



SLIGO BAY COASTAL EROSION STUDY

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Introductions



Kris Calder

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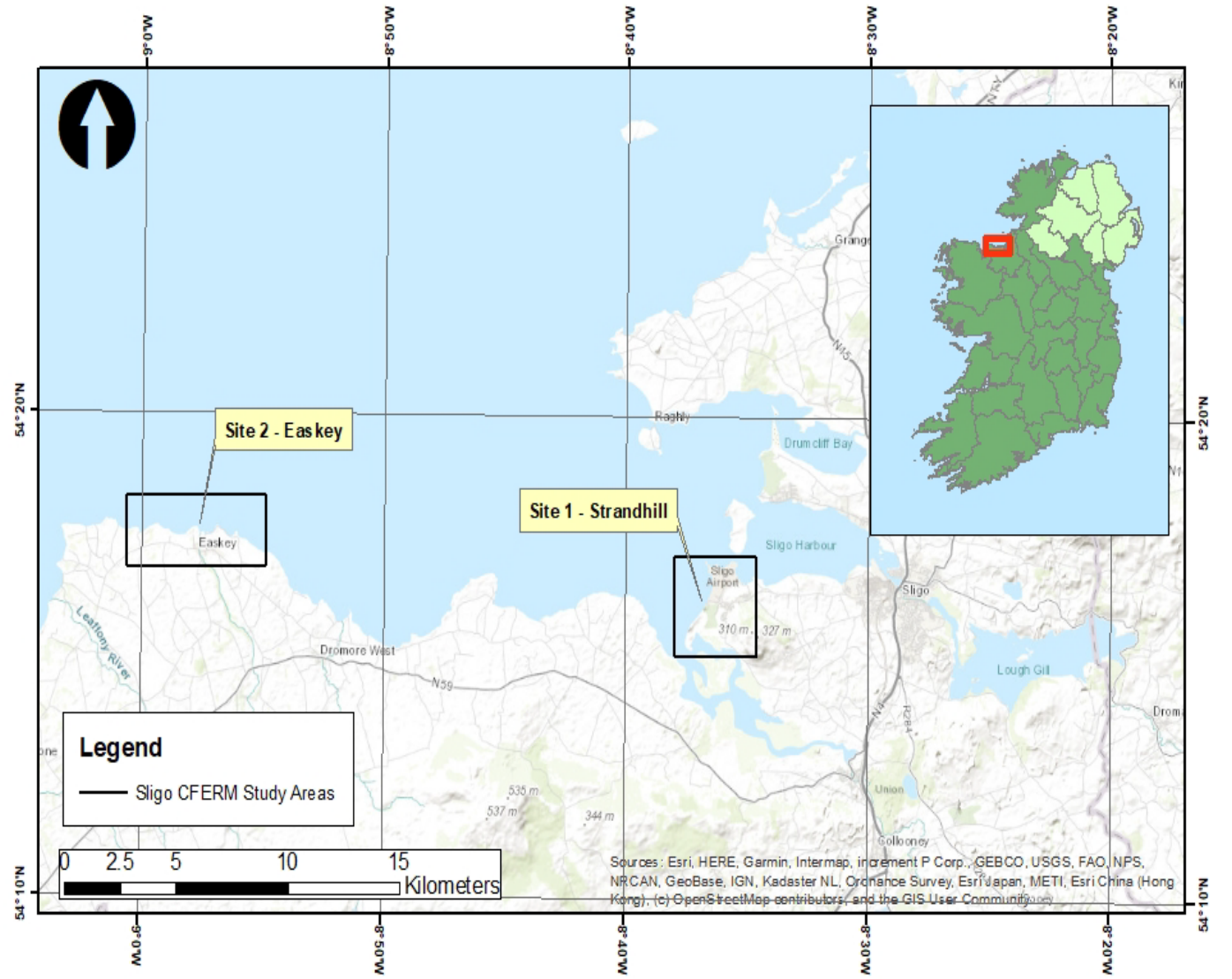
Adrian Bell

Senior Director, Coastal Specialist



Study Area & Scope of Works

Stage	Summary OPW Guidelines
1	Review and Assess Existing Information
2	Identify Information Gaps & Arrange Surveys
3	Undertake Surveys
4	Assess Existing Coastal Processes & Coastline Evolution
5	Prepare Current & Future Coastal Change Maps
6	Detailed Risk Assessment
7	Preliminary Environmental Assessment
8	Options & Feasibility Assessment
9	Prepare Coastal Erosion Risk Management Plan





Site 1:
Strandhill



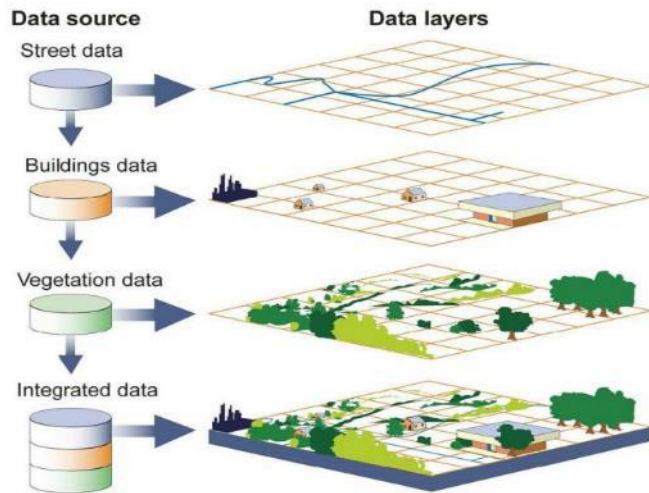


- Repair works to southern half of revetment in September 2023
- Replenished with c. 200T of armour

Assessing Coastal Erosion

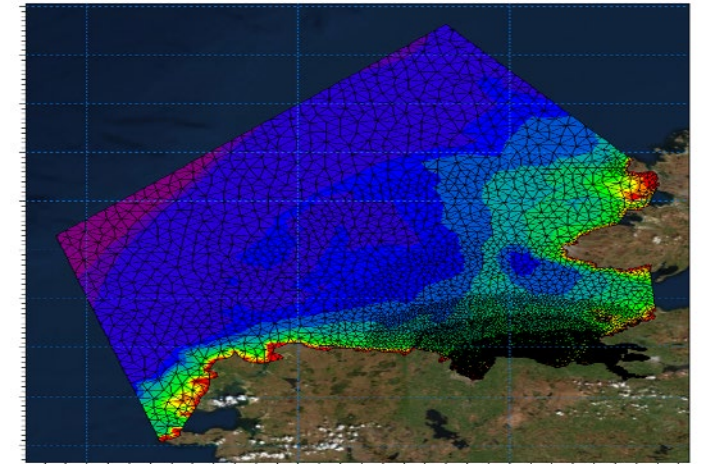
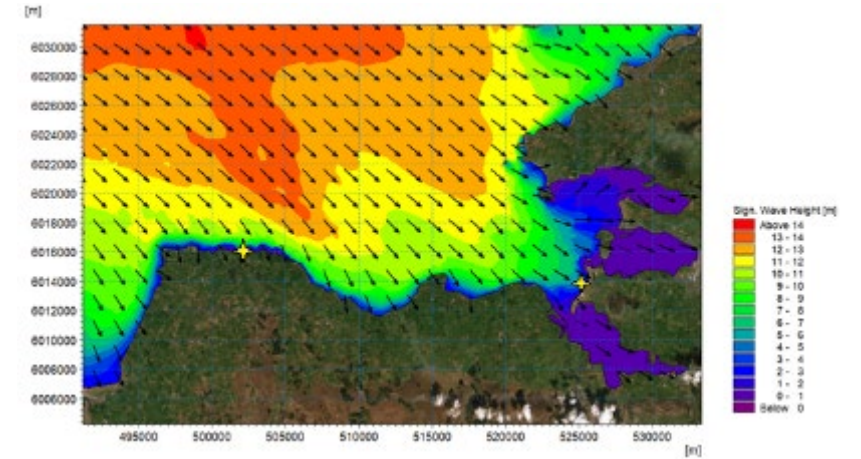
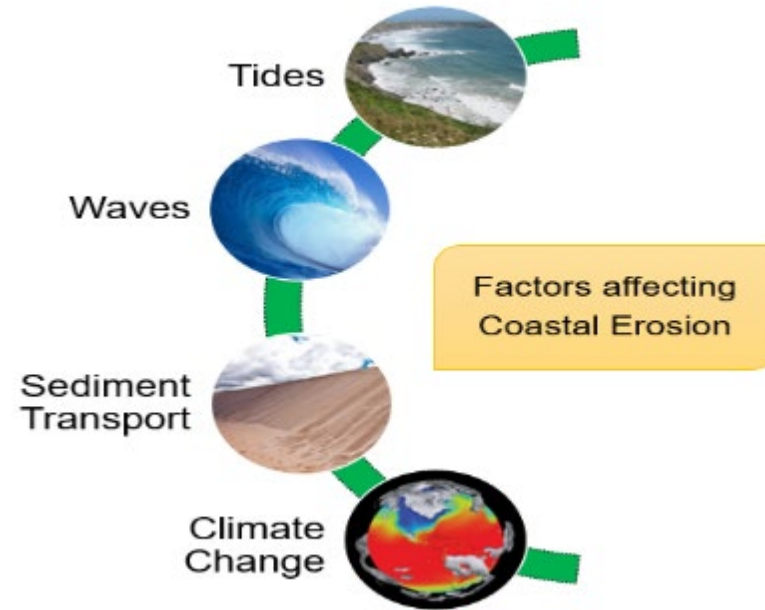
Geo-information Systems (GIS)

