Lossiemouth East Beach Footbridge Replacement Business Case

LOSSIEMOUTH EAST BEACH FOOTBRIDGE REPLACEMENT BUSINESS CASE

MORAY COUNCIL |

Lossiemouth East Beach Footbridge

Document Control

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Executive Summary

The loss of the footbridge connecting Lossiemouth to East Beach has had a negative impact on the town and it is anticipated that if the bridge is not replaced the significance of this impact will increase over time.

The replacement of the bridge provides a strategic fit both locally and nationally, which is demonstrated in Section 3 of this report.

An Option Appraisal has been undertaken to identify the best value option, which is the shortest crossing located at the Esplanade. The total capital cost of the preferred option is **£1,375,000** and the whole life cost is **£1,540,00**0.

A robust procurement process has been followed in line with national procurement guidelines, which is demonstrated in Section 5 of this report.

An Economic Impact Assessment has been undertaken, which demonstrates the value of replacing the bridge in both economic terms and potential employment opportunities. The estimated visitor spend associated with having a crossing from the town to the beach is **£1,500,000** which equates to **30 FTE jobs**. This demonstrates excellent value for money as even after a short period of 5 years, additional visitor spend in Lossiemouth totalling **£7,500,000** is significantly more than the whole life cost of the bridge at **£1,540,000**.

The design and build of the replacement bridge will be managed by Moray Council under the NEC3 Design and Build Contract. A risk register has been developed and the risks quantified. The risk allowance estimated for this project is **£365,000**. Once construction is complete and the bridge is fully operational Moray Council will take ownership of the bridge and be responsible for all future maintenance.

Community engagement events have been undertaken throughout the development of this project. A Steering Group has been set up with community representatives and the project team to ensure community expectations are taken into consideration and to facilitate communication with the wider community.

To progress to the second stage of this project, design and build of the bridge, grant funding of **£1,800,000** is required. This cost includes the capital cost of £1,375,000, risk £365,000 and site supervision £60,000.

1 Introduction

This report provides details of the business case developed to support the replacement crossing from the town of Lossiemouth to East Beach. The business case has been developed by Moray Council on behalf of the Lossiemouth community and is informed by an Option Appraisal and Economic Impact Assessment funded by the Lossiemouth Community Development Trust, Highlands and Islands Enterprise and Scottish Government.

2 Background

The original bridge linking the town of Lossiemouth to East Beach was constructed by the Railhead in 1906 by Lossiemouth Town Council. In 1918 the bridge was relocated to its current position by the Old Harbour Commission, to make it easier for boats to come in and out of the old harbour. The Lossiemouth Old Harbour Commission ceased to exist when the harbour closed, at which point the bridge became ownerless. This was confirmed in 2016 by the "Queens And Lord Treasurers Remembrance" Crown.

In August 2019 a central span of the bridge failed. The bridge was then classed as a dangerous structure and closed by Moray Council under Section 29 of The Building (Scotland) Act 2003. Since this time there has been no direct crossing from the town to East Beach.

In September 2019 The Scottish Government's Culture Secretary committed to funding the work required to reinstate a crossing to the beach.

In December 2019, Moray Council agreed to manage the design and build of the replacement bridge and take ownership of the bridge once completed.

In September 2020, Moray Council awarded the contract to replace the bridge on a Design and Build basis to Beaver Bridges. This contract has been split into two stages, Stage 1 is the development of an Option Appraisal and Economic Impact Assessment, which will inform the Business Case required by Scottish Government to secure funding. Stage 2 is the detailed design and construction of the replacement bridge.



3 Strategic Case

3.1 Business as Usual

The footbridge from the town of Lossiemouth to East Beach was closed in August 2019. Business as usual is considered the current situation, which is no direct access from the town to East Beach.

The impact of not having access to the bridge has been assessed in an Economic Impact Assessment (refer Appendix A). This assessment estimates that the difference in visitor spend, without direct access to the beach, would be £1,500,000 each year. Based on this spend it is estimated that at least 30 FTE jobs could be lost if the bridge is not replaced.

A survey undertaken as part of the Economic Impact Assessment indicates that 72% of the local businesses that responded have experienced a loss in trade since the closure of the bridge. The survey also indicates that the closer a business is to the existing East Beach bridge, the greater their anticipated risk should there be no replacement bridge. 19 of the 21 businesses within 5 minutes' walk of the bridge expected risk of closure, reduction in staffing, and/or reduction in opening hours or season.

Without access to the east beach, many local residents, particularly those living in close proximity to the beach, have lost a part of their daily life and routine and access to activities which improve health and wellbeing, including: walking or running along the beach, dog walking, water sports, wildlife, and birdwatching from the beach and dunes.

3.2 Moray Local Development Plan – Moray Council

The Local Development Plan 2020 vision is for Moray to be a place where people want to live, work, and invest because of the outstanding quality of life and environment. Easy, safe and inclusive access to Moray's landscape and environment and supporting tourism are key aspects of the placemaking approach taken within the Local Development Plan. A replacement bridge at Lossiemouth East Beach would improve access, which would support healthier lifestyles and support mental wellbeing by providing a place to relax and unwind. Tourism is identified as a target sector in the Moray Economic Strategy with LDP 2020 policy PP2 supporting sustainable economic growth and policy DP8 Tourism Facilities and Accommodation specifically supporting proposals that contribute to Moray's tourism. Much of Moray's attraction is its environment with scenery and outdoor activities being key features. The replacement bridge is likely to increase footfall at the Esplanade, which will have positive benefits for local shops, cafes, restaurants and other tourist facilities.

The LDP policies support proposals that are well designed, support good physical and mental health, improve wellbeing and support sustainable economic development, whilst ensuring that the environment is safeguarded (PP1 Placemaking). The preferred option for the replacement bridge is located within the ENV1 Old Station Park and Promenade designation. Policy EP5 Open Space would not support proposals that change the use of the ENV to anything other than open space. The proposed replacement bridge will enhance the function of the ENV as an open space and provide opportunities to improve the quality and accessibility of the wider open space.

3.3 Moray Council 10 Year Plan – Local Outcomes Improvement Plan

The reinstatement of a crossing from Lossiemouth to East Beach is consistent with the Moray Council Local Outcome Improvement Plan Priorities listed below.

- 1. "Building a better future for our children and young people in Moray" access to the beach would improve the mental and physical wellbeing of children helping them to get the healthiest start in life.
- "Growing, diverse and sustainable economy" replacing the bridge will reduce the risk of business closures with associated job losses. Increased confidence through sustainable visitor numbers to the town would encourage expansion of existing businesses as well as new startup businesses, such as the proposed surf therapy centre identified in the Economic Impact Assessment.

3.4 Scottish Tourism Strategy – Scotland Outlook 2030

The benefits that could be achieved by reinstating the bridge at Lossiemouth are consistent with the key priorities set out in the Scotland Outlook 2030.

- 1. "Our Passionate People" There is strong community support for the replacement of the bridge to East Beach, along with a desire to undertake complementary projects in the future that will improve facilities in the town for both locals and visitors. The community's commitment to replacing the bridge is evident from the funding provided to develop an Options Appraisal and Economic Impact Assessment to demonstrate the value of a replacement bridge. Community representatives also sit on a Steering Group with Moray Council to advise on local public opinion and expectations and communicate progress of this project to the wider community.
- "Our Thriving Places" replacement of the bridge will result in increased visitor numbers and an estimated increase in visitor spend of £1,500,000. Local businesses have also indicated that they are likely to expand if the increase in visitor numbers can be sustained, which is likely if the bridge is replaced.
- 3. "Our Diverse Businesses" In addition to the potential expansion of existing businesses, the replacement bridge is likely to encourage new start-up businesses, such as the proposed surf therapy centre.
- 4. "Our Memorable Experiences" this very popular holiday destination relies on access to the beach as part of the holiday experience that brings visitors back to this location every year. With a DDA compliant bridge, activities and memorable experiences on the East Beach will be accessible for people of all ages and abilities.

3.5 National Performance Framework – National Outcomes

The reinstatement of the bridge connecting Lossiemouth to East Beach would contribute to achieving the national outcomes listed below.

- 1. Value, enjoy and enhance their environment.
- 2. Have thriving and innovative businesses, with quality jobs and fair work for everyone.
- 3. Are healthy and active.

3.6 Conclusion

Not having direct access from the town to East Beach, i.e. Business as Usual, would have a negative impact on the local economy and the wellbeing of local residents. The replacement of the bridge provides a strategic fit both locally and nationally.

4 Economic Case

An Option Appraisal to establish the best value option for reinstating the bridge was commissioned by Moray Council in September 2020. This work was joint funded by the Lossiemouth Community Development Trust, Highlands and Islands Enterprise and Scottish Government. The appraisal assessed five options including "Do nothing" and "Do minimum". Full details of the Option Appraisal are provided in Appendix B.

4.1 Option Appraisal

Five options were assessed as part of this appraisal and these are listed below.

- Option 1 Do Nothing
- Option 2 Do Minimum
- Option 3 New bridge local to existing
- Option 4 New bridge at Esplanade
- Option 5 New bridge at Seatown Road

The location of Options 3 – 5 are provided on the plan below.



Location Plan

4.1.1 Methodology

The criteria used in selecting an option focuses primarily on whole life cost, providing that the economically favourable solution delivers the desired outcome. As defined in clause 1.3 of DMRB document CD 355 'The lowest whole life cost option shall become the recommended solution in an options report, except where other factors override that selection".

Other criteria considered during the assessment of each option are environmental impact, geology and hydraulic impact. Details of the surveys undertaken into each of these criteria is provided in Appendix B.

4.1.2 Option Description

Option 1 – Do Nothing

The Do Nothing option would involve leaving the bridge in its current condition. As the current condition of the bridge is considered dangerous it would remain closed and there would be no direct link from the town to the beach. The condition of the bridge would further deteriorate over time and progressively collapse. There would be no capital cost associated with this option.

Option 2 – Do Minimum

Refurbishing the existing superstructure is not feasible. The majority of steel members have significant section loss and there are several areas where sections are missing. The condition of the existing wooden piled piers is not known. The option for their use to support a new superstructure could be considered. A key consideration for the reuse of the existing piles is that the proposed replacement superstructure should not impose loadings that the substructure and its foundations were not originally designed for. To achieve this, the replacement superstructure would be limited to the footprint and self-weight of the existing structure. The existing bridge is approximately 1.2 metres wide between parapets and 120 metres long, which is not compliant with current design standards and would exclude wheelchair access to the beach.

The 100-year plus age of the substructure does raise concern as it is likely the remaining working life is shorter than would be achieved by replacing the whole bridge. Taking this into account it would be prudent to design the superstructure with consideration to the reconstruction of the substructure at a later date. This would require the temporary removal of the superstructure, demolition of the existing substructure and subsequent reconstruction to allow replacement of the bridge.

The cost of replacing the superstructure is estimated at $\pm 900,000$ and the work required to replace the substructure at a later date would be $\pm 1,800,000$, therefore the total capital cost of this option is estimated at $\pm 2,700,000$.

Option 3 – New bridge local to existing

A number of positions have been investigated on Church Street and it is proposed to land the structure local to the Spynie Canal Bridge (grid ref. NJ 23721 70424) to take advantage of the current public paved area and shorter distance to the East Beach carpark, this is approximately 30m to the west of the existing bridge. Between these points the proposed bridge would approximately be made up of 5 separate 29m spans equating to a total length of 145m.

Considering the length of the individual spans it would be wise to adopt half through truss forms similar to that of the existing bridge, owing to their inherent structural efficiency. Above 20 metres in span a simple underslung steel beam arrangement starts to become uneconomical and presents issues with clearance given the increasing depth of beams required to support the loading. A half through truss allows the user to traverse in between the main structural elements as opposed to above, this results in a shallow overall deck depth meaning less elevation is required to clear obstacles. Using a truss form would provide a replacement bridge that is aesthetically similar to the existing bridge.



Option 3 viewed from Church Street

The capital cost of this option is estimated at £2,225,000.

Option 4 – New bridge at the Esplanade

The projection from the sea wall at the Esplanade provides a good location to cross from the mainland to East Beach as the river channel is at its narrowest point. The bridge would project from an increased level at the Esplanade over to the beach in 4 spans totalling an approximate 75m length. The approach spans would rise at 1 in 20 to meet an arched span over the main river channel, clearing the required flood soffit height as required.

At this location it is considered that a steel beam/plate girder type bridge would be suitable for a number of reasons. Firstly, the distance to the proposed supports allows for an economic solution to this style of bridge, particularly if designed as continuous across the supports. The underslung superstructure allows for a clean looking deck, on which an aesthetic parapet can be incorporated. To expand upon the parapets design, it is proposed to adopt a backward raking post (to prevent climbing) and horizontal tension wire system to allow flood water to flow through during extreme tidal events.



Option 4 viewed from the esplanade

The estimated capital cost of this option is £1,375,000.

Option 5 – New bridge at Seatown Road

The proposed alignment from this location starts 25m to the northeast of the public conveniences on Seatown Road, just above the sea wall and continues to the beach over an approximate total distance of 100m, made up of 3 separate spans. This location is 90m southeast of the Esplanade option and 140m to the northwest of the existing option.

Given the length of the individual spans it is proposed to adopt truss forms as this is a more economical design. Although this location is some distance away from the existing bridge, its alignment and appearance would be similar. The reduced overall span may also make more costly durable material options more economically viable in comparison to Option 3. A beam bridge similar to that proposed for Option 4 could be constructed but this would require additional supports within the channel, increasing cost.



Option 5 viewed from Seatown Road

The estimated capital cost of this option is £1,750,000.

4.1.3 Option Assessment

Each option was assessed against the criteria listed below.

- 1. Cost
- 2. Environmental Impact
- 3. Geology
- 4. Hydrology

<u>Cost</u>

The cost of each option is provided in the table below

Options	Capital Cost	Whole Life Cost
Do Nothing	£0	£0
Do Minimum	£2,900,000	£2,700,000
Option 3 – New bridge local to existing	£2,225,000.	£2,700,000
Option 4 – New bridge at the Esplanade	£1,375,000.	£1,695,000
Option 5 – New bridge at Seatown Road	£1,750,000.	£2,100,000

Environmental impact

A Preliminary Ecological Appraisal (PEA) survey has been undertaken. The PEA report concluded the proposed works are in an area which has significant human disturbance. The dune and saltmarsh grasslands are an important habitat, and damage to these areas should be kept to a minimum. A range of bird species use the area but are unlikely to nest close to the bridge. However, any disturbance of breeding birds should be avoided by either timing the works out with the breeding season or checking the ground prior to commencing works.

The environmental impact of constructing a new bridge would be the same for all of the options considered.

<u>Geology</u>

The exploratory excavations undertaken as part of the site investigation encountered the following geological profile, in order of superposition:

- Made Ground (Land side only) to depths of 0.8m to 0.9m from ground level.
- Marine Beach Deposits (Beach side only) from ground level to termination depth of 5.1m.
- Storm Beach Deposits (Land side only) from underside of made ground to 6.50m at the Esplanade position and 9.65m to the south of the existing bridge.
- Burghead Sandstone Formation (Land side only) from 6.5m at the Esplanade position.

The naturally deposited Marine Beach Deposits and Storm Beach Deposits are theoretically capable of supporting the proposed bridge structures on ground bearing foundations at a reasonably shallow depth. However, forming excavations on the beach and within the river channel would involve significant temporary works to keep out the tidal waters. Additionally, a large mass of concrete within the flow of water presents a heightened scour risk, something that would require significant consideration at detailed design. To alleviate these risks a piled solution that also incorporates the role of the in-channel piers would be more practical and beneficial, particularly for long term stability.

These ground conditions would be the same for each of the options considered.

Hydrology

The preliminary flood risk assessment demonstrates a range of events which could be used to assess flood risk to the proposed bridges. These water levels combine both fluvial and coastal flooding for a number of events with differing likelihood. A fully comprehensive FRA would be needed to identify which values are to be used at detailed design stage, however, it is believed that the existing bridge location would be the preferential location when considering flood risk. As the design is for a footbridge there will be no change to flood risk from surface or ground water and although the bridge will cross the River Lossie, due to the location of the design and the fact there is an existing bridge in its location, it is not expected to have any differing effects on fluvial or coastal flood risk.

This conclusion offers the theoretical best location for the bridge with reference to two key points, these being the effects of wave action and water velocities. The Esplanade location is more exposed to the sea and is positioned over a narrower section of the river so inherently will see the worst of these two factors. For example, the maximum velocity at low tide and 200 year + climate change fluvial event (critical condition) is 1.10 m/s at the existing bridge and 2.50 m/s at the proposed Esplanade bridge location. The difference in these velocities should not draw particular favour to one option as the upper value can be suitably accommodated with considered design.

4.1.4 Assessment Matrix

Each option has been assessed against this criteria and the results are provided in the table below.



Key: 1 = No impact / lowest figure 5 = Greatest impact / highest figure

4.2 Conclusion

The preferred option is Option 4, as this provides the best value option. The capital cost of the preferred option is $\pm 1,375,000$ and a whole life cost of $\pm 1,695,000$.

5 Commercial Case

Following the closure of the footbridge at East Beach, Scottish Government's Culture Secretary committed to funding the work required to reinstate it. Moray Council was asked to project manage the work required to reinstate the bridge on behalf of Scottish Government and the community. The Lossiemouth Community Development Trust agreed to fund the development of the business case required to secure funding for the design and build of the bridge. This funding included a contribution from Highlands & Islands Enterprise.

Two main items of work are required to inform the business case, an Option Appraisal to identify the best value option for replacing the bridge; and an Economic Impact Assessment to assess the economic impact of replacing the bridge.

Traditionally the Option Appraisal and outline design would be procured separately from the Design and Build of the bridge. Moray Council's project management team considered a different approach that would facilitate early contractor involvement in the option appraisal and outline design. By adopting this approach it was considered that we could reduce risk and increase cost certainty at the outline design / funding application stage of this project. As funding for the replacement bridge is dependent on the business case the contract would be split into two stages. Stage 1 would be the development of the option appraisal, which would inform the business case. Stage 2 would be the design and build of the bridge, however, Stage 2 will only be progressed if funding is secured.

This work was procured through Public Contract Scotland and the procurement was undertaken in two stages. Before starting the procurement process a Prior Information Notice was published to identify what interest there would be for this project in the market place. A total of 49 notes of interest were received.

The first stage of the procurement process was pre-qualification. This involved a number of questions that would assess how suitable a contractor or consultant would be to take on a project of this nature. A total of 11 responses were submitted and the top 5 bidders were taken forward to the second stage of the process.

The second stage of the tender process was evaluated through a gateway process to ensure consistency and fairness.

- Gateway 1: Technical Evaluation of Written Submissions this was done based on 13 technical issues relating to the key processes of the Project.
- Gateway 2: Technical Evaluation of Oral Submission this was a 30 minute presentation on challenges you may face during the construction of the footbridge and the measures you will implement to overcome these challenges. The presentation was followed by clarification questions on Technical Elements.
- Gateway 3 Commercial Evaluation this was done using the NEC Model Assessment, which looks at both submitted prices as well as submitted fees and creates a Nominal Tender Value, based on an example footbridge of similar size to that required for Lossiemouth.

Only 4 of the top 5 bidders submitted a tender and the results of the tender assessment are provided in the table below.

Contractor	TECH SCORE 70%	Comm Score 30%	Total	
АМСО	58.25	64.21	60.04	
BEAVER	56	100	69.2	
PAT MUNRO	65.083	70.47	66.7	
STORY	77.167	47.64	68.31	

Full details of the tender evaluation are provided in Appendix C.

5.1 Conclusion

Moray Council has followed a robust procurement process in line with national procurement guidelines. The outcome of this process is contract award to Beaver Bridges whose tender provided best value in terms of both quality and cost.

6 Financial Case

The town of Lossiemouth is a popular destination for tourist and day trippers throughout the year but particularly in the spring and summer months. The town's East Beach is one of the main features that attracts visitors to the town. A significant percentage of the local economy is dependent on trade from tourism, which to a large extent is influenced by access to East Beach. The impact closure of the bridge has had on the town's businesses and the economic impact the town derives from having access to the bridge has been assessed in an Economic Impact Assessment. A brief description and the findings of this assessment are provided below. Full details of the Economic Impact Assessment are provided in Appendix A.

6.1 Economic Impact Assessment

6.1.1 Methodology

Initial research was undertaken and this included:

- a. Online research into accommodation providers and other key tourism related businesses and activities in Lossiemouth, supplemented by information provided by the Lossiemouth Business Association on its members and other local businesses
- b. 2019 bridge count statistics compiled by Lossiemouth Community Development Trust (LCDT)
- c. VisitScotland Accommodation Occupancy Survey, 2018 and 2019
- d. STEAM Final Trend Report for Visit Moray Speyside, 2009-2019 Global Tourism Solutions (UK) Ltd

Following the initial research a consultation was carried out using an online survey, which was sent to 180 local businesses of which 50 were completed. The survey was followed up with telephone interviews with 17 key local businesses.

It is appreciated that there will have been a tendency for negatively affected businesses to respond to the survey, and this has been considered in the quantification. The diagram below shows that 72% of businesses reported that the closure of the East Beach bridge has had a negative or significant negative impact on their business trade, whilst just 2% have experienced a positive impact (due to their location and some people using the West Beach rather than the East Beach).



The economic impact with and without replacing the bridge to the East Beach, was estimated using two methods, both of which showed similar impacts:

(i) Estimating the number of East Beach users in a typical year attributable to the access provided by the bridge; estimating the breakdown of this total across local residents, overnight stay visitors in Lossiemouth, and day trippers (from elsewhere in Moray and further afield, including tourists); estimating the average spend in Lossiemouth by overnight stay and day trippers attributable to their East Beach visit; and estimating the employment impact from this in Full Time Equivalent (FTE) jobs.

This FTE employment impact measure includes "direct" jobs in Lossiemouth businesses supported by visitor spending (including proprietors and employees), "indirect" jobs in Lossiemouth generated

through the local supply chains of these businesses that benefit from direct spending; and "induced" jobs in Lossiemouth generated by the spending of direct plus indirect proprietors and employees from their additional income.

(ii) Drawing on information and estimates provided to us by Lossiemouth businesses who benefit from visitor spending on the difference in spend that they would expect between 2018 (the last full year with an operational bridge, which was broadly typical of recent years), and the first full year should there not be a replacement bridge and without Covid-related impacts. Also, based on our consultation and assumptions of spend on related development and marketing, the potential impacts in a medium term typical year with a replacement bridge were also considered.

6.1.2 Visitor Spend

Bridge count data, taken in early 2019 before the bridge was closed, indicates that on average 200,000 people visit East Beach every year. Based on anecdotal evidence, it is estimated that 50,000 of these 200,000 annual visits are by local residents – including people living beyond Lossiemouth who use the beach (e.g. for dog walking) without spending any money in the town before or after their visit.

Based on the available data, of the remaining 150,000 assumed East Beach visitors, it is estimated that 30,000 will stay overnight in Lossiemouth and 120,000 will be day trippers.

Conservatively, an average spend of £5 per person per day visit is attributed below to day trippers (including children), and £30 to overnight stay visitors.

VisitScotland data gives average spend from day trips of all kinds in 2019 in Scotland of £43; and in the North of Scotland of £54. Visit England data shows an average spend by day trippers to seaside destinations of £33, an average spend of £23 for day trippers who undertook an outdoor leisure activity (including walking and cycling), and £37 for day trippers on general days out/to explore an area.

VisitScotland data for the Highlands for 2019, based on the International Passenger Survey and the Great Britain Tourism Survey, shows an average spend of £67 per 24 hours by overnight stay visitors. Figures for Moray are not available, but STEAM data indicate average spend by overnight visitors to Moray Speyside averaging £42 in 2019 (as calculated from its summary data).

Estimate of Visitor Spend Attributable to the East Beach in a Typical Year								
Approximate Estimated average Total spend per year								
Day trippers	120,000	£5	£600,000					
Overnight visitors	30,000	£30	£900,000					
Total 150,000 £1,500,000								

6.1.3 Employment Impact

From other impact studies using actual visitor spend and employment data, we estimate that an appropriate ratio of FTE employment (direct, indirect plus induced) to visitor spend for the Lossiemouth economy (with a number of small and family businesses) would be 1 FTE to £50,000 of visitor spend (inclusive of VAT where applicable). This would give an annual total of **30 FTEs** (full time equivalent jobs, including proprietors) generated in Lossiemouth from visitor spend of **£1,500,000**.

The difference in annual visitor spend at £1,500,000 in an average year between constructing a new bridge and not having bridge access to the East Beach is considered very good value for money. After

5 years, for example, additional visitor spend in Lossiemouth totalling at least **£7,500,000** compares with the whole life cost of the bridge at **£1,540,000**.

6.2 Longer Term Economic Impact

Annual impacts with a new bridge in place could significantly increase from the 200,000 annual visits, £1,500,000 attributable visitor spend, and 30 additional FTE jobs estimated above through a combination of the following factors:

- Business investment, particularly across the accommodation sector through providing additional bed spaces encouraged by the confidence that a new bridge will provide in the sustainability of future visits to Lossiemouth.
- Visits by people who move to live in the new housing to be built to the north of Elgin related to the increased employment and activity at RAF Lossiemouth.
- Activities on the East Beach and in the sea for people of all ages (including those with disabilities) that Friendly Access with its proposed surf therapy centre, H20 Watersports Instruction, Outfit Moray and others will be able to develop with improved bridge access helping to establish Lossiemouth East Beach as a regional centre for beach and sea-related activities.
- The post-Covid surge in "staycations" that is expected; with people spending more time away to compensate for being inactive in 2020 (and probably for much of 2021) and with money to spend that they have saved during the period of reduced holiday, day-trip, and retail spend.

6.3 Physical and Social Outcomes

Positive aspects of the physical and social environment in which we live that can nurture health and wellbeing include:

- contact with nature in everyday life
- feelings of safety
- the ability to move around places easily and safely on foot or by bike
- a sense of belonging and a sense of control
- thriving communities with an abundance of local businesses and good access to job opportunities

Without access to the East Beach, many local residents, particularly those living in close proximity to the beach, have lost a part of their daily life and routine and access to activities which improve health and wellbeing, including: walking or running along the beach, dog walking, water sports, wildlife, and birdwatching from the beach and the dunes.

A bridge compliant with current equalities requirements would increase the accessibility of the beach to those in wheelchairs and could enable easier transfer of water sports equipment.

6.4 Health and Safety

There is currently no safe and reliable access to the beach for local residents and visitors. Since the bridge closed in 2019 there have been a number of incidents where families and young people have become stranded on the beach after crossing the river at low tide.

Without a bridge, there is no land based emergency access to the beach.

6.5 Potential Projects Complementary to Replacing the Bridge

The Economic Impact Assessment also looked at potential projects that are complementary to the bridge that would be taken forward by the community. The table below provides a summary of the project/action ideas obtained from the survey telephone interviews. More detail on these potential projects is provided in Section 3 of Appendix A.

Ref	Project		Funding Cost		Impact (High Medium		Support Expressed		Potential Funding	
			COSC		or Low)				Jources	
		Н	Μ	L	Н	Μ	L	LBA	LCDT	
1	Signage and information	✓			✓			✓	✓	
2	Development of surrounding area and heritage trails	~			~				•	EB Scotland (Landfill)
3	Accessible changing facilities	√				~				National Lottery Awards for All
4	Additional 'seaside' attractions and equipment	1			~				~	HIE
5	Traffic management and parking	1			~					Moray Council
6	Marketing and promotion			✓	✓			✓	✓	Visit Moray Speyside
7	Events		✓			✓				
8	Support for businesses		✓				✓			
9	More take-away dining options			~			✓			

6.6 Conclusion

Since the closure of the footbridge to East Beach in 2019 a number of businesses in Lossiemouth have experienced a negative impact on trade. This assessment has found that visitor spend in Lossiemouth is increased by **£1,500,000** with a bridge connecting the town to East Beach. This level of increased spend would equate to an additional **30 FTE jobs**. The bridge would also encourage investment in existing businesses and sporting activities. Access to the beach provides additional benefits for the town in terms of health and wellbeing.

7 Management Case

Moray Council was asked to project manage the replacement bridge on behalf of Scottish Government and the community. Moray Council awarded a design and build contract to Beaver Bridges under the New Civil Engineering Contract (NEC3). This contract was split into two stages. The first stage is the development of an option appraisal to identify the best values option for replacing the bridge and the second stage is the design and build of the bridge. The first stage is required to inform the business case, which will be used to secure funding for the second stage. If funding is not secured then the second stage will not be progressed.

A number of actions were required during the option appraisal stage to reduce risk to the project. A list of these risks and the mitigation measures applied are provided below.

- 1. **Ground conditions** detailed ground investigations are normally undertaken at the detailed design stage of a project. However, this increases the risk of design changes that could significantly increase costs. As such it was agreed that Scottish Government would fund this work at the option appraisal stage of the project to reduce risk and increase cost certainty.
- 2. **Statutory consents** a number of statutory consents must be obtained before the replacement bridge can be constructed. Early consultation with statutory bodies has been undertaken to reduce the risk of delay in obtaining these consents during the design and build stage of the project.
- 3. Land ownership ownership of the land on which the bridge abutments will be constructed is unknown. Initial research undertaken indicates that the land originally belonged to the Old Harbour Commission and when it ceased trading the land became ownerless, however, there is some uncertainty over the Old Harbour Commission's Title. To reduce the risk of any delays the land required will be acquired through a Compulsory Purchase Order (CPO). This process is currently being progressed and when funding is secured the CPO will be finalised.

7.1 Contract

Using the NEC3 contract allows for effective contract and change management, with key points highlighted below.

- 1. **Early Warning** The use of early warnings allows both Beaver Bridges and Moray Council to actively manage risk and ensure that robust mitigation processes are in place, should risk events occur. Early warning is the basis of the contract risk register.
- 2. **Defined Reply periods** Using the NEC contract means that clearly defined time periods are in place, with regard to change and cost, which allows the client to be aware of what the potential final out turn cost is at all stages of the project. These defined time periods ensure that changes are actively dealt with and resolved timeously, ensuring effective payments to the contractor and limiting financial exposure to the client due to unresolved variation.
- 3. **Management of change** The process for compensation events provides clarity to both parties on why change has happened and allows for proposed change to be assessed but not acted upon.

To assist with the effective application of the contract, Moray Council will be using an online contract management tool called CEMAR. By using this tool a number of advantages are achieved to ensure effective management of the project:-

- 1. All correspondence is done in line with the appropriate clauses of the contract.
- 2. All time bound items are marked and identified if they are due or late.
- 3. Early warnings and risk reduction meetings are recorded.
- 4. All Instruction, payments, approvals and compensation events are managed through the system.
- 5. Complete project administration is logged and archived at the end of the project.
- 6. Only authorised people can approve and agree contractual matters.

7.2 Risk

The contract risk register has been built up from a number of pre-identified risks and risks identified through early warnings issued during Stage 1. Prior to Stage 2 award a risk mitigation meeting will be held with the contractor to identify possible mitigation measures to reduce the impact of the identified risks. During the contract any early warnings raised will be dealt with through a risk mitigation meeting. At the progress meetings, the risk register will be reviewed and updated accordingly. The current estimated risk for this project is **£365,000**. The risk register is provided in Appendix D.

7.3 Operation and Maintenance

On completion of construction of the bridge, Moray Council will take ownership of the bridge and be responsible for future inspection and maintenance requirements. This maintenance work will be funded from Moray Council's bridge maintenance budget.

7.4 Conclusion

Management of the design and build of this project will be undertaken by Moray Council, under the NEC3 contract. On completion of construction Moray Council will take ownership of the bridge and will undertake all future maintenance requirements.

8 Community Engagement

Engagement with the local community has been actively undertaken throughout the development of this project. A number of engagement events have been undertaken, as well as setting up a Steering Group consisting of community representatives and members of the project team.

8.1 Lossiemouth Connects – Design Priorities Workshop

In November 2019 Architect Design Scotland facilitated a workshop on the future of the recently closed footbridge from the town of Lossiemouth to East Beach. The workshop was attended by local people and organisations, Scottish Government and Moray Council.

The workshop explored the Place, Parts, Process approach to priorities. Participants were asked to share their views on the current situation and discuss actions that would maximise the benefits of reinstating the bridge.

The main finding from the workshop is that access to East Beach is considered a valuable asset to the community that has a significant impact on the local economy and wellbeing of the local community. There was also a lot of enthusiasm for projects that could be taken forward by the community to maximise the benefits of a reinstated bridge. Full details of the workshop are provided in Appendix E.

8.2 Lossiemouth Footbridge Replacement Steering Group

A Steering Group consisting of Moray Council, Beaver Bridges and community representatives was set up by Moray Council. The purpose of this group is to make sure the expectations of the community are considered during the development of the project and to facilitate communication with the wider community. The organisations representing the community on this group are Lossiemouth Community Development Trust, Lossiemouth Community Council and Lossiemouth Business Association.

8.3 Community Survey

One of the main issues raised by the community representatives on the Steering Group was the location of the replacement bridge. A survey was undertaken both online and in paper asking people

to indicate where they would prefer the bridge to be located. Participants were also asked to provide comments on why they had made that choice.

A total of 1348 people responded to the survey, which is approximately 17% of the population of Lossiemouth. Approximately 63% of the people who responded expressed a preference for a bridge at Seatown, where the current bridge is located.

Concerns about changing the location of the bridge predominantly focused on increased traffic congestion, parking issues associated with having a bridge located at the Esplanade and the heritage value of having a bridge at the existing location. The issues raised about increase traffic congestion and any associated safety issues would be addressed through the planning process, with mitigation measures being a condition of obtaining planning approval to construct the bridge. With regard to the heritage value of the existing bridge, this would not change as the existing bridge would not be removed as part of this project.

Support for the location at the Esplanade focused on easy access to local amenities.

Details of the feedback is provided in Appendix E.

8.4 Virtual Exhibition

Details of the Option Appraisal and Economic Impact Assessment were made available for the public to view at a virtual exhibition that ran from 1 March 2021 to 7 March 2021. People who attended the exhibition were encouraged to provide feedback.

A total of 9545 visits were made to the exhibition and 394 visitors provided feedback. Visitors were asked to "Please provide your comments on the preferred option". As with the survey undertaken in 2020 the responses were mixed.

The main concerns raised in the feedback were similar to those raised in the survey. These concerns focused mainly on parking issues and the potential for increased traffic congestion. Concern was also raised with regard to exposure to weather and tides at the Esplanade. The issue of the bridges "iconic" status was also raised.

The advantages of the preferred option in relation to access to the town and local amenities was raised.

Details of the feedback is provided in Appendix E.

8.5 Conclusion

Community engagement has been undertaken throughout the development of this project and it is clear from this engagement that there is a strong desire to reinstate access from the town to East Beach. The response has been mixed, with a number of people expressing a desire to have a new bridge that is similar to the existing bridge both in style and location. Some of the concerns raised about locating the bridge to the Esplanade can be mitigated through design and traffic management, however, this will not address the concerns over the loss of what is considered the iconic status of the existing bridge. When undertaking the assessment of the options the desire for a bridge similar to the existing bridge has been considered. However, this desire had to be assessed against the need to provide best value and the significant difference in cost means that Option 4, a new bridge at the Esplanade has been recommended.

9 Funding Requirements

At the request of Scottish Government and the local community, Moray Council agreed to progress the development of this project to replace the footbridge between Lossiemouth and East Beach. To achieve this goal, grant funding of £1,800,000 will be required from Scottish Government. A breakdown of this funding is provided below.

Capital cost	£1,375,000
Risk	£365,000
Site supervision	£60.000
Total	£1,800,000

As stated above Moray Council will take ownership of the bridge and be responsible for all future maintenance costs.

Appendix A – Economic Impact Assessment

Lossiemouth East Beach Bridge Replacement

Economic Impact Assessment

by

Steve Westbrook, Economist, and Fiona Hepburn

2 March 2021

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Executive Summary

- E1 This Economic Impact Analysis (EIA) values the economic impact that the Lossiemouth community derives from the East Beach (with access), and considers two options: 1. Do nothing; and 2. Replace the existing bridge. The EIA demonstrates the impact each would have in terms of visitor spending, employment and public well-being. The EIA also considers potential projects/actions that could be taken forward by the community to ensure that the community maximises benefits after the bridge has been replaced, and potential sources of future financing to implement these projects/actions are indicated.
- E2 The Options Appraisal has been produced for Moray Council by Beaver Bridges, and this identifies the best value option for replacing access to the East Beach as a new bridge from the Esplanade – the shortest crossing of the options considered. The cost of this option is given as £1,375,000 capital cost plus £165,000 net present value maintenance cost over 60 years = £1,540,000.
- E3 Our initial research included: identifying all relevant accommodation providers and other key tourism related businesses and activities in Lossiemouth; accessing 2019 bridge count statistics compiled by Lossiemouth Community Development Trust; and reviewing accommodation occupancy survey and visitor spend data from VisitScotland and other sources.
- E4 We circulated an online survey to 180 businesses on 21st December 2020 via the Lossiemouth Business Association (LBA), and this was completed by 50 businesses within 4 weeks. Follow up telephone interviews were conducted with 17 businesses identified with LBA as being highly impacted by the bridge closure and to ensure input from a range of businesses types.
- E5 72% of business respondents reported a negative impact on their trade from the closure of the East Beach bridge, including 26% who had experienced a significant negative impact. Walking distance from the existing bridge is a key factor.
- E6 Without a replacement bridge, respondents located within 5 minutes' walk of the existing bridge anticipated the reductions in turnover (net of inflation) illustrated below between 2018, the last full year prior to bridge closure, and 2022, assuming that Covid-related impacts have subsided and that the bridge has been replaced. 19 of the 21 businesses within 5 minutes' walk of the bridge reported an expected risk of closure, reduction in staffing, and/or reduction in opening hours or season.



- E7 Whilst just over a third (38%) of businesses told us they have developed plans for expansion or are considering expansion, three quarters (76%) said that a high quality bridge replacement would influence their future investment or expansion plans to some degree.
- E8 Based on bridge usage statistics and our survey and other research, we estimated the following difference in attributable visitor spend in a typical year with and without a replacement bridge. The spending of local residents (50,000 estimated East Beach visits per year) is not included in the impacts below.

Estimate of Visitor Spend Attributable to the East Beach in a Typical Year								
	Approximate Estimated average Total spend per year							
	numbers per year	spend per day	(including VAT)					
Day trippers	120,000	£5	£600,000					
Overnight visitors	30,000	£30	£900,000					
Total	150,000		£1,500,000					

- E9 From other impact studies using actual visitor spend and employment data, we estimate that an appropriate ratio of Full Time Equivalent (FTE) employment (direct, indirect plus induced) to visitor spend for the Lossiemouth economy (with a number of small and family businesses) would be 1 FTE to £50,000 of visitor spend (inclusive of VAT where applicable). This would give an annual total of c30 FTEs (full time equivalent jobs, including proprietors) generated in Lossiemouth from visitor spend of £1,500,000.
- E10 From our discussions with those businesses that would potentially lose the most trade without a replacement bridge, combined with our online survey data, we calculate that they expect a total difference of an estimated £1.4 million per year which (allowing for some over-estimation) is consistent with our £1.5 million estimate when direct plus indirect employment related to businesses not included in the total for these businesses and induced impacts are added.
- E11 Our analysis of available bedspaces, occupancy rates by accommodation type, and attribution of East Beach visits endorsed the spend impacts summarised above.
- E12 Health and wellbeing benefits of the East Beach have included walking or running along the beach, dog walking, watersports, and wildlife and bird watching from the beach and the dunes behind the beach. A wider footbridge (3.5 metres is planned) would increase the accessibility of the East Beach to those in wheelchairs and could enable easier transfer of watersports equipment.
- E13 Annual impacts with a new bridge in place, subject to continuing annual maintenance as advised in the Options Appraisal, could significantly increase from the 200,000 annual visits, £1.5 million attributable visitor spend, and 30 additional FTE years estimated above through a combination of the following factors:
 - Business investment, particularly across the accommodation sector through providing additional bedspaces – encouraged by the confidence that a new well maintained bridge will provide in the sustainability of future visits to Lossiemouth, plus new events and activities over the year that will attract additional day and overnight visitors to the East Beach and the town more generally.

- Visits by people who move to live in the new housing to be built to the north of Elgin related to the increased employment and activity at RAF Lossiemouth.
- Marketing initiatives that it will be possible to introduce once the bridge is again available especially around the celebrations that could accompany bridge re-opening.
- Activities on the East Beach and in the sea for people of all ages (including those with disabilities) that Friendly Access with its proposed surf therapy centre, H20 Watersports Instruction, Outfit Moray and others will be able to develop with improved bridge access – helping to establish Lossiemouth East Beach as a regional centre for beach and sea-related activities.
- E14 Even before taking into account the factors in E13 above that would increase annual impacts from those estimated in E9, the difference in annual visitor spend of c£1.5 million in an average year between constructing a new bridge and not having bridge access to the East Beach is considered very good value for money. After 5 years, for example, additional visitor spend in Lossiemouth totalling at least £7.5 million compares with a bridge build plus maintenance cost of less than £1.5 million (see E2 above).
- E15 More than 40 new projects or activities that would be complementary to replacing the bridge were given by survey respondents and through our telephone interviews; and our report lists these under the following categories:
 - 1. Signage and information.
 - 2. Development of the surrounding area and heritage trails.
 - 3. Additional "seaside" attractions and equipment.
 - 4. Accessible changing facilities, which would support Friendly Access and SurfABLE Scotland in offering fully adaptive surf therapy through providing watersports and adventure activities to children and adults with disabilities or other conditions.
 - 5. Traffic management and parking.
 - 6. Marketing and promotion.
 - 7. Events.
 - 8. Support for businesses.
 - 9. Take-away food & drink options.
- E16 A very wide range of funding sources would potentially be available for such developments, and the report notes some of particular relevance currently although these could increase or change their focus through supporting the national recovery from Covid-related impacts.

1 Introduction

The town of Lossiemouth on the north east coast of Scotland in Moray benefits from an attractive coastal location with sandy beaches to the west and east of the town. Access from Lossiemouth town to its east beach is by a wooden footbridge, which was constructed by the then harbour authority in 1906. In July 2019, a central span of this bridge failed, and the bridge was closed in the interest of public safety. In September 2019, Scottish Government committed to funding a replacement bridge, subject to a business case, which includes an Options Appraisal and this Economic Impact Assessment.

The overall business case is being produced by Moray Council, in partnership with the Lossiemouth Community Development Trust (LCDT), the Lossiemouth Business Association (LBA), Lossiemouth Community Council and Highlands and Islands Enterprise. The Options Appraisal has been produced for Moray Council by Beaver Bridges, and this identifies the best value option for replacing access to the East Beach as a new bridge from the Esplanade – the shortest crossing of the options considered.

The cost of this option is given as $\pm 1,375,000$ capital cost plus $\pm 165,000$ net present value maintenance cost over 60 years = $\pm 1,540,000$.

1.1 Scope

This Economic Impact Analysis (EIA) values the economic impact that the Lossiemouth community derives from the East Beach (with access), and considers two options: 1. Do nothing; and 2. Replace the existing bridge. The EIA demonstrates the impact each would have in terms of visitor spending, employment and public well-being.

The EIA also considers potential projects/actions that could be taken forward by the community to ensure that the community maximises benefits after the bridge has been replaced, and potential sources of future financing to implement these projects/actions are indicated.

1.2 Methodology

Our methodology included primary and secondary research as detailed below:

- 1. Scoping meeting with the Project Steering Group
- 2. Initial research, including:
 - a. Online research into accommodation providers and other key tourism related businesses and activities in Lossiemouth, supplemented by information provided by the LBA on its members and other local businesses
 - b. 2019 bridge count statistics compiled by Lossiemouth Community Development Trust (LCDT)
 - c. VisitScotland Accommodation Occupancy Survey, 2018 and 2019
 - d. STEAM Final Trend Report for Visit Moray Speyside, 2009-2019 Global Tourism Solutions (UK) Ltd
- 3. Consultation:
 - a. Online Survey completed by 50 business
 - b. Follow up telephone interviews with 17 key businesses
- 4. Analysis of survey results and our wider consultation findings, and compilation of this report and appendices with supporting information

Throughout our study we have liaised with members of the project steering group, which comprises representatives from the following groups:

- Lossiemouth Business Association has members from a variety of businesses within the town and includes a Tourism sub group focused on initiatives to attract tourism
- Lossiemouth Community Development Trust has charitable status and was formed to represent and promote plans for residents and tourism by adopting a joint community approach towards improving facilities for the benefit of everyone
- Lossiemouth Community Council the statutory body representing the town
- Moray Council
- Highlands and Islands Enterprise (HIE)

2 Background

Lossiemouth, often referred to as "the jewel of the Moray Firth", is located at the most northerly point of the south coast of the Moray Firth at the mouth of the River Lossie. The town is popular with tourists and is also home to RAF Lossiemouth, which supports significant local employment. It has a population of around 7,700.

Lossiemouth's east beach is predominantly characterised by a large strip of sand dunes separated from the rest of the town by the River Lossie. The town looks down on this and the existing wooden footbridge, offering a natural viewpoint to the most photographed beach in the whole of the UK last year, and in the top 50 in the world on Instagram.



https://www.northern-scot.co.uk/news/moray-beach-most-instagrammed-in-uk-during-2020-223424/#:~:text=Lossiemouth's%20East%20Beach%20was%20the,beaches%20across%20the%20ent ire%20globe.

Visit Moray Speyside's website has the following summary for Lossiemouth:

"The West is dominated by the iconic Covesea Lighthouse, while the East meets the town at the River Lossie and offers stunning views of the iconic old wooden bridge".

As demonstrated in Appendix E, most Lossiemouth accommodation businesses highlight the East Beach in their online publicity; and the East Beach is Trip Advisor's No 1 attraction in Lossiemouth.

The east beach has traditionally been a popular location for surfers, and is part of the Moray Coastal Trail, a popular walking route. For local residents *"the East beach is one of Lossiemouth's greatest*

assets", "East beach is the high point of our beautiful town", stated two of our online survey respondents.

Since closure of the existing footbridge, direct access to the beach has not been possible from the town. There is no alternative signed access to the east beach, although 3 miles east of the town, the beach can be reached through Lossie Forest, following a mile of uneven forestry track road and a 5-10 minute walk through the forest. This is not a signposted or pathed route to the beach.

Lossiemouth's west beach is approximately 3 miles from the east beach and is approximately 3 miles long, running along the length of the popular and highly regarded Moray Golf Club's two courses to Covesea Lighthouse and Silver Sands Caravan Park. Limited parking is available, and is extensively used by golfers and camper vans, however the tidal nature of this beach often makes the car park inaccessible at high tide. There is a small cafe with limited toilet facilities serving the west beach.

A number of accommodation businesses in Lossiemouth, and other businesses in the town that benefit from visitor spend, have been protected from the significantly reduced viability in late 2019, 2020, and early 2021 that would have resulted from East Beach bridge closure and reduced visitor spend due to Covid through spending by workforces related to major construction contracts for RAF Lossiemouth expansion and the building of a new Lossiemouth Academy. The cost of the airport revamp since January 2020 has been around £75million, and the new Academy will have cost c£42m. Thus, the business base in Lossiemouth should be strong enough once the new bridge is in place to achieve the levels of impact through East Beach visitor spend that we estimate in this EIA – with additional future trade from the eventual expectation of up to 1,500 homes, a new primary school, and commercial land for shops and other businesses expected to be built on land related to the RAF Lossiemouth expansion to the north of Elgin over the next twenty years. The arrival of the new P-8 Poseidon fleet at RAF Lossiemouth could increase the local population by about 4,000, including the spouses and children of forces' families – although this will include developments, such as in Findrossie, that expand Elgin rather than being in the Lossiemouth area as defined for this EIA.

3 Consultation

We circulated an online survey to 180 businesses on 21st December 2020 via the Lossiemouth Business Association (LBA), and this was completed by 50 businesses within 4 weeks. Follow up telephone interviews were conducted with 17 businesses identified with LBA as being highly impacted by the bridge closure and to ensure input from a range of businesses types.

3.1 Online survey findings

Respondent profile

A broad range of businesses responded to the online survey, with the greatest number of responses from retail businesses. Table 1 below summarises these results, with respondents asked to describe their type of business from a number of pre-defined categories.

Table 1: Online Survey Respondents

Business Type	Number of online survey	% of total responses
	respondents	
Serviced accommodation		6%
- With catering for their residents only	3	
Serviced accommodation		6%
 With catering also for non-residents 	3	
Un-serviced accommodation	2	4%
Caravan/motorhome/camping site	3	6%
Restaurant/café/pub	3	6%
Takeaway food	1	2%
Retail - Highly geared to visitor trade	1	2%
Retail - Visitor trade of some importance	5	10%
Retail - For visitors and local residents, but visitor trade		16%
important	8	
Supplier to local businesses that serve visitors	5	10%
Recreational - With retail and/or catering sales to visitors	2	4%
Recreational - Without such sales to visitors	3	6%
Cultural - Without such sales to visitors	1	2%
Other (incl. other retail businesses not covered above)	10	20%
Total	50	100%

Respondents varied in distance from the existing east beach bridge, but the majority (60%) were located within 10 minutes' walk, as illustrated in Figure 1 below:





Impact of East Beach bridge closure on business trade

Figure 2 below shows that 72% of businesses reported that the closure of the east beach bridge has had a negative or significant negative impact on their business trade, whilst just 2% have experienced a positive impact (due to their location and some people using the west beach rather than the east beach). It is appreciated that there will have been a tendency for negatively affected businesses to respond to the survey, and we have taken account of the nature and scale of these respondents in our quantification and other analysis of bridge closure impacts rather than grossing up the survey results from 50 to 180 businesses.





Figure 3 shows that the closer their proximity to the bridge, the greater the level of impact on responding businesses.



Figure 3: Impact of bridge closure on business trade by distance from existing bridge

Focus on businesses within 5 minutes' walking distance of the existing East Beach bridge

Figure 4 shows that 59% of businesses within 5 minutes' walk of the bridge have experienced a significant negative impact on business trade.




Expected change in turnover without a replacement bridge

Respondents were asked to compare what they would expect their turnover to be in 2022 without a replacement bridge (assuming that Covid-related impacts have subsided and that the bridge has been replaced) against their turnover in calendar year 2018 (net of inflation); i.e. the last full year prior to bridge closure. There was a large variance between responses, but, of the businesses that were less than 5 minutes' walk from the bridge, almost all (88%) anticipated experiencing a reduction in turnover, as shown in Figure 5 below.





Risk to businesses without a replacement bridge

Figure 6 shows that the closer a business is to the existing east beach bridge, the greater their anticipated risk should there be no replacement bridge. 19 of the 21 businesses within 5 minutes' walk of the bridge expected risk of closure (high, medium or low), reduction in staffing, and/or reduction in opening hours or season.



Figure 6: Risk to businesses without a replacement bridge

Figure 7 shows that the percentage of businesses anticipating at least one of these risks reduces the further away from the bridge they are.



Figure 7: Percentage of businesses anticipating at least one risk

Expansion plans

Whilst just over a third (38%) of businesses told us they have developed plans for expansion or are considering expansion, three quarters (76%) said that a high quality bridge replacement would influence their future investment or expansion plans to some degree.

Figure 8: Were you planning to expand your business?



Figure 9: Do you think a high quality replacement bridge would influence your future investment or expansion aspirations?



Our interviews with key businesses gave us supplementary information on impacts to that which these businesses provided through completing the online survey.

3.2: Telephone interview responses

Background

- 20 businesses were contacted to undertake a telephone interview
- Contact was successfully made with 18 businesses
- 14 full interviews were conducted and key information captured for a further four.

These 18 businesses comprised:

- 3 serviced accommodation providers
- 2 un-serviced accommodation providers
- 2 caravan/ camping/ motorhome sites
- 3 restaurants/café/pub
- 4 retailers
- 1 supplier to local businesses
- 3 recreational operators

Impact of bridge closure

Almost all businesses expressed how the closure of the east beach bridge has adversely affected their business.

- **Retailers** The impact was significant for retailers highly geared towards visitor trade; one advised 70% of customers in summer are holidaymakers. Amongst these businesses the reduction in sales immediately after bridge closure ranged from 25% to over 50%. For these largely seasonal businesses, their customer base "*relies on pull factor, and access to the east beach is the pull factor*". One respondent believed that without a bridge, "eventually the shops will not be viable, leaving a dead zone"
- **Restaurant/ café/ pub category** one respondent stated that they *"definitely traded down 20-25% in August and September after the bridge closed"*
- Accommodation providers that took part in the telephone interview had not been impacted to the same extent as other business categories. This was due to repeat customers, walkers, and the large number of business customers for whom access to the east beach is not a critical factor.

4 Economic Impacts

4.1 Methodology

In order to estimate the difference in economic impact in Lossiemouth between replacing and not replacing the bridge to the East Beach, we used two methods, which, as shown below, gave us broadly the same impacts:

(i) Estimating the number of East Beach users in a typical year attributable to the access provided by the bridge; estimating the breakdown of this total across local residents, overnight stay visitors in Lossiemouth, and day trippers (from elsewhere in Moray and further afield, including tourists); estimating the average spend in Lossiemouth by overnight stay and day trippers attributable to their East Beach visit; and estimating the employment impact from this in FTEs (full time equivalent jobs).

This FTE employment impact measure includes "direct" jobs in Lossiemouth businesses supported by visitor spending (including proprietors and employees), "indirect" jobs in Lossiemouth generated through the local supply chains of these businesses that benefit from direct spending; and "induced" jobs in Lossiemouth generated by the spending of direct plus indirect proprietors and employees from their additional income.

(ii) Drawing on information and estimates provided to us by Lossiemouth businesses who benefit from visitor spending on the difference in spend that they would expect between 2018 (the last full year with an operational bridge, which was broadly typical of recent years), and the first full year should there not be a replacement bridge and without Covid-related impacts (although a full recovery in tourism and day visits – including international trade – could take a few years). Also, based on our consultation and assumptions of spend on related development and marketing initiatives (see Section 5 below), the potential impacts in a medium term typical year with a replacement bridge were also considered.

Businesses gave us some information on their staffing (including themselves as proprietors and their families), the relationship between staffing and turnover, recent customer numbers and how these have changed since bridge closure (acknowledging that 2020 has been an exceptional year), and how failure to replace the bridge might affect their overall future viability.

Estimates of reduced visitor spend between 2018 and a future year without a replacement bridge drawn from aggregating the data provided to us by businesses was then supplemented by estimating the reduced spending in other businesses in specific and miscellaneous sectors of employment in Lossiemouth that will have benefited from visitor spending.

Attribution of impacts is not straightforward as many East Beach visitors will spend time elsewhere in Lossiemouth during their day, in addition to spending money in local businesses, related to their time in the town mainly for leisure purposes (e.g. walking around the harbour, visiting the west beach and/or Covesea Lighthouse, etc). Some of these visitors (as in 2020) will continue to visit without the East Beach option – although, to counterbalance this, the overall attraction of Lossiemouth as a place to visit for some will have included their experience from previous visits to

the East Beach even where (e.g. because of the weather or lack of time) they might not always include an East Beach visit having chosen to spend leisure time in Lossiemouth.

These effects are accounted for in our visitor spend estimates by attributing only a proportion of an average day trip visitor's spend in the town to their East Beach visit. As an approximation, a high proportion of the spending over up to 24 hours of an overnight stay visitor who visits the East Beach on a particular day is attributed as this is considered broadly balanced where people spending more than one night in local accommodation might, on some days, be in Lossiemouth without visiting the East Beach or visit other places (distilleries, castles, visitor attractions, Elgin for shopping, etc).

Without East Beach access, the additional nights in local accommodation related to these non-East Beach days might instead have been in other places (e.g Hopeman, Cullen, Elgin, etc).

Impacts for local residents' visits to the East Beach are not included in the impact totals (which is the usual convention in impact analysis) – although these visits will often entail associated spend in cafés, restaurants, ice cream purchases, etc, that would have accrued elsewhere had they visited beaches in other places without the East Beach option.

Our consultation and analysis suggests that the new bridge proposed as the preferred option from the Esplanade will have broadly similar economic impacts to a replacement bridge close to the existing bridge provided that traffic management and parking provision do not constrain visits to the East Beach.

Indeed, if the now unusable but still iconic existing bridge is not demolished and kept safe, photographing it without a new bridge next to it will be more attractive than with the replacement bridge being closer to the sea.

4.2 Visitor spend and related employment impact

The bridge count data provided to us by LCDT for the early summer season 2019 (before bridge closure) indicates total annual East Beach users over a typical year of c200,000. The counts showed the following:

Bridge count dates	Daily Average crossings to the Beach
24 th March – 25 th March 2019	425
1 st April – 30 th April 2019	590
1 st May – 31 st May 2019	346
17 th June 2019	704
Daily Average	516

April included Good Friday with 2,116 visitors.

Grossing-up pro rata would give an annual total of 188,340 visits. Given, however, that peak season East Beach usage on a typical day will be much higher than these averages, it is considered that an annual average for a typical year would be c200,000 visits (including multiple visits by many people).

From speaking to people who observe East Beach usage over the year, it is estimated that c50,000 of these 200,000 assumed annual visits are by local residents – including people living beyond

Lossiemouth but who use the beach (e.g. for dog walking) without spending any money in the town before or after their visit.

Of the remaining 150,000 assumed East Beach visitors, we estimate from the information we have obtained and the people we have consulted, that c30,000 of these visitors will stay overnight in Lossiemouth the night before and/or the night after their visit, and that c120,000 will be day trippers.

Conservatively, an average spend of £5 per person per day visit is attributed below to day trippers (including children), and £30 in Lossiemouth to overnight stay visitors.

VisitScotland data gives average spend from day trips of all kinds in 2019 in Scotland of £43; and in the North of Scotland of £54. Visit England data shows an average spend by day trippers to seaside destinations of £33, an average spend of £23 for day trippers who undertook an outdoor leisure activity (including walking and cycling), and £37 for day trippers on general days out/to explore an area.

VisitScotland data for the Highlands for 2019, based on the International Passenger Survey and the Great Britain Tourism Survey, shows an average spend of £67 per 24 hours by overnight stay visitors. Figures for Moray are not available, but STEAM data indicate average spend by overnight visitors to Moray Speyside averaging £42 in 2019 (as calculated from its summary data).

Estimate of Visitor Spend Attributable to the East Beach in a Typical Year				
	Approximate Estimated average Total spend p			
Deve trivere e re		spend per day		
Day trippers	120,000	£5	£600,000	
Overnight visitors	30,000	£30	£900,000	
Total	150,000		£1,500,000	

Employment Impact

From other impact studies using actual visitor spend and employment data, we estimate that an appropriate ratio of Full Time Equivalent (FTE) employment (direct, indirect plus induced) to visitor spend for the Lossiemouth economy (with a number of small and family businesses) would be 1 FTE to £50,000 of visitor spend (inclusive of VAT where applicable). This would give an annual total of **c30 FTEs** (full time equivalent jobs, including proprietors) generated in Lossiemouth **from visitor spend of £1,500,000**.

From our discussions with those businesses that would potentially lose the most trade without a replacement bridge, combined with our online survey data, we calculate that they expect a total difference of an estimated £1.4 million per year – which (allowing for some over-estimation) is consistent with our £1.5 million estimate when direct plus indirect employment related to businesses not included in the total for these businesses and induced impacts are added.

4.3 Visitor nights and visitor spend

For validation of the above assumptions, our sources of information on all visitor nights and associated spend in Lossiemouth included:

- Our review of accommodation providers
- Visit Scotland occupancy rates
- Our occupancy analysis based on our online and interview surveys

Our calculation of visitor nights in Lossiemouth relates to the following accommodation types: hotels, bed & breakfasts, and self-catering (including rental static caravans). Visitors staying with friends and relatives are not covered.

A review of major online booking accommodation sites (Booking.com, Airbnb and Trip Advisor) shows that there are at least 116 bedrooms available in serviced accommodation (hotels and bed & breakfasts), 70 self-catering accommodation units (including Airbnb) and 44 static caravans for visitor lease for potential East Beach visitors.

Accommodation Type	Total number	Total number	Total number
		of bedrooms	of beds
Hotels	4	90	181 (est)
Bed & Breakfasts	4	16	37 (est)
Self-Catering Units	70	138	300 (est)
Static Caravans	44	c100+	150 (est)
Totals	122	344+	668+

Applying the VisitScotland average occupancy rates for 2019 below to the total number of beds across the year enabled us to estimate (broadly) total visitor nights.

Accommodation Type	VisitScotland
	Average Occupancy %
Hotel Bedrooms	71%
Hotel Beds	53%
Bed & Breakfast Bedrooms	50%
Bed & Breakfast Beds	42%
Self-Catering Units and Caravans	48%

Applying these bed occupancy rates over 350 days for serviced accommodation and 250 days for self-catering units and caravans gives:

Hotel beds occupied	33,576
Bed & breakfast beds occupied	5,439
Self-catering and caravan visitor nights	54,000
Total	93,015

Taking account of other overnight markets – for golf, the marina, west beach and lighthouse visits, business visits, etc – it is considered that an estimate of 30,000 East Beach visits by people staying overnight in Lossiemouth is consistent with this total.

4.4 Longer term economic impacts

Annual impacts with a new bridge in place, subject to continuing annual maintenance as advised in the Beaver Bridges Options Appraisal, could significantly increase from the 200,000 annual visits, £1.5 million attributable visitor spend, and 30 additional FTE years estimated above through a combination of the following factors:

- Business investment, particularly across the accommodation sector through providing additional bedspaces – encouraged by the confidence that a new well maintained bridge will provide in the sustainability of future visits to Lossiemouth, plus new events and activities over the year that will attract additional day and overnight visitors to the East Beach and the town more generally.
- Visits by people who move to live in the new housing to be built to the north of Elgin related to the increased employment and activity at RAF Lossiemouth.
- Marketing initiatives that it will be possible to introduce once the bridge is again available especially around the celebrations that could accompany bridge re-opening.
- Activities on the East Beach and in the sea for people of all ages (including those with disabilities) that Friendly Access with its proposed surf therapy centre, H20 Watersports Instruction, Outfit Moray and others will be able to develop with improved bridge access – helping to establish Lossiemouth East Beach as a regional centre for beach and sea-related activities.
- The post-Covid surge in "staycations" that is expected; with people spending more time away to compensate for being inactive in 2020 (and probably for much of 2021) and with money to spend that they have saved during the period of reduced holiday, day-trip, and retail spend.

4.5 Value for money

Even before taking into account the factors in 4.4 above that would increase annual impacts from those estimated in 4.2, the difference in annual visitor spend at c£1.5 million in an average year between constructing a new bridge and not having bridge access to the East Beach is considered very good value for money. After 5 years, for example, additional visitor spend in Lossiemouth totalling at least £7.5 million compares with a bridge build plus maintenance cost of less than £1.5 million.

4.6 Physical and social outcomes

4.6.1 Health and wellbeing

Positive aspects of the physical and social environment in which we live that can nurture health and wellbeing include:

- contact with nature in everyday life
- feelings of safety
- the ability to move around places easily and safely on foot or by bike
- a sense of belonging and a sense of control
- thriving communities with an abundance of local businesses and good access to job opportunities

(http://www.healthscotland.scot/health-inequalities/impact-of-social-and-physicalenvironments/place/place-overview)

Without access to the east beach, many local residents, particularly those living in close proximity to the beach, have lost a part of their daily life and routine and access to activities which improve health and wellbeing, including: walking or running along the beach, dog walking, watersports, and wildlife and birdwatching from the beach and the dunes behind the beach.

Although board sport enthusiasts can paddle across the river to access the beach, there are safety risks without direct bridge access as outlined below.

A wider footbridge (3.5metres is planned) would increase the accessibility of the beach to those in wheelchairs and could enable easier transfer of water sports equipment.

4.6.2 Safety risks

Health and safety concerns were raised by survey respondents regarding both the east and west beaches. Without a bridge to the east beach, there is no safe and reliable access for the many watersports enthusiasts, local families and holidaymakers keen to use the beach and water.

Our consultation captured personal accounts of local residents assisting families and young people who have become stranded on the beach after crossing the river between tides.

The Moray Coastal Trail, a popular walking route, relies on a bridge crossing over the river Lossie, and as a result, walkers have also become stranded when walking this route. The alternative route involves an additional 2 mile diversion along a public road with no pavement (https://www.morayways.org.uk/routes/the-moray-coast-trail/).

Without a bridge, there is no land based emergency access to the beach, and one respondent commented that *"there will be a casualty at some point"* – a concern that was reflected by others.

Lack of access to the east beach displaces many to Lossiemouth's west beach which runs parallel to Moray golf course. This has resulted in an increase of visitors crossing the golf course to access the beach, which puts them at risk, particularly during high tide when they are pushed onto dunes and course pathways.

5 Potential Projects Complementary to Replacing the Bridge

The following summarises by category the project/action ideas given by survey respondents and through our telephone interviews. These have been broadly grouped into 9 categories of projects/ideas, and were reviewed at a high level by the project steering group – although more detailed review and wider consultation with community groups will be required.

