



Keith Hall Drainage System Active Floodgate Management Plan

2020-2023

Management Plan operational summary

The **Keith Hall Drainage System** (KHDS) is located at South Ballina in Northern New South Wales. The approximately 7-kilometre-long drainage system enters the Richmond River on its right (southern) bank.

The system drains a low-lying area between South Ballina Beach and the Richmond River and has two arms: Keith Hall No.1 and Keith Hall No.2 flood mitigation drains. The No.1 drain runs north behind the sand dunes from its connection with the Keith Hall Drainage Union Drain (near the far end of Carrs Lane). The No.2 drain joins it just before the river and runs around an old sand dune north from Keith Hall Lane. Both drains and the floodgate structure form the KHDS, for which Rous County Council has management responsibility.

The KHDS is a constructed drainage system that shows no natural characteristics and is now surrounded by agricultural land used for grazing, mixed small enterprises, and sugar cane. A sand quarry is located in between the No.1 and No. 2 drains, and a caravan park is adjacent to the floodgates. Many rural residential properties are located along the drainage system. Although the drainage system shows few natural features, it discharges into Mobbs Bay, which is identified as key fish habitat by the Department of Primary Industries, has been an oyster growing area, and is a popular recreation area for Ballina residents.

The drainage system has been floodgated at its junction with Mobbs Bay in the Richmond River, with a large concrete headwall that the South Ballina Road runs over. Six floodgates are installed on the downstream side. Two floodgates are modified to allow tidal exchange, one with a sluice window and another with an automatic tidal float mechanism. It is these modifications to which this Plan applies. The term 'floodgate' within this Plan refers to the sluice window and the automatic tidal float mechanism that open and close to allow tidal exchange between the drainage system and Mobbs Bay.

Active floodgate management commenced in the KHDS in 2006. Although minimal monitoring has occurred, it is reasonable to expect that tidal exchange can improve water quality discharging from the drainage system. It is important to acknowledge that active floodgate management does not resolve all water quality issues in the system, e.g. tidal exchange does not reduce deoxygenation (blackwater) events after flooding and the degree of improvement is linked to how much exchange occurs.

While acknowledging the limitations, the environmental impact of the KHDS can be reduced through active floodgate management. This Plan outlines how tidal exchange will continue at this site.

Environmental goals and strategies

The goals and strategies listed here specifically relate to the KHDS and identify the desired outcome from actively managing the floodgates. Goals are listed in priority order.

Goals

1. Reduce the impact of the KHDS on Mobbs Bay.

2. Reduce and control vegetation growing in the drainage system.

Strategies

Formalise the current opening strategy for the system's floodgates.

Encourage best management practices and additional remediation strategies to further reduce the impact of the KHDS.

Opening strategy for floodgate

From October 2019 to February 2020, Rous County Council ran a trial to decide whether additional tidal exchange could occur through the Keith Hall floodgates. The results of the trial have informed the review of this Plan and how tidal exchange will be managed into the future.

A sluice window was installed as part of the trial, replacing one of the two existing automatic tidal float mechanisms. The Keith Hall floodgates are currently fitted with both a sluice window (controlled by a winch) and an automatic tidal float mechanism.

