

A scheme plan for the subdivision of the property has been prepared by Survey Worx and it shows 26 rural/residential lifestyle lots (includes an existing farmer residence) and 10 common accessways to vest.

The key engineering issues associated with developing the land are:

- The extent of the earthworks that is necessary to achieve stable finished ground for each lot and to enable the roads and accessways to be constructed.
- The sediment controls are necessary to protect the environment.
- The construction of roads and accessways at acceptable gradients and widths to provide access to the building platforms.
- Stormwater controls to ensure that the runoff volumes are no greater than the existing runoff from the site, that adequate stormwater management is undertaken and that the potential for erosion is minimised.
- The ability to provide adequate services for the development including wastewater disposal fields, and utility services.

These issues are addressed in this report, besides on-site wastewater disposal which is designed by KPG Geotechnical Group Ltd.

2 Earthworks

2.1 Earthworks Description

Earthworks are necessary on site to enable the construction of the new access roads and provide stable building platforms. The design also achieves the following:

- Minimises the earthworks volumes as much as practical.
- Provides an appropriate balance of cut to fill for the project.
- Provides stable access to roads and lots.
- Achieves road gradients that are similar to the existing farm tracks.

A copy of the earthworks design and sediment control plans is included as part of the engineering plans in Appendix A.

The quantities of earthworks are as follows in Table:

Table 1 Earthworks Volumes

Material Source	Cut, m ³	Fill, m ³
Topsoil Stripping	22,385	
Respread of Topsoil		17,000
Surplus Topsoil Spread to Vegetation regeneration Area		5,385
Clay Cut (Incl. Road Gulleys & Drainage Spoil)	49,670	
Clay Fill		50,080
TOTAL	72,055	72,465

The total earthworks area is approximately 9.1ha.

Earthworks machinery will comprise hydraulic excavators, trucks, graders and compactors. The final number, type, size and quantity of equipment that will be used will depend on the contractor chosen, their methodology and the resources that they have available.

Any unsuitable material will be disposed of offsite to appropriate locations which will be determined as necessary.

2.2 Timing of Works

It is anticipated that the earthworks will occur over the 2023/ 2024 construction season with completion in June 2024. This timeframe is subject to obtaining the required resource consents.

2.3 Erosion and Sediment Control

Erosion and sediment controls will comply with the requirements of the GD05 "Erosion and Sediment Control Guide for Land Disturbing Activities in the Auckland Region". A combination of erosion and sediment control measures will be employed as follows:

- The use of cleanwater diversion bunds, to intercept and direct cleanwater away from the proposed area of works. These bunds will be sized to accommodate flows from 5% Annual Exceedance Probability (AEP) storm event.
- The construction of sediment retention ponds at key locations where the sediment control catchment exceeds 3000m².
- The use of runoff diversion bunds to direct dirty water to the sediment ponds.
- The construction of topsoil bunds with decants for areas that are outside of the catchment of a sediment pond.
- Installation of contour drains at the completion of each day's work.
- Progressive stabilisation of the earthworks area as it is completed.
- Maintain a stabilised construction entrance at the crossing place off the Kaipara Coast Highway during the works in accordance with the ARC GD05 document. This will ensure that any vehicles leaving the site do not deposit earth onto the public roading network.

The main sediment control measures are the sediment ponds as shown on the sediment control drawings. They have been designed at the 3% criteria for the catchment that they are servicing. Flocculation of the ponds will also be provided. Details are provided on the engineering drawings in Appendix A.

2.4 Sediment Pond Sizing

Sediment ponds will be constructed at key locations during the earthworks as follows in Table 2:

Table 2: Sediment Pond Sizing Table

Sed Pond	Catchment Area	Length	Width	Depth	No of Decants	Min Volume
	Ha	m	m	m		m ³
1	2.37	30	6	2	2	711
2	0.92	12	4	2	1	276
3	0.93	12	4	2	1	279
4	1.29	15	5	2	1	387

2.5 Estimation of Sediment Yield

Stabilisation of earth worked areas will be completed progressively as the earthworks are completed. Silt control measures will remain in place for some time after completion of the grassing.

For the purposes of estimating sediment yield we have assumed that the area of exposed bare ground will correspond to the total earthworks area within three separate areas of earthworks as works will be progressively stabilised as they are undertaken. The calculations have therefore taken a catchment area of 3 ha with a sediment pond being the primary control feature.

Based on the USLE formula: $A = R \times K \times LS \times C \times P$ where:

A=Total sediment generated (tones/hectare/year)

R=Rainfall Erosion Index = $0.00828 \times p^{2.2} \times 1.7 = 82$

K=Resistance of surface to erosion = 0.26 from nomograph = .343 corrected to metric units

L=Length and slope factor = 6.51

C=Ratio of loss under a specified condition compared to that of a bare site = 1.0 (track walked on contour)

P=Surface Roughness Factor = 1.3

From this data $A = 238$ tonnes/hectare/year.

This translates to a total of 358 tonnes for the project over a 6-month construction period.

Estimation of sediment loss to the environment:

SL = $A \times SDR \times (1 - \text{eff})$, where

SL = Total sediment loss to the receiving environment (tones/hectare/year)

SDR= Sediment Delivery Ratio = 0.5 has been assumed for the area, taking into consideration topography and the proposed sediment retention measures.

Eff = 0.75 (or 75%) which is the efficiency corresponding to a flocculated sediment pond, which is the main sediment control feature.

For the site the total estimated sediment loss to the environment is $SL = 45$ tonne

This translates to an attenuation of 313 tonne or 87% of the total estimated sediment generated on site being captured and retained.

A calculation of the predevelopment sediment loss has determined that 41 tonne is lost to the receiving environment. This shows that the proposed re sediment controls will provide good protection to the environment and that the increase efficiencies obtained by using a flocculent in the sediment pond is justified.

2.6 Receiving Environment

The immediate receiving environments are watercourses that flow west and discharge to the Kaipara Harbour. These watercourses are highly modified by farming activities however they are likely to have some reaches with high aquatic values.

The area of the Kaipara Harbour that these streams discharge contains areas of intertidal banks and shell banks forming a complex habitat for a variety of animal and plant communities. In the mouth of the Makaurau River grow important areas of mangroves and salt marsh. The vegetation grades from the mangroves and salt marsh into mature kanuka forest with emergent tanekaha and kauri at the Makaurau River. The saline vegetation provides high quality habitat for threatened secretive coastal fringe birds. The Department of Conservation has selected this area, with the addition of an area of intertidal bank to the north, as an Area of Significant Conservation Value (ASCV).

Due to the potential of the watercourses and the natural character of the coastal environment all efforts will be made to protect the existing ecosystem.

3 Access Road Design

The access roads design has been undertaken to ensure the following:

- The stability of the road platform and batters achieves a minimum factor of safety. This is reported in the KGA geotechnical assessment.
- Have gradients that meet the standard required by Council.
- Have appropriate stormwater management.

The location of the access roads follows existing farm tracks as much as possible so that the functioning of the farm can be maintained, and earthworks are minimised.

The accessways will be sealed and include table drains for the primary purpose of stormwater conveyance. The width of the access roads has been designed depending on the number of lots they serve. For the narrower access roads passing bays have been included at approximate 50m intervals. At the locations where cattle cross the road the pavement will be strengthened with a concrete finish.

Some retaining walls are proposed to minimise the earthworks extents. A building consent will be applied once resource consent has been obtained.

There are archaeological features on the property and careful design has been done to avoid these features. A separate report has been completed by an archaeologist.

Access to the site is proposed by the creation of a new access off the Kaipara Coast Highway. This will replace the existing access off the highway which has poor visibility. An approval for the new intersection has been sought from NZTA/Waka Kotahi.

The access roads have been reviewed by Commute consultants and reported on separately.

4 Stormwater Management Plan

4.1 Introduction

The Council Network Discharge Consent only authorises diversion and discharge in urban area, therefore the discharges for this development will require its own stormwater discharge consent.

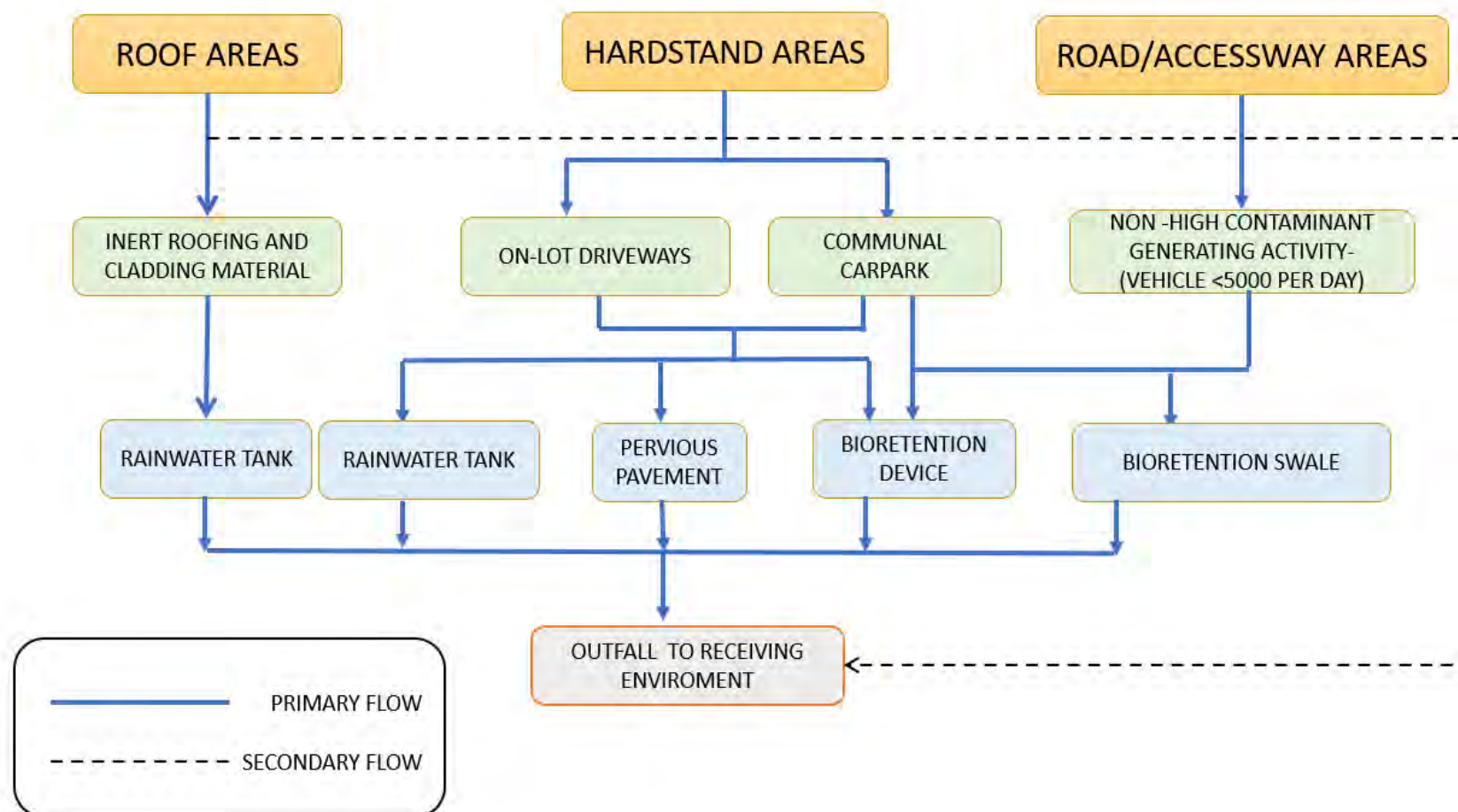
The total impervious area has been estimated at 4.73ha. This allows for approximately 800 to 1100m² of impervious area on each lot, as well as the impervious areas associated with the proposed roads and accessways.

A best practical option (BPO) approach has been taken so that the effects on the environment are less than minor. This approach is summarised as follows:

- Stormwater management area – Flow 1 (SMAF 1) has been adopted as hydrology mitigation approach for new impervious areas
- Stormwater quality control on road and on lot
- Hydraulic neutrality by undertaking extensive planting infill and re-vegetation
- Erosion control at outlets in accordance with TR2013/18
- Outlets located prior to streams so that flows are spread on grassed paddocks to mimic predevelopment scenarios
- Ensure all building platforms are located outside of overland flow paths and flood plains.

This BPO approach is detailed below for each type of impervious area, see Table 3.

Table 3: Stormwater management approach summary



4.2 Stormwater Quantity

The development has stormwater runoff from new impervious areas discharged to the existing stream receiving environment, therefore SMAF 1 mitigation has been adopted. It is proposed to achieve the required SMAF retention and detention volumes via the following approach for the 95th percentile rainfall event:

- Retention
 - o Within the residential lots, the 5 mm depth reduction will be achieved via water reuse. Whilst for the new impervious areas on roads, the retention requirement will be met by implementing bioretention swale, see calculations in Appendix D.
- Detention
 - o Accessways and roads – a bioretention swale has been designed to accommodate the detention volume required for the impervious areas of the accessways and roads.
 - o Building roofs – stormwater tank will be used to provide the required detention volume associated with the roof area.
 - o Other hardstand areas such as on-lot driveway and communal parking areas, options are rainwater tank, raingarden and permeable pavement.

The proposal includes extensive planting and enhancement planting, which is detailed in the Kaipara Coast Landscape Architecture plans.

The TP108 calculations have been undertaken to assess stormwater runoff from pre and post developments. The key findings are summarised in Table 3 below, while more details can be found in Appendix B.

Table 4: TP108 Hydrology Runoff Calculations

	10yrs ARI Average Peak Flow Rate (m3/s)	100yrs ARI Average Peak Flow Rate (m3/s)	10yrs ARI Runoff Volume (m3)	100yrs ARI Runoff Volume(m3)
<i>Pre-development</i>	1.7	3.3	145,470	283,386
<i>Post-development</i>	1.7	3.3	144,987	282,136

With the assessment results given above, it is considered that the impacts from the proposed development on downstream systems or ecology is negligible.

4.3 Stormwater Quality

To protect the ecosystems downstream of the development, the design has made provisions to implement the following methods to manage stormwater runoff from additional impervious areas before it discharges to the receiving environment. These are:

- Bioretention swales are designed to collect and treat stormwater runoff generated on road following GD 01 guideline.
- Although the grassed table drains for the proposed roads and jointly owned accessways for the primary function of overland flow conveyance, they are designed to be wide and shallow, and intercepted with rock check dams on steep roads and accessways for improving water quality at source.

- Roofs on dwellings will be constructed using inert roofing materials. A consent notice can be put on the titles if required. The discharge from roofs will be collected by rainwater tank for domestic consumption. Dead storage shall be allowed in tank for settling small particles. Any overflows from the tanks will pass through an energy dissipation structure at the outlet to minimise concreted flows and mimic predevelopment conditions.
- The construction of wing wall structures and other required energy dissipation structure for each reticulated outlet. This is to minimise risk of erosion and hence improve water quality.

The proposed development is expected to attract less than 5000 vehicles per day and have less than 30 vehicles in the parking area, therefore any proposed accessway, on-lot driveway and car park are not classified as high use area. These new impervious areas do not trigger the water quality treatment requirements under AUP E9.

Where a stormwater device is required as part of the management approach, Stormwater Management Devices in the Auckland Region (GD 01) shall be used as the main design guidelines. The document aims to create an effective balance of protected ecosystem and residential development.

The construction of rock rip rap across the steeper gullies downstream of outlets to prevent erosion of the slopes, dissipate flows and provide some water filtering. This will provide some additional stormwater treatment and prevent erosion of the soils. The design of the outlets is included in Appendix A.

4.4 Stormwater Reticulation

A stormwater reticulation network is proposed to collect the runoff from the road and upstream areas and discharge it to a suitable discharge location without having any effects on the downstream system.

The stormwater pipe is designed to cater for the 10-year ARI storm. Whilst the grassed table drain on each side of the road has been designed to have capacity to convey flow up to 100-year ARI storm.

4.5 Overland Flow Paths and Flooding

Due to the hilly characteristic of the site, the proposed building platforms are well above any overland flow paths, watercourses and 100-year flood plains. It is expected that the minimum freeboard of finished floor levels can easily be achieved. See engineering plan C904 included in Appendix A of the report for details.

5 Wastewater, Water, Power and Telecommunications

Each lot will need to provide its own on-site wastewater disposal system at the time they build a dwelling. There are many suitable wastewater treatment systems that future lot owners can use. Some examples in the marketplace are the Biolytix system, Hynds Lifestyle system and Oasis Clearwater System.

