

REPORT

# MANGAWHAI STORMWATER INFRASTRUCTURE STRATEGY - STAGE 2





PREPARED FOR **KAIPARA DISTRICT COUNCIL**

09/03/2018

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# Kaipara District Council

## Mangawhai Stormwater Infrastructure Strategy - Stage 2

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# 1. Introduction

## 1.1 The Stormwater Infrastructure Strategy Process

The objectives of this Mangawhai Stormwater Infrastructure Strategy (MSIS) are to:

- Guide the future stormwater management for Mangawhai integrating:
  - Community expectations
  - Regional Council drivers
  - Engineering drivers.
- Specify appropriate stormwater measures to guide the mitigation of the effects of development, including upstream and downstream effects, within the Mangawhai catchments.

The Mangawhai Stormwater Infrastructure Strategy outlines the stormwater management options and measures to manage the effects of stormwater discharges resulting from both the existing and proposed development for Mangawhai. For this purpose it includes:

- Identification of stormwater issues within the Mangawhai area (including infrastructure information gaps)
- Identification of potential options or a pathway to address these issues
- Recommendations for the long-term stormwater catchment management including; information gathering, generic and site specific controls, planning controls, physical works and operation and maintenance strategies
- An improvement plan for the implementation of those recommendations.

## 1.2 Drivers and Expectations

One of the main objectives of the Mangawhai Stormwater Infrastructure Strategy is to guide the stormwater management within the Mangawhai catchment integrating community expectations, Regional Council and engineering drivers.

In order to understand these drivers and expectations, the following process has been followed and documents reviewed.

### 1.2.1 Community Expectations

The draft Mangawhai Community Plan has been reviewed. A copy of the draft Mangawhai Community Plan is included in Appendix A. The purpose of the draft Mangawhai Community Plan is described as being to “...provide guidance to Kaipara District Council in the management of growth in the wider Mangawhai area. It is confined to the roles of Council; ... [including] stormwater...” The draft Mangawhai Community Plan has been developed in association with the Mangawhai Community Panel set up by Council in mid-2016.

The draft Mangawhai Community Plan is informed by the Mangawhai Town Plan Stormwater Infrastructure Strategy, prepared by Stantec in May 2017 (attached as Appendix B). The Mangawhai Town Plan Stormwater Infrastructure Strategy set out at a principle level, the

community expectations and drivers for the development of Mangawhai Village and Mangawhai Heads with relation to stormwater discharges. These expectations were based on:

- The Mangawhai Town Plan (MTP) and in particular the MTP Guiding Principles and Assumptions.
- The Mangawhai Advisory Panel Workshop held on Friday 24th March 2017. The goal of this workshop was to discuss stormwater issues and options and to gain an understanding of what is important to the community from the Advisory Panel's perspective.
- Discussions conducted with District Council Officers on community expectations.

These principles have been carried forward and updated based on the draft Mangawhai Community Plan and are included within the present Mangawhai Stormwater Infrastructure Strategy.

### **1.2.2 Drivers from Regional Council**

In order to set a sustainable future direction for stormwater management in Mangawhai it is also important that the likely future direction for stormwater management is understood from Northland Regional Council's perspective as set out in various documents.

Stormwater management expectations are set out in Northland Regional Council documents such as the Water and Soil Plan. The Regional Council had advised that it is intending to notify a new Regional Plan to update the Water and Soil Plan (as it is now somewhat dated). The proposed Regional Plan, notified in November 2017, has been reviewed to provide direction as to the likely Regional Council directions with respect to stormwater discharges.

Kaipara District Council was granted a 35 year stormwater discharge consent for Mangawhai on the 26<sup>th</sup> of July of 2017 (expires on 1<sup>st</sup> of June of 2052). The conditions of the stormwater consents are integrated into this Stormwater Infrastructure Strategy.

The Regional Council Documents considered as inputs into this strategy include:

- Northland Regional Council proposed Regional Plan, November 2017 (excepts included in Appendix C)
- Mangawhai Stormwater discharge consent, July 2017 (copy included in Appendix D).

### **1.2.3 Engineering Requirements and Expectations**

The relevant engineering requirements relate to the physical constraints around, in particular, the stormwater infrastructure and the design basis for new or renewed infrastructure. In this regard, the particular documents considered within this Stormwater Infrastructure Strategy include:

- Kaipara District Council Engineering Standards, 2011
- Building Act, 2004: Sections 71-74
- Building Act: Building Code E1 Surface Water, Acceptable Solutions.

## 1.3 Information sources

This Mangawhai Stormwater Infrastructure Strategy references a range of existing documents and sources of information in order to identify the stormwater issues, outline the stormwater management options and measures to manage the effects of stormwater discharges resulting from the proposed development for Mangawhai Village and Mangawhai Heads. These documents include:

- Mangawhai Stormwater Management Plan, KDC, Duffill Watts & King Ltd 2006
- Kaipara District Council Engineering Standards, 2011
- Northland Regional Council Proposed Regional Plan, August 2016
- Stormwater discharge consent for Mangawhai, July 2017
- Mangawhai Land Use and Future Growth Area Plans, District Plan
- Updated GIS network data from Kaipara District Council. Including stormwater, wastewater and water supply. KDC 2017 – Note that an error has been identified by LINZ on the One Tree Point datum which has changed by 1 metre. This will affect KDC asset information posted on the GIS since 1985.
- Mangawhai Town Plan Maps from KDC website. KDC 2016
- Customer Service Requests forms from KDC. From 2008 to 2016. Total 76 forms
- Kaipara District Council Proposed Cycleway. MWH 2016
- LIDAR 2016. Contours lines (each 0.5 m). Provided by KDC
- LINZ GIS data. Provided by KDC 2017
- Mangawhai Proposed Developments Plans, 2017, total 6
- Mangawhai Approved Development Plans, 2003 to 2016, total 10
- Acid Sulphate Soil Areas Mangawhai Plans, OPUS 2017
- Quail Way Stormwater Improvement: Investigation and catchment Analysis Report, OPUS 2017
- Mangawhai Fagan Place Stormwater Disposal Plan Pond and Silt trap Chamber Details, DuffillWatts Kind Ltd, 1998
- Mangawhai Village and Mangawhai Heads Infrastructure Plan – Transportation, MWH now part of Stantec 2016
- Mangawhai Town Plan Stormwater Infrastructure Strategy, MWH now part of Stantec 2017
- Mangawhai Town Plan Change Stormwater Infrastructure Report. GHD 2016
- Mangawhai Stormwater Consent Renewal Affected Parties Assessment. MWH 2015
- The draft Mangawhai Community Plan, KDC, 2017



## 1.4 Basis of Analysis

Due to the nature of the information available and the limitations of it in a quantitative form, this Stormwater Infrastructure Strategy is focussed initially on a qualitative assessment. It has recommendations for improvements to the available data to allow the future quantification of issues and solutions.

## 2. Expectations from Stormwater Infrastructure Strategy

### 2.1 Community Expectations

The community expectations are highlighted in the draft Mangawhai Community Plan. The draft Mangawhai Community Plan sets out six of what it calls “Key Moves” to guide the continued growth of Mangawhai. The key Moves which relate to stormwater management and their implications from a stormwater perspective include:

- Key Move one: Slow street from school to beach

*Once in Mangawhai, it is an active place, with a safe and slow pace. A slow street will connect the different areas of Mangawhai, from the school to the beach over time, invigorating town centres along the way.*

- Key move two: Blue-green Infrastructure

*Connecting people with nature by using the coast, streams and creeks as routes for tracks, integrated with protecting bush, coastal and riparian landscaping and revegetation to sustain high water quality, eco-corridors and biodiversity.*

- Key move five: Protecting coastal character

Looking back to the coast from the harbour, you see low rise houses on larger lots with extensive bush. In the Mangawhai coastal strip, retain coastal character with large lots, height limits and spacious setback from the road and an esplanade reserve.

The vision conveyed from the draft Mangawhai Community Plan is to keep the feeling of a beach area. The blue-green infrastructure, where blue refers to the rivers and water bodies and green refers to greening landscapes (open spaces, swales instead of kerbs and channels, wetlands), encourages natural themed solutions to stormwater management and urban design over highly engineered solutions. This type of infrastructure is also integral with Key Move One in the slowing down of traffic and providing alternative connectivity options.

From a stormwater perspective the outcomes of this type of approach can include:

- The reduction in contaminant generation and an increase in contaminant removal. Providing alternatives to vehicle usage such as the use of shared paths will assist in reducing contaminant generation that would usually be associated with higher vehicle usage in areas undergoing intensification.
- A volume and peak flow reduction for the more regular rainfall and stormwater discharge events. Providing more naturalised stormwater solutions can reduce the impacts of stormwater discharges on stream and beach environments by encouraging infiltration and delaying the discharges.

The draft Mangawhai Community Plan is informed (in part) by the Mangawhai Town Plan (MTP) and in particular the MTP Guiding Principles and Assumptions. The use of blue-green infrastructure is encouraged by the MTP guiding principle **9. Environmentally sustainable design will be encouraged in Council and private development**

The other MTP Guiding Principle which relates to stormwater management issues and its implications from a stormwater perspective is:

**1. Mangawhai will continue to rely upon rainwater collection and tank storage.**

The requirement for on-site and individually owned stormwater infrastructure creates both opportunities but also introduces some constraints.

From an opportunities perspective on-site devices create the opportunity to manage stormwater discharges at source. It reinforces individual responsibility with respect to stormwater discharges. On-site tanks provide a reduction in the total volume of stormwater discharges by reuse and it also creates opportunities for on-site attenuation and in some circumstances enhances the possibility of on-site disposal.

From a constraints perspective, reliance on a large number of individually owned and managed devices to achieve a downstream public good increases the need for the provisions of comprehensive design information and strategies, the carrying out of good design, implementation of the good design through the construction process and the long-term monitoring and maintenance of the devices to ensure the long-term achievement of the design outcomes.

In order to achieve the main community expectations and maintaining the community vision, different stormwater management options were discussed and are included within this Stormwater Strategy:

- Blue-green infrastructure, or the use of natural based stormwater management systems over engineered drainage systems, using "biofiltration" to lessen flood risks and improved water quality, in the form of swales and overland flow and retention ponds and rain gardens.
- Utilise appropriately designed and maintained soakage systems wherever possible as a primary means of disposal. Soakage systems may also be utilised even where the full "engineered" soakage may not be achievable; if regular events can be discharged to soakage, this can have a positive effect on maintaining stream base flow, reducing volumes and peak flows of stormwater discharges.
- Avoid the creation of multiple piped discharges onto the estuary and consolidate to as few discharges points as practicable.
- Keep water on the surface by using swales for treatment and conveyance avoiding kerb and channel wherever is possible.

## **2.2 Regional and Council Expectations**

Kaipara District Council was granted a stormwater discharge consent for Mangawhai on the 26<sup>th</sup> of July of 2017 until 1<sup>st</sup> of June of 2052. The Mangawhai stormwater discharge consent details the immediate Regional Council expectations for stormwater discharges in Mangawhai.

The Northland Regional Council Proposed Regional Plan outlines the expected long-term directions for stormwater management. The Resource Consent is generally consistent with the directions of the Northland Regional Council Proposed Regional Plan. The main expectations set out in Regional Council documents can be summarised as:

- Stormwater diversion and discharge is not to cause, or increase, the scale or extent of existing ponding areas
- The stormwater collection system from new industrial and commercial development is to be designed to avoid any contaminants stored or used on site to enter any stormwater discharges
- Stormwater discharges are not to permanently scour or erode the bed and banks of a watercourse or the coastal marine area
- The provision of protection for existing and new overland flow paths and watercourses
- Adequate Operation and Maintenance Plan that includes all the assets within the stormwater network system.
- The stormwater discharges are not to cause the; production of any conspicuous oil or grease film, scums or foams, or floatable or suspended materials, or emissions of objectionable odour, or any significant adverse effects to the aquatic life on the receiving water. Any effects will be measured and controlled a specific distance from the discharge point.

## 2.3 Engineering Requirements and Expectations

The existing Kaipara District Council Engineering Standards (October 2011) describe the target standards for the stormwater drainage systems. These targets apply to all new land development projects and also represent a target level of service for the existing drainage system.

- Primary system rural and residential land use design for a 20% AEP rainfall event
- Primary system industrial land use design for a 10% AEP rainfall event
- Primary system commercial land use design for a 5% AEP rainfall event
- Stormwater systems shall be designed including allowance for the anticipated effects of climate change, with guidance on what this means provided
- Overland flow paths and secondary flow paths for piped networks are to be designed to accommodate and provide protection for up to the 1% AEP rainfall event
- Primary system, overland flow paths and secondary flow paths should be designed to comply with health and safety requirements.

There is very limited guidance in the engineering standards on the design and maintenance requirements of soakage systems, swales or other blue-green infrastructure. This gap presents limitations on what can be required by the Kaipara District Council in terms of long term effective blue-green infrastructure as it relates to stormwater design.

As rules change or more information becomes available, the existing Kaipara District Council Engineering Standards (October 2011) will be updated. Therefore, the requirements that are applied to all new land development projects and target level of service for the existing and new drainage system will need to be based on the most recent iteration of the Engineering Standards at the time of the new land developments.



## 3. Stormwater Infrastructure Strategy Outcomes

Based on the community expectations, Regional Council expectations and engineering requirements, this section discusses the main elements and desired outcomes of the Mangawhai Stormwater Infrastructure Strategy under the heading of stormwater quantity, stormwater quality and asset management.

### 3.1 Stormwater Quantity

The desired outcomes from a stormwater quantity perspective are:

- Encourage the use of blue-green infrastructure in order to achieve;
  - No increase and where possible a reduction in existing flooding risks.
  - No creation of new flooding risks.
- The identification of overland flowpath routes.
- Provision and protection of existing and new overland flowpath routes.
- Encourage on-site reuse and disposal. Even where soakage is not possible the use of blue-green techniques can effectively reduce the total annual volume of stormwater discharges and the contaminants carried within them.
- Establish guidelines for the design and construction of discharge points not to be physically intrusive on the environment.

### 3.2 Stormwater Quality

The desired outcomes from a stormwater quality perspective are:

- Encourage the use of blue-green infrastructure in order to;
  - Manage contamination as close to source as possible and particularly to address the risks in commercial or industrial areas which have the potential to be the source of concentrated contaminant discharges.
- To not create erosion of stream bed or banks or the beach at discharge points.
- To include the provision of stormwater and sediment control measures and energy dissipation to be installed and maintained to minimise erosion at discharge points.
- To not increase environmental or nuisance risks at outfall locations.
- To meet the conditions of the Mangawhai Stormwater discharge consent granted to KDC on July 2017 and Regional Plan requirements for Stormwater discharges.
- Not to cause any; production of any conspicuous oil or grease film, scums or foams, or floatable or suspended materials, or emissions of objectionable odour, or any significant adverse effects to the aquatic life on the receiving water.

### 3.3 Asset Management

The desired outcomes from an asset management perspective are:

- No increased hazard at discharge points.

- Provide support for stormwater management practices through:
  - Enhanced Engineering Standards.
  - Improved and complete stormwater infrastructure data.
  - The provision of standardised design methodologies to simplify (building and resource) consent applications and processing.
  - The provision of examples of acceptable solutions.
  - The provision of standard Operation and Maintenance Requirements and Plans.

## 4. Existing Catchments

### 4.1 Existing Catchment Descriptions

This section describes the physical attributes of each of the individually identified catchments within the MSIS area. For consistency of approach the catchment numbers within the Duffill Watts & King Ltd Catchment Management Plan (2006 updated 2010) (CMP) have been retained. Where the catchment boundary has changed or a new catchment has been added due the study area extending, these changes have been numbered as a progression from the CMP system. The catchments and their numbers are identified on the Issues drawings in Appendix E.



Figure 1. Mangawhai area catchments wide figure and land use based on Kaipara District Plan

The existing land use described in each of the catchments is based on the Kaipara District Plan ('the District Plan') which was notified as the Proposed District Plan in 2009, and became the Operative District Plan on 1st November 2013. Figure 1 includes a small scale plan of the overall study area catchments including zoning based on the Operative Kaipara District Plan.

#### 4.1.1 Catchment 1

This catchment includes the Mangawhai Heads Recreation Reserve, developed residential land and rural land that drains into the Mangawhai Harbour approximately 200m upstream of the harbour entrance.

Two privately owned and operated treatment and detention ponds upstream of Wintle Street were constructed to mitigate the effects of the Back Bay subdivision.

The catchment is generally steep with clay soils and a high proportion of regenerating Manuka/Kanuka forest. Figure 2 includes an overview of catchment 1





Figure 2. Catchment 1 overview plan

#### 4.1.2 Catchment 2

This catchment includes a large rural area and a smaller area of residentially developed land adjacent to the Mangawhai Harbour, all draining into the harbour opposite Pearl Street.

Two detention ponds upstream of Pearl Street and a pipe stormwater system along Pearl Street were constructed to mitigate the effects of the Joyden Productions subdivision.

The overland flow path along Pearl Street crosses Wintle Street near the intersection and discharges to the harbour across private property. The existing CMP identifies the need for a piped system with capacity for the 1% AEP flows to discharge across Wintle Street. A large bore piped system has been constructed in the area but no information is available on the capacity of this system. There are also a number of open drains and pipes on private property and road reserve within this catchment.

The catchment is generally steep with clay soils and a high proportion of regenerating Manuka/Kanuka forest. Figure 3 includes an overview of catchment 2

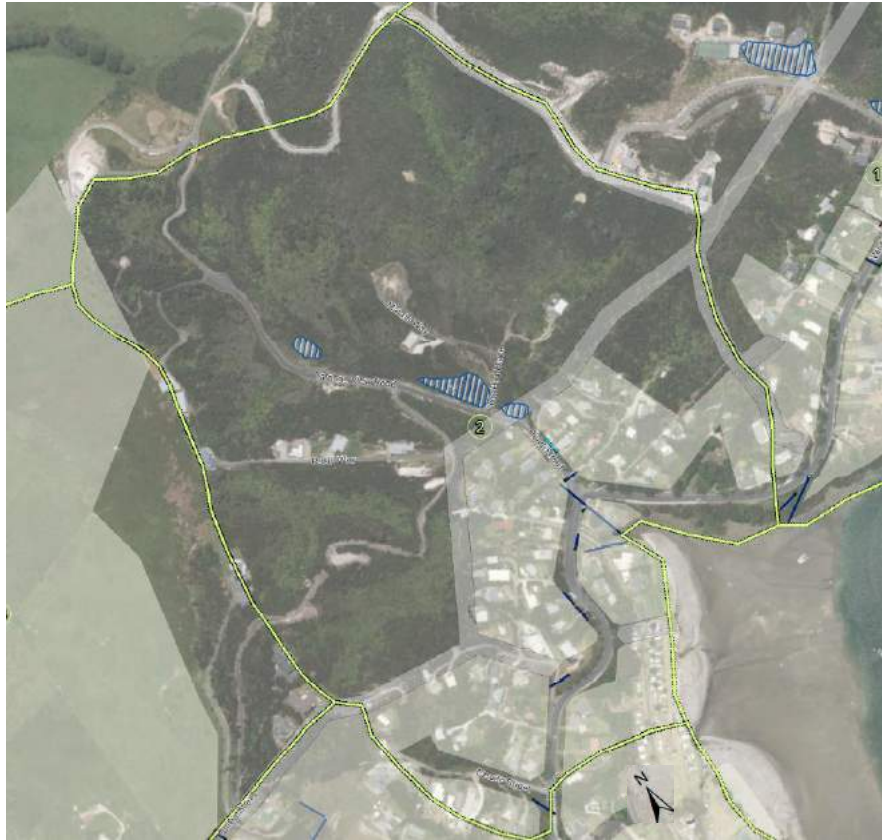


Figure 3. Catchment 2 overview plan

### 4.1.3 Catchment 3

This catchment is dominated by residentially developed land draining to the harbour via a stream that runs through the back of the Mangawhai Heads Holiday Park.

A stormwater system combining pipes and open channels has been constructed at the top of the catchment between Cullen Street and Taranui Place. The overland flow path (including a natural stream) runs through private properties from Taranui Place to and beneath Mangawhai Heads Road to the stream that runs through the back of the Mangawhai Heads Holiday Park.

The catchment is generally steep with clay soils. The lower areas through the Mangawhai Heads Holiday Park though are flat. Figure 4 includes an overview of catchment 3.



Figure 4. Catchment 3 overview plan

#### 4.1.4 Catchment 4

This catchment comprises predominantly residential zoned and developed land as well as the commercial area of Mangawhai Heads. The northern end and the majority of the Mangawhai Heads structure plan area is contained within this catchment.

The catchment generally comprises free draining sandy soils, development has occurred on consolidated sand dunes with limited historical earthworks. There are natural depressions which have been retained within developments. There are other areas where the natural infiltration into the sand has been sealed off by development and the surface has effectively become impervious. Figure 5 includes an overview of catchment 4.





Figure 5. Catchment 4 overview plan

#### 4.1.5 Catchment 5

This catchment comprises residentially zoned and developed land. . The southern portion of the Mangawhai Heads structure plan area is contained within this catchment. The catchment is built on consolidated sand dunes and slopes naturally towards the harbour. Figure 6 includes an overview of catchment 5.



Figure 6. Catchment 5 overview plan

#### 4.1.6 Catchment 6

This catchment comprises residentially zoned and developed land. The land slopes steeply down to the estuary with a flat largely reserve area abutting the estuary.

The catchment generally comprises free draining sandy soils, development has occurred on consolidated sand dunes with limited historical earthworks. There are natural depressions which have been retained within developments. There are other areas where the natural infiltration into the sand has been sealed off by development and the surface has effectively become impervious. Figure 7 includes an overview of catchment 6.



Figure 7. Catchment 6 overview plan

#### 4.1.7 Catchment 7

This catchment includes a developed residential area to the north and a large area of undeveloped residential zoned land to the south including land undergoing development at the time of writing.

Future and existing developments would result in a significant increase of impervious area. Figure 8 includes an overview of catchment 7.





Figure 8. Catchment 7 overview plan

#### 4.1.8 Catchment 8

This catchment comprises a large undeveloped residential zoned area at the southern end of the peninsula.

Two privately owned detention ponds upstream of Estuary Drive were constructed to mitigate the effects of the subdivision. Figure 9 includes an overview of catchment 8.

The catchment is generally on sandy soils.



Figure 9. Catchment 8 overview plan

#### 4.1.9 Catchment 9

This catchment comprises a large developed residential zone and a small industrial zone to the north of the catchment.

The runoff from the upper area used to rely on soakage capacity, however, increased development in the area resulting in natural depressions being developed has led to reduced soakage capacity and increased localised flooding. Two stormwater improvement projects are scheduled to be constructed mid-2018 at Quail Way and Pohutukawa Place. In concept, these stormwater improvements will allow those upper areas to discharge to the Estuary through Breeve Street.

The runoff from the lower area of the catchment discharges into the Mangawhai Estuary near to Molesworth Drive Bridge.

The catchment is generally on sandy soils. Figure 10 includes an overview of catchment 9.

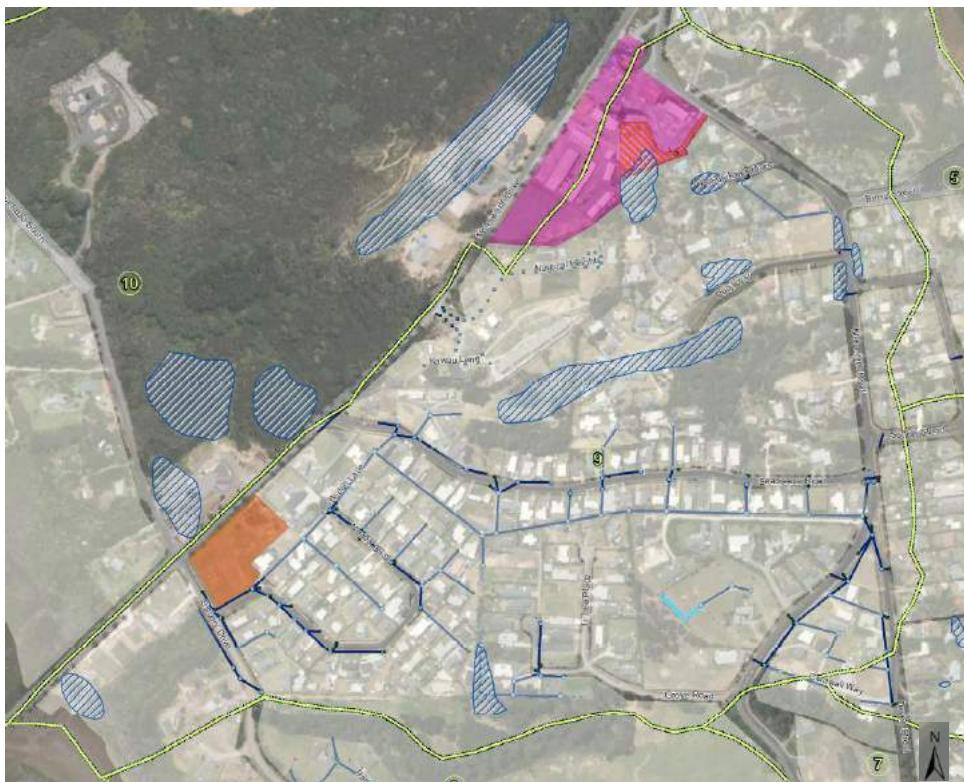


Figure 10. Catchment 9 overview plan

#### 4.1.10 Catchment 10

This catchment comprises a large area of rural zoned land and a smaller area of residentially zone land that drains into a concentrated discharge point to the Coastal marine area upstream of the Molesworth Drive Bridge.

The land is covered in woody vegetation and includes the Mangawhai Community Park precinct. There is a natural wetland to the south of the catchment close to the Mangawhai Museum. This area could have a possibility for a demonstration wetland including recreational and educational possibilities. Figure 11 includes an overview of catchment 10.



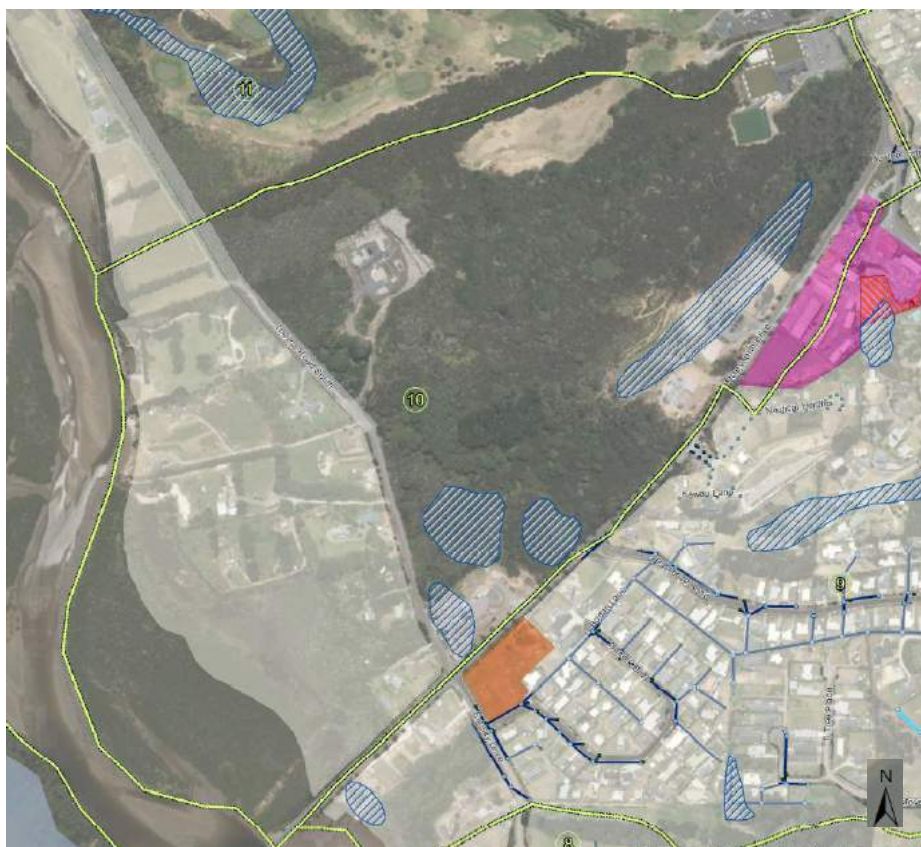


Figure 11. Catchment 10 overview plan

#### 4.1.11 Catchment 11

This catchment is dominated by the golf course with a small area of residentially zoned land off the end of Jack Boyd Drive. The catchment drains to the estuary through an open drain near the southern end of Jack Boyd Drive. There is a small area enclosed by a bund off the end of Thelma Road.

The southwestern portion of the Mangawhai Heads structure plan area is included within this catchment.

The land is covered in grass with some areas of bush. Figure 12 includes an overview of catchment 11.





Figure 12. Catchment 11 overview plan

#### 4.1.12 Catchment 12

This catchment comprises a large catchment of residential zoned land. The upper and central half of the catchment has been subject to intense subdivision in recent years while the lower part is less developed.

The developments have been built on soils with moderate soakage capacity, however, there are areas where the natural infiltration has been sealed off by development and the surface has effectively become impervious.

Figure 13 includes an overview of catchment 12.

Figure 14 shows a representation of the catchment drainage paths of the area at the downstream end of Jack Boyd Drive prior to the upstream development (supplied in support of the Cullen Subdivision, Mangawhai Heads 1997). These catchment drainage paths were to be protected and rerouted in the majority to a 750mm culvert below the road near the western boundary of Lots 9 and 10 (existing 65 and 67 Jack Boyd Drive).

The Cullen Subdivision identified a contributing area of the catchment of 47.1 ha discharging through this culvert with a design discharge of approximately  $6.2\text{m}^3$  for a 1% AEP event. The design finished centreline at the location of the culvert was RL 2.6 LINZ and the invert level of the culvert was RL 1.1. According to the Cullen Subdivision the 750mm culvert without freeboard was able to perform to an ultimate capacity of  $1.5\text{m}^3$ . As such the road (Jack Boyd Drive) was designed to overtop during the peak of a storm event.

Intense development which has occurred upstream of Jack Boyd Drive in recent years, will have substantially increased the peak flow and volume of runoff from the upstream catchment stressing the Jack Boyd Drive system and increasing the risk of flooding in the catchment. This area is also very low lying and drainage from it is constrained by water levels in the estuary.



Figure 13. Catchment 12 overview plan

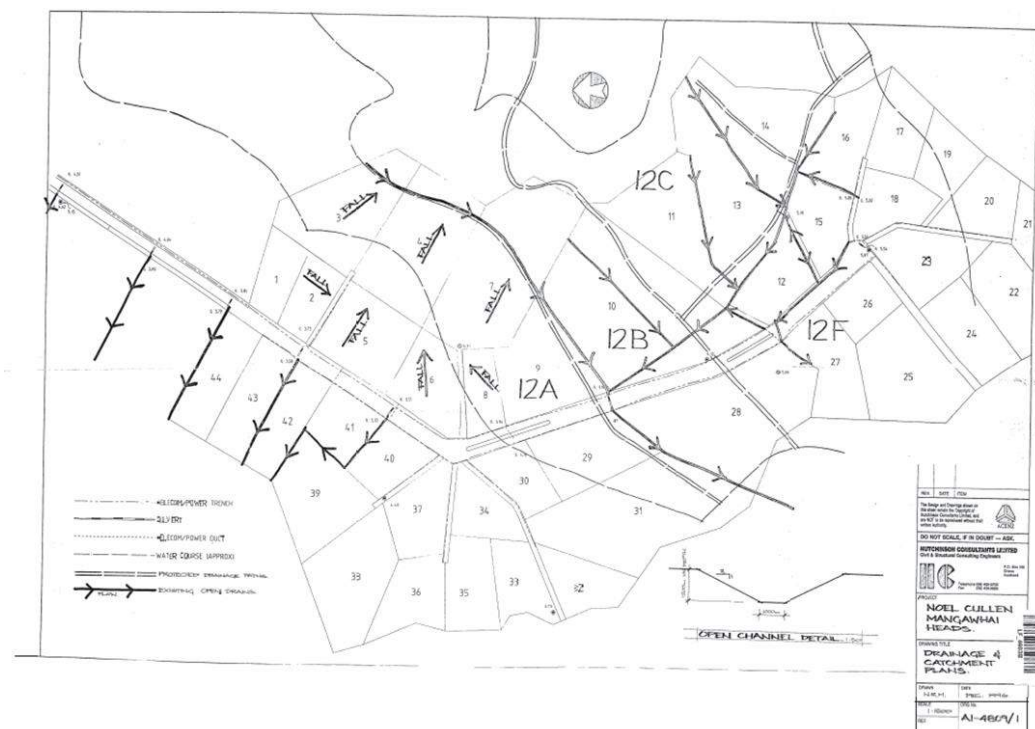


Figure 14. Catchment 12 drainage plan 1997

#### 4.1.13 Catchment 13

This catchment comprises a large catchment of rural zoned land and a medium size catchment of residential zone land below Mangawhai heads Road. The catchment drains on to flat land that is subject to periodic flooding.

The increased intensity of development has resulted in more stormwater discharges to the flat land, increasing the risk of flooding. Figure 15 includes an overview of catchment 13 and catchment 14.





Figure 15. Catchment 13 overview plan

#### 4.1.14 Catchment 14

This catchment comprises a small catchment of residential zoned land and small catchment of rural zone. There is a large culvert under Cove Road which drains a large are of rural and rural residential lane through and along the boundary of this catchment. Figure 15 includes an overview of catchment 13 and catchment 14.

#### 4.1.15 Catchment 15

This catchment comprises predominantly residential zoned land as well as the Estuary Estate Structure Plan area and the rural land upstream of the Estuary Estate land.

The Estuary Estate Structure Plan is defined to the north by the Tara Creek estuary which drains into the upper Mangawhai Harbour and to the west to a wetland that discharges to the Tara Creek. A specific stormwater study is currently being undertaken for the Estuary Estate Structure Plan land. Issues within the Estuary Estate Structure Plan are not considered in this Stormwater Infrastructure Strategy.

The catchment has two natural watercourses and two concentrated stormwater discharge points to the Coastal Marine Area. Figure 16 includes an overview of catchment 15.



Figure 16. Catchment 15 overview plan

#### 4.1.16 Catchment 16

This catchment comprises the predominantly residential zoned and developed land and the commercial area of Mangawhai Village. The eastern end and the majority of the Mangawhai Village structure plan area is contained within this catchment.

The land is generally flat and poorly drained with a number of open drains and piped systems installed as part of specific developments conveying stormwater to the estuary. Figure 17 includes an overview of catchment 16.





Figure 17. Catchment 16 overview plan

#### 4.1.17 Catchment 17

This catchment comprises residential zoned land on the flat and rural zoned land on the hills. Tara Road is under pressure for residential growth to the east and rural residential growth to the west. The western portion of the Mangawhai Village structure plan area is contained within this catchment.

The flat land is generally poorly drained with a number of piped systems installed as part of specific developments conveying stormwater to the estuary. The hills are typical farm and rural residential land that drain via a number of watercourses to the estuary. Figure 18 includes an overview of catchment 17.

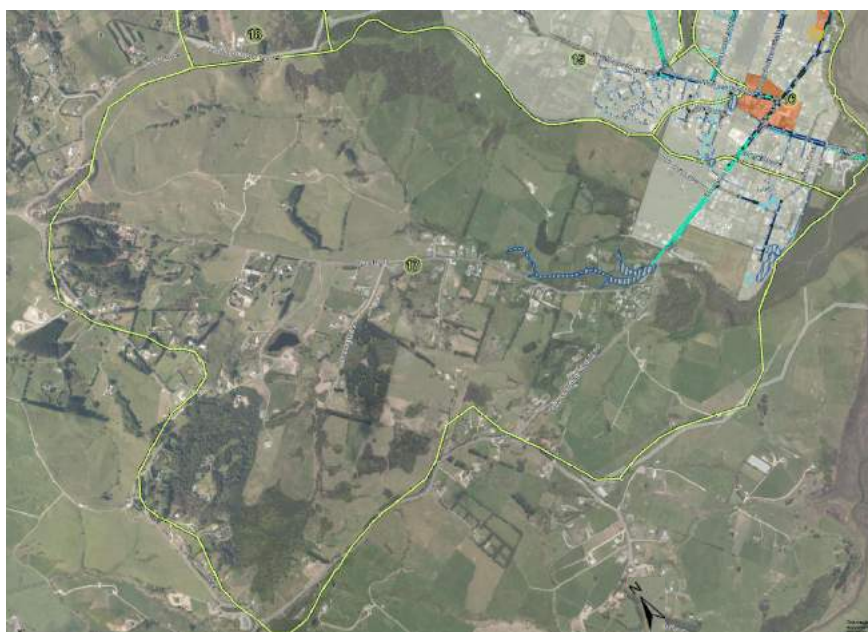


Figure 18. Catchment 17 overview plan



#### 4.1.18 Catchment 18

This catchment comprises rural zoned land generally delineated by Cove Road on the northwest side and the Old Waipu Road to the South. Part of the Estuary States Structure Plan falls into this catchment. The Estuary Estate Structure Plan is defined to the north by the Tara Creek estuary which drains into the upper Mangawhai Harbour and to the west to a wetland that discharges to the Tara Creek. A stormwater study is currently being undertaken for the Estuary Estate Structure Plan. Issues within the Estuary Estate Structure Plan are not considered in this Stormwater Infrastructure Strategy. Figure 19 includes an overview of catchment 18.



Figure 19. Catchment 18 overview plan

## 4.2 Potential Future Growth Areas

This section summarises the land use changes from the Kaipara District Plan and the future study areas which have been considered (for the purposes of this strategy) as potential future growth areas and how it will influence each of the catchments.

### 4.2.1 Existing Rural Land

The strategy considers the implications and information requirements in the event that existing rural zoned land (outside of existing urban zonings) were to be considered for more intensive development. Land included within this consideration includes that east of Tara Road and south east of Cove Road.

Any potential development in existing rural zone land would be managed ultimately by regulatory requirements, however it will require specific stormwater analysis and design including mitigation of the stormwater flows and where possible incorporating blue-green infrastructure and multi-purpose structures or facilities.

### 4.2.2 Plan Change 3

Plan Change 3, North City Developments, was accepted and decision was released in May 2017 and became operative in October 2017. This Plan Change area is included in catchment 9. Figure 20 includes an overview of the Plan Change 3 area.



Figure 20. Plan change 3 North City Developments Plan overview

### 4.2.3 Mangawhai Town Plan Area

The future study area includes the Mangawhai Town Plan areas. The Mangawhai Town Plan is a Council project which is currently being undertaken, at this stage it is on-statutory stage, however, it shows the proposed intensified development areas for the Mangawhai Heads and the Mangawhai Village.

The Mangawhai Town Plan Map 4: *New Medium Zones and Proposed Expansion Commercial Zones* proposes intensification of development around the commercial areas in both Mangawhai Village and Mangawhai Heads. This map sets the boundaries for the proposed expanded commercial zone and the proposed medium density residential zone.

Figure 21 and Figure 22 show the proposed intensified development areas for the Mangawhai Heads and the Mangawhai Village, respectively.

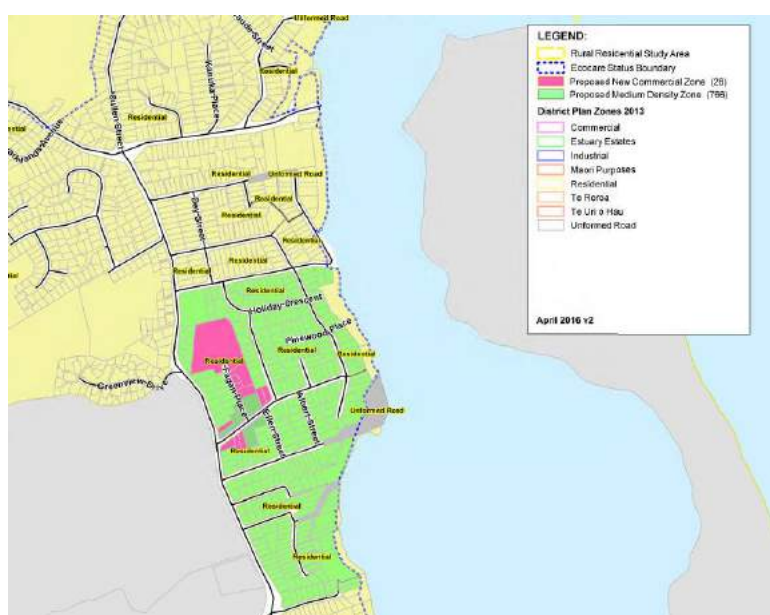


Figure 21. Mangawhai Heads Proposed Intensification Rezoning from the Mangawhai Town Plan

Figure 21 is an extract from the Mangawhai Town Plan *Map 4 New Medium Zones and Proposed Expansion of Commercial Zones* showing the proposed expansion of the commercial zone at Wood Street and Fagan Place for Mangawhai Heads. It also proposes a Medium density residential zone for the rest of the area.

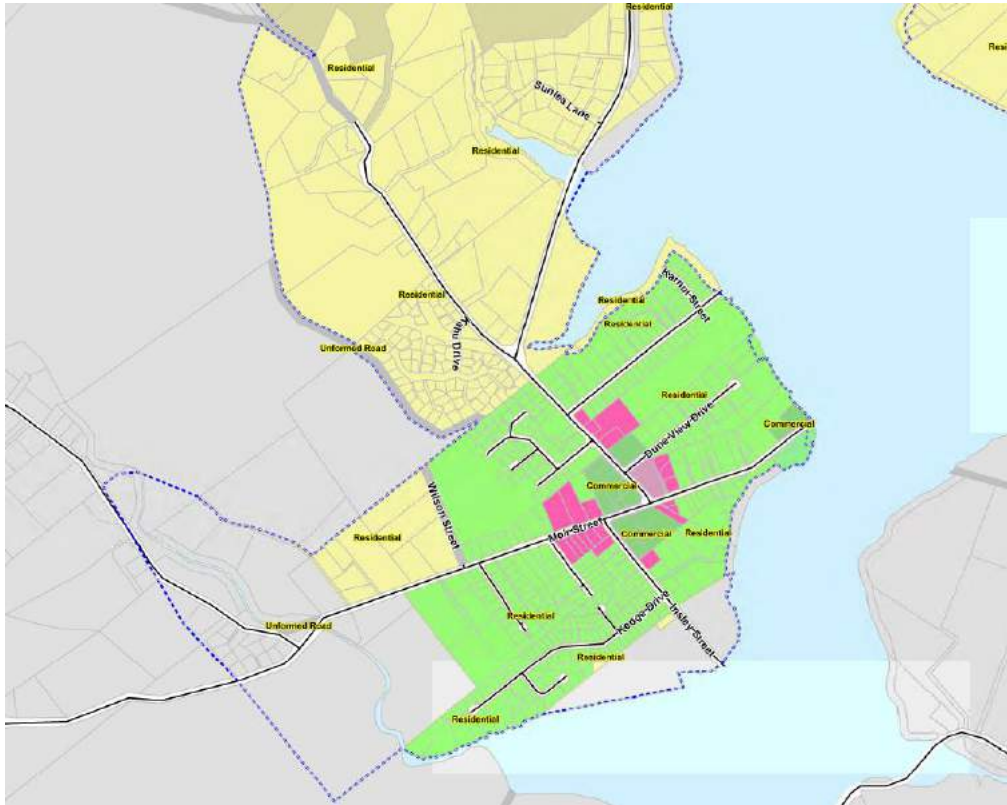


Figure 22. Mangawhai Heads Proposed Intensification Rezoning from the Mangawhai Town Plan

Figure 22 is an extract from the Mangawhai Town Plan *Map 4 New Medium Zones and Proposed Expansion of Commercial Zones* showing the proposed expansion of the commercial zone at Moir Street and Molesworth Drive for Mangawhai Village. It also shows a Medium density residential zone for the rest of the catchment.

The Mangawhai Town Plan developments were included within the Stage 1 Stormwater Infrastructure Strategy included within Appendix B to this document.

## 5. Stormwater Infrastructure Strategy Issues

The main issues affecting stormwater have been identified by stormwater catchments and are included within the issues and options table (Table 1 below) and the Issues Plans presented in Appendix D.

The Issues Table and Plans have been developed as a result of the analysis of the combination of the following information combined with Rapid Flood Hazard Mapping results (where available):

- Updated GIS network data from Kaipara District Council. Including SW, WW and WS infrastructure KDC 2017
- Mangawhai Town Plan Change Stormwater Infrastructure Report. GHD 2016
- Mangawhai Stormwater Consent Renewal Affected Parties Assessment. MWH 2015
- Mangawhai Town Plan Maps from KDC website. KDC 2016
- Customer Service Requests forms from KDC. From 2008 to 2016.
- Kaipara District Council Proposed Cycleway. MWH 2016
- LiDAR 2016. Contours lines (each 0.5m for limited future growth area and each 8 m outside of the limited future growth area) for the limited future growth area. Provided by KDC
- LINZ GIS data. Provided by KDC 2017
- MWH Site visit information recompile. MWH 07 February 2017
- Stantec Site visit information recompile. Stantec 24 and 25 October 2017.

The "Acid Sulphate Soil Risk Areas Mangawhai Plans", prepared by OPUS in 2017 and included in Figure 23, have been reviewed and are referenced in the issues table. Acid sulphate soils when disturbed or exposed to air can release acid which can damage built structures and harm animals and plants. The potential presence of these soils needs to be taken in to account prior to any work (particularly earthworks) in the potentially affected areas. Further soil investigation would be required in any area subject to Acid Sulphate Soil Risk.



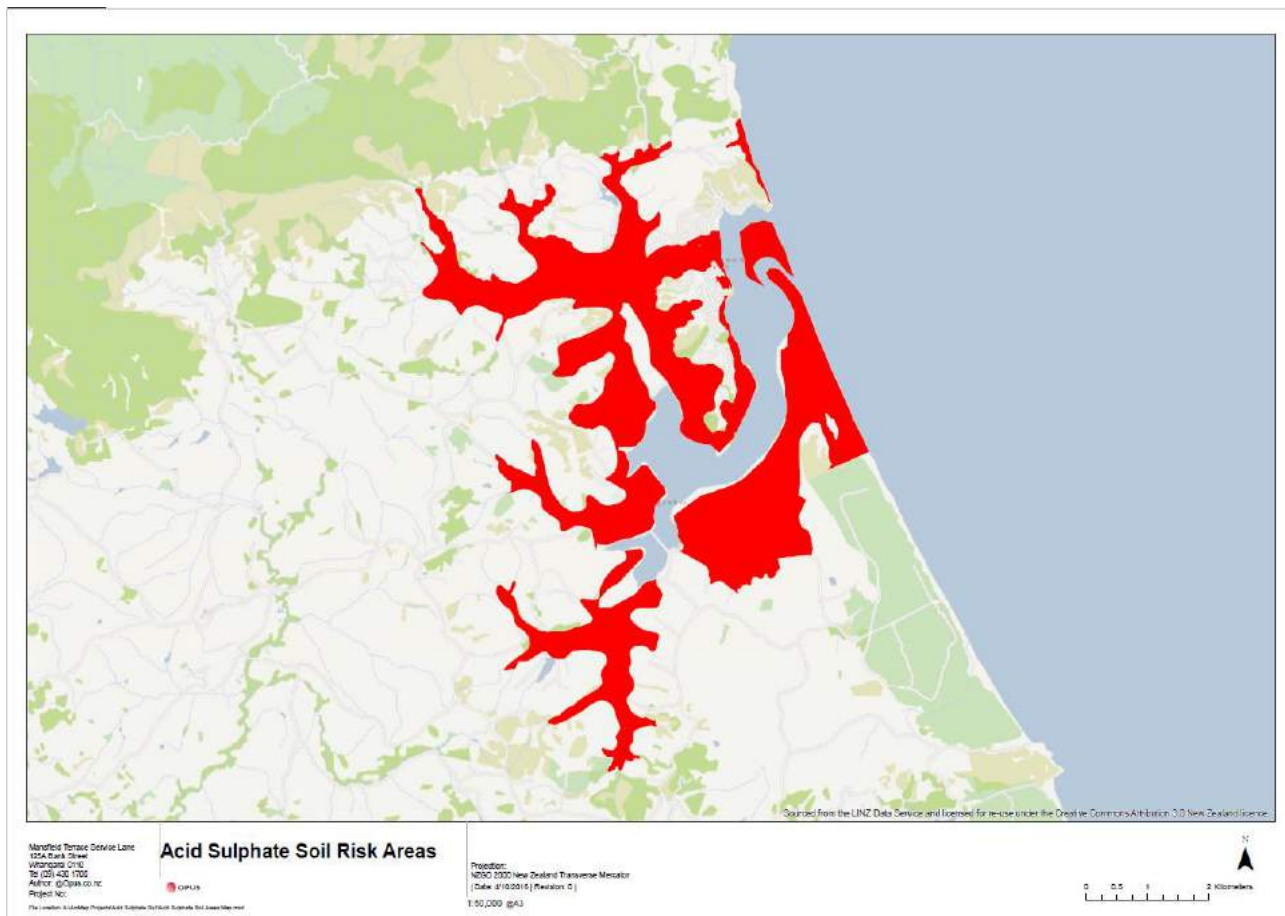


Figure 23. Acid Sulphate Soil Risk Areas Mangawhai Plans, prepared by OPUS in 2017

A number of limitations and assumptions have been made as part of the issues mapping which include:

- There is no existing comprehensive stormwater modelling for the area, therefore issues are mapped using a range of available information (as above) and are qualitative at this stage rather than quantitative.
- The Rapid Flood Hazard Mapping does not include the reticulated network. It considered an extreme scenario and is an input into the strategy, rather than an output from it.
- The Rapid Flood Hazard Mapping does not include the area outside of the area covered by NRC supplied LiDAR data. The only other available data (available from LINZ) was trialled but was too coarse to be useful for this Strategy.
- The level of detail has been set in line with the project objectives.
- The validity of existing asset data has not been verified for this strategy. It is assumed that the supplied data is fit for purpose.

The identification of the stormwater management issues have been separated into two main categories; Stormwater Infrastructure Strategy area wide (or common issues) and specific site (or catchment specific) issues. The site specific issues have been described within the issues description for the catchment within which they fall.

In order to provide prioritisation of the issues, the identified issues have been categorized as high, medium and low based on the likely consequences of the issues being realised and their



likelihood. This risk assessment is a qualitative rather than a quantitative assessment and it based on:

- Existing known effects.
- Upstream development likely to exacerbate effects.
- Base information needed for informed decision making process.
- Water quality and probability of impacting on the estuary.

## 6. Stormwater Infrastructure Strategy Options

This section identifies the implementation options, actions and mitigation measures necessary to achieve the Mangawhai Stormwater Infrastructure Strategy objectives.

It identifies the potential options to address the catchments issues discussed previously and it sets out the recommendations for the long-term stormwater management for each of the issues

### 6.1 Stormwater Management Options

Possible stormwater management options are presented in Table 1 and include stormwater management options presented on a Stormwater Infrastructure Strategy area wide or common implementation level and a site specific (catchment specific) implementation level.

