New Brighton
Village Association Inc.

NBVA Flood Submission

To: The General Manager Byron Shire Council

Flood Inquiry Submission

As follow up to the community round table meeting held on the 10th of May 2022 (see invitation below), the New Brighton Village Association (NBVA) presents the following brief submission to the Byron Shire Council (BSC) for inclusion in the New South Wales Flood Inquiry.

Subject:

Community Roundtable - Flood Inquiry

Hi Michael

Following are the details for the community roundtable tomorrow afternoon.

Council is preparing a submission for the NSW Flood Inquiry and to inform our submission we want to gather information from community groups and chambers of commerce.

We are holding a virtual roundtable for community groups and chambers of commerce on Tuesday 10 May from 4pm – 6pm. The meeting will be held via Zoom.

We are hoping to receive information on :

- *Causes and factors contributing to the recent flood events*
- *Location and impact of these floods*
- *Responses and recovery so far*

If your group is interested in providing feedback to Council please nominate one representative to attend.

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Flood Inquiry Submission from the NBVA

NBVA support the initial submission from North Byron Activation Committee, but wish to add further information focussing specifically on the causes of flooding, its impact and the consequent short, medium and long term needs of the New Brighton community.

Note that this submission was prepared by community members with strong science backgrounds but limited professional experience in hydrology. As a community, we are quite open to meaningful and constructive discussion to achieve a better understanding of the issues and potential pathways to improve the situation.

1.1 Factors Contributing to the Recent Flood event in New Brighton

1.1.1 Causes of Flooding

The New South Wales Government commissioned and built a time-series of 3D digital models of the northern Byron Shire area over a period of almost 60 years dating back to 1947 from historic aerial photography. These models provide a clear and concise record of changes to landform and drainage systems in this region. Details of the terrain, water flow paths and storage capacities were obtained from a high-resolution Digital Terrain Model (DTM) derived from LIDAR and available from the national ELVIS data repository. Please refer to Appendix 1 for this important information as it lays the foundations for our recommendations.

The changes to the immediate Brunswick Valley catchments of Marshalls Creek, Billinudgel Creek, Yelgun Creek and the Brunswick River, and further afield in the Crabbes Creek and Burringbar Creek catchments that feed into Marshalls Creek through the wetlands of the Billinudgel Nature Reserve, and the effects of those changes on the hydrological flows are also documented in Appendix 1 of this document.

Key causes of flooding in the northern part of the Byron Shire LGA include land development, sand mining and sugar cane farms, which have all redirected or filled the natural drainage systems and wetland storage capacity that otherwise managed flood flows through the hydrological system.

Probably the most significant alteration on the floodplain was the infilling by the developers of the ocean outfall located where Helen Street in South Golden Beach (SGB) is now sited. This outfall received waters from the north from Wooyung Creek (and Burringbar Creek), and from the south via an overflow channel from Marshalls Creek, and discharged water into the ocean.

This and the other alterations to the floodplain has resulted in continued and excessive flooding in the New Brighton Village and the broader local area including SGB, Billinudgel, Ocean Shores and beyond (See Appendix 1 for documentation of changes to the floodplain and inferred impacts on flooding). These changes have affected the flooding impacts during significant rain events and in particular during events defined as moderate or major floods.

1.1.2 Further Contributing Factors

While the build-up of overflow water from Marshalls Creek behind the levee at SGB and the overland flow of this water back into New Brighton is the major factor in flooding in New Brighton,

there are a number of other factors nominated by the community as potentially causing or increasing flooding in New Brighton:

1. Lack of Maintenance over decades to the local drainage systems and street channel runoffs
2. Failure of the SGB pumping station due to power failure
3. Closure of ocean outfalls to the north and south of SGB
4. Potential reduced river flow during floods from sand build-up in the creek and the Readings Bay Rock wall

While some of these have been dismissed through hydrology modelling, the results of the modelling have not been conveyed to the community in a way that has changed opinions. This has resulted in community focus on potential solutions that would have little impact and could potentially cause broader problems such as tidal inundation.