The Urbanist has identified the location where the effluent disposal field should be constructed to ensure that the stability of the site is not compromised.

Potable water will be sourced by the future lot owners by rain harvesting. Typically each dwelling will store rain water in two 25000 litre tanks.

Power and telecommunication services are available for the site from the Kaipara Coast Highway. All internal reticulation will be installed underground. Design details for the reticulation can be provided at a later stage as part of engineering approvals.

6 Conclusions

The following conclusions can be drawn from the engineering assessment of the proposed development at 2127 Kaipara Coast Highway:

- Earthworks can be undertaken in accordance with the geotechnical engineer's recommendations to achieve stable building platforms, suitable road grades and stable batters. This will involve a large embankment fill and extensive groundwater controls.
- Stringent environmental control measures can be maintained to ensure that the potential effects from sediment discharges and dust are no more than minor.
- The proposed crossing place has been designed in accordance with Auckland Transport requirements.
- The proposed roads and accessways have been designed to acceptable gradients and geometry to provide access to the building platforms.
- New stormwater infrastructure will be provided to achieve the followings:
 - Adoption of SMAF 1 mitigation for all new impervious areas
 - 10-year design capacity for the primary pipe network and 100-year design capacity for the secondary stormwater network (i.e. grassed table drain)
- Power and telecommunication infrastructure can be provided for the development.

It is considered that the proposed engineering design will support the development and ensure the potential effects on the environment are less than minor.

APPENDIX A:
ENGINEERING DRAWINGS

APPENDIX B:

STORMWATER HYDROLOGY CALCULATIONS

TP108 Calcs - Hydraulic Neutrality

Project:	2127 Kaipara coast highway	Prepared B ZY	
Date:	24/07/2023		

Pre-Development - Pervious

Runoff Curve Number (CN) and Initial Abstraction (Ia)				
Soil Name and classification	Cover Description(cover description, treatment and hydrolic condition)	Curve Number (CN)	Area	Product of CN x area
C	Existing good vegetation	70	18.5	1295
C	Existing average vegetation	71	14.8	1050.8
C	Pasture	74	104.7	7747.8
		Totals=	138	10093.6

CN (weighted) =	73.14	
Ia (weighted) =	5	mm

Post-Development-Pervious

Runoff Curve Number (CN) and Initial Abstraction (Ia)				
Soil Name and classification	Cover Description(cover description, treatment and hydraulic condition)	Curve Number (CN)	Area (ha)	Product of CN x area
C	Existing native vegetation to be restored	70	33.47	2342.9
C	Area to be revegetated, Terrestrial	70	15.04	1052.8
C	Area to be revegetated, Wetland/damp areas	70	3.32	232.4
C	Infill areas between existing planting, Terrestrial	70	12.73	891.1
C	Infill areas between existing planting, Wetland	70	0.00	0
C	Wi grassland to regenerate	70	3.48	243.6
C	Planting adjacent to reclaimed land and slopes	70	1.58	110.6
C	Grass within reclaimed land to be left	70	1.80	126
C	Pasture	74	61.85	4576.9

		Totals=	133.27	9576.3
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CN (weighted) =	72	
Ia (weighted) =	5.00	mm

Post-Development-Impervious

Runoff Curve Number (CN) and Initial Abstraction (Ia)				
Soil Name and classification	Cover Description(cover description, treatment and hydrolic condition)	Curve Number (CN)	Area (ha)	Product of CN x area
C	Building platform	98	2.60	254.8
C	Car parking area	98	0.10	9.7118
C	Roads and accessways	98	2.03	198.94

Totals=	4.73	463.45
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CN (weighted) =	98.00	
Ia (weighted) =	0.00	mm

Pre-Development

Catchment Area =	1.38	km ²
Runoff curve number=	73	
Initial Abstraction=	5	mm

Storage=	93.27	mm
24 Hour rainfall ARI 10yrs=	170	mm
24 Hour rainfall ARI 100yrs=	280	mm
ARI 10yrs Runoff depth Q24 =	105.41	mm
ARI 10yrs Runoff volume =	145470	m ³
ARI 100yrs Runoff depth Q24 =	205.35	mm
ARI 100yrs Runoff volume =	283386	m ³
ARI 10yrs Average peak flow rate=	1.68	m ³ /s
ARI 100yrs Average Peak flow rate=	3.28	m ³ /s

Post-Development Pervious

Catchment Area =	1.33	km ²
Runoff curve number=	72	
Initial Abstraction=	5.00	mm

Storage=	99.48	mm
24 Hour rainfall ARI 10yrs (CC inclusive)=	170.00	mm
24 Hour rainfall ARI 100yrs (CC inclusive)=	280.00	mm

ARI 10yrs Runoff depth Q24 =	102.94	mm
ARI 10yrs Runoff volume =	137184	m ³
ARI 100yrs Runoff depth Q24 =	201.95	mm
ARI 100yrs Runoff volume =	269132	m ³
ARI 10yrs Average Peak flow rate=	1.59	m ³ /s
ARI 100yrs Average Peak flow rate=	3.11	m ³ /s

Post-Development Impervious

Catchment Area =	0.05	km ²
Runoff curve number=	98.00	
Initial Abstraction=	0.00	mm

Storage=	5.18	mm
24 Hour rainfall ARI 10yrs (CC inclusive)=	170.00	mm
24 Hour rainfall ARI 100yrs (CC inclusive)=	280	mm

ARI 10yrs Runoff depth Q24 =	164.97	mm
ARI 10yrs Runoff volume =	7803	m ³
ARI 100yrs Runoff depth Q24 =	274.91	mm
ARI 100yrs Runoff volume =	13003	m ³
ARI 10yrs Average Peak flow rate=	0.090	m ³ /s
ARI 100yrs Average Peak flow rate=	0.151	m ³ /s

APPENDIX C:

CULVERT AND SCOUR & ERSOSION DESIGN CALCULATIONS

Project: 2127 KAIPARA COAST HIGHWAY, KAKANUI
Client: GOODLAND

CALCULATED MA
 CHECKED
 Date: 21/07/2023

Culvert 1 Flow Rate Calculation

Worksheet 1: Runoff Parameters and Time of Concentration

Circle one: Present Developed (ENTIRE CATCHMENT, PERVIOUS& IMPERVIOUS)

1. Runoff Curve Number (CN) and Initial Abstraction (Ia)

Soil name and classification	Cover description (cover type, treatment & hydrologic condition)	Curve Number CN*	Area (ha)	Product of CN x area
Type C	Urbun Lawn	72	1.1500	82.80
Totals =			1.1500	83

CN (weighted) = total produced / total area = **72.00**

Ia (weighted) = 5 x pervious area / total area = **5.0 mm**

1. Time of Concentration

Channelisation factor C = **0.90** (from Table 4.2)
 Catchment length L = **0.20** km (along drainage path)
 Catchment slope S_c = **0.14** m/m (by equal area method)

Runoff factor, CN / (200 - CN) = **0.56**

t_c = 0.14 C L^{0.66} (CN / (200 - CN))^{-0.55} S_c^{-0.30} **0.106** hrs

Adopted t_c = **0.17** hrs *0.17hrs min*

SCS Lag for HEC-HMS T_p = 2 / 3 t_c **0.11** hrs

Worksheet 2: Graphical Peak Flow rate

1. Data

Catchment area A = **0.011500** km²
 Runoff Curve No CN = **72.00** (from Worksheet 1)
 Initial abstraction Ia = **5.00** mm (from Worksheet 1)
 Time of concentration t_c = **0.170** hrs (from Worksheet 1)

2. Calculate Storage, S = (1000 / CN - 10) x 25.4 **98.8** mm

3. Average recurrence Interval, ARI (yr)

4. 24 hour rainfall depth, P₂₄ (mm)

5. Compute C* = $\frac{P_{24} - 2Ia}{P_{24} - 2Ia + 2S}$

6. Specific peak flow rate q* (from fig 6.1)

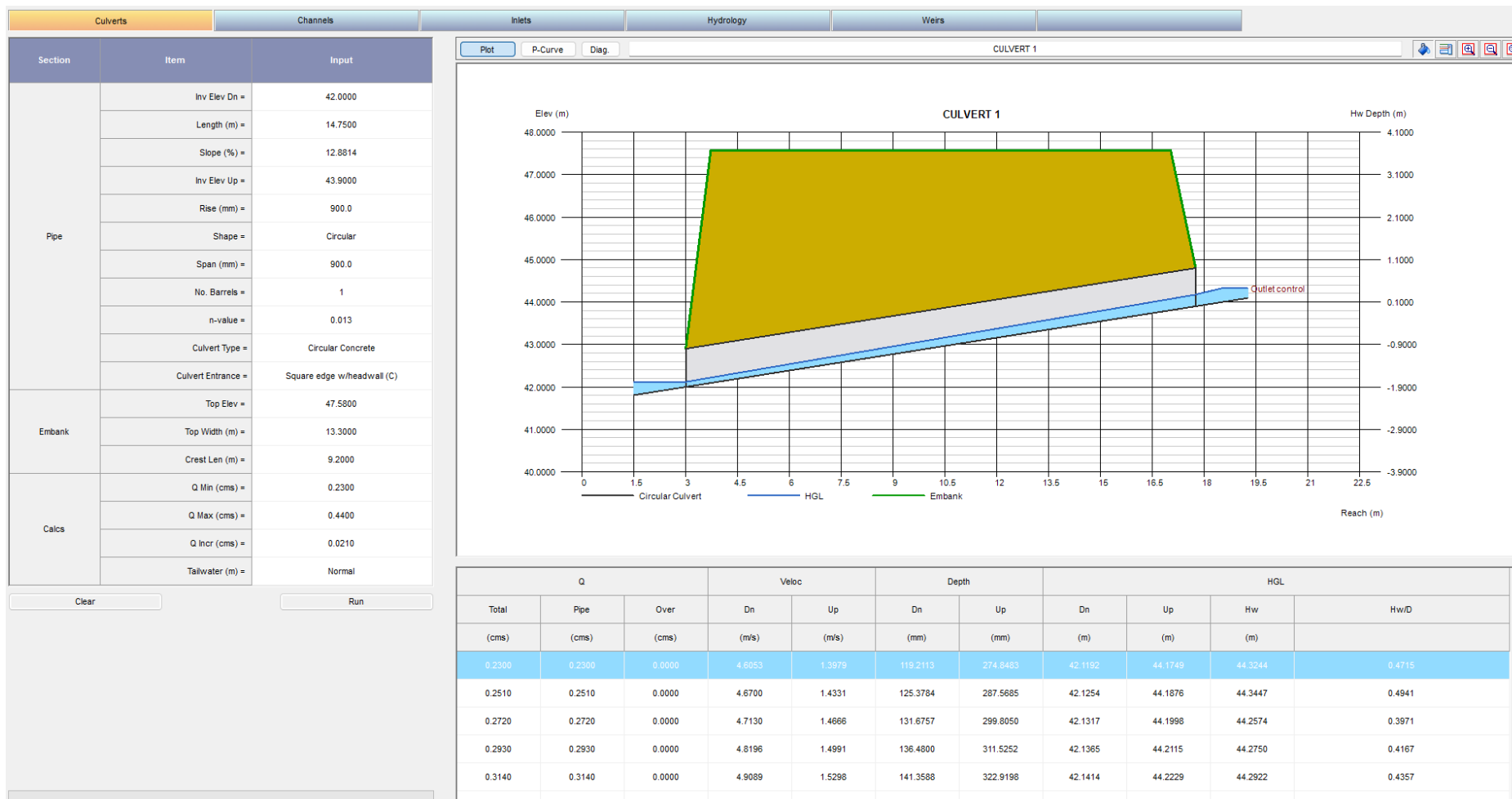
7. Peak Flow rate, q_p = q* A P₂₄ (m³ / s)

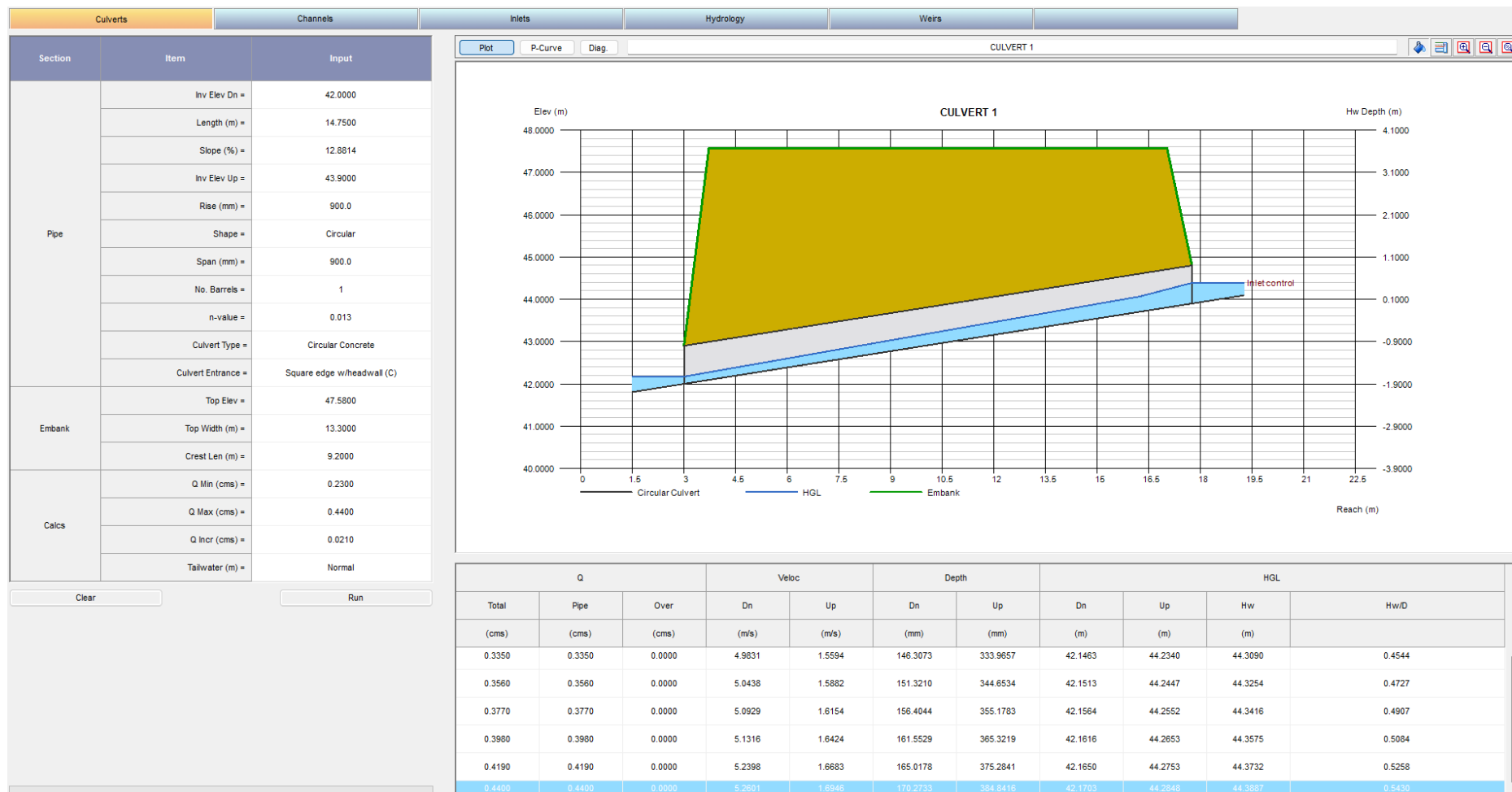
8. Runoff depth, Q₂₄ (mm) =

$$\frac{(P_{24} - Ia)^2}{(P_{24} - Ia) + S}$$

9. Runoff volume, V₂₄ = 1000 x Q₂₄ A (m³)

Storm#1	Storm#2
1% AEP	10% AEP
280.3	170.0
0.58	0.45
0.136	0.115
0.438	0.225
202.62	103.21
2330	1187





Project: 2127 KAIPARA COAST HIGHWAY, KAKANUI
Client: GOODLAND

CALCULATED MA
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 Date: 21/07/2023

Culvert 2 Flow Rate Calculation

Worksheet 1: Runoff Parameters and Time of Concentration

Circle one: Present Developed (ENTIRE CATCHMENT, PERVIOUS& IMPERVIOUS)

1. Runoff Curve Number (CN) and Initial Abstraction (Ia)

Soil name and classification	Cover description (cover type, treatment & hydrologic condition)	Curve Number CN*	Area (ha)	Product of CN x area
Type C	Urbun Lawn	72	4.8600	349.92
Totals =			4.8600	350