Ref	Project	Fun (Higl	ding C h, Mec or Low	ost lium)	ا Higl(د	mpact n, Med or Low)	ium	Sup Expi	oport ressed
		Н	М	L	Н	Μ	L	LBA	LCDT
1	Signage and information	✓			✓			✓	✓
2	Development of surrounding area and heritage trails	~			~				✓
3	Additional 'seaside' attractions and equipment	~			~				~
4	Accessible changing facilities	✓				✓			
5	Traffic management and parking	✓			✓				
6	Marketing and promotion		✓		✓			✓	√
7	Events		✓			✓			
8	Support for businesses		✓			✓			
9	Take-away food & drink			✓			✓		

1. Signage and information

- 1.1. Improved signage to Lossiemouth on A96 at Forres and Llanbryde highlighting available facilities
- 1.2. Improved signage in Lossiemouth to all attractions and recreational areas [although this has already been commissioned by the LBA throughout the town as well as paper maps distributed that are available in accommodation properties, cafés/restaurants, etc]
- **1.3.** Tourist information kiosk situated close to the bridge access to provide details of local attractions, accommodation etc

2. Development of the surrounding area and heritage trails

- 2.1. Regeneration of spaces and establishment of new visitor attractions, such as boardwalks/heritage trails/revitalised Station Park
- 2.2. Walking trails through Lossiemouth, including the fishing heritage and surrounding woods
- 2.3. QPR codes scan in any language
- 2.4. Seating areas and benches along the seafront
- 2.5. Viewing points with fixed binoculars for spotting sealife and boats
- 2.6. New jets area for viewing
- 2.7. Colour changing lights on the new bridge

3. Additional 'seaside' attractions and equipment

- 3.1. More tourist services on the beach the wider bridge would make transfer of items over the bridge easier
- 3.2. Hiring of beach wheelchairs, fishing gear, scuba diving gear, floats, surfwear/boards, etc
- 3.3. Increase over 50s visits to Lossiemouth (high spend) with senior play park, indoor wet weather facility for adults/children, toilets; with publications (online/paper) showing walks/wildlife, history
- 3.4. Reinstate the pitch and putt
- 3.5. Beach games
- 3.6. More tourist attractions where station was
- 3.7. Outdoor cinema
- 3.8. Arcade centre
- 3.9. Businesses on seafront selling tourist souvenir items

4. Accessible changing facilities

A safe and user-friendly changing area with toilets would support Friendly Access and SurfABLE Scotland in offering fully adaptive surf therapy through providing watersports and adventure activities to children and adults with disabilities and conditions (physical, hidden, learning, sensory and medical). A similar facility and location in Wales (developed by Surfability UK) has made it possible for growth from 200 participating athletes a year now on track to 500; hosting events with up to 15 wheelchair users in a single day. The facility in Wales has accessible changing rooms, kit drying facilities and kit storage space.

5. Traffic management and parking

- 5.1. Better and more visible parking in the town, especially at the river area
- 5.2. Increase non chargeable parking spaces
- 5.3. Pedestrian friendly seafront with some disabled access spaces. Introduce pedestrian crossing near the memorial
- 5.4. Improve parking facilities at West Beach car park
- 5.5. From Miele's to toilet block could be car parking. If people don't get parked on the promenade they will not go on to the car park; they want to park on the prom with their ice cream

6. Marketing and promotion

- 6.1. YouTube videos and marketing through social media
- 6.2. Make it clear that Lossiemouth is still open for business
- 6.3. Draw everything together and focus on what we have the hidden gems, the lighthouse and caves, to Windswept etc; and market all of what Lossiemouth has to offer
- 6.4. Walking competitions for kids What is in your town?
- 6.5. Promoting Lossiemouth as a destination when walking along the coastal trail that includes the bridge would help increase visitor numbers and encourage them to spend money at overnight accommodation, souvenir shops, and food providers.
- 6.6. Capitalise on visitors to the distillery areas, Baxters, Walkers and Johnstons Mill.
- 6.7. A discount booklet could be produced with local businesses represented for free if they offered a discount on their product. The booklet could be sold for a very small amount,

which would allow all locals and visitors discounted access to many of the attractions of Lossiemouth. This would attract more use of the town's businesses and increase spending overall whilst generating funds from the sale of the discount booklet

6.8. This could be an amazing opportunity for local business to advertise on the bridge. Although this would have to be done extremely tastefully and not take away from the beauty of the bridge itself.

7. Events

- 7.1. One-day events similar to Raft Race, Seafest, Christmas Lights switch-on
- 7.2. A seafood festival celebrating the fishing heritage, including cooking demos from local chefs, food stalls, photo ops with seafood character (e.g. Laurie the Lobster), food competitions, "big beach BBQ" encompassing use of the bridge
- 7.3. Farmers market once a month with a charge for stall holders
- 7.4. Jazz festival

8. Support for businesses

- 8.1. Incentives and investment for pop up shops in empty shop spaces [although empty shops are not currently a problem in the town]
- 8.2. Fishing museum is run by volunteers with variable opening hours. If this was always open on set days, advertised and manned by someone on a full time basis, this would benefit tourist trade

9. Take-away food & drink options

- 9.1. More cafes and restaurants with take-out options
- 9.2. Open air cafe/shops in old bandstand (by old train terminus)
- 9.3. Sell refreshments on the beach, with app-based order and delivery

Potential Funding Sources

Across the above categories of project or activity, there are potentially a very large number of funding sources – sub-regional, regional, and national – and these could increase (or change their focus) through supporting the recovery from negative Covid-related impacts.

Funding Scotland lists funders with a track record of supporting projects in Scotland (from small grants to funding for large capital projects, and is run by the Scottish Council for Voluntary Organisations (SCVO). This is a free online search engine.

Many funding sources favour (or are restricted to) applications from charities.

Once projects have been specified and costed, it is best to apply to as many relevant sources as possible to maximise overall funding.

Potential significant funding sources might include:

- The National Lottery, including Awards for All
- EB Scotland, which distributes money raised through a tax credit scheme (The Scottish Communities Landfill Fund) from money contributed by landfill operators
- Highlands and Islands Enterprise, which can fund a range of project types subject to a robust investment appraisal and budget availability
- Moray Council in particular for traffic management and parking expenditures
- Rural Scotland Infrastructure Fund (VisitScotland), with applications via Local Authorities
- Visit Moray Speyside
- Scottish Marine Environmental Enhancement Fund a new fund to be launched later in 2021
- Crown Estates Scotland Community Capacity Grants Programme and the Crown Estate Fund Grant Aid Scheme operated through Local Authorities
- Funds that will be set up by the UK and/or Scottish Government to replace previous EU funding programmes

6 Respondents Comments

Comments on the impact of the bridge closure included:

Bridge closure and now Covid has already meant that half of our business, the convenience side, has closed. Turnover has been dramatically reduced.

All summer I was speaking to people who came to Lossie to go to the beach and then moved on when they realised that wasn't an option. Although busy I had many customers from previous years who did not return due to the bridge being closed.

Without the east beach we have lost the main reason that a family would choose Lossiemouth for their holiday. The shops on the front complement the beach experience, the accommodation provided in the town allows tourists to stay, but without the beach there is no reason for them to require the other services, and so the town declines. This bridge is key to the success of the town, and with holidays in the UK being very much on the agenda for the next few years, we must act quickly to gain our share of this market. If we don't, we will lose our services and businesses, and a bridge won't be enough to bring these back, so we must act now.

My husband and I have a puppy that we'd love to take to East Beach and get some ice cream from Miele's on the way, but since the bridge is down we've been going to West Beach and not spending any money instead. My husband's parents are less interested in visiting since the East Beach is their favourite Lossie feature and I'm sure there are many other tourists with similar feelings.

Whilst we have another beach, it is not accessible much of the week due to tides. Parking is also a big problem there. The economy of our community is hugely dependent on tourism and tourists love that beach as do locals from all over Moray. They come to the beach from Elgin and buy an ice cream or go for lunch.

Comments relating to a new bridge and retaining the existing bridge as an icon

We believe a high quality bridge in the same position as the existing bridge is the only suitable option that will genuinely benefit the town and wider Moray. A smaller/shorter version as has been mentioned in front of our business may well benefit our business directly but we feel it would be to the detriment of the picturesque town and to some other businesses.

A bridge built simply as a crossing to access the beach is fine but will not protect the local economy; it must be built as a visitor attraction also. Any argument for initial saving on a shorter/position for the bridge in our view could eventually see the spend escalate by way of infrastructure costs and would be short minded also. As it stands we have a beautiful promenade which should remain as the name suggests a walk way and a free space. The promenade, bridge and the higher road of Prospect Terrace running at a parallel are where the beauty of the existing bridge can be appreciated and we believe it is important we try to replicate if not improve this view and promenade. A shorter bridge in a different location would limit the photography of the bridge that many people come for. We should be careful of congestion should the position of the bridge be moved. Where it stands now allows the town to offer space to the locals and visitors alike. A more architectural, funky bridge will bring people.

These days people can search where to visit and it is the picturesque nature of our bridge that will pull extra visitors in their numbers to Lossiemouth for what can be a very short season.

Moray deserves something spectacular, iconic, not just about accessibility but it could be a huge pull factor for Moray. It would be a disgrace to build anything less than what is there at the moment. The bridge, we feel must look as beautiful an attraction as it stands now

Appendix A: Online survey questions

Q1 Please provide your business name

Click here to enter text.

Q2 Please select from the drop down menu below the category that best fits your business: Other - please specify

If retail please specify category (food, clothing etc) Click here to enter text.

If other, please specify Click here to enter text.

Q3 Approximately how far is your business located from the bridge that is to be replaced

Less than 5 minutes walk 5-10 minutes walk 11-15 minutes walk 16-20 minutes walk More than 20 minutes

(Note that the Options Appraisal is considering alternative locations and that value for public money will be a key consideration – although a recent Business Association survey has found a majority preference for keeping the current location)

Q4 Has the absence of a bridge affected your business trade since it closed on 24 July 2019?

Significantly negatively To an extent negatively No impact Positive impact (benefit from visitors focusing on other areas in Lossiemouth without the bridge access)

Q5 Compared with calendar year 2018, how much lower do you think your turnover would be in 2022 without a bridge compared with having a replacement bridge

No measurable difference 1-5% reduction 6-10% reduction 11-20% reduction 21-30% reduction 31-40% reduction 41-50% reduction More than 50% reduction

Q5(a) How much (approx) might this annual turnover reduction be (optional)

- Q6 Without other changes in Lossiemouth (e.g. continuing Covid-related constraints, increased local population, high demand from other markets), might your business, without a replacement bridge:
 - (i) Need to close high risk / medium risk / low risk, but possible
 - (ii) Reduce its opening season or hours, or reduce staffing

Q7 Were you planning before the bridge closure to expand your business?

Yes – plans were developed Had been considering No

Q8 Might a high quality replacement bridge influence your future investment or expansion aspirations?

Yes, fairly definitely Probably Possibly Unlikely

- Q8(a) *(Optional)* Please provide summary details of what your plans might be, and *(optional)* how much increased annual turnover might result
- Q9 Please summarise any ideas you might have on how Lossiemouth might increase visitor spend in the future with a replacement bridge which could require public sector spending or support. This might involve attracting more visitors and/or increasing average visitor spend.
- Q10 Any other comments, or clarifications on the information you have provided above

Appendix B: List of online survey respondents

Serviced accommodation - With catering for residents only Links Lodge Guest House, Stoffield Road Lossiemouth House B&B Royce Clark / Stoffield Ltd / Grampian Furnishers Ltd Serviced accommodation - With catering for non-residents Firth Hotel Stoffield Hotel Un-serviced accommodation Pitgaveny Court holiday let Wickie holiday lets Caravan/motorhome/camping site Lossiemouth Bay Caravan Park Beachview house holiday lets Restaurant/cafe/pub Bridge 45, Salt Cellar, Guidis, Smugglers Harbour Lights The Seafood Restaurant and Grill Takeaway food The Galley Chip shop Retail - Highly geared to visitor trade Miele's of Lossie Retail - Visitor trade of some importance McClintock optical styling boutique Morgans Of Lossiemouth Ltd Moray Trophies Ltd The ResiTore Unique Retail - For visitors and local residents, but visitor trade important Ashers Bakery D&I Tropicals Fabulous Hairdressing/ GHQ barbers James Rizza and Sons my Younger day Spa Supplier to local businesses that serve visitors Dmdotpr Signworks Pascobi Design Windswept Brewing Co. Digital Routes Ltd Recreational - With retail and/or catering sales to visitors New Wave Surf School – surf apparel retail Outift Woray Moray Golf Club Recreational - With outsuch sales to visitors New Wave Surf School – surf apparel retail Outift Woray Moray Golf Club Recreational - With outsuch sales to visitors New Wave Surf School – surf apparel retail Outift Woray Moray Golf Club Recreational - With paster and CBT		
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On the Up Physio, Pilates and CBT	J	Buckley's Newsagent Ltd

Other Lossie taxis Campbell & McConnachie Ltd BeeDeck Balloons Shoreline Motors and Properties Ltd Covesea Lighthouse Community Company Limited (non-profit charity) Vix the Barbers Stuart Mason / Action COACH

Appendix C: List of telephone interview participants

Business Type	Business Name	Description	Walking time		
		_	То	То	
			existing	esplanade	
			bridge		
Serviced accommodation -	Lossiemouth	6 bedroom Bed & Breakfast	4 mins	1 min	
With catering for residents	House B&B				
only					
Serviced accommodation -	Firth Hotel	9 bedroom hotel with restaurant	6 mins	2 min	
with catering for non-	Stotfield Hotel	4 / bedroom hotel with restaurant	15 mins	14 mins	
	Comment	seating 70	50 mins	50	
	Lighthouse	2 and 5 bedroom sen- catering	50 mins	50 mins	
accommodation	Cottages	conages			
	Seatown Cottage	2 bedroom cottage	1 min	5 min	
Caravan/motorhome/	Lossiemouth Bay	Static carayan park with 155	5 mins	10 mins	
camping site	Caravan Park	pitches (4 units available to let)	0 111115	10 11115	
	Silver Sands	1 of 9 Bridge Leisure Parks in	50 mins	50 mins	
	Holiday Park	UK. Next to West Beach, offers			
	, , , , , , , , , , , , , , , , , , ,	static caravans, touring &			
		camping with indoor pool, fitness,			
		restaurant, bar and live			
		entertainment.			
Restaurant/café/pub	Bridge 45, Salt	Family run business of 4 venues:	4 mins	0 min	
	Cellar, Guidis,	Steak & seafood restaurant seats			
	Smuggiers	85, restaurant/ cale seats 70,			
		35 which x gin har seats			
		35. Outdoor seating for 65			
	Harbour Lights	Bistro & Café situated at the	11 mins	7 mins	
	0	marina seating 62 with additional			
		outdoor tables			
	The Seafood	BYOB restaurant and takeaway	6 min	5 mins	
	Restaurant and	with seating for 20			
	Grill				
Retail - Highly geared to	Miele's of Lossie	Long established family run ice	5 min	1 min	
visitor trade	· · ·	cream and convenience store	- ·		
Retail - Visitor trade of	Unique	Ladies clothing and accessories	7 min	3 min	
Some importance	Ashana Daltany	Noim based below, shop	1 min	1 min	
local residents but visitor	Ashers Dakery	Established in 1020's family ice	4 min	1 mm	
trade important	Sons	cream and confectioners	5 111115	0 IIIII	
Supplier to local	Windswent	Brewery with tours visitor centre	22 mins	21 mins	
businesses that serve	Brewing Co.	café/ bar and shop. Located in	22 11113	21 11115	
visitors	Die mig coi	industrial estate close to RAF			
		Lossiemouth			
Recreational - With retail	New Wave Surf	Surf school offering lessons and	2 mins	4 mins	
and/or catering sales to	School	hire of surf and Stand up Paddle			
visitors		boards. Surf hut with changing			
		rooms and board store			
Other	Moray Golf Club	Comprises an old links and new	16 mins	15 mins	
		course with pro shop and			
1		outsourced restaurant seating 40	I		

Appendix D: Telephone interview questions

1. Introduction

- 1.1. Please can you provide me with a background to your business?
- 1.2. Please describe how the closure of the east beach bridge has impacted your business
- 1.3. How important is the east beach to customers/ your business?

2. Customer Information

2.1. In 2018 / typical year what was your approximate split of customer type (Holidaymaker/ Business traveller/ Day tripper/ Local/ Other)?

3. Employees

- 3.1. Number of FTEs
- 3.2. How does this vary over the year?
- 4. Do you have any further ideas you would like to share regarding how Lossiemouth might increase visitor spend in the future with a replacement bridge which could require public sector spending or support. This might involve attracting more visitors and/or increasing average visitor spend.
- 5. Do you have anything else you would like to add?

6. Industry specific questions:

Accommodation

- Capacity and Occupancy in 2018/ typical year
- Number of rooms
- Maximum bed space capacity
- Did bridge closure affect occupancy levels in 2018? If so, to what extent? How do you think occupancy in 2022 would be with/without bridge?
- How does occupancy typically vary by season?
- Do holidaymakers use Lossiemouth as a base to explore or stay in the town?

Catering

- Restaurant capacity and covers
- Max covers/seating capacity
- Average weekly covers
- Number of sittings if applicable
- Variation by season

Appendix E: Lossiemouth accommodation detailed overview

[separately available]

Appendix B – Option Appraisal



Lossiemouth East Beach Bridge Replacement BB2020



Options Report For Moray Council Date: December 2020



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1 Introduction

The existing footbridge connecting the town of Lossiemouth to the east beach has been closed since August 2019 and Moray Council has agreed to deliver a new crossing for the town and its communities. To deliver this footbridge, Moray Council has awarded a single contract to design and build the replacement, and this has been split into two stages. The first stage is to comprise of feasibility and preliminary design work in order to secure funding from Scottish Government and obtain the relevant statutory consents. Beaver Bridges have been awarded this contract following a competitive tender process.

The existing bridge was constructed in circa 1918 at its current position (grid ref. NJ 23775 70453) and has been in operation up until its closure in 2019. The closure notice issued by Moray Council at the time can be found in appendix F. The bridge is a multi-span steel through truss, supported on timber piled piers. The deck consists of timber planks spanning the narrow width of the bridge and the parapet is of simple mesh infill. Between 1913 and 1915 there was a bridge located at the projection of the Esplanade, serving as access to the beach. There are several theories to why the bridge was relocated but unfortunately these cannot be substantiated. The existing bridge is believed to contain elements of the 1913 structure as can be evidenced by comparing historic photography. It is understood to have been constructed by the Elgin Harbour Board who no longer exist. Consequently, the bridge is currently considered ownerless, but this is being investigated by Moray Council.

Beaver Bridges have started the process of investigating the feasibility of providing a replacement crossing by presentation of this options report. Initially two locations were to be investigated for potential crossing points, one local to the existing bridge and one at the location of the 1913 bridge on the Esplanade. An additional third location is also presented as a viable option; this starts at Seatown Road adjacent to the public conveniences and lands local to the 1913 bridge. Various consultations and studies have taken place to inform the options design and appraisal process, these are presented in the following sub sections.



Figure 1 – Location Plan



1.1 Consultations and Requirements

Parties to be consulted in relation to this scheme and engagement thus far:

1.1.1 Moray Council

Employer for the scheme and eventual owner of the completed structure. Also covers the local consent process including but not limited to Planning and Highways Technical Approval.

Project Managers

Moray Council Consultancy Services are fulfilling the role of client's project manager. They have been consulted at regular intervals throughout project and have offered valuable input on a number of items.

Planning Officer

Consulted for preliminary comment on the options to understand any likely planning issues.

Transport Development

Consulted to understand potential traffic and user interface issues at the proposed bridge locations. Also advised on mitigation to facilitate each option.

Technical Approval Authority

Consulted on technical matters, compliance of regulations and departures from standards.

Access Officer

The existing bridge forms part of a core path hence consultation required.

1.1.2 The Scottish Government

A business case (produced by Moray Council) including this options report will be submitted to Scottish Government for the purpose of securing funding to construct the proposed bridge.

1.1.3 Lossiemouth East Beach Bridge Replacement Steering Group

A group set up by Moray Council consisting of key local organisations that represent the local population. The group has been established to ensure the expectations of the local community are considered during the development of the replacement bridge scheme. They will also be utilised as a line of communication between the community and project team. The organisations involved are as follows:

Lossiemouth Community Development Trust

A registered charitable organisation which aims to represent and promote plans for residents and tourism in Lossiemouth. A Key driver for the replacement of the footbridge and also responsible for gaining funding in partnership with Highlands and Islands Enterprise for stages proceeding and including the options phase.

Lossiemouth Community Council

A community participation body that has a statutory right to be consulted on planning and licensing applications as elected representatives of the local population.



Lossiemouth Business Association

An organisation representing local business members.

Highlands and Islands Enterprise

A Scottish government development agency responsible for economic and community development for the north and west of Scotland. A partner for gaining funding for the initial stages of the scheme.

An introductory meeting was held with the steering group and Moray Council on November 3rd 2020, where progress was communicated and thoughts and desires discussed. A key action from the meeting was for the steering group to issue a survey to the community asking for a preferred location for the bridge. A similar survey had been completed previously but it was thought best to restart the process to coincide with the current options appraisal. The survey was conducted online via SurveyMonkey and by paper submission to be as inclusive as possible. Three options were presented to gauge opinion with an opportunity to include comment, these were for a replacement in the present position, a new bridge from the Esplanade, and an option for those 'on the fence' who would just like the facility of a bridge regardless of position.

The results of the survey were compiled on November 14th following a suitable consultation period. The total number of votes represents an approximate turnout of 17% for Lossiemouth, assuming a population of 7870. This is the most current available figure and was obtained from the National Records of Scotland data set 'Mid-2016 Population Estimates for Settlements and Localities in Scotland'. The results of the survey are provided below:

Location	Number of Votes	Percentage of Votes
Replacement bridge in present position	550	56.6%
Replacement bridge from the Esplanade	217	22.3%
I don't care. I just want a bridge	205	21.1%
Total	972	

Table 1 - Online Survey

Table 2 - Paper Survey

Location	Number of Votes	Percentage of Votes
Replacement bridge in present position	296	78.7%
Replacement bridge from the Esplanade	44	11.7%
I don't care. I just want a bridge	36	9.6%
Total	376	

Table 3 - Combined Survey (Online & Paper)

Location	Number of Votes	Percentage of Votes
Replacement bridge in present position	846	62.7%
Replacement bridge from the Esplanade	261	19.4%
I don't care. I just want a bridge	241	17.9%
Total	1348	



A total of 324 anonymous comments accompanied the online survey which have been reviewed and summarised for consideration in the development of potential options. The full list of comments has been redacted to remove any suggestion of identity and can be found in appendix G. The common issues raised are listed below:

• Increased traffic

Predicted increase in traffic along Clifton Road if the bridge were to be located at the Esplanade.

• Parking

Increase in walking distance from East Beach Car Park to the Esplanade location compared to the existing bridge. Also concerns that increased on street parking could cause further traffic issues on Clifton Road.

• Increase in pedestrians at the Esplanade

Increase in foot traffic at the Esplanade could impact on public safety. This increase was also considered an opportunity for business on Clifton Road.

• Access for all

The proposed bridge should accommodate access for all with sufficient width to allow free passage. The current bridge is noted as being narrow.

• Access to amenities

Locating the bridge at the Esplande brings together the amenities of Clifton Road with the beach.

• Exposure

Concern there would be an increase in weather and wave actions if the bridge is located at the Esplanade.

• Heritage

The existing bridge and its location are considered aesthetically important as an iconic part of Lossiemouth's heritage.

• Anti-social behaviour

Concerns about vandalism and thrill seekers using the structure to jump from into the water. Concern that the Esplanade location poses more risk to jumpers due to currents and waves.

1.1.4 Crown Estate Scotland

Manages land and property owned by the Monarch in right of the Crown. This includes the foreshore and seabed local to east beach.

According to the records of CES, the seabed below mean low water mark of spring tides at this location, which will be affected by the works, is Crown property under the management of CES.

Consent was required from CES to undertake ground investigations to inform the options appraisal. This consent was for a 4-month period starting from the 19th October 2020. Further licensing and consent will be required to construct the bridge, this will be gained through a marine works (general) application upon delivery of a finalised layout.

CES will still be consulted as part of the formal planning process.



1.1.5 Scottish Environment Protection Agency (SEPA) Environmental regulator and national flood forecasting organisation.

The construction will be below the National Tidal Limit (NTL) hence it is understood that no authorisation or licensing will be required from SEPA for the works. The SEPA document 'The Water Environment (Controlled Activities) (Scotland) Regulations 2011 – A Practical Guide Ver. 8.4' states 'Engineering works in coastal and transitional waters are not regulated by SEPA under the Controlled Activities Regulations (CAR), but by Marine Scotland'.

SEPA are a statutory consultee in the planning system hence will be engaged as part of the formal planning process.

1.1.6 NatureScot (Formerly Scottish Natural Heritage) *Scotland's nature agency.*

Consultation of SiteLink and Magic Map shows no areas of interest within the proposed scheme boundary although the seas around Lossiemouth form part of the following protected areas:

- Moray Firth Special Area of Conservation (SAC)
- Moray Firth Special Protection Area (SPA)

The SAC is designated for its bottlenose dolphin population and subtidal sandbanks whilst the SPA is designated for a number of bird species.

NatureScot have been consulted and have provided information on local protected areas, species and access. The main points of note from the correspondence are:

'Any bridge works at the site of the existing bridge or the previous bridge site will have to be carried out to the satisfaction of SEPA [sic*]. This will ensure that there is no adverse impact on water quality. Subject to there being no adverse effect on water quality, my advice is that no qualifying interest of the SAC or pSPA will be affected either directly or indirectly'.

'The River Lossie is used by otters but it is unlikely that they will rest up local to the sites of the existing and previous bridges, given the amount of human (and dog) activity. Nonetheless, it may be prudent to establish if there is any use of the immediate area by otters or any other protected species which may be affected by proposed works.'

We are supportive of the intention to make public access to Lossie East Beach as inclusive to as many user groups as possible'.

NatureScot will be consulted as part of the formal planning process.

* Engineering works in coastal and transitional waters are not regulated by SEPA under CAR, but by Marine Scotland.



1.1.7 Marine Scotland

Responsible for the licensing of marine activities to protect the marine environment.

A marine license will be required as the proposed bridge is to be constructed in/over the marine environment. In addition, Marine Scotland – Licensing Operations Team (MS-LOT) is of the opinion that the marine activity is of a class or description prescribed in Regulation 4 (c) of The Marine Licensing (Pre-Application Consultation) (Scotland) Regulations 2013 ("the Regulations") and as such will require pre-application consultation. The pre-application consultation is similar to that involved in a typical planning application and requires a number of elements to be satisfied. These include notification to stakeholders of the intention to apply for a marine license including a published notice within a local newspaper, holding at least one consultation event, and finally producing a pre-application consultation report. MS-LOT have confirmed that the pre-application consultation can be encompassed within the planning consultation if their requirements are met.

1.1.8 Historic Environment Scotland

Public body responsible for the care of and promotion of Scotland's historic environment.

Consultation of PastMAP reveals the area local to the scheme has a Historic Environment Record reference NJ27SW0011, relating to Lossiemouth Old Harbour. There are also Canmore records relating to the Promenade, Quay, existing footbridge, and a maritime listing documenting shipwrecks. There are several listed buildings in the locality including the masonry bridge crossing the outfall of the Spynie Canal.

Lossiemouth is not a Conservation Area and the coastal waters where the works will take place is not a Historic Marine Protected Area. A HES representative has verbally confirmed that there are no particular items of interest within the area of the scheme, hence no objection or restrictions.

HES will only be consulted as part of the formal planning process if the Planning Authority deem it necessary.

1.1.9 The Findhorn, Nairn and Lossie Fisheries Trust

A registered charitable organisation that promotes sustainable management of river resources and fish populations through research, restoration and education.

The Fisheries Trust will be consulted at planning and detailed design stage to seek views on construction practice and potential effect of the permanent works on migratory fish.

1.1.10 Existing Utilities

A Statutory Undertakers search was conducted by Moray Council and the findings included within the works information. An interpretive drawing can be found in Appendix A and the returns are as follows:

- Openreach No apparatus within the immediate vicinity
- SGN (Gas) Medium and low-pressure gas supply is indicated within road opposite the existing bridge approach.



- SSE (Electric) Buried cable indicated within road opposite the existing bridge approach.
- Scottish Water Water main indicated within road opposite the existing bridge approach. Stormwater outfall indicated to the east of the esplanade projection. Storm sewer runs parallel with harbour wall to outfall.

1.1.11 Proposed Utilities

It is not planned to incorporate any utilities into or onto the proposed structure.

The provision for any illumination on the bridge will be considered at detailed design.

1.1.12 Health and Safety

Under Construction Design and Management regulations 2015 Moray Council will take on the role of the Client, whilst the Contractor will be expected to take on the roles of Designer/Principal Designer and Principal Contractor. The Contractor will be appointed at Stage 2 of the project.

1.2 Geology

The Ground Investigation report can be found in appendix B and is summarised as follows.

The exploratory excavations encountered the following geological profile, in order of superposition:

- Made Ground (Land side only) to depths of 0.8m to 0.9m from ground level.
- Marine Beach Deposits (Beach side only) from ground level to termination depth of 5.1m.
- Storm Beach Deposits (Land side only) from underside of made ground to 6.50m at the Esplanade position and 9.65m to the south of the existing bridge.
- Burghead Sandstone Formation (Land side only) from 6.5m at the Esplanade position.

The naturally deposited Marine Beach Deposits and Storm Beach Deposits are theoretically capable of supporting the proposed bridge structures on ground bearing foundations at a reasonably shallow depth. However, forming excavations on the beach and within the river channel would involve significant temporary works to keep out the tidal waters. Additionally, a large mass of concrete within the flow of water presents a heightened scour risk, something that would require significant consideration at detailed design. To alleviate these risks a piled solution that also incorporates the role of the in-channel piers would be more practical and beneficial, particularly for long term stability.

The exact piling method will be determined at detailed design stage when all the loading conditions are better understood.



1.3 Hydrology

The combined Hydrology and Flood Risk Assessments can be found in appendix C and are concluded as follows:

'This preliminary flood risk assessment has demonstrated a range of events which could be used to assess flood risk to the proposed footbridges. These water levels combine both fluvial and coastal flooding for a number of events with differing likelihood. A fully comprehensive FRA would be needed to identify which values are to be used at detailed design stage, however, it is believed that the existing bridge location would be the preferential location when considering flood risk. As the design is for a footbridge there will be no change to flood risk from surface or ground water and although the bridge will cross the River Lossie, due to the location of the design and fact there is an existing bridge in its location, it is not expected to have any differing effects on fluvial or coastal flood risk.'

This conclusion offers the theoretical best location for the bridge with reference to two key points, these being the effects of wave action and water velocities. The Esplanade location is more exposed to the sea and is positioned over a narrower section of the river so inherently will see the worst of these two factors. For example, the maximum velocity at low tide and 200 year + climate change fluvial event (critical condition) is 1.10 m/s at the existing bridge and 2.50 m/s at the proposed Esplanade bridge location. The difference in these velocities should not draw particular favour to one option as the upper value can be suitably accommodated with considered design.

The FRA also provides a maximum flood level of 4.24m Above Ordnance Datum (mAOD) which is attributed to the '200-year Return Period tidal/storm Still Water Level plus climate uplift' flood condition, see figure 2 for extents. The advice within the report is that the soffit of the bridge should be above this level plus the SEPA recommended freeboard of 600mm, this equates to a clear height of 4.84mAOD. To position the soffit above this level would require the use of long approach ramps to maintain accessibility, increasing cost and the overall footprint of the bridge. In addition, this specific event would flood the whole low level lying area of Lossiemouth, hence the structure would be an insignificant factor overall and is highly unlikely to hinder any receding flow. For robustness, the bridge and its supports will be designed to resist this event, but for the purpose of clearance to the soffit of the main river channel, it is proposed to adopt a more pragmatic approach. The '200-year Return Period fluvial plus 37% climate change plus High Astronomical Tide plus climate change' flood condition will be proposed in this instance as the 2nd highest but more likely flood event. This gives a level of 3.55mAOD as a worst case at the existing location, and with a 600mm freeboard gives a soffit clearance of 4.15mAOD. For reference, the soffit of height of the existing bridge over the main channel is approximately 4.00mAOD.

The proposed clearance and alignment of the chosen bridge will need to be agreed with Marine Scotland and additionally SEPA if required.





Figure 2 - 200-year Return Period tidal/storm Still Water Level plus climate uplift' flood condition (4.24mAOD)

A sediment movement study has also been conducted as part of the works and can be found in appendix D It is concluded as follows:

'In addition to the potential influence of fluvial scour in undermining the bridge piers, sand accumulation (overloading) has likely been an active factor in the River Lossie outlet as whole. However, overall, in evaluating the dynamic nature of both the dunes and riverbed within the area of the proposed footbridge relocation (Esplanade), there appears to be a lower risk of failure due to sediment dynamics at the site of the existing footbridge than the alternative one. This conclusion is based on apparently lower rates of channel migration and a wider channel that appears to facilitate broader rather than more focused scour associated with tidal fluctuations.'

As per the FRA conclusion, this preference for location should not rule out the other but the findings must be considered in the design and weighed up against all other factors when choosing a location.


1.4 Environment

1.4.1 Ecology and Habitat

A Preliminary Ecological Appraisal (PEA) survey has been conducted and can be found in appendix E. The report concludes as follows:

The proposed works are in an area which has significant human disturbance. The dune and saltmarsh grasslands are an important habitat, and damage to these areas should be kept to a minimum. A range of bird species use the area but are relatively unlikely to nest close to the bridge. However, any disturbance of breeding should be avoided by either timing the works out with the breeding season or checking the ground prior to commencing work.

Constraints culminating from the PEA:

- Efforts should be made to limit the footprint of the proposed footbridge works within the saltmarsh and dune habitats.
- To avoid disturbance to traveling Otter, works local to the river should not take place during the hours of darkness.
- Any works that could cause entrapment (trenches, pipes etc.) should be covered or have an allowance for escape.
- Construction should avoid the main bird breeding season (Feb July). However, if this is not possible, the site should be checked for the presence of nesting birds before works commence.
- If piling is to be conducted a risk assessment should be undertaken to understand the potential disturbance to fish and marine mammals.
- During construction, work should stop if seals come close to the site or start to use it to haul out. Work should only resume once the seal has left the area, to avoid any risk of accidental injury.

A Habitats Regulations Appraisal (HRA) should be conducted for any projects which affect Natura sites, such as Special Areas of Conservation (SAC), or Special Protection Areas (SPA). The project is not within a Natura site but is local to both the Moray Firth SAC and SPA. The Moray Firth SAC is designated for its subtidal sandbanks and bottlenose dolphins and the SPA for its bird species hence it is unlikely that a link can be formed between the proposal and those specific features. Therefore, it is assumed a HRA is not required but this could change should a piling assessment show there is potential for disturbing any dolphins in the area.

To summarise, the environmental constraints do not appear overly onerous and neither do they warrant favour of a particular location for the proposed footbridge.

1.4.2 Contamination

The Ground Investigation Report as found in appendix B contains a preliminary evaluation of potential chemical and gaseous contamination of the site with a corresponding risk assessment in relation to contamination. The results of this risk assessment conclude that the existing site possess a negligible to low risk to all identified receptors.



1.5 Land and Property

Moray Council are currently investigating land ownership within the immediate area of the proposed crossing locations. They are also trying to determine the ownership of the existing bridge. No pertinent issues are envisaged. Full details of the findings will follow.



2 Options

The following section presents options and supporting information for the provision of a pedestrian crossing from the mainland of Lossiemouth over the tidal River Lossie and onto East Beach.

A total of five options are documented in section 2.1, this includes the standard 'do nothing' and 'do minimum' scenarios. The other three options provide alternate locations for a replacement bridge.

Section 2.3 is allocated to the investigation into bridging materials and finishes with a focus on durability. This has been separated from the preceding section to highlight the importance of selecting suitable materials, it also allows the opportunity to present sub-alternatives for each location.

Section 2.4 provides capital and whole life costing for all option derivatives (location + material/finish) to assist the reader in understanding the monetary pros and cons for each.

The ensuing subsections provide further collective information relating to each option, including design, risks, and operation.

The options are compared and concluded in section 3.

2.1 General Option Descriptions

2.1.1 Option 1 – Do-nothing

Under the do-nothing scenario the existing bridge would be left as is, closed to access and allowed to deteriorate at an ongoing rate. The public would continue to have no direct link to East Beach, potentially impacting the local economy and wellness of the community through loss of a vital outdoor asset.

In the short term it is envisaged that the superstructure will progressively collapse, causing disruption of flow and potential contamination (risk of lead-based paint on steelwork) to the water below.

The safety risk will also continue to evolve, and it is likely further measures will be required to restrict access on and below the structure to avoid any potential harm to the public. Deteriorating, seemingly abandoned assets can also attract unwanted attention and become a magnet for antisocial behaviour.

Without a usable footbridge it is possible that the reduction in human footfall will allow for improvement of the natural habitat, and in turn increasing the diversity of species frequenting East Beach. Given time this positive could become a major constraint to any future crossing.

All the above points should be considered concurrent with the issue of unknown ownership and the subsequent liability should problems arise going forward.



Positives	Negatives	
Zero capital cost to Moray Council	The deteriorating structure presents a safety	
	risk and will become a visual eyesore	
Less human disturbance on East Beach	Impact on local economy through loss of	
resulting in a potential ecological benefit	major attraction	
	Impact on wellness of local community	
	through loss of access to a valued outdoor	
	asset	
	Disturbance of river flow should the	
	structure collapse	
	Unknown ownership	

Table 4 – Option 1 Considerations

2.1.2 Option 2 – Do-minimum

Considering the points raised in the do-nothing option, the do-minimum scenario would need to address the issues that the existing bridge presents.

Unfortunately, the option of refurbishing the existing superstructure is clearly not feasible. The majority of steel members appear to have significant section loss with several areas where sections are missing in their entirety.

The existing wooden piled piers appear to be in good condition for their age and the option for their use to support a new superstructure could be considered. A key consideration for the reuse of the existing piles is that the proposed replacement superstructure should not impose loadings that the substructure and its foundations were not originally designed for. To achieve this, the replacement superstructure would be limited to the footprint and self-weight of the existing structure as not to impart any additional or destabilising loads. The existing bridge is approximately 1.2 metres wide between parapets and 120 metres long.

The 100-year plus age of the substructure does raise some concern as it is likely the remaining working life is shorter than would be desired. Taking this into account it would be prudent to design the superstructure with consideration to the reconstruction of the substructure at a later date. This would require the temporary removal of the superstructure, demolition of the existing substructure and subsequent reconstruction to allow replacement of the bridge.

Positives	Negatives
Crossing to East Beach reinstated	Remaining life of substructure unknown
lower capital cost in relation to complete	Short term solution, theoretical whole life
replacement	cost will be high
Heritage retained	The bridge would continue to be narrow,
	constrained by the existing substructure
	Ownership of the existing bridge would need
	to be transferred to Moray Council, potential
	to be a protracted process

Table 5 – Option 2 Considerations



Bridge Replacement Options

Options 3 to 5 below give differing positions for replacement structures, documenting how each one will be achieved. Options 3 and 4 have been taken forward from the pretender proposals issued by Moray Council. Option 5 has been considered as an alternative. The following points are applicable to all the options and have been included in this prefacing section to avoid repeat text.

- All superstructures would be set a suitable distance above High Astronomical Tide (HAT) level in their entirety to ensure they are not regularly submerged.
- The span(s) over the main river channel will be positioned clear above the flood level with the approach spans set at a maximum gradient of 1 in 20 to facilitate ease of access for all.
- Where necessary to lift the superstructure out of HAT level, an approach structure with compliant gradient will be incorporated on the land side.
- Where future flood defences are considered it is proposed that flood gates are provided at the bridge access as opposed to setting the approach height above the level of flood. This negates the need for lengthy ramps to navigate over the defence infrastructure.
- At the beach approach a concrete abutment and ramp is proposed, set well into the ground with an
 allowance for erosion and shifting of the sands. The front face of the buried ramp will be formed in
 steps as to allow continued access should the local area erode considerably. The structure would be
 protected from scour by rock armour with the addition of native planting if feasible. It is proposed to
 investigate the use of a sand-coloured pigment within the surface of that the ramp to allow it to
 blend in with the surroundings.
- Where a structural steel superstructure is preferred, an FRP deck board system will be proposed to allow for free draining and increased durability overall.
- Where FRP or Aluminium superstructures are preferred they will incorporate decking systems manufactured in a similar material.
- Overall clear width on the bridge deck will be 3.5m.
- Minimum parapet height will be 1.4m.

2.1.3 Option 3 – New Bridge Local to the Existing

See Drawings BB2020-GA-001, BB2020-RV-001 & BB2020-TR-001 in Appendix A for the proposed General Arrangement, rendered conceptual views and public network connectivity proposal.

The position for a bridge at this location is constrained by existing structure. The optimal position to land on the beach is between the two established dunes where the existing structure lies. Some minor adjustment to the western dune may be required to facilitate the abutment and ramp construction, and to also prevent it from being encompassed in sand. A number of positions have been investigated on church street and it is proposed to land the structure local to the Spynie Canal bridge (grid ref. NJ 23721 70424) to take advantage of the current public paved area and shorter distance to the East Beach carpark, this is approximately 30m to the northwest of the existing bridge. Between these points the proposed bridge would approximately be made up of 5 separate 29m spans equating to a total length of 145m.

Considering the length of the individual spans it would be wise to adopt half through truss forms similar to that of the existing bridge, owing to their inherent structural efficiency. Above 20 metres in span a simple



underslung steel beam arrangement starts to become uneconomical and presents issues with clearance given the increasing depth of beams required to support the loading. A half through truss allows the user to traverse in between the main structural elements as opposed to above, this results in a shallow overall deck depth meaning less elevation is required to clear obstacles. Using a truss form would provide a replacement bridge that is sympathetic to the existing structure but with the betterment that current bridge standards bring.

Hydrology in this area is favourable which is clear to see given how long the existing structure has stood (+100 years). The proposed structure would have a vastly reduced number of supports in the water so an improvement over existing.

As this position is local to the existing there should be no greater impact on the locality through traffic or pedestrian movements than there would have been pre-closure of the existing bridge. It is noted that the existing footpath in this location is not particularly wide at approximately 1.4m to 1.6m in width, so a reduced distance from the car park and other amenities is favourable. For reference, the Transport Scotland document Roads for All – Good Practice Guide for Roads stipulates '*The minimum width of a footway is to be 2000 millimetres in normal circumstances, since this width allows two wheelchair users to pass*'.

This location presents difficulties with construction as access is served from one direction only and the limited space for a works area would likely result in issues for residents east of the Spynie Canal Bridge. Sea defences are also likely to be compromised during the works hence temporary measures would be required.



Figure 3 – Option 3 – View from Church Street



Table 6 – Option 3 Considerations

Positives	Negatives
The provision of a new bridge structure with	Longest overall span of the 3 potential
a 120-year design life.	replacement bridge locations, hence
	greatest capital and whole life costs.
There is likely to be no impact to the existing	The existing footway to the bridge from the
traffic and pedestrian movements as the	East Beach carpark is narrow.
bridge remains in a similar locality to the	
existing.	
Comparable overall appearance to the	Constrained works area off church street,
existing structure.	disturbance to local residents is likely to be
	unavoidable during construction.
The existing bridge has survived over 100	Sea defences will be compromised during
years in this location, likely owing to the	the works hence temporary measures will be
shelter from the dunes and favourable	required.
hydrology.	
	The location appears disconnected from
	local amenities.

2.1.4 Option 4 – New Bridge at the Esplanade

See Drawings BB2020-GA-002, BB2020-RV-002 & BB2020-TR-002 in Appendix A for the proposed General Arrangement, rendered conceptual views and public network connectivity proposal.

The historic projection from the sea wall at the Esplanade (grid ref. NJ 23725 70637) provides a theoretical ideal location to cross from the mainland to East Beach as the river channel is at its narrowest point. Positioning the bridge more local to the amenities of Clifton Road can present opportunities to both business and users, enabling people more ready access to shops and café's when visiting the beach. The location also offers greater scope for incorporating the bridge into a wider public realm improvement scheme, but this and its potential benefits are something that would have to be explored separately.

The bridge would project from an increased level at the Esplanade over to the beach in an envisaged 4 spans totalling an approximate 75m length. The approach spans would rise at 1 in 20 to meet an arched span over the main river channel, clearing the required flood soffit height as required.

At this location it is felt that a steel beam/plate girder type bridge would suit best for a number of complimentary reasons. Firstly, the distance to the proposed supports allows for an economic solution to this style of bridge, particularly if designed as continuous across the supports. The underslung superstructure allows for a clean looking deck on which an aesthetic parapet can be incorporated. As an addition and safety betterment to the Esplanade area, matching parapets could be placed on the edge of the sea wall to tie in with the bridge. To expand upon the parapets design, it is proposed to adopt a backward raking post (to prevent climbing) and horizontal tension wire system to allow flood water to flow through at peak flood events. Should a storm event damage the tensioned wires within the parapet, these can be easily replaced at reasonable cost in comparison to more rigid parapet systems. For clarity, a truss form has not been considered at this locality as a beam style bridge is more favourable for several reasons as discussed above.



Hydrology in this area is less favourable than in the existing position. Flood levels are very marginally reduced but peak water velocities are over twice as high due to the constriction of the channel. It is envisaged that the proposed bridge form will help alleviate these issues by better allowing water to flow through the structure at high flood because of its relatively small cross-sectional area. Sediment movement is predicted to be more active in this location, but this can be accounted for through considered foundation design.

There are concerns that moving the crossing to this location would focus a large amount of activity into one area of Lossiemouth, creating traffic and pedestrian safety issues. Moray Council traffic engineering team have been contacted for advice on how best to facilitate the bridge at this position and their recommendations have been included in drawing BB2020-TR-002.



Figure 4 – Option 4 – View from The Esplanade



Table 7 – Option 4 Considerations

Positives	Negatives
The provision of a new bridge structure with	The location is more exposed to the sea, and
a 120-year design life.	the river channel is constricted hence less
	favourable hydrology.
Shortest overall span of the 3 potential	Potential for increased traffic and pedestrian
replacement bridge locations, hence lowest	safety issues as Lossiemouth's attractions
capital and whole life costs.	will be focused more to one area.
Potential economic and social benefit as	Greater distance from East Beach carpark for
located closer to amenities. Better	pedestrians to walk compared to existing.
integration into the wider public realm.	
The shorter individual spans allow the use of	The seawall in this area is noted to be in poor
an underslung structure providing a more	condition.
open and pleasurable bridge crossing.	

2.1.5 Option 5 – New Bridge at Seatown Road

See Drawings BB2020-GA-003, BB2020-RV-003 & BB2020-TR-003 in Appendix A for the proposed General Arrangement, rendered conceptual views and public network connectivity proposal.

As an alternative to the bridge locations suggested at tender stage, a position between the two was investigated in an effort to balance the pros and cons of each. Positioning the bridge at the Esplanade has its benefits but there are clearly some public concerns that have already been covered in option 4. The proposed bridge local to the existing is long and set some distance away from the main amenities but again there are also positives to its location.

The proposed alignment from this location starts 25m to the northeast of the public conveniences on Seatown Road (grid ref. NJ 23669 70566) just above the sea wall and continues to the beach over an approximate total distance of 100m, made up of 3 separate spans. This location is 90m southwest of the Esplanade option and 140m to the north of the existing option. The position balances access to the frontage of Clifton Road without directly causing further traffic issues. It is a short distance to the public conveniences and the existing Lossiemouth East Beach carpark, the latter being a key concern raised in the public survey. The area in which the bridge starts is a sizable public space which could be altered locally to improve tie-in with the public footpath and road networks.

Given the length of the individual spans it would be prudent to adopt truss forms to keep the option within a sensible budget. Although this location is some distance away from the existing bridge, its alignment is of similar vein and could potentially offer a sympathetic replacement for the locally admired bridge. The reduced overall span may also make more costly durable material options more economically viable in comparison to the existing alignment. A beam bridge similar to that proposed at the Esplanade could be proposed but this would require additional supports within the channel, increasing cost as a result.

The hydrology assessments and FRA do not focus on this area as it was not originally intended to investigate a bridge in this location, so flow velocities and sediment activity can only be predicted. Given that the channel is wider at this point and there is slightly more protection from the effects of the sea, it would be sensible to assume more favourable hydrological conditions in relation to the Esplanade option.





Figure 5 – Option 5 – View from Seatown Road

Table 8 – Option 5 Considerations

Positives	Negatives
The provision of a new bridge structure with	A bridge has not been sited in this location
a 120-year design life.	before so may present planning issues.
A middle ground of the 3 replacement	Not the most cost-effective option.
options in many respects.	
Lands in an open existing area adjacent to	
public conveniences.	



2.2 Durability/Design Life

The primary structure for options 3 to 5 and the superstructure only for option 2 would be design working life category 5 (typically > 120 years) in accordance with table 7.1of CD 350.

The following replaceable/maintainable parts will be design working life category 2 (up to 50 years):

- Bearings
- Parapets
- Decking system
- Protective coatings

The remaining working life for the existing footbridge sub-structure as utilised in option 2 cannot be quantified at this stage. As a high-level assumption, 10 years remaining service has been considered.

2.2.1 Superstructure Materials

The following gives a non-exhaustive list of pro's and con's for typical bridging materials which would be applicable to options 2 to 5:

- Weathering Steel (Corten)
 - Forms a protective rust 'patina', that inhibits corrosion and hence does not require additional protective coatings. 120-year design life achievable without major maintenance.
 - Similar properties to ordinary structural steel.
 - Off-site construction.
 - Requires careful detaining to prevent areas of accelerated corrosion and unwanted staining.
 - Not suitable where in contact with chlorides e.g., salt spray and seawater contact.
 - Patina can be affected by human contact.
 - Removal of graffiti very difficult.
 - Availability of Hot Rolled Sections limited within the UK.
 - Easily recyclable.
- Structural Steel
 - Commonly used for footbridges within the UK.
 - Requires a maintainable protective coating to prevent corrosion. Several systems available with a typical life of up to 25 years to re-coat.
 - 120-year design life achievable if protective coating is maintained.
 - Strong, ductile, and durable.
 - High quality off-site construction.
 - \circ $\;$ Considered detailing required to prevent water ponding.
 - \circ Cost effective.
 - Easily recyclable.



- Aluminium
 - Corrosion resistant. Does not require a protective coating but does form an undesirable patina over time. 120-year design life achievable without major maintenance.
 - Coating required for decorative purposes.
 - Lightweight.
 - Lower strength properties in comparison to structural steel.
 - Careful detailing of connections and fixings to avoid galvanic corrosion.
 - Non typical highway bridge construction material in the UK.
 - High initial cost.
 - Off-site construction.
 - Easily recyclable.
- Fibre Reinforced Plastic (FRP)
 - Durable, does not corrode as per traditional structural steel.
 - Assumed to achieve a 120-year design life but there is limited historical performance data.
 - High strength to weight ratio.
 - Requires a maintainable coating to protect it from UV degradation, weathering, and water ingress.
 - Low shear strength.
 - Requires careful detailing of connections.
 - High initial cost.
 - Off-site construction.
 - Pultruded and moulded options, the latter being custom at a time and cost increase.
 - Difficult to recycle.
- Timber (Hardwood)
 - \circ Low maintenance if specified suitably but required design life is unachievable.
 - Organic appearance.
 - Sustainable if sourced correctly (genuine FSC certification).
 - Requires careful detailing of connections.
 - Off-site construction.
 - Non typical highway bridge construction material in the UK.
 - Easily recyclable.
- Reinforced Concrete
 - Durable when detailed and specified correctly.
 - o 120-year design life achievable but questionable in marine environment.
 - Use in composite construction e.g., steel beams and concrete deck.
 - Flexibility of form.
 - Heavy in comparison to other materials. More substantial superstructure.
 - In-situ construction phase can be lengthy.
 - High volume of wet works over water not ideal e.g., environmental hazard.
 - Recyclable.



- Stainless Steel
 - Proven durability (when specified to suit the environment).
 - Very high cost.
 - Non typical highway bridge construction material in the UK.
 - Typically used for aesthetic purpose and in areas of high wear e.g., handrails.
 - Recyclable.

Based upon the preceding points there are three clear materials which should be considered for construction at this location, Structural Steel, Aluminium and FRP.

Structural Steel is very typical in footbridge construction and with considered detailing and surface protection can deliver both an aesthetically desirable and durable structure. Its long-term durability is questionable in a marine environment, but its comparable low capital cost allows for more balanced view towards the whole life cost. Additionally, steel offers more aesthetic options in comparison to FRP and Aluminium which within budget constraints are likely to be based on pultruded and extruded modular forms.

Aluminium is commonly used in marine environments owning to its corrosion resistance and can be typically seen used in gangway construction at ports and marinas. It is not a commonly found material in UK bridging so it can be difficult to source. Typical, aluminium bridge construction follows the truss form using extruded sections that are bolted together at node points. Aluminium has lower strength properties in comparison to steel hence a similar structure will need to be larger to support the same load. Notwithstanding this the aluminium bridge would still be lighter of the two. Construction in aluminium does require a much higher capital cost compared to traditional materials but whole life costing will be vastly reduced.

Fibre Reinforced Plastics are becoming more common in UK bridging particularly in the rail industry. Their long-term performance is still questionable due to lack of historic data in the field. Its many advantages (e.g. non-corrosive, high strength to weight, non-conductive) can strike the balance of this uncertainty. FRP bridges are typically constructed in modular form using standard pultruded sections. For footbridges, this usually consists of hollow sections joined together at node points with reinforcing stainless-steel plate connections to form a truss. This type of structure can look bulky to compensate for its relatively low stiffness, the truss is also tall in comparison to those of other materials. Wet lay custom moulded decks are a possibility but would come at considerable cost with long lead-in times for a one-off application such as this.

The remainder of materials have been dismissed for several reasons:

- Weathering steel is simply not suited to coastal environments.
- Concrete does not typically lend itself well to large scale construction over water due to the environmental risk and construction time. It is also an inherently heavy material for a footbridge, and the embedded nature of the required steel reinforcement can be problematic should chlorides be able to penetrate.
- The design life of hardwood is very questionable particularly in a damp climate.
- Stainless steel is vastly expensive.



These dismissals are not total as it is likely that discrete elements will use the materials where suited. Tropical hardwood is a good decking material, stainless steel is well suited to decorative items and concrete will be used for the substructures.

2.2.2 Protective Coatings

Two of the three materials chosen to take forward from the previous section require some form of protective coating to ensure a serviceable working life of 120 years. Raw steel in its very nature will corrode if left unprotected, and in a coastal environment that process will be drastically accelerated. FRP does not corrode but is susceptible to degradation via Ultraviolet Light exposure from the sun, weathering and water absorption hence requires a suitable paint or gel coating. Aluminium is the only material of the three which strictly does not require a protective coating, it is typically painted for aesthetic reasons as bare aluminium oxidises over time leaving a surface patina. This patina does not affect performance but can look undesirable, particularly if organisms such as Lichen develop on the surface.

The following documents two typical surface treatments that could utilised in this location, the first is limited to steel protection and the latter applicable to all:

Hot Dip Galvanising for Structural Steel

Applicable only to open section steel (closed hollow sections are not typically suitable as venting holes are required), Hot Dip Galvanising (HDG) provides a zinc barrier between the coated steel surfaces and their environment. The process provides protection through a continuous, tough metallurgically bonded coating that has the ability to self-heal. The zinc coating will corrode in preference to steel, sacrificing itself and resealing the exposed area if not too significant in size.

Galvanizers Association (GA), the representational body for the hot dip galvanizing industry in the UK and the Republic of Ireland have been consulted to understand the feasibility of a HDG coating in this specific location. They have conducted wide scale atmospheric corrosion rate testing to produce the Zinc Corrosion Map and for Lossiemouth this map indicates a background atmospheric corrosion rate 1-micron per year. Further interrogation of the data base of results by a technical representative of GA indicates a background atmospheric corrosion rate of 0.4-microns per year for a sample located at Lossiemouth. In addition to this it has been advised that an additional 1.5-micron loss per year be allowed for considering the exposure to seaborne chlorides. Based upon available data a value of 2.5-micron per year might be taken as an indication of the expected corrosion rate.

In order to maximise the level of corrosion protection provided the following specification for a thicker galvanized coating would be proposed which assumes all steelwork is more than 6 mm thick.

Grit blasting to Sa2½ with G24 chilled angular iron grit prior to batch hot dip galvanizing to BS EN ISO 1461 : 2009 to achieve a nominal coating thickness of 140-micron.

Assuming a total annual corrosion rate of 2.5-microns per year a 140-micron coating would give and expected coating life of 56 years.



Galvanized steel can also be painted for additional corrosion protection or for aesthetic reasons if the dull grey appearance is not desired. While painting will increase the overall level of corrosion protection it is likely that there will be a reduced time to first maintenance due to the shorter working life of most paint systems. It must also be noted that failure to maintain the paint system could allow saline seawater to sit and propagate beneath compromised areas causing a localised increase in the corrosion rate.

There are limits to the type and size of the fabrication that can be physically galvanised hence this can be a deciding factor to its feasibility.

Paint systems

Typically, a steel footbridge would be protected with a Type II (for Inland Difficult Access, **Marine Ready** or Difficult Access) paint system in accordance with Series 1900 of the Specification for Highways Works. This system is used on approximately 90% of all steel pedestrian structures in the UK regardless of location owing to the difficultly in repainting an operational asset in a typical trafficked area.

A Type II paint system has an approximate design life of up to 25 years and after that period it is predicted that the bridge will require a full repaint. As a result, in the whole 120 year predicted life of the structure it can be reasonable to expect to repaint the bridge up to a minimum of 4 times. This can be a costly process, mainly because of the temporary works involved.

As an alternative to the standard approved polyurethane paint system (Type II) there is a new product to the UK market that has potential for a vastly increased serviceable life. Fluoropolymer paint has started to appear on some national infrastructure projects with manufacturers predicting serviceable lifespans in the region of 60 years. Previously the system has been used under a departure from standard but recently it has been approved by the Highways Authority Product Approval Scheme (HAPAS). To gain HAPAS certification a system must be expected to perform satisfactorily for a period in excess of 15 years before its first major maintenance. The current standard regime of testing for certification does not go beyond this, hence the acceptance of its predicted life would need to be agreed with the adopting body. Initial discussions with manufacturers and painting contractors suggest a 100% increase in cost over the equivalent traditional type II system.

If a 60 year plus serviceable life can be agreed on a Fluoropolymer paint system, then the predicted whole life cost of a structural steel asset would reduce considerably.

Surface colour and combinations are limitless within reason. This gives the opportunity to create a costeffective statement if desired.

The majority of the above also applies to decorative aluminium finishes, basically any coating applied to it will require forward maintenance hence will need inclusion into the whole life costing analysis.

The FRP pultruded sections that are considered are coated in a Fluoropolymer paint system as noted above. The manufacturer of these sections offers a warranty based upon a minimum coating life of 25 years. As also mentioned above, it is anticipated that coating life will surpass this but remains a maintainable element for consideration.



2.2.3 Substructure

All substructures for options 3 to 5 would be designed in accordance with the relevant standards with the aim of providing minimal to no maintenance. Concrete will be specified in accordance with BS 8500-1 utilising the appropriate exposure conditions and reinforcement cover to achieve a 120-year design life. Where required, exposed steel to piles will provide sufficient sacrificial thickness to allow for corrosion loss without effecting structural performance over the working life.

2.3 Capital and whole life costing

High level capital cost estimates have been derived utilising previous experience of bridging projects and with the assistance of relevant specialist sub-contractors.

Each option has been costed utilising the appropriate materials for each. Pricing each material allows comparison of capital cost against future maintenance cost. This is particularly pertinent in justifying the use of high capital cost low maintenance materials such as aluminium. Option 2 has been limited to the use of a steel truss to keep within the spirit of a do minimum scenario, namely low cost.

Option	Material and Form	Cost £
1	Not applicable	0
2	Steel Truss	400,000
3	Steel Truss	650,000
3	Aluminium (Raw) Truss	1,050,000
3	Aluminium (Painted) Truss	1,255,000
3	FRP Truss	1,075,000
4	Steel Beam/Plate girder	450,000
5	Steel Truss	500,000
5	Aluminium (Raw) Truss	800,000
5	Aluminium (Painted) Truss	900,000
5	FRP Truss	800,000

Table 9 - Superstructure Costs

Note, prices are for supply only. Paint allowance for steel options is a standard type II system.

Table 10 - Substructure, installation, and all other associated costs

Option	Cost £
1	0
2	500,000
3	1,500,000
4	900,000
5	1,200,000

Note, assumes the same costings for each superstructure material. Option 2 excludes substructure as the existing is utilised.



Whole life costing for a 120-year period has been estimated utilising the DMRB document CD 355 'Application of whole-life costs for design and maintenance of highway structures' and the CIPFA Structures Asset Management Planning Toolkit. Net Present Values are presented in table 6, these are the value of costs incurred at future dates when discounted to the present value year. Discount factors taken from the 'Green Book' are based on a discount rate of 3.5% for years 1-30, 3.0% for years 31-75 and 2.5% for years 76-120.

The following assumptions have been made in calculating the Net Present Value of the anticipated maintenance activities over the 120-year life of each structure:

- It is assumed that the existing substructure for option 2 has a remaining working life of 10 years and will be replaced in its entirety after this period. This cost is added to the maintenance value.
- Reapplication of finish to the painted steel structures is assumed to be required every 20 years.
- Reapplication of finish to the painted FRP and Aluminium structures is assumed to be required every 30 years.
- Reapplication of the resin bonded nonslip deck surface on the Aluminium structures is assumed be required every 10 years.
- Replacement of the FRP deck boards on the Steel and FRP structures is assumed to be required every 30 years.
- A percentage uplift of 20% is applied to all activities to cover Works Contract Preliminaries and Design and Works Supervision Costs.
- There are no provisions for traffic management.
- The bridge is assumed to be in a severe environment hence a reduced cycle time to activity has been adopted.
- An estimate of cost for General and Principal Inspections is included.

Option	Material and Form	Maintenance Net Present Value £	Net Present Value Total (inc. Capital) £
1	Not Applicable	0	0
2	Steel Truss	1,800,000	2,700,000
3	Steel Truss	550,000	2,700,000
3	Aluminium (Raw) Truss	190,000	2,740,000
3	Aluminium (Painted) Truss	390,000	3,145,000
3	FRP Truss	385,000	2,960,000
4	Steel Beam/Plate girder	345,000	1,695,000
5	Steel Truss	400,000	2,100,000
5	Aluminium (Raw) Truss	125,000	2,125,000
5	Aluminium (Painted) Truss	290,000	2,390,000
5	FRP Truss	290,000	2,290,000

Table 11 - Whole life cost of complete structure



2.4 Health and safety, and potential risks and constraints to the project

The following are unusual hazards and risks that have been identified following a preliminary design risk review:

• Effects of the sea – Options 2 to 5

Changing tides, storm surges and flood should be considered through the life of the structure. A competent specialist marine contractor should be consulted at construction stage with measures put in place to safeguard construction workers and the public throughout the project.

- Jumping from the bridge for leisure and self-harm purposes All options
 It is understood that people frequently jumped from the existing bridge into the water below for
 pleasure. The location of the bridge and the ability to climb over should be considered in the design
 to dissuade the activity. The existing bridge is difficult to access following the installation of barriers,
 but a risk of unwanted entry and jumping is still present.
- Alcohol induced incident Options 4 & 5 There is a possible increase in risk of incident particularly at the Esplanade as the bridge would be directly opposite establishments selling alcohol.
- Unexploded Ordnance All options
 See section 2.8.2
- Condition of the existing sea walls All options See section 2.8.5

2.5 Loading and Usage

It is proposed that a complete replacement footbridge (options 3 to 5) be designed for unsegregated combined use by pedestrians and cyclists in accordance with the DMRB document CD 353, providing a 3.5m wide clear footway and 1.4m high parapets. Although the route is not particularly suited to cycling, the width prescribed will offer ample space for a multitude of users to cross without conflict. The wide consistent width will also allow users to seek refuge at any point along the bridge without impeding those around them.

The proposed bridge will not be designed for equestrian usage as it is felt the governing requirements will far out way the benefits of inclusion. For instance, the two main documents for parapets, BS 7818 'Specification for pedestrian restraint systems in metal' and CD 377 'Requirements for road restraint systems' call for a minimum of height of 1.8m for equestrian usage. Unfortunately, high containment parapets are difficult to accommodate visually and can severely impact the ability of other bridge users to experience the landscape. High sides to a structure can also give the effect of funnelling and enclosure, something that is particularly undesirable to all users on longer crossings. The exclusion is no change to the present arrangement as the existing bridge is not suitable for equine use.

The bridge will be designed for pedestrian Loads in accordance Section 5 of BSEN1991-2 'Actions on structures - Traffic loads on bridges' and its accompanying UK National Annex. In addition, these codes define a concentrated load on the bridge deck in Cl. 5.3.2.2. Our understand is that this load relates to quad bikes and equine traffic, which we propose the bridge is not subjected to as it can restrict the type of deck construction. Adequate signage and physical barriers in the form of bollards would be provided to prevent access from these users. As such this load will be omitted along with the Service Vehicle loading (Cl 5.3.2.3).



2.6 Proposed Design Method

To ensure robustness the complete scheme will be designed as a Roads project with reference to the Design Manual for Roads and Bridges (DMRB) and its associate standards and guidance.

The superstructure regardless of form shall be analysed using a linear elastic 3D space frame with a commercial computer package and by simple hand calculations.

The truss options will be modelled as simply supported and treated as pin jointed structures, but with moment connections (and rotational stiffness) for the U-Frame restraints to the top chord. The deck would be considered to act independently of the structure with plan bracing incorporated to provide the lateral restraint to hydrodynamic, wind and other transverse loadings.

The beam bridge option from the Esplanade will be modelled as a continuous structure comprising a minimum of two main beams, positioned beneath the deck and attracting live load based on linear distribution. The beams will be designed to act structurally independent in terms of loading, but for strength purposes they will be treated as braced at centres to correspond with the position of the lateral bracing.

