KAPITI COAST DISTRICT COUNCIL

CODE COMPLIANCE CERTIFICATE

SECTION 95, BUILDING ACT 2004

THE OWNER

KCDC Road Reserve C/- Geoff Brown P.O. Box 3942 Wellington	No. Issue date Application date	100764 12/04/12 20/09/10

THE BUILDING

Street Address	Near building on 86 Emerald Glen Road Paekakariki
Valuation No.	
Legal Description	
Intended Use	Currently there is a stream, after construction there will be a road over stream.
Intended Life	Indefinite, but not less than 50 years
Current Use	Stream/waterway crossing road reserve
Proposal	Retaining walls(over culvert) to support a new road. Road to connect existingEmerald Glen Road to Mackays Crossing roundabout to provide access once water fall road level closes.
Estimated Value	$200,000

Code Compliance

The building consent authority named below is satisfied, on reasonable grounds, that –

a) The building work complies with the building consent; and

b) The property owner must follow and carry out the manufacturers prescribed maintenance procedures.

Signed for and on behalf of the Kapiti Coast District Council:

Signature: RBrook **Date:** 12/4/12

KCDC Form 342 ver. 1

KAPITI COAST DISTRICT COUNCIL

SCOPE OF INSPECTION SHEET

Date 27/3/2012. SR or BCA 100764. Inspection No. 2.

Time 11.00 AM. Documents on site YES (NO)

Owner Name Project Description Culvert.

Site Address 86. Emerald. Glen Road. Restricted Building Work YES / NO

(Building) Plumbing Circle appropriate Type & Inspection Other

Site Found Piles PreSlab Subfloor Drainage PreWrap PreClad Weathertight PreLine PostLine Block Brick Ret.Wall (Final)

Engineer Supervision (Yes) No n/a – Name Opus.

Notes Culvert Completed. Fence on Western Side in Place.

Diagram (if necessary)

Engineers P.S4 Accepted. Under Policy 002.

2/4/12.

Photo's Taken – Nos. saved / scanned? Y / N

Site instruction issued Engineer. Not Cpeng on P.S4.

Confirmation of person on site

Result: (Pass) Part pass Fail

Name	LBP No.

Your next inspection will be

(Guidance notes for inspection on the rear of this sheet)

Agreed, (Print Name) Sign

Officer Name Tony Sign

Information entered into data base ☐ Initial Date 27/3/2012

Form 242

SCOPE OF INSPECTION

Inspections are made in conjunction with, and with the cooperation of, the owner/owner's agent to ensure that the building work complies with the provisions of the Building Act and NZ Building Code. The inspection is general in nature and involves an audit of the following aspects:

Engineer – Civil/Structural/Fire/Geotechnical: An engineer has been engaged to carry out inspections on behalf of the owner. Please ensure those inspections are carried out. A Certificate of Expert Opinion is required to be supplied to Council.

Site: A surveyor's report, or visible boundary markers provided, so that the set out of the project can be clearly identified.

Foundation: When all formwork has been completed, footings have been excavated and reinforcement is in place.

Piles: When all holes are excavated prior to installation.

Pre-slab plumbing (concrete slab): When all plumbing and drainage pipes have been installed, prior to backfilling.

Pre-slab building (concrete slab): When DPM has been placed with all laps and penetrations sealed, reinforcing in place and in position with chairs as appropriate.

Sub-floor (timber suspended floor): When all sub-floor connections, joists and required blocking, and any suspended plumbing pipe work have been completed, but before any flooring or base boards have been fitted. Relocated dwellings require a sub-floor inspection prior to the base boards being fitted.

Drainage: When all drainage works is completed and is under test, before backfilling occurs. As laid drainage plan is required at time of inspection.

Pre-wrap: When all roof and wall framing is complete, including any exterior sheet bracing, but before building wrap has been installed.

Pre-clad: When building wrap and window and door flexible flashing tape has been installed, cavity battens (cavity systems), cavity closers and all flashing systems are in place, but before joinery has been installed.

Weathertightness: When exterior cladding has been installed, flashings in place, air seals fitted to openings, but before any coating system have been applied.

Pre-line (plumbing): When all internal plumbing is complete and plumbing pipe work is under test pressure.

Pre-line (building): When the exterior of the building is weather tight, all structural components (including bracing) have been completed and wall insulation is in place.

Wet area membranes, decks, roofs and shower area: Pre application of wet area membrane, when all outlets and flashings have been installed, ready for membrane installation.
Post application of wet area membrane.

Post-line: When all interior linings have been installed, but before skirting, Scotia or plastering stopping. Installation details of screws check of wall bracing element.

Block: When all masonry block work including block foundations for slab floors, is completed, reinforcing in place and washout openings in place.

Brick Veneer: When veneer is at half height and all flashings are in place.

Retaining wall: Pre application of waterproof membrane system.
Post application of waterproof membrane system.
Protection installed for membrane system and installation of perforated drainage system before back filling.

Final: Final inspections are carried out at the completion of the project and may include entire project, plumbing, drainage and storm water. The Code Compliance Certificate is issued if the building work complies with the approved building consent.

Free Standing Fireplace: Final inspection required only.

In Built Fireplace: Inspection required before installation **and** after installation.

PRIVACY STATEMENT

1. The information contained on the Building Inspection Report Sheet is held by the Kapiti Coast District Council, whose address is Private Bag 601, Paraparaumu.
2. The information is available for public inspection as part of the Building Record of the property concerned.
3. You have the right under the Privacy Act 1993 to obtain access to, and to request correction of any personal information held by Council concerning you.

Council has a Privacy Officer. If you have any concerns regarding privacy issues please telephone (04) 296 4700

KAPITI COAST DISTRICT COUNCIL

SCOPE OF INSPECTION SHEET

Date 27/3/2012. SR or BCA 100764. Inspection No. 2.

Time 11.00 AM. Documents on site YES / NO

Owner Name Project Description Culvert.

Site Address 86. Emerald Glen Road. Restricted Building Work YES / NO

Building Plumbing Circle appropriate Type & Inspection Other

Site Found Piles PreSlab Subfloor Drainage PreWrap PreClad Weathertight PreLine PostLine Block Brick Ret.Wall Final

Engineer Supervision Yes No n/a – Name Opus.

Notes Culvert. Completed. Fence on Western side. in Place.

Engineers. PS4 Accepted. Under. Policy 002.

Diagram (if necessary)

2/4/12.

Photo's Taken – Nos. saved / scanned? Y / N

Site instruction issued Engineer. not. Cert. on PS4.

Confirmation of person on site

Result: Pass Part pass Fail

Name	LBP No.

Your next inspection will be

(Guidance notes for inspection on the rear of this sheet)

Agreed, (Print Name) Sign

Officer Name Tony Sign

Information entered into data base ☐ Initial Date 27/3/2012

Form 242

KAPITI COAST DISTRICT COUNCIL

FINAL INSPECTION

Date 27/3/2012. SR or BCA 100764. Inspection No. 2.

Time 11.00 AM. Documents on site YES / NO

Owner Name ..... Project Description CULVERT.

Site Address 86. EMERALD GLEN Road.

All inspections are carried out with strict reference to the building consent granted.

P = Pass F = Fail NA = Non-Applicable

Inspection decisions are based on the extent of work inspected at the time of inspection.

Please refer to the related scope sheet for definition of the inspections extent.

Applicable to all inspections

Sighted previous inspection notes	Y	N	NA	Conforms with approved drawings	Y	N	NA	Confirm Additional information/amended plan	Y	N	NA
	(Y)				(Y)						(NA)

FINAL – Exterior

Sub-floor ventilation	P	F	NA	Roof fixings	P	F	NA	Spouting + Down-pipes	P	F	NA
Deck Structure	P	F	NA	Flashings – Roof	P	F	NA	Penetrations – Flashings	P	F	NA
Barriers	(P)	F	NA	Gully Dishes	P	F	NA	Storm-water + site drainage	P	F	NA
Handrails	P	F	NA	Wastes to gully	P	F	NA	Fixings – Durability	P	F	NA
Steps/Stairs	P	F	NA	Terminal vents/AAV's	P	F	NA	Cladding painted/sealed	P	F	NA
Flashings – Windows/Doors	P	F	NA	Cladding Ground Clearance	P	F	NA		P	F	NA

FINAL – Interior

Service areas – floors/walls	P	F	NA	Food storage/preparation	P	F	NA	Hot water temp	P	F	NA
Stair design	P	F	NA	Ventilation	P	F	NA	Solid fuel heater	P	F	NA
Handrails	P	F	NA	Insulation + clearance	P	F	NA	Water supply tank	P	F	NA
Balustrades	P	F	NA	HWC flues	P	F	NA	Trap seals + AAV's	P	F	NA
Lightings	P	F	NA	HWC valves	P	F	NA	Cistern flushing	P	F	NA
Laundering	P	F	NA	HWC restraint	P	F	NA	WC pan connection	P	F	NA
Cooking facilities	P	F	NA	Tempering valve	P	F	NA	Septic tank	P	F	NA
Smoke detectors	P	F	NA	Glazing – Human Impact	P	F	NA	Window labels	P	F	NA

FINAL – Intertenancy/Commercial

Fire/Life systems sighted	P	F	NA	Guarantees/Warranties/ Certificates/ Expert Opinion	P	F	NA	Intertenancy STC	P	F	NA

All Inspections

Road Crossing Complete	P	F	(NA)	Energy Certificates supplied	P	F	(NA)	Final Check Complete	(Y)	N	

Name: TONY King Officer Sign: Date: 2.4.2012

Form 242

KAPITI COAST DISTRICT COUNCIL

SCOPE OF INSPECTION SHEET

Date 26/10/10 SR or BCA 100764 Inspection No.

Time 2:30 Documents on site YES / NO

Owner Name QUS. Project Description Culvert.

Site Address 86 EMERALD GLEN RD.

Building Plumbing

Circle appropriate Type & Inspection Other

Site Found Piles PreSlab Subfloor Drainage PreWrap PreClad Weathertight PreLine PostLine Block Brick Ret.Wall Final

Engineer Supervision Yes No n/a – Name

Notes

Diagram (if necessary)

Bot for Culvert

Photo's Taken – Nos. saved / scanned? Y / N

Site instruction issued

ENGINEER PSI for BASE FOOTINGS To Conc.

Result: **Pass** **Part pass** **Fail**

Confirmation of inspection by person on site

Person on site: Builder ☐ Owner ☐ Other ☐ No One on site ☐

Your next inspection will be

(Guidance notes for inspection on the rear of this sheet)

Agreed, Wayne Holcroft (Print Name) Sign Date 26/10/10

Officer Name AHP Sign Date 26/10/10

Additional Insp. Sheet No.

Information entered into data base ☐ ***Initial*** ***Date*** / /

Form 242

KAPITI COAST DISTRICT COUNCIL

SITE / FOUNDATIONS / PILES / PRE SLAB / SUBFLOOR / DRAINAGE

Date 26/5/15 **SR or BCA** 100764 **Inspection No.**

Time 2:35 **Documents on site YES / NO**

Owner Name QUS. **Project Description** CULVERT

Site Address 86 EMERALD GLEN RD.

All inspections are carried out with strict reference to the building consent granted.

P = Pass F = Fail NA = Non-Applicable

Inspection decisions are based on the extent of work inspected at the time of inspection.

Please refer to the related scope sheet for definition of the inspections extent.

SITE

Conforms with approved drawings	Y	N	NA	Checked driveway	Y	N	NA	Engineer supervision required	Y	N	NA	
Scope of Resource consent granted?	Y	N	NA	Checked position off relevant boundaries and datum height	Y	N	NA		Y	N	NA	
Expert Opinion (Producer statement) required	Y	N	NA	Name of Surveyor Company				Name of Engineer Company				

FOUNDATIONS / PILES / SUBFLOOR

Footing Depth	P	F	NA	Pile size	P	F	NA	Pile/Bearer/Joist Fixings	P	F	NA	
Good bearing (NZS 3604)	P	F	NA	Pile layout is to plan	P	F	NA	Notching, Holes, etc	P	F	NA	
Reinforcing	P	F	NA	Special piles - point load	P	F	NA	Solid Blocking	P	F	NA	
Siting	P	F	NA	Timber Treatment	P	F	NA	Joists	P	F	NA	
Sub-floor vents	P	F	NA	Hole depth	P	F	NA	Beams/Bearers	P	F	NA	

PRE SLAB

Rebate for brick veneer	P	F	NA	Sand blinding	P	F	NA	Steel reinforcing	P	F	NA	
Ground clearance	P	F	NA	Slab thickenings	P	F	NA	Bar chairs	P	F	NA	
Concrete Cover	P	F	NA	Vapour barrier (DPC)	P	F	NA	DPC penetrations taped	P	F	NA	
Driveway s/w control	P	F	NA	Bottom plate fixings	P	F	NA	Minimum Floor Level	P	F	NA	
Secondary flow path	P	F	NA	TPR line	P	F	NA	Wastes and drains – size / fall	P	F	NA	
Pipe material	P	F	NA	Plumbing layout	P	F	NA	Test – Water / Air	P	F	NA	
Pipe protection	P	F	NA	Pipes supported	P	F	NA	Visual leak check	P	F	NA	

DRAINAGE

Pipe diameter	P	F	NA	Connections/Angles	P	F	NA	Holding water	P	F	NA	
Bedding material	P	F	NA	Branch length	P	F	NA	Terminal vent	P	F	NA	
Gully trap(s)	P	F	NA	Direction/Fall	P	F	NA	LBP/Registration No:				

Officer Name: ..... **Sign:** ..... **Date:** ../../..

FOR COUNCIL USE:

DEPARTMENT	TICK FOR REFERRAL	COMMENTS	APPROVING OFFICER/ DATE
Site Inspection	✓	Refer to Form 241 for completion of site Inspection & sign off this form when completed.	
Resource Consents (refer PIM Sheet)	✓		
Plumbing and Drainage	✓	N/A.	
Building	✓	Approved – Specific design by Cheng.	SAGE 5/10/10
Fire Design			
Compliance Schedule			
Environmental Health			
Other……			

NOTES:

KCDC Form 123 ver. 2

KAPITI COAST

Building Consent	100764
Building Project	**Retaining Walls over culvert**
Location (Site Ad	**Road Reserve near 86 Emerald Glen Road**
Building Category	*Circle appropriate category* 0 1 2 3

RECEIVED
20 SEP 2010
KAPITI COAST DISTRICT COUNCIL

Application workflow checklist

	Name & Signature Note # A signature confirms that the application contains sufficient information to enable compliance with the building code to be assessed	Date
# Note: Checked, date stamped and initialled by TO/BCO. Select and circle appropriate category above & identify allocation to appropriate technical groups and if required to go to "site inspection" **AP-WI-001**	GP Johnson	20/9/10
Payment taken and receipted (details entered inside this cover sheet) by CSO **CS-WI-008**	Angie Stokes	20/9/10
Data entered and invoiced by CSO **CS-WI-008**	Angie Stokes	20/09/10
Pages numbered by CSO **CS-WI-008**	GP Johnson	20/9/10
BC Application and documentation scanned, checked & status update by CSO **CS-WI-009**	Angie	20/9/10
BC Application signed over to BC **CS-WI-009**	Angie	20/9/10
Application reviewed by Technical Officers who sign off at back of this form **AP-WI-026 & AP-WI-009**	SAGE	5/10/10
Once Technical review complete, passed to CS for Plan Production and Invoicing **AP-WI-009**		
CSO checks data entry input, including required inspections **CS-WI-012**		
BC, plans and other appropriate paperwork produced by CSO **CS-WI-012**	Yinjun	6/10/10
BC, Approved plans and appropriate paperwork sent to applicant or agent with receipt by CSO **CS-WI-012**		
Inspection envelope prepared by CSO with endorsed plans and other appropriate paperwork and filed to cabinet. **CS-WI-012**		

KCDC Form 123 ver. 2

CONSENT DATA INPUT REQUIREMENTS

	REQUIRED INSPECTIONS
✓	Foundation/Piles
	Block
	Pre-Slab (Plumbing)
	Pre-Slab (Building)
	Sub-Floor
	Drainage
	Pre-Wrap
	Pre-Clad
	Weathertightness
	Pre-lining (Building)
	Pre-lining (Plumbing)
	Wet areas - membrane
	Post Lining
	Brick Veneer
	Retaining Wall
	Final (Dwelling)
✓	Final (Commercial) &Multi-resd)

32	✓	Lapse and cancellation after 12mths of consent	23		Installation of solid fuel appliance (wood burner) comply and secured
2	✓	Engineer design specific components	23A		Second hand wood burner certified
3		Foundations to solid bearing of 200mm	25		Contractor to leave site clean and clear
4		NZS3604 as acceptable solution in terms of NZ Building Code	30		To comply with Food Hygiene Regulations 1974
6		Not approved as Habitable Room	31		As in CCZ, all fixings need to be stainless steel
9		Note and comply with all endorsements on approved plans	33		Approval only given for relocation purposes
10		Names and Registration of plumber and drain-layer required	34		If cladding to have pre-finished colour coating, to be appropriate for coastal conditions
11		Concealed soil and TV pipes and gas flues only allowed in ducts or minimum framed	38		Window sashes on upper levels less than 760mm above floor to have stays fixed
12		Hot & Cold water pipes tested to 1500kPa	39		Construction of playground to comply with NZS5828
13		Roof stormwater to be connected to existing	40		Fencing, gates, doors directly leading to swimming pool to comply with Pool Act 1987
14		Copper water pipes not permitted	43		Textured systems should be applied by licensed, trained applicators – supply warranty
15		Owner/builder to ensure prop foundation height will allow satisfactory connection	44		Exterior cladding system to be completed and inspected prior to internal lining
21		Minimum FFL to comply with NZS3604			

	STANDARD CONSENT CONDITIONS	
	37	
	72	
	80	

NON-STANDARD ADDENDA

N/A

KCDC Form 123 ver. 2

FOR OFFICE USE ONLY

FEES		
Building Fee	$ 718.00	
Sewer Connection	$	
Water Connection	$	
Vehicle Crossing	$	
Damage Deposit	$	
Code Compliance Administration	$	
Building Research Levy	$ 200.00	
Development Levy	$	
DBH Levy	$ 394.00	
Compliance Schedule	$ 38.00	
Digital Storage Fee	$	
Certificate of Title Charge	$	
Photocopying	$	
SUBTOTAL	$	
Less Fee Paid	$	
TOTAL	$ 1350.00	
GST INCLUDED	$	

APPLICATION FEE $ $1350.00

RECEIPT NO ..... DATE .....

INVOICE NO 9737 DATE 20-09-10

RECEIPT NO 356771 DATE 20-09-10

FEES PAID BY: Opus Int Consultants

BUILDING CONSENT NUMBER 100764 DATE ISSUED

AUTHORISATION FOR REFUND OF DEPOSIT

Deposit held = $

Cost to Repair Damage Caused During Construction = $

Total Balance to be Refunded

Authority Number:

Authorised: DATE:

GST 51-860-608

Received with thanks by 36/01
KAPITI COAST DISTRICT COUNCIL

20-09-10 12:35 Receipt no.356771

COPY *COPY* *COPY*
DR BC100764 OPUS 1,350.00-
Opus::Opus Int : Majestic Centre:100 Wi
CQ B
Opus Int consultants 1,350.00

KCDC Form 123 ver. 2

Kāpiti Coast District Council

Private Bag 60 601
Paraparaumu 5254
New Zealand

Tel (04) 296 4700
or 0800 486 486
Fax (04) 296 4830 ■
kapiti.council@kapiticoast.govt.nz ■
www.kapiticoast.govt.nz ■

Building consent 100764

Section 51, Building Act 2004

The building

Street address of building: Near building on 86 Emerald Glen Road Paekakariki

Legal description of land where building is located:

Valuation number:

Building name:

Location of building within site/block number:

Level/unit number:

The owner

Name of owner: KCDC Road Reserve

Contact person:

Mailing address: 175 Rimu Road, Private Bag 60 601, Paraparaumu 5254

Street address/registered office:

Phone number: Landline: 2964700 Mobile:

Daytime: After hours:

Facsimile number: 042964830

Email address:

Website:

First point of contact for communications with the council/building consent authority:
Full Name: Opus

Mailing Address: Opus Int : Majestic Centre, 100 Willis Street, PO Box 1200, Wellington

Phones:: 04 4717000

Fax: 04 499 3699

Email: richard.coles@opus.co.nz

Building work

The following building work is authorised by this building consent:

Retaining walls(over culvert) to support a new road. Road to connect existingEmerald Glen Road to Mackays Crossing roundabout to provide access once water fall road level closes.

Currently there is a stream, after construction there will be a road over stream.

This building consent is issued under section 51 of the Building Act 2004. This building consent does not relieve the owner of the building (or proposed building) of any duty or responsibility under any other Act relating to or affecting the building (or proposed building).

This building consent also does not permit the construction, alteration, demolition, or removal of the building (or proposed building) if that construction, alteration, demolition, or removal would be in breach of any other Act.

Compliance schedule

A compliance schedule is not required for the building.

Attachments

Copies of the following documents are attached to this building consent:

Signature

CSO

Position

On behalf of: KAPITI COAST DISTRICT COUNCIL

Date: 5/10/10

7 October 2010

KCDC Road Reserve
175 Rimu Road
Private Bag 60 601
Paraparaumu 5254

Dear Sir/Madam

Approval of Building Consent: 100764

Description: Retaining walls(over culvert) to support a new road. Road to connect existingEmerald Glen Road to Mackays Crossing roundabout to provide access once water fall road level closes.
Location: Near building on 86 Emerald Glen Road Paekakariki
Legal Description:

I am pleased to inform you that the above building consent application has been approved. The building consent documents have been issued and are enclosed.

Before starting any work please read ALL the building consent documents carefully and in full so that you as the owner understand the conditions under which the consent has been issued.

As the owner you are also responsible for the following:

- ensuring that building work starts within 12 months of the approval of the building consent and that work progresses at a reasonable pace.
- ensuring that all required inspections are completed and that a Code Compliance Certificate is obtained once the work has been completed – please be aware that before a Code Compliance Certificate is issued, the building work must comply with the Building Act 2004 and the Building Code as at the date of final inspection.
- that no work with noisy equipment is to be carried out before 7.30 a.m. or after 6 p.m. Monday to Saturday. During the week there may be workers on site from 6.30 a.m. quietly preparing for work. Work with noisy equipment is not permitted on Sundays and public holidays.
- ensuring that no damage occurs to public property, for example footpaths or retaining structures. Should damage occur you will be required to pay for any repairs.
- ensuring that if you wish to make any changes to the approved building consent, then an amendment to the building consent will need to be lodged with us.

If you have any questions regarding your building consent or your responsibilities, please contact Kapiti Coast District Council on (04) 9045 617.

Addenda to Application

Application

Opus Opus Int : Majestic Centre 100 Willis Street PO Box 1200	No.	100764

Project

Description	Retaining Walls Being Stage 1 of an intended 1 Stages Retaining walls(over culvert) to support a new road. Road to connect existingEmerald Glen Road to Mackays Crossing
Intended Life	Indefinite, but not less than 50 years
Intended Use	Currently there is a stream, after construction there will be a road over stream.
Estimated Value	$200,000
Location	Near building on 86 Emerald Glen Road Paekakariki
Legal Description	
Valuation No.	

Designer: R Coles Opus 100 Willis Street Wellington : 044993699

Contractor: Fletcher c/o Gerald Carty Level 1, 816 Great South Rd Penrose 1142 : 0276711870

General Requirements

a) The Building Inspector is to be given 24 hours' notice before carrying out the following inspections:

1. Foundations
2. Final Inspection - Commercial

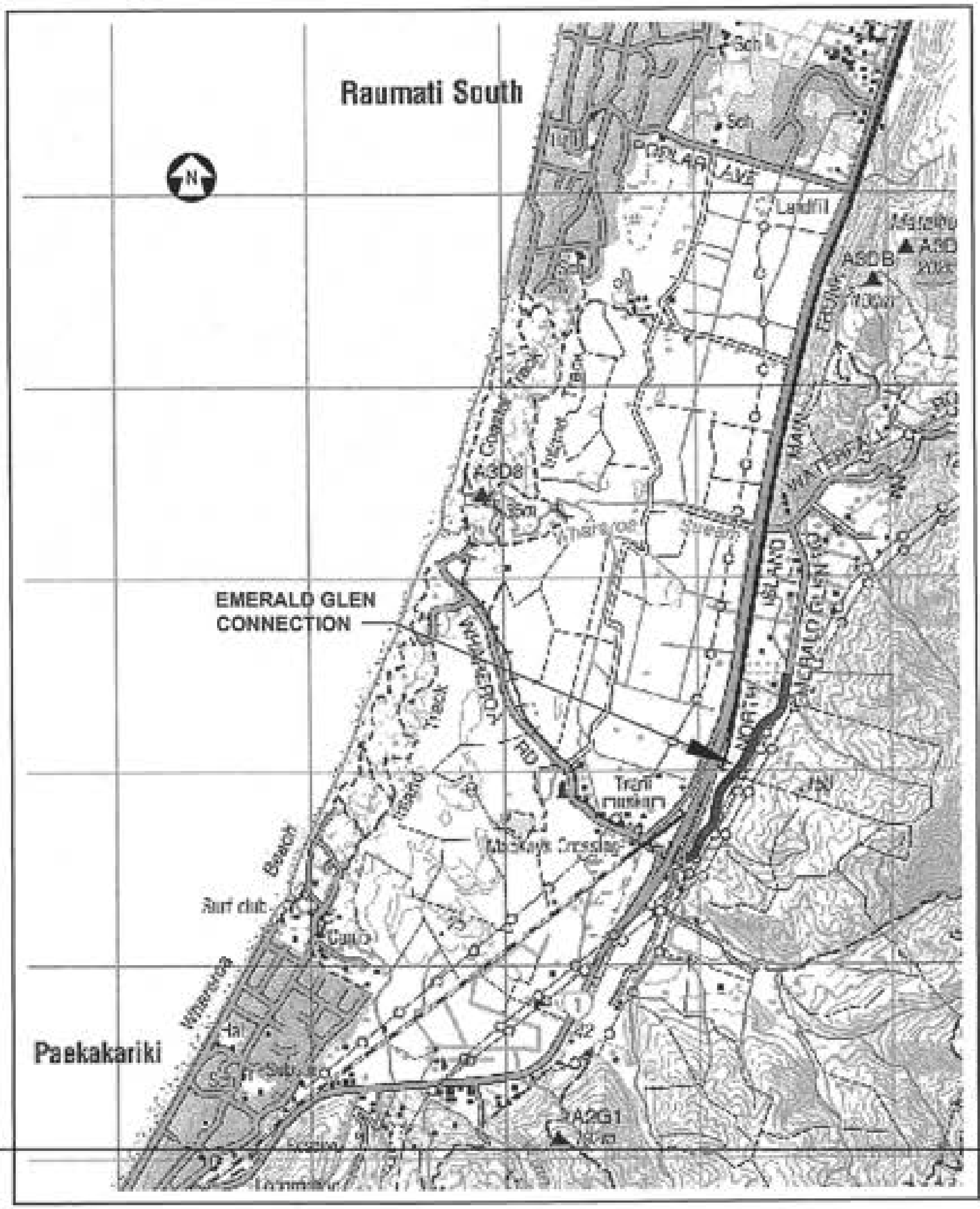
b) To arrange for any of the above required inspections by Building Control Team, please contact the Call Centre on (04) 296 4700 between the hours of 8am and 5pm.

2	Addenda to Application 100764

1. LAPSE AND CANCELLATION OF BUILDING CONSENT. A building consent shall lapse and be of no effect if the building work concerned has not been commenced within 12 calendar months after the date of issue. Or within such further period as the territorial authority allows.
2. The inspection of all specific design components of the building is the responsibility of the Design Engineer who is also required to supply a written report to Council.

I have read the foregoing addenda to application, and the Owner/Builder/Authorised Person hereby agrees to comply with them.

OWNER/BUILDER/
AUTHORISED PERSON **Date:**



LOCALITY PLAN
N.T.S.

WATERFALL ROAD CONNECTION, KAPITI

DRAWING INDEX
5/2573/1/7504

GENERAL ARRANGEMENT

1. DRAWING INDEX

ROADING

101. PLAN AND LONGITUDINAL SECTION - SHEET 1
102. PLAN AND LONGITUDINAL SECTION - SHEET 2
111. PLAN LAYOUT - Sta. 60 to Sta. 260
112. PLAN LAYOUT - Sta. 260 to Sta. 450
113. PLAN LAYOUT - Sta. 450 to Sta. 640
114. PLAN LAYOUT - Sta. 640 to Sta. 830
115. PLAN LAYOUT - Sta. 830. to Sta. 1020
116. PLAN LAYOUT - Sta. 1020 to End
121. TYPICAL CROSS SECTIONS
122. MISCELLANEOUS DETAILS
131. CLOSURE OF S.H.1 MEDIAN BARRIER BREAK

STORMWATER & DRAINAGE

301. EMERALD GLEN CULVERT - PLAN
302. EMERALD GLEN CULVERT - SECTION & FISH PASS DETAILS
303. EMERALD GLEN CULVERT - TERRAMESH EARTH WALL DETAILS
304. EMERALD GLEN CULVERT - END ELEVATIONS - TERRAMESH WALL DETAILS
305. EMERALD GLEN CULVERT - HEADWALL DETAIL
311. TRAMWAY AND MINOR CULVERT DETAILS
312. MANHOLE AND WINGWALL ARRANGEMENTS
313. SCRUFFY DOME INSTALLATION
321. TYPICAL SWALE DETAIL AND EROSION PROTECTION FOR BRIDGE
322. DIVERSION CHANNEL DETAILS
331. ROAD DRAINAGE DETAILS - SHEET 1
331. ROAD DRAINAGE DETAILS - SHEET 2

LANDSCAPE

401. TYPICAL CROSS SECTION & DESIGN PRINCIPLES
404. PLANTING PLAN 1
405. PLANTING PLAN 2

BRIDGING (DRAFT)

500. GENERAL ARRANGEMENT
501. ABUTMENT GEOMETRY
502. ABUTMENT A REINFORCEMENT
503. ABUTMENT B REINFORCEMENT
504. ABUTMENT & PILE REINFORCEMENT DETAILS
505. 14m SPAN DHC BEAMS - REINFORCEMENT & STRESSING DETAILS
506. 14m SPAN DHC BEAMS - OUTER BEAM UNIT TYPE 2
507. 14m SPAN DHC BEAMS - UNIT DATA & LAYOUT PLAN
508. DECK PLAN & GUARDRAIL LAYOUT
509. W-SECTION GUARDRAIL - ASSEMBLY & FIXING DETAILS
510. ALUMINIUM HANDRAIL - ASSEMBLY & FIXING DETAILS
511. ALUMINIUM HANDRAIL - FABRICATION DETAILS
512. CONCRETE NOTES

APPROVED BY BUILDING leighs OFFICER 5/10/2010

RECEIVED 2 0 SEP 2010 KAPITI COAST DISTRICT COUNCIL

CONSTRUCTION

R2	ISSUED FOR CONSTRUCTION	C.L.	02/09/2010

NZ TRANSPORT AGENCY
WAKA KOTAHI

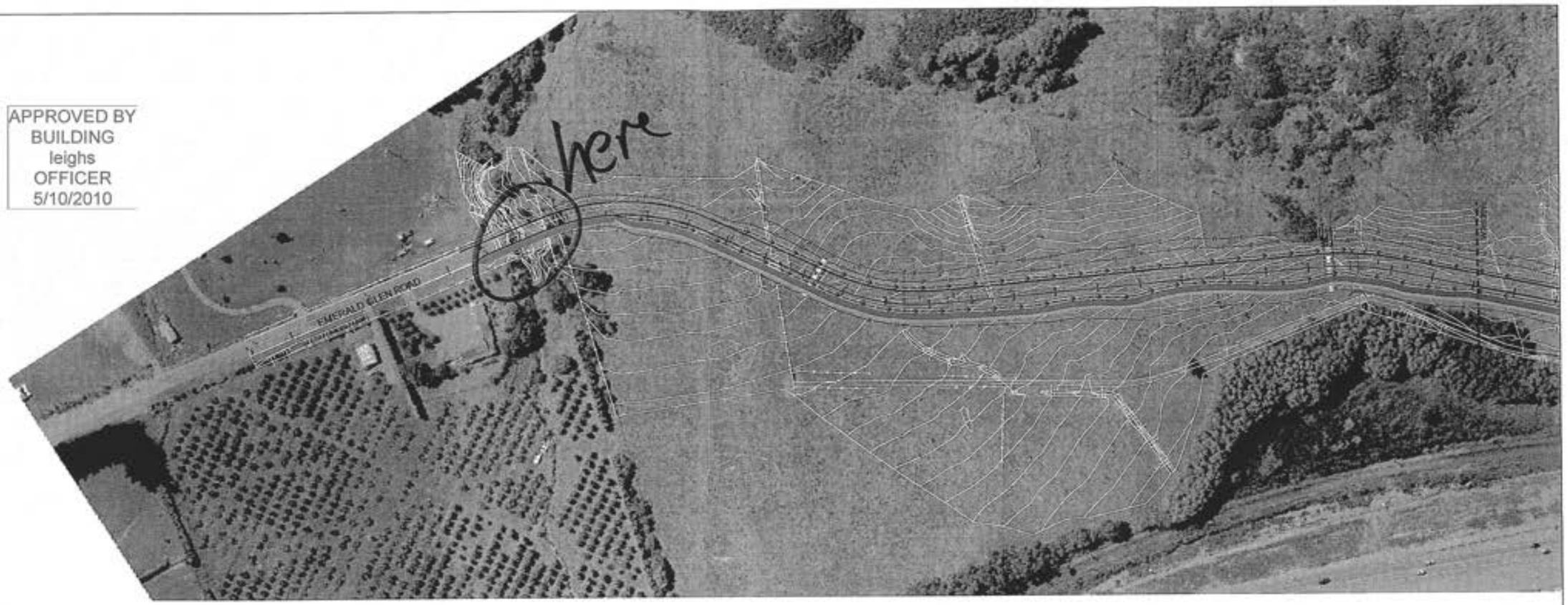
OPUS
Wellington Office

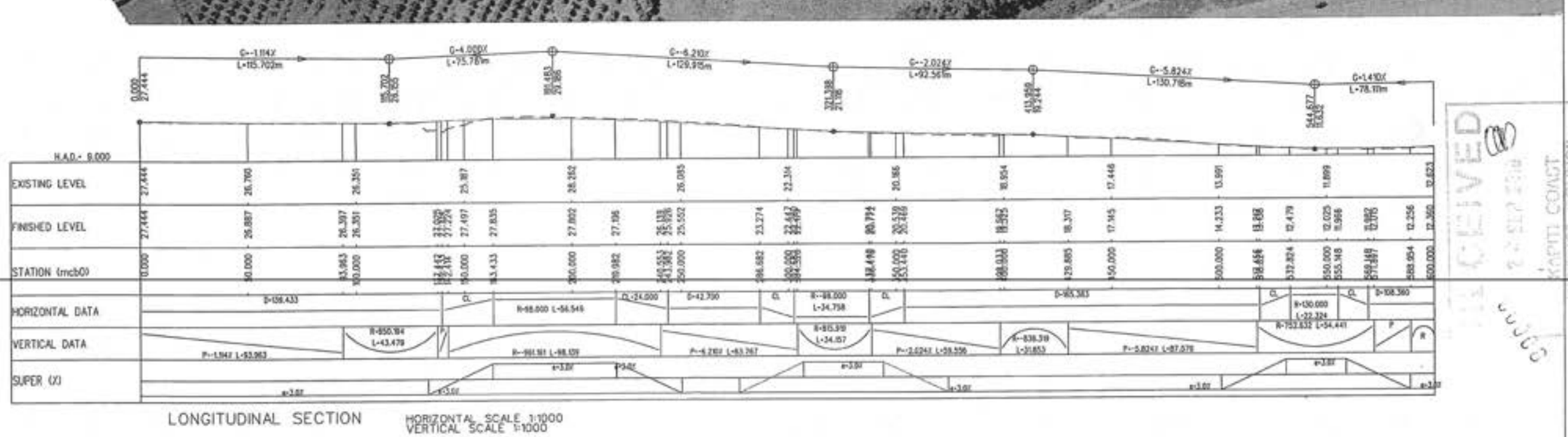
NEW ZEALAND TRANSPORT AGENCY
EMERALD GLEN CONNECTION, KAPITI
ROAD ALIGNMENT

LOCALITY PLAN & DRAWING INDEX

R.O.	I.T.	C.LEE		02/09/2010
5C1744.02	N.T.S	5/2573/1/7504	1	R2

APPROVED BY
BUILDING
leighs
OFFICER
5/10/2010





LONGITUDINAL SECTION HORIZONTAL SCALE 1:1000
VERTICAL SCALE 1:1000

CONSTRUCTION

KEY

- POSSIBLE ARCHAEOLOGICAL SITE
- PROPOSED FOOTPATH LOCATION
- SWALES
- STOCK PROOF FENCE
- PROPOSED STOCK CROSSINGS
- CULVERTS

Revision	Amendment	Approved	Revision Date
A2	ISSUED FOR CONSTRUCTION	D.L.	02/09/2010

NZ TRANSPORT AGENCY
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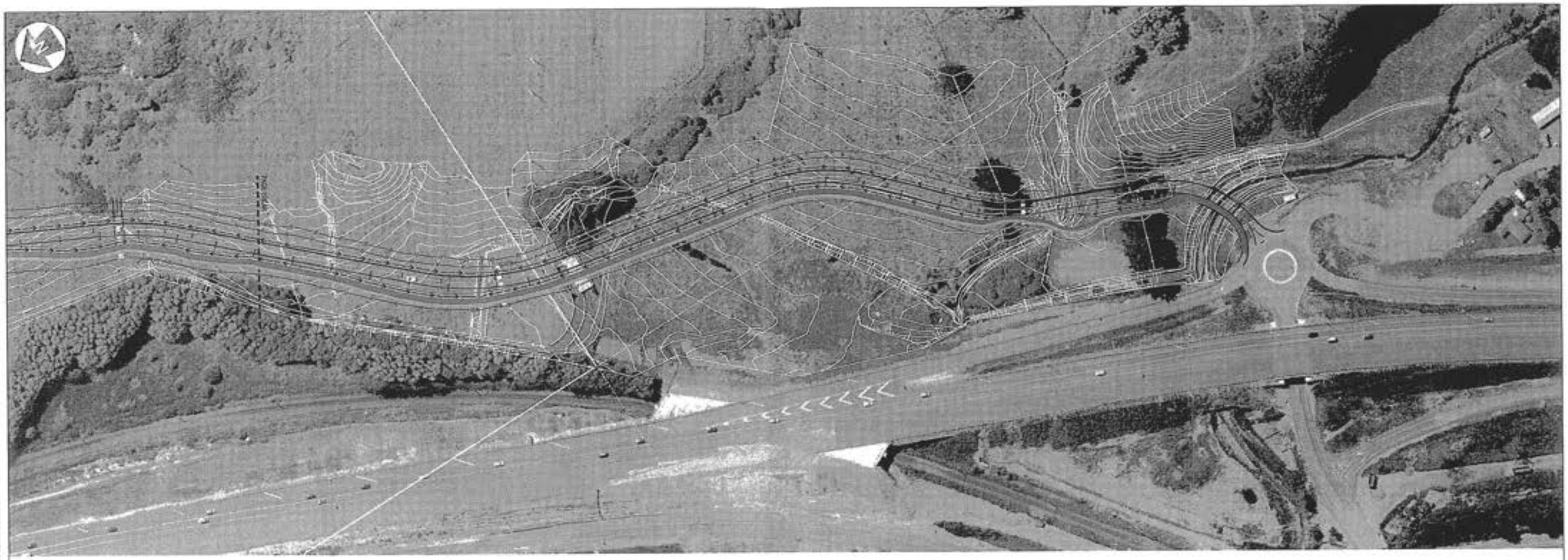
Drawn	Design Verified	Approved	Revision Date
RG	RG		

Project No.	Scale
5-C1744.01	1:1000 (A1)

NEW ZEALAND TRANSPORT AGENCY
EMERALD GLEN LINK ROAD, KAPITI
ROAD ALIGNMENT

PRELIMINARY ALIGNMENT - FOR CONSTRUCTION
SHEET 1 OF 2

Drawing No.	Sheet No.	Revision
5 / 2573 / 1 / 7504	101	R2



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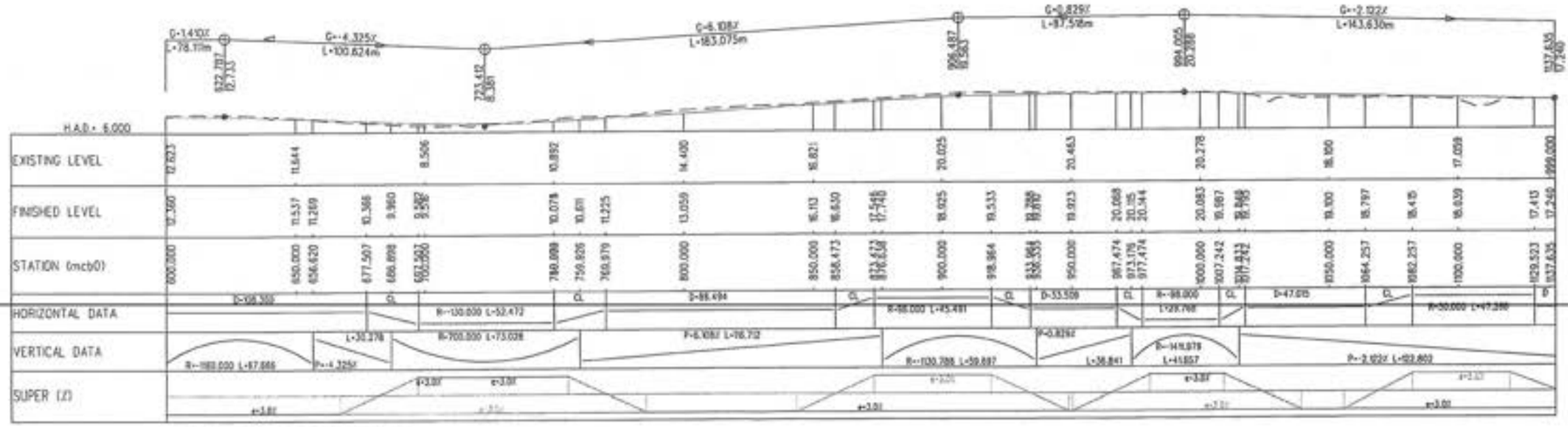

LONGITUDINAL SECTION

HORIZONTAL SCALE 1:1000
VERTICAL SCALE 1:1000

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CONSTRUCTION

KEY

- POSSIBLE ARCHAEOLOGICAL SITE
- PROPOSED FOOTPATH LOCATION
- SWALES
- STOCK PROOF FENCE
- PROPOSED STOCK CROSSINGS
- CULVERTS

Rev	Amendment	By	Revision Date
R2	ISSUED FOR CONSTRUCTION	C.L.	02/09/2010

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Drawn	Design Lead	Approved	Revision Date
RG	RG		

Project No.	Scale	Drawing No.	Sheet No.	Revision
5-C1744.01	1:1000 (A1)	5 / 2573 / 1 / 7504	102	R2

NEW ZEALAND TRANSPORT AGENCY
EMERALD GLEN LINK ROAD, KAPITI
ROAD ALIGNMENT

PRELIMINARY ALIGNMENT - FOR CONSTRUCTION
SHEET 2 OF 2

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STOCK PROOF FENCE TO TIE INTO EXISTING FENCE LINE

DIVERSION CHANNEL 1A
DETAILS SHEET 333

ELECTRA DISTRIBUTION POWER POLE (49381A)

TL - 3 W-BEAM SAFETY BARRIER EXTENDED ACROSS CULVERT TO PROTECT POWER POLE

ELECTRA DISTRIBUTION POWER POLE LOCATED NEAR TO CUT SLOPE (49381A)

DIVERSION CHANNEL 1A

DC 1B

CONTRACTOR TO BACKFILL BEHIND CULVERT HEADWALL WITH 150mm OF TOPSOIL AND HYDROSEED

WW.M.1

PW-36

PW-37

SUMP 1

SWALE TYPE 3

SWALE TYPE 2

KERB AND CHANNEL ON BOTH SIDES OF ROAD FROM STN 120 TO STN 180

TIMBER POST AND RAIL FENCE

3.0m LONG CONCRETE CHANNEL (150mm THICK) TO TRANSITION FROM K&C TO SWALE

SOLID 100mm WHITE PAINTED CENTRELINE AROUND CURVE

TRAFFIC CALMING MEASURES FOR EXISTING EMERALD GLEN ROAD STILL TO BE AGREED WITH KCDC

MH/M1

SUMP 2

NORTHERN CULVERT
FOR DETAILS OF NORTHERN CULVERT (INC. WING WALL, TERRAMESH, RIPRAP AND EARTHWALLS) SEE SHEETS 301 TO 305

RIP-RAP SCOUR PROTECTION AS SHOWN ON SHEET 302

PAGE BREAK

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NOTES:
1. CONTOURS ARE SHOWN AT 1m SPACING
2. ALL BARRIER TERMINAL ENDS ARE TO BE STANDARD LEADING AND TRAILING EXCEPT WHERE SHOWN OTHERWISE
3. EACH SWALE END WILL HAVE 3.0m CHANNEL (150mm THICK) TRANSITIONS FROM/TO KERB AND CHANNEL OR TO DISCHARGE

SERVICES KEY
- TRANSPOWER 110KV OH LINES
- VECTOR UNDERGROUND TRANSMISSION GAS PIPELINES
- ELECTRA DISTRIBUTION OH LINES
- TELECOM UNDERGROUND FIBRE-OPTIC LINES

LEGEND
- MINOR DRAINAGE CHANNEL
- MINOR STREAM
- SIGNIFICANT STREAM
- DIVERSION CHANNEL
- SWALES
- FOOTPATH / BRIDLEWAY
- GRASSED BRIDLEWAY
- PROPOSED ROAD ALIGNMENT
- EXISTING ROAD SIGNS & LIGHTING
- NEW ROAD SIGNS & LIGHTING
- TIMBER POST & RAIL FENCE
- STOCK PROOF FENCING
- STOCK CROSSING
- SIGHT RAILS
- MANHOLE
- SCRUFFY DOME MH
- WINGWALL
- CULVERT

NO	ISSUED FOR CONSTRUCTION	C.L.	02/09/2010

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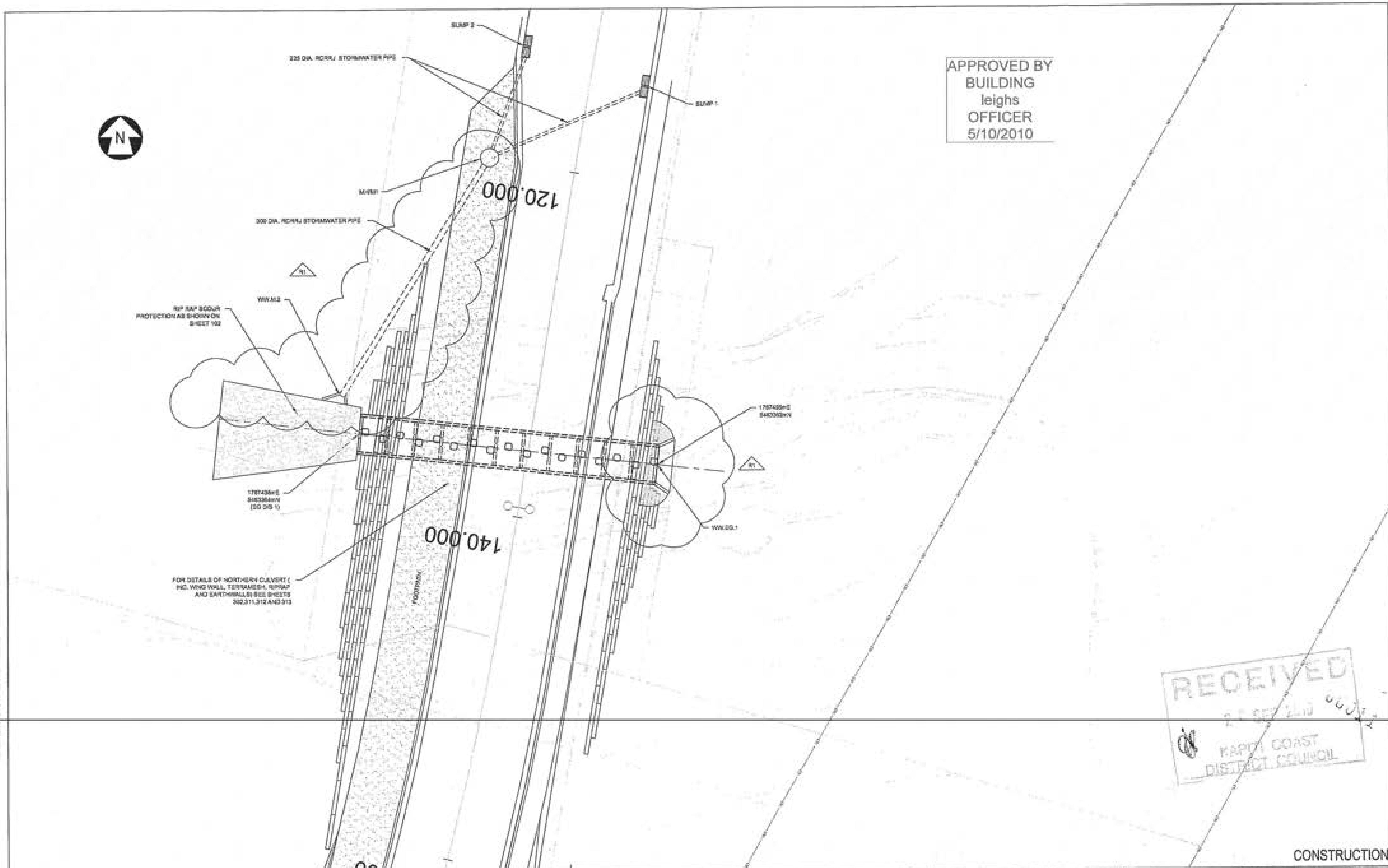
R.G.	R.G.	C.LEE	02/09/2010

CONSTRUCTION

NEW ZEALAND TRANSPORT AGENCY
EMERALD GLEN CONNECTION, KAPITI
ROAD ALIGNMENT

PLAN LAYOUT
Sta 60 to Sta 260

Project No.	Scale	Drawing No.		
5C1744.01	1:250(A1), 1:500(A3)	5/2573/1/7504	111	R2



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CONSTRUCTION

Revision	Amendment	Approved	Revision Date
R0	ISSUED FOR INFO	C.L.	[illegible]
R1	ISSUED FOR CONSTRUCTION	C.L.	[illegible]

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NZ Transport Agency
Emerald Glen Connection Road, Kapiti
Road Alignment

Culverts - Emerald Glan Culvert
Plan Layout

Project No.	Scale	Drawing No.	Sheet No.	Revision
5-C1744.01	1:100(A1), 1:200(A3)	5 / 2573 / 1 / 7504	301	R1

