Review of Canal Maintenance Procedures

204295

Prepared for
Sunshine Coast Council

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Cardno

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1 Scope of Report

This report has been prepared in response to a brief provided by Sunshine Coast Regional Council for the review of a range of issues related to Council's obligations to maintain the canals within its local government area and also in relation to Council's discharge of these obligations.

The essential elements of this brief were:

- Inception meeting with Council officers
- Review and comment on existing council reports/documentation/designs/surveys/fact sheets etc.
- Undertake a site inspection with Council officers
- Review and comment on Council's legislative requirements
- Review and comment on maintenance operations including dredging program, de-silting program, rock scour protection replacement
- Review and comment on amenity considerations of the canal systems
- Review and comment on Council's protocols for engagement with external stakeholders
- Attend meeting with external stakeholders
- Preparation of locality plans of all canals showing extents of current maintenance practices in all canal systems
- Review and comment on Council's current Quality Assurance practices for maintenance programs, reporting and data managements
- Review and comment on Council's financial administration procedures for maintenance operations
- Research similar Queensland LGA canal maintenance procedures and how these compare with SCRC
- Preparation of a report presenting the outcomes of the above tasks

The report addresses only matters relating to the maintenance of tidal canals and does not consider the following:

- Maintenance of constructed, non-tidal, water bodies
- Maintenance of natural waterways or coastal lakes, such as Currimundi Creek and the Mooloolah and Maroochy Rivers
- Matters related to the management of stormwater discharges, including water quality and litter, from adjacent properties and development sites. These matters are dealt with under Council's Local Laws and the conditions of the relevant development approvals.
- Issues related to the navigation and mooring of vessels in canals
- Control of insect breeding
- Matters related to Council's budgeting process for canal maintenance

2 Sunshine Coast Canals

Within the Sunshine Coast local government area, Sunshine Coast Regional Council is responsible for the maintenance of a number of canal systems which have been constructed since the early 1970s.

These canal systems are located in the following areas:

- Maroochy Waters canal system, connected to the Maroochy River at Picnic Point
- Mooloolaba canal system, with canals located on both the eastern and western sides of Brisbane Road and connected to the Mooloolah River
- Minyama canal system, with canals connected to the Mooloolah River, closer to its mouth than the Mooloolaba Canals
- Hideaway Waters canal system, connected to Mountain Creek
- Wurtulla canal system, connected to Currimundi Creek
- Pelican Waters canal system, connected to Pumicestone Passage

These canal systems are shown on Figures 2-1 to 2-6. Copies of these figures in A3 format are also included in Appendix B.

Figure 2-1 Maroochy Waters Canal System

Figure 2-2 Mooloolaba Canal System

Figure 2-3 Minyama Canal System

Figure 2-4 Hideaway Waters Canal System

Figure 2-5 Wurtulla Canal System

Figure 2-6 Pelican Waters Canal System

2.2 Legislative History of Canals in Queensland

The first canals in Queensland were constructed under approvals issued pursuant to the Canals Act 1958. This legislation was repealed in 2003.

The mechanisms of the Canals Act were replaced by amendments made, in 2001, to the Coastal Protection and Management Act 1995. Section 176 of the Coastal Protection and Management Act provides continuing effect to approvals granted under the Canals Act:

176 Continuing effect of approvals under Canals Act

(1) This section applies to the following approvals in force immediately before the commencement of the section—

(a) a provisional approval granted under the Canals Act, section 5(4)(b);

(b) a final approval granted under the Canals Act, section 7(3).

(2) Despite the repeal of the Canals Act, from the commencement—

(a) the provisional approval, and any conditions of the approval, have effect as if the approval were a development permit for a material change of use of premises, but only to the extent authorised by the approval; and

(b) the final approval, and any conditions of the approval, have effect as if the approval were a development approval in the form of a development permit for—

(i) reconfiguration of a lot to construct an artificial waterway; and

(ii) operational works to construct the waterway and the access channel.

(3) Subsection (2) has effect only for the period the approval would have had effect if the Canals Act had not been repealed.

s **176** ins 2001 No. 93 s 19

The essential elements which define a waterway as a canal are that it must be an artificial waterway which is connected to tidal water and, from which, vessel access is available to tidal water, unhindered by any manmade structures. The formal definition of a canal is contained in Section 9 of the Coastal Protection and Management Act:

9 Meaning of *canal*

(1) ***Canal*** means an artificial waterway—

(a) connected, or intended to be connected, to tidal water; and

(b) from which boating access to the tidal water is not hindered by a lock, weir or similar structure.

(2) ***Canal*** includes a canal surrendered to the State under the Canals Act, section 13(4).

(3) However, ***canal*** does not include any part of tidal water containing facilities that are used commercially or by members of a club or association for 1 or more of the following—

(a) boat launching, landing, berthing or storing;

(b) boat repairs of a minor nature;

(c) boat provisioning, fuelling or servicing;

(d) recreation, comfort and convenience of persons who own or use boats.

(4) Also, ***canal*** does not include an artificial waterway that intersects, or is connected to, inundated land or leased land if a registered proprietor of the land or lessee of the leased land may restrict or prohibit the use or movement of vessels in water on the land.

(5) In this section—

registered proprietor, of land, means a person recorded in the freehold land register under the *Land Title Act 1994* as a proprietor of the land.

s **9** ins 2001 No. 93 s 7

The provisions of the Canals Act relating to the obligations of local authorities to maintain canals were also carried over into the Coastal Protection and Management Act. These obligations are expressed in Chapter 2, Part 7, Section 121 of this act:

121 Maintenance of canals

(1) 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.

(2) Subsection (1) does not apply to—

(a) a canal, other than an access channel for the canal, constructed under the *Integrated Resort Development Act 1987*; or

(b) a canal constructed under the *Sanctuary Cove Resort Act 1985*.

(3) In this section—

canal means—

(a) an artificial waterway surrendered to the State under this Act or the Canals Act; or

(b) a canal surrendered under a lease under the *Land Act 1994*.

s **121** ins 2001 No. 93 s 15

As noted in Section 121, a local authority is also required to maintain any access channel associated with a canal system. An access channel is defined in Chapter 1, Part 3, Division 1 of the Coastal Protection and Management Act:

7 Meaning of *access channel*

(1) ***Access channel*** means an artificial channel constructed in tidal water and connected, or intended to be connected, to a canal.

(2) Without limiting subsection (1), ***access channel*** includes—

(a) training walls or other works associated with the channel; and

(b) additions or alterations to the channel, training walls or other works.

For the purposes of the maintenance obligations of the local authority, an access channel is an artificial channel approved and constructed in conjunction with a canal system. It does not include natural channels or an artificial channel not constructed in conjunction with a canal system. Access channels are defined by boundaries separate to the boundaries of the associated canal system.

Within the canal systems maintained by the Sunshine Coast Regional Council, the only canal system which has an access channel is the Maroochy Waters system. The extent of this access channel is shown on Figure 2-1.

2.3 Land Tenure of Canals and Separation of Responsibilities for Maintenance

Section 116 of the Coastal Protection and Management Act requires that the area of a canal is surrendered to the State as a public waterway, with the responsibility for maintenance of the canal devolved to the local authority, as outlined above.

Typically, the real property boundary of the canal is defined by the outermost projection of the waterside face of the revetment wall and the revetment wall itself is located within the adjacent private property. The maintenance of the revetment wall, therefore, becomes the responsibility of the property owner.

Pontoons, jetties and other mooring structures constructed within canals are generally located within leases established for this purpose. The maintenance of structures within the lease areas is solely the responsibility of the lessee. This also includes the maintenance of bed levels in the vicinity of these structures to the extent that changes to bed levels have occurred as a result of the presence of the structure. Typically, pontoons and jetties function as floating or fixed permeable breakwaters and dissipate wave energy in their vicinity. This results in the deposition of additional sediment in these areas, compared with similar locations without structures. The maintenance of these areas is discussed further in Section 3.2.

2.4 Interpretation of Requirements for Canal Maintenance

It is considered that the primary objectives of a canal maintenance program by a local authority are those which are related to the function of the canal as a whole. This includes the preservation of the structural integrity of privately owned assets, to the extent that this is directly affected by the condition of the canal. The local authority is also responsible for the preservation of the structural integrity of Council owned assets.

The local authority maintenance program should include:

- Maintenance of the canal and any access channel to ensure that navigation access is maintained, as reasonably as possible, similar to that which was available when the canal was originally constructed. It is not considered to be reasonable to require the canal waterway profile to be maintained to match exactly its design profile or for it to be modified by widening or deepening.
- Maintenance of the canal in a manner which, as reasonably as possible, retains the canal in a condition which does not directly result in adverse effects on private property. For example, Council maintains existing rock scour protection in locations such as the Lamerough Canal to a standard which provides adequate protection to privately owned revetment walls.
- Maintenance of Council owned assets in the canal, such as stormwater outlet structures, in a satisfactory condition.
- Removal of vegetation which has colonised canals, as this may affect the structural integrity of revetment walls and other structures.
- Removal of illegal or unsafe structures and other hazards.
- The testing of accumulated sediments or material to be used for canal bank re-profiling. This is considered to form part of the statutory maintenance obligation of a local authority, as it is directly associated with the management of the maintenance operations.
- Undertaking of regular surveys of canal profiles, including pre and post-dredging surveys. This is also considered to form part of the statutory maintenance obligation of a local authority, as it is directly associated with the management of the maintenance operations.

Secondary objectives of a canal maintenance program are considered to be those which do not form part of the statutory maintenance obligations of a local authority. These are generally related to non-engineering issues and would include:

- The removal of floating litter from canals. This activity is frequently undertaken by local authorities as part of their overall local area maintenance operations, in a similar manner to the way in which parks and streets are maintained for amenity purposes.

- The requirement to undertake water quality testing within a canal is also not considered to form part of the statutory maintenance obligation of a local authority. It may, however, be undertaken as part of the general health and safety duties of a local authority.

2.5 Maintenance of Revetment Walls and Rock Scour Protection

Depending on their design, some canal revetment walls, such as those of the Lamerough Canal, are provided with a strip of rock scour protection, placed along the beach in front of the wall, to provide protection against wind induced and vessel generated waves. The width and sizing of the rock scour protection can vary depending upon the degree of exposure to wave attack.