The analysis model will be augmented to provide eigenvalues for the whole structure to evaluate the principal modes of vibration with the aim of providing a suitably comfortable structure for the user. CD 353 of the DMRB notes 'Footbridges with vertical modes of vibration less than 5 Hz and/or lateral modes of vibration less than 2.5 Hz can be particularly susceptible (to vibrations), and the resulting motions can cause discomfort to bridge users'. If these minimum vibration values are unachievable, dynamic analysis will be carried out to determine the sensitivity of the structure to excitation under pedestrian loading with appropriate response limits set.

The substructure and foundations for options 3 to 5 will be analysed by simple hand calculations. Piles and pile groups will be analysed by means of an industry standard pile analysis program.

The existing substructure for option 2 would be qualitatively assessed.

Scour and flooding effects will be assessed and designed for in accordance with the DMRB document CD 356. For wave effects reference will be made to BS 6349-1-2.

2.7 Departures from Standard

It is not envisaged that significant departures will be necessary for options 3 to 5. Some minor deviations are likely, but these will be fully justified. For example, the omission of the service vehicle loading in BSEN1991-2 and the use of horizontal infill in the parapet as opposed to vertical as defined in BS 7818.

Option 2 would require an agreement for a reduced footway width given that CD 353 of the DMRB prescribes a minimum clear width of 2.0 metres for a pedestrian footbridge.



2.8 Construction Issues

2.8.1 Lossiemouth Canal Bridge

Lossiemouth Canal Bridge provides the sole road access to the existing footbridge and landing site for option 3. It is Category B listed as set out by law in the Planning Listed Buildings and Conservation Areas (Scotland) Act 1997, hence construction movements should be considered. The structure appears to be in good condition and has been assessed to 40/44 tonne vehicle loading. The following information has been provided by Moray Council.

Lossiemouth Canal Bridge (U172/10) was built in approximately 1810 and consists of a single span masonry arch bridge, with a culverted section to the south side which is in the form of 4 culvert spans, with flap valves (to stop the tide backing up the canal). The bridge was Category B Listed on 24th March 1988.

Most recent Inspection was on 24th June 2019 and gave the bridge an average condition score of 93.27, with the critical elements being scored 100 (100 is perfect condition, no defects). The elements scores as having defects were the carriageway surfacing and the waterproofing system. No load-carrying elements showed significant defects.

The recorded span of the bridge is 9.2m and the recorded width is 8.68m, which is the total width of the bridge including the parapets. The available width between the parapets will be less than this.

The most recent load capacity assessment was on 22nd March 2002, and indicated that the bridge has ample strength for full HA loading (40/44T) or for up to 30 units of HB loading (abnormal loads etc.)

2.8.2 Unexploded Ordnance (UXO) Risk

As part of the Ground Investigation works a preliminary UXO risk review identified that the surrounding area of Lossiemouth suffered enemy bombing raids during WWII, with one raid impacting RAF Lossiemouth (located approximately 1.7km to the south-west). The report discussed a credible possibility that items of UXO may have found their way onto the site (being washed up in storm events) and remained there buried to the present day. To reduce the risk of unexpectedly encountering UXO during the GI the services of a specialist Explosive Ordinance Disposal Engineer were enlisted. No abnormalities were encountered during the works, but this is something that should be considered during the construction phase. This risk would apply to options 3 to 5 and additionally option 2 when substructure replacement is required.

2.8.3 The existing bridge

It is understood that the existing bridge would not be removed as part of a total bridge replacement scheme as it is not owned Moray Council, unless it is required on safety grounds. If the existing location (option 3) is chosen, this will present some issues for the construction of the abutment and lifting in of the spans at the beach approach. If possible, it would be beneficial to remove the existing structure (even if just a section at the beach) prior to construction of the proposed.



2.8.4 Proposed flood defence works

A feasibility Study into the provision of a Flood Protection Scheme at Lossiemouth Seatown is included in the Local Flood Risk Management Plan for the Findhorn, Nairn and Speyside Local Plan District. Any interaction this scheme may have with the replacement bridge will be considered as part of the detailed design process. This does not appear to affect the Esplanade location (option 4).

2.8.5 Condition of the existing sea wall

There are concerns that the existing sea walls are in poor condition, particularly at the Esplanade. In terms of temporary works, any construction close to the sea wall will require assessment and appropriate action to ensure the continued stability. Any abutment works will either need to be set back to avoid surcharge or more proactive measures taken such as local improvement, reconstruction and/or incorporation into the proposed abutment.

2.8.6 Traffic Management

In all locations traffic management will be difficult to implement given the limited diversion routes. Clifton Road (option 4) is a main route through Lossiemouth, and Church Street (options 2 & 3) is the only access to the south section of Seatown and the caravan park. Seatown road (option 5) would present less issues and could potentially be managed with a partial closure. All proposed traffic management would need to be agreed with Moray Council.



2.9 Operation and maintenance

A proposed replacement bridge would be designed to ensure there are no unusual operation and maintenance procedures.

2.9.1 General Inspection

General inspections can be carried out under normal operation of the proposed footbridge. The abutments can be inspected from ground level, preferably at low tide. The deck soffit steelwork and outer surfaces of the structure can be viewed from ground level using binoculars if required. The deck surfacing, expansion joints, and parapets can also be inspected from deck level.

2.9.2 Principal Inspection

Principal inspections can be carried out under normal operation of the proposed footbridge with local demarcation and a banksman where required. The abutments can be inspected from ground level, preferably at low tide. The deck soffit steelwork and outer surfaces of the structure can be reached for a touching distance inspection either via a pontoon and scaffold tower or by a specialist rope access team. Substructures within the river channel would be inspected by a specialist water access/diving team. All operations will require careful planning with a good understanding of the tidal movements given the unavoidable risk of working over/in water.



3 Conclusion

The following conclusions are based upon the information obtained and presented within this report. Each option has been appraised in an un-biased manner and a single option has been put forward for recommendation.

The criteria used in selecting an option focuses primarily on whole life cost, providing that the economically favourable solution delivers the desired outcome. As defined in clause 1.3 of DMRB document CD 355 'The lowest whole life cost option shall become the recommended solution in an options report, except where other factors override that selection.'

Options

Option 1 in the very nature of a do-nothing scenario, presents no cost, but it also offers little in forward benefit. The rationale for this report was to investigate a proposed replacement crossing to East Beach, but this option does not fulfil that need. There is some potential ecological benefit to restricting human presence at East Beach, but there is a firm argument for the long-standing usage of the area for recreational purposes.

Option 2 is a compromised short-term solution with a high degree of imbedded risk, this is due to the proposed re-use of the existing timber substructure. The capital cost is likely to be lower than all the other bridge crossing options but the whole life cost will be un-favourable due to the impending replacement of the substructure. In summary this option gives some benefit as it would reinstate a crossing to the beach, but Murray Council are unlikely to accept the inherent risks and hence are unlikely to back or adopt this option.

Option 3 the proposal local to the existing bridge presents the **greatest of all whole life costs**, this is because it has the largest overall span (**145 metres**) of all the proposed options. It appears that the existing bridge was positioned at this location out of necessity rather than it being a favoured location. It would have been more costly to construct than the original 1913 bridge and the same has been concluded for the proposed replacement structure. In its favour, the location offers good protection from the elements and the hydrodynamic actions are less prevalent than they are at the other proposed locations. The distance from the Esplanade allows separation of users in Lossiemouth but equally detaches beach goers from the amenities of Clifton Road. The clear draw of this option is that it maintains the status quo of the existing arrangement and additionally is sympathetic to the current visual landscape.

Option 4 presents the shortest span (**75 metres**) of all the locations, hence by default a shorter bridge to construct and maintain, resulting in the **lowest whole life cost**. The span arrangement permits for a less obtrusive superstructure to be adopted whilst still being economically favourable, this will allow the bridge to better tie in with the locality and provide the user a more pleasant crossing experience. The main perceived issue that this location presents, which cannot be designed out within the immediate proposed structure, is the potential for traffic increase and pedestrian conflict on Clifton Road. If this were deemed an issue, a small amount of targeted investment could be utilised to improve local user interaction as shown on drawing BB2020-TR-002 in appendix A. It is felt this would negate any apparent concern and potentially provide betterment to the immediate area. The hydrodynamics are least favourable at this location but not so much so to cause an obvious issue.



Option 5 was studied as a more economical alternative to option 3. At **100 metres** in total span, it is 45 metres shorter than option 3 hence provides a valuable cost saving. It also appears to have an improved access point from the land side, and better integrates existing facilities without compromising some of the perceived benefits that option 3 brings. The location is suitably distanced from the Esplanade to avoid conflicts yet remains close to the existing East Beach Car Park, again balancing the benefits of the other options.

Materials

The discussion on bridging materials has been made separately to the options as per section 2.

Utilising steel in a costal location presents higher maintenance costs than the equivalent FRP and Aluminium structures but the capital cost is vastly lower, hence a balance can be struck. A particular downfall of FRP is that it requires a protective coating which is typically warranted for 30 years. It is assumed that the coating will exceed this, but it is difficult to prove as there are limited historical examples to draw information from. Aluminium does not require a protective coating, but a paint system is typically applied for aesthetic purpose and this becomes a maintenance liability. A raw finish aluminium bridge gives the lowest maintenance cost as in theory only the deck anti-slip requires replacement, but unfortunately the capital cost is high.

With regards to surface finish, galvanising as a choice would be restricted to option 4 as this is the only structural form offered that would be suitable if detailed appropriately. The steel trusses presented in options 2, 3 and 5 do not lend themselves to the galvanising process as they would be formed with closed hollow sections. Galvanising can provide an enduring finish, but at the end of the coatings working life the structure must either be painted or taken off site to be cleaned and re-dipped. Additionally, an exposed galvanised finish is unlikely to provide the desired aesthetics in this location. A painted finish could be applied, but to maintain appearance it would require recoating at regular intervals.

A traditional type II painted coating is not the most durable option, but capital cost is inherently low. Fluoropolymer paint should be considered with the aim to reduce maintenance and resulting overall whole life cost. The manufacturers estimated life span of 60 years would need to be accepted by the overseeing organisation to warrant the initial added cost of the coating. An estimated saving based upon option 4 has been shown in the following table.

Paint System	Total Capital Cost £	Maintenance Net Present Value £	Net Present Value Total (inc. Capital) £
Standard Type II	1,350,000	345,000	1,695,000
Fluoropolymer	1,375,000	165,000	1,540,000

Table 12 - Option 4 estimated costs with superstructure paint comparison

As can be seen in table 12 above, an approximate 2% uplift in capital cost has the potential to save over 50% on the maintenance net present value. This assumes that a type II paint system will require 5 reapplications in the 120-year life of the bridge, against the single recoat for Fluoropolymer based on accepting a 60-year design life.



Studies and Consultation

With regards the consultations and studies within section 1 of the report, there are no particular items that dictate where a proposed bridge should be sighted.

The **Geology** appears comparable throughout the area and no pertinent issues are expected, hence there is no geological preference to a particular location.

The **hydrological** studies offer favour to option 3, this is based upon the immediate area having the least onerous effects on a bridge. Options 4 and 5 can be economically designed to withstand the increased local effects, hence this should not be an overriding factor when selecting a bridge location.

From an **Environmental** perspective any proposed bridge is unlikely to cause untoward effect or change to the current regime. Construction techniques will be carefully considered to mitigate any direct impact.

Land ownership has not yet been clarified, but it is understood issues are unlikely.

The **current bridge ownership** is still unclear, and efforts are underway to understand this better. All 3 replacement options have been derived with this ownership uncertainty in mind.

The **consultations** with the various authoritative bodies have been constructive and a number of their representatives appear keen to see the scheme progress. There appears to be no obvious blocks and the process for permissions is now understood.

The **Public survey** has offered a valuable contribution. The clear outcome from the combined survey is for a bridge local to the existing and the reasoning for this has been made clear in the accompanying comments. These comments have been considered in each option with the aim of addressing any genuine concerns.



3.1 Recommendation

Contemplating all the options it is recommended that **option 4**, a new footbridge from the Esplanade is taken forward. This solution presents itself as the most cost-effective compliant bridge crossing in both capital and whole life terms. Comparing equivalent steel painted superstructures this option is approximately £800,000 cheaper than option 3 in capital cost, raising to £1,000,000 difference in whole life cost. The monetary benefit over option 5 is reduced at £350,000 capital and £400,000 whole life but still a notable difference.

Regards corrosion protection it is envisaged that a standard type II paint system would require to be repainted at 20-year intervals, costing Moray Council significant sums at each interval. For this to be viable it is likely that the council would require the promise of future funding or a commuted sum to cover the impending costs. Neither of which are likely to be agreed by Scottish Government. Alternatively, a Fluoropolymer system is predicted to have a serviceable life of up to 60 years and therefor would only require repainting once during the 120-year working life of the superstructure. Moray Council are more likely to accept this maintenance liability and therefore it is proposed that a Fluoropolymer paint system is adopted.

For optimum durability and a theoretical do-nothing maintenance approach a Fluoropolymer system with a suitable grey finish and undercoats could be applied over a 140-micron galvanised coating. In theory, as the paint degrades up to its 60 years predicted life, the galvanising would still be present, giving a hypothetical additional 50 years plus of protection. By using a grey paint, this would avoid a patchy appearance as the paint system gives way to the galvanising underneath. However, a dull grey paint finish and future possibility of a degraded appearance is not particularly desirable at this location. As such, although this is an option to reconsider at the detail design stage, it is not the preferred option at present. There are some embedded issues with the Esplanade location as already noted, but it is felt these can be addressed with considered integration into the local network. This will increase expense marginally but not so much as to outweigh the capital and whole life cost benefits.

Positioning the bridge at the Esplanade has the potential to alleviate some safety concerns, particularly the existing issue of people jumping off the current bridge. Having the bridge in a more populated open area will inherently discourage antisocial behaviour, this can also be true of vandalism.

Table 13 -	Option 4	Preliminary	costing
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Total Capital Cost £	Maintenance Net Present Value £	Net Present Value Total (inc. Capital) £
1,375,000	165,000	1,540,000

Assumes Fluouroploymer paint system



Appendix A - Drawings







Proposed Level

Chainage 100.000 (17)

Proposed Level

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Proposed Level

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VIEW 1: FROM THE EAST



VIEW 3: FROM CHURCH STREET BRIDGE







VIEW 5: FROM EAST BEACH

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VIEW 2: FROM THE NORTH



VIEW 4: FROM CHURCH STREET BRIDGE AT HIGH ASTRONOMICAL TIDE

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VIEW 1: FROM THE NORTH-EAST



VIEW 3: FROM THE ESPLANADE





VIEW 5: FROM EAST BEACH



VIEW 2: FROM THE WEST



VIEW 4: FROM THE WEST AT HIGH ASTRONOMICAL TIDE

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VIEW 1: FROM THE NORTH



VIEW 3: FROM SEATOWN ROAD







VIEW 5: FROM EAST BEACH

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VIEW 2: FROM THE SOUTH

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Appendix B – Ground Investigation Report

environmental • geotechnical • building fabric

Proposed redevelopment East Beach Footbridge Lossiemouth

Ground Investigation Report

Unit 9, Clarence Avenue, Westpoint Enterprise Park, Trafford Park, Manchester, M17 1QSt: 0161 9470270e: mail@soiltechnics.netw: www.soiltechnics.net



Proposed footbridge redevelopment at East Beach Lossiemouth Scotland IV30 8NQ

GROUND INVESTIGATION REPORT

Soiltechnics Ltd. Unit 9, Clarence Avenue, Westpoint Enterprise Park, Trafford Park, Manchester, M17 1QS Tel: (0161) 9470270 E-mail: mail@soiltechnics.net						
Report orig	Report originators					
Prepared by	to	<u>farhad.gayum@soiltechnics.net</u>				
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Supervised/ reviewed by	V. fell					
	7	Mark.hamill@soiltechnics.net				
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Reviewed by	SP					
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	Sam Dean B.Sc. (Hons)., CEnv., MIEnvSc., FGS	Director				



Aerial photograph of site



Site boundary outlined in MAGENTA

Bookmarking

As a PDF version this document is bookmarked. If you click on the bookmark icon on a PDF viewer then the main contents listing is shown and by clicking on the bookmark you can navigate through the report.

Report status and format

Report	ort Principal coverage		status
section		Revision	Comments
1	Executive summary		
2	Introduction		
3	Desk study information and site observations		
4	Chemical contamination		
5	Fieldwork		
6	Laboratory testing		
7	Ground conditions encountered		
8	Geotechnical Appraisal		
9	Further investigations		

List of drawings

Drawing	Principal coverage	Status	
		Revision	Comments
01	Site location plan		
02	Plan showing existing site features, location of exploratory points and proposed footbridge location		

List of appendices

Appendix	Content	Status	
		Revision	Comments
А	Definitions of geotechnical terms used in this report		
В	Definitions of geo-environmental terms used in this report		
С	Borehole in-situ test results		
D	Borehole log records		
E	Site photographs		
F	Soil classification laboratory test results		
G	Copies of statutory undertakers' replies		
Н	Envirocheck Report		
I	MACC preliminary risk review		
J	Insitu CPT report		

1 Executive summary

General

We recommend the following executive summary is not read in isolation to the main report which follows.

Site description, history and development proposals

The site is a proposed footbridge with two potential crossings being considered, allowing access to East Beach, located to the east of Lossiemouth. In general, the site comprises three areas: East Beach, the River Lossie, and mainland areas off Church Street and Clifton Road.

The site has generally remained the same with historic maps indicating no significant change since the 1870s. The River Lossie flows north-west then north towards the Old Harbour with East Beach to the east and Lossiemouth to the west. The current footbridge existed from as early as 1959.

We understand the scheme will comprise a replacement footbridge to allow access to East Beach from either the west (via Clifton Road), or from the south at the location of the current footbridge (via Church Street). We understand this existing footbridge crossing the River Lossie is structurally unsafe and has therefore been closed for use.

Ground conditions encountered

On the land side, the general geological sequence comprised Made Ground soils from surface to a depth of 0.8 to 0.9m comprising reworked sands over Storm Beach Deposits. Groundwater was encountered at 3.0m depth and is expected to be tidal.

On East Beach, the geological sequence comprised Marine Beach Deposits from surface. Groundwater was encountered at 1.3m and 3.0m and tidally influenced.

Suspected Burghead Sandstone Formation was encountered in BH01 at 6.50m depth, comprising a grey sandstone.

Foundation solution

In our opinion, the naturally deposited Marine Beach Deposits and Storm Beach Deposits could support the proposed development on pad type foundations. However, due to the nature of the site and difficulty working in the tidal channel and increased potential for scour, a piled solution has also been considered.

Chemical and gaseous contamination

As no source of significant chemical contamination has been identified on site, we are of the opinion that the site represents a low risk of causing harm to the health of identified current and proposed users of the site, and to construction operatives.



Due to the nature of the development comprising of a footbridge, with no enclosed spaces anticipated, the risk of any gaseous contamination affecting human receptors is considered negligible.

Unexploded Ordnance

A detailed UXO desk study identified Lossiemouth to have experienced enemy bombing raids during WWII suggesting the site is within a medium level risk zone. The report states there is a credible possibility that items of UXO may have found their way onto the site and could remain buried to the present day.

2 Introduction

2.1	Objectives
2.2	Status of this report
2.3	Client instructions and confidentiality
2.4	Site location and scheme proposals
2.5	Report format and investigation standards
2.6	Report distribution
2.7	Soiltechnics liability

2.1 Objectives

- 2.1.1 This report describes a ground investigation carried out for the proposed construction of a replacement footbridge at East Beach, Lossiemouth.
- 2.1.2 The objective of the ground investigation was to establish ground conditions at the site, sufficient to identify possible foundation solutions for the development and provide parameters necessary for the design and construction of foundations.
- 2.1.3 The investigation also included a preliminary evaluation of potential chemical and gaseous contamination of the site leading to the production of a risk assessment in relation to contamination.

2.2 Status of this report

2.2.1 This report is final based on our current instructions.

2.3 Client instructions and confidentiality

- 2.3.1 The investigation was carried out in October 2020 and reported in November 2020 acting on instructions received from Beaver Bridges Ltd.
- 2.3.2 This report has been prepared for the sole benefit of our above named instructing client, but this report, and its contents, remains the property of Soiltechnics Limited until payment in full of our invoices in connection with production of this report.
- 2.3.3 Our original investigation proposals were outlined in our letter to Beaver Bridges Ltd dated October 2020. The investigation generally followed our original investigation proposals. The investigation process was also determined to maintain as far as possible the original investigation budget costs.

2.4 Site location and scheme proposals

2.4.1 The National Grid reference for the site is 323760, 870540. A plan showing the location of the site is presented on Drawing 01.

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- 2.4.2 At present, an existing footbridge allows access to East Beach from Church Street, from the south. We understand this existing footbridge crossing the River Lossie is structurally unsafe and has therefore been closed for use.
- 2.4.3 We understand the scheme will comprise the development of a footbridge to allow access to East Beach. Two potential route crossings are being considered; one option comprises a replacement crossing in the same location as the current condemned bridge, with the alternative route suggestion providing access from the west, via Clifton Road.
- 2.4.4 The two proposed bridge routes are indicated approximately on Drawings 01 and 02.

2.5 **Report format and investigation standards**

2.5.1 Sections 2, 3, 5, 6 and 7 of this report describe the factual aspects of the investigation with Section 4 providing a risk assessment of chemical contamination and Section 8 presenting an engineering assessment of the investigatory data. Section 9 outlines any further works.

2.5.2 **Geotechnical aspects**

2.5.2.1 Geotechnical investigations were carried out generally, and where practical following the recommendations of BS EN 1997:2 2007 'Eurocode 7 – Geotechnical Design – Part 2: Ground Investigation and Testing'. From a geotechnical viewpoint this is deemed to be a Ground Investigation Report (GIR) as set out in BS EN 1997:2. This report does not constitute a Geotechnical Design Report as defined in section 2.8 of BS EN 1997-1:2004+A1:2013 'Eurocode 7 – Geotechnical Design – Part 1: General Rules' and in particular will exclude assessment of lifetime actions to buildings from geotechnical influences.

2.5.3 **Geo-environmental aspects**

- 2.5.3.1 The investigation process also followed the principles of BS 10175:2011+A2:2017 'Investigation of potentially Contaminated Sites – Code of Practice'. The following elements, defined in BS 10175, have been completed and incorporated in this report.
 - a) Phase I Preliminary investigation (desk study and site reconnaissance)
- 2.5.3.2 This investigation has been carried out and reported based on our understanding of best practice. Improved practices, technology, new information and changes in legislation may necessitate an alteration to the report in whole or part after publication. Hence, should the development commence after expiry of one year from the publication date of this report then we would recommend the report be referred back to Soiltechnics for reassessment. Equally, if the nature of the development changes, Soiltechnics should be advised and a reassessment carried out if considered appropriate.

2.6 Report distribution

2.6.1 This report has been prepared to assist in the design and planning process of the development and normally will require distribution to the following parties, subject to Soiltechnics liabilities defined below, although this list may not be exhaustive:

Table summarising parties likely to require information contained in this report				
Party	Reason			
Client	For information / reference and cost planning			
Developer / Contractor / project manager	To ensure procedures are implemented, programmed and costed			
Planning department	Potentially to discharge planning conditions			
Environment Agency	If controlled waters are affected and obtain approvals to any remediation strategies			
Independent inspectors such as Building Control	To ensure procedures are implemented and compliance with building regulations			
Project design team	To progress the design			
Principal Designer (PD)	To advise in construction risk identification and management under the Construction (design and management) regulations			
Table 2.6				

2.7 Soiltechnics liability

2.7.1 Soiltechnics disclaims any responsibility to our Client and others in respect of any matters outside the scope of this report. This report has been prepared with reasonable skill, care and diligence in accordance with the terms of our contract, taking account of the manpower, resources, investigations and testing devoted to it by agreement with our Client. This report is confidential to our Client and Soiltechnics accepts no responsibility of whatsoever nature to third parties to whom this report or any part thereof is made known. Any such party relies upon the report at their own risk.

3

Desk study information and site observations

- 3.1 General3.2 Description of the site
- 3.3 Injurious and invasive weeds and asbestos
- 3.4 History of the site
- 3.5 Geology and geohydrology of the area
- 3.6 Landfill and infilled ground
- 3.7 Flood risk
- 3.8 Environmental sensitivity
- 3.9 Recent industrial activity
- 3.10 Enquiries with statutory undertakers
- 3.11 Unexploded Ordnance (UXO) Risk

3.1 General

- 3.1.1 We have carried out a desk study which was limited to a review of readily available information including:
 - a) Review of published Ordnance Survey maps dating back to 1871 at various published scales
 - b) Inspection of geological maps produced by the British Geological Survey together with relevant geological memoirs
 - c) Consultation with Statutory Undertakers
 - d) Site reconnaissance
 - e) Other relevant published documents
- 3.1.2 We have obtained old Ordnance Survey maps using the Envirocheck database system. In addition to retrieval of historical and current Ordnance Survey data, Envirocheck provide information compiled from outside agencies.
- 3.1.3 The study did not extend to the research of meteorological information, ecological or archaeological considerations, or consultation with any interested parties.
- 3.1.4 A copy of records produced by Envirocheck is presented in Appendix H. Envirocheck produce a wealth of factual database information. Although we can provide a discussion on each of the database topics, this would produce a very lengthy document, but some of these discussions would not be relevant to the aims of this report. As a consequence, we have extracted some of the relevant topics and discussed them in this section of the report.

3.2 Description of the site

- 3.2.1 The site comprises two potential crossing routes for a proposed footbridge allowing access from Lossiemouth to the East Beach land-spit, which is separated from the mainland by the River Lossie.
- 3.2.2 The River Lossie flows to the northwest before meandering northwards towards the North Sea. At high tide the river is approximately 110m wide beneath the existing footbridge, and 60m wide where it begins to flow north.
- 3.2.3 East Beach is a predominantly sandy stretch of coastline, forming a gently sloping beach, with sand dunes and sporadic vegetation running along the approximate centre of the land-spit.
- 3.2.4 One potential bridge route comprises a replacement of the existing footbridge, which is an approximately 120m long steel and timber structure allowing access from the south off Church Street. The alternative route would provide access from the old harbour wall, off Clifton Street, to the west of East Beach.
- 3.2.5 Along the landside of the River Lossie, the banks comprise of a stone-built sea wall with the land approximately 2m higher than the high tide level. The proposed abutment areas comprise of relatively flat grassed landscaped areas.
- 3.2.6 A plan showing observed site features and location of exploratory points together with scheme proposals is presented on Drawing 02. Photographs of the site are presented in Appendix E.

3.3 Injurious and invasive weeds and asbestos

3.3.1 Injurious and invasive weeds

3.3.1.1 Our investigations exclude surveys to identify the presence of injurious and invasive weeds. We did not observe any obvious evidence the above species, however, a specialist would need to confirm this.

3.3.2 Asbestos

3.3.2.1 Our investigations exclude surveys to identify the presence or indeed absence of asbestos on site. It should be noted however, that where intrusive investigations were undertaken, we did not observe any obvious evidence of potential asbestos containing materials.

3.4 History of the site

3.4.1 An attempt to trace the history of the site has been carried out by reviewing copies of old Ordnance Survey maps provided by Envirocheck. The recent history of the site based on published Ordnance Survey maps is summarised below.

environmental • geotechnical • building fabric

- 3.4.2 The East Beach, River Lossie and immediate land-side coastline has generally remained the same with no significant changes noted since the 1870s. The River Lossie flows north-west then north towards the Old Harbour with East Beach to the east and Lossiemouth to the west. The current footbridge existed from as early as 1959.
- 3.4.3 From the 1870s, residential properties are predominantly located to the south of the site, with mixed residential, commercial and light industrial land uses present to the north and west. Lossiemouth Railway Station existed to the north with a railway line running south along the now named Clifton Road immediately west of the site. A series of quarries are also recorded at this time c.80m west of the site.
- 3.4.4 An Old Pier is indicated protruding from the East Beach's northern tip, which is later developed into a breakwater in subsequent mapping records.
- 3.4.4 By the late 1960s, the quarries, railway line and station are no longer recorded.

Geology and geohydrology of the area 3.5

3.5.1 Geology of the area

- 3.5.1.1 Envirocheck reproduce geological map extracts taken from the British Geological Survey (BGS) digital geological map of Great Britain at 1:50,000 scale (ref Appendix H).
- 3.5.1.2 Surface geology at the East Beach comprises recent Marine Beach Deposits (sand), with the sand dunes comprising of Blown Sand.
- 3.5.1.3 Land-side, the surface geology is recorded to comprise post-glacial Storm Beach Deposits. It is also noted that the former coastline ran further east and south of the site, and it is therefore anticipated this is underlain by older strata of Marine Beach Deposits, potentially containing marine and estuarine alluvium.
- 3.5.1.3 A summary of the recorded geological information for the site is presented in the following table:

Summary of Geology and likely aquifer containing strata					
Strata	Bedrock or superficial	Approximate thickness	Typical soil type	Likely permeability	Aquifer designation
Blown Sand			Sands	Permeable	-
Storm Beach Deposits	Superficial		Gravels	Permeable	Secondary A
Marine		Unknown	Predominantly		
Beach			sands with some	Permeable	Secondary A
Deposits			gravels and silts		
Burghead					Principal
Sandstone				Permeable	Aquifor
Formation	Podrock		Candetana		Aquilei
Kingsteps	Deurock		Sanustone		Principal
Sandstone		Up to 73m		Permeable	Aquifor
Formation					Aquiler
Table 3.5.1					

3.5.2 Water abstractions

- 3.5.2.1 There are no active groundwater or surface water abstraction points located within 2000m of the site.
- 3.5.2.2 The site is not located within a zone protecting a potable water supply abstracting from a Principal Aquifer (i.e. a Source Protection Zone).
- 3.5.3 Coal mining and brine extraction
- 3.5.3.1 The site is not recorded to be within an area affected by past or present coal mining, or minerals worked in association with coal or brine extraction (within the Cheshire Brine Compensation District).

3.5.4 Shallow mining and natural subsidence hazards

3.5.4.1 The British Geological Survey present hazard ratings for shallow mining and natural subsidence hazards. The site has the following ratings:

Table summarising mining and subsidence hazards			
Hazard	Rating		
Mining hazard in non-coal mining areas	Rare		
Potential for collapsible ground stability hazard	No hazard		
Potential for compressible ground stability hazard	No hazard		
Potential for ground dissolution stability hazard	No hazard		
Potential for landslide ground stability hazard	Very low		
Potential for running sand ground stability hazard	Moderate		
Potential for shrinking or swelling clay ground stability hazard	No hazard		
Table 3.5.4			

3.5.4.2 The moderate rating for running sands is associated with the unconsolidated sand deposits on East Beach and the high groundwater levels.

3.6 Landfill and infilled ground

- 3.6.1 There are no registered landfill sites within 1000m of the site. Inspection of old Ordnance Survey maps indicates Lossie Quarry c.80m west of the subject site and we are aware from our site reconnaissance visit that the quarry face is still exposed with the local area now comprising of roads and residential properties.
- 3.6.2 In addition, records also indicate two areas of potentially infilled land within 250m of the site; 92m and 204m to the north west. Both areas are described as unknown filled ground and presently comprise residential properties and public open space.

3.7 Flood risk

3.7.1 The site is located within a tidal flood plain. The site is in an area which has a high likelihood of coastal and river flooding, and is also recorded to be in an area which has the potential for groundwater flooding to occur at surface.

3.7.2 It should be noted that this information does not constitute a site-specific Flood Risk Assessment (FRA), and a full FRA may be required for the development to support a planning application or satisfy planning conditions.

3.8 Environmental sensitivity

- 3.8.1 The site is not reported to be within or close to an area of designated sensitive land use, such as a Ramsar Site or Special Area of Conservation.
- 3.8.2 The site is located in a Nitrate Vulnerable Zone associated to polluted waters.

3.9 Recent industrial activity

- 3.9.1 There are no recorded pollution incidents or discharge consents within 200m of the site.
- 3.9.2 There are no pertinent Contemporary Trade Directory entries on site. There are a small number of records held within 250m, which include an active engineers, dry cleaners and garage services. None of these lie within 50m of the site.
- 3.9.3 There are no Integrated Pollution Control (IPC), Integrated Pollution Prevention and Control (IPPC), or Hazardous Substances records held within 200m of the site

3.10 Enquiries with statutory undertakers

- 3.10.1 We have obtained a Linesearch report and contacted the following Statutory Undertakers (SUs) to obtain copies of their records in order to avoid damaging their apparatus during our fieldwork activities:
 - a) BT Openreach Ltd
 - b) Scottish Water
 - c) Scotia Gas Networks plc
 - d) Scottish & Southern Electricity Networks
 - e) Indigo Pipelines Ltd
- 3.10.2 Copies of responses received prior to publication of this report are presented in Appendix G.
- 3.10.3 Normally Statutory Undertakers drawings record the approximate location of their services. We recommend further on site investigations be undertaken to confirm the position of the apparatus and thus establish the effect on the proposed development and the necessity or otherwise for the permanent or temporary diversion of the service to allow the construction of the development to safely and successfully proceed.
- 3.10.4 It should be noted that statutory undertakers' records normally exclude private services.

3.11 Unexploded Ordnance (UXO) Risk

- 3.11.1 As part of our fieldwork activities we obtained a preliminary UXO risk review, from MACC International. The report confirmed that the surrounding area of Lossiemouth did suffer enemy bombing raids during WWII, with one raid impacting RAF Lossiemouth (located approximately 1.7km to the south-west).
- 3.11.2 The report discussed a credible possibility that items of UXO may have found their way onto the site (being washed up in storm events), and remained there buried to the present day. A copy of the report produced by MACC is presented in Appendix I.
- 3.11.3 Owing to the potential risk of encountering UXO on site a specialist EOD engineer attended site during fieldwork activities. The EOD Engineer provided a UXO briefing to all site workers and conducted frequent scanning using a magnetometer to identify potential UXO objects in advance of and during our drilling operations. No abnormalities were encountered during the works.

4 Chemical contamination

- 4.1 Objectives and procedures
 - 4.2 Development characterisation and identified receptors
 - 4.3 Identification of pathways
 - 4.4 Assessment of sources of contamination
 - 4.5 Initial conceptual model
 - 4.6 Risk assessment summary and recommendations
 - 4.7 Gaseous contamination

4.1 **Objectives and procedures**

- 4.1.1 This report section discusses investigations carried out with respect to chemical contamination issues relating to the site. The investigation process followed the principles of BS 10175:2011+A2:2017 *'Investigation of potentially contaminated sites Code of Practice'* and was limited to a desk study (preliminary investigation).
- 4.1.2 This section of the report produces an 'Initial Conceptual Site Model' (iCSM) based on desk study information obtained to date. The conceptual model is constructed by identification of contaminants and establishment of feasible pathways and receptors. The conceptual model allows a risk assessment to be derived. Depending upon the outcome of the risk assessment it may be necessary to carry out remediation and/or further investigations with a view to eliminating, reducing or refining the risk of harm being caused to identified receptors. If appropriate, our report will provide recommendations in this respect.
- 4.1.3 In determining our iCSM, We have adopted, in general, the procedures described in CIRIA C552 *'Contaminated land risk assessment a guide to good practice'*
- 4.1.4 Definition of terms used in the preceding paragraph and subsequent parts of this section of the report are presented in Appendix B.

4.2 Development characterisation and identified receptors

4.2.1 Site characterisation

4.2.1.1 The nature of the site has a significant influence the likely exposure pathways between potentially contaminated soils and potential receptors. The following table summarises elements which characterise the site based on desk study information.

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Summary of site characteristics				
Element	Source / criteria	Characteristic		
Current land use	Observations	Existing footbridge over River Lossie. Currently condemned and inaccessible to the public.		
Future land use	Advice	Footbridge over River Lossie to access East Beach.		
Site history	Desk study	Similar to the present day with current footbridge existing from as early as 1959.		
Geology	Desk study	Beach side: Blown Sands and Marine Beach Deposits, underlain by Kingsteps Sandstone Formation. Land side: Storm Beach Deposits underlain by Marine Beach deposits and sandstone bedrock.		
Groundwater	Aquifer potential	Secondary A in Marine Beach Deposits and Storm Beach Deposits. Principal Aquifer in Burghead Sandstone Formation and Kingsteps Sandstone Formation.		
	Abstractions	None within 500m of site.		
	Source protection zone	Site not within a Source protection zone		
Surface waters	Location	River Lossie flows north westerly beneath the proposed footbridge and north into the North Sea.		
	Abstractions	None within 500m of site.		
Table 4.2.1				

4.2.2 Identified receptors

4.2.2.1 The principal receptors subject to harm caused by any contamination of the proposed development site are as follows.

Principle Receptor	Detail
Humans	Users of the current site
	End user of the developed site
	Construction operatives and other site investigators
Vegetation	Plants and trees, both before and after development
Controlled waters	Surface waters (Rivers, streams, ponds and above ground reservoirs)
	Ground waters (used for abstraction or feeding rivers / streams etc)
Building materials	Materials in contact with the ground
Table 4.2.2	

4.2.2.2 This section of the report assesses those receptors tabulated above.

4.2.3 Human receptors

- 4.2.3.1 Currently, the bridge is not accessible to the general public, and would only be accessible to construction operatives following appropriate CDM and H&S protocols. We therefore do not consider humans a viable receptor to the current site.
- 4.2.3.2 Following completion of the development the critical site user (receptor) is considered to be a child under the age of 6 years. Our assessment also considers the risk to construction operatives as adult receptors during the construction phase.

4.2.4 Vegetation receptors

- 4.2.4.1 Soil contaminants can have an adverse effect on plants if they are present at sufficient concentrations. The effects of phytotoxic contaminations include growth inhibition, interference with natural processes within the plant and nutrient deficiencies.
- 4.2.4.2 No significant vegetation is present on, or adjacent to the site, and we understand that no planting is proposed as part of the bridge redevelopment, therefore vegetation is discounted as a potential receptor and from further consideration within this report.

4.2.5 Water receptors

- 4.2.5.1 The site lies in an area designated as a Secondary A Aquifer, associated with the Marine Beach Deposits and Storm Beach Deposits. The underlying sandstone bedrocks are classified as Principal Aquifers.
- 4.2.5.2 The River Lossie runs directly beneath the proposed bridge development, ultimately discharging into the North Sea some 250m north of the site.
- 4.2.5.3 In consideration of the permeable geology and proximity to surface water features (the river and sea), any contaminants entering the groundwater locally is highly likely to quickly migrate into the nearby surface waters. Therefore, the surface waters are considered to be the primary surface water receptor, with the groundwater being a transient receptor only.

4.2.6 Building materials

4.2.6.1 Building materials in contact with the ground such as concrete foundations and water supply pipes, are receptive to damage caused by aggressive ground conditions. Generally risks and preventative measures are impossible to establish at the desk study stage and investigations are required to manage any identified risks. At this stage this receptor group is not considered further.

4.2.7 Summary of identified receptors

4.2.7.1 Based on the above assessments, the following table summarises identified and critical receptors.

Table summarising identified (viable) receptors				
Principle	Detail	Viable a	nd critical receptors	
Receptor		Viability	,	Critical receptor
Humans	Users of the current site	No	Site inaccessible to public	-
	End user of the developed site	Yes	Site accessible to public including children	Child
	Construction operatives and other site investigators	Yes		Adult
Vegetation	Current site	No	None on site	Vegetation
	Developed site		None anticipated	Vegetation
Controlled waters	Surface waters: River Lossie and the North Sea)	Yes	Close proximity to sea	Surface waters
	Ground waters: Transient only, quickly discharging into surface waters	Yes	Site over Secondary A and Principal Aquifers	Groundwater
Building materials	Materials in contact with the ground	Yes	Not considered further	Building materials
Table 4.2.7				

4.3 Identification of pathways

4.3.1 Pathways to human receptors

4.3.1.1 Guidance published by the Environment Agency in Science Report SC050021/SR3 *'Updated technical background to the CLEA model'* provides a detailed assessment of pathways and assessment and human exposure rates to source contaminants. In summary, there are three principal pathway groups for a human receptor:

Table summarising likely pathways			
Principal pathways	Detail		
Ingestion through the mouth	Ingestion of air-borne dusts		
	Ingestion of soil		
	Ingestion of soil attached to vegetables		
	Ingestion of home-grown vegetables		
Inhalation through the nose and mouth.	Inhalation of air-borne dusts		
	Inhalation of vapours		
Absorption through the skin.	Dermal contact with dust		
	Dermal contact with soil		
Table 4.3.1			

4.3.1.2 The proposed development comprises a new footbridge with associated hardstanding. The presence of hardstanding will severely restrict pathways to the potentially contaminated soils to human receptors, and the absence of any indoor spaces limits the potential for the inhalation of vapours (due to fresh air dilution).

4.3.2 Pathways to controlled waters

- 4.3.2.1 A number of pathways exist for transport of soil contamination to controlled waters. A summary of these pathways are:
 - Percolation of water through contaminated soils.
 - Near-surface water run-off through contaminated soils.
 - Saturation of contaminated soils by flood waters.
- 4.3.2.2 Based on our current understanding of development proposals, the bridge and associated abutments areas will comprise of hardstanding materials. Pathways for percolation and near surface run off through near surface soils would, therefore, be limited post-development; however the presence of foundations may present preferential pathways for the vertical migration of contaminants.
- 4.3.3.3 The site is within the tidal floodplain for the River Lossie and the North Sea, and there is considered to be a high likelihood of coastal and surface water flooding. Therefore, saturation of contaminated soils by flood and tidal waters is considered to be a viable pathway post-development.

4.3.4 Summary of identified likely pathways

4.3.4.1 Based on the above assessments, the following table summarises likely pathways of potential chemical contaminants at the site to identified receptors.

Table of likely pathways			
Receptor group	Critical receptor	Pathway	
Proposed site users	Child	Inhalation, ingestion and dermal contact with soils and dusts (limited) Inhalation of vapour (limited)	
Construction operatives	Adult	Inhalation, ingestion and dermal contact with soils and dusts Inhalation of vapour	
Groundwaters and surface waters	Secondary A and Principal Aquifers, River Lossie, North Sea	Vertical migration of contaminants down foundation edges. Percolation (limited); Saturation from tidal and flood waters.	

4.4 Assessment of sources of chemical contamination

4.4.1 Introduction

- 4.4.1.1 Initially, potential sources of contamination are assessed using the following elements of the investigation process.
 - 1. History of the site
 - 2. Desk study information
 - 3. Site reconnaissance
 - 4. Geology

These elements will dictate a relevant soil/water testing regime to quantify possible risks of any identified contaminative sources which may harm identified receptors.

4.4.2 Source assessment – History of the site

4.4.2.1 Based on published historical maps, there is limited evidence to indicate the site or its immediate surroundings have been subject to activities likely to result in a significant source of chemical contamination.

4.4.3 Source assessment – Desk study information

- 4.4.3.1 Envirocheck presents a detailed database of environmental information in relation to the site including;
 - Pollution incidents
 - Landfill sites
 - Trading activities
- 4.4.3.2 Based on the Envirocheck data (refer Appendix H) the site has no recorded history of any pollution events, land uses, or trading activities in close proximity to the site which is likely to result in a significant source of contamination.

4.4.4 Source assessment – Site reconnaissance

- 4.4.4.1 A full description of the site and observed adjacent land uses is provided in Section 3 of this report. A plan summarising observations made on site during our site reconnaissance visit is presented on Drawing 02.
- 4.4.4.2 We did not observe any obvious evidence of any current or recent activities on site or adjacent sites likely to result in a potential source of chemical contamination.

4.4.5 Source assessment – Geology

4.4.5.1 The recorded superficial deposits do not typically exhibit any abnormal concentrations of naturally occurring chemical contaminants.

4.4.6 Source assessment – Summary

4.4.6.1 With consideration to a range of available data sources, no viable contaminant sources have been identified on site or within influencing distance of the site.

4.5 Initial Conceptual Model

- 4.5.1 As no significant contaminant sources have been identified, no viable pollutant linkages can be established. Therefore, the risk to identified receptors is considered to be low.
- 4.5.2 Due to the absence of pollutant linkages, a tabulated or diagrammatic iCSM is not considered appropriate.

4.6 Risk assessment summary and recommendations

4.6.1 Based on our assessments described above, we can provide the following summary and recommendations for each identified receptor.

4.6.2 Current and end site users

4.6.2.1 As no source of significant chemical contamination has been identified on site, we are of the opinion that the site represents a low risk of causing harm to the health of identified current and proposed users of the site.

4.6.3 Construction operatives and other site investigators

- 4.6.3.1 The risk of damage to health of construction operatives and other site investigators is, in our opinion, low. As a precautionary approach, however, we recommend adequate hygiene and safety precautions are adopted on site, in line with good working practices on brownfield sites. Guidance on safe working practices can be obtained from the following documents
 - The Health and Safety Executive Publication "Protection of Workers and the General Public during the Development of Contaminated Land" (HMSO) and
 - "A Guide to Safer Working on Contaminated Sites" (CIRIA Report 132).

4.6.4 Controlled waters

4.6.4.1 As no source of significant chemical contamination has been identified on/adjacent to the site, we are of the opinion that the site represents a low risk of causing harm to water receptors.

4.7 Gaseous contamination

4.7.1 Due to the nature of the development comprising of a footbridge, with no enclosed spaces anticipated, the risk of any gaseous contamination affecting human receptors is considered to be negligible.

5 Fieldwork

5.1	General
5.2	Site restrictions
5.3	Light cable percussion boring
5.4	Static cone penetration testing
5.5	Sampling strategy

5.1 General

- 5.1.1 Fieldwork was carried out from 19th to 23rd October 2020 and comprised the following activities:-
 - Excavation of 5 (five) exploratory boreholes using cable and tool percussion drilling techniques
 - Cone Penetration Testing (CPT) in 34 (thirty-four) locations
- 5.1.2 A plan of the site showing observed/existing site features and position of proposed footbridge and exploratory points is presented on Drawing 02. The position of exploratory points shown on these plans is approximate only.
- 5.1.3 The extent of fieldwork activities and position of exploratory points were defined by both the Client and Soiltechnics.
- 5.1.4 Exploratory points were positioned to avoid known locations of underground services, to avoid possible location of proposed foundations but were also positioned to provide a reasonable coverage of the site. Prior to commencement of exploratory excavations an electronic cable locating tool was used to scan the area of the excavation. If we received a response to this equipment, then the excavation would be relocated
- 5.1.5 All soils exposed in excavations were described in accordance with BS EN ISO 14688 *(Identification and Classification of soil'* and BS EN ISO 14689 *(Identification and classification of rock'.*

5.2 Site restrictions

- 5.2.1 Access to East Beach for pedestrians and road vehicles was unachievable due to the channel of the River Lossie separating the beach from mainland; unless a lengthy journey was undertaken allowing access from the east.
- 5.2.2 A cable percussive rig mounted on to a tracked all-terrain vehicle (ATV) was used to ford across the River Lossie, which was only possible during low tide events. Pedestrian access was made possible by the use of a small boat, provided by the client.
- 5.2.3 Boreholes undertaken on East Beach were restricted to areas which were relatively flat and this was assessed by Soiltechnics and sub-contractors.

- 5.2.4 Boreholes were also restricted to being located beyond the high tide level.
- 5.2.5 BH02 was terminated at 2m depth due to flooding by swells of the incoming tide. The borehole was reattempted as BH02A and located further to the east.

5.3 Light cable and tool percussion boring

- 5.3.1 Boreholes BH01 to BH04, (including BH02A) were excavated using light cable percussion boring techniques as described in EN ISO 22475-1:2006 forming 150mm diameter holes. Temporary casing was advanced within the borehole excavation to maintain the stability of the hole. When groundwater was encountered the excavation was temporarily halted to allow for groundwater observations to be made. Following groundwater observations the casing was advanced within the hole and the location/locations of the water strikes recorded. The casing was subsequently advanced to maintain the stability of the borehole and seal off the water to prevent further ingress. Additional records were taken when (and if) the casing produced a seal against water ingress and at the commencement and completion of a days drilling operations. When obstructions were encountered a chisel was employed to break through the obstruction. Time taken to progress the excavation using the chisel is recorded on the borehole logs.
- 5.3.2 1.2m deep service inspection pits were excavated prior to the drilling of BH01 and BH03.
- 5.3.3 On completion of the boreholes, they were backfilled with arisings and compacted using drilling tools.
- 5.3.4 Bulk soil samples for identification or subsequent 'classification' laboratory testing were taken from borehole cutting equipment. The samples were placed in a plastic bag and subsequently sealed and labelled. Soil samples were obtained where possible to meet category B quality classes 3 to 5 as described in BS EN 1997-2:2007 (table 3.1).
- 5.3.5 Standard Penetration Testing (SPT) was carried out at regular frequencies in the borehole. The test was carried out in accordance with BS EN ISO 22476-3:2005. Key details of the test, as required by BS EN ISO 22476-3 are recorded in Appendix D. The drive rods were type AW. Samples taken from the open sampler (SPT) were placed in a plastic bag, sealed and labelled. In coarse granular soils, a solid 60° cone may have been used to replace the SPT cutting shoe. This test is reported as SPT(C). Summary of standard penetration testing is recorded on borehole logs.
- 5.3.6 A graphical summary of standard penetration test results is presented in Appendix C.
- 5.3.7 The borehole excavations were formed by drillers who are NVQ Level 2 qualified in Land Drilling under the Construction Awards Alliance CAA with samples relogged by an experienced Geotechnical Engineer.
- 5.3.8 Records of boreholes formed by light cable and tool percussion drilling techniques are presented in Appendix D.

5.4 Static cone penetration testing

- 5.4.1 The static cone penetration test involves hydraulically pushing a 15cm² cone into the ground at a standard rate of 2cm/sec and measuring its penetration resistance. The cone is equipped with a 'friction sleeve', which measures the shear stress applied by the soil as the sleeve passes through it. The ratio between cone resistance (expressed in units of stress) and the side shear is termed 'friction ratio' and is used to estimate the type of soil through which the cone is being driven. The equipment is housed in a tracked vehicle, which is used for the hydraulic equipment to the jack against.
- 5.4.2 The static cone penetrating testing was carried out following BS EN ISO 22476-1:2012 Geotechnical investigation and testing. Field testing. Electrical cone and piezocone penetration test'. Static cone penetration testing was carried out by Insitu Site Investigations Ltd in a total of 34 locations to depths ranging between 1.74m and 6.67m.
- 5.4.3 A copy of their report and interpretation of soils types penetrated by the cone is provided in their report presented in Appendix J.

5.5 Sampling strategy

5.5.1 Geotechnical

- 5.5.1.1 In general we adopted a judgemental sampling strategy in relation to geotechnical aspects of the investigation. The location and frequency of sampling was carried out in consideration of the following:
 - i) Topography
 - ii) Geology (including Made Ground)
 - iii) Nature of development proposals

5.5.2 Sample retention

5.5.2.1 Samples are stored for a period of one month following issue of this report, unless otherwise requested.

6 Laboratory testing

6.1 Classification testing

6.1 Classification

6.1.1 Laboratory testing was carried out on samples retrieved from site. The method of testing is recorded on the laboratory test certificate. The following table summarises the classification testing scheduled;

Table summa	rising classifica	ation testing	
Exploratory point	Depth (m)	Soil type	Testing scheduled (determination of)
BH01	2.0		
BH01	4.0		
BH01	5.0		
BH02	1.2		
BH02A	3.2		
BH02A	4.2	Granular	Particle size distribution (searce signe)
BH03	3.0	Granular	Particle size distribution (coarse sieve)
BH03	5.0		
BH03	8.0		
BH04	1.2		
BH04	2.2		
BH04	3.8		
Table 6.1.1			

6.1.2 Laboratory test certificates are presented in Appendix F.

7 Ground conditions encountered

7.1	Soils/rocks
7.2	Geotechnical parameters
7.3	Groundwater
7.4	Evidence of contamination
7.5	Obstructions and instability

7.1 Soils

- 7.1.1 The exploratory excavations encountered the following geological profile, in order of superposition:
 - Made Ground (Land side only)
 - Marine Beach Deposits (Beach side only)
 - Storm Beach Deposits (Land side only)
 - Burghead Sandstone Formation (Land side only)

7.1.2 Made Ground

7.1.2.1 Made Ground soils were encountered in the two land side boreholes (BH01 and BH03) to depths of 0.8m and 0.9m, typically comprising a veneer of Topsoil (0.1m to 0.2m thick) over brown and greyish brown slightly gravelly/gravelly fine to medium sand with medium cobble content. Gravel comprised of sub angular to rounded fine to coarse mixed lithologies predominantly sandstone and quartzite and cobbles comprised of angular to sub angular sandstone.

7.1.3 Marine Beach Deposits

- 7.1.3.1 Marine Beach Deposits were encountered in BH02, BH02A, and BH04 to termination depths of approximately 5.10m.
- 7.1.3.2 Typically, these deposits comprised of a medium dense light brown fine to medium sand to 4m bgl, where it became slightly gravelly with occasional cobbles of sandstone.
- 7.1.3.3 CPT in-situ testing carried out along the proposed routes and abutment locations generally confirm the geology encountered within the boreholes. The testing shows a general increase of density with depth, and also indicates that localised silt bands are present within the unit. The results are included within Appendix J.

7.1.4 Storm Beach Deposits

7.1.4.1 Storm Beach Deposits were encountered in BH01 (to 6.50m depth) and BH03 (to 9.65m depth) directly underlying the Made Ground soils. This deposit comprised of light brown to brown slightly gravelly slightly silty fine to coarse sand with gravels consisting of sub angular to rounded fine to coarse mixed lithologies predominantly sandstone and quartzite. From 3.9m to 5.0m in BH01 this was encountered as a sand and gravel and as a slightly sandy gravel from 7.0m to termination depth of 9.65m in BH03.

7.1.5 Burghead Sandstone Formation

7.1.5.1 Suspected bedrock was only encountered in BH01 at 6.50m comprising of a light grey sandstone, recovered as a gravel after a prolonged effort of chiselling.

7.1.6 Summary

- Table summarising soil types Thickness Strata Depth to Depth to **Summary description** bottom (m) top (m) (m) 0.1-0.2 0.1 - 0.2Made Ground Topsoil 0.0 Grass onto dark brown slightly gravelly sand with some rootlets (0.15) (0.15) Made Ground – 0.1 - 0.20.8 - 0.9Brown and greyish brown slightly 0.7 **Reworked Sand** gravelly/gravelly fine to medium sand with (0.15)(0.85) medium cobble content Marine Beach Deposits 0.0 3.8 - 4.13.8 - 4.1Light brown fine to medium sand. (shallow) (3.95) (3.95) Marine Beach Deposits 3.8 - 4.15.05 - 5.17 1.07 - 1.25Greyish brown slightly gravelly/gravelly slightly (3.95) (1.16) silty fine to medium sand (deep) (5.11)Storm Beach Deposits 0.8 - 0.9 5.7 - 8.75 Light brown to brown slightly gravelly slightly 6.5 -9.65 (8.1) (0.85)(7.2) silty fine to coarse sand **Burghead Sandstone** 6.5 Light grey sandstone Formation Table 7.1.6.1
- 7.1.6.1 The following table summarises the geology encountered;

Figures in brackets are average values

7.1.6.2 With the exception of Made Ground, the investigation generally confirmed published geological records.

7.1.7 River Channel

7.1.7.1 The CPT testing encountered Marine Beach Deposits within the river channel, with the overall depths in relative parity with the holes undertaken on East Beach. Within the northern route crossing, the depth of the superficial deposits were proven to a depth of approximately 1.8m, where they met refusal on competent ground. Within the southern crossing, refusal was generally met at a depth of around 3m bgl.

Geotechnical parameters 7.2

7.2.1 The following table summarises test data in all of the natural geological strata encountered.

Table summarising soil testing and derived geotechnical parameters						
Geotechnical parameter	Geological unit	Method	Value range (kN/m³)	Characteristic value (kN/m ³)	Comments	Notes
Weight density (above water table)	Marine Beach Deposits (shallow)	- Coil	15.5 - 18	16	Derived from BS 8004 figure 1. Lowest value to be used in structural design for a medium dense sand.	1, 2
	Marine Beach Deposits (deep)	descriptions	17 – 19	17	Derived from BS 8004 figure 1. Lowest value to be used in structural design for a dense sand.	1, 2
	Storm Beach Deposits	-	15.5 - 19	17		1, 2
Weight density (below water table)	Marine Beach Deposits (shallow)		18 – 20.5	18	Derived from BS 8004 figure 2. Lowest value to be used in structural design for a medium dense sand.	1, 2
	Marine Beach de Deposits (deep)	- Soil descriptions -	19.5 – 21.5	19.5	Derived from BS 8004 figure 2. Lowest value to be used in structural design for a dense sand.	1, 2
	Storm Beach Deposits		18 - 21.5	19.5		1, 2
SPT 'N' Value	Marine Beach Deposits (shallow)		4 - 38	15	Average value used	1, 2
	Marine Beach Deposits (deep)	Insitu testing	52 - refusal	50	Typical value for refusal used	1, 2
	Storm Beach Deposits	-	4 - 44	35	Average value used	1, 2
Angle of shearing resistance,	Marine Beach Deposits (shallow)	Soil	30 – 35	31	Derived using BS8004:2015 Equation 5 and literature	1, 2
φ _{pk} (°)	φ _{pk} (°) Marine Beach and Deposits laborat	and laboratory	36 - 40	36	-	1, 2
Table 7.2.1	Storm Beach Deposits	- testing	35 – 40	37	-	1, 2

Insitu test data presented in Appendix C 1.

CPT test data, presented in Appendix J. 2.

7.2.2 The following table summarises test data in Made Ground.

Table summarising soil testing and derived geotechnical parameters						
Geotechnical parameter	Geological unit	Method	Value range (kN/m³)	Characteristic value (kN/m³)	Comments	Notes
Weight density	Reworked	Soil	16 - 20	16	Derived from BS 8004 figure 1.	
(above water	sands	descriptions			Lowest value to be used in	
table)					structural design.	
Table 7.2.2						

7.3 Groundwater

7.3.1 Groundwater inflows were observed in all of the exploratory excavations. A summary of our observations is tabulated below:

Table summarising groundwater observations				
Exploratory point	Date of observation	Depth (m) below ground levels	Observations	
BH01	19/10/20	3.0	Rising to 2.8m after 20 minutes	
BH02	19/10/20	1.3	Rising associated with tide	
BH02A	20/10/20	1.3	Rising associated with tide	
BH03	21/10/20	3.0	Rising to 2.8m after 20 minutes	
BH04	21/10/20	3.0	Rising associated with tide, 2m at end of shift and at 3.10m at beginning of shift on 22/10/20.	
Table 7.3.1				

7.3.2 It should be noted that due to the close proximity of the coast, the site is located within a tidal flood plain and water levels will vary depending generally on recent weather conditions and tide levels. Only long-term monitoring of levels in standpipes will provide a measure of seasonal variations in groundwater levels.

7.4 Evidence of contamination

7.4.1 During excavation of our exploratory points, no evidence of contamination was noted.

7.5 **Obstructions and instability**

7.5.1 The following table summarises obstructions encountered during our exploratory excavations;

Table summarising obstructions and instability observations			
Exploratory	Depth of	Description of obstruction and/or instability	
point	obstruction (m)		
BH01	0.1 - 0.8	Frequent sandstone cobbles encountered in Made Ground	
BH01	3.7 – 3.9	Sandstone cobble encountered	
BH03	0.2 – 0.9	Frequent sandstone cobbles encountered in Made Ground	
BH03	2.5 – 2.9	Sandstone boulder encountered	
Table 7.5.1			

8 Geotechnical Appraisal

- 8.1 General description of the development
- 8.2 Building regulations and this report section
- 8.3 The geological model
- 8.4 Footbridge foundation solution
- 8.5 Pad type foundations
- 8.6 Piled foundations
- 8.7 Concrete classification

8.1 General description of the development

- 8.1.1 The following assessments are made on the investigatory data presented in the preceding sections of this report and are made with reference to specific nature of the development. Should scheme proposals change then it may be necessary to review the investigation and report.
- 8.1.2 The project will comprise the construction of a footbridge to allow access between East Beach and Lossiemouth. The proposed footbridge will replace an existing footbridge which has structural defects and is deemed unsafe.

8.2 Building regulations and this report section

8.2.1 Building Regulations

8.2.1.1 Current Approved Document A of the building Regulations references Eurocodes and their UK National Annexes as practical guidance in meeting part A requirements. Approved document A advises there may be alternative ways of achieving compliance with requirements where it can be demonstrated that the use of withdrawn standards no longer maintained by the British Standards Institution continues to meet Part A requirements.

8.2.2 This report section

8.2.2.1 This chapter of the report provides both a foundation strategy for the proposed development and geotechnical design parameters to comply with Eurocode 7 (BSEN1997-1:2004 '*Geotechnical Design – part 1 General Rules*' and the corresponding UK National Annex).

8.2.3 Geotechnical terms

8.2.3.1 Definitions of geotechnical terms used in the following paragraphs are provided in Appendix A.

8.2.4 This report

8.2.4.1 This report is a ground investigation report (GIR) and does not constitute a Geotechnical Design Report as defined in section 2.8 of BS EN 1997-1:2004 'Eurocode 7 – Geotechnical Design – Part 1: General Rules' and in particular will exclude assessment of lifetime actions to buildings from geotechnical influences.

8.3 The geological model

8.3.1 Landside

8.3.1.1 Made Ground was encountered in both land side boreholes (BH01 and BH03) to depths 0.8m and 0.9m. Made Ground is underlain by Storm Beach Deposits, typically described as medium dense and dense silty Sand and Gravel to 6.50m and 9.65m depths in BH01 and BH03 respectively. It is conjectured that bedrock was encountered in BH01 at 6.50m BGL.

8.3.2 Beach Side

8.3.2.1 Marine Beach Deposits, typically described as medium dense fine to medium sand, becoming slightly gravelly from c. 4m depth, were encountered to the termination depths of the boreholes at circa 5.10m BGL. It should be noted that the boreholes were terminated due to competency of the ground, i.e. unable to progress the hole further.

8.3.3 Groundwater

8.3.3.1 Groundwater is interpreted to be in hydraulic connectivity with river and sea levels, and heavily influenced by the tide. Accordingly, groundwater is anticipated to be at shallow depth on the beach side. Due to the elevated location around BH01, groundwater is anticipated to be relatively deep at this location.

8.4 Footbridge foundation solution

8.4.1 In our opinion, the naturally deposited Marine Beach Deposits and Storm Beach Deposits could support the proposed development on pad type foundations. However, forming excavations on the beach to facilitate construction of the pads would be difficult due to the presence of shallow groundwater. Additionally, scour protection measures would need to be considered as part of the detailed design. For these reasons, a piled solution may be more practical and beneficial in the long term.

8.5 Pad type foundations

8.5.1 The natural soils encountered at the site were generally granular in composition and encountered in a medium dense to dense state. Accordingly, natural soils would be suitable founding strata for proposed foundations. The soils are granular, hence not shrinkable and thus are not anticipated to be impacted by any future tree planting. It is recommended foundations extend a minimum of 1.2m below existing or proposed ground levels on both the beach and land. This depth has been considered which allows foundations to penetrate Made Ground soils on land and to depths where soils are of medium dense state on East Beach.

8.5.2 Geotechnical category

8.5.2.1 In our opinion the project will comprise conventional types of structure and foundations with no exceptional risk, or difficult ground or loading conditions thus meeting the requirements of geotechnical category 2.

8.5.3 Assumptions

8.5.3.1 Eurocode 7 list assumptions made in the provision of the standard (in section 1.3). Comments against some assumptions are provided below.

Assumption	Comment
Data for the design are collected, recorded and interpreted by appropriately qualified personnel	This report follows an in-house procedure of review and checking, ultimately approved by a Director of the company who by virtue of experience in geotechnical engineering and qualification is deemed appropriately qualified
Adequate continuity and communication exist between the personnel involved in data collection, design and construction	This can be challenging in situations in which structural and geotechnical design is carried out by different individuals and indeed different organisations. Invariably the ground investigation is carried out at an early stage of a development and prior to actions on buildings being established let alone their magnitude. It is important that we the geotechnical consultant form part of the design team with continuous review of geotechnical design data in the context of the structural design process.
Table 8.5.3	

8.5.4 Ultimate limit state assessment

8.5.4.1 Ultimate limit state analyses (bearing capacity) have been undertaken in accordance with the approach outlined in Annex D of Eurocode 7 to derive the following design bearing resistances. In light of the tidal conditions at the site we have assumed that groundwater could rise to ground level.
Marine

Deposits

Beach

Storm

Beach

Deposits

Table 8.5.4

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kN/m²

 $R_{d2} = 285$

 $R_{d2} = 300$

 $R_{d2} = 315$

 $R_{d2} = 600$

 $R_{d2} = 640$

 $R_{d2} = 680$

Table of bearing resistance (pad foundations)			
Ultimate limit state derived using Design approach 1			
Strata	Foundation plan size	Combination 1	Combination 2

kN/m²

 $R_{d1} = 595$

 $R_{d1} = 630$

 $R_{d1} = 670$

 $R_{d1} = 1430$

 $R_{d1} = 1530$

 $R_{d1} = 1630$

8.5.4.2 The following table provides derived ultimate limit state bearing resistances.

(m x m)

3.5 x 3.5

4 x 4

4.5 x 4.5

3.5 x 3.5

4 x 4

4.5 x 4.5

8.5.4.4	It is vitally important to note that partial factors given in table A3 of the code must
	be applied to actions (V _{uls}) imposed on the ground at foundation formation level
	(including self-weight of the foundation) to satisfy the requirement of: -

 $V_{uls} \leq R_d$

8.5.5 Serviceability limit state (SLS) assessment

8.5.5.1 Serviceability limit state has been assessed by undertaking settlement analyses in accordance with the approach outlined in Annex F of Eurocode 7 and adopting the following variables.