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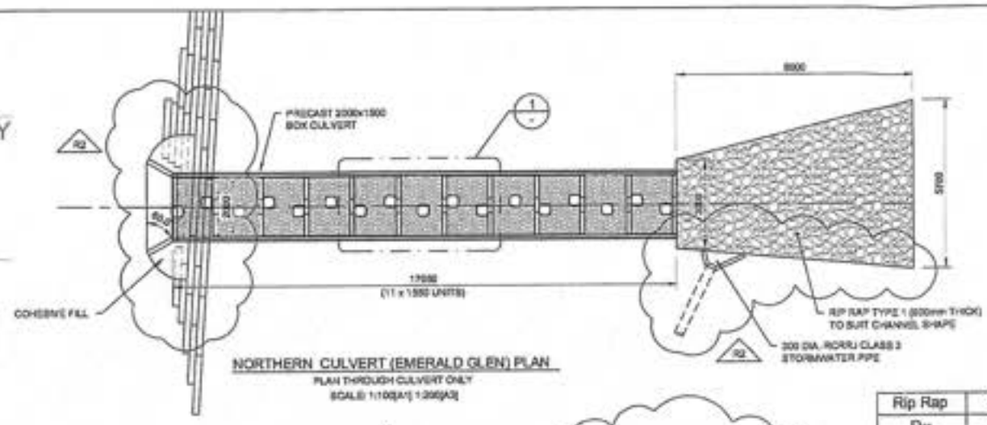
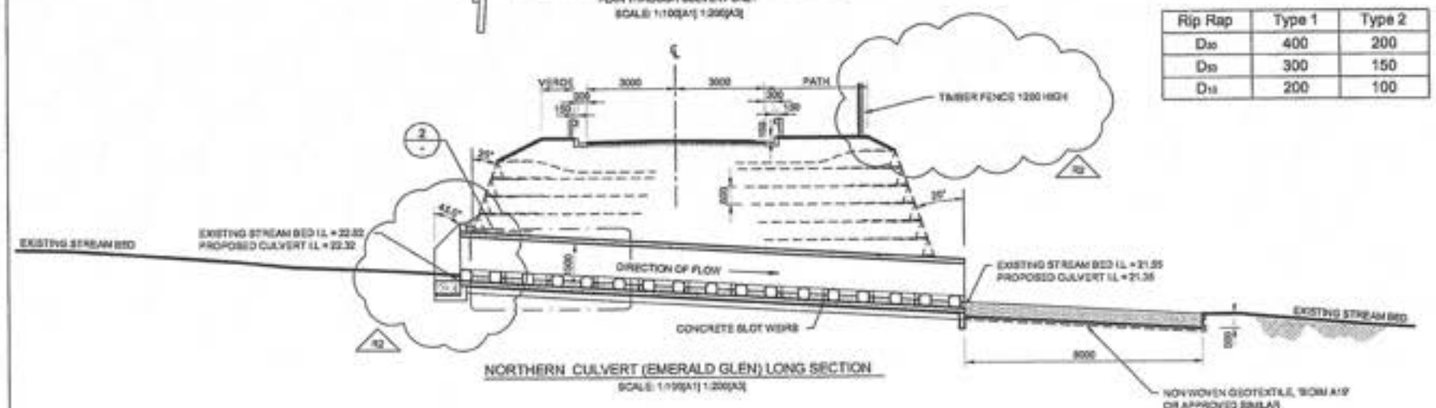
5/10/2010

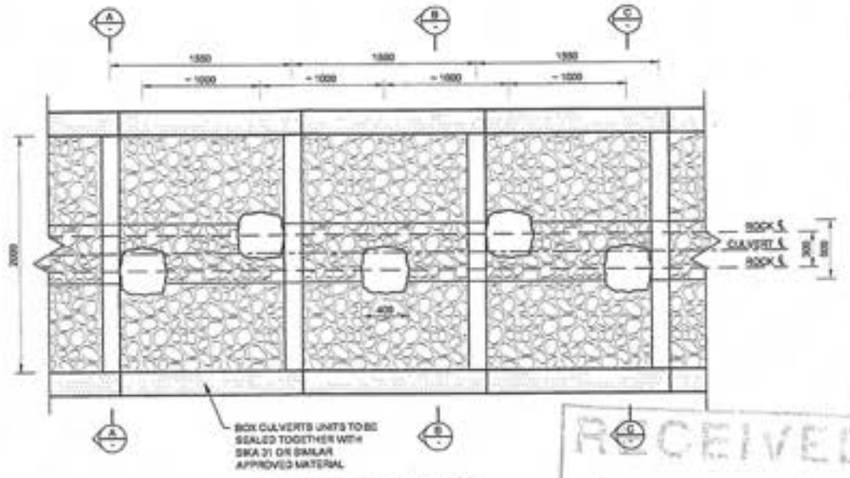


NORTHERN CULVERT (EMERALD GLEN) PLAN
PLAN THROUGH CULVERT ONLY
SCALE: 1:100[A1] 1:200[A3]

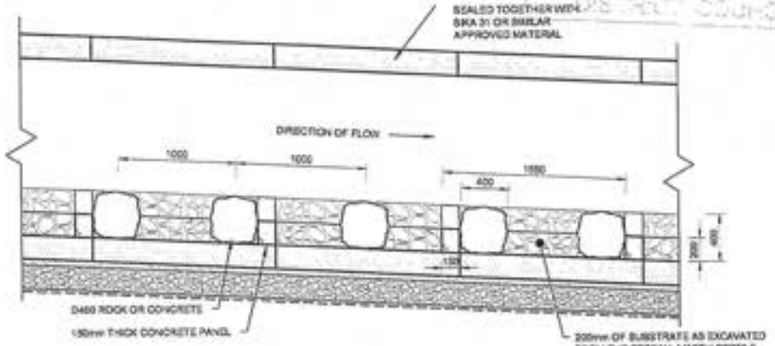


NORTHERN CULVERT (EMERALD GLEN) LONG SECTION
SCALE: 1:100[A1] 1:200[A3]

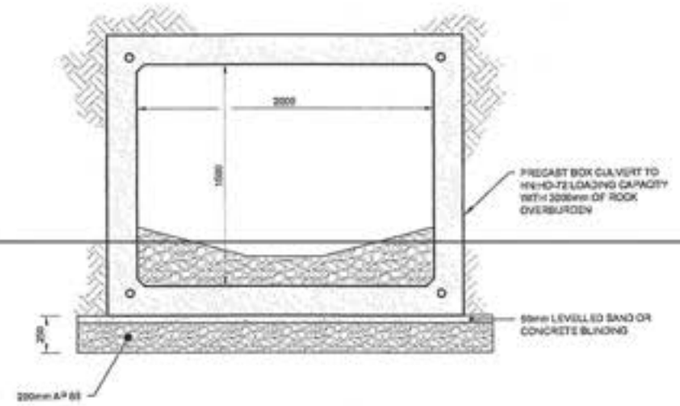
Rip Rap	Type 1	Type 2
D_{50}	400	200
D_{50}	300	150
D_{10}	200	100



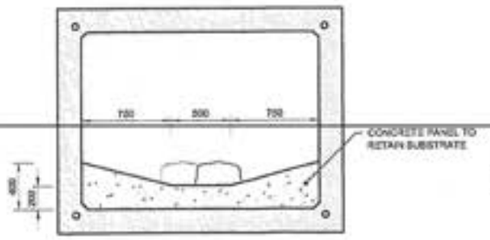
DETAIL 1: PLAN OF FISH PASS
SCALE: 1:25[A1] 1:50[A3]



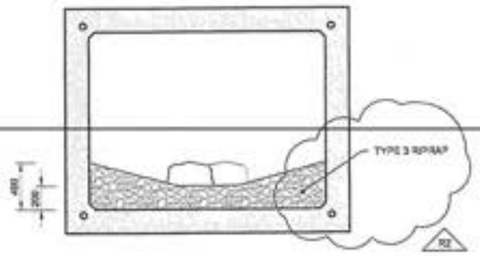
DETAIL 2: FISH PASS DETAILS
SCALE: 1:25[A1] 1:50[A3]



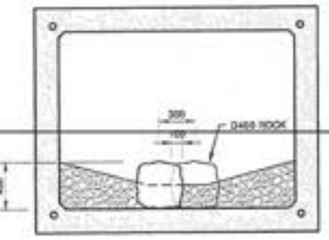
CULVERT BEDDING DETAIL
SCALE: 1:20[A1] 1:40[A3]



SECTION A-A
SCALE: 1:25[A1] 1:50[A3]



SECTION B-B
SCALE: 1:25[A1] 1:50[A3]



SECTION C-C
SCALE: 1:25[A1] 1:50[A3]

CONSTRUCTION

REFERENCE DRAWINGS:
S/2573/1/T504/001 TO 005 CULVERTS-EMERALD GLEN
S/2573/1/T504/011 TO 013 CULVERTS-MINOR
S/2573/1/T504/021 AND 022 OPEN CHANNELS
S/2573/1/T504/031 ROAD DRAINAGE

Rev	Amendment	Approved	Revision Date
R0	ISSUED FOR CONSENT	-	-
R1	ISSUED FOR RFD	C.L	18/5/10
R2	ISSUED FOR CONSTRUCTION	C.L	30/9/10

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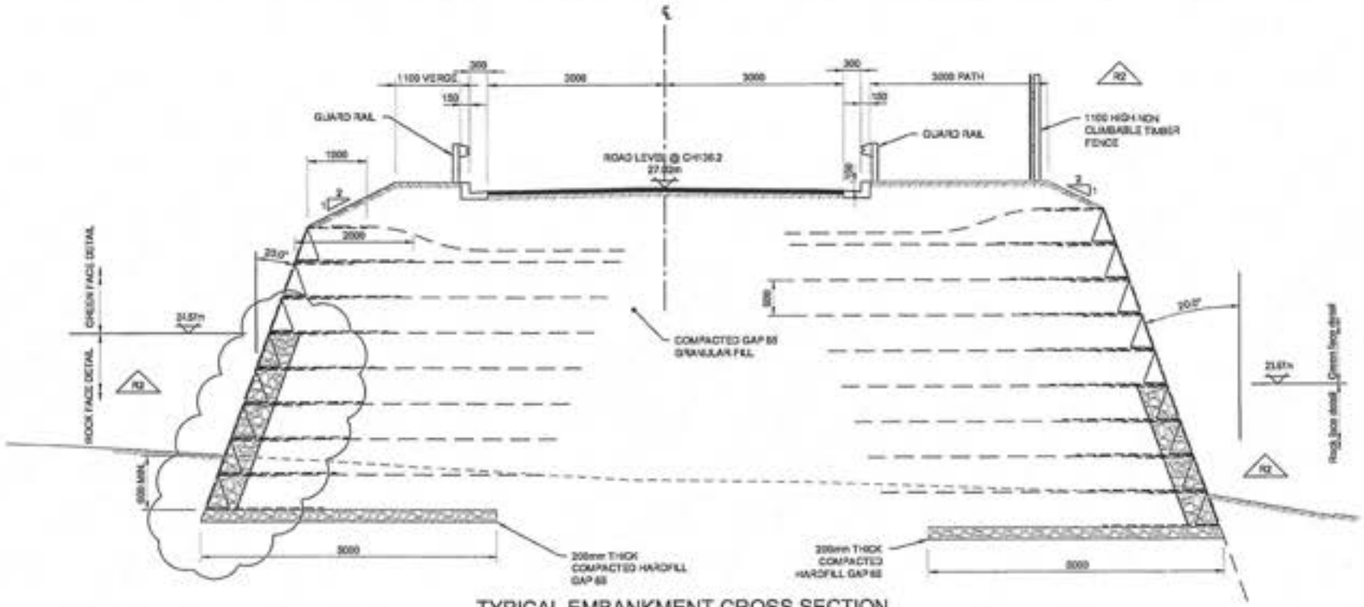
Designed	Drawn	Approved	Revision Date
H.Clarke	R.Davies	C. Lee	SEPT. 2010

Project No: 5-C1744.01
Scale: As Shown

Project: NZ Transport Agency
Emerald Glen Connection Road, Kapiti
Road Alignment

Drawing: Culvert Details - Emerald Glen Culvert
Culvert Section and Fish Pass Details

Drawing No: 5 / 2573 / 1 / 7504
Sheet No: 302
Revision: R2



TYPICAL EMBANKMENT CROSS SECTION
(South of Northern Culvert, chainage 138m)
SCALE: 1:50[A1] 1:100[A3]

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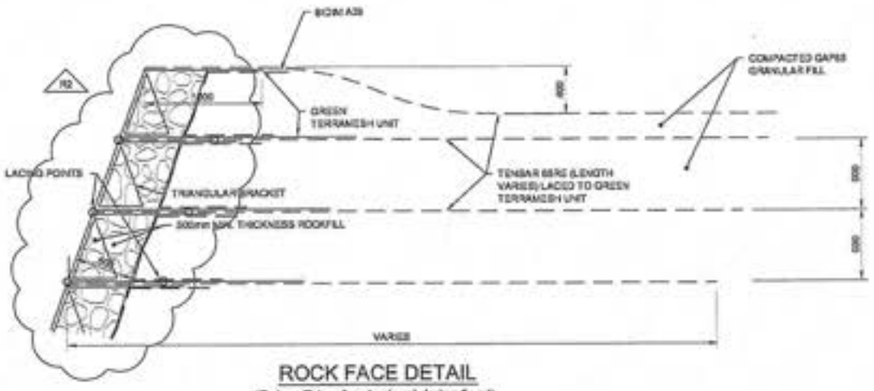
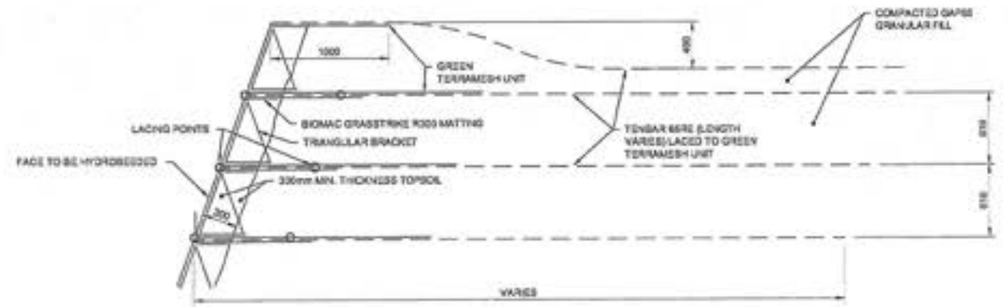
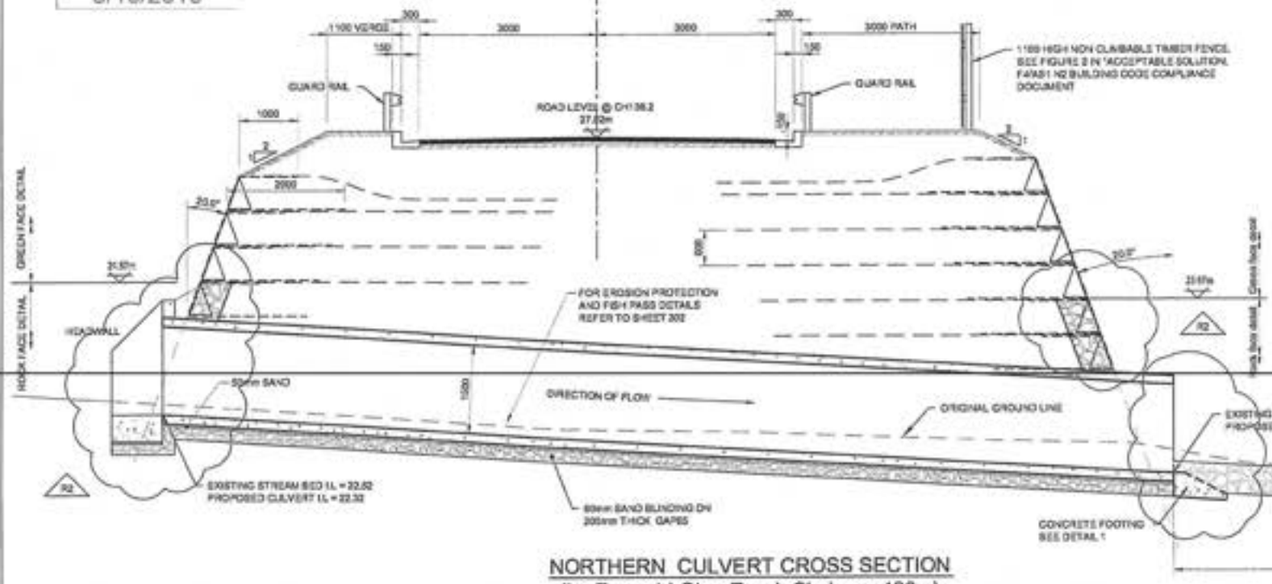


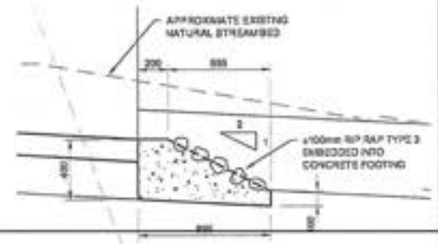
ROCK FACE DETAIL
(Below R.L. of water level during flood)
SCALE: 1:25[A1] 1:50[A3]



GREEN FACE DETAIL
(Above R.L. of water level during flood)
SCALE: 1:25[A1] 1:50[A3]



NORTHERN CULVERT CROSS SECTION
(by Emerald Glen Road, Chainage 136m)
SCALE: 1:50[A1] 1:100[A3]



CONCRETE FOOTING DETAIL 1
SCALE: 1:20[A1] 1:40[A3]

CONSTRUCTION

Notes.
1. Reinforcement shall be Tensar 65RE or 85RE Geogrid
2. The reinforcement shall be connected to the Terramesh unit by lacing at 2 points
3. The reinforcement shall extend from the face of the Terramesh unit into the fill embankment (lengths shown)
4. The reinforcement shall be orientated with the highest strength axis perpendicular to the wall face alignment
5. Reinforcement shall be continuous throughout their embedment lengths and placed side by side to provide 100% coverage. Spliced connections between shorter pieces of Geogrid or gaps between adjacent pieces of reinforcement are not permitted
6. The reinforcement shall be pulled tight prior to backfill placement on the reinforcement.

REFERENCE DRAWINGS:
5/2573/1/7504/301 TO 305 CULVERTS-EMERALD GLEN
5/2573/1/7504/311 TO 313 CULVERTS-MINOR
5/2573/1/7504/321 AND 322 OPEN CHANNELS
5/2573/1/7504/331 ROAD DRAINAGE

Revision	Amendment	Approved	Revision Date
R0	ISSUED FOR INFO		
R1	RE-NUMBERED AND REVISED	G.L	15/09/10
R2	ISSUED FOR CONSTRUCTION	G.L	8/09/10

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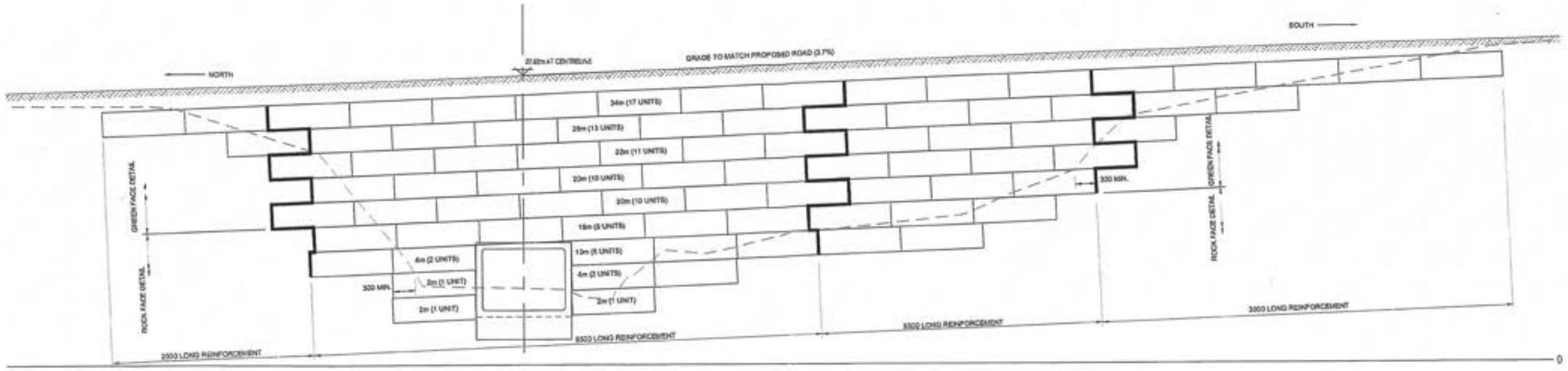
Drawn	Design/Draft	Approved	Revision Date
H Clarke	R.Cullen & J.O.	C Lee	SEPT 2010

Project No.: 5-C1744.01
Scale: As Shown

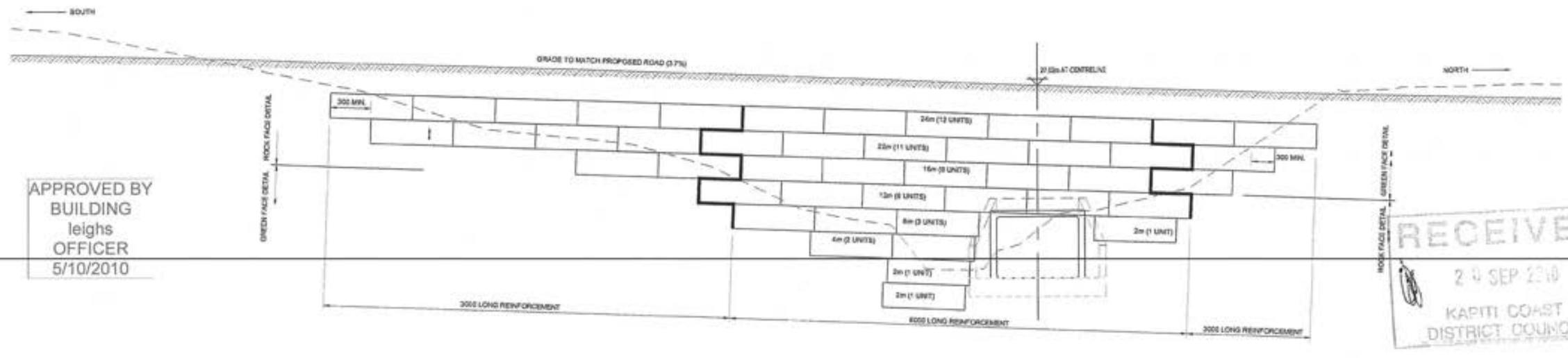
Project: NZ Transport Agency Emerald Glen Connection Road, Kapiti Road Alignment

Drawing: Culverts - Emerald Glen Culvert Section ShowingTerramesh Earth Wall Details

Drawing No.: 5 / 2573 / 1 / 7504
Sheet No.: 303
Revision: R2



8.4m
DOWNSTREAM ELEVATION (LOOKING UPSTREAM)



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24.2m
UPSTREAM ELEVATION (LOOKING DOWNSTREAM)

CONSTRUCTION

Notes.
1. Reinforcement shall be Tensar SR2 or SR1 Geogrid
2. The reinforcement shall be connected to the Terramesh unit by tieing at 2 points
3. The reinforcement shall extend from the face of the Terramesh unit into the fill embankment (lengths shown)
4. The reinforcement shall be orientated with the highest strength axis perpendicular to the wall face alignment.
5. Reinforcement shall be continuous throughout their embedment lengths and placed side by side to provide 100% coverage. Spliced connections between shorter pieces of Geogrid or gaps between adjacent pieces of reinforcement are not permitted
6. The reinforcement shall be pulled tight prior to backfill placement on the reinforcement.

REFERENCE DRAWINGS
5/2573/1/7504/301 TO 308 CULVERTS-EMERALD GLEN
5/2573/1/7504/311 TO 313 CULVERTS-MINOR
5/2573/1/7504/321 AND 322 OPEN CHANNELS
5/2573/1/7504/331 ROAD DRAINAGE

Number	Amendment	Approved	Revision Date
R2	ISSUED FOR INFO		
R1	RE-NUMBERED AND REVISED	C.L.	19/08/10
R2	ISSUED FOR CONSTRUCTION	C.L.	07/09/10

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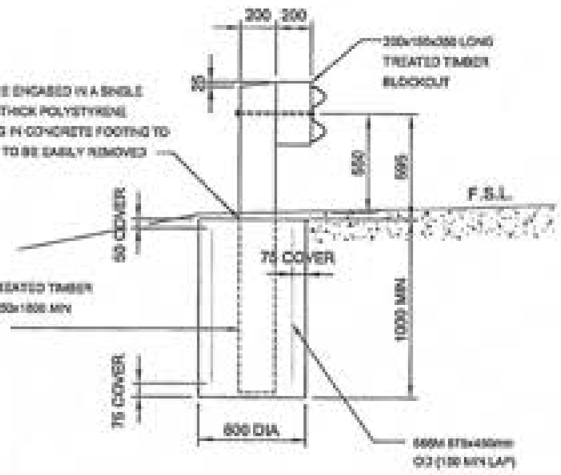
Drawn	Designed	Approved	Revision Date
N Clarke	R.Colas B.E.(H)	C.Lee	SEPT. 2010

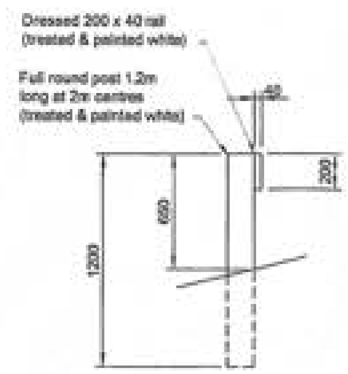
Project No.	Scale	Drawing No.	Sheet No.	Revision
5-C1744.01	1:50(A1), 1:100(A3)	5 / 2573 / 1 / 7504	304	R2

Project
NZ Transport Agency
Emerald Glen Connection Road, Kapiti
Road Alignment

Sheet
Culverts - Emerald Glen Culvert
End Elevations Showing Terramesh Earth Wall Details



TYPICAL GUARDRAIL POST DETAIL
IN CONCRETE FOOTING
1:20



SIGHTRAIL
1:20

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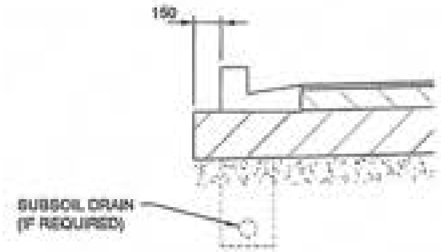
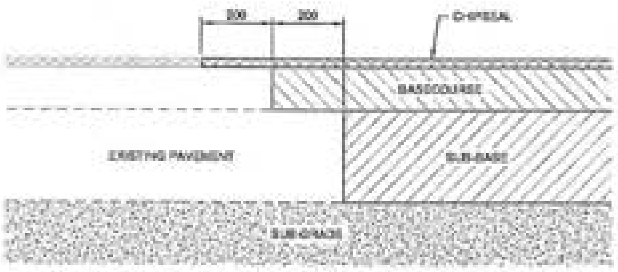
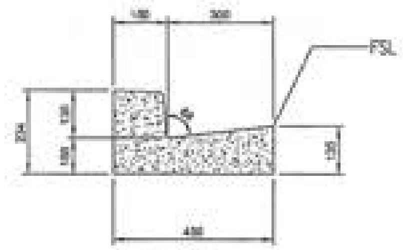
5/10/2010



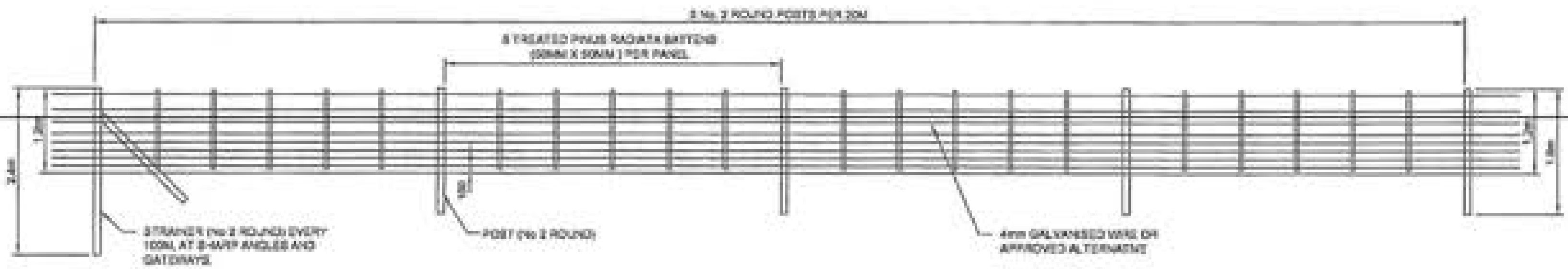
KERB & CHANNEL DETAIL
1:20



TRANSVERSE JOINT BETWEEN
NEW & EXISTING PAVEMENT
1:10



KERB AND CHANNEL - TYPE 1
SCALE 1:10



PERMANENT POST AND 8-WIRE FENCE DETAIL
SCALE 1:50

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R2	ISSUED FOR CONSTRUCTION	C.L	

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NEW ZEALAND TRANSPORT AGENCY
EMERALD GLEN CONNECTION, KAPITI
ROAD ALIGNMENT

MISCELLANEOUS DETAILS

G.J YOUNG | R.G

5C1744.00 | AS SHOWN | 5/2573/1/7504 | 122 | R2

1 Introduction

The level crossing for the railway between Waterfall Road and State Highway 1 (SH1) is to be closed due to safety concerns. In order to prevent serious inconvenience to the residents who live in the Waterfall Road area, the New Zealand Transport Agency (NZTA) is planning to extend Emerald Glen Road to connect with the existing SH1 connection at MacKays Crossing as shown in Figure 1.

The proposed road alignment crosses predominantly gently sloping (less than 10%) land in the lee of the foothills of the Taranua Range. The alignment crosses two perennial watercourses and one which we consider intermittent. There are also two crossing places for ephemeral land drainage as shown in Figure 2.

Hydraulic analysis has been performed to determine the required sizes of these culverts. Due to the close proximity of the rail tracks and SH1 downstream of the Emerald Glen extension, the influence from downstream culverts was investigated as part of the analysis.

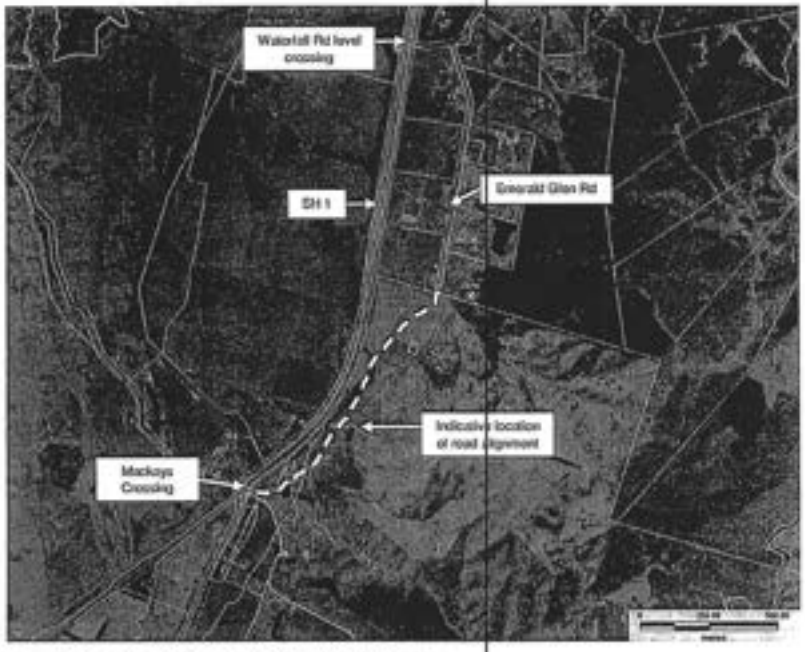

Figure 1 Location of Emerald Glen Road Extension

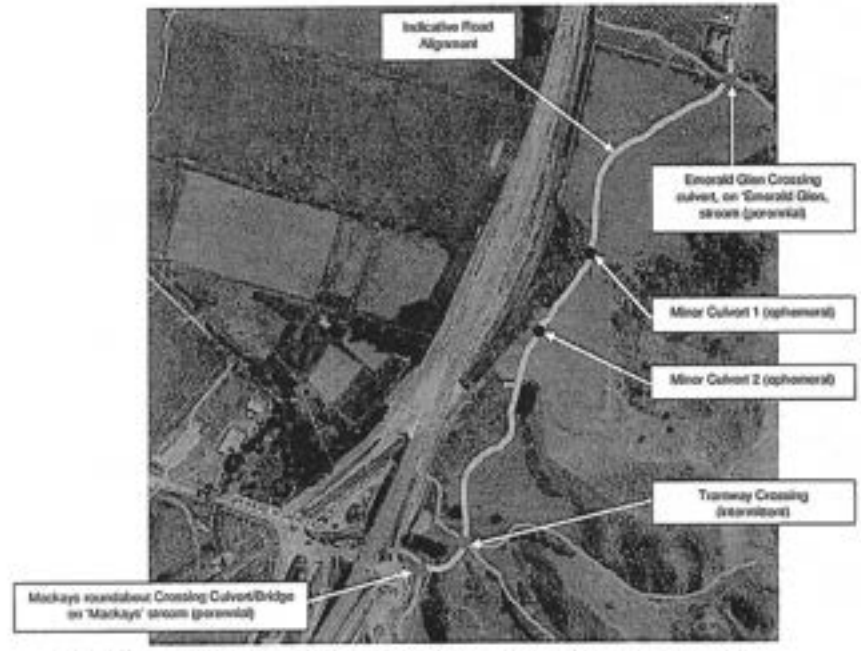

Figure 2 Major & minor waterway crossings along Emerald Glen Road extension

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5/10/2010

Figure 1 - Showing Minor Catchments as Hydrology Report.

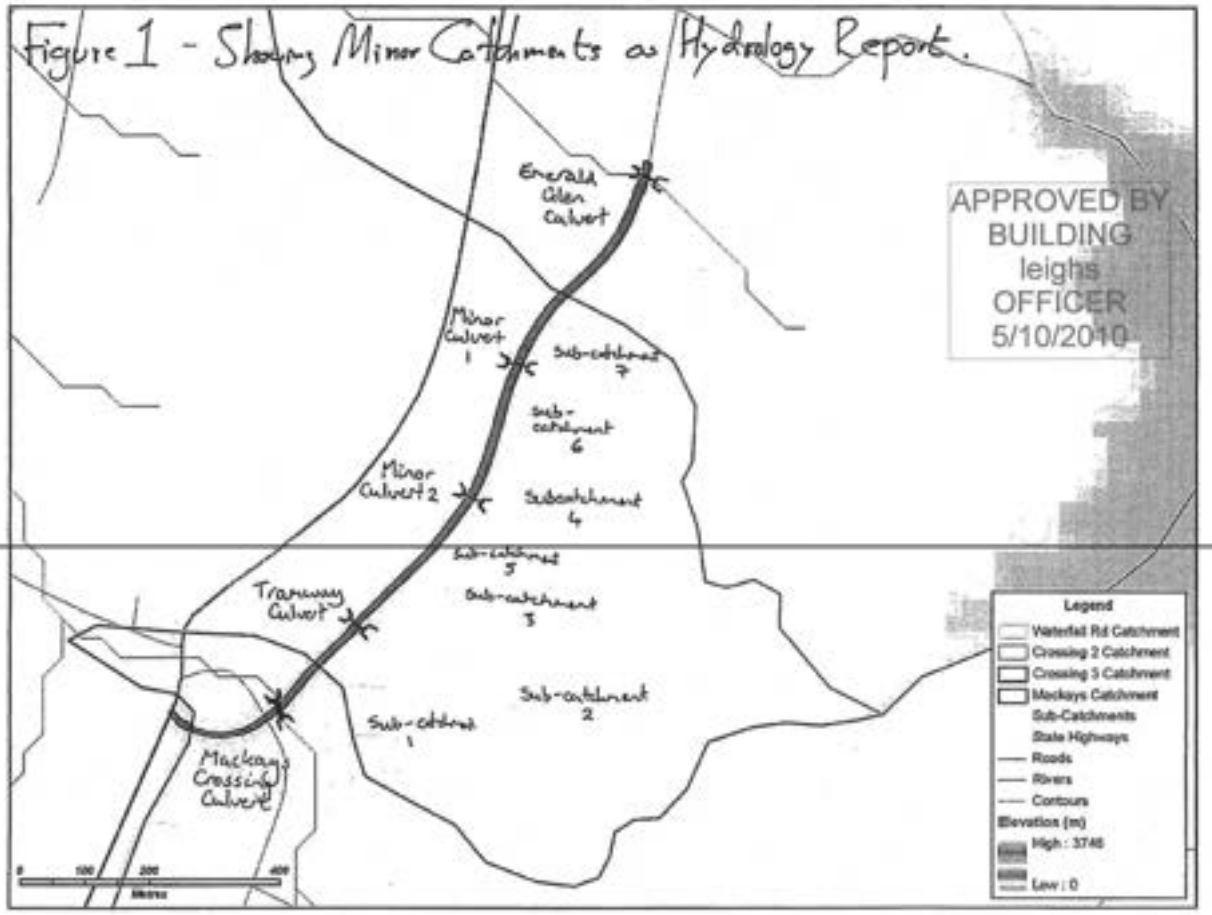
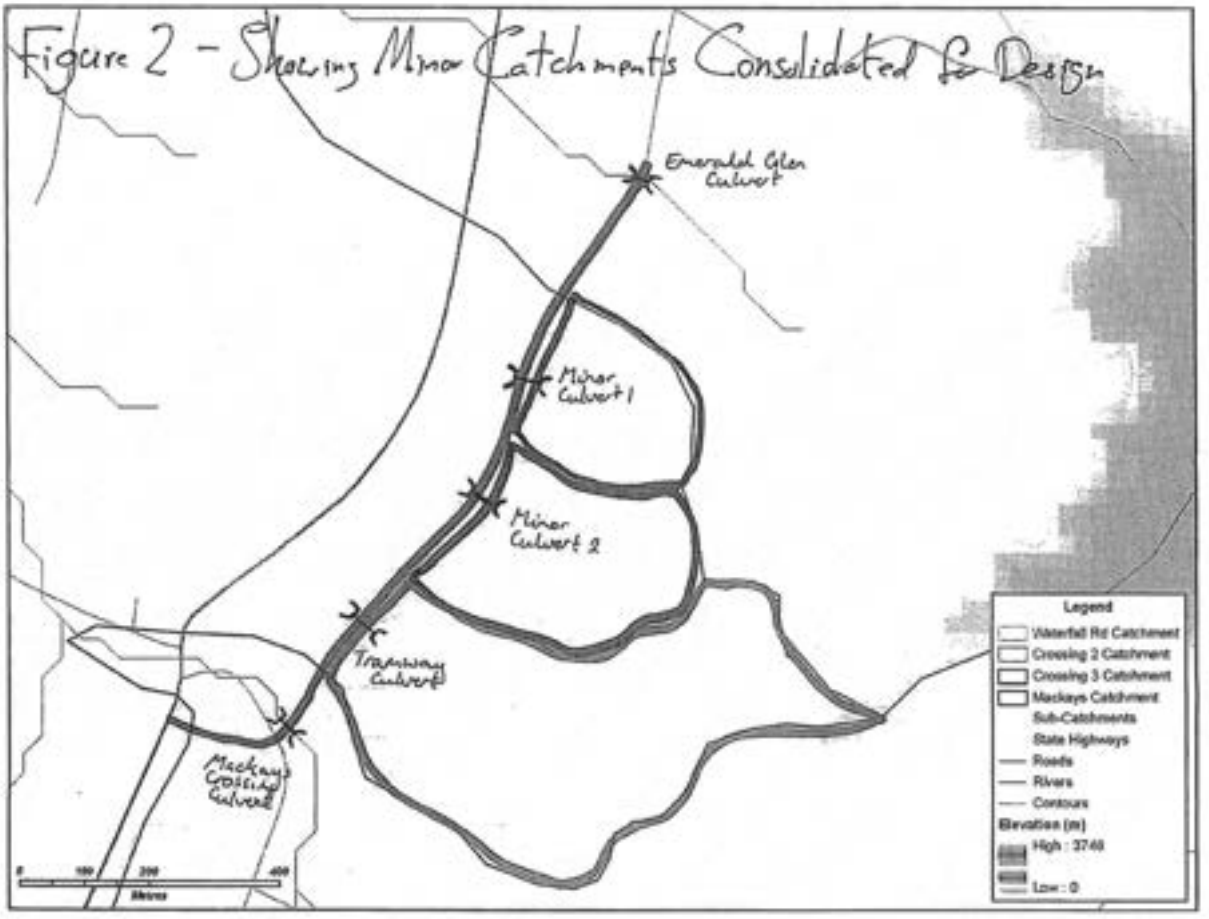
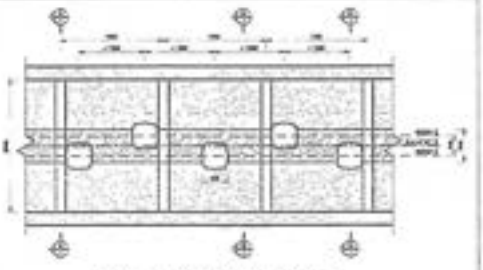


Figure 2 - Showing Minor Catchments Consolidated for Design

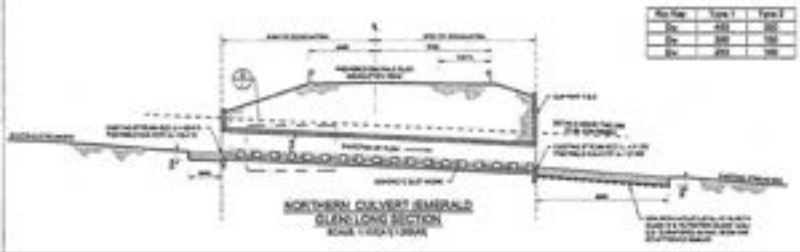


APPROVED BY
BUILDING
leighs
OFFICER
5/10/2010

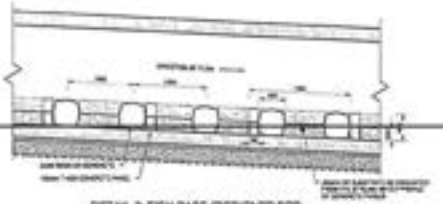
NORTHERN CULVERT
EMERALD GLEN PLAN



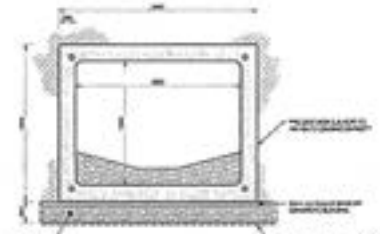
DETAIL 3: PLAN OF FISH PASS DESIGNED
FOR 5% GRADE & FLOWS 8 TO 9 l/s



NORTHERN CULVERT EMERALD
GLEN: LONG SECTION

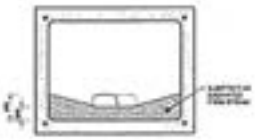


DETAIL 2: FISH PASS DESIGNED FOR
5% GRADE & FLOWS 10 l/s TO 300 l/s

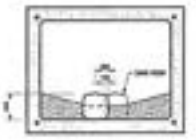


CULVERT BEDDING DETAIL

SECTION A-A



SECTION B-B



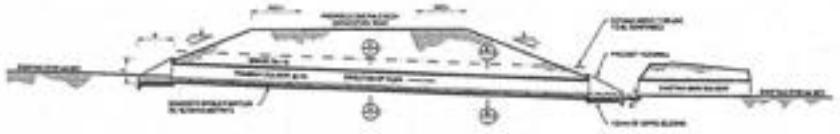
SECTION C-C

CONSENT

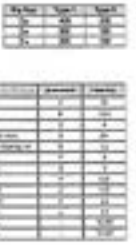
OPUS

Stormwater Details - Northern Culvert (By Emerald Glen Rd)

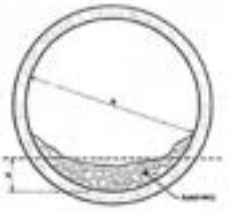
TYPICAL PLAN FOR ROUND CULVERTS
(TEMARAVY CULVERT SHOWN)



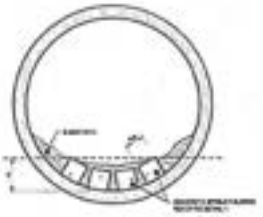
TYPICAL LONG SECTION FOR ROUND CULVERTS
(TEMARAVY CULVERT SHOWN)



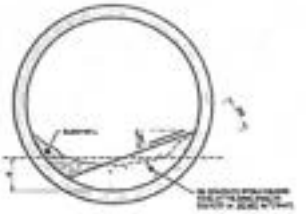
FISH PASS NOTE:



SECTION A-A: FISH PASS DETAIL



SECTION B-B: FISH PASS DETAIL



ALTERNATIVE SECTION B-B:
FISH PASS DETAIL

DETAIL 1: SPOILER BLOCK

CONSENT

OPUS

Stormwater Details - Round Culverts

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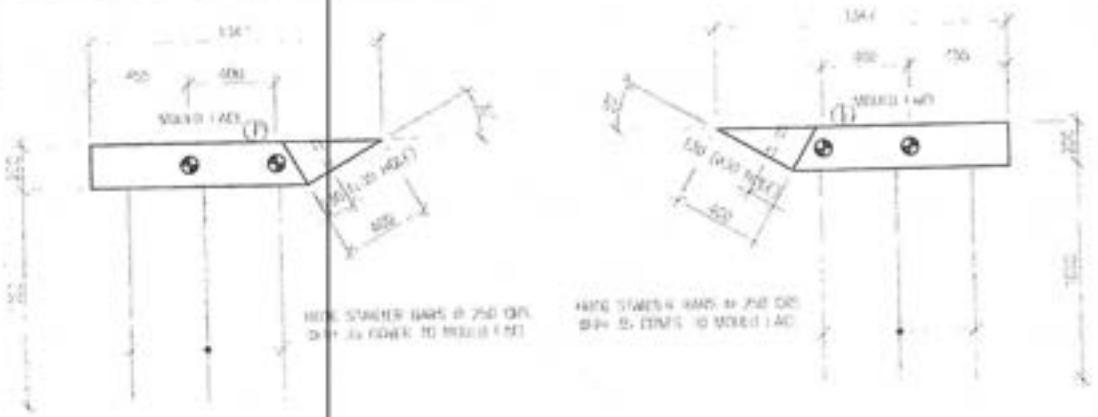
BY
BUILDING
leighs
OFFICER
5/10/2010



NOTES:

1 MANUFACTURE IN ACCORDANCE WITH NZS 3109:1997 (PRECAST UNITS)

2 CONCRETE STRENGTH @ 28 DAYS 50MPa, MIN. STRIPPING STRENGTH 15MPa

3 SURFACE FINISHES TO NZS 3114:1987,
FORMED SURFACE – F4 FINISH
TROWELLED SURFACE – U2 FINISH

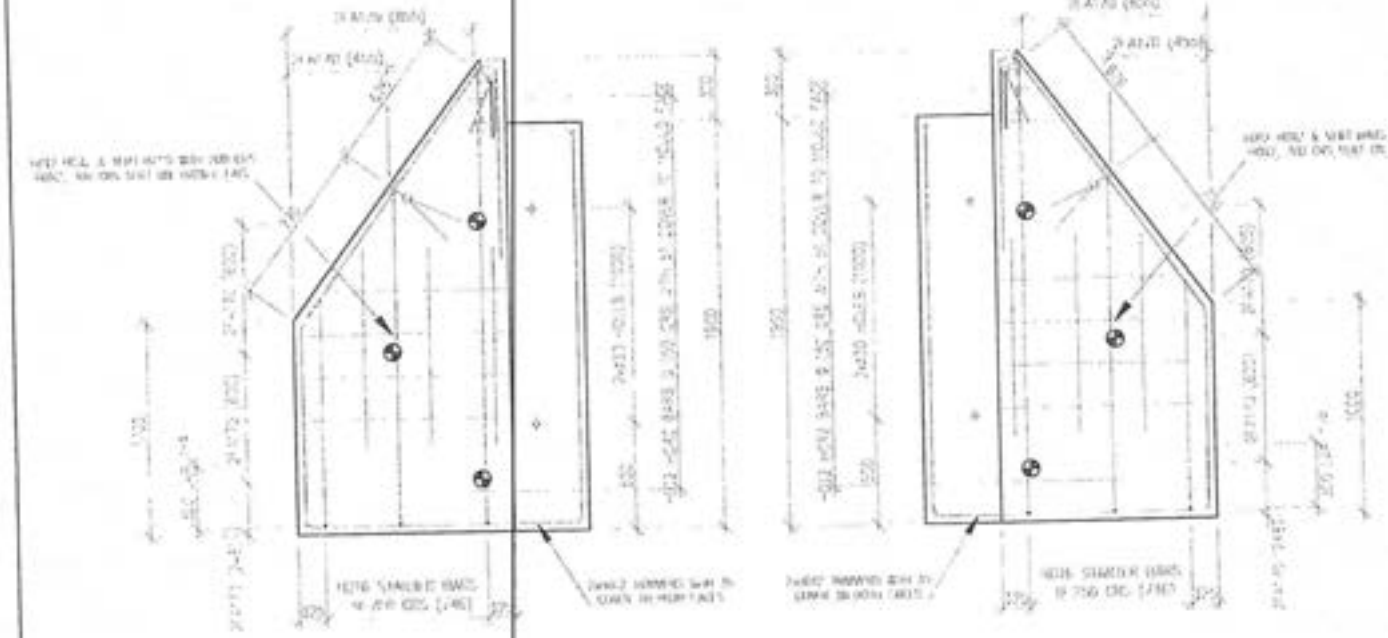
4 CONCRETE COVER TO REO. 35mm UNLESS STATED

5 BAR DIMENSIONS TO OUTSIDE

6 B1\B2 EXPOSURE

7 DESIGN:
a) HN–HO–72
b) LIFE 100 YEARS

RECEIVED
20 SEP 2010
KAPITI COAST
DISTRICT COUNCIL



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NOT FOR CONSTRUCTION

HUMES

Humes Pipeline Systems
Private Bag 92817
Auckland
Freephone 0800 502 112
www.humes.co.nz

VOLUME:- 0.38m³
WEIGHT:- 0.96Tonne
— REQUIRED

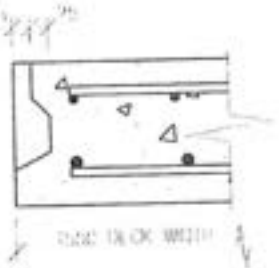
Rev	Description	Date	By	Chkd
A	FOR APPROVAL	9/09/10	GB	

Product SPC
Code 00000
Project Name
EMERALD GLEN BOX CULVERTS
WING WALLS
Dwg Title ELEVATIONS

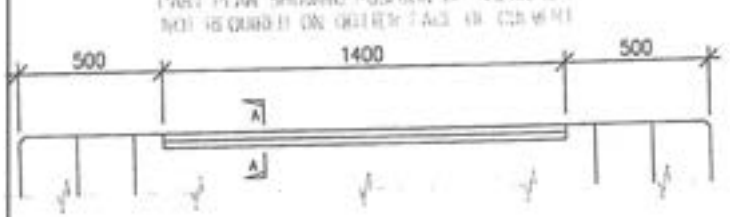
Details On SHEET 4/4
Layout On –

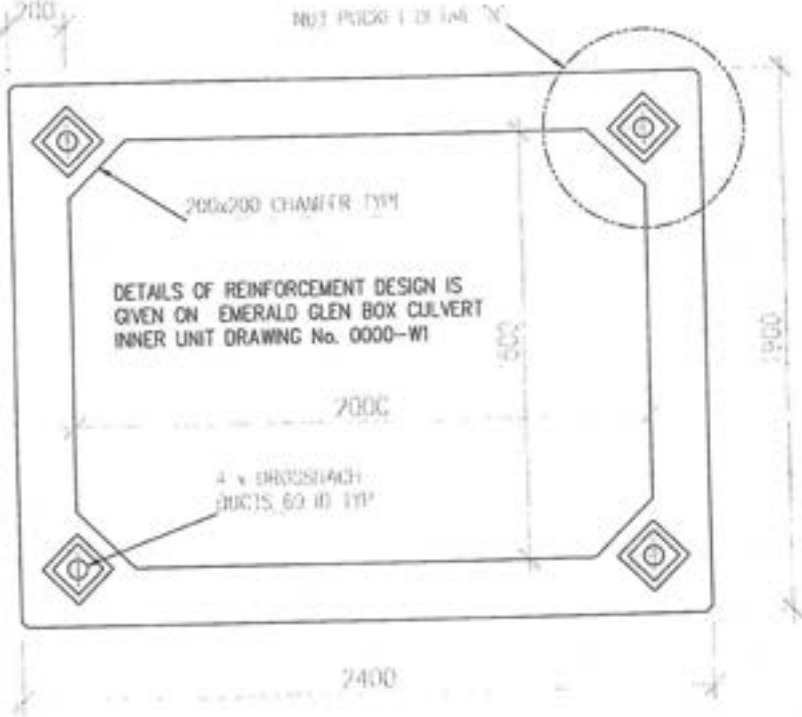
Scales NTS
Drawn GB
Date 9-09-2010
Checked By –

00000–W4 A
Dwg. No. Rev.



