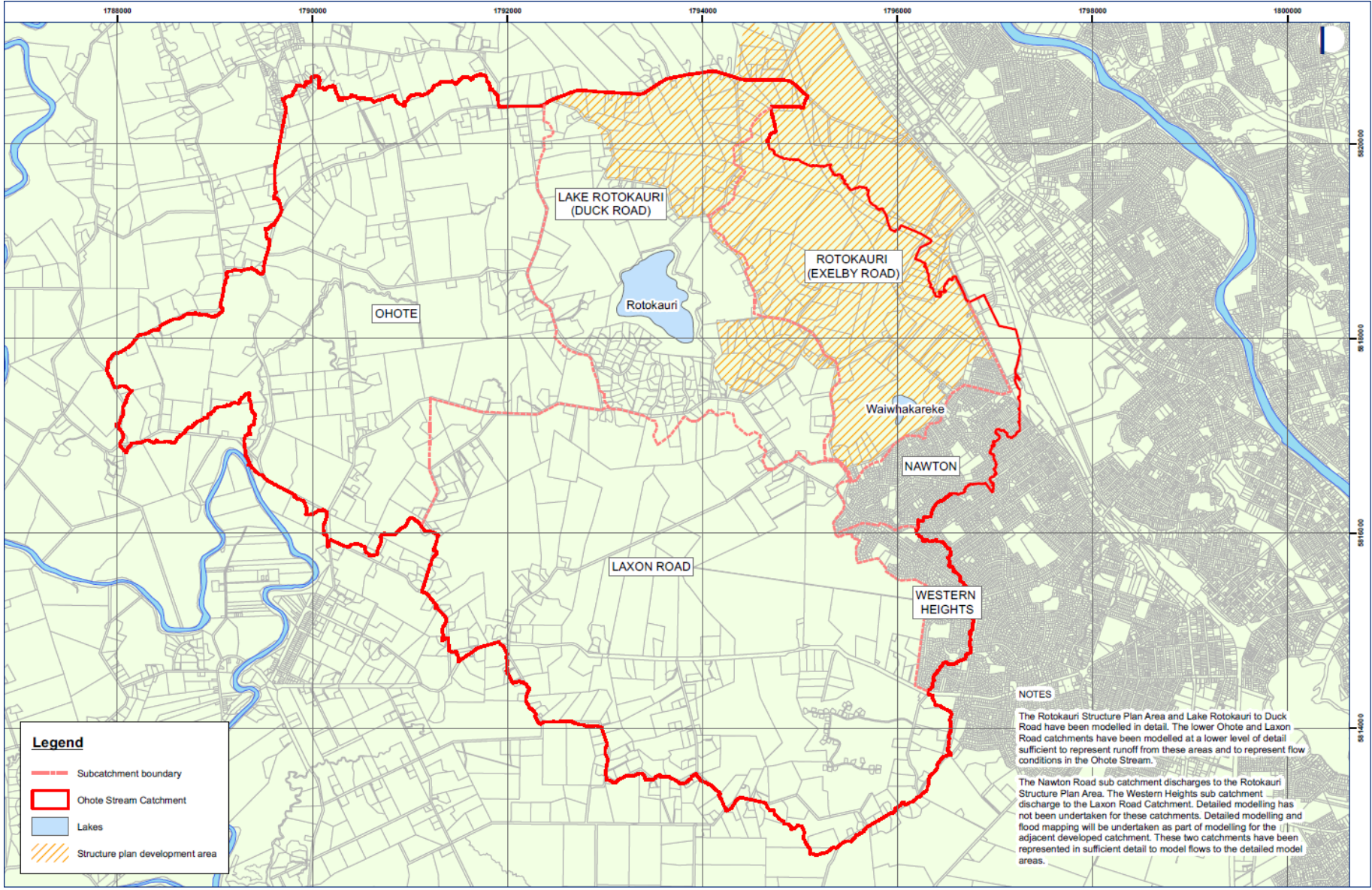
EVOLVING WATER QUALITY MANAGEMENT

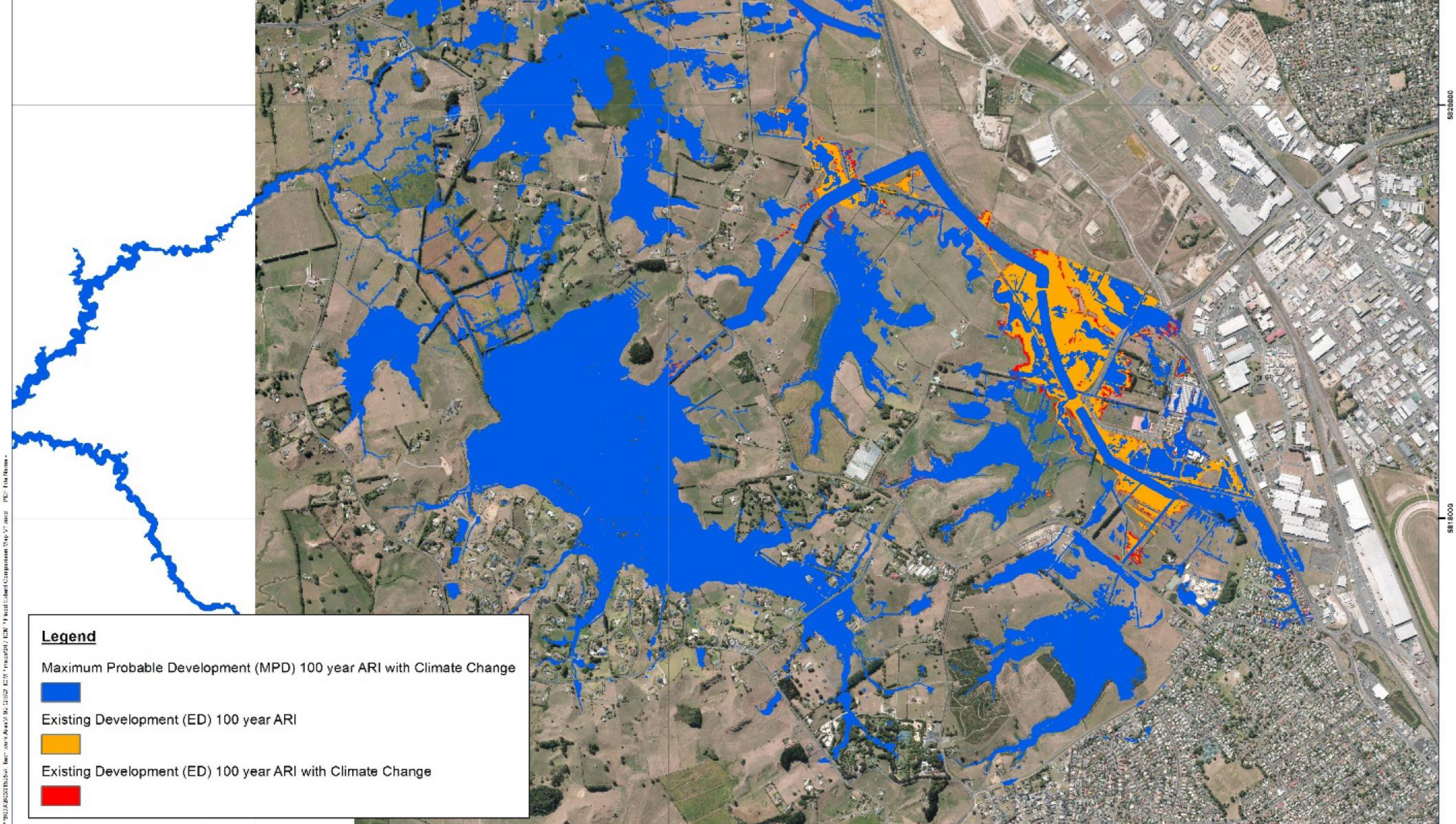
IN THE ROTOKAURI CATCHMENT, HAMILTON

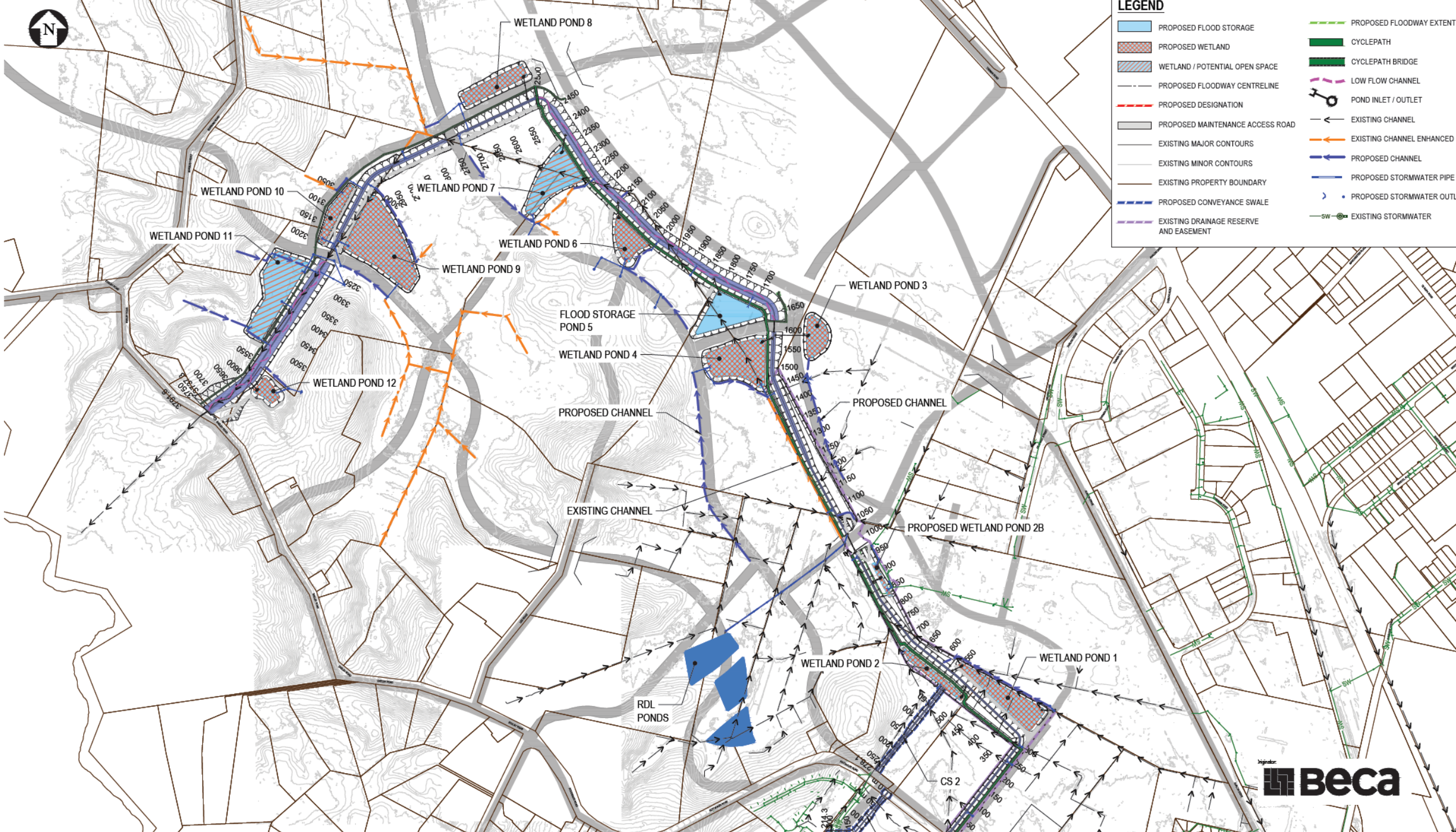
Caleb Clarke
& Lance Haycock

Rotokauri Integrated Catchment Management Plan

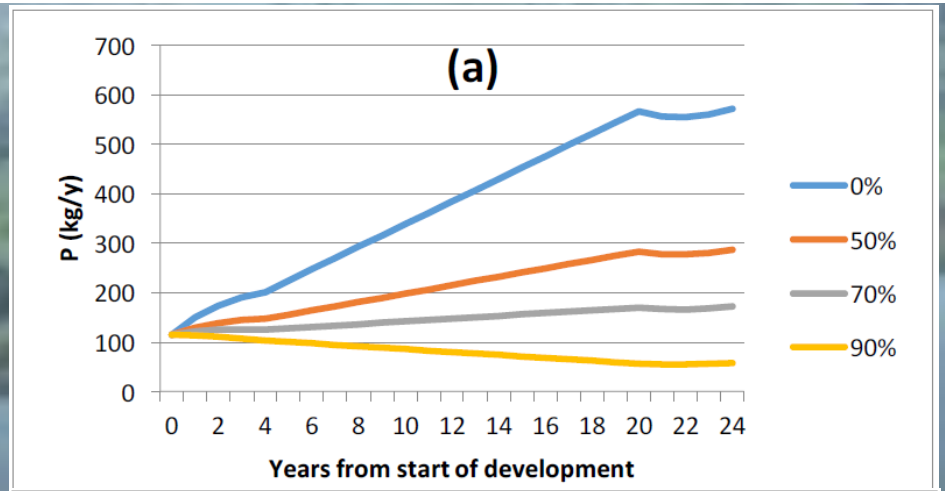


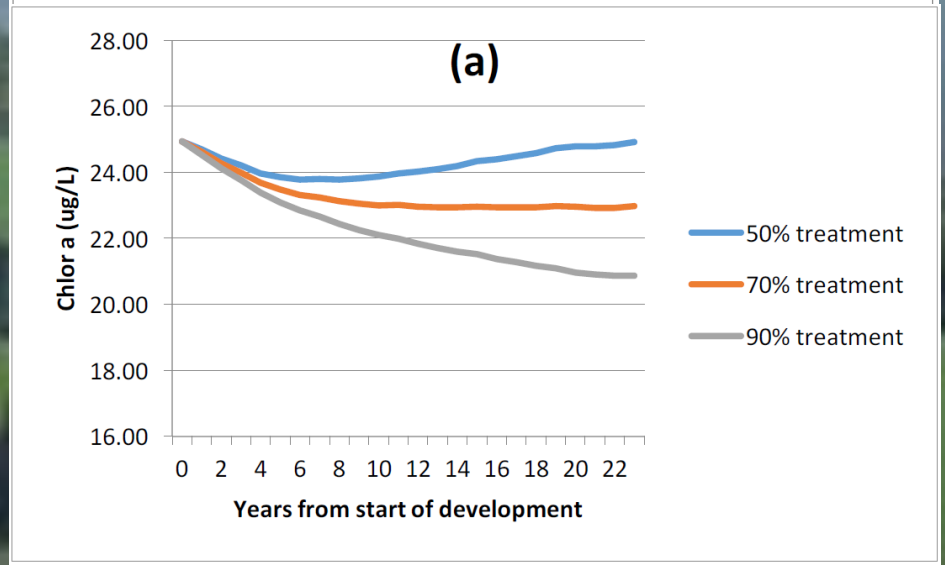
The union of engineering design and nature.


Legend
Maximum Probable Development (MPD) 100 year ARI with Climate Change
Existing Development (ED) 100 year ARI
Existing Development (ED) 100 year ARI with Climate Change