Table of geotechnical parameters to estimate settlement				
Symbol	Parameter	Range of values	Comment	
N _{ave}	Average Standard Penetration Test N Value in	4 -38 (15)	Average value adopted for Marine Beach Deposits	
	soils below foundation	35	Lower bound adopted for Storm Beach Deposits	
Table 8.5.5.1				

8.5.5.2 The following table presents bearing resistances and associated estimates of settlement. It should be noted that the adopted methodology incorporates a creep factor which we have applied assuming a 50-year lifespan.

Table of bearing resistance (pad foundations)				
Strata	Foundation plan size (m x m)	Bearing resistance kN/m ²	Settlement limit (initial and consolidation) mm	
Marine	3.5 x 3.5	$R_{sls} = 120$	25	
Beach	4 x 4	R _{sls =} 110	25	
Deposits	4.5 x 4.5	R _{sls =} 100	25	
Storm	3.5 x 3.5	R _{sls =} 225	25	
Beach	4 x 4	R _{sls =} 205	25	
Deposits	4.5 x 4.5	R _{sls =} 190	25	
Table 8.5.5.2				

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8.5.5.3 Differential settlement is totally dependent upon the variation of loads (actions) imposed on the ground and consistency of the foundation supporting ground. Assuming foundation loads are reasonably uniform, we consider differential settlement is unlikely to exceed 60% of the estimated total settlement. It is likely settlement will be substantially achieved within say 5 years of construction. If stresses applied at foundation formation levels vary significantly then this will increase levels of differential settlement produced by variation in ground conditions alone.

8.6 Piled foundations

- 8.6.1 Due to the nature of the site, difficulties in working in a tidal channel and increased potential for scour, a piled solution may be considered more suitable.
- 8.6.2 A preliminary assessment of single pile capacity has been undertaken to assist the foundation designer in establishing a foundation layout who will also retain design responsibility. The assessment has been undertaken in accordance with BS EN1997-1:2004 + A1:2013 and BS 8004:2015. It is recommended that the design and installation of the piles are determined by a specialist piling contractor who has experience in pile installation in these or similar ground conditions.
- 8.6.3 It is assumed that the piles will be installed using displacement piling techniques i.e. driven piles.
- 8.6.4 The calculations have been undertaken with the aid of PILE, a specialist geotechnical software programme developed by OASYS. The analyses have been undertaken without explicit verification of serviceability limit state. Accordingly, set R4 partial factors have been adopted for Combination 2. However, as a general guide, the settlement of a single pile at working loads (factor of safety > 2) is typically of the order of 1% of the pile diameter.
- 8.6.5 A model factor of 1.4 has been adopted in the analyses. The value may be reduced to 1.2 If the resistance is verified by a maintained load test taken to the required, unfactored ultimate resistance.
- 8.6.6 Shaft resistance within the Made Ground is assumed to be zero. It is further assumed that the Made Ground will not cause downdrag on the pile.
- 8.6.7 Unit base and shaft resistance within the granular strata have been derived using an effective stress approach, adopting the variables detailed below. When deriving unit base resistance, a bearing pressure coefficient has been adopted based on the relationship suggested by Berezantsev (1961).

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Table of pile parameters				
Strata	Foundation plan size (m x m)	Value	Derivation	
Marine Beach	Earth pressure coefficient, K _s	1	BS 8004:2015 – Table 8	
Deposits (upper 4m)	Angle of interface friction, $\delta\left(^\circ\right)$	21	BS 8004:2015 – Eqn 36	
Storm Beach	Earth pressure coefficient, Ks	1	BS 8004:2015 – Table 8	
Deposits	Angle of interface friction, δ (°)	25	BS 8004:2015 – Eqn 36	
Marine Beach	Earth pressure coefficient, K _s	1	BS 8004:2015 – Table 8	
Deposits (>4m)	Angle of interface friction, $\delta\left(^\circ\right)$	24	BS 8004:2015 – Eqn 36	
Table 8.6.7				

8.6.8

It is assumed that piles on the beach will be primarily end bearing and founded within the Marine Beach Deposits at a depth of circa 5m. This depth coincides with the termination of the borehole due to competency of the ground. Accordingly, the following preliminary pile resistances have been derived for a 5m long pile installed on the beach side of the site: -

Table of pile resistances for a 5m long pile on the beach side			
Pile diameter	Resistance (kN)		
(m)	Combination 1	Combination 2	
0.15	38	23	
0.30	139	83	
0.45	313	187	
Table 8.6.8			

8.6.9

For the land side of the site, the variation of a single pile resistance in relation to pile toe depth is presented below for three different pile diameters. It should be noted that the analysis is based on the ground conditions encountered in BH03 and therefore assumes that bedrock is not present at 6.50m as conjectured in BH01. Whilst this is a conservative assumption for deriving pile capacities, such conditions would not be compatible with pile driving to lower depths. Accordingly, should these conditions be encountered then piles would need to be terminated early and cut off.



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8.6.10 It should be noted that the resistance of a single pile is reduced in the vicinity of other piles. Accordingly, detailed design of the piled foundation arrangement should take into account spacing between piles and pile group effects.

8.7 Concrete classification

8.7.1 Due to the site being located in a marine environment where cyclic wetting and drying will occur, an exposure class of XS3 will apply accordance with BS EN 206.

9 Further investigations

9.1 Further investigations

9.1 At this stage we do not consider further investigations to be necessary.

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Кеу	
🕂 вн	Cable percussive borehole location
🛛 СРТ	Cone Penetration Test (CPT) location
	Proposed footbridge route
P1	Location and orientation of site photographs (See Appendix E)

Notes:

Locations are approximate

A	First issue		KD	FQ	мон	30.11.2020
RE	/ DESCRIPTION		PRODUCED BY	CHECKED BY	REVIEWED BY	DATE
のためのとう	soiltechnics					
PF	PROJECT					
Lo	Lossiemouth East Beach Footbridge					
TI	TITLE					
Pl ex	Plan showing existing site features, location of exploratory points and proposed footbridge location					
PF	OJECT NO.	SCALE AT A3		RAW	/ING	NO.
S	FS5161M	1:1250	0)2		

Definition of geotechnical terms used in this report - foundations

Strip foundations.

A foundation providing a continuous longitudinal ground bearing.

Trench fill concrete foundation.

A trench filled with mass concrete providing continuous longitudinal ground bearing.

Pad foundation.

An isolated foundation to spread a concentrated load.

Raft foundation.

A foundation continuous in two directions, usually covering an area equal to or greater than the base area of the structure.

Substructure.

That part of any structure (including building, road, runway or earthwork) which is below natural or artificial ground level. In a bridge this includes piers and abutments (and wing walls), whether below ground level or not, which support the superstructure.

Piled foundations and end bearing piles. A pile driven or formed in the ground for transmitting the weight of a structure to the soil by the resistance developed at the pile point or base and the friction along its surface. If the pile supports the load mainly by the resistance developed at its point or base, it is referred to as an end-bearing pile; if mainly by friction along its surface, as a friction pile.

Bored cast in place pile.

A pile formed with or without a casing by excavating or boring a hole in the ground and subsequently filling it with plain or reinforced concrete.

Driven pile.

A pile driven into the ground by the blows of a hammer or a vibrator.

Precast pile.

A reinforced or pre-stressed concrete pile cast before driving.

Driven cast in place pile.

A pile installed by driving a permanent or temporary casing, and filling the hole so formed with plan or reinforced concrete.

Displacement piles.

Piled formed by displacement of the soil or ground through which they are driven.

Skin friction.

The frictional resistance of the surrounding soil on the surface of cofferdam or caisson walls, and pile shafts.

Downdrag or negative skin friction. A downwards frictional force applied to the shaft of a pile caused by the consolidation of compressible strata, e.g. under recently placed fill. Downdrag has the effect of adding load to the pile and reducing the factor of safety.

Definition of geotechnical terms used in this report – bearing values

To Eurocode 7

Formal definitions of Eurocode terms are provided in BS EN 1990:2002 '*Eurocode – Basis of Structural Design*'. The following are considered informal definitions relating to the context of the geotechnical design report.

Bearing resistance

Calculated ability of a foundation to resist applied actions considered for ultimate and serviceability limit states.

Ultimate limit state (ULS) considerations

Partial factors applied to soil parameters, and actions (applied loads) in bearing resistance calculations to avoid risk of failure of the foundation in bearing.

Serviceability limit state (SLS) considerations

Calculations to determine bearing resistance of a foundation which will generate acceptable levels of settlement under applied actions

Characteristic geotechnical parameters

These are based on results and derived values from laboratory field tests, complemented by wellestablished experience.

Pre-Eurocode 7 methods.

Ultimate bearing capacity.

The value of the gross loading intensity for a particular foundation at which the resistance of the soil to displacement of the foundation is fully mobilised.

Presumed bearing value.

The net loading intensity considered appropriate to the particular type of ground for preliminary design purposes. The particular value is based on calculation from shear strength tests or other field tests incorporating a factor of safety against shear failure.

Allowable bearing pressure.

The maximum allowable net loading intensity at the base of the foundation, taking into account the ultimate bearing capacity, the amount and kind of settlement expected and our estimate of ability of the structure to accommodate this settlement.

Factor of safety.

The ratio of the ultimate bearing capacity to the intensity of the applied bearing pressure or the ratio of the ultimate load to the applied load.

Definition of geotechnical terms used in this report – road pavements

The following definitions are based on Transport and Road Research Laboratory (TRRL) Report LR1132.

Equilibrium CBR values.

A prediction of the CBR value, which will be attained at formation level under the completed pavement.

Thin pavement.

A thin pavement (which includes both bound and unbound pavement construction materials) is 300mm thick (very lightly trafficked road) and a thick pavement is 1200mm thick (typical of motorway construction).

Definition of geo-environmental terms used in this report

Conceptual model

Textual and/or schematic hypothesis of the nature and sources of contamination, potential migration pathways (including description of the ground and groundwater) and potential receptors, developed on the basis of the information obtained from the investigatory process.

Contamination

Presence of a substance which is in, on or under land, and which has the potential to cause harm or to cause pollution of controlled water.

Controlled water

Inland freshwater (any lake, pond or watercourse above the freshwater limit), water contained in underground strata and any coastal water between the limit of highest tide or the freshwater line to the three mile limit of territorial waters.

Harm

Adverse effect on the health of living organisms, or other interference with ecological systems of which they form part, and, in the case of humans, including property.

Pathway

Mechanism or route by which a contaminant comes into contact with, or otherwise affects, a receptor.

Receptor

Persons, living organisms, ecological systems, controlled waters, atmosphere, structures and utilities that could be adversely affected by the contaminant(s).

Risk

Probability of the occurrence of, and magnitude of the consequences of, an unwanted adverse effect on a receptor.

Risk assessment

Process of establishing, to the extent possible, the existence, nature and significance of risk.

Definition of environmental risk/hazard terms used in this report

Based on CIRIA report C552 'Contaminated land risk assessment – A guide to good practice'.

Potential hazard severity definition

Category	Definition
Severe	Acute risks to human health, catastrophic damage to buildings/property, major pollution of controlled waters
Medium	Chronic risk to human health, pollution of sensitive controlled waters, significant effects on sensitive ecosystems or species, significant damage to buildings or structures
Mild	Pollution of non-sensitive waters, minor damage to buildings or structures
Minor	Requirement for protective equipment during site works to mitigate health effects, damage to non-sensitive ecosystems or species

Probability of risk definition

Category	Definition
High likelihood	Pollutant linkage may be present, and risk is almost certain to occur in long term, or there is evidence of harm to the receptor
Likely	Pollutant linkage may be present, and it is probable that the risk will occur over the long term
Low likelihood	Pollutant linkage may be present, and there is a possibility of the risk occurring, although there is no certainty that it will do so
Unlikely	Pollutant linkage may be present, but the circumstances under which harm would occur are improbable

Level of risk for potential hazard definition

Probability of	Potential severity					
risk	Severe	Medium	Mild	Minor		
High likelihood	Very high	High	Moderate	Low/Moderate		
Likely	High	Moderate	Low/Moderate	Low		
Low likelihood	Moderate	Low/Moderate	Low	Very low		
Unlikely	Low/Moderate	Low	Very low	Very low		

See below for definitions of 'very high' to 'very low'

Definition of environmental risk/hazard terms used in this report

Based on CIRIA report C552 'Contaminated land risk assessment – A guide to good practice'.

Risk classifications and likely action required:

Very high risk

High probability that severe harm could arise to a designated receptor from an identified hazard OR there is evidence that severe harm to a designated receptor is currently happening. This risk, if realised is likely to result in substantial liability. Urgent investigation and remediation are likely to be required.

High risk

Harm is likely to arise to a designated receptor from an identified hazard. This risk, if realised, is likely to result in substantial liability. Urgent investigation is required and remedial works may be necessary in the short term and are likely over the long term.

Moderate risk

It is possible that harm could arise to a designated receptor from an identified hazard. However, it is either relatively unlikely that any such harm would be severe, or if any harm were to occur it is likely that the harm would be relatively mild. Investigation is normally required to clarify risks and to determine potential liability. Some remedial works may be required in the long term.

Low risk

It is possible that harm could arise to a designated receptor from an identified hazard but it is likely that this harm, if realised, would at worst normally be mild.

Very low risk

It is a low possibility that harm could arise to a designated receptor. On the event of such harm being realised it is not likely to be severe.

List of documents used in assessment of chemical contamination

No.	Title	Publication reference / publisher
1	Human health toxicological assessment of contaminants in soil	EA Science Report – SC050021/SR2
2	Updated technical background to the CLEA model	EA Science Report – SC050021/SR3
3	CLEA Software (Version 1.03 beta) Handbook	EA Science Report - SC050021/SR4
4	Guidance on comparing Soil Contamination Data with a Critical Concentration	CIEH
5	The LQM/CIEH S4ULs for Human Health Risk Assessment (2015)	LQM/CIEH
6	Assessment of Risks to Human Health from Land Contamination: An overview of the development of soil guideline values and related research	R&D Publication, Contaminated Land Report CLR 7
7	Contaminants of Soil: Collation of Toxicological Data and Intake Values for Humans	R&D Publication, Contaminated Land Report CLR 9
8	The Contaminated Land Exposure Assessment Model (CLEA): Technical Basis and Algorithms	R&D Publication, Contaminated Land Report CLR 10
9	Model Procedures for the Management of Land Contamination	R&D Publication, Contaminated Land Report CLR 11
10	Contaminants in Soil: Collection of Toxicological Data and Intake Values for Human Values	R&D Publications, Tox. 6
11	Soil Guideline Values for Contamination (2002)	R&D Publications, SGV 10
12	Soil Guideline Values (2009)	EA Science Reports – SC050021
13	Atkins ATRISK ^{SOIL} (2011)	http://www.atrisksoil.co.uk
14	Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination (September 2014)	CL:AIRE
CIEH LQM EA CL:AIRI	Chartered institute of Environmental Health Land Quality Management Environment Agency E Contaminated Land: Applications in Real Enviro	nments



Testing suite summary

Table sum	marising testing suites	
Suite	Parameters	Medium
Suite 1	Arsenic, beryllium, boron, cadmium, chromium (total and VI), copper, lead, mercury, nickel, selenium, vanadium zinc, cyanide (free, total and complex), organic matter content, PAH (16 speciated), pH, phenol (total), TOC	Soil
Suite 2	Arsenic, boron (water soluble), beryllium, cadmium, chromium (total), copper, lead, mercury, nickel, selenium, vanadium, zinc, cyanide (free, total and complex, PAH (16 speciated), pH, phenol (total), sulfate (water soluble), sulfide, nitrate	Leachate
Suite 3	Arsenic, boron (water soluble), beryllium, cadmium, chromium (total), copper, lead, mercury, nickel, selenium, vanadium, zinc, cyanide (free, total and complex, PAH (16 speciated), pH, phenol (total), sulfate (water soluble), sulfide, nitrate	Water
Suite 4	TPH Texas Banding Aliphatic/Aromatic Split, BTEX, MTBE, PAH (16 speciated), organic matter	Soil
Suite 5	TPH Texas Banding Aliphatic/Aromatic Split, BTEX, MTBE, PAH (16 speciated)	Leachate
Suite 6	TPH Texas Banding Aliphatic/Aromatic Split, BTEX, MTBE, PAH (16 speciated)	Water
Suite 7	TPH Texas Banding Aliphatic/Aromatic Split, BTEX, TOC, organic matter	Soil
Suite 8	Sulphur (total), sulphate (water and acid soluble), pH	Soil
Suite 9	Sulphate, ammoniacal nitrogen, dissolved magnesium, pH	Water
Suite 10	VOC, SVOC, TOC, organic matter	Soil
Suite 11	VOC, SVOC	Leachate
Suite 12	VOC, SVOC	Water
Suite 13	Organotins dibutyltin/ tributyl-tin/tetrabutyltin/triphenyl-tin, tetraethyl- lead/tetramethyl-lead	Soil
Suite 14	Organotin	Leachate
Suite 15	Organotin	Water
Suite 16	TPH Texas Banding Aliphatic/Aromatic Split, BTEX, VOC, SVOC	Soil, water, leachate
Suite 17	TPH Texas Banding Aliphatic/Aromatic Split, BTEX, SVOC, VOC, arsenic, boron (water soluble), beryllium, cadmium, chromium (total), copper, lead, mercury, nickel, selenium, vanadium, zinc, cyanide (free, total and complex, pH, phenol (total), sulfate (water soluble), sulfide, nitrate	Soil, water, leachate
Concrete BRE suite	pH, sulphate (water and acid soluble), magnesium (water soluble), ammonia (water soluble), chloride, nitrate	Soil



Plot summarising Standard Penetration Test (SPT) results versus depth filtered by location





Plot summarising Standard Penetration Test (SPT) results versus depth filtered by geology



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Table summarising Standard Penetration Test (SPT) results

Location	Start Depth					Penetration (mm)		
Location	(m)	Seating 1-2	Main 1-4	Total Seating	Total Main	Total Seating	Total Main	
BH01	1.20	1/2	1/1/1/2	3	5	150	300	
BH01	2.00	2/3	3/2/4/3	5	12	150	300	
BH01	3.00	6/8	12/10/10/11	14	43	150	300	
BH01	4.00	9/9	12/10/10/10	18	42	150	300	
BH01	5.00	9/7	7/11/11/12	16	41	150	300	
BH01	6.50	25/25		50	0	40		
BH01	6.70	50		50	0	0		
BH02	1.20	2/3	2/4/6/4	5	16	150	300	
BH02	2.00	4/6	5/9/12/12	10	38	150	300	
BH02A	3.20	0/0	1/1/1/1	0	4	150	300	
BH02A	4.20	11/13	10/10/17/15	24	52	150	300	
BH02A	5.00	12/15	25	27	25	150	20	
BH03	1.20	1/1	1/1/1/1	2	4	150	300	
BH03	2.00	3/9	9/7/7/9	12	32	150	300	
BH03	3.00	10/10	7/10/9/9	20	35	150	300	
BH03	4.00	8/8	7/10/9/9	16	35	150	300	
BH03	5.00	7/8	8/50/8/8	15	74	150	150	
BH03	6.50	8/8	8/9/12/12	16	41	150	300	
BH03	8.00	10/14	17/50	24	67	150	105	
BH03	9.20	3/10	10/9/11/14	13	44	150	300	
BH04	1.20	1/2	2/4/4/4	3	14	150	300	
BH04	2.20	1/2	1/3/4/5	3	13	150	300	
BH04	3.20	1/2	2/2/5/8	3	17	150	300	
BH04	4.00	5/15	25/25	20	50	150	95	
BH04	5.05	25		25	0	0		

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ALL	STRATA				WATER	SPT TESTING			OTHER IN SI	TU TESTING	:	SAMPLING		
INST	DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND	STRIKES	TYPE / DEPTH (m)	RESULT	CASING DEPTH (m)	WATER LEVEL (m)	TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
	Grass onto dark brown slightly gravelly fine to medium SAND with some rootlets. Gravels consists of fine to coarse angular to rounded mixed lithologies. (TOPSOIL - REWORKED TOPSOIL) Greyish brown slightly gravelly fine to medium SAND with medium cobble content. Gravel consists of fine to medium angular to	0.10												
	rounded mixed lithologies. Cobbles are angular of sandstone. (MADE GROUND) Loose light brown slightly gravelly fine to medium SAND. Gravel consists of subangular to rounded mixed lithologies, predominantly sandstone.					S 1.20 - 1.65	(3) 5	1.20				1.20 1.20		B D
	STORM BEACH DEPOSITS) Medium dense brown silty very sandy fine to coarse subangular to rounded GRAVEL. Gravel consists of mixed lithologies predominantly sandstone and quartz. Sand is fine to coarse. (STORM BEACH DEPOSITS)	2.00	20 e - 70	× × × × × × × ×		S 2.00 - 2.45	(5) 12	2.00				2.00 2.00		B D
	from 3.0m depth, becoming dense.		2 e	× × × ×		C 3.00 - 3.45	(14) 43	3.00	2.80			3.00		В
	Dense brown slightly silty very sandy fine to coarse subangular to rounded GRAVEL. Gravel consists of mixed lithologies predominantly sandstone and quartz. Sand is fine to coarse. (STORM BEACH DEPOSITS)	3.90	4 9 9 9	×		C 4.00 - 4.45	(18) 42	4.00	3.50			4.00		В
	Dense greyish brown and light brown silty fine to coarse SAND. (MARINE BEACH DEPOSITS)	5.00				C 5.00 - 5.45	(16) 41	5.00	4.80			5.00		В
	Light grey fine grained SANDSTONE. Recovered as angular gravel. (BURGHEAD SANDSTONE FORMATION) BOREHOLE TERMINATED AT 6.70m	6.50 6.70		· · · · ·		S 6.50 - 6.54 S 6.70 - 6.70	(50/40mm) (50/0mm)	6.50 6.70	3.00 4.00			6.50		D

Notes	Chise	elling details	Drillin	g details	Title	Date(s)	
Inspection pit excavated to 1.2m depth. Borehole terminated due to encountering bedrock.	Depth (m)	Duration (hh:mm)	Diameter	Base depth (m)	Borehole record		19/10/2020 - 20/10/2020
	3.70 - 3.90 6.50 - 6.70	01:00 01:00	150	6.70	Method Cable tool percussion	Logged by FQ	Sheet number Sheet 1 of 1
Groundwater observations	Water	added details	Casin	g details	Level (m OD)	Compiled by	Revision
Groundwater strike at 3m depth, filling borehole to 2.8m in 20 minutes.	Depth (m)	Water Added (I)	Diameter	Base depth (m)	-	KD	
			150	6.70	Co-ordinates	Checked by MOH	BH01

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ALL	STRATA				WATER		SPT TES	TING		OTHER IN SI	TU TESTING		SAMPLING	i
INST	DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND	STRIKES	TYPE / DEPTH (m)	RESULT	CASING DEPTH (m)	WATER LEVEL (m)	TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
	Medium dense light brown fine to medium SAND. (MARINE BEACH DEPOSITS)				•	S 1.20 - 1.65 S 2.00 - 2.45	(5) 16 (10) 38					1.20 1.20 2.20 2.20	(m)	B D B D

Notes	Chise	lling details	Drillir	ng details	Title		Date(s)
Borehole terminated due to high tide reaching position.	Depth (m)	Duration (hh:mm)	Diameter	Base depth (m)	Borehole record		19/10/2020
					Method Cable tool percussion	Logged by FQ	Sheet number Sheet 1 of 1
Groundwater observations	Water	added details	Casin	g details	Level (m OD)	Compiled by	Revision
Groundwater strike at 1.3m depth, filling borehole with rising tide.	Depth (m)	Water Added (I)	Diameter	Base depth (m)	-	KD	
					Co-ordinates	Checked by MOH	BH02

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ALL	STRATA	STRATA			WATER		SPT TE	STING		OTHER IN SITU TESTING		SAMPLING		
ISNI	DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND	STRIKES	TYPE / DEPTH (m)	RESULT	CASING DEPTH (m)	WATER LEVEL (m)	TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
INSTAL	DESCRIPTION [Medium dense] light brown fine to medium SAND. (MARINE BEACH DEPOSITS) ot 3.2m depth, SPT likely affected by piping / blowing sands.	DEPTH (m)	REDUCED LVL (m OD)			ТҮРЕ / DEPTH (m) S 3.20 - 3.65 S 4.20 - 4.65 S 5.00 - 5.17	(0) 4 (24) 52 (27) 25/20mm	CASING DEPTH (m)	WATER LEVEL (m)	TYPE / DEPTH (m)	RESULT	FROM (m) 2.20 3.20 3.20 4.20 4.20 5.00	TO (m)	B B D D D

Notes	Chise	elling details	Drilling details		Title		Date(s)
Borehole terminated due to competency of soil.	Depth (m)	Duration (hh:mm)	Diameter	Base depth (m)	Borehole record		20/10/2020
	4.35 - 4.85	00:15			Method	Logged by	Sheet number
					Cable tool percussion	FQ	Sheet 1 of 1
Groundwater observations	Water	added details	Casin	g details	Level (m OD)	Compiled by	Revision
Groundwater strike at 1.3m depth.	Depth (m)	Water Added (I)	Diameter	Base depth (m)	-	KD	
					Co-ordinates	Checked by MOH	BH02A

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ALL	STRATA				WATER		SPT TES	TING		OTHER IN SI	TU TESTING	:	SAMPLING	j
INST	DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	EGEND	STRIKES	TYPE / DEPTH (m)	RESULT	CASING DEPTH (m)	WATER LEVEL (m)	TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
	Grass onto dark brown slightly gravelly SAND. Gravel consists of fine to medium subangular to rounded mixed lithologies, predominantly sandstone. (TOPSOIL - REWORKED TOPSOIL) Brown gravelly fine to medium SAND with medium cobble content of angular to subangular sandstone. Gravel consists of fine to coarse subangular to rounded mixed lithologies, predominantly sandstone.	0.20				6.1.20	(2) 4	1.20				1.20		
	(MADE GROUND) Dense light brown silty slightly gravelly fine to medium SAND. Gravel consists of is fine to coarse subangular to rounded mixed	/E				5 1.20 - 1.65	(2) 4	1.20				1.20		D
	lithologies. (STORM BEACH DEPOSITS) from 0.9m to 1.8m depth, locally loose.					S 2.00 - 2.45	(12) 32	2.00				2.00 2.00		B D
	at 2.5m depth, 400mm long sandstone boulder.					S 3.00 - 3.45	(20) 35	3.00	2.80			3.00 3.00		B D
						S 4.00 - 4.45	(16) 35	4.00	3.00			4.00 4.00		B D
	at 5.0m depth, SPT likely affected by cobble / boulder obstruction.					S 5.00 - 5.30	(15) 74/150mm	5.00	3.00			5.00 5.00		B D
		7.00				S 6.50 - 6.95	(16) 41	6.50	4.00			6.50 6.50 7.00		B D B
	bense brown and grey SAND and GRAVEL. Gravel consists of the to coarse subangular to rounded mixed lithologies. Sand is the to coarse. (STORM BEACH DEPOSITS)						<i>(</i>)							
	at 8.0m depth, SPT likely affected by cobble / boulder obstruction.					C 8.00 - 8.26	(24) 67/105mm	8.00	3.00			8.00		В
		9.65	64.9 5.9 6.4 6.9 6.9 7.9 7.4 7.4 7.4 7.4 7.4 7.4 7.4 7.4 7.4 7.4			C 9.20 - 9.65	(13) 44	9.20	6.00			9.20		В
	BOREHOLE TERMINATED AT 9.65m													

Notes	Chise	elling details	Drillin	Drilling details Title		Title		
Running sands encountered resulting in redrilling of borehole from 3.0m to 6.0m and from 4.0m to 7.0m. Inspection pit	Depth (m)	Duration (hh:mm)	Diameter	Base depth (m)	Borehole record		20/10/2020 - 22/10/2020	
excavated to 1.2m depth.	2.50 - 2.90	01:00			Method	Logged by	Sheet number	
					Cable tool percussion	FQ	Sheet 1 of 1	
Groundwater observations	Water	added details	Casin	g details	Level (m OD)	Compiled by	Revision	
Groundwater strike at 3m depth, filling borehole to 2.8m in 20 minutes.	Depth (m)	Water Added (I)	Diameter	Base depth (m)	-	KD		
					Co-ordinates	Checked by MOH	ВН03	

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ALL	STRATA				WATER	ER				OTHER IN SI	TU TESTING	SAMPLING		
ISNI	DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND	STRIKES	TYPE / DEPTH (m)	RESULT	CASING DEPTH (m)	WATER LEVEL (m)	TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
	Medium dense light brown fine to medium SAND. (MARINE BEACH DEPOSITS)											0.00		В
						S 1.20 - 1.65	(3) 14					1.20 1.20		B D
						S 2.20 - 2.65	(3) 13					2.20 2.20		B D
	Vacuations around brown clightly aroundly SAND with law cabble content of angular to subrounded conditions. Groupl consists of	3.80		¢	_	S 3.20 - 3.65	(3) 17					3.20 3.20 3.80		B D B
	fine to coarse subangular to rounded mixed lithologies predominantly sandstone and quartzite. (MARINE BEACH DEPOSITS)			0 0 0 0 0 0		S 4.00 - 4.24	(20) 50/95mm					4.00 4.00		B D
	BOREHOLE TERMINATED AT 5.05m					C 5.05 - 5.05	(25/0mm)							

Notes	Chise	lling details	Drilling details		Title	Date(s)	
Borehole terminated due to competency of soil.	Depth (m)	Duration (hh:mm)	Diameter	Base depth (m)	Borehole record		21/10/2020 - 22/10/2020
	4.15 - 4.55 5.00 - 5.05	00:20 01:00	150	5.05	Method Logged by Cable tool percussion FQ		Sheet number Sheet 1 of 1
Groundwater observations	Water	added details	Casin	g details	Level (m OD)	Compiled by	Revision
Groundwater strike at 3m depth.	Depth (m)	Water Added (I)	Diameter	Base depth (m)	-	KD	
			150	3.20	Co-ordinates	Checked by MOH	BH04

Key to legends, columns & water observations Boreholes

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Key to legends

Composi	ite materials, soil	s and litho	logy				
	Topsoil		Made Ground	ୖୄୖୄୖୄ	Boulders		Chalk
	Clay		Coal	a 0 ° 6 0 ° 0 ° ° 6 ° a 0 ° 6 °	Cobbles		Concrete
	Gravel		Limestone		Mudstone	es silles silles se silles silles silles ta silles silles se	Peat
	Sand	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Sandstone		Silt	X X X X X X X X X X X X X X X X X X X	Siltstone

Note: Composite soil types are signified by combined symbols.

Key to 'test results' and 'sampling' columns

Test res	ult	Sampling	g	
Depth	Records depth that the test was carried out (i.e.: at 2.10m or between 2.10m and 2.55m)	 From (m) To (m)	Record	ls depth of sampling
	PP - Pocket penetrometer result reported as an equivalent undrained shear strength (kN/m2) by		D	Disturbed sample
	applying a factor of 50.		В	Bulk disturbed sample
	SV – Hand held shear vane result reported as an undrained shear strength (kN/m ²).		ES	Environmental sample
	Where multiple readings are taken at the same level the average value is shown on the log.	Type	W	Water sample
Result	* Signifies that instrument limit reached.	Type	U	Undisturbed thick-walled sample 100mm diameter sampler
	(uncorrected) ^{1,2,3} SPT(c) – Standard Penetration Test result (solid cone) (N value) (uncorrected) ^{1,2,3}		UT	Undisturbed thin walled sample 100mm diameter sampler
	UT – Undisturbed sample 100mm diameter sampler with number of blows of driving		UTF	Failed undisturbed sample

Note 1: Seating blows recorded in brackets.

Note 2: Casing depth records depth of casing when SPT or SPT(c) was carried out.

Note 3: Water depth records depth of water when SPT or SPT(c) was carried out.

Water observations

Described at foot of log and shown in the 'water strike' column.

Water level observed after specified delay in drilling

☑ Water strike

Installation details

·. •	Gravel filter	Bentonite
	Slotted pipe	Unslotted pipe
	Arisings	Grout
X	Extensometer magnet	Vibrating wire piezometer

Density

Density recorded in brackets determined by qualitative field assessment or inferred from density testing and soil descriptions from across the site (i.e.: [Medium dense]).

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P1: Photograph looking south showing the existing footbridge over the River Lossie



P2: Area of BH01, looking south-east towards East Beach



Title	
Photographic records	

Appendix

E

Revision: O

P3: Area of BH03, looking north-west, Church Street on left leading to footbridge.



P4: Looking south along existing footbridge from East Beach.





Photographic records

Appendix

Е

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P5: Looking north along exisitng footbridge towards East Beach with River Lossie at low tide.



P6: Looking west from East Beach towards Lossiemouth.



 Title
 Appendix

 Photographic records
 E

Revision: O

Particle Size Distribution

Tested in Accordance with: BS 1377-2: 1990

i2 Analytical Ltd Unit 8 Harrowden Road Brackmills Industrial Estate Northampton NN4 7EB



	•																																								
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The material submitted - fails to meet the minimum mass requirements as stated in BS1377 Part 2 Table 3 Remarks:

Signed:

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Anosthe

Monika Janoszek PL Deputy Head of Geotechnical Section for and on behalf of i2 Analytical Ltd

Marika

Particle Size Distribution

Tested in Accordance with: BS 1377-2: 1990

i2 Analytical Ltd Unit 8 Harrowden Road Brackmills Industrial Estate Northampton NN4 7EB



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Remarks:

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Signed:

Particle Size Distribution

Tested in Accordance with: BS 1377-2: 1990

i2 Analytical Ltd Unit 8 Harrowden Road Brackmills Industrial Estate Northampton NN4 7EB



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6 Note: Tested in Accordance with BS1377:Part 2:1990, clause 9.2

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Remarks:

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Signed: Marika

Monika Janoszek PL Deputy Head of Geotechnical Section for and on behalf of i2 Analytical Ltd

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Particle Size Distribution

Tested in Accordance with: BS 1377-2: 1990

i2 Analytical Ltd Unit 8 Harrowden Road Brackmills Industrial Estate Northampton NN4 7EB



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Remarks:

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Signed:

Monika Janoszek PL Deputy Head of Geotechnical Section for and on behalf of i2 Analytical Ltd

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Marika

Particle Size Distribution

Tested in Accordance with: BS 1377-2: 1990

i2 Analytical Ltd Unit 8 Harrowden Road Brackmills Industrial Estate Northampton NN4 7EB



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Clie	ent Ad	dress:	Cedar Barn, Whi	te Lodae.			Job 1	Number: 20-3	8678
0			Walgrave North	ampton			Date S	ampled: 20/1	0/2020
			NN6 9PY				Date B	20/1	0/2020
<u> </u>	ata at		Alova Band					Tested: 06/1	1/2020
00			Alexa Dallu	le vi el er e			Date	Tested: 00/1	1/2020
Site	e Addr	ess:	East Beach Foot	bridge			Sam	pled By: Not	Given
Te	sting c	arried out at i2	Analytical Limite	d, ul. Pionierow 39	, 41-711 Ruda Slas	ka, Poland			
Те	st Re	sults:							
Lat	orato	ry Reference:	1669122				Depth ⁻	Top [m]: 3.20	1
Но	le No.:	:	BH02A				Depth B	ase [m]: Not	Given
Sa	mple F	Reference:	14				Samp	le Type: B	
Sa	mple E	Description:	Brown slightly cla	ayey SAND					
Sa	mple F	Preparation:	Sample was qua	rtered, oven dried	at 107.1 °C and bro	ken down bv har	nd.		
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0.063 2 Note: Tested in Accordance with BS1377:Part 2:1990, clause 9.2

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Remarks:

0.425

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0.15

Signed:

Months PLI Complete for

Monika Janoszek PL Deputy Head of Geotechnical Section for and on behalf of i2 Analytical Ltd

Opinions and interpretations expressed herein are outside of the scope of the UKAS Accreditation. This report may not be reproduced other than in full without the prior written approval of the issuing laboratory. The results included within the report relate only to the sample(s) submitted for testing.

Particle Size Distribution

Tested in Accordance with: BS 1377-2: 1990

i2 Analytical Ltd Unit 8 Harrowden Road Brackmills Industrial Estate Northampton NN4 7EB



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Remarks: The material submitted - fails to meet the minimum mass requirements as stated in BS1377 Part 2 Table 3

Signed:

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TEST CERTIFICATE

Particle Size Distribution

Tested in Accordance with: BS 1377-2: 1990

i2 Analytical Ltd Unit 8 Harrowden Road Brackmills Industrial Estate Northampton NN4 7EB



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0.063 8 Note: Tested in Accordance with BS1377:Part 2:1990, clause 9.2

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Remarks:

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Page 1 of 1

Marika PL Depu Buraside for and

Particle Size Distribution

Tested in Accordance with: BS 1377-2: 1990

i2 Analytical Ltd Unit 8 Harrowden Road Brackmills Industrial Estate Northampton NN4 7EB



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	⊢	0.212			10	-																										
	┢	0.13			2	-																										
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Note: Tested in Accordance with BS1377:Part 2:1990, clause 9.2

Remarks:

Signed:

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Monika Junoshile

Particle Size Distribution

Tested in Accordance with: BS 1377-2: 1990

i2 Analytical Ltd Unit 8 Harrowden Road Brackmills Industrial Estate Northampton NN4 7EB



404																										
Clie	ent:	S	Soiltechnics Limited											Client Reference: STS5161												
Clie	ent Address:	С	Cedar Barn, White Lodge,												Job Number: 20-38678											
		W	Walgrave, Northampton,												Date Sampled: 22/10/2020											
		Ν	N6 9PY												Date Received: 29/10/2020											
Со	ntact:	А													Date Tested: 06/11/2020											
Site	e Address:	E	East Beach Footbridge												Sampled By: Not Given											
Te	sting carried out	tati2 A	nalytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland																							
Те	st Results:		•	· ·																						
l ał	oratory Referen	nce 16	1669126													Depth Top [m]: 8.00										
Ho		R	H03												г	Depth Base [m]: Not Given										
Sa	mnle Reference	· 3	2													Sample Type: B										
Sa	mple Reference	n B	- rown verv ara	wn very gravelly SAND																						
Sa	mple Description	n S	ample was di	artered or	en dried	at 106	0°C a	nd hi	roken i	hown	hv ha	and														
ou		n. O																						T		
centage Passing %	CLAY	Fine	Medium	Coarse	Fine	N	Medium C			F	ine	Medium			(Coarse			COBBLES			BOULDERS		RS		
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	90																									
	80																									
	70									_		$\boldsymbol{/}$		+	-	+						_	_			
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	0 001		0.01 0.1 1										10	-					1	00						0
					Particle S					mm														-		
		Sievir	ng		Sedimentation					Sample Proportions								% dry mass								
	Particle Size	mm	% Passing	Particle	Size mm	0/	% Passing				Very coarse							0.00								
			70 T 233119			/0		Gravel							48.50											
	500		100	_				_	Sand								50.30									
	300		100						4																	
	150		100	_								Fines <0.063mm								1.30						
	125		100						4																	
	90		100						4	<u> </u>		Iradi	ina	Ana	lvei	6										
	63		100			-			1	D100						mm					37.5					
	50		100						-	D60	5						m	m				3.	12			
	37.5		100			1			1	D30							m	m				0.2	276			-
	28		97						1	D10							m	m				0.1	163			
	20		94							Unif	ormit	y Coe	effic	ient								1	9			
	14		88						1	Cur∖	ature	e Coe	effic	ent								0.	15			
	10		82							Unif	ormity	y Coe	effic	ient	and	I Co	beffi	cie	nt c	of Cu	urva	ture	calc	ulate	d in	
	6.3		72							acco	ordan	ce wi	ith E	BS E	N IS	SO	146	88	-2:	2004	4 + /	A1: 2	2013			
	5		67						1																	
	3.35		61																							
	2		52	_					4																	
	1.18		45	_																						
	0.6		38																							
	0.420		30 30	_																						
	0.3		23						1																	
	0.15		6	-1																						
	0.10		-																							

0.063 1 Note: Tested in Accordance with BS1377:Part 2:1990, clause 9.2

Remarks:

Signed:

Monika Janoszek PL Deputy Head of Geotechnical Section for and on behalf of i2 Analytical Ltd

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Marika
TEST CERTIFICATE

Particle Size Distribution

Tested in Accordance with: BS 1377-2: 1990

i2 Analytical Ltd Unit 8 Harrowden Road Brackmills Industrial Estate Northampton NN4 7EB



404										
Clie	ent:		Soiltechnics Lim	ited			Client Re	ference: STS	65161	
Clie	ent Ad	dress:	Cedar Barn, Wh	ite Lodge,			Job I	Number: 20-3	38678	
			NN6 9PY	ampion,			Date S	ampled: 21/	10/2020	
Со	ntact:		Alexa Band				Date	Tested: 06/	11/2020	
Site	e Addr	ress:	East Beach Foo	tbridge			Sam	pled By: Not	Given	
Te	sting c	arried out at i	2 Analytical Limite	d, ul. Pionierow 39	, 41-711 Ruda Slask	a, Poland				
Те	st Re	sults:								
Lat	orato	ry Reference:	1669127				Depth	Top [m]: 1.20	D	
Но	e No.:	:	BH04				Depth B	ase [m]: Not	Given	
Sa	mple F	Reference:	35				Samp	le Type: B		
Sa	mple [Description:	Brown SAND							
Sa	mple F	Preparation:	Sample was qua	rtered, oven dried a	at 106.0 °C and brok	en down by han	d.			-
		CLAY	SILT e Medium	Coarse Fine	SAND Medium Coa	rse Fine	GRAVEL Medium Coarse	COBBLES	BOULDERS	
	100 -					••••••••••••••••••••••••••••••••••••••				-
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	10 -				/					
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	0.0	001	0.01	0.1	Particle Siz	ze mm	10	100	100	00
		Sie	eving	Sedime	entation	San	ple Proportions	%	6 dry mass	
	Pa	rticle Size mr	% Passing	Particle Size mm	% Passing	Very coars	e		0.00	
	i u		70 T 435111g		70 T dooling	Gravel			0.40	
		500	100	-		Sand			97.90	
		150	100			Fines <0.0	63mm		1 70	
		125	100			1 1100 20.0			1.70	
		90	100							
		75	100			Gr	ading Analysis			
		63	100			D100	mn	า	5	
		50	100			D60	mn	า	0.269	
		37.5	100			D30	mn	1	0.221	
		20	100	-		Uniformity	Coefficient	1	1.6	
		14	100	1		Curvature	Coefficient		1.1	
		10	100	1		Uniformity	Coefficient and Coeffic	ient of Curva	ature calculated in	n
		6.3	100			accordance	e with BS EN ISO 1468	38-2: 2004 +	A1: 2013	
		5	100							
		3.35	100	-1						
	\vdash	2	100	╢────						
	-	0.6	99	╢						
	4	J.J								

0.063 2 Note: Tested in Accordance with BS1377:Part 2:1990, clause 9.2

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Remarks:

0.425

0.3

0.212

0.15

Signed:

Marika

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Durchelle Page 1 of 1

for and on behalf of i2 Analytical Ltd Date Reported: 12/11/2020

PL Deputy Head of Geotechnical Section

Monika Janoszek

TEST CERTIFICATE

Particle Size Distribution

Tested in Accordance with: BS 1377-2: 1990

i2 Analytical Ltd Unit 8 Harrowden Road Brackmills Industrial Estate Northampton NN4 7EB



	•																										
Clie	ent:		Soiltechnics Lin	nited													Clie	nt Re	efer	en	ce:	ST	S516	31			
Clie	ent Ac	dress:	Cedar Barn, Wh	nite Lodge	,													Job	Nu	mb)er:	: 20-	-3867	78			
			Walgrave, North	nampton,													D	ate S	San	nple	ed:	21/	10/2	.020			
			NN6 9PY														Da	ate F	Rece	eiv	ed:	: 29/	10/2	.020			
Co	ntact:		Alexa Band															Date	e Te	este	ed:	: 06/	11/2	.020			
Site	e Add	ress:	East Beach Foo	otbridge														San	nple	ed I	By:	No	t Giv	en			
Tes	sting o	carried out at i	2 Analytical Limite	ed, ul. Pio	niero	ow 39,	41-7	'11 R	uda	Sla	aska, l	Polar	nd														
Те	st Re	esults:																									
Lab	orato	ry Reference:	1669128														D	epth	То	p [ı	m]:	: 2.2	20				
Hol	e No.	:	BH04														De	pth E	Bas	.e [ı	m]:	: No	t Giv	en			
Sai	nple	Reference:	37														ę	Sam	ple	Ty	pe:	: В					
Sai	nple	Description:	Brown medium	fine SANE)																						
Sai	nple	Preparation:	Sample was qu	artered, o	ven	dried a	at 106	6.0 °C	C and	d b	roken	dowr	ı by h	and.													
			SILT					SAND)					(GR	AVEL				COF	RRI	FS	B			2	T
		CLAT Fin	e Medium	Coarse		Fine	Ν	Aediu	m	0	Coarse		Fine		Me	dium	Coa	arse								,	
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								F	artic	cie	Size	mm															
		Sie	eving		S	edime	entati	on					S	amp	le l	Propo	rtions	6				Q	% dr	ry m	ass		
	Pa	uticle Size mm	% Passing	Particle	Siz	e mm	%	6 Pas	sino	1		Ve	у соа	irse									0	00.0			
										,		Gra	avel							L			0).00			
		500	100	-∥							_	Sa	nd							⊢			98	8.30			
		150	100	_							_	Ein	<u> </u>	063	mn					┢			1	70	—		
	-	125	100								_		63 <0	.005		1								.70			
		90	100																								
		75	100											Grad	ling	g Anal	ysis							-			
		63	100									D1	00			-		m	m					2			
		50	100									D6	0					m	m				0.	.278			
		37.5	100									D3	0					m	m				0.	.225			
		28	100	_							4	D1	0					m	m	L			0.	.169			
		20	100								4	Un	tormi	ty Co	eff	icient				⊢	_			1.6			
	\vdash	14	100								-	Cu	vatur		effi	cient	and C	ocf:	oia	L.	of (<u></u>	oture	1.1	oute	ter	d in
	\vdash	6.3	100								-	200	ordar	ιy 00 1ce Μ	/ith	BS FI		0eili) 146	6191 888-		20	Jurva 04 +	ature - A1·	201	3	ileC	111
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0.063 2 Note: Tested in Accordance with BS1377:Part 2:1990, clause 9.2

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100 100

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Remarks:

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3.35

2

1.18 0.6

0.425

0.3

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Signed:

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Marika

Monika Janoszek PL Deputy Head of Geotechnical Section for and on behalf of i2 Analytical Ltd

TEST CERTIFICATE

Particle Size Distribution

Tested in Accordance with: BS 1377-2: 1990

i2 Analytical Ltd Unit 8 Harrowden Road Brackmills Industrial Estate Northampton NN4 7EB



404	1								
Clie	ent:	Soiltechnics Lim	ited			Client Refe	rence: STS	5161	
Clie	ent Address:	Cedar Barn, Wh	ite Lodge,			Job Nu	mber: 20-3	8678	
		Walgrave, North	ampton,			Date Sar	npled: 22/1	0/2020	
		NN6 9PY				Date Rec	eived: 29/1	0/2020	
Со	ntact:	Alexa Band				Date T	ested: 06/1	1/2020	
Site	e Address:	East Beach Foot	lbridge			Sample	ed By: Not	Given	
Te	sting carried out at	i2 Analytical Limite	d, ul. Pionierow	39, 41-711 Ruda Slasl	a, Poland				
Те	st Results:								
Lat	ooratory Reference:	1669129				Depth To	op [m]: 3.80		
Ho	le No.:	BH04				Depth Bas	e [m]: Not	Given	
Sa	mple Reference:	40				Sample	Туре: В		
Sa	mple Description:	Brown gravelly S	SAND	d at 100 1 00 and bas					
Sa	mple Preparation:	Sample was qua	irterea, oven arie		ten down by nand.				-
	CLAY	ne Medium	Coarse Fin	e Medium Coa	rse Fine Medium	Coarse	COBBLES	BOULDERS	
	100								7
	90								_
	00			Γ					
	80			/					
%	70								-
Б.	60								-
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Ра	10								
age	40								
ent	30								-
Perc	20								-
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				_/					
	0.001	0.01	0.1	Dertiele C	10		100	1(000
					e mm				
	Si	eving	Sedi	mentation	Sample Proport	ions	%	dry mass	
	Particle Size mr	n % Passing	Particle Size m	m % Passing	Very coarse			0.00	
	500	100			Sand			88 40	
	300	100			Cana			00.10	
	150	100			Fines <0.063mm			1.20	
	125	100							
	90	100					r		
	75	100			Grading Analy	SIS		20	
	50	100		_	D100	mm		0.286	
	37.5	100			D30	mm		0.229	
	28	100			D10	mm		0.174	
	20	97			Uniformity Coefficient			1.6	
	14	94			Curvature Coefficient			1.1	
	10	92	-		Uniformity Coefficient a	nd Coefficie	nt of Curval	ure calculated	in
	<u> </u>	90	_		accordance with BS EN	150 14000	-2. 2004 + 7	AT. 2013	
	3.35	90	_						
	2	90	1						
	1.18	90							
	0.6	89	4						
	0.425	88	-1						
	0.3	67	<u>µ</u>						
	0.212	3	4						
		· ·							

1 Note: Tested in Accordance with BS1377:Part 2:1990, clause 9.2

Remarks:

0.063

Signed:

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Page 1 of 1

Monika Janoszek PL Deputy Head of Geotechnical Section for and on behalf of i2 Analytical Ltd

Date Reported: 12/11/2020



Enquiry Confirmation LSBUD Ref: 20047775

Enquirer			
Name	Miss Alexa Band	Phone	01604 781877
Company	Soiltechnics	Mobile	Not Supplied
Address	Cedar Barn White Lodge		
	Walgrave Northamptonshire NN6 9PY		
Email	Alexa.Band@soiltechnics.net		

Enquiry Details					
Scheme/Reference	sts5161m				
Enquiry type	Initial Enquiry	Work cate	gory	Develop	oment Projects
Start date	29/09/2020	Work type		Comme	ercial/industrial
End date	29/09/2020	Site size		139814	metres square
Searched location	XY= 323720, 870517	Work type	buffer*	25 metr	es
Confirmed location	323778 870497				
Site Contact Name	Not Supplied		Site Ph	one No	Not Supplied
Description of Works					

* The WORK TYPE BUFFER is a distance added to your search area based on the Work type you have chosen.





Asset Owners

Terms and Conditions. Please note that this enquiry is subject always to our standard terms and conditions available at www.linesearchbeforeudig.co.uk ("Terms of Use") and the disclaimer at the end of this document. Please note that in the event of any conflict or ambiguity between the terms of this Enquiry Confirmation and the Terms of Use, the Terms of Use shall take precedence.

Notes. Please ensure your contact details are correct and up to date on the system in case the LSBUD Members need to contact you.

Validity and search criteria. The results of this enquiry are based on the confirmed information you entered and are valid only as at the date of the enquiry. It is your responsibility to ensure that the Enquiry Details are correct, and LinesearchbeforeUdig accepts no responsibility for any errors or omissions in the Enquiry Details or any consequences thereof. LSBUD Members update their asset information on a regular basis so you are advised to consider this when undertaking any works. It is your responsibility to choose the period of time after which you need to resubmit any enquiry but the maximum time (after which your enquiry will no longer be dealt with by the LSBUD Helpdesk and LSBUD Members) is 28 days. If any details of the enquiry change, particularly including, but not limited to, the location of the work, then a further enquiry must be made.

Asset Owners & Responses. Please note the enquiry results include the following:

- 1. "LSBUD Members" who are asset owners who have registered their assets on the LSBUD service.
- 2. "Non LSBUD Members" are asset owners who have not registered their assets on the LSBUD service but LSBUD is aware of their existence. Please note that there could be other asset owners within your search area.

Below are three lists of asset owners:

- 1. LSBUD Members who have assets registered within your search area. ("Affected")
 - a.These LSBUD Members will either:
 - i. Ask for further information ("Email Additional Info" noted in status). The additional information includes: Site contact name and number, Location plan, Detailed plan (minimum scale 1:2500), Cross sectional drawings (if available), Work Specification.
 - ii. Respond directly to you ("Await Response"). In this response they may either send plans directly to you or ask for further information before being able to do so, particularly if any payments or authorisations are required.
- 2. LSBUD Members who do not have assets registered within your search area. ("Not Affected")
- 3. Non LSBUD Members who may have assets within your search area. Please note that this list is not exhaustive and all details are provided as a guide only. It is your responsibility to identify and consult with all asset owners before proceeding.

National Grid. Please note that the LSBUD service only contains information on National Grid's Gas above 7 bar asset, all National Grid Electricity Transmission assets and National Grid's Gas Distribution Limited above 2 bar asset.

For National Grid Gas Distribution Ltd below 2 bar asset information please go to www.beforeyoudig.nationalgrid.com



LSBUD Members who have assets registered on the LSBUD service within the vicinity of your search area.

List of affect	ed LSBUD members		
Asset Owner	Phone/Email	Emergency Only	Status
Scottish and Southern Electricity Networks	08000483516	08000727282	Await response
SGN	08009121722	0800111999	Await response
		Gas 0800111999	
SSE Litility Solutions Limited	03450707386	Enterprise Water	Await response
	00400707000	and Electric 0345	Await response
		078 3268	

LSBUD Members who do not have assets registered on the LSBUD service within the vicinity of your search area. Please be aware that LSBUD Members make regular changes to their assets and this list may vary for new enquiries in the same area.

List of not affected LSBUD members

AWE Pipeline	Balfour Beatty Investments Limited	BOC Limited (A Member of the Linde Group)
BP Exploration Operating Company Limited	ВРА	Carrington Gas Pipeline
CATS Pipeline c/o Wood Group PSN	Cemex	Centrica Storage Ltd
Chrysaor Production (UK) Limited	CLH Pipeline System Ltd	CNG Services Ltd
Concept Solutions People Ltd	ConocoPhillips (UK) Teesside Operator Ltd	Diamond Transmission Corporation
DIO (MOD Abandoned Pipelines)	DIO (MOD Live Pipelines)	Drax Group
E.ON UK CHP Limited	EirGrid	Electricity North West Limited
ENI & Himor c/o Penspen Ltd	EnQuest NNS Limited	EP Langage Limited
ESP Utilities Group	ESSAR	Esso Petroleum Company Limited
Fulcrum Pipelines Limited	Gamma	Gas Networks Ireland (UK)
Gateshead Energy Company	Gigaclear Ltd	Gtt
Heathrow Airport LTD	Humbly Grove Energy	IGas Energy
INEOS FPS Pipelines	INEOS Manufacturing (Scotland and TSEP)	INOVYN Enterprises Limited
Intergen (Coryton Energy or Spalding Energy)	Jurassic Fibre Ltd	Mainline Pipelines Limited
Manchester Jetline Limited	Manx Cable Company	Marchwood Power Ltd (Gas Pipeline)
Melbourn Solar Limited	Murphy Utility Assets	National Grid Gas (Above 7 bar), National Grid Gas Distribution Limited (Above 2 bar) and National Grid Electricity Transmission
Northumbrian Water Group	NPower CHP Pipelines	NYnet Ltd
Oikos Storage Limited	Ørsted	Perenco UK Limited (Purbeck Southampton Pipeline)
Petroineos	Phillips 66	Portsmouth Water
Premier Transmission Ltd (SNIP)	Redundant Pipelines - LPDA	RWE - Great Yarmouth Pipeline (Bacton to Great Yarmouth Power Station)
RWEnpower (Little Barford and South Haven)	SABIC UK Petrochemicals	Scottish Power Generation
Seabank Power Ltd	SES Water	Shell
Shell NOP	SSE (Peterhead Power Station)	SSE Enterprise Telecoms
SSE Generation Ltd	Tata Communications (c/o JSM Construction Ltd)	Total (Colnbrook & Colwick Pipelines)

Total Finaline Pipelines	Transmission Capital	UK Power Networks
Uniper UK Ltd	University of Cambridge Granta Backbone Network	Vattenfall
Veolia ES SELCHP Limited	Veolia ES Sheffield Ltd	Wales and West Utilities
West of Duddon Sands Transmission Ltd	Western Power Distribution	Westminster City Council
Zayo Group UK Ltd c/o JSM Group Ltd		



Enquiry Confirmation LSBUD Ref: 20047775

The following Non-LSBUD Members may have assets in your search area. It is YOUR RESPONSIBILITY to contact them before proceeding. Please be aware this list is not exhaustive and it is your responsibility to identify and contact all asset owners within your search area.

Non-LSBUD m	embers (Asset owners not registered or	n LSBUD)	
Asset Owner	Preferred contact method	Phone	Status
ВТ	https://www.swns.bt.com/pls/mbe/welcome.home	08000232023	Not Notified
CenturyLink Communications UK Limited	plantenquiries@instalcom.co.uk	02087314613	Not Notified
CityFibre	asset.team@cityfibre.com	033 3150 7282	Not Notified
Colt	plantenquiries@catelecomuk.com	01227768427	Not Notified
Energetics Electricity	plantenquiries@lastmile-uk.com	01698404646	Not Notified
ENGIE	nrswa.uk@engie.com	01293 549944	Not Notified
GTC	https://pe.gtc-uk.co.uk/PlantEnqMembership	01359240363	Not Notified
KPN (c/-Instalcom)	kpn.plantenquiries@instalcom.co.uk	n/a	Not Notified
Mobile Broadband Network Limited	mbnlplantenquiries@turntown.com	01212 621 100	Not Notified
Moray Council	road.maint@moray.gov.uk		Not Notified
Scottish Water	searches@scottishwater.co.uk	01382563666	Not Notified
Utility assets Ltd	assetrecords@utilityassets.co.uk		Not Notified
Verizon Business	osp-team@uk.verizonbusiness.com	01293611736	Not Notified
Virgin Media	http://www.digdat.co.uk	08708883116	Not Notified
Vodafone	osm.enquiries@atkinsglobal.com	01454662881	Not Notified

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Maps by email Plant Information Reply



IMPORTANT WARNING

Information regarding the location of BT apparatus is given for your assistance and is intended for general guidance only. No guarantee is given of its accuracy. It should not be relied upon in the event of excavations or other works being made near to BT apparatus which may exist at various depths and may deviate from the marked route.



openreach

CLICK BEFORE YOU DIG FOR PROFESSIONAL FREE ON SITE ASSISTANCE PRIOR TO COMMENCEMENT OF EXCAVATION WORKS INCLUDING LOCATE AND MARKING SERVICE

email cbyd@openreach.co.uk

ADVANCE NOTICE REQUIRED (Office hours: Monday - Friday 08.00 to 17.00) www.openreach.co.uk/cbyd

Accidents happen

If you do damage any Openreach equipment please let us know by calling 0800 023 2023 (opt 1 + opt 1) and we can get it fixed ASAP

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KEY	TO BT SYM	BOLS	Change Of State	+	Hatchings	***
	Planned	Live	Split Coupling	\times	Built	~
РСР			Duct Tee		Planned	
Pole	0	0	Building		Inferred	~
Вох			Kiosk	ĸ	Duct	\sim
Manhole			Other prop	osed plant is	shown using da	ashed lines.
Cabinet		Û	Exist	ing BT Plant n	nay not be reco	rded.
			only valid f	or 90 days af	e of preparation ter the date of p	n. Maps are publication.
	Pending Add	In Place	Pending Remove	Not In Use		
Power Cable	#-#	NN	##.	NH		
Power Duct	##	× N	+++	N/A	1	

BT Ref : QQY02455F

Map Reference : (centre) NJ2372070517 Easting/Northing : (centre) 323720,870517 Issued : 28/09/2020 14:45:47

WARNING: IF PLANNED WORKS FALL INSIDE HATCHED AREA IT IS ESSENTIAL BEFORE PROCEEDING THAT YOU CONTACT THE NATIONAL NOTICE HANDLING CENTRE. PLEASE SEND E-MAIL TO: nnhc@openreach.co.uk





















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13 Warning: PDF designed for A4 colour print only with no page scaling 20m Dig Sites Area: 0 dido pipelines Date Requested: 28/09/2020 LP Main Valve Closed ₽ Reducer ◀ Job Reference: 20047775 LP Service Valve Open Ducting Site Location: 323778 870497 Indigo Pipelines Ltd. MP Main CSEP Gas Supply Point Registered Office: Requested by: Miss Alexa Band Å MP Service Pressure Reduction Station Loddon Reach, Your Scheme/Reference: sts5161m - - IP Main 1 End Closure Reading Road, CES S This information is given as a guide only and its accuracy cannot be guaranteed The plan only shows pipes owned by SSE Utility Solutions Limited, Indigo Pipelines Limited Service pipes etc. may not be shown but their presence should be anticipated You must use add edigping practices in accordance with HS(G)47 to establish the actual p excavation is used Arborfield, Reading, Bearkshire, RG2 9HU It is your responsibility to ensure this information is provided to all persons working near our plant If in doubt call the SSE Enterprise Dial Before You Dig team on 0345 O70 7386. we overlaps or misalignments between base maps that make it difficult to understand please contact DBYD Scale: 1:500 (When plotted at A4) or call 0345 070 7386 Crown Copyright. © - Reproduced by permission of Ordnance Survey on behalf of HMSO. and database right 2019. All rights reserved. Ordnance Survey Licence number 100030994 (ESRI) and 100048660 (direct). Plans generated by DigSAFE Pro^w software provided by LinesearchbeforeUdig







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SGN Safety Admin Team: 0800 912 1722	Valve Syphon O Depth of Cover Change T Change I Change I
Email: plantlocation@sgn.co.uk	This plan shows the location of those pipes owned by Scotia Gas Networks (SGN) by virtue of being a licensed Gas Transporter (GT). Gas
Date Requested: 28/09/2020	such pipes should be obtained from the relevant owners. No warranties are given with regard to the accuracy of the information shown on this plan. Service pipes, valves, siphons, sub-connections etc. are not shown but their presence should be anticipated. You should be
Job Reference: 20047775 Site Location: 323795 870466	aware that a small percentage of our pipes/assets may be undergoing review and will temporarily be highlighted in yellow. If your proposed works are close to one of these pipes, you should contact the SGN Safety Admin Team on 0800 912 1722 for advice. No liability
Requested by: Miss Alexa Band	of any kind whatsoever is accepted by SGN or its agents, servants or sub-contractors for any error or omission contained herein. Safe digging practices, in accordance with HS (G)47, must be used to verify and establish the actual position of mains, pipes, services and other apparatus on site before any mechanical plant is used. It is your responsibility to onsure that plant location information is provided.
sts5161m	to all persons (whether direct labour or sub-contractors) working for you on or near gas apparatus. Information included on this plan should not be referred to beyond a period of 28 days from the date of issue.
Exact Scales:	Report damage immediately – KEEP EVERYONE AWAY FROM THE AREA 0800 111 999
1:1000 Area or Circle dig site 1:1000 Line dig site	This plan is reproduced from or based on the OS map by Scotia Gas Networks plc, with the sanction of the controller of HM Stationery Office. Crown Copyright Reserved. Southern Gas – 100044373 and Scotland Gas – 100044366.
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Contact Us SGN Safety Admin Team: 0800 912 1722	High Pressure Mains Some Examples Of Plant Items Valve \bowtie Syphon O Depth of Cover \checkmark Diameter \ddagger Material Change \ddagger Material Change I Diameter Change I
Email: plantlocation@sgn.co.uk Date Requested: 28/09/2020 Job Reference: 20047775 Site Location: 323795 870466 Requested by: Miss Alexa Band Your Scheme/Reference: sts5161m Exact Scales:	This plan shows the location of those pipes owned by Scotia Gas Networks (SGN) by virtue of being a licensed Gas Transporter (GT). Gas pipes owned by other GTs or third parties may also be present in this area but are not shown on this plan. Information with regard to such pipes should be obtained from the relevant owners. No warranties are given with regard to the accuracy of the information shown on this plan. Service pipes, valves, siphons, sub-connections etc. are not shown but their presence should be anticipated. You should be aware that a small percentage of our pipes/assets may be undergoing review and will temporarily be highlighted in yellow. If your proposed works are close to one of these pipes, you should contact the SGN Safety Admin Team on 0800 912 1722 for advice. No liability of any kind whatsoever is accepted by SGN or its agents, servants or sub-contractors for any error or omission contained herein. Safe digging practices, in accordance with HS (G)47, must be used to verify and establish the actual position of mains, pipes, services and other apparatus on site before any mechanical plant is used. It is your responsibility to ensure that plant location information is provided to all persons (whether direct labour or sub-contractors) working for you on or near gas apparatus. Information included on this plan should not be referred to beyond a period of 28 days from the date of issue. Report damage immediately – KEEP EVERYONE AWAY FROM THE AREA 0800 111 999
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Date Requested: 28/09/2020 Job Reference: 20047775 Site Location: 323795 870466 Requested by: Miss Alexa Band Your Scheme/Reference: sts5161m	pipes owned by other GIS or third parties may also be present in this area but are not shown on this plan. Information with regard to such pipes should be obtained from the relevant owners. No warranties are given with regard to the accuracy of the information shown on this plan. Service pipes, valves, siphons, sub-connections etc. are not shown but their presence should be anticipated. You should be aware that a small percentage of our pipes/assets may be undergoing review and will temporarily be highlighted in yellow. If your proposed works are close to one of these pipes, you should contact the SGN Safety Admin Team on 0800 912 1722 for advice. No liability of any kind whatsoever is accepted by SGN or its agents, servants or sub-contractors for any error or omission contained herein. Safe digging practices, in accordance with HS (G)47, must be used to verify and establish the actual position of mains, pipes, services and other apparatus on site before any mechanical plant is used. It is your responsibility to ensure that plant location information is provided to all persons (whether direct labour or sub-contractors) working for you on or near gas apparatus. Information included on this plan should not be referred to beyond a period of 28 days from the date of issue.
Exact Scales: 1:1000 Area or Circle dig site 1:1000 Line dig site	Report damage immediately – KEEP EVERYONE AWAY FROM THE AREA 0800 111 999 This plan is reproduced from or based on the OS map by Scotia Gas Networks plc, with the sanction of the controller of HM Stationery Office. Crown Copyright Reserved. Southern Gas – 100044373 and Scotland Gas – 100044366.



