
| *BILINGA, GOLD COAST CITY* | Tallebudgera-Currumbin | 4224 |
| *CURRUMBIN, GOLD COAST CITY* | Tallebudgera-Currumbin | 4224 |
| *CURRUMBIN WATERS, GOLD COAST CITY* | Tallebudgera-Currumbin | 4224 |
| *TUGUN, GOLD COAST CITY* | Tallebudgera-Currumbin | 4224 |
| *BILINGA, GOLD COAST CITY* | Tallebudgera-Currumbin | 4225 |
| *COOLANGATTA, GOLD COAST CITY* | Tallebudgera-Currumbin | 4225 |
| *TUGUN, GOLD COAST CITY* | Tallebudgera-Currumbin | 4225 |
| *BROADBEACH WATERS, GOLD COAST CITY* | Nerang | 4226 |
| *BURLEIGH WATERS, GOLD COAST CITY* | Nerang | 4226 |
| *CARRARA, GOLD COAST CITY* | Nerang | 4226 |
| *CLEAR ISLAND WATERS, GOLD COAST CITY* | Nerang | 4226 |
| *VARSITY LAKES, GOLD COAST CITY* | Nerang | 4226 |
| *MERRIMAC, GOLD COAST CITY* | Nerang | 4226 |
| *MERMAID WATERS, GOLD COAST CITY* | Nerang | 4226 |
| *WORONGARY, GOLD COAST CITY* | Nerang | 4226 |
| *ROBINA, GOLD COAST CITY* | Nerang | 4226 |
| *BURLEIGH HEADS, GOLD COAST CITY* | Nerang | 4227 |
| *BURLEIGH WATERS, GOLD COAST CITY* | Nerang | 4227 |
| *VARSITY LAKES, GOLD COAST CITY* | Nerang | 4227 |
| *ROBINA, GOLD COAST CITY* | Nerang | 4227 |
| *AUSTINVILLE, GOLD COAST CITY* | Nerang | 4228 |
| *BONOGIN, GOLD COAST CITY* | Nerang | 4228 |
| *BURLEIGH HEADS, GOLD COAST CITY* | Nerang | 4228 |
| *VARSITY LAKES, GOLD COAST CITY* | Nerang | 4228 |
| *MUDGEERABA, GOLD COAST CITY* | Nerang | 4228 |
| *TALLEBUDGERA VALLEY, GOLD COAST CITY* | Nerang | 4228 |
| *SPRINGBROOK, GOLD COAST CITY* | Nerang | 4228 |
| *REEDY CREEK, GOLD COAST CITY* | Nerang | 4228 |
| *AUSTINVILLE, GOLD COAST CITY* | Tallebudgera-Currumbin | 4228 |
| *BONOGIN, GOLD COAST CITY* | Tallebudgera-Currumbin | 4228 |

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| *BURLEIGH HEADS, GOLD COAST CITY* | Tallebudgera-Currumbin | 4228 |
| *ELANORA, GOLD COAST CITY* | Tallebudgera-Currumbin | 4228 |
| *CURRUMBIN VALLEY, GOLD COAST CITY* | Tallebudgera-Currumbin | 4228 |
| *CURRUMBIN WATERS, GOLD COAST CITY* | Tallebudgera-Currumbin | 4228 |
| *TALLEBUDGERA VALLEY, GOLD COAST CITY* | Tallebudgera-Currumbin | 4228 |
| *TALLEBUDGERA, GOLD COAST CITY* | Tallebudgera-Currumbin | 4228 |
| *SPRINGBROOK, GOLD COAST CITY* | Tallebudgera-Currumbin | 4228 |
| *REEDY CREEK, GOLD COAST CITY* | Tallebudgera-Currumbin | 4228 |
| *VARSITY LAKES, GOLD COAST CITY* | Nerang | 4229 |
| *ROBINA, GOLD COAST CITY* | Nerang | 4229 |
| *ROBINA, GOLD COAST CITY* | Nerang | 4230 |
| *BOYLAND, SCENIC RIM REGIONAL* | Albert | 4270 |
| *CEDAR CREEK, GOLD COAST CITY* | Albert | 4270 |
| *CEDAR CREEK, LOGAN CITY* | Albert | 4270 |
| *JIMBOOMBA, LOGAN CITY* | Albert | 4270 |
| *MUNDOOLUN, LOGAN CITY* | Albert | 4270 |
| *KAIRABAH, LOGAN CITY* | Albert | 4270 |
| *YARRABILBA, LOGAN CITY* | Albert | 4270 |
| *TAMBORINE MOUNTAIN, SCENIC RIM REGIONAL* | Albert | 4270 |
| *TAMBORINE, LOGAN CITY* | Albert | 4270 |
| *TAMBORINE, SCENIC RIM REGIONAL* | Albert | 4270 |
| *JIMBOOMBA, LOGAN CITY* | Logan | 4270 |
| *LOGAN VILLAGE, LOGAN CITY* | Logan | 4270 |
| *YARRABILBA, LOGAN CITY* | Logan | 4270 |
| *TAMBORINE, LOGAN CITY* | Logan | 4270 |
| *CEDAR CREEK, GOLD COAST CITY* | Albert | 4271 |
| *WONGAWALLAN, GOLD COAST CITY* | Albert | 4271 |
| *TAMBORINE MOUNTAIN, SCENIC RIM REGIONAL* | Albert | 4271 |
| *TAMBORINE, SCENIC RIM REGIONAL* | Albert | 4271 |
| *GUANABA, GOLD COAST CITY* | Pimpama-Coomera | 4271 |
| *WONGAWALLAN, GOLD COAST CITY* | Pimpama-Coomera | 4271 |
| *TAMBORINE MOUNTAIN, SCENIC RIM REGIONAL* | Pimpama-Coomera | 4271 |
| *BENOBBLE, SCENIC RIM REGIONAL* | Albert | 4272 |
| *BOYLAND, SCENIC RIM REGIONAL* | Albert | 4272 |
| *WONGLEPONG, SCENIC RIM REGIONAL* | Albert | 4272 |
| *TAMBORINE MOUNTAIN, SCENIC RIM REGIONAL* | Albert | 4272 |
| *TAMBORINE, SCENIC RIM REGIONAL* | Albert | 4272 |
| *CLAGIRABA, GOLD COAST CITY* | Pimpama-Coomera | 4272 |
| *GUANABA, GOLD COAST CITY* | Pimpama-Coomera | 4272 |
| *WITHEREN, SCENIC RIM REGIONAL* | Pimpama-Coomera | 4272 |
| *TAMBORINE MOUNTAIN, SCENIC RIM REGIONAL* | Pimpama-Coomera | 4272 |
| *BIRNAM, SCENIC RIM REGIONAL* | Albert | 4275 |
| *BENOBBLE, SCENIC RIM REGIONAL* | Albert | 4275 |
| *BIDDADDABA, SCENIC RIM REGIONAL* | Albert | 4275 |
| *BINNA BURRA, SCENIC RIM REGIONAL* | Albert | 4275 |
| *BOYLAND, SCENIC RIM REGIONAL* | Albert | 4275 |

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| *CAINBABLE, SCENIC RIM REGIONAL* | Albert | 4275 |
| *CANUNGRA, SCENIC RIM REGIONAL* | Albert | 4275 |
| *KERRY, SCENIC RIM REGIONAL* | Albert | 4275 |
| *ILLINBAH, SCENIC RIM REGIONAL* | Albert | 4275 |
| *DARLINGTON, SCENIC RIM REGIONAL* | Albert | 4275 |
| *NINDOOINBAH, SCENIC RIM REGIONAL* | Albert | 4275 |
| *MUNDOOLUN, LOGAN CITY* | Albert | 4275 |
| *O'REILLY, SCENIC RIM REGIONAL* | Albert | 4275 |
| *WONGLEPONG, SCENIC RIM REGIONAL* | Albert | 4275 |
| *WITHEREN, SCENIC RIM REGIONAL* | Albert | 4275 |
| *TABRAGALBA, SCENIC RIM REGIONAL* | Albert | 4275 |
| *SOUTHERN LAMINGTON, SCENIC RIM REGIONAL* | Albert | 4275 |
| *SARABAH, SCENIC RIM REGIONAL* | Albert | 4275 |
| *TAMBORINE MOUNTAIN, SCENIC RIM REGIONAL* | Albert | 4275 |
| *TAMBORINE, SCENIC RIM REGIONAL* | Albert | 4275 |
| *MOUNT GIPPS, SCENIC RIM REGIONAL* | Logan | 4275 |
| *DARLINGTON, SCENIC RIM REGIONAL* | Logan | 4275 |
| *LAMINGTON, SCENIC RIM REGIONAL* | Logan | 4275 |
| *SOUTHERN LAMINGTON, SCENIC RIM REGIONAL* | Logan | 4275 |
| *BINNA BURRA, SCENIC RIM REGIONAL* | Nerang | 4275 |
| *NATURAL BRIDGE, GOLD COAST CITY* | Nerang | 4275 |
| *BEECHMONT, SCENIC RIM REGIONAL* | Pimpama-Coomera | 4275 |
| *BENOBBLE, SCENIC RIM REGIONAL* | Pimpama-Coomera | 4275 |
| *BINNA BURRA, SCENIC RIM REGIONAL* | Pimpama-Coomera | 4275 |
| *CANUNGRA, SCENIC RIM REGIONAL* | Pimpama-Coomera | 4275 |
| *CLAGIRABA, GOLD COAST CITY* | Pimpama-Coomera | 4275 |
| *ILLINBAH, SCENIC RIM REGIONAL* | Pimpama-Coomera | 4275 |
| *FLYING FOX, SCENIC RIM REGIONAL* | Pimpama-Coomera | 4275 |
| *FERNY GLEN, SCENIC RIM REGIONAL* | Pimpama-Coomera | 4275 |
| *O'REILLY, SCENIC RIM REGIONAL* | Pimpama-Coomera | 4275 |
| *LOWER BEECHMONT, GOLD COAST CITY* | Pimpama-Coomera | 4275 |
| *NATURAL BRIDGE, GOLD COAST CITY* | Pimpama-Coomera | 4275 |
| *WITHEREN, SCENIC RIM REGIONAL* | Pimpama-Coomera | 4275 |
| *SARABAH, SCENIC RIM REGIONAL* | Pimpama-Coomera | 4275 |
| *TAMBORINE MOUNTAIN, SCENIC RIM REGIONAL* | Pimpama-Coomera | 4275 |
| *JIMBOOMBA, LOGAN CITY* | Albert | 4280 |
| *MUNDOOLUN, LOGAN CITY* | Albert | 4280 |
| *CEDAR GROVE, LOGAN CITY* | Logan | 4280 |
| *CEDAR VALE, LOGAN CITY* | Logan | 4280 |
| *CHAMBERS FLAT, LOGAN CITY* | Logan | 4280 |
| *KAGARU, LOGAN CITY* | Logan | 4280 |
| *KAGARU, SCENIC RIM REGIONAL* | Logan | 4280 |
| *JIMBOOMBA, LOGAN CITY* | Logan | 4280 |
| *GREENBANK, LOGAN CITY* | Logan | 4280 |
| *NEW BEITH, LOGAN CITY* | Logan | 4280 |
| *MUNDOOLUN, LOGAN CITY* | Logan | 4280 |

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| *SOUTH MACLEAN, LOGAN CITY* | Logan | 4280 |
| *MUNRUBEN, LOGAN CITY* | Logan | 4280 |
| *LOGAN VILLAGE, LOGAN CITY* | Logan | 4280 |
| *NORTH MACLEAN, LOGAN CITY* | Logan | 4280 |
| *STOCKLEIGH, LOGAN CITY* | Logan | 4280 |
| *UNDULLAH, LOGAN CITY* | Logan | 4280 |
| *TAMBORINE, LOGAN CITY* | Logan | 4280 |
| *BEAUDESERT, SCENIC RIM REGIONAL* | Albert | 4285 |
| *BIRNAM, SCENIC RIM REGIONAL* | Albert | 4285 |
| *BOYLAND, SCENIC RIM REGIONAL* | Albert | 4285 |
| *CAINBABLE, SCENIC RIM REGIONAL* | Albert | 4285 |
| *CEDAR VALE, LOGAN CITY* | Albert | 4285 |
| *CHRISTMAS CREEK, SCENIC RIM REGIONAL* | Albert | 4285 |
| *KERRY, SCENIC RIM REGIONAL* | Albert | 4285 |
| *JIMBOOMBA, LOGAN CITY* | Albert | 4285 |
| *HILLVIEW, SCENIC RIM REGIONAL* | Albert | 4285 |
| *CRYNA, SCENIC RIM REGIONAL* | Albert | 4285 |
| *DARLINGTON, SCENIC RIM REGIONAL* | Albert | 4285 |
| *NINDOOINBAH, SCENIC RIM REGIONAL* | Albert | 4285 |
| *MUNDOOLUN, LOGAN CITY* | Albert | 4285 |
| *O'REILLY, SCENIC RIM REGIONAL* | Albert | 4285 |
| *LARAVALE, SCENIC RIM REGIONAL* | Albert | 4285 |
| *VERESDALE, SCENIC RIM REGIONAL* | Albert | 4285 |
| *VERESDALE SCRUB, SCENIC RIM REGIONAL* | Albert | 4285 |
| *TABOOBA, SCENIC RIM REGIONAL* | Albert | 4285 |
| *TABRAGALBA, SCENIC RIM REGIONAL* | Albert | 4285 |
| *SOUTHERN LAMINGTON, SCENIC RIM REGIONAL* | Albert | 4285 |
| *SARABAH, SCENIC RIM REGIONAL* | Albert | 4285 |
| *TAMBORINE, LOGAN CITY* | Albert | 4285 |
| *TAMBORINE, SCENIC RIM REGIONAL* | Albert | 4285 |
| *LYONS, LOGAN CITY* | Bremer | 4285 |
| *WASHPOOL, SCENIC RIM REGIONAL* | Bremer | 4285 |
| *SOUTH RIPLEY, IPSWICH CITY* | Bremer | 4285 |
| *WOOLOOMAN, SCENIC RIM REGIONAL* | Bremer | 4285 |
| *UNDULLAH, LOGAN CITY* | Bremer | 4285 |
| *UNDULLAH, SCENIC RIM REGIONAL* | Bremer | 4285 |
| *PEAK CROSSING, IPSWICH CITY* | Bremer | 4285 |
| *ALLANDALE, SCENIC RIM REGIONAL* | Logan | 4285 |
| *ALLENVIEW, SCENIC RIM REGIONAL* | Logan | 4285 |
| *BEAUDESERT, SCENIC RIM REGIONAL* | Logan | 4285 |
| *BARNEY VIEW, SCENIC RIM REGIONAL* | Logan | 4285 |
| *BIRNAM, SCENIC RIM REGIONAL* | Logan | 4285 |
| *BROMELTON, SCENIC RIM REGIONAL* | Logan | 4285 |
| *CANNON CREEK, SCENIC RIM REGIONAL* | Logan | 4285 |
| *CEDAR GROVE, LOGAN CITY* | Logan | 4285 |
| *CEDAR VALE, LOGAN CITY* | Logan | 4285 |

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|---|---|---|
| *CHINGHEE CREEK, SCENIC RIM REGIONAL* | Logan | 4285 |
| *CHRISTMAS CREEK, SCENIC RIM REGIONAL* | Logan | 4285 |
| *COULSON, SCENIC RIM REGIONAL* | Logan | 4285 |
| *KERRY, SCENIC RIM REGIONAL* | Logan | 4285 |
| *KAGARU, LOGAN CITY* | Logan | 4285 |
| *KAGARU, SCENIC RIM REGIONAL* | Logan | 4285 |
| *LYONS, LOGAN CITY* | Logan | 4285 |
| *WASHPOOL, SCENIC RIM REGIONAL* | Logan | 4285 |
| *JIMBOOMBA, LOGAN CITY* | Logan | 4285 |
| *HILLVIEW, SCENIC RIM REGIONAL* | Logan | 4285 |
| *JOSEPHVILLE, SCENIC RIM REGIONAL* | Logan | 4285 |
| *GLENEAGLE, SCENIC RIM REGIONAL* | Logan | 4285 |
| *INNISPLAIN, SCENIC RIM REGIONAL* | Logan | 4285 |
| *NEW BEITH, LOGAN CITY* | Logan | 4285 |
| *CRYNA, SCENIC RIM REGIONAL* | Logan | 4285 |
| *PALEN CREEK, SCENIC RIM REGIONAL* | Logan | 4285 |
| *MOUNT GIPPS, SCENIC RIM REGIONAL* | Logan | 4285 |
| *DARLINGTON, SCENIC RIM REGIONAL* | Logan | 4285 |
| *NINDOOINBAH, SCENIC RIM REGIONAL* | Logan | 4285 |
| *MUNDOOLUN, LOGAN CITY* | Logan | 4285 |
| *OAKY CREEK, SCENIC RIM REGIONAL* | Logan | 4285 |
| *MOUNT BARNEY, SCENIC RIM REGIONAL* | Logan | 4285 |
| *KNAPP CREEK, SCENIC RIM REGIONAL* | Logan | 4285 |
| *LARAVALE, SCENIC RIM REGIONAL* | Logan | 4285 |
| *MAROON, SCENIC RIM REGIONAL* | Logan | 4285 |
| *LAMINGTON, SCENIC RIM REGIONAL* | Logan | 4285 |
| *KOORALBYN, SCENIC RIM REGIONAL* | Logan | 4285 |
| *VERESDALE, SCENIC RIM REGIONAL* | Logan | 4285 |
| *WYARALONG, SCENIC RIM REGIONAL* | Logan | 4285 |
| *WOOLOOMAN, SCENIC RIM REGIONAL* | Logan | 4285 |
| *VERESDALE SCRUB, LOGAN CITY* | Logan | 4285 |
| *VERESDALE SCRUB, SCENIC RIM REGIONAL* | Logan | 4285 |
| *WOODHILL, LOGAN CITY* | Logan | 4285 |
| *VERESDALE, LOGAN CITY* | Logan | 4285 |
| *TABOOBA, SCENIC RIM REGIONAL* | Logan | 4285 |
| *SOUTHERN LAMINGTON, SCENIC RIM REGIONAL* | Logan | 4285 |
| *TAMROOKUM CREEK, SCENIC RIM REGIONAL* | Logan | 4285 |
| *UNDULLAH, LOGAN CITY* | Logan | 4285 |
| *UNDULLAH, SCENIC RIM REGIONAL* | Logan | 4285 |
| *TAMBORINE, LOGAN CITY* | Logan | 4285 |
| *PEAK CROSSING, IPSWICH CITY* | Logan | 4285 |
| *PEAK CROSSING, SCENIC RIM REGIONAL* | Logan | 4285 |
| *TAMROOKUM, SCENIC RIM REGIONAL* | Logan | 4285 |
| *RUNNING CREEK, SCENIC RIM REGIONAL* | Logan | 4285 |
| *RATHDOWNEY, SCENIC RIM REGIONAL* | Logan | 4285 |
| *LYONS, LOGAN CITY* | Lower Brisbane | 4285 |

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|---|---|---|
| *GREENBANK, LOGAN CITY* | Lower Brisbane | 4285 |
| *NEW BEITH, LOGAN CITY* | Lower Brisbane | 4285 |
| *SOUTH RIPLEY, IPSWICH CITY* | Lower Brisbane | 4285 |
| *UNDULLAH, LOGAN CITY* | Lower Brisbane | 4285 |
| *PEAK CROSSING, IPSWICH CITY* | Lower Brisbane | 4285 |
| *BARNEY VIEW, SCENIC RIM REGIONAL* | Logan | 4287 |
| *BURNETT CREEK, SCENIC RIM REGIONAL* | Logan | 4287 |
| *PALEN CREEK, SCENIC RIM REGIONAL* | Logan | 4287 |
| *MOUNT LINDESAY, SCENIC RIM REGIONAL* | Logan | 4287 |
| *MOUNT BARNEY, SCENIC RIM REGIONAL* | Logan | 4287 |
| *MAROON, SCENIC RIM REGIONAL* | Logan | 4287 |
| *RUNNING CREEK, SCENIC RIM REGIONAL* | Logan | 4287 |
| *RATHDOWNEY, SCENIC RIM REGIONAL* | Logan | 4287 |
| *AUGUSTINE HEIGHTS, IPSWICH CITY* | Lower Brisbane | 4300 |
| *BELLBIRD PARK, IPSWICH CITY* | Lower Brisbane | 4300 |
| *BROOKWATER, IPSWICH CITY* | Lower Brisbane | 4300 |
| *CAMIRA, IPSWICH CITY* | Lower Brisbane | 4300 |
| *CAROLE PARK, IPSWICH CITY* | Lower Brisbane | 4300 |
| *FOREST LAKE, BRISBANE CITY* | Lower Brisbane | 4300 |
| *GREENBANK, LOGAN CITY* | Lower Brisbane | 4300 |
| *GOODNA, IPSWICH CITY* | Lower Brisbane | 4300 |
| *GAILES, IPSWICH CITY* | Lower Brisbane | 4300 |
| *ELLEN GROVE, BRISBANE CITY* | Lower Brisbane | 4300 |
| *SOUTH RIPLEY, IPSWICH CITY* | Lower Brisbane | 4300 |
| *REDBANK PLAINS, IPSWICH CITY* | Lower Brisbane | 4300 |
| *REDBANK, IPSWICH CITY* | Lower Brisbane | 4300 |
| *SPRING MOUNTAIN, IPSWICH CITY* | Lower Brisbane | 4300 |
| *WHITE ROCK, IPSWICH CITY* | Lower Brisbane | 4300 |
| *SPRINGFIELD CENTRAL, IPSWICH CITY* | Lower Brisbane | 4300 |
| *SPRINGFIELD LAKES, IPSWICH CITY* | Lower Brisbane | 4300 |
| *SPRINGFIELD, IPSWICH CITY* | Lower Brisbane | 4300 |
| *WACOL, BRISBANE CITY* | Lower Brisbane | 4300 |
| *AUGUSTINE HEIGHTS, IPSWICH CITY* | Lower Brisbane | 4301 |
| *BELLBIRD PARK, IPSWICH CITY* | Lower Brisbane | 4301 |
| *COLLINGWOOD PARK, IPSWICH CITY* | Lower Brisbane | 4301 |
| *GOODNA, IPSWICH CITY* | Lower Brisbane | 4301 |
| *NEW CHUM, IPSWICH CITY* | Lower Brisbane | 4301 |
| *REDBANK PLAINS, IPSWICH CITY* | Lower Brisbane | 4301 |
| *REDBANK, IPSWICH CITY* | Lower Brisbane | 4301 |
| *SPRING MOUNTAIN, IPSWICH CITY* | Lower Brisbane | 4301 |
| *WHITE ROCK, IPSWICH CITY* | Lower Brisbane | 4301 |
| *RIVERVIEW, IPSWICH CITY* | Lower Brisbane | 4301 |
| *BARELLAN POINT, IPSWICH CITY* | Bremer | 4303 |
| *BLACKSTONE, IPSWICH CITY* | Bremer | 4303 |
| *BUNDAMBA, IPSWICH CITY* | Bremer | 4303 |
| *DINMORE, IPSWICH CITY* | Bremer | 4303 |

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| *EBBW VALE, IPSWICH CITY* | Bremer | 4303 |
| *NEW CHUM, IPSWICH CITY* | Bremer | 4303 |
| *KARALEE, IPSWICH CITY* | Bremer | 4303 |
| *SWANBANK, IPSWICH CITY* | Bremer | 4303 |
| *RIVERVIEW, IPSWICH CITY* | Bremer | 4303 |
| *BARELLAN POINT, IPSWICH CITY* | Lower Brisbane | 4303 |
| *COLLINGWOOD PARK, IPSWICH CITY* | Lower Brisbane | 4303 |
| *NEW CHUM, IPSWICH CITY* | Lower Brisbane | 4303 |
| *MOGGILL, BRISBANE CITY* | Lower Brisbane | 4303 |
| *REDBANK PLAINS, IPSWICH CITY* | Lower Brisbane | 4303 |
| *REDBANK, IPSWICH CITY* | Lower Brisbane | 4303 |
| *SWANBANK, IPSWICH CITY* | Lower Brisbane | 4303 |
| *RIVERVIEW, IPSWICH CITY* | Lower Brisbane | 4303 |
| *BLACKSTONE, IPSWICH CITY* | Bremer | 4304 |
| *BOOVAL, IPSWICH CITY* | Bremer | 4304 |
| *BUNDAMBA, IPSWICH CITY* | Bremer | 4304 |
| *DINMORE, IPSWICH CITY* | Bremer | 4304 |
| *EBBW VALE, IPSWICH CITY* | Bremer | 4304 |
| *NEW CHUM, IPSWICH CITY* | Bremer | 4304 |
| *EAST IPSWICH, IPSWICH CITY* | Bremer | 4304 |
| *EASTERN HEIGHTS, IPSWICH CITY* | Bremer | 4304 |
| *NORTH TIVOLI, IPSWICH CITY* | Bremer | 4304 |
| *RACEVIEW, IPSWICH CITY* | Bremer | 4304 |
| *NEWTOWN, IPSWICH CITY* | Bremer | 4304 |
| *NORTH BOOVAL, IPSWICH CITY* | Bremer | 4304 |
| *MOORES POCKET, IPSWICH CITY* | Bremer | 4304 |
| *KARALEE, IPSWICH CITY* | Bremer | 4304 |
| *SWANBANK, IPSWICH CITY* | Bremer | 4304 |
| *SILKSTONE, IPSWICH CITY* | Bremer | 4304 |
| *TIVOLI, IPSWICH CITY* | Bremer | 4304 |
| *AMBERLEY, IPSWICH CITY* | Bremer | 4305 |
| *BASIN POCKET, IPSWICH CITY* | Bremer | 4305 |
| *BRASSALL, IPSWICH CITY* | Bremer | 4305 |
| *BLACKSTONE, IPSWICH CITY* | Bremer | 4305 |
| *BOOVAL, IPSWICH CITY* | Bremer | 4305 |
| *BUNDAMBA, IPSWICH CITY* | Bremer | 4305 |
| *CHURCHILL, IPSWICH CITY* | Bremer | 4305 |
| *CHUWAR, IPSWICH CITY* | Bremer | 4305 |
| *COALFALLS, IPSWICH CITY* | Bremer | 4305 |
| *FLINDERS VIEW, IPSWICH CITY* | Bremer | 4305 |
| *IPSWICH, IPSWICH CITY* | Bremer | 4305 |
| *KARRABIN, IPSWICH CITY* | Bremer | 4305 |
| *EAST IPSWICH, IPSWICH CITY* | Bremer | 4305 |
| *EASTERN HEIGHTS, IPSWICH CITY* | Bremer | 4305 |
| *MUIRLEA, IPSWICH CITY* | Bremer | 4305 |
| *NORTH TIVOLI, IPSWICH CITY* | Bremer | 4305 |

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| *ONE MILE, IPSWICH CITY* | Bremer | 4305 |
| *RIPLEY, IPSWICH CITY* | Bremer | 4305 |
| *RACEVIEW, IPSWICH CITY* | Bremer | 4305 |
| *PURGA, IPSWICH CITY* | Bremer | 4305 |
| *NEWTOWN, IPSWICH CITY* | Bremer | 4305 |
| *NORTH BOOVAL, IPSWICH CITY* | Bremer | 4305 |
| *LEICHHARDT, IPSWICH CITY* | Bremer | 4305 |
| *NORTH IPSWICH, IPSWICH CITY* | Bremer | 4305 |
| *MOORES POCKET, IPSWICH CITY* | Bremer | 4305 |
| *KARALEE, IPSWICH CITY* | Bremer | 4305 |
| *WULKURAKA, IPSWICH CITY* | Bremer | 4305 |
| *WEST IPSWICH, IPSWICH CITY* | Bremer | 4305 |
| *SADLIERS CROSSING, IPSWICH CITY* | Bremer | 4305 |
| *YAMANTO, IPSWICH CITY* | Bremer | 4305 |
| *SWANBANK, IPSWICH CITY* | Bremer | 4305 |
| *WOODEND, IPSWICH CITY* | Bremer | 4305 |
| *SILKSTONE, IPSWICH CITY* | Bremer | 4305 |
| *TIVOLI, IPSWICH CITY* | Bremer | 4305 |
| *AMBERLEY, IPSWICH CITY* | Bremer | 4306 |
| *BARELLAN POINT, IPSWICH CITY* | Bremer | 4306 |
| *BRASSALL, IPSWICH CITY* | Bremer | 4306 |
| *BLACKSOIL, IPSWICH CITY* | Bremer | 4306 |
| *BLACKSTONE, IPSWICH CITY* | Bremer | 4306 |
| *BUNDAMBA, IPSWICH CITY* | Bremer | 4306 |
| *CHUWAR, BRISBANE CITY* | Bremer | 4306 |
| *CHUWAR, IPSWICH CITY* | Bremer | 4306 |
| *FLINDERS VIEW, IPSWICH CITY* | Bremer | 4306 |
| *LYONS, LOGAN CITY* | Bremer | 4306 |
| *WASHPOOL, SCENIC RIM REGIONAL* | Bremer | 4306 |
| *HARRISVILLE, SCENIC RIM REGIONAL* | Bremer | 4306 |
| *IRONBARK, IPSWICH CITY* | Bremer | 4306 |
| *HAIGSLEA, IPSWICH CITY* | Bremer | 4306 |
| *KARRABIN, IPSWICH CITY* | Bremer | 4306 |
| *GOOLMAN, IPSWICH CITY* | Bremer | 4306 |
| *EBENEZER, IPSWICH CITY* | Bremer | 4306 |
| *DEEBING HEIGHTS, IPSWICH CITY* | Bremer | 4306 |
| *JEEBROPILLY, IPSWICH CITY* | Bremer | 4306 |
| *MILORA, SCENIC RIM REGIONAL* | Bremer | 4306 |
| *MUIRLEA, IPSWICH CITY* | Bremer | 4306 |
| *SOUTH RIPLEY, IPSWICH CITY* | Bremer | 4306 |
| *NORTH TIVOLI, IPSWICH CITY* | Bremer | 4306 |
| *RIPLEY, IPSWICH CITY* | Bremer | 4306 |
| *PINE MOUNTAIN, IPSWICH CITY* | Bremer | 4306 |
| *RACEVIEW, IPSWICH CITY* | Bremer | 4306 |
| *MOUNT MARROW, IPSWICH CITY* | Bremer | 4306 |
| *PURGA, IPSWICH CITY* | Bremer | 4306 |

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| *REDBANK PLAINS, IPSWICH CITY* | Bremer | 4306 |
| *ROSEWOOD, IPSWICH CITY* | Bremer | 4306 |
| *MOUNT FORBES, IPSWICH CITY* | Bremer | 4306 |
| *LIMESTONE RIDGES, SCENIC RIM REGIONAL* | Bremer | 4306 |
| *MUTDAPILLY, IPSWICH CITY* | Bremer | 4306 |
| *NORTH IPSWICH, IPSWICH CITY* | Bremer | 4306 |
| *MUTDAPILLY, SCENIC RIM REGIONAL* | Bremer | 4306 |
| *KARALEE, IPSWICH CITY* | Bremer | 4306 |
| *THAGOONA, IPSWICH CITY* | Bremer | 4306 |
| *WULKURAKA, IPSWICH CITY* | Bremer | 4306 |
| *TALLEGALLA, IPSWICH CITY* | Bremer | 4306 |
| *WHITE ROCK, IPSWICH CITY* | Bremer | 4306 |
| *YAMANTO, IPSWICH CITY* | Bremer | 4306 |
| *SWANBANK, IPSWICH CITY* | Bremer | 4306 |
| *WALLOON, IPSWICH CITY* | Bremer | 4306 |
| *WILLOWBANK, IPSWICH CITY* | Bremer | 4306 |
| *WARRILL VIEW, SCENIC RIM REGIONAL* | Bremer | 4306 |
| *RIVERVIEW, IPSWICH CITY* | Bremer | 4306 |
| *UNDULLAH, LOGAN CITY* | Bremer | 4306 |
| *PEAK CROSSING, IPSWICH CITY* | Bremer | 4306 |
| *PEAK CROSSING, SCENIC RIM REGIONAL* | Bremer | 4306 |
| *TIVOLI, IPSWICH CITY* | Bremer | 4306 |
| *COOLANA, SOMERSET REGIONAL* | Lockyer | 4306 |
| *GLAMORGAN VALE, SOMERSET REGIONAL* | Lockyer | 4306 |
| *MINDEN, SOMERSET REGIONAL* | Lockyer | 4306 |
| *MARBURG, IPSWICH CITY* | Lockyer | 4306 |
| *LARK HILL, SOMERSET REGIONAL* | Lockyer | 4306 |
| *MARBURG, SOMERSET REGIONAL* | Lockyer | 4306 |
| *TARAMPA, SOMERSET REGIONAL* | Lockyer | 4306 |
| *WASHPOOL, SCENIC RIM REGIONAL* | Logan | 4306 |
| *UNDULLAH, LOGAN CITY* | Logan | 4306 |
| *PEAK CROSSING, IPSWICH CITY* | Logan | 4306 |
| *PEAK CROSSING, SCENIC RIM REGIONAL* | Logan | 4306 |
| *ANSTEAD, BRISBANE CITY* | Lower Brisbane | 4306 |
| *BARELLAN POINT, IPSWICH CITY* | Lower Brisbane | 4306 |
| *CHUWAR, BRISBANE CITY* | Lower Brisbane | 4306 |
| *CHUWAR, IPSWICH CITY* | Lower Brisbane | 4306 |
| *LAKE MANCHESTER, BRISBANE CITY* | Lower Brisbane | 4306 |
| *LYONS, LOGAN CITY* | Lower Brisbane | 4306 |
| *KHOLO, BRISBANE CITY* | Lower Brisbane | 4306 |
| *GREENBANK, LOGAN CITY* | Lower Brisbane | 4306 |
| *ENOGGERA RESERVOIR, BRISBANE CITY* | Lower Brisbane | 4306 |
| *SOUTH RIPLEY, IPSWICH CITY* | Lower Brisbane | 4306 |
| *PULLENVALE, BRISBANE CITY* | Lower Brisbane | 4306 |
| *MOGGILL, BRISBANE CITY* | Lower Brisbane | 4306 |
| *REDBANK PLAINS, IPSWICH CITY* | Lower Brisbane | 4306 |

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| *MOUNT CROSBY, BRISBANE CITY* | Lower Brisbane | 4306 |
| *KARALEE, IPSWICH CITY* | Lower Brisbane | 4306 |
| *KARANA DOWNS, BRISBANE CITY* | Lower Brisbane | 4306 |
| *UPPER BROOKFIELD, BRISBANE CITY* | Lower Brisbane | 4306 |
| *SPRING MOUNTAIN, IPSWICH CITY* | Lower Brisbane | 4306 |
| *WHITE ROCK, IPSWICH CITY* | Lower Brisbane | 4306 |
| *SWANBANK, IPSWICH CITY* | Lower Brisbane | 4306 |
| *RIVERVIEW, IPSWICH CITY* | Lower Brisbane | 4306 |
| *BANKS CREEK, BRISBANE CITY* | Mid Brisbane | 4306 |
| *BANKS CREEK, SOMERSET REGIONAL* | Mid Brisbane | 4306 |
| *BORALLON, SOMERSET REGIONAL* | Mid Brisbane | 4306 |
| *CHUWAR, BRISBANE CITY* | Mid Brisbane | 4306 |
| *CHUWAR, IPSWICH CITY* | Mid Brisbane | 4306 |
| *LAKE MANCHESTER, BRISBANE CITY* | Mid Brisbane | 4306 |
| *KHOLO, BRISBANE CITY* | Mid Brisbane | 4306 |
| *GLAMORGAN VALE, SOMERSET REGIONAL* | Mid Brisbane | 4306 |
| *LAKE MANCHESTER, SOMERSET REGIONAL* | Mid Brisbane | 4306 |
| *IRONBARK, IPSWICH CITY* | Mid Brisbane | 4306 |
| *HAIGSLEA, IPSWICH CITY* | Mid Brisbane | 4306 |
| *HAIGSLEA, SOMERSET REGIONAL* | Mid Brisbane | 4306 |
| *DUNDAS, SOMERSET REGIONAL* | Mid Brisbane | 4306 |
| *ENGLAND CREEK, BRISBANE CITY* | Mid Brisbane | 4306 |
| *ENGLAND CREEK, SOMERSET REGIONAL* | Mid Brisbane | 4306 |
| *ENOGGERA RESERVOIR, BRISBANE CITY* | Mid Brisbane | 4306 |
| *FAIRNEY VIEW, SOMERSET REGIONAL* | Mid Brisbane | 4306 |
| *MOUNT GLORIOUS, MORETON BAY REGIONAL* | Mid Brisbane | 4306 |
| *FERNVALE, SOMERSET REGIONAL* | Mid Brisbane | 4306 |
| *MINDEN, SOMERSET REGIONAL* | Mid Brisbane | 4306 |
| *MUIRLEA, IPSWICH CITY* | Mid Brisbane | 4306 |
| *PINE MOUNTAIN, IPSWICH CITY* | Mid Brisbane | 4306 |
| *MOUNT NEBO, MORETON BAY REGIONAL* | Mid Brisbane | 4306 |
| *PATRICK ESTATE, SOMERSET REGIONAL* | Mid Brisbane | 4306 |
| *MOUNT MARROW, IPSWICH CITY* | Mid Brisbane | 4306 |
| *ROSEWOOD, IPSWICH CITY* | Mid Brisbane | 4306 |
| *LAKE WIVENHOE, SOMERSET REGIONAL* | Mid Brisbane | 4306 |
| *LOWOOD, SOMERSET REGIONAL* | Mid Brisbane | 4306 |
| *MOUNT CROSBY, BRISBANE CITY* | Mid Brisbane | 4306 |
| *MARBURG, IPSWICH CITY* | Mid Brisbane | 4306 |
| *LARK HILL, SOMERSET REGIONAL* | Mid Brisbane | 4306 |
| *MARBURG, SOMERSET REGIONAL* | Mid Brisbane | 4306 |
| *WIVENHOE POCKET, SOMERSET REGIONAL* | Mid Brisbane | 4306 |
| *TALLEGALLA, IPSWICH CITY* | Mid Brisbane | 4306 |
| *UPPER BROOKFIELD, BRISBANE CITY* | Mid Brisbane | 4306 |
| *TARAMPA, SOMERSET REGIONAL* | Mid Brisbane | 4306 |
| *VERNOR, SOMERSET REGIONAL* | Mid Brisbane | 4306 |
| *WALLOON, IPSWICH CITY* | Mid Brisbane | 4306 |

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| *WANORA, SOMERSET REGIONAL* | Mid Brisbane | 4306 |
| *SPLIT YARD CREEK, SOMERSET REGIONAL* | Mid Brisbane | 4306 |
| *BANKS CREEK, BRISBANE CITY* | Pine | 4306 |
| *LAKE MANCHESTER, BRISBANE CITY* | Pine | 4306 |
| *DUNDAS, SOMERSET REGIONAL* | Pine | 4306 |
| *ENGLAND CREEK, BRISBANE CITY* | Pine | 4306 |
| *MOUNT GLORIOUS, MORETON BAY REGIONAL* | Pine | 4306 |
| *MOUNT NEBO, MORETON BAY REGIONAL* | Pine | 4306 |
| *HARLIN, SOMERSET REGIONAL* | Stanley | 4306 |
| *MOORE, SOMERSET REGIONAL* | Stanley | 4306 |
| *WOOLMAR, SOMERSET REGIONAL* | Stanley | 4306 |
| *SHEEP STATION CREEK, SOMERSET REGIONAL* | Stanley | 4306 |
| *ANDURAMBA, TOOWOOMBA REGIONAL* | Upper Brisbane | 4306 |
| *BANKS CREEK, BRISBANE CITY* | Upper Brisbane | 4306 |
| *BANKS CREEK, SOMERSET REGIONAL* | Upper Brisbane | 4306 |
| *AVOCA VALE, SOMERSET REGIONAL* | Upper Brisbane | 4306 |
| *BENARKIN NORTH, SOUTH BURNETT REGIONAL* | Upper Brisbane | 4306 |
| *BENARKIN, SOUTH BURNETT REGIONAL* | Upper Brisbane | 4306 |
| *BLACKBUTT NORTH, SOUTH BURNETT REGIONAL* | Upper Brisbane | 4306 |
| *BLACKBUTT SOUTH, SOUTH BURNETT REGIONAL* | Upper Brisbane | 4306 |
| *BLACKBUTT, SOUTH BURNETT REGIONAL* | Upper Brisbane | 4306 |
| *BORALLON, SOMERSET REGIONAL* | Upper Brisbane | 4306 |
| *BULLCAMP, SOUTH BURNETT REGIONAL* | Upper Brisbane | 4306 |
| *BRYDEN, SOMERSET REGIONAL* | Upper Brisbane | 4306 |
| *CHERRY CREEK, TOOWOOMBA REGIONAL* | Upper Brisbane | 4306 |
| *COLINTON, SOMERSET REGIONAL* | Upper Brisbane | 4306 |
| *CHUWAR, BRISBANE CITY* | Upper Brisbane | 4306 |
| *CHUWAR, IPSWICH CITY* | Upper Brisbane | 4306 |
| *JOHNSTOWN, SOUTH BURNETT REGIONAL* | Upper Brisbane | 4306 |
| *LAKE MANCHESTER, BRISBANE CITY* | Upper Brisbane | 4306 |
| *HARLIN, SOMERSET REGIONAL* | Upper Brisbane | 4306 |
| *GILLA, TOOWOOMBA REGIONAL* | Upper Brisbane | 4306 |
| *KHOLO, BRISBANE CITY* | Upper Brisbane | 4306 |
| *TAROMEO, SOUTH BURNETT REGIONAL* | Upper Brisbane | 4306 |
| *GLAMORGAN VALE, SOMERSET REGIONAL* | Upper Brisbane | 4306 |
| *LAKE MANCHESTER, SOMERSET REGIONAL* | Upper Brisbane | 4306 |
| *GOOGA CREEK, TOOWOOMBA REGIONAL* | Upper Brisbane | 4306 |
| *IRONBARK, IPSWICH CITY* | Upper Brisbane | 4306 |
| *HAIGSLEA, IPSWICH CITY* | Upper Brisbane | 4306 |
| *HAIGSLEA, SOMERSET REGIONAL* | Upper Brisbane | 4306 |
| *EAST NANANGO, SOUTH BURNETT REGIONAL* | Upper Brisbane | 4306 |
| *DUNDAS, SOMERSET REGIONAL* | Upper Brisbane | 4306 |
| *ENGLAND CREEK, BRISBANE CITY* | Upper Brisbane | 4306 |
| *ENGLAND CREEK, SOMERSET REGIONAL* | Upper Brisbane | 4306 |
| *ENOGGERA RESERVOIR, BRISBANE CITY* | Upper Brisbane | 4306 |
| *ELGIN VALE, GYMPIE REGIONAL* | Upper Brisbane | 4306 |

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| *FAIRNEY VIEW, SOMERSET REGIONAL* | Upper Brisbane | 4306 |
| *MOUNT GLORIOUS, MORETON BAY REGIONAL* | Upper Brisbane | 4306 |
| *FERNVALE, SOMERSET REGIONAL* | Upper Brisbane | 4306 |
| *MINDEN, SOMERSET REGIONAL* | Upper Brisbane | 4306 |
| *MUIRLEA, IPSWICH CITY* | Upper Brisbane | 4306 |
| *MOUNT STANLEY, SOMERSET REGIONAL* | Upper Brisbane | 4306 |
| *PINE MOUNTAIN, IPSWICH CITY* | Upper Brisbane | 4306 |
| *MOUNT NEBO, MORETON BAY REGIONAL* | Upper Brisbane | 4306 |
| *PATRICK ESTATE, SOMERSET REGIONAL* | Upper Brisbane | 4306 |
| *MOUNT MARROW, IPSWICH CITY* | Upper Brisbane | 4306 |
| *NUKKU, SOUTH BURNETT REGIONAL* | Upper Brisbane | 4306 |
| *ROSEWOOD, IPSWICH CITY* | Upper Brisbane | 4306 |
| *MANUMBAR, GYMPIE REGIONAL* | Upper Brisbane | 4306 |
| *LAKE WIVENHOE, SOMERSET REGIONAL* | Upper Brisbane | 4306 |
| *LOWOOD, SOMERSET REGIONAL* | Upper Brisbane | 4306 |
| *MONSILDALE, SOMERSET REGIONAL* | Upper Brisbane | 4306 |
| *KINGAHAM, SOMERSET REGIONAL* | Upper Brisbane | 4306 |
| *MOUNT CROSBY, BRISBANE CITY* | Upper Brisbane | 4306 |
| *MARBURG, IPSWICH CITY* | Upper Brisbane | 4306 |
| *LARK HILL, SOMERSET REGIONAL* | Upper Brisbane | 4306 |
| *TEELAH, SOUTH BURNETT REGIONAL* | Upper Brisbane | 4306 |
| *MARBURG, SOMERSET REGIONAL* | Upper Brisbane | 4306 |
| *LINVILLE, SOMERSET REGIONAL* | Upper Brisbane | 4306 |
| *MOORE, SOMERSET REGIONAL* | Upper Brisbane | 4306 |
| *WIVENHOE POCKET, SOMERSET REGIONAL* | Upper Brisbane | 4306 |
| *WOOLMAR, SOMERSET REGIONAL* | Upper Brisbane | 4306 |
| *YARRAMAN, TOOWOOMBA REGIONAL* | Upper Brisbane | 4306 |
| *TALLEGALLA, IPSWICH CITY* | Upper Brisbane | 4306 |
| *UPPER BROOKFIELD, BRISBANE CITY* | Upper Brisbane | 4306 |
| *TARAMPA, SOMERSET REGIONAL* | Upper Brisbane | 4306 |
| *VERNOR, SOMERSET REGIONAL* | Upper Brisbane | 4306 |
| *WANORA, SOMERSET REGIONAL* | Upper Brisbane | 4306 |
| *RUNNYMEDE, SOUTH BURNETT REGIONAL* | Upper Brisbane | 4306 |
| *SHEEP STATION CREEK, SOMERSET REGIONAL* | Upper Brisbane | 4306 |
| *SPLIT YARD CREEK, SOMERSET REGIONAL* | Upper Brisbane | 4306 |
| *SOUTH EAST NANANGO, SOUTH BURNETT REGION* | Upper Brisbane | 4306 |
| *COLEYVILLE, SCENIC RIM REGIONAL* | Bremer | 4307 |
| *HARRISVILLE, SCENIC RIM REGIONAL* | Bremer | 4307 |
| *MOUNT FORBES, SCENIC RIM REGIONAL* | Bremer | 4307 |
| *MOUNT FORBES, IPSWICH CITY* | Bremer | 4307 |
| *LOWER MOUNT WALKER, SCENIC RIM REGIONAL* | Bremer | 4307 |
| *MUTDAPILLY, IPSWICH CITY* | Bremer | 4307 |
| *MOUNT WALKER, SCENIC RIM REGIONAL* | Bremer | 4307 |
| *MUTDAPILLY, SCENIC RIM REGIONAL* | Bremer | 4307 |
| *LOWER MOUNT WALKER, IPSWICH CITY* | Bremer | 4307 |
| *WARRILL VIEW, SCENIC RIM REGIONAL* | Bremer | 4307 |

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| *ARATULA, SCENIC RIM REGIONAL* | Bremer | 4309 |
| *ANTHONY, SCENIC RIM REGIONAL* | Bremer | 4309 |
| *CARNEYS CREEK, SCENIC RIM REGIONAL* | Bremer | 4309 |
| *CHARLWOOD, SCENIC RIM REGIONAL* | Bremer | 4309 |
| *CLUMBER, SCENIC RIM REGIONAL* | Bremer | 4309 |
| *TAROME, SCENIC RIM REGIONAL* | Bremer | 4309 |
| *WASHPOOL, SCENIC RIM REGIONAL* | Bremer | 4309 |
| *HARRISVILLE, SCENIC RIM REGIONAL* | Bremer | 4309 |
| *GOOMBURRA, SOUTHERN DOWNS REGIONAL* | Bremer | 4309 |
| *FASSIFERN VALLEY, SCENIC RIM REGIONAL* | Bremer | 4309 |
| *CROFTBY, SCENIC RIM REGIONAL* | Bremer | 4309 |
| *FASSIFERN, SCENIC RIM REGIONAL* | Bremer | 4309 |
| *EMU VALE, SOUTHERN DOWNS REGIONAL* | Bremer | 4309 |
| *FRAZERVIEW, SCENIC RIM REGIONAL* | Bremer | 4309 |
| *MILORA, SCENIC RIM REGIONAL* | Bremer | 4309 |
| *MOOGERAH, SCENIC RIM REGIONAL* | Bremer | 4309 |
| *OBUM, SCENIC RIM REGIONAL* | Bremer | 4309 |
| *SILVERDALE, SCENIC RIM REGIONAL* | Bremer | 4309 |
| *RADFORD, SCENIC RIM REGIONAL* | Bremer | 4309 |
| *MOUNT ALFORD, SCENIC RIM REGIONAL* | Bremer | 4309 |
| *MOUNT EDWARDS, SCENIC RIM REGIONAL* | Bremer | 4309 |
| *ROSEVALE, SCENIC RIM REGIONAL* | Bremer | 4309 |
| *MORWINCHA, SCENIC RIM REGIONAL* | Bremer | 4309 |
| *MUNBILLA, SCENIC RIM REGIONAL* | Bremer | 4309 |
| *LIMESTONE RIDGES, SCENIC RIM REGIONAL* | Bremer | 4309 |
| *KENTS LAGOON, SCENIC RIM REGIONAL* | Bremer | 4309 |
| *MILBONG, SCENIC RIM REGIONAL* | Bremer | 4309 |
| *MOORANG, SCENIC RIM REGIONAL* | Bremer | 4309 |
| *KALBAR, SCENIC RIM REGIONAL* | Bremer | 4309 |
| *WILSONS PLAINS, SCENIC RIM REGIONAL* | Bremer | 4309 |
| *TOWNSON, LOCKYER VALLEY REGIONAL* | Bremer | 4309 |
| *WOOLOOMAN, SCENIC RIM REGIONAL* | Bremer | 4309 |
| *SWANFELS, SOUTHERN DOWNS REGIONAL* | Bremer | 4309 |
| *WARRILL VIEW, SCENIC RIM REGIONAL* | Bremer | 4309 |
| *TREGONY, SOUTHERN DOWNS REGIONAL* | Bremer | 4309 |
| *UNDULLAH, SCENIC RIM REGIONAL* | Bremer | 4309 |
| *PEAK CROSSING, SCENIC RIM REGIONAL* | Bremer | 4309 |
| *TAROME, SCENIC RIM REGIONAL* | Lockyer | 4309 |
| *MOORANG, SCENIC RIM REGIONAL* | Lockyer | 4309 |
| *TOWNSON, LOCKYER VALLEY REGIONAL* | Lockyer | 4309 |
| *CARNEYS CREEK, SCENIC RIM REGIONAL* | Logan | 4309 |
| *COOCHIN, SCENIC RIM REGIONAL* | Logan | 4309 |
| *WASHPOOL, SCENIC RIM REGIONAL* | Logan | 4309 |
| *CROFTBY, SCENIC RIM REGIONAL* | Logan | 4309 |
| *EMU VALE, SOUTHERN DOWNS REGIONAL* | Logan | 4309 |
| *MOOGERAH, SCENIC RIM REGIONAL* | Logan | 4309 |

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| *MOUNT ALFORD, SCENIC RIM REGIONAL* | Logan | 4309 |
| *UNDULLAH, LOGAN CITY* | Logan | 4309 |
| *UNDULLAH, SCENIC RIM REGIONAL* | Logan | 4309 |
| *PEAK CROSSING, SCENIC RIM REGIONAL* | Logan | 4309 |
| *ARATULA, SCENIC RIM REGIONAL* | Bremer | 4310 |
| *ANTHONY, SCENIC RIM REGIONAL* | Bremer | 4310 |
| *BLANTYRE, SCENIC RIM REGIONAL* | Bremer | 4310 |
| *CHARLWOOD, SCENIC RIM REGIONAL* | Bremer | 4310 |
| *CLUMBER, SCENIC RIM REGIONAL* | Bremer | 4310 |
| *COULSON, SCENIC RIM REGIONAL* | Bremer | 4310 |
| *WASHPOOL, SCENIC RIM REGIONAL* | Bremer | 4310 |
| *FASSIFERN VALLEY, SCENIC RIM REGIONAL* | Bremer | 4310 |
| *FASSIFERN, SCENIC RIM REGIONAL* | Bremer | 4310 |
| *MOUNT FRENCH, SCENIC RIM REGIONAL* | Bremer | 4310 |
| *MILORA, SCENIC RIM REGIONAL* | Bremer | 4310 |
| *MOOGERAH, SCENIC RIM REGIONAL* | Bremer | 4310 |
| *OBUM, SCENIC RIM REGIONAL* | Bremer | 4310 |
| *MOUNT ALFORD, SCENIC RIM REGIONAL* | Bremer | 4310 |
| *MOUNT EDWARDS, SCENIC RIM REGIONAL* | Bremer | 4310 |
| *MORWINCHA, SCENIC RIM REGIONAL* | Bremer | 4310 |
| *MUNBILLA, SCENIC RIM REGIONAL* | Bremer | 4310 |
| *LIMESTONE RIDGES, SCENIC RIM REGIONAL* | Bremer | 4310 |
| *KULGUN, SCENIC RIM REGIONAL* | Bremer | 4310 |
| *MILBONG, SCENIC RIM REGIONAL* | Bremer | 4310 |
| *KALBAR, SCENIC RIM REGIONAL* | Bremer | 4310 |
| *TEVIOTVILLE, SCENIC RIM REGIONAL* | Bremer | 4310 |
| *WYARALONG, SCENIC RIM REGIONAL* | Bremer | 4310 |
| *WOOLOOMAN, SCENIC RIM REGIONAL* | Bremer | 4310 |
| *UNDULLAH, SCENIC RIM REGIONAL* | Bremer | 4310 |
| *TEMPLIN, SCENIC RIM REGIONAL* | Bremer | 4310 |
| *ROADVALE, SCENIC RIM REGIONAL* | Bremer | 4310 |
| *ALLANDALE, SCENIC RIM REGIONAL* | Logan | 4310 |
| *ALLENVIEW, SCENIC RIM REGIONAL* | Logan | 4310 |
| *BARNEY VIEW, SCENIC RIM REGIONAL* | Logan | 4310 |
| *BROMELTON, SCENIC RIM REGIONAL* | Logan | 4310 |
| *BOONAH, SCENIC RIM REGIONAL* | Logan | 4310 |
| *BUNJURGEN, SCENIC RIM REGIONAL* | Logan | 4310 |
| *BURNETT CREEK, SCENIC RIM REGIONAL* | Logan | 4310 |
| *BUNBURRA, SCENIC RIM REGIONAL* | Logan | 4310 |
| *CANNON CREEK, SCENIC RIM REGIONAL* | Logan | 4310 |
| *CARNEYS CREEK, SCENIC RIM REGIONAL* | Logan | 4310 |
| *CHARLWOOD, SCENIC RIM REGIONAL* | Logan | 4310 |
| *COOCHIN, SCENIC RIM REGIONAL* | Logan | 4310 |
| *COULSON, SCENIC RIM REGIONAL* | Logan | 4310 |
| *KAGARU, SCENIC RIM REGIONAL* | Logan | 4310 |
| *HOYA, SCENIC RIM REGIONAL* | Logan | 4310 |

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| *FRENCHES CREEK, SCENIC RIM REGIONAL* | Logan | 4310 |
| *CROFTBY, SCENIC RIM REGIONAL* | Logan | 4310 |
| *MOUNT FRENCH, SCENIC RIM REGIONAL* | Logan | 4310 |
| *DUGANDAN, SCENIC RIM REGIONAL* | Logan | 4310 |
| *MOOGERAH, SCENIC RIM REGIONAL* | Logan | 4310 |
| *MOUNT ALFORD, SCENIC RIM REGIONAL* | Logan | 4310 |
| *MOUNT BARNEY, SCENIC RIM REGIONAL* | Logan | 4310 |
| *MILFORD, SCENIC RIM REGIONAL* | Logan | 4310 |
| *KNAPP CREEK, SCENIC RIM REGIONAL* | Logan | 4310 |
| *MOUNT COLLIERY, SOUTHERN DOWNS REGIONAL* | Logan | 4310 |
| *KENTS POCKET, SCENIC RIM REGIONAL* | Logan | 4310 |
| *MILBONG, SCENIC RIM REGIONAL* | Logan | 4310 |
| *MAROON, SCENIC RIM REGIONAL* | Logan | 4310 |
| *KOORALBYN, SCENIC RIM REGIONAL* | Logan | 4310 |
| *TEVIOTVILLE, SCENIC RIM REGIONAL* | Logan | 4310 |
| *WYARALONG, SCENIC RIM REGIONAL* | Logan | 4310 |
| *WOOLOOMAN, SCENIC RIM REGIONAL* | Logan | 4310 |
| *THE HEAD, SOUTHERN DOWNS REGIONAL* | Logan | 4310 |
| *UNDULLAH, SCENIC RIM REGIONAL* | Logan | 4310 |
| *TEMPLIN, SCENIC RIM REGIONAL* | Logan | 4310 |
| *ROADVALE, SCENIC RIM REGIONAL* | Logan | 4310 |
| *RATHDOWNEY, SCENIC RIM REGIONAL* | Logan | 4310 |
| *WALLACES CREEK, SCENIC RIM REGIONAL* | Logan | 4310 |
| *ATKINSONS DAM, SOMERSET REGIONAL* | Lockyer | 4311 |
| *BRIGHTVIEW, LOCKYER VALLEY REGIONAL* | Lockyer | 4311 |
| *BRIGHTVIEW, SOMERSET REGIONAL* | Lockyer | 4311 |
| *BUARABA, SOMERSET REGIONAL* | Lockyer | 4311 |
| *CHURCHABLE, LOCKYER VALLEY REGIONAL* | Lockyer | 4311 |
| *CLARENDON, SOMERSET REGIONAL* | Lockyer | 4311 |
| *COOLANA, SOMERSET REGIONAL* | Lockyer | 4311 |
| *COOMINYA, SOMERSET REGIONAL* | Lockyer | 4311 |
| *LYNFORD, LOCKYER VALLEY REGIONAL* | Lockyer | 4311 |
| *GLAMORGAN VALE, SOMERSET REGIONAL* | Lockyer | 4311 |
| *GLENORE GROVE, LOCKYER VALLEY REGIONAL* | Lockyer | 4311 |
| *HATTON VALE, LOCKYER VALLEY REGIONAL* | Lockyer | 4311 |
| *MOUNT HALLEN, SOMERSET REGIONAL* | Lockyer | 4311 |
| *MORTON VALE, LOCKYER VALLEY REGIONAL* | Lockyer | 4311 |
| *MINDEN, SOMERSET REGIONAL* | Lockyer | 4311 |
| *PATRICK ESTATE, SOMERSET REGIONAL* | Lockyer | 4311 |
| *SPRING CREEK, LOCKYER VALLEY REGIONAL* | Lockyer | 4311 |
| *MOUNT TARAMPA, SOMERSET REGIONAL* | Lockyer | 4311 |
| *LOCKROSE, LOCKYER VALLEY REGIONAL* | Lockyer | 4311 |
| *LOCKROSE, SOMERSET REGIONAL* | Lockyer | 4311 |
| *LOCKYER WATERS, LOCKYER VALLEY REGIONAL* | Lockyer | 4311 |
| *LOWOOD, SOMERSET REGIONAL* | Lockyer | 4311 |
| *MARBURG, IPSWICH CITY* | Lockyer | 4311 |

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| *KENSINGTON GROVE, LOCKYER VALLEY REGIONA* | Lockyer | 4311 |
| *MARBURG, SOMERSET REGIONAL* | Lockyer | 4311 |
| *KENTVILLE, LOCKYER VALLEY REGIONAL* | Lockyer | 4311 |
| *TALLEGALLA, IPSWICH CITY* | Lockyer | 4311 |
| *TARAMPA, SOMERSET REGIONAL* | Lockyer | 4311 |
| *PRENZLAU, SOMERSET REGIONAL* | Lockyer | 4311 |
| *REGENCY DOWNS, LOCKYER VALLEY REGIONAL* | Lockyer | 4311 |
| *RIFLE RANGE, SOMERSET REGIONAL* | Lockyer | 4311 |
| *COOMINYA, SOMERSET REGIONAL* | Mid Brisbane | 4311 |
| *GLAMORGAN VALE, SOMERSET REGIONAL* | Mid Brisbane | 4311 |
| *MINDEN, SOMERSET REGIONAL* | Mid Brisbane | 4311 |
| *PATRICK ESTATE, SOMERSET REGIONAL* | Mid Brisbane | 4311 |
| *LAKE WIVENHOE, SOMERSET REGIONAL* | Mid Brisbane | 4311 |
| *LOWOOD, SOMERSET REGIONAL* | Mid Brisbane | 4311 |
| *MARBURG, IPSWICH CITY* | Mid Brisbane | 4311 |
| *MARBURG, SOMERSET REGIONAL* | Mid Brisbane | 4311 |
| *WIVENHOE POCKET, SOMERSET REGIONAL* | Mid Brisbane | 4311 |
| *TARAMPA, SOMERSET REGIONAL* | Mid Brisbane | 4311 |
| *WIVENHOE HILL, SOMERSET REGIONAL* | Mid Brisbane | 4311 |
| *COOMINYA, SOMERSET REGIONAL* | Upper Brisbane | 4311 |
| *GLAMORGAN VALE, SOMERSET REGIONAL* | Upper Brisbane | 4311 |
| *MOUNT HALLEN, SOMERSET REGIONAL* | Upper Brisbane | 4311 |
| *MINDEN, SOMERSET REGIONAL* | Upper Brisbane | 4311 |
| *PATRICK ESTATE, SOMERSET REGIONAL* | Upper Brisbane | 4311 |
| *MOOMBRA, SOMERSET REGIONAL* | Upper Brisbane | 4311 |
| *LAKE WIVENHOE, SOMERSET REGIONAL* | Upper Brisbane | 4311 |
| *LOWOOD, SOMERSET REGIONAL* | Upper Brisbane | 4311 |
| *MARBURG, IPSWICH CITY* | Upper Brisbane | 4311 |
| *MARBURG, SOMERSET REGIONAL* | Upper Brisbane | 4311 |
| *WIVENHOE POCKET, SOMERSET REGIONAL* | Upper Brisbane | 4311 |
| *TARAMPA, SOMERSET REGIONAL* | Upper Brisbane | 4311 |
| *WIVENHOE HILL, SOMERSET REGIONAL* | Upper Brisbane | 4311 |
| *BUARABA SOUTH, LOCKYER VALLEY REGIONAL* | Lockyer | 4312 |
| *BUARABA, SOMERSET REGIONAL* | Lockyer | 4312 |
| *CHURCHABLE, LOCKYER VALLEY REGIONAL* | Lockyer | 4312 |
| *MOUNT HALLEN, SOMERSET REGIONAL* | Lockyer | 4312 |
| *SPRING CREEK, LOCKYER VALLEY REGIONAL* | Lockyer | 4312 |
| *REDBANK CREEK, SOMERSET REGIONAL* | Lockyer | 4312 |
| *PALMTREE, TOOWOOMBA REGIONAL* | Lockyer | 4312 |
| *VINEGAR HILL, LOCKYER VALLEY REGIONAL* | Lockyer | 4312 |
| *RAVENSBOURNE, TOOWOOMBA REGIONAL* | Lockyer | 4312 |
| *DUNDAS, SOMERSET REGIONAL* | Pine | 4312 |
| *MOUNT MEE, MORETON BAY REGIONAL* | Pine | 4312 |
| *MOUNT PLEASANT, MORETON BAY REGIONAL* | Pine | 4312 |
| *MOUNT BYRON, SOMERSET REGIONAL* | Pine | 4312 |
| *LACEYS CREEK, MORETON BAY REGIONAL* | Pine | 4312 |

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| *BRYDEN, SOMERSET REGIONAL* | Stanley | 4312 |
| *COOEEIMBARDI, SOMERSET REGIONAL* | Stanley | 4312 |
| *HAZELDEAN, SOMERSET REGIONAL* | Stanley | 4312 |
| *CROSSDALE, SOMERSET REGIONAL* | Stanley | 4312 |
| *DUNDAS, SOMERSET REGIONAL* | Stanley | 4312 |
| *FULHAM, SOMERSET REGIONAL* | Stanley | 4312 |
| *MOUNT MEE, MORETON BAY REGIONAL* | Stanley | 4312 |
| *LAKE WIVENHOE, SOMERSET REGIONAL* | Stanley | 4312 |
| *MOUNT PLEASANT, MORETON BAY REGIONAL* | Stanley | 4312 |
| *MOUNT BYRON, SOMERSET REGIONAL* | Stanley | 4312 |
| *LACEYS CREEK, MORETON BAY REGIONAL* | Stanley | 4312 |
| *WESTVALE, SOMERSET REGIONAL* | Stanley | 4312 |
| *SOMERSET DAM, SOMERSET REGIONAL* | Stanley | 4312 |
| *BIARRA, SOMERSET REGIONAL* | Upper Brisbane | 4312 |
| *BUARABA, SOMERSET REGIONAL* | Upper Brisbane | 4312 |
| *BRYDEN, SOMERSET REGIONAL* | Upper Brisbane | 4312 |
| *COOEEIMBARDI, SOMERSET REGIONAL* | Upper Brisbane | 4312 |
| *COAL CREEK, SOMERSET REGIONAL* | Upper Brisbane | 4312 |
| *COOMINYA, SOMERSET REGIONAL* | Upper Brisbane | 4312 |
| *GLEN ESK, SOMERSET REGIONAL* | Upper Brisbane | 4312 |
| *HAZELDEAN, SOMERSET REGIONAL* | Upper Brisbane | 4312 |
| *ESK, SOMERSET REGIONAL* | Upper Brisbane | 4312 |
| *CRESSBROOK CREEK, TOOWOOMBA REGIONAL* | Upper Brisbane | 4312 |
| *CRESSBROOK, SOMERSET REGIONAL* | Upper Brisbane | 4312 |
| *CROSSDALE, SOMERSET REGIONAL* | Upper Brisbane | 4312 |
| *DUNDAS, SOMERSET REGIONAL* | Upper Brisbane | 4312 |
| *MOUNT HALLEN, SOMERSET REGIONAL* | Upper Brisbane | 4312 |
| *FULHAM, SOMERSET REGIONAL* | Upper Brisbane | 4312 |
| *REDBANK CREEK, SOMERSET REGIONAL* | Upper Brisbane | 4312 |
| *MOOMBRA, SOMERSET REGIONAL* | Upper Brisbane | 4312 |
| *LAKE WIVENHOE, SOMERSET REGIONAL* | Upper Brisbane | 4312 |
| *MOUNT BYRON, SOMERSET REGIONAL* | Upper Brisbane | 4312 |
| *MURRUMBA, SOMERSET REGIONAL* | Upper Brisbane | 4312 |
| *LACEYS CREEK, MORETON BAY REGIONAL* | Upper Brisbane | 4312 |
| *LOWER CRESSBROOK, SOMERSET REGIONAL* | Upper Brisbane | 4312 |
| *RAVENSBOURNE, TOOWOOMBA REGIONAL* | Upper Brisbane | 4312 |
| *SOMERSET DAM, SOMERSET REGIONAL* | Upper Brisbane | 4312 |
| *GREGORS CREEK, SOMERSET REGIONAL* | Stanley | 4313 |
| *HAZELDEAN, SOMERSET REGIONAL* | Stanley | 4313 |
| *FULHAM, SOMERSET REGIONAL* | Stanley | 4313 |
| *ANDURAMBA, TOOWOOMBA REGIONAL* | Upper Brisbane | 4313 |
| *BIARRA, SOMERSET REGIONAL* | Upper Brisbane | 4313 |
| *BRAEMORE, SOMERSET REGIONAL* | Upper Brisbane | 4313 |
| *CABOONBAH, SOMERSET REGIONAL* | Upper Brisbane | 4313 |
| *COAL CREEK, SOMERSET REGIONAL* | Upper Brisbane | 4313 |
| *HARLIN, SOMERSET REGIONAL* | Upper Brisbane | 4313 |

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| *IVORY CREEK, SOMERSET REGIONAL* | Upper Brisbane | 4313 |
| *GREGORS CREEK, SOMERSET REGIONAL* | Upper Brisbane | 4313 |
| *HAZELDEAN, SOMERSET REGIONAL* | Upper Brisbane | 4313 |
| *ESK, SOMERSET REGIONAL* | Upper Brisbane | 4313 |
| *ESKDALE, SOMERSET REGIONAL* | Upper Brisbane | 4313 |
| *CRESSBROOK CREEK, TOOWOOMBA REGIONAL* | Upper Brisbane | 4313 |
| *CRESSBROOK, SOMERSET REGIONAL* | Upper Brisbane | 4313 |
| *FULHAM, SOMERSET REGIONAL* | Upper Brisbane | 4313 |
| *MOUNT BEPPO, SOMERSET REGIONAL* | Upper Brisbane | 4313 |
| *OTTABA, SOMERSET REGIONAL* | Upper Brisbane | 4313 |
| *LAKE WIVENHOE, SOMERSET REGIONAL* | Upper Brisbane | 4313 |
| *LOWER CRESSBROOK, SOMERSET REGIONAL* | Upper Brisbane | 4313 |
| *WOOLMAR, SOMERSET REGIONAL* | Upper Brisbane | 4313 |
| *THE BLUFF, TOOWOOMBA REGIONAL* | Upper Brisbane | 4313 |
| *YIMBUN, SOMERSET REGIONAL* | Upper Brisbane | 4313 |
| *TOOGOOLAWAH, SOMERSET REGIONAL* | Upper Brisbane | 4313 |
| *SCRUB CREEK, SOMERSET REGIONAL* | Upper Brisbane | 4313 |
| *ASHWELL, IPSWICH CITY* | Bremer | 4340 |
| *CALVERT, IPSWICH CITY* | Bremer | 4340 |
| *COLEYVILLE, SCENIC RIM REGIONAL* | Bremer | 4340 |
| *LAIDLEY SOUTH, LOCKYER VALLEY REGIONAL* | Bremer | 4340 |
| *LAIDLEY, LOCKYER VALLEY REGIONAL* | Bremer | 4340 |
| *TAROME, SCENIC RIM REGIONAL* | Bremer | 4340 |
| *HARRISVILLE, SCENIC RIM REGIONAL* | Bremer | 4340 |
| *GRANDCHESTER, IPSWICH CITY* | Bremer | 4340 |
| *EBENEZER, IPSWICH CITY* | Bremer | 4340 |
| *JEEBROPILLY, IPSWICH CITY* | Bremer | 4340 |
| *MOUNT FORBES, SCENIC RIM REGIONAL* | Bremer | 4340 |
| *FRAZERVIEW, SCENIC RIM REGIONAL* | Bremer | 4340 |
| *LANEFIELD, IPSWICH CITY* | Bremer | 4340 |
| *MULGOWIE, LOCKYER VALLEY REGIONAL* | Bremer | 4340 |
| *MOUNT MORT, IPSWICH CITY* | Bremer | 4340 |
| *SILVERDALE, SCENIC RIM REGIONAL* | Bremer | 4340 |
| *RADFORD, SCENIC RIM REGIONAL* | Bremer | 4340 |
| *PURGA, IPSWICH CITY* | Bremer | 4340 |
| *ROSEVALE, SCENIC RIM REGIONAL* | Bremer | 4340 |
| *ROSEWOOD, IPSWICH CITY* | Bremer | 4340 |
| *MOUNT FORBES, IPSWICH CITY* | Bremer | 4340 |
| *MERRYVALE, SCENIC RIM REGIONAL* | Bremer | 4340 |
| *LOWER MOUNT WALKER, SCENIC RIM REGIONAL* | Bremer | 4340 |
| *MUTDAPILLY, IPSWICH CITY* | Bremer | 4340 |
| *MOUNT WALKER WEST, IPSWICH CITY* | Bremer | 4340 |
| *MOUNT WALKER WEST, SCENIC RIM REGIONAL* | Bremer | 4340 |
| *MOUNT WALKER, SCENIC RIM REGIONAL* | Bremer | 4340 |
| *MUTDAPILLY, SCENIC RIM REGIONAL* | Bremer | 4340 |
| *MOORANG, SCENIC RIM REGIONAL* | Bremer | 4340 |

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| *LOWER MOUNT WALKER, IPSWICH CITY* | Bremer | 4340 |
| *WILSONS PLAINS, SCENIC RIM REGIONAL* | Bremer | 4340 |
| *THE BLUFF, IPSWICH CITY* | Bremer | 4340 |
| *TALLEGALLA, IPSWICH CITY* | Bremer | 4340 |
| *TOWNSON, LOCKYER VALLEY REGIONAL* | Bremer | 4340 |
| *WILLOWBANK, IPSWICH CITY* | Bremer | 4340 |
| *WARRILL VIEW, SCENIC RIM REGIONAL* | Bremer | 4340 |
| *THORNTON, LOCKYER VALLEY REGIONAL* | Bremer | 4340 |
| *SUMMERHOLM, LOCKYER VALLEY REGIONAL* | Bremer | 4340 |
| *PEAK CROSSING, IPSWICH CITY* | Bremer | 4340 |
| *PEAK CROSSING, SCENIC RIM REGIONAL* | Bremer | 4340 |
| *CALVERT, IPSWICH CITY* | Lockyer | 4340 |
| *LAIDLEY SOUTH, LOCKYER VALLEY REGIONAL* | Lockyer | 4340 |
| *LAIDLEY, LOCKYER VALLEY REGIONAL* | Lockyer | 4340 |
| *HATTON VALE, LOCKYER VALLEY REGIONAL* | Lockyer | 4340 |
| *GRANDCHESTER, IPSWICH CITY* | Lockyer | 4340 |
| *MINDEN, SOMERSET REGIONAL* | Lockyer | 4340 |
| *MULGOWIE, LOCKYER VALLEY REGIONAL* | Lockyer | 4340 |
| *MOUNT MORT, IPSWICH CITY* | Lockyer | 4340 |
| *ROSEVALE, SCENIC RIM REGIONAL* | Lockyer | 4340 |
| *MARBURG, IPSWICH CITY* | Lockyer | 4340 |
| *MOORANG, SCENIC RIM REGIONAL* | Lockyer | 4340 |
| *THE BLUFF, IPSWICH CITY* | Lockyer | 4340 |
| *TALLEGALLA, IPSWICH CITY* | Lockyer | 4340 |
| *TOWNSON, LOCKYER VALLEY REGIONAL* | Lockyer | 4340 |
| *WOOLSHED, IPSWICH CITY* | Lockyer | 4340 |
| *THORNTON, LOCKYER VALLEY REGIONAL* | Lockyer | 4340 |
| *SUMMERHOLM, LOCKYER VALLEY REGIONAL* | Lockyer | 4340 |
| *ASHWELL, IPSWICH CITY* | Mid Brisbane | 4340 |
| *MINDEN, SOMERSET REGIONAL* | Mid Brisbane | 4340 |
| *ROSEWOOD, IPSWICH CITY* | Mid Brisbane | 4340 |
| *MARBURG, IPSWICH CITY* | Mid Brisbane | 4340 |
| *MARBURG, SOMERSET REGIONAL* | Mid Brisbane | 4340 |
| *TALLEGALLA, IPSWICH CITY* | Mid Brisbane | 4340 |
| *ASHWELL, IPSWICH CITY* | Upper Brisbane | 4340 |
| *MINDEN, SOMERSET REGIONAL* | Upper Brisbane | 4340 |
| *MARBURG, IPSWICH CITY* | Upper Brisbane | 4340 |
| *MARBURG, SOMERSET REGIONAL* | Upper Brisbane | 4340 |
| *TALLEGALLA, IPSWICH CITY* | Upper Brisbane | 4340 |
| *LAIDLEY SOUTH, LOCKYER VALLEY REGIONAL* | Bremer | 4341 |
| *LAIDLEY, LOCKYER VALLEY REGIONAL* | Bremer | 4341 |
| *TAROME, SCENIC RIM REGIONAL* | Bremer | 4341 |
| *GRANDCHESTER, IPSWICH CITY* | Bremer | 4341 |
| *MULGOWIE, LOCKYER VALLEY REGIONAL* | Bremer | 4341 |
| *MOUNT MORT, IPSWICH CITY* | Bremer | 4341 |
| *ROSEVALE, SCENIC RIM REGIONAL* | Bremer | 4341 |

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| *MOORANG, SCENIC RIM REGIONAL* | Bremer | 4341 |
| *TOWNSON, LOCKYER VALLEY REGIONAL* | Bremer | 4341 |
| *THORNTON, LOCKYER VALLEY REGIONAL* | Bremer | 4341 |
| *SUMMERHOLM, LOCKYER VALLEY REGIONAL* | Bremer | 4341 |
| *BLENHEIM, LOCKYER VALLEY REGIONAL* | Lockyer | 4341 |
| *BRIGHTVIEW, LOCKYER VALLEY REGIONAL* | Lockyer | 4341 |
| *FOREST HILL, LOCKYER VALLEY REGIONAL* | Lockyer | 4341 |
| *INGOLDSBY, LOCKYER VALLEY REGIONAL* | Lockyer | 4341 |
| *LAIDLEY CREEK WEST, LOCKYER VALLEY REGIO* | Lockyer | 4341 |
| *LAIDLEY HEIGHTS, LOCKYER VALLEY REGIONAL* | Lockyer | 4341 |
| *LAIDLEY NORTH, LOCKYER VALLEY REGIONAL* | Lockyer | 4341 |
| *LAIDLEY SOUTH, LOCKYER VALLEY REGIONAL* | Lockyer | 4341 |
| *LAIDLEY, LOCKYER VALLEY REGIONAL* | Lockyer | 4341 |
| *TAROME, SCENIC RIM REGIONAL* | Lockyer | 4341 |
| *GLENORE GROVE, LOCKYER VALLEY REGIONAL* | Lockyer | 4341 |
| *GATTON, LOCKYER VALLEY REGIONAL* | Lockyer | 4341 |
| *GLEN CAIRN, LOCKYER VALLEY REGIONAL* | Lockyer | 4341 |
| *HATTON VALE, LOCKYER VALLEY REGIONAL* | Lockyer | 4341 |
| *GOOMBURRA, SOUTHERN DOWNS REGIONAL* | Lockyer | 4341 |
| *GRANDCHESTER, IPSWICH CITY* | Lockyer | 4341 |
| *EAST HALDON, LOCKYER VALLEY REGIONAL* | Lockyer | 4341 |
| *MINDEN, SOMERSET REGIONAL* | Lockyer | 4341 |
| *MULGOWIE, LOCKYER VALLEY REGIONAL* | Lockyer | 4341 |
| *MOUNT MORT, IPSWICH CITY* | Lockyer | 4341 |
| *ROSEVALE, SCENIC RIM REGIONAL* | Lockyer | 4341 |
| *LOCKROSE, LOCKYER VALLEY REGIONAL* | Lockyer | 4341 |
| *LAWES, LOCKYER VALLEY REGIONAL* | Lockyer | 4341 |
| *MOUNT BERRYMAN, LOCKYER VALLEY REGIONAL* | Lockyer | 4341 |
| *KENSINGTON GROVE, LOCKYER VALLEY REGIONA* | Lockyer | 4341 |
| *LEFTHAND BRANCH, LOCKYER VALLEY REGIONAL* | Lockyer | 4341 |
| *MOORANG, SCENIC RIM REGIONAL* | Lockyer | 4341 |
| *TALLEGALLA, IPSWICH CITY* | Lockyer | 4341 |
| *PLAINLAND, LOCKYER VALLEY REGIONAL* | Lockyer | 4341 |
| *TOWNSON, LOCKYER VALLEY REGIONAL* | Lockyer | 4341 |
| *WOOLSHED, IPSWICH CITY* | Lockyer | 4341 |
| *THORNTON, LOCKYER VALLEY REGIONAL* | Lockyer | 4341 |
| *SUMMERHOLM, LOCKYER VALLEY REGIONAL* | Lockyer | 4341 |
| *WOODLANDS, LOCKYER VALLEY REGIONAL* | Lockyer | 4341 |
| *PRENZLAU, SOMERSET REGIONAL* | Lockyer | 4341 |
| *REGENCY DOWNS, LOCKYER VALLEY REGIONAL* | Lockyer | 4341 |
| *ROPELEY, LOCKYER VALLEY REGIONAL* | Lockyer | 4341 |
| *ROCKSIDE, LOCKYER VALLEY REGIONAL* | Lockyer | 4341 |
| *BRIGHTVIEW, LOCKYER VALLEY REGIONAL* | Lockyer | 4342 |
| *COLLEGE VIEW, LOCKYER VALLEY REGIONAL* | Lockyer | 4342 |
| *FOREST HILL, LOCKYER VALLEY REGIONAL* | Lockyer | 4342 |
| *LYNFORD, LOCKYER VALLEY REGIONAL* | Lockyer | 4342 |

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|---|---|---|
| *GLENORE GROVE, LOCKYER VALLEY REGIONAL* | Lockyer | 4342 |
| *CROWLEY VALE, LOCKYER VALLEY REGIONAL* | Lockyer | 4342 |
| *MOUNT TARAMPA, SOMERSET REGIONAL* | Lockyer | 4342 |
| *LOCKROSE, LOCKYER VALLEY REGIONAL* | Lockyer | 4342 |
| *LOCKROSE, SOMERSET REGIONAL* | Lockyer | 4342 |
| *LAWES, LOCKYER VALLEY REGIONAL* | Lockyer | 4342 |
| *KENTVILLE, LOCKYER VALLEY REGIONAL* | Lockyer | 4342 |
| *PLAINLAND, LOCKYER VALLEY REGIONAL* | Lockyer | 4342 |
| *REGENCY DOWNS, LOCKYER VALLEY REGIONAL* | Lockyer | 4342 |
| *ADARE, LOCKYER VALLEY REGIONAL* | Lockyer | 4343 |
| *BLENHEIM, LOCKYER VALLEY REGIONAL* | Lockyer | 4343 |
| *BLACK DUCK CREEK, LOCKYER VALLEY REGIONA* | Lockyer | 4343 |
| *BUARABA SOUTH, LOCKYER VALLEY REGIONAL* | Lockyer | 4343 |
| *BUARABA, SOMERSET REGIONAL* | Lockyer | 4343 |
| *CAFFEY, LOCKYER VALLEY REGIONAL* | Lockyer | 4343 |
| *CHURCHABLE, LOCKYER VALLEY REGIONAL* | Lockyer | 4343 |
| *COLLEGE VIEW, LOCKYER VALLEY REGIONAL* | Lockyer | 4343 |
| *FOREST HILL, LOCKYER VALLEY REGIONAL* | Lockyer | 4343 |
| *HIRSTGLEN, TOOWOOMBA REGIONAL* | Lockyer | 4343 |
| *INGOLDSBY, LOCKYER VALLEY REGIONAL* | Lockyer | 4343 |
| *JUNCTION VIEW, LOCKYER VALLEY REGIONAL* | Lockyer | 4343 |
| *LAKE CLARENDON, LOCKYER VALLEY REGIONAL* | Lockyer | 4343 |
| *GRANTHAM, LOCKYER VALLEY REGIONAL* | Lockyer | 4343 |
| *GLENORE GROVE, LOCKYER VALLEY REGIONAL* | Lockyer | 4343 |
| *GATTON, LOCKYER VALLEY REGIONAL* | Lockyer | 4343 |
| *GLEN CAIRN, LOCKYER VALLEY REGIONAL* | Lockyer | 4343 |
| *GOOMBURRA, SOUTHERN DOWNS REGIONAL* | Lockyer | 4343 |
| *HELIDON, LOCKYER VALLEY REGIONAL* | Lockyer | 4343 |
| *FORDSDALE, LOCKYER VALLEY REGIONAL* | Lockyer | 4343 |
| *EAST HALDON, LOCKYER VALLEY REGIONAL* | Lockyer | 4343 |
| *CROWLEY VALE, LOCKYER VALLEY REGIONAL* | Lockyer | 4343 |
| *MORTON VALE, LOCKYER VALLEY REGIONAL* | Lockyer | 4343 |
| *MOUNT SYLVIA, LOCKYER VALLEY REGIONAL* | Lockyer | 4343 |
| *RINGWOOD, LOCKYER VALLEY REGIONAL* | Lockyer | 4343 |
| *SPRING CREEK, LOCKYER VALLEY REGIONAL* | Lockyer | 4343 |
| *MOUNT WHITESTONE, LOCKYER VALLEY REGIONA* | Lockyer | 4343 |
| *PALMTREE, TOOWOOMBA REGIONAL* | Lockyer | 4343 |
| *LOCKROSE, LOCKYER VALLEY REGIONAL* | Lockyer | 4343 |
| *LAWES, LOCKYER VALLEY REGIONAL* | Lockyer | 4343 |
| *MA MA CREEK, LOCKYER VALLEY REGIONAL* | Lockyer | 4343 |
| *LOWER TENTHILL, LOCKYER VALLEY REGIONAL* | Lockyer | 4343 |
| *MOUNT BERRYMAN, LOCKYER VALLEY REGIONAL* | Lockyer | 4343 |
| *LEFTHAND BRANCH, LOCKYER VALLEY REGIONAL* | Lockyer | 4343 |
| *KENTVILLE, LOCKYER VALLEY REGIONAL* | Lockyer | 4343 |
| *WEST HALDON, LOCKYER VALLEY REGIONAL* | Lockyer | 4343 |
| *WEST HALDON, TOOWOOMBA REGIONAL* | Lockyer | 4343 |

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| *TOWNSON, LOCKYER VALLEY REGIONAL* | Lockyer | 4343 |
| *VINEGAR HILL, LOCKYER VALLEY REGIONAL* | Lockyer | 4343 |
| *PLACID HILLS, LOCKYER VALLEY REGIONAL* | Lockyer | 4343 |
| *WOODBINE, LOCKYER VALLEY REGIONAL* | Lockyer | 4343 |
| *WINWILL, LOCKYER VALLEY REGIONAL* | Lockyer | 4343 |
| *THORNTON, LOCKYER VALLEY REGIONAL* | Lockyer | 4343 |
| *WOODLANDS, LOCKYER VALLEY REGIONAL* | Lockyer | 4343 |
| *UPPER TENTHILL, LOCKYER VALLEY REGIONAL* | Lockyer | 4343 |
| *SEVENTEEN MILE, LOCKYER VALLEY REGIONAL* | Lockyer | 4343 |
| *UPPER PILTON, TOOWOOMBA REGIONAL* | Lockyer | 4343 |
| *ROPELEY, LOCKYER VALLEY REGIONAL* | Lockyer | 4343 |
| *ROCKSIDE, LOCKYER VALLEY REGIONAL* | Lockyer | 4343 |
| *BLANCHVIEW, LOCKYER VALLEY REGIONAL* | Lockyer | 4344 |
| *BUARABA SOUTH, LOCKYER VALLEY REGIONAL* | Lockyer | 4344 |
| *CARPENDALE, LOCKYER VALLEY REGIONAL* | Lockyer | 4344 |
| *GRANTHAM, LOCKYER VALLEY REGIONAL* | Lockyer | 4344 |
| *GATTON, LOCKYER VALLEY REGIONAL* | Lockyer | 4344 |
| *IREDALE, LOCKYER VALLEY REGIONAL* | Lockyer | 4344 |
| *HELIDON SPA, LOCKYER VALLEY REGIONAL* | Lockyer | 4344 |
| *HELIDON, LOCKYER VALLEY REGIONAL* | Lockyer | 4344 |
| *FORDSDALE, LOCKYER VALLEY REGIONAL* | Lockyer | 4344 |
| *DERRYMORE, LOCKYER VALLEY REGIONAL* | Lockyer | 4344 |
| *FLAGSTONE CREEK, LOCKYER VALLEY REGIONAL* | Lockyer | 4344 |
| *EGYPT, LOCKYER VALLEY REGIONAL* | Lockyer | 4344 |
| *POSTMANS RIDGE, LOCKYER VALLEY REGIONAL* | Lockyer | 4344 |
| *RAMSAY, TOOWOOMBA REGIONAL* | Lockyer | 4344 |
| *MOUNT WHITESTONE, LOCKYER VALLEY REGIONA* | Lockyer | 4344 |
| *PALMTREE, TOOWOOMBA REGIONAL* | Lockyer | 4344 |
| *KEARNEYS SPRING, TOOWOOMBA REGIONAL* | Lockyer | 4344 |
| *MA MA CREEK, LOCKYER VALLEY REGIONAL* | Lockyer | 4344 |
| *LOCKYER, LOCKYER VALLEY REGIONAL* | Lockyer | 4344 |
| *LILYDALE, LOCKYER VALLEY REGIONAL* | Lockyer | 4344 |
| *MIDDLE RIDGE, TOOWOOMBA REGIONAL* | Lockyer | 4344 |
| *WEST HALDON, TOOWOOMBA REGIONAL* | Lockyer | 4344 |
| *WHITE MOUNTAIN, LOCKYER VALLEY REGIONAL* | Lockyer | 4344 |
| *TOP CAMP, TOOWOOMBA REGIONAL* | Lockyer | 4344 |
| *VERADILLA, LOCKYER VALLEY REGIONAL* | Lockyer | 4344 |
| *UPPER FLAGSTONE, LOCKYER VALLEY REGIONAL* | Lockyer | 4344 |
| *WITHCOTT, LOCKYER VALLEY REGIONAL* | Lockyer | 4344 |
| *STOCKYARD, LOCKYER VALLEY REGIONAL* | Lockyer | 4344 |
| *PRESTON, LOCKYER VALLEY REGIONAL* | Lockyer | 4344 |
| *PRESTON, TOOWOOMBA REGIONAL* | Lockyer | 4344 |
| *UPPER LOCKYER, LOCKYER VALLEY REGIONAL* | Lockyer | 4344 |
| *SEVENTEEN MILE, LOCKYER VALLEY REGIONAL* | Lockyer | 4344 |
| *SILVER RIDGE, LOCKYER VALLEY REGIONAL* | Lockyer | 4344 |
| *ROCKMOUNT, LOCKYER VALLEY REGIONAL* | Lockyer | 4344 |

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| *COLLEGE VIEW, LOCKYER VALLEY REGIONAL* | Lockyer | 4345 |
| *GATTON, LOCKYER VALLEY REGIONAL* | Lockyer | 4345 |
| *LAWES, LOCKYER VALLEY REGIONAL* | Lockyer | 4345 |
| *HAIGSLEA, IPSWICH CITY* | Mid Brisbane | 4346 |
| *MARBURG, IPSWICH CITY* | Mid Brisbane | 4346 |
| *HAIGSLEA, IPSWICH CITY* | Upper Brisbane | 4346 |
| *MARBURG, IPSWICH CITY* | Upper Brisbane | 4346 |
| *GRANTHAM, LOCKYER VALLEY REGIONAL* | Lockyer | 4347 |
| *GATTON, LOCKYER VALLEY REGIONAL* | Lockyer | 4347 |
| *MA MA CREEK, LOCKYER VALLEY REGIONAL* | Lockyer | 4347 |
| *LOWER TENTHILL, LOCKYER VALLEY REGIONAL* | Lockyer | 4347 |
| *VERADILLA, LOCKYER VALLEY REGIONAL* | Lockyer | 4347 |
| *PLACID HILLS, LOCKYER VALLEY REGIONAL* | Lockyer | 4347 |
| *WINWILL, LOCKYER VALLEY REGIONAL* | Lockyer | 4347 |
| *UPPER TENTHILL, LOCKYER VALLEY REGIONAL* | Lockyer | 4347 |
| *BALLARD, LOCKYER VALLEY REGIONAL* | Lockyer | 4350 |
| *BLUE MOUNTAIN HEIGHTS, TOOWOOMBA REGIONA* | Lockyer | 4350 |
| *BLANCHVIEW, LOCKYER VALLEY REGIONAL* | Lockyer | 4350 |
| *HARLAXTON, TOOWOOMBA REGIONAL* | Lockyer | 4350 |
| *HIGHFIELDS, TOOWOOMBA REGIONAL* | Lockyer | 4350 |
| *EAST TOOWOOMBA, TOOWOOMBA REGIONAL* | Lockyer | 4350 |
| *MOUNT KYNOCH, TOOWOOMBA REGIONAL* | Lockyer | 4350 |
| *MOUNT LOFTY, TOOWOOMBA REGIONAL* | Lockyer | 4350 |
| *KEARNEYS SPRING, TOOWOOMBA REGIONAL* | Lockyer | 4350 |
| *MIDDLE RIDGE, TOOWOOMBA REGIONAL* | Lockyer | 4350 |
| *REDWOOD, TOOWOOMBA REGIONAL* | Lockyer | 4350 |
| *UPPER FLAGSTONE, LOCKYER VALLEY REGIONAL* | Lockyer | 4350 |
| *WITHCOTT, LOCKYER VALLEY REGIONAL* | Lockyer | 4350 |
| *PRINCE HENRY HEIGHTS, TOOWOOMBA REGIONAL* | Lockyer | 4350 |
| *SILVER RIDGE, LOCKYER VALLEY REGIONAL* | Lockyer | 4350 |
| *RANGEVILLE, TOOWOOMBA REGIONAL* | Lockyer | 4350 |
| *BALLARD, LOCKYER VALLEY REGIONAL* | Lockyer | 4352 |
| *BLUE MOUNTAIN HEIGHTS, TOOWOOMBA REGIONA* | Lockyer | 4352 |
| *BLANCHVIEW, LOCKYER VALLEY REGIONAL* | Lockyer | 4352 |
| *BUARABA SOUTH, LOCKYER VALLEY REGIONAL* | Lockyer | 4352 |
| *BUARABA, SOMERSET REGIONAL* | Lockyer | 4352 |
| *CABARLAH, TOOWOOMBA REGIONAL* | Lockyer | 4352 |
| *CARPENDALE, LOCKYER VALLEY REGIONAL* | Lockyer | 4352 |
| *HAMPTON, TOOWOOMBA REGIONAL* | Lockyer | 4352 |
| *HARLAXTON, TOOWOOMBA REGIONAL* | Lockyer | 4352 |
| *GEHAM, TOOWOOMBA REGIONAL* | Lockyer | 4352 |
| *IREDALE, LOCKYER VALLEY REGIONAL* | Lockyer | 4352 |
| *HELIDON SPA, LOCKYER VALLEY REGIONAL* | Lockyer | 4352 |
| *HELIDON, LOCKYER VALLEY REGIONAL* | Lockyer | 4352 |
| *HIGHFIELDS, TOOWOOMBA REGIONAL* | Lockyer | 4352 |
| *DERRYMORE, LOCKYER VALLEY REGIONAL* | Lockyer | 4352 |

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| *FLAGSTONE CREEK, LOCKYER VALLEY REGIONAL* | Lockyer | 4352 |
| *FIFTEEN MILE, LOCKYER VALLEY REGIONAL* | Lockyer | 4352 |
| *MOUNT KYNOCH, TOOWOOMBA REGIONAL* | Lockyer | 4352 |
| *POSTMANS RIDGE, LOCKYER VALLEY REGIONAL* | Lockyer | 4352 |
| *PALMTREE, TOOWOOMBA REGIONAL* | Lockyer | 4352 |
| *MURPHYS CREEK, LOCKYER VALLEY REGIONAL* | Lockyer | 4352 |
| *MOUNT LOFTY, TOOWOOMBA REGIONAL* | Lockyer | 4352 |
| *MOUNT LUKE, TOOWOOMBA REGIONAL* | Lockyer | 4352 |
| *PERSEVERANCE, TOOWOOMBA REGIONAL* | Lockyer | 4352 |
| *KEARNEYS SPRING, TOOWOOMBA REGIONAL* | Lockyer | 4352 |
| *LOCKYER, LOCKYER VALLEY REGIONAL* | Lockyer | 4352 |
| *LILYDALE, LOCKYER VALLEY REGIONAL* | Lockyer | 4352 |
| *MIDDLE RIDGE, TOOWOOMBA REGIONAL* | Lockyer | 4352 |
| *WHITE MOUNTAIN, LOCKYER VALLEY REGIONAL* | Lockyer | 4352 |
| *REDWOOD, TOOWOOMBA REGIONAL* | Lockyer | 4352 |
| *TOP CAMP, TOOWOOMBA REGIONAL* | Lockyer | 4352 |
| *UPPER FLAGSTONE, LOCKYER VALLEY REGIONAL* | Lockyer | 4352 |
| *WITHCOTT, LOCKYER VALLEY REGIONAL* | Lockyer | 4352 |
| *PRINCE HENRY HEIGHTS, TOOWOOMBA REGIONAL* | Lockyer | 4352 |
| *PRESTON, LOCKYER VALLEY REGIONAL* | Lockyer | 4352 |
| *PRESTON, TOOWOOMBA REGIONAL* | Lockyer | 4352 |
| *UPPER LOCKYER, LOCKYER VALLEY REGIONAL* | Lockyer | 4352 |
| *SEVENTEEN MILE, LOCKYER VALLEY REGIONAL* | Lockyer | 4352 |
| *SPRING BLUFF, TOOWOOMBA REGIONAL* | Lockyer | 4352 |
| *SILVER RIDGE, LOCKYER VALLEY REGIONAL* | Lockyer | 4352 |
| *RANGEVILLE, TOOWOOMBA REGIONAL* | Lockyer | 4352 |
| *RAVENSBOURNE, TOOWOOMBA REGIONAL* | Lockyer | 4352 |
| *ANDURAMBA, TOOWOOMBA REGIONAL* | Upper Brisbane | 4352 |
| *BENARKIN, SOUTH BURNETT REGIONAL* | Upper Brisbane | 4352 |
| *BIARRA, SOMERSET REGIONAL* | Upper Brisbane | 4352 |
| *CHERRY CREEK, TOOWOOMBA REGIONAL* | Upper Brisbane | 4352 |
| *COLINTON, SOMERSET REGIONAL* | Upper Brisbane | 4352 |
| *COALBANK, TOOWOOMBA REGIONAL* | Upper Brisbane | 4352 |
| *COOYAR, TOOWOOMBA REGIONAL* | Upper Brisbane | 4352 |
| *EAST COOYAR, TOOWOOMBA REGIONAL* | Upper Brisbane | 4352 |
| *HAMPTON, TOOWOOMBA REGIONAL* | Upper Brisbane | 4352 |
| *HARLIN, SOMERSET REGIONAL* | Upper Brisbane | 4352 |
| *GILLA, TOOWOOMBA REGIONAL* | Upper Brisbane | 4352 |
| *GOOGA CREEK, TOOWOOMBA REGIONAL* | Upper Brisbane | 4352 |
| *GRAPETREE, TOOWOOMBA REGIONAL* | Upper Brisbane | 4352 |
| *HIGHGROVE, TOOWOOMBA REGIONAL* | Upper Brisbane | 4352 |
| *ESKDALE, SOMERSET REGIONAL* | Upper Brisbane | 4352 |
| *HADEN, TOOWOOMBA REGIONAL* | Upper Brisbane | 4352 |
| *DJUAN, TOOWOOMBA REGIONAL* | Upper Brisbane | 4352 |
| *DOCTOR CREEK, TOOWOOMBA REGIONAL* | Upper Brisbane | 4352 |
| *CRESSBROOK CREEK, TOOWOOMBA REGIONAL* | Upper Brisbane | 4352 |

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| *EMU CREEK, TOOWOOMBA REGIONAL* | Upper Brisbane | 4352 |
| *CROWS NEST, TOOWOOMBA REGIONAL* | Upper Brisbane | 4352 |
| *REDBANK CREEK, SOMERSET REGIONAL* | Upper Brisbane | 4352 |
| *PALMTREE, TOOWOOMBA REGIONAL* | Upper Brisbane | 4352 |
| *NUTGROVE, TOOWOOMBA REGIONAL* | Upper Brisbane | 4352 |
| *PERSEVERANCE, TOOWOOMBA REGIONAL* | Upper Brisbane | 4352 |
| *MOUNT BINGA, TOOWOOMBA REGIONAL* | Upper Brisbane | 4352 |
| *MACLAGAN, TOOWOOMBA REGIONAL* | Upper Brisbane | 4352 |
| *MOORE, SOMERSET REGIONAL* | Upper Brisbane | 4352 |
| *NARKO, TOOWOOMBA REGIONAL* | Upper Brisbane | 4352 |
| *WUTUL, TOOWOOMBA REGIONAL* | Upper Brisbane | 4352 |
| *UPPER COOYAR CREEK, TOOWOOMBA REGIONAL* | Upper Brisbane | 4352 |
| *THORNVILLE, TOOWOOMBA REGIONAL* | Upper Brisbane | 4352 |
| *RANGEMORE, TOOWOOMBA REGIONAL* | Upper Brisbane | 4352 |
| *PECHEY, TOOWOOMBA REGIONAL* | Upper Brisbane | 4352 |
| *ST AUBYN, TOOWOOMBA REGIONAL* | Upper Brisbane | 4352 |
| *RAVENSBOURNE, TOOWOOMBA REGIONAL* | Upper Brisbane | 4352 |
| *BERGEN, TOOWOOMBA REGIONAL* | Upper Brisbane | 4354 |
| *HADEN, TOOWOOMBA REGIONAL* | Upper Brisbane | 4354 |
| *PLAINBY, TOOWOOMBA REGIONAL* | Upper Brisbane | 4354 |
| *UPPER PINELANDS, TOOWOOMBA REGIONAL* | Upper Brisbane | 4354 |
| *ANDURAMBA, TOOWOOMBA REGIONAL* | Upper Brisbane | 4355 |
| *BERGEN, TOOWOOMBA REGIONAL* | Upper Brisbane | 4355 |
| *BIARRA, SOMERSET REGIONAL* | Upper Brisbane | 4355 |
| *COALBANK, TOOWOOMBA REGIONAL* | Upper Brisbane | 4355 |
| *JONES GULLY, TOOWOOMBA REGIONAL* | Upper Brisbane | 4355 |
| *GLENAVEN, TOOWOOMBA REGIONAL* | Upper Brisbane | 4355 |
| *ESKDALE, SOMERSET REGIONAL* | Upper Brisbane | 4355 |
| *HADEN, TOOWOOMBA REGIONAL* | Upper Brisbane | 4355 |
| *DJUAN, TOOWOOMBA REGIONAL* | Upper Brisbane | 4355 |
| *CRESSBROOK CREEK, TOOWOOMBA REGIONAL* | Upper Brisbane | 4355 |
| *EMU CREEK, TOOWOOMBA REGIONAL* | Upper Brisbane | 4355 |
| *CROWS NEST, TOOWOOMBA REGIONAL* | Upper Brisbane | 4355 |
| *PIERCES CREEK, TOOWOOMBA REGIONAL* | Upper Brisbane | 4355 |
| *PINELANDS, TOOWOOMBA REGIONAL* | Upper Brisbane | 4355 |
| *MOUNTAIN CAMP, TOOWOOMBA REGIONAL* | Upper Brisbane | 4355 |
| *THE BLUFF, TOOWOOMBA REGIONAL* | Upper Brisbane | 4355 |
| *WHICHELLO, TOOWOOMBA REGIONAL* | Upper Brisbane | 4355 |
| *PLAINBY, TOOWOOMBA REGIONAL* | Upper Brisbane | 4355 |
| *UPPER PINELANDS, TOOWOOMBA REGIONAL* | Upper Brisbane | 4355 |
| *PECHEY, TOOWOOMBA REGIONAL* | Upper Brisbane | 4355 |
| *BUDGEE, TOOWOOMBA REGIONAL* | Lockyer | 4358 |
| *FORDSDALE, LOCKYER VALLEY REGIONAL* | Lockyer | 4358 |
| *EAST GREENMOUNT, TOOWOOMBA REGIONAL* | Lockyer | 4358 |
| *RAMSAY, TOOWOOMBA REGIONAL* | Lockyer | 4358 |
| *WEST HALDON, TOOWOOMBA REGIONAL* | Lockyer | 4358 |