The Stormwater Infrastructure Strategy area wide stormwater management options include:

- Develop a Stormwater Infrastructure Strategy which includes a clear definition of the expected or desired stormwater outcome. (This document)
- Set Council policy on what will be accepted in terms of stormwater management devices and in what circumstances. Such as what minimum catchment area will wetlands be accepted for
- Develop and provide guidance on the stormwater outcomes within the KDC Engineering Standards including
  - Testing, design and implementation for soakage systems
  - Standard soakage system details enabling monitoring of private stormwater management system (such as soakage systems) performance and maintainability
  - Standard blue-green infrastructure design details, such as for swales, rain gardens or wetlands
  - Requirements with respect to the identification and protection of overland flowpaths
  - Operation, Maintenance and monitoring strategies for the stormwater management systems.
  - Stormwater management systems construction on acid soils
- Gather ,verify and update the KDC GIS:
  - Accurate topographic information
  - Accurate existing asset infrastructure data including condition of pipes, location, size, length, invert levels and connections
  - Other Council owned underground services information
  - Accurate existing open drain information including: cross-sections, invert levels, lengths, connecting pipes, crossing drains and driveway crossings
  - Soakage capacity information: such as groundwater levels and soil type.

As discussed previously, the existing KDC asset data has been considered fit for the purpose for this Stormwater Infrastructure Strategy, however, it is acknowledged that the quality of

the existing KDC data must be improved and updated for detailed planning and implementation.

- Once data acquisition is complete, carry out more detailed modelling of the system to confirm and quantify the existing and future problem areas and enable better scoping of the solutions
- Develop a Stormwater Bylaw that allows for the intervention in areas where legacy issues require resolution.

Site specific stormwater management options are included within the issues and options table (Table 1 below) and are presented on the Stormwater Management Proposals Plans presented in Appendix E.

## 7. Stormwater Infrastructure Strategy Recommendations

Based on the community expectations, Regional Council expectations, engineering requirements and the desired outcome of the Stormwater Strategy, a series of stormwater management recommendations have been made and are recorded in Table 1 below.

The following sections provide a summary of the recommendations grouped under the respective stormwater quantity, quality and asset management disciplines.

### 7.1.1 Stormwater Quantity and Quality

Recommendations to manage stormwater quantity and/or quality related issues include:

- Develop a Stormwater Infrastructure Strategy which includes a clear definition of the expected or desired stormwater outcome. (This document)
- Develop and provide guidance on additional requirements in the KDC Engineering Standards including
  - Testing, design, construction, monitoring and maintenance of soakage systems
  - Standard details enabling monitoring of soakage systems performance and maintainability
  - Standard details enabling blue-green infrastructure, monitoring and maintainability
  - Requirements with respect to location and protection of overland flowpaths
  - Operation, Maintenance and monitoring strategies for the stormwater management systems.
  - Standard details enabling construction of stormwater systems on acid soils, monitoring and maintainability
- Develop a Stormwater Bylaw that allows for the intervention in areas where legacy issues require resolution

### 7.1.2 Asset Management

Recommendations to manage stormwater asset management related issues include:

- Gather ,verify and update information in the KDC GIS:
  - Accurate topographic information i.e. contours / LIDAR data.
  - Accurate asset infrastructure data including condition of pipes, location, size, length, invert levels and connections.
  - Other Council owned underground services information.
  - Accurate existing open drain information including: cross-sections, invert levels, lengths, connecting pipes, crossing drains and driveway crossings.
  - Soakage capacity information such as groundwater levels and soil type.
- Once data acquisition is complete, carry out more detailed modelling of the system to confirm and quantify the existing and future problem areas and enable better scoping of

the solutions including different scenarios including the impacts of possible development upstream and downstream and considering blockages.

- Infrastructure upgrade works:
  - Formalise and protect existing overland flow paths preferably within the road network.
  - Formalise and protect overland flowpaths on private property with easements where possible or direct overland flow to public lands or roads where possible.
  - Identify, record and protect overland flowpaths as part of future developments.
  - Incorporate the overland flow function into the road corridor as part of future road upgrading works.
  - Upgrade existing stormwater pipes where identified through modelling.
  - Implement additional stormwater pipes where identified through modelling.



Table 1. Mangawhai Stormwater Infrastructure Strategy issues, potential options and recommendations

	Issue	Site Location	Management Options	Stormwater Management Recommendation	Rough Order of Cost Stormwater Management Proposal	Risk category
Stormwater Infrastructure Strategy area wide						
	Lack of codified guidance for construction on acid soils	Refer to Figure 23		Develop and provide guidance including standard details enabling construction of stormwater systems on acid soils, monitoring and maintainability within the KDC Engineering Standards	\$10k	High
	Lack of codified guidance for KDC acceptable soakage design and treatment. Soakage systems may also provide benefits where the full "engineered" soakage may not be achievable; regular events can be discharged to soakage and can have a positive effect on maintaining stream base flows and reducing volume and peak flow of stormwater discharges			Develop and provide guidance for testing and design for soakage systems and incorporate these into the KDC Engineering Standards  Soakage systems include for low flows for volume reduction outcomes	\$10k	High
	Lack of codified guidance for soakage maintainability and maintenance plans			Develop and provide guidance including standard details enabling monitoring of soakage system performance and maintainability within the KDC Engineering Standards	\$10k	High
	Lack of defined and protected overland flowpaths (OLFP)			Identify and protect existing overland flowpaths and include them in the KDC GIS and possibly incorporate into the District Plan Maps  Develop and provide guidance on requirements with respect to location and protection of overland flowpaths within KDC Engineering Standards	\$45k	High
	Limited and incomplete information on existing underground assets			Gather, verify and update underground services and topographic information in the KDC GIS	Included below within specific site budgets	High
	Limited Information on existing reticulation, performance for both piped and open drains		1. Improve Modelling to better define risk areas  2. Accept lack of information and limitations on decision making	Once data acquisition is complete, carry out more detailed modelling of the system to confirm existing and future problem areas, ponding areas, overland flow paths, floodplains and network constraints	\$250k	Medium
	Legacy issues with historical inadequate attention to stormwater management		1. Accept legacy issues and timeframe to resolve through site redevelopments.  2. Develop a Stormwater Bylaw that allows for the intervention in areas where legacy issues require resolution	Develop a Stormwater Bylaw that allows for the intervention in areas where legacy issues are creating issues including those linked to private system performance	\$15k	Medium
	No clear definition of outcomes to be achieved with stormwater management in Mangawhai provided in Council documents			Include outcomes within Stormwater Strategy	Included below in specific sites	Medium

	Issue	Site Location	Management Options	Stormwater Management Recommendation	Rough Order of Cost Stormwater Management Proposal	Risk category
<b>Specific Sites</b>						
<b>Catchment 1</b>						
<b>1</b>	Existing privately owned stormwater infrastructure the performance of which is unknown and which has effects on downstream public assets	Existing ponds upstream of Wintle Street constructed to mitigate the effects of the Back Bay subdivision	<p>1. Do nothing, accept lack of understanding and deal with problems as or when they arise.</p> <p>2. Gather information on the existing assets, update GIS and model the effects on the downstream systems to provide guidance to future developers on the required assets, inputs into Council's development contributions on upgrades required to the downstream systems as a consequence of future development.</p> <p>3. Private owners to report regularly to KDC as part of the O&amp;M requirements</p>	<p>Gather information on the existing assets, update GIS and model the effects on the downstream systems to provide guidance to future developers on the required assets, inputs into Council's development contributions on upgrades required to the downstream systems as a consequence of future development.</p> <p>Private owners to report regularly to KDC as part of the O&amp;M requirements</p>	<p>\$50k</p> <p>Included above</p>	Low
<b>Catchment 2</b>						
<b>2</b>	A number of private properties and houses are in hollows or/and on an existing overland flow path and potentially subject to a flood hazard. However, there has been a large bore pipe constructed in the area and there have been no recently reported flooding events. Performance of the existing public stormwater network is not well understood. This includes primary (piped and open channel) as well as the secondary overland flow or ponding systems and blockage consequences. Risk may worsen in the event of future upstream development	1, 3, 5, 7 Pearl Street and 46, 71, 69, 63 and 61 Wintle Street	<p>1. Do nothing, accept lack of information and limitations on confidence in long-term decision making.</p> <p>2. Gather more accurate information on the existing asset, update GIS and use in modelling system performance with different scenarios as development upstream and potential blockages</p> <p>3. Formalise and protect overland flow paths with easements where possible or direct to public lands or roads where possible</p> <p>4. Map and allow for overland flowpaths as part of future developments and provide guidance to private owners/developers with respect to on-site management techniques to mitigate their effects off-site, including: operation, maintenance and monitoring strategies</p>	<p>Gather more accurate information on the existing assets and topography update GIS.</p> <p>Model system performance</p> <p>Map and allow for overland flowpaths as part of future developments and provide guidance to private owners/developers with respect to on-site management techniques to mitigate their effects off-site, including: operation, maintenance and monitoring strategies</p>	<p>\$50k</p> <p>\$20k</p> <p>Included above</p>	Low
<b>Catchment 3</b>						
<b>2</b>	Development has occurred across an old stream channel and overland flow path. Performance of the existing public stormwater network is not well understood. This includes primary (piped and open channel) as well as the secondary overland flow or ponding systems	Cullen Street and Taranui Place Land between 10, 8, 6, 4 Taranui Place, 16 and 14 Mangawhai Heads Road, and 1, 3, 5, 7, 9, 11, 13 Kanuka Place	<p>1. Do nothing, accept lack of information and limitations on confidence in long-term decision making.</p> <p>2. Gather more accurate information on the existing asset, update GIS and use in modelling system performance with different scenarios as development upstream and potential blockages</p> <p>3. Formalise and protect overland flow paths with easements where possible or direct to public lands or roads where possible</p>	<p>Gather more accurate information on the existing assets and topography, update GIS.</p> <p>Model system performance</p> <p>Map and allow for overland flowpaths as part of future developments and provide guidance to private owners/developers with respect to on-site management techniques to mitigate their effects off-site, including: operation, maintenance and monitoring strategies</p>	<p>\$50k</p> <p>\$20k</p> <p>Included above</p>	Medium



	Issue	Site Location	Management Options	Stormwater Management Recommendation	Rough Order of Cost Stormwater Management Proposal	Risk category
<b>Catchment 4</b>						
<b>Refer to the Mangawhai Town Plan Stormwater Infrastructure Strategy in Appendix B for Mangawhai Heads catchment issues and proposed stormwater management recommendations</b>						
<b>3</b>	A number of private properties and houses are in existing low lying land, hollows or depressions and are potentially subject to a flood hazard  There is no or limited primary stormwater network	27, 25, 23 and 21 and 9 Dye Street  2 and 4 Harbourview Street  21, 19, 17, 15 and 11 Wharfdale Crescent	1. Do nothing, accept effect and rely on developers to provide solutions at the time of development or redevelopment.  2. Gather information on the existing assets and model the effects on the downstream systems to provide: guidance to future developers on the required assets, inputs into Council's development contributions on upgrades required to the downstream systems as a consequence of development.  3. Formalise and protect overland flow paths within public roads as far as possible  4. Provide guidance to future developers with respect to on-site management techniques to mitigate their effects off-site, including: operation, maintenance and monitoring strategies.  5. Include requirements for mitigation within the District Plan  6. New stormwater system or upgrade of the existing stormwater system	Gather information on the existing assets and topography and model the effects on the downstream systems to provide: guidance to future developers on the required assets, inputs into Council's development contributions on upgrades required to the downstream systems as a consequence of development.  Formalise and protect overland flow paths within public roads as far as possible  Provide guidance to future developers with respect to on-site management techniques to mitigate their effects off-site, including: operation, maintenance and monitoring strategies  Include requirements for mitigation within the District Plan.  New stormwater system Oslen Avenue, Wharfdale crescent and Alamar Crescent.  Upgrade existing coastal outfall at 16 Alamar Crescent.	\$50k  \$100k  Included above  \$1,850k	High
<b>4</b>	Existing overland flow path not understood or protected or maintained	Back of 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29, 31, 33 Alamar Crescent. From North Avenue to Olsen Avenue	1. Do nothing, accept lack of understanding and deal with problems as they arise.  2. Gather more accurate information of the existing and designed overland flowpath  3. Formalise and protect OLFP with easements where possible or direct to public lands or roads where possible  4. Map and allow for overland flowpaths as part of future developments	Gather more accurate information of the existing and designed overland flowpath  Formalise and protect OLFP with easements where possible or direct to public lands or roads where possible  Map and allow for overland flowpaths as part of future developments	\$50k  \$100k  Included above	High
<b>14</b>	Existing stormwater pipes or channel located on site but not identified in KDC GIS and therefore performance unable to be quantified	Outfall at 38 North Ave	1. Do nothing, accept inaccuracy in GIS data.  2. Gather and update As-Built data in the GIS and model the system performance	Gather and update As-Built data in the GIS and model the system performance.	\$70k	Medium
<b>15</b>	Risk of coastal outfall blocking	Outfall at 38 North Ave	1. Do nothing and accept effect  2. Clear outlet and provide protected flowpath from outlet  3. On-going Operation and Maintenance  4. Provide overland flow path for surcharged system in the event of blockage	On-going Operation and Maintenance  Provide overland flow path for surcharged system in the event of blockage	\$25k	Medium





	Issue	Site Location	Management Options	Stormwater Management Recommendation	Rough Order of Cost Stormwater Management Proposal	Risk category
		– Jessie Trust Ltd development	5. New stormwater system or upgrade of the existing stormwater system.			
7	Likely degradation in water quality and increase on peak flow and volume from greater impervious areas and filling low lying areas during development	Discharge point at Jordan Street Discharge point at Estuary Drive	1 .Do nothing and accept degradation in water quality and increase on peak flow and volume. 2. Require treatment to be included within development, through the Plan Change. 3. Require volume reduction to also be included within developments.	Require treatment to be included within development, through the District Plan.  Require volume reduction to also be included within developments Implement through the KDC Engineering Standards.	Included above	Medium
10	Lack of control on stormwater volumes, velocities and erosion leading to an increased risk of erosion at the outlet	Moir Point Road and Estuary Drive – Jessie Trust Ltd development	1. Do nothing, accept effect and rely on developers to provide solutions at the time of development. 2. Formalise and protect OLFPs within public roads as far as possible 3. Provide guidance to developers with respect to on-site management techniques to mitigate their effects off-site 4. Include requirements for mitigation within the District Plan 5. New stormwater system or upgrade of the existing stormwater system	Provide guidance to developers with respect to on-site management techniques to mitigate their effects  Include requirements for mitigation within the District Plan.  Implement through the KDC Engineering Standards  New stormwater system or upgrade of the existing stormwater system	Included above    \$370k	Medium
8	Land instability likely related to stormwater infrastructure	Hermes development Jessie Trust development	1. Do nothing, accept effect and rely on developers to provide solutions at the time of development. 2. Formalise and protect OLFPs within public roads as far as possible 3. Provide guidance to developers with respect to on-site management techniques to mitigate their effects off-site, including: operation, maintenance and monitoring strategies 4. Include requirements for mitigation within the District Plan 5. New structural erosion protection	Formalise and protect OLFPs within public roads as far as possible  Provide guidance to developers with respect to on-site management techniques to mitigate their effects off-site, including: operation, maintenance and monitoring strategies  Include requirements for mitigation within the District Plan  New structural erosion protection	\$100k  Included above  \$50k	Medium
<b>Catchment 8</b>						
4	Existing overland flow path not understood or protected	Back of Park Lane and Park Ave	1. Do nothing, accept lack of understanding and deal with problems as they arise. 2. Gather more accurate information of the existing and designed overland flowpath. 3. Formalise and protect OLFP with easements where possible or direct to public lands or roads where possible 4. Map and allow for overland flowpaths as part of future developments.	Gather more accurate information of the existing and designed overland flowpath.  Formalise and protect OLFP with easements where possible or direct to public lands or roads where possible.  Map and allow for overland flowpaths as part of future developments.	\$50k  \$100k  Included above	Medium

	Issue	Site Location	Management Options	Stormwater Management Recommendation	Rough Order of Cost Stormwater Management Proposal	Risk category
1	Existing privately owned stormwater infrastructure the performance of which is unknown and which has effects on downstream flow paths	Existing ponds intersection Estuary Drive with Moir Point Road	<ol style="list-style-type: none"> <li>1. Do nothing, accept lack of understanding and deal with problems as they arise.</li> <li>2. Gather information on the existing assets, update GIS and model the effects on the downstream systems to provide guidance to future developers on the required assets, inputs into Council's development contributions on upgrades required to the downstream systems as a consequence of development.</li> <li>3. Private owners to report regularly to KDC as part of the O&amp;M requirements</li> <li>4. New stormwater system or upgrade of the existing stormwater system.</li> </ol>	<p>Gather information on the existing assets, update GIS and model the effects on the downstream systems to provide guidance to future developers on the required assets, inputs into Council's development contributions on upgrades required to the downstream systems as a consequence of development.</p> <p>Private owners to report regularly to KDC as part of the O&amp;M requirements</p> <p>New stormwater system through the east of 54 Estuary Drive</p>	<p>\$50k</p> <p>Included above</p> <p>\$800k</p>	Medium
7	Likely degradation in water quality and increase on peak flow and volume from greater impervious areas and filling low lying areas during development	Discharge point from east of 54 Estuary Drive	<ol style="list-style-type: none"> <li>1 .Do nothing and accept degradation in water quality and increase on peak flow and volume.</li> <li>2. Require treatment to be included within development, through the Plan Change.</li> <li>3. Require volume reduction to also be included within developments.</li> </ol>	<p>Require treatment to be included within development, through the District Plan.</p> <p>Require volume reduction to also be included within developments Implement through the KDC Engineering Standards.</p>	Included above	Medium
8	Land instability likely related to stormwater infrastructure	Discharge point from east of 54 Estuary Drive	<ol style="list-style-type: none"> <li>1. Do nothing, accept effect and rely on developers to provide solutions at the time of development.</li> <li>2. Formalise and protect OLFPs within public roads as far as possible</li> <li>3. Provide guidance to developers with respect to on-site management techniques to mitigate their effects off-site, including: operation, maintenance and monitoring strategies</li> <li>4. Include requirements for mitigation within the District Plan</li> <li>5. New structural erosion protection</li> </ol>	<p>Formalise and protect OLFPs within public roads as far as possible</p> <p>Provide guidance to developers with respect to on-site management techniques to mitigate their effects off-site, including: operation, maintenance and monitoring strategies</p> <p>Include requirements for mitigation within the District Plan</p> <p>New structural erosion protection</p>	<p>Included above</p> <p>Included above</p> <p>\$50k</p>	Medium
<b>Catchment 9</b>						
3	<p>A number of private properties and houses are in hollows or/and on an existing overland flowpaths and potentially subject to a flood hazards</p> <p>There is no or limited primary stormwater network. Lack of stormwater network, connectivity or information on the system performance</p>	<p>Quail Way (specially 10, 12, 14, 21, 31, 34 Quail Way) and Pohutukawa Place (specially 8, 12 Pohutukawa Place)</p> <p>6 Moir Point Road</p> <p>7A Seabreeze Road</p>	<ol style="list-style-type: none"> <li>1. Do nothing, accept lack of information and limitations on confidence in long-term decision making.</li> <li>2. Gather more accurate information on the existing asset, update GIS and use in modelling system performance.</li> <li>3. New stormwater system or upgrade of the existing stormwater system.</li> <li>4. Limit further development until management measures are in place unless developers can demonstrate both on-site</li> </ol>	<p>Gather more accurate information on the existing asset, update GIS and use in modelling system performance</p> <p>New stormwater system or upgrade of the existing stormwater system</p> <p>For 30D Norfolk Dr Limit further development until management measures are in place unless developers can demonstrate both on-site and off-site effects are managed by the proposal for the long term.</p>	<p>\$50k</p> <p>Stormwater upgrade project in progress at Quail Way. Detailed design estimated cost \$1,200K</p> <p>Extra \$410K estimated for Pohutukawa Place project</p>	Low

	Issue	Site Location	Management Options	Stormwater Management Recommendation	Rough Order of Cost Stormwater Management Proposal	Risk category
		25, 23, 21, 19, 17, 15, 13, 11 and 9 Grove Road and 7, 5, 3, 1 Ti Tree Place 30D Norfolk Dr	and off-site effects are managed by the proposal for the long term.  5. Flow and volume management to be included as requirement for future development.			
5	Lack of design of Roads to act as overland flow paths	Quail Way Pohutukawa Place  Seabreeze Road Grove Road	1. Do nothing, accept inadequate overland flowpaths and consequences in high rainfall events  2. Formalize and protect existing OLFP within the roads  3. Incorporate the overland flow function into the road as part of future road upgrading	Formalise and protect existing OLFP within the road and incorporate the overland flow function into the road as part of future road upgrading. Scoping of proposed works to include in LTP process	\$100k	High
8	Land instability possibly or partly related to stormwater infrastructure or discharges	Discharge point Mangawhai Estuary near to Molesworth Drive bridge	1. Do nothing, accept effect and rely on developers to provide solutions at the time of development.  2. Formalise and protect OLFPs within public roads as far as possible  3. Provide guidance to developers with respect to on-site management techniques to mitigate their effects off-site, including: operation, maintenance and monitoring strategies.  4. Include requirements for mitigation of land instability for future development.  5. New stormwater system or upgrade of the existing stormwater system.  6. New structural erosion protection	Formalise and protect OLFPs within public roads as far as possible  Provide guidance to developers with respect to on-site management techniques to mitigate their effects off-site, including: operation, maintenance and monitoring strategies and stabilising OLFPs  Include requirements for mitigation of land instability for future development New stormwater system.  New structural erosion protection	\$100k   Included above  \$50k	High
6	Loss of opportunity due to development	Pond at Molesworth drive	1 .Do nothing and accept degradation of the estuary and likely consent breaches.  2. Treatment to be included as a requirement for future development.  3. Assess, design and construct an alternative water treatment system for the catchment in catchment 10 (Initial option assessment included in Appendix .E Estuary Drive Stormwater Improvement Options).	Treatment, flow and volume management to be included as a requirement for future development Assess, design options and construct alternative water treatment system(s) for the catchment.	\$1,100k	Medium
<b>Catchment 10</b>						
3	A number of private properties and houses are in hollows and/or on an existing overland flowpath and potentially subject to a flood hazards.  There is no or limited primary stormwater network. Lack of stormwater network,	188-198 Molesworth Drive	1. Do nothing, accept lack of information and limitations on confidence in long-term decision making.  2. Gather more accurate information on the existing asset, update GIS and use in modelling system performance	Gather more accurate information on the existing asset, update GIS and use in modelling system performance.  Soakage system enhanced in blind hollow.  Assess the hazard when further information is provided and provide protection.	\$50k  \$100k	Low

	Issue	Site Location	Management Options	Stormwater Management Recommendation	Rough Order of Cost Stormwater Management Proposal	Risk category
	connectivity or information on the system performance.		3. New stormwater system or upgrade of the existing stormwater system 4. Limit further development until management measures are in place unless developers can demonstrate both on-site and off-site effects are managed by the proposal for the long term. 5. Flow and volume management to be included as requirement for future development 6. Soakage system enhanced in blind hollow 7. Assess the hazard when further information is provided and provide protection to the hazard	Limit further development until management measures are in place unless developers can demonstrate both on-site and off-site effects are managed by the proposal for the long term.		
20	Blind hollow in the back of the Mangawhai Activity Zone area.	Low lying land behind activity zone and ambulance station	1. Do nothing, accept lack of information and limitations on confidence in long-term decision making. 2. Gather more accurate information on the existing asset, update GIS and use in modelling system performance. 3. Avoid further discharges stormwater into the area. 4. Set minimum levels and requirements to ensure long-term performance of soakage systems.	Gather more accurate information on the existing asset, update GIS and use in modelling system performance.  Enhance existing low land for soakage purposes and setup maintenance regime to assist long-term performance.	\$50k	
22	Wetland behind museum site being filled	Mangawhai Museum area	1. Do nothing, accept lack of information and limitations on confidence in long-term decision making. 2. Gather more accurate information on the existing asset, update GIS and use in modelling system performance 3. Enhance existing wetland 4. Consider water treatment and utilise for educational purposes	Gather more accurate information on the existing asset, update GIS and use in modelling system performance  Enhance existing wetland  Consider water treatment and utilise for educational purposes	\$50k  \$200k	
14	Existing stormwater pipes or channel located on site but not identified in KDC GIS and therefore performance unable to be quantified.	198-188 Molesworth Drive	1. Do nothing, accept inaccuracy in GIS data. 2. Gather and update As-Built data in the GIS and model the system performance.	Gather and update As-Built data in the GIS and model the system performance.	\$70k	Medium
Catchment 11						
9	Golf course looking for water for irrigation purposes	Golf course	1. Do nothing, accept lack of water and lose opportunity. 2. Gather more accurate information on the existing asset, update GIS and use in modelling system performance with different scenarios to take advantage of the opportunity.	Gather more accurate information on the existing asset, update GIS and use in modelling system performance with different scenarios to take advantage of the opportunity.  Consider options for diversion of catchment 4 flows once system performance is known. Consult with Golf Club.	\$50k	Low



	Issue	Site Location	Management Options	Stormwater Management Recommendation	Rough Order of Cost Stormwater Management Proposal	Risk category
			3. Divert flows from catchment 4 to golf course and construct storage on golf course			
<b>Catchment 12</b>						
<b>11</b>	Proposed and existing development with primary stormwater system (pipe and open channel) and secondary overland flow paths or ponding systems constructed on high groundwater table with low lying land subject to tidal backwater effects	Jack boyd drive	<ol style="list-style-type: none"> <li>1. Do nothing, accept effects and resolve future problems as they arise if possible.</li> <li>2. Gather more accurate information on the existing asset and surface survey and use in modelling existing system performance and potential future scenarios including future developments and blockages</li> <li>3. Formalise and protect OLFP with easements where possible and direct to public lands or roads where possible.</li> <li>4. Design stormwater detention systems for the whole catchment.</li> <li>5. Redirect flows from the catchment to other catchments.</li> <li>6. Provide guidance to developers with respect to on-site management techniques to mitigate their effects off-site, including: operation, maintenance and monitoring strategies.</li> <li>7. Include requirements for mitigation within the District Plan.</li> <li>8. Reduce development intensification until mitigation measures are in place.</li> </ol>	<p>Gather more accurate information on the existing asset and surface survey and use in modelling existing system performance and potential future scenarios including future developments and blockages</p> <p>Limit further development until management measures are in place unless developers can demonstrate both on-site and off-site effects are managed by the proposal for the long term.</p>	<p>\$50k</p> <p><b>\$N/A</b></p>	High
<b>3</b>	A number of private properties and houses are in hollows and/or on existing overland flowpaths and potentially subject to a flood hazards	63A, 65 Jack Boyd Drive 51, 52, 56 and 44 Greenview Drive	<ol style="list-style-type: none"> <li>1. Done nothing, accept lack of information and limitations on confidence in long-term decision making.</li> <li>2. Gather more accurate information on the existing asset, update GIS and use in modelling system performance.</li> <li>3. Reduce development intensification until mitigation measures are in place.</li> <li>4. Upgrade existing pipes stormwater pipes</li> </ol>	<p>Gather more accurate information on the existing asset, update GIS and use in modelling system performance.</p> <p>Limit further development until management measures are in place unless developers can demonstrate both on-site and off-site effects are managed by the proposal for the long term.</p> <p>Increase size of the stormwater pipe located at 70 Jack Boy Drive</p>	<p>\$50k</p> <p><b>\$N/A</b></p> <p>\$290K</p>	High
<b>5</b>	Lack of design of Roads to act as overland flow paths and inadequate sized road crossings	Jack Boyd Drive	<ol style="list-style-type: none"> <li>1. Do nothing, accept inadequate overland flowpaths and consequences in high rainfall events.</li> <li>2. Formalize and protect existing OLFP within the roads.</li> <li>3. Incorporate the overland flow function into the road as part of future road upgrading.</li> </ol>	Formalise and protect existing OLFP within the road and incorporate the overland flow function into the road as part of future road upgrading. Scoping of proposed works to be included in LTP process.	\$100k	High
<b>17</b>	Existing development (Northcoast development) and future development (Buttlers) designed to rely on soakage	Northcoast development	1. Do nothing, accept effects and resolve future problems as they arise if possible.	Gather more accurate information on the existing asset and surface survey and use in modelling existing system performance and	\$50k	High

	Issue	Site Location	Management Options	Stormwater Management Recommendation	Rough Order of Cost Stormwater Management Proposal	Risk category
	system with overflows to the Northcoast development pond that has historically soaked away via infiltration through the base, Currently infiltration is not happening increasing downstream peak flow rates frequency and volumes discharging to the low lying land at Jack Boyd Drive.	Buttlers development	2. Gather more accurate information on the existing asset and surface survey and use in modelling existing system performance and potential future scenarios including future developments and blockages. 3. Provide guidance to owners/developers for testing, design and enhance soakage systems. 4. Minimise flow rates, frequency and provide volume reduction through pond modifications.	potential future scenarios including future developments and blockages Provide guidance to owners/developers for testing, design and enhance for soakage systems. Minimise flow rates, frequency and provide volume reduction through pond modifications..	<b>\$N/A</b>  \$20k	
<b>21</b>	Northcoast development pond has historically soaked away via infiltration through the base. Currently infiltration is not happening increasing downstream peak flow rates frequency and volumes discharging to the low lying land at Jack Boyd Drive	Northcoast pond	1. Do nothing, accept effects and resolve future problems as they arise if possible. 2. Gather more accurate information on the existing asset and surface survey and use in modelling existing system performance. 3. Change how the pond performs to enable it to provide storage and soakage.	Gather more accurate information on the existing asset and surface survey and use in modelling existing system performance. Change how the pond performs to enable it to provide storage and soakage.	\$100k	High
<b>18</b>	Changes in primary drainage due to roading upgrades to discharge to undersized stormwater reticulation which eventually discharges to stormwater at Jack Boyd Drive	52, 50, 42, 40, 38 Mangawhai Heads Road and 17, 15, 13, 11, 9, 3, 1 Cullen Street	1. Do nothing, accept effects and resolve future problems as they arise if possible. 2. Gather more accurate information on the existing asset and surface survey and use in modelling existing system performance 3. Redirect flows from the catchment to other catchments. New stormwater system or upgrade of the existing stormwater system	Gather more accurate information on the existing asset and surface survey and use in modelling existing system performance Redirect flows from the catchment 12 to catchment 13. New stormwater system in Mangawhai Heads Road	\$50k  \$370K	Medium
<b>14</b>	Existing stormwater pipes or channel located on site but not identified in KDC GIS and therefore performance unable to be quantified.	61 and 73 Mangawhai Heads Road. 70 Jack Boyd Drive	1. Do nothing, accept inaccuracy in GIS data. 2. Gather and update As-Built data in the GIS and model the system performance.	Gather and update As-Built data in the GIS and model the system performance.	\$70k	Medium
<b>4</b>	Existing overland flow path not understood or protected	<b>Bottom of Parklands Drive, Marram Place to 67-71 Jack Boyd Drive, 77-79 Jack Boyd Drive and 63 Jack Boyd Drive</b>	1. Do nothing, accept lack of understanding and deal with problems as they arise. 2. Gather more accurate information of the existing and designed overland flowpath. 3. Formalise and protect OLFP with easements where possible or direct to public lands or roads where possible 4. Map and allow for overland flowpaths as part of future developments.	Gather more accurate information of the existing and designed overland flowpath. Formalise and protect OLFP with easements where possible or direct to public lands or roads where possible. Map and allow for overland flowpaths as part of future developments.	\$50k  \$200k  Included above	Medium
<b>7</b>	Likely degradation in water quality and increase on peak flow and volume from greater impervious areas and filling low lying areas during development	Discharge to the Mangawhai Estuary from pipe at 70 Jack Boyd Drive	1 .Do nothing and accept degradation in water quality and increase on peak flow and volume. 2. Require treatment to be included within development, through the Plan Change. 3. Require volume reduction to also be included within developments.	Require treatment to be included within development, through the District Plan. Require volume reduction to also be included within developments Implement through the KDC Engineering Standards.	Included above	High

	Issue	Site Location	Management Options	Stormwater Management Recommendation	Rough Order of Cost Stormwater Management Proposal	Risk category
<b>Catchment 13</b>						
<b>2</b>	Performance of the existing natural system, open channels and public stormwater network is not well understood. This includes primary (piped and open channel) as well as the secondary overland flow, ponding systems and stream. Risk can be worsened by intensification of the upstream development and system capacity restrictions.	Channel in the back of 130-138 and 90-126 Mangawhai Heads Road  82-83 Mangawhai Heads Road- dual culvert.  Stream at Clemway Holding subdivision. Existing subdivision Clemway Holding – Jack Boyd Drive (RM06007A) – Incorporate the information for mapping and flood level information.  Parklands avenue to Te Whai Street	1. Do nothing, accept lack of information and limitations on confidence in long-term decision making.  2. Gather more accurate information on the existing asset, update GIS and use in modelling system performance with different scenarios as development upstream and potential blockages.	Gather more accurate information on the existing asset and topography, update GIS and use in modelling system performance	\$50k  \$20k	Medium
<b>3</b>	A number of private properties and houses are in hollows and/or on an existing overland flowpaths and potentially subject to a flood hazards.  Flooding has been reported upstream of Mangawhai Heads Road.	130-138 Mangawhai Heads Road.	1. Do nothing, accept lack of information and limitations on confidence in long-term decision making.  2. Gather more accurate information on the existing asset, update GIS and use in modelling system performance.  3. Redirect flow to catchment 14 at 130-138 Mangawhai Heads Road.  4. Upgrade culvert under 130-138 Mangawhai Heads Road.	Gather more accurate information on the existing asset and topography, update GIS and use in modelling system performance  Redirect flow to catchment 14 at 130-138 Mangawhai Heads Road.  Upgrade culvert under 130-138 Mangawhai Heads Road.	\$50k  \$200k	High
<b>14</b>	Existing stormwater pipes or channel located on site but not identified in KDC GIS and therefore performance unable to be quantified.	130-138 and 90-126 and 76 Mangawhai Heads Road.	1. Do nothing, accept inaccuracy in GIS data.  2. Gather and update As-Built data in the GIS and model the system performance.	Gather and update As-Built data in the GIS and model the system performance.	\$70k	Medium
<b>13</b>	Road crossing forms a constraint on flood levels. Mangawhai Heads Road dual culvert capacity restrictions	82-83 Mangawhai Heads Road	1. Do nothing, accept effects and resolve future problems as they arise if possible.  2. Increase the capacity of the existing dual culvert for level of services of the Mangawhai Heads Road. Increase the level on the road as it is an existing low point.  3. Possible diversion of some section of catchment 13 through catchment 14 through overland flow modifications.	Increase the capacity of the existing dual culvert for level of services of the Mangawhai Heads Road. Increase the level on the road as it is an existing low point.  Divert section of catchment 13 through catchment 14 through overland flow modifications. Formalise and protect OLFP.  Downstream channel improvements by on-going operational and maintenance.	\$320k  \$100k  \$100k	High

	Issue	Site Location	Management Options	Stormwater Management Recommendation	Rough Order of Cost Stormwater Management Proposal	Risk category
			4. Downstream channel improvements by on-going operational and maintenance.			
16	Existing rural zone land (outside of existing urban zonings) considered for more intensive development	Development pressure upstream of 140 Mangawhai Heads Roads	<ol style="list-style-type: none"> <li>1. Do nothing, accept effects and resolve future problems as they arise if possible.</li> <li>2. Gather more accurate information on the existing asset, update GIS and use in modelling system performance with different scenarios as development upstream and potential blockages.</li> <li>3. Divert section of catchment 13 through catchment 14.</li> <li>4. Provide guidance to developers around the information requirements and planning requirements.</li> <li>5. Include requirements for mitigation within the District Plan including flow and volume reduction and erosion protection.</li> <li>6. Include requirements for developers to demonstrate impact to downstream properties is managed.</li> <li>5. Provide guidance to future developers with respect to on-site management techniques to mitigate their effects off-site, including: operation, maintenance and monitoring strategies.</li> </ol>	<p>Gather more accurate information on the existing asset, update GIS and use in modelling system performance with different scenarios as development upstream and potential blockages.</p> <p>Provide guidance to developers around the information requirements and planning requirements.</p> <p>Include requirements for mitigation within the District Plan including flow and volume reduction and erosion protection.</p> <p>Include requirements for developer to demonstrate impact to downstream properties is managed.</p> <p>Provide guidance to future developers with respect to on-site management techniques to mitigate their effects off-site, including: operation, maintenance and monitoring strategies.</p>	\$50k	High
5	Lack of design of Roads to act as overland flow paths and inadequate sized road crossings	Jack Boyd Drive	<ol style="list-style-type: none"> <li>1. Do nothing, accept inadequate overland flowpaths and consequences in high rainfall events</li> <li>2. Formalize and protect existing OLFP within the roads</li> <li>3. Incorporate the overland flow function into the road as part of future road upgrading</li> </ol>	Formalise and protect existing OLFP within the road and incorporate the overland flow function into the road as part of future road upgrading. Scoping of proposed works to be included in LTP process.	\$100k	Medium
Catchment 14						
Catchment 15						
19	Manage flows under and across Molesworth Drive from the Estuary Estates Structure Plan	Molesworth Drive	<ol style="list-style-type: none"> <li>1. Do nothing, accept effects and resolve future problems as they arise if possible</li> <li>2. Gather more accurate information and use in modelling system performance with different scenarios</li> <li>3. Include management of flows at Molesworth Drive as part of the stormwater study for the Estuary Estates Structure Plan.</li> <li>4. Design Molesworth Drive to allow for possible overtopping.</li> <li>5. Understand existing consider culvert size and condition.</li> </ol>	<p>Gather more accurate information and use in modelling system performance with different scenarios</p> <p>Include management of flows at Molesworth Drive as part of the stormwater study for the Estuary Estates Structure Plan.</p> <p>Design Molesworth Drive for possible overtopping</p> <p>On-going operation and maintenance requirements</p> <p>Understand existing consider culvert size and conditions</p>	\$200k	Low



	Issue	Site Location	Management Options	Stormwater Management Recommendation	Rough Order of Cost Stormwater Management Proposal	Risk category
			6. On-going operation and maintenance requirements.			
4	Existing overland flow path not understood or protected	60-88 Old Waipu Road	1. Do nothing, accept lack of understanding and deal with problems as they arise. 2. Gather more accurate information of the existing and designed overland flowpath. 3. Formalise and protect OLFP with easements where possible or direct to public lands or roads where possible. 4. Map and allow for overland flowpaths as part of future developments.	Gather more accurate information of the existing and designed overland flowpath.  Map and allow for overland flowpaths as part of future developments.	\$50k  Included above	Low
Catchment 16						
Refer to the Mangawhai Town Plan Stormwater Infrastructure Strategy in Appendix B for Mangawhai Village catchment issues and proposed stormwater management recommendations						
Catchment 17						
Refer to the Mangawhai Town Plan Stormwater Infrastructure Strategy in Appendix B for Mangawhai Village catchment issues and proposed stormwater management recommendations						
2	Performance of the existing public stormwater network is not well understood. This includes primary (piped and open channel) as well as the secondary overland flow or ponding systems. Risk may worsen in the event of future upstream development as Tara Road is under pressure for residential growth	Tara road. The existing low point floods in medium to large flow events	1. Do nothing, accept lack of information and limitations on confidence in long-term decision making. 2. Gather more accurate information on the existing asset, update GIS and use in modelling system performance with different scenarios as development upstream and potential blockages 3. Formalise and protect OLFP with easements where possible or direct to public lands or roads where possible	Gather more accurate information on the existing asset and topography, update GIS and use in modelling system performance with different scenarios as development upstream and potential blockages  Formalise and protect OLFP with easements where possible or direct to public lands or roads where possible	\$50k  \$100k	Low
16	Existing rural zoned land (outside of the study area) considered for more intensive development	Development pressure upstream of Tara Road	1. Do nothing, accept effects and resolve future problems as they arise if possible 2. Gather more accurate information on the existing asset, update GIS and use in modelling system performance with different scenarios as development upstream and potential blockages 3. Provide guidance to developers around the information requirements and planning requirements. 4. Include requirements for mitigation within the District Plan including flow and volume reduction and erosion protection for development on rural land (particularly rural residential type developments). 5. Include requirements for developer to demonstrate impact to downstream properties is managed. 6. Provide guidance to future developers with respect to on-site management	Gather more accurate information on the existing asset, update GIS and use in modelling system performance with different scenarios as development upstream and potential blockages  Provide guidance to developers around the information requirements and planning requirements.  Include requirements for mitigation within the District Plan including flow and volume reduction and erosion protection for development on rural land (particularly rural residential type developments).  Include requirements for developer to demonstrate impact to downstream properties is managed.  Provide guidance to future developers with respect to on-site management techniques to mitigate their effects off-site, including:	\$50k  Extra \$20k for system performance  \$10k	Low

	Issue	Site Location	Management Options	Stormwater Management Recommendation	Rough Order of Cost Stormwater Management Proposal	Risk category
			techniques to mitigate their effects off-site, including: operation, maintenance and monitoring strategies.	operation, maintenance and monitoring strategies.		
<b>Catchment 18</b>						
<b>16</b>	Existing rural zone land (outside of existing urban zonings) considered for more intensive development including low lying upper harbour areas.	Development pressure upstream of Catchment 15	<ol style="list-style-type: none"> <li>1. Do nothing, accept effects and resolve future problems as they arise if possible.</li> <li>2. Gather more accurate information on the existing asset, update GIS and use in modelling system performance with different scenarios as development upstream and potential blockages.</li> <li>3. Divert section of catchment 13 through catchment 14.</li> <li>4. Provide guidance to developers around the information requirements and planning requirements.</li> <li>5. Include requirements for mitigation within the District Plan including flow and volume reduction and erosion protection.</li> <li>6. Include requirements for developer to demonstrate impact to downstream properties is managed.</li> <li>5. Provide guidance to future developers with respect to on-site management techniques to mitigate their effects off-site, including: operation, maintenance and monitoring strategies.</li> <li>6. Limit any development at the low lying upper harbour areas until mitigation measures are in place unless developers can demonstrate long-term effects, both on-site and off-site, are managed by the proposal for the long term.</li> </ol>	<p>Gather more accurate information on the existing asset, update GIS and use in modelling system performance with different scenarios as development upstream and potential blockages.</p> <p>Provide guidance to developers around the information requirements and planning requirements.</p> <p>Include requirements for mitigation within the District Plan including flow and volume reduction and erosion protection.</p> <p>Include requirements for developer to demonstrate impact to downstream properties is managed.</p> <p>Provide guidance to future developers with respect to on-site management techniques to mitigate their effects off-site, including: operation, maintenance and monitoring strategies.</p>	<p>\$50k</p> <p>Extra \$20k for system performance</p>	Low

## 8. Improvement Plan

The Stormwater Infrastructure Strategy has been developed to provide a strategic direction for stormwater management activities to support the future planning and development of the Mangawhai catchments.

During the development of this Stormwater Infrastructure Strategy, it is acknowledge that further investigations and improvement activity is required to fully support the implementation of the stormwater infrastructure strategy. These further investigations and improvement activities include:

- Improvement of the KDC Engineering Standards to include direction for the testing, design and implementation of soakage systems, performance monitoring and operations and maintenance requirements for soakage systems, overland flow path requirements with respect to location and protection, floor levels requirements, stormwater reticulation requirements and stormwater management system construction on acid soils.
- Further consideration of incorporating overland flow path requirements into the roading upgrade programme.
- Gather information on new and existing assets, including updated LiDAR information and model the effects on the stormwater system to inform decisions on capital improvements including stormwater infrastructure to manage water quality and quantity aspects. These will be used to inform the development of a Catchment Management Plan.
- Areas outside of the limited future growth area will need to be investigated in the future and better contour information should be sourced.
- Development of an Operation, Maintenance and Monitoring plan for soakage systems, overland flow paths and stormwater systems.
- Development of a Catchment Management Plan (CMP) to include direction on public / private stormwater management responsibilities, capital improvements, on-going monitoring, inspection and maintenance requirements and a more detailed assessment of stormwater flood locations and flood management options. The CMP will consider in greater detail those parts of the catchments that have existing issues and existing physical constraints.

## 9. Limitations

A number of limitations and assumptions have been made in the development of the Stormwater Infrastructure Strategy. The principal ones include:

- There is no existing comprehensive stormwater modelling for the area, therefore issues are mapped using a range of available information (as above) and are qualitative at this stage rather than quantitative
- The Rapid Flood Hazard Mapping does not include the reticulated network. It considered an extreme scenario and is an input into the strategy, rather than an output from it
- The Rapid Flood Hazard Mapping does not include the area outside of the limited growth area as the results could not be verified.
- The level of detail has been set in line with the project objectives.
- The validity of existing asset data has not been verified for this strategy. It is assumed that this data is fit for purpose.
- The rapid flood hazard model only represents open channel and overland flow at discrete sections where these have been defined with the available LIDAR data. Due to the data issues, no flood plain extents have been available for this strategy.
- An error has been identified by LINZ on the One Tree Point datum, which has changed by 1m. This affects KDC asset information published on the GIS since 1985.
- Statistically generated rainfall patterns have been used for the rapid flood hazard mapping.
- The accuracy of existing aerial photographs, imperviousness data, and contour data is assumed as fit for purpose
- No information was available on habitable floors and hence these have been excluded from any analysis / assessment.



# Appendices



# Appendix A    The Draft Mangawhai Community Plan



A scenic view of a coastal path with palm trees and a beach in the background. The path is dirt and leads down towards a sandy beach and the ocean. Several people are walking on the path. The sky is blue and the water is a deep blue. The foreground is filled with green grass and palm trees.

# DRAFT MANGAWHAI COMMUNITY PLAN



The Mangawhai Community Plan is a document to provide guidance to Kaipara District Council in the management of growth in the wider Mangawhai area. It is confined to the roles of Council; planning and regulation, investment in services and infrastructure for transport, water supply, stormwater, wastewater, parks and reserves.

It does not include services provided by central government or the private sector. Budgets are estimates at this point and will be confirmed as part of Council's development of the next Long Term Plan 2018/2028. In mid-2016, as part of the project, Council set up a Mangawhai Community Panel to make recommendations for a community plan.

The recommendations were received by Council in July 2017. This draft Community Plan is consistent with the recommendations made by the Panel.



# Mangawhai – growing well

In the years 2001 – 2016 there was an increase of 1,304 houses or an average of 87 new houses each year (1,391 to 2,695, almost double). Improvements to State Highway 1 will bring us closer to Auckland, and the growth of Auckland may create migration north in search of a better and simpler life.

Now just under a half of housing is lived in full time. The rest are holiday/weekend homes. This creates peaks of demand and demand for different housing choices.

The permanent population between the 2001 and 2013 Census grew by 57% from 1,391 to 2,429. It is estimated that current population is now around 3,000. This expands considerably every weekend and moreso over summer.

By 2030, it is expected that the number of homes in Mangawhai will have increased by about 1,400 (medium growth scenario) with a usually resident population of more than 4,000, assuming continued half half between permanently occupied/not occupied dwellings.



- Where will these homes go?
- How can we grow without losing what is special about Mangawhai?
- What is the impact on the environment?
- Will it still be easy to get around?



## 87

**new houses per year**

From 2001 – 2016 the increase in the number of houses

just under **1/2**

**full time residents**

The rest are holiday/weekend homes.

## 57%

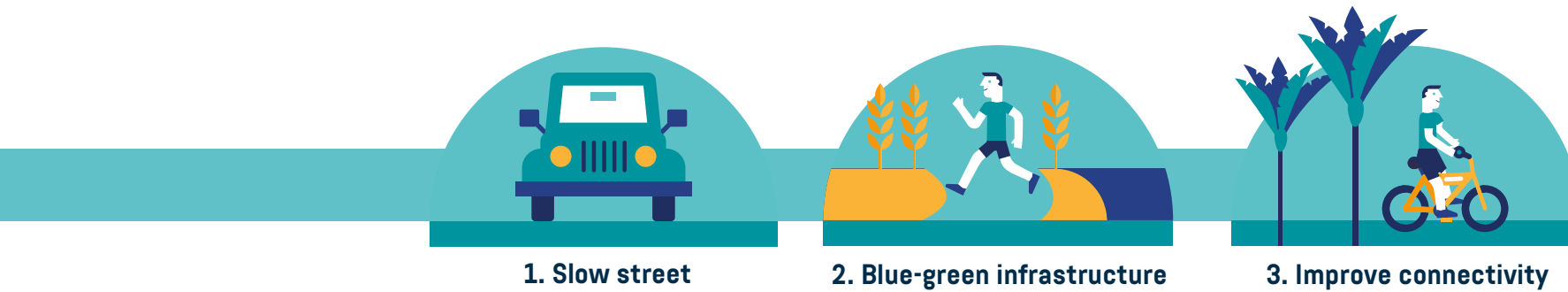
**growth in population**

It is estimated that current population is now around 3,000.

## 4,000

**Residents by 2030**

half-half between permanently occupied/not occupied dwellings.



You told us that you are here because of the beach, the bush, the active way of life, the informality and the slower pace. You value community; lots of volunteering, looking after our environment, looking after each other. You do not want to lose these things as Mangawhai grows. We have reflected this in the following six key moves.

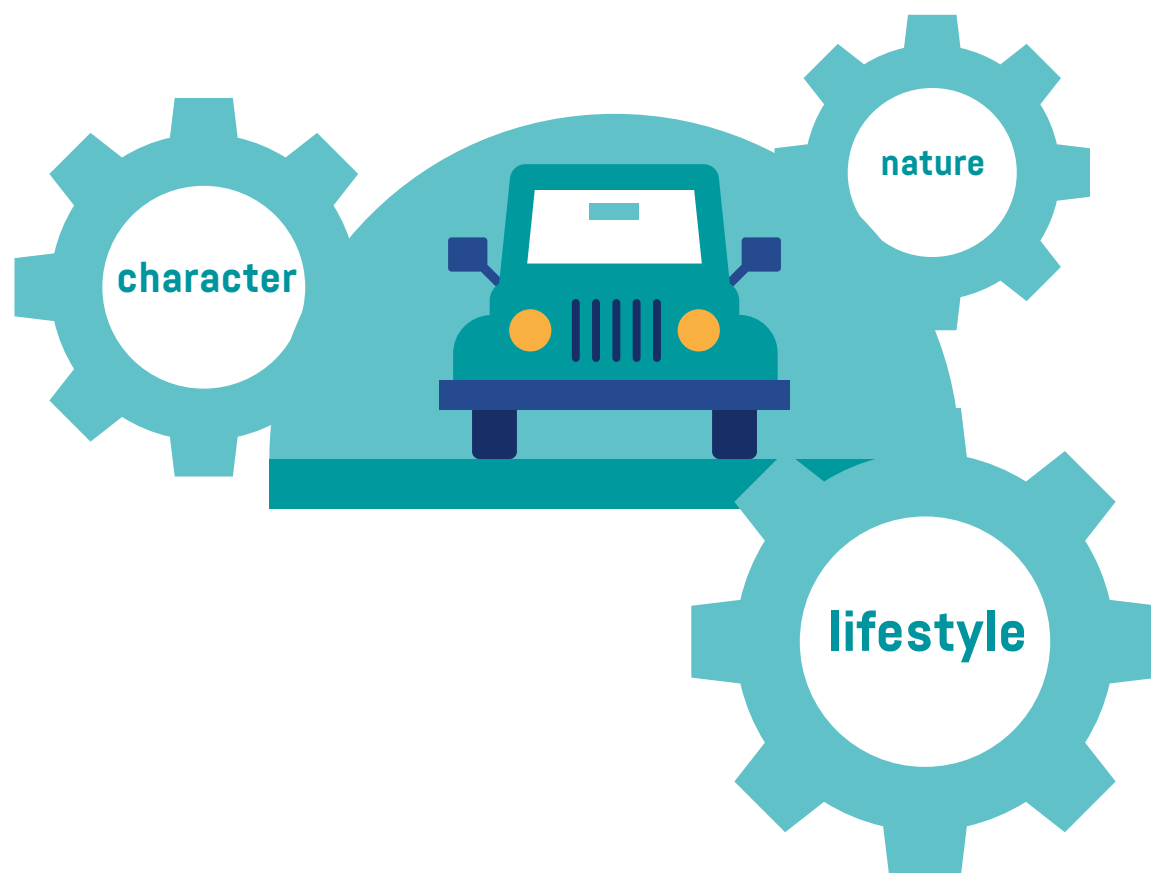


This is a synthesis of information gathered from the 2015 summer survey and stakeholder interviews.