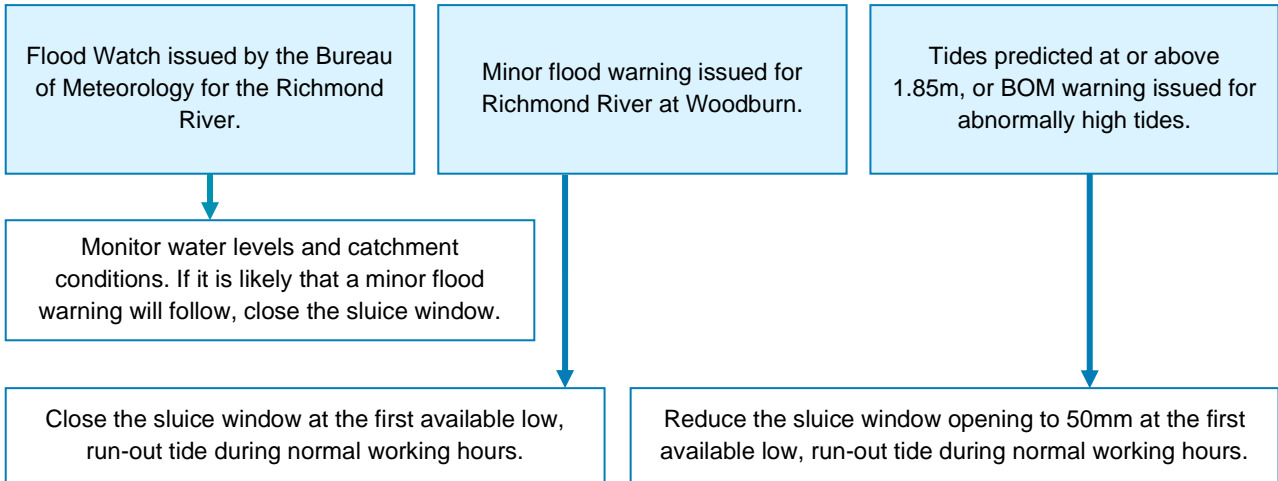
The trial has determined that the sluice window can be kept open 200mm and lowered before flooding in the river and extreme high tides. The impact of this opening strategy still needs to be monitored for any negative impact on upstream properties during extended wet weather.

The remaining tidal float mechanism operates automatically and is designed to shut on the rising tide and to open on the falling tide. The trial established that it only allows limited tidal exchange because of the force of tidal water moving into the opening and pulling the window shut. This closes it off a few hours after the lowest point of the tide and the mechanism cannot be adjusted to allow more exchange by moving the float arms.

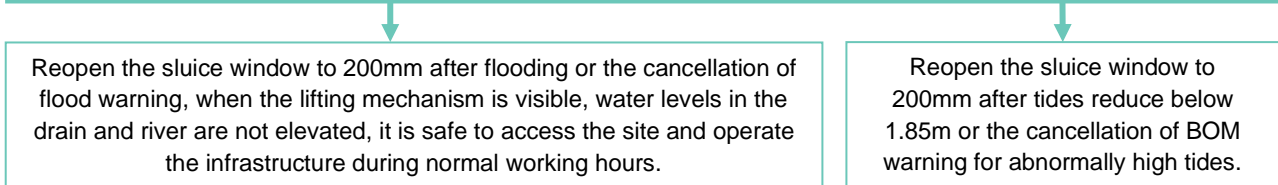
This amount of tidal exchange occurring through both the sluice window and automatic tidal float mechanism can improve discharged water quality while having minimal impact on surrounding land use. The function of the remaining automatic tidal float mechanism should be assessed when this Plan is reviewed in 2023, if not beforehand.

The sluice window will be opened and closed, in accordance with the details below by Rous County Council staff. Council acknowledge there are many variables during flood events and will be guided by the details below. This Plan will not restrict Council from taking emergency actions outside of those listed, taking into consideration safe work procedures. The automatic tidal float mechanism will also be operated by Council Operators.

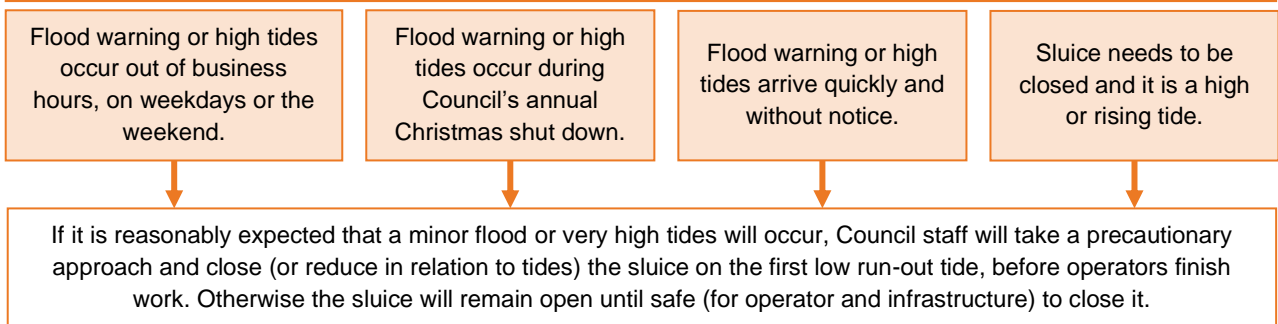
Close sluice in floodgate



Open sluice in floodgate



Contingencies



Note: Landowners will not be directly notified of the sluice being closed, lowered or opened. However all affected landowners have been involved with the review of this Plan and have a copy of the authorised version that outlines when the sluice window will be opened or closed. Council will update the status of the floodgate on their website (www.rous.nsw.gov.au) after either the opening or closing of the sluice window. Any issues arising should be communicated to Council on 6623 3800 or council@rous.nsw.gov.au