Envirocheck® Report:

Datasheet

Order Details:

Order Number: 262408444_1_1

Customer Reference: STS5161M

National Grid Reference: 323760, 870540

Slice:

Site Area (Ha): 0.73

Search Buffer (m): 1000

Site Details: Lossiemouth

Client Details:

Ms R Brown Soiltechnics Cedar Barn White Lodge Walgrave Northampton NN6 9PY



environmental - geotechnical - building fabric

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Introduction

The Environment Act 1995 has made site sensitivity a key issue, as the legislation pays as much attention to the pathways by which contamination could spread, and to the vulnerable targets of contamination, as it does the potential sources of contamination.

Tor this reason, Landmark's Site Sensitivity maps and Datasheet(s) place great emphasis on statutory data provided by the Environment Agency/Natural Resources Wales and the Scottish Environment Protection Agency; it also incorporates data from Natural England (and the Scottish and Welsh equivalents) and Local Authorities; and highlights hydrogeological features required by environmental and geotechnical consultants. It does not include any information concerning past uses of land. The datasheet is produced by querying the Landmark database to a distance defined by the client from a site boundary provided by the client. In this datasheet the National Grid References (NGRs) are rounded to the nearest 10m in accordance with Landmark's agreements with a number of Data Suppliers.

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Report Version v53.0

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Summary

Data Type	Page Number	On Site	0 to 250m	251 to 500m	501 to 1000m (*up to 2000m)
Agency & Hydrological					
BGS Groundwater Flooding Susceptibility	pg 1	Yes	Yes	Yes	n/a
Contaminated Land Register Entries and Notices					
Discharge Consents	pg 4			5	8
Prosecutions Relating to Controlled Waters			n/a	n/a	n/a
Enforcement and Prohibition Notices					
Integrated Pollution Controls					
Integrated Pollution Prevention And Control					
Local Authority Integrated Pollution Prevention And Control					
Local Authority Pollution Prevention and Controls	pg 7		1		
Local Authority Pollution Prevention and Control Enforcements					
Nearest Surface Water Feature		Yes			
Pollution Incidents to Controlled Waters					
Prosecutions Relating to Authorised Processes					
Registered Radioactive Substances	pg 8				1
River Quality					
Substantiated Pollution Incident Register					
Water Abstractions					
Water Industry Act Referrals					
Groundwater Vulnerability	pg 8	Yes	n/a	n/a	n/a
Drift Deposits			n/a	n/a	n/a
Source Protection Zones					
River Flood Data (Scotland)	pg 8		Yes	n/a	n/a
OS Water Network Lines	pg 8	2	5	3	1
Waste					
BGS Recorded Landfill Sites					
Integrated Pollution Control Registered Waste Sites					
Licensed Waste Management Facilities (Landfill Boundaries)					
Licensed Waste Management Facilities (Locations)					
Local Authority Landfill Coverage	pg 10	1	n/a	n/a	n/a
Local Authority Recorded Landfill Sites					
Potentially Infilled Land (Non-Water)	pg 10		2		4
Potentially Infilled Land (Water)	pg 10				1
Registered Landfill Sites					
Registered Waste Transfer Sites					
Registered Waste Treatment or Disposal Sites					

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Summary

Data Type	Page Number	On Site	0 to 250m	251 to 500m	501 to 1000m (*up to 2000m)
Hazardous Substances					
Control of Major Accident Hazards Sites (COMAH)					
Explosive Sites					
Notification of Installations Handling Hazardous Substances (NIHHS)					
Planning Hazardous Substance Consents					
Planning Hazardous Substance Enforcements					
Geological					
BGS 1:625,000 Solid Geology	pg 11	Yes	n/a	n/a	n/a
BGS Estimated Soil Chemistry	pg 11	Yes		Yes	Yes
BGS Recorded Mineral Sites	pg 11		4		3
BGS Urban Soil Chemistry					
BGS Urban Soil Chemistry Averages					
CBSCB Compensation District			n/a	n/a	n/a
Coal Mining Affected Areas			n/a	n/a	n/a
Mining Instability			n/a	n/a	n/a
Man-Made Mining Cavities	pg 13				4
Natural Cavities					
Non Coal Mining Areas of Great Britain	pg 13	Yes		n/a	n/a
Potential for Collapsible Ground Stability Hazards	pg 13		Yes	n/a	n/a
Potential for Compressible Ground Stability Hazards	pg 13		Yes	n/a	n/a
Potential for Ground Dissolution Stability Hazards				n/a	n/a
Potential for Landslide Ground Stability Hazards	pg 13	Yes	Yes	n/a	n/a
Potential for Running Sand Ground Stability Hazards	pg 14	Yes	Yes	n/a	n/a
Potential for Shrinking or Swelling Clay Ground Stability Hazards				n/a	n/a
Radon Potential - Radon Affected Areas			n/a	n/a	n/a
Radon Potential - Radon Protection Measures			n/a	n/a	n/a
Industrial Land Use					
Contemporary Trade Directory Entries	pg 15		4	11	11
Fuel Station Entries	pg 17		1	1	
Points of Interest - Commercial Services	pg 17		8	4	3
Points of Interest - Education and Health					
Points of Interest - Manufacturing and Production	pg 18			6	6
Points of Interest - Public Infrastructure	pg 19		7	3	
Points of Interest - Recreational and Environmental	pg 20			1	6
Gas Pipelines					

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Summary

Data Type	Page Number	On Site	0 to 250m	251 to 500m	501 to 1000m (*up to 2000m)
Sensitive Land Use					
Ancient Woodland	pg 22				1
Areas of Adopted Green Belt					
Areas of Unadopted Green Belt					
Environmentally Sensitive Areas					
Forest Parks					
Local Nature Reserves					
Marine Nature Reserves					
National Nature Reserves					
National Parks					
National Scenic Areas					
Nitrate Sensitive Areas					
Nitrate Vulnerable Zones	pg 22	1			
Ramsar Sites					
Sites of Special Scientific Interest	pg 22		1		1
Special Areas of Conservation	pg 22				1
Special Protection Areas					
World Heritage Sites					

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Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A13NE (E)	0	1	323800 870550
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding to Occur at Surface	A13NW (N)	0	1	323755 870550
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding to Occur at Surface	A13NW (SW)	0	1	323755 870541
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A13NW (NW)	0	1	323700 870650
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A13NW (N)	0	1	323750 870650
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A13NW (NW)	0	1	323700 870600
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A13SW (S)	1	1	323755 870400
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding to Occur at Surface	A13SW (S)	4	1	323750 870400
	BGS Groundwater Flooding Susceptibility Flooding Type: Limited Potential for Groundwater Flooding to Occur	A13NW (NW)	35	1	323650 870650
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A13NW (N)	35	1	323750 870700
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A13NW (NW)	37	1	323650 870600
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A13NW (N)	55	1	323755 870700
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A13NE (E)	56	1	323900 870541
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A13NW (W)	64	1	323650 870541
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A13SE (E)	80	1	323900 870500
	BGS Groundwater Flooding Susceptibility Flooding Type: Limited Potential for Groundwater Flooding to Occur	A13NW (N)	85	1	323750 870750
	BGS Groundwater Flooding Susceptibility Flooding Type: Limited Potential for Groundwater Flooding to Occur	A13NW (N)	85	1	323700 870750
	BGS Groundwater Flooding Susceptibility Flooding Type: Limited Potential for Groundwater Flooding to Occur	A13NW (W)	87	1	323600 870600
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding to Occur at Surface	A13SW (SW)	91	1	323650 870450
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A13NW (N)	98	1	323755 870750
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A13NE (E)	103	1	323950 870541
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding to Occur at Surface	A13SW (SW)	110	1	323650 870350

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Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding to Occur at Surface	A13SW (S)	115	1	323700 870300
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A13NE (N)	123	1	323800 870750
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A13SE (E)	124	1	323950 870500
	BGS Groundwater Flooding Susceptibility Flooding Type: Limited Potential for Groundwater Flooding to Occur	A13NW (N)	143	1	323755 870800
	BGS Groundwater Flooding Susceptibility Flooding Type: Limited Potential for Groundwater Flooding to Occur	A13NW (W)	147	1	323550 870550
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A13SE (E)	168	1	324000 870500
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding to Occur at Surface	A13SW (SW)	179	1	323600 870300
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A13NE (N)	210	1	323800 870850
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A13NW (W)	213	1	323500 870541
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding to Occur at Surface	A13SW (S)	227	1	323650 870200
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A13NE (N)	235	1	323850 870850
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A13SE (E)	236	1	324050 870450
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A13SW (W)	241	1	323500 870500
	BGS Groundwater Flooding Susceptibility Flooding Type: Limited Potential for Groundwater Flooding to Occur	A13NW (W)	243	1	323450 870550
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding to Occur at Surface	A13SW (SW)	250	1	323550 870250
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A18SE (N)	255	1	323800 870900
	BGS Groundwater Flooding Susceptibility Flooding Type: Limited Potential for Groundwater Flooding to Occur	A13NW (W)	258	1	323450 870541
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A13SE (SE)	260	1	324050 870400
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A18SE (N)	278	1	323850 870900
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding to Occur at Surface	A13SE (SE)	284	1	324050 870350
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A18SE (N)	302	1	323800 870950
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A13SE (E)	303	1	324100 870400

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Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding to Occur at Surface	A18SE	303	1	323900 870900
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding to Occur at Surface	A13SW (SW)	320	1	323500 870200
	BGS Groundwater Flooding Susceptibility Flooding Type: Limited Potential for Groundwater Flooding to Occur	A12SE (W)	325	1	323400 870500
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A13SE (SE)	328	1	324100 870350
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A12SE (W)	341	1	323400 870450
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding to Occur at Surface	A8NW (SW)	355	1	323500 870150
	BGS Groundwater Flooding Susceptibility Flooding Type: Limited Potential for Groundwater Flooding to Occur	A14SW (SE)	371	1	324150 870350
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A12SE (W)	391	1	323350 870450
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A14SW (SE)	396	1	324150 870300
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A8NW (S)	401	1	323755 870000
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A12SE (SW)	407	1	323350 870300
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A18SE (N)	413	1	323850 871050
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A8NE (S)	413	1	323850 870000
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding to Occur at Surface	A14SW (SE)	415	1	324200 870350
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding to Occur at Surface	A8NW (S)	415	1	323650 870000
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding to Occur at Surface	A14SW (SE)	420	1	324150 870250
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A8NE (S)	427	1	323900 870000
	BGS Groundwater Flooding Susceptibility Flooding Type: Potential for Groundwater Flooding of Property Situated Below Ground Level	A8NW (S)	430	1	323600 870000
	BGS Groundwater Flooding Susceptibility Flooding Type: Limited Potential for Groundwater Flooding to Occur	A18SW (N)	435	1	323755 871100
	BGS Groundwater Flooding Susceptibility Flooding Type: Limited Potential for Groundwater Flooding to Occur	A12SE (W)	437	1	323300 870450
	BGS Groundwater Flooding Susceptibility Flooding Type: Limited Potential for Groundwater Flooding to Occur	A14SW (SE)	439	1	324200 870300
	BGS Groundwater Flooding Susceptibility Flooding Type: Limited Potential for Groundwater Flooding to Occur	A12SE (W)	441	1	323300 870400

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Map ID		Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	BGS Groundwater I	Flooding Susceptibility				
	Flooding Type:	Potential for Groundwater Flooding of Property Situated Below Ground Level	A12SE (SW)	444	1	323350 870200
	BGS Groundwater F	Flooding Susceptibility				
	Flooding Type:	Potential for Groundwater Flooding of Property Situated Below Ground Level	A12SE (SW)	445	1	323300 870350
	BGS Groundwater I	Flooding Susceptibility	A () N/A	454		000750
	Flooding Type:	Potential for Groundwater Flooding of Property Situated Below Ground Level	(S)	451	1	323750 869950
	BGS Groundwater I	Flooding Susceptibility	(-)			
	Flooding Type:	Potential for Groundwater Flooding to Occur at Surface	A8NW (S)	455	1	323700 869950
	BGS Groundwater I	Flooding Susceptibility				
	Flooding Type:	Potential for Groundwater Flooding of Property Situated Below Ground Level	A14SW (SE)	464	1	324200 870250
	BGS Groundwater F	Flooding Susceptibility				
	Flooding Type:	Potential for Groundwater Flooding of Property Situated Below Ground Level	A7NE (SW)	470	1	323350 870150
	BGS Groundwater I	Flooding Susceptibility				
	Flooding Type:	Potential for Groundwater Flooding to Occur at Surface	A8NE (SE)	471	1	324000 870000
	BGS Groundwater I	Flooding Susceptibility				
	Flooding Type:	Potential for Groundwater Flooding of Property Situated Below Ground Level	A14SW (SE)	483	1	324250 870300
	BGS Groundwater I	Flooding Susceptibility				
	Flooding Type:	Potential for Groundwater Flooding of Property Situated Below Ground Level	A18SW (N)	485	1	323755 871150
	BGS Groundwater F	Flooding Susceptibility		100		
	Flooding Type:	Limited Potential for Groundwater Flooding to Occur	A18SVV (N)	488	1	323650 871150
	BGS Groundwater F	Flooding Susceptibility				
	Flooding Type:	Limited Potential for Groundwater Flooding to Occur	A12SE (W)	491	1	323250 870400
	BGS Groundwater F	Flooding Susceptibility				
	Flooding Type:	Limited Potential for Groundwater Flooding to Occur	A12SE (W)	495	1	323250 870350
	BGS Groundwater I	Flooding Susceptibility				
	Flooding Type:	Potential for Groundwater Flooding of Property Situated Below Ground Level	A18SE (N)	495	1	323800 871150
	BGS Groundwater I	Flooding Susceptibility				
	Flooding Type:	Potential for Groundwater Flooding to Occur at Surface	A8NE (SE)	499	1	324050 870000
	BGS Groundwater I	Flooding Susceptibility				
	Flooding Type:	Potential for Groundwater Flooding of Property Situated Below Ground Level	A7NE (SW)	500	1	323350 870100
	Discharge Consents	S		a		
1	Operator: Property Type:	A And H R Adams Not Given	A18SE	349	2	323800
	Location:	Sunbank, DUFFUS	(14)			071000
	Authority:	Scottish Environment Protection Agency, North Region				
	Reference:	L/73/56				
	Permit Version:	Not Supplied				
	Effective Date:	Not Supplied 21st January 1974				
	Revocation Date:	Not Supplied				
	Discharge Type:	Septic tank				
	Environment:	עונטו				
	Receiving Water:	Ditch Of Spynie Canal				
	Positional Accuracy:	Located by supplier to within 100m				

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Map ID		Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	Discharge Consents	3				
2	Operator: Property Type: Location: Authority: Catchment Area: Reference: Permit Version: Effective Date: Issued Date: Revocation Date: Discharge Type: Discharge Environment: Receiving Water: Status: Positional Accuracy:	Grampian Regional Council Not Given Lossiemouth Sewerage System, Pitgaveny Street Pumping Station Scottish Environment Protection Agency, North Region Lossie L/92/13/C/A Not Supplied Not Supplied 13th August 1992 Not Supplied Unknown Coastal Not Supplied Not Supplied Not Supplied Located by supplier to within 100m	A18SE (NE)	367	2	323940 870950
2	Discharge Consents Operator: Property Type: Location: Authority: Catchment Area: Reference: Permit Version: Effective Date: Issued Date: Revocation Date: Discharge Type: Discharge Type: Discharge Environment: Receiving Water: Status: Positional Accuracy:	s Grampian Regional Council Not Given Sea Outfall No 2 (Harbour), LOSSIEMOUTH Scottish Environment Protection Agency, North Region Lossie L/93/31/C/X Not Supplied Not Supplied 22nd November 1993 Not Supplied Sewage Effluent Coastal Not Supplied Not Supplied Located by supplier to within 100m	A18SE (NE)	381	2	323960 870955
	Discharge Consents					
2	Operator: Property Type: Location: Authority: Catchment Area: Reference: Permit Version: Effective Date: Issued Date: Revocation Date: Discharge Type: Discharge Environment: Receiving Water: Status: Positional Accuracy:	Grampian Regional Council Not Given Sea Outfall No2 (Harbour), LOSSIEMOUTH Scottish Environment Protection Agency, North Region Lossie L/87/20/D* Not Supplied Not Supplied 15th October 1987 Not Supplied Sewage Effluent Coastal Not Supplied Not Supplied Located by supplier to within 100m	A18SE (NE)	386	2	323960 870960
2	Discharge Consents Operator: Property Type: Location: Authority: Catchment Area: Reference: Permit Version: Effective Date: Issued Date: Revocation Date: Discharge Type: Discharge Environment: Receiving Water: Status: Positional Accuracy:	Grampian Regional Council Not Given Sea Outfall No 2 (Harbour), LOSSIEMOUTH Scottish Environment Protection Agency, North Region Lossie L/92/20/C/R* Not Supplied Not Supplied 26th August 1992 Not Supplied Sewage Effluent Coastal Not Supplied Located by supplied Located by supplied	A18SE (NE)	391	2	323970 870960

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Map ID		Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	Discharge Consents					
3	Operator: Property Type: Location: Authority: Catchment Area: Reference: Permit Version: Effective Date: Issued Date: Revocation Date: Discharge Type: Discharge Environment: Receiving Water: Status: Positional Accuracy:	Elgin & Lossiemouth Harbour Co Not Given Fishmarket, Lossiemouth Harbour, LOSSIEMOUTH Scottish Environment Protection Agency, North Region Lossie L/90/34/A Not Supplied Not Supplied 23rd January 1991 Not Supplied Trade Effluent Coastal Not Supplied Not Supplied Located by supplier to within 100m	A18SW (N)	516	2	323730 871180
4	Discharge Consents Operator: Property Type: Location: Authority: Catchment Area: Reference: Permit Version: Effective Date: Issued Date: Revocation Date: Discharge Type: Discharge Type: Discharge Environment: Receiving Water: Status: Positional Accuracy:	Grampian Regional Council Not Given Harbour Storm Sewage Overflow, LOSSIEMOUTH Scottish Environment Protection Agency, North Region Lossie L/92/21/C/R* Not Supplied Not Supplied 26th August 1992 Not Supplied Storm Sewage Coastal Not Supplied Not Supplied Located by supplier to within 100m	A18SE (N)	543	2	323820 871195
4	Discharge Consents Operator: Property Type: Location: Authority: Catchment Area: Reference: Permit Version: Effective Date: Issued Date: Revocation Date: Discharge Type: Discharge Type: Discharge Type: Discharge Environment: Receiving Water: Status: Positional Accuracy:	Grampian Regional Council Not Given Storm Sewage Overflow (Harbour), LOSSIEMOUTH Scottish Environment Protection Agency, North Region Lossie L/87/21/D* Not Supplied Not Supplied 15th October 1987 Not Supplied Storm Sewage Coastal Not Supplied Not Supplied Located by supplier to within 100m	A18SE (N)	544	2	323825 871195
4	Discharge Consents Operator: Property Type: Location: Authority: Catchment Area: Reference: Permit Version: Effective Date: Issued Date: Revocation Date: Discharge Type: Discharge Environment: Receiving Water: Status: Positional Accuracy:	Grampian Regional Council Not Given Storm Sewage Overflow (Harbour), LOSSIEMOUTH Scottish Environment Protection Agency, North Region Lossie L/93/30/C/X Not Supplied Not Supplied 22nd November 1993 Not Supplied Storm Sewage Coastal Not Supplied Not Supplied Located by supplied Located by supplied	A18SE (N)	548	2	323820 871200

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Map ID	Details		Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	Discharge Consents	3				
5	Operator: Property Type: Location: Authority: Catchment Area: Reference: Permit Version: Effective Date: Issued Date: Revocation Date: Discharge Type: Discharge Environment: Receiving Water: Status: Positional Accuracy:	Grampian Regional Council Not Given Lossiemouth Sewerage System, Shore Street Pumping Station Scottish Environment Protection Agency, North Region Lossie L/92/14/C/A Not Supplied Not Supplied J3th August 1992 Not Supplied Unknown Coastal Not Supplied Not Supplied Located by supplier to within 100m	A18NW (N)	682	2	323550 871330
	Discharge Consents	3				
6	Operator: Property Type: Location: Authority: Catchment Area: Reference: Permit Version: Effective Date: Issued Date: Revocation Date: Discharge Environment: Receiving Water: Status: Positional Accuracy:	Mr & Mrs R Conti Not Given Rianna Cottage, Shore Street, LOSSIEMOUTH Scottish Environment Protection Agency, North Region Lossie L/89/22 Not Supplied Not Supplied 23rd November 1989 Not Supplied Septic tank Onto Land Not Supplied Not Supplied Located by supplier to within 100m	A17SE (NW)	768	2	323150 871200
	Discharge Consents	3				
7	Operator: Property Type: Location: Authority: Catchment Area: Reference: Permit Version: Effective Date: Issued Date: Revocation Date: Discharge Type: Discharge Environment: Receiving Water: Status: Positional Accuracy:	A And H R Adams Not Given Kinneddar, DUFFUS Scottish Environment Protection Agency, North Region Lossie U73/55 Not Supplied Not Supplied 21st January 1974 Not Supplied Septic tank Ditch Ditch Of Spynie Canal Not Supplied Located by supplier to within 100m	A17SW (NW)	906	2	322900 871100
	Discharge Consents	3				
8	Operator: Property Type: Location: Authority: Catchment Area: Reference: Permit Version: Effective Date: Issued Date: Issued Date: Discharge Type: Discharge Environment: Receiving Water: Status: Positional Accuracy:	Mr John Cowe Not Given Freelands, Stotfield, LOSSIEMOUTH Scottish Environment Protection Agency, North Region Lossie L/85/3(CP) Not Supplied Not Supplied 22nd January 1985 Not Supplied Septic tank Onto Land Not Supplied Located by supplier to within 100m	A17SW (W)	922	2	322800 870900
-	Local Authority Poll	ution Prevention and Controls			_	
9	Name: Location: Authority: Permit Reference: Dated: Process Type: Description: Status: Positional Accuracy:	Ian Watt Garage Limited James Square, LOSSIEMOUTH, Morayshire, IV31 Scottish Environment Protection Agency, North Region MOR/WOB/5 9th December 1993 Local Authority Air Pollution Control PG1/1Waste oil burners, less than 0.4MW net rated thermal input Not Supplied Manually positioned to the address or location	A18SW (NW)	233	2	323608 870879

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Map ID	Details		Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	Nearest Surface Wa	ter Feature				
			A13SE (SE)	0	-	323803 870511
	Registered Radioad	tive Substances				
10	Name: Location: Authority: Permit Reference: Dated: Process Type:	Grampian Regional Council Lossiemouth Secondary School, Coularbank Road, LOSSIEMOUTH, Morayshire, IV31 6JU Scottish Environment Protection Agency, Head Office IPB/3/6/GE/002 1st December 1987 Registration under S7 RSA for the keeping and use of Radioactive materials	A12SE (W)	552	3	323150 870525
	Description: Status: Positional Accuracy:	Registration under S7 RSA for 1 or more closed sources Not Given Unknown				
	Groundwater Vulne	rability				
	Geological Classification: Soil Classification: Map Sheet: Scale:	Inland water or sea Not classified Sheet 54 Map Of Scotland 1:625,000	A13NW (SW)	0	3	323755 870541
	Groundwater Vulne Geological Classification: Soil Classification:	rability Major or Highly Permeable Aquifer - Highly permeable strata usually with a known or probable presence of significant fracturing Soils of High Leaching Potential - Soils with little ability to attenuate diffuse source pollutants and in which non-absorbed diffuse source pollutants and liquid discharges will percolate rapidly	A13NW (W)	0	3	323737 870543
	Scale:	1:625,000				
	Drift Deposits None					
	River Flood Data (Scotland)					
	Type: Flood Plain Type: Source:	Flood Plain Depth 0 -1 Metres 0-1m estimated 100yr flood depth Centre for Ecology and Hydrology	A13SW (S)	2	4	323739 870483
	River Flood Data (S	cotland)				
	Type: Flood Plain Type: Source:	Flood Plain Depth 0 -1 Metres 0-1m estimated 100yr flood depth Centre for Ecology and Hydrology	A13SW (S)	4	4	323750 870400
	River Flood Data (S	cotland)				
	Type: Flood Plain Type: Source:	Flood Plain Depth 1 - 2 Metres 1-2m estimated 100yr flood depth Centre for Ecology and Hydrology	A13SW (SW)	41	4	323700 870450
	OS Water Network	Lines				
11	Watercourse Form: Watercourse Length Watercourse Level: Permanent: Watercourse Name: Catchment Name: Primacy:	Tidal river 87.4 On ground surface True River Lossie River Lossie 1	A13SW (SW)	0	5	323738 870521
	OS Water Network	Lines				
12	Watercourse Form: Watercourse Length Watercourse Level: Permanent: Watercourse Name: Catchment Name: Primacy:	Tidal river 453.8 On ground surface True River Lossie River Lossie 1	A13SW (SW)	0	5	323728 870528
	OS Water Network	Lines				
13	Watercourse Form: Watercourse Length Watercourse Level: Permanent: Watercourse Name: Catchment Name: Primacv:	Tidal river : 156.9 On ground surface True River Lossie River Lossie 1	A13SE (SE)	1	5	323794 870472

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Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
14	OS Water Network Lines Watercourse Form: Tidal river Watercourse Length: 206.8 Watercourse Level: On ground surface Permanent: True Watercourse Name: River Lossie Catchment Name: River Lossie Primacy: 2	A13SE (SE)	1	5	323794 870472
15	OS Water Network Lines Watercourse Form: Tidal river Watercourse Length: 397.6 Watercourse Level: On ground surface Permanent: True Watercourse Name: Spynie Canal Catchment Name: Moray Coastal Primacy: 1	A13SW (SW)	46	5	323728 870528
16	OS Water Network Lines Watercourse Form: Tidal river Watercourse Length: 364.7 Watercourse Level: On ground surface Permanent: True Watercourse Name: River Lossie Catchment Name: River Lossie Primacy: 1	A13SE (SE)	127	5	323860 870333
17	OS Water Network Lines Watercourse Form: Tidal river Watercourse Length: 186.9 Watercourse Level: On ground surface Permanent: True Watercourse Name: Not Supplied Catchment Name: Moray Coastal Primacy: 1	A13SE (S)	187	5	323807 870222
18	OS Water Network Lines Watercourse Form: Tidal river Watercourse Length: 2291.4 Watercourse Level: On ground surface Permanent: True Watercourse Name: Spynie Canal Catchment Name: Moray Coastal Primacy: 1	A8NW (S)	283	5	323639 870143
19	OS Water Network Lines Watercourse Form: Tidal river Watercourse Length: 108.8 Watercourse Level: On ground surface Permanent: True Watercourse Name: River Lossie Catchment Name: River Lossie Primacy: 2	A8NE (SE)	466	5	324041 870035
20	OS Water Network Lines Watercourse Form: Tidal river Watercourse Length: 96.5 Watercourse Level: On ground surface Permanent: True Watercourse Name: River Lossie Catchment Name: River Lossie Primacy: 1	A8NE (SE)	466	5	324041 870035
21	OS Water Network Lines Watercourse Form: Tidal river Watercourse Length: 579.3 Watercourse Level: On ground surface Permanent: True Watercourse Name: River Lossie Catchment Name: River Lossie Primacy: 1	A9NW (SE)	558	5	324110 869972
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Waste

Map ID		Details		Estimated Distance From Site	Contact	NGR
	Local Authority La	cal Authority Landfill Coverage				
	Name:	Moray Council - Has supplied landfill data		0	6	323755 870541
	Potentially Infilled	Land (Non-Water)				
22	Bearing Ref: Use: Date of Mapping:	NW Unknown Filled Ground (Pit, quarry etc) 1994	A13NW (NW)	92	-	323635 870730
	Potentially Infilled	Land (Non-Water)				
23	Bearing Ref: Use: Date of Mapping:	W Unknown Filled Ground (Pit, quarry etc) 1994	A13NW (W)	204	-	323488 870610
	Potentially Infilled	Potentially Infilled Land (Non-Water)				
24	Bearing Ref: Use: Date of Mapping:	W Unknown Filled Ground (Pit, quarry etc) 1994	A12SE (W)	538	-	323197 870429
	Potentially Infilled	Land (Non-Water)				
25	Bearing Ref: Use: Date of Mapping:	SW Unknown Filled Ground (Pit, quarry etc) 1991	A7NE (SW)	783	-	323171 869874
	Potentially Infilled	Land (Non-Water)				
26	Bearing Ref: Use: Date of Mapping:	NW Unknown Filled Ground (Pit, quarry etc) 1994	A17SW (NW)	840	-	323008 871145
	Potentially Infilled	Land (Non-Water)				
27	Bearing Ref: Use: Date of Mapping:	SW Unknown Filled Ground (Pit, quarry etc) 1991	A7SE (SW)	884	-	323268 869663
	Potentially Infilled	Land (Water)				
28	Use: Date of Mapping:	Unknown Filled Ground (Pond, marsh, river, stream, dock etc) 1873	A17NE (NW)	780	-	323213 871274

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Map ID		Details		Estimated Distance From Site	Contact	NGR
	BGS 1:625,000 Solid	d Geology				
	Description:	New Red Sandstone Supergroup	A13NW (NW)	0	1	323711 870636
	BGS 1:625,000 Solid	d Geology				
	Description:	Upper Old Red Sandstone	A13NW (NW)	0	1	323711 870594
	BGS Estimated Soil	Chemistry				
	Source: Soil Sample Type: Arsenic	British Geological Survey, National Geoscience Information Service Sediment <15 mg/kg	A13NW (SW)	0	1	323755 870541
	Concentration:					
	Concentration:	no data				
	Chromium	40 - 60 mg/kg				
	Concentration: Lead Concentration: Nickel	<100 mg/kg 15 - 30 mg/kg				
	BCS Estimated Sail	Chamiatay				
	Source:	British Geological Survey, National Geoscience Information Service	A13NE	261	1	323924
	Soil Sample Type: Arsenic	Sediment no data	(NE)	201		870837
	Concentration: Cadmium	no data				
	Concentration:					
	Chromium Concentration:	no data				
	Lead Concentration:	<100 mg/kg				
	Nickel Concentration:	no data				
	BGS Estimated Soil	Chamistry				
	Source.	British Geological Survey, National Geoscience Information Service	A17NE	847	1	323344
	Soil Sample Type:	Sediment	(NW)			871433
	Arsenic Concentration:	<15 mg/kg				
	Cadmium	no data				
	Concentration: Chromium	40 - 60 ma/ka				
	Concentration:					
	Lead Concentration: Nickel	<100 mg/kg 15 - 30 mg/kg				
	Concentration:					
	BGS Recorded Mine	eral Sites				
29	Site Name:	Lossiemouth Quarries	A13NW	78	1	323620
	Source:	British Geological Survey, National Geoscience Information Service	(1977)			870690
	Reference:	163397 Opencest				
	Status:	Ceased				
	Operator:	Unknown Operator				
	Periodic Type:	Triassic				
	Geology:	Lossiemouth Sandstone Formation				
	Positional Accuracy:	Located by supplier to within 10m				
	BGS Recorded Mine	eral Sites				
29	Site Name:	Lossiemouth Quarries	A13NW	78	1	323620
	Location: Source:	Branderburgh, Lossiemouth, Morayshire British Geological Survey, National Geoscience Information Service	(NW)			870690
	Reference:	163397				
	Type: Status:	Opencast Ceased				
	Operator:	Unknown Operator				
	Operator Location:	Not Supplied Triassic				
	Geology:	Burghead Sandstone Formation				
	Commodity: Positional Accuracy:	Sandstone Located by supplier to within 10m				

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Map ID		Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	BGS Recorded Mine	eral Sites				
30	Site Name: Location: Source: Reference: Type: Status: Operator: Operator: Operator Location: Periodic Type: Geology: Commodity: Positional Accuracy:	Lossiemouth Quarries Branderburgh, Lossiemouth, Morayshire British Geological Survey, National Geoscience Information Service 94084 Opencast Ceased Unknown Operator Not Supplied Triassic Lossiemouth Sandstone Formation Sandstone Located by supplier to within 10m	A13NW (N)	108	1	323723 870771
	DOO Deservised Mine					
31	BGS Recorded Mine Site Name: Location: Source: Reference: Type: Status: Operator: Operator: Operator: Operator Location: Periodic Type: Geology: Commodity: Positional Accuracy:	Para Sites Lossiemouth Quarries Branderburgh, Lossiemouth, Morayshire British Geological Survey, National Geoscience Information Service 94050 Opencast Ceased Unknown Operator Not Supplied Triassic Burghead Sandstone Formation Sandstone Located by supplier to within 10m	A13NW (NW)	143	1	323545 870635
	BGS Recorded Mine	eral Sites				
32	Site Name: Location: Source: Reference: Type: Status: Operator: Operator: Operator: Periodic Type: Geology: Commodity: Positional Accuracy:	School Brae Lossiemouth, Morayshire British Geological Survey, National Geoscience Information Service 163723 Opencast Ceased Unknown Operator Not Supplied Triassic Lossiemouth Sandstone Formation Sandstone Located by supplier to within 10m	A12SE (W)	548	1	323183 870437
	BGS Recorded Mine	eral Sites				
33	Site Name: Location: Source: Reference: Type: Status: Operator: Operator: Operator: Deriodic Type: Geology: Commodity: Positional Accuracy:	Lossiemouth West Stotfield, Lossiemouth, Morayshire British Geological Survey, National Geoscience Information Service 94083 Opencast Ceased Individual'S Name Withheld Not Supplied Triassic Lossiemouth Sandstone Formation Sandstone Located by supplier to within 10m	A12SE (W)	616	1	323112 870431
	BGS Recorded Mine	eral Sites				
34	Site Name: Location: Source: Reference: Type: Status: Operator: Operator Location: Periodic Type: Geology: Commodity: Positional Accuracy:	Sunbank Shingle Pits Lossiemouth, Morayshire British Geological Survey, National Geoscience Information Service 163727 Opencast Ceased Individual'S Name Withheld Not Supplied Quaternary Storm Beach Deposits Gravel Located by supplier to within 10m	A7SW (SW)	977	1	323088 869684
	BGS Measured Urba	an Soil Chemistry				
	No data available					
	BGS Urban Soil Che No data available	emistry Averages				
	Coal Mining Affecte	d Areas				
	In an area that might	not be attected by coal mining				

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Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	Man-Made Mining Cavities				
	Easting: 322900 Northing: 871000 Distance: 861 Quadrant Reference: A17 Quadrant Reference: SW Bearing Ref: NW Cavity Type: Not supplied Commodity: Lead Solid Geology Detail: Permian and Triassic sandstones, Undifferentiated Superficial Geology No Details	A17SW (NW)	861	7	322900 871000
	Man-Mada Mining Cavities				
	Wainwade winning Cavities Easting: 323000 Northing: 871200 Distance: 880 Quadrant Reference: A17 Quadrant Reference: SW Bearing Ref: NW Cavity Type: Not supplied Commodity: Galena Solid Geology Detail: No Details Superficial Geology No Details Detail: Voltable	A17SW (NW)	880	7	323000 871200
	Man-Made Mining Cavities				
	Easting: 322900 Northing: 871100 Distance: 906 Quadrant Reference: A17 Quadrant Reference: SW Bearing Ref: NW Cavity Type: Not supplied Commodity: Lead Solid Geology Detail: Permian and Triassic sandstones, Undifferentiated Superficial Geology No Details Detail: Permian	A17SW (NW)	906	7	322900 871100
	Man-Made Mining Cavities				
	Easting: 322900 Northing: 871100 Distance: 906 Quadrant Reference: A17 Quadrant Reference: SW Bearing Ref: NW Cavity Type: Not supplied Commodity: Lead Solid Geology Detail: Permian and Triassic sandstones, Undifferentiated Superficial Geology No Details	A17SW (NW)	906	7	322900 871100
	Non Coal Mining Areas of Great Britain				
	Risk: Rare Ritich Coological Survey, National Cooperings Information Contract	A13NW	0	1	323755
	Source. British Geological Survey, National Geoscience Information Service	(SW)			870541
	Potential for Collapsible Ground Stability Hazards Hazard Potential: No Hazard Source: British Geological Survey, National Geoscience Information Service	A13NW (SW)	0	1	323755 870541
	Potential for Collapsible Ground Stability Hazards Hazard Potential: Very Low Source: British Geological Survey, National Geoscience Information Service	A13NW (NW)	29	1	323667 870676
	Potential for Compressible Ground Stability Hazards Hazard Potential: No Hazard Source: British Geological Survey, National Geoscience Information Service	A13NW (SW)	0	1	323755 870541
	Potential for Compressible Ground Stability Hazards				
	Hazard Potential: Low Source: British Geological Survey, National Geoscience Information Service	A13NW (NW)	102	1	323642 870749
	Potential for Ground Dissolution Stability Hazards Hazard Potential: No Hazard Source: British Geological Survey, National Geoscience Information Service	A13NW (SW)	0	1	323755 870541
	Potential for Landslide Ground Stability Hazards				
	Hazard Potential: Very Low Source: British Geological Survey, National Geoscience Information Service	A13NW (SW)	0	1	323755 870541
	Potential for Landslide Ground Stability Hazards Hazard Potential: Low Source: British Geological Survey, National Geoscience Information Service	A13NW (NW)	115	1	323598 870725

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Map ID		Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	Potential for Runnin	ng Sand Ground Stability Hazards				
	Hazard Potential: Source:	Moderate British Geological Survey, National Geoscience Information Service	A13NW (SW)	0	1	323755 870541
	Potential for Runnin	ng Sand Ground Stability Hazards				
	Hazard Potential: Source:	Low British Geological Survey, National Geoscience Information Service	A13NE (NE)	0	1	323826 870590
	Potential for Runnin	ng Sand Ground Stability Hazards				
	Hazard Potential: Source:	No Hazard British Geological Survey, National Geoscience Information Service	A13SW (W)	0	1	323682 870533
	Potential for Runni	ng Sand Ground Stability Hazards				
	Hazard Potential: Source:	Very Low British Geological Survey, National Geoscience Information Service	A13NW (NW)	102	1	323642 870749
	Potential for Shrink	ing or Swelling Clay Ground Stability Hazards				
	Hazard Potential: Source:	No Hazard British Geological Survey, National Geoscience Information Service	A13NW (SW)	0	1	323755 870541
	Radon Potential - R	adon Affected Areas				
	Affected Area:	The property is in a Lower probability radon area (less than 1% of homes are estimated to be at or above the Action Level). British Geological Survey, National Geoscience Information Service	A13NW (SW)	0	1	323755 870541
	Padan Potential P	adan Protection Measures				
	Protection Measure	No radon protective measures are necessary in the construction of new	A13NW	0	1	323755
	Source:	dwellings or extensions British Geological Survey, National Geoscience Information Service	(SW)	0	1	870541

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Map ID		Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
35	Contemporary Trad Name: Location: Classification: Status:	e Directory Entries R G Stewart Engineering Services 31, Seatown, Lossiemouth, Morayshire, IV31 6JJ Engineers - General Active	A13SE (S)	97	-	323771 870306
	Positional Accuracy: Contemporary Trad	Automatically positioned to the address e Directory Entries				
36	Name: Location: Classification: Status: Positional Accuracy:	Dry Cleaning Well 1, Clifton Road, Lossiemouth, Morayshire, IV31 6DJ Dry Cleaners Inactive Automatically positioned to the address	A13NE (N)	133	-	323775 870776
37	Contemporary Trad Name: Location: Classification: Status: Positional Accuracy:	e Directory Entries Lossiemouth Garage 35, Clifton Road, Lossiemouth, IV31 6DP Garage Services Active Automatically positioned to the address	A13SW (W)	210	-	323530 870512
37	Contemporary Trad Name: Location: Classification: Status: Positional Accuracy:	e Directory Entries Sureline Motors 37, Clifton Road, Lossiemouth, Morayshire, IV31 6DP Garage Services Inactive Automatically positioned to the address	A13SW (W)	255	-	323492 870487
37	Contemporary Trad Name: Location: Classification: Status: Positional Accuracy:	e Directory Entries Shoreline Motors 37, Clifton Road, Lossiemouth, Morayshire, IV31 6DP Car Dealers Inactive Automatically positioned to the address	A13SW (W)	255	-	323492 870487
38	Contemporary Trad Name: Location: Classification: Status: Positional Accuracy:	e Directory Entries Ian Watt Garage James Street, Lossiemouth, Morayshire, IV31 6DD Garage Services Active Automatically positioned to the address	A18SW (NW)	234	-	323610 870881
39	Contemporary Trad Name: Location: Classification: Status: Positional Accuracy:	e Directory Entries Morgans Of Lossiemouth 61, Clifton Road, Lossiemouth, Morayshire, IV31 6DP Electrical Goods Sales, Manufacturers & Wholesalers Active Automatically positioned to the address	A13SW (W)	300	-	323448 870471
40	Contemporary Trad Name: Location: Classification: Status: Positional Accuracy:	e Directory Entries W F Liebnitz Ltd Parklands, Dunbar Street, Lossiemouth, Morayshire, IV31 6AL Electronic Engineers Inactive Automatically positioned to the address	A12NE (NW)	321	-	323423 870833
41	Contemporary Trad Name: Location: Classification: Status: Positional Accuracy:	e Directory Entries Bill Ellis 24b, Argyle Street, Lossiemouth, Morayshire, IV31 6AX Commercial Vehicle Dealers Inactive Automatically positioned to the address	A18SW (NW)	346	-	323459 870911
42	Contemporary Trad Name: Location: Classification: Status: Positional Accuracy:	e Directory Entries Hendry Fleetwood & Sons Ltd Baker Street, Lossiemouth, Morayshire, IV31 6NZ Marine Engineers Inactive Automatically positioned to the address	A18SE (N)	377	-	323797 871030
42	Contemporary Trad Name: Location: Classification: Status: Positional Accuracy:	e Directory Entries Frith Heating Ltd 13, High Street, Lossiemouth, Morayshire, IV31 6PH Boilers - Servicing, Replacements & Repairs Active Automatically positioned to the address	A18SE (N)	412	-	323786 871069
43	Contemporary Trad Name: Location: Classification: Status: Positional Accuracy:	e Directory Entries Bill Ellis 24, Argyle Street, Lossiemouth, Morayshire, IV31 6AX Commercial Vehicle Dealers Inactive Automatically positioned to the address	A18SW (NW)	378	-	323472 870965

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Map ID		Details			Contact	NGR
	Contemporary Trad	le Directory Entries				
44	Name: Location: Classification: Status: Positional Accuracy:	Chipsaway 37, Queen Street, Lossiemouth, Morayshire, IV31 6PR Car Body Repairs Inactive Automatically positioned to the address	A18SW (NW)	403	-	323518 871023
	Contemporary Trad	e Directory Entries				
45	Name: Location: Classification: Status: Positional Accuracy:	Lossie 5, High Street, Lossiemouth, Morayshire, IV31 6PF Printers Inactive Automatically positioned to the address	A18SE (N)	482	-	323818 871132
	Contemporary Trad	e Directory Entries				
46	Name: Location: Classification: Status: Positional Accuracy:	Harbour Service Station Ltd 5, Shore Street, Lossiemouth, Morayshire, IV31 6PB Car Dealers - Used Active Manually positioned to the address or location	A18SW (N)	493	-	323746 871156
	Contemporary Trad	le Directory Entries				
47	Name: Location: Classification: Status: Positional Accuracy:	Morscot Utilities 57, Queen Street, Lossiemouth, IV31 6PY Electricity Companies Inactive Automatically positioned to the address	A17SE (NW)	506	-	323378 871054
	Contemporary Trad	e Directory Entries				
48	Name: Location: Classification: Status: Positional Accuracy:	Elgin Express 2, Argyle Street, Lossiemouth, Morayshire, IV31 6PS Dry Cleaners Inactive Automatically positioned to the address	A18SW (N)	508	-	323510 871136
	Contomporary Trad					
49	Name: Location: Classification: Status: Positional Accuracy:	Elgin & Lossiemouth Harbour Co Lossiemouth Marina,Shore St, Lossiemouth, Morayshire, IV31 6PB Ports, Docks & Harbours Inactive Manually positioned within the geographical locality	A18NW (N)	567	-	323545 871210
	Contemporary Trad	le Directory Entries				
49	Name: Location: Classification: Status: Positional Accuracy:	Ace Tuning Shore Street, Lossiemouth, IV31 6PB Garage Services Inactive Automatically positioned to the address	A18NW (N)	588	-	323556 871235
	Contemporary Trad	le Directory Entries				
49	Name: Location: Classification: Status: Positional Accuracy:	Nor-Coat Shore St, Lossiemouth, Morayshire, IV31 6PB Floorcoverings - Manufacturers & Wholesalers Inactive Automatically positioned to the address	A18NW (N)	592	-	323538 871234
	Contemporary Trad	le Directory Entries				
49	Name: Location: Classification: Status: Positional Accuracy:	Shoreline Motors Shore St, Lossiemouth, Morayshire, IV31 6PB Garage Services Inactive Automatically positioned to the address	A18NW (N)	592	-	323538 871234
	Contemporary Trad	le Directory Entries				
49	Name: Location: Classification: Status: Positional Accuracy:	Lossie Pre-Cast Shore Street, Lossiemouth, Morayshire, IV31 6PB Concrete Products Inactive Automatically positioned to the address	A18NW (N)	607	-	323515 871243
	Contemporary Trad	le Directory Entries				
50	Name: Location: Classification: Status: Positional Accuracy:	L D L 90, Queen Street, Lossiemouth, Morayshire, IV31 6PY Medical & Dental Laboratories Active Automatically positioned to the address	A17SE (NW)	572	-	323325 871096
	Contemporary Trad	e Directory Entries				
51	Name: Location: Classification: Status: Positional Accuracy:	Mcandie Garage Services Unit 13, Shore Street, Lossiemouth, IV31 6PB Garage Services Active Automatically positioned to the address	A18NW (NW)	654	-	323433 871262

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Map ID		Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
52	Contemporary Trad Name: Location: Classification: Status: Positional Accuracy:	e Directory Entries Netdatatel Skerryview, Dunbar Street, Lossiemouth, IV31 6RD Telecommunications Equipment & Systems Inactive Automatically positioned to the address	A12NW (W)	686	-	323007 870736
53	Contemporary Trad Name: Location: Classification: Status: Positional Accuracy:	e Directory Entries Lossie Sails Kinvara, Dunbar Street, Lossiemouth, Morayshire, IV31 6RD Sailmakers & Repairers Active Automatically positioned to the address	A12NW (W)	772	-	322916 870620
54	Fuel Station Entries Name: Location: Brand: Premises Type: Status: Positional Accuracy:	ian Watt Garage The Square , , Lossiemouth, Moray, IV31 6DD GLEANER Petrol Station Open Manually positioned to the address or location	A18SW (NW)	234	-	323610 870881
55	Fuel Station Entries Name: Location: Brand: Premises Type: Status: Positional Accuracy:	Harbour Service Station 5, Shore Street , , Lossiemouth, Moray, IV31 6PB Gleaner Petrol Station Open Manually positioned to the address or location	A18SW (N)	492	-	323733 871156
56	Points of Interest - (Name: Location: Category: Class Code: Positional Accuracy:	Commercial Services Lossiemouth Garage 35 Clifton Road, Lossiemouth, IV31 6DP Repair and Servicing Vehicle Repair, Testing and Servicing Positioned to address or location	A13SW (W)	210	8	323530 870512
56	Points of Interest - (Name: Location: Category: Class Code: Positional Accuracy:	Commercial Services Lossiemouth Garage 35 Clifton Road, Lossiemouth, IV31 6DP Repair and Servicing Vehicle Repair, Testing and Servicing Positioned to address or location	A13SW (W)	211	8	323529 870512
57	Points of Interest - (Name: Location: Category: Class Code: Positional Accuracy:	Commercial Services Car Wash James Street, Lossiemouth, IV31 6DD Personal, Consumer and other Services Vehicle Cleaning Services Positioned to address or location	A18SW (NW)	234	8	323610 870881
57	Points of Interest - (Name: Location: Category: Class Code: Positional Accuracy:	Commercial Services Ian Watt Garage James Street, Lossiemouth, Morayshire, IV31 6DD Personal, Consumer and other Services Vehicle Cleaning Services Positioned to address or location	A18SW (NW)	234	8	323610 870881
57	Points of Interest - (Name: Location: Category: Class Code: Positional Accuracy:	Commercial Services Ian Watt Garage James Street, Lossiemouth, IV31 6DD Repair and Servicing Vehicle Repair, Testing and Servicing Positioned to address or location	A18SW (NW)	234	8	323610 870881
57	Points of Interest - O Name: Location: Category: Class Code: Positional Accuracy:	Commercial Services Ian Watt James Street, Lossiemouth, IV31 6DD Repair and Servicing Vehicle Repair, Testing and Servicing Positioned to address or location	A18SW (NW)	234	8	323610 870881
57	Points of Interest - (Name: Location: Category: Class Code: Positional Accuracy:	Commercial Services Ian Watt Garage James Street, Lossiemouth, IV31 6DD Repair and Servicing Vehicle Repair, Testing and Servicing Positioned to address or location	A18SW (NW)	234	8	323610 870880

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Map ID		Details			Contact	NGR
	Points of Interest -	Commercial Services				
57	Name: Location: Category: Class Code: Positional Accuracy:	Ian Watt Garage James Street, Lossiemouth, IV31 6DD Repair and Servicing Vehicle Repair, Testing and Servicing Positioned to address or location	A18SW (NW)	234	8	323610 870881
	Points of Interest - (Commercial Services				
58	Name: Location: Category: Class Code: Positional Accuracy:	Chipsaway 37 Queen Street, Lossiemouth, IV31 6PR Repair and Servicing Vehicle Repair, Testing and Servicing Positioned to address or location	A18SW (NW)	403	8	323518 871023
	Points of Interest -	Commercial Services				
58	Name: Location: Category: Class Code: Positional Accuracy:	Chipsaway Ltd 37 Queen Street, Lossiemouth, IV31 6PR Repair and Servicing Vehicle Repair, Testing and Servicing Positioned to address or location	A18SW (NW)	403	8	323518 871023
	Points of Interest -	Commercial Services				
59	Name: Location: Category: Class Code: Positional Accuracy:	Harbour Service Station 5 Shore Street, Lossiemouth, Morayshire, IV31 6PB Personal, Consumer and other Services Vehicle Cleaning Services Positioned to address or location	A18SW (N)	492	8	323733 871156
	Points of Interest -	Commercial Services				
59	Name: Location: Category: Class Code: Positional Accuracy:	Car Wash 5 Shore Street, Lossiemouth, IV31 6PB Personal, Consumer and other Services Vehicle Cleaning Services Positioned to address or location	A18SW (N)	492	8	323733 871156
	Points of Interest - 0	Commercial Services				
60	Name: Location: Category: Class Code: Positional Accuracy:	Ace Tuning Shore Street, Lossiemouth, IV31 6PB Repair and Servicing Vehicle Repair, Testing and Servicing Positioned to address or location	A18NW (N)	589	8	323555 871236
	Points of Interest -	Commercial Services				
61	Name: Location: Category: Class Code: Positional Accuracy:	McAndie Garage Services 13 Shore Street, Lossiemouth, Morayshire, IV31 6PB Repair and Servicing Vehicle Repair, Testing and Servicing Positioned to address or location	A18NW (NW)	654	8	323434 871262
	Points of Interest -	Commercial Services				
61	Name: Location: Category: Class Code: Positional Accuracy:	Ace Tuning Commerce Street, Lossiemouth, IV31 6QH Repair and Servicing Vehicle Repair, Testing and Servicing Positioned to address or location	A17NE (NW)	683	8	323385 871270
	Points of Interest - I	Manufacturing and Production				
62	Name: Location: Category: Class Code: Positional Accuracy:	Works IV31 Industrial Features Unspecified Works Or Factories Positioned to an adjacent address or location	A18SE (N)	377	8	323800 871029
	Points of Interest - I	Manufacturing and Production				
62	Name: Location: Category: Class Code: Positional Accuracy:	Works Not Supplied Industrial Features Unspecified Works Or Factories Positioned to an adjacent address or location	A18SE (N)	378	8	323800 871030
	Points of Interest - I	Manufacturing and Production				
62	Name: Location: Category: Class Code: Positional Accuracy:	Works Not Supplied Industrial Features Unspecified Works Or Factories Positioned to an adjacent address or location	A18SE (N)	387	8	323822 871033
	Points of Interest - I	Manufacturing and Production				
62	Name: Location: Category: Class Code: Positional Accuracy:	Works IV31 Industrial Features Unspecified Works Or Factories Positioned to an adjacent address or location	A18SE (N)	387	8	323824 871032

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Map ID		Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	Points of Interest - I	Manufacturing and Production				
63	Name: Location: Category: Class Code: Positional Accuracy:	Works Not Supplied Industrial Features Unspecified Works Or Factories Positioned to an adjacent address or location	A18SE (N)	482	8	323821 871132
	Points of Interest - I	Manufacturing and Production				
63	Name: Location: Category: Class Code: Positional Accuracy:	Works IV31 Industrial Features Unspecified Works Or Factories Positioned to an adjacent address or location	A18SE (N)	482	8	323822 871132
	Points of Interest - I	Manufacturing and Production				
64	Name: Location: Category: Class Code: Positional Accuracy:	Works Not Supplied Industrial Features Unspecified Works Or Factories Positioned to an adjacent address or location	A18NW (N)	555	8	323637 871216
	Points of Interest - I	Manufacturing and Production				
64	Name: Location: Category: Class Code: Positional Accuracy:	Works IV31 Industrial Features Unspecified Works Or Factories Positioned to an adjacent address or location	A18NW (N)	558	8	323628 871218
	Points of Interest - I	Manufacturing and Production				
65	Name: Location: Category: Class Code: Positional Accuracy:	Works Not Supplied Industrial Features Unspecified Works Or Factories Positioned to an adjacent address or location	A18NW (NW)	619	8	323445 871228
	Points of Interest - I	Manufacturing and Production				
65	Name: Location: Category: Class Code: Positional Accuracy:	Works IV31 Industrial Features Unspecified Works Or Factories Positioned to address or location	A18NW (NW)	621	8	323447 871232
65	Points of Interest - I Name: Location: Category: Class Code: Positional Accuracy:	Manufacturing and Production Works Not Supplied Industrial Features Unspecified Works Or Factories Positioned to an adjacent address or location	A17NE (NW)	632	8	323423 871233
	Points of Interest - I	Manufacturing and Production				
65	Name: Location: Category: Class Code: Positional Accuracy:	Works IV31 Industrial Features Unspecified Works Or Factories Positioned to an adjacent address or location	A17NE (NW)	632	8	323423 871233
	Points of Interest - I	Public Infrastructure				
66	Name: Location: Category: Class Code: Positional Accuracy:	Outfall IV31 Infrastructure and Facilities Waste Storage, Processing and Disposal Positioned to an adjacent address or location	A13SW (SW)	48	8	323693 870414
	Points of Interest - I	Public Infrastructure				
66	Name: Location: Category: Class Code: Positional Accuracy:	Outfall IV31 Infrastructure and Facilities Waste Storage, Processing and Disposal Positioned to an adjacent address or location	A13SW (SW)	53	8	323689 870404
	Points of Interest - I	Public Infrastructure				
67	Name: Location: Category: Class Code: Positional Accuracy:	Lossiemouth Police Station Police Station 31a, Clifton Road, Lossiemouth, IV31 6DJ Central and Local Government Police Stations Positioned to address or location	A13NW (W)	133	8	323601 870550
	Points of Interest - I	Public Infrastructure				
67	Name: Location: Category: Class Code: Positional Accuracy:	Lossiemouth Police Station Clifton Rd, Lossiemouth, Morayshire, IV31 6DJ Central and Local Government Police Stations Positioned to address or location	A13NW (W)	134	8	323600 870550

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Map ID		Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	Points of Interest -	Public Infrastructure				
67	Name: Location: Category: Class Code: Positional Accuracy:	Lossiemouth Police Station Clifton Road, Lossiemouth, Morayshire, IV31 6DJ Central and Local Government Police Stations Positioned to address or location	A13NW (W)	134	8	323600 870550
67	Points of Interest - I Name: Location: Category: Class Code: Positional Accuracy:	Public Infrastructure Lossiemouth Fire Station Clifton Road, Lossiemouth, IV31 6DP Central and Local Government Fire Brigade Stations Positioned to address or location	A13NW (W)	204	8	323517 870540
	Points of Interest -	Public Infrastructure				
68	Name: Location: Category: Class Code: Positional Accuracy:	Ian Watt Garage James Street, Lossiemouth, Morayshire, IV31 6DD Road And Rail Petrol and Fuel Stations Positioned to address or location	A18SW (NW)	234	8	323610 870881
	Points of Interest -	Public Infrastructure				
69	Name: Location: Category: Class Code: Positional Accuracy:	Harbour Service Station Ltd 5 Shore Street, Lossiemouth, IV31 6PB Road And Rail Petrol and Fuel Stations Positioned to address or location	A18SW (N)	491	8	323732 871155
	Points of Interest -	Public Infrastructure				
69	Name: Location: Category: Class Code: Positional Accuracy:	Harbour Service Station 5 Shore Street, Lossiemouth, Morayshire, IV31 6PB Road And Rail Petrol and Fuel Stations Positioned to address or location	A18SW (N)	492	8	323733 871156
	Points of Interest -	Public Infrastructure				
69	Name: Location: Category: Class Code: Positional Accuracy:	Harbour Service Station 5 Shore Street, Lossiemouth, IV31 6PB Road And Rail Petrol and Fuel Stations Positioned to address or location	A18SW (N)	493	8	323746 871156
	Points of Interest -	Recreational and Environmental				
70	Name: Location: Category: Class Code: Positional Accuracy:	Play Area IV31 Recreational Playgrounds Positioned to an adjacent address or location	A18SE (N)	327	8	323875 870942
	Points of Interest -	Recreational and Environmental				
71	Name: Location: Category: Class Code: Positional Accuracy:	Play Area Inchbroom Avenue, IV31 Recreational Playgrounds Positioned to address or location	A8NW (SW)	565	8	323465 869916
	Points of Interest -	Recreational and Environmental				
71	Name: Location: Category: Class Code: Positional Accuracy:	Play Area Not Supplied Recreational Playgrounds Positioned to an adjacent address or location	A8NW (SW)	577	8	323458 869906
	Points of Interest -	Recreational and Environmental				
72	Name: Location: Category: Class Code: Positional Accuracy:	Playground Coulardbank Road, IV31 Recreational Playgrounds Positioned to address or location	A12SE (SW)	636	8	323130 870233
	Points of Interest -	Recreational and Environmental				
72	Name: Location: Category: Class Code: Positional Accuracy:	Playground Not Supplied Recreational Playgrounds Positioned to an adjacent address or location	A12SE (SW)	647	8	323114 870250
	Points of Interest -	Recreational and Environmental				
73	Name: Location: Category: Class Code: Positional Accuracy:	Playground Not Supplied Recreational Playgrounds Positioned to an adjacent address or location	A17SE (NW)	728	8	323217 871208

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Map ID		Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	Points of Interest -	Recreational and Environmental				
73	Name: Location: Category: Class Code: Positional Accuracy:	Playground Commerce Street, IV31 Recreational Playgrounds Positioned to an adjacent address or location	A17SE (NW)	744	8	323185 871201

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Sensitive Land Use

Map ID	Details			Estimated Distance From Site	Contact	NGR
	Ancient Woodland					
74	Name: Reference: Area(m²): Type:	Not Supplied 8404 52804.58 Long-Established Woodland of Plantation Origin	A7SE (SW)	697	9	323373 869818
	Nitrate Vulnerable Z	lones				
75	Name: Description: Source:	Aberdeenshire, Banff, Buchan And Moray Polluted Water Scottish Government	A13NW (SW)	0	10	323755 870541
	Sites of Special Scie	entific Interest				
76	Name: Multiple Areas: Total Area (m2): Source: Reference: Designation Details: Designation Date: Date Type:	Lossiemouth East Quarry N 12288.95 Scottish Natural Heritage 1100 Geological 8th April 1987 Designated	A13NW (NW)	52	9	323656 870697
	Sites of Special Sci	entific Interest				
77	Name: Multiple Areas: Total Area (m2): Source: Reference: Designation Details: Designation Date: Date Type:	Lossiemouth Shore Y 69030.26999999999 Scottish Natural Heritage 1101 Geological 16th January 1989 Designated	A17SW (NW)	851	9	322920 871026
	Special Areas of Co	nservation				
78	Name: Multiple Areas: Total Area (m2): Source: Reference: Status:	Moray Firth Y 1512783523.43 Scottish Natural Heritage 8327 Designated	A18NE (N)	633	9	323816 871287

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Agency & Hydrological	Version	Update Cycle
Contaminated Land Register Entries and Notices		
Scottish Environment Protection Agency - Head Office	June 2020	Annually
Moray Council	November 2013	Annual Rolling Update
Discharge Consents		
Scottish Environment Protection Agency - North Region	February 1998	Not Applicable
Enforcement and Prohibition Notices		
Scottish Environment Protection Agency - North Region	January 2012	Not Applicable
Integrated Pollution Controls		
Scottish Environment Protection Agency - Head Office	February 1998	Variable
Scottish Environment Protection Agency - North Region	March 2002	Variable
Local Authority Pollution Prevention and Controls		
Scottish Environment Protection Agency - North Region	March 2002	Not Applicable
Local Authority Pollution Prevention and Control Enforcements		
Scottish Environment Protection Agency - North Region	June 2001	Variable
Nearest Surface Water Feature		
Ordnance Survey	August 2020	
Prosecutions Relating to Authorised Processes		
Scottish Environment Protection Agency - North Region	March 2007	Not Applicable
Prosecutions Relating to Controlled Waters		
Scottish Environment Protection Agency - North Region	March 2007	Annual Rolling Update
Registered Radioactive Substances		
Scottish Environment Protection Agency - North Region	February 1998	Not Applicable
Scottish Environment Protection Agency - Head Office	January 1998	Not Applicable
River Quality		
Scottish Environment Protection Agency - Head Office	December 1990	Not Applicable
Scottish Environment Protection Agency - North Region	December 1990	Not Applicable
Water Abstractions		
Scottish Government - Agriculture, Environment and Fisheries Department	December 1997	Not Applicable
Water Industry Act Referrals		
Scottish Environment Protection Agency - North Region	April 1996	As Designated
Groundwater Vulnerability		
Scottish Environment Protection Agency - Head Office	December 1995	Not Applicable
Scottish Environment Protection Agency - North Region	December 1995	Not Applicable
Drift Deposits		
Scottish Environment Protection Agency - Head Office	December 1995	Not Applicable
Scottish Environment Protection Agency - North Region	December 1995	Not Applicable
River Flood Data (Scotland)		
Centre for Ecology and Hydrology	September 1999	Not Applicable
OS Water Network Lines		
Ordnance Survey	June 2020	Quarterly
BGS Groundwater Flooding Susceptibility		
British Geological Survey - National Geoscience Information Service	May 2013	Annually

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Waste	Version	Update Cycle
BGS Recorded Landfill Sites		
British Geological Survey - National Geoscience Information Service	June 1996	Not Applicable
Integrated Pollution Control Registered Waste Sites		
Scottish Environment Protection Agency - North Region	February 1998	Not Applicable
Scottish Environment Protection Agency - Head Office	January 1998	Not Applicable
Local Authority Landfill Coverage	,, ,	
Moray Council	May 2000	Not Applicable
	Widy 2000	
Local Authority Recorded Landfill Sites	May 2000	Net Applicable
	May 2000	Not Applicable
Potentially Infilled Land (Non-Water)		
Landmark Information Group Limited	December 1999	Not Applicable
Potentially Infilled Land (Water)		
Landmark Information Group Limited	December 1999	Not Applicable
Registered Landfill Sites		
Scottish Environment Protection Agency - Head Office	December 2005	Not Applicable
Scottish Environment Protection Agency - North Region	December 2005	Not Applicable
Scottish Environment Protection Agency - North Region - Aberdeen Office	December 2005	Not Applicable
Scottish Environment Protection Agency - North Region - Elgin Office	December 2005	Not Applicable
Scottish Environment Protection Agency - North Region - Fort William Office	December 2005	Not Applicable
Scottish Environment Protection Agency - North Region - Fraserburgh Office	December 2005	Not Applicable
Scottish Environment Protection Agency - North Region - Orkney Islands Office	December 2005	Not Applicable
Scottish Environment Protection Agency - North Region - Shetland Islands Office	December 2005	Not Applicable
Scottish Environment Protection Agency - North Region - Thurso Office	December 2005	Not Applicable
Scottish Environment Protection Agency - North Region - Western Isles Office	December 2005	Not Applicable
Registered Waste Transfer Sites		
Scottish Environment Protection Agency - Head Office	December 2005	Not Applicable
Scottish Environment Protection Agency - North Region	December 2005	Not Applicable
Scottish Environment Protection Agency - North Region - Aberdeen Office	December 2005	Not Applicable
Scottish Environment Protection Agency - North Region - Elgin Office	December 2005	Not Applicable
Scottish Environment Protection Agency - North Region - Fort William Office	December 2005	Not Applicable
Scottish Environment Protection Agency - North Region - Fraserburgh Office	December 2005	Not Applicable
Scottish Environment Protection Agency - North Region - Orkney Islands Office	December 2005	Not Applicable
Scottish Environment Protection Agency - North Region - Shetland Islands Office	December 2005	Not Applicable
Scottish Environment Protection Agency - North Region - Thurso Office	December 2005	Not Applicable
Scottish Environment Protection Agency - North Region - Western Isles Office	December 2005	Not Applicable
Registered Waste Treatment or Disposal Sites		
Scottish Environment Protection Agency - Head Office	December 2005	Not Applicable
Scottish Environment Protection Agency - North Region	December 2005	Not Applicable
Scottish Environment Protection Agency - North Region - Aberdeen Office	December 2005	Not Applicable
Scottish Environment Protection Agency - North Region - Elgin Office	December 2005	Not Applicable
Scottish Environment Protection Agency - North Region - Fort William Office	December 2005	Not Applicable
Scottish Environment Protection Agency - North Region - Fraserburgh Office	December 2005	Not Applicable
Scottish Environment Protection Agency - North Region - Orkney Islands Office	December 2005	Not Applicable
Scottish Environment Protection Agency - North Region - Shetland Islands Office	December 2005	Not Applicable
Scottish Environment Protection Agency - North Region - Thurso Office	December 2005	Not Applicable
Scoulsn Environment Protection Agency - North Region - Western Isles Office	December 2005	INOT APPLICABLE

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Hazardous Substances	Version	Update Cycle
Control of Major Accident Hazards Sites (COMAH)		
Health and Safety Executive	April 2018	Bi-Annually
Explosive Sites		
Health and Safety Executive	March 2017	Annually
Notification of Installations Handling Hazardous Substances (NIHHS)		
Health and Safety Executive	November 2000	Not Applicable
Planning Hazardous Substance Enforcements		
Moray Council - Planning Department	February 2016	Variable
Planning Hazardous Substance Consents		
Moray Council - Planning Department	February 2016	Variable
Geological	Version	Update Cycle
BGS 1:625,000 Solid Geology		
British Geological Survey - National Geoscience Information Service	January 2009	Not Applicable
BGS Estimated Soil Chemistry		
British Geological Survey - National Geoscience Information Service	October 2015	Annually
BGS Recorded Mineral Sites		
British Geological Survey - National Geoscience Information Service	June 2020	Bi-Annually
CBSCB Compensation District		
Cheshire Brine Subsidence Compensation Board (CBSCB)	August 2011	Not Applicable
Coal Mining Affected Areas		
The Coal Authority - Property Searches	March 2014	Annual Rolling Update
Mining Instability		
Ove Arup & Partners	October 2000	Not Applicable
Non Coal Mining Areas of Great Britain		
British Geological Survey - National Geoscience Information Service	May 2015	Not Applicable
Potential for Collapsible Ground Stability Hazards		
British Geological Survey - National Geoscience Information Service	April 2020	Annually
Potential for Compressible Ground Stability Hazards		
British Geological Survey - National Geoscience Information Service	January 2019	Annually
Potential for Ground Dissolution Stability Hazards		
British Geological Survey - National Geoscience Information Service	January 2019	Annually
Potential for Landslide Ground Stability Hazards		
British Geological Survey - National Geoscience Information Service	January 2019	Annually
Potential for Running Sand Ground Stability Hazards		
British Geological Survey - National Geoscience Information Service	January 2019	Annually
Potential for Shrinking or Swelling Clay Ground Stability Hazards		, I
British Geological Survey - National Geoscience Information Service	January 2019	Annually
Radon Potential - Radon Affected Areas		
British Geological Survey - National Geoscience Information Service	July 2011	Annually
Radon Potential - Radon Protection Measures		_
British Geological Survey - National Geoscience Information Service	July 2011	Annually

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Industrial Land Use	Version	Update Cycle
Contemporary Trade Directory Entries Thomson Directories	July 2020	Quarterly
Fuel Station Entries Catalist Ltd - Experian	September 2020	Quarterly
Gas Pipelines National Grid	September 2020	
Points of Interest - Commercial Services PointX	September 2020	Quarterly
Points of Interest - Education and Health PointX	September 2020	Quarterly
Points of Interest - Manufacturing and Production PointX	September 2020	Quarterly
Points of Interest - Public Infrastructure PointX	September 2020	Quarterly
Points of Interest - Recreational and Environmental PointX	September 2020	Quarterly
Sensitive Land Use	Version	Update Cycle
Ancient Woodland Scottish Natural Heritage	July 2014	Bi-Annually
Areas of Adopted Green Belt Moray Council	June 2020	As notified
Areas of Unadopted Green Belt Moray Council	June 2020	As notified
Environmentally Sensitive Areas Scottish Government	January 2017	
Forest Parks Forestry Commission	April 1997	Not Applicable
Local Nature Reserves Moray Council	February 2018	Bi-Annually
Marine Nature Reserves Scottish Natural Heritage	July 2019	Bi-Annually
National Nature Reserves Scottish Natural Heritage	June 2018	Bi-Annually
National Parks Scottish Government	December 2013	Bi-Annually
National Scenic Areas Scottish Government	December 2013	Bi-Annually
Nitrate Vulnerable Zones Scottish Government	July 2019	Annually
Ramsar Sites Scottish Natural Heritage	April 2019	Bi-Annually
Sites of Special Scientific Interest Scottish Natural Heritage	March 2019	Bi-Annually
Special Areas of Conservation Scottish Natural Heritage	August 2020	Bi-Annually
Special Protection Areas Scottish Natural Heritage	September 2020	Bi-Annually

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Data Suppliers

A selection of organisations who provide data within this report

Data Supplier	Data Supplier Logo
Ordnance Survey	Map data
Environment Agency	Environment Agency
Scottish Environment Protection Agency	Scottish Environment Protection Agency
The Coal Authority	The Coal Authority
British Geological Survey	British Geological Survey
Centre for Ecology and Hydrology	Centre for Ecology & Hydrology NATURAL ENVIRONMENT RESEARCH COUNCIL
Natural Resources Wales	Cyfoeth Naturiol Cymru Natural Resources Wales
Scottish Natural Heritage	SCOTTISH NATURAL HERITAGE
Natural England	NATURAL ENGLAND
Public Health England	Public Health England
Ove Arup	ARUP
Stantec UK Ltd	Stantec

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Useful Contacts

Contact	Name and Address	Contact Details
1	British Geological Survey - Enquiry Service British Geological Survey, Environmental Science Centre, Keyworth, Nottingham, Nottinghamshire, NG12 5GG	Telephone: 0115 936 3143 Fax: 0115 936 3276 Email: enquiries@bgs.ac.uk Website: www.bgs.ac.uk
2	Scottish Environment Protection Agency - North Region Graesser House, Fodderty Way, Dingwall Business Park, Dingwall, Highland, IV15 9XB	Telephone: 01349 862021 Fax: 01349 863987
3	Scottish Environment Protection Agency - Head Office Erskine Court, The Castle Business Park, Stirling, Stirlingshire, FK9 4TR	Telephone: 01786 457700 Fax: 01786 446885
4	Centre for Ecology and Hydrology Maclean Building, Crowmarsh Gifford, WALLINGFORD, Oxfordshire, OX10 8BB	Telephone: 01491 838800 Fax: 01491 692424
5	Ordnance Survey Adanac Drive, Southampton, Hampshire, SO16 0AS	Telephone: 03456 05 05 05 Email: customerservices@ordnancesurvey.co.uk Website: www.ordnancesurvey.gov.uk
6	Moray Council District Headquarters, High Street, Elgin, Moray, IV30 1BX	Telephone: 01343 543451 Fax: 01343 540183 Website: www.moray.gov.uk
7	Stantec UK Ltd Caversham Bridge House, Waterman Place, Reading, RG1 8DN	Telephone: 0118 950 0761 Email: pba.reading@stantec.com Website: www.stantec.com
8	PointX 7 Abbey Court, Eagle Way, Sowton, Exeter, Devon, EX2 7HY	Website: www.pointx.co.uk
9	Scottish Natural Heritage 12 Hope Terrace, Edinburgh, Midlothian, EH9 2AS	Telephone: 01463 725000
10	Scottish Government St Andrews House, Regent Road, Edinburgh, EH1 3DG	Telephone: 0300 244 4000 Email: ceu@gov.scot Website: www.gov.scot
-	Public Health England - Radon Survey, Centre for Radiation, Chemical and Environmental Hazards Chilton, Didcot, Oxfordshire, OX11 0RQ	Telephone: 01235 822622 Fax: 01235 833891 Email: radon@phe.gov.uk Website: www.ukradon.org
-	Landmark Information Group Limited Imperium, Imperial Way, Reading, Berkshire, RG2 0TD	Telephone: 0844 844 9952 Fax: 0844 844 9951 Email: customerservices@landmarkinfo.co.uk Website: www.landmarkinfo.co.uk

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Index Map

For ease of identification, your site and buffer have been split into Slices, Segments and Quadrants. These are illustrated on the Index Map opposite and explained further below.