- Review & compare historical aerial imagery
- Identify areas at risk
- Quantify rates of coastal change



Numerical Modelling

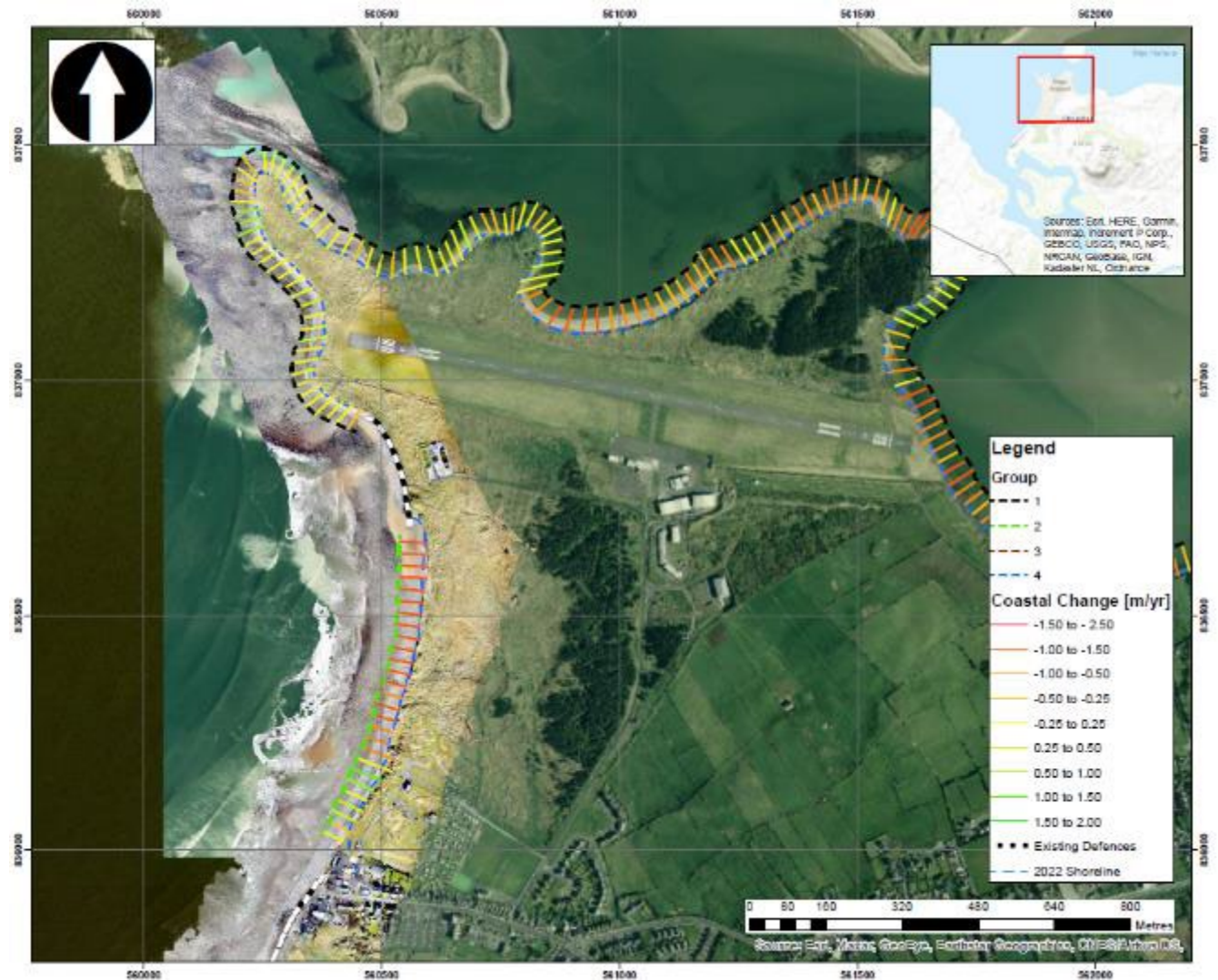
- Identify areas of coastal pressure
- Define tide and sediment movements
- Simulate extreme storms

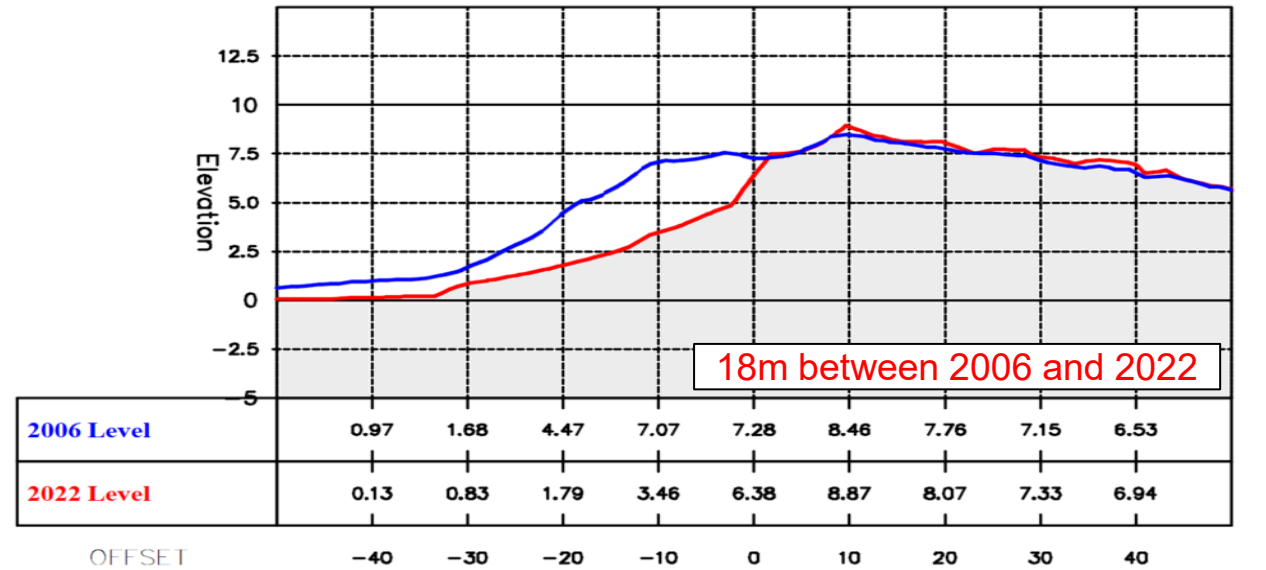
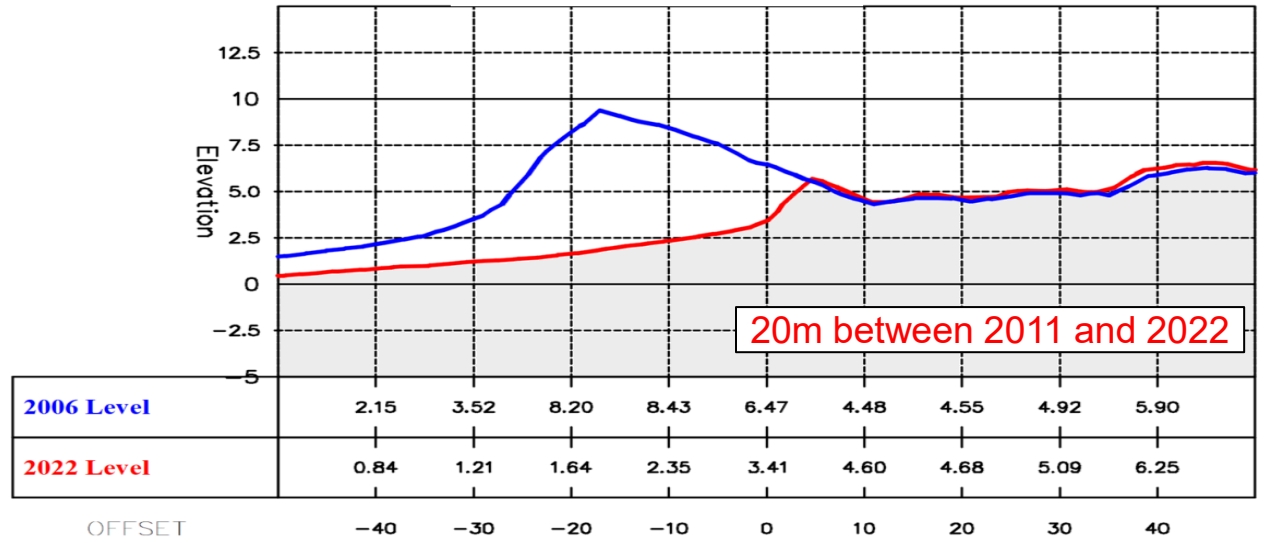


Historical rate of coastal change - Strandhill North

- Greatest erosion of up to -2.0m/yr south of the revetment at the WWTP.
- Erosion in this area before the construction of this defence was much less at c. 0.50m/yr
- Regions of this coastline further north also retreated between 1995 and 2022.

