The Impacts of Projects & Plans to the threat of Flooding

Pete Morton – Manager of Roads Assets

Andrew Brown – Team Leader Coastal and Flood Risk

Angus Assets

- 1814km of carriageway and 1489km of footway (adopted)
- 591 Bridges & Culverts
- 359 Retaining Walls
- 70km of Coastline
- 6 Potentially Vulnerable Areas designated by SEPA
- 4 formally designated Fluvial and 2 Coastal Flood Schemes
- 6 Controlled Reservoirs

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Topics

- Current Key Plans
- Arbroath (Brothock Water) Flood Protection Scheme
- Flooding Incidents – Storm Babet
- Coastal Project - Montrose

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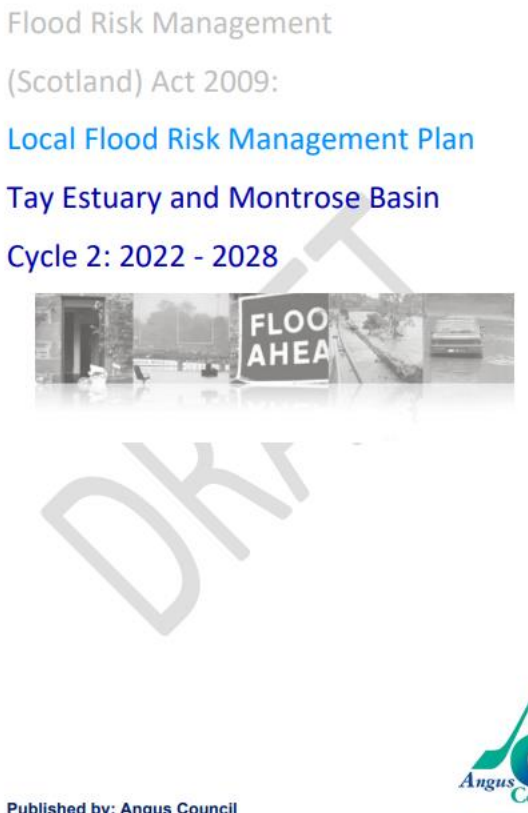
Local Flood Risk Management Plans (TEAMB)

- Lead local authority
- Cycle 2 (2022-2028)
- Aligned with Tay Area plan
- Outlines actions focused on delivering sustainable flood risk management
- Identifies the partners and stakeholders involved
- Delivery heavily dependent on available funding



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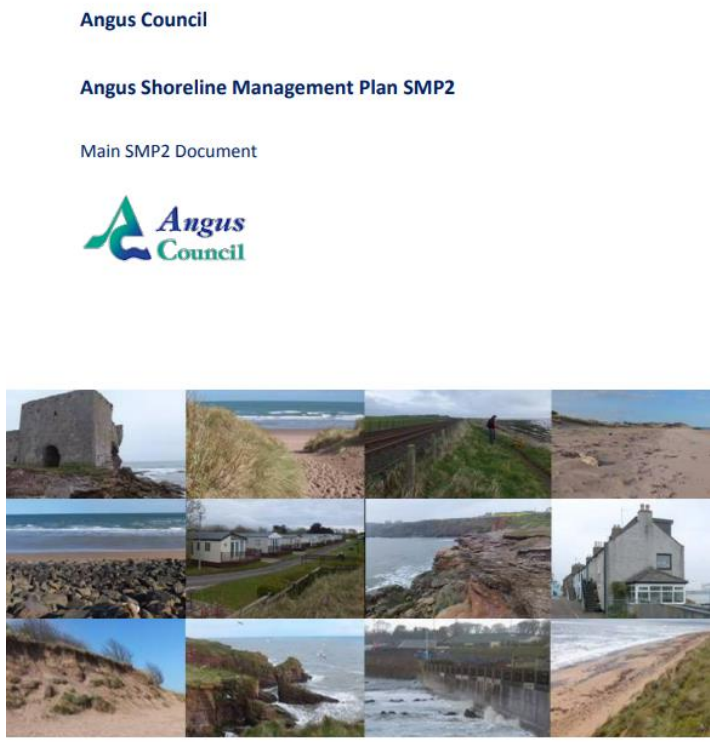
Shoreline Management Plan II (2017)

- Assessment of the risks associated with erosion and coastal flooding
- Presents policies to manage risks in a sustainable manner
- Realistic with regards to what can be delivered
- Identifies policies over short, medium and long timescales
- Discourages inappropriate development in high-risk areas
- Is a working document