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| *PRESTON, LOCKYER VALLEY REGIONAL* | Lockyer | 4358 |
| *PRESTON, TOOWOOMBA REGIONAL* | Lockyer | 4358 |
| *ROCKMOUNT, LOCKYER VALLEY REGIONAL* | Lockyer | 4358 |
| *BLACK DUCK CREEK, LOCKYER VALLEY REGIONA* | Lockyer | 4359 |
| *BUDGEE, TOOWOOMBA REGIONAL* | Lockyer | 4359 |
| *HIRSTGLEN, TOOWOOMBA REGIONAL* | Lockyer | 4359 |
| *JUNCTION VIEW, LOCKYER VALLEY REGIONAL* | Lockyer | 4359 |
| *FORDSDALE, LOCKYER VALLEY REGIONAL* | Lockyer | 4359 |
| *WEST HALDON, LOCKYER VALLEY REGIONAL* | Lockyer | 4359 |
| *WEST HALDON, TOOWOOMBA REGIONAL* | Lockyer | 4359 |
| *UPPER PILTON, TOOWOOMBA REGIONAL* | Lockyer | 4359 |
| *BLACK DUCK CREEK, LOCKYER VALLEY REGIONA* | Lockyer | 4361 |
| *UPPER PILTON, TOOWOOMBA REGIONAL* | Lockyer | 4361 |
| *CLUMBER, SCENIC RIM REGIONAL* | Bremer | 4370 |
| *TAROME, SCENIC RIM REGIONAL* | Bremer | 4370 |
| *GOOMBURRA, SOUTHERN DOWNS REGIONAL* | Bremer | 4370 |
| *SWANFELS, SOUTHERN DOWNS REGIONAL* | Bremer | 4370 |
| *TREGONY, SOUTHERN DOWNS REGIONAL* | Bremer | 4370 |
| *BLACK DUCK CREEK, LOCKYER VALLEY REGIONA* | Lockyer | 4370 |
| *GOOMBURRA, SOUTHERN DOWNS REGIONAL* | Lockyer | 4370 |
| *EAST HALDON, LOCKYER VALLEY REGIONAL* | Lockyer | 4370 |
| *TOWNSON, LOCKYER VALLEY REGIONAL* | Lockyer | 4370 |
| *UPPER PILTON, TOOWOOMBA REGIONAL* | Lockyer | 4370 |
| *CARNEYS CREEK, SCENIC RIM REGIONAL* | Logan | 4370 |
| *MOUNT COLLIERY, SOUTHERN DOWNS REGIONAL* | Logan | 4370 |
| *THE HEAD, SOUTHERN DOWNS REGIONAL* | Logan | 4370 |
| *CARNEYS CREEK, SCENIC RIM REGIONAL* | Bremer | 4371 |
| *CLUMBER, SCENIC RIM REGIONAL* | Bremer | 4371 |
| *EMU VALE, SOUTHERN DOWNS REGIONAL* | Bremer | 4371 |
| *MOOGERAH, SCENIC RIM REGIONAL* | Bremer | 4371 |
| *SWANFELS, SOUTHERN DOWNS REGIONAL* | Bremer | 4371 |
| *CARNEYS CREEK, SCENIC RIM REGIONAL* | Logan | 4371 |
| *EMU VALE, SOUTHERN DOWNS REGIONAL* | Logan | 4371 |
| *BLACKBUTT SOUTH, SOUTH BURNETT REGIONAL* | Upper Brisbane | 4402 |
| *BUNYA MOUNTAINS, WESTERN DOWNS REGIONAL* | Upper Brisbane | 4402 |
| *COOYAR, TOOWOOMBA REGIONAL* | Upper Brisbane | 4402 |
| *EAST COOYAR, TOOWOOMBA REGIONAL* | Upper Brisbane | 4402 |
| *GILLA, TOOWOOMBA REGIONAL* | Upper Brisbane | 4402 |
| *TAROMEO, SOUTH BURNETT REGIONAL* | Upper Brisbane | 4402 |
| *GOOGA CREEK, TOOWOOMBA REGIONAL* | Upper Brisbane | 4402 |
| *HIGHGROVE, TOOWOOMBA REGIONAL* | Upper Brisbane | 4402 |
| *NEUMGNA, SOUTH BURNETT REGIONAL* | Upper Brisbane | 4402 |
| *SOUTH NANANGO, SOUTH BURNETT REGIONAL* | Upper Brisbane | 4402 |
| *NUKKU, SOUTH BURNETT REGIONAL* | Upper Brisbane | 4402 |
| *NUTGROVE, TOOWOOMBA REGIONAL* | Upper Brisbane | 4402 |
| *TEELAH, SOUTH BURNETT REGIONAL* | Upper Brisbane | 4402 |

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| *MOUNT BINGA, TOOWOOMBA REGIONAL* | Upper Brisbane | 4402 |
| *KOORALGIN, TOOWOOMBA REGIONAL* | Upper Brisbane | 4402 |
| *YARRAMAN, TOOWOOMBA REGIONAL* | Upper Brisbane | 4402 |
| *WUTUL, TOOWOOMBA REGIONAL* | Upper Brisbane | 4402 |
| *UPPER COOYAR CREEK, TOOWOOMBA REGIONAL* | Upper Brisbane | 4402 |
| *UPPER YARRAMAN, TOOWOOMBA REGIONAL* | Upper Brisbane | 4402 |
| *THORNVILLE, TOOWOOMBA REGIONAL* | Upper Brisbane | 4402 |
| *RANGEMORE, TOOWOOMBA REGIONAL* | Upper Brisbane | 4402 |
| *ST AUBYN, TOOWOOMBA REGIONAL* | Upper Brisbane | 4402 |
| *SOUTH EAST NANANGO, SOUTH BURNETT REGION* | Upper Brisbane | 4402 |
| *BUNYA MOUNTAINS, SOUTH BURNETT REGIONAL* | Upper Brisbane | 4405 |
| *BUNYA MOUNTAINS, WESTERN DOWNS REGIONAL* | Upper Brisbane | 4405 |
| *UPPER COOYAR CREEK, TOOWOOMBA REGIONAL* | Upper Brisbane | 4405 |
| *RANGEMORE, TOOWOOMBA REGIONAL* | Upper Brisbane | 4405 |
| *ALBANY CREEK, MORETON BAY REGIONAL* | Pine | 4500 |
| *BALD HILLS, BRISBANE CITY* | Pine | 4500 |
| *BRAY PARK, MORETON BAY REGIONAL* | Pine | 4500 |
| *BRIDGEMAN DOWNS, BRISBANE CITY* | Pine | 4500 |
| *BRENDALE, MORETON BAY REGIONAL* | Pine | 4500 |
| *CASHMERE, MORETON BAY REGIONAL* | Pine | 4500 |
| *CLEAR MOUNTAIN, MORETON BAY REGIONAL* | Pine | 4500 |
| *CLOSEBURN, MORETON BAY REGIONAL* | Pine | 4500 |
| *JOYNER, MORETON BAY REGIONAL* | Pine | 4500 |
| *EATONS HILL, MORETON BAY REGIONAL* | Pine | 4500 |
| *DRAPER, MORETON BAY REGIONAL* | Pine | 4500 |
| *MOUNT SAMSON, MORETON BAY REGIONAL* | Pine | 4500 |
| *LAWNTON, MORETON BAY REGIONAL* | Pine | 4500 |
| *WHITESIDE, MORETON BAY REGIONAL* | Pine | 4500 |
| *WARNER, MORETON BAY REGIONAL* | Pine | 4500 |
| *RUSH CREEK, MORETON BAY REGIONAL* | Pine | 4500 |
| *SAMSONVALE, MORETON BAY REGIONAL* | Pine | 4500 |
| *STRATHPINE, MORETON BAY REGIONAL* | Pine | 4500 |
| *BALD HILLS, BRISBANE CITY* | Pine | 4501 |
| *BRAY PARK, MORETON BAY REGIONAL* | Pine | 4501 |
| *JOYNER, MORETON BAY REGIONAL* | Pine | 4501 |
| *MURRUMBA DOWNS, MORETON BAY REGIONAL* | Pine | 4501 |
| *PETRIE, MORETON BAY REGIONAL* | Pine | 4501 |
| *LAWNTON, MORETON BAY REGIONAL* | Pine | 4501 |
| *WHITESIDE, MORETON BAY REGIONAL* | Pine | 4501 |
| *STRATHPINE, MORETON BAY REGIONAL* | Pine | 4501 |
| *JOYNER, MORETON BAY REGIONAL* | Pine | 4502 |
| *PETRIE, MORETON BAY REGIONAL* | Pine | 4502 |
| *KALLANGUR, MORETON BAY REGIONAL* | Pine | 4502 |
| *LAWNTON, MORETON BAY REGIONAL* | Pine | 4502 |
| *KURWONGBAH, MORETON BAY REGIONAL* | Pine | 4502 |
| *WHITESIDE, MORETON BAY REGIONAL* | Pine | 4502 |

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| *BALD HILLS, BRISBANE CITY* | Pine | 4503 |
| *GRIFFIN, MORETON BAY REGIONAL* | Pine | 4503 |
| *JOYNER, MORETON BAY REGIONAL* | Pine | 4503 |
| *DAKABIN, MORETON BAY REGIONAL* | Pine | 4503 |
| *MURRUMBA DOWNS, MORETON BAY REGIONAL* | Pine | 4503 |
| *MANGO HILL, MORETON BAY REGIONAL* | Pine | 4503 |
| *PETRIE, MORETON BAY REGIONAL* | Pine | 4503 |
| *KALLANGUR, MORETON BAY REGIONAL* | Pine | 4503 |
| *LAWNTON, MORETON BAY REGIONAL* | Pine | 4503 |
| *KURWONGBAH, MORETON BAY REGIONAL* | Pine | 4503 |
| *NORTH LAKES, MORETON BAY REGIONAL* | Pine | 4503 |
| *NARANGBA, MORETON BAY REGIONAL* | Pine | 4503 |
| *WHITESIDE, MORETON BAY REGIONAL* | Pine | 4503 |
| *BURPENGARY, MORETON BAY REGIONAL* | Caboolture | 4504 |
| *DECEPTION BAY, MORETON BAY REGIONAL* | Caboolture | 4504 |
| *OCEAN VIEW, MORETON BAY REGIONAL* | Caboolture | 4504 |
| *MORAYFIELD, MORETON BAY REGIONAL* | Caboolture | 4504 |
| *KING SCRUB, MORETON BAY REGIONAL* | Caboolture | 4504 |
| *MOORINA, MORETON BAY REGIONAL* | Caboolture | 4504 |
| *NARANGBA, MORETON BAY REGIONAL* | Caboolture | 4504 |
| *RUSH CREEK, MORETON BAY REGIONAL* | Caboolture | 4504 |
| *BURPENGARY, MORETON BAY REGIONAL* | Pine | 4504 |
| *DAKABIN, MORETON BAY REGIONAL* | Pine | 4504 |
| *KING SCRUB, MORETON BAY REGIONAL* | Pine | 4504 |
| *KURWONGBAH, MORETON BAY REGIONAL* | Pine | 4504 |
| *NORTH LAKES, MORETON BAY REGIONAL* | Pine | 4504 |
| *NARANGBA, MORETON BAY REGIONAL* | Pine | 4504 |
| *RUSH CREEK, MORETON BAY REGIONAL* | Pine | 4504 |
| *BURPENGARY EAST, MORETON BAY REGIONAL* | Caboolture | 4505 |
| *BURPENGARY, MORETON BAY REGIONAL* | Caboolture | 4505 |
| *DECEPTION BAY, MORETON BAY REGIONAL* | Caboolture | 4505 |
| *MORAYFIELD, MORETON BAY REGIONAL* | Caboolture | 4505 |
| *NARANGBA, MORETON BAY REGIONAL* | Caboolture | 4505 |
| *BEACHMERE, MORETON BAY REGIONAL* | Caboolture | 4506 |
| *BELLMERE, MORETON BAY REGIONAL* | Caboolture | 4506 |
| *BURPENGARY EAST, MORETON BAY REGIONAL* | Caboolture | 4506 |
| *BURPENGARY, MORETON BAY REGIONAL* | Caboolture | 4506 |
| *CABOOLTURE SOUTH, MORETON BAY REGIONAL* | Caboolture | 4506 |
| *CABOOLTURE, MORETON BAY REGIONAL* | Caboolture | 4506 |
| *MORAYFIELD, MORETON BAY REGIONAL* | Caboolture | 4506 |
| *MOORINA, MORETON BAY REGIONAL* | Caboolture | 4506 |
| *NARANGBA, MORETON BAY REGIONAL* | Caboolture | 4506 |
| *UPPER CABOOLTURE, MORETON BAY REGIONAL* | Caboolture | 4506 |
| *BANKSIA BEACH, MORETON BAY REGIONAL* | Bribie Island | 4507 |
| *BELLARA, MORETON BAY REGIONAL* | Bribie Island | 4507 |
| *BEERBURRUM, SUNSHINE COAST REGIONAL* | Bribie Island | 4507 |

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| *BRIBIE ISLAND NORTH, SUNSHINE COAST REGI* | Bribie Island | 4507 |
| *BONGAREE, MORETON BAY REGIONAL* | Bribie Island | 4507 |
| *WHITE PATCH, MORETON BAY REGIONAL* | Bribie Island | 4507 |
| *WOORIM, MORETON BAY REGIONAL* | Bribie Island | 4507 |
| *WELSBY, MORETON BAY REGIONAL* | Bribie Island | 4507 |
| *BURPENGARY EAST, MORETON BAY REGIONAL* | Caboolture | 4508 |
| *DECEPTION BAY, MORETON BAY REGIONAL* | Caboolture | 4508 |
| *NARANGBA, MORETON BAY REGIONAL* | Caboolture | 4508 |
| *DECEPTION BAY, MORETON BAY REGIONAL* | Pine | 4508 |
| *NORTH LAKES, MORETON BAY REGIONAL* | Pine | 4508 |
| *NARANGBA, MORETON BAY REGIONAL* | Pine | 4508 |
| *ROTHWELL, MORETON BAY REGIONAL* | Pine | 4508 |
| *CLONTARF, MORETON BAY REGIONAL* | Pine | 4509 |
| *GRIFFIN, MORETON BAY REGIONAL* | Pine | 4509 |
| *DECEPTION BAY, MORETON BAY REGIONAL* | Pine | 4509 |
| *DAKABIN, MORETON BAY REGIONAL* | Pine | 4509 |
| *MURRUMBA DOWNS, MORETON BAY REGIONAL* | Pine | 4509 |
| *MANGO HILL, MORETON BAY REGIONAL* | Pine | 4509 |
| *KALLANGUR, MORETON BAY REGIONAL* | Pine | 4509 |
| *NORTH LAKES, MORETON BAY REGIONAL* | Pine | 4509 |
| *NARANGBA, MORETON BAY REGIONAL* | Pine | 4509 |
| *ROTHWELL, MORETON BAY REGIONAL* | Pine | 4509 |
| *BEACHMERE, MORETON BAY REGIONAL* | Caboolture | 4510 |
| *BELLMERE, MORETON BAY REGIONAL* | Caboolture | 4510 |
| *BRACALBA, MORETON BAY REGIONAL* | Caboolture | 4510 |
| *BURPENGARY EAST, MORETON BAY REGIONAL* | Caboolture | 4510 |
| *CABOOLTURE SOUTH, MORETON BAY REGIONAL* | Caboolture | 4510 |
| *CABOOLTURE, MORETON BAY REGIONAL* | Caboolture | 4510 |
| *CAMPBELLS POCKET, MORETON BAY REGIONAL* | Caboolture | 4510 |
| *GODWIN BEACH, MORETON BAY REGIONAL* | Caboolture | 4510 |
| *ELIMBAH, MORETON BAY REGIONAL* | Caboolture | 4510 |
| *NINGI, MORETON BAY REGIONAL* | Caboolture | 4510 |
| *MOODLU, MORETON BAY REGIONAL* | Caboolture | 4510 |
| *OCEAN VIEW, MORETON BAY REGIONAL* | Caboolture | 4510 |
| *MORAYFIELD, MORETON BAY REGIONAL* | Caboolture | 4510 |
| *MOORINA, MORETON BAY REGIONAL* | Caboolture | 4510 |
| *UPPER CABOOLTURE, MORETON BAY REGIONAL* | Caboolture | 4510 |
| *WAMURAN BASIN, MORETON BAY REGIONAL* | Caboolture | 4510 |
| *WAMURAN, MORETON BAY REGIONAL* | Caboolture | 4510 |
| *ROCKSBERG, MORETON BAY REGIONAL* | Caboolture | 4510 |
| *BEERBURRUM, SUNSHINE COAST REGIONAL* | Pumicestone | 4510 |
| *CABOOLTURE, MORETON BAY REGIONAL* | Pumicestone | 4510 |
| *DONNYBROOK, MORETON BAY REGIONAL* | Pumicestone | 4510 |
| *MELDALE, MORETON BAY REGIONAL* | Pumicestone | 4510 |
| *ELIMBAH, MORETON BAY REGIONAL* | Pumicestone | 4510 |
| *NINGI, MORETON BAY REGIONAL* | Pumicestone | 4510 |

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| *TOORBUL, MORETON BAY REGIONAL* | Pumicestone | 4510 |
| *BEACHMERE, MORETON BAY REGIONAL* | Caboolture | 4511 |
| *GODWIN BEACH, MORETON BAY REGIONAL* | Caboolture | 4511 |
| *NINGI, MORETON BAY REGIONAL* | Caboolture | 4511 |
| *SANDSTONE POINT, MORETON BAY REGIONAL* | Caboolture | 4511 |
| *CABOOLTURE, MORETON BAY REGIONAL* | Pumicestone | 4511 |
| *GODWIN BEACH, MORETON BAY REGIONAL* | Pumicestone | 4511 |
| *NINGI, MORETON BAY REGIONAL* | Pumicestone | 4511 |
| *SANDSTONE POINT, MORETON BAY REGIONAL* | Pumicestone | 4511 |
| *TOORBUL, MORETON BAY REGIONAL* | Pumicestone | 4511 |
| *BELLMERE, MORETON BAY REGIONAL* | Caboolture | 4512 |
| *BRACALBA, MORETON BAY REGIONAL* | Caboolture | 4512 |
| *CAMPBELLS POCKET, MORETON BAY REGIONAL* | Caboolture | 4512 |
| *D'AGUILAR, MORETON BAY REGIONAL* | Caboolture | 4512 |
| *DELANEYS CREEK, MORETON BAY REGIONAL* | Caboolture | 4512 |
| *OCEAN VIEW, MORETON BAY REGIONAL* | Caboolture | 4512 |
| *MOUNT MEE, MORETON BAY REGIONAL* | Caboolture | 4512 |
| *UPPER CABOOLTURE, MORETON BAY REGIONAL* | Caboolture | 4512 |
| *WAMURAN BASIN, MORETON BAY REGIONAL* | Caboolture | 4512 |
| *WAMURAN, MORETON BAY REGIONAL* | Caboolture | 4512 |
| *ROCKSBERG, MORETON BAY REGIONAL* | Caboolture | 4512 |
| *BRACALBA, MORETON BAY REGIONAL* | Pumicestone | 4512 |
| *WOODFORD, MORETON BAY REGIONAL* | Pumicestone | 4512 |
| *WAMURAN, MORETON BAY REGIONAL* | Pumicestone | 4512 |
| *BRACALBA, MORETON BAY REGIONAL* | Stanley | 4512 |
| *D'AGUILAR, MORETON BAY REGIONAL* | Stanley | 4512 |
| *DELANEYS CREEK, MORETON BAY REGIONAL* | Stanley | 4512 |
| *MOUNT MEE, MORETON BAY REGIONAL* | Stanley | 4512 |
| *WOODFORD, MORETON BAY REGIONAL* | Stanley | 4512 |
| *WAMURAN BASIN, MORETON BAY REGIONAL* | Stanley | 4512 |
| *WAMURAN, MORETON BAY REGIONAL* | Stanley | 4512 |
| *BRACALBA, MORETON BAY REGIONAL* | Caboolture | 4514 |
| *D'AGUILAR, MORETON BAY REGIONAL* | Caboolture | 4514 |
| *DELANEYS CREEK, MORETON BAY REGIONAL* | Caboolture | 4514 |
| *WOODFORD, MORETON BAY REGIONAL* | Caboolture | 4514 |
| *BEERBURRUM, SUNSHINE COAST REGIONAL* | Pumicestone | 4514 |
| *BRACALBA, MORETON BAY REGIONAL* | Pumicestone | 4514 |
| *WOODFORD, MORETON BAY REGIONAL* | Pumicestone | 4514 |
| *WAMURAN, MORETON BAY REGIONAL* | Pumicestone | 4514 |
| *BELLTHORPE, MORETON BAY REGIONAL* | Stanley | 4514 |
| *BEERBURRUM, SUNSHINE COAST REGIONAL* | Stanley | 4514 |
| *BRACALBA, MORETON BAY REGIONAL* | Stanley | 4514 |
| *BOOROOBIN, MORETON BAY REGIONAL* | Stanley | 4514 |
| *BOOROOBIN, SUNSHINE COAST REGIONAL* | Stanley | 4514 |
| *CEDARTON, MORETON BAY REGIONAL* | Stanley | 4514 |
| *COMMISSIONERS FLAT, MORETON BAY REGIONAL* | Stanley | 4514 |

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| *GLASS HOUSE MOUNTAINS, SUNSHINE COAST RE* | Stanley | 4514 |
| *NEURUM, MORETON BAY REGIONAL* | Stanley | 4514 |
| *D'AGUILAR, MORETON BAY REGIONAL* | Stanley | 4514 |
| *DELANEYS CREEK, MORETON BAY REGIONAL* | Stanley | 4514 |
| *STONY CREEK, MORETON BAY REGIONAL* | Stanley | 4514 |
| *PEACHESTER, SUNSHINE COAST REGIONAL* | Stanley | 4514 |
| *MOUNT DELANEY, MORETON BAY REGIONAL* | Stanley | 4514 |
| *MOUNT MEE, MORETON BAY REGIONAL* | Stanley | 4514 |
| *MOUNT ARCHER, SOMERSET REGIONAL* | Stanley | 4514 |
| *MOUNT BYRON, SOMERSET REGIONAL* | Stanley | 4514 |
| *VILLENEUVE, SOMERSET REGIONAL* | Stanley | 4514 |
| *WOODFORD, MORETON BAY REGIONAL* | Stanley | 4514 |
| *SANDY CREEK, SOMERSET REGIONAL* | Stanley | 4514 |
| *STANMORE, MORETON BAY REGIONAL* | Stanley | 4514 |
| *WAMURAN, MORETON BAY REGIONAL* | Stanley | 4514 |
| *ROYSTON, SOMERSET REGIONAL* | Stanley | 4514 |
| *BELLTHORPE, MORETON BAY REGIONAL* | Stanley | 4515 |
| *COOEEIMBARDI, SOMERSET REGIONAL* | Stanley | 4515 |
| *CONONDALE, SUNSHINE COAST REGIONAL* | Stanley | 4515 |
| *HARLIN, SOMERSET REGIONAL* | Stanley | 4515 |
| *JIMNA, SOMERSET REGIONAL* | Stanley | 4515 |
| *GLENFERN, SOMERSET REGIONAL* | Stanley | 4515 |
| *GREGORS CREEK, SOMERSET REGIONAL* | Stanley | 4515 |
| *HAZELDEAN, SOMERSET REGIONAL* | Stanley | 4515 |
| *CROSSDALE, SOMERSET REGIONAL* | Stanley | 4515 |
| *FULHAM, SOMERSET REGIONAL* | Stanley | 4515 |
| *MOUNT KILCOY, SOMERSET REGIONAL* | Stanley | 4515 |
| *KENILWORTH, SUNSHINE COAST REGIONAL* | Stanley | 4515 |
| *MONSILDALE, SOMERSET REGIONAL* | Stanley | 4515 |
| *KILCOY, SOMERSET REGIONAL* | Stanley | 4515 |
| *MOORE, SOMERSET REGIONAL* | Stanley | 4515 |
| *WOOLMAR, SOMERSET REGIONAL* | Stanley | 4515 |
| *WESTVALE, SOMERSET REGIONAL* | Stanley | 4515 |
| *WINYA, SOMERSET REGIONAL* | Stanley | 4515 |
| *SANDY CREEK, SOMERSET REGIONAL* | Stanley | 4515 |
| *SHEEP STATION CREEK, SOMERSET REGIONAL* | Stanley | 4515 |
| *SOMERSET DAM, SOMERSET REGIONAL* | Stanley | 4515 |
| *AVOCA VALE, SOMERSET REGIONAL* | Upper Brisbane | 4515 |
| *COOEEIMBARDI, SOMERSET REGIONAL* | Upper Brisbane | 4515 |
| *HARLIN, SOMERSET REGIONAL* | Upper Brisbane | 4515 |
| *JIMNA, SOMERSET REGIONAL* | Upper Brisbane | 4515 |
| *GREGORS CREEK, SOMERSET REGIONAL* | Upper Brisbane | 4515 |
| *HAZELDEAN, SOMERSET REGIONAL* | Upper Brisbane | 4515 |
| *FULHAM, SOMERSET REGIONAL* | Upper Brisbane | 4515 |
| *MOUNT STANLEY, SOMERSET REGIONAL* | Upper Brisbane | 4515 |
| *MANUMBAR, GYMPIE REGIONAL* | Upper Brisbane | 4515 |

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| *MONSILDALE, SOMERSET REGIONAL* | Upper Brisbane | 4515 |
| *KINGAHAM, SOMERSET REGIONAL* | Upper Brisbane | 4515 |
| *LINVILLE, SOMERSET REGIONAL* | Upper Brisbane | 4515 |
| *MOORE, SOMERSET REGIONAL* | Upper Brisbane | 4515 |
| *WOOLMAR, SOMERSET REGIONAL* | Upper Brisbane | 4515 |
| *SHEEP STATION CREEK, SOMERSET REGIONAL* | Upper Brisbane | 4515 |
| *SOMERSET DAM, SOMERSET REGIONAL* | Upper Brisbane | 4515 |
| *CABOOLTURE, MORETON BAY REGIONAL* | Caboolture | 4516 |
| *ELIMBAH, MORETON BAY REGIONAL* | Caboolture | 4516 |
| *WAMURAN, MORETON BAY REGIONAL* | Caboolture | 4516 |
| *BEERBURRUM, SUNSHINE COAST REGIONAL* | Pumicestone | 4516 |
| *CABOOLTURE, MORETON BAY REGIONAL* | Pumicestone | 4516 |
| *DONNYBROOK, MORETON BAY REGIONAL* | Pumicestone | 4516 |
| *ELIMBAH, MORETON BAY REGIONAL* | Pumicestone | 4516 |
| *WOODFORD, MORETON BAY REGIONAL* | Pumicestone | 4516 |
| *TOORBUL, MORETON BAY REGIONAL* | Pumicestone | 4516 |
| *WAMURAN, MORETON BAY REGIONAL* | Pumicestone | 4516 |
| *BEERBURRUM, SUNSHINE COAST REGIONAL* | Pumicestone | 4517 |
| *ELIMBAH, MORETON BAY REGIONAL* | Pumicestone | 4517 |
| *BEERBURRUM, SUNSHINE COAST REGIONAL* | Bribie Island | 4518 |
| *BRIBIE ISLAND NORTH, SUNSHINE COAST REGI* | Bribie Island | 4518 |
| *COOCHIN CREEK, SUNSHINE COAST REGIONAL* | Bribie Island | 4518 |
| *WELSBY, MORETON BAY REGIONAL* | Bribie Island | 4518 |
| *BEERWAH, SUNSHINE COAST REGIONAL* | Pumicestone | 4518 |
| *BEERBURRUM, SUNSHINE COAST REGIONAL* | Pumicestone | 4518 |
| *COOCHIN CREEK, SUNSHINE COAST REGIONAL* | Pumicestone | 4518 |
| *DONNYBROOK, MORETON BAY REGIONAL* | Pumicestone | 4518 |
| *GLASS HOUSE MOUNTAINS, SUNSHINE COAST RE* | Pumicestone | 4518 |
| *ELIMBAH, MORETON BAY REGIONAL* | Pumicestone | 4518 |
| *PEACHESTER, SUNSHINE COAST REGIONAL* | Pumicestone | 4518 |
| *WOODFORD, MORETON BAY REGIONAL* | Pumicestone | 4518 |
| *BEERWAH, SUNSHINE COAST REGIONAL* | Stanley | 4518 |
| *BEERBURRUM, SUNSHINE COAST REGIONAL* | Stanley | 4518 |
| *BOOROOBIN, SUNSHINE COAST REGIONAL* | Stanley | 4518 |
| *CEDARTON, MORETON BAY REGIONAL* | Stanley | 4518 |
| *COMMISSIONERS FLAT, MORETON BAY REGIONAL* | Stanley | 4518 |
| *GLASS HOUSE MOUNTAINS, SUNSHINE COAST RE* | Stanley | 4518 |
| *PEACHESTER, SUNSHINE COAST REGIONAL* | Stanley | 4518 |
| *WOODFORD, MORETON BAY REGIONAL* | Stanley | 4518 |
| *BALD KNOB, SUNSHINE COAST REGIONAL* | Mooloolah | 4519 |
| *GLENVIEW, SUNSHINE COAST REGIONAL* | Mooloolah | 4519 |
| *LANDSBOROUGH, SUNSHINE COAST REGIONAL* | Mooloolah | 4519 |
| *MERIDAN PLAINS, SUNSHINE COAST REGIONAL* | Mooloolah | 4519 |
| *BEERWAH, SUNSHINE COAST REGIONAL* | Pumicestone | 4519 |
| *BELLS CREEK, SUNSHINE COAST REGIONAL* | Pumicestone | 4519 |
| *COOCHIN CREEK, SUNSHINE COAST REGIONAL* | Pumicestone | 4519 |

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| *GLASS HOUSE MOUNTAINS, SUNSHINE COAST RE* | Pumicestone | 4519 |
| *GLENVIEW, SUNSHINE COAST REGIONAL* | Pumicestone | 4519 |
| *MOUNT MELLUM, SUNSHINE COAST REGIONAL* | Pumicestone | 4519 |
| *PEACHESTER, SUNSHINE COAST REGIONAL* | Pumicestone | 4519 |
| *LANDSBOROUGH, SUNSHINE COAST REGIONAL* | Pumicestone | 4519 |
| *MERIDAN PLAINS, SUNSHINE COAST REGIONAL* | Pumicestone | 4519 |
| *BALD KNOB, SUNSHINE COAST REGIONAL* | Stanley | 4519 |
| *BEERWAH, SUNSHINE COAST REGIONAL* | Stanley | 4519 |
| *CROHAMHURST, SUNSHINE COAST REGIONAL* | Stanley | 4519 |
| *MOUNT MELLUM, SUNSHINE COAST REGIONAL* | Stanley | 4519 |
| *PEACHESTER, SUNSHINE COAST REGIONAL* | Stanley | 4519 |
| *MALENY, SUNSHINE COAST REGIONAL* | Stanley | 4519 |
| *WOOTHA, SUNSHINE COAST REGIONAL* | Stanley | 4519 |
| *BROOKFIELD, BRISBANE CITY* | Lower Brisbane | 4520 |
| *CAMP MOUNTAIN, MORETON BAY REGIONAL* | Lower Brisbane | 4520 |
| *LAKE MANCHESTER, BRISBANE CITY* | Lower Brisbane | 4520 |
| *JOLLYS LOOKOUT, MORETON BAY REGIONAL* | Lower Brisbane | 4520 |
| *ENOGGERA RESERVOIR, BRISBANE CITY* | Lower Brisbane | 4520 |
| *UPPER BROOKFIELD, BRISBANE CITY* | Lower Brisbane | 4520 |
| *THE GAP, BRISBANE CITY* | Lower Brisbane | 4520 |
| *UPPER KEDRON, BRISBANE CITY* | Lower Brisbane | 4520 |
| *BANKS CREEK, BRISBANE CITY* | Mid Brisbane | 4520 |
| *LAKE MANCHESTER, BRISBANE CITY* | Mid Brisbane | 4520 |
| *ENGLAND CREEK, BRISBANE CITY* | Mid Brisbane | 4520 |
| *ENOGGERA RESERVOIR, BRISBANE CITY* | Mid Brisbane | 4520 |
| *MOUNT GLORIOUS, MORETON BAY REGIONAL* | Mid Brisbane | 4520 |
| *MOUNT NEBO, MORETON BAY REGIONAL* | Mid Brisbane | 4520 |
| *ARMSTRONG CREEK, MORETON BAY REGIONAL* | Pine | 4520 |
| *BANKS CREEK, BRISBANE CITY* | Pine | 4520 |
| *BUNYA, MORETON BAY REGIONAL* | Pine | 4520 |
| *CAMP MOUNTAIN, MORETON BAY REGIONAL* | Pine | 4520 |
| *CEDAR CREEK, MORETON BAY REGIONAL* | Pine | 4520 |
| *CASHMERE, MORETON BAY REGIONAL* | Pine | 4520 |
| *CLEAR MOUNTAIN, MORETON BAY REGIONAL* | Pine | 4520 |
| *CLOSEBURN, MORETON BAY REGIONAL* | Pine | 4520 |
| *LAKE MANCHESTER, BRISBANE CITY* | Pine | 4520 |
| *HIGHVALE, MORETON BAY REGIONAL* | Pine | 4520 |
| *KOBBLE CREEK, MORETON BAY REGIONAL* | Pine | 4520 |
| *JOLLYS LOOKOUT, MORETON BAY REGIONAL* | Pine | 4520 |
| *EATONS HILL, MORETON BAY REGIONAL* | Pine | 4520 |
| *DAYBORO, MORETON BAY REGIONAL* | Pine | 4520 |
| *DRAPER, MORETON BAY REGIONAL* | Pine | 4520 |
| *DUNDAS, SOMERSET REGIONAL* | Pine | 4520 |
| *ENGLAND CREEK, BRISBANE CITY* | Pine | 4520 |
| *ENOGGERA RESERVOIR, BRISBANE CITY* | Pine | 4520 |
| *FERNY HILLS, MORETON BAY REGIONAL* | Pine | 4520 |

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| *MOUNT GLORIOUS, MORETON BAY REGIONAL* | Pine | 4520 |
| *MOUNT NEBO, MORETON BAY REGIONAL* | Pine | 4520 |
| *MOUNT SAMSON, MORETON BAY REGIONAL* | Pine | 4520 |
| *LACEYS CREEK, MORETON BAY REGIONAL* | Pine | 4520 |
| *YUGAR, MORETON BAY REGIONAL* | Pine | 4520 |
| *WIGHTS MOUNTAIN, MORETON BAY REGIONAL* | Pine | 4520 |
| *SAMFORD VALLEY, MORETON BAY REGIONAL* | Pine | 4520 |
| *RUSH CREEK, MORETON BAY REGIONAL* | Pine | 4520 |
| *SAMFORD VILLAGE, MORETON BAY REGIONAL* | Pine | 4520 |
| *SAMSONVALE, MORETON BAY REGIONAL* | Pine | 4520 |
| *UPPER KEDRON, BRISBANE CITY* | Pine | 4520 |
| *BANKS CREEK, BRISBANE CITY* | Upper Brisbane | 4520 |
| *LAKE MANCHESTER, BRISBANE CITY* | Upper Brisbane | 4520 |
| *DUNDAS, SOMERSET REGIONAL* | Upper Brisbane | 4520 |
| *ENGLAND CREEK, BRISBANE CITY* | Upper Brisbane | 4520 |
| *ENOGGERA RESERVOIR, BRISBANE CITY* | Upper Brisbane | 4520 |
| *MOUNT GLORIOUS, MORETON BAY REGIONAL* | Upper Brisbane | 4520 |
| *MOUNT NEBO, MORETON BAY REGIONAL* | Upper Brisbane | 4520 |
| *CAMPBELLS POCKET, MORETON BAY REGIONAL* | Caboolture | 4521 |
| *OCEAN VIEW, MORETON BAY REGIONAL* | Caboolture | 4521 |
| *MOUNT MEE, MORETON BAY REGIONAL* | Caboolture | 4521 |
| *KING SCRUB, MORETON BAY REGIONAL* | Caboolture | 4521 |
| *MOUNT PLEASANT, MORETON BAY REGIONAL* | Caboolture | 4521 |
| *MOORINA, MORETON BAY REGIONAL* | Caboolture | 4521 |
| *NARANGBA, MORETON BAY REGIONAL* | Caboolture | 4521 |
| *RUSH CREEK, MORETON BAY REGIONAL* | Caboolture | 4521 |
| *WAMURAN BASIN, MORETON BAY REGIONAL* | Caboolture | 4521 |
| *ROCKSBERG, MORETON BAY REGIONAL* | Caboolture | 4521 |
| *ARMSTRONG CREEK, MORETON BAY REGIONAL* | Pine | 4521 |
| *KOBBLE CREEK, MORETON BAY REGIONAL* | Pine | 4521 |
| *DAYBORO, MORETON BAY REGIONAL* | Pine | 4521 |
| *DUNDAS, SOMERSET REGIONAL* | Pine | 4521 |
| *OCEAN VIEW, MORETON BAY REGIONAL* | Pine | 4521 |
| *MOUNT MEE, MORETON BAY REGIONAL* | Pine | 4521 |
| *KING SCRUB, MORETON BAY REGIONAL* | Pine | 4521 |
| *KURWONGBAH, MORETON BAY REGIONAL* | Pine | 4521 |
| *MOUNT PLEASANT, MORETON BAY REGIONAL* | Pine | 4521 |
| *MOUNT BYRON, SOMERSET REGIONAL* | Pine | 4521 |
| *NARANGBA, MORETON BAY REGIONAL* | Pine | 4521 |
| *LACEYS CREEK, MORETON BAY REGIONAL* | Pine | 4521 |
| *WHITESIDE, MORETON BAY REGIONAL* | Pine | 4521 |
| *RUSH CREEK, MORETON BAY REGIONAL* | Pine | 4521 |
| *SAMSONVALE, MORETON BAY REGIONAL* | Pine | 4521 |
| *GLENFERN, SOMERSET REGIONAL* | Stanley | 4521 |
| *HAZELDEAN, SOMERSET REGIONAL* | Stanley | 4521 |
| *NEURUM, MORETON BAY REGIONAL* | Stanley | 4521 |

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| *CROSSDALE, SOMERSET REGIONAL* | Stanley | 4521 |
| *DUNDAS, SOMERSET REGIONAL* | Stanley | 4521 |
| *STONY CREEK, MORETON BAY REGIONAL* | Stanley | 4521 |
| *MOUNT DELANEY, MORETON BAY REGIONAL* | Stanley | 4521 |
| *MOUNT MEE, MORETON BAY REGIONAL* | Stanley | 4521 |
| *MOUNT ARCHER, SOMERSET REGIONAL* | Stanley | 4521 |
| *MOUNT PLEASANT, MORETON BAY REGIONAL* | Stanley | 4521 |
| *MOUNT BYRON, SOMERSET REGIONAL* | Stanley | 4521 |
| *LACEYS CREEK, MORETON BAY REGIONAL* | Stanley | 4521 |
| *VILLENEUVE, SOMERSET REGIONAL* | Stanley | 4521 |
| *WESTVALE, SOMERSET REGIONAL* | Stanley | 4521 |
| *WINYA, SOMERSET REGIONAL* | Stanley | 4521 |
| *SANDY CREEK, SOMERSET REGIONAL* | Stanley | 4521 |
| *ROYSTON, SOMERSET REGIONAL* | Stanley | 4521 |
| *DUNDAS, SOMERSET REGIONAL* | Upper Brisbane | 4521 |
| *LACEYS CREEK, MORETON BAY REGIONAL* | Upper Brisbane | 4521 |
| *BALD KNOB, SUNSHINE COAST REGIONAL* | Mooloolah | 4550 |
| *DIAMOND VALLEY, SUNSHINE COAST REGIONAL* | Mooloolah | 4550 |
| *MOUNT MELLUM, SUNSHINE COAST REGIONAL* | Mooloolah | 4550 |
| *MOOLOOLAH VALLEY, SUNSHINE COAST REGIONA* | Mooloolah | 4550 |
| *LANDSBOROUGH, SUNSHINE COAST REGIONAL* | Mooloolah | 4550 |
| *BEERWAH, SUNSHINE COAST REGIONAL* | Pumicestone | 4550 |
| *MOUNT MELLUM, SUNSHINE COAST REGIONAL* | Pumicestone | 4550 |
| *PEACHESTER, SUNSHINE COAST REGIONAL* | Pumicestone | 4550 |
| *LANDSBOROUGH, SUNSHINE COAST REGIONAL* | Pumicestone | 4550 |
| *BALD KNOB, SUNSHINE COAST REGIONAL* | Stanley | 4550 |
| *MOUNT MELLUM, SUNSHINE COAST REGIONAL* | Stanley | 4550 |
| *AROONA, SUNSHINE COAST REGIONAL* | Mooloolah | 4551 |
| *BATTERY HILL, SUNSHINE COAST REGIONAL* | Mooloolah | 4551 |
| *BELLS CREEK, SUNSHINE COAST REGIONAL* | Mooloolah | 4551 |
| *BIRTINYA, SUNSHINE COAST REGIONAL* | Mooloolah | 4551 |
| *CALOUNDRA WEST, SUNSHINE COAST REGIONAL* | Mooloolah | 4551 |
| *CALOUNDRA, SUNSHINE COAST REGIONAL* | Mooloolah | 4551 |
| *GLENVIEW, SUNSHINE COAST REGIONAL* | Mooloolah | 4551 |
| *KINGS BEACH, SUNSHINE COAST REGIONAL* | Mooloolah | 4551 |
| *CURRIMUNDI, SUNSHINE COAST REGIONAL* | Mooloolah | 4551 |
| *DICKY BEACH, SUNSHINE COAST REGIONAL* | Mooloolah | 4551 |
| *PALMVIEW, SUNSHINE COAST REGIONAL* | Mooloolah | 4551 |
| *MERIDAN PLAINS, SUNSHINE COAST REGIONAL* | Mooloolah | 4551 |
| *MOFFAT BEACH, SUNSHINE COAST REGIONAL* | Mooloolah | 4551 |
| *LITTLE MOUNTAIN, SUNSHINE COAST REGIONAL* | Mooloolah | 4551 |
| *WURTULLA, SUNSHINE COAST REGIONAL* | Mooloolah | 4551 |
| *SHELLY BEACH, SUNSHINE COAST REGIONAL* | Mooloolah | 4551 |
| *AROONA, SUNSHINE COAST REGIONAL* | Pumicestone | 4551 |
| *BELLS CREEK, SUNSHINE COAST REGIONAL* | Pumicestone | 4551 |
| *CALOUNDRA WEST, SUNSHINE COAST REGIONAL* | Pumicestone | 4551 |

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| *CALOUNDRA, SUNSHINE COAST REGIONAL* | Pumicestone | 4551 |
| *COOCHIN CREEK, SUNSHINE COAST REGIONAL* | Pumicestone | 4551 |
| *GOLDEN BEACH, SUNSHINE COAST REGIONAL* | Pumicestone | 4551 |
| *KINGS BEACH, SUNSHINE COAST REGIONAL* | Pumicestone | 4551 |
| *MERIDAN PLAINS, SUNSHINE COAST REGIONAL* | Pumicestone | 4551 |
| *MOFFAT BEACH, SUNSHINE COAST REGIONAL* | Pumicestone | 4551 |
| *LITTLE MOUNTAIN, SUNSHINE COAST REGIONAL* | Pumicestone | 4551 |
| *PELICAN WATERS, SUNSHINE COAST REGIONAL* | Pumicestone | 4551 |
| *SHELLY BEACH, SUNSHINE COAST REGIONAL* | Pumicestone | 4551 |
| *BALMORAL RIDGE, SUNSHINE COAST REGIONAL* | Maroochy | 4552 |
| *EUDLO, SUNSHINE COAST REGIONAL* | Maroochy | 4552 |
| *MONTVILLE, SUNSHINE COAST REGIONAL* | Maroochy | 4552 |
| *BALD KNOB, SUNSHINE COAST REGIONAL* | Mooloolah | 4552 |
| *BALMORAL RIDGE, SUNSHINE COAST REGIONAL* | Mooloolah | 4552 |
| *EUDLO, SUNSHINE COAST REGIONAL* | Mooloolah | 4552 |
| *DIAMOND VALLEY, SUNSHINE COAST REGIONAL* | Mooloolah | 4552 |
| *MALENY, SUNSHINE COAST REGIONAL* | Mooloolah | 4552 |
| *MOOLOOLAH VALLEY, SUNSHINE COAST REGIONA* | Mooloolah | 4552 |
| *BALD KNOB, SUNSHINE COAST REGIONAL* | Stanley | 4552 |
| *BOOROOBIN, MORETON BAY REGIONAL* | Stanley | 4552 |
| *BOOROOBIN, SUNSHINE COAST REGIONAL* | Stanley | 4552 |
| *CONONDALE, SUNSHINE COAST REGIONAL* | Stanley | 4552 |
| *JIMNA, SOMERSET REGIONAL* | Stanley | 4552 |
| *CROHAMHURST, SUNSHINE COAST REGIONAL* | Stanley | 4552 |
| *PEACHESTER, SUNSHINE COAST REGIONAL* | Stanley | 4552 |
| *MALENY, SUNSHINE COAST REGIONAL* | Stanley | 4552 |
| *WOOTHA, SUNSHINE COAST REGIONAL* | Stanley | 4552 |
| *SANDY CREEK, SOMERSET REGIONAL* | Stanley | 4552 |
| *ILKLEY, SUNSHINE COAST REGIONAL* | Maroochy | 4553 |
| *EUDLO, SUNSHINE COAST REGIONAL* | Maroochy | 4553 |
| *DIAMOND VALLEY, SUNSHINE COAST REGIONAL* | Maroochy | 4553 |
| *MOOLOOLAH VALLEY, SUNSHINE COAST REGIONA* | Maroochy | 4553 |
| *BIRTINYA, SUNSHINE COAST REGIONAL* | Mooloolah | 4553 |
| *ILKLEY, SUNSHINE COAST REGIONAL* | Mooloolah | 4553 |
| *GLENVIEW, SUNSHINE COAST REGIONAL* | Mooloolah | 4553 |
| *EUDLO, SUNSHINE COAST REGIONAL* | Mooloolah | 4553 |
| *DIAMOND VALLEY, SUNSHINE COAST REGIONAL* | Mooloolah | 4553 |
| *PALMVIEW, SUNSHINE COAST REGIONAL* | Mooloolah | 4553 |
| *SIPPY DOWNS, SUNSHINE COAST REGIONAL* | Mooloolah | 4553 |
| *MOOLOOLAH VALLEY, SUNSHINE COAST REGIONA* | Mooloolah | 4553 |
| *LANDSBOROUGH, SUNSHINE COAST REGIONAL* | Mooloolah | 4553 |
| *MERIDAN PLAINS, SUNSHINE COAST REGIONAL* | Mooloolah | 4553 |
| *TANAWHA, SUNSHINE COAST REGIONAL* | Mooloolah | 4553 |
| *WARANA, SUNSHINE COAST REGIONAL* | Mooloolah | 4553 |
| *LANDSBOROUGH, SUNSHINE COAST REGIONAL* | Pumicestone | 4553 |
| *BALMORAL RIDGE, SUNSHINE COAST REGIONAL* | Maroochy | 4554 |

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| *CHEVALLUM, SUNSHINE COAST REGIONAL* | Maroochy | 4554 |
| *ILKLEY, SUNSHINE COAST REGIONAL* | Maroochy | 4554 |
| *EUDLO, SUNSHINE COAST REGIONAL* | Maroochy | 4554 |
| *DIAMOND VALLEY, SUNSHINE COAST REGIONAL* | Maroochy | 4554 |
| *MONTVILLE, SUNSHINE COAST REGIONAL* | Maroochy | 4554 |
| *PALMWOODS, SUNSHINE COAST REGIONAL* | Maroochy | 4554 |
| *MOOLOOLAH VALLEY, SUNSHINE COAST REGIONA* | Maroochy | 4554 |
| *LANDERS SHOOT, SUNSHINE COAST REGIONAL* | Maroochy | 4554 |
| *TANAWHA, SUNSHINE COAST REGIONAL* | Maroochy | 4554 |
| *BALMORAL RIDGE, SUNSHINE COAST REGIONAL* | Mooloolah | 4554 |
| *ILKLEY, SUNSHINE COAST REGIONAL* | Mooloolah | 4554 |
| *GLENVIEW, SUNSHINE COAST REGIONAL* | Mooloolah | 4554 |
| *EUDLO, SUNSHINE COAST REGIONAL* | Mooloolah | 4554 |
| *DIAMOND VALLEY, SUNSHINE COAST REGIONAL* | Mooloolah | 4554 |
| *PALMVIEW, SUNSHINE COAST REGIONAL* | Mooloolah | 4554 |
| *SIPPY DOWNS, SUNSHINE COAST REGIONAL* | Mooloolah | 4554 |
| *MOOLOOLAH VALLEY, SUNSHINE COAST REGIONA* | Mooloolah | 4554 |
| *TANAWHA, SUNSHINE COAST REGIONAL* | Mooloolah | 4554 |
| *CHEVALLUM, SUNSHINE COAST REGIONAL* | Maroochy | 4555 |
| *FOREST GLEN, SUNSHINE COAST REGIONAL* | Maroochy | 4555 |
| *FLAXTON, SUNSHINE COAST REGIONAL* | Maroochy | 4555 |
| *HUNCHY, SUNSHINE COAST REGIONAL* | Maroochy | 4555 |
| *ILKLEY, SUNSHINE COAST REGIONAL* | Maroochy | 4555 |
| *EUDLO, SUNSHINE COAST REGIONAL* | Maroochy | 4555 |
| *DULONG, SUNSHINE COAST REGIONAL* | Maroochy | 4555 |
| *MONTVILLE, SUNSHINE COAST REGIONAL* | Maroochy | 4555 |
| *PALMWOODS, SUNSHINE COAST REGIONAL* | Maroochy | 4555 |
| *LANDERS SHOOT, SUNSHINE COAST REGIONAL* | Maroochy | 4555 |
| *TANAWHA, SUNSHINE COAST REGIONAL* | Maroochy | 4555 |
| *WOOMBYE, SUNSHINE COAST REGIONAL* | Maroochy | 4555 |
| *WEST WOOMBYE, SUNSHINE COAST REGIONAL* | Maroochy | 4555 |
| *ILKLEY, SUNSHINE COAST REGIONAL* | Mooloolah | 4555 |
| *TANAWHA, SUNSHINE COAST REGIONAL* | Mooloolah | 4555 |
| *ALEXANDRA HEADLAND, SUNSHINE COAST REGIO* | Maroochy | 4556 |
| *BUDERIM, SUNSHINE COAST REGIONAL* | Maroochy | 4556 |
| *CHEVALLUM, SUNSHINE COAST REGIONAL* | Maroochy | 4556 |
| *FOREST GLEN, SUNSHINE COAST REGIONAL* | Maroochy | 4556 |
| *KULUIN, SUNSHINE COAST REGIONAL* | Maroochy | 4556 |
| *MONS, SUNSHINE COAST REGIONAL* | Maroochy | 4556 |
| *KUNDA PARK, SUNSHINE COAST REGIONAL* | Maroochy | 4556 |
| *MAROOCHYDORE, SUNSHINE COAST REGIONAL* | Maroochy | 4556 |
| *TANAWHA, SUNSHINE COAST REGIONAL* | Maroochy | 4556 |
| *WOOMBYE, SUNSHINE COAST REGIONAL* | Maroochy | 4556 |
| *BIRTINYA, SUNSHINE COAST REGIONAL* | Mooloolah | 4556 |
| *BUDERIM, SUNSHINE COAST REGIONAL* | Mooloolah | 4556 |
| *PALMVIEW, SUNSHINE COAST REGIONAL* | Mooloolah | 4556 |

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| *SIPPY DOWNS, SUNSHINE COAST REGIONAL* | Mooloolah | 4556 |
| *MOUNTAIN CREEK, SUNSHINE COAST REGIONAL* | Mooloolah | 4556 |
| *MONS, SUNSHINE COAST REGIONAL* | Mooloolah | 4556 |
| *TANAWHA, SUNSHINE COAST REGIONAL* | Mooloolah | 4556 |
| *WARANA, SUNSHINE COAST REGIONAL* | Mooloolah | 4556 |
| *PARREARRA, SUNSHINE COAST REGIONAL* | Mooloolah | 4556 |
| *MOOLOOLABA, SUNSHINE COAST REGIONAL* | Maroochy | 4557 |
| *ALEXANDRA HEADLAND, SUNSHINE COAST REGIO* | Mooloolah | 4557 |
| *BUDERIM, SUNSHINE COAST REGIONAL* | Mooloolah | 4557 |
| *SIPPY DOWNS, SUNSHINE COAST REGIONAL* | Mooloolah | 4557 |
| *MOUNTAIN CREEK, SUNSHINE COAST REGIONAL* | Mooloolah | 4557 |
| *MOOLOOLABA, SUNSHINE COAST REGIONAL* | Mooloolah | 4557 |
| *MINYAMA, SUNSHINE COAST REGIONAL* | Mooloolah | 4557 |
| *PARREARRA, SUNSHINE COAST REGIONAL* | Mooloolah | 4557 |
| *ALEXANDRA HEADLAND, SUNSHINE COAST REGIO* | Maroochy | 4558 |
| *BLI BLI, SUNSHINE COAST REGIONAL* | Maroochy | 4558 |
| *BUDERIM, SUNSHINE COAST REGIONAL* | Maroochy | 4558 |
| *DIDDILLIBAH, SUNSHINE COAST REGIONAL* | Maroochy | 4558 |
| *PACIFIC PARADISE, SUNSHINE COAST REGIONA* | Maroochy | 4558 |
| *KULUIN, SUNSHINE COAST REGIONAL* | Maroochy | 4558 |
| *KUNDA PARK, SUNSHINE COAST REGIONAL* | Maroochy | 4558 |
| *MAROOCHYDORE, SUNSHINE COAST REGIONAL* | Maroochy | 4558 |
| *TWIN WATERS, SUNSHINE COAST REGIONAL* | Maroochy | 4558 |
| *BLI BLI, SUNSHINE COAST REGIONAL* | Maroochy | 4559 |
| *COES CREEK, SUNSHINE COAST REGIONAL* | Maroochy | 4559 |
| *FOREST GLEN, SUNSHINE COAST REGIONAL* | Maroochy | 4559 |
| *HUNCHY, SUNSHINE COAST REGIONAL* | Maroochy | 4559 |
| *DIDDILLIBAH, SUNSHINE COAST REGIONAL* | Maroochy | 4559 |
| *NAMBOUR, SUNSHINE COAST REGIONAL* | Maroochy | 4559 |
| *ROSEMOUNT, SUNSHINE COAST REGIONAL* | Maroochy | 4559 |
| *PALMWOODS, SUNSHINE COAST REGIONAL* | Maroochy | 4559 |
| *KULUIN, SUNSHINE COAST REGIONAL* | Maroochy | 4559 |
| *KUNDA PARK, SUNSHINE COAST REGIONAL* | Maroochy | 4559 |
| *KIELS MOUNTAIN, SUNSHINE COAST REGIONAL* | Maroochy | 4559 |
| *MAROOCHYDORE, SUNSHINE COAST REGIONAL* | Maroochy | 4559 |
| *WOOMBYE, SUNSHINE COAST REGIONAL* | Maroochy | 4559 |
| *WEST WOOMBYE, SUNSHINE COAST REGIONAL* | Maroochy | 4559 |
| *BALMORAL RIDGE, SUNSHINE COAST REGIONAL* | Maroochy | 4560 |
| *BELLI PARK, SUNSHINE COAST REGIONAL* | Maroochy | 4560 |
| *BLI BLI, SUNSHINE COAST REGIONAL* | Maroochy | 4560 |
| *BRIDGES, SUNSHINE COAST REGIONAL* | Maroochy | 4560 |
| *BURNSIDE, SUNSHINE COAST REGIONAL* | Maroochy | 4560 |
| *COES CREEK, SUNSHINE COAST REGIONAL* | Maroochy | 4560 |
| *COOLOOLABIN, SUNSHINE COAST REGIONAL* | Maroochy | 4560 |
| *FLAXTON, SUNSHINE COAST REGIONAL* | Maroochy | 4560 |
| *KIAMBA, SUNSHINE COAST REGIONAL* | Maroochy | 4560 |

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| *HUNCHY, SUNSHINE COAST REGIONAL* | Maroochy | 4560 |
| *GHEERULLA, SUNSHINE COAST REGIONAL* | Maroochy | 4560 |
| *HIGHWORTH, SUNSHINE COAST REGIONAL* | Maroochy | 4560 |
| *IMAGE FLAT, SUNSHINE COAST REGIONAL* | Maroochy | 4560 |
| *DULONG, SUNSHINE COAST REGIONAL* | Maroochy | 4560 |
| *DIDDILLIBAH, SUNSHINE COAST REGIONAL* | Maroochy | 4560 |
| *PERWILLOWEN, SUNSHINE COAST REGIONAL* | Maroochy | 4560 |
| *MONTVILLE, SUNSHINE COAST REGIONAL* | Maroochy | 4560 |
| *NAMBOUR, SUNSHINE COAST REGIONAL* | Maroochy | 4560 |
| *PACIFIC PARADISE, SUNSHINE COAST REGIONA* | Maroochy | 4560 |
| *ROSEMOUNT, SUNSHINE COAST REGIONAL* | Maroochy | 4560 |
| *PALMWOODS, SUNSHINE COAST REGIONAL* | Maroochy | 4560 |
| *LANDERS SHOOT, SUNSHINE COAST REGIONAL* | Maroochy | 4560 |
| *MAPLETON, SUNSHINE COAST REGIONAL* | Maroochy | 4560 |
| *MARCOOLA, SUNSHINE COAST REGIONAL* | Maroochy | 4560 |
| *MAROOCHY RIVER, SUNSHINE COAST REGIONAL* | Maroochy | 4560 |
| *MAROOCHYDORE, SUNSHINE COAST REGIONAL* | Maroochy | 4560 |
| *KUREELPA, SUNSHINE COAST REGIONAL* | Maroochy | 4560 |
| *KULANGOOR, SUNSHINE COAST REGIONAL* | Maroochy | 4560 |
| *TOWEN MOUNTAIN, SUNSHINE COAST REGIONAL* | Maroochy | 4560 |
| *WOOMBYE, SUNSHINE COAST REGIONAL* | Maroochy | 4560 |
| *WEST WOOMBYE, SUNSHINE COAST REGIONAL* | Maroochy | 4560 |
| *YANDINA, SUNSHINE COAST REGIONAL* | Maroochy | 4560 |
| *PARKLANDS, SUNSHINE COAST REGIONAL* | Maroochy | 4560 |
| *BLI BLI, SUNSHINE COAST REGIONAL* | Maroochy | 4561 |
| *BRIDGES, SUNSHINE COAST REGIONAL* | Maroochy | 4561 |
| *COOLOOLABIN, SUNSHINE COAST REGIONAL* | Maroochy | 4561 |
| *COOLUM BEACH, SUNSHINE COAST REGIONAL* | Maroochy | 4561 |
| *VALDORA, SUNSHINE COAST REGIONAL* | Maroochy | 4561 |
| *IMAGE FLAT, SUNSHINE COAST REGIONAL* | Maroochy | 4561 |
| *EERWAH VALE, SUNSHINE COAST REGIONAL* | Maroochy | 4561 |
| *NINDERRY, SUNSHINE COAST REGIONAL* | Maroochy | 4561 |
| *PACIFIC PARADISE, SUNSHINE COAST REGIONA* | Maroochy | 4561 |
| *MOUNT COOLUM, SUNSHINE COAST REGIONAL* | Maroochy | 4561 |
| *NORTH ARM, SUNSHINE COAST REGIONAL* | Maroochy | 4561 |
| *MARCOOLA, SUNSHINE COAST REGIONAL* | Maroochy | 4561 |
| *MAROOCHY RIVER, SUNSHINE COAST REGIONAL* | Maroochy | 4561 |
| *KULANGOOR, SUNSHINE COAST REGIONAL* | Maroochy | 4561 |
| *VERRIERDALE, SUNSHINE COAST REGIONAL* | Maroochy | 4561 |
| *YANDINA CREEK, SUNSHINE COAST REGIONAL* | Maroochy | 4561 |
| *YANDINA, SUNSHINE COAST REGIONAL* | Maroochy | 4561 |
| *PARKLANDS, SUNSHINE COAST REGIONAL* | Maroochy | 4561 |
| *BELLI PARK, SUNSHINE COAST REGIONAL* | Maroochy | 4562 |
| *COOLOOLABIN, SUNSHINE COAST REGIONAL* | Maroochy | 4562 |
| *DOONAN, SUNSHINE COAST REGIONAL* | Maroochy | 4562 |
| *COOROY, NOOSA SHIRE* | Maroochy | 4562 |

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|---|---|---|
| *EUMUNDI, SUNSHINE COAST REGIONAL* | Maroochy | 4562 |
| *DOONAN, NOOSA SHIRE* | Maroochy | 4562 |
| *EERWAH VALE, NOOSA SHIRE* | Maroochy | 4562 |
| *EERWAH VALE, SUNSHINE COAST REGIONAL* | Maroochy | 4562 |
| *NORTH ARM, SUNSHINE COAST REGIONAL* | Maroochy | 4562 |
| *VERRIERDALE, SUNSHINE COAST REGIONAL* | Maroochy | 4562 |
| *WEYBA DOWNS, SUNSHINE COAST REGIONAL* | Maroochy | 4562 |
| *YANDINA CREEK, SUNSHINE COAST REGIONAL* | Maroochy | 4562 |
| *TINBEERWAH, NOOSA SHIRE* | Maroochy | 4562 |
| *PEREGIAN BEACH, NOOSA SHIRE* | Maroochy | 4562 |
| *PEREGIAN BEACH, SUNSHINE COAST REGIONAL* | Maroochy | 4562 |
| *PEREGIAN SPRINGS, SUNSHINE COAST REGIONA* | Maroochy | 4562 |
| *CASTAWAYS BEACH, NOOSA SHIRE* | Noosa | 4562 |
| *DOONAN, SUNSHINE COAST REGIONAL* | Noosa | 4562 |
| *DOONAN, NOOSA SHIRE* | Noosa | 4562 |
| *NOOSA HEADS, NOOSA SHIRE* | Noosa | 4562 |
| *NOOSAVILLE, NOOSA SHIRE* | Noosa | 4562 |
| *MARCUS BEACH, NOOSA SHIRE* | Noosa | 4562 |
| *TEWANTIN, NOOSA SHIRE* | Noosa | 4562 |
| *WEYBA DOWNS, SUNSHINE COAST REGIONAL* | Noosa | 4562 |
| *PEREGIAN BEACH, NOOSA SHIRE* | Noosa | 4562 |
| *PEREGIAN BEACH, SUNSHINE COAST REGIONAL* | Noosa | 4562 |
| *BELLI PARK, SUNSHINE COAST REGIONAL* | Maroochy | 4563 |
| *COOROY, NOOSA SHIRE* | Maroochy | 4563 |
| *EUMUNDI, SUNSHINE COAST REGIONAL* | Maroochy | 4563 |
| *DOONAN, NOOSA SHIRE* | Maroochy | 4563 |
| *EERWAH VALE, NOOSA SHIRE* | Maroochy | 4563 |
| *EERWAH VALE, SUNSHINE COAST REGIONAL* | Maroochy | 4563 |
| *TEWANTIN, NOOSA SHIRE* | Maroochy | 4563 |
| *TINBEERWAH, NOOSA SHIRE* | Maroochy | 4563 |
| *COOROIBAH, NOOSA SHIRE* | Noosa | 4563 |
| *COOTHARABA, NOOSA SHIRE* | Noosa | 4563 |
| *LAKE MACDONALD, NOOSA SHIRE* | Noosa | 4563 |
| *DOONAN, NOOSA SHIRE* | Noosa | 4563 |
| *RINGTAIL CREEK, NOOSA SHIRE* | Noosa | 4563 |
| *TEWANTIN, NOOSA SHIRE* | Noosa | 4563 |
| *TINBEERWAH, NOOSA SHIRE* | Noosa | 4563 |
| *BLI BLI, SUNSHINE COAST REGIONAL* | Maroochy | 4564 |
| *MUDJIMBA, SUNSHINE COAST REGIONAL* | Maroochy | 4564 |
| *PACIFIC PARADISE, SUNSHINE COAST REGIONA* | Maroochy | 4564 |
| *MOUNT COOLUM, SUNSHINE COAST REGIONAL* | Maroochy | 4564 |
| *MARCOOLA, SUNSHINE COAST REGIONAL* | Maroochy | 4564 |
| *MAROOCHYDORE, SUNSHINE COAST REGIONAL* | Maroochy | 4564 |
| *TWIN WATERS, SUNSHINE COAST REGIONAL* | Maroochy | 4564 |
| *BOREEN POINT, NOOSA SHIRE* | Noosa | 4565 |
| *COMO, NOOSA SHIRE* | Noosa | 4565 |

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|---|---|---|
| *COOROIBAH, NOOSA SHIRE* | Noosa | 4565 |
| *COOTHARABA, NOOSA SHIRE* | Noosa | 4565 |
| *LAKE MACDONALD, NOOSA SHIRE* | Noosa | 4565 |
| *RINGTAIL CREEK, NOOSA SHIRE* | Noosa | 4565 |
| *NOOSA HEADS, NOOSA SHIRE* | Noosa | 4565 |
| *NOOSA NORTH SHORE, NOOSA SHIRE* | Noosa | 4565 |
| *NOOSAVILLE, NOOSA SHIRE* | Noosa | 4565 |
| *KIN KIN, NOOSA SHIRE* | Noosa | 4565 |
| *TEWANTIN, NOOSA SHIRE* | Noosa | 4565 |
| *TOOLARA FOREST, GYMPIE REGIONAL* | Noosa | 4565 |
| *TINBEERWAH, NOOSA SHIRE* | Noosa | 4565 |
| *NOOSA HEADS, NOOSA SHIRE* | Noosa | 4566 |
| *NOOSA NORTH SHORE, NOOSA SHIRE* | Noosa | 4566 |
| *NOOSAVILLE, NOOSA SHIRE* | Noosa | 4566 |
| *TEWANTIN, NOOSA SHIRE* | Noosa | 4566 |
| *CASTAWAYS BEACH, NOOSA SHIRE* | Noosa | 4567 |
| *NOOSA HEADS, NOOSA SHIRE* | Noosa | 4567 |
| *NOOSA NORTH SHORE, NOOSA SHIRE* | Noosa | 4567 |
| *NOOSAVILLE, NOOSA SHIRE* | Noosa | 4567 |
| *MARCUS BEACH, NOOSA SHIRE* | Noosa | 4567 |
| *SUNRISE BEACH, NOOSA SHIRE* | Noosa | 4567 |
| *SUNSHINE BEACH, NOOSA SHIRE* | Noosa | 4567 |
| *COOTHARABA, NOOSA SHIRE* | Noosa | 4568 |
| *KIN KIN, NOOSA SHIRE* | Noosa | 4568 |
| *PINBARREN, NOOSA SHIRE* | Noosa | 4568 |
| *KIN KIN, NOOSA SHIRE* | Noosa | 4569 |
| *PINBARREN, NOOSA SHIRE* | Noosa | 4569 |
| *COONDOO, GYMPIE REGIONAL* | Noosa | 4570 |
| *COMO, NOOSA SHIRE* | Noosa | 4570 |
| *KIN KIN, NOOSA SHIRE* | Noosa | 4570 |
| *TOOLARA FOREST, GYMPIE REGIONAL* | Noosa | 4570 |
| *BELLTHORPE, MORETON BAY REGIONAL* | Stanley | 4570 |
| *GLENFERN, SOMERSET REGIONAL* | Stanley | 4570 |
| *STONY CREEK, MORETON BAY REGIONAL* | Stanley | 4570 |
| *MOUNT KILCOY, SOMERSET REGIONAL* | Stanley | 4570 |
| *VILLENEUVE, SOMERSET REGIONAL* | Stanley | 4570 |
| *WINYA, SOMERSET REGIONAL* | Stanley | 4570 |
| *SANDY CREEK, SOMERSET REGIONAL* | Stanley | 4570 |
| *ROYSTON, SOMERSET REGIONAL* | Stanley | 4570 |
| *COONDOO, GYMPIE REGIONAL* | Noosa | 4571 |
| *COMO, NOOSA SHIRE* | Noosa | 4571 |
| *COOTHARABA, NOOSA SHIRE* | Noosa | 4571 |
| *KIN KIN, NOOSA SHIRE* | Noosa | 4571 |
| *PINBARREN, NOOSA SHIRE* | Noosa | 4571 |
| *ALEXANDRA HEADLAND, SUNSHINE COAST REGIO* | Maroochy | 4572 |
| *BUDERIM, SUNSHINE COAST REGIONAL* | Maroochy | 4572 |

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|---|---|---|
| *MOOLOOLABA, SUNSHINE COAST REGIONAL* | Maroochy | 4572 |
| *MAROOCHYDORE, SUNSHINE COAST REGIONAL* | Maroochy | 4572 |
| *ALEXANDRA HEADLAND, SUNSHINE COAST REGIO* | Mooloolah | 4572 |
| *BUDERIM, SUNSHINE COAST REGIONAL* | Mooloolah | 4572 |
| *MOOLOOLABA, SUNSHINE COAST REGIONAL* | Mooloolah | 4572 |
| *COOLUM BEACH, SUNSHINE COAST REGIONAL* | Maroochy | 4573 |
| *DOONAN, SUNSHINE COAST REGIONAL* | Maroochy | 4573 |
| *MOUNT COOLUM, SUNSHINE COAST REGIONAL* | Maroochy | 4573 |
| *MARCOOLA, SUNSHINE COAST REGIONAL* | Maroochy | 4573 |
| *VERRIERDALE, SUNSHINE COAST REGIONAL* | Maroochy | 4573 |
| *YANDINA CREEK, SUNSHINE COAST REGIONAL* | Maroochy | 4573 |
| *YAROOMBA, SUNSHINE COAST REGIONAL* | Maroochy | 4573 |
| *POINT ARKWRIGHT, SUNSHINE COAST REGIONAL* | Maroochy | 4573 |
| *PEREGIAN BEACH, NOOSA SHIRE* | Maroochy | 4573 |
| *PEREGIAN BEACH, SUNSHINE COAST REGIONAL* | Maroochy | 4573 |
| *PEREGIAN SPRINGS, SUNSHINE COAST REGIONA* | Maroochy | 4573 |
| *CASTAWAYS BEACH, NOOSA SHIRE* | Noosa | 4573 |
| *COOLUM BEACH, SUNSHINE COAST REGIONAL* | Noosa | 4573 |
| *NOOSA HEADS, NOOSA SHIRE* | Noosa | 4573 |
| *NOOSAVILLE, NOOSA SHIRE* | Noosa | 4573 |
| *MARCUS BEACH, NOOSA SHIRE* | Noosa | 4573 |
| *SUNRISE BEACH, NOOSA SHIRE* | Noosa | 4573 |
| *PEREGIAN BEACH, NOOSA SHIRE* | Noosa | 4573 |
| *PEREGIAN BEACH, SUNSHINE COAST REGIONAL* | Noosa | 4573 |
| *PEREGIAN SPRINGS, SUNSHINE COAST REGIONA* | Noosa | 4573 |
| *BELLI PARK, SUNSHINE COAST REGIONAL* | Maroochy | 4574 |
| *COOLOOLABIN, SUNSHINE COAST REGIONAL* | Maroochy | 4574 |
| *GHEERULLA, SUNSHINE COAST REGIONAL* | Maroochy | 4574 |
| *MAPLETON, SUNSHINE COAST REGIONAL* | Maroochy | 4574 |
| *JIMNA, SOMERSET REGIONAL* | Stanley | 4574 |
| *KENILWORTH, SUNSHINE COAST REGIONAL* | Stanley | 4574 |
| *BIRTINYA, SUNSHINE COAST REGIONAL* | Mooloolah | 4575 |
| *BOKARINA, SUNSHINE COAST REGIONAL* | Mooloolah | 4575 |
| *BUDDINA, SUNSHINE COAST REGIONAL* | Mooloolah | 4575 |
| *CURRIMUNDI, SUNSHINE COAST REGIONAL* | Mooloolah | 4575 |
| *SIPPY DOWNS, SUNSHINE COAST REGIONAL* | Mooloolah | 4575 |
| *MOUNTAIN CREEK, SUNSHINE COAST REGIONAL* | Mooloolah | 4575 |
| *MOOLOOLABA, SUNSHINE COAST REGIONAL* | Mooloolah | 4575 |
| *MINYAMA, SUNSHINE COAST REGIONAL* | Mooloolah | 4575 |
| *WURTULLA, SUNSHINE COAST REGIONAL* | Mooloolah | 4575 |
| *WARANA, SUNSHINE COAST REGIONAL* | Mooloolah | 4575 |
| *PARREARRA, SUNSHINE COAST REGIONAL* | Mooloolah | 4575 |
| *ELGIN VALE, GYMPIE REGIONAL* | Upper Brisbane | 4601 |
| *MOUNT STANLEY, SOMERSET REGIONAL* | Upper Brisbane | 4601 |
| *MANUMBAR, GYMPIE REGIONAL* | Upper Brisbane | 4601 |
| *KINGAHAM, SOMERSET REGIONAL* | Upper Brisbane | 4601 |

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|---|---|---|
| *BUNYA MOUNTAINS, SOUTH BURNETT REGIONAL* | Upper Brisbane | 4610 |
| *UPPER COOYAR CREEK, TOOWOOMBA REGIONAL* | Upper Brisbane | 4610 |
| *GILLA, TOOWOOMBA REGIONAL* | Upper Brisbane | 4614 |
| *YARRAMAN, TOOWOOMBA REGIONAL* | Upper Brisbane | 4614 |
| *AVOCA VALE, SOMERSET REGIONAL* | Upper Brisbane | 4615 |
| *BULLCAMP, SOUTH BURNETT REGIONAL* | Upper Brisbane | 4615 |
| *BUNYA MOUNTAINS, SOUTH BURNETT REGIONAL* | Upper Brisbane | 4615 |
| *JOHNSTOWN, SOUTH BURNETT REGIONAL* | Upper Brisbane | 4615 |
| *COOYAR, TOOWOOMBA REGIONAL* | Upper Brisbane | 4615 |
| *TAROMEO, SOUTH BURNETT REGIONAL* | Upper Brisbane | 4615 |
| *TARONG, SOUTH BURNETT REGIONAL* | Upper Brisbane | 4615 |
| *NEUMGNA, SOUTH BURNETT REGIONAL* | Upper Brisbane | 4615 |
| *EAST NANANGO, SOUTH BURNETT REGIONAL* | Upper Brisbane | 4615 |
| *NANANGO, SOUTH BURNETT REGIONAL* | Upper Brisbane | 4615 |
| *SOUTH NANANGO, SOUTH BURNETT REGIONAL* | Upper Brisbane | 4615 |
| *MOUNT STANLEY, SOMERSET REGIONAL* | Upper Brisbane | 4615 |
| *TEELAH, SOUTH BURNETT REGIONAL* | Upper Brisbane | 4615 |
| *YARRAMAN, TOOWOOMBA REGIONAL* | Upper Brisbane | 4615 |
| *UPPER COOYAR CREEK, TOOWOOMBA REGIONAL* | Upper Brisbane | 4615 |
| *WYALLA, SOUTH BURNETT REGIONAL* | Upper Brisbane | 4615 |
| *UPPER YARRAMAN, TOOWOOMBA REGIONAL* | Upper Brisbane | 4615 |
| *RUNNYMEDE, SOUTH BURNETT REGIONAL* | Upper Brisbane | 4615 |
| *SOUTH EAST NANANGO, SOUTH BURNETT REGION* | Upper Brisbane | 4615 |
| *PIMPIMBUDGEE, SOUTH BURNETT REGIONAL* | Upper Brisbane | 4615 |

# Appendix B –Ethics

| Queensland University of Technology Brisbane Australia | PARTICIPANT INFORMATION FOR QUT RESEARCH PROJECT – Survey – |
|---|---|
| | **Healthy Waterways Social Science Research** QUT Ethics Approval Number 1500000402 |

**RESEARCH TEAM**

Principal Researcher: Dr Kim Johnston, QUT Business School, Queensland University of Technology
Associate Researchers: Dr Amanda Beatson, QUT Business School, Queensland University of Technology
Dr Paul Maxwell, Principal Scientist – Monitoring and Research, Healthy Waterways

**DESCRIPTION**

The purpose of this research is to understand the attitudes and behaviours that underpin expectations and actions towards using and valuing local waterways in communities across Queensland. You are invited to participate in this project because you are over 18 years old and you live in South East Queensland.

**PARTICIPATION**

Your participation will involve completing an anonymous online survey with Likert scale answers (strongly agree – strongly disagree). The survey will take approximately 20 minutes of your time. Questions will include:

- Management of waterways has little effect on the waterway quality in my area.
- I know what I need to do to protect my waterways.
- Visiting waterways is pleasurable.

Your participation in this project is entirely voluntary. If you agree to participate you do not have to complete any question(s) you are uncomfortable answering. Your decision to participate or not participate will in no way impact upon your current or future relationship with QUT or with Healthy Waterways. If you do agree to participate you can withdraw from the project without comment or penalty by closing your browser before you submit. If you close your browser, any data collected may be used. As the survey is anonymous, once it has been submitted it will not be possible to withdraw.

**EXPECTED BENEFITS**

It is expected that this project will not directly benefit you. However, it may help to inform policy and community education programs about using and protecting waterways in Queensland. A summary report of this research, in the form of the waterways report card, will be available in October 2016. If you would like to receive a copy of this report via email in October, you will be offered the opportunity to leave your email address at the end of the survey.

**RISKS**

There are no foreseen risks associated with your participation in this study. However, if you experience any level of discomfort as a result of completing the survey, you can contact Lifeline on 13 11 14.

**PRIVACY AND CONFIDENTIALITY**

All comments and responses are anonymous and will be treated confidentially unless required by law. The names of individual persons are not required in any of the responses. Any data collected as part of this project will be stored securely as per QUT's Management of research data policy. Please note that non-identifiable data collected in this project may be used as comparative data in future projects or stored on an open access database for secondary analysis. Data collected in this survey will be used to inform the social component of the 2015 Queensland Waterways report card and also for comparison for future report cards. The project is jointly funded by QUT and Healthy Waterways. Healthy Waterways will have access to the data obtained during the project.

**CONSENT TO PARTICIPATE**

Commencing the online survey is accepted as an indication of your consent to participate in this project.

**QUESTIONS / FURTHER INFORMATION ABOUT THE PROJECT**

If you have any questions or require further information please contact one of the research team members below.

**Dr Kim Johnston**, QUT Business School
Phone 31384089
Email kim.johnston@qut.edu.au

**Dr Amanda Beatson**, QUT Business School
Phone 31381241
Email a.beatson@qut.edu.au

**CONCERNS / COMPLAINTS REGARDING THE CONDUCT OF THE PROJECT**

QUT is committed to research integrity and the ethical conduct of research projects. However, if you do have any concerns or complaints about the ethical conduct of the project you may contact the QUT Research Ethics Unit on [+61 7] 3138 5123 or email ethicscontact@qut.edu.au. The QUT Research Ethics Unit is not connected with the research project and can facilitate a resolution to your concern in an impartial manner.

***Thank you for helping with this research project. Please keep this sheet for your information.***

# Appendix C –Instrument

In this survey we would like you to think about waterways. First some definitions:

**A Waterway**: is a passage for water or a body of water, including all types of permanent and short term streams, rivers, wetlands and bays.
A waterway includes all estuaries, foreshores, coastal and marine waters. Waterways may be a freshwater or saltwater creek or river, a lake or dam, a bay, lagoon or canal, or a surf beach.

**Local waterways**: When we talk about local waterways, we mean waterways that are within **15 kilometres of your home**.

**SEQ Waterways**: When we talk about SEQ waterways, we mean **any waterway located in south east Queensland**.

**Visiting or using waterways**: When we talk about visiting or using these waterways, we mean taking part in activities in, and on, the water such as boating or swimming. We *also* mean taking part in activities alongside these waterways such as walking or having a picnic. Commuting to work using waterways is also included in this category.

**Please move the red marker and place it in the suburb where you live.**

**NOTE: Zoom in using the controls in the bottom right of the map or using the scroll wheel of the mouse and you can drag the map to find your suburb.**

**Please move the red marker and place it in the waterway that you have visited the most in the past 12 months.**

**NOTE: Zoom in using the controls in the bottom right of the map or using the scroll wheel of the mouse and you can drag the map to find the waterway.**

**How often did you visit this waterway in the last 12 months?**

| | | Response percent | Response total |
|---|---|---|---|
| Almost every day | | | |
| Every week | | | |
| Every fortnight | | | |
| Every month | | | |
| Every 6 months | | | |
| Once a year | | | |
| I haven't visited or used any waterway in the past 12 months | | | |

## Please move the red marker and place it in the second waterway that you have visited the most in the past 12 months.

**NOTE: Zoom in using the controls in the bottom right of the map or using the scroll wheel of the mouse and you can drag the map to find the waterway.**

**The following questions ask about the environment and waterways. Please indicate how much you agree or disagree with each of the following statements:**

| | Strongly disagree | 2 | 3 | 4 | 5 | 6 | Strongly agree | | Response total |
|---|---|---|---|---|---|---|---|---|---|
| I feel very connected to all living things and the earth | | | | | | | | | |
| My ideal vacation spot would be a remote, wilderness area | | | | | | | | | |
| I take notice of wildlife wherever I am | | | | | | | | | |
| My relationship to nature is an important part of who I am | | | | | | | | | |
| My connection to nature and the environment is a part of my spirituality | | | | | | | | | |
| I always think about how my actions affect the environment | | | | | | | | | |

**The following questions ask your views about waterways in South East Queensland. Thinking about these terms, indicate how much you agree or disagree with each of the following statements:**

| | Strongly disagree | 2 | 3 | 4 | 5 | 6 | Strongly agree | | Response total |
|---|---|---|---|---|---|---|---|---|---|
| Excess sediment entering waterways can harm waterways | | | | | | | | | |
| I am very concerned about local waterways | | | | | | | | | |
| Damage to waterways is increasing to dangerous levels | | | | | | | | | |
| Continued use of chemicals in agriculture will damage waterways | | | | | | | | | |
| People don't look after their local waterways | | | | | | | | | |
| I would be willing to change my behaviour to help protect local waterways | | | | | | | | | |
| Shortages in clean drinking water will occur in the future | | | | | | | | | |

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|---|---|---|---|---|---|---|---|---|---|
| Laws to protect local waterways should be enforced more strongly | | | | | | | | | |
| Urban development can impact waterways | | | | | | | | | |
| Stormwater runoff can damage waterways | | | | | | | | | |
| Some plants, fish, or animals that live in waterways are threatened with extinction | | | | | | | | | |
| I feel bad about not using my local waterways for a while | | | | | | | | | |
| Using local waterways is part of the way I have chosen to live my life | | | | | | | | | |
| I use local waterways because I want others to think I am an active person | | | | | | | | | |
| I use local waterways because my friends or family think that I should | | | | | | | | | |

**The following questions ask your views about waterways in South East Queensland. Thinking about these terms, indicate how much you agree or disagree with each of the following statements:**

| | Strongly disagree | 2 | 3 | 4 | 5 | 6 | Strongly agree | | Response total |
|---|---|---|---|---|---|---|---|---|---|
| I value the benefits of using local waterways | | | | | | | | | |
| I find using local waterways pleasurable | | | | | | | | | |
| I get satisfaction from using local waterways | | | | | | | | | |
| Using local waterways is an integral part of my life | | | | | | | | | |
| I use local waterways the way I want | | | | | | | | | |
| I use local waterways because it's fun | | | | | | | | | |
| My friends/ family would be disappointed if I did not use local waterways | | | | | | | | | |
| Using local waterways makes sense | | | | | | | | | |
| I get restless if I don’t get out to my local waterways regularly | | | | | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Using local waterways is a fundamental part of who I am | | | | | | | | | |
| I feel guilty if I don't get out to my local waterways | | | | | | | | | |
| I feel disappointed when I don’t get out to use or visit my local waterways | | | | | | | | | |
| I enjoy using local waterways | | | | | | | | | |
| It’s important to me to use local waterways regularly | | | | | | | | | |
| I think it is important to use/make use of local waterways | | | | | | | | | |
| Climate change is a threat to waterways | | | | | | | | | |

**The following questions ask you about using and visiting your local waterway in South East Queensland. A local waterway is a waterway located within the catchment that you reside in, is close to your home, or is within 15 km of your home. Please indicate how much you agree or disagree with each of the following statements:**

**The next question asks you to think about things that "encourage" or contribute to you visiting or using local waterways close to your home. How much do you agree or disagree with the following:**

| | Strongly disagree | 2 | 3 | 4 | 5 | 6 | Strongly agree | | Response total |
|---|---|---|---|---|---|---|---|---|---|
| Suitable weather | | | | | | | | | |
| Condition of water - cleanliness | | | | | | | | | |
| Colour of water | | | | | | | | | |
| Peaceful/quiet | | | | | | | | | |
| Local beauty/scenery | | | | | | | | | |
| Not crowded | | | | | | | | | |
| Allow dogs | | | | | | | | | |
| Parks and playgrounds | | | | | | | | | |
| Picnic areas | | | | | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Paths and walkways | | | | | | | | | |
| Easy to get to | | | | | | | | | |
| Shelter and shade | | | | | | | | | |
| Toilets | | | | | | | | | |
| Cleanliness of surrounding area | | | | | | | | | |
| Access to waterway | | | | | | | | | |
| Time availability | | | | | | | | | |
| With family or friends | | | | | | | | | |

**Thinking about the past 12 months, please indicate how often did you use or visit a waterway in South East Queensland for the following activities?**

| | Never | Almost every day | Every week | Every fortnight | Every month | Once or twice a year | Every few years | | Response total |
|---|---|---|---|---|---|---|---|---|---|
| Boating, sailing | | | | | | | | | |
| Jet skiing, Water skiing | | | | | | | | | |
| Walking or running | | | | | | | | | |
| Cycling | | | | | | | | | |
| Picnics, BBQs | | | | | | | | | |
| Recreational fishing | | | | | | | | | |
| Rowing, kayaking, canoeing | | | | | | | | | |
| Scuba diving, snorkelling | | | | | | | | | |
| Surfing, kite-surfing, sail boarding | | | | | | | | | |
| Swimming | | | | | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Enjoying nature e.g. birdwatching, conservation, photography, camping | | | | | | | | | |
| For commuting or getting to work | | | | | | | | | |

**Thinking about the past 12 months please indicate how often you used or visited a local waterway in your catchment, within 15 km of your home for the following activities?**

| | Never | Almost every day | Every week | Every fortnight | Every month | Once or twice a year | Every few years | | Response total |
|---|---|---|---|---|---|---|---|---|---|
| Boating, sailing | | | | | | | | | |
| Jet skiing, Water skiing | | | | | | | | | |
| Walking or running | | | | | | | | | |
| Cycling | | | | | | | | | |
| Picnics, BBQs | | | | | | | | | |
| Recreational fishing | | | | | | | | | |
| Rowing, kayaking, canoeing | | | | | | | | | |
| Scuba diving, snorkelling | | | | | | | | | |
| Surfing, kite-surfing, sail boarding | | | | | | | | | |
| Swimming | | | | | | | | | |
| Enjoying nature e.g. birdwatching, conservation, photography, camping | | | | | | | | | |
| For commuting or getting to work | | | | | | | | | |

**The next questions ask you to think about your LOCAL waterways generally over the past 12 months. Local waterways are waterways that you use or visit in your catchment and are within 15kms of your home. How much do you agree or disagree with the following statements:**

| | Strongly disagree | 2 | 3 | 4 | 5 | 6 | Strongly agree | | Response total |
|---|---|---|---|---|---|---|---|---|---|
| Overall, I am very happy to use/visit my local waterways | | | | | | | | | |
| Overall, I am satisfied with my local waterways | | | | | | | | | |
| Overall, my local waterways are close to my ideal | | | | | | | | | |
| Overall, I am satisfied with my decisions to use/visit my local waterways | | | | | | | | | |
| Overall, I am delighted with my experiences with my local waterways | | | | | | | | | |
| Overall, my local waterways exceed my expectations | | | | | | | | | |
| Overall, I have no problems accessing my local waterways | | | | | | | | | |
| Overall, my local waterways are easily reached from the parking/transport areas | | | | | | | | | |
| Overall, I find it easy to access my local waterways | | | | | | | | | |
| Overall, I can get to my local waterways quickly | | | | | | | | | |
| Overall, accessing my local waterways is simple | | | | | | | | | |
| Overall, it is fairly simple to get to my local waterways | | | | | | | | | |
| Overall, I am satisfied with the convenience to my local waterways | | | | | | | | | |
| Overall, I find my local waterways easy to use | | | | | | | | | |
| Overall, I get a lot out of using my local waterways | | | | | | | | | |
| Overall, I would like to use my local waterways more often | | | | | | | | | |
| Overall, it doesn't take much effort to use my local waterways | | | | | | | | | |

**Are there any things you would like to change to improve your satisfaction of your local waterway?**

| | | | Response total |
|---|---|---|---|
| | | | . |

**The next question asks you to think about barriers – or the things that stop you from visiting or using a local waterway close to your home.**
**How much do you agree or disagree with the following barriers:**

| | Strongly disagree | 2 | 3 | 4 | 5 | 6 | Strongly agree | | Response total |
|---|---|---|---|---|---|---|---|---|---|
| Not enough time | | | | | | | | | . |
| It is polluted | | | | | | | | | . |
| Appearance of water i.e.: looks brown | | | | | | | | | . |
| Lack of infrastructure e.g. Carparks, paths, ramps, pontoons | | | | | | | | | . |
| Odour or smell of water | | | | | | | | | . |
| I have poor physical health | | | | | | | | | . |
| I don't have enough information (e.g. where or how) | | | | | | | | | . |
| Litter | | | | | | | | | . |
| Lack of natural vegetation | | | | | | | | | . |
| It is a threat to my health and safety | | | | | | | | | . |
| Creatures that bite or sting | | | | | | | | | . |
| Lack of amenities e.g. toilets, BBQs, shelter | | | | | | | | | . |
| Weather | | | | | | | | | . |
| Family or carer responsibilities | | | | | | | | | . |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Distance | | | | | | | | | . |
| Safety or security concerns | | | | | | | | | . |
| Personal finances | | | | | | | | | . |

**The following questions ask about various things that can affect waterways in South East Queensland. Thinking about these statements, indicate how much you agree or disagree with each of the following statements:**

| | Strongly disagree | 2 | 3 | 4 | 5 | 6 | Strongly agree | | Response total |
|---|---|---|---|---|---|---|---|---|---|
| Planting native plants along a waterway's bank improves the health of the waterway | | | | | | | | | . |
| What individual residents do in their home and garden has consequences for the health of waterways and coastal bays | | | | | | | | | . |
| Storm water from roofs and roads is treated to remove pollutants before entering the waterways | | | | | | | | | . |
| Wastewater from domestic bathrooms and laundries receives little or no treatment before entering waterways | | | | | | | | | . |
| The pesticides that individual householders use in their garden have no negative impact on the health of waterways | | | | | | | | | . |
| Waterways cannot cope easily with large amounts of sediment (i.e., eroded soil suspended in the water) | | | | | | | | | . |

**Which of the following best represents your understanding of what a catchment is?**

| | | Response percent | Response total |
|---|---|---|---|
| The area that retains water like a wetland or a marsh | | | |
| All of the land area that drains to a specific river or waterway | | | |
| Reservoir that serves as a water source | | | |
| Small building where water is stored | | | |

| | | | |
|---|---|---|---|
| None of these | | | |
| Do not know | | | |

**Thinking more generally about using and visiting your local waterways please indicate how much you agree or disagree with the following statements:**

| | Strongly disagree | 2 | 3 | 4 | 5 | 6 | Strongly agree | | Response total |
|---|---|---|---|---|---|---|---|---|---|
| Overall, it is worth visiting or using my local waterways | | | | | | | | | |
| Considering the time I spend, it is worth using/visiting my local waterways | | | | | | | | | |
| My local waterways are of an acceptable quality to me | | | | | | | | | |
| Considering the effort I make, it is worth using or visiting my local waterways | | | | | | | | | |
| My local waterways are of a consistent quality | | | | | | | | | |
| I have learnt more about my local waterways by using/visiting them | | | | | | | | | |
| There is always something different when I visit my local waterways | | | | | | | | | |
| Visiting my local waterways has increased my curiosity about visiting other waterways | | | | | | | | | |
| The quality of my local waterways makes me want to find out about other waterways | | | | | | | | | |
| Using/visiting my local waterways has taught me more about what waterways are available | | | | | | | | | |
| I go to waterways that offer the best value | | | | | | | | | |
| Using/visiting my local waterways makes me feel excited | | | | | | | | | |
| My knowledge of waterways influences how much I value my waterway experience | | | | | | | | | |
| The number of people using my local waterway influences how I value my visit | | | | | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| What I know about the environment helps me value my waterways | | | | | | | | | |
| Using or visiting my local waterways gives me feelings of well being | | | | | | | | | |
| My local waterways are well presented | | | | | | | | | |
| I enjoy being engaged with my local waterways | | | | | | | | | |
| While using my local waterways, I feel a sense of adventure | | | | | | | | | |

**Thinking more generally about using and visiting your local waterways please indicate how much you agree or disagree with the following statements:**

| | Strongly disagree | 2 | 3 | 4 | 5 | 6 | Strongly agree | | Response total |
|---|---|---|---|---|---|---|---|---|---|
| Using my local waterways truly feel like an escape | | | | | | | | | |
| Using or visiting my local waterways gives me pleasure | | | | | | | | | |
| I continue to use my local waterways, because I want to, not because I have to | | | | | | | | | |
| Considering the money I spend, it is worth using/visiting my local waterways | | | | | | | | | |
| While using my local waterways, I am able to forget my problems | | | | | | | | | |
| Using my local waterways is truly a delight | | | | | | | | | |
| I see natural beauty in my local waterways | | | | | | | | | |
| Using my local waterways satisfies my curiosity | | | | | | | | | |
| Using or visiting my local waterways is exciting | | | | | | | | | |
| Compared to other things I could have done, the time spent using my local waterways is truly enjoyable | | | | | | | | | |
| Using my local waterways helps me to feel accepted by others | | | | | | | | | |
| I am happy when my friends are using or visiting my local waterways with me | | | | | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Using my local waterways improves the way other people see me | | | | | | | | | |
| My local waterways are nice | | | | | | | | | |
| Social outings at my local waterways make them more interesting | | | | | | | | | |
| I believe that I have a responsibility to help others | | | | | | | | | |
| I feel adventurous when I use my local waterways | | | | | | | | | |
| My local waterways more interesting when my friends are with me | | | | | | | | | |
| It is more interesting to use my local waterway as part of a group | | | | | | | | | |
| Using my local waterways gives me social approval | | | | | | | | | |

**The following questions ask about your general views. Please indicate how much you agree or disagree with the following statements:**

| | Strongly disagree | 2 | 3 | 4 | 5 | 6 | Strongly agree | | Response total |
|---|---|---|---|---|---|---|---|---|---|
| I feel that I am helping society by using my local waterways | | | | | | | | | |
| Using my local waterways is ethically right | | | | | | | | | |
| I volunteer because I want to help others | | | | | | | | | |
| My local waterways are aesthetically appealing | | | | | | | | | |
| I want to help my community | | | | | | | | | |
| Using or vising a waterway is a good fit with my ethical and moral values | | | | | | | | | |
| By using my local waterways I feel that I am fulfilling my social responsibility | | | | | | | | | |
| Using my local waterways makes a good impression on other people | | | | | | | | | |
| I enjoy helping others | | | | | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Overall, my use of local waterways provides an ethical and spiritual value | | | | | | | | | |
| Using or visiting a waterway makes me feel good and a whole person | | | | | | | | | |
| I feel that I am helping others by using my local waterways | | | | | | | | | |
| Using my local waterways is a reliable experience | | | | | | | | | |
| I like the way my local waterways look | | | | | | | | | |
| My local waterways look picturesque | | | | | | | | | |
| Using/visiting my local waterways makes me feel happy | | | | | | | | | |
| My local waterways look attractive | | | | | | | | | |
| I like the scenery at my local waterways | | | | | | | | | |
| Using my local waterways enables me to experience new things | | | | | | | | | |
| Spending time using my local waterways gives me a break from my day-to-day routine | | | | | | | | | |

**The following questions ask you to think about role of local waterways in your life. Please indicate how much you agree or disagree with the following statements:**

| | Strongly disagree | 2 | 3 | 4 | 5 | 6 | Strongly agree | | Response total |
|---|---|---|---|---|---|---|---|---|---|
| There are lots of things worth looking at my local waterways | | | | | | | | | |
| My attention is drawn to many interesting things at my local waterways | | | | | | | | | |
| Using my local waterways helps me to relax | | | | | | | | | |
| I feel loyal to my local waterways | | | | | | | | | |
| My local waterways are a place to get away from it all | | | | | | | | | |
| My local waterways have fascinating qualities | | | | | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| I want to get to know my local waterways better | | | | | | | | | |
| There is a lot to explore and discover at my local waterways | | | | | | | | | |
| My local waterways are exciting | | | | | | | | | |
| I would like to spend more time at my local waterways looking at the activities | | | | | | | | | |
| My local waterways are fascinating | | | | | | | | | |
| I have a sense that I belong at my local waterways | | | | | | | | | |
| I can do things I like at my local waterways | | | | | | | | | |
| I have a sense of oneness (like being united) with my local waterways | | | | | | | | | |
| Using my local waterways suits my personality | | | | | | | | | |
| I can find ways to enjoy myself at my local waterways | | | | | | | | | |
| I intend to go back to my local waterways in the near future | | | | | | | | | |
| Using my local waterways helps me to get relief from everyday stress | | | | | | | | | |
| I feel a commitment to continue to visit/use my local waterways | | | | | | | | | |
| I would expend extra effort to keep visiting/using my local waterways | | | | | | | | | |

## The next questions ask you to select which South East Queensland waterways you have visited in the past 12 months.

**Which beach did you visit?**

| | | Response percent | Response total |
|---|---|---|---|
| Didn't visit | | | |
| Noosa | | | |
| Northern Sunshine Coast | | | |

| | | | |
|---|---|---|---|
| Southern Sunshine Coast | | | |
| Bribie Island | | | |
| Moreton Island | | | |
| Stradbroke Islands | | | |
| Northern Gold Coast | | | |
| Southern Gold Coast | | | |
| Other, please name the beach you visited or used | | | |

**Which fresh water creeks or waterholes did you visit?**

| | | Response percent | Response total |
|---|---|---|---|
| Didn't visit | | | |
| Noosa Hinterland | | | |
| Sunshine Coast Hinterland | | | |
| Upper Caboolture/ Dayboro/Samford Valley | | | |
| Upper Brisbane | | | |
| Greater Brisbane (Urban) | | | |
| Ipswich/Lockyer | | | |
| Scenic Rim | | | |
| Gold Coast Hinterland | | | |
| Other | | | |

**Which dam or lake did you visit?**

| | Response percent | Response total |
|---|---|---|
| Didn't visit | | |
| Lake Cooroibah | | |
| Lake Macdonald | | |
| Lake Weyba | | |
| Ewan Maddock Dam | | |
| Lake Wivenhoe/Somerset Dam | | |
| Lake Samsonvale | | |
| Lake Manchester | | |
| Enoggera Reservoir | | |
| Tingalpa Reservoir | | |
| Wyaralong Dam | | |
| Lake Moogerah | | |
| Advancetown Lake | | |
| Lake Maroon | | |
| Other | | |

**Which Sheltered Bay did you visit?**

| | Response percent | Response total |
|---|---|---|
| Didn't visit | | |
| Pumicestone Passage | | |
| Northern Moreton Bay | | |

| | | | |
|---|---|---|---|
| Southern Moreton Bay | | | |
| Western Moreton Island (Tangalooma) | | | |
| Western North Stradbroke Island (Dunwich) | | | |
| Gold Coast Broadwater | | | |
| Other | | | |

**Which rivers or estuaries did you visit?**

| | | Response percent | Response total |
|---|---|---|---|
| Didn't visit | | | |
| Noosa | | | |
| Maroochydore | | | |
| Mooloolah | | | |
| Caboolture River | | | |
| Pine Rivers | | | |
| Brisbane/Oxley/Bulimba | | | |
| Bremer | | | |
| Tingalpa Creek | | | |
| Logan/Albert River | | | |
| Coomera River | | | |
| Nerang | | | |
| Tallebudgera Creek | | | |
| Currumbin Creek | | | |

| | | | |
|---|---|---|---|
| Other | | | |

### Which Wetland did you visit?

| | | Response percent | Response total |
|---|---|---|---|
| Didn't visit | | | |
| Noosa Everglades | | | |
| Maroochy Wetlands | | | |
| Mooloolah River National Park | | | |
| Pumicestone Passage Wetlands | | | |
| Moreton Bay National Parks (Moreton Island, Stradbroke Island etc) | | | |
| Tinchi Tamba Wetlands | | | |
| Boondal Wetlands | | | |
| North East Wetlands | | | |
| Weinam Creek Wetland | | | |
| Southern Moreton Bay/Northern Gold Coast Wetlands | | | |
| Eagleby Wetlands | | | |
| Coombabah Wetlands | | | |
| Elanora Wetlands | | | |
| Hope Island | | | |
| Other | | | |

**In the past 12 months, think about the waterway you visit or use the most in South East Queensland, indicate how far you typically travel to visit this waterway:**

| | Response percent | Response total |
|---|---|---|
| 0-5 km | | |
| 6-10 km | | |
| 11-20 km | | |
| 21-30 km | | |
| 31-50 km | | |
| 51-100 km | | |
| More than 100km | | |

**How much money would you normally spend a month on activities at the waterway you visit or use the most?**

| | Response percent | Response total |
|---|---|---|
| I spend no money | | |
| Less than $10 | | |
| 10-30 | | |
| 31-50 | | |
| 51-100 | | |
| 100-200 | | |
| More than $200 | | |

**Thinking about your future intentions to use your most frequently visited waterway in the next 12 months, how likely or unlikely are you to use this waterway given the following conditions:**

| | Highly likely | Likely | Somewhat likely | Somewhat unlikely | Unlikely | Highly unlikely | | Response total |
|---|---|---|---|---|---|---|---|---|
| Water clarity is murky or very murky | | | | | | | | . |
| Water colour is brown or stained | | | | | | | | . |
| Water clarity is partly murky | | | | | | | | . |
| Water is polluted | | | | | | | | . |
| Water has some pollution | | | | | | | | . |
| Water has many species of fish or water animals | | | | | | | | . |
| Water has no evidence of fish or sea/water animals | | | | | | | | . |
| Water has the amount of fish of sea/water animals I would expect | | | | | | | | . |
| The waterway surrounds (e.g., plant life, litter, erosion) are in poor condition | | | | | | | | . |
| The waterway surrounds (e.g., plant life, litter, erosion) are in moderate condition | | | | | | | | . |
| The waterway surrounds (e.g., plant life, litter, erosion) are in good condition | | | | | | | | . |
| The water colour looks normal | | | | | | | | . |
| The water colour looks slightly unusual | | | | | | | | . |
| The water colour looks unusual | | | | | | | | . |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| The water colour looks slightly unnatural | | | | | | | | |
| The water colour looks unnatural | | | | | | | | |
| The waterway amenities (e.g., bbqs, toilets) are in good condition | | | | | | | | |
| The waterway amenities (e.g., bbqs, toilets) are in moderate condition | | | | | | | | |
| The waterway amenities (e.g., bbqs, toilets) are in poor condition | | | | | | | | |

**These questions relate to the waterways you used or visited the most in the past 12 months. Please indicate how much you agree or disagree with the following statements:**

| | Strongly disagree | 2 | 3 | 4 | 5 | 6 | Strongly agree | | Response total |
|---|---|---|---|---|---|---|---|---|---|
| I found the waterway easy to use | | | | | | | | | |
| I am satisfied with my experiences with this waterway | | | | | | | | | |
| My experiences with this waterway exceed my expectations | | | | | | | | | |
| My waterway are quickly reached from the parking areas | | | | | | | | | |
| These waterway are close to my ideal I get a lot out of using the waterway | | | | | | | | | |
| Accessing my waterway is simple | | | | | | | | | |
| I would like to use the waterway frequently | | | | | | | | | |
| I am delighted with my experiences with this waterway | | | | | | | | | |
| It is fairly simple to get to my waterway | | | | | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| I find it easy to access this waterway | | | | | | | | | |
| I have no problems accessing this waterway | | | | | | | | | |
| It doesn’t take much effort to use this waterway | | | | | | | | | |
| Overall, I am satisfied with the convenience to this waterway | | | | | | | | | |
| I am very happy to use/visit this waterway | | | | | | | | | |
| I can get to my waterway quickly | | | | | | | | | |
| I am satisfied with my decisions to use/visit this waterway | | | | | | | | | |

## How familiar are you with Healthy Waterways Ltd?

| | | Response percent | Response total |
|---|---|---|---|
| I know a lot about Healthy Waterways Ltd | | | |
| I know a little about Healthy Waterways Ltd | | | |
| I've heard the name but don't know what it is | | | |
| I've never heard of Healthy Waterways Ltd | | | |

## What year were you born?

| | | Mean | | Response total |
|---|---|---|---|---|
| | | | | |

## How long have you lived in South East Queensland?

| | Response percent | Response total |
|---|---|---|
| less than a year | | |
| 1 to 3 years | | |
| 4 to 6 years | | |
| 7 to 10 years | | |
| More than 10 years | | |

**What is the highest level of education you have attained to date?**

| | Response percent | Response total |
|---|---|---|
| Primary School | | |
| High School | | |
| Diploma / Certificate or equivalent | | |
| Apprenticeship or trade certificate or equivalent | | |
| Bachelor Degree or equivalent | | |
| Postgraduate Degree or equivalent | | |
| Other qualification | | |

**How would you describe your current employment?**

| | Response percent | Response total |
|---|---|---|
| Retired | | |
| Carer | | |
| Full time student | | |
| Unemployed and not seeking work | | |
| Unemployed and seeking work | | |

| | | | |
|---|---|---|---|
| Part time employee | | | |
| Full time work | | | |

**What industry do you work in, or recently worked in?**

| | | Response percent | Response total |
|---|---|---|---|
| Agriculture, Forestry and Fishing | | | |
| Mining | | | |
| Manufacturing | | | |
| Electricity, Gas and Water Supply | | | |
| Construction and development | | | |
| Wholesale Trade | | | |
| Retail Trade | | | |
| Hospitality and Tourism | | | |
| Transport and Storage | | | |
| Communication Services | | | |
| Finance and Insurance | | | |
| Property and Business Services | | | |
| Government Administration and Defence | | | |
| Education | | | |
| Health and Community Services | | | |
| Cultural and Recreational Services | | | |
| Personal and Other Services | | | |
| I have not worked | | | |

| | | | |
|---|---|---|---|
| I am retired and do not identify with any of these industries | | | |
| Other - please provide  | | | |

**Thinking about the industry you work in, how much do you agree or disagree with the following statements?**

| | Strongly disagree | 2 | 3 | 4 | 5 | 6 | Strongly agree | | Response total |
|---|---|---|---|---|---|---|---|---|---|
| My industry is aware of its potential for negative impacts for water quality | | | | | | | | | |
| Within my industry, roles and responsibilities for minimising negative impacts for waterways are clearly defined and understood | | | | | | | | | |
| My industry is proactive in improving practice and promoting responsible environmental behaviour | | | | | | | | | |
| My industry could manage its impact on waterways more effectively | | | | | | | | | |
| My industry manages its impact on waterways to an acceptable degree | | | | | | | | | |
| My industry could improve its performance in managing its impact on waterways | | | | | | | | | |

