Independent Review of the Current and Future Management of Water Assets in the Geographe Catchment, WA

Summary of issues

Professor Barry T Hart

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Summary

This Issues Paper is a progress report by Professor Barry Hart, Director of Water Science Pty Ltd, who has been engaged by the Western Australian Department of Water to undertake this independent review of the management of water assets in the Geographe Catchment.

The Issues Paper is intended to provide the community and the key agencies with confidence that the independent review is underway and progressing well.

It contains a summary of the stakeholder discussions and key issues identified by the community and key agencies to date, and conveyed to Professor Hart when he visited the Geographe region 13-18 November 2013. Some initial impressions, and the areas where Prof Hart is seeking additional information and undertaking further analysis are also documented.

Prof Hart welcomes comments on any of the issues identified in this document. Please send comments to barry.hart@waterscience.com.au or mail to PO Box 2128, Echuca 3564.

It is intended that a formal Discussion Document will be released in late January 2014, with 2 weeks allowed before Prof Hart makes his second visit to the region for a further round of discussions.

A final report will then be prepared for submission to the Minister for Water in early March 2013.

1. Introduction

The Lower Vasse River, Toby Inlet and the Vasse-Wonnerup Wetlands have experienced poor water quality over the past 20 years, with persistent blue green algal blooms and occasional fish kills. Over the last 12 months, community and local government concern about the poor water quality has increased, particularly in the aftermath of a major fish kill event in the Vasse-Wonnerup Wetlands in April 2013.

State and Commonwealth governments initiated and funded the development of the Vasse-Wonnerup Wetlands and Geographe Bay Water Quality Improvement Plan (WQIP, DoW 2010), which provides a whole-of-catchment approach to improving water quality. The WQIP contains good information on the main sources of nutrients (the main cause of the poor water quality), the high priority management actions to reduce these nutrient loads, and targets to be achieved over the first 10-years and then beyond.

Although there has been considerable on-ground action aimed at introducing Best Management Practices in agricultural areas, not surprisingly water quality still remains a major concern across the Geographe catchment. The experience in other regions of Australia and overseas is that it takes considerable time and investment to reduce nutrients from agricultural catchments – there is no 'quick fix'.

In response to community concern, the Minister for Water, the Honourable Terry Redman MLA, announced the decision to undertake an independent review of waterways management efforts in the Vasse-Wonnerup Wetlands and Geographe catchment in August 2013. This recommendation was supported by an interagency workshop, coordinated by the Western Australian Government Department of Water (DoW) in May 2013, as a critical step towards improving water quality management in this catchment.

Professor Barry Hart, Director of Water Science Pty Ltd, was engaged by DoW in October 2013 to undertake this independent review of the management of water assets in the Geographe Catchment.

The Terms of Reference require the review to focus on governance structure and management priorities within three areas:

- Management of the Vasse-Wonnerup Ramsar Wetlands,
- Overall water quality management of the catchment contributing to Geographe Bay, and
- Water quality management of local waterways, including the Lower Vasse River, Vasse Diversion drain and Toby Inlet.

The outcomes of this review are expected to provide:

- An evaluation of the current roles and responsibilities of key organisations involved in managing the above assets, which identifies the positive and negative aspects of the current governance frameworks,
- Recommended options for alternative governance model(s) and management arrangements for future management of the three areas of this review, which may include a lead agency for each asset type, management body (with or without statutory responsibility), or an alternative model, and
- Priority actions to improve the management and condition of the three areas.

2. Phase 1

Professor Hart visited the Geographe region in the period 13-18 November 2013 to hold talks with key stakeholders[1] and to visit the key water-related assets in the region. He also held an open community forum on the evening of 14 November 2013.

This document is intended to provide the community and the key agencies with confidence that the independent review is underway and progressing well.

Information is provided on the key issues identified by the community and key agencies to date, some initial impressions and the areas Prof Hart is seeking additional information and analysis. The discussion on the issues is grouped geographically.

Comments on any of the issues identified in this document are welcome. Please send comments to barry.hart@waterscience.com.au or mail to PO Box 2128, Echuca 3564.

It is intended that a formal Discussion Document will be release late in January 2014, with 2 weeks allowed before Prof Hart makes his second visit to the region for a further round of discussions.

A final document will be prepared for submission to the Minister for Water in early March 2013.