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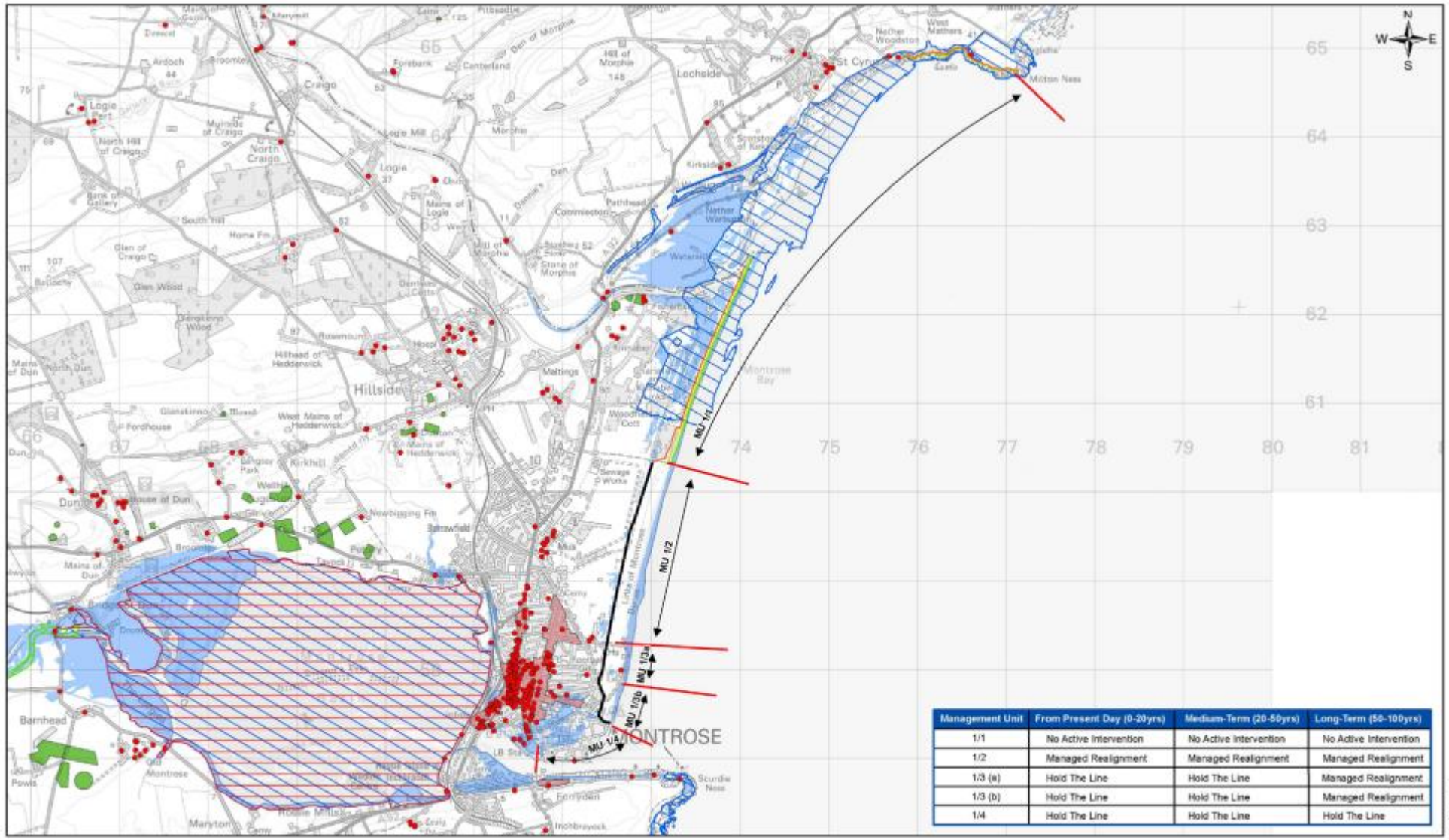

Management Unit	From Present Day (0-20yrs)	Medium-Term (20-50yrs)	Long-Term (50-100yrs)
1/1	No Active Intervention	No Active Intervention	No Active Intervention
1/2	Managed Realignment	Managed Realignment	Managed Realignment
1/3 (a)	Hold The Line	Hold The Line	Managed Realignment
1/3 (b)	Hold The Line	Hold The Line	Managed Realignment
1/4	Hold The Line	Hold The Line	Hold The Line

Project :
Angus Shoreline Management Plan 2

Drawing :
Management Unit: 1 Montrose

Drawn By :	MPC 31/10/2016
Checked By :	SB 31/10/2016
Approved By :	JY 31/10/2016

Halcrow
A CH2M HILL COMPANY

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Legend

- Management Units (MU)
- Indicative no Development Zone

Erosion Risk - Predicted Shoreline Position*
- 20 Year
- 50 Year
- 100 Year

- Listed Building
- Conservation Areas
- Scheduled Monuments
- Special Protection Area and RAMSAR
- Special Areas of Conservation
- Sites of Special Scientific Interest

Flood Risk - Year 100
- 0.5% AEP event (coastal)

*Limited long term erosion rates available for this section of coast. Therefore rates for similar types of cliffs and exposure have been applied.