# KEY MOVE ONE

## Slow street from school to beach

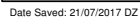


### Explanation:

Once in Mangawhai, it is an active place, with a safe and slow pace. A slow street will connect the different areas of Mangawhai, from the school to the beach over time, invigorating town centres along the way.



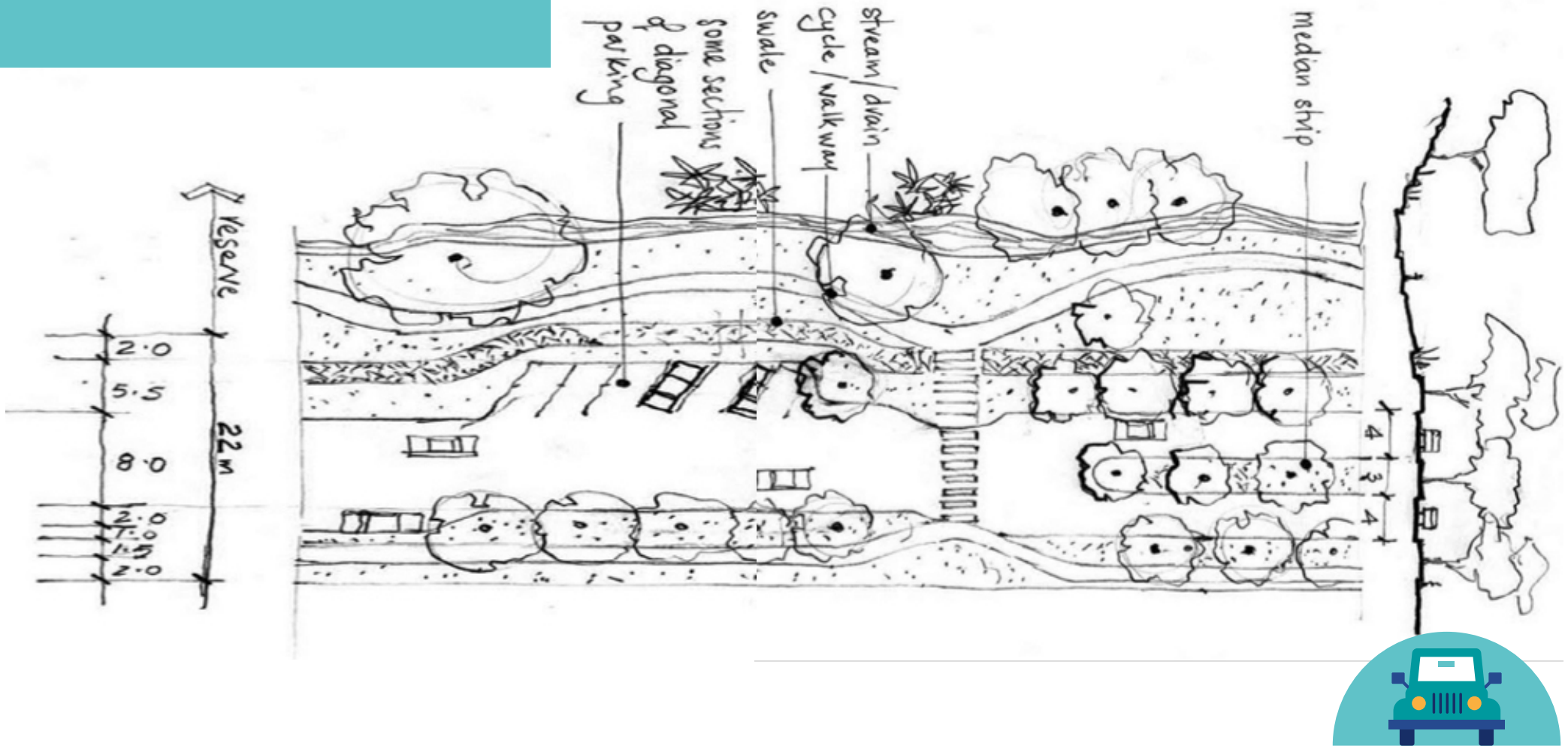




A **shared use path** for cycling and walking would follow the road carriageway for its full length.

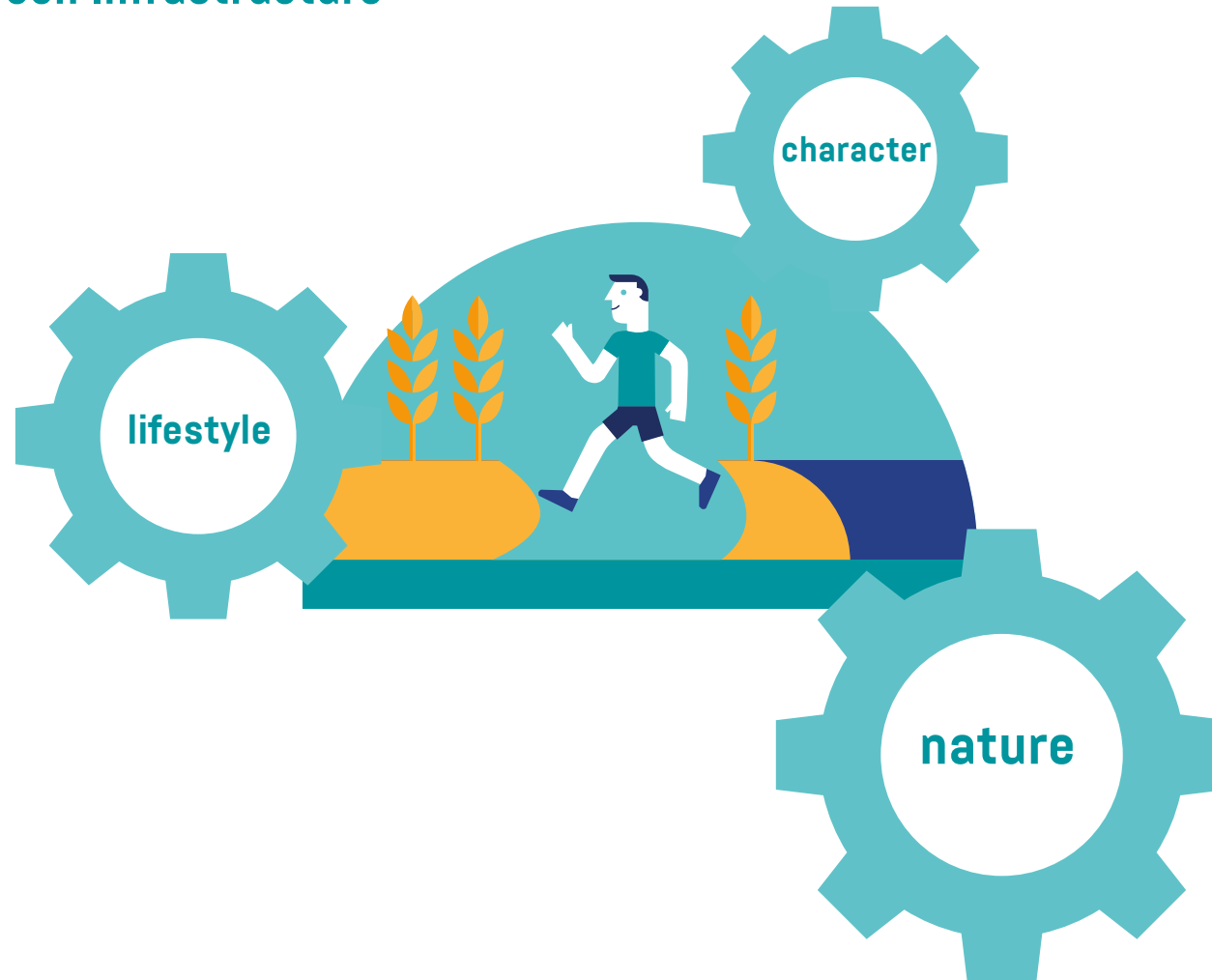
Intersections would be managed using **roundabouts**.

Below is a concept drawing of what a slow street might look like.



## KEY MOVE TWO

### Blue-green Infrastructure



#### Explanation:

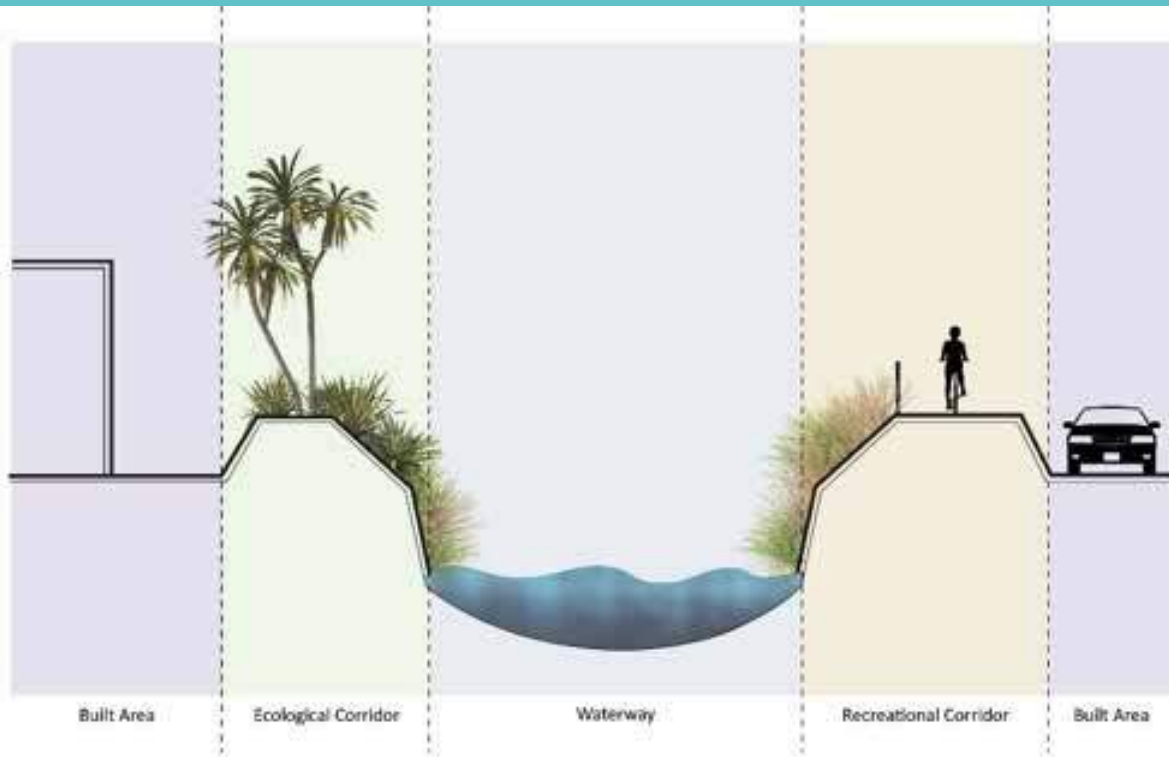
Connecting people with nature by using the coast, streams and creeks as routes for tracks, integrated with protecting bush, coastal and riparian landscaping and revegetation to sustain high water quality, eco-corridors and biodiversity.



Blue-green infrastructure using “**biofiltration**” is increasingly used to design stormwater management and manage natural waterways to lessen flood risk, and improve water quality, in the form of swales, overland flow and retention ponds/rain gardens.

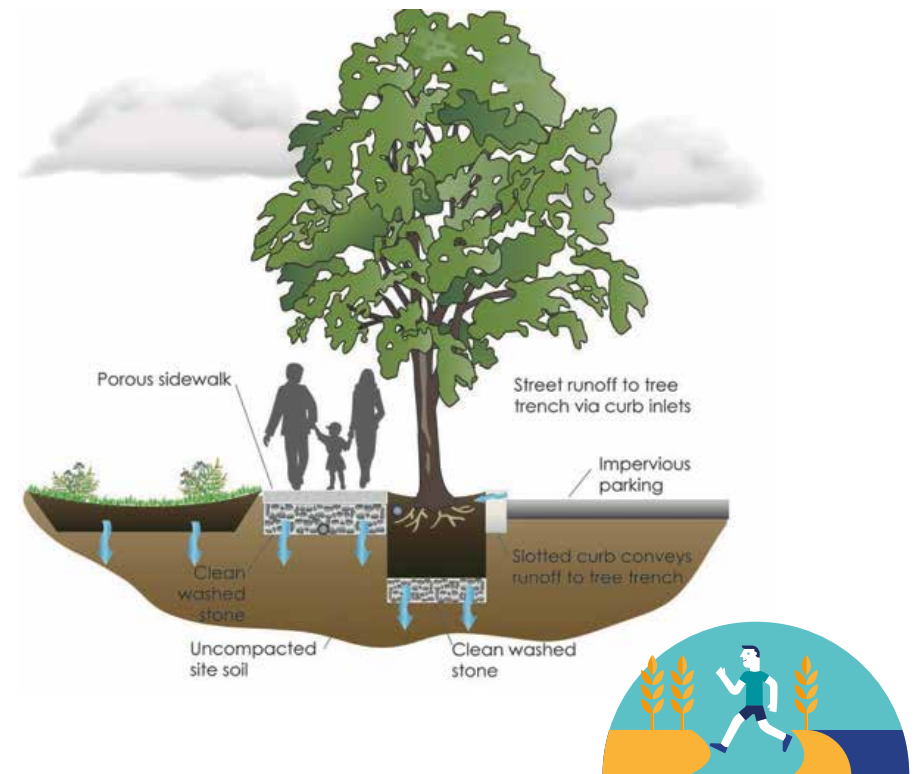
There is an associated use of landscaping to enhance **biodiversity**, create **eco-corridors** and improve **amenity**.

**Wetlands** could include the old wetlands in Mangawhai Community Park, the Mangawhai Golf Course and perhaps new wetlands on land that currently ponds at Fagan Place.



## Blue-Green Infrastructure

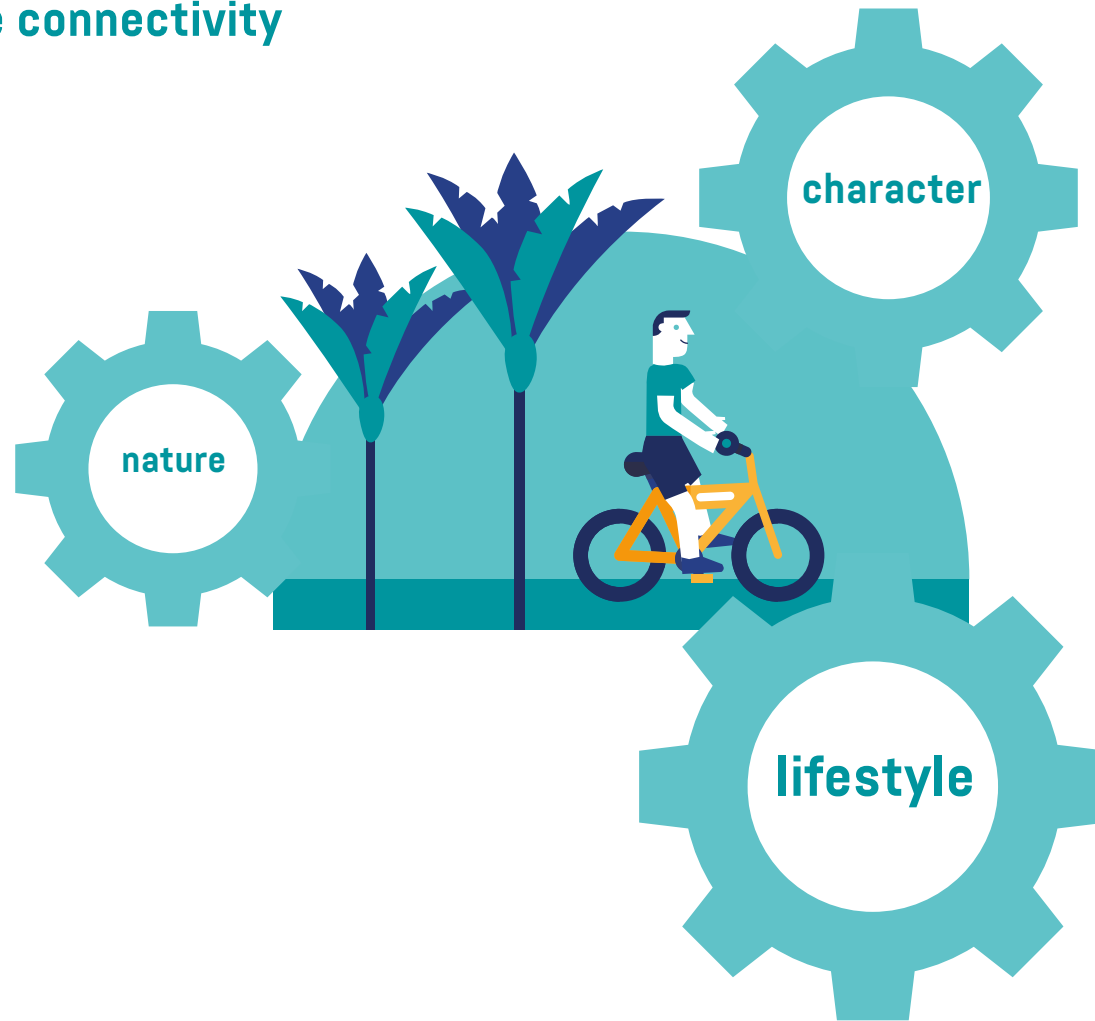
- Blue refers to rivers and water bodies, whereas green refers to greening landscapes.
- Build a drainage layout in urban areas that interweaves the natural environment with community characteristics and contemporary functions.





## KEY MOVE THREE

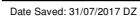
### Improve connectivity



#### Explanation:

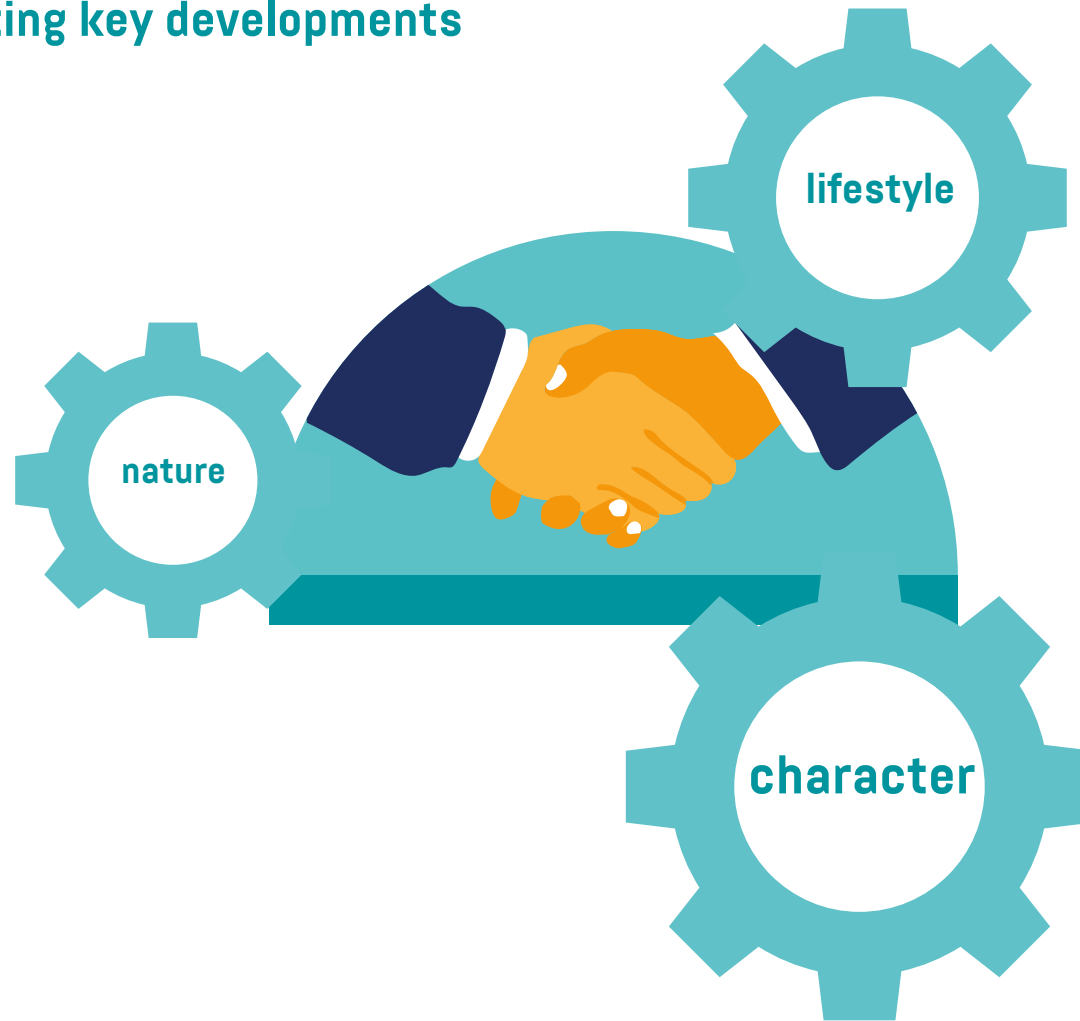
Making it attractive, safer and quicker to walk, cycle or scoot to where you want to go on shared paths along main routes, and connecting no exit streets. For vehicles, connecting of the two ends of Old Waipu Road as an alternative route into Mangawhai. A through route for through traffic (e.g. Garbolino/ Cove Roads corridor).





# KEY MOVE FOUR

## Facilitating key developments



### Explanation:

For example – Mangawhai Central (Estuary Estates) has 500 residential lots - equivalent to the capacity needed for five years. Any barriers to development need to be addressed if this capacity is to be released. Council will work with developers to maximise community benefits.



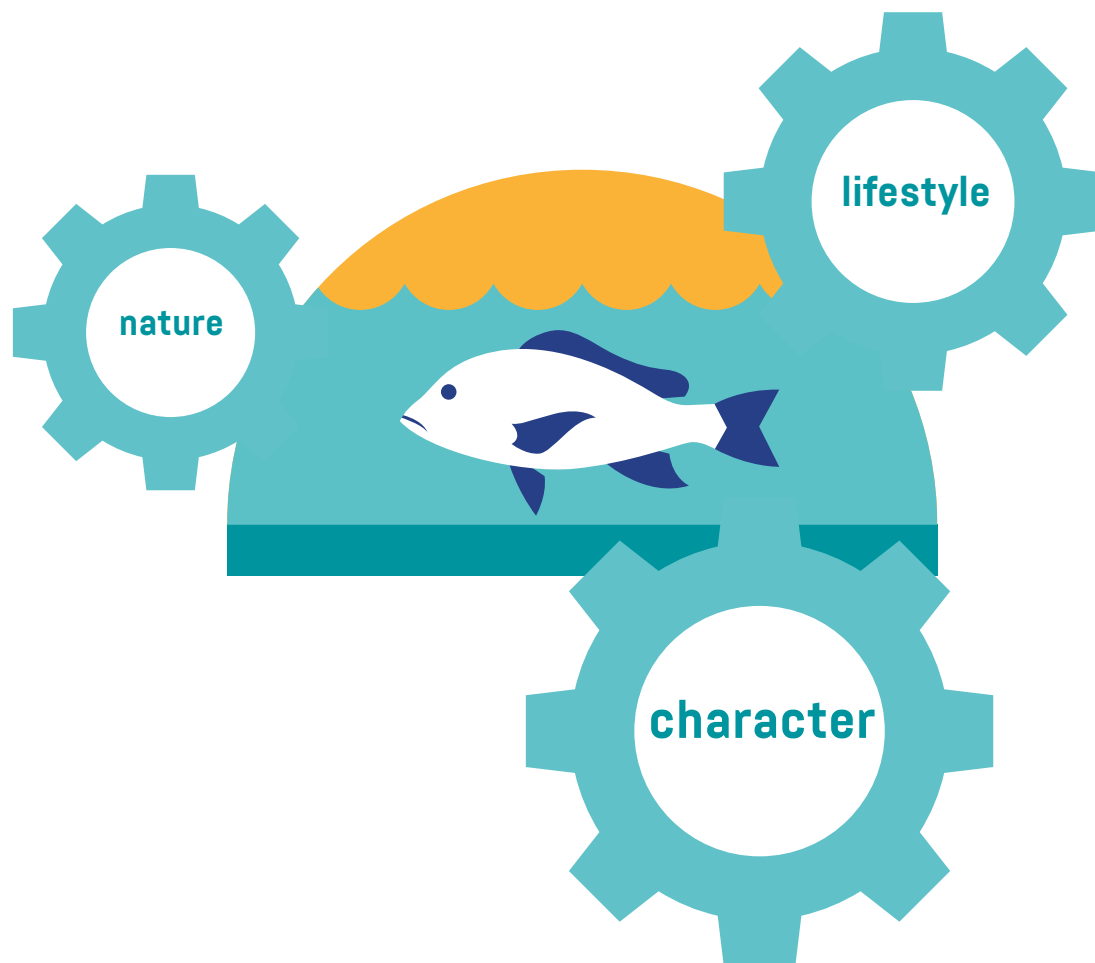
## Green Network Plan Map





# KEY MOVE FIVE

## Protecting coastal character and history



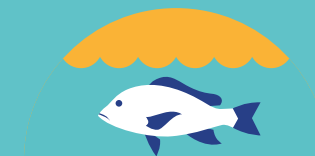
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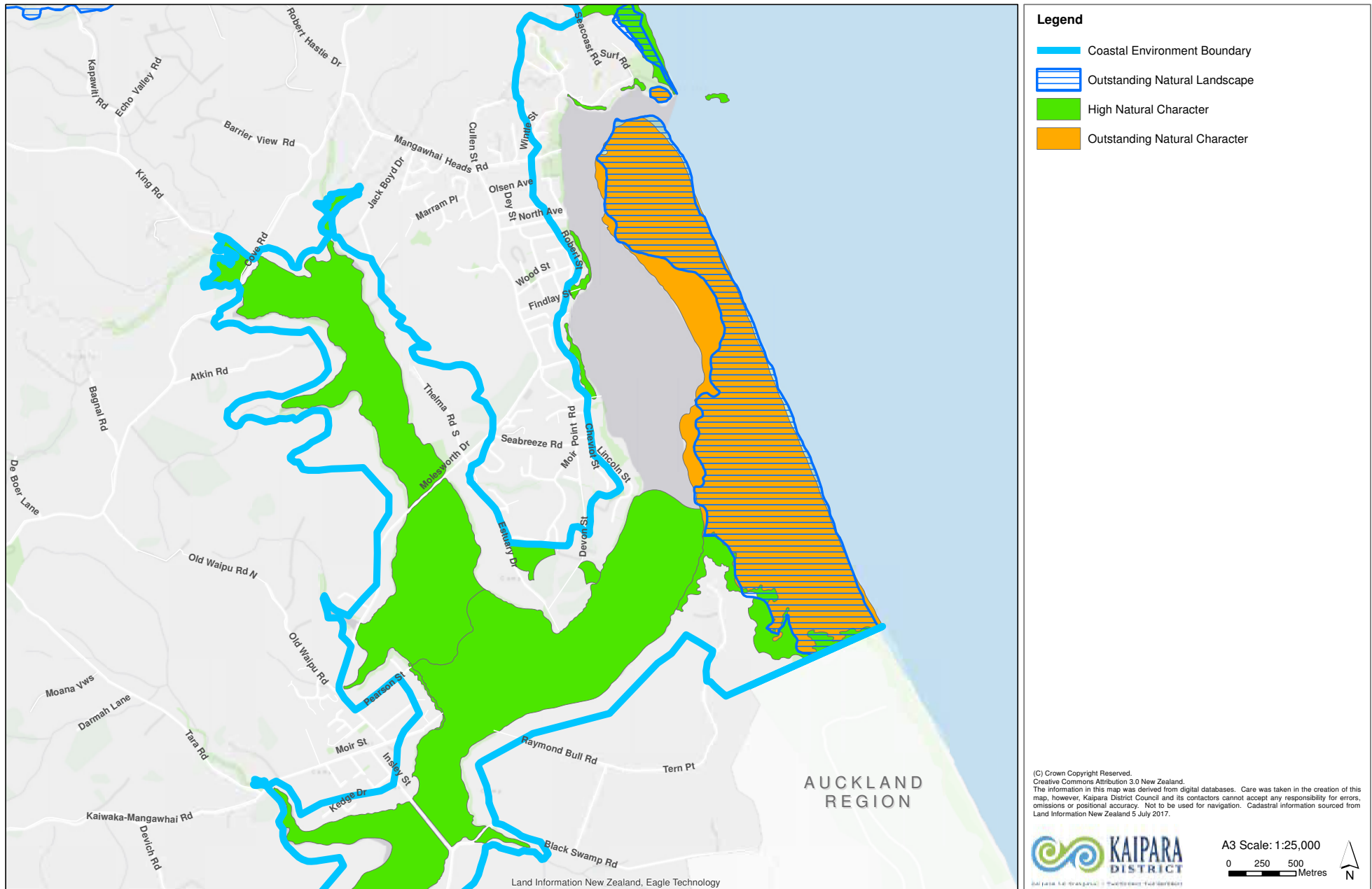
### Explanation:

Looking back to the coast from the harbour, you see low rise houses on larger lots with extensive bush. In the Mangawhai coastal strip, retain coastal character with large lots, height limits and spacious setback from the road and any esplanade reserve.

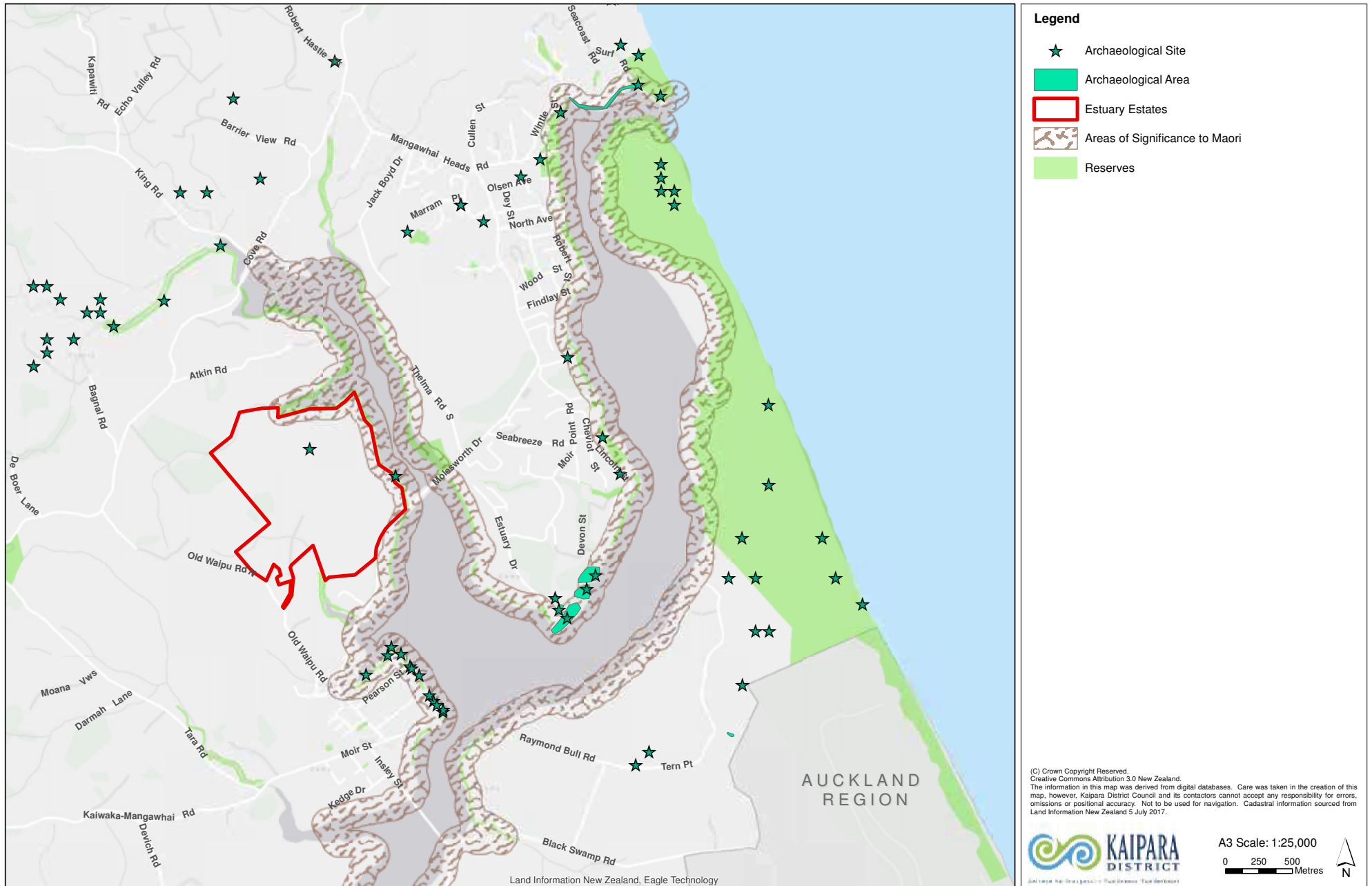
Complete the network of esplanade reserves, protect archaeological sites of significance to Maori (mainly within the coastal area) and remove private uses of public reserves, together with providing more facilities on the coast.



# Regional Policy Statement Map

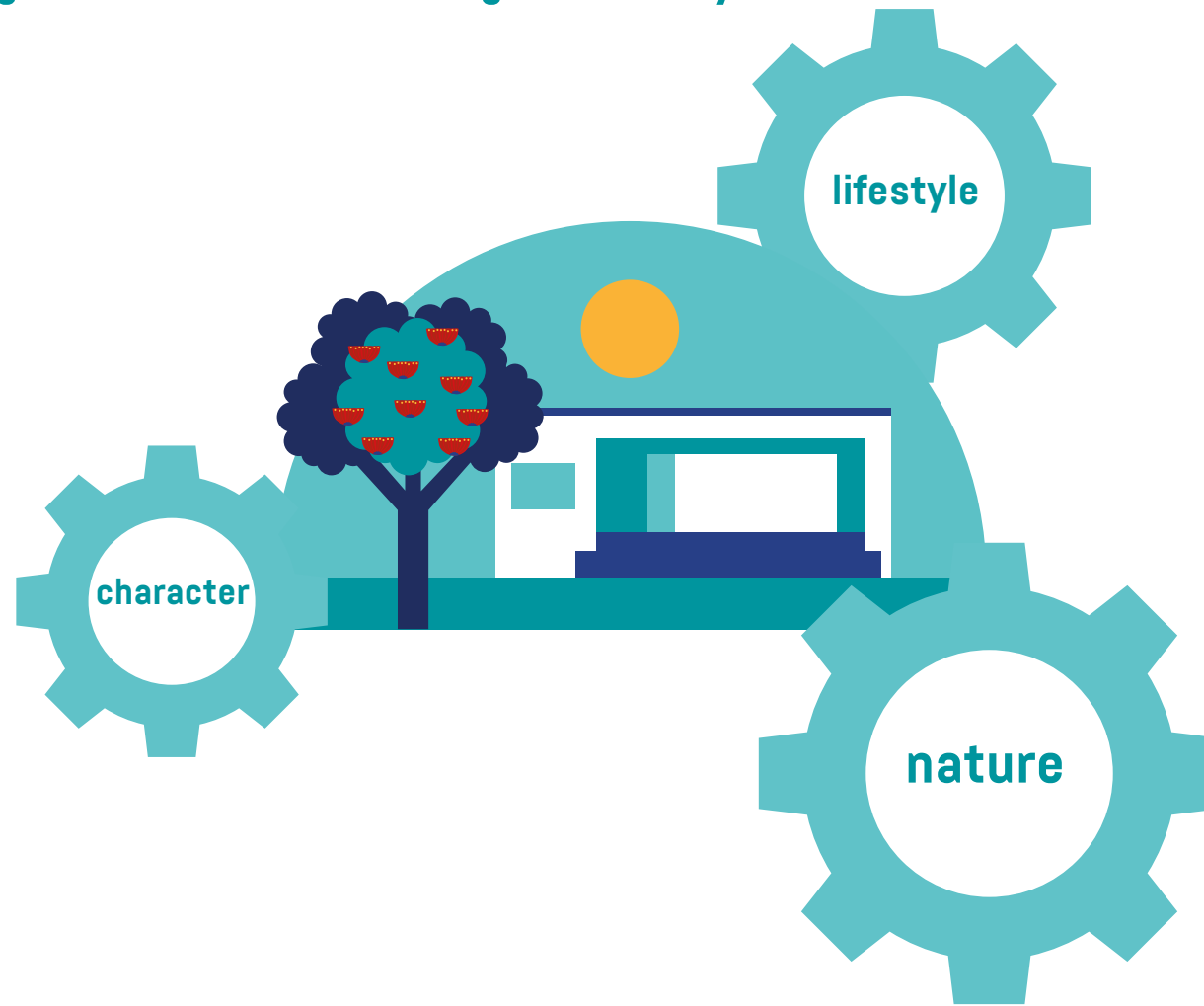


# Mangawhai Community Plan - Archaeological Sites Map



# KEY MOVE SIX

## Providing for a choice of housing and lifestyles



### Explanation:

Providing for projected growth with **housing choice**, while retaining our valued **lifestyle** and **coastal character**.

Ideas for how to **cater for lifestyle** and housing choices other than in Mangawhai Central have produced the following suggestions to date:

- A rural-residential zone?
- Larger town centres with mixed residential/business use?
- New smaller lot multi lot subdivisions outside the coastal area?
- Minor secondary dwelling on current lots in a way that the property is unable to be subdivided?

It is proposed that these options be examined more thoroughly through a Resource Management Act Section 32 analysis and a possible plan change that could begin next year.





## In Summary:



Mangawhai will **grow well**. While we grow, we shall care for **nature**, encourage a **slow pace** and **active lifestyle**, and retain the **coastal character** and **history**.



# What does this mean for Transport initiatives?



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The suggested approach to transport development is to fix “pain points” in the network (notably the two intersections at the Village shops) but otherwise use cycling and walking to improve connectivity.

The intent is to slow traffic and life down generally when people are in Mangawhai. Roundabouts are the preferred mechanism for improving vehicle flow at intersections, while keeping movement at a reasonable speed that promotes the slow pace and safety for pedestrians and cyclists.



Project	Description	Year (beginning 01 July 2018)	Cost estimate (net) rounded (capex)
<b>Stage one – slow street</b> Mangawhai Village	Shared path and landscaping from: - Mangawhai School to Insley/Moir Streets intersection - Tara Bridge to Pearson Street (including Mangawhai Domain)	1-3 years	\$78,000
	Roundabout at Insley/Moir Streets intersection	1-3 years	\$1,000,000
	Roundabout at Moir Street/Molesworth Drive intersection.	1-3 years	\$600,000
	Review parking provisions	1-3 years	tbc
	Improved arrival experience from the south.	1-3 years	Included above
<b>Stage two – slow street</b> Mangawhai Community Park	Shared path and landscaping along Molesworth Drive from Moir Point Road to the southern end of the Causeway Bridge	4-6 years	\$207,100
<b>Stage three – slow street</b> Mangawhai Central	Shared path and landscaping along Molesworth Drive from Pearson Street to the Causeway Bridge	4-6 years	\$195,000
	Two roundabouts at entrances to Estuary Estates off Molesworth Drive.	tbc	tbc
<b>Stage four – slow street</b> Molesworth Drive Roundabout to Surf Club	Shared path and landscaping along Mangawhai Heads Road and Wintle Street from the Pearl Street Corner to Surf Club	7-10 years	\$180,000
<b>Stage five – slow street</b> Mangawhai Heads	Shared path and landscaping along Molesworth Drive from Moir Point Road to the Mangawhai Heads roundabout	7-10 years	\$137,000
	Wood Street/Molesworth Drive roundabout		\$600,000
<b>Cycling/walking on road shared paths (other than on “slow street”)</b>	Mangawhai Heads loop shared path (Wood Street / Robert Street / North Avenue / Alamar Crescent / camping grounds / Mangawhai Heads Road including Wood Street upgrade	4-6 years	\$1,128,000
	Mangawhai Village loop path (signage on existing esplanade) (Kainui Street / Pearson Street / coastal reserve / Moir Street)	1-3 years	\$10,000
<b>Footpaths</b>	Footpath along Alamar Crescent	7-10 years	\$47,000
	Pedestrian connection on Insley Street causeway and bridge	Beyond 10 years	\$224,000
<b>Future stage – cycling/walking</b>	Shared path to Mangawhai Central via Old Waipu Road.	Beyond 10 years	\$250,000
<b>Connecting the two sections of Old Waipu Road</b>	Provide an alternate route into Mangawhai and Estuary Estates from an upgraded and joined up Old Waipu Road.	Beyond 10 years	\$1,800,000
<b>Through route for through traffic</b>	Develop an alternate route for travellers to Langs Beach and Waipu Cove to time with Warkworth to Te Hana State Highway 1 upgrade (Cove Corridor). Include 2m verge for cyclists refuge along Cove Rd.	Beyond 10 years	unknown
<b>Plan for other intersection improvements as Mangawhai grows</b>	These may include Molesworth Drive /Sail Rock Drive, Molesworth Drive /Estuary Drive / Thelma Road, Tara Road / Mangawhai-Kaiwaka Road.	Beyond 10 years	unknown



# What does this mean for Water Supply?



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The preferred option for water supply is to continue to rely on water harvesting for household use with no extension of the public supply, except to new commercial connections at Wood Street Town Centre.

This will require new houses to be capable of collecting rainwater in sufficient quantities. Communal water storage for firefighting is supported. This water could also be sourced from MCWWS for emergencies, via connection to the Fire Station to be sited on Mangawhai Community Park.





# What does this mean for Stormwater Management initiatives?



The intent is that no untreated stormwater flows directly into the harbour or sea. This is a Council activity that has seen the least investment in Mangawhai over time, with plentiful remedial work required.

While more knowledge is needed to determine the best response, the preferred approach is, where practical, low impact bio-mechanisms (biofiltration) to manage stormwater.

This is not always possible because of differing ground conditions. Where there is insufficient soakage, or workable overland flow, piped network may be necessary. Where possible, drains/overland flow paths will be naturalised into streams with biodiverse riparian planting. Roads will be the first choice for overland flow in storm events. Retention ponding/swales will be used to treat stormwater before it soaks into groundwater or flows into the harbour where this will work. Otherwise a mechanical treatment device may be necessary.



Project	Description	Year (beginning 01 July 2018)	Cost estimate (net) rounded (capex)
Overland flow path/ ponding location and protection	Development a Stormwater bylaw that allows intervention in areas where legacy issues require resolution.	1-3 years	\$15,000 (opex)
	Use easements to protect existing overland flow not effected by development (or re-direct to the road corridor if possible).		\$200,000 (opex)
	Formalise and protect overland flow paths within roads and incorporate overland flow function into the road corridor as part of future road upgrading works.		\$40,000 – plus costs of proposed works (capex)
Install new systems at current pain points	Pain points exist in sections of: - Eveline Street - Quail Way	Pain points exist in sections of: 1-3 years 1-3 years	Capex: \$130,000 tbc
	Reduction of outflow pipes into the estuary from North Avenue to Mangawhai Heads Road.		
Improve knowledge and remodel performance (Catchment management plan)	Identify more clearly existing overland flow paths.	1-5 years	Opex:
	Gather accurate information of current infrastructure and systems.		\$200,000
	Understand soakage capacity including effects of groundwater levels and soil types.		
	Complete downstream assessments.		
	Gather and log as-built information in GIS.		
Investigate and develop where appropriate wetlands/ponding to collect stormwater in the Mangawhai Heads area that would otherwise go directly into the harbour	Identify new or improvements to Stormwater system and implement them	Annually from 2018/2019	
	Re-water the original wetlands within Mangawhai Community Park from overland flow paths.		Opex/Capex:
	Look to create wetlands as public parklands on land around the Community Housing units at Fagan Place, where there is already natural ponding from the general area of Fagan Place, Wood Street, Margaret Street, Robert Street (otherwise, it would cost an estimated \$4.4m to pipe to the estuary).		\$500,000
Engineering standards revision	Improve outlets and operation of stormwater to Golf Course wetlands.	1-3 years	
	Revise engineering standards to include: - Testing, design, construction, monitoring and maintenance of soakage systems (biofiltration)		Opex:
	- Protection of overland flows from development - Protection of amenity and character.		\$25,000
Harbour Outlets	Reduce the number of outlets into harbour from Wood Street – Picnic Bay		Included in other projects



# What does this mean for Wastewater Management?



The intent of the Mangawhai Community Wastewater Scheme (MCWWS) was to improve the quality of the water in the Mangawhai Harbour. This intent is still current. The future approach to connecting new properties and areas within the drainage district was agreed after recommendations from a Community Advisory Panel in 2016. Council is currently considering options. The decision on the preferred option will be made in 2018 as part of the Long Term Plan considerations.

Project	Description	Year (beginning 01 July 2018)	Cost estimate (net) rounded (capex)
Extending the number of connections to cover all the Residential zoned land/ drainage area and ensure the two match.	This involves how the treatment plant is managed, improvements to the farm and extension to reticulation.	NOW	\$350,000
		From 2018	Medium option is \$7.7 million over 10 years



# What does this mean for Open Space and Recreation initiatives?



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The intent is to complete a continuous esplanade reserve around the harbour over time. Esplanade reserves will be developed for coastal recreation including boat/kayak launching, walking and cycling where accessible. Recreational walking and cycling tracks will continue to be developed with the help of the Tracks Trust, where possible along streams and coast to connect people with nature. A model “bio filtration” system is intended for Lincoln Reserve. Active recreation is intended for Mangawhai Domain, where Council can assist the Domain Committee in fulfilling this purpose.



Project	Description	Year (beginning 01 July 2018)	Cost estimate
Lincoln Road biofiltration demonstration on stormwater management.	Create a demonstration area on Lincoln Reserve as a model for using biofiltration (rain gardens, wetlands, retention ponds and biodiverse plantings) to clean stormwater.	1-3 years	\$30,000 for each of 1 3 years, total \$90,000
Non-motorised sea craft storage and launching on coast	Provide spaces for craft storage by launching places, to reduce need to drive craft to beach, at Alamar Reserve and Eveline Street	1-3 years	\$10,000 for each of 1 3 years, total \$30,000
Picnic and barbecue spots along the coast	Establish barbecues at Alamar and Lincoln Reserves Provide more seats at Lincoln, Pearson, Moir, Jordan and Robert reserves.	1-3 years	\$10,000 for each of 1 3 years, total \$30,000
Improved access to and use of beaches	Increase parking availability at Heads by reconfiguring current parking.	1-2 years	Capex:\$70,000
	Increase public use of Pacific Beach through improved signage.	1-3 years	\$5,000
	Enhance overflow parking by the Police units at Alamar Crescent. This may require reconfiguration of the camp ground boundary.	4-6 years	\$50,000
	Improve car parking at Pearson Reserve.	4-6 years	Paid by developer
	Bike stands at key locations	1-3 years	\$2,000 for each of 1 3 years, total \$6,000
	Public toilets at Lincoln Reserve and Mangawhai Heads Road by beach.	1-3 years	\$150,000 each



Project	Description	Year (beginning 01 July 2018)	Cost estimate
<b>Off-road walking and cycling recreation tracks</b>	Work with the Tracks Trust or developers to extend and improve tracks, using unformed (paper) roads if possible and connecting new subdivisions. See below.	Ongoing	Financial contributions, development contributions and/or MELA
	Continuous Coastal walkway Stage one – Heads Beach to Pearl Street	1-10 years Year 1	\$1.45m over 10 years \$300,600
	Tracks through Mangawhai Central	1-5 years	\$64,000
	Connecting no exit streets with walking and cycling tracks		
	- Thelma Road to Thelma Road link	7-10 years	\$95,500
	- Esplanade to Jack Boyd Drive link	1-3 years	\$36,000
	- Jack Boyd Drive to Thelma Road link	1-3 years	\$26,000
	- Across estuary (Tara Creek)	10+ years	\$1,000,000
<b>Kaipara Walking and Cycling Strategy</b>	Prepare and develop a strategy to determine future walking and cycling connections, formalising the routes in this plan	NOW	Done
<b>Domain development</b>	Work with Domain Committee to support them in developing the Domain for active recreational uses e.g. improving drainage.	Ongoing	\$100,000 for three years – Fundraising and financial contributions and/or MELA
<b>Wood Street business area</b>	Work with business owners and property owners to redevelop the public spaces within the centre.	2-4 years	\$800,000 over three years
	Provide public toilets	4-6 years	\$200,000
<b>Urban forest</b>	Develop a landscape/planting plan and programme for public streets and parks to enhance amenity and biodiversity that also provides guidance for people wishing to plant appropriate trees on their own properties and street berms.	NOW 1-3 years	\$20,000 \$60,000 over three years
<b>Re-establish the wharf on the estuary at the end of Moir Street</b>	Support the volunteer group looking to re-instate the Moir Street historic wharf.  Purchase esplanade land adjacent to potential wharf location on Moir Street (owned by Ministry of Education)	TBC  Land Purchase Wharf	  \$200,000 Unknown – Fundraising and MELA/ financial contributions
<b>Complete the network of esplanade reserves along the residential coast</b>	Create, as they become available through subdivisions, the missing links to the network – Jordan Street, Estuary Drive, Molesworth Drive, Pearson Street, Moir Street and Insley Street.  Remove private encroachment onto public esplanade reserves	As subdivisions occur	Unknown – Financial contributions
<b>Another all-tide boat ramp</b>	With the Harbour Restoration Society and Boating and Fishing Club, investigate the potential for a second all-tide boat ramp on to the harbour	4-6 years	Unknown until investigation complete
<b>Cultural Place Making</b>	Protection and celebration of sites of significance to Maori e.g. - Te Whai Pa - Two Pa and middens on Mangawhai Heads Reserve - Small coastal Pa and middens on Pearson Reserve Telling the story of the history through interpretation signage on walking tracks	Ongoing/ incorporated into projects above	
<b>Solid waste management</b>	Installing recycling bins in public areas such as town centres, beaches.	1-3 years	\$10,000



# What does this mean for developing Mangawhai Community Park?



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The Master Plan for Mangawhai Community Park was completed in 2013. A Friends of the Park and a Council Committee work together to maintain and develop the Park. There is an approved programme of work listed below.

Project	Description	Year (beginning 01 July 2018)	Cost (opex – reserves contribution funding)
Historic Village/Museum Hub	Complete landscaping and car parking at this hub	2017/2018	\$70,000
MAZ/St Johns Hub	Complete landscaping and car parking at this hub	annual	\$100,000 p.a.
Walkways/service lanes	Establish through routes to MAZ and the Museum from the Club, with improved planting and signage	annual	\$90,000 p.a.
Cultural place-making	Include stories of Iwi history through the pioneer village and Park signage in association with the Museum.	Included in other Park projects	
Community Development	Facilitate more collaboration between community groups with similar aspirations.	NOW	



# What does this mean for possible new provisions in the District Plan?



There is sufficient capacity for new housing for some years in line with growth projections, within the current residential zone, especially if Mangawhai Central is included in the calculation. However, this is not a good match with demand. Greater housing choice is needed if the demand is to be met in a managed rather than ad hoc way. This ranges from rural-residential sites, to town houses on smaller lots.