3. Issues

3.1 General

Issues

- The Terms of Reference for this independent review require that the current roles and responsibilities of key organisations involved in managing the water-related assets in the Geographe Catchment are evaluated.
- From discussions with community groups and agencies, four broad issues have become obvious:
  - There is confusion over the organizational roles and responsibilities concerning the planning and management of the water-related assets in the Geographe Catchment. No one agency has taken the responsibility for the overall planning and management, but some agencies have relevant powers in a legislative sense and some agencies have legal responsibilities over some aspects.
  - There may be a need for an overall coherent Management (Action) Plan for managing all the water-related assets in the Geographe Catchment. The current WQIP is an excellent start, but is focused largely on nutrient reductions and does not include the detailed management of either the Vasse-Wonnerup Wetlands or Toby Inlet.
  - However, given the current situation, even if an overall Management (Action) Plan is recommended it must involve both long-term actions (e.g. reduction of

[1] Included: Department of Water, Geographe Catchment Council, Murdoch University, University of Western Australia, Dept Parks and Wildlife, City of Busselton, Shire of Capel, Busselton Wetlands Group, Water Corporation, Agriculture and Food, Busselton Water Corporation, South West Catchment Council, Toby Inlet Catchment Group

nutrient loads from agricultural activities and urban areas) and short-term emergency actions (e.g. mitigation of fish kills in the Vasse-Wonnerup Wetlands),

- Despite the fact that both State and Federal governments have provided funding for the implementation of the WQIP and other natural resource management actions in the region, this appears to be insufficient investment to achieve the expected changes in water quality over the next 10 years.

Additional work

- Work will be done to scope alternative governance model(s) and management arrangements for future management of the two broad areas of this review (the Vasse-Wonnerup Wetlands, and the overall water quality management of the catchment including local waterways).
- Options may include: (a) a lead agency for each asset type, (b) a single management body (with or without statutory responsibility, such as the Victorian Catchment Management Authority model), or (c) an alternative model.
- The Discussion Document in January 2014 will provide information on possible options for the community and agencies to comment upon.

3.2 Geographe Catchment

Description

- The Geographe Catchment occupies an area of approximately 2000 km^2 between Bunbury and Cape Naturaliste. The catchment is bounded by the Darling Range, the Whicher Range and the Leeuwin-Naturaliste Ridge.
- Below these ridges is the southern-most part of the Swan coastal plain extending south and west to Dunsborough. This coastal plain is characterised by predominantly sandy-loam soils as well as poorly drained flats and wetlands. It has been extensively cleared and developed for agriculture and is becoming more urbanised, particularly Busselton.
- Much of the catchment is used for agriculture, mostly dairy production and beef cattle grazing.
- These agricultural activities contribute a large amount of nutrients (mainly P and N) to the local waterways, the Vasse-Wonnerup Wetlands and Geographe Bay. The main activities contributing nutrients include: dairy shed effluent, fertilizer use, grazing and un-sewered urban areas.
- A number of Best Management Practices (BMP) has been identified, which if fully implemented, would reduce the nutrient losses from agricultural land and urban areas.
- The Geographe Bay region is typical of many rural areas in Australia where the major land use in the catchment is productive agriculture, while downstream the increasingly urban population (Busselton) is focused on tourism and recreational use of aquatic assets (Geographe Bay and the Vasse-Wonnerup wetland in this case) that can be adversely impacted by upstream pollution. This dichotomy is not an easy one to manage and generally requires the community to accept some ‘trade-offs’.