Location Plan

Arbroath (Brothock Water) Flood Protection Scheme

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Scheme Background

- Substantial Flooding occurred in Arbroath in October 1976 and February 1977 coinciding with exceptional floods in Perth and the Tay Valley
- Original Scheme promoted in 1985
- In 1987 a flood Prevention Scheme was constructed with the general aim being to limit over-bank flows in the areas, which flooded during the 1976 and 1977 events

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Scheme Background

- The Arbroath (Brothock Water) Flood Prevention Scheme 1985 was designed to provide protection against a 1:25 year flood (4% probability)

- Scottish Government review of all flood schemes in Scotland in 2005 identified the Brothock Scheme to be far below the 1:25 years return period design……1:5

- Why – new methods of modelling, climate change guidance upgraded & freeboard (uncertainty) allowance to increase maximum protection

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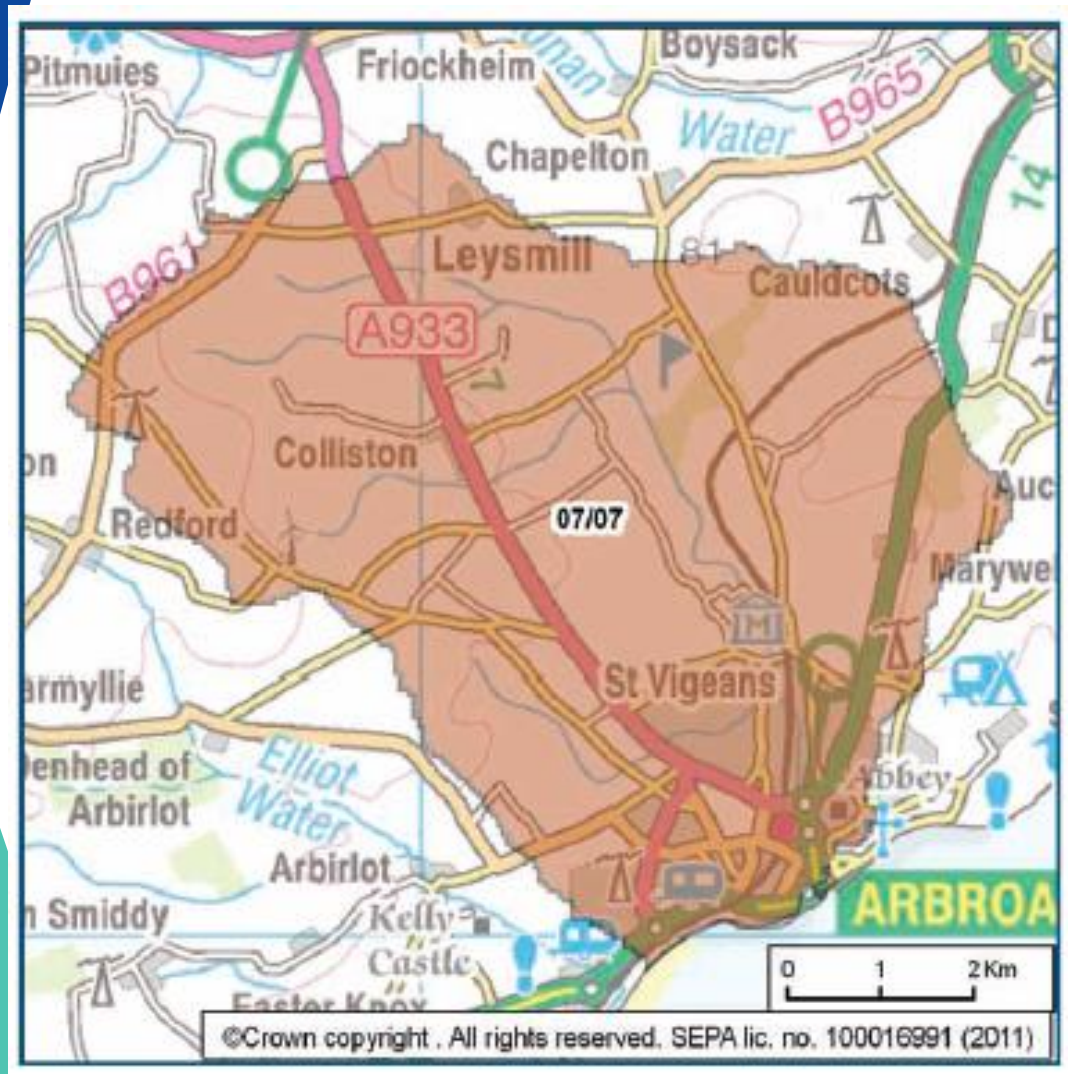
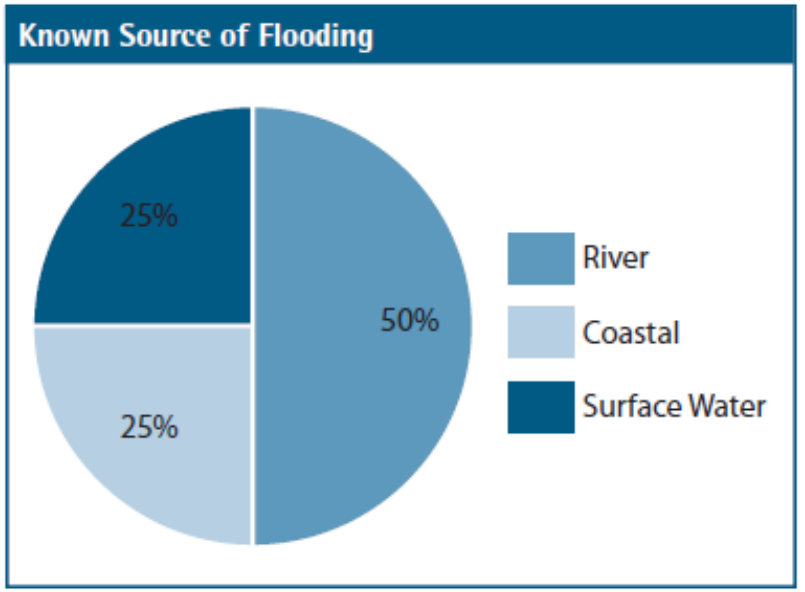
PVA 07/07 - Arbroath