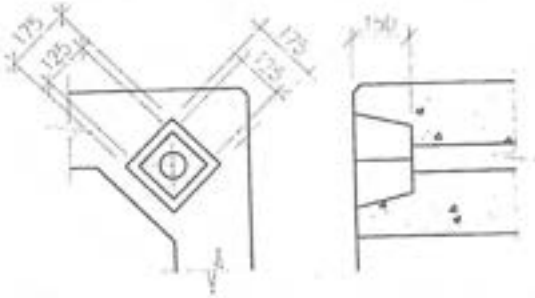
SECTION A A
SHEAR KEY





NOTES:

1. MANUFACTURE IN ACCORDANCE WITH NZS 3109:1997 (PRECAST UNITS)
2. CONCRETE STRENGTH @ 28 DAYS 40MPa, MIN. STRIPPING STRENGTH 15MPa
3. SURFACE FINISHES TO NZS 3114:1987, FORMED SURFACE - F4 FINISH & TROWELLED SURFACE - U2 FINISH
4. BOX UNITS ARE NOT SUITABLE FOR USE IN SEA WATER OR TIDAL SITES
5. CONCRETE COVER TO REINFORCEMENT IS 40mm INSIDE BOX SURFACE, 35mm OUTSIDE BOX SURFACE
6. REINFORCEMENT DENOTED 'DH' IS DEFORMED GRADE 500E STEEL
7. DESIGN:- LOADING HN-HO-72
   DEPTH OF FILL 1000-4000mm
   DESIGN LIFE 100 YEARS
   EXPOSURE B1\B2
8. BOX UNITS ARE TO BE CURED



NOT HOOKED IN FAR 'N'

APPROVED
BY
BUILDING
leighs
OFFICER
5/10/2010

FOR APPROVAL ONLY
NOT FOR CONSTRUCTION

Humes Pipeline Systems
Private Bag 92817
Auckland
Freephone 0800 502 112
www.humes.co.nz

VOLUME> 3.88m³
WEIGHT> 9.71Tonne
— REQUIRED

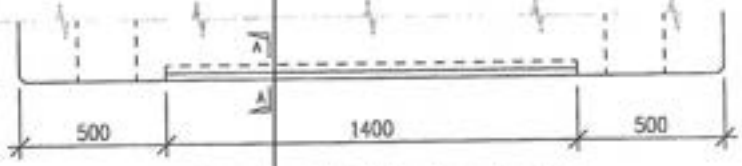
Rev	Description	Date	By	Chkd
A	FOR APPROVAL	6.10.10	DH	JP

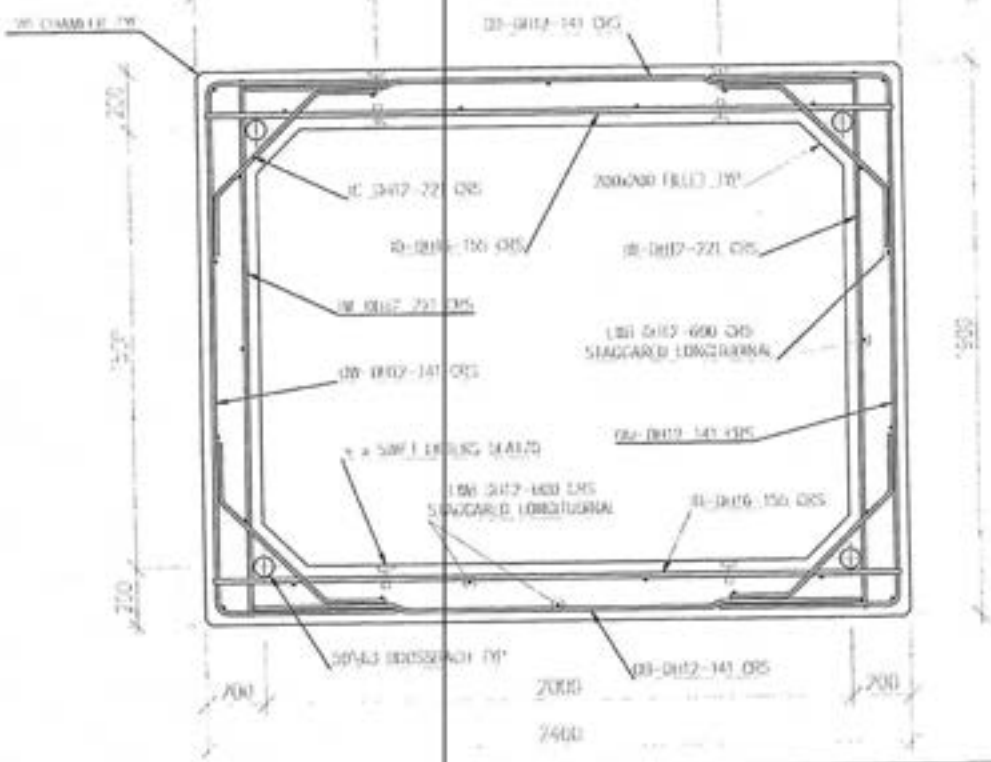
Product CULVERT
Details On SHEET 2/3
Code SPC00000
Layout On
Project Name
EMERALD GLEN BOX CULVERTS
WINGWALL END UNIT
Dwg Title ELEVATIONS

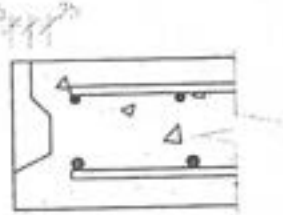
Scales NTS
Drawn GB
Date 5-09-2010
Checked By —

Dwg. No. 00000-W2
Rev. A

APPROVED
BY
BUILDING
leighs
OFFICER
5/10/2010







SECTION A-A
SHEAR KEY

NOTES:

1. MANUFACTURE IN ACCORDANCE WITH NZS 3109:1997 (PRECAST UNITS)
2. CONCRETE STRENGTH @ 28 DAYS 40MPa, MIN. STRIPPING STRENGTH 15MPa
3. SURFACE FINISHES TO NZS 3114:1987. FORMED SURFACE – F4 FINISH & TROWELLED SURFACE – U2 FINISH
4. BOX UNITS ARE NOT SUITABLE FOR USE IN SEA WATER OR TIDAL SITES
5. CONCRETE COVER TO REINFORCEMENT IS 40mm INSIDE BOX SURFACE, 35mm OUTSIDE BOX SURFACE
6. REINFORCEMENT DENOTED 'DH' IS DEFORMED GRADE 500E STEEL
7. DESIGN:- LOADING HN-HO-72
   DEPTH OF FILL 1000-4000mm
   DESIGN LIFE 100 YEARS
   EXPOSURE B1\B2
8. BOX UNITS ARE TO BE CURED

MAIN BARS: GRADE 500E

ID = 10-HD16 @ 155 CRS (INNER DECK) — 2330

IW = 7-HD12 @ 221 CRS. (INNER WALL) — 1930

OW = 11-HD12 @ 141 CRS.(OUTTER WALL) — 650 | 1930 | 650

IB = 10-HD16 @ 155 (INNER BASE) — 2330

OD = 11-HD12 @ 141 CRS (OUTTER DECK) — 2000

OB = 11-HD12 @ 141 (OUTTER BASE) — 2000

IC = 7-HD12 @ 221 CRS. (INNER CORNER) — 200 | 575 | 200

LONGITUDINAL BARS: GRADE 500E

LWB = 28-HD10 (INNER, OUTER WALL DECK & BASE) — 1400

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NOT FOR CONSTRUCTION

Humes Pipeline Systems
Private Bag 92817
Auckland
Freephone 0800 502 112
www.humes.co.nz

VOLUME:- 2.54m³
WEIGHT:- 6.36Tonne
— REQUIRED

Rev	Description	Date	By	Chkd
A	FOR APPROVAL	8-09-09	GB	-

Product	CULVERT
Detail On	SHEET 1\4
Code	00000
Layout On	-
Project Name	EMERALD GLEN BOX CULVERTS 2000x1500x200 INNER UNIT
Drg Title	ELEVATIONS
Scales	NTS
Drawn	GB
Date	8-09-09
Checked By	-
Drg. No.	00000-W1
Rev.	A

IPENZ ENGINEERS NEW ZEALAND | NEW ZEALAND INSTITUTE OF ARCHITECTS INCORPORATED | ACENZ

Building Code Clause(s) B1

PRODUCER STATEMENT – PS4 – CONSTRUCTION REVIEW

(Guidance notes on the use of this form are printed on the reverse side)

Verified / Authenticated in accordance with KCDC Policy 002

1 / 2 APR 2012

ISSUED BY: Beca Carter Hollings and Ferner, Ltd. *(Construction Review Firm)*

TO: NZTA *(Owner/Developer)*

TO BE SUPPLIED TO: Kapiti Coast District Council *(Building Consent Authority)*

IN RESPECT OF: Northern Box Culvert *(Description of Building Work)*

AT: Emerald Glen Connection Road, Kapiti *(Address)*

..... **LOT** ..... **DP** ..... **SO** .....

Beca Carter Hollings and Ferner, Ltd. *(Construction Review Firm)* has been engaged by NZTA

to provide ○ CM1 ○ CM2 ◉ CM3 ○ CM4 ○ CM5 *(Engineering Categories)* or ○ OL1 ○ OL2 ○ OL3 ○ OL4 *(Architectural Categories)*

observation ○ or other ..... *(Extent of Engagement)* services

in respect of clause(s) B1 of the Building Code for the building work described in documents relating to Building Consent No. 100767 and those relating to Building Consent Amendment(s) Nos. N/A issued during the course of the works. We have sighted these Building Consents and the conditions of attached to them.

Authorised instructions / variation(s) No. N/A (copies attached)

or by the attached Schedule ☐ have been issued during the course of the works.

On the basis of ◉ this ○ these review(s) and information supplied by the contractor during the course of the works, **I believe on reasonable grounds** that ○ All ◉ Part only of the building works have been completed in accordance with the relevant requirements of the Building Consents and Building Consent Amendments identified above, with respect to Clause(s) B1 of the Building Regulations. (EXCLUDES LONGITUDINAL DESIGN OF MULTIPLE CULVERTS)

I, Geoff Brown *(Name of Construction Review Professional)* am: ☐ CPEng No. .....

☐ Reg Arch No. .....

I am a Member of : ☐ IPENZ ☐ NZIA and hold the following qualifications: BEng, MICE, MIStructE, CEng (UK)

The Construction Review Firm issuing this statement holds a current policy of Professional Indemnity Insurance no less than $200,000*

The Construction Review Firm is a member of ACENZ : ◉ YES ○ NO

SIGNED BY Geoff Brown ON BEHALF OF Beca Carter Hollings and Ferner, Ltd.

Date : 15-02-2012 Signature : G. Brown

Note: This statement shall only be relied upon by the Building Consent Authority named above. Liability under this statement accrues to the Construction Review Firm only. The total maximum amount of damages payable arising from this statement and all other statements provided to the Building Consent Authority in relation to this building work, whether in contract, tort or otherwise (including negligence), is limited to the sum of $200,000.*

This form to accompany **Forms 6 or 8 of the Building (Form) Regulations** 2004 for the issue of a Code Compliance Certificate.

GUIDANCE ON USE OF PRODUCER STATEMENTS

Producer statements were first introduced with the Building Act 1992. The producer statements were developed by a combined task committee consisting of members of the New Zealand Institute of Architects, Institution of Professional Engineers New Zealand, Association of Consulting Engineers New Zealand in consultation with the Building Officials Institute of New Zealand. The original suite of producer statements has been revised as at the date of this form as a result of enactment of the Building Act (2004) by these organisations to ensure standard use within the industry.

The producer statement system is intended to provide Building Consent Authorities (BCAs) with reasonable grounds for the issue of a Building Consent or a Code Compliance Certificate, without having to duplicate design or construction checking undertaken by others.

PS1 Design	Intended for the use by a suitably qualified independent design professional in circumstances where the BCA accepts a producer statement for establishing reasonable grounds to issue a Building Consent;
PS2 Design Review	Intended for use by a suitably qualified independent design professional where the BCA accepts an independent design professional's review as the basis for establishing reasonable grounds to issue a Building Consent;
PS3 Construction	Forms commonly used as a certificate of completion of building work are Schedule 6 of NZS 3910:2003[1] ; or Schedules E1/E2 of NZIA's SCC 2007 [2]
PS 4 Construction Review	Intended for use by a suitably qualified independent design professional who undertakes construction monitoring of the building works where the BCA requests a producer statement prior to issuing a Code Compliance Certificate. This must be accompanied by a statement of completion of building work (Schedule 6).

The following guidelines are provided by ACENZ, IPENZ and NZIA to interpret the Producer Statement.

Competence of Design Professional

This statement is made by a Design Firm that has undertaken a contract of services for the services named, and is signed by a person authorised by that firm to verify the processes within the firm and competence of its designers.

A competent design professional will have a professional qualification and proven current competence through registration on a national competence-based register, either as a Chartered Professional Engineer (CPEng) or a Registered Architect.

Membership of a professional body, such as the Institution of Professional Engineers New Zealand (IPENZ)or the New Zealand Institute of Architects (NZIA) provides additional assurance of the designer's standing within the profession. If the design firm is a member of the Association of Consulting Engineers New Zealand (ACENZ), this provides additional assurance about the standing of the firm.

Persons or firms meeting these criteria satisfy the term "suitably qualified independent design professional".

*** Professional Indemnity Insurance**

As part of membership requirements, ACENZ requires all member firms to hold Professional Indemnity Insurance to a minimum level.

The PI insurance minimum stated on the front of this form reflects standard, small projects. If the parties deem this inappropriate for large projects the minimum may be up to $500,000.

Professional Services during Construction Phase

There are several levels of service which a Design Firm may provide during the construction phase of a project (CM1-5)[3] (OL1-OL4)[2]. The Building Consent Authority is encouraged to require that the service to be provided by the Design Firm is appropriate for the project concerned.

Requirement to provide Producer Statement PS4

Building Consent Authorities should ensure that the applicant is aware of any requirement for producer statements for the construction phase of building work at the time the building consent is issued as no design professional should be expected to provide a producer statement unless such a requirement forms part of the Design Firm's engagement.

Attached Particulars

Attached particulars referred to in this producer statement refer to supplementary information appended to the producer statement.

Refer Also:

1 *Conditions of Contract for Building & Civil Engineering Construction NZS 3910: 2003*

2 *NZIA Standard Conditions of Contract SCC 2007 (1st edition)*

3 *Guideline on the Briefing & Engagement for Consulting Engineering Services (ACENZ/IPENZ 2004)*

www.acenz.org.nz
www.ipenz.org.nz
www.nzia.co.nz

IPENZ ENGINEERS NEW ZEALAND | NEW ZEALAND INSTITUTE OF ARCHITECTS INCORPORATED | ACENZ

Building Code Clause(s) B1 & B2

PRODUCER STATEMENT – PS1 – DESIGN

(Guidance notes on the use of this form are printed on the reverse side)*

ISSUED BY: Opus International Consultants Limited (Design Firm)

TO: New Zealand Transport Authority (Owner/Developer)

TO BE SUPPLIED TO: Kapiti Coast District Council (Building Consent Authority)

IN RESPECT OF: Terramesh Green Wall (Description of Building Work)

AT: Emerald Glen Connection, Northern Culvert (Address)

N/A LOT N/A DP N/A SO N/A

RECEIVED 2 SEP 2010 KAPITI COAST DISTRICT COUNCIL

We have been engaged by the owner/developer referred to above to provide design of retaining wall at the northern culvert (Extent of Engagement) services in respect of the requirements of

Clause(s) B1 and B2 of the Building Code for

○ All or ◉ Part only (as specified in the attachment to this statement), of the proposed building work.

The design carried out by us has been prepared in accordance with:

☑ Compliance Documents issued by Department of Building & Housing B1/VM4 (verification method / acceptable solution)

or

☐ Alternative solution as per the attached schedule

The proposed building work covered by this producer statement is described on the drawings titled Culverts-Emerald Glen Culvert Section Showing Terramesh Earth Wall Details and numbered 512573/1/17504/303R2 & 304R2; together with the specification, and other documents set out in the schedule attached to this statement.

On behalf of the Design Firm, and subject to:

(i) Site verification of the following design assumptions refer to the Specification

(ii) All proprietary products meeting their performance specification requirements;

I believe on reasonable grounds the building, if constructed in accordance with the drawings, specifications, and other documents provided or listed in the attached schedule, will comply with the relevant provisions of the Building Code.

I, Alexei Murashev (Name of Design Professional) am: ☑ CPEng 178533 #

☐ Reg Arch # -

I am a Member of: ☑ IPENZ ☐ NZIA and hold the following qualifications:

The Design Firm issuing this statement holds a current policy of Professional Indemnity Insurance no less than $200,000*.

The Design Firm is a member of ACENZ ◉ YES ○ NO

SIGNED BY Alexei Murashev ON BEHALF OF Opus International Consultants (Design Firm)

Date 14/09/10 (signature)

Note: This statement shall only be relied upon by the Building Consent Authority named above. Liability under this statement accrues to the Design Firm only. The total maximum amount of damages payable arising from this statement and all other statements provided to the Building Consent Authority in relation to this building work, whether in contract, tort or otherwise (including negligence), is limited to the sum of $200,000.*

This form is to accompany **Form 2 of the Building (Forms) Regulations 2004** for the application of a Building Consent.

APPROVED BY BUILDING leighs OFFICER 5/10/2010

Tony King

From: Leigh Sage
Sent: Thursday, 29 March 2012 5:01 p.m.
To: Tony King
Subject: FW: Geoff Brown CV
Attachments: Geoff Brown CV.pdf

Hi Tony,
Here is some information you can use in determining whether Mr. Brown is acceptable under AP_WI_020 – Acceptance of Expert Opinion, in line with Policy 002 – Producer Statements

Leigh Sage
Building Control Manager
Te Kaiwhakahaere Tautuku Whare

Kāpiti Coast District Council
Tel 04 296 4650
Mobile 027 5555 650
www.kapiticoast.govt.nz

From: Geoff Brown [mailto:Geoff.Brown@beca.com]
Sent: Thursday, 29 March 2012 4:32 p.m.
To: Leigh Sage
Subject: Geoff Brown CV

Leigh

Further to our discussion, I attach my CV which demonstrates my extensive experience in the design and construction of bridges over the last 33 years. I am the Technical Director for bridges in Beca's Wellington office where I look after bridge design and construction management across the lower North island and South Island.

I am a professional engineer and member of the Institutions of Civil Engineers and Structural Engineers in the UK and I am a Chartered Engineer in the UK. I have been working in New Zealand for nearly 15 years and have previously been MIPENZ and Registered Engineer in New Zealand.

I am responsible for bridge design and construction management for many bridges across New Zealand and submit PS1, 2 and 4 statements on a regular basis to all the main local authorities including Auckland Council, Wellington and Christchurch where my qualifications and experience are accepted.

Please contact me if you require any additional information.

Regards

Geoff

Geoff Brown
Technical Director, Bridges
Beca
Phone +64-4-473 7551 Fax +64-4-473 7911
DDI +64-4-496 2527 Mobile +64-021-242 4837
geoff.brown@beca.com

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This e-mail together with any attachments is confidential, may be subject to legal privilege and may contain proprietary information, including information protected by copyright. If you are not the intended recipient, please do not copy, use or disclose this e-mail; please notify us immediately by return e-mail and then delete this e-mail.

Geoff Brown – Bridges & Civil Structures

BEng (Hons Class 2:1) Civil and Structural Engineering, University of Bradford, 1978

Certificate in Management, Sheffield Business School, 1998

MICE, MIStruct E, Chartered Engineer.

Geoff is a structural specialist with over 30 years experience in the design and construction of bridges and civil structures. He also has led the design of major highway projects during the scheme investigation and detailed design stages. He is currently a Technical Director with Beca Group in New Zealand where he leads the bridge and civil structures engineering discipline in the Wellington office. Geoff was previously Chief Engineer, Bridges & Structures with RailCorp in Sydney, Principal Engineer and Partner with Opus International Consultants in Wellington and commenced his career with Husband and Company and subsequently Mott MacDonald in the UK where he was the Principal Engineer for bridges in the Sheffield office until 1997. Geoff also spent 12 months working in Taiwan with Mott MacDonald.

Geoff has specialist skills across the full spectrum of bridge design, concrete box girder bridges constructed in balanced cantilever and by incremental launching and asset management of bridges. He also has specialist skills related to rail structures through the design of numerous rail bridges and from his role with RailCorp. Geoff has strong design management skills for bridge and highway projects as demonstrated through his team leadership of a major road design projects.

Membership	▪ Member, Institution of Civil Engineers, 1982 ▪ Member, Institution of Structural Engineers, 1984 ▪ Chartered Engineer (UK)
Special competence	▪ Project leadership for transportation projects, bridges and civil structures design and asset management of structures
Awards	▪ ACENZ Merit Award in 2002 for Shelley Beach Overbridge Lengthening ▪ ACENZ Gold Award in 2002 for Candys Bend to Starvation Point Reconstruction ▪ International Roads Federation Environmental (IRF) Award in 2003 for Candys Bend to Starvation Point Reconstruction ▪ Austroads Bridge Award in 2004 for the structures at Candys Bend to Starvation Point Reconstruction

Background	2008 – Present	Technical Director, Bridge Engineering, Beca Group, Wellington, NZ
	2005 – 2008	Chief Engineer, Bridges & Structures, RailCorp, Sydney, Australia
	1997 – 2005	Principal, Bridges & Civil Engineering and Partner, Opus International Consultants, Wellington, NZ
	1991 – 1997	Principal Engineer, Mott MacDonald Group, Sheffield, UK & Taiwan
	1978 – 1991	Graduate, Assistant, and Senior Engineer, Husband & Co, Sheffield, UK

Selected experience

SH73 Christchurch Southern Motorway, Christchurch, New Zealand Transport Agency, 2009-Present
Overall structural design leadership and verification for design and construct tender phase and now detailed design stage for 16 structures comprising 3 span overbridges and underpasses, interchange bridges, subways and culverts for $100M motorway duplication and extension working for major contractor.

SH20 Waterview Connection, Auckland, New Zealand Transport Agency, 2008-Present Structural design package leader responsible for developing structural forms and providing structural inputs to the resource consent applications for structures on this $1.2B section of new motorway. Structures comprise a grade separated interchange comprising 4 major elevated ramps up to 500m long, a 450m cut and cover tunnel, a 3-span overbridge, a stream crossing and 4 pedestrian bridges.

Review of ONTRACK Bridge Inspection Standards, Wellington, ONTRACK, 2008
Review ONTRACK's bridge inspection standards on basis of types of structures, condition and materials based on literature search of similar organisations, site inspections and risk assessment and prepared report with recommended changes to standards.

SH2 Matahorua Gorge Realignment, Napier, New Zealand Transport Agency – 2008-09
Structural team leader for the specimen design of a major bridge over Matahorua Gorge and a Rail Overbridge over the Napier-Gisborne Railway. Estimated total cost of structures is $11M. Gorge crossing is a 3-span bridge, 150m long with 50m high piers. Post award review of the designs was also undertaken.

Port Botany Expansion, Sydney, Sydney Ports Corporation, 2008-09
Structural verifier for the design of the marine structures for the expansion of the container port in Sydney involving 1.5km of 20m high RC counterfort walls, blockwork caissons, coping beams and crane beams. The design was procured under a design and construct contract and Geoff worked for the project verifier team as the structural reviewer. Total project cost is $500M.

Johnsonville Tunnel Modifications, Wellington, ONTRACK, 2008
Design of modifications to the 7 existing brick tunnel linings for invert lowering and tunnel widening to suit larger trains. The tunnel brick lining was anchored with ground anchors and a design prepared to widen the tunnels by installing precast wall units to replace the brickwork over their lower height. Total project cost $2.5M.

Grade Leadership of Corporate Governance Program, Sydney RailCorp, 2005 – 2008
Discipline head responsible for the lead program of corporate governance activities related to bridges and structures including asset integrity audits, development of new standards and preparation of the Annual Asset Integrity Report for Bridges and Structures, including presentation to the RailCorp Board of Directors. Also includes technical leadership activities across RailCorp and with external suppliers.

Review of Design for New Rail Infrastructure being designed for TIDC, Sydney, RailCorp, 2005-2008
Discipline head responsible for the review and acceptance of designs on behalf of RailCorp produced by TIDC and their contractors for new rail infrastructure including bridges, retaining walls, station structures, overhead wiring structures, station buildings and drainage as part of $3B Rail Clearways project. This includes allocation of engineering authority for all design to appropriately qualified personnel. Reviews included extensive retaining walls associated with track duplications and turn-back roads.

MacKays Crossing D&C, Wellington Fulton Hogan Construction, 2004 – 2005
Design Manager responsible for the leading tender and detailed design for roading and bridging aspects of this design and construct (D&C) grade separated interchange project, comprising a rail overbridge, underpass and approach embankments with $18m tender cost. Working for Fulton Hogan Ltd on Opus' first successful D&C roading related project in NZ.

SH2 Rimutaka Hill (Muldooon's Corner) Upgrade, Wellington, Transit New Zealand, 2003-2005
Team leader responsible for the investigation of options for scheme assessment stage of this project to improve the alignment of SH2 on its approach to the summit. A range of geometric options were considered with different design speeds to find the most appropriate overall solution. Large scale cuttings and geogrid reinforced embankments were required and ecological considerations were an important aspect of this project.

Newmarket Viaduct Upgrade, Auckland Transit New Zealand, 2002 – 2003

Structural Group Leader responsible for the assessment of existing bridge and development of scheme options to retrofit for dead and live loads and widen the 16 span 650m long Newmarket Viaduct originally constructed in balanced cantilever with typical 42m spans. $60M scheme cost.

Upper Harbour Bridge, Auckland Transit New Zealand, 2001 – 2003
Bridge Team Leader and Principal's Advisor for design/build responsible for the conceptual and specimen design of $30M duplicate crossing of Upper Harbour using 450m long box girder bridge to be constructed in balanced cantilever with 73m typical spans.
Shelly Beach Bus Priority, Auckland Transit New Zealand, 1999 – 2001

Christchurch Southern Motorway, Christchurch, Transit New Zealand, 2001 – 2002
Team Leader responsible for the development of the scheme for $100m motorway extension and duplication of 10.5km length including five grade separated interchanges and construction over landfills. Managing project team across Opus' Wellington, Christchurch and Auckland offices.

Waiohine Bridge Upgrade, Wellington, Transit New Zealand, 1999 – 2002
Team Leader responsible for the investigation of options and detailed design for bridge upgrade to improve width and security against scour and seismic failure. Options include full replacement and widening of existing bridge.

Shelly Beach Bus Priority, Auckland Transit New Zealand, 1999 – 2001
Structural Team Leader responsible for the development of innovative design solutions to increase the span of the existing bridge over SH1 Motorway on approach to Harbour Bridge, options report and detailed design of selected option. Winner of Bronze ACENZ Award in 2002.

Candys Bend to Starvation Point Reconstruction, Arthurs Pass, Transit New Zealand, 1998 – 2001
Structural Team Leader responsible for the design and scheme assessment for structures on the Candys Bend to Starvation Point Realignment on SH73 in Otira Gorge for Transit New Zealand. Structures include cantilever half bridging, rock shelters and a three span stream bridge. Winner of Gold ACENZ Award in 2002, IRF Environmental Award in 2003 and Austroads Bridge Award in 2004.

Grade Separated Interchange, Malaysia United Engineers Construction, 1997 - 1998
Project manager for concept and detailed design of grade separated interchange on existing North-South Freeway. Co-ordinated inputs from roading, geotechnical and bridging engineers and production of tender documentation.

Bridge Asset Management Contract, Wellington, Transit New Zealand, 1997–2000 & 2004 -2005
Team leader and Bridge Inspection Engineer responsible for the Region 9 bridge inspection contract comprising the inspection and asset management of 160 bridges in the Wellington region. Geoff carried out general and detailed bridge inspections, developed list of repairs for structural and routine maintenance and organised repair contracts each year for the works. Geoff also provided a range advise to Transit on asset management and specific problems that aose.

High Speed Railway, Taiwan Taiwan High Speed Rail Authority, 1995
Structural Team Leader responsible for the preliminary design of 30 km of high-speed railway viaduct to be constructed using span by span techniques, based in Taipei. Led team of local engineers through analysis, design of box girder prestress and construction methodology for 25m long box girder units to be precast and erected in full span lengths.

Freeway Bridge Widening, Taiwan Taiwan Highway Bureau, 1993 – 1994
Structural Team Leader responsible for the preliminary and detailed design of widening to existing freeway structures to provide an additional traffic lane. Based in Taipei. Structures comprised a 28 span river crossing, a 9 span viaduct and two 3 span river bridges.

Balanced Cantilever Freeway Bridge, Taiwan Taiwan Highway Bureau, 1993 – 1994
Structural Team Leader responsible for the detailed design of twin 150m long box girder bridges to be constructed in balanced cantilever with 70m main spans using specialist time dependent analysis software. Based in Taipei.

A638 Improvements, Doncaster, UK Department of Transport, 1991 - 1993
Bridge Group Leader responsible for the design supervision of the design team for preliminary and detailed design of six highway structures including subways, footbridge, flood relief structures and retaining walls in an urban environment with high traffic flows.

Grade Separated Underpasses, Qatar, Middle East, Government of Qatar, 1982-1985
Design Team Leader responsible for the design of three grade separated underpasses to improve capacity of congested intersections in Doha City. Underpasses comprised major concrete retaining walls and roundabout bridges to be constructed in heavily trafficked and serviced corridor.

A55 Improvements, North Wales, UK Welsh Office, 1991-1993
Bridge Group Leader responsible for the design supervision of the design team for preliminary and detailed design of five highway structures including two steel-concrete composite overbridges to be constructed over existing trunk road, and prestressed concrete stream bridges.

16 Span Glued Segmental Viaduct, Doncaster, UK Doncaster MBC, 1987–1992
Structural Team Leader responsible for the conceptual and detailed design of a 650m long 16 span concrete box girder viaduct with typical 42m spans to be constructed using balanced cantilever precast glued segmental construction.

Tyne Crossing, Newcastle, UK Department of Transport, 1985 – 1986
Team Leader responsible for the detailed independent design check of twin 300m long 5 span concrete box girder river bridges constructed using balanced cantilever over the River Tyne with 107m main span and 17 span steel composite approach viaduct.

Stanley Ferry Aqueduct, Wakefield, British Waterways Board, 1979 -1980
Bridge Designer responsible for the design of an innovative push-launch aqueduct structure to carry a canal over the River Calder. Design of prestress and launching analysis for the large U-shaped trough structure including temporary cable stays to support the cantilever during launching.

Thorne Colliery Overbridge, Doncaster, National Coal Board, 1978 -1981
Bridge Designer and Resident Engineer responsible for the design of a single span prestressed concrete access road bridge to new colliery constructed over railway. Site supervision of road and bridge construction.

Training Courses Attended

1992 Certificate in Management, Sheffield Business School (1 year part time)
1997 Project Management, APESMA (2 days)
1998 Managing Strategic Relationships, Target Marketing Systems (2 days)
1998 Effective Proposal Management, Opus (1 day)
2000 Business Relationship Skills, Opus (2 days)
2000 Business Management, Melbourne Business School (4 days)
2001 Contract Law, Ingenium (1 day)
2002 Expert Witness, Simpson Grierson (1/2 day)
2002 Transfund CPP Procedures, NZIHT (1 day)
2003 Presentation Skills (1 day)
2004 Risk Management (1 day)

2005 Leadership, Change & Thinking (1day)
2006 Just Culture (3 days)
2008 Project Director (Beca)

Papers and Presentations

New Standard Bridge Beams for New Zealand, Austroads Bridge Conference, Auckland, 2009.

A Bridge Management System for Sydney's Railways, Austroads Bridge Conference, Perth 2006.

Newmarket Viaduct Upgrade, Auckland, Austroads Bridge Conference, Perth 2006.

Shelley Beach Overbridge Lengthening, Austroads Bridge Conference, Hobart, 2004.

New Standard Precast Concrete Bridge Beams: Stage 1 – Identification of New Standard Beam Shapes, Transfund New Zealand Research Report No 252, Gray, Gaby, Brown, Kirkcaldie, Cato and Sweetman, 2003.

Highway Structures in the Gulf, Institution of Civil Engineers/Institution of Structural Engineers, Sheffield, 1986.

KCDC Building Consent Authority
Building Consent Documentation Filed

00324

BC No.	
Street Address.	**Retaining Walls over culvert** **Road Reserve near** **86 Emerald Glen Road**

Tick indicates document(s) included in this Building Consent

Building Consent Application,	✓
Application checksheet,	✓
Costing schedule,	✓
Plans and specifications,	✓
Invoice and receipt,	✓
Processing records/checksheets,	✓
Inspection page printouts 1-9 | 18 | 37 | 40 | 55-58 | 72	
Building consent and memorandum,	✓
Inspection reports,	✓
Application for CCC,	✓
Code of Compliance Certificate.	✓
Producer statements and supporting documentation,	✓
Peer review documents,	
Fire design documents,	
Requests for further information and other correspondence,	
Amendments,	
Supplementary information,	
Energy work certificates,	
Notices to Fix.	

This form comprises part of the Building Consent documentation and indicates the contents of the Building Consent File. Refer KCDC Policy 029.

KCDC CODE COMPLIANCE REVIEW CHECK SHEET 00023

Criteria s or major projects. *Refer BI-WI-024*

Address: **Retaining Walls over culvert Road Reserve near 86 Emerald Glen Road**	Date: 27/3/2012
	BC No: 100764.

application for code compliance certificate (Form 278) completed	Y	N

Confirm all required inspections have been completed and passed: Answer: **Yes** or **No**

If inspections have been missed, what supporting info and method of verification has been provided to compensate for missed inspection. (Describe): ----------

Work in accordance with approved consent and approved amendments		Yes	No
If no, has NTF been issued:	N/A	Yes	No
Have items of non compliance been resolved and NTF uplifted.	N/A	Yes	No

Note: If work is not in accordance with consent, (and approved amendments) or NTF matters have not been resolved, suspend application for Code Compliance Certificate

Supporting documentation required in building consent addenda *(Accept in accordance with KCDC Policy 002)* ***Form completed during BC Approval process***

Tick (√) indicates yes, N/A indicates considered - but not applicable	Req'd	Supplied	Accept
copy of electrical certificate	N/A		
copy of gas certificate			
an "as-built" drainage plan			
plumbing (Form 125) for pressure test and installation piped services			
drainage (Form 126) for stormwater installation			
drainage (Form 127) for private sewer installation	N/A		
a Construction Review (PS4) statement for Structural engineering	✓	✓	✓
a Construction Review (PS4) statement for Fire engineering	N/A		
a Construction Review (PS4) statement for Geo-technical engineering			
Roof cladding warranty			
Solar water heating technical specifications			
wall cladding/texture coating installation applicator warranty			
a copy of the lift certificate			
a certificate from the fire alarm installer			
a certificate from the sprinkler installer			
a copy of wet-area membrane installers warranty			
A copy of deck membrane manufacturer's installers warranty/guarantee			
FPIS (verifier) Fire Systems Certification	N/A		

If specified supporting documentation has not been provided, what alternative information or verification method has been provided to compensate. (describe):

Compliance Schedule

Is a new or amended compliance schedule required?	Y	N
If "Y" Has it been issued? (Refer note below)	Y	N

If the new/ revised compliance schedule has not been issued, what action has been taken to ensure it will be issued? Outline:

Note: If the draft/ revised compliance schedule has not been issued, the Code Compliance Certificate cannot be issued. Suspend issuing CCC until this matter is addressed.

Building consent requirements.

Are there any item specified in the building consent or PIM that have not been completed.

Outline: ----------

Are there any development impact fees to be paid outstanding? Yes / No *(if yes, CCC cannot be issued)*

Approve to issue Code Compliance Certificate if all other outstanding fees are paid. YES / NO

Building officer:

Signature: .....

Date: 2.1.4.12

Name: Tony Ly

Co- reviewer:

Signature: .....

Date: 12.4.12

Name: Russell Brook

Form 436

Retaining Walls over culvert
Road Reserve near
86 Emerald Glen Road

BC.....

:KLIST

RECEIVED 20 SEP 2010 KAPITI COAST DISTRICT COUNCIL

No = Plans , spe... Building Cod... ...angular each prompt)
Yes = Plans , specifications & documentation complying with the Building Code &/or Bld. Act (The reason specified alongside each prompt)
N/A = Not Applicable to this application. (The deletion of whole sections as N/A is permitted) For alternatives comment below each section.
Note – The further information requests are identified by hand written numbers and corresponding on FIR letters / e-mails sent

Category.....0.....

2021

Site Plan (*NZS 3604 Sec 3.4, 4,5 Code clB1, B2,E1, E2 F1&F2* Sect. 72, 75 BA04)

N/A	NO	YES		Comments
☐	☐	☑	Wind zone High V/ High Specific..... *GIS*	
☑	☐	☐	Flooding / ponding hazards ..... *GIS*	
☑	☐	☐	Slippage/ fault line hazards ..... *GIS*	
☑	☐	☐	Erosion, river & coastal hazards ..... *GIS*	Culvert in stream bed.
☑	☐	☐	Subsidence/ soft soil hazards ..... *Site inspection notes*	
☐	☐	☑	Corrosion zone *Sea spray* or Zone 1 ..... GIS	
☑	☐	☐	Soil contamination ..... GIS	
☐	☐	☑	Distances to boundaries / siting..... *District plan*	Road designation
☐	☐	☑	Floor levels/ contours.....E2/AS1 & *NZS 3604 E1*	Road level 27.02
☑	☐	☐	Two or More Allotments.....Sec 75 – 83 Bld Act	
☑	☐	☐	Noise / sound insulation (airport & highway)	

Specific Design (*Verified Online PS2 B1 B2 VM1*)

				Comments
☐	☐	☑	*PS1* Design Certificate *B1 B2 VM1*	
☑	☐	☐	*PS2* Peer Review..... *B1 B2 VM1*	
☐	☐	☑	Calculations *VM1*	
☐	☐	☑	CPeng ..... *Verified Online*	Max Attwater

Concrete / Foundation Plan (*NZS 3604 NZS 4210 & 4229 E2/AS1*)

				Comments
Layout				
☐	☐	☑	Layout dimensions..... *NZS 3604*	
☑	☐	☐	Control joints..... *NZS 3604*	
☑	☐	☐	Slab thickening..... *NZS 3604*, cl 7.5	
☐	☐	☑	Alternative..... *specify reason*	Specific eng design B1
Section				
☑	☐	☐	Depth & width..... *NZS 3604*	
☑	☐	☐	Reinforcement..... *NZS 3604;B2*	
☑	☐	☐	Plate fixings..... *NZS 3604:B2 cl 7.5*	
☑	☐	☐	DPM ..... *NZS 3604;B2*	
☐	☐	☑	Engineer design and Calcs.....*B1;B2*	
☐	☐	☑	Concrete strength.....*B1;B2 cl 4.8.2*	Reformed Culvert 45 MPA @ 28 days
☐	☐	☑	Alternative.....specify reason	

Timber / Subfloor Plan *(NZS3604 NZS 3602 & 3640 , B1,B2)*

Comments

Layout

N/A	NO	YES	
☐	☐	☐	Layout dimensions
☐	☐	☐	Bearers details.....*B1 ; B2*
☐	☐	☐	Joist details.....*B1;B2*
☐	☐	☐	Alternative.....specify reason

Section

☐	☐	☐	Foundation type/size..... *NZS 3604;B2* Culvert - Preformed.
☐	☐	☐	Piles post sizes & treatment ..... *NZS 36043602;3640;B2*
☐	☐	☐	Pile c/c..... *NZS 3604*
☐	☐	☐	Fixing..... *NZS 3604:B2*
☐	☐	☐	Coatings(durability)..... *NZS3604 ;B2*
☐	☐	☐	Ventilation& Access to sub floor spaces ..... *NZS 3604*
☐	☐	☐	Alternative.....specify reason

If the addition is an upper storey show details on upgrading existing foundations, joints, piles, etc (may require Engineer design)

Floor plans / layout *(B1, B2, C1-4, D1, E3, F7, G1, G2, G12 G3, G9, G11, G13)*

Comments

General

N/A	NO	YES	
☐	☐	☐	Room dimensions
☐	☐	☐	Sectional lines
☐	☐	☐	Location of partitions
☐	☐	☐	All designated spaces
☐	☐	☐	Lintels..... *NZS 3604:B2*
☐	☐	☐	Beams..... *NZS 3604, B2 by engineer* Culvert - Preformed.
☐	☐	☐	Point loads by engineer or prenailer....*B1 B2*
☐	☐	☐	Smoke detectors.....*F7*
☐	☐	☐	Wet areas / WCs ..... *D1, Table 2; B2*
☐	☐	☐	Kitchen.....*G3, G9,G11.*
☐	☐	☐	Alternative.....specify reason

Changes to existing work requires both an existing floor plan & a proposed floor plans
Facility provided for washing utensils / food G3, Section 1.1 & Figure 1:
Preparation Area and Access to Facility Paragraphs 1.1.2 and 1.5

Wall / Framing B1, B2, E3

Comment

General

☐	☐	☐	Identify engineering / Structural Items/ portals. *B1 B2*
☐	☐	☐	By prenailer or to NZS 3604..... .....*B1 B2*
☐	☐	☐	Fixing types ..... *NZS 3604*.....*B1 B2*
☐	☐	☐	Stud c/c as per wind zone.... *NZS 3604*.....*B1 B2*
☐	☐	☐	Building wrap..... *NZS 3604*
☐	☐	☐	Stud heights of rooms..... *NZS 3604*.....*B1 B2*
☐	☐	☐	Alternative.....specify reason

Roof..... *NZS 3604,3602 &3640 B1B2E2 E2/AS1*

Trussed / by prenailer or Framed roof *NZS 3604* *Comments*

N/A NO YES

- ☐ ☐ ☐ Fixing layout & details.....*B1 B2*
- ☐ ☐ ☐ Correct layout.....*B1*
- ☐ ☐ ☐ Max span (12m or Engineer).....*B1*
- ☐ ☐ ☐ Purlin or batten c/c....*B1 B2*
- ☐ ☐ ☐ Rafters / Beams.....*B1 B2*
- ☐ ☐ ☐ Alternative.....specify reason

Roof cladding - Metal ; Profiled Metal; Masonry, Membranes *Code E2, E2/AS1 B2*

- ☐ ☐ ☐ Pitch / profile.....*E2*
- ☐ ☐ ☐ Underlay.....*E2*
- ☐ ☐ ☐ Flashings.....*E3;E2.....B1 B2*
- ☐ ☐ ☐ Parapets.....*B1 E2 B2*
- ☐ ☐ ☐ Membrane Roofs and substrate *Code E2/AS1 B2*
- ☐ ☐ ☐ Gutters, Barges & Fascias detail *Refer E2, section 8.3, cl 8.3.9*
- ☐ ☐ ☐ Alternative.....specify reason

Installation of profiled metal roof cladding shall be by trained installers, approved by the tile manufacturer or NZ agent. In some cases experienced builders undertake installation, refer E2, section 8.4, cl 8.4.2 'General'.

Claddings *CodeB1 & B2 E2/AS1,Branz good practice Guides &,Weather tightness Vol 12&3* *Comments*

- ☐ ☐ ☐ Risk matrix Cavity or direct.....*E2*
- ☐ ☐ ☐ Brick Veneer.....*E2 "The brick book" Branz Masonry Guide ; B2*
- ☐ ☐ ☐ Timber Weatherboard ....*E2 Branz Timber Guide Vol 1&2; B2*
- ☐ ☐ ☐ Stucco .....*B1 NZS 3604 Branz good practice guide; B2*
- ☐ ☐ ☐ Profiled Metal.....*E2 Metal Roofing Practice; B2*
- ☐ ☐ ☐ Plywood .....*E2 ; B2*
- ☐ ☐ ☐ Fiber Cement W/b.....*E2; B2*
- ☐ ☐ ☐ Board & Batten..... *Branz good practice guide; B2*
- ☐ ☐ ☐ Fiber Cement Sheet.....*E2; B2*
- ☐ ☐ ☐ Weathertightness details.....*E2' ; B2*
- ☐ ☐ ☐ Alternative.....specify reason

Bracing *NZS 3604* B1, B2, E3 *Comments*

N/A NO YES

- ☐ ☐ ☐ Subfloor bracing.....B1& *NZS 3604*
- ☐ ☐ ☐ Wall bracing..... B1 & *NZS 3604*
- ☐ ☐ ☐ Roof bracing..... B1& *NZS 3604*
- ☐ ☐ ☐ Bracing calculations..... B1 & *NZS 3604*
- ☐ ☐ ☐ Provide bracing plan layout..... B1 & *NZS 3604*
- ☐ ☐ ☐ Double top plate (if > 5m)..... B1 & *NZS 3604*
- ☐ ☐ ☐ Indicate dragon tie (if > 6.m)..... B1.& *NZS 3604*
- ☐ ☐ ☐ Diaphragm ceilings (if > 7.5m)..... B1 & *NZS 3604*
- ☐ ☐ ☐ Check for distribution ..... B1 & *NZS 3604*
- ☐ ☐ ☐ Alternative.....specify reason

Light & Ventilation *B1 G4, Clause 1.2 ; G4, clause 1.3* G7,G9 F2

General

Comments

N/A NO YES

- ☐ ☐ ☐ Vent 5%.....*G4*
- ☐ ☐ ☐ Light 10%.....*G7*
- ☐ ☐ ☐ Electrical.....*G9*
- ☐ ☐ ☐ Mechanical ventilation.....*G4*
- ☐ ☐ ☐ Exterior space for awareness.....*G7*

Glazing

- ☐ ☐ ☐ Safety glass.....*F2*
- ☐ ☐ ☐ Wind zone..... *B1. NZS 3604*
- ☐ ☐ ☐ Alternative.....specify reason

Pre-Lintel Culvert

Insulation *BRANZ Home Insulation Guide, NZS 4218, AS/NZS 2918*

Comments

- ☐ ☐ ☐ Floor *H1*
- ☐ ☐ ☐ Wall..... *H1*
- ☐ ☐ ☐ Roof..... *H1*
- ☐ ☐ ☐ Windows / glazing..... *H1*
- ☐ ☐ ☐ Alternative.....specify reason

Stairs / Landings / Handrails *D1,sec 4*

Comments

- ☐ ☐ ☐ Stair tread & risers.....*D1*
- ☐ ☐ ☐ Landing size.....*D1*
- ☐ ☐ ☐ Handrail.....*D1*
- ☐ ☐ ☐ Riser opening (min) where children.....*D1*
- ☐ ☐ ☐ Residential Accessibility.....*D1*
- ☐ ☐ ☐ Alternative.....specify reason

Stair type

Minor Private: Max rise 220mm/Min tread 220mm,
Secondary Private: Max rise 200mm/Min tread 250mm,
Main Private: Max rise 190mm/Min tread 280mm. (Main private includes exterior stairs)

Decks / Balconies / Barriers *D1, F4 & NZS 3604, Section6 & 7,*

Comments

- ☐ ☐ ☑ Barrier & deck fixing durability.....*D1 B1 B2*
- ☐ ☐ ☑ Top rails, balusters, bottom rails, palings.....*D1 B1* Shown in scale section
- ☐ ☐ ☑ If Engineer then calculations required.....*B1 B2*
- ☐ ☐ ☑ Max 3m height or Engineer.....*B1 B2*
- ☐ ☐ ☐ Deck joist sizes, grade, treatment, span & spacing.....*D1 B1 B2*
- ☐ ☐ ☐ Piles & bearers the correct grade, treatment, size, spacing & span.....*D1 B1 B2*
- ☐ ☐ ☐ Slip resistance *D1*
- ☐ ☐ ☐ Appropriate waterproofing membrane..... *B1 B2*
- ☐ ☐ ☐ Stringer size & connections *D1 B1 B2*
- ☐ ☐ ☐ Thresholds.....*D1 E2*
- ☐ ☐ ☐ Alternative.....specify reason

Fire *(Residential) NZBC F7;Cdoc*

Comments

N/A NO YES

- ☐ ☐ ☐ Travel distances max 24m.....C3.15.....
- ☐ ☐ ☐ Smoke detectors.....F7.....
- ☐ ☐ ☐ Wood burners .....F7.....
- ☐ ☐ ☐ Garage fire wall details .....C7 (C7.10 C7.8) .....
- ☐ ☐ ☐ Alternative.....specify reason .....

Swimming Pool & Fencing *Fencing of Swimming Pools Act 1987*

Comments

- ☐ ☐ ☐ Refer to Compliance for sign off.....
- ☐ ☐ ☐ Specific Engineering Design .....
- ☐ ☐ ☐ Proprietary system/design.....
- ☐ ☐ ☐ Section/construction .....
- ☐ ☐ ☐ Pool backwash discharging the sewer.....
- ☐ ☐ ☐ Fence height .....
- ☐ ☐ ☐ Gate(s) / door(s) open outward.....

Pre formed culvert

Ambiguity / Contradictions

Comments

- ☐ ☐ ☐ Manufacturers Specs .....
- ☐ ☐ ☐ Engineer compared with Designer/Architect .....
- ☐ ☐ ☐ Any Other contradictions .....