Metric	North of the WWTP	South of the WWTP
Average rate of change between 1995 to 2022 [m/yr]	- 0.01	- 0.95
Portion of coastline retreating	51%	85%
Maximum rate of retreat [m/yr]	-0.89	<u>-2.50</u>

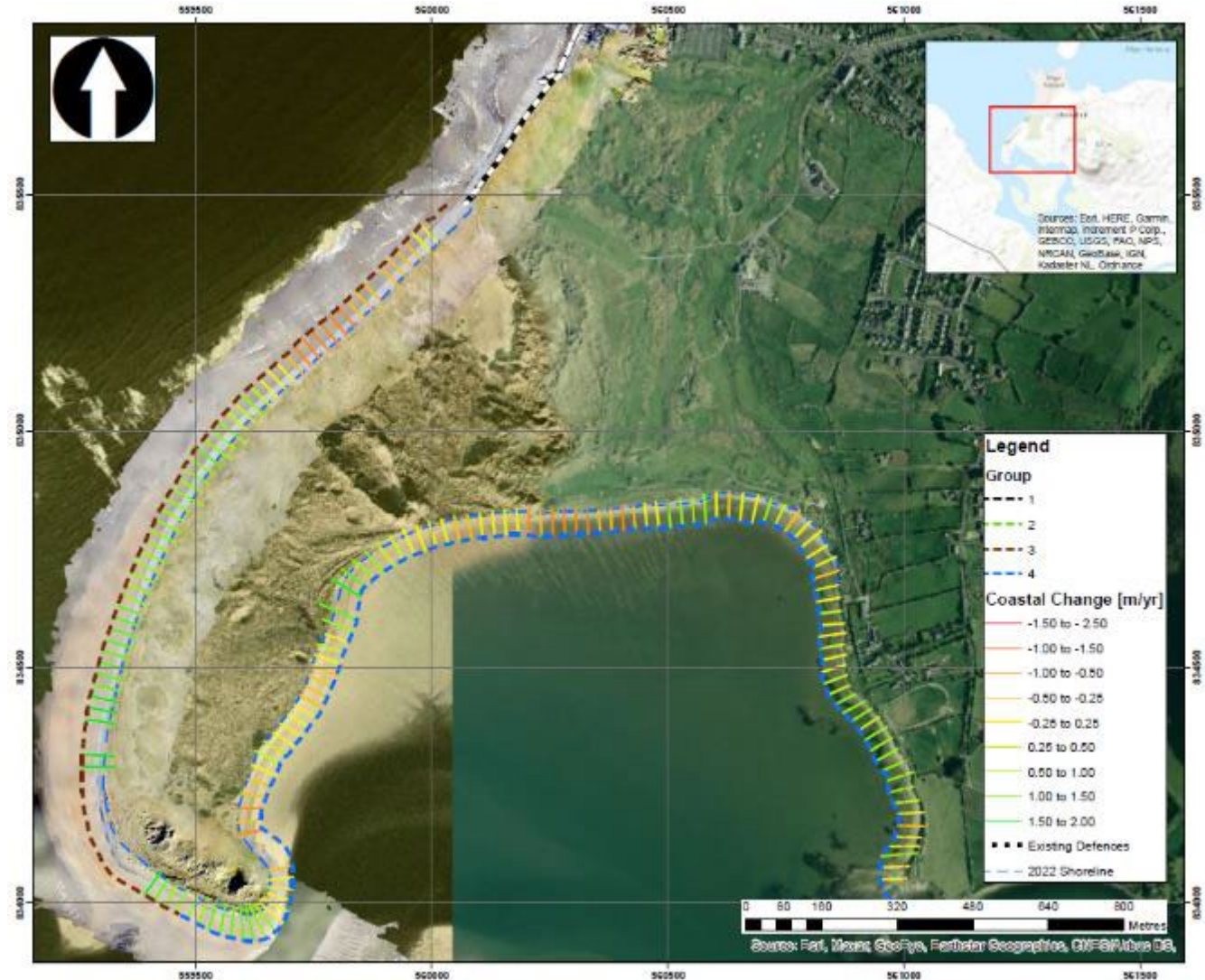




Historical rate of coastal change - Strandhill South

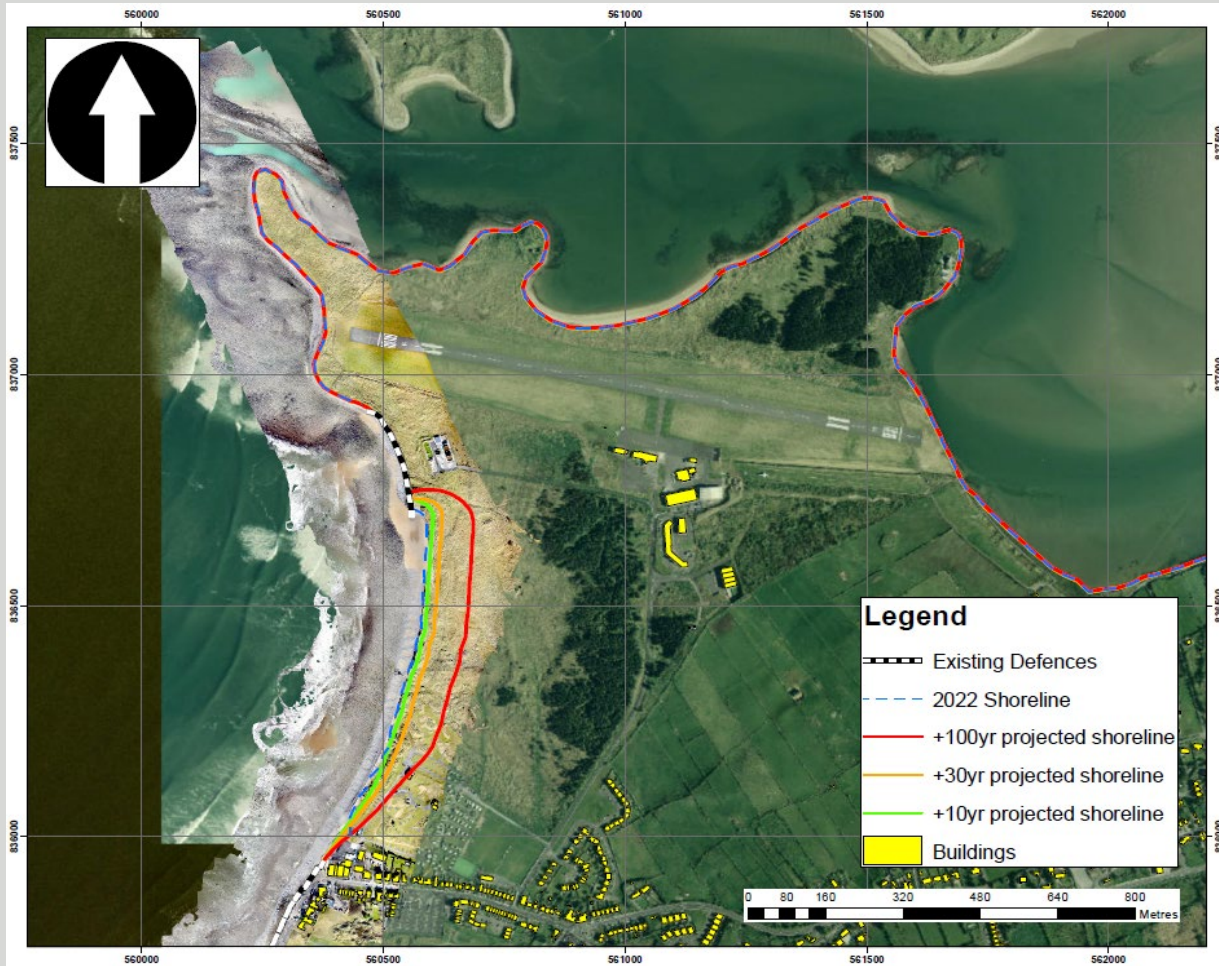
- Modest levels of accretion south of Strandhill
- Notable accretion around Carrowdough Spit
- Longshore drift transports sediment into Ballysadare Bay
- Episodic terminal erosion at ramp near Shelly Valley

Metric	South of Strandhill	Ballysadare Bay
Average rate of change between 1995 to 2022 [m/yr]	+0.41	+0.12
Portion of coastline retreating	27%	26%
Maximum rate of retreat [m/yr]	-2.33	-3.00