CN (weighted) = total product / total area = **72.00**

Ia (weighted) = 5 x pervious area / total area = **5.0 mm**

1. Time of Concentration

Channelisation factor C = **0.90** (from Table 4.2)
 Catchment length L = **0.40** km (along drainage path)
 Catchment slope S_c = **0.15** m/m (by equal area method)

Runoff factor, CN / (200 - CN) = **0.56**

t_c = 0.14 C L^{0.66} (CN / (200 - CN))^{-0.55} S_c^{-0.30} **0.167** hrs

Adopted t_c = **0.17** hrs *0.17hrs min*

SCS Lag for HEC-HMS T_p = 2 / 3 t_c **0.11** hrs

Worksheet 2: Graphical Peak Flow rate

1. Data

Catchment area A = **0.048600** km²
 Runoff Curve No CN = **72.00** (from Worksheet 1)
 Initial abstraction Ia = **5.00** mm (from Worksheet 1)
 Time of concentration t_c = **0.170** hrs (from Worksheet 1)

2. Calculate Storage, S = (1000 / CN - 10) x 25.4 **98.8** mm

3. Average recurrence Interval, ARI (yr)

4. 24 hour rainfall depth, P₂₄ (mm)

5. Compute C* = $\frac{P_{24} - 2Ia}{P_{24} - 2Ia + 2S}$

6. Specific peak flow rate q* (from fig 6.1)

7. Peak Flow rate, q_p = q* A P₂₄ (m³ / s)

8. Runoff depth, Q₂₄ (mm) =

$$\frac{(P_{24} - Ia)^2}{(P_{24} - Ia) + S}$$

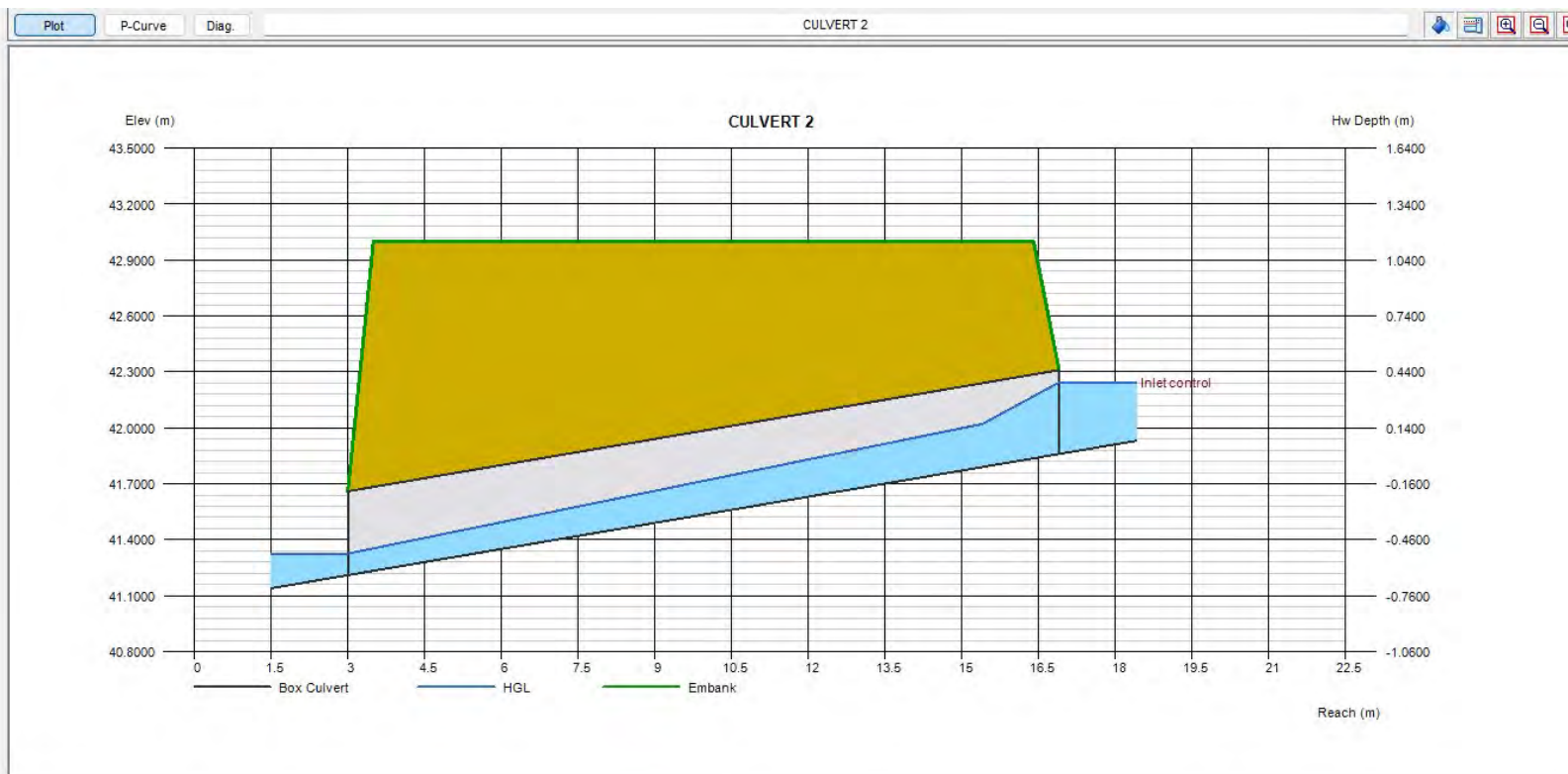
9. Runoff volume, V₂₄ = 1000 x Q₂₄ A (m³)

Storm#1	Storm#2
1% AEP	10% AEP
280.32	170
0.58	0.45
0.136	0.115
1.853	0.950
202.62	103.21
9848	5016

Section	Item	Input
Pipe	Inv Elev Dn =	41.2100
	Length (m) =	13.9000
	Slope (%) =	4.6762
	Inv Elev Up =	41.8600
	Rise (mm) =	450.0
	Shape =	Box
	Span (mm) =	2500.0
	No. Barrels =	1
	n-value =	0.013
	Culvert Type =	Flared Wingwalls
Embank	Culvert Entrance =	30D to 75D wingwall flares
	Top Elev =	43.0000
	Top Width (m) =	12.9000
Calcs	Crest Len (m) =	12.0000
	Q Min (cms) =	0.9500
	Q Max (cms) =	1.9000
	Q Incr (cms) =	0.0500
	Tailwater (m) =	Normal

Clear

Run

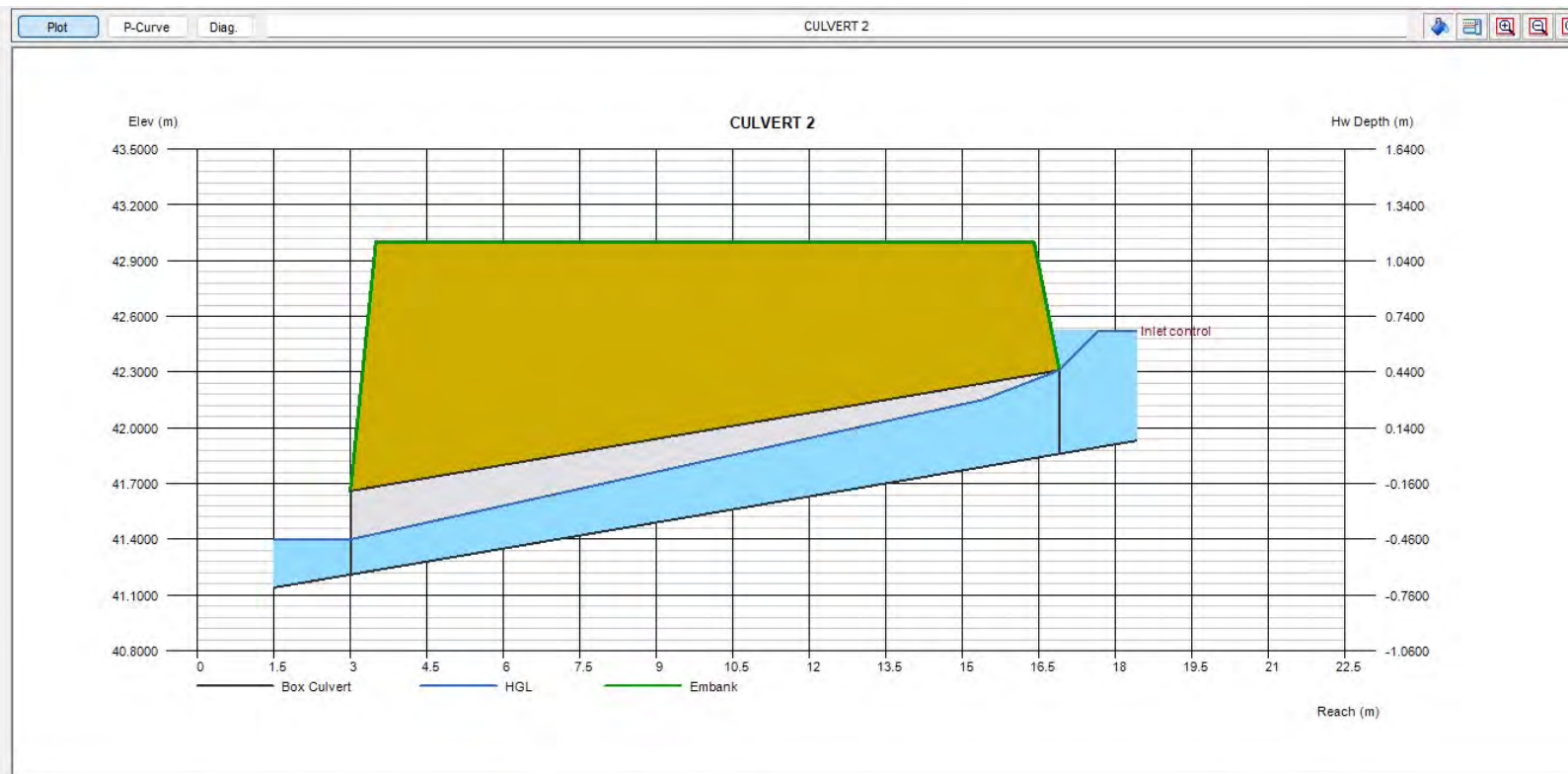


Q			Veloc		Depth		HGL			
Total	Pipe	Over	Dn	Up	Dn	Up	Dn	Up	Hw	Hw/D
(cms)	(cms)	(cms)	(m/s)	(m/s)	(mm)	(mm)	(m)	(m)	(m)	
0.9500	0.9500	0.0000	3.7838	1.5498	115.6255	248.1097	41.3382	42.1052	42.2439	0.8830
1.0000	1.0000	0.0000	3.3649	1.5766	118.8718	253.7101	41.3289	42.1137	42.2581	0.8846
1.0500	1.0500	0.0000	3.4449	1.6025	121.9181	262.0910	41.3319	42.1221	42.2720	0.9156
1.1000	1.1000	0.0000	3.5209	1.6276	124.9691	270.3370	41.3350	42.1303	42.2858	0.9463
1.1500	1.1500	0.0000	3.5097	1.6519	131.0618	278.4621	41.3411	42.1385	42.2994	0.9765

Section	Item	Input
Pipe	Inv Elev Dn =	41.2100
	Length (m) =	13.9000
	Slope (%) =	4.6762
	Inv Elev Up =	41.8600
	Rise (mm) =	450.0
	Shape =	Box
	Span (mm) =	2500.0
	No. Barrels =	1
	n-value =	0.013
	Culvert Type =	Flared Wingwalls
	Culvert Entrance =	30D to 75D wingwall flares
Embank	Top Elev =	43.0000
	Top Width (m) =	12.9000
	Crest Len (m) =	12.0000
Calcs	Q Min (cms) =	0.9500
	Q Max (cms) =	1.9000
	Q Incr (cms) =	0.0500
	Tailwater (m) =	Normal

Clear

Run



Q			Veloc		Depth		HGL			
Total	Pipe	Over	Dn	Up	Dn	Up	Dn	Up	Hw	Hw/D
(cms)	(cms)	(cms)	(m/s)	(m/s)	(mm)	(mm)	(m)	(m)	(m)	
1.6000	1.6000	0.0000	3.7495	1.8446	170.6873	346.9649	41.3807	42.2070	42.4443	1.2983
1.6500	1.6500	0.0000	3.7988	1.8636	173.7382	354.1505	41.3837	42.2142	42.4589	1.3308
1.7000	1.7000	0.0000	3.8465	1.8823	176.7846	361.2617	41.3868	42.2213	42.4739	1.3643
1.7500	1.7500	0.0000	3.8276	1.9006	182.8819	368.3031	41.3929	42.2283	42.4895	1.3988
1.8000	1.8000	0.0000	3.8724	1.9186	185.9262	375.2794	41.3959	42.2353	42.5054	1.4343
1.8500	1.8500	0.0000	3.9156	1.9362	189.9745	382.1006	41.3980	42.2422	42.5198	1.4707

Project: 2127 KAIPARA COAST HIGHWAY, KAKANUI
Client: GOODLAND

CALCULATED MA
 CHECKED
 Date: 21/07/2023

Culvert 3 Flow Rate Calculation

Worksheet 1: Runoff Parameters and Time of Concentration

Circle one: Present Developed (ENTIRE CATCHMENT, PERVIOUS& IMPERVIOUS)

1. Runoff Curve Number (CN) and Initial Abstraction (Ia)

Soil name and classification	Cover description (cover type, treatment & hydrologic condition)	Curve Number CN*	Area (ha)	Product of CN x area
Type C	Urbun Lawn	72	1.0600	76.32
Totals =			1.0600	76

CN (weighted) = total produced / total area = **72.00**

Ia (weighted) = 5 x pervious area / total area = **5.0 mm**

1. Time of Concentration

Channelisation factor C = **0.90** (from Table 4.2)
 Catchment length L = **0.12** km (along drainage path)
 Catchment slope S_c = **0.29** m/m (by equal area method)

Runoff factor, CN / (200 - CN) = **0.56**

t_c = 0.14 C L^{0.66} (CN / (200 - CN))^{-0.55} S_c^{-0.30} **0.062** hrs

Adopted t_c = **0.17** hrs *0.17hrs min*

SCS Lag for HEC-HMS T_p = 2 / 3 t_c **0.11** hrs

Worksheet 2: Graphical Peak Flow rate

1. Data

Catchment area A = **0.010600** km²
 Runoff Curve No CN = **72.00** (from Worksheet 1)
 Initial abstraction Ia = **5.00** mm (from Worksheet 1)
 Time of concentration t_c = **0.170** hrs (from Worksheet 1)

2. Calculate Storage, S = (1000 / CN - 10) x 25.4 **98.8** mm

3. Average recurrence Interval, ARI (yr)

4. 24 hour rainfall depth, P₂₄ (mm)

