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Kaipara District Council

Mangawhai Town Plan Change Stormwater Infrastructure Report

March 2016

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1. Introduction

1.1 Terms of reference

GHD were commissioned by Kaipara District Council to undertake a stormwater infrastructure assessment to support the Mangawhai Town Plan Change.

The assessment was limited to availability of catchment information.

A proposal was sent to KDC on 7/03/2016 and approval received on 10/03/2016 by email.

1.2 Mangawhai Town Plan Change Proposed Areas

The Mangawhai catchment is described as an urban drainage area comprising land zoned residential, rural residential, commercial and industrial at Mangawhai Heads and Mangawhai Village with reserves and land zoned rural within the same catchments.

The two proposed Town Plan change areas are shown in Appendix A. One area is in the Mangawhai Heads area and the other includes the Mangawhai Village area.

1.3 Mangawhai Catchment Management Plan

In 2005, a catchment management plan was prepared for KDC by Duffill Watts and King.

The plan provided the following main outcomes:

- Calculations of the design flows in the catchment and sub-catchments;
- Identification of the primary flows and design of culvert sizes;
- Identification of secondary flow paths;
- Identification and prioritisation of stormwater infrastructure upgrading and cost estimate;
- Identification of management responsibilities; and
- Recommendations for implementation of the SWCMP.

1.4 2016 Mangawhai Catchment Assessments

Recent work was undertaken by GHD to assess the scope to update the catchment management plan and from one of the recommendations, a scope to build capacity within KDC. The key findings included;

- Since 2005, the catchment management plan has not been updated as development progressed and there is insufficient evidence whether all the pipelines that were recommended to mitigate flooding risk have been constructed.
- There has been significant development in the catchment since 2005 and there are uncertainties in how overland flowpaths have been managed and whether floor levels for new developments are above the required maximum probable development 100 year flood levels (plus 100 mm).
- There are also uncertainties regarding the recording of vested stormwater assets (public infrastructure that is transferred to KDC by Developers) in the KDC GIS database.
- There have been significant technical advances in modelling software and techniques since 2005. LiDAR information is now also available for part of the catchment which would provide a much more accurate representation of the surface flows and location

and extent of overland flows and ponding areas. The models and outputs used for the Mangawhai SWCMP could potentially be redundant and some of the recommendations on new pipelines will require further consideration. Detailed 1D/2D flood modelling of the catchment is required to understand the capacity of the existing system and capital works to meet the level of service for flood protection.

- There is a significant and long term financial risk to KDC if the catchment management plan is not updated as this is required to ensure that day-to-day approvals of consents of new dwellings are based on reliable and accurate catchment information.
- A number of recommendations have been made including capacity building to understand the stormwater system in the catchment better, GIS data management and master planning of the catchment which will assist in decision-making of future investments in the catchment.

1.5 Purpose of this report

The purpose of this report is to inform KDC the potential impacts of the proposed Mangawhai Town Plan Change on the stormwater infrastructure.

1.6 Scope and limitations

This report: has been prepared by GHD for Kaipara District Council and may only be used and relied on by Kaipara District Council for the purpose agreed between GHD and the Kaipara District Council as set out in the proposal and this report.

GHD otherwise disclaims responsibility to any person other than Kaipara District Council arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by Kaipara District Council and others who provided information to GHD (including Government authorities)], which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

1.7 Assumptions

This report will provide a high level summary of the impacts of any proposed Town Plan changes in two catchment areas of the Mangawhai catchment. It is assumed that more detailed assessments will be undertaken to confirm the findings of this report.

2. Scope of Work

2.1 Mangawhai Town Plan Change Brief

The following sets out the requirements of the assessment;

- What is the current condition and capacity of the public stormwater network and what is need to bring it to standard;
- What is the quality and condition of stormwater assets built by Developers in areas experiencing growth such as Jack Boyd Drive;
- What are the maintenance costs of existing assets;
- What information is available indicating the flood risk from stormwater run-off including maps of problem areas an suggested mitigation measures of flood prone areas;
- Recommend three options and costings of each including potential funding streams;
 - Do nothing;
 - Quick fixes (low cost) and priority projects such as filling in open drainage ditches;
 - Upgrade and extension of KDC system to keep pace with growth.

3. Mangawhai Stormwater Infrastructure

3.1 Mangawhai Heads Plan Change Area

The Mangawhai Heads Plan area is shown in Fig 1 in the Appendices. The plan shows sub-catchments and overland flowpaths generated from LiDAR information. The plans also show potential ponding areas and where new pipelines may be required.

The Mangawhai Heads area is elevated higher than the Mangawhai Village area and is in mostly fine sand which is good for soakage for most of the catchment. The availability of good soakage may be the reason for the lack of stormwater pipeline infrastructure in the catchment. There are some areas of poor soakage in the catchment due to the presence of sandstone (example Sea breeze Road) but in these cases, stormwater is being managed by road swale drains.

There are also some steep areas in the Mangawhai Heads area where properties on the downhill side tend to receive uncontrolled stormwater over-land flows from upstream.

Using LiDAR as the base information and overland flow paths, potential areas of ponding and potential routes of new pipelines have been assessed and identified in Fig 1 in the Appendices. Some areas prone to ponding are very low lying without much fall indicated by straight overland flow lines (example near Margaret Street).

The capacity of the soakage system which is currently the predominant stormwater system in the catchment is unknown. There are a number of methods in which the system works; through direct discharge to soakage pits on private property, through sheet flows discharging to soakage on private property and through direct discharge to roadside swales. Information obtained verbally on flooding in the catchment indicates that ponding occurs in several low lying areas but soaks away within a couple of hours.

The stormwater pipelines proposed in Fig 1 are indicative, without consideration of detailed flooding modelling and mapping and may be required if there is a current flooding problem

impacting on property floor levels in the related catchment area or if the soakage capacity is reached in future as a result of further development.

3.2 Mangawhai Village Plan Change Area

The Mangawhai Village Plan area is shown in Fig 2.0 in the Appendices. The plan shows sub-catchments and overland flowpaths generated from LiDAR information. The plans also show potential ponding areas, where previously recommended pipes have been constructed and where new pipelines may be required.

The Mangawhai Village Plan area, in contrast to the Mangawhai Heads area has very few areas of good soakage. The majority of the catchment is very flat and over a reasonably thick layer of sandstone. The higher elevated areas are in clay soils. Soakage is poor across most of the catchment.

Using LiDAR as the base information and overland flow paths, potential areas of ponding and potential routes of new pipelines have been assessed and identified in Fig 2 in the Appendices. Stormwater pipelines that were recommended previously to mitigate flood risk and that have been constructed have been identified in Fig 2.

The stormwater system in the catchment comprises of stormwater pipelines and roadside drains and swales conveying flows to the Estuary. Private property drainage is via direct discharge to the road side drains, pipes or to soakage where available. With the poor soakage in the catchment there are known areas that are prone to ponding for a number of days in major storm events. Property floor levels however are higher than the ponding water levels and currently there are no known property floor level flooding in the catchment.

The stormwater pipelines proposed in Fig 2 are indicative, without consideration of detailed flooding modelling and mapping and may be required if there is a current flooding problem impacting on property floor levels in the related catchment area or if there is a risk of flooding in future as a result of further development.

3.3 Current Condition and Capacity of Stormwater Systems

The condition and capacity of the stormwater system is largely unknown for both the Plan Change areas. The capacity of the soakage system and roadside swales as discussed above for the Mangawhai Heads Plan Change area is unknown but currently there are no known floor level flooding problems. The condition and capacity of the pipe system and roadside swales in the Mangawhai Village Plan Change area is unknown but currently there are no known floor level flooding problems.

As discussed in 1.4 above, detailed 1D/2D flood modelling of the catchment is required to understand the capacity of the existing system in both catchments and any upgrading works to meet the level of service for flood protection. However, as mentioned above for both catchments, there is no known floor level flooding problems in the two Town Plan Change areas. The condition of existing stormwater pipelines can be assessed by CCTV inspection, however there is no evidence that suggests that the condition is poor.

3.4 Quality of Vested Stormwater Assets

KDC has good sound building consent approval processes based on discussions with Council officers on internal processes. Records of vested assets are generally well kept although some work is required to confirm that all vested assets are recorded in the KDC GIS database. The quality of assets constructed has not been assessed but there is no evidence to suggest that the assets transferred are in poor condition. However, a review should be undertaken and any suggested improvements incorporated into KDC's internal processes.

3.5 Maintenance Costs of Existing Assets

The costs associated with maintaining the stormwater assets have not been assessed in detail for the two Town Plan Change areas. However, the following should be considered;

- The Mangawhai Head Town Plan Change area's stormwater system predominantly includes private soakage pits and roadside drains and swales. Maintenance of the roadside drains and swales is generally undertaken as an operations and maintenance task as part of maintaining the road corridor. Only one Council soakpit was located on the KDC's GIS database. Soakpits require maintenance at least twice annually.
- The Mangawhai Village Town Plan Change area's stormwater system predominantly includes stormwater pipelines and roadside drains and swales. Catchpits on roads require regular cleaning at least twice per annum to prevent blockage so that they are operational during flood conditions. Stormwater pipelines generally do not require maintenance unless silt and debris is allowed to be discharged into the pipe system and/or they have been poorly constructed. Maintenance of the roadside drains and swales is as discussed above but will require more regular cleaning to ensure they are not blocked during flood condition.

3.6 Information and Maps on Flood Risk

The overland flow maps developed recently for the Mangawhai Town Plan Change areas and the 2016 assessments referred to in 1.4 above provide a good appreciation of the flood risk information of the catchments. Further detailed flood modelling will be required as discussed above to understand the stormwater infrastructure capacities to enable decision making on any future investments.

4. Impact of Town Plan Change

4.1 Impact on Flood Protection Level of Service

Although the current capacity of the stormwater infrastructure in both the Town Plan Change areas seem to be meeting the level of service for floor level flood protection, further development up to the maximum probable development under the current Town Plan and/or future changes is likely to increase the flood risk to floor levels, roadside swales and properties.

An important consideration should also be given to the potential sea level rise in future and the impact on flood risk to properties along the coast but also properties inland that may come within the tidal zone and impacted by flooding during high tide levels coinciding with peak storm flows. The impacts of future sea level rise can be assessed with detailed flood modelling and mapping of the catchment which will be required to assess the impacts of the Town Plan Changes and optimise mitigation solutions.

4.2 Mitigation of Impacts via KDC Engineering Standards

KDC's engineering standards require post-development stormwater flows from developments to be kept to pre-development flows for the 1 in 100 year storm event. This means that there should be no additional flows to the public stormwater system, ie pipe networks, roadside drains and swales, ground soakage systems and overland flow paths. Floor levels for new developments are required to be above the peak 100 year storm flood levels.

For the Mangawhai Heads catchment, Developers will be required to discharge all stormwater into private soakage systems and/or retain stormwater in detention tanks and discharge stormwater to roadside drains and swales for soakage in the road corridor. If new pipe systems

are constructed in future to manage ponding in low lying areas, discharge from those areas will be to these pipe systems.

For the Mangawhai Village catchment, Developers will be required to retain stormwater in detention tanks and discharge stormwater to either pipe systems or roadside drains and swales for conveyance to the Estuary.

In both catchments, especially in known ponding areas and flood risk areas identified from detailed flood modelling, floor levels will be required be above the peak flood levels.

Although enforcing the KDC Engineering standards can mitigate the impacts of the Town Plan Change on the stormwater infrastructure, the following are some risks to consider;

- Enforcement of the Engineering standards will require both a detailed understanding of the catchment and internal tools and resources for decision making in consent approval processes.
- The cost of private soakage systems, detention tanks and associated pipe systems can be costly to individual Developers and hence the community.
- Private soakage and detention systems require on-going maintenance to be fully operational during storm events. Failure of these systems can occur resulting in localised flooding in built up areas.
- In known flood risk areas, setting un-realistic higher floor levels for new developments can increase the cost of development significantly and may also prohibit development in some cases.
- Although floor levels can be protected, nuisance property and road corridor flooding can still occur giving a lower level of service for flood protection.
- The capacity of the existing stormwater infrastructure under the current Town Plan to meet flood protection levels of service for the maximum probable development of the catchment has not been assessed using detailed flood models. For the Mangawhai Heads catchment, the soakage capacity has not been assessed. For the Mangawhai Village catchment, the capacity of roadside drains and swales has not been assessed for flow conveyance.
- The impact of climate change in the Mangawhai catchments has not been assessed and allowed for in the KDC Engineering standards. It is likely that there will be more intense rainfall, more volume of rainfall and tidal influences on stormwater flows due to increased sea levels.

Although enforcing the KDC Engineering standards provides a “Do Nothing” Option for KDC with respect to the proposed Town Plan Change, contingencies to manage risks as discussed above and optimisation of the total catchment stormwater infrastructure costs should be considered.

4.3 Town Plan Change Impacts and Mitigation Solutions

The following table lists the potential impacts together with mitigation solutions and costs of the Town Plan Changes on the stormwater infrastructure if the risks discussed in 4.2 are not managed and/or if more cost effective and optimised mitigation solutions are to be considered.

Some costs are yet to be determined through further investigations, detailed flood modelling and master planning.

No	Key Impacts	Mangawhai Heads	Mangawhai Village	Mitigation Solutions	Estimated Cost
1	Overland flow paths blocked and impeded by additional development causing localised flooding	Yes	Yes	Option 1A Master Planning to designate overland flow paths and to assist in the consenting approval process Resourcing of KDC team to manage and protect flow paths through day to day consent approvals and monitoring of designated overland flowpaths post development to ensure these are not impeded	Option 1A Master Planning \$70,000 KDC resourcing \$50,000 per annum
2	Ground soakage capacity is reached in localised areas leading to localised flooding	Yes	NA	Option 2A Floor level control of new dwellings – higher to prevent flooding New KDC soakpits as required to prevent flooding of existing properties Pipeline Corridor protection Option 2B New KDC soakpits as required to prevent flooding of all properties Pipeline Corridor protection Option 2C New Pipe network as suggested in Fig 1 as required over time depending on development and soakage capacities Option 2D Combination of options	Option 2A & 2B Soakpits \$15,000 each on average Total TBA Option 2C Entire pipe network \$1,430,000 based on 2,200 metres @average rate \$650 per m Option 2D TBA

				A,B and C	
3	Pipe capacities reached leading to localised flooding	NA	Yes	<p>Option 3A</p> <p>Floor level control of new dwellings – higher to prevent flooding</p> <p>Option 3B</p> <p>New pipe network as suggested in Fig 2 as required over time depending on development</p> <p>Option 3C</p> <p>Combination of Option 3A and 3B</p>	<p>Option 3A</p> <p>Nil</p> <p>Option 3B</p> <p>Entire pipe network \$1,000,000 based on 2,000 metres @ average rate \$500 per m</p> <p>Option 3C</p> <p>TBA</p>
4	Road drains and swale capacities reached leading to localised flooding	Yes	Yes	<p>Option 4A</p> <p>Improve soakage and retention capacity in Mangawhai Heads catchment</p> <p>Improve retention capacity and conveyance in Mangawhai Village catchment</p>	<p>Option 4A</p> <p>Mangawhai Heads TBA</p> <p>Mangawhai Village TBA</p>
5	Future sea level rise leading to increased flood risk of properties in tidal zone	Yes	Yes	<p>Option 5A</p> <p>Exclude properties at risk from Town Plan area</p> <p>Option 5B</p> <p>Floor level control – higher floor levels to minimise flood risk</p> <p>Option 5C</p> <p>Combination of Options 5A and 5B.</p>	<p>Option 5A, 5B & 5C</p> <p>Minimal KDC cost</p>

Table 1 Town Plan Change impacts, mitigation solutions and costs

5. Town Plan Change Mitigation Options

5.1 General

KDC is seeking the recommendation of three options from this assessment together with costs and funding streams to mitigate the impacts of the proposed Town Plan Changes. The options recommended below are based on the above assessments.

5.2 Option 1 – Do nothing

The “Do nothing” option is for no additional public KDC systems. As discussed in 4.2 above, this option is to enforce the KDC Engineering standards that require all stormwater from new developments to be kept to the pre-development flows for up to the 100 year storm event. This option is feasible but has associated risks as discussed in 4.2 above. To minimise risks, this option will require the following;

- Enforcement of KDC engineering standards to keep post development flows the same as pre-development flow, new floor levels above 100 year storm flood levels and monitoring to ensure private drainage systems are maintained and operating as designed.
- 1D/2D catchment modelling and flood hazard modelling including modelling of sea level rise scenarios and detailed master planning to understand the capacity of existing stormwater infrastructure, set minimum floor levels across the catchments, designate overland flow paths, identification of pipeline corridors for protection and identification of properties at risk from future sea level rise to exclude from the Town Plan Change area.
- If detailed flood modelling identifies stormwater capacity issues of the existing stormwater infrastructure under the current Town Plan, further assessments and decision making may be required.

The cost to KDC for this option for capital works is minimal, however there are internal operational costs to consider if risks as discussed in 4.2 are to be minimised. Detailed flood modelling may also identify capacity issues under the existing Town Plan.

5.3 Option 2 – Quick Fixes

This option is for a low cost solution to undertake minimal work to mitigate the impacts of the Town Plan Change.

This option follows on from Option 1. To minimise the risks as discussed in Option 1, the recommendations in Option 1 will be required to be carried out for Option 2.

Additionally, based on the outcomes of the recommended works for Option 1, quick fixes may be identified that will optimise the overall costs to both KDC and Private Developers. This may include Options 2A, 2B and 2D and/or Option 3C and/or Option 4A as described in Table 1 above. The options are summarised below.

Options 2A, 2B and 2D

Additional soakpits and/or new pipe network where building floor level control is not feasible and/or uneconomical.

Option 3C

New pipe network where building floor level control is not feasible and/or uneconomical.

Option 4A

For roadside drains and swales, improve soakage and retention and conveyance capacities.

The costs of Option 2 – “Quick Fixes” are to be determined when flood modelling and master planning of the catchment is completed.

For certain areas of the catchments, it may be feasible to fund the quick fixes through Developer contributions.

5.4 Option 3 – Upgrade and extension of KDC Stormwater Infrastructure

This option follows on from Option 2, but includes provision of public infrastructure to manage additional flows from the Town Plan Changes. This will include options 2D, 3C and 4A as described in Table 1 above. The options are summarised below.

Option 2D

New pipe network supplemented with soakpits and some building floor level control where soakpits and pipe network are not feasible and/or uneconomical.

The maximum estimated cost for pipe network is \$1,430,000 as estimated in Table 1 (Option 2C).

The costs for soakpits are to be determined.

Option 3C

New pipe network and some building floor level control where pipe network is not feasible and/or uneconomical.

The maximum estimated cost for pipe network is \$1,000,000 as estimated in Table 1 (Option 3B).

Option 4A

For roadside drains and swales, improve soakage and retention and conveyance capacities.

The costs are to be determined.

The above cost estimates are based on the proposed new infrastructure shown on the stormwater maps in Appendix A. Option 3 – “Upgrade and extend network” can be funded through Developer contributions in areas where the costs of private drainage to manage additional flows from development are minimised.

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Appendices

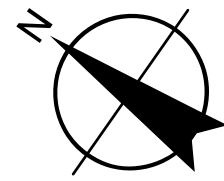
Appendix A - (Mangawhai Town Plan Stormwater Maps)

Content

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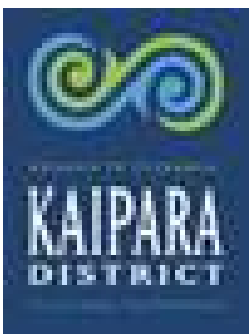


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Map Projection: Transverse Mercator
Horizontal Datum: NZGD 2000
Grid: NZGD 2000 New Zealand Transverse Mercator



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| ■ CatchPit | ▲ Outlet | — Stormwater Pipe | — Wastewater Pipe |
| ● Inlet | ● Soakpit | — Overland Flow Paths | — Subcatchment |
| ● Manhole | ▲ Sump | — Town Plan Area | |

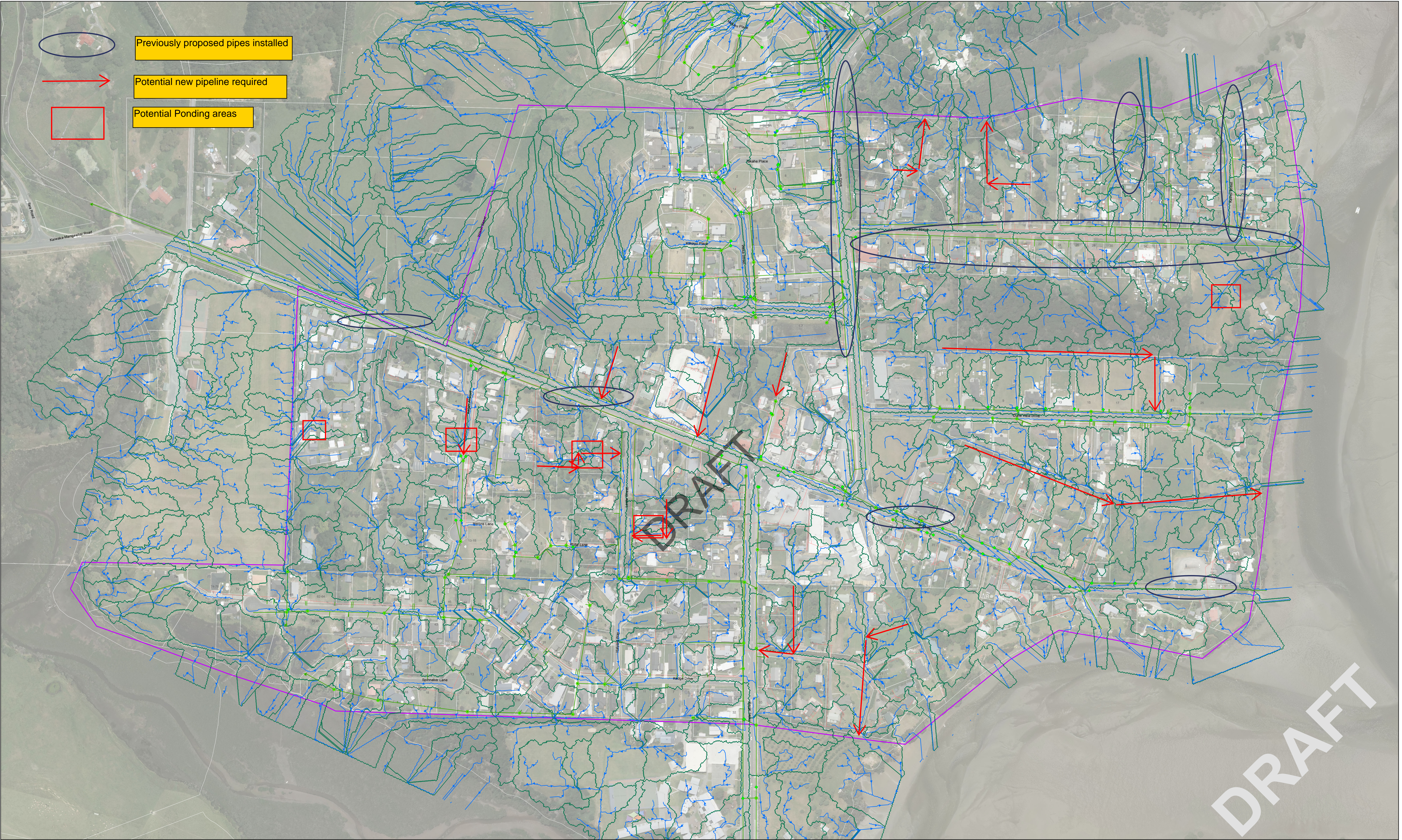


Kaipara District Council
Mangawhai Catchment Scoping

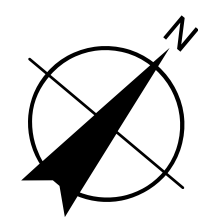
Mangawhai Head Town Plan Area

Job Number	51-33761
Revision	A
Date	15 Mar 2016

Figure 1



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Metres
Map Projection: Transverse Mercator
Horizontal Datum: NZGD 2000
Grid: NZGD 2000 New Zealand Transverse Mercator



- LEGEND
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|------------|-----------|-----------------------|-------------------|
| ■ CatchPit | ▲ Outlet | — Stormwater Pipe | — Wastewater Pipe |
| ● Inlet | ● Soakpit | — Overland Flow Paths | — Subcatchment |
| ● Manhole | ▲ Sump | | — Town Plan Area |



Kaipara District Council
Mangawhai Catchment Scoping

Mangawhai Village Town Plan Area

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Figure 2

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GHD

Level 3, 27 Napier Street
Freemans Bay

T: 64 9 370 8000 F: 64 9 370 8001 E: aklmail@ghd.co.nz

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Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
	Vijesh Chandra	John Tetteroo		Vijesh Chandra	<i>Vijesh Chandra</i>	29/03/16