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Authorisation

This Plan has been endorsed by the landowners within the immediate catchment whose land is influenced by the management of floodgates. Those landowners have signed a letter of endorsement stating they understand the management strategy for the floodgates, including the triggers for opening and lowering into the operational position.

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Version control

Version	Description	By	Date
0.1	Draft developed before landowner consultation	Chrisy Clay	06/05/20
0.2	Final draft incorporating landowner feedback	Chrisy Clay	26/06/20
1.0	Final version – issued to landowners	Brenda Ford	14/08/20

Rous County Council File 2547.2

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1. Overview

The majority of coastal floodplains in New South Wales have been extensively modified for flood mitigation. Networks of drains have been constructed, natural water courses altered, and floodgates installed to mitigate the impacts of floods and large rainfall events.

Constructed drains reduce inundation after flooding and floodgates prevent flood and tidal water from inundating low areas of the floodplain. This in many cases has converted prior wetlands and low-lying floodplain areas into dryland farming areas. While these developments have enhanced rural settlement and agricultural industries, they have also caused unintended adverse impacts to downstream water users, fisheries, and the ecology of estuaries.

Rous County Council ('Council') is the Flood Mitigation Authority operating across the local government areas of Ballina, Lismore and Richmond Valley. Council is responsible for the construction, replacement, and routine maintenance of flood mitigation infrastructure, including floodgates and some pipes, levees, rural drains, and canals. Council's natural resource management function relates to the environmental consequence resulting from the operation of this infrastructure.

The flood mitigation directive that Council operates under in the *Local Government Act 1993* is '*Prevent and mitigate menace to the safety of life or property from floods and natural resource management issues arising therefrom*'.

Purpose of a Floodgate Management Plan

Council has an Active Floodgate Management Plan ('Plan') for each of its floodgates that are actively managed. Active management is the opening of floodgates during non-flood periods when the floodgate is otherwise operating passively. Opening floodgates and allowing tidal exchange can reduce their environmental impact by improving water quality and enhancing aquatic habitat and fish passage. Opening a floodgate for tidal exchange can occur by modifying a floodgate with a sluice window or an automatic, tidally operated float system, or the floodgate can be winched opened.

These plans document and communicate:

- how active management can assist in reducing the environmental impact of the floodgate,
- a strategy for how that will be monitored and achieved,
- appropriate and consistent strategy for opening the floodgate and returning it to the operational position or state and by whom,
- safe operating procedures for volunteers and Council staff,
- how adverse effects on current land use will be identified and prevented, and
- additional management strategies for the drainage system that would further reduce the environmental impact of flood mitigation.

Each Plan is tailored for the system and its floodgates, considering their location, purpose, and function.

Guiding principles for management

- Rous County Council is the Flood Mitigation Authority and acts in consultation with stakeholders on the management of its infrastructure.
- The primary function of Council's infrastructure is for flood mitigation.
- The intention of active floodgate management is to reduce environmental impact without causing adverse effect on current land use.
- All landowners behind the floodgate whose property may be impacted will be invited to participate in reviewing and updating the Plan and will be sent a final version of the Plan for their records. Where property ownership changes, the new landowner will be involved at the time the Plan is reviewed, unless their location and role are critical to the management strategy.
- Active floodgate management is a cooperative exercise between Council, as the Flood Mitigation Authority, and the surrounding landowners. Council appreciates landowners' continued support of this important activity.

Stakeholder involvement

This Plan is a formal agreement between Rous County Council and landowners on how tidal exchange will occur on the identified drainage system. The Plan has been developed in consultation with landowners whose property may be impacted from the floodgate's operation.

Rous County Council seeks the input and support of other stakeholders for their active floodgate management program and its delivery.