**Which of following categories best indicate your annual household income?**

| | Response percent | Response total |
|---|---|---|
| Under $25,000 | | |
| $25,001 to $50,000 | | |
| $50,001 to $75,000 | | |
| $75,001 to $100,000 | | |
| $100,001 to $150,000 | | |
| $150,001 to $200,000 | | |
| Over $200,000 | | |

| | | | |
|---|---|---|---|
| Prefer not to say | | | |

**Do you have any other comments or feedback about your local waterway or any topic related to this research?**

| | | | Response total |
|---|---|---|---|
| | | | |

**Would you like to receive a copy of the summary report?**

| | | Response percent | Response total |
|---|---|---|---|
| Yes | | | |
| No | | | |

# Appendix C – Construct Map and Modifications

The following table documents the constructs and mapping to questions and modifications. It should be noted some questions were removed at various stages of piloting (due to time) and some were not reported in this field report but will be reported in future academic publications.

| Construct | | |
|---|---|---|
| NATREL _1 | ~~My ideal vacation spot would be a remote, wilderness area.~~ Removed after pilot | Nisbet, Zelenski, & Murphy, S. A. (2009). The Nature Relatedness Scale<br><br>NATREL_1 removed. Other items not modified |
| NATREL_2 | I always think about how my actions affect the environment. | |
| NATREL_3 | My connection to nature and the environment is a part of my spirituality. | |
| NATREL_4 | I take notice of wildlife wherever I am. | |
| NATREL_5 | My relationship to nature is an important part of who I am. | |
| NATREL_6 | I feel very connected to all living things and the earth. | |
| ENV-CON_1 | Damage to waterways is increasing to dangerous levels. | Not modified |
| ENV-CON_2 | Some plants, fish, or animals that live in waterways are threatened with extinction. | Some living things are threatened with extinction. |
| ENV-CON_3 | Continued use of chemicals in agriculture will damage waterways | Not modified |
| ENV-CON_4 | Shortages in clean drinking water will occur in the future. | Shortages of some important resources like clean water will occur in the near future. |
| ENV-CON_5 | Climate change is a threat to waterways. | Global warming is becoming a problem. |
| ENV-CON_6 | Urban development can impact waterways | Ozone depletion is an environmental problem. |
| ENV-CON_7 | Stormwater runoff can damage waterways | Excess sediment entering waterways will harm waterways. |
| ENV-CON_8 | Excess sediment entering waterways can harm waterways. | Excess sediment entering waterways will harm waterways. |
| ENV_BELI_1 | I am very concerned about local waterways. | I am very concerned about waterways. |
| ENV_BELI_2 | People don't look after their local waterways. | Humans are severely abusing waterways. |
| ENV_BELI_3 | I would be willing to change my behaviour to help protect local waterways. | I would be willing to change my behaviour to help protect waterways. |
| ENV_BELI_6 | Laws to protect local waterways should be enforced more strongly. | Water protection laws should be enforced more strongly. |
| Intrinsic regulation _1 | I use local /waterways because it's fun | I exercise because it's fun<br>(Mullan et al., 1997) |
| Intrinsic regulation_2 | I find using local waterways pleasurable | I find exercise a pleasurable activity |
| Intrinsic regulation_3 | I get satisfaction from using local waterways | I get pleasure and satisfaction from participating in exercise |
| Intrinsic regulation _4 | I enjoy using local waterways | I enjoy my exercise sessions |

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| **Integrated regulation**_1 | Using local waterways is part of the way I have chosen to live my life | because being environmentally conscious has become part of the way I've chosen to live my life" |
| Integrated regulation_2 | Using local waterways is a fundamental part of who I am | "because being environmentally conscious has become a fundamental part of who I am" |
| Integrated regulation_3 | Using local waterways is an integral part of my life | Because being environmentally conscious has become an integral part of my life" |
| Identified regulation_1 | I value the benefits of using local waterways | I value the benefits of exercise |
| Identified regulation_2 | It's important to me to use local waterways regularly | It's important to me to exercise regularly |
| Identified regulation_3 | I think it is important to use/make use of local waterways | I think it is important to make the effort to exercise regularly |
| Identified regulation_4 | Using local waterways makes sense | Is sensible |
| Identified regulation_5 | I get restless if I don't get out to my local waterways regularly | I get restless if I don't exercise regularly |
| Introjected regulation_1 | I feel disappointed when I don't get out to use or visit my local waterways | I feel ashamed when I don't exercise |
| Introjected regulation_2 | I feel bad about not using my local waterways for a while | I feel like a failure when I haven't exercise in a while |
| Introjected regulation_3 | I feel guilty if I don't get out to my local waterways | I feel guilty when I don't exercise |
| External regulation _1 | I use local waterways because I want others to think I am an active person | I exercise because other people say I should (**modified)** |
| External regulation_2 | I use local waterways because my friends or family think that I should | "to avoid being criticized") (?original);I take part in exercise because my friends/ family/ spouse say I should |
| External regulation_3 | My friends/ family would be **disappointed** if I did not use local waterways | I exercise because others will not be pleased with me if I don't |
| External regulation_4 | I use local waterways the way I want | I feel under pressure from my friends/family to exercise |
| Accessibility_1 | I can get to my Beach/Ocean quickly | Teller and Reutterer (2008) cited in Swoboda, Berg, Schramm-Klein and Foscht (2013) |
| Accessibility_2 | I have no problems accessing my Beach/Ocean | |
| Accessibility_3 | I find it easy to access Beach/Ocean | |
| Accessibility_4 | Accessing my Beach / Ocean is simple | |
| Accessibility_5 | It is fairly straightforward to get to my Beach/Ocean | modified |
| Accessibility_6 | My Beach/Ocean is easily reached from the parking/transport areas | Teller and Reutterer (2008) cited in Swoboda, Berg, Schramm-Klein and Foscht (2013) |
| Accessibility_7 | Overall, I am satisfied with the accessibility to my Beach ocean | |
| Useability_1 | I get a lot out of using the beach/ocean? | Johnston |
| Useability_2 | I would like to use the beach/Ocean frequently | Adapted from Jordan,1996 |
| Useability_3 | I found the beach/ocean easy to use | Adapted from Jordan,1996 |
| Useability_4 | It doesn't take much effort to use the beach/ocean | Johnston |
| Satisfaction_1 | I am happy with the experiences I have had at the Beach/Ocean I visit/use | |
| Satisfaction_2 | I have been satisfied with the condition of the Beach/Ocean I visit and use | |
| Satisfaction_3 | I truly enjoy visiting the Beach/Ocean | |
| Satisfaction_4 | I am happy with the Beach/Ocean I visit and use | |
| Satisfaction_5 | Visiting the Beach/Ocean is always a good experience | |

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| OverallSat_1 | Overall, I am satisfied with my local waterways | Overall, I am satisfied with the self-service technologies offered by the firm<br>The self-service technologies offered by the firm exceed my expectations.<br>The self-service technologies offered by the firm are close to my ideal.<br><br>Original: Fornell, Johnson, Anderson, Cha, & Bryant, 1996 – American Customer Satisfaction Index (.Most frequently cited measure of satisfaction) |
| OverallSat_2 | Overall, my local waterways exceed my expectations | |
| OverallSat_3 | Overall, my local waterways are close to my ideal. | |
| OverallSat_4 | Overall, I am delighted with my experiences with my local waterways | |
| OverallSat_5 | Overall, I am very happy to use/visit my local waterways | Anaza 2014 |
| OverallSat_6 | Overall, I am satisfied with my decisions to use/visit my local waterways | |
| OverallAcc_1 | Overall, I can get to my local waterways quickly | |
| OverallAcc_2 | Overall, I have no problems accessing my local waterways | |
| OverallAcc_3 | Overall, I find it easy to access my local waterways | |
| OverallAcc_4 | Overall, accessing my local waterways is simple | |
| OverallAcc_5 | Overall, it is fairly straightforward to get to my local waterways | |
| OverallAcc_6 | Overall, my local waterways are easily reached from the parking/transport areas | |
| OverallAcc_7 | Overall, I am satisfied with the accessibility/access to my local waterways / or Overall, my local waterway is easy to access | |
| OverUse_1 | Overall, I get a lot out of using my local waterways | |
| OverUse_2 | Overall, I would like to frequently use my local waterways | |
| OverUse_3 | Overall, I find my local waterways easy to use | |
| OverUse_4 | Overall, it doesn't take much effort to use my local waterways | |
| Overuse_5 | My local waterway is easy to use | |
| Expertise_1 | Healthy Waterways reminds me of someone who is competent and knows what s/he is doing | adapting Erdem and Swait's (2004) and Ohanian's (1990) scales.<br>Expertise/Trustworthiness (5) Attractiveness/likeableness (3) two components – expertise and trustworthiness treated as one construct for analysis) |
| Expertise_2 | Healthy Waterways has the ability to deliver what it promises. | |
| Trustworthiness_1 | Healthy Waterways delivers what it promises | **Brand credibility** (Cronbach's alpha = .92): was measured by adapting Erdem and Swait's (2004) and Ohanian's (1990) scales.<br>**Trustworthiness** measures are composed of five items:<br>"This brand delivers what it promises,"<br>"This brand's product claims are believable,"<br>"Over time, my experiences with this brand have led me to expect it to keep its promises, no more and no less,"<br>"This brand has a name you can trust," and<br>"This brand does not pretend to be something it is not." |

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| WLit_1 | Wastewater from domestic bathrooms and laundries receives little or no treatment before entering waterways. | https://watersensitivecities.org.au/wp-content/uploads/2016/05/A2.3_National_survey_WaterLiteracy_web.pdf |
| WLit_2 | What individual residents do in their home and garden has consequences for the health of waterways and coastal bays. | |
| WLit_3 | Planting native plants along a waterway's bank improves the health of the waterway. | |
| WLit_4 | Storm water from roofs and roads is treated to remove pollutants before entering the waterways. | |
| WLit_5 | Waterways cannot cope easily with large amounts of sediment (i.e., eroded soil suspended in the water). | |
| WLit_6 | The pesticides that individual householders use in their garden have no negative impact on the health of waterways. | |
| WLit_7 | **Which of the following best represents your understanding of what a catchment is?**<br>• The area that retains water like a wetland or a marsh<br>• All of the land area that drains to a specific river or waterway<br>• Reservoir that serves as a water source<br>• Small building where water is stored<br>• None of these<br>• Do not know | (select one) |
| **Overall Perceived Value** The concept of perceived value is a source for understanding the fundamental role of satisfaction in developing long term relationships with users/customers. Iniesta-Bonillo, M.A., et al., Sustainability, value, and satisfaction: Model testing and cross-validation in tourist destinations, Journal of Business Research(2016) | | |
| O/ perceived value_1 | Considering the money I spend, it is worth using/visiting my local waterways. | Considering the money I spent, it is worth visiting this destination. |
| O/ perceived value_2 | Considering the time I spend, it is worth using/visiting my local waterways | Considering the time I spent, it is worth visiting this destination. |
| O/ perceived value_3 | Considering the effort I make, it is worth using/visiting my local waterways | Considering the effort I made, it is worth visiting this destination. |
| O/ perceived value_4 | Overall, it is worth using/visiting my local waterways | Overall, it is worth visiting this destination. |
| **Epistemic value (Curiosity)** | The perceived utility acquired from an alternative's capacity to arouse curiosity, provide novelty, and/or satisfy a desire for knowledge. (Sheth et al., 1991) | |
| Epistval(curiosity)_1 | I have learnt more about my local waterways by using/visiting them | (Sheth et al, 1991) |
| Epistval(curiosity)_2 | Using/visiting my local waterways has taught me more about what waterways are available | (Sheth et al, 1991) |
| Epistval(curiosity)_3 | Using/Visiting my local waterways has increased my curiosity about other available waterways | (Sheth et al, 1991) |
| Epistval(curiosity)_4 | Using/visiting my local waterways was something different or novel | (Sheth et al, 1991) |
| Epistval(curiosity)_5 | The quality of my local waterways influences my knowledge to find out about other waterways | |
| **Epistemic value (Knowledge)** | Epistemic value is defined as the ability of a product/service to provide novelty and/or satisfy a desire for knowledge (LeBlanc & Nguyen, 1999) | |
| Epistval (knowledge)_1 | **How I learnt about the environment** influences the value of my knowledge about waterways | The quality of education received from my professors influences the value of my degree(LeBlanc & Nguyen, 1999) |
| Epistval (knowledge)_2 | I GO TO WATERWAYS THAT I KNOW WILL OFFER ME THE BEST VALUE | Course content influences the value of my education(LeBlanc & Nguyen, 1999) |

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| Epistval (knowledge)_3 | The number of people using my local waterway influences the value of my visit | The number of students in my classes influences the value of my education(LeBlanc & Nguyen, 1999) |
| Epistval (knowledge)_4 | The knowledge I learn about waterways influences the value of my waterway experience | The guidance received from professors effects the value of my education(LeBlanc & Nguyen, 1999) |
| Epistval (knowledge)_5 | I learn new things about waterways from a number of places | I learn new things in many of my courses(LeBlanc & Nguyen, 1999) |
| **Emotional value** The utility derived from the feelings or affective states that a product generates Social-psychological dimension that is dependent on a product's ability to arouse feelings or affective states. Sweeney and Soutar (2001) | | |
| Emotional value_1 | Using/visiting my local waterways: Gives me feelings of well being | .is one that I would enjoy (Sweeney & Soutar, 2001) |
| Emotional value_2 | Using/visiting my local waterways is exciting | …would make me want to use it (Sweeney & Soutar, 2001) |
| Emotional value_3 | Using/visiting my local waterways makes me feel elated | …is one that I would feel relaxed about using (Sweeney & Soutar, 2001) |
| Emotional value_4 | Using/visiting my local waterways makes me feel happy | …would make me feel good (Sweeney & Soutar, 2001) |
| Emotional value_4 | Using/visiting my local waterways gives me pleasure | …would give me pleasure (Sweeney & Soutar, 2001) |
| **Functional value** | | The utility derived from the perceived quality and expected performance of the product (Sweeney & Soutar, 2001) |
| Functional value_1 | My local waterways are of a consistent quality | …has consistent quality (Sweeney & Soutar, 2001) |
| Functional value_2 | My local waterways are nice | …is well made (Sweeney & Soutar, 2001) |
| Functional value_3 | My local waterways are of an acceptable quality to me | …has acceptable standard of quality (Sweeney & Soutar, 2001) |
| Functional value_4 | My local waterways are well presented | …would perform consistently (Sweeney & Soutar, 2001) |
| **Hedonic Value** | Hedonic value is more subjective and personal than its utilitarian counterpart and results more from fun and playfulness than from task completion (Holbrook & Hirschman 1982)/ (Babin, Darden, Griffith, 1994) | |
| Hedonic_1 | Using my local waterways is truly a delight | This shopping trip was truly a joy (Holbrook & Hirschman 1982)/ (Babin, Darden, Griffith, 1994) |
| Hedonic_2 | I continue to use my local waterways, because I want to - not because I have to | I continued to shop, not because I had to, but because I wanted to (Holbrook & Hirschman 1982)/ (Babin, Darden, Griffith, 1994) |
| Hedonic_3 | Using my local waterways truly feel like an escape. | This shopping trip truly felt like an escape (Holbrook & Hirschman 1982)/ (Babin, Darden, Griffith, 1994) |
| Hedonic_4 | Compared to other things I could have done, the time spent using my local waterways is truly enjoyable | Compared to other things I could have done, the time spent shopping was truly enjoyable (Holbrook & Hirschman 1982)/ (Babin, Darden, Griffith, 1994) |
| Hedonic_5 | I enjoy being engaged with my local waterways. | I enjoyed being immersed in exciting new products (Holbrook & Hirschman 1982)/ (Babin, Darden, Griffith, 1994) |
| Hedonic_6 | I enjoy using my local waterways for their own sake - not just for the things I have done there. | I enjoyed this shopping trip for its own sake, not just for the items I may have purchased (Holbrook & Hirschman 1982)/ (Babin, Darden, Griffith, 1994) |
| ~~Hedonic_7~~ | ~~I have a good time when I use my local waterways because I can be spontaneous~~ | ~~I had a good time because I was able to act on the "spur-of-the-moment." (Holbrook & Hirschman 1982)/ (Babin, Darden, Griffith, 1994)~~ |
| Hedonic_8 | While using my local waterways, I am able to forget my problems. | While shopping, I was able to forget my problems (Holbrook & Hirschman 1982)/ (Babin, Darden, Griffith, 1994) |
| Hedonic_9 | While using my local waterways, I feel a sense of adventure | While shopping, I felt a sense of adventure (Holbrook & Hirschman 1982)/ (Babin, Darden, Griffith, 1994) |
| Hedonic_10 | I see natural beauty in my local waterways | Additional item added based on qualitative research (Holbrook & Hirschman 1982)/ (Babin, Darden, Griffith, 1994) |
| **Social Value** | Social value has been defined as the ''perceived utility acquired from an alternative's association with one or more specific social groups'' (Sheth et al 1991:161). Social value concerns the utility derived from the customers' association with certain social groups (LeBlanc & Nguyen, 2001) | |
| Social Value_1 | I am happy when my friends are using/visiting my local waterways with me | I am happy when friends are in my classes (LeBlanc & Nguyen, 2001) |
| Social Value_2 | I find using my local waterways more interesting when my friends are with me | I find courses more interesting when friends are in my classes (LeBlanc & Nguyen, 2001) |

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| Social Value_3 | It is more interesting to use my local waterway as part of a group | Working in groups has a positive effect on the value of my education (LeBlanc & Nguyen, 2001) |
| Social Value_4 | Social outings at my local waterways make them more interesting | Social activities at my business school my studies more interesting (LeBlanc & Nguyen, 2001) |
| Social value_1 | Using my local waterways helps me to feel accepted by others | Would help me to feel acceptable (Sweeney and Soutar 1991) |
| Social value_2 | Using my local waterways makes a good impression on other people | Would make a good impression on other people (Sweeney and Soutar, 1991) |
| Social value_3 | Using my local waterways gives me social approval | Would give its owner social approval (Sweeney and Soutar, 1991) |
| Social value_4 | Using my local waterways improves the way other people see me | Would improve the way I am perceived (Sweeney and Soutar, 1991) |
| **Altruistic Value** | | Original items |
| Altruistic value_1 | Using or vising a waterway is a good fit with my ethical and moral values | • -Studying at university is coherent with your ethical and moral values(Altruistic value- Jimenez-Castillo, et al, 2013) |
| Altruistic value_2 | Using or visiting a waterway makes me feel good and a whole person | • Studying at this university has contributed to feel good with yourself and to your self-fulfilment (Jimenez-Castillo, et al, 2013) |
| Altruistic value_3 | Overall, my use of local waterways provides an ethical and spiritual value | • Overall, studying at this university has provided an ethical and spiritual value to you (Jimenez-Castillo, et al, 2013) |
| Altruistic value_4 | By using my local waterways I feel that I am fulfilling my social responsibility. | • The design of the product is such that I will feel that I am fulfilling a social responsibility when I use it (Kumar & Noble 2016 Altruistic scale) |
| Altruistic value_5 | I feel that I am helping society by using my local waterways. | • The design of the product is such that I feel that I am helping society by using it (Kumar & Noble 2016 Altruistic scale) |
| Altruistic value_6 | I feel that I am helping others by using my local waterways. | • The design of the product is such that I will feel I am helping others by using this design |
| Altruistic value_7 | Using my local waterways is ethically right. | • The design of the product communicates to me that it would be ethically right to buy this product Functional value |
| Altruistic value_8 | I believe that I have a responsibility to help others. | I believe that I have a responsibility to help others (Glynn et al. 2006) |
| Altruistic value_9 | I enjoy helping others. | I enjoy helping others (Glynn et al. 2006) |
| Altruistic value_10 | I want to help in a community | I wanted to help in a community of national crisis(Glynn et al. 2006) |
| Altruistic value_11 | I volunteer because I want to help others. | I believe that donating blood is a duty (Glynn et al. 2006) |
| Novelty Value (EPISTEMIC) | Novelty represents doing novel and adventurous things and escaping from the routine (Bello & Etzel, 1985; Weber, 2001 cited in Willams & Soutar, 2009). Epistemic value is created when a product arouses curiosity, provides novelty and/or satisfies a desire for knowledge (Sheth et al 1991). | |
| Novelty_1 | Using my local waterways…Makes me feel adventurous | Made me feel adventurous(Bello & Etzel, 1985; Weber, 2001 cited in Willams & Soutar, 2009) |
| Novelty_2 | Using my local waterways…Satisfied my curiosity | Satisfied my curiosity (Bello & Etzel, 1985; Weber, 2001 cited in Willams & Soutar, 2009) |
| Novelty_3 | Using my local waterways…is an authentic experience | Was an authentic experience (Bello & Etzel, 1985; Weber, 2001 cited in Willams & Soutar, 2009) |
| Novelty_4 | Using my local waterways…Enables me to experience new things | We did a lot of things on the tour (Bello & Etzel, 1985; Weber, 2001 cited in Willams & Soutar, 2009) |
| Visual Appeal (Mathwick et al. 2001) | An aesthetic response is a reaction to the symmetry, proportion and unity of a physical object, a work of poetry or a performance (Olson, 1981; Veryzer, 1993). | |
| Aesthetics_1 | My local waterways look attractive | The way XYZ displays its products is attractive (Mathwick et al. 2001) |
| Aesthetics_2 | My local waterways are aesthetically appealing | XYZ's Internet site is aesthetically appealing(Mathwick et al. 2001) |
| Aesthetics_3 | I like the way my local waterways look | I like the way XYZ's Internet site look (Mathwick et al. 2001) |
| Aesthetics_4 | I like the scenery at my local waterways | Additional questions developed from qualitative research (Beatson) |
| Aesthetics_5 | My local waterways look picturesque | (Beatson) |

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| **Third place (Rosenbaum, 2009)** | A person's capacity to focus can become fatigued with use but is restored in the presence of natural settings, such as parks and gardens (Rosenbaum, 2009). Nature possesses restorative characteristics. These stimuli delight people's senses through attractive, enchanting, and even rapturous scenery, sights, sounds, smells and are devoid of providing negative feedback (Cumes, 1998). | |
| **Being-away prop_1** | Using my local waterways is an "escape experience" for me | Being here is an "escape experience" for me (Cumes, 1998)/ (Rosenbaum, 2009). |
| Being-away prop_2 | Spending time using my local waterways gives me a break from my day-to-day routine | Spending time here gives me a break from my day-to-day routine (Cumes, 1998)/ (Rosenbaum, 2009). |
| Being-away prop_3 | My local waterways are a place to get away from it all | It is a place to get away from it all (Cumes, 1998)/ (Rosenbaum, 2009). |
| Being-away prop_4 | Using my local waterways helps me to relax | Being here helps me to relax (Cumes, 1998)/ (Rosenbaum, 2009). |
| Being-away prop_5 | Using my local waterways helps me to get relief from everyday stress | Coming here helps me to get relief from everyday stress (Cumes, 1998)/ (Rosenbaum, 2009). |
| **Fascination prop_1** | My local waterways have fascinating qualities | This place has fascinating qualities (Cumes, 1998)/ (Rosenbaum, 2009). |
| Fascination prop_2 | My attention is drawn to many interesting things at my local waterways | My attention is drawn to many interesting things here (Cumes, 1998)/ (Rosenbaum, 2009). |
| Fascination prop_3 | I want to get to know my local waterways better | I want to get to know this place better (Cumes, 1998)/ (Rosenbaum, 2009). |
| Fascination prop_4 | There is a lot to explore and discover at my local waterways | There is a lot to explore and discover here (Cumes, 1998)/ (Rosenbaum, 2009). |
| Fascination prop_5 | I would like to spend more time at my local waterways looking at the activities | I would like to spend more time here looking at the games (Cumes, 1998)/ (Rosenbaum, 2009). |
| Fascination prop_6 | My local waterways are exciting | This place is boring (R) (Cumes, 1998)/ (Rosenbaum, 2009). |
| Fascination prop_7 | My local waterways are fascinating | This place is fascinating (Cumes, 1998)/ (Rosenbaum, 2009). |
| Fascination prop_8 | There are lots of things worth looking at my local waterways | There is nothing worth looking at here (R) (Cumes, 1998)/ (Rosenbaum, 2009). |
| **Coherence prop_1** | ~~There is too much going on at my local waterways (R)~~ | There is too much going on here (R) (Cumes, 1998)/ (Rosenbaum, 2009). |
| Coherence prop_2 | ~~My local waterways are user friendly~~ | It is a confusing place (R) (Cumes, 1998)/ (Rosenbaum, 2009). |
| Coherence prop_3 | ~~There are no distractions at my local waterways~~ | There is a great deal of distraction here (R) (Cumes, 1998)/ (Rosenbaum, 2009). |
| ~~Coherence prop_4~~ | ~~It is calm at my local waterways~~ | ~~It is chaotic here (R) (Cumes, 1998)/ (Rosenbaum, 2009).~~ |
| Compatibility prop_1 | Using my local waterways suits my personality | Being here suits my personality(Cumes, 1998)/ (Rosenbaum, 2009). |
| Compatibility prop_2 | I can do things I like at my local waterways | I can do things I like here(Cumes, 1998)/ (Rosenbaum, 2009). |
| Compatibility prop_3 | I have a sense that I belong at my local waterways | I have a sense that I belong here(Cumes, 1998)/ (Rosenbaum, 2009). |
| Compatibility prop_4 | I can find ways to enjoy myself at my local waterways | I can find ways to enjoy myself here(Cumes, 1998)/ (Rosenbaum, 2009). |
| Compatibility prop_5 | I have a sense of oneness (like being united) with my local waterways | I have a sense of oneness (like being united) with this place(Cumes, 1998)/ (Rosenbaum, 2009). |
| Loyalty (Rosenbaum, 2009) | Loyalty has been defined as "a deeply held commitment to rebuy or repatronize a preferred product/service consistently in the future" (Oliver, 1999, p. 34). | |
| Loyalty scale_1 | I feel a commitment to continue to visit/use my local waterways | I feel a sense of commitment to continuing a relationship with the [arcade] (Oliver, 1999)/ (Rosenbaum, 2009). |
| Loyalty scale_2 | I would expend extra effort to keep visiting/using my local waterways | I would expend extra effort (driving distance) to keep patronizing the [arcade] (Oliver, 1999)/ (Rosenbaum, 2009). |
| Loyalty scale_3 | I feel loyal to my local waterways | I feel loyal to the [arcade] (Oliver, 1999)/ (Rosenbaum, 2009). |
| Loyalty scale_4 | I intend to go back to my local waterways in the near future | I intend to go back to the [arcade] again in the very near future (Oliver, 1999)/ (Rosenbaum, 2009).<br>~~I would continue to go to the [arcade] again even if its prices increased somewhat~~ |

**References:**

Ali, F., Kim, W. G., Li, J., & Jeon, H. M. (2016). Make it delightful: Customers' experience, satisfaction and loyalty in Malaysian theme parks. Journal of Destination Marketing & Management.

Babin, B. J., Darden, W. R., Griffin, M. (1994). Work and/or Fun: Measuring hedonic and utilitarian shopping value. Journal of Consumer Research, 20 (4), 644-656.

Bello, D. C., & Etzel, M. J. (1985). The Role of Novelty in the Pleasure Travel Experience. Journal of Travel Research, (Summer), 20-26.

Cumes, D. (1998). Inner Passages, Outer Jorneys. Llewellyn, St Paul, MN.

Holbrook, M. B., & Hirschman, E. C. (1982). The experiential aspects of consumption: Consumer fantasies, feelings, and fun. Journal of Consumer Research, 9 (September), 132-140.

Iniesta-Bonillo, M., Sánchez-Fernández, R. A., Jiménez-Castillo, D. (2016). Sustainability, value, and satisfaction: Model testing and cross-validation in tourist destinations. Journal of Business Research, XX (XX), XX-XX.

Mullan, E., & Markland, D. (1997). Variations in self-determination across the stages of change for exercise in adults. *Motivation and Emotion, 21*(4), 349-362. doi:http://dx.doi.org/10.1023/A:1024436423492

Oliver, R. L. (1999). Whence consumer loyalty? Journal of Marketing, 63, 33-44.

Olson, Jerry C. (1981). What is an Esthetic Response? pp. 71–74 in *Symbolic Consumer Behavior*, Elizabeth C. Hirschman and Morris B. Holbrook, (Eds). Ann Arbor, NY: Association for Consumer Research.

Sheth, J. N., Newman, B. I., & Gross, B. L. (1991). Why we buy what we buy: A theory of consumption values. *Journal of Business Research*, *22*(2), 159-170. doi:10.1016/0148-2963(91)90050-8

Sweeney, J. C., & Soutar, G. N. (2001). Consumer Perceived Value: The Development of a Multiple Item Scale. Journal of Retailing, 77(1), 203–220.

Rosenbaum, M. S. (2009). Restorative servicescapes: Restoring directed attention in third places. Journal of Service Management, 20 (2), 173-191.

Weber, K. (2001). Outdoor Adventure Tourism: A Review of Research Approaches. Annals of Tourism Research, 28 (2), 363-380.

Williams, P., & Soutar, G. N. (2009). Values, satisfaction and behavioural intentions in an adventure tourism context. Annals of Tourism Research, 36 (3), 413-438.

Veryzer, Robert W. Jr (1993). Aesthetic Response and the Influence of Design Principles on Product Preferences, pp. 224–228 in *Advances in Consumer Research*, 20, Association for Consumer Research.

## SDT

**Self-Determination Theory (SDT)** is a theory of motivation. It is concerned with supporting our natural or intrinsic tendencies to behave in effective and healthy ways.

People are centrally concerned with ***motivation***— how to move themselves or others to act. People are often moved by external factors such as reward systems, or the opinions they fear others might have of them. Yet, just as frequently, people are motivated from within, by interests, curiosity, care or abiding values. These intrinsic motivations are not necessarily externally rewarded or supported, but nonetheless they can sustain passions, creativity, and sustained efforts. The interplay between the extrinsic forces acting on persons and the intrinsic motives and needs inherent in human nature is the territory of Self-Determination Theory.

**Self-Determination Theory** (SDT) represents a broad framework for the study of human motivation and personality. SDT articulates a meta-theory for framing motivational studies, outlining intrinsic and extrinsic sources of motivation. These provide us with an understanding of why people act in a certain way and can provide us with knowledge about levels of satisfaction correlated with the motivations of why people use waterways. This can be useful for possible branding and communication strategies about encouraging waterway usage.

1. Extrinsic motivation refers to behaviours that are done to attain some outcome separate from what exists within an activity, such as visiting waterways to attain a positive feedback or to avoid punishment.
2. Introjected motivation describes internalisation of behaviours based on the provision of relatedness, such visiting waterways to avoid the anxiety associated with disappointing loved ones.
3. Identified motivation occurs when the goal of an activity is accepted as personally important, such as using waterways to build particular skills.
4. Integrated motivation occurs when motives for using waterways are fully in line with one's personal values and needs.
5. Intrinsic motivation occurs when individuals feel visiting waterways is inherently satisfying and enjoyable.

## Knowledge value (epistemic value)

**Sheth et al 1991 Epistemic value relates to experienced curiosity, novelty or gained knowledge (Sheth et al, 1991)**

*Definition by Sheth, Newman and Gross (1991) The perceived utility acquired by an alternative as a result of its ability to arouse curiosity, provide novelty, and/or satisfy a desire for knowledge. Alternatives acquire epistemic value through the capacity to provide something new or different. A consumer driven by epistemic values will choose the alternatives that are able to satisfy a desire for something new or different, or fashionable*

- I have learnt more about my local waterways by using/visiting them (**Sheth et al, 1991)**
- Using/visiting my local waterways has taught me more about what waterways are available (**Sheth et al, 1991)**
- Using/Visiting my local waterways has increased my curiosity about other available waterways (**Sheth et al, 1991)**
- Using/visiting my local waterways was something different or novel (**Sheth et al, 1991)**
- The quality of my local waterways influences my knowledge to find out about other waterways (LeBlanc and Nguyen 1999)

**Epistemic value (knowledge)** Gaston LeBlanc Nha Nguye (1999),"Listening to the customer's voice: examining perceived service value among business college students", International Journal of Educational Management, Vol. 13 Iss 4 pp. 187 - 1

- The quality of education received from my professors influences the value of my degree
- Course content influences the value of my education – *(The amenities available at my local waterways influence the value of my visit??????)*
- The number of students in my classes influences the value of my education *(the number of other people using my local waterways influences the value of my visit??)*
- The guidance received from professors effects the value of my education
- I learn new things in many of my courses

**Altruistic Scales**

By using my local waterways I feel that I am fulfilling my social responsibility.
I feel that I am helping society by using my local waterways.
I feel that I am helping others by using my local waterways.
Using my local waterways is ethically right.

Altruistic value
(Kumar and Noble, Journal of Business Research, 2016) "Beyond form and function: Why do consumers value product design?". 69 (2), p. 613

Kankanhalli et al. (2005)
It feels good to help someone by sharing online group buying information through
Sharing online group buying information with others through X gives me pleasure
I enjoy sharing online group buying information with friends through X
I enjoy helping others through sharing online group buying information through

Glynn et al., 2006
I believe that I have a responsibility to help others.
I enjoy helping others.
I wanted to help in a community or national crisis.
I donate blood because I want to help others.

## ZBOJA 2006 – Brand Trust

- Zboja, J. J., & Voorhees, C. M. (2006). The impact of brand trust and satisfaction on retailer repurchase intentions. *Journal of Services Marketing, 20*(6), 381-390. doi:10.1108/08876040610691275

Appendix. Survey instrument

General instructions to respondents In order to complete the survey, please reflect on a recent experience (i.e. within the last six months) when you purchased one of the following products (audio/visual equipment or computer or related accessories) from a reseller (i.e. Best Buy, CompUSA). Based on this experience, we ask that you answer questions regarding your opinion of the product manufacturer and the reseller. For example, you could evaluate an experience where you bought a Sony big screen television from Best Buy. When responding to the questions, Sony would be the manufacturer and Best Buy would be the reseller. Qualitative information The name of the manufacturer that I am evaluating is (i.e. Sony/Panasonic; Compaq/Toshiba): "The name of the reseller that I am evaluating is (i.e. Best Buy/Rex; CompUSA)."

**Scale items**

All items were measured using **seven-point Likert-Type Scales** that were anchored at 1 by "Strongly disagree" and at 7 by "Strongly agree."

Some items were reverse coded are denoted below (R).

**Trust in the brand** The manufacturer of this product:

- Can be trusted at all times.
- Cannot be depended on to do what is right (R).
- Has high integrity.
- Is not competent (R).
- Is very dependable.
- Is unresponsive (R)

**Satisfaction with the brand**

- I am satisfied with my decision to purchase this manufacturer's product.
- My choice to buy this manufacturer's product was a wise one.
- I think that I did the right thing when I bought this manufacturer's product.
- I am not happy that I bought this manufacturer's product.
- I truly enjoyed my purchase of this manufacturer's product.
-

**Trust in the retailer** The reseller:

- Can be trusted at all times.
- Cannot be depended on to do what is right (R).
- Has high integrity.
- Is not competent (R).
- Is very dependable.
- Is unresponsive (R).

**Satisfaction with the retailer** .

- I am satisfied with my decision to visit this reseller.
- My choice to visit this reseller was a wise one.
- I think that I did the right thing when I visited this reseller.
- I am not happy that I visited this reseller.

- I truly enjoyed my visit to this reseller.

**Repeat purchase intentions I will:** .

- Buy this manufacturer's products again.
- Do business with this manufacturer in the future.
- Do more business with this manufacturer in the coming years.

**Williams and Soutar**

Functional Value Consistent quality Sweeney and Soutar (2001) Done well Acceptable standard of quality Well organized Value for Money Good return for money Sweeney and Soutar (2001) Value for money Good one for the price paid Reasonably priced Emotional Value Gave me feelings of well being Sweeney and Soutar (2001) Was exciting Made me elated Made me feel happy Social Value Gives social approval from others Sweeney and Soutar (2001) Makes me feel acceptable to others Improves the way a person is perceived Give a good impression on other people Novelty Value Made me feel adventurous Bello and Etzel (1985) Satisfied my curiosity Weber (2001) Was an authentic experience We did a lot of things on the tour

# RABY BAY CANAL BATTER STABILITY UPDATE

# Geotechnical Investigation Analysis Report

*Prepared for:*

**REDLAND CITY COUNCIL**
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*Prepared by:*

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**24 June 2013**

BEJ809.002-W-REP-003 Rev. 0

**Acknowledgments**

KBR has permission to use SLOPEW for commercial purposes

**Limitations Statement**

The sole purpose of this report and the associated services performed by Kellogg Brown & Root Pty Ltd (KBR) is to provide costs estimates and propose staging options for the Client to carry out geotechnical investigation (by others) in accordance with the scope of services set out in the contract between KBR and Redland City Council ('the Client'). That scope of services was defined by the requests of the Client, by the time and budgetary constraints imposed by the Client, and by the availability of access to the site.

KBR derived the data in this report primarily from information provided by the Client. The passage of time, manifestation of latent conditions or impacts of future events may require further exploration at the site and subsequent data analysis, and re-evaluation of the findings, observations and conclusions expressed in this report.

In preparing this report, KBR has relied upon and presumed accurate certain information (or absence thereof) relative to Raby Bay provided by government officials and authorities, the Client and others identified herein. Except as otherwise stated in the report, KBR has not attempted to verify the accuracy or completeness of any such information.

The findings, observations and conclusions expressed by KBR in this report are not, and should not be considered, an opinion concerning geotechnical soil conditions of the site. No warranty or guarantee, whether express or implied, is made with respect to the data reported or to the findings, observations and conclusions expressed in this report. Further, such data, findings, observations and conclusions are based solely upon information supplied by the Client in existence at the time of the investigation.

This report has been prepared on behalf of and for the exclusive use of the Client, and is subject to and issued in connection with the provisions of the agreement between KBR and the Client. KBR accepts no liability or responsibility whatsoever for or in respect of any use of or reliance upon this report by any third party.

**Revision History**

| Revision | Date | Comment | Signatures | | |
|---|---|---|---|---|---|
| | | | Originated by | Checked by | Approved by |
| A | 12/07/12 | Issued to Client for review | | | |
| 0 | 24/06/13 | Final Issue<br>Incorporation of review outcomes | J. Schloss [redacted] | P. Cummings [redacted] | S. Ciner [redacted] |

# CONTENTS

# Summary

In 2010, Kellogg Brown & Root Pty Ltd (KBR) was commissioned by Redland City Council to develop a geotechnical investigation plan to gain an appreciation of the scale of the slope stability problem within the Raby Bay Canal Estate development and to examine rectification options. Based on the factual geotechnical reports 1-13601BR and 1-14061BR provided by Soil Surveys (2012a & b), a summary of KBR's interpretative notes and recommendations follows:

KBR's interpretation of the geotechnical investigation test results:

- the soil strata profile is varied throughout the canal estate, with no obvious spatial pattern
- there appears to be a 'wedge' of uncompacted fill underneath the canal batter rock protection and concrete wall
- under the house platforms and roads there appear to be compacted fill, either imported or sourced from the canal cut
- underlying these two materials there is native very stiff clay overlying clayey sand, hard clays and extremely weathered rock
- the inclinometer measurements indicate movement at every location tested. The movement is more pronounced above –4.0 mAHD. It is not reported whether small indicated movements are due to soil distortion of movement of the inclinometer tube inside it's borehole
- generally, soil shear strength properties increase with depth. In particular, undrained cohesion from the dilatometer tests shows that shear strength increases notably below approximately –4.0 mAHD.

KBR's slope stability analysis confirms the conclusions presented in report 1-14061BR, indicating a relatively shallow failure mainly confined to the uncompacted fill material under the concrete wall and rock protection. Deep slip failures are not indicated.

The recommended rectification plan:

- the existing approach of using screw piles appears to be an overdesign for the shallow failure observed
- grout injection into the uncompacted fill is suggested as an alternative. This option appears to be significantly cheaper than current methods. A preliminary concept for this option involves 600 mm diameter soil/cement piles formed to a length of approximately 3 m at about 1 m centres
- kbr recommends some test rectification sites be built and instrumented, plus a finite element soil model of the tests. The object of the tests and finite element model is to confirm and refine the design. Taking into consideration that there are approximately 20-25kms of canal frontage that might require rectification, optimising the design of the remedial works will generate significant savings for Redland City Council

- it is suggested that periodic laser scanning surveys be carried out to monitor movement of the canal batters and retaining wall. This will inform a strategic plan for managing and implementing rectification works prior to significant damage to the infrastructure.

Revision A of this report was reviewed by Redland City Council (RCC) Project Delivery Group (PDG) 21-09-2012), the Raby Bay Residents Association (01-11-2012) and GHD (01-03-2013). The main outcomes of these reviews, included in this Revision 0, are:

- hypothesised deep seated slip circle slope failures due to the possible presence of a fissured stiff clay stratum are not indicated by the slope stability analysis, nor are they observed in the field. According to the literature, the long term shear strength of the fissured stiff clay does not appear to be much affected by the presence / absence of these fissures (Spangler & Handy 1973, p445; Coduto et al 2011, p582)
- the canal cross sections and soil strata are expected to vary somewhat throughout such a large site and hence rectification works should be adjusted accordingly
- at some properties the current RCC surcharge criterion of 2.0kPa has been exceeded and hence a higher surcharge load should be taken into account at these places
- 'pre-failure' and 'during-failure' rectification works will necessarily be somewhat different
- whilst past slope movement monitoring methods were appropriate and economic, the recent rapid reduction in the cost of laser scanning methods means that these methods should be considered for future monitoring.

# 1 Introduction

Raby Bay is a residential canal estate located at Cleveland, Redland City in southern Moreton Bay, Queensland. The site was formerly mainly tidal wetlands. The estate was developed using a cut to fill method, constructed in the dry and subsequently flooded. During and after construction some of the canal batters failed in a classic slip circle fashion.

On a case-by-case basis where the failures occurred, various geotechnical consultants have been engaged to address slope failures and other ground movements over the history of the development. Various remedial responses and restoration methods have been employed generally with technical success, but at high cost. The complexity of mechanisms behind ground movements and slope failures, and the very high projected costs of restoration works have led the Redland City Council (RCC) to investigate more permanent and economical approaches to the problem.

Kellogg Brown & Root Pty Ltd (KBR) was engaged by RCC to summarise the findings from a geotechnical investigation at Raby Bay, Queensland. This extensive geotechnical investigation was performed by Soil Surveys Engineering Pty Limited between January and April 2012.

This report presents a summary of the recent geotechnical investigation and is to be read in conjunction with geotechnical reports 1-13601BR and 1-14061BR provided by Soil Surveys.

Revision A of this report was reviewed by Redland City Council (RCC) Project Delivery Group (PDG) 21-09-2012), the Raby Bay Residents Association (01-11-2012) and GHD (01-03-2013). The outcomes of these reviews are included in this Revision 0.

# 2 Geotechnical data review

## 2.1 INTRODUCTION

This geotechnical review is based on information provided in reports 1-13601BR (April 2012) and 1-14061BR (March 2012) prepared by Soil Surveys for RCC. These reports contain the geotechnical data from a total of 20 locations in the Raby Bay canal estate. Of particular interest are boreholes from Piermont Place, where a slope failure was occurring during the testing.

## 2.2 KEY OBSERVATIONS

The data provided in the reports has been reviewed by KBR to identify reasonable patterns and particular observations that may be relevant to the slip failure that is being observed at sites within the canal estate.

A soil profile summary for each borehole location, along with its relevant soil property data, is presented in Appendix B. Key observations have been made with respect to the soil strata profiles, displacements recorded by the inclinometer and soil strength parameters.

### 2.2.1 Soil strata profiles

A typical canal cross section is shown in Figure 2.1 based on Cardno & Davies Drawing 956/1-37 in Appendix D. The cross section varies somewhat through the estate.

In report 1-13601BR by Soil Surveys it is noted that significant variation in the borehole logs throughout the canal sections was observed. Additionally, the report also makes comment on the presence of a ‘thin layer of soft to firm clay immediately under the revetment rock’.

Relying mainly on the borehole data and the simplified soil profile of the Piermont Place slope in report 1-14061BR, the soil profile as shown in Figure 2.1 is believed to be typical of Raby Bay. This soil profile layout has been used for the basis of the slope stability calculations in Chapter 3.

The interpretation of this profile is as follows:

- the original ground surface was approximately zero AHD (Department of Harbours and Marine, Peel Island to Russel Island Small Craft Chart, 1979)
- organic marine clay was stripped down to approximately RL -2.0 mAHD where a very stiff clay was encountered. This clay is probably a ‘residual soil’ from when

sea levels were lower in the last Ice Age (from 6,000 years ago when sea levels stabilised)

This stiff clay has been observed to be possibly ‘fissured’. This means that at some time in the past the clay was subjected to wetting and drying and hence cracking; the cracks subsequently filled with loose material (Bowles 1988, p81)

- the canal invert was dug in the dry. The resulting clayey sand and very stiff clay was used as compacted fill under houses and road – the ‘stiff clay’ layer. The ‘clayey sand’ in the canal invert might be an extremely weathered rock that looks like a clayey sand
- ‘general fill’ was imported and compacted under house platforms and roads
- in order to build the rock armour and concrete wall, the fill in this area had to be brought up to profile. The usual method is to overfill this area slightly with the ‘stiff clay’ or the imported ‘general fill’ and compact with rollers in 300 mm layers. After compaction the profile is cut using an excavator. Instead it appears that ‘foundation fill’ was pushed into the ‘wedge’ between the ‘stiff clay’ batter and the design profile and not compacted (i.e. left loose). This ‘wedge’ is difficult to compact; a vehicle roller might not have safe access so hand rollers or compaction plates or the addition of cement would have to be used – all of these are expensive; hence it appears many Raby Bay canal frontages have an uncompacted fill wedge under the rock protection and concrete wall
- the author’s interpretation of the geotechnical data is the observed slope failures are largely confined to this uncompacted ‘foundation fill’ wedge, thus the slips appear to be shallow and short in length.

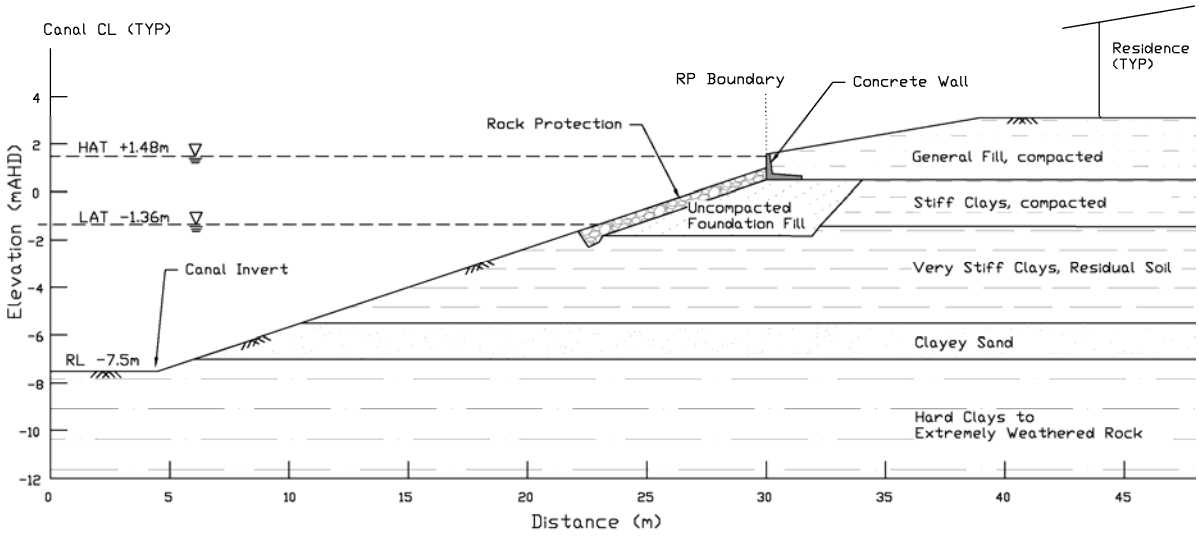



**Figure 2.1**
**SIMPLIFIED SOIL PROFILE LAYOUT**

Figure 2.1 is based on construction drawings, Soil Surveys report and KBR interpretation. An A3 copy of this diagram is included in Appendix C.

### 2.2.2 Displacements

Of the 17 borehole locations reported in 1-13601BR there are six locations that do not have displacement measurements recorded following the initial installation of the inclinometer. Of the locations with displacement data, it is important to note that all borehole locations are showing indication of soil movement. Most of the observed soil movement is above the toe of the rock protection. However movement is indicated down to about RL –5.0 mAHD. Below approximately RL –2.0 m to –3.0 mAHD the reported inclinometer deflections are quite small. It might be possible that the inclinometer tube is moving inside the borehole if it was not tightly backfilled and/or the inclinometers weren't fully 'zeroed'. We have assumed:

- 75 mm diameter chopping tip (i.e. hole diameter)
- 63.5 mm diameter casing
- 58 mm diameter OD inclinometer.

This information suggests that the soil slip is occurring in a shallow zone underneath the rock protection and concrete wall. As the soil begins to move in these higher layers, the movement stresses the lower soil layers which result in the small displacements observed here. Figure 2.2 and 2.3 show the displacement records from the boreholes demonstrating this pattern of soil movement.

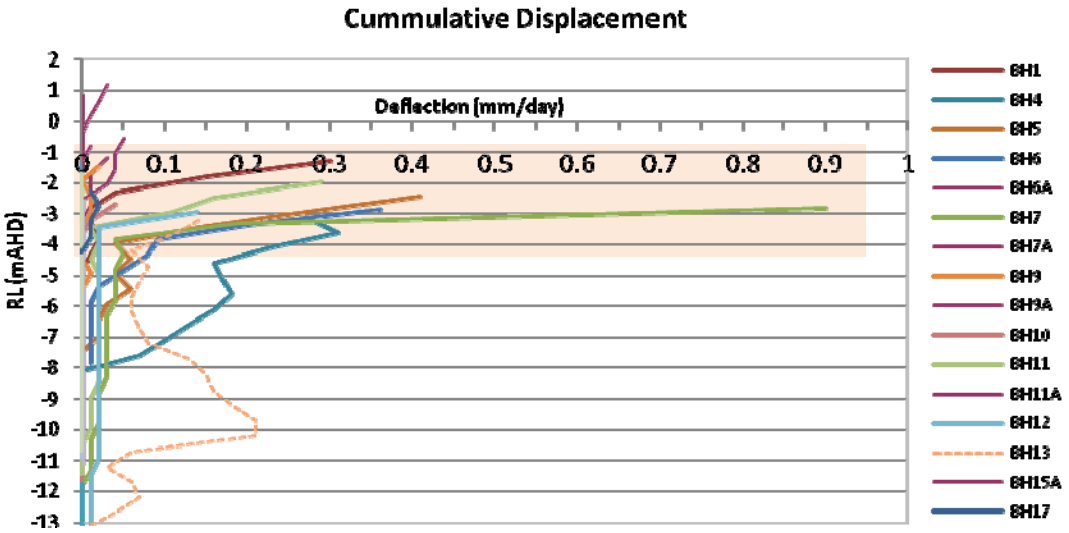



**Figure 2.2**
**BOREHOLE DISPLACEMENT RECORDS**

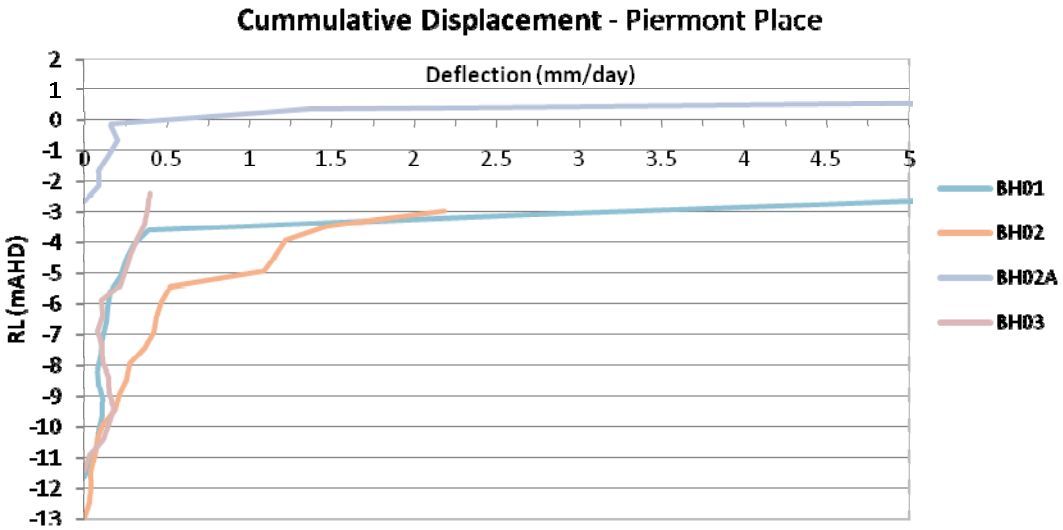



**Figure 2.3**
**BOREHOLE DISPLACEMENT RECORDS – PIERMONT PLACE**

### 2.2.3 Soil properties

Soil density, pore water pressures, cohesion and friction angle values are the main properties that affect slope stability. Figure 2.4 shows two plots of undrained cohesion values $c_u$ with respect to depth. The first plot includes all data from the dilatometer tests, while the second shows these values averaged over 0.5 m bins. It is important to note that there is a significant increase in average recorded shear strength at approximately –4.0 mAHD. This is consistent with the typical level where lateral displacement is first observed in the borehole displacement records in Figure 2.2. It is inferred that this is near the level where very stiff clay was encountered after soft overlying material was removed during construction.

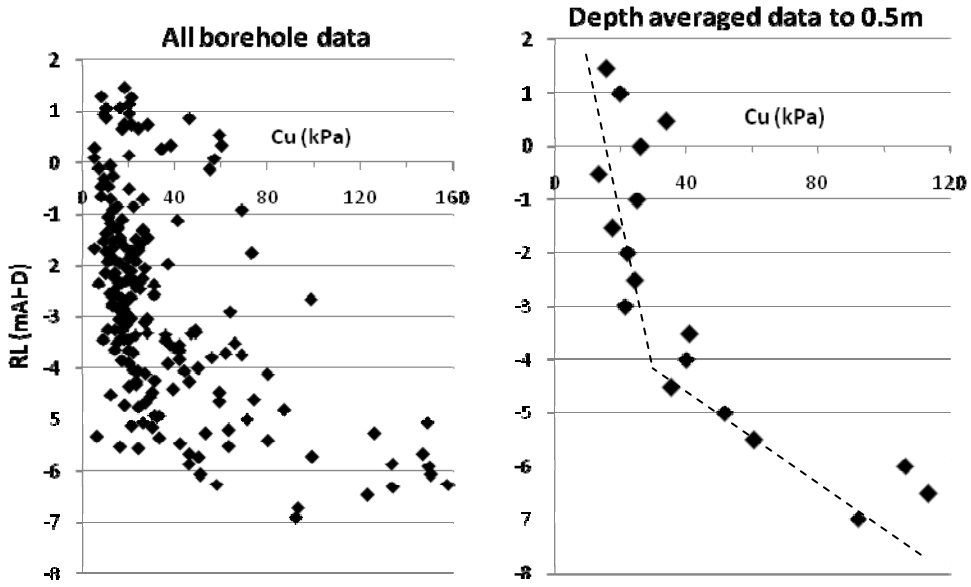



**Figure 2.4**
**UNDRAINED SHEAR STRENGTH MEASUREMENTS FROM DILATOMETER TESTS**

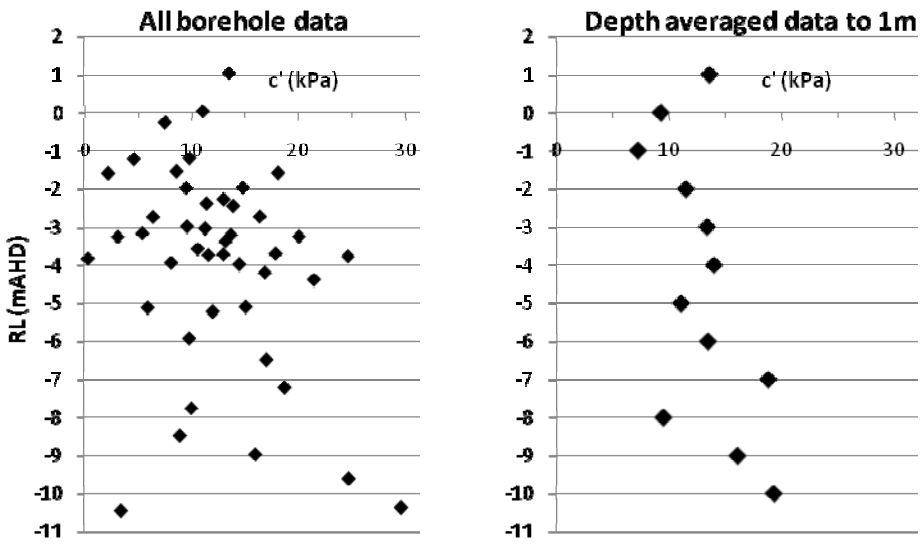



**Figure 2.5**
**DRAINED SHEAR STRENGTH VALUES FROM TRIAXIAL TESTS**

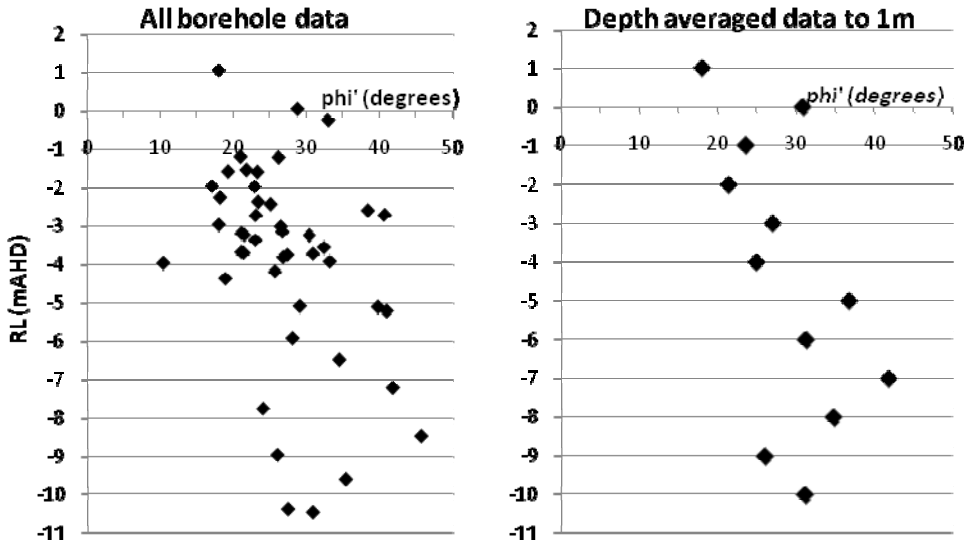



**Figure 2.6**
**DRAINED FRICTION ANGLE VALUES FROM TRIAXIAL TESTS**

Note that the tested shear strength of the stiff clay can be affected by the presence / absence of fissures in the test samples (Bowles 1988, p81)

# 3 Slope stability modelling

## 3.1 INTRODUCTION

Slope stability analyses were conducted to:

- test the analysis method and assumed soil properties for the Piermont Place. situation where failure was occurring and hence the Factor of Safety (FOS) ≈ 1.0
- test the efficacy of a typical low cost shallow failure repair method: grout injection.

The slope stability analysis was performed using the commercially available software, Geostudio (Slope/W) 2007 version 7.14. Two-dimensional Coulomb (slip circle) method was used with the Morgenstern-Price interslice stress assumptions. The assumed soil parameters are based on consolidated test data in Soil Surveys (2012a&b).

The slope section was analysed using the following assumptions:

- slope geometry as per Drawing No. 956/1-37, located in Appendix D.
- soil profile similar to Soil Surveys (2012a).
- effective strength parameters (i.e. long-term, drained condition) have been assumed, as this is the critical case.
- a slip circle with a factor of safety (FOS) of approximately 1.0 indicates slope failure.
- for the addition of remedial work to the slope, the minimum required stability FOS is 1.5. The key reference for the appropriate FOS is AS 4678 Earth retaining structures code. Clause 4.1 (iii) recommends an FOS =1.5 to be consistent with the loading codes AS 1170 series.

Borehole geotechnical data for each location is summarised in Appendix B.

## 3.2 ASSUMPTIONS

A number of assumptions and simplifications have been adopted in the slope stability analysis:

- the RCC recommended maximum 2.0 kPa surcharge is applied to the slope above the concrete wall in all cases and represents loads from swimming pools, decks and filling. Some properties appear to have surcharges that exceed this load
- soil is fully saturated behind the revetment wall following a heavy rainfall event (i.e. water table at the surface)

- canal water level at LAT
- an attempt has been made to match modelled mode to resemble the slip observed
- grout-injected piles have been used in the models to demonstrate a plausible low cost slope stabilizing option. The shear strength of the piles are based on a soil/cement compressive strength of 10 MPa
- as there is no recent survey data available, the as built profile has been adopted for models (see Appendix D). As built thickness of rock protection is assumed to be 0.5 m.

## 3.3 SLOPE/W MODELS

The Slope/W model is shown in Figure 3.1. The assumed soil strength parameters are shown in Table 3.1.

**Table 3.1 Soil strength parameters (long term)**

| Soil Description | Saturated Unit Weight in Air ($kN/m^3$) | Cohesion (kPa) | Phi (degrees) |
|---|---|---|---|
| Concrete Wall | 24 | 4000 | 0 |
| Rock Protection | 20 | 0 | 30 |
| General Fill | 18 | 0 | 26 |
| Foundation Fill | 17.5 | 2 | 18 |
| Stiff Clays (refer Note 1) | 17.5 | 5 | 26 |
| Very Stiff Clays (refer Note 1) | 17.5 | 10 | 27 |
| Clayey Sand | 18 | 2 | 30 |

Note 1. It is possible that that these clays are ‘fissured’. Whilst fissures are expected to reduce the short term shear strength, the literature advice (Spangler & Handy 1973, p445; Coduto et. Al. 2011, p582) is that the long term shear strength is not much affected by the presence / absence of fissures. Hence the long term analyses that follow are reasonably applicable to both fissured and non-fissured stiff clays.

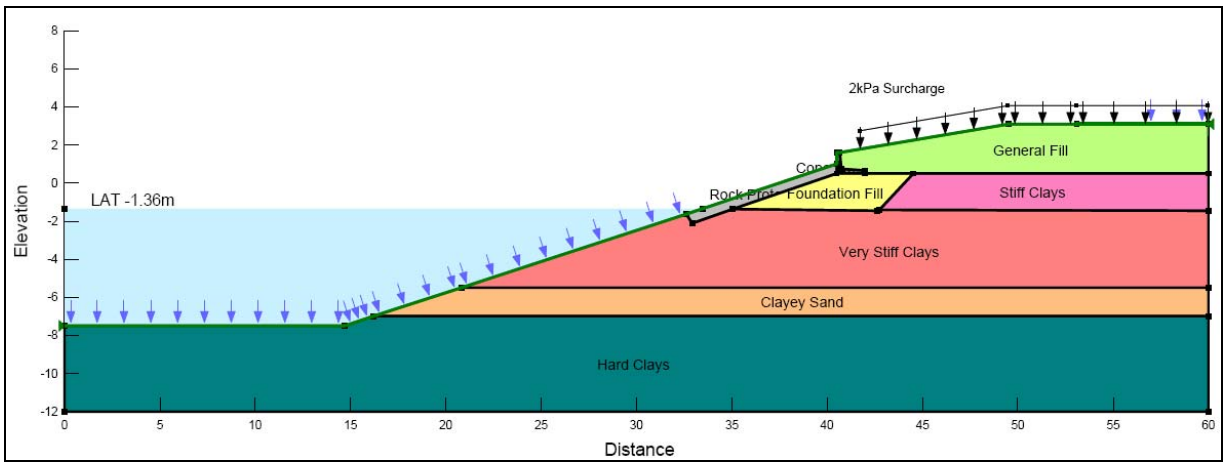



**Figure 3.1**
**SLOPE/W MODEL LAYOUT**

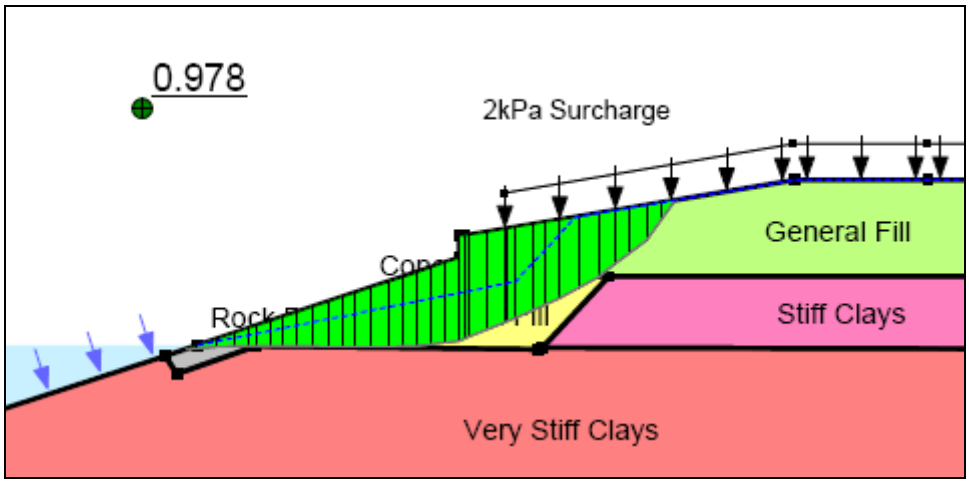



**Figure 3.2**
**CRITICAL SLOPE FAILURE – FOS ≈ 1.0**

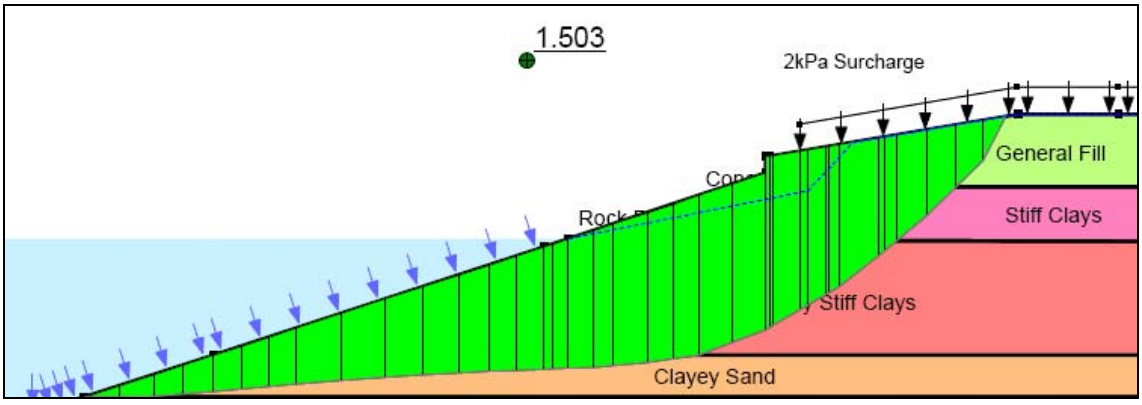



**Figure 3.3**
**CHECK OF DEEP SLIP FAILURE – FOS >1.5**

The critical slip surface is shown in Figure 3.2. The authors believe that the model result is consistent with the surface observation of slope failures in Raby Bay; a shallow slip surface through the weak wedge of uncompacted fill behind the rock protection. Borehole data indicates lower shear strength in this region. A hypothetical deep slip failure mode doesn't appear to be critical, nor has it been observed in the field by the writers.

A plausible low cost method of stabilizing a shallow slip is the installation of grout-injected piles into the soil behind the rock protection. Figure 3.4, 3.5 and 3.6 show the Slope/W model with the addition of 0.6 m diameter piles at varying spacings, to a depth of 3 m to test the impact to slope stability.

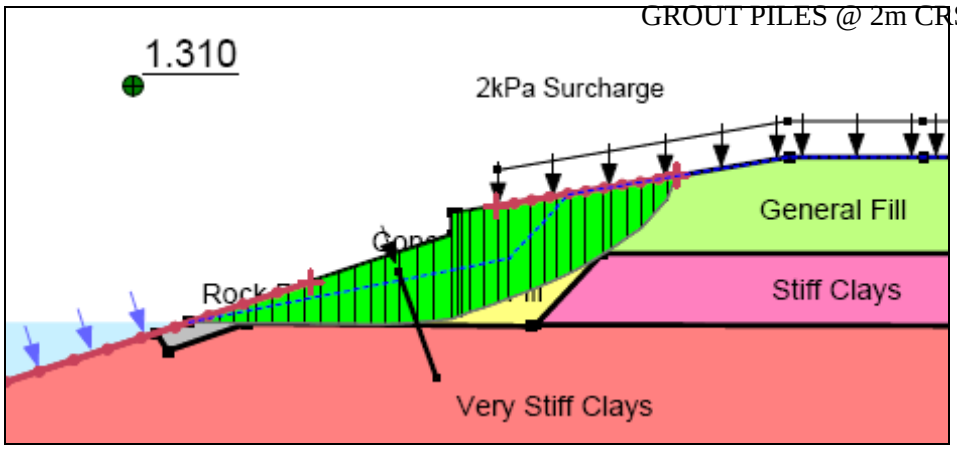



**Figure 3.4**
**GROUTED PILES INCLUDED (A) – FOS < 1.5**

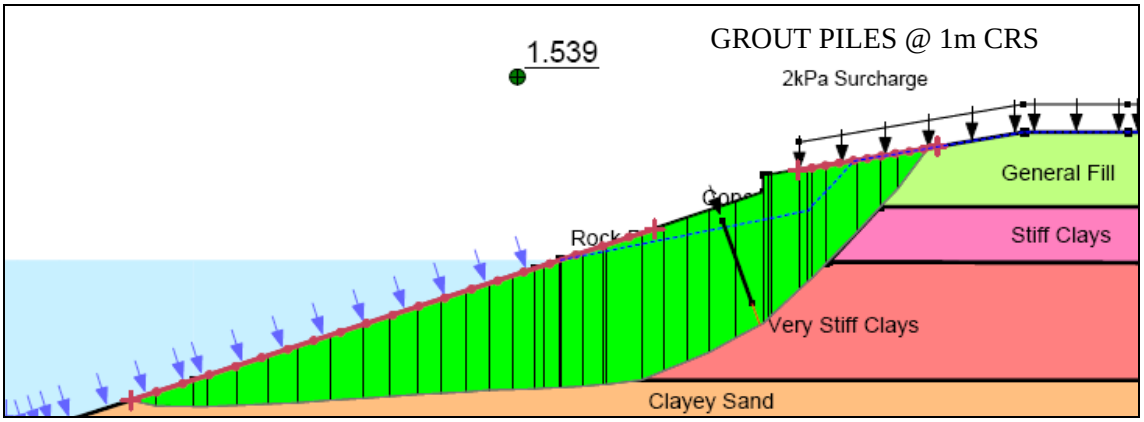



**Figure 3.5**
**GROUTED PILES INCLUDED (B) – FOS > 1.5**

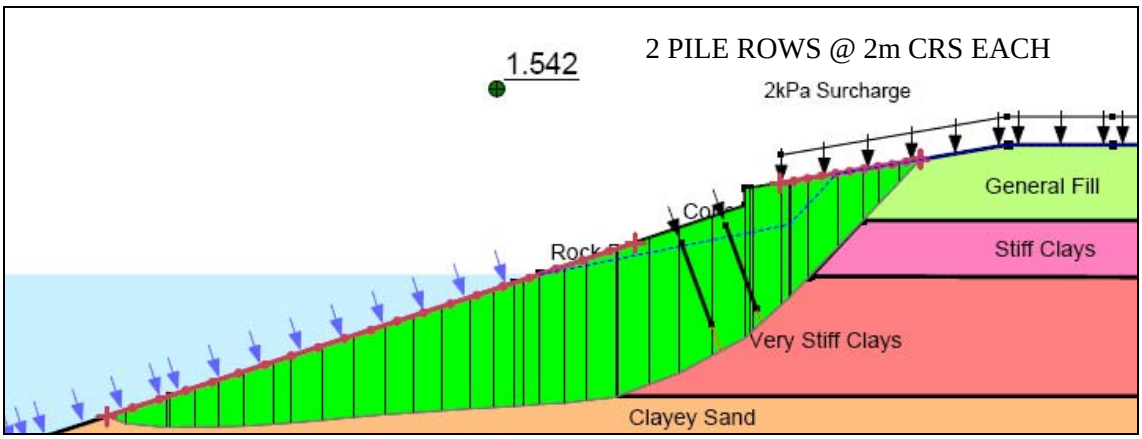



**Figure 3.6**
**GROUTED PILES INCLUDED (VARIED) – FOS > 1.5**

## 3.4 RESULTS

A summary of the Slope/W analysis results are shown in Table 3.1.

**Table 3.3 FOS results from Slope/W analysis**

| Case | FOS | Figure | Type of failure |
|---|---|---|---|
| Critical slip failure for approximated current slope | 0.978 | 3.2 | Shallow slip failure through fill material |
| Check for deep slip failure | 1.503 | 3.3 | Deep slip through toe of slope |
| 3 m grout piles at 2 m spacing (0 mAHD) | 1.310 | 3.4 | Shallow slip failure through piles in fill material |
| 3 m grout piles at 1 m spacing (0 mAHD) | 1.539 | 3.5 | Deep slip below pile depth into sandy clay layer |
| 2x 3m grout piles each at 2 m spacing (0.5 m above and below 0 mAHD) | 1.542 | 3.6 | Deep slip below pile depth into sandy clay layer |

It appears that grout injection could be an effective method of stabilizing the canal slopes based on the assumed soil profile and properties. Grout piling is further discussed in Section 4.2.1.

The slip surface diagram for each Slope/W model is located in Appendix A.

# 4 Conclusions and recommendations

## 4.1 CONCLUSION

From interpretation of the geotechnical data prepared by Soil Surveys, we believe that a shallow slip failure is occurring on the canal slopes. This slip appears to be confined to a wedge of uncompacted fill under the rock armour. This wedge has maximum thickness of approximately 3 m.

Inclinometer readings indicate minor movement below this wedge in a 'very stiff clay'. The authors believe that movement and/or incomplete 'zeroing' of the inclinometer tube inside the borehole might be partially responsible. Distortion of the soil mass below the shear layer is also possible. A finite element soil model might indicate such distortion; a slipe circle analysis concentrates movement into a thin surface shear zone.

As the soil material behind the rock armour goes from an undrained to drained state, the cohesion declines until a critical point is reached where, in combination with factors such as tide level, rainfall and loads behind the concrete wall, the soil begins to fail as a shallow slip.

The current rectification methods used for slope stabilization have used quite long piles which therefore appear to be an overdesign. The assumption behind this overdesign is the existence of a critical deep slip circle failure mode, which we do not observe in the field nor do we find it to be a critical failure mode theoretically. Alternative methods to stabilize the slope such as shallow grout injection may provide a more economic solution.

## 4.2 RECOMMENDATION

With the current methods of rectification costing approximately $17,000/m, there appears to be alternative rectification methods that would be more economic e.g. grout injection. This method is estimated to be in the order of approximately $1,000/m based on very preliminary advice from one contractor.

KBR recommends that RCC call long rectification. To match RCC's revenue stream from the special canal levy, the rectification program could be based on a 5 to 10 year construction period. Proposed alternatives to the current methods could be assessed on their suitability through additional modelling.

Once a slope stabilization method is selected, such as grout injection, we recommend that trials be performed over limited length of the canal batter, at vacant lots and parks. These trials could be performed at locations where a slip movement failure is being observed. The trail should be instrumented so that continued movement can be

monitored to confirm the effectiveness of the stabilization work. Additionally, a finite element soil model could be built of the tests. The object of the tests and finite element model is to refine the design.

### 4.2.1 Grout injection

Grout injection could be done from a barge, with grout lines running from a pump on the street next to the properties. Grout injection should be less disruptive than pile driving. It may be possible to grout inject one frontage in one to two days.

An initial slope stability analysis model indicates:

- grout injected pile spacing of 1 m along the shoreline
- grout injected pile diameter of 600 mm
- minimum compressive strength of 10 MPa
- pile length of about 3 m or a specified depth into the stiff clay layer.

For this option, KBR recommends some test grout injection sites be built, possibly in parks owned by RCC. To gain a greater understanding of the effectiveness of the piles, the tests would be instrumented.

### 4.2.2 Remedial work priority

Soil profile variations means that not all areas of the canal slopes may require remedial work and that some slopes will reach a critical stage before others. It is recommended that a priority system should be set in place to allow rectification work to be performed on-sites that are in the stages of failing or beginning to fail in the short term. Probing should be done in advance of any stabilization work, so if the uncompacted fill is not found, rectification of that area can be omitted. The canal cross sections vary somewhat throughout the estate, plus the details of the soil strata are expected to vary, hence the rectification works will have to be adjusted to suit. Rather than reacting to slip failures, an attempt should be made where possible to provide stabilization work in advance of failures to avoid damage to infrastructure.

KBR recommends that laser scanning of the revetments throughout the entire estate be performed every 6 months. This scanning can be performed from a boat. Special software can then be used to compare these scans to detect movements. Past movement monitoring methods have been appropriate and economic, however the recent rapidly reduction in the cost of laser scanning means that this technology should be considered for future monitoring. It offers speed and completeness advantages.

### 4.2.3 Final comments

At this stage, we believe that no more geotechnical investigations are needed. We believe that the apparent issue with the canal slopes has been identified and that laser scanning and probing ahead of remedial work is the way forward.

Ideas discussed in previous reports, like maintaining a high water table using a lock, or placing more rock on the toe of the slip circle, are now not considered to be effective based on the apparent slip being quite small and shallow.

# 5 References


Bowles, J.E. (1988), '*Foundation Analysis & Design*', 4th ed., McGraw-Hill, Singapore

Coduto, D.P.; Yeung, M-c.R. & Kitch, W. (2011), '*Geotechnical engineering: principles & practices*', 2nd ed., Pearson, NJ.

Craig, R.F. (2004). *Craig's Soil Mechanics.* Spon Press. Oxon.

Soil Surveys Engineering Pty Limited 2012a. *Geotechnical Investigation, Distressed Revetment Wall 47-49 Piermont Place Cleveland*. Report to Redland City Council, March 2012, Ref. 1-14061BR

Soil Surveys Engineering Pty Limited 2012b. *Geotechnical Investigation, Raby Bay Residential Canal Estate Cleveland*. Report to Redland City Council, April 2012, Ref. 1-13601BR

Spangler, M.G. & Handy, R.L. (1973), '*Soil Engineering*', 3rd ed., Harper & Row, NY.

Standards Australia (2002), 'AS 1170.0 Structural Design Actions – General Principles'.

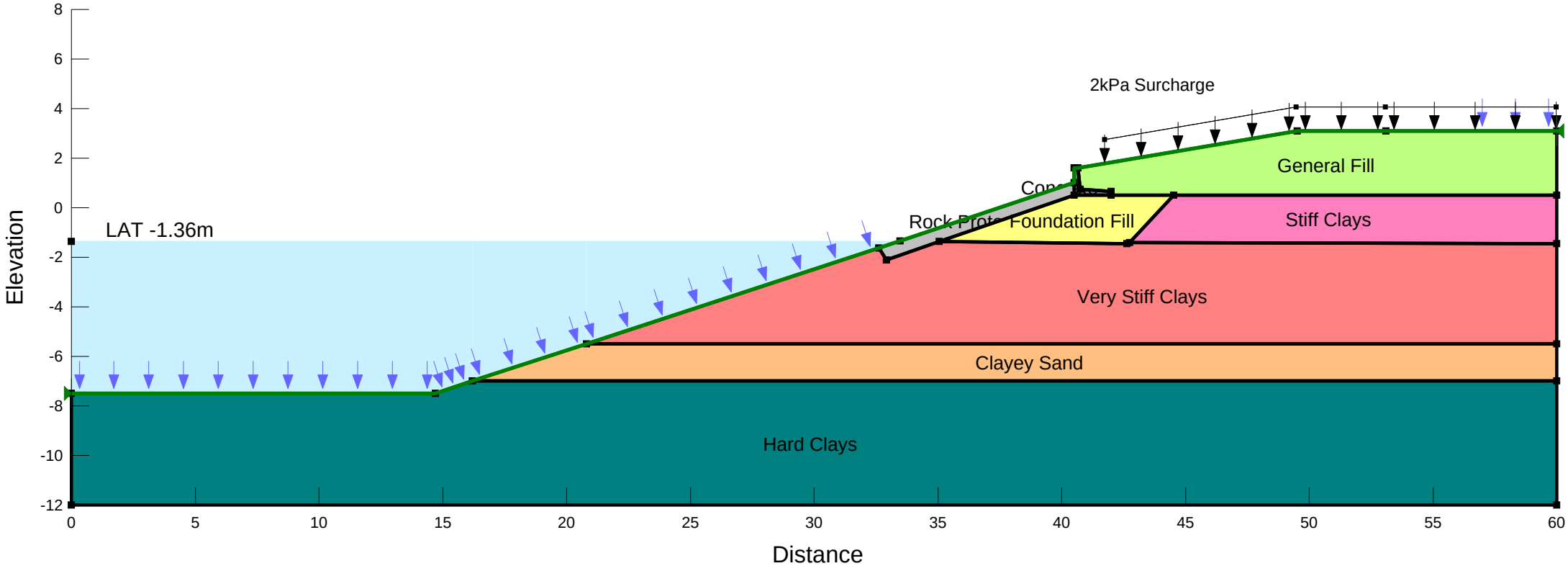
Standards Australia (2002), 'AS 4678 Earth-retaining Structures'.

*Appendix A*

# SLOPE/W MODELS

# Slope/W Model Layout

| | | | | |
|---|---|---|---|---|
| Name: Concrete Wall | Model: Mohr-Coulomb | Unit Weight: 24 kN/m³ | Cohesion: 4000 kPa | Phi: 0 ° |
| Name: Rock Protection | Model: Mohr-Coulomb | Unit Weight: 20 kN/m³ | Cohesion: 0 kPa | Phi: 30 ° |
| Name: General Fill | Model: Mohr-Coulomb | Unit Weight: 18 kN/m³ | Cohesion: 0 kPa | Phi: 26 ° |
| Name: Foundation Fill | Model: Mohr-Coulomb | Unit Weight: 17.5 kN/m³ | Cohesion: 2 kPa | Phi: 18 ° |
| Name: Stiff Clays | Model: Mohr-Coulomb | Unit Weight: 17.5 kN/m³ | Cohesion: 5 kPa | Phi: 26 ° |
| Name: Very Stiff Clays | Model: Mohr-Coulomb | Unit Weight: 17.5 kN/m³ | Cohesion: 10 kPa | Phi: 27 ° |
| Name: Clayey Sand | Model: Mohr-Coulomb | Unit Weight: 18 kN/m³ | Cohesion: 2 kPa | Phi: 30 ° |
| Name: Hard Clays | Model: Mohr-Coulomb | Unit Weight: 18 kN/m³ | Cohesion: 15 kPa | Phi: 28 ° |



# Model: Critical Slip Failure

| | | | | |
|---|---|---|---|---|
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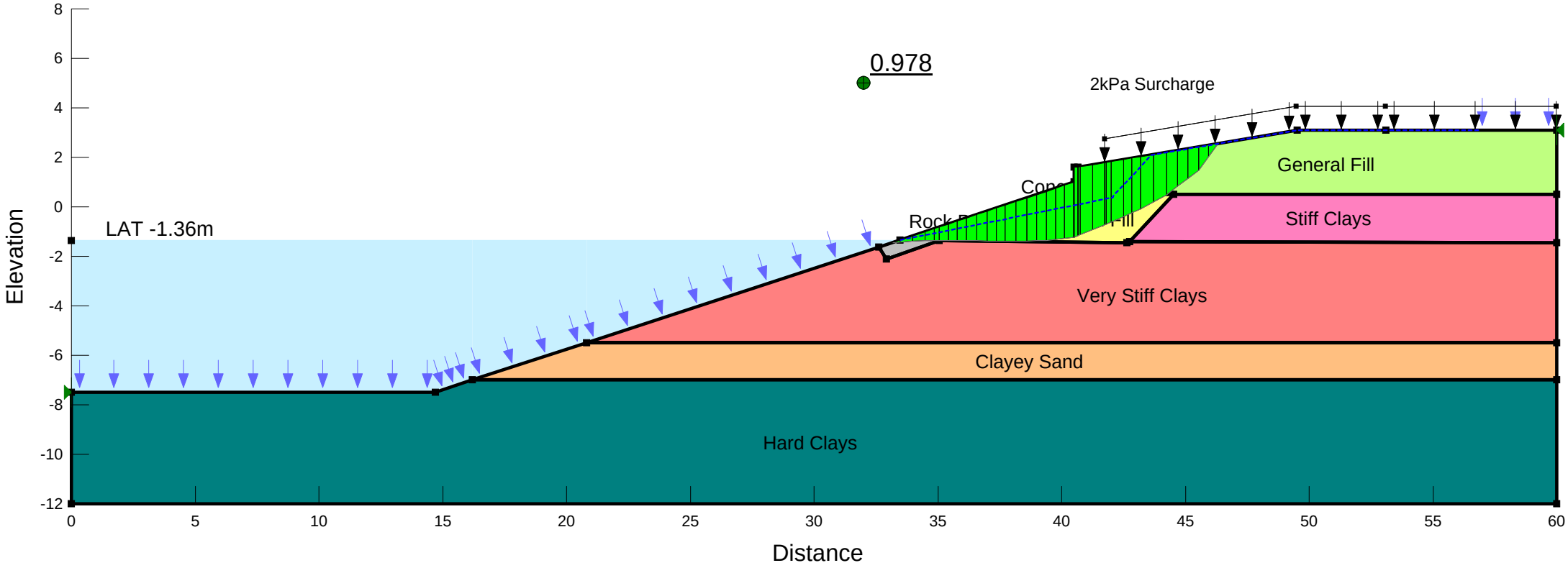
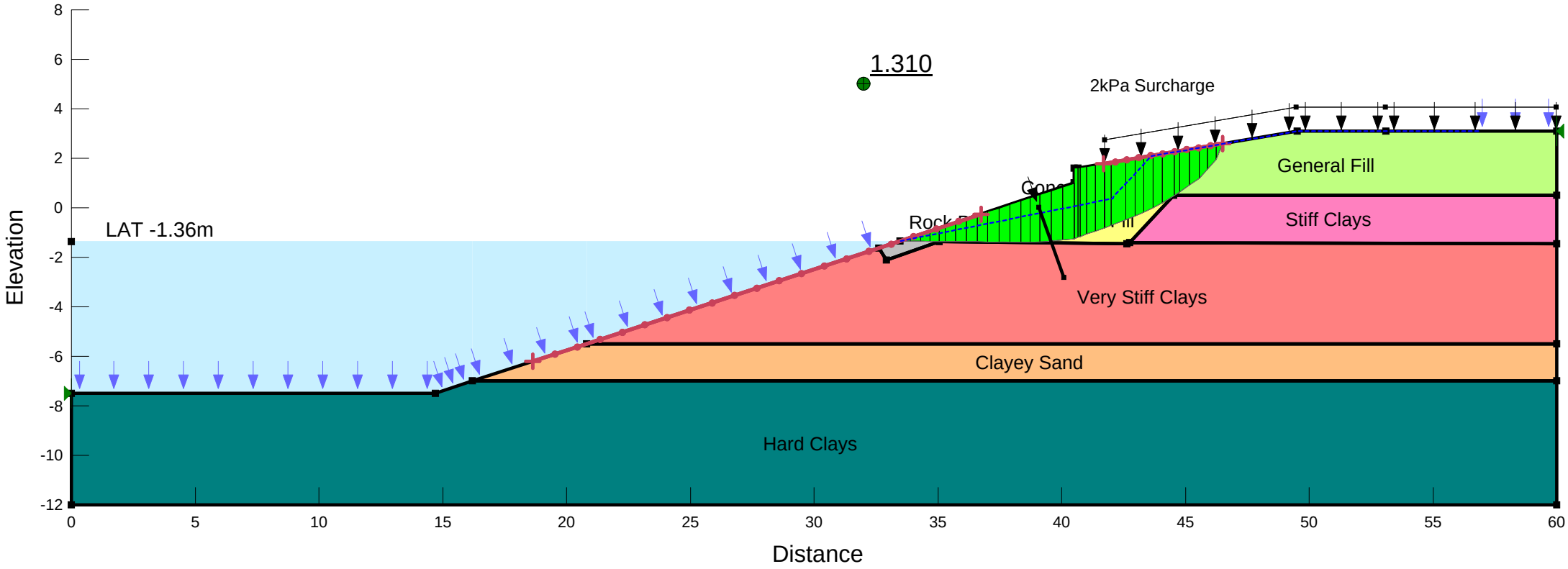
| Name: Rock Protection | Model: Mohr-Coulomb | Unit Weight: 20 kN/m³ | Cohesion: 0 kPa | Phi: 30 ° |
| Name: General Fill | Model: Mohr-Coulomb | Unit Weight: 18 kN/m³ | Cohesion: 0 kPa | Phi: 26 ° |
| Name: Foundation Fill | Model: Mohr-Coulomb | Unit Weight: 17.5 kN/m³ | Cohesion: 2 kPa | Phi: 18 ° |
| Name: Stiff Clays | Model: Mohr-Coulomb | Unit Weight: 17.5 kN/m³ | Cohesion: 5 kPa | Phi: 26 ° |
| Name: Very Stiff Clays | Model: Mohr-Coulomb | Unit Weight: 17.5 kN/m³ | Cohesion: 10 kPa | Phi: 27 ° |
| Name: Clayey Sand | Model: Mohr-Coulomb | Unit Weight: 18 kN/m³ | Cohesion: 2 kPa | Phi: 30 ° |
| Name: Hard Clays | Model: Mohr-Coulomb | Unit Weight: 18 kN/m³ | Cohesion: 15 kPa | Phi: 28 ° |



# Model: 3m Grout Piles at 2m crs

| | | | | |
|---|---|---|---|---|
| Name: Concrete Wall | Model: Mohr-Coulomb | Unit Weight: 24 kN/m³ | Cohesion: 4000 kPa | Phi: 0 ° |
| Name: Rock Protection | Model: Mohr-Coulomb | Unit Weight: 20 kN/m³ | Cohesion: 0 kPa | Phi: 30 ° |
| Name: General Fill | Model: Mohr-Coulomb | Unit Weight: 18 kN/m³ | Cohesion: 0 kPa | Phi: 26 ° |
| Name: Foundation Fill | Model: Mohr-Coulomb | Unit Weight: 17.5 kN/m³ | Cohesion: 2 kPa | Phi: 18 ° |
| Name: Stiff Clays | Model: Mohr-Coulomb | Unit Weight: 17.5 kN/m³ | Cohesion: 5 kPa | Phi: 26 ° |
| Name: Very Stiff Clays | Model: Mohr-Coulomb | Unit Weight: 17.5 kN/m³ | Cohesion: 10 kPa | Phi: 27 ° |
| Name: Clayey Sand | Model: Mohr-Coulomb | Unit Weight: 18 kN/m³ | Cohesion: 2 kPa | Phi: 30 ° |
| Name: Hard Clays | Model: Mohr-Coulomb | Unit Weight: 18 kN/m³ | Cohesion: 15 kPa | Phi: 28 ° |



# Model: 3m Grout Piles at 1m crs

| | | | | |
|---|---|---|---|---|
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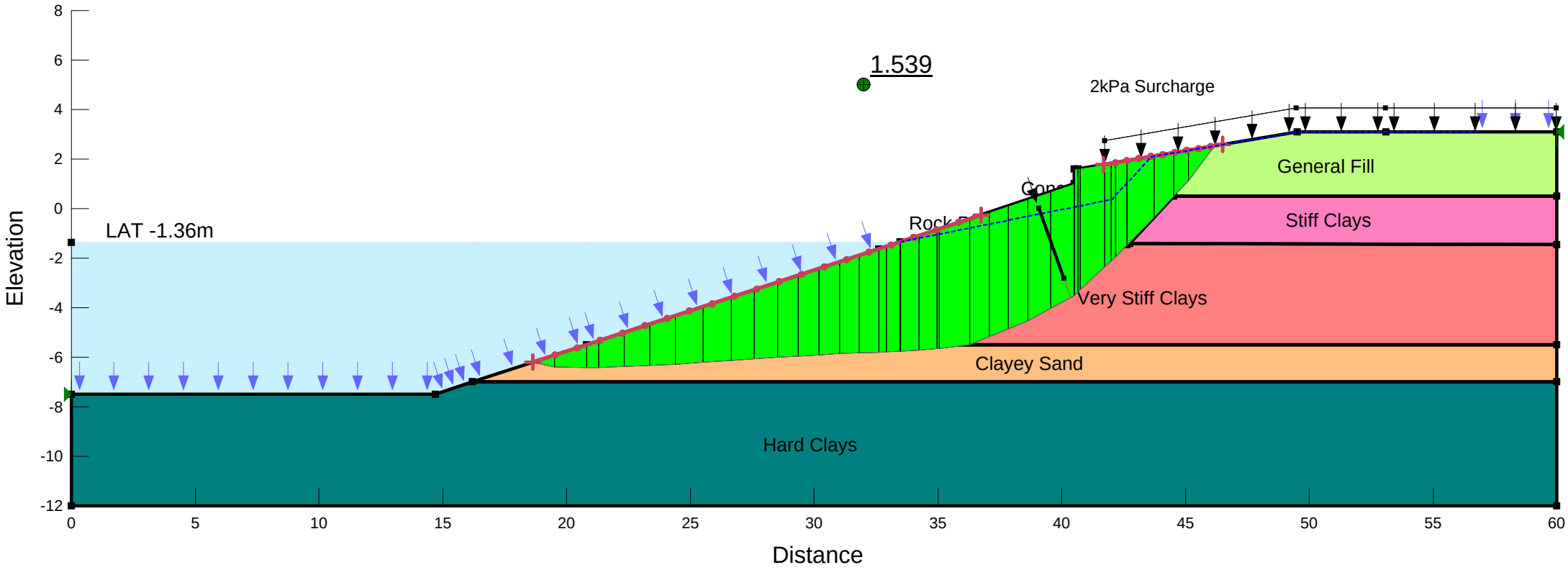
| Name: Rock Protection | Model: Mohr-Coulomb | Unit Weight: 20 kN/m³ | Cohesion: 0 kPa | Phi: 30 ° |
| Name: General Fill | Model: Mohr-Coulomb | Unit Weight: 18 kN/m³ | Cohesion: 0 kPa | Phi: 26 ° |
| Name: Foundation Fill | Model: Mohr-Coulomb | Unit Weight: 17.5 kN/m³ | Cohesion: 2 kPa | Phi: 18 ° |
| Name: Stiff Clays | Model: Mohr-Coulomb | Unit Weight: 17.5 kN/m³ | Cohesion: 5 kPa | Phi: 26 ° |
| Name: Very Stiff Clays | Model: Mohr-Coulomb | Unit Weight: 17.5 kN/m³ | Cohesion: 10 kPa | Phi: 27 ° |
| Name: Clayey Sand | Model: Mohr-Coulomb | Unit Weight: 18 kN/m³ | Cohesion: 2 kPa | Phi: 30 ° |
| Name: Hard Clays | Model: Mohr-Coulomb | Unit Weight: 18 kN/m³ | Cohesion: 15 kPa | Phi: 28 ° |



# Model: 2x 3m Grout Piles at 2m crs each

| | | | | |
|---|---|---|---|---|
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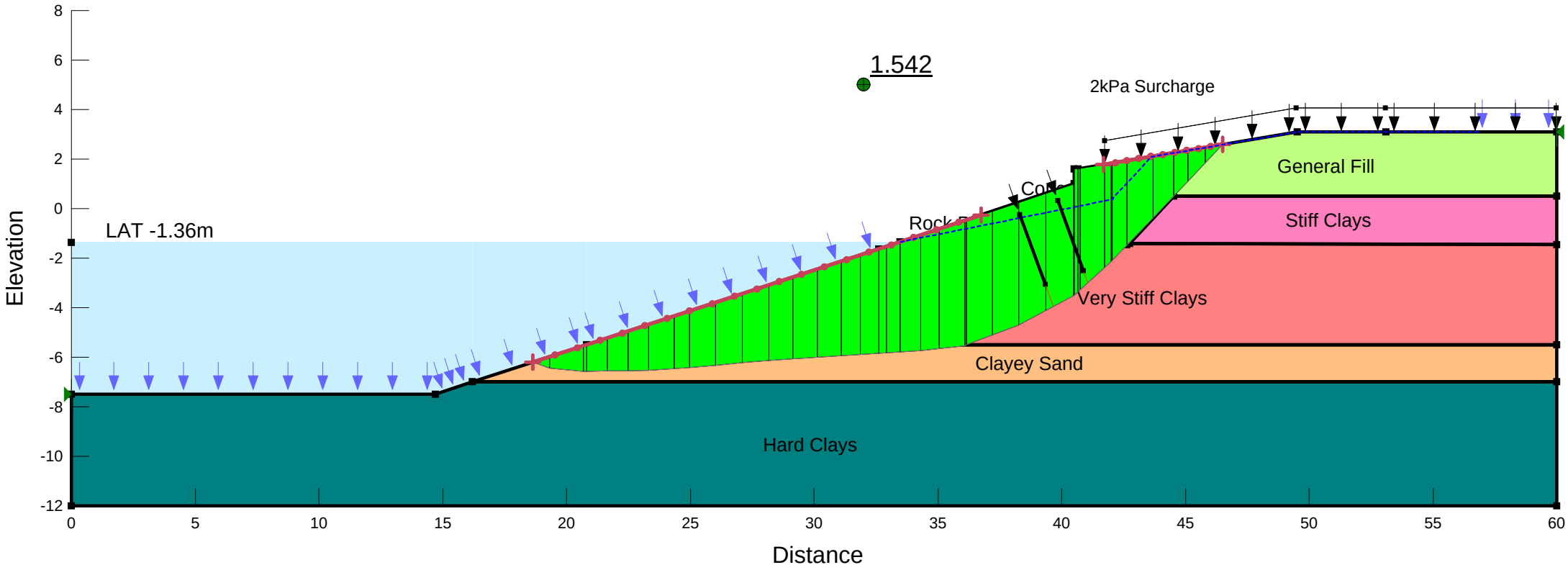
| Name: Rock Protection | Model: Mohr-Coulomb | Unit Weight: 20 kN/m³ | Cohesion: 0 kPa | Phi: 30 ° |
| Name: General Fill | Model: Mohr-Coulomb | Unit Weight: 18 kN/m³ | Cohesion: 0 kPa | Phi: 26 ° |
| Name: Foundation Fill | Model: Mohr-Coulomb | Unit Weight: 17.5 kN/m³ | Cohesion: 2 kPa | Phi: 18 ° |
| Name: Stiff Clays | Model: Mohr-Coulomb | Unit Weight: 17.5 kN/m³ | Cohesion: 5 kPa | Phi: 26 ° |
| Name: Very Stiff Clays | Model: Mohr-Coulomb | Unit Weight: 17.5 kN/m³ | Cohesion: 10 kPa | Phi: 27 ° |
| Name: Clayey Sand | Model: Mohr-Coulomb | Unit Weight: 18 kN/m³ | Cohesion: 2 kPa | Phi: 30 ° |
| Name: Hard Clays | Model: Mohr-Coulomb | Unit Weight: 18 kN/m³ | Cohesion: 15 kPa | Phi: 28 ° |



# Model: Deep Failure

| | | | | |
|---|---|---|---|---|
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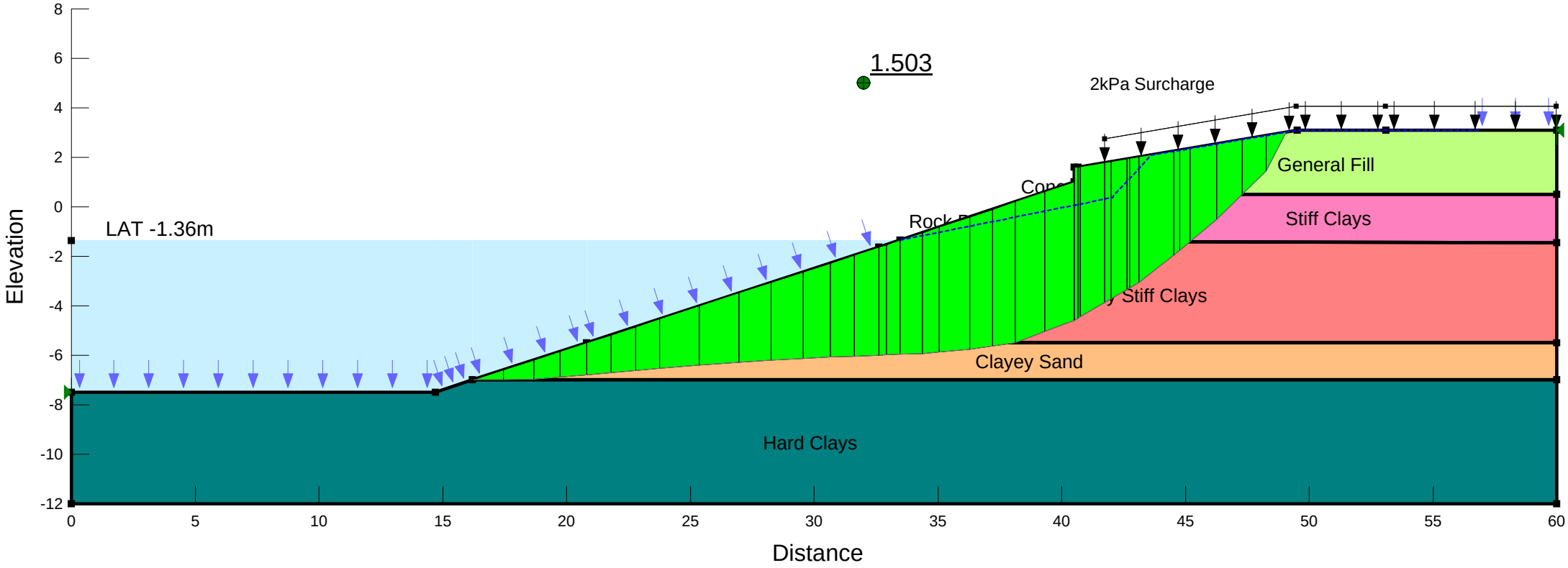
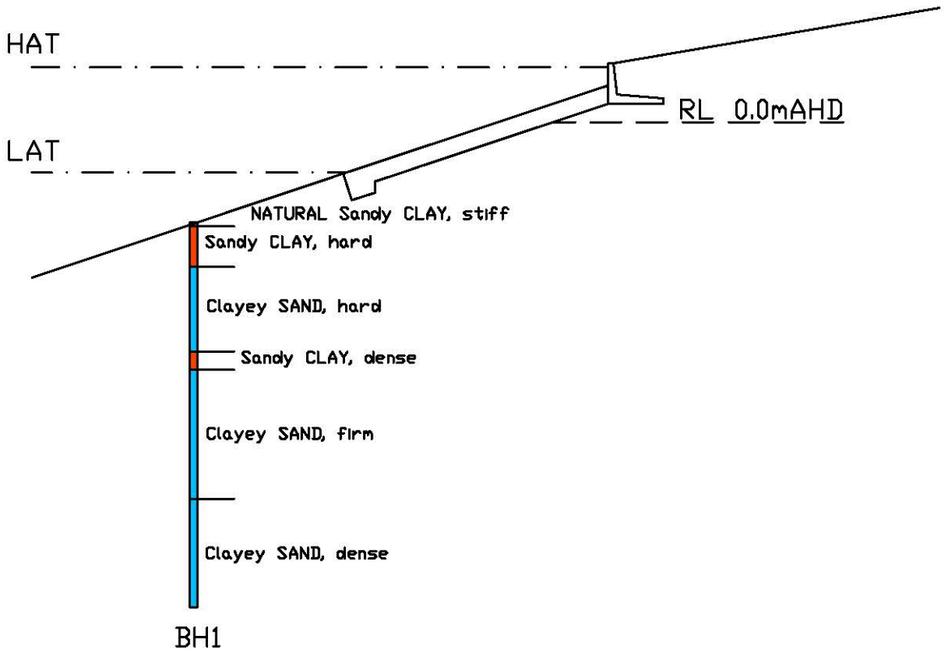
| Name: Rock Protection | Model: Mohr-Coulomb | Unit Weight: 20 kN/m³ | Cohesion: 0 kPa | Phi: 30 ° |
| Name: General Fill | Model: Mohr-Coulomb | Unit Weight: 18 kN/m³ | Cohesion: 0 kPa | Phi: 26 ° |
| Name: Foundation Fill | Model: Mohr-Coulomb | Unit Weight: 17.5 kN/m³ | Cohesion: 2 kPa | Phi: 18 ° |
| Name: Stiff Clays | Model: Mohr-Coulomb | Unit Weight: 17.5 kN/m³ | Cohesion: 5 kPa | Phi: 26 ° |
| Name: Very Stiff Clays | Model: Mohr-Coulomb | Unit Weight: 17.5 kN/m³ | Cohesion: 10 kPa | Phi: 27 ° |
| Name: Clayey Sand | Model: Mohr-Coulomb | Unit Weight: 18 kN/m³ | Cohesion: 2 kPa | Phi: 30 ° |
| Name: Hard Clays | Model: Mohr-Coulomb | Unit Weight: 18 kN/m³ | Cohesion: 15 kPa | Phi: 28 ° |

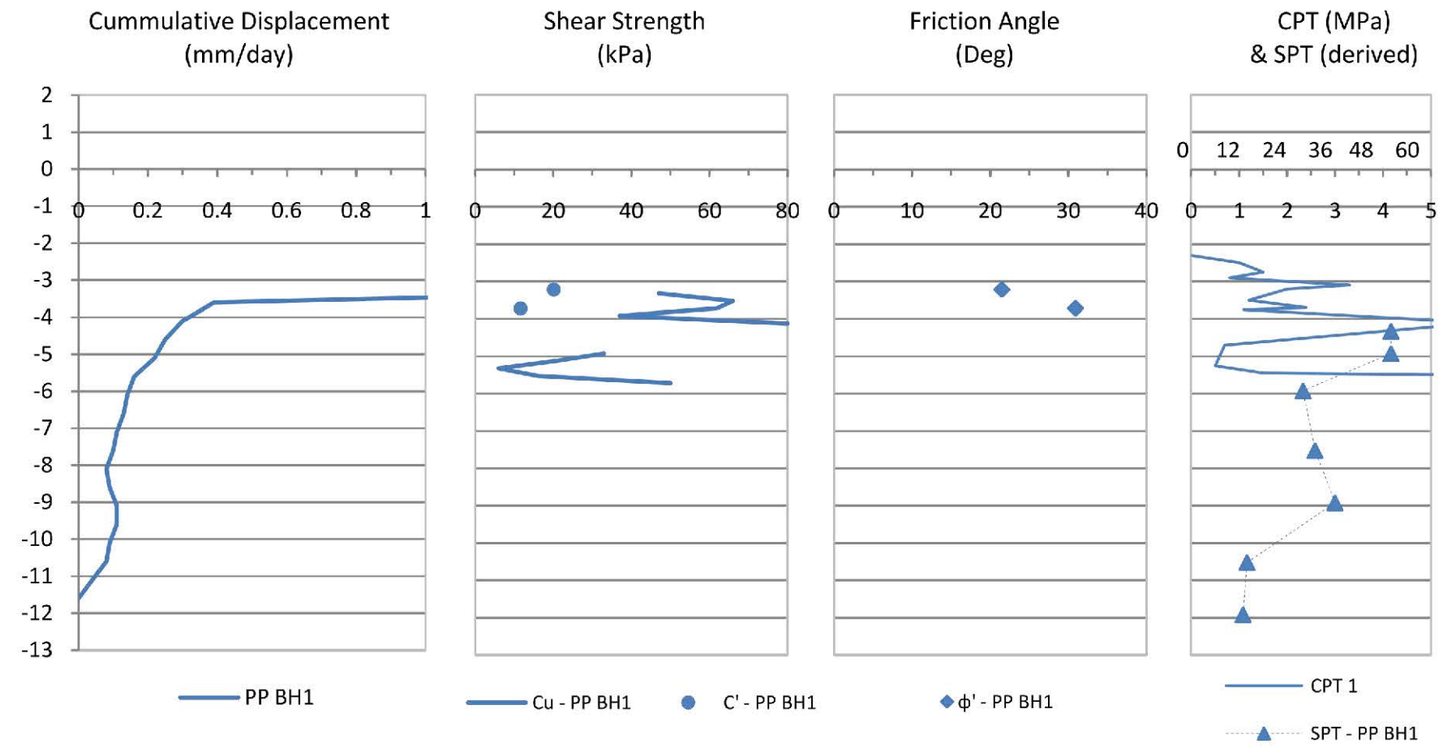


*Appendix B*

# BOREHOLE PROFILES

# Piermont Place - Section 1

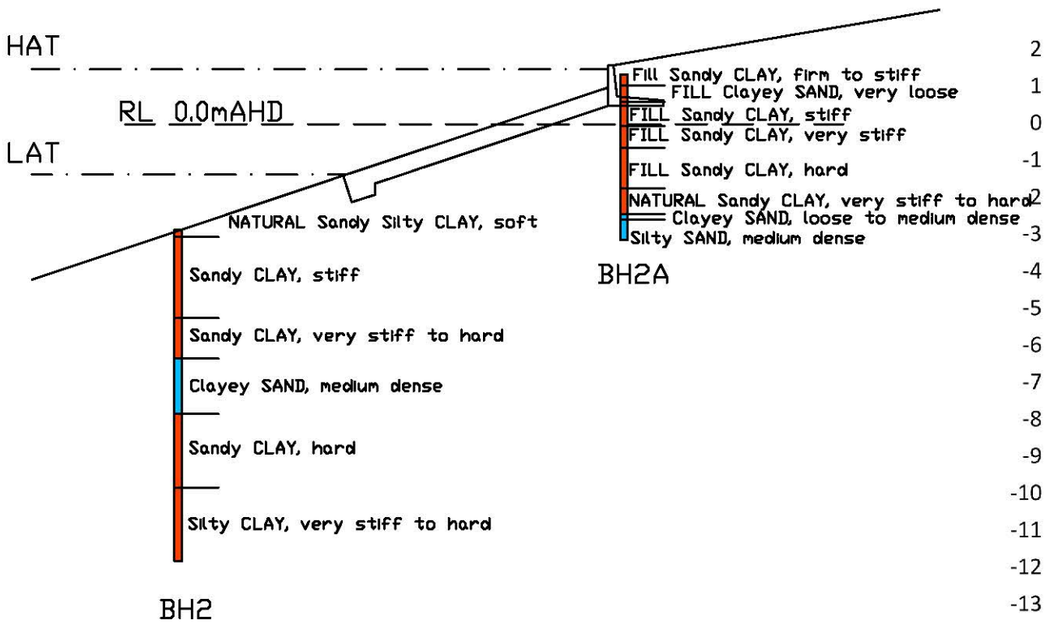


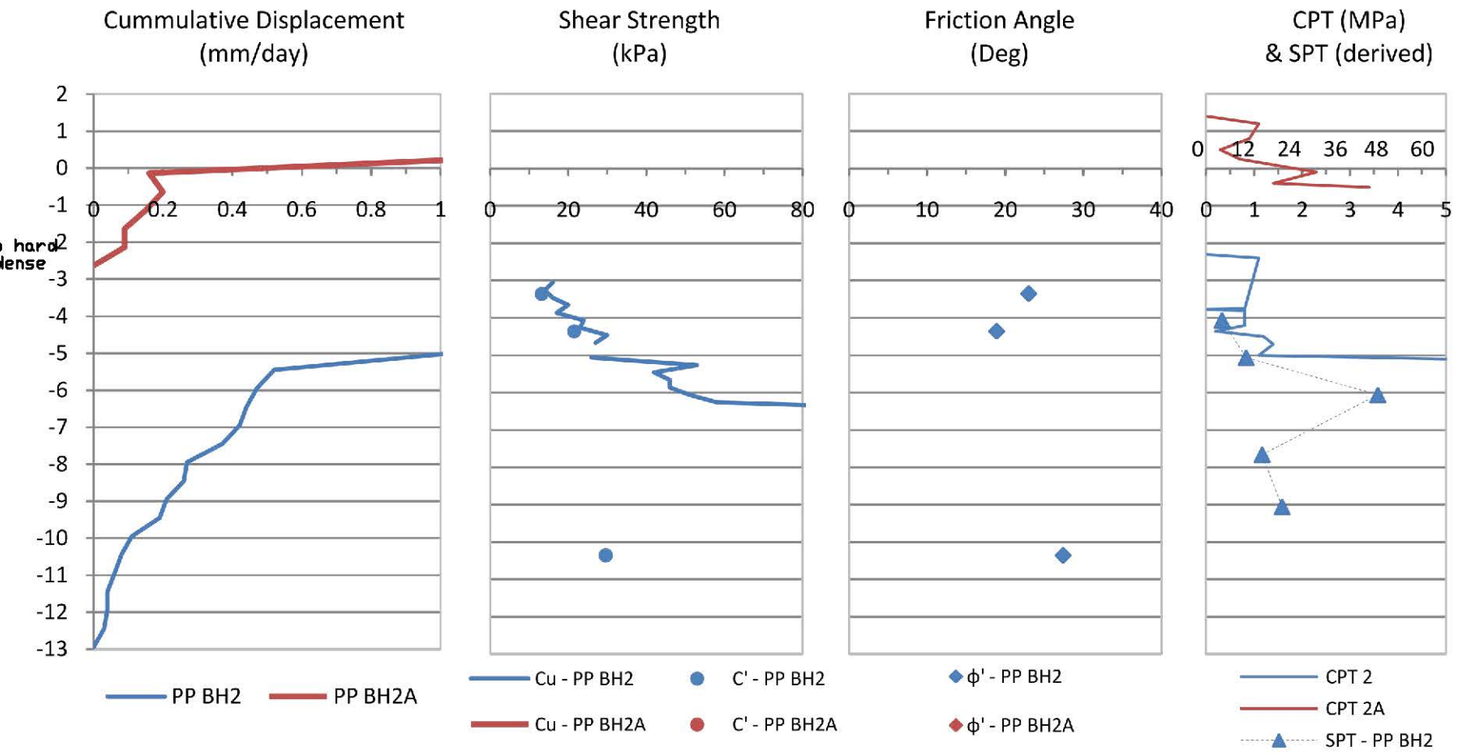




Record Length: PP BH1 = 6 days

NOTE: Approximate borehole locations shown above based on recorded RL. For location of CPT and dilatometer tests refer borehole locations in Soil Surveys reports.

