Pre-feasibility Report

Property No. [redacted] Newtownstewart Castle Brae Road.

CO401611 / PFR-001

03/12/2019

ameyconsulting

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Document Control Sheet

Project Name:	Property [redacted]
Project Number:	CO401611
Report Title:	Pre-feasibility Report
Report Number:	Report Number: PFR-001

Issue Status/Amendment	Prepared	Reviewed	Approved
Revision 00	Name: [redacted] Signature: [redacted] Date:03/12/19	Name: [redacted] Signature: [redacted] Date: 03/12/19	Name: [redacted] Signature: [redacted] Date:04/12/19

Executive Summary

Summary	
Issue/Problem	The Strule River overtopped its banks on 22/23 August 2017, due to high level flows resulting from prolonged heavy rainfall over the river catchment and inundated a number of dwellings and commercial properties in Newtownstewart.
Flood Risk	Property [redacted] located on the Castle Brae and Douglas Road Newtownstewart, Co. Tyrone is at risk from a Q5 flood event (derived from Infoworks ICM version 8.5.7). Residents of this property made an assertion that in protecting their property it would subsequently protect the 5 properties located on the opposite side of Castle Brae road.
Mitigation	The option for defending **Property** [redacted] against a Q100CC flood event is made up of 3 elements as detailed below: ▪ Sheet Piling 36m along riverside boundary ▪ Construction of 84m of reinforced concrete walls surrounding the property. ▪ Two flood gates (vehicular and pedestrian) at the existing entrances to [redacted]
Cost	The costs associated with the mitigation option is: Property [redacted] (in isolation): £430,000
Recommendations	The existing standard of protection to Property [redacted] and the surrounding properties indicates a Q5 flood event (Multicoloured Manual). This was analysed over a 100-year period The outline economic analysis undertaken in this optioneering study demonstrates that protecting Property [redacted] would have a benefit cost of 0.21, which is significantly below the unity threshold at which public funding can be justified for an improvement scheme.

Contents

Tables

Figures

1. Job Description and location

1.1. Introduction & Background

Subsequent to the findings of the June 2019 report, "Newtonstewart Castle Brae Road Pre-Feasibility Report – Rev A" an additional report was commissioned by DfI Rivers to investigate the potential benefit of a Q100CC (1% Annual Exceedance Probability plus Climate Change allowance) localised flood defence around property [redacted]. It has been suggested by the resident at [redacted] that localised works to their property would benefit properties on the opposite side of Castle Brae (i.e. Strule Veterinary Services and the residential properties [redacted]) by closing off a potential flood route.

Outlined within the report is the project aim, methodology, model outputs, exploration of viable options, estimation of chosen options and recommendations.