Organisation	Role
Rous County Council	Owns, develops, and uses individual active floodgate management plans.
Relevant landowners	Endorses and uses individual active floodgate management plans.
Lismore City Council Ballina Shire Council Richmond Valley Council	Supports active floodgate management and provides input on general program where relevant.
NSW Department of Primary Industries	Supports active floodgate management and provides input on general program where relevant. Regulatory role under <i>Fisheries Management Act 1994</i> .

Plan review frequency

The Plan will be formally reviewed every three years (from the date of adoption) and the effectiveness of the outlined strategy assessed.

Feedback on the Plan and active floodgate management matters

Feedback and comments should be referred to Council by telephone on (02) 6623 3800 or by email: council@rous.nsw.gov.au

2. Keith Hall Drainage System

Asset number and description

A reference in this section to 'asset number' is to a unique reference that Council has assigned to the specified asset.

Asset number 0010 – Keith Hall Drainage System

- Six square 1,800mm floodgates, one with a sluice window operated with a winch, another with an automatic, tidal float mechanism.

Asset No.	Description	Number
0010-290	Outlet	1
0010-030	Aluminium floodgate (1800mm square) two modified for tidal exchange	6
0010-035	Lifting gear	2
0010-610	Handrail	2
0010-227	Keith Hall No.1 canal	1
0020-031	Secondary floodgates on Keith Hall No.1 canal aluminium 900mm round	2
0030-120	Culvert on Keith Hall No.1 canal	3
0080-100	Pipe on Keith Hall No.1 canal	1
0010-261	Keith Hall No.2 canal	1
0130-100	Pipe on Keith Hall No.2 canal	1
0025-120	Culvert on Keith Hall No.2 canal	1

Aerial photograph of asset location and images of asset



1: KHDS locality map.



2: KHDS floodgates, showing two previously installed automatic tidal float mechanisms.



3: KHDS floodgates, showing the automatic tidal float mechanism and new sluice window on the far right floodgate.



4: Keith Hall No.1 flood mitigation drain looking immediately upstream of the floodgates at Mobbs Bay. Note incoming tidal water through the sluice window.

Drainage system characteristics

Location in estuary.	Very lower estuary.
Location in landscape.	Riverine natural floodplain.
Land elevation.	2m - 0.7m AHD.
Land use.	Agriculture: grazing, mixed small enterprises, and sugar cane. A sand quarry is located in between the No.1 and No. 2 drains, and a caravan park is adjacent to the floodgates. Many rural residential properties are located along the drainage system.
Vegetation.	Grasses and pastures. Nearby are <i>Casuarina glauca</i> and <i>Melaleuca quinquenervia</i> , which are trees associated with Endangered Ecological Communities under the <i>NSW Biodiversity Conservation Act 2016</i> .
Salinity levels and estuary dilution capacity.	Very high.
Tidal range.	Very high.
Land elevation adjacent to drains.	Generally low, some elevated areas around the old sand dune between No.1 and 2 drains.
Soil type.	Many different types along length of drain, including alluvial sediment, estuarine clay, white beach sand and coffee rock.
Acid sulfate soils.	Some areas of high risk, areas of sulfuric sediments (actual sulfate soils). MBOs present in drain.
Hydraulic conductivity.	Mostly unknown, likely to be varied based on soil type. Two spot assessments identified high hydraulic conductivity in the upper sections of both No.1 and No.2 drains (UNSW WRL, 2019).
Acid export.	Unknown. Areas of acid sulfate soils exist; discharged water quality is thought to be influenced by exchange with almost marine water.
Water quality issues.	Well known for discharging discoloured water after heavy rain and flooding, causes of discolouration unknown. Before tidal exchange increased, the system would almost continuously discharge discoloured water. Area has acid sulfate soils and MBOs can be present in the drain. Can discharge deoxygenated water (blackwater) after flooding. Naturally occurring iron-rich groundwater can enter drainage system and dominate sections of the drain. Concerns have also been raised on nutrient levels and runoff from septics.

Water quality

Although the KHDS is tidally flushed, water quality discharging into Mobbs Bay is something that Council is mindful of.

The system is known to regularly discharge discoloured water; however little is known about its chemistry or impact. Before tidal flushing was increased in late 2019, the system would almost continuously discharge discoloured water. Discharge plumes from Keith Hall drains are visible in past aerial images (see figure 6).