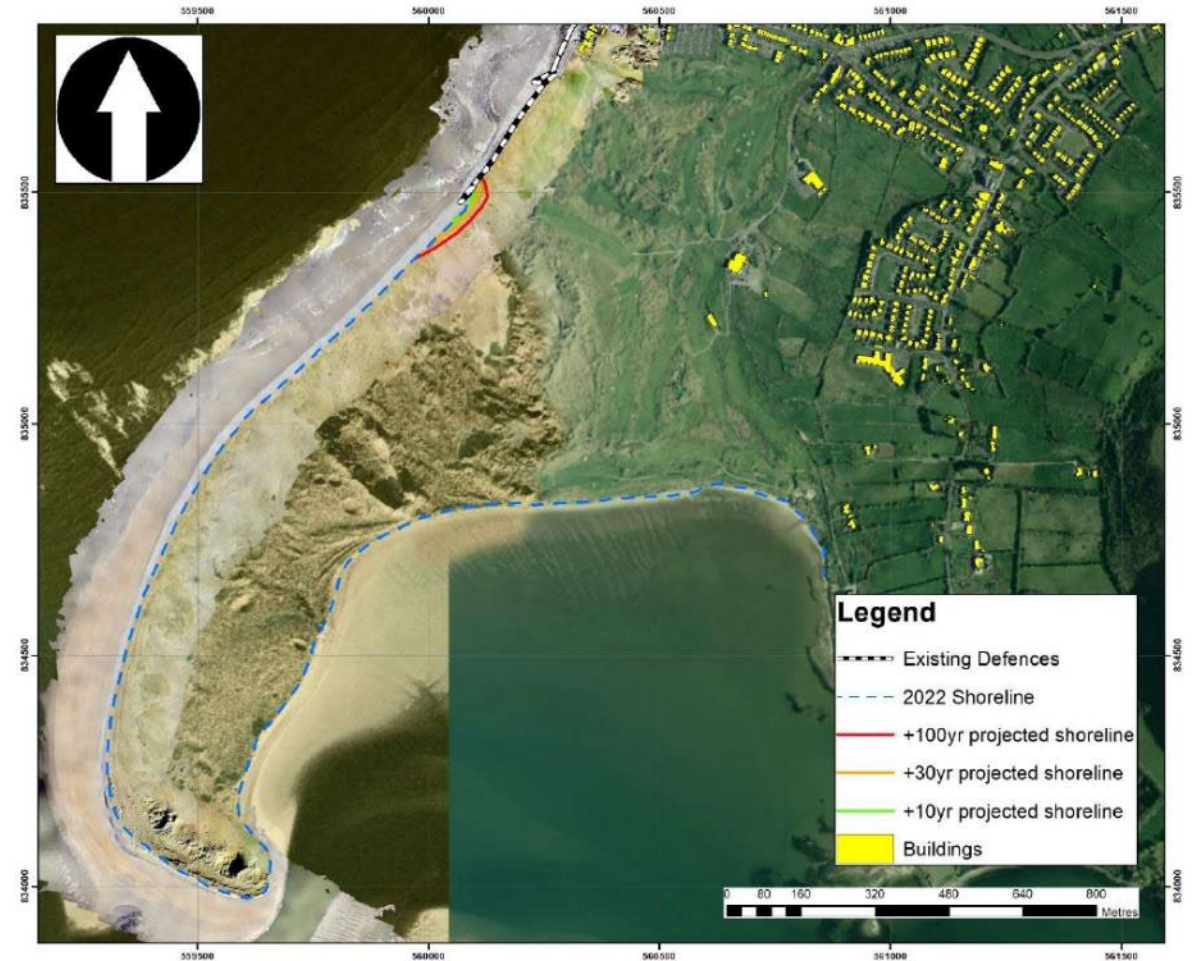


Future Projections

- Retreat c. 94m by 2100



- Accretion likely to be offset by SLR
- But episodic terminal erosion south of Strandhill

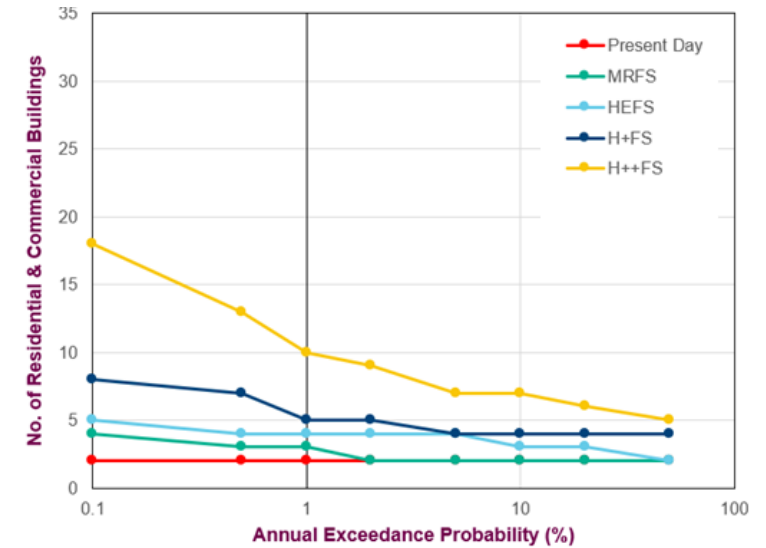
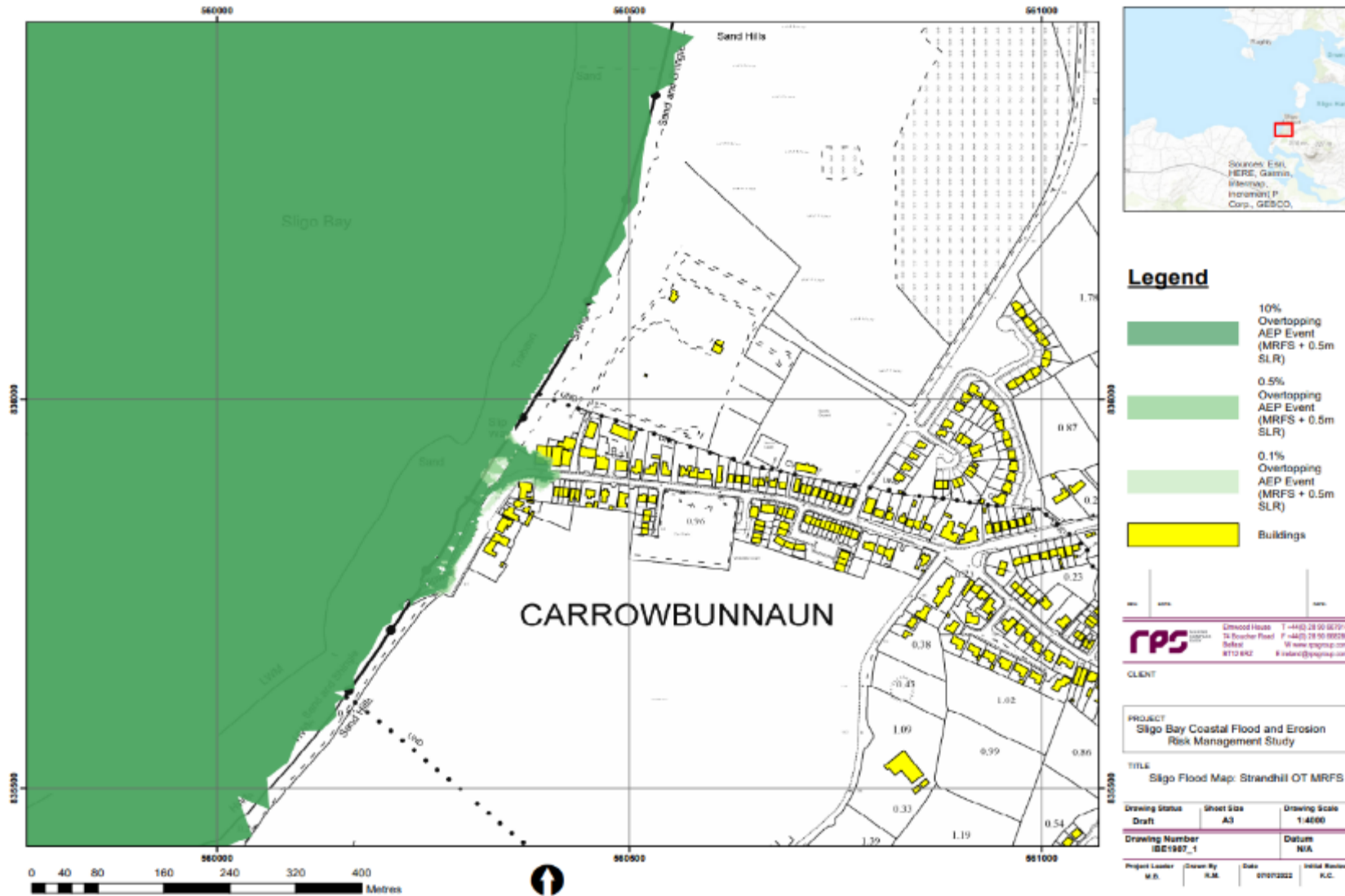




Tidal inundation at Strandhill



Wave Overtopping at Strandhill



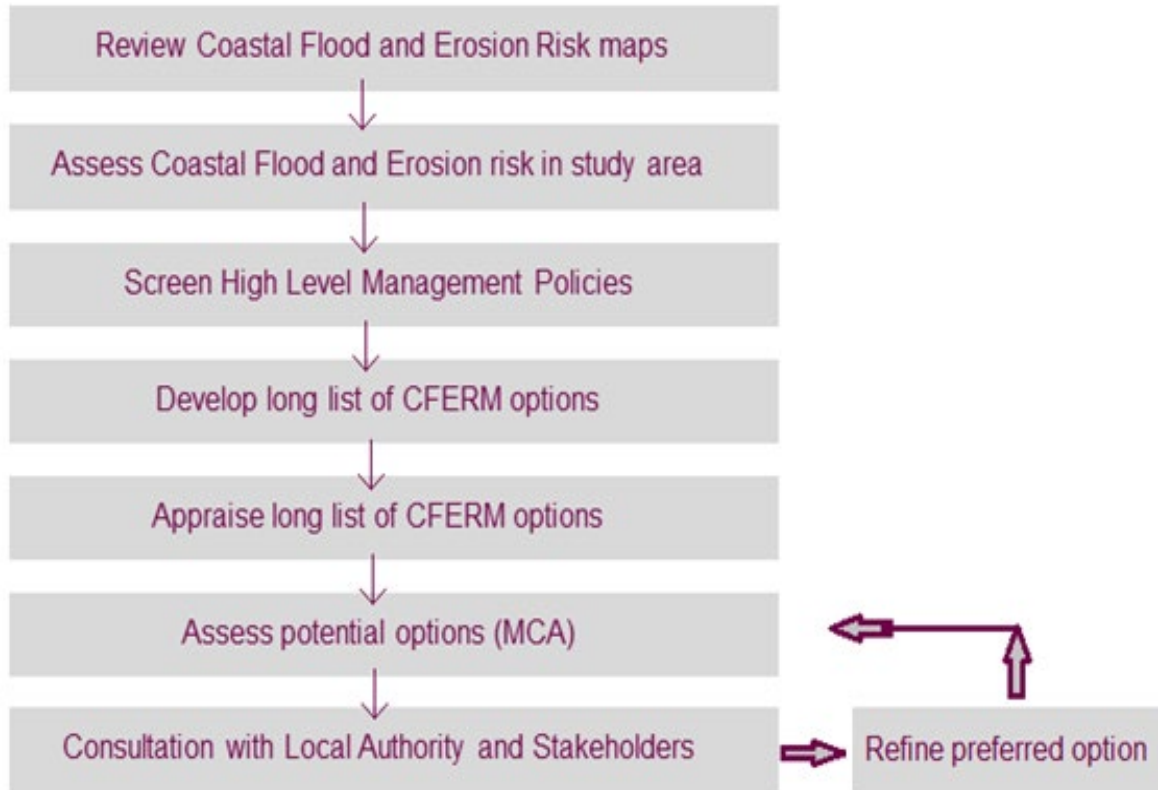
Summary of Present Day Risk at Strandhill