# Piermont Place - Section 2



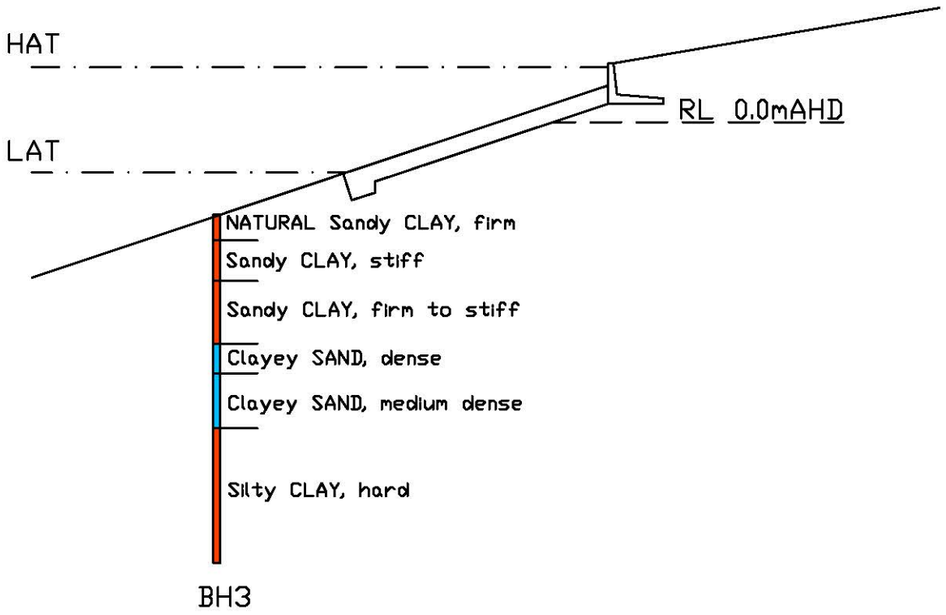



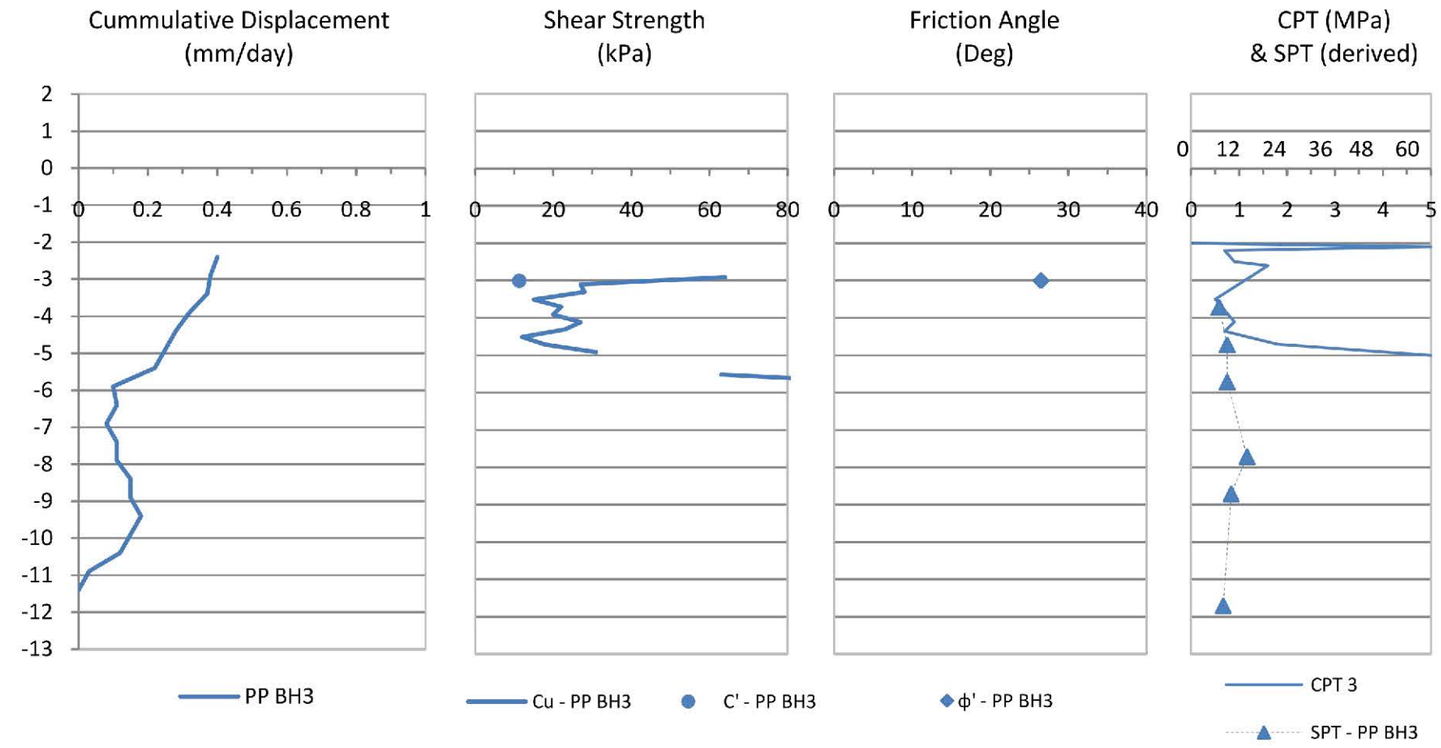

Record Length: PP BH2 = 6 days

PP BH2A = 14 days

NOTE: Approximate borehole locations shown above based on recorded RL. For location of CPT and dilatometer tests refer borehole locations in Soil Surveys reports.

# Piermont Place - Section 3

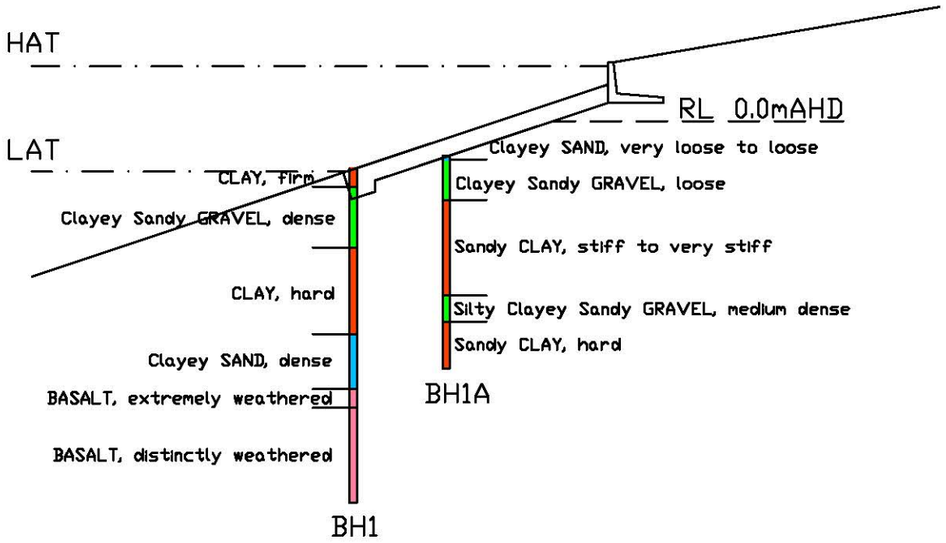


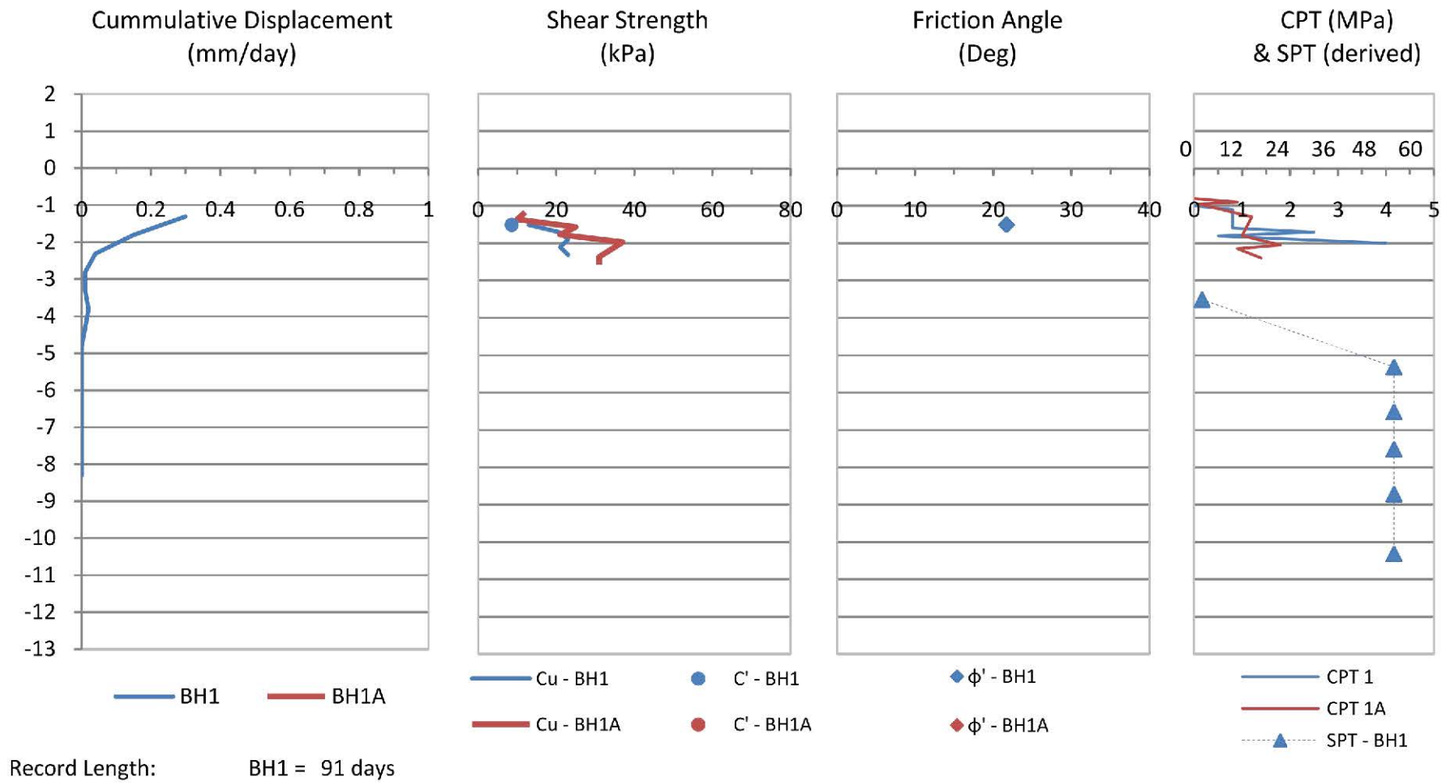




Record Length: PP BH3 = 6 days

NOTE: Approximate borehole locations shown above based on recorded RL. For location of CPT and dilatometer tests refer borehole locations in Soil Surveys reports.

# Test Location 1

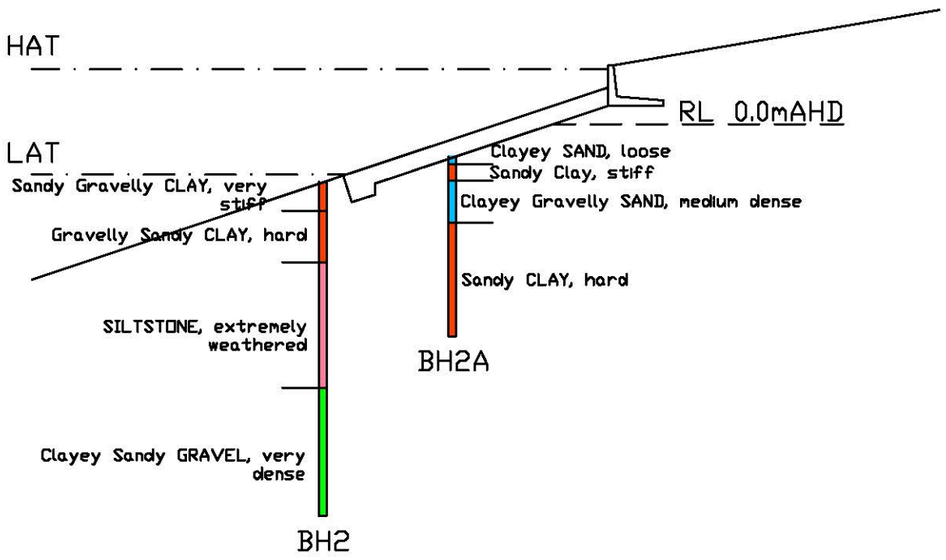


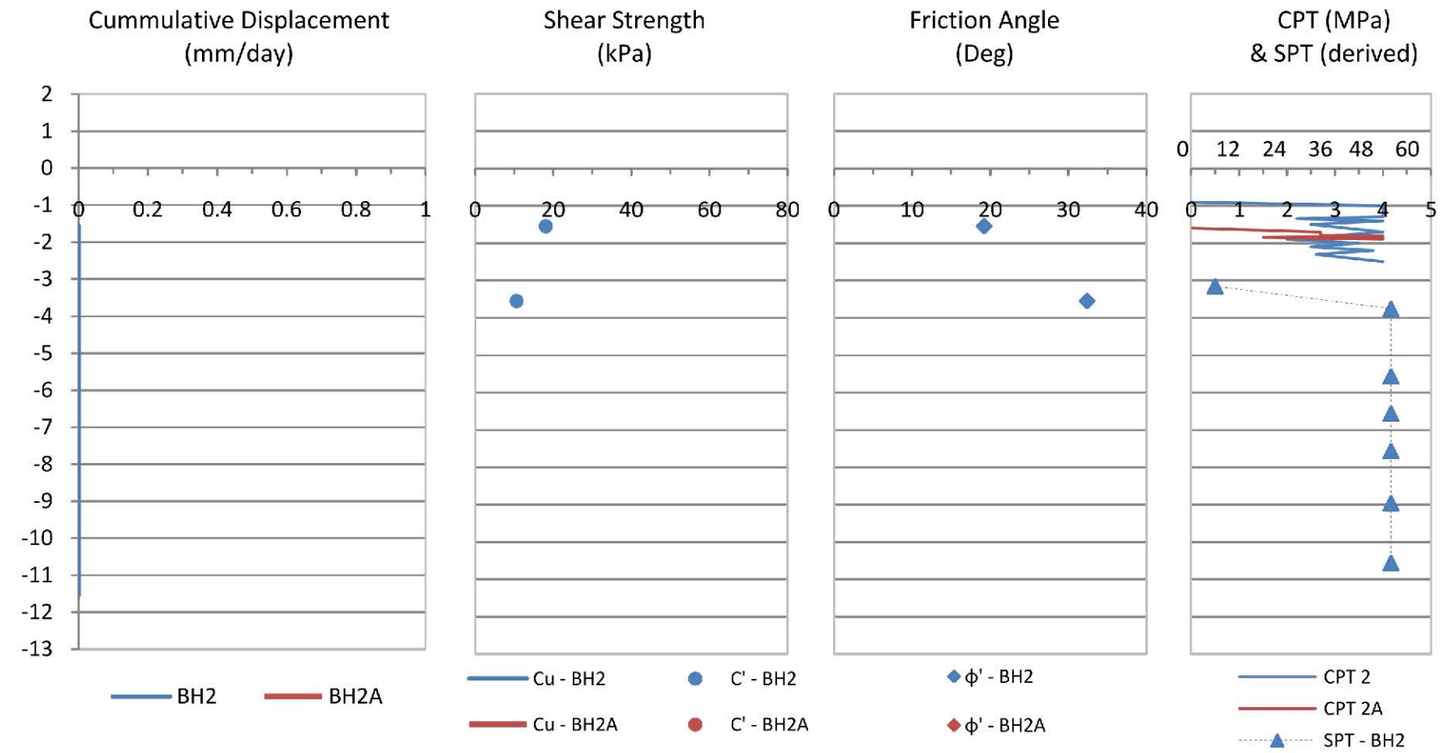




Record Length: BH1 = 91 days

NOTE: Approximate borehole locations shown above based on recorded RL. For location of CPT and dilatometer tests refer borehole locations in Soil Surveys reports.

# Test Location 2

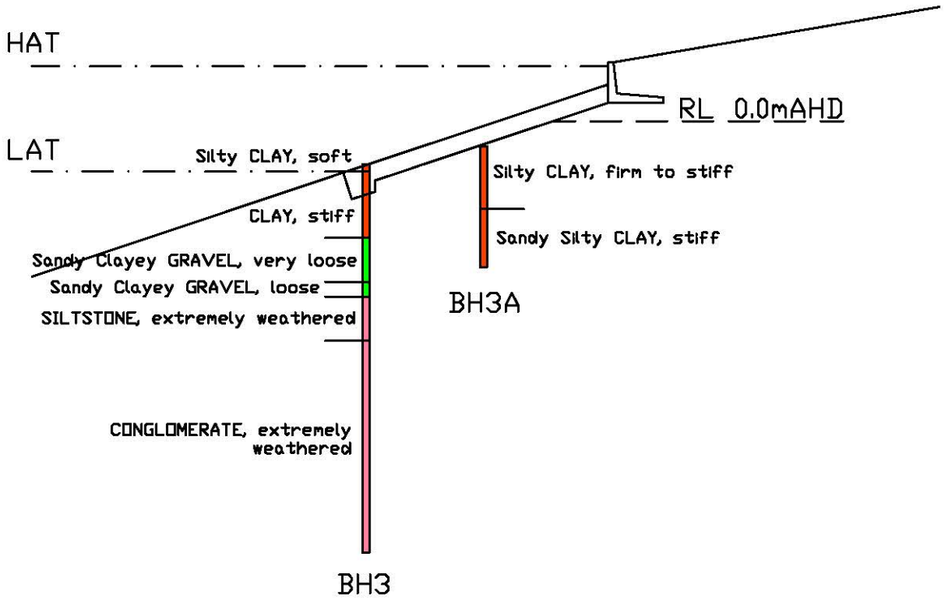


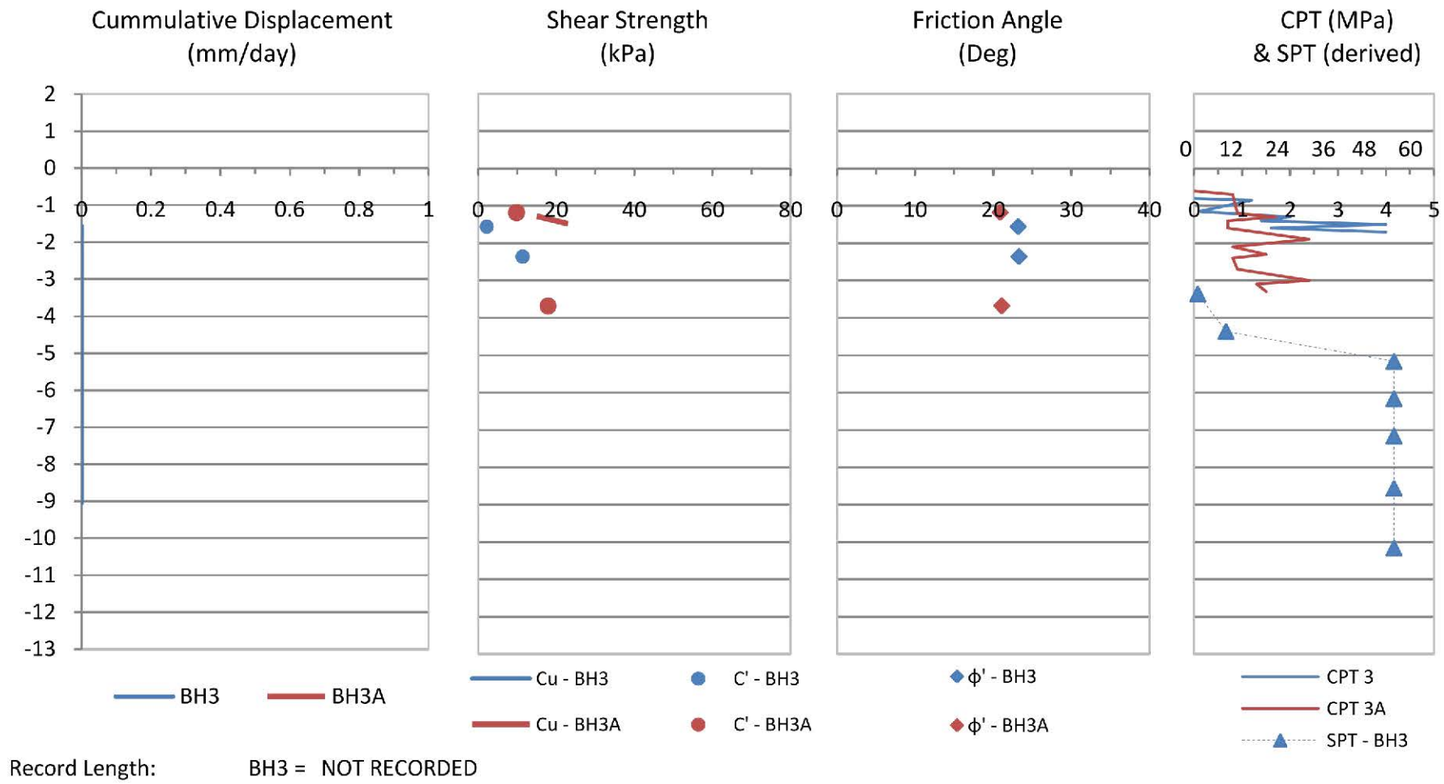




Record Length: BH2 = NOT RECORDED

NOTE: Approximate borehole locations shown above based on recorded RL. For location of CPT and dilatometer tests refer borehole locations in Soil Surveys reports.

# Test Location 3

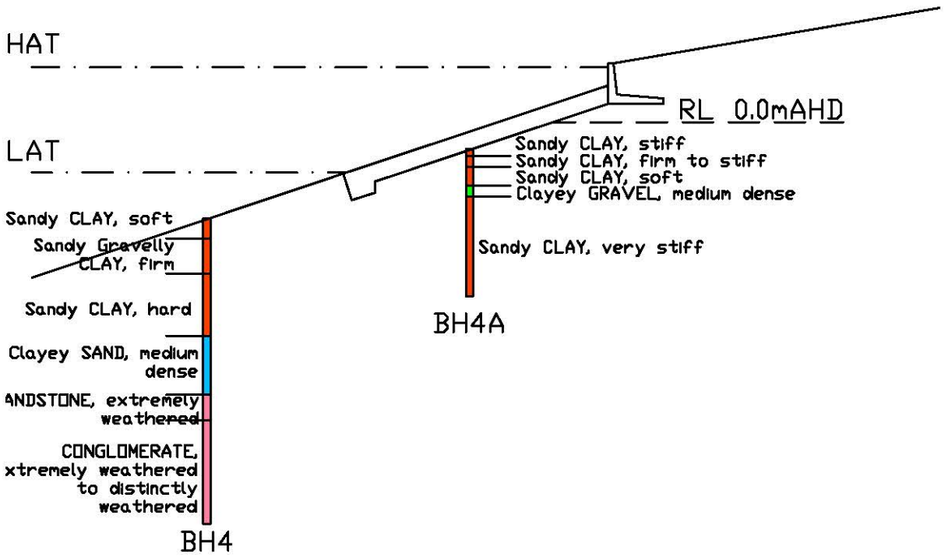


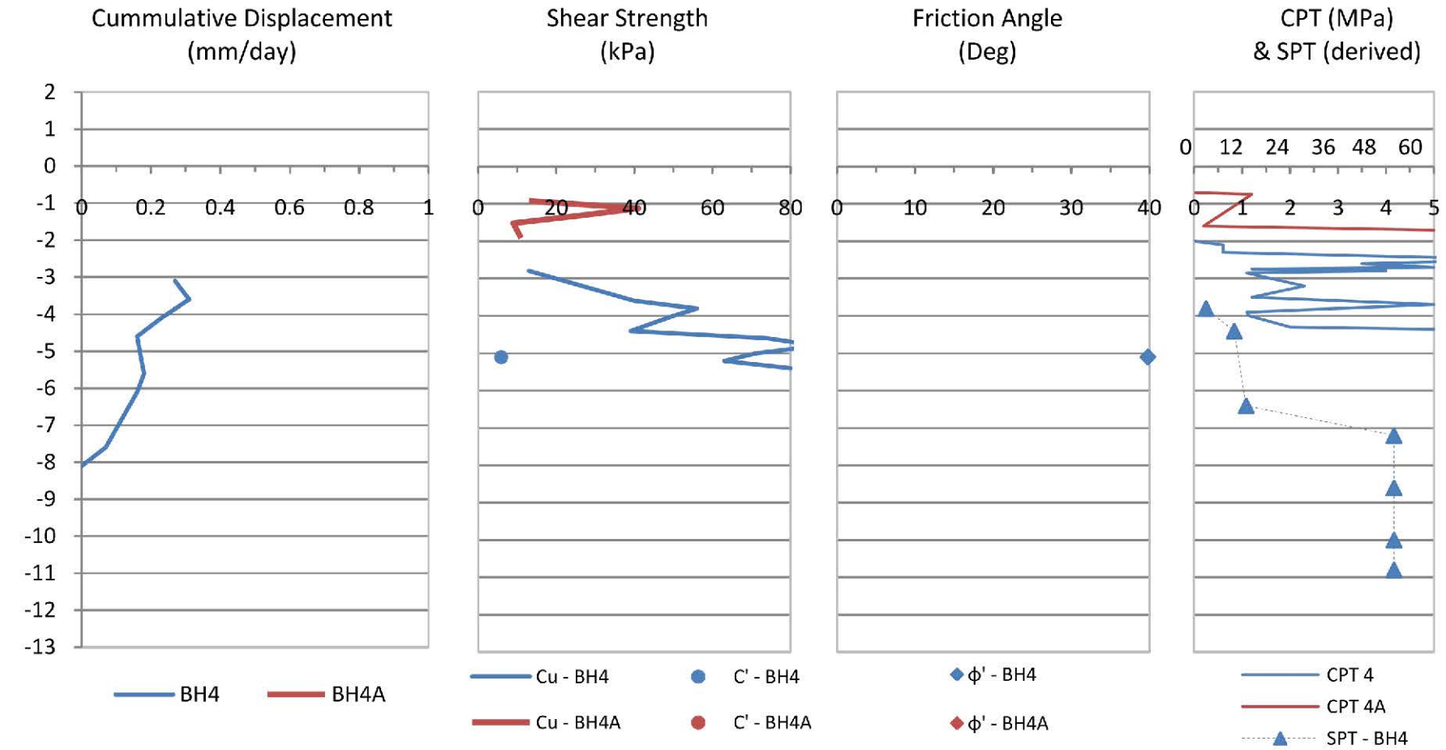




Record Length: BH3 = NOT RECORDED

NOTE: Approximate borehole locations shown above based on recorded RL. For location of CPT and dilatometer tests refer borehole locations in Soil Surveys reports.

# Test Location 4

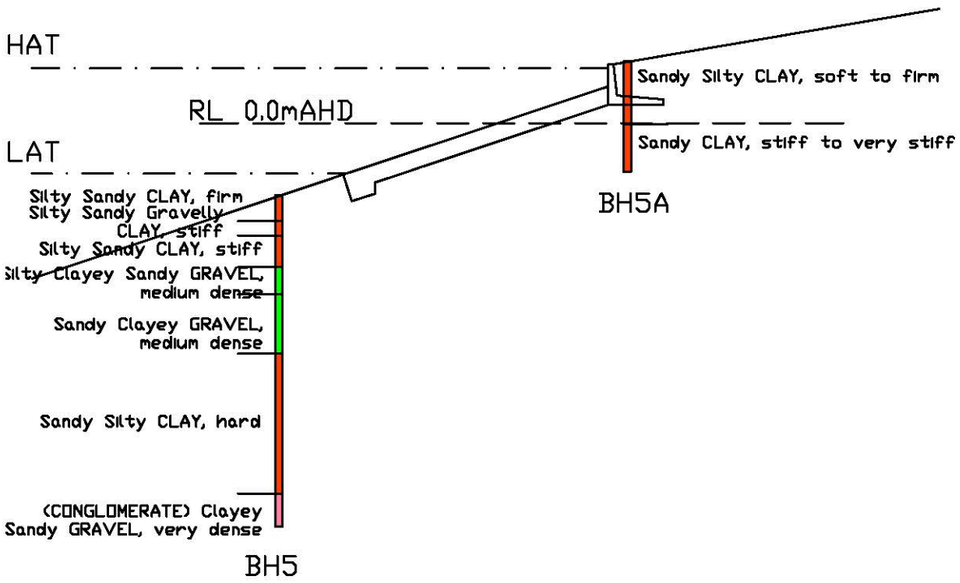


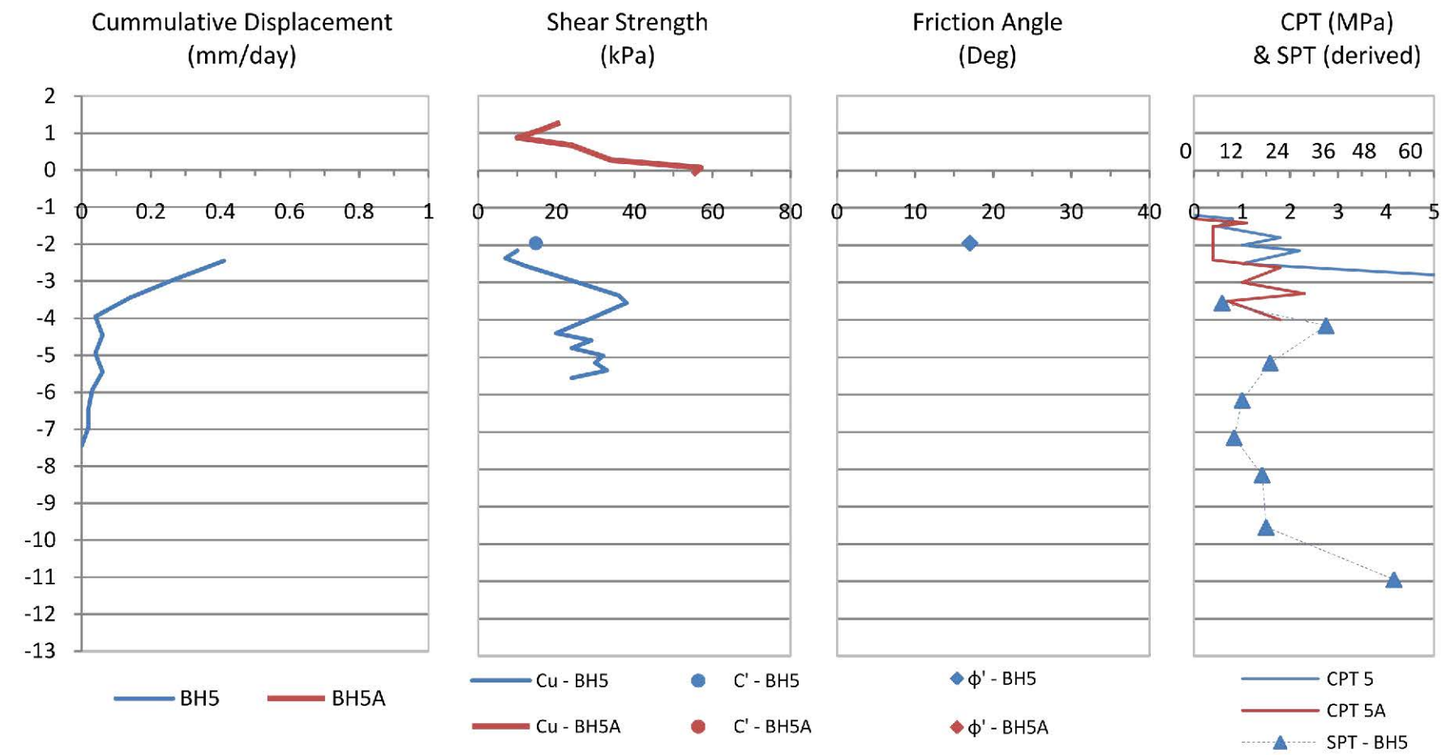




Record Length: BH4 = 56 days

NOTE: Approximate borehole locations shown above based on recorded RL. For location of CPT and dilatometer tests refer borehole locations in Soil Surveys reports.

# Test Location 5

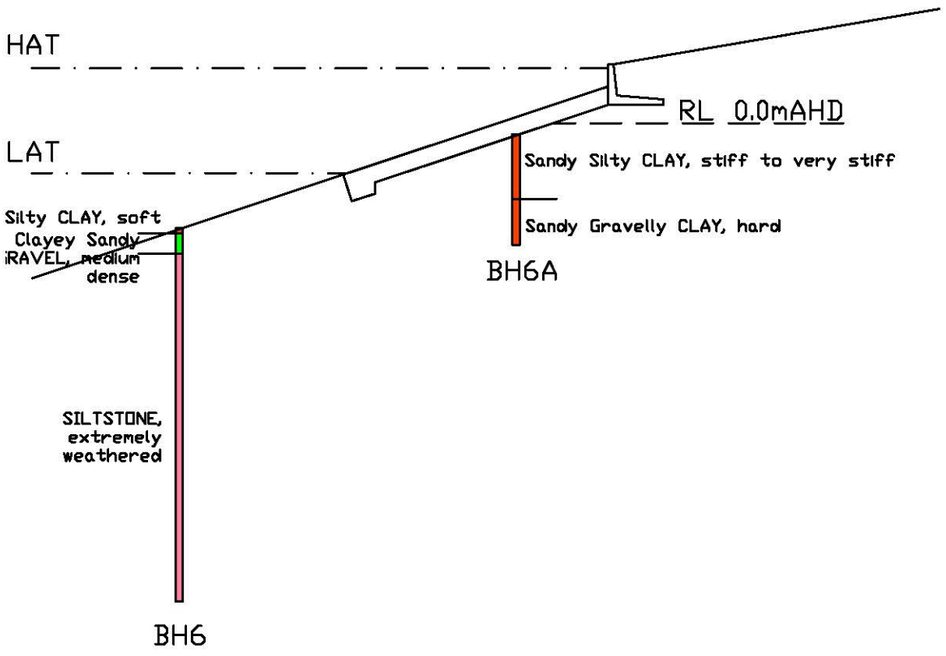


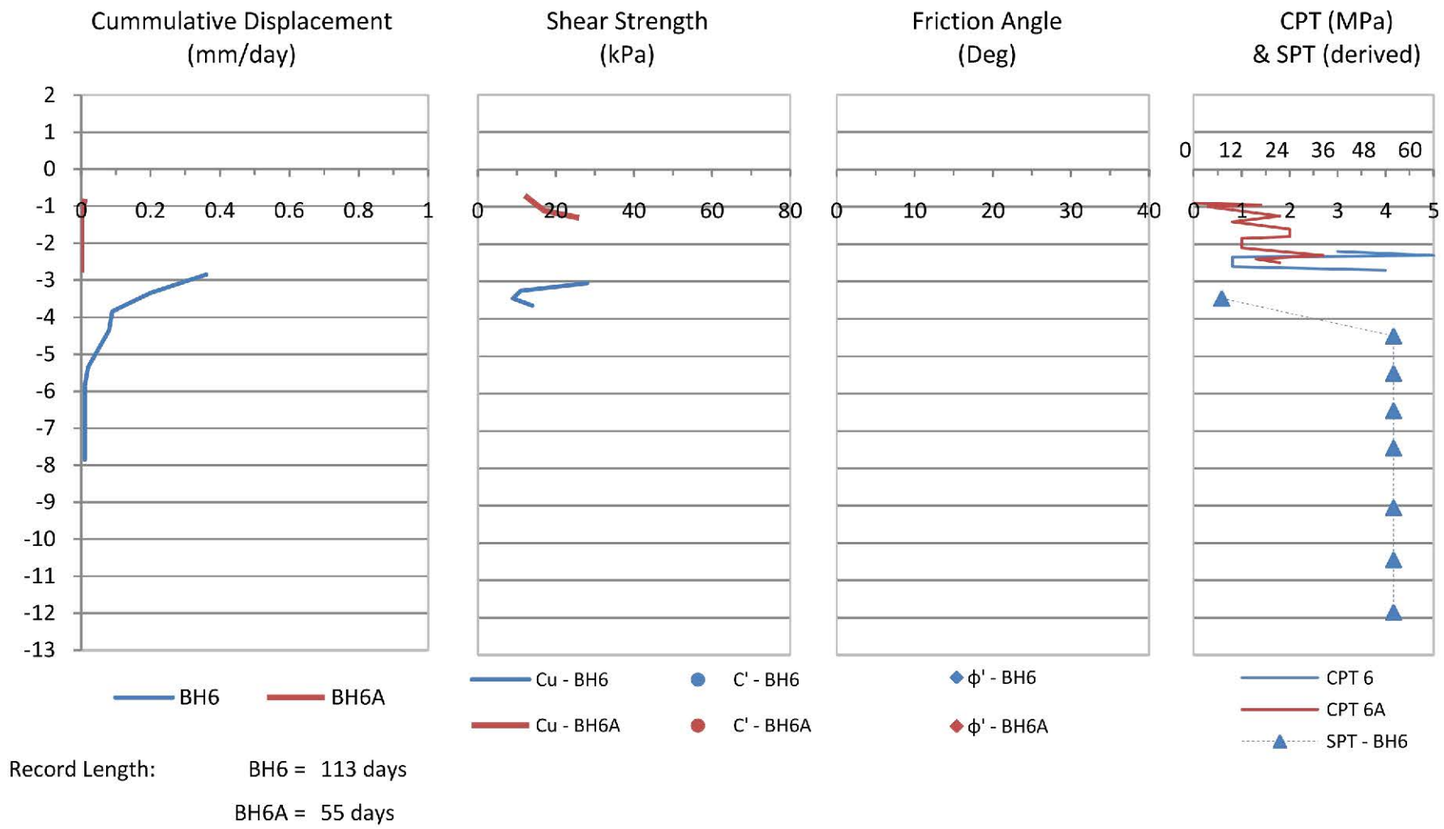




Record Length: BH5 = 69 days

NOTE: Approximate borehole locations shown above based on recorded RL. For location of CPT and dilatometer tests refer borehole locations in Soil Surveys reports.

# Test Location 6



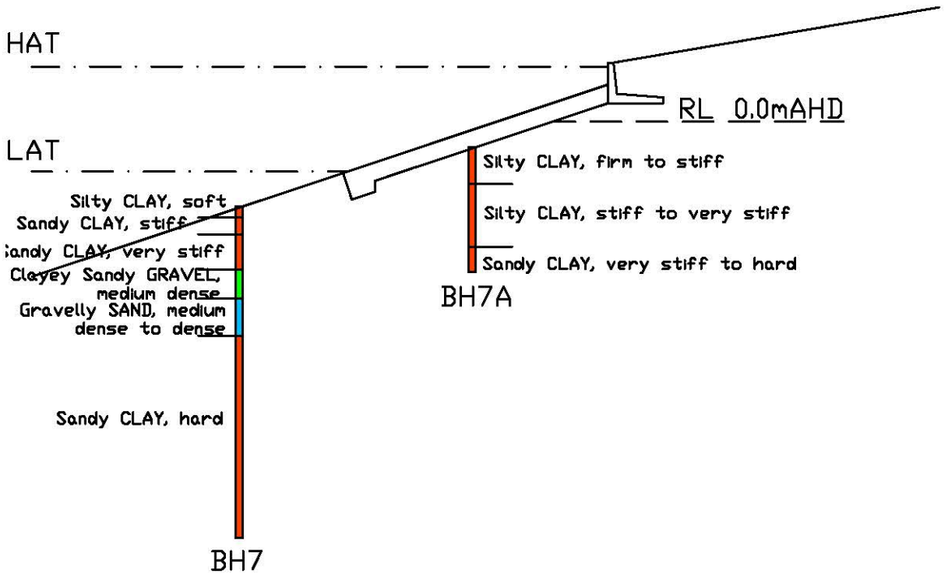



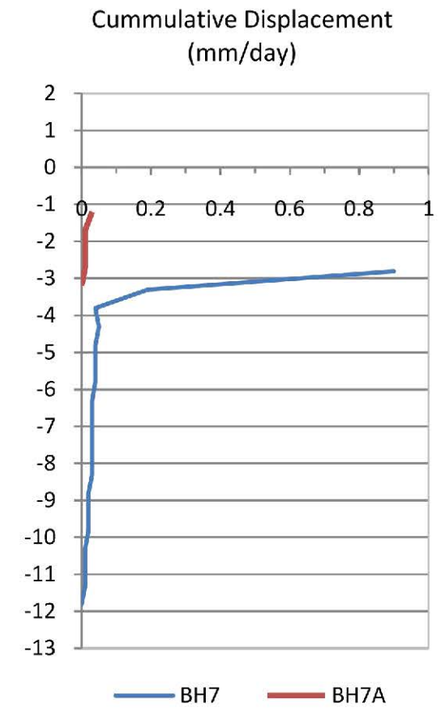

Record Length: BH6 = 113 days

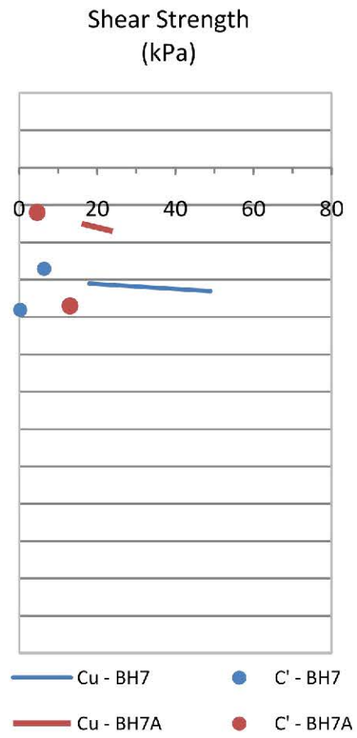
BH6A = 55 days

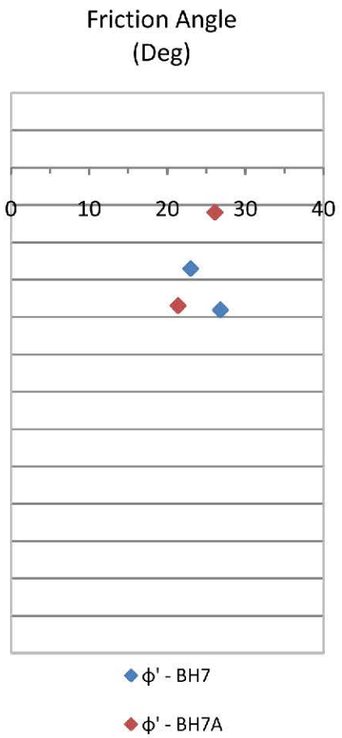
NOTE: Approximate borehole locations shown above based on recorded RL. For location of CPT and dilatometer tests refer borehole locations in Soil Surveys reports.

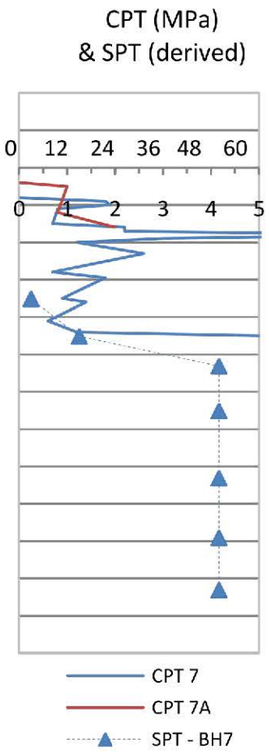
# Test Location 7



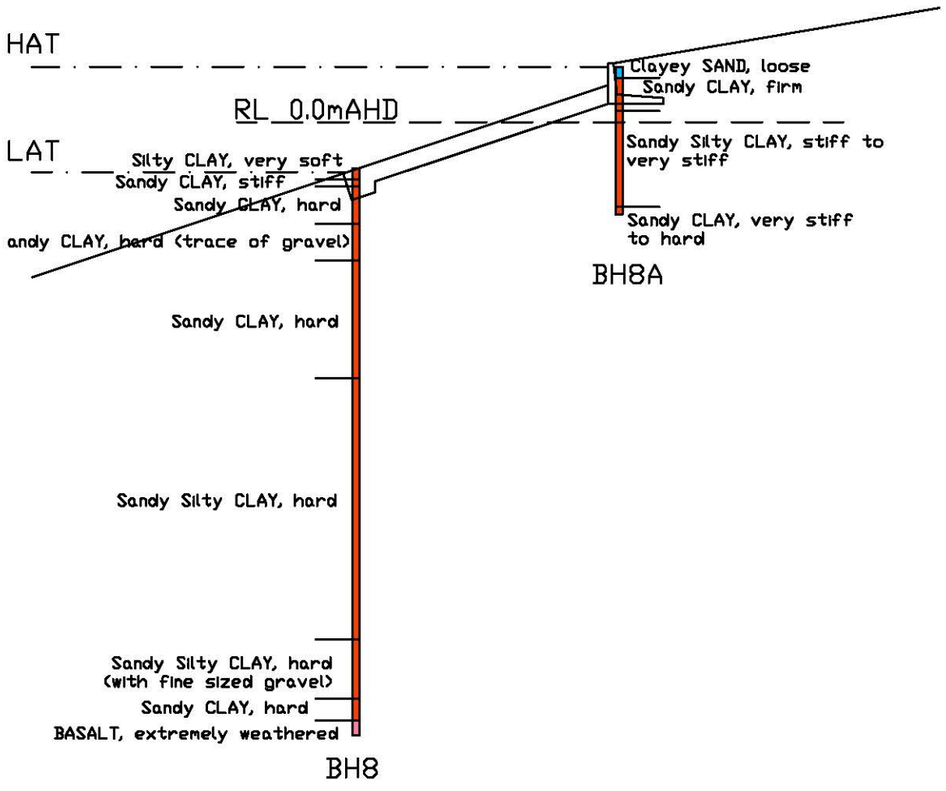



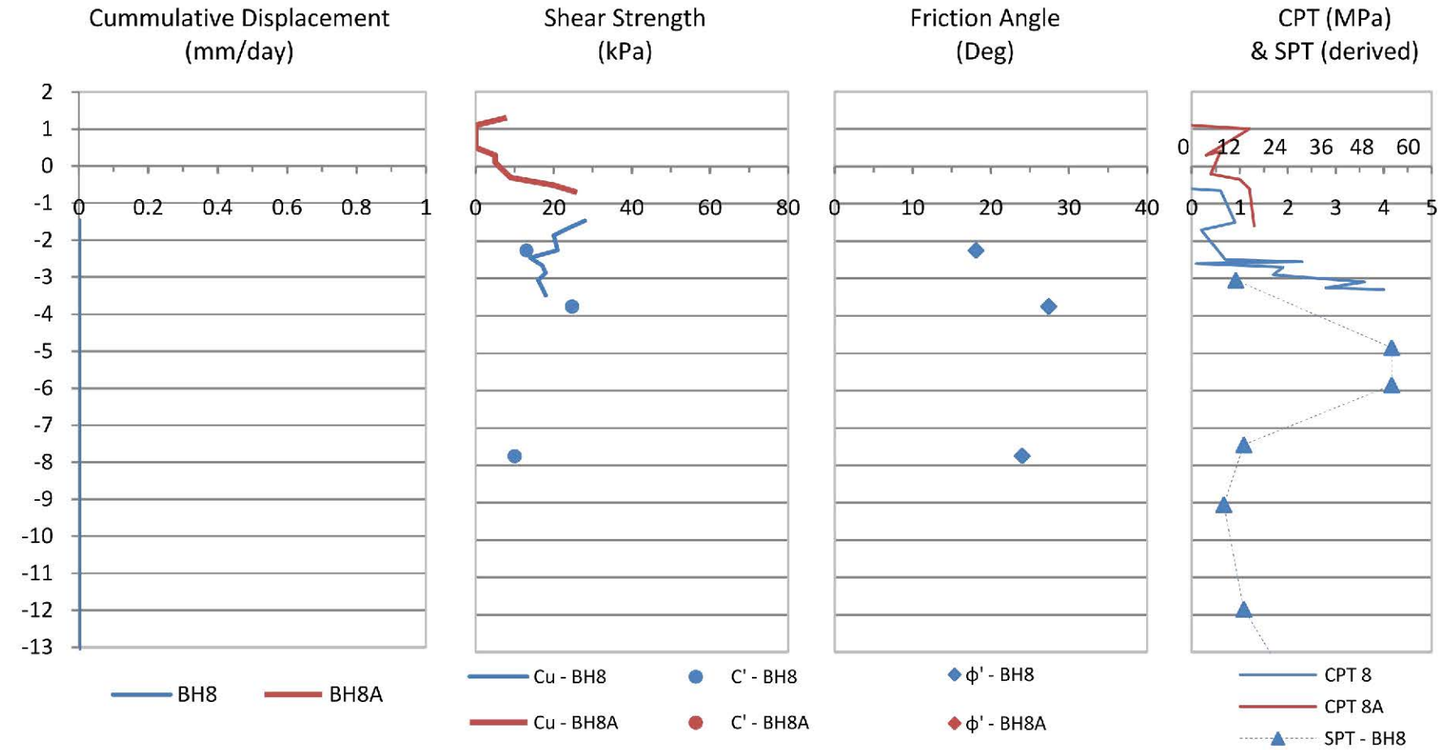

Record Length: BH7 = 56 days

BH7A = 56 days

NOTE: Approximate borehole locations shown above based on recorded RL. For location of CPT and dilatometer tests refer borehole locations in Soil Surveys reports.

# Test Location 8

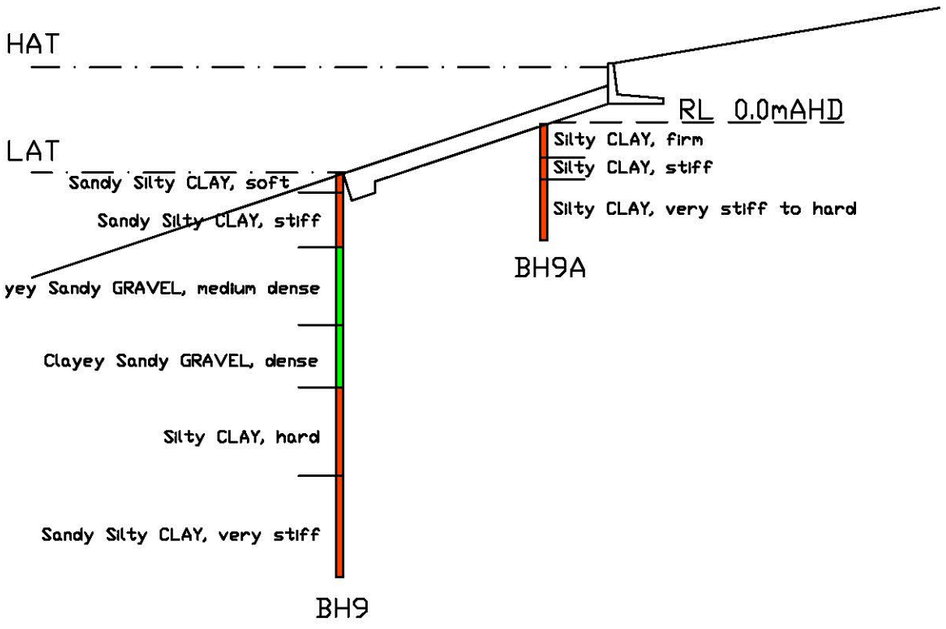


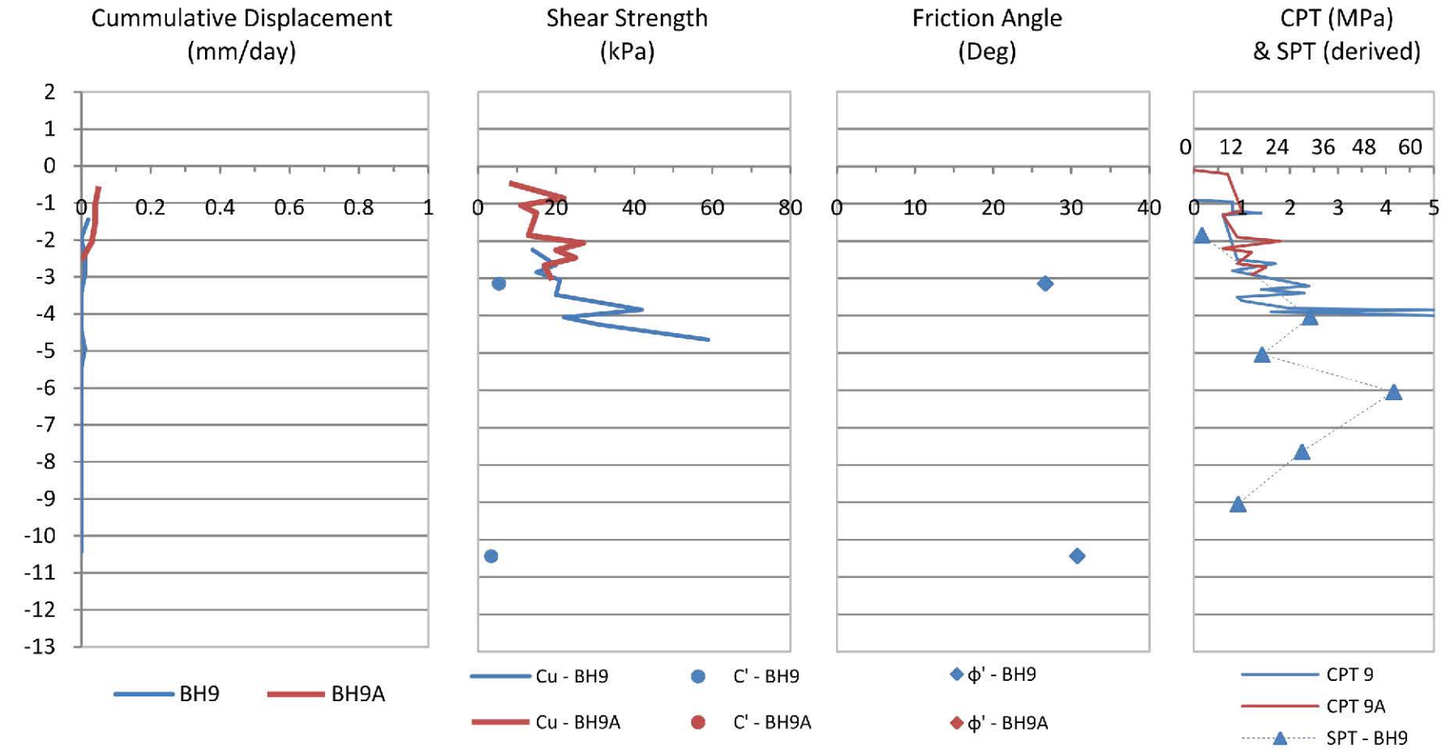




Record Length: BH8 = NOT RECORDED

NOTE: Approximate borehole locations shown above based on recorded RL. For location of CPT and dilatometer tests refer borehole locations in Soil Surveys reports.

# Test Location 9



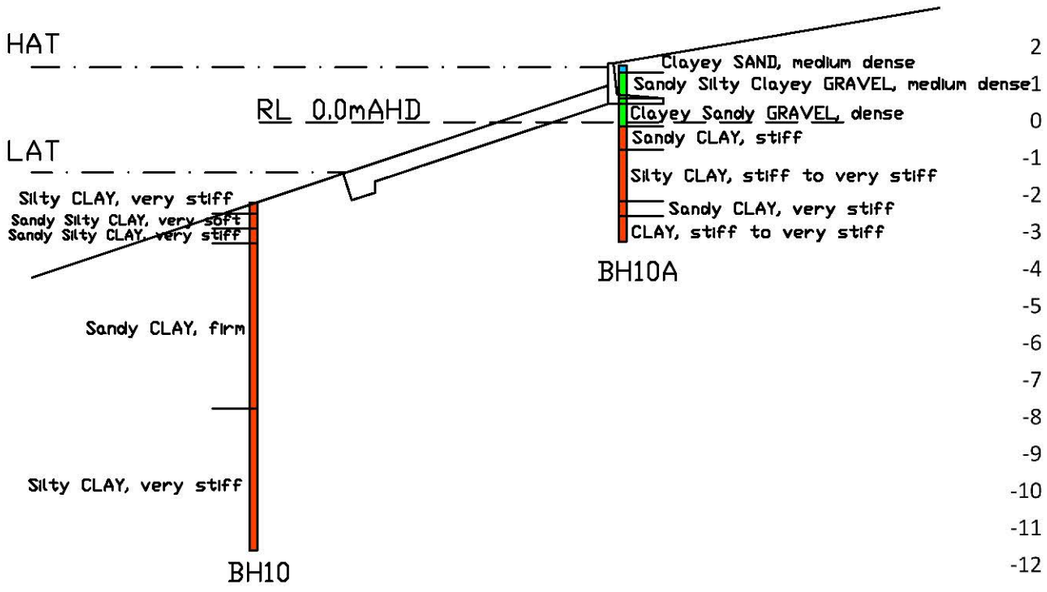



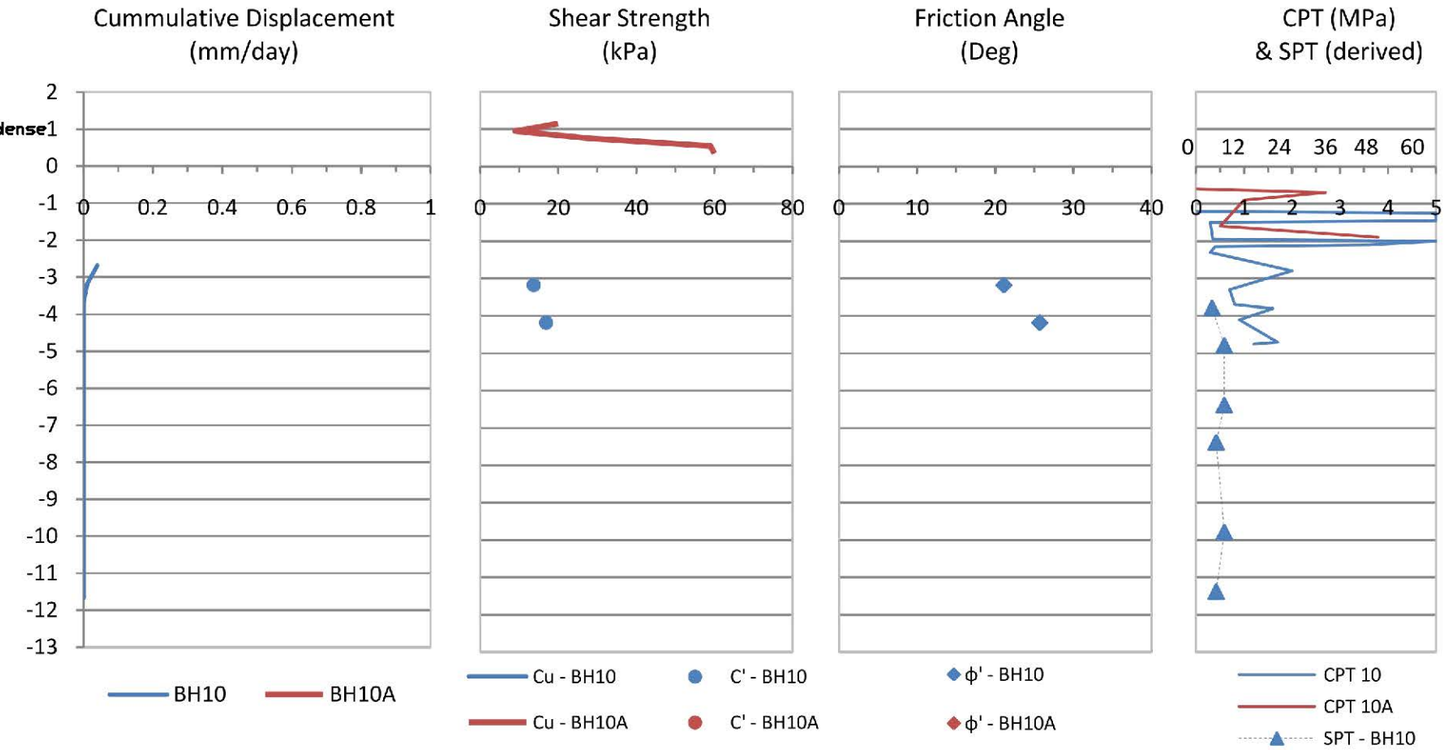

Record Length: BH9 = 91 days

BH9A = 55 days

NOTE: Approximate borehole locations shown above based on recorded RL. For location of CPT and dilatometer tests refer borehole locations in Soil Surveys reports.

# Test Location 10

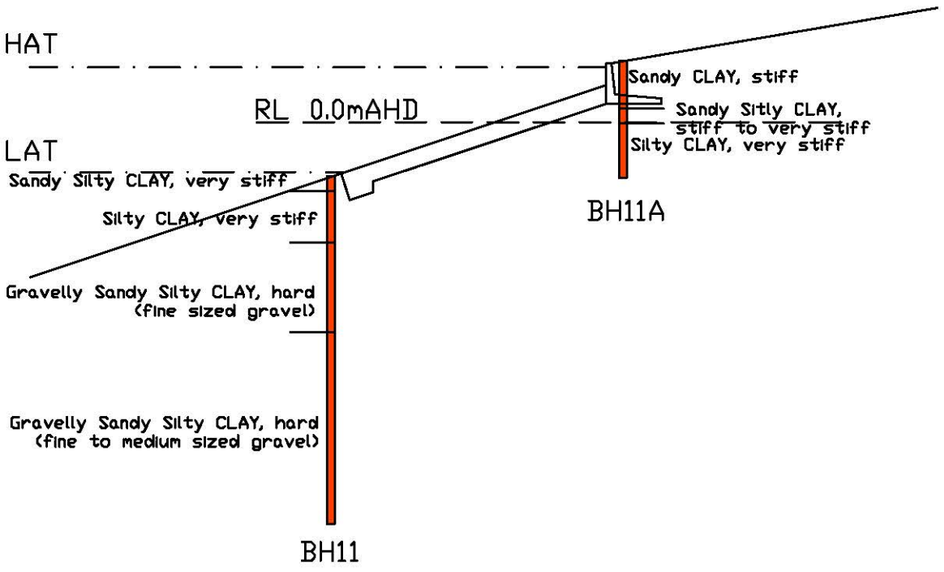


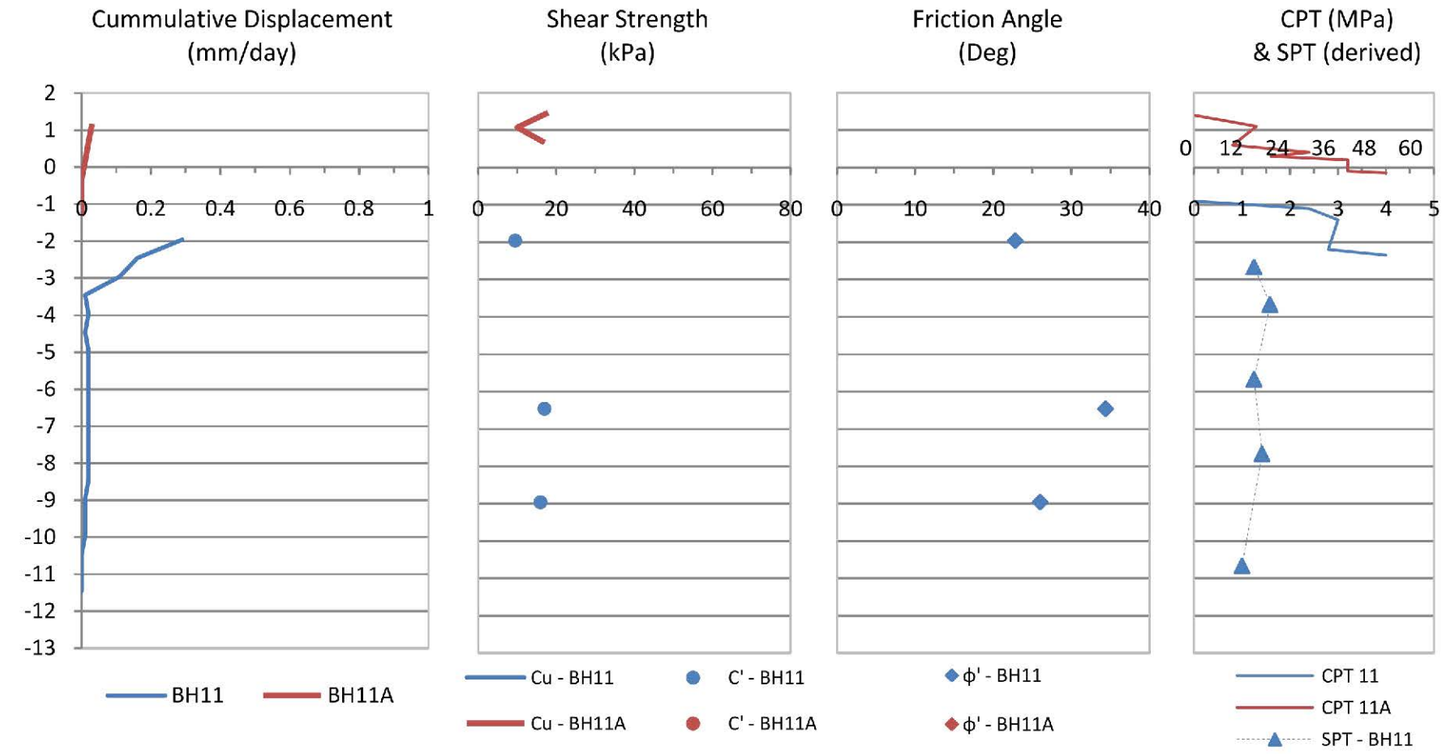




Record Length: BH10 = 39 days

NOTE: Approximate borehole locations shown above based on recorded RL. For location of CPT and dilatometer tests refer borehole locations in Soil Surveys reports.

# Test Location 11



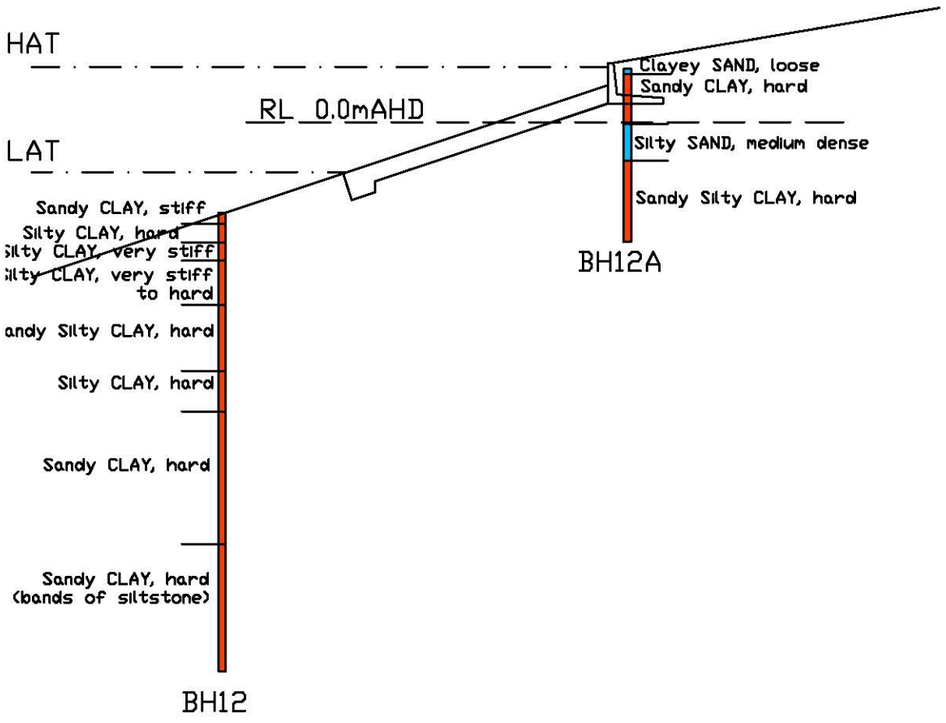



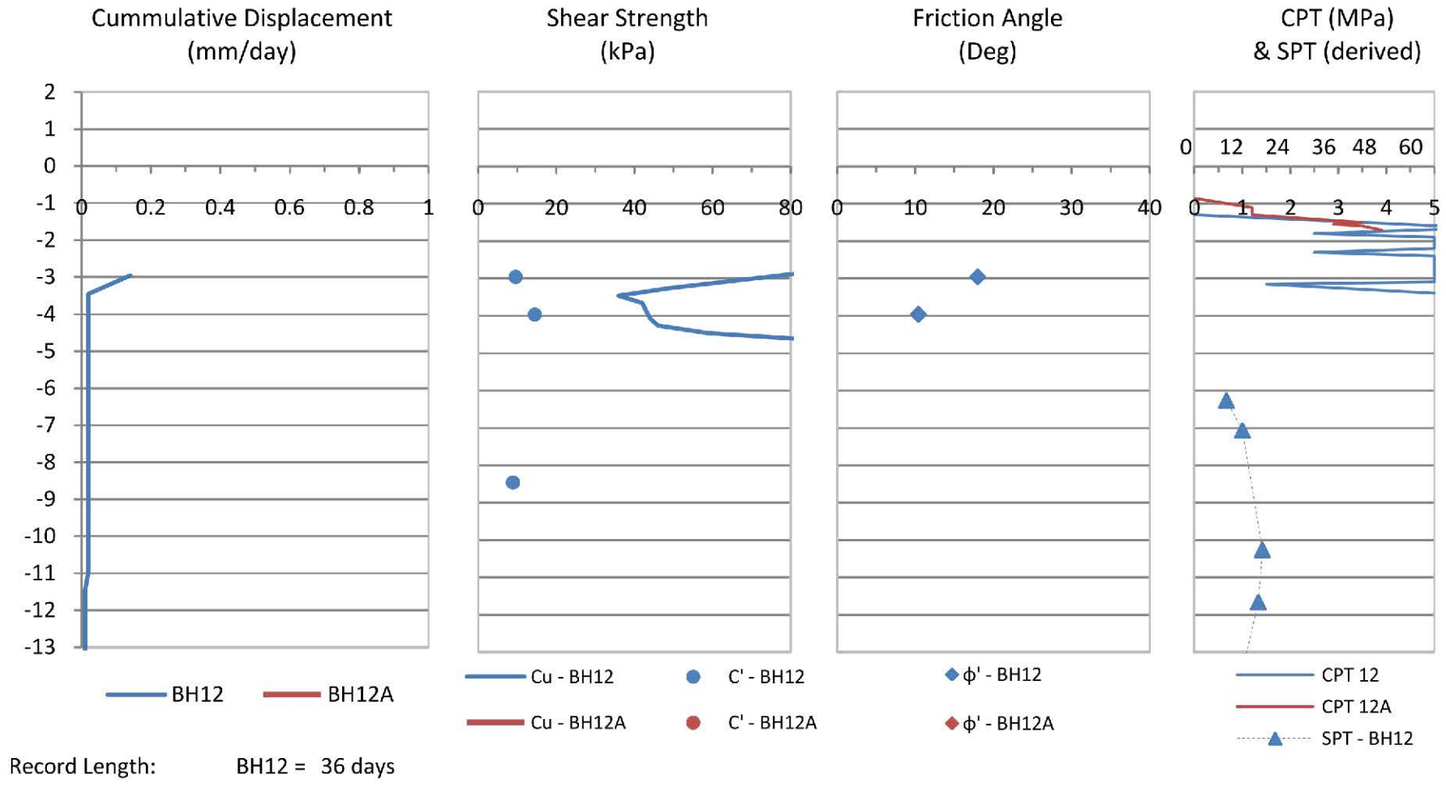

Record Length: BH11 = 37 days

BH11A = 37 days

NOTE: Approximate borehole locations shown above based on recorded RL. For location of CPT and dilatometer tests refer borehole locations in Soil Surveys reports.

# Test Location 12

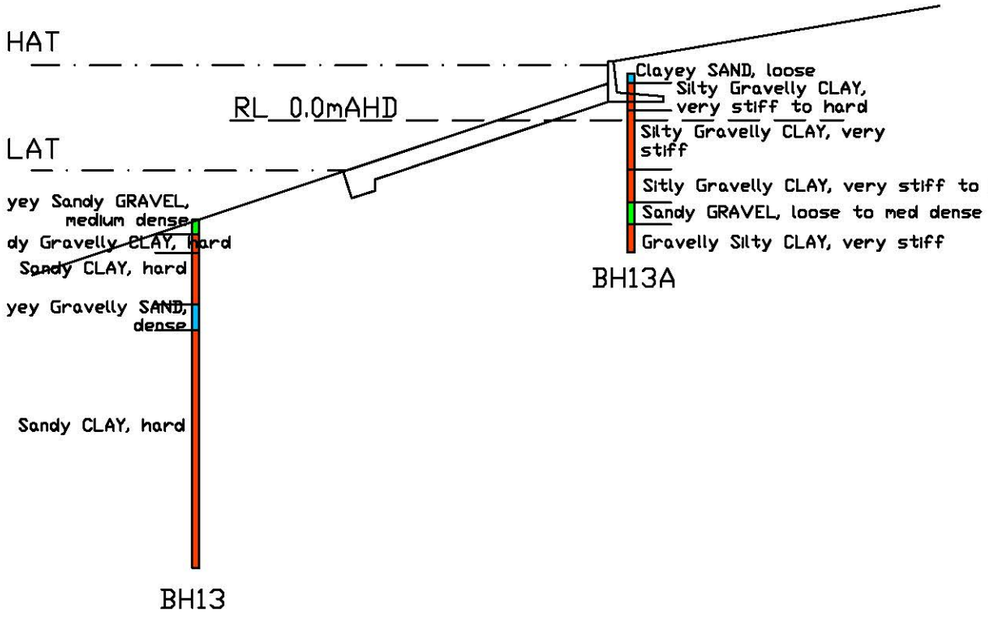


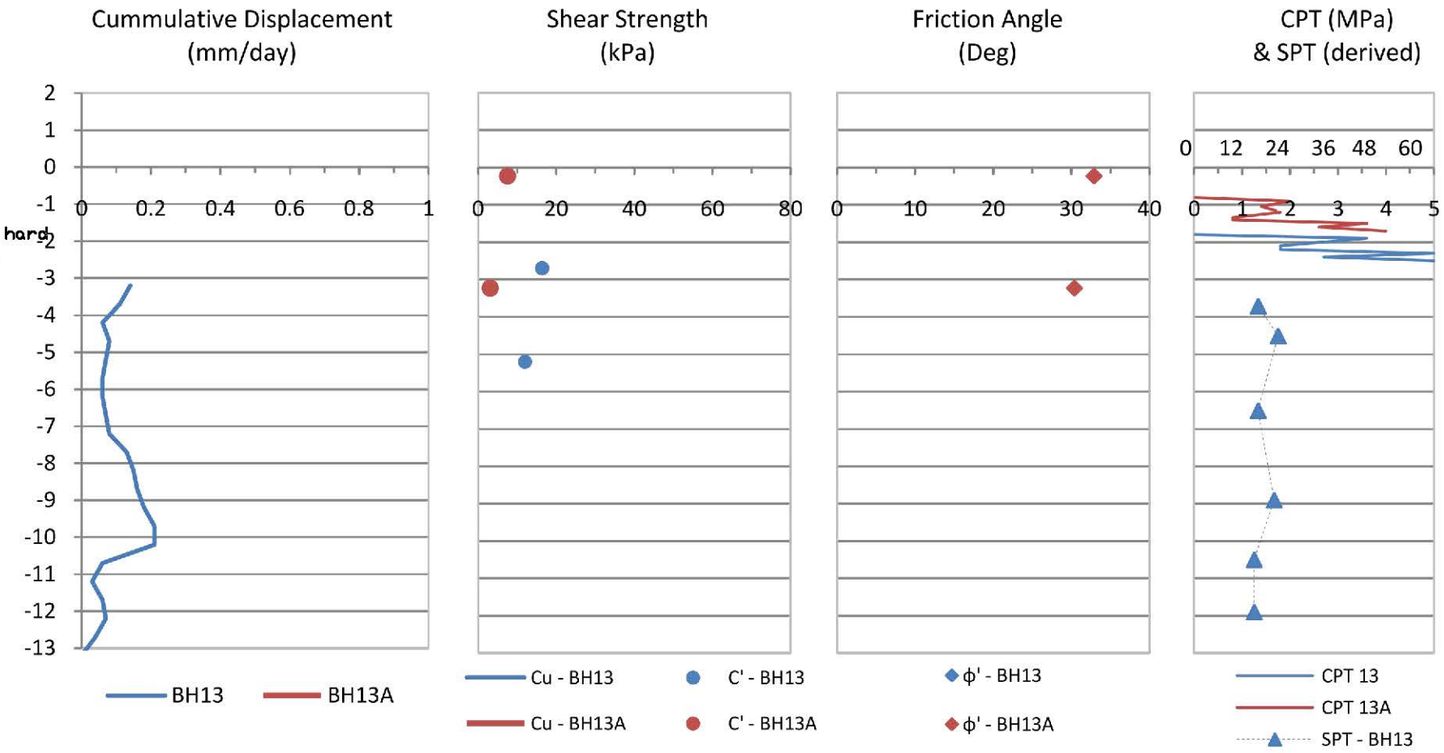




Record Length: BH12 = 36 days

NOTE: Approximate borehole locations shown above based on recorded RL. For location of CPT and dilatometer tests refer borehole locations in Soil Surveys reports.

# Test Location 13

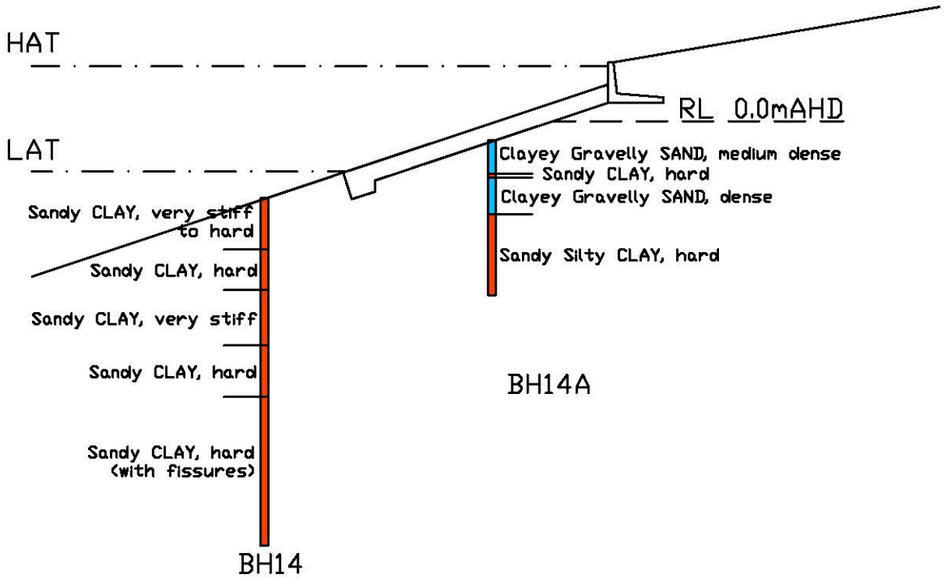


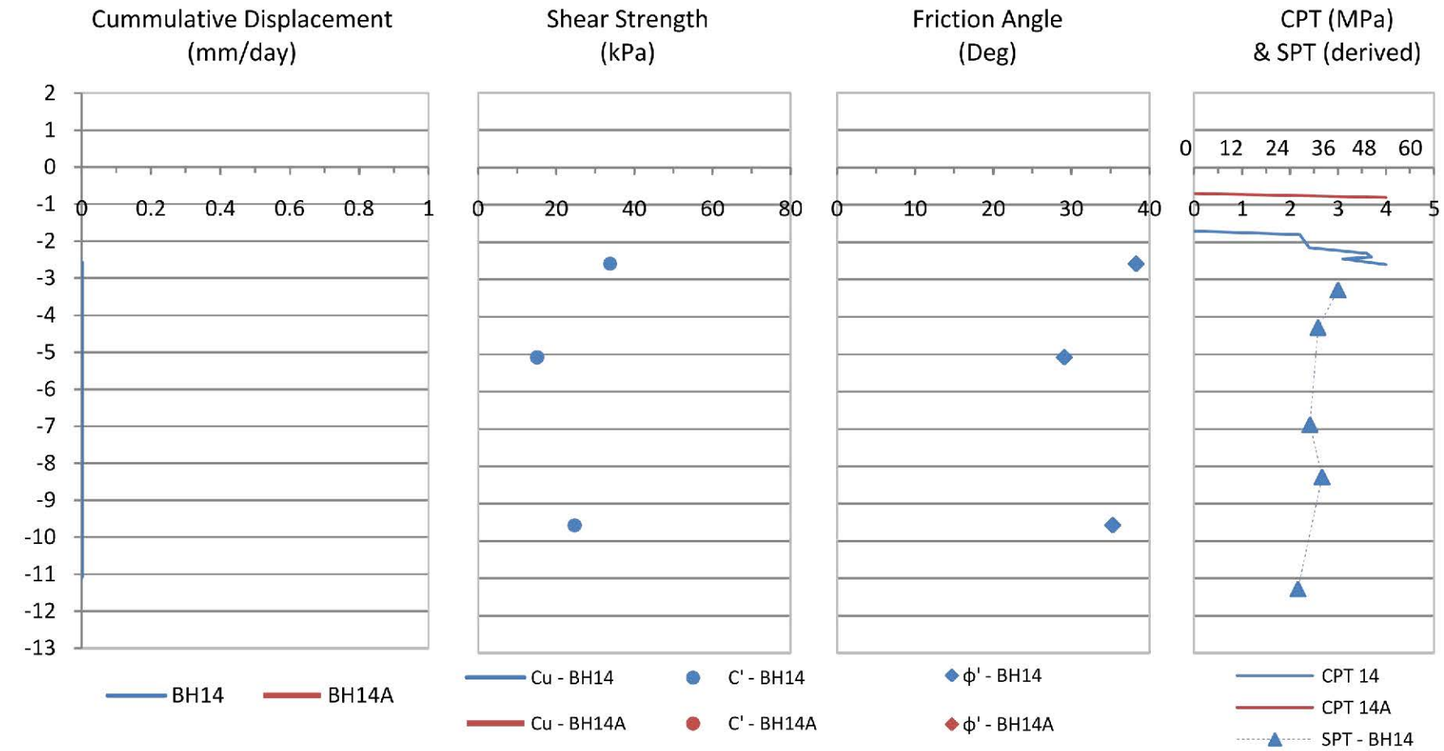




Record Length: BH13 = 37 days

NOTE: Approximate borehole locations shown above based on recorded RL. For location of CPT and dilatometer tests refer borehole locations in Soil Surveys reports.

# Test Location 14

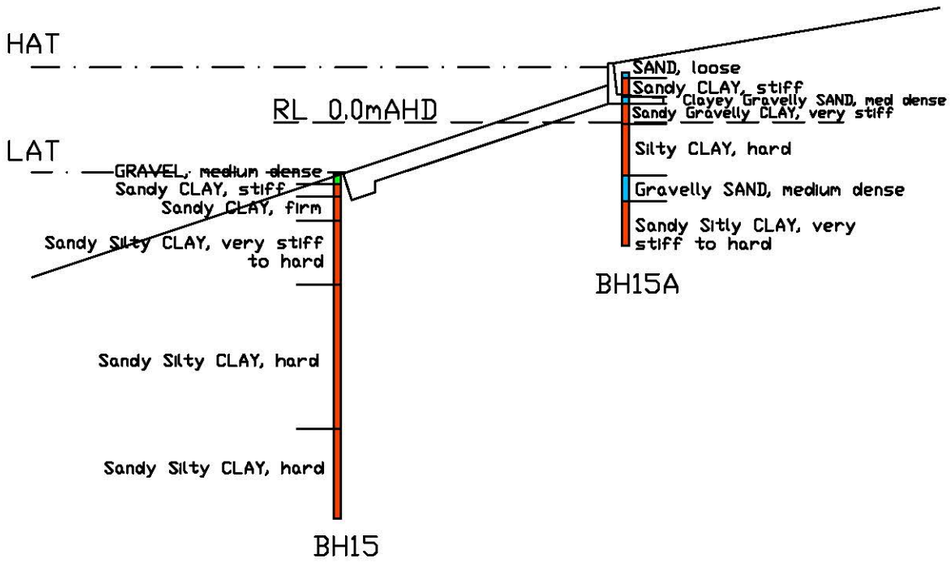


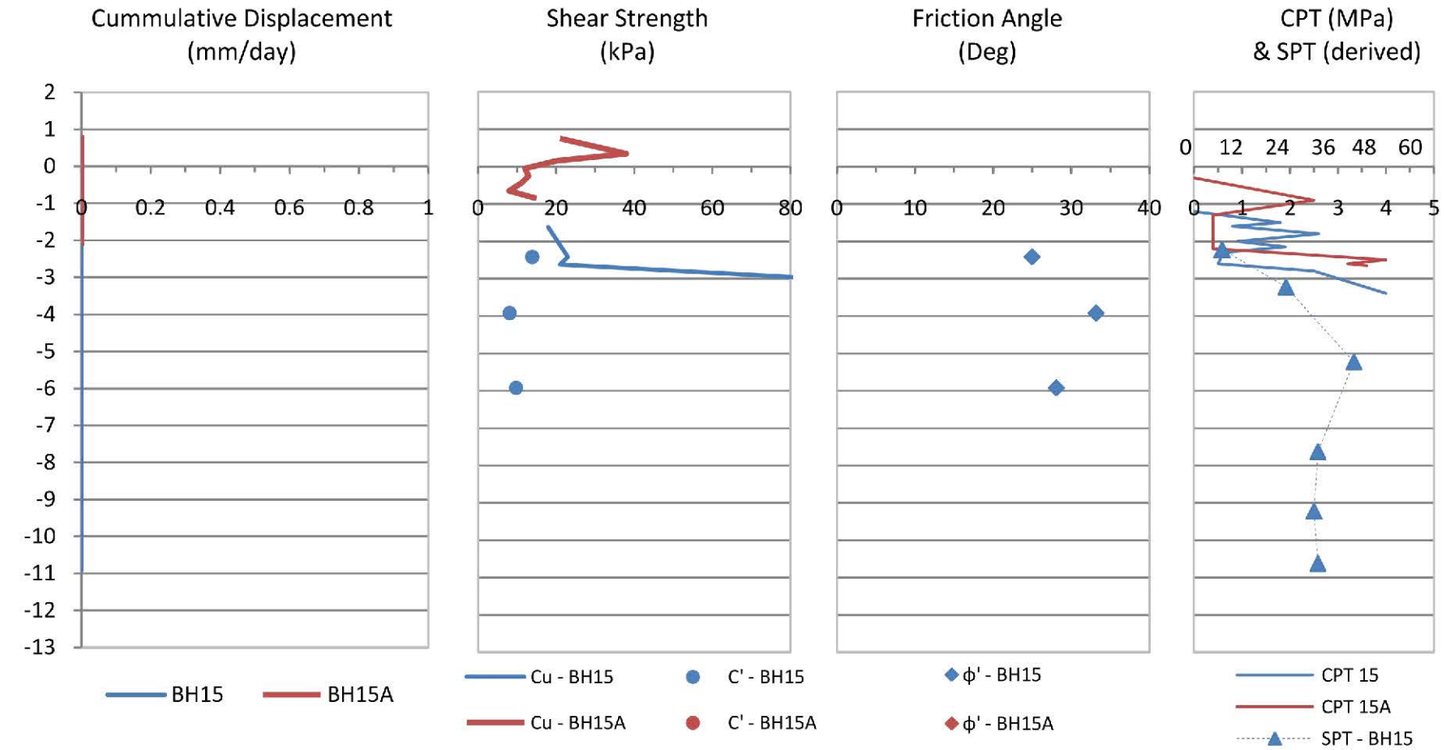




Record Length: BH14 = NOT RECORDED

NOTE: Approximate borehole locations shown above based on recorded RL. For location of CPT and dilatometer tests refer borehole locations in Soil Surveys reports.

# Test Location 15



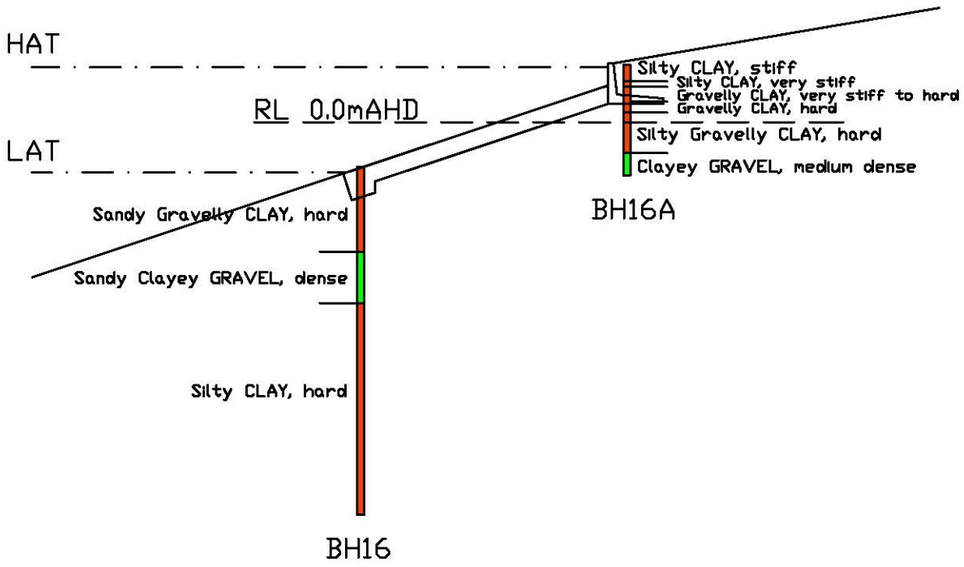



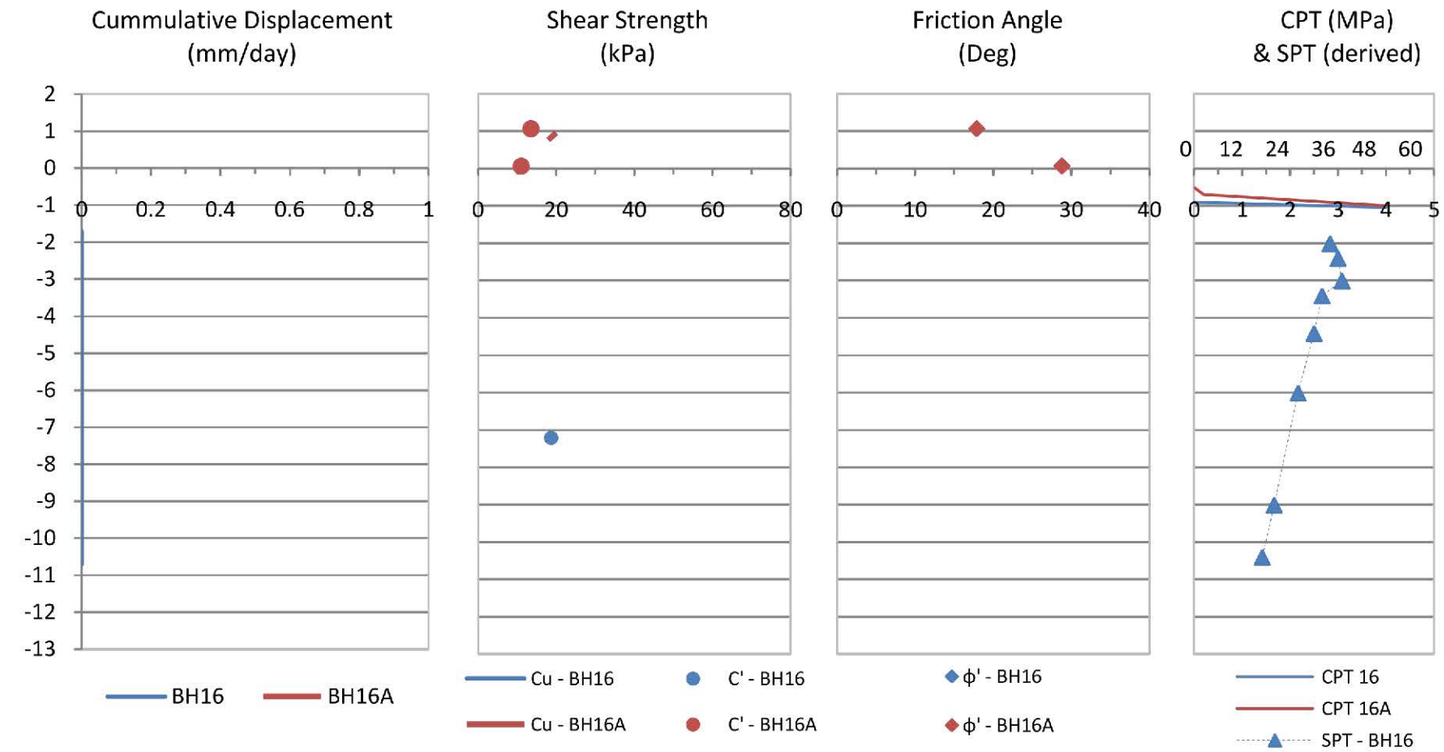

Record Length: BH15 = NOT RECORDED

BH15A = NOT RECORDED

NOTE: Approximate borehole locations shown above based on recorded RL. For location of CPT and dilatometer tests refer borehole locations in Soil Surveys reports.

# Test Location 16

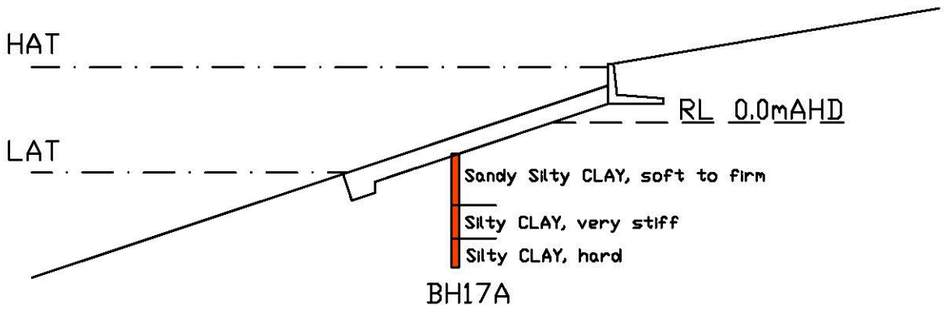


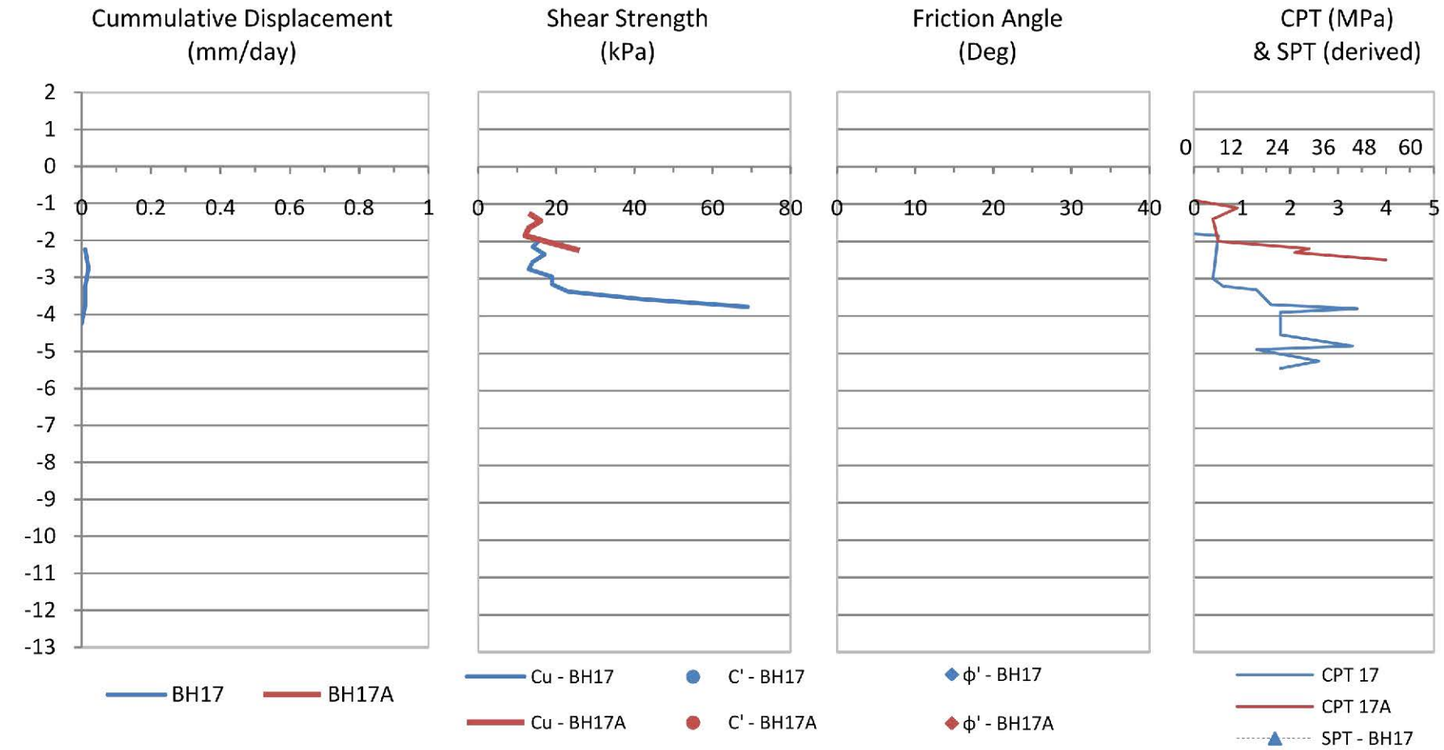




Record Length: BH16 = NOT RECORDED

NOTE: Approximate borehole locations shown above based on recorded RL. For location of CPT and dilatometer tests refer borehole locations in Soil Surveys reports.