5. Compute C* = $\frac{P_{24} - 2Ia}{P_{24} - 2Ia + 2S}$

6. Specific peak flow rate q* (from fig 6.1)

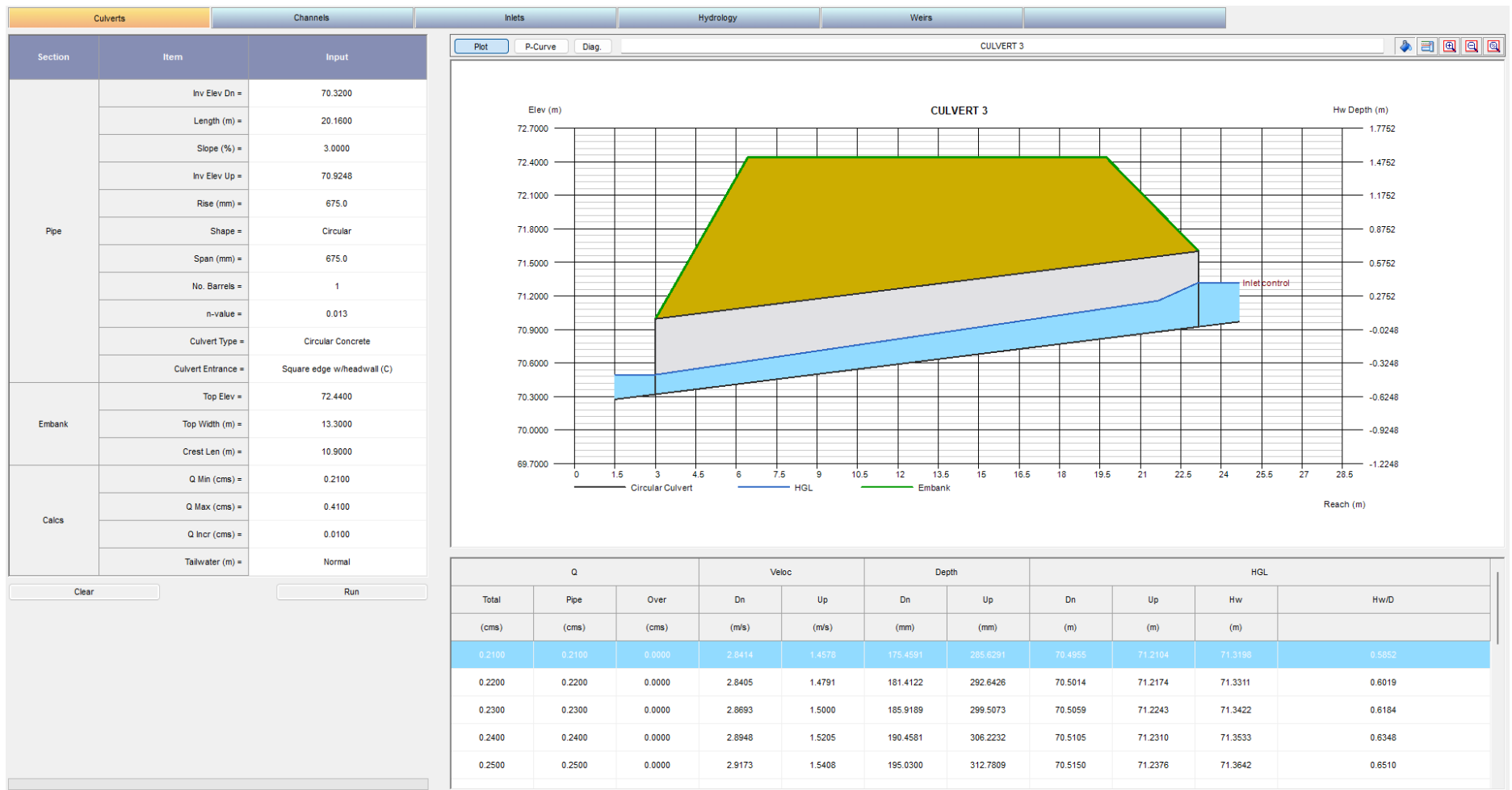
7. Peak Flow rate, q_p = q* A P₂₄ (m³ / s)

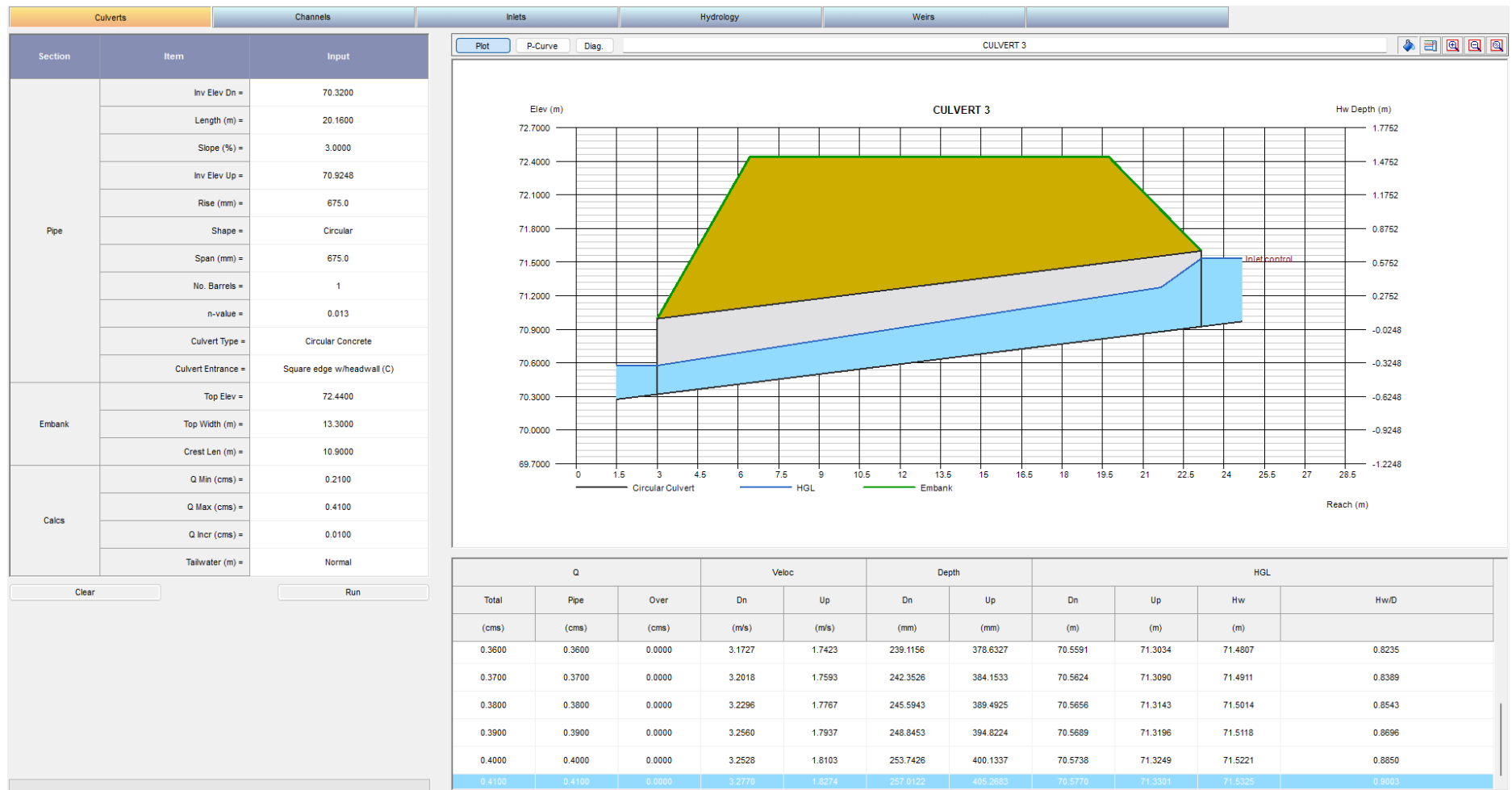
8. Runoff depth, Q₂₄ (mm) =

$$\frac{(P_{24} - Ia)^2}{(P_{24} - Ia) + S}$$

9. Runoff volume, V₂₄ = 1000 x Q₂₄ A (m³)

Storm#1	Storm#2
1% AEP	1% AEP
280.32	170
0.58	0.45
0.136	0.115
0.404	0.207
202.62	103.21
2148	1094





Project: 2127 KAIPARA COAST HIGHWAY, KAKANUI
Client: GOODLAND

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Culvert 4 Flow Rate Calculation

Worksheet 1: Runoff Parameters and Time of Concentration

Circle one: **Present** Developed (ENTIRE CATCHMENT, PERVIOUS& IMPERVIOUS)

1. Runoff Curve Number (CN) and Initial Abstraction (Ia)

Soil name and classification	Cover description (cover type, treatment & hydrologic condition)	Curve Number CN*	Area (ha)	Product of CN x area
Type C	Urbun Lawn	72	3.7042	266.70
Type C	Building Platform	98	0.5758	56.43
Totals =			4.2800	323

CN (weighted) = total product / total area = **75.50**

Ia (weighted) = 5 x pervious area / total area = **4.3 mm**

1. Time of Concentration

Channelisation factor C = **0.90** (from Table 4.2)
 Catchment length L = **0.33** km (along drainage path)
 Catchment slope S_c = **0.16** m/m (by equal area method)

Runoff factor, CN / (200 - CN) = **0.61**

t_c = 0.14 C L^{0.66} (CN / (200 - CN))^{-0.55} S_c^{-0.30} **0.138** hrs
 Adopted t_c = **0.17** hrs *0.17hrs min*

SCS Lag for HEC-HMS T_p = 2 / 3 t_c **0.11** hrs

Worksheet 2: Graphical Peak Flow rate

1. Data

Catchment area A = **0.042800** km²
 Runoff Curve No CN = **75.50** (from Worksheet 1)
 Initial abstraction Ia = **4.33** mm (from Worksheet 1)
 Time of concentration t_c = **0.170** hrs (from Worksheet 1)

2. Calculate Storage, S = (1000 / CN - 10) x 25.4 **82.4** mm

3. Average recurrence Interval, ARI (yr)

4. 24 hour rainfall depth, P₂₄ (mm)

5. Compute C* = $\frac{P_{24} - 2Ia}{P_{24} - 2Ia + 2S}$

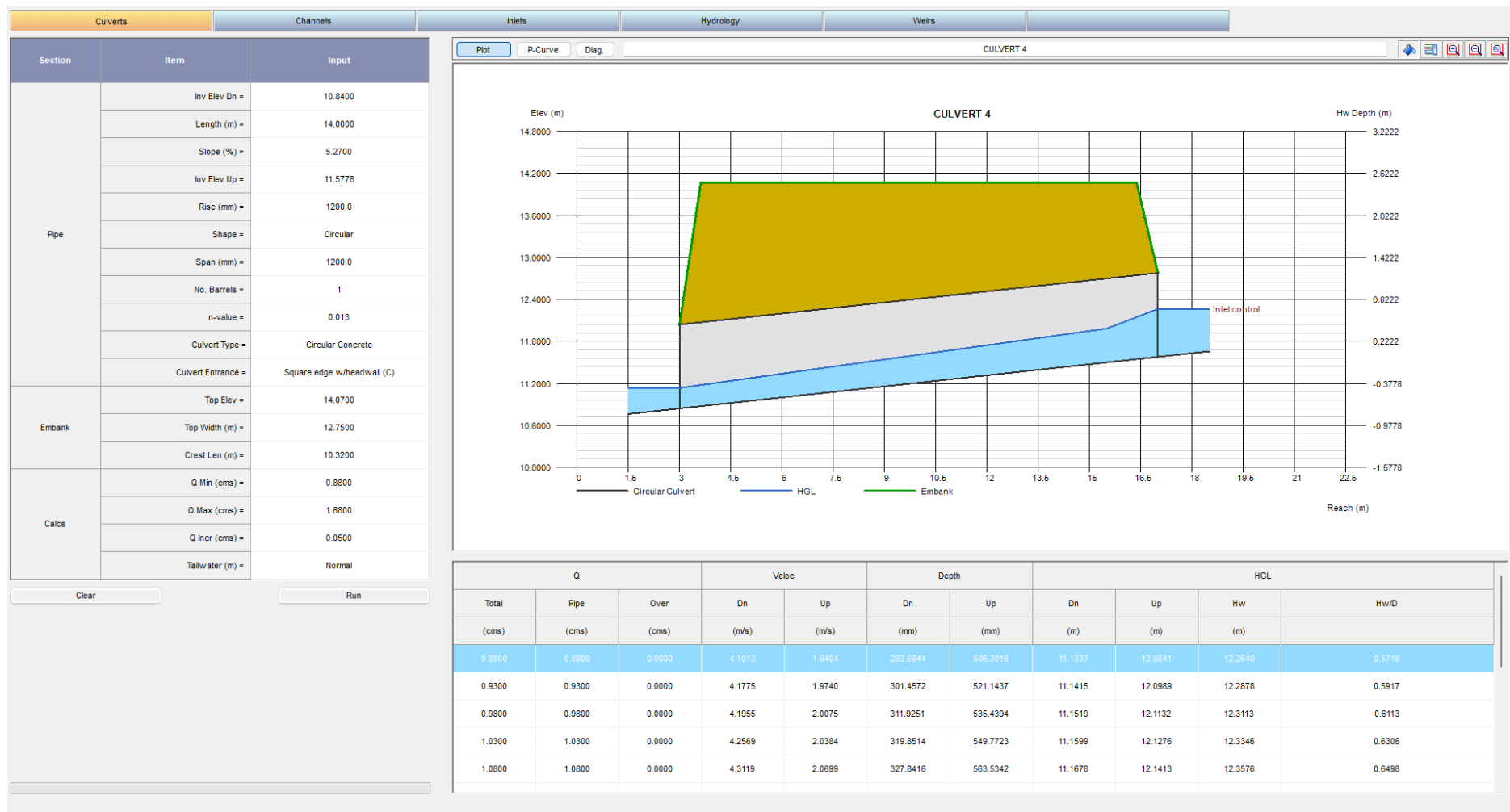
6. Specific peak flow rate q* (from fig 6.1)

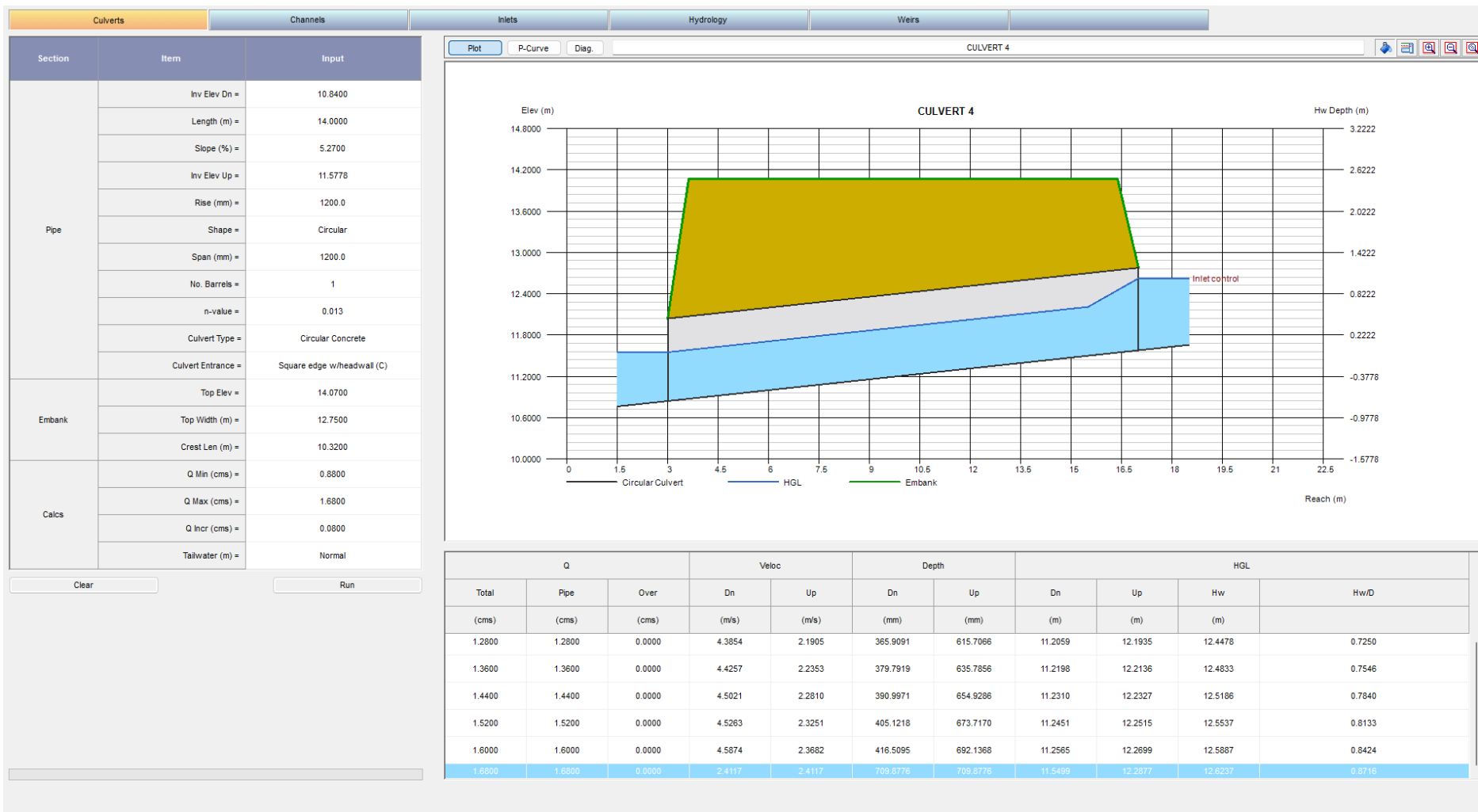
7. Peak Flow rate, q_p = q* A P₂₄ (m³ / s)

8. Runoff depth, Q₂₄ (mm) = $\frac{(P_{24} - Ia)^2}{(P_{24} - Ia) + S}$

9. Runoff volume, V₂₄ = 1000 x Q₂₄ A (m³)

Storm#1	Storm#2
1% AEP	1% AEP
280.32	170
0.62	0.49
0.14	0.12
1.680	0.873
212.52	110.63
9096	4735