- The coastline between Strandhill and the WWTP revetment could retreat by up to c.94m over the long term (+100yrs).
- This magnitude of erosion could:
 - Result in the partial but significant loss of the Cummeen Strand/ Drumcliff Bay SAC
 - Result in the partial but significant loss of Strandhill Camping and Caravan park
 - Impact surfing amenity
- Stormwater manhole which is in a state of disrepair could impact coastal processes and represents a health and safety risk.
- Existing coastal defences at Strandhill **must be maintained** to mitigate any risk of erosion & flooding to the town.
- Coast to the south is relatively stable and at little risk of coastal erosion. However, some localised sections maybe eroded following a succession of extreme events.



Optioneering Process

- Long list of management policies and measures progressed through the Optioneering Process



Strandhill – Option 1



New Structures

- c.875m of new rock armour revetment between Strandhill town and the existing WWTP rock armour
- c.175m of new rock armour at Graveyard
- A new access ramp to facilitate surfers at the WWTP rock armour

Repairs

- Re-instate WWTP manhole
- Immediate repair of 80m of rock armour at town (OPW half)

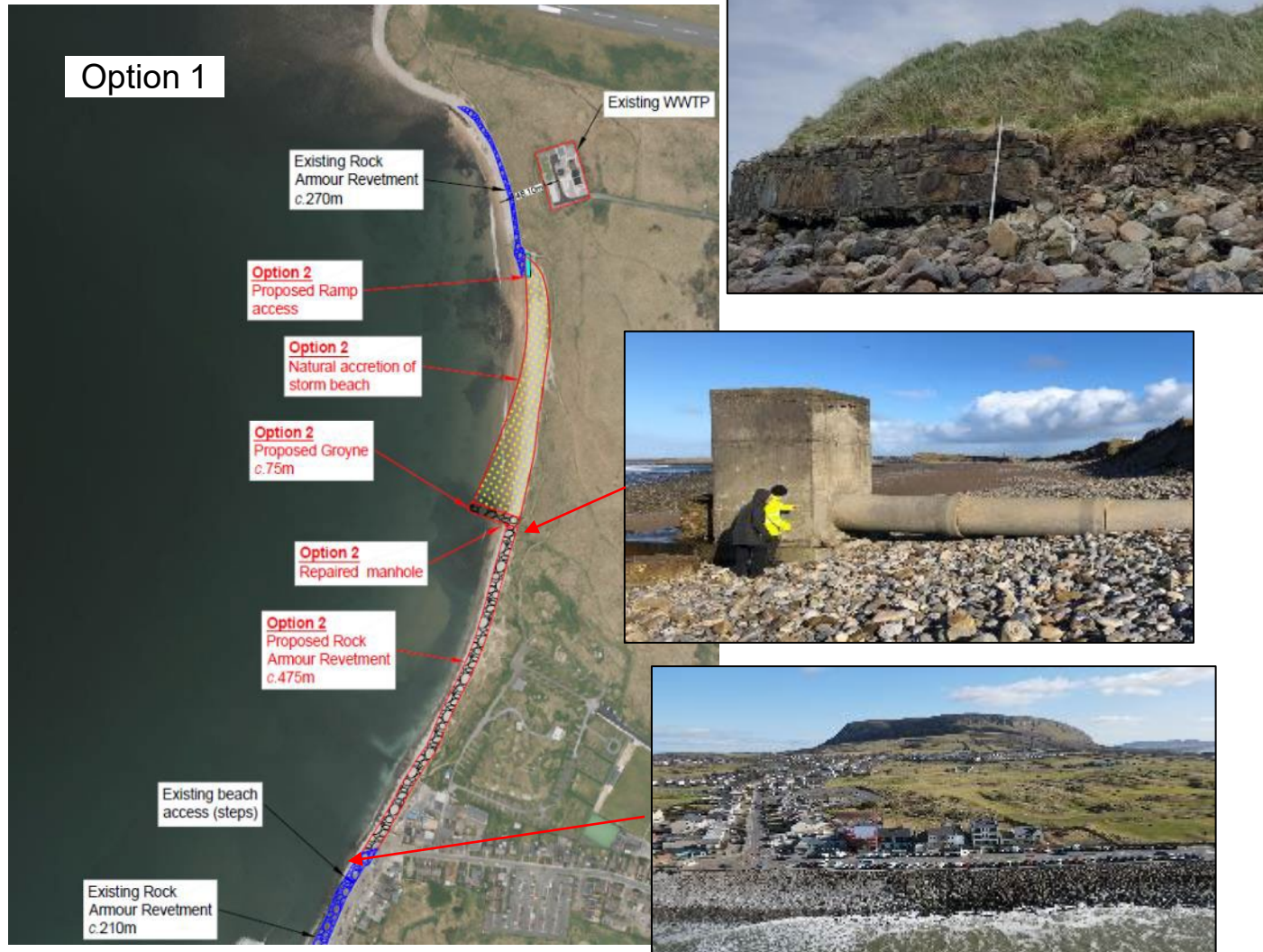
Future Upgrade (+30yrs)

- Additional layer of primary rock armour along GCC half of revetment at town

South of Strandhill

- Soft engineering measures over c. 80m: Sand trap fencing, reprofiling, marram planting

Strandhill – Option 2



New Structures

- c.475m of new rock armour revetment between Strandhill town and the exposed stormwater manhole
- c.175m of new rock armour at Graveyard
- A new access ramp to facilitate surfers at the WWTP rock armour

Repairs

- Re-instate WWTP manhole
- Immediate repair of 80m of rock armour at town (OPW half)

Future Upgrade (+30yrs)

- Additional layer of primary rock armour along GCC half of revetment at town

South of Strandhill

- Soft engineering measures over c. 80m: Sand trap fencing, reprofiling, marram planting

Strandhill – Benefit Cost Ratios

Option 1 – Complete Rock armour solution

Element	Cost per unit	Unit/Length	Total Cost (€)
Rock Armour	€6,200	875m	5,425,000
Ramp Access	€50,000	1	50,000
Reinstate WWTP Manhole	€75,000	1	75,000
Immediate Repair of Rock Armour	€6,200	80m	496,000
Graveyard Rock Armour	€4,000	175m	700,000
Initial Capital Cost (€)			c. €6.8mill
Maintenance Cost (€)			c. €1.0mill
Total PV Cost (€)			c. €7.8mill

	Costs and benefits €	
	Do nothing	Opt. 1 Rock armour
PV costs PVc	-	7,991,127.74
PV damage PVd	11,415,614.54	1,110.73
PV damage avoided		11,414,503.81
Total PV benefits PVb		11,414,503.81
Net Present Value NPV		3,423,376.07
Average benefit/cost ratio		1.43

- BCR just less than the 1.5 recommended by OPW



Strandhill – Benefit Cost Ratios

Option 2 – Rock revetment and groyne

Element	Cost per unit	Unit/Length	Total Cost (€)
Rock Armour	€6,200	475m	2,945,000
Groyne	€6,200	75m	465,000
Ramp Access	€50,000	1	50,000
Reinstate WWTP Manhole	€75,000	1	75,000
Immediate Repair of Rock Armour	€6,200	80m	496,000
Graveyard Rock Armour	€4,000	175 m	700,000
Initial Capital Cost (€)			c. €4.8mill
Maintenance Cost (€)			c. €0.8mill
Total PV Cost (€)			c. €5.6mill