Issues

Water Quality Improvement Plan

- A Water Quality Improvement Plan (DoW, 2010) has been developed for the Geographe Catchment, the Vasse-Wonnerup Wetlands and Geographe Bay. This Plan is very good in that it identifies the main problems (excess nutrients from the agricultural activities entering the Vasse-Wonnerup Wetlands and Geographe Bay) and the actions required to reduce these nutrient inputs (introduce Best Management Practices (BMP)). It also provides targets for the reductions in TP and TN loads required to meet the water quality objectives for the Vasse-Wonnerup Wetlands (and Geographe Bay).
- However, despite the progress in implementing some of these BMPs (and an evaluation of this progress is needed as a priority), it will take decades for these catchment nutrient sources to be sufficiently reduced. There will always be nutrients contributed from agricultural catchments and increasingly from urban areas as the region further develops.
- To achieve a healthy Vasse-Wonnerup Wetland ecosystem, the WQIP indicates that total phosphorus (TP) concentrations in the streams entering the wetlands should be less than 0.1 mg/L and total nitrogen (TN) concentrations should be less than 1.0 mg/L. Currently, there are no nutrient targets for the actual Vasse-Wonnerup Wetland system.
- Water quality modeling of runoff from the catchment indicates that to achieve these targets, the annual load of TP and TN entering the wetlands each need to be reduced by around 40% of the current loads (15.6 tonne and 53.4 tonne respectively). However, it was decided that this was unachievable in the short-term and interim reduction targets have been established, which require a reduction of 23% in the TP load and 19% in the TN load over a 10-year period.
- The bottom line is that 'clean-up' of agricultural land is difficult, needs a long-term commitment and is costly. It must be recognized that reducing the downstream eutrophication (excessive aquatic plant growth) problems will not occur overnight, and that there will be the need for 'symptom' management of the Vasse-Wonnerup Wetlands, and the Lower Vasse River, in the short to medium term.

Implementation cost

- The WQIP recommended that an annual capital cost of $1.6 million over 10-years to implement BMPs to achieved the interim targets, but it appears that the actual investment in implementing the WQIP has been considerably less than this amount.

Effectiveness of the BMPs

- The Department of Agriculture and Food (DAFWA) have conducted a considerable amount of research on the identified BMPs (e.g. riparian buffers, fertilizer management, soil amendments and dairy shed management).
- The evidence from these DAFWA studies suggests that the effectiveness of many of these BMPs in reducing phosphorus loss from agricultural land may be less than generally assumed (Rivers et al., 2013).
- This information is concerning, since it suggests that even if the various BMPs were largely adopted (and the evidence suggests this will be difficult without either large incentives or mandated requirements), the required reduction in phosphorus loads entering the Vasse-Wonnerup wetlands may be difficult to achieve (Gourley and Weaver, 2012).

- However, DoW do not agree with this conclusion, since their numerical modeling shows that the P-reduction targets are achievable if all actions recommended in the WQIP are undertaken.

Uptake of the BMPs

- Currently, the uptake of BMPs by farmers is voluntary, although there is considerable advice provided by DAFWA and GeoCatch, and a variety of incentive packages through natural resource management (NRM) programs.
- There is no major and consistent program of incentive payments currently available to assist farmers to introduce BMPs. They must rely on State and Federal NRM programs for support.
- Additionally, there appears to be no regulation (or enforcement) that requires farmers to contain and treat polluted runoff from dairy sheds or to keep cattle out of waterways.

Drainage network

- The drainage network in the Geographe Catchment is old and poorly maintained by the Water Corporation, largely because farmers (the beneficiaries) are now not required to pay a drainage levee.
- Additionally, the drains are largely single purpose, i.e. to transport water from agricultural land to prevent flooding. There is no requirement for these drains to achieve a certain water quality.
- It is possible that at least part of the drainage network could be managed differently, such that the drains are 'multi-purpose', being managed to also remove nutrients.
- There is a need for the management of this drainage network to be reviewed, given that it is old, was developed in a different era, and in the next decades will need to be able to handle changes to the climate, particularly increased incidences of flash flooding in the summer. I understand that DoW are currently undertaking a review of drainage issues statewide.

Additional work

- Obtain information on the implementation success of the WQIP to date, particularly related to: (a) the level of funding for implementation of the WQIP, (b) water quality monitoring that has occurred over the past 3 years, (c) progress towards the nutrient reduction targets, (d) progress towards implementation of the recommended BMPs, and (e) the effectiveness of the GeoCatch and DoW partnership.
- Further evaluate the DAFWA and DoW evidence on the relative effectiveness of the available BMPs.
- Obtain information on the Statewide review of drainage being undertaken by DoW, and determine whether it is considering what might be done to make the current drainage network more effective at reducing nutrients, in addition to its flood protection and land drainage functions.
- The clean-up costs recommended in the WQIP seem low, although these only reflect the capital costs of implementing the BMPs. DoW has indicated that they have an improved cost-benefit method and this will be applied to update the figures for the Geographe Catchment. Additionally, I will investigate the application of other methods for assessing the costs to achieve the recommended TP and TN reduction targets (e.g. the INFFER method use to

assess the costs to achieve the TP reduction targets for the Gippsland Lakes in Victoria (Roberts et al., 2012)).