Project: 2127 KAIPARA COAST HIGHWAY, KAKANUI
Client: GOODLAND

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Date: 21/07/2023

Culvert 5 Flow Rate Calculation

Worksheet 1: Runoff Parameters and Time of Concentration

Circle one: Present Developed (ENTIRE CATCHMENT, PERVIOUS& IMPERVIOUS)

1. Runoff Curve Number (CN) and Initial Abstraction (Ia)

Soil name and classification	Cover description (cover type, treatment & hydrologic condition)	Curve Number CN*	Area (ha)	Product of CN x area
Type C	Urbun Lawn	72	2.3000	165.60
Type C	Building Platform	98	0.1400	13.72
Totals =			2.4400	179

CN (weighted) = total produced / total area = **73.49**

Ia (weighted) = 5 x pervious area / total area = **4.7 mm**

1. Time of Concentration

Channelisation factor C = **0.90** (from Table 4.2)
Catchment length L = **0.38** km (along drainage path)
Catchment slope S_c = **0.14** m/m (by equal area method)

Runoff factor, CN / (200 - CN) = **0.58**

t_c = 0.14 C L^{0.66} (CN / (200 - CN))^{-0.55} S_c^{-0.30} **0.162** hrs

Adopted t_c = **0.17** hrs *0.17hrs min*

SCS Lag for HEC-HMS T_p = 2 / 3 t_c **0.11** hrs

Worksheet 2: Graphical Peak Flow rate

1. Data

Catchment area A = **0.024400** km²
Runoff Curve No CN = **73.49** (from Worksheet 1)
Initial abstraction Ia = **4.71** mm (from Worksheet 1)
Time of concentration t_c = **0.170** hrs (from Worksheet 1)

2. Calculate Storage, S = (1000 / CN - 10) x 25.4 **91.6** mm

3. Average recurrence Interval, ARI (yr)

4. 24 hour rainfall depth, P₂₄ (mm)

5. Compute C* = $\frac{P_{24} - 2Ia}{P_{24} - 2Ia + 2S}$

6. Specific peak flow rate q* (from fig 6.1)

7. Peak Flow rate, q_p = q* A P₂₄ (m³ / s)

8. Runoff depth, Q₂₄ (mm) =

$$\frac{(P_{24} - Ia)^2}{(P_{24} - Ia) + S}$$

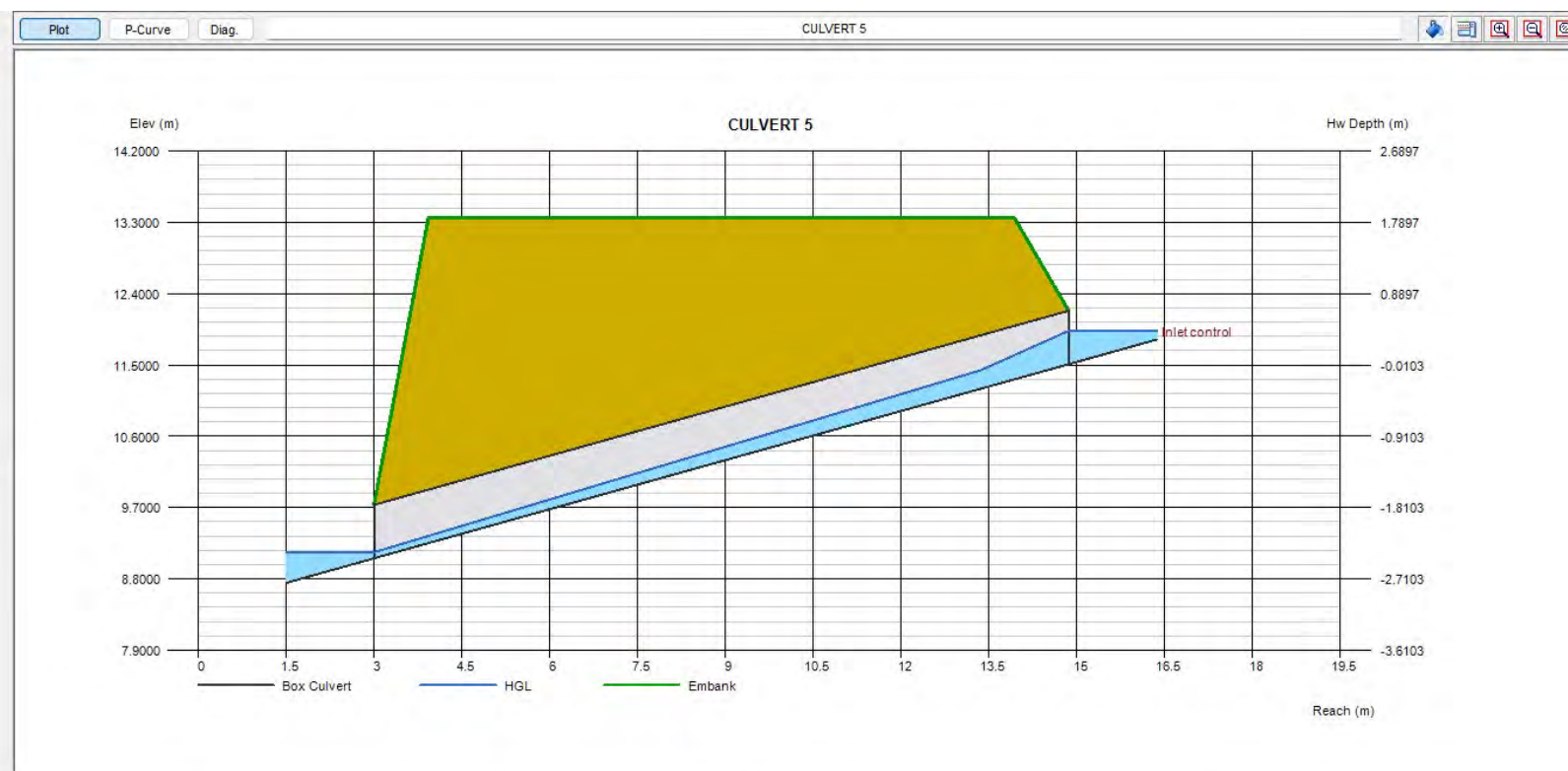
9. Runoff volume, V₂₄ = 1000 x Q₂₄ A (m³)

Storm#1	Storm#2
1% AEP	10% AEP
280.32	170
0.60	0.47
0.14	0.118
0.958	0.489
206.85	106.34
5047	2595

Section	Item	Input
Pipe	Inv Elev Dn =	9.0600
	Length (m) =	11.8600
	Slope (%) =	20.6602
	Inv Elev Up =	11.5103
	Rise (mm) =	675.0
	Shape =	Box
	Span (mm) =	1200.0
	No. Barrels =	1
	n-value =	0.013
	Culvert Type =	Headwall, Chamfered or Beveled Inlet Edge
	Culvert Entrance =	90D headwall w/3/4-in chamfers
Embank	Top Elev =	13.3600
	Top Width (m) =	10.0000
	Crest Len (m) =	9.3500
Calcs	Q Min (cms) =	0.4900
	Q Max (cms) =	1.0000
	Q Incr (cms) =	0.0500
	Tailwater (m) =	Normal

Clear

Run

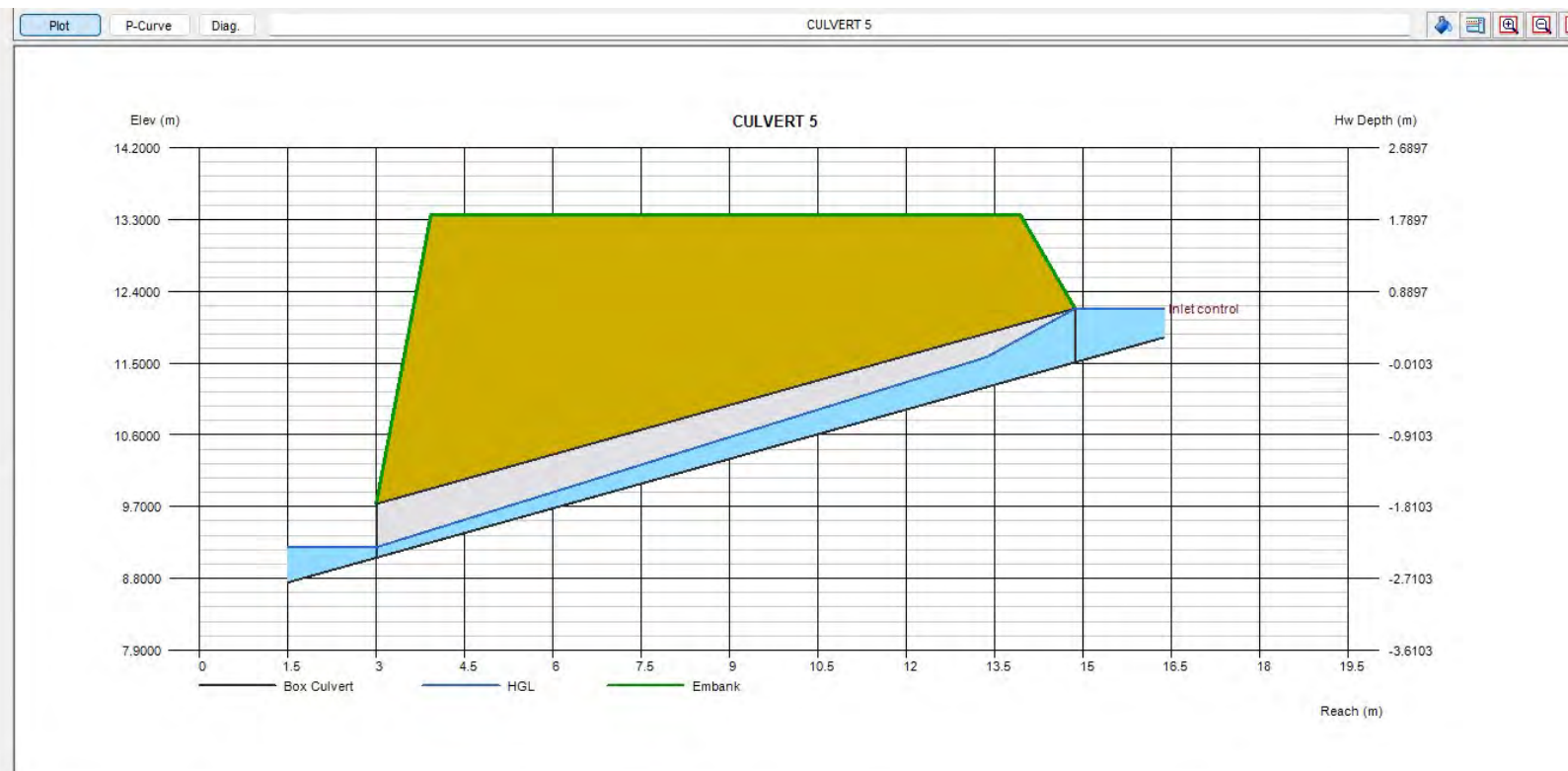


Q			Veloc		Depth		HGL			
Total	Pipe	Over	Dn	Up	Dn	Up	Dn	Up	Hw	Hw/D
(cms)	(cms)	(cms)	(m/s)	(m/s)	(mm)	(mm)	(m)	(m)	(m)	
0.4900	0.4900	0.0000	5.3897	1.5075	76.2090	257.2203	9.1362	11.7076	11.9315	0.6240
0.5400	0.5400	0.0000	5.4680	1.6398	82.2961	274.4158	9.1423	11.7847	11.9597	0.6658
0.5900	0.5900	0.0000	5.5623	1.6891	88.3923	291.0669	9.1484	11.8014	11.9871	0.7063
0.6400	0.6400	0.0000	5.8326	1.7356	91.4398	307.2917	9.1514	11.8176	12.0137	0.7457
0.6900	0.6900	0.0000	5.8952	1.7797	97.5359	323.0779	9.1575	11.8334	12.0396	0.7841

Section	Item	Input
Pipe	Inv Elev Dn =	9.0600
	Length (m) =	11.8600
	Slope (%) =	20.6602
	Inv Elev Up =	11.5103
	Rise (mm) =	675.0
	Shape =	Box
	Span (mm) =	1200.0
	No. Barrels =	1
	n-value =	0.013
	Culvert Type =	Headwall, Chamfered or Beveled Inlet Edge
Culvert Entrance =	90D headwall w/3/4-in chamfers	
Embank	Top Elev =	13.3600
	Top Width (m) =	10.0000
	Crest Len (m) =	9.3500
Calcs	Q Min (cms) =	0.4900
	Q Max (cms) =	1.0000
	Q Incr (cms) =	0.0500
	Tailwater (m) =	Normal

Clear

Run



Q			Veloc		Depth		HGL			
Total	Pipe	Over	Dn	Up	Dn	Up	Dn	Up	Hw	Hw/D
(cms)	(cms)	(cms)	(m/s)	(m/s)	(mm)	(mm)	(m)	(m)	(m)	
0.7400	0.7400	0.0000	5.9505	1.8218	103.6320	338.4875	9.1636	11.8488	12.0648	0.8215
0.7900	0.7900	0.0000	5.9997	1.8620	109.7282	353.5528	9.1697	11.8639	12.0896	0.8582
0.8400	0.8400	0.0000	6.0436	1.9006	115.8237	368.3019	9.1758	11.8786	12.1138	0.8940
0.8900	0.8900	0.0000	6.0832	1.9377	121.9199	382.7615	9.1819	11.8931	12.1375	0.9292
0.9400	0.9400	0.0000	6.2682	1.9734	124.9679	396.9514	9.1850	11.9073	12.1608	0.9637
0.9900	0.9900	0.0000	6.2946	2.0078	131.0641	410.8624	9.1811	11.9012	12.1831	0.9976

Outlet Protection Design - Concrete Baffle Block - Culvert 1

CLINET GOODLAND
PROJECT: GOODLAND COASTAL FARM-2127 KAIPARA COAST HIGHWAY
JOB NO. 1366
BY: ZY
DATE: 30/01/2024

1. Typical Baffle Block Inputs

Height of culvert / pipe		0.90 m
Baffle height	$d =$	0.3 m
Baffle width	$w =$	0.5 m
Flow Cross-sectional Area	$A_c =$	0.08 m ²
Wetted perimeter	$P_w =$	0.78 m
	$R_h =$	0.10

2. Baffle Block Arrangement

Row spacing	$S_d =$	0.71 m
Horizontal spacing	$S_w =$	0.46 m

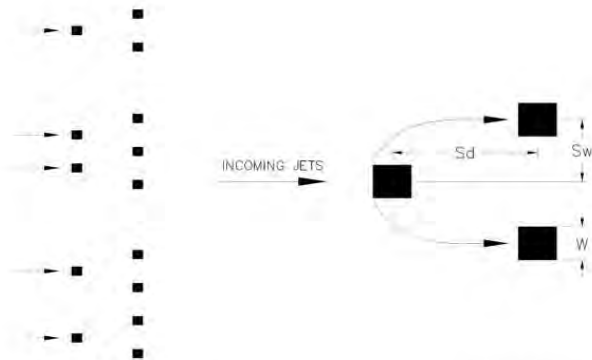


Figure 24: Typical Baffle Block Arrangement and Spacing for Single or Double Outlet Jets

Theoretically, in order for the baffle blocks to be effective at full flow, the blocks' height should be equal to the height of the pipe or culvert, however practically this may cause excessive turbulence or spray therefore a height no more than half the diameter of the pipe is recommended. Optimal baffle block spacing to allow the free flow of debris, where practicable, should be sized as per Equation 24 and Equation 25, and Figure 24.

Row spacing $S_d = 4R_h + d$ Equation 24

Block width $S_w = 2R_h + \frac{w}{2}$ Equation 25

Where;

R_h = hydraulic radius of the culvert, in full pipe flow = $\frac{1}{4}$ diameter of the pipe, m.

w = baffle block width, m.

d = theoretical baffle block depth, equal to the height of the outlet, m.

S_d = spacing of two consecutive rows of blocks, Figure 24, m.

S_w = spacing between two impact blocks in different but consecutive rows, Figure 24, m.
Excludes the first row, where spacing is determined by the spacing of the approaching jets.