As the rock scour protection is located within the canal, this creates a situation where the effectiveness of the maintenance of an asset by the local authority has the potential to affect the integrity of an asset in private ownership.

This situation is further complicated by the fact that actions within the adjoining private property can also affect the rock scour protection.

As a result, both the property owner and the local authority have a responsibility to ensure that their actions do not result in damage to the rock scour protection.

Actions by the property owner which may result in damage to the rock scour protection and to the revetment wall include:

- Directing overland flow from the property over the revetment wall
- Cutting openings through the revetment wall
- Driving piles through the rock scour protection, without first cutting the underlying geotextile fabric to ensure that it is not dragged down with the pile
- Raising the height of the revetment wall
- Constructing structures or planting vegetation behind the revetment wall which damages the wall or its foundations
- Not promptly addressing the cause of any leaching of fine grained material through or beneath the wall. Over time, this will result is loss of support for the wall and adjacent structures.
- Allowing excessive vessel propeller wash from vessels moored at structures fronting the property to erode the canal batter
- Deliberately removing or relocating the rock scour protection

Actions by the local authority which may result in damage to the rock scour protection and to the revetment wall include:

- Over-dredging of the canal profile, resulting in slumping of the canal batters
- Failing to reinstate slumped or eroded canal batters to a stable profile

Usually, when damage is observed to a revetment wall or to the rock scour protection, the cause is apparent and can be attributed to actions such as those noted above. Occasionally, the cause of the damage is not clear and detailed investigation may be required. This may result in disagreements between the property owner and the local authority.

When there is a disagreement between a landowner and the local authority regarding the cause of damage to the revetment wall or to the rock scour protection, or regarding the appropriate method for repair, often an external consultant is engaged to provide independent advice. On occasion, the local authority may also exercise its discretion and undertake work, such as out of sequence dredging to re-establish a canal batter profile, placement of sand against the front face of the revetment wall and even the placement of additional rock to the front of the wall.

It is not possible to provide general guidance regarding these situations, except to note that the local authority is not responsible for the rectification of damage to revetment walls or for the implementation of measures to prevent ongoing damage to revetment walls, except in cases where the damage is the direct result of the actions of the local authority. Where departures occur from this principle, there arises the likelihood that the lines of responsibility for the maintenance of the canal and revetment walls become

blurred and expectations are created among property owners that the local authority will address maintenance issues which are not part of its statutory obligations.

As noted in Section 2.3, another area of canal maintenance where it is considered that local authorities are likely to be undertaking work which is outside of their statutory obligations is dredging around private mooring structures such as jetties and pontoons. This work is often undertaken to ensure that pontoons do not become grounded at low tide due to accumulated sediment. Local authorities may be willing to undertake this work, as it can provide a useful source of material for the replenishment of canal beaches.

Recommendations to address a number of the issues outlined above are presented in Section 5 of this report.

2.6 Approvals to Undertake Canal Maintenance

Dredging is a Prescribed Environmentally Relevant Activity (ERA) under Part 4, Section 16 of Schedule 2 of the Environmental Protection Regulation 2019.

The dredging ERA has a range of thresholds in terms of the annual quantity of material removed. These thresholds commence at 1,000 tonnes/annum and extend up to greater than 1,000,000 tonnes/annum.

For the maintenance of the canals within the Sunshine Coast local government area, Council has obtained approval to undertake ERAs 16 1(a) and 16 1(b). ERA 16 1(a) covers the removal by dredging of between 1,000 tonnes and 10,000 tonnes of material per year. ERA 16 1(b) covers the removal by dredging of between 10,000 tonnes and 100,000 tonnes of material per year.

The approved removal of material relates to the operations undertaken by Council to remove accumulated silt from canals and the transport and disposal of this material at an approved off-site disposal facility. This includes the removal of broadly distributed silt from the canal bed, as well as locally concentrated silt accumulations which have been observed at the outlets of stormwater drainage pipes.

Council's current ERA 16 1(a) and 16 1(b) permit is EPPR00187013.

This Environmental Authority states that activities must not be carried out contrary to the purposes of dredging for reprofiling of the canal system and maintaining canal access within the following canal systems:

- Mooloolah River in the Mooloolah River Canal (ERA 16 1(a));
- Maroochy River, Maroochy Waters, Riverbreeze Estate (ERA 16 1(b));
- Mooloolah River, Hideaway Waters (ERA 16 1(b));
- Mooloolah River Canals, Emerald Waters Estate (ERA 16 1(b)).

The Environmental Authority does not include the removal of material from the Wurtulla or Pelican Waters canal systems.

This Environmental Authority contains conditions relating to:

- Environmental management
- Record keeping
- Air, noise and water quality monitoring
- Spoil and waste disposal

Council is required to notify the administering authority prior to commencing a new dredging operation and to maintain relevant records, including a register of environmental complaints and response actions.

Dredging operations undertaken to remove accumulated silt from a canal and to dispose of it off site are distinct from the dredging undertaken by a local authority to maintain or enhance the canal profiles, for which specific approvals are not required.

Approvals are also not required for a local authority to remove illegal or unsafe structures from a canal, although consultation with residents would usually occur beforehand.

Similarly, a lessee of an area within a canal for the purposes of constructing a mooring structure is able to maintain that structure and the canal profile within the lease area without the need for further approvals.

3 Canal Maintenance Undertaken by Sunshine Coast Regional Council

3.1 Canal Maintenance Undertaken by Sunshine Coast Regional Council

As discussed in previous sections, the statutory obligations imposed upon a local authority under section 121 of the Coastal Protection and Management Act require the local authority to:

- Generally maintain the canal profile for navigation purposes.
- Generally maintain the canal beach design profile, where practicable, while undertaking maintenance of the canal profile for navigation purposes. This assists in the protection of privately owned assets, but Council is not required to undertake maintenance of the privately owned assets themselves.
- Maintain Council owned assets within the canal in a satisfactory condition.
- Undertake the removal of vegetation which has colonised in the canals. It may sometimes be necessary for Council to remove vegetation within a canal without the consent of an adjacent property owner where the vegetation is considered likely to cause damage to public or private infrastructure, or if it impedes other maintenance activities which form part of Council's statutory obligations.
- Remove illegal or unsafe structures. It may also be necessary for Council to remove illegal or unsafe structures within a canal without the consent of an adjacent property owner where these structures detrimentally affect the function and use of the canal for its intended purpose.

In addition, local authorities may, at their discretion, provide a range of additional services, beyond the scope of their statutory obligations, to owners of canal front properties to maintain general amenity and also to assist with the maintenance of privately owned structures.

3.2 Maintenance of Canal and Beach Profiles

Sunshine Coast Regional Council currently undertakes three types of maintenance activities related to the maintenance of canal and canal beach profiles.

The major activity is the use of small cutter suction dredges to remove sand which has accumulated on the underwater batters of the canal profile and place it on the canal beaches in front of the privately owned revetment walls. The sand is usually placed to the level of the top of the revetment wall. This is significantly higher than the original beach level and is intended to provide increased protection to the revetments against undermining, as well as additional support to walls which may be showing evidence of distress.

The quantity of sand placed on the canal beaches significantly influences the duration of each maintenance cycle. The frequency of maintenance dredging could be increased if the beach levels are not raised to the top of the revetment walls and a post-dredging beach profile with levels closer to the original design levels was adopted.

The placement of sand to the level of the top of the revetment wall creates a beach profile (Figure 3-1 - Profile 2) with a slope which is steeper than the slope for the original design profile (Figure 3-1 - Profile 1).

Some residents have questioned whether it would be possible to provide a finished beach slope which is closer to the original design slope. In general, it is considered unlikely that this would be able to be achieved with sand placed to the top of the revetment walls, as the higher level of the sand would result in the beach slope extending much further out into the canal and, as a consequence, also require the underwater batter to be built up and widened, extending down to the canal bed. The resulting indicative bank profile is shown as Profile 3 on Figure 3-1.

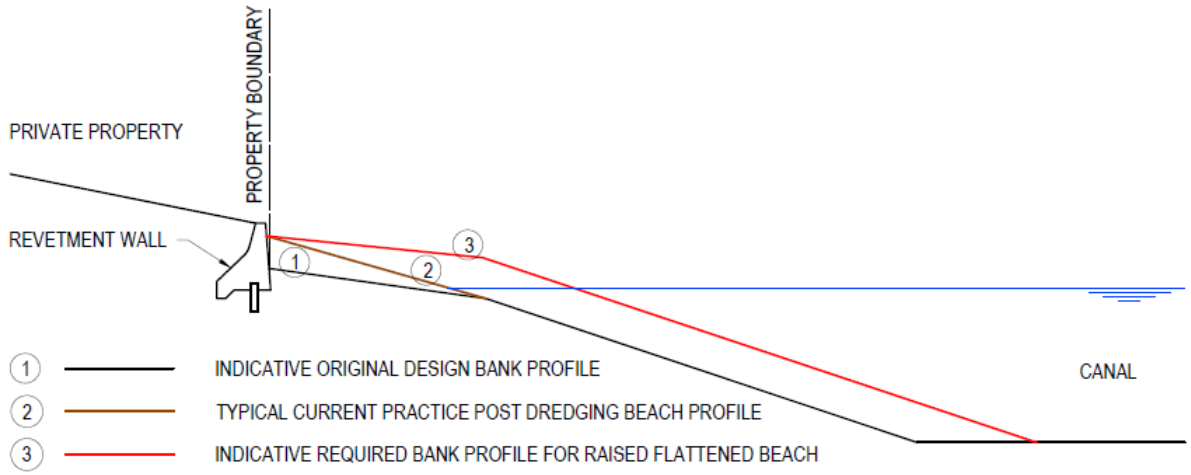

Figure 3-1 Comparison of indicative design bank profile, current practice post-dredging beach profile and indicative, raised, flattened profile.

This would be impracticable due to the limited amount of sand available within the canal systems and the fact that the additional material required to build up the underwater batters would reduce navigability. The modification of the beach slope resulting from the placement of sand to the level of the top of the revetment wall is considered to be a trade-off against the increased protection provided by the higher beach levels.