To address the community concern about loss of character design guides or rules may be added to the District Plan, and a new “coastal” residential zone that limits development within a defined area along the coast from the Heads beach to the Insley causeway. It is also proposed to create a new zone on the periphery of the residential area for smaller lot lifestyle blocks, with associated environmental benefit rules. The commercial zones within the town centres are also proposed to be enlarged and allow for mixed use developments of a more intense nature.





The intention is Council will undertake a District Plan Effectiveness and Efficiency Review in 2018 as a statutory requirement under the RMA. This is a check on whether or not the outcomes in the District Plan are being met.

This may include:

- Plan changes to address issues;
- Extending town centre commercial zones including allowing for mixed use?
- Including urban design rules?
- Introducing a new Rural Residential zone with requirements to provide environmental benefit?
- Allow smaller lot size in some areas away from the coast?

Project	Description	Year (beginning 01 July 2018)	Cost (all opex)
<b>Enforce the current provisions in the District Plan</b>	The Kaipara District Plan can be more robustly administered in the short term while any plan changes are considered over the next year or two. Guidelines/practice notes will be developed to show how the Plan will be administered.	NOW	\$0 Within current budgets and fees/charges
<b>Develop Urban Design Strategy</b>	Develop a framework for the inclusion of urban design rules in the District Plan – it should be noted that Estuary Estates has urban design guidelines that may serve this purpose.	1-3 years	\$25,000
<b>Proposed Plan Change 1 – coastal character</b>	Propose a Plan Change that protects the character of the coastal area and harbour fringe streetscape urban design controls, also implementing the Northland Regional Council Regional Policy Statement for coastal areas.	NOW	\$200,000 annually
<b>Mangawhai Central (Estuary estates)</b>	Work with the owners to more connectivity, and faster development, without changing the land use.	NOW	Opex/Capex: \$500,000
<b>Review of District Plan for Mangawhai area</b>	Efficiency and Effectiveness review of the District Plan, then analysis of options for providing for future growth.	Year 1	Opex: \$25,000
<b>Proposed Plan Change 2 – housing choice</b>	Complete a Section 32 analysis considering options for extending housing choice. Propose a Plan Change that implements the preferred option, as identified in the Section 32 analysis.	1-3 years	Included in other projects





# Funding the Implementation of this Plan:

## Indicative cost summary- total \$29.3m

- Of the \$29.3m total, \$6.9m is already underway or planned; \$22.4m is new, as follows
- Indicative baseline is an interim update of the LTP 2015-25 budget used for comparison purposes

\$000's	Existing budgets (2016/2017 & 2017/2018)	Indicative Baseline (2018-2028)	Mangawhai Community Plan (2018-2028)	Mangawhai Community Plan (future years)	Total
Roading Total	1,455		6,260	2,374	10,089
Stormwater Total	130	1,543	2,677		4,350
Wastewater Total		400	7,250		7,650
Community Activities Total	401	2,970	2,844	1,000	7,215
Grand Total	1,986	4,913	19,031	3,374	29,304

## Indicative cost summary- Funding for \$19.0 m 2018/2028

- Inflation adjusted, the requirement is for an additional \$33.6m (\$21.7m new capital expenditure and \$11.9m operational expenditure) and is funded as follows

\$000's	New total to be funded	General rates	Targeted rates	Development Contributions	Subsidy	Loans	Other
Transport	10,114	✓		✓	✓		✓
Stormwater	4,882	✓	✓	✓		✓	✓
Wastewater	14,030	✓	✓	✓		✓	✓
Community activities	4,536	✓				✓	✓
Total	33,562	✓	✓	✓	✓	✓	✓

Rate increases average just over 3% for the 10 years to June 2028, ie average of around 0.5% over indicative base of 2.6%  
Debt increases from projected \$58 m in June 2018 to \$63 m by June 2028 (cf indicative base of \$36 m)



# Sources of Information:

The following technical working papers have been produced to support the development of the Mangawhai Community Plan:

## MANGAWHAI COMMUNITY ADVISORY PANEL

*Mangawhai Programme – Input to development of the Mangawhai Community Plan*

July 2017

## KDC – Katrina Roos, Principal Planner

*Kaipara District Plan Review – Mangawhai Town Plan*

February 2016

## GHD

*Mangawhai Town Plan Stormwater Infrastructure Report*

May 2016

## KDC – Katrina Roos, Principal Planner

*Land Development and Density – Mangawhai Town Plan*

May 2016

## ROB BATES

*Mangawhai Town Plan – Growth and Development Outlook*

May 2016

## OPUS

*Mangawhai Water and Fire Supply Options Feasibility and Cost Analysis*

April 2016

## OPUS

*Mangawhai Town Plan – Urban Design Study Phase 1*

June 2016

## KDC – Annie van der Plas, Community Planner

*Mangawhai Open Space Review*

October 2016

## OPUS

*Mangawhai/Mangawhai Heads Review of Speed Limit Provisions*

March 2017

## MWH now part of Stantec

*Mangawhai Town Plan – Transportation*

March 2017

## KDC – Howard Alchin, Policy Manager

*Planning Technical Report, Mangawhai Town Plan Project*

April 2017

## MWH, now part of Stantec

*Mangawhai Town Plan Stormwater Infrastructure Strategy*

May 2017

## TE URI O HAU – Environs Holdings Ltd

*Cultural Impact Assessment Mangawhai Town Plan Development*

May 2017

## OPUS

*Mangawhai Cycleway connections*

May 2017





# Appendix B    Mangawhai Town Plan Stormwater Infrastructure Strategy, Stantec 2017



# MANGAWHAI TOWN PLAN STORMWATER INFRASTRUCTURE STRATEGY

Prepared for Kaipara District Council

May 2017





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## REVISION SCHEDULE

Rev No.	Date	Description	Signature or Typed Name (documentation on file)			
			Prepared by	Checked by	Reviewed by	Approved by
0	13/4/2017	Working Draft				
1	28/4/2017	Draft for Client Review	Patricia Melero	Allan Leahy	Allan Leahy	Grant Lorimer
2	22/5/2017	Final	Patricia Melero	Allan Leahy	Allan Leahy	Grant Lorimer





## Kaipara District Council

### Mangawhai Town Plan Stormwater Infrastructure Strategy

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## APPENDIX

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Appendix B	Northland District Council Draft Regional Plan (Stormwater Related Rules)
Appendix C	Draft Stormwater Discharge Consent
Appendix D	Possible Stormwater Issues Plans
Appendix E	Stormwater Management Proposals Plans

# 1 Introduction

## 1.1 The Stormwater Infrastructure Strategy Process

The Mangawhai Town Plan Map 4: New Medium Zones and Proposed Expansion Commercial Zones proposes intensified development around the commercial areas in both Mangawhai Village and Mangawhai Heads. This map sets the boundaries for the proposed expanded commercial zone and the proposed medium density residential zone.

The objectives of this Mangawhai Stormwater Infrastructure Strategy are to:

- Provide information with respect to the stormwater system to be incorporated into the Mangawhai Town Plan
- Guide the future stormwater management for Mangawhai integrating:
  - Community expectations
  - Regional Council drivers
  - Engineering drivers.
- Specify appropriate stormwater measures to guide the mitigation of the effects of development, within the catchment.

This Mangawhai Stormwater Infrastructure Strategy outlines the stormwater management options and measures to manage the effects of stormwater discharges resulting from the proposed development for Mangawhai Village and Heads. For this purpose it includes:

- Identification of stormwater issues within the Mangawhai Village catchment and the Mangawhai Heads catchment
- Identification of potential options to address these issues
- Recommendations for the long-term stormwater management within the two catchments including; generic and township controls, planning controls, physical works and operation and maintenance strategies
- An improvement plan for the implementation of those recommendations.

## 1.2 Drivers and Expectations

One of the main objectives of the Mangawhai Stormwater Infrastructure Strategy is to guide the stormwater management within the Mangawhai Heads and Village catchment integrating community expectations, Regional Council and engineering drivers.

In order to understand these drivers and expectations, the following process has been followed and documents reviewed.

### 1.2.1 Community expectations

The Mangawhai Town Plan (MTP) and in particular the MTP Guiding Principles and Assumptions has been reviewed. A copy of these guiding principles is included within Appendix A. These principles set out at a high level, the community expectations and drivers for the development of Mangawhai, including a number of principles which relate to stormwater discharges.

A Mangawhai Advisory Panel Workshop was attended on Friday 24<sup>th</sup> March 2017 to discuss stormwater issues and options and to gain an understanding of what is important to the community from the Advisory Panel's perspective.

Discussions have also been conducted with District Council Officers on community expectations.

### 1.2.2 Drivers from Regional Council

In order to set a sustainable future direction for stormwater management in Mangawhai it is also important that the likely future direction for stormwater management is understood from Northland Regional Council's perspective as set out in various documents.

Stormwater management expectations are set out in Northland Regional Council documents such as the Water and Soil Plan. The Regional Council has advised that it is intending to notify a new Regional Plan to update the Water and Soil Plan (as it is now somewhat dated). The proposed Regional Plan (issued in draft, August 2016, for consultation purposes) has been reviewed to provide direction as to the likely Regional Council directions with respect to stormwater discharges.

Kaipara District Council (KDC) is also in the process of obtaining a comprehensive stormwater discharge consent for Mangawhai and at the time of drafting this strategy a set of draft conditions for this consent are under discussion.

The Regional Council Documents considered as inputs into this strategy include:

- Northland Regional Council draft Regional Plan, August 2016 (excerpts included in Appendix B)
- Draft Stormwater discharge consent (copy included in Appendix C).

### 1.2.3 Engineering Requirements and Expectations

The relevant engineering requirements relate to the physical constraints around, in particular, the stormwater infrastructure and the design basis for new or renewed infrastructure. In this regard the particular documents considered within this strategy include:

- Kaipara District Council Engineering Standards, 2011
- Building Act, 2004: Sections 71-74
- Building Act: Building Code E1 Surface Water, Acceptable Solutions.

## 1.3 Information sources

This Mangawhai Stormwater Infrastructure Strategy references a range of existing documents and sources of information in order to identify the stormwater issues, outline the stormwater management options and measures to manage the effects of stormwater discharges resulting from the proposed development for Mangawhai Village and Mangawhai Heads. These include:

- Mangawhai Stormwater Management Plan, KDC, Duffill Watts & King Ltd 2006
- Kaipara District Council Engineering Standards, 2011
- Northland Regional Council draft Regional Plan, August 2016
- Draft Stormwater discharge consent for Mangawhai
- Updated GIS network data from Kaipara District Council. Including stormwater, wastewater and water supply. KDC 2017
- Mangawhai Town Plan Change Stormwater Infrastructure Report. GHD 2016
- Mangawhai Stormwater Consent Renewal Affected Parties Assessment. MWH 2015
- Mangawhai Town Plan Maps from KDC website. KDC 2016
- Customer Service Requests forms from KDC. From 2008 to 2016. Total 76 forms
- Kaipara District Council Proposed Cycleway. MWH 2016
- LiDAR 2016. Contours lines (each 0.5 m). Provided by KDC
- LINZ GIS data. Provided by KDC 2017



- MWH Site visit information recompile. MWH 07 February 2017.

## 1.4 Basis of Analysis

Due to the nature of the information available and the limitations of it in a quantitative form, this strategy is focussed initially on a qualitative assessment. It has recommendations for improvements to the available data to allow the future quantification of solutions, whether these be soakage, piping or overland flows.

# 2 Expectations from Stormwater Infrastructure Strategy

## 2.1 Community Expectations

The community expectations are summarised in the Mangawhai Town Plan (MTP) Guiding Principles, expectations were also explored with the Community Advisory Panel in March 2017. Key MTP Guiding Principles which relate to stormwater management issues and some of their implications from a stormwater perspective include:

**1. Mangawhai will continue to rely upon rainwater collection and tank storage.**

*While the potential for a reticulated water supply for Mangawhai is being investigated, it is likely that full reticulation will be unfeasible, although there may be scope for community-based schemes or communal water supplies for firefighting purposes.*

The requirement for on-site and individually owned stormwater infrastructure creates both opportunities but also introduces some constraints.

From an opportunities perspective on-site devices create the opportunity to manage stormwater discharges at source. It reinforces individual responsibility with respect to stormwater discharges. On-site tanks provide a reduction in the total volume of stormwater discharges by reuse and it also creates opportunities for on-site attenuation and in some circumstances enhances the possibility of on-site disposal.

From a constraints perspective, reliance on a large number of individually owned and managed devices to achieve a downstream public good increases the need for the provisions of comprehensive design information and strategies, the carrying out of good design, enforcement of the good design through construction and the long-term monitoring and maintenance of the devices to ensure the long-term achievement of the design outcomes.

**2. Medium density living will be encouraged around the key nodes of Mangawhai Village, Wood Street shopping centre and Estuary Estates.**

*Council is under increasing pressure from developers to consent smaller lots for buyers who desire low maintenance holiday houses. Rather than permit such development in an ad hoc fashion, it is proposed to concentrate medium density living around activity nodes.*

From a stormwater perspective medium density living will result in smaller sections and higher levels of impermeable surfaces. Without mitigation, this will result in greater total volumes and peak flow rates of stormwater discharges. Unchecked these will lead to increased local flooding issues, increased scour and potentially increased contaminant discharges to the estuarine receiving environment.

**5. Urban design standards will be introduced to manage medium density development.**

*The best practice principles of urban design will inform the MTP and urban design standards will form part of the project to manage the effects of medium density development.*

Urban design standards are a vehicle used to ensure good quality and overall high urban design standards through land use change processes. Good urban design also allows for the incorporation of engineering outcomes in the design. In this case and with the intensification envisaged it will be

important that the urban design standards include consideration of the future stormwater scenario. For example, where soakage is to be retained as the primary (or first) means of disposal the urban design will need to allow space for this as well as clearance to structures and boundaries as well as future maintenance access.

**9. Environmentally sustainable design will be encouraged in Council and private developments.**

*Low impact stormwater design, walking and cycling, improving biodiversity through planting and weed control and recognising and providing for walkways will be advocated for in the project.*

Low impact design is not an outcome in itself but a tool to achieve a range of outcomes. From a stormwater perspective this can include contaminant removal as well as volume reduction and flow reduction for the more regular stormwater discharge events. Improving alternatives to vehicle usage will assist in reducing contaminant generation that would usually be associated with higher vehicle usage in areas undergoing intensification.

The outcomes sought from a stormwater perspective were discussed with the Community Advisory Panel at the Mangawhai Advisory Panel Workshop on the 24th of March. In this workshop, it was accepted that the Mangawhai Village catchment and the Mangawhai Heads catchment are very different catchments with regards to existing stormwater networks and stormwater issues and therefore they may have different criteria. However, it was agreed that the stormwater management proposals should look as similar as possible on the surface.

The vision conveyed from the Community Advisory Panel was to keep the feeling of a beach area with open spaces, swales instead of kerbs and channels and to encourage natural looking solutions to stormwater management (and urban design) over highly engineered solutions.

In order to achieve the main community expectations and maintaining the community vision, different stormwater management options were discussed and are included within this Stormwater Strategy:

- Low impact design, or the use of natural based stormwater management systems over engineered drainage systems
- Utilise appropriately designed and maintained soakage systems wherever possible as a primary means of disposal
- Avoid the creation of multiple piped discharges onto the estuary and consolidate to as few discharges points as practicable
- Keep water on the surface by using swales for treatment and conveyance avoiding kerb and channel wherever possible

## 2.2 Regional Council Expectations

The main expectations set out in Regional Council documents such as the Northland Regional Council draft Regional Plan and the draft conditions of the KDC discharge consent can be summarized as:

- Stormwater diversion and discharge is not to cause, or increase, flooding to property in rainfall events up to a 10% AEP event or the inundation of buildings in events up to the 1% AEP event outside of the area serviced by the public stormwater network
- Discharges are not to erode the bed and banks of a lake or river, or foreshore
- The discharges are not to cause any change of colour or visual clarity on the receiving water beyond a 10m radius from the discharge point
- Minimisation of stormwater borne contaminants entering the receiving environment. Proposed limits are set out in H.7 "Water quality limits" of the draft Regional Plan a copy is included in Appendix B

- 
- Stormwater and sediment control measures are to be installed and maintained to minimise erosion and sediment discharges to water bodies or coastal water
  - Encouraging on-site disposal of stormwater and including allowance for the ongoing maintenance in the design
  - The provision and protection of existing and new overland flow paths

## 2.3 Engineering Requirements and Expectations

The existing Kaipara District Council Engineering Standards (October 2011) describe the target standards for the stormwater drainage systems. These targets levels apply to all new land development projects and also represent a target level of service for the existing drainage system.

- Primary system rural and residential land use design for a 20% AEP rainfall event
- Primary system industrial land use design for a 10% AEP rainfall event
- Primary system commercial land use design for a 5% AEP rainfall event
- Stormwater systems shall be designed including allowance for the anticipated effects of climate change, with guidance on what this means provided
- Overland flow paths and secondary flow paths for piped networks are to be designed to accommodate and provide protection for up to the 1% AEP rainfall event
- Primary system, overland flow paths and secondary flow paths should be designed to comply with health and safety requirements.

There is very limited guidance in the engineering standards on the design and maintenance requirements of soakage systems, swales or other low impact design systems. This gap presents limitations on what can be required by the Kaipara District Council in terms of long term effective low impact stormwater design.

## 3 Stormwater Strategy Outcomes

Based on the community expectations, Regional Council expectations and engineering requirements, this section discusses the main elements and desired outcomes of the Stormwater Strategy regime under the heading of stormwater quantity, stormwater quality and asset management.

### 3.1 Stormwater Quantity

Without mitigation the proposed intensification under the Mangawhai Town Plan will result in an increase in the stormwater peak flows and volumes for the Mangawhai Village and Mangawhai Heads catchments.

The desired outcomes from a stormwater quantity perspective for this Stormwater Strategy are:

- No increase and where possible a reduction in existing flooding risks
- No creation of new flooding risks
- The identification of overland flowpath routes
- Provision and protection of existing and new overland flowpath routes
- Encourage on-site reuse and disposal. Even where soakage is not possible the use of low impact techniques can effectively reduce the total annual volume of stormwater discharges and the contaminants carried within them
- Establish guidelines for the design and construction of discharge points not to be physically intrusive on the environment.

### 3.2 Stormwater Quality

Without mitigation the proposed intensification under the Mangawhai Town Plan will result in an increase in the amount of contaminants contained within the stormwater flows and discharged to the estuarine environment in both the Mangawhai Village and Mangawhai Heads catchments. Harbour sediment monitoring available to date indicates that the existing harbour sediment contaminant loads are in the order of one tenth of the maximum concentrations sought to be maintained by the proposed discharge consent and the draft regional Plan. The Stormwater Infrastructure Strategy should seek to maintain (or if possible) improve the sediment quality.

The desired outcomes from a stormwater quality perspective for this Stormwater Strategy are:

- To not create erosion of stream bed or banks or the beach at discharge points
- To include the provision of stormwater and sediment control measures and energy dissipation to be installed and maintained to minimise erosion at discharge points
- To not increase environmental or nuisance risks at outfall locations
- To meet the finally adopted Regional Plan requirements for Stormwater discharges. At this stage only the draft Regional Plan requirements are known and it can only be assumed that these will be adopted when the Plan becomes operative
- No conspicuous change in the colour or visual clarity of the receiving water beyond a 10 m radius from the discharge point
- To manage contamination as close to source as possible and particularly to address the risks in commercial or industrial areas which may be the sources of concentrated contaminant discharges.

### 3.3 Asset Management

The desired outcome from an asset management perspective for this Stormwater Strategy are:





- No increased hazard at discharge point
- Provide support for stormwater management practises through:
  - Enhanced Engineering Standards
  - Improved and complete stormwater infrastructure data
  - The provision of standardised design methodologies to simplify (building and resource) consent applications and processing
  - The provision of examples of acceptable solutions
  - The provision of standard Operation and Maintenance Requirements and Plans.

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## 4 Land Use

### 4.1 Existing Catchment Description

The Mangawhai Village and Mangawhai Heads catchments are contained within the existing Mangawhai Stormwater Management Plan, 2006, (SMP) catchments 4, 16 and 17.

- Mangawhai Village (catchments 16 and 17) is described in the SMP as existing Residential zoned areas with a small Commercial zone around the intersection of Molesworth Drive and Moir Street.

The land is generally flat and poorly drained with a number of open drains and piped systems installed with developments carrying stormwater to the estuary.

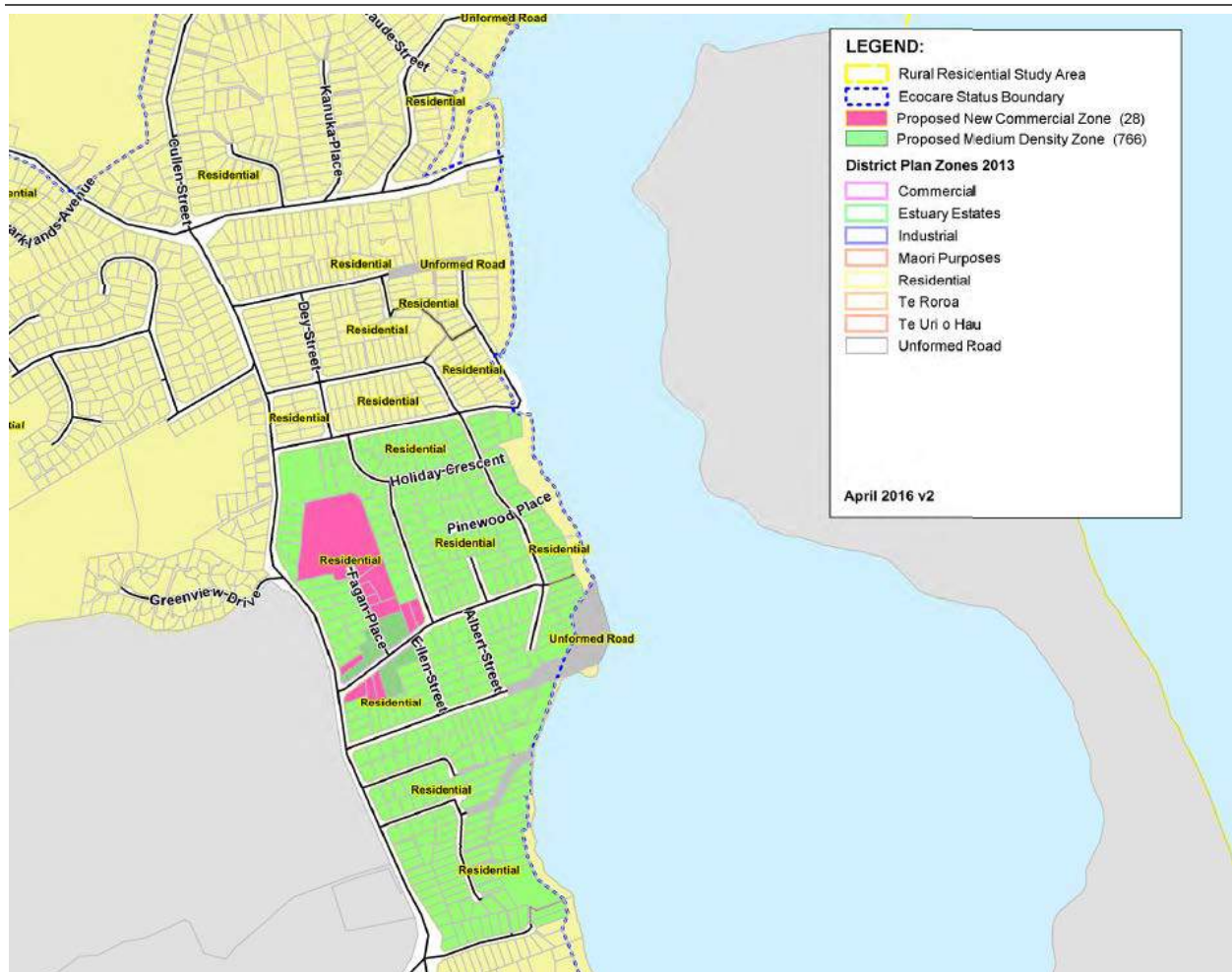
- Mangawhai Heads (catchment 4) is described as developed residential land with a small commercial area at Wood Street.

Development has been built on consolidated sand dunes. There are many natural depressions which have been retained within developments and areas where the natural infiltration into the sand has been sealed off and the surface has effectively become impervious.

### 4.2 Future Land Use

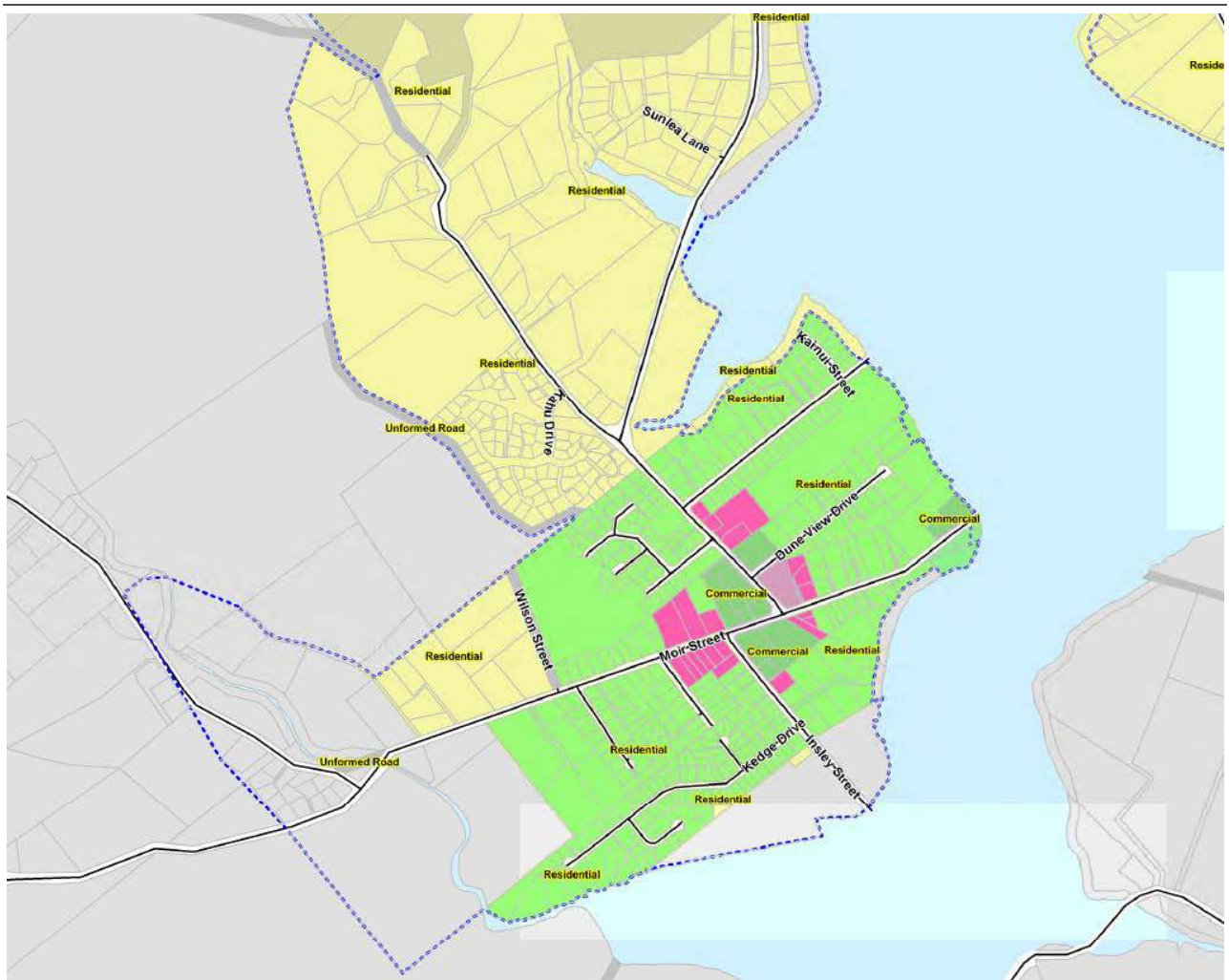
The Mangawhai Town Plan Map 4: *New Medium Zones and Proposed Expansion Commercial Zones* proposes intensification of development around the commercial areas in both Mangawhai Village and Mangawhai Heads. This map sets the boundaries for the proposed expanded commercial zone and the proposed medium density residential zone.

Figure 1 and Figure 2 show the proposed intensified development areas for the Mangawhai Heads and the Mangawhai Village, respectively.



**Figure 1. Mangawhai Heads Proposed Intensification Rezoning from the Mangawhai Town Plan**

Figure 1 is an extract from the Mangawhai Town Plan *Map 4 New Medium Zones and Proposed Expansion of Commercial Zones* showing the proposed expansion of the commercial zone at Wood Street and Fagan Place for Mangawhai Heads. It also proposes a Medium density residential zone for the rest of the area.



**Figure 2. Mangawhai Heads Proposed Intensification Rezoning from the Mangawhai Town Plan**

Figure 2 is an extract from the Mangawhai Town Plan *Map 4 New Medium Zones and Proposed Expansion of Commercial Zones* showing the proposed expansion of the commercial zone at Moir Street and Molesworth Drive for Mangawhai Village. It also proposes a Medium density residential zone for the rest of the catchment.

## 5 Stormwater Management Issues (Issues Plan)

The main stormwater issues affecting the MTP areas have been identified and are included within the issues and options table (Table 1 below) and the Issues Plans presented in Appendix D.

The Issues Plans have been developed as a result of the analysis of the combination of the following information combined with Rapid Flood Hazard Mapping results:

- Updated GIS network data from Kaipara District Council. Including SW, WW and WS infrastructure KDC 2017
- Mangawhai Town Plan Change Stormwater Infrastructure Report. GHD 2016
- Mangawhai Stormwater Consent Renewal Affected Parties Assessment. MWH 2015
- Mangawhai Town Plan Maps from KDC website. KDC 2016
- Customer Service Requests forms from KDC. From 2008 to 2016. Total 76 forms
- Kaipara District Council Proposed Cycleway. MWH 2016
- LiDAR 2016. Contours lines (each 0.5m). Provided by KDC
- LINZ GIS data. Provided by KDC 2017
- MWH Site visit information recompilation. MWH 07 February 2017.

A number of limitations and assumptions have been made as part of the issues mapping which include:

- There is no existing comprehensive stormwater modelling for the area, therefore issues are mapped using a range of available information (as above) and are qualitative at this stage rather than quantitative
- The Rapid Flood Hazard Mapping does not include the reticulated network. It considered an extreme scenario and is an input into the strategy, rather than an output from it
- The level of detail has been set in line with the project objectives
- The validity of existing asset data has not been verified for this strategy. It is assumed that this data is fit for purpose.

The identification of the stormwater management issues have been separated in two main categories; Township wide (or common issues) and site specific issues.



## 6 Stormwater Management Options

This section identifies the implementation options, actions and mitigation measures necessary to achieve the Mangawhai Stormwater Infrastructure Strategy objectives.

It identifies the potential options to address the catchments issues discussed previously and it sets out the recommendations for the long-term stormwater management for each of the issues

### 6.1 Stormwater Management Options

Possible stormwater management options are presented in Table 1 and include stormwater management options presented on a township wide or common implementation level and a site specific implementation level.

The township wide stormwater management options include:

- Develop a township wide Stormwater Infrastructure Strategy which includes a clear definition of the expected or desired stormwater outcome. (This document)
- Set Council policy on what will be accepted in terms of stormwater management devices and in what circumstances. Such as what minimum catchment area will wetlands be accepted for
- Develop and provide guidance on the stormwater outcomes within the KDC Engineering Standards including
  - Testing, design and implementation for soakage systems
  - Standard soakage system details enabling monitoring of private stormwater management system (such as soakage systems) performance and maintainability
  - Standard low impact design details, such as for swales, rain gardens or wetlands
  - Requirements with respect to the identification and protection of overland flowpaths
  - Operation, Maintenance and monitoring strategies for the stormwater management systems.
- Gather ,verify and update in KDC GIS:
  - Accurate topographic information
  - Accurate existing asset infrastructure data including condition of pipes, location, size, length, invert levels and connections
  - Other Council owned underground services information
  - Accurate existing open drain information including: cross-sections, invert levels, lengths, connecting pipes, crossing drains and driveway crossings
  - Soakage capacity information: such as groundwater levels and soil type.
- Once data acquisition is complete, carry out more detailed modelling of the system to confirm and quantify the existing and future problem areas and enable better scoping of the solutions
- Develop a Stormwater Bylaw that allows for the intervention in areas where legacy issues require resolution
- Include stormwater infrastructure provisions and constraints within the development of the urban design standards referred to in item 5 of the Mangawhai Town Plan Guiding Principles.

Site specific stormwater management options are included within the issues and options table (Table 1 below) and are presented on the Stormwater Management Proposals Plans presented in Appendix E.

## 6.2 Stormwater Management Recommendations

Based on the community expectations, Regional Council expectations, engineering requirements and the desired outcome of the Stormwater Strategy, a series of stormwater management recommendations have been made and are recorded in Table 1 below.

The following sections provide a summary of the recommendations grouped under the respective stormwater quantity, quality and asset management disciplines.

### 6.2.1 Stormwater Quantity and Quality

Recommendations to manage stormwater quantity and/or quality related issues include:

- Develop and provide guidance on additional requirements in the KDC Engineering Standards including
  - Testing, design, construction, monitoring and maintenance of soakage systems
  - Standard details enabling monitoring of soakage systems performance and maintainability
  - Requirements with respect to location and protection of overland flowpaths
  - Operation, Maintenance and monitoring strategies for the stormwater management systems.
- Develop a Stormwater Bylaw that allows for the intervention in areas where legacy issues require resolution
- Include stormwater infrastructure provisions and constraints within the development of the urban design standards referred to in the Mangawhai Town Plan Guiding Principles.

### 6.2.2 Asset management

Recommendations to manage stormwater asset management related issues include:

- Gather ,verify and update in to the KDC GIS:
  - Accurate topographic information i.e. contours / LiDAR data
  - Accurate asset infrastructure data including condition of pipes, location, size, length, invert levels and connections
  - Other Council owned underground services information
  - Accurate existing open drain information including: cross-sections, invert levels, lengths, connecting pipes, crossing drains and driveway crossings
  - Soakage capacity information such as groundwater levels and soil type.
- Once data acquisition is complete, carry out more detailed modelling of the system to confirm and quantify the existing and future problem areas and enable better scoping of the solutions.
- Infrastructure upgrade works:
  - Formalise and protect existing overland flow paths within the roads
  - Formalise and protect overland flowpaths on private property with easements where possible or direct overland flow to public lands or roads where possible
  - Identify, record and protect overland flowpaths as part of future developments
  - Incorporate the overland flow function into the road corridor as part of future road upgrading works
  - Upgrade existing stormwater pipes where identified through modelling
  - Implement additional stormwater pipes where identified through modelling

**Table 1. Mangawhai Village and Mangawhai Heads Stormwater management issues, potential options and recommendations**

	Issue	Site Location	Management Options	Stormwater Management Recommendation	Rough Order of Cost Stormwater Management Proposal
Township wide					
	Lack of codified guidance for KDC acceptable soakage design and treatment			Develop and provide guidance for testing and design for soakage systems and incorporate these into the KDC Engineering Standards	\$10k
	Lack of codified guidance for soakage maintainability and maintenance plans			Develop and provide guidance including standard details enabling monitoring of soakage system performance and maintainability within the KDC Engineering Standards	\$10k
	Lack of defined and protected overland flowpaths (OLFP)			Identify and protect existing overland flowpaths  Develop and provide guidance on requirements with respect to location and protection of overland flowpaths within KDC Engineering Standards	\$5k
	Limited and incomplete information on existing underground assets			Gather, verify and update underground services and topographic information in the KDC GIS	Included below in Village and Heads areas
	Limited Information on existing reticulation, performance for both piped and open drains		1. Improve Modelling to better define risk areas 2. Accept lack of information and limitations on decision making	Once data acquisition is complete, carry out more detailed modelling of the system to confirm existing and future problem areas	\$50k
	Legacy issues with historical inadequate attention to stormwater management and soakage		1. Accept legacy issues and timeframe to resolve through site redevelopments. 2. Develop a Stormwater Bylaw that allows for the intervention in areas where legacy issues require resolution	Develop a Stormwater Bylaw that allows for the intervention in areas where legacy issues are creating issues	\$15k
	No Urban Design Standards particularly in those areas where intensification is proposed. These need to be developed to include allowance for on-site disposal			Include stormwater infrastructure provisions and constraints within the development of the urban design standards referred to in the Mangawhai Town Plan Guiding Principles	\$20k
	No clear definition of outcomes to be achieved with stormwater management in Mangawhai provided in Council documents			Include outcomes within Stormwater Strategy	Included

	Issue	Site Location	Management Options	Stormwater Management Recommendation	Rough Order of Cost Stormwater Management Proposal
Specific Sites					
Mangawhai Village					
1	Performance of the existing public stormwater network is not well understood. This includes primary (piped and open channel) as well as the secondary overland flow or ponding systems	Kainui Street, Pearson Street, Drain between Dune View Drive and Moir Street, Drain between Dune View Drive and Pearson Street,	<ol style="list-style-type: none"> <li>1. Done nothing, accept lack of information and limitations on confidence in long-term decision making.</li> <li>2. Gather more accurate information on the existing asset, update GIS and use in calculating system performance</li> </ol>	Gather more accurate information on the existing asset, update GIS and use in calculating system performance	Included above
2	Lack of design of Roads to act as OLFP	OLFP at Dune View Road, Moir Street,	<ol style="list-style-type: none"> <li>1. Do nothing, accept inadequate overland flowpaths and consequences in high rainfall events</li> <li>2. Formalize and protect existing OLFP within the roads</li> <li>3. Incorporate the overland flow function into the road as part of future road upgrading</li> </ol>	Formalise and protect existing OLFP within the road and incorporate the overland flow function into the road as part of future road upgrading. Scoping of proposed works to include in LTP process.	\$20k
3	Existing OLFPs on private property or parks not understood or protected	Back of 52-56 Kedge Drive, Back of 70,68,66 Kedge Drive, Side of Mangawhai Domain, 48,50,52 Moir Street, 6,8B,8C and 10 Halyard Way, 68 Moir Street (KSR Pond Development), 63-65 Kedge Drive	<ol style="list-style-type: none"> <li>1. Do nothing, accept lack of understanding and deal with problems as they arise.</li> <li>2. Gather more accurate information of the existing and designed overland flowpath</li> <li>3. Formalise and protect OLFP with easements where possible or direct to public lands or roads where possible</li> <li>4. Map and allow for overland flowpaths as part of future developments</li> </ol>	<p>Gather more accurate information of the existing and designed overland flowpath</p> <p>Formalise and protect OLFP with easements where possible or direct to public lands or roads where possible</p> <p>Map and allow for overland flowpaths as part of future developments</p>	\$100k
4	Existing low land, hollow or depression within areas of proposed commercial rezoning. Commercial redevelopment will likely fill or drain the low lying areas generating more and faster runoff affecting downstream properties and networks	5, 45 – 53, 56, 58, 60, 6269, 71 Moir Street, 7 Molesworth Drive, Area between Dune View Drive and Pearson Street, 36A,36B Kedge Drive, 7A,7B, 9 and 12 Hayard Way and 1 Ruby Lane, 11,13,16, 18 Leslie Street	<ol style="list-style-type: none"> <li>1. Do nothing, accept effect and rely on developers to provide solutions at the time of development.</li> <li>2. Gather information on the existing assets and model the effects on the downstream systems to provide: guidance to developers on the required assets, inputs into Council's development contributions on upgrades required to the downstream systems as a consequence of development.</li> <li>3. Formalise and protect OLFPs within public roads as far as possible</li> <li>4. Provide guidance to developers with respect to on-site management techniques to mitigate their effects off-site, including: operation, maintenance and monitoring strategies</li> <li>5. Include requirements for mitigation within the plan change documentation.</li> </ol>	<p>Gather information on the existing assets and model the effects on the downstream systems to provide: guidance to developers on the required assets, inputs into Council's development contributions on upgrades required to the downstream systems as a consequence of development.</p> <p>Formalise and protect OLFPs within public roads as far as possible</p> <p>Provide guidance to developers with respect to on-site management techniques to mitigate their effects off-site, including: operation, maintenance and monitoring strategies</p>	<p>Mostly included above.</p> <p>Allow a further \$20k for downstream assessments</p>

	Issue	Site Location	Management Options	Stormwater Management Recommendation	Rough Order of Cost Stormwater Proposal
				Include requirements for mitigation within the plan change documentation	
5	Existing stormwater pipes or channels located on site but not registered in KDC GIS and therefore benefit unable to be quantified within the understanding of the performance of the stormwater system.	1 Moir Street, 45 Pearson Street and possibly at other locations	1. Do nothing, accept inaccuracy in GIS data. 2. Gather and update As-Built data in the GIS	Gather and update As-Built data in the GIS.	\$50k
6	Likely degradation in water quality and estuarine effects from greater impervious areas and commercial development. Possible breach of proposed consent conditions and loss of amenity in estuary		1 .Do nothing and accept degradation of the estuary and likely consent breaches. 2. Require treatment to be included with development, through the Plan Change. 3. Require volume reduction to also be included within developments to minimise increases in erosion at stormwater outfalls.	Require treatment to be included with development, through the Plan Change.  Require volume reduction to also be included within developments to minimise increases in erosion at stormwater outfalls.  Implement through the KDC Engineering Standards	Included above
Mangawhai Heads					
1	Lack of design of Roads to act as OLFP	North Avenue, Holiday Crescent to North Avenue, Robert street	1. Do nothing, accept inadequate overland flowpaths and consequences in high rainfall events 2. Formalize and protect existing OLFP within the roads 3. Incorporate the overland flow function into the road as part of future road upgrading	Formalise and protect existing OLFP within the road and incorporate the overland flow function into the road as part of future road upgrading. Scoping of proposed works to include in LTP process.	\$20k
2	Existing OLFP on private property or parks not understood or protected	55-57 Eveline Street, 45-47 Eveline Street, 28,26,24,22 Robert Street, 8A,8,4 Fagan Place, 6,8,10 North Avenue,15 Margaret Street, 1/10-24/10,1/12-10/12 Fagan Place,270,272,274,276,278-288 Molesworth Drive, 17,15,13,11,9,7,5,3 Holiday Crescent, 40-42 Eveline Street	1. Do nothing, accept lack of understanding and deal with problems as they arise. 2. Gather more accurate information of the existing and designed overland flowpath 3. Formalise and protect OLFP with easements where possible or direct to public lands or roads where possible 4. Map and allow for overland flowpaths as part of future developments 5. New stormwater system or upgrade of the existing stormwater system	Gather more accurate information of the existing and designed overland flowpath  Formalise and protect OLFP with easements where possible or direct to public lands or roads where possible  Map and allow for overland flowpaths as part of future developments  In some cases, new stormwater system is recommended (45-47 Eveline Street)	\$100k          \$82k



[illegible]

	Issue	Site Location	Management Options	Stormwater Management Recommendation	Rough Order of Cost Stormwater Management Proposal
			including: operation, maintenance and monitoring strategies 4. Include requirements for mitigation within the plan change documentation. 6. New stormwater system or upgrade of the existing stormwater system	Include requirements for mitigation within the plan change documentation. New stormwater system	\$82k
7	Likely degradation in water quality and estuarine effects from greater impervious areas and commercial development. Possible breach of proposed consent conditions and loss of amenity in estuary	Back of 11 Robert Street, End of Eveline Street, Back of 44 Eveline Street, Back of 21 Heather Street	1 .Do nothing and accept degradation of the estuary and likely consent breaches. 2. Require treatment to be included with development, through the Plan Change. 3. Require volume reduction to also be included within developments to minimise increases in erosion at stormwater outfalls.	Require treatment to be included with development, through the Plan Change. Require volume reduction to also be included within developments to minimise increases in erosion at stormwater outfalls. Implement through the KDC Engineering Standards	Included above
8	Lack of stormwater network system or connectivity in the system	Intersection between Robert street and Woods Street, Margaret Street, 12,14 and 37 Eveline Street	1. Do nothing, accept inaccuracy in GIS data. 2. Gather and update As-Built data in the GIS	Gather and update As-Built data in the GIS.	Included above
9	Lack of specific design	Existing outlets to the golf course	1. Do nothing, accept effect of lack of maintenance. 4.. Include requirements for operation and maintenance within the plan change documentation	Include requirements for design, operation and maintenance within the plan change documentation and the KDC Engineering Standards	\$10k
10	Lack of control on stormwater velocities and erosion	31 Eveline Street	1. Do nothing, accept effect and rely on developers to provide solutions at the time of development. 2. Formalise and protect OLFPs within public roads as far as possible 3. Provide guidance to developers with respect to on-site management techniques to mitigate their effects off-site 4. Include requirements for mitigation within the plan change documentation. 5. New stormwater system or upgrade of the existing stormwater system	Provide guidance to developers with respect to on-site management techniques to mitigate their effects Include requirements for mitigation within the plan change documentation. Implement through the KDC Engineering Standards New stormwater system or upgrade of the existing stormwater system	\$160k

## 7 Improvement Plan

The Stormwater Infrastructure Strategy has been developed to provide a strategic direction for stormwater management activities to support the future planning and development of the Mangawhai Village and Mangawhai Heads catchments.

During the development of this Stormwater Infrastructure Strategy, it is acknowledge that further investigations and improvement activity is required to fully support the implementation of the stormwater infrastructure strategy. These further investigations and improvement activities include:

- An improved Town Centre Plan to include the findings from this Stormwater Infrastructure Strategy
- Improvement of the KDC Engineering Standards to include direction for the testing, design and implementation of soakage systems, performance monitoring and operations and maintenance requirements for soakage systems, overland flow path requirements with respect to location and protection, floor levels requirements, stormwater reticulation requirements
- Further consideration of incorporating overland flow path requirements into the roading upgrade programme
- Gather information on the existing assets, including updated LiDAR information and model the effects on the stormwater system to inform decisions on capital improvements including stormwater infrastructure to manage water quality and quantity aspects. These will be used to inform the development of a Catchment Management Plan
- Development of an Operation, Maintenance and Monitoring plan for soakage systems, overland flow paths and stormwater systems
- Development of a Catchment Management Plan (CMP) to include direction on public / private stormwater management responsibilities, capital improvements, on-going monitoring, inspection and maintenance requirements and a more detailed assessment of stormwater flood locations and flood management options. The CMP will consider in greater detail those parts of the catchments that have existing issues and existing physical constraints.

## 8 Limitations

A number of limitations and assumptions have been made in the development of the Stormwater Infrastructure Strategy. The principal ones include:

- There is no existing comprehensive stormwater modelling for the area, therefore issues are mapped using a range of available information (as above) and are qualitative at this stage rather than quantitative
- The Rapid Flood Hazard Mapping does not include the reticulated network. It considered an extreme scenario and is an input into the strategy, rather than an output from it
- The level of detail has been set in line with the project objectives
- The validity of existing asset data has not been verified for this strategy. It is assumed that this data is fit for purpose
- The model only represents open channel and overland flow at discrete sections where these have been defined with the available LiDAR data. Flood lines at interim points are indicative
- Statistically generated rainfall patterns have been used for the rapid flood hazard mapping
- The accuracy of existing aerial photographs, imperviousness data, and contour data is assumed as fit for purpose
- No information was available on habitable floors and hence these have been excluded from any analysis / assessment.

## Appendices



## **Appendix A    Mangawhai Town Plan (MTP) Guiding Principles and Assumptions**

## **Mangawhai Town Plan (MTP)**

### **Guiding Principles or Assumptions**

#### **1 Mangawhai will continue to rely upon rainwater collection and tank storage.**

While the potential for a reticulated water supply for Mangawhai is being investigated, it is likely that full reticulation will be unfeasible, although there may be scope for community-based schemes or communal water supplies for firefighting purposes.

#### **2 Medium density living will be encouraged around the key nodes of Mangawhai Village, Wood Street shopping centre and Estuary Estates.**

Council is under increasing pressure from developers to consent smaller lots for buyers who desire low maintenance holiday houses. Rather than permit such development in an ad hoc fashion, it is proposed to concentrate medium density living around activity nodes.

#### **3 Application of a town boundary.**

There is sufficient surplus undeveloped land within the existing Residential Zone defined by the Kaipara District Plan to accommodate residential growth in Mangawhai that the zone boundary only requires minor adjustments in certain areas.

#### **4 Lifestyle block development will be directed to a sub-zone of land surrounding Mangawhai.**

Lifestyle block subdivision has been the dominant trend in Mangawhai in recent years. It is proposed to introduce a rural/residential or rural/lifestyle zone for a belt of land around Mangawhai to direct and accommodate such development.

#### **5 Urban design standards will be introduced to manage medium density development.**

The best practice principles of urban design will inform the MTP and urban design standards will form part of the project to manage the effects of medium density development.

#### **6 Roads will be used to define public space.**

Roadways and the assets within them, such as footpaths and planting, inform the usability and character of public space. The project will review how existing roads define public space and how cost-effective improvements can be made.

**7 Improving walking and cycling uptake and connectivity will be a priority.**

The majority of Mangawhai residents and visitors use cars to move around the area. This is due to poor connectivity between existing footpaths and the lack of cycling facilities. The project will advocate for improving connectivity through infrastructure spending and medium density development around existing nodes.

**8 Population growth will not be matched by increase in roading capacity.**

Rather than catering for growth by expanding the roading network it is assumed that road improvements and more walking and cycling will replace local traffic movements.

**9 Environmentally sustainable design will be encouraged in Council and private developments.**

Low impact stormwater design, walking and cycling, improving biodiversity through planting and weed control and recognising and providing for walkways will be advocated for in the project.

**10 Partnerships with community groups, developers and businesses are vital to the future of Mangawhai.**

The MTP will only be successful if it recognises existing partnerships between Council and the community and other key stakeholders, involves public consultation and encourages further collaboration with volunteer groups, property developers and business owners.



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## **Appendix B     Northland District Council Draft Regional Plan (stormwater related rules)**



## Draft Regional Plan for Northland (August 2016)

### - Rules

- Existing minor structures – permitted activity (stormwater outlet pipes and road and railway culverts)
- Stormwater discharge from a public stormwater network –permitted activity

#### Stormwater discharge from a public stormwater network – permitted activity

The diversion and discharge of stormwater from a public stormwater network into water or onto or into land is a permitted activity provided:

- 1) a stormwater management plan for the network is in place and meets the requirements in H.3 'Stormwater management plans', and is provided to the council within five years of the notification date of this plan, and
- 2) the stormwater management plan is updated to include any physical or planned changes that exceed the most recent design horizon of the plan. A copy of the stormwater management plan is provided to the regional council within one month of it being amended, and
- 3) the stormwater network is operated in accordance with the stormwater management plan, and
- 4) the diversion and discharge does not cause, or increase, flooding of properties in rainfall events up to the 10% Annual Exceedance Probability (AEP) or the inundation of buildings in events up to the 1% AEP outside of the area serviced by the public stormwater network, and
- 5) the discharge does not erode the bed or banks of a lake or river, or the foreshore, and
- 6) the discharge does not cause any conspicuous change in the colour or visual clarity of the receiving water beyond a 10 m radius from a point of discharge, and
- 7) the discharge does not cause any water quality limit in H.7 'Water quality limits' to be exceeded.