- Remove 530 people at risk
- £840k annual average damages saving

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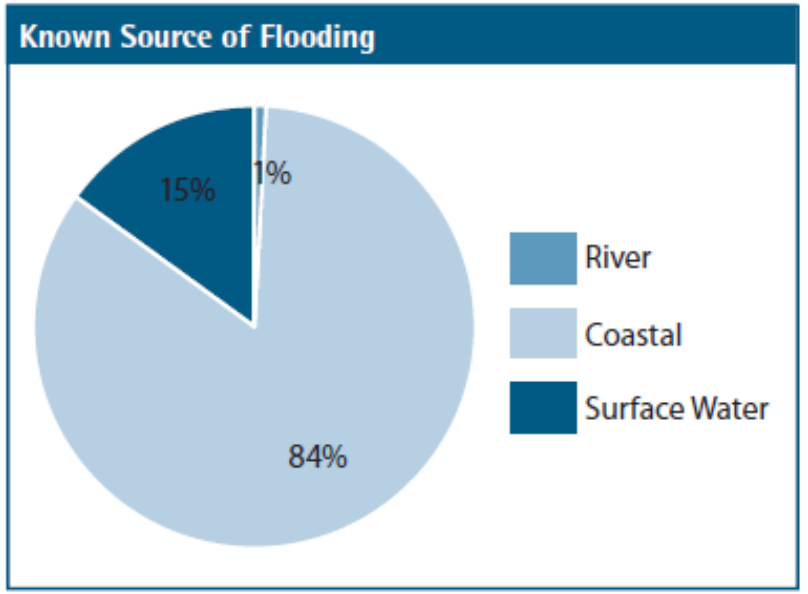
PVA 07/08 – Coast North of Arbroath



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Initial Works

Early Intervention - Filling a section of wall and raising three sections of wall provided a 1:10 (10%) year protection to Arbroath.

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Scheme Options

- AC and consultants AECOM developed the scheme.

- 3 upstream flood storage areas with direct defences in Arbroath,
    i. Brothock Meadows
    ii.St Vigeans
    iii.Hercules Den

- Direct defences within Arbroath – 36 separate operations comprising new wall construction, existing wall remedial works (to strengthen and heighten) etc.