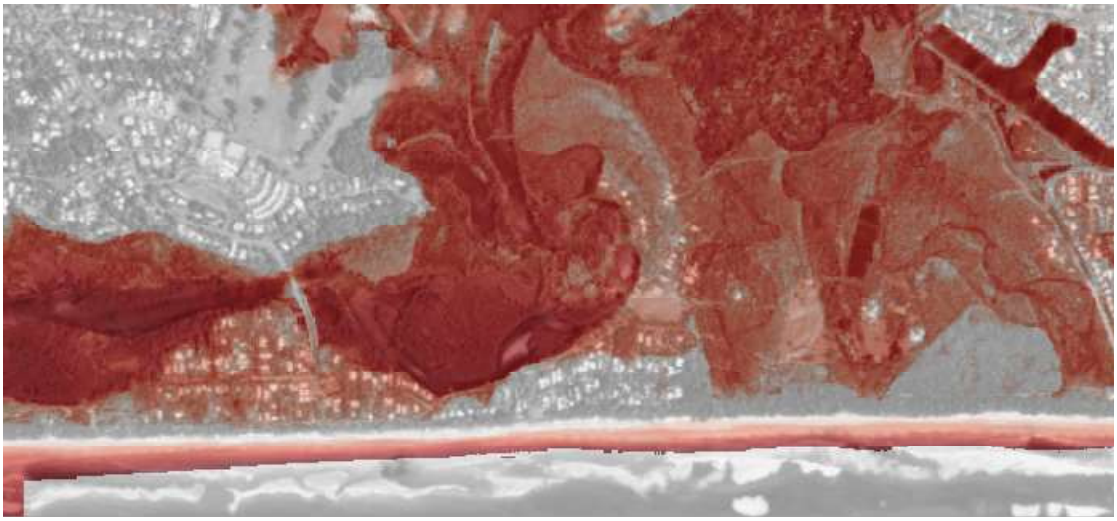
Another major factor in the impact of the flooding and the angst experienced by residents was the lack of information due to long and unprecedented communication failures. This was a significant factor during the rescue and recovery phase and put many lives at risk.

1.2 Location and Impacts of Floods

1.2.1 Location

Flooding in late February 2022 was observed to be 600 - 800 mm higher than any previously recorded events at New Brighten and reached an RL of ~3m and possibly higher. This could be better defined once surveyed heights from the DTM are calibrated to river heights measured by river height gauges.

Figure 1 – Digital Terrain Model showing area inundated at 3m elevation.



1.2.2 Impacts

The February 2022 flooding impacted approximately 80% of buildings in the village (~180 homes) including the local Post Office General Store and Café. The village was cut off for two days. Damage to personal property and housing has been both significant and ongoing, with all streets in New

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Brighton having to deal with extensive household goods clean up that went on for approximately 2 weeks.

In addition to content and property damage to resident's homes, local road, bike, drainage and pedestrian infrastructure was moderately to severely damaged. Creek banks have been severely impacted with tree collapses and rubbish remains in the river. Contamination from inundated sewerage systems was severe in places and potentially remains an ongoing impact. The main thoroughfare and coastal connection access from SGB to Ocean Shores along River Street is now in danger of subsidence.

The dune face has been reduced as the slow moving low pressure system with associated large waves and elevated storm action caused extensive beach and dune erosion over the 2 to 3 day event.

The social and health welfare impacts on many residents have been major. Many residents are now homeless and awaiting repairs, having to leave their homes and their village for many months while they await repairs.

Impacts to wildlife habitats are not noted in this submission.

1.3 Response and Recovery Needs

1.3.1 Response

Various local state and federal government agencies responded to the crisis eventually but in the immediate rescue and early recovery phase, it was the local community who were the first responders. Notwithstanding improved agency response in the future, the local community require improved resources to avoid or mitigate the high personal risks undertaken by local first responders.

These groups require simple infrastructure support, for example:

1. an active boat and boat shed with rescue capacity for volunteers in the village
2. UHF radio made available to local volunteers to activate in emergency response. In addition, a coordinated, publicised UHF protocol to use in emergencies when power and mobile coverage go down, so that households can use this if they purchase hand-held radios.

The size and scale of this weather system has impacted the ability of Insurers to deal with claims and respond in a timely manner and those without insurance have dealt with the situation as best they can.

Service NSW established a recovery centre at SGB and Mullumbimby and also provided a mobile service with pop up locations. It appears none of these were in New Brighton. The overall response should have been more co-ordinated and rapid and there are lessons for agencies at all levels to improve strategic planning for future events.

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1.3.2 Recovery

Near Term Needs

Whilst the flood recovery for the New Brighton community is ongoing, the major clean-up is complete and rebuilding and repair of houses is underway. Continued funding support for those in dire need is required.