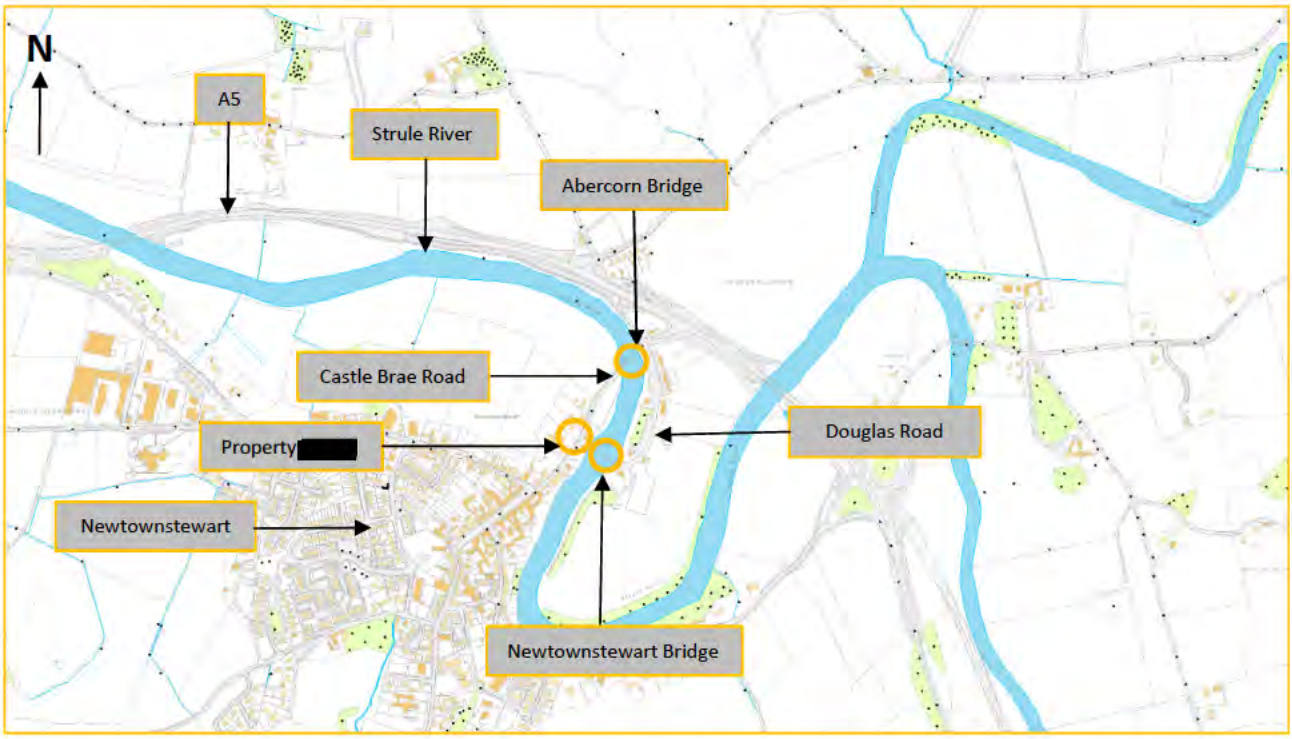

Figure 1 - Scheme Location

2. Existing Conditions

2.1. Historic Flooding

Prior to the flooding of August 2017, a masonry wall formed the boundary of [redacted] along the left bank of the River Strule, downstream of Newtownstewart Bridge (see figures 2 to 5). However, the surcharge of the flood levels in the Strule River caused the wall to collapse above bank level resulting in flooding of the dwelling.

Figure 2 – Wall at rear of [redacted] prior to August 2017 flooding.

Figure 3 – Wall at rear of [redacted] partially collapsed as a result of the high river levels in the August 2017 flood event (photo Sept 2018).

Figure 4 - Wall at rear of [redacted] before high river levels of August 2017 flood event (photo March 2009)

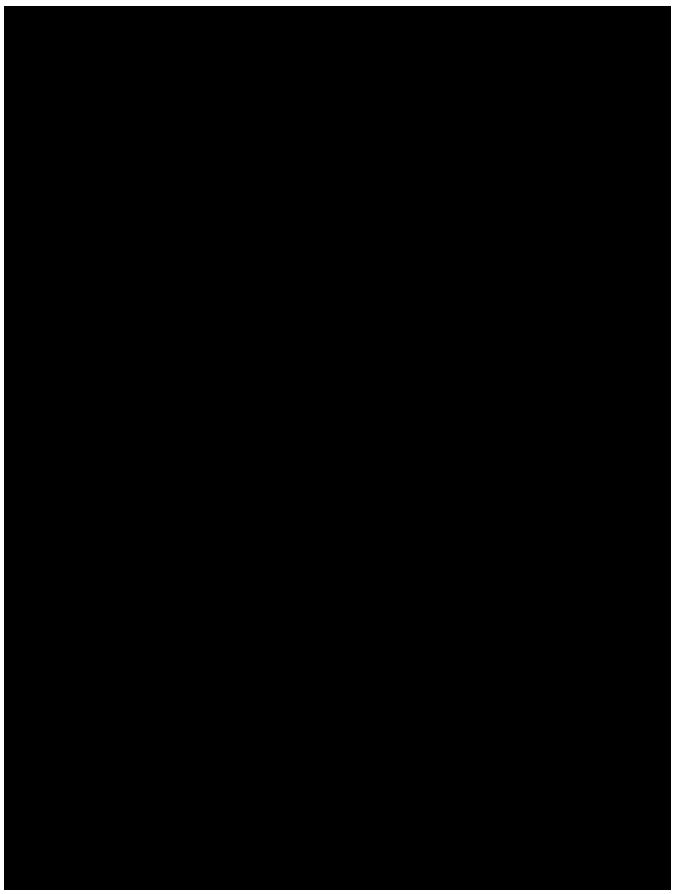

Figure 5 - Wall at rear of [redacted] partially collapsed as a result of the high river levels in the August 2017 flood event (photo Sept 2018).

3. Stakeholders/Contact Details

Table 2 - Stake Holder and Contact Details.

Name	Address	Title/Position
Henry Thompson	DfI Rivers Omagh Western Regional Office 3a St Julian's Road Lisnamallard Omagh BT79 7HQ	Authorising officer
Bryan Stewart	DfI Rivers Omagh Western Regional Office 3a St Julian's Road Lisnamallard Omagh BT79 7HQ	DfI Rivers Project Manager
George Thompson	DfI Rivers Omagh Western Regional Office 3a St Julian's Road Lisnamallard Omagh BT79 7HQ	Client Project Manager

4. Description of Flooding and Flood Risk

4.1. Source of flooding and Risk

Table 3 - Source/Risk of Flooding of the Strule River.

Flooding Risk	Yes	No	Unknown
Structural Defect	✓		
Hydraulic Deficiency	✓		
Development Pressure		✓	
Overland Flow	✓		
Out of Bank Flooding	✓		
Over topping Flood Defences	✓		
Maintenance Required			✓
Others (detail Below)		✓	

4.2. Areas of Risk

Number of Properties Flooded

- Hydraulic modelling of the Q100CC flood event has shown that in the vicinity of property [redacted] there are 5 No. residential properties and a business, Strule Veterinary Services, at risk of flooding.

Infrastructure Flooded

- Castle Brae Newtownstewart.

Estimate of number of properties at risk from a Q100CC flooding event

- Estimation of hydraulic model using Infoworks ICM 8.5.7 flood modelling software.

  - Dwelling House: 5

  - Business: 1

5. Analysis

5.1. Methodology

The Infoworks ICM hydraulic model used in developing the "Newtonstewart Castle Brae Road Pre-Feasibility Report – Rev A" has been re-run to include flood defences around the perimeter of [redacted]

5.2. Results - Pre-Mitigation

The hydraulic model shows that flooding starts to occur at property [redacted] in a Q5 flood event.