1.2 Lower Vasse River in Busselton

Description

- The Lower Vasse River flows through Busselton and is maintained as a lake by a set of barriers located at the Butter Factory.
- The Vasse River only flows during winter (June through to November), with no flow in summer.
- Even during winter the Lower Vasse River is poorly flushed because of the very low gradient – the region is very flat.
- The Lower Vasse River is eutrophic and regularly experiences algal (*Microcystis*) blooms over most of summer, which reduce the amenity value of the river and cause offensive odours.
- It should be noted that the water quality problems experienced in the Lower Vasse River are largely the result of it being dammed up to form a 'lake' in the township region, presumably for aesthetic reasons. If it were not artificially backed-up, the river would be dry during summer and there would not be any algal problems.

Issues

- There does not appear to be a coherent Management Plan for the Lower Vasse River and particularly the 'lake' section. Such a Management Plan would need to address the dual objectives of achieving good water quality in the 'lake' section, while also preventing flooding in Busselton.
- There appears to be some confusion over who is 'responsible' for management of this system. Currently, both the City of Busselton and DoW appear to be involved, but with DoW more focused on reducing nutrients from the broader Geographe Catchment (and protecting Geographe Bay) than on the 'lake'.
- Questions have been raised over the proportion of flow that goes down the Lower Vasse River compared with that down the Vasse Diversion Drain, suggesting that if there were more flow at critical times down the river, the algal problems in Busselton may be less. The relative flow is controlled via a diversion culvert that can let water into the Lower Vasse River. However, currently most flow goes down the Vasse Diversion Drain. Additionally, there appears to be some confusion over who has the responsibility for making decisions on the relative flows and for operating the diversion culvert valve.
- There have been experiments to reduce the nutrient concentrations in the Lower Vasse River and reduce the possibility of algal blooms. For example, in 2001-2002 DoW ran an experiment using 'Phoslock' a clay-like substance that adsorbs phosphorus. This was very effective in reducing the P concentration, but only lasted until the next rain when high nutrient flows entered the Lower Vasse River (Robb et al., 2003).
- Currently, the City of Busselton is experimenting with three nutrient-reduction methods – floating islands of macrophytes, nano-clay, and a bacterial water cleanse method. The issue is will they work and are they cost-effective?

Additional work

- Consider the development of a Management (Action) Plan for this system – What should be in it and who should have responsibility?
- Assess the effectiveness of possible 'technological' actions/options to reduce nutrient concentrations in the 'river pool' during the summer period. Note that a less costly Phoslock-like product may be available in the near future for this purpose.
- Obtain information on whether there is advantage in allowing more flow to travel down the Lower Vasse River at critical time, rather than the Vasse Diversion Drain (noting that prevention of flooding in Busselton is a primary requirement).
- Obtain information on the operation of the Vasse diversion valve - who controls it and what are the criteria for opening or closing?
- Assess other options to manage this system more effectively, e.g. diversion of the Busselton treated wastewater from the Vasse Diversion Drain to the Lower Vasse River at critical times.

1.3 Vasse-Wonnerup Wetlands

Description

- The Vasse-Wonnerup wetlands are located east of the township of Busselton in the South-West Region of Western Australia. Originally the wetlands consisted of two estuarine basins, the Vasse and the Wonnerup, which discharged directly to Geographe Bay. There were several rivers, the Capel, Ludlow, Abba, Sabina, Vasse and Buayanup that flowed into these estuaries.
- However, since the early 1900s the wetlands have been extensively modified by an artificial drainage network, so that now the wetlands consist of two fresh to brackish lagoons separated by two sets of floodgates, which regulate water levels, exclude seawater and minimise flooding of the adjoining lands and Busselton township (Lane et al., 2011).
- The hydrology of the wetlands was further modified by diversion of part of the Sabina and Vasse Rivers directly into Geographe Bay via the Vasse Diversion drain, and discharge of the Buayanup River directly into Geographe Bay.
- The Vasse-Wonnerup Wetlands have experienced severe nutrient problems for many years including sudden mass fish deaths, blooms of macroalgae (e.g. *Ulva*, *Rhizoclonium*), toxic phytoplankton blooms (e.g. *Microcystis*), nuisance odours and mosquito problems (DoW, 2010). The nutrient enrichment is the result of catchment agricultural land uses (principally dairy and beef cattle grazing) and point sources of septic tanks and dairy sheds. Additionally, the reduced flushing of the wetlands caused by the river diversions has set up the conditions for increased macroalgal and phytoplankton growth.
- The Vasse-Wonnerup wetlands were listed as a Ramsar site in June 1990, largely on the basis that they are an important habitat for waterbirds (WRM, 2007). These wetlands feature tens of thousands of resident and migratory birds of a wide variety of species and the largest regular breeding colony of Black Swan in South-Western Australia (Lane et al., 2007). The diversity and abundance of waterbirds, is dependent on aquatic plants, in particular macrophytes such as *Ruppia* and *Lepilaena*. It is crucial that the quality of this food source be maintained if waterbirds are to be conserved on the wetlands (Chambers et al.,