5820000
5818000


WETLAND POND 8
WETLAND POND 10
WETLAND POND 7
WETLAND POND 11
WETLAND POND 9
WETLAND POND 6
WETLAND POND 12
FLOOD STORAGE POND 5
WETLAND POND 3
WETLAND POND 4
PROPOSED CHANNEL
PROPOSED CHANNEL
EXISTING CHANNEL
PROPOSED WETLAND POND 2B
WETLAND POND 2
WETLAND POND 1
RDL PONDS
CS 2
LEGEND
PROPOSED FLOOD STORAGE
PROPOSED WETLAND
WETLAND / POTENTIAL OPEN SPACE
PROPOSED FLOODWAY CENTRELINE
PROPOSED DESIGNATION
PROPOSED MAINTENANCE ACCESS ROAD
EXISTING MAJOR CONTOURS
EXISTING MINOR CONTOURS
EXISTING PROPERTY BOUNDARY
PROPOSED CONVEYANCE SWALE
EXISTING DRAINAGE RESERVE AND EASEMENT
PROPOSED FLOODWAY EXTENT
CYCLEPATH
CYCLEPATH BRIDGE
LOW FLOW CHANNEL
POND INLET / OUTLET
EXISTING CHANNEL
EXISTING CHANNEL ENHANCED
PROPOSED CHANNEL
PROPOSED STORMWATER PIPE
PROPOSED STORMWATER OUTL
EXISTING STORMWATER
Originator:
Beca

Rotokauri Integrated Catchment Management Plan





streamlined ENVIRONMENTAL

70% Phosphorous Removal Target

Rotokauri ICMP – Broad scale Water Quality Assessment

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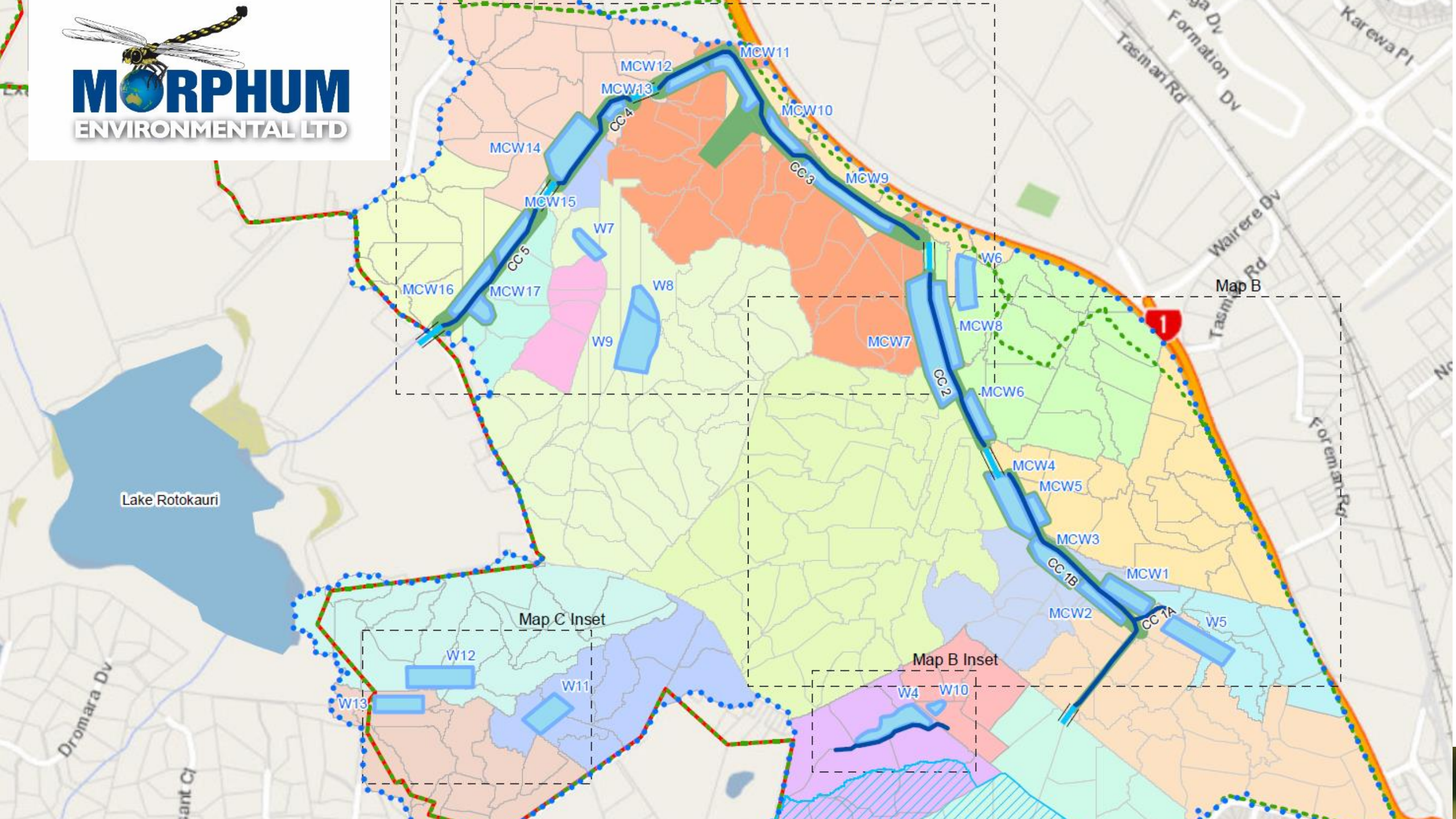
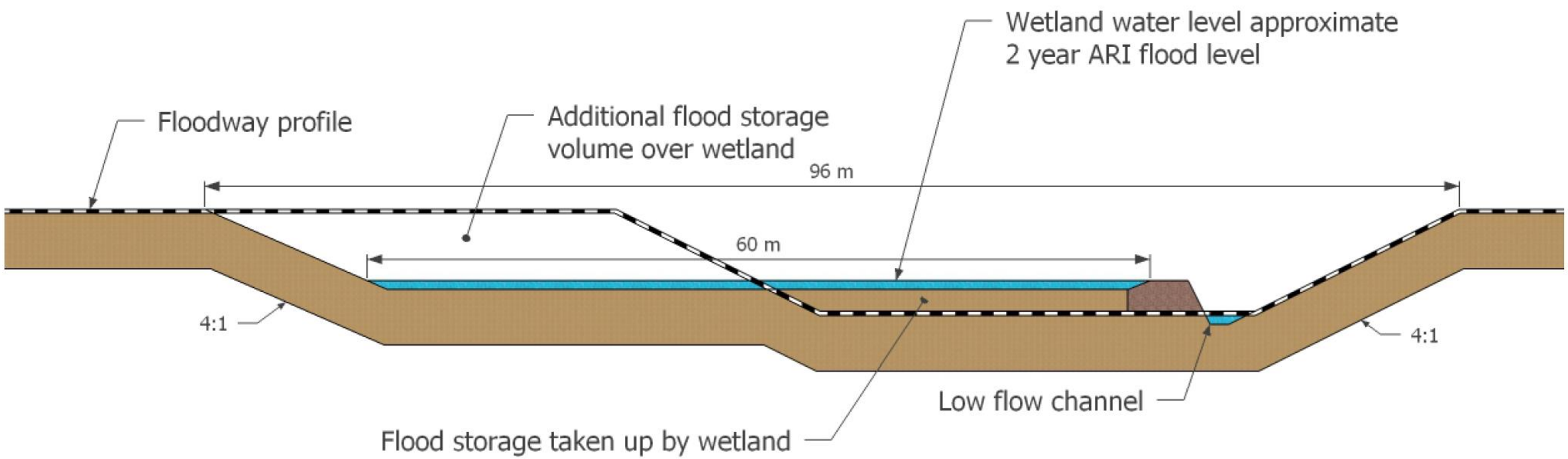