Outlet Protection Design - Concrete Baffle Block - Culvert 2

CLINET GOODLAND
PROJECT: GOODLAND COASTAL FARM-2127 KAIPARA COAST HIGHWAY
JOB NO. 1366
BY: ZY
DATE: 30/01/2024

1. Typical Baffle Block Inputs

Height of culvert / pipe		0.45 m
Baffle height	$d =$	0.15 m
Baffle width	$w =$	0.5 m
Flow Cross-sectional Area	$A_c =$	1.1 m ²
Wetted perimeter	$P_w =$	5.9 m
	$R_h =$	0.19

2. Baffle Block Arrangement

Row spacing	$S_d =$	0.91 m
Horizontal spacing	$S_w =$	0.63 m

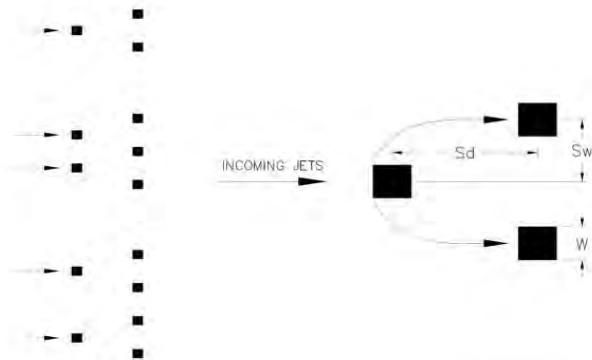


Figure 24: Typical Baffle Block Arrangement and Spacing for Single or Double Outlet Jets

Theoretically, in order for the baffle blocks to be effective at full flow, the blocks' height should be equal to the height of the pipe or culvert, however practically this may cause excessive turbulence or spray therefore a height no more than half the diameter of the pipe is recommended. Optimal baffle block spacing to allow the free flow of debris, where practicable, should be sized as per Equation 24 and Equation 25, and Figure 24.

Row spacing $S_d = 4R_h + d$ Equation 24

Block width $S_w = 2R_h + \frac{w}{2}$ Equation 25

Where;

R_h = hydraulic radius of the culvert, in full pipe flow = $\frac{1}{4}$ diameter of the pipe, m.

w = baffle block width, m.

d = theoretical baffle block depth, equal to the height of the outlet, m.

S_d = spacing of two consecutive rows of blocks, Figure 24, m.

S_w = spacing between two impact blocks in different but consecutive rows, Figure 24, m.
Excludes the first row, where spacing is determined by the spacing of the approaching jets.

Outlet Protection Design - Rip Rap - Culvert 3

CLINET GOODLAND
 PROJECT: GOODLAND COASTAL FARM-2127 KAIPARA COAST HIGHWAY
 JOB NO. 1366
 BY: ZY
 DATE: 30/01/2024

1. Discharge Velocity

Determine the discharge velocity for the design storm. For Stormwater management structures the design storm is the maximum flow that can be carried by the pipe. This will normally be the 10 year design flow.

$$V = 3.3 \text{ m/s} \quad 100Y$$

2. Equivalent Diameter of Stone

Enter that value into the following equation to determine the equivalent diameter of the stone

$$d_s = 0.25 \times D_0 \times F_0$$

Where

d_s = riprap diameter (m)

D_0 = pipe diameter (m)

F_0 = Froude number = $V/(g \times d_p)^{0.5}$

V = velocity of flow in pipe (m/s)

D_0 =	0.675	m
DS pit HGL =	70.58	m RL
DS IL =	70.32	m RL
d_p =	0.26	m
V =	3.3	m/s
g =	9.81	
F_0 =	2.066	
d_s =	0.349	m

3. Thickness of Stone Layer

The thickness of the stone layer is 2 times the stone dimension

$$D_A = 2d_s$$

d_s =	0.349 m
D_A =	0.697 m

4. Width of the protected area

The width of the area protected is 3 times diameter of the pipe

$$W_A = 3D_0$$

D_0 =	0.675 m
---------	---------

$W_A =$

2.025 m

5. Height of the stone

The height of the stone is the crown of the pipe + 300mm

Crown of pipe =	0.675 m
Height of stone =	0.975 m

6. Length of outfall protection

$$L_a = D_0(8 + 17 \times \log F_0)$$

$D_0 =$	0.675 m
$F_0 =$	2.066
$\log F_0 =$	0.315
$L_a =$	9.017 m

Summary

Stone Diameter	$d_s =$	0.349 m
Stone Layer	$D_A =$	0.697 m
Width	$W_A =$	2.025 m
Height of stone	$H =$	0.975 m
Length	$L_a =$	9.017 m

Outlet Protection Design - Rip Rap - Culvert 4

CLINET GOODLAND
 PROJECT: GOODLAND COASTAL FARM-2127 KAIPARA COAST HIGHWAY
 JOB NO. 1366
 BY: ZY
 DATE: 30/01/2024

1. Discharge Velocity

Determine the discharge velocity for the design storm. For Stormwater management structures the design storm is the maximum flow that can be carried by the pipe. This will normally be the 10 year design flow.

$$V = 2.41 \text{ m/s} \quad 100Y$$

2. Equivalent Diameter of Stone

Enter that value into the following equation to determine the equivalent diameter of the stone

$$d_s = 0.25 \times D_0 \times F_0$$

Where

d_s = riprap diameter (m)
 D_0 = pipe diameter (m)
 F_0 = Froude number = $V/(g \times d_p)^{0.5}$
 V = velocity of flow in pipe (m/s)

$$\begin{aligned} D_0 &= 1.2 \text{ m} \\ \text{DS pit HGL} &= 11.55 \text{ m RL} \\ \text{DS IL} &= 10.84 \text{ m RL} \\ d_p &= 0.71 \text{ m} \\ V &= 2.41 \text{ m/s} \\ g &= 9.81 \\ F_0 &= 0.913 \\ d_s &= 0.274 \text{ m} \end{aligned}$$

3. Thickness of Stone Layer

The thickness of the stone layer is 2 times the stone dimension

$$D_A = 2d_s$$

$$\begin{aligned} d_s &= 0.274 \text{ m} \\ D_A &= 0.548 \text{ m} \end{aligned}$$

4. Width of the protected area

The width of the area protected is 3 times diameter of the pipe

$$W_A = 3D_0$$

$$D_0 = 1.2 \text{ m}$$

$W_A =$

3.6 m

5. Height of the stone

The height of the stone is the crown of the pipe + 300mm

Crown of pipe =	1.2 m
Height of stone =	1.5 m

6. Length of outfall protection

$$L_a = D_0(8 + 17 \times \log F_0)$$

$D_0 =$	1.2 m
$F_0 =$	0.913
$\log F_0 =$	-0.039
$L_a =$	8.795 m

Summary

Stone Diameter	$d_s =$	0.274 m
Stone Layer	$D_A =$	0.548 m
Width	$W_A =$	3.60 m
Height of stone	$H =$	1.50 m
Length	$L_a =$	8.795 m

Outlet Protection Design - Concrete Baffle Block - Culvert 5

CLINET GOODLAND
PROJECT: GOODLAND COASTAL FARM-2127 KAIPARA COAST HIGHWAY
JOB NO. 1366
BY: ZY
DATE: 30/01/2024

1. Typical Baffle Block Inputs

Height of culvert / pipe		0.68 m
Baffle height	$d =$	0.23 m
Baffle width	$w =$	0.5 m
Flow Cross-sectional Area	$A_c =$	0.24 m ²
Wetted perimeter	$P_w =$	3.76 m
	$R_h =$	0.06

2. Baffle Block Arrangement

Row spacing	$S_d =$	0.48 m
Horizontal spacing	$S_w =$	0.38 m

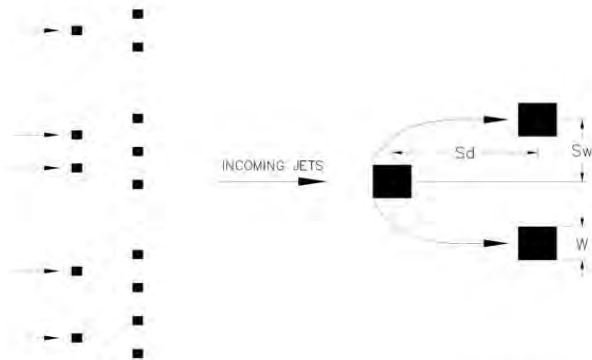


Figure 24: Typical Baffle Block Arrangement and Spacing for Single or Double Outlet Jets

Theoretically, in order for the baffle blocks to be effective at full flow, the blocks' height should be equal to the height of the pipe or culvert, however practically this may cause excessive turbulence or spray therefore a height no more than half the diameter of the pipe is recommended. Optimal baffle block spacing to allow the free flow of debris, where practicable, should be sized as per Equation 24 and Equation 25, and Figure 24.

$$\text{Row spacing} \quad S_d = 4R_h + d \quad \text{Equation 24}$$

$$\text{Block width} \quad S_w = 2R_h + \frac{w}{2} \quad \text{Equation 25}$$

Where;

R_h = hydraulic radius of the culvert, in full pipe flow = $\frac{1}{4}$ diameter of the pipe, m.

w = baffle block width, m.

d = theoretical baffle block depth, equal to the height of the outlet, m.

S_d = spacing of two consecutive rows of blocks, Figure 24, m.

S_w = spacing between two impact blocks in different but consecutive rows, Figure 24, m.
Excludes the first row, where spacing is determined by the spacing of the approaching jets.

APPENDIX D:

BIORETENTION SWALE DESIGN CALCULATIONS

Bioretention swale	Length (m)	Top Width (m)	Ponding Depth (m)	Media Depth (m)	Drainage Layer Depth (m)
1	56.0	2.00	0.23	0.20	0.60
2	56.0	2.00	0.23	0.20	0.60
3	58.3	2.00	0.23	0.20	0.60
4	58.3	2.00	0.23	0.20	0.60
5	39.7	2.00	0.23	0.20	0.60
6	13.1	2.00	0.23	0.20	0.60
7	26.8	2.00	0.23	0.20	0.60
8	26.8	2.00	0.23	0.20	0.60
9	46.7	2.00	0.23	0.20	0.60
10	44.3	2.00	0.23	0.20	0.60
11	39.7	2.00	0.23	0.20	0.60
12	19.8	2.00	0.23	0.20	0.60
13	30.3	2.00	0.23	0.20	0.60
14	30.3	2.00	0.23	0.20	0.60
15	31.5	2.00	0.23	0.20	0.60
16	31.5	2.00	0.23	0.20	0.60
17	22.2	2.00	0.23	0.20	0.60
18	22.2	2.00	0.23	0.20	0.60
19	37.3	2.00	0.23	0.20	0.60
20	37.3	2.00	0.23	0.20	0.60
21	33.8	2.00	0.23	0.20	0.60
22	33.8	2.00	0.23	0.20	0.60
23	43.2	2.00	0.23	0.20	0.60
24	43.2	2.00	0.23	0.20	0.60
25	46.7	2.00	0.23	0.20	0.60
26	46.7	2.00	0.23	0.20	0.60
27	47.8	2.00	0.23	0.20	0.60
28	14.0	2.00	0.23	0.20	0.60
29	18.4	2.00	0.23	0.20	0.60
30	18.4	2.00	0.23	0.20	0.60
31	15.3	2.00	0.23	0.20	0.60
32	15.3	2.00	0.23	0.20	0.60
33	24.5	2.00	0.23	0.20	0.60
34	13.0	2.00	0.23	0.20	0.60
35	13.8	2.00	0.23	0.20	0.60
36	15.3	2.00	0.23	0.20	0.60
37	19.9	2.00	0.23	0.20	0.60
38	28.4	2.00	0.23	0.20	0.60
39	23.8	2.00	0.23	0.20	0.60
40	24.5	2.00	0.23	0.20	0.60
41	12.3	2.00	0.23	0.20	0.60
42	12.3	2.00	0.23	0.20	0.60
43	28.4	2.00	0.23	0.20	0.60
44	28.4	2.00	0.23	0.20	0.60
45	21.5	2.00	0.23	0.20	0.60
46	21.5	2.00	0.23	0.20	0.60
47	22.2	2.00	0.23	0.20	0.60
48	22.2	2.00	0.23	0.20	0.60
49	27.6	2.00	0.23	0.20	0.60
50	27.6	2.00	0.23	0.20	0.60

*The proposed roads 1 to 3 have the same typical cross sectional layout, hence the length of bioretention is prorata based on sizing for a 150m long road catchment. Same design approach used on accessways 1 to 4.

SMAF 1 Detention Volume Calculations (Per 150 m Road Length)

Project

Design By

Date

2127 KAIPARA COAST HIGHWAY

ZY

31/01/2024

Parameters

SMAF 1 (95th)

Void Ratio for Ponding

Void Ratio for Media (Gravel)

Void Ratio for Drainage

Subsoils suitable for Infiltration?

Half road width

35 mm

1

0.35

0.35

No

3m

Input Cells

Key Output Cells

Check Cells

Catchment Name	Total Impervious		CN	Ia	Area km ²	Storage	Depth	Volume	Retention Volume	Detention Volume		Design for Detention											
												Length Ponding	Width Ponding	Height Ponding	Void Ponding	Length Media	Width Media	Height Media	Void Media	Length Drainage	Width Drainage	Height Drainage	Void Drainage

In Ground Bioretention Device

Road 1, 2, 3 (per 150 m length)	450.00	Pre-development	74	5	0.000450	89.24	7.55	3.40	2.25	8.07	35	0.6	0.23	1	35	0.6	0.2	0.35	35	0.6	0.6	0.35
		Post-development	98	0	0.000450	5.18	30.49	13.72			V _(ponding)	2.42	A _(ponding)	21.00	V _(media)	1.47	A _(media)	21.00	V _(drainage)	4.41	A _(drainage)	21.00
											V _(detention)				8.30 Greater than Required Mitigation				YES			
Accessway 1, 2, 3, 4,5 (per 150 m length)	300.00	Pre-development	74	5	0.000300	89.24	7.55	2.26	1.50	5.38	23	0.6	0.23	1	23	0.6	0.2	0.35	23	0.6	0.6	0.35
		Post-development	98	0	0.000300	5.18	30.49	9.15			V _(ponding)	1.59	A _(ponding)	13.80	V _(media)	0.97	A _(media)	13.80	V _(drainage)	2.90	A _(drainage)	13.80
											V _(detention)				5.45 Greater than Required Mitigation				YES			

APPENDIX E:

OUTFALL DESIGN CALCULATIONS

STORMWATER RETICULATION CALCULATIONS

PROJECT : 2127 Kaipara Coast Highway
JOB NO : 1366



CALCULATIONS BY : ZY
DATE : 31/01/2024

CHECKED BY : ZY
DATE : 31/01/2024

Storm Frequency (yr) = 10 Storm Duration (min) = 10 Ks= 1.5 D≤1.0m I = 170.00 mm/h 0.047 mm/s