5.3. Mitigation Options Considered

Practical solutions based on available space to construct the required flood defence have been considered. The lowest cost and buildable flood protection option to improve the standard of protection for property [redacted] consists of 3 elements (sheet pile retaining wall, reinforced concrete floodwall and 2 No. flood gates). Along the riverside boundary of the property, where space is limited and the structural integrity of the existing wall is uncertain, sheet piling was considered. Along the remaining property boundary, a reinforced concrete floodwall has been adopted, steel flood gates to provide vehicular and pedestrian access:

- Sheet Piling 36m along riverside boundary
- Construction of 84m of reinforced concrete walls surrounding the property.
- Two flood gates (vehicular and pedestrian) at the existing entrances to [redacted].

6. Assessment of the Problem

6.1. Likely Causes, Possible Constraints.

Likely Cause

- Overtopping existing bank along the Strule River in the vicinity of Castle Brae and Douglas Road during intense rainfall/high flows (e.g. August 2017 flood event).

Effects to Properties and surrounding area.

- Internal flooding of residential and a commercial property.
- Damage to surrounding gardens and landscaped areas.
- Possible damage to the substructure of the residential and commercial properties.
- Damage and restrictions to local infrastructure and road access.

Possible Constraints

- Economic justification (benefit cost ratio must be greater than unity).
- Aesthetics of defences in this historic town.

7. Consequences of options for Q100CC Flood Protection

7.1. Status Quo (Maintain Current status)

Temporary closure of the Castle Brae and Douglas Road, continual bad press and complaints from residents/politicians, flooding of residential and commercial properties, costs of flood response and clean-up operations. Maintaining the current status does not remove the risk of flooding to the properties and businesses.

7.2. Do Minimum

Continue to provide maintenance of bank protection and debris clearance through bridge arches. However, routine maintenance will not mitigate a Q100CC event.

7.3. Undertake Improvement works

Hydraulic modelling has shown that localised flood protection measures to property [redacted] will not provide the wider benefits to nearby residential and commercial properties (i.e. Strule Veterinary Services and the residential properties [redacted]) as had been suggested by the resident of property [redacted]

Details of the proposed works are provided below, with typical cross-section details of the proposed defences provided in Appendix D.

8. Estimation of costs for Improvement works

Table 5 – A summary of cost for defences at [redacted]

Flood Cell One (undertaken in conjunction with flood cell two).	Capital Works Order of Cost.	Design, Supervision and Contingencies Order of Costs. *(* Assume 50% of Capital Costs)*	Compensation and Land Purchase Order of Costs.	Order of Costs. *(*Rounded up to nearest £5,000)*
A - 34m long sheet piles 9m high	£152,389**	£76,195	----	**£230,000**
B – 84m long retaining wall	£111,443**	£55,722	-----	**£170,000**
C – 2 Flood gates at existing entrances	£18,983**	£9,492	-----	**£30,000**
			Total cost of works at Property [redacted]	**£430,000**

Source:

*Percentages based on DfI Rivers guidelines.

**prices derived from Spon's Engineering and Highway Works Price Book and Watertight International for the Flood Gates

Note: Further breakdown of construction costs are provided within appendix F.

9. Damages Avoided

The cost of the proposed construction works must be compared with the damages avoided to determine the cost benefit of any potential option. The hydraulic modelling has shown that the construction of localised property defences at property [redacted] will not safeguard any of the surrounding properties and therefore the damages avoided can only be taken for a single residential property (property [redacted].

The damages avoided have been determined using the industry standard guidance provided by the Flood and Coastal Erosion Risk Management Handbook for Economic Appraisal (2015). Hydraulic modelling (see Appendix C) demonstrates that the onset of flooding at property [redacted] occurs in a Q5 fluvial flood event.

Flood Cell One

Table 6 - Flood Alleviation

Number of houses/commercial units at risk from flooding (Nr)	Direct Tangible losses per house/commercial unit	Total Direct Tangible losses
1No. residential property @ 5-year flood event.	£89,600	£89,600

Table 7 - Development Benefit

Area of Proposed Development (Hectares)	Development Benefit	Development Benefit
n/a	n/a	n/a

Table 8 - Vehicle Damage.

Number of vehicles affected	Value per vehicle	Total direct tangible losses
1 vehicle @ 1No. properties (28% occurrence)	£3,100	£868

Total Damage Avoided

The total damage avoided is estimated as £90,468

For Property [redacted] the benefit/cost ratio = £90,468/ £430,000 = 0.21

Where the benefit/cost ratio falls below unity (1) the use of public funds cannot be justified.

10. Recommendations

The onset of flooding to property [redacted] occurs in a Q5 (20% AEP) fluvial flood event.

The outline economic analysis undertaken in this pre-feasibility report demonstrates that the most cost-effective option for property protection achieves a benefit/cost ratio of 0.21, which is below the unity threshold at which public funding cannot be justified for any improvement scheme.

Appendix A: Site Photographs

Photo A1 - Strule River immediately downstream of the Newtownstewart Bridge

Photo A2 - Property wall demolished as a result of August 2017 flooding located west of the Strule River, immediately downstream of the Newtownstewart Bridge.

Appendix B: Site Location Plan

[redacted]

Sturle Veterinary Services

Property No. 23

	Chkd	Appd
JC		Dec 19
CE		Dec 19
WB		Dec 19
RL		Dec 19

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Western Division
County Hall, Drumragh Avenue
Omagh, BT79 7AF (028) 82254111

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Property No. [redacted] - Newtownstewart
[redacted]

Scheme Location Plan - Property No. 23.