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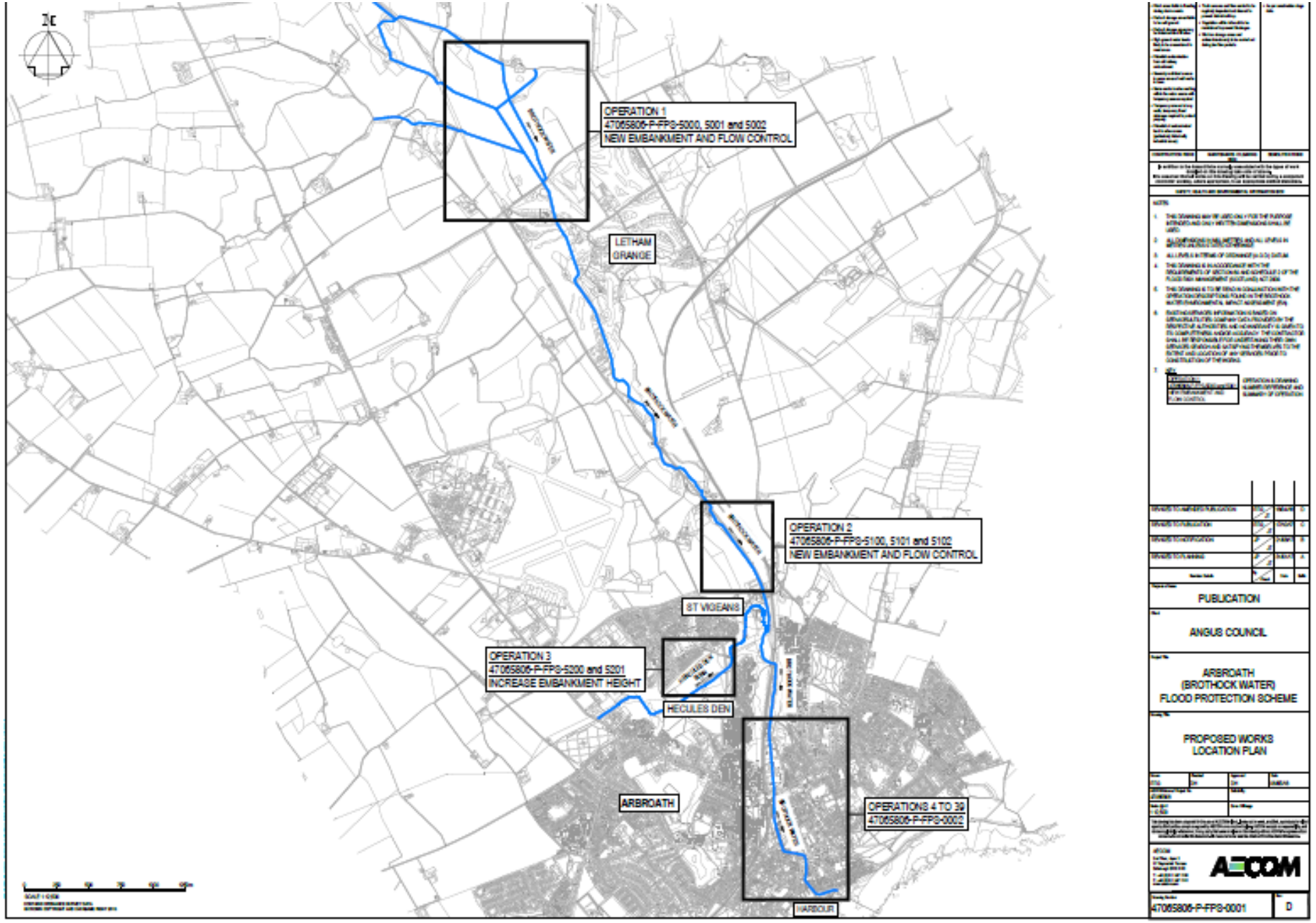
OPERATION 1
47065806-P-FPS-5000, 5001 and 5002
NEW EMBANKMENT AND FLOW CONTROL
LETHAM GRANGE
OPERATION 2
47065806-P-FPS-5100, 5101 and 5102
NEW EMBANKMENT AND FLOW CONTROL
ST VIGEANS
OPERATION 3
47065806-P-FPS-5200 and 5201
INCREASE EMBANKMENT HEIGHT
HECULES DEN
ARBROATH
OPERATIONS 4 TO 39
47065806-P-FPS-0002
HARBOUR
PUBLICATION
ANGUS COUNCIL
ARBROATH
(BROTHOCK WATER)
FLOOD PROTECTION SCHEME
PROPOSED WORKS
LOCATION PLAN
AECOM
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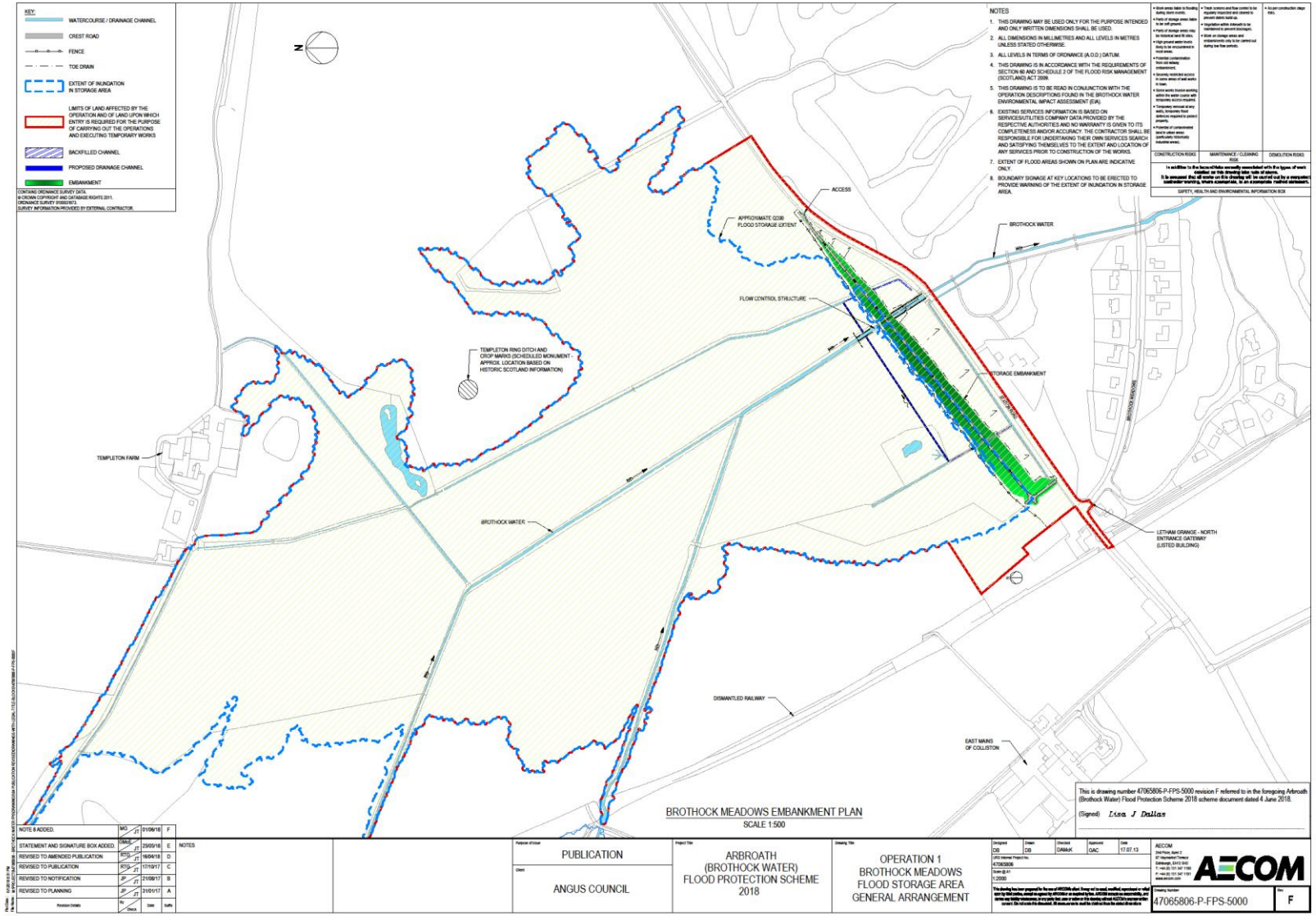
Brothock Meadows