The area has actual sulfate soils (sulfuric sediments), particularly in the upper sections of both the No.1 and No.2 drains. However tidal flushing in the lower part of the drainage system influences discharged water quality, particularly pH, with tidal water being almost marine in nature. Acidic water of pH of 3.5-4.6 has been recorded in the upper sections of both the No.1 and No.2 drains.

In 2018, Rous County Council had drain sediment samples collected from along the bottom of both channels and analysed them for the presence of acid sulfate soil material. Analysis showed extremely elevated levels of acidity within the sediment and sludge with highest readings of

4.3% S_{cr} . This indicates the system is located through areas of high-risk acid sulfate soils and Mono-sulfidic Black Ooze (MBOs) can be present in the drain.

Two spot assessments showed soils in the upper sections of both the No.1 and No.2 drains have high hydraulic conductivity (UNSW WRL, 2019). Given the right conditions, when the gradient is favourable, means groundwater can easily enter the drainage system. The areas of high hydraulic conductivity coincide with the presence of acid sulfate soils and indicate that acidic groundwater can enter the drainage system.

Rous County Council also observed that the No. 1 flood mitigation drain can at times be dominated with iron-rich groundwater (see figure 5). This was observed during a prolonged hot and dry spring in October 2019 when drain water levels were low. Samples of drain water were analysed at a laboratory and the results showed the iron-rich water was not associated with acid sulfate soils and is likely to be naturally occurring. Very high levels of dissolved iron (27mg/L) were recorded at the mid-point of the No.1 drain, however tidal exchange buffered levels before water was discharged into Mobbs Bay. Anecdotally, iron-rich groundwater is considered common from South Ballina to Empire Vale and has been intercepted frequently by bores for many decades. Although naturally occurring, drainage now transports this iron-rich water downstream into the estuary with unknown consequences.



5: Mid-point of the No.1 flood mitigation drain in October 2019 when the drain was dominated by naturally occurring iron-rich groundwater.

After major summer floods, the system does discharge deoxygenated water (blackwater). This is caused from inundation and decomposition of dryland pasture, which now grows in low-lying areas. Concerns have also been raised on nutrient levels and runoff from septic systems into the drain.



6: Aerial of KHDS discharging discoloured water into Mobbs Bay.

Aquatic habitat values

The KHDS is a constructed drainage system that shows no natural characteristics. The drainage system provides little aquatic habitat, however it discharges into Mobbs Bay. Active floodgate management aims to reduce the system's impact upon the aquatic habitat in Mobbs Bay.

Mobbs Bay is a significant area in the lower Richmond River estuary due to its environmental and recreational value and proximity to Ballina. Mobbs Bay is an important habitat for migratory birds and aquatic fauna and flora. Fishing is a popular recreational activity, and the Bay also represents significant oyster habitat in the lower Richmond River estuary.



7: Oyster growing area immediately downstream of the KHDS floodgates.



8: Aerial photographs showing discoloured discharge from the KHDS and the proximity of oyster growing areas.

Whole of system management

The following table outlines what management changes have already been made to the KHDS and what could be explored in the future. A cooperative approach that balances the needs of current land use and environmental benefits is promoted by Council. The KHDS has benefitted from the willingness of landowners to trial and adopt different management strategies to improve its environmental condition, and Council acknowledges their efforts.

Council provides this information for landowners and other organisations that are responsible for promoting and facilitating natural resource management on private freehold land. This information identifies a range of relevant strategies for improving water quality based on the characteristics of the system and are consistent with current best management practice.