Support for those needing rental accommodation is an issue, and the balance between holiday and long-term rentals has an impact on availability.

Medium Term Needs

Ongoing assistance at the state and federal level is essential to address future planning to minimise the impact of these major flood events.

We support:

- Planning instruments that result in flood-resistant building and design
- Federal support for a reinsurance scheme
- Finalising designs for flood mitigation

Flooding in New Brighton is caused by developments on the floodplain that have occurred over time, and while these changes cannot be undone, funding and implementing solutions to mitigate the impacts of those changes is reasonable. We believe studies are needed to identify possible solutions to mitigate the causes of flooding. To facilitate this the hydrology modelling done in these studies need to:

1. Be recalibrated to include the latest event data
2. Focus on strategies rather than assessing a particular engineering options, eg.
    a. how much water would have to be removed from the area north of New Brighton to mitigate flooding (rather than model the effect of an outflow of a particular design)
    b. the quantity of water that would need to be retained and release flow rates would need to be achieved in the upper parts of the catchment to reduce flood peaks
3. Once potential strategies are defined, separately investigate the engineering options required to achieve those outcomes, including consequences of those options such as increased tidal flows and sea water inundation.
4. Provide a cost-benefit analysis of the various potential solutions.
5. Secure funding to complete the works required

Long Term Needs

Capital investment at a state or national level is needed to implement the capital works required to address the root cause of flooding. The level of funding required needs to be quantified professionally, but we expect these solutions to cost in excess of 10 million dollars, which is a fraction of the cost that the community has suffered. In principal commitment for funding from higher levels of government needs to be provided while the issue is prominent.

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The community also needs greater capacity to respond to emergencies. This includes improved SES support and engagement with the community (membership campaigns for example) and first-responder training for the community.

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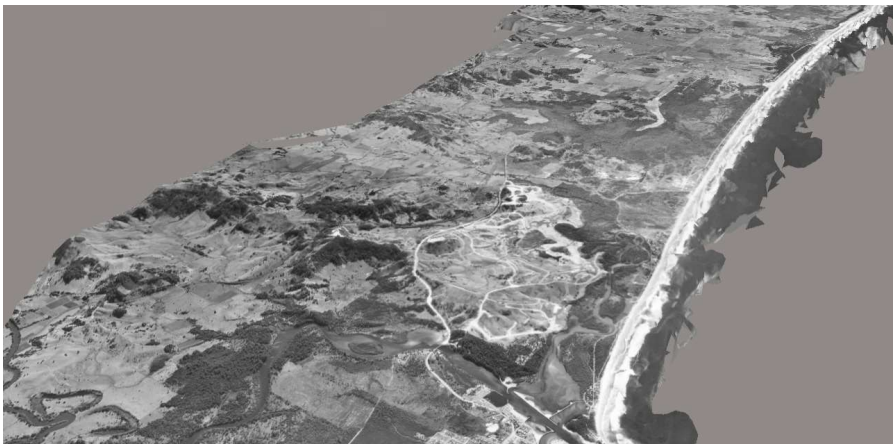
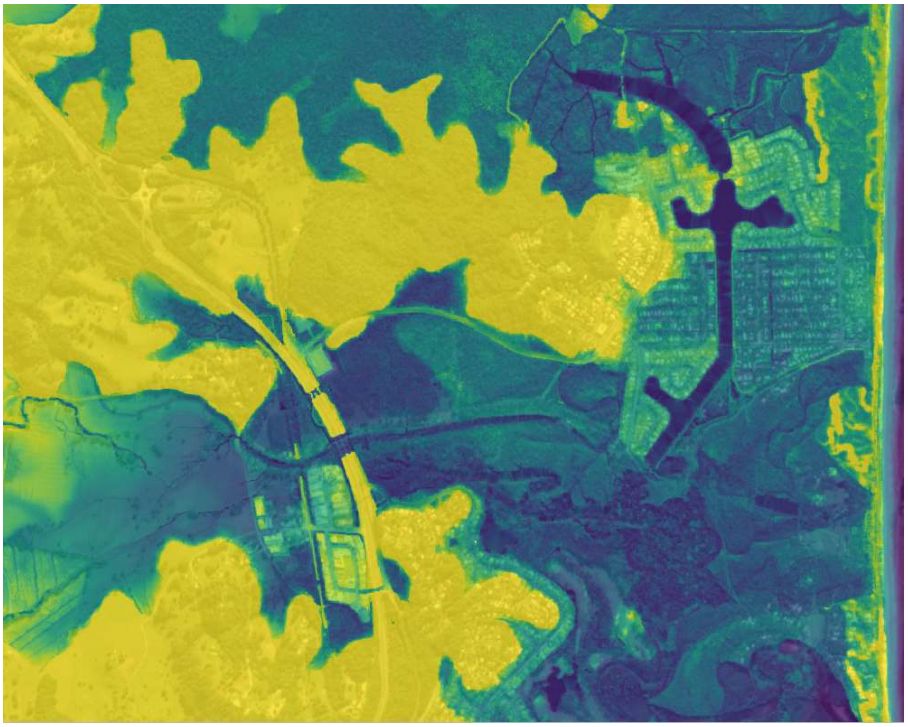
Appendix 1