Slice

Each slice represents a 1:10,000 plot area (2.7km x 2.7km) for your site and buffer. A large site and buffer may be made up of several slices (represented by a red outline), that are referenced by letters of the alphabet, starting from the bottom left corner of the slice "grid". This grid does not relate to National Grid lines but is designed to give best fit over the site and buffer.

Segment

A segment represents a 1:2,500 plot area. Segments that have plot files associated with them are shown in dark green, others in light blue. These are numbered from the bottom left hand corner within each slice.

Quadrant

A quadrant is a quarter of a segment. These are labelled as NW, NE, SW, SE and are referenced in the datasheet to allow features to be quickly located on plots. Therefore a feature that has a quadrant reference of A7NW will be in Slice A, Segment 7 and the NW Quadrant.

A selection of organisations who provide data within this report:





British Geological Survey NATURAL ENVIRONMENT RESEARCH COUNCIL



Envirocheck reports are compiled from 136 different sources of data.

Client Details

Ms R Brown, Soiltechnics, Cedar Barn, White Lodge, Walgrave, Northampton, NN6 9PY

Order Details

Order Number:262408444_1_1Customer Ref:STS5161MNational Grid Reference:323780, 870550Site Area (Ha):0.73Search Buffer (m):1000

Site Details

Lossiemouth

Full Terms and Conditions can be found on the following link: http://www.landmarkinfo.co.uk/Terms/Show/515



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Geology 1:50,000 Maps Legends

Superficial Geology

Map Colour	Lex Code	Rock Name	Rock Type	Min and Max Age
	RMDF	RAISED MARINE DEPOSITS OF HOLOCENE AGE	Gravel, Sand and Silt	Not Supplied - Holocene
	ALV	Alluvium	Clay, Silt, Sand and Gravel	Not Supplied - Holocene
	RMDV	Raised Marine Deposits, Devensian	Gravel, Sand and Silt	Not Supplied - Devensian
	TILLD	Till, Devensian	Diamicton	Not Supplied - Devensian
	BSA	Blown Sand	Sand	Not Supplied - Quaternary
	MBD	Marine Beach Deposits	Gravel, Sand and Silt	Not Supplied - Quaternary
	STOB	Storm Beach Deposits	Gravel	Not Supplied - Quaternary

Bedrock and Faults

Map Colour	Lex Code	Rock Name	Rock Type	Min and Max Age
	DRB	DUNRobin Bay Formation [See also DUNR]	Sandstone and Siltstone, Interbedded	Not Supplied - Hettangian
	STOT	Stotfield Cherty Rock Formation	Sandstone, Chert and Limestone	Not Supplied - Late Triassic
	LMSF	Lossiemouth Sandstone Formation	Sandstone	Not Supplied - Ladinian
	BRSF	Burghead Sandstone Formation	Sandstone	Not Supplied - Early Triassic
	KISA	Kingsteps Sandstone Formation	Sandstone, Pebbly (Gravelly)	Not Supplied - Late Devonian
/		Faults		

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Geology 1:50,000 Maps

This report contains geological map extracts taken from the BGS Digital Geological map of Great Britain at 1:50,000 scale and is designed for users carrying out preliminary site assessments who require geological maps for the area around the site. This mapping may be more up to date than previously published paper maps. The various geological layers - artificial and landslip deposits, superficial

geology and solid (bedrock) geology are displayed in separate maps, but superimposed on the final 'Combined Surface Geology' map. All map legends feature on this page. Not all layers have complete nationwide coverage, so availability of data for relevant map sheets is indicated below.

Geology 1:50,000 Maps Coverage

Map ID:	1
Map Sheet No:	095
Map Name:	Elgin
Map Date:	1969
Bedrock Geology:	Not Available
Superficial Geology:	Available
Artificial Geology:	Not Available
Faults:	Not Supplied
Landslip:	Not Available
Rock Segments:	Not Supplied

Geology 1:50,000 Maps - Slice A



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Artificial Ground and Landslip

Artificial ground is a term used by BGS for those areas where the ground surface has been significantly modified by human activity. Information about previously developed ground is especially important, as it is often associated with potentially contaminated material, unpredictable engineering conditions and unstable ground.

Artificial ground includes:

- Made ground man-made deposits such as embankments and spoil heaps on the natural ground surface.
 Worked ground - areas where the ground has been cut away such as
- Worked ground areas where the ground has been cut away such as quarries and road cuttings.

- Infilled ground - areas where the ground has been cut away then wholly or partially backfilled.

 - Landscaped ground - areas where the surface has been reshaped.
 - Disturbed ground - areas of ill-defined shallow or near surface mineral workings where it is impracticable to map made and worked ground separately.

Mass movement (landslip) deposits on BGS geological maps are primarily superficial deposits that have moved down slope under gravity to form landslips. These affect bedrock, other superficial deposits and artificial ground. The dataset also includes foundered strata, where the ground has collapsed due to subsidence.





Order Details. Order Number: Customer Reference: National Grid Reference: Slice: Site Area (Ha): Search Buffer (m):	262408444_1_1 STS5161M 323760, 870540 A 0.73 1000	,	
Site Details: Lossiemouth			
	8 Tel: Fax Web:	0844 844 9952 0844 844 9951 www.envirocheck.co.uk	-
v15.0 15-Oct-2020		Page 2 of	5



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Superficial Geology

Superficial Deposits are the youngest geological deposits formed during the most recent period of geological time, the Quaternary, which extends back about 1.8 million years from the present.

They rest on older deposits or rocks referred to as Bedrock. This dataset contains Superficial deposits that are of natural origin and 'in place'. Other superficial strata may be held in the Mass Movement dataset where they have been moved, or in the Artificial Ground dataset where they are of man-made origin.

Most of these Superficial deposits are unconsolidated sediments such as gravel, sand, silt and clay, and onshore they form relatively thin, often discontinuous patches or larger spreads.

Superficial Geology Map - Slice A



Order Details: Order Number: Customer Reference: 262408444_1_1 STS5161M National Grid Reference: 323760, 870540 Slice: A 0.73 Site Area (Ha): Search Buffer (m): 1000 Site Details: Lossiemouth Tel: Fax: 0844 844 9952 0844 844 9951 Landmark Web www.envirocheck.co.uk INFORMATION v15.0 15-Oct-2020 Page 3 of 5



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Bedrock and Faults

Bedrock geology is a term used for the main mass of rocks forming the Earth and are present everywhere, whether exposed at the surface in outcrops or concealed beneath superficial deposits or water.

The bedrock has formed over vast lengths of geological time ranging from ancient and highly altered rocks of the Proterozoic, some 2500 million years ago, or older, up to the relatively young Pliocene, 1.8 million years ago.

The bedrock geology includes many lithologies, often classified into three types based on origin: igneous, metamorphic and sedimentary.

The BGS Faults and Rock Segments dataset includes geological faults (e.g. normal, thrust), and thin beds mapped as lines (e.g. coal seam, gypsum bed). Some of these are linked to other particular 1:50,000 Geology datasets, for example, coal seams are part of the bedrock sequence, most faults and mineral veins primarily affect the bedrock but cut across the strata and post date its deposition.





Order Details: Order Number: Customer Reference: National Grid Reference: Slice: Site Area (Ha): Search Buffer (m):	262408444_1 STS5161M 323760, 8705 A 0.73 1000	_1 40	
Site Details: Lossiemouth			
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v15.0 15-Oct-2020			Page 4 of 5



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Combined Surface Geology

The Combined Surface Geology map combines all the previous maps into one combined geological overview of your site.

Please consult the legends to the previous maps to interpret the Combined "Surface Geology" map.

Additional Information

More information on 1:50,000 Geological mapping and explanations of rock classifications can be found on the BCS website. Using the LEX Codes in this report, further descriptions of rock types can be obtained by interrogating the 'BGS Lexicon of Named Rock Units'. This database can be accessed by following the 'Information and Data' link on the BGS website.

Contact

British Geological Survey Kingsley Dunham Centre Keyworth Nottingham NG12 5GG Telephone: 0115 936 3143 Fax: 0115 936 3276 email: enquiries@bgs.ac.uk website: www.bgs.ac.uk

Combined Geology Map - Slice A



Landmark • INFORMATION GROUP v15.0 15-Oct-2020



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Historical Mapping & Photography included:

Manufing Type	Caala	Data	De
mapping Type	Scale	Date	Pg
Elginshire	1:2,500	1871 - 1878	2
Elginshire	1:2,500	1905	3
Ordnance Survey Plan	1:2,500	1965	4
Ordnance Survey Plan	1:2,500	1975	5
Additional SIMs	1:2,500	1983	6
Additional SIMs	1:2,500	1992	7
Large-Scale National Grid Data	1:2,500	1995	8
Historical Aerial Photography	1:2,500	2008	9

Historical Map - Segment A13



Order Details

Order Number:	262408444_1_1
Customer Ref:	STS5161M
National Grid Reference:	323760, 870540
Slice:	A
Site Area (Ha):	0.73
Search Buffer (m):	100

Site Details Lossiemouth



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Elginshire

Published 1871 - 1878

Source map scale - 1:2,500

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840's. In 1854 the 1:2,500 scale was adopted for mapping urban areas and by 1896 it covered the whole of what were considered to be the cultivated parts of Great Britain. The published date given below is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas.

Map Name(s) and Date(s)



Historical Map - Segment A13



Order Details

Order Number:	262408444_1_1
Customer Ref:	STS5161M
National Grid Reference:	323760, 870540
Slice:	Α
Site Area (Ha):	0.73
Search Buffer (m):	100

Site Details Lossiemouth



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Elginshire Published 1905

Source map scale - 1:2,500

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840's. In 1854 the 1:2,500 scale was adopted for mapping urban areas and by 1896 it covered the whole of what were considered to be the cultivated parts of Great Britain. The published date given below is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas.

Map Name(s) and Date(s)



Historical Map - Segment A13



Order Details

Order Number:	262408444_1_1
Customer Ref:	STS5161M
National Grid Reference:	323760, 870540
Slice:	A
Site Area (Ha):	0.73
Search Buffer (m):	100

Site Details Lossiemouth



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Tel: Fax: Web:





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Ordnance Survey Plan

Source map scale - 1:2,500

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840's. In 1854 the 1:2,500 scale was adopted for mapping urban areas and by 1896 it covered the whole of what were considered to be the cultivated parts of Great Britain. The published date given below is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas.

Map Name(s) and Date(s)

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Historical Map - Segment A13



Order Number:	262408444_1_1
Customer Ref:	STS5161M
National Grid Reference:	323760, 870540
Slice:	A
Site Area (Ha):	0.73
Search Buffer (m):	100

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Fax:

Web:

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Order Number:	262408444_1_
Customer Ref:	STS5161M
National Grid Reference:	323760, 87054
Slice:	A
Site Area (Ha):	0.73
Search Buffer (m):	100



Order Number:	262408444_1_
Customer Ref:	STS5161M
National Grid Reference:	323760, 87054
Slice:	A
Site Area (Ha):	0.73
Search Buffer (m):	100




Historical Aerial Photography Published 2008

This aerial photography was produced by Getmapping, these vertical aerial photographs provide a seamless, full colour survey of the whole of Great Britain

Historical Aerial Photography - Segment A13

A21	A22	SEISW NE NW	A23	SE SW NE NW	A24	A25	
-A16	-A17-		-A18		-A19-	A20-	
SE SW NE NW		SE SW NE NW		NENW		SE SW NE NW	N
-A11	-A12-	(-A13-		-A14-	A15-	
SE SW NE NW		SE SW NEIWW		SE SW NENW		SE SW NE NW	V
-•A6			- • A <mark>8</mark> - •		- · Å9 -	A10-	
SE SW NE NW	 	SE SW NE NW	– –	SE SW NE NW		sesw NENW A5	
Al	A2		A3		A4	A5	

Order Details

Order Number:262408444_1_1Customer Ref:STS5161MNational Grid Reference:323760, 870540Slice:ASite Area (Ha):0.73Search Buffer (m):100

Site Details Lossiemouth



Tel: Fax: Web: 0844 844 9952 0844 844 9951 www.envirocheck.co.uk

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Historical Mapping Legends

Ordnance	Survey County Series 1:10,560	Ordnance Survey Plan 1:10,000	1:10,000 Raster Mapping		
Grav Pit	vel Sand Other Pit Pits	مرین کر Chalk Pit, Clay Pit کر Gravel Pit در Chalk Pit, Clay Pit در Chalk Pit	Gravel Pit Gravel Pit Gravel Pit		
C Qua	rry Shingle Orchard	Sand Pit Oisused Pit	Rock (scattered)		
په ^م ه ^م ه ^م ه ² [*] م ² [*] ⁴ ⁴ ⁴ [*] ⁴ ⁴ ⁴ ⁴ ⁴ [*] ⁴ ⁴ ⁴ ⁴ ⁴ ⁴ [*] ⁴ ⁴ ⁴ ⁴ ⁴ ⁴	ers	Refuse or Lake, Loch	ີ້ໍ້ຈີ່ Boulders Boulders (scattered)		
4 2 5 4 6 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	and the second s	Dunes 200 Boulders	Shingle Mud Mud		
Mixed Woo	d Deciduous Brushwood	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	Sand Sand Sand Pit		
			Slopes reaction Top of cliff		
Fir	Furze Rough Pasture	ஒ் ் Orchard ெ தொல் \Y்ஸ் Coppice ரிரி Bracken ஸ்ப்ப்ச் Heath பட்டா, Rough ரி Grassland	General detail — — — — Underground detail — — — Overhead detail — — — — Narrow gauge railway		
++++→ Ai flo	rrow denotes <u>a</u> Trigonometrical ow of water Station	<u> معا</u> يد Marsh ،،،∨//، Reeds <u>معا</u> دد Saltings	railway railway		
r ∔ • Si	ite of Antiquities 🔹 🔹 Bench Mark	Direction of Flow of Water Building	Civil, parish or County boundary (England only) Civil, parish or community boundary		
• 285 S	ump, Guide Post, Well, Spring, ignal Post Boundary Post urface Level	Glasshouse Sand	District, Unitary, Metropolitan, Constituency London Borough boundary boundary		
Sketched	Instrumental Contour	Pylon ————————————————————————————————————	Area of wooded vegetation Area of wooded vegetation Area of wooded vegetation Area of wooded vegetation Area of wooded vegetation Area of wooded vegetation Area of wooded vegetation Area of wooded vegetation Area of wooded vegetation Area of wooded vegetation Area of wooded vegetation Area of vegetation Area of vegetatio		
Main Roads	Fenced Minor Roads	Cutting Embankment Standard Gauge	Coniferous Coni		
	Sunken Road Raised Road	Road ''''''' Road Level Foot Single Track	★ trees (scattered) ★ tree Coppice or Osiers		
And the second s	Road over Railway over Railway River	Giding, Tramway Or Mineral Line	متله Rough متله Grassland میلاه ۱۹۹۲ Heath		
	Railway over Level Crossing	—— —— Geographical County	∩o_ Crub →⊻∠ Marsh, Salt →⊻∠ Marsh or Reeds		
	Road over Road over River or Canal Stream	Administrative County, County Borough or County of City Municipal Borough Urban or Bural District	Water feature Flow arrows		
	Road over Stream	Burgh or District Council Borough, Burgh or County Constituency Shown only when not coincident with other boundaries	MHW(S) Mean high water (springs) Mean low water (springs)		
	County Boundary (Geographical)	Civil Parish — — — — Civil Parish Shown alternately when coincidence of boundaries occurs	Telephone line (where shown)		
	County & Civil Parish Boundary	BP, BS Boundary Post or Stone Pol Sta Police Station	← Bench mark Triangulation		
	County Borough Boundary (England)	Ch Church PO Post Office CH Club House PC Public Convenience	Point feature Pylon, flare stack		
Co. Boro. Bdy.	County Burgh Boundary (Scotland)	FE Sta Fire Engine Stadon PH Public House FB Foot Bridge SB Signal Box Fn Fountain Spr Spring	or Mile Stone)		
y	Rural District Boundary	GP Guide Post TCB Telephone Call Box MP Mile Post TCP Telephone Call Post	· ↓• Site of (antiquity) Glasshouse		
	Civil Parish Boundary	MS Mile Stone W Well	General Building Important Building		

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Historical Mapping & Photography included:

Mapping Type	Scale	Date	Pg
Elginshire	1:10,560	1873	2
Elginshire	1:10,560	1905 - 1906	3
Elginshire	1:10,560	1938	4
Ordnance Survey Plan	1:10,000	1959	5
Ordnance Survey Plan	1:10,000	1966 - 1968	6
Ordnance Survey Plan	1:10,000	1970 - 1975	7
Ordnance Survey Plan	1:10,000	1991 - 1994	8
10K Raster Mapping	1:10,000	2000	9
10K Raster Mapping	1:10,000	2006	10
VectorMap Local	1:10,000	2020	11

Historical Map - Slice A



Order Details

Site Details

Lossiemouth

Order Number: Customer Ref: STS5161M National Grid Reference: 323760, 870540 Slice: Site Area (Ha): Search Buffer (m):

262408444_1_1 Α 0.73 1000



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A Landmark Information Group Service v50.0 15-Oct-2020 Page 1 of 11

















10k Raster Mapping Published 2000

Source map scale - 1:10,000

The historical maps shown were produced from the Ordnance Survey's 1:10,000 colour raster mapping. These maps are derived from Landplan which replaced the old 1:10,000 maps originally published in 1970. The data is highly detailed showing buildings, fences and field boundaries as well as all roads, tracks and paths. Road names are also included together with the relevant road number and classification. Boundary information depiction includes county, unitary authority, district, civil parish and constituency.

Map Name(s) and Date(s)



Historical Map - Slice A



Order Details

Order Number:	262408444_1_1
Customer Ref:	STS5161M
National Grid Reference:	323760, 870540
Slice:	A
Site Area (Ha):	0.73
Search Buffer (m):	1000

Site Details Lossiemouth



Tel: Fax: Web:



10k Raster Mapping Published 2006

Source map scale - 1:10,000

The historical maps shown were produced from the Ordnance Survey's 1:10,000 colour raster mapping. These maps are derived from Landplan which replaced the old 1:10,000 maps originally published in 1970. The data is highly detailed showing buildings, fences and field boundaries as well as all roads, tracks and paths. Road names are also included together with the relevant road number and classification. Boundary information depiction includes county, unitary authority, district, civil parish and constituency.

Map Name(s) and Date(s)



Historical Map - Slice A



Order Details

Order Number:	262408444_1_1
Customer Ref:	STS5161M
National Grid Reference:	323760, 870540
Slice:	A
Site Area (Ha):	0.73
Search Buffer (m):	1000

Site Details Lossiemouth







VectorMap Local Published 2020

Source map scale - 1:10,000

VectorMap Local (Raster) is Ordnance Survey's highest detailed 'backdrop' mapping product. These maps are produced from OS's VectorMap Local, a simple vector dataset at a nominal scale of 1:10,000, covering the whole of Great Britain, that has been designed for creating graphical mapping. OS VectorMap Local is derived from large-scale information surveyed at 1:1250 scale (covering major towns and cities),1:2500 scale (smaller towns, villages and developed rural areas), and 1:10 000 scale (mountain, moorland and river estuary areas).





___ **Historical Map - Slice A**



Order Details Order Number: Customer Ref:

262408444_1_1 STS5161M National Grid Reference: 323760, 870540 А 0.73 1000

Site Details Lossiemouth



Tel: Fax: Web:



General



- 🙀 NIHHS Site
- * Planning Hazardous Substance Consent
- 🗱 Planning Hazardous Substance Enforcement

🦳 Overhead Transmission Line

- BGS Recorded Landfill Site (Location)
- 💋 BGS Recorded Landfill Site
- A Integrated Pollution Control Registered Waste Site
- Local Authority Recorded Landfill Site (Location)
- IIII Local Authority Recorded Landfill Site
- Potentially Infilled Land (Non-water)
- Potentially Infilled Land (Non-water)
- Potentially Infilled Land (Water)
- Y Potentially Infilled Land (Water)
- 🚫 Registered Landfill Site
- Registered Landfill Site (Location)
- Registered Landfill Site (Point Buffered to 100m)
- Registered Landfill Site (Point Buffered to 250m)
- Registered Waste Transfer Site (Location)
- IIII Registered Waste Transfer Site
- Registered Waste Treatment or Disposal Site
- 🧮 Registered Waste Treatment or Disposal Site

Geological

BGS Recorded Mineral Site

Site Sensitivity Map - Segment A13



Order Details

Order Number:	262408444_1_1
Customer Ref:	STS5161M
National Grid Reference:	323760, 870540
Slice:	A
Site Area (Ha):	0.73
Plot Buffer (m):	100

Site Details Lossiemouth



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General

🔼 Specified Site 🛛 💍 Specified Buffer(s)	X Bearing Reference Point 🛛 🛽 🕅 Map ID
Several of Type at Location	
Agency and Hydrological	Waste
Contaminated Land Register Entry or Notice	BGS Recorded Landfill Site (Location)
Contaminated Land Register Entry or Notice	🔀 BGS Recorded Landfill Site
🔶 Discharge Consent	Integrated Pollution Control Registered Waste Site
Leforcement or Prohibition Notice	Local Authority Recorded Landfill Site (Location)
Integrated Pollution Control	III Local Authority Recorded Landfill Site
Integrated Pollution Prevention Control	😑 Potentially Infilled Land (Non-water)
Local Authority Integrated Pollution Prevention and Control	Y Potentially Infilled Land (Non-water)
\triangle Local Authority Pollution Prevention and Control	Potentially Infilled Land (Non-water)
Control Enforcement	Potentially Infilled Land (Water)
Pollution Incident to Controlled Waters	Yotentially Infilled Land (Water)
V Prosecution Relating to Authorised Processes	Potentially Infilled Land (Water)
Prosecution Relating to Controlled Waters	🔀 Registered Landfill Site
A Registered Radioactive Substance	Registered Landfill Site (Location)
Y River Network or Water Feature	Registered Landfill Site (Point Buffered to 100m)
合 Substantiated Pollution Incident Register	Registered Landfill Site (Point Buffered to 250m)
🔷 Water Abstraction	┢ Registered Waste Transfer Site (Location)
🔶 Water Industry Act Referral	IIII Registered Waste Transfer Site
Hazardous Substances	Registered Waste Treatment or Disposal Site (Location)
🙀 COMAH Site 🛛 🙀 Explosive Site	Registered Waste Treatment or Disposal Site
NIHHS Site	Geological
🗱 Planning Hazardous Substance Consent	BGS Recorded Mineral Site
🗱 Planning Hazardous Substance Enforcement	•

Site Sensitivity Map - Slice A



Order Details

С

262408444_1_1 STS5161M Ice: 323760, 870540 A 0.73 1000



Tel: Fax: Web:



Industrial Land Use Map

General



8 Map ID

Specified Site
Specified Buffer(s)
Specified Site

Industrial Land Use

- ★ Contemporary Trade Directory Entry
- 🛧 Fuel Station Entry
- 📉 Gas Pipeline
- 🔆 Points of Interest Commercial Services
- 🔆 Points of Interest Education and Health
- ★ Points of Interest Manufacturing and Production
- ★ Points of Interest Public Infrastructure
- 🜟 Points of Interest Recreational and Environmental
- 🛰 Underground Electrical Cables

Industrial Land Use Map - Slice A



Order Details

Order Number: 262408444_1_1 Customer Ref: STS5161M National Grid Reference: 323760, 870540 Slice: Α Site Area (Ha): Search Buffer (m): 0.73 1000

Site Details Lossiemouth



Tel: Fax: Web:



General

Specified Site

Specified Buffer(s)

X Bearing Reference Point

Agency and Hydrological (Flood)

0 - 1m estimated 100yr flood depth

1 - 2m estimated 100yr flood depth

Over 2m estimated 100yr flood depth

The flooded areas have been generated using a generalised technique and should not, by themselves, be used to infer that specific areas are or are not at risk of inundation. Flood risk at any specific location may be influenced by local factors - not least flood defence - that have not been taken into account.

Flood Map - Slice A



Order Details

Order Number: 262408444_1_1 Customer Ref: STS5161M National Grid Reference: 323760, 870540 Slice: Site Area (Ha): Search Buffer (m):

А 0.73 1000





Tel: Fax: Web:



General

Specified Site
Specified Buffer(s)
Bearing Reference Point
Map ID
Several of Type at Location

Agency and Hydrological (Boreholes)

- 😑 BGS Borehole Depth 0 10m
- BGS Borehole Depth 10 30m
- 🔴 BGS Borehole Depth 30m +
- Confidential
- ⊖ Other

For Borehole information please refer to the Borehole .csv file which accompanied this slice.

A copy of the BGS Borehole Ordering Form is available to download from the Support section of www.envirocheck.co.uk.



Site Details Lossiemouth



Tel: Fax: Web:







General

- 🔼 Specified Site
- Specified Buffer(s)
- X Bearing Reference Point

Risk of Flooding from Surface Water



Low - 1000 Year Return

Suitability See the suitability map below

National to county County to town

Town to street

Street to parcels of land

Property

EA/NRW Suitability Map - Slice A



Order Details

Order Number:	26
Customer Ref:	S
National Grid Reference:	32
Slice:	А
Site Area (Ha):	0.
Search Buffer (m):	1(

262408444_1_1 STS5161M 323760, 870540 . 0.73 1000

Site Details Lossiemouth



Tel: Fax: Web:





























MACC International Ltd, Camilla Court, Nacton, Ipswich, Suffolk, IP10 0EU, UK

Alexa Band Receptionist Soiltechnics Ltd Your Reference:

Our Reference: JM/3536/566

Email 1st Instance: Alexa.Band@soiltechnics.net

Date: 01/10/2020

Unexploded Ordnance Preliminary Risk Review East Beach Footbridge, Lossiemouth, IV31 6JD

MACC International Ltd (MACC) has conducted a preliminary risk review for the site footprint. The review has drawn on open source and in-house information, references have been provided where available (See Annex A).

The review has been conducted to provide Soiltechnics Ltd with a review of the risk which may be posed by UXO while conducting investigations on the site.

This document has been produced in the United Kingdom by MACC International Limited and has been provided solely as an aid in decision making. It is not intended to be used by any person for any purpose other than that specified. Any liability arising out of use by a third party of this document for purposes not wholly connected with the above shall be the responsibility of that party, who shall indemnify MACC International Limited against all claims, costs, damages and losses arising out of such use.

Several HE bomb strikes were recorded within the immediate vicinity of the site during WWII. It is also considered possible for an item of UXO to have been imported onto the site due to tidal action. Whilst considering the history of the site and the level of post-war development, the following conclusions have been reached:

 It is considered that there is a credible likelihood of encountering UXO on the plot. <u>Consequently, the UXO risk is considered to be Medium within the site</u> <u>boundary.</u>

It is recommended that a Detailed UXO Study is conducted to more accurately define the risk levels within the site footprint. Alternatively, the stated preliminary risk level is accepted and the following mitigation procedures are implemented:

- 1. All site personnel are provided with a UXO Safety Awareness Talk before intrusive works are commenced.
- 2. All intrusive investigations into post war un-worked ground should be supported by specialist EOD services.

I trust this document has provided you with sufficient information to meet your immediate needs, should you require anything further, please do not hesitate to contact me.

Yours Sincerely

Reine.

John Morrison Operations Manager



Tel: +44 (0)1473 655127 Fax: +44 (0)1473 655098 E-mail: info@macc-eod.com Web: www.macc-eod.com Registered in England: No. 3014471

Unexploded Ordnance Preliminary Risk Review

Site location	Site Address: East Beach Footbridge, Lossiemouth, IV31 6JD Grid Reference: 323767, 870383
Scope of Intended works	Preliminary review of the risk that may be posed by UXO to geotechnical investigations.
History	 Wartime Use: During WWII, the majority of the site was undeveloped land occupied by mud and shingle/beach areas. Post War Development: The majority of the site has undergone little post-war development.
Wartime History	Enemy Bombing: Lossiemouth did suffer enemy bombing raids during WWII. One raid affected RAF Lossiemouth (located approximately 1.7km to the south west of the site) in October 1940 and Lossiemouth Town was also raided in 1941. Several HE bomb strikes were recorded within the immediate vicinity of the site at Dunbar Street, Kinneddar Street, and at the junction of King Street and Prospect Terrace approximately 90m to the north-west of the site.
	Given the undeveloped marine nature of much of the site, it is considered more likely for munitions to have fallen unrecorded. It is also considered possible for an item of UXO to be imported onto the site due to tidal action.
	Anti-Aircraft Guns: No guns were recorded to have been positioned on the site. The nearest recorded Heavy Anti-Aircraft battery was located approximately 900m to the west.
	Military Use: RAF Lossiemouth is located approximately 1.7km to the south-west of the site. No records were found to confirm military use of the site footprint; however, the possibility that wartime coastal defences were positioned within the site cannot be ruled out.
Unexploded Ordnance (UXO) Finds	No records were found to confirm a UXO find within the site footprint.



STATIC CONE PENETRATION TEST FACTUAL REPORT

CLIENT: Soiltechnics PROJECT: Lossiemouth





Project	Lossiemouth
Project No.	1200410
Client	Soiltechnics
Address	Unit 9, Clarence Avenue, Westpoint Enterprise Park, Trafford Park, Manchester, M17 1QS

Attention: Mr Mark Hamill

Dear Mr Hamill,

We have pleasure in providing a digital copy of our report and data in AGS format for the above project.

We hope that you are satisfied with the performance of our staff, equipment and reporting on this project. If you should have any queries about any aspect of the works carried out, please do not hesitate to contact us. We look forward to being of service to you in the future.

Yours faithfully, In Situ Site Investigation Limited

Miller

Darren Ward Director

Report Issue

Issue	Date	Prepared	Sign	Checked	Sign	Approved	Sign
01	26/10/2020	Chloe Donovan	CBU	Luisa Dhimitri	Sut	Darren Ward	Liller





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1.0 INTRODUCTION

In Situ Site Investigation Limited (In Situ) was engaged in a geotechnical site investigation at Lossiemouth at the request of Soiltechnics. The site investigation consisted of completing 34 Static Piezocone Penetration Tests (CPTU) to provide information on the soil conditions and derived geotechnical parameters at:

Clifton Rd, Lossiemouth IV31 6DJ

All test locations were provided by the client. A site map is included in the end of Appendix A of this report (if provided by the client). The tests were stopped when they reached the target depth as per the client's technical specifications or for other technical reasons, as detailed in the *Project Summary Table* in *Appendix A.1* and on each CPTU log included in Appendix B of this report.

The fieldwork was carried out from 19th October 2020 to 20th October 2020 as per the client's request.

The work on site and the final factual reporting have been undertaken in accordance with the international technical standard *BS EN ISO 22476-1:2012*.





2.0 FIELDWORK

2.1 CONE PENETRATION TESTS

The fieldwork activity is summarised in Table 2.1.

Table 2.1 Fieldwork Summary				
CPT Operator/s	Roger Shepherd			
Date Started	19 th October 2020			
Date Finished	20 th October 2020			
In Situ S.I. Project Manager	Darren Ward			
Main Contractor's Site Manager	Farhad Qayum			

2.1.1 Rig Information

Details of CPTU rig used in this project are shown in Table 2.2. Full data sheet for the rig is presented in *Appendix A.2*.

Table 2.2 Rig Summary				
Rig Name	Rig Description			
CPT017	20 Tonne Track Mounted CPT Rig			

2.1.2 CPTU Cone

Details of electric CPTU cone (Type TE2) used in this project conforming to the requirements of Application Class 2 of *ISO* 22476-1:2012, are shown in Table 2.3.

Table 2.3 Cone Summary						
Number	Cross-section area	Filter position				
S15-CFIP.1858	15cm ²	U ₂				

A full datasheet of the cone used is shown in Appendix A.3.

The cone's measured parameters are shown in Table 2.4.



Table 2.4 Completed Fieldwork Summary

34 CPTU to a maximum depth of 6.67m. Each test measured Cone Resistance, q_c , Sleeve Friction, f_s , Porewater Pressure in the shoulder position, u_2 , Inclination in X and Y axes. 34 MAG tests to a maximum depth of 6.67m. Each MAG test measured Magnetic Field X

(nT), Magnetic Field Y (nT) and Magnetic Field Z (nT).

Provision of factual report with estimated soil type, derived geotechnical parameters & AGS data file.

2.1.3 CPTU Cone Calibration

The cone resistance and sleeve friction are recorded by calibrated load cells in the cone. The CPTU load cells and pressure transducers are regularly calibrated in line with *ISO 22476-1:2012* standard by the cone manufacturer. The cone calibration certificate for the cone used at this site are presented in *Appendix A.4*.

2.1.4 CPTU Cone Saturation

The pore water pressure is recorded using a calibrated pressure transducer located in the piezocone. To ensure pore water pressure measurements are not affected by the presence of air in the measuring transducer, a de-airing procedure is carried out prior to each test. The cone and filter are saturated using a glycerine fluid with a viscosity of 10,000 CST.

2.1.5 Test Procedure

The tests are carried out in accordance with the International Standard for Electrical Cone and Piezocone Penetration Test (ISO 22476-1:2012).

The final depths of the tests were determined by either completion to the specified test depth or when the maximal safe capacity of the equipment was reached. A schedule of the tests performed is shown in *Appendix A.1*, which has been compiled from the operators' daily progress reports.

The data is transmitted from the digital CPTU through an umbilical cable that runs through the push rods to the data acquisition system. Results are displayed instantaneously on the computer logging screen. The results are recorded on the computer hard disc.

The rate of penetration is kept constant at $2 \text{ cm/s} \pm 10\%$ except when penetrating very dense or hard strata. Before each test is carried out zero values are taken of the cone to check if it is within calibration. At the end of each test, zero values are taken again to see if there has been any drift during the test. These values are inspected during the post processing stage. This is a quality check on the data and the testing procedure. Individual test zero values are shown on their corresponding test results in *Appendix B*.



2.1.6 In Situ Pore Pressure (u_0)

The in situ or hydrostatic pore pressure is required for the calculation of several derived parameters included in this report. For this report, the groundwater level is assumed at 2.00 m below ground surface, for calculation purposes. The in situ pore pressure (u_0) values are presented on the pore pressure plot, on *CPT Log 01*, which is included in *Appendix B*.

2.2 **POSITIONING**

Positioning and surveying of all investigated locations was the responsibility of the client.



3.0 CONE PENETRATION MEASURED PARAMETERS

All measured parameters of tests carried with the CPTU cone are shown in *Appendix B* and all the information about data processing and results are given in sections *3.1*, *3.2* and *3.3*.

3.1 DATA PROCESSING

The measured parameters, cone end resistance, q_c , sleeve friction, f_s , porewater pressure measurements with filter in shoulder position, u_2 and inclination for *x* and *y* axis, I_x , I_y , were recorded for every 10 mm of penetration keeping a constant speed of 20 mm/s \pm 2 mm/s, which may slightly change when the cone is penetrating hard strata.

The measured data from the site works is processed and presented using specialised CPT software. The interpretations on the CPTU results were carried out following the recommendations of *Lunne et al. (1997), Robertson (2015)* and *BS EN ISO 22476-1:2012.* Measured parameters, mentioned in *Sections 3.2* and *3.3*, were used to derive all the geotechnical parameters, which are presented in *Chapter 4.0.* The soil behaviour type method used on this report is *Robertson et al. (1986)*, shown in *Figure 3.2.*

3.1.1 Zero Measurements

Before and after each CPTU test, zero measurements are recorded for each channel of the cone. The zero measurements are presented on the logs in *Appendix B*. This is a routine quality check carried out on site.

3.2 MEASURED PARAMETERS

3.2.1 Cone Resistance (q_c)

Cone resistance, q_c , is measured as the total force acting on the cone, divided by the projected area of the cone. The results are presented in *MPa*, on *CPT Log 01*, in *Appendix B*, scale *0-20 MPa* with a minor scale printing on the same graph at *0-4 MPa*.

3.2.2 Sleeve Friction (f_s)

Sleeve friction, f_s , is measured as the total frictional force acting on the friction sleeve divided by its surface area. The results are presented in *kPa*, on *CPT Log 01*, in *Appendix B*, using a scale of *0-500 kPa*.


3.2.3 Porewater pressure (u₂)

The pore pressure, u_2 , is measured during the test. If the material is free draining and saturation is maintained it will normally measure hydrostatic pore pressure. In materials that are not free draining, it will record the total pore pressure (hydrostatic plus any excess pore pressures generated) created by the cone penetration through this material.

The filter element can be mounted in one of three positions. For all tests carried out in this project the filter was mounted in the u_2 position (see *Figure 3.1*).



Figure 3.1: Diagram showing pore pressure filter locations (after Lunne et al., 1997)

3.2.4 Inclination (I_x, I_y)

The CPT rig was set up to obtain a thrust direction as near as possible to vertical. The CPTU cones have inclinometers incorporated to measure the non-verticality of the test. For test depths less than *15 m*, significant non-verticality is unusual, provided the initial thrust direction is vertical.

3.3 ESTIMATED SOIL BEHAVIOUR TYPE

3.3.1 Friction Ratio (R_f)

The friction ratio, R_f is the ratio between the sleeve friction and the cone resistance (Lunne *et al.,* 1997).

Fricton Ratio
$$(R_f) = \left(\frac{Sleeve \ Friction \ (f_s)}{Cone \ Resistance \ (q_c)}\right) \times 100$$

3.3.2 Estimated Soil Behaviour Type (SBT)

The estimation of soil behaviour type, *SBT*, using measurements of cone resistance and sleeve friction is based upon the variations of the friction ratio and cone resistance. The friction



ratio varies depending upon whether the soil is cohesive or granular. The cone resistance varies depending on the strength and densities of the soil.

The interpretation used in this report is *Robertson et al. (1986)*, which is shown in Figure 3.2. The results are presented on *CPT Log 01*, in *Appendix B*.



Figure 3.2: Robertson et al., 1986 soil behaviour type chart.

3.3.3 Pore Pressure Ratio (B_q)

Pore pressure ratio, B_q is the ratio between the measured pore pressure generated during penetration and the corrected cone resistance minus the total overburden stress.

Pore pressure ratio as defined by Senneset and Janbu (1985) is defined as:

$$B_q = \frac{u_2 - u_0}{q_t - \sigma_{vo}}$$

where

 u_2 is pore pressure measured between the cone and the friction sleeve

*u*₀ is equilibrium pore pressure

 σ_{vo} is total overburden stress

 q_t is cone resistance corrected for unequal end area effects





3.4 APPLIED CORRECTIONS

3.4.1 Corrected Cone Resistance (q_t)

For each penetration test, the measured cone resistance, q_c , can be corrected for the "unequal area effect" due to the influence of the ambient pore water pressure acting on the cone.

The correction has been applied using the following equation by Lunne et al., 1997:

$$q_t = q_c + [u_{2.}(1 - \alpha)]$$

where

 α is the cone area ratio

The cone used on this project has a cone area ratio of *0.79*. This value is geometrically measured.

3.4.2 Depth Correction

All tests in the report have been corrected for depth difference caused by inclination. This has been calculated using the method described in *ISO* 22476-1:2012.

To calculate the corrected depth the following formula is used:

$$z = \int_{0}^{l} C_{inc} \cdot dl$$

where

z is penetration depth, in *m*

I is penetration length, in *m*

C_{inc} is correction factor for the effect of the inclination of the CPTU relative to the vertical axis.

The equation for calculating the correction factor for the influence of the inclination for a biaxial inclinometer is:

$$C_{inc} = \frac{1}{\sqrt{(1 + \tan^2\beta_1 + \tan^2\beta_2)}}$$

where

- β_1 is the angle between the vertical axis and the projection of the axis of the CPTU on a vertical plane, in degrees
- β_2 is the angle between the vertical axis and the projection of the axis of the CPTU on a vertical plane that is perpendicular to the plane of angle β_1 , in degrees

4.0 GEOTECHNICAL DERIVED PARAMETERS

A number of empirical correlations can be used to derive geotechnical parameters from CPTU data. This report includes only the parameters which are described in this chapter. The results of all correlations used to obtain the geotechnical derived parameters are presented on *CPT Log 02* and *CPT Log 03* in *Appendix B*.

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Please, note that each empirical correlation is derived for a certain type of soil, and may not be appropriate for all the soil types encountered on this project.

4.1 SOIL BEHAVIOUR TYPE INDEX (Ic)

The soil behaviour type index, I_c , was derived by *Jefferies and Davies (1991)*, and was created to simplify the application of CPTU SBT chart shown in *Chapter 3*, *Figure 3.2*. This approach has been modified for use with the *Robertson (1990)* normalised CPT soil classification chart, *Figure 4.1*. The normalised cone parameters Q_t and F_r (for definitions see *Appendix A5* Symbol List) can be combined into one Soil Behaviour Type Index, I_c , (Lunne et al., 1997).



Figure 4.1: Robertson 1990 soil behaviour type chart.



The soil behaviour type index, I_c , can then be defined using *Robertson (2010)* formula, given below:

$$I_c = ((3.47 - \log Q_t)^2 + (\log F_r + 1.22)^2)^{0.5}$$

where

- Q_t is the normalized cone resistance which represents the simple normalization with a stress exponent (n) of *1.0*, which applies well to clay-like soils
- F_R is the normalized friction ratio, in %

The boundaries of soil behaviour type are then given in terms of the index, I_c , presented in *Table 4.1* below.

The soils behaviour type index does not apply to zones *1*, *8* and *9*. The profiles of *I_c* provide a simple guide to the continuous variation of soil behaviour type in a given soil profile based on CPTU results, with a reliability greater than *80%* compared with soil samples *(Robertson, 2015).*

Zone	Soil Behaviour Type	l _c
1	Sensitive fine grained	N/A
2	Organic Soils – clay	>3.6
3	Clays – silty clay to clay	2.95 – 3.6
4	Silt mixtures – clayey silt to silty clay	2.60 – 2.95
5	Sand mixtures – silty sand to sandy silt	2.05 – 2.6
6	Sands – clean sand to silty sand	1.31 – 2.05
7	Gravelly sand to dense sand	<1.31
8	Very stiff sand to clayey sand*	N/A
9	Very stiff fine grained *	N/A

* Heavily over consolidated or cemented

Table 4.1: Normalized CPTU Soil Behaviour Type (SBT_n) Index values, Ic. (Robertson, 2010)



4.2 N VALUE OF STANDARD PENETRATION TEST (SPT) (N60)

The derived N value of SPT, N_{60} , is strongly and directly related to the cone resistance, q_c .

In this report the N_{60} value is derived using the following correlations, developed by *Robertson* and Wride (1998) and Jefferies and Davies (1998)

1) Robertson & Wride (1998)

$$N_{60} = \frac{q_c}{8.5 \cdot p_a \left(1 - \frac{I_c}{4.6}\right)}$$

2) Jefferies and Davies (1993)

$$N_{60} = \frac{q_c}{0.85 \cdot \left(1 - \frac{l_c}{4.75}\right)}$$

where

q_c is the cone resistance

p_a is the atmospheric pressure equal to 100 kPa

I_c is the soil behaviour type index calculated as given in section 4.1

It is suggested that this method provides a better estimation of the *N* value than the actual *SPT* test, due to its poor repeatability. But in fine grained soil with high sensitivity these methods of estimating N_{60} may overestimate it (*Jefferies and Davies, 1991*).

4.3 **RELATIVE DENSITY** (*D_r*)

Relative density, *D_r*, is an intermediate parameter for coarse grained soils, widely used to describe sand deposits. All the research on deriving the relative density from CPTU tests results are carried out for *clean predominantly quartz sands*. The studies have shown that CPTU resistance in granular soils is controlled by sand relative density, in situ effective stresses and compressibility. The more compressible sands tend to give lower penetration resistance for a given relative density then less compressible sands.

In this report relative density is calculated using the methods suggested by *Baldi et al., (1986), Jamiolkowski et al., (2001)* and *Kulhawy and Mayne (1990)* as shown in the equations below:

1) Baldi et al., (1986)

$$D_r = \frac{1}{C_2} \cdot ln \left(\frac{q_c \cdot Wehr}{C_1 \cdot (\sigma'_{\nu 0})^{0.55}} \right) \cdot 100$$



where

- C₁ is a consolidation coefficient which is *157* for normally consolidated soils and *181* for over consolidated soils
- C₂ is a consolidation coefficient which is 2.41 for normally consolidated soils and 2.46 for over consolidated soils

Wehr is a correction coefficient for calcareous soils

2) Jamiolkowski et al., (2001)

$$D_r = 100 \cdot \left[0.268 \cdot ln \left(\frac{q_t / \sigma_{atm}}{\sqrt{\sigma'_{\nu 0} / \sigma_{atm}}} \right) + C_1 \right]$$

where

- C₁ is a compressibility coefficient which is -0.675 for average compressible soils, ≤1.0 for high compressible soils and carbonate or calcareous sands and ≥-2.0 for low compressible soils
- qt is corrected cone resistance
- σ_{atm} is the atmospheric pressure
- 3) Kulhawy and Mayne, (1990)

$$D_r = \left[\frac{q_{c1}}{305 \cdot C_1 \cdot OCR^{0.18} \cdot (1.2 + 0.05 \cdot \log(t/100))}\right]^{0.5} \cdot 100$$

where

q_{c1} is the cone resistance corrected for initial vertical effective stress and atmospheric pressure, calculated by the following formula

$$q_{c1} = \frac{q_c}{\sqrt{\sigma'_{\nu 0} \cdot \sigma_{atm}}}$$

where

 q_c is the cone resistance in *kPa* σ'_{v0} is the initial vertical effective stress in *kPa*

C₁ is a compressibility coefficient which is -0.91 for low compressible sands, 1.0 for medium compressible sands and 1.09 for high compressible sands t is time in years

4.4 FRICTION ANGLE (ϕ ')

Friction angle, φ' , is used to express the shear strength of uncemented, coarse grained soils. In this report friction angle is derived by the correlations of *Mayne and Campanella (2005)*, *Robertson and Campanella (1983)* and *Kulhawy and Mayne (1990)*.

1) Mayne and Campanella, (2005)



$$\varphi' = 29.5^0 \cdot B_q^{0.121} \cdot \left[0.256 + 0.336 \cdot B_q + \log Q_t \right]$$

where

- B_q is the pore pressure ratio, calculated as in Session 3.3
- Qt is the normalized cone resistance
- 2) Robertson and Campanella, (1983)

$$\varphi' = \tan^{-1} \left(0.1 + 0.38 \cdot \log \left(\frac{q_t}{\sigma'_{\nu 0}} \right) \right)$$

where

- σ'_{v0} is the initial vertical effective stress in *kPa*
- 3) Kulhawy and Mayne, (1990)

$$\varphi' = 17.6^0 + 11.0^0 \cdot \log(q_{t1})$$

where

 $q_{t1} \qquad \text{is the corrected cone resistance corrected for initial vertical effective stress and} \\ atmospheric pressure, calculated by the following formula$

$$q_{t1} = \frac{q_t}{\sqrt{\sigma'_{\nu 0} \cdot \sigma_{atm}}}$$

The method suggested by *Mayne and Campanella (2005)* will not provide reliable results for heavily over consolidated soils, fissured geomaterials and highly cemented or structures clays. This approach gives reliable results when pore pressure is positive and varies $0.1 < B_q < 1.0$. The correlation suggested by *Robertson and Campanella (1983)* estimates the peak friction angle for uncemented, unaged, moderately compressible, predominately quartz sands. For sands of higher compressibility, the method will tend to predict low friction angles. The method suggested by *Kulhawy and Mayne (1990)* is an alternate relationship for clean, rounded, uncemented, quartz sands.

4.5 FINES CONTENT (FC)

The fines content, *FC*, in this report is estimated using two different methods, one from *Robertson and Wride (1998)* and the other, *Suzuki et al. (1998)* as presented below:

1) Robertson and Wride (1998)



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2) Suzuki et al. (1998)

$$FC(\%) = 2.8I_C^{2.6}$$

where

I_c

is the soil behaviour type index, calculated as in section 4.1

4.6 UNDRAINED SHEAR STRENGTH (su)

Estimation of undrained shear strength, s_u , from CPTU tests using corrected cone resistance is carried out using the following correlation from *Lunne et al. (1981)*:

$$S_u = \frac{(q_t - \sigma_{v0})}{N_{kt}}$$

where

 N_{kt} is the empirical cone factor, which varies from 10 (6 for very soft sensitive fine grained soils) to 20. In this report 3 values are considered: 15, 17.5 and 20. N_{kt} tends to increase with increasing plasticity and decrease with increasing soil sensitivity. It decreases as B_q increases. (*Lunne et al., 1997*) σ_{vo} = total overburden stress.

This report only presents the undrained shear strength data on soils with soil behaviour type index, I_c values greater than 2.60.

The value of undrained shear strength, s_u to be used in analysis depends on the design problem. In general, the simple shear in the direction of loading often represents the average undrained strength. For larger, moderate to high risk projects, where high quality field and laboratory data may be available, site specific correlations should be developed based on appropriate and reliable values of s_u .

4.7 SENSITIVITY (St)

The sensitivity, S_t of clays is defined as the ratio of undisturbed peak undrained shear strength to totally remoulded undrained shear strength.

In this report S_t is calculated using two correlations developed by *Schmertmann (1978)* and *Mayne (2007)*.



1) Schmertmann (1978)

$$S_t = \frac{S_u}{S_{u(rem)}} = \frac{q_t - \sigma_v}{N_{kt}} (\frac{1}{f_s})$$

where

 $s_{u(rem)}$ is the remoulded undrained shear strength. It can be assumed equal to the sleeve resistance, f_s .

2) Mayne (2007)

$$S_t = \frac{0.073 \cdot (q_t - \sigma_{v0})}{f_s}$$

For relatively sensitive clays, $S_t > 10$, the value of f_s can be very low and not very accurate, hence the estimate of sensitivity should be used as a guide only.

4.8 SOIL UNIT WEIGHT (γ)

Soil unit weight, γ in this report is calculated by using one method for sands, considered under dry conditions and two methods for clays, considered under saturated conditions. These relationships are developed by *Mayne (2007)* and the equations are presented below:

1) Mayne (2007)

Dry unit weight for sands:

$$\gamma_{dry} = 1.89 \cdot log(q_{t1}) + 11.82$$

Saturated unit weight for clays method 1

$$\gamma_{sat} = 8.32 \cdot \log(V_S) - 1.61 \cdot \log(z)$$

Saturated unit for clays method 2

$$\gamma_{sat} = 2.60 \cdot log(f_s) + 15 \cdot G_s - 26.5$$

where

q_{t1} is the corrected cone resistance corrected for initial vertical effective stress and atmospheric pressure, calculated by the following formula:

$$q_{t1} = \frac{q_t}{\sqrt{\sigma_{v0}' \cdot \sigma_{atm}}}$$

- z is the depth
- V_s is the shear wave velocity, calculated as $V_S = 118.8 \cdot log(f_s) + 18.5$
- G_s is the specific gravity of solids, typically between 2.40 and 2.90



5.0 MAGNETOMETER TESTS MEASUREMENTS

All measured parameters of MAG tests carried with the combined CPTU and MAG cone are shown in *Appendix B*.

5.1 DATA PROCESSING

The measured parameters, Magnetic Field X (nT), Magnetic Field Y (nT) and Magnetic Field Z (nT) were recorded for every 10 mm of penetration.

The measured magnetometer data from the site works is processed and presented using specialised CPT software. During processing the three measured components are combined to give the total magnetic field strength.

5.1.1 Zero Measurements and Data quality

Before and after each MAG test, zero measurements are recorded for each magnetic channel of the cone. The zero measurements are presented on the logs in *Appendix B*. This is a routine quality check carried out on site.

The summary of MAG tests is presented in Appendix A.1

5.2 MEASURED AND DERIVED PARAMETERS

5.2.1 Magnetic Field X, Magnetic Field Y and Magnetic Field Z

The measured parameters, Magnetic Field X, Magnetic Field Y and Magnetic Field Z are measured on site. The results are presented in *nT*, on *MAG Log*, in *Appendix B*, scale *-100000 to 100000 nT*.

5.2.2 Total Magnetic Field

Total Magnetic Field is calculated based on each measured Magnetic Field, using the formula below:

$$Magnetic \ Field \ Total = \sqrt{MAGX^2 + MAGY^2 + MAGZ^2}$$

where

MAGX is the Magnetic Field measured in X direction

MAGYis the Magnetic Field measured in Y directionMAGZis the Magnetic Field measured in Z direction

The results are presented in *nT*, on *MAG Log*, in *Appendix B*, using a scale of 0-100000 nT.

5.2.3 Magnetic Field Gradient

Magnetic Field Gradient is calculated as the difference between two consecutive values of Total Magnetic Field.

The results are presented in *nT/cm*, on *MAG Log*, in *Appendix B*, using a scale of -500 to 500 *nT/cm*.

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APPENDIX A



APPENDIX A1 – Project Summary Sheet

Piezocone Tests Summary Sheet

HOLE ID Final Depth (m)		Date of Test	Cone Used	Test Remarks		
1	1.76	19/10/2020	S15-CFIP.1858	Test refused on tip resistance.		
2	1.89	19/10/2020	S15-CFIP.1858	Test refused on tip resistance.		
3	5.17	19/10/2020	S15-CFIP.1858	Test refused on tip resistance.		
4	4.26	19/10/2020	S15-CFIP.1858	Test refused on tip resistance.		
5	4.81	19/10/2020	S15-CFIP.1858	Test refused on tip resistance.		
6	2.97	19/10/2020	S15-CFIP.1858	Test refused on tip resistance.		
7	4.25	19/10/2020	S15-CFIP.1858	Test refused on tip resistance.		
8	6.42	19/10/2020	S15-CFIP.1858	Test refused on tip resistance.		
9	3.76	19/10/2020	S15-CFIP.1858	Test refused on tip resistance.		
10	3.31	19/10/2020	S15-CFIP.1858	Test refused on tip resistance.		
11	6.55	19/10/2020	S15-CFIP.1858	Test refused on tip resistance.		
12	6.67	19/10/2020	S15-CFIP.1858	Test refused on tip resistance.		
13	5.52	19/10/2020	S15-CFIP.1858	Test refused on tip resistance.		
14	5.44	19/10/2020	S15-CFIP.1858	Test refused on tip resistance.		
15	5.99	19/10/2020	S15-CFIP.1858	Test refused on tip resistance.		
16	4.66	20/10/2020	S15-CFIP.1858	Test refused on tip resistance.		
17	3.10 20/10/2020		S15-CFIP.1858	Test refused on tip resistance.		
18	2.96	20/10/2020	S15-CFIP.1858	Test refused on tip resistance.		
19	2.74	20/10/2020	S15-CFIP.1858	Test refused on tip resistance.		
20	3.39	20/10/2020	S15-CFIP.1858	Test refused on tip resistance.		
21	3.34	20/10/2020	S15-CFIP.1858	Test refused on tip resistance.		
22	3.24	20/10/2020	S15-CFIP.1858	Test refused on tip resistance.		
23	2.93	20/10/2020	S15-CFIP.1858	Test refused on tip resistance.		
24	2.92	20/10/2020	S15-CFIP.1858	Test refused on tip resistance.		
25	3.01	20/10/2020	S15-CFIP.1858	Test refused on tip resistance.		
26	3.43	20/10/2020	S15-CFIP.1858	Test refused on tip resistance.		
27	3.77	20/10/2020	S15-CFIP.1858	Test refused on tip resistance.		
28	3.87	20/10/2020	S15-CFIP.1858	Test refused on tip resistance.		

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29	4.81	20/10/2020	S15-CFIP.1858	Test refused on total pressure.
30	5.36	20/10/2020	S15-CFIP.1858	Test refused on total pressure.
31	4.59	20/10/2020	S15-CFIP.1858	Test refused on total pressure.
32	2.47	20/10/2020	S15-CFIP.1858	Test refused on tip resistance.
33	5.73	20/10/2020	S15-CFIP.1858	Test refused on tip resistance.
34	1.74	20/10/2020	S15-CFIP.1858	Test refused on inclination.