As noted above, a post-dredging beach profile, with levels closer to the original design levels, could be adopted. This would go some way towards addressing the issues raised by residents regarding the steepness of the completed beach slopes and would also allow the frequency of maintenance dredging to be increased. This type of post-dredging profile is shown indicatively on Figure 3-2 as Profile 3.

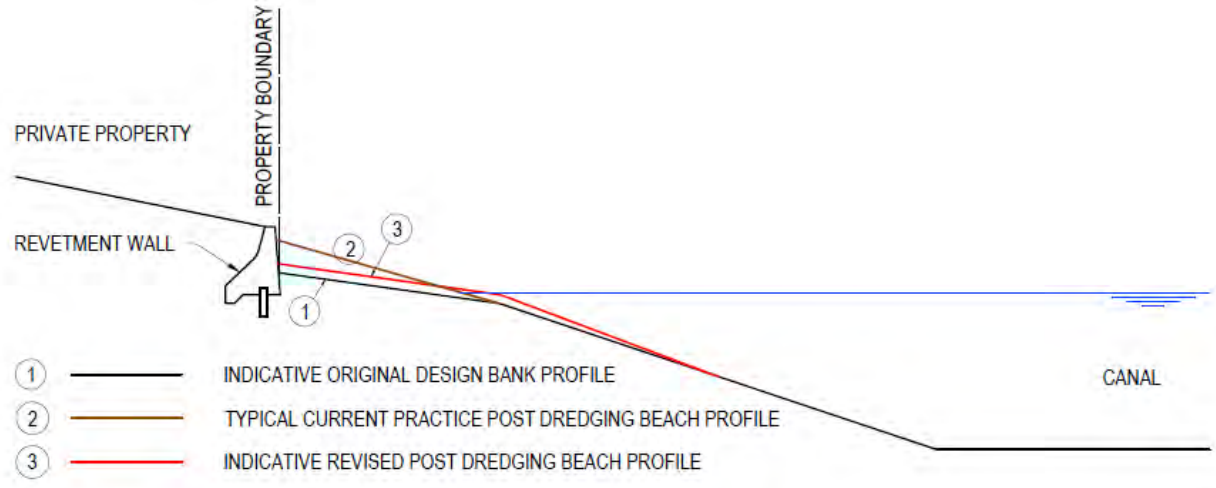

Figure 3-2 Comparison of indicative design bank profile, current practice post-dredging beach profile and indicative, revised, post-dredging profile.

Figure 3-3 shows dredging in progress to raise beach levels in front of the revetment wall. In this photograph, recently placed sand can be seen beneath the deck and around the edges of the boat ramp.

Figure 3-3 Dredging in progress to raise canal beach levels

The size of the dredges required for the canal profile maintenance is specified in Council's tender documents. These specifications have been developed based upon experience and with consideration of the requirement for the dredges to operate between and close to mooring structures.

The dredges have an on-board pump which delivers the water-sand slurry via a floating pipeline, approximately 100mm in diameter, to a separation cyclone on the shore which separates the heavier sand particles from the finer material fractions and also from the majority of the transport water. The finer materials and transport water are returned to the canal by surface flow across the beach. The heavier sand particles are deposited on the beach via a delivery pipe which is relocated as required to distribute the sand along the beach.

To permit the placement of sand beneath decks, Council requires, as a condition of the Prescribed Tidal Works approvals for these structures, that access hatches are provided through the decks.

Due to the small size of the equipment used, the delivery rate is quite low and the dredging of sand to the beach frontage of one property typically takes a full day, with the material usually obtained from the canal immediately in front of the property. As a result, complete maintenance of the larger canal systems can take 18 months or longer, with dredging undertaken on a three to four year cycle. This cycle time could be reduced if the beach levels are not raised to the top of the revetment walls, but to a level closer to the original design levels.

In locations where it is observed that sand is removed from the canal beach design profile by wave action, at a rate which is greater than the average rate of removal within a canal system, Council, in consultation with the property owner, may place rock scour protection against the face of the revetment wall to provide more effective protection over the long term. This rock is placed immediately in front of the revetment wall with the objective of protecting the wall. This technique is considered effective in maintaining the general amenity of the foreshore, as it may not involve the placement of rock over the full width of the beach or extending down the underwater batter.

Maintenance of rock scour protection may also be undertaken in locations where the beaches were provided with rock scour protection as part of the original design and this rock has been removed or displaced by natural causes or human intervention.

As noted previously, Council also undertakes the removal of sand deposited under and around mooring structures as an additional service to residents during the maintenance dredging program. This work is beyond the scope of Council's statutory maintenance obligations and is only undertaken as part of the dredging program and not on an ad-hoc basis. These activities are generally referred to as "pontoon blowouts" and are undertaken by applying the dredge pump to produce a jet of high velocity water from a flexible pipeline which is manoeuvred beneath the pontoon to displace the accumulated sand out towards

the centre of the canal. This sand is then collected by the dredge, operating in conventional mode, and placed on the canal beaches.

The third type of canal profile maintenance activity undertaken by Council is the removal of accumulated silt from the canals generally, and also localised deposits which may occur at stormwater drainage outlets. This work is usually undertaken using an excavator or dragline. Due to the anaerobic nature of the silt and the fact that it may contain pollutants, such as hydrocarbons and heavy metals, the silt is transported within sealed trucks to a purpose built, approved, disposal facility at Duck Holes Creek, Caloundra.

Council undertakes sampling and chemical testing of silt deposits prior to commencing desilting operations. Due to the relatively low rates of silt deposition, desilting is required less frequently than the dredging to rebuild canal beach profiles. When undertaken, desilting is usually undertaken following maintenance dredging. This allows for the removal of any additional silt deposited as a result of the dredging operation.

3.3 Maintenance of Council Owned Assets

Council undertakes regular inspections of the canals within its local government area. This enables the assessment of the general condition of the canals, including of any Council owned assets. Maintenance of these assets is undertaken as required. The types of assets for which Council is responsible include:

- Navigation aids and signage, including speed signs and navigation lighting
- Stormwater outlet structures
- Revetment walls fronting Council owned land, such as parks
- Bridges
- Kayak launching facilities and public boat ramps
- Council owned pontoons and jetties

3.4 General Canal Maintenance by Council

In a number of canal systems, vegetation and, in particular, mangroves becomes established in the intertidal areas. This vegetation is removed by Council on a regular basis. A canal beach with colonising mangroves is shown in Figure 3-4

Figure 3-4 Mangroves colonising canal beach

In some canal systems, the placement of sand to high levels on the beaches has enabled non-marine grass species to become established. This has resulted in some residents using these stabilised areas as extensions of their property and, in some cases, even planting additional vegetation. These areas often detract from the general amenity of the canal and the vegetation is removed by Council when necessary.

It may be necessary for Council to remove vegetation within a canal without the consent of an adjacent property owner where the vegetation is considered likely to cause damage to public or private infrastructure or if it impedes other maintenance activities which form part of Council's statutory obligations.

Council also undertakes the removal of illegal or unsafe structures from canals when necessary.

An example of a grass stabilised canal beach with an unapproved timber revetment wall is shown in Figure 3-5.

Figure 3-5 Grass stabilised canal beach with unapproved timber revetment wall

As discussed previously, Council also undertakes water quality testing within canals and the removal of floating litter as part of its general health, safety and maintenance activities.

3.5 Documentation Held by Sunshine Coast Regional Council

Council maintains a range of records and documents in relation to its canal maintenance activities.

These include:

- Records of requests from residents relating to canal maintenance and issues. These records are maintained within Council's customer relationship management (CRM) system. This system enables the tracking of requests from residents and responses by Council. This system is also used to record any out of sequence maintenance activities undertaken by Council in relation to individual properties.
- Records required to be kept by the Environmental Authorities held by Council to undertake dredging for the desilting of canals
- Survey data of canal system profiles
- Records of dredge operating dates, times and locations maintained by the operators of the dredges engaged by Council to undertake canal maintenance
- Records of water quality testing, using field instruments, undertaken by the dredge operators
- Records of water quality testing, using field instruments and laboratory analysis, undertaken by Council and other agencies
- Records of chemical and bio-chemical testing of canal sediments and silt

3.6 Site Inspections of Sunshine Coast Canals

Inspections of the current Sunshine Coast canal systems were undertaken from a vessel provided by Council during April 2021. The locations and dates of the inspections were as follows:

- 20 April 2021 – Pelican Waters, Wurtulla and Maroochy Waters canal systems
- 21 April 2021 – Hideaway Waters, Mooloolaba and Minyama canal systems

Weather conditions were fine on both days, with suitable low tides, enabling a good appreciation to be obtained of the range of maintenance activities undertaken within the canal systems, as well as the current condition of these systems.

In addition, dredges were observed to be operating within the Maroochy Waters and Mooloolaba canal systems.

3.7 Canal Dredging Program

Council uses the data contained within the dredging water quality monitoring spreadsheets prepared by the dredge operators as an historical record of the locations at which dredging has been undertaken. This data provides information down to details and times of dredging at individual properties. Tables 3-1 to 3-5 provide a summary of the canal dredging undertaken from 2003-4 to 2020, based upon the data contained within these spreadsheets.

This information may not be complete and is not intended to indicate that the respective canal systems were dredged in their entirety between the stated dates. The tables are provided to indicate the general frequency of maintenance dredging. The tables also show the dredging contractors which undertook the dredging.

Additional details of Council's tendering process for the canal maintenance contracts are provided in Section 3.14.