Review of Historical Changes to the Marshalls Creek Floodplain and Potential Impacts on Flood Flows





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2 Acknowledgments and Reference Data

This document is based on personal interpretation of the available aerial imagery since 1947, the stories of the local residents and the reports of scientific studies that have been produced in the past. I do not profess to know all the answers, and am always open to be proven wrong by evidence. This document hopes to progress the conversation in improving the situation.

I would like to acknowledge:

1. the traditional owners of the lands that we live on, the Midgenbul, Bunjalung and Durunbal people, and their elders past, present and emerging.
2. the government sources of digital data that I heavily rely on in this document, particularly the recently developed historical 3D models of the Marshalls Creek flood plain. These models were produced for this purpose by the NSW Department of Finance, Services and Innovation by their Spatial Services team, mainly through the vision of Bruce Thompson (RIP).

   Links to these models are provided below.

   1947: https://s3-ap-southeast-2.amazonaws.com/nsw-reality-models/NorthCoast_Historic/1947a/App/index.html

   1971: https://s3-ap-southeast-2.amazonaws.com/nsw-reality-models/NorthCoast_Historic/1971/App/index.html

   1987: https://s3-ap-southeast-2.amazonaws.com/nsw-reality-models/NorthCoast_Historic/1987/App/index.html

   1991: https://s3-ap-southeast-2.amazonaws.com/nsw-reality-models/NorthCoast_Historic/1991/App/index.html

   2004: https://s3-ap-southeast-2.amazonaws.com/nsw-reality-models/NorthCoast_Historic/2004/App/index.html
3. the NSW government historical photo library accessed through https://portal.spatial.nsw.gov.au/portal/apps/webappviewer/index.html?id=f7c215b873864d44bccddda8075238cb#
4. the government sources of the high resolution LIDAR data that has been collected and collated by GeoSciences Australia: https://www.ga.gov.au/scientific-topics/national-location-information/digital-elevation-data
5. The work done by the Floodplain committees over the last decades, and the reports produced.
6. The work done by local citizens in collating historical data and observations. Much of this work is available at:
   a. http://brunswickvalley.com.au/flood-history/index.htm
   b. http://brunswickvalley.com.au/flood-history/flood_story51.pdf

Robert Crossley

New Brighton Resident.

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Executive Summary

This review aims to provide a more complete review of the history of development on the Marshalls Creek floodplain to understand the underlying natural flood processes, and how development has interfered with these processes.

A range of material was used to complete the review, as described in the foreword. This included constructed 3D models from historical aerial photography dating back to 1947, historical aerial photography, anecdotes from the community and previous food studies.

History

Two villages existed on the floodplain prior to 1950, Billinudgel and New Brighton.

Flooding was mitigated in the village of Billinudgel to some degree by an overflow channel that allowed floodwaters to flow around the village and return to the creek below the village. This drainage path was filled as a result of the development of an industrial estate. Flood mitigation now relies on constructed drainage channels.

The village of New Brighton was protected from flooding to some degree by overflow channels that channelled floodwaters that were excess to the creek capacity to flow to the north and discharge to the ocean through a major ocean outflow. This outflow was closed by the developers of South Golden Beach around 1958.

Development

South Golden Beach was built in the 1960's over a network of major drainage channels that had directed water from the north and south to an ocean outfall located where the South Golden Beach Hall now exists, along a drainage channel located where Helen Street is now.