1:500

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Rev

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Appendix C: Infoworks ICM Outputs

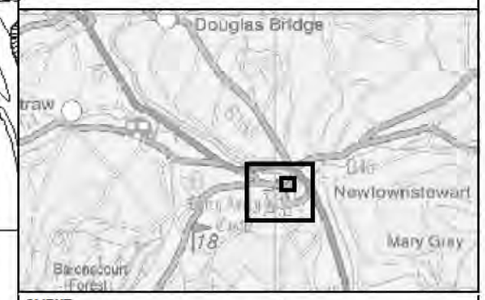
N

NOTES
1) ALL DIMENSIONS ARE IN METRES AND ALL LEVELS IN METRES ABOVE ORDNANCE DATUM UNLESS STATED OTHERWISE

LEGEND

Maximum Flood Depth (m)

- < 0.3
- 0.3 - 0.6
- 0.6 - 1.2
- 1.2 - 2.4
- >2.4



PLOT SCALE @ A3: 1:2,000

0 20 40 80 120 160 200 m

0 50 100 200 300 400 500 m

CLIENT

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SCHEME

NEWTOWNSTEWART PROPERTY [redacted]

PLOT TITLE

MAXIMUM FLOOD DEPTH
1% AEP +20%CC FLUVIAL EVENT
EXISTING SITE LAYOUT
NORMAL FLOW CONDITIONS

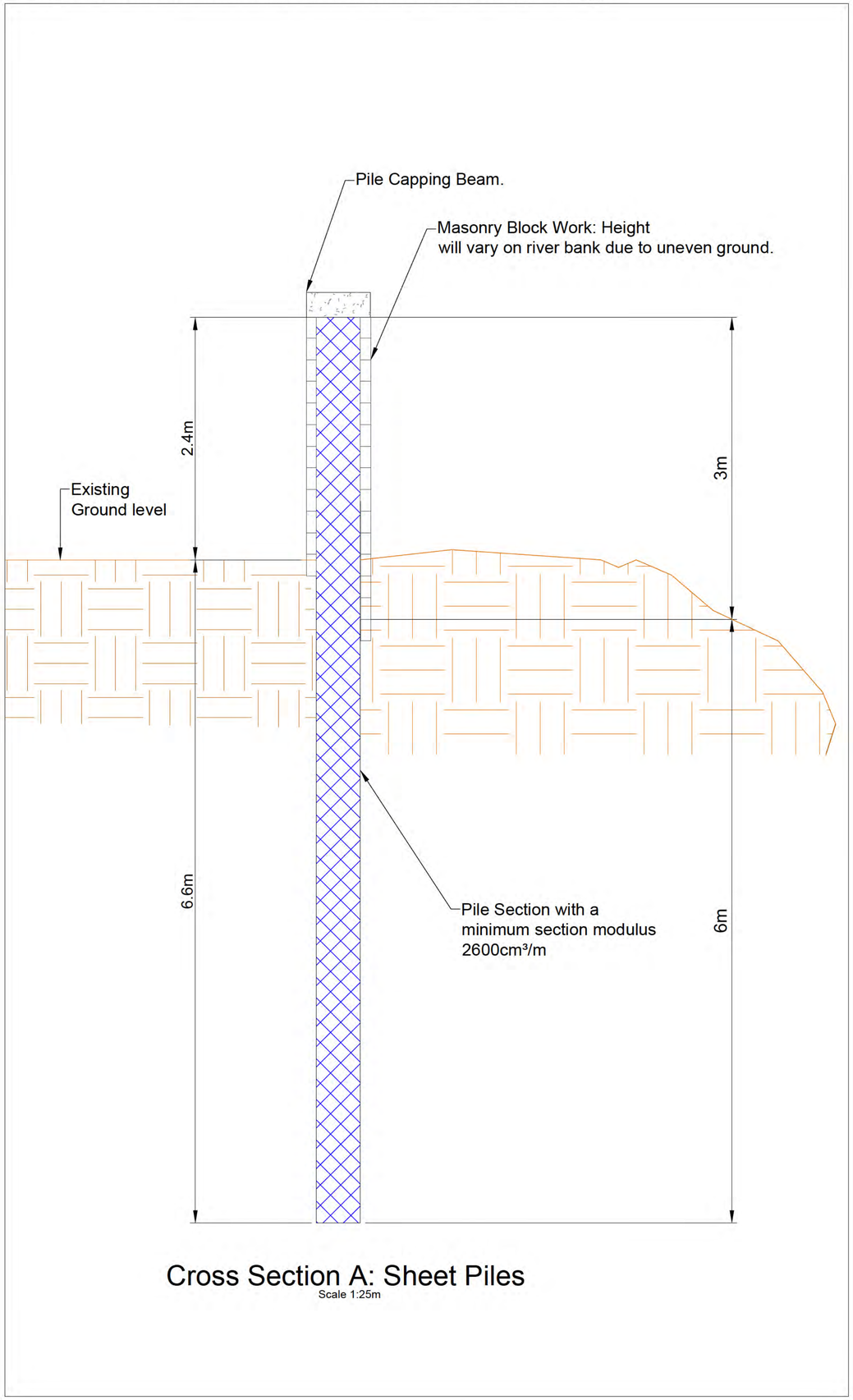
PLOT STATUS	DATE
FINAL	16/10/2019

DRAWN	CHECKED	APPROVED	PLOT SCALE @ A3
VJ	LW	APR	1 5,000 (UNLESS STATED OTHERWISE)