Management strategy	Works	Undertaken	Location	Recommendation	Suggested responsibility
Further information to understand the drainage system.	Sampling and analysis of drain bottom sediments.	Yes, in 2018. Funded by Rous County Council.	Entire drainage system.	Sampling found sediments and oozes with extremely elevated levels of acidity.	Rous County Council
	Drain invert survey.	Yes, in 2019. Funded by Rous County Council.	Entire drainage system.	The drain invert survey identified two restrictions to low flows in the No.1 flood mitigation drain. The survey also identified low-lying areas to monitor during the floodgate trial.	Rous County Council
Tidal flushing for dilution and buffering of poor water quality.	Actively manage floodgates.	Yes, by RRCC in 2006.	An automatic, tidal float mechanism was installed, and an additional one installed in 2014.	Strategy was reviewed in 2019.	Private landowners Rous County Council
		Reviewed by Rous County Council in 2019-2020 and more exchange trialled.	One automatic tidal float mechanism replaced with a sluice in 2019.	Implement new strategy based on the outcome of the trial, as documented in this Plan.	
	Continue to monitor impact during extended wet weather.	Planned to continue.	Entire drainage system.	Visually monitor of the impact of the new floodgate strategy during extended wet weather, using photographs, observations, and spot water quality measurements.	
	Review remaining automatic tidal float mechanism.	No.	Floodgate structure.	Review function of the mechanism and either remove or replace with a sluice window.	
Reduce sediment going into drain and erosion of drain banks.	Restricting stock access to drain.	Yes, fencing and troughs installed on properties between floodgates and Keith Hall Lane on No.1 drain.	Priority is for No. 1 drain where animals are grazed.	Explore with landowners on No.1 drain from Keith Hall Lane south to the Drainage Union drain.	Rous County Council Ballina Shire Council Landowners State Government: <ul style="list-style-type: none"> • North Coast Local Land Services. • Department of Primary Industries. • Department of Planning, Industry and Environment (previously Office of

Management strategy	Works	Undertaken	Location	Recommendation	Suggested responsibility
					Environment and Heritage). • Marine Estate Management Authority.
Detailed site assessment and hydrologic options study.	Obtain up to date technical information on the system's hydrology, drainage, and flooding patterns to provide guidance on how water quality and the silt/vegetative blockages could be addressed without impacting upon current land use.	No.	Drainage sub-catchment.	Identify funding sources and discuss with landowners.	Rous County Council Ballina Shire Council Landowners Keith Hall Drainage Union
Water quality monitoring.	Monitoring program to identify any water quality issues and confirm benefits of managing floodgate.	No, only spot samples and observations.	Main floodgates and on locations on No.1 and No.2 drains.	That a program be developed to determine success of Active Floodgate Management Plan. Could be run alongside further assessments and studies.	Local Government: • Rous County Council. • Ballina Shire Council

RRCC = Richmond River County Council, former Flood Mitigation Authority on the Richmond.

3. Risks of actively managing floodgates

Work Health and Safety

- The sluice window is fitted with a winch and large forces can be involved in winch systems.
- The sluice window should only be opened on a low or falling tide. This will reduce the risk of the wire rope breaking and the floodgate bowing.
- The sluice window is opened and closed by Council Operators, who must consult and follow the approved Safe Work Procedure relevant for the activity.
- Operating the sluice window during and after heavy rain or flooding can require working in wet and slippery conditions. Safe access to the site should be assessed after events.
- Council Operators will manipulate the automatic tidal gate following the approved Safe Work Procedure relevant for the activity.

Environmental / Agricultural

Flooding

There is a risk of flooding to land upstream of the floodgate and surrounding areas, if the sluice window is not closed before a flood arrives and floodwater from the Richmond River enters the drainage system.

Increased salt levels in drainage system

Salinity levels are very high and almost marine in this part of the Richmond River estuary. There is a high risk posed by increasing salt levels within the drainage system.

Saline water overtopping

There are a number of low points along both the No.1 and No.2 drains where tidal water could overtop and inundate nearby land. These have been monitored during the trial up to a 1.8m high tide. An additional secondary floodgate was installed on a side drain off the No.2 drain to reduce this risk. All other points have shown to be not a concern on tides up to 1.8m.

Lateral salt seepage

Signs for lateral salt seepage into surrounding soil and groundwater were monitored during the floodgate trial. The trial coincided with a record hot and dry period when groundwater levels were low and lateral salt seepage would have been more likely to occur. Salinity within the drain was also very high during this time. No signs of lateral salt seepage were observed or reported. Areas of greatest risk, where soil hydraulic conductivity is high, are thought to be largely above where tidal exchange and increased salinity in the drain occurs under the current floodgate opening strategy.

4. Monitoring, evaluation and reporting

Council will explore whether further water quality monitoring can occur at the KHDS. However if resources are not available for monitoring, scientific principles and visual observations support the assumption that implementing the outlined management strategy will improve water quality.

An evaluation of the success of the Plan will be made at the 3-yearly review, and a report provided by Council to landowners and relevant stakeholders.