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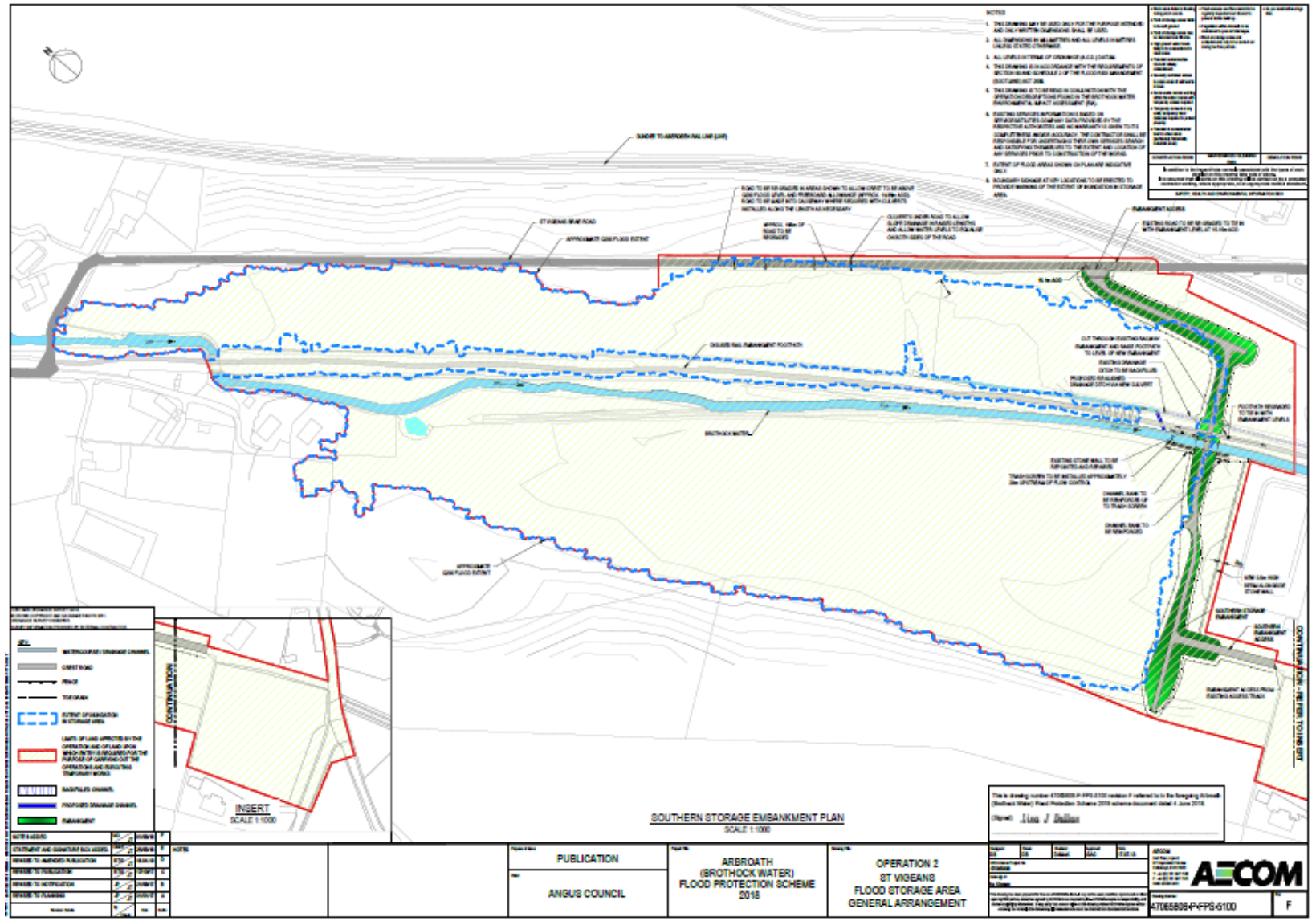
St Vigeans