#### Other stormwater discharges – permitted activity

The diversion and discharge of stormwater into water, or onto or into land from any road, track, or stormwater collection system is a permitted activity provided:

- 1) the discharge is not from:
  - a) a public stormwater network, or
  - b) a high risk industrial or trade premises, and
- 2) the discharge or diversion does not cause adverse effects on other people or property, and
- 3) where the stormwater discharge is from an industrial or trade premises that is not a high risk industrial or trade premises:
  - a) the stormwater collection system is designed to prevent any hazardous substances (including unintentional releases) entering the system, and
  - b) the stormwater collection system is designed to prevent any other contaminants from being entrained in the discharge unless the stormwater is discharged through a stormwater interceptor system, and
  - c) any trade waste is banded, or otherwise contained, within an area of sufficient capacity to provide secondary containment equivalent to 100% of the quantity of any process water or waste that has the potential to spill into a stormwater collection system, in order to prevent trade waste entering the stormwater collection system, and
- 4) stormwater and sediment control measures are installed and maintained to minimise erosion and sediment discharges to water bodies or coastal water, and
- 5) the discharge does not erode the bed or banks of a lake or river, or the foreshore, and
- 6) the discharge does not cause any conspicuous change in the colour or visual clarity of the receiving water beyond a 10m radius from a point of discharge, and
- 7) the discharge does not cause any water quality limit in H.7 'Water quality limits' to be exceeded.





- Stormwater discharge from a public stormwater network –controlled activity

#### C.4.4.3

##### Stormwater discharge from a public stormwater network – controlled activity

The diversion and discharge of stormwater from a public stormwater network into water or onto or into land that is not a permitted by rule C.4.4.1 'Stormwater discharge from a public stormwater network – permitted activity' is a controlled activity provided:

- 1) outside of the area serviced by the public stormwater network, the discharge does not cause, or increase, flooding of properties in rainfall events up to the 10% Annual Exceedance Probability (AEP) or the inundation of buildings in events up to the 1% AEP and
- 2) the discharge does not erode the bed or banks of a lake or river, or the foreshore, and
- 3) the discharge does not cause any conspicuous change in the colour or visual clarity of the receiving water beyond a 10 m radius from a point of discharge, and
- 4) the discharge does not cause any water quality limit in H.7 'Water quality limits' to be exceeded.

##### Matters of control

- 1) the maximum concentration or load of contaminants in the discharge,
- 2) the adequacy of measures to minimise erosion,
- 3) the adequacy of measures to minimise flooding in areas affected by the stormwater network, and
- 4) the design of the stormwater network and any staging of works.

##### The RMA activities this rule covers:

- restrictions relating to water (s14(2)), and
- discharge of contaminants into environment (s15(1)).

- Stormwater discharge from a public stormwater network –discretionary activity

#### C.4.4.4

##### Stormwater discharge – discretionary activity

The diversion and discharge of stormwater into water or onto or into land that is a not:

- 1) a permitted activity under C.4.4.1 'Stormwater discharge from a public stormwater network – permitted activity', or
- 2) a permitted activity under C.4.4.2 'Other stormwater discharges – permitted activity', or
- 3) a controlled activity under C.4.4.3 'Stormwater discharge from a public stormwater network – controlled activity'

is a discretionary activity.

##### The RMA activities this rule covers:

- restrictions relating to water (s14(2)), and
- discharge of contaminants into environment (s15(1)).

- H3 stormwater management plans

A stormwater management plan must be matched to the scale and complexity of the network and include the following:

- 1) plans showing the stormwater catchment area and the public stormwater network, and
- 2) the expected performance of system as a result of likely development, and
- 3) identification of existing drainage and flooding problems and potential flood hazards and other sensitive areas such as overland flow paths, and
- 4) the location of registered contaminated sites, and
- 5) the location of industrial and trade premises that undertake any of the activities listed in Table 17 'High risk industrial and trade premises,' and
- 6) methods by which the network operator will control the quality of stormwater discharged from industrial and trade premises to the public stormwater network, and
- 7) a prioritised programme for capital works, and
- 8) the operation and maintenance programme for the network.

*Table 17 High risk industrial and trade premises.*

Industrial or trade premise
Chemical manufacture, formulation or bulk storage.
Fertiliser manufacture or bulk storage.
Petroleum or petrochemical industries, including a petroleum depot, terminal, blending plant or refinery, or facilities for recovery, reprocessing or recycling petroleum-based materials, or bulk storage of petroleum or petrochemicals above or below ground.
Wood treatment or preservation including the commercial use of anti-sapstain chemicals during milling, or bulk storage or treated timber outside.
Abrasive blasting including abrasive blast cleaning (excluding cleaning carried out in fully enclosed booths) or the disposal of abrasive blasting material.
Cement or lime manufacture using a kiln including the storage of wastes from the manufacturing process.
Commercial concrete manufacture or commercial cement storage.
Coal or coke yards.
Hydrocarbon exploration or production including well sites or flare pits.
Mining industries (excluding gravel extraction) including exposure of faces or release of groundwater containing hazardous contaminants, or the storage of hazardous wastes including waste dumps or dam tailings.
Boat construction facilities.
Boat storage and maintenance facilities.
Port activities, including dry docks.
Landfill sites.

### Industrial of trade premise

Scrap yards including automotive dismantling, wrecking or scrap metal yards.

Waste recycling or waste treatment.

## H.7 Water quality limits

The water quality limits in the following tables apply to Northland's freshwater management units and coastal water quality management units (1.10 "Water quality and quantity management units map")

### Rivers

Table 22 Water quality limits for rivers

Attribute	Unit	Compliance metric	River water quality management unit		
			Lowland rivers	Hill country rivers	Outstanding rivers
Periphyton (chl-a)	mg chl-a/m <sup>2</sup>	exceeded no more than 8% of samples**	To be determined. <sup>(3)</sup>	To be determined. <sup>(4)</sup>	≤50 (applies only to rivers with hard substrates)
Nitrate (toxicity)	mg NO <sub>3</sub> -N/L	annual median	≤1.0	≤1.0	≤1.0
		annual 95 <sup>th</sup> percentile	≤1.5	≤1.5	≤1.5
Ammonia (toxicity)	mg NH <sub>3</sub> -N/L	annual median*	>0.03 and ≤0.24	>0.03 and ≤0.24	≤0.03
		annual maximum*	>0.05 and ≤0.40	≤0.05	≤0.05
Other toxicants (Table 3.4.1, ANZECC 2000)	mg/m <sup>3</sup>	maximum	95% species protection level.	99% species protection level.	99% species protection level.
Dissolved oxygen (below point source discharges)	mg/L	7-day mean minimum (1 November-30 April)	≥7.0 and <8.0	≥7.0 and <8.0	≥8.0
		1-day minimum (1	≥5.0 and <8.0	≥5.0 and <8.0	≥7.5

4. The council currently has insufficient data to set a limit for periphyton.

3. The council currently has insufficient data to set a limit for periphyton.

Attribute	Unit	Compliance metric	River water quality management unit		
			Lowland rivers	Hill country rivers	Outstanding rivers
		November-30 April)			
E.coli	E.coli /100mL	annual median	≤260	≤260	≤260

\*Based on pH 8 and temperature of 20°C. Compliance with the water quality limit should be undertaken after pH adjustment.

\*\*Based on a monthly monitoring regime. The minimum record length for grading a site based on periphyton (chl-a) is three years.

## Lakes

Table 23 Water quality limits for lakes

Attribute	Unit	Compliance metric	Lake management unit	
			Shallow lakes management unit	Deep lakes management unit
Phytoplankton (chl-a)	mg Chl-a/m <sup>3</sup>	Annual median	>5 and ≤12	>2 and ≤5
		Annual maximum	>25 and ≤60	≤10
Total nitrogen	mg/m <sup>3</sup>	Annual median	>500 and ≤800	>160 and ≤350
Total phosphorus	mg/m <sup>3</sup>	Annual median	>10 and ≤20	≤10
Ammonia (toxicity)	mg NH <sub>4</sub> -N/L	Annual median	≤0.03	≤0.03
		Annual maximum	≤0.05	≤0.05
Other toxicants (Table 3.4.1, ANZECC 2000)	mg/m <sup>3</sup>	Maximum	99% species protection level (table 3.4.1 in ANZECC 2000)	99% species protection level (table 3.4.1 in ANZECC 2000)

Attribute	Unit	Compliance metric	Lake management unit	
			Shallow lakes management unit	Deep lakes management unit
<i>E.coli</i>	<i>E.coli</i> /100 mL	Annual median	≤260	≤260
		95 <sup>th</sup> percentile	>260 and ≤540	≤260
Cyanobacteria	mm <sup>3</sup> /L OR cells/mL	80 <sup>th</sup> percentile	>0.5 and ≤1.8 mm <sup>3</sup> /L biovolume equivalent of potentially toxic cyanobacteria OR >0.5 and ≤10 mm <sup>3</sup> /L of total cyanobacteria	≤0.5 mm <sup>3</sup> /L biovolume equivalent for the combined total of all cyanobacteria OR ≤500 cells/mL of total cyanobacteria

### Coastal waters

Table 24 Water quality limits for coastal waters

Attribute	Unit	Compliance metric	Coastal water quality management unit			
			Hātea river	Tidal creeks	Estuaries	Open coast
Dissolved oxygen	% saturation	Minimum (95th percentile)	80%	80%	90%	90%
	mg/L	Minimum (95th percentile)	6.2	6.3	6.9	7.3
Temperature	°C	Maximum change	3°C	3°C	3°C	3°C
pH			7.0-8.5	7.0-8.5	7.0-8.5	8-8.4
Turbidity	NTU	Annual median	9.0	10.8	6.9	2.2
Secchi depth	m	Minimum (95th percentile)	0.8	0.7	1.00	2.90
Chlorophyll-a	mg/L	annual median	0.004	0.004	0.004	0.002
TP	mg/L	annual median	0.119	0.044	0.030	0.015
DRP	mg/L	annual median	0.092	0.021	0.017	0.008
TN	mg/L	annual median	0.300	0.290	0.190	0.120



Attribute	Unit	Compliance metric	Coastal water quality management unit			
			Hātea river	Tidal creeks	Estuaries	Open coast
NNN	mg/L	annual median	0.580	0.218	0.048	0.005
NH <sub>4</sub> -N	mg/L	annual median	0.099	0.043	0.023	0.012
Heavy metals and other toxicants (see Table 3.4.1, ANZECC 2000)	µg/L	Maximum	95% species protection			99% species protection level
Benthic sediment quality (see table 3.5.1, ANZECC)	mg/kg dry wt.	Maximum	ISQQ-Low trigger values			
Faecal coliforms	MPN	Median	Not applicable	Not applicable	14	14
		90th percentile	Not applicable	Not applicable	43	43
Enterococci	Enterococci/100 mL	95th percentile	Not applicable	200	200	40



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Mangawhai Town Plan Stormwater Infrastructure Strategy

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## **Appendix C     Draft Stormwater Discharge Consent**

Document date: xx.03.2016

**KAIPARA DISTRICT COUNCIL, PRIVATE BAG 1001, DARGAVILLE 0340**

To undertake the following activities associated with stormwater management at Mangawhai

- |                          |                                                                                           |
|--------------------------|-------------------------------------------------------------------------------------------|
| <b>AUT.002111.01.03</b>  | To divert stormwater.                                                                     |
| <b>AUT.002111.02.02</b>  | To discharge stormwater to water outside of the Coastal Marine Area of Mangawhai Harbour. |
| <b>AUT. 002111.03.02</b> | To discharge stormwater into the Coastal Marine Area of Mangawhai Harbour.                |
| <b>AUT. 002111.04.02</b> | To maintain and repair stormwater outlet structures.                                      |

*Note: All location co-ordinates in this document refer to Geodetic Datum 2000, New Zealand Transverse Mercator Projection.*

Subject to the following conditions:

**AUT.002111.01.03 to AUT.002111.03.02: Stormwater diversion and discharges**

- 1 The stormwater network system shall be in general accordance with the attached MWH Ltd drawings entitled "Mangawhai Stormwater Catchment Management Plan", Project Number 80500973, Sheet Number 1 to 31, Date 15/04/2015.
- 2 As a result of the exercise of these consents, there shall be no significant increase in the scale or extent of ponding areas as shown on the plans attached to Condition 1.  
**Advice Note:** *The ponding areas shown on these drawings have not been verified by modelling and do not take into account the effects of predicted climate change.*
- 3 The stormwater collection system for new industrial and commercial developments shall be either:
  - (a) designed to avoid any contaminants stored or used on the site from being entrained in any stormwater discharge; or
  - (b) include an appropriately designed stormwater interceptor system; and
- 4 Within 12 months of the date of commencement of this consent, any process water or waste stream on an industrial lot that has the potential to spill into a stormwater collection system shall be bunded, or otherwise contained, within an area of sufficient capacity to provide secondary containment equivalent to 100% of the quantity of process water or waste.
- 5 Within 12 months of the date of commencement of this consent, the Consent Holder shall have a register for industrial and commercial properties which includes the location of the property, the nature of the activity being undertaken on the property, and the stormwater system in place for the property.

6 The Consent Holder shall notify the Northland Regional Council's assigned monitoring officer of any amendment to the register required to be kept in accordance with Condition 5 within two weeks of the amendment occurring. A copy of this register shall be provided to the Northland Regional Council assigned monitoring officer on written request.

7 The stormwater discharge does not result in any permanent scouring or erosion of the bed of a waterbody or the coastal marine area. For compliance purposes, "permanent" is defined as scouring or erosion that will not be fully remediated by natural processes during the following 3 month period.

8 There shall be no obstructions within any watercourse or identified overland flow path, as shown on the plans attached to Condition 1, that could result in an increase:

- (a) to the frequency of flooding of a property; or
- (b) the scale or extent of the ponding areas shown on the plans attached to Condition 1.

**Advice Note:** *The maintenance of the free flow of water is a permitted activity provided all the requirements of the relevant rule in the Regional Water and Soil Plan for Northland are met. Any other works within the bed of a watercourse are likely to require separate resource consent.*

9 The assets within the stormwater network system that are owned by the Consent Holder, including stormwater ponds, outlet structures, cesspits, energy dissipation devices, and overland flow paths, shall be adequately maintained to ensure that they operate efficiently and effectively at all times.

10 All sediment removed from the stormwater network system shall be disposed of at a site that is authorised to accept such waste material.

11 Within 12 months of the date of commencement of these consents, the Consent Holder shall forward to the Northland Regional Council's assigned monitoring officer an Operation and Maintenance Plan that details how Conditions 9 and 10 will be complied with. This Plan shall include, as a minimum:

- (a) a schedule of inspection frequencies for all sediment traps and stormwater treatment devices;
- (b) the maintenance requirements for sediment traps and treatment devices;
- (c) a schedule of inspection frequencies for obstructions within open watercourses, drains and overland flow paths.

12 The Operation and Maintenance Plan may be amended at any time by the Consent Holder and shall be updated to include any new connections to the network that have stormwater collection and treatment systems that are owned by the Consent Holder. A copy of the amended Operation and Maintenance Plan shall be forwarded to the Northland Regional Council's assigned monitoring officer within two weeks of it becoming operational, and shall be deemed to be the latest version for compliance purposes.

13 The stormwater network system shall be operated and maintained in accordance with the most recent version of the Operation and Maintenance Plan that the Northland Regional Council has received.

- 14 An assessment of compliance with the maintenance requirements of the Operation and Maintenance Plan and any programmed works for the year, being 1 July to 30 June, shall be provided to the Northland Regional Council's assigned monitoring officer by 31 July each year. A schedule of any programmed works for the following year shall also be provided at the same time.

**Advice Note:** *These requirements should occur as part of Local Government Annual Plan process.*

- 15 The exercise of these consents shall not result in the concentration of metals in sediment, as measured at or beyond a 30 metre radius from any final outlet from the network system into water, to exceed the following:

Ecosystem type	milligrams per kilogram dry weight
Copper	65
Lead	50
Zinc	200
Chromium	80
Nickel	21
Cadmium	1.5

#### **AUT.002111.04.02 Maintain and repair stormwater outlet structures**

- 16 The Consent Holder shall notify the Northland Regional Council's assigned monitoring officer in writing of any works to be undertaken adjacent to or within the coastal marine area at least one month prior to those works commencing. This written notification shall include the location, details and duration of the works.
- 17 Slash, soil and debris associated with the exercise of this consent shall not be placed in a position where it may be washed into a water body.
- 18 All unwanted materials and debris shall be removed from area of work upon the completion of the works authorised by this consent.
- 19 No heavy machinery shall be allowed to enter the foreshore as part of the exercise of this consent.

#### **General Conditions**

- 20 The exercise of these consents shall not result in any of the following effects on water quality, as measured at or beyond a 30 metre radius down current from any discharge final outlet from the network system:
- (a) The production of any conspicuous oil or grease film, scums or foams, or floatable or suspended materials, or emissions of objectionable odour;
  - (b) The destruction of natural aquatic life by reason of a concentration of toxic substances;
  - (c) Shellfish to become tainted so as to make them unpalatable or contain toxic substances to the extent that they are unsafe for human consumption.



- 21 The Consent Holder shall, for the purposes of adequately monitoring these consents as required under Section 35 of the Act, on becoming aware of any contaminant associated with the Consent Holder's operations escaping otherwise than in conformity with this consent:
- (a) Immediately take such action, or execute such work as may be necessary, to stop and/or contain such escape; and
  - (b) Immediately notify the Northland Regional Council by telephone of an escape of contaminant; and
  - (c) Take all reasonable steps to remedy or mitigate any adverse effects on the environment resulting from the escape; and
  - (d) Report to the Northland Regional Council in writing within 1 week on the cause of the escape of the contaminant and the steps taken or being taken to effectively control or prevent such escape.

With regard to telephone notification, during Regional Council opening hours the Council's assigned monitoring officer for these consents shall be contacted. If that person cannot be spoken to directly, or it is outside of Regional Council's opening hours, then the Pollution Hotline shall be contacted.

- 22 The Council may, in accordance with Section 128 of the Resource Management Act 1991, serve notice on the Consent Holder of its intention to review the conditions annually during the month of May for any one or more of the following purposes:
- (a) To deal with any adverse effects on the environment that may arise from the exercise of the consent and which it is appropriate to deal with at a later stage; or
  - (b) To require the adoption of the best practicable option to remove or reduce any adverse effect on the environment; or

The Consent Holder shall meet all reasonable costs of any such review.

**EXPIRY DATE: 30 FEBRUARY 2051**



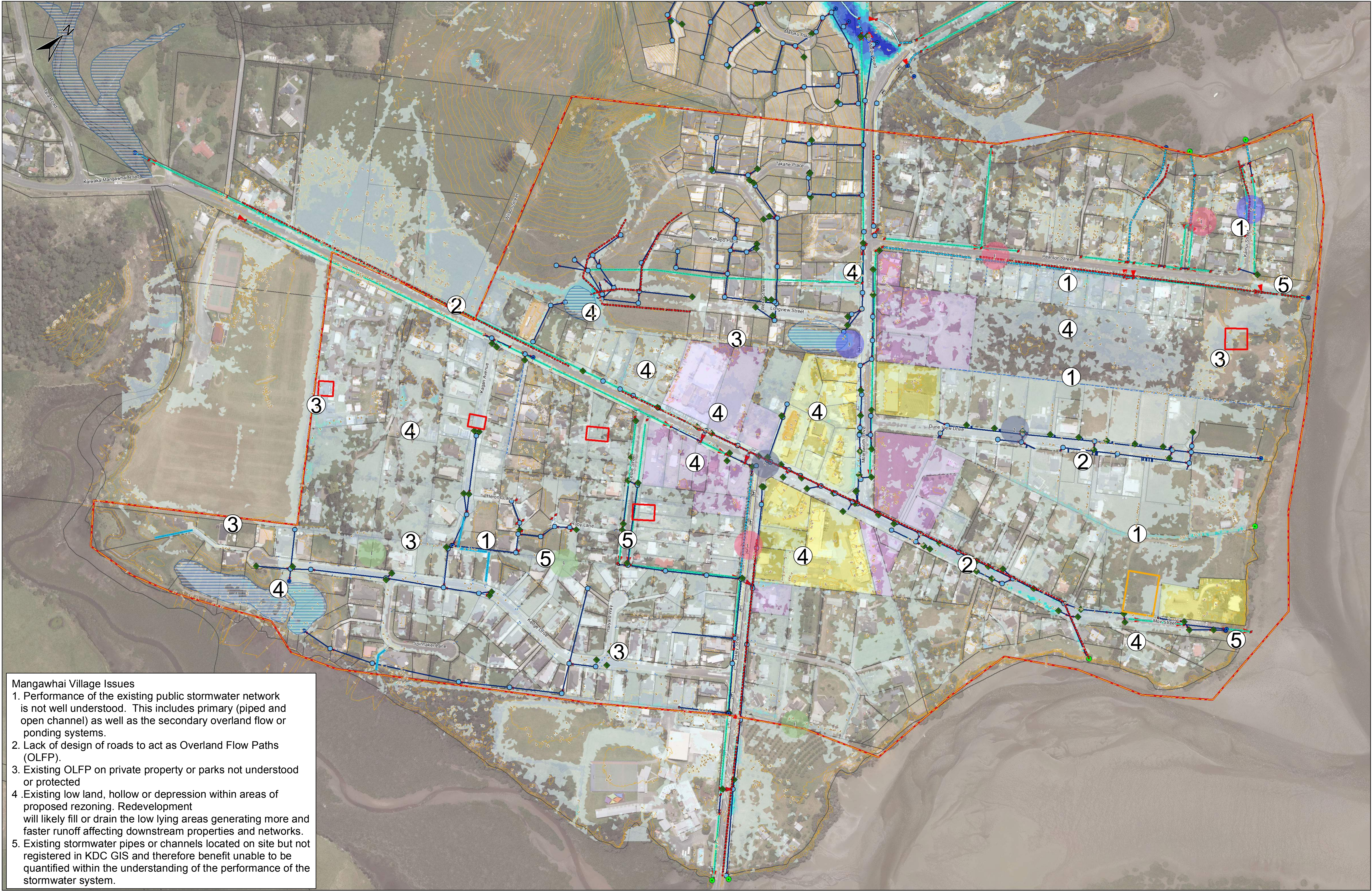
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## **Appendix D      Possible Stormwater Issues Plans**





- Mangawhai Village Issues**
1. Performance of the existing public stormwater network is not well understood. This includes primary (piped and open channel) as well as the secondary overland flow or ponding systems.
  2. Lack of design of roads to act as Overland Flow Paths (OLFP).
  3. Existing OLFP on private property or parks not understood or protected
  4. Existing low land, hollow or depression within areas of proposed rezoning. Redevelopment will likely fill or drain the low lying areas generating more and faster runoff affecting downstream properties and networks.
  5. Existing stormwater pipes or channels located on site but not registered in KDC GIS and therefore benefit unable to be quantified within the understanding of the performance of the stormwater system.

**Cause / Effect (Reports Count)**

- Block, Open/Building FI
- Block, Open/Land FI
- Block, Pipe/Building FI
- Block, Pipe/Land FI
- Soakage/Building FI
- Soakage/Land FI

**Asset Result**

- Flooding Risk - Likely (MWH 2015)
- Flooding Risk - Possibly (MWH 2015)
- Ponding Areas (MWH 2015)
- Identified Ponding (GHD 2016)
- Proposed Pipes (CMP 2006)
- Potential Ponding (GHD 2016)

**Asset Type**

- Observed Outlets (MWH 2017)
- Soakpit
- Sump
- Catchpit Lead
- Creek
- Inlet
- Manhole
- Outlet

**Zone Use (TCP 2016)**

- Commercial Zone
- Proposed New Commercial Zone
- Uniformed Road

**Issues Plan**

- Issue Number

**Possible Ponding/Overland Flow**

Min  
Max

**Legend**

- Overland flowpath
- Service
- Swale Drain
- Unknown
- Proposed Cypoth
- Contours LIDAR 2016
- Contours every 1 meters

**Disclaimer:**

The information presented on this plan is for high level analysis of stormwater issues within the town plan areas of Mangawhai and is for internal use by Kaipara District Council officers only. The information was obtained from many sources and is not a complete nor accurate representation of flooding hazards.

The plans DO NOT accurately depict flood extents, depths or quantitative risk and therefore should only be treated as indicative and are for risk assessment purposes only.

MWH have prepared this indicative information solely for the use of Kaipara District Council. MWH does not accept liability for the use of this information by third parties or for the use of this information beyond its intended purpose.

**Scale:** 0 12.5 25 50 75 100 Meters

**Map Title:** STORMWATER ISSUES PLAN

**Project:** Mangawhai Stormwater Catchment Management Plan 2016/2017

File:	1:2,000	Designed:	MH	Drawing Number:	
Scale:	A1	Drawn:	MH	Status:	Mangawhai Village
Date:	28/04/2017	Checked:	GL	Rev:	
Approved:	AL	DRAFT	A		





- Mangawai Heads Issues**
1. Lack of design of roads to act as Overland Flow Paths (OLFP).
  2. Existing OLFP on private property or parks not understood or protected.
  3. Existing low land, hollow or depression within areas of proposed commercial or residential rezoning.  
Redevelopment will likely fill or drain the low lying areas generating more and faster runoff affecting downstream properties and networks.
  4. Existing stormwater pipes or channels located of site but not registered in KDC GIS and therefore benefit unable to be quantified within the understanding of the performance of the stormwater system.
  5. Likely degradation in water quality and increase on peak flow and volume from greater impervious areas, commercial development and filling low lying areas during development.
  6. Land instability possible related to stormwater infrastructure.
  7. Likely degradation in water quality and estuarine effects from greater impervious areas and commercial development. Possible breach of proposed consent conditions and loss of amenity in estuary.
  8. Lack of SW Network or connectivity in the system.
  9. Lack of maintenance.
  10. Lack of control of storm water velocity.

**Cause / Effect (Reports Count)**

- Block, Open/Bldg FI
- Block, Open/Land FI
- Block, Pipe/Bldg FI
- Block, Pipe/Land FI
- Soakage/Bldg FI
- Soakage/Land FI

**Assesst Result**

- Flooding Risk - Likely (MWH 2015)
- Flooding Risk - Possibly (MWH 2015)
- Ponding Areas (MWH 2015)
- Study Boundary
- Identified Ponding (GHD 2016)
- Proposed Pipes (CMP 2006)
- Potential Ponding (GHD, 2016)

**Assesst Type**

- Observed Outlets (MWH 2017)
- Catch Pit
- Dummy Node
- Inlet
- Manhole
- Outlet

**Soakpit**

- Sump
- Catchpit Lead
- Creek
- Culvert
- Drain
- Gravity Main
- Open Drain

**Zone Use (TCP 2016)**

- Commercial Zone
- Proposed New Commercial Zone
- Unformed Road

**Issues Plan**

- Issue Number

**Possible Ponding/Overland Flow**

Min  
Max

**Disclaimer:**

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**Map Title:** STORMWATER ISSUES PLAN

**Project:** Mangawai Stormwater Catchment Management Plan 2016/2017

File:	1:1,500	Designed:	MH	Drawing Number:	Mangawai Village
Scale:	A1	Drawn:	MH	Status:	DRAFT
Date:	28/04/2017	Checked:	AL	Rev:	A
Approved:					





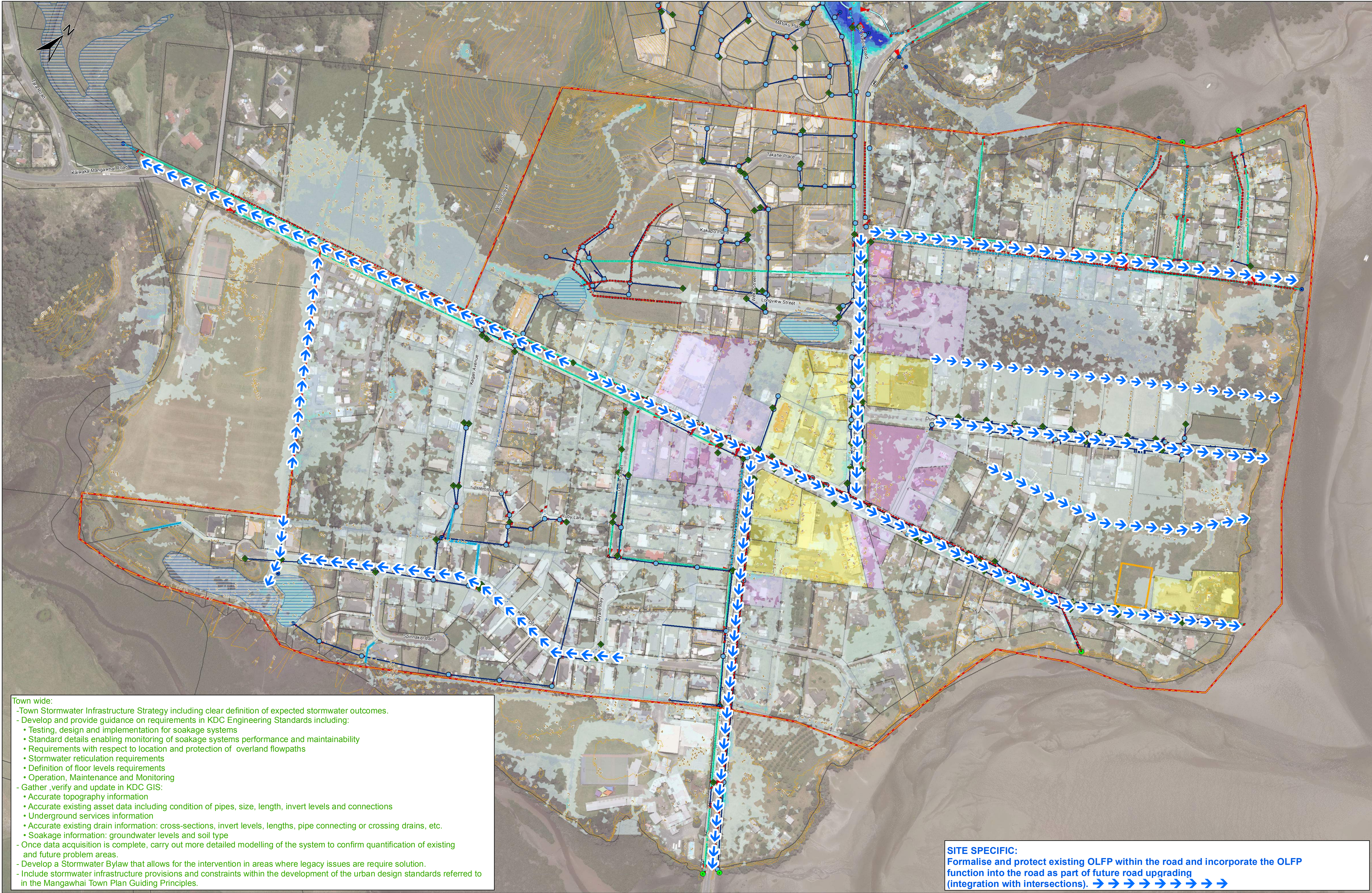
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## **Appendix E      Stormwater Management Proposals Plans**





**Town wide:**

- Town Stormwater Infrastructure Strategy including clear definition of expected stormwater outcomes.
- Develop and provide guidance on requirements in KDC Engineering Standards including:
  - Testing, design and implementation for soakage systems
  - Standard details enabling monitoring of soakage systems performance and maintainability
  - Requirements with respect to location and protection of overland flowpaths
  - Stormwater reticulation requirements
  - Definition of floor levels requirements
  - Operation, Maintenance and Monitoring
- Gather, verify and update in KDC GIS:
  - Accurate topography information
  - Accurate existing asset data including condition of pipes, size, length, invert levels and connections
  - Underground services information
  - Accurate existing drain information: cross-sections, invert levels, lengths, pipe connecting or crossing drains, etc.
  - Soakage information: groundwater levels and soil type
- Once data acquisition is complete, carry out more detailed modelling of the system to confirm quantification of existing and future problem areas.
- Develop a Stormwater Bylaw that allows for the intervention in areas where legacy issues are require solution.
- Include stormwater infrastructure provisions and constraints within the development of the urban design standards referred to in the Mangawhai Town Plan Guiding Principles.

**SITE SPECIFIC:**  
Formalise and protect existing OLFP within the road and incorporate the OLFP function into the road as part of future road upgrading (integration with intersections). → → → → → → → →

**Asset Result**

- Flooding Risk - Likely (MWH 2015)
- Flooding Risk - Possibly (MWH 2015)
- Study boundary
- Proposed Pipes (CMP 2006)
- Observed Outlets (MWH 2017)

**Asset Type**

- Catchpit
- Dummy Node
- Inlet
- Manhole
- Outlet
- Soakpit
- Sump

**Proposed New Commercial Zone**

- Unformed Road

**Possible Ponding/Overland Flow**

Min  
Max

**Legend**

- Catchpit Lead
- Creek
- Unknown
- Proposed Cyclopath
- Contours LIDAR 2016
- Contours every 1 meters
- Zone Use (TCP 2016)
- Commercial Zone

**Disclaimer:**

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The plans DO NOT accurately depict flood extents, depths or quantitative risk and therefore should only be treated as indicative and are for risk assessment purposes only.

MWH have prepared this indicative information solely for the use of Kaipara District Council. MWH does not accept liability for the use of this information by third parties or for the use of this information beyond its intended purpose.

0 12.5 25 50 75 100 Meters

This mapplan is illustrative only and all information should be independently verified on site before taking any action.

Boundary information from LINZ (Crown Copyright Reserved).

Projection: NTM 2000

Height datum: Auckland 1946

MapTitle: STORMWATER MANAGEMENT PROPOSAL - MANGAWHAI

Project: Mangawhai Stormwater Catchment Management Plan 2016/2017

File:	12.000	Designed:	MH	Drawing Number:	
Scale:	A1	Drawn:	MH	Status:	Mangawhai Village
Size:	28/04/2017	Checked:	GL	Rev:	
Date:	28/04/2017	Approved:	AL	DRAFT	A









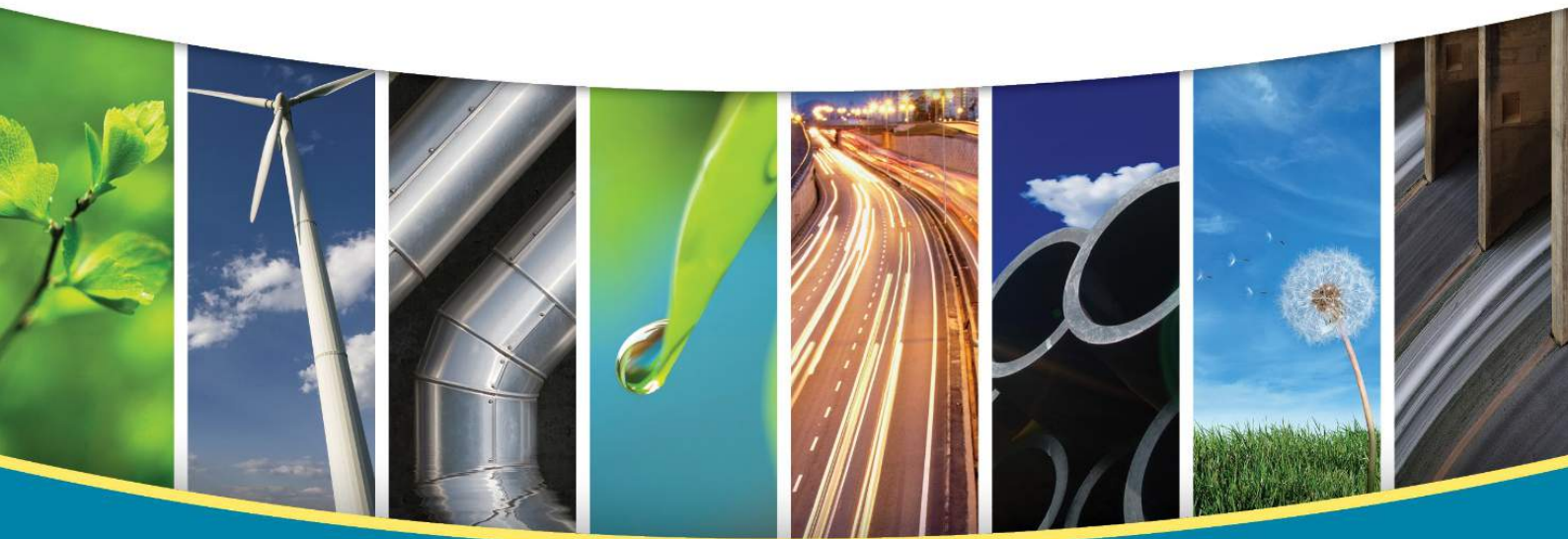
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## Appendix C Northland Regional Council proposed Regional Plan, November 2017

Proposed Regional Plan for Northland (November, 2017)

- Rules
  - Existing minor structures – permitted activity (stormwater outlet pipes and road and railway culverts)
  - Stormwater discharge from a public stormwater network –permitted activity
  - Other stormwater discharge – permitted activity

## C.6.4 Stormwater discharges

### C.6.4.1

#### Stormwater discharges from a public stormwater network – permitted activity

The diversion and discharge of stormwater from a [public stormwater network](#) into water or onto or into land where it may enter water is a permitted activity, provided:

- 1) the diversion and discharge does not cause erosion at the point of discharge or downstream, and
- 2) the diversion and discharge does not cause or increase flooding of land outside the area serviced by the stormwater network up to the 10 percent annual exceedance probability or flooding of buildings outside the area serviced by the network up to the one percent annual exceedance probability, and
- 3) the discharge does not contain any wastes or cooling water from a trade or industrial premise, and
- 4) the discharge does not contain more than:
  - a) 15 milligrams per litre of total petroleum hydrocarbons, or
  - b) 100 milligrams per litre of suspended solids, and
- 5) the discharge does not cause any of the following effects in the receiving waters beyond a 20-metre radius from the point of discharge:
  - a) an exceedance of a [water quality standard](#) or a [sediment quality standard](#), or
  - b) the production of conspicuous oil or grease films, scums or foams, of floatable or suspended materials, or
  - c) a conspicuous change in the colour or visual clarity, or
  - d) an emission of objectionable odour, or
  - e) the rendering of fresh water unsuitable for consumption by farm animals, or
  - f) a significant adverse effect on aquatic life, and
- 6) within two years of the operative date of this rule, a stormwater management plan for the networks listed in Table 5 'Priority public stormwater networks' is provided to the council, and
- 7) the stormwater management plan is consistent with the requirements in H.2 'Stormwater management plans' and is regularly updated to reflect any physical or planned changes that exceed the most recent design horizon of the plan and is provided to the council, and
- 8) the stormwater network is operated in accordance with the stormwater management plan.



#### C.6.4.2

##### Other stormwater discharge – permitted activity

The diversion and discharge of stormwater into water, or onto or into land where it may enter water from an [impervious area](#), recontoured land, or by way of a [stormwater collection system](#) is a permitted activity, provided:

- 1) the discharge is not from:
  - a) a [public stormwater network](#), or
  - b) a [high risk industrial or trade premise](#), and
- 2) the discharge or diversion does not cause or increase nuisance or damage to other property, and
- 3) where the stormwater diversion or discharge is from a hazardous substance storage area:
  - a) the [stormwater collection system](#) is designed and operated to prevent hazardous substances stored or used on the site from entering the system, or
  - b) there is an [stormwater interceptor](#) in place to collect stormwater that may contain hazardous substances and discharge or divert it to a trade waste system or store it for removal and treatment, unless the stormwater contains no hazardous substances except oil or grease and the stormwater is passed through an oil interceptor system prior to discharge, and
- 4) where the stormwater diversion or discharge is from an industrial or trade premises that is not a [high risk industrial or trade premises](#):
  - a) the [stormwater collection system](#) is designed and operated to prevent any other contaminants stored or used on the site from entering stormwater unless the stormwater is discharged through a stormwater interceptor, and
  - b) any process water or waste stream on the site is bunded, or otherwise contained, within an area of sufficient capacity to provide secondary containment equivalent to 100 percent of the quantity of any process water or waste that has the potential to spill into a [stormwater collection system](#), in order to prevent trade waste entering the [stormwater collection system](#), and
- 5) where the stormwater diversion or discharge is from [contaminated land](#):
  - a) a site investigation report prepared by a suitably qualified and experienced practitioner demonstrates that the stormwater discharge does not contain more than;
    - i) 15 milligrams per litre of total petroleum hydrocarbons, and
    - ii) 0.13 micrograms per litre of perfluorooctane sulfonate acid and perfluorohexane sulfonate, and
    - iii) 632 micrograms per litre of perfluorooctanoic acid, and
    - iv) the concentrations listed in Table 3.4.1 in the Australian and New Zealand Guidelines for Fresh and Marine Waters (ANZECC 2000), at the 95% species protection level, and
  - b) the discharge is not via deep soakage or rapid infiltration systems, and
- 6) the discharge does not erode the bed or banks of a lake or river, or the foreshore, and
- 7) the discharge does not contain more than:
  - a) 15 milligrams per litre of total petroleum hydrocarbons
  - b) 100 milligrams per litre of suspended solids
- 8) the discharge does not cause any of the following effects in the receiving waters beyond a 20-metre radius from the point of discharge:
  - a) an exceedance of a [water quality standard](#) or a [sediment quality standard](#), or
  - b) the production of conspicuous oil or grease films, scums or foams, of floatable or suspended materials, or
  - c) a conspicuous change in the colour or visual clarity, or
  - d) an emission of objectionable odour, or
  - e) the rendering of fresh water unsuitable for consumption by farm animals, or
  - f) a significant adverse effect on aquatic life.

- Stormwater discharge – controlled activity

### C.6.4.3

#### Stormwater discharges – controlled activity

The diversion and discharge of stormwater into water or onto or into land that is not:

- 1) a permitted activity under C.6.4.1 'Stormwater discharges from a public stormwater network – permitted activity', or
- 2) a permitted activity under C.6.4.2 'Other stormwater discharge – permitted activity',

is a controlled activity, provided the discharge is not from a [high risk industrial or trade premise](#) or contaminated land.

#### Matters of control

- 1) The maximum concentration or load of contaminants in the discharge.
- 2) The size of the zone of reasonable mixing.
- 3) The adequacy of measures to minimise erosion.
- 4) The adequacy of measures to minimise flooding in areas affected by the stormwater network.
- 5) The design and operation of the stormwater system and any staging of works.

- Stormwater discharge from contaminated land and high risk industrial or trade premises – discretionary activity

### C.6.4.4

#### Stormwater discharge from contaminated land and high risk industrial or trade premises - discretionary activity

The diversion and discharge of stormwater into water or onto land where it may enter water from a [high risk industrial or trade premise](#) or [contaminated land](#) is a discretionary activity.

- H2 stormwater management plans

## H.2 Stormwater management plans

A stormwater management plan must be matched to the scale and complexity of the network and include the following:

- 1) Plans showing the stormwater catchment area and the [public stormwater network](#), and
- 2) The expected performance of system as a result of likely development, and
- 3) Identification of existing drainage and flooding problems and potential flood hazards and other sensitive areas such as [overland flow paths](#), and
- 4) The location of registered contaminated sites, and
- 5) The location of [high risk industrial and trade premises](#), and
- 6) Methods by which the network operator will control the quality of stormwater discharged from industrial and trade premises to the [public stormwater network](#), and
- 7) Any prioritised programme for capital works, and
- 8) The operation and maintenance programme for the network.

## **Appendix D   Mangawhai Stormwater discharge Resource Consent, July 2017**



FILE: 2111  
(01 to 03)  
Replacement

Document Date: 26.07.2017

# *Resource Consent*

*Pursuant to the Resource Management Act 1991, the Northland Regional Council (hereinafter called "the Council") does hereby grant a Resource Consent to:*

**KAIPARA DISTRICT COUNCIL, PRIVATE BAG 1001, DARGAVILLE 0340**

To undertake the following activities associated with stormwater management at Mangawhai:

**AUT.002111.01.03** To divert stormwater.

**AUT.002111.02.02** To discharge stormwater to water outside of the Coastal Marine Area of Mangawhai Harbour.

**AUT.002111.03.02** To discharge stormwater into the Coastal Marine Area of Mangawhai Harbour.

*Note: All location co-ordinates in this document refer to Geodetic Datum 2000, New Zealand Transverse Mercator Projection.*

Subject to the following conditions:

1 The stormwater network system shall be in general accordance with the **attached** MWH Ltd drawings entitled "Mangawhai Stormwater Catchment Management Plan", Project Number 80500973, Sheet Number 1 to 31, Date 15/04/2015.

2 The exercise of these consents shall not result in any significant increase in the scale or extent of the ponding areas as shown on the plans attached to Condition 1.

**Advice Note:** *The ponding areas shown on these drawings have not been verified by modelling and do not take into account the effects of predicted climate change.*

3 The stormwater collection system for new industrial and commercial developments shall be either:

- (a) Designed to avoid any contaminants stored or used on the site from being entrained in any stormwater discharge; or
- (b) Include an appropriately designed stormwater interceptor system.



- 4 Within 12 months of the date of commencement of these consents, any process water or waste stream on an industrial lot that has the potential to spill into a stormwater collection system shall be bunded, or otherwise contained, within an area of sufficient capacity to provide secondary containment equivalent to 100% of the quantity of process water or waste.
- 5 Within 12 months of the date of commencement of these consents, the Consent Holder shall have a register for industrial and commercial properties which includes the location of the property, the nature of the activity being undertaken on the property, and the stormwater system in place for the property.
- 6 The Consent Holder shall notify the Northland Regional Council's assigned monitoring officer of any amendment to the register required to be kept in accordance with Condition 5 within two weeks of the amendment occurring. A copy of this register shall be provided to the Northland Regional Council's assigned monitoring officer on written request.
- 7 The stormwater discharge shall not result in any permanent scouring or erosion of the bed of a waterbody or the coastal marine area. For compliance purposes, "permanent" is defined as scouring or erosion that will not be fully remediated by natural processes during the following six month period.
- 8 There shall be no obstructions within any watercourse or identified overland flow path within the stormwater network system owned by the Consent Holder, as shown on the plans referred to in Condition 1, that could result in an increase:
  - (a) To the frequency of flooding of a property; or
  - (b) The scale or extent of the ponding areas shown on the plans referred to in Condition 1.

**Advice Note:** *The maintenance of the free flow of water is a permitted activity provided all the requirements of the relevant rule in the Regional Water and Soil Plan for Northland are met. Any other works within the bed of a watercourse are likely to require separate resource consent.*

- 9 The assets within the stormwater network system that are owned by the Consent Holder, including stormwater ponds, outlet structures, cesspits, energy dissipation devices, and overland flow paths, shall be adequately maintained to ensure that they operate efficiently and effectively at all times.
- 10 All sediment removed from the stormwater network system shall be disposed of at a site that is authorised to accept such waste material.
- 11 Within 12 months of the date of commencement of these consents, the Consent Holder shall forward to the Northland Regional Council's assigned monitoring officer an Operation and Maintenance Plan that details how Conditions 8 to 10 will be complied with. This plan shall include, as a minimum:
  - (a) A schedule of inspection frequencies for all sediment traps and stormwater treatment devices;

- (b) The maintenance requirements for sediment traps and treatment devices;
  - (c) A schedule of inspection frequencies for obstructions within open watercourses, drains and overland flow paths; and
  - (d) Details of how vegetation cover, especially on swale drains, steep land, coastal margins and natural water courses, within the stormwater network system owned by the Consent Holder will be retained and, where possible, enhanced.
- 12 The Operation and Maintenance Plan may be amended at any time by the Consent Holder and shall be updated to include any new connections to the network that have stormwater collection and treatment systems that are owned by the Consent Holder. A copy of the amended Operation and Maintenance Plan shall be forwarded to the Northland Regional Council's assigned monitoring officer within two weeks of it becoming operational, and shall be deemed to be the latest version for compliance purposes.
- 13 The stormwater network system shall be operated and maintained in accordance with the most recent version of the Operation and Maintenance Plan that the Northland Regional Council has received.
- 14 An assessment of compliance with the maintenance requirements of the Operation and Maintenance Plan and any programmed works for the year, being 1 July to 30 June, shall be provided to the Northland Regional Council's assigned monitoring officer by 31 July each year. A schedule of any programmed works for the following year shall also be provided at the same time.

**Advice Note:** *These requirements should occur as part of Local Government Annual Plan process.*

- 15 The exercise of these consents shall not result in the concentration of metals in sediment, as measured at or beyond a 30 metre radius from any final outlet from the network system, to exceed the following:

Metal	Milligrams per kilogram dry weight
Copper	65
Lead	50
Zinc	200
Chromium	80
Nickel	21
Cadmium	1.5

- 16 The exercise of these consents shall not result in any of the following effects on water quality, as measured at or beyond a 30 metre radius down current from any final outlet from the network system:
- (a) The production of any conspicuous oil or grease film, scums or foams, or floatable or suspended materials, or emissions of objectionable odour;
  - (b) The destruction of natural aquatic life by reason of a concentration of toxic substances;

- (c) Shellfish to become tainted so as to make them unpalatable or contain toxic substances to the extent that they are unsafe for human consumption.

17 The Consent Holder shall, for the purposes of adequately monitoring these consents as required under Section 35 of the Act, on becoming aware of any contaminant associated with the Consent Holder's operations escaping otherwise than in conformity with these consents:

- (a) Immediately take such action, or execute such work as may be necessary, to stop and/or contain such escape; and
- (b) Immediately notify the Northland Regional Council by telephone of an escape of contaminant; and
- (c) Take all reasonable steps to remedy or mitigate any adverse effects on the environment resulting from the escape; and
- (d) Report to the Northland Regional Council's Compliance Manager in writing within one week on the cause of the escape of the contaminant and the steps taken or being taken to effectively control or prevent such escape.

In regard to telephone notification, during Northland Regional Council opening hours the Northland Regional Council's assigned monitoring officer for these consents shall be contacted. If that person cannot be spoken to directly, or it is outside of Northland Regional Council's opening hours, then the Environmental Emergency Hotline shall be contacted.

**Advice Note:** *The Environmental Emergency Hotline is a 24 hour, seven day a week, service that is free to call on 0800 504 639.*

18 The Northland Regional Council may, in accordance with Section 128 of the Resource Management Act 1991, serve notice on the Consent Holder of its intention to review the conditions annually during the month of May for any one or more of the following purposes:

- (a) To deal with any adverse effects on the environment that may arise from the exercise of the consent and which it is appropriate to deal with at a later stage; or
- (b) To require the adoption of the best practicable option to remove or reduce any adverse effect on the environment.

The Consent Holder shall meet all reasonable costs of any such review.

**EXPIRY DATE:** 1 JUNE 2052

**These consents were granted on 22 June 2017 (being the date of the decision) under delegated authority from the Council by Paul Maxwell, Coastal and Works Consents Manager.**

**Note:** *The plans attached to this consent are reduced copies and therefore may not be to scale and may be difficult to read. In the event that compliance and/or enforcement action is to be based on compliance with the attached plans, it is important that the original plans, are sighted and used. Originals of the plans referred to are available for viewing at the Council's Whāngārei office.*

# Appendix E     Estuary Drive Stormwater Improvement Options

MWH Ref: 80507319 - 0108  
Client Ref: Estuary Drive Stormwater Improvements

3 December 2015

Kaipara District Council  
42 Hokianga Road  
Dargaville 0310

Attention: Rohit Srivastava

## **RE: Estuary Drive Stormwater Improvement Options**

Dear Rohit:

MWH have been asked to consider drainage solutions in the Molesworth Drive area of Mangawhai. The project has been initiated to address three stormwater related issues in the area. These being:

- 1. Flooding to a dwelling at 8 Pohutukawa Place.**
- 2. Stormwater Treatment Pond Options for Catchment 9**
- 3. Proposed upgrades to Molesworth Drive.**

This letter has been prepared following a site visit to consider high level options and potential routes to discharge points. Pipe sizing has assumed a 0.5% gradient. Cost estimates have been prepared using an all-inclusive per meter rate for the piping of:

- 900mm diameter pipe \$2,500/m
- 1,200mm diameter pipe: \$3,500/m

Pond construction estimates are high level estimates based on average rates per hectare for stormwater treatment ponds provided by Auckland Council in 2012.