Table 3-1 **Dredging History - Mooloolah River Canals East of Brisbane Road**

Dredging Program	Contractor
August 2020 to October 2020	Broadwater Dredging
March 2017 to August 2017	Broadwater Dredging
April 2013 to September 2013	Broadwater Dredging
February 2012 to June 2012	Broadwater Dredging
August 2010 to November 2010	Broadwater Dredging
July 2009 to August 2009	Broadwater Dredging
December 2003 to March 2004	Broadwater Dredging

Table 3-2 **Dredging History - Mooloolah River Canals West of Brisbane Road**

Dredging Program	Contractor
November 2016 to March 2020	Broadwater Dredging
October 2017 to November 2017	Broadwater Dredging
March 2013 to July 2015	Broadwater Dredging
February 2012 to October 2012	Broadwater Dredging
September 2010 to May 2011	Broadwater Dredging
July 2009 to September 2010	Broadwater Dredging
April 2002 to November 2003	Broadwater Dredging

Table 3-3 **Dredging History – Maroochy Waters Canals**

Dredging Program	Contractor
August 2020 to September 2020	Nabis Dredging
May 2019 to August 2019	Nabis Dredging
May 2018 to November 2018	Nabis Dredging
July 2017 to June 2018	Nabis Dredging
July 2009 to October 2009	Broadwater Dredging
September 2004 to January 2006	Broadwater Dredging

Table 3-4 **Dredging History – Minyama Canals**

Dredging Program	Contractor
June 2019 to September 2020	Nabis Dredging
January 2017 to June 2019	Nabis Dredging
July 2013 to October 2016	Nabis Dredging

Table 3-5 **Dredging History – Hideaway Waters Canals**

Dredging Program	Contractor
November 2019 to July 2020	Nabis Dredging
July 2017 to June 2018	Nabis Dredging
September 2015 to October 2016	Broadwater Dredging
May 2011 to February 2012	Broadwater Dredging
April 2004 to August 2004	Broadwater Dredging

3.8 Canal Maintenance Amenity Aspects

A number of the issues raised by residents in the meeting with stakeholders held on 30 April 2021 and discussed in Section 3.11 were related to amenity.

These included:

3.8.1 Control of Midge and Mosquito Breeding

Vector control does not form part of the scope of this report and does not lie within the responsibilities of Council's Coastal Constructed Water and Planning Section. Officers from this section have noted these concerns and have forwarded them to Council's Vector Control staff.

3.8.2 Runoff Water Quality and Accumulation of Silt

Matters related to the management of stormwater discharges, including water quality and litter, from adjacent properties and development sites and, in particular, commercial sites, were a significant issue for a number of residents. These matters are dealt with under Council's Local Laws, or as part of the development compliance process where they relate to the conditions of the relevant development approvals. Officers from Council's Coastal Constructed Water and Planning Section have noted these concerns and have passed them on to Development Audit and Response staff.

The presence within the canals of accumulated silt and its embodied contaminants was a concern raised by residents. Concern was expressed regarding silt deposited within canals and at discharge locations from stormwater outlets, particularly from construction sites and commercial developments.

Council does undertake a program of removal of silt from canals as discussed in Section 3.2. To ensure that this program is targeted and effective, it is recommended a program of regular bed surveys of the canals is implemented to identify locations prone to siltation and to formulate a program for its removal. This is also likely to require sampling and testing of the silt deposits. The surveys and sampling should also be accompanied by inspections of stormwater outlet structures and other locations where localised siltation has been observed to occur.

These surveys would also assist in the monitoring of changes to the canal profile over time and would provide a record of the completed bed profiles after dredging, as well as information on likely source locations for beach replenishment sand prior to dredging.

As an initial guide, it is suggested that pre and post-dredging surveys are undertaken on a staged basis prior to and following the completion of dredging within defined areas of each canal system. These areas may be determined based upon the area of dredging completed within a nominated period of time.

If the pre-dredging surveys indicate that unusually large rates of sediment accumulation or removal in particular areas, more frequent surveys may be required in these areas.

3.8.3 Removal of Litter

The removal of litter does not form part of Council's statutory responsibility for canal maintenance. Litter removal from canals is undertaken by Council as part of its overall local area maintenance operations, in a similar manner to the way in which parks and streets are maintained for amenity purposes.

Residents also have a role to play by ensuring that litter, lawn clippings and other waste is not disposed of into stormwater drainage systems.

As indicated by residents, the control of the accumulation of litter within canals is also related to the management and collection of gross pollutants from the contributing stormwater drainage catchments, with some evidence of significant litter generation from commercial sites. Council's planning scheme codes require that all commercial developments incorporate appropriate stormwater quality management devices, including gross pollutant traps for litter. The effectiveness of these devices is dependent upon their regular maintenance and also other litter control strategies such as street sweeping.

In canal areas which regularly exhibit significant quantities of accumulated litter, Council may wish to investigate the source of this litter and also the effectiveness of any existing litter control measures within the catchment and possible additional management measures which may be warranted.

3.8.4 Completed Dredged Profiles

The technique adopted by Council for the rebuilding of canal beach profiles using sand dredged from further out in the canals is outlined in Section 3.2. This section also provides an explanation of the requirement for the placement of sand on the beaches at slopes steeper than the original constructed slope, as shown by Profile 2 on Figure 3-1.

Residents have commented that different dredging contractors provide differing standards of finish for the surface to the beach profile. The expressed preference is for an evenly graded finish. To ensure that the desired finish is achieved, it is recommended that this is included in the specification for the dredging contract.

The additional work required to produce an evenly graded beach finish within the canal systems is likely to result in increased maintenance costs and possibly reduced maintenance frequency. The achievability of this would need to be considered in terms of the available budgets.

3.8.5 Maintenance of Beach Profiles at Private Structures

Council's obligations to maintain beach profiles at private structures, as part of its overall canal maintenance responsibilities, are discussed in Section 2.3, with an outline of the approach adopted by Council presented in Section 3.2.

Some residents have raised concerns regarding the maintenance of beach levels at private boat ramps. Council does endeavour to maintain beach levels at boat ramps as shown by the recently completed dredging in Figure 3-3. Some structures, however, require greater than usual attention to maintain beach levels. This can be due to factors such as their design, location or construction. In these cases, it is the responsibility of the owner of the structure to undertake any additional maintenance required.

Such cases include where property runoff results in erosion of beaches or where revetment walls have been raised by property owners resulting in damage to the original wall.

3.8.6 Turbidity from Dredging Activities

Some residents have commented regarding the generation of plumes of elevated turbidity as a result of canal dredging operations. As discussed in Sections 2.6 and 3.14, both the Environmental Authorities for dredging for desilting and the specification for dredging for beach maintenance contain explicit requirements for the monitoring and management of turbid plumes.

It is recommended that compliance checks are undertaken by Council with respect to the above requirements. If it is found that the specified turbidity control measures are insufficient, it is recommended that enhanced measures are implemented.

3.8.7 Frequency of Maintenance

Several residents have raised concerns regarding the frequency of canal beach maintenance.

One subject of these concerns is the maintenance of bed and beach levels in the vicinity of private structures. As noted elsewhere in this report, Council provides a standard level of service with respect to the maintenance of beach and bed levels. Where the nature of a private structure is such that more frequent maintenance is required, this maintenance is the responsibility of the owner of the structure.

The maintenance of beach levels is the second subject about which residents have expressed concern regarding frequency. As discussed in Section 3.14, Council's contract specification for dredging for the maintenance of beach levels specifies a time interval between dredging campaigns of 3.5 years. Council generally endeavours to achieve this, but acknowledges that this is subject to budgetary constraints.

It may be feasible, subject to a number of considerations, to reduce the time intervals between dredging campaigns by utilising alternative, higher capacity equipment, as discussed in Section 3.14.

Other measures which may assist to increase maintenance frequency include the placement of sand to the beaches to levels which are closer to the original design levels, rather than to the top of the revetment walls, thereby reducing the volume of material required to be dredged during each maintenance cycle, and also the replacement with rock scour protection of sand loss from areas which prove difficult to stabilise.

3.9 Council Resident Communications

Communication between Council and residents on issues related to canals occurs primarily through resident enquiries and service requests which are logged within Council's customer relationship management (CRM) system.

Council also holds regular meetings with representatives from a range of resident groups.

Prior to maintenance works being undertaken in canals, the dredging contractors undertake letterbox drops and, in some cases, visit residents to advise of the nature and timing of the proposed works, and also to ascertain any resident concerns.

During discussions with Council, residents and one of the current dredging contractors, it was established that communication processes with residents regarding canal maintenance activities have not been consistent. It is recommended that Council implements a joint communication protocol with the dredging contractors to ensure that the communication process is standardised and that this process is included in the documentation for the dredging contracts.

Council also undertakes communication with residents, as required, in relation to the removal of vegetation and illegal structures.

3.10 Council Canal and Waterway Fact Sheets

Council has prepared the following documents for the information of residents:

- Residents' handbook: Artificial waterways (April 2019)
- Residents' handbook: Private Structures in Canals (December 2020 – Draft)

The handbook on artificial waterways provides a wide range of information in relation to both tidal and semi-tidal artificial waterways. It addresses topics such as water quality, dredging and maintenance, boat ramps, jetties and decks, boating and safety.

The handbook on private structures is currently in draft format. It has been prepared to provide information to residents regarding the approval and maintenance of private structures in canals, including revetment walls, pontoons, jetties, decks and boat ramps. It expands upon some of the material contained within the handbook on artificial waterways. It also clarifies the division of maintenance responsibilities between property owners and Council.

3.11 Meeting with Stakeholders

A meeting with stakeholders was held at Council's Caloundra office on 30 April 2021. The stakeholder attendees consisted of a number of members of the Maroochy Canal Action Group, representing residents on the Maroochy Waters canal, and residents living on, or with an interest in, the Mooloolaba Canals, the Minyama Canals, the Wurtulla Canals, the Hideaway Waters Canals and Currimundi Creek.

The purpose of the meeting was to obtain stakeholder views regarding issues which they consider to be significant. Notes on the meeting are included in Appendix A.

A wide range of issues was raised at the meeting and these were found to be useful in shaping the discussion in this report. Issues from the meeting are discussed within the relevant sections of the report and also as part of the recommendations in Section 5.

3.12 Meetings with Dredging Contractors

As noted in Section 3.14, the current canal dredging contracts have been awarded to two Sunshine Coast based contractors, Nabis Dredging and Broadwater Dredging.

Of these contractors, Nabis Dredging was available to discuss their experiences in undertaking the canal maintenance dredging. The meeting with Nabis Dredging occurred on 21 April 2021. This meeting provided useful information regarding the way that dredging is undertaken within the canals and also the methods used for communication with residents.

An observation from this meeting was that it would be beneficial to prepare a documented specification for the beach topography to be achieved following dredging and also a documented communication protocol with residents.