MORPHUM
ENVIRONMENTAL LTD
MCW11
MCW12
MCW13
MCW10
CC 4
MCW14
CC 3
MCW9
MCW15
W7
CC 5
W6
MCW16
MCW17
W8
Map B
W9
MCW8
MCW7
CC 2
MCW6
Lake Rotokauri
MCW4
MCW5
MCW3
CC 1B
MCW1
MCW2
CC 1A
W5
Map C Inset
W12
W11
W13
Map B Inset
W4
W10
Dromara Dv
Tasman Rd
Formation Dv
Karewa Pl
Wairere Dv
Foreman Rd

Rotokauri ICMP Water Quality Treatment Concept



Rotokauri ICMP Water Quality Treatment Concept

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Water Quality Assessment – NZTA

Table 8-1 Removal Rates for Various Stormwater Practices for TSS and Nutrients					
Practice	Removal rates (%)				
	TSS	Nitrogen	Phosphorus	Zinc	Copper
Swales	70	20	30	75	60
Filter Strips	80	20	20	75	60
Sand Filters	80	35	45	90	90
Rain Gardens (normal)	90	40	60	90	90
Rain Gardens (w/anaerobic zone)	90	50	80		
Infiltration Practices	80	30	60	80	70
Wet Ponds	75	25	40	50	40
Wetlands	90	40	50	80	80
Oil Water Separators	15	0	5	5	5

$$R = A + B - [(A \times B)/ 100]$$

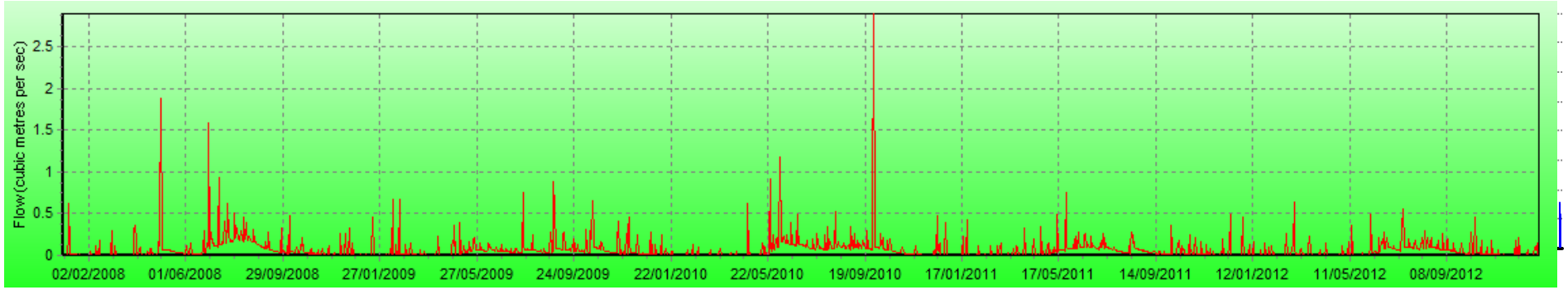
Water Quality Assessment – TP 10 Partial Treatment Relationship

Table 3-1
Relative levels of removal efficiency

Practice Volume	Efficiency
150% of WQV	82%
100% of WQV	75%
75% of WQV	70%
50% of WQV	60%
25% of WQV	50%
10% of WQV	40%
5% of WQV	30%