# Test Location 17




Record Length: BH17 = 38 days

NOTE: Approximate borehole locations shown above based on recorded RL. For location of CPT and dilatometer tests refer borehole locations in Soil Surveys reports.

*Appendix C*

# TYPICAL CANAL BATTER CROSS SECTION

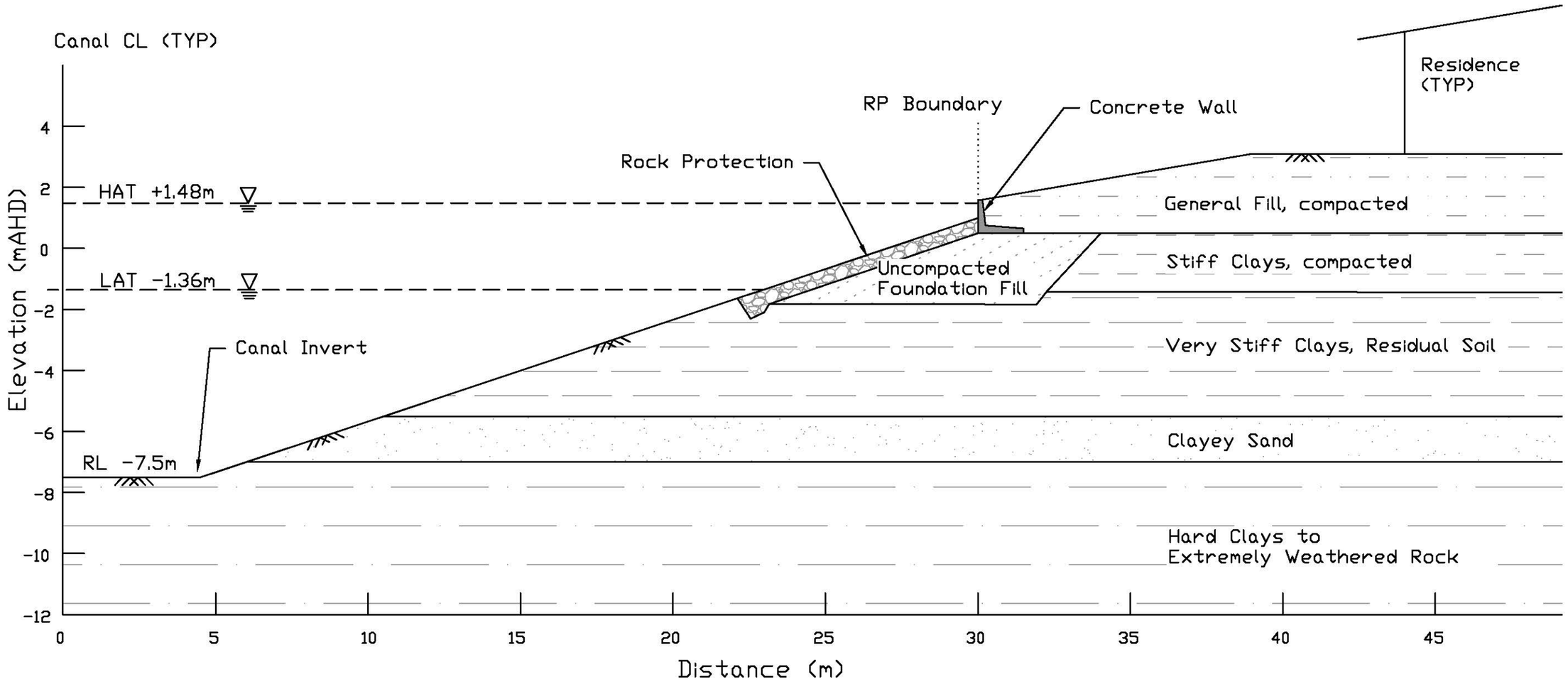
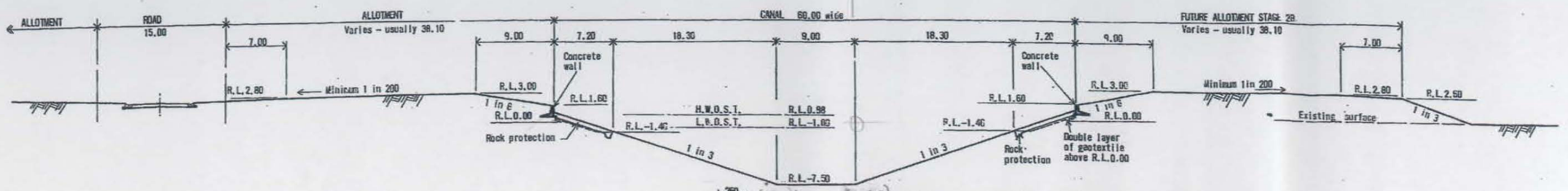



Figure 2.1 SIMPLIFIED SOIL PROFILE LAYOUT

Based on Construction Drawings, Soil Surveys Report and KBR Interpretation

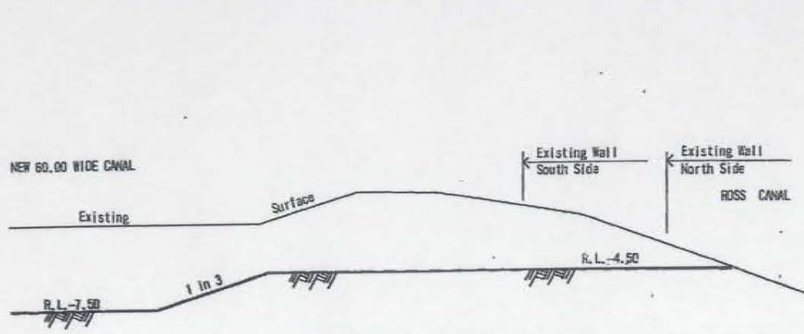
*Appendix D*

# HISTORICAL DRAWINGS



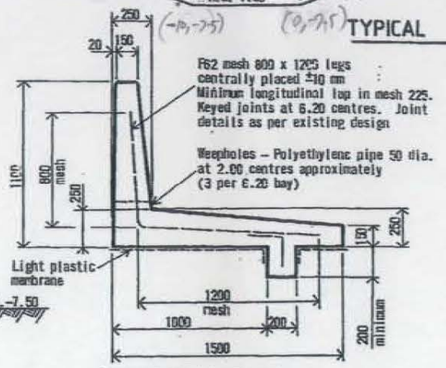

## TYPICAL SECTION THROUGH MAIN CANAL

SCALE: 1 : 250



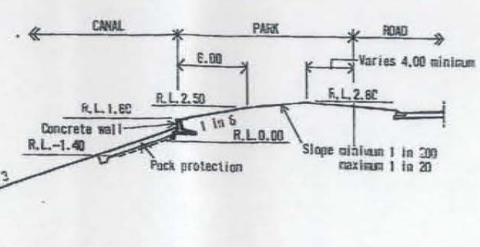

## SECTION ALONG CANAL ℄ AT JUNCTION WITH ROSS CANAL

SCALE: 1 : 250



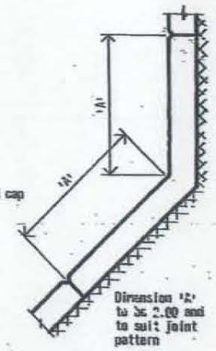

## REVETMENT TYPE 3

NOT TO SCALE



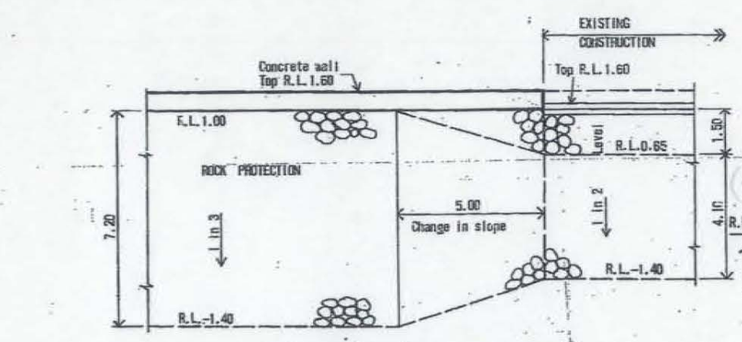

## SECTION THROUGH CANAL AT PARKS

SCALE: 1 : 250



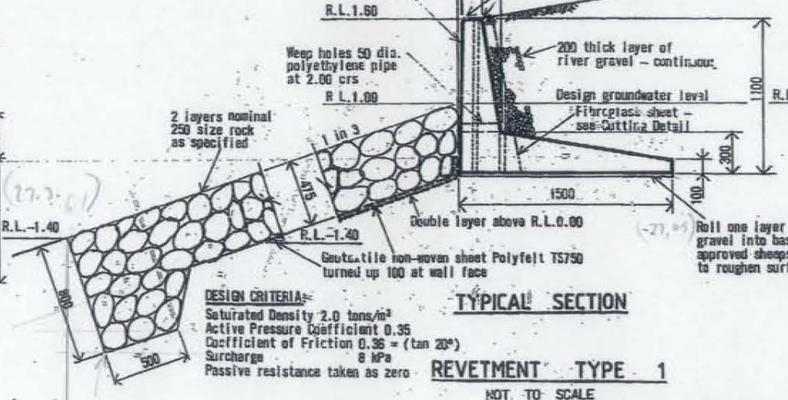

## REVETMENT TYPE 2

NOT TO SCALE




## REVETMENT PLAN AT JUNCTION WITH ROSS CANAL

SCALE: 1 : 100

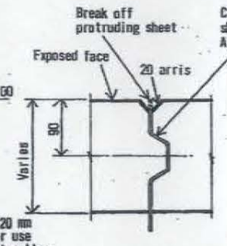



## TYPICAL SECTION

DESIGN CRITERIA:
Saturated Density 2.0 tons/m³
Active Pressure Coefficient 0.35
Coefficient of Friction 0.36 = (tan 20°)
Surcharge 8 kPa
Passive resistance taken as zero

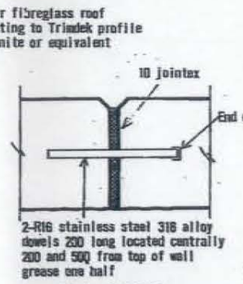
## REVETMENT TYPE 1

NOT TO SCALE




## CONTRACTION

6.20 crs maximum




## EXPANSION

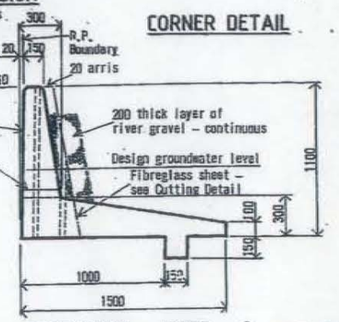
31.00 crs maximum

## JOINTS IN WALL

NOT TO SCALE




## CORNER DETAIL




## REVETMENT TYPE 2

NOT TO SCALE

## ROCK REVETMENT SPECIFICATION

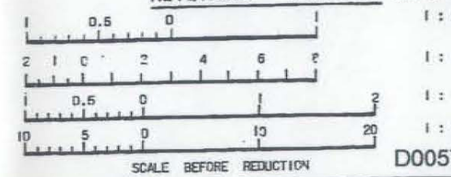
GRADING OF STONE (BASED ON REQUIRED D75 WEIGHT)

| | D100 | D85 | D75 | D50 | D15 | D0 |
|---|---|---|---|---|---|---|
| 'M' | 77.5 kg | 38 kg | 23.5 kg | 11.5 kg | 4.5 kg | 0.7 kg |
| 'D' | 385 mm | 300 mm | 260 mm | 200 mm | 150 mm | 80 mm |

Stone sizes based on specific weight of stone 2600 kg per cubic metre. D100, D85, D75 etc. are the sizes of sieve or screen openings passing 100%, 85%, 75% etc. of the material by weight. D50 is the average size.

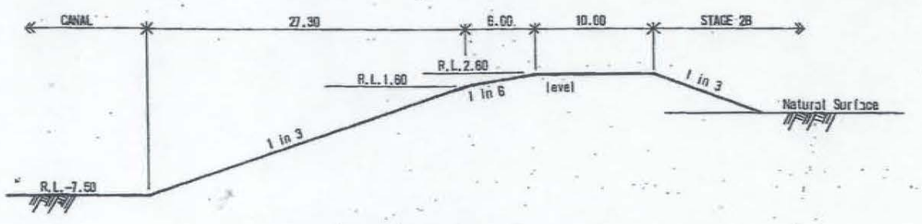
'M' Nominal unit armour mass (Based on specific gravity of rock 2.6 T/m³)
'D' Equivalent spherical diameter as described in Hudsons equation

Reference :– R.Y. Hudson 'Lab. Investigation of Rubble Mound Break Waters' A.M. Soc. Civil Eng. paper 2171 September 1954.



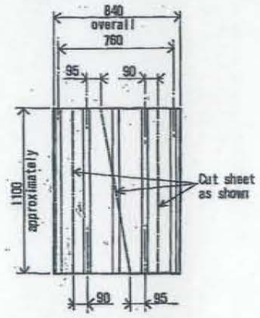

1 : 20
1 : 100
1 : 25
1 : 250

SCALE BEFORE REDUCTION




## SECTION ALONG CANAL ℄ AT TEMPORARY END

SCALE: 1 : 250




## CUTTING DETAIL FIBREGLASS SHEET

SCALE: 1 : 20

WORK AS EXECUTED
SUPERVISED: M.K.B. DRAWN: H.P. CHECKED:
PASSED: A.R.C.
DATE: 11/11/86

'WORK AS EXECUTED'
It is certified that the original drawing has been carefully compared with the works as constructed, as to line, level and dimensions, and has been suitably amended so as to constitute a true and correct record of the works as constructed.

Date of completion 11/11/86

Supervising Engineer

D005702

| DATE | REVISIONS | INIT. | Rv. |
|---|---|---|---|
| 16-10-1986 | Revetment Types 1 to 3 added | R.W.P. | E |
| 9-4-1986 | Note for preparation of base for concrete wall added | S.T.W. | D |
| 7-4-1986 | Geotextile position amended | S.T.W. | C |
| 27-3-1986 | Rock specification and thickness and wall joints amended – Cutting Detail added | S.T.W. | B |
| 14-3-1986 | Typical Section, Contraction and Expansion Joints amended and Corner Detail revised | S.T.W. | A |

DATUM A.H.D.

ASSOCIATED CONSULTANTS

CARDNO & DAVIES Australia Pty. Ltd.
CONSULTING CIVIL STRUCTURAL AND TRAFFIC ENGINEERS
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SURFERS PARADISE 4217 PHONE (075) 398333
TOWNSVILLE 4810 PHONE (077) 715092
PORT MORESBY (P.N.G.) PHONE 212264 MARGOCHYDORE 4558 Phone (074) 435555

DESIGNED: E.P.M. SCALE: AS SHOWN APPROVED:
DRAWN: B.J.G. REF: A1
CHECKED:

CIVIC PROJECTS (RABY BAY) PTY. LTD.
RABY BAY DEVELOPMENT – STAGES 2-5
TYPICAL CANAL SECTIONS AND REVETMENT DETAILS

DATE: 1 - 5 - 1985
DRAWING No: 956/1-37 Rv. E
R1-7134-24

February 2018

# Raby Bay canals
## Community update

## Updating residents of Raby Bay on issues relating to canals

### You pay – have your say

Redland City Council maintains the Raby Bay and Aquatic Paradise canals and the Sovereign Waters lake. Activities include dredging the waterways so they remain navigable and repairing the revetment walls. Those who own canal or lake waterfront property pay the most for maintenance but all ratepayers contribute to some degree through general rates.

Council is undertaking citywide community engagement to find the best way to fund and manage the maintenance required for our city's canals and lake, and wants to hear from you. A survey on the use of the canals and lake waterways and parks is available online at **yoursay.redland.qld.gov.au/canal-and-lake-waterways**

### Funding and managing our canal and lake estates into the future

Redland City Council's community consultation on the funding and maintenance of the city's canal and lake waterways and revetment walls is proceeding well.

#### Ratepayer association meetings

A series of meetings with canal and lake ratepayer associations, or ratepayers where no association exists, is well under way. Ratepayers from our city's canal and lake estates, and their representatives, have been involved in meetings with the consultants, Articulous Communications. At the conclusion of the consultation process, a report on the outcomes of these meetings will be presented to Council as it decides how the city's canals and lake infrastructure will be funded and managed into the future.

#### Citizens' Advisory Panel

A mini representation of the Redlands, the Citizens' Advisory Panel will present to Council a report of its suggestions on ways to fund and manage the maintenance activities at our canals and lake estates. The panel does not have a decision-making role. Rather, the panel is acting in an advisory capacity, with meetings staged over a period of time, giving panel members the time and information they need to become familiar with the history and issues of this complex matter. Following the panel process, market research will be undertaken to test the panel's suggestions against the wider community. This will be conducted by an independent, specialist market research firm and the findings, along with the Citizens' Advisory Panel's outcomes, will be made available in a public report.

The first meeting of the Citizens' Advisory Panel on the funding and management of Redlands' canals and lake estates was held on Saturday, December 2 and the second meeting on Saturday, January 20. Panellists have heard from canal residents, Council officers, engineering and legal experts, as well as a representative from the Local Government Association of Queensland. They also took a bus tour of the canal and lake estates.

Not all panel members were able to attend the first meeting, so another meeting to adequately inform the extra members was held on Friday, January 19. The panel members at that meeting received the same presentations as those at the meeting on December 2, with the exception of the bus tour. However, they viewed drone footage of the canal and lake estates, with an explanation of Council's maintenance activities given by a Council officer. The drone footage can be viewed on Council's website at: **yoursay.redland.qld.gov.au/canal-and-lake-waterways**

The consultation's timeframe allows for the sharing of key ideas and outcomes with the wider community – a process that Council is committed to. Council has not yet made a decision on how the canal and lake waterways will be funded and maintained into the future. As part of the decision-making process, Council will receive reports on the outcomes of the Citizens' Advisory Panel deliberations, the ratepayer and ratepayer association meetings and the wider community consultation, including the market research.

For further information on the community consultation, and answers to questions about the Citizens' Advisory Panel process, visit **yoursay.redland.qld.gov.au/canal-and-lake-waterways**

#### Citywide engagement

As Council is committed to holding a citywide conversation about the funding and maintenance of the city's canal and lake estates, opportunities to access further information are being provided to all community members. A series of pop-up stands has been held in shopping centres across the city and, in addition to information available online, Council is also holding information displays at the following locations:

- **Victoria Point Library – February 12 to 16**
- **Capalaba Library – February 19 to 23**

**For more information visit Council's website:**
**www.redland.qld.gov.au**

Redland CITY COUNCIL

## Maintenance activities

An aerial survey of Raby Bay was recently undertaken, and data analysis is under way.

Maintenance works, including mangrove removal, revetment wall rock restacks and some concrete repairs to revetment walls, are out to tender and Council anticipates work commencing soon.

The final trial site at Masthead Drive is scheduled to start soon, with the contractor finalising documents.

## Special charges

In the ongoing consultation, Council has been asked about the special charges levied to owners of canal and lakefront properties.

Section 94 of the *Local Government Regulation 2012* allows councils to make and levy a special charge on rateable land identified as enjoying special benefit to fund the maintenance, construction or renewal of that benefit. This regulation allows Council to collect money to pay for the significant works required to maintain the canal and lake walls and waterways, from those who get a special benefit from them.

Special charges are not unique to the Redlands – other councils also levy them – and, in Redland City, they are not unique to canal and lakefront properties. Further explanation of general rates for canal and lake waterfront properties and the special charge is available in the Q&A documents online at **yoursay.redland.qld.gov.au/canal-and-lake-waterways**

## Canal and lake refunds

Council announced in March last year it would refund unspent monies levied for canal and lake maintenance and repairs from July 1, 2011 to March 31, 2017.

Refunds commenced to current and former property owners in October 2017.

At the end of November 2017 Council had processed more than 94 per cent of the refunds. Further information and a list of properties to which outstanding refunds apply can be found at **yoursay.redland.qld.gov.au/canal-and-lake-waterways**

0020 2/18

**For more information visit Council's website:**
**www.redland.qld.gov.au**

Redland CITY COUNCIL

December 2017

# Raby Bay canals
## Community update

## Updating residents of Raby Bay on issues relating to canals

### Canal and lake refunds

A public meeting was held on 20 November 2017 at the Redland Performing Arts Centre, where BDO, the accounting company appointed to calculate and manage the refund, answered residents' questions in relation to refunds.

Reserve fund balances, calculation methodology and the refund process itself were some of the topics discussed, to clarify how the canal and lake levy refunds were calculated.

Questions asked included queries about the interest paid back to property owners and the link between the reserve balances and refund project.

BDO representatives and Council officers talked through the approach taken, explained how the refunds were generated and referred to the range of material on the website where all community members can review the process.

The distinction between the reserves and the refund project was explained. In some years Council spent more than was raised through the levies in that year, while in other years Council spent less. Based on Council's external legal and financial advice, Council refunded the unspent special charges.

Attendees also heard how Council chose to apply interest to the refund amounts that was significantly higher than the interest revenue earned by Council and transferred to the reserve over the six financial years, and higher than standard commercial rates of around 3 per cent. It was actually based on rates from the Queensland Law Society and ranged from 9% to 11%.

The vast majority of ratepayers have now received their individual refunds from Council. Council took the proactive step to refund the unspent charges, following a review of relevant legislation.

A copy of the BDO report, its summary and Q&A's from the meeting are on the Council's website. They are also available at the Cleveland Customer Contact Centre for those without easy access to a computer and/or the internet.

If you cannot access these online documents please call Council on: 07 3829 8999. It is also on Council's website: **www.redland.qld.gov.au**


**On 20 November, residents asked their refund queries of Council and BDO.**

### Have your say

Redland City Council maintains the canals at Raby Bay and Aquatic Paradise and the lake at Sovereign Waters. Activities include dredging the waterways so they remain navigable and repairing the revetment walls. Those who own canal or lake waterfront property pay the most for maintenance, however all ratepayers contribute to some degree through general rates.

Council is undertaking citywide community engagement to find the best way to manage and fund the maintenance required for our city's canals and lake.

Meetings have been held with ratepayer associations and estate ratepayers. Other community feedback opportunities will include open house displays, pop-up stands at local events, library displays, and telephone surveys. A survey on the use of the canals and lakes is available at **www.yoursay.redland.qld.gov.au/canal-and-lake-waterways**.

In addition, a Citizen's Advisory Panel is being coordinated and comprises 40 randomly selected and independently recruited residents from Redlands. The panel includes 10 canal and lakefront residents, 10 coastal residents, 10 island residents, and 10 from the broader ratepayer group.

The Panel will hear from experts and local residents, when they meet over the next few months until February 2018, to carry out detailed deliberations and make recommendations to Council.

For more details visit: **yoursay.redland.qld.gov.au**

Redland CITY COUNCIL

# Setbacks to canal revetment walls

Redland City Council has been working with canal residents regarding the application of the nine metre setback from revetment walls on waterfront properties. Discussions have centred around three broad areas: structural integrity, amenity, and access to revetment walls for maintenance. Local Councillors in the areas of Raby Bay and Sovereign Waters and Council officers have met with local residents during November to hear their concerns on these complex issues.

## Structural integrity

The Canal and Lakeside Structures Overlay (CLSO) came into effect as part of the Redlands Planning Scheme in March 2015. It is this overlay code which currently guides how revetment walls adjoining canals and lakes can be developed.

The overlay code triggers the requirement to obtain a planning approval where development is proposed within nine metres of a revetment wall. To demonstrate compliance with the code, engineering design certificates must be provided to Council to ensure that any development within that zone will not cause any movement or damage to the existing revetment wall and canal frontage.

However, Council was advised by state government that the Draft Redland City Plan 2015 could no longer regulate the impacts of development on the structural integrity of revetment walls as this matter is covered by the State Building Assessment Provisions. Instead, these impacts will be assessed as part of a building application, with an advisory note to certifiers in the Draft City Plan.

At this time Council continues to lobby the state government to specifically require the protection of the structural integrity of revetment walls in its building provisions. Depending on the response Council receives from state government, potential amendments to the draft City Plan may need to be further considered.

## Amenity

Protecting the amenity of the canals (where new development is proposed within nine metres of a revetment wall) is also being discussed with residents, particularly the impacts on vistas and view lines.

The existing provisions contained within the Canal and Lakeside Structures Overlay and the provisions in the Draft Redland City Plan 2015 specifically protect the amenity of the canals. For proposed development in Raby Bay, Aquatic Paradise and Sovereign Waters, the provisions ensure that the amenity of adjoining premises is maintained by:

- ensuring consistency with the setbacks of adjoining buildings and structures, and
- avoiding dominating or detracting from the built form, waterway and landscape setting of the location.

Council is considering stringent planning controls are will seek residents input into any changes to the provisions..

## Access for maintenance

Council is currently evaluating the best way to address concerns about structures overhanging revetment walls, and the potential for such development to affect the costs associated with repair and maintenance activities.

0012I 11/17

**For more information visit Council's website on www.redland.qld.gov.au**

Redland CITY COUNCIL

28 March 2013

Redland City Council
Cnr Bloomfield & Middle Streets
Cleveland
Qld 4163

Our ref: 41/25756
445500
Your ref: T-1502-11/12-RCC

Attn. Mr. Rodney Powell
By email (Rodney.Powell@redland.qld.gov.au) and post

Dear Sir

**Peer Review of Raby Bay Geotechnical Study**

## 1 Introduction

We refer to our proposal to Redland City Council (RCC) dated 29 October 2012 (Ref: 41/09157/60) in relation to an Independent Review of Proposed Works (by consultants KBR) for stabilisation of canal slopes at Raby Bay, Cleveland. This letter report presents the findings of GHD's review of the provided information and confirms the advices provided to you in telecons of 11 and 17 February 2013.

It should be noted that GHD has not been referenced in any of the documents reviewed, has no corporate record of involvement in the Raby Bay development (before or after) relating to canal bank stability, and the people participating in this review have also not been involved.

GHD therefore fulfils RCC's requirement for independence.

## 2 Material reviewed

The reference list attached presents a bibliography of the documents provided for review. It should be noted that as the development initiated in the early 1980s and documentation has spanned some 30 years it is inevitable that further information exists which has not formed part of this review and, if it did still exist, may add greater clarity to some of the issues and uncertainties identified. GHD has therefore had to rely on the documents provided, and where these refer to other documents, on the reasonableness of the interpretations and comments therein. Further, GHD's exposure to site and ground conditions is a limited one-off site visit in January 2013. Whilst the above are limitations to this review, GHD considers that the issues identified are relevant for the purposes here. Were new information specifically targeted to the issues raised to become available, this could affect GHD's findings. Please note GHD's scope and limitations in the relevant Appendix to this report.

## 3 Brief history

This canal development commenced some 30 years with Stage 1 being developed in the early 1980s and Stage 15 completed in 1995/96. Sherwood Geotechnical and Research Services (SGRS) in their 1995 Report (number 95006-1) present various information on the nature and staging/timing of the

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development, the various design consultants involved to that time, development of canal bank failures, and specialist advice up to 1995 and this is not repeated here. From our review the following succinct summary paints a general picture of the last 30 years:

- Development of Stage 1 commenced in the early 1980s and progressed to completion of Stage 15 in late 1995/early 1996 – the residential development is largely located in a tidal foreshore.
- The canals were formed using conventional mass earthworks techniques (cut and fill) with the sea held back with bunding (understood that earthworks were executed inside the tidal zone within a bunded area) and rainfall and seepage presumably were managed by drainage to and pumping from sumps.
- Materials won from the canal excavations were used as allotment filling for creation of house lots.
- Whilst canals were designed for a typical bed level of RL-3.5 (presumably to satisfy navigation requirements) the option to deepen to RL-7.5 was also evident in the designs.
- A bathymetric survey undertaken in mid-1995 indicated that most canals have been deepened to around RL-6 to RL-7 (even reaching RL-8 in parts) – these depths have also been confirmed for later stages when individual slips in various stages were investigated.
- At some locations, localised deepening for additional borrow has been reported, sometimes backfilled with waste fill.
- Failures of canal batters occurred at the outset of the development i.e. from Stage 1 onwards and have continued through most if not all stages.
- The 1995 SGRS report categorised the various failures known at that time and reported on a predictive exercise in order for council to reach agreement with the Developer on hand-over of responsibility for the canals.
- The early failures were considered to be primarily caused by the presence of insitu clays with low strength defects (termed for consistency with prior reports as “fissured” clays) in the cut profile – the 1995 SGRS report concluded that large-scale failure caused by sheared (i.e. fissured) clay occurred during or shortly following construction and should not occur following canal filling, particularly as appropriate remedial measures were implemented during and after Stage 1 once the problem was identified. SGRS also raised and discussed the issue of fill quality leading to a variety of failure types and were of the view that research into this aspect was required.
- SGRS also advised that of the failure causes they categorised by frequency at that time, the “U”ncertain category frequencies generally outweighed by a considerable margin the frequencies of “L”ot fill and “F”issured clay occurrences.
- It is understood that on the basis of the 1995 SGRS advices RCC reached agreement with the Developer on a fixed commercial arrangement to address predicted ongoing failures.
- It should be noted that the as-constructed (as-con) drawings sighted indicate that from Stage 6 onwards an earthworks preparation detail for removal of the insitu “marine layer” was employed extending to the canal batter, and from Stage 8 onwards (Stage 7 information not sighted) a detail for dealing with “fissured clay” was depicted – the as-con drawings sighted for all stages did not show the location, details and extent of where these treatments were deployed.

- It is understood that further failures occurred from 1995 to 1998, repairs for which are understood to have reached or exceeded the available funds set aside for ongoing repairs.
- In 1998/99 SGRS were engaged for several tasks and advised that fissured clay had only been a cause of short term failure during construction, areas where there may still have been some remnant insitu fissured clay were not considered to be at risk of future instability, all fissured clay and immediate wetting-related lot fill failures had occurred and what remained was the time uncertainty of time-dependent fill failure in the lot fill ; SGRS presented sketches of types of localised failure involving the fill in the immediate vicinity of the localised splash zone rock armour (see Figure 2 attached).
- In 1999 SGRS reported their research and development activities on the fill in relation to bank stability and concluded that, beyond reasonable doubt that the weakening and failure of canal banks was directly linked to interactions of water with clay fill that was not sufficiently compacted.
- Since 1995 it is evident that failures have been ongoing in various locations and have manifested in a variety of distress ranging from differential settlement/movement induced cracking of the concrete revetment wall, failure of rip-rap, ranging through to larger scale slope failure such as at Lots 841-844 and apparently elsewhere – these have been investigated by a variety of consultants.
- From 1995 to 2012 various investigations involving drilling have been undertaken, including the installation of inclinometers and extensometers at Lot 209 in 1999, 17 inclinometers (by Soil Surveys) in Stages 4-9 and some in what appears to be Lot 809/810(?) in 2012 – extensive DCP testing and some CPT, Dilatometer and Vane Shear testing has been carried out in the materials beneath the rock armour - significant laboratory testing has also been undertaken.
- In January 2009 KBR undertook a Desktop Review of previous documents and concluded that all canal bank failures appear to be slip circle failures with failures either in fill and confined to the upper part of the batter, or through the underlying fissured clays, with stability analysis covering these postulated failure mechanisms.
- In 2012 KBR, based on the Soil Surveys investigation in Stages 4-9 together with their interpretation of inclinometer monitoring, concluded that the information suggested that the soil slip is occurring in a shallow zone (of fill) underneath the rock protection and concrete wall – they support this with revised stability analyses where the presence of insitu fissured clays has been omitted and which inevitably show that theoretically, deeper failures aren't relevant and shallow failures in fill beneath the rock armour are the issue, coupled with a suggested technique for associated slope stabilisation.
- As a result of ongoing failures and the various advices RCC has received over the years, RCC in late 2012 engaged GHD to undertake an independent review of provided information and KBR's suggested slope stabilisation works.

## 4 Comments on site and marine earthworks

Original design documentation (plans and specifications) were not available for review – available as-con plans appear to be design drawings with minor or no alterations, signed-off as-constructed.

In the early Stages 1-5, the canal bank was typically shown as predominantly in cut although fill was required to reach finished allotment level of around RL+3.5. The change in designer from Cardno & Davies to Sinclair Knight in Stage 6 brought greater detail around surface preparation prior to placement of canal bank filling over natural ground and from the Stage 8 drawings (Stage 7 not sighted) included specific treatment for fissured clays in the foundation. With an indicated design requirement for removal of near surface marine sediments to a maximum of 1.5 m depth from Stage 8 onwards, and an unknown amount from Stage 1-7, coupled with a natural surface typically in the range of RL+1.5 to RL-1.0, it is unlikely that the prepared surface for fill placement would have been deeper than RL-2.5 and typically expected to be higher. Coupled with a canal floor of around RL-6 to -7 or so at many locations, it can be reasonably expected that there is 3.5+ m of exposed insitu cut face at many locations, excepting when remove and replace repairs were executed during construction, wherever these might have occurred.

Whilst in 1995 SGRS present their Figure 17 showing mass replacement of cut material where ordered, and also qualify this as being generic and varying widely at specific sites, it is unclear what the typical geometry of excavation and replacement was actually used prior to Stage 8. For example, Coffey in 1984 when dealing with a deeper failure at the easternmost finger in Stage 1, required backfilling of the canal from RL-6 to RL-3.5 and excavation of the head of the slip to near the bottom of the stone pitching i.e. about RL-1.4 and replacement with compacted fill. On the face of it around 2 m of slipped material remained untouched, whereas repair of Lots 81/82 indicated significant rockfill replacement to RL-4.50.

Based on GHD's experience with geotechnics and earthworks in both terrestrial and marine environments, the following comments are relevant:

- The insitu stiff and residual clays at this site are likely over-consolidated with significant locked-in horizontal stresses which are relieved on excavation.
- It is common practice to ignore for engineering purposes the near surface 0.5-1 m of soil like materials permanently submerged due to unrestrained swelling and softening.
- To ensure compaction to the full outside sloping edge of placed fill would require placement over-width and cutting back the lesser compacted edge material where plant won't fully traverse for safety.
- In order to achieve full width fill density where fill overlies a cut batter and the fill material is won from forming the cuts (where borrow is short), a well-planned and coordinated earthworks operation is required.
- It is conceivable, for reasons of cost and profitability pressures associated with development activities, that identification, excavation and replacement of intact fissured materials, repairs of failures, and exacting control of earthworks operations could have been managed such that only what was needed at the immediate time (or thought to be needed) was implemented and no more. Noting that control of the earthworks operation was in the hands of the contractor and likely that the designer's input and specialist consultants were only required to assist when called for.

There is good evidence presented that the fills near surface within the canal banks are low strength. This is to be expected to a limited depth for submerged and unprotected earthen materials, and/or to a greater extent if there wasn't careful attention paid to construction sequencing to ensure proper full width compaction at the outset.

It is also clear that, aside from repaired areas or areas where fissured clays were positively identified during construction of Stages 8-15 and treated as per the design, there is a substantial exposed cut batter forming the canal banks and supporting the placed fill at many locations. Even for the shallow canals in Stages 8, 12 and 13 (bed RL~-3.7 to -4), some exposure of insitu material in cut batters can be expected. The likelihood of exposed cut batters is further supported by the Earthtech 1997 investigation of the Tasman and Magellan Canal slips where some of the developed cross sections indicated bare cut slopes and where fill was thought to be present, a thin veneer paralleling the slopes is inferred.

The as-con drawings however lack the necessary detail (which would have been reasonably expected to have been included) to identify where fissured clays were identified and treated in the canal floor and cut batters, which is a significant shortcoming in managing the asset now.

Indeed, more recent failures have identified fissured clays which clearly were not identified and treated during the original construction which indicates that the method of identification was not as comprehensive as necessary and contrasting with SGRS's 1995 conclusion that appropriate remedial measures had been introduced (perhaps in design from Stage 8 onwards but not necessarily executed in construction) and that the risk of future sheared clay failure was not material.

## 5 Nature of the reported failures

In the information reviewed there does not appear to be one location where the actual failure surface has been investigated and positively identified. Typically, failure surfaces have been postulated based on (often) circular failure surfaces generated from stability analyses. Whist SGRS in 1995 categorised the failures as caused by "L"ot fill, "F"issured clays or "U"ncertain, the information on actual proven failure surfaces was not available in the information reviewed by GHD. Therefore, the robustness of the information leading to the SGRS categories could not be determined.

Further, the contribution of fissured clays to the more recent failures is virtually impossible to determine from the information reviewed. Due to their nature and occurrence, unless an investigation was specifically targeted at identifying fissures, it is the author's experience that they can be easily missed. Limiting geotechnical investigation budgets, constraints due the investigation technique (e.g. excavation and mapping not feasible under water and therefore rely on small scale drilling), sparseness of sampling and inexperienced practitioners can all conspire against finding fissures and hence leading to the conclusion that they are not present. Experience informs that fissures can be difficult to find with small size boreholes, even more so with infrequent sampling spacing. With sampling spacing often up to 1.5 m a zone of fissures could easily be missed. Another way of looking at this issue is, if fissures are positively found recognising the constraints above, then it is likely that they are prevalent notwithstanding material variability. Table 1 below summarises some of the investigation locations post 1995 where fissures have

been found in the zone relevant and/or considered by the consultants to be significant with respect to bank stability.

**Table 1 Investigation locations since 1995 where fissured clays identified**

| Date | Stage | Lot #/Canal | BH # | Source |
|---|---|---|---|---|
| September 1997 | 3-7 | Tasman and Magellan | BHs 105, 109, 111, 112 | Earthtech |
| September 1997 | 3/4? | 226 | BH 1 | Douglas |
| November 1998 | 15 | 837 to 839 | TP 101 | Earthtech |
| October 2000 | 6 | 362 to 364 | Dwg #3 | Earthtech |
| September 2006 | 15 | 841 to 844 | BH 787 | Golder |
| June 2007 | 8 | 340 and 447 | BH 1 | Morrison |

Figure 1 attached presents a simple and practical depiction of the broad subsurface profile at the development and is a useful contextual reference when considering further comments relating to ground conditions. Of course, variability (both natural and man-made) cannot be depicted in such a simplified model, and it has been noted in the literature reviewed that variability can be extreme and over very short distances.

In April 2012 Soil Surveys report on the installation of 17 inclinometers spread across Stages 4 to 9, with a view to measuring movements of the bank. Monitoring results to end of August 2012 were also reported by Soil Surveys with various trends identified. GHD has reviewed the monitoring data and is unable to identify any reliable trends since:

- Most movements are small and near the accuracy of reading for a high quality installation.
- What appear to be outward bank movement trends are often reversed.
- Movements along the alignment of the banks is often the same order of magnitude or larger than bank movements towards the canal.
- Most movements are in the upper metre or so which raises the question of the security of the inclinometer casing installation through the armour rock.
- Some movements are into the bank.

Given some 30 years of investigations into the slips at Raby Bay it is surprising that none of the failure investigations available for this review definitively identified the actual insitu failure surface. Many of the stability assessments have however thought it appropriate to look at deeper seated failures passing through natural materials likely weakened by fissures. The presence of near surface fill material in a low strength state would also be a contributor as would softening of overconsolidated insitu clayey materials either through unrestrained swelling and/or shear strain localisation on stress relief and pore pressure equilibration with time. Most recent failures appear reasonably large scale implying deeper failures into natural material.

In reference to the scale of slips, GHD's use of the terms "large", "deep" and their derivatives refer to failures that of their observable scale and/or from the factual and/or anecdotal evidence provided either in reports or advised by RCC, indicate that failure is not specifically constrained to a small zone of near surface fill and extends to the contact with or more likely into natural (potentially if not likely fissured/sheared/weakened) clays. That is, the natural clays play a role. GHD is aware of anecdotal evidence that KBR have, in their limited exposure to the site (understood to be 2008 to present), considered failures exclusively in fill to be the cause. As subsequently discussed, factual information was not presented in sufficient detail for GHD to meaningfully independently review.

Where the scale of "failure" is lesser e.g. unacceptable differential or total settlements that have not progressed to collapse, there are a number of possible scenarios including creep of fill, creep of softened and /or fissured clays, etc. as it is to be expected that the canal banks have a low Factor of Safety (FoS) discussed as follows:

- Unloading (by excavation) of overconsolidated fissured clays results in depressed pore pressures in saturated materials, time-dependent recovery of these followed by strain localisation and strain softening to at or near the fully softened condition (or known as critical state in contemporary soil mechanics) – for the high plasticity clays here this would be a long term effective frictional strength component phi' of low 20°'s and negligible cohesive intercept. Poorly compacted fills prone to collapse on inundation and possible swelling could also be expected to have a frictional component in the low 20°'s.
- With a slope of circa 18° (1V on 3H) an approximate long term FoS in the range of 1.1 to 1.4 could be expected for translational slips in material with phi' of 20°-25°.
- It is well understood that at these FoS values there will be portions of a "failure" surface at limiting conditions (i.e. FoS ~1) and therefore ongoing creep and strain softening can be expected where conditions prevail.
- For collapse to occur (with hydrostatic pore pressures) a frictional strength component of less than 18° is required indicating that in some part of the failure surface, residual or near residual conditions must have been reached, either movement induced and/or the presence and interaction of low strength fissures.

Such a model provides one plausible explanation for the deep seated failure at Lot #843 (verified by hydrographical survey), which occurred more than 10 years after completion. It also provides one plausible explanation where RCC have seen failures/movement continuing below structural repairs effected near the revetment wall (at Lot # 812) where RCC advise that stabilisation in 2010 of the fill above the natural materials did not fully arrest lower bank movements pointing to deeper issues likely in the natural materials.

This is also consistent with RCC's comments that often, once a failure initiates, it progresses along the bank affecting other properties i.e. reflecting a low FoS situation where, once lateral restraint is reduced by a failure, adjacent areas are triggered.

Whilst the above points to the insitu fissured clays being a key contributor to distress, this doesn't remove the issue of poorly compacted reactive fill playing a role, nor the absence of a sacrificial surficial zone of submerged material that would normally be allowed for submerged and unprotected soil-like

materials. The ultimate difficulty for this review was the absence of definitive and objective information on actual failure surfaces and mechanisms. Rather, most of the assessments undertaken post SGRS were influenced in their assessments and choice of parameters for analyses by the earlier reports and seemed to rely on their experience and theoretical analyses to justify the failures observed and remediation design.

## 6 KBR assessment

In January 2009 KBR reported on their Desktop Review (of prior information) and Pre-feasibility Study and concluded that all canal bank failures appear to be slip circle failures. As GHD could not find one example of where the actual failure surface was physically identified and shape defined, this appears to be a speculative conclusion, even though it may reflect almost all of the historical theoretical analyses.

The parameters adopted for stability analyses are largely derived from the previous work reviewed and, whilst further investigation and testing work was recommended, the interpretations of others have largely been relied upon. There are a number of issues with the KBR stability analysis as follows:

- It is not clear where the ground model is derived from and how it reflects the changing approach to dealing with fissured clays as the development progressed.
- The analytical models do not name or show the properties of each of the typically 6 ground profile layers making it difficult to know exactly what has been analysed.
- The analyses seem to use residual strengths for the natural and fill clay layers above the canal floor – residual properties apply post failure, not prior, and it is inconceivable that residual properties apply to all parts of the failure surface in these layers given the structural orientation and surficial properties of fissures.
- The analyses adopt the residual (post failure) strength for fissured clays, but applies it to fills – this is considered excessively conservative for fill materials as they are unlikely to be extensively pre-sheared insitu to the extent of being anywhere near residual – further most of the fill material is a mixture with silts and sands – regardless of composition a critical state strength would be more appropriate.
- Whilst Section 3.1 of the KBR report identifies two forms of failure (traversing fissured clays and failures confined solely to placed fill) the summary concludes that most canal slope failures are limited to the engineered clay fill – there is no stated substantiation for such a definitive conclusion which is presumably influenced by the perceptions of others and/or KBR's stability analyses.
- Although KBR consider most canal slope failures are limited to the engineered clay fill, their Table 3.1, para 3.7 and Figure 2(a) (Appendix A) demonstrates low FoS<1 (0.82) for failure surfaces where the toe clearly traverses natural/fissured clays, demonstrating that deeper seated failures are equally if not more likely to occur if suitable conditions prevail, such as at Lots 809/810 and 843.
- The report concludes by theoretically assessing the potential effect of introducing various slope support measures at the pre-feasibility level of assessment.

In 2010 KBR prepared a Geotechnical Investigation Options report detailing a 60 borehole investigation from land and water covering all stages at an initial cost of $1.5-$1.6M (understood to be deferred due to excessive tendered sums at the time). The approach included a number of insitu tests together with recovering samples for a suite of laboratory testing. Much of the testing proposed had previously been undertaken at a variety of locations, but it was not clear how the investigation was tailored around and to complement the existing information. The purpose of the report primarily appears to be, as indicated in KBR's Summary, to present and justify the basis for the investigation proposed on economic and safety factors following the abandoned call for tenders in mid-2009.

Subsequently Soil Surveys were engaged in 2012 and undertook a broad investigation within Stages 4-9 including the installation of 21 inclinometers at 17 locations (Stages 4-9) and some inclinometers in a (then) developing failure at Piermont Place (Stage 15) as noted in KBR's 2012 report (thought by GHD to be at Lots 809/810). GHD's view of the inclinometer measurements from Stages 4-9 is presented in Section 5, suffice to say that no reliable trends were able to be conclusively identified.

In 2012 KBR presented their Geotech Analysis Report detailing their views on, and concept design addressing the canal stability issues concluding that:

- Inclinometers indicate failures are confined to the fill materials.
- Stabilisation of the fill supporting the rock armour could be achieved by grout injection into uncompacted fill.
- Optimisation of their concept design was required through field trials and numerical (finite element) modelling.

Whilst GHD are of the view that reliable trends were not evident from the inclinometers in Stages 4 to 9, KBR have interpreted these, and the additional inclinometers installed at Piermont Place at the time, as showing that slip is occurring in a shallow zone underneath the rock protection and concrete wall with most of the movement above the toe of the rock protection.

This led to KBR undertaking stability analyses with revised strength parameters, most notably changing the strength of the natural stiff and very stiff clays (where fissured zones have generally been identified) by significantly increasing the strengths from residual used in their 2009 analyses to peak strengths (see KBR Table 3). This has the inevitable effect of forcing the critical failure surfaces to be localised in the foundation fill beneath the rock armour. The 2012 stability analyses therefore don't provide any other insight into the failures other than to mirror KBR's view that failures are localised to the fill and insitu fissured or softened natural clays are not relevant to either the stability of the existing slopes nor the design of stabilisation measures

In this context, it is pertinent to consider the inclinometer data and subsurface profile prepared (and relied on more broadly) by KBR for Piermont Place – Section 2 from their 2012 report. The section has been annotated by GHD and this version is presented in Figure 3 attached. GHD considers this the most useful and reliable inclinometer data reviewed as it was located in a known moving mass and there are consistent movement trends identified. This clearly indicates a translational slide developing with movements occurring at depth in natural stiff clayey materials (not only in fill as postulated by KBR) well downslope of the toe of the rock armour. This contrasts with KBR's view that all movements are largely in fill and exiting at/near the toe of the rock armour. The location of greatest movement at around RL-4.5 is

consistent with the understood construction practice i.e. foundation preparation for placement of fill would not have extended to this depth according to the design and hence insitu material forms much of the bank as a cut face profile.

For the failure at Piermont Place to have occurred, the only reasonable conclusion from the material reviewed is that natural material with a low strength likely caused by fissuring and/or softening existed at some depth and combined with many other factors, was the main contributor to the collapse. Lot # 843 is across the canal from where GHD understand this failure occurred, and from the available information likely suffered a similar fate.

The 2012 KBR report does not address this mode of failure and neither do the stabilisation measures proposed. GHD considers this a notable omission.

GHD understands that there is anecdotal evidence underpinning KBR's belief that the failures are high level and localised to the fill beneath the wall and revetment. Unfortunately, in the context of past life of this estate, KBR has only recently been involved (understood to be since 2008) and therefore hasn't seen any of the prior failures dating back. Aspects of the failures KBR have observed are not presented in sufficient detail for GHD to meaningfully independently review. Further, it is unclear how KBR have rationalised the previous reports which present contrasting information indicating the occurrence of larger/deeper failures and fissured clays, particularly in respect of the works KBR propose to resolve the stability issues across the estate.

# 7 Response to the brief

GHD's brief is given in Section 2 of our proposal and involved review of KBR's findings including:

1. The data used to construct ground models.
2. Analysis methodology.
3. Remedial measures proposed and associated risks.
4. By necessity, review of the plethora of background documents spanning over some 30 years.
5. Reporting of the above including discussion on risks and opportunities associated with the work.

## 7.1 Data used to construct ground models

It is understood that KBR's literature review led to the typical ground model geometry adopted. Unfortunately the absence of detailed as-con drawings documenting exactly what was done and where do not exist and this is a fundamental drawback to any model proposed. As a simple example, the contact between fill and prepared natural surface (if prepared) is simply not known aside from interpreting point data from drill holes. Further, given the variability at this site one model does not suit all. Also, some of the details of the ground model used in the 2009 KBR analyses are unclear.

The most significant change in the model from the 2009 to the final 2012 analyses is the consideration of insitu clays in the zone of site wide identified fissuring. In 2009 KBR's assessment of residual strength was used, whilst in 2012 substantially higher peak strengths were adopted. No reason has been given

for this, other than the changed focus to failures being totally contained in the fill supporting the rock armour. GHD considers that the model in this regard does not fully reflect the likely reality and attendant risks.

### 7.2 Analysis methodology

The analysis methodology used by KBR is limited to circular and non-circular failure surfaces assessed using simple limiting equilibrium analyses. This type of analysis does not take into account strain compatibility of elements (e.g. hard inclusions such as grout injected (under pressure) columns displaced into low strength materials), nor the effect of ground movements (e.g. bending of unreinforced columns with little moment capacity) nor the effect on overall stability of displacing ground at a likely already low FoS (e.g. disturbance to and/or potential for mobilisation of fissured/softened clay zones marginally stable). GHD considers the analyses suitable for concept assessment only and would urge caution in implementing the treatment without further consideration of the issues above (and any others which arise) and their impact on the viability of the technique proposed. KBR do recommend numerical modelling to refine the design but it is not clear if the above issues have been contemplated.

A particularly critical issue is that the final analyses are predicated on the failure mechanism being solely confined to the fill supporting the rock armour and not contributed to or caused by the natural insitu materials. There is sufficient evidence to suggest the failure surface at a number of the failures exists below the rock armour and the likelihood of fissured/softened insitu clays contributing is almost certain. In this case, the proposed stabilisation can be expected to be inadequate.

### 7.3 Proposed stabilisation measure

(600 mm diameter, 3m long grout injected piles at 1m spacing along shoreline)

The stabilisation measure suggested is grout injection into the “uncompacted” fill (i.e. fill supporting the rock armour) to stabilise this zone exclusively with soil cement piles (or pins). Whilst deeper seated failure surfaces have been analysed using simple limiting equilibrium techniques, it has been assumed that weakened zones of insitu material due to fissuring and/or strain softening are absent. From the material reviewed, GHD does not support this contention and sees this amongst the other issues raised in 7.2 as significant risks to the effectiveness of this treatment.

In this situation, where failure surfaces and mechanisms have not been well defined, it would be prudent to err on the side of caution, as many consultants have done in the past i.e. use of robust structural solutions making some allowance for the likelihood of failures being contributed to by lower strength insitu materials. From the material reviewed, GHD cannot find any adequately substantiated reason(s) to change from this approach at this time.

### 7.4 Document review

Within the budget and time constraints for this review, GHD has perused the documents provided but it was clearly impractical to delve deeply into all reports nor reprocess data or undertake numerical stability analyses. Further, there are other documents referred in the documents reviewed which were unavailable. It would also have been very desirable to actually view soil samples recovered from the site

to better understand the nature of the materials, but this was outside of the scope and samples may not have been retained over the years regardless.

Notwithstanding these constraints, the following is evident:

- Ground conditions at Raby Bay are complex and variable.
- As-con records sighted provide little to no information on actual ground conditions encountered, repairs implemented and inherent site variability.
- There is no doubt that a significant cut face of natural material is exposed in the majority of the canals, especially where excavation for borrow often extended down to RL-6 to RL-7.
- There is little doubt that ground preparation, fill conditioning, placement and compaction practices appeared wanting, including the need to compact over-width and cut back to well compacted.
- The original design did not appear to recognise the typical outer-skin softening which occurs with submerged soil like materials, cut or fill.
- Failures have continued at a rate and magnitude not expected by RCC nor originally contemplated in terms of ongoing repair costs.
- Many consultants have been involved over the 30 year life acting for various parties and each bringing their own views to the problem.
- Many of the failure assessments and/or stabilisation designs have been influenced by the extensive work of SGRS and the soil properties they have considered continue to be used.
- Although previously considered to be unlikely post-inundation, there is sufficient evidence from failures since 1995 to point to fissured clays likely playing a role in the larger failures that have occurred.
- Inclinometers installed in 2012 in Stages 4 to 9 have been interpreted by Soil Surveys and KBR as providing some movement trends – GHD could not conclusively identify these trends and consider interpreted trends from the limited readings taken as unproven.
- KBR recognised the role of fissured clays in their 2009 review but took a different view in their 2012 work, where they considered slips to be confined to a wedge of uncompacted fill under the rock armour and developed a concept design to locally stabilise this fill solely– Figure 3 attached depicts inclinometers in a mobile area of Piermont Place which presents a different picture and confirms the likelihood of larger scale failures extending into the natural (likely fissured in places) clays.

### 7.5 Reporting – summary

It is understood that RCC's preference is to determine and implement a cost effective and practical solution globally across the estate that solves the stability issues.

On the basis of the information reviewed GHD is not able to recommend that the KBR solution (which is at concept level only) would solve the Raby Bay canal failure potential nor that it should be implemented as a broad coverage fit and forget solution. GHD has raised a number of reservations and the key issue is that even if implemented, instability on a larger scale involving insitu natural clays is a real and

significant risk. The concept treatment may also not totally arrest creep movement of fills such that some degree of distress to the revetment wall and upper canal bank may still occur.

In terms of concepts for stabilising the banks, there are many factors (known and unknown) impacting on choice. It is understood that, to date, reasonably robust designs involving structural piled retainment have been deployed and that these have generally catered for (in practice if not design) the effects of lower strength insitu materials such as softened and/or fissured clays. It is understood that this has mostly been proven to be effective but costly and is executed on a case by case reactive basis usually requiring some time (1-2 years) to implement. It is understood such a treatment would be cost prohibitive if it were implemented pre-emptively on a widespread basis, and on at least one recent occasion advised by RCC has not totally arrested movements.

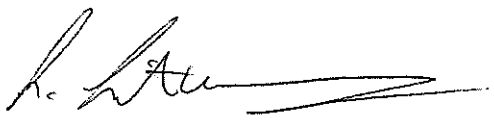
At a conceptual level it should be possible to install more rows of grout piles lower in the bank profile or at the toe to reinforce for both localised and larger scale failures extending into the insitu clays. This would require consideration of the various risks already raised before being further considered.

A combination treatment where toe loading the canal (sand/rock fill) could be considered for larger failures and grout piles for the localised fill issue. To be effective this would likely require a change to the useable waterway depth/profile which may not be acceptable. This would also prove costly as the majority of canals were deepened to RL-6 to RL-7, even up RL-8 apparently for borrow.

It is unfortunate that reliable and definitive information on failure surfaces and their location, implemented construction details, pore pressures within the bank etc. are not available, as these are key inputs into any selection and optimisation process for ground stabilisation.

We also note that KBR are of the view (section 4.2.3 of their 2012 report) that the apparent issue with the canal slopes has been identified, no further geotechnical investigations are required and simple survey and probing ahead of remedial work is all that is required for the way forward. From this review and the risks and uncertainties identified GHD cannot accord with this definitive view on such a complex issue.

Sincerely
GHD Pty Ltd



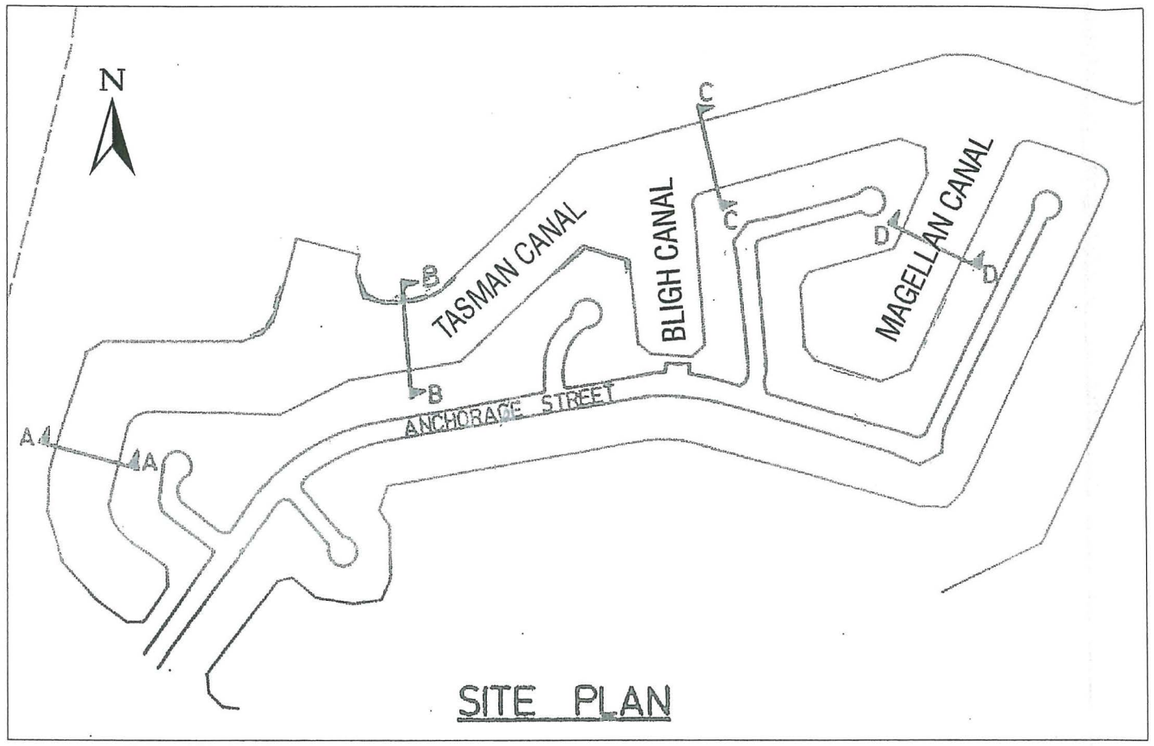
**Alex Litwinowicz**

07 3316 3582

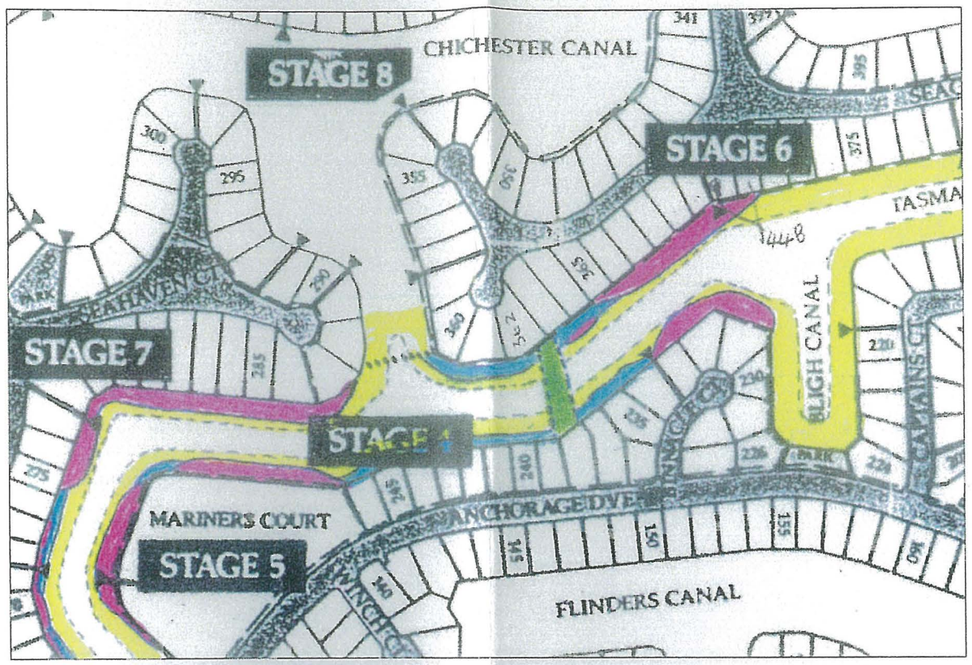
Attachments:

Figures
Bibliography
Scope and Limitations

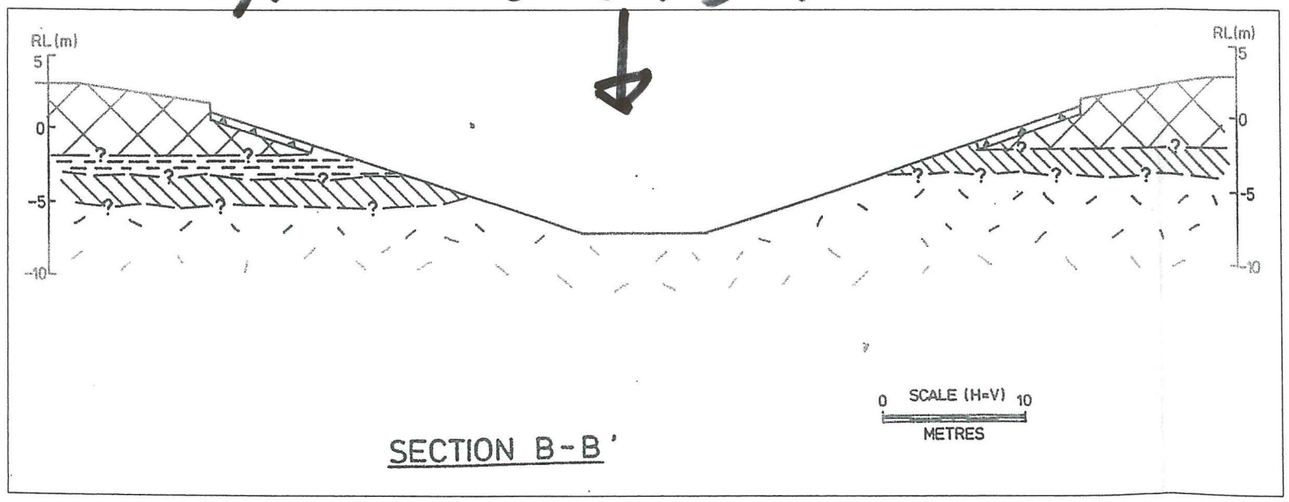
# Figures




SITE PLAN




TYPICAL GROUND MODEL




SECTION B-B'

LEGEND

- RIP RAP
- ZONE OF NATURAL MATERIAL REMOVED AND ENGINEERED FILL REPLACEMENT (NOTE : Area outlines based on Leighton survey data but modified in parts for consistency with site observations)
- APPROXIMATE TO INFERRED GEOLOGICAL BOUNDARY
- CLAY, high plasticity, red-brown.
- CLAY, high plasticity, mottled green to grey and red-brown, occasionally fissured with some polished surfaces.
- BASALT, extremely to highly weathered, mottled green / red-brown and orange-brown with localised ferruginous concentrations; very low to low rock substance strength.
- BASALT, highly to moderately weathered, dark brown-grey medium to high rock substance strength.

FIGURE 1

EARTHTECH CONSULTANTS
Geotechnical & Environmental Engineering

| | | |
|---|---|---|
| DRAWN: MRS | REDLAND SHIRE COUNCIL<br>RABY BAY CANAL ESTATES LOTS 362 TO 364 - TASMAN CANAL<br>SCHEMATIC CROSS-SECTION FROM<br>COFFEY & PARTNERS REPORT, NOV '86 | |
| CHECKED: ALM | | |
| DATE: OCTOBER 2000 | | |
| JOB NO: MF1621 | SCALE: As Shown | Drawing No. 3 |

MF1621-003A

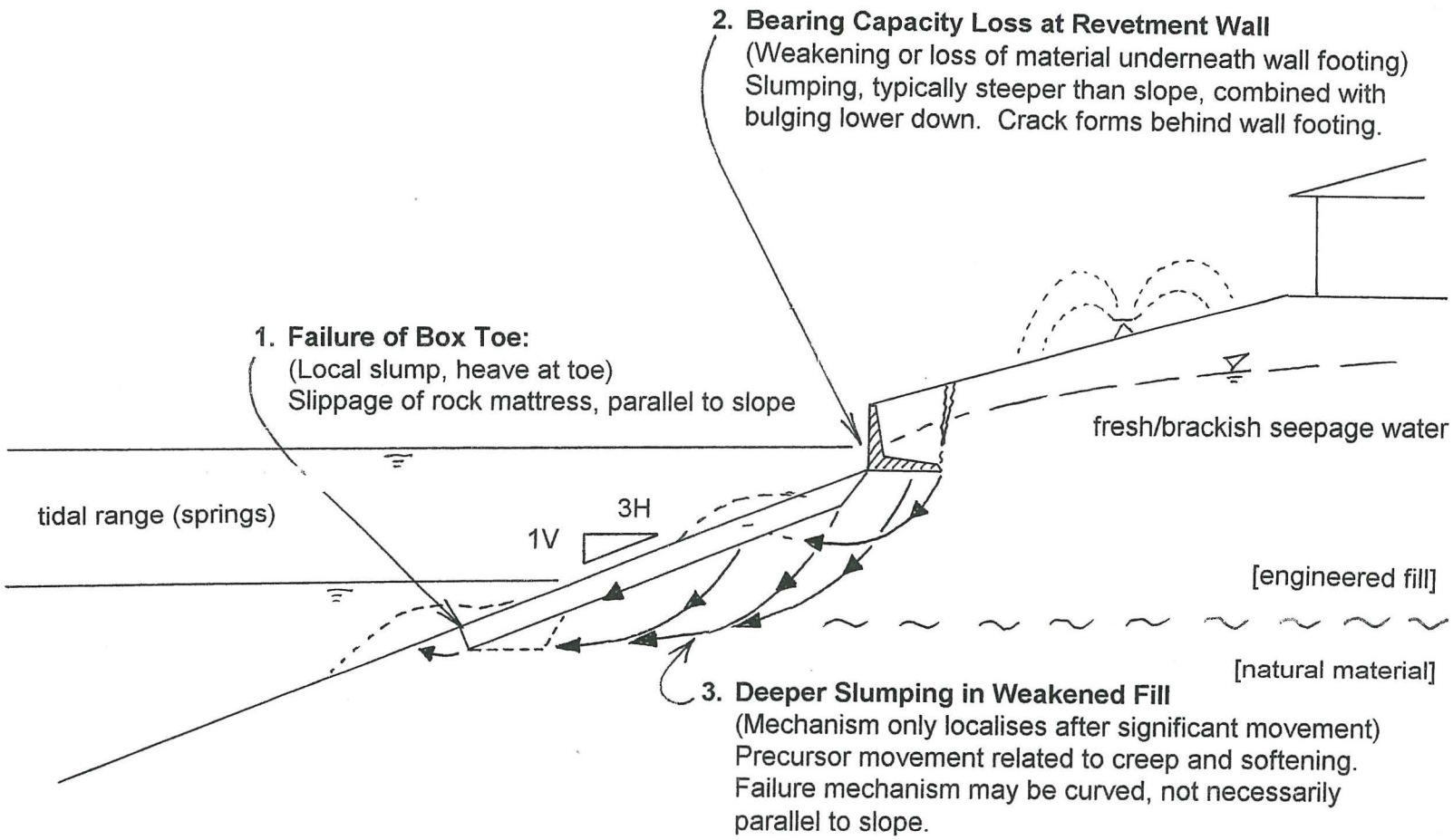
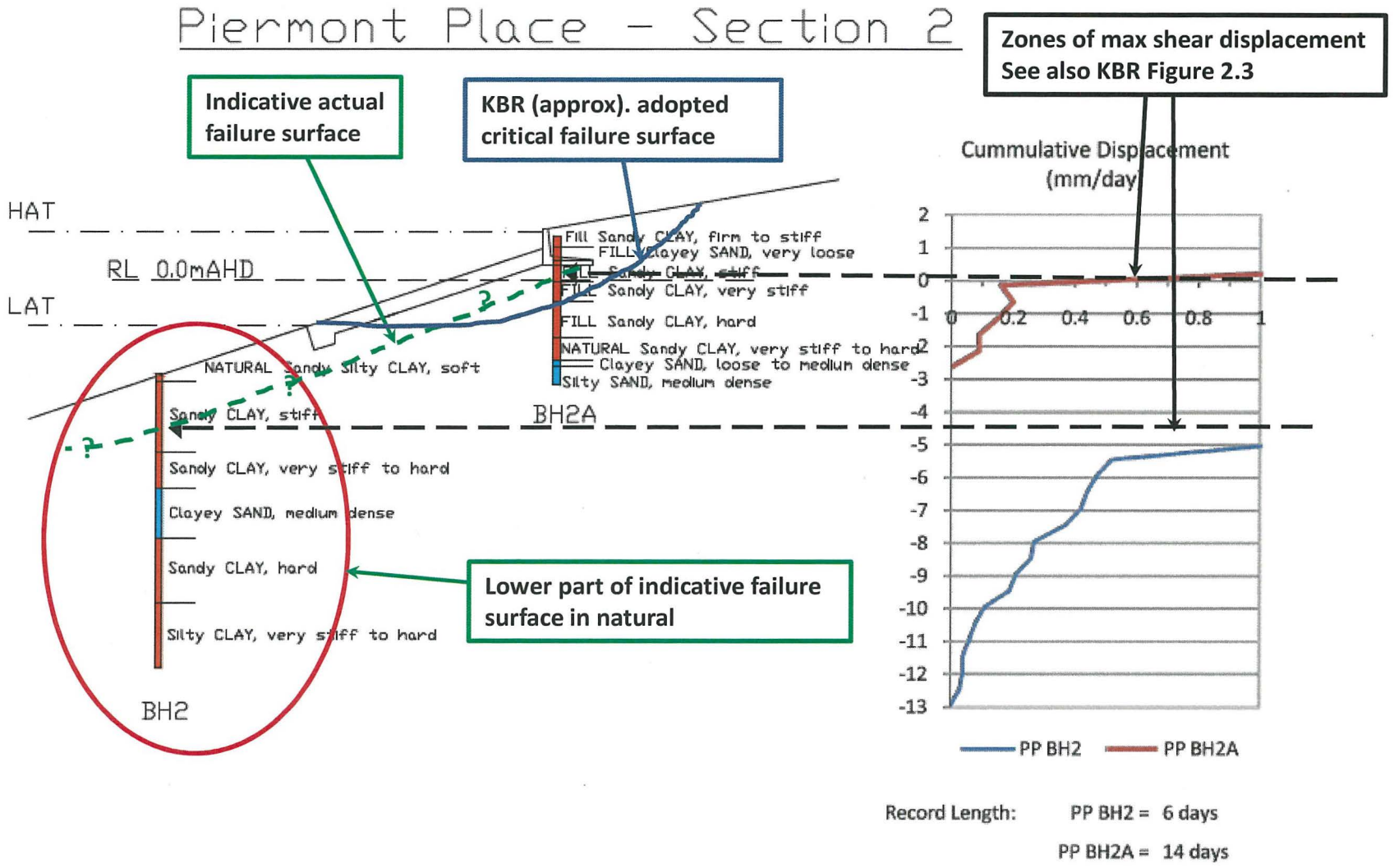



Figure 2 Explanation for Slip-Related Movement Directions



FIGURE 2

**N.B. Annotations by GHD**




Record Length: PP BH2 = 6 days

PP BH2A = 14 days

FIGURE 3

# Bibliography

Coffey & Partners Pty Ltd letter to Civic Projects (Raby Bay) Pty Ltd, 19 April 1984, *Slip Failure – Raby Bay*

Coffey Partners International Pty Ltd letter report to Mr & Mrs Franck, 17 March 1993, *Slope Stability Assessment, Lot 167, Stage 1, Raby Bay Estate*

Douglas Partners, January 1998, *Canal Bank Geotechnical Study, 42 Anchorage Drive, Cleveland*

Earthtech Consultants, November 1998, *Raby Bay Canal Estate Lots 837-839 Raby Canal Geotechnical Investigations*

Earthtech Consultants, July 1999, *Raby Bay Canal Estate Lot 574 Mainroyal Court*

Earthtech Consultants, 18 January 2000, *Raby Bay Canal Estate – On-going Monitoring*

Earthtech Consultants, 30 October 2000, *Raby Bay Canal Estate Studies into Remedial Works to Rock Revetments Proposed Trials at Lot 448 (Tasman Canal) & Lots 197-199 (Magellan Canal)*

Earthtech Consultants, October 2000, *Raby Bay Canal Estate, Geotechnical Investigations Lots 362 to 364, Tasman Canal*

Earthtech Consultants, May 2002, *Geotechnical Investigation & Foundation Recommendations Proposed Residence Lot 29 Waverly Court Ormiston*

Earthtech Laboratories, October 1997, *Raby Bay Canal Estate Tasman & Magellan Canal Slips Geotechnical Investigations for Remedial Design – Progress Report*

Earthtech Laboratories, *Raby Bay – Remedial Works to Tasman & Magellan Canals Status of Extent of Repairs – Revised 21 Jan 98*

Earthtech Laboratories letter to Tod Group, 27 January 1998, *Redland Shire Council, Raby Bay – Tasman & Magellan Canals, Amendments to Design Drawings*

Golder Associates, 2006, Construction Drawings – Lots 841 to 844

Golder Associates, September 2006, *Draft Report on Lots 841 – 844 Raby Bay Canal Estate 2006/2007 Priority 1 Remedial Design Works, Cleveland, Queensland*

Golder Associates, May 2008, *Report on Preliminary Revetment Investigation Lots 14 & 15, Raby Bay Canal Estate (26 & 24 Sternlight Court) Cleveland, Queensland*, Revision 0

Hughes, Beal & Wright Pty Ltd, 22 February 1993, *Slope Stability Investigation, Raby Bay Canal Estate – Stage 1 – Lot 167*

Hughes, Beal & Wright Pty Ltd, 7 April 1993, *Slope Stability – Lot 167, Stage 1, Raby Bay, Lot 582 (No 16) Mainroyal Court, Stage 13, Raby Bay*

Hughes, Beal & Wright Pty Ltd, 15 April 1993, *Slope Stability Investigation, Raby Bay Canal Estate – Stage 1 – Completion of Current Engagement*

Hughes, Beal & Wright Pty Ltd report for Civic Projects (Raby Bay) Pty Ltd, April 1988, *Raby Bay Canal Estate, Cleveland – Stage 1 (Western End of Cook Canal), Investigation of Slip in Canal Bank of Lot 79 (5 Masthead Drive) and Recommendations for Repair*

Kellogg Brown & Root Pty Ltd, 19 January 2009, *Raby Bay Canal Study, Draft Phase 1 Report – Stability of Raby Bay Canal Slopes – Desktop Review and Pre-feasibility study*, Rev A

Kellogg Brown & Root Pty Ltd, 10 March 2010, *Raby Bay Canal Slope Stability Update, Results of underpinning on Area 103 using screw piles*, Rev A

Kellogg Brown & Root Pty Ltd, 18 May 2010, *Raby Bay Canal Batter Stability Update, Geotechnical Investigation Options Report*, Rev A

Kellogg Brown & Root Pty Ltd, 12 July 2012, *Raby Bay Canal Batter Stability Update, Geotechnical Investigation Analysis Report*, Rev A

Morrison Geotechnic, 28 June 2007, *Geotechnical Assessment of Revetment Stability and Remedial Work – Lots 340 and 447 Masthead Drive, Raby Bay*

Redland Shire Council memo, 31 January 1995, *Raby Bay Canal Sites*

Redland Shire Council memo, 7 February 1995, *Proposed Review - Raby Bay Revetment Walls*

Redland Shire Council memo, 26 October 1995, *Raby Bay Revetment Study*

Redland Shire Council letter to McCarthy Durie Ryan Neil, 4 June 1997, *Raby Bay Canal Estate – Revetment Wall Stability*

Redland Shire Council facsimile to Sherwood Geotechnical, 28 November 1997, Raby Bay *Canal Estate Geotechnical Study*

Redland Shire Council letter to TJ & LA Johnson, 12 January 1998, *Remedial Works to Canal Walls and Rock Revetments, Tasman and Magellan Canals – Raby Bay*

Redland Shire Council, *Section E Geotechnical Information, Borehole Records & DCP Plots*

Redland Shire Council, *Tender Documents, Ray Bay Canal Estate Remedial Works to Revetment Lots 837-839, Raby Canal*

S. Settle, John Wilson and Partners, 4 September 1985, *Raby Bay Development – Stage 1, Slip in Canal Bank at Lots 81 and 82*

Sherwood Geotechnical and Research Services, October 1995, *Review of Revetment Stability, Raby Bay Canal Estate*, Report Number 95006-1

Sherwood Geotechnical and Research Services, June 1998, *Raby Bay Canal Estate, Weakening of Canal Bank Clay Materials*, Report Number 97030-2

Sherwood Geotechnical and Research Services, June 1998, *Raby Bay Canal Estate, Future Extent and Costs of Canal Bank Failures*, Report Number 97030-3

Sherwood Geotechnical and Research Services, October 1999, *Raby Bay Canal Estate, Inspection Report Canal Bank Condition 20/9/99*, Report Number 99031-1

Sherwood Geotechnical and Research Services, November 1999, *Raby Bay Canal Estate, Canal Bank Stability Research & Development*, Report Number 98074-1

Soil Surveys, December 2011, *Quality Management Plan, Raby Bay Canal Estate Geotechnical Investigation*

Soil Surveys, April 2012, *Geotechnical Investigation – T-1500-11/12-IFP – Raby Bay Residential Canal Estate, Cleveland*

Soil Surveys, 15 October 2012, *Inclinometers Results Report*

Stanley and Partners, 2008, Drawings, *Canal Bank Restraint System, 117 & 119 Masthead Drive, Raby Bay*

Raby Bay As-Constructed Drawings, Stage 1 to 15

# Scope and Limitations

*This Report: has been prepared by GHD for* RCC and *may only be used and relied on by* RCC *for the purpose agreed between GHD and* RCC *as set out in section in GHD's Proposal and this Report.*

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*The opinions, conclusions and any recommendations in this Report are based on conditions encountered and information reviewed at the date of preparation of the Report. GHD has no responsibility or obligation to update this Report to account for events or changes occurring subsequent to the date that the Report was prepared.*

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*Climate change and its potential impacts did not form part of the Scope of this assignment and has not been further considered.*

# Redland City Council

# Raby Bay Risk Assessment Workshop

**May 2014**

Constructive Solutions

*Realising potential*

Report prepared by:

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Realising potential

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## DOCUMENT HISTORY AND STATUS

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| 1 | 1 | Rodney Powell | 1e | 8 April 14 | R. Black | S. O'Rourke |
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Project Manager: Steve O'Rourke
Name of Project: Raby Bay Risk Assessment Workshop
Name of Client: Redland City Council
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# TABLE OF CONTENTS

# 1. Introduction

This report describes the process and outcomes of a workshop held at Raby Bay on 1st April 2014 to assess the risks associated with a planned trial of new repair practices for upper level failures in fill on Raby Bay Canal Estate. In summary, the report outlines:

- The workshop process and participants;
- Community expectations of Raby Bay ratepayers;
- The failure mechanism to be addressed in the trials;
- Other failure mechanisms;
- Key Performance Indicators to evaluate the success of the trials;
- Risk assessment, consequences and likelihood of management options; and
- An action plan to outline the way forward.

## 1.1 Project history

Rectification of the periodic canal bank failures of the batters in the Raby Bay canals is a large scale, long term and expensive problem. It is clear from Council data that the frequency of canal bank failures has remained relatively static over the past 7 to 10 years and is imposing an unsustainable cost burden on Council and the Ratepayers.

Past repair methods have included:

- Bored piles at top of slope;
- Deep bored pile slope retainments;
- Screw piles;
- Driven timber piles at bottom of slope;
- Reconstruction of revetment wall and ties into piles; and
- Reconstruct pools, jetties, jetty piles, landscaping, etc.

In summary, the task as presently defined involves:

- Total canal batters approximately 22km;
- Repaired to date approximately 1.7km;
- Unsupported batters remaining approximately 20.3km; and
- $9.8M (307m) of unsupported wall is programmed for repair over the next 2 years.[1]

The reactive methods that had been implemented to date were resulting in repairs that cost, on average, in the range of $17,000/m to $30,000/m. Given the length of batter remaining to be treated on the Estate, continuance of this method is not economically sustainable. It is also desirable to conduct rectification works prior to significant movement and resulting damage occurring; ie. conduct “pro-active remediation”.

[1] Figures for discussion purposes only. Planning Estimate sourced from forward works program and includes contingencies for unknowns that would be refined following geotech and design.

The time has come to initiate a much less costly, pro-active and effective remediation methodology. KBR have concluded in their July 2012 report that the slope failures at Raby Bay are primarily upper level (smaller scale) failures in fill and potential repair methods of less than $1,000/m had been proposed by some suppliers. Accordingly, the purpose of this workshop was to assess such proposed alternative strategies, to assess the risks involved and clearly propose a way forward.

# 2. The Workshop

## 2.1 Workshop Participants

The workshop was facilitated by Steve O'Rourke and Dr Ron Black of Constructive Solutions Pty Ltd and participants included:

- Redland City Council Marine Infrastructure Planning team;
- Redlands City Council Project Design, Development and Delivery;
- Raby Bay Ratepayers Association;
- Consultants responsible for previous geotechnical investigations;
- Geotechnical contractors; and
- Remediation contractors representative of potential options available for remediation.

A full list of workshop attendees is included as Appendix 3.

## 2.2 Workshop Objectives

Given that a series of remediation trials are to be conducted, a number of questions were addressed in the workshop to fully define the objectives of those trials; viz.

- In broad terms, what are the revetment failures or imminent failure criteria that warrant a trial?
- Can any suitable locations be identified?
- What does a trial involve, and what method(s) will be employed?
- How can success or failure of the trial(s) be measured?
- What are the risks associated with the trial(s)
- How can these risks be reduced to a manageable level?
- How can risks be allocated between designers, builders and Council to avoid over-design?

## 3. Community Expectations

As noted in 2.1, the Raby Bay Ratepayers Association was represented at the workshop and they outlined very clearly their expectations of the proposed trials. Their views may be summarized as follows:

- Early failures began when the Developer was still on site, and thus they could be managed as and when they arose;
- The problems are not adequately communicated to new residents moving into the Raby Bay Canal estate;
- The time for further geotechnical studies has passed and what the ratepayers want is some action to trial strategies that can prevent or reduce further localised failures, provide some structural integrity for fill immediately behind the revetment wall and prevent loss of soil locally behind the revetment wall;
- It needs to be remembered that about 30% of owners live overseas and their properties are rented out;
- They are not seeking to ignore the “deep failure “ problems of fissured clays, but believe that these failures, which can only be remediated by expensive piling, can be dealt with as and where they arise; and
- What is needed is a long-term sustainable solution.

## 4. Shallow Failure Mechanism

In July 2012, KBR's Geotechnical Investigation Analysis Report concluded that there appears to be a wedge of uncompacted fill underneath the canal batter rock protection, resulting frequently in relatively shallow failures mainly confined to this uncompacted fill material (see below for profiles). They assert that there are alternative rectification methods, such as soil stabilisation, that would be much more economical than the current rectification strategies of using long piles. The current design implies the existence of a critical deep slip circle failure, which they have not found in the field to occur in many instances – in the few instances when this occurs, the problem can be addressed in this manner.

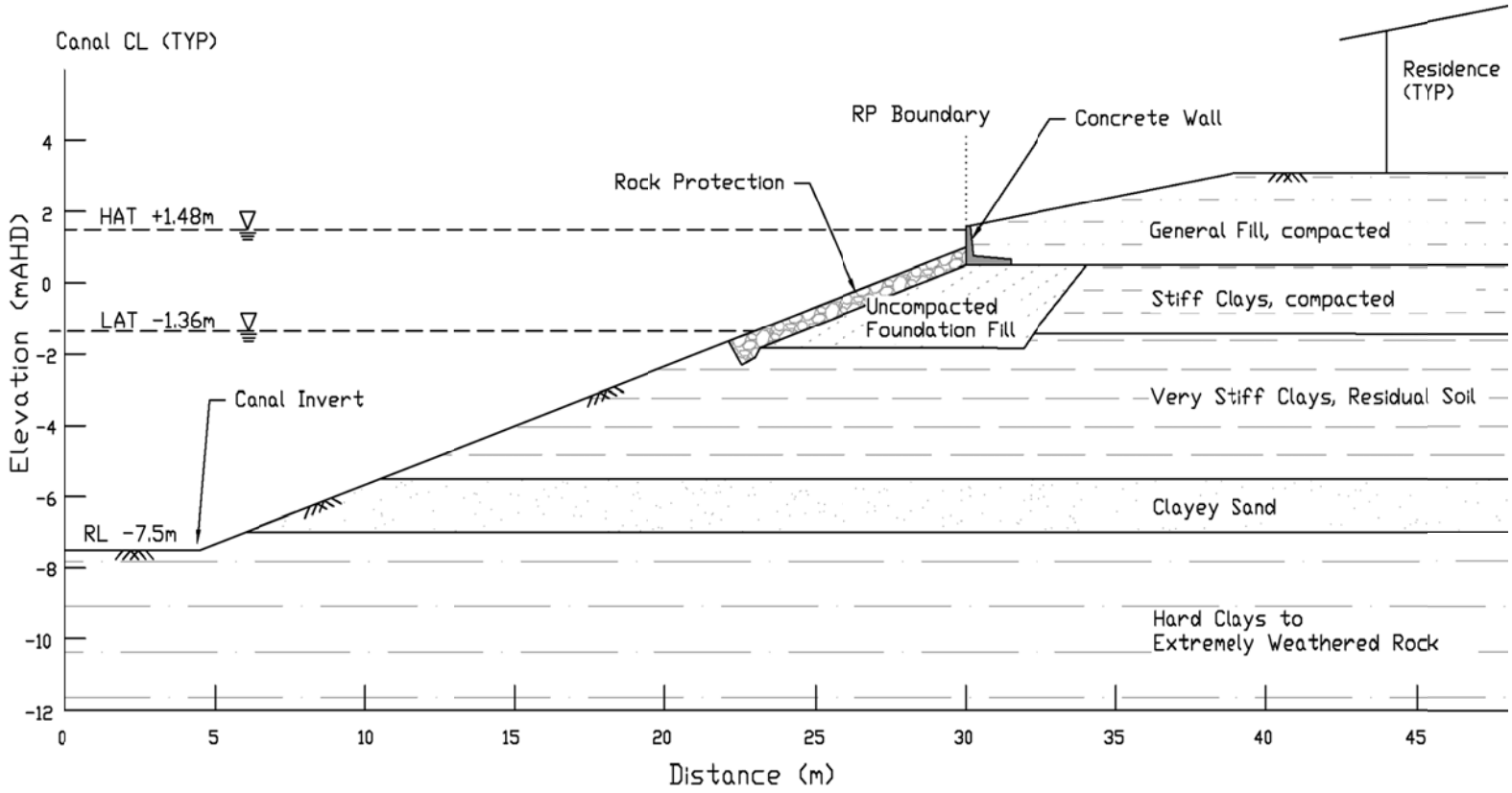



**Figure 1: Indicative canal batter soil profile**

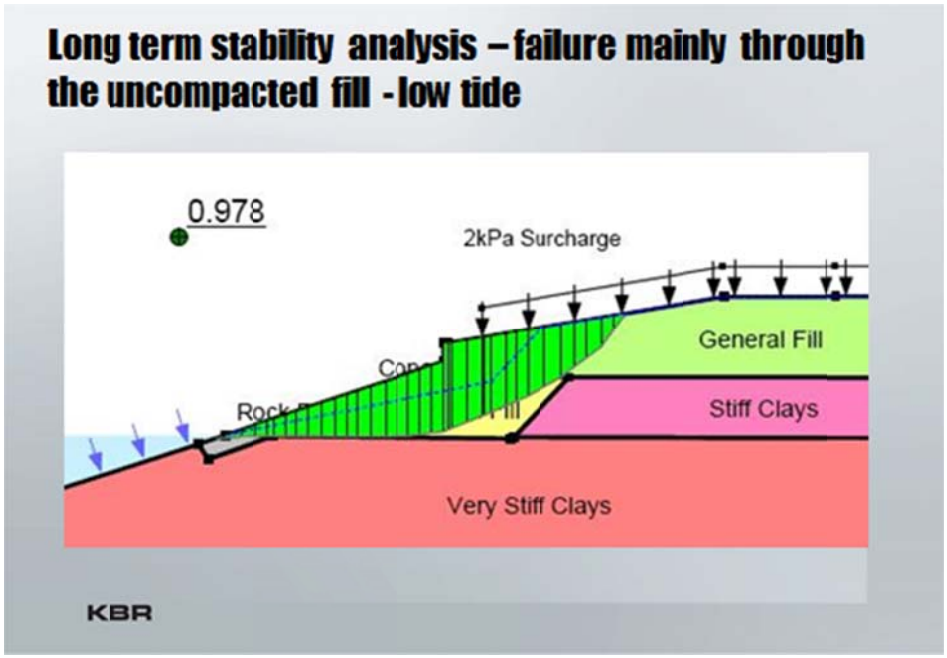



**Figure 2: Long term stability analysis**

## 5. Trial Site Locations

After discussion within the Group, it was generally agreed amongst affected parties that the there is no direct evidence of deep slip circle slip failures of the fissured clays being a contributing factor to recent failures. It was noted that:

- KBR concluded that there had been very few failures to date that could be attributed to this mechanism;
- There was no evidence that these failures would become any more prevalent in the next 20 or 30 years; and
- Appropriate repair methods were implemented during construction of the canal where this type of failure was identified.

Accordingly, the trials discussed in this workshop relate solely to the rectifying problems due to failures in the shallow uncompacted fill described above.

It was initially considered by some participants that, if possible:

- The selected site(s) should be one that is already showing movement – in that way, the effectiveness of the treatments can be evaluated; and
- When treatment has been carried out, the site should be loaded to failure – this was not supported by the Ratepayers Association representatives.

However the site selection process was further discussed with the following key parameters determined for site selection and preparation:

- 30mm to 50mm of wall movement observed and monitored;
- Significant revetment wall movement (greater than 50mm);
- Geotechnical information from previous studies would be available in the immediate area, noting that additional bore holes would be required to determine depth of fill material characteristics;
- Occupied sites will have public relations value if the resident is enthusiastic about the trial and remediation;
- It was noted that five adjacent lots on Masthead Drive (for example) may meet the above criteria. It was also noted that if the proposed grout injection treatment (or alternative methodology) is successful then there would be no need for further action at these lots. If not, then more expensive solutions (say screw piling) could be the subject of further trials at these sites; and
- A pre-trial site should be used to ensure that the grout injection process does not further de-stabilise the slope.

# 6. Key Performance Indicators (KPIs)

The Group determined that the trial would be judged to be a success if for:

**The Trial**

- There is a significant reduction in the cost of repair; and
- Movement is arrested as demonstrated by inclinometer readings.

**The Chosen Remedy**

- There is a reduction in the average number of wall failures;
- There is a reduction in the net present value cost per lot (including administration costs);
- Negative community feedback is reduced, or if there are positive responses;
- There is a reduction in the time spent on site (fewer workers, less heavy machinery);
- Loss of amenity due to failures is minimized; Continuous improvement (in time, cost and quality) results from the implementation of the trial methodology – which in turn will lead to an improved ability to predict potential failures, that is, improved understanding of the processes;
- Better understanding the problem so that the number of lots requiring any form and type of rectification is clear; and
- The trial represents a successful solution that can be used proactively to provide a reduction in the average number of wall repairs.

## 6.1 Random failures

Given that there are on average, four repairs per year at present, failures will continue throughout the trial period and probably out of the trial test area. The question remains – are these failures different from the slip mechanism in the upper part of the batter that is the subject of the trials?

The strategy that could be used to address these failures would include:

- Use an array of inclinometers to determine whether the failure extends down into the natural materials;
- Proceed to rectify by grout, or piling as appropriate to the depth of failure determined; and
- Utilise the knowledge gained from the random failures to add to that gained from the trial section.

# 7. Risk Register

The workshop conducted a risk assessment on the proposed trials to examine:

- The key risks and immediate consequences confronting the trials to stabilise potential failures confined to fill;
- The causes of these risks;
- The effectiveness of the current risk treatments that are in place;
- The consequence level of each risk;
- The likelihood of each risk occurring;
- The residual risk that thus resulted from the nominated consequence level and likelihood; and
- Additional actions that may be considered to further mitigate the risks.

It should be noted that a further and more detailed risk assessment will be necessary on completion of the trials and prior to any implementation of selected techniques at Raby Bay.

The outcome of these assessments is given in **Appendix 1**.

The Risk Assessment tools used, including tables of consequence, likelihood, effectiveness and the residual risk outcomes are shown in **Appendix 2**.

# 8. Conclusions and Recommendations

## 8.1 Conclusions

The current very costly method of rectification of the periodic, but regular, canal bank failures in the batters of the canals is considered by the affected parties to be unsustainable in the long term.

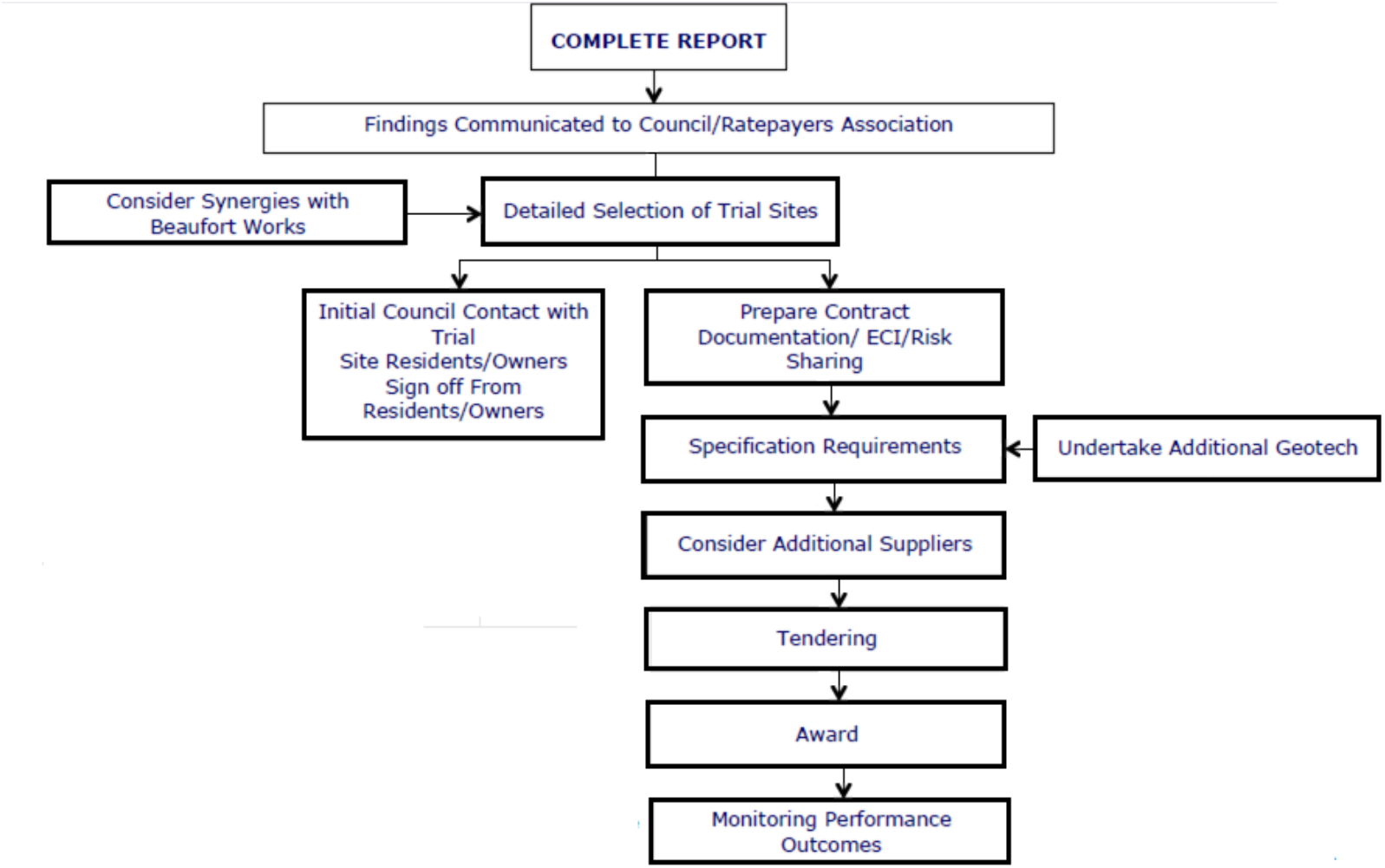
The workshop participants discussed the treatment of smaller slips in fill using grout injection (or similar) technologies that can be a substantially cheaper, less intrusive and proactive solution that may, subject to successful trialling and proven longer term performance, address the problems observed. If and when soil slips occur in lower level, fissured clays, these can be treated on a case-by-case basis using the much more costly methods currently in use.

It will be necessary to conduct trials of grout injection and other methods proposed by the specialist contractors to determine their likely success, and the risks of these trials have been evaluated by the workshop and are now in general terms understood.

## 8.2 Outcomes

The outcomes from the Workshop can be summarised by the action flow chart set out in Section 9 (below) which Council and the Ratepayers Association have undertaken to implement.

## 9. Action Plan



# APPENDIX 1
# Trial Site Risk Register

| No. | Statement of Risk and immediate Consequences | Causation | Existing Risk Treatments | Effective-ness | Conseq. Level | Likeli-hood | Residual Risk Rating & treatment status * |
|---|---|---|---|---|---|---|---|
| 1 | Fail to achieve significant cost reduction per metre | • Changing ground conditions<br>• Changes in development impacting on loadings on wall<br>• Grouting techniques doesn't work<br>• Increased material costs<br>• Change in regulatory (e.g. environmental) requirements<br>• Access problems<br>• Council approach to procurement and risk sharing<br>• Market competition | • Geotechnical information available<br>• Designs customised to site<br>• Proposed trial<br>• Access from road or canal<br>• Collaboration with contractors to achieve optimal risk apportionment<br>• Continual market testing<br>• Risk workshop<br>• Existing reports on similar risk treatments | 2<br>4<br>4<br>4<br>2<br>3 | Major | Unlikely | High |
| 2 | Recorded movement will not have reduced within six months of treatment | • Incorrect treatment used for failure mechanism<br>• Technique used was not successful<br>• Failure of monitoring equipment<br>• Deep failure occurring | • Trial is only to address shallow failure<br>• Multiple techniques used<br>• Multiple monitoring equipment<br>• Inclinometer approach to better define deeper failures | 4<br>4<br>4 | Moderate | Possible | High |
| 3 | Proposed treatment will make current situation worse | • Introducing high pressure grout on low FoS slope | • Pre trial site on Council/vacant land<br>• Review case studies | 4<br>4 | Minor | Unlikely | Low |
| 4 | Unacceptable environmental impact | • Grout entering water system | • Inert grouts used<br>• Bunding on outside of seawall<br>• Environmental | 4<br>4<br>4 | Minor | Unlikely | Low |

| No. | Statement of Risk and immediate Consequences | Causation | Existing Risk Treatments | Effective-ness | Conseq. Level | Likeli-hood | Residual Risk Rating & treatment status * |
|---|---|---|---|---|---|---|---|
| | | | requirements in specification<br>• Cleaning up waste material<br>• Service location | <br>4<br>4 | | | |
| 5 | Damage to assets on private property | • Uncontrolled expansion of material near private assets | • Dilapidation survey<br>• Work procedures and supervision<br>• Release form signed by Owner | 2<br>4<br>1 | Minor | Unlikely | Low |

Set out below are additional risk treatments which can be implemented to further reduce the level of risk:

**Risk 1**

Increasing geotechnical information – bore holes to better determine layer thicknesses and depths

Increased consultation with potential contractors

Discussion with contractors on apportionment of risk – better risk sharing

Include additional technologies

Consider recovering costs where appropriate for actions which may cause damage to wall

Council to promote trial to community and communicate with impacted residents

**Risk 2**

Increasing geotechnical information – bore holes to better determine layer thicknesses and depths

Improve monitoring regime

# APPENDIX 2
# Risk Assessment Matrix

# 1. CSPL Risk Assessment Tools

## Measures of Effectiveness

The following table can be used to assess the effectiveness of existing risk treatments, which should then be taken into account when determining the Consequence, Likelihood and therefore the level of Residual Risk.

| No. | Level | Communication and documentation | General effectiveness |
|---|---|---|---|
| 5 | Excellent | Risk treatments and procedures are implemented, with communication and monitoring on a regular basis to determine their level of effectiveness in 'managing' the risk. | Is effective in reducing the risk under all conditions. |
| 4 | Good | Risk treatments and procedures are well documented and implemented, but with some room for improvement. Good communication and understanding of treatments with some degree of monitoring. | Is effective in reducing the risk under most conditions. |
| 3 | Fair | Risk treatments and procedures documented, but not well implemented, with minimal monitoring to ensure compliance or to determine their level of relevance. | Is effective in reducing the risk under ideal conditions. |
| 2 | Marginal | Risk treatments and procedures are informal, not well communicated and are implemented in an inconsistent manner. | Is partially effective in reducing the risk. |
| 1 | Poor or non-existent | Risk treatments and procedures are non–existent or ineffective; not communicated, sparsely implemented and of little value. | Makes little impact in reducing the risk. |

## Measures of Consequence (or Impact)

| Level | Examples | | | | | | |
|---|---|---|---|---|---|---|---|
| | Financial (Revenue & Costs) | Information & Data | Property | People | Provision of Service | Reputation | Environment |
| 1. Insignificant | • Low financial loss (e.g. < 1% of revenue or budget) | • Negligible loss of or damage to IT and communications.<br>• No loss of data. | • Negligible damage to or loss of assets. | • No significant injuries.<br>• No significant impact on personnel. | • Short-term, localised interruption to service / performance. | • Issue of no public concern.<br>• Isolated communications expressing concern. | • Minor breach of environmental policy / practices.<br>• Negligible impact on the environment. |
| 2. Minor | • Minor financial loss (e.g. 1% to 2% of revenue or budget) | • Minor loss / damage to IT and communication. Some data catch-up may be required. | • Minor loss / damage. Some repairs may be required. | • Small number of injuries; first aid or out-patients treatment required.<br>• Some inconvenience to personnel. | • Minor, temporary disruption to services; Minor inconvenience to client(s). | • Local public concern.<br>• May cause some complaints (justified or unjustified). | • Minor localised impact; one-off situation easily remedied. |
| 3. Moderate | • High financial loss (e.g. 2% to 5% of revenue or budget) | • Moderate to high loss of IT. Some data may be permanently lost. Workarounds may be required. | • Moderate to high damage requiring specialist/contractor equipment to repair or replace. | • A number of injuries requiring hospitalisation and long-term treatment.<br>• Moderate disruption to work routines and schedules. | • Some serious disruption to services; some contravention of legal/contractual obligations. | • Regional public concern.<br>• Significant complaints.<br>• Some adverse publicity.<br>• Local media coverage. | • Moderate impact on the environment; no long term or irreversible damage.<br>• May incur cautionary notice or infringement notice |
| 4. Major | • Major financial loss (e.g. 5% to 10% of revenue or budget) | • High risk of loss/ corruption of data; significant | • Significant / permanent damage to assets and / or infrastructure. | • Major disruption to work routines and practices. Additional resources may | • Major, long-term disruption to services. | • Significant public concern.<br>• Adverse publicity in national | • Severe impact requiring remedial action and review of processes to prevent |

| Level | Examples | | | | | | |
|---|---|---|---|---|---|---|---|
| | Financial (Revenue & Costs) | Information & Data | Property | People | Provision of Service | Reputation | Environment |
| | | catch-up will be required.<br>• Business continuity plans need to be implemented. | | be required.<br>• Significant number of serious injuries requiring hospitalisation and long-term treatment. Small number of fatalities. | • Serious breach of a legal / contractual obligation. | media.<br>• Embarrassment to the organisation.<br>• Damage to credibility and confidence in the organisation.<br>• Inquiry by regulators.<br>• State or regional media coverage. | reoccurrence.<br>• Penalties and / or direction or compliance order incurred. |
| 5. Catastrophic | • Huge financial loss (e.g. >10% of revenue or budget) | • Extensive loss of / damage to IT and communications assets and infrastructure.<br>• Permanent loss of data. Widespread disruption to the business. | • Widespread, substantial / permanent damage to assets and/or infrastructure. | • Long-term disruption to work practices and routines. Impact on well-being of personnel.<br>• Extensive, life-threatening impact; potentially large numbers of serious injuries and fatalities. | • Long term/irreversible impact on ability to deliver client services.<br>• Viability of the organisation in its current form is questionable. | • Major public concern.<br>• Widespread, ongoing national and possibly international media attention.<br>• Severe embarrassment to the organisation.<br>• Loss of credibility and confidence in the organisation.<br>• Adverse findings and/or penalties by regulator. | • Long-term, large-scale damage to habitat or environment.<br>• Serious / repeated breach of legislation / licence conditions.<br>• Cancellation of licence and / or prosecution. |

## Measures of Likelihood

| No. | Level | Description | Examples |
|---|---|---|---|
| 5 | Almost certain | The event will occur in most conditions | Expected frequency range: Greater than one or more per annum |
| 4 | Likely | The event will probably occur in most conditions | Expected frequency range: Between one in 5 years and one per annum |
| 3 | Possible | The event should happen at some time | Expected frequency range: Between one in 10 years and one in 5 years |
| 2 | Unlikely | The event could happen at some time | Expected frequency range: Between one in a 100 years and one in 10 years |
| 1 | Rare | The event may only occur in exceptional circumstances | Expected frequency range: Less than one in a hundred years |

## Residual Risk Assessment Matrix

| Likelihood | | Consequence | | | | |
|---|---|---|---|---|---|---|
| | | Insignificant | Minor | Moderate | Major | Catastrophic |
| | | 1 | 2 | 3 | 4 | 5 |
| Almost certain | 5 | M (ii) | H (ii) | E (i) | E (iv) | E (v) |
| Likely | 4 | M (i) | H (i) | H (ii) | E (ii) | E (iv) |
| Possible | 3 | L (iv) | M (ii) | H (i) | H (iv) | E (iii) |
| Unlikely | 2 | L (ii) | L (iv) | M (iii) | H (iii) | E (i) |
| Rare | 1 | L (i) | L (iii) | M (ii) | M (iii) | H (iv) |

| Legend | L (i – iv) | M (i – iii) | H (i – iv) | E (i – v) |
|---|---|---|---|---|
| Risk Level: | Low | Moderate | High | Extreme |
| Refer to: | | Manager | Executive Management | Board |
| Refer within: | 1 month | 1 month | 1 week | 1 day |
| Actions: | Routine procedures | Routine procedures | Specific treatment | Specific treatment |
| Monitoring: | Quarterly | Quarterly | Monthly | Weekly |

# APPENDIX 3
# Attendance List

**REDLAND CITY COUNCIL**

**RABY BAY RISK ASSESSMENT WORKSHOP Tuesday 1 April 2014**

**ATTENDANCE SHEET**

| NAME | AFFILIATION/POSITION | SIGNATURE |
|---|---|---|
| RON BLACK | SNR Cons. Const. Sol/ns | [redacted] |
| MORRAY EARLS | RCC | |
| Toby Epsom | RCC | |
| Steve O'Rourke | Constructive Solutions | |
| ALEX LITWINOWICZ | GHD | |
| Peter Elkington | Soil Surveys | |
| GEORGE HARRIS | RBRPA | |
| Peter Cummings | KBR | |
| BENJAMIN BRUCE | RCC | |
| Michael Kriedemann | RCC | |
| BRAD SALTON | RCC | |
| GREG FINAY | RCC | |
| DAVID HUMPHREY | RCC | |
| GORDON WILSON | RBRPA | |
| Scott Cundy | URETEK | |
| Ian Purdie | RCC | |
| MICHAEL McALLEY | GHD | |
| PETER SAMPSON | AUZCON | |
| Barney Seldenburys | auzcon | |

February 2018

# Sovereign Waters lake
## Community update

## Updating Sovereign Waters residents on issues relating to the lake

### You pay – have your say

Redland City Council maintains the Sovereign Waters lake and the Aquatic Paradise and Raby Bay canals. Activities include dredging the waterways so they remain navigable and repairing the revetment walls. Those who own canal or lake waterfront property pay the most for maintenance but all ratepayers contribute to some degree through general rates.