3.13 Council Quality Control, Reporting and Data Management

Management of the canal maintenance program is provided by Council's Coastal Constructed Water and Planning Section, within the Liveability and Natural Assets Department.

Officers from this section are responsible for the tendering and contract management of the canal maintenance contracts, as discussed in Section 3.14.

The range of records and data held by Council is outlined in Section 3.5. The majority of this information is held within the Coastal Constructed Water and Planning Section. It is understood that the results of water quality and sediment testing are held by another section within Council.

A selection of the records held by the Coastal Constructed Water and Planning Section has been sighted.

If not already the case, it is recommended that a process, similar to a quality assurance system, is implemented which provides for the following:

- Standardised naming conventions and storage locations for each category of records
- Documented processes of actions required to be undertaken and records obtained, prior to, during, and following canal maintenance activities
- Documented processes for monitoring activities and inspections undertaken by Council and relevant records to be kept
- A standardised reporting procedure to document and evaluate the effectiveness of canal maintenance activities
- A procedure to document and address non-conformances

3.14 Council Contracts for Canal Maintenance

Council calls open tenders for its canal maintenance work. The most recent tenders were called in 2016. The scope of work included in the tenders covered:

- Dredging for canal beach replenishment
- Dredge operation for "pontoon blowouts"
- Vegetation removal
- Supply and placement of rock scour protection
- Supply of labour and various items of plant

The tenders provided for the works to be undertaken on a schedule of rates basis, with the scope of work divided into separable portions for each of the respective canal systems. Tenderers had the option of submitting tenders for some or all of the separable portions. The contracts awarded were for a duration of

three years, with the option of two extensions of 12 months each. The tender and contract award process was administered under Council's internal probity system.

Some notable requirements included in the Technical Specification prepared by Council for the works were:

- Each waterway system was required to be entirely dredged every three and a half years. By default, this established the minimum required dredge production capacity.

- Detailed requirements for the management and monitoring of water quality and, specifically, turbidity resulting from the dredging operations. This included the placement of a silt curtain around the dredge.

Schedules included in the tender documents included lists of works items to be priced by the tenderers for each separable portion. The schedules included items for the provision and operation of dredging equipment of a range of sizes, commencing with dredges of dimensions of 6m x 4m as the default option.

Provisional items were also included for the provision of larger dredges of dimensions 8m x 6m and 12m x 12m, if requested by Council. The tender documents did not nominate a minimum dredge production capacity, apart from the requirement that each canal system was required to be entirely dredged every three and a half years. The tender documents also did not nominate a minimum depth reach for the dredges.

As noted previously, it is understood that the default dredge dimensions of 6m x 4m were chosen based upon experience and the requirement for the dredges to operate in shallow areas and between and close to mooring structures.

The current dredging contracts were awarded to two Sunshine Coast based dredging contractors, Nabis Dredging and Broadwater Dredging, both of which operate dredges at the smaller end of the size range discussed above. Both of these contractors have been undertaking canal maintenance dredging on the Sunshine Coast for a number of decades.

It is recommended that the dredging contract tender documents are reviewed to require tenderers to provide additional data regarding their offered equipment, including typical production rates and operating depth ranges. This is with a view to ensuring that the most effective equipment is chosen, in terms of both cost and the length of time required to complete the dredging program.

In considering the capacity of the dredging equipment, it should be noted that there is an upper limit to the size of the dredges which can be used within the canals for beach replenishment, as very high delivery rates will result in much of the placed material running back into the canal, decreasing the efficiency of the operation. This would also result in increased turbidity within the canal. For high dredging rates, the greater volume of return water would also result in increased turbidity. In discussions with residents, the use of dredges with a production rate of more than 100m³/hour (solid volume) was suggested. A production rate of this magnitude is considered unlikely to be feasible for the reasons presented previously.

The experience of other local authorities which are required to undertake canal maintenance also provides valuable insight into possible alternative techniques and equipment.

4 Canal Maintenance by Other Local Authorities

4.1 Canal Maintenance by Other Local Authorities

A number of other local authorities within southeast Queensland are also responsible for the maintenance of canals within their local government areas. These include:

- Noosa Shire Council
- Moreton Bay Regional Council, and
- Gold Coast City Council
- Redland City Council

Of these local authorities, Gold Coast City Council is responsible for the maintenance of the largest area of canals.

Contact was made with officers from these Councils, except Redland City, to obtain an understanding of the canal maintenance practices undertaken within their local government areas.

The results of these discussions are summarised below.

4.1.1 Gold Coast City Council

An on-line meeting with officers from Gold Coast City Council (GCCC) was held on 2 June 2021. This meeting provided valuable insights into the management of canal maintenance by GCCC, including similarities and differences with the processes utilised by Sunshine Coast Council.

A number of the processes currently used by GCCC are also recommended for implementation by Sunshine Coast Council. The following is a summary of the major points of discussion at the meeting with GCCC:

- GCCC undertake canal maintenance dredging under two separate contracts, with five separable portions of works, and using three contractors. The dredging equipment used is similar to that utilised on the Sunshine Coast, with the majority of the dredging undertaken by a 4 inch dredge and with a cyclone separator used for placement of sand to the canal beaches. A 6 inch dredge is utilised for larger scale dredging. Five dredges are utilised full time.
- GCCC do not undertake any hand profiling of canal beaches as part of the maintenance dredging.
- GCCC utilise barges for maintenance of rock scour protection, with a trend towards larger barges for efficiency.
- GCCC generally undertake canal maintenance on a rolling 3 year program, with some flexibility for additional maintenance to areas exposed to long wind fetches or prolonged vessel wash.
- GCCC have obtained legal advice to clarify their statutory obligations in relation to canal maintenance. On the basis of this advice, GCCC view their obligation to maintain the canal “as a whole”. Out of sequence maintenance is not provided for minor localised issues.
- GCCC has prepared a database of the original design profiles for the majority of its canal systems. These profiles, with a small “top up” buffer are used as the profiles to which the dredging contractors are required to reinstate the beach profiles. Legacy issues resulting from previous policies of placing dredged sand to the top of the revetment walls are being dealt with by not placing additional sand in these areas, removal of vegetation, allowing the beach to revert to the design profile and, in some cases, using machinery to reprofile the beaches.
- The rate of progress by the contractors employed by GCCC is generally 2 to 3 properties per day, depending on the availability of sand. Sunshine Coast Council achieves about one property per day.
- GCCC has a policy of removing all vegetation from canals. This is completed prior to scheduled maintenance dredging and may include the mechanical profiling of sand that is above design levels. These works are considered to be part of Council’s statutory maintenance obligations. An arborist is employed on the maintenance barge to provide advice regarding the removal of large vegetation.

- GCCC also removes illegal structures prior to maintenance dredging and following notification to property owners.
- The GCCC planning scheme establishes a waterway regulation line to control development within a 1 metre wide strip on the landward side of canal revetment walls.
- GCCC does not undertake any maintenance work to remove sand from around private pontoons and other private structures, unless the sand is the result of previous over placement. GCCC only maintains the canal to design profile. Many residents do not realise that their pontoons were originally designed to ground at low tide, based on the design canal profile.
- GCCC does place rock scour protection to beaches in high scour areas, as well as maintaining areas of rock scour protection included in the original canal design. The rock is placed to the original design profile and is not overlaid with sand.
- GCCC undertakes cross-section surveys of its canals approximately every 18 months, with one cross-section and one photograph obtained per property. Real time kinetic GPS survey methods are utilised for the upper parts of the canal profiles, with echo sounder methods utilised below water. GCCC is aiming ultimately to undertake combined 3D terrestrial scanning and echo sounder surveys from a vessel.
- GCCC has established intervention levels for the initiation of maintenance within its canal systems. The intervention levels vary between canal systems. The general guide is to maintain 200mm to 300mm of sand cover to the toe of the revetment walls. To confirm these requirements, GCCC has undertaken stability calculations for all revetment walls. These calculations do not consider additional or raised walls, or any other structures or modifications which may impact private revetment walls, as these are the responsibility of the property owners.
- GCCC has established a quality management system which identifies responses and levels of maintenance intervention actions for a range of circumstances. If a revetment wall is in danger of collapse due to low beach levels resulting from scour originating from processes within the canal, GCCC will rectify the beach profile immediately. If the situation is due to processes originating within private property, GCCC has implemented a local law which allows Council to serve notice on the property owner to rectify the situation.
- GCCC allows residents to undertake private works within canals, providing that the canal profile is not altered from the original design.
- GCCC has implemented a local law which requires potential purchasers to be informed in property searches of their responsibility to maintain revetment walls.
- GCCC has developed standard letters for issue to residents prior to canal maintenance works. A large number of fact sheets have also been produced.
- GCCC maintains canal maintenance records in a spreadsheet database which is updated manually.
- GCCC do not have specific canal management plans.

4.1.2 Moreton Bay Regional Council

An on-line meeting with officers from Moreton Bay Regional Council (MBRC) was held on 8 June 2021.

The following is a summary of the major points of discussion at the meeting with MBRC:

- MBRC maintain three canal systems at Newport Waters, Bribie Gardens and Pacific Harbour. All of these systems have different maintenance requirements. Newport Waters has the greatest maintenance requirements, due to tidal silt transport from Deception Bay. Maintenance within all systems is funded by a levy on waterfront properties.
- Newport Waters has historically had issues with residents not appreciating that their pontoons were originally designed to ground at low tide with the canal at design profile.
- MBRC has prepared a Canal Portfolio Maintenance Plan which is available on Council's website. MBRC has prepared 50 year, fully costed, maintenance plans for each canal system. At the end of each year, resident groups are provided with a copy of the maintenance accounts for their canal systems.

- MBRC have implemented a policy to completely remove vegetation within canals.
- MBRC have established specified intervention levels for maintenance within each canal system.
- MBRC do not have any canals with sand beaches. Any sand beaches were replaced with gravel between 2012 and 2015. This has also assisted to reduce midge breeding.
- MBRC intend to prepare a Canals Handbook similar to SCRC.
- MBRC provide communication with residents regarding canal maintenance via mail and Council's website. MBRC undertakes pre-dredging and post-dredging surveys of each canal system. The surveys are available on Council's website. Payment of dredging contractors is based upon surveyed quantities.
- MBRC does not have a regular top up program for canal beach rock scour protection.