Alternative Solutions

Record assessment, decision and reasons for decisions below. Has the designer substantiated why they believe the proposal complies with the building code? Is there a determination on a similar proposal? Has corroborative evidence been provided (peer review, appraisal or determination)? Include reference to comparison with acceptable solutions, other documents / standards / best practice guides / publications, expert opinion, determinations, in-service history, product certification, professional judgment, building code objectives. Refer BRANZ Bulletin # 456 (Dec 2004). List any conditions / communications / actions:

Opus consultants in association with NZTA. Ewald Glen extension to road joining at Mckay's crossing to South. Humes pre-formed concrete culvert section with a gabion basket earth embankments with road over. Specific design by Alexei Murashev, CPENG. Calcs supplied & relevant.

This sheet relevant to plumbing & drainage only

General

Comments

N/A NO YES

- ☐ ☐ ☐ Kitchen area.....G3/AS1
- ☐ ☐ ☐ Laundry.....
- ☐ ☐ ☐ Bathrooms.....
- ☐ ☐ ☐ Location of sanitary fixtures.....
- ☐ ☐ ☐ Plumbing layout.....

Plumber's Reg no..... Drainlayers Reg no.....

Effluent Disposal Systems

Comments

- ☐ ☐ ☐ Engineering Site Investigation
- ☐ ☐ ☐ Design Specification & Producer Statement

(The design criteria should include; Capacity based on bedroom numbers, Loading calculation, site evaluation, soil profile, site characteristics.)

Water Supplies

Comments

- ☐ ☐ ☐ G 12 .....
- ☐ ☐ ☐ Town supply,.....
- ☐ ☐ ☐ Private scheme.....
- ☐ ☐ ☐ Type & location.....
- ☐ ☐ ☐ Alternative.....specify reason.....

Sanitary Drainage

Comments

- ☐ ☐ ☐ G13.....
- ☐ ☐ ☐ Layout .....
- ☐ ☐ ☐ Council availability or .....
- ☐ ☐ ☐ Septic tank design & calcs.....
- ☐ ☐ ☐ Alternative.....specify reason

Stormwater Drainage

Comments

- ☐ ☐ ☑ E1 ..... Existing stream bed
- ☐ ☐ ☑ Layout .....
- ☑ ☐ ☐ Council availability .....
- ☐ ☐ ☑ Alternative.....specify reason Opus - Emerald Glen flow regimes report

Jack McConchie, Principal Water Resource Scientist - DHL. Feb. 2016

Sanitary Plumbing

Comments

- ☐ ☐ ☐ G13 .....
- ☐ ☐ ☐ Layout .....
- ☐ ☐ ☐ Alternative.....specify reason .....

Accessibility D1 ; NZS 4121

Comments

N/A NO YES

- ☐ ☐ ☐ Car parks
- ☐ ☐ ☐ Projections
- ☐ ☐ ☐ Kerb Ramps
- ☐ ☐ ☐ Footpaths/Ramps / Landings
- ☐ ☐ ☐ Entrances
- ☐ ☐ ☐ Public Facilities
- ☐ ☐ ☐ Lifts
- ☐ ☐ ☐ Stairs
- ☐ ☐ ☐ Stair / handrails
- ☐ ☐ ☐ Doorways/Doors/Corridors/ Lobbies
- ☐ ☐ ☐ Controls
- ☐ ☐ ☐ Places of assembly/entertainment/Recreation
- ☐ ☐ ☐ Warning Systems
- ☐ ☐ ☐ Toilet Facilities / Laundering
- ☐ ☐ ☐ Food preparation / accommodation
- ☐ ☐ ☑ Signs

Carpark

Road Signage

Fire report C1,C2, C3, C4

Comments

- ☐ ☐ ☐ Purpose group FHC
- ☐ ☐ ☐ Fire cell separation /use of building
- ☐ ☐ ☐ f- rating
- ☐ ☐ ☐ s- rating
- ☐ ☐ ☐ Occupancy numbers
- ☐ ☐ ☐ Means of escape
- ☐ ☐ ☐ Travel distances
- ☐ ☐ ☐ External walls/unprotected areas
- ☐ ☐ ☐ Fire resistance to supporting elements/floors/ walls.
- ☐ ☐ ☐ Risks to/below escape routes
- ☐ ☐ ☐ Fire safety precautions
- ☐ ☐ ☐ SFI's / SDI's
- ☐ ☐ ☐ Alternatives
- ☐ ☐ ☐ Referal to DRU
- ☐ ☐ ☐ Alternative.....specify reason

Pre Lined Ceiling

Solid waste G15

Comments

- ☐ ☐ ☐ Waste bin area
- ☐ ☐ ☐ ~~Environmental health referral~~
- ☐ ☐ ☐ Alternative.....specify reason

Hazardous Agents, Materials & substances F1 - F3

Comments

- ☐ ☐ ☐ Waste bin
- ☐ ☐ ☐ Environmental health referral

Work Sheet

Wind: N2 TC.
Preferred subbie - Hynes.
Earth bunding: - Terramesh & Gabion Basket.

General stamp prompts

Wind Zone
Corrosion
Cladding
Electrical
Bracing Highlighted
Boundary setting out
Engineers design

Set Status
Complete checklist
Addenda
Section 72 / ponding
Set inspections

Dialogue Record

List further information requested , info received , records / reference of communication etc. via Phone / Email / letter / counter / fax

Date /time	State the content of discussion !!!	Initials

Change Of Use – Sec 114: *(record decisions and basis for decisions – confirm whether sec 115 applies)*		.....
Date	N/A – New road section.	
Alteration to Existing Building – Sec 112: *(record decisions and basis for decisions – confirm whether sec 118 applies and if so, has it been complied with?). List conditions / communications / actions:*		.....
Date	N/A	
Hazards – Sec 71-74 : *(record decisions and basis for decisions – see under "site plan above already done")*		.....
Date:	N/A.	
Compliance Schedule – Sec 100 - 107: *(record if new / amended compliance schedule required, and attach copy of replica compliance schedule. Ensure that note is recorded on building consent that new / amended compliance schedule will be issued).*		
Date	N/A – New road section – No specified sys:	

Note :- Refer to the associate code clause along side each prompt above for compliance or reason of decision

Plan checked yet Unsatisfactory
(request for further information- see attached copy)

Signature, name & date

Bldg.....

Plumbing.....

Fire.....

I am satisfied on reasonable grounds that the provisions of the Building Code are met and the **Building consent may be granted (refer Bld Act See 49(1))**

All previous Further Information Requests now satisfactory.

Signature, name & date

Bldg..... SAGE 5/10/10.
(for all pages except those listed below)

Plumbing..... N/A.
(For pages 6 of 11 unless otherwise listed)

Fire..... N/A.
(As listed on page 7 of 11)

Addenda to Form 436

Allocation of work to approvals officer outside current competency

Building Category	*Circle appropriate category* 0 1 2 3

1) Authorized by Team leader or delegate	Level of supervision reqd	Reason for decision
Name, Signature &date	Coaching Mentoring Peer review on completion	In training Vetting one level above competency Other
2) Approval Officer undertaking training	**Record of Learning**	
Name, Signature & date Current competency level Category 0,1or 2		**Decision** I am satisfied on reasonable grounds that the provisions of the Building Code are met and the building consent may be granted (refer Bld Act 49(1))
3) Coach/Mentor/Peer reviewer	**Training needs identified**	**Comments**
Name,Signature & date Current competency level Category 1,2 or 3		I am satisfied on reasonable grounds that the provisions of the Building Code are met and the building consent may be granted (refer Bld Act 49(1))

Allocation notes

- Categories of building are determined on receipt of application
- All applications are re assessed for the category and allocated to each appropriate Officer at the earliest opportunity and then placed in processing shelves accordingly
- Approvals staff are aware of their own competency level and check the allocation of work.
- Approvals staff may select, for training purpose, a consent 1 (one) category higher than their current competency for the purpose of increasing their skill level provided they gain approval from the Team Leader Building Consent Approvals. Once approval is given the Team Leader Building Consent Approvals will arrange for the appropriate supervision and final peer review.

FOR COUNCIL USE:

DEPARTMENT	TICK FOR REFERRAL	COMMENTS	APPROVING OFFICER/ DATE
Site Inspection	✓	Refer to Form 241 for completion of site Inspection & sign off this form when completed.	
Resource Consents (refer PIM Sheet)	✓		
Plumbing and Drainage	✓	N/A.	
Building	✓	Approved – Specific design by CEngg.	SAGE 5/10/10
Fire Design			
Compliance Schedule			
Environmental Health			
Other……..			

NOTES:

KCDC Form 123 ver. 2

KAPITI COAST

100764

Retaining Walls over culvert
Road Reserve near
86 Emerald Glen Road

Building Consent		
Building Project		
Location (Site Ad		
Building Category	*Circle appropriate category*	**0** 1 2 3

RECEIVED
20 SEP 2010
KAPITI COAST
DISTRICT COUNCIL

Application workflow checklist	**Name & Signature** Note # A signature confirms that the application contains sufficient information to enable compliance with the building code to be assessed	**Date**
# Note: Checked, date stamped and initialled by TO/BCO. Select and circle appropriate category above & identify allocation to appropriate technical groups and if required to go to "site inspection" **AP-WI-001**	GPearson	20/9/10
Payment taken and receipted (details entered inside this cover sheet) by CSO **CS-WI-008**	Angie Stokes	20/9/10
Data entered and invoiced by CSO **CS-WI-008**	Angie Stokes	20/09/10
Pages numbered by CSO **CS-WI-008**	GPearson	20/9/10
BC Application and documentation scanned, checked & status update by CSO **CS-WI-009**	Angie	20/9/10
BC Application signed over to BC **CS-WI-009**	Angie	20/9/10
Application reviewed by Technical Officers who sign off at back of this form **AP-WI-026 & AP-WI-009**	SAGE	5/10/10
Once Technical review complete, passed to CS for Plan Production and Invoicing **AP-WI-009**		
CSO checks data entry input, including required inspections **CS-WI-012**		
BC, plans and other appropriate paperwork produced by CSO **CS-WI-012**	Yinjun	6/10/10
BC, Approved plans and appropriate paperwork sent to applicant or agent with receipt by CSO **CS-WI-012**		
Inspection envelope prepared by CSO with endorsed plans and other appropriate paperwork and filed to cabinet. **CS-WI-012**		

KCDC Form 123 ver. 2

CONSENT DATA INPUT REQUIREMENTS

	REQUIRED INSPECTIONS						
✓	Foundation/Piles	32	✓	Lapse and cancellation after 12mths of consent	23		Installation of solid fuel appliance (wood burner) comply and secured
	Block	2	✓	Engineer design specific components	23A		Second hand wood burner certified
	Pre-Slab (Plumbing)	3		Foundations to solid bearing of 200mm	25		Contractor to leave site clean and clear
	Pre-Slab (Building)	4		NZS3604 as acceptable solution in terms of NZ Building Code	30		To comply with Food Hygiene Regulations 1974
	Sub-Floor	6		Not approved as Habitable Room	31		As in CCZ, all fixings need to be stainless steel
	Drainage	9		Note and comply with all endorsements on approved plans	33		Approval only given for relocation purposes
	Pre-Wrap	10		Names and Registration of plumber and drain-layer required	34		If cladding to have pre-finished colour coating, to be appropriate for coastal conditions
	Pre-Clad	11		Concealed soil and TV pipes and gas flues only allowed in ducts or minimum framed	38		Window sashes on upper levels less than 760mm above floor to have stays fixed
	Weathertightness	12		Hot & Cold water pipes tested to 1500kPa	39		Construction of playground to comply with NZS5828
	Pre-lining (Building)	13		Roof stormwater to be connected to existing	40		Fencing, gates, doors directly leading to swimming pool to comply with Pool Act 1987
	Pre-lining (Plumbing)	14		Copper water pipes not permitted	43		Textured systems should be applied by licensed, trained applicators – supply warranty
	Wet areas - membrane	15		Owner/builder to ensure prop foundation height will allow satisfactory connection	44		Exterior cladding system to be completed and inspected prior to internal lining
	Post Lining	21		Minimum FFL to comply with NZS3604			
	Brick Veneer						
	Retaining Wall						
	Final (Dwelling)						
✓	Final (Commercial &Multi-resd)						

	STANDARD CONSENT CONDITIONS	
	37	
	72	
	80	

NON-STANDARD ADDENDA

N/A

KCDC Form 123 ver. 2

FOR OFFICE USE ONLY

FEES		
Building Fee	$ 718.00	
Sewer Connection	$	
Water Connection	$	
Vehicle Crossing	$	
Damage Deposit	$	
Code Compliance Administration	$	
Building Research Levy	$ 200.00	
Development Levy	$	
DBH Levy	$ 394.00	
Compliance Schedule	$ 38.00	
Digital Storage Fee	$	
Certificate of Title Charge	$	
Photocopying	$	
SUBTOTAL	$	
Less Fee Paid	$	
TOTAL	$ 1350.00	
GST INCLUDED	$	

APPLICATION FEE $ $1350.00

RECEIPT NO ____ DATE ____

INVOICE NO 9737 DATE 20-09-10

RECEIPT NO 356771 DATE 20-09-10

FEES PAID BY: Opus Int Consultants

BUILDING CONSENT NUMBER 100764 DATE ISSUED

AUTHORISATION FOR REFUND OF DEPOSIT

Deposit held = $

Cost to Repair Damage Caused During Construction = $

Total Balance to be Refunded

Authority Number:

Authorised: DATE:

GST 51-860-608

Received with thanks by 36/01
KAPITI COAST DISTRICT COUNCIL

20-09-10 12:35 Receipt no.356771

COPY *COPY* *COPY*
DR BC100764 OPUS 1,350.00-
Opus::Opus Int : Majestic Centre:100 Wi
CQ B
Opus Int consultants 1,350.00

KCDC Form 123 ver. 2

Kāpiti Coast District Council

Private Bag 60 601
Paraparaumu 5254
New Zealand

Tel (04) 296 4700
or 0800 486 486
Fax (04) 296 4830 ■
kapiti.council@kapiticoast.govt.nz ■
www.kapiticoast.govt.nz ■

Building consent 100764

Section 51, Building Act 2004

The building

Street address of building: Near building on 86 Emerald Glen Road Paekakariki

Legal description of land where building is located:

Valuation number:

Building name:

Location of building within site/block number:

Level/unit number:

The owner

Name of owner: KCDC Road Reserve

Contact person:

Mailing address: 175 Rimu Road, Private Bag 60 601, Paraparaumu 5254

Street address/registered office:

Phone number: Landline: 2964700 Mobile:

Daytime: After hours:

Facsimile number: 042964830

Email address:

Website:

First point of contact for communications with the council/building consent authority:
Full Name: Opus

Mailing Address: Opus Int : Majestic Centre, 100 Willis Street, PO Box 1200, Wellington

Phones:: 04 4717000

Fax: 04 499 3699

Email: richard.coles@opus.co.nz

Building work

The following building work is authorised by this building consent:

Retaining walls(over culvert) to support a new road. Road to connect existingEmerald Glen Road to Mackays Crossing roundabout to provide access once water fall road level closes.

Currently there is a stream, after construction there will be a road over stream.

This building consent is issued under section 51 of the Building Act 2004. This building consent does not relieve the owner of the building (or proposed building) of any duty or responsibility under any other Act relating to or affecting the building (or proposed building).

This building consent also does not permit the construction, alteration, demolition, or removal of the building (or proposed building) if that construction, alteration, demolition, or removal would be in breach of any other Act.

Compliance schedule

A compliance schedule is not required for the building.

Attachments

Copies of the following documents are attached to this building consent:

Signature

CSO

Position

On behalf of: KAPITI COAST DISTRICT COUNCIL

Date: 5/10/10

7 October 2010

KCDC Road Reserve
175 Rimu Road
Private Bag 60 601
Paraparaumu 5254

Dear Sir/Madam

Approval of Building Consent: 100764

Description: Retaining walls(over culvert) to support a new road. Road to connect existingEmerald Glen Road to Mackays Crossing roundabout to provide access once water fall road level closes.
Location: Near building on 86 Emerald Glen Road Paekakariki
Legal Description:

I am pleased to inform you that the above building consent application has been approved. The building consent documents have been issued and are enclosed.

Before starting any work please read ALL the building consent documents carefully and in full so that you as the owner understand the conditions under which the consent has been issued.

As the owner you are also responsible for the following:

- ensuring that building work starts within 12 months of the approval of the building consent and that work progresses at a reasonable pace.
- ensuring that all required inspections are completed and that a Code Compliance Certificate is obtained once the work has been completed – please be aware that before a Code Compliance Certificate is issued, the building work must comply with the Building Act 2004 and the Building Code as at the date of final inspection.
- that no work with noisy equipment is to be carried out before 7.30 a.m. or after 6 p.m. Monday to Saturday. During the week there may be workers on site from 6.30 a.m. quietly preparing for work. Work with noisy equipment is not permitted on Sundays and public holidays.
- ensuring that no damage occurs to public property, for example footpaths or retaining structures. Should damage occur you will be required to pay for any repairs.
- ensuring that if you wish to make any changes to the approved building consent, then an amendment to the building consent will need to be lodged with us.

If you have any questions regarding your building consent or your responsibilities, please contact Kapiti Coast District Council on (04) 9045 617.

Addenda to Application

Application

Opus Opus Int : Majestic Centre 100 Willis Street PO Box 1200	No.	100764

Project

Description	Retaining Walls Being Stage 1 of an intended 1 Stages Retaining walls(over culvert) to support a new road. Road to connect existingEmerald Glen Road to Mackays Crossing
Intended Life	Indefinite, but not less than 50 years
Intended Use	Currently there is a stream, after construction there will be a road over stream.
Estimated Value	$200,000
Location	Near building on 86 Emerald Glen Road Paekakariki
Legal Description	
Valuation No.	

Designer: R Coles Opus 100 Willis Street Wellington : 044993699

Contractor: Fletcher c/o Gerald Carty Level 1, 816 Great South Rd Penrose 1142 : 0276711870

General Requirements

a) The Building Inspector is to be given 24 hours' notice before carrying out the following inspections:

1. Foundations
2. Final Inspection - Commercial

b) To arrange for any of the above required inspections by Building Control Team, please contact the Call Centre on (04) 296 4700 between the hours of 8am and 5pm.

2	Addenda to Application 100764

1. LAPSE AND CANCELLATION OF BUILDING CONSENT. A building consent shall lapse and be of no effect if the building work concerned has not been commenced within 12 calendar months after the date of issue. Or within such further period as the territorial authority allows.
2. The inspection of all specific design components of the building is the responsibility of the Design Engineer who is also required to supply a written report to Council.

I have read the foregoing addenda to application, and the Owner/Builder/Authorised Person hereby agrees to comply with them.

OWNER/BUILDER/
AUTHORISED PERSON **Date:**

WATERFALL ROAD CONNECTION, KAPITI

DRAWING INDEX

5/2573/1/7504

LOCALITY PLAN
N.T.S.

GENERAL ARRANGEMENT

1. DRAWING INDEX

ROADING

101. PLAN AND LONGITUDINAL SECTION - SHEET 1
102. PLAN AND LONGITUDINAL SECTION - SHEET 2
111. PLAN LAYOUT - Sta. 60 to Sta. 260
112. PLAN LAYOUT - Sta. 260 to Sta. 450
113. PLAN LAYOUT - Sta. 450 to Sta. 640
114. PLAN LAYOUT - Sta. 640 to Sta. 830
115. PLAN LAYOUT - Sta. 830. to Sta. 1020
116. PLAN LAYOUT - Sta. 1020 to End
121. TYPICAL CROSS SECTIONS
122. MISCELLANEOUS DETAILS
131. CLOSURE OF S.H.1 MEDIAN BARRIER BREAK

STORMWATER & DRAINAGE

301. EMERALD GLEN CULVERT - PLAN
302. EMERALD GLEN CULVERT - SECTION & FISH PASS DETAILS
303. EMERALD GLEN CULVERT - TERRAMESH EARTH WALL DETAILS
304. EMERALD GLEN CULVERT - END ELEVATIONS - TERRAMESH WALL DETAILS
305. EMERALD GLEN CULVERT - HEADWALL DETAIL
311. TRAMWAY AND MINOR CULVERT DETAILS
312. MANHOLE AND WINGWALL ARRANGEMENTS
313. SCRUFFY DOME INSTALLATION
321. TYPICAL SWALE DETAIL AND EROSION PROTECTION FOR BRIDGE
322. DIVERSION CHANNEL DETAILS
331. ROAD DRAINAGE DETAILS - SHEET 1
331. ROAD DRAINAGE DETAILS - SHEET 2

LANDSCAPE

401. TYPICAL CROSS SECTION & DESIGN PRINCIPLES
404. PLANTING PLAN 1
405. PLANTING PLAN 2

BRIDGING (DRAFT)

500. GENERAL ARRANGEMENT
501. ABUTMENT GEOMETRY
502. ABUTMENT A REINFORCEMENT
503. ABUTMENT B REINFORCEMENT
504. ABUTMENT & PILE REINFORCEMENT DETAILS
505. 14m SPAN DHC BEAMS - REINFORCEMENT & STRESSING DETAILS
506. 14m SPAN DHC BEAMS - OUTER BEAM UNIT TYPE 2
507. 14m SPAN DHC BEAMS - UNIT DATA & LAYOUT PLAN
508. DECK PLAN & GUARDRAIL LAYOUT
509. W-SECTION GUARDRAIL - ASSEMBLY & FIXING DETAILS
510. ALUMINIUM HANDRAIL - ASSEMBLY & FIXING DETAILS
511. ALUMINIUM HANDRAIL - FABRICATION DETAILS
512. CONCRETE NOTES

CONSTRUCTION

Revision	Amendment	Approved	Revision Date
R2	ISSUED FOR CONSTRUCTION	C.L.	02/09/2010

NZ TRANSPORT AGENCY
WAKA KOTAHI

OPUS
Wellington Office
P.O.Box 12-003
Wellington 6144, New Zealand
+64 4 471 7000

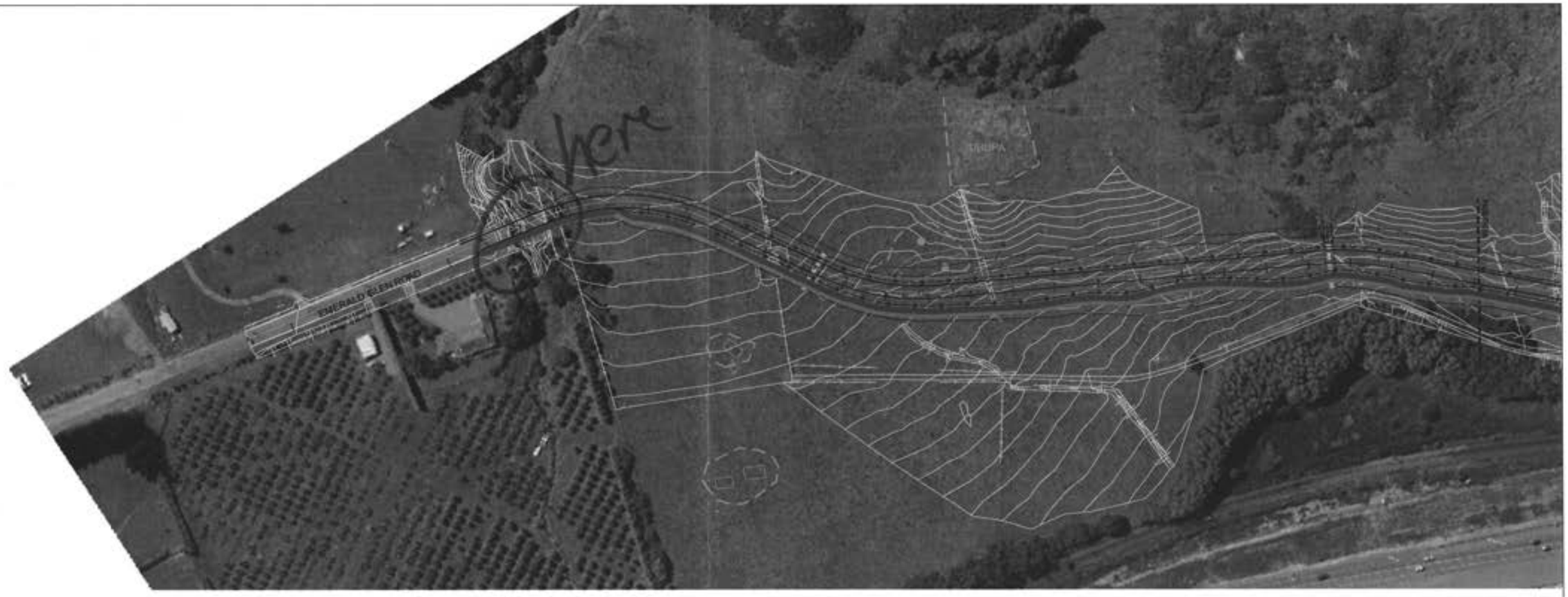
Drawn	Design by	Approved	Revision Date
R.G	I.T.	C.LEE	02/09/2010

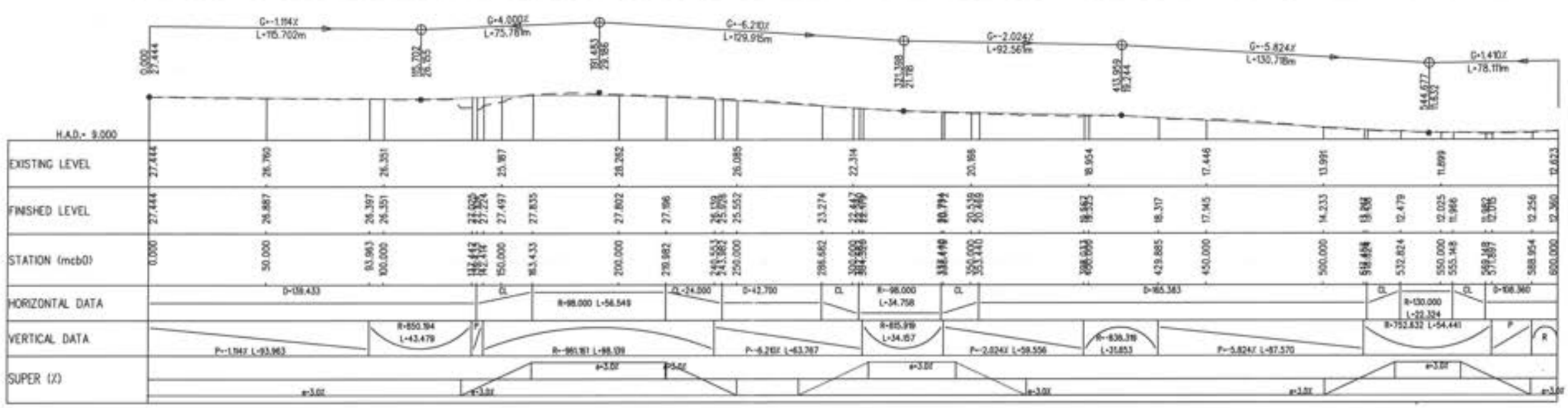
Project: NEW ZEALAND TRANSPORT AGENCY
EMERALD GLEN CONNECTION, KAPITI
ROAD ALIGNMENT

Sheet: LOCALITY PLAN & DRAWING INDEX

Project No.	Scale	Drawing No.	Sheet No.	Revision
5C1744.02	N.T.S	5/2573/1/7504	1	R2

Original Sheet Size A1 [841x594] Plot Date 03/09/10 @ 08:32 g:\transport\roads\design\all f\emerald glen connection\dwg\2x2_5_2573_1_7504_1.dwg





LONGITUDINAL SECTION

HORIZONTAL SCALE 1:1000
VERTICAL SCALE 1:1000

CONSTRUCTION

KEY

- POSSIBLE ARCHAEOLOGICAL SITE
- PROPOSED FOOTPATH LOCATION
- SWALES
- STOCK PROOF FENCE
- PROPOSED STOCK CROSSINGS
- CULVERTS

1:1000 @ A1

Number	Amendment	Approved	Revision Date
R2	ISSUED FOR CONSTRUCTION	C.L	03/09/2010

NZ TRANSPORT AGENCY
WAKA KOTAHI

OPUS
Wellington Office
P.O.Box 12-003
Wellington 6144, New Zealand
+64 4 471 7000

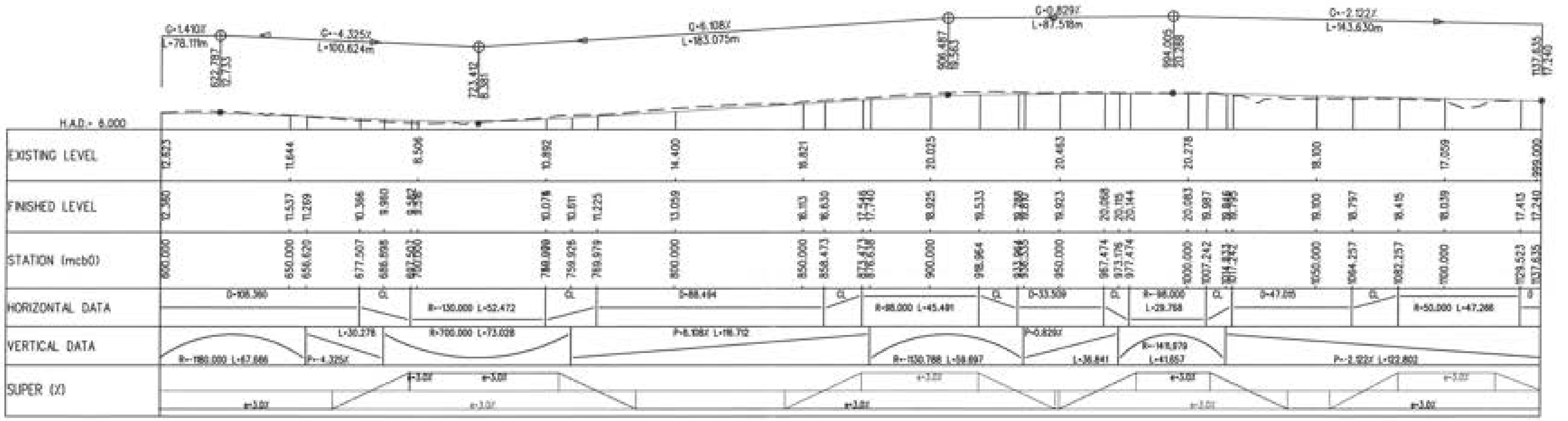
Drawn	Designed	Approved	Revision Date
RG	RG		

Project No.	Scale	Drawing No.	Sheet No.	Revision
5-C1744.01	1:1000 (A1)	5 / 2573 / 1 / 7504	101	R2

Project: NEW ZEALAND TRANSPORT AGENCY
EMERALD GLEN LINK ROAD, KAPITI
ROAD ALIGNMENT

Sheet: PRELIMINARY ALIGNMENT - FOR CONSTRUCTION
SHEET 1 OF 2

Original Sheet Size A1 (841x594) Plot Date: 03/09/10 @ 16:58 g:\transport\projects\emerald glen connect\civil\2v2_5_2573_1_7504_101-102.dwg



LONGITUDINAL SECTION
HORIZONTAL SCALE 1:1000
VERTICAL SCALE 1:1000

CONSTRUCTION

KEY

- POSSIBLE ARCHAEOLOGICAL SITE
- PROPOSED FOOTPATH LOCATION
- SWALES
- STOCK PROOF FENCE
- PROPOSED STOCK CROSSINGS
- CULVERTS

Revision	Amendment	Approved	Revision Date
R2	ISSUED FOR CONSTRUCTION	C.L.	03/09/2010

NZ TRANSPORT AGENCY
WAKA KOTAHI

OPUS
Wellington Office
P.O.Box 12-003
Wellington 6144, New Zealand
+64 4 471 7000

Drawn: RQ Designed: RQ

NEW ZEALAND TRANSPORT AGENCY
EMERALD GLEN LINK ROAD, KAPITI
ROAD ALIGNMENT

PRELIMINARY ALIGNMENT - FOR CONSTRUCTION
SHEET 2 OF 2

Project No.	Scale	Drawing No.	Sheet No.	Revision
5-C1744.01	1:1000 (A1)	5 / 2573 / 1 / 7504	102	R2

STOCK PROOF FENCE TO TIE INTO EXISTING FENCE LINE

DIVERSION CHANNEL 1A
DETAILS SHEET 333

ELECTRA DISTRIBUTION POWER POLE (49381A)

TL - 3 W-BEAM SAFETY BARRIER EXTENDED ACROSS CULVERT TO PROTECT POWER POLE

ELECTRA DISTRIBUTION POWER POLE LOCATED NEAR TO CUT SLOPE (49381A)

DIVERSION CHANNEL 1A

DC 18

CONTRACTOR TO BACKFILL BEHIND CULVERT HEADWALL WITH 150mm OF TOPSOIL AND HYDROSEED

WW.M.1

PW-36

PW-37

SUMP 1

SWALE TYPE 3

SWALE TYPE 2

KERB AND CHANNEL ON BOTH SIDES OF ROAD FROM STN 120 TO STN 180

TIMBER POST AND RAIL FENCE

3.0m LONG CONCRETE CHANNEL (150mm THICK) TO TRANSITION FROM K&C TO SWALE

SOLID 100mm WHITE PAINTED CENTRELINE AROUND CURVE

MH/M1

SUMP 2

NORTHERN CULVERT
FOR DETAILS OF NORTHERN CULVERT (INC. WING WALL, TERRAMESH, RIPRAP AND EARTHWALLS) SEE SHEETS 301 TO 305

RIP-RAP SCOUR PROTECTION AS SHOWN ON SHEET 302

TRAFFIC CALMING MEASURES FOR EXISTING EMERALD GLEN ROAD STILL TO BE AGREED WITH KCDC

PAGE BREAK

NOTES:
1. CONTOURS ARE SHOWN AT 1m SPACING
2. ALL BARRIER TERMINAL ENDS ARE TO BE STANDARD LEADING AND TRAILING EXCEPT WHERE SHOWN OTHERWISE
3. EACH SWALE END WILL HAVE 3.0m CHANNEL (150mm THICK) TRANSITIONS FROM/TO KERB AND CHANNEL OR TO DISCHARGE

SERVICES KEY
- TRANSPOWER 110KV OH LINES
- VECTOR UNDERGROUND TRANSMISSION GAS PIPELINES
- ELECTRA DISTRIBUTION OH LINES
- TELECOM UNDERGROUND FIBRE-OPTIC LINES

LEGEND
- MINOR DRAINAGE CHANNEL
- MINOR STREAM
- SIGNIFICANT STREAM
- DIVERSION CHANNEL
- SWALES
- FOOTPATH / BRIDLEWAY
- GRASSED BRIDLEWAY
- PROPOSED ROAD ALIGNMENT
- EXISTING ROAD SIGNS & LIGHTING
- NEW ROAD SIGNS & LIGHTING
- TIMBER POST & RAIL FENCE
- STOCK PROOF FENCING
- STOCK CROSSING
- SIGHT RAILS
- MANHOLE
- SCRUFFY DOME MH
- WINGWALL
- CULVERT

Revision	Description	Approved	Revision Date
R2	ISSUED FOR CONSTRUCTION	C.L.	02/09/2010

RECEIVED
20 SEP 2010
KAPITI COAST DISTRICT COUNCIL

CONSTRUCTION

NZ TRANSPORT AGENCY
WAKA KOTAHI

OPUS
Wellington Office
P.O Box 12-003
Wellington 6144, New Zealand
+64 4 471 7000

Drawn	Designed	Approved	Revision Date
R.G.	R.G.	C.LEE	02/09/2010

NEW ZEALAND TRANSPORT AGENCY
EMERALD GLEN CONNECTION, KAPITI
ROAD ALIGNMENT

PLAN LAYOUT
Sta 60 to Sta 260

Project No.	Scale	Drawing No.	Sheet No.	Revision
5C1744.01	1:250(A1), 1:500(A3)	5/2573/1/7504	111	R2

Original Sheet Size A1 (841x594) Plot Date: 03/09/10 @ 08:28 z:\transport\projects\wellington\emerald glen connection\cdv\2x2_5_2573_1_7504_111-115.dwg

1:250 @ A1 (1111) 0 4 8 12 16 20 24 m

SUMP 2

225 DIA. RCRRJ STORMWATER PIPE

SUMP 1

MHSM1

120.000

300 DIA. RCRRJ STORMWATER PIPE

R1

WW.M.2

RIP RAP SCOUR PROTECTION AS SHOWN ON SHEET 102

1757455mE
5463362mN

R1

1757439mE
5463364mN
(CD DIS 1)

WW.CC.1

140.000

FOR DETAILS OF NORTHERN CULVERT (INC. WING WALL, TERRAMESH, RIPRAP AND EARTHWALLS) SEE SHEETS 302,311,312 AND 313

Footpath

RECEIVED
7 F SEP 2010
KAPITI COAST
DISTRICT COUNCIL

CONSTRUCTION

Number	Amendments	Approved	Revision Date
R2	ISSUED FOR INFO	C.L	MSP10
R1	ISSUED FOR CONSTRUCTION	C.L	MSP10

NZ TRANSPORT AGENCY
WAKA KOTAHI

OPUS
Wellington Office
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Wellington 6144, New Zealand
+64 4 471 7000

Drawn	Designed	Approved	Revision Date
Ken Mercer	R.Coles	C. Lee	SEPT. 2010

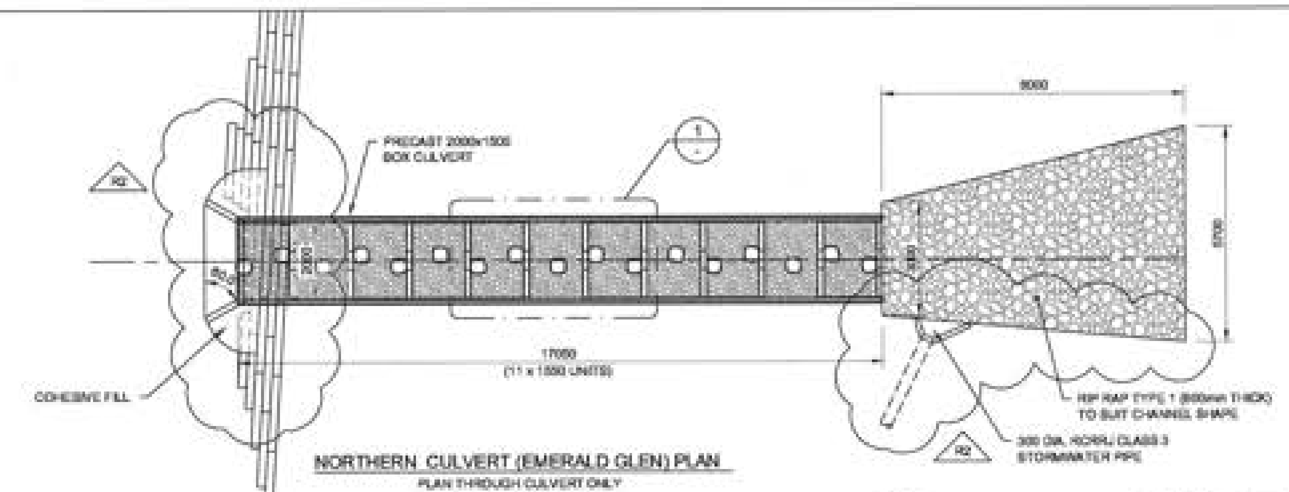
Project
NZ Transport Agency
Emerald Glen Connection Road, Kapiti
Road Alignment

Sheet
Culverts - Emerald Glan Culvert
Plan Layout

Project No.	Scale	Drawing No.	Sheet No.	Revision
5-C1744.01	1:100(A1), 1:200(A3)	5 / 2573 / 1 / 7504	301	R1

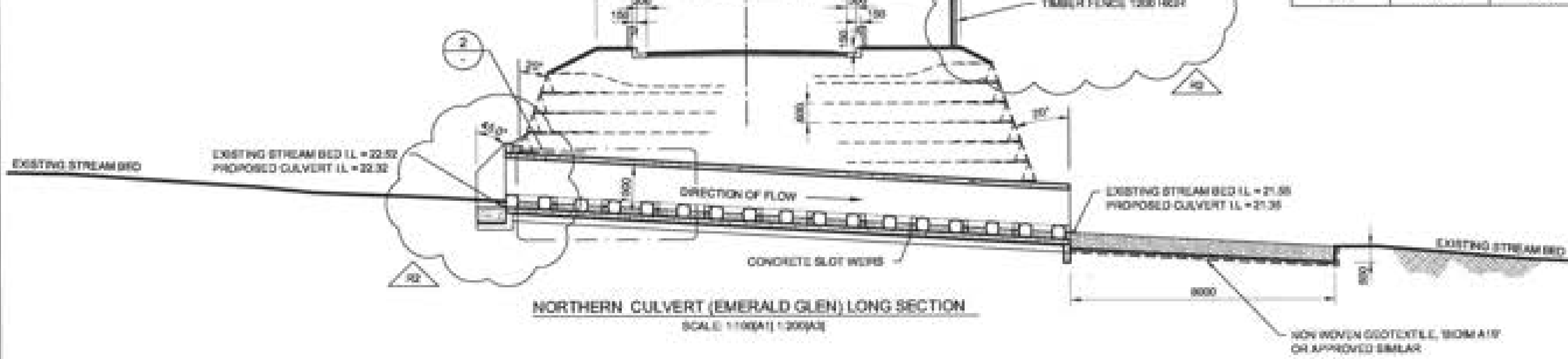
1:100 @ A1 0 1 2 3 4 5 6 7 8 9 10 m

Original Sheet Size A1 [841x594] Plot Date: 09/09/10 @ 09:07 s:\transport\roads\projects\kapiti\emerald glen connection\301 - 400 stormwater details\5 .2573 1 7504 301 r1.dwg

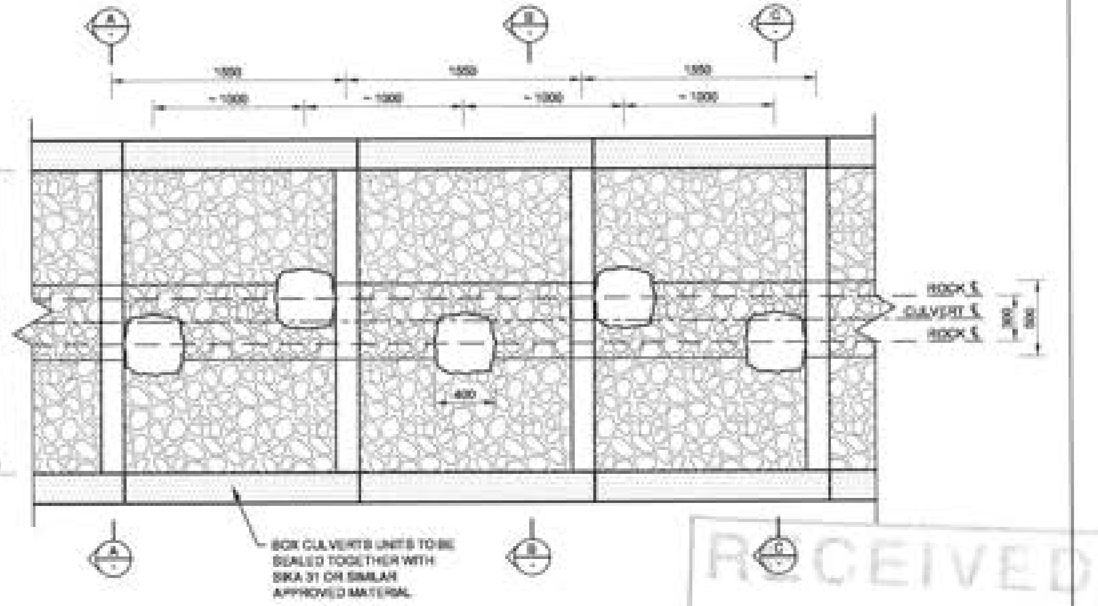


NORTHERN CULVERT (EMERALD GLEN) PLAN
PLAN THROUGH CULVERT ONLY
SCALE: 1:100[A1] 1:200[A3]

Rip Rap	Type 1	Type 2
D50	400	200
D90	300	150
D15	200	100

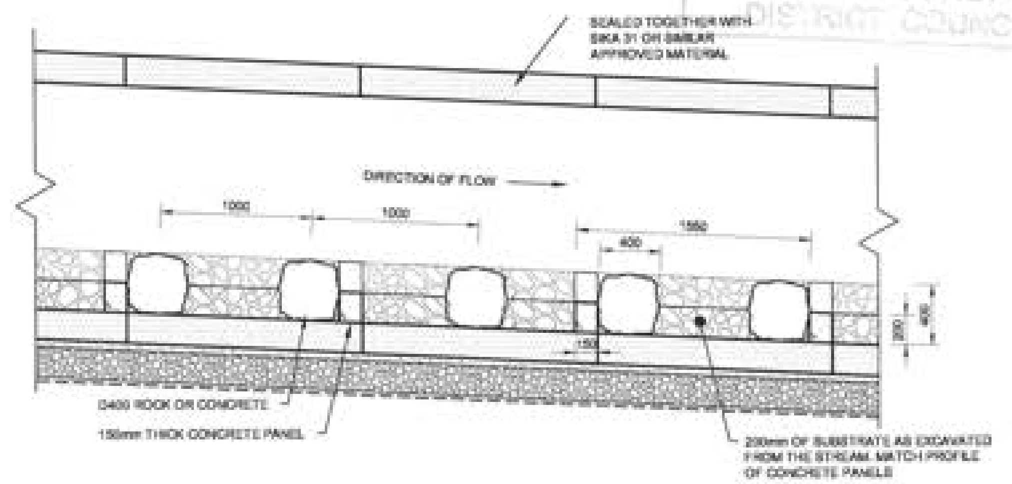


NORTHERN CULVERT (EMERALD GLEN) LONG SECTION
SCALE: 1:100[A1] 1:200[A3]

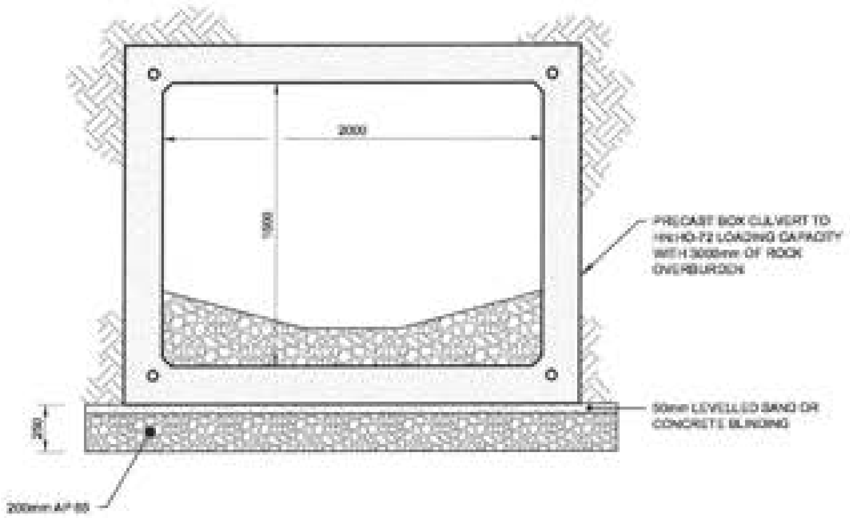


DETAIL 1: PLAN OF FISH PASS
SCALE: 1:25[A1] 1:50[A3]

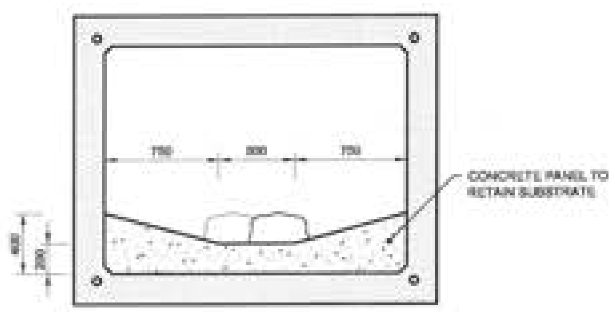
RECEIVED
2 0 SEP 2010
KAPITI COAST DISTRICT COUNCIL



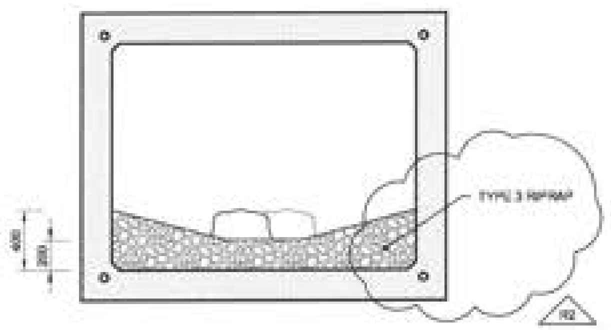
DETAIL 2: FISH PASS DETAILS
SCALE: 1:25[A1] 1:50[A3]



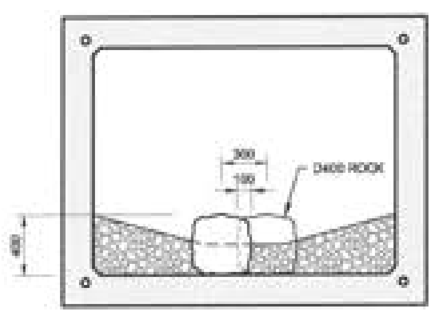
CULVERT BEDDING DETAIL
SCALE: 1:20[A1] 1:40[A3]



SECTION A-A
SCALE: 1:25[A1] 1:50[A3]



SECTION B-B
SCALE: 1:25[A1] 1:50[A3]



SECTION C-C
SCALE: 1:25[A1] 1:50[A3]

CONSTRUCTION

REFERENCE DRAWINGS:
5/2573/1/7504/301 TO 305 CULVERTS-EMERALD GLEN
5/2573/1/7504/311 TO 313 CULVERTS-MINOR
5/2573/1/7504/321 AND 322 OPEN CHANNELS
5/2573/1/7504/331 ROAD DRAINAGE

Revision	Amendment	Approved	Revision Date
R0	ISSUED FOR CONSENT		
R1	ISSUED FOR INFO	C.L.	19/08/10
R2	ISSUED FOR CONSTRUCTION	C.L.	8/09/10