- Pond Rate \$30,000/ha of contributing catchment.

The follow pages provide a summary of the options considered and indicative costings for items 1 and 2 above.

Item 3 essentially considers only the Molesworth Drive stormwater aspects and provides an indication of potential options only. If options within item 3 are to be progressed – these will form part of the road up-grade works and the incidental costs of the work will be included within the transportation activity.



## **1. Flooding to a dwelling at 8 Pohutukawa Place.**

This issue has previously been considered by:

- Kaipara DC in May 2011.
- MWH in August 2012.
- Kaipara DC (A. MacGregor) Stormwater piping option consideredX on 27 March 2014.

Pohutakawa Place and its immediate subcatchment area is essentially a “blind” catchment, with stormwater / rainfall run-off in the area generally falling towards a depression centred around 8 & 12 Pohutakawa Place. The only current means of stormwater disposal in the catchment is via soakage. Overflows from the soakage systems aggregate in the low point at 8 Pohutakawa Place. 8 Pohutakawa Place has been developed with a habitable holiday home (on short piles) and a garage which has been converted into accommodation; we understand that this conversion is unconsented. 12 Pohutakawa Place is developed with a permanent dwelling and garaging.

Contributing overland flow from Molesworth Drive and the adjacent properties was the subject of an earlier MWH report (August 2012) which recommended both the purchase of 8 Pohutakawa Place (and conversion of the property into a drainage reserve) and Council enforcement to ensure private stormwater disposal systems were being maintained and were operational.

The outcome of the follow up action by Council regulatory officers is unknown with regard to satisfactory performance of private drainage systems in adjacent properties.

The development of dwellings in a blind depression, for which the primary source of stormwater disposal in the catchment is via soakage, is not ideal. No overland flow path provision has been made to enable stormwater ponding to leave the low lying area, prior to flooding the habitable floor of 8 Pohutakawa Place (in extreme events 12 Pohutakawa Place could also flood). Surrounding development has now also precluded the opportunity to construct a suitable low level overland flowpath from the depression.

Review of the property records associated with the Pohutakawa Place subdivision and historical plans revealed a number of observations.

### **Pohutakawa Place Subdivision records:**

- The Pohutakawa Place subdivision process started in 1988.
- An updated scheme plan of the subdivision was submitted in Jan 1989.
- The Pohutakawa Place subdivision was finalised in November 1990.
- The original application documentation does not highlight any issues with stormwater disposal. Nor any ponding areas. It is assumed that because of the sandy nature of the soils this will not be an issue.
- The need for appropriate stormwater design was flagged in a number of items of correspondence during the subdivision process, including internal council documents and information from council's consultants during 1989.
- Council's consultant advised that the construction of soakpits could be used as a temporary measure but that they were not recommended.

- It was noted in correspondence that Lots 8, 9 and 11 (what has become 14, 12 and 8 Pohutukawa Place) drain to the south (it is unclear how this would occur as currently it cannot occur by overland flow). Also that piped drainage should be provided for these lots in the adjoining subdivision. This allowance has not been provided on the adjacent subdivisions.
- Prior to final council signoff of the subdivision a site visit was carried out and a number of deficiencies identified. These included the uneven contour and pockets of ponded water and that Lots 9 and 11 (12 and 8 Pohutukawa Place) had a local problem (the focus in the note was on effluent disposal) as they receive runoff from the adjacent building supply yard. The subdivision designer's response did not specifically address the ponded water issues, however it was accepted and a recommendation made to issue a section 306 certificate "Because of the circumstances of processing this application".
- A building consent was issued (1993) for the construction of a garage on 8 Pohutukawa Place. This consent specifically precluded the habitable use of this garage. No information was found on the file for the dwelling construction.

A summary of the source documents from the subdivision file is included in Appendix A

### **Historical Plan (Mangawhai Infrastructural Assets Study (1999):**

An historic plan sourced from the above study indicates an overland flow path passing through the area (refer Appendix B) indicating knowledge of potential flooding in the area (at least as far back as 1999).

The timing of the construction of the dwelling at 8 Pohutakwa place could not be obtained from the information reviewed. The garage was consented in 1993 and specifically excluded habitable use of the garage.

It is evident from the correspondence and records reviewed, that there was concern regarding stormwater management at the time of processing the subdivision consent for Pohutakawa Place, but it appears that those concerns may have been "lost" during the process, with soakage being the default means of stormwater management being implemented.

This is an historical issue which appears to have been in contention for a number of years to which no viable engineering solution has yet been identified.

A number of options have been investigated and are available to potentially resolve the habitable floor flooding at 8 Pohutakawa Place. These include:

**Option 1** Purchase 8 Pohutakawa Place - this involves the negotiation and purchase of the property, removal of the dwelling and conversion of the property into a drainage reserve.

The current property is recorded with a Capital Value of \$215,000. The opportunity exists for Council to enter negotiations with the property owner for the purchase of the property.

If a property purchase agreement can be met, Council then has options to retain the property as is, or alternatively sell the dwelling to be removed from the site, leaving Council with the property to convert into a drainage reserve to service stormwater from the surrounding areas. This would require investment to implement appropriate soakage design and ongoing maintenance. The option of converting this property into a soakage device has not been costed at this stage.



**Option 2 - 4** Install a pipeline system – this involves the installation of a suitable sized pipeline to collect the stormwater from 8 Pohutakawa Place and the conveyance to an alternative point of discharge.

A proposed piping system to transfer stormwater from 8 Pohutakawa Place to the reserve on the opposite side of Molesworth Drive, was compiled by Andrew MacGregor (KDC 27 March 2014), and forms part of Option 2 in Table 1 (Appendix C).

The primary concern with this option is the relative difference in height between the property (low spot RL = 25.4m) and the reserve (lowest surveyed point in reserve RL = 26.0m). The low level of 8 Pohutakawa Place implies a relatively deep pipe would be required to provide adequate fall to a suitable point of discharge. At this stage there is not enough information to confirm fall is feasible or if disposal is possible.

The size of the catchment and contributing stormwater flow requires a pipe size ranging from 900mm to 1200mm diameter, depending on the design event and levels of service to be provided. If, due to the lack of a secondary overland flow path a pipe design to cater for the 1:100 year AEP design event is required, the larger pipe size (1200mm) will result.

The proposed discharge location in the reserve, and the potential volume of storage to dissipate the flow, is being impacted by the St Johns Ambulance and Fire Station developments, with potential fill reducing the effective ponding and soakage area available.

Due to the topography of the reserve, there is no gravity flow path down through the reserve to the estuary. The solution will be dependent on ponding and soakage disposal in the reserve, unless significant construction is progressed to provide a controlled overland flow path to a suitable discharge point into the estuary. Deep cuts in the order of 10m are likely to be required to create the overland flowpath, and this is deemed not practical in this situation. Further detailed investigation (topographical survey / geotechnical / soakage tests) will be required to determine the full extent of work required and the practicalities of construction.

Alternative options (3 and 4) have been considered, and these involve different pipe routes to convey the stormwater from 8 Pohutakawa Place further down Molesworth Drive towards the estuary, to appropriate discharge points. Existing wetland areas are able to be used to provide some detention and treatment, but these will need to be modified to reflect the increased volume of water that may pass through the system. Accordingly, as the pipe routes are longer and of equal pipe size, the construction cost estimates are significantly larger than for Option 2.

A summary of the options and commentary / indicative cost estimates are included in Table 1 and Figure 1 (Appendices C and D respectively)

## **2. Stormwater Treatment Pond Options**

The original site of the proposed pond as indicated in the Stormwater Discharge consent and the Stormwater Management Plan was lost due to a recent development and alternative options need to be assessed, near the outlet for Catchment 9, adjacent to Molesworth Drive.

Three options have been considered and evaluated based on a preliminary site visit.

**Option 1** includes the installation of a pond suitably sized to drain all of catchment 9, Molesworth Drive and the Pohutakawa place sub-catchment. The area of land required is approximately 7,000m<sup>2</sup>, and is in a similar position to that originally proposed in the Stormwater Discharge Consent, but moved into the Esplanade Reserve. Additional land area will be required to be sourced from an adjoining subdivision (Airey subdivision) to provide the required treatment capacity.

**Option 2** includes the upgrade of an existing wetland area located behind the museum on Molesworth Drive. The proposed wetland area is located further away from the estuary, at a slightly higher elevation, enabling approximately 50% of the catchment 9 area (upstream of Seabreeze Road) to be captured and passed through the pond system. A secondary ponding system will be required in a similar location to Option 1 to cater for the balance of the catchment. The adequacy of the available area in the Esplanade Reserve will need to be assessed to determine if additional land from the adjoining subdivision (Airey subdivision) is needed to provide the required capacity.

**Option 3** includes the installation of a pond, suitably sized to drain all of catchment 9, Molesworth drive and the Pohutakawa place sub-catchment. The area of land required is approximately 7,000m<sup>2</sup>, and is located in Esplanade Reserve on the north west side of Molesworth drive, immediately adjacent the estuary.

A summary of the pond options and commentary / indicative cost estimates are included in Table 2 and Figure 2 (Appendix E and F respectively).

### **3. Proposed upgrades to Molesworth Drive.**

These upgrades include kerb and channelling and the provision of positive stormwater drainage from the upgraded road. Appendix G Table 3 and Appendix H Figure 3 refer to options for the discharge of the stormwater from Molesworth Drive and contributing areas.

Molesworth Drive drainage options have not been separately priced. If combined with wider drainage options discussed above, the prices will be similar to those in Appendix C Table 1. If drainage is only carried out to service Molesworth Drive, then drainage costs will be minor additions to the roading upgrade costs.

## **Summary**

Three stormwater issues within the Molesworth Drive area of Mangawhai need to be resolved to mitigate flooding and stormwater quality issues.

**8 Pohutakawa Place** - The development of habitable floor dwellings in a blind catchment area, of which the primary source of stormwater disposal is via soakage, is not ideal. No overland flow path provision has been made to enable stormwater ponding to leave the low lying area, prior to flooding the habitable floor of 8 Pohutakawa Place (In extreme events 12 Pohutakawa Place could also flood).

Soakage systems in adjoining properties appear to have failed due to a lack of installation, maintenance and ongoing servicing to maintain the required soakage discharge rates. Reliance on additional soakage systems to rectify the flooding issue at 8 Pohutakawa place, may provide short term relief, but from evidence obtained through this and earlier investigations, soakage is not proven to be an effective long term drainage solution in Mangawhai due to lack of maintenance.

The negotiated purchase of the property provides a cost effective means of resolving the habitable floor flooding. Through the progression of the negotiations, the property owner may elect to accept or decline the offer. If the offer is accepted, the property would then become a Council asset which could be put up for sale to be removed from the site. Utilising funds from the sale and removal of the dwelling, the property could then be converted into a drainage reserve serving the surrounding area. Alternatively if the property owner declines the purchase offer, they may accept that this is the only viable solution from Council and either accept the flooding and / or look at other means to resolve independently.



Piped solutions require large pipes upwards of 1200mm diameter. Significant cost (\$millions) have been estimated to provide a piped solution to collect and convey the 100year AEP design event away from 8 Pohutakawa Place.

**Stormwater Treatment Pond Options** – Whilst the ideal opportunity to treat all stormwater flows from the Catchment 9 area as defined in the Stormwater Management Plan, has been lost, alternative options have been identified and discussed above. The ultimate decision on the appropriate sizing and location of a pond treatment system will be very strongly linked into the decision on the means of stormwater collection and disposal for 8 Pohutakawa Place, as this will direct a significant volume of additional stormwater to a different area of the catchment, which will need to be treated prior to discharge into the estuary.

**Molesworth Drive Upgrades** – regardless of the decisions and location of infrastructure determined through the protection of 8 Pohutakawa Place and the provision of stormwater treatment ponds, stormwater infrastructure is required to be installed along Molesworth Drive to contain and adequately dispose of stormwater runoff, from the improved road profile.

If the solutions of the above stormwater issues present an opportunity to integrate the Molesworth Drainage, this will be utilised, otherwise an independent system or series of smaller systems is likely. Appendix G and H contains a summary of potential options.

## Recommendations

A combination of solutions is required to provide appropriate drainage infrastructure to ensure appropriate levels of stormwater flood protection, collection, treatment and disposal can be provided within Catchment 9. For this reason, it is recommended that:

- 1) **8 Pohutakawa Place** – Option 1 to purchase the property is considered further to identify the respective benefit of either abandoning the property completely or selling the property and reinvesting the funds into a soakage system within the property to service the surrounding area

Estimated Costs - \$\$215,000 - \$300,000 (purchase price subject to negotiations)

- 2) **Stormwater Treatment Pond** – Option 2 is investigated further to refine the sizing and treatment capacity requirements for a twin pond system to effectively divide Catchment 9 into two separate treatment areas. This enables the upgrade to the existing wetland area behind the museum to facilitate treatment of the catchment area above Seabreeze Road, and the provision of a second pond system on the south east side of Molesworth Drive in Esplanade Reserve to treat the lower portion of Catchment 9 below Seabreeze Road.

Estimated Construction Cost - \$1,020,000

- 3) **Proposed Upgrades to Molesworth Drive** – Integration of stormwater collection and disposal along Molesworth Drive is possible with Option 2 contained in Recommendation 1, for the portion of Molesworth Drive located above the line of the proposed stormwater pipeline from 8 Pohutakawa Place.

Stormwater in sections of Molesworth Drive below this pipeline can be collected in a local system can be disposed of independently into the reserve area, or conveyed down to the wetland / treatment area located behind the museum.

Based on the above recommendations, it is proposed that Council:

- 1) Commence negotiations with the property owner at 8 Pohutakawa Place to purchase the property.

2) Develop Concept Design solutions and refined construction cost estimates for the proposed options for items 2 and 3. Additional investigations will be required to supplement the concept design development including:

- Additional topographic survey
- Geotechnical investigation
- Soakage testing
- Liaison with NRC over concept options development and consenting requirements.

We trust the above adequately explains the option development for Catchment 9 and the Molesworth Drive / Pohutakawa Place stormwater issues.

Yours sincerely

A handwritten signature in black ink, appearing to read 'G Lorimer', with a long horizontal flourish extending to the right.

Grant Lorimer  
Project Manager  
MWH New Zealand



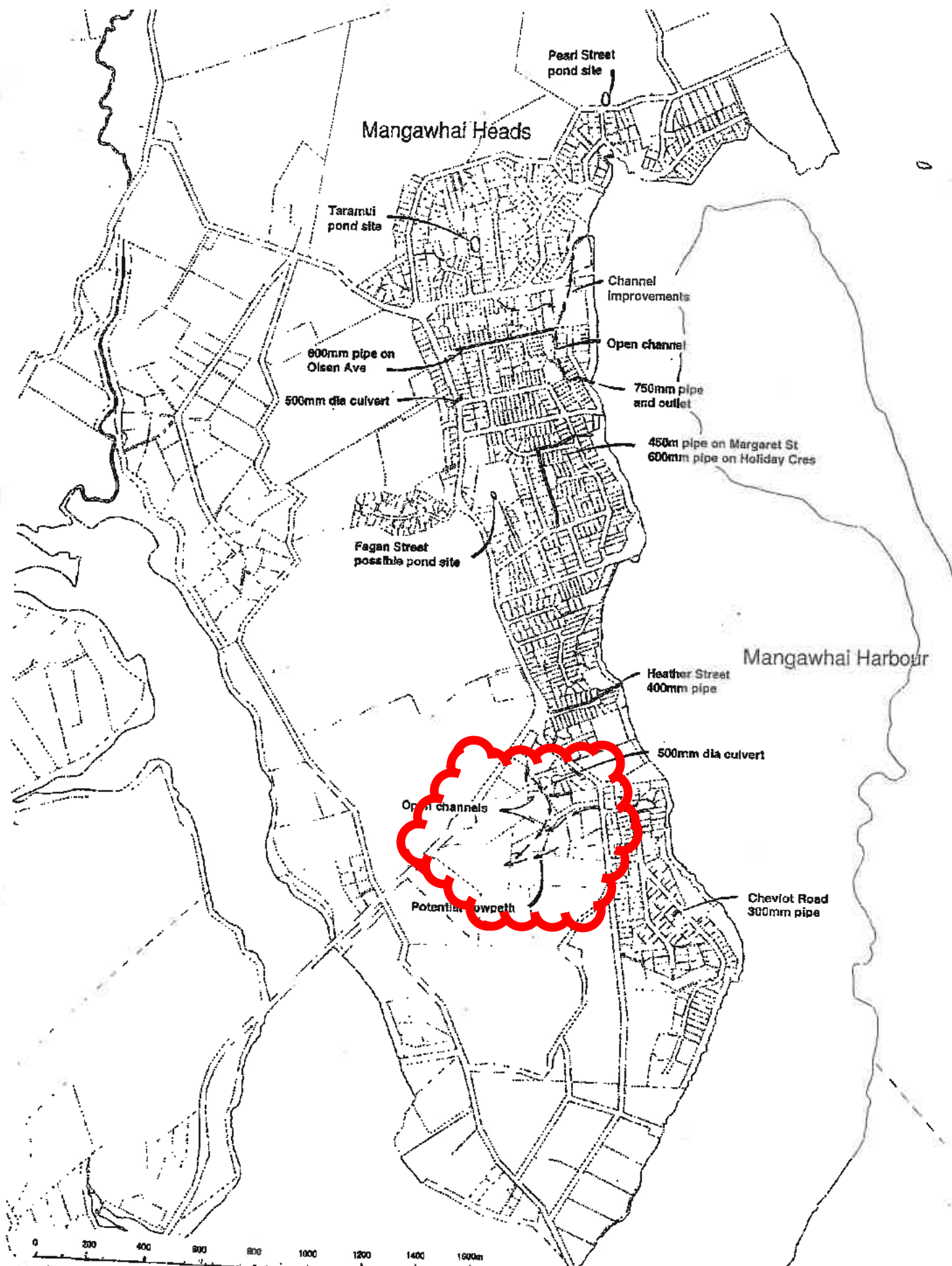
## Appendix A: - Pohutakawa Place Subdivision - Summary References

Date	Type	From	To	Discussion
18 July 1988	Letter	Thompson Fish & Associates	Otamatea County Council (OCC)	Application for planning consent for new subdivision. No specific reference to subject sites
18 Jan 1989	Letter	Thompson Fish & Associates	OCC	Amended Scheme Plan submitted. No specific reference to subject sites
30 Jan 1989	Memo	Senior Admin Officer (SAO)	Building Inspector	Recommended that specific design of effluent disposal needed on subject site plus 3 others. Other 10 sites no constraints
7 Mar 1989	Memo	SAO	CEO	Recommended approval of subdivision. Stormwater not a problem on most lots. Piped stormwater disposal to be provided unless adequate alternative demonstrated.
15 Mar 1989	Letter	CEO	Thompson Fish & Associates	Subdivision approved with conditions
14 Feb 1989	Letter	Reelick & Assoc	OCC	Highlighted Builders yard next door discharges stormwater onto site
12 Apr 1989	Letter	Cook Costello	OCC	Need to provide for SW disposal for whole area. Probably to Breve Rd. Construction of soakage pits would only be a temporary measure and is not recommended.
30 Oct 1989	Engineering Report	Frank Muldowney Ltd		Stormwater disposal to be via soakage. Part reticulation provided not affecting subject site.
31 Jan 1990	Letter	Cook Costello	KDC	Provide for Lots 8, 9 and 11 (14, 12 and 8 Pohutukawa Place) SW drainage in subdivision to the south
7 Sept 1990	Letter	KDC	Frank Muldowney Ltd	Ponding of water noted especially on 8 and 12 Puhutukawa which receive runoff from adjacent building supply yard. Reinforce statement on As-Built to provide 1 in 50 yr SW disposal.

5 Oct 1990	Letter	Frank Muldowney Ltd	KDC	Includes SW calcs, annotated by KDC about depth of GW. No other specific SW comments
11 Oct 1990	Memo	Development Engineer	Dir of Works	All items relevant to subject site addressed. <i>"Because of the circumstances of processing this subdivision, I recommend that a 306 certificate be issued"</i>
16 Dec 1993	Building Consent	KDC	B & J Clark	Consent to erect garage on 8 Pohutukawa. Noted <i>"Not to be used for habitation"</i>



## Appendix B: - Historical Overland Flowpath



BECA

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## MANGAWHAI HEADS PROPOSED STORMWATER UPGRADING WORKS

Source : Mangawhai Infrastructural Assets Study (1999)



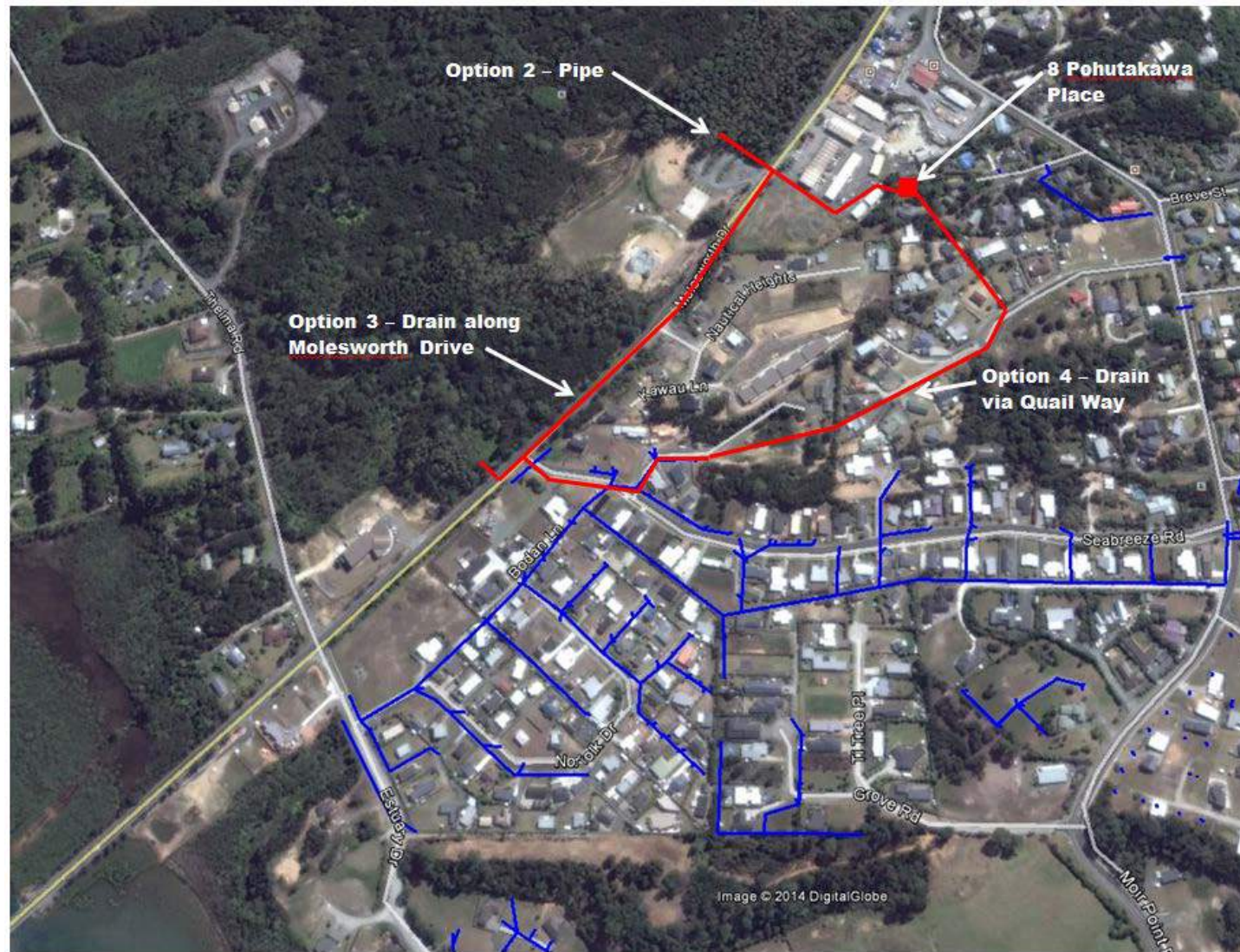
## **Appendix C: - Table 1 - Options to Protect 8 Pohutakawa Place**

Option	Description	Discussion
1	Buy and abandon property	<ul style="list-style-type: none"> <li>Property is in a blind hollow surrounded by development and will always be subject to a flooding risk.</li> <li>Could combine with construction of a soakage system to service the upstream industrial/commercial area.</li> <li>Risk to 12 Pohutukawa Place remains, although improved soakage would reduce this.</li> <li>Property GV \$215K (from Kaipara DC records)</li> </ul>
2	Construct pipe to reserve across Molesworth Drive	<ul style="list-style-type: none"> <li>More level information needed to confirm feasibility. (Currently low point on #8 is around RL 25.4, lowest point surveyed in reserve RL 26.0)</li> <li>Work needed to confirm extent of filling proposed for new St John's Ambulance station and Fire station.</li> <li>Hollow behind ambulance station will need to be hydraulically linked to the rest of the reserve.</li> <li>Flow from reserve is blocked by topography. Flows will ultimately pond below the sports field, possibly flooding the sports field until they soak away.</li> <li>Resource consent issues to be confirmed.</li> <li>Able to be combined with road drainage for Nautical heights to Moir Pt Road section.</li> <li>Drains all of industrial area above 8 Pohutukawa Place.</li> <li>Pipe: Q10 = 1.2m<sup>3</sup>/s, pipe diameter = 900mm, \$620k. Q100 = 2.2m<sup>3</sup>/s, pipe diameter = 1200mm, \$870k.</li> </ul>
3	Pipe down Molesworth Drive to wetland behind the museum. Discharge opposite Seabreeze Road.	<ul style="list-style-type: none"> <li>Able to be combined with road drainage from Moir Pt Road to Seabreeze Road.</li> <li>Deep excavation (approximately 5m deep) required around Nautical heights intersection.</li> <li>Able to drain 8 Pohutukawa, need to consider pipe size, inlet system and residual ponding.</li> <li>Wetland behind museum could act as a treatment system.</li> <li>Resource consent issues to be confirmed.</li> <li>Will increase flows to 375mm diameter culvert on Thelma Road. Culvert will need upgrading or flow</li> </ul>



		<p>detention provided.</p> <ul style="list-style-type: none"> <li>• Pipe: Q10 = 1.2m<sup>3</sup>/s, pipe diameter = 900mm, \$1.4 million. Q100 = 2.2m<sup>3</sup>/s, pipe diameter = 1200mm, \$2.0 million</li> <li>• Pond upgrades \$470K</li> <li>• Thelma Rd culvert upgrade 1200mm diameter, \$90K</li> </ul>
4	Drain to Seabreeze via Quail Way.	<ul style="list-style-type: none"> <li>• Not able to be combined with Molesworth Road drainage.</li> <li>• Passes through approximately 8 private properties.</li> <li>• Can be combined with collecting drainage from Seabreeze Road to discharge to wetland opposite Seabreeze/Molesworth intersection.</li> <li>• Able to drain 8 Pohutukawa, need to consider impacts on Thelma Road. Culvert will need upgrading or detention provided.</li> <li>• Resource consent issues to be confirmed.</li> <li>• Pipe sizes Q10 = 1.2m<sup>3</sup>/s, pipe diameter = 900mm, \$ 1.8 million Q100 = 2.2m<sup>3</sup>/s, pipe diameter = 1200mm, \$ 2.5 million</li> <li>• Pond upgrades \$470k</li> <li>• Thelma Rd culvert upgrade 1200mm diameter, \$90k</li> </ul>

Appendix D : Figure 1 - Options to protect 8 Pohutukawa Place





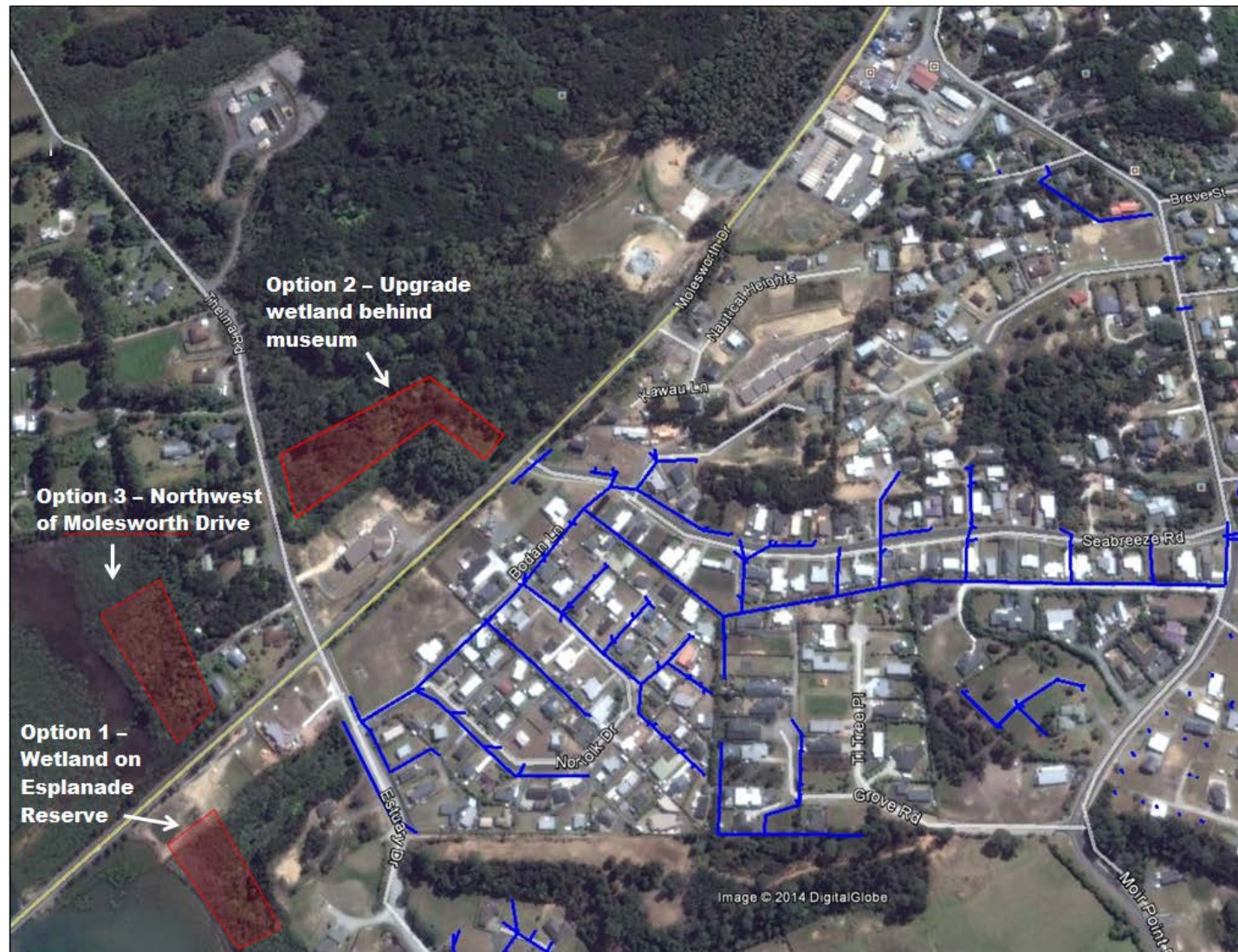
**Appendix E: Table 2 – Options to Treat Catchment 9 Stormwater Run off**

Option	Description	Discussion
1	New treatment wetland on Esplanade Reserve south east of Molesworth Drive	<ul style="list-style-type: none"> <li>• Can drain all of catchment 9, Molesworth Drive and Pohutukawa Place subcatchment to this point.</li> <li>• Area likely to be too small without taking part of an adjacent subdivision for full treatment.</li> <li>• Adjacent Airey subdivision scheme plan approved (excludes pond allowance)</li> <li>• Rough Order area required: 7,000m<sup>2</sup> plus access and surrounds.</li> <li>• Resource consent issues to be determined.</li> <li>• Rough order construction cost estimate is \$1.1 million plus reticulation and amenity. This assumes that the catchment to 8 Pohutukawa Place is also reticulated to the wetland (construction cost estimate not included)</li> </ul>
2	<p>Twin Pond system:</p> <p>Upgrade wetland behind the Museum</p> <p>New pond in equivalent location as Option 1</p>	<p>Upgrade wetland behind the Museum</p> <ul style="list-style-type: none"> <li>• The upgraded wetland can treat all of catchment 9 upstream of Seabreeze Road.</li> <li>• May be possible to direct flows from Estuary Drive to the lower part of a wetland.</li> <li>• Can treat most of Molesworth Drive and Pohutukawa Place subcatchment.</li> <li>• Can utilise and modify an existing wetland rather than constructing from scratch.</li> <li>• Approximate area required 3,500m<sup>2</sup> plus access and surrounds.</li> <li>• Resource consent issues to be determined.</li> <li>• Rough order cost estimate to upgrade wetland is \$470k plus reticulation, access and amenity.</li> </ul> <p>New pond in equivalent location as Option 1</p> <ul style="list-style-type: none"> <li>• Second Pond system required for catchment area below Seabreeze Road</li> <li>• Approximate area required 3,500m<sup>2</sup> plus access and surrounds.</li> <li>• Resource consent issues to be determined.</li> <li>• Rough order construction cost estimate is \$550k plus reticulation and amenity..</li> </ul>
3	New pond North west of	<ul style="list-style-type: none"> <li>• Can treat all of catchment 9 apart from lowest parts of Airey subdivision.</li> </ul>



	Molesworth Drive and west Thelma Road.	<ul style="list-style-type: none"> <li>• Access through private properties off Thelma Road or new access off Molesworth Drive.</li> <li>• Will take up most of esplanade reserve.</li> <li>• Approximate area required 7,000m<sup>2</sup> plus access and surrounds.</li> <li>• Resource consent issues to be determined.</li> <li>• Rough order cost estimate is \$1.1 million plus reticulation and amenity.</li> </ul>
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Appendix F: Figure 2 - Options to Treat Catchment 9 Stormwater Run off



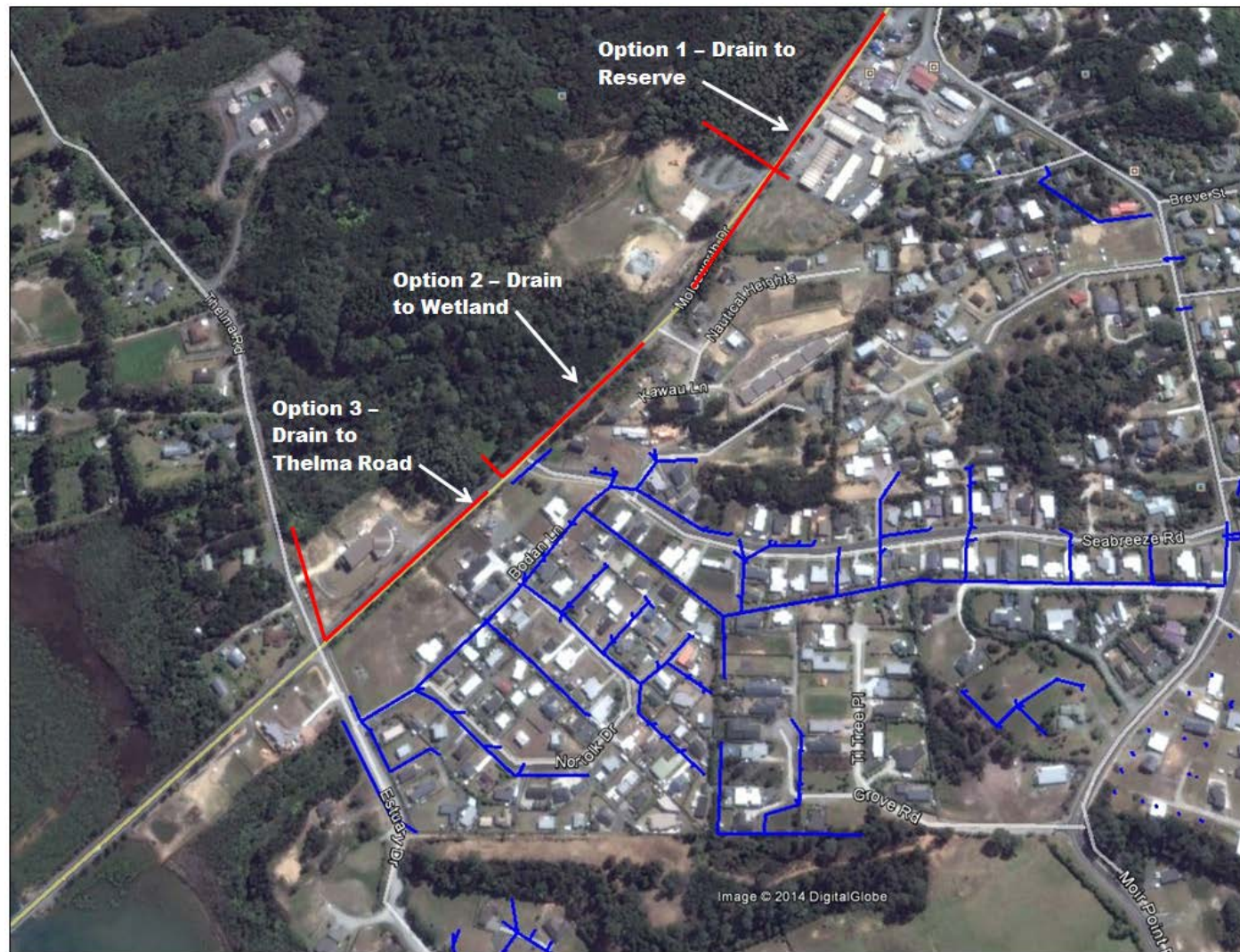


**Appendix G: Table 3 - Options to Drain Molesworth Drive Improvements**

Option	Description	Discussion
1	Behind Reserve adjacent to Molesworth  (Refer to Table 1, Option 2)	<ul style="list-style-type: none"> <li>• Can link with drainage from 8 Pohutukawa Place.</li> <li>• New ambulance and fire station developments will impact on opportunities and need consideration.</li> <li>• Will drain from Nautical Heights to Moir Point Road.</li> <li>• Flow is into a blind hollow. Detail will need to consider ponding levels and long-term efficiency of soakage.</li> <li>• Flows and costs discussed under 8 Pohutukawa Place table Molesworth Drive Road contribution is quite small.</li> <li>• Alternative system could be shallower and not drain 8 Pohutukawa but drain the higher commercially zoned sites.</li> </ul>
2	Discharge to wetland behind the museum  (Refer to Table 1, Option 3)	<ul style="list-style-type: none"> <li>• Will drain from Nautical Heights to around Seabreeze Road.</li> <li>• Able to be combined with drainage from 8 Pohutukawa Place and Moir Point Road with deep pipe at Nautical Heights.</li> <li>• Able to be combined with treatment of catchment 9 above Seabreeze Road.</li> <li>• Effect on Thelma Road culvert and downstream to be considered.</li> <li>• Flows and costs discussed under 8 Pohutukawa Place table Molesworth Drive Road contribution is quite small.</li> </ul>
3	Discharge at Thelma Road	<ul style="list-style-type: none"> <li>• Can be combined with all reticulation upstream of Estuary Drive for a common discharge.</li> <li>• Will likely require a new treatment device to be constructed (consenting check to be carried out).</li> <li>• Able to be confirmed with drainage from 8 Pohutukawa Place with deep pipe at Nautical Heights.</li> <li>• Effects on Thelma Road culvert and downstream to be considered, however may be able to avoid this with new discharge point to the estuary.</li> <li>• Further discharge point required for Molesworth Drive below Estuary Drive.</li> </ul>

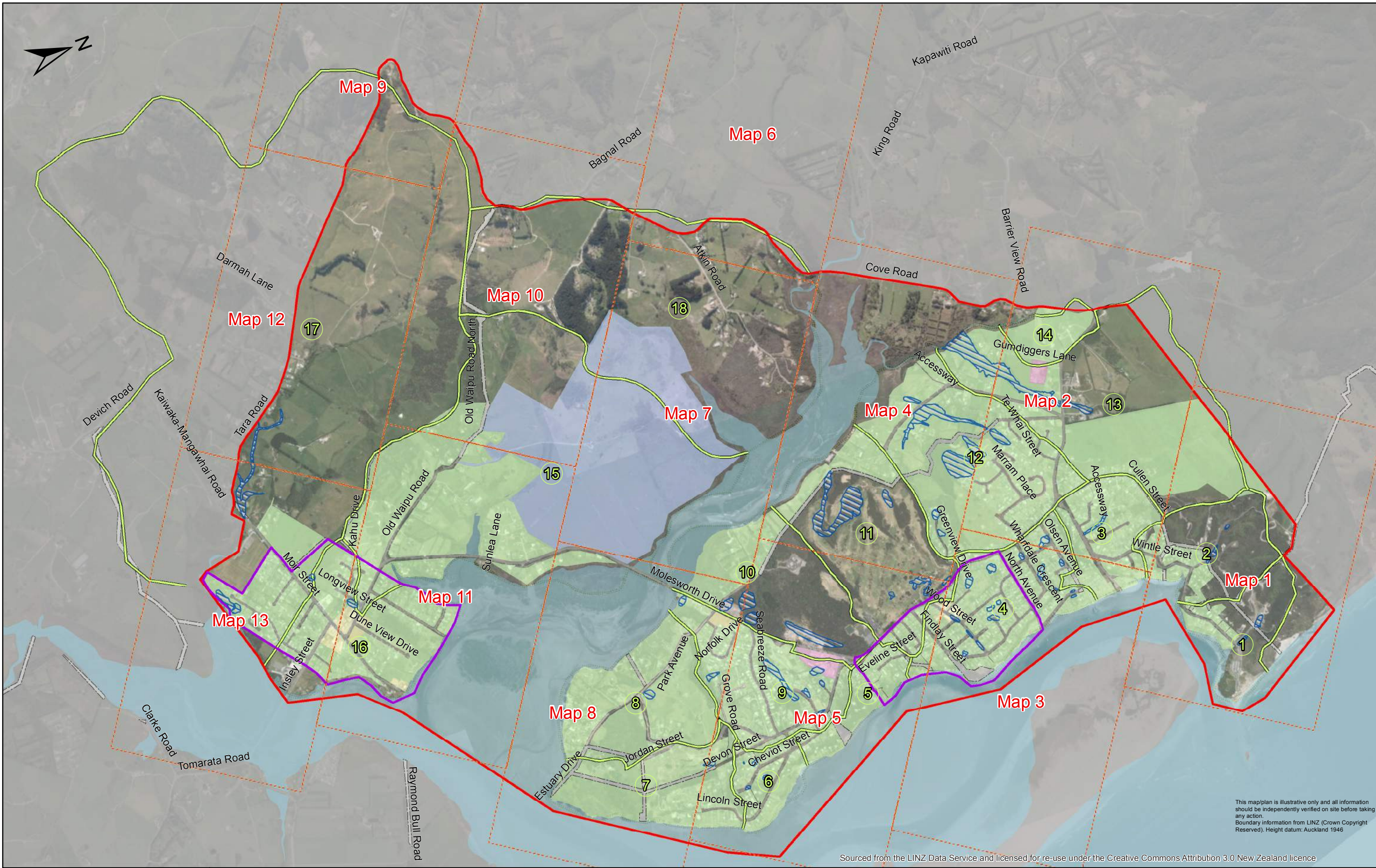


Appendix H: Figure 3: Options to Drain Molesworth Drive Improvements



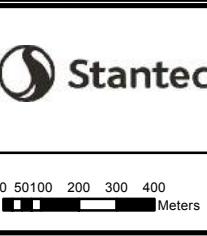
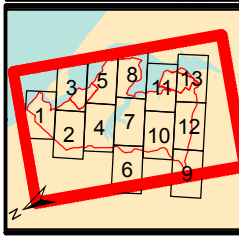
# Appendix F     Stormwater Issues Plans





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Boundary information from LINZ (Crown Copyright Reserved). Height datum: Auckland 1946

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0 50 100 200 300 400 Meters

**General Layers**

- Map Grid
- Catchment Number
- Stage 1 Study Area
- Stage 2 Study Area
- Ponding Areas (MWH 2015)
- Out of study area
- LINZ - Hydroparcel

**Plan Zones**

**Plan Type**

- Commercial
- Estuary Estates
- Industrial
- Residential
- Unformed Road

Catchment Boundary

MapTitle: <b>STORMWATER ISSUES PLAN</b>			
Project: <b>Mangawhai CMP</b>			
Map:	Designed: <b>MH</b>	Drawing Number	
Scale: <b>1:20,000</b>	Drawn: <b>MH</b>	Keymap - Mangawhai	
Size: <b>A3</b>	Checked: <b>PM</b>	Status	Rev
Date: <b>8/03/2018</b>	Approved: <b>AL</b>	<b>FINAL</b>	<b>0</b>



- Key to Mangawhai Stormwater Issues:**
- Existing privately owned stormwater infrastructure the performance of which is unknown and which has effects on downstream public assets
  - Performance of the existing public or private stormwater network is not well understood. This includes primary (piped and open channel) as well as the secondary overland flow or ponding systems and blockage consequences
  - A number of private properties and houses are in existing low lying land, hollows or depressions and are potentially subject to a flood hazard. There is no or limited primary stormwater network
  - Existing overland flow path not understood, protected or maintained
  - Lack of design of Roads to act as overland flow paths
  - Loss of opportunity due to development
  - Likely degradation in water quality and increase on peak flow and volume from greater impervious areas and filling low lying areas during development
  - Land instability likely related to stormwater infrastructure
  - Golf course looking for water for irrigation purposes
  - Lack of control on stormwater volumes, velocities and erosion leading to an increased risk of erosion at the outlet
  - Proposed and existing development with primary stormwater system (pipe and open channel) and secondary overland flow paths or ponding systems constructed on high groundwater table with low lying land subject to tidal backwater effects
  - Taranui Road piped system outlet submerged almost to pipe overtop
  - Road crossing forms a constraint on flood levels. Mangawhai Heads Road dual culvert capacity restrictions
  - Existing stormwater pipes or channel located on site but not identified in KDC GIS and therefore performance unable to be quantified
  - Risk of coastal outfall blocking
  - Existing rural zone land (outside of existing urban zoning) considered for more intensive development
  - Existing development (Northcoast development) and future development (Butlers) designed to rely on soakage system with overflows to the Northcoast development pond
  - Changes in primary drainage due to roading upgrades to discharge to undersized stormwater reticulation which eventually discharges to stormwater at Jack Boyd Drive
  - Manage flows across Molesworth Drive from the Estuary Estates Structure Plan
  - Blind hollow back of Mangawhai Activity Zone
  - Northcoast pond has historically soaked away via infiltration through the base. Currently infiltration is not happening increasing downstream peak flow rates frequency and volume discharging to low lying land at Jack Boyd Drive
  - Wetland behind the Museum site being filled



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Map 2

Map 3

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		<b>Stage 1 Study Area</b> <b>Stage 2 Study Area</b> Catchment Boundary Catchment Number Issue Number, Count (3) Out of study area <b>General Layers</b> Map Grid		<b>KDC Request 2008-16</b> Cause / Effect (Reports Count) Block, Open/Building FI (0) Block, Open/Land FI (0) Block, Pipe/Building FI (0) Block, Pipe/Land FI (0) Soakage/Building FI (0) Soakage/Land FI (0) Ponding Areas (MWH 2015) Identified Ponding (GHD 2016)		<b>Flooding Risk (CMP 2006)</b> Assesst Result Flooding Risk - Likely (MWH 2015) Flooding Risk - Possibly (MWH 2015) <b>Risk Properties</b> NRC Potentially Affected Properties Likely Possible Unlikely		<b>Plan Zones</b> Plan Type Commercial Estuary Estates Industrial Residential Unformed Road <b>Expansion Commercial Zones</b> Zone Use (TCP 2016) Commercial Zone		<b>Proposed New Commercial Zone</b> Unformed Road <b>Stormwater Assests</b> Assesst Type CatchPit Dummy Node Inlet Manhole Outlet Soakpit		Sump Catchpit Lead Creek Culvert Drain Gravity Main Open Drain Overland flowpath Service		Swale Drain Unknown		MapTitle: <b>STORMWATER ISSUES PLAN - MANGAWHAI</b> Project: <b>Mangawhai CMP</b> Map: 1 Scale: 1:5,000 Size: A3 Date: 8/05/2018 Designed: PM Drawn: MH Checked: GL Approved: AL Drawing Number Map 1 Status FINAL Rev 0	
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Boundary information from LINZ (Crown Copyright Reserved). Height datum: Auckland 1946

Map 1

Map 3

Map 4

**Key to Mangawhai Stormwater Issues:**

- Existing privately owned stormwater infrastructure the performance of which is unknown and which has effects on downstream public assets
- Performance of the existing public or private stormwater network is not well understood. This includes primary (pipd and open channel) as well as the secondary overland flow or ponding systems and blockage consequences
- A number of private properties and houses are in existing low lying land, hollows or depressions and are potentially subject to a flood hazard. There is no or limited primary stormwater network
- Existing overland flow path not understood, protected or maintained
- Lack of design of Roads to act as overland flow paths
- Loss of opportunity due to development
- Likely degradation in water quality and increase on peak flow and volume from greater impervious areas and filling low lying areas during development
- Land instability likely related to stormwater infrastructure
- Golf course looking for water for irrigation purposes
- Lack of control on stormwater volumes, velocities and erosion leading to an increased risk of erosion at the outlet
- Proposed and existing development with primary stormwater system (pipe and open channel) and secondary overland flow paths or ponding systems constructed on high groundwater table with low lying land subject to tidal backwater effects
- Taranui Road piped system outlet submerged almost to pipe overtop
- Road crossing forms a constraint on flood levels. Mangawhai Heads Road dual culvert capacity restrictions
- Existing stormwater pipes or channel located on site but not identified in KDC GIS and therefore performance unable to be quantified
- Risk of coastal outfall blocking
- Existing rural zone land (outside of existing urban zoning) considered for more intensive development
- Existing development (Northcoast development) and future development (Butlers) designed to rely on soakage system with overflows to the Northcoast development pond
- Changes in primary drainage due to roading upgrades to discharge to undersized stormwater reticulation which eventually discharges to stormwater at Jack Boyd Drive
- Manage flows across Molesworth Drive from the Estuary Estates Structure Plan
- Blind hollow back of Mangawhai Activity Zone
- Northcoast pond has historically soaked away via infiltration through the base. Currently infiltration is not happening increasing downstream peak flow rates frequency and volume discharging to low lying land at Jack Boyd Drive
- Wetland behind the Museum site being filled

**Key to Mangawhai Stormwater Issues:**

- Existing privately owned stormwater infrastructure the performance of which is unknown and which has effects on downstream public assets
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012.25 50 75 100 Meters

**Stage 1 Study Area**  
**Stage 2 Study Area**  
**Catchment Boundary**  
**Catchment Number**  
**Issue Number, Count (27)**  
**Out of study area**  
**General Layers**  
**Map Grid**

**KDC Request 2008-16**  
Cause / Effect (Reports Count)  
Block, Open/Building FI (0)  
Block, Open/Land FI (1)  
Block, Pipe/Building FI (0)  
Block, Pipe/Land FI (1)  
Soakage/Building FI (0)  
Soakage/Land FI (1)  
Ponding Areas (MWH 2015)  
Identified Ponding (GHD 2016)