A number of engineering interventions were attempted to prevent flooding from the water that would have naturally discharged to the ocean through this outflow over the last 40 years, including:

1. construction of Capricornia Canal to try to connect waters from the north and south to bypass the development,
2. depositing considerable fill in Kolora way and throughout South Golden Beach to prevent the natural inflow of water or to raise the ground level above the flood water level,
3. construction of a man-made canal and outflow to the north of South Golden Beach to attempt to reinstate the discharge of water to the ocean, and
4. levees to try to prevent the inflow of water into South Golden Beach.

Arguably, the flooding was also made worse by closure of other natural outflows at Wooyung and between South Golden Beach and New Brighton with sand mining in the 1960's and 1970's.

Going Forward

Any flood mitigation work must account for the natural drainage patterns that drive the flooding process. Mitigation should be aimed at one of the following strategies: Store, Divert or Dispose.

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The flood waters from Billinudgel Nature Reserve and Marshalls Creek that once flowed into the ocean now pond on the floodplain, and build up to a level that it flows into South Golden Beach and back to Marshalls Creek to flood New Brighton. Any flood mitigation must get rid of this water from the floodplain as it did prior to development.

It is also critical to recognise that the extensive urban development at South Golden Beach and North Ocean Shores has altered the natural drainage channels and flood flows, and that reinstatement of natural flows is probably not an option, implying that an engineered solution is likely to be required.

The village of New Brighton requests action to evaluate options to provide a solution to the flood issues and to commit resource to fund:

1. Hydrology studies to quantify how much water needs to be removed from the floodplain to the north and south of South Golden Beach to reduce flooding damage to urban centres, and strategic locations where this can be done effectively. Target areas are to the north and south of the South Golden Beach levees and bunds, and within the leveed area itself.
2. Engineering studies to evaluate options to discharge the required quantities of water from the floodplain to the ocean at identified key locations, including flood pumps and ocean outflows.
3. Engineering studies to define the required capacity of channels to handle localised flood/ drainage issues in Billinudgel and Ocean Shores where flooding occurred.
4. The works deemed appropriate to mitigate flooding under the current and future climate scenarios and predicted changes in ocean levels.

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Development Timeline

Key Points

This review is aimed at creating a more complete record of the development on the Marshalls Creek floodplain to ensure the conversation regarding causes of flooding is based on data, not hearsay.

The review relies mainly on aerial photography interpretation, but also on recollections of long-term residents. The original flood flows were interpreted from landscape patterns in 1947 and 1958 photography, and 3D models developed from that photography by NSW government.

A timeline of development on the floodplain is provided based on the evidence from the series of aerial photos available from NSW government spatial portal. These can be downloaded through the links provided in the foreword. Comments on the likely influence on the natural flood flows of development are also provided, but these are personal views only and open to discussion.

Billinudgel

The photos clearly show that the natural flow of water in Billinudgel was via an overflow channel that flowed past the school (now pre-school) to the south of the village, then filled a swamp area before flowing back into Marshalls Creek to the east of the village (through the area that would become the industrial estate).

The development of the industrial estate filled this swamp causing the overflows to back up and increase the flood height in the village. This is backed up by anecdotes from the headmaster at Billinudgel school (1958-1984). Substantial drains were constructed to carry the overflow water through the industrial estate, but any retention storage offered by the swamp area was eliminated by fill in the industrial estate.

The worst flood in Billinudgel was in 2017, and it was thought to have been worsened by blocked drains (I worked there at the time, and they were). Works to clear these drains subsequently may have improved the severity of the flood, as flood heights in 2022 were approximately 30cm lower, whereas the flood levels were much higher in other areas.

South Golden Beach (SGB)/ New Brighton (NB)

The natural flood overflows from Marshalls Creek flowed to a major ocean outfall where SGB Hall is now located. This outlet was closed by 1958 by developers. This outlet was also fed by waters coming south from Billinudgel Nature Reserve, and would have been expected to have had considerable volumes of water discharging from it in its natural state.

There were other ocean outflows evident in aerial photography between Wooyung to New Brighton prior to 1958. There is evidence of an ocean outfall at Wooyung in historical records, and the area is heavily disturbed in a photo from1962 (possibly by a sand-mining dredge?).

The most prominent ocean outflow was located where the SGB Hall is located today, and this was supported by a well defined network of drainage lines that would have carried water from both the nature reserve and flood overflows from Marshalls Creek. The major Marshalls Creek overflow

passed through where Kolora Way is now, and would have diverted flood water from Marshalls Creek directly to the ocean, thereby reducing flood flows from reaching New Brighton.