NZ TRANSPORT AGENCY
WAKA KOTAHI

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PO Box 12-003, Thorndon
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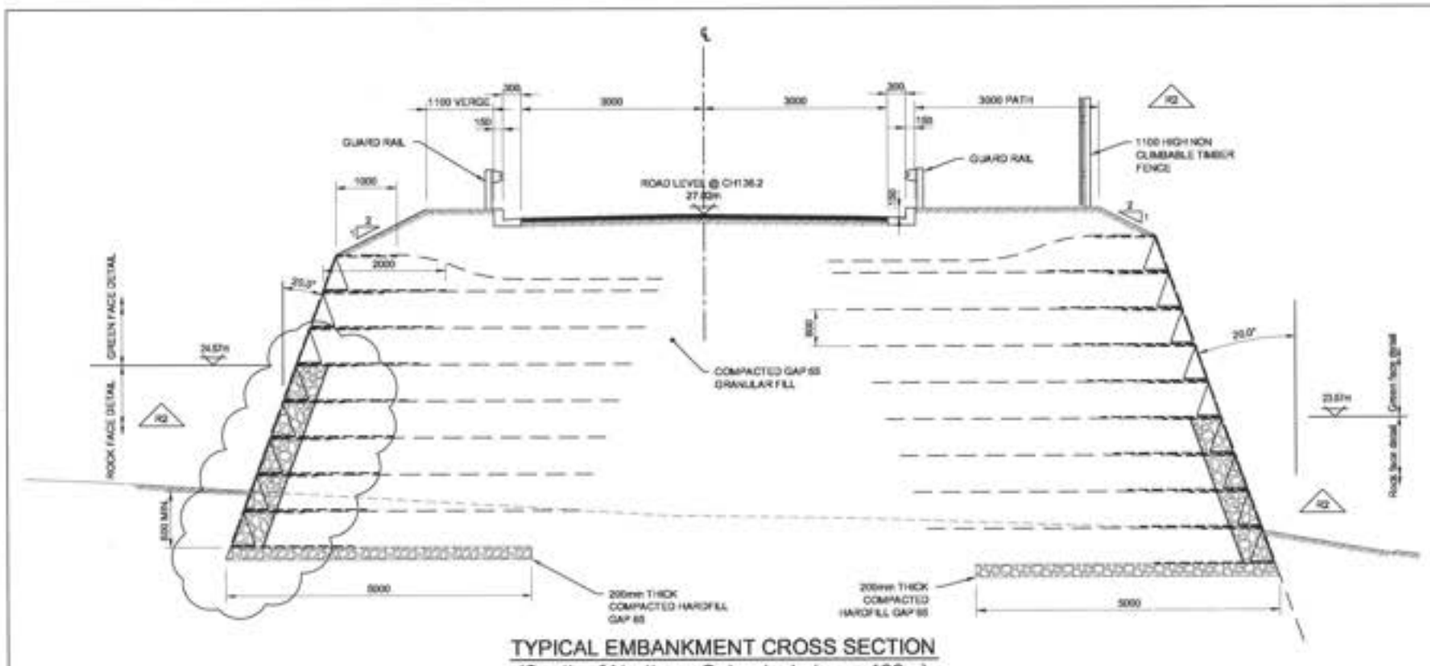
NZ Transport Agency
Emerald Glen Connection Road, Kapiti
Road Alignment

Culvert Details - Emerald Glen Culvert
Culvert Section and Fish Pass Details

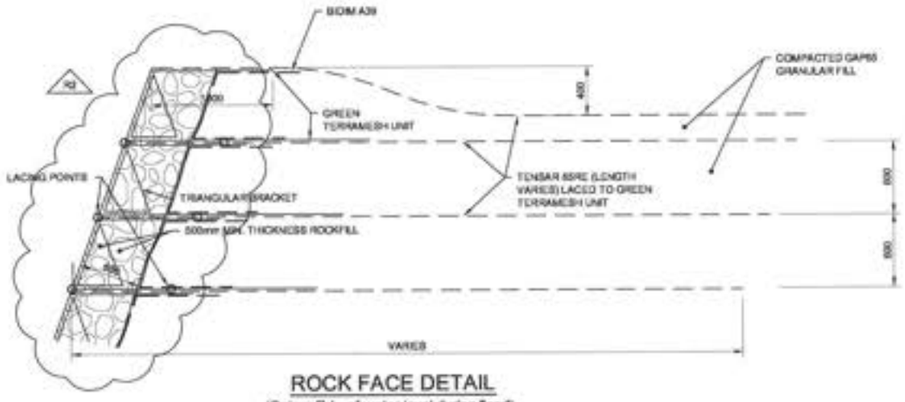
Drawn	Designed	Approved	Revision Date
H.Clarke	R.Coles	C. Lee	SEPT 2010

Project No.	Scale	Drawing No.	Sheet No.	Revision
5-C1744.01	As Shown	5 / 2573 / 1 / 7504	302	R2

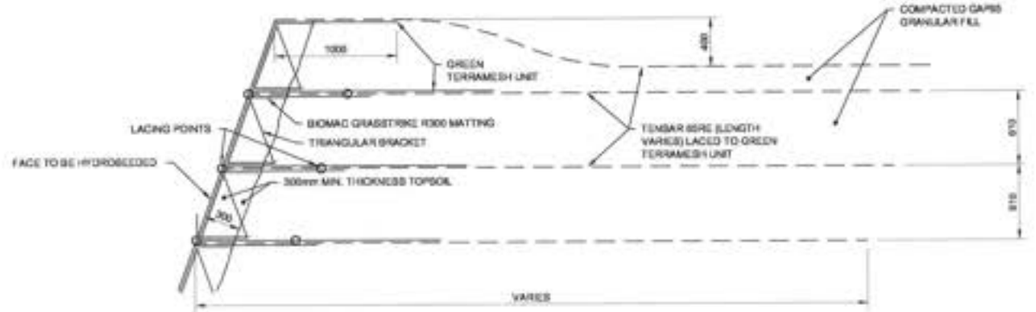
Original Sheet Size A1 [841x594]



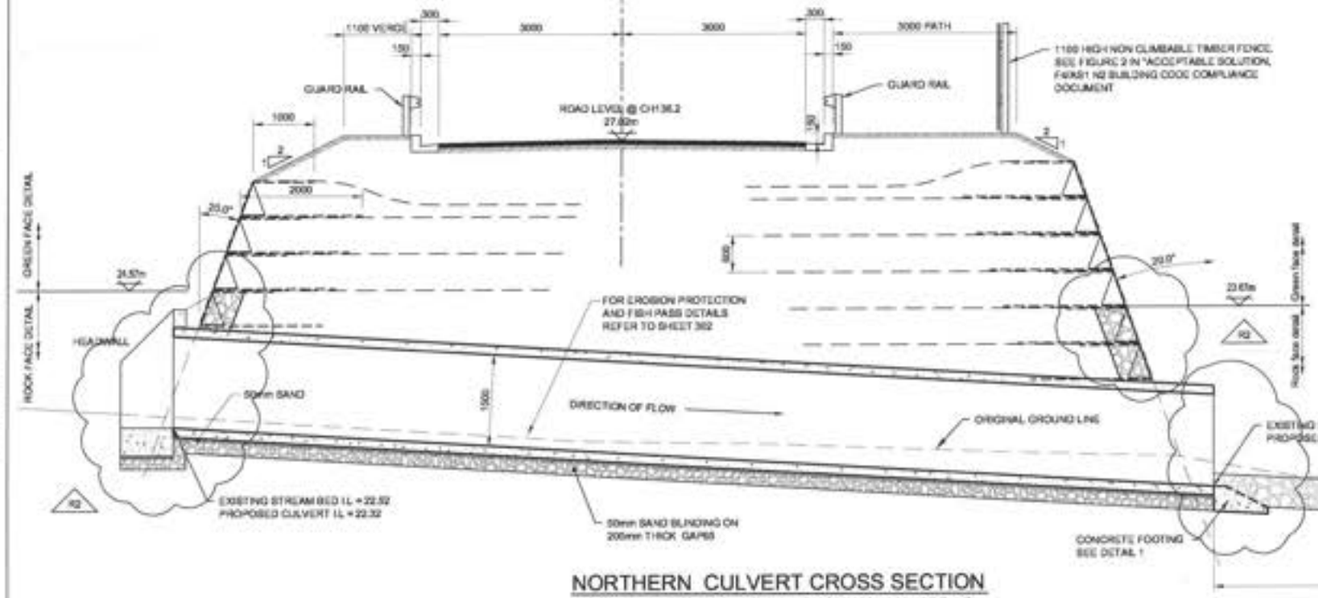
TYPICAL EMBANKMENT CROSS SECTION
(South of Northern Culvert, chainage 138m)
SCALE: 1:50[A1] 1:100[A3]



ROCK FACE DETAIL
(Below R.L. of water level during flood)
SCALE: 1:25[A1] 1:50[A3]



GREEN FACE DETAIL
(Above R.L. of water level during flood)
SCALE: 1:25[A1] 1:50[A3]



NORTHERN CULVERT CROSS SECTION
(by Emerald Glen Road, Chainage 136m)
SCALE: 1:50[A1] 1:100[A3]

CONCRETE FOOTING DETAIL 1
SCALE: 1:20[A1] 1:40[A3]

A2

CONSTRUCTION

Notes.
1. Reinforcement shall be Tensar 65RE or 85RE Geogrid
2. The reinforcement shall be connected to the Terramesh unit by lacing at 2 points
3. The reinforcement shall extend from the face of the Terramesh unit into the fill embankment (lengths shown)
4. The reinforcement shall be orientated with the highest strength axis perpendicular to the wall face alignment
5. Reinforcement shall be continuous throughout their embedment lengths and placed side by side to provide 100% coverage. Spliced connections between shorter pieces of Geogrid or gaps between adjacent pieces of reinforcement are not permitted
6. The reinforcement shall be pulled tight prior to backfill placement on the reinforcement.

REFERENCE DRAWINGS:
S/2573/1/7504/301 TO 305 CULVERTS-EMERALD GLEN
S/2573/1/7504/311 TO 313 CULVERTS-MINOR
S/2573/1/7504/321 AND 322 OPEN CHANNELS
S/2573/1/7504/331 ROAD DRAINAGE

Revision	Amendment	Approved	Revision Date
R0	ISSUED FOR INFO		
R1	RE-NUMBERED AND REVISED	C.L.	19/09/10
R2	ISSUED FOR CONSTRUCTION	C.L.	20/9/10

NZ TRANSPORT AGENCY
WAKA KOTAHI

OPUS
Wellington Office
PO Box 12 003, Thorndon
Wellington 6144, New Zealand
t 64 4 471 7000

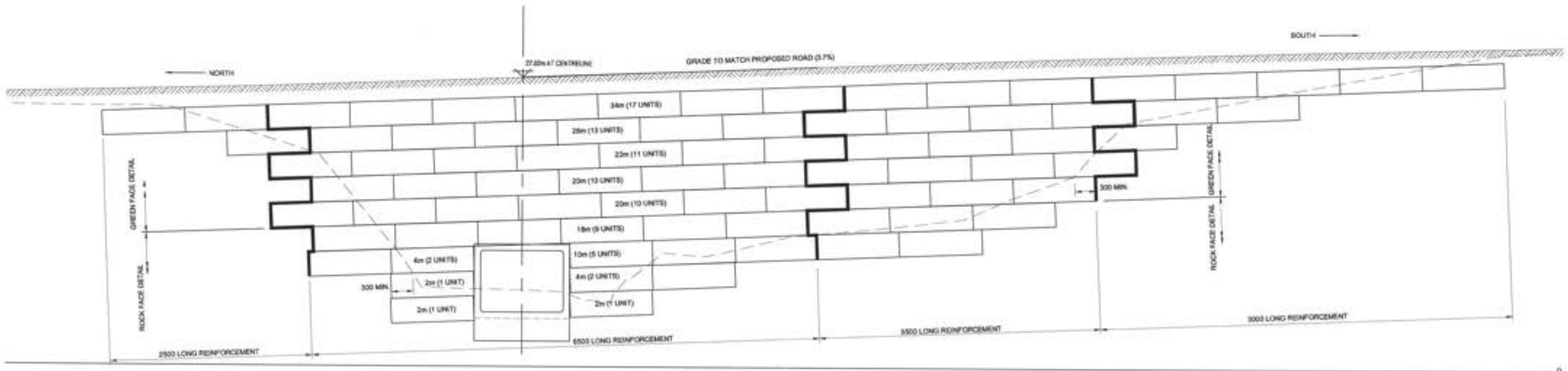
Drawn	Designed	Approved	Revision Date
H Clarke	R Coles & J.O	C Lee	SEPT 2010

Project: NZ Transport Agency
Emerald Glen Connection Road, Kapiti
Road Alignment

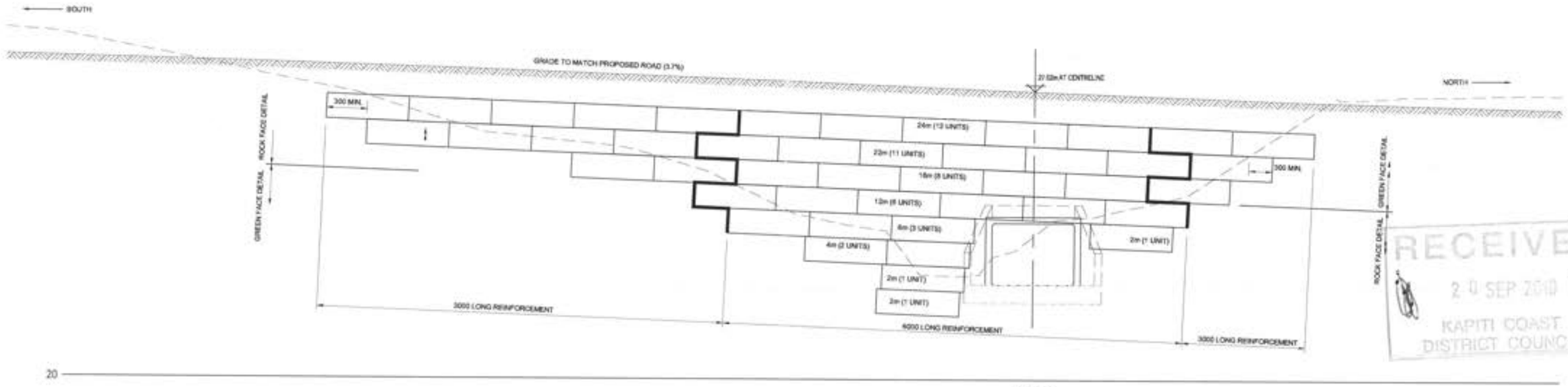
Name: Culverts - Emerald Glen Culvert
Section Showing Terramesh Earth Wall Details

Project No.	Scale	Drawing No.	Sheet No.	Revision
5-C1744.01	As Shown	5 / 2573 / 1 / 7504	303	R2

Original Sheet Size A1 (841x594) Plot Date 09/09/10 @ 09:52 x:\transport\roads\design\sh 1\emerald glen connection\0201 - 400 stormwater details\E 2573 1 7504 303 r0.304 r0.dwg



8.4m
DOWNSTREAM ELEVATION (LOOKING UPSTREAM)



24.2m
UPSTREAM ELEVATION (LOOKING DOWNSTREAM)

CONSTRUCTION

Notes.
1. Reinforcement shall be Tensar 60RE or 80RE Geogrid.
2. The reinforcement shall be connected to the Terramesh unit by lacing at 2 points.
3. The reinforcement shall extend from the face of the Terramesh unit into the fill embankment (lengths shown).
4. The reinforcement shall be orientated with the highest strength axis perpendicular to the wall face alignment.
5. Reinforcement shall be continuous throughout their embedment lengths and placed side by side to provide 100% coverage. Spliced connections between shorter pieces of Geogrid or gaps between adjacent pieces of reinforcement are not permitted.
6. The reinforcement shall be pulled tight prior to backfill placement on the reinforcement.

1:50 @ A1

REFERENCE DRAWINGS:
5/2573/1/7504/301 TO 305 CULVERTS-EMERALD GLEN
5/2573/1/7504/311 TO 313 CULVERTS-MINOR
5/2573/1/7504/321 AND 322 OPEN CHANNELS
5/2573/1/7504/331 ROAD DRAINAGE

Revision	Amendment	Approved	Revision Date
R0	ISSUED FOR INFO.		
R1	RE-NUMBERED AND REVISED	C.L.	16/9/10
R2	ISSUED FOR CONSTRUCTION	C.L.	8/09/10

NZ TRANSPORT AGENCY
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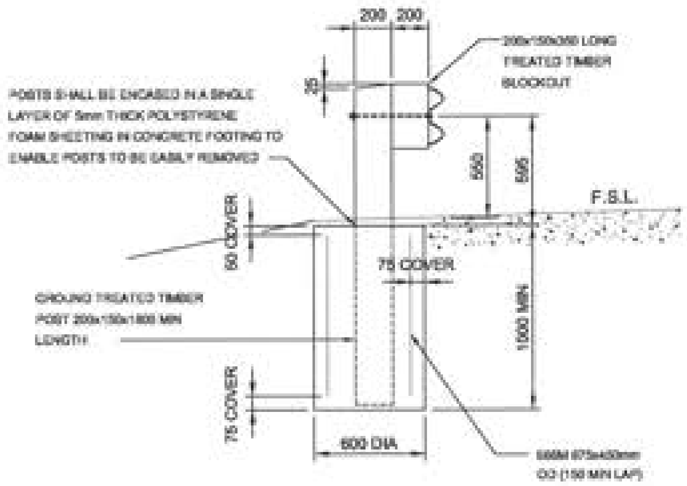
Drawn	Designed	Approved	Revision Date
H.Clarke	R.Colvin & J.O	C.Lee	SEPT. 2010

Project No.	Scale	Drawing No.	Sheet No.	Revision
5-C1744.01	1:50(A1), 1:100(A3)	5 / 2573 / 1 / 7504	304	R2

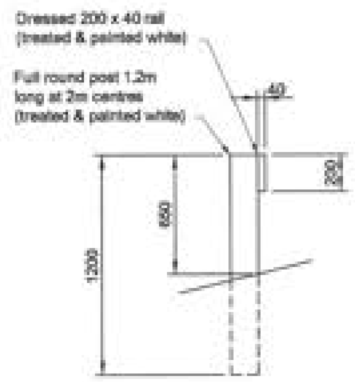
Project: NZ Transport Agency
Emerald Glen Connection Road, Kapiti
Road Alignment

Sheet: Culverts - Emerald Glen Culvert
End Elevations Showing Terramesh Earth Wall Details

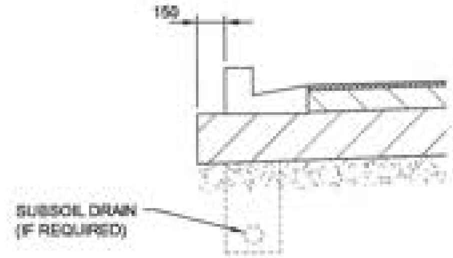
Original Sheet Size A1 (841x594) Plot Date 08/09/10 @ 15:56 s:\transport\roads\design\jobs\Tenterfield glen connection\201 - 400 stormwater data\s5 2573 1 7504 303 r2.304 r2.dwg



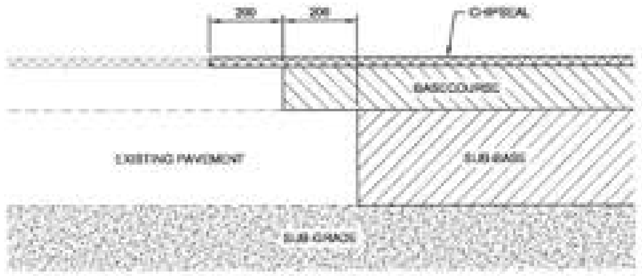
TYPICAL GUARDRAIL POST DETAIL
IN CONCRETE FOOTING
1:20



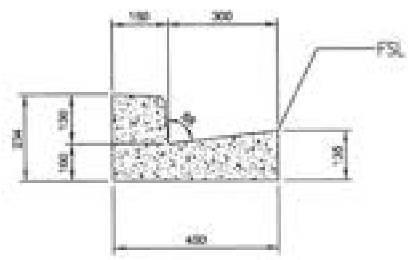
SIGHTRAIL
1:20



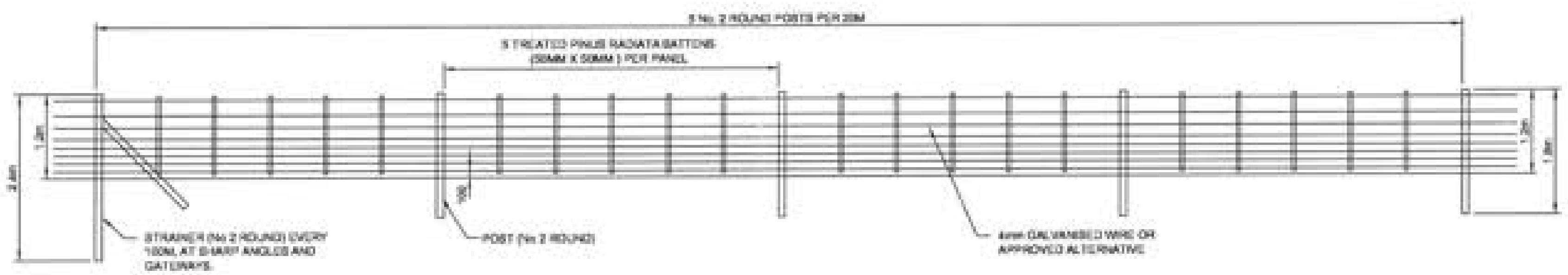
KERB & CHANNEL DETAIL
1:20



TRANSVERSE JOINT BETWEEN
NEW & EXISTING PAVEMENT
1:10



KERB AND CHANNEL - TYPE 1
SCALE 1:10



PERMANENT POST AND 8-WIRE FENCE DETAIL
SCALE 1:50

CONSTRUCTION

Revision	Amendment	Approved	Revision Date
R2	ISSUED FOR CONSTRUCTION	C.L.	02/09/2010

NZ TRANSPORT AGENCY
WAKA KOTAHI

OPUS
Wellington Office

NEW ZEALAND TRANSPORT AGENCY
EMERALD GLEN CONNECTION, KAPITI
ROAD ALIGNMENT

MISCELLANEOUS DETAILS

Drawn	Designed	Scale	Drawing No.	Sheet No.	Revision
G.J.YOUNG	R.Q.	AS SHOWN	5/2573/1/7504	122	R2

Project No. 5C1744.01

GUIDANCE ON USE OF PRODUCER STATEMENTS

Producer statements were first introduced with the Building Act 1992. The producer statements were developed by a combined task committee consisting of members of the New Zealand Institute of Architects, Institution of Professional Engineers New Zealand, Association of Consulting Engineers New Zealand in consultation with the Building Officials Institute of New Zealand. The original suite of producer statements has been revised at the date of this form as a result of enactment of the Building Act (2004) by these organisations to ensure standard use within the industry.

The producer statement system is intended to provide Building Consent Authorities (BCAs) with reasonable grounds for the issue of a Building Consent or a Code Compliance Certificate, without having to duplicate design or construction checking undertaken by others.

PS1 Design	Intended for use by a suitably qualified independent design professional in circumstances where the BCA accepts a producer statement for establishing reasonable grounds to issue a Building Consent;
PS2 Design Review	Intended for use by a suitably qualified independent design professional where the BCA accepts an independent design professional's review as the basis for establishing reasonable grounds to issue a Building Consent;
PS3 Construction	Forms commonly used as a certificate of completion of building work are Schedule 6 of NZS 3910:2003[1] or Schedules E1/E2 of NZIA's SCC 2007 [2]
PS4 Construction Review	Intended for use by a suitably qualified independent design professional who undertakes construction monitoring of the building works where the BCA requests a producer statement prior to issuing a Code Compliance Certificate. This must be accompanied by a statement of completion of building work (Schedule 6).

The following guidelines are provided by ACENZ, IPENZ and NZIA to interpret the Producer Statement.

Competence of Design Professional

This statement is made by a Design Firm that has undertaken a contract of services for the services named, and is signed by a person authorised by that firm to verify the processes within the firm and competence of its designers.

A competent design professional will have a professional qualification and proven current competence through registration on a national competence-based register, either as a Chartered Professional Engineer (CPEng) or a Registered Architect.

Membership of a professional body, such as the Institution of Professional Engineers New Zealand (IPENZ)or the New Zealand Institute of Architects (NZIA), provides additional assurance of the designer's standing within the profession. If the design firm is a member of the Association of Consulting Engineers New Zealand (ACENZ), this provides additional assurance about the standing of the firm.

Persons or firms meeting these criteria satisfy the term "suitably qualified independent design professional".

*** Professional Indemnity Insurance**

As part of membership requirements, ACENZ requires all member firms to hold Professional Indemnity Insurance to a minimum level.

The PI insurance minimum stated on the front of this form reflects standard, small projects. If the parties deem this inappropriate for large projects the minimum may be up to $500,000.

Professional Services during Construction Phase

There are several levels of service which a Design Firm may provide during the construction phase of a project (CM1-CM5)[3] (OL1-OL4)[2]. The Building Consent Authority is encouraged to require that the service to be provided by the Design Firm is appropriate for the project concerned.

Requirement to provide Producer Statement PS4

Building Consent Authorities should ensure that the applicant is aware of any requirement for producer statements for the construction phase of building work at the time the building consent is issued as no design professional should be expected to provide a producer statement unless such a requirement forms part of the Design Firm's engagement.

Attached Particulars

Attached particulars referred to in this producer statement refer to supplementary information appended to the producer statement.

Refer Also:

1 *Conditions of Contract for Building & Civil Engineering Construction NZS 3910: 2003*

2 *NZIA Standard Conditions of Contract SCC 2007 (1st edition)*

3 *Guideline on the Briefing & Engagement for Consulting Engineering Services (ACENZ/IPENZ 2004)*

www.acenz.org.nz
www.ipenz.org.nz
www.nzia.co.nz

IPENZ ENGINEERS NEW ZEALAND | NEW ZEALAND INSTITUTE OF ARCHITECTS INCORPORATED | ACENZ

Building Code Clause(s) B1 & B2

PRODUCER STATEMENT – PS1 – DESIGN

(Guidance notes on the use of this form are printed on the reverse side)*

ISSUED BY: Opus International Consultants Limited
(Design Firm)

TO: New Zealand Transport Authority
(Owner/Developer)

TO BE SUPPLIED TO: Kapiti Coast District Council
(Building Consent Authority)

IN RESPECT OF: Terramesh Green Wall
(Description of Building Work)

AT: Emerald Glen Connection, Northern Culvert
(Address)

N/A LOT N/A DP N/A SO N/A

RECEIVED 20 SEP 2010 KAPITI COAST DISTRICT COUNCIL

We have been engaged by the owner/developer referred to above to provide design of retaining wall at the northern culvert services in respect of the requirements of
(Extent of Engagement)

Clause(s) B1 and B2 of the Building Code for

○ All or ◉ Part only (as specified in the attachment to this statement), of the proposed building work.

The design carried out by us has been prepared in accordance with:

☑ Compliance Documents issued by Department of Building & Housing B1/VM4
(verification method / acceptable solution)

or

☐ Alternative solution as per the attached schedule

The proposed building work covered by this producer statement is described on the drawings titled Culverts - Emerald Glen Culvert Section Showing Terramesh Earth Wall Details and numbered 512573/1/7504/303 R2 & 304 R2, together with the specification, and other documents set out in the schedule attached to this statement.

On behalf of the Design Firm, and subject to:

(i) Site verification of the following design assumptions refer to the Specification

(ii) All proprietary products meeting their performance specification requirements;

I **believe on reasonable grounds** the building, if constructed in accordance with the drawings, specifications, and other documents provided or listed in the attached schedule, will comply with the relevant provisions of the Building Code.

I, Alexei Murashev (Name of Design Professional) am: ☑ CPEng 178533 #

☐ Reg Arch #

I am a Member of : ☑ IPENZ ☐ NZIA and hold the following qualifications:

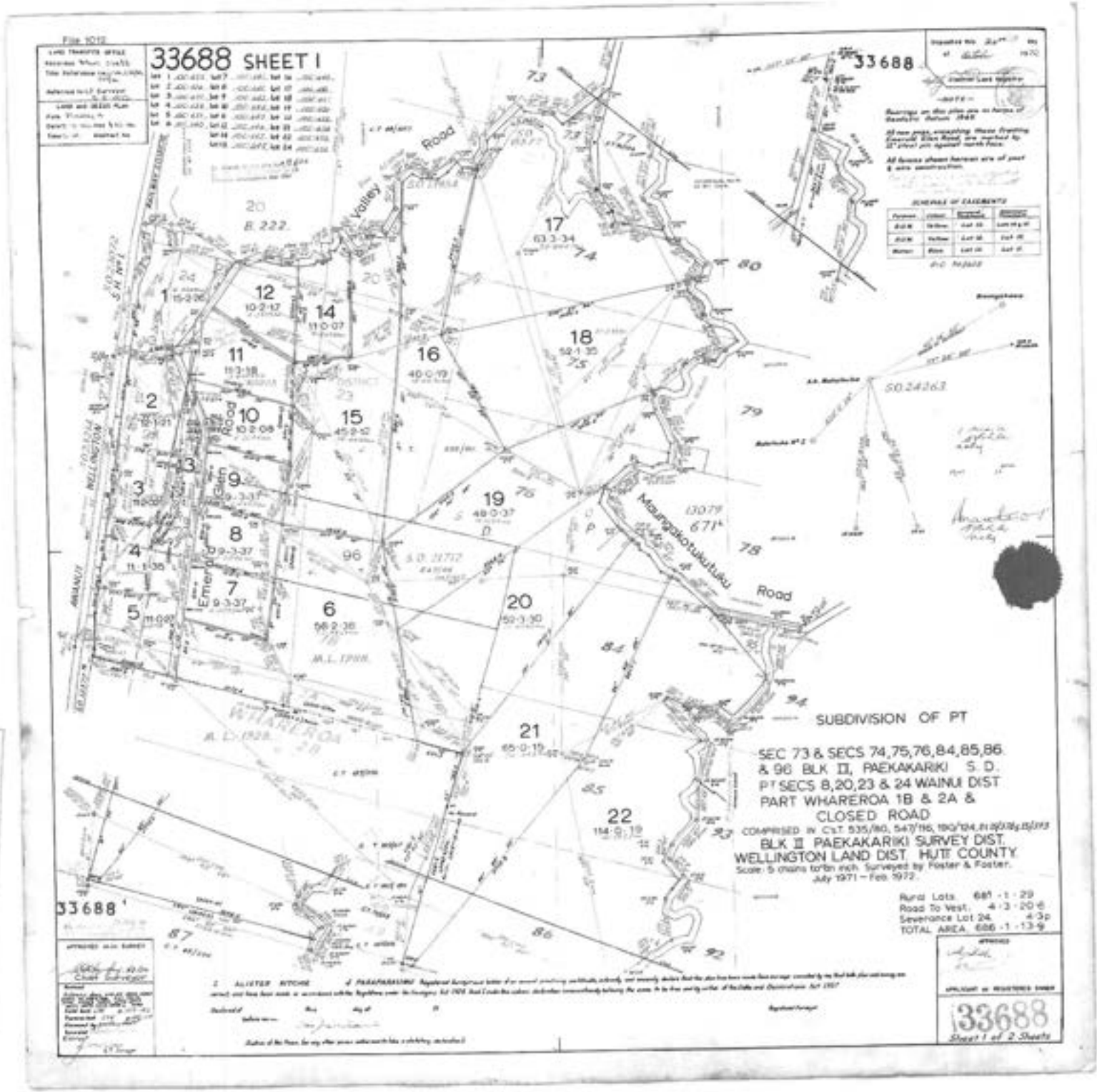
The Design Firm issuing this statement holds a current policy of Professional Indemnity Insurance no less than $200,000*.
The Design Firm is a member of ACENZ ◉ YES ○ NO

SIGNED BY Alexei Murashev ON BEHALF OF Opus International Consultants
(Design Firm)

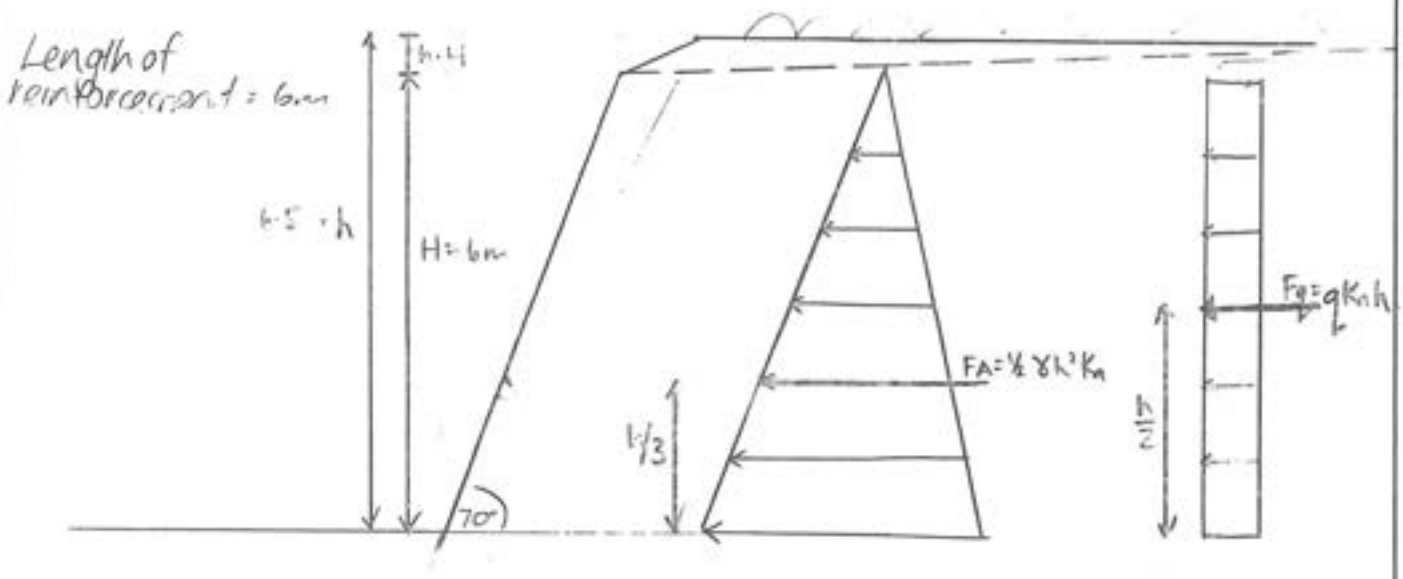
Date 14/09/10 (signature)

Note: This statement shall only be relied upon by the Building Consent Authority named above. Liability under this statement accrues to the Design Firm only. The total maximum amount of damages payable arising from this statement and all other statements provided to the Building Consent Authority in relation to this building work, whether in contract, tort or otherwise (including negligence), is limited to the sum of $200,000.*

This form is to accompany **Form 2 of the Building (Forms) Regulations 2004** for the application of a Building Consent.



External stability under static conditions



Minimum Embedment.

* note: assume flat backfill

Slope in front of wall = 3H:1V ⇒ H/10
= 600mm

$$Kaf = \frac{\sin^2(\theta+\phi)}{\sin^2\theta \sin(\theta-\delta)\left[1+\sqrt{\frac{\sin(\phi+\delta)\sin(\phi-\beta)}{\sin(\theta-\delta)\sin(\theta+\beta)}}\right]^2}$$

$\phi = 35°$
$\beta = 3°$ (ignore)
$\delta = \phi/2 = 17.5°$
$\theta = 110°$

$$Kaf = \frac{\sin^2(145)}{\sin^2 110 \sin 92.5\left[1+\sqrt{\frac{\sin(52.5)\sin(32)}{\sin 92.5 \sin 113}}\right]^2} \quad (35),\ (115)$$

$$= \frac{0.329}{0.883\left[1+0.676\right]^2} \quad (0.676)$$

$Kaf = 0.133$ (0.130)

OPUS

$F_A = 0.5 K_{AP} \gamma_f h^2 = 0.5 \times 0.133 \times 19 \times 6^2$

$= 45.5\ kN$

Weight of wall $= \gamma h L$

$= 19 \times 6 \times 6$

$= 684\ kN$

$F_q = q K_{af} h = 10 \times 0.133 \times 6$

$= 7.98\ kN$

1. Forward Sliding

$F_h^* \leq \Phi F_v^* \tan\phi$ (A/B)

$F_h^* \leq T_{di,2}^*$ (C)

$F_h^* \leq \Phi c_u L$ (cohesive soil)

$F_h^* = (45.5 + 7.98) \times 1.5$

$= 80.22\ kN$

$F_v^* = 684 \times 1.0$

$= 684\ kN$ where $\Phi = 1.0$

$\Phi F_v^* \tan\phi = 1.0 \times 684 \times \tan 35$

$= 478\ kN$

$> F_h^*$ OK!!

$T_{di,2}^* = T_{i,2} \Phi \Phi_n$ where $\Phi = 0.8$ Table A6, $\Phi_n = 1.0$ Table A5

$T_{dp}^* = (\tan\rho(\alpha \sigma_v' L_e)) \Phi \Phi_n$ $\alpha_s = 0.9$ Maccaferri interaction factor

$= (\tan 35 \times 0.9 \times 19 \times 6 \times 6) \times 0.8 \times 1.0$

$= 345\ kN$

$> F_h^*$ OK!!

Calculation Sheet

Project/Task/File No:	Sheet No of
Project/Description:	Office:
	Computed: / /
	Checked: / /

2. Bearing Capacity Failure

$\sigma_v^* = F_v^* / (L - 2e)$

e = 700 mm (refer to Slope/W diagram)

$\sigma_v^* = \frac{684}{(6 - 2\times 0.7)}$

$= 148.7$ kN/m

$\sigma_v^* \leq \Phi q_u$

q_u = $cN_c + p_o N_q + 1/2\ \gamma B N_\gamma$

$= 19 \times 6 \times 23.8 + 1/2 \times 19 \times 7 \times 33.9$

$= 6,050$ kPa

$\phi = 35$
$N_c = 46.1$
$N_q = 33.3$
$N_\gamma = 32.9$

Reduced Foundation Strength

$\Phi q_u = 0.6 \times 6050$ $\quad \Phi = 0.6$

$= 3,630.3$ kN/m

$> \sigma_v^*$ OK!!

$\phi = 28$ $\gamma = 17$
$N_c = 25.8$
$N_q = 14.7$
$N_\gamma = 10.9$

$\therefore q_{ult} = 2,150$ kN/m

$0.6 q_{ult} = 1288.8$

$\gg \sigma_v^*$

OK!!

3. Overturning

M_d^* $= 1.5 \times [45.5 \times 2 + 7.98 \times 3]$

$= 172.4$ kN/m

M_r^* $= 1.0 \times [684 \times 3]$

$= 2052$ kNm

$172 \leq 2052 \times 0.75$

≤ 1539 kNm OK!!

References: Opus Retaining Wall Design Guide Notes

OPUS

Calculation Sheet

Project/Task/File No:	Sheet No of
Project/Description:	Office:
	Computed: / /
	Checked: / /

Internal stability under seismic conditions

1 ~~Reinforce~~

$$K_{ar} = \frac{\sin^2(\theta + \phi_r)}{\sin^3\theta\left[1 + \frac{\sin\phi_r}{\sin\theta}\right]^2} \qquad \theta = 110° \quad \phi_r = 35°$$

$$= \frac{\sin^2(145)}{\sin^3 110\left[1 + \frac{\sin 35}{\sin 110}\right]^2} \qquad = \frac{0.329}{0.8298 (\times 2.593)}$$

$$= 0.153$$

1. Internal sliding

Use 6m long Tensar 65RE @ 0.6m CRS vert

$$F^*_{h,2} = 0.5 K_{ar} \gamma_r H^2$$
$$= 0.5 \times 0.153 \times 19 \times 6^2$$
$$= 52.3 \text{ kN}$$

$T^*_{di,2}$ = 345 kN (from External stability)

T^*_{fr} =

$F^*_{h2} < T^*_{di,2} + T^*_{fr}$

2 Connection Failure.

$F^*_j \leq \Phi_1 T_{c1}$ $\qquad \Phi = 1.0$ (static conditions)

$F^*_j = \sigma^*_{hj} S_{vj}$

$= 19 \times 0.6 \times 0.6$

$= 6.84 \text{ kN/m}$

	Normal load	Connection Strength
At top	11.4 kN	15 kN/m
At bottom	114 kN	50 kN/m

(refer to table in Maccaferri brochure)

$\Phi T_c = 15 \text{ kN/m} \geq F^*_j$ OK!!

OPUS

Calculation Sheet

Project/Task/File No:	Sheet No of
Project/Description:	Office:
Design PGA.	Computed: / /
	Checked: / /

$$C(T) = C_h(T)\, Z\, R\, N(T,D) \times S_p$$

Subsoil Class = C

$S_p = 0.8$

$C_h(T) = 1.33$

$N(T,D) = 1$ ← $D \leq 2$ km. $\Rightarrow N(T,D) = N_{max}'(T)$ $= 0$

Importance Level = 2 (permanent) } from bridge manual.

APE = 1/1000

$\Rightarrow R = 1.3$

$Z = 0.4$

$C(T) = 1.33 \times 0.8 \times 1.3 \times 0.4$

$= 0.553$

For stability

$C(T) = 1.33 \times 1.3 \times 0.4 \times 2$

$= 0.69g$

OPUS

Calculation Sheet

Project/Task/File No:	Sheet No 1 of 4
Project/Description:	Office:
	Computed: / /
	Checked: / /

Seismic Loading

NZ Bridge Manual =

Design PGA = 0.55g

* Based on Guidelines for Design and construction of Geosynthetic-Rail forest Soil structures in NZ -- Alexi, Murashev

$a_h = a_{h\,ext} = 0.6 \times PGA$

$= 0.33g$

$a_h = a_{h\,int} = (1.3 - PGA)PGA$

$= 0.41g$

$I = 0 \quad \varepsilon = 0$
$\theta = 110$
$\phi = 35$
$a_v = 0$
$a_h = 0.55g$

$$K_{AE} = \frac{\cos^2(35 - 90 + 110)}{\left[\cos^2(90-110)\cos(90-110)\right]\left[1+\sqrt{\frac{\sin(35+35)\sin(35-20)}{\cos(90-35-110)\cos(-90-110)}}\right]^2}$$

$$= \frac{0.329}{[0.830][1+0.781]^2}$$

$$= 0.125$$

$F_{AE} = 0.5 \times K_{AE} \gamma h^2$

$= 0.5 \times 0.125 \times 19 \times 6^2$

$= 42.75 \quad \Rightarrow 0.0625\,\gamma h^2$

-

OPUS

External Stability under seismic conditions.

Inertia Force = $F_{ie} = 0.5 a_{h,ext} \gamma h^2$

$= 0.5 \times 0.33 \times (19 \times 6^2)$

$= 112.86$

F_A (static) = 45.5 kN

$F_{AE}' = F_A + 0.5 \Delta F_{AE}$

$K_A = K_{AP}$

$K_{AR} = \dfrac{\sin^2(\theta + \phi)}{\sin^2\theta \left[1 + \sqrt{\dfrac{\sin(\phi + \delta) \sin(\phi - \beta)}{\sin(\theta - \beta)}}\right]^2} = \dfrac{\sin^2(146)}{\sin^2 110 \left[1 + \sqrt{\dfrac{\sin 36 \sin 110}{\sin 110}}\right]^2}$ ($\theta = 110°$, $\phi = 35$)

$= \dfrac{0.329}{0.830 \times 2.593} = 0.153$

$\Delta K_{AE} = K_{AE} - K_A = 0.125 - 0.153$

$= -0.028$

$\Delta F_{AE} = 0.5 \times -0.028 \times 19 \times 6^2$

$= 9.58$ kN

$F_{AE}' = F_A + 0.5 \Delta F_{AE}$

$= 45.5 + 0.5 \times 9.576$

$= 40.712$ kN

θ (surcharge) = 8 kN

Forward Sliding.

i) $\phi F^* \tan \phi$ ($\phi = 0.9$ (seismic))

$= 0.9 \times 684 \times \tan 35$

$= 431$ kN

$F_h^* = 1.0 \times (112.9 + 40.7 + 8) = 161.6$ kN < 431 kN

OK!!

Forward Sliding

$F^*_h \leq \phi F^*_v \tan\phi$

$F^*_h \leq T^*_{di,2}$

$F^*_h \leq \phi c_u L$

~~$F^*_h = (45.5 + 7.98) \times 1.0$~~

~~$\rightarrow 53.5$ kN~~

i) $F^*_v = 684$ kN

$\phi F^*_v \tan\phi = 0.9 \times 684 \times \tan 35$ $\quad \phi = 0.9$ (seismic)

$= 431$ kN

$F^*_h = F_{fR} + F_{AE}' + F_q$

$= 1.0 (112.9 + 40.7 + 8)$

$= 161.6$ kN < 431 kN OK!!

ii) $T^*_{di,2} = 345$ kN $> F^*_h = 161.6$ kN OK!!

Bearing Failure

$\phi = 0.7$ (seismic)

$e = 700$ mm

$\sigma^*_v = F^*/(L - 2e)$

$= 684$ kN$/(6 - 2 \times 0.7)$

$= 148.7$ kN/m

$\sigma^*_v \leq \phi q_u$

$q_{ult} = 6050$ (high strength parameters) $q_u = 2150$ kN/m (lower strength parameters)

$\phi q_u = 0.7 \times 6050$ $\quad 0.7 q_u = 902.1$ kN/m $\gg \sigma^*_v$

$= 4235 > \sigma^*_v$ OK!!

OPUS

Calculation Sheet

Project/Task/File No:	Sheet No 4 of 4
Project/Description:	Office:
	Computed: / /
	Checked: / /

Overturning

ϕ-reduction factor = 0.9

$M_d^* \leq \phi M_r^*$

$M_d^* = 1.0 \times [45.5 \times 2 + 7.98 \times 3]$

$= 106.92$ kN/m

$\phi M_r^* = 0.9 \times [684 \times 3]$

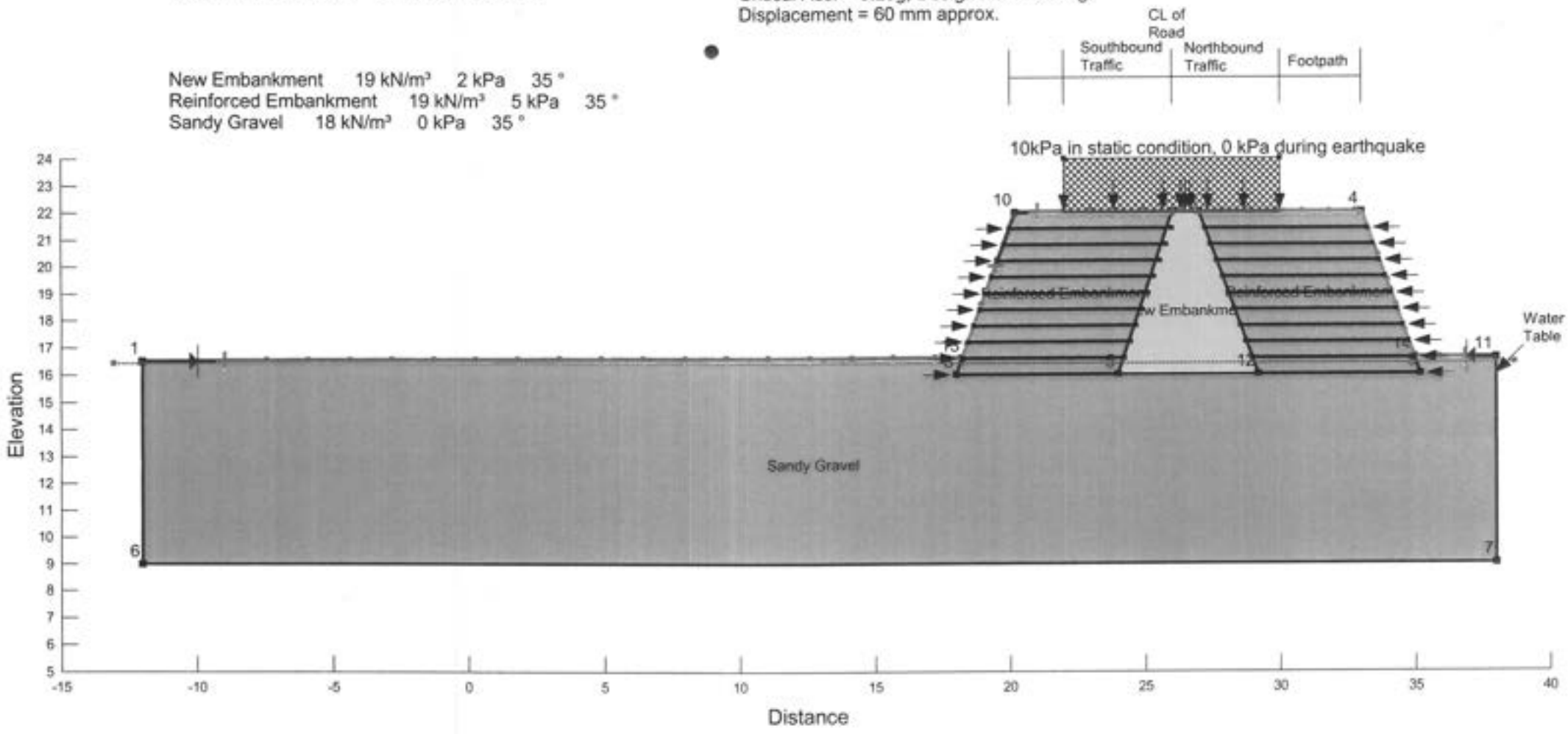
$= 1847$ kN/m $> M_d^*$ OK !!

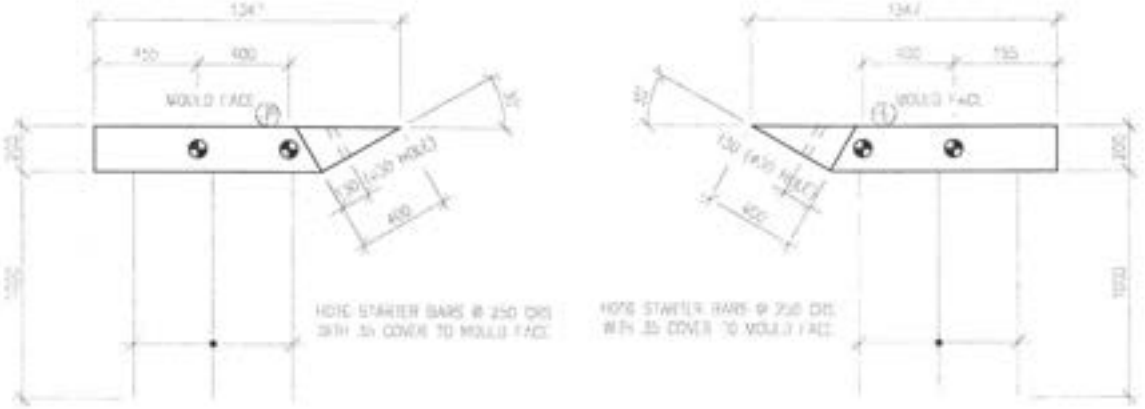
OPUS

Northern Culvert - Circular Failure

FOS (Static) = 1.558
Critical Acc. = 0.23g, Design PGA = 0.55g
Displacement = 60 mm approx.