Pipe Section	Start MH	End MH	L (m)	Catchment (m ²)	Run off Coef. C	C*A	Cumm C*A	I (mm/sec)	Q (line) L/s	S(%)	Dia (mm)	V (m/s)	Pipe Cap (L/s)	Pipe OK?
Line 1														
SWMH 1.2 to SW OUTLET 1.1	41.723m	41.741m	3.612m	3360	0.80	2688	2688	0.047	127	3.0%	300	2.41	170	PIPE OK
SWMH 2.2 to SW OUTLET 2.1	53.873m	54.000m	11.187m	3240	0.80	2592	2592	0.047	122	5.0%	300	3.11	220	PIPE OK
SWMH 3.2 to SW OUTLET 3.1	69.713m	70.485m	9.533m	3000	0.80	2400	2400	0.047	113	8.1%	300	3.96	280	PIPE OK
SW OUTLET 4.1 to SWMH 4.2	77.232m	76.599m	9.042m	1920	0.80	1536	1536	0.047	73	7.0%	300	3.68	260	PIPE OK
SW OUTLET 5.1 to SWMH 5.2	62.915m	62.807m	15.401m	2160	0.80	1728	1728	0.047	82	1.0%	300	1.39	98	PIPE OK
SWMH 6.2 to SW OUTLET 6.1	35.306m	35.944m	8.636m	1920	0.80	1536	1536	0.047	73	7.4%	300	3.78	267	PIPE OK
SWMH 7.2 to SW OUTLET 7.1	23.635m	24.010m	9.952m	1200	0.80	960	960	0.047	45	3.8%	300	2.70	191	PIPE OK
SWMH 8.2 to SW OUTLET 8.1	37.557m	37.679m	6.560m	1100	0.80	880	880	0.047	42	1.9%	300	1.91	135	PIPE OK
SW OUTLET 9.1 to SWMH 9.2	67.335m	67.000m	11.174m	1920	0.80	1536	1536	0.047	73	3.0%	300	2.41	170	PIPE OK
SWMH 10.2 to SW OUTLET 10.1	64.736m	64.865m	12.924m	1920	0.80	1536	1536	0.047	73	1.0%	300	1.39	98	PIPE OK
SWMH 11.2 to SW OUTLET 11.1	47.047m	47.629m	14.702m	1200	0.80	960	960	0.047	45	4.0%	300	2.77	196	PIPE OK
SWMH 12.2 to SW OUTLET 12.1	40.579m	40.691m	22.314m	1260	0.80	1008	1008	0.047	48	1.0%	300	1.39	98	PIPE OK
SWMH 13.2 to SW OUTLET 13.1	26.033m	26.217m	38.759m	2160	0.80	1728	1728	0.047	82	1.0%	300	1.39	98	PIPE OK
SWMH 14.2 to SW OUTLET 14.1	9.530m	9.799m	4.394m	990	0.80	792	792	0.047	37	6.1%	300	3.45	244	PIPE OK
SW OUTLET 16.1 to SWMH 16.2	6.300m	6.009m	6.170m	1020	0.80	816	816	0.047	39	4.7%	300	3.02	213	PIPE OK
SW OUTLET 17.1 to SWMH 17.2	84.247m	84.000m	24.656m	1980	0.80	1584	1584	0.047	75	3.0%	300	2.41	170	PIPE OK
SW OUTLET 18.1 to SWMH 18.2	34.661m	34.604m	5.731m	1650	0.80	1320	1320	0.047	62	5.0%	300	3.11	220	PIPE OK
SWMH 19.2 to SW OUTLET 19.1	92.874m	92.915m	8.076m	2035	0.80	1628	1628	0.047	77	1.0%	300	1.39	98	PIPE OK
SWMH 20.2 to SW OUTLET 20.1	85.094m	85.132m	4.832m	1045	0.80	836	836	0.047	39	0.8%	300	1.24	88	PIPE OK
SWMH 21.2 to SW OUTLET 21.1	81.602m	81.681m	7.836m	1210	0.80	968	968	0.047	46	3.0%	300	2.41	170	PIPE OK
SW OUTLET 22.1 to SWMH 22.2	70.916m	70.837m	7.820m	1320	0.80	1056	1056	0.047	50	5.0%	300	3.11	220	PIPE OK
SW OUTLET 23.1 to SWMH 23.2	56.863m	56.616m	57.157m	1540	0.80	1232	1232	0.047	58	0.4%	300	0.91	64	PIPE OK
SW OUTLET 24.1 to SWMH 24.2	70.608m	70.541m	6.743m	1540	0.80	1232	1232	0.047	58	5.0%	300	3.11	220	PIPE OK
SW OUTLET 48.1 to SWMH 48.2	56.829m	56.762m	5.110m	2035	0.80	1628	1628	0.047	77	1.3%	300	1.59	112	PIPE OK
SW OUTLET 49.1 to SWMH 49.2	20.062m	19.983m	7.898m	2090	0.80	1672	1672	0.047	79	1.0%	300	1.39	98	PIPE OK

Stormwater Outlet Calculations



Project 2127 Kaipara Coast Highway
 Client Abib(Oamaru)
 Calculated By ZY
 Checked By ZY
 Date 31/01/2024

2127 Kaipara Coast Highway										
	Outlet	Pipe size (D0)	Min. WA (m)	dp(m)	Gradient (%)	V (m/s)	Fo	ds (m)	DA (m)	La (m)
	SW OUTLET 1.1	300	0.90	0.20	3.0%	2.41	1.72	0.13	0.26	3.60
	SW OUTLET 2.1	300	0.90	0.16	5.0%	3.11	2.47	0.19	0.37	4.40
	SW OUTLET 3.1	300	0.90	0.13	8.1%	3.96	3.48	0.26	0.52	5.16
	SW OUTLET 4.1	300	0.90	0.11	7.0%	3.68	3.63	0.27	0.54	5.25
	SW OUTLET 5.1	300	0.90	0.22	1.0%	1.39	0.95	0.07	0.14	2.29
	SW OUTLET 6.1	300	0.90	0.10	7.4%	3.78	3.75	0.28	0.56	5.32
	SW OUTLET 7.1	300	0.90	0.10	3.8%	2.70	2.78	0.21	0.42	4.67
	SW OUTLET 8.1	300	0.90	0.11	1.9%	1.91	1.83	0.14	0.27	3.73
	SW OUTLET 9.1	300	0.90	0.14	3.0%	2.41	2.09	0.16	0.31	4.03
	SW OUTLET 10.1	300	0.90	0.20	1.0%	1.39	1.00	0.07	0.15	2.40
	SW OUTLET 11.1	300	0.90	0.10	4.0%	2.77	2.87	0.22	0.43	4.73
	SW OUTLET 12.1	300	0.90	0.15	1.0%	1.39	1.15	0.09	0.17	2.72
	SW OUTLET 13.1	300	0.90	0.22	1.0%	1.39	0.95	0.07	0.14	2.29
	SW OUTLET 14.1	300	0.90	0.08	6.1%	3.45	3.99	0.30	0.60	5.47
	SW OUTLET 16.1	300	0.90	0.08	4.7%	3.02	3.34	0.25	0.50	5.07
	SW OUTLET 17.1	300	0.90	0.14	3.0%	2.41	2.06	0.15	0.31	4.00
	SW OUTLET 18.1	300	0.90	0.11	5.0%	3.11	3.05	0.23	0.46	4.87
	SW OUTLET 19.1	300	0.90	0.21	1.0%	1.39	0.98	0.07	0.15	2.35
	SW OUTLET 20.1	300	0.90	0.14	0.8%	1.24	1.06	0.08	0.16	2.52
	SW OUTLET 21.1	300	0.90	0.10	3.0%	2.41	2.40	0.18	0.36	4.34
	SW OUTLET 22.1	300	0.90	0.09	5.0%	3.11	3.24	0.24	0.49	5.00
	SW OUTLET 23.1	300	0.90	0.23	0.4%	0.91	0.60	0.05	0.09	1.29
	SW OUTLET 24.1	300	0.90	0.10	5.0%	3.11	3.11	0.23	0.47	4.91
	SW OUTLET 48.1	300	0.90	0.19	1.3%	1.59	1.17	0.09	0.18	2.74
	SW OUTLET 49.1	300	0.90	0.21	1.0%	1.39	0.97	0.07	0.15	2.33

TREE REMOVAL ALONG STATE HIGHWAY 16 (Kaipara Coast Highway) as a result of the proposed development at 2127 Kaipara Coast Highway.

The trees listed below are to be removed as part of the proposed development of 2127 Kaipara Coast Highway.

The purpose of this removal is for the widening of the road to provide for turning bays into a new access onto the state highway.

The new access is required for safety reasons given that the sight lines of the existing farm access were not deemed appropriate (by a traffic engineer) for an increased number of vehicle movements.

The trees are predominantly native, the majority of them mature kanuka with some understorey vegetation. These trees are likely to have been self seeded. Included in the mix are pine trees and wattle, with one Yunnan Poplar. With the exception of the poplar the other exotic trees are weed species that should ideally be eradicated.

There is only one native canopy tree (a totara that stands approximate 6 metres tall) that is over four metres that is to be removed. The rest of the native vegetation includes either colonising species (kanuka, mahoe, mapou) or large shrubs and cabbage trees (Ti kouka).

Kanuka trees are a first generation/colonising plant species that establishes first in restoration areas, acting as a nursery for other slower growing species and then dying as a result of being shaded. They do not have the long term value associated with some of the larger canopy trees such as pohutukawa, totara, rimu or puriri.

The removal of the trees will change the nature of this stretch of road by removing the sense of enclosure currently experienced, to one that is more open, with views through to the open pasture of 2127 Kaipara Coast Highway. This would still be in keeping with the character of the surrounding rural landscape.

It is understood that it would not be possible to widen this stretch of road without removing these trees.

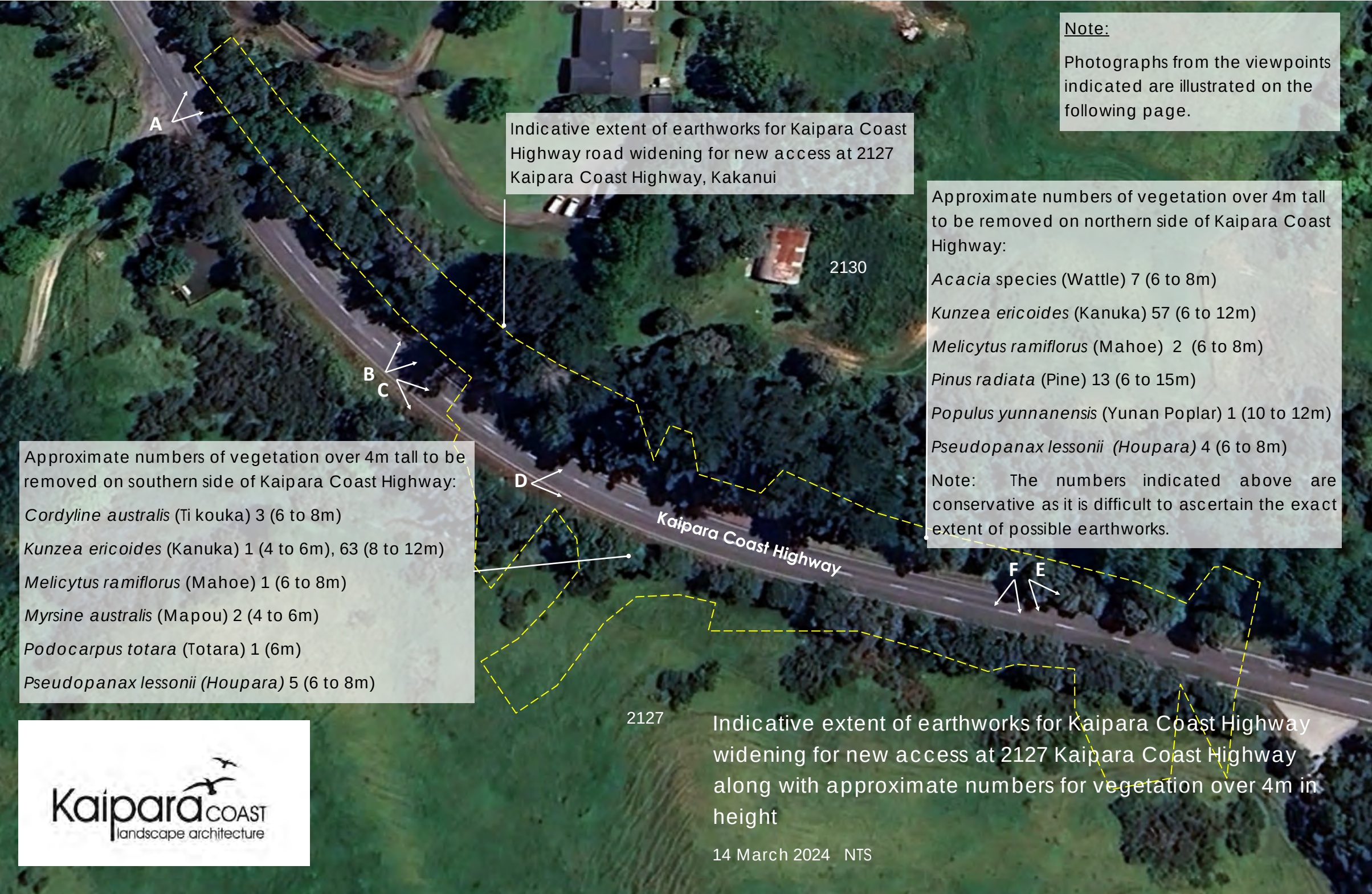
The removal of some of these tall trees could have positive effects on the long term safety of users of this state highway given that many of the trees are located in close proximity to this 100km / hour road and tree fall can be problematic. This is particularly applicable to pine trees.

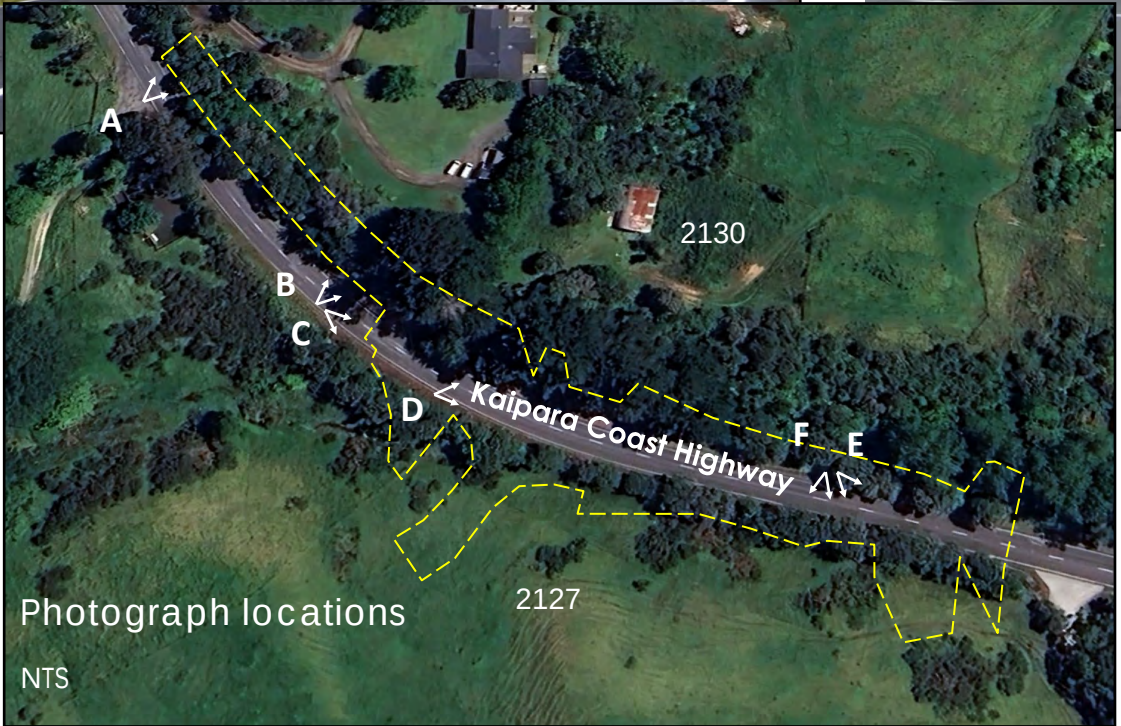
In the large storms of 2023 a number of trees blew down along the stretch of state highway within one kilometre of the subject land and had to be removed off the road.

Given the safety issues with trees along the state highway it is not uncommon to see arborist teams removing trees along the state highway in close proximity to the road, such as those included in the proposal.

The removal of the pines and wattle trees is considered to be at least part mitigation for the removal of the native trees.

If the Council arborist determines that mitigation is required for the removal of these trees along the state highway some restoration of low growing native vegetation could be included as conditions of consent for the works.





Images of vegetation adjacent to the Kaipara Coast Highway in and around the area in which road widening is proposed for the development at 2127 Kaipara Coast Highway

14 March 2024

LANDSCAPE AND VISUAL S92 RESPONSE

Goodland Coastal Farm

2127 Kaipara Coast Highway, Kakanui

Written by: Geraldine Bayly

Date: 15 February 2024

Application Numbers: BUN60406128 (LUC60406129, SUB60406160)

Kaipara Coast Landscape Architecture prepared a Landscape and Visual Effects Assessment for the proposed development of 2127 Kaipara Coast Highway, Kakanui into 25 Lots, with an updated version of the document produced in May 2022 further to changes arising from an informal S92 request issued in December 2022 which was then responded to.

The following is a response to a formal Section 92 request for further information regarding landscape and visual matters. The numbers of this document correspond with the number of the Auckland Council S92 questions.

LANDSCAPE AND VISUAL

57. What is the proposed materiality of the retaining walls?

Retaining walls have been minimised as much as possible. The preference has been to recontour the land to grade it back as naturally as possible into the surrounding landform.

Where required for stability and for preservation of adjacent vegetation, retaining walls are to be timber up to 2.5 metres and are to be stained dark grey tones. These walls either have vegetation located in front of them to screen them, or have vegetation spilling over the top of them to soften their appearance.

Where walls are over 1 metre high a simple black pool fence is to be attached to the top.

Some of the walls, such as those in and around the stream crossing at the site entry, are to be either gabion basket, stacked concrete blocks, or a reinforced soil system that can be planted. The exact nature of these walls have not yet been finalised and will likely change during the detailed design process. However, the intention is for these walls to be as narrow as possible so that they have as small a footprint as possible and for them to disappear into the surrounding landscape and be as inconspicuous as possible.