Other flood overflow channels still exist to the east of Redgate Road, and these were connected to less substantial ocean outflows between New Brighton and SBG, but probably also discharged water through the ocean outflow at SGB Hall.

The ocean outfall and these drainage channels in the SGB area were filled in by the SGB development in the late 1950's through to the early 1970's. A bypass canal was also constructed before 1962 through the SGB area that connected Marshalls Creek to the Billinudgel Nature Reserve, which along with fill in the SBG area effectively removed the major ocean outfall at SGB. This meant that flood waters from Marshalls Creek and Billinudgel Nature Reserve were connected, but cut off from the previous natural flows to the ocean.

A man-made canal was then constructed to the north of the SGB development seemingly between 1971 and 1987 (no aerial imagery was available between these dates for that area), although its location can be seen in the 1987 imagery. This outlet was originally intended to establish a marina by the developers, and was closed in 1976 (http://brunswickvalley.com.au/). If there was a natural outfall that existed previously at this location, it was small and was not supported by any significant drainage network.

While this outlet may have impacted flood flooding in the Billinudgel Nature Reserve and SGB area, given the restricted potential for flow from Marshalls Creek to enter Capricornia Canal from Marshalls Creek (historic overflows have been blocked), any outlet would be unlikely to reduce flooding on Marshalls Creek. It may, however, reduce floodwaters coming into SGB from the north.

A levee was constructed alongside Redgate Road near the SGB Hall between 1987 and 1991, to protect SBG from flooding (justifiably) from overflow water from Marshalls Creek from flowing north, which was its natural course. The water now ponds behind the levee until it reaches a level that then causes the water to flow back over the Village Green in New Brighton, adding significantly to the flooding in that location. Without this additional water, the peak flood flow would be limited to the capacity of the channel upstream and therefore unlikely to flood the village at all.

No-one is suggesting that the levee be removed as it protects the SGB village.

Implications to Flooding

Given the changes that have occurred as documented in the subsequent timeline, it would seem that removing the water that would have naturally gone out of the outflow at South Golden Beach Hall from the floodplain would be an obvious overarching strategy for flood mitigation.

Opening ocean outflows has been modelled as part of floodplain management studies in 1997 and 2017, but the results suggest minimal improvement on flooding. However, it is likely that flood waters would no longer flow strongly towards these outflow as they did in the past due to filling the drainage channels that used to concentrate the water flows towards the outfalls. (see LIDAR model of the area between SGB and NB).

However, it seems logical that the following strategies should be investigated further.

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1. Stop pumping water from SGB into the canal, as this will simply recirculate the flood water to either Billinudgel Nature Reserve or back in Marshalls Creek, and contribute to the more flooding in New Brighton. This water needs to be pumped out of the system into the ocean, and needs to be supported by well-maintained internal drainage to drain the water to the pumps. Better still, get rid of the water before it comes into SGB.
2. Remove floodwater that used to naturally flow out of Marshalls Creek upstream from New Brighton and into the overflow channels that went into SGB, and take it off the floodplain and into the ocean as it did in the past. This water should not be allowed to pond behind the levee and flow back to increase the flooding of New Brighton. Considerable amounts of water also entered SGB through these levees. We need to investigate either (a) the relationship between the size of the flood pumps and the resulting reduction in flooding, or (b) if drainage channels can be established in the area between SGB and NB to sustain a constructed ocean outfall.
3. Remove the floodwater from the Billinudgel Nature Reserve before it overtops the area to the east of Fern Beach and floods SGB. The water needs to be discharged into the ocean and out of the system. Again, what sized flood pump would be required to do this? Could an ocean outfall be constructed to work without leaving the area susceptible to sea water incursion in storm surge events? There is a call to reinstate the ocean outfall that was built by the developers in the 1970s, but the question remains if the natural drainage channels in the Billinudgel Nature Reserve would deliver sufficient water to an outflow to maintain a natural flow balance, and whether it would be stable to the heavy ocean swells.

It should be emphasised that I am not a hydraulic engineer and the above strategies are not proposed as solutions, but rather should be investigated by hydraulic engineers with the scope of finding the extent of intervention that would be necessary to rectify the impact of the historical development, and evaluating the ROI of those works against outcomes.