4.1.3 Noosa Shire Council

An on-line meeting with an officer from Noosa Shire Council (NSC) was held on 22 June 2021.

The following is a summary of the major points of discussion at the meeting with NSC:

- NSC has only the canal system at Noosa Sound to maintain. This system only requires dredging to rebuild beach levels, as there is no rock scour protection in front of the revetment walls. Maintenance of the Noosa Sound canals is funded from general rates revenue.
- NSC advised that its general approach is to rebuild canal beaches to a maximum level of RL1.5m AHD, with a one metre wide flat area and a batter with a slope of 1(V):7(H) into the canal. NSC also specifies a maximum volume of sand of 3.5m³ per linear metre to be placed by the dredging contractor at each property.
- The dredging contracts require that bed levels around private pontoons are maintained as part of the maintenance dredging works.
- NSC have, in the past, engaged one of the dredging contractors also used by Sunshine Coast Regional Council. NSC is currently tendering its canal maintenance dredging work.
- NSC also maintains the Noosa Waters lake and parts of the Noosa River foreshore. Maintenance of the Noosa Waters lake is funded by levies paid by lakefront residents.
- NSC relies upon letterbox drops by the canal maintenance contractors to inform residents of planned maintenance activities. There is an active residents' association for the Noosa Waters lake.
- NSC aims to ensure that each property within the Noosa Sound canals and along the Noosa River foreshore, at which beach maintenance is required, is visited by the dredge once every two years. The current average interval between dredging campaigns is approximately 3 to 4 years. The dredging campaigns within the Noosa Sound canals, and along the Noosa River foreshore, take approximately 3 months each to complete.
- NSC does not have a formal policy for the management of vegetation within canals and other artificial waterways, however, it does not place additional sand to canal beaches with already high or grass stabilised beaches.
- NSC advised that they do not have a significant problem with illegal structures within canals and artificial waterways.
- NSC do not undertake terrestrial or hydrographic surveys of their canals.
- NSC advised that they do not experience any significant siltation within their canals and that litter is also not a serious issue.
- NSC maintains records of its waterway maintenance activities using its standard project filing system.

5 Recommendations

The following recommendations draw upon the discussion and analysis presented in the preceding sections and are provided to assist Council in prioritising possible changes to its canal maintenance procedures. The order in which they are presented below is arbitrary.

5.1 Responsibility for Canal Maintenance and Level of Service

It is considered that it would beneficial to all parties if the Council prepared documentation which:

- States in detail the statutory obligations of Council in relation to canal maintenance. These obligations have been set out in this report.
- Sets out the type and frequency of the canal maintenance which will be undertaken by Council as a level of service provided for the rates levied upon canal front properties for that purpose.
- Explains the responsibility of the land owner to maintain the revetment wall and private structures.
- Notes that Council usually would not undertake works of a discretionary nature and, where it does undertake such works, it is not obliged to maintain those works in a particular manner, including for the improvement of aesthetics.

This documentation could ultimately extend to multiple Canal Maintenance Management Plans, each tailored to the requirements of a particular canal system. Alternatively, Council's Local Law structure and planning scheme could be utilised to establish a regulatory and compliance framework covering all of its canal systems. This is the process which has been adopted by GCCC and is likely to more efficient to maintain and administer than the Management Plan approach. It is recommended that Council also considers an approach similar to that implemented by GCCC.

As part of this process, it is suggested that Sunshine Coast Council gives consideration to the preparation of a database showing the original canal design profiles at each property. This database would also include details of the required "top up" levels to be achieved by the dredging contractors, as well as information regarding intervention levels which would trigger maintenance. This would eliminate much of the uncertainty which currently exists among residents regarding maintenance operations.

MBRC has also established specified intervention levels for maintenance within its canal systems.

5.2 Dredging Approvals

It is recommended that Council undertakes a review of its current Environmental Authority for dredging to ascertain if the approved thresholds for the quantity of material permitted to be removed are consistent with current and planned dredging operations. It is also recommended that consideration is given to extending the areas included in the Environmental Authority to include the Wurtulla and Pelican Waters canal systems.

5.3 Dredging Specification

It is recommended that the dredging contract tender documents are reviewed to require tenderers to provide additional data regarding their offered equipment, including typical production rates and operating depth ranges. This is with a view to ensuring that the most effective equipment is chosen, in terms of both cost and the length of time required to complete the dredging program.

It would be beneficial for the dredging specification to provide details for the beach topography to be achieved following dredging and also a documented communication protocol with residents.

It is recommended that the dredging specification also includes requirements in relation to the protection of private structures from damage by dredging equipment, as well as providing clear guidelines regarding the mooring of dredging equipment at private structures.

To enable a broader range of contractors to tender for the canal maintenance works, it is suggested that Council gives consideration to the separation of the tenders for the dredging works and barge based activities such as vegetation removal and the maintenance of rock scour protection.

In considering the capacity of the dredging equipment, it should be noted that there is an upper limit to the size of the dredges which can be used within the canals for beach replenishment, as very high delivery rates will result in much of the placed material running back into the canal, decreasing the efficiency of the operation. This would also result in increased turbidity within the canal. For high dredging rates, the greater volume of return water would also result in increased turbidity. Large dredges would also be affected by their reduced manoeuvrability.

The experience of other local authorities which are required to undertake canal maintenance has provided valuable insight into suitable techniques and equipment.

The dredging equipment used by GCCC is similar to that utilised on the Sunshine Coast, with the majority of the dredging undertaken by a 4 inch dredge and with a cyclone separator used for placement of sand to the canal beaches. A 6 inch dredge is utilised for larger scale dredging. Noosa Shire Council also utilises similar dredging equipment to that utilised by Sunshine Coast Council.

5.4 Finishing of Beach Profiles

It is suggested that Council gives consideration to standardising the finishes of the beach profiles required to be achieved by the dredging contractors by specifying that hand profiling of the dredge-placed sand is not required. This is likely to result in reduced costs and increased efficiency, as has been the experience of GCCC within its canal systems, where the placed sand is permitted to redistribute due to wave and tidal action.

If desired, this approach could be implemented as a trial.

Where GCCC places rock scour protection to beaches in high scour areas or maintains areas of rock scour protection included in the original canal design, the rock is placed to the original design profile and is not overlaid with sand.

It is recommended that Council also adopts a similar approach when maintaining or installing rock scour protection.

As discussed, the cycle time for dredging campaigns could be reduced if the beach levels are not raised to the top of the revetment walls, but to a level closer to the original design levels.

It is also suggested that this approach is implemented by Council as a trial.

5.5 Dredging Turbidity Control

It is recommended that compliance checks are undertaken by Council with respect to the requirements of the dredging Environmental Authority and the dredging specification. If it is found that the specified turbidity control measures are insufficient, it is recommended that enhanced measures are implemented.

5.6 Desilting Operations

Council undertakes a program of removal of silt from canals as discussed in Section 3.2. To ensure that this program is targeted and effective, it is recommended that a program of regular bed surveys of the canals is implemented as outlined in Section 5.12. This should include detailed surveys in the vicinity of stormwater drainage outlet structures and other locations prone to siltation.

The survey data will enable the formulation of a program for the removal of the silt. This is also likely to require sampling and testing of the silt deposits.

The timing of the siltation surveys may initially coincide with the overall canal surveys, but will be required to be adjusted to suit the desilting program. It is suggested that pre and post-desilting surveys are undertaken in a manner similar to the pre and post-dredging surveys.

5.7 Rock Scour Protection

Council manages areas of rock scour protection within the canal profiles to their original design specification. In some cases, additional rock scour protection is placed to areas which experience sand loss which proves difficult to stabilise between maintenance dredging cycles.

These measures appear to be appropriate and successful, and it is recommended that they are continued.

5.8 Vegetation Removal

Council undertakes a program to remove vegetation which sporadically colonises canal beaches.

The placement of sand to high levels on the beaches has also enabled non-marine grass species to become established in some areas, resulting in exaggerated beach profiles, particularly when further stabilisation is carried out by residents.

These areas often detract from the general amenity of the canal and the vegetation has historically been removed by Council when necessary. Observations show that the removal of this vegetation has not been consistent over time and between canal systems.

Other local authorities have adopted the approach of removing all vegetation within their canal systems, as they see this as part of their statutory maintenance obligations.

In areas where beach profiles have become exaggerated due to the historical placement of sand to high levels, and sometimes combined with stabilisation by vegetation, GCCC has adopted an approach of removing the vegetation and using a barge mounted excavator to return the profile closer to the original design.

It is recommended that Sunshine Coast Council adopts a similar consistent approach to vegetation removal throughout its canal systems, with notification to residents where vegetation is well established and has been in place for a considerable period of time. This would improve the aesthetics of some canals and would also release additional sand for beach rebuilding.

5.9 Illegal Structures

GCCC also applies a policy of removing illegal structures within canals prior to maintenance dredging. GCCC view this as part of the obligation to maintain their canals in their “as-designed” condition. Residents are provided with notification prior to the removal of these structures.

It is suggested that Council gives consideration to the implementation of a similar policy under its Local Law structure. This would have a similar effect to that described above resulting from the removal of vegetation and allowing canal beaches to revert to the original design profile.

5.10 Communication with Residents

It is recommended that Council implements a joint communication protocol with the dredging contractors to ensure that the communication process is standardised. This process should also be included in the documentation for the dredging contracts.

It is recommended that standard notification letters to residents are prepared, similar to those issued by GCCC prior to commencing canal maintenance.

5.11 Litter Control

In canal areas which regularly exhibit significant quantities of accumulated litter, Council may wish to investigate the source of this litter and also the effectiveness of any existing litter control measures within the catchment and possible additional management measures which may be warranted.

5.12 Canal Surveys

To ensure that the canal maintenance dredging program is targeted and effective, it is recommended that a program of regular bed surveys of the canals is implemented to identify locations prone to siltation and to formulate a program for its removal. This is also likely to require periodic sampling and testing of the silt deposits.

These surveys would also assist in the monitoring of changes to the canal profile over time and would provide a record of the completed bed profiles after dredging, as well as information on likely source locations for beach replenishment sand prior to dredging.