**Proposed Pipes (CMP 2006)**  
**Flooding Risk (CMP 2006)**  
Assesst Result  
Flooding Risk - Likely (MWH 2015)  
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**RiskProperties**  
NRC Potentially Affected Properties  
Likely  
Possible  
Unlikely

**Plan Zones**  
Plan Type  
Commercial  
Estuary Estates  
Industrial  
Residential  
Unformed Road  
**Expansion Commercial Zones**  
Zone Use (TCP 2016)  
Commercial Zone

**Proposed New Commercial Zone**  
Unformed Road  
**Stormwater Assests**  
Assest Type  
CatchPit  
Dummy Node  
Inlet  
Manhole  
Outlet  
Soakpit

Sump  
Catchpit Lead  
Creek  
Culvert  
Drain  
Gravity Main  
Open Drain  
Overland flowpath  
Service  
Swale Drain  
Unknown

MapTitle: **STORMWATER ISSUES PLAN - MANGAWHAI**

Project: **Mangawhai CMP**

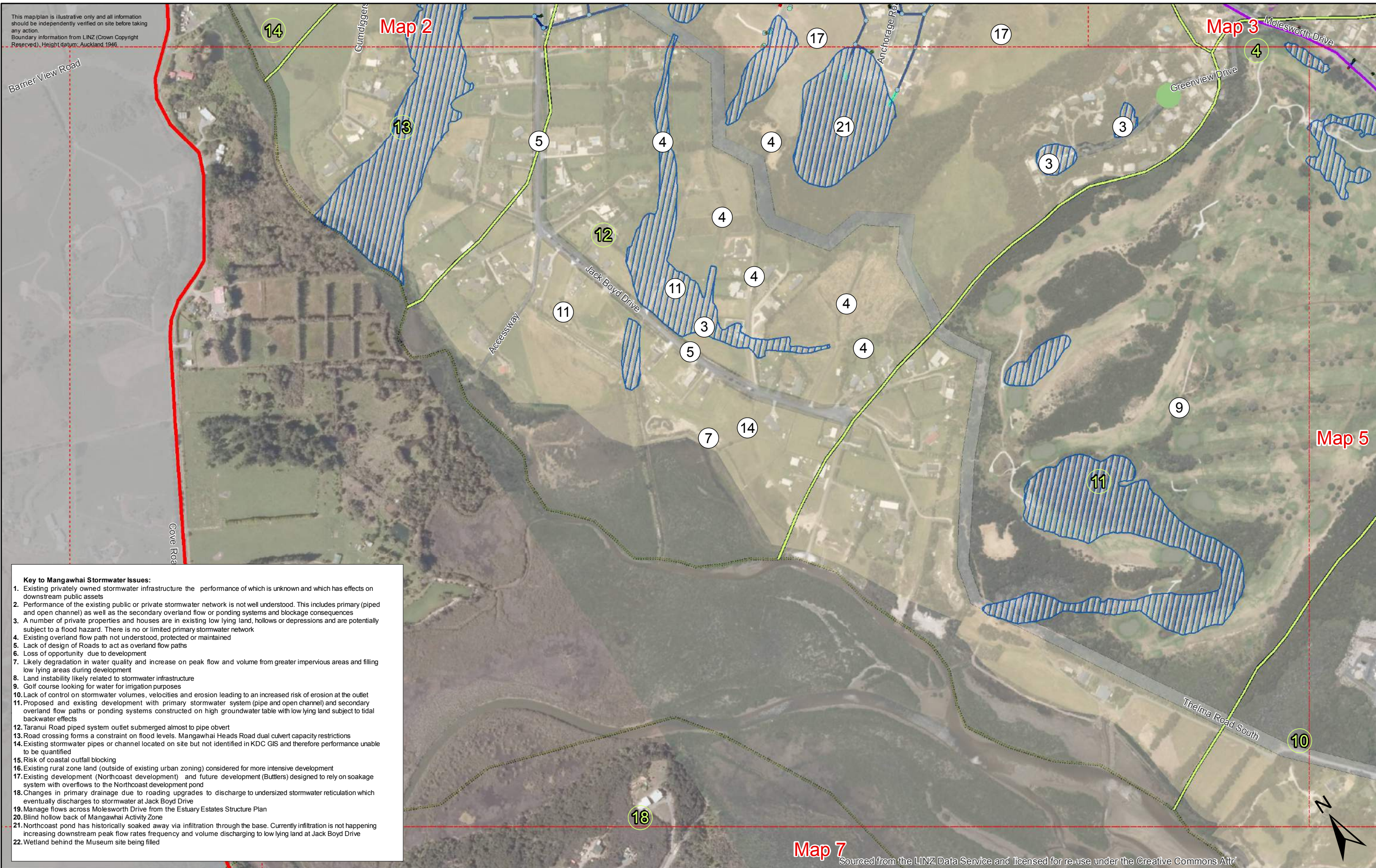
Map: 2	Designed: PM	Drawing Number	Map 2
Scale: 1:5,000	Drawn: MH	Status	FINAL
Size: A3	Checked: GL	Rev	0
Date: 8/05/2018	Approved: AL		







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Boundary information from LINZ (Crown Copyright Reserved), Height datum: Auckland 1946



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**Stage 2 Study Area**  
**Catchment Boundary**  
**Catchment Number**  
**Issue Number, Count (19)**  
**Out of study area**  
**General Layers**  
**Map Grid**

**KDC Request 2008-16**  
Cause / Effect (Reports Count)  
Block, Open/Building FI (1)  
Block, Open/Land FI (0)  
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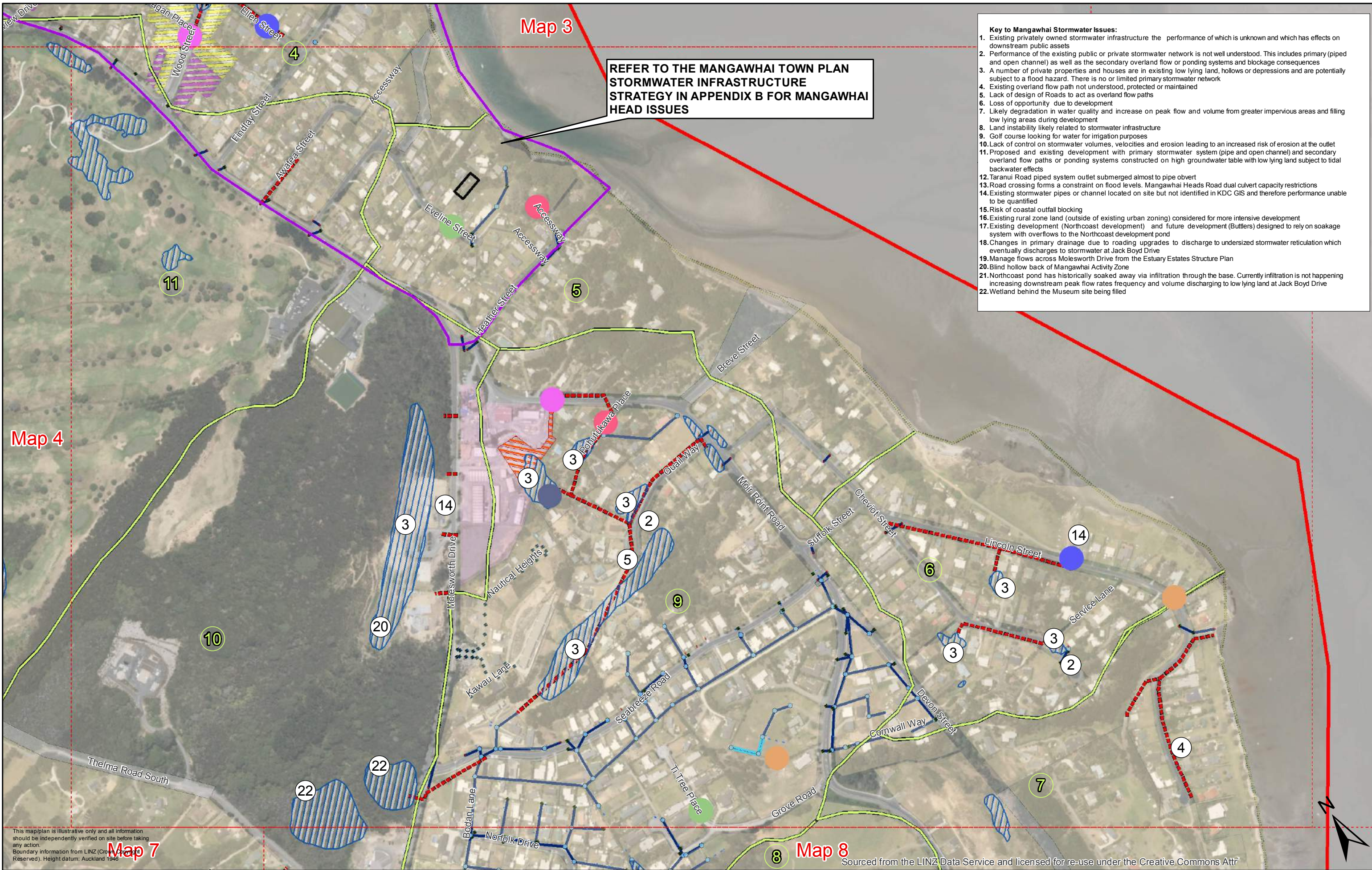
**Swale Drain**  
Unknown

MapTitle: **STORMWATER ISSUES PLAN - MANGAWHAI**

Project: **Mangawhai CMP**

Map: 4	Designed: PM	Drawing Number	Map 4
Scale: 1:5,000	Drawn: MH	Status	FINAL
Size: A3	Checked: GL	Rev	0
Date: 8/05/2018	Approved: AL		





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012.25 50 75 100 Meters

**Map 7**

**Map 8**

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**Map 4**

**Map 3**

**Map 5**

**Map 6**

**Map 7**

**Map 8**

**Map 9**

**Map 10**

**Map 11**

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**Map 13**

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**Map 18**

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**Map 599**

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**Map 633**

**Map 634**

**Map 635**

**Map 636**

**Map 637**

**Map 638**

**Map 639**

**Map 640**

**Map 641**

**Map 642**

**Map 643**

**Map 644**

**Map 645**

**Map 646**</



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Map 4

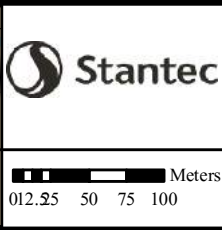
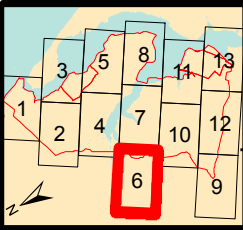
Map 7

18

Map 10

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- Stage 1 Study Area
  - Stage 2 Study Area
  - Catchment Boundary
  - Catchment Number
  - Issue Number, Count (0)
  - Out of study area
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- Map Grid

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- Flooding Risk (CMP 2006)**
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- NRC Potentially Affected Properties
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  - Possible
  - Unlikely

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- Plan Type
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  - Estuary Estates
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  - Unformed Road
- Expansion Comercial Zones**
- Zone Use (TCP 2016)
- Commercial Zone

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- Assest Type
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- Sump
- Catchpit Lead
- Creek
- Culvert
- Drain
- Gravity Main
- Open Drain
- Overland flowpath
- Service
- Swale Drain
- Unknown

MapTitle: <b>STORMWATER ISSUES PLAN - MANGAWHAI</b>				
Project: <b>Mangawhai CMP</b>				
Map:	6	Designed:	PM	Drawing Number <b>Map 6</b>
Scale:	1:5,000	Drawn:	MH	
Size:	A3	Checked:	GL	Status <b>FINAL</b>
Date:	8/05/2018	Approved:	AL	
			Rev	0





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  - Performance of the existing public or private stormwater network is not well understood. This includes primary (piped and open channel) as well as the secondary overland flow or ponding systems and blockage consequences
  - A number of private properties and houses are in existing low lying land, hollows or depressions and are potentially subject to a flood hazard. There is no or limited primary stormwater network
  - Existing overland flow path not understood, protected or maintained
  - Lack of design of Roads to act as overland flow paths
  - Loss of opportunity due to development
  - Likely degradation in water quality and increase on peak flow and volume from greater impervious areas and filling low lying areas during development
  - Land instability likely related to stormwater infrastructure
  - Golf course looking for water for irrigation purposes
  - Lack of control on stormwater volumes, velocities and erosion leading to an increased risk of erosion at the outlet
  - Proposed and existing development with primary stormwater system (pipe and open channel) and secondary overland flow paths or ponding systems constructed on high groundwater table with low lying land subject to tidal backwater effects
  - Taranui Road piped system outlet submerged almost to pipe overtop
  - Road crossing forms a constraint on flood levels. Mangawhai Heads Road dual culvert capacity restrictions
  - Existing stormwater pipes or channel located on site but not identified in KDC GIS and therefore performance unable to be quantified
  - Risk of coastal outfall blocking
  - Existing rural zone land (outside of existing urban zoning) considered for more intensive development
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  - Manage flows across Molesworth Drive from the Estuary Estates Structure Plan
  - Blind hollow back of Mangawhai Activity Zone
  - Northcoast pond has historically soaked away via infiltration through the base. Currently infiltration is not happening increasing downstream peak flow rates frequency and volume discharging to low lying land at Jack Boyd Drive
  - Wetland behind the Museum site being filled

012.25 50 75 100 Meters

**Stage 1 Study Area**  
**Stage 2 Study Area**  
**Catchment Boundary**  
**Catchment Number**  
**Issue Number. Count (2)**  
**Out of study area**  
**General Layers**  
**Map Grid**

**KDC Request 2008-16**  
Cause / Effect (Reports Count)  
● Block. Open/Building FI (0)  
● Block. Open/Land FI (0)  
● Block. Pipe/Building FI (0)  
● Block. Pipe/Land FI (0)  
● Soakage/Building FI (0)  
● Soakage/Land FI (0)  
● Ponding Areas (MWH 2015)  
■ Identified Ponding (GHD 2016)

**Proposed Pipes (CMP 2006)**  
**Flooding Risk (CMP 2006)**  
Assest Result  
■ Flooding Risk - Likely (MWH 2015)  
■ Flooding Risk - Possibly (MWH 2015)  
**Risk Properties**  
NRC Potentially Affected Properties  
■ Likely  
■ Possible  
■ Unlikely

**Plan Zones**  
Plan Type  
■ Commercial  
■ Estuary Estates  
■ Industrial  
■ Residential  
■ Unformed Road  
**Expansion Commercial Zones**  
Zone Use (TCP 2016)  
■ Commercial Zone

**Proposed New Comercial Zone**  
■ Unformed Road  
**Stormwater Assests**  
Assest Type  
■ CatchPit  
■ Dummy Node  
● Inlet  
● Manhole  
● Outlet  
■ Soakpit

● Sump  
— Catchpit Lead  
— Creek  
— Culvert  
— Drain  
— Gravity Main  
— Open Drain  
— Overland flowpath  
— Service  
— Swale Drain  
— Unknown

MapTitle: **STORMWATER ISSUES PLAN - MANGAWHAI**

Project: **Mangawhai CMP**

Map: 7	Designed: PM	Drawing Number	Map 7
Scale: 1:5,000	Drawn: MH	Status	FINAL
Size: A3	Checked: GL	Rev	0
Date: 8/05/2018	Approved: AL		



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Map 5

Map 7

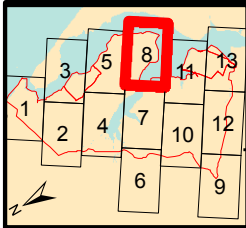
Map 11

**Key to Mangawhai Stormwater Issues:**

- Existing privately owned stormwater infrastructure the performance of which is unknown and which has effects on downstream public assets
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012.25 50 75 100 Meters

Stage 1 Study Area

Stage 2 Study Area

Catchment Boundary

Catchment Number

Issue Number, Count (18)

Out of study area

General Layers

Map Grid

**KDC Request 2008-16**

Cause / Effect (Reports Count)

Block, Open/Building FI (1)

Block, Open/Land FI (0)

Block, Pipe/Building FI (0)

Block, Pipe/Land FI (1)

Soakage/Building FI (0)

Soakage/Land FI (0)

Ponding Areas (MWH 2015)

Identified Ponding (GHD 2016)

**Proposed Pipes (CMP 2006)**

**Flooding Risk (CMP 2006)**

Assesst Result

Flooding Risk - Likely (MWH 2015)

Flooding Risk - Possibly (MWH 2015)

**RiskProperties**

NRC Potentially Affected Properties

Likely

Possible

Unlikely

**Plan Zones**

Plan Type

Commercial

Estuary Estates

Industrial

Residential

Unformed Road

**Expansion Commercial Zones**

Zone Use (TCP 2016)

Commercial Zone

**Proposed New Comercial Zone**

Unformed Road

**Stormwater Assests**

Assest Type

CatchPit

Dummy Node

Inlet

Manhole

Outlet

Soakpit

Sump

Catchpit Lead

Creek

Culvert

Drain

Gravity Main

Open Drain

Overland flowpath

Service

Swale Drain

Unknown

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MapTitle: <b>STORMWATER ISSUES PLAN - MANGAWHAI</b>				
Project: <b>Mangawhai CMP</b>				
Map: 8	Designed: PM	Drawing Number Map 8		
Scale: 1:5,000	Drawn: MH			
Size: A3	Checked: GL	Status	Rev	
Date: 8/05/2018	Approved: AL	<b>FINAL</b>	<b>0</b>	



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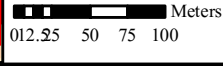
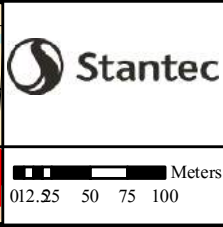
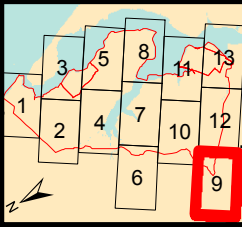
Map 10

Map 12

Key to Mangawhai Stormwater Issues:

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**Stage 1 Study Area**  
**Stage 2 Study Area**  
Catchment Boundary  
Catchment Number  
Issue Number, Count (0)  
Out of study area  
**General Layers**  
Map Grid

**KDC Request 2008-16**  
Cause / Effect (Reports Count)  
Block. Open/Building FI (0)  
Block. Open/Land FI (0)  
Block. Pipe/Building FI (0)  
Block. Pipe/Land FI (0)  
Soakage/Building FI (0)  
Soakage/Land FI (0)  
Ponding Areas (MWH 2015)  
Identified Ponding (GHD 2016)

**Flooding Risk (CMP 2006)**  
Assesst Result  
Flooding Risk - Likely (MWH 2015)  
Flooding Risk - Possibly (MWH 2015)  
**Risk Properties**  
NRC Potentially Affected Properties  
Likely  
Possible  
Unlikely

**Plan Zones**  
Plan Type  
Commercial  
Estuary Estates  
Industrial  
Residential  
Unformed Road  
**Expansion Comercial Zones**  
Zone Use (TCP 2016)  
Comercial Zone

**Proposed New Comercial Zone**  
Unformed Road  
**Stormwater Assests**  
Assest Type  
CatchPit  
Dummy Node  
Inlet  
Manhole  
Outlet  
Soakpit

Sump  
Catchpit Lead  
Creek  
Culvert  
Drain  
Gravity Main  
Open Drain  
Overland flowpath  
Service  
Swale Drain  
Unknown

MapTitle: **STORMWATER ISSUES PLAN - MANGAWHAI**

Project: **Mangawhai CMP**

Map: 9	Designed: <b>PM</b>	Drawing Number	
Scale: 1:5,000	Drawn: <b>MH</b>	Map 9	
Size: A3	Checked: <b>GL</b>	Status	Rev
Date: 8/05/2018	Approved: <b>AL</b>	<b>FINAL</b>	<b>0</b>



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Map 6

Map 7

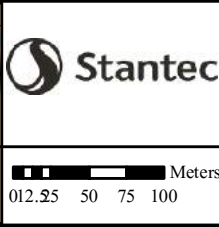
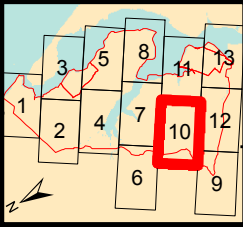
Map 11

Map 12

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- Wetland behind the Museum site being filled



- Stage 1 Study Area
- Stage 2 Study Area
- Catchment Boundary
- Catchment Number
- Issue Number, Count (0)
- Out of study area
- General Layers
- Map Grid

- KDC Request 2008-16**  
Cause / Effect (Reports Count)
- Block. Open/Building FI (0)
  - Block. Open/Land FI (0)
  - Block. Pipe/Building FI (0)
  - Block. Pipe/Land FI (0)
  - Soakage/Building FI (0)
  - Soakage/Land FI (0)
  - Ponding Areas (MWH 2015)
  - Identified Ponding (GHD 2016)

- Proposed Pipes (CMP 2006)**  
**Flooding Risk (CMP 2006)**  
Assesst Result
- Flooding Risk - Likely (MWH 2015)
  - Flooding Risk - Possibly (MWH 2015)
  - Risk Properties**  
NRC Potentially Affected Properties
  - Likely
  - Possible
  - Unlikely

- Plan Zones**  
Plan Type
- Commercial
  - Estuary Estates
  - Industrial
  - Residential
  - Unformed Road
  - Expansion Commercial Zones  
Zone Use (TCP 2016)
  - Commercial Zone

- Proposed New Commercial Zone**  
Unformed Road
- Stormwater Assests**  
Assest Type
- CatchPit
  - Dummy Node
  - Inlet
  - Manhole
  - Outlet
  - Soakpit

- Sump
- Catchpit Lead
- Creek
- Culvert
- Drain
- Gravity Main
- Open Drain
- Overland flowpath
- Service
- Swale Drain
- Unknown

MapTitle: <b>STORMWATER ISSUES PLAN - MANGAWHAI</b>					
Project: <b>Mangawhai CMP</b>					
Map:	10	Designed:	PM	Drawing Number	
Scale:	1:5,000	Drawn:	MH	Map 10	
Size:	A3	Checked:	GL	Status	Rev
Date:	8/05/2018	Approved:	AL	<b>FINAL</b>	<b>0</b>



Map 7

Map 8

- Key to Mangawhai Stormwater Issues:**
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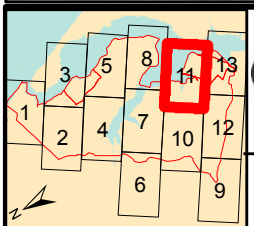
REFER TO THE MANGAWHAI TOWN PLAN  
STORMWATER INFRASTRUCTURE STRATEGY IN  
APPENDIX B FOR MANGAWHAI VILLAGE ISSUES

Map 10

Map 12

Map 13

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**Stantec**

0 25 50 75 100 Meters

- Stage 1 Study Area
- Stage 2 Study Area
- Catchment Boundary
- Catchment Number
- Issue Number, Count (4)
- Out of study area
- General Layers
- Map Grid

- KDC Request 2008-16**  
Cause / Effect (Reports Count)
- Block, Open/Building FI (0)
  - Block, Open/Land FI (2)
  - Block, Pipe/Building FI (2)
  - Block, Pipe/Land FI (2)
  - Soakage/Building FI (0)
  - Soakage/Land FI (0)
  - Ponding Areas (MWH 2015)
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Assesst Result
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NRC Potentially Affected Properties
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  - Estuary Estates
  - Industrial
  - Residential
  - Unformed Road
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Zone Use (TCP 2016)
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- Proposed New Commercial Zone**  
Unformed Road
- Stormwater Assessts**  
Assesst Type
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  - Dummy Node
  - Inlet
  - Manhole
  - Outlet
  - Soakpit

- Sump
- Catchpit Lead
- Creek
- Culvert
- Drain
- Gravity Main
- Open Drain
- Overland flowpath
- Service
- Swale Drain
- Unknown

Map Title: <b>STORMWATER ISSUES PLAN - MANGAWHAI</b>				
Project: <b>Mangawhai CMP</b>				
Map:	11	Designed:	PM	Drawing Number
Scale:	1:5,000	Drawn:	MH	Map 11
Size:	A3	Checked:	GL	Status
Date:	8/05/2018	Approved:	AL	Rev
				FINAL
				0



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Boundary information from LINZ (Crown Copyright Reserved), Height datum: Auckland 1946

Map 10

Map 11

Map 9

Map 13

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012.25 50 75 100 Meters

**Stage 1 Study Area**  
**Stage 2 Study Area**  
**Catchment Boundary**  
**Catchment Number**  
**Issue Number, Count (2)**  
**Out of study area**  
**General Layers**  
**Map Grid**

**KDC Request 2008-16**  
Cause / Effect (Reports Count)  
Block. Open/Building FI (0)  
Block. Open/Land FI (0)  
Block. Pipe/Building FI (0)  
Block. Pipe/Land FI (0)  
Soakage/Building FI (0)  
Soakage/Land FI (0)  
Ponding Areas (MWH 2015)  
Identified Ponding (GHD 2016)

**Flooding Risk (CMP 2006)**  
Assesst Result  
Flooding Risk - Likely (MWH 2015)  
Flooding Risk - Possibly (MWH 2015)  
**Risk Properties**  
NRC Potentially Affected Properties  
Likely  
Possible  
Unlikely

**Plan Zones**  
Plan Type  
Commercial  
Estuary Estates  
Industrial  
Residential  
Unformed Road  
**Expansion Commercial Zones**  
Zone Use (TCP 2016)  
Commercial Zone

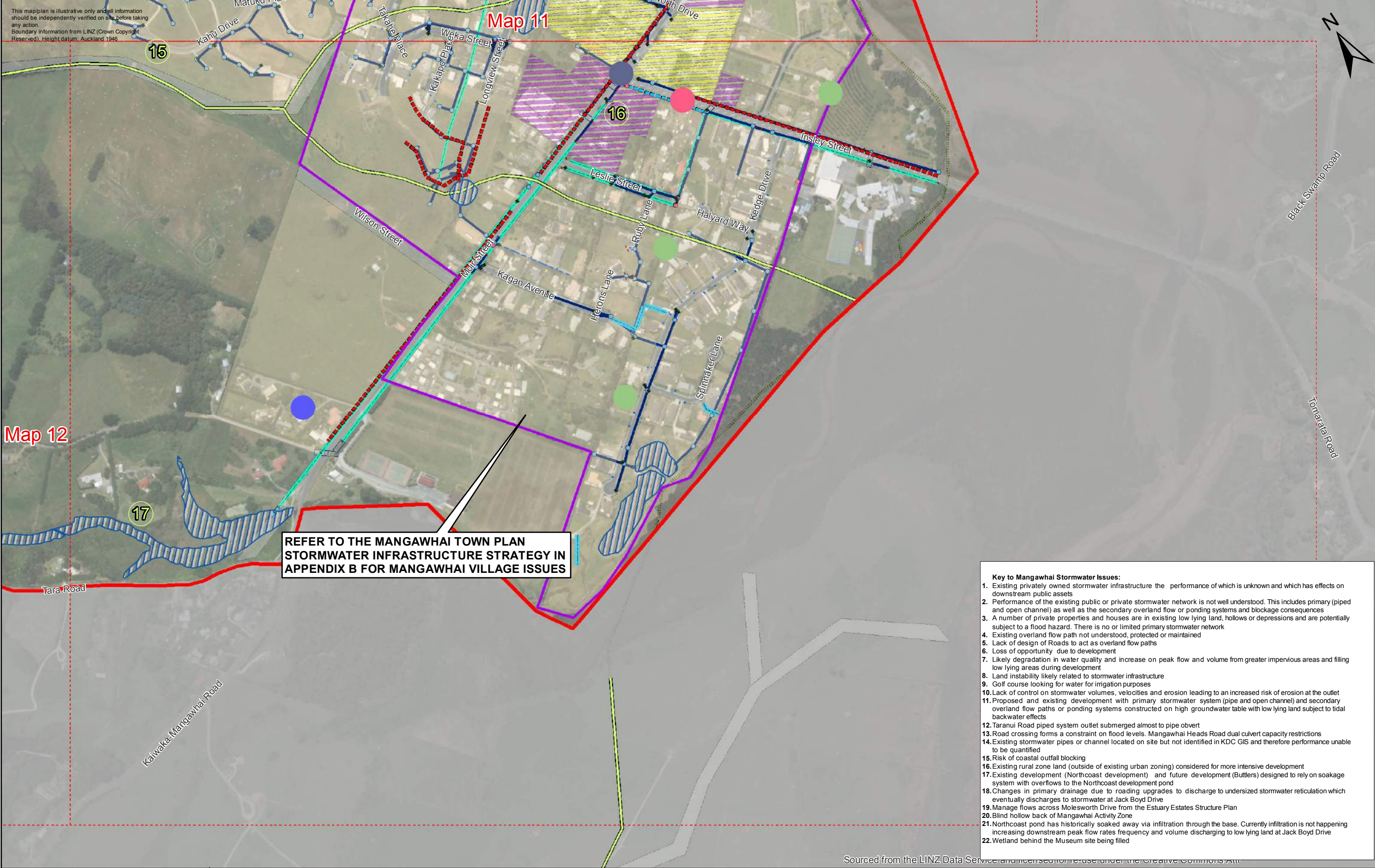
**Proposed Pipes (CMP 2006)**  
**Stormwater Assests**  
Assesst Type  
CatchPit  
Dummy Node  
Inlet  
Manhole  
Outlet  
Soakpit

**Proposed New Comercial Zone**  
Unformed Road  
**Drain**  
Catchpit Lead  
Creek  
Culvert  
Gravity Main  
Open Drain  
Overland flowpath  
Service

**MapTitle:**  
**STORMWATER ISSUES PLAN - MANGAWHAI**  
**Project:**  
**Mangawhai CMP**  
Map: 12  
Scale: 1:5,000  
Size: A3  
Date: 8/05/2018  
Designed: PM  
Drawn: MH  
Checked: GL  
Approved: AL  
Drawing Number: Map 12  
Status: FINAL  
Rev: 0



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REFER TO THE MANGAWHAI TOWN PLAN  
STORMWATER INFRASTRUCTURE STRATEGY IN  
APPENDIX B FOR MANGAWHAI VILLAGE ISSUES

- Key to Mangawhai Stormwater Issues:**
- Existing privately owned stormwater infrastructure the performance of which is unknown and which has effects on downstream public assets
  - Performance of the existing public or private stormwater network is not well understood. This includes primary (piped and open channel) as well as the secondary overland flow or ponding systems and blockage consequences
  - A number of private properties and houses are in existing low lying land, hollows or depressions and are potentially subject to a flood hazard. There is no or limited primary stormwater network
  - Existing overland flow path not understood, protected or maintained
  - Lack of design of Roads to act as overland flow paths
  - Loss of opportunity due to development
  - Likely degradation in water quality and increase on peak flow and volume from greater impervious areas and filling low lying areas during development
  - Land instability likely related to stormwater infrastructure
  - Golf course looking for water for irrigation purposes
  - Lack of control on stormwater volumes, velocities and erosion leading to an increased risk of erosion at the outlet
  - Proposed and existing development with primary stormwater system (pipe and open channel) and secondary overland flow paths or ponding systems constructed on high groundwater table with low lying land subject to tidal backwater effects
  - Taranui Road piped system outlet submerged almost to pipe overtop
  - Road crossing forms a constraint on flood levels. Mangawhai Heads Road dual culvert capacity restrictions
  - Existing stormwater pipes or channel located on site but not identified in KDC GIS and therefore performance unable to be quantified
  - Risk of coastal outfall blocking
  - Existing rural zone land (outside of existing urban zoning) considered for more intensive development
  - Existing development (Northcoast development) and future development (Butlers) designed to rely on soakage system with overflows to the Northcoast development pond
  - Changes in primary drainage due to roading upgrades to discharge to undersized stormwater reticulation which eventually discharges to stormwater at Jack Boyd Drive
  - Manage flows across Molesworth Drive from the Estuary Estates Structure Plan
  - Blind hollow back of Mangawhai Activity Zone
  - Northcoast pond has historically soaked away via infiltration through the base. Currently infiltration is not happening increasing downstream peak flow rates frequency and volume discharging to low lying land at Jack Boyd Drive
  - Wetland behind the Museum site being filled

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012.25 50 75 100 Meters

**Map 13**

1 2 3 4 5 6 7 8 9 10 11 12 13

**Stage 1 Study Area**  
Stage 2 Study Area  
Catchment Boundary  
Catchment Number  
Issue Number, Count (0)  
Out of study area  
**General Layers**  
Map Grid

**KDC Request 2008-16**  
Cause / Effect (Reports Count)  
Block, Open/Building FI (3)  
Block, Open/Land FI (1)  
Block, Pipe/Building FI (1)  
Block, Pipe/Land FI (1)  
Soakage/Building FI (0)  
Soakage/Land FI (0)  
Ponding Areas (MWH 2015)  
Identified Ponding (GHD 2016)

**Flooding Risk (CMP 2006)**  
Assesst Result  
Flooding Risk - Likely (MWH 2015)  
Flooding Risk - Possibly (MWH 2015)  
**Risk Properties**  
NRC Potentially Affected Properties  
Likely  
Possible  
Unlikely

**Plan Zones**  
Plan Type  
Commercial  
Estuary Estates  
Industrial  
Residential  
Unformed Road  
**Expansion Commercial Zones**  
Zone Use (TCP 2016)  
Commercial Zone

**Proposed New Commercial Zone**  
Unformed Road  
**Stormwater Assessts**  
Assesst Type  
CatchPit  
Dummy Node  
Inlet  
Manhole  
Outlet  
Soakpit

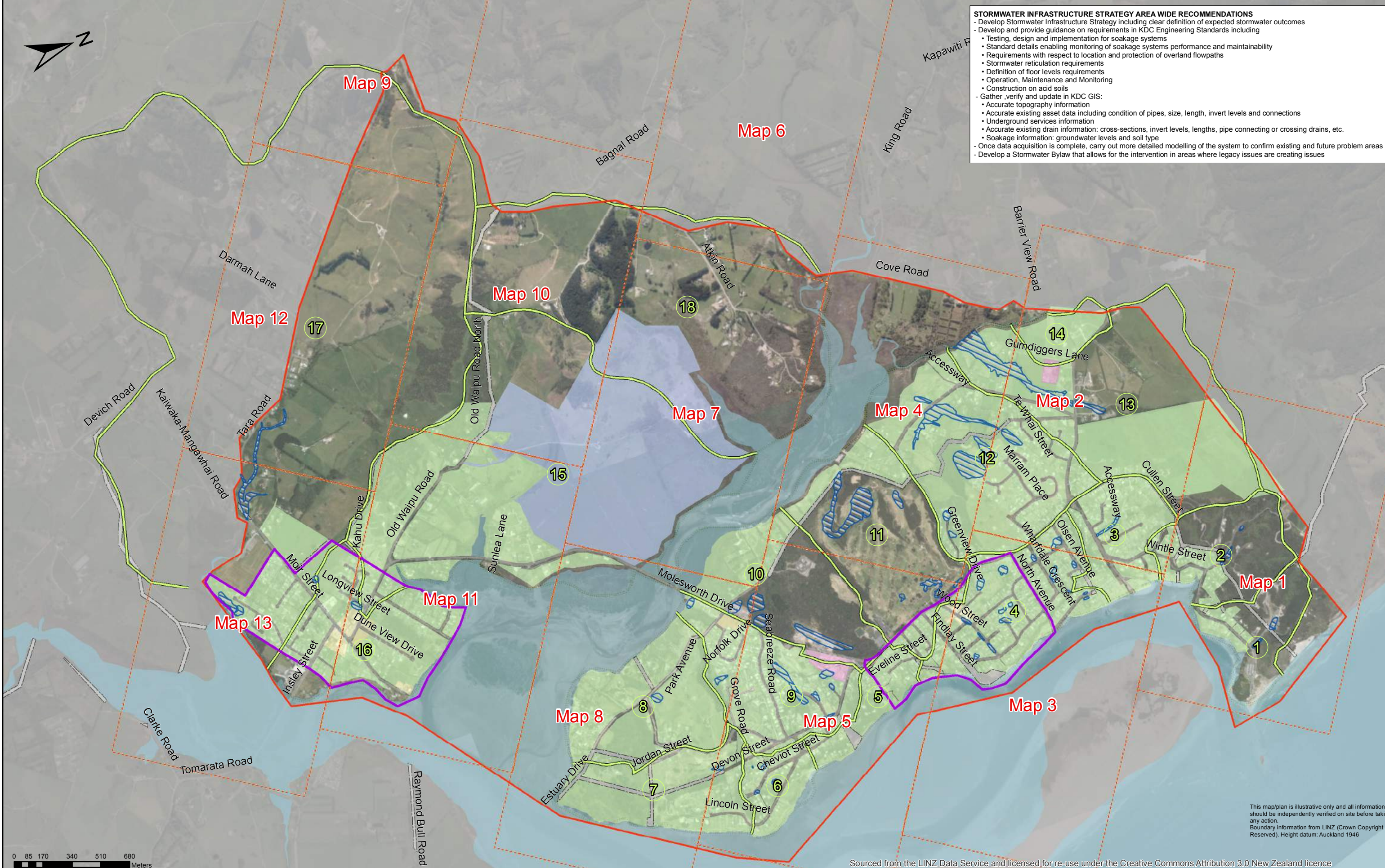
Sump  
Catchpit Lead  
Creek  
Culvert  
Drain  
Gravity Main  
Open Drain  
Overland flowpath  
Service

**Map Title:**  
**STORMWATER ISSUES PLAN - MANGAWHAI**  
**Project:**  
**Mangawhai CMP**  
**Map:** 13  
**Scale:** 1:5,000  
**Size:** A3  
**Date:** 8/05/2018  
**Designed:** PM  
**Drawn:** MH  
**Checked:** GL  
**Approved:** AL  
**Drawing Number:** Map 13  
**Status:** FINAL  
**Rev:** 0



# Appendix G   Stormwater management recommendations plans

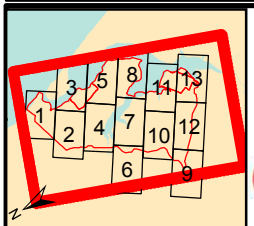




- STORMWATER INFRASTRUCTURE STRATEGY AREA WIDE RECOMMENDATIONS**
- Develop Stormwater Infrastructure Strategy including clear definition of expected stormwater outcomes
  - Develop and provide guidance on requirements in KDC Engineering Standards including
    - Testing, design and implementation for soakage systems
    - Standard details enabling monitoring of soakage systems performance and maintainability
    - Requirements with respect to location and protection of overland flowpaths
    - Stormwater reticulation requirements
    - Definition of floor levels requirements
    - Operation, Maintenance and Monitoring
    - Construction on acid soils
  - Gather, verify and update in KDC GIS:
    - Accurate topography information
    - Accurate existing asset data including condition of pipes, size, length, invert levels and connections
    - Underground services information
    - Accurate existing drain information: cross-sections, invert levels, lengths, pipe connecting or crossing drains, etc.
    - Soakage information: groundwater levels and soil type
  - Once data acquisition is complete, carry out more detailed modelling of the system to confirm existing and future problem areas
  - Develop a Stormwater Bylaw that allows for the intervention in areas where legacy issues are creating issues

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- General Layers**
- Map Grid
  - Catchment Number
  - Stage 1 Study Area
  - Stage 2 Study Area
  - Ponding Areas (MWH 2015)
  - Out of study area
  - LINZ - Hydroparcel
- Plan Zones**
- Plan Type**
- Commercial
  - Estuary Estates
  - Industrial
  - Residential
  - Unformed Road
- Catchment Boundary**

MapTitle: <b>STORMWATER RECOMMENDATIONS PLAN</b>				
Project: <b>Mangawhai CMP</b>				
Map:		Designed: <b>MH</b>	Drawing Number	
Scale: <b>1:20,000</b>		Drawn: <b>MH</b>	Keymap - Mangawhai	
Size: <b>A3</b>		Checked: <b>PM</b>	Status	Rev
Date: <b>6/03/2018</b>		Approved: <b>AL</b>	<b>FINAL</b>	<b>0</b>



- STORMWATER INFRASTRUCTURE STRATEGY AREA WIDE RECOMMENDATIONS**
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    - Standard details enabling monitoring of soakage systems performance and maintainability
    - Requirements with respect to location and protection of overland flowpaths
    - Stormwater reticulation requirements
    - Definition of floor levels requirements
    - Standard details enabling construction of stormwater systems on acid soils, monitoring and maintainability
    - Standard details enabling blue-green infrastructure, monitoring and maintainability
  - Operation, Maintenance and Monitoring
  - Gather, verify and update KDC GIS:
    - Accurate topography information
    - Accurate existing asset data including condition of pipes, size, length, invert levels and connections
    - Underground service information
    - Accurate existing drain information: cross-sections, invert levels, lengths, pipes, pipe connecting or crossing drains, etc.
    - Soakage information: ground level and soil type
    - Existing overland flowpaths
  - Once data acquisition is complete, carry out more detailed modelling of the system to confirm quantification of existing and future problems areas, ponding areas, overland flow paths, floodplains and network constraints
  - Develop a Stormwater Bylaw that allows for the intervention in areas where legacy issues require resolution

- KEY TO SITE SPECIFIC RECOMMENDATIONS, REFER TABLE 1 FOR DETAILS:**
- -Identify and map in KDC GIS existing overland flowpaths. Formalise and protect existing overland flowpaths
    - Note, not all overland flowpaths have been identified in this plan
  - -On-going operation and maintenance plan
  - -Upgrade existing stormwater pipes
  - -New stormwater pipe
    - Limit further development until mitigation measures are in place unless developers can demonstrate both on-site and off-site effects are managed by the proposal for the long term
  - -New Erosion Protection Structure
  - -More accurate information on existing assets
    - Provide guidance to owners/developers on operation, maintenance and monitoring strategies
    - Water treatment and/or volume reduction requirements as part of development
    - Provide guidance to owners/developers for enhanced soakage systems
  - -Rural land draining to urban or future urban areas. Guidance and planning rules required to mitigate impacts of development of this land
  - ⊕ -Allow to fill hollow to drain to road during redevelopment
  - ▲ -Upgrade outlet to beach
  - ① -Include discharges to golf course or downstream in modelling
  - ② -Upgrade existing pond to achieve water quality, attenuation and amenity outcomes

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**General Layers**

- Map Grid
- Ponding Areas (MWH 2015)
- Stage 1 Study Area
- Stage 2 Study Area
- Risk Properties**
- NRC Potentially Affected Properties
- Likely
- Possible
- Unlikely

**Flooding Risk (CMP 2006)**

Assesst Result

- Flooding Risk - Likely (MWH 2015)
- Flooding Risk - Possibly (MWH 2015)
- Identified Ponding (GHD 2016)
- Proposed Pipes (CMP 2006)
- Catchment Number

**TownPlan\_MediumExpansionComercialZones**

Zone Use (TCP 2016)

- Commercial Zone
- Proposed New Commercial Zone
- Unformed Road

**Plan Zones**

Plan Type

- Commercial
- Estuary Estates
- Industrial

**Residential**

- Residential
- Unformed Road

**Stormwater Assests**

Assest Type

- CatchPit
- Dummy Node
- Inlet
- Manhole
- Outlet
- Soakpit
- Sump
- Catchpit Lead
- Creek
- Culvert
- Drain
- Gravity Main
- Open Drain
- Overland flowpath
- Service
- Swale Drain
- Unknown
- Out of Study Area

MapTitle: **STORMWATER RECOMMENDATIONS PLAN - MANGAWHAI**

Project: **Mangawhai CMP**

Map:	1	Designed:	PM	Drawing Number	Map 1
Scale:	1:5,000	Drawn:	MH	Status	FINAL
Size:	A3	Checked:	GL	Rev	0
Date:	7/05/2018	Approved:	AL		

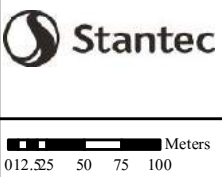
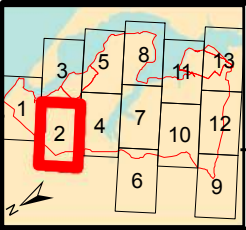


- STORMWATER INFRASTRUCTURE STRATEGY AREA WIDE RECOMMENDATIONS**
- Develop Stormwater Infrastructure Strategy including clear definition of expected stormwater outcomes.
  - Develop and provide guidance on requirements in KDC Engineering Standards including
    - Testing, design and implementation for soakage systems
    - Standard details enabling monitoring of soakage systems performance and maintainability
    - Requirements with respect to location and protection of overland flowpaths
    - Stormwater reticulation requirements
    - Definition of floor levels requirements
    - Standard details enabling construction of stormwater systems on acid soils, monitoring and maintainability
    - Standard details enabling blue-green infrastructure, monitoring and maintainability
  - Operation, Maintenance and Monitoring
  - Gather, verify and update KDC GIS:
    - Accurate topography information
    - Accurate existing asset data including condition of pipes, size, length, invert levels and connections
    - Underground service information
    - Accurate existing drain information: cross-sections, invert levels, lengths, pipes, pipe connecting or crossing drains, etc.
    - Soakage information: ground level and soil type
    - Existing overland flowpaths
  - Once data acquisition is complete, carry out more detailed modelling of the system to confirm quantification of existing and future problems areas, ponding areas, overland flow paths, floodplains and network constraints
  - Develop a Stormwater Bylaw that allows for the intervention in areas where legacy issues require resolution

REDIRECT FLOWS FROM  
CATCHMENT 13 TO 14  
CATCHMENT BOUNDARY  
CHANGE

REDIRECT FLOWS FROM  
CATCHMENT 12 TO 13  
CATCHMENT BOUNDARY  
CHANGE

- KEY TO SITE SPECIFIC RECOMMENDATIONS, REFER TABLE 1 FOR DETAILS:**
- Identify and map in KDC GIS existing overland flowpaths. Formalise and protect existing overland flowpaths
    - Note, not all overland flowpaths have been identified in this plan
  - On-going operation and maintenance plan
  - Upgrade existing stormwater pipes
  - New stormwater pipe
  - Limit further development until mitigation measures are in place unless developers can demonstrate both on-site and off-site effects are managed by the proposal for the long term
  - New Erosion Protection Structure
  - More accurate information on existing assets
  - Provide guidance to owners/developers on operation, maintenance and monitoring strategies
  - Water treatment and/or volume reduction requirements as part of development
  - Provide guidance to owners/developers for enhanced soakage systems
  - Rural land draining to urban or future urban areas. Guidance and planning rules required to mitigate impacts of development of this land
  - Allow to fill hollow to drain to road during redevelopment
  - Upgrade outlet to beach
  - Include discharges to golf course or downstream in modelling
  - Upgrade existing pond to achieve water quality, attenuation and amenity outcomes



**General Layers**

- Map Grid
- Ponding Areas (MWH 2015)
- Stage 1 Study Area
- Stage 2 Study Area
- Risk Properties**
- NRC Potentially Affected Properties
- Likely
- Possible
- Unlikely

**Flooding Risk (CMP 2006)**

Assess Result

- Flooding Risk - Likely (MWH 2015)
- Flooding Risk - Possibly (MWH 2015)
- Identified Ponding (GHD 2016)
- Proposed Pipes (CMP 2006)
- Catchment Number

**TownPlan\_MediumExpansionCommercialZones**

Zone Use (TCP 2016)

- Commercial Zone
- Proposed New Commercial Zone
- Unformed Road
- Plan Zones
- Plan Type
- Commercial
- Estuary Estates
- Industrial

**Stormwater Assets**

Asset Type

- CatchPit
- Dummy Node
- Inlet
- Manhole
- Outlet
- Soakpit
- Culvert
- Drain
- Gravity Main
- Open Drain
- Overland flowpath
- Service

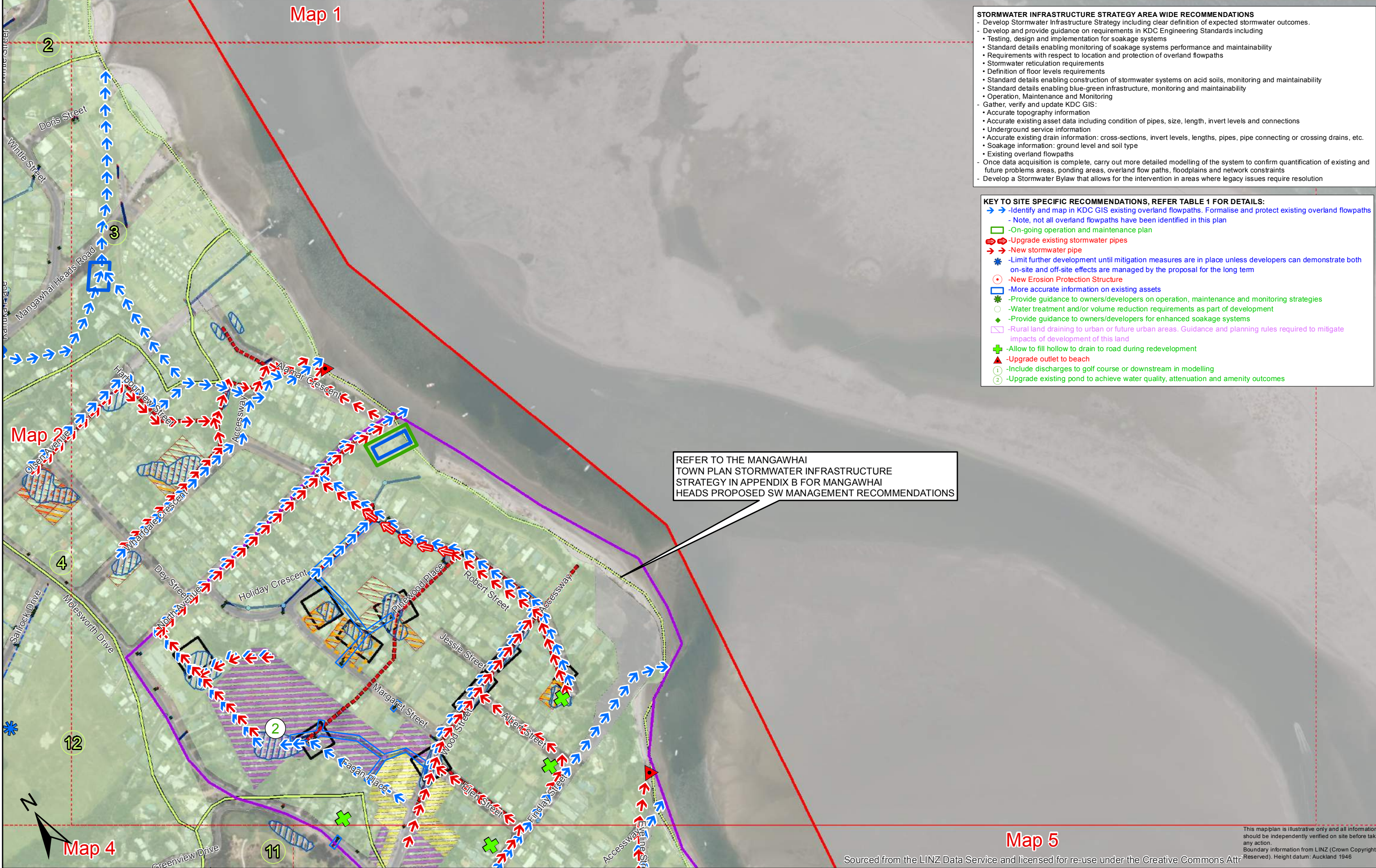
Swale Drain

Unknown

Out of Study Area

Map Title: <b>STORMWATER RECOMMENDATIONS PLAN - MANGAWHAI</b>				
Project: <b>Mangawhai CMP</b>				
Map:	2	Designed:	PM	Drawing Number
Scale:	1:5,000	Drawn:	MH	Map 2
Size:	A3	Checked:	GL	Status
Date:	3/05/2018	Approved:	AL	Rev
FINAL				0