MAG Tests Summary Sheet

HOLE ID	Final Depth (m)	Date of Test	MAG Status	Test Remarks
1	1.76	19/10/2020		Test refused on tip resistance.
2	1.89	19/10/2020		Test refused on tip resistance.
3	5.17	19/10/2020	Clear 3.4m onwards	Test refused on tip resistance.
4	4.26	19/10/2020	Clear 2.0m onwards	Test refused on tip resistance.
5	4.81	19/10/2020	Clear 2.6m onwards	Test refused on tip resistance.
6	2.97	19/10/2020		Test refused on tip resistance.
7	4.25	19/10/2020	Clear 3.0m onwards	Test refused on tip resistance.
8	6.42	19/10/2020		Test refused on tip resistance.
9	3.76	19/10/2020		Test refused on tip resistance.
10	3.31	19/10/2020	Clear 2.8m onwards	Test refused on tip resistance.
11	6.55	19/10/2020	Clear 2.0m onwards	Test refused on tip resistance.
12	6.67	19/10/2020	Clear 4.0m onwards	Test refused on tip resistance.
13	5.52	19/10/2020	Clear 0.2m onwards	Test refused on tip resistance.
14	5.44	19/10/2020	Clear 3.4m onwards	Test refused on tip resistance.
15	5.99	19/10/2020	Clear 0.6m onwards	Test refused on tip resistance.
16	4.66	20/10/2020	Clear 1.0m onwards	Test refused on tip resistance.
17	3.10	20/10/2020		Test refused on tip resistance.
18	2.96	20/10/2020		Test refused on tip resistance.
19	2.74	20/10/2020		Test refused on tip resistance.
20	3.39	20/10/2020		Test refused on tip resistance.
21	3.34	20/10/2020	Clear 1.0m onwards	Test refused on tip resistance.
22	3.24	20/10/2020	Clear 1.4m onwards	Test refused on tip resistance.
23	2.93	20/10/2020	Clear 0.2m onwards	Test refused on tip resistance.
24	2.92	20/10/2020	Clear 1.2m onwards	Test refused on tip resistance.
25	3.01	20/10/2020	Clear 1.2m onwards	Test refused on tip resistance.
26	3.43	20/10/2020	Clear 0.2m onwards	Test refused on tip resistance.
27	3.77	20/10/2020	Clear 1.0m onwards	Test refused on tip resistance.
28	3.87	20/10/2020		Test refused on tip resistance.
29	4.81	20/10/2020	Clear 1.8m onwards	Test refused on total pressure.
30	5.36	20/10/2020	Clear 2.0m onwards	Test refused on total pressure.





31	4.59	20/10/2020	Clear 2.0m onwards	Test refused on total pressure.
32	2.47	20/10/2020	Clear 1.6m onwards	Test refused on tip resistance.
33	5.73	20/10/2020	Clear 3.2m onwards	Test refused on tip resistance.
34	1.74	20/10/2020		Test refused on inclination.

	KEY for MAG Status						
Clear	Clear of UXO.						
Clear 1.0m onwards	Disturbance of magnetic field to depth shown due to artificial ground but otherwise clear.						
Obstruction	Buried obstruction or refused test due to geology. Change location, then re-test.						
Low risk 2.3m	Low risk anomaly at depth shown. Unlikely to be UXB, and clear below.						
Suspected existing pile	Disturbance of magnetic field at depth of 0- 7.0m, clear below.						
Anomaly x metres	Significant magnetic anomaly at depth shown.						





APPENDIX A2 – CPT Rig Datasheet

RIGS

20 TONNE CPT TRACK MOUNTED RIG (CPT017)

We have a variety of rigs giving us the capacity to meet our clients' needs and specifications for each individual project.

This rubber tracked rig weighs 20 tonnes and is able to push up to a depth of 40 metres, depending on the ground conditions. It has low ground bearing pressure and is ideal for soft, boggy sites which are inaccessible for our wheeled rigs.

	GPT RIG DETAILS
DRIVE SYSTEM	RUBBER TRACKED
OTAL WEIGHT	20 TONNES
ROUND BEARING Pressure	35kPA
PT RAM THRUST CAPACITY	20 TONNES
MAXIMUM PENETRATION	30-40M DEPENDING ON THE GROUND CONDITIONS,
PERFORMANCE RATES	100-150M OF TESTING A DAY, DEPENDING ON ACCESS TO POSITIONS.
TYPICAL SITES FOR This rig	SOFT, BOGGY SITES. THE RIG HAS LOW GROUND BEARING PRESSURE.











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SPECIFICATIONS S15 SERIES **ELECTRICAL CONES**

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The electronic subtraction cones have been developed to address the durability problems inherent in other cone designs. The unit consists of a single element temperature compensated strain gauge transducer for measuring both cone resistance and local sleeve friction. This design is therefore more robust than a compression type cone. The cone support electronics package is located directly behind the transducer. The precision strain gauge amplifiers and power supply eliminate the effects of cable resistance on the measurements. A standard subtraction cone is capable of measuring simultaneously the following channels: Tip, Local friction, Pore pressure, Temperature and Inclination.

GENERAL SPECIFICATIONS

Cone Tip Section Area Friction Sleeve Surface Total Length Weight Power Supply Output Working Temperature Storage Temperature Connector

1,500 mm2 22,500 mm2 325 mm 4200 g ± 15 VDC, 100 mA. 0-10 VDC* 0 - 60°C - 40 to + 85°C Lemo 10 pins (others on request)

Range

Accuracy

LOCAL SLEEVE FRICTION

Maximum Load 150 %

Sleeve Area Ratio 1.0 (EA)

TIP RESISTANCE

Range Accuracy 0.25 % FS Maximum Load 150 % of range Cone Area Ratio 0.75

100/150* kN

PORE PRESSURE

Range Accuracy Maximum Load

INCLINATION 1/2/5/10* MPa Range 0.5 % FS Accuracy 150 % of range

25° (biaxial) < 2 °

100/150* kN

0.50 % FS

All our equipment complies with the ISSMGE, ASTM, DIN and NEN Standards.

*Other output and voltage ranges available on request. Loadcells may be calibrated for lower ranges.





APPENDIX A4 – Cone Calibration Certificate

		Co	ne Ca	librat	ion Ce	rtificat	te		
Certificate:				GS-1858	8-003	ne			
Model:	6			S15-CFIIP	-MAG	110			
Serial number:				1858	0				
Client:				Insitu					
Calibrated by:	rumente			M.de Bruir	1				
Manufacturer:	ruments			Hottinger	Baldwin Mes	stechnik Gmb	н		
NMi certificate	ditions			2461165.0	00501				
Ambient temper	ature:			18.5	°C				
Atmospheric pre	ssure:			995	mBar		10		
Cone base area	:			1500	mm2				
Load tip resistar	nce (nom.):			50 22500	kN mm2				
Load tip + local	friction (nom	.):		50	kN				
Load friction sle	eve (nom.):			22.5	kN MPa				
Inclination (nom	.):			+/- 20	0				
Temperature co Maximum overlo	mpensation ad capacity	(all channels (all channel	5): s):	0+40 50	%				
Cone area ratio	(a):		nan an an an an an an an an an an an an	0.79	.07				
Max. Inaccuracy	y, relative to	measureme	nt value:	1.0	70				
	Ti	p:	SI fo in kN	eeve:	Pore	Pressure:	Degrees	Inclinometer	: Y (mV)
Zero points:	qc in KN	0209	IS III KIN	0217	MIFG	0225	Degrees	7 (10.7)	. (
	0	0	0	0319	0	0	-20	2454	2426
	10	0617	10	0637	0.8	3249	20	4460	4470
	15	0926	15	0956	1.2	6447	-		
	25	1543	25	1594	2.0	8042	1		
1	30	1851	30	1912	-	Max eror a	abs. ac:	35 kPa	
	40	2461	40	2542	1	Max. error,	abs. fs:	2 kPa	
	45	2767	45	2858	-	Max. error, Max. error.	abs. u2: abs. l:	10 KPa 1 °	
	50	3073	1 00	5114	- 55	max. on on,	abo. n		
This calibration is com	pliant with Eijkelk	amp GeoPoint S	oilSolutions inte	ernal quality syste	em, internal calibra	tion procedures an	d meets the req	uirements of	
NEN2649, NEN-EN-IS	SO 22476-1, NOR	SOK G-001, ISS	MFE and ASTM	using calibration	equipment traces	ble to (inter-)Nation	nal Standards.		
			\						
Approved by: Date:		B. Kop 06-10-2020	A						
Bate.		122240-2120-2222	16						
			V	/					
-			N						
-									
Elikalkanan Cooffoi	nt SoilSolution	S	RAN NIAS RA	BO 0326 7904	38				
V.A.T. NO. NL 8584	21.422.B01	1	Duria identity into						
V.A.T. NO. NL 8584. Trade Reg. Arnhem	.21.422.801 1 no. 70686149) E	IC: RABONLI	20					





APPENDIX A5 – Symbol List

English

0	
а	is area ratio of the cone $(= A_n / A_c)$
А	is area
Ac	is projected area of the cone
An	is cross sectional area of load cell or shaft
As	is area of friction sleeve
A_{sb}	is bottom end area of friction sleeve
A _{st}	is top end area of friction sleeve
Bq	is pore pressure parameter $\left(=\frac{(u_2 - u_0)}{(a_1 - a_2)}\right)$
Ch	is horizontal coefficient of consolidation
Cv	is vertical coefficient of consolidation
D	is diameter
Dr	is relative density $\left(=\frac{e_{max}-e}{2}x100\%\right)$
е	is void ratio
e _{max}	is maximum void ratio
emin	is minimum void ratio
E	is Young's modulus
f _s	is unit sleeve friction resistance
ft	is sleeve friction corrected for pore pressure effects
Fs	is total force acting on friction sleeve
F_R	is normalized friction ratio $(=f_s/(a_1 - a_2))$
FoS	is factor of safety
FC	is fines content
q	is acceleration due to gravity
Ğ ₀	is initial or maximum shear modulus, shear stiffness
l _c	is soil behavior type index
l _r	is rigidity index $(= G/S_{1})$
l _p	is plasticity index
k	is coefficient of permeability
k h	is coefficient of permeability in horizontal direction
kv	is coefficient of permeability in vertical direction
K ₀	is coefficient of earth pressure at rest $(= \frac{\sigma'_{h0}}{\sigma'})$
L	is length
m _v	is coefficient of volume change
M	is constrained deformation modulus
M7.5	is earthquake magnitude of 7.5 Richter scale
Ν	is number of blows of SPT
N ₆₀	is SPT energy ratio
Nĸ	is cone factor
N _{ke}	is cone factor
N _{kt}	is cone factor
N∆u	is cone factor
pa	is reference stress $(= 100 kPa)$
q _c	is measured cone resistance
q _e	is effective cone resistance $(= q_t - u_2)$
qn	is net cone resistance (= $q_t - \sigma_{v0}$)
q t	is corrected cone resistance (= $q_c - (1 - a)u_2$)
Q _c	is total force acting on the cone
Qt	is normalized cone resistance (= $\frac{q_t}{\sigma'_{v_0}}$)





- R_f is friction ratio (= $(f_t/q_t) x 100\%$ or alternatively = $(f_t/q_t) x 100\%$)
- s_u is undrained shear strength
- sur is remoulded undrained shear strength
- St is sensitivity
- t is time
- t_{50} is time for 50% dissipation of excess pore water pressure
- T_{50} is time factor at U = 50 %
- u is pore water pressure
- u₀ is in situ pore pressure
- u_1 is pore pressure measured on the cone
- u_2 is pore pressure measured behind the cone
- u_3 is pore pressure measured behind sleeve friction
- Δu is excess pore water pressure
- U is normalized excess pore pressure
- V_s is shear wave velocity
- z is depth

Greek

- α is constant
- α is cone roughness
- β is constant
- β_1 is the angle between the vertical axis and the projection of the axis of the CPTU on a vertical plane, in degrees
- β_2 is the angle between the vertical axis and the projection of the axis of the CPTU on a vertical plane that is perpendicular to the plane of angle β_1 , in degrees
- γ is unit weight of soil
- γ_w unit weight of water
- Δ is change
- Δu is excess pore pressure (= $u u_0$)
- μ is Poisson's ratio
- ρ is density
- ψ is state parameter
- σ , σ' is normal stress (total, effective)
- σ_h , σ_h ' is horizontal stress (total, effective)
- σ_v, σ_v' is horizontal stress (total, effective)
- σ_{v0}, σ_{v0} ' is overburden stress (total, effective)
- T_{av} is average cyclic shear stress
- T_{cy} is cyclic shear stress
- ϕ' is effective friction angle





APPENDIX A6 – Abbreviations

- ASTM American Society for Testing and Materials
- CPTU Cone Penetration Test with Pore Pressure Measurement (Piezocone Test)
- CRR Cyclic Resistance Ratio
- CSR Cyclic Stress Ratio
- GWT Ground Water Table
- NC Normally Consolidated
- OC Over consolidated
- OCR Over consolidation Ratio
- PL Limit Pressure
- SDMT Seismic Dilatometer Marchetti
- SPT Standard Penetration Test
- TC Technical Committee





APPENDIX A7 – Glossary

СРТ

Cone Penetration Test.

Cone

The part of the cone penetrometer on which the end bearing is developed.

Cone Penetrometer

The assembly containing the *cone*, *friction sleeve*, any other sensors and measuring systems, as well as the connections to the *push-rods*.

Cone resistance, q_c

The total force acting on the cone, Q_c , divided by the projected area of the cone, A_c . $q_c = \frac{Q_c}{A_c}$

Corrected cone resistance, q_t

The cone resistance, q_c corrected for pore water pressure effects.

Corrected sleeve friction, f_t

The sleeve friction corrected for pore water pressure effects on the ends of the friction sleeve.

Data acquisition system

The system used to measure and record the measurements made by the cone penetrometer.

Dissipation Test

A test when the decay of the pore water pressure is monitored during a pause in penetration.

Filter element

The porous element inserted into the cone penetrometer to allow transmission of the pore water pressure to the pore pressure sensor, while maintaining the correct profile of the *cone penetrometer*.

Friction ratio, R_f

The ratio, expressed as a percentage of the *sleeve friction*, f_s , to the *cone resistance*, q_c , both measured at the same depth.

Friction reducer

A local enlargement on the push-rod surface, placed at a distance above the cone penetrometer, and provided to reduce the friction on the *push-rods*.

Friction sleeve

The section of the *cone penetrometer* upon which the *sleeve friction* is measured.

Normalized cone resistance, Q_c or Q_t

The cone resistance expressed in a non-dimensional form and taking account of stress changes in situ, $q_c = \frac{(q_c - \sigma_{v0})}{\sigma'_{v0}}$, or when the corrected cone resistance is used $q_t = \frac{(q_t - \sigma_{v0})}{\sigma'_{v0}}$. Where σ_{v0} and σ'_{v0} are the total and effective vertical stress respectively.

Net cone resistance, q_n

The corrected cone resistance minus the vertical total stress. $q_n = q_t - \sigma_{v0}$

Normalized friction ratio, F_r

The sleeve friction normalized by the net cone resistance.

Piezocone

A cone penetrometer containing a pore pressure sensor.



Pore pressure, *u*

The pore pressure generated during penetration and measured by a pore pressure sensor, u_1 when measured on the cone, u_2 when measured just behind the cone and u_3 when measured just behind the friction sleeve.

Pore pressure ratio, B_q

The net pore pressure normalized with respect to the net cone resistance.

Push-rods

The thick-walled tubes or rods used for advancing the cone penetrometer.

Rig machine

The equipment which pushes the cone penetrometer and rods into the ground.

Sleeve friction, fs

The total frictional force acting on the *friction sleeve*, F_s , divided by its *surface area*, A_s . $f_s = \frac{F_s}{A_s}$



APPENDIX A8 – Soils Description Tables

GRANULAR SOILS (Sands and Gravels)

Description	Relative Density <i>D</i> _r (%)	SPT N value, N _{SPT}
Very Loose	0 – 15	0 - 4
Loose	15 – 35	4 - 10
Medium Dense	35 – 65	10 - 30
Dense	65 – 85	30 - 50
Very Dense	>85	>50

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COHESIVE SOILS (Clays and Silts)

Term based on measurement	Undrained Shear Strength Classification, s _u (kPa)
Extremely low	<10
Very low	10 - 20
Low	20 - 40
Medium	40 - 75
High	75 - 150
Very high	150 - 300
Extremely high	>300





APPENDIX A9 – Site Map and Pictures from Site Works





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Appendix A

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APPENDIX B

Cone Penetration Measured Parameters and Geotechnical Derived Parameters

												CPT LOG 01
Sľ	TE	INVESTIGA		soiltech						PointID	01	
C P LC PF		NT : Soiltech JECT: Lossiem ION : Lossiemouth CT No. : 1200410	nics Iouth		EASTING NORTHING ELEVATION CHECKED BY TERMINATIO	/ N REASON	: 0.0 m : 0.0 m : 0.00 m OD : LD N : Refusal		Remark: Test refused on tip res	istance.	SHEET: 1STATUS: FinTEST DATE: 19PLOT DATE: 26METHOD: IS	OF 1 hal //10/2020 //10/2020 O 22476-1:2012
Depth (m)	Elevation (m)	Corrected Cone I 0 5 0 0.5 Sleeve Friction f 0 100	Resistance, qt (MPa) 10 15 1 1.5 Resistance, fs (kPa) 200 300	-20 Friction Ratio, R, (% -2 500 0 2 4) In Situ P Porewal 6 8 -300 0	ore Pressure, u_0 (der Pressure, u_2 (k 300 600	(kPa) Inclination (°) (kPa) 1	Pore Pressure	Ratio, B _q Soil 1 	Behaviour Type: on et al. 1986 qc Rf 5 6 7 8 9 10 1 ⁻	bo piyu tebo 1	al Description
1-	+ + + + + 										Low strength I Autors becoming 0.40 silty SAND (8 Dense becoming 1.76	becoming high strength clayey SILT (6) ing medium dense SAND to) ing very dense SAND (9)
2- 3-	2	Terminated at 1.76 Refusal										
4- 5-												
6-	6											
7- 8-	-7											
9-	9											
CON CAL CON CON FILT FILT	ie ID Ibratio Ie Mod Ie Are. Ie Are. Er Pos Er Typ	: S15-CFIP.1858 ON DATE : 26/07/2020 DEL : Subtraction A : 15cm ² A RATIO : 0.79 SITION : u2 *E : HDPE	TEST TYPE : APPLICATION CLASS : RIG : OPERATOR : FRICTION REDUCER : WEATHER : GROUNDWATER DEPTH :	TE2 2 CPT 017 - Griffen RS None Raining & Mild Assumed for calculation purpos	Transducer Tip Sleeve Pore Pressure 2 X-Y Inclinometer	CPTU ZEF Pre 209 mV 208 mV 282 mV 2463 mV	RO VALUES Difference 203 mV -0.065 MPa 204 mV -0.003 kPa 242 mV -0.01 kPa 2473 mV -0.01 kPa	METHOD: Robertson et 1 - Sensitive fine grained mai 2 - Organic material 3 - CLAY 4 - Sitly CLAY to CLAY	t al. 1986 qc Rf terial 5 - Clayey SILT to silty (6 - Sardy SILT to claye; 7 - Sity SAND to sardy 8 - SAND to silty SAND	SLAY 9 - 5 (SILT 10 - SILT 11 - 12 -	SAND Gravely SAND to SAND Very stiff fine grained SAND to clayey SAND	Groundwater Level ଐ Dissipation Test

															CPT I	LOG 02
SITE		STIGATIC	Working with		ecn d geotechnic								PointID		01	
CLIENT : Soiltechnics PROJECT: Lossiemouth LOCATION : Lossiemouth PROJECT No. : 1200410					EASTING: 0.0 mRemark:NORTHING: 0.0 mTest refused on tip reELEVATION: 0.00 m ODCHECKED BY: LDTERMINATION REASON : Refusal				SHEET : 1 OF 1 esistance. STATUS : Final TEST DATE : 19/10/2020 PLOT DATE : 26/10/2020 METHOD : ISO 22476-1:2012							
Depth (m) Elevation	0 100	Corrected Cone Resistance 5 10 200 30 Sleeve Friction Resistance	e, q ₁ (MPa) <u>15</u> 20 0500 e, f _s (kPa)	Non-normaliz	ed Soil Behav Robertson (viour Type Index, I _{SBT} 2010)	1. R 2. Je 3. R	ob. & Wride 98 off. & Davies 93 obertson 2012	SPT N ₆₀	an 45 50	1. Bat 2. Jan 3. Kull	Relative Density, D, (%) if et al. (1986); Al-Homoul & Wehr (2006) idokovski et al. (2001) tawy & Mayne (1990) 25 50 75	100 0	Friction An 1. Senneset et al. (1988 & 19 2. Robertson & Campanella (3. Kulhawy & Mayne (1990) 20	gle, \equiv (deg) 189); Mayne & Campanella (2005) 1983) 40 60	B Graphic Log
	and a g			and to gravelly sand	sands to suity sands the sand sandy site	ayey suity clay ays: clay to sity clay 						Loose - Loose				
	Tern Refi	inated at 1.76 m isal </td <td></td> <td></td> <td>Bands: gear Sands: gear Sands: gear Sands: gear Sands: gear Sands: gear Sands: gear</td> <td></td>			Bands: gear Sands: gear Sands: gear Sands: gear Sands: gear Sands: gear Sands: gear											
CONE ID CONE M CONE AI CONE AI FILTER F FILTER 1) : ODEL : REA : REA RATIO : POSITION : TYPE :	S15-CFIP.1858 Subtraction 15cm ² 0.79 u2 HDPE	TEST TYPE APPLICATION CLASS RIG OPERATOR FRICTION REDUCER WEATHER	: TE2 : 2 : CPT 017 - Griff : RS : None : Raining & Mild	en	Transducer Tip Sleeve Pore Pressure 2 X-Y Inclinometer	CPTU Z Pre 209 mV 208 mV 282 mV 2463 mV	ERO VALUE Post 203 mV 204 mV 242 mV 2473 mV	S Difference -0.065 MPa -0.003 kPa -0.01 kPa	GRANUL/ Description Clays Silt mixtures Sand mixtures Sands Gravelly sand	AR SOILS (SBT Index, 2.95-3.60 2.60-2.95 2.05-2.60 1.31-2.05 c1 31	Sands & Gravels) Robertson et . lc Description SPT N value, NSP Very Losse 04 Losse 410 Medium Dense 1030 Dense 3050 Very Dense 750	al. 1986 Zones ' T Description Very Loose Loose Medium Dense Dense Very Dense	7-10 and Zone 12 Relative Density Dr (%) 0 - 15 15 - 35 35 - 65 65 - 85 >95	Groundwat Level ∭Dissipation ⁻	ier Test

CPT LOG 03 IN SITU soiltechnics PointID 01 SITE INVESTIGATION Working with: CLIENT : Soiltechnics EASTING : 0.0 m Remark: SHEET : 1 OF 1 STATUS NORTHING : 0.0 m Test refused on tip resistance. : Final **PROJECT:** Lossiemouth : 0.00 m OD TEST DATE : 19/10/2020 ELEVATION LOCATION : Lossiemouth CHECKED BY PLOT DATE : 26/10/2020 ·ID PROJECT No. : 1200410 **TERMINATION REASON: Refusal** METHOD : ISO 22476-1:2012 Unit Weight, y (kN/m³) Fines Content, FC (%) Undrained Shear Strength, s, (kPa) Sensitivity, S Corrected Cone Resistance, q, (MPa) Graphic Log ----- **Y** bulk . R&W 98 and NCEER 2001 LB. $s_u = (q_t - \sigma_{vo})/N_{st}$, where $N_{st} = 20$ BE. $s_u = (q_t - \sigma_{vo})/N_{st}$, where $N_{st} = 17.5$ 1. Schmertmann78; R&L86 2. Mayne (2007) 10 15 1. Mayne (2007) 1. Mayne (2007) Depth (m) 3. Boulanger and Idriss (2014 ion 100 200 300 400 - 500 Шex; Sleeve Friction Resistance, fs (kPa) 100 200 300 0 12.5 25 37.5 12 16 25 50 75 100 0 50 8 20 24 X Х _ ^ Ī Terminated at 1.76 m 2----2 Refusal 3---3 + 4_[†] --4 + 5-6. -6 + 7-----7 8---8 9---9 t COHESIVE SOILS (Clays & Silts) Robertson et al. 1986 Zones 1-6 and Zone 11 CONE ID : S15-CFIP.1858 TEST TYPE : TE2 CPTU ZERO VALUES Groundwater <u></u> Level CONE MODEL Subtraction APPLICATION CLASS : 2 Transducer Pre Post Difference su (kPa) Term based on measurement su (kPa) Term based on measurement : CPT 017 - Griffen -0.065 MPa CONE AREA : 15cm² RIG Tip 209 mV 203 mV Extremely low strength <10 Medium strength 40-75 CONE AREA RATIO : 0.79 OPERATOR : RS Sleeve 208 mV 204 mV -0.003 kPa 10-20 High strength 75-150 Very low strength FILTER POSITION : u2 FRICTION REDUCER : None Pore Pressure 2 282 mV 242 mV -0.01 kPa Low strength 20-40 Very high strength 150-300 I Dissipation Test FILTER TYPE : HDPE WEATHER : Raining & Mild X-Y Inclinometer 2463 mV 2473 mV Extremely high strength >300



				217 1								CPT LOG 01			
SITE INVESTIGATION Working with:									PointID 02						
C P LC PF		NT : Soiltech JECT: Lossiem ON : Lossiemouth CT No. : 1200410	nics outh		EASTING NORTHING ELEVATION CHECKED BY TERMINATIO	, , N REASON :	0.0 m 0.0 m 0.00 m OD LD Refusal		Remark: Test refused on tip resi	stance.	SHEET : 1 OF 1 STATUS : Final TEST DATE : 19/10/2020 PLOT DATE : 26/10/2020 METHOD : ISO 22476-1:2012				
Jepth (m)	elevation m)	Corrected Cone I Correc	Resistance, q _t (MPa) 10 15 1 1.5 Resistance, f _s (kPa)	-20 Friction Ratio, R _r (%) In Situ P Porewa	er Pressure, u ₀ (kPa) Inclination (°) — — 1 — 1 — 1	Pore Pressure	e Ratio, B _q Soil B Robertso	ehaviour Type: n et al. 1986 qc Rf	B B B B B B B B B B B B B B B B B B B	rial Description			
1-											X 0.40 Medium strei X 0.40 sandy SILT t Medium den: X 1.20	ngth becoming high strength o clayey SILT (6) se SAND to silty SAND (8)			
	+										Lense becor	ning very dense SAND (9)			
3- 4- 5-															
6- 7-															
9-															
CON CAL CON CON	IE ID IBRATIO IE MOD IE ARE/	: S15-CFIP.1858 DN DATE : 26/07/2020 EL : Subtraction A : 15cm ² A RATIO : 0.79	TEST TYPE : APPLICATION CLASS : RIG : OPERATOR : FRICTION REDUCER	TE2 2 CPT 017 - Griffen RS None	Transducer Tip Sleeve	CPTU ZERO V Pre Po 207 mV 20 205 mV 20	/ALUES st Difference 5 mV -0.022 MPa 4 mV -0.001 kPa	METHOD: Robertson e 1 - Sensitive fine grained ma 2 - Organic material 3 - CLAY	et al. 1986 qc Rf aterial 5 - Clayey SILT to silty CL 6 - Sandy SILT to clayey 1 7 - Silty SAND to sandy S	AY 9-S SILT 10- ILT 11-	SAND Gravelly SAND to SAND Very stiff fine grained	Groundwater Level			
FILT	ER POS	SITION : u2 E : HDPE	WEATHER : GROUNDWATER DEPTH :	Raining & Mild Assumed for calculation purpos	X-Y Inclinometer	255 mV 24 2413 mV 24	3 mV -0.003 kPa 04 mV	4 - Silty CLAY to CLAY	8 - SAND to silty SAND	12 -	SAND to clayey SAND	""順Dissipation Test			
														СРТ	LOG 02
--	---	---	--	---	---	--	---	--	--	---	---	---	--	---	-----------------------
SITE	INVESTI	GATION Work	ing with:									PointID	(02	
CLIE PRO LOCAT PROJE	NT : Soilt JECT : Loss ION : Lossien CT No. : 120041	echnics iemouth ^{10uth}			EASTING NORTHING ELEVATION CHECKED B TERMINATIC	Y DN REAS	: 0.0 : 0.0 : 0.00 : LD ON : Refi	m m) m OD usal			Remark: Test refused on tip re	esistance.	SHEET STATUS TEST D/ PLOT D/ METHOI	: 1 OF 1 ; : Final ATE : 19/10/20 ATE : 26/10/20 D : ISO 2247	20 20 76-1:2012
Depth (m) Elevation m)	Correcte 0 5 0 100 Sleeve	rd Cone Resistance, q _t (MPa) 10 15 200 300 400 - Friction Resistance, f _s (kPa)	20 Non-no	ormalized Soil Beha Robertson	, aviour Type Index, I _{SBT} (2010)	1. R 2. Je 3. R	20. & Wride 98 ff. & Davies 93 obertson 2012	SPT N ₆₀	- 40 AE E	1. Bale 2. Jan 3. Kull	Relative Density, D, (%) di et al. (1986); Al-Hornoud & Wehr (2006) akkowski et al. (2001) hawy & Mayne (1990) 25 50 75	100.0	Friction An — 1. Senneset et al. (1988 & 19 — 2. Robertson & Campanella (— 3. Kulhawy & Mayne (1990) 20	igle, ♦' (deg) 389): Mayne & Campanella (2005 (1963)	Graphic Log
	A A A A A A A A A A A A A A A A A A A		sand to gravelly sand	ait sands to sully sands sits and to sandy silt	clayey slift & silty clay Clayes clay to silty clay Clays clay to silty clay Clay - prganic soil						23 50 10 				
		at 1.89 m		Image: second											
CONE ID CONE MO CONE AR CONE AR FILTER P FILTER T	: S15-CFI DDEL : Subtract REA : 15cm ² REA RATIO : 0.79 OSITION : u2 YPE : HDPE	IP.1858 TEST TYPE tion APPLICATION RIG OPERATOR FRICTION RE WEATHER	: TE2 I CLASS : 2 : CPT 017 : RS DUCER : None : Raining 8	- Griffen Mild	Transducer Tip Sleeve Pore Pressure 2 X-Y Inclinometer	CPTU Z Pre 207 mV 205 mV 255 mV 2413 mV	ERO VALUES Post 205 mV 204 mV 243 mV 2404 mV	Difference -0.022 MPa -0.001 kPa -0.003 kPa	GRANUL Description Clays Silt mixtures Sand mixtures Sands Crowilly cond	AR SOILS (\$ SBT Index, 2.95-3.60 2.60-2.95 2.05-2.60 1.31-2.05 c1 21	Sands & Gravels) Robertson et . Ic Description SPT N value, NSP Very Loose 0 - 4 Loose 4 - 10 Medium Dense 10 - 30 Dense 30 - 50 Very Doppe 50	al. 1986 Zones Description Very Loose Loose Medium Dense Dense	7-10 and Zone 12 Relative Density Dr (%) 0 - 15 15 - 35 35 - 65 65 - 85 295	- Groundwa Level - I Dissipation	ater n Test

IN SITU soiltechnics PointID 02 SITE INVESTIGATION Working with: CLIENT : Soiltechnics EASTING : 0.0 m Remark: SHEET : 1 OF 1 STATUS NORTHING : 0.0 m Test refused on tip resistance. : Final **PROJECT:** Lossiemouth : 0.00 m OD TEST DATE : 19/10/2020 ELEVATION LOCATION : Lossiemouth CHECKED BY PLOT DATE : 26/10/2020 ·ID PROJECT No. : 1200410 **TERMINATION REASON: Refusal** METHOD : ISO 22476-1:2012 Unit Weight, y (kN/m³) Fines Content, FC (%) Undrained Shear Strength, s, (kPa) Sensitivity, S Corrected Cone Resistance, q, (MPa) Graphic Log ----- **Y** bulk . R&W 98 and NCEER 2001 LB. $s_u = (q_t - \sigma_{v_0})/N_{tc}$, where $N_{tc} = 20$ BE. $s_u = (q_t - \sigma_{v_0})/N_{tc}$, where $N_{tc} = 17.5$ 1. Schmertmann78; R&L86 2. Mayne (2007) 10 15 1. Mayne (2007) 1. Mayne (2007) Depth (m) 3. Boulanger and Idriss (2014 <u>lo</u> 100 200 300 400 - 500 Шex; Sleeve Friction Resistance, fs (kPa) 100 200 300 0 12.5 25 37.5 12 25 50 75 100 0 50 8 16 20 24 X -HB × × _ 1 + ٤ 2----2 Terminated at 1.89 m Refusal 3---3 + 4---/ + 5-6. -6 + 7----7 8---8 9---9 COHESIVE SOILS (Clays & Silts) Robertson et al. 1986 Zones 1-6 and Zone 11 CONE ID : S15-CFIP.1858 TEST TYPE : TE2 CPTU ZERO VALUES Groundwater <u></u> Level CONE MODEL Subtraction APPLICATION CLASS : 2 Transducer Pre Post Difference su (kPa) Term based on measurement su (kPa) Term based on measurement : CPT 017 - Griffen -0.022 MPa CONE AREA : 15cm² RIG Tip 207 mV 205 mV Extremely low strength <10 Medium strength 40-75 CONE AREA RATIO : 0.79 OPERATOR : RS Sleeve 205 mV 204 mV -0.001 kPa 10-20 High strength 75-150 Very low strength FILTER POSITION : u2 FRICTION REDUCER : None Pore Pressure 2 255 mV 243 mV -0.003 kPa Low strength 20-40 Very high strength 150-300 I Dissipation Test FILTER TYPE : HDPE WEATHER : Raining & Mild X-Y Inclinometer 2413 mV 2404 mV Extremely high strength >300





IN SITLI	10 L L				CPT LOG 02
SITE INVESTIGATION Working with	BOIITECNNICS	S		PointID	03
CLIENT : Soiltechnics PROJECT : Lossiemouth LOCATION : Lossiemouth PROJECT No. : 1200410	EASTIN NORTH ELEVAT CHECK TERMIN	ING : 0.0 m THING : 0.0 m ATION : 0.00 m OD CKED BY : LD IINATION REASON : Refusal	Remark: Test refused on tip re	SHEET Sistance. STATUS TEST D/ PLOT D/ METHO	: 1 OF 1 : Final ATE : 19/10/2020 ATE : 26/10/2020 D : ISO 22476-1:2012
E Corrected Cone Resistance, qt (MPa) 0 5 10 15 20 0 10 200 300 400 500 0 100 200 300 400 500 0 Sleeve Friction Resistance, ft (kPa) 0 0 0 0	Non-normalized Soil Behaviour Type Inde Robertson (2010)	SPT N ₆₀ . Rob. & Wride 98 . 2. Jeff. & Darkes 93 . 3. Robertson 2012 	Relative Density, D, (%)	Friction Ar 	rgle, ♦' (deg) 989): Mayne & Campanella (2005)
Image: Contract of the second seco	1 2 3 1 2 3 1 2 3 1 2 3 1 2 3 1 2 3 1 2 3 1 2 3 1 2 3 1 3 1 <td>4 5 10 15 20 25 30 35 100 1 1 1 1 1 1 1 100 1 1 1 1 1 1 1 1 100 1 1 1 1 1 1 1 1 1 100 1 1 1 1 1 1 1 1 1 100 1 <t< td=""><td></td><td></td><td></td></t<></td>	4 5 10 15 20 25 30 35 100 1 1 1 1 1 1 1 100 1 1 1 1 1 1 1 1 100 1 1 1 1 1 1 1 1 1 100 1 1 1 1 1 1 1 1 1 100 1 <t< td=""><td></td><td></td><td></td></t<>			
CONE ID : S15-CFIP.1858 TEST TYPE : TE CONE MODEL : Subtraction APPLICATION CLASS : 2 CONE AREA : 15cm ² RIG : CF CONE AREA RATIO : 0.79 OPERATOR : RS FILTER POSITION : u2 FRICTION REDUCER : NK FILTER TYPE : HDPE WEATHER : Ri	E2 Transduce CPT 017 - Griffen Tip KS Sleeve Jone Pore Pres Raining & Mild X-Y Inclinc	CPTU ZERO VALUES ucer Pre Post Difference Differenc Difference Differenc	GRANULAR SOILS (Sands & Gravels) Robertson et a scription SBT Index, Ic Description SPT Nalue, NSPT ys 2,95-3.80 Very Losse 0-4 industres 2.60-2.95 Losse 4-10 nd mixtures 2.05-2.60 Medium Dense 10-30 nds 1.31-205 Dense 30-50	I. 1986 Zones 7-10 and Zone 12 r Description Relative Density Dr (%) Very Losse 0 - 15 Losse 15 - 35 Medium Dense 35 - 65 Dense 65 - 85 Very Longe 285	-

													CPT L	.OG 03
SITE	INVESTIGATIC	Working with								Po	bintID	03		
CLIEI PROJ LOCATI PROJEC	NT : Soiltechnics JECT : Lossiemouth ON : Lossiemouth CT No. : 1200410	1		EASTING NORTHING ELEVATION CHECKED B' TERMINATIC	Y DN REASON	: 0.0 m : 0.0 m : 0.00 m C : LD N : Refusal	D		Remark: Test refused o	on tip resistar	nce. SH TE PL ME	IEET ATUS ST DATE OT DATE ETHOD	: 1 OF 1 : Final : 19/10/2020 : 26/10/2020 : ISO 22476)) -1:2012
Depth (m) Elevation (m)	Corrected Cone Resistanc 0 5 10 0 100 200 30 Sleeve Friction Resistanc	e, q _t (MPa) 15 - 20 10 400 - 500 e, f _s (kPa)	Fines Conter 1. R&W 99 and NCEER 2001 2. Suzuki et al. (1996) 3. Boulanger and Idriss (2014) 0 25 50	rt, FC (%)	Ur LB. s _u = (BE. s _u = (UB. s _u = (100 0	Indrained Shear Strer $q_{1} - \phi_{m}$)/N _e , where N _e = 20 $q_{2} - \phi_{m}$)/N _e , where N _e = 17 $q_{2} - \phi_{m}$)/N _e , where N _e = 15 100	ngth, s _u (kPa)	1. Sch 2. May 300 0	Sensitivity, S metman78; R&L86 yne (2007) 12.5 25	37.5	1. Mayne (2007) 1. Mayne (2007) 2. Mayne (2007) 50 8 12	Jnit Weight, γ (kN	//m³) 20	Graphic Log
														X X X X X X X X X X X X X X X X X X X
5 -5 + 6 + -6 + 7 + -7 + 8 + -8 + 9 + -9 + 9 + -9 + + +	Terminated at 5.17 m Refusal													
CONE ID CONE MOI CONE ARE CONE ARE FILTER PC FILTER TY	: S15-CFIP.1858 DEL : Subtraction EA : 15cm ² A RATIO : 0.79 SITION : u2 PE : HDPE	TEST TYPE APPLICATION CLASS RIG OPERATOR FRICTION REDUCER WEATHER	: TE2 : 2 : CPT 017 - Griffen : RS : None : Raining & Mild	Transducer Tip Sleeve Pore Pressure 2 X-Y Inclinometer	CPTU ZER Pre 206 mV 205 mV 249 mV 2341 mV	O VALUES Post Diffe 204 mV -0.02 204 mV -0.00 249 mV 0 kP 2324 mV	rence Te 22 MPa Ex 01 kPa Ve a Lor	COHESIVE SO rm based on meas tremely low strengt ry low strength w strength	ILS (Clays & Silts) Ro urement su (kPa) h <10 10-20 20-40	bertson et al. 198 Term based Medium strer High strength Very high str Extremely hig	6 Zones 1-6 and Zon on measurement ngth ength ength gh strength	ne 11 su (kPa) 40-75 75-150 150-300 >300	-	water on Test







INI GITI I									CPT LOG 03
SITE INVESTIGATION Working	solitech environmental and geotech						Pointl	D 04	
CLIENT : Soiltechnics PROJECT : Lossiemouth LOCATION : Lossiemouth PROJECT No. : 1200410		EASTING NORTHING ELEVATION CHECKED B' TERMINATIC	: 0.0 : 0.0 : 0.0 Y : LD N REASON : Ref	m m) m OD usal	F T	emark: est refused on	tip resistance.	SHEET STATUS TEST DATE PLOT DATE METHOD	: 1 OF 1 : Final : 19/10/2020 : 26/10/2020 : ISO 22476-1:2012
E 5 10 15 0 5 10 15 0 100 200 300 400 Sleeve Friction Resistance, fs (kPa) Sleeve Friction Resistance, fs (kPa) 100 100	-20 Fines Conte -21 - 2. Suzuki ef al. (1989) -500 0 25 55	ont, FC (%)	Undrained St LB.s.= (q - g _)/N_w w BE.s.= (q - g _)/N_w w UB.s.= (q - g _)/N_w w 100 0 100	ear Strength, s _u (kl are N _u = 20 ere N _u = 17.5 ere N _u = 15 200	2a)	Sensitivity, S _t mann78; R&L86 2007) 5 25	37.5 50 8	Unit Weight, Y (i 1. Mayne (2007) 2. Mayne (2007) 3. 12 16	KN/m ³) Bon piques Bon
Image: matrix and a set of									
CONE ID : S15-CFIP.1858 TEST TYPE CONE MODEL : Subtraction APPLICATION CL/ CONE AREA : 15cm ² RIG CONE AREA RATIO : 0.79 OPERATOR FILTER POSITION : u2 FRICTION REDUC FILTER TYPE : HDPE WEATHER	: TE2 SS : 2 : CPT 017 - Griffen : RS ER : None : Raining & Mild	Transducer Tip Sleeve Pore Pressure 2 X-Y Inclinometer	CPTU ZERO VALUE Pre Post 207 mV 198 mV 205 mV 201 mV 262 mV 226 mV 2049 mV 2081 mV	5 Difference -0.098 MPa -0.003 kPa -0.009 kPa	COHESIVE SOILS Term based on measure Extremely low strength Very low strength Low strength	(Clays & Silts) Robe nent su (kPa) <10 10-20 20-40	rtson et al. 1986 Zo Term based on m Medium strength High strength Very high strengt Extremely high st	nes 1-6 and Zone 11 easurement su (kPa) 40-75 75-150 n 150-300 rength >300	Groundwater Level ຟ∭Dissipation Test





		112								CPT LC	DG 02
SITE INVESTIO		SOIItech environmental and geotechn ith:						PointID	05)	
CLIENT : Soilte PROJECT : Loss LOCATION : Lossiem PROJECT No. : 1200410	echnics emouth _{outh}		EASTING NORTHING ELEVATION CHECKED B TERMINATIC	Y DN REASON	0.0 m 0.0 m 0.00 m OD LD Refusal		Remark: Test refused on tip re	esistance.	SHEET STATUS TEST DATE PLOT DATE METHOD	: 1 OF 1 : Final : 19/10/2020 : 26/10/2020 : ISO 22476-1	1:2012
(E) tide (E)	Cone Resistance, q _t (MPa) 10 15 10 15 10 20 10 400 5 riction Resistance, f _s (kPa)	20 Non-normalized Soil Beh Robertson	aviour Type Index, I _{SBT} (2010)		SPT N ₈₀ e 98 ss 93 012		Relative Density, D, (%) Baidi et al. (1986); Al-Homoud & Wehr (2006) Jamobiowski et al. (2001) Kulhawy & Mayne (1990)	1000	Friction Angle, d . Senneset et al. (1988 & 1989); N . Robertson & Campanella (1983) . Kulhawy & Mayne (1990)	¢' (deg) tayne & Campanella (2005)	Graphic Log
Image: Second state 1 1 2 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3		0 1 2 - - - - - - <td>P E Silt mixtures: clayed silt/silt/silt/silt/silt/silt/silt/silt/</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>	P E Silt mixtures: clayed silt/silt/silt/silt/silt/silt/silt/silt/								
CONE ID : S15-CFI CONE MODEL : Subtract CONE AREA : 15cm ² CONE AREA RATIO : 0.79	2.1858 TEST TYPE APPLICATION CLAS RIG OPERATOR	: TE2 S : 2 : CPT 017 - Griffen : RS	Transducer Tip Sleeve	† I CPTU ZERO V Pre Po 207 mV 197 205 mV 198	ALUES t Difference mV -0.108 MPa mV -0.004 kPa	GRANULAR SOILS Description SBT Inc Clays 2.95-3.1 Silt mixtures 2.60-2. See description	S (Sands & Gravels) Robertson et tex. (c Description SPT N value, NSP 80 Very Loose 0 - 4 95 Loose 4 - 10	al. 1986 Zones 7-10 T Description Very Loose Loose) and Zone 12 Relative Density Dr (%) 0 - 15 15 - 35	Groundwater Level	1
FILTER POSITION: u2FILTER TYPE: HDPE	FRICTION REDUCER WEATHER	R : None : Raining & Mild	Pore Pressure 2 X-Y Inclinometer	247 mV 214 2313 mV 232	mV -0.008 kPa 0 mV	Sand mixtures 2.05-2.0 Sands 1.31-2.0 Gravelly sand <1.31	Medium Dense 10 - 30 05 Dense 30 - 50 Very Dense >50	Medium Dense Dense Verv Dense	35 - 65 65 - 85 >85	·//∥ Dissipation Tes	st

		CPT LOG 03
SITE INVESTIGATION Working with:	technics	PointID 05
CLIENT : Soiltechnics PROJECT : Lossiemouth LOCATION : Lossiemouth PROJECT No. : 1200410	EASTING : 0.0 m NORTHING : 0.0 m ELEVATION : 0.00 m OD CHECKED BY : LD TERMINATION REASON : Refusal	Remark: Test refused on tip resistance.SHEET: 1 OF 1 STATUSSTATUS: Final TEST DATE: 19/10/2020 PLOT DATEPLOT DATE: 26/10/2020 METHOD: ISO 22476-1:2012
E Corrected Cone Resistance, q, (MPa) 1. R8W 98 a 0 5 10 15 20 0 100 200 300 400 500 0 100 200 300 400 500 0 Sleeve Friction Resistance, f, (kPa) 0 25	Fines Content, FC (%) Undrained Shear Strength, s _u (kPa) and NCEER 2001 LB s ₁ = (q. • ♥_u) K _u where N _u = 20 stal. (1998) BE s ₁ = (q. • ♥_u) K _u where N _u = 17.5 br and Idriss (2014) UB s _u = (q. • ♥_u) K _u where N _u = 15 5 50 75 100 0 100 200 300 0	Sensitivity, S, Unit Weight, Y (kV/m³) 9 1. Schmertmann/8; R&L86
5		
CONE ID : S15-CFIP.1858 TEST TYPE : TE2 CONE MODEL : Subtraction APPLICATION CLASS : 2 CONE AREA : 15cm ² RIG : CPT 017 - G CONE AREA RATIO : 0.79 OPERATOR : RS FILTER POSITION : u2 FRICTION REDUCER : None FILTER TYPE : HDPE WEATHER : Raining & Mi	Griffen Transducer Pre Post Difference Tip 207 mV 197 mV -0.108 MPa Sleeve 205 mV 199 mV -0.004 kPa Pore Pressure 2 247 mV 214 mV -0.008 kPa Vilid X-Y Inclinometer 2313 mV 2320 mV	SOILS (Clays & Silts) Robertson et al. 1986 Zones 1-6 and Zone 11 Groundwater neasurement su (kPa) Term based on measurement su (kPa) ength <10



													CPT LOG 01
SI	TE	INVESTIGAT									PointID	06	
C F L(CATI ROJEC	NT : Soiltechni JECT : Lossiemo ON : Lossiemouth CT No. : 1200410	ics uth		EASTING NORTHING ELEVATION CHECKED BY TERMINATIO	/ N REASON	: 0.0 m : 0.0 m : 0.00 n : LD N : Refus	n OD al		Remark: Test refused on tip re	sistance.	SHEET: 1STATUS: FinTEST DATE: 19PLOT DATE: 26METHOD: IS	OF 1 nal //10/2020 //10/2020 O 22476-1:2012
Depth (m)	Elevation (m)	Corrected Cone Res 0 5 10 0 0.5 1 0 0.5 1 Sleeve Friction Res 0 100 200	istance, q, (MPa) 15	Friction Ratio, R ₁ (%)	In Situ P Porewat 6 8 -300 0	ore Pressure, u ₀	(kPa) kPa) 10 900 -5 0	Inclination (°) — — — 1 — — 1 —) 5 10	Pore Pressur 2 15 -0.6 -0.1 0.4	re Ratio, B _q Soil Robert 4 0.9 1.4 1 2 3 4	Behaviour Type: xon et al. 1986 qc Rf 5 6 7 8 9 10 1	Bo jude Bo 1	al Description
1												X Low strength sandy SILT to Coose to med SAND (8) with X 1.40	becoming high strength o clayey SILT (6) ium dense SAND to silty n a layer of clay
2												X Dense SAND X Medium dens X 2.20 X Medium dens X 2.97 Very dense gi 2.97	e SAND to silty SAND (8)
4		Ierminated at 2.97 m Refusal 				 							
5			 										
7	+ + + + - - - - - - - - -										+ $+$ $+$ $+$ $+$ $+$ $+$ $+$ $+$ $+$		
8													
		: S15-CFIP.1858 T DN DATE : 26/07/2020 A	EST TYPE : TE: PPLICATION CLASS : 2	2	Transducer	CPTU ZEI Pre	RO VALUES Post	Difference	METHOD: Robertson	et al. 1986 qc Rf	CLAY	SAND	Groundwater
CO CO CO FIL	NE MOD NE ARE/ NE ARE/ TER POS TER TYP	IEL : Subtraction R A : 15cm ² O A RATIO : 0.79 F SITION : u2 W F : HDPE G	IIG : CP IPERATOR : RS RICTION REDUCER : No VEATHER : Ra IROUNDWATER DEPTH : Ass	PT 017 - Griffen S Ine Ining & Mild Sumed for calculation purpose	Tip Sleeve Pore Pressure 2 X-Y Inclinometer	208 mV 206 mV 245 mV 2358 mV	204 mV 204 mV 254 mV 2354 mV	-0.043 MPa -0.001 kPa 0.002 kPa	2 - Organic material 3 - CLAY 4 - Silty CLAY to CLAY	6 - Sandy SILT to clave 7 - Silty SAND to sand 8 - SAND to silty SANE	ry SILT 10 - y SILT 11 - 0 12 -	Gravelly SAND to SAND Very stiff fine grained SAND to clayey SAND	ull Dissipation Test

				212										CPT	LOG 02
SITE		ESTIGATIC	Working with	Solitech								PointID		06	
CLIE PRC LOCAT	ENT DJECT TION ECT No. :	Soiltechnics Lossiemouth Lossiemouth 1200410	١		EASTING NORTHING ELEVATION CHECKED B TERMINATIC	Y DN REAS	: 0.0 r : 0.0 r : 0.00 : LD ON : Refu	n n ⊨m OD ısal			Remark: Test refused on tip	o resistance.	SHEET STATUS TEST D PLOT D METHO	: 1 OF 1 : Final ATE : 19/10/202 ATE : 26/10/202 D : ISO 2247	20 20 76-1:2012
Depth (m) Elevation (m)	0	Corrected Cone Resistance 5 10 100 200 30 Sleeve Friction Resistance	ze, q _t (MPa) 15	Non-normalized Soil Beha Robertson	aviour Type Index, I _{SBT} (2010) 3 4	1.R 2.J 3.R	S tob. & Wride 98 eff. & Davies 93 tobertson 2012 10 15 20	SPT N ₆₀ 25 30 35	40 45 50	1. Baid 2. Jam 3. Kulh	Relative Density, D _r (%) di et al. (1986); Al-Homoud & Wehr (200 isolkowski et al. (2001) nawy & Mayne (1990) 25 50	⁶⁾	Friction Ar 1. Seneset et al. (1988 & 1 2. Robertson & Campanella 3. Kulhawy & Mayne (1990) 20	ngle, ♦' (deg) 989): Mayne & Campanella (2005) (1983) 40 60	08 Graphic Log
	And the			Dense sand to gravelly sand Sands: gean sands to stily sands Sand mixtures: stily sand bandy hit	Silt mixtures: clayey silt& silty clayer Clays: clay o silty clay Clays: clay o silty clay Clay - Clay - brganic soil							Derse			
		Terminated at 2.97 m Refusal 													
8															
CONE ID CONE M CONE AF CONE AF FILTER F FILTER T	ODEL REA REA RATIO POSITION TYPE	: S15-CFIP.1858 : Subtraction : 15cm ² : 0.79 : u2 : HDPE	TEST TYPE APPLICATION CLASS RIG OPERATOR FRICTION REDUCER WEATHER	: TE2 : 2 : CPT 017 - Griffen : RS : None : Raining & Mild	Transducer Tip Sleeve Pore Pressure 2 X-Y Inclinometer	CPTU Z Pre 208 mV 206 mV 245 mV 2358 mV	ERO VALUES Post 204 mV 204 mV 254 mV 2354 mV	Difference -0.043 MPa -0.001 kPa 0.002 kPa	GRANULA Description Clays Silt mixtures Sand mixtures Sands Gravelly cand	AR SOILS (S SBT Index, I 2.95-3.60 2.60-2.95 2.05-2.60 1.31-2.05 <1.31	Sands & Gravels) Robertson Ic Description SPT N value Very Loose 0 - 4 Loose 4 - 10 Medium Dense 10 - 30 Dense 30 - 50	n et al. 1986 Zones NSPT Description Very Loose Loose Medium Dense Very Dense	7-10 and Zone 12 Relative Density Dr (%) 0 - 15 15 - 35 e 35 - 65 65 - 85 - 95	-	ater Test

				11. I											CPT L	OG 03
SITE	INVE	STIGATIO										Poi	ntID	06		
CLIE PRO LOCATI PROJE	NT : JECT : ION : CT №. :	Soiltechnics Lossiemout Lossiemouth 1200410	s h		EASTING NORTHING ELEVATION CHECKED BY TERMINATIO	, N REASC	: 0.0 n : 0.0 n : 0.00 : LD ON : Refu	n n m OD sal		Remai Test re	'k: ⊧fused on	tip resistan	ce. S F	SHEET STATUS FEST DATE PLOT DATE METHOD	: 1 OF 1 : Final : 19/10/2020 : 26/10/2020 : ISO 22476)) -1:2012
Depth (m) Elevation (m)	0 0 10	Corrected Cone Resistan 5 10 10 200 3 Sleeve Friction Resistan	ice, q _t (MPa) <u>15</u> 20 300 400 500 ice, f _s (kPa)	Fines Conter . R8W 98 and NCEER 2001 . Strukki et al. (1998) . Boulanger and kirtss (2014) 0 25 50	ıt, FC (%) 75 1		Undrained She = $(q_{-} \sigma_{w_0})/N_{w_0}$, when = $(q_{-} \sigma_{w_0})/N_{w_0}$, when = $(q_{-} \sigma_{w_0})/N_{w_0}$ when 100	ar Strength, s _u (k e N _e = 20 e N _e = 17.5 e N _e = 15 200	Pa)	- 1. Schmertmann78; R - 2. Mayne (2007) 12.5	Sensitivity, S _t &L86 25	37.5	1. Mayne (2 1. Mayne (2 2. Mayne (2 50 8 12	Unit Weight, Y (k 007) 007) 16	(N/m ³) 20 :	Graphic Log
	and a second								uGr (sey		 					× × × × × × × × × × × × × × × × × × ×
3-3 4-4 5-5 5-5 6-6 7-7 8-8 9-9 -9 9 9		eminated at 2.97 m iefusal 														
CONE ID CONE MO CONE ARE CONE ARE FILTER PO FILTER TY	DEL EA EA RATIO DSITION (PE	: S15-CFIP.1858 : Subtraction : 15cm ² : 0.79 : u2 : HDPE	TEST TYPE APPLICATION CLASS RIG OPERATOR FRICTION REDUCER WEATHER	: TE2 : 2 : CPT 017 - Griffen : RS : None : Raining & Mild	Transducer Tip Sleeve Pore Pressure 2 X-Y Inclinometer	CPTU ZE Pre 208 mV 206 mV 245 mV 2358 mV	RO VALUES Post 204 mV 204 mV 254 mV 2354 mV	Difference -0.043 MPa -0.001 kPa 0.002 kPa	COHESIV Term based on I Extremely low st Very low strengt Low strength	E SOILS (Clays measurement rength h	& Silts) Robe su (kPa) <10 10-20 20-40	rtson et al. 1986 Term based o Medium streng High strength Very high stre Extremely higl	5 Zones 1-6 and 2 n measurement gth ngth h strength	Zone 11 su (kPa) 40-75 75-150 150-300 >300	Ground Level	water on Test





					CPT LOG 02
SITE INVESTIGATION Working with	SOIItechnical cons			PointID	07
CLIENT : Soiltechnics PROJECT : Lossiemouth LOCATION : Lossiemouth PROJECT No. : 1200410	EAS NOI ELE CHI TEF	ASTING : 0.0 m ORTHING : 0.0 m LEVATION : 0.00 m OD HECKED BY : LD ERMINATION REASON : Refusal	Remark: Test refused on tip re	sistance. PLOT D METHC	: 1 OF 1 S : Final ATE : 19/10/2020 DATE : 26/10/2020 D : ISO 22476-1:2012
E Corrected Cone Resistance, qt (MPa) 0 5 10 15 20 0 100 200 300 400 500 0 100 200 300 400 500 0 Sleeve Friction Resistance, fs (kPa) 500 500 500	Non-normalized Soil Behaviour Ty Robertson (2010)	Type Index, I _{SST} SPT N ₀₀ 1. Rob. 8. Wride 98 2. Jeff, 8. Davies 93 3. Robertson 2012 4. 5. 0. 5. 10. 15. 20. 25. 20	Relative Density, D, (%) 1. Bald et al. (1986); Al-Homoud & Wehr (2006) 2. Jamickowski et al. (2001) 3. Kulhowy & Mayne (1990) 35. 40. 45. 50. 25. 50. 75.	Friction A 	ngle, 🍦 (deg) 1989; Mayne & Campanella (2005) 1(155) 40. 60. 80
A III E Siever FILLION RESIdentitie, f ₂ (APR) III E III E III E III E III E IIII E III E IIII E IIII E III E IIII E IIII E III E IIII E IIII E III E IIII E IIII E III E IIII E IIII E III E IIII E IIIII E III	Dense 1 0 Sands: 2 1 Dense 3 Sands: Sands:	4 5 0 5 10 15 20 25 30 A 5 0 5 10 15 20 25 30 A 5 0 5 10 1			
CONE ID : S15-CFIP.1858 TEST TYPE CONE MODEL : Subtraction APPLICATION CLASS CONE AREA : 15cm ² RIG CONE AREA RATIO : 0.79 OPERATOR FILTER POSITION : u2 FRICTION REDUCER FILTER TYPE : HDPE WEATHER	: TE2 : 2 Tran : CPT 017 - Griffen Tip : RS Slee : None Pore : Raining & Mild X-Y	CPTU ZERO VALUES ransducer Pre Post Differen p 206 mV 196 mV -0.108 leeve 204 mV 198 mV -0.004 ore Pressure 2 259 mV 215 mV -0.011 -Y Inclinometer 2771 mV 2820 mV 2015 mV	GRANULAR SOILS (Sands & Gravels) Robertson et a Description SBT Index, Ic Description SPT N value, NSPT Clays 2.95-3.60 Very Loose 0 - 4 KPa Slit Indux, res 2.60-2.95 Loose 4 - 10 Sand mixtures 2.05-2.60 Medium Dense 10 - 30 Sands 1.31-2.05 Dense 30 - 50 Gravelly sand 1.31 Very Dense 5-0	II. 1986 Zones 7-10 and Zone 12 Very Loose 0 - 15 Loose 15 - 35 Medium Dense 35 - 65 Dense 65 - 85 Very Dense 285	Groundwater Level √∭ Dissipation Test

INI C														СРТ	LOG 03
SITE INVE	STIGATIO	Working with	Solitech environmental and geotechr								Poir	ntID	07		
CLIENT : PROJECT : LOCATION : L PROJECT No. : 1	Soiltechnics Lossiemouth 200410			EASTING NORTHING ELEVATION CHECKED BY TERMINATIO	, N REASC	: 0.0 n : 0.0 n : 0.00 : LD ON : Refu	n n m OD sal		Rema Test re	rk: efused on	tip resistanc	e.	SHEET STATUS TEST DATE PLOT DATE METHOD	: 1 OF 1 : Final : 19/10/20 : 26/10/20 : ISO 2247	20 20 76-1:2012
Depth (m) (m) (m) (m) (m) (m) (m)	Corrected Cone Resistance 5 10 200 300 Sleeve Friction Resistance	e, q _t (MPa) <u>15</u> 0 400 5, f _s (kPa)	Fines Conte 1. R&W 98 and NCEER 2001 2. Suzuki et al. (1998) 3. Boulanger and Idriss (2014) 0 25 56	nt, FC (%)		Undrained She = $(q_c - \sigma_{vo})/N_{uc}$, when = $(q_c - \sigma_{vo})/N_{uc}$, when = $(q_c - \sigma_{vo})/N_{uc}$ when 100	ar Strength, s _u (kl s N _u = 20 s N _u = 17.5 s N _u = 15 200	² a)	- 1. Schmertmann78; F - 2. Mayne (2007) 12.5	Sensitivity, S _t &L86 25	37.5 5	1. Mayne (2 1. Mayne (2 2. Mayne (2	Unit Weight, Y (I Y bulk 007) 007) 007) 16	xN/m³) 20	Graphic Log
1 -1 2 -2 3 -3 4 -4 5 -5 6 -6 7 -7 8 -8 9 -9 -9 -9	rminated at 4.25 m fusal														
CONE ID : CONE MODEL : CONE AREA : CONE AREA RATIO : FILTER POSITION : FILTER TYPE :	: S15-CFIP.1858 : Subtraction : 15cm ² : 0.79 : u2 : HDPE	TEST TYPE APPLICATION CLASS RIG OPERATOR FRICTION REDUCER WEATHER	: TE2 : 2 : CPT 017 - Griffen : RS : None : Raining & Mild	Transducer Tip Sleeve Pore Pressure 2 X-Y Inclinometer	CPTU ZE Pre 206 mV 204 mV 259 mV 2771 mV	ERO VALUES Post 196 mV 198 mV 215 mV 2820 mV	Difference -0.108 MPa -0.004 kPa -0.011 kPa	COHESIVI Term based on r Extremely low str Very low strength Low strength	E SOILS (Clays neasurement rength n	& Silts) Robe su (kPa) <10 10-20 20-40	ertson et al. 1986 Term based on Medium streng High strength Very high stren Extremely high	Zones 1-6 and measurement th gth strength	Zone 11 su (kPa) 40-75 75-150 150-300 >300	-	ndwater ntion Test













					10 J	•									CF	'T LOG 02
SI	TE	INVE	STIGATI	ON Working wit	SOIICECC environmental and geotechr th:								Poir	htlD	09	
C P L(PI	RO CAT ROJE	NT : JECT : 10N : 1	Soiltechnic Lossiemouth 1200410	s th		EASTING NORTHING ELEVATION CHECKED B TERMINATIC	Y DN REASC	: 0.0 n : 0.0 n : 0.00 : LD ON : Refu	n n m OD ısal			Remark: Test refused on	tip resistanc	ce. SHEET TEST D PLOT D METHO	: 1 OF S : Final DATE : 19/10 DATE : 26/10 DD : ISO 2	1 /2020 /2020 :2476-1:2012
Depth (m)	Elevation (m)	0 0 10	Corrected Cone Resist 5 10 0 200 Sleeve Friction Resist	ance, q, (MPa) 15 2 300 400 50 ance, f _s (kPa)	Non-normalized Soil Ber Robertson	naviour Type Index, I _{SBT} n (2010)	1. Rol 2. Jef 3. Rol	S 2. & Wride 98 7. & Davies 93 pertson 2012 10. 15. 20	3PT N ₆₀	40 45 50	1. Baldi 2. Jamia 3. Kulha	Relative Density, D, (et al. (1986); Al-Homoud & Wehr (okowski et al. (2001) www & Mayne (1990)	%) 2006) 75 10	Friction A 	ungle, ∳' (deg) 1989): Mayne & Campanella a (1983))	1 (2005) Do Jitter
1 ⁻ 2 ⁻ 3		And a second sec			Denjse sand to gravelly sand Denjse sand to gravelly sand Denjse sand to gravelly sand Denjse sands to sands to sands to sands with Sand mixturgs: sily sand the sand with	Clarker and the second se						20 30				
4	-4 	Ts R 	erminated at 3.76 m efysal													
6 7																·
8	+8 +9 +9 +9															·
CC CC CC FIL FIL	DNE ID DNE MC DNE AR DNE AR TER PO	DDEL REA REA RATIO OSITION YPE	: S15-CFIP.1858 : Subtraction : 15cm ² : 0.79 : u2 : HDPE	TEST TYPE APPLICATION CLASS RIG OPERATOR FRICTION REDUCER WEATHER	: TE2 : CP : CPT 017 - Griffen : RS : None : Raining & Mild	Transducer Tip Sleeve Pore Pressure 2 X-Y Inclinometer	CPTU ZE Pre 208 mV 206 mV 244 mV 2404 mV	RO VALUES Post 199 mV 200 mV 225 mV 2394 mV	Difference -0.098 MPa -0.004 kPa -0.005 kPa	GRANULAR Description Clays Silt mixtures Sand mixtures Sands Gravelly sand	R SOILS (S SBT Index, Ic 2.95-3.60 2.60-2.95 2.05-2.60 1.31-2.05 <1.31	ands & Gravels) Roberts Description SPT N v Very Loose 0 - 4 Loose 4 - 10 Medium Dense 10 - 30 Dense 30 - 50 Very Dense 550	Son et al. 1986 Zi alue, NSPT Descrip Very Lo Loose Medium Dense	I I ones 7-10 and Zone 12 I tion Relative Density Dr (%) osse 0 - 15 15 - 35 I n Dense 35 - 65 65 - 85 anse 285	Grour	idwater ation Test