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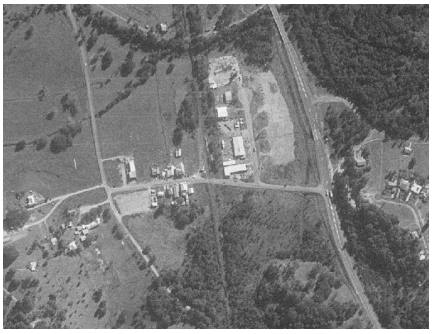
Timeline of development on Marshalls Creek Floodplain.

Photo	Event	Impact
BILLINUDGEL		
	Billinudgel 1947	Flood flows in Billinudgel followed a broad overflow channel to the south of the village to a swampy area to the southeast/ east. Water from this swamp then re-joined Marshalls Creek to the east of the old highway.
	Billinudgel 1971	
	Billinudgel 1987	Industrial estate development started to the north of the access road to Billinudgel
	Billinudgel 1997	Bonanza Drive in the Industrial estate developed to a much high level than surrounding areas.

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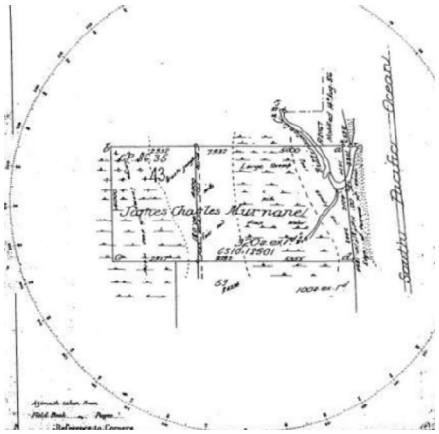
	Modern Terrain Model - Billinudgel	

WOOYUNG		
	Original survey plan 1887	Original survey plan shows an ocean outlet at Wooyung, immediately south of the now caravan park. http://brunswickvalley.com.au/flood-history/flood_map3.pdf
	Wooyung 1962	Location where outflow noted previously heavily altered and apparently closed off from the ocean. Sand dredge still present?

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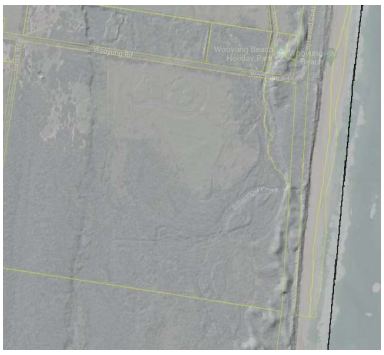	LIDAR data over Wooyung area overlain by Google imagery	Modern LIDAR data exposes the general underlying drainage patterns. This image shows the creek channels in the Wooyung area, and their pattern suggests that there was an ocean outflow in that vicinity at some point.

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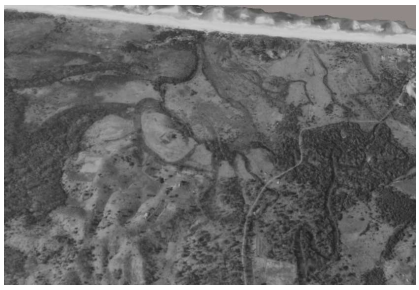
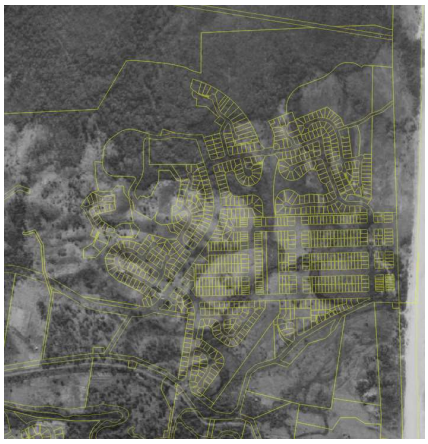
SOUTH GOLDEN BEACH (SGB) and NEW BRIGHTON (NB)

	SGB/ New Brighton 1947	Flood flows from Marshalls Creek left the main channel in a couple of locations to flow into well-defined channels that then flowed into the ocean through openings in the dunes. The main outfall is located where the SBG shop and Community Hall are now. This outfall was also supplied by a major drainage channel coming from the Billinudgel Nature Reserve. Two smaller outflows existed between SBG and NB.
	1947 photo with modern cadastral overlay to locate features.	The location of the main ocean outflow was located where the SGB hall was built.
	Area north of SGB 1958	There was either no significant ocean outflow to the north of SGB where a canal was later established, or it was poorly defined. Drainage patterns clearly showed that the dominant channel flowed to an outfall at SGB hall.