- STORMWATER INFRASTRUCTURE STRATEGY AREA WIDE RECOMMENDATIONS**
- Develop Stormwater Infrastructure Strategy including clear definition of expected stormwater outcomes.
  - Develop and provide guidance on requirements in KDC Engineering Standards including
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    - Definition of floor levels requirements
    - Standard details enabling construction of stormwater systems on acid soils, monitoring and maintainability
    - Standard details enabling blue-green infrastructure, monitoring and maintainability
    - Operation, Maintenance and Monitoring
  - Gather, verify and update KDC GIS:
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- KEY TO SITE SPECIFIC RECOMMENDATIONS, REFER TABLE 1 FOR DETAILS:**
- -Identify and map in KDC GIS existing overland flowpaths. Formalise and protect existing overland flowpaths
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  - -Upgrade existing stormwater pipes
  - -New stormwater pipe
  - \* -Limit further development until mitigation measures are in place unless developers can demonstrate both on-site and off-site effects are managed by the proposal for the long term
  - -New Erosion Protection Structure
  - -More accurate information on existing assets
  - \* -Provide guidance to owners/developers on operation, maintenance and monitoring strategies
  - -Water treatment and/or volume reduction requirements as part of development
  - ◆ -Provide guidance to owners/developers for enhanced soakage systems
  - -Rural land draining to urban or future urban areas. Guidance and planning rules required to mitigate impacts of development of this land
  - + -Allow to fill hollow to drain to road during redevelopment
  - ▲ -Upgrade outlet to beach
  - ① -Include discharges to golf course or downstream in modelling
  - ② -Upgrade existing pond to achieve water quality, attenuation and amenity outcomes

**General Layers**

- Map Grid
- Ponding Areas (MWH 2015)
- Stage 1 Study Area
- Stage 2 Study Area
- Risk Properties**
- NRC Potentially Affected Properties
- Likely
- Possible
- Unlikely

**Flooding Risk (CMP 2006)**

Assesst Result

- Flooding Risk - Likely (MWH 2015)
- Flooding Risk - Possibly (MWH 2015)
- Identified Ponding (GHD 2016)
- Proposed Pipes (CMP 2006)
- Catchment Number

**TownPlan\_MediumExpansionCommercialZones**

Zone Use (TCP 2016)

- Commercial Zone
- Proposed New Commercial Zone
- Unformed Road

**Plan Zones**

Plan Type

- Commercial
- Estuary Estates
- Industrial

**Stormwater Assests**

Assest Type

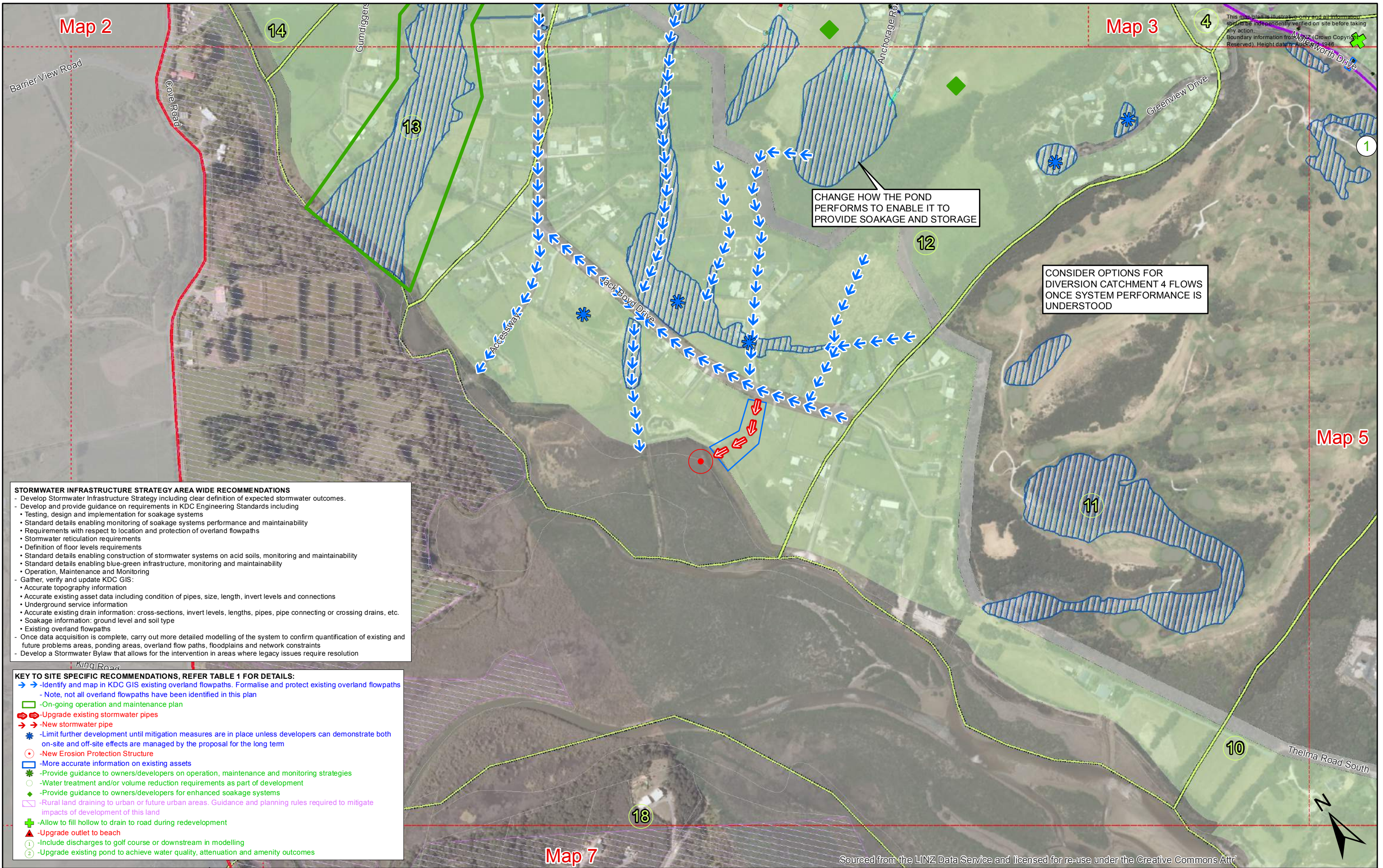
- CatchPit
- Dummy Node
- Inlet
- Manhole
- Outlet
- Soakpit
- Sump
- Catchpit Lead
- Creek
- Culvert
- Drain
- Gravity Main
- Open Drain
- Overland flowpath
- Service
- Swale Drain
- Unknown
- Out of Study Area

MapTitle: **STORMWATER RECOMMENDATIONS PLAN - MANGAWHAI**

Project: **Mangawhai CMP**

Map:	3	Designed:	PM	Drawing Number	Map 3
Scale:	1:5,000	Drawn:	MH	Status	FINAL
Size:	A3	Checked:	GL	Rev	0
Date:	3/05/2018	Approved:	AL		





- STORMWATER INFRASTRUCTURE STRATEGY AREA WIDE RECOMMENDATIONS**
- Develop Stormwater Infrastructure Strategy including clear definition of expected stormwater outcomes.
  - Develop and provide guidance on requirements in KDC Engineering Standards including
    - Testing, design and implementation for soakage systems
    - Standard details enabling monitoring of soakage systems performance and maintainability
    - Requirements with respect to location and protection of overland flowpaths
    - Stormwater reticulation requirements
    - Definition of floor levels requirements
    - Standard details enabling construction of stormwater systems on acid soils, monitoring and maintainability
    - Standard details enabling blue-green infrastructure, monitoring and maintainability
  - Operation, Maintenance and Monitoring
  - Gather, verify and update KDC GIS:
    - Accurate topography information
    - Accurate existing asset data including condition of pipes, size, length, invert levels and connections
    - Underground service information
    - Accurate existing drain information: cross-sections, invert levels, lengths, pipes, pipe connecting or crossing drains, etc.
    - Soakage information: ground level and soil type
    - Existing overland flowpaths
  - Once data acquisition is complete, carry out more detailed modelling of the system to confirm quantification of existing and future problems areas, ponding areas, overland flow paths, floodplains and network constraints
  - Develop a Stormwater Bylaw that allows for the intervention in areas where legacy issues require resolution

- KEY TO SITE SPECIFIC RECOMMENDATIONS, REFER TABLE 1 FOR DETAILS:**
- → -Identify and map in KDC GIS existing overland flowpaths. Formalise and protect existing overland flowpaths
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  - -On-going operation and maintenance plan
  - → -Upgrade existing stormwater pipes
  - → -New stormwater pipe
  - \* -Limit further development until mitigation measures are in place unless developers can demonstrate both on-site and off-site effects are managed by the proposal for the long term
  - -New Erosion Protection Structure
  - -More accurate information on existing assets
  - \* -Provide guidance to owners/developers on operation, maintenance and monitoring strategies
  - -Water treatment and/or volume reduction requirements as part of development
  - ◆ -Provide guidance to owners/developers for enhanced soakage systems
  - -Rural land draining to urban or future urban areas. Guidance and planning rules required to mitigate impacts of development of this land
  - ✚ -Allow to fill hollow to drain to road during redevelopment
  - ▲ -Upgrade outlet to beach
  - ① -Include discharges to golf course or downstream in modelling
  - ② -Upgrade existing pond to achieve water quality, attenuation and amenity outcomes

**General Layers**

- Map Grid
- Ponding Areas (MWH 2015)
- Stage 1 Study Area
- Stage 2 Study Area
- Risk Properties**
- NRC Potentially Affected Properties
- Likely
- Possible
- Unlikely

**Flooding Risk (CMP 2006)**

Assesst Result

- Flooding Risk - Likely (MWH 2015)
- Flooding Risk - Possibly (MWH 2015)
- Identified Ponding (GHD 2016)
- Proposed Pipes (CMP 2006)
- Catchment Number

**TownPlan\_MediumExpansionCommercialZones**

Zone Use (TCP 2016)

- Commercial Zone
- Proposed New Commercial Zone
- Unformed Road
- Proposed Pipes (CMP 2006)

**Plan Zones**

Plan Type

- Commercial
- Estuary Estates
- Industrial

**Residential**

- Residential
- Unformed Road

**Stormwater Assests**

Assest Type

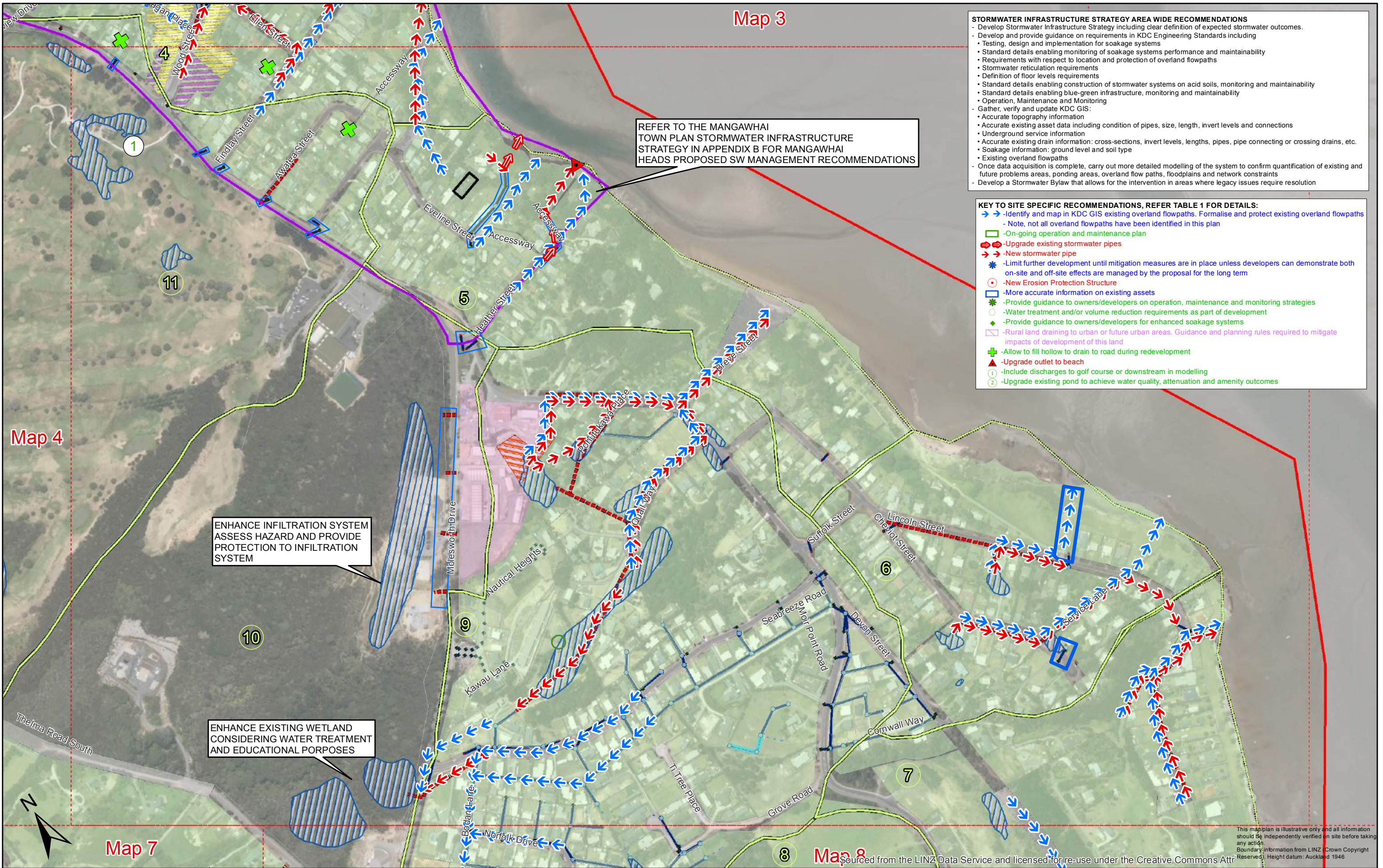
- CatchPit
- Dummy Node
- Inlet
- Manhole
- Outlet
- Soakpit
- Sump
- Catchpit Lead
- Creek
- Culvert
- Drain
- Gravity Main
- Open Drain
- Overland flowpath
- Service
- Swale Drain
- Unknown
- Out of Study Area

MapTitle: **STORMWATER RECOMMENDATIONS PLAN - MANGAWHAI**

Project: **Mangawhai CMP**

Map: 4	Designed: PM	Drawing Number	Map 4
Scale: 1:5,000	Drawn: MH	Status	FINAL
Size: A3	Checked: GL	Rev	0
Date: 3/05/2018	Approved: AL		





- STORMWATER INFRASTRUCTURE STRATEGY AREA WIDE RECOMMENDATIONS**
- Develop Stormwater Infrastructure Strategy including clear definition of expected stormwater outcomes.
  - Develop and provide guidance on requirements in KDC Engineering Standards including
    - Testing, design and implementation for soakage systems
    - Standard details enabling monitoring of soakage systems performance and maintainability
    - Requirements with respect to location and protection of overland flowpaths
    - Stormwater reticulation requirements
    - Definition of floor levels requirements
    - Standard details enabling construction of stormwater systems on acid soils, monitoring and maintainability
    - Standard details enabling blue-green infrastructure, monitoring and maintainability
    - Operation, Maintenance and Monitoring
  - Gather, verify and update KDC GIS:
    - Accurate topography information
    - Accurate existing asset data including condition of pipes, size, length, invert levels and connections
    - Underground service information
    - Accurate existing drain information: cross-sections, invert levels, lengths, pipes, pipe connecting or crossing drains, etc.
    - Soakage information: ground level and soil type
    - Existing overland flowpaths
  - Once data acquisition is complete, carry out more detailed modelling of the system to confirm quantification of existing and future problems areas, ponding areas, overland flow paths, floodplains and network constraints
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    - Note, not all overland flowpaths have been identified in this plan
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  - -Upgrade existing stormwater pipes
  - -New stormwater pipe
  - \* -Limit further development until mitigation measures are in place unless developers can demonstrate both on-site and off-site effects are managed by the proposal for the long term
  - -New Erosion Protection Structure
  - -More accurate information on existing assets
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  - ▲ -Upgrade outlet to beach
  - ① -Include discharges to golf course or downstream in modelling
  - ② -Upgrade existing pond to achieve water quality, attenuation and amenity outcomes

**Map 3**

**Map 4**

**Map 7**

**Map 8**

ENHANCE INFILTRATION SYSTEM  
ASSESS HAZARD AND PROVIDE  
PROTECTION TO INFILTRATION  
SYSTEM

ENHANCE EXISTING WETLAND  
CONSIDERING WATER TREATMENT  
AND EDUCATIONAL PURPOSES

This map plan is illustrative only and all information should be independently verified on site before taking any action.  
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Map Title:  
**STORMWATER RECOMMENDATIONS PLAN - MANGAWHAI**

Project:  
**Mangawhai CMP**

Map:	5	Designed:	PM	Drawing Number	Map 5
Scale:	1:5,000	Drawn:	MH	Status	Rev
Size:	A3	Checked:	GL	FINAL	0
Date:	3/05/2018	Approved:	AL		

**General Layers**

- Map Grid
- Ponding Areas (MWH 2015)
- Stage 1 Study Area
- Stage 2 Study Area
- Risk Properties
- NRC Potentially Affected Properties
- Likely
- Possible
- Unlikely

**Flooding Risk (CMP 2006)**

- Assesst Result
- Flooding Risk - Likely (MWH 2015)
- Flooding Risk - Possibly (MWH 2015)
- Identified Ponding (GHD 2016)
- Proposed Pipes (CMP 2006)
- Catchment Number

**TownPlan\_MediumExpansionCommercialZones**

- Zone Use (TCP 2016)
- Commercial Zone
- Proposed New Commercial Zone
- Unformed Road
- Plan Zones
- Plan Type
- Commercial
- Estuary Estates
- Industrial

**Stormwater Assests**

- Assest Type
- CatchPit
- Dummy Node
- Inlet
- Manhole
- Outlet
- Soakpit
- Sump
- Catchpit Lead
- Creek
- Culvert
- Drain
- Gravity Main
- Open Drain
- Overland flowpath
- Service
- Swale Drain
- Unknown
- Out of Study Area



- STORMWATER INFRASTRUCTURE STRATEGY AREA WIDE RECOMMENDATIONS**
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  - Develop and provide guidance on requirements in KDC Engineering Standards including
    - Testing, design and implementation for soakage systems
    - Standard details enabling monitoring of soakage systems performance and maintainability
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    - Stormwater reticulation requirements
    - Definition of floor levels requirements
    - Standard details enabling construction of stormwater systems on acid soils, monitoring and maintainability
    - Standard details enabling blue-green infrastructure, monitoring and maintainability
    - Operation, Maintenance and Monitoring
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    - Existing overland flowpaths
  - Once data acquisition is complete, carry out more detailed modelling of the system to confirm quantification of existing and future problems areas, ponding areas, overland flow paths, floodplains and network constraints
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  - → -New stormwater pipe
  - \* -Limit further development until mitigation measures are in place unless developers can demonstrate both on-site and off-site effects are managed by the proposal for the long term
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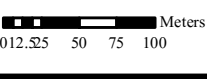
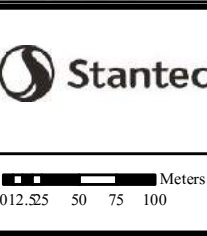
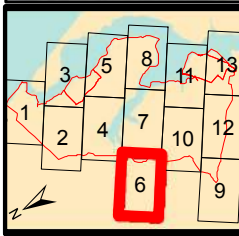
Map 4

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Map 7

Map 10

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**General Layers**

- Map Grid
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**Risk Properties**

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- Likely
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**Flooding Risk (CMP 2006)**

Assest Result

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**TownPlan\_MediumExpansionComercialZones**

Zone Use (TCP 2016)

- Commercial Zone
- Proposed New Comercial Zone
- Unformed Road
- Plan Zones
- Plan Type
- Commercial
- Estuary Estates
- Industrial

**Stormwater Assests**

Assest Type

- CatchPit
- Dummy Node
- Inlet
- Manhole
- Outlet
- Soakpit
- Sump
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- Culvert
- Drain
- Gravity Main
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- Service
- Swale Drain
- Unknown
- Out of Study Area

Map Title: **STORMWATER RECOMMENDATIONS PLAN - MANGAWHAI**

Project: **Mangawhai CMP**

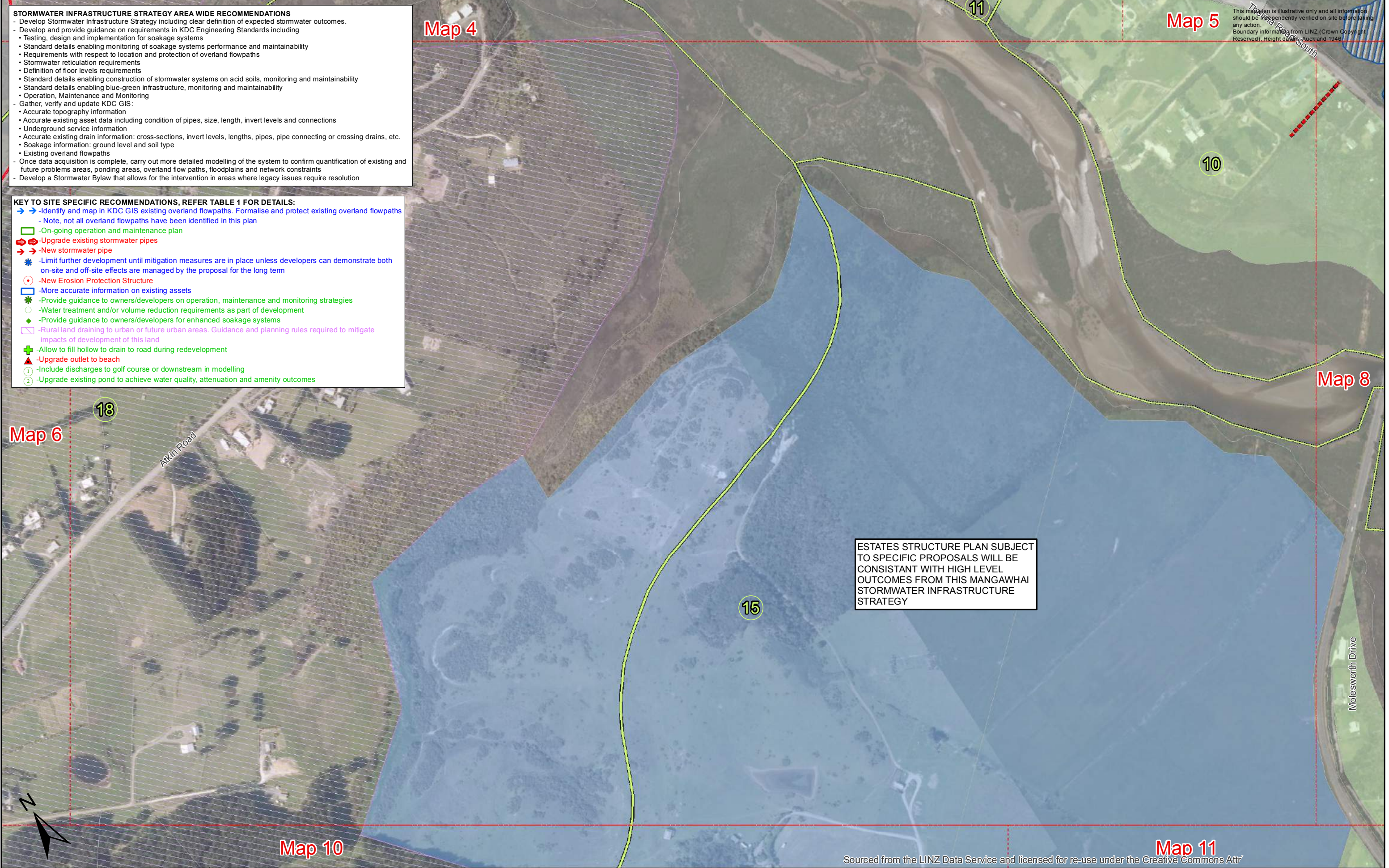
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Scale:	1:5,000	Drawn:	MH	Status	FINAL
Size:	A3	Checked:	GL	Rev	0
Date:	3/05/2018	Approved:	AL		



- STORMWATER INFRASTRUCTURE STRATEGY AREA WIDE RECOMMENDATIONS**
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- Plan Zones
- Plan Type
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Assest Type

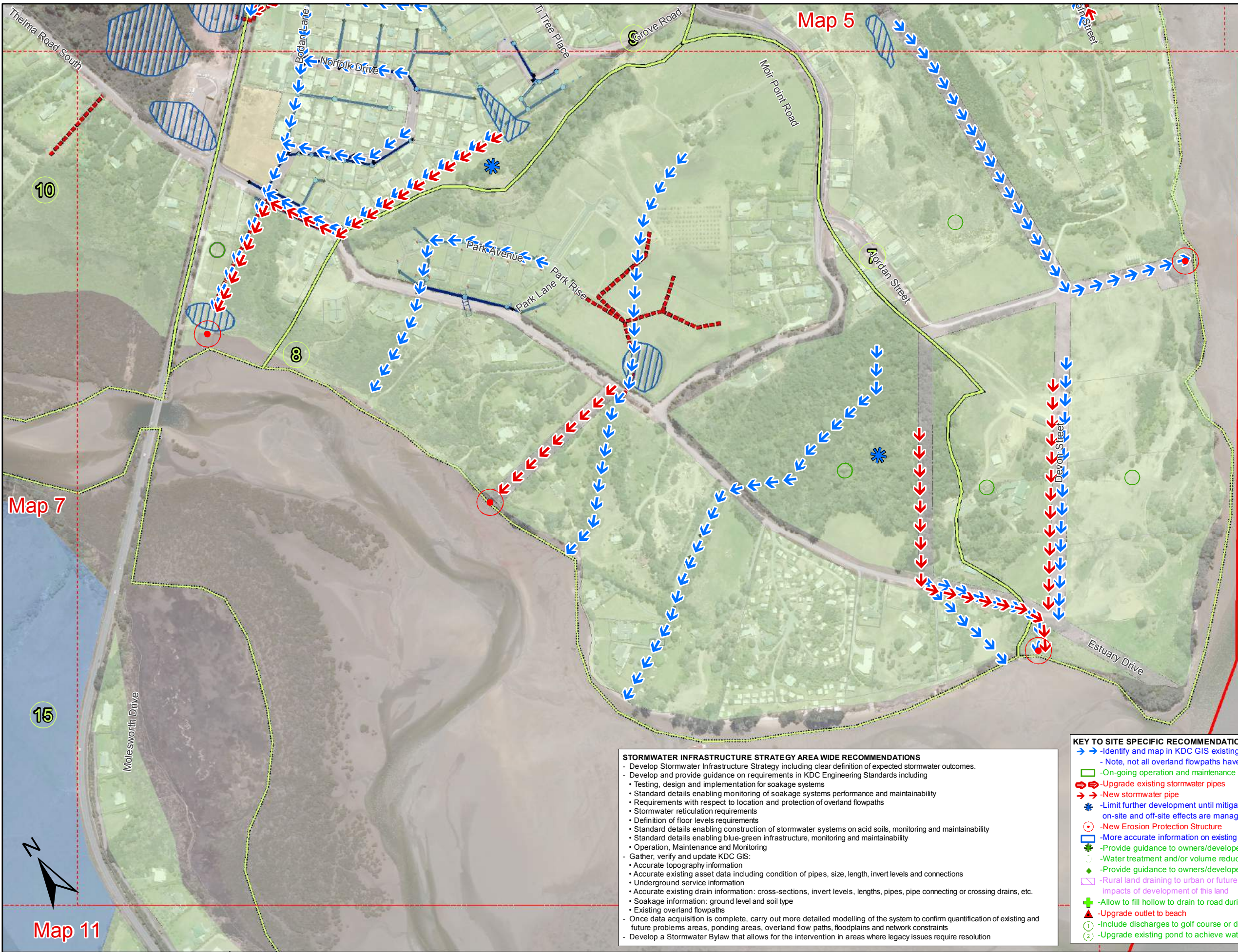
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- Dummy Node
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- Outlet
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- Catchpit Lead
- Creek
- Culvert
- Drain
- Gravity Main
- Open Drain
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- Service
- Swale Drain
- Unknown
- Out of Study Area

MapTitle:  
**STORMWATER RECOMMENDATIONS PLAN - MANGAWHAI**

Project:  
**Mangawhai CMP**

Map:	7	Designed:	PM	Drawing Number	Map 7
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Size:	A3	Checked:	GL	Rev	0
Date:	3/05/2018	Approved:	AL		



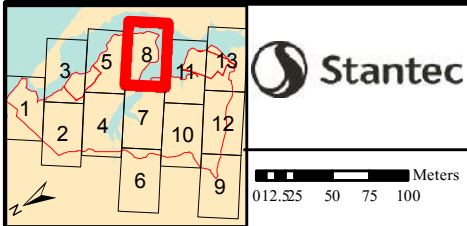


**STORMWATER INFRASTRUCTURE STRATEGY AREA WIDE RECOMMENDATIONS**

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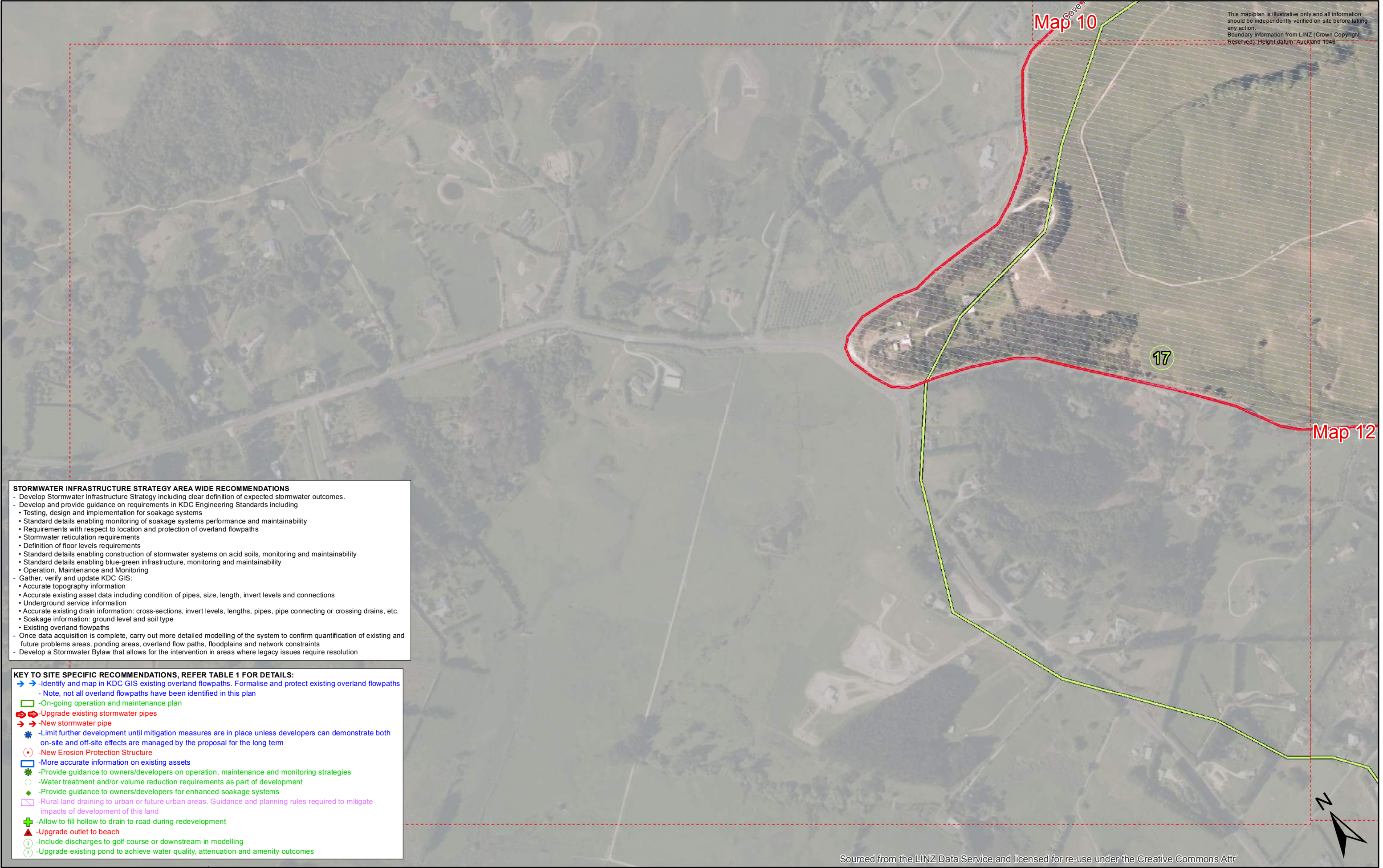
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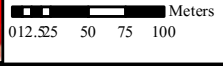
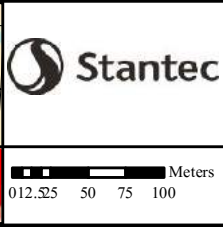
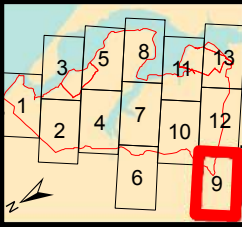


<b>General Layers</b>		<b>Flooding Risk (CMP 2006)</b>		<b>TownPlan_MediumExpansionCommercialZones</b>		<b>Stormwater Assests</b>	
Map Grid		Assesst Result		Zone Use (TCP 2016)		Assesst Type	
Ponding Areas (MWH 2015)		Flood Risk - Likely (MWH 2015)		Commercial Zone		CatchPit	
Stage 1 Study Area		Flood Risk - Possibly (MWH 2015)		Proposed New Commercial Zone		Dummy Node	
Stage 2 Study Area		Identified Ponding (GHD 2016)		Unformed Road		Inlet	
<b>Risk Properties</b>		Proposed Pipes (CMP 2006)		<b>Plan Zones</b>		Manhole	
NRC Potentially Affected Properties		Catchment Number		Commercial		Outlet	
Likely				Estuary Estates		Soakpit	
Possible				Industrial		Sump	
Unlikely						Catchpit Lead	
						Creek	
						Culvert	
						Drain	
						Gravity Main	
						Open Drain	
						Overland flowpath	
						Service	
						Swale Drain	
						Unknown	
						Out of Study Area	

Map Title:			
<b>STORMWATER RECOMMENDATIONS PLAN - MANGAWHAI</b>			
Project:			
<b>Mangawhai CMP</b>			
Map:	8	Designed:	PM
Scale:	1:5,000	Drawn:	MH
Size:	A3	Checked:	GL
Date:	8/05/2018	Approved:	AL
Drawing Number		Status	Rev
Map 8		FINAL	0







**General Layers**

- Map Grid
- Ponding Areas (MWH 2015)
- Stage 1 Study Area
- Stage 2 Study Area
- Risk Properties**
- NRC Potentially Affected Properties
- Likely
- Possible
- Unlikely

**Flooding Risk (CMP 2006)**

Asset Result

- Flooding Risk - Likely (MWH 2015)
- Flooding Risk - Possibly (MWH 2015)
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- Proposed Pipes (CMP 2006)
- Catchment Number

**TownPlan\_MediumExpansionComercialZones**

Zone Use (TCP 2016)

- Commercial Zone
- Proposed New Commercial Zone
- Unformed Road
- Plan Zones
- Plan Type
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**Stormwater Assests**

Assest Type

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- Service
- Swale Drain
- Unknown
- Out of Study Area

MapTitle:

**STORMWATER RECOMMENDATIONS PLAN - MANGAWHAI**

Project:

**Mangawhai CMP**

Map:	9	Designed:	PM	Drawing Number	Map 9
Scale:	1:5,000	Drawn:	MH	Status	FINAL
Size:	A3	Checked:	GL	Rev	0
Date:	3/05/2018	Approved:	AL		



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Map 6

Map 7

Map 11

Map 12

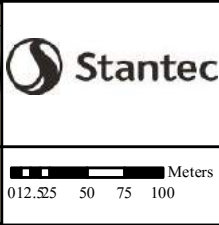
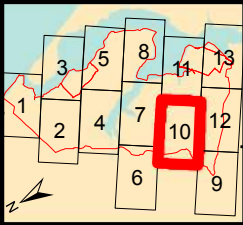
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**STORMWATER INFRASTRUCTURE STRATEGY AREA WIDE RECOMMENDATIONS**

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General Layers	
Map Grid	
Ponding Areas (MWH 2015)	
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Risk Properties	
NRC Potentially Affected Properties	
Likely	
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Flood Risk (CMP 2006)	
Assesst Result	
Flood Risk - Likely (MWH 2015)	
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TownPlan_MediumExpansionComercialZones	
Zone Use (TCP 2016)	
Commercial Zone	
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Unformed Road	
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Assest Type	
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Dummy Node	
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Soakpit	
Culvert	

Sump	
Catchpit Lead	
Creek	
Swale Drain	
Unknown	
Out of Study Area	

MapTitle: <b>STORMWATER RECOMMENDATIONS PLAN - MANGAWHAI</b>				
Project: <b>Mangawhai CMP</b>				
Map:	10	Designed:	PM	Drawing Number
Scale:	1:5,000	Drawn:	MH	Map 10
Size:	A3	Checked:	GL	Status
Date:	3/05/2018	Approved:	AL	Rev
				0
				FINAL



Map 7

Map

- STORMWATER INFRASTRUCTURE STRATEGY AREA WIDE RECOMMENDATIONS**
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REFER TO THE MANGAWHAI  
TOWN PLAN STORMWATER INFRASTRUCTURE  
STRATEGY IN APPENDIX B FOR MANGAWHAI  
VILLAGE PROPOSED SW MANAGEMENT RECOMMENDATIONS

Map 10

Old Waipu Road North

Sunlea Lane

Moesworth Drive

16

Kainui Street

Pearson Street

Queensway Drive

Muir Street

Old Waipu Road

Matuku Place

Kahu Drive

Takane Place

Waka Street

Longview Street

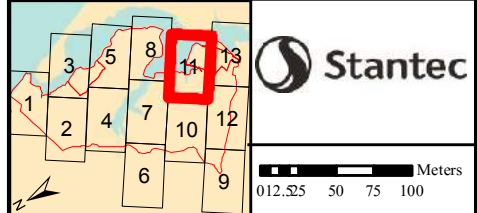
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Map 12

Map 13

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- Assess Result
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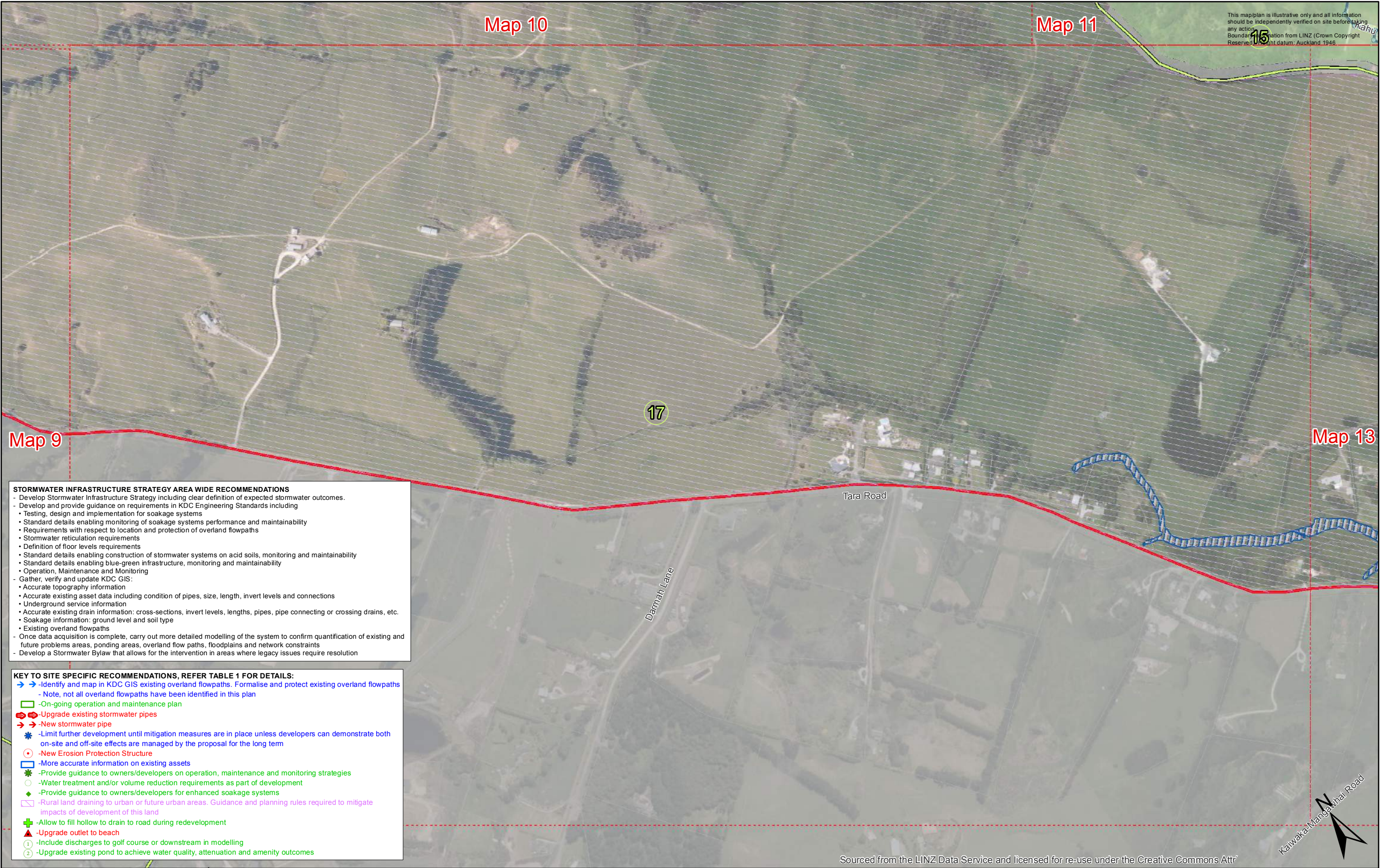
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  - Estuary Estates
  - Industrial

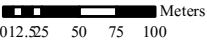

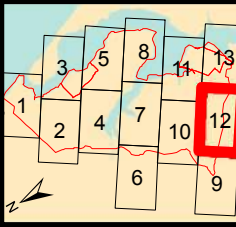
- Stormwater Assets**
- Asset Type
- CatchPit
  - Dummy Node
  - Inlet
  - Manhole
  - Outlet
  - Soakpit
  - Sump
  - Catchpit Lead
  - Creek
  - Culvert
  - Drain
  - Gravity Main
  - Open Drain
  - Overland flowpath
  - Service

- Swale Drain
- Unknown
- Out of Study Area

Map Title: <b>STORMWATER RECOMMENDATIONS PLAN - MANGAWHAI</b>				
Project: <b>Mangawhai CMP</b>				
Map:	11	Designed:	PM	Drawing Number
Scale:	1:5,000	Drawn:	MH	Map 11
Size:	A3	Checked:	GL	Status
Date:	3/05/2018	Approved:	AL	Rev
				<b>FINAL</b>
				<b>0</b>







**General Layers**

- Map Grid
- Ponding Areas (MWH 2015)
- Stage 1 Study Area
- Stage 2 Study Area
- Risk Properties**
- NRC Potentially Affected Properties
- Likely
- Possible
- Unlikely

**Flooding Risk (CMP 2006)**

Assesst Result

- Flooding Risk - Likely (MWH 2015)
- Flooding Risk - Possibly (MWH 2015)
- Identified Ponding (GHD 2016)
- Proposed Pipes (CMP 2006)
- Catchment Number

**TownPlan\_MediumExpansionComercialZones**

Zone Use (TCP 2016)

- Commercial Zone
- Proposed New Comercial Zone
- Unformed Road

**Plan Zones**

Plan Type

- Commercial
- Estuary Estates
- Industrial

**Stormwater Assests**

Assest Type

- CatchPit
- Dummy Node
- Inlet
- Manhole
- Outlet
- Soakpit
- Sump
- Catchpit Lead
- Creek
- Culvert
- Drain
- Gravity Main
- Open Drain
- Overland flowpath
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- Swale Drain
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MapTitle:

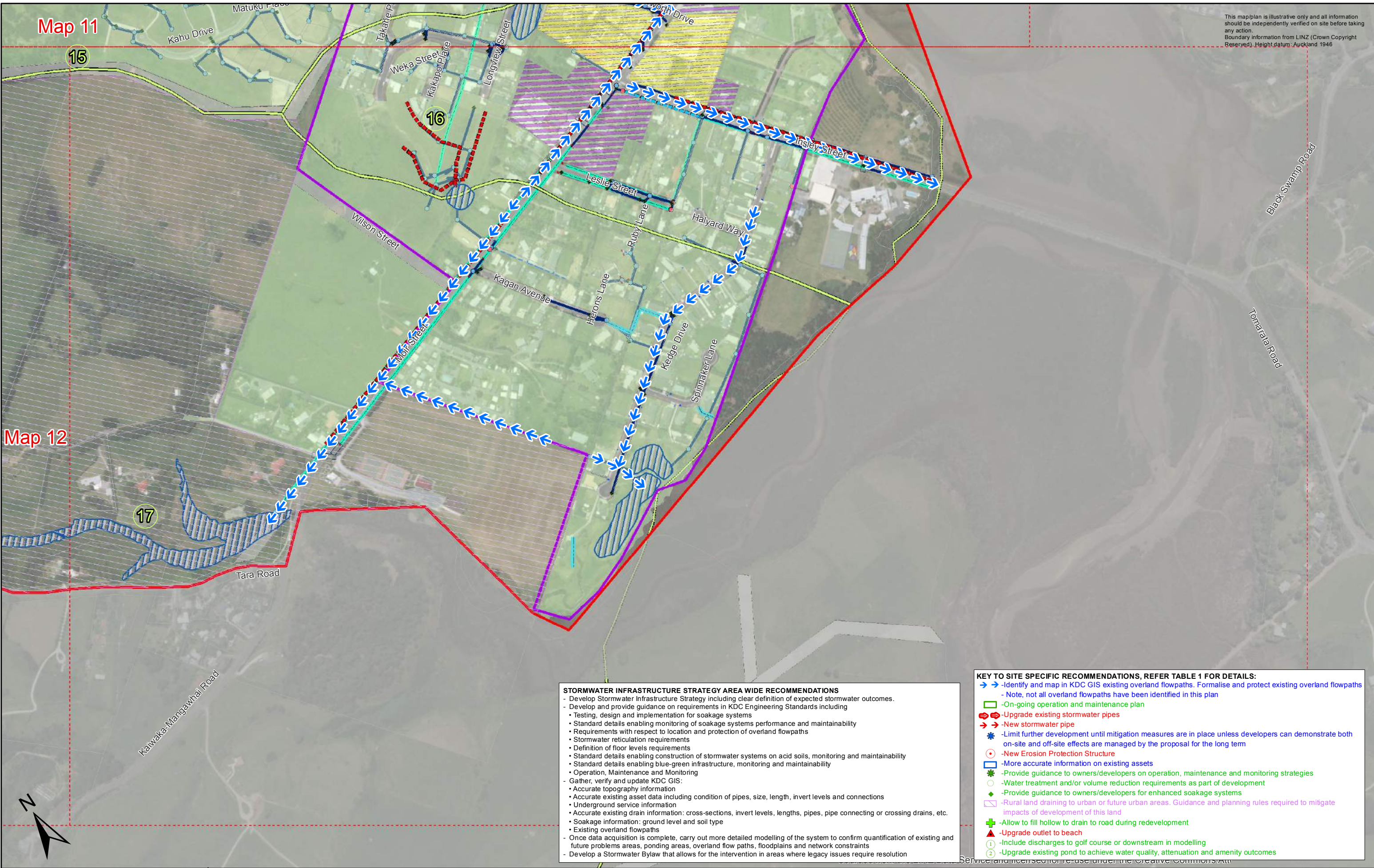
**STORMWATER RECOMMENDATIONS PLAN - MANGAWHAI**

Project:

**Mangawhai CMP**

Map:	12	Designed:	PM	Drawing Number	Map 12
Scale:	1:5,000	Drawn:	MH	Status	FINAL
Size:	A3	Checked:	GL	Rev	0
Date:	3/05/2018	Approved:	AL		





**STORMWATER INFRASTRUCTURE STRATEGY AREA WIDE RECOMMENDATIONS**

- Develop Stormwater Infrastructure Strategy including clear definition of expected stormwater outcomes.
- Develop and provide guidance on requirements in KDC Engineering Standards including
  - Testing, design and implementation for soakage systems
  - Standard details enabling monitoring of soakage systems performance and maintainability
  - Requirements with respect to location and protection of overland flowpaths
  - Stormwater reticulation requirements
  - Definition of floor levels requirements
  - Standard details enabling construction of stormwater systems on acid soils, monitoring and maintainability
  - Standard details enabling blue-green infrastructure, monitoring and maintainability
  - Operation, Maintenance and Monitoring
- Gather, verify and update KDC GIS:
  - Accurate topography information
  - Accurate existing asset data including condition of pipes, size, length, invert levels and connections
  - Underground service information
  - Accurate existing drain information: cross-sections, invert levels, lengths, pipes, pipe connecting or crossing drains, etc.
  - Soakage information: ground level and soil type
  - Existing overland flowpaths
- Once data acquisition is complete, carry out more detailed modelling of the system to confirm quantification of existing and future problems areas, ponding areas, overland flow paths, floodplains and network constraints
- Develop a Stormwater Bylaw that allows for the intervention in areas where legacy issues require resolution

**KEY TO SITE SPECIFIC RECOMMENDATIONS, REFER TABLE 1 FOR DETAILS:**

- -Identify and map in KDC GIS existing overland flowpaths. Formalise and protect existing overland flowpaths  
- Note, not all overland flowpaths have been identified in this plan
- -On-going operation and maintenance plan
- -Upgrade existing stormwater pipes
- -New stormwater pipe
- \* -Limit further development until mitigation measures are in place unless developers can demonstrate both on-site and off-site effects are managed by the proposal for the long term
- -New Erosion Protection Structure
- -More accurate information on existing assets
- \* -Provide guidance to owners/developers on operation, maintenance and monitoring strategies
- -Water treatment and/or volume reduction requirements as part of development
- ◆ -Provide guidance to owners/developers for enhanced soakage systems
- -Rural land draining to urban or future urban areas. Guidance and planning rules required to mitigate impacts of development of this land
- ⊕ -Allow to fill hollow to drain to road during redevelopment
- ▲ -Upgrade outlet to beach
- ① -Include discharges to golf course or downstream in modelling
- ② -Upgrade existing pond to achieve water quality, attenuation and amenity outcomes

**General Layers**

- Map Grid
- Ponding Areas (MWH 2015)
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**Flooding Risk (CMP 2006)**

Assess Result

- Flooding Risk - Likely (MWH 2015)
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- Catchment Number

**TownPlan\_MediumExpansionCommercialZones**

Zone Use (TCP 2016)

- Commercial Zone
- Proposed New Commercial Zone
- Unformed Road
- Plan Zones
- Plan Type
- Commercial
- Estuary Estates
- Industrial

**Stormwater Assets**

Asset Type

- CatchPit
- Dummy Node
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Map Title:  
**STORMWATER RECOMMENDATIONS PLAN - MANGAWHAI**

Project:  
**Mangawhai CMP**

Map:	13	Designed:	PM	Drawing Number	Map 13
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