Council is undertaking citywide community engagement to find the best way to fund and manage the maintenance required for our city's canals and lake, and wants to hear from you. A survey on the use of the canals and lake waterways and parks is available online at **yoursay.redland.qld.gov.au/canal-and-lake-waterways**

### Funding and managing our canal and lake estates into the future

Redland City Council's community consultation on the funding and maintenance of the city's canal and lake waterways and revetment walls is proceeding well.

#### Ratepayer association meetings

A series of meetings with canal and lake ratepayer associations, or ratepayers where no association exists, is well under way. Ratepayers from our city's canal and lake estates, and their representatives, have been involved in meetings with the consultants, Articulous Communications. At the conclusion of the consultation process, a report on the outcomes of these meetings will be presented to Council as it decides how the city's canals and lake infrastructure will be funded and managed into the future.

#### Citizens' Advisory Panel

A mini representation of the Redlands, the Citizens' Advisory Panel will present to Council a report of its suggestions on ways to fund and manage the maintenance activities at our canals and lake estates. The panel does not have a decision-making role. Rather, the panel is acting in an advisory capacity, with meetings staged over a period of time, giving panel members the time and information they need to become familiar with the history and issues of this complex matter. Following the panel process, market research will be undertaken to test the panel's suggestions against the wider community. This will be conducted by an independent, specialist market research firm and the findings, along with the Citizens' Advisory Panel's outcomes, will be made available in a public report.

The first meeting of the Citizens' Advisory Panel on the funding and management of Redlands' canals and lake estates was held on Saturday, December 2 and the second meeting on Saturday, January 20. Panellists have heard from canal residents, Council officers, engineering and legal experts, as well as a representative from the Local Government Association of Queensland. They also took a bus tour of the canal and lake estates.

Not all panel members were able to attend the first meeting, so another meeting to adequately inform the extra members was held on Friday, January 19. The panel members at that meeting received the same presentations as those at the meeting on December 2, with the exception of the bus tour. However, they viewed drone footage of the canal and lake estates, with an explanation of Council's maintenance activities given by a Council officer. The drone footage can be viewed on Council's website at: **yoursay.redland.qld.gov.au/canal-and-lake-waterways**

The consultation's timeframe allows for the sharing of key ideas and outcomes with the wider community – a process that Council is committed to. Council has not yet made a decision on how the canal and lake waterways will be funded and maintained into the future. As part of the decision-making process, Council will receive reports on the outcomes of the Citizens' Advisory Panel deliberations, the ratepayer and ratepayer association meetings and the wider community consultation, including the market research.

For further information on the community consultation, and answers to questions about the Citizens' Advisory Panel process, visit **yoursay.redland.qld.gov.au/canal-and-lake-waterways**

#### Citywide engagement

As Council is committed to holding a citywide conversation about the funding and maintenance of the city's canal and lake estates, opportunities to access further information are being provided to all community members. A series of pop-up stands has been held in shopping centres across the city and, in addition to information available online, Council is also holding information displays at the following locations:

- **Victoria Point Library – February 12 to 16**
- **Capalaba Library – February 19 to 23**

**For more information visit Council's website:**
**www.redland.qld.gov.au**

Redland CITY COUNCIL

## Maintenance activities

Scheduled maintenance, including cleaning and inspections of the lake and associated infrastructure, is being completed as programmed. The rehabilitation of the two wetlands adjacent to the lake is currently out to tender and the work is expected to commence late in the current financial year.

## Special charges

In the ongoing consultation, Council has been asked about the special charges levied to owners of canal and lakefront properties. Section 94 of the *Local Government Regulation 2012* allows councils to make and levy a special charge on rateable land identified as enjoying special benefit to fund the maintenance, construction or renewal of that benefit. This regulation allows Council to collect money to pay for the significant works required to maintain the canal and lake walls and waterways, from those who get a special benefit from them.

Special charges are not unique to the Redlands – other councils also levy them – and, in Redland City, they are not unique to canal and lakefront properties. Further explanation of general rates for canal and lake waterfront properties and the special charge is available in the Q&A documents online at **yoursay.redland.qld.gov.au/canal-and-lake-waterways**

## Canal and lake refunds

Council announced in March last year it would refund unspent monies levied for canal and lake maintenance and repairs from July 1, 2011 to March 31, 2017.

Refunds commenced to current and former property owners in October 2017.

At the end of November, 2017 Council had processed more than 94 per cent of the refunds. Further information and a list of properties to which outstanding refunds apply can be found at **yoursay.redland.qld.gov.au/canal-and-lake-waterways**

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**For more information visit Council's website:**
**www.redland.qld.gov.au**

Redland CITY COUNCIL

December 2017

# Sovereign Waters lake
## Community update

## Updating Sovereign Waters residents on issues relating to the lake

### Lake and canal refunds

A public meeting was held on 20 November 2017 at the Redland Performing Arts Centre, where BDO, the accounting company appointed to calculate and manage the refund, answered residents' questions in relation to refunds.

Reserve fund balances, calculation methodology and the refund process itself were some of the topics discussed, to clarify how the canal and lake levy refunds were calculated.

Questions asked included queries about the interest paid back to property owners and the link between the reserve balances and refund project.

BDO representatives and Council officers talked through the approach taken, explained how the refunds were generated and referred to the range of material on the website where all community members can review the process.

The distinction between the reserves and the refund project was explained. In some years Council spent more than was raised through the levies in that year, while in other years Council spent less. Based on Council's external legal and financial advice, Council refunded the unspent special charges.

Attendees also heard how Council chose to apply interest to the refund amounts that was significantly higher than the interest revenue earned by Council and transferred to the reserve over the six financial years, and higher than standard commercial rates of around 3 per cent. It was actually based on rates from the Queensland Law Society and ranged from 9% to 11%.

The vast majority of ratepayers have now received their individual refunds from Council. Council took the proactive step to refund the unspent charges, following a review of relevant legislation.

A copy of the BDO report, its summary, and Q&A's from the meeting are on the Council's website. They are also available at the Cleveland Customer Contact Centre for those without easy access to a computer and/or the internet.

If you cannot access these online documents please call Council on: 07 3829 8999. It is also on Council's website: **www.redland.qld.gov.au**


**On 20 November, residents asked their refund queries of Council and BDO.**

### Have your say

Redland City Council maintains the lake at Sovereign Waters and the canals at Raby Bay and Aquatic Paradise. Activities include dredging the waterways so they remain navigable and repairing the revetment walls. Those who own lake or canal waterfront property pay the most for maintenance, however all ratepayers contribute to some degree through general rates.

Council is undertaking citywide community engagement to find the best way to manage and fund the maintenance required for our city's lake and canals.

Meetings have been held with ratepayer associations and estate ratepayers. Other community feedback opportunities will include open house displays, pop-up stands at local events, library displays, and telephone surveys. A survey on the use of the canals and lakes is available at **www.yoursay.redland.qld.gov.au/canal-and-lake-waterways**.

In addition, a Citizen's Advisory Panel is being coordinated and comprises 40 randomly selected and independently recruited residents from Redlands. The panel includes 10 canal and lakefront residents, 10 coastal residents, 10 island residents, and 10 from the broader ratepayer group.

The Panel will hear from experts and local residents, when they meet over the next few months until February 2018, to carry out detailed deliberations and make recommendations to Council.

For more details visit: **yoursay.redland.qld.gov.au**

Redland CITY COUNCIL

# Setbacks to lake revetment walls

Redland City Council has been working with canal residents regarding the application of the nine metre setback from revetment walls on waterfront properties. Discussions have centred around three broad areas: structural integrity, amenity, and access to revetment walls for maintenance. Local Councillors in the areas of Raby Bay and Sovereign Waters have communicated with local residents during November to hear their concerns on these complex issues.

## Structural integrity

The Canal and Lakeside Structures Overlay (CLSO) came into effect as part of the Redlands Planning Scheme in March 2015. It is this overlay code which currently guides how revetment walls adjoining canals and lakes can be developed.

The overlay code triggers the requirement to obtain a planning approval where development is proposed within nine metres of a revetment wall. To demonstrate compliance with the code, engineering design certificates must be provided to Council to ensure that any development within that zone will not cause any movement or damage to the existing revetment wall and canal frontage.

However, Council was advised by state government that the Draft Redland City Plan 2015 could no longer regulate the impacts of development on the structural integrity of revetment walls as this matter is covered by the State Building Assessment Provisions. Instead, these impacts will be assessed as part of a building application, with an advisory note to certifiers in the Draft City Plan.

At this time Council continues to lobby the state government to specifically require the protection of the structural integrity of revetment walls in its building provisions. Depending on the response Council receives from state government, potential amendments to the draft City Plan may need to be further considered.

## Amenity

Protecting the amenity of the canals (where new development is proposed within nine metres of a revetment wall) is also being discussed with residents, particularly the impacts on vistas and view lines.
The existing provisions contained within the Canal and Lakeside Structures Overlay and the provisions in the Draft Redland City Plan 2015 specifically protect the amenity of the canals. For proposed development in Raby Bay, Aquatic Paradise and Sovereign Waters, the provisions ensure that the amenity of adjoining premises is maintained by:

- ensuring consistency with the setbacks of adjoining buildings and structures, and
- avoiding dominating or detracting from the built form, waterway and landscape setting of the location.

Council is considering stringent planning controls are will seek residents input into any changes to the provisions.

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**For more information visit Council's website on www.redland.qld.gov.au**

Redland CITY COUNCIL

# SOVEREIGN WATERS ESTATE

# Lake Management Plan

*Prepared for:*

**REDLAND CITY COUNCIL**
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Cleveland QLD 4163

*Prepared by:*

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**8 May 2013**

BEJ252-TD-MN-REP-0002 Rev. 0

**Acknowledgments**

Cadastral Data and Aerial photography supplied by the Department of Environment and Resource Management (DERM).

Information and data supplied by Redland City Council.

**Limitations Statement**

The sole purpose of this report and the associated services performed by Kellogg Brown & Root Pty Ltd (KBR) is to provide a lake management plan in accordance with the scope of services set out in the contract between KBR and Redland City Council (RCC). That scope of services was defined by the requests of the Client, by the time and budgetary constraints imposed by the Client, and by the availability of access to the site.

KBR derived the data in this report primarily from sampled data, visual observations and inspections, examination of records, documents and information in the public domain, interviews with individuals with information regarding the site and community interactions. The passage of time, manifestation of latent conditions or impacts of future events may require further exploration at the site and subsequent data analysis, and re-evaluation of the findings, observations and conclusions expressed in this report.

In preparing this report, KBR has relied upon and presumed accurate certain information (or absence thereof) relative to the local catchment and waterway system provided by government officials and authorities, the Client and others identified herein. Except as otherwise stated in the report, KBR has not attempted to verify the accuracy or completeness of any such information.

The findings, observations and conclusions expressed by KBR in this report are not, and should not be considered, an opinion concerning the correctness of past lake bed survey data and the suitability of the design of the Soverign Waters wetland and lake system. No warranty or guarantee, whether express or implied, is made with respect to the data reported or to the findings, observations and conclusions expressed in this report. Further, such data, findings, observations and conclusions are based solely upon site conditions, information, drawings supplied by the Client in existence at the time of the investigation.

This report has been prepared on behalf of and for the exclusive use of the Client, and is subject to and issued in connection with the provisions of the agreement between KBR and the Client. KBR accepts no liability or responsibility whatsoever for or in respect of any use of or reliance upon this report by any third party.

Revision History

| Revision | Date | Comment | Signatures | | |
|---|---|---|---|---|---|
| | | | Originated by | Checked by | Approved by |
| A | 30/01/2013 | Issued for review and comment | P. Christie | D. Shooter | C. Gimber |
| 0 | 8/05/2013 | Issued to client for use | P. Christie | C. Gimber | C. Gimber |

# CONTENTS

# 1 Overview

## 1.1 BACKGROUND

This Lake Management Plan (LMP) has been prepared for the Sovereign Waters Estate lake system. Its preparation was commissioned by the Redland City Council (RCC) and it has been prepared by Kellogg Brown & Root Pty Ltd (KBR).

The Sovereign Waters Estate lake is situated between Birkdale and Wellington Point, north of Birkdale Road. The lake and associated wetland system are part of a water sensitive urban design (WSUD) as the constructed system provides influent water and urban run-off treatment for a developed catchment which is approximately 2 km².

Upstream of the wetland area there are several ponds built between 2005 and 2011 on the southern side of Birkdale Road in EGW Wood Park. These feed into the Sovereign Waters wetland area via five reinforced concrete box culverts (RCBCs). The wetland area consists of two ponds, which act as treatment areas for the removal of sediments and nutrients from the influent water. The water enters the lake from the wetlands via two RCBCs controlled by submerged one way top hinged flap gates.

The lake is designed to be brackish due to the tidal exchange system. Volumetric turnover of the lake is achieved within approximately 24 days and if required the turnover frequency can be reduced to 10 days using a manually operated emergency outlet (Redland Shire Council, 2000).

In August 2000 filling of the lake with water began and construction of over 80% of the surrounding housing had been completed. The development then moved into its operational phase.

In July and August 2000 RCC implemented an operations and maintenance manual and Lake and Wetland Management Plan respectively. These documents identified post construction and continued management requirements and operations and maintenance tasks which should be conducted to ensure the site maintains its designed functions and water quality objectives. As a result several surveys, observational and water quality studies were carried out during construction and throughout operations to present date.

RCC has identified the requirement to update the existing LMP. To do this existing data and documents have been reviewed, a sedimentation study was undertaken and a management framework and maintenance model has been developed.

This technical investigation of the lake was completed as an input to the preparation of this LMP. This was documented in report, BEJ252-TD-MN-REP-0001 – *Sovereign Waters Estate Sedimentation Study* (KBR, 2012).

## 1.2 PURPOSE

The scope of this LMP is to provide a guide for the management of the Sovereign Waters lake system. This includes the wetlands and lake, tidal exchange system, pollutant control devices and parkland areas.

The LMP is an asset based management plan which:

- Identifies the components of the lake and describes their functions.
- Provides a water level and water quality monitoring program guideline.
- Identifies management requirements and inspection frequencies for the components.
- Provides sediment removal and disposal options based on information gathered from the sediment study.
- Includes a 10 year scheduled and costed capital plan. This costed plan is an operations and maintenance schedule which is an addendum to the original Operations and Maintenance Manual (Redlands Shire Council, 2000).
- Reviews mitigation options which include plausible upstream treatment options and recommendations to improve the system.

## 1.3 PLAN CONTEXT – LEGISLATION AND GUIDELINES

Legislation and guidelines which are of relevance to the Sovereign Water Lake and its management are identified below:

- Marine Park (Moreton Bay) Zoning Plan 2008
- Marine Park Act 2004
- Aboriginal Cultural Heritage Act 2003
- Environment Protection and Biodiversity Conservation Act 1999 (Cth)
- Sustainable Planning Act 2009
- Coastal Protection and Management Act 1995
- Environmental Protection Act 1994
- Nature Conservation Act 1992
- Environment Protection (Sea Dumping) Act 1981 (Cth)
- Brisbane City (2005). Water Sensitive Urban Design Engineering Guidelines: Stormwater
- Healthy Waterways (2006) Water Sensitive Urban Design Technical Guidelines for South East Queensland.

RCC and their contracted parties are to give due consideration to legislation, requirements and guidelines when proceeding with any planning, implementation and operations within the Sovereign Waters wetland and lake system.

# 2 Introduction

## 2.1 LOCATION

The Sovereign Waters development is situated in South East Queensland, on the coastline of Waterloo Bay. The urban development is between Birkdale and Wellington Point, on the northern side of Birkdale Road (refer to Figure 2.1). It is situated in the Tarradarapin Creek catchment (Redland City Council, 2008). The lake and wetland facilitates treatment of a subcatchment area of approximately 2 km². The subcatchment is the area of land defined by topographical and man made features which drain rainfall runoff into the lake. The main stream length of the catchment is approximately 1.7 km. The subcatchment for Sovereign Waters has been derived by assessing influent water drainage plans and land contours provided by RCC and is shown in Figure 2.2.

## 2.2 GENERAL ARRANGEMENT

The primary hydrodynamic components which influence the system can be seen in Figure 2.3 and consist of the following:

- upstream ponds (EGW Wood Park)
- gross pollutant traps (GPTs) and influent water inlets
- wetland with two zones; one inlet zone and one macrophyte zone
- the Sovereign Waters Lake
- boat ramp and overflow channel for flood events
- piped tidal exchange system connected to the adjacent tidal perimeter channel which is in turn open to Waterloo Bay.

## 2.3 LAND TENURE

The lake and wetland system and areas within the vicinity which may be used during operations or maintenance work is identified in this section for planning purposes. This information has been based on GIS data provided in June 2012.

The ponds upstream of Birkdale Road, the wetland system, lake, overflow channel, the connecting foreshore and parkland to the left of the Sovereign Waters Lake are under the control of RCC as trustee to the State of Queensland. If the use of this land is required for any operations or maintenance tasks, this should be planned with RCC.


**Figure 2.1**
**SOVEREIGN WATERS LOCATION**

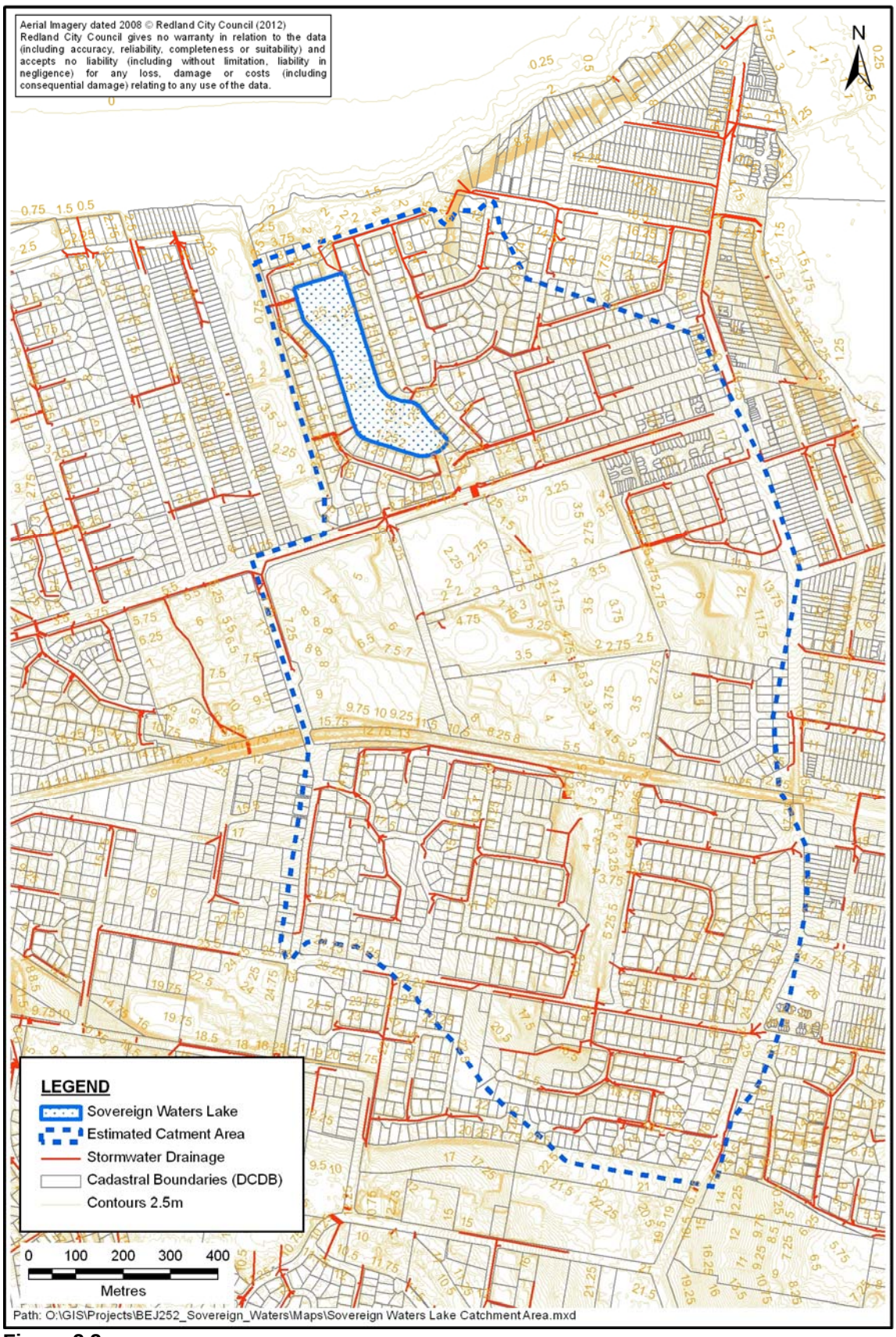



**Figure 2.2**
**SOVEREIGN WATERS SUBCATCHMENT AREA**


**Figure 2.3**
**SOVEREIGN WATERS MAIN HYDRODYNAMIC COMPONENTS**

# 3 Management framework

The management of the constructed wetland and Sovereign Waters Lake generally consists of four high level tasks. These are included below, with examples:

1. Monitoring: water quality, habitat, flora and fauna performance
2. Operational control: water levels
3. Inspection: checking of structures, embankments and exchange system components
4. Maintenance: Repair/replace damaged structures, vegetation and sediment control.

The LMP has been laid out with this framework at its core. The monitoring of the system has been detailed in Chapter 5 and following this each component of the system has been separated (Chapters 6–12). Management requirements have been detailed where applicable using the management framework adopted.

The costed maintenance model has, where possible, costed the inspection/checks that have been recommended within the management plan. The 'inspection/action' frequency relates the 'Program' section of the costed maintenance model.

Where maintenance items are known they have been detailed. However, in various cases the time and cost of maintenance for a specific component has been an estimate.

In many cases scheduled inspections and checks will determine the maintenance requirements. The management plan is intended to be adaptable, editable and non-prescriptive and therefore provide a framework to assist in managing the system.

# 4 Water quality

The required water quality to be maintained is directly linked to the uses of the lake and wetland system. This section identifies the functionality, and thus the water quality objectives of the system.

## 4.1 OBJECTIVES

The lake has been designed to provide for passive non-contact recreation (i.e. amenity and visual aesthetics) and secondary contact recreational activities (i.e. use of kayaks, canoes and other small non-powered vessels). The lake is not intended to support primary contact recreation (such as swimming) or recreational fishing, although it is reported that these activities do sometimes occur.

Lake uses and associated water quality requirements were discussed at a community consultation meeting in August 2012. The water quality standards to be maintained for the lake remain to be Australian and New Zealand Guidelines for Fresh and Marine Water Quality: secondary contact recreational standards (ANZECC, 2000) until superseded by updated guidelines.

The two wetland areas help maintain lake water quality. They are not intended for recreational activities and should only be accessed during inspection and maintenance activities by authorised persons. Given this, the water quality objectives applied to this part of the system should be those relating to amenity and aesthetic condition.

The lake water surface should be free from floating debris and weeds, the water should be relatively clear and algal blooms should be prevented by ensuring tidal mixing of the water minimises the risk of nutrient build up.

## 4.2 GUIDELINES

In accordance with the National Water Quality Monitoring Strategy (NWQMS) and National Health and Medical Research Council (NHMRC) procedures, the ANZECC Section 5 'Guidelines for recreational water quality and aesthetics' are currently under review. It has been identified that there is a need for a single guideline document to supersede earlier sets of guidelines historically published, creating a sole source of information for Australian users. In the interim the endorsed and validated ANZECC guidelines can be used. According to Section 5 'the eventual guidelines that result from the NHMRC's current revision will be the definitive guidelines' (ANZECC, 2000).

A regional framework has been identified based on the NHMRC (2008) Guidelines and Healthy Waterways publications. This framework derives a 'Regional Management Response Flow Chart' for 'Microbial Testing of Recreational Waters'.

This flow chart can be used across the catchment and works on a trigger and response mechanism, specifically for analysis of Enterococci. The World Health Organisation (WHO) advocates the use of Enterococci as the single preferred faecal identifier (WHO, 2003). The flowchart applies to the Sovereign Waters site and has been adopted for use in conjunction with routine sampling and can be found in Appendices C.

It should be noted that the routine sampling section of the flowchart does not directly apply to Sovereign Waters (which is secondary contact only) and the monitoring frequency should be taken from Section 5.1 of this Lake Management Plan.

The guidelines for recreational secondary contact focus on less frequent body contact with the water. The third recreational category of visual aesthetics also applies to the Sovereign Waters site and does not include any contact with the water body. Table 4.1 has been extracted from the guidelines and broadly identifies the characteristics relevant to these levels of recreational use.

**Table 4.1 Water quality characteristics relevant to recreational use (extract from ANZECC, 2000. p.5-2)**

| Characteristics | Secondary Contact (e.g. boating) | Visual Use (no contact) |
|---|---|---|
| Microbiological guidelines | X | |
| Nuisance organisms (e.g. algae) | X | X |
| Physical and chemical guidelines: | | |
| • Aesthetics | X | X |
| • Clarity | X | X |
| • Colour | X | X |
| • pH | | |
| • Temperature | | |
| • Toxic chemicals | X | |
| • Oil, debris | X | X |

Specifically, the guidelines recommend the parameter values in Table 4.2.

**Table 4.2 Water Quality parameters guidelines for secondary and tertiary recreational standards**

| Parameter | Guideline Value |
|---|---|
| pH | 6.5–8.5 |
| DO | >6.5 (>80% saturation) |
| Total Phosphorous | 70 µg/L |
| Total Nitrogen | 650 µg/L |
| Total Suspended Solids (TSS) - combined wet and dry periods | 15 mg/l |
| Total Suspended Solids (TSS) - wet periods | $90^{th}$percentile<100 mg/l |
| Enterococci | 230 organisms/100 ml*^ |

**median bacterial content that should not be exceeded (ANZECC, 2000)*

*^ Maximum number that should not be exceed in any one sample: 450-700 organisms/1000ml (ANZECC, 2000).*

The maintenance regime within this LMP has been developed with consideration to the water quality objectives and lake functions detailed in this section.

# 5 Monitoring

Monitoring assesses the present state of a component, its functionality and system performance and usually provides opportunity to plan preventative maintenance measures. For this reason the management framework adopted identifies monitoring as the first framework task.

This chapter details the types of monitoring to be undertaken. The monitoring task and frequency for each task has been detailed in the component sections of the plan. The associated costs of monitoring at the proposed frequencies have been included in the costed maintenance model in Appendix B.

## 5.1 WATER QUALITY MONITORING

Monitoring water quality of the wetlands, lake and perimeter channel waters provides an indication of performance of the aquatic habitat and system for sediment and nutrient removal.

The lake is designed to fluctuate in salinity during peak catchment flows and after storm events and this will cause periodic salinity related to layering followed by re-mixing. Therefore, studying the composition of the water profile through the water column is integral to understanding whether the lake is performing as it should do to prevent adverse water quality effects and provide for the intended uses.

A consistent water quality monitoring program allows data analysis of historical results to identify trends and possible areas of improvement for the system.

A monitoring approach has been detailed below and this methodology should be adopted when developing a water quality monitoring program. Costs have been incorporated into the maintenance model based on this monitoring program, which can be found in Appendix B.

- Routine monitoring: once every quarter at a minimum. If there is a requirement to understand the system and its physiochemical changes over a year of seasonal change, a program can be developed which has monthly monitoring for a year followed by a data review. After this an agreed change to the water quality monitoring frequency could be adopted.
- Event based monitoring: monitoring will be triggered by high rainfall events. The rainfall trigger for event-based monitoring in RCC is 50 mm over a 24 hour period. The event-based monitoring program and cost allowance is limited to three times per year.
- Depth profiles should be taken for the lake using direct measuring equipment, at 0.50 m increments at a minimum of three locations throughout the lake. In addition, secchi disk measurements at all locations should be taken. Surface

measurements would be sufficient for the EGW Wood pond upstream, Sovereign Waters wetland ponds, and the perimeter channel.

- The direct field measurement results obtained should be for temperature (ºC), conductivity (ms/cm), pH, DO (% saturation) and turbidity (NTU) as a minimum to understand physical conditions and provide the basis for comparison with ANZECC (2000) guidelines.
- Samples should be sent for laboratory testing for
  - Microbial testing, assessing levels using the NHMRC guidelines for Managing Risks in Recreational Water (NHMRC, 2008)
  - TN, TP, TSS (mg/L) and faecal coliforms (CFU/100 mL) as a minimum, for comparison with ANZECC (2000) guidelines.
- Observational field notes should be taken whilst sampling which state the aquatic and environmental conditions, including qualitative observations fauna presence (birds especially), debris, litter, floating scums, algal mats, or evidence of spills or floating films.
- Observation should also include any dead fish found in an of the water bodies, these should be reported and logged – whether observed by RCC or as information received from a resident. Fish mortality may be an indication of water quality problems and should be assessed appropriately, if occurring.
- The Regional Management Response Flowchart set out in Appendix C should be followed based on field and laboratory results for every sampling event.

## 5.2 WATER LEVEL MONITORING

Water level monitoring allows the operations staff to identify if there is any potential clogging up or reduced efficiency of the hydrodynamic components of the system, such as the wetland outlet structure to the lake and tidal exchange system.

Water level gauges would need to be installed in both wetland ponds and the lake. The gauges would need to relate to a specific datum, such as Australian Height Datum (AHD). This installation has been detailed in Chapter 15 and estimated cost incorporated into the maintenance model.

Inspection of water levels of the Sovereign Waters wetlands are to be completed every three months as a minimum and inspection checklists should be logged and stored. The checklists should include sections for logging information, such as:

- environmental conditions, i.e. temperature and weather conditions
- observed water quality
- tidal levels at the time of monitoring and for the entire day
- summarised rainfall data for a minimum of five days (including the day of survey).

Tide levels and rainfall data can be obtained from the Bureau of Meteorology.

Water level monitoring has been brought forward as a management action for each water body in this plan. The cost of water level monitoring has been included in the

maintenance model spreadsheet as a cost item, allocated as the time required for one operations staff to conduct 8 hours of monitoring per quarter.

## 5.3 SEDIMENTATION MONITORING

Monitoring sediment accumulation in the wetland ponds, the lake and the GPTs will provide indicative information on the rate of sediment accumulation. Having incremental data on sediment accumulation will allow foreword planning of small to large scale sediment removal maintenance tasks well in advance.

The sedimentation study conducted (*Sovereign Waters Estate Sedimentation Study* (KBR, 2012)) identified the total accumulation in most areas of the wetland and lake system. However, the construction of the EGW Wood Park upstream ponds may have had a large influence on the rate of total suspended sediments entering the lake from the catchment. For example, the sediment accumulation may have slowed down since the development of the detention ponds. Consistent data will provide insight into trends imposed on the system from external sources.

Sedimentation surveys have been recommended for the wetland ponds and the lake in the management activities and have been included as an item in the costed maintenance plan. The model has allowed for 5 yearly bed surface monitoring of the wetlands and lake.

The number of samples, equipment used, frequency and methodology should be well planned prior to implementation. It is difficult to acquire accurate sedimentation data without costly equipment. However, the use of adequate tools and good, consistent methods will reduce data inaccuracies. The upper most layer of sediment on a bed surface in slow moving water bodies is usually an unconsolidated very fine fluid mud, which is difficult to account for.

The proposed method of monitoring is similar to the method used in the *Sovereign Waters Estate Sedimentation Study* (KBR, 2012). Sediment sampling conducted using a piston sampler provides qualitative and quantitative data for both the wetlands and lake with accuracy to 0.05 m per core. To do this a boat and a minimum of two staff plus sampling equipment is required.

A simple and cost effective method to conduct bed surface surveys for the wetland inlet zone, macrophyte zone and lake is by use of a large diameter weighted plastic disc at the end of measured cord. The water depths are taken relative to the water level. If deemed suitable more extensive sediment sampling using sonar equipment will provide very accurate results.

# 6 EGW Wood Park upstream ponds

The lake and wetland is at the end of a system of WSUD features. Upstream of the wetlands on the southern side of Birkdale Road there are several detention ponds (water basins) in EGW Wood Park. In 2002 a Waterway Enhancement Master Plan was drafted (Redland Shire Council, 2002) which included computational modelling of catchment flows under several annual recurrence intervals, proposed improvements and design drawings. The document is essential background information for a study undertaken on the Sovereign Waters Estate water system and can be obtained from RCC if required.

The upstream pond has a direct influence on the Sovereign Waters wetland and lake system. Water quality monitoring of the pond upstream of Birkdale Road has been conducted previously and it is recommended that this continue (see Chapter 5). However, management of the EGW Wood ponds is not within the scope of this plan as they are managed under another framework.

During water quality monitoring of the upstream pond it would be preferential if visual observation and assessment is conducted to ensure the upstream pond is being managed effectively. For example, checking for sediment and gross pollutant build up.

# 7 Parkland areas

## 7.1 DESCRIPTION

A portion of the areas surrounding the Sovereign Waters Lake and wetland provide public recreational and scenic amenities. These include:

- terrestrial and wetland vegetation
- shared bike and path ways in the wetland area
- the boardwalk between the two wetland ponds
- maintenance access channels from Allan Day Drive to the lake and to the perimeter channel from Allan Day Drive
- overflow channel at the northern end of the lake.

Two grassed maintenance access channels from Allan Day Drive to the lake are accessed through a locked gate. These continue over the other side of Allan Day Drive to the perimeter channel, but are open access. At the northern end of the lake the overflow channel and boat ramp access area is open to community use during certain hours.

Some of these areas also act as operations and maintenance service areas and have subsurface local influent water drainage and GPT infrastructure. Maintenance is required for continued use and to ensure the surrounding areas of the system contribute positively to the objectives of the entire system.

## 7.2 FUNCTION

Access ways to system components provide serviceable areas for any maintenance requirements that need to be carried out. Pathways, bikeways and boardwalks for recreational purposes need to be maintained to ensure they remain safe, useable and aesthetic. The overflow channel provides launching access for kayaks and canoes and also acts as a suitable launching ramp for powered maintenance or monitoring vessels, only under the authorisation of the responsible council representative.

The landscaped and open vegetation areas also provide some run-off, filtering and infiltration values, as well as habitat values.

## 7.3 MANAGEMENT REQUIREMENTS

Parkland area maintenance is beyond the scope of the LMP and management occurs under a different framework.

# 8 Local pollutant controls

## 8.1 DESCRIPTION

There are five GPTs installed in the local influent water piping infrastructure. The model type and inlet/outlet dimensions of the installed GPTs can be seen in the RCC (2000) Operations and Maintenance Manual. The GPTs are buried concrete structures which are accessible via a hatch or manhole at ground level. There are three GPTs in local influent water piping and two GPTs in the tidal exchange system piping which adjoins the perimeter channel to the lake. Approximate locations of these devices are shown on Figure 8.1.

There were two trash racks installed in the system and described in the original Operations and Maintenance Manual (Redland Shire Council, 2000). The first is situated in the inlet zone of the wetland bolted to the culverts under Birkdale Road, which has vertical bars, evenly spaced and spanning across all culverts. The second is a cubic rack over the tidal exchange inlet which has a square gridded mesh to prevent marine animals, seaweed, trash and debris of larger than the gridded mesh entering the system.

## 8.2 FUNCTION

GPTs prevent coarse sediments, litter and urban debris from entering the wetland and lake via influent water infrastructure. The trash racks prevent litter and large debris entering the tidal system, wetland and lake.

## 8.3 MANAGEMENT REQUIREMENTS

Regular checks should be undertaken on pollutant control devices. The Humegard Manual (RCC (2000) Operations and Maintenance Manual) specifies inspection and maintenance frequencies.

The need for maintenance is determined through inspection, which is recommended every three months in the Humeguard manual. It is recommended to initially remove litter every three months and inspect sediment depth. Depending on the amount of pollutants captured the inspection frequency can be increased or decreased. A sediment depth of 0.3 m indicates cleaning may be required. Refer to the Humeguard Manual for more detail, such as cleaning instructions.

The tasks identified have been tabulated with frequency and description in Table 8.1. These maintenance tasks have also been included in the costed maintenance plan (Appendix B).


**Figure 8.1**
**LOCATION OF SOVEREIGN WATERS GPT DEVICES**

**Table 8.1 Pollutant control device management requirements**

| Objective | Zone/ Component | Function | Management Activity | Inspection/Action Frequency |
|---|---|---|---|---|
| Water quality and amenity | Inlet zone/ Trash rack | Inflow structure – trash rack | Remove litter and debris from trash rack. | 3 months and after high flow events |
| | Macrophyte zone/ influent water infrastructure | GPT 3 – trap large sediment, litter and debris | Remove litter and debris from GPTs. | 3 months and after high flow events |
| | | | Inspect depth of accumulated sediment. | If sediment depth is greater than 30 cm then action sediment removal operation |
| | | | Inspect GPT lid/manhole cover, locks, chains and hinges for rust or damage. | |
| | Lake/ influent water infrastructure | GPT 2 – trap large sediment, litter and debris | Remove litter and debris from GPTs. | 3 months and after high flow events |
| | | | Inspect depth of accumulated sediment. | If sediment depth is greater than 30 cm then action sediment removal operation |
| | | | Inspect GPT lid/manhole cover, locks, chains and hinges for rust or damage. | |
| | | GPT 1 – trap large sediment, litter and debris | Remove litter and debris from GPTs. | 3 months and after high flow events |
| | | | Inspect depth of accumulated sediment. | If sediment depth is greater than 30 cm then action sediment removal operation |
| | | | Inspect GPT lid/manhole cover, locks, chains and hinges for rust or damage. | |
| | Lake/tidal exchange system | GPT 5 – trap large sediment, litter and debris | Remove litter and debris from GPTs. | 3 months and after high flow events |
| | | | Inspect depth of accumulated sediment. | If sediment depth is greater than 30 cm then action sediment removal operation |
| | | | Inspect GPT lid/manhole cover, locks, chains and hinges for rust or damage. | |
| | | GPT 4 – trap large sediment, litter and debris | Remove litter and debris from GPTs. | 3 months and after high flow events |
| | | | Inspect depth of accumulated sediment. | If sediment depth is greater than 30 cm then action sediment removal operation |
| | | | Inspect GPT lid/manhole cover, locks, chains and hinges for rust or damage. | |
| | Perimeter channel/tidal exchange system | inflow structure – trash rack | Remove litter and debris from trash rack. | 3 months and after high flow events |

# 9 Sovereign Waters wetlands

## 9.1 OBJECTIVES

The wetland system should:

- achieve removal of TSS to ANZECC recreational secondary contact standards to achieve the targets required for the lake
- have 70–80% macrophyte cover in the macrophyte zone for algal epiphyte and biofilm growth (Brisbane City Council, 2005)
- have a hydraulic efficiency ($\lambda$) of no less than 0.5 and preferably be greater than 0.7 (Persson *et al*, 1999)
- have open water zones with water depths greater than 1 m (Brisbane City Council, 2005).

Brisbane City Council (BCC) guidelines (Brisbane City Council, 2005) recommend de-silting an inlet zone every five years, or once the sediment accumulates to half the design depth.

The inlet zone de-silting frequency of every five years has been adopted. It is not possible to determine the de-silting frequency from the data available. Therefore, a high frequency has been adopted. Annual surveys will identify an appropriate frequency in advance and amendments can be made to the costed maintenance plan by the user to suit.

## 9.2 DESCRIPTION

The wetlands have been designed as a passive recreation and aesthetically pleasing area. They have also been designed to achieve the expected water quality parameters in the Sovereign Waters lake and as such improve water quality, reduce metal, fluvial nutrient and sediment loads entering the lake that may jeopardise lake water quality.

There are two wetlands on the northern side of Birkdale Road which are separated by a rip rap rock revetment and raised boardwalk at RL 0.80 m AHD and RL 1.80 m AHD respectively.

The first wetland area is an inlet zone which receives catchment run-off from three inlet structures:

- the EGW Wood Park ponds through five reinforced concrete box culverts (RCBCs – dimensions: 2.40 m by 0.75 m) situated under Birkdale Road
- directly from Birkdale Road influent water infrastructure east of the development

- directly from Birkdale Road influent water infrastructure west of the development.

Inflow from the inlet zone is spread throughout the rip rap revetment and into the second wetland.

The second wetland is deeper and has verges planted with macrophytes on constructed submerged ridges approximately 1 m from the wetland edge. There is also influent water infrastructure which discharges drainage from a small area of local roads west of the wetland to the macrophyte zone.

The physical characteristics of both wetlands are identified in Table 9.1 and presented schematically in Figure 9.1.

**Table 9.1 Physical Characteristics of the Wetlands (Redland Shire Council, 2000)**

| Description | Unit | Inlet Zone (Wetland 1) | Macrophyte Zone (Wetland 2) |
|---|---|---|---|
| Top Water Level | (m AHD) | 0.60 | 0.60 |
| Bed Level | (m AHD) | 0.35 | -0.65 |
| Operational Depth | (m) | 0.25 | 1.25 |
| Bank Slopes | (V:H) | 1:4 | 1:4 |
| Surface Area (approx) | ($m^2$) | 1700 | 1900 |
| Volume (approx) | ($m^3$) | 375 | 1250 |

## 9.3 INLET ZONE

### 9.3.1 Function

The inlet zone (wetland 1) is designed to:

- provide an aesthetic and functioning habitat
- screen gross pollutants, heavy metals and coarse sediments
- dissipate the inflow energy through an energy dissipater, in this case a rip rap rock revetment.

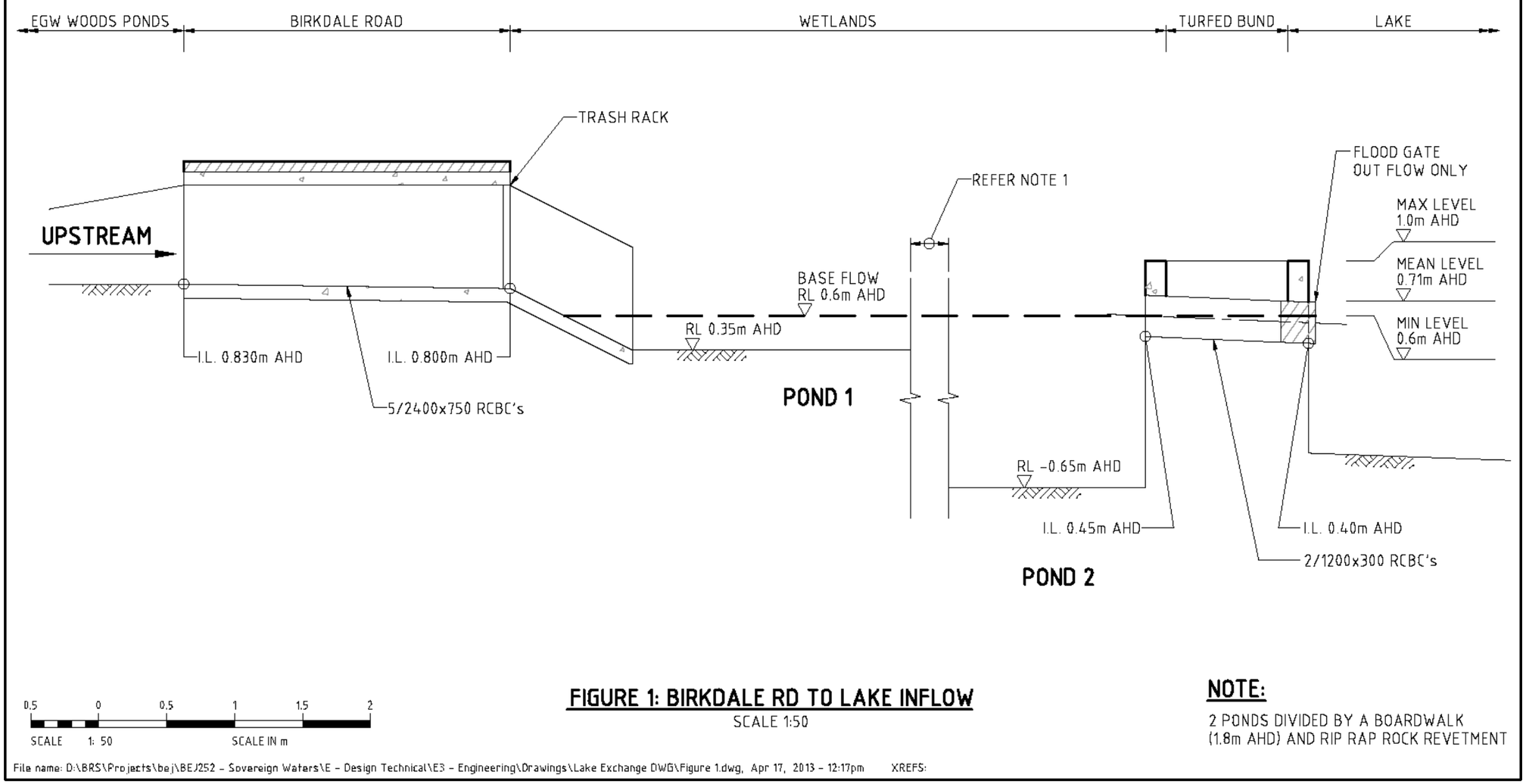



**Figure 9.1**
**LEVELS AND DIMENSIONS OF THE UPSTREAM INFLOW TO THE WETLAND OUTLET STRUCTURES**

### 9.3.2 Management requirements

The tasks identified have been tabulated with frequency and description in Table 9.2. The associated maintenance costs have also been included in the costed maintenance plan (Appendix B).

**Table 9.2 Wetland: Inlet zone management requirements**

| Objective | Zone/ Component | Function | Management Activity | Inspection/Action Frequency |
|---|---|---|---|---|
| Influent water Treatment | Inlet zone/ detention pond | Hydraulic residence<br>Removal of gross pollutants, heavy metals and bacteria | Survey accumulation of sediment | 60 months |
| Water quality | Inlet zone/ detention pond | Temporarily hold runoff<br>Screen gross pollutants, heavy metals and bacteria | Litter collection<br>Inspect banks for erosion and slumping | 3 months and after high flow events |
| | | | Water quality monitoring | 3 months |
| Habitat | Inlet zone/ detention pond | Provide for fauna<br>Provide refuge area during dry periods | Algae/undesired weed removal | 3 months (season dependent) |
| | | | Complete vegetation performance checklist | 6 months and after high flow events |
| | | | Control water levels at dry periods | event based |
| Recreational and Visual Amenity | Inlet zone/ detention pond | Scenic area | Litter collection<br>Mosquito and waterbird control | 3 months and after high flow events |

## 9.4 MACROPHYTE ZONE

### 9.4.1 Function

The deeper 'open water' area reduces the hydraulic flow, increases residence time and settling of finer sediments, nutrients, heavy metals and bacteria not captured in the inlet zone. The fringing macrophtyte areas divert flows and reduce velocities to accrete sediments and nutrients further.

### 9.4.2 Management requirements

The tasks identified have been tabulated with frequency and description in Table 9.3. The associated maintenance costs have also been included in the costed maintenance plan (Appendix B).

**Table 9.3 Wetland: Macrophyte zone management requirements**

| Objective | Zone/ Component | Function | Management Activity | Inspection/Action Frequency |
|---|---|---|---|---|
| Influent water Treatment | Macrophyte zone/open water | Hydraulic residence<br>Removal of gross pollutants, heavy metals and bacteria | Survey accumulation of sediment | 60 months |
| Water quality | Macrophyte zone/all areas | Temporarily hold runoff<br>Screen gross pollutants, heavy metals and bacteria | Litter collection<br>Inspect banks for erosion and slumping | 3 months and after high flow events |
| | | | Water quality monitoring | 3 months |
| Habitat | Macrophyte zone/all areas | Provide for fauna<br>Provide refuge area during dry periods | Algae / undesired weed removal | 3 months (season dependent) |
| | | | complete vegetation performance checklist | 6 months and after high flow events |
| | | | Control water levels at dry periods | event based |
| Recreational and Visual Amenity | Inlet zone/ detention pond | Scenic area | Mosquito and waterbird control | 3 months and after high flow events (season dependent) |

## 9.5 OUTLET STRUCTURE

### 9.5.1 Function

The outlet structure allows one way flow from the wetland to the lake.

### 9.5.2 Management requirements

The tasks identified have been tabulated with frequency and description in Table 9.4. The associated maintenance costs have also been included in the costed maintenance plan (Appendix B).

**Table 9.4 Wetland: Outlet structure management requirements**

| Objective | Zone/ Component | Function | Management Activity | Inspection/Action Frequency |
|---|---|---|---|---|
| Functionality | Outlet structures | Water level control – plant establishment, weed and pest control | Inspect integrity of structure<br>Inspect moving components for damage or restrictions<br>Inspect both entrance and exit are not obstructed by plant growth, sediment accumulation, litter and other debris | 6 months and after high flow events |

# 10 Sovereign Waters lake

## 10.1 DESCRIPTION

The lake is predominantly brackish and during periods of low catchment flow, salinity increases to approach average sea water salinity through the dominance of tidal exchange. During periods of rainfall sufficient to generate runoff and particularly after large runoff events the salinity of lake waters will decrease. In general, the lake is well mixed with respect to depth when water salinity is high and tidal exchange is dominant, and becomes stratified (layered) when freshwater runoff enters the lake.

The geometry of the lake is typical of constructed lake systems, which are designed upon many factors, one being hydraulic efficiency ($\lambda$). The lake is approximately 450 m in length and 110 m in width at its longest and widest points.

Water levels are controlled by a tidal exchange system which has one inlet and two outlet pipes which transfer seawater to and from Waterloo Bay via the perimeter channel adjacent to the west of the lake. Tidal exchange inflow and outflow is controlled by one way top hinged tidal flap valves and complete lake turnover is achieved within 24 days (based upon volumetric exchange), while maintaining a lake level between 0.6 m AHD and 1.0 m AHD.

There are two influent water inlets into the lake which have GPTs housed in the influent water drainage infrastructure which services the roads directly to the east of the lake.

There are two boat access ramps to the lake, one at the northern end of the lake and one located in the park off Helena Street. These are for public access and use of non-powered vessels. Under approval from RCC powered vessels can enter for operations and maintenance purposes from Allan Day Drive.

The physical characteristics of the lake are identified in Table 10.1.

**Table 10.1 Physical Lake Characteristics to design levels (extract from Redlands Shire Council, 2000)**

| Characteristic | Unit | Value |
|---|---|---|
| Max water level under 100 yr ARI | m AHD | 2.40 |
| Max water level under HAT | m AHD | 1.00 |
| Min water level | m AHD | 0.60 |
| Mean water level | m AHD | 0.70 |
| Bed level | m AHD | -1.60 |
| Over excavated bed level | m AHD | -3.00 |
| Batter/bank slope (1) | m | 1:10 |
| Batter/bank slope (2) | m | 1:4 |
| Surface area | $m^2$ | 42,000 |
| Volume* | $m^3$ | 84,000 |

* *Approximation*

## 10.2 FUNCTION

The lake serves several functions of importance:

- secondary contact recreational water body for vessels such as kayaks and canoes
- visual and aesthetic amenity for the surrounding residential areas and the community
- provide a habitat for fauna.

### 10.2.1 Management requirements

The tasks identified have been tabulated with frequency and description in Table 10.2. The associated maintenance costs have also been included in the costed maintenance plan (Appendix B).

**Table 10.2 Lake management requirements**

| Objective | Zone/ Component | Function | Management Activity | Inspection/Action Frequency |
|---|---|---|---|---|
| Influent water treatment | Lake/open water | Long detention of water<br>Removal of gross pollutants, heavy metals and bacteria | Survey accumulation of sediment | 12 months |
| Water quality | Lake/open water | Secondary contact recreational standards<br>Influent water treatment and sediment and nutrient removal | Litter collection | 3 months and after high flow events |
| | | | Water quality monitoring | 3 months |
| Habitat | Lake/all areas | Provide a habitat for fauna | Water quality monitoring | 3 months |
| Recreational and visual amenity | Lake/all areas | Scenic area | Check water surface is free from plant growth | 3 months |
| Safety | Lake/access ramp | Provide access area for canoes and kayaks | Inspect ramp condition, able to be safely operable | 6 months |
| | Submerged piping | Tidal exchange | Inspect signage highlighting position of submerged structures | 12 months |

# 11 Tidal exchange system

## 11.1 DESCRIPTION

The lake has been designed to achieve volumetric turnover through its tidal exchange system within 24 days (Redland Shire Council, 2000). This detention period of the total volume can be decreased to 10 days. There is a submerged emergency outlet which can only be manually operated by qualified persons.

In the north-western corner of the lake there is an overflow outlet weir designed at 1.00 m AHD and a submerged tidal inlet which has a one way valve allowing inflow only to the lake. The overflow outlet and tidal inlet uses the same piping system and the piping can be used for inflow or outflow. The regulation of levels and direction of flow is dominated by the hydraulic head and one way flow using tide valves.

There are two operational discharges and one emergency outlet. The discharge of the lake is governed by the level of the pipe within the manhole at Allan Day Drive, which is at 0.4 mAHD (see Figure 11.1). This component serves as an outlet weir, stopping emptying of the lake and controlling outflow and inflow via the tidal inlet. The system is self-regulating and does not require operational interaction. There are some management tasks, and standard checks on the system components which are needed as part of the overall management of the lake and wetland system.

Figure 11.1 and Figure 11.2 show the design levels of the tidal inlet and discharge system.

## 11.2 FUNCTION

The system design ensures that turnover of lake water volume is achieved even under dry periods by tidal exchange. The lake water level varies between a minimum 0.6 m AHD and maximum 1.0 m AHD due to tidal influence and does not exceed this range even under HAT (Redland Shire Council, 2000). This regulation of lake water by the tidal exchange:

- ensures lake water does not become stagnant
- creates variable lake water salinity, minimising plant and algae establishment
- prevents nutrient build up in the water column.

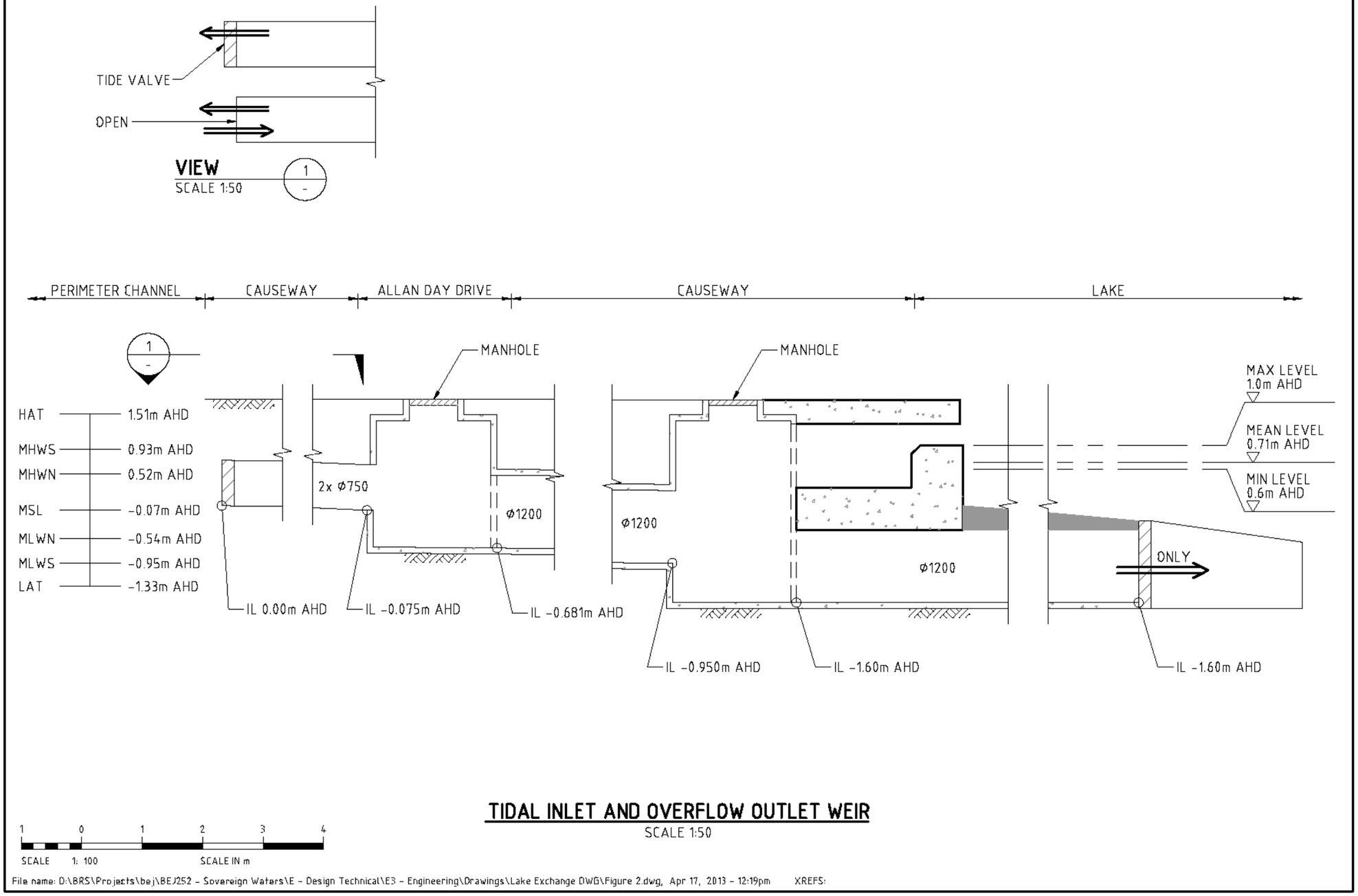
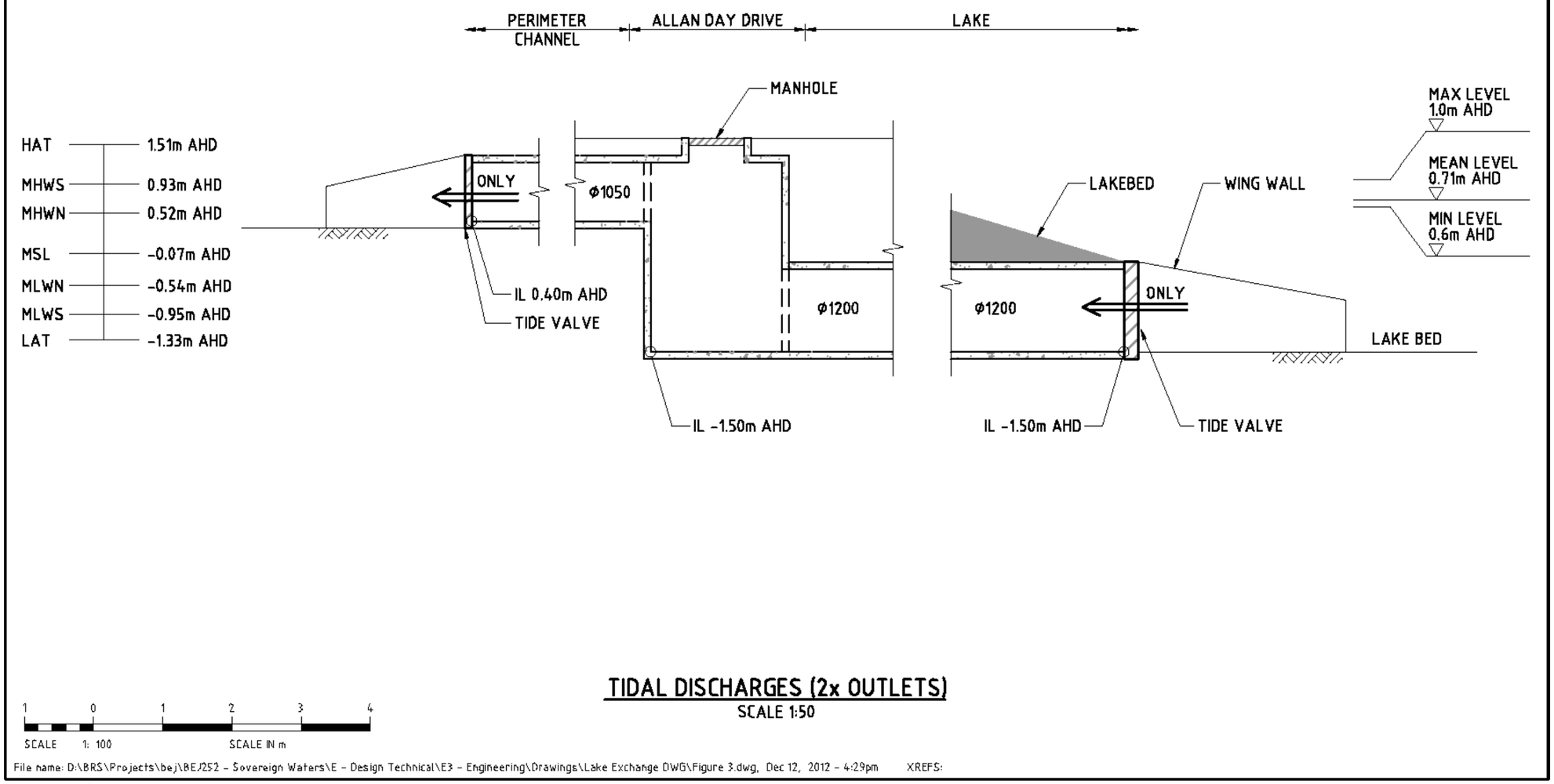



**Figure 11.1**
**LAKE TIDAL INLET AND OVERFLOW WEIR**




**TIDAL DISCHARGES (2x OUTLETS)**
SCALE 1:50

**Figure 11.2**
**LAKE TIDAL DISCHARGES**

## 11.3 MANAGEMENT REQUIREMENTS

The tidal exchange system is self-regulating. However, there are inspections that can be done which ensure the system works at its optimum (Table 11.1). The associated maintenance costs have also been included in the costed maintenance plan (Appendix B).

**Table 11.1 Tidal exchange system management requirements**

| Objective | Zone/ Component | Function | Management Activity | Inspection Frequency |
|---|---|---|---|---|
| Water quality | Tidal exchange/ overflow weir | Discharge water from lake under high flow events | Inspect weir is free from debris and free from blockages | 3 months and after high flow events |
| | Tidal exchange/ tide valves | Regulate flow direction | Inspect valves are not restricted and are free from debris | 3 months and after high flow events |
| | Tidal exchange/ perimeter channel trash rack | Prevents trash from entering he lake via the inlet | Clear debris from trash rack | 3 months and after high flow events |
| | Tidal exchange/ service pits | Change in pipe Internal Level - acting internal weir | Inspect for sediment accumulation | 3 months and after high flow events |

# 12 Lake perimeter wall

## 12.1 DESCRIPTION

The lake perimeter wall is the boundary between the waters edge and the residential properties. Details of the design can be seen in Development Consulting Pty Ltd drawing number 9729-03.

## 12.2 FUNCTION

The wall contains the lake water body and is only inundated if the lake water level is surcharged by runoff from a 1 year annual recurrence interval (ARI) or greater rainfall event. The hydrostatic pressure of the water and the walls footing structure prevent slope failure of the raised properties.

## 12.3 MANAGEMENT REQUIREMENTS

**Table 12.1 Perimeter wall management requirements**

| Objective | Zone/ component | Function | Management activity | Inspection frequency |
|---|---|---|---|---|
| Safety | Lake/ perimeter wall | lake/property boundary | Conduct integrity inspection (visual observations) | 60 months |

# 13 Sediment removal and disposal

## 13.1 OBJECTIVES

Sediment removal in the wetland and specific lake areas near influent water inlets will be required within the design lifetime of the Sovereign Waters Estate waterway system. Reducing sediment loads serves to maintain the objectives of the system by keeping the morphology relatively unchanged and removing nutrient loads from the system. The water quality and functional objectives have been identified in Chapter 4.

## 13.2 PLANNING AND APPROVALS

Sediment removal operations have been identified in the costed maintenance plan spreadsheet. Sediment removal operations tasks will be low impact, where small (less than 10,000 m³) volumes of sediment will need to be removed from locations which are accessible by use of earthworks machinery. Disposal of the sediment will occur onshore, at a location to be assessed during the planning phase. Given this, the planning and approvals process is less extensive and the frameworks RCC has to work within is not as rigorous.

Legislation may be amended, repealed or new legislation introduced which can in turn alter approval pathways, assessment triggers, timeframes and other requirements for a project. To minimise the potential for this to be adverse to the project, regular reviews of legislative changes should be undertaken by RCC to take the most current legislative requirements into account, say every 5 years and more frequently where the planned activity date has been confirmed. Revisions to the project to respond to the legislative framework applicable at the time can be made accordingly.

## 13.3 PROPOSED METHODOLOGIES

The proposed methodologies are guidelines for planning purposes based on 2012 methods and have been derived by undertaking a methodology assessment. This process involved identifying various methodologies and working through to determine the most suitable.

The constraints, equipment and operations required for each option has been discussed. During planning more thorough assessment should identify the specific tasks. All methodologies assume that the appropriate approvals and assessment framework will have been completed.

### 13.3.1 Wetland sediment removal

The inlet zone is more accessible due to a service ramp and access to Birkdale Road. Sediment removal of the macrophyte zone independently would be more difficult due to restricted access.

Sediment removal in the wetlands can be achievable by either:

- using a long arm excavator which transfers to a lined truck and dumps directly at landfill
- dewatering the wetlands, excavating and trucking the spoil directly to landfill.

Table 13.1 summarises the options.

**Table 13.1 Wetland sediment removal summary**

| Option | Constraints/Limitations | Plant/Equipment | Major operation tasks |
|---|---|---|---|
| 1 | Machinery access<br>Disturbance to surrounding ecosystem<br>Disruption to public use<br>Release of nutrients and sediments into the lake<br>Potential odour and acid sulfate soils | Long arm excavator<br>Earthworks machinery<br>Slurry tanker or lined truck(s) | Clear required wetland parkland for machinery access<br>Excavation of wetlands to desired depth<br>Filling of trucks on Birkdale Road and transportation of spoil to landfill<br>Monitor water quality |
| 2 | Disturbance to surrounding ecosystem<br>Disruption to public use.<br>Operation relies upon dry period or bypassing of wetlands<br>Potential odour and acid sulfate soils | Excavators<br>Earthworks machinery<br>Lined truck(s) | Clear required wetland parkland for machinery access<br>Implement wetland bypass for influent water run-off<br>Excavation of wetlands to desired depth<br>Filling of trucks on Birkdale Road and transportation of spoil to landfill using lined trucks<br>Monitor water quality |

Provided wetland rehabilitation is required Option 2 is the most feasible and cost effective, especially if both works; sediment removal and wetland rehabilitation are conducted in parallel.

The costed maintenance plan has adopted option 2 and proposes wetland rehabilitation within the five years. After this occasion, sediment removal of the inlet zone and macrophyte zone have been recommended and costed based on Option 1 in Table 13.1.

### 13.3.2 Influent water inlet sediment removal

The sedimentation study (*Sovereign Waters Estate Sedimentation Study* (KBR, 2012)) identified a requirement to remove accumulated sediments in approximately 20 m radius of influent water inlets into the lake by 2035.

### 13.3.3 Lake bed sediment removal

The sedimentation study used mean lake depths and mean annual siltation rates for the lake bed sediment accumulation projection. The area, referred to as 'Zone 1 – General zone' accretes at a very slow rate. The period until sediment removal will be required exceeds any RCC planning timeframes and the costed maintenance plan period within

this study. Refer to *Sovereign Waters Estate Sedimentation Study* (KBR, 2012) for further details.

## 13.4 FREQUENCY

Frequency of sediment removal operations has been assessed based on the sedimentation rates provided in the *Sovereign Waters Estate Sedimentation Study* (KBR, 2012), the importance of maintaining the functionality of the component and the effect the works have on the surrounding environment, residents and community. 'Frequency' in the 'Program' section of the maintenance model; can be amended by the user. This may be required after a review concludes that sediment removal frequencies should be altered.

### 13.4.1 Wetlands

BCC guidelines (Brisbane City Council, 2005) recommend de-silting an inlet zone every five years, or once the sediment accumulates to half the design depth. The maintenance model has assumed the five yearly de-silting frequency recommended in the BCC guidelines as an upper limit, monitoring of sediment accumulation will assist develop actual action frequencies.

There is no set period between macrophyte rehabilitation events recommended in BCC guidelines. However, wetland inspection checklists provide a range of criteria to assess the state of the vegetation. There should be pre-defined targets for the wetland performance which can be monitored and the checklist should be a framework for assessing the maintenance requirements and need for vegetation rehabilitation.

### 13.4.2 Influent water inlets

The trigger for sediment removal in the Influent water inlet areas of the lake should be when a minimum depth of 1.5 m is reached. Surveys of the lake every five years are highly recommended, these will provide prior indication as to the time sediment removal will need to occur. The mean annual sedimentation projections (*Sovereign Waters Estate Sedimentation Study* (KBR, 2012)) estimate that the first sediment removal may be required in 2035 for this area.

### 13.4.3 Lake

The rate of accumulation for the general lake area is slow enough that for planning and costing purposes we can assume that the option to 'do nothing' is the most suitable.

## 13.5 ESTIMATED SEDIMENT REMOVAL VOLUMES

The estimated sediment removal volumes for the wetlands have been provided in the costed maintenance model (Appendix B). The 'Sediment Removal Volumes' tab displays the volumes which the user can amend if required.

# 14 Costed maintenance plan

## 14.1 COSTS SUMMARY

The annual maintenance cost varies significantly between years of sediment removal and years where normal operations and maintenance tasks occur. For the ten year period of 2013–2023 the average annual maintenance cost is $83,500.

These values represent the cost over a ten year period in 2013 dollars, where the change in the value of money over time and from inflation has not been projected.

The cost items and associated assumptions used in the estimation of the annual maintenance costs are outlined in Section 14.3 and the maintenance plans are attached in Appendix B.

## 14.2 FINANCIAL MODEL

To determine the annual maintenance costs, a financial model was developed. The model was prepared as Excel spreadsheets and each contain a number of worksheets. The financial model is described in detail in an explanatory report in Appendix A. The costs applied to the various maintenance activities in the financial models are outlined in the following section.

The scope set out by RCC detailed the development of a costed 10 year maintenance plan. Some appreciable maintenance tasks extend beyond this period and others are ongoing annual tasks. The costed maintenance model has provided indicative costs for these tasks in the 'Program and Assumptions' section in the 'Instructions for Use' in the Maintenance Model, Appendix B.

## 14.3 COST ITEMS

The following sections outline the costs used to estimate the overall annual maintenance costs. They are divided into several maintenance sections; general maintenance, sediment removal and disposal, local influent water infrastructure and tidal exchange maintenance, administration and monitoring, as per the financial model. These costs, and their basis, are also detailed in the Appendix A explanatory report and the financial model worksheets which are shown in Appendix B.

### 14.3.1 General maintenance costs

The general maintenance costs have been estimated on the basis of information provided by RCC and KBR's relevant previous project experience.

The average annual general maintenance cost for all components for Sovereign Waters over the next ten years is $14,000.

The items which make up these general maintenance costs include:

- litter collection
- aquatic vegetation removal
- cleaning of access ramps
- signage maintenance.

### 14.3.2 Wetland sediment removal and disposal costs

The sediment removal costs were based on the proposed methodologies presented in Chapter 13. Further to this, the sediment removal and disposal cost estimates have been based on the following assumptions as well as those set out in Section 14.4.1. The average annual wetland sediment removal and disposal costs for Sovereign Waters over the next ten years is $20,900.

#### General assumptions

- surveys are undertaken prior to (pre) and following (post) each sediment removal campaign to verify the removal depths and volumes
- removed material is uncontaminated fill and is disposed of at the closest landfill
- it takes several months to complete planning and detailed design works for sediment removal of the wetlands.

#### Sediment removal costs summary

- Table 14.1 outlines the rates for the sediment removal and disposal maintenance items included in the financial model for each water body.

**Table 14.1 Sediment removal and disposal rates summary**

| Item | Estimated cost |
|---|---|
| Excavation of material | $10/m³ |
| Mob/demob excavator | $2,200 |
| Sediment removal survey (wetlands) | $7,600 |
| sediment removal design, approvals and monitoring | $5,500 |
| Wet uncontaminated spoil treatment, haulage and disposal at landfill | $27/m³ |

### 14.3.3 Local pollutant controls and tidal exchange maintenance costs

Maintenance costs incurred to prevent litter and debris entering the system, clogging up moving parts and flowing out to Waterloo Bay fall into this category. In particular the following components:

- wetland outlet structure to the lake
- local GPTs
- trash racks
- tidal exchange system.

The average annual costs for maintenance and repair of these components over the next 10 years is $13,700.

The most appreciable cost which may occur is the replacement of tidal flaps and valves. The design life of the components is 25 years; therefore replacement of the components may be required by approximately 2025. This large ticket item extends beyond the models proposed schedule, however, a basic indicative estimate has been produced and inserted into the 'Raw unit rates' tab for estimating, if required. The cost estimate is a basic addition of materials and labour.

### 14.3.4 Administration

The overall site maintenance program will require management by RCC and there will be subsequent administration costs. The annual administrations costs are $14,500 comprising:

- five yearly review of the maintenance model, including the financial model and siltation rates, an average annual cost of $3,800
- RCC annual administration: $10,700.

### 14.3.5 Monitoring

There are several cost items in relation to monitoring of the sovereign waters site. The annual monitoring cost is $20,400. These include:

- annual water quality monitoring and laboratory sample analysis, including labour for sampling and event based microbial testing: $16,150
- annual water level monitoring (includes one off installation of water level gauges): $1,950
- annual vegetation performance monitoring: $250
- average annual cost of five yearly wetland sedimentation survey: $700
- average annual cost of five yearly lake sedimentation surveys: $1,350.

## 14.4 FINANCIAL CALCULATION DISCUSSION

### 14.4.1 Important assumptions

As stated earlier in this section, there are a number of assumptions which underpin the cost estimation. There are also several important broad assumptions which include:

- All rates and costs are based on calculated estimates, precedents and provided information thus there will be some inaccuracies. Rates will change and become more certain in the future, especially once the initial round of maintenance items are undertaken and as a result they should be appropriately updated in the financial model.
- Waste disposal sites must comply with their licence agreements and the soils extracted should be checked for any potential to produce acid.
- The mean annual sedimentation rates and volumes are the essential basis for the cost estimates and the recommended sediment removal and disposal

methodologies. It is assumed that the estimates (*Sovereign Waters Estate Sedimentation Study* (KBR, 2012)) are sufficiently accurate to define the dredging, treatment and disposal costs. It should be noted that sedimentation rates are likely to change in the future which will affect the maintenance costs.

### 14.4.2 Accuracy of estimate

The annual maintenance costs have been presented as a range to show the possible cost fluctuations. This range is based on the 'Confidence Factor Adjustment' function on the 'Raw Unit Rates' sheet in the Financial Models. The lower limit of the range is the 'optimistic' confidence meaning there is a 90% probability of exceedance, while the upper limit of the range is the 'pessimistic' confidence meaning there is a 10% probability of exceedance. Hence the neutral (mean) position represents a 50% probability that the forecast cost will be exceeded.

Variation in the estimated maintenance costs could occur due to:

- climate variations leading to fluctuations in siltation rates
- modelling and survey inaccuracies
- variations in dredging and disposal costs.

The sensitivity variation factor does not cover items such as:

- changing legislation
- major changes in fuel costs
- change to the required maintenance dredging volumes due to incomplete siltation information.

Additional work will be required if this accuracy value is to be improved. Such work would include:

- obtaining a range of quotes from required service contractors and researching more similar precedent projects
- feasibility study and detailed design of a wetland inlet and macrophyte zone restructure.

# 15 Mitigation options

The options provided have the potential to improve the recreational and visual value of the wetland and lake and reduce the total volume of sediments, nutrients, organic matter and pollutants entering or exiting the system. They do not form part of the management requirements at present. They range from recommended improvements to options identified for interest and review, with the potential for RCC to expand further on the options.

Mitigation should reduce maintenance frequency or overall cost. Only options which reduce maintenance or improve the system for the foreseeable future have been discussed. Only water level gauges have been incorporated as a forecasted cost in the financial maintenance model, the feasibility of the remaining suggested options herein would have to be assessed at a later date.

## 15.1 RECOMMENDED IMPROVEMENTS

The items within this section are advised improvements to the system. These have been developed from site observations conducted in June and July of 2012. These items would be best implemented within the first year or two of establishing the LMP.

### 15.1.1 Water level gauges

Installation of water level gauges to AHD would assist in water quality monitoring, bed surface surveys and water level operations that need be conducted, as identified in Section 5.2. When there is high influent water flow into the system these can also readily be monitored. Overall, the data will provide another parameter which assists in evaluating performance of the system. Approximate costs have been identified in the maintenance model and the addition of gauges has been incorporated into the annual cost in 2014.

### 15.1.2 Wetland Pond 2 (macrophyte zone) overflow weir

During periods of high rainfall and high tides it is likely that water within the wetland will overtop the wetland wall. This can cause scouring, firstly of the earth bund between the wetland wall and lake perimeter wall and of the lake bed. Concreting of the most commonly overtopped area of the wall would prevent scouring of the bund, however, it would also be very expensive. Scour is very slow to occur and the added value does not outweigh the cost. Secondly, to mitigate lake bed scour rocks have been placed in the area. Provided these are kept in place and observation of the bund condition occurs annually an overflow weir is not necessary within the timeframe of this LMP.

## 15.2 SILTATION MITIGATION

The sediment sampling undertaken (detailed in *Sovereign Waters Estate Sedimentation Study* (KBR, 2012)) identified that the fastest accretion of sediment since operations commenced and the lake was filled in August 2000 was in the proximity of influent water inlets to the lake. Although the time until sediment removal is appreciable (approximately in 2035), hence mitigating action is not pressing.

The influents from influent water infrastructure is an appreciable source of localised sediment and organic matter deposition and the siltation mitigation option reviewed is a preventative measure to reducing organic matter and sediment loads in the system.

### 15.2.1 RCC silt bag trial

RCC carried out a silt bag trial on 21 influent water pits at various locations throughout the Aquatic Paradise catchment. The catchment is adjacent to the Sovereign waters sub-catchment, hence very close. The findings can be used to evaluate the possible use for the Sovereign Waters catchment.

#### Ecosol summary report and findings

The Ecosol Rapid Influent water Filtration (RSF) 100s were installed and commissioned on 24 December 2010 with the study operating over a 12 month period. All units were inspected monthly and at those times approximate pollutant volumes and compositions were recorded. Cleaning of the units occurred every three months.

The following points are comments from Ecosol in their summary report regarding the nature and volumes of pollutants found in the traps and the effectiveness of the Ecosol RSF 100s:

- 'The units were found to capture approximately 41% (Average) volume of pollutants each month. This volume mainly consisted of organic/vegetative pollutants at approximately 85%.
- Due to the type of catchment (residential) it can be expected that organic pollutants will be high due to grass clippings, established trees, and shrubs, etc.
- During each inspection/clean it appeared that the organic/vegetative pollutants captured within the units were breaking down to form a heavier soil like substance. It is assumed that without the RSF 100s these same pollutants would normally breakdown within the bottom of the influent water pits and pipes in between rain events.
- It is therefore assumed that silt may not be contributing to problems downstream, but broken down organic pollutants, especially with the recorded volumes monthly.
- It should also be noted that another contribution to the pollutant volumes was the build up of concrete mix within some of the RSF 100 filter liners, due to residents renovating and/or constructing new driveways.'

Across a sample of six silt bags, the average filled volume was 58% with an average dry sediment weight of 8 kg. This gives an indication of the amount of sediment removed from the silt traps.

#### Evaluation

The results and summary report of the silt bag trial show that by far the largest contributor of pollutants entering the influent water drains which were fitted with Ecosol RSF 100s was organic matter. It is suggested in the summary report that this largely includes material such as grass clippings and organic debris from shrubs and trees, etc. This correlated well with the results from the sediment sampling near influent water inlets in the Sovereign Waters Estate, where the samples had a high odour, high organic matter and the sediment texture was also consistent with Ecosol's findings.

The silt bag trial in the Aquatic Paradise catchment works successfully to reduce the volume of pollutants entering the canal system, especially organic matter and debris.

The overall volume of accumulation that the silt bags trap is very small in comparison to the volume of accumulated sediment in the entire lake. However, this preventative measure may decrease annual sediment accretion rates in proximity of influent water inlets and may prolong or prevent sediment removal operations in these areas.

It is probable that the greatest benefit of using the RSF units in the Sovereign Waters sub-catchment is the improvement to water quality, since fewer pollutants would be entering the lake.

## 15.3 WETLAND RE-STRUCTURE AND REHABILITATION

### 15.3.1 Guidelines

Brisbane City Council (2005) Engineering Guidelines on water sensitive urban design provides detailed information for constructed wetlands, most of which is analogous to several other Australia based wetland design guidelines. They detail the design considerations, design process and maintenance requirements of constructed wetland systems.

Wetlands generally consist of an inlet zone, a macrophyte zone and a high flow bypass. The inlet zone is usually a sedimentation basin which is designed based upon target sediment size, design discharge, detention time and hydraulic efficiency. It is quite deep, which allows coarse to medium sediments to drop out of the water column. The target sediment size typically defines the size of an inlet zone. Dense marsh vegetation in the littoral zone provides scour and erosion protection to the batters and restricts public access to the open water.

The macrophyte zone will typically be shallower (0.25–0.50 m depending on plant species), have 70–80% macrophyte cover, a hydraulic efficiency of no less than 0.5 and open water zones with water depths greater than 1 m. The bed may undulate creating a sequence of ephemeral, shallow marsh and deep marsh zones in a geometry which promotes radial spreading of the inflow. As a result the design should remove the majority of TSS in the water and algal epiphytes and bacterial biofilms which colonise submerged plants will actively reduce nutrient loads into the downstream.

During 'above design flow' conditions it is likely that damage can be caused to the wetland plants, banks and structures by increased hydraulic energy. For this reason a bypass channel is recommended, which activates under a specific level of water.

### 15.3.2 Sovereign Waters wetland evaluation

Sediment sampling and water depth checks of the inlet zone identified the water depth to be quite shallow (no greater than 0.30 m). The macrophyte zone is deeper (approximately 1 m) and has less than 20% aquatic vegetation cover.

The wetlands were designed prior to the construction of the upstream EGW Wood Park ponds and thus were designed to perform a function under certain conditions which have since evolved.

The Sovereign Waters wetland ponds could be re-structured and replanted. The design process would identify the size, area and depth of the ponds. There are several advantages:

- opportunity to re-design inlet zone to have serviceability access for sediment removal
- increased removal of coarse, medium and fine sediments
- increased removal of nutrients from the water column
- environmental; increased habitat for flora and fauna
- educational; detailed signage of inlet and macrophyte zone designs, the objectives and functions, and of aquatic flora and fauna which the wetland supports.

Sediment removal of the inlet zone should be conducted every five years or when the sediment depth is 50% of the design depth. Bed surface monitoring has been suggested in the maintenance model for both wetland ponds. This will identify the requirement to remove sediments.

If re-structuring and rehabilitation of the wetland was opted for, then it would be financially beneficial to do so at the time of sediment removal due to the following reasons:

- Most of the equipment required will have been mobilised for sediment removal.
- The in situ material removed to make the inlet zone deeper could be used to reform the macrophyte zone.
- The most efficient and cost effective way to remove and dispose of sediment would be to dewater the wetlands to less than 20% moisture content and dispose of the spoil directly in lined trucks. Dewatering would also be required for macrophyte rehabilitation.
- Dewatering would require a wetland bypass channel to be constructed in the event of catchment flow during the operation. This could be constructed to double as a permanent high flow bypass channel, possibly including a GPT or trap.

The water quality monitoring data reviewed suggests the system is performing well, which may largely be as a result of several upstream detention ponds in EGW Wood Park. Therefore, wetland restructure value would have to be evaluated after more data has been acquired on the wetland system, as will be brought about by this LMP. These options are indicative and no cost estimates have been derived or provided in the maintenance model.

# 16 References


Australian and New Zealand Environment Conservation Council (ANZECC), 2000. Australian and New Zealand Guidelines for Fresh and Marine Water Quality.

Brisbane City Council, 2005 Water Sensitive Urban Design Engineering Guidelines: Stormwater.

Development Consulting Pty Ltd, 1999. Lake Section & Revetment Wall Details; drawing number 9729-03.

KBR, 2012. Sovereign Waters Estate Sedimentation Study.

National Health and Medical Research Council (NHMRC), 2008. Guidelines for Managing Risks in Recreational Water. Australian Government.

Persson, J., Somes, N.L.G. and Wong, T.H.F., 1999. Hydraulics efficiency of constructed wetlands and ponds. ***Wat. Sci. Tech.*** Vol.40, No.3, pp. 291-300.

Redland City Council, 2008, Catchment Boundaries. Produced by Redland City Council GIS Services April 2008.

Redland Shire Council, 2000, *Sovereign Waters Estate: Operations and Maintenance Manual*. Prepared by: Lawson and Treloar Pty Ltd.

Redland Shire Council, 2002, *EGW Wood Pak Waterway Enhancement Plan*. Prepared by: John Wilson and Partners Pty Ltd.

WHO (World Health Organization) (2003). *Guidelines for Safe Recreational Water Environments*. *Volume 1. Coastal and Fresh Waters*. WHO, Geneva.

*Appendix A*

# SOVEREIGN WATERS ESTATE
# FINANCIAL MODEL
# EXPLANATORY REPORT

*Appendix A*

# Financial Model Explanatory Notes

## 1 Introduction

The Sovereign Waters Estate is located in Birkdale on the southern side of Waterloo Bay. The wetland and lake system is part of a water sensitive urban design (WSUD) as the constructed system provides stormwater and urban run-off treatment for a catchment which is approximately 2 km².

Kellogg Brown & Root Pty Ltd (KBR) was commissioned by Redland City Council (RCC) to develop a Costed Maintenance Plan for Sovereign Waters as part of the preparation of a Lake Management Plan (LMP). The Costed Maintenance Plan was created as a financial model in Excel which examined the long-term maintenance requirements and costs for the site. The model serves to assist Council in planning the necessary maintenance works and in forecasting the associated costs.

This financial model is described herein.

This explanatory report outlines the methodology including key assumptions, and general instructions for using the model. This report is not intended to provide the detailed technical basis of the maintenance model. It is rather a user-guide.

## 2 Methodology

### Introduction

The Sovereign Waters maintenance model consists of two separate sections:

- A maintenance expenditure cash flow Excel (*.xls) spreadsheet that incorporates the following worksheets
  - Amendments Register
  - Instructions for Use
  - Model Summary
  - Model Cash Flow
  - Derived Unit Rates
  - Program
  - Raw Unit Rates Table
  - Sediment Removal Volumes.

- A Redland City Council generated 'Finance Model' that uses output from the Model Cash Flow worksheet to perform financial calculations.

### Worksheet data flow

The data flow is mapped out graphically on the 'Instructions for Use' worksheet.

A data flow map (Figure A.1) shows that information flows in a linear progression through the model. The exception to this linear flow occurs on the 'Model Cash Flow' worksheet, which is the product of two previous worksheets. These worksheets, 'Derived Unit Rates' and 'Program', contain costs and quantities converted into a useable format from the raw input worksheets (see 'Section 3 – How to Use the Maintenance Model' for details).

Additionally, a governing equation is shown in Figure A.1. This equation shows that the cash flow is the product of costs (with a sensitivity factor), and quantities (also with a sensitivity factor).

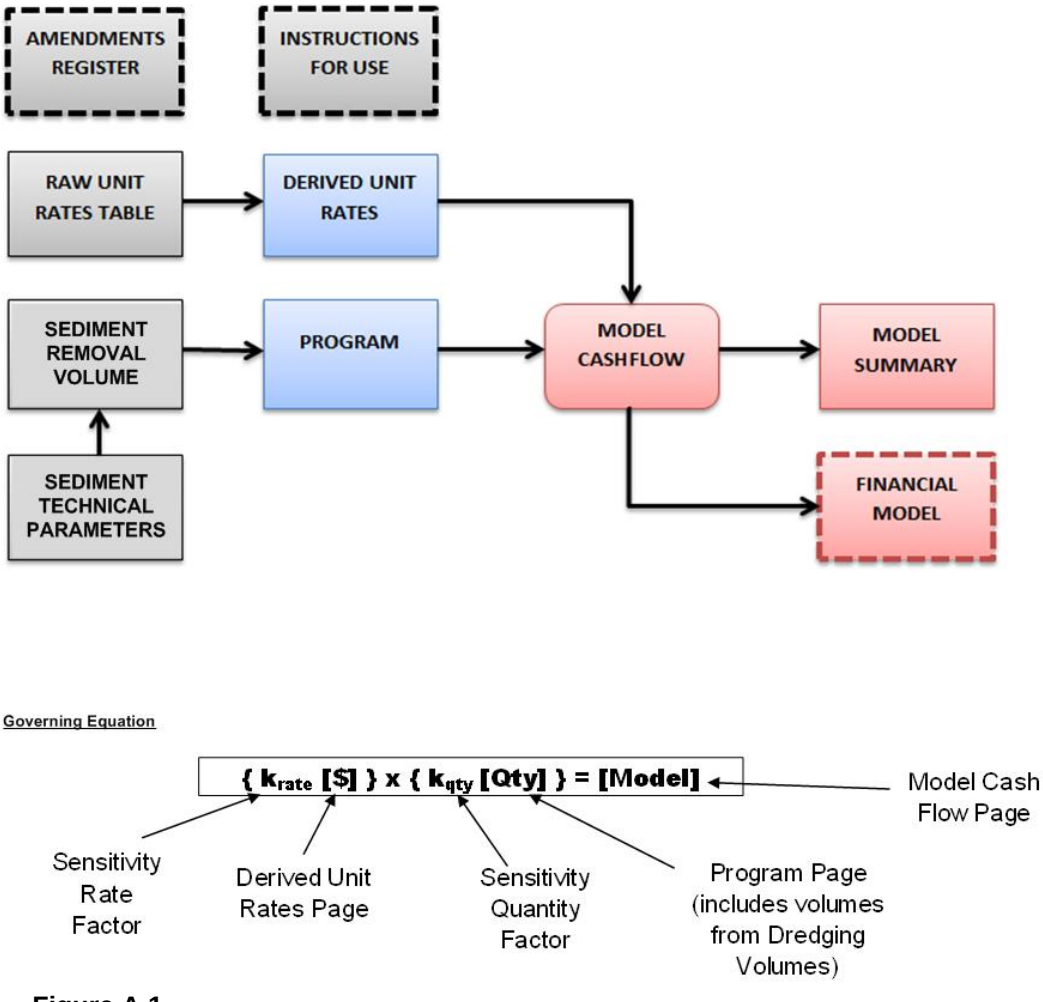



**Figure A.1**
**WORKSHEET DATA FLOW AND GOVERNING EQUATION**

### Assumptions

The assumptions are detailed in the model under the following categories:

- General assumptions
- Sediment removal volumes
- Sediment removal and disposal methodology
- Raw unit rates
- Program
- Derived unit rates
- Model Cash Flow/Model Summary.

# 3 How to use Maintenance Model

### General instructions

*Prepare the model and data entry*

The spreadsheet is structured so that key information is input into the 'Raw Unit Rates Table' and 'Program' worksheets. Additionally, the 'Derived Unit Rates' and 'Sediment Removal Volumes' sheets have adjustable sensitivity factors.

The 'Sediment Removal Volumes' sheet is where the financial model sediment volumes input occurs. The sediment volumes based on the sediment removal plan are input into the table at the bottom of the spreadsheet in Rows 40, 41 and 42. Inputs are required for Wetland; Inlet zone and macrophyte zone. The volume proportions are determined in the sediment removal plan.

Manual manipulation of the sediment volumes input is allowed (cells shown in bold blue font and shaded light green). This allows the user to view the effects of alternate sediment removal scenarios. However, care should be taken to ensure that manual input volumes are realistic. Therefore, knowledge of the proposed sediment removal plan and all sediment removal and disposal constraints is advised before attempting this.

*Run and refine model*

The 'Model Cash flow' worksheet is essentially the product of 'Program' and 'Derived Unit Rates'.

The model may be refined by adding or deleting new cost items. This must be done with care as data is linked across multiple worksheets to provide relevant output. Create a new saved version of the document before attempting this.

Use adjustable sensitivity factors on ‘Derived Unit Rates’ and ‘Sediment Removal Volumes’ worksheets, and the sliding ‘confidence factor adjustment’ on the ‘Raw Unit Rates Table’ for sensitivity analysis.

When running the model ensure that all selectable functions are set correctly. These include:

- Extra volume due to increased siltation – use the check box to turn the event ‘on’ and ‘off’ and the drop down box to choose the siltation volume increase percentage (‘Sediment Removal Volumes’ – cell A20.)
- Sensitivity rates factors - (‘Sediment Removal Volumes’ – cells C9:N9)
- Confidence factor adjustment – using the slide scale (‘Raw Unit Rates Table’ – cells M15:P16)
- Confidence levels – (‘Raw Unit Rates Table’ – cells D7:D67)
- Sensitivity Rate Factor – (‘Derived Unit Rates’ – cells E10:E94)

Update ‘Amendments Register’ following model changes.

*Output*

‘Model Cash Flow’ and ‘Model Summary’ worksheets are output pages, showing a breakdown of costs for given cost items. The spreadsheet shows all costs in 2012 dollars, with no allowance for inflation.

### General spreadsheet functions

*Password protection*

Password protection is applied to all linked cells to protect the document from being accidentally edited. Each worksheet is locked individually.

To unlock a worksheet, go to Tools > Protection > Unprotect Sheet (in Excel v.2003) and enter the password. When editing is completed, lock the worksheet again using the same password as shown below.

The password to unlock each worksheet is: **BEJ252**

Note the password is case sensitive.

*Hidden comments*

Certain cells contain hidden comments, which are marked with a red corner in the top right hand corner of the cell. Hover over the cell to view the hidden comments.

To hide any visible comments, right click and select hide from the menu.

*Locking cells*

As RCC develop the ‘Finance Model’ worksheet, locking cells that contain calculations while maintaining ability to modify any input cells is important. To do this, select all the cells on the worksheet, right click and select Format Cells > Protection, then uncheck ‘Locked’. Following this unlocking of all cells, select all the

cells containing calculations and repeat the steps above, however check 'Locked'. Then protect the worksheet by Tools > Protection > Protect Sheet and enter the password. Once the worksheet is protected, only those cells which are ticked as 'locked' are locked, and other cells remain active.

### Sediment Removal Volumes

On the 'Sediment Removal Volumes' worksheet, user input is available in a number of areas. Any input cell containing '**bold blue**' font and light green shading is for user editing which allows manual entry of Sediment Removal Volumes. Cells in '**bold red**' font represent an adjustable quantity sensitivity factor. Additionally, one drop down boxes and a check box are also embedded in the calculations. User input areas are outlined below:

*Quantity Sensitivity Factor – Row 9*

This is a Sediment Removal Volumes multiplier. The factor can be used to test the effect of larger or smaller than expected dredged volumes on a year by year basis; its default value is unity.

*Increase or Reduction in Dredge Volumes – Cell A22 (switch and drop down box)*

A check box has been embedded into the worksheet to facilitate the inclusion of an increase or decrease in siltation. It acts as a switch to turn on/off increased or reduced volumes by the chosen percentage (chosen in the adjacent drop down box).

### Raw Unit Rates table

Cells available for input are highlighted by bold red font. This includes unit rates, and the associated confidence level factor (which is used to assign an allowance to represent uncertainty in the rate). Each rate is to be given a confidence level of 0 to 5, based on the guidance provided in Table 3.1.

**Table 3.1 Raw unit rates table**

| Confidence | | Optimistic (P10) | Pessimistic (P90) | Indicative Situation |
|---|---|---|---|---|
| Very High | 0 | -2% | 5% | Clear, concise scope supported by fixed quotes & labour rates, etc. |
| High | 1 | -5% | 10% | Some minor uncertainty exists regarding scope and/or estimate process, etc. |
| Moderate | 2 | -10% | 20% | Scope moderately clear, estimate based on mix of quotes & prices from similar jobs. |
| Low | 3 | -15% | 30% | Low scope confidence. Estimate based on factoring from other non-identical jobs. |
| Very Low | 4 | -20% | 40% | Vague/uncertain scope, prices factored from other similar (not identical) projects. |
| Order of Magnitude | 5 | -25% | 50% | Based on the best guess of experienced employees or similar methods. |

To modify the effects of this confidence factor, a confidence factor adjustment slider bar has been included (located at cells M15:P16). This slider bar calculates an adopted

confidence, which is a linear interpolation between the optimistic and pessimistic limits given in the above table.

It is possible to add additional rates in this worksheet; however integrating any new data into the rest of the model will require a password. Care must be taken including any new cost items. The suggested method for inserting a new cost item into the model is to change the definition of a redundant cost item, and replace it with the relevant costing data and program information.

The reference numbers are a code for each rate. The 'Derived Unit Rates' worksheet then references these rates in the 'Source' column.

It is important to note the units used for each cost item.

### Program

As discussed in Section 2.2, the 'Program' and 'Derived Unit Rates' are multiplied together to yield the 'Model Cash Flow'. When using the 'Program' worksheet, special attention must be paid to the units used.

Cells in light brown are locked calculations which are inputs from other sheets.

Cells in light blue are for user input. They are generally at the discretion of the user in how and when to be applied. However knowledge of the sediment removal plan and constraints is recommended before alterations are made to the default program. In the event that cost items are shared between sections, place a fraction in each cell for distribution of costs (to sum to 1).

### Derived Unit Rates

On the 'Derived Unit Rates' worksheet, only the Rate Sensitivity Factor is unlocked for editing. The derived rates shown here are calculated as follows:

*Derived Rate = Sensitivity Factor x [Raw Unit Rate x (1 + Adopted Confidence %)]*

As these derived rates include calculations, they are locked. Also included in this table is a 'Source' column which references the appropriate raw unit rate on the 'Raw Unit Rates Table'.

This worksheet essentially serves the function of converting raw data into usable forms to then be multiplied with the 'Program' worksheet.

### Model Cash Flow

'Model Cash Flow' is simply the product of the 'Program' and 'Derived Unit Rates'.

This entire worksheet is output and is therefore locked. There is no user input required.

### Model Summary

'Model Summary' is a concise version of the 'Model Cash Flow'.

This entire worksheet is output and is therefore locked. There is no user input required.

### Finance model

This sheet is left blank and is available for use by the RCC accounting services department. This sheet is where calculations regarding net present value and levy rates for wet block residents etc can be determined.

### Instructions for use

This worksheet provides user information, including instructions for use and 'built in' assumptions.

RCC is encouraged to update and populate this sheet with any new information as the Finance Model is developed.

### Amendments Register

The first worksheet in the maintenance model spreadsheet is the 'Amendments Register' which is included to help track any changes to the maintenance model. Users who edit the spreadsheet are required to include their name, date and details of the changes made.

It is also encouraged that the spreadsheet be saved with a new filename following each update, and that the filename includes the revision code and date.

*Appendix B*

# SOVEREIGN WATERS ESTATE COSTED MAINTENANCE MODEL

## SOVEREIGN WATERS MAINTENANCE MODEL

## AMENDMENTS REGISTER

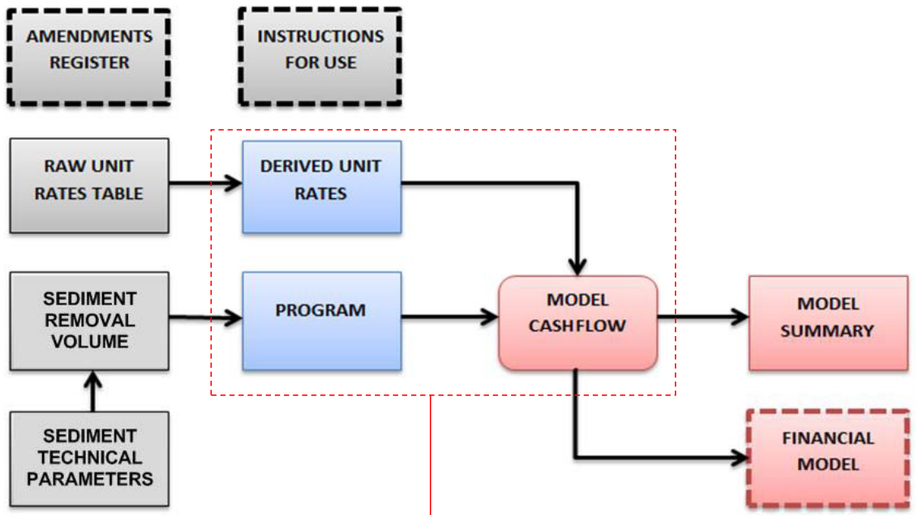
| DATE | REV No. | BY | DETAILS |
|---|---|---|---|
| | A | KBR | |
| | 0 | KBR | |

# SOVEREIGN WATERS MAINTENANCE MODEL

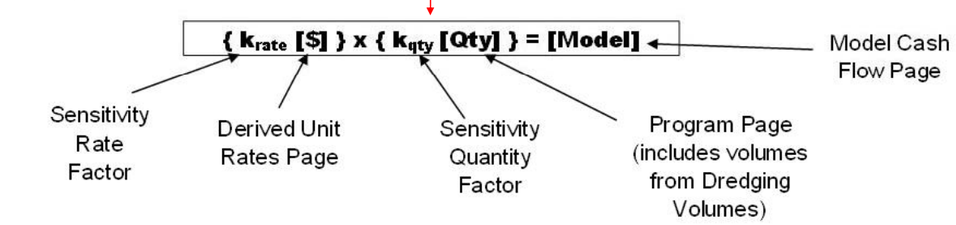
## Guidelines on the Use of this Model

**Note: Worksheet is ordered such that data flows from RIGHT to LEFT. This results in the SUMMARY data being on tabs to the LEFT and INPUT data on tabs to the RIGHT**

**Worksheet Data Flow**




**Governing Equation**




## Assumptions

**General Assumptions**

The Lake Management Plan identified several recommendations which would improve the system. These have been identified and discussed. However, costing of these items has not been performed and the costs are not included in the maintenance model. These are:

- Re-installation of the trash rack
- Construction of a weir between the macrophyte wetland and lake to avoid scouring of the bund in between the wetland and lake walls
- Wetland re-habilitation, including excavation of a high flow bypass channel

Maintenance frequencies have been estimated based on best practice, experience or where available published guidelines. It is expected that monitoring and inspection throughout will identify the requirement to conduct maintenance. Therefore, the costs developed herewithin are accurate based on proposed maintenance requirements and reviews by council will be performed to develop more accurate maintenance frequencies based on inspection findings.