New Embankment 19 kN/m³ 2 kPa 35 °
Reinforced Embankment 19 kN/m³ 5 kPa 35 °
Sandy Gravel 18 kN/m³ 0 kPa 35 °





NOTES:

1 MANUFACTURE IN ACCORDANCE WITH NZS 3109:1997 (PRECAST UNITS)

2 CONCRETE STRENGTH @ 28 DAYS 50MPa, MIN. STRIPPING STRENGTH 15MPa

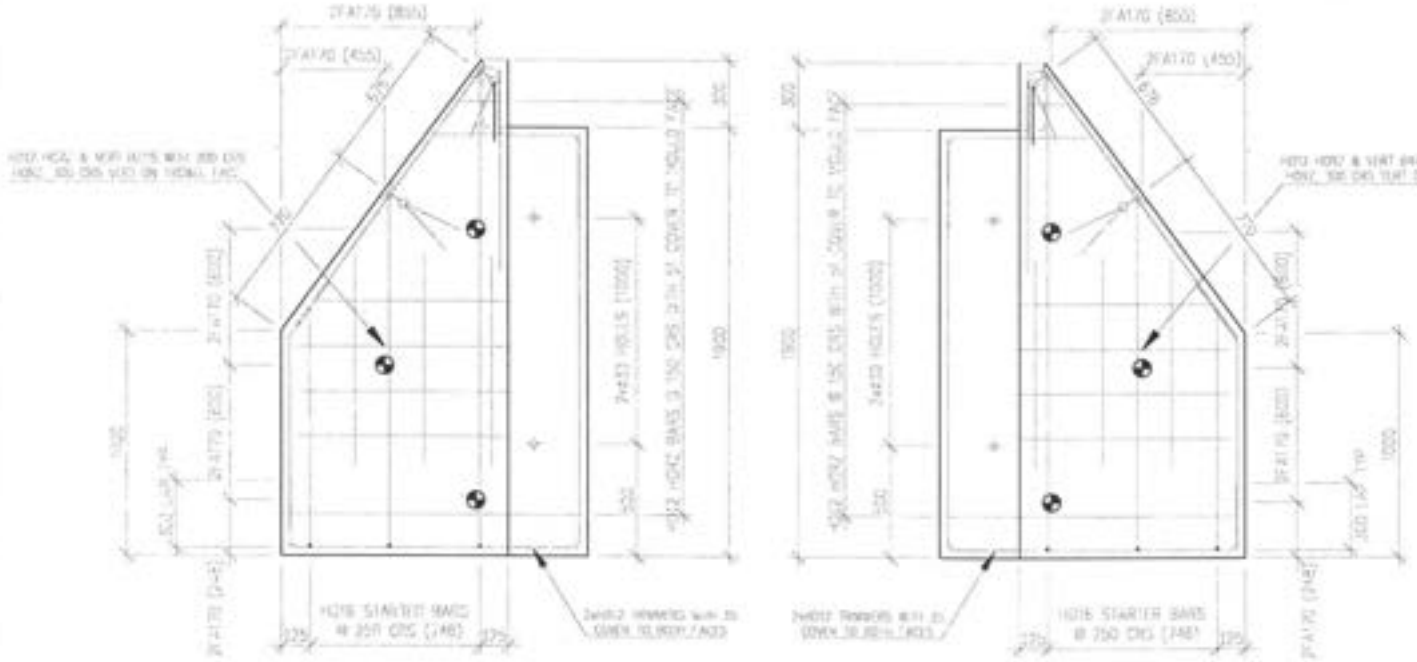
3 SURFACE FINISHES TO NZS 3114:1987,
FORMED SURFACE – F4 FINISH
TROWELLED SURFACE – U2 FINISH

4 CONCRETE COVER TO REO. 35mm UNLESS STATED

5 BAR DIMENSIONS TO OUTSIDE

6 B1\B2 EXPOSURE

7 DESIGN:
a) HN–HO–72
b) LIFE 100 YEARS



PART SECTION A–A

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20 SEP 2010
KAPITI COAST DISTRICT COUNCIL

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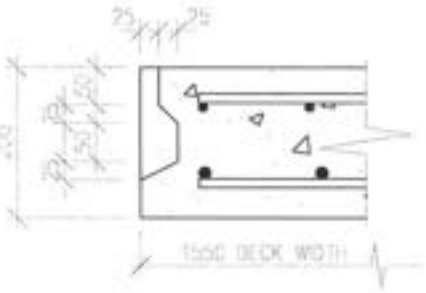
Freephone 0800 502 112
www.humes.co.nz

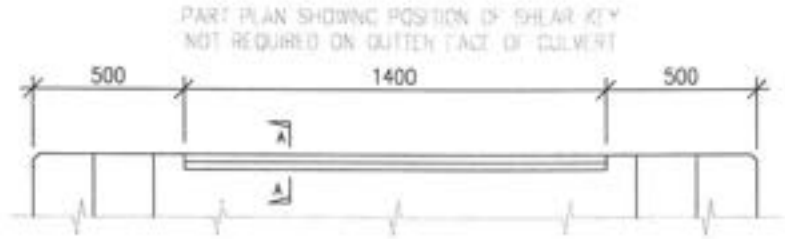
VOLUME:- 0.38m³
WEIGHT:- 0.96Tonne
— REQUIRED

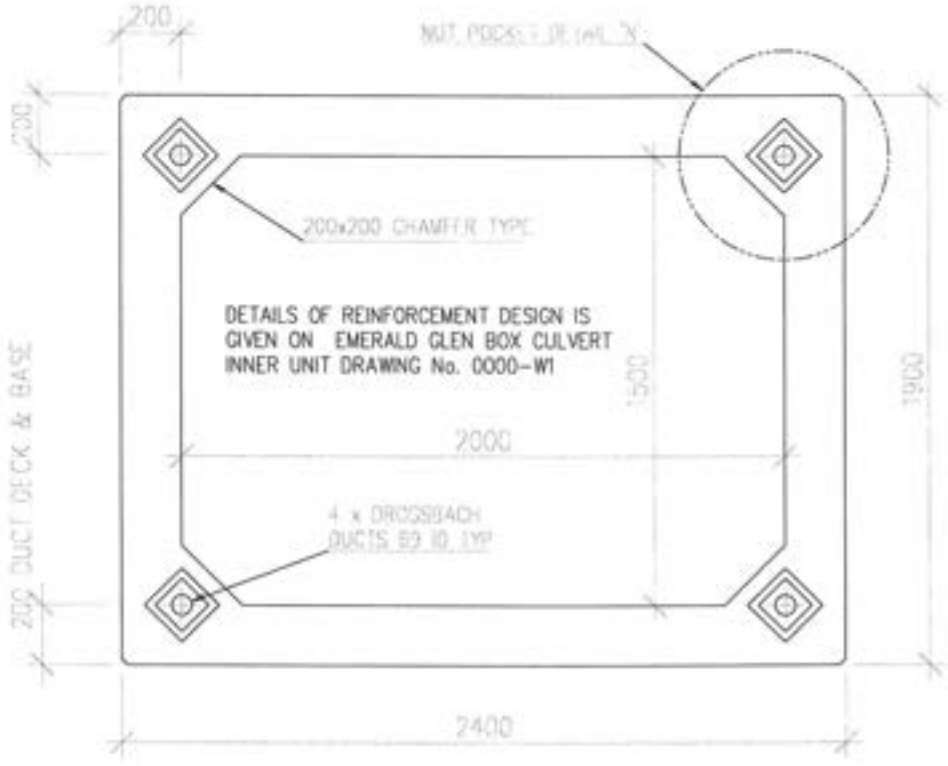
Rev	Description	Date	By	Chkd
A	FOR APPROVAL	9-09-10	GB	

Product SPC | Details On SHEET 4/4 | Scales NTS
Code 00000 | Layout On – | Drawn GB
Project Name: EMERALD GLEN BOX CULVERTS
WING WALLS
Date 9-09-2010
Checked By –
Dwg Title ELEVATIONS
Dwg. No. 00000–W4 Rev. A



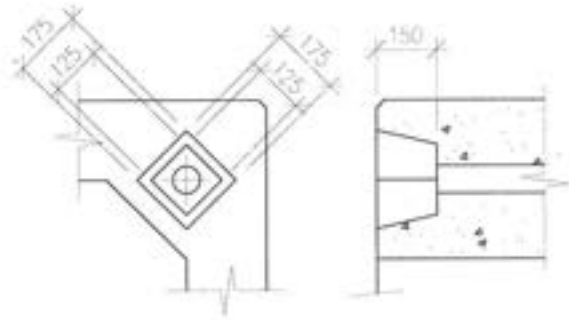
SECTION A-A
SHEAR KEY





NOTES:

1. MANUFACTURE IN ACCORDANCE WITH NZS 3109:1997 (PRECAST UNITS)
2. CONCRETE STRENGTH @ 28 DAYS 40MPa, MIN. STRIPPING STRENGTH 15MPa
3. SURFACE FINISHES TO NZS 3114:1987, FORMED SURFACE – F4 FINISH & TROWELLED SURFACE – U2 FINISH
4. BOX UNITS ARE NOT SUITABLE FOR USE IN SEA WATER OR TIDAL SITES
5. CONCRETE COVER TO REINFORCEMENT IS 40mm INSIDE BOX SURFACE, 35mm OUTSIDE BOX SURFACE
6. REINFORCEMENT DENOTED 'DH' IS DEFORMED GRADE 500E STEEL
7. DESIGN:- LOADING HN-HO-72 DEPTH OF FILL 1000-4000mm DESIGN LIFE 100 YEARS EXPOSURE B1\B2
8. BOX UNITS ARE TO BE CURED



NUT POCKET DETAIL 'N'

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Auckland
Freephone 0800 502 112
www.humes.co.nz

VOLUME:- 3.88m³
WEIGHT:- 9.71Tonne
— REQUIRED

Rev	Description	Date	By	Chkd
A	FOR APPROVAL	9-09-10	GB	—

Product CULVERT	Details On SHEET 2/3	Scales NTS
Code SPC00000	Layout On	Drawn GB
Project Name EMERALD GLEN BOX CULVERTS		Date 9-09-2010
WINGWALL END UNIT		Checked By —
Dwg Title ELEVATIONS		Dwg. No. 00000-W2 Rev. A

NOTES:

1 MANUFACTURE IN ACCORDANCE WITH NZS 3109:1997 (PRECAST UNITS)

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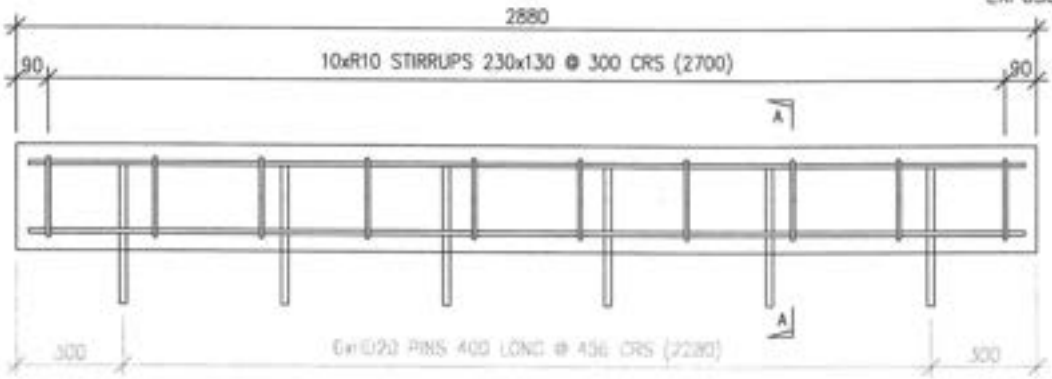
3 SURFACE FINISHES TO NZS 3114:1987, FORMED SURFACE – F4 FINISH & TROWELLED SURFACE – U2 FINISH

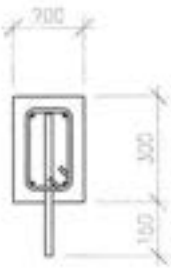
4 BOX UNITS ARE NOT SUITABLE FOR USE IN SEA WATER OR TIDAL SITES

5 CONCRETE COVER TO REINFORCEMENT IS 35mm

6 REINFORCEMENT DENOTED 'DH' IS DEFORMED GRADE 500E STEEL & THAT DENOTED 'R' IS ROUND GRADE 300E STEEL

7 DESIGN:- LOADING HN-HO-72
DEPTH OF FILL 1000-4000mm
DESIGN LIFE 100 YEARS
EXPOSURE B1\B2





SECTION A-A

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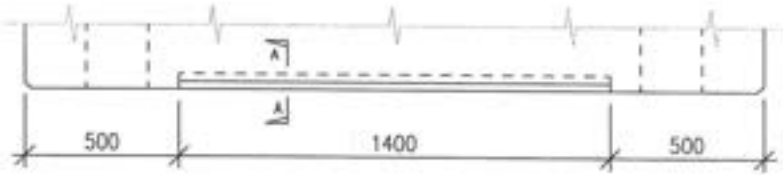
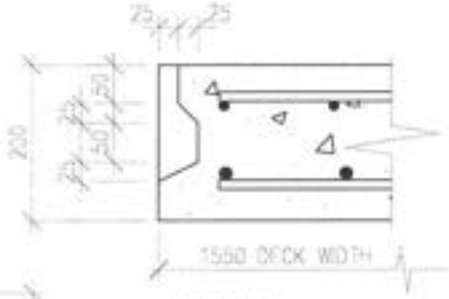
VOLUME:- 0.17m³
WEIGHT:- 0.43Tonne
— REQUIRED

Rev	Description	Date	By	Chkd
A	FOR APPROVAL	9-09-10	GB	

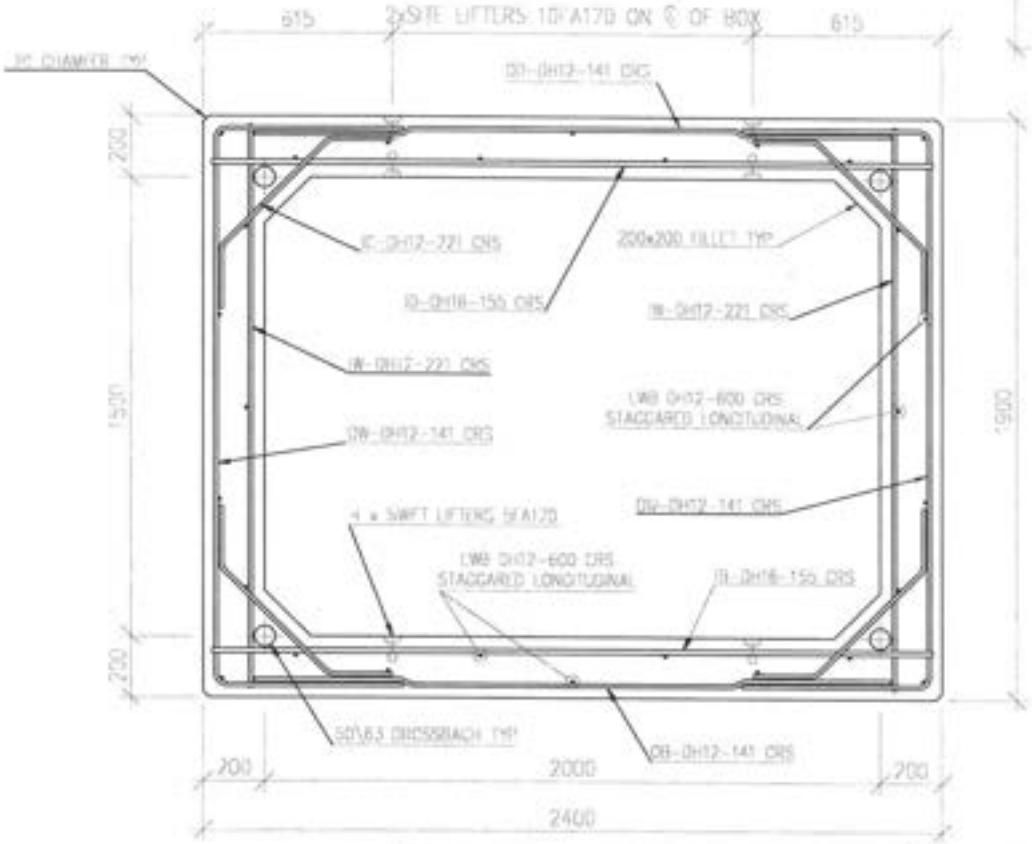
Product SPC | Details On SHEET 3/4 | Scales NTS
Code 00000 | Layout On – | Drawn GB
Project Name | Date 9-09-2010
EMRALD GLEN BOX CULVERTS | Checked By –
HEAD WALL
Dwg Title ELEVATIONS
Dwg. No. 00000-W3 | Rev. A



PART PLAN SHOWING POSITION OF SHEAR KEY



SECTION A-A
SHEAR KEY



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7. DESIGN:- LOADING HN-HO-72 DEPTH OF FILL 1000-4000mm DESIGN LIFE 100 YEARS EXPOSURE B1\B2
8. BOX UNITS ARE TO BE CURED

MAIN BARS: GRADE 500E

ID = 10-HD16 @ 155 CRS (INNER DECK) — 2330

IW = 7-HD12 @ 221 CRS. (INNER WALL) — 1830

OW = 11-HD12 @ 141 CRS.(OUTTER WALL) — 650 | 1830 | 650

IB = 10-HD16 @ 155 (INNER BASE) — 2330

OD = 11-HD12 @ 141 CRS (OUTTER DECK) — 2000

OB = 11-HD12 @ 141 (OUTTER BASE) — 2000

IC = 7-HD12 @ 221 CRS. (INNER CORNER) — 200 | 575 | 200

LONGITUDINAL BARS: GRADE 500E

LWB = 28-HD10 (INNER, OUTER WALL DECK & BASE) — 1400

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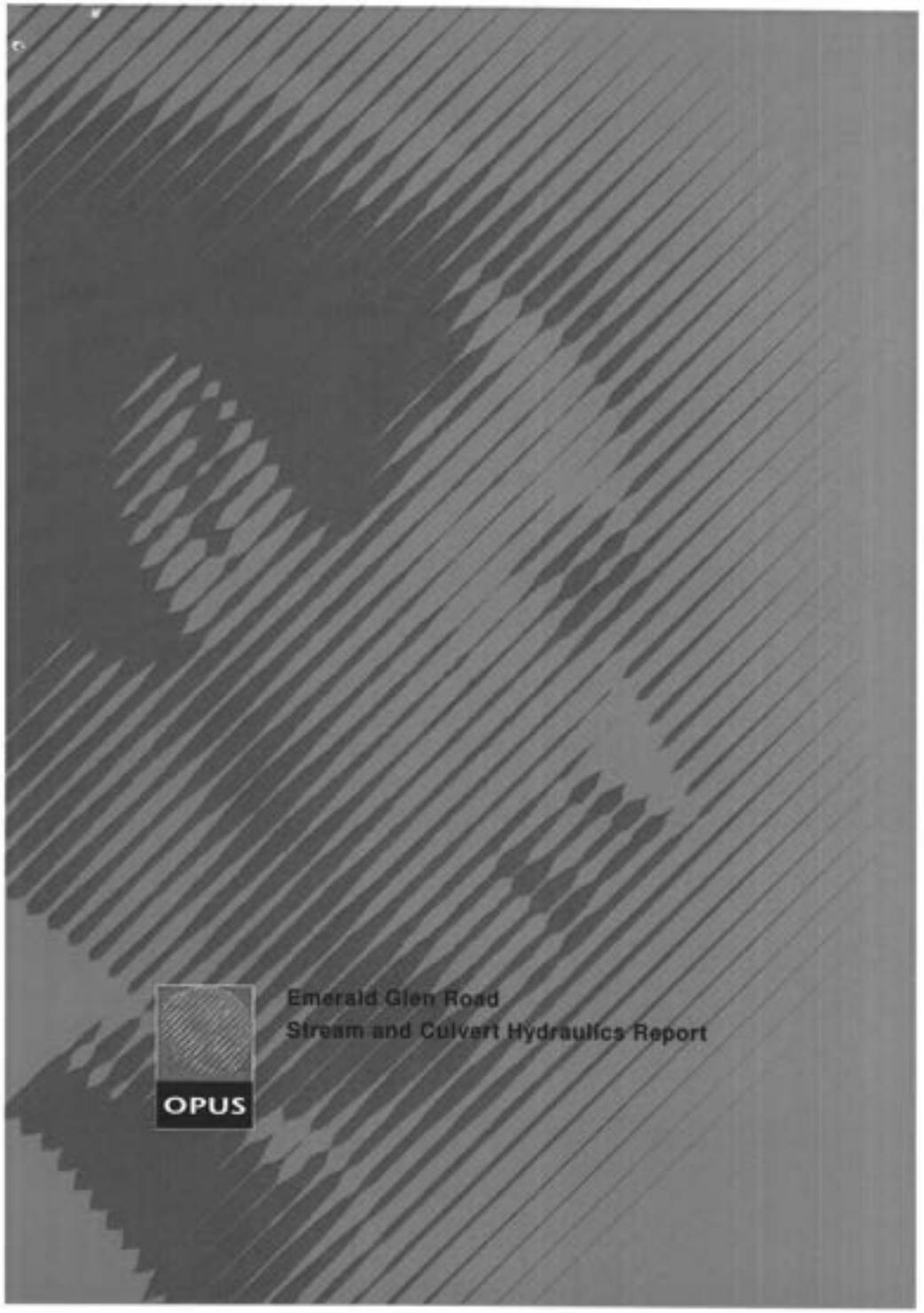
VOLUME:- 2.54m³
WEIGHT:- 6.36Tonne
— REQUIRED

Rev	Description	Date	By	Chkd
A	FOR APPROVAL	8-09-09	GB	–

Product CULVERT | Details On SHEET 1\4 | Scales NTS
Code 00000 | Layout On – | Drawn GB
Project Name: EMERALD GLEN BOX CULVERTS
2000x1500x200 INNER UNIT | Date 8-09-09 | Checked By –
Dwg Title ELEVATIONS | 00000-W1 | A
Dwg No. | Rev.



Emerald Glen Road Extension
Stream and Culvert Hydraulics Report

Prepared By
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Reviewed By
Richard Coles
Environmental Engineer

Approved for Release by:
Keith Atkinson
Principal Projects Engineer

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Date: July 2010
Reference: 5-C1744.00-02EE-012
Status: Final

Contents

1 Introduction

The level crossing for the railway between Waterfall Road and State Highway 1 (SH1) is to be closed due to safety concerns. In order to prevent serious inconvenience to the residents who live in the Waterfall Road area, the New Zealand Transport Agency (NZTA) is planning to extend Emerald Glen Road to connect with the existing SH1 connection at MacKays Crossing as shown in Figure 1.

The proposed road alignment crosses predominantly gently sloping (less than 10%) land in the lee of the foothills of the Tararua Range. The alignment crosses two perennial watercourses and one which we consider intermittent. There are also two crossing places for ephemeral land drainage as shown in Figure 2.

Hydraulic analysis has been performed to determine the required sizes of these culverts. Due to the close proximity of the rail tracks and SH1 downstream of the Emerald Glen extension, the influence from downstream culverts was investigated as part of the analysis.

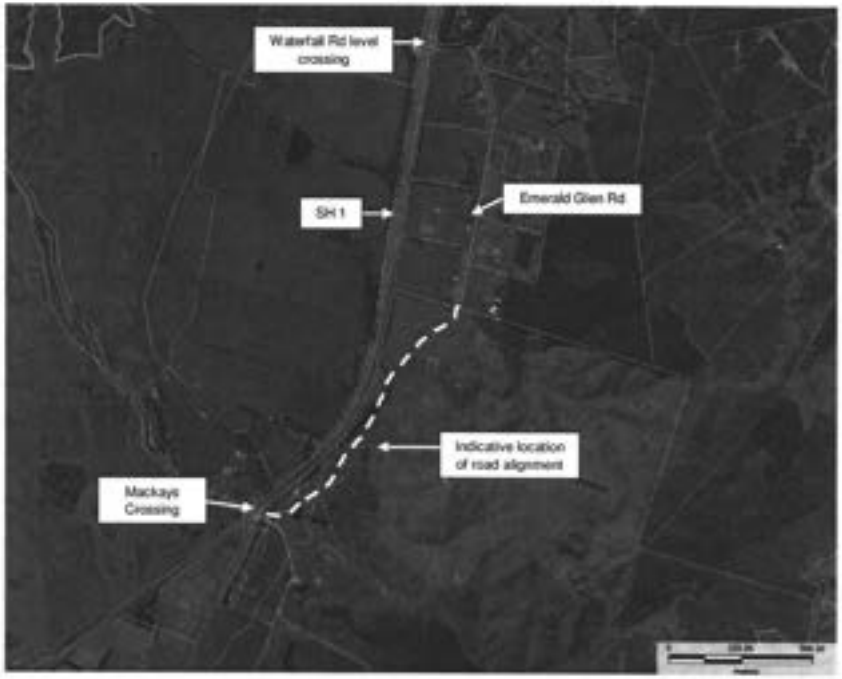

Figure 1 Location of Emerald Glen Road Extension

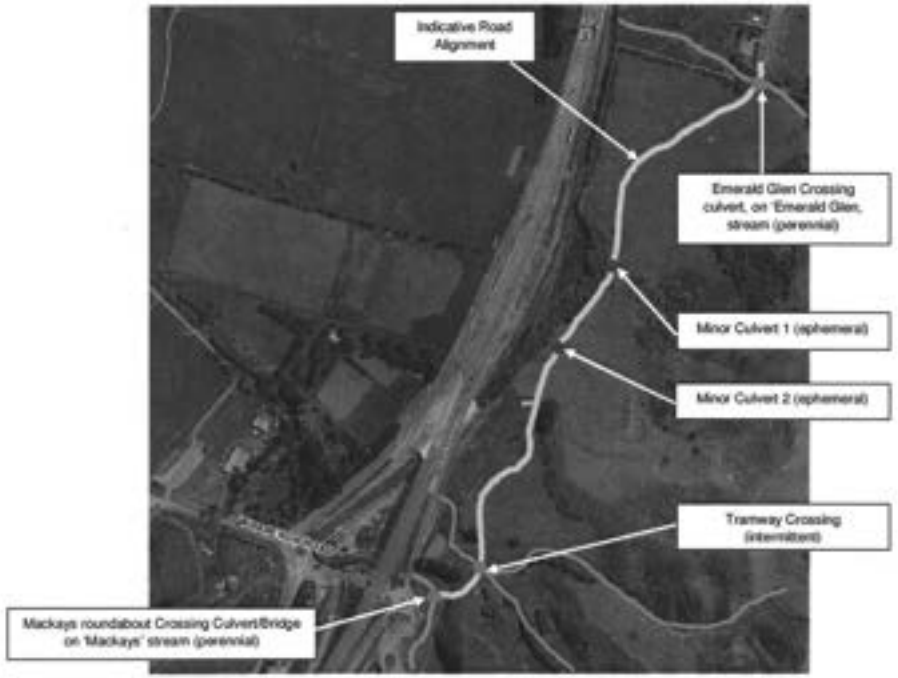

Figure 2 Major & minor waterway crossings along Emerald Glen Road extension

2 Summary of Culvert Sizes

The following table summarises the size of culvert required for each waterway crossing based on the design process described in Section 4.

Culvert	Type	Size (m)	Design Storm (yr)
MacKays roundabout Crossing	Box	Twin 2.5 x 2.5	100
Emerald Glen Crossing	Box	2 x 1.5	100
Tramway Crossing	Circular	1.050	10
Minor Culvert 1	Circular	0.525	10
Minor Culvert 2	Circular	0.600	10

The water way crossing at MacKays roundabout, was initially proposed to be a culvert, however it is now proposed to be a bridge.

3 Hydrology (Design Flows)

Opus' specialist hydrologists have isolated the catchments for both the perennial streams and the land drainage areas. Multiple methods have been used to determine the flow for each catchment. Experience has then been used to judge which values are the most realistic portrayal of actual flows experienced within the watercourses. A summary of the flows is given below in Table 1. For a full explanation and analysis of flows, please see the hydrology report 'Emerald Glen Flow Regimes' (2010) located in Appendix A.

The expected increase in rainfall intensity due to climate change has been included in this analysis. The Ministry for the Environment's report 'Climate Change Effects and Impacts Assessment – A guidance manual for local government in New Zealand 2nd Edition' May 2008, was used to determine the expected increased rainfall in 2090.

Table 1 Flows For Each New Culvert

Culvert Name	Contributing Sub-catchments[1]	Catchment Area (ha)	10 year Flow Q_{10} 2090 (m^3/s)	100 year Flow Q_{100} 2090 (m^3/s)
Emerald Glen	Crossing 3	96	3.47	5.20
Mackays Crossing	Mackays Crossing	588	14.80	22.15
Tramway	Sub-catchment 1	8	0.48	0.71
Tramway	Sub-catchment 2	14	0.74	1.11
Tramway	Total	22	1.22	1.82
Minor Culvert 2	Sub-catchment 3	3	0.22	0.33
Minor Culvert 2	Sub-catchment 4	5	0.33	0.49
Minor Culvert 2	Sub-catchment 5	1	0.09	0.14
Minor Culvert 2	Total	9	0.64	0.96
Minor Culvert 1	Sub-catchment 6	2	0.16	0.23
Minor Culvert 1	Sub-catchment 7	3	0.22	0.33
Minor Culvert 1	Total	5	0.38	0.56

For a map of the major catchments in the area, see the hydrology report in Appendix A. For a map of the minor catchments, see Appendix B.

[1] These refer to the catchments/sub-catchments of the Hydrology Report

3.1 Bridge Considerations for MacKays Crossing

For the design of bridges, flows greater than the 100 year flow need to be considered. For a minor road, such as this, the 1000 year flow has been considered.

The flow record that we used to construct our synthetic flow record fits very closely to a natural log scale. Thus we have extrapolated the data we have, to a 1000 year return period on this basis.

For the MacKays Crossing stream, we have assessed the 1 in 1000 year flow to be $31 m^3/s$. See Appendix E.

4 Selecting a level of service

4.1 For culverts

Kapiti Coast District Council's (KCDC) guiding document Subdivision and Development Principles and Requirements (2005), states that culverts must be designed to cater for the 10% Annual Exceedance Probability (AEP) (10 year return period) storm event. However it also states "culverts may need to be designed up to the 1% AEP (100 year return period) event depending on circumstances. This will be determined on a case by case basis."

The Emerald Glen Road extension is a local purpose road expected to have very low traffic volumes. In normal circumstances designing culverts to the 10 year event on such a road would be sufficient. However, due to the particular circumstances of the area, larger events have been used in some cases, as outlined below.

A house is located on the true right bank of the stream at the end of the existing Emerald Glen Road. In our opinion, it is important to ensure that the culvert to be installed on the Emerald Glen stream does not cause flooding to this property. We have therefore designed the Emerald Glen Crossing culvert to pass the 100 year flow.

The Mackays Crossing culvert is to be located within a constructed channel where the stream was diverted in 2004 during the construction of the Mackays Crossing intersection on SH1. A twin 2.5m x 2.5m box culvert allows the stream to pass beneath SH1. Both the box culvert and the constructed channel were designed to pass the 100 year flow and keep the flow within the stream banks. The secondary overflow path at this point has been estimated to be across the Mackays Crossing roundabout and through the underpass to Whareroa Road. To protect Mackays crossing roundabout to state highway standard (as it is an integral part of SH1), the new Mackays Crossing culvert has also been designed for a 100 year flow event, keeping all the flow within the stream banks.

The Tramway culvert has been designed to the 10 year event as we consider localised upstream ponding and the overtopping of the road as a secondary flow path during larger events as acceptable (and in line with KCDC standards). The depth of flow across the road during a 100 year event is expected to be less then 100mm, so emergency vehicles should be able to pass. This culvert is not considered to cause an increase in flooding or other significant impacts to property downstream.

The two minor land drainage culverts have also been sized to pass the 10 year flow without any significant upstream effects. However in larger events, as with the Tramway culvert, some localised upstream ponding or overtopping of the road may occur.

4.2 For Bridges

The waterway crossing at Mackays Crossing, was initially proposed to be a culvert. It is now proposed to be a bridge.

From the NZTA Bridge manual, the free board from the surface of the 100 year event should be 600mm (or 1200mm if the debris load is expected to be high) to the bottom of the bridge deck. The 1000 year event should also be considered, such that the bridge deck does not get damaged.

We have assessed the land uses of the upstream catchment and consider the debris load to be relatively low. The upstream catchment consists of approximately 65% exotic grassland, 30% board leaved indigenous hardwoods, 5% pine forest and a small amount gorse and broom. The exotic grassland, indigenous hardwoods and gorse and broom, are not expected to generate a significant amount of large debris items that will block the culvert. The pine forest is a potential source of debris if the area is harvested however the percentage area covered by pine is very small, so we would not expect it to generate a sufficient quantity of large debris.

Thus the level of service for this bridge is 100 year plus 600mm to the underside of the bridge deck. It is likely that the 1000 year event will also pass under the bridge deck.

5 Hydraulic Methodology

5.1 Hydraulic Methodology for Major Culverts

Design Process

The three major culverts have been sized based on detailed hydraulic analysis. This process involved the following steps:

- Determining the flow regime (sub or super critical),
- Investigating the effects on the new culvert from downstream conditions,
- Based on these downstream conditions, finding the headwater depth assuming the culvert is inlet and outlet controlled,
- The greater headwater value between the inlet / outlet control is used as the expected headwater depth for the given flow.

This process was carried out for a variety of culvert sizes. The smallest culvert size which produced a reasonable headwater depth was then selected.

In the hydraulic analysis of these culverts, we assumed that the bottom 0.3 metres is to be filled with suitably sized gravel and baffles, the spacing of which is dependent on the grade. This is to provide a flow environment within the culvert which native fish can navigate.

Determination of Downstream Conditions

Due to the close proximity of the Emerald Glen Road extension to the main trunk railway and SH1, the downstream flow conditions of the new major waterway crossing culverts have been assessed. This assessment was undertaken to estimate the tailwater depth for the new culverts during the design storm events.

We used the computer programme CivilTools V 1.1s, to estimate the headwater depth produced at downstream culverts. We also estimated the depth of flow within the stream channel based on its geometry. The greater depth at the new culvert outlet between the flow depth and the headwater depth produced from downstream culverts was then used as the tailwater depth in hydraulic calculations for the new culvert. See Figure 3.

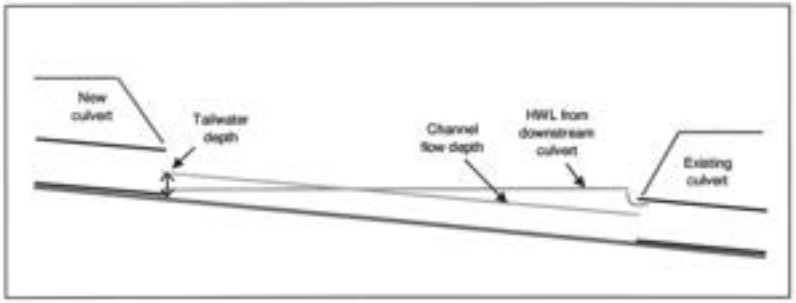

Figure 3 Finding tailwater depth from downstream conditions

5.2 Hydraulic Methodology of the Minor Land Drainage Culverts

The programme CivilTools V 1.1s has been used to determine a minimum culvert size to pass the 10 year flow. This size has then been increased by approximately 200 mm to account for the gravel in the base. The net effect is a conservative culvert size with a hydraulic capacity greater than the 10 year flow.

Although these culverts are not expected to be wet all the time, we are still proposing to place gravel in the bottom 200 mm of the culvert. This is to ensure that ecological connectivity can be maintained across the road.

5.3 Hydraulic Methodology for Bridge(s)

To determine the water level in the channel for several design events, we considered the channel hydraulics and the back water effect of the downstream structures. In this case, to determine the back water effect, we used the programme 'hydrochan". This allow us to analyse the levels as a gradually verging flow, rather than in a steady state condition. See Appendix F.

6 Results of Major Waterway Crossing Sizing

6.1 Mackays Crossing Bridge

The existing downstream box culvert has a back water effect on the water level at the bridge location. Approximate water levels including this backwater effect and climate change to 2090, are shown here (these water levels assume a manning roughness of 0.06).

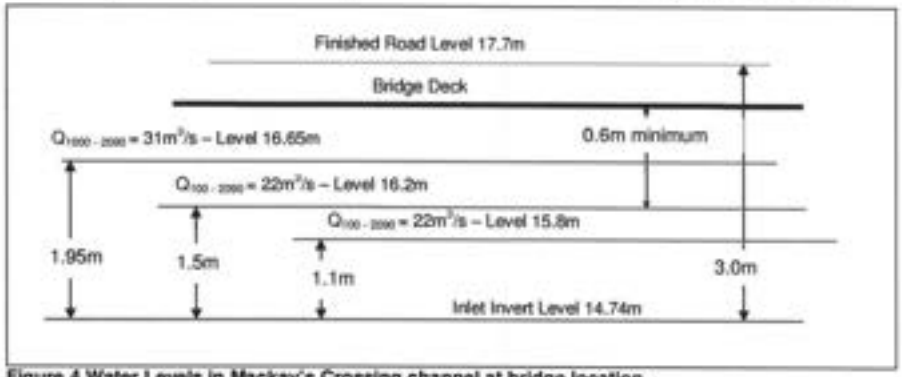

Figure 4 Water Levels in Mackay's Crossing channel at bridge location

6.2 Emerald Glen Culvert

A 2m wide and 1.5m high box culvert has been selected for the Emerald Glen crossing.

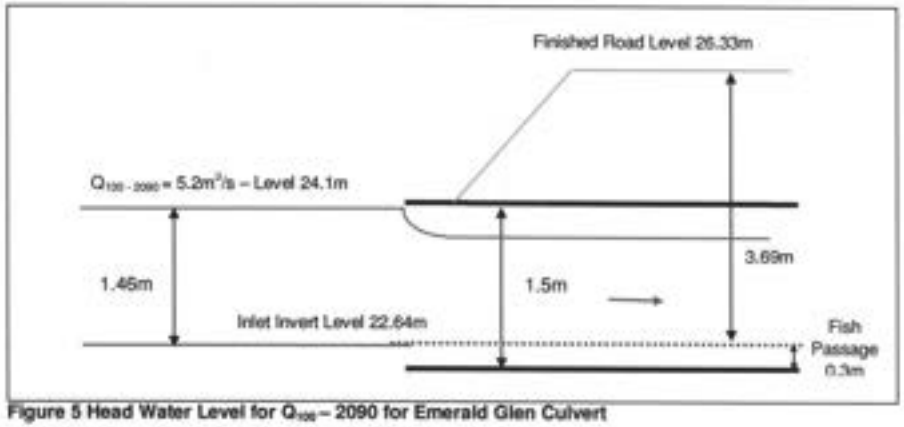

Figure 5 Head Water Level for Q_{100} – 2090 for Emerald Glen Culvert

6.3 Tramway Culvert

A 1050 mm diameter round culvert has been selected for the Tramway crossing. The flow conditions during the 10 year and 100 year events are shown below in **Figure 6**.

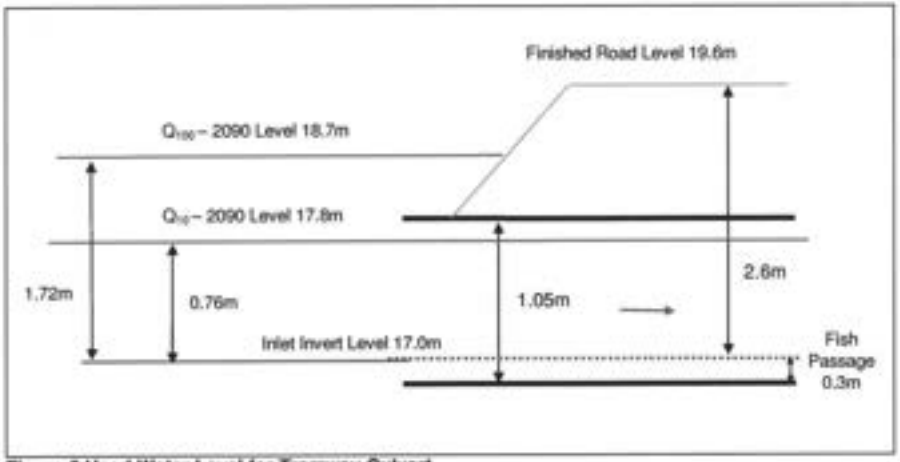

Figure 6 Head Water Level for Tramway Culvert

7 Physical works

See Appendix C for draft drawings showing location and details of the culverts.

7.1 Fish pass design

For most of the culverts we will follow the general GWRC (and other general) guidelines to design the fish pass through them.

The Northern culvert (Emerald Glen culvert) is at a grade of approximately 5%. As such we intend to deviate from the standard approach (of burying the invert of the culvert by 200mm). The approach we intend to use is a slot weir system where we can calculate the velocity and depth of the flow through the slot weir for a given flow.

In our opinion a reasonable flow range to work with is long term average flow for the mid 300 days in a typical year. As there is no flow record for this stream, we will use the flow record from an adjacent (or nearby) catchment and scale the flows to our catchment.

The flow depth and velocities we will design the slot weir system to, will depend on which fish species GWRC include in the consent conditions.

Appendix A - Hydrology report '*Emerald Glen Flow Regimes*'

Emerald Glen Extension – Stream and Culvert Hydraulics

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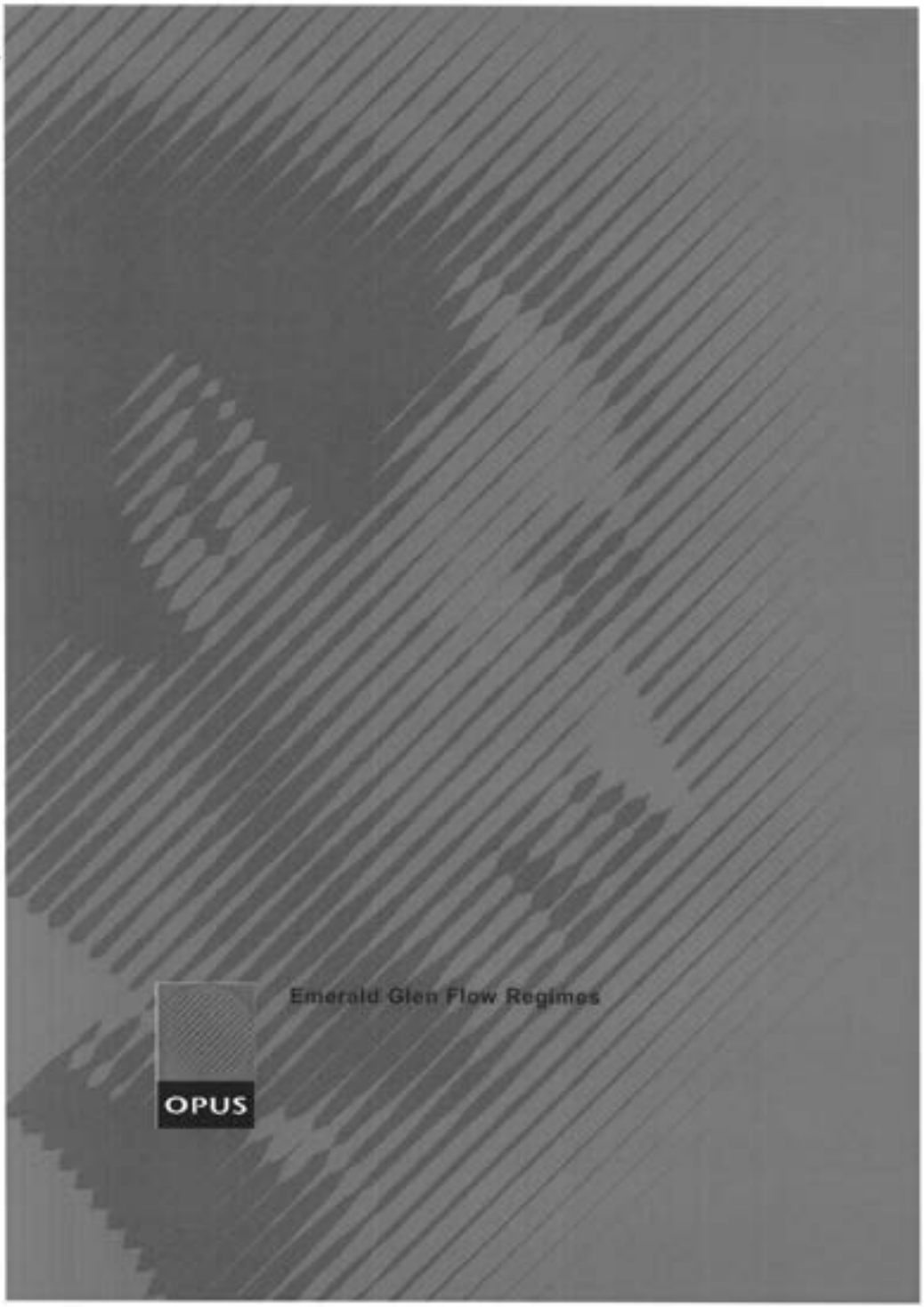
July 2010


Emerald Glen Flow Regimes
OPUS

Emerald Glen Flow Regimes

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Contents

1 Introduction

NZTA is developing a strategy for designing and upgrading roading infrastructure on the Kapiti Coast. The local hydrology has the potential to affect the design of some of this infrastructure. Therefore an understanding of the flow regimes, particularly the frequency and magnitude of flood events of the streams and rivers in close proximity to any development is essential.

This report characterises the expected peak flows of the various streams in the vicinity of Emerald Glen Road (Figure1). As there was no specific flow data from the study sites the REC database, Rational Method, and Regional Flood Frequency Method were used to derive peak flows for specific reaches of interest i.e., the Waterfall Road Crossing, Mackays Crossing, Crossings 2 and 3, and the smaller sub-catchments. The REC database obtains its values using the Regional Flood Frequency Method so it is expected that these two methods would give similar results. The catchments extend below Emerald Glen road as the REC values relate to the whole reach. The values provided in this report are therefore likely to be conservative i.e., slightly higher than expected.

Figure 1: Location of the study catchments near Emerald Glen Road.

2 River Environment Classification

The national River Environment Classification (REC) groups and classifies rivers, or parts of rivers, at six hierarchical levels. The location of each REC class is mapped so that the class of any reach of a river in New Zealand can be identified. REC classes discriminate variation in physical and biological characteristics at a range of spatial scales. Characteristics that are important for management such as hydrology, hydraulics, water quality, and biological communities are similar within classes; and significantly different between classes.

Each of the REC's six hierarchical classification levels is defined by a controlling factor: climate, source-of-flow, geology, land-cover, network-position and valley-landform. The REC represents rivers as networks of sections, including their upstream catchments. Each level of the REC hierarchy is based on differences in a set of processes that directly affect the physical and biological characteristics of rivers.

The REC can therefore be used to assess the spatial distribution of river resources and values. In particular, it allows the estimation of various flow parameters and attributes of catchments and river reaches for which no flow data exist. It is therefore possible to extract from the REC estimates of various flow parameters for the study streams. It is also possible to extract data for those sites for which there are flow data. This allows comparison of the accuracy and appropriateness of the data contained in the REC for a particular study area.

Estimated flow parameters for the sites of interest were therefore extracted from the REC database (Table 1). The small sub-catchments between Mackays Crossing and Crossing 3 cannot be estimated using the REC database as they do not contain a recognised waterway, and are therefore not included in the database.

Table 1: Flow characteristics predicted from the REC database.

Name	Area (km^2)	Q_{100} (m^3/s)	Mean flow (l/s)	7-day MALF (l/s)
Waterfall Rd Crossing	2.78	8.33	57.06	6.08
Crossing 2	0.38	1.73	7.82	1.12
Crossing 3	0.87	3.66	17.98	2.44
Mackays Crossing	5.72	18.05	123.09	16.16

3 The Rational Method

The Rational Method is a probabilistic or statistical method and is used to estimate the peak flow for a given return period from the average rainfall intensity of the same return period.

The Rational Method is based upon the following formula:

$QT = C\ iT\ A$

where:

QT = estimate of the peak rate of runoff for some recurrence interval, T
C = runoff coefficient; fraction of rainfall, expressed as a dimensionless decimal that appears as surface runoff from the contributing drainage area
iT = average rainfall intensity (mm/hr) for some recurrence interval, T, during that period of time equal to Tc
A= the contributing tributary drainage area to the point of design
Tc = time of concentration. The time it takes runoff from the furthest part of the catchment to reach the point of interest.

The runoff coefficient (C) represents the integrated effects of infiltration, evaporation, retention, flow routing, and interception; all of which affect the time distribution and peak rate of runoff.

Estimated flows for the sites of interest were therefore obtained using the Rational Method. The results are listed in Table 2.

Table 2: Flow characteristics predicted using the Rational Method.

Name	Area (km^2)	Q_2 (m^3/s)	Q_{10} (m^3/s)	Q_{20} (m^3/s)	Q_{50} (m^3/s)	Q_{100} (m^3/s)
Waterfall Rd Crossing	2.60	16.3	25.1	29.6	34.2	37.2
Crossing 2	0.29	3.6	5.5	6.5	7.3	8.2
Crossing 3	0.96	7.9	13.2	15.6	17.6	19.7
Mackays Crossing	5.88	33.8	51.8	61.2	70.5	76.9
Sub-catchment 1	0.08	0.7	1.1	1.3	1.5	1.6
Sub-catchment 2	0.14	0.7	1.4	1.6	2.0	2.2
Sub-catchment 3	0.03	0.3	0.5	0.6	0.7	0.8
Sub-catchment 4	0.05	0.5	0.8	1.0	1.1	1.3
Sub-catchment 5	0.01	0.1	0.2	0.2	0.2	0.3
Sub-catchment 6	0.02	0.2	0.4	0.4	0.5	0.5
Sub-catchment 7	0.03	0.3	0.5	0.6	0.7	0.8

These results appear to be significantly higher than can be realistically expected, especially at Mackays Crossing. It was therefore decided to provide an independent calibration or alternative approach. This is detailed in section 4.

4 Scaled Design Peak Floods

As the study sites do not have any flow data, the general relationship between catchment area and flow was considered. This assumes that given the same rainfall-runoff relationship a bigger catchment produces higher flows and vice versa. The flood peak estimates used for scaling were obtained by the Regional Flood Frequency Method during a previous investigation (Webby, 2004; Appendix A) (Table 3).

Table 3: Flows for Whareroa Stream taken at Mackays Crossing (6.13km^2) predicted using the Regional Flood Frequency Method (Webby, 2004).

Return Period (yrs)	Flow (m^3/s)
2.33	8.5
5	11.1
10	13.1
20	14.9
50	17.6
100	19.6

The 100-year design flood peaks were obtained for the study catchments by scaling the flood flows from the Whareroa Stream as a function of catchment area (Model 1, Table 4). A second technique was also used which raises the ratio of the two catchment areas to the power of 0.8 (Model 2, Table 4). Appendix B lists both the models for all the return periods. This is the approach recommended in the McKerchar and Pearson (1989) Regional Flood Frequency methodology when analysing flood frequencies.

Table 4: Peak Floods predicted using Model 1 and Model 2 to scale flows.

Name	Area (km^2)	Q_{100} (m^3/s) Model 1	Q_{100} (m^3/s) Model 2
Waterfall Rd Crossing	2.60	8.31	9.87
Crossing 2	0.29	0.93	1.71
Crossing 3	0.96	3.07	4.45
Mackays Crossing	5.88	18.80	18.96
Sub-catchment 1	0.08	0.26	0.61
Sub-catchment 2	0.14	0.45	0.95
Sub-catchment 3	0.03	0.10	0.28
Sub-catchment 4	0.05	0.16	0.42
Sub-catchment 5	0.01	0.03	0.12
Sub-catchment 6	0.02	0.06	0.20
Sub-catchment 7	0.03	0.10	0.28

5 Comparisons

Comparisons of the REC 'scaled flows', and Rational Methods show a significant difference in flood peaks (Table 5). The scaled flows from the Regional Flood Frequency Method are consistent with those from the REC database as expected. They appear much more realistic than the flows derived from the Rational Method. Scaling by $A^{0.8}$ provides a little more conservatism to the estimated peak discharge.