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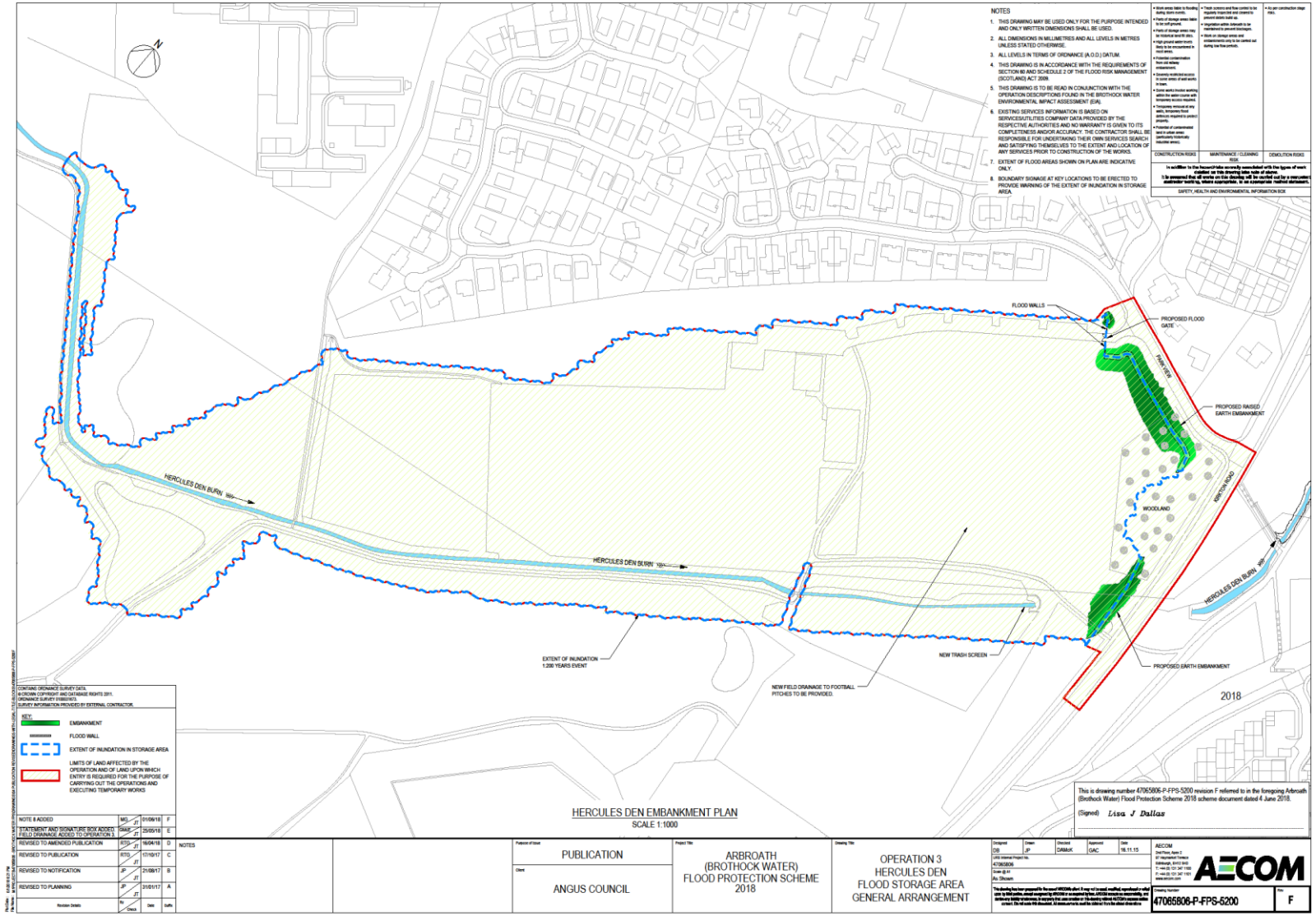
Hercules Den