Due to the small scale of sediment removal the costs for sediment removal design and approvals for conducting sediment removal and for disposal at landfill or large quantities has not been included.

A routine maintenance fee has been included for repairs to the lake wall, as a one off item at the end of the ten year maintenance model.

**Sediment Technical Parameters**

Key assumptions used in the development of these parameters include:

- density of solids = 2.6 t/m$^3$
- density of water = 1.025 t/m$^3$
- moisture content assumed at key stages in the spoil life cycle.
  - o pond wet – M.C. = 130 %
  - o pond crust – M.C. = 20%
  - o Heaped Dry – M.C. = 10%
- bulking factor = 1.2
- dry density of spoil = 1.6 t/m$^3$
- bulk density of insitu sediment = 1.350 t/m$^3$
- bulk density of spoil within cutter section dredge = 1.135 t/m$^3$.

**Sediment Removal Volumes**

Rev A data has been input from the sedimentation study presented in the Sovereign Waters Estate Management Plan Draft Report (KBR, 2012).
This plan covers the period 2013 to 2023.
The plan produced in the referenced report is based upon a number of important assumptions, most notably the siltation rates within the wetlands and lake. It is critical that the siltation be assessed using surveys to ensure that the actual siltation rates are comparable to those assumed in the dredging plan. If the siltation rates are found to vary appreciably from those assumed for the proposed schedule (whether higher or lower) then an update of the schedule will be necessary.

Allowance can be made for the possibility of increased or reduced siltation. This is implemented via an increase or reduction in dredging volumes across all years (using the increased/reduced siltation check box in the dredging volumes worksheet), or in individual years by altering the dredge volumes sensitivity

**Raw Unit Rates**

Key assumptions with regards to the spoil disposal system include:

- **Sediment to be disposed of has been assumed to be uncontaminated fill**
- The user selects their 'confidence percentage' preference; however as default it is set to 50% - that is there is a 50% probability that the costs will be exceeded.
- Costs for RCC administration have been sourced from the 'Aquatic Paradise Transactions Ledger' provided by RCC are indicative of future costs for comparable items.

**Program**

Some key events have been assumed and inserted into the model. These include:

- Wetland re-structure and rehabilitation in 2015
- The only cost of wetland re-structure and rehabilitation included is excavation; other costs are too difficult to determine at this stage.
- Repair of signage within the next ten years.
- Minor lake wall repair in the next ten years.
- Humes tide flap replacement at end of design life; in approximately 2025 - rough cost to replace these is estimated at $140,000
- Review of maintenance model – commencing in 2012 and again in 2015, then every 5 years thereafter.
- Each sediment removal operation has 2 surveys - pre and post dredging/excavation
- Sediment sampling and analysis is undertaken prior to grab dredging to assess spoils suitability to dispose at landfill.
- Wet disposal (>20% moisture content) of the spoil at landfill as uncontaminated waste.

**Assumptions for this section are to be entered by RCC**

**Derived Unit Rates**

No Assumptions made

**Model Cash Flow / Model Summary**

No Assumptions made

**Finance Model**

**Assumptions for this section are to be written by RCC as it is developed**

# SOVEREIGN WATERS MAINTENANCE MODEL

## FINANCE MODEL

*To be completed by RCC*

# SOVEREIGN WATERS MAINTENANCE MODEL

## MODEL SUMMARY

| Budget No. | Component No. | ITEM / DESCRIPTION | 1<br>2013 | 2<br>2014 | 3<br>2015 | 4<br>2016 | 5<br>2017 | 6<br>2018 | 7<br>2019 | 8<br>2020 | 9<br>2021 | 10<br>2022 | 11<br>2023 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **1. LOCAL POLLUTANT CONTROLS** | | | | | | | | | | | |
| | | 1.1 Trash Racks | $ 1,075.00 | $ 1,075.00 | $ 1,075.00 | $ 1,075.00 | $ 1,075.00 | $ 1,075.00 | $ 1,075.00 | $ 1,075.00 | $ 1,075.00 | $ 1,075.00 | $ 1,075.00 |
| | | 1.2 Gross Pollutant Traps (GPTs) | $ 12,647.63 | $ 12,647.63 | $ 12,647.63 | $ 12,647.63 | $ 12,647.63 | $ 12,647.63 | $ 12,647.63 | $ 12,647.63 | $ 12,647.63 | $ 12,647.63 | $ 12,647.63 |
| | | TOTAL | $ 13,722.63 | $ 13,722.63 | $ 13,722.63 | $ 13,722.63 | $ 13,722.63 | $ 13,722.63 | $ 13,722.63 | $ 13,722.63 | $ 13,722.63 | $ 13,722.63 | $ 13,722.63 |
| | | **2. WETLAND (INLET ZONE)** | | | | | | | | | | | |
| | | 2.1 General Maintenance | $ 2,131.00 | $ 2,131.00 | $ 2,131.00 | $ 2,131.00 | $ 2,131.00 | $ 2,421.25 | $ 2,131.00 | $ 2,131.00 | $ 2,131.00 | $ 2,131.00 | $ 2,421.25 |
| | | 2.2 Sediment removal | $ - | $ - | $ 31,594.38 | $ - | $ - | $ - | $ - | $ 9,594.38 | $ - | $ - | $ - |
| | | 2.3 Spoil Disposal | $ - | $ - | $ 65,101.55 | $ - | $ - | $ - | $ - | $ 11,409.55 | $ - | $ - | $ - |
| | | 2.4 Monitoring | $ - | $ - | $ 1,911.00 | $ - | $ - | $ - | $ - | $ 1,911.00 | $ - | $ - | $ - |
| | | TOTAL | $ 2,131.00 | $ 2,131.00 | $ 100,737.93 | $ 2,131.00 | $ 2,131.00 | $ 2,421.25 | $ 2,131.00 | $ 25,045.93 | $ 2,131.00 | $ 2,131.00 | $ 2,421.25 |
| | | **3. WETLAND (MACROPHYTE ZONE)** | | | | | | | | | | | |
| | | 3.1 General Maintenance | $ 5,167.00 | $ 5,167.00 | $ 5,167.00 | $ 5,167.00 | $ 5,167.00 | $ 5,167.00 | $ 5,167.00 | $ 5,167.00 | $ 5,167.00 | $ 5,167.00 | $ 5,167.00 |
| | | 3.2 Sediment removal | $ - | $ - | $ 23,619.38 | $ - | $ - | $ - | $ - | $ 23,619.38 | $ - | $ - | $ - |
| | | 3.3 Spoil Disposal | $ - | $ - | $ 32,215.20 | $ - | $ - | $ - | $ - | $ 32,215.20 | $ - | $ - | $ - |
| | | 3.4 Monitoring | $ 252.00 | $ 252.00 | $ 2,163.00 | $ 252.00 | $ 252.00 | $ 252.00 | $ 252.00 | $ 2,163.00 | $ 252.00 | $ 252.00 | $ 252.00 |
| | | TOTAL | $ 5,419.00 | $ 5,419.00 | $ 63,164.58 | $ 5,419.00 | $ 5,419.00 | $ 5,419.00 | $ 5,419.00 | $ 63,164.58 | $ 5,419.00 | $ 5,419.00 | $ 5,419.00 |
| | | **4. LAKE** | | | | | | | | | | | |
| | | 4.1 General Maintenance | $ 2,623.00 | $ 2,623.00 | $ 2,623.00 | $ 2,623.00 | $ 2,623.00 | $ 4,074.25 | $ 2,623.00 | $ 2,623.00 | $ 2,623.00 | $ 2,623.00 | $ 4,074.25 |
| | | 4.2 Monitoring | $ - | $ - | $ - | $ - | $ 7,456.88 | $ - | $ - | $ - | $ - | $ 7,456.88 | $ - |
| | | TOTAL | $ 2,623.00 | $ 2,623.00 | $ 2,623.00 | $ 2,623.00 | $ 10,079.88 | $ 4,074.25 | $ 2,623.00 | $ 2,623.00 | $ 2,623.00 | $ 10,079.88 | $ 4,074.25 |
| | | **5. TIDAL EXCHANGE SYSTEM** | | | | | | | | | | | |
| | | 5.1 General Maintenance | $ 1,053.50 | $ 1,053.50 | $ 1,053.50 | $ 1,053.50 | $ 1,053.50 | $ 1,053.50 | $ 1,053.50 | $ 1,053.50 | $ 1,053.50 | $ 1,053.50 | $ 1,053.50 |
| | | TOTAL | $ 1,053.50 | $ 1,053.50 | $ 1,053.50 | $ 1,053.50 | $ 1,053.50 | $ 1,053.50 | $ 1,053.50 | $ 1,053.50 | $ 1,053.50 | $ 1,053.50 | $ 1,053.50 |
| | | **6. LAKE PERIMETER WALL** | | | | | | | | | | | |
| | | 6.4 General Maintenance | $ - | $ - | $ 2,431.00 | $ - | $ - | $ 2,431.00 | $ - | $ - | $ 2,431.00 | $ - | $ 22,000.00 |
| | | TOTAL | $ - | $ - | $ 2,431.00 | $ - | $ - | $ 2,431.00 | $ - | $ - | $ 2,431.00 | $ - | $ 22,000.00 |
| | | **7. ENVIRONMENTAL MONITORING** | $ 16,148.65 | $ 33,152.65 | $ 16,652.65 | $ 16,652.65 | $ 16,652.65 | $ 16,652.65 | $ 16,652.65 | $ 16,652.65 | $ 16,652.65 | $ 16,652.65 | $ 16,652.65 |
| | | TOTAL | $ 16,148.65 | $ 33,152.65 | $ 16,652.65 | $ 16,652.65 | $ 16,652.65 | $ 16,652.65 | $ 16,652.65 | $ 16,652.65 | $ 16,652.65 | $ 16,652.65 | $ 16,652.65 |
| | | **8. MAINTENANCE MODEL REVIEW & ADMINISTRATION** | $ 10,750.00 | $ 10,750.00 | $ 31,750.00 | $ 10,750.00 | $ 10,750.00 | $ 10,750.00 | $ 10,750.00 | $ 31,750.00 | $ 10,750.00 | $ 10,750.00 | $ 10,750.00 |
| | | TOTAL | $ 10,750.00 | $ 10,750.00 | $ 31,750.00 | $ 10,750.00 | $ 10,750.00 | $ 10,750.00 | $ 10,750.00 | $ 31,750.00 | $ 10,750.00 | $ 10,750.00 | $ 10,750.00 |
| | | GRAND TOTAL | $ 51,847.78 | $ 68,851.78 | $ 232,135.28 | $ 52,351.78 | $ 59,808.65 | $ 56,524.28 | $ 52,351.78 | $ 154,012.28 | $ 54,782.78 | $ 59,808.65 | $ 76,093.28 |
| | | ACCUMULATIVE TOTAL | $ 51,847.78 | $ 120,699.55 | $ 352,834.83 | $ 405,186.60 | $ 464,995.25 | $ 521,519.53 | $ 573,871.30 | $ 727,883.58 | $ 782,666.35 | $ 842,475.00 | $ 918,568.28 |
| | | RUNNING AVERAGE FROM 2013 | $ 51,847.78 | $ 60,349.78 | $ 117,611.61 | $ 101,296.65 | $ 92,999.05 | $ 86,919.92 | $ 81,981.61 | $ 90,985.45 | $ 86,962.93 | $ 84,247.50 | $ 83,506.21 |

**Instructions for Model Summary Worksheet**
DO NOT MODIFY CELL CONTENTS DIRECTLY
MODIFY RAW UNIT RATES AND PROGRAM SHEETS TO UPDATE DATA.

TO SIMULATE EFFECTS OF COST VARIATION, USE SENSITIVITY FACTORS ON DERIVED UNIT RATES AND DREDGING VOLUMES PAGES (FOR RATES AND QUANTITIES RESPECTIVELY)

## SOVEREIGN WATERS MAINTENANCE MODEL

## MAINTENANCE MODEL CASH FLOW

| ITEM / DESCRIPTION | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **1. LOCAL POLLUTANT CONTROLS** | | | | | | | | | | | |
| **1.1 Trash Racks** | | | | | | | | | | | |
| Litter & debris removal | $ 1,075.00 | $ 1,075.00 | $ 1,075.00 | $ 1,075.00 | $ 1,075.00 | $ 1,075.00 | $ 1,075.00 | $ 1,075.00 | $ 1,075.00 | $ 1,075.00 | $ 1,075.00 |
| **1.2 Gross Pollutant Traps (GPTs)** | | | | | | | | | | | |
| Inspection | $ 892.50 | $ 892.50 | $ 892.50 | $ 892.50 | $ 892.50 | $ 892.50 | $ 892.50 | $ 892.50 | $ 892.50 | $ 892.50 | $ 892.50 |
| Servicing (Full removal of materials) | $ 11,755.13 | $ 11,755.13 | $ 11,755.13 | $ 11,755.13 | $ 11,755.13 | $ 11,755.13 | $ 11,755.13 | $ 11,755.13 | $ 11,755.13 | $ 11,755.13 | $ 11,755.13 |
| **TOTAL** | $ 13,722.63 | $ 13,722.63 | $ 13,722.63 | $ 13,722.63 | $ 13,722.63 | $ 13,722.63 | $ 13,722.63 | $ 13,722.63 | $ 13,722.63 | $ 13,722.63 | $ 13,722.63 |
| **2. WETLAND (INLET ZONE)** | | | | | | | | | | | |
| **2.1 General Maintenance** | | | | | | | | | | | |
| Litter collection | $ 1,075.00 | $ 1,075.00 | $ 1,075.00 | $ 1,075.00 | $ 1,075.00 | $ 1,075.00 | $ 1,075.00 | $ 1,075.00 | $ 1,075.00 | $ 1,075.00 | $ 1,075.00 |
| Algae / undesired weed removal | $ 1,056.00 | $ 1,056.00 | $ 1,056.00 | $ 1,056.00 | $ 1,056.00 | $ 1,056.00 | $ 1,056.00 | $ 1,056.00 | $ 1,056.00 | $ 1,056.00 | $ 1,056.00 |
| Signage maintenance | $ - | $ - | $ - | $ - | $ - | $ 290.25 | $ - | $ - | $ - | $ - | $ 290.25 |
| **2.2 Sediment removal** | | | | | | | | | | | |
| Survey | $ - | $ - | $ 3,819.38 | $ - | $ - | $ - | $ - | $ 3,819.38 | $ - | $ - | $ - |
| Mob/Demob - Excavator | $ - | $ - | $ 1,100.00 | $ - | $ - | $ - | $ - | $ 1,100.00 | $ - | $ - | $ - |
| Excavating | $ - | $ - | $ 26,675.00 | $ - | $ - | $ - | $ - | $ 4,675.00 | $ - | $ - | $ - |
| Dredging Design, Approvals & Monitoring | $ - | $ - | $ - | $ - | $ - | $ - | $ - | $ - | $ - | $ - | $ - |
| **2.3 Spoil Disposal** | | | | | | | | | | | |
| Wet Spoil Disposal - Directly to landfill (>20% MC) | $ - | $ - | $ 65,101.55 | $ - | $ - | $ - | $ - | $ 11,409.55 | $ - | $ - | $ - |
| **2.4 Monitoring** | | | | | | | | | | | |
| Inlet zone bed surface survey | $ - | $ - | $ 1,911.00 | $ - | $ - | $ - | $ - | $ 1,911.00 | $ - | $ - | $ - |
| **TOTAL** | $ 2,131.00 | $ 2,131.00 | $ 100,737.93 | $ 2,131.00 | $ 2,131.00 | $ 2,421.25 | $ 2,131.00 | $ 25,045.93 | $ 2,131.00 | $ 2,131.00 | $ 2,421.25 |
| **3. WETLAND (MACROPHYTE ZONE)** | | | | | | | | | | | |
| **3.1 General Maintenance** | | | | | | | | | | | |
| Litter collection | $ 1,075.00 | $ 1,075.00 | $ 1,075.00 | $ 1,075.00 | $ 1,075.00 | $ 1,075.00 | $ 1,075.00 | $ 1,075.00 | $ 1,075.00 | $ 1,075.00 | $ 1,075.00 |
| Aquatic vegetation removal | $ 1,584.00 | $ 1,584.00 | $ 1,584.00 | $ 1,584.00 | $ 1,584.00 | $ 1,584.00 | $ 1,584.00 | $ 1,584.00 | $ 1,584.00 | $ 1,584.00 | $ 1,584.00 |
| Algae / undesired weed removal | $ 2,112.00 | $ 2,112.00 | $ 2,112.00 | $ 2,112.00 | $ 2,112.00 | $ 2,112.00 | $ 2,112.00 | $ 2,112.00 | $ 2,112.00 | $ 2,112.00 | $ 2,112.00 |
| Clear and rehabilitate wetland outlet structure to lake - free from macrophyte growth and litter | $ 396.00 | $ 396.00 | $ 396.00 | $ 396.00 | $ 396.00 | $ 396.00 | $ 396.00 | $ 396.00 | $ 396.00 | $ 396.00 | $ 396.00 |
| **3.2 Sediment removal** | | | | | | | | | | | |
| Survey | $ - | $ - | $ 3,819.38 | $ - | $ - | $ - | $ - | $ 3,819.38 | $ - | $ - | $ - |
| Mob/Demob - Excavator | $ - | $ - | $ 1,100.00 | $ - | $ - | $ - | $ - | $ 1,100.00 | $ - | $ - | $ - |
| Excavating | $ - | $ - | $ 13,200.00 | $ - | $ - | $ - | $ - | $ 13,200.00 | $ - | $ - | $ - |
| Dredging Design, Approvals & Monitoring | $ - | $ - | $ 5,500.00 | $ - | $ - | $ - | $ - | $ 5,500.00 | $ - | $ - | $ - |
| **3.3 Spoil Disposal** | | | | | | | | | | | |
| Wet Spoil Disposal - From Spoil Facility to landfill (>20% MC) | $ - | $ - | $ 32,215.20 | $ - | $ - | $ - | $ - | $ 32,215.20 | $ - | $ - | $ - |
| **3.4 Monitoring** | | | | | | | | | | | |
| Vegetation performance | $ 252.00 | $ 252.00 | $ 252.00 | $ 252.00 | $ 252.00 | $ 252.00 | $ 252.00 | $ 252.00 | $ 252.00 | $ 252.00 | $ 252.00 |
| Macrophyte zone bed surface survey | $ - | $ - | $ 1,911.00 | $ - | $ - | $ - | $ - | $ 1,911.00 | $ - | $ - | $ - |
| **TOTAL** | $ 5,419.00 | $ 5,419.00 | $ 63,164.58 | $ 5,419.00 | $ 5,419.00 | $ 5,419.00 | $ 5,419.00 | $ 63,164.58 | $ 5,419.00 | $ 5,419.00 | $ 5,419.00 |
| **4. LAKE** | | | | | | | | | | | |
| **4.1 General Maintenance** | | | | | | | | | | | |
| Litter collection | $ 2,107.00 | $ 2,107.00 | $ 2,107.00 | $ 2,107.00 | $ 2,107.00 | $ 2,107.00 | $ 2,107.00 | $ 2,107.00 | $ 2,107.00 | $ 2,107.00 | $ 2,107.00 |
| Access ramps - remove slip hazards and marine fouling | $ 516.00 | $ 516.00 | $ 516.00 | $ 516.00 | $ 516.00 | $ 516.00 | $ 516.00 | $ 516.00 | $ 516.00 | $ 516.00 | $ 516.00 |
| Signage maintenance | $ - | $ - | $ - | $ - | $ - | $ 1,451.25 | $ - | $ - | $ - | $ - | $ 1,451.25 |
| **4.2 Monitoring** | | | | | | | | | | | |
| Lake bed surface survey | $ - | $ - | $ - | $ - | $ 7,456.88 | $ - | $ - | $ - | $ - | $ 7,456.88 | $ - |
| **TOTAL** | $ 2,623.00 | $ 2,623.00 | $ 2,623.00 | $ 2,623.00 | $ 10,079.88 | $ 4,074.25 | $ 2,623.00 | $ 2,623.00 | $ 2,623.00 | $ 10,079.88 | $ 4,074.25 |
| **5. TIDAL EXCHANGE SYSTEM** | | | | | | | | | | | |
| **5.1 General Maintenance** | | | | | | | | | | | |
| Litter collection | $ 1,053.50 | $ 1,053.50 | $ 1,053.50 | $ 1,053.50 | $ 1,053.50 | $ 1,053.50 | $ 1,053.50 | $ 1,053.50 | $ 1,053.50 | $ 1,053.50 | $ 1,053.50 |
| **TOTAL** | $ 1,053.50 | $ 1,053.50 | $ 1,053.50 | $ 1,053.50 | $ 1,053.50 | $ 1,053.50 | $ 1,053.50 | $ 1,053.50 | $ 1,053.50 | $ 1,053.50 | $ 1,053.50 |
| **6. LAKE PERIMETER WALL** | | | | | | | | | | | |
| **6.4 General Maintenance** | | | | | | | | | | | |
| Complete wall inspection | $ - | $ - | $ 2,431.00 | $ - | $ - | $ 2,431.00 | $ - | $ - | $ 2,431.00 | $ - | $ - |
| Wall repair | $ - | $ - | $ - | $ - | $ - | $ - | $ - | $ - | $ - | $ - | $ 22,000.00 |
| **TOTAL** | $ - | $ - | $ 2,431.00 | $ - | $ - | $ 2,431.00 | $ - | $ - | $ 2,431.00 | $ - | $ 22,000.00 |
| **7. ENVIRONMENTAL MONITORING** | | | | | | | | | | | |
| Water level gauge/ruler installation | $ - | $ 16,500.00 | $ - | $ - | $ - | $ - | $ - | $ - | $ - | $ - | $ - |
| Water level | $ - | $ 504.00 | $ 504.00 | $ 504.00 | $ 504.00 | $ 504.00 | $ 504.00 | $ 504.00 | $ 504.00 | $ 504.00 | $ 504.00 |
| Water quality | $ 12,724.04 | $ 12,724.04 | $ 12,724.04 | $ 12,724.04 | $ 12,724.04 | $ 12,724.04 | $ 12,724.04 | $ 12,724.04 | $ 12,724.04 | $ 12,724.04 | $ 12,724.04 |
| Event based Microbial testing of recreational water (as per Appendices C) | $ 3,424.61 | $ 3,424.61 | $ 3,424.61 | $ 3,424.61 | $ 3,424.61 | $ 3,424.61 | $ 3,424.61 | $ 3,424.61 | $ 3,424.61 | $ 3,424.61 | $ 3,424.61 |
| **TOTAL** | $ 16,148.65 | $ 33,152.65 | $ 16,652.65 | $ 16,652.65 | $ 16,652.65 | $ 16,652.65 | $ 16,652.65 | $ 16,652.65 | $ 16,652.65 | $ 16,652.65 | $ 16,652.65 |
| **8. MAINTENANCE MODEL REVIEW & ADMINISTRATION** | | | | | | | | | | | |
| Review of Maintenance Model (ALL ITEMS) | $ - | $ - | $ 21,000.00 | $ - | $ - | $ - | $ - | $ 21,000.00 | $ - | $ - | $ - |
| RCC Administration | $ 10,750.00 | $ 10,750.00 | $ 10,750.00 | $ 10,750.00 | $ 10,750.00 | $ 10,750.00 | $ 10,750.00 | $ 10,750.00 | $ 10,750.00 | $ 10,750.00 | $ 10,750.00 |
| **TOTAL** | $ 10,750.00 | $ 10,750.00 | $ 31,750.00 | $ 10,750.00 | $ 10,750.00 | $ 10,750.00 | $ 10,750.00 | $ 31,750.00 | $ 10,750.00 | $ 10,750.00 | $ 10,750.00 |
| **Grand Total** | $ 51,847.78 | $ 68,851.78 | $ 232,135.28 | $ 52,351.78 | $ 59,808.65 | $ 56,524.28 | $ 52,351.78 | $ 154,012.28 | $ 54,782.78 | $ 59,808.65 | $ 76,093.28 |
| **Cumulative Total** | $ 51,847.78 | $ 120,699.55 | $ 352,834.83 | $ 405,186.60 | $ 464,995.25 | $ 521,519.53 | $ 573,871.30 | $ 727,883.58 | $ 782,666.35 | $ 842,475.00 | $ 918,568.28 |
| **Running Average from 2013** | $ 51,847.78 | $ 60,349.78 | $ 117,611.61 | $ 101,296.65 | $ 92,999.05 | $ 86,919.92 | $ 81,981.61 | $ 90,985.45 | $ 86,962.93 | $ 84,247.50 | $ 83,506.21 |

**Instructions for Model Cash Flow Worksheet**
DO NOT MODIFY CELL CONTENTS DIRECTLY
MODIFY UNIT RATES AND PROGRAM SHEETS TO UPDATE DATA.
TO SIMULATE EFFECTS OF COST VARIATION, USE SENSITIVITY FACTORS
ON DERIVED UNIT RATES AND DREDGING VOLUMES PAGES
(FOR RATES AND QUANTITIES RESPECTIVELY)

## SOVEREIGN WATERS MAINTENANCE MODEL

## MAINTENANCE MODEL DERIVED UNIT RATES

| ITEM / DESCRIPTION | Units | RATE | SENSITIVITY: RATE FACTOR | COMMENT |
|---|---|---|---|---|
| **1. LOCAL POLLUTANT CONTROLS** | | | | |
| **1.1 Trash Racks** | | | | |
| Litter & debris removal | $ | $ 268.75 | 1 | Derived Rate = Sensitivity Rate Factor * [ Raw Unit Rate * ( 1 + Adopted Confidence Percentage ) ] |
| **1.2 Gross Pollutant Traps (GPTs)** | | | | |
| Inspection | $ | $ 44.63 | 1 | Derived Rate = Sensitivity Rate Factor * [ Raw Unit Rate * ( 1 + Adopted Confidence Percentage ) ] |
| Servicing (full removal of all materials) | $ | $ 2,351.03 | 1 | Derived Rate = Sensitivity Rate Factor * [ Raw Unit Rate * ( 1 + Adopted Confidence Percentage ) ] |
| **2. WETLAND (INLET ZONE)** | | | | |
| **2.1 General Maintenance** | | | | |
| Litter collection | $ | $ 268.75 | 1 | Derived Rate = Sensitivity Rate Factor * [ Raw Unit Rate * ( 1 + Adopted Confidence Percentage ) ] |
| Algae / undesired weed removal | $ | $ 528.00 | 1 | Derived Rate = Sensitivity Rate Factor * [ Raw Unit Rate * ( 1 + Adopted Confidence Percentage ) ] |
| Signage maintenance | $/sign | $ 290.25 | 1 | Derived Rate = Sensitivity Rate Factor * [ Raw Unit Rate * ( 1 + Adopted Confidence Percentage ) ] |
| **2.2 Sediment removal** | | | | |
| Survey | $ | $ 7,638.75 | 1 | Derived Rate = Sensitivity Rate Factor * [ Raw Unit Rate * ( 1 + Adopted Confidence Percentage ) ] |
| Mob/Demob - Excavator | $ | $ 2,200.00 | 1 | Derived Rate = Sensitivity Rate Factor * [ Raw Unit Rate * ( 1 + Adopted Confidence Percentage ) ] |
| Excavating | $/m³ | $ 11.00 | 1 | Derived Rate = Sensitivity Rate Factor * [ Raw Unit Rate * ( 1 + Adopted Confidence Percentage ) ] |
| Dredging Design, Approvals & Monitoring | $ | $ 5,500.00 | 1 | Derived Rate = Sensitivity Rate Factor * [ Raw Unit Rate * ( 1 + Adopted Confidence Percentage ) ] |
| **2.3 Spoil Disposal** | | | | |
| Wet Spoil Disposal - Directly to landfill (>20% MC) | $/m³ | $ 26.85 | 1 | Derived Rate = Sensitivity Rate Factor * [ Raw Unit Rate * ( 1 + Adopted Confidence Percentage ) ] |
| **2.4 Monitoring** | | | | |
| Inlet zone bed surface survey | $ | $ 3,822.00 | 1 | Derived Rate = Sensitivity Rate Factor * [ Raw Unit Rate * ( 1 + Adopted Confidence Percentage ) ] |
| **3. WETLAND (MACROPHYTE ZONE)** | | | | |
| **3.1 General Maintenance** | | | | |
| Litter collection | $ | $ 268.75 | 1 | Derived Rate = Sensitivity Rate Factor * [ Raw Unit Rate * ( 1 + Adopted Confidence Percentage ) ] |
| Aquatic vegetation removal | $ | $ 792.00 | 1 | Derived Rate = Sensitivity Rate Factor * [ Raw Unit Rate * ( 1 + Adopted Confidence Percentage ) ] |
| Algae / undesired weed removal | $ | $ 528.00 | 1 | Derived Rate = Sensitivity Rate Factor * [ Raw Unit Rate * ( 1 + Adopted Confidence Percentage ) ] |
| Clear and rehabilitate wetland outlet structure to lake - free from macrophyte growth and litter | $ | $ 396.00 | 1 | Derived Rate = Sensitivity Rate Factor * [ Raw Unit Rate * ( 1 + Adopted Confidence Percentage ) ] |
| **3.2 Sediment removal** | | | | |
| Survey | $ | $ 7,638.75 | 1 | Derived Rate = Sensitivity Rate Factor * [ Raw Unit Rate * ( 1 + Adopted Confidence Percentage ) ] |
| Mob/Demob - Excavator | $ | $ 2,200.00 | 1 | Derived Rate = Sensitivity Rate Factor * [ Raw Unit Rate * ( 1 + Adopted Confidence Percentage ) ] |
| Excavating | $/m³ | $ 11.00 | 1 | Derived Rate = Sensitivity Rate Factor * [ Raw Unit Rate * ( 1 + Adopted Confidence Percentage ) ] |
| Dredging Design, Approvals & Monitoring | $ | $ 5,500.00 | 1 | Derived Rate = Sensitivity Rate Factor * [ Raw Unit Rate * ( 1 + Adopted Confidence Percentage ) ] |
| **3.3 Spoil Disposal** | | | | |
| Wet Spoil Disposal - From Spoil Facility to landfill (>20% MC) | $/m³ | $ 26.85 | 1 | Derived Rate = Sensitivity Rate Factor * [ Raw Unit Rate * ( 1 + Adopted Confidence Percentage ) ] |
| **3.4 Monitoring** | | | | |
| Vegetation performance | $ | $ 126.00 | 1 | Derived Rate = Sensitivity Rate Factor * [ Raw Unit Rate * ( 1 + Adopted Confidence Percentage ) ] |
| Macrophyte zone bed surface survey | $ | $ 3,822.00 | 1 | Derived Rate = Sensitivity Rate Factor * [ Raw Unit Rate * ( 1 + Adopted Confidence Percentage ) ] |
| **4. LAKE** | | | | |
| **4.1 General Maintenance** | | | | |
| Litter collection | $ | $ 526.75 | 1 | Derived Rate = Sensitivity Rate Factor * [ Raw Unit Rate * ( 1 + Adopted Confidence Percentage ) ] |
| Access ramps - remove slip hazards and fouling | $ | $ 258.00 | 1 | Derived Rate = Sensitivity Rate Factor * [ Raw Unit Rate * ( 1 + Adopted Confidence Percentage ) ] |
| Signage maintenance | $ | $ 1,451.25 | 1 | Derived Rate = Sensitivity Rate Factor * [ Raw Unit Rate * ( 1 + Adopted Confidence Percentage ) |
| **4.4 Monitoring** | | | | |
| Lake bed surface survey | $ | $ 7,456.88 | 1 | Derived Rate = Sensitivity Rate Factor * [ Raw Unit Rate * ( 1 + Adopted Confidence Percentage ) ] |
| **5. TIDAL EXCHANGE SYSTEM** | | | | |
| **5.1 General Maintenance** | | | | |
| Litter collection | $ | $ 526.75 | 1 | Derived Rate = Sensitivity Rate Factor * [ Raw Unit Rate * ( 1 + Adopted Confidence Percentage ) ] |
| **6. LAKE PERIMETER WALL** | | | | |
| **6.4 General Maintenance** | | | | |
| Complete wall inspection | $ | $ 2,431.00 | 1 | Derived Rate = Sensitivity Rate Factor * [ Raw Unit Rate * ( 1 + Adopted Confidence Percentage ) ] |
| Wall repair | $ | $ 22,000.00 | 1 | Derived Rate = Sensitivity Rate Factor * [ Raw Unit Rate * ( 1 + Adopted Confidence Percentage ) ] |
| **7. HYDRAULIC & ENVIRONMENTAL MONITORING** | | | | |
| Water level gauge/ruler installation | $/Unit | $ 5,500.00 | 1 | Derived Rate = Sensitivity Rate Factor * [ Raw Unit Rate * ( 1 + Adopted Confidence Percentage ) ] |
| Water level | $/event | $ 126.00 | 1 | Derived Rate = Sensitivity Rate Factor * [ Raw Unit Rate * ( 1 + Adopted Confidence Percentage ) ] |
| Water quality | $/event | $ 3,181.01 | 1 | Derived Rate = Sensitivity Rate Factor * [ Raw Unit Rate * ( 1 + Adopted Confidence Percentage ) ] |
| Event based Microbial testing of recreational water (as per Appendices C) | $/event | $ 3,424.61 | 1 | Derived Rate = Sensitivity Rate Factor * [ Raw Unit Rate * ( 1 + Adopted Confidence Percentage ) ] |
| **8. MAINTENANCE MODEL REVIEW & ADMINISTRATION** | | | | |
| Review of Maintenance Model (ALL ITEMS) | $ | $ 21,000.00 | 1 | Derived Rate = Sensitivity Rate Factor * [ Raw Unit Rate * ( 1 + Adopted Confidence Percentage ) ] |
| RCC Administration (ALL ITEMS) | $ | $ 10,750.00 | 1 | Derived Rate = Sensitivity Rate Factor * [ Raw Unit Rate * ( 1 + Adopted Confidence Percentage ) ] |

| ITEM / DESCRIPTION | Units | RATE | REF NO. | COMMENT |
|---|---|---|---|---|
| **Dry Spoil Disposal - Drying at disposal pond site then Haul to Landfi** | | | | Assuming drying necessary to be trucked to Landfill site |
| Treat | $/m³ | $ 5.25 | | Dry and Lime |
| Spoil Trenching, Loading, and Haul to Landfill Sit | $/m³ | $ 60.90 | | |
| Dispose at Landfill Site | $/m³ | $ 6.50 | | Derived unit rate shown below |
| | $/m³ | $ 72.65 | miii | |
| **Wet Spoil Disposal - Haul straight to Landfil** | | | | Excess material to be taken to land fill while wet. |
| Treat | $/m³ | $ 5.35 | | |
| Haul to Landfill Site | $/m³ | $ 15.00 | | |
| Dispose at Landfill Site | $/m³ | $ 6.50 | | Derived unit rate shown below |
| | $/m² | $ 26.85 | miv | |

**CALCULATED UNIT RATES - CONVERSION FOR $/T TO $/M³**

| ITEM / DESCRIPTION | Units | RATE | REF NO. | COMMENT |
|---|---|---|---|---|
| Dispose at Landfill (20% MC) | $/m³ | $ 6.50 | 36 | Quote from trial disposal(2011) * density |
| Wet Disposal | $/m³ | $ 159.08 | 37 | Quote from MBRC - Moreton Bay Waste (2011) * density |

## SOVEREIGN WATERS MAINTENANCE MODEL

## MAINTENANCE MODEL PROGRAM (QUANTITIES TIME SERIES)

| ITEM / DESCRIPTION | Units | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1. LOCAL POLLUTANT CONTROLS** | | | | | | | | | | | | |
| **1.1 Trash Racks** | | | | | | | | | | | | |
| Litter & debris removal | No. | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| **1.2 Gross Pollutant Traps (GPTs)** | | | | | | | | | | | | |
| Inspection | No. | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| Servicing (full removal of all materials) | No. | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| **2. WETLAND (INLET ZONE)** | | | | | | | | | | | | |
| **2.1 General Maintenance** | | | | | | | | | | | | |
| Litter collection | No. | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| Algae / undesired weed removal | No. | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Signage maintenance | No. | | | | | | 1 | | | | | 1 |
| **2.2 Sediment removal** | | | | | | | | | | | | |
| Survey | No. | | | 0.5 | | | | | 0.5 | | | |
| Mob/Demob - Excavator | No. | | | 0.5 | | | | | 0.5 | | | |
| Excavating | $m^3$ | - | - | 2,425 | - | - | - | - | 425 | - | - | - |
| Dredging Design, Approvals & Monitoring | No. | | | | | | | | | | | |
| **2.3 Spoil Disposal** | | | | | | | | | | | | |
| Wet Spoil Disposal - Directly to landfill (>20% MC) | $m^3$ | - | - | 2,425 | - | - | - | - | 425 | - | - | - |
| **2.4 Monitoring** | | | | | | | | | | | | |
| Inlet zone bed surface survey | No. | | | 0.5 | | | | | 0.5 | | | |
| **3. WETLAND (MACROPHYTE ZONE)** | | | | | | | | | | | | |
| **3.1 General Maintenance** | | | | | | | | | | | | |
| Litter collection | No. | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| Aquatic vegetation removal | No. | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Algae / undesired weed removal | No. | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| Clear and rehabilitate wetland outlet structure to lake - free from macrophyte growth and litter | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| **3.2 Sediment removal** | | | | | | | | | | | | |
| Survey | No. | | | 0.5 | | | | | 0.5 | | | |
| Mob/Demob - Excavator | No. | | | 0.5 | | | | | 0.5 | | | |
| Excavating | $m^3$ | - | - | 1,200 | - | - | - | - | 1,200 | - | - | - |
| Dredging Design, Approvals & Monitoring | No. | | | 1 | | | | | 1 | | | |
| **3.3 Spoil Disposal** | | | | | | | | | | | | |
| Wet Spoil Disposal - From Spoil Facility to landfill (>20% MC) | $m^3$ | - | - | 1,200 | - | - | - | - | 1,200 | - | - | - |
| **3.4 Monitoring** | | | | | | | | | | | | |
| Vegetation performance | No. | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Macrophyte zone bed surface survey | No. | | | 0.5 | | | | | 0.5 | | | |
| **4. LAKE** | | | | | | | | | | | | |
| **4.1 General Maintenance** | | | | | | | | | | | | |
| Litter collection | No. | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| Access ramps - remove slip hazards and fouling | No. | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Signage maintenance | No. | | | | | | 1 | | | | | 1 |
| **4.4 Monitoring** | | | | | | | | | | | | |
| Lake bed surface survey | No. | | | | | 1 | | | | | 1 | |
| **5. TIDAL EXCHANGE SYSTEM** | | | | | | | | | | | | |
| **5.1 General Maintenance** | | | | | | | | | | | | |
| Litter collection | No. | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| **6. LAKE PERIMETER WALL** | | | | | | | | | | | | |
| **6.4 General Maintenance** | | | | | | | | | | | | |
| Complete wall inspection | No. | | | 1 | | | 1 | | | 1 | | |
| Wall repair | No. | | | | | | | | | | | 1 |
| **7. HYDRAULIC & ENVIRONMENTAL MONITORING** | | | | | | | | | | | | |
| Water level gauge/ruler installation | No. | | 3 | | | | | | | | | |
| Water level | No. | | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| Water quality | No. | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| Event based Microbial testing of recreational water (as per Appendices C) | No. | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| **8. MAINTENANCE MODEL REVIEW & ADMINISTRATION** | | | | | | | | | | | | |
| Review of Maintenance Model (ALL ITEMS) | No. | | | 1 | | | | | 1 | | | |
| RCC Administration (ALL ITEMS) | No. | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

**Instructions for Model Sensitivity Worksheet**
MODIFY DIMENSIONLESS EVENTS BY INSERTING THE NUMBER OF EVENTS FOR THAT YEAR.
DO NOT MODIFY CELLS IN THIS SPREADSHEET WHICH APPEAR IN BROWN, AS THEY ARE LINKED TO DREDGING VOLUMES WORKSHEET. MODIFY BLUE CELLS.

THIS WORKSHEET IS THEN MULTIPLIED BY THE COSTS WORKSHEET TO PRODUCE COSTS FOR EACH ITEM
IN EVENT THAT COSTS ITEMS ARE SHARED BETWEEN 'WETLAND (BOTH)' & 'LAKE' SECTIONS,
PLACE A FRACTION IN EACH CELL FOR DISTRIBUTION OF COSTS (TO SUM TO 1)

## SOVEREIGN WATERS MAINTENANCE MODEL

## RAW UNIT RATES TABLE

| ITEM | UNIT | RATE | CONFIDENCE LEVEL | ORIGIN / REFERENCE / DATE / COMMENT |
|---|---|---|---|---|
| **Maintenance - Inlet Zone** | | | | |
| Litter collection | $ | 250.00 | 3 | (Rawlinsons 2012 Ed.30, p.692: Labourer group 1) 2 persons * 2 hours + (RedWaste commercial & industrial disposal cost/tonne * estimated weight(kg) of litter) |
| Algae / undesired weed removal | $ | 480.00 | 4 | (Rawlinsons 2012 Ed.30, p.692: Labourer group 1) 2 persons * 4 hours |
| Signage maintenance | $/sign | 270.00 | 3 | Estimate from australiasigns.com.au based on a 200mm * 500mm Aluminium sign with moderate artwork, GST&delivery |
| **Maintenance - Macrophyte Zone** | | | | |
| Litter collection | $ | 250.00 | 3 | (Rawlinsons 2012 Ed.30, p.692: Labourer group 1) 2 persons * 2 hours + (RedWaste commercial & industrial disposal cost/tonne * estimated weight(kg) of litter) |
| Aquatic vegetation removal | $ | 720.00 | 4 | (Rawlinsons 2012 Ed.30, p.692: Labourer group 1) 2 persons * 6 hours |
| Algae / undesired weed removal | $ | 480.00 | 4 | (Rawlinsons 2012 Ed.30, p.692: Labourer group 1) 2 persons * 4 hours |
| Clear and rehabilitate wetland outlet structure to lake - free from macrophyte growth and litter | $ | 360.00 | 4 | (Rawlinsons 2012 Ed.30, p.692: Labourer group 1) 2 persons * 3 hours |
| Signage maintenance | $/sign | 270.00 | 3 | Estimate from australiasigns.com.au based on a 200mm * 500mm Aluminium sign with moderate artwork, GST&delivery |
| **Maintenance - Lake** | | | | |
| Litter collection | $ | 490.00 | 3 | (Rawlinsons 2012 Ed.30, p.692: Labourer group 1) 2 persons * 4 hours + (RedWaste commercial & industrial disposal cost/tonne * estimated weight(kg) of litter |
| Replace all tidal exchange flap valves | $ | 90,600.00 | 5 | Cost for gate(s) + cartage + scuba diver(s) labour to replace submerged valves + labour for replacement of valves which are not submerged * 50% for additional fees and equipment |
| Replace wetland outlet structure gates | $ | 50,280.00 | 5 | Cost for gate(s) + cartage + labour for replacement of flood gates + cost of installation |
| Access ramp maintenance | $ | 240.00 | 3 | 2012 actual expenditure based on a fortnightly cycle. Cost is inspection of 2x ramps. Cost is for inspection and clean only. - Quotes supplied by Steve Turfrey |
| Signage maintenance | $ | 1,350.00 | 3 | Estimate from australiasigns.com.au based on 5 * 200mm * 500mm Aluminium sign with moderate artwork, GST&delivery |
| Lake wall repair | $ | 20,000.00 | 5 | |
| **Maintenance - Pollutant Controls** | | | | |
| Litter collection - trash racks | $/event | 250.00 | 3 | (Rawlinsons 2012 Ed.30, p.692: Labourer group 1) 2 persons * 2 hours + (RedWaste commercial & industrial disposal cost/tonne * estimated weight(kg) of litter) |
| GPT inspections | $/asset | 42.50 | 2 | 2012 actual expenditure based on a 4monthly cycle. Cost is per asset to be inspected. Cost is for inspection only. - Quotes supplied by Steve Turfrey |
| GPT servicing (full removal of materials) | $/asset | 2,187.00 | 3 | 2012 actual expenditure based on average expenditure on assets in a yearly cycle. Cost is per asset to be cleaned. Cost is for full clean. - Quotes supplied by Steve Turfrey |
| **Sediment Removal - Excavation** | | | | |
| Survey | $ | 7,275.00 | 2 | Based on KBR Sovereign Waters variation #1 - sediment sampling of lake - and factored by 1.5 (if for variation in cost of other/specialist contractors are used) |
| Mob/demob excavator | $ | 2,000.00 | 5 | based on: (Tender - PoB (2007) + BCI increase - factored by 2 due to locality) factored down due to location and size of plant |
| Sediment removal | $/m³ | 10.00 | 4 | [(Excavator ($/hr) / volume moveable (m³/hr)) + (Rawlinsons 2012 Ed.30, p.692: Labourer group 1: 2 persons * 8 hours] |
| Sediment Removal Design, Approvals & Monitoring | $ | 5,000.00 | 5 | KBR Estimate -based upon previous Newport work - largely dependant upon Monitoring component - factored to half due to small scale of sediment removal |
| **Spoil Treatment** | | | | |
| Lime treatment (ASS) | $/$m^3$ | 5.00 | 4 | KBR Estimate - *assumes agricultural lime is spread onto spoil pond surface and sufficient mixing occurs during crust scraping & disposal process |
| **Spoil Disposal** | | | | |
| Dry spoil disposal (crust scraping, loading and haul to landfill) | $/$m^3$ | 35.00 | 3 | KBR Calculation (2012) including Crust Scraping (for drying) Loading and Transport to Dakabin |
| Wet spoil disposal (loading & haul to landfill) | $/$m^3$ | 15.00 | 5 | BEJ009 - Unit Cost Estimate 2 - doc #: TD-MN-CAL-0002 (sullage tanker transport, using tanker pump) |
| Spoil facility construction & preparation | $/m³ | 58.00 | 5 | BEJ009 - Unit Cost Estimate 2 - doc #: TD-MN-CAL-0002 - **{COST/VOLUME}** |
| **Direct Disposal Costs** | | | | |
| Dry Disposal at landfill | $/tonne | 4.00 | 0 | RWBU Fee for uncontaminated Clean fill / soil (2011) |
| Wet Disposal | $/tonne | 97.00 | 1 | Quote from MBRC - Moreton Bay Waste (2011) |
| **Monitoring** | | | | |
| Water Level | $/event | 120.00 | 2 | (Rawlinsons 2012 Ed.30, p.692: Labourer group 1) 2 persons x 1 hours |
| Water level gauge/ruler | $/unit | 5,000.00 | 5 | Estimate based on a simple 'ruler' gauge. Cost of a surveyor and installation |
| Water quality | $/event | 3,134.00 | 0 | RCC provided cost estimate + Labour (Rawlinsons 2012 Ed.30, p.692: Labourer group 1: 2 persons * 4 hours) |
| Event based Microbial testing of recreational water (as per Appendices C) | $/event | 3,374.00 | 0 | Estimate based of RCC cost estimate + Labour (Rawlinsons 2012 Ed.30, p.692: Labourer group 1: 2 persons * 4 hours) |
| Wetland vegetation check | $/event | 120.00 | 2 | (Rawlinsons 2012 Ed.30, p.692: Labourer group 1) 1 persons x 2 hours |
| Wetland bed surface surveys | $/event | 3,640.00 | 2 | Based on KBR variation 1 - sediment sampling of lake - halved and factored by 1.5 (if for variation in cost of other/specialist contractors are used) |
| Lake bed surface survey | $/event | 7,275.00 | 1 | Based on KBR variation 1 - sediment sampling of lake - and factored by 1.5 (if for variation in cost of other/specialist contractors are used) |
| Lake perimeter wall visual monitoring | $/event | 2,210.00 | 4 | (Rawlinsons 2012 Ed.30, p.692: Labourer group 1) 2 persons x 8 hours + boat hire + equipment |
| **Administration** | | | | |
| Review of Maintenance Model | $/annum | 20,000.00 | 2 | KBR Estimate |
| RCC Management, Administration& Staff Costs* | $/annum | 10,000.00 | 3 | Aquatic Paradise Ledger - by RCC |

# SOVEREIGN WATERS MAINTENANCE MODEL

## ANNUAL TOTAL SEDIMENT REMOVAL VOLUMES

**Proposed Sediment Removals Schedule Based on Calculated Siltation Rates**

| ITEM / DESCRIPTION | Units | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SENSITIVITY: QUANTITIES FACTOR | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| SEDIMENT REMOVAL VOLUMES TOTAL (INSITU) | ($m^3$) | - | - | - | 3,625 | - | - | - | - | 1,625 | - | - | - |
| **SEDIMENT REMOVAL METHOD & CORRESPONDING VOLUMES** | | | | | | | | | | | | | |
| EXCAVATION | ($m^3$) | - | - | - | 3,625 | - | - | - | - | 1,625 | - | - | - |
| SEDIMENT REMOVAL VOLUMES PROPORTION WETLAND INLET ZONE | % | 0% | 0% | 0% | 67% | 0% | 0% | 0% | 0% | 26% | 0% | 0% | 0% |
| SEDIMENT REMOVAL VOLUMES PROPORTION WETLAND MACROPHYTE ZONE | | 0% | 0% | 0% | 33% | 0% | 0% | 0% | 0% | 74% | 0% | 0% | 0% |
| INCREASE OR REDUCTION IN SEDIMENT REMOVAL VOLUMES | | | | | | | | | | | | | |
| ☐ INCREASED/REDUCED SILTATION - factored by: 25% | ($m^3$) | | | | - | - | - | - | - | - | - | - | - |
| FACTORED SEDIMENT REMOVAL VOLUMES (INSITU) | | | | | | | | | | | | | |
| Total volumes of sediment removal | ($m^3$) | - | - | - | 3,625 | - | - | - | - | 1,625 | - | - | - |
| Wetland volume of sediment removal | ($m^3$) | - | - | - | 3,625 | - | - | - | - | 1,625 | - | - | - |
| **DISPOSAL** | | | | | | | | | | | | | |
| WET SPOIL DISPOSAL - FROM DEWATERING FACILITY TO LANDFILL (>20%MC) | | | | | | | | | | | | | |
| Total Volumes % wet dispos 100% | ($m^3$) | - | - | - | 3,625 | - | - | - | - | 1,625 | - | - | - |
| Inlet Zone | | - | - | - | 2,425 | - | - | - | - | 425 | - | - | - |
| Macrophyte Zone | | - | - | - | 1,200 | - | - | - | - | 1,200 | - | - | - |

### SEDIMENT REMOVAL VOLUMES INPUT

| | | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | Total | % of Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Total Volumes** | ($m^3$) | - | - | - | 3,625 | | | | | 1,625 | | | | 5,250 | 100% |
| **INLET ZONE SEDIMENT REMOVAL** | ($m^3$) | | | | **425** | | | | | **425** | | | | 850 | 16% |
| **INLET ZONE RE-STRUCTURE** | ($m^3$) | | | | **2,000** | | | | | | | | | 2,000 | 38% |
| **MACROPHYTE ZONE SEDIMENT REMOVAL** | ($m^3$) | | | | **1,200** | | | | | **1,200** | | | | 2,400 | 46% |

**Instructions for Sediment Removal Details Workpage**
SEDIMENT VOLUMES INPUT TABLE IS BASED ON SEDIMENT REMOVAL SCHEDULE - VALUES CAN ALSO BE MANUALLY MANIPULATED (CELLS SHOWN IN BOLD BLUE FONT AND GREEN SHADING)
MANUAL MANIPULATION IS ONLY ADVISABLE IF THE USER HAS A KNOWLEDGE OF THE SEDIMENT REMOVAL SCHEDULE AND SEDIMENT REMOVAL AND DISPOSAL CONSTRAINTS
THE SPOIL VOLUMES FOR EACH DISPOSAL METHOD ARE TRACKED THROUGH AND FACTORED BY THE SEDIMENT REMOVAL TECHNICAL PARAMETERS
SPOIL VOLUMES DIRECTLY INFORMS THE PROGRAM SHEET, AND THEREFORE AFFECTS COSTS

# SOVEREIGN WATERS MAINTENANCE MODEL

## SEDIMENT VOLUMES - TECHNICAL PARAMETERS TABLE

| Volume Conversion Factors - Dredge Spoil | | | |
|---|---|---|---|
| **Spoil Location** | **From Insitu to the following:** | **M.C. %** | **% Air Volume** |
| Insitu | 1.00 | 152 | 0.00 |
| C/S Dredge | 2.95 | 525 | 0.00 |
| Pond wet | 0.89 | 130 | 0.00 |
| Pond Crust on Batter | 0.36 | 20 | 7.24 |
| Pond Crust in Truck - Bulked | 0.44 | 10 | 22.85 |

Assuming:

| | |
|---|---|
| Bulking Factor | 1.2 |
| Density of Spoil ($t/m^3$) | 1.6 |

**Instructions for Technical Parameters Worksheet**
DO NOT MODIFY CELL CONTENTS WITHOUT NEW GEOTECHNICAL DATA
BULKING FACTOR APPLIED FOR TRUCKING VOLUMES

## SUPPORTING GEOTECHNICAL CALCULATIONS

$\rho_{solids}$ = 2.600 $t/m^3$ $\rho_{water}$ = 1.025 $t/m^3$

| Location | Total V($m^3$) | $\rho_{bulk}$ ($t/m^3$) | Solids ($t/m^3$) | Water ($t/m^3$) | % Solids Mass | % Solids Vol | % Water Vol | % Air Vol | M.C. (%) | Total Mass (t) | Solids Mass (t) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Insitu | ***1,000*** | ***1.350*** | 0.537 | 0.813 | 39.74 | 20.63 | 79.37 | ***0.00*** | 152 | 1,350 | 537 |
| C/S Dredge | 2,955 | ***1.135*** | 0.182 | 0.953 | 16.00 | 6.98 | 93.02 | ***0.00*** | 525 | 3,353 | 537 |
| Pond wet | 887 | 1.391 | 0.605 | 0.786 | 43.48 | 23.27 | 76.73 | ***0.00*** | ***130*** | 1,234 | 537 |
| Spadeable | 363 | 1.919 | 1.476 | 0.443 | 76.92 | 56.79 | 43.21 | ***0.00*** | ***30*** | 697 | 537 |
| Pond Crust | 335 | ***1.920*** | 1.600 | 0.320 | 83.33 | 61.54 | 31.22 | 7.24 | ***20*** | 644 | 537 |
| Heaped Dry | 335 | 1.760 | 1.600 | 0.160 | 90.91 | 61.54 | 15.61 | 22.85 | ***10*** | 590 | 537 |

***Note : Bold and italic is the assumed or known value***

*Appendix C*

# SOVEREIGN WATERS ESTATE MICROBIAL TESTING OF RECREATIONAL WATERS REGIONAL MANAGEMENT RESPONSE FLOWCHART

HEALTHY WATERWAYS

# Microbial Testing of Recreational Waters
# Regional Management Response Flowchart: FINAL DRAFT V2
## Adapted for use by Redland City Council (April 2013)

**Routine Sampling**
Conduct routine recreational water sampling at selected recreational sites (selection based on risk assessment) across the catchment. Minimum of 20 samples per site collected at regular intervals (e.g. weekly) over the swimming season (September to April).

**Sample Analysis and Data Management**
Samples sent to the laboratory within six hours of collection for enterococci testing.
Laboratory returns results within 48 hours of receiving sample.
Data received and entered into data storage for analysis. Results are examined for enterococci counts.

**Trigger Level**
**Equal to or Greater than 201 Enterococci per 100 mL**
The counts are equal to or greater than 201 enterococci per 100 mL as measured against the Guidelines for Managing Risks in Recreational Water (NHMRC, 2008).

Counts are within guidelines (less than or equal to 200 enterococci per 100 mL), no further action required.
Continue routine monitoring schedule.

**Intensive resampling and Investigation**
Conduct intensive sampling for enterococci. It is recommended that when sampling affected the site to take multiple samples to rule out anomalies. This should be carried out on a on a weekly basis.
Review field observation notes collected on the day of sampling (e.g.) heavy rainfall, high bird numbers, stormwater runoff.
Similarly, conduct a Sanitary Inspection to assess possible contamination points and guide corrective management actions.

**Trigger Level**
**Equal to or Greater than 501 Enterococci per 100 mL**

For two consecutive weeks the counts are equal to o greater than 500 enterococci per 100 mL as measured against the Guidelines for Managing Risks in Recreational Water (NHMRC 2008).

**Preliminary sanitary Inspection and review of field notes indicate a public health risk coupled with monitoring values that remain between 201-500 Enterococci per 100 mL**

For three consecutive weeks the counts are between 201-500 enterococci per 100 ml and the sanitary inspection and field notes indicate a public health risk.

**Three Consecutive Samples Less than or Equal to 200 Enterococci per 100 ml**

Return to routine monitoring schedule.

Action 1
Deploy generic warning signage around the site informing users of risks.
Notify residents around the lake with a letter drop.

Action 2
Where persistent (weekly) high readings cannot be resolved through investigations notify residents and stakeholder groups.
Develop a plan to manage or resolve the source issues

Action 3
Closure of the site and installation of permanent warning and /or information signage.
Advise stakeholder groups.

**Investigation**
Use results from the Sanitary Inspection, review of field notes and Intensive resampling to determine the most appropriate corrective management actions to implement. It is also recommended that methods to determine the source of bacterial pollution be carried out (e.g. Microbial Source Tracking).

**Implement Corrective Actions**
Implement corrective actions until suitable conditions for primary contact are restored.

**Prolonged Closure**
If suitable conditions cannot be attained through short term corrective actions then the site should remain closed for primary contact.

**Long Term Corrective Management Plan**
Significant remediation work on the recreational site returns to it to an acceptable standard for recreational use.

**Corrective Actions Result in Suitable Conditions Re-Open Site**

For three consecutive days the counts are **less than or equal to 200 enterococci per 100 ml** and the Sanitary Inspection reveals no health risk to swimmers then signs may be removed and public access to the recreational water area restored.

Return to routine monitoring schedule.

# Appendix 7

**Redland City Council Community Consultation**

*Canal and lake waterways and revetment walls*

Citizens Advisory Panel Meeting 1 | Pacific International Resort, Cleveland

Saturday, 2 December 2017

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The first meeting of the Independent Citizens' Advisory Panel comprising randomly selected residents from Redland's four distinct regions – Canal and Lake, Coastal, Inland and Island was held on Saturday, 2 December 2017 at the Pacific International Resort from 9:15am to 4:15pm

| | |
|---|---|
| **Facilitator:** | Mr Max Hardy |
| **Community Engagement Consultants:** | Ms Amanda Newbery (Articulous)<br>Mr Bernard Houston (Articulous)<br>Mr Luke Myers (Articulous) |

## Opening and welcome

The Panel session was opened by Ms Tracey Walker, representing the Mayor, Councillors and the Chief Executive Officer of Redland City Council, who thanked panel members for their attendance and reaffirmed Council's commitment to the process.

Ms Amanda Newbery then welcomed panel members and provided an overview of the Citizens Advisory Panel and what Redland City Council was asking them to do, and the importance of all members of the panel having the freedom to ask questions, to learn and to speak in confidence.

## Tour of Redland canal and lake precincts

To begin deliberations, panel members were given a guided tour of Redland's canal and lake precincts – Raby Bay, Sovereign Waters and Aquatic Paradise. The tour was conducted by Mr Rod Powell from Redland City Council who provided a general overview of each area use of the areas, the type of maintenance and repairs undertaken by Council at Raby Bay including the trial of a new repair program, the maintenance undertaken by Council at Aquatic Paradise especially dredging to deal with siltration within the waterways, and filtering. Activities undertaken at Sovereign Waters to ensure the lake waters are clean and healthy, as well as the costs of these activities.

## Conclusion of tour

Following the tour, members of the Citizens Advisory Panel returned to the Pacific International Resort for where they were asked to write down what they learnt and what they were still curious about in relation to Redland's canal and lake precincts.

## Panel Presentations

To assist members of the Citizens Advisory Panel, representatives of Redland's canal and lake precincts were invited to give a presentation outlining their specific areas of interest.

**Presentation 1 – Raby Bay Rate Payers Association**
*Presenters:* *and*

**Summary of Presentation 1 by Mr Max Hardy**

Mr Hardy thanks and for their detailed presentation which outlined what they saw as the major concerns of member of the Raby Bay Rate Payers Association.

Mr Hardy reaffirmed the importance of the role of panellists and their task of providing advice to council on a fair and reasonable solution that is in the interest of the whole city. He advised that there would be a lot of great information presented and a range of views offered for people to weigh up.

Mr Hardy noted that politicians vary rarely get frank advice from everyday people and the panel is an opportunity for 'ordinary people' to have their say.

**Presentation 2 –**

**Summary of presentation by**

Mr Hardy thanked for his detailed presentation which included historical observations and advised the panellists that this information needs to be thoughtfully considered during deliberations.

**Panel Presentation – Redland City Council officers**

Mr Hardy introduced four senior representatives of Redland City Council who would be able to answer panellists' questions following the site tour and presentations.

The representatives of Redland City Council were:

- Mr Andrew Ross – Chief Legal Officer
- Mr Rod Powell – Senior Marine Engineer
- Mr Gerard Noon – Senior Communications, Engagement and Issues Management
- Mr Matt O'Connor – Acting Chief Financial Officer

**Questions and answers.**

Panellists were invited to ask questions of the panel with the following topics discussed:

- Allocation of funds raised from the special levy;
- Current and future revetment wall repairs and associated costs;
- Legal responsibility of council and councillors in relation to decisions about Raby Bay;
- Previous investigations into canal and lake infrastructure and maintenance;

- Planning guidelines, approvals and development along the canals;
- Council budget decisions and responsibility of funding allocation;
- Land valuations;
- Schedule of rates and charges;
- Machinery of Council; and
- Records of property history.

**Summary of panel presentation**

Following the conclusion of the Panel Session, Mr Hardy thanks the representatives of Redland City Council for their responses and invited panellists to suggest possible topics to be covered in the following sessions.

Panellists suggested they would like further information on:

- How much does council contribute to canal wall repairs?
- How much is spent by Council on canals and what is the projected expenditure?
- What has been done in other places re: canals?
- What are the different funding/ management scenarios of repairs to the canal walls, based on the outcome of the current trials of a new repair approach?
- Need an expert on rates and how local government can raise money to present to panel?
- Need to identify criteria for a solution
- Real quantification of the issue.

**Conclusion**

Mr Hardy thanks panellists for their attendance and participation during the first session. He asked panellists to use the time between now and the next sessions to think about the information that was presented today and consider what they may think would be a workable solution for the entire city.

The first session of the Redland City Council Citizens Advisory Panel closed at 4:15pm.

**ENDS**

# Redland City Council Community Consultation

*Canal and lake waterways and revetment walls*

Citizens Advisory Panel Meeting 1a | Alexandra Hills Hotel, Alexandra Hills

Friday, 19 January 2018

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The 'make up' meeting (1a) of the Independent Citizens' Advisory Panel comprising randomly selected residents from Redland's four distinct regions – Canal and Lake, Coastal, Inland and Island was held on Friday, January 19 at the Alexandra Hills Hotel from 5pm to 8:30pm

| | |
|---|---|
| **Facilitator:** | Mr Max Hardy (Max Hardy Consulting) |
| **Community Engagement Consultants:** | Ms Amanda Newbery (Articulous)<br>Mr Bernard Houston (Articulous)<br>Mr Luke Myers (Articulous) |

## Opening and welcome

The panel session was opened by Ms Claire Lovejoy, representing the Mayor, Councillors and the Chief Executive Officer of Redland City Council, who thanked panel members for their attendance and reaffirmed Council's commitment to the process.

Ms Amanda Newbery then welcomed panel members and provided an overview of the Citizens' Advisory Panel and what Redland City Council was asking them to do, and the importance of all members of the panel having the freedom to ask questions, to learn and to speak in confidence.

## Tour of Redland canal and lake precincts

To begin deliberations, panel members were shown drone footage of Redland's canal and lake precincts – Raby Bay, Sovereign Waters and Aquatic Paradise. Mr Rod Powell, from Redland City Council, provided a general overview of the type of maintenance and repairs undertaken by Council at Raby Bay, including the trial of a new repair program; the maintenance undertaken by Council at Raby Bay, especially dredging to deal with siltation within the waterways, and filtering; activities undertaken at Sovereign Waters to ensure the lake waters are clean and healthy; as well as the costs of these activities.

## Questions from panel on precinct virtual tour

Question:

- Why did they block off the creek that used to flow into the bay to create the Sovereign Waters lake?

Response:

- Mr Powell explained how the lake system works.

Question:

- Do these estates have storm inundation issues?

Response:
- Yes they do. In the recent December high tide, water flooded into the backyards of canal properties.
- Raby Bay is reclaimed land.

Question:
- Is there a boat size limit at Raby Bay?

Response:
- The maximum draft at Raby Bay is 2.5m.

Question:
- Why can you eat fish caught in Sovereign Waters but you cannot swim in it?

Response:
- RCC consulted the Sovereign Waters community on what was a satisfactory water quality for the lake.
- The community agreed that the lake should be maintained to secondary contact (boats and other small water craft).
- There are big Jew fish in the lake at Sovereign Waters.

Question from Max Hardy:
- How many of you use the estates?

Responses:
- I think they are a real asset; the houses are a draw card for people to move here.
- I live near Aquatic Paradise and I love walking there.
- I use Raby Bay restaurants; reliable to dine when taking visitors and family.
- You don't realise the millions that go into the estates.

Question:
- Is maintaining the estates more of a problem now than it used to be?

Response:
- Costs are going up more and more all the time and RCC is always trying new methods to reduce costs.

Question:
- Are the water levels rising?

Response:
- Yes they are.
- When Raby Bay estate was first built, the people who built it did not design the revetment walls to have a high load bearing. Many residents have built structures that can place load on these walls.

- However, none of the experts have been really able to work out what causes walls to fail and they may fail for different reasons in different places.

**Panel Presentations**

To assist members of the Citizens Advisory Panel, representatives of Redland's canal and lake precincts were invited to give a presentation outlining their specific areas of interest.

**Presentation 1 – Raby Bay Rate Payers Association (RBRPA)**

*(Appendix 1 – Presentation by Raby Bay Rate Payers Association)*

RBRA members were unable to attend the panel session. A copy of their presentation from the December panel meeting and a flyer they had requested distributed was given to all panel members for their consideration.

**Presentation 2 – Resident of Raby Bay**

*(Appendix 2 – Presentation by resident)*

Resident said:

- Raby Bay was built in 16 stages between 1983 and 1998.
- Council wanted the estate and Redland City Council generally used Raby Bay in its promotional materials when promoting the city.
- The estate (Raby Bay) was built on clay and fill used to create new land was not compacted enough to prevent subsidence.
- Tidal movement also pulls loose soil through the revetment wall, creating voids and weakness.
- During construction the developer dug deep holes to create new land and in some cases made the batter steeper to dig these holes. This has led to the wall sliding down this slope and collapsing.
- Redland City Council commissioned geotech reports throughout the period of Raby Bay's construction.
- At least three of these reports suggested the land wasn't compacted enough to support the revetment walls and one report detailed the properties where wall failures would occur.
- In 1996 residents took writs against Council about land subsidence.

Resident continued that:

- Redland City Council demanded a $1.5 million bond from the developer to cover 10 years of maintenance and this amount was consumed in the first year (1998).
- Former Redland Mayor Eddie Santagiuliana introduced a levy under the canal levy to pay for minor repairs and cleaning.
- This levy was implemented under the powers of the (then) Canal Act. Resident explained that the Canal Act was repealed in 1993 and this is when Redland City Council introduced the concept of user benefit.

Resident said it was his belief that:

- Redland City Council granted the developer permission to leave the site and is now responsible for the estate, including walls and navigation aids and all failures that were predicted have occurred.
- Redland City Council was negligent in original construction and should be held accountable, and he gave an example of a geotech report dated 24 June, 2013 which said the foundation fill was uncompacted.
- Redland City Council approved properties without informing buyers that this land is subject to failure and that nowhere in the city are residents asked to fix infrastructure.

Resident said a possible alternative solution to fixing the revetment walls could be an epoxy fill that sets in 30 minutes, which he said seals the void, and stops water incursion. He said he had never known of one to fail yet and once the voids are filled the material won't fail because it isn't susceptible to water. Resident said the trial costs would be done for approximately $600 per metre.

**Summary of presentation by resident**

Mr Hardy thanked resident for his detailed presentation, which included historical observations, and advised the panellists that this information needs to be thoughtfully considered during deliberations.

**Conclusion**

Resident thanked panellists for their attendance and participation during the first session. He asked panellists to use the time between now and the next sessions to think about the information that was presented today and consider what they may think would be a workable solution for the entire city.

This session of the Redland City Council Citizens' Advisory Panel closed at 8:30pm.

**ENDS**

# Redland City Council Community Consultation

*Canal and lake waterways and revetment walls*

Citizens' Advisory Panel Meeting 2 | Alexandra Hills Hotel, Alexandra Hills

Saturday, January 20, 2018

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The second meeting of the Independent Citizens' Advisory Panel comprising randomly selected residents from Redland's four distinct regions – Canal and Lake, Coastal, Inland and Island was held on Saturday, 2 December 2017 at the Alexandra Hills Hotel from 9:15am to 4:15pm.

| | |
|---|---|
| **Facilitator:** | Mr Max Hardy (Max Hardy Consulting) |
| **Community Engagement Consultants:** | Ms Amanda Newbery (Articulous)<br>Mr Bernard Houston (Articulous)<br>Mr Luke Myers (Articulous) |

**Opening and welcome**

The panel session was opened by Ms Claire Lovejoy, representing the Mayor, Councillors and the Chief Executive Officer of Redland City Council, who:
Thanked panel members for their attendance.
Outlined the Citizens' Advisory Panel's role and how the panel was recruited.
Reaffirmed Council's commitment to the process.

Mrs Lovejoy reiterated that Council has committed to a citywide engagement program because potentially the preferred solution may impact all residents through their rates. It was also decided that as residents who live in the canal and lake estates would be most affected by the decision that special care would be given to ensure these residents were given opportunity to participate in this engagement program. Consequently, the Citizens' Advisory Panel was recruited to reflect the city's geographic and demographic diversity but was weighted in favour of canal and lake residents.

An independent company was engaged to recruit a panel of 40 citizens comprising:

- 10 residents who currently pay the special charge
- 10 residents who live in mainland coastal areas
- 10 residents who live on the islands
- 10 residents from other parts of the city

Ms Amanda Newbery advised the room that the director of the market research company originally selected to recruit the panel had been diagnosed with a terminal disease on the day that recruitment was meant to start and was forced to close her business.

Ms Newbery explained that because of this unforeseeable event Council and Articulous had to engage an alternative supplier and this delay brought the project start date close to the State election and the Christmas season. Consequently, eight panellists withdrew and Q&A research were commissioned to re-recruit panellists that exactly matched the demographic

profile of these individuals. A special workshop was held for these panellists on Friday 19 January 2018 (Community Advisory Panel Meeting 1A).

These panellists were provided the same presentations and information as the December workshop.

**Recap on session 1**

Mr Max Hardy:

- Recapped the first Citizens' Advisory Panel meeting.
- Provided a summary of Citizens' Advisory Panel Meeting 1A.
- Thanked panellists for returning to this engagement program and welcomed the eight new panellists to the wider group.
- Explained that the role of a panel member is to be a sponge and learn as much as you can.
- Emphasised that a panellist should come with an open mind.

**Discussion**

Some panellists asked if those who attended Panel Session 1A could possibly understand what happened at the December workshop and if they could understand the feelings of the community groups that presented in December.

One of the eight attendees of Workshop 1A confirmed to the room that they had received the same information and they had felt the emotion and felt well informed.

One Citizens' Advisory Panel member asked to make an announcement on behalf of the Raby Bay Ratepayers Association (RBRA). He disputed the budget figures quoted in Redland Council's factsheets. He tabled a fact sheet produced by the RBRA saying that in the previous six years RCC ratepayers had contributed a total of $3,190,174 to the Raby Bay canals, which equated to around $8.60 per property. The RBRA factsheet was distributed to all panel members.

**Panel questions to Mr Hardy**

Question:

- How many special levies are in place in the Redlands? Are any further levies planned and how are they calculated?

Response:

- Council has two other special charges, the Southern Moreton Bay Island (SMBI) transport levy and the SMBI fire levy.

**Objectives (Community Advisory Panel Meeting 2)**

Mr Bernard Houston recapped the questions raised in Citizens' Advisory Panel Meeting 1:

At this meeting, panellists asked for further information on:

- How much does Council contribute to canal wall repairs?
- How much is spent by Council on canals and what is the projected expenditure?
- What has been done in other places re canals?
- What are the different funding/ management scenarios of repairs to the canal walls, based on the outcome of the current trials of a new repair approach?
- Need an expert on rates and how local government can raise money to present to panel.
- Need to identify criteria for a solution.
- Real quantification of the issue.

Mr Houston explained that in response to these questions three guest speakers had been invited to present to the panel and there would also be a presentation from a community group affected by the special charge.
Speaker 1 – Representing a Community Title Scheme (CTS) at Raby Bay.

Speaker 2 - Dr David Callaghan (University of Queensland Coastal Engineering Research Group) to present on:

- What is done in other places; specifically, how are revetment walls generally constructed – what is best practice?
- What forces generally act upon revetment walls (tide, wash etc.) and what impact does this have on the wall?
- How does siltation generally occur in the mouths of waterways that enter Moreton Bay?
- In summary, what does the Aquatic Paradise siltation study say and how does this compare with other estuaries that enter Moreton Bay?

Speaker 3 – Mr Rodney Powell (Redland City Council Marine Engineer)

- What is Council doing to manage canal and lake estates?
    - Cleaning
    - Mangrove removal
    - Water quality monitoring
    - Dredging
    - Revetment wall monitoring
    - Revetment wall repairs

Submission from Department of Environment and Heritage Protection

Speaker 4 – Mr Mark Leyland (Local Government Association of Queensland) to present on:

- How are LGs allowed to raise money for infrastructure works?
- What are the key principles that underpin each of these methods?
- What, for the community, are the advantages/disadvantages associated with each method?
- How can Council reduce the cost of infrastructure maintenance?

**Presentation by representative of the Community Title Scheme (CTS) at Raby Bay.**

Facilitator Max Hardy invited the representative of the CTS to share his point of view and provide frank advice to the panel.

The speaker began by thanking the panel for their time and explained he was chair of one of two community title schemes that currently pay the special charge. He said he moved to Raby Bay 35 years ago for the lifestyle and believes that Raby Bay is the jewel in the Redlands' Crown. He felt the harbour draws people to the city.

He said:

- CTS areas have attached marinas but these are owned separate to the title scheme.
- Community title scheme residents do not enjoy special benefit as they often have no direct access to the water and often have no water view.
- The canals benefit a wide range of users, including anyone with a boat, commercial operators, visitors and event operators.

He also described:

- The difference paid by CTS owners compared with other Raby Bay residents.
- How including the special charge into the general rate might impact the average rate per household.
- How rates can be varied.
- A potential solution to calculate the special charge per property based on the length of the wall at that address.

**Panel questions to the CTS representative**

Question:

- Does someone have to live in the CTS area to own a marina berth in that area?

Response:

- At Edgewater marina no, at Raby Bay Marina to some extent yes.
- The Marina lease is owned by the State Government and is separate from the freehold title of the CTS.
- To obtain a marina berth you purchase a share in a private company and that share is the berth.

Question:

- Who pays the special charge?

Response:

- CTS representative used a wall map to indicate the areas that pay the special charge. He said the commercial areas of Raby Bay Harbour do not pay the charge.

Question:

- What contribution do pontoon owners and boat owners make?

Response:

- You pay a special charge from when you purchase a marina berth.

Question:

- There are a lot of people who have no view and that pay the levy. Did you put that to Council?

Response:

- Yes and it took a year to get a response.

Statement

- Every boat owner who uses the waterway should pay some kind of charge.
- The general rate does reflect property value and those who have higher valued properties pay more.

**Presentation by Dr David Callaghan**

Facilitator Max Hardy invited Dr Callaghan to share his knowledge and provide frank advice to the panel.

Dr Callaghan began by explaining that he was a civil engineer with expertise in coastal sedimentation processes. He also explained that he had collaborated with other academic staff with specific expertise in other aspects of coastal engineering to prepare his presentation.

Dr Callaghan described:

- What is a revetment wall and why they are built.
- How such walls are supposed to stabilise horizontal and vertical movement.
- How revetment walls control static, dynamic, secondary and feedback forces.
- Best practice in constructing revetment walls.
- Best types of revetment wall to bring in aesthetics and developable land.
- How sedimentation occurs in Moreton Bay river mouths and comment on the Aquatic Paradise siltation study.
- How small rivers, such as Eprapah Creek, generally do not flood enough to clear sediment deposits at the river mouth.
- That the Aquatic Paradise siltation study was clearly based on samples and evidence gathered from the canal estate.

**Panel questions to Dr Callaghan**

Question:

- Gold Coast canals have higher level of stability than Raby Bay. Is it fair to say this difference is due the materials used?

Response:

- Gold Coast canals were built using pumped sand. It is best to use very granular materials that move.
- Generally do not want reactive materials underneath the structure.

- If a cantilevered wall is built on unconsolidated fill then it will rotate as fill settles.
- Piles will stop the rotation but these will eventually shear off and need to be fixed.

Statement:
- Redland City Council is currently trialling resin injected walls at Raby Bay.

Response:
- Resin injection will eventually fail.

Questions:
- Who approves canal revetment walls?

Response:
- Previously, these were government approved.
- They are currently self-assessed by the developer.
- They are certified by a qualified RPEQ engineer (with recognised expertise in coastal infrastructure).

Statement
- Aquatic Paradise residents have commissioned their own siltation report that indicates sediment is coming from the rubbish tip and building activity outside the estate.

Question:
- What is the status of approval for canal estates in the future?

Response:
- Since the mid-80s, new reclaimed land structures have been built in the middle of the ocean. An example of this is the new islands in Dubai.

**Presentation by Mr Rodney Powell**

Facilitator Max Hardy invited Mr Powell to share his knowledge and provide frank advice to the panel.

Mr Powell described:
- RCC's canal cleaning and mangrove removal program.
- Water quality treatment activities at Sovereign Waters.
- How RCC monitors condition of Raby Bay revetment walls.
- How RCC tracks the condition of these walls over time and how this information is stored in a central data base.
- How work is prioritised based on the condition of the walls.
- How RCC repairs revetment walls.
- How RCC monitors and manages siltation in Aquatic Paradise.
- How RCC has partnered with this local community to substantially reduce the cost of management activities (by up to 50 per cent of the original budget).

**Panel questions to Mr Powell**

Question:

- Why is Council doing this work?

Response:

- Originally, these developments were done under the Queensland State Government's Canal Act. This act was repealed and replaced by the Coastal Protection and Management Act 1995. This act requires local government to maintain canals and their entrance channels.

Question:

- How does RCC manage canal depth?

Response:

- Each canal estate has an approved depth. Raby Bay has an approved depth of 2.2m and Aquatic Paradise has an approved depth of 1.5m. In addition to this, the canal must allow an additional 300mm at mooring and 400mm clearance in movement.
- Council is required to maintain these depths.
- Some Raby Bay canals have a depth of more than 6m.

Question:

- Do you do regular water quality checks at Sovereign Waters?

Response:

- Yes.
- RCC sought community feedback on what standard water quality should be maintained.
- Community response was that water should be maintained to secondary emersion (that is, of sufficient quality for canoes and small water craft).
- Swimming is not permitted at Sovereign Waters and there are signs advising this.

Question:

- What is the threshold for intervention for a Raby Bay wall failure?

Response:

- Once we know there is a problem, RCC monitors the problem and keeps going back to that address.

Question:

- What is a slip circle failure?

Response:

- This occurs when underground soil movement makes a slope unstable.
- In this case the weight of the wall causes it to rotate.
- This is treated with piles and an anchor system.
- This is very expensive but it has a low failure rate.

At this point, Mr Powell showed a photo of a slip circle failure.

Question:

- What happens to dredged spoil?

Response:

- This is currently taken to Mud Island.
- This disposal is nearly half the cost of the dredge.

Question:

- How are Raby Bay Boulevard Park groins maintained?

Response:

- These are funded through general rates and not through a special charge.

**Submission from Department of Environment and Heritage Protection (DEHP)**

DEHP was requested to provide a response to these questions:

Question:

- Why is Council repairing revetment walls and dredging canals – under what legislation (if any) does this occur?

Response:

- Section 121 of the *Coastal Protection and Management Act 1995* (Coastal Act) states that a local government must maintain and keep clean each:
  a) canal in its area; and
  b) access channel for a canal mentioned in paragraph (a), whether or not the access channel is in its area.

  This section of the Coastal Act was a continuation of provisions under the repealed *Canals Act 1958*, which also required the Local Government to "preserve, maintain and keep clean any canal within its area". The Canals Act 1958 also contained provisions for a Local Government to apply a special rate levied under the Local Government Act to provide for canal maintenance.

  Section 92 of the *Local Government Act 2009* allows Local Government to apply special rates and charges, "for services, facilities and activities that have a special association with particular land". This provision is often used by Local Governments to fund maintenance (e.g. maintenance dredging) of canals. In relation to the maintenance of revetment walls, it is understood that Gold Coast City Council has determined that the revetment walls are within the private property boundaries and therefore maintenance is the responsibility of the landowner.

Question:

- How were the canal estates (especially Raby Bay estate) approved?

Response:

- These estates were approved under the provisions of the *Canals Act 1958*, which required provisional and final approval of the estate. This legislation was repealed in 2003 and replaced with amendments to the *Coastal Protection and Management Act 1995.*

Question:

- Any engineering/building standards that were applicable to their construction.

Response:

- We would need to check the file records to determine the engineering standards that applied at the time of the approval.

Question:

- What were the transfer conditions for Redlands when the State delegated their management to Local Government?

Response:

- The transfer of the canal waterway was undertaken following the issue of a final approval under the *Canals Act 1958*.

**Presentation by Mr Mark Leyland (Local Government Association of Queensland)**

Facilitator Max Hardy invited Mr Powell to share his knowledge and provide frank advice to the panel.

Mr Leyland addressed these questions:

- How are Local Governments allowed to raise money?
- When can Local Government use these methods to raise money and how do they work?
- What are the key principles that underpin each of these methods?
- What, for the community, are the advantages/disadvantages associated with each method?
- What other methods can Local Governments use to reduce expense?

**Panel questions to Mr Leyland**

Question:

- What is the difference between unimproved capital value (UCV) and site value (SV)?

Response:

- UCV is applied in rural areas and SV is applied in urban areas where the land has been developed.
- In the case of canal and lake estates, the site value would include the revetment wall.

- These values are set by the Valuer General (State Government).

Question:
- Are there guidelines for how Council can apply special charges and how these are calculated?

Response:
- Local Government Act Section 94.1.

Question:
- A panellist made reference to a news report stating that Redland City and Ipswich City councils have the highest paid Councillors.

Response:
- These rates are set by the Remuneration and Discipline Tribunal.

**Activity – Mr Max Hardy**

Mr Hardy led a discussion on infrastructure and funding principles.

The themes discussed included:
- Infrastructure principles
- Asset management (preventative, proactive or reactive)
- Risk management (innovation/novelty versus established practice)
- Service level (minimum acceptable versus gold plated)

Financial principles
- Surety (negotiated versus guaranteed)
- Reporting frequency (weekly versus end of year)
- Cost recovery (user pay versus universal
- Fairness

The panel prioritised these principles

How should Council maintain assets?
- Majority support for qualitative early detection.

To what extent should Council be experimenting with new methods?
- Majority support that Council moderately invest in new methods.

What level of service should Redland City Council provide?
- Majority support for maintenance to a level consistent with other assets.

How should Redland City Council secure funds for maintenance?

- There was a split view, with more people saying “there should be a base level of funding with the option to negotiate more annually” and slightly fewer people saying funding should be negotiated through Council’s annual budgeting process.

How frequently should Council track and report on expenditure?

- Majority support for quarterly reporting.

How should we define beneficiaries/uses?

- Majority support for “all of the above” (Those who border the canals/lakes, those who have boats, those who have jetties, anyone living within 500m of the estates, those who have a nice view of the waterways, those who derive financial benefit from the canals/lakes) but <u>not</u> everyone in the Redlands.

The broad consensus of the panel regarding commercial operators in the canal/lake estates was best summarised by one panellist who said *“I am flabbergasted that the businesses at Raby Bay do not pay any levy at all; that just does not seem fair.”*

**<u>Questions on notice (from wall)</u>**

<u>For Council</u>

How many international (overseas/ foreign) owners are there at Raby Bay, Aquatic Paradise and Sovereign Waters?

What is the current turnover of housing in Raby Bay compared to other areas collecting stamp duty and taxes for the State?

How much do jetties/pontoons add to the value of a property?

With every stage taking a different idea of how to build their revetment walls, isn’t that a sure system of failure with the estate?

What is the total income from fees (special charge) versus rates?

What is the special charges benefits definition?

<u>For estate agents</u>

Why do people sell in Raby Bay?

**Redland City Council Community Consultation**
*Canal and lake waterways and revetment walls*
Citizens Advisory Panel Meeting 3 | Alexandra Hills Hotel, Alexandra Hills
Saturday, 10 February 2018

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The third meeting of the Independent Citizens' Advisory Panel comprising randomly selected residents from Redland's four distinct regions – Canal and Lake, Coastal, Inland and Island was held on Saturday, 10 February at the Alexandra Hills Hotel from 9:15am to 4:15pm

| | |
|---|---|
| **Facilitator:** | Mr Max Hardy<br>(Max Hardy Consulting) |
| **Community Engagement Consultants:** | Ms Amanda Newbery (Articulous)<br>Mr Bernard Houston (Articulous)<br>Mr Luke Myers (Articulous) |

## Submissions from Ratepayer Associations and Estate Ratepayers

Estate Ratepayer Associations and representative ratepayers were asked to give their preferred solution to how these estates should be managed to the panel in a provided template. These solutions were emailed to the panel in advance of this workshop and hard copies were distributed to the panel at the beginning of this session.

## Opening and welcome

The Panel session was opened by Mr John Oberhardt, representing the Mayor, Councillors and the Chief Executive Officer of Redland City Council who:

- Thanked panel members for their attendance
- Outlined the Citizen's Advisory Panel's role
- Described the community engagement process supporting this decision
- Reaffirmed Council's commitment to the process

## Recap on sessions 1 and 2

Mr Max Hardy:

- Recapped the outcomes of the first two Citizen Advisory Panel Meetings
- Thanked panelists for returning to this engagement program
- Reminded panelists of their role and remit
- Confirmed the day's objectives

## Checking in regarding infrastructure principles

Mr Max Hardy recapped these outcomes identified in session 2.

The panel supports:

- Qualitative early detection
- Moderate investment by Council in new infrastructure management methods
- That cannal infrastructure is maintained to a level consistent with other assets
- That there should be a broader definition of beneficiaries and users
- Quarterly expenditure reporting

## Discussion and questions

Statement:

- One panelist thought there should be more discussion on infrastructure management in these estates.

Question

- One panelist wanted to confirm that the purpose of this day was to discuss and identify principles and not to set a budget.

Response:

- This was confirmed.

Question:

- How is the annual budget negotiated within Council?

Response:

- Different departments negotiate amongst themselves. The outcomes of these discussions are presented to Council who make the final decision.

## Presentation by Aquatic Paradise Residents Association

Facilitator Max Hardy invited five members of the Aquatic Paradise Residents Association (ARPA) to share their points of view and provide frank advice to the panel.

APRA said their presentation would:

- Explain the big picture
- Provide their own business case for funding canal maintenance
- Explain the history of the Aquatic Paradise estate
- Suggest ways forward
- Answer any questions

APRA also distributed printed materials to the panel. Scanned copies of these are included in this report.

### Panel questions to APRA

Question:

- Is the general rate set by Council?

Response:
- APRA confirmed that this was true

**Presentation by Ms Noela Barton (Finance Manager, Financial Operations Redland City Council)**

Facilitator Max Hardy invited Ms Barton to share her knowledge and provide frank advice to the panel.

Ms Barton described:
- Redland City Council's rating policies
- An explanation on Council's current special charges for canal and lake estates
- The current contribution residents in these estate these make toward infrastructure management
- The legislative principles that underpin how Council applies the general rate
- The financial impact on residents of removing the special charge

Following Ms Barton's Redland City Council presentation about how Council charges rates and how changes to the levy system could impact on council rates, there was considerable discussion amongst the panel about Council's rating policy and current 20% rate reduction on higher valued properties. Many panelists disagreed with this policy and some expressed strong feelings.

**Presentation by Sovereign Waters resident**

Facilitator Max Hardy invited a Sovereign Waters resident to share his knowledge and provide frank advice to the panel.

He described:
- The history of the lake and how it operates
- Who Benefits from the lake
- Who currently pays for lake maintenance
- How is the Lake Managed
- His recommendations and conclusions

**Panel questions**

Question:
- Are all blocks at Sovereign Waters the same size?

Response:
- There is some variation in block size.

Question:

- How does the water in the lake turn over?

Response:
- The resident described how lake water is refreshed from the ocean via an o-ring seal.

Question:
- Is the flood overflow working?

Response:
- The resident felt that flood control was inadequate.

Question:
- What is being done about acid flow into the water?

Response:
- The resident said that Council has reassured him on water quality treatment activities but there is little transparency on this.

**Activity - Generating Options**

The panel was asked to development options for managing and funding infrastructure in each of the three estates. These options included the current (base) case and removing the special charge completely.

Ten options were developed for Raby Bay, five for Aquatic Paradise and three for Sovereign Waters.

The panel was asked to evaluate each option using PollEv software. As a final activity panelists were asked to individually rank these funding options on a response form. These results were entered into Excel in presence of two panel witnesses one of whom was a Justice of the Peace.

The following options were developed by the panelists and then ranked by the panelists, with 1 being the most favourable ranking.

Raby Bay
1. Business with walkways pay, units with no view don't pay
2. Remove levy & remove 20% discount
3. Levy based on points system
4. Special levy includes businesses and dry blocks
5. Tiered system based on quay line
6. Owner pays 50%
7. Remove levy & retain 20% discount
8. Self managed body corporate
9. Owner pays 100%
10. Base case

Aquatic Paradise

1. Remove levy & remove 20% discount
2. Annual fee for pontoons
3. Remove  levy & retain 20% discount
4. Tiered system based on quay line
5. Base case

Sovereign Waters

1. Base case
2. Remove  levy & retain 20% discount
3. Remove levy & remove 20% discount

The full results of this discussion are described in the Redland City Council Canal and Lake Special Charges Review - Citizen Advisory Panel Report

[redacted]
Redland Shire Resident
8th February 2018
[redacted]

Thank you for the opportunity to be part of the Citizens Advisory Panel, an opportunity which I have taken seriously and applied myself to with the hope of contributing in a small way to assist with a solution.

In the two weeks since our last meeting I have put in over 150 hours of research, reading and on the ground fact finding. Being in the Redlands since the mid 1940s, Redlands is my home and I take seriously any problems in the area.

The panel was asked to look at 3 areas of concern: Sovereign Waters, Aquatic Paradise, and Raby Bay.
To this end, we were supplied with a wealth of information in the form of papers, visual aids and lecturers presentations, all in all a very good supply over a vast range of points concerning the targeted topics.

**Sovereign Waters.**
Lake type development, nil revetment failures, siltation problem nil, good control of rubbish. Management of this area appears to be working well with existing silt and rubbish control methods effective. Management would seem to be within budget.

**Aquatic Paradise canal development.**
This development was of the "**bring water in on to existing land**" type. To date there have been zero revetment failures, but there is a problem with siltation, both the entrance leads of 2.8 Klm and within the canal system. Siltation removal at this time is by clam dredge and lighter removal of the spoil to Mud Island in Moreton Bay. I would like to know just where the siltation is coming from, as all banks behind their revetment walls are stable, ie: the fines in the material are not being removed by tidal action. How much is coming in from the bay, and how much is from creek/drainage flow?

Clam dredging is space hungry, and this seems to be having effects in the canals with regard to mobility of the clam dredge and increased turbidity of the water. Costs are rising and seem to be impacting Council's budget. Costs are going to keep increasing in coming years, and a more effective and cheaper means of silt removal long term must be implemented as soon as possible. I understand that the residents working committee is working in close contact with the RCC on the dredging program.

One possible remedy would be to implement a different method of dredging in conjunction with silt traps where any creeks/drains enter from land side, which seems to work well at Sovereign Waters. Council could investigate using Westminster Dredging, a Dutch firm and very experienced, known in Australia as Boskalis Environmental Dredging. They would perhaps be able to facilitate the use of a small **Trailing Suction dredge,** which is more efficient, much easier to operate in tight canal applications, and reducing time spent on the job by a great percentage. This method would perhaps be higher in cost initially, but used in conjunction with silt traps at entrance points should reduce greatly in costs as needed works reduced.

**And now to the Jewel in the Crown, Raby Bay.**
This development was different in construction methods to Aquatic Paradise; **land was put out into the sea**. Nobody who lives in the Redlands argues that this canal development is our very own Venice, Opera House or Statue of Liberty. On weekends and public holidays it's beaches and roadways are packed with sightseers, fisher persons, boaties and general lookenpeepers. And because of this repeating influx of people, we all benefit to varying degrees.

Unfortunately, the canals have a problem which will not go away, and will increasingly cost more in time, effort and money to fix. Looking at the canals, the eye is drawn to the water, the walls and the homes. Firstly, I looked and saw retaining walls. **Wrong**. They aren't retaining walls, they are revetment walls, and designed only to protect against wave action, boat wash and tidal run. This I only found out during this series of Advisory C'tee meetings. It begs the question **"how many stakeholders knew what a revetment wall is, and the difference to a retaining wall?"** I am reliably informed that during the recent neap tide event the water was over the concrete header on the revetment wall, in fact it was many centimeters OVER the wall, which wouldn't be too much of a problem if the fill on the land side was compacted to reduce absorption, which is isn't. And this happens EVERY NEAP TIDE EVENT or EXTREEM WEATHER EVENT. I am also informed that salt leaching out of concrete house walls, paths and other constructions is becoming common. What effect on concrete strength and durability does this have? And does salt have any effect on 2 pack epoxy strength or adhesion? We have had slip circle erosion explained to us, along with many other causes of wall degradation, and seen many photos as back up. We have also seen photos of unrestrained development above, on and over the revetment wall (problem 1). We have been told the maximum weight bearing on the 9m slope is **2 kpa**, the equalivent of 2 adult males standing on a 1m square of ply.

So how much does that 40,000litre pool weigh? The water alone is 40tons. How much does that large overhanging deck weigh? Talking about visual impact, some of the photos look like they were taken in some S E Asia back water, not in the Redlands. Some of it is so bad I would not take friends from overseas to look at it. Looking at CMPA section 121 it states it is a Local Government responsibility to maintain and keep clean each canal. It also imposes a responsibility on Council to maintain revetments. But Section 124 of the same act imposes responsibility on land owners adjoining and benefiting from revetments to keep such revetments safe.

**Types of repair – the Options.**
We have been shown different ways of repairing the wall. The screw anchor, which effectively converts the revetment wall to a retaining wall has some merit until we are told it will only last a few years until lateral stresses will snap the rod. Driving piles down and locking them with a concrete header, while being the most expensive, appears to be the most effective and long lasting, once again converting the flawed revetment wall into a retaining wall. Innovative methods, i.e. epoxy 2 part foam fillers, should be further investigated as the cost is significantly lower than other methods, and the results of one experiment seem to be effective if a bit ad-hoc in placement. Practice should make perfect, and it appears there will be lots of opportunity for practice. Remember there are **22klm** of potential wall failure.

**The Almighty Dollar.**
So how much will it cost to fix? At present practice, the figure is up to $30,000 per meter, or $30,000,000 per Klm, of which there are 2 klm at immediate risk, and given construction method history, 22 Klm at potential risk, which my calculator says equals $660,000,000. That's right, $660 million. And that's to be shared out over all 67,000 rate payers. **And all these prices at today's labour costs**. No wonder Council is in a panic. I am as well! It is an emotive and complex problem which seems to have lost the rule book of repair. Lax certification can accept a large portion of the blame, and it will take some hard line Council rules to sort out.

**Some recommendations.**
**Please** would Council's Planning Dept talk to the Marine Dept, which should be easy, they are in the same building.

Remove all private certifiers from the equation and let the above departments of Planning and Marine do their work.

Put an immediate moratorium on all canal blocks of all applications for anything until they are considered by the relevand departments.

Nothing further to be built or placed on the 9m revetment section including large trees.

Existing developments on this 9m section to be removed at Council expense (if they OK'ed it) unless they can prove the inclusion of supporting piles to the correct depth (**below the base of the canal**). Any unapproved structures/pools removed at owner's expense.

Budget increases to allow further monitoring for longer than 12 months and repair methods to be modernized and applied.

A world wide search for, and the trial of, other novel methods of stabilization. Try the Dutch; they have kept Holland afloat for many years.

Residents paid enormous amounts for these blocks initially, and are charged several times the annual rate level for the privilege of living waterfront. I feel the present canal levy is ineffective and unjust, and suggest its removal.

Councils past and present appear to have abrogated their commitment and control of the whole situation. **It seems time for council to man up**, regain control of the canals, wall AND 9m buffer and act accordingly without delay.

**In conclusion,**
I feel privileged to have been given this opportunity and offer my thoughts and considerations in the hope they will be of assistance to those tasked with fixing these problems.

Yours Faithfully,

[redacted]

**These comments are made by me As a Panel member, and having participated in all 3 sessions.**

Thank you for your offer and support for including my Panel comments on the record. I hope they can help to provide a constructive positive way forward for all.

I will recap them briefly here.

I have lived in Raby Bay [redacted] years, worked [redacted] years as a [redacted] ([redacted], Consulting in [redacted]), and am a member of the Rate Payers Association - Management.

**********

**Comment:**

The Panel sessions were very comprehensive and covered almost all areas regarding the Canals and Lake areas.

Many people gave presentations, and many different points of view were expressed.

One aspect of the Canals that was not covered was the **Method and Organisation** of RCC to manage the canal works.

I believe that much of the dissatisfaction expressed in the community is not about the cost, or work, but about the inefficiency of RCC departments to communicate, and manage the projects properly.

There seems to be many departments, all with some vested interest, and no **"One"** person seems to be totally in charge to ensure things are being done rapidly, properly, or cost effectively.

There has been some lack of co-operation between citizens and RCC in the past, likely for the very reason mentioned above.

If RCC can **Designate** one department to be in charge, or a separate agency, who is responsible to ensure things are done properly, with one key person to act as a direct liason between the RCC and RB community; then I believe most all problems can be solved much easier, as communications will have been streamlined.

The issue about the levy funding can be simple to be solved. My personal suggestion is in 4 points:

- The Rate Payers now pay for 80% of all canal works, maintenance and repairs. This can be increased to 90% if needed, it makes little difference. A levy is fully legal, that was explained.

- Few people disagree with a levy/tax of some sort, it's how our society works. It is a way for everyone to share the risk and cost, that **No One person can afford on their own**. Personally I thought it was just a pontoon fee when I bought my house.
- The other 10-20% paid by RCC can, if necessary, be found in reducing the tax discount in the higher tier of land tax's. In this way 100% of all costs can be covered, and tax's reduced for the majority of city households.
- For fairness, there should be some rebalance of levy amounts between users ie. Shop owners who benefit, or people with no access CTS, boaters, larger canal Key-line, lakes vs canals etc.

No one on the panel objected to any ideas that would make things seem more fair. If I pay more for fairness and efficiency so be it, at least the work will all get done well, and all the city community will feel happier.

Regards,

Panel Member

(ps. Please feel free to call on me anytime, if you or others would like to discuss with me.)

# Appendix 8

**Redland City Council Canal and Lake Engagement Public Consultation**

**Date:** 12 November 2017

**Venue:** Redland City Council Library Elders Room

**Attendees:** Aquatic Paradise Residents Association
Mr Bernard Houston (Articulous Communications)
Mr Luke Myers (Articulous Communications)

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**INTRODUCTION**

The Aquatic Paradise Residents Association (APRA) began by providing a historical overview of their residential estate which was officially opened in 1986.

APRA advised that the estate was developed by [redacted] who still lives in Aquatic Paradise, surveyed by Burchell and Partners and was allowed to proceed as Council would be responsible for its maintenance.

APRA outlined their canal was built on an existing creek and is not subject to the subsidence issues at Raby Bay and that under Queensland Government Legislation of that time, it was not subject to a special charge.

**TOPICS DISCUSSED**

**Unique problems**

- APRA advised that in recent years the Geotech matting that holds the revetment wall in place has become worn and that rocks are slipping down the slope in some areas.
- APRA mentioned that one resident built a boat ramp, which Redland City Council gave in principle permission for, that cut the wall and that the wall was compromised at that point. Following construction of the boat ramp, Council denied final permission and the ramp had been signed off by a private certifier.
- APRA reported that people launching canoes from council parks had worn rocks away in some areas.

**Siltation**

- APRA reported that siltation is Aquatic Paradise's principle issue.
- APRA advised that the developer used Nundah's Schulz Canal as a template for Aquatic Paradise and as such shares the same siltation modelling. It was suggested that at the time the developer thought siltation would be a minor issue for the estate, but this has been proven to be incorrect.
- APRA then outlined two sources of siltation

***Sedimentation from Moreton Bay***

- APRA said the construction of the Port of Brisbane has impacted tidal movement in Moreton Bay turning Waterloo Bay into a sedimentation trap.
- APRA reported these tidal movements bring soil from as far away as Ipswich into the canal and tide often traps fresh water in the canal entrance.
- APRA referred to a report produced by KBR (consultants) that supported this view.

***Sedimentation from inland sources***

- APRA said that considerable sediment enters the canal estate from Tarradarrapin Creek.
- APRA reported that new housing developments in Birkdale did not have sufficient onsite sediment traps to prevent soil washing into creeks during rain.
- APRA said Google Maps showed soil coming from Birkdale Land Fill and that Council had videos of clear water turning brown.
- APRA reported they often saw red soil dirtying the bottom of their boats.
- APRA noted that at low tide flood water cannot escape the creek and circulates at the entrance of the estate which is where the worst sedimentation occurs.
- APRA were of the view that the Leslie Harris Dam has contributed to the situation.
- APRA offered the view that extending groins from the coast into deep water might alleviate these problems.

**Infrastructure issues**

***Navigation aids***

- APRA said there were two lots of six lights (leads) extending from the exit of the estate to deep water, some of which may be extraneous because they in the same depth.
- APRA stated that Council at the time of construction asked the developer to make the canals 20m wider than the original design to mitigate flooding, however they also felt that this additional width may increase siltation.
- APRA noted that big drains in front of the estate where the creek enters the canal quickly fill with soil and rubbish in rain events.
- APRA reported that when the developer installed a creek crossing at Chart Street they installed a solid wall instead of a bridge which traps debris.

**Special Charge**

***Inflation***

- APRA reported that when the special charge was introduced in 1992 it was only $100 per quarter and that since then it had increased considerably and is now much higher than the general rate.

***Auditing***

- APRA expressed their frustration that the levy is expended on costs they perceive as unrelated to canal and wall maintenance such as:

    - Victoria Point EPA license fee
    - Survey costs for where creeks enter the canals is charged to the estates
    - Silt trap trials for water that comes down roads
    - Removal of graffiti from estate entrance sign
    - Removing storm damaged trees/branches from the estate

- APRA said they had found over $100,000 of mischarged items in audited Council reports over the past ten years which had been credited back to the maintenance fund after they made queries.

- ARPA felt that this was unfair and asked why they were doing council's job in terms of auditing.

***Wet and Dry blocks***

- APRA stated that 'wet blocks' with canal frontage pay a considerably higher general rate that neighbouring 'dry blocks' and that apart from water access 'dry blocks' enjoyed the same services as 'wet blocks'.

- They said that the land value of these 'wet blocks' was linked to the land value of similar blocks in Raby Bay. However, that unlike Raby Bay the market value of these blocks had not increased since the Global Financial Crisis.

- APRA felt that the higher general rate paid by 'wet blocks' should be used to fund canal maintenance.

- APRA felt that every area of the city enjoyed services that did not benefit the general community and that were funded from the general rate including:

    - Sealed roads and cul-de-sacs in rural areas
    - The Point Lookout Surf Life-saving Club (Stradbroke Island)

**Community Benefit**

- APRA said the canals were 'water roads' and as such were accessible to the general public and should be maintained from the general rate.

- APRA said the Thorneside public boat ramp uses the navigation beacons paid for by Aquatic Paradise residents to exit the bay.

**Active Community**

APRA said they do voluntary work to reduce Council maintenance costs including:

- Removing pest mangroves from the revetment wall to prevent erosion
- Working closely with Council on the dredge operation to ensure private boats were moved at the right time to allow work to proceed smoothly.

**Working towards a positive relationship**

- APRA were highly satisfied with how dredging operations are now managed stating "anything done by Council with regards to dredging is now exemplary".

- APRA said they hoped Council didn't return to a differential rating system for Canal estates.

**Redland City Council Canal and Lake Engagement Public Consultation**

**Date:** Monday, 13 November 2017 -11:30am -12:30pm

**Venue:** Redland City Council Library Elders Room

**Attendees:** [redacted] (Raby Bay resident)
Mr Bernard Houston (Articulous Communications)
Mr Luke Myers (Articulous Communications)

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## INTRODUCTION

- [redacted] resident of Raby Bay and previous member of the Raby Bay Ratepayers Association [redacted] was invited to share his views on the public engagement program being undertaken by Redland City Council and to detail his position on canal and lake maintenance and funding.