5. Historical context

History of drainage in the area

Drainage in the Keith Hall area is historically linked with sugar cane production. The broader Keith Hall area was cultivated for sugar cane very early, with a reference from local newspaper in 1895 of drainage trials occurring on the Keith Hall Estate of how to efficiently remove water off sugar cane.

In the late 1800s, many families that still own land along the KHDS were established and farming the area, including the O'Connor, Carr, and Ellis families.

In 1918, Colonial Sugar Refining (CSR) funded farm drainage systems in the area. The local newspaper, The Northern Star, reported in 1918 that the Keith Hall Drainage Scheme would be carried out by the CSR. The scheme proposed is estimated to cost £1860 and will drain 1,000 acres. CSR would fund and conduct the works and then hand the drains to landowners, who had 10 years or more to repay the cost at 5% interest. The works involved 16 farmers. It's unsure exactly where this drainage works occurred, but it is likely to be in the vicinity of the Keith Hall Drainage Union or the Rous County Council Flood Mitigation drain system.

In 1919, the Keith Hall Drainage Union formed to the south of the current Keith Hall Drainage (Flood Mitigation) system. The Union area included farms now at the top of the Keith Hall No.1 flood mitigation drain. In 1920, the Keith Hall Drainage Union drain was constructed.

Before the flood mitigation system was constructed in the 1960s there was a channel downstream of the Keith Hall Lane with a timber culvert and floodgates.

History of when and why asset was installed

In 1961, Richmond River County Council advertised a tender brief to construct the beginnings of the No.1 flood mitigation drain (contract no.7, item 9). The tender brief included the amount of land that needed to be cleared of native vegetation.

By 1962, the lower half of the No.1 flood mitigation drain (from Keith Hall Lane north) and the floodgate structure was constructed. This first stage was undertaken to enable a considerable proportion of floodwaters that flow along the inside of the sand dunes to be given direct access to the river.

In 1965, Richmond River County Council advertised a tender brief to extend the top of Keith Hall No.1 flood mitigation drain (contract 32) to help drain a problematic area at the eastern end of the

Drainage Union drain. Engineering plans from that time show the intention was to construct this drain with no fall.

By 1968 the extension of the Keith Hall No.1 flood mitigation drain was completed so it joined the Drainage Union drain. Again, reference was made to this extension addressing the issue of drainage in the eastern end of the Union drain *“It is considered that a very significant improvement of the situation at the eastern end of the Keith Hall Drainage Union drain, can be achieved at relatively small cost in the method outlined, which closely follows the natural drainage depression”*.

History of previous natural values

The KHDS altered the function of channels and low-lying areas naturally present in the area and large straightened canals were constructed to alleviate flooding and inundation of land.

An article in The Northern Star newspaper in 1931 titled “Reclamation of Swamp Lands. Crops thrive on formerly useless country”, provides some evidence of what the area looked like before the drainage system was constructed.



9: 1931 article in *The Northern Star* describing the natural features of the land, before the KHDS was constructed.

The article says that in 1916 the land bordering the coastline between German Creek (now Empire Vale Creek) and the southern boundary of the Keith Hall Estate *“... were in such a state as to be classed waste lands. They were covered with heavy, impenetrable ti-tree and the land was under water during eight months of the year, even in dry season. The portion of the farms used for agriculture was a strip along the creek and riverbank. Today, will be found, acres and acres of sugar cane, bananas, corn, in fact any crop that can be produced from the soil...”*.

The original tender brief for constructing the flood mitigation drainage system identifies that 16.6 acres of land was to be cleared of native vegetation. That native vegetation was identified as “dense with oak and undergrowth” “heavily timbered with oak, mahogany and ti-tree with dense undergrowth” and “heavily timbered with mahogany, ti-tree and undergrowth”.