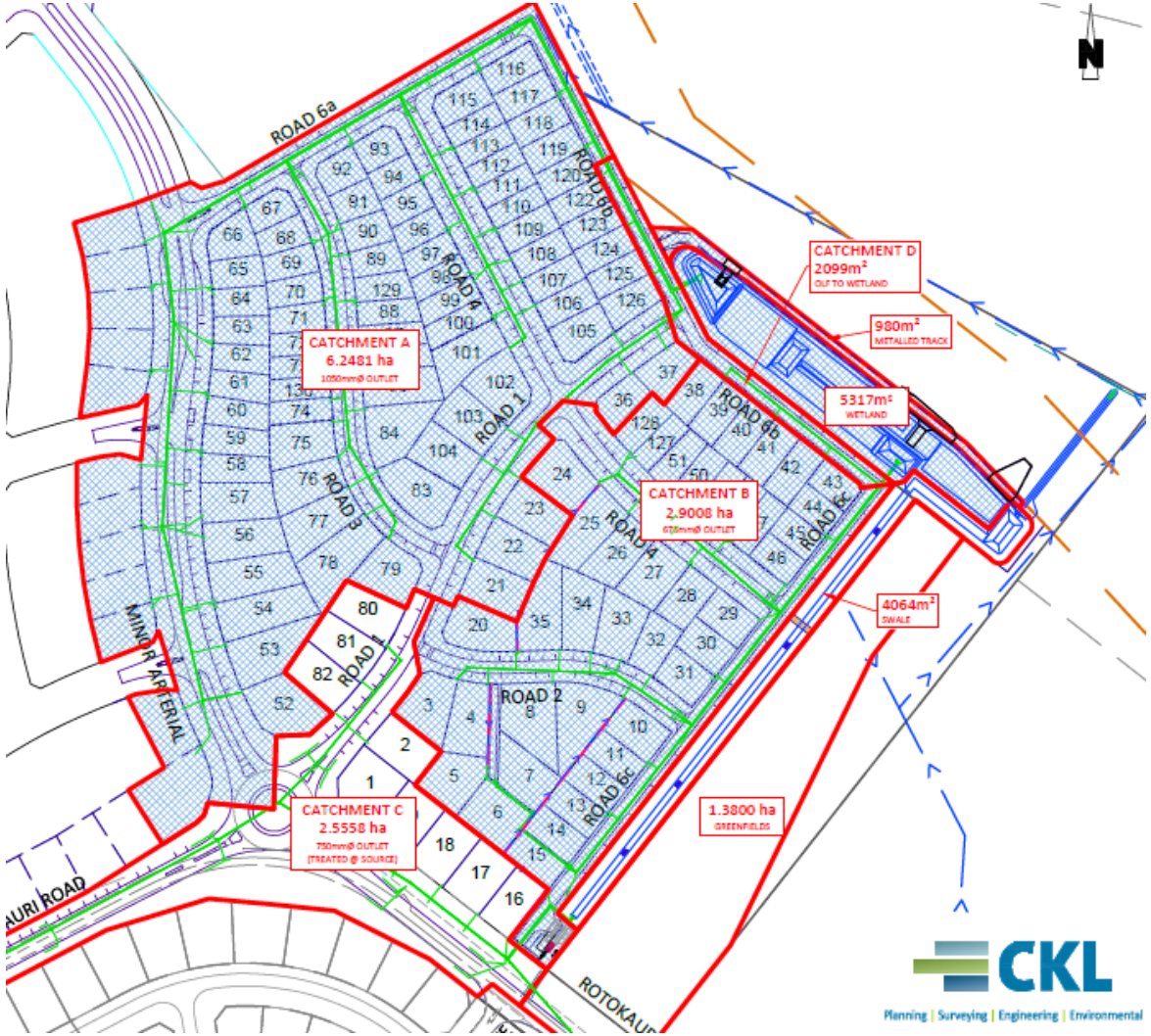
Continuous simulation modelling - MUSIC

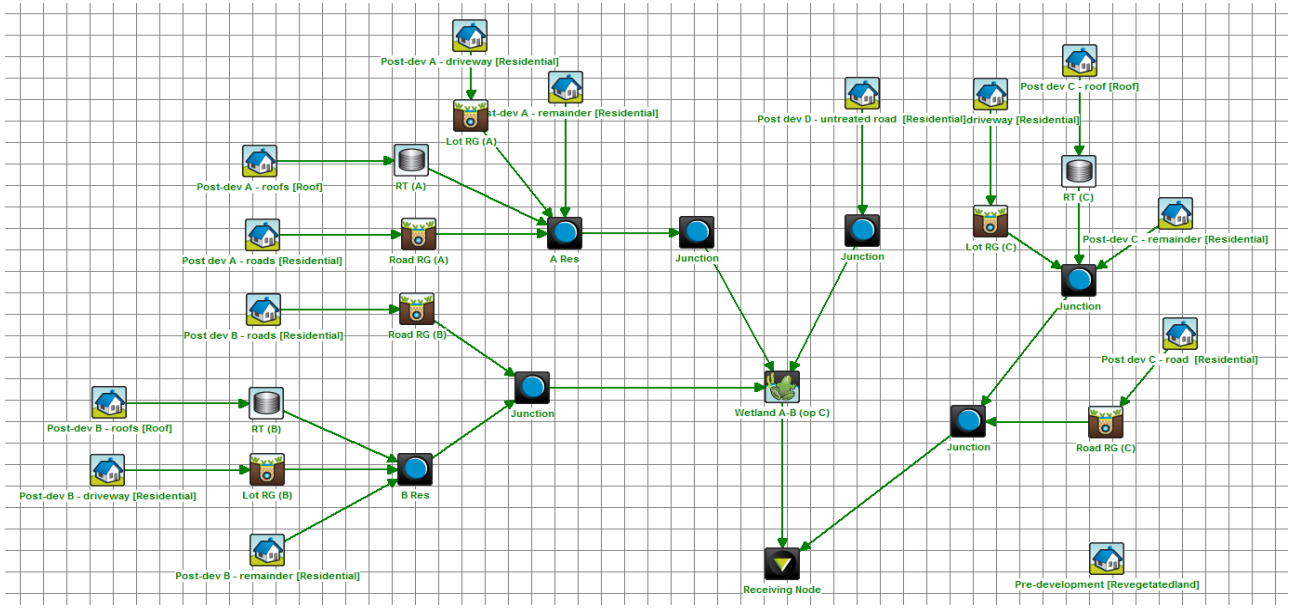
- **M**odel for **U**rban **S**tormwater **I**mprovement **C**onceptualisation (eWater)
- Generate continuous flow and pollutant series from observed rainfall and ET



- Describes long-term flow and contaminant variability
- Accounts for processes not fully described in single-event models
    - Evapotranspiration and infiltration to shallow & deep groundwater
    - Antecedence (inter-storm conditions)
    - Device bypass volumes
- Model cumulative effects of connected devices