Table 5: Comparison of the 1-in-100year REC, Rational Method and scaled floods.

	REC (Q_{100})	Rational Method (Q_{100})	Synthetic Flows (Q_{100}) - Model 1	Synthetic Flows (Q_{100}) - Model 2
Mackays Crossing	18.10	76.90	18.80	18.96
Waterfall Rd	8.30	37.20	8.31	9.87
Crossing 2	1.70	8.20	0.93	1.71
Crossing 3	3.70	19.70	3.07	4.45

6 Concluding Comment

There is no instrumental flow record for Mackays Crossing or any of the other study sites. Scaling as a simple function of the ratio of catchment areas provides an estimate of the peak discharge of the 100-year event of 18.80m³/s. This is very close to the magnitude of this extreme event derived from the REC (18.10m³/s). However, the Rational Method predicted flows are 4 times higher than the REC predicted flood and 4 times greater than the scaled flood peaks.

The recommended methodology for scaling catchments as a function of area for flood frequency analysis is to raise area to the power of 0.8 (i.e., $A^{0.8}$). When applied to the current situation this would appear to give reasonable but still conservative estimates of peak flows. This is expected as the REC database uses the Regional Flood Frequency Method to estimate the flows.

Assuming that 18.96m³/s is a realistic estimate of the peak discharge for the 100-year event at Mackays Crossing, this can be scaled by 7.2% and 16.8% to allow for predicted climate change effects in 2040s and 2090s respectively (MfE, 2008). If a percentage increase in rainfall generates the same percentage in peak discharge, this would give peak discharges of 20.33 and 22.15m³/s for the 2040s and 2090s. Table 5 lists the predicted increase in flood peaks for the 2040s and 2090s for all the study catchments. Appendix B lists all the return periods and the associated values scaled for climate change.

Table 5: Flood peaks scaled to allow for climate change.

Name	Q_{100} (m³/s)	2040	2090
Waterfall Rd Crossing	9.87	10.58	11.53
Crossing 2	1.71	1.83	2.00
Crossing 3	4.45	4.77	5.20
Mackays Crossing	18.96	20.33	22.15
Sub-catchment 1	0.61	0.65	0.71
Sub-catchment 2	0.95	1.02	1.11
Sub-catchment 3	0.28	0.30	0.33
Sub-catchment 4	0.42	0.45	0.49
Sub-catchment 5	0.12	0.13	0.14
Sub-catchment 6	0.20	0.21	0.23
Sub-catchment 7	0.28	0.30	0.33

7 References

McKerchar, A.I. and Pearson, C.P. (1989). Flood frequency in New Zealand. Christchurch, New Zealand.

MfE (Ministry for the Environment), 2008. Climate change effects and impacts assessment. Wellington, New Zealand.

Webby, G. (2004). Whareroa Stream at State Highway 1 – Flood flow estimation.

Appendix A
Flood Flow Estimation
(Webby, 2004)

Whareroa Stream at State Highway 1 – Flood Flow Estimation

Flood frequency estimates for the catchment of the Whareroa Stream at SH1 (Mackay's Crossing) have been calculated by two methods.

1. Nearby flow data with area reduction ($A^{0.8}$) method using nearby catchments with long term flow records.
2. The Regional Flood Frequency Method.

1. Nearby Flow Data with Area Reduction

The nearby flow data with area reduction method applied here is a commonly used hydrological technique in New Zealand. Catchment areas for the Whareroa Stream and the nearby flow recorder catchments are factored down by a ratio of $A^{0.8}$ (area to the power of 0.8). Table 1 details the $A^{0.8}$ values for the recorder sites and the Whareroa catchment.

Table 1. Catchment Details

	Catchment Area (km^2)	Catchment Area $^{0.8}$
Whareroa at SH1	6.13	4.27
Waikanae at WTP*	124.5	47.44
Wharemakau at Coastlands*	7.77	5.16
Pauatahanui at Gorge*	38.4	18.51

*Nearby gauging station

Flood frequency estimates for the three nearby recorder sites have been calculated as detailed in Table 2.

Table 2. Flood Frequency Estimates of Nearby Catchments (m^3/s)

Catchment	Wharemauku Stm at Coastlands	Waikanae River at WTP	Pauatahanui Stm at Gorge
Area (km^2)	7.77	124.5	38.4

Return Period (yrs)	Flow (m^3/s)		
2.33	6.7	151	40.3
5	9.9	199	51.4
10	12.7	238	60.5
2	15.5	274	69.2
50	19.0	323	80.4
100	21.7	359	88.8

The ratios of $A^{0.8}$ between the Whareroa at SH1 catchments and the nearby recorder catchments are applied to the return period flows for the recorder catchments (Table 2) to derive a corresponding return period flow for each of the study catchments. Table 3 shows resulting return period flows derived for the Whareroa Stream at SH1.

2. Regional Flood Frequency Method

The Regional Flood Frequency Method is commonly applied to determine flood estimates in areas where there is no long-term flow record.

The method used is that described in *Flood Frequency in New Zealand* (McKerchar and Pearson 1989). Contour maps based on measured flow data have been derived that cover New Zealand. The catchments being investigated in this study are located off the contour maps and the respective coefficients are therefore used in equations involving catchment area to determine the design flood frequency estimates as detailed in column six of Table 3.

Table 3. Summary of Whareroa Stream at SH1 Flood Frequency Estimates

Return Period (yrs)	Based on Wharemauku Stream	Based on Waikanae River	Based on Pauatahanui Stream	Average of Nearby Catchments	Regional Flood Frequency Method
2.33	5.5	13.6	9.3	9.5	8.5
5	8.2	17.9	11.9	12.7	11.1
10	10.5	21.4	14.0	15.3	13.1
20	12.8	24.7	16.0	17.8	14.9
50	15.7	29.1	18.5	21.1	17.6
100	18.0	32.3	20.5	23.6	19.6

3. Recommended Flood Estimates

The Whareroa Stream does not entirely fit into one hydrological region and so a range of nearby gauging stations were selected.

The Waikanae River catchment rises in the Tararua Ranges in a higher rainfall area than the Whareroa catchment. It is considered to over estimate the flood frequency for the Whareroa Stream.

The Wharemauku catchment is of a similar size to the Whareroa catchment and is geographically the closest of those analysed. The Wharemauku is also located in similar foothill topography and within the same rainfall band as the Whareroa catchment. Of the three nearby catchments analysed it is the most appropriate to use in calculation of flood frequency estimates for the Whareroa Stream.

However, the Wharemauku catchment has a long narrow shape with the main channel following a gently sloping floor. The elongated nature means the peak flows from tributaries, although peaking at the same time, will not concentrate in the main channel at the same place. This is opposed to the Whareroa catchment, which is more of a rounded shape, where the peak flows from all tributaries will concentrate in the main channel at the same time and place giving a higher flood peak.

The Pauatahanui catchment is further away but tends to closely confirm the average results.

Because of the variation in catchment shape between the Whareroa and Wharemauku streams a slightly conservative approach to using flood frequency estimates derived from the Wharemauku is to adopt the results from the Regional Flood Frequency Method. The recommended flood frequency estimates for the Whareroa Stream at SH1 are detailed in Table 4.

Table 4. Whareroa stream at SH1 recommended Flood Frequency Estimates

Return Period (years)	Flow (m^3/s)
2.33	8.5
5	11.1
10	13.1
20	14.9
50	17.6
100	19.6

It should be noted, however, that there were major storms at nearby Paekakariki on 3 October 2003 and 17/18 February 2004. These events mobilised a lot of bed material and although the proposed State Highway 1 bridge over Whareroa Stream is not adjacent to the hills there may still be a debris load which may need factoring into the design. This needs verification by field inspection.

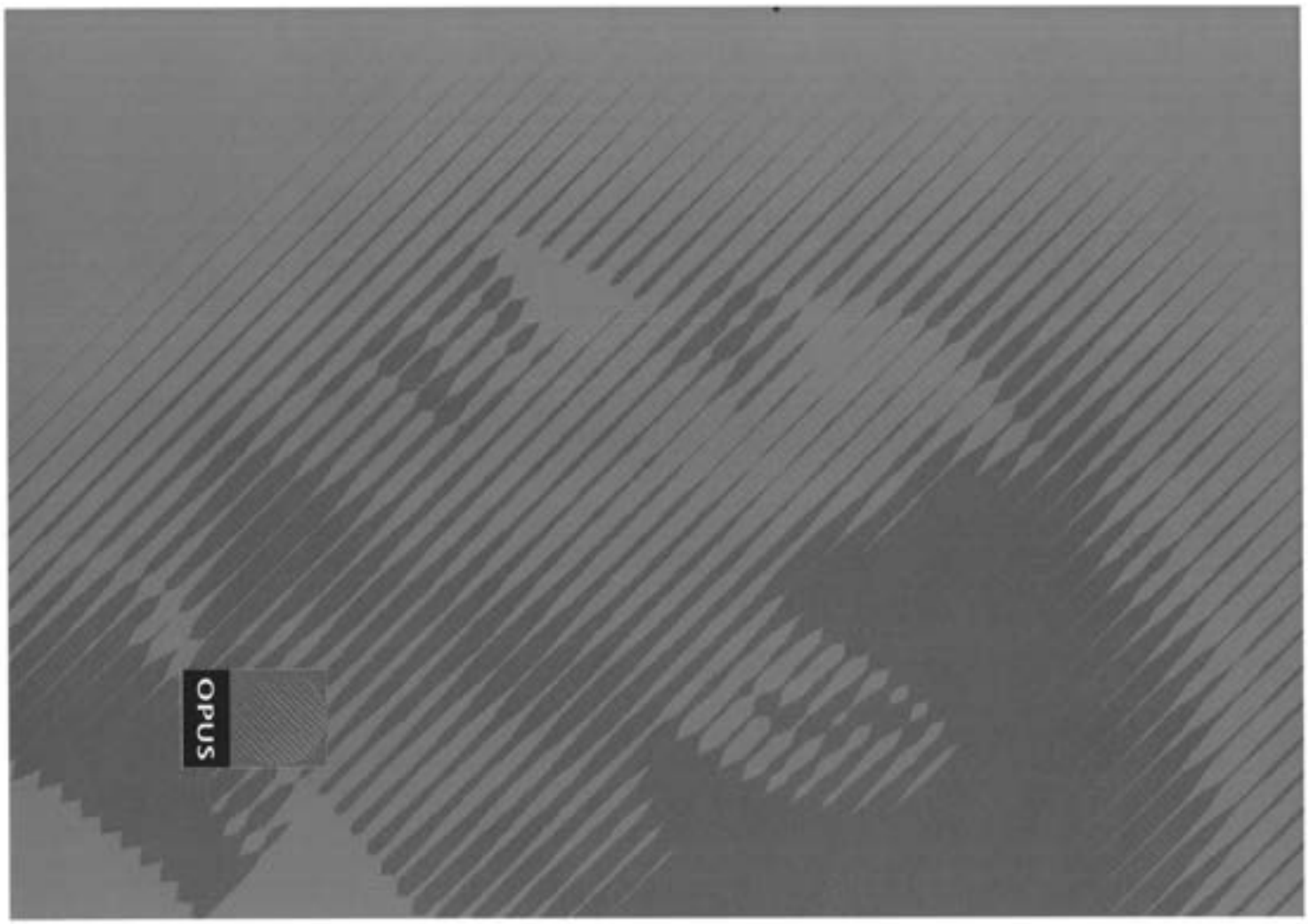
Appendix B
Peak Floods and Climate Change

Table B-1: Peak floods predicted using Model 1 and Model 2 to scale flows.

Name	Area (km^2)	$Q_{2.33}$ (m^3/s) Model 1	$Q_{2.33}$ (m^3/s) Model 2	Q_5 (m^3/s) Model 1	Q_5 (m^3/s) Model 2	Q_{10} (m^3/s) Model 1	Q_{10} (m^3/s) Model 2	Q_{20} (m^3/s) Model 1	Q_{20} (m^3/s) Model 2	Q_{50} (m^3/s) Model 1	Q_{50} (m^3/s) Model 2	Q_{100} (m^3/s) Model 1	Q_{100} (m^3/s) Model 2
Waterfall Rd Crossing	2.60	3.61	4.28	4.71	5.59	5.56	6.60	6.32	7.50	7.46	8.86	8.31	9.87
Crossing 2	0.29	0.40	0.74	0.53	0.97	0.62	1.14	0.70	1.30	0.83	1.53	0.93	1.71
Crossing 3	0.96	1.33	1.93	1.74	2.52	2.05	2.97	2.33	3.38	2.76	3.99	3.07	4.45
Mackays Crossing	5.88	8.15	8.22	10.65	10.74	12.57	12.67	14.29	14.41	16.88	17.02	18.80	18.96
Sub-catchment 1	0.08	0.11	0.26	0.14	0.35	0.17	0.41	0.19	0.46	0.23	0.55	0.26	0.61
Sub-catchment 2	0.14	0.19	0.41	0.25	0.54	0.30	0.64	0.34	0.72	0.40	0.86	0.45	0.95
Sub-catchment 3	0.03	0.04	0.12	0.05	0.16	0.06	0.19	0.07	0.21	0.09	0.25	0.10	0.28
Sub-catchment 4	0.05	0.07	0.18	0.09	0.24	0.11	0.28	0.12	0.32	0.14	0.38	0.16	0.42
Sub-catchment 5	0.01	0.01	0.05	0.02	0.07	0.02	0.08	0.02	0.09	0.03	0.10	0.03	0.12
Sub-catchment 6	0.02	0.03	0.09	0.04	0.11	0.04	0.13	0.05	0.15	0.06	0.18	0.06	0.20
Sub-catchment 7	0.03	0.04	0.12	0.05	0.16	0.06	0.19	0.07	0.21	0.09	0.25	0.10	0.28

Table B-2: Peak floods scaled to allow for climate change.

Name	$Q_{0.33}$ (m^3/s)	2040	2090	Q_2 (m^3/s)	2040	2090	Q_{10} (m^3/s)	2040	2090	Q_{20} (m^3/s)	2040	2090	Q_{50} (m^3/s)	2040	2090	Q_{100} (m^3/s)	2040	2090
Waterfall Rd Crossing	4.28	4.59	5.00	5.59	5.99	6.53	6.60	7.07	7.70	7.50	8.04	9.39	8.86	9.50	10.35	9.87	10.58	11.53
Crossing 2	0.74	0.79	0.86	0.97	1.04	1.13	1.14	1.22	1.33	1.30	1.39	1.62	1.53	1.64	1.79	1.71	1.83	2.00
Crossing 3	1.93	2.07	2.25	2.52	2.70	2.94	2.97	3.19	3.47	3.38	3.62	4.23	3.99	4.28	4.66	4.45	4.77	5.20
Mackays Crossing	8.22	8.81	9.60	10.74	11.51	12.54	12.67	13.58	14.80	14.41	15.45	18.05	17.02	18.25	19.88	18.96	20.33	22.15
Sub-catchment 1	0.26	0.28	0.31	0.35	0.37	0.40	0.41	0.44	0.48	0.46	0.50	0.58	0.55	0.59	0.64	0.61	0.65	0.71
Sub-catchment 2	0.41	0.44	0.48	0.54	0.58	0.63	0.64	0.68	0.74	0.72	0.78	0.91	0.86	0.92	1.00	0.95	1.02	1.11
Sub-catchment 3	0.12	0.13	0.14	0.16	0.17	0.18	0.19	0.20	0.22	0.21	0.23	0.26	0.25	0.27	0.29	0.28	0.30	0.33
Sub-catchment 4	0.18	0.19	0.21	0.24	0.25	0.28	0.28	0.30	0.33	0.32	0.34	0.40	0.38	0.40	0.44	0.42	0.45	0.49
Sub-catchment 5	0.05	0.05	0.06	0.07	0.07	0.08	0.08	0.08	0.09	0.09	0.09	0.11	0.10	0.11	0.12	0.12	0.13	0.14
Sub-catchment 6	0.09	0.09	0.10	0.11	0.12	0.13	0.13	0.14	0.16	0.15	0.16	0.19	0.18	0.19	0.21	0.20	0.21	0.23
Sub-catchment 7	0.12	0.13	0.14	0.16	0.17	0.18	0.19	0.20	0.22	0.21	0.23	0.26	0.25	0.27	0.29	0.28	0.30	0.33



Appendix B – Hydrology Report (*Emerald Glen Flow Regimes)* Addendum – Maps Showing Minor Catchments

Emerald Glen Extension – Stream and Culvert Hydraulics

5-C1744.00
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Figure 1 - Showing Minor Catchments as Hydrology Report.

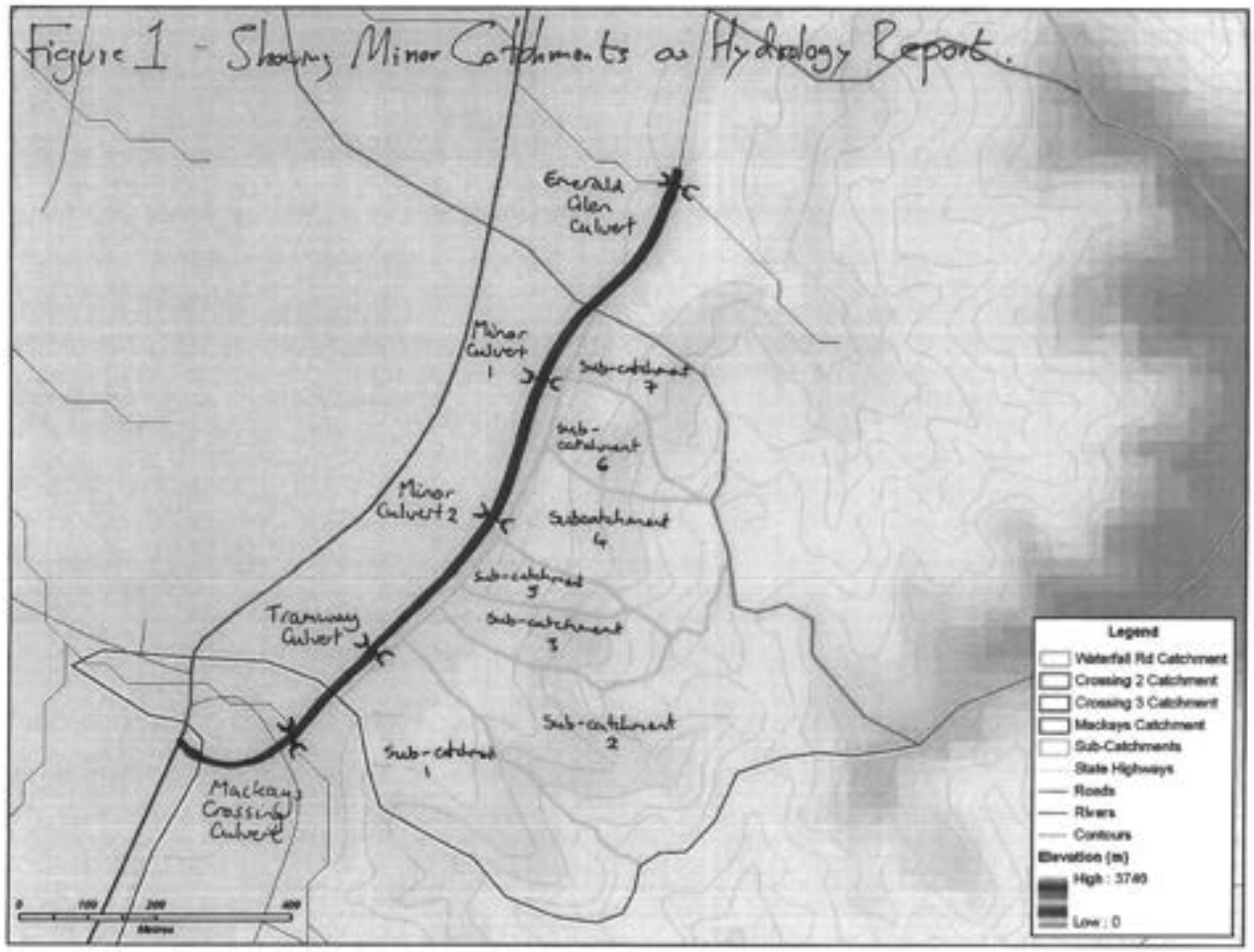
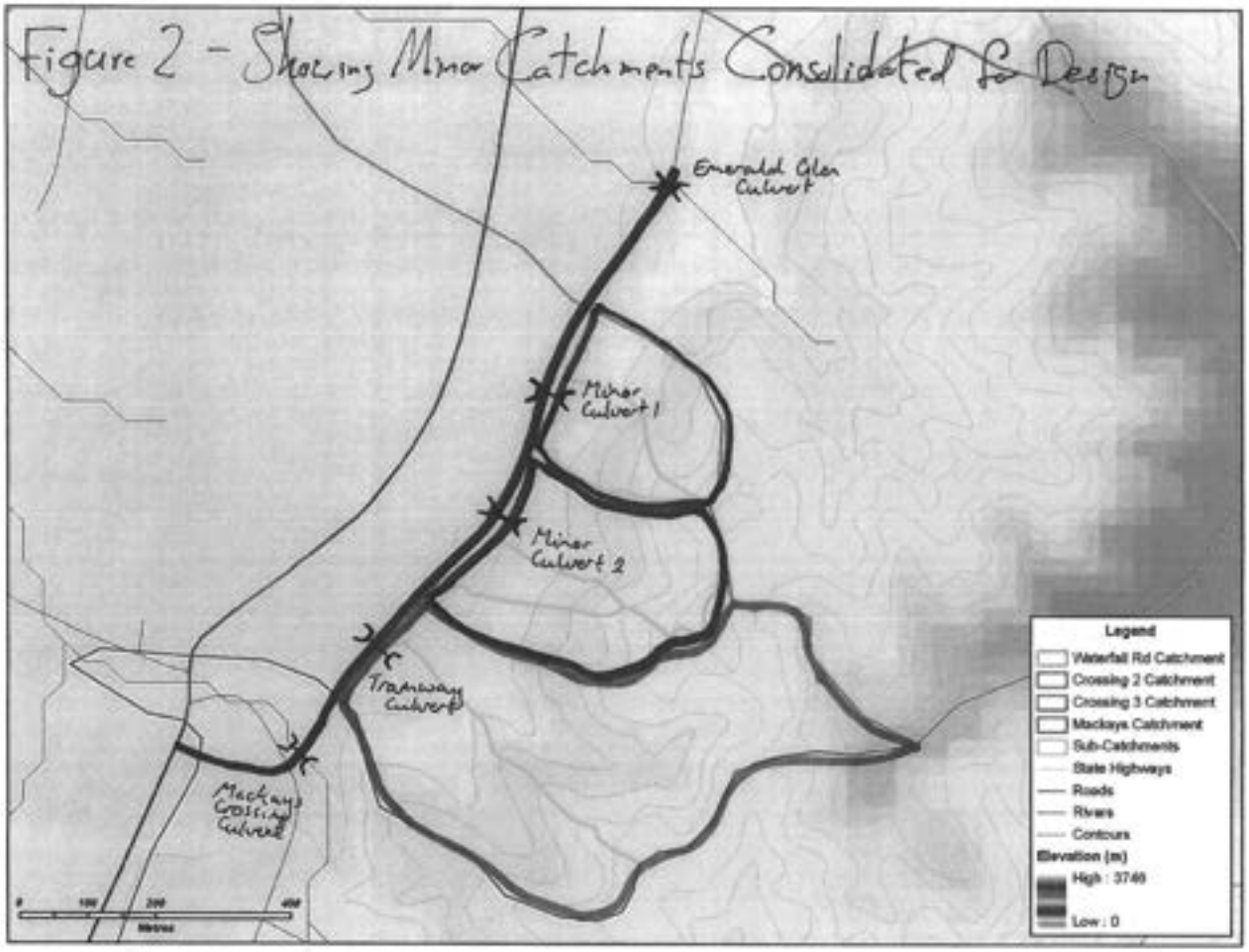


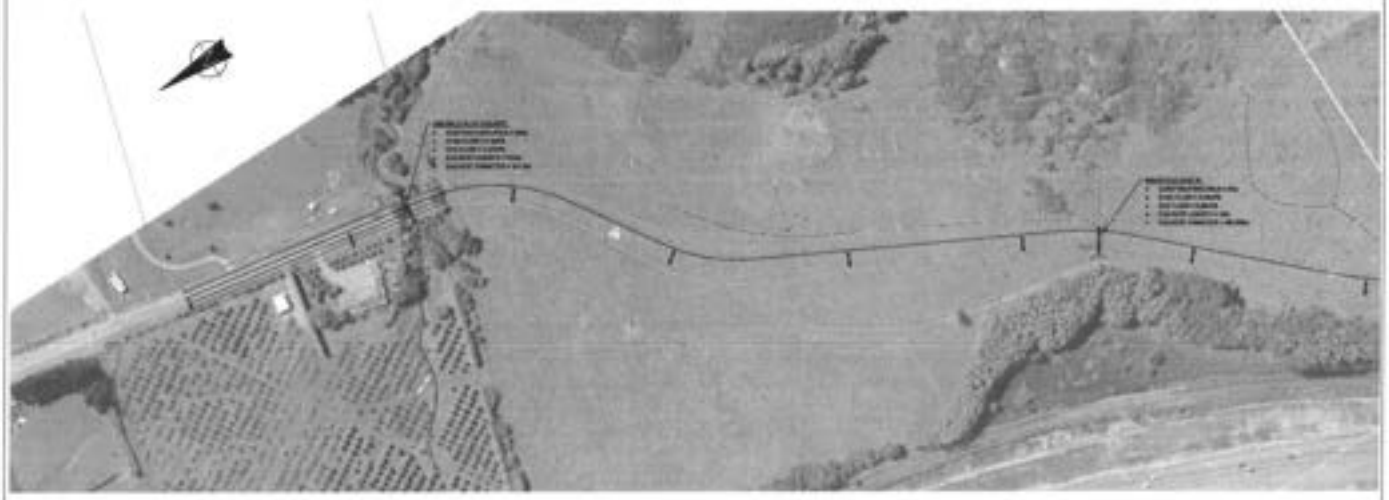
Figure 2 - Showing Minor Catchments Consolidated for Design



Appendix C – Drawings Showing Location and Details of Culverts for Consent Application

Emerald Glen Extension – Stream and Culvert Hydraulics

5-C1744.00
July 2010



CONSTRUCTION

OPUS

NZ TRANSPORT AGENCY
EMERALD GLEN CONNECTION ROAD, ISAFIO
ROAD ALIGNMENT

Proposed Stormwater Plan - Culverts
Sheet 2 of 2

S / 2573 / 1 / 7506

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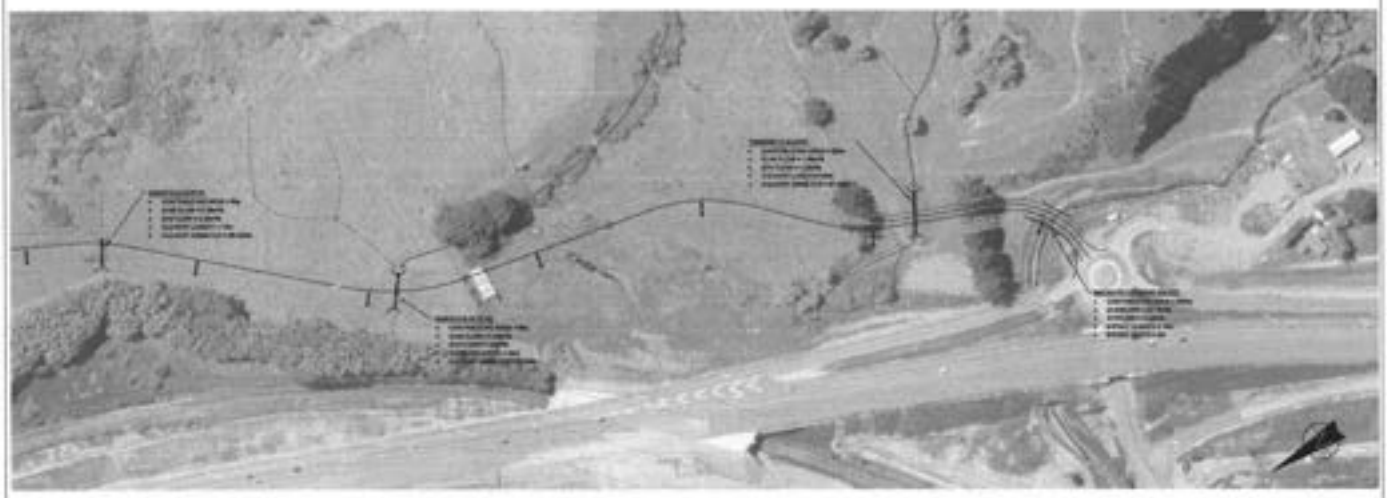
RD



CONSENT

OPUS

NZ Transport Agency
Emerald Glen Connection Road, Isafjd
Road Alignment

Proposed Stormwater Plan - Culverts
Sheet 2 of 2

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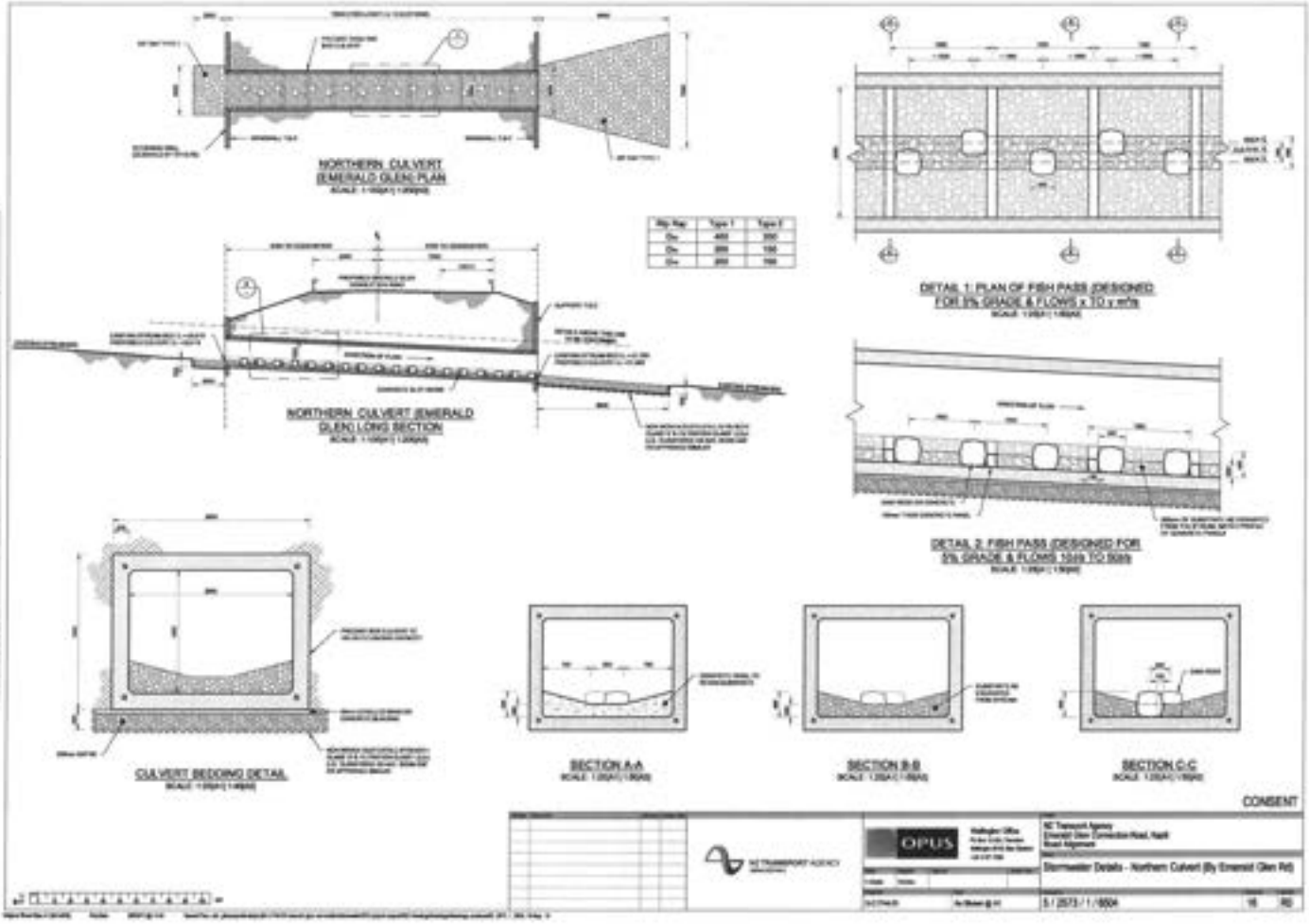
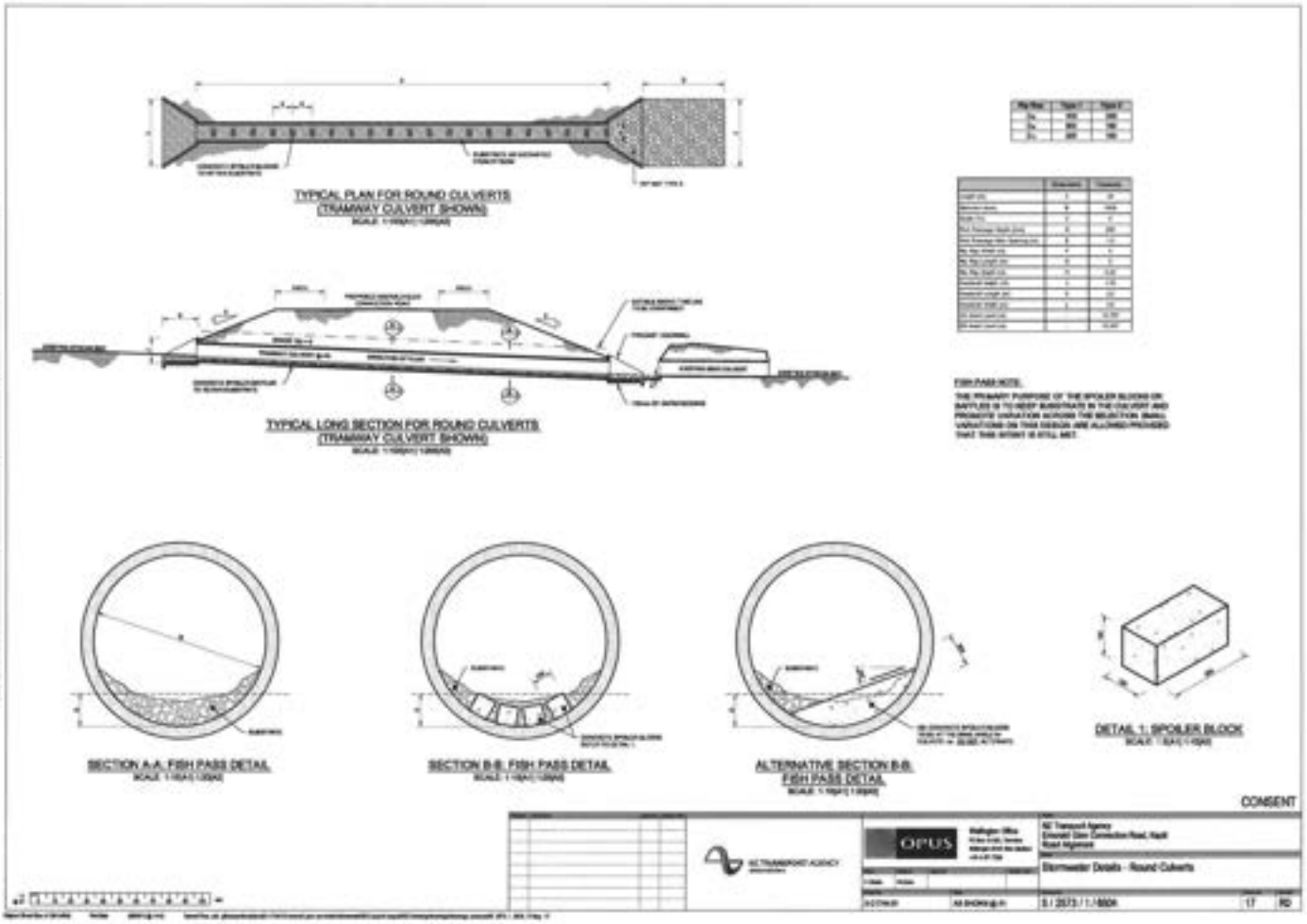
RD


NORTHERN CULVERT (EMERALD GLEN) PLAN
DETAIL 1: PLAN OF FISH PASS (DESIGNED FOR 5% GRADE & FLOWS x TO y m³/s
NORTHERN CULVERT (EMERALD GLEN) LONG SECTION
DETAIL 2: FISH PASS (DESIGNED FOR 5% GRADE & FLOWS 10l/s TO 50l/s
CULVERT BEDDING DETAIL
SECTION A-A
SECTION B-B
SECTION C-C
CONSENT
OPUS
NZ TRANSPORT AGENCY
Stormwater Details - Northern Culvert (By Emerald Glen Rd)
5 / 2573 / 1 / 9504


TYPICAL PLAN FOR ROUND CULVERTS (TRAMWAY CULVERT SHOWN)
TYPICAL LONG SECTION FOR ROUND CULVERTS (TRAMWAY CULVERT SHOWN)
SECTION A-A: FISH PASS DETAIL
SECTION B-B: FISH PASS DETAIL
ALTERNATIVE SECTION B-B: FISH PASS DETAIL
DETAIL 1: SPOILER BLOCK
CONSENT
OPUS
NZ TRANSPORT AGENCY
Stormwater Details - Round Culverts
5 / 2573 / 1 / 9504

Appendix D – Culvert Sizing Calculations

Emerald Glen Extension – Stream and Culvert Hydraulics

5-C1744.00
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Summary of Culvert Sizing

Culvert	Size	Downstream Influence?	Inlet Invert RL (m)	Finished Road level RL (m)	Left Bank RL (m)	Right Bank RL (m)	Inlet Control WL RL (m)		Outlet Control WL RL (m)		Inlet or Outlet Control?
							10 yr	100 yr	10 yr	100 yr	
Emerald Glen	2mW x 1.5mD	No	22.64	26.7	24.1	24.2	23.72	24.10	NA	NA	Inlet
Mackays Crossing	5mW x 2.5mD	Yes	14.74	17.7	17.7	17.7	16.30	16.78	15.46	16.16	Inlet
Tramway	1050mm	Yes	17	19.6	18.4	18.46	17.76	17.91	17.66	18.72	Inlet 10yr

Culvert Capacity for Inlet Control Box Culvert
Emerald Glen Culvert

Where: Q = 2/3*C*B*H*sqrt(2/3*g*H)
(Based on orifice equation)

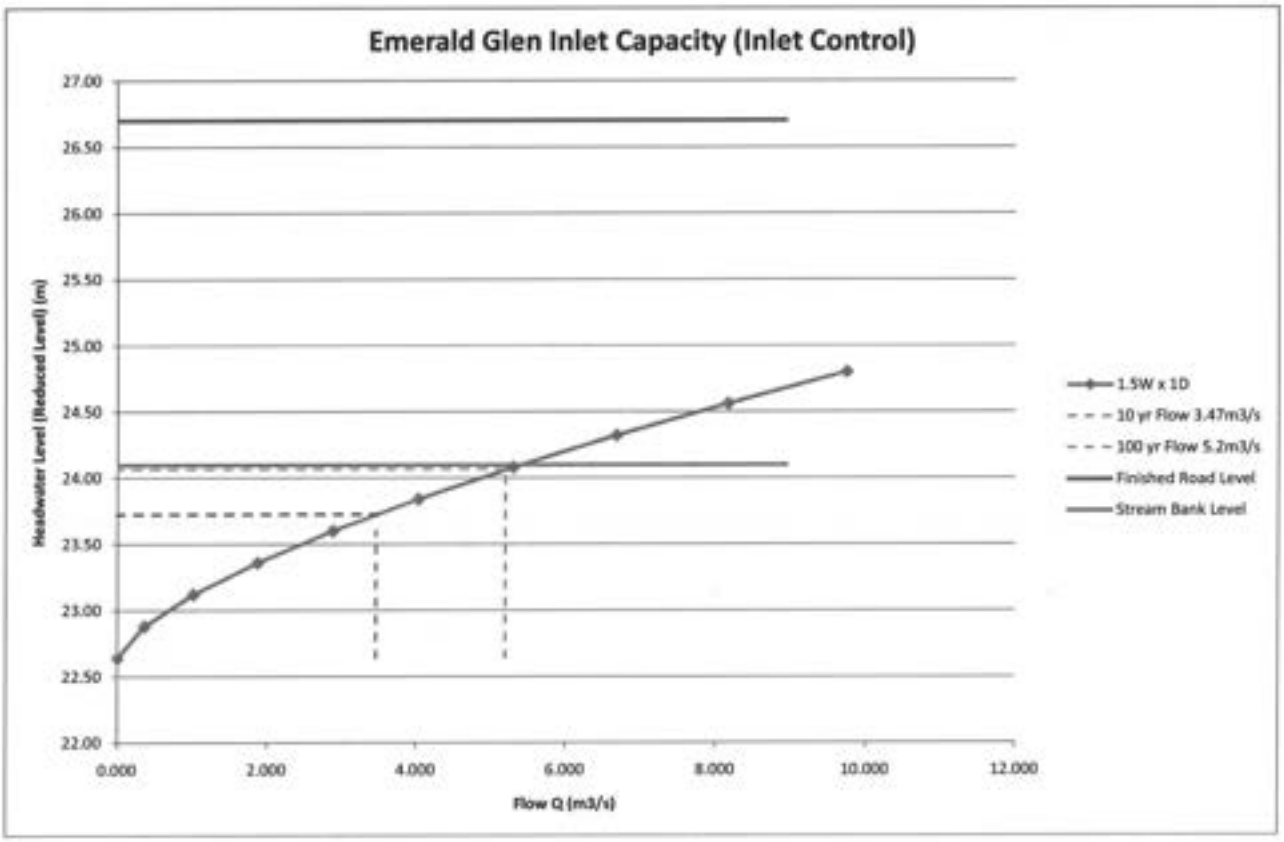
Note: as there are no culverts in the immediate area downstream of the new culvert and the grade is realtively steep (~8%) it was assumed that this culvert is inlet controlled

Procedure
1. A range of values for H/D is first assigned where H is headwater level and D is culvert depth
2. Find headwater level H by multiplying H/D by the culvert depth D
3. Find the reduced level of headwater level by adding the reduced level of the invert to H
4. Find the inlet capacity flow Q for the headwater level (H) using the equation above.
5. Plot the inlet capacity flow against the headwater level to determine where head water level is in relation to the road level and stream banks.

Dimensions		
Culvert 2m wide x1.5m deep		
g	9.81	m/s2
B (width)	2	m
D (depth)	1.5	m
Dactual	1.2	m
Cb (coeff)	0.9	
RL invert inlet	22.64	m

*0.3m of bottom assumed to be used for fish passage)

Working			
H/D	H (m)	RL (m)	Q (m3/s)
0.00	0.00	22.64	0.000
0.20	0.24	22.88	0.361
0.40	0.48	23.12	1.021
0.60	0.72	23.36	1.875
0.80	0.96	23.60	2.887
1.00	1.20	23.84	4.034
1.20	1.44	24.08	5.303
1.40	1.68	24.32	6.682
1.60	1.92	24.56	8.164
1.80	2.16	24.80	9.742



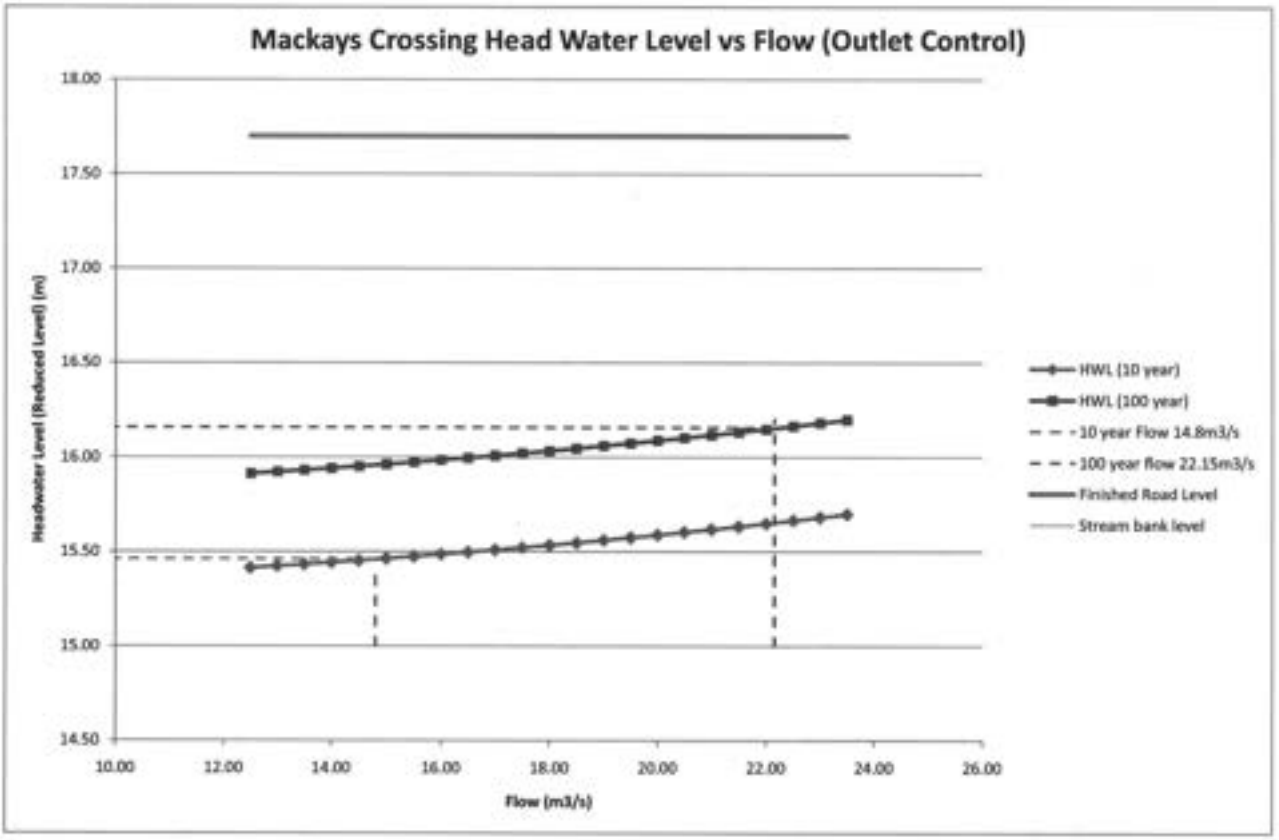
Culvert Capacity for Outlet Control Box Culvert
Mackays Crossing Culvert

	Procedure
1	A range of values for inlet flow Q is first assigned
2	The flow velocity is then determined by V=Q/A where A is cross sectional area of culvert
3	Determine velocity head = $V^2/(2*g)$ where g=9.81 m^2/s
4	Determine losses due to friction $h_f = f \times (L / (4xR)) \times V_{head}$
5	Determine inlet losses $H_i = V_{head} \times K_i$
6	Determine outlet losses $H_o = V_{head} \times K_o$
7	Determine total head losses $H_{tot} = h_f+H_i+H_o$
8	Determine the headwater level HWL for the 100 yr and 10 yr flows where HWL = Tailwater level + Total losses

Culvert Dimensions 5m wide x 2.5m deep			
			Notes/Assumptions
Width B	5	m	
Depth D	2.5	m	
Depth actual D_{actual}	2.2	m	Assuming bottom 0.3m is filled with gravel for fish passage
Pipe Area A	11.00	m2	Cross sectional area $A=BxD_{actual}$
Wetted Perimeter P	14.40	m	Assuming pipe is flowing full
Hydraulic Radius R	0.76	m	R=A/P
Coeff. of friction f	0.06		
K_i	0.2		(inlet loss coefficient)
K_o	1		(outlet loss coefficient)
Length L	26	m	
Manning's n	0.035		
RL Mackays Outlet	14.25	m	
10 yr Tailwater	1.05	m	(Civil Tools used to estimate downstream flow depth from downstream culvert)
100 yr Tailwater	1.55	m	(Civil Tools used to estimate downstream flow depth from downstream culvert)
RL Mackays TW 100yr	15.80	m	
RL Mackays TW 10yr	15.30	m	

Working

Flow Q (m3/s)	Velocity v (m/s)	Velocity Head V_{head} (m)	Friction Loss h_f (m)	Inlet Loss H_i (m)	Outlet loss H_o (m)	Total Loss H_{tot} (m)	HWL 100yr (m)	HWL 10yr (m)
12.50	1.14	0.066	0.03	0.013	0.066	0.11	15.91	15.41
13.00	1.18	0.071	0.04	0.014	0.071	0.12	15.92	15.42
13.50	1.23	0.077	0.04	0.015	0.077	0.13	15.93	15.43
14.00	1.27	0.083	0.04	0.017	0.083	0.14	15.94	15.44
14.50	1.32	0.089	0.05	0.018	0.089	0.15	15.95	15.45
15.00	1.36	0.095	0.05	0.019	0.095	0.16	15.96	15.46
15.50	1.41	0.101	0.05	0.020	0.101	0.17	15.97	15.47
16.00	1.45	0.108	0.06	0.022	0.108	0.18	15.98	15.48
16.50	1.50	0.115	0.06	0.023	0.115	0.20	16.00	15.50
17.00	1.55	0.122	0.06	0.024	0.122	0.21	16.01	15.51
17.50	1.59	0.129	0.07	0.026	0.129	0.22	16.02	15.52
18.00	1.64	0.136	0.07	0.027	0.136	0.23	16.03	15.53
18.50	1.68	0.144	0.07	0.029	0.144	0.25	16.05	15.55
19.00	1.73	0.152	0.08	0.030	0.152	0.26	16.06	15.56
19.50	1.77	0.160	0.08	0.032	0.160	0.27	16.07	15.57
20.00	1.82	0.168	0.09	0.034	0.168	0.29	16.09	15.59
20.50	1.86	0.177	0.09	0.035	0.177	0.30	16.10	15.60
21.00	1.91	0.186	0.09	0.037	0.186	0.32	16.12	15.62
21.50	1.95	0.195	0.10	0.039	0.195	0.33	16.13	15.63
22.00	2.00	0.204	0.10	0.041	0.204	0.35	16.15	15.65
22.50	2.05	0.213	0.11	0.043	0.213	0.36	16.16	15.66
23.00	2.09	0.223	0.11	0.045	0.223	0.38	16.18	15.68
23.50	2.14	0.233	0.12	0.047	0.233	0.40	16.20	15.70



Culvert Capacity for Inlet Control Box Culvert
Mackays Crossing Culvert

Where: Q = 2/3*C*B*H*sqrt(2/3*g*H)
(Based on orifice equation)

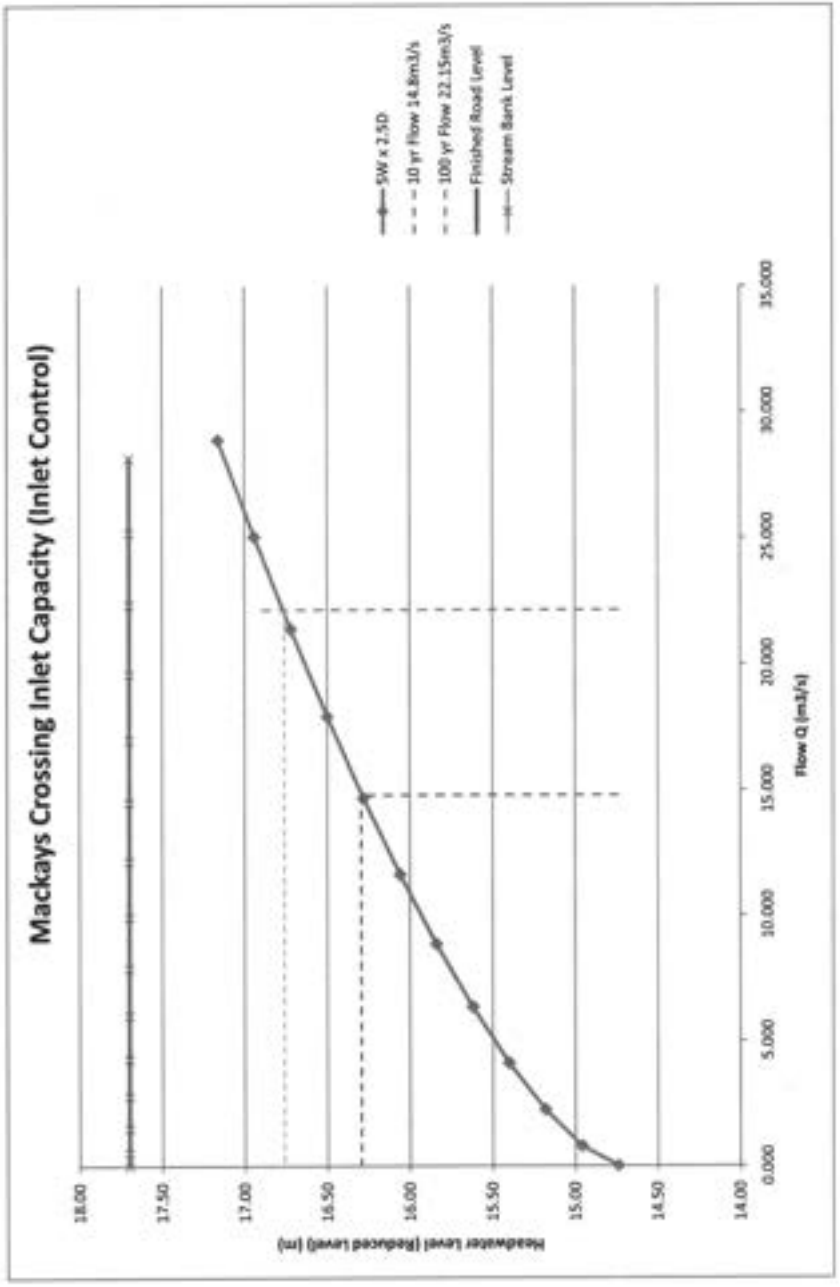
Procedure	
1	A range of values for H/D is first assigned where H is headwater level and D is culvert depth
2	Find headwater level H by multiplying H/D by the culvert depth D
3	Find the reduced level of headwater level by adding the reduced level of the invert to H
4	Find the inlet capacity flow Q for the headwater level (H) using the equation above.
5	Plot the inlet capacity flow against the headwater level to determine where head water level is in relation to the road level and stream banks.