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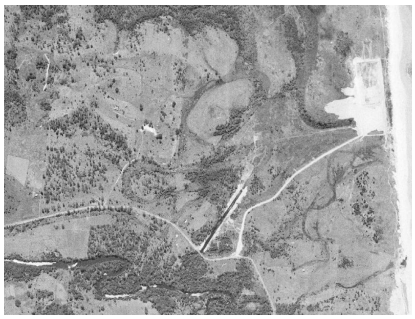
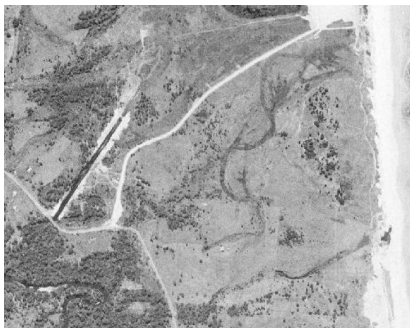
	SGB area 1958	Development of the area of SGB commenced between 1947 and 1958, with the major ocean outfall fill in the area to construct what would later become the SBG blocks closest to the beach. This was probably the area used for an airfield by the American developers at the time. The photo clearly shows the location of the major drainage channel ending at the developed area. Overflow channels are still apparent where Kolora Way is not located.
	Area between SGB and NB 1958	It is unclear if the ocean outfalls between SGB and NB were still open in 1958, but the drainage channels were still well defined. Overflow channels from Marshalls Creek through Kolora Way were less well defined, possibly with the construction of the canal?
	SGB area 1962	Further development of the SGB area was evident by 1962, including a motel. A quarry established at the present-day Seventh Day Adventist Church site. Channels at SGB filled. Capricornia Canal was extended through the area to link to the Billinudgel Nature Reserve.
	Area between SGB and NB 1971	Drainage channels to ocean outfalls between SGB and NB are less well defined, and do not appear to have a clear channel through the dunes. Similarly for overflow channels through the Kolora Way area.

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	Area north of SGB 1971	In 1971, there was no evidence of an ocean outflow to the north of SGB.
	SGB area 1987	The 1987 photos show considerable development of the canal and housing. It is unclear if the levee was constructed at this time.
	Kolora Way 1987	Any evidence of the major overflow channels from Marshalls Creek through the Kolora Way area are no longer evident.
	Area north of SGB 1987	A man-made canal is clearly shown in 1987, although it is not connected to the ocean at this time. This channel was believed to be opened in the early 1970's, but was closed at the request of Council due to sea water inundation during a cyclone.

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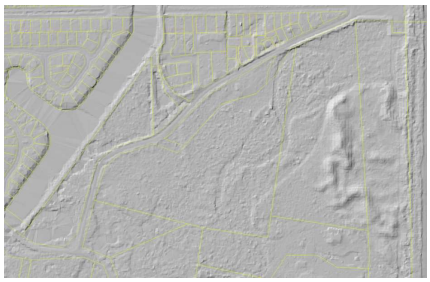
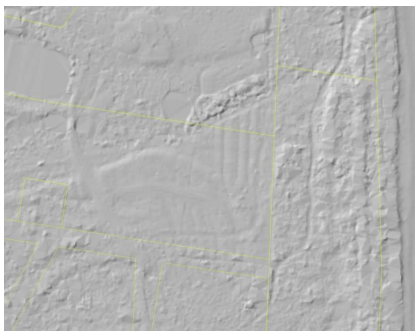
	SGB Hall area 1991	By 1991, the levee stopping any northward flow of water from Marshalls Creek into SGB had been constructed.
	Terrain Model of levee at SGB	A detailed terrain model created by LIDAR shows the levee system that prevents water flowing from Marshalls Creek into the SGB area.
	Terrain Model Kolora Way	Fill deposited in Kolora Way prevents overflow water from Marshalls Creek from flowing north.
	Terrain Model - area between SBG and NB	Ocean outfalls in the area between SGB and NB were fed by distinct drainage channels across the floodplain. These channels and outflows have been altered by sand mining and fill brought in by property owners. The effectiveness of any reconstructed outflow through the dunes would be restricted by the in-filling of these channels.