PLOT NAME	REV
Q100CC EXG NFC D	-

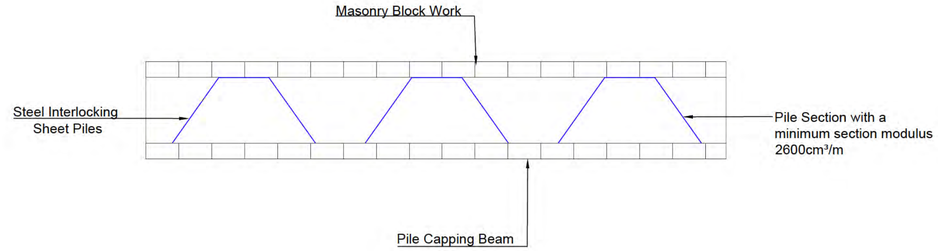
Appendix D: Option Drawings

File ref - g:\1 active\coni08 rivers west\co401611 newtownstewart castle brea rd\newtownstewart property no. 23\cad\401611- scheme location property [redacted].dwg



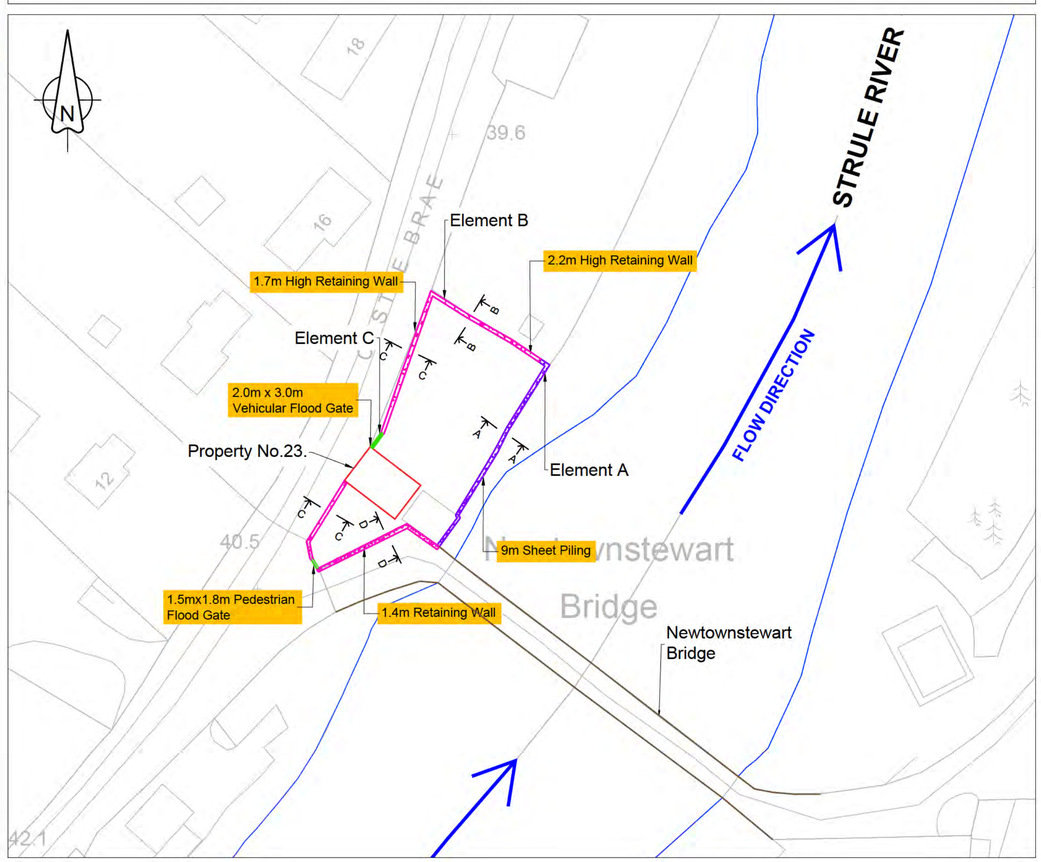
Cross Section A: Sheet Piles

Scale 1:25m



Plan View of Cross Section A

Scale 1:20m



Key

- River Extents
- Concrete Wall
- Interlocking Sheet Piling
- Flood Gate
- Soil
- Property 23

JC	Dec 19
CE	Dec 19
WB	Dec 19
RL	Dec 19

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Newtonstewart Castle Brae Road