As an initial guide, it is suggested that pre and post-dredging surveys are undertaken on a staged basis prior to and following the completion of dredging within defined areas of each canal system. These areas and their timing may be determined based upon the area of dredging to be completed within a nominated period of time. Surveys at the commencement and the end of each financial year would align with Council’s budgetary processes.

If the pre-dredging surveys indicate that unusually large rates of sediment accumulation or removal in particular areas, more frequent surveys may be required in these areas.

Both GCCC and MBRC undertake regular surveys of their canal systems. It is recommended that Council undertakes further discussions with both of these local authorities, with a view to the implementation of a survey program for the Sunshine Coast canals incorporating the most appropriate aspects of both approaches.

5.13 Quality Control, Reporting and Data Management

If not already the case, it is recommended that a process, similar to a quality assurance system, is implemented by Council which provides for the following:

- Standardised naming conventions and storage locations for each category of records
- Documented processes of actions required to be undertaken and records obtained, prior to, during, and following canal maintenance activities
- Documented processes for monitoring activities and inspections undertaken by Council and records to be kept
- A standardised reporting procedure to document and evaluate the effectiveness of canal maintenance activities
- A procedure to document and address non-conformances

It is suggested that the implementation of a spreadsheet database, similar to that used by GCCC, is investigated to assess whether this would be useful to Sunshine Coast Council.

5.14 Outcomes from Discussions with Other Local Authorities

The discussions which have been held with other south-east Queensland local authorities, which are also responsible for the maintenance of canals within their local government areas, have provided valuable insights into the canal maintenance activities undertaken in other areas and the approaches which have been adopted for their management.

Consideration of the implementation of a number of these or similar approaches by Sunshine Coast Council has been recommended.

A further beneficial outcome from these discussions has been the desire from all of the local authorities to establish an ongoing working group to discuss and improve the overall approach to the maintenance of canals in south-east Queensland.

A

NOTES FROM MEETING WITH STAKEHOLDERS

Sunshine Coast COUNCIL

Meeting minutes

Canal Maintenance Review – Resident's Consultation Meeting

Venue	Caloundra Administration Building, Beerwah Room, Level 3
Date & Time	Friday 30 April 2021, 9:00am
Facilitator	Michael Anderson (Coordinator Coastal Constructed Waterbodies and Planning)
Minutes	India Smith
Invitees / Attendees	Georgia Keeshan (SCC), Julian Homewood (SCC), Tony Howard (Cardno), Robert Herd, Brian Kesby, Ian Brodie, Bob Carrol, Ivan Wilks, Graham McDonald, Rowan Berney, Graham Gillies, Rhondda Alexander, Stewart Dows, David Netherton, Robert Carswell, Damien Abby, Mary Ann Abby, Warren Bennet, Margaret Weilenmann
Apologies	

Meeting Minutes

Item		Responsible
1	**Welcome and introductions** • Michael Anderson provided introduction including current Covid-19 parameters, evacuation exits and advised meeting is matter of public record (brief on privacy responsibilities on Council's website should you wish to review) • Michael Anderson advised canal maintenance is an emotive issue and we will aim to discuss the following; o Concerns residents would like to bring to the table o How did we get here? Historic review, legal advice, service levels, budget requirements, engineering & DA advice, current service o What are the hotspots from residents in terms of concerns?	Michael Anderson
2	**Cardno to outline project deliverables and Scope of Works** • Tony Howard provided information of his background – Civil Engineer who has spent most of his career working on water related projects. Involved in the design of the Mooloolah River canal systems and flood bypass (Parrearra Lake). • Tony Howard advised Inspections of canals were undertaken from boat last week • Tony Howard provided an outline of project deliverables and Scope of Works which was consistent with the information provided by Council.	Tony Howard
3	**Residents Presentations – Round the Table** • *Robert Herd – Maroochy Canal System* o Advised his concerns in relation to this process is looking at what Cardno is doing and if Cardno are taking into account the legal obligations? o Advised the design profile isn't being maintained by Council o Why or how Council can say that it is complying when the survey shows that it isn't being maintained in accordance with the legislation o Does the brief or scope of works include the examining of the profile which was approved for the design of the canal? o Advised that there were different dredging processes that have been done by the two different companies which was interesting. The first dredging crew manually made the profile of the beach after they heaped the sand against the wall. The crews were changed and all they did was dump sand and nothing was actioned around maintenance of the profile. o Advised major concern is that heaping sand on the revetment wall is a pointless exercise as it washes away and is a band-aid approach o Advised he wants to see the design profile maintained and that Council acknowledges that the design profile is maintained o Advised if the person is responsible for the maintenance of the canal is the developer, Council would be coming down on the developer o Advised confused why Council doesn't see themselves bound by the same conditions • *Brian Kesby – Maroochy Canal Action Group – passed to Ian Brodie*	Residents

- *Ian Brodie – Maroochy Waters*
    - Advised he has prepared a detailed paper and acknowledges that it's great that Cardno are on board
    - Advised 3 points from a technical perspective
    - 1. Design profiles – advised that it's quite clear that the original profiles are not being maintained, that is the crux of the problem, sand has been put on a much steeper profile, fundamental issue
    - 2. Methodology of the dredging – Are the contractors being briefed properly on what they are supposed to do? End result should be meeting the original design profiles. Is the equipment fit for purpose? Some of the dredging equipment cannot reach into the base of the canal to reach the sand, therefore the angle of the suction of the dredge is going to take the sand from the canal edges?
    - 3. Canal structures – concern that private boat ramps are adversely affected as they are not included in the sand replenishment program

- *Bob Carrol – President of Maroochy Canal Action Group*
    - Advised that due to the amenity that we pay for (if you live on the canal area the properties are rated higher), the maintenance budgets should be separated for each canal system so that there is proper accountability for what work is being undertaken in each canal system.
    - Advised it is the responsibility of the companies contracted to Council to provide effective maintenance and therefore it should go back to Council for being ultimately responsible
    - Believes that to achieve maintenance of a premium state, the maintenance must be ongoing
    - Confirmed that the Plumbing and Drainage areas of Council are more than happy to operate and give advice to residents of what they can and can't do, as this adds to the erosion
    - MCAG are working with Council with the view to develop a more user-friendly handbook for residents
    - Bob has high expectations of Council which he does not believe have been met, residents are more than happy to work cooperatively with Council

- *Ivan Wilks – Secretary – passed to Graham McDonald*
- *Graham McDonald*
    - Advised that his canal has more weed, debris and rubbish than most due to the shopping centre next door
    - Advised many people swim in the canal including children, elderly, kayakers, paddle boards, fishing & commercial traffic (cruisers) and specifically at Christmas time there is a huge amount of traffic
    - Requested to see dredging in a timelier fashion, as if it's not dredged it doesn't take long before private pontoons stick on the sand
    - Big problem with drainage caused by developers (new shopping centre extensions) particularly on Sundays there is more brown sludge as developers are trying to get around the process and pumping into the canal when nobody is watching
    - Water is being pumped into canal could be contaminated. Graham advised this could be a big problem for Council in the future
    - Long term anchoring of vessels – this is supposed to be controlled however seeing more anchoring at Laurie's Marina
    - Midge control – is there any plans? This is an item Graham requested to be addressed in the canal review

- *Rowan Berney – Resident of 33 Aroona Ave since 1993*
    - Advised of seemingly poor distribution and fore knowledge for this review
    - As Cardno were involved in hydraulic and scientific analysis (Minyama canal systems), Rowan would like to think that Cardno would have access to the scientific analysis from 30-40 years ago, presumably the studies are still relevant, this is an important aspect
    - The potential impact on ratepayers of any shifting of responsibility from Council maintaining infrastructure on the canals to the resident
    - Safety aspect of vessels in the canal systems – commercial operators, swimming, boating, kayaking. Infrastructure and tourism associated with Mooloolaba Harbour
    - Rowan does not want this to degenerate into a petty debate about who pays for what in regard to canal maintenance costs

- The small-scale dredging operations which we've has for decades, the same dredging happening since 1993 only less frequently. Time for investment to do the dredging and Council should be supporting
- Hope of Cardno to have in Scope of Works – stormwater discharge in Myuna canal, low tide chance of erosion and scouring is considerably high. That is why Rowan would like to think that Cardno will have access to the scientific analysis that goes right to the point of what can be discharged

- *Graham Gillies – Currimundi Lakefront resident*
  - Graham believes the lake is impacted by the canal system and therefore should be as one system and as such anything that is done in the canals affects him, advising all problems in Currimundi Lake commenced when the canals were first constructed
  - Data collecting – advised he would be surprised if Cardno don't find that there is a lack of data as he has been asking engineers to give surveys to Council on the lake and the canal to have a look at erosion of siltation
  - Silt from canals are coming down onto the foreshore of the lake, where any dredging has been done it's going on top of the mud that's there, hiding the problem not eliminating the problem
  - Flooding – catchment has been hardened which greatly increases runoff and speed of runoff, combined with the sediment dropped into the lake gives Graham real concerns. The lake has silted up massively
  - Erosion in sections because of volume of water coming down, trying to force much greater volumes of water through existing channels
  - Water quality – Council monitors water quality every 2-3 months (Georgia confirmed). Request for trend by eliminating any extraneous things like flooding and rainfall events or lake closures or anything else that makes a difference to water quality
  - If dredging is done in canals, Graham advised it should be done in the lake as it's more relevant in lake then canals

- *Rhondda Alexander*
  - Rhondda advised she does not have much to say except that whatever is done in the canals affects Currimundi Lake
  - The water goes through Currimundi Lake and into the ocean and therefore has concerns about the ocean

- *Stewart Dows – Hideaway Canal resident*
  - Advised after speaking with locals in the area, they feel like they are being left behind, however when listening to other residents he feels that they have the same problems as others
  - Request for education of speed limits in the water for people driving boats
  - Safety issue at Cootamundra Drive Bridge – kids jumping off of bridges. Occasionally kids dumping things into canals (bikes etc) is a problem. Kids also complain of mud on their feet when hitting the bottom. Can a sign be erected? Georgia advised you are not allowed to dredge under bridges due to safety of the bridge piles.