MUSIC – Greenfields Example





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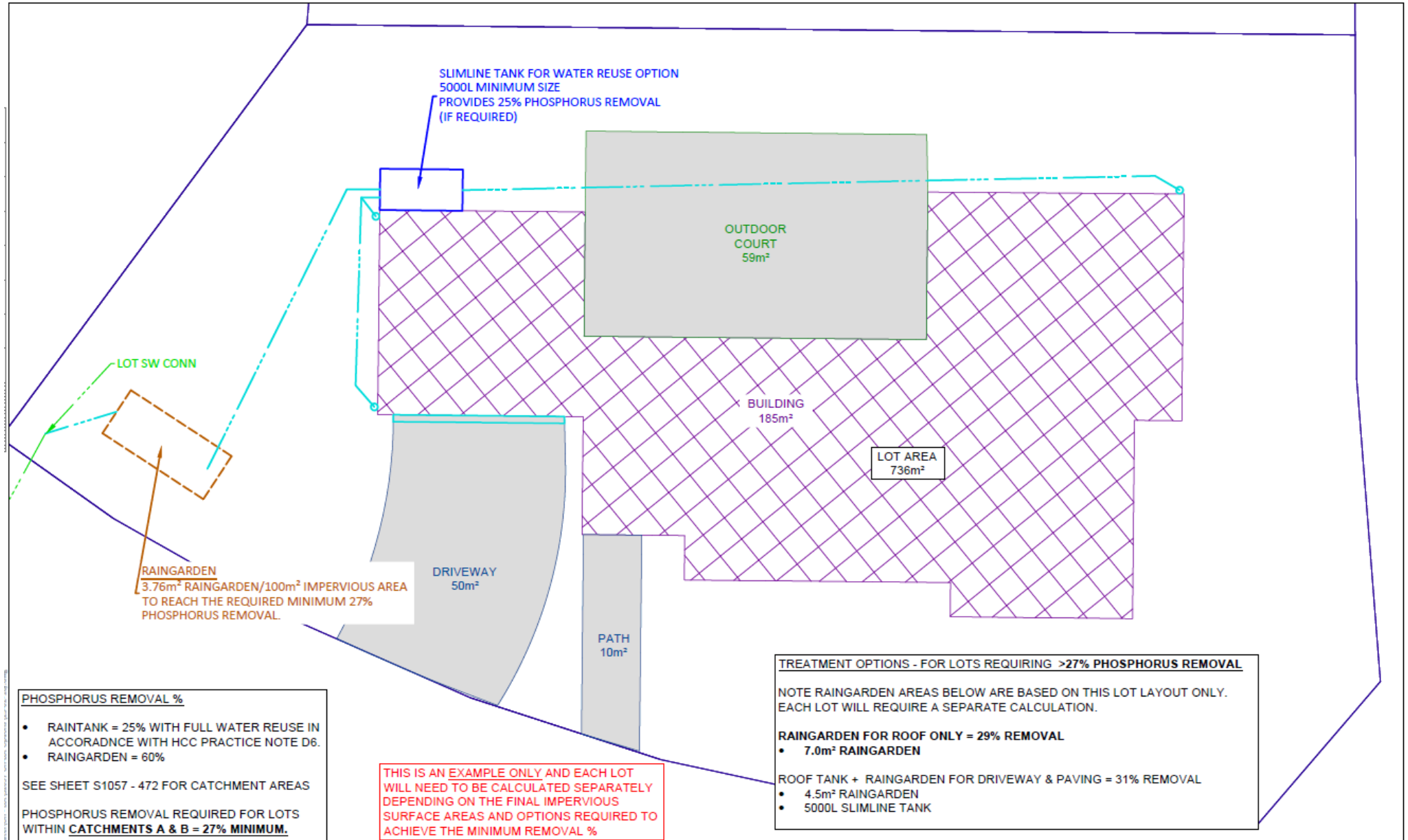
Wetland Performance

Pre-treatment Raingardens



PHOSPHORUS REMOVAL %

- RAINTANK = 25% WITH FULL WATER REUSE IN ACCORADNCE WITH HCC PRACTICE NOTE D6.
- RAINGARDEN = 60%

SEE SHEET S1057 - 472 FOR CATCHMENT AREAS

PHOSPHORUS REMOVAL REQUIRED FOR LOTS WITHIN **CATCHMENTS A & B = 27% MINIMUM.**

PHOSPHORUS REMOVAL REQUIRED FOR LOTS WITHIN **CATCHMENT C = 60% MINIMUM**

THIS IS AN EXAMPLE ONLY AND EACH LOT WILL NEED TO BE CALCULATED SEPARATELY DEPENDING ON THE FINAL IMPERVIOUS SURFACE AREAS AND OPTIONS REQUIRED TO ACHIEVE THE MINIMUM REMOVAL %

TREATMENT OPTIONS - FOR LOTS REQUIRING **>27% PHOSPHORUS REMOVAL**

NOTE RAINGARDEN AREAS BELOW ARE BASED ON THIS LOT LAYOUT ONLY. EACH LOT WILL REQUIRE A SEPARATE CALCULATION.

RAINGARDEN FOR ROOF ONLY = 29% REMOVAL
- **7.0m² RAINGARDEN**

ROOF TANK + RAINGARDEN FOR DRIVEWAY & PAVING = 31% REMOVAL
- 4.5m² RAINGARDEN
- 5000L SLIMLINE TANK

FOR INFORMATION

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Planning | Surveying | Engineering | Environmental

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P: 09 524 7029
Hamilton Office
A: 58 Church Road, Hamilton
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Te Awamutu Office
A: 103 Market Street, Te Awamutu
P: 07 871 6144

Rotokauri Rise
Rotokauri Development Ltd
Rotokauri Road, Hamilton

Lot Stormwater Treatment
>27% Phosphorus Removal
ON-LOT TREATMENT OPTIONS

Issue	Description	Checked	Date
1	Notes added		28.11.17
2	Notes amended & Grass Equivalent removed		23.02.18
3	Raintank changed to 25%		02.03.18

			Date
Designed:			
Drawn:	GCW	15.11.17	
Checked:			

Scale: 1:100 (A3 Original)

Job No:	Dwg No:	Rev:
S1057	701	3

MUSIC – Mixed (Brownfields/Greenfields) Example

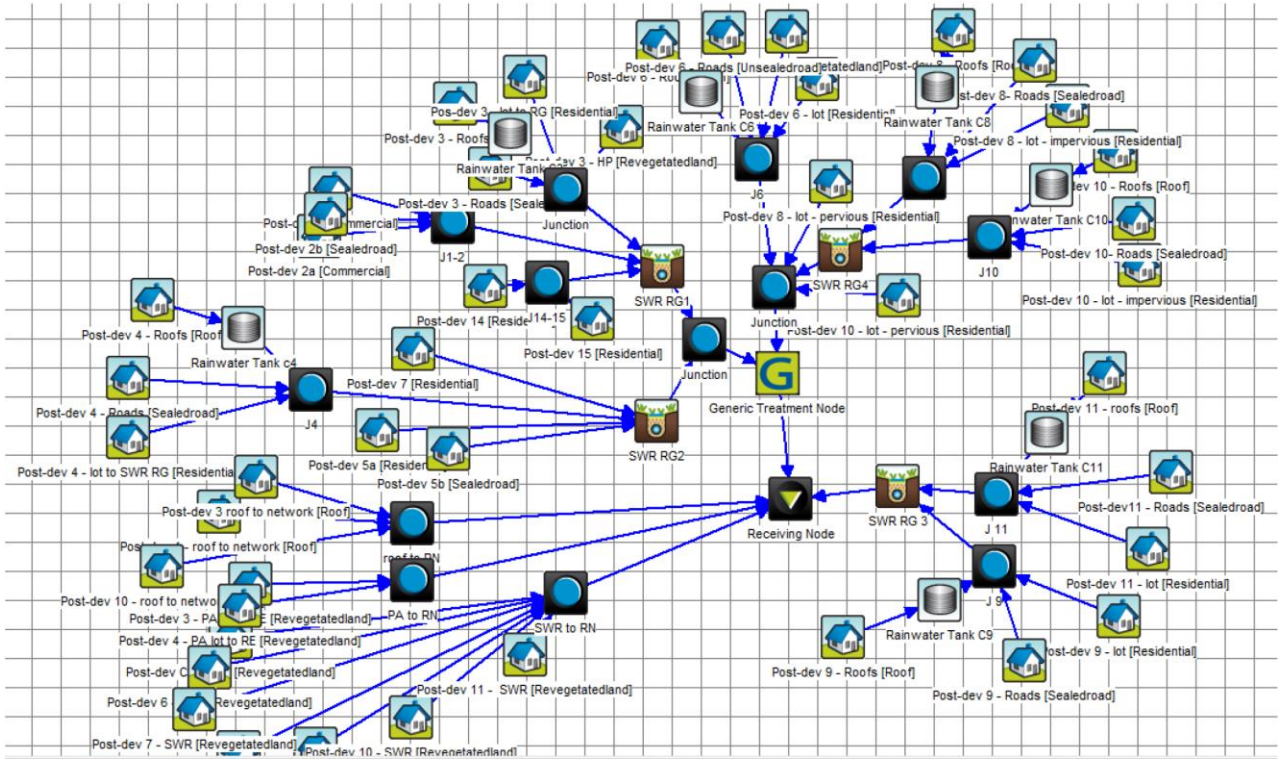
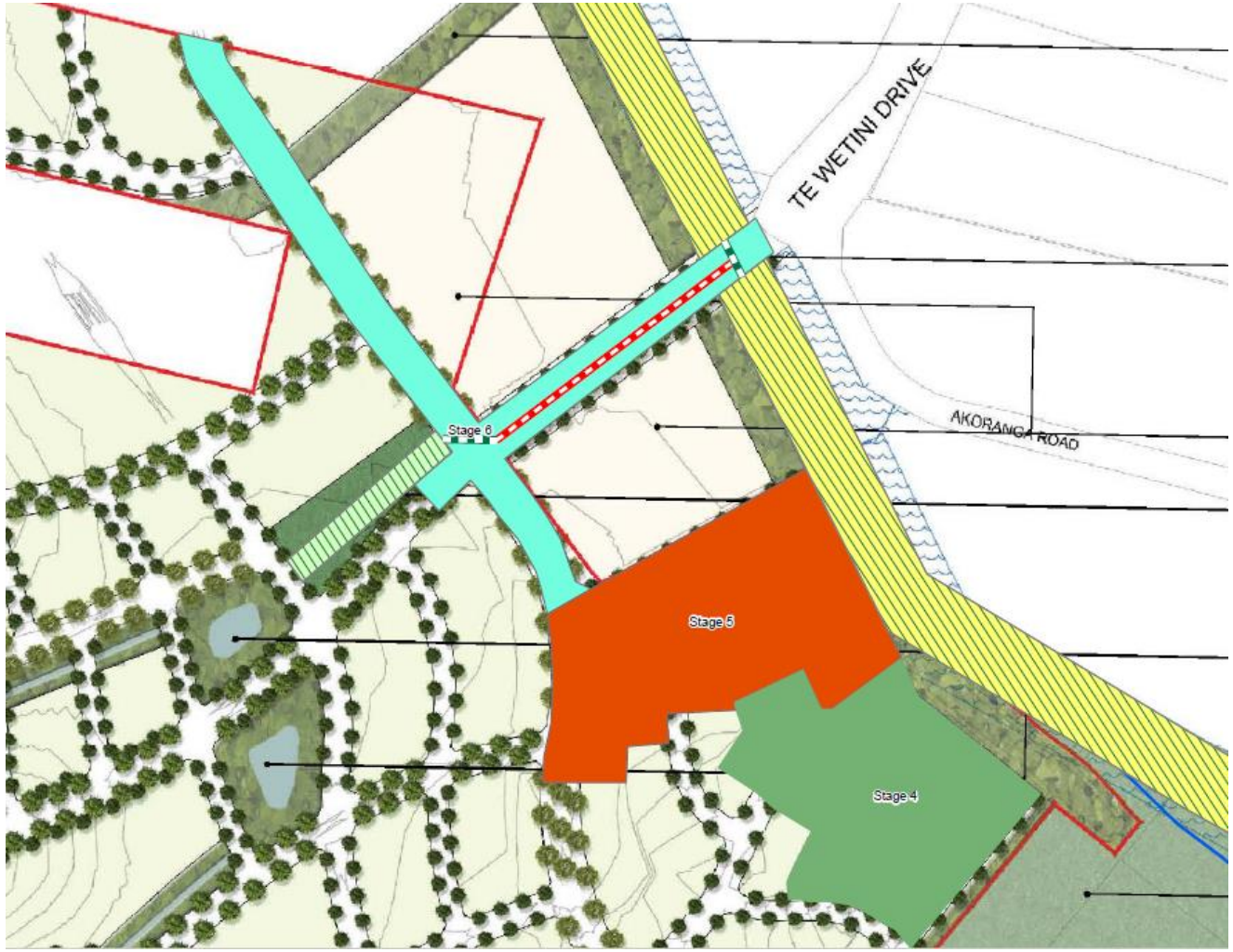


Table 3 MUSIC outputs and TP removal percentages from concept post development treatment scenarios

Options	S1	S2	S3	S4a	S4b	S4b
Total Phosphorus load (kg/yr)	24.9	24.9	27.9	24.9	24.9	24.9
Total Phosphorus after treatment (kg/yr)	9.63	8.62	5.83	5.93	7.67	7.63


LEGEND:
55.0 EXISTING CONTOURS (MAJOR 2.5m)
54.5 EXISTING CONTOURS (MINOR 0.5m)
MAIN WATERCOURSE
SWALE FLOWS
SWD EXISTING STORMWATER LOCATION
SWD PROPOSED STORMWATER LOCATION (INDICATIVE)
SECONDARY OVERLAND FLOWPATHS
PROPOSED 1.5m TIMBER BOARDWALK
PROPOSED 1.5m GRAVEL TRACK
PROPOSED CULVERT
PROPOSED TREES (SUBJECT TO DETAILED LANDSCAPING DESIGN)
N
LOT 1 DP 425316
(NATURAL HERITAGE PARK) RESERVE WAIWHAKAREKE
CULVERT DISCHARGING TO EXISTING WATERCOURSE
RAINGARDEN 3. TREATED SW FLOWS TO DISCHARGE TO WETLAND
1.5m GRAVEL WALKING TRACK
WATERCOURSE TO HAVE LOW FLOW DIVERSION TO WETLAND
SWALE B. TREATED FLOWS TO DISCHARGE TO WETLAND
WETLAND 1
1.5m TIMBER BOARDWALK ON WETLAND BUND
PROPOSED GRAVEL WALKING TRACK TO EXTEND UP TO PUBLIC ROAD
PROPOSED ROAD
ROAD A
4m WIDE ALL-WEATHER ACCESS TRACK
CONSTRUCTED WATERCOURSE 100 YEAR ARI CAPACITY
RAINGARDEN 2. TREATED SW FLOWS TO DISCHARGE TO MAIN WATERCOURSE
EXISTING KAHIKATEA TREE TO REMAIN??
SW DISCHARGE TO GULLY
SEALED MAINTENANCE PLATFORM
LOT 4 DP 486464
RAINGARDEN 1. TREATED SW FLOWS TO DISCHARGE TO WETLAND. OVERFLOWS TO DISCHARGE TO MAIN WATERCOURSE
SWALE A. TREATED FLOWS TO DISCHARGE TO WETLAND VIA
Lot 1 614m²
Lot 2 485m
Lot 28 518m
Lot 3 466m
Lot 4 472m
Lot 5 461m
Lot 23 182m
Lot 7 1345m
Lot 8 528m
Lot 6 449m
Lot 21 1303m
Lot 20 1566m
Lot 22
34 895m² Ex. Acc
39 791m² Ex. Acc
11 755m² Ex. Acc
10 653m²
43 597m²
5 767m²
6 597m²
7 568m²
8 612m²
19 643m²
20 533m²
21 681m²
22 624m²
25 635m²
40 3889m² (Road to Vest)
44 1806m (Road to Vest)
wainui environmental
PO Box 32245, Raglan 3225, NZ
p: 07 825 8336 e: office@wainuienvironmental.co.nz
www.wainuienvironmental.co.nz

ICMP Implementation Considerations



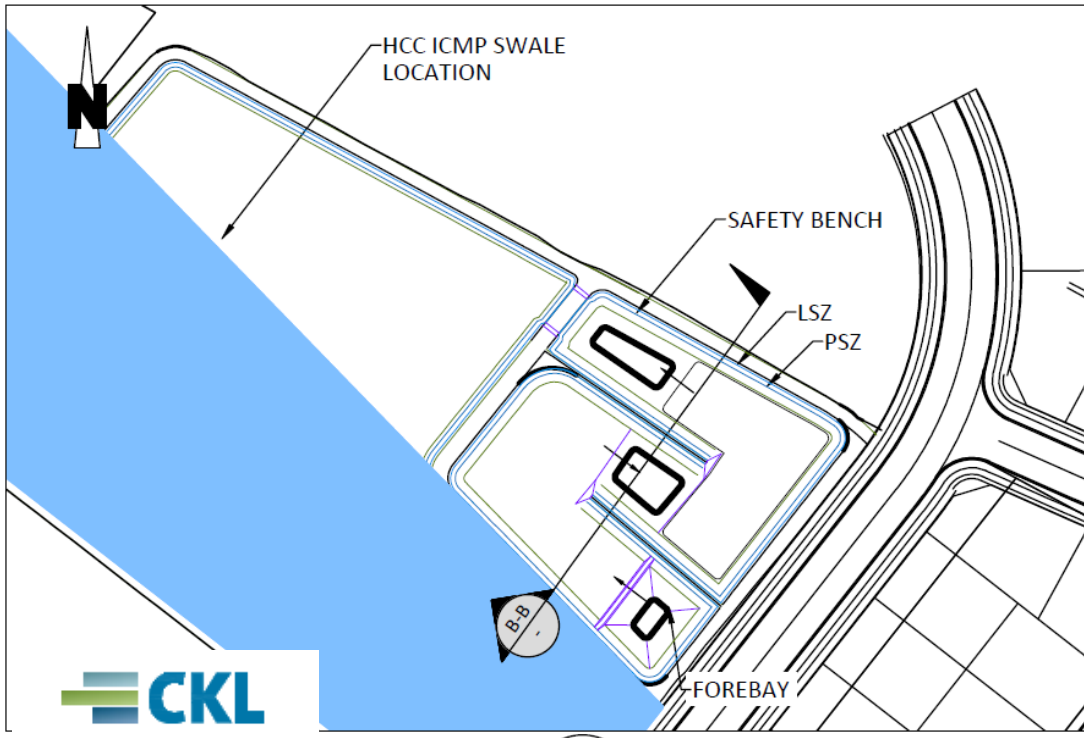
- Developer proposed alternative piped 50Ha subcatchment drainage
- Interim pumped road footprint and upstream diversions
- Hydraulic and ecological issues currently being progressed

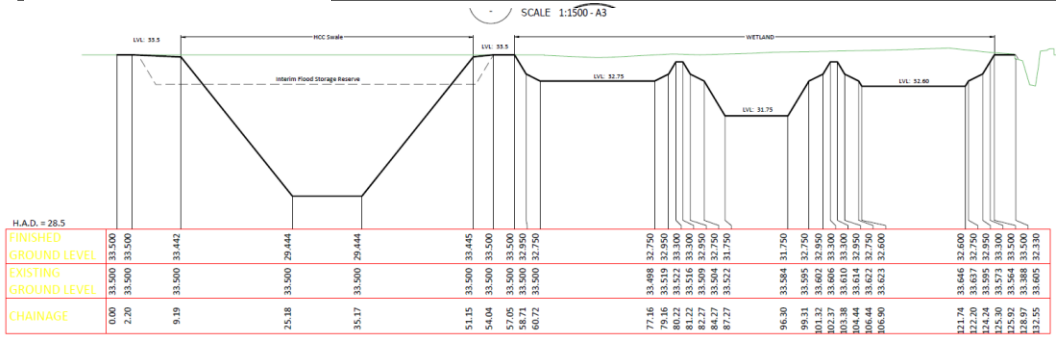
ICMP Implementation Considerations

Flood issues	Interim provisions	After Floodway Provisions
Road Drainage	Pumped flows and existing catchment flooding meets NZTA Guidance (300mm deep)	Max 150mm Depth In Lane (District Plan)
Subcatchment Flows	Diverted Overland with Interim Flood Storage	1800mm pipe 100yr capacity, Pipe block secondary flowpath within existing freebord requirements of adjacent Land (1% w CC+300mm)
Main Catchment Flows	Avoid upstream flood level impacts	Maximum height to allow safe overland flow above culverts

* Aquatic Ecology Considerations and Consenting

ICMP Implementation Considerations – Everton Heights Example





Conclusions

- ICMPs navigate a path through a complex network of challenges
- Water quality assessment tools can drive useful alternative approaches
  - Partial treatment/pre-treatment devices
  - Greenfields/brownfields shared outcomes
- Departure from an integrated solution can lead to large challenges
- Urban Design / Structure Planning needs iteration with ICMP
- Staging of Land Development and enabling infrastructure Important
- Dirty water in a pipe has diminished mauri, we all need to be part of sustainable development to rise to the challenge of providing for Wai Ora

Credits

- Hamilton City Council - Lance Haycock, Andrea Phillips, Tony Denton, Martyn Smith et. al.
- Hartland Environmental – Rob Hart – (Rotokauri ICMP)
- AECOM – RTK ICMP Major Drainage Options
- Streamlined Environmental – RTK ICMP Broad Scale Water Quality Assessment
- Wainui Environmental – Hayden Vink
- CKL – Bronwyn Rynd, Glenn Wheatley et. al.
- BECA – Roger Seyb and Nicola Black