Dimensions
Culvert 5m wide x 2.5m deep

g	9.81	m/s2	
B	5	m	
D	2.5	m	
Dactual	2.2	m	Assuming 0.3m at base is used for fish passage
Cb	0.9		
RL invert inlet	14.74	m	

Working

H/D	H (m)	RL (m)	Q (m3/s)
0.00	0.00	14.74	0.000
0.10	0.22	14.96	0.792
0.20	0.44	15.18	2.239
0.30	0.66	15.40	4.114
0.40	0.88	15.62	6.333
0.50	1.10	15.84	8.851
0.60	1.32	16.06	11.635
0.70	1.54	16.28	14.662
0.80	1.76	16.50	17.913
0.90	1.98	16.72	21.375
1.00	2.20	16.94	25.035
1.10	2.42	17.16	28.882



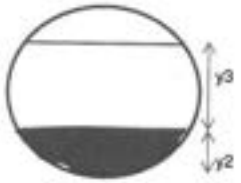
Culvert Capacity for Inlet Control Round Culvert
Tramway Culvert Inlet Control

Where: Q = C*A*sqrt(2/3*g*H)
(Orifice equation)

	Procedure
1	A range of values for H/D is first assigned where H is headwater level and D is culvert depth
2	Find headwater level H by multiplying H/D by the culvert diameter D
3	Find the reduced level of headwater level by adding the reduced level of the invert to H
4	Find the inlet capacity flow Q for the headwater level (H) using the equation above.
5	Plot the inlet capacity flow against the headwater level to determine where head water level is in relation to the road level and stream banks.

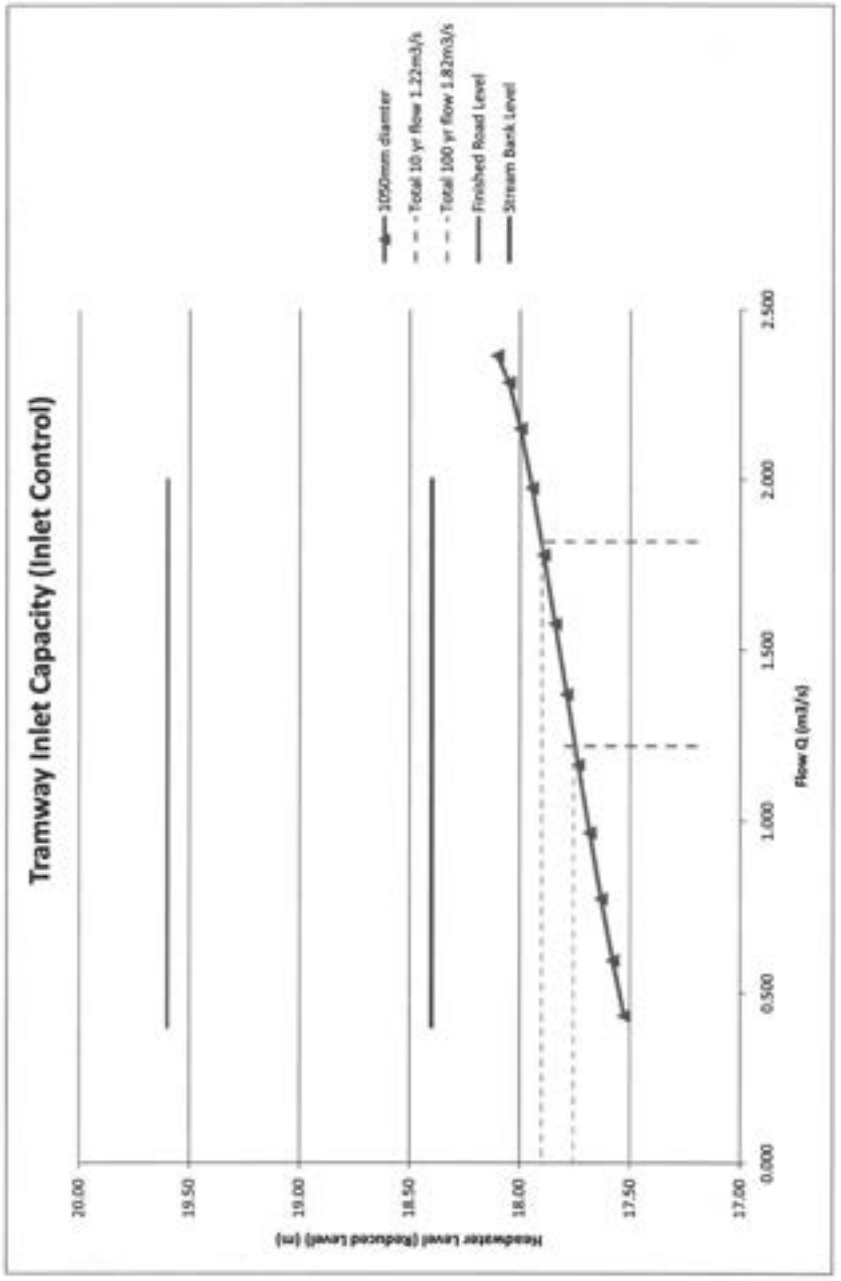
Dimensions
1050 mm diameter

g	9.81	m/s^2	
Diameter D	1.05	m	
Fish Pass area	0.204	m2	Assuming 0.3m of base filled used for fish passage
Total Area A	0.661	m2	
Cd	0.9		
RL invert	17	m	
H	y2+y3	m	(y2 =0.3m fish passage allowance)



Working

H/D	H (m)	Theta (rads)	y3 (m)	Area A (m2)	RL (m)	Q (m^3/s)
~~0.00~~	~~0.00~~	~~0.00~~	~~-0.30~~	~~-0.20~~	~~17.00~~	~~#NUM!~~
~~0.10~~	~~0.11~~	~~1.29~~	~~-0.20~~	~~-0.16~~	~~17.11~~	~~#NUM!~~
~~0.20~~	~~0.21~~	~~1.85~~	~~-0.09~~	~~-0.08~~	~~17.21~~	~~#NUM!~~
0.30	0.32	2.32	0.02	0.01	17.32	0.007
0.35	0.37	2.53	0.07	0.07	17.37	0.068
0.40	0.42	2.74	0.12	0.12	17.42	0.165
0.45	0.47	2.94	0.17	0.17	17.47	0.288
0.50	0.53	3.14	0.23	0.23	17.53	0.433
0.55	0.58	3.34	0.28	0.28	17.58	0.596
0.60	0.63	3.54	0.33	0.34	17.63	0.775
0.65	0.68	3.75	0.38	0.39	17.68	0.968
0.70	0.74	3.96	0.44	0.44	17.74	1.166
0.75	0.79	4.19	0.49	0.49	17.79	1.371
0.80	0.84	4.43	0.54	0.54	17.84	1.578
0.85	0.89	4.69	0.59	0.58	17.89	1.781
0.90	0.95	5.00	0.65	0.62	17.95	1.975
0.95	1.00	5.38	0.70	0.65	18.00	2.150
1.00	1.05	6.28	0.75	0.66	18.05	2.285
1.05	1.10	6.28	0.80	0.66	18.10	2.364



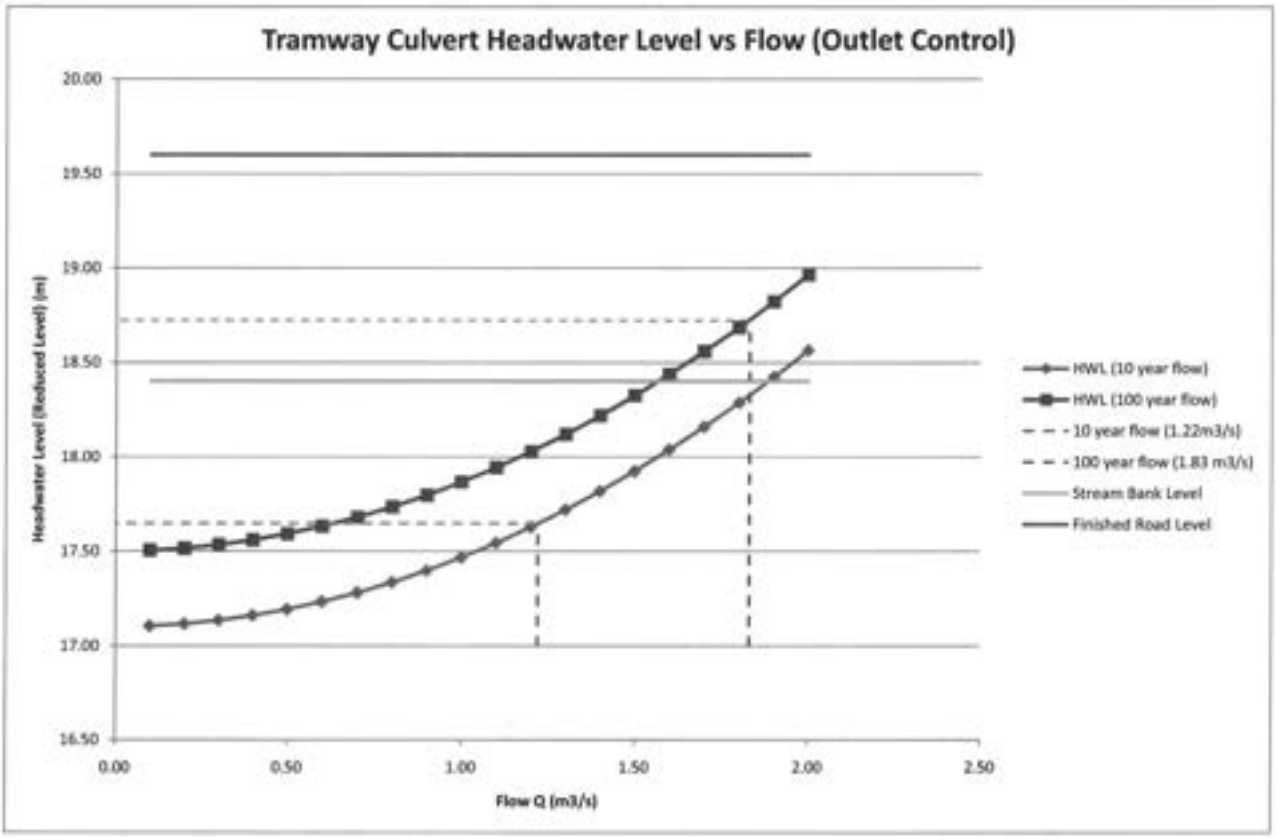
Culvert Capacity for Outlet Control Round Culvert
Tramway Culvert Outlet Control

	Procedure
1	A range of values for inlet flow Q is first assigned
2	The flow velocity is then determined by V=Q/A where A is cross sectional area of culvert
3	Determine velocity head = $V^2/(2*g)$ where g=9.81 m^2/s
4	Determine losses due to friction h_f= f x (L / (4xR)) x V_{head}
5	Determine inlet losses H_i = V_{head} x K_i
6	Determine outlet losses H_o = V_{head} x K_o
7	Determine total head losses H_{tot} = h_f+H_i+H_o
8	Determine the headwater level HWL for the 100 yr and 10 yr flows where HWL = Tailwater level + Total losses

Culvert Dimensions			
1050mm			
Diameter	1.05	m	
Fish pass area a	0.204	m	Assuming bottom 0.3m filled for fish passage
Pipe Area A	0.66	m2	Pipe area - fish passage area
Wetted Perimeter P	3.30	m	Assuming pipe flowing full
Hydraulic Radius R	0.20	m	
Coeff. of friction f	0.06		
K_i	0.2		(inlet loss coefficient)
K_o	1		(outlet loss coefficient)
Length L	26	m	
Manning's n	0.025		
RL SubC 1 Outlet	15.90	m	
100 yr TW depth	1.60	m	Civil Tools used to estimate tailwater depth caused by downstream culvert
10 yr TW depth	1.20	m	Civil Tools used to estimate tailwater depth caused by downstream culvert
RL Tramway TW 100yr	17.50	m	
RL tramway TW 10yr	17.10	m	

Working

Flow Q (m3/s)	Velocity v (m/s)	Velocity Head V_{head} (m)	Friction Loss h_f (m)	Inlet Loss H_i (m)	Outlet loss H_o (m)	Total Loss H_{tot} (m)	HWL 100yr (m)	HWL 10yr (m)
0.10	0.15	0.001	0.00	0.000	0.001	0.00	17.50	17.10
0.20	0.30	0.005	0.01	0.001	0.005	0.01	17.51	17.11
0.30	0.45	0.010	0.02	0.002	0.010	0.03	17.53	17.13
0.40	0.60	0.019	0.04	0.004	0.019	0.06	17.56	17.16
0.50	0.76	0.029	0.06	0.006	0.029	0.09	17.59	17.19
0.60	0.91	0.042	0.08	0.008	0.042	0.13	17.63	17.23
0.70	1.06	0.057	0.11	0.011	0.057	0.18	17.68	17.28
0.80	1.21	0.075	0.14	0.015	0.075	0.23	17.73	17.33
0.90	1.36	0.094	0.18	0.019	0.094	0.30	17.80	17.40
1.00	1.51	0.116	0.23	0.023	0.116	0.37	17.87	17.47
1.10	1.66	0.141	0.27	0.028	0.141	0.44	17.94	17.54
1.20	1.81	0.168	0.33	0.034	0.168	0.53	18.03	17.63
1.30	1.97	0.197	0.38	0.039	0.197	0.62	18.12	17.72
1.40	2.12	0.228	0.44	0.046	0.228	0.72	18.22	17.82
1.50	2.27	0.262	0.51	0.052	0.262	0.82	18.32	17.92
1.60	2.42	0.298	0.58	0.060	0.298	0.94	18.44	18.04
1.70	2.57	0.337	0.65	0.067	0.337	1.06	18.56	18.16
1.80	2.72	0.377	0.73	0.075	0.377	1.19	18.69	18.29
1.90	2.87	0.421	0.82	0.084	0.421	1.32	18.82	18.42
2.00	3.02	0.466	0.91	0.093	0.466	1.46	18.96	18.56


Tramway Culvert Headwater Level vs Flow (Outlet Control)
Headwater Level (Reduced Level) (m)
20.00
19.50
19.00
18.50
18.00
17.50
17.00
16.50
0.00
0.50
1.00
1.50
2.00
2.50
Flow Q (m3/s)
HWL (10 year flow)
HWL (100 year flow)
10 year flow (1.22m3/s)
100 year flow (1.83 m3/s)
Stream Bank Level
Finished Road Level

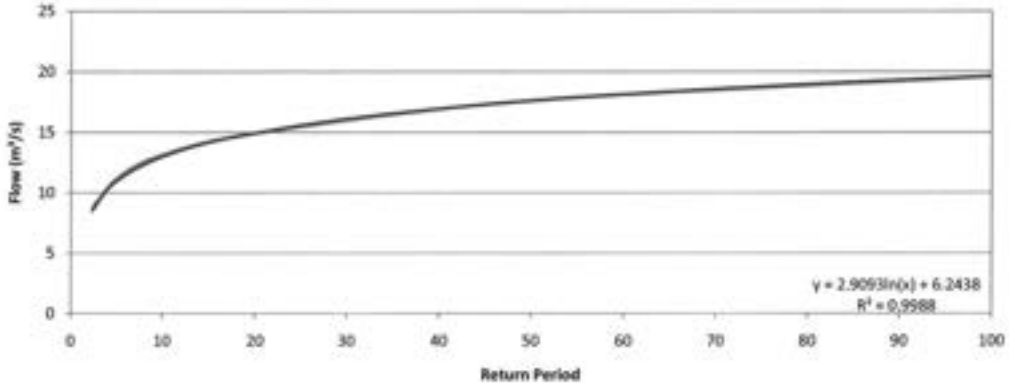
Appendix E Mackays Crossing flow Extrapolation

Emerald Glen Extension – Stream and Culvert Hydraulics

5-C1744.00
July 2010

Determining the Q200, 500 and 1000 at Mackays Crossing
- Extrapolating the flow, from the Whareroa Stream flood report by Opus (Grant Webby) 2004

2.33	8.5
5	11.1
10	13.1
20	14.9
50	17.6
100	19.6



	ARI	Flow (m³/s)	Climate Change 2040	Climate Change 2090
Extrap	200	21.6	23.16	25.23
Extrap	500	24.32	26.07	28.41
Extrap	1000	26.34	28.24	30.77

Appendix F Mackays Crossing Backwater effect assessment

Emerald Glen Extension – Stream and Culvert Hydraulics

5-C1744.00
July 2010

HydroChan v1.0 Output for Project : Emerald Glen - southern culvert

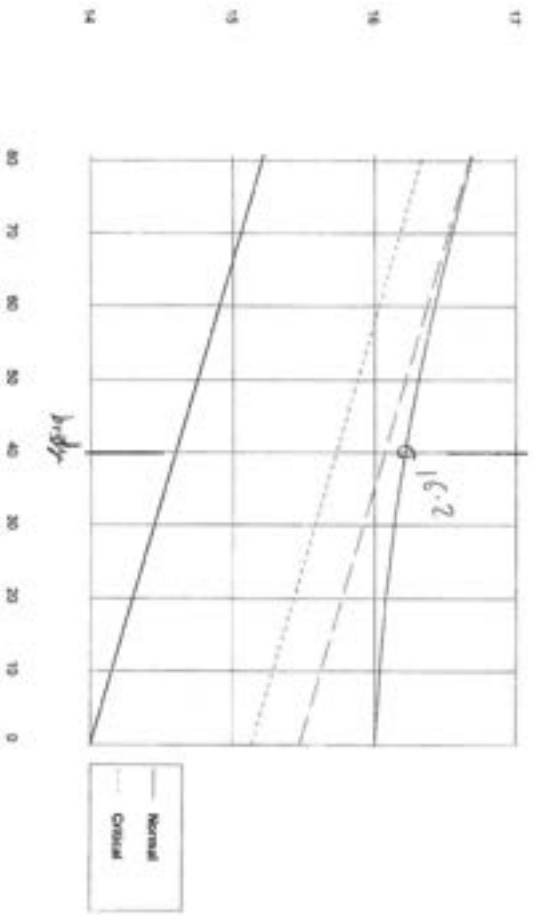
Date : 10-07-13

Results :

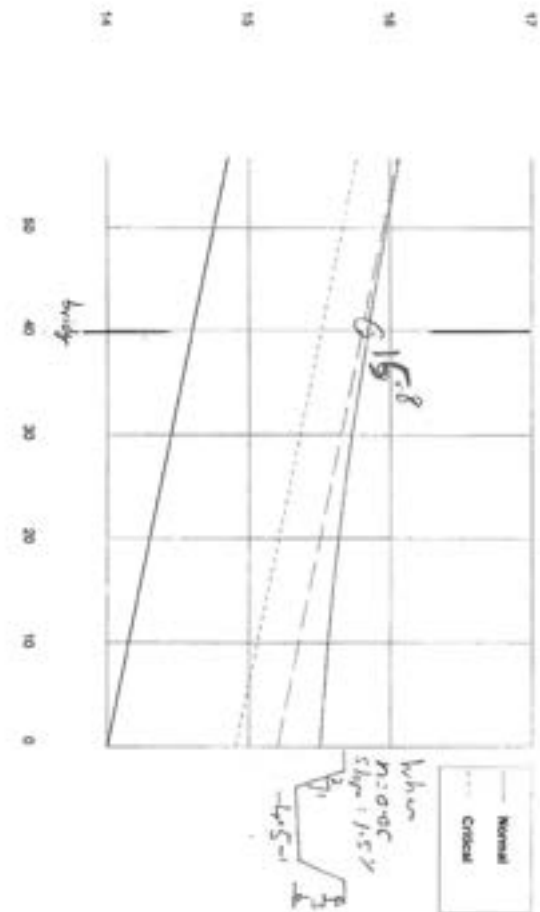
Q (cms)	15.000	22.000	31.000
TW El. (m)	15.500	16.000	16.500
Normal Depth (m)	0.977	1.211	1.462
Critical Depth (m)	0.722	0.914	1.125

Profiles :

Q = 15.000		Q = 22.000		Q = 31.000	
X (m)	El. (m)	X (m)	El. (m)	X (m)	El. (m)
0.000	15.500	0.000	16.000	0.000	16.500
4.000	15.509	10.000	16.016	10.000	16.513
8.000	15.519	20.000	16.038	20.000	16.529
12.000	15.531	30.000	16.069	30.000	16.550
16.000	15.545	40.000	16.110	40.000	16.578
20.000	15.561	50.000	16.167	50.000	16.614
24.000	15.580	60.000	16.242	60.000	16.662
28.000	15.601	70.000	16.339	70.000	16.725
32.000	15.626	80.000	16.455	80.000	16.804
36.000	15.655	90.000	16.584	90.000	16.903
40.000	15.687	86.532	16.656	100.000	17.018
44.000	15.724			110.000	17.145
48.000	15.764			118.376	17.252
52.000	15.809				
56.000	15.854				
60.000	15.907				
64.000	15.960				
68.000	16.012				
71.027	16.052				



Flow Description for Q = 22.0 (cms) : M1



HydroChan v1.0 Output for Project : Emerald Glen - southern culvert

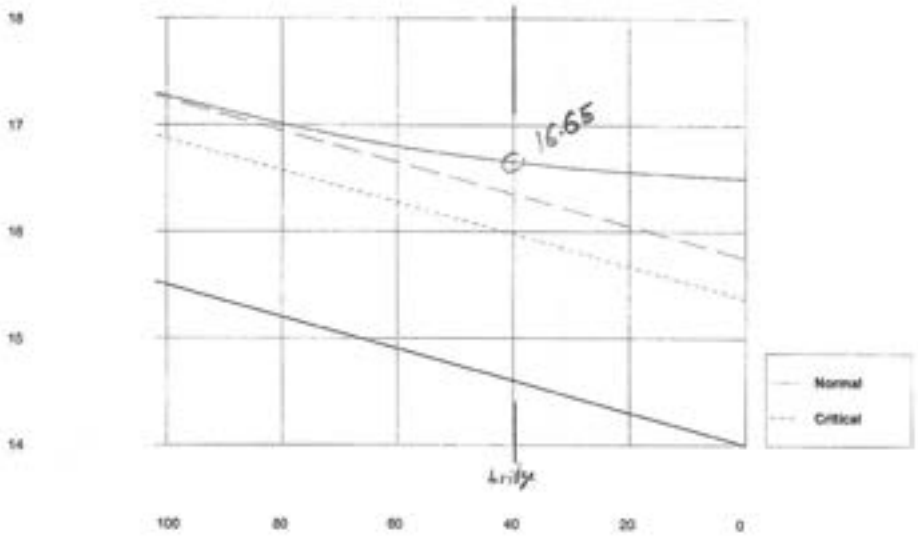
Flow Description for Q = 15.0 (cms) : M1

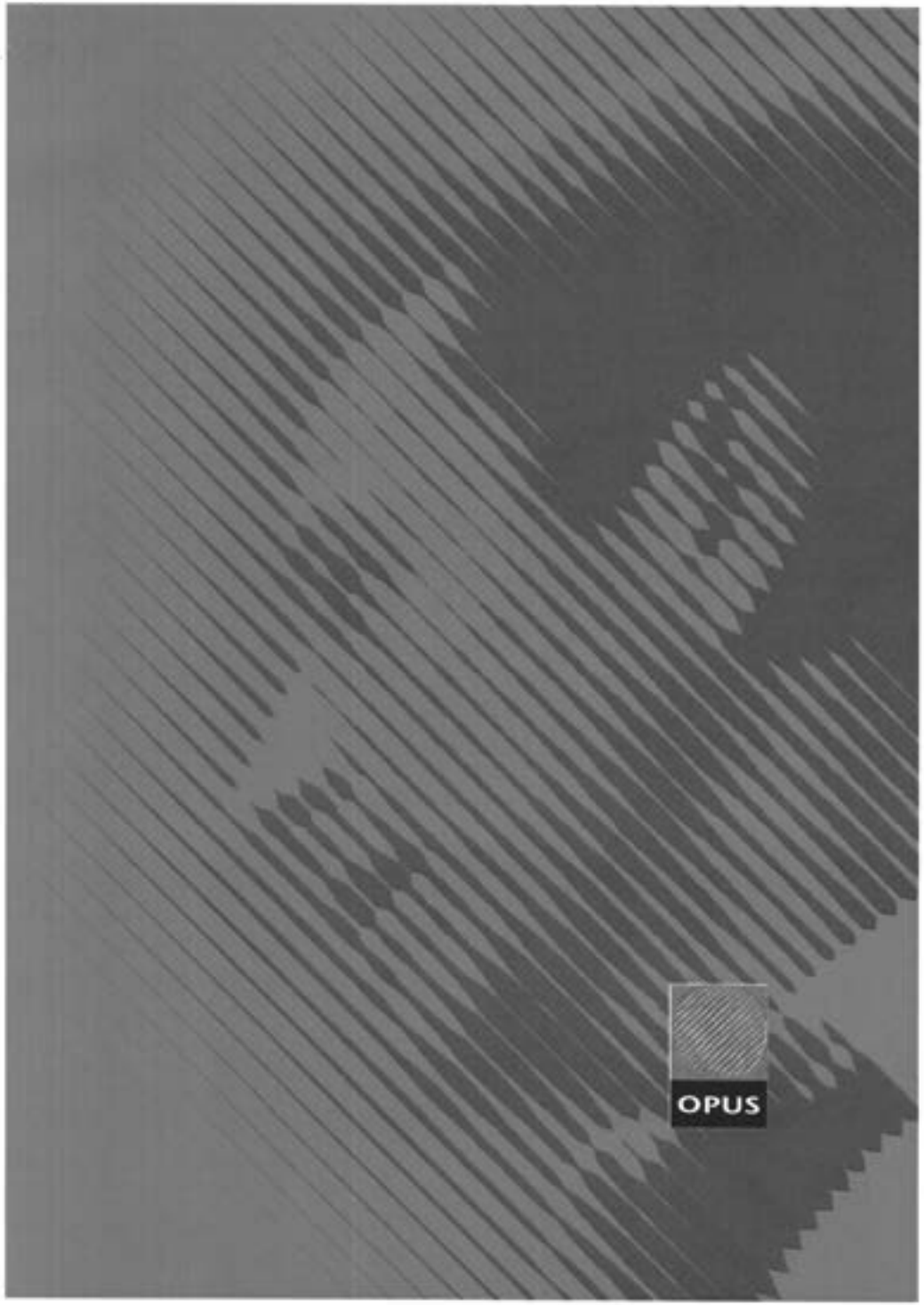
Date : 10-07-13

HydroChan v1.0 Output for Project : Emerald Glen - southern culvert

Date : 10-07-13

Flow Description for Q = 31.8 (cms) : M1




OPUS

16th September, 2010

Leigh Sage
Building Consents Officer
Kapiti Coast District Council
175 Rimu Road
Private Bag 601
Paraparaumu 5254

5-C1744.03.WE02.65

Dear Leigh

NZTA: Emerald Glen Connection - Retaining Walls - Building Consent Approvals

Thank you for your time talking through the retaining wall designs proposed for NZTA's Emerald Glen Connection project.

General
There are two proposed retaining walls, which will support the proposed road above the proposed Emerald Glen Culvert, around Station 140.

Fence
From our preliminary meeting we have made alterations to the pedestrian fence, along the footpath, at the top of the retaining wall. The fence now complies with Clause F4 of the New Zealand Building Code (as can be seen on drawings sheet 303r2, and we have instructed the contractor to use the fence 'a' from figure 2 of Acceptable Solution F4/AS1.

Public access
During the works: The site will be part of a larger formal construction site. As such the public will not have access.

After the works: The public will be able to drive over the road, which is supported by the two retaining walls. The design includes road barriers either side of the road and a fence on the retaining wall side of the foot path. The public would need to climb over these barriers to gain access to the retaining walls.

Land ownership
A certificate of title has not been included in this application, as there is no certificate of title. This is because the proposed retaining walls are located within an existing KCDC road reserve (although there is no road there yet). There is also no Gazetted reference as this road was not acquired under the public works act but vested to Council in 1972, see survey drawing number SO33688 which is attached.

Opus International Consultants Limited
Wellington Office

Level 9, Majestic Centre, 100 Willis Street
PO Box 12 003, Wellington 6144,
New Zealand

Telephone: +64 4 471 7000
Facsimile: +64 4 471 1397
Website: www.opus.co.nz

Supporting information
The attached information provided for the retaining walls includes the following:

- Completed building consent application (1 copy);
- Application Fee (1 copy);
- Producer statements PS1(2 copies);
- Locality plan and construction drawings (2 copies);
- Design calculations for the walls (2 copies);
- Specifications for the walls (2 copies);
- Hydraulics report for the culvert (2 copies);
- Shop drawings from Humes, for the manufacturing details (2 copies);
- Breakdown of construction costs from our engineers' estimate (2 copies);
- Copy of survey plan SO33688 (2 copies);
- E-mail to contractor regarding selection of pedestrian fence (2 copies).

Application fee
I have included a cheque for $1,350.00 as advised by Michelle Salmon, based on our construction estimate of circa $200,000.

Timing
Please can you process this consent at you earliest convenience. This would be greatly appreciated as the contractors need to start work very soon, in order that this road can be opened before the Waterfall Road railway crossing is closed, so the double tracking of the railway can operate safely.

Contact
If you have any inquiries or require further information about this application, please do not hesitate to contact me on DDI (04) 471 7120.

Yours sincerely

Richard Coles
Environmental Engineer.

Richard Coles

From: Curtis Lee [Curtis.Lee@opus.co.nz]
Sent: Thursday, 9 September 2010 15:00
To: 'Gerald Carty [FCC-CivEng]'
Cc: 'Wayne Holcroft'; 'Andrew Quinn'
Subject: FW: Emerald Glen - Fence on Northern Culvert
Attachments: F4-safety-from-falling.pdf

Gerald

I'd like to confirm that the type of timber fence along the edge of the footpath over the northern culvert, should be the same as shown on Figure 2 (a) in the Building Code attached.

If you need any further information just let me know. I shouldn't think we'd have to create a drawing for this fence.

Thanks

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From: Curtis Lee [mailto:Curtis.Lee@opus.co.nz]
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Subject: Emerald Glen - Fence on Northern Culvert

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Attached is a copy of the building code which talks about these fence types.

When I get chance I will have a read through this code and let you know which fence we should go for.

But in the meantime, it might be worth you doing the same.

Thanks

Curtis

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Curtis Lee
Team Leader Transportation Engineering Design
Opus International Consultants Ltd
Curtis.Lee@opus.co.nz
Tel +64 4 471 7012, Fax +64 4 471 1397
http://www.opus.co.nz
Level 7 Majestic Centre, 100 Willis St, PO Box 12 003, Wellington, New Zealand

1 Green Terramesh Retaining Wall

1.1 Scope

This specification covers the procedures and requirements for the construction of the Green Terramesh retaining wall at the northern culvert of the proposed Emerald Glen Road extension.

The Contractor shall supply all materials, plant, equipment, labour and supervision necessary to complete the specified work as detailed on the Drawings.

1.2 Materials

Green Terramesh

The Green Terramesh units are prefabricated from a single panel of wire mesh with an additional welded steel mesh at the facing and triangular supporting bracket. Opening and pivoting of the triangular supporting brackets will create a 70° face angle.

The material (including zinc coated wires, PVC coating, wire mesh gabions, lacing wire, internal stiffeners, steel mesh and fasteners) properties, requirements, tolerances, and fabrication of the Terramesh System and woven mesh gabions shall be in accordance with the latest product standard Specification issued by the manufacturer Maccaferri Inc.

Unit size of the gabions shall be in accordance with the construction Drawings.

HDPE Geogrid

Geogrid shall be Tensar HDPE geogrid as specified in the Drawings or approved equivalent.

Erosion Control Mat

Biomac Grasstrike 300 or equivalent approved shall be used as the erosion control mat at the wall face.

Reinforced Backfill Materials

(a) Rock Fill

The rock fill material in the gabion basket shall be hard, unweathered, free from fissures and flaking, angular to round, durable rock and of such quality that they shall not disintegrate on exposure to water or weathering during the life of the structure.

The material shall have unit weight of at least 24 kN/m³. The rocks shall range between 100 mm and 200 mm. The range in sizes shall allow for a variation of 5% oversize and/or 5% undersize rock, provided it is not placed on the gabion exposed surface. Rock fill shall not be more than 10% passing a 75 mm aperture sieve opening.

(b) Structural Fill Material

Structural fill material within the reinforced zone for the reinforced soil wall shall be obtained from natural sources. It shall be free from organic or otherwise deleterious materials (timber, metal, bricks, paper etc) and shall Contain no material retained on a 75 mm sieve, and for which the material passing a 19 mm sieve when tested in accordance with NZS 4402: 1986 Test 6.1.1 has a soaked CBR greater than 20.

Compaction

The in situ density shall not be less than 98% of the maximum dry density (MDD) for that material as determined by Standard Compaction Test 4.1.1 of NZS 4402:1986 for each set of tests being the average of five separate field measurements. No separate field density measurement shall be less than 95%.

Internal Friction Angle

Material shall exhibit an effective angle of internal friction of not less than 36°, as determined by large diameter triaxial testing or approved equivalent on the portion of material finer than the 20 mm, utilizing a sample of material compacted to 98 percent of Heavy Compaction NZS 4402: 1988; Test 4.1.2. Sampling for triaxial testing shall be carried out in accordance with NZS4407: 1991.

Soundness

The material shall be free of shale or other soft, poor durability particles.

Drainage Filter Material

All material used for the filter around subsoil drain pipes (wrapped in geotextile) shall comply with TNZ F/6 unless otherwise specified.

When tested in accordance with NZS 4407:1991, Test 3.8.1, the drainage aggregate shall comply with the following gradings:

Test Sieve Aperture	Percentage Passing
20 mm	100
1.5 mm	5 max

Geotextile

The geotextile shall be a non-woven geotextile meeting the requirements of TNZ F/7 for Strength Class C and Filtration Class 1 (i.e. Bidim A29 or equivalent approved).

1 Green Terramesh Retaining Wall

1.3 Acceptance of Material

The Contractor shall ensure that all the materials specified comply with the applicable contract specifications and Maccaferri Specifications.

1.4 Excavation for Green Terramesh

Excavation shall be carried out in such a manner that the surface is neatly cut, free draining over its length. The Contractor shall be responsible for the design and construction of any temporary cut and/or lateral support required during construction.

The final founding level shall be approved by a qualified Engineer.

1.5 Foundation Preparation

The foundations for the walls shall be graded level. Any surface irregularities, soft or loose materials, and vegetation shall be removed and replaced by compacted granular fill during the preparation of the foundation.

The final foundation platform shall be approved by a Geotechnical Engineer before construction of the Green Terramesh wall system.

1.6 Green Terramesh combined with Geogrid

(i) Geogrid shall be oriented with the highest strength axis perpendicular to the wall face alignment.

(ii) Geogrid reinforcement shall be placed at the lengths and elevations shown on the construction Drawings.

(iii) The geogrid shall be attached to the Terramesh Green units by lacing or stainless steel rings. The geogrid shall be pulled tight prior to backfill placement on the geogrid.

(iv) Geogrid reinforcements shall be continuous throughout their embedment lengths and placed side-by-side to provide 100% coverage at each level. Spliced connections between shorter pieces of geogrid or gaps between adjacent pieces of geogrid are not permitted.

(v) Install the Green Terramesh units as described in Clause 1.7. Once the first row of Terramesh Green units are placed in position, the units shall be connected through the geogrid layer along the front reinforced bar using lacing or stainless steel rings. Refer to the manufacturer's specifications for ring connection spacing.

1 Green Terramesh Retaining Wall

1.7 Green Terramesh System Wall Installation

(i) Place the Green Terramesh units in their positions. Alignment and level shall be checked in all directions and insure that all gabion units are in full contact with the base and properly seated.

(ii) Raise the unit's facing, turn the triangular stiffening brackets perpendicular to the facing and connect to base panel with lacing wire or steel fasteners.

(iii) Roll out the erosion mat and place the erosion mat through the triangular brackets located behind the front face of the Green Terramesh unit and fix top and bottom to the mesh face. Slitting of the erosion mat in line with the brackets is required to ensure that it extends horizontally back against the horizontal mesh by at least 400 mm.

(iv) Place approved backfill up to 300 mm of the face and compact to the required degree of compaction as stated in Clause 2.1. Compaction is to proceed parallel to the slope face, ensuring that the compacting machine does not come within 1 m of the face element. Lighter compaction equipment should be used towards the front face zone.

(v) Topsoil with suitable seed mix shall be placed in the 300 mm zone of the structure, behind the Green Terramesh face. The top soil should be firmly compacted by plate or small machine compactor. Overfill topsoil zone by 5 % to allow for some local settlement of the top soil.

(vi) The erosion mat and 1 m long Green Terramesh tieback is folded back into the slope ready for the next unit. The next row of Green Terramesh units shall be laid out as previously described directly on the lower units. The upper and lower units shall be all connected along the front reinforced bar using lacing or stainless steel rings.

(vii) Adjacent panels shall be laced longitudinally to provide a homogeneous reinforcement layer. Each lacing loop shall be pulled tight to prevent the joint opening during backfilling.

1.8 Reinforced Backfill Placement

(i) Reinforced backfill shall be placed, spread, and compacted in such a manner that minimizes the development of slack in the geogrid and installation damage.

(ii) Reinforced backfill shall be placed and compacted in lifts not to exceed 150mm loose lift thickness where hand compaction is used, or 200mm loose lift thickness where heavy compaction equipment is used. Lift thickness shall be decreased to achieve the required density as required.

(iii) Reinforced backfill shall be compacted to 98% of the maximum density as determined by Heavy Compaction in accordance with NZS 4402. The moisture

content of the backfill material prior to and during compaction shall be uniformly distributed throughout each layer and shall be + 2%, and - 3% of optimum.

(iv) Only lightweight hand-operated equipment shall be allowed within 1 meter from the tail of the gabion unit.

(v) Tracked construction equipment shall not be operated directly upon the geogrid reinforcement. A minimum fill thickness of 150 mm is required prior to operation of tracked vehicles over the geogrid. Tracked vehicle turning should be kept to a minimum to prevent tracks from displacing the fill and damaging the geogrid.

(vi) Rubber tired equipment may pass over geogrid reinforcement at slow speeds, less than 15 KPH. Sudden braking and sharp turning shall be avoided.

(vii) At the end of each day's operation, the Contractor shall slope the last lift of reinforced backfill away from the wall units to direct runoff away from wall face. The Contractor shall not allow surface runoff from adjacent areas to enter the wall construction site.

1.9 Quality Control Records

The Contractor shall keep records of at least the following information during the entire construction stage.

(a) Foundation excavation levels

(b) All laboratory and field quality control tests results.

Planning Processing Check Sheet

Retaining Walls over culvert
Road Reserve near
86 Emerald Glen Road

Building Consent Number: BC 100764.

Property Information				
Property Address	86 Emerald Glen Road, Paraparaumu			
Legal Description	Lot 5 DP 33688.			
Planning Zone	Rural.			
Building Project	Culvert, Retaining Walls.			
	Yes	No	Action reqd	Actioned
Certificate of Title		✓		
Easements		✓		
Section 221		✓	Include copy	
District Plan Items to Check				
	Yes	No	Action Reqd	Actioned
Designations	✓		Airport Conical Surface / Hillcountry.	
Heritage Register		✓	Noise Corridor	
Flood Hazards		✓		
Min Floor Level		✓		
Other Hazards		✓		
EQ Faults		✓	80m from Ohariu Fault trace	
Services		✓		
Eco-site/Native Veg				
	Complies?		Action Reqd	Actioned
Yards (+water bodies)			Neighbours Approval??	
HIRB	NA			
Max Height				
Site Coverage				

BC Number: BC 100764

Permeable Surface		NA		
Earthworks				
Fences/Retaining Wall				
Parking				
Water Tank / Siting				
Airport Noise 45dbl				

Other Provisions

	Yes	No	Action reqd	Actioned
Does the building straddle a Title/cross-lease boundary?		✓		
Existing Resource Consent?	✓		RM100140	
Resource Consent Required?		✓	Apply Section 37 and advise Plan Vetting Team. Already granted.	
DIF Required?		✓	Calculate Fees:	
Section 72 or 77 Required?		✓	Advise Plan Vetting Team and send letters out.	
Section 221 Consent Notice		✓	Advise Plan Vetting Team	

Additional Comments

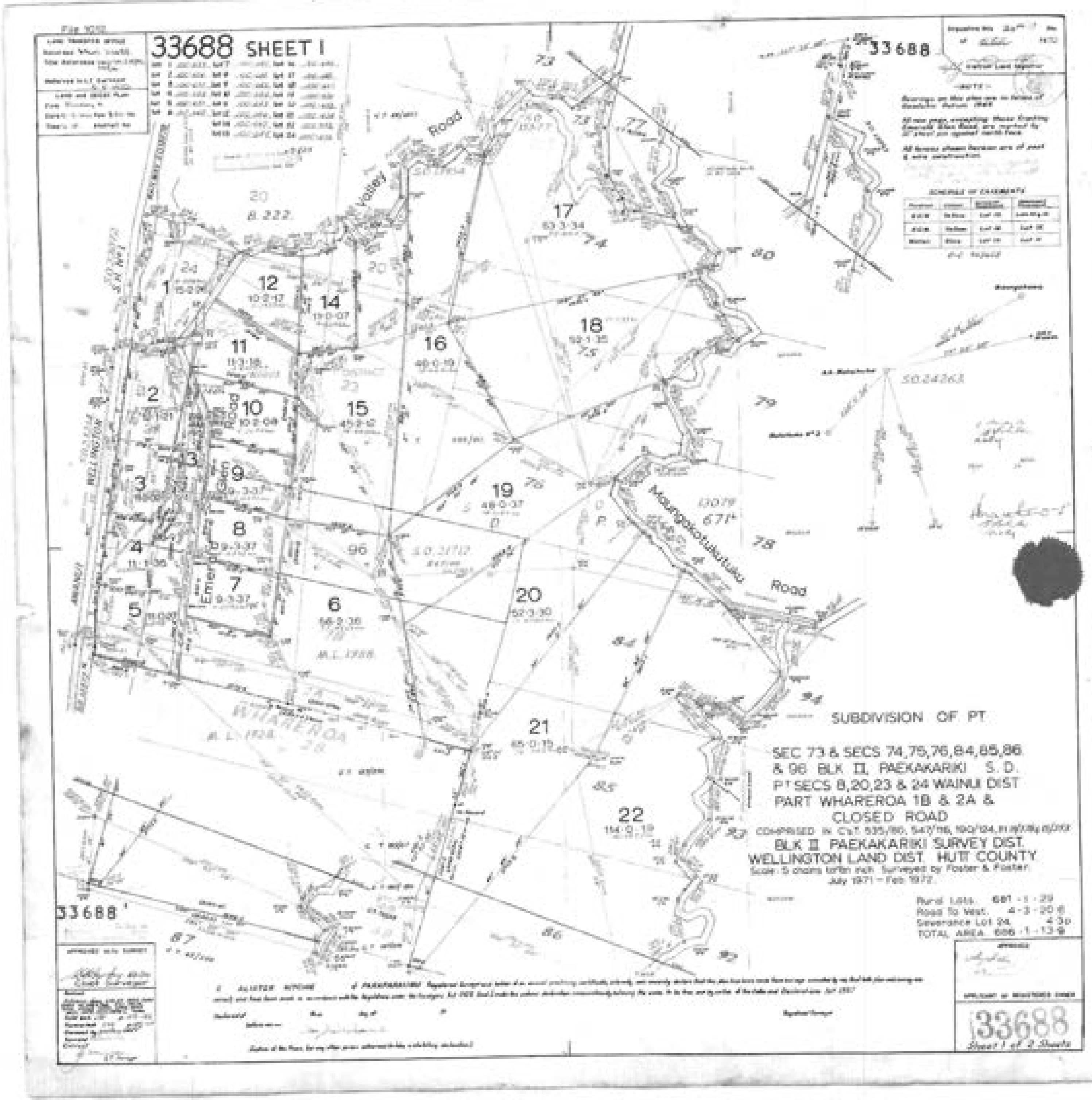
* ALL WORK TO BE IN ACCORDANCE WITH RM 100140.

Decision: (*delete item that does not apply*)

- Application complies with District Plan requirements
- Application does not comply with District Plan – BC to be issued subject to s37

Officer's Name & Signature: J Burke

Date: 6.10.10


33688 SHEET 1
33688
Road
Valley
Emerald
Glen
Road
Maungakotukutuku
Road
WHAREROA
WELLINGTON
SUBDIVISION OF PT
SEC 73 & SECS 74,75,76,84,85,86
& 96 BLK II, PAEKAKARIKI S.D.
PT SECS 8,20,23 & 24 WAINUI DIST
PART WHAREROA 1B & 2A &
CLOSED ROAD
BLK II PAEKAKARIKI SURVEY DIST.
WELLINGTON LAND DIST. HUTT COUNTY
Scale: 5 chains to 1 inch. Surveyed by Foster & Foster.
July 1971 – Feb 1972.
Rural Lots 681 -1 -29
Road To Vest. 4 -3 -20·6
Severance Lot 24. 4·3p
TOTAL AREA 686 -1 -13·9
33688
Sheet 1 of 2 Sheets

Richard Coles

From: Curtis Lee [Curtis.Lee@opus.co.nz]
Sent: Thursday, 9 September 2010 15:00
To: 'Gerald Carty [FCC-CivEng]'
Cc: 'Wayne Holcroft'; 'Andrew Quinn'
Subject: FW: Emerald Glen - Fence on Northern Culvert
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OPUS

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Team Leader Transportation Engineering Design
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http://www.opus.co.nz
Level 7 Majestic Centre, 100 Willis St, PO Box 12 003, Wellington, New Zealand

106September 2010

Kapiti Coast District Council
Private Bag 601
Paraparaumu 5254

Request for Tax Invoice/Receipt

Attached is our cheque for $1,350.00

For: Building Consent

Would you please arrange to send a Tax Invoice /Receipt, including your GST registration number for tax purposes, to me at the address printed below.

Yours faithfully

Colin Widdis
Accounting Office Manager

Opus International Consultants Limited
Wellington Office

Level 9, Majestic Centre
100 Willis Street, PO Box 12-003
Wellington, New Zealand

Telephone +64 4 471 7000
Facsimile +64 4 471 1291
Website www.opus.co.nz

Items applicable to the retaining walls over emerald glen culvert

Item	Description	Unit	Quantity	Rate	Amount
1	**Retaining walls**				
	Reinforced Earth Walls - northern culvert				
1.1	Green Terramesh (approx 152.4m2 facing). Excludes Imported Fill, which is scheduled separately.	sq.m	152	100	$15,240
1.2	Imported Fill	cu.m	1,420	25	$35,500
2	**Drainage**				
2.1	Culverts				
	Single Box 2.0x1.5	m	17	5,000	$85,250
	E/O for fish passage beams (2.0m x 0.2m x 0.15m)	ea	11	200	$2,200
	Wingwall	ea	1	20,000	$20,000
	Rip Rap Protection	m3	25	100	$2,500
2.3	Kerb & channel	m	120	50	$6,000
2.2	Sumps				
	Double Sump	ea	2	3,050	$6,100
2.4	225 pipe	m	17	150	$2,550
2.5	Manholes - 1050mm dia (Up to 2m deep)	ea	1	2,000	$2,000
2.6	300 pipe	m	16	250	$4,000
2.7	Wingwall (for 300 pipe)	ea	1	2,000	$2,000
3	**Traffic Services**				
3.1	Safety Barriers				
	TL-3 W-Beam	m	150	100	$15,000
	Post and Rail	m	35	50	$1,750
	Total				$200,090