



Auckland Council Healthy Waters

Glorit Drainage District Asset Investigation



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Summary – Glorit Drainage District

ACH Consulting Limited has been commissioned by Auckland Council Healthy Waters to undertake an investigation of the condition of existing drainage assets in the Glorit Drainage District, and provide comment on future maintenance costs and requirements.

Existing Condition

On-site investigation showed that the public drains were generally in good condition, with some outlying areas of drain having significant vegetation overgrowth causing poor drainage. It is determined that with regular spraying these drains can be restored to their optimal condition and prevent the spread of nuisance vegetation to other areas.

Maintenance Schedule

Best practice is to spray drains for nuisance plants twice yearly. This has proven to be the most cost effective solution in keeping drains operating effectively, at about 10% the cost of mechanical cleaning.

Mechanical cleaning is generally required on a 5-year rotation, ideally with 1/5th of the total drains being cleaned each year.

Budgeting Summary

Fund Allocation:	Cost/year:	Description:
Annual Maintenance	\$19,586	Spray all drains twice yearly. Mechanically clean drains on a 5-year rotation.
Replacement Contingency	\$6,500	Funds set aside for repair and replacement of critical drainage assets including, culverts, floodgates and stopbanks.
Management Fee (10%)	\$2,609	Based on 10% of the base annual costs as a general management fee for allocating and overseeing works.
Risk Contingency (20%)	\$5,218	Based on 20% of the base annual costs. Fund allocation for dealing with extraordinary events and emergency works.
Total Annual Cost	\$33,913	Total annual cost for managing and maintaining the drainage district.

A full cost breakdown can be found in Appendix A

Actionable Items

- Implement maintenance and remediation plan;
- Investigate and repair Culvert 1.

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1. Introduction

Auckland Council manages the removal and disposal of stormwater runoff in defined rural areas. The activity predominantly relates to inhabited areas and developed farmland where additional drainage is required to prevent flooding and damage to property.

A high-level asset management assessment has been undertaken on the Glorit Drainage District. The assessment aims to provide Council with the necessary tools and information to implement a generalised management plan for the drainage assets going forward. It also aims to give an indication of future costs for budgeting purposes.

The management assessment identifies the various assets within the area and their respective condition, functionality, and significance to the region. Additionally, the assessment outlines future funding requirements including renewals and maintenance where appropriate.

1.1 Objectives

The key objectives of the Management Plan are to:

- Identify and document condition of drainage assets in the area;
- Provide a future maintenance strategy for drainage assets;
- Provide an estimate of future asset condition and useful life by taking a snapshot of the existing asset condition;
- Aid in the formalisation of future management, maintenance and renewal works for the area;
- Provide a budget estimate for future work.

1.2 Strategic Goals

To plan, maintain and improve the drainage network, minimising the effects of flooding on people, dwellings, damage to property and to promote sustainable management of the drainage network in terms of both monetary and environmental sustainability.

- Develop and implement a planned maintenance and inspection register;
- Review and update the maintenance plan as required;
- Allocate or raise the budget as required.

2. Background

Drainage maintenance is an ongoing issue for communities that rely on utilising farmland for economic benefit. Maintenance generally involves regular spraying of nuisance plants combined with mechanical removal, usually by an excavator. The mechanical excavation process also provides an opportunity to reform the banks of drainage channels where necessary and remove any excess silt.

Drainage that has been neglected and has dense overgrowth and choking may require higher intensity spraying and mechanical cleaning to bring it up to standard. Once recovered, the drain may be maintained under a regular maintenance schedule.

2.1 Chemical Spraying

Vegetation can be both beneficial and detrimental to drains. While grass and other plants can aid in erosion control on the banks of drains by holding together soil, some species can grow excessively, choking drains and impeding stormwater flows.

Vegetative choking greatly reduces the discharge capacity of drains and increases the risk of flooding. Alligator weed, in particular, is prevalent throughout the region and will require targeted treatment. Careful planning and execution is required to mitigate and minimise the growth of alligator weed and other unwanted vegetation, and stop it spreading further.

Regular spraying has proven to be the most effective maintenance practice to keep vegetation under control. Recommended procedure indicates spraying twice a year, which is an effective proactive treatment, staying ahead of weed growth. As well as being very effective when implemented properly, spraying is also very economical at around 10% of the cost of mechanical cleaning per metre.