2011).

- Research undertaken by Murdoch University (Chambers et al., 2011) has shown that the Vasse-Wonnerup Wetlands have high biodiversity and ecological values, despite their high nutrient status. But, the researchers warn that these wetlands are in a transition zone between macrophyte (good) and phytoplankton (bad) dominance – they are close to a tipping point (Chambers et al., 2013).
- Importantly, despite the fact that the Vasse-Wonnerup Wetlands are a Ramsar site, and contain high biodiversity and ecological values, the community generally does not seem to know about them or to value them. But they do know and value Geographe Bay.
- The community seems focused on the problems (e.g. fish kills) rather that on the proper management of these wetland systems for their ecological and biodiversity values.

Issues

Problems with the wetlands

- The Vasse-Wonnerup Wetlands are eutophic with high nutrient concentrations. These nutrients come from the inflow of the Vasse, Sabina and Ludlow Rivers during winter, from the sediments and from grazing of the wetlands themselves.
- These high nutrient concentrations are resulting in increased growth of macroalgae, e.g. *Ulva*) and at times toxic blue-green algae. These are unsightly and cause additional problems when they die.
- The wetlands are poorly flushed, with essentially no flow occurring during the summer period when most plant growth occurs.
- The Vasse Wetland in particular has accumulated large amounts of organic sediment in the region close to the floodgates, which are a source of nutrients and may also assist in drawing down the dissolved oxygen concentration (Tweedley et al., 2013).
- There have been fish kills due to deoxygenation of water column when macroalgae and phytoplankton die. The most recent fish kill was in April 2013.
- At times there are obnoxious odours (H_2S?).
- All wetlands in the region are breeding grounds for mosquito's – there is a high incidence of Ross River virus, at least in Capel Shire.

Management Plan

- While the WQIP includes a strategy for managing the nutrients in each sub-catchment, there is no plan or clear set of objectives that specifically focuses on the broad range of issues required to effectively manage the Vasse-Wonnerup Wetlands.
- There appears to be a need for a more comprehensive management plan for the Vasse-Wonnerup Wetlands, which would focus on broader management objectives, such as biodiversity, water bird habitat, recreation, aesthetics and flood protection.

Short-term solutions

- Many solutions have been suggested by community members to 'solve' the fish kill problem at least in the short-term.
- These include: dredging the sediments and 'resetting' the wetlands, operating the floodgates and the opening of the Wonnerup Estuary to the ocean such that

oxygenation marine water enters the wetlands at times when O_2 levels are dropping, modifying the floodgates so that fish can move freely between the wetlands and the 'Deadwater' on the ocean side of the gates, adding a fish ladder to the floodgates, and establishing an oxygenation plant at the floodgates to oxygenate the water when levels are dropping - this already occurs in the Swan River estuary where DoW operates two oxygenation plants.