- The meeting commenced with Articulous Communications providing [redacted] with an overview of the Redland City Council Canal and Lake Public Engagement program.

- Beginning the conversation, [redacted] stated his concerns that Council may have already made their mind up on the outcome of this engagement process and sought reassurances that the process would be open and transparent.

## TOPICS DISCUSSED

### Why are revetment walls failing?

- [redacted] reported that the estate (Raby Bay) was built on clay and that fill used to create new land was not compacted enough to prevent subsidence. He said tidal movement also pulls loose soil through the revetment wall creating voids and weakness.

- It was [redacted] belief that the canals were causing the walls to fail and that these canals are crown land.

- [redacted] noted that Council had commissioned five consultant reports throughout the period of Raby Bay's construction with at least three of these reports suggesting the land wasn't compacted enough to support the revetment walls. [redacted] said one report detailed the properties where wall failures would occur.

- [redacted] said these reports only became publicly available after properties were

sold and was strongly of the view that because Council knew that the walls were vulnerable and potentially subject to failure, Council was liable for that failure.

**How have maintenance and repair activities been funded?**

- [redacted] said that in the early 1990s Raby Bay residents took a writ against Redland City Council and that in response to this writ, then Mayor Cr Eddie Santaguiliana suggested Raby Bay residents pay a levy to maintain the walls. At the time this levy was $100 per year.

- [redacted] reported that since 1992 residents have contributed $20million to maintaining and repairing Raby Bay's canals walls.

- [redacted] noted that every area of the city includes infrastructure that is funded out of general rates including libraries, sporting facilities and the Redland Performing Arts Centre. It was his belief that residents in the canal estates were unique in having to contribute to infrastructure in their local area, in addition to paying higher rates.

- [redacted] noted the different approaches of Redland's Mayors to the issue including:

    - *Mayor Don Seccombe* wanted to introduce a "user pays principle" for funding canal maintenance.

    - *Mayor Melva Hobson* introduced a convergence ratio that ensured that the highest rated properties paid no more than three times as much than the lowest rated properties.

    - *Mayor Karen Williams* removed the convergence ratio in her first term with the general rate increased by 22% and the special charge also increasing.

- [redacted] concluded by saying that between 6% and 7% of canal walls had been repaired since the canal estate was constructed.

**Funding**

- [redacted] was strongly of the opinion that Canal residents should either pay a lower general rate if Council imposed a special charge or that canal maintenance costs should be taken out of the general rate. Further, [redacted] said it was unfair for Council to impose a high general rate and a high special charge on canal residents calling it 'double dipping'.

- [redacted] felt that the amount raised in general rates should cover the cost of canal maintenance and repair.

- [redacted] said that most South-East Queensland residents pay $1,100 in rates per annum, however residents of Raby Bay pay between $7,000 and $8,000 per year.

- [redacted] felt that larger blocks needed more services than smaller blocks and that site value was only indicative of what should be charged in rates.

- [redacted] also commented that 10% of the land in Raby Bay is owned by Council and used as a park.

- It was [redacted] belief that Redland City Council was liable for past mistakes in how the canals were constructed and that the recent decision to refund levies raised since 2011 had given canal resident's hope. [redacted] asked if this liability issue should be subject to a court decision.

- [redacted] said although the Raby Bay Rate Payers Association wanted to create a body corporate to manage canal maintenance he did not support this idea as Council was liable for the condition of the canal estates.

**Transparency**

- [redacted] said he has fought for years for income and expenditure reports about the canal levy and had discovered that things were being paid from the levy that had nothing to do with canal maintenance.

**Statutory Instruments**

- Canals Act – Canals (Solander Waters Estate Stage P1 – Final Approval) Order 1992, No. 314. Order in Council granting final approval to Shinko Australia Pty Ltd to construct canals on the land described Raby Bay Development Stages 15A to 15F (Final Approval to Construct Canals) Order 1992.

- www.parliament.qld.gov.au/documents/hansard/1992/921105ha.pdf

**Redland City Council Canal and Lake Engagement Public Consultation**

**Date:** 16 November 2017

**Venue:** Redland City Council Library Elders Room

**Attendees:** Raby Bay Ratepayers Association
Mr Bernard Houston (Articulous Communications)
Mr Luke Myers (Articulous Communications)

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## INTRODUCTION

- The Raby Bay Ratepayers Association (RBRPA) presented three broad concerns that they would like considered as part of the Redland City Council engagement process.

## INFORMATION PROVIDED BY RRRPA

### Management of the works and acceptance of past mistakes

- RBRPA felt that Council's management of canal estates is haphazard.

- RBRPA stated that since 2001 not one (maintenance) program has been implemented despite residents' paying the levy.

### Development approvals

- RBRPA said that the estate was built on clay soil that has been moving and this instability is causing revetment wall failure.

- RBRPA suggested that older areas of the development were built around the original creeks and that the soil in these areas is especially unstable. It was their belief that newer areas of the estate may have the same problem.

- RBRPA said that Raby Bay's original covent prevented any structures being built within nine metres of the revetment wall with the intention to protect the integrity of the wall and the amenity of the estate.

- RBRPA reported that this covenant was replaced with an amenity overlay that similarly restricted building within 9m of the wall but that in the last 12 years approvals have been given to a number of dwellings or structures whose structure extends all the way to and even overhanging the revetment wall.

- RBRPA thought this issue would be fixed in 2015 with a new, stronger overlay that prohibited development close to the revetment wall and were disappointed that this was not included in the new city planning scheme which requires that any structures built within nine metres of the revetment wall have building certification and states the

structure does not place any load on the wall.

- RBRPA said repairs to the revetment walls require large equipment that is brought in by barge and requires excavation on both sides of the wall and any structure that extends to the wall would make repairs difficult as it prohibits machinery excavating on the land ward site of the wall to fix its bearings.

- RBRPA reported this problem had worsened as owners sub-divide 800m blocks into 400m blocks and buildings on these smaller blocks extend to the property boundary.

- In the context of structures built within 9m of the revetment walls, the RBRPA asked who is liable if a wall fails?

**Funding**

- RBRPA reported it costs $30,000/m to repair the revetment walls and historically canal residents have paid a special levy for this work.

- RBRPA stated that Council currently contributes 20% into a reserve fund toward this cost which is calculated on the wall length covering public parks and open space.

- RBRPA noted Council has an annual operational budget for repair work at Raby Bay which was rarely expended.

- RBRPA said Council's annual capital works budget is $82,000,000 for the whole Council aria of which $800,000 is spent on canal maintenance.

**Redland City Council Canal and Lake Engagement Public Consultation**

**Date:** Friday 27 November 2017

**Venue:** Redland City Council Macleay Room

**Attendees:** Four Sovereign Water Lake rate paying residents

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## INTRODUCTION

- Sovereign Waters has no residents association. Council invited all residents to meet Articulous and share their views on the public engagement program being undertaken by Redland City Council and to detail their position on canal and lake maintenance and funding. Four residents took up this offer.
- The meeting commenced with Articulous Communications providing an overview of the Redland City Council Canal and Lake Public Engagement program.

## TOPICS DISCUSSED

### Unique problems

- These residents reported that they had purchased their homes off the plan and understood they would be charged a special levy for lake maintenance activities.
- Residents reported there is little transparency on how this money is spent.
- Residents reported that the lake's mechanisms for refreshing its water supply are effective and that the lake is well stocked with fish.
- However, they also reported that drainage grates have become blocked and the parklands are poorly maintained and mowed infrequently.
- Residents reported that the entire lake revetment wall has started to crumble along its length and needs repair.
- Residents complained about waste left by visitors fishing in the lake.
- Residents reported that the lake's water quality is tested four times a year but these results are not provided to the community.

### Desired outcomes from community engagement process

- All four residents expressed a strong desire for clearer reporting from Council on how the special levy is spent.

**Redland City Council Canal and Lake Engagement Public Consultation**

**Date:** Wednesday 17 January 2018

**Venue:** Redland City Council Library Elders Room

**Attendees:** Aquatic Paradise Residents Association
Mr Luke Myers (Articulous Communications

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## INTRODUCTION

Representatives from the Aquatic Paradise Residents Association (APRA) were invited to share their views on the public engagement program being undertaken by Redland City Council and to detail their position on canal and lake maintenance and funding.

This was the second meeting with representatives from APRA

The meeting commenced with Articulous Communications providing an overview of the first panel session and advise APRA that there would be a new panel session on Friday night that would include eight new panel members who were unable to attend the first session. Articulous Communications explained that the new session would be an abridged version of the first session allowing new panellists to be brought up to speed on the issues presented at the first session.

APRA advised that they were not happy with this new session as it would not capture the sentiment of the first session.

APRA advised Articulous Communications they had significant concerns about the Canal and Lake Public Engagement program.

Articulous Communications advised APRA that they had been engaged as an independent facilitator and did not have any opinion on the issues that were being considered as part of the engagement process and were acting as a liaison between community and council.

Articulous Communications reaffirmed its commitment and desire to work with resident groups such as APRA and hoped to maintain a strong, open dialogue through the process.

APRA queried who prepared the information published on the Redland City Council website and were advised that it had been prepared by Redland City Council. APRA stated the facts and figures used by council in the fact sheets were misleading and were biased against resident groups.

Articulous Communications asked APRA to advise if they thought any material contained disputed information. APRA advised that they disputed the information in the Q&A Fact Sheet – Maintenance Activities and Cost as well as information stating the canals were 1.5 metres deep.

APRA advised that they thought all information sheets provided to the public should be prepared by an independent source.

APRA further detailed their concerns about council's 'charge' and stated council had arbitrarily decided what to 'return' to the residents.

APRA advised that residents have paid substantial amounts of money for works which are the responsibility of council.

Articulous Communications advised APRA that they would raise their concerns with council.

Articulous Communications reaffirmed its commitment to working with APRA through the remainder of the process and offered to assist with the upcoming presentation as well as distribute information to members of the panel.

**Redland City Council Canal and Lake Engagement Public Consultation**

**Date:** Wednesday 18 January 2018

**Venue:** Redland City Council Library Elders Room

**Attendees:** Raby Bay Ratepayers Association
Mr Luke Myers (Articulous Communications

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## INTRODUCTION

Representatives from the Raby Bay Ratepayers Association (RBRA) were invited to share their views on the public engagement program being undertaken by Redland City Council and to detail their position on canal and lake maintenance and funding.

This was the second meeting with representatives from the Raby Bay Ratepayers Association.

The meeting commenced with Articulous Communications providing an overview of the first panel session and advising RBRA that there would be a new panel session on Friday night that would include eight new panel members who were unable to attend the first session. Articulous Communications explained that the new session would be an abridged version of the first session allowing new panellists to be brought up to speed on the issues presented at the first session.

RBRA commenced by stating they had significant concerns about the Canal and Lake Public Engagement program and had written two letters of complaint to both Redland City Council and Articulous Communications.

Articulous Communications advised that Council has no preferred outcome and had not advised to deliver any preferred outcome. Articulous Communications advised they were engaged as an independent facilitator and did not have any opinion on the issues that were being considered as part of the engagement process.

Articulous Communications reaffirmed its commitment and desire to work with resident groups such as RBRA and hoped to maintain a strong, open dialogue through the process.

RBRA acknowledged the role being played by Articulous Communications and said they understood it's representatives were 'just doing their job'.

RBRPA advised they would have liked more time to present to the panel.

Articulous Communications advised RBRA that it was important for everyone to have their say of the issues under consideration in the engagement process including residents, council and independent experts.

RBRA then asked about panel sessions two and three and their next presentations.

Articulous Communications advised RBRA that there would be no further opportunity for them to formally present to members of the Citizens Advisory Panel due to time constraints and the importance of allowing other resident groups and independent experts the same opportunity they were afforded.

Articulous Communications advised RBRA that they were committed to working with them through the remainder of the process and offered to distribute further information on their behalf to panellists for consideration. This offer was accepted by RBRA.

RBRA asked who prepared the information published on the Redland City Council website and were advised that it had been prepared by Redland City Council. RBRA advised they thought all information distributed to the community during this process should be prepared by an independent source.

Articulous Communications asked RBRA to advise if they thought any material contained disputed information.

RBRA stated that they thought the pull-up banner that was displayed at the first panel session and included the statement 'proposed expenditure for general ratepayers is $54 each for canals' was misleading and did not tell the full story.

RBRA stated they had serious concerns with figures quoted in the fact sheets 'Maintenance Activities and Cost' and 'Engineering – current condition of canals'.

Articulous Communications noted the concerns raised by RBRA and said this would be communicated to Redlands City Council.

RBRA asked about the format of the first panel, in particular the Question and Answer session featuring Redland City Council officers.

Articulous Communications advised that council officers were invited to answer questions from members of the panel in relation to Redland's Canals and Lakes in general. Further, RBRA were advised that the officer panel was not formed to critique previous presentations, rather, it served as an opportunity for panel members to ask questions of council on a range of issues that had been discussed.

The meeting concluded with Articulous Communications reiterating their desire to continue working with resident groups including RBRA and hoping they accept the invitation to present at the Friday night panel session. Articulous Communications

reminded RBRA that they would be willing to facilitate distributing information to panel members on their behalf.

**Redland City Council Canal and Lake Engagement Public Consultation**

**Date:** Tuesday 16 January 2018

**Venue:** Redland City Council Library Elders Room

**Attendees:** Sovereign Waters resident
Mr Luke Myers Articulous Communications

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Only one Sovereign Waters resident expressed an interest to continue meeting Articulous. This resident shared his view on the public engagement program being undertaken by Redland City Council and offered to detail his position on canal and lake maintenance and funding.

This was the second meeting with the representative from Sovereign Waters.

The meeting commenced with Articulous Communications providing an overview of the first panel session and advising the resident that there would be a new panel session on Friday night that would include eight new panel members who were unable to attend the first session. Articulous Communications explained that the new session would be an abridged version of the first session allowing new panellists to be brought up to speed on the issues presented at the first session.

The resident from Sovereign Waters advised that they were willing to present to the panel, however, due to previous commitments, it would have to be at the third and final panel session.

The resident then asked Articulous Communications what other presenters had focussed on and how they presented.

Articulous Communications advised the resident that the panel was keen to hear from interested stakeholders about solutions to the issues being discussed.

The resident from Sovereign Waters outlined his key issues and identified possible solutions to which they would like the panel to consider.

The resident asked if copies of other presentations could be provided which Articulous Communications agreed to facilitate.

Articulous Communications reaffirmed its commitment to working with the resident through the remainder of the process and offered to assist with the upcoming presentation as well as distribute information to members of the panel.

**Redland City Council Canal and Lake Engagement Public Consultation**

**Date:** Wednesday 18 January 2018 - 1:30pm -3:00pm

**Venue:** Redland City Council Library Elders Room

**Attendees:** [redacted] (Raby Bay resident)
Mr Luke Myers (Articulous Communications)

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## INTRODUCTION

This was the second meeting with [redacted] with the first meeting being held on 13 November 2017.

Articulous Communications providing [redacted] with a copy of the transcript of the previous meeting and asking [redacted] if he had any questions on how the Redland City Council Canal and Lake Public Engagement program was progressing.

[redacted] said he was concerned Council has already made their mind up on the outcome of this engagement process and said nobody within the organisation (Redland City Council) or the community had his level of detailed knowledge of the issue.

Articulous Communications further advised [redacted] that it was important that the entire community was involved in this discussion and it was important that a wide variety of views were considered in the process.

[redacted] queried the previous meeting of the panel and if his statements were being undermined.

[redacted] was advised that after each witness presentation panel members would be given the opportunity to ask questions and seek further information.

Articulous Communications noted the experience and in-depth knowledge of the local area that [redacted] had and asked how the issues should be addressed.

[redacted] asked if he would be presenting his solutions and more of the history at the following two panel sessions.

[redacted] was advised that there would be no further opportunity for him to formally present to members of the Citizens Advisory Panel due to time constraints and the importance of allowing other resident groups and independent experts the same opportunity afforded to him.

Articulous Communications advised [redacted] that if he would like to communicate

further information to members of the Citizens Advisory Panel that this could be arranged.

[redacted] stated that it was important for the panel to look at the history of the canal precincts, so they (the panel) could determine how they would be paid for in the future.

[redacted] asked Articulous Communications who else would be presenting at the panel session and was advised that representatives from the Queensland Government, Local Government Association, University of Queensland, Sovereign Waters and CTS residents.

Articulous Communications thanked [redacted] for his participation to date and offered to meet with him following the second panel session.

**Redland City Council Canal and Lake Engagement Public Consultation**

**Date:** Tuesday, 06 February 2018 – 8:30am

**Venue:** Redland City Council, Rosella Meeting Room

**Attendees:** Aquatic Paradise Residents Association

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## INTRODUCTION

Aquatic Paradise Residents Association (APRA) were invited to share their views on the public engagement program being undertaken by Redland City Council and to detail their position on canal and lake maintenance and funding.

This was the third meeting with APRA.

The meeting commenced with Articulous Communications providing APRA with an overview of the previous panel session and asking if they had any questions on how the Redland City Council Canal and Lake Public Engagement program was progressing.

APRA asked if it was possible to obtain the drone footage that was used during panel session 1a. Articulous Communications advised they would follow this request up with Council.

APRA asked for a copy of the consultants' brief for the engagement process as promised by Andrew Ross at a meeting on 7 December 2017. Articulous Communications advised they would follow up with Council.

APRA asked for the date, the venue and their presentation time for the of the third panel session which were provided by Articulous Communications.

Articulous Communications advised APRA that they would relay their feedback to Council and that their comments would be included in their final report.

The meeting concluded at 9:10am.

**Redland City Council Canal and Lake Engagement Public Consultation**

**Date:** Wednesday 31 January 2018

**Venue:** Redland City Council, Macleay Meeting Room

**Attendees:** Raby Bay Ratepayers Association

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## INTRODUCTION

Raby Bay Ratepayers Association (RBRA) were invited to share their views on the public engagement program being undertaken by Redland City Council and to detail their position on canal and lake maintenance and funding.

This was the third meeting with RBRA.

The meeting commenced with Articulous Communications providing RBRA with an overview of the previous panel session and the template questionnaire that was sent to interested stakeholders earlier in the day.

RBRA advised that they had received the questionnaire and that they would complete it by the nominated deadline. RBRA advised that if they had any questions when completing the document, they would contact Articulous Communications.

RBRA asked if council would receive a copy of their template response and were advised that the response would be sent to panel members and council at the same time so all interested parties could consider ahead of the final deliberations.

RBRA advised that they would have liked to present again to the community panel and acknowledged Articulous Communications had distributed a memo to panel members at the last session.

RBRA advised that they would like to distribute further information to panel members in lieu of being able to again present and asked if Articulous Communications would facilitate that request.

Articulous Communications advised that they would send any information RBRA provided to panel members and suggested that it should be sent as soon as possible to allow the panel time to consider the information ahead of the final deliberations.

RBRA advised that they would send through information as soon as they could.

Articulous Communications thanked RBRA for their participation during the

engagement process and noted their strong advocacy for their position.

# Appendix 9

# Raby Bay Ratepayers Association Inc.

[redacted]
President: [redacted]
Secretary: [redacted]

22 March, 2018

Councillor Paul Golle,
PO Box 21,
Cleveland, Qld, 4163

Dear Paul,

As foreshadowed in our letter of 27 February 2018 the meeting of Raby Bay residents was held on 14 March 2018. Over 300 residents attended (the largest in RBRA's three decade history) and those present overwhelmingly endorsed the actions and recommendations of RBRA.

Following a briefing by Association representatives, and a question and answer session, the meeting agreed to the following resolutions upon an overwhelming show of hands from the floor:

1. **That the ratepayers of Raby Bay request the Redland City Council to continue the maintenance and repair arrangements for the canals which have existed for the last 22 years with regular reports back to the Association on progress against an agreed plan, budget and delivery schedule.**
2. **That the Raby Bay ratepayers support the arrangement whereby a fair and equitable levy is raised by Council to meet the cost to efficiently carry out these works.**
3. **In acknowledgement of the wider community use of the canals and RCC ownership of many canal properties, the RCC continues to pay a fair and reasonable contribution to the levy.**
4. **That Council and the Association continue to engage in meaningful discussions to establish an efficient management structure with active participation by the Association in the planning, budgeting and delivery of the maintenance and repairs of the canals and canal revetment walls on a proactive basis.**

RBRA has a very strong Management Committee and Advisory Group and now clear evidence of strong support by Raby Bay residents. We stand ready at all times to negotiate and discuss issues with yourself and officers of RCC.

Kind regards

[redacted]
**Secretary**

# Raby Bay Ratepayers Association Inc.

[redacted],

President: [redacted]
Secretary: [redacted]

Mayor Karen Williams,

PO Box 21,

Cleveland,

QLD, 4163.

February 27, 2018

Dear Karen

**Re: Raby Bay Estate Canal Funding and Management**

The recently completed Community Consultation process has provided the Association with the opportunity to review and reflect upon the best way forward in securing the future for the Raby Bay residents and other recreational parkland users of Raby Bay in the context of the wider Redlands community of which it is proudly a part.

Although we already understood the unique needs of our residents, the dialogue has given us a greater understanding of the perspectives and aspirations of the vibrant community beyond the canals and across the entire Redlands. From the feedback we have received, it is clear that most of the other residents with whom our constituents interacted with during that process, expressed overall goodwill to Raby Bay and its residents and generally supported a fair and equitable future funding arrangement and efficient planning and management of the maintenance and repairs of the canals and canal revetment walls.

Now that the consultation process has finished and the Council awaits the consultant's report, we thought it important to draw your attention to our position as the historically accepted Association representing the interests of the residents of Raby Bay so that our position may be factored into your deliberations.

We have called a public meeting of Raby Bay residents for Wednesday 14 March 2018 at which we propose to put the following resolutions based on feedback and input we have gained from the consultation process:

- That the ratepayers of Raby Bay request the Redland City Council to continue the arrangement which has existed for the last 22 years whereby the Council attends to the maintenance and repair of the canals and revetment walls within the estate with regular reports back to the Association on progress against an agreed plan, budget and delivery schedule;
- That the Raby Bay ratepayers support the arrangement whereby fair and equitable levies are raised by Council to meet the cost to efficiently carry out these works;
- That the wider Redlands Community not be required to contribute to these works except for Council owned and other public lands and parks within the estate and;

- That Council and the Association engage in meaningful discussions to establish an efficient management structure with active participation by the Association in the planning, budgeting and delivery of the maintenance and repairs of the canals and canal revetment walls.

These proposed resolutions, which reflect the position of the Executive of the RBRA, were arrived at after detailed discussions and taking into account the following considerations:

- Raby Bay residents have generally accepted that by paying the existing levy they will be protected against the very high cost of major revetment wall repairs. To require residents to now pay for the cost of repairing their own wall would place considerable financial stress and possible bankruptcy of some residents, many of whom are in retirement.
- The Raby BAY development was approved and supervised by Council and residents have relied upon Council's involvement to this time in buying property in Raby Bay.
- The Raby Bay canal walls are unique in that they were constructed on highly reactive clay which over the years have experienced many failures and which cannot be insured.
- Alternative methods of canal wall repairs have recently been trialed with some success. A predictive wall failure computer analysis will soon also be introduced. It is anticipated that these new endeavours will greatly reduce the cost of future canal wall repairs by enabling proactive stabilization repairs to be carried at a fraction on the cost of current repair methods.
- The RBRA is fortunate to have the active involvement and technical input of many highly experienced and skilled professionals such as civil engineers, project managers, lawyers, accountants, developers and builders. These residents are prepared to offer their professional services to the establishment of an efficient and competent management structure, working with Council officers, for the long term benefit of not only the Raby Bay estate but the overall Redlands community.

The above considerations and the resolutions we propose to put to the public meeting on 14 March reflect the commitment of our Association to work constructively with the Council to achieve an outcome that is beneficial to the entire Redlands community without any additional financial burden. It is not in the interests of the wider Redlands community to see the estate fall into disrepair.

We would be grateful if you could give our position due consideration in your upcoming deliberations as a solution satisfactory to all relevant Redland City stakeholders.

Kind Regards

[redacted]

[redacted]

President

Raby Bay Ratepayers Association Inc.

**REDLAND CITY COUNCIL CANAL AND LAKE ENGAGEMENT – Stakeholder Solution Submissions**

**ORGANISATION:** Aquatic Paradise Residents' Association Inc. (APRA)

**ORGANISATION CONTACT:** [redacted]

**CONTACT PHONE NUMBER:** [redacted]

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**What is your proposed solution for the funding and maintenance of Redland's Canal and Lakes?**

"**WITHOUT PREJUDICE TO OUR CURRENT AND FUTURE LEGAL RIGHTS**"

- It is now clear from our analysis that the RCC presentation on the financials is misleading. We dispute the methodology used and many of the figures. Aquatic Paradise is contributing to the Redlands and is not being subsided.
- Unfortunately, this misleading financial presentation has diverted the emotions and analysis of participants and is preventing the Citizen's Advisory Panel achieving the best result.
- In other words, the Panel has been asked to solve the wrong problem. The problem is not one of subsidies to Aquatic Paradise. The problem is double taxation of Aquatic and us having to pay for the removal of everyone else's mud.
- We note that this question above is different to that asked of the Panel, as referred to in letter from Claire Lovejoy dated 30th January 2018.
- Is extra money the main interest of RCC for the Panel?

CANAL LEVY CANNOT BE USED

- The general rating system takes into account all the differences between properties by using the site value. There are no special benefits excluded from this value.
- As there are no additional special benefits then, Section 94 of the 2012 Government Regulations cannot be used to make the canal levy.
- The current rates and levy are double taxation on the wet block owners. Double taxation is NOT ALLOWED as it is NOT FAIR.

GENERAL RATING SYSTEM TO BE USED

- Aquatic owners (wet and dry blocks) pay more in general rates than most RCC residents because of the higher values of their properties
- Any increase in the general rate percentage will also mean that we will contribute more dollars of the increase than most other residents. THIS IS FAIR.

COUNCIL TO PROVIDE THE FINAL SOLUTION - RCC, COUNCILLORS/CEO/OFFICERS

- We pay you good money to do your jobs. You find a way to do it that meets the legal requirements, etc.

- Do not ask amateurs to originate the ideas in this complex area and then come back and say that none of them will work.
- We are happy to review your final recommendation, if it helps to prevent some of the recent debacles.

**Does your solution relate to the canals and waterways, to the revetment walls or to both?**

Our solution is intended to cover all of the above for Aquatic Paradise.

It could potentially also cover all of the above for the other estates. As we do not know the maintenance, legal, etc. situation of those estates, we are not well enough informed to make comment.

**How would your solution be applied?**

Whether it is applied through:

- General Rates
- Infrastructure rate/levy ; or
- Other

is up to RCC to decide. But the rate should be across all of Redland ratepayers.

**What would the impact of your solution be on different groups within the Redlands community – i.e. ratepayers in different areas of the city, council, business owners, transport operators etc**

- All ratepayers would pay in proportion to their property values
- The double taxation on wet block owners would be STOPPED

**What is the rationale or principles used in drafting this solution?**

This solution is based on the following principles:

A. RCC (and other Government Bodies) own all infrastructure throughout the Redlands
    - Roads
    - Drains
    - Footpaths
    - Parks & playground equipment
    - Libraries
    - Street Lighting
    - Canals

- All were initially transferred from developers at no cost
- RCC agreed to maintain all infrastructure (except Street Lighting)

- In principle, RCC should be treating the canals the same as any other infrastructure. We note that RCC has not provided any principle as to why canals should be treated any differently to roads, etc.

B. In the original business case for the development of Aquatic Paradise – RCC agreed to pay all the maintenance out of general rates with NO LEVY – the principle is for RCC to KEEP ITS WORD.

C. An update into current dollars of the original RCC development business case for Aquatic Paradise shows that the council and RCC residents strongly benefit from Aquatic Paradise being built. The direct benefits from the construction of Aquatic Paradise to RCC are substantial. In principle and practice, Aquatic Paradise is subsiding the rest of RCC not vice versa.

D. The indirect benefits of Aquatic Paradise enabling further development in the catchment area also need to the recognised. There are at least 84 stormwater drains feeding into our main canal. These developments provide major rate revenue to RCC and would not have been possible without Aquatic Paradise being developed.

E. Another example of an indirect benefit to the public is the use of navigation aids and channel, maintained and paid for by the Aquatic Paradise wet block owners. All users of the RCC Thorneside Boat Ramp at Tingalpa Creek to access Moreton Bay receive this benefit. In principle, the State should be paying for to at least the last 3 sets of 2 navigational leads and the dredge from that point out to the Bay as they collect boat registrations for this purpose.

F. In principle, the Canal Special Charge/Levy can only be charged for additional special benefit not included in the site value used for general rates. All special benefits are included in all site Values as determined by the Valuer General. Therefore, the canal Special Charge/Levy is a form of DOUBLE taxation on the Aquatic Paradise wet-block residents. This is against all rating principles and is IMMORAL.

G. In the current dredge program, 164,000m3 of MUD will be removed from the canals. This comes from either catchment areas or Moreton Bay. Both are OUTSIDE the Aquatic Paradise estate. It is not MUD from our properties! They are not OUR CANALS! We SHOULD NOT HAVE TO BEAR ANY OF THIS COST. In principle, no-one else in Redlands is asked or expected to pay for the cost to collect and remove someone else's rubbish/mud.

H. In principle, the best people to manage the canals are with RCC. Only RCC can work through the complex issues. APRA is happy to assist but not to take the lead.

I. In principle, RCC is best placed to do the following:

- Reduce costs
- Find new solutions
- Work to change Legislation
- Learn from other Councils
- Co-ordinate and contribute across local/state/national governments to change Legislation

J. In principle, the council should be fair and consistent in its application of the supposed special benefits policy OR NOT APPLY IT AT ALL. (We believe it should not be applied at all because we dispute the special benefits apply outside the existing site value calculated by the Valuer-General). If other areas within RCC are not considered having a special benefit then neither should Aquatic Paradise. RCC has never provided any principles on how an area is defined as a special benefit.

**REDLAND CITY COUNCIL CANAL AND LAKE ENGAGEMENT – Stakeholder Solution Submissions**

**ORGANISATION: Raby Bay Quays CTS and Edgewater CTS**

**ORGANISATION CONTACT:** [redacted]

**CONTACT PHONE NUMBER:** [redacted]

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*What is your proposed solution for the funding and maintenance of Redland's Canal and Lakes?*

1. **Terminate special levy.**
2. **All fees from Redlands Rates Payers to be collected via General Rates**
3. **Contribution from State Govt to pay for benefits to visitors from outside Redlands.** One option worth exploring is for an existing State funded body such as MSQ or The Gold Coast Waterways Authority to take over responsibility for the main navigable channels (similar to the Gold Coast). This would at least see a contribution from boat registrations to compensate for the benefits received by general boat owners.

*Does your solution relate to the canals and waterways, to the revetment walls or to both?*

**Both –** Further, the proposed solution is applicable to all infrastructure projects that provide benefits to a range of groups in addition to those who may be considered prime beneficiaries due to their properties proximity to that infrastructure

*How would your solution be applied?*

**Through the existing General Rating system.** This is simple to implement, would reduce administrative costs and provide greater financial and operational flexibility to the Council.

*What would the impact of your solution be on different groups within the Redlands community – i.e. ratepayers in different areas of the city, council, business owners, transport operators etc?*

**With an appropriately tuned and implemented general rating system, together with an appropriate contribution from the State Government, all those who benefit from the infrastructure, including visitors from outside of the Redlands would pay a fair, equitable and proportionate contribution to the maintenance of the infrastructure.**

Fine tuning of the rating system would enable council to charge all ratepayers an equitable contribution for the benefit they receive from all publicly maintained infrastructure.

*What is the rationale or principles used in drafting this solution*

**Fairness, Equity, proportionality and practicality**

**Fairness and Equity:**

**The current system is unfair and inequitable in a number of respects.**

- **Charges some ratepayers for benefits they don't receive.**
- **It does not charge many who do receive the same or greater benefits.**
- **It discriminates against small sub-groups of rate-payers who Council has unjustifiably targeted as the privileged few.**
- **It double-charges those who currently pay the levy** – They already pay increased General Rates for the property being valued higher because of its location on the water, and then the Special Levy is applied in addition.

**Proportionality:**

**The amount paid by any ratepayer or taxpayer should be proportional to the benefit received.** While all people who reside within the Redlands benefit to some degree from the canals, there are also a large number of people from outside the Redlands who receive substantial benefits and it is only fair that the State Govt contribute. One obvious group is the boating community, and so a contribution via Maritime Services Queensland (MSQ) or a State Govt funded body such as the Gold Coast Waterways Authority would make sense. It is the State Govt that receives the revenue from boat registrations. The boating community is just one example and there are many others who also benefit, so Council should also explore a greater contribution from the State Govt.

**Practicality:**

**A special levy to pay for infrastructure is inherently problematic and unfair. By its very nature it targets one group of tax payers despite the fact that many other groups or people benefit in some way. Further, it is costly and complex to administer and open to challenges which inevitably result in higher costs to the community. The cost of this consultation process itself is evidence of this!**

***Please ask yourself:*** Where will this end? If Council charges a special levy for the canals, which provide different benefits for so many people who live away from the canals, then what else will Council apply a special charge to in the future?

- Properties that adjoin public parks?
- Properties in the Southern Moreton Bay for ferries and car parks?
- Properties in cul-de-sac's for the road that services only those properties?

**By contrast, using the general rate to service such infrastructure is simple and already has a built in mechanism to charge more to those who benefit more as is reflected in their property valuation and has no additional overhead. Further, the council has the ability to fine-tune the fixed (minimum) component of the general rate, as well as the variable component that is charged only to those properties with higher valuations.**

# Raby Bay Marina
# Berth Owners Representative Group (BORG)
# Special Rates Charge Community Consultation Submission
# 6th February 2018

Raby Bay Berth Owners Representative Group (BORG) is an elected group of berth owners who have volunteered to represent the berth owners at Raby Bay Marina.
The following submission is provided under Redland City Council (RCC) Community Consultation on funding of maintenance within the Raby Bay Canals.

Under the current Raby Bay Canal Estate Special Charge, a fee of $1,189.96 has been set by the RCC for each marina berth in Raby Bay Marina (RBM).
Under the lease conditions berths owners are required to pay all Rate charges incurred by the marina owner with the addition of a 7.5% management charge.
As such berth owners ultimately paid the special charge fee of $1,189.96 ($1,279.20 including the 7.5% management fee)

Berth Owners object to the payment of $1,189 per berth as it is not equitable or reflective of the benefit received by the activities performed within the Annual Implementation Plans associated with the Special Rates Charge.
The establishment of the special rates charge for the maintenance of the Raby Bay Canals by RCC is based on the logic that those who contribute will receive a benefit from the works funded by the special rates charge.
As detailed in this submission the berth owners do not receive benefit from funding repairs to revetment walls on residential properties.

Berth owners are willing to pay a fair amount for maintaining canal depths and navigation equipment, but believe it is unreasonable they are required to contribute to funding repairs to revetment walls on million-dollar residential properties. It should also be noted the value of marina berths at RBM have reduced dramatically in recent years while residential properties have continued to rise in value.

The following submission is provided in the hope the community consolation will result in the setting of the Raby Bay Canal Estate Special Charge fee for marina berths at a reasonable amount that reflects the benefit received by berth owners from payment of the special charge fee.

1. **The establishment of the RBM Special Rates Charge for Raby Bay Marina berths does not comply with the Local Government Act 2009 (Act).**

Section 92(3) of the Local Government Act provides the following criteria under which a council must consider in the establishment of a special rates charge;

***Special rates and charges are for services, facilities and activities that have a special association with particular land because—***
***(a) the land or its occupier—***
***(i) specially benefits from the service, facility or activity; or***
***(ii) has or will have special access to the service, facility or activity; or***

***(b) the land is or will be used in a way that specially contributes to the need for the service, facility or activity; or***

***(c) the occupier of the land specially contributes to the need for the service, facility or activity.***

The owner and users of the rateable land for which the RBM Special Charge has been applied, receive **no special benefit** from the activities that relate to revetment wall repairs on residential properties within the Raby Bay Canals.

To provide an example of the works that are funded by the Special Rates Charge, which provide no special benefit to RBM berths owners, BORG have reviewed the works scheduled in the RBM Special Charge Annual Implementation Plan for 2015 /2016.
The following work activates were listed in that Plan;

1. [redacted] Revetment Wall upgrade
2. [redacted] revetment wall upgrade
3. [redacted] Revetment wall upgrade
4. Raby Bay Revetment wall repair trial
5. Raby Bay Monitoring of Revetment Walls
6. Raby Bay Rock Armour replacement
7. Raby Bay Canal Planning reports
8. Loan repayments (loans that fund revetment wall repairs)
9. Raby Bay Canal Maintenance
10. Raby Bay canal bed levelling

Similar activities have been noted within the RBM Special Charge Annual Implementation Plans prepared by the RCC since 2007.

Table 1 below undertakes a comparison of the activities within the 2015-2016 RBM Annual Implementation Plan with the criteria provided in section 92(3) of the Act.

**Table 1**

| Item | Activities from 2015-2016 Annual Implementation Plan | Compliance with criteria provided in Section 92(3) of the Act | | | | Reasons |
|---|---|---|---|---|---|---|
| | | a (i) | a(ii) | b | c | |
| 1 | [redacted] Revetment Wall upgrade | No | No | No | No | **a (i)** The occupier **does not specially benefit** from activities that fund repairs to residential properties within Raby Bay Canals. If revetment walls to residential properties were to collapse it would not affect the stability of the marina or impact navigation from RBM to open water.<br><br>**a (ii)** The occupier **does not have access to** revetment wall repairs as the Crown Lease conditions require the owner to fund all repairs to marina infrastructure.<br><br>**b.** The land has **no need for the service** to undertake repairs to residential properties. If revetment walls collapse it will not affect the stability of the marina or impact navigation from the marina to open waters.<br><br>**c.** The occupier has **no need for the service** to undertake repairs to residential properties. If revetment walls collapse it will not affect the stability of the marina or impact navigation in to open waters. |
| 2 | [redacted] revetment wall upgrade | No | No | No | No | |
| 3 | [redacted] Revetment wall upgrade | No | No | No | No | |
| 4 | Raby Bay Revetment wall repair trial | No | No | No | No | |
| 5 | Raby Bay Monitoring of Revetment Walls | No | No | No | No | |
| 6 | Raby Bay Rock Armour replacement | No | No | No | No | |
| 7 | Raby Bay Canal Planning reports | No | No | No | No | |
| 8 | Loan repayments for loans undertaken by RCC to fund revetment wall repairs | No | No | No | No | |
| 9 | Raby Bay Canal Maintenance | **Yes** | **Yes** | **Yes** | **Yes** | The occupier **does specially benefit** from works to maintain navigation equipment and canal depth. |
| 10 | Raby Bay canal bed levelling | **Yes** | **Yes** | **Yes** | **Yes** | |

Table 1 above clearly demonstrates the only activities that provide special benefit to berth owners are; item 9 (maintenance of navigation equipment) and item 10 (canal bed levelling).

Accordingly, the inclusion of the items 1-8 in the RBM Special Charge Annual Implementation Plan for 2015 /2016 conflicts with section 92(3) of the Act.

RCC have a requirement to ensure all works within the Annual Implementation Plans or the Overall Plan issued in 2017 comply with the criteria contained in section 92(3) of the Act.

From review of the Annual Implementation Plans prepared by the RCC in the period 2007 to June 2016, it is evident the primary reason for the Special Charge is to fund repairs to revetment walls on residential properties in the Raby Bay canals.
Table 2 below provides a summary of funds allocated within the Annual Implementation Plans since 2007. The table indicates 96.6% of funds were used to fund works associated with revetment wall repairs and rock armour replacement to residential properties.
Refer Appendix 'A' for copies on Annual Implementation Plans.

**Table 2**

| Year | Total Budget | Costs of Revetment wall & rock repairs | % of budget for revetment wall & rock repairs |
|---|---|---|---|
| 2007-2008 | 2,423,800 | 2,403,800 | 99% |
| 2008-2009 | 2,714,595 | 2,698,605 | 99% |
| 2009-2010 | 1,969,521 | RCC have no records | |
| 2010-2011 | 2,885,860 | 2,885,860 | 100% |
| 2011-2012 | 248,456 | 229,882 | 92% |
| 2012-2013 | 320,921 | 310,841 | 97% |
| 2013-2014 | 239,150 | 229,550 | 96% |
| 2014-2015 | 261,194 | 261,194 | 100% |
| 2015-2016 | 545,457 | 527,136 | 97% |
| 2016/2017 | 306,144 | 273,632 | 90% |
| **Average %** | | | **96.6%** |

Table 2 clearly demonstrates the primary function of the Special Rates Charge is to fund revetment wall repairs on residential properties within the Raby Bay canals.
As berth owners of RBM receive no benefit from revetment wall repairs to residential properties it is unreasonable for 96.6% of the funds raised by the RBM Special Rates Charged to be allocated for these works.
BORG request all costs associated with revetment wall repairs to residential properties be removed from the Annual Implementation Plans prepared under RBM Special Rates Charge.

On review of the RBM Annual Implementation Plans prepared by the RCC since 2011 it was noted that **all** repairs to revetment walls funded by the RBM Special Rates Charge have occurred in eastern Raby Bay Canal system that is accessed via Ross Canal.
Appendix 'B' contains the map of revetment wall repairs undertaken since 2011. The numbers on the map refer to the numbers of the Annual Implementation plans.

BORG believe the eastern canal system entered via Ross Canal is a separate canal system to the western canal system entered via Endeavour Canal where RBM is located.
The east and west canals are considered to be individual canal systems as they have a separate entrance and are divided by Masthead Drive roadway.

**2. The Marina operates under a Crown Lease from the State Government**

RBM operates under a Crown Lease provided by the State of Queensland. The Crown Lease requires the lessee to maintain the marina infrastructure *'in a good and substantial state of repair'* and *'pay all associated costs'*.

If the revetment walls or other infrastructure within RBM required repair the lessee is required under the Crown Lease to undertake those repairs not the RCC.

Accordingly, if repairs were required to the RBM revetment walls the owner would undertake those repairs and pass on all costs incurred to berth owners.

If the Special Rates Charge continues to include an allowance for costs associated with revetment wall repairs to residential properties, berth owners would in effect be paying twice if repairs were required for revetment wall at RBM;

- once via the Special Rates Charge
- second time when costs of repairs are passed on from the marina owner.

**3. The application of the Raby Bay Marina Special Rates Charge by RCC on a per berth basis is inequitable.**

The RCC decision to apply the Special Charge on a per berth basis is inequitable as it has resulted in RBM berth owners contributing at a higher percentage than residential property owners as is detailed below;

**3 (a)** The RBM Special Charge is applied to rateable land with a canal frontage of 190m. Based on an average residential property width of 17m, the 190m equates to 11 residential properties (190/17).

Under the 2017-2018 Raby Bay Tidal works (non-CTS) Special Charge each residential property is charged $2,354. Accordingly, if the 11 properties were located on the site of RBM those properties would contribute $25,894 (11x $2,354) under the special rates charge.

With the RBM Special Charge applied on a per berth basis RCC receive $89,175 (75 x $1,189) from the 190m of canal frontage.

Based on a lineal meter rate, berth owners are paying **$469.34/Lm** ($89,175/190) while residential property owners pay on average **$133.42/Lm** ($25,354/190).

Comparing these amounts RBM berth owners are paying **345%** more than residential property owners based on a lineal meter rate.

**3(b)** The inequity is more dramatic when considered from an asset valuation perspective;

Using $1,800,000 as the average Raby Bay canal property value, the Special Rates Charge of $2,354 equates to **$1.31** per $1,000 of asset value. ($2,354 / 1,800).

Using $45,000 as the average value for a marina berth at RBM, the Special Rates Charge of $1,189 equates to **$26.42** per $1,000 of asset value. ($1,189 / 45).

Refer Appendix 'C' for evidence of current berth values.

Accordingly, RBM berth owners are paying **2,000%** more than property owners based on the value of their asset, but receive little benefit from the payment of the Special Rates Charge.

**3(c)** The RCC has not explained the logic of the amounts payable by the three distinct categories within the 2017/2018 Raby Bay Canal Estate Special Charge as follows were calculated;

1. CA12- Standard residential lot; $2,354.28 per lot
2. CA13- Community Title lot; $1,364.24 per unit
3. CA14- Marina berths; $1,189.96 per marina berth

Based on the standard residential lot amount of $2,354.28 the marina berth payment of $1,189.96 is 51% of the residential lot. ($1,189/$2,354 x 100)
This suggests owners of marina berths receive 51% less special benefit in comparison to residential properties from the works undertaken in the 2017/2018 Overall Plan, refer Appendix 'D'.
The following italic text details the works to be undertaken in the 2017/2018 Overall Plan;

*The activities which Council is to carry out in, or in respect of, the canals (as identified on map RBC Version 1) of the Raby Bay canal estate (the estate) are:*

*1. monitoring state of, and (where renewal is identified as required) renewing, beacon piles*

*2. monitoring state of, and (where identified as required) carrying out maintenance works for, revetment walls*

*3. without limiting the foregoing:*

***a. stabilising revetment wall(s) at [redacted] to [redacted]***

***b. upgrading revetment wall at [redacted]***

***c. upgrading revetment wall at [redacted]***

*4. monitoring of, and (where replacement is identified as required) replacing, rock armouring*

*5. engaging consultants for project management work associated to the Raby Bay repair trial*

*6. otherwise, maintaining (including monitoring of state of canals) and keeping clean the canals in accordance with section 121 of the Coastal Protection and Management Act 1995.*

The above activates are almost identical to the activates contained in the Annual Implementation Plans prepared by the RCC in the period 2007-2016.
As detailed in Table 2, 96.6% of the expenditure in the Annual Implementation Plans since 2007 relate to revetment wall repairs on residential properties.
It is reasonable to assume this figure would be similar for the 2017/2018 Overall Plan.

As marina berth owners only receive benefit from 4% of the works undertaken in the Overall Plan and residential properties receive 96% benefit, it is inequitable to set the marina berth special charge at 51% of the standard lot amount.

4. **RCC have no basis to undertake works on Commercial Marina.**

RCC have no basis to justify expenditure of ratepayer's money on repairs to a **commercial marina** that operates under a Crown Lease.
If repairs were necessary to the revetment walls of RBM, the lessee would be required to undertake those repairs in accordance with the Crown Lease conditions.

5. **RBM Revetment walls were constructed as commercial grade walls.**

The revetment walls at RBM were constructed to accept loads from the operation of a commercial marina. The initial design of RBM included a commercial maintenance facility on the site that included the use of a travel-lift for removing vessels from the water.

Accordingly, the revetment walls are of a superior design to the light weight revetment walls that are failing on residential properties.
Refer to Appendix 'E' for the 'As Constructed' drawings received from the RCC that contain the design of the Raby Bay Marina and general canal revetment walls.

It is very clear from the drawings the marina revetment walls are a superior structure in comparison to the general canal walls.
It is noted that berth owners paid a premium when they purchased their marina berths to offset the cost incurred by the Developer to construct the superior revetment walls of Raby Bay Marina. Accordingly, it is unreasonable for berth owners to contribute to fund repairs on poorly constructed inferior canal revetment walls on residential properties.

**RCC decision requested by BORG**

For the reasons outlined in items 1-5 above, BORG request RCC calculate all future Raby Bay Canal Estate Special Charge fee for the 75 marina berths associated with RBM, without the inclusion of costs relating to repairs of revetment walls on standard lot and community title lot residential properties.

**Raby Bay Marina**
**Berth Owners Representative Group**

# Appendix

# A

## Annual Implementation Plans; July 2007- June 2017

## OVERALL PLAN - 2017/2018

The purpose of the new Raby Bay Canal Estate Special Charge (special charge) is to fund the service, facility or activity of works, as further described below, in respect of the canals of the Raby Bay canal estate. Council will contribute 20 per cent of the total revenue, equating to $560,730.

### Description of service, facility, or activity

The activities which Council is to carry out in, or in respect of, the canals (as identified on map RBC Version 1) of the Raby Bay canal estate (the **estate**) are:

- monitoring state of, and (where renewal is identified as required) renewing, beacon piles
- monitoring state of, and (where identified as required) carrying out maintenance works for, revetment walls
- without limiting the foregoing:
  3 a. stabilising revetment wall(s) at [redacted] to [redacted]
  2 b. upgrading revetment wall at [redacted]
  1 c. upgrading revetment wall at [redacted]
- monitoring of, and (where replacement is identified as required) replacing, rock armouring
- engaging consultants for project management work associated to the Raby Bay repair trial
- otherwise, maintaining (including monitoring of state of canals) and keeping clean the canals in accordance with section 121 of the *Coastal Protection and Management Act 1995*.

(the **activities**)

### The rateable land to which the special charge applies

The rateable land to which the special charge applies is described as all rateable land in the estate where such land abuts a canal, as identified on the benefited area map RBC Version 1 (and coloured dark blue).

The rateable land to which the special charge applies specially benefits from the activities to be carried out under the Overall Plan because:

a) maintaining the revetment walls assists in retaining land to which the special charge applies

b) monitoring the canals, beacon piles, rock armouring, and revetment walls assists in planning maintenance and dredging activities to keep the canals navigable and assists in retaining land to which the special charge applies

c) keeping the canals and navigational aids clean maintains the overall amenity of the land to which the special charge applies and the functionality of the canals

d) the land to which the special charge applies and the owners and occupiers of that land are directly proximate to the canals and the associated special amenity of the canals' structural, recreational, social, health and visual elements.

### Estimated cost of carrying out the Overall Plan

The estimated cost of carrying out the Overall Plan for 2017-2018 is $4,330,104.

## RABY BAY MARINA SPECIAL CHARGE
## 2016-2017 Annual Implementation Plan

| Job Number | Activity | Estimated Cost |
|---|---|---|
| 30394 | Raby Bay Canal Maintenance | $18,786 |
| 30399 | Monitoring Revetment Walls | $14,666 |
| 70833 | Raby Bay Canal Planning (consultants) | $13,726 |
| 70084 | Rock armour replacement | $12,149 |
| 40579 | Revetment Wall Stabilisation [redacted] | $61,387 |
| 41178 | Revetment Wall Stabilisation [redacted] | $29,255 |
| 41187 | Revetment Wall Stabilisation [redacted] to [redacted] | $14,387 |
| 41189 | Raby Bay New Repair Trial | $95,916 |
| | | |
| **Service** | | |
| N/a | Loan and interest repayment plus administration fees | $45,871 |
| | **Total Estimated Cost** | **$306,144** |

## Raby Bay Marina Special Charge
## Annual Implementation Plan 2015-2016

| | Job Number | Activity | Estimated Cost |
|---|---|---|---|
| 6 | 40577 | [redacted] Revetment Wall Upgrade | $189,781 |
| 7 | 40578 | [redacted] Revetment Wall Upgrade | $84,592 |
| 8 | 41087 | [redacted] Revetment Wall | $180,000 |
| | 41189 | Raby Bay New Repair Trial | $6,000 |
| | 30394 | Raby Bay Canal Maintenance | $11,438 |
| | 30399 | Raby Bay Monitoring of Revetment Walls | $8,932 |
| | 70084 | Raby Bay Rock Armour Replacement | $7,394 |
| | 70132 | Raby Bay Canal Bed Levelling | $6,883 |
| | 70833 | Raby Bay Canal Planning | $21,467 |
| | | | |
| | | **Service** | |
| | N/a | Loan repayment | $28,969 |
| | | **Estimated Total Cost** | **$545,457** |

| RABY BAY MARINA SPECIAL CHARGE<br>Annual Implementation Plan for 2014/2015 | | |
|---|---|---|
| **Job Number** | **Activity** | **Estimated Cost** |
| 40577 6 | [redacted] Revetment Wall Upgrade | $ 199,200 |
| 30394 | Raby Bay Canal Maintenance | $ 11,133 |
| 30399 | Monitoring Revetment Walls | $ 8,692 |
| 70833 | Raby Bay Canal Planning (consultants) | $ 6,000 |
| 70084 | Rock Armour Replacement | $ 7,200 |
| | | |
| | **Service** | |
| | Loan Repayment | $ 28,969 |
| | *TOTAL* | $ 261,194 |

## ATTACHMENT 2 - RABY BAY MARINA SPECIAL CHARGE

**Annual Implementation Plan for 2013/2014**

| ***Job Number*** | ***Activity*** | | ***Estimated Cost*** |
|---|---|---|---|
| 40420 9 | [redacted] 2 blocks | $ | 67,500 |
| 42092 10 | [redacted] 4 blocks | $ | 123,647 |
| 30394 | Raby Bay Canal Maintenance | $ | 9,600 |
| 30399 | Monitoring Revetment Walls | $ | 8,403 |
| 70833 | Raby Bay Canal Planning (consultants) | $ | 15,000 |
| TBC | Rock armour replacement | $ | 15,000 |
| | TOTAL | $ | **239,150** |

| Attachment 2 - Raby Bay Special Charge Marina Berths Annual Implementation Plan for 2012/2013 | | | |
|---|---|---|---|
| ***Job Number*** | ***Activity*** | | Estimated Cost |
| ***Capital*** | | | |
| | *Geotech (Seacreast and completion of 11/12 study)* | | 8,400 |
| | *Rock armour replacement* | | 9,600 |
| 40065 11 | [redacted] *2 blocks* | | 114,000 |
| 40419 12 | [redacted] | | 84,000 |
| 40420 9 | [redacted] *2 blocks* | | 6,000 |
| 46045 13 | [redacted] *3 blocks* | | 68,580 |
| 46248 | *Raby Bay Lay Down Area* | | 9,000 |
| XXXXX 14 | [redacted] *1 block* | | 1,960 |
| XXXXX 7 | [redacted] *1 block* | | 4,334 |
| XXXXX 15 | [redacted] *2 blocks* | | 4,967 |
| | ***Note 'XXXX" denotes no job number issued design only in 2012/13*** | | |
| | | Sub Total | 310,841 |
| ***Operational*** | | | |
| 30394 | Monitoring & Maintenance | | 4,800 |
| 30399 | Future Dredging | | 5,280 |
| | | Sub Total | 10,080 |
| | | GRAND TOTAL | $ **320,921** |

| Raby Bay Tidal Works Marina Special Charge Implemetation Plan for 2011/2012 | | |
|---|---|---|
| **Job Number** | **Activity** | **Estimated Cost** |
| **Capital** | | |
| 40138 16 | [redacted] | 48,000 |
| 40065 11 | [redacted] | 113,307 |
| 46045 13 | [redacted] | 68,577 |
| **Operational** | | |
| | Monitoring & Maintenance | 12,574 |
| | Future Dredge | 6,000 |
| | TOTAL | **248,458** |

commencement of this new legislation), Council's 2010/11 Budget and supporting resolutions need only refer to the current legislation (predominantly the *Local Government Act 1993* and the *Local Government Finance Standard 2005*).

Section 971 of the Local Government Act 1993 requires a local government to adopt, by resolution, an overall plan in relation to special rates and charges for the supply of the service, facility or activity. The overall plan must be adopted either before, or at the same time as the local government first makes the special rate or charge.

If the overall plan adopted will not be implemented within one year, the local government must, at or before the budget meeting for each year of the period for implementing the overall plan, adopt by resolution an annual implementation plan for the year.

Council adopted the overall plan for the Shire Canals – Special Charge on 12 July 2000, Inclusive of works for Raby Bay and Aquatic Paradise.

An annual implementation plan for the Shire Canals – Special Charge has been adopted every year since the overall plan was adopted inclusive of works for Raby Bay and Aquatic Paradise.

## ISSUES

Previously Council has administered the Shire Canal special charges inclusive of both Raby Bay and Aquatic Paradise locations. In 2007/2008, it was determined that it would be more appropriate to report separately to Council.

**For the 2010/2011 financial year, revenue collected through the Amended Raby Bay Canal Special Charge will be held in a reserve to finance ongoing works. The details of the works programmed for the 2010/2011 financial year are:**

| | | |
|---|---|---|
| **Geotechnical Testing** | | **$ 1,000,000** |
| **Repair revetment walls - Masthead Drive (95-105)** | | **$ 1,885,680** |
| | **Total** | **$ 2,885,860** |

17

## RELATIONSHIP TO CORPORATE PLAN

The recommendation primarily supports Council's strategic priority to ensure the long term financial viability of the City and provide public accountability in financial management.

## FINANCIAL IMPLICATIONS

The levies are proposed to be increased to accommodate specific requirements identified in the annual implementation plan and to facilitate longer term planning for the estate.

## CONSULTATION

During the budget 2010/2011 workshops, the Executive Leadership Group and Councillors have been presented with details pertaining to the planning for this Special Charge and on the future planning for the estate.

# AMENDED RABY BAY CANAL - SPECIAL CHARGE - ANNUAL IMPLEMENTATION PLAN 2008-2009

**Dataworks Filename:** FM Corporate Budget

**Responsible Officer Name:** Greg Underwood
Acting Chief Executive Officer

**Author Name:** Kerry Phillips
Manager, Financial Services

## EXECUTIVE SUMMARY

Council is required to adopt, by resolution, an annual implementation plan each year before it can levy the Amended Raby Bay Canal Special Charge.

The annual implementation plan for the 2008/2009 financial year for the Amended Raby Bay Canal Special Charge (reference: Benefited Area Maps RBC-3, RBC-3-1) is submitted to Council for adoption.

## PURPOSE

Section 971 of the *Local Government Act 1993* requires a local government to adopt, by resolution, an overall plan in relation to special rates and charges for the supply of the service, facility or activity. The overall plan must be adopted either before, or at the same time as the local government first makes the special rate or charge.

If the overall plan adopted will not be implemented within one year, the local government must, at or before the budget meeting for each year of the period for implementing the overall plan, adopt by resolution an annual implementation plan for the year.

The annual implementation plan for the 2008/2009 financial year for the Amended Raby Bay Canal Special Charge is submitted to Council for adoption.

## BACKGROUND

Council adopted the overall plan for the Shire Canals – Special Charge on 12 July 2000, Inclusive of works for Raby Bay and Aquatic Paradise.

An annual implementation plan for the Shire Canals – Special Charge has been adopted every year since the overall plan was adopted inclusive of works for Raby Bay and Aquatic Paradise.

## ISSUES

Previously Council has administered the Shire Canal special charges inclusive of both Raby Bay and Aquatic Paradise locations. Commencing 2007/2008, it has been determined that it would be more appropriate to report separately to Council.

For the 2008/2009 financial year, revenue collected through the Amended Raby Bay Canal Special Charge will be held in a reserve to finance ongoing works.

The details of the works programmed for the 2008/2009 financial year are:

| | |
|---|---|
| 1. Remedial works relating to revetments | $2,594,805 |
| 2. Canal cleaning | $15,990 |

3. Planning, investigations, monitoring, navigation, beacons, etc $103,800

**RELATIONSHIP TO CORPORATE PLAN**

The recommendation primarily supports Council's strategic priority to ensure the long term financial viability of the City and provide public accountability in financial management.

**FINANCIAL IMPLICATIONS**

The levies are proposed to be increased to accommodate specific requirements identified in the annual implementation plan and to facilitate longer term planning for the estate.

**CONSULTATION**

During the budget 2008/2009 workshops, the Executive Leadership Group and Councillors have been presented with details pertaining to the planning for this Special Charge. The Manager, Financial Services has been briefed by the Manager, Infrastructure Planning and the Senior Advisor Infrastructure Projects on the future planning for the estate.

**OFFICER'S RECOMMENDATION**

**That Council resolve to adopt the annual implementation plan for the 2008/2009 financial year for the Amended Raby Bay Canal Special Charge (reference: Benefited Area Maps RBC-3, RBC-3-1), as attached.**

Author: _____

Group Manager: _____

General Manager/
Chief Executive Officer: _____

Date: _____

# AMENDED RABY BAY CANAL - SPECIAL CHARGE - ANNUAL IMPLEMENTATION PLAN 2007-2008

**Dataworks Filename:** FM Corporate Budget

**Responsible Officer Name:** Susan Rankin
Chief Executive Officer

**Author Name:** Kerry Phillips
Manager Financial Services

## EXECUTIVE SUMMARY

Previously Council has administered the Shire Canal special charges inclusive of both Raby bay and Aquatic Paradise locations. It has been determined that it would be more appropriate to report separately to Council in future.

Council is required to adopt, by resolution, an annual implementation plan each year before it can levy the Amended Raby Bay Canal Special Charge.

The annual implementation plan for the 2007/2008 financial year for the Amended Raby Bay Canal Special Charge (reference: Benefited Area Maps RBC-3, RBC-3-1 ) is submitted to Council for adoption.

## PURPOSE

Section 971 of the *Local Government Act 1993* requires a local government to adopt, by resolution, an overall plan in relation to special rates and charges for the supply of the service, facility or activity. The overall plan must be adopted either before, or at the same time as the local government first makes the special rate or charge.

If the overall plan adopted will not be implemented within one year, the local government must, at or before the budget meeting for each year of the period for implementing the overall plan, adopt by resolution an annual implementation plan for the year.

The annual implementation plan for the 2007/2008 financial year for the Amended Raby Bay Canal Special Charge is submitted to Council for adoption.

## BACKGROUND

Council adopted the overall plan for the Shire Canals – Special Charge on 12 July 2000. Inclusive of works for Raby Bay and Aquatic Paradise

An annual implementation plan for the Shire Canals – Special Charge has been adopted every year since the overall plan was adopted inclusive of works for Raby Bay and Aquatic Paradise.

## ISSUES

Previously Council has administered the Shire Canal special charges inclusive of both Raby bay and Aquatic Paradise locations. It has been determined that it would be more appropriate to report separately to Council in future.

For the 2007/2008 financial year, revenue collected through the Amended Raby Bay Canal Special Charge will be held in a reserve to finance ongoing works.

The details of the works programmed for the 2007/2008 financial year are:

1. Remedial works relating to revetments $2,300,000;
2. Canal cleaning $20,000; and
3. Planning $103,800.

## RELATIONSHIP TO CORPORATE PLAN

The recommendation primarily supports Council's strategic priority to ensure the long term financial viability of the Shire and provide public accountability in financial management.

## FINANCIAL IMPLICATIONS

The levies are proposed to be increased to accommodate specific requirements identified in the annual implementation plan and to facilitate longer term planning for the estate.

## PLANNING SCHEME IMPLICATIONS

The Land Use Planning Group was consulted and it is considered that the outcome of recommendations in this report will not require any amendments to the Redlands Planning Scheme.

## CONSULTATION

During the budget 2007/2008 workshops, the Executive Leadership Group and Councillors have been presented with details pertaining to the planning for this Special Charge. The Manager, Financial Services has been briefed by the Manager, Infrastructure Planning and the Senior Advisor Infrastructure Projects on the future planning for the estate.

## OPTIONS

### Preferred

That Council resolve to adopt the annual implementation plan for the 2007/2008 financial year for the Amended Raby Bay Canal Special Charge (reference: Benefited Area Maps RBC-3, RBC-3-1).

### Alternative

Council is required by legislation to adopt an annual implementation plan, therefore, there is no alternative option.

## OFFICER'S RECOMMENDATION

**That Council resolve to adopt the annual implementation plan for the 2007/2008 financial year for the Amended Raby Bay Canal Special Charge (reference: Benefited Area Maps RBC-3, RBC-3-1).**

Author: _____

Group Manager: _____

General Manager/
Chief Executive Officer: _____

Date: _____

# Appendix

# B

**Map of revetment wall repairs funded under the**

**Special Rates Charge since 2011**

[redacted]

**BENEFIT AREA MAP**
**Map: RBC-8 Version 4**

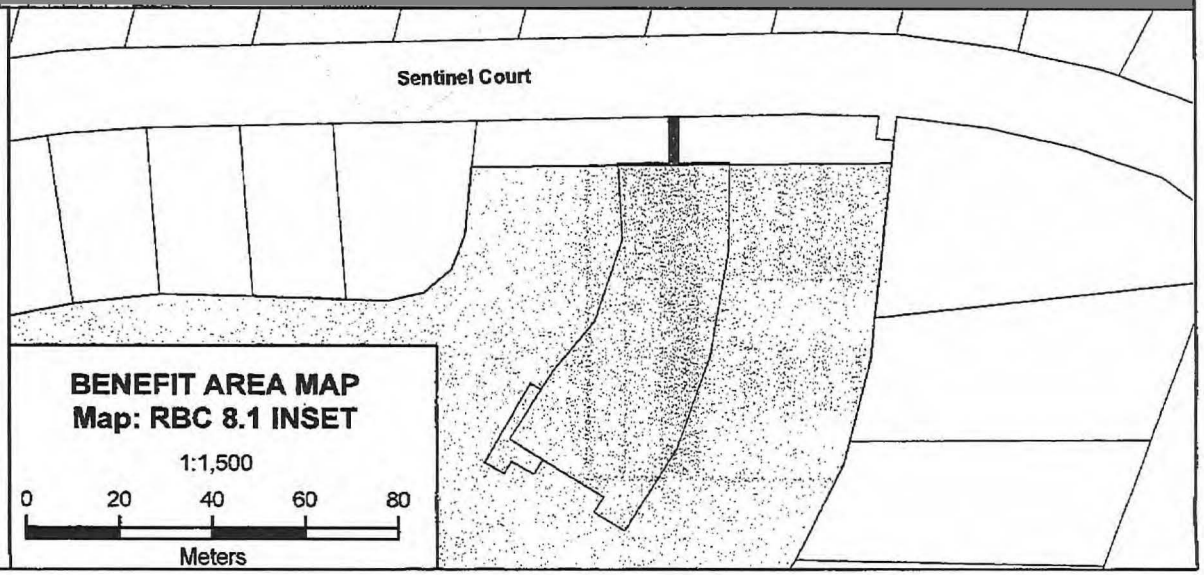
**Canal Charges**
CA08 - Raby Bay Marina Special Charge

1:10,000
0 100 200 300 400
Meters

Redland CITY COUNCIL

**Produced by**
**Spatial Business Intelligence**
**30 June 2013**

Data correct at time of production




**BENEFIT AREA MAP**
**Map: RBC 8.1 INSET**

1:1,500
0 20 40 60 80
Meters

# Appendix

# C

## Evidence of Marina Berth Values

## MARINA BERTH FOR SALE - 15m Mono Raby Bay Marina B09

B09 - RABY BAY MARINA - 15 METRE MONO BERTH FOR SALE LEASE RUNS TO 31.12.2030 Rare opportunity to acquire secure berthing in...

49' 3" - 15.00m

Cleveland QLD, Queensland

**AU $40,000**

View Listing

## MARINA BERTH FOR SALE - 15m Mono Raby Bay Marina B08

B08 - RABY BAY MARINA - 15 METRE MONO BERTH FOR SALE LEASE RUNS TO 31.12.2030 Rare opportunity to acquire secure berthing in...

49' 3" - 15.00m

Cleveland QLD, Queensland

**AU $40,000**

View Listing

## MARINA BERTH FOR SALE - 15M MONO RABY BAY MARINA A18

RABY BAY MARINA - A18 - 15 METRE MONO BERTH FOR SALE LEASE RUNS TO 31.12.2030 Rare opportunity to acquire secure berthing in...

0' 0" - 0.00m

Cleveland QLD, Queensland

**AU $40,000**

View Listing

## MARINA BERTH FOR SALE - 15m Mono Raby Bay Marina A8

RABY BAY MARINA - A8 - 15 METRE MONO BERTH FOR SALE LEASE RUNS TO 31.12.2030 Rare opportunity to acquire secure berthing in...

49' 3" - 15.00m

Cleveland QLD, Queensland

**AU $49,000**

View Listing

## MARINA BERTH FOR SALE - 10m Mono Raby Bay Marina B1

RABY BAY MARINA - 10 METRE MONO BERTH B1 FOR SALE LEASE RUNS TO 31.12.2030 Rare opportunity to acquire secure berthing in a...

32' 10" - 10.00m

Cleveland QLD, Queensland

**AU $28,000**

View Listing

# Appendix

# D

**2017/2018 Overall Plan**

## 5.6.8 RABY BAY CANAL ESTATE SPECIAL CHARGE 2017-2018 OVERALL PLAN

**Objective Reference:** **A2376058**
**Reports and Attachments (Archives)**

**Attachment:** **Benefited Area Map RBC version 1**

**Authorising Officer:**
**Deborah Corbett-Hall**
**Chief Financial Officer**

**Responsible Officer:** **Bradley Salton**
**Group Manager City Infrastructure, Acting**

**Report Author:** **Noela Barton**
**Finance Manager, Financial Operations**

### PURPOSE

This report submits to Council for adoption the 2017-2018 Raby Bay Canal Estate Special Charge Overall Plan.

### BACKGROUND

On 30 March 2017 Council ended the following special charges levied on canal homeowners in order to address potential technical errors in the charge setting process:

- Raby Bay Marina Special Charge
- Raby Bay Tidal Works (Non Community Title Scheme) Special Charge
- Raby Bay Tidal Works (Community Title Scheme) Special Charge.

Unspent money quarantined in reserves for canal maintenance and repairs since 2011-2012 will be assessed to determine the appropriate amount to refund to ratepayers.

The new 2017-2018 Raby Bay Canal Estate Special Charge maintains Council's position that the maintenance of the canals should predominantly be funded by those who own rateable land within the estate that abuts a canal, revetment wall, such land being specially benefited by Council's carrying out the activities relating to the general maintenance of the canals.

### ISSUES

Redland City has a number of canal and lake estates where residents enjoy water-front properties and in some cases private berths adjacent to their homes. The waterways in the canal estate require regular upkeep and maintenance. This includes work on more than 20 kilometres of revetment walls, as well as regular dredging to clear the canals so boats can access Moreton Bay. In 2017-2018 the cost of this maintenance will be partly covered under a special charge to be paid by ratepayers who own rateable land that abuts a canal revetment wall in the canal estate. This means the majority of the cost of maintenance is borne by those who specially benefit from the work rather than the cost being subsidised by other ratepayers across the city.

## OVERALL PLAN

The purpose of the new Raby Bay Canal Estate Special Charge (special charge) is to fund the service, facility or activity of works, as further described below, in respect of the canals of the Raby Bay canal estate. Council will contribute 20 per cent of the total revenue, equating to $560,730.

### Description of service, facility, or activity

The activities which Council is to carry out in, or in respect of, the canals (as identified on map RBC Version 1) of the Raby Bay canal estate (the **estate**) are:

- monitoring state of, and (where renewal is identified as required) renewing, beacon piles
- monitoring state of, and (where identified as required) carrying out maintenance works for, revetment walls
- without limiting the foregoing:
    a. stabilising revetment wall(s) at 5 Binnacle Close to 24 Anchorage Drive
    b. upgrading revetment wall at 19 Seacrest Court
    c. upgrading revetment wall at 37 Piermont Place
- monitoring of, and (where replacement is identified as required) replacing, rock armouring
- engaging consultants for project management work associated to the Raby Bay repair trial
- otherwise, maintaining (including monitoring of state of canals) and keeping clean the canals in accordance with section 121 of the *Coastal Protection and Management Act 1995*.

(the **activities**)

### The rateable land to which the special charge applies

The rateable land to which the special charge applies is described as all rateable land in the estate where such land abuts a canal, as identified on the benefited area map RBC Version 1 (and coloured dark blue).

The rateable land to which the special charge applies specially benefits from the activities to be carried out under the Overall Plan because:

a) maintaining the revetment walls assists in retaining land to which the special charge applies

b) monitoring the canals, beacon piles, rock armouring, and revetment walls assists in planning maintenance and dredging activities to keep the canals navigable and assists in retaining land to which the special charge applies

c) keeping the canals and navigational aids clean maintains the overall amenity of the land to which the special charge applies and the functionality of the canals

d) the land to which the special charge applies and the owners and occupiers of that land are directly proximate to the canals and the associated special amenity of the canals' structural, recreational, social, health and visual elements.

### Estimated cost of carrying out the Overall Plan

The estimated cost of carrying out the Overall Plan for 2017-2018 is $4,330,104.

### Estimated time for carrying out the Overall Plan

The estimated time for carrying out the Overall Plan is one year commencing 1 July 2017 and ending 30 June 2018.

## STRATEGIC IMPLICATIONS

### Legislative Requirements

Section 94 of the *Local Government Act 2009* (Act) provides that local governments may levy a special rate or charge.

Section 92(3) of the Act describes a special rate or charge as being for services, facilities and activities that have a special association with particular land because:

a) the land or its occupier—
   i) specially benefits from the service, facility or activity; or
   ii) has or will have special access to the service, facility or activity; or
b) the land is or will be used in a way that specially contributes to the need for the service, facility or activity; or
c) the occupier of the land specially contributes to the need for the service, facility or activity.

Section 94(2) of the *Local Government Regulation 2012* (Regulation) requires that a local government's resolution to levy special rates or charges must identify the rateable land to which the special rates or charges apply and the Overall Plan for the service, facility or activity to which the special rates or charges apply.

Section 94(3) of the Regulation sets out the information that must be included in an overall plan.

Section 94(4) of the Regulation requires the local government to adopt the Overall Plan before, or at the same time as, the local government first resolves to levy the special rates or charges.

Section 94(6) of the Regulation requires that if an Overall Plan is for more than one year, the local government is to also adopt an annual implementation plan for each year.

Section 94(7) of the Regulation sets out the information that must be included in an annual implementation plan adopted each financial year.

Section 94(9) of the Regulation enables a local government to at any time, by resolution, amend an Overall Plan or annual implementation plan.

### Risk Management

Council has engaged external legal counsel to advise on the making of the new Raby Bay Canal Estate Special Charge.

### Financial

The estimated cost of carrying out the Overall Plan for 2017-2018 is $4,330,104.

The Raby Bay Canal Estate Special Charge will raise revenue of $2,242,921. Council will contribute 20 per cent of the total revenue, equating to $560,730.

The shortfall for 2017-2018 in revenue to fund the Overall Plan is $1,526,453. Consultation will be held with the wider Redlands community during 2017-2018 about the best way to manage the activities and that conversation will guide future decisions about funding contributions.

**People**

Nil impact expected.

**Environmental**

Nil impact expected.

**Social**

Nil impact expected.

**Alignment with Council's Policy and Plans**

This report aligns with Council's Corporate Plan 2015-2020 statement 8:

> Inclusive and ethical governance: Deep engagement, quality leadership at all levels, transparent and accountable democratic processes and a spirit of partnership between the community and Council will enrich residents' participation in local decision-making to achieve the community's Redlands 2030 vision and goals.

## CONSULTATION

- Councillors
- Executive Leadership Team
- Representatives from the City Infrastructure Group
- Financial Services officers
- Internal and external legal counsel.

## OPTIONS

### Option 1

Pursuant to section 94 of the *Local Government Act 2009* and section 94 of the *Local Government Regulation 2012*, Council resolves to adopt the Raby Bay Canal Estate Special Charge Overall Plan as follows:

1) Council will levy the Raby Bay Canal Estate Special Charge (special charge) for the purpose of funding the activities described in the Overall Plan.

   The Raby Bay Canal Estate Special Charge will raise revenue of $2,242,921. Council will contribute 20 per cent of the total revenue, equating to $560,730.

   The shortfall for 2017-2018 in revenue to fund the Overall Plan is $1,526,453. Consultation will be held with the wider Redlands community during 2017-2018 about the best way to manage the activities and that conversation will guide future decisions about funding contributions.

2) The rateable land levied with the special charge specially benefits from the works to be carried out in the Overall Plan because:

   a) maintaining the revetment walls assists in retaining land to which the special charge applies

b) monitoring the canals, beacon piles, rock armouring, and revetment walls assists in planning maintenance and dredging activities to keep the canals navigable and assists in retaining land to which the special charge applies

c) keeping the canals and navigational aids clean maintains the overall amenity of the land to which the special charges applies and the functionality of the canals

d) the land to which the special charge applies and the owners and occupiers of that land are directly proximate to the canals and the associated special amenity of the canals' structural, recreational, social, health and visual elements.

3) The Overall Plan to which the special charge applies is described as follows:

a) the service, facility or activity to which the special charge applies:

- monitoring state of, and (where renewal is identified as required) renewing, beacon piles
- monitoring state of, and (where identified as required) carrying out maintenance works for, revetment walls
- without limiting the foregoing:
    - stabilising revetment wall(s) at 5 Binnacle Close to 24 Anchorage Drive
    - upgrading revetment wall at 19 Seacrest Court
    - upgrading revetment wall at 37 Piermont Place
- monitoring of, and (where replacement is identified as required) replacing, rock armouring
- engaging consultants for project management work associated to the Raby Bay repair trial
- otherwise, maintaining (including monitoring of state of canals) and keeping clean the canals in accordance with section 121 of the *Coastal Protection and Management Act 1995*

b) the rateable land to which the special charge applies is all rateable land that abuts a canal revetment wall identified in the benefited area map reference RBC Version 1 (and coloured dark blue)

c) the estimated cost of implementing the Overall Plan for 2017-2018 is $4,330,104

d) the estimated time for implementing the Overall Plan is one year commencing 1 July 2017 and ending 30 June 2018.

**Option 2**

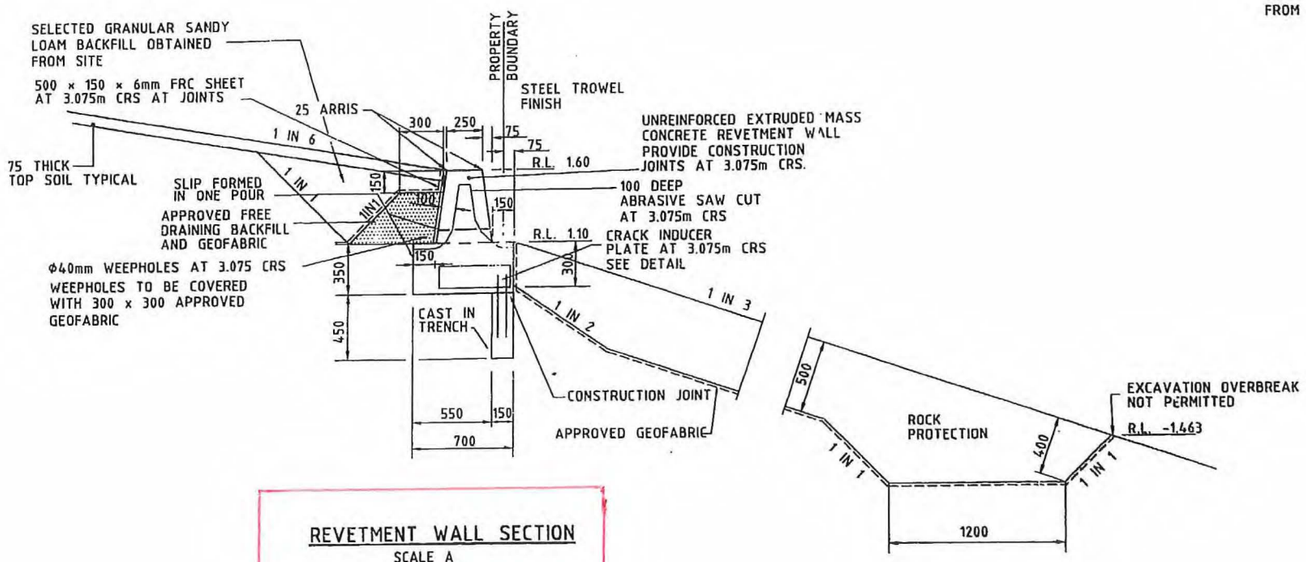
Council resolves to request further information.

# Appendix

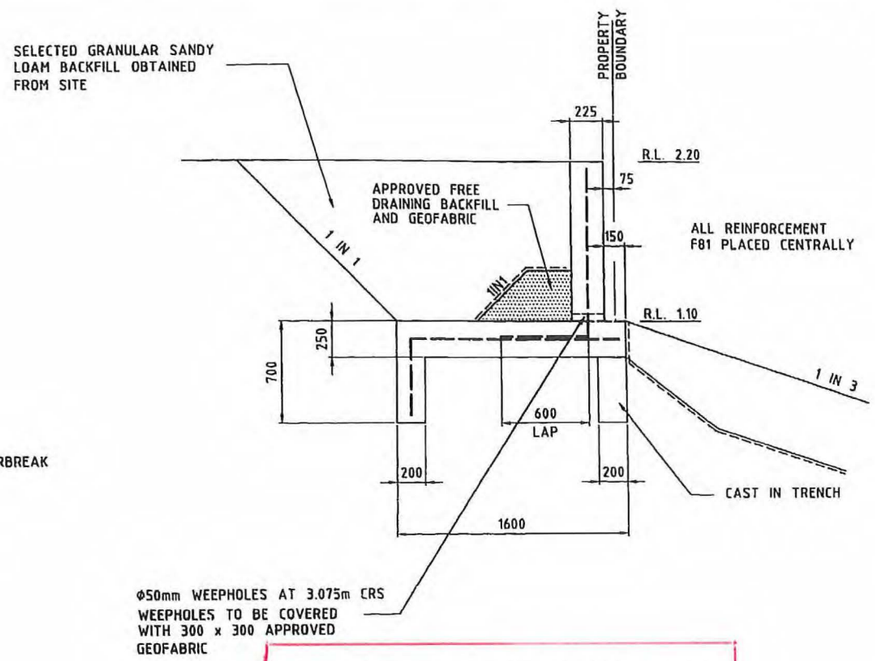
# E

- **As Constructed Structural Drawing for Raby Bay Marina & General Canal Revetment Walls**

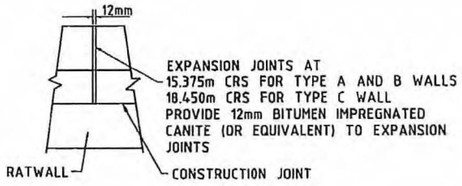
- **Photo showing junction of Raby Bay Marina revetment wall and general canal revetment wall**



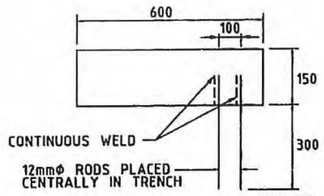

REVETMENT WALL SECTION
SCALE A




REVETMENT WALL - MARINA AREA SECTION
SCALE A



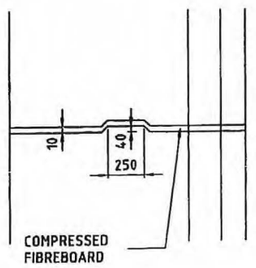

TYPICAL SEAWARD ELEVATION
NTS



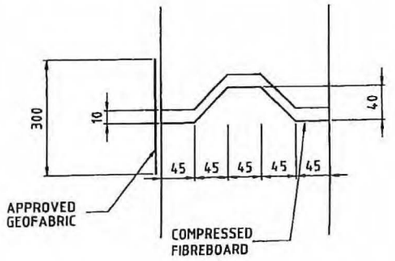

3mm MS PLATE
NTS

HOT DIP GALVANISE AFTER FABRICATION

CRACK INDUCER PLATE TO BE COATED WITH FORM RELEASE OIL PRIOR TO SLIPFORM OPERATION




FOOTING DETAIL




WALL DETAIL

EXPANSION JOINT DETAIL AT 18.450m CRS SHOWN
CONSTRUCTION JOINTS SIMILAR AT 6.150m CRS
WITHOUT FIBREBOARD OR PROVIDE 2 x 16 x 600 DOWELS TO FOOTING AND 2 x 16 x 600 DOWELS TO WALL, PAINT ONE END WITH BITUMEN.

JOINT DETAIL
NTS

## REVETMENT WALL DETAIL

## REVETMENT WALL - MARINA AREA DETAIL

### NOTES

1. ALL CONCRETE SHALL HAVE A MINIMUM CEMENT CONTENT OF 400 KG/M3 OF CEMENTITIOUS MATERIAL. ALL CEMENT SHALL BE O.P.C. TYPE A. EITHER 30% OF THE CEMENTITIOUS CONTENT SHALL BE FLY ASH OR 65% OF THE CEMENTITIOUS MATERIAL SHALL BE BLAST FURNACE SLAG. AN APPROVED SPRAYED CURING COMPOUND MUST BE APPLIED IMMEDIATELY AFTER FORMING THE WALL
2. DESIGN CRITERIA
   LIVE LOAD SURCHARGE : 5 0 kPa
   WALLS FOUNDED ON BASE MATERIAL ACHIEVING A BASE FRICTION ANGLE OF 27°
3. CONSTRUCTION JOINTS IN RATWALL ARE NOT REQUIRED
4. TOPSOIL AND ROCK DETAILS TYPICAL

**WORK AS EXECUTED**
IT IS CERTIFIED THAT THE ORIGINAL DRAWING HAS BEEN CAREFULLY COMPARED WITH THE WORKS AS CONSTRUCTED, AS TO LINE, LEVEL, AND DIMENSIONS, AND HAS BEEN SUITABLY AMENDED SO AS TO CONSTITUTE A TRUE AND CORRECT RECORD OF THE WORKS AS CONSTRUCTED.
DATE OF COMPLETION 11/7/94
SINCLAIR KNIGHT MERZ
SUPERVISING ENGINEER

SCALE A 1:200 0 4 8 12 16 20 m
SCALE B 1:10 0 200 400 600 800 1000 mm

FILENAME EARTH11DWG
VIEW NAME REVET
PLOT SCALE 1:1
PLOT DATE 7/7/94
DISK No 617/05

| No | DATE | DESIGN REVIEW | REVD PMGR | APPD DIR | AMENDMENT |
|---|---|---|---|---|---|
| D | 5/7/94 | RLR | GP | NC | AS CONSTRUCTED (RLR) |
| C | 2/2/94 | RLR | GP | NC | MARINA WALL DETAIL ADDED (RLR) |
| B | 3 11 93 | RLR | GP | NC | JOINT SPACINGS AMENDED (CHH) |
| A | 27/8/93 | RLR | GP | NC | GRANULAR SANDY LOAM ADDED (RLR) |



SINCLAIR KNIGHT
CONSULTING ENGINEERS
Sinclair Knight & Partners Pty. Ltd.
A.C.N. 001 024 095
62 Astor Terrace Spring Hill
Qld 4004 Australia
Telephone (07)8350222
Facsimile (07)8326335

CLIENT: CIVIL PROJECTS (RABY BAY) PTY.LTD.
PROJECT: RABY BAY DEVELOPMENT - STAGE 11 A & B
DRAFTER: RLR
PROJECT DRAFTER: 8/7/94
APPROVED-PROJECT DIRECTOR: 11/7/94
DESIGN REVIEW: GP 8/7/94
REVIEWED PROJECT MANAGER: GP 8/7/94

DOCUMENT CONTROL STATUS
UNLESS STAMPED OTHERWISE IN RED THIS DRAWING IS UNCONTROLLED AND MUST BE VERIFIED AGAINST A CONTROLLED COPY OF THE DRAWING PRIOR TO USE TO ENSURE IT IS THE CURRENT ISSUE.

TITLE: CANAL REVETMENT WALL DETAILS
R1 - 7/34 - 115
SCALE: AS SHOWN
DRAWING No: 86007-311-4
No in Set: 20
Rev: D

D005792

**REDLAND CITY COUNCIL CANAL AND LAKE ENGAGEMENT – Stakeholder Solution Submissions**

**ORGANISATION: RABY BAY RATEPAYERS ASSOCIATION INC.**

**ORGANISATION CONTACT: [redacted], SECRETARY**

**CONTACT PHONE NUMBER: [redacted]**

---

## What is your proposed solution for the funding and maintenance of Redland's Canal and Lakes?

*Continue to implement the arrangement entered into by the Council in 1996 with the company which developed Raby Bay, Civic Projects (Raby Bay) Pty Ltd (the Developer) through a legally binding agreement and upon which the residents of the Raby Bay precinct have acted ever since either directly (through knowledge of the arrangement) or impliedly (by accepting that Council had taken on the responsibility to undertake the work).*

*For 22 years since that agreement was executed, the ratepayers of Raby Bay have bought and sold their residences, paid rates commensurate with high site values, mindful that this arrangement governed the maintenance of the canals in Raby Bay.*

## Does your solution relate to the canals and waterways, to the revetment walls or to both?

*The repair, replacement and/or stabilisation of the land mass, the concrete revetment walls, canal banks and improvements as described in the legally binding agreement specified above and the funding of the costs thereof.*

## How would your solution be applied?

1. *The collection of general rates from properties fronting the canals massively above those from other properties due to higher valuations provides an adequate supply of funds to meet all costs incurred in honouring commitments entered into in 1996.*
2. *Ensure that all new construction on canal front land is subjected to an Overlay which includes strict provisions relating to setbacks (as was agreed during development), that construction within the 9 metre setback from revetment walls meets strict rules and is impact assessable.*
3. *Solve the problems of excessive costs and delays evidenced throughout the period since 1996 by establishing a separate corporation or Council unit responsible for the works*

**What would the impact of your solution be on different groups within the Redlands community – i.e. ratepayers in different areas of the city, council, business owners, transport operators etc**

1. *There can be no impact on any group within the Redlands community if Council undertakes its responsibilities in accordance with its legally agreed obligations as it has done during the last 22 years. However if Council decides to renege on these obligations the adverse impacts on canal residents would be catastrophic. Property values would decline drastically resulting in declines in rate income. Serious anomalies would occur between past and future wall repair costs. The situation would likely result in difficult legal action between ratepayers and between ratepayers and Council.*
2. *Strict planning rules (as existed for many years) would ensure the precinct remains among the most important features of the Redlands community and ensure its continuation as a vital local attraction.*
3. *The appointment of a separate corporation or Council unit under appropriate governance would ensure that ongoing works are carried out efficiently and economically.*

**What is the rationale or principles used in drafting this solution?**

1. *The need for Council to comply with its Mission and Values Statement, take ownership of its responsibilities and comply with its obligations under the legally binding agreement entered into in 1996 and the associated correspondence entered into among the parties which named this Association as a representative of the land holders (refer letter from the Council to the Developer dated 16 April, 1996).*
2. *The future well-being and prosperity of any community depends on proper enforcement of appropriate planning rules*
3. *This would enable Council to comply with its Values Statement "We challenge ourselves to deliver better value for money."*

**REDLAND CITY COUNCIL CANAL AND LAKE ENGAGEMENT – Stakeholder Solution Submissions**

| | |
|---|---|
| **ORGANISATION:** | **Resident** |
| **ORGANISATION CONTACT:** | [redacted] |
| **CONTACT PHONE NUMBER:** | [redacted] |
| **SUPPORTING MATERIAL:** | **PowerPoint Presentation dated 10 February 2018** |
| **DATE:** | **4 February 2018** |

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## What is your proposed solution for the funding and maintenance of Redland's Canal and Lakes?

**Sovereign Waters Lake**

- **As reported to Council and circulated to residents, as the lake may not need draining until 2050, as BMD initially proposed 2008, the Special Charges levy should be reduced significantly.**

- **As the lake is well frequented by more and more non-residents, Council's contribution should be increased by 10% and resident's contribution reduced by 10%.**

- **Alternative arrangements should be considered for lake maintenance including Handover to another body (State Government). For example, the Gold Coast Waterways Authority, which is State Government funded, properly staffed and equipped to effectively manage public waterways.**

## Does your solution relate to the canals and waterways, to the revetment walls or to both?

- **The lake, as the revetment wall around the lake is owned by the residents, as per the contracts that were signed in 2000.**

**How would your solution be applied?**

- **Transparent, audited full disclosure of all funding collected by Council since 2000, all expenditure by Council since 2000, remaining fund balances.**
- **Engineering re-assessment of the lake maintenance requirements and funding model, this would be included in a sophisticated and detailed Asset Management Plan for the lake.**

## What would the impact of your solution be on different groups within the Redlands community – i.e. ratepayers in different areas of the city, council, business owners, transport operators etc

- Lake residents would be treated more equitably.
- A better user-pays / "who benefits" model would be positively received by the community and benefits Council's Asset Management credentials.
- Expenditure and funding would be based upon 18 years of lake experience / lake management/ and current engineering views on lake drainage requirements.

## What is the rationale or principles used in drafting this solution

- User pays
- Fair and equitable
- Consideration of the impacts of upstream pollutants reaching the lake at no fault of lake residents.
- Transparent and effective processes, and decision-making in the public interest; and
- Sustainable development and management of assets and infrastructure, and delivery of effective services; and
- Democratic representation, social inclusion and meaningful community engagement; and
- Good governance of, and by, local government; and
- Ethical and legal behaviour of councillors and local government employees
- Funds raised by Special Charge must be spent on the works/services/infrastructure that the levy is raised for – and before making the levy, the Council must have passed a resolution adopting a plan of works and a plan of the benefitting area, the estimated cost of the works and timeframe for doing the works.

SOVEREIGN WATERS ESTATE

STAKEHOLDER SOLUTION SUBMISSION

# Any changes to this submission would be unacceptable interference of the process and our right to present.

**ORGANISATION: Raby Bay Resident**

**ORGANISATION CONTACT:** [redacted]

**CONTACT PHONE NUMBER:** [redacted]

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## What is your proposed solution for the funding and maintenance of Redland's Canal and Lakes?

The canals were built in many stages between the years 1983 to 1996. When the canals were being constructed, there was considerable concern by people in the area about the method of construction.

Because of these concerns, the then Redland Shire Council (RSC) commissioned several studies by reputable consultants. Some of the resulting reports have since come to our attention and contain information and advice raising very serious concerns about the construction methodologies. **These reports outline that the method of construction used was not recommended for canal construction due to the associated risks of possible failure.**

We believe RSC was negligent in its original decision-making at the time of construction and should be held accountable, we also believe the current RCC has no right to levy current canal estate ratepayers through a dubious Special Charge.

**This Special Charge is charged for costs for which the land owner is neither responsible nor which the land owner should be contributing.**

While Council was in possession of advice that the construction methodology was flawed, continued with its approvals. The Council has never pointed out to potential landowners in these areas that the works were deficient and have never negotiated with affected land owners about a levy.

## Does your solution relate to the canals and waterways, to the revetment walls or to both?

The failures occur in the waterways which is crown land, administered by RCC and through revetment walls which had not been constructed properly. Properties that are vulnerable to failure have tidal waters penetrating into these properties twice per day with continuing removal of material under the revetment walls. The time taken to failure depends on the amount of water penetration and can take several years before sufficient material has been removed to cause failure.

**Redland Shire Council accepted the sub divisional civil works per "As Constructed Drawings" by a Deed of Agreement and became the responsible party for any maintenance/failure for the entirety of that development**

## How would your solution be applied?

RCC have tried to scare residents by trying to convince them that they are actually paying for canal maintenance out of their general rates and have indeed, try to determine a figure that they actually pay. This is scaremongering. These waterfront properties because of their location, generally have a high site valuation and therefore very high general rates. We believe that we pay the highest rates anywhere in Australia as we have been unable to find any higher. Remember, these high valuations have also increased property valuations in the areas surrounding them and therefore further gains in general rate income.

Because we believe that Council were derelict in their duties by approving these properties knowing the construction methods were flawed and there would be failures, it is bad enough that any Redland resident should be contributing let alone those residents that live on the canals. As the general rates for these properties are very high, it is possible that these high rates should be used for the maintenance of the area and would not be a burden on unaffected ratepayers.

As the housing lots on Raby Bay average around 800 to 900 $m^2$, I would like to demonstrate where repairs should be funded. Assume an average 800 $m^2$ dry block in Capalaba with a Site Value of $300,000. The annual General Rates on this property would be $1,217.54. If this was the same size block on the canals, the Site Value would be $1,000,000 and the annual General Rate would be $3,246.81. This shows that the difference between an average 800 $m^2$ dry block and an 800 $m^2$ canal block is $2,029.27.

As general rates are to cover the cost of services provided, there is no extra services to the canal lot. The $2,029.27 is then available to provide maintenance to the canals without affecting any other ratepayer. The expected repair and maintenance cost on the canals is generally over budgeted as the actual costs are considerably lower – hence the reason why RCC had to pay back unused reserve funds recently.

While RCC ignore the fact that **Redland Shire Council accepted the sub divisional civil works per "As Constructed Drawings" by a Deed of Agreement and became the responsible party for any maintenance/failure for the entirety of that development,** it has continued to set a very dangerous precedent by passing responsibility for its past decisions to existing and future residents.

Our position is that these costs should be absorbed out of the General Rate funds and the presentation of these Charges clearly shows these properties are already contributing more than their fair share.

**The underlying fact to remember here is that peoples' homes are being targeted by the Redland City Council for punitive and ill-founded levying with seemingly no end in sight. If it is acceptable to society for public bodies to carry out indiscriminate levying on minorities then there are no principled limits to where this may lead.**

**Local government bodies are not entitled to charge a minority of the population for its mistakes.**

**What would the impact of your solution be on different groups within the Redlands community – i.e. ratepayers in different areas of the city, council, business owners, transport operators etc**

Council is telling ratepayers through 'Fact Sheets' that every ratepayer is paying a contribution towards canal maintenance. All general rates income is pooled to provide sufficient funds to provide the services that the community is perceived to require. The previous example on Page 2 clearly shows that canal residents pay sufficient rates to provide reasonable maintenance costs without affecting other ratepayers.

Council is masquerading the fact that it is using far more of the rate payer pool of funds to provide other services that are mentioned on Page 4.

Council needs to consider the amount of money it is spending on other infrastructure projects which it is trying to fund from ratepayer funds.

**What is the rationale or principles used in drafting this solution?**

**Fairness and Equity:** These three waterway estates are being totally discriminated on as there is **no other use where a levy is applied to finance infrastructure in Redlands**. RCC claim that these residents obtain benefits by living on these estates and should pay extra for maintenance. The canals are not for exclusive use of the residents that live there. They are similar to roads as any one is entitled to use them and as roads, we cannot exclude traffic from using them. We would get more visiting and commercial traffic in the canals than most roads in the City. There are many areas that we can demonstrate where people get benefit from obtaining infrastructure and yet it is **all funded from general rates.**

Over the past couple of years, millions of dollars have been spent on SMBI infrastructure and the only residents that benefit from this spending are the island residents and this spending has all come from general rates. RCC has recently spent $3,2M of rate payer's funds to obtain land on the mainland so that islanders can park their vehicles there – who gets that benefit.

RCC used rate payer funds to build Talty Rd, a road approx. 900 metres long. A dead end road servicing two residents – one owned by Councillor Talty and the other a family member. As a dead end road, nobody uses the road other than vehicles servicing those properties. These two properties are the only people to benefit from this infrastructure. **Wouldn't this be a benefitted area under Council's absurd idea?**

**Council needs to be consistent in the application. It is absurd that any Council would try to recoup further funding than General Rates to provide the services that the residents need. General Rates are to provide funds for the services that the entire community are able to use – they are not a WEALTH TAX. The Supreme Court has ruled on these matters many times.**

These waterfront canal or lake estates lift the rating value of not only the estates themselves, but also the adjacent estates which in turn, increases the income from rates all of these areas.

**Does Council believe that it has no responsibility for the ongoing maintenance given they were the body that gave full approval knowing that the construction method was flawed and that there would be failures?**

**Council sets a very dangerous precedent by passing responsibility for its past decisions to existing and future residents.**

**Redland Shire Council:**

- is the properly and legally constituted approval authority for the Raby Bay subdivision;
- accepted the sub divisional approval as per plans and specifications; and
- **accepted the sub divisional civil works per "As Constructed Drawings" by a Deed of Agreement and became the responsible party for any maintenance/failure for the entirety of that development.**

Our position is that these costs should be absorbed out of the General Rate funds and the presentation of these Charges clearly shows these properties are already contributing more than their fair share.

**The underlying fact to remember here is that peoples' homes are being targeted by the Redland City Council for punitive and ill-founded levying with seemingly no end in sight. If it is acceptable to society for public bodies to carry out indiscriminate levying on minorities then there are no principled limits to where this may lead.**

# Appendix 10

| Project Stage | Activity | Detail | Who | 16/10/2017 | 23/10/2017 | 30/10/2017 | 6/11/2017 | 13/11/2017 | 20/11/2017 | 27/11/2017 | 4/12/2017 | 11/12/2017 | 18/12/2017 | 25/12/2017 | 1/01/2018 | 8/01/2018 | 15/01/2018 | 22/01/2018 | 29/01/2018 | 5/02/2018 | 12/02/2018 | 19/02/2018 | 26/02/2018 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Phase 1 | **1. Engagement Strategy** | | | | | | | | | | | | | | | | | | | | | | |
| | 1.1 Inception meeting | Discussion on methodology conducted with RCC. Key stakeholders identified. | BH/LM/AN/MH | | 24-Oct | | | | | | | | | | | | | | | | | | |
| | 1.2 Review of documents - | The Articulous team have reviewed previous reform activities on a previous project and this cost would minimised and provide a cost saving to RCC. | BH/LM | | | | | | | | | | | | | | | | | | | | |
| | 1.3 Draft engagement plan including two meetings. The Plan will include: | - Overarching engagement questions / focus | BH/LM | | | 30-Oct - 3-Nov | | | | | | | | | | | | | | | | | |
| | | - Overarching messages and Q&As | BH/LM | | | | | | | | | | | | | | | | | | | | |
| | | - Identify and confirm preferred tools | BH/LM | | | | | | | | | | | | | | | | | | | | |
| | | - Create project implementation plan and timeline | BH/LM | | | | | | | | | | | | | | | | | | | | |
| | 1.4 Finalise engagement plan | | BH/LM | | | 5-Nov | | | | | | | | | | | | | | | | | |
| | **2. Resident Group engagement** | | | | | | | | | | | | | | | | | | | | | | |
| | 2.1 Meetings with key resident groups | (allow 6 half days) | BH/LM | | | | 6-14 Nov | | | | | | | | | | | | | | | | |
| | 2.2 Prepare and deliver workshop | with representatives of canal/lake ratepayer associations including preparation | BH/LM | | | | 6-14 Nov | | | | | | | | | | | | | | | | |
| | 2.3 Reporting | on meetings and workshop with canal / lake ratepayer associations | BH/LM | | | | | 15-24 Nov | | | | | | | | | | | | | | | |
| Phase 2 | **3. Panel engagement** | | | | | | | | | | | | | | | | | | | | | | |
| | **Panel set up** | | | | | | | | | | | | | | | | | | | | | | |
| | 3.1 Liaison with market research firm | recruit participants including brief to firm and to Council | BH/LM/MH | 16-Oct | | | | | | | | | | | | | | | | | | | |
| | 3.2 Develop recruitment kit | kit and script for deliberative panel | AN/MH | | | | 6-10 Nov | | | | | | | | | | | | | | | | |
| | 3.3 Develop terms | | BH/LM/MH | | | | | 13-21 Nov | | | | | | | | | | | | | | | |
| | 3.4 Develop and design deliberative panel information packs | to ensure all participants had knowledge | BH/LM/MH | | | | | 15-21 Nov | | | | | | | | | | | | | | | |
| | 3.5 Preparation and orientation meeting with deliberative panel participants | - explain the process | BH/LM | | | | | | 25-Nov | | | | | | | | | | | | | | |
| | | - getting to know you | BH/LM | | | | | | | | | | | | | | | | | | | | |
| | | - provide background information | BH/LM | | | | | | | | | | | | | | | | | | | | |
| | | - feedback and decisions on final expert list | BH/LM | | | | | | | | | | | | | | | | | | | | |
| | | - official thank you from Council | BH/LM | | | | | | | | | | | | | | | | | | | | |
| | | - Terms of Reference – processes and protocols (including any confidentiality, media liaison, safety and security etc) | BH/LM | | | | | | | | | | | | | | | | | | | | |
| | 3.6 Finalise expert | | BH/LM | | | | | | 1-Dec | | | | | | | | | | | | | | |
| | 3.7 Advice to RCC about which experts to secure | RCC to organise and Articulous to liaise with. Assume 6 experts. | BH/LM | | | | | | 1-Dec | | | | | | | | | | | | | | |
| Phase 3 | **4. Panel implementation** | | | | | | | | | | | | | | | | | | | | | | |
| | 4.1 Deliberative panel liaison | organisation - attendance, answering questions, building understanding and capacity prior to attendance, and being a liaison point for panel members. Logistics associated with attending | BH/LM/MH | | | | | | | 25-Nov - 28-Feb | | | | | | | | | | | | | |
| | 4.2 Workshop 1 - Prepare panel workshop | | BH/LM/AN/MH | | | | | | | 25-Nov - 8-Dec | | | | | | | | | | | | | |
| | 4.2 Workshop 1 - deliver first deliberative panel workshop | | | | | | | | | | 9-Dec | | | | | | | | | | | | |
| | 5.1 Prepare and publish workshop report - Workshop 1 | | | | | | | | | | 9-15-Dec | | | | | | | | | | | | |
| | 4.2 Workshop 2 - Prepare panel workshop | | BH/LM/AN/MH | | | | | | | | | 16-Dec - 19-Jan | | | | | | | | | | | |
| | 4.2 Workshop 2 - deliver deliberative panel workshop | | | | | | | | | | | | 20-Jan | | | | | | | | | | |
| | 5.2 Prepare and publish workshop | | | | | | | | | | | | | 22-25-Jan | | | | | | | | | |
| | 4.2 Workshop 3 - Prepare panel | | BH/LM/AN/MH | | | | | | | | | | | 26-Jan - 10-Feb | | | | | | | | | |
| | 4.2 Workshop 3 - deliver deliberative panel workshop | | | | | | | | | | | | | | 10-Feb | | | | | | | | |
| | Internal draft for Preliminary report | | | | | | | | | | | | | | | | | 23-Feb | | | | | |
| | | | | | | | | | | | | | | | | | | | 26-Feb | | | | |

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|---|---|---|---|
| | 5.3 Prepare draft report for consideration by Redland City Council for feedback by Council staff | BH/LM | 28-Feb |
| | **Market Research** | | |
| | Survey design | Deborah Wison Consulting | 13-Feb |
| | Implementation | Deborah Wison Consulting | 17-18 Feb |
| | Research report | Deborah Wison | 19-20 Feb |
| | Integration with | BH/LM | 21-23 Feb |
| | **5. Reporting** | | |