Keeping to a strict spraying schedule is essential in staying ahead of vegetation growth and having the best results from the treatment. An experienced person should be consulted to advise on the chemicals used and where best to spray dependent on the weeds present to achieve the most effective results.

2.2 Minimising the need for Mechanical Drain Cleaning

Mechanical drain cleaning is primarily required to remove weed growth and/or sediments which impede drainage. Mechanical cleaning can be expensive as it involves the use of a digger and may require trucks to transport the spoil offsite.

A proactive approach to keeping drains clean is generally the most cost-effective way of maintaining a healthy drainage system, which makes regular spraying the first and most preferred option. In general, spraying drains more often to prevent excessive weed growth means that mechanical cleaning will be required less often, resulting in significant cost savings.

Preventing the spread of weeds is essential to limiting growth and maintaining efficient drainage. Two key ways of doing this are:

1. If possible, mechanically removed vegetation should be trucked away to a fill site. If this is not possible, ensure the vegetation is dropped a minimum of 4 m away from drainage channels and waterways.
2. Remove vegetation from mechanical equipment, tools and footwear between drainage sites to prevent transfer between sites.

2.3 Mechanical Cleaning Cycle

Research indicates that drains, if well maintained, need to be mechanically cleaned about once every five years. Using this timeline, best practice is to clean one fifth of the district's drains each year. This method gives the highest probability that the overall drainage network will be in sufficient condition to handle an extreme weather event in any given year. It also means that if emergency excavator work is needed it can be done during that year's drain cleaning.

2.3.1 Risks

The greatest risk in the practice of maintaining drains is that of over-cleaning. The risk being that the removal of sediment from drains will lower the level of the drains such that water will no longer flow through permanent structures such as culverts.

Excavator operators should avoid over cleaning drains, excessive removal of soils and over-steepening of banks.

Additionally, there is the risk of damage to the banks. Slips and damage, however minor, may result in encroachment of drains to surrounding infrastructure such as roads, houses, fences etc.

2.4 Cost

Costs have been estimated with consultation from Council's maintenance contractor and other drain cleaning contractors.

In a report prepared by Environment Waikato the conclusion is that, "Undertaking a twice yearly spray program has more than halved the need for mechanical clearance and reduced costs considerably." (Gibbs, M.; 2007). This information was confirmed in discussions with resident farmer's noting that in particular, the alligator weed could not be controlled with yearly spraying. As such, 6 monthly spraying is recommended for all drains.

Extra over costs for cartage of material off site have been included, and assumed no tip fees and a local point of disposal (farmers paddock etc).

The table below indicates costs for drain cleaning.

Maintenance	Estimated Cost Per Metre	Suggested Recurrence
Chemical Spraying	\$0.35	6 months
Mechanical Cleaning	\$3.5	5 years
Removal of Spoil	\$3.5	5 years

3. Glorit Drainage District Investigation

Site inspections were carried out in the Glorit Drainage District by ACH Consulting Engineers during November 2017. The inspections involved visual assessments of all culverts, floodgates, and stopbanks, as well as, aerial drone footage of drains.

The inspections revealed that the drains were generally in good condition, with low levels of weeds present. Furthermore, drainage infrastructure was found to be in satisfactory condition.

3.1 Public Drains

ACH identified eight public drains in the district that fall under the Council's obligation. The drains are identified as 'A' through 'H'.

Overall, the majority of the lengths of drainage were clear and free flowing, although some areas were densely vegetated and choked with weed. It is likely that without timely remediation and control nuisance plants will continue to spread, intensifying the issue and significantly increasing the chance of a catastrophic flood event.

3.2 Drainage Assets

ACH identified three culverts, two floodgates and the perimeter stopbank as essential Council assets in the drainage district.

The assets were inspected and an estimate given for their remaining life, replacement cost and importance in the network.

All of the assets were in good working condition allowing free drainage. Culvert 1 however had been disjointed and requires remedial works.

It is recommended that an asset register is implemented, identifying these assets and updating their condition on a yearly basis.

4. Proposed Maintenance Schedule

The proposed maintenance schedule is designed on best practice and evidence based investigation to achieve a pro-active approach in keeping drains free flowing. As such, it is essential that *both* spraying and mechanical cleaning are undertaken as scheduled to stay on top of vegetation growth and sedimentation. In this way, significant blockages and catastrophic failures will be minimised and the Council will have the resources to deal with them effectively, should they occur.