																CPT L	OG 03	
S	TE		ESTIGATIO		Solitech environmental and geotechr								Poin	itID	09			
CLIENT : Soiltechnics PROJECT: Lossiemouth LOCATION : Lossiemouth PROJECT No. : 1200410							EASTING: 0.0 mRemark:NORTHING: 0.0 mTest refused on tip						o resistanc	SHEET : 1 OF 1 esistance. STATUS : Final TEST DATE : 19/10/2020 PLOT DATE : 26/10/2020 METHOD : ISO 22476-1:2012				
Depth (m)	Elevation (m)	0	Corrected Cone Resista 5 10 1 1 1 100 200 Sleeve Friction Resista	ance, q, (MPa) 15 20 10 400 500 ance, f _s (kPa)	Fines Conte 1. R8W 98 and NCER 2001 2. Sixula et al. (1999) 3. Boulanger and Idriss (2014) 0. 25 50	nt, FC (%)		Undrained She: $\delta_{u} = (\mathbf{q}_{1} - \boldsymbol{\sigma}_{u})/N_{u}$, where $\delta_{u} = (\mathbf{q}_{1} - \boldsymbol{\sigma}_{u})/N_{u}$, where $\delta_{u} = (\mathbf{q}_{1} - \boldsymbol{\sigma}_{u})/N_{u}$, where 100	ar Strength, s _u (kl 9 N _u = 20 9 N _u = 17.5 6 N _u = 15 200	Pa)	Se 1. Schmertmann78; R&L 2. Mayne (2007) 12. 5	nsitivity, S _t 36 25	37.5 5(1. Mayne (200 1. Mayne (200 2. Mayne (200 0. 8 12	Unit Weight, Y (k	N/m³)	Graphic Log	
1		and a series of the series of															- X X X X X X X X X X X X X X X X X X X	
4 5 6 7 8 9	4 4 		Terminated at 3.76 m Refusal															
CC CC CC FII FII	DNE ID DNE M DNE AF DNE AF TER F	DDEL REA REA RATIO OSITION YPE	: S15-CFIP.1858 : Subtraction : 15cm ² : 0.79 : u2 : HDPE	TEST TYPE APPLICATION CLASS RIG OPERATOR FRICTION REDUCER WEATHER	: TE2 : 2 : CPT 017 - Griffen : RS : None : Raining & Mild	Transducer Tip Sleeve Pore Pressure 2 X-Y Inclinometer	CPTU Z Pre 208 mV 206 mV 244 mV 2404 mV	ERO VALUES Post 199 mV 200 mV 225 mV 2394 mV	Difference -0.098 MPa -0.004 kPa -0.005 kPa	COHESIVE Term based on n Extremely low str Very low strength Low strength	E SOILS (Clays & neasurement sength 1	Silts) Roberts su (kPa) T <10 N 0-20 H 0-40 V E	on et al. 1986 erm based on ledium strengt ligh strength 'ery high stren xtremely high	Zones 1-6 and Zo measurement h gth strength	su (kPa) 40-75 75-150 150-300 >300	_ य Groundv Level ग∭ Dissipatic	vater on Test	



												CPT LOG 01
SI	TE	INVESTIGAT								PointID	10	
C P LC PF	LIE RO DCATI ROJE	NT : Soiltechn JECT: Lossiemouth ON : Lossiemouth CT No. : 1200410	ics outh		EASTING NORTHING ELEVATION CHECKED BY TERMINATIO	: (: (: (: (/ : L N REASON : F	0.0 m 0.0 m 0.00 m OD .D Refusal	SHEET : 1 OF 1 STATUS : Final TEST DATE : 19/10/2020 PLOT DATE : 26/10/2020 METHOD : ISO 22476-1:/				
Depth (m)	Elevation (m)	Corrected Cone Re 0 5 10 0 0.5 1 Sleeve Friction Re 0 100 20	esistance, q, (MPa) 0 15	2 Friction Ratio, R _r (%) In Situ P Porewa 6 8 -300 0	ore Pressure, u ₀ (kPa) ter Pressure, u ₂ (kPa) 	Inclination (°) — — 1 — 0 -5 0 5 10	Pore Pressu 2 15 -0.6 -0.1 0.4	re Ratio, B _q So Rober 4 0.9 1.4 1 2 3	il Behaviour Type: tson et al. 1986 qc Rf 4 5 6 7 8 9 10 1	Bo J J J H de U J 1	ial Description
1.	+ + + + +1 +					+					X 0.40 Sentence Sente	ngth becoming high strength o clayey SILT (6) æ SAND to silty SAND (8)
2.											× · · · · · · · · · · · · · · · · · · ·	
4- 5- 6- 7- 8-	4 	Terminated at 3.31 m Refusal Image: Image and the second seco									3.31 Very dense g	raveily Sand to Sand (10)
9.												
COI COI COI COI FIL1 FIL1	IBRATIO NE MOD NE ARE NE ARE TER POS TER TYF	313-0717-1030 ON DATE : 26/07/2020 DEL : Subtraction A : 15cm ² A RATIO : 0.79 SITION : u2 DE : HDPE	APPLICATION CLASS : 2 RIG : CF OPERATOR : RS FRICTION REDUCER : No WEATHER : Ra GROUNDWATER DEPTH : As	∠ PT 017 - Griffen S one nining & Mild sumed for calculation ouroos	Transducer Tip Sleeve Pore Pressure 2 X-Y Inclinometer	CPTU ZERO VA Pre Post 206 mV 202 r 203 mV 202 r 250 mV 244 r 2483 mV 2473	LUES Difference nV -0.043 MPa nV -0.001 kPa nV -0.001 kPa mV	ME THOD: Robertson 1 - Sensitive fine grained r 2 - Organic material 3 - CLAY 4 - Silty CLAY to CLAY	et al. 1986 qc Rf material 5 - Clayey SILT to silt 6 - Sandy SILT to cla 7 - Silty SAND to sint SAN	y CLAY 9 - 5 yey SILT 10 - dy SILT 11 - 10 12 -	SAND Gravelly SAND to SAND Very stiff fine grained SAND to clayey SAND	Groundwater Level I Dissipation Test

	SITI		210 - L										CPT	LOG 02
SITE INV	ESTIGATIC	Working with	SOIICECN environmental and geotechni								PointID	1	0	
CLIENT PROJECT LOCATION PROJECT No.	: Soiltechnics : Lossiemouth : Lossiemouth : 1200410	EASTING: 0.0 mRemark:NORTHING: 0.0 mTest refused on tip resELEVATION: 0.00 m ODCHECKED BY: LDTERMINATION REASON: Refusal						resistance.	SHEET : 1 OF 1 STATUS : Final TEST DATE : 19/10/2020 PLOT DATE : 26/10/2020 METHOD : ISO 22476-1:201					
Depth (m)	Corrected Cone Resistanc 5 10 1 1 1 100 200 30 Sleeve Friction Resistance	e, q, (MPa) 15	Non-normalized Soil Beha Robertson	iviour Type Index, I _{set} (2010)	1. R 2. J 3. R	S tob. & Wride 98 eff. & Davies 93 tobertson 2012	PT N ₆₀	40 45 50	1. Bald 2. Jami 3. Kulh	Relative Density, D, (%) il et al. (1986); Al-Homoud & Wehr (2006) idexovaki et al. (2011) awy & Mayne (1990) 25. 50.	75 100 0	Friction Angl 1. Senneset et al. (1988 & 1986 2. Robertson & Campanella (19 3. Kulhawy & Mayne (1990) 20. 40	e, \$ ' (deg))); Mayne & Campanella (2005) 83)	6 Graphic Log
	Sleeve Friction Resistance	e, f _s (kPa)	0 1 2 pues di la constructione di pues di si constructione di pues di	3 4 Itimuxtures: clayed, silly clay lifts sintex sill silly clay lifts silly clay lifts silly clay l								20 40		
CONE ID CONE MODEL CONE AREA CONE AREA RATIO FILTER POSITION FILTER TYPE	: S15-CFIP.1858 : Subtraction : 15cm ² : 0.79 : u2 : HDPE	TEST TYPE APPLICATION CLASS RIG OPERATOR FRICTION REDUCER WEATHER	: TE2 : 2 : CPT 017 - Griffen : RS : None : Raining & Mild	Transducer Tip Sleeve Pore Pressure 2 X-Y Inclinometer	CPTU Z Pre 206 mV 203 mV 250 mV 2483 mV	ERO VALUES Post 202 mV 202 mV 244 mV 2473 mV	Difference -0.043 MPa -0.001 kPa -0.001 kPa	GRANULAR Description Clays Silt mixtures Sand mixtures Sands Gravelly sand	R SOILS (S SBT Index, ld 2.95-3.60 2.60-2.95 2.05-2.60 1.31-2.05 <1.31	Sands & Gravels) Robertson c Description SPT N value, 1 Very Losse 0 - 4 1 Losse 4 - 10 Medium Dense 10 - 30 Dense 30 - 50 Very Dense 30 - 50	et al. 1986 Zones 7-1 NSPT Description Very Loose Loose Medium Dense Dense Very Dense	0 and Zone 12 Relative Density Dr (%) 0 - 15 15 - 35 35 - 65 65 - 85 >85	Groundwa Level ≝∭Dissipation	ater Test

			21. I											CPT L	-OG 03
SITE	INVESTIGATIO	DN Working with									Point	tID	10		
CLIENT : Soiltechnics PROJECT : Lossiemouth LOCATION : Lossiemouth PROJECT No. : 1200410					EASTING:0.0 mNORTHING:0.0 mELEVATION:0.00 m ODCHECKED BY:LDTERMINATION REASON:Refusal				Remark: Test refused on tip resistance.			e. SI TI PI M	SHEET : 1 OF 1 STATUS : Final TEST DATE : 19/10/2020 PLOT DATE : 26/10/2020 METHOD : ISO 22476-1:2012		
Depth (m) Elevation (m)	Corrected Cone Resistant 0 5 10 0 100 200 3 Sleeve Friction Resistant	ce, q _t (MPa) 1520 00 400500 ce, f _s (kPa)	Fines Conter 1. R&W 99 and NCECR 2001 2. Suzuki et al. (1996) 3. Boulanger and Idriss (2014) 0 25 50	- t, FC (%) 75 1	LB. s BE. s UB. s	Undrained She $u_{\mu} = (\mathbf{q} - \boldsymbol{\sigma}_{\mu\nu})/N_{\mu\nu}$, where $u_{\mu} = (\mathbf{q} - \boldsymbol{\sigma}_{\mu\nu})/N_{\mu\nu}$, where $u_{\mu\nu} = (\mathbf{q} - \boldsymbol{\sigma}_{\mu\nu})/N_{\mu\nu}$, where 100	ar Strength, s _u (k e N _e = 20 e N _e = 17.5 e N _e = 15 200	Pa)	Sensi 1. Schmertmann78; R&L86 2. Mayne (2007) 12.5	tivity, S _t 25 3	7.5 50	1. Mayne (200 1. Mayne (200 2. Mayne (200 8 12	Unit Weight, γ (k	:N/m³) 20	Graphic Log
						H H H H H H H H H H H H H H H H H H H									× × · · · · · · · · · · · · · · · · · ·
44 55 66 77 88 99 9	Terminated at 3.31 m Refusal I														
CONE ID CONE MO CONE ARI CONE ARI FILTER PO FILTER TY	: S15-CFIP.1858 DEL : Subtraction EA : 15cm ² EA RATIO : 0.79 SOTION : u2 /PE : HDPE	TEST TYPE APPLICATION CLASS RIG OPERATOR FRICTION REDUCER WEATHER	: TE2 : 2 : CPT 017 - Griffen : RS : None : Raining & Mild	Transducer Tip Sleeve Pore Pressure 2 X-Y Inclinometer	CPTU Z8 Pre 206 mV 203 mV 250 mV 2483 mV	ERO VALUES Post 202 mV 202 mV 202 mV 244 mV 2473 mV	Difference -0.043 MPa -0.001 kPa -0.001 kPa	COHESIVE Term based on m Extremely low stree Very low strength Low strength	SOILS (Clays & Si leasurement su ength <10 10- 20-	ts) Robertsor (kPa) Tei 0 Me 20 Hig 40 Ve Ext	et al. 1986 Z m based on i dium strength h strength ry high streng remely high s	Zones 1-6 and Zo measurement n yth strength	ne 11 su (kPa) 40-75 75-150 150-300 >300	Ground Level ⊮∭Dissipati	lwater on Test














CPT LOG 02









CPT LOG 02

		·	112 1									CPT LO	DG 03
SITE	INVESTIGAT									PointID	13		
CLIE PRO LOCAT PROJE	NT : Soiltechn JECT: Lossiemo ION : Lossiemouth CT No. : 1200410	ics outh		EASTING NORTHING ELEVATION CHECKED B TERMINATIC	Y DN REASO!	: 0.0 m : 0.0 m : 0.00 m OD : LD N : Refusal		Remark: Test refus	sed on tip resi	stance. S F N	SHEET STATUS EST DATE PLOT DATE METHOD	: 1 OF 1 : Final : 19/10/2020 : 26/10/2020 : ISO 22476-	1:2012
Depth (m) Elevation (m)	Corrected Cone Re 0 5 10 0 100 200 Sleeve Friction Re	sistance, q, (MPa)) 15	Fines Conte 1. R&W 98 and NCEER 2001 2. Suzuki et al. (1998) 3. Boulanger and Idriss (2014) 0 25 50	nt, FC (%)	U LB. s ₀ = BE. s ₀ = UB. s ₀ = 100 0	Indrained Shear Strength $(q_1 - q_{e_1})N_{q_1}$ where $N_{q_1} = 20$ $(q_1 - q_{e_1})N_{q_2}$ where $N_{q_1} = 17.5$ $(q_1 - q_{e_1})N_{q_2}$ where $N_{q_2} = 15$ 100	s _u (kPa)	Sensit <u>1. Schmertmann78; R&L86</u> 2. Mayne (2007) 12.5	tivity, S _t 25 37.5	1. Mayne (2) 1. Mayne (2) 2. Mayne (2) 50 8 12	Unit Weight, Y (kN 007) 007) 16	//m ³) 20 24	6 Graphic Log
$ \begin{array}{c} $	Terminated at 5.52 m Refusal												
CONE ID CONE MO CONE ARI CONE ARI FILTER PO FILTER TY	: S15-CFIP.1858 DEL : Subtraction EA : 15cm ² EA RATIO : 0.79 SITION : U2 'PE : HDPE	TEST TYPE APPLICATION CLASS RIG OPERATOR FRICTION REDUCER WEATHER	: TE2 : 2 : CPT 017 - Griffen : RS : None : Raining & Mild	Transducer Tip Sleeve Pore Pressure 2 X-Y Inclinometer	CPTU ZER Pre 206 mV 203 mV 245 mV 2675 mV	O VALUES Post Differer 193 mV -0.141 1 196 mV -0.005 1 208 mV -0.009 1 2681 mV	COHES Term based o IPa Extremely low Pa Very low stren Low strength	IVE SOILS (Clays & Sil n measurement su strength <10 gth 10-7 20-4	Its) Robertson et al (kPa) Term ba 0 Medium 20 High stru 40 Very hig Extreme	. 1986 Zones 1-6 and 2 sed on measurement strength ength h strength ly high strength	Zone 11 su (kPa) 40-75 75-150 150-300 >300	Groundwa Level [.] "∭ Dissipation	ater า Test





				CPT LOG 02
SITE INVESTIGATION Working with:	BOIITECHNICS	5	Point	^{ID} 14
CLIENT : Soiltechnics PROJECT : Lossiemouth LOCATION : Lossiemouth PROJECT No. : 1200410	EASTING NORTHIN ELEVATIO CHECKED TERMINA	NG : 0.0 m HING : 0.0 m TION : 0.00 m OD KED BY : LD NATION REASON : Refusal	Remark: Test refused on tip resistance	SHEET : 1 OF 1 STATUS : Final TEST DATE : 19/10/2020 PLOT DATE : 26/10/2020 METHOD : ISO 22476-1:2012
E G Corrected Cone Resistance, qi (MPa) 0 5 10 15 20 0 100 200 300 400 500 0 100 200 300 400 500 0 Sleeve Friction Resistance, fi (kPa) 0 0 0 0	Non-normalized Soil Behaviour Type Index, Robertson (2010)	SPT N ₈₀ 	Relative Density, D, (%) ald et al. (1996); Al-Homoud & Wehr (2006) minicioxyki et al. (2011) ulhawy & Mayne (1990) 25 50 75 100	Friction Angle, (deg) Operating Operating
u u	1 2 3 4 1 2 3 4 1 2 3 4 1 2 3 4 1 2 3 4 1 2 3 4 1 3 4 4 1 3 4 4 1 4 4 4 1 1 4 4 1 1 4 4 1 1 4 4 1 1 4 4 1 1 1 4 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 <td></td> <td></td> <td></td>			
CONE ID: \$15-CFIP.1858TEST TYPE: TE2CONE MODEL: SubtractionAPPLICATION CLASS: 2CONE AREA: 15cm²RIG: CPCONE AREA RATIO: 0.79OPERATOR: RSFILTER POSITION: u2FRICTION REDUCER: NoFILTER TYPE: HDPEWEATHER: Ra	E2 Transducer CPT 017 - Griffen Tip SS Sleeve Jone Pore Pressur taining & Mild X-Y Inclinome	CPTU ZERO VALUES GRANULAR SOILS er Pre Post Difference Carso Still Inductor 202 mV 193 mV -0.098 MPa Carso 2.095.36 Still Inductor Carso 2.02.37 Still Inductor 2.02.67.26 Still Inductor 2.02.67.26 Still Inductor 2.05.26 Still Inductor Still Inductor 2.05.26 Still Inductor 2.05.26 Still Inductor Still Inductor Still Inductor 2.05.26 Still Inductor Still I	(Sands & Gravels) Robertson et al. 1986 Zor k, lc Description SPT N value, NSPT Description v Very Loss 0 - 4 Very Loss c Losse 4 - 10 Losse Medium Dense 10 - 30 Medium ID Dense Dense 30 - 50 Dense Very Loss	Second State Groundwater n Relative Density Dr (%) de 0 - 15 15 - 35 Level Dense 35 - 65 65 - 85 4III Dissipation Test

															CPT I	_OG 03
SIT	EINV	ESTIGATIC	Working with									Pointl	D	14		
CL PR LOC PRC	IENT OJECT ATION DJECT No.	: Soiltechnics : Lossiemouth : Lossiemouth : 1200410	1		EASTING NORTHING ELEVATION CHECKED BY TERMINATIO	Y N REASC	: 0.0 n : 0.0 n : 0.00 : LD ON : Refu	n n m OD sal		Remark: Test refuse	d on tip r	esistance.	. SF S ⁻ TE PL M	HEET TATUS EST DATE LOT DATE ETHOD	: 1 OF 1 : Final : 19/10/202 : 26/10/202 : ISO 22476	0 0 6-1:2012
Depth (m)	(m) 0	Corrected Cone Resistance 5 10 100 200 30 Sleeve Friction Resistance	e, q _t (MPa) 1520 00500 e, f _s (kPa)	Fines Conten 1. R&W 98 and NCEER 2001 2. Suzuki et al. (1998) 3. Boulanger and Idriss (2014) 0 25 50	ıt, FC (%) 75 1	LB. s. BE. s. UB. s	Undrained She $_{u} = (\mathbf{q} - \sigma_{w})/N_{u}$, wher $_{u} = (\mathbf{q} - \sigma_{w})/N_{u}$, wher $_{u} = (\mathbf{q} - \sigma_{w})/N_{u}$, where 100	ar Strength, s _u (kl e N _u = 20 e N _u = 17.5 e N _u = 15 200	2a)1 2 300 0	Sensitiv Schmertmann78; R&L86 Mayne (2007) 12.5 25	ity, S _t 37.	5 50 8	1. Mayne (2007 1. Mayne (2007 2. Mayne (2007 8 12	Unit Weight, Y (kN	I/m³) 20	Graphic Log
	1 2 3 4 5 6 7 7 8 9 9	Terminated at 5.44 m Refusal														
CONE CONE CONE CONE	ID MODEL AREA AREA RATIO	: S15-CFIP.1858 : Subtraction : 15cm ² : 0.79 : u2	TEST TYPE APPLICATION CLASS RIG OPERATOR ERICTION REDUCED	: TE2 : 2 : CPT 017 - Griffen : RS : None	Transducer Tip Sleeve Pore Pressure 2	CPTU ZE Pre 202 mV 201 mV 226 mV	ERO VALUES Post 193 mV 196 mV 214 mV	Difference -0.098 MPa -0.004 kPa	COHESIVE S Term based on me Extremely low strength Low strength	SOILS (Clays & Silts easurement su (k ngth <10 10-20 20,40) Robertson e Pa) Tern Med High	et al. 1986 Zo n based on m ium strength strength	ones 1-6 and Zo leasurement	su (kPa) 40-75 75-150	- Ground Level	lwater
FILTE	R TYPE	: HDPE	WEATHER	: Raining & Mild	X-Y Inclinometer	2889 mV	2908 mV	0.000 10 0	2011 Outongui	20-40	Extre	emely high st	rength	>300	In Dissipat	





							CPT LOC	G 02
SITE INVESTIGATION Workir	solitech environmental and geotechn ng with:				Po	intID	15	
CLIENT : Soiltechnics PROJECT : Lossiemouth LOCATION : Lossiemouth PROJECT No. : 1200410		EASTING NORTHING ELEVATION CHECKED BY TERMINATION F	: 0.0 m : 0.0 m : 0.00 m OD : LD REASON : Refusal	Rem Test	ark: refused on tip resistar	SHEET STATUS TEST D PLOT D METHO	: 1 OF 1 : Final ATE : 19/10/2020 ATE : 26/10/2020 D : ISO 22476-1:24	012
E Corrected Cone Resistance, q, (MPa) 0 5 10 15 0 100 200 300 400 0 100 200 300 400 0 Sleeve Friction Resistance, f, (kPa) 5 10 10	20 Non-normalized Soil Beh Robertson	(2010)	SPT N ₆₀ — 1. Rds. 8. Wride 98 — 2. Jeff. 8. Davies 93 — 3. Robertson 2012 0. 5. 10. 15. 20. 25. 30. 35. 40.	45 50 0 25	ative Density, D, (%) 3); Al-Homoud & Wehr (2006) al. (2001) 50. 75	Friction Ar 1. Senseet et al. (1988 & 1 2. Robertson's Campanella 3. Kulhawy & Meyne (1990) 100, 0 20	rgle, ∳'(deg) 989): Mayne & Campanella (2005) (1963)	Graphic Log
1 -1 1 -1 2 -2 3 -3 4 -4 5 -5 6 -6 7 -7 8 -8 9 -9 -9 -9	Derise sand to gravely sand Several terms of the sand to gravely sand Several terms of the sand to gravely sand	Slitt mixtures: clayery slitt& slitty clay						
CONE ID : S15-CFIP.1858 TEST TYPE CONE MODEL : Subtraction APPLICATION CONE AREA : 15cm² RIG CONE AREA RATIO : 0.79 OPERATOR FILTER POSITION : u2 FRICTION REE FILTER TYPE : HDPE WEATHER	: TE2 CLASS : 2 : CPT 017 - Griffen : RS UCER : None : Raining & Mild	Transducer Pr Tip 20 Sleeve 20 Pore Pressure 2 23 X-Y Inclinometer 23	CPTU ZERO VALUES GR re Post Difference 02 mV 196 mV -0.065 MPa 01 mV 196 mV -0.004 kPa 32 mV 240 mV 0.002 kPa 373 mV 2378 mV -0.05 MPa	ANULAR SOILS (Sands & ion SBT Index, Ic Descr 2.95-3.60 Very I ures 2.60-2.95 Loose xtures 2.05-2.60 Mediu 1.31-2.05 Denser Sand	Gravels) Robertson et al. 1986 (ption SPT N value, NSPT Desc. 0.006 0 - 4 Very 0 4 - 10 Loos um Dense 10 - 30 Med a 30 - 50 Dem	Zones 7-10 and Zone 12 ription Relative Density Dr (%) Loose 0 - 15 e 15 - 35 um Dense 35 - 65 se 65 - 85 Dense >85	Groundwater Level ⅆ∭Dissipation Test	

	1	_	CPT LOG 03
SITE INVESTIGATION Working with:	CCNNICS	P	ointID 15
CLIENT : Soiltechnics PROJECT : Lossiemouth LOCATION : Lossiemouth PROJECT No. : 1200410	EASTING : 0.0 m NORTHING : 0.0 m ELEVATION : 0.00 m OD CHECKED BY : LD TERMINATION REASON : Refusal	Remark: Test refused on tip resista	SHEET : 1 OF 1 STATUS : Final TEST DATE : 19/10/2020 PLOT DATE : 26/10/2020 METHOD : ISO 22476-1:2012
E Corrected Cone Resistance, q, (MPa) 1, R8W 98 and 0 5 10 15 20 1, R8W 98 and 0 5 10 15 20 2, Standi et al. 0 100 200 300 400 500 3, Boulanger at 0 Sleeve Friction Resistance, f, (kPa) 0 25 25	Fines Content, FC (%) Undrained Shear Strength, s _u (kPa) INCEER 2001 (1999) di briss (2014) LB, s _p = (q, - ♥_w)N _w where N _v = 20 BE, s _p = (q, -♥_w)N _w where N _v = 15 50 75 100 0 100 200	Sensitivity, St 	Unit Weight, Y (kN/m ³)
1 1 2 2 3 3 4 4 5 5 6 6 Terminated at 5.99 m Refusal 7 7 8 8 9 9			
CONE ID : \$15-CFIP.1858 TEST TYPE : TE2 CONE MODEL : Subtraction APPLICATION CLASS : 2 CONE AREA : 15cm ² RIG : CPT 017 - Gril CONE AREA RATIO : 0.79 OPERATOR : RS FILTER POSITION : u2 FRICTION REDUCER None FILTER TYPE : HDPE WEATHER : Raining & Milc	CPTU ZERO VALUES Term 1 Transducer Pre Post Difference Term 1 Tip 202 mV 196 mV -0.065 MPa Extrem Sleeve 201 mV 196 mV -0.004 kPa Very k Pore Pressure 2 232 mV 240 mV 0.002 kPa Low st X-Y Inclinometer 2373 mV 2378 mV 2378 mV Low st	COHESIVE SOILS (Clays & Silts) Robertson et al. 19 pased on measurement nely low strength su (kPa) Term based Medium strength Term based Medium strength 10-20 High strengty Very high st Extremely h	186 Zones 1-6 and Zone 11 ✓ Groundwater 1 on measurement su (kPa) angth 40-75 th 75-150 rength 150-300 igh strength >300







											_			СРТ	LOG 03
SITE		ESTIGATIO										PointID	10	6	
CLI PRO LOCA PRO	ENT DJECT ATION JECT No.	: Soiltechnics : Lossiemout : Lossiemouth : 1200410	s h		EASTING NORTHING ELEVATION CHECKED BY TERMINATIO	, N REASC	: 0.0 n : 0.0 n : 0.00 : LD ON : Refu	n n m OD sal		Remark: Test refused o	on tip resis	stance.	SHEET STATUS TEST DAT PLOT DAT METHOD	: 1 OF 1 : Final E : 20/10/2 E : 26/10/2 : ISO 224	020 020 176-1:2012
Depth (m) Elevation	0 0 Ē	Corrected Cone Resistan 5 10 100 200 3 Sleeve Friction Resistan	ice, q _t (MPa) 15 20 10 400 500 ice, f _s (kPa)	Fines Conter 1. R&W 98 and NCEER 2001 2. Suzuki et al. (1998) 3. Boulanger and Idriss (2014) 0 25 50	ıt, FC (%) 75 1		Undrained She = $(q_c - \sigma_{wc})/N_{uc}$, when = $(q_c - \sigma_{wc})/N_{uc}$, when = $(q_c - \sigma_{wc})/N_{uc}$, when 100	ar Strength, s _u (kl e N _u = 20 e N _u = 17.5 e N _u = 15 200	Pa)12.	Sensitivity, S Schmertmann78; R&L86 Mayne (2007) 12.5 25	St 37.5	1. May 1. May 2. May	Unit Weight, 1 he (2007) he (2007) he (2007) 12 16	r (kN/m ³) ^{bulk} 20	Graphic Log
		Terrhinated at 4.66 m Refusal													
CONE I CONE I CONE / CONE / FILTER FILTER	D MODEL AREA AREA RATIO POSITION TYPE	: S15-CFIP.1858 : Subtraction : 15cm ² : 0.79 : u2 : HDPE	TEST TYPE APPLICATION CLASS RIG OPERATOR FRICTION REDUCER WEATHER	: TE2 : 2 : CPT 017 - Griffen : RS : None : Raining & Mild	Transducer Tip Sleeve Pore Pressure 2 X-Y Inclinometer	CPTU ZE Pre 206 mV 203 mV 262 mV 2554 mV	RO VALUES Post 201 mV 202 mV 231 mV 2535 mV	Difference -0.054 MPa -0.001 kPa -0.008 kPa	COHESIVE S Term based on me Extremely low strer Very low strength Low strength	SOILS (Clays & Silts) Ro asurement su (kPa) ngth <10	bertson et al. Term bas Medium s High stre Very high Extremely	1986 Zones 1-6 an eed on measureme strength ngth n strength y high strength	nd Zone 11 Int su (kPa) 40-75 75-150 150-300 >300	Grou ∠ Leve	undwater el pation Test





														C	PT LO	G 02
SITE INVE	ESTIGATIC	Working with	Solitech									PointID		17		
CLIENT : PROJECT : LOCATION : PROJECT No. :	Soiltechnics Lossiemouth Lossiemouth 1200410	١		EASTING NORTHING ELEVATION CHECKED B TERMINATIC	Y DN REAS(: 0.0 : 0.0 : 0.00 : LD ON : Refu	m m) m OD usal			Remark: Test refuse	d on tip resi	stance.	SHEET STATU TEST I PLOT I METHO	: 1 (S : Fin DATE : 20/ DATE : 26/ DD : ISC)F 1 al 10/2020 10/2020) 22476-1:	2012
Depth (m) Elevation (m) 0	Corrected Cone Resistant 5 10 100 200 30 Sleeve Friction Resistant	ze, q _t (MPa) 15 - 20 100 400 - 500 ze, f _s (kPa)	Non-normalized Soil Beha Robertson 0 1 2	aviour Type Index, I _{SBT} (2010) 3 4	1. Ro 2. Je 3. Ro 5 0 5	bb. & Wride 98 ff. & Davies 93 bbertson 2012 10 15 20	SPT N ₆₀ 25 30 35	40 45 50	1. Bald 2. Jam 3. Kulh	Relative Dens ii et al. (1986); Al-Homoud iolkowski et al. (2001) hawy & Mayne (1990) 25 50	sity, D _r (%) & & Wehr (2006) 75	100 0	Friction . - 1. Semesset et al. (1988 & - 2. Robertson & Campanel - 3. Kulhawy & Mayne (199 20	Angle, \equiv (deg) 1989): Mayne & Camp: a (1983))) 40 6	unella (2005) 0 80	Graphic Log
			Dense sand to gravely sand Sands, rear sands to gravely sand Sands, rear sands to gravely sup	Silt mixtures: claye's slift & slifty day Clays: clayer positiy day Clays: clayer positiy day Clays: clayer of the day Clayer of the								A A A A A A A A A A A A A A A A A A A				000000000000000000000000000000000000000
	Terminated at 3.10 m Refusal															
CONE ID CONE MODEL CONE AREA CONE AREA RATIO FILTER POSITION FILTER TYPE	: S15-CFIP.1858 : Subtraction : 15cm ² : 0.79 : u2 : HDPE	TEST TYPE APPLICATION CLASS RIG OPERATOR FRICTION REDUCER WEATHER	: TE2 : 2 : CPT 017 - Griffen : RS : None : Raining & Mild	Transducer Tip Sleeve Pore Pressure 2 X-Y Inclinometer	CPTU ZI Pre 207 mV 205 mV 252 mV 2422 mV	ERO VALUES Post 205 mV 207 mV 241 mV 2496 mV	Difference -0.022 MPa 0.001 kPa -0.003 kPa	GRANUL/ Description Clays Silt mixtures Sand mixtures Sands Gravelly sand	AR SOILS (S SBT Index, k 2.95-3.60 2.60-2.95 2.05-2.60 1.31-2.05 <1.31	Cands & Gravels) C Description Very Loose Loose Medium Dense Dense Very Dense	Robertson et al. SPT N value, NSPT 0 - 4 4 - 10 10 - 30 30 - 50	1986 Zones 7 Description Very Loose Loose Medium Dense Dense Very Dense	7-10 and Zone 12 Relative Density Dr (%) 0 - 15 15 - 35 35 - 65 65 - 85 >85	Gra Le*	oundwater /el sipation Test	

			112 1											CPT L	.OG 03
SITE	INVESTIGATIO	DN Working with									Po	intID	17		
CLIEN PROJ LOCATI PROJEC	NT : Soiltechnics JECT: Lossiemout ON : Lossiemouth CT No. : 1200410	i h		EASTING NORTHING ELEVATION CHECKED BY TERMINATIO	, N REASC	: 0.0 m : 0.0 m : 0.00 r : LD ON : Refus	m OD		Remar Test re	k: fused on	tip resistar	nce. S F N	SHEET STATUS EST DATE PLOT DATE METHOD	: 1 OF 1 : Final : 20/10/2020 : 26/10/2020 : ISO 22476)) i-1:2012
Depth (m) Elevation (m)	Corrected Cone Resistan 0 5 10 0 100 200 3 Sleeve Friction Resistan	ce, q _t (MPa) 15 20 100 400 500 ce, f _s (kPa)	Fines Contel I. R&W 98 and NCEER 2001 2. Suzuki et al. (1998) 3. Boulanger and Idriss (2014) 0 25 50	nt, FC (%) 75 11	UB. s _u UB. s _u UB. s _a	Undrained Shea = $(\mathbf{q}_{-} \bullet_{\infty})/N_{\text{st}}$, where = $(\mathbf{q}_{-} \bullet_{\infty})/N_{\text{st}}$, where = $(\mathbf{q}_{-} \bullet_{\infty})/N_{\text{st}}$, where 100	r Strength, s _u (kl N _g = 20 N _g = 17.5 N _g = 15 200	Pa)	\$ 1. Schmertmann78; R 2. Mayne (2007) 12.5	Sensitivity, S _t 8L86 25	37.5	1. Mayne (20 1. Mayne (20 2. Mayne (20 50 8 12	Unit Weight, Y (k 	W/m³) 20	Graphic Log
						Hgh									
3 	Terminated at 3.10 m Refusal Image: Image of the second														
CONE ID CONE MOI CONE ARE CONE ARE FILTER PO FILTER TY	: S15-CFIP.1858 DEL : Subtraction EA : 15cm ² EA RATIO : 0.79 SITION : u2 PE : HDPE	TEST TYPE APPLICATION CLASS RIG OPERATOR FRICTION REDUCER WEATHER	: TE2 : 2 : CPT 017 - Griffen : RS : None : Raining & Mild	Transducer Tip Sleeve Pore Pressure 2 X-Y Inclinometer	CPTU ZE Pre 207 mV 205 mV 252 mV 2422 mV	RO VALUES Post 205 mV 207 mV 241 mV 2496 mV	Difference -0.022 MPa 0.001 kPa -0.003 kPa	COHES Term based o Extremely low Very low strer Low strength	SIVE SOILS (Clays on measurement / strength ngth	& Silts) Rober su (kPa) <10 10-20 20-40	rtson et al. 198 Term based o Medium stren High strength Very high stre Extremely hig	6 Zones 1-6 and 2 on measurement ligth ength ih strength	Zone 11 su (kPa) 40-75 75-150 150-300 >300	-	water on Test





															(CPT LC)G 02
SIT		STIGATIC	Working with	SOIICECN environmental and geotechn									PointID		18		
CL PF LOC PR	LIENT : ROJECT : CATION : DJECT No. :	Soiltechnics Lossiemouth Lossiemouth 1200410	ו		EASTING NORTHING ELEVATION CHECKED B TERMINATIC	Y DN REAS	: 0.0 : 0.0 : 0.00 : LD ON : Refi	m m) m OD usal			Remark: Test refused	d on tip resi	stance.	SHEE STATU TEST PLOT METH	T : 1 JS : Fir DATE : 20 DATE : 26 OD : IS0	OF 1 al (10/2020 (10/2020 O 22476-1:	:2012
Depth (m)	Elevation (m) 0	Corrected Cone Resistance 5 10 1 1 00 200 30 Sleeve Friction Resistance	20, q _t (MPa) 15 20 00 400 500 20, f _s (kPa)	Non-normalized Soil Beh Robertson	aviour Type Index, I _{SBT} (2010) 	1. Rr 2. Je 3. Rr	xb. & Wride 98 ff. & Davies 93 xbertson 2012	SPT N ₆₀	40 45 50	1. Baldi 2. Jami 3. Kulhi	Relative Dens i et al. (1986); Al-Homoud iolkowski et al. (2001) awy & Mayne (1990) 25 50	ity, D _r (%) & Wehr (2006) 75	100 0	Frictior 1. Senneset et al. (1988 2. Robertson & Campan 3. Kulhawy & Mayne (19 20	a Angle, ∳' (deg) & 1989): Mayne & Camp ella (1983) 90) 40	anella (2005) 50 80	Graphic Log
		Terminated at 2.96 m Refusal		Dense sand to gravely sand Dense sand to gravely sand Bands to sinty and sand	A Silit Asily clay Image: Silit Asily clay Silit Asily clay I												
CON CON CON FILTI FILTI	E ID E MODEL E AREA E AREA RATIO ER POSITION ER TYPE	: S15-CFIP.1858 : Subtraction : 15cm ² : 0.79 : u2 : HDPE	TEST TYPE APPLICATION CLASS RIG OPERATOR FRICTION REDUCER WEATHER	: TE2 : 2 : CPT 017 - Griffen : RS : None : Raining & Mild	Transducer Tip Sleeve Pore Pressure 2 X-Y Inclinometer	CPTU Z Pre 201 mV 202 mV 237 mV 2333 mV	ERO VALUES Post 206 mV 205 mV 240 mV 2338 mV	5 Difference 0.054 MPa 0.002 kPa 0.001 kPa	GRANULA Description Clays Silt mixtures Sand mixtures Sands Gravelly sand	AR SOILS (S SBT Index, Io 2.95-3.60 2.60-2.95 2.05-2.60 1.31-2.05 <1.31	Cands & Gravels) F C Description Very Loose Loose Medium Dense Dense Very Dense	Robertson et al. SPT N value, NSPT 0 - 4 4 - 10 10 - 30 30 - 50 50	1986 Zones Description Very Loose Loose Medium Dense Dense Very Dense	7-10 and Zone 12 Relative Density Dr (% 0 - 15 15 - 35 35 - 65 65 - 85 >85	Gi Le · - III Dis	oundwater vel sipation Test	i.

				21. I											CPT L	OG 03
SITE	INVE	STIGATIO	DN Working with									Poi	ntID	18		
CLIE PRO LOCATI PROJEC	NT : JECT : ION : CT No. :	Soiltechnics Lossiemouth Lossiemouth 1200410	n		EASTING NORTHING ELEVATION CHECKED BY TERMINATIO	, N REASO	: 0.0 r : 0.0 r : 0.00 : LD ON : Refu	n n m OD sal		Remar Test re	ˈkː efused on	tip resistan	ce. S T P M	HEET TATUS EST DATE LOT DATE IETHOD	: 1 OF 1 : Final : 20/10/2020 : 26/10/2020 : ISO 22476-	-1:2012
Jepth (m) Elevation m)	0	Corrected Cone Resistant 5 10 1 200 3 Sleeve Friction Resistant	ce, q _t (MPa) 1520 10 400500 ce, f _s (kPa)	Fines Conter 1. R&W 98 and NCEER 2001 2. Suzuki et al. (1996) 3. Boulanger and Idriss (2014)	tt, FC (%)	LB. s BE. s UB. s	Undrained She $u = (q_{1} - \sigma_{u_{0}})/N_{u_{0}}$, wher $u = (q_{2} - \sigma_{u_{0}})/N_{u_{0}}$, wher $u_{0} = (q_{1} - \sigma_{u_{0}})/N_{u_{0}}$, where 100	ar Strength, s _u (k e N _u = 20 e N _u = 17.5 e N _u = 15	Pa)	- 1. Schmertmann78; R - 2. Mayne (2007)	Sensitivity, S _t &L86	27.6	1. Mayne (20 1. Mayne (20 2. Mayne (20	Unit Weight, Y (k Y bulk Y bulk 	N/m ³)	Graphic Log
	and a															
		Implicated at 2.96 m rempirated at 2.96 m Implicated at 2.96 m														
	-					+ + +			+					· 		-
CONE ID CONE MO	DEL	: S15-CFIP.1858 : Subtraction	TEST TYPE APPLICATION CLASS	: TE2 : 2	Transducer	CPTU ZE Pre	ERO VALUES Post	Difference	COHESIV	E SOILS (Clays	& Silts) Robe su (kPa)	rtson et al. 1986 Term based or	Zones 1-6 and Z	one 11 su (kPa)	Groundv	vater
CONE ARE CONE ARE FILTER PC FILTER TY	EA EA RATIO OSITION (PE	: 15cm ² : 0.79 : u2 : HDPE	RIG OPERATOR FRICTION REDUCER WEATHER	: CPT 017 - Griffen : RS : None : Raining & Mild	Tip Sleeve Pore Pressure 2 X-Y Inclinometer	201 mV 202 mV 237 mV 2333 mV	206 mV 205 mV 240 mV 2338 mV	0.054 MPa 0.002 kPa 0.001 kPa	Extremely low st Very low strength	rength h	<10 10-20 20-40	Medium strengt High strength Very high stren Extremely high	ngth ngth	40-75 75-150 150-300 >300	Level 베 Dissipatio	n Test





	SITI			•							,			CP	T LOG 02
SITE INV	ESTIGATIC	DN Working with	SOIICECN environmental and geotechni									PointID		19	
CLIENT PROJECT LOCATION PROJECT No.	: Soiltechnics T: Lossiemouth : Lossiemouth : 1200410	า		EASTING NORTHING ELEVATION CHECKED B' TERMINATIC	Y IN REASC	: 0.0 r : 0.0 r : 0.00 : LD ON : Refu	n n ⊢m OD usal			Remark: Test refuse	d on tip resi	stance.	SHEET STATUS TEST D PLOT D METHO	: 1 OF S : Final ATE : 20/10/ ATE : 26/10/ D : ISO 22	1 2020 2020 2476-1:2012
Depth (m) Elevation (m) 0 0	Corrected Cone Resistanc 5 10 100 200 3/ Sleeve Friction Resistanc	ze, q _t (MPa) 15	Non-normalized Soil Beha Robertson	aviour Type Index, I _{SBT} (2010)		5. & Wride 98 f. & Davies 93 bertson 2012	SPT N ₆₀	40 45 50 0	1. Baldi 2. Jamia 3. Kulha	Relative Den et al. (1986); Al-Homou olkowski et al. (2001) wy & Mayne (1990)	sity, D _r (%) d & Wehr (2006) 75	100 0	Friction A - 1. Senneset et al. (1988 & 1 - 2. Robertson & Campanelia - 3. Kulhawy & Mayne (1990) 20	ngle, \ (deg) 999): Mayne & Campanella ((1983) 40 60	2005) John State (2005) Babyic Policies
		2 2	Derjse sand to gravelly sand Eands: desmeards upanty and family and the sand slit	silt mixtures: clayey silt & silty clay					Aery Loose						
	Terminated at 2.74 m Refusal								+ - 						
CONE ID CONE MODEL CONE AREA CONE AREA CONE AREA CONE AREA CONE AREA CONE AREA FILTER POSITION FILTER TYPE	: S15-CFIP.1858 : Subtraction : 15cm ² D : 0.79 : u2 : HDPE	I TEST TYPE APPLICATION CLASS RIG OPERATOR FRICTION REDUCER WEATHER	TE2 2 CPT 017 - Griffen SNone Raining & Mild	Transducer Tip Sleeve Pore Pressure 2 X-Y Inclinometer	CPTU ZE Pre 198 mV 200 mV 249 mV 2469 mV	ERO VALUES Post 204 mV 204 mV 249 mV 2475 mV	Difference 0.065 MPa 0.003 kPa 0 kPa	GRANULAR Description Clays Silt mixtures Sand mixtures Sands Gravelly sand	R SOILS (S SBT Index, Ic 2.95-3.60 2.60-2.95 2.05-2.60 1.31-2.05 <1.31	ands & Gravels) Description Very Loose Loose Medium Dense Dense	Robertson et al. SPT N value, NSPT 0 - 4 4 - 10 10 - 30 30 - 50 >50	1986 Zones 7 Description Very Loose Loose Medium Dense Dense	-10 and Zone 12 Relative Density Dr (%) 0 - 15 15 - 35 35 - 65 65 - 85	Ground → Ground Level → III Dissipat	dwater tion Test

	CITI									_			CPT L	OG 03
SITE IN	VESTIGATION	Working with								F	PointID	19		
CLIENT PROJEC LOCATION PROJECT N	: Soiltechnics CT: Lossiemouth : Lossiemouth No. : 1200410			EASTING NORTHING ELEVATION CHECKED B TERMINATIC	Y DN REASC	: 0.0 m : 0.0 m : 0.00 m : LD N : Refusa	OD I		Remark: Test refused	on tip resist	ance.	SHEET STATUS TEST DATE PLOT DATE METHOD	: 1 OF 1 : Final : 20/10/2020 : 26/10/2020 : ISO 22476)) -1:2012
Depth (m) Elevation (m) 0 0	Corrected Cone Resistance, c 5 10 10 200 300 Sleeve Friction Resistance, f	15 - 20 400 - 500 (kPa)	Fines Conter 1. R&W 98 and NOEER 2001 2. Southle et al. (1998) 3. Boulanger and Idriss (2014) 0. 25 50	nt, FC (%)	LB. s BE. s. UB. s.	Undrained Shear S = $(\mathbf{q}_{-} \bullet_{m})/N_{tr}$, where N_{tr} = $(\mathbf{q}_{r} \bullet_{m})/N_{tr}$, where N_{tr} = $(\mathbf{q}_{-} \bullet_{m})/N_{tr}$, where N_{tr} 100	trength, s _u (kP = 20 = 17.5 = 15 200	a) 1. S 2. M 300 0	Sensitivity, chmertmann78; R&L86 ayne (2007) 12.5 25	St 37.5	1. Mayne 1. Mayne 2. Mayne	Unit Weight, Y (k 2007) 2007) 2007) 2016	N/m³) 20	Graphic Log
				 										××
CONE ID CONE MODEL CONE AREA CONE AREA R/ FILTER POSITIC FILTER TYPE	: S15-CFIP.1858 7 : Subtraction 4 : 15cm ² F ATIO : 0.79 0 ON : u2 F : HDPE V	TEST TYPE APPLICATION CLASS RIG DPERATOR FRICTION REDUCER WEATHER	: TE2 : 2 : CPT 017 - Griffen : RS : None : Raining & Mild	Transducer Tip Sleeve Pore Pressure 2 X-Y Inclinometer	CPTU ZE Pre 198 mV 200 mV 249 mV 249 mV 2469 mV	RO VALUES Post D 204 mV 0. 204 mV 0. 204 mV 0. 249 mV 0 2475 mV 0	ifference 065 MPa 003 kPa kPa	COHESIVE SC Term based on mea Extremely low strengt Very low strength Low strength	DILS (Clays & Silts) R surement su (kPa th <10 10-20 20-40	obertson et al. 1 Term base Medium st High stren Very high Extremely	986 Zones 1-6 and ed on measurement rrength gth strength high strength	Zone 11 su (kPa) 40-75 75-150 150-300 >300	Ground Level	vater on Test



														CPT LOG 01				
SITE INVESTIGATION Working with:											PointID 20							
CI PI LO PR		NT : Soil ECT: Los DN : Lossie DN : 12004	echnics siemouth ^{nouth} 0			EASTING:0.0 mNORTHING:0.0 mELEVATION:0.00 m ODCHECKED BY:LDTERMINATION REASON:Refusal					Remark: Test refused on tip resistance.		SHEET : 1 OF 1 STATUS : Final TEST DATE : 20/10/2020 PLOT DATE : 26/10/2020 METHOD : ISO 22476-1:2012					
Depth (m)	Elevation (m)	Correc 0 5 0 0.5 Sleev	ed Cone Resistance, q _t (N 10 1 Friction Resistance, f _s (ki 200	MPa) 15	Friction Ratio, R	(%) In Situ P Porewa	ter Pressure, u ₂ ((kPa) kPa)	Inclination (°) — — — 1 —— :	Pore Pressure	PRatio, B _q O 9 14 1 2 3 4	ehaviour Type: n et al. 1986 qc Rf 5 6 7 8 9 10 11	bo yiu de bo Mater	ial Description				
													Low strength sandy SiLT to 0.60	becoming high strength o clayey SILT (6) medium dense SAND (9)				
2									 				2.80 2.80 3.10 Very high str 3.10 SILT (6) 3.39 Medium dens	angth sandy SILT to clayey				
4		Terminated Refusal — — — — — — — _ — — — — — — — —	at 3.39 m 										_ \gravelly SAN	D to SAND (10)				
6			 															
			— — — — — — — — — — — — — — — — — — —															
9	9																	
CON CALI CON CON CON FILTE FILTE	e id Bratic E Mode E Area E Area E Area Er Pos Er Type	: S15-ĈFIP. IN DATE : 26/07/2020 EL : Subtractior A : 15cm² A : 0.79 ITION : u2 E : HDPE	858 TEST TYPE APPLICATIO RIG OPERATOR FRICTION R WEATHER GROUNDW	DN CLASS : 2 : CP : RS :EDUCER : Noi : Rai : ATER DEPTH : Ass	2 T 017 - Griffen ne ning & Mild sumed for calculation purp	Transducer Tip Sleeve Pore Pressure 2 X-Y Inclinometer	CPTU ZEI Pre 207 mV 205 mV 260 mV 2274 mV	RO VALUES Post 203 mV 203 mV 240 mV 2415 mV	Difference -0.043 MPa -0.001 kPa -0.005 kPa	METHOD: Robertson e 1 - Sensitive fine grained ma 2 - Organic material 3 - CLAY 4 - Silty CLAY to CLAY	t al. 1986 qc Rf terial 5 - Clayey SiLT to sitly C 6 - Sandy SiLT to clayey 7 - Sitly SAND to sandy S 8 - SAND to sitly SAND	LAY 9 - S SILT 10 - SILT 11 - 12 -	Gravelly SAND to SAND Very stiff fine grained SAND to clayey SAND	Groundwater Level I Dissipation Test				
																	CPT LO)G 02
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S	ITE		ESTIGATIO	Working with										PointID		20		
(F F	PRO OCAT	NT JECT	Soiltechnics Lossiemouth 1200410	s h		EASTING NORTHING ELEVATION CHECKED B TERMINATIC	Y DN REAS	: 0.0 r : 0.0 r : 0.00 : LD ON : Refu	n n ⊨m OD ısal			Remark: Test refuse	ed on tip resi	stance.	SHEE STATI TEST PLOT METH	T : 1 JS : Fir DATE : 20 DATE : 26 OD : IS(OF 1 ial /10/2020 /10/2020 O 22476-1:	:2012
Denth (m)	Elevation (m)	0	Corrected Cone Resistar 5 10 1 1 1 100 200 5 Sleeve Friction Resistar	nce, q _t (MPa) 15 20 10 400 500 10 ce, f _s (kPa)	Non-normalized Soil Beha Robertson	(2010) 3 4	1. R 2. Je 3. R	5 20. & Wride 98 iff. & Davies 93 obertson 2012 10 15 20	SPT N ₆₀ 25 30 35	40 45 50	1. Bald 2. Jam 3. Kulh	Relative Den li et al. (1996); AL-Homou lolkowski et al. (2001) hawy & Mayne (1990) 25 50	sity, D _r (%) d & Wehr (2006) 0 75	100 0	Frictior 1. Senneset et al. (1998 2. Robertson & Campana 3. Kulhawy & Mayne (19 20	a Angle, ∳' (deg) & 1989): Mayne & Cam ella (1963) 90) 40	xanella (2005) 60 80	Graphic Log
			Terminated at 3.39 m Refusal		0 1 2 u Image: state s	P S Silt Mitthes: clayby silt 8 silt day Image: silt day												
C C C C C F F	ONE ID ONE M ONE AF ONE AF LTER F LTER T	DDEL REA REA RATIO POSITION YPE	: S15-CFIP.1858 : Subtraction : 15cm ² : 0.79 : u2 : HDPE	TEST TYPE APPLICATION CLASS RIG OPERATOR FRICTION REDUCER WEATHER	: TE2 : 2 : CPT 017 - Griffen : RS : None : Raining & Mild	Transducer Tip Sleeve Pore Pressure 2 X-Y Inclinometer	CPTU Z Pre 207 mV 205 mV 260 mV 2274 mV	ERO VALUES Post 203 mV 203 mV 240 mV 2415 mV	Difference -0.043 MPa -0.001 kPa -0.005 kPa	GRANUL/ Description Clays Silt mixtures Sand mixtures Sands Gravelly sand	AR SOILS (S SBT Index, ld 2.95-3.60 2.60-2.95 2.05-2.60 1.31-2.05 <1.31	Cands & Gravels) c Description Very Loose Loose Medium Dense Dense Very Dense	Robertson et al. SPT N value, NSPT 0 - 4 4 - 10 10 - 30 30 - 50 >50	1986 Zones Description Very Loose Loose Medium Dense Dense Very Dense	7-10 and Zone 12 Relative Density Dr (% 0 - 15 15 - 35 35 - 65 65 - 85 >85	Dis	oundwater vel sipation Test	t

															CPT LC	DG 03
SI	TE	INVE	STIGATIO	DN Working wit	Solitech environmental and geotechr							Point	lID	20		
C P LC Pf	LIE RO. DCAT ROJE	NT : JECT : ION : CT No. :	Soiltechnics Lossiemout Lossiemouth 1200410	s h		EASTING NORTHING ELEVATION CHECKED B' TERMINATIC	Y IN REAS	: 0.0 r : 0.0 r : 0.00 : LD ON : Refu	n n m OD ısal		Remark: Test refused or	tip resistance	e. SF TE PL MI	IEET : ATUS : ST DATE : OT DATE : ETHOD :	1 OF 1 Final 20/10/2020 26/10/2020 ISO 22476-´	1:2012
Depth (m)	Elevation (m)	0 1	Corrected Cone Resistar 5 10 1 200 Sleeve Friction Resistar	nce, q _r (MPa) 15 2 300 400 50 ice, f _s (kPa)	Fines Conte 1. R&W 98 and NCEER 2001 2. Suzuki et al. (1998) 3. Boulanger and Idriss (2014) 0 25 56	ont, FC (%)		Undrained She $s_u = (q_t - \phi_{ro})/N_{st}$, when $s_u = (q_t - \phi_{ro})/N_{st}$, when $s_u = (q_t - \phi_{ro})/N_{st}$, when 100	ear Strength, s _u (k re N _{is} = 20 re N _{is} = 17.5 re N _{is} = 15 200	Pa)12. 300 0	Sensitivity, S _t Schmertmann78; R&L&6 Mayne (2007) 12.5 25	37.5 50	1. Mayne (2007 1. Mayne (2007 2. Mayne (2007 8 12	Jnit Weight, Y (kN/m	³) 20 24	6 Graphic Log
1- 2-		A MARKEN A					Land the state of	Medius								
4-			Ferminated at 3.39 m Refusal			 										
6- 7-		- - - - - - - - - - - - - - - - - - -				 								 		
8- 9-						 										
CC CC CC FIL FIL	DNE ID DNE MO DNE ARI DNE ARI TER PO TER TY	DEL EA EA RATIO DSITION (PE	: S15-CFIP.1858 : Subtraction : 15cm ² : 0.79 : u2 : HDPE	TEST TYPE APPLICATION CLASS RIG OPERATOR FRICTION REDUCER WEATHER	: TE2 : 2 : CPT 017 - Griffen : RS : None : Raining & Mild	Transducer Tip Sleeve Pore Pressure 2 X-Y Inclinometer	CPTU Z Pre 207 mV 205 mV 260 mV 2274 mV	ERO VALUES Post 203 mV 203 mV 240 mV 2415 mV	Difference -0.043 MPa -0.001 kPa -0.005 kPa	COHESIVE S Term based on me Extremely low strer Very low strength Low strength	GOILS (Clays & Silts) Rob asurement su (kPa) ngth <10 10-20 20-40	ertson et al. 1986 Z Term based on r Medium strength High strength Very high streng Extremely high s	tones 1-6 and Zo measurement th strength	ne 11 su (kPa) 40-75 75-150 150-300 >300	Groundwa Level - Ⅲ Dissipation	ater 1 Test







CPT LOG 02

														CPT	LOG 03
SITE	INVESTIGATI										Pa	intID	21		
CLIE PRO LOCAT	NT : Soiltechnic JECT: Lossiemour ION : Lossiemouth CT No. : 1200410	s th		EASTING NORTHING ELEVATION CHECKED BY TERMINATIO	Y N REASO	: 0.0 r : 0.0 r : 0.00 : LD ON : Refu	n n m OD sal		Rema Test r	rk: efused on	tip resistar	nce.	SHEET STATUS TEST DATE PLOT DATE METHOD	: 1 OF 1 : Final : 20/10/202 : 26/10/202 : ISO 2247	20 20 6-1:2012
Depth (m) Elevation (m)	Corrected Cone Resista 0 5 10 0 100 200 Sleeve Friction Resista	nce, q _t (MPa) 15	Fines Conter 1. R&W 98 and NCEER 2001 2. Suzuki et al. (1998) 3. Boulanger and Idriss (2014) 0 25 50	ıt, FC (%) 75 1	LB. s BE. s UB. s	Undrained She $y_u = (q_t - \phi_{os})/N_{st}$, where $y_u = (q_t - \phi_{os})/N_{st}$, where $y_u = (q_t - \phi_{os})/N_{st}$, where 100	ar Strength, s _u (kl e N _u = 20 e N _u = 17.5 e N _u = 15 200	Pa) 		Sensitivity, S _t R&L86 25	37.5	1. Mayne (1. Mayne (2. Mayne (Unit Weight, Y 2007) 2007) 2017) 2017) 2016	(kN/m³) ^k 20	Graphic Log
								a A Hah	MATCH W WWW AND AND AND AND AND AND AND AND AND AND						
	Terminated at 3.34 m Refusal Image: Image of the second secon														
	: S15-CFIP.1858	TEST TYPE	: TE2			ERO VALUES		COHE	SIVE SOILS (Clays	& Silts) Robe	ertson et al. 198	f 6 Zones 1-6 and	Zone 11	Ground	dwater
CONE MO CONE ARI CONE ARI FILTER PO FILTER TY	IDEL : Subtraction EA : 15cm ² EA RATIO : 0.79 SITION : U2 /PE : HDPE	APPLICATION CLASS RIG OPERATOR FRICTION REDUCER WEATHER	: 2 : CPT 017 - Griffen : RS : None : Raining & Mild	Transducer Tip Sleeve Pore Pressure 2 X-Y Inclinometer	Pre 207 mV 204 mV 255 mV 2500 mV	Post 205 mV 205 mV 236 mV 2541 mV	Difference -0.022 MPa 0.001 kPa -0.005 kPa	Term based Extremely lov Very low stree Low strength	on measurement w strength ength	su (kPa) <10 10-20 20-40	Term based Medium stren High strength Very high stre Extremely hig	on measurement ngth n ength gh strength	su (kPa) 40-75 75-150 150-300 >300	⊥ Level	ion Test



	CIT									_		CPT LOG 01
SITE II			solltech environmental and geotechnic with:							PointID	22	
CLIEN PROJE LOCATION PROJECT	T : Soiltech ECT: Lossiem N : Lossiemouth No. : 1200410	nics outh		EASTING NORTHING ELEVATION CHECKED BY TERMINATIOI	, N REASOI	: 0.0 m : 0.0 m : 0.00 m Ol : LD N : Refusal	D		Remark: Test refused on tip res	istance.	SHEET : 1 STATUS : Fin TEST DATE : 20 PLOT DATE : 26 METHOD : IS	OF 1 hal /10/2020 /10/2020 O 22476-1:2012
Depth (m) Elevation (m)	Corrected Cone I 5 1 0.5 Sleeve Friction I 100	Resistance, q, (MPa) 10 15 1 1.5 1 1.5 200 300	-20 Friction Ratio, R _r (%)	In Situ Po Porewat	ore Pressure, u_0 er Pressure, u_2 ((kPa) Inclinat (kPa) - 1	ion (°) — 2 10 15	Pore Pressure	Ratio, B _q Soll F 	ehaviour Type: n et al. 1986 qc Rf 5 6 7 8 9 10 11	D D D D D D D D D D D D D D D D D D D	al Description
											Pre dug 0.50 Medium dense	e to dense SAND (9)
	Terminated at 3.24 Refusal	m 										e becoming very dense b to SAND (10)
7												
CONE ID CALIBRATION CONE MODEL CONE AREA CONE AREA FILTER POSIT FILTER TYPE	: S15-CFIP.1858 I DATE: 26/07/2020 - : Subtraction : 15cm ² RATIO: 0.79 TON: u2 : HDPE	TEST TYPE APPLICATION CLASS RIG OPERATOR FRICTION REDUCER WEATHER IGROUNDWATER DEPTH	TE2 TE2 CPT 017 - Griffen RS None Raining & Mild Assumed for calculation purpose	Transducer Tip Sleeve Pore Pressure 2 A-Y Inclinometer	CPTU ZE Pre 205 mV 204 mV 245 mV 2633 mV	RO VALUES Post Diffe 203 mV -0.02 203 mV -0.00 236 mV -0.00 2656 mV	rence 2 MPa 1 kPa 2 kPa	METHOD: Robertson et 1 - Sensitive fine grained material 2 - Organic material 3 - CLAY 4 - Sitty CLAY to CLAY	al. 1986 qc Rf terial 5 - Clayey SILT to silty C 6 - Sandy SILT to clayey 7 - Silty SAND to sandy 8 - SAND to silty SAND	AY 9-S SILT 10- SILT 11- 12-	AND Gravelly SAND to SAND Very stiff fine grained SAND to clayey SAND	Groundwater Level Issipation Test

IN CI									CPT	LOG 02
SITE INVESTI		Solitech environmental and geotechni ith:						PointID	22	
CLIENT : Soilt PROJECT : Loss LOCATION : Lossier PROJECT No. : 120041	echnics iemouth		EASTING NORTHING ELEVATION CHECKED B ^V TERMINATIO	Y N REASON	: 0.0 m : 0.0 m : 0.00 m OD : LD : Refusal		Remark: Test refused on tip res	sistance. S P M	HEET : 1 OF 1 TATUS : Final EST DATE : 20/10/202 LOT DATE : 26/10/202 ETHOD : ISO 2247	20 20 '6-1:2012
(iii) upper line (iii) (d Cone Resistance, q, (MPa) 10 15 200 300 400 Friction Resistance, f, (kPa)	Non-normalized Soil Behr Robertson	aviour Type Index, I _{SBT} (2010) 	1. Rob. & W 2. Jeff. & D 3. Robertso 5 0 5 10	SPT N ₆₀ tride 98 n 2012 15 20 25 30 36	5 40 45 50 0	Relative Density, D, (%) ald et al. (1986); Al-Homoud & Wehr (2006) amolikowski et al. (2001) ulhawy & Mayne (1990) 25 50 75		Friction Angle, & (deg) al (1988 & 1989): Mayne & Campanella (2005) Campanella (1983) Mayne (1990) 40 60	08 Graphic Log
		Derise sand to gravelly sand Sands dean sandre reprint sands Sands dean sandre sandre sands Sand mixtures sity sand b sandy sitt	Slit mixtures: clayey slitts slitty clay Clayers: clayers slitts slitty clay Clayers: clayers: clayers Clayers: r>Clayers Clayers: clayers Claye				Losse Losse	Vi) Derse		
- Terminated 4 -4 5 -5 5 -5 6 -6 7 -7 7 -7 8 -8 9 -9 -1 -1 -2 -1 -3 -1 -4 -1 -5 -1 -6 -1 -7 -1 -7 -1 -7 -1 -4 -1 -5 -1 -6 -1 -7 -1 -7 -1 -7 -1 -7 -1 -7 -1 -7 -1 -7 -1 -7 -1 -7 -1 -7 -1 -7 -1 -7 -1 -7 -1 -7 -1 -7 -1 -1 -1	at 3.24 m									
CONE ID : \$15-CF CONE MODEL : Subtrac CONE AREA : 15cm ² CONE AREA RATIO : 0.79 FILTER POSITION : u2 FILTER TYPE : HDPE	P.1858 TEST TYPE APPLICATION CLAS RIG OPERATOR FRICTION REDUCEF WEATHER	: TE2 S : 2 : CPT 017 - Griffen : RS R : None : Raining & Mild	Transducer Tip Sleeve Pore Pressure 2 X-Y Inclinometer	CPTU ZERO Pre P 205 mV 20 204 mV 20 245 mV 2 2633 mV 2	VALUES bost Difference 03 mV -0.022 MPa 03 mV -0.001 kPa 36 mV -0.002 kPa 556 mV	GKANULAR SOILS Description SBT Indee Clays 2.95-3.60 Silt mixtures 2.60-2.95 Sand mixtures 2.05-2.60 Sands 1.31-2.05 Gravelly sand <1.31	(Sanda & Gravels) Robertson et al. x, Ic Description yer SPT N value, NSPT very Losse 0 - 4 Losse 4 - 10 Medium Dense 10 - 30 Dense 30 - 50 Very Dense >50	1986 Zones 7-10 and Zon Description Relative Den Very Loose 0 - 15 Loose 15 - 35 Medium Dense 35 - 65 Dense 65 - 85 Very Dense 285	Groundwa sity Dr (%) ↓ ↓ ↓ ↓ ↓ ↓ Dissipation	iter Test

IN GITLI									r			CPT LO	OG 03
SITE INVESTIGATION	Working with									PointID	22		
CLIENT : Soiltechnics PROJECT : Lossiemouth LOCATION : Lossiemouