6.ii APPENDIX B - ENGINEERING CALCULATIONS

MAVEN ASSOCIATES	Job Number 147007&147016	Sheets 1	Rev A
Job Title Rangitoopuni Calc Title Decant Sizing Calculation	Author HN	Date 1/04/2025	Checked KH

Max Catchment Area	3000	m^2
Decant Volume 3% of Area	90	m^3
Dead Storage 30% of volume	27	m^3
Live Storage 70% of volume	63	m^3
Decant Dewatering (3l/s/ha)	0.9	l/s

Size Decant

Standard decant	4.5	l/s	=	200 holes
Therefore	0.90	l/s	=	40 holes

Use 1 decants

Pond Dimensions

v = 90 m^3

d = 1 m

x = width of pond base

Pond calculations allow for the sides and outlet of the pond to be at a 2:1 batter slope and for the inlet of the pond to be at a 3:1 batter slope.

Calc 2: Calculate width and length of base, Quadratic Equation

3:1 ratio

$v = (((3x^2)+((x+4d)(3x+5d)))/2)d$

=> $v = 3x^2d+8.5xd^2+10d^3$ quadratic equation to find "x"

		a		b		c
0	=	3	x^2+	8.5	x+	-80
x	=	3.94	width of pond base			
or	=	-6.77				

Check = 90 m^3

5:1 ratio

$v = (((5x^2)+((x+4d)(5x+5d)))/2)d$

=> $v = 5x^2d+12.5xd^2+10d^3$ quadratic equation to find "x"

		a		b		c
0	=	5	x^2+	12.5	x+	-80
x	=	2.94	width of pond base			
or	=	-5.44				

Check = 90 m^3

Width = 3.94 m

Length = 11.81 m

Dead Storage Depth

Pond Dimensions

x = 3.94 m

v = 27.0 m^3

d = Dead storage depth

Pond calculations allow for the sides and outlet of the pond to be at a 2:1 batter slope and for the inlet of the pond to be at a 3:1 batter slope.

3:1 ratio

$v = (((3x^2)+((x+4d)(3x+5d)))/2)d$

=> $v = 10d^3+8.5xd^2+3x^2d$ cubic equation to find "d"

			a		b		c
0	=	d^3+	3.347391751	d^2+	4.652608	+d	-2.7
e	=		0.31				

f	=		2.56	
g	=		1.72	
h	=		-0.18	
d	**=**		**0.430**	depth of dead storage
Check v	=	27.00		m^3

Spillway Dimensions

Side Slope	horizontal	3	vertical	1	
Gradient		**1**	**%**		
Base Width		0.50	m		

Calc 3: Calculate spillway flow (Q) Rational Formula

Q=CIA 1% AEP

where C	=		0.85			
I	**=**		3.91667E-05	mm/s	141	100yr/10min mm/hr)
A	**=**		3000	m2		
Therefor **Q**	**=**		**0.10**	**m3/sec**		

Calc 4: Calculate spillway depth (H) Mannings Formula

$V=(1/n)R^{2/3}S^{1/2}$ R=A/P Q=AV

n	**=**	0.018	Flow path is firm earth

Where: H = depth of channel P = wetted parameter

A = Sectional Area S = slope of channel

H	P	A	S	R	V	Q
0.15	1.49	0.143	0.01	0.095973154	1.164557	0.166532

Therefor **H**	**=**	**0.15**	**m**	Min 250mm
Therefore	=	**300**	mm	

MAVEN ASSOCIATES	Job Number 147007&147016	Sheets 2	Rev A
Job Title: Rangitoopuni Calc Title: SEDIMENT RETEENTION POND 1	Author: HN	Date: 1/04/2025	Checked: KH

Max Catchment Area	**10000**	m^2
Pond Volume 3% of Area	300	m^3
Dead Storage 30% of volume	90	m^3
Live Storage 70% of volume	210	m^3
Decant Dewatering (3l/s/ha)	3	l/s

Size Decant

Standard decent	4.5 l/s	=	200	holes
Therefore	3.00 l/s	=	133	holes
Use	**1**	**decants**		

Pond Dimensions

v = 300 m^3
d = 1.5 m
x = width of pond base

Pond calculations allow for the sides and outlet of the pond to be at a 2:1 batter slope and for the inlet of the pond to be at a 3:1 batter slope.

Calc 2: Calculate width and length of base, Quadratic Equation

3:1 ratio

$v = (((3x^2)+((x+4d)(3x+5d)))/2)d$

=> $v = 3x^2d+8.5xd^2+10d^3$ quadratic equation to find "x"

		a		b		c
0	=	4.5	x^2+	19.125	x+	-266.25
x	=	5.86	width of pond base			
or	=	-10.11				

Check = 300 m^3

5:1 ratio

$v = (((5x^2)+((x+4d)(5x+5d)))/2)d$

=> $v = 5x^2d+12.5xd^2+10d^3$ quadratic equation to find "x"

		a		b		c
0	=	7.5	x^2+	28.125	x+	-266.25
x	=	4.37	width of pond base			
or	=	-8.12				

Check = 300 m^3

Width = 5.86 m
Length = 17.57 m

Dead Storage Depth

Pond Dimensions
x = 5.86 m
v = 90.0 m^3
d = Dead storage depth

Pond calculations allow for the sides and outlet of the pond to be at a 2:1 batter slope and for the inlet of the pond to be at a 3:1 batter slope.

3:1 ratio

$v = (((3x^2)+((x+4d)(3x+5d)))/2)d$

=> $v = 10d^3+8.5xd^2+3x^2d$ cubic equation to find "d"

			a		b		c
0	=	d^3+	4.976850746	d^2+	10.28472	+d	-9

e	=	0.68		
f	=	8.47		
g	=	2.57		
h	=	-0.26		
d	**=**	**0.647**	**depth of dead storage**	

Check v = 90.00 m^3

Spillway Dimensions

Side Slope	horizontal	3	vertical	1
Gradient		**1**	**%**	
Base Width		2.00	m	

Calc 3: Calculate spillway flow (Q) Rational Formula

Q=CIA 1% AEP

where	C	=	0.85			
	I	=	3.91667E-05	mm/s	141	100yr/10min mm/hr)
	A	=	10000	m2		

Therefore **Q = 0.332916667 m3/sec**

Calc 4: Calculate spillway depth (H) Mannings Formula

$V=(1/n)R^{2/3}S^{1/2}$ R=A/P Q=AV

n = 0.018 Flow path is firm earth

Where: H = depth of channel P = wetted parameter

A = Sectional Area S = slope of channel

H	P	A	S	R	V	Q
0.15	2.948683	0.3675	0.01	0.124632	1.386161	0.5094141

Therefore **H = 0.15 m** Min 300mm

Therefore = **300** mm

MAVEN ASSOCIATES	Job Number 147007&147016	Sheets 3	Rev A
Job Title: Rangitoopuni Calc Title: SEDIMENT RETENTION POND 2	Author HN	Date 1/04/2025	Checked KH

Max Catchment Area	**15000**	**m^2**
Pond Volume 3% of Area	450	m^3
Dead Storage 30% of volume	135	m^3
Live Storage 70% of volume	315	m^3
Decant Dewatering (3l/s/ha)	4.5	l/s

Size Decant

Standard decent	4.5 l/s	=	200	holes
Therefore	4.50 l/s	=	200	holes

Use 1 decants

Pond Dimensions

v = 450 m^3

d = 1.5 m

x = width of pond base

Pond calculations allow for the sides and outlet of the pond to be at a 2:1 batter slope and for the inlet of the pond to be at a 3:1 batter slope.

Calc 2: Calculate width and length of base, Quadratic Equation

3:1 ratio

$v = (((3x^2)+((x+4d)(3x+5d)))/2)d$

=> $v = 3x^2d+8.5xd^2+10d^3$ quadratic equation to find "x"

		a		b		c
0	=	4.5	x^2+	19.125	x+	-416.25
x	=	7.72	width of pond base			
or	=	-11.97				

Check = 450 m^3

5:1 ratio

$v = (((5x^2)+((x+4d)(5x+5d)))/2)d$

=> $v = 5x^2d+12.5xd^2+10d^3$ quadratic equation to find "x"

		a		b		c
0	=	7.5	x^2+	28.125	x+	-416.25
x	=	5.81	width of pond base			
or	=	-9.56				

Check = 450 m^3

Width	**=**	**7.72**	**m**
Length	**=**	**23.17**	**m**

Dead Storage Depth

Pond Dimensions

x = 7.72 m

v = 135.0 m^3

d = Dead storage depth

Pond calculations allow for the sides and outlet of the pond to be at a 2:1 batter slope and for the inlet of the pond to be at a 3:1 batter slope.

3:1 ratio

$v = (((3x^2)+((x+4d)(3x+5d)))/2)d$

=>	$v = 10d^3+8.5xd^2+3x^2d$	cubic equation to find "d"							
				a		b		c	
0	=		d^3+	6.565953358	d^2+	17.90107	+d	-13.5	
	e	=		1.18					
	f	=		15.86					
	g	=		3.17					
	h	=		-0.37					
	d	**=**		**0.607**	**depth of dead storage**				
Check	v	=	135.00		m^3				

Spillway Dimensions

Side Slope	horizontal	3	vertical	1	
Gradient		**1**	**%**		
Base Width		2.00	m		

Calc 3: Calculate spillway flow (Q) Rational Formula

Q=CIA 1% AEP

where	C	=	0.85			
	I	=	3.91667E-05	mm/s	141	100yr/10min mm/hr)
	A	=	15000	m2		
Therefore	**Q**	**=**	**0.499375**	**m3/sec**		

Calc 4: Calculate spillway depth (H) Mannings Formula

$V=(1/n)R^{2/3}S^{1/2}$ R=A/P Q=AV

n = 0.018 Flow path is firm earth

Where: H = depth of channel P = wetted parameter

A = Sectional Area S = slope of channel

H	P	A	S	R	V	Q
0.15	2.948683	0.3675	0.01	0.124632	1.386161	0.5094141

Therefore	**H**	**=**	**0.15**	**m**	Min 300mm
Therefore		=	**300**	mm	

MAVEN ASSOCIATES	Job Number 147007&147016	Sheets 4	Rev A
Job Title: Rangitoopuni Calc Title: SEDIMENT RETENTION POND 3	Author: HN	Date: 1/04/2025	Checked: KH

Max Catchment Area	**20000**	m^2
Pond Volume 3% of Area	600	m^3
Dead Storage 30% of volume	180	m^3
Live Storage 70% of volume	420	m^3
Decant Dewatering (3l/s/ha)	6	l/s

Size Decant

Standard decent	4.5	l/s	=	200	holes
Therefore	6.00	l/s	=	267	holes

Use 2 decants

Pond Dimensions

v = 600 m^3
d = 1.5 m
x = width of pond base

Pond calculations allow for the sides and outlet of the pond to be at a 2:1 batter slope and for the inlet of the pond to be at a 3:1 batter slope.

Calc 2: Calculate width and length of base, Quadratic Equation

3:1 ratio

$v = (((3x^2)+((x+4d)(3x+5d)))/2)d$

=> $v = 3x^2d+8.5xd^2+10d^3$ quadratic equation to find "x"

		a		b		c
0	=	4.5	x^2+	19.125	x+	-566.25
x	=	9.29	width of pond base			
or	=	-13.54				

Check = 600 m^3

5:1 ratio

$v = (((5x^2)+((x+4d)(5x+5d)))/2)d$

=> $v = 5x^2d+12.5xd^2+10d^3$ quadratic equation to find "x"

		a		b		c
0	=	7.5	x^2+	28.125	x+	-566.25
x	=	7.01	width of pond base			
or	=	-10.76				

Check = 600 m^3

Width = 9.29 m
Length = 27.88 m

Dead Storage Depth

Pond Dimensions
x = 9.29 m
v = 180.0 m^3
d = Dead storage depth

Pond calculations allow for the sides and outlet of the pond to be at a 2:1 batter slope and for the inlet of the pond to be at a 3:1 batter slope.

3:1 ratio

$v = (((3x^2)+((x+4d)(3x+5d)))/2)d$

=>	$v = 10d^3+8.5xd^2+3x^2d$	cubic equation to find "d"						
			a		b		c	
0	=	d^3+	7.898239806	d^2+	25.90264	+d	-18	
	e	=	1.70					
	f	=	24.85					
	g	=	3.68					
	h	=	-0.46					
	d	**=**	**0.583**	**depth of dead storage**				
Check	v	=	180.00	m^3				

Spillway Dimensions

Side Slope	horizontal	3	vertical	1	
Gradient		**1**	**%**		
Base Width		2.00	m		

Calc 3: Calculate spillway flow (Q) Rational Formula

Q=CIA 1% AEP

where	C	=	0.85			
	I	=	3.91667E-05	mm/s	141	100yr/10min mm/hr)
	A	=	20000	m2		
Therefore	**Q**	**=**	**0.665833333**	**m3/sec**		

Calc 4: Calculate spillway depth (H) Mannings Formula

$V=(1/n)R^{2/3}S^{1/2}$ R=A/P Q=AV

n = 0.018 Flow path is firm earth

Where: H = depth of channel P = wetted parameter

A = Sectional Area S = slope of channel

H	P	A	S	R	V	Q
0.18	3.13842	0.4572	0.01	0.145678	1.538122	0.7032296

Therefore	**H**	**=**	**0.18**	**m**	Min 300mm
Therefore		=	**300**	mm	

MAVEN ASSOCIATES	Job Number 147007&147016	Sheets 5	Rev A
Job Title Rangitoopuni Calc Title Sediment Retention Pond 4	Author HN	Date 1/04/2025	Checked KH

Max Catchment Area	**30000**	m^2
Pond Volume 3% of Area	900	m^3
Dead Storage 30% of volume	270	m^3
Live Storage 70% of volume	630	m^3
Decant Dewatering (3l/s/ha)	9	l/s

Size Decant

Standard decent	4.5 l/s	=	200	holes
Therefore	9.00 l/s	=	400	holes

Use 2 decants

Pond Dimensions

v = 900 m^3
d = 1.5 m
x = width of pond base

Pond calculations allow for the sides and outlet of the pond to be at a 2:1 batter slope and for the inlet of the pond to be at a 3:1 batter slope.

Calc 2: Calculate width and length of base, Quadratic Equation

3:1 ratio

$v = (((3x^2)+((x+4d)(3x+5d)))/2)d$

=> $v = 3x^2d+8.5xd^2+10d^3$ quadratic equation to find "x"

		a		b		c
0	=	4.5	x^2+	19.125	x+	-866.25
x	=	11.91	width of pond base			
or	=	-16.16				

Check = 900 m^3

5:1 ratio

$v = (((5x^2)+((x+4d)(5x+5d)))/2)d$

=> $v = 5x^2d+12.5xd^2+10d^3$ quadratic equation to find "x"

		a		b		c
0	=	7.5	x^2+	28.125	x+	-866.25
x	=	9.03	width of pond base			
or	=	-12.78				

Check = 900 m^3

Width	**=**	**11.91**	**m**
Length	**=**	**35.73**	**m**

Dead Storage Depth

Pond Dimensions

x = 11.91 m
v = 270.0 m^3
d = Dead storage depth

Pond calculations allow for the sides and outlet of the pond to be at a 2:1 batter slope and for the inlet of the pond to be at a 3:1 batter slope.

3:1 ratio

$v = (((3x^2)+((x+4d)(3x+5d)))/2)d$

=>	$v = 10d^3+8.5xd^2+3x^2d$	cubic equation to find "d"							
				a		b		c	
0	=		d^3+	10.12454164	d^2+	42.56319	+d	-27	
	e	=		2.80					
	f	=		46.88					
	g	=		4.55					
	h	=		-0.62					
	d	**=**		**0.557**	**depth of dead storage**				
Check	v	=	270.00		m^3				

Spillway Dimensions

Side Slope	horizontal	3	vertical	1	
Gradient		**1**	**%**		
Base Width		2.00	m		

Calc 3: Calculate spillway flow (Q) Rational Formula

Q=CIA 1% AEP

where	C	=	0.85			
	I	=	3.91667E-05	mm/s	141	100yr/10min mm/hr)
	A	=	30000	m2		
Therefore	**Q**	**=**	**0.99875**	**m3/sec**		

Calc 4: Calculate spillway depth (H) Mannings Formula

$V=(1/n)R^{2/3}S^{1/2}$ R=A/P Q=AV

n	=	0.018	Flow path is firm earth

Where: H = depth of channel P = wetted parameter

A = Sectional Area S = slope of channel

H	P	A	S	R	V	Q
0.22	3.391402	0.5852	0.01	0.172554	1.721911	1.0076626

Therefore	**H**	**=**	**0.22**	**m**	Min 300mm
Therefore		=	**300**	mm	

MAVEN ASSOCIATES	Job Number 147007&147016	Sheets 6	Rev A
Job Title: Rangitoopuni Calc Title: Sediment Retention Pond 5	Author: KH	Date: 1/04/2025	Checked: KH

Max Catchment Area	**50000**	m^2
Pond Volume 3% of Area	1500	m^3
Dead Storage 30% of volume	450	m^3
Live Storage 70% of volume	1050	m^3
Decant Dewatering (3l/s/ha)	15	l/s

Size Decant

Standard decent	4.5	l/s	=	200	holes
Therefore	15.00	l/s	=	667	holes

Use 4 decants

Pond Dimensions

v = 1500 m^3

d = 1.5 m

x = width of pond base

Pond calculations allow for the sides and outlet of the pond to be at a 2:1 batter slope and for the inlet of the pond to be at a 3:1 batter slope.

Calc 2: Calculate width and length of base, Quadratic Equation

3:1 ratio

$v = (((3x^2)+((x+4d)(3x+5d)))/2)d$

=> $v = 3x^2d+8.5xd^2+10d^3$ quadratic equation to find "x"

		a		b		c
0	=	4.5	x^2+	19.125	x+	-1466.25
x	=	16.05	width of pond base			
or	=	-20.30				

Check = 1500 m^3

5:1 ratio

$v = (((5x^2)+((x+4d)(5x+5d)))/2)d$

=> $v = 5x^2d+12.5xd^2+10d^3$ quadratic equation to find "x"

		a		b		c
0	=	7.5	x^2+	28.125	x+	-1466.25
x	=	12.23	width of pond base			
or	=	-15.98				

Check = 1500 m^3

Width = 16.05 m

Length = 48.15 m

Dead Storage Depth

Pond calculations allow for the sides

Pond Dimensions

x = 16.05 m

v = 450.0 m^3

d = Dead storage depth

and outlet of the pond to be at a 2:1 batter slope and for the inlet of the pond to be at a 3:1 batter slope.

3:1 ratio

$v = (((3x^2)+((x+4d)(3x+5d)))/2)d$

=> $v = 10d^3+8.5xd^2+3x^2d$ cubic equation to find "d"

			a		b		c
0	=	d^3+	13.6429287	d^2+	77.28561	+d	-45

e	=	5.08	
f	=	104.18	
g	=	5.93	
h	=	-0.86	
d	**=**	**0.531**	**depth of dead storage**

Check v = 450.00 m^3

Spillway Dimensions

Side Slope horizontal 3 vertical 1

Gradient **1 %**

Base Width 5.00 m

Calc 3: Calculate spillway flow (Q) Rational Formula

Q=CIA 1% AEP

where	C	=	0.85			
	I	=	3.91667E-05	mm/s	141	100yr/10min mm/hr)
	A	=	50000	m2		

Therefore **Q** **=** **1.664583333** **m3/sec**

Calc 4: Calculate spillway depth (H) Mannings Formula

$V=(1/n)R^{2/3}S^{1/2}$ R=A/P Q=AV

n **=** 0.018 Flow path is firm earth

Where: H = depth of channel P = wetted parameter

A = Sectional Area S = slope of channel

H	P	A	S	R	V	Q
0.2	6.264911	1.12	0.01	0.178773	1.763043	1.974608

Therefore **H** **=** **0.2** **m** Min 300mm

Therefore = **300** mm