4.1 Spraying

Chemical spraying should be undertaken twice yearly on all drains. Optimal spraying times are when drainage flows are low, allowing maximum exposure of vegetation.

Ideally spraying is undertaken in February to March and October to November.

A proposed chemical spraying schedule is outlined in Appendix A.

4.2 Mechanical Cleaning

Mechanical cleaning should be undertaken on drains every five years. The cleaning should be staggered such that one fifth of the drains are cleaned each year.

A proposed mechanical cleaning schedule is outlined in Appendix A.

4.3 Drainage Asset Renewal and Repair

Spraying and cleaning maintenance should be used as an opportunity to inspect the drainage assets, record any damage or blockages and schedule further maintenance.

A contingency cost for renewing the assets within the district is provided. No formal costing have been carried out for this item. Further works are required to develop an accurate long term asset renewal cost.

4.4 Asset Inspection Register

Every opportunity should be taken to inspect and record the condition of assets within the districts. Appendix D outlines an asset register for the district which should be filled out by the spraying operator.

4.5 Cost

The cost of bi-annual cleaning of the drains and mechanical removal of vegetation and sediments come to a total of \$25,463 including a 10% management fee and 20% risk contingency.

The fund allocation to asset renewal and repair is \$8,450 including a 10% management fee and 20% risk contingency.

The total yearly cost for the proposed maintenance plan is \$33,913 per year. The total fund allocation should be inflation adjusted on a regular timeframe.

5. Discussion and Recommendation

The assets in the Glorit Drainage District are in generally good condition. The first priority is to implement the maintenance plan, commencing with spraying. Any issues with the proposed plan that arise should be addressed at first chance.

Culvert 1 requires repair in the near future.

Residual funds should be kept and reallocated annually based on investigation and asset inspections.

It is worth noting that many of the issues raised by farmers in the region stemmed from the lack of contractor's understanding of the Glorit region. Their recommendation is that local contractors be engaged to undertake maintenance works due to their existing knowledge of the region and its conditions, and are likely to be more efficient in maintaining the drainage district.

The farmers and residents should be notified where possible and used as a source of knowledge for maintenance and monitoring.

6. References



















Far North District Council, September 2017: *Kaitaia Drainage Area, Management and Operational Plan*, Far North District Council, reference: A1839401

Gibbs, M. 2007: Best Practice Environmental Guidelines – Land Drainage. Environment Waikato

Appendix A

Maintenance and Cost Sheet

Public Drains - Spraying and Cleaning Works

I.D.	Drain Type	Length (m)	Maintenance Schedule	Initiate Mechanical Cleaning	Spraying Cost (\$)	Mechanical Cleaning Cost (\$)	Cost per year (\$)	
A	Primary	5820	Spray twice-yearly. Clean mechanically once every 5 years.	 	Year 0	2037	20370	8148
B	Secondary	1640	Spray twice-yearly. Clean mechanically once every 5 years.	 	Year 1	574	5740	2296
C	Secondary	320	Spray twice-yearly. Clean mechanically once every 5 years.	 	Year 1	112	1120	448
D	Secondary	480	Spray twice-yearly. Clean mechanically once every 5 years.	 	Year 2	168	1680	672
E	Secondary	450	Spray twice-yearly. Clean mechanically once every 5 years.	 	Year 2	157.5	1575	630
F	Secondary	450	Spray twice-yearly. Clean mechanically once every 5 years.	 	Year 2	157.5	1575	630
G	Secondary	1610	Spray twice-yearly. Clean mechanically once every 5 years, truck spoil away.	  	Year 3	563.5	11270	3381
H	Secondary	1610	Spray twice-yearly. Clean mechanically once every 5 years, truck spoil away.	  	Year 4	563.5	11270	3381

- i. *Spraying based on a cost of \$0.35 per metre*
- ii. *Mechanical cleaning based on cost of \$3.50 per metre*
- iii. *Removal of spoil based on cost of \$3.50 per metre*

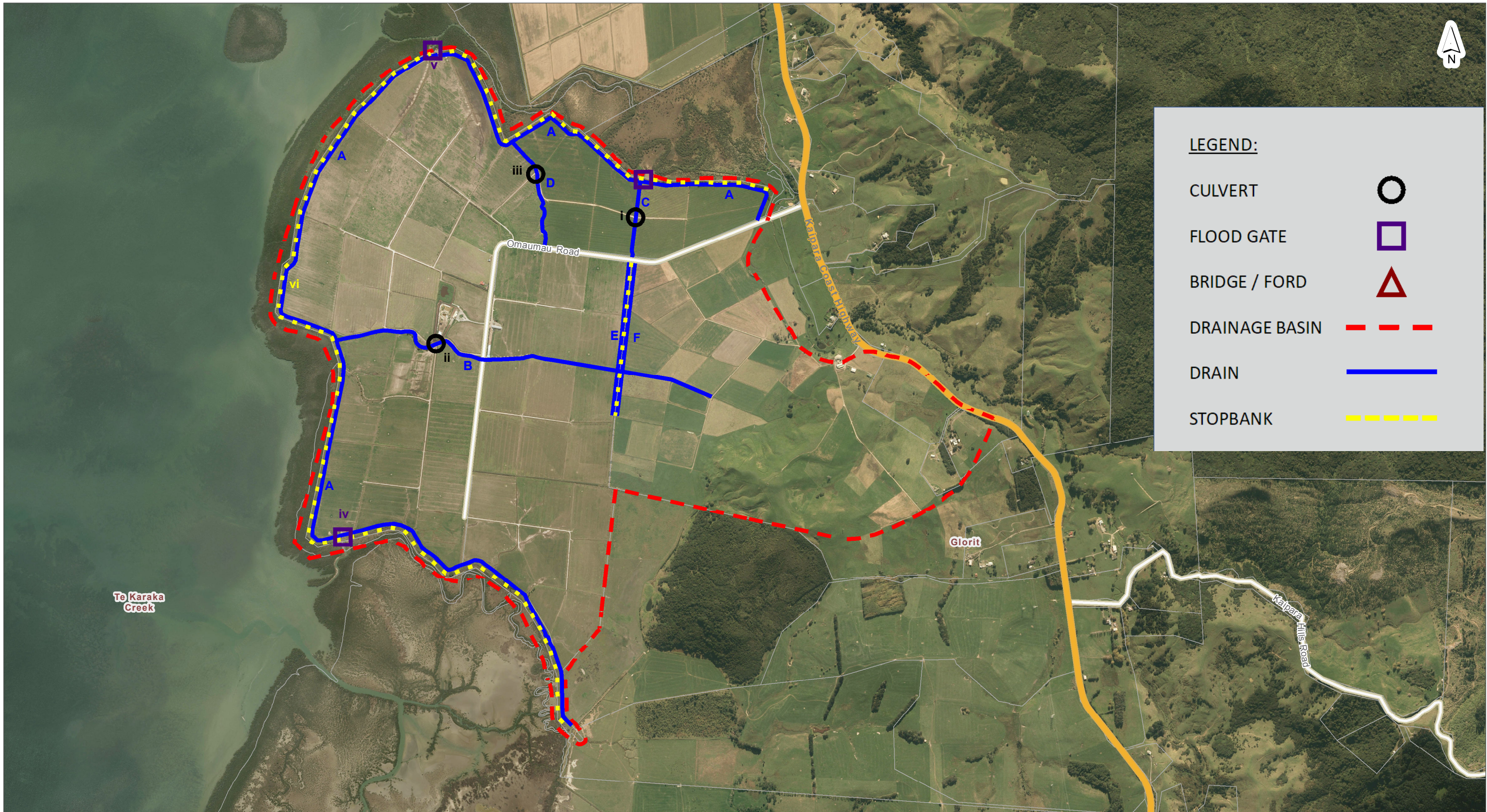
Base Annual Cost	\$ 19,586
Management Fee (+10%)	1,959
Risk Contingency (+20%)	3,918
Total Annual Cost	\$ 25,463

Drainage Assets – Ongoing Maintenance

ID	Type	Description and Condition	Ongoing/required Maintenance	Remaining Life	Replacement Cost	Importance Factor	Annual Replacement Contingency
i	Culverts	Culverts on main drains inspected, generally in good condition. Crossing to floodgate 2 has become disjointed and requires remedial works.	Annual inspection and review. Undertake remediation.	25 years	-	High	500
ii	Culverts	Culverts on main drains. Generally in good condition.	Annual inspection and review.	25 years	-	High	500
iii	Culverts	Culverts on main drains. Generally in good condition.	Annual inspection and review.	25 years	-	High	500
iv	Floodgate 1	Located at the southern end of the drainage district. Appears to be in good condition and working well	Annual inspection and review.	15 years	-	Medium	2000
v	Floodgate 2	Located at the northern end of the drainage district. Appears to be in good condition and working well.	Annual inspection and review.	15 years	-	Medium	2000
vi	Stopbank	Stopbank around perimeter of drainage area. Appears to be in good overall condition	Annual inspection and review. Keep accessways clear. Authorise excavator works for maintenance and repair as deemed necessary by inspection.	100 years	-	Very High	1000
Base Annual Cost					-		\$ 6,500
Management Fee (+10%)					-		650
Risk Contingency (+20%)					-		1300
Total Annual Cost					-		\$ 8,450

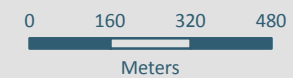
Appendix B

Drainage District Map



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Glorit Drainage District



Scale @ A3
 = 1:15,000

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Appendix C

Photographs Of Noteworthy Assets

Drain 'A'



Drain 'A'



Drain 'B'



Floodgate 'v'



Floodgate 'v' on drain 'A'



Appendix D

Drain and Asset Inspection Register

Date: _____

Inspected By: _____

Company: _____

**GLORIT DRAINAGE DISTRICT
PUBLIC DRAIN SPRAYING AND INSPECTION RECORD**

Drain	Date Sprayed	Vegetation Identified	Chemicals Used	Date Last Excavated	Observations (Circle One)			General Notes
					Water Level	Drainage	Drain Condition	
A					High	Free Flowing	Good	
					Mid	Adequate	Adequate	
					Low	Poor	Poor	
					Dry	Blocked	Failed	
B					High	Free Flowing	Good	
					Mid	Adequate	Adequate	
					Low	Poor	Poor	
					Dry	Blocked	Failed	
C					High	Free Flowing	Good	
					Mid	Adequate	Adequate	
					Low	Poor	Poor	
					Dry	Blocked	Failed	
D					High	Free Flowing	Good	
					Mid	Adequate	Adequate	
					Low	Poor	Poor	
					Dry	Blocked	Failed	
E					High	Free Flowing	Good	
					Mid	Adequate	Adequate	
					Low	Poor	Poor	
					Dry	Blocked	Failed	
F					High	Free Flowing	Good	
					Mid	Adequate	Adequate	
					Low	Poor	Poor	
					Dry	Blocked	Failed	
G					High	Free Flowing	Good	
					Mid	Adequate	Adequate	
					Low	Poor	Poor	
					Dry	Blocked	Failed	
H					High	Free Flowing	Good	
					Mid	Adequate	Adequate	
					Low	Poor	Poor	
					Dry	Blocked	Failed	

Date: _____

Inspected By: _____

Company: _____

**GLORIT DRAINAGE DISTRICT
ASSET INSPECTION AND CONDITION RECORD**

Asset ID	Observations (Circle One)				General Notes
	Water Level	Operating Condition	Structural Condition	Overall Condition	
Culvert i	High Mid Low Dry	Free Flowing Adequate Poor Blocked	Good Adequate Poor Failed	Good Adequate Poor Failed	
Culvert iii	High Mid Low Dry	Free Flowing Adequate Poor Blocked	Good Adequate Poor Failed	Good Adequate Poor Failed	
Culvert iii	High Mid Low Dry	Free Flowing Adequate Poor Blocked	Good Adequate Poor Failed	Good Adequate Poor Failed	
Floodgate 1	High Mid Low Dry	Free Flowing Adequate Poor Blocked	Good Adequate Poor Failed	Good Adequate Poor Failed	
Floodgate 2	High Mid Low Dry	Free Flowing Adequate Poor Blocked	Good Adequate Poor Failed	Good Adequate Poor Failed	
Stopbank	High Mid Low Dry	Free Flowing Adequate Poor Blocked	Good Adequate Poor Failed	Good Adequate Poor Failed	

Site Inspection Record as Prepared By ACH Consulting, Dec 2017



DRAINAGE CHANNEL: POOR FLOW



FLOOD GATE: GOOD CONDITION



CULVERT: GOOD CONDITION



CULVERT: STRUCTURAL FAILURE



CULVERT: POOR FLOW