Emergency response

- The community is concerned that the agencies emergency response action plan to avert fish kills has been poorly coordinated, with no obvious lead agency.
- The community noted that an earlier emergency response action plan MOU, developed by the Vasse Estuary Technical Working Group (VETWG) in 2004, was not signed by all responsible agencies.
- A new *Fish Kill Mitigation and Response Plan for 2013-14* has been developed by the responsible agencies (Department of Water, Department of Parks and Wildlife, Department of Fisheries, City of Busselton, Water Corporation).
- This plan seeks to monitor key indicators (e.g. water levels, dissolved oxygen levels, environmental conditions) that can indicate the likelihood of a fish kill occurring, and to then take appropriate action to prevent this occurring. Actions include increased frequency of monitoring, opening the Wonnerup inlet bar, opening the fish gate penstock in the floodgates, and installing pumps to circulate the water.
- DoW has taken on additional responsibilities and will lead the response during 2013-14 until the outcomes of the independent review are completed.
- Climate change in the region appears to be increasing the occurrence of high intensity summer rainfall. This summer rainfall, with an inflow of nutrient-rich runoff, often occurs before fish kill events and this increases the difficulty of 'preventing' these events.

Longer-term solutions

- The long-term solution to the issues plaguing the Vasse-Wonnerup wetlands is to significantly reduce the loads of P and N entering them from the catchment. However, as noted above this is difficult, costly and a long-term task.
- And because of the difficulty in reducing nutrient concentrations from the catchment, it is likely that there will need to be an annual response plan in place for many years.
- It would seem sensible if this annual response plan was part of a large Vasse-Wonnerup Wetland Management Plan.

Additional work

- Investigate the feasibility of developing a long-term Management Plan for the Vasse-Wonnerup wetland system, including what organisation or management body should be responsible and what legislative requirements might be required.
- Monitor the operational success of the new Emergency Response Action Plan during the 2013-2014 summer period.
- Investigate options to get greater freshwater flows into these wetlands, possibilities include:
  - Vasse – modify the operation of the River/Diversion drain so that more flow goes down the Vasse River at key times, also possibly divert wastewater flows from the Vasse Diversion Drain to the river at times of need,

  - Wonnerup – re-engineer the Capel River so that some flow is directed to the upper section of the Wonnerup Wetlands (currently all the flow goes directly to Geographe Bay). It has been suggested that this could be partially achieved by opening up the weir gates to send freshwater down the drains. This is done during summer to flood-irrigate pasture areas and with some minor modifications to the drain network, could possibly be increased to the Wonnerup Wetland.

- Identify what needs to be done to scope a study to investigate the feasibility, cost and effectiveness of possible solutions to minimise the fish kill problem, e.g. dredge the sediments and 'reset' the wetlands; operate the floodgates and opening to the ocean such that oxygenation marine water enters the wetlands at times when O_2 levels are dropping; modify the flood gates so that fish can move freely between the wetlands and the 'Dead Water' on the ocean side of the gates; establish an oxygenation plant at the floodgates to oxygenate the water when dissolved oxygen levels are dropping.

Toby Inlet

Description

- Toby Inlet and its catchment are located at the western end of the Geographe catchment, close to Dunsborough. The Inlet is a narrow shore-parallel inter-barrier lagoon, which is separated from the ocean by high beach ridges, and is highly valued for its recreational and aesthetic values. It is approximately 4 km long.
- The hydrology of Toby Inlet has been significantly modified by artificial drainage schemes within the catchment. The most recent was the construction of the Station Gully channel that drains much of the region and flow directly through the eastern end of Toby Inlet to the ocean.
- Toby Inlet is largely managed by a community group, the Toby Inlet Catchment Group (TICG). This group has been in existence since the early 1990's and are knowledgeable, enthusiastic and have achieved a considerable amount particularly in terms of revegetation around the Inlet and its catchment.
- The TICG have developed a *Management Plan for Toby Inlet Foreshore and Waters (2006),* which has been accepted by the City of Busselton. The City provides some funds to assist with the management of Toby Inlet.

Issues

- The main issue seems to be the causeway at the Station Gully drain, where the culvert connecting the two sections of this wetland is too small and is restricting the interchange of water between the two sections of the Inlet. The TIMG would like to see either the causeway removed or the culvert significantly enlarged
- Additionally, there is still too great a nutrient load entering these wetlands from the catchment and from septic tanks directly around the Inlet. This, plus the poor flushing, has resulted in the regular occurrence of macroalgal and phytoplankton blooms in the inlet.
- There is evidence that the Inlet has received considerable sediment from the catchment, which has led to a decrease in water depth.

Additional work

- Obtain information on the feasibility, cost and effectiveness of either removing the causeway at Station Gully or significantly enlarging the culvert through the causeway.
- Assess the likely effectiveness of the WQIP implementation in reducing nutrient inputs to Toby Inlet.

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