Issues with flow and function in No.1 flood mitigation drain

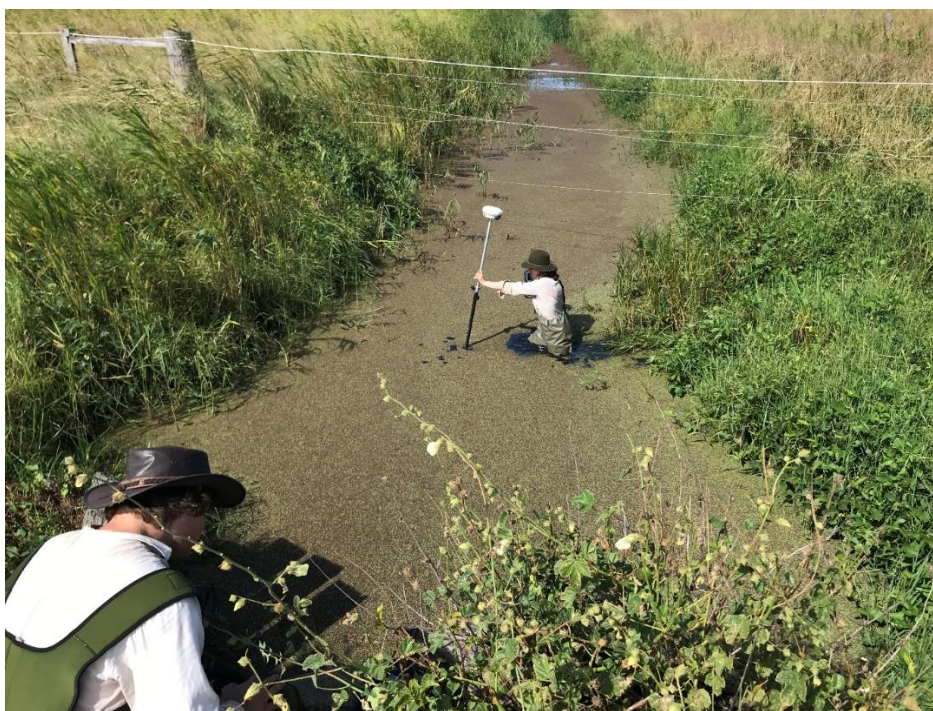
Only four years after it was constructed, the Keith Hall Drainage Union wrote to Richmond River County Council (in 1972) concerned with water flowing from the No.1 flood mitigation drain into the Drainage Union drain. They reported this was because of a build-up of vegetation in the No.1 flood mitigation drain. They noted the flood mitigation drain had recently been mechanically cleaned, but the vegetation grew back very quickly after heavy rain.

Since that time, the flow efficiency of the No.1 flood mitigation drain due to sedimentation and aquatic vegetation has been raised as an on-going issue. These concerns and a review of Council’s historic engineering plans that showed the drain was planned to be constructed with no fall, prompted a survey of the drainage system in 2019.

In 2019, the University of New South Wales conducted a survey for Rous County Council of the drain invert to provide a better understanding of fall across the system and how the drain functions. The invert survey showed two significant restrictions to flow heading down Keith Hall No.1 flood mitigation drain to the floodgates after heavy rain or small events. The restrictions pose no restriction to larger events, when there is sufficient head to move water towards the floodgates at Mobbs Bay.

Any benefit from increased tidal exchange in reducing and controlling vegetation in the drain is limited to the lower (northern) end of the drainage system, closest to the floodgate. The increased tidal flushing has not reduced the vegetation build up in the upper (southern) end of the drainage system. Tidal flow is prevented from reaching the upper half of the drain because of rises in the drain's invert. Increased tidal flow has had no discernible impact on the silt blockages and they remain in place.

Landowners remain concerned on the flow and function of the No.1 flood mitigation drain and the economic impact this can have on upstream properties. A long-term solution is required to address the fundamental issues with how the Keith Hall No.1 flood mitigation drain functions. Identifying potential long-term options will require further information on the drainage system and surrounding land.



10: University of New South Wales staff surveying the invert of the Keith Hall No.1 flood mitigation drain.

History of active floodgate management

Active floodgate management commenced at the KHDS in 2006. Initially one automatic tidal float mechanism was installed on the system. In 2014, an additional automatic tidal float mechanism was added.

In 2019, Rous County Council replaced one of the automatic tidal float mechanisms with a sluice window to allow more tidal exchange.

5. References

University of New South Wales Water Research Laboratory (2019) Keith Hall Drain Invert Survey results. Unpublished report.



Drainage Keith Hall Area

THE INFORMATION ON THIS MAP MAY NOT BE ACCURATE.

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Printed Date: 20/02/2019
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 Projection: MGA Zone 56

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