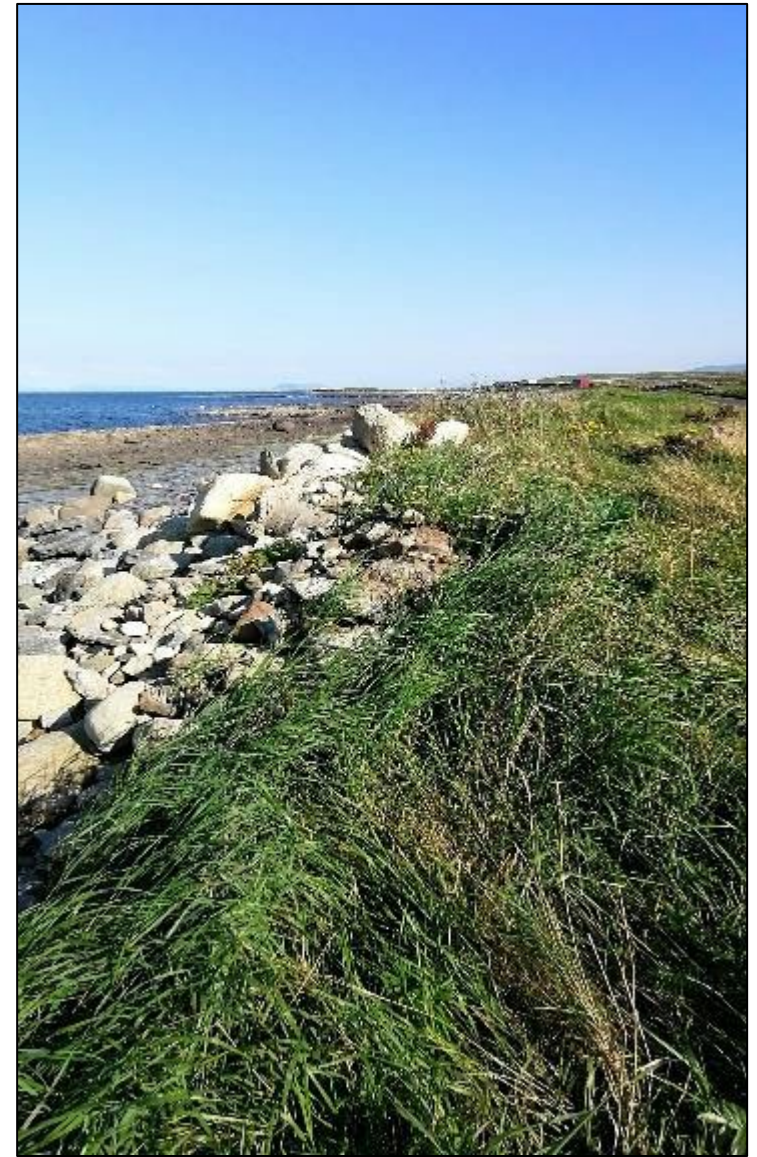
	Costs and benefits €	
	Do nothing	Opt. 2 Rock armour & Groyne
PV costs PVc	-	5,653,272.55
PV damage PVd	11,415,614.54	1,110.73
PV damage avoided		11,414,503.81
Total PV benefits PVb		11,414,503.81
Net Present Value NPV		5,761,231.26
Average benefit/cost ratio		2.02

- BCR significantly greater than the 1.5 recommended by OPW





Site 2:
Easkey

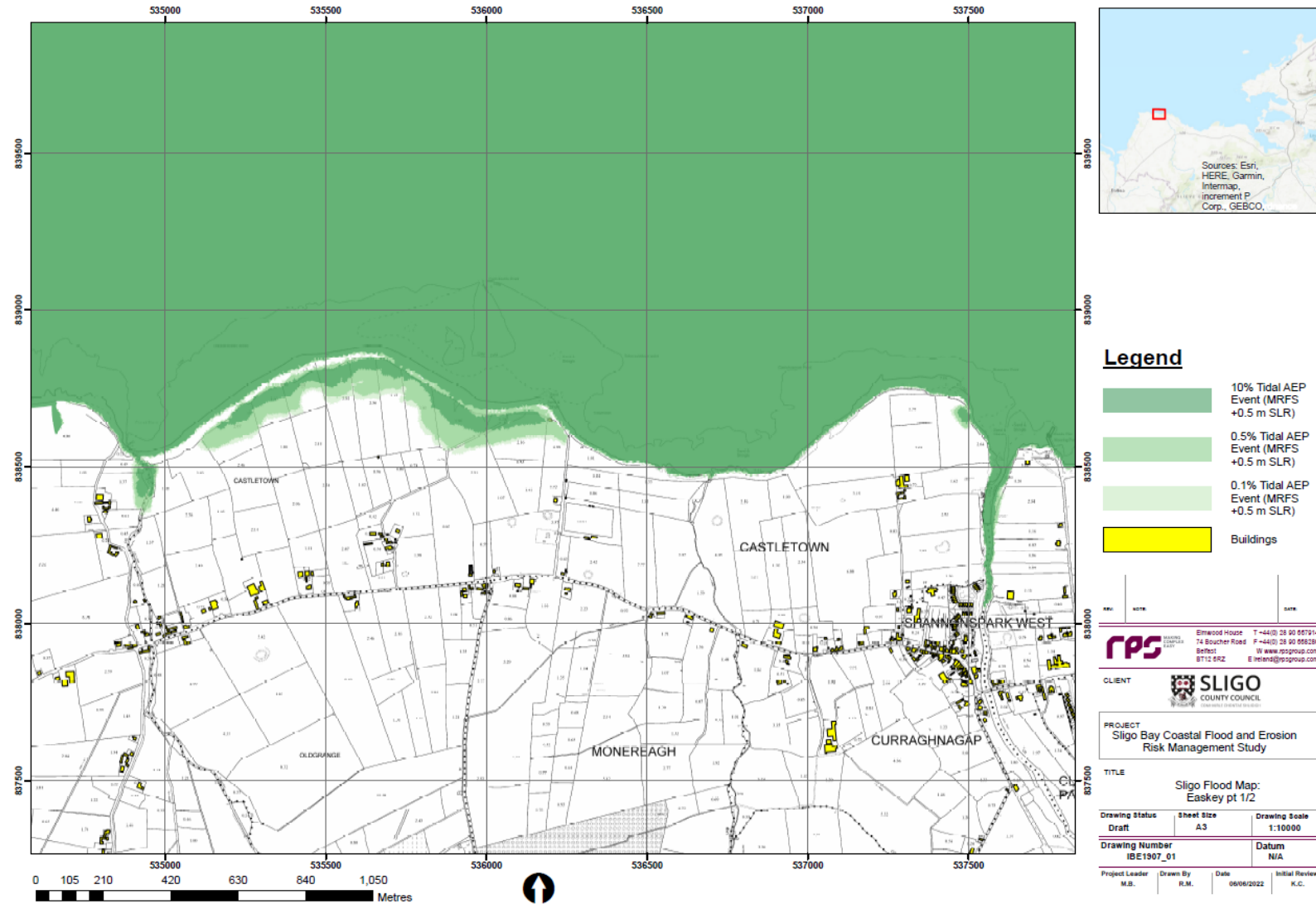


Historical change at Easkey

- Average rate of retreat of -0.01m per year
- Accuracy and confidence compromised by lack of quality data
- Localised, episodic erosion rather than continuous erosion.



Tidal inundation at Easkey





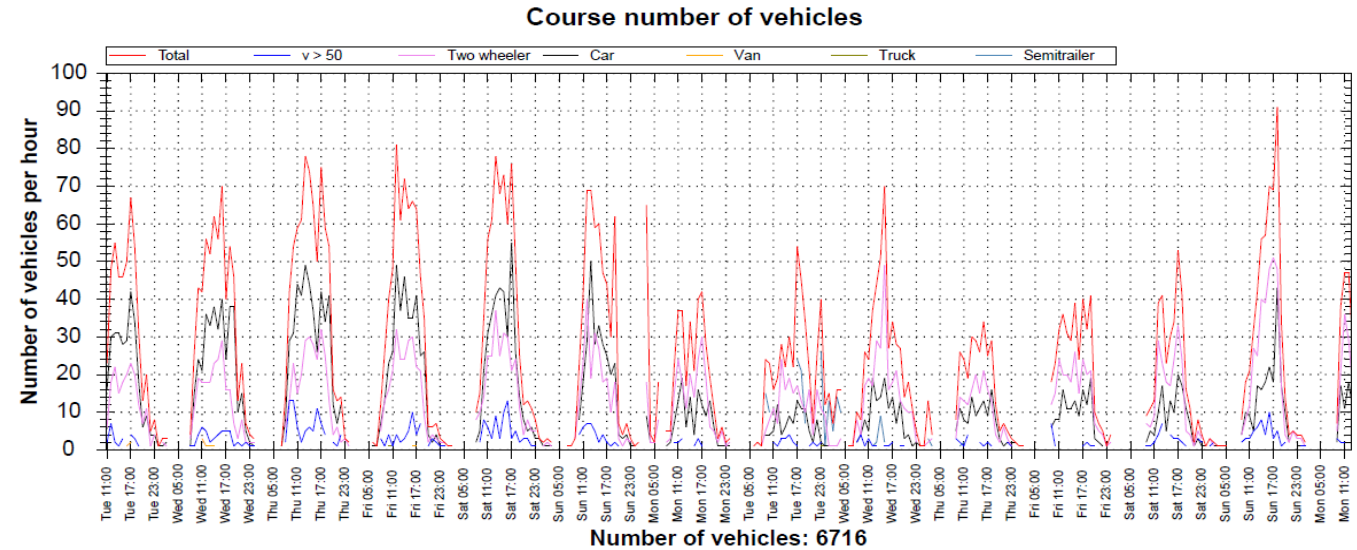
Summary of Risk at Easkey

- Localised, episodic erosion of coastline
- Future climate change could result in up to 25m of retreat
- Part of the Wild Atlantic Way at considerable risk of erosion
 - *Some sections of this road could be lost to erosion in within +10 years).*
 - *Almost immediate and complete loss of recreational gain or benefit associated with this amenity.*
- Temporal flood risk of WAW during extreme events
 - *No built assets (i.e. commercial or residential properties at risk)*