- *David Netherton – Resident of Buddina*
  - David advises he has seen a change in how quickly the sand does go
  - David's 3 boys spend a lot of time in and around using the canal (swimming) – environmental health of the canal is a big concern
  - Stormwater outlet – New development for Kawana being proposed, as we get more development and traffic in the area there will be more rubbish and sludge in the bottom of canal

- *Robert Carswell*
  - Quality of the water – as you get to the shopping centre there is no filtration and more amounts of brake dust and rubber
  - When canals were built there was no sand there, all the sand came from what was built up, no natural sand
  - Robert advised he is required to hose his lawn on a weekly basis
  - Use of dredging equipment is increasing the siltation in the bottom of the lake
  - Stormwater drains are discharging a lot of silt into canals which includes the break dust etc

	○ Sand flies – Robert advised *"you could put a saddle on them and ride them now"* • *Damien Abby – passed to Mary Ann Abbey (mother)* • *Mary Ann Abbey – lived in area for 10 years (provided the attached PowerPoint)* ○ Infrequency of dredging, people can't get there vessels out which is a problem – consequences are that boats are beached, and causes damage to pontoons ○ Mary Ann advised she called Council and requested dredging to rectify and was told they are not entitled to this at the time and that it will occur every 5 years ○ Quality assurance – Mary Ann advised Council is not visible to the residents, questioned if they could stop and speak to some of the residents? Did they go at high tide or low tide? Requested to please consider tides to make it more beneficial to Council • *Warren Bennet – Resident of 34 Aroona Ave, bought property in 2002* ○ Questioned if the current dredge is fit for purpose? ○ Advised Damien and Warren himself looked at alternative arrangements for dredging of sand – suggestion is an Auger Dredge which is contained so sludge being stirred up is not mixed with the water. If they could do 110 cubic meters per hour which would be great. Geotech bags could be used for the sludge to be pumped out. Reiterated that there are other options than what we have ○ Development of the new movie theatre and builds thereabout – advised there was no Council input into looking after the material that was being put back into the canal on a regular basis ○ Questioned where does the stormwater go? Warren advised he asked and Council advised it is held on site however Warren was not allowed to view ○ Development of apartment block – installed filters to filter water, Warren attended when heavy rainfall and confirmed the filters could not handle and was therefore running straight into stormwater drain ○ Council Legislative requirements – Questioned who is responsible for incident that happened in the canal? Advised Council should take hold of responsibilities for the contractor of which they have employed • *Margaret Weilenmann* ○ Advised problems with water quality in Currimundi Lake ○ Noel Burns Park – problems of speeding of boats which has taken away a lot of natural trees along lake area ○ Margaret advised rubbish is a huge issue – Every time Margaret walks her dog there is problems with fishing line dropped everywhere and animals are getting caught, fishing hooks are being stepped on ○ Advised that residents don't look after their drainage systems, creating dirty and filthy environments for animals – residents say it is Council's requirement ○ People who mow their lawn blow the grass into the streets and don't collect which then goes into drains including whipper snipper cords ○ Advised people are pushing the above rubbish into drains therefore people need to be responsible to pick up rubbish, lawn clippings, leaves etc ○ Confirmed sludge has been happening since 70's an 80's	
4	**Q&A** **Q1.** Original design – Scope of Works – Bridge was intended to go over Wingara instead of roadway – If the original bridge had been put in would it let water flow straight through? Why were the 2 proposed bridges in Minyama not built? **A1.** Tony Howard advised that they did large scale model of canal system to determine tidal flows in Mooloolaba system and associated canals. His recollection was that the bridges were included in the marketing material but were not part of the final design due to hydraulic issues created when canal systems had been built through to connect Currimundi & Mooloolah River **Q2.** Will reinstatement of profile help eliminate the sludge issue and midge issue?	Residents, Michael Anderson, Tony Howard & Georgia Keeshan

A2. Any tidal beach area is likely to be subject to midge breeding unless control put in place – there is no engineer solution for midges.
Tony advised by product of urban development is stormwater runoff with associated contaminants; more frequent surveys of sampling may address some of these concerns.
Michael advised residents' comments about siltation due to stormwater inflows will be included in review. Midges issues will be directed to Healthy Places, and compliance with water quality parameters will be directed to DA for new developments. The coastal team will deal with the end result of siltation in canals.

Q3. Request for commitment that Currimundi Lake to be included in the review?
A3. While the feedback from this process will be highlighted, actions for Currimundi Lake will not be included in this review as there are under a different management regime which includes regular meetings with Cr Cox as part of that process, Michael advised he does not want to duplicate. That Currimundi Lake is connected and impacted by canal management is acknowledged but won't be directly included in the review.

Q4. Will the desilting component be included in the review?
A4. Yes siltation of the canal and the management of the desilting program will be included in the review

Q5. Will Lake Kawana be excluded from the review?
A5. Yes.

Q6. Maroochy Waters canal entrance, entry exit from canal, very shallow, is this a part of the review?
A6. Yes entrance channel maintenance will be included in the review. The Act states this is a responsibility of Council

Q7. Best practice – Cost efficiencies of dredging programs drilled down to in report?
A7. There will be 2 components of the dredging program included in the review; Councils legislative responsibilities, and if amenity value of canal is sufficient for increase service levels. Confirmed amenity aspects will be included in report.

Q8. Will submissions be made available to the group/attendees?
A8. Yes.

Q9. Poor outcomes from replacing sand with rock on the profile, hoping that this would not happen?
A9. Michael is suggesting that there is no intent at this stage to replace the rock however we do occasionally offer that to residents that can't keep sand profile and where it inherently benefits the delivery of Council's maintenance program.

Q10. Every year the Maroochy Canal System is told that the dredge isn't coming because we've ran out of money – is this in the scope of works as to why? Is council not allocating enough money? Will budgets considerations and subsequent service levels be included in the report? Is this something Cardno are looking at as the reason why?
A10. Tony advises he doesn't believe the scope includes budgets but will be looking at service levels.
Q11. Is Safe navigation part of Council's obligations of maintenance of canals?
A11. Yes, Council has provided Cardno with the declared access channels.

Q12. What are you going to do about midges?
A12. Taken on advisement, will pass on to Healthy Places who are the responsible team for this issue.

Q13. Legislative requirements – Councils duty of care to residents – Do contractors have the same duty of care to the residents?
A13. The dredge contractor responsibilities point has previously been made and will be included in the review.

APPENDIX

B

CANAL SYSTEM PLANS

DATE PLOTTED: 19 July 2021 4:31 PM BY - AARON ELLARD

0 50 100 150 200 250m

SCALE 1:2500 @A1

XREF's:
CAD File: P:\204295 SCRC Canal Maintenance Review_DESIGN\ACAD\Figures\204295-FIG-001 MAROOCHY WATERS.dwg

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nearmap
IMAGE SUPPLIED BY NEARMAP DATED:
26/03/2021

NORTH

SUNSHINE COAST REGIONAL COUNCIL
SCRC CANAL MAINTENTANCE REVIEW

MAROOCHY WATERS CANAL SYSTEM

Date	Scale	Size
14/05/2021	AS SHOWN	A1

Drawing Number	Revision
204295-FIG-001	1

DATE PLOTTED: 19 July 2021 4:32 PM BY - AARON ELLARD

0 50 100 150 200 250m

SCALE 1:2500 @A1

XREFs:
CAD File: P:\204295 SCRC Canal Maintenance Review_DESIGN\ACAD\Figures\204295-FIG-002 TUCKERS CK.dwg

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NORTH

SUNSHINE COAST REGIONAL COUNCIL
SCRC CANAL MAINTENTANCE REVIEW

Date	Scale	Size
14/05/2021	AS SHOWN	A1

MOOLOOLABA CANAL SYSTEM

204295-FIG-002	1
Drawing Number	Revision

DATE PLOTTED: 19 JUN 2021 4:31 PM BY: AARON ELLARD

0 50 100 200 300m

SCALE 1:3000 @A1

XREFs:
CAD File: P:\204295 SCRC Canal Maintenance Review\ DESIGN\ACAD\Figures\204295-FIG-003 MINYAMA.dwg

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SUNSHINE COAST REGIONAL COUNCIL
SCRC CANAL MAINTENTANCE REVIEW

MINYAMA CANAL SYSTEM

Date	Scale	Size
14/05/2021	AS SHOWN	A1

Drawing Number	Revision
204295-FIG-003	1

DATE PLOTTED: 19 July 2021 4:29 PM BY - AARON ELLARD

0 50 100 150 200m

SCALE 1:2000 @A1

XREFs:
CAD File: P:\204295 SCRC Canal Maintenance Review\ DESIGN\ACAD\Figures\204295-FIG-004 HIDEAWAY CANAL.dwg

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SCRC CANAL MAINTENTANCE REVIEW

HIDEAWAY WATERS CANAL SYSTEM

Date	Scale	Size
14/05/2021	AS SHOWN	A1

Drawing Number	Revision
204295-FIG-004	1

DATE PLOTTED: 19 July 2021 4:29 PM BY - AARON ELLARD

0 50 100 150 200 250m

SCALE 1:2500 @A1

XREFs:
CAD File: P:\204295 SCRC Canal Maintenance Review_DESIGN\ACAD\Figures\204295-FIG-005 WURTULLA CANAL.dwg

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SCRC CANAL MAINTENTANCE REVIEW

WURTULLA CANAL SYSTEM

Date	Scale	Size
14/05/2021	AS SHOWN	A1

204295-FIG-005	1
Drawing Number	Revision

DATE PLOTTED: 19 July 2021 4:31 PM BY - AARON ELLARD

0 50 100 200 300m

SCALE 1:3000 @A1

XREFs:
CAD File: P:\204295 SCRC Canal Maintenance Review_DESIGN\ACAD\Figures\204295-FIG-006 PELICAN WATERS.dwg

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IMAGE SUPPLIED BY NEARMAP DATED: 26/03/2021

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SUNSHINE COAST REGIONAL COUNCIL
SCRC CANAL MAINTENTANCE REVIEW

PELICAN WATERS CANAL SYSTEM

Date	Scale	Size
14/05/2021	AS SHOWN	A1

Drawing Number	Revision
204295-FIG-006	1