58. Section 5.1.1 of the LVA from Kaipara Coast Landscape Architecture discusses the potential adverse effect of the proposal on the ONL and on the HNCA. The LVA notes that (in particular) the values of the HNCA are linked to the unbuilt and rural / natural character of the landscape. Further, it was noted in Schedule 8 of the AUP that". the peripheral

modification associated with the reclaimed flats disrupts the sense of cohesion and intactness within the wider coastal environment."

It is acknowledged that the proposed areas for development are separate from the ONL and HNCA, but it is questioned whether the development of a sequence of clusters of settlement, with associated infrastructure may have the potential to detract from the perceptual naturalness of the HNCA. Please provide further assessment in relation to this matter.

A lot of thought and care has been taken in the strategic design of the proposal to ensure that the natural landscape features and characteristics of the subject property and the surrounding landscape are retained and enhanced. The underlying factors that were considered during the design phase of this proposal have been articulated in the background assessment of the LVEA.

The subject property is currently in a state of degradation, with stock allowed to roam through the established native vegetation and wetland areas that are pugged which no doubt results in silt entering into the adjacent waterways and the Kaipara Harbour. There are tufts of mature canopy trees located in and around the majority of the riparian areas however the current grazing practices mean that any potential regeneration under these trees do not have a chance to establish.

One of the big challenges currently facing the Kaipara Harbour environs is the pollution of the waterways, predominantly through silt entering the stream networks and making its way out to the harbour. Given this issue, the Kaipara Moana Remediation Programme has been set up to restore the health and mauri of the Kaipara Moana catchment area and reduce the amount of sediment entering the harbour. This is primarily focusing on fencing and planting riparian, coastal and eroding hill country areas. This is similar to the areas on the subject land that are to be restored. Over time, this will positively contribute to the reinforcement of the natural landscape values of the Kaipara Moana broader area. Landscape patterns associated with native vegetation in and around riparian areas will have a stronger influence on the character of the Kaipara Harbour environs, with pasture associated with grazing woven around these areas. The proposal for the subject land is very complementary to this land management regime.

The proposal to fence off, protect and replant large areas of native bush in broad areas around the existing vegetation will significantly enhance the natural landscape values and enable the existing native vegetation to thrive. When viewed from the surrounding landscape, including the Kaipara Harbour, the landscape patterns, with vegetation planted on steep slopes and within gully systems, will be strong and clear. This outcome to restore the health and vitality of large areas of native vegetation and enhance the natural landscape values has been one of the guiding principles behind the proposal. The open pasture is to be woven in and around the vegetation linkages in an organic layout and using management regimes that protects the soils.

The overriding strategy for the design of the development in and around this farm is to ensure that built form is subservient to the natural landscape features. This is why the building platforms are tucked in adjacent to existing mature vegetation, and why they are to be framed in existing and proposed vegetation. The convoluted nature of the landform is such that the only place in which it would be possible to see all possible building platforms is from the air, with discrete pockets of development potentially visible from any one location in the broader surrounds. Design controls are in place to ensure that the potential adverse visual impact of buildings is minimised. The recessive colours, complex style and nature of the built form, prevalence of vegetation in and around the buildings and the low impact on the landform assist in this.

The anticipated outcome is that the proposal will represent a significant enhancement of the natural landscape values of the subject property when viewed from the broader surrounds. There will be clear landscape patterns with the natural complexity of the native vegetation forming strong patterns within the gully systems and with the pasture wrapping around this. From different locations, such as on the Kaipara Harbour, parts of buildings will be visible in amongst vegetation which will be visually associated with the complexity of the surrounding native bush. The large areas of the reclaimed flats at the base of the property will revert back to rushes and native vegetation bringing back a cohesion and connection with the coastal environment in and around this large peninsula of land. This includes the large flat areas located between the Kakanui Stream and the subject land that are currently included as part of the grazing regime for the farm, but are outside the farm boundary.

59. In 5.1.1, the LVA discusses the biotic / biophysical benefits that will be provided, notes that the perceptual elements of landscape character will be advantaged by the enhancement of the natural vegetation patterns. It opines that the enhanced vegetation patterns will enable the integration of the proposed development, and that this will be facilitated by the design guidelines. The relevant AUP(OP) provisions have a strong focus on the maintenance and enhancement of rural character, amenity values and biodiversity values. Given the existing pastoral character of the Harbour hinterland hills with very low existing density of development, the integration of built form, and landscape patterns associated with the domestic use of the landscape (including roading, accessory buildings and structures, gardens etc) is potentially challenging and some reliance is therefore placed on the guidelines achieving the stated objectives of the development.

The Design Guidelines explain that prior to Building Consent being lodged, the plans must be reviewed against the guidelines by a design review group.

A consent notice condition relating to the Design Guidelines is proposed in the AEE (and it is agreed that references to development controls would be necessary in a consent notice condition) however this approach would require review and approval by both the design review group and the Council.

- a. How is the design review group proposed to operate, and who will be on this group?
- b. The language used in some aspects of the Design Guidelines enables a degree of flexibility and could result in different conclusions by the design review group and the Council. Is this

your expectation (i.e. that this could occur) and that this could require individual future owners to obtain consents (such as 221 RMA variation)?

Goodland Coastal Farm Residents Association will employ independent experts in landscape architecture, architecture and / or urban design to form a design review panel to confirm that the buildings, surrounds and landscaping meets the approved guidelines prior to lodging the application with Auckland Council.

This panel is to be put in place to provide constructive feedback for designers, and may request changes if buildings / proposals don't meet expectations.

The Design Guidelines have been constructed to enable as much flexibility as possible within the parameters created to achieve an outcome where the buildings are to visually and physically be tucked into, or disappear into, existing and proposed vegetation. The intention is not for the buildings to look the same, but that the buildings all be recessive and comply with the development vision statement, core values and objectives.

The Goodland Coastal Farm Residents' Association panel of experts will assess the proposals prior to them being lodged with the Council and therefore the Council can be satisfied that the design intent for the subdivision has been satisfied. It is anticipated that future owners should not need to obtain a 221 RMA variation.

60. When considering the effect of the proposed built form and associated infrastructure on the character of the landscape, what assumptions were made in the LVA - ie, was the potential for a dwelling, minor household unit and accessory building (cumulatively up to the maximum allowable coverage of 500m²) on the majority of lots, as well as the subdivision roading / driveways, retaining walls, communal building and car park taken into account in the assessment?

From the outset, the proposed capacity of development of this landscape and the overriding design principles were guided by landscape architecture outcomes. The sensitive nature of this landscape, proximity to the Kaipara Harbour and value placed on the land by Mana Whenua were primary considerations. All aspects of the design have been rigorously assessed during the design process to ensure that they will result in an outcome that has positive visual and environmental outcomes.

Future development has been kept away from the state highway with proposed building platforms kept off ridgelines and tucked down in the lower reaches of the property and adjacent to existing and proposed vegetation which will assist in screening and softening any structures which is intended to merge into the complexity of the adjacent native bush.

The relatively contained nature of the building platforms and maximum controls on allowable building coverage, combined with the controls detailed within the design guidelines restrict the size, nature and style of the built form. It is considered that providing that built form complies with these controls a degree of flexibility as to the exact nature of the outcome is desirable. They will provide enough controls to have the desired outcome, but enough flexibility to enable future owners to put their own stamp on their properties.

The aim is to construct the subdivision roading/driveways so that they blend in as much as possible. If they are visible from the surrounds, they are to appear to be farm tracks. The land surrounding them is to be blended back into the natural contours of the landform and reseeded with grass. In the areas where retaining walls are required they are to either be screened by vegetation in the front, or have vegetation spilling over them. They are to be recessive in colour.

The communal building is to be single level and located on a lower elevation. As with other buildings it will be recessive in colour and will be largely screened behind vegetation. The car parking associated with the communal building will be tucked in behind the building and adjacent to proposed vegetation.

61. The LVA determines that the landscape effect of the proposal will be very low, that the effect on the ONL and HNCA will be positive, that the effect on rural character will be very low, and that the potential adverse visual effect will be very low. Since the establishment of a vegetative structure on the Site is a key integrative and mitigative measure proposed in the application, will the level of adverse effect be very low (or positive) from the outset, or is a temporary elevated level of adverse effect anticipated? What will temporary effects be?

It is anticipated that one of the first elements of the development to be constructed will be the roading network. There will be some temporary adverse visual effect as this is established given that there will likely be some scarring on the landform with the exposure of soil as the earthworks are being undertaken. This is to be remedied as soon as possible and is only expected to have short term adverse effects that may be low – moderate in nature.

With few exceptions, the proposed planting can be implemented within the first planting season following issuing of consent (provisional on adequate supply of plants). Given the steep nature of the site and the soil type, the installation of the fencing will likely need to be undertaken during the dryer summer months. This means that the planting programme over most of the site will not have to wait until other works have been completed. This is able to be achieved as the only earthworks anticipated is that required for the construction of the roading network.

As noted within the Design Guidelines, the building platforms for each site are to retain their natural form which means that any earthworks on each site will be minor and will likely occur immediately prior to the construction of each dwelling on the site. This will minimise potential visual scarring when viewed from the surrounds and will ensure that earthworks is undertaken incrementally, in a piecemeal fashion, which will be less visually intrusive.

The proposed vegetation will take a while to establish and therefore for the first five years, while vegetation is establishing and not yet at a point where the canopies join, buildings will likely be more prominent. It is noted that there will likely be a delay of one to two years between the planting of the proposed vegetation required (and restoration of the native bush) as part of subdivision consent and construction beginning on future dwellings. This is

due to the time delays between subdivision consent being granted then purchase of a title followed by design and building consent being granted and construction beginning.

It is concluded that the potential adverse temporary landscape and visual effects of the proposed development for the first five years are likely to be low to moderate in nature reducing to very low and positive once the vegetation has established enough to adequately screen future built form with the vegetative patterns being more visible.



Soil and Resource Report for 2127 Kaipara Coast Highway.

Prepared By: Ian Hanmore

Prepared For: Abib (Oamaru) Ltd

24th January 2024

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1.0 INTRODUCTION

This report has been prepared at the request of the client to assess the Land Use Capability (LUC) classifications at a potential subdivision site at 2127 Kaipara Coast Highway. The New Zealand Land Resource Inventory (NZLRI) maps have classified a part of the site as LUC class 3. As such, this area could potentially fall under the National Policy Statement for Highly Productive Land (NPS-HPL).

The purpose of the report is to map the area of potential LUC class 3 land and identify any Highly Productive Land as defined by the National Policy Statement for Highly Productive Land (NPS-HPL). To achieve this, a site visit was carried out to map the soils and land use classes present and assess them in relation to the NPS-HPL.

This report presents the description of each of the soil types identified on the area of interest as well as descriptions of each of the LUC units mapped. This information is then used to determine and quantify any highly productive land present. This information is accompanied by LUC, soil and HPL classification maps along with the relevant LUC unit and soil profile descriptions.

2.0 MAPPING METHOD

A site visit was carried out on the 23rd of January 2024 to evaluate and describe the soil types and the LUC units present at the area of interest. Mapping was carried out at a scale of between 1:5,000 and 1:10,000.

LUC mapping was carried out in accordance with the methods described in the 3rd Edition of the Land Use Capability Survey Handbook (Lynn et al 2009). This process involves making a land resource inventory (LRI) of the property in which soil types, soil parent materials, land slopes, erosion type and severity and land cover are recorded. Whenever any of these land features change a new unit is made.

Specific field work activities include digging and describing soil profiles on each landform with supporting holes dug or profiles observed on bank/drain cuttings to establish soil boundaries, measuring slopes with a clinometer, and gathering any other data that may be of assistance in assessing the suitability of the land for primary production such as erosion, susceptibility of the land to flooding, winter wetness and/or cold, high temperatures, exposure to salt winds, aspect, and accessibility. This information is then used to determine the specific LUC units, as described in the Land Use Capability Classifications of the Northland Region (Harmsworth, 1996) for the area. At times when mapping at a scale finer than Harmsworth (1996) of 1:50,000, new LUC units are recorded and are noted with an * in the LUC description table.

3.0 SITE DESCRIPTION

The area of interest is located on the western boundary of the property at 2127 Kaipara Coast Highway and covers approximately 9ha. It includes the boundary between the rolling to steep sandstone hills that dominate the majority of the property and the estuarine flats to the west. Soils on the flats are poorly drained estuarine clays while those on the hills are moderately well

drained sedimentary clays and clay loams. In the past the property has been run as a dairy unit but at the time of the site visit no stock were present and paddocks had overgrown pasture.

3.1 Soil Profiles and Descriptions

The soils identified on the area of interest are presented and described in the table below with their distribution shown on the soil maps in Section 6.

Soil Profile	Soil Profile Description
	Soil Name: Kaipara clay (KP) Soil classification: Gley soils from the Kaipara suite. Parent material: Estuarine clays, sands and alluvium. Soil description: 0-200mm: Friable to firm, strongly developed, 2-5mm nut, sticky, plastic, 2.5y 3/1 clay with rusting around roots 200-410mm: Friable, strongly developed, 2-10mm nut, very sticky, plastic, 2.5y 4/1 clay with 10-20% 7.5yr 4/6 mottling 410-1000mm Massive, Gley 1, 7/10Y, sticky, plastic, clay Overall drainage: Poorly to very poorly drained
	Soil Name: Whangaripo clay loam (WR), Whangaripo clay loam hill soil (WRH) Soil classification: Moderately to strongly leached yellow-brown earths and related steep land soil from the Puhoi suite. Parent material: Banded sandstone. Soil description: 0-150mm: Friable, strongly developed, sticky, medium crumb, plastic, brown (10yr 4/3) sandy clay loam. 150-350mm: Friable, strongly developed, medium crumb, sticky, plastic, dark yellowish brown (10yr 4/4) sandy clay loam. 350-550mm: Friable strong developed, coarse crumb, sticky, plastic, yellowish brown (10yr 5/6) sandy clay. Overall drainage: Moderately well drained.

3.2 Land Use Capability Descriptions

LUC classifications categorize land into eight classes according to its long-term capability to sustain one or more productive uses.

- Classes 1-4 have arable potential with limitations to this land use moving from class one being the most versatile, multi-use land with minimal physical limitations for arable use and increasing to severe limitations under class four land. These classes are also suitable to viticulture, berry production, pastoralism, tree crops and production forestry.
- Classes 5-7 are suitable for pastoral farming and production forestry.
- Class 8 land has no productive use and is rather managed for catchment protection and conservation purposes.

The LUC units mapped on the proposed sites are presented in the table below with copies of the full unit descriptions taken from Harmsworth (1996) contained in the Appendix. LUC maps showing the distribution of the mapped units is contained in Section 6.

Resource information	LUC unit	Total area (ha)	Parent material	Dominant soil type	Slope (degree)	Land Cover	Erosion degree & severity		Landuse suitability	Stock carrying capacity (su/ha)
							Actual	Potential		Forestry site index (FSI)
3w 2 Poorly drained flat areas within floodplains, valley plains on low terraces with gley, fertile soils developed on sedimentary and volcanic alluvium		5.32	Fine alluvium	Gley soils on estuarine clays, sands, and alluvium	0-3°	Pasture & rushes	Nil	Slight streambank and deposition	Horticulture Vegetables Intensive Grazing Forestry	Average: 17 Top: 20 Potential: 24 FSI: 18-21 Revised Average: 15 Top: 20 Potential: 22
4w 1 Flat to undulating areas on floodplains, valley plains and low terraces with severe continuing wetness or flooding limitation.		0.24	Fine alluvium.	Recent soils on sedimentary and volcanic alluvium.	0-7°	Pasture	Nil.	Moderate streambank and deposition.	Intensive grazing Root and green fodder crops. Forestry	Average: 17 Top: 20 Potential: 24 FSI: 20-23 Revised Average: 13 Top: 15 Potential: 18

Resource information	LUC unit	Total area (ha)	Parent material	Dominant soil type	Slope (degree)	Land Cover	Erosion degree & severity		Landuse suitability	Stock carrying capacity (su/ha)
							Actual	Potential		Forestry site index (FSI)
6e 8 Moderate to steep slopes forming hilly to steep land terrain.		3.53	Interbedded sandstone and mudstone	Yellow-Brown earth hill soils on stratified sandstones and mudstones	21-35°	Pasture, native trees	Slight sheet and soil slip.	Moderate sheet, soil slip, gully and earthflow. Slight tunnel gully	Pasture Forestry	Average: 7 Top farmer: 8 Potential: 9 FSI:31-34m Revised Average: 11 Top: 13 Potential: 15

Land use capability unit descriptions are taken from the author's field work, and the Land use capability classification of the Northland region (Harmsworth, 1996).

Revised stock carry capacities are taken from a review of Harmsworth (1996) stock carry capacities by Bob Cathcart in 2017