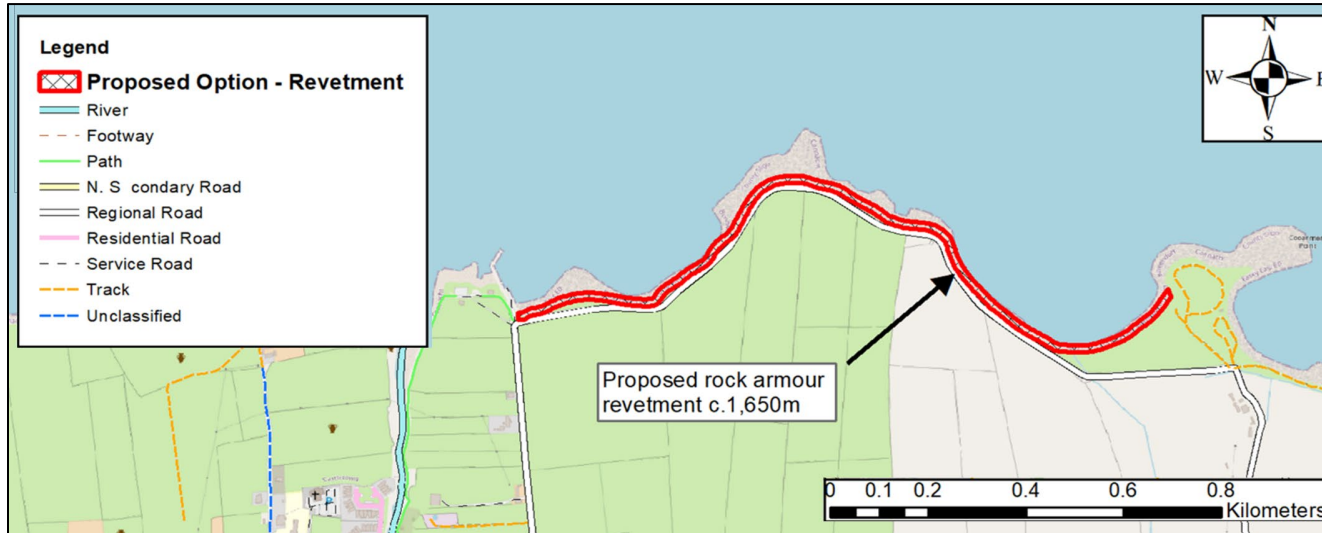
Easkey – Economic Assessment

Damages / Losses

- Virtually no “direct damages” to commercial or residential property
- Localised sections of the Wild Atlantic Way at risk of erosion
- Recreational losses if WAW closed.
- Using traffic count data (c.775 cars per day!) , John Chatterton estimated a Value of Enjoyment of 8.5million Euros per year!
- *Recommended using an annual VoE of 2million to be conservative*
- **Assuming the WAW road is unusable in +10years, this equates to a Present Value damage of c.40million Euro over 100yrs**

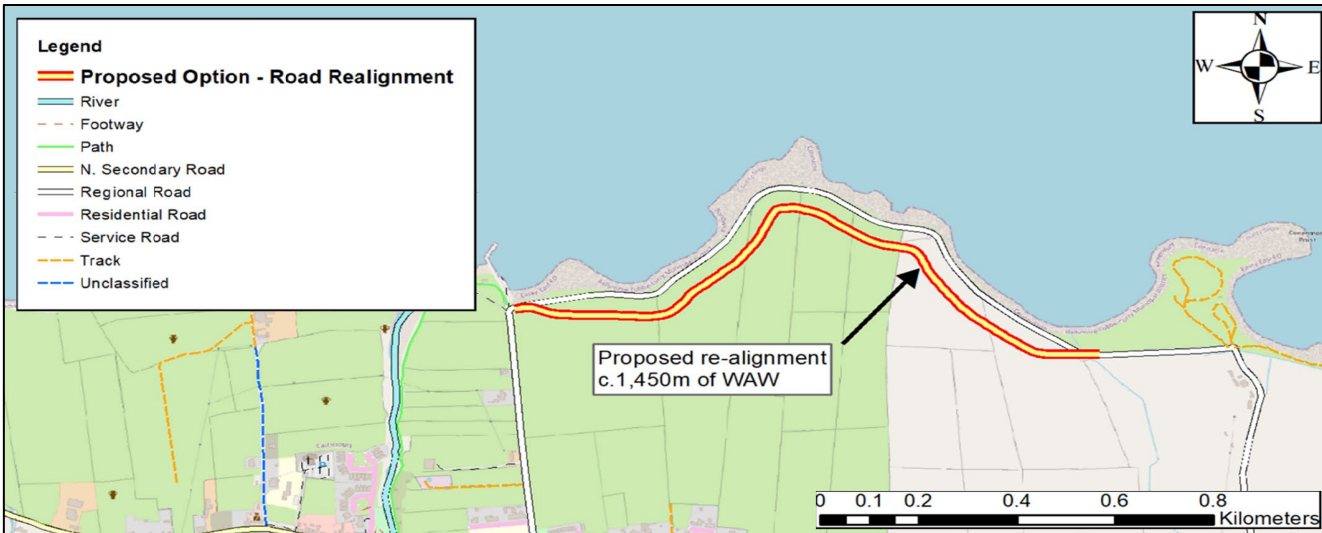


Easkey – Options 1 and 2



Easkey, Option 1 – Rock armour

- c. 1650m of rock armour to protect the vulnerable section of the Wild Atlantic Way
 - Would require a foreshore license
 - Potential impact to surfing amenity

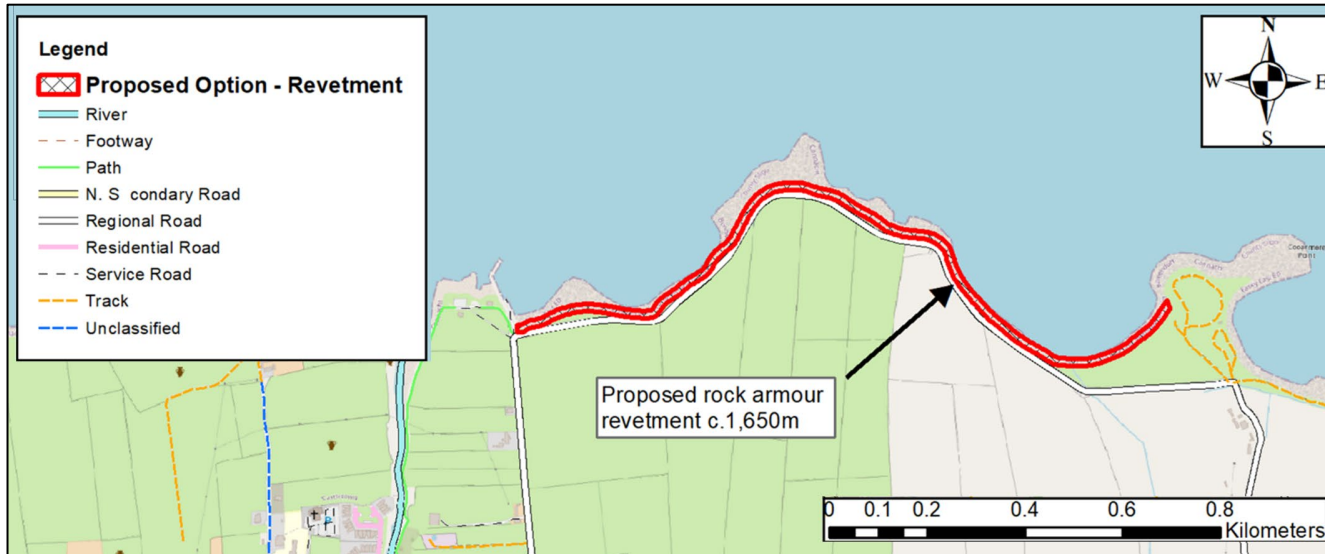


Easkey, Option 2 – Road Re-alignment

- Re-aligning a c. 1,450m section of the Wild Atlantic Way
 - Would require engagement with landowners, CPO?
 - Maintain surfing amenity
 - Avoid foreshore license requirement

Easkey – Benefit Cost Ratios

Option 1 –Rock armour solution



Option 1 – Costs & Benefits

	Costs and benefits €	
	Do nothing	Option 1
PV costs PVc	-	11,676,268.73
PV damage PVd	40,130,123.11	1,110.73
PV damage avoided		40,129,012.38
Total PV benefits PVb		40,129,012.38
Net Present Value NPV		28,452,743.65
Average benefit/cost ratio		3.44

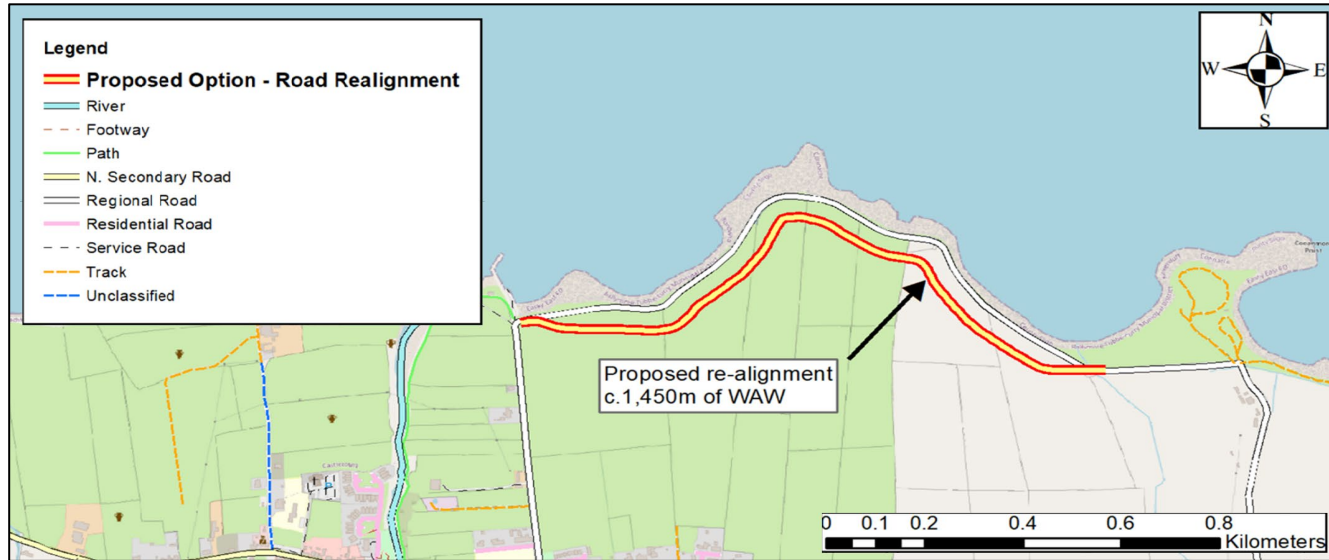
- Average BCR of 3.44
- BCR greater than the 1.5 as required by the OPW for Minor Works Scheme