Cross Section A - Sheet Piles

1:500

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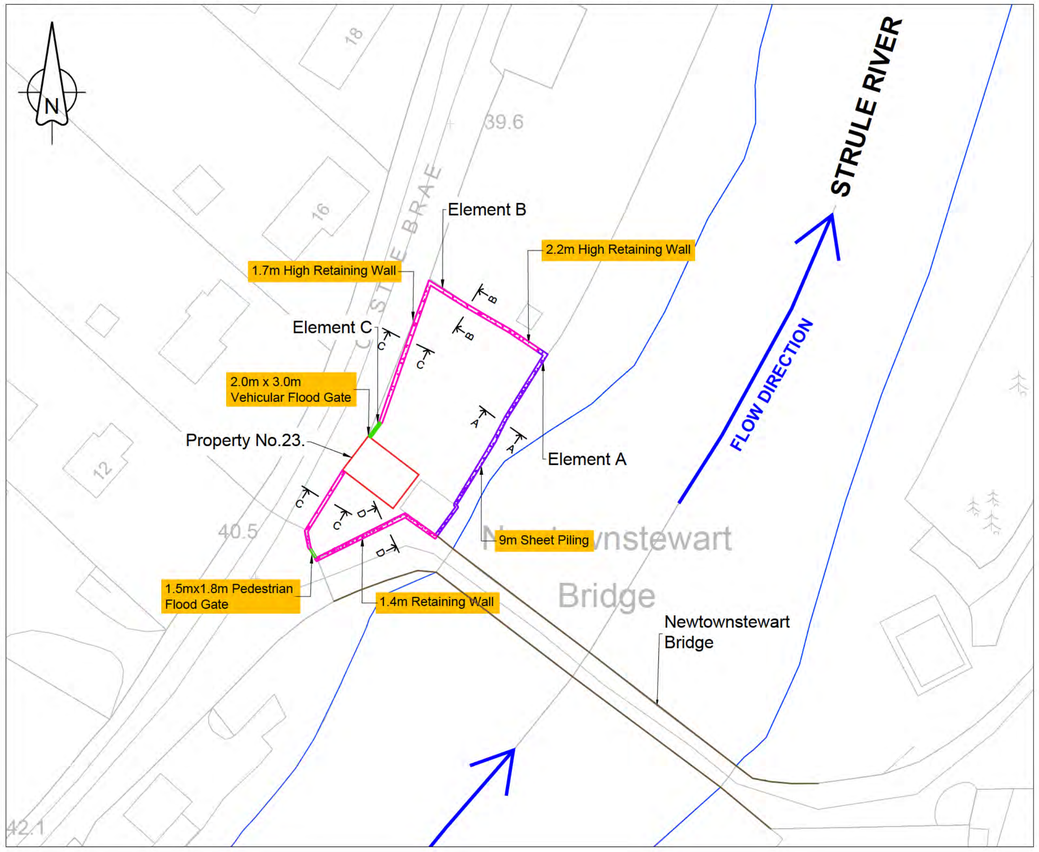
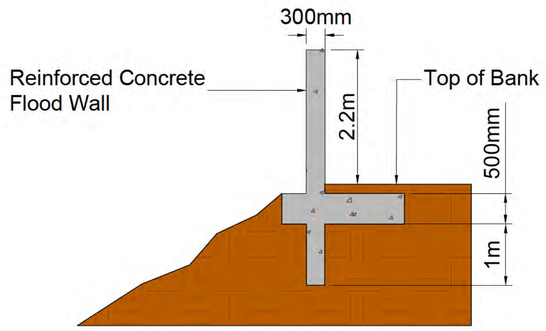
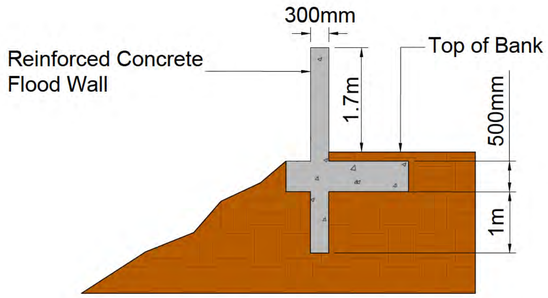
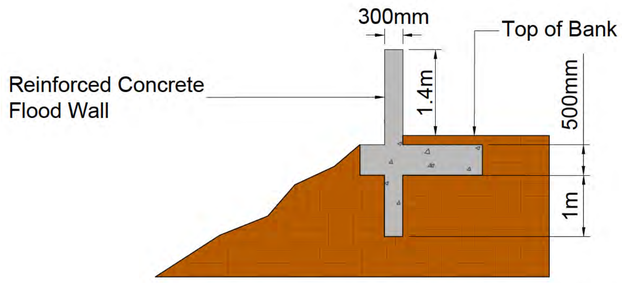




Cross Section B: Reinforced Concrete Wall
Scale 1:50m



Cross Section C: Reinforced Concrete Wall
Scale 1:50m



Cross Section D: Reinforced Concrete Wall
Scale 1:50m

Key

- River Extents
- Concrete Wall
- Interlocking Sheet Piling
- Flood Gate
- Soil
- Property 23

JC	Dec 19
CE	Dec 19
WB	Dec 19
RL	Dec 19

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Newtonstewart Castle Brae Road

Cross section B,C&D - Reinforced Concrete Wall.

1:500

-

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Appendix E: Post Mitigation Model Outputs

Flood Map showing the Q100CC Flood Event with defences in place to protect No23 Castle Brae.

N

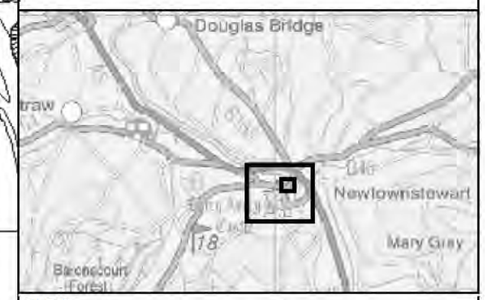
NOTES
1) ALL DIMENSIONS ARE IN METRES AND ALL LEVELS IN METRES ABOVE ORDNANCE DATUM UNLESS STATED OTHERWISE

LEGEND

Proposed Flood Defences

Maximum Flood Depth (m)

- < 0.3
- 0.3 - 0.6
- 0.6 - 1.2
- 1.2 - 2.4
- >2.4



PLOT SCALE @ A3: 1:2,000

0 20 40 80 120 160 200 m

0 50 100 200 300 400 500 m

CLIENT

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SCHEME

NEWTOWNSTEWART PROPERTY [redacted]

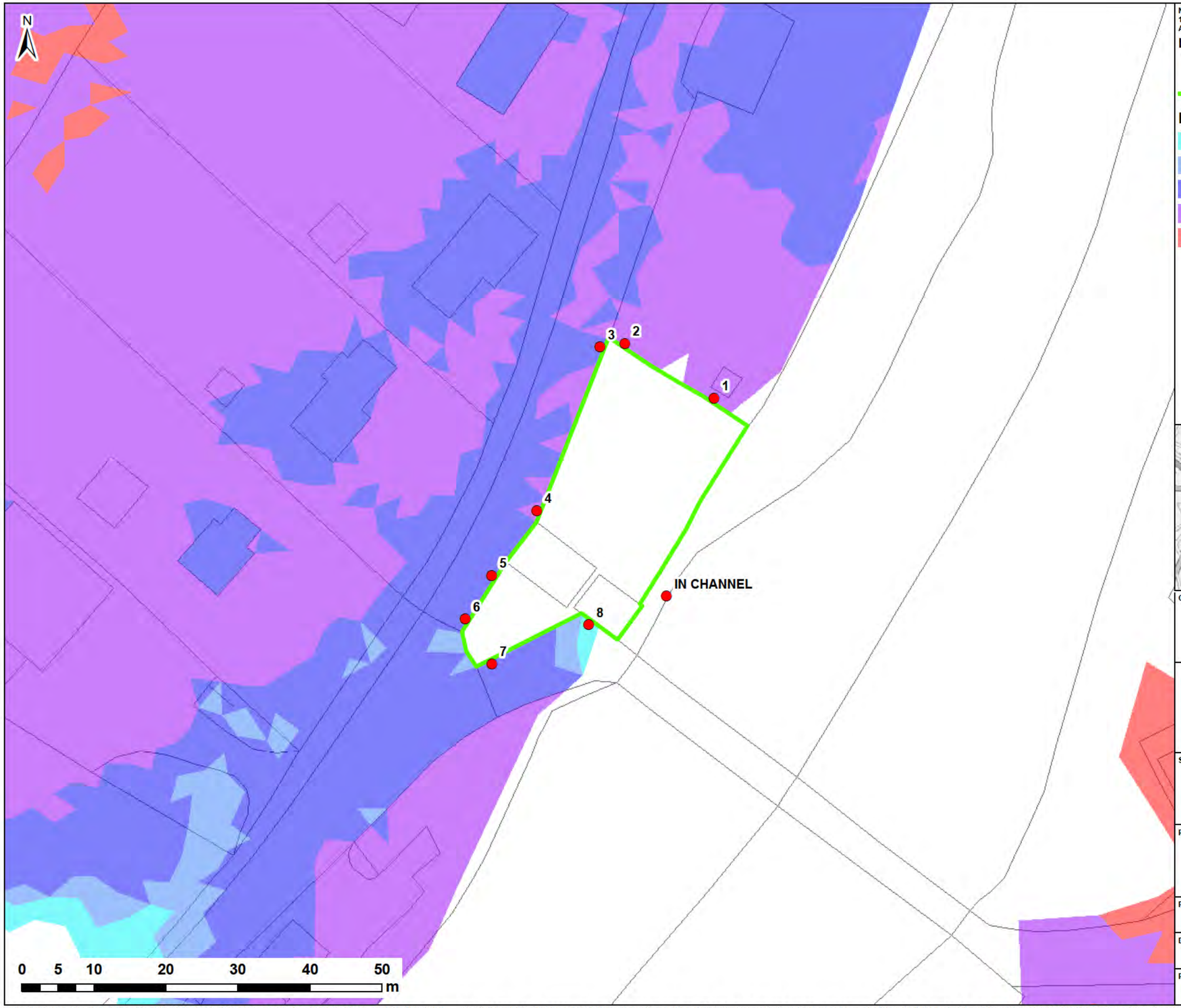
PLOT TITLE

MAXIMUM FLOOD DEPTH
1% AEP +20%CC FLUVIAL EVENT
OPTION LAYOUT
NORMAL FLOW CONDITIONS

PLOT STATUS	DATE
FINAL	16/10/2019

DRAWN	CHECKED	APPROVED	PLOT SCALE @ A3
VJ	LW	APR	1 5,000 (UNLESS STATED OTHERWISE)

PLOT NAME	REV
Q100CC OPT NFC D	-



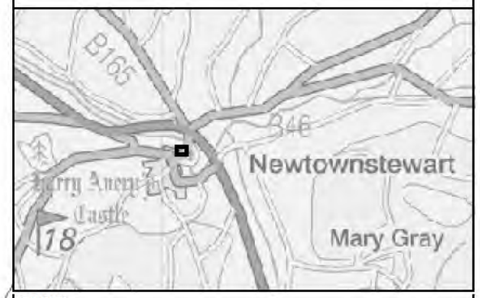
NOTES
1) ALL DIMENSIONS ARE IN METRES AND ALL LEVELS IN METRES ABOVE ORDNANCE DATUM UNLESS STATED OTHERWISE

LEGEND

- Results Extraction Points
- Proposed Flood Wall

Maximum Flood Depth (m)

- 0 - 0.3
- 0.3 - 0.6
- 0.6 - 1.2
- 1.2 - 2.4
- > 2.4



CLIENT

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SCHEME

NEWTOWNSTEWART PROPERTY [redacted]

PLOT TITLE

RESULTS EXTRACTION POINT LOCATIONS

PLOT STATUS	DATE
FINAL	17/10/2019

DRAWN	CHECKED	APPROVED	PLOT SCALE @ A3
DH	LW	APR	1 500 (UNLESS STATED OTHERWISE)

PLOT NAME	REV
12489-Extract Point Locations	-

Point ID	Eastings (m)	Northings (m)	Maximum Adjacent Flood Depth (m)	Maximum Adjacent Flood Level (m AOD)	Required Freeboard (mm)	Minimum Recommended Wall Height (m)	Minimum Recommended Wall Crest Level (m AOD)
1	240364	385904	1.78	40.86	600	2.42	41.50
2	240351	385912	1.40	40.86	600	2.04	41.50
3	240348	385911	1.19	40.82	600	1.87	41.50
4	240339	385889	1.25	40.83	600	1.92	41.50
5	240333	385880	0.84	40.83	600	1.51	41.50
6	240329	385874	0.77	40.81	600	1.46	41.50
7	240333	385868	1.08	41.88	600	1.80	42.60
8	240346	385873	0.30	41.91	600	0.99	42.60
IN CHANNEL	240357	385877	5.78	41.56	600	6.42	42.20

Appendix F: Approximate Construction Costs

	Number	£/Week	Weeks	Total Cost	
Prelims - Contractor Staff					
Site Agent	1	1895	12	£22,740.00	pg 88
Senior Engineer (50%)	0.5	1745	12	£10,470.00	pg 88
Foreman	1	1020	12	£12,240.00	pg 88
QS (25%)	0.25	1566	12	£4,698.00	pg 88
Security Guard	0	510	0	£0.00	pg 88
2 x vans	2	610	12	£14,640.00	pg 88
				£64,788.00	
Prelims - Units	**Unit**	**Qty**	**Rate**	**Total Cost**	**Reference**
Erect and dismantle site mobile, site huts, canteen, toilets etc	Item	1	3022	£ 3,022.00	Spons P90
Site Section Office	Week	12	50	£600.00	Spons P89
Site Hut	Week	12	56	£672.00	Spons P89
Canteen	Week	12	180	£2,160.00	Spons P89
Washroom	Week	12	70	£840.00	Spons P89
1no. Toilet	Week	12	240	£2,880.00	Spons P89
				£10,174.00	
Prelims - Plant not already covered	**Unit**	**Qty**	**Rate**	**Total Cost**	**Reference**
compressor	1	360.00	12	£4,320.00	
5kva Generator	1	200.00	12	£2,400.00	
				£6,720.00	
	Total Prelims			**£81,682.00**	

Property[redacted] Sheet Piling (36m) - Element A				
Item	Unit	Quantity	Rate (£)	Total (£)
CLASS P - PILING				
Section modulus 2000-3000cm3/m; section reference AZ 26;mass 155.2kg/m2;sectional modulus 2600cm3/m;EN10248 grade S270GP steel driven area	m^2	216	183.75	£39,690.00
Area of piles of length 6-18m	m^2	324	139.8	£45,295.20
Class Q - PILING ANCILLARIES				
Cutting off surplus lengths - Section modulus 2000-3000cm3/m	m	36	24.68	£888.48
CLASS U: BRICKWORK,BLOCKWORK AND MASONARY				
Facing bricks;in plasticized cement mortar designation (iii) Thickness 103mm				
vertical straight walls	m^2	194.4	87.98	£17,103.31
Reconstituted stone masonry blocks, Bradstone Architectural dressing in weathered Cotswald or North Cerney shades;in coloured cement-lime mortar designation				
530x76mm, twice weathered and throated	m	36	83.7	£3,013.20
CLASS F: IN SITU CONCRETE				
C30 - 20mm aggregate	m^3	4.6	92.14	£423.92
Placing of concrete reinforced - pile cap thickness				
Beams; cross sectional area : 0.10-0.25m2	m^3	4.6	63.15	£290.54
Backfilling steel piles	m^3	36	46.43	£1,671.48
			TOTAL	**£108,376.13**
Prelim Costs (pro rata on Construction Costs)				**£44,012.80**
			TOTAL	**£152,388.93**

Property[redacted] concrete walls - Element B				
Item	Unit	Quantity	Rate (£)	Total (£)
Series 1700: STRUCTURAL CONCRETE				
Retaining Wall (2.2m high)	m^2	46.9	£540.00	£25,304.40
Retaining Wall (1.7m high)	m^2	67.15	£540.00	£36,261.00
Retaining Wall (1.4m high)	m^2	32.76	£540.00	£17,690.40
			Sub-Total	**£79,255.80**
Prelim Costs (pro rata on Construction Costs)				**£32,186.70**
			TOTAL	**£111,442.50**

Property[redacted] Flood gate - Element C				
Item	Unit	Quantity	Rate (£)	Total (£)
Watertight Int. Flood gate (Fitted)				
Flood Gate (2m high)	m	2.0x3.0		£8,500.00
Flood Gate (1.5m high)	m	1.5x1.8		£5,000.00
			Sub-Total	**£13,500.00**
Prelim Costs (pro rata on Construction Costs)				**£5,482.51**
			TOTAL	**£18,982.51**