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Storage Area Volumes

	Area	Volume
Brothock Meadows	445,262m² (44.5ha)	661,700m³
St Vigeans	105,530m² (10.5ha)	99,900m³
Hercules Den	117,617m² (11.8ha)	176,700m³
Totals	**668,409m² (66.8ha)**	**938,300m³**

- Combined storage volume can hold enough water to provide everyone in Scotland with a bath

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Tested

Tested

Storm Babet

- Unprecedented winter storm event impacting across several days
- Prompted multiple Red Weather Warnings across Angus area
- A month worth of rain within a day, ground was already saturated from previous heavy rainfall in the area
- Recovery operations still ongoing

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Storm Babet
Before, During and After

- Multi agency response
- Transport links impacted
- Rest Centres
- Evacuations
- Loss of power
- Relocating
- Infrastructure assessment
- Communication
- Prioritising
- Storm Gerrit, Isha, & Jocelyn Impacts
- Funding
- Coordination
- Extensive Repairs

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Brechin

Photo Iain Masterton

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Brechin

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Brechin

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Brechin

- Flood Prevention Scheme was designed in 2011 and construction completed in 2015
- Designed to contain flows up to 334m3/s, peak flows during Storm Babet estimated as much higher
- Gauging station at Brechin submerged in water during the event, wrack marks used for estimating purposes

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Angus Wide Impacts

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Montrose Coastal Erosion

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Background

- Dune Frontage offers natural protection
- Bay is suffering from loss of sediment
- Erosion rates are higher than historic rates
- Learning the best ways to combat erosion

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Monitoring

- Working with technical experts to monitor erosion rates and develop long and short term erosion management strategies
- Dynamic Coast and the University of Glasgow have measured changes in the dunes and used modelling to predict future shoreline changes
- Together we will continue to monitor and update predictions for the rate of future erosion

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Long Term Strategy

- **Phase 1 – Dune Restoration and beach nourishment**
  - This includes importing suitable sediment to reform the dunes and restore beach levels. This will retain defence levels and reduce the risk of further erosion
- **Phase 2 – Beach Recharge**
  - Some imported sediment would inevitably be lost, so future replenishment of material would be required. work will continue until the beach has re-nourished and gives some natural protection.
  - Potential sites from where sand (dredged material) can be sourced are currently being explored and the environmental risks assessed using Environmental Options Appraisals. The feasibility of transporting material is also being investigated.

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Managing Erosion in the Short-Term

- Sourcing, transporting and placing the sediment will take time. As will obtaining funding for the long-term proposals.
- In the meantime, work to prevent further erosion in the most vulnerable locations of the dunes in the short-term, is being progressed.
- This includes considerations around reprofiling of limited existing rock and the inclusion of specially engineered large sand bags.

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Why Dune Restoration

- The shoreline along the links is subject to high wave energy. This is likely to undermine any fixed hard engineered solutions.
- Installations such as gabion baskets have a limited life due to corrosion. They also need continual maintenance.
- Restoring the dunes and beach with imported sand will enhance the beach volumes. and over time distribute sand across the bay. Raising the level of the beach will increase the dissipative properties of the intertidal area, acting to absorb more wave energy.

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Key Project Partners

- Montrose Golf Links
- Montrose Port Authority
- Montrose Community Council
- Marine Directorate
- Nature Scot
- Dynamic Coast
- Glasgow University
- SEPA

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Thank You

- Pete Morton – mortonp@angus.gov.uk
- Andrew Brown – browna@angus.gov.uk

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