Option 1 – Costs

Element	Cost per unit	Unit/Length	Total Cost (€)
Rock Armour	€6,200	1,600m	10,230,000
		<i>Initial Capital Cost (€)</i>	<i>c. €10.2 mil</i>
		<i>Maintenance Cost (€)</i>	<i>c. €1.4 mil</i>
		Total PV Cost (€)	c. €11.6 mil

Easkey – Benefit Cost Ratios

Option 2 –Road Re-alignment



Option 2 – Costs & Benefits

	Costs and benefits €	
	Do nothing	Option 2
PV costs PVc	-	2,848,948.84
PV damage PVd	40,130,123.11	1,110.73
PV damage avoided		40,129,012.38
Total PV benefits PVb		40,129,012.38
Net Present Value NPV		37,280,063.54
Average benefit/cost ratio		14.09

- Average BCR of 14.09
- BCR significantly greater than the 1.5 as required by the OPW for Minor Works Scheme

Option 2 – Costs

Element	Cost per unit	Unit/Length	Total Cost (€)
Road re-alignment	€1,300	1,450m	1,900,504
Purchasing of land	€123,548 per hectare	6.5ha	809,239
		Initial Capital Cost (€)	c. €2.7 mil
		Maintenance Cost (€)	c. €130 k
		Total PV Cost (€)	c. €2.85 mil

Summary of preferred plans





Item	Strandhill	Easkey
Option	2	1
Description	Revetment, Groyne and repairs to existing structures	Road re-alignment
Scheme cost	€ 5,653,272	€ 2,848,948
Scheme benefits	€ 11,414,503	€ 40,129,012
Average Benefit / Cost Ratio	2.02	14.09





**Thank you
Any Questions....**

Additional slides if required

Strandhill – Economic Assessment

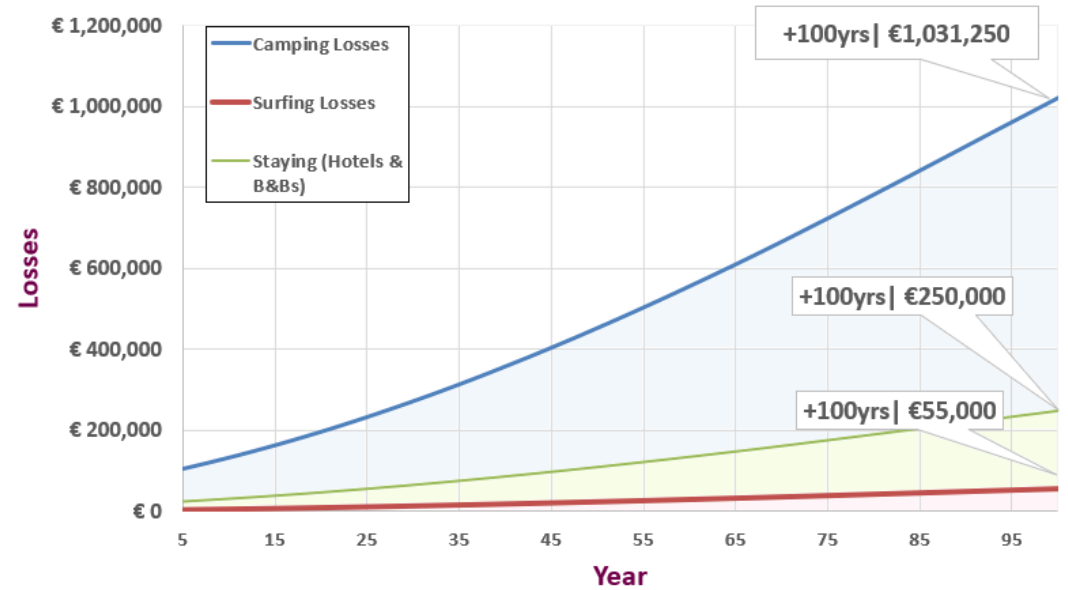
Direct Damages / Losses

- Very few “Direct Damages” under present day conditions
 - *Loss of land at Strandhill Camping and Caravan park*
 - *Impact to Cummeen Strand/ Drumcliff Bay Special Areas of Conservation (SAC)*
- WWTP or Airport unlikely to be affected under present day conditions

Recreational losses

Based on economic assessment undertaken by John Chatterton

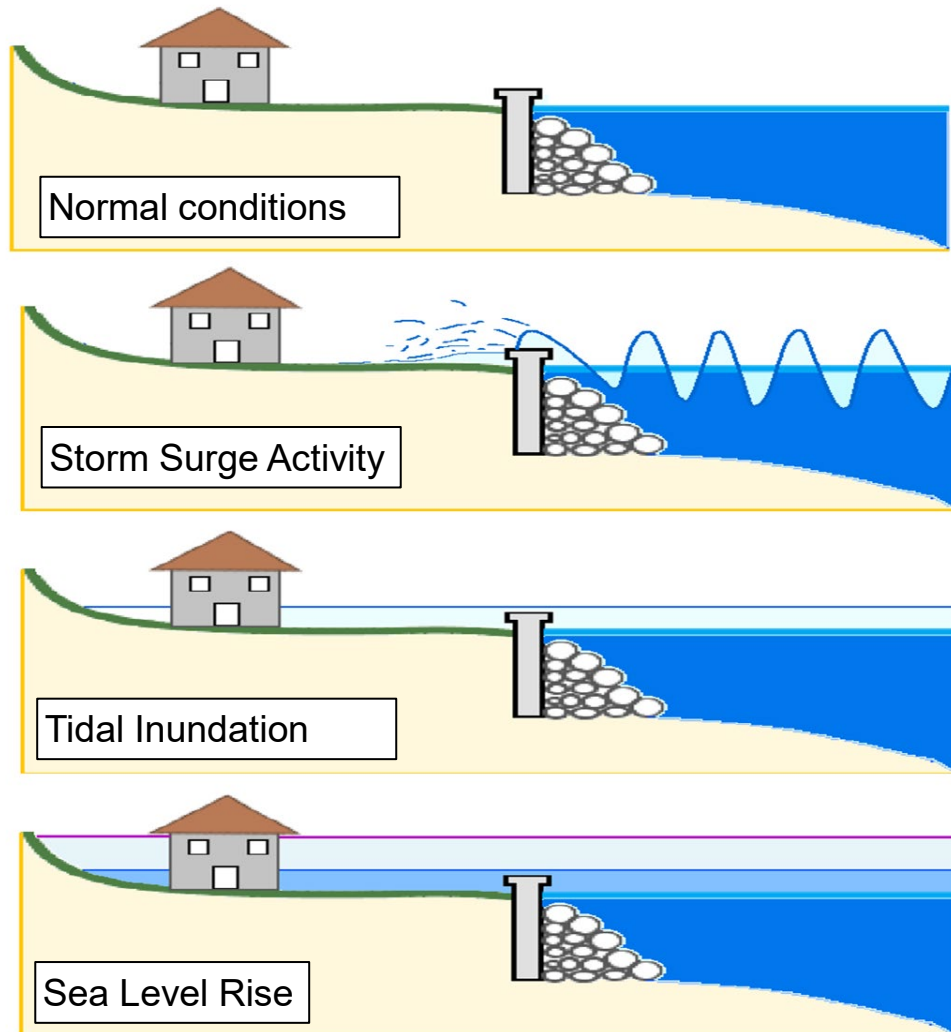
Receptor	Comment	Annual Value of Enjoyment (€)
Losses per annum to Strandhill	Staying (hotels and B&B's)	500,000 euros
Loss of Enjoyment pa (camping fraternity)	All visitors	2,062,500 euros
Loss of Enjoyment pa (surfing fraternity)	All visitors	111,650 euros



Assumed 50% of benefits are gradually lost by +100years for the purposes of a cost benefit assessment

When discounted in line with OPW guidance, this equates to €11.5million of damages/benefits

Assessing Flood Risk



- Flood risk mechanisms considered for multiple return period events and climate scenarios
 - *MIKE Flood modelling software*
 - *Industry standard Eur0top calculations*
- Output from flood extents used to identify areas at risk and quantify average annual damages
- Range of climate scenarios considered, but damages and risk for present day used to justify proposed schemes

Return period and water level scenarios considered

Return Period	Present Day	High Probability (+0.5m SLR)	Medium Probability (+1.0m SLR)	Low Probability (+1.5m SLR)
2	2.79	3.29	4.79	4.29
10	3.03	3.53	5.03	4.53
50	3.27	3.77	5.27	4.77
100	3.37	3.87	5.37	4.87
200	3.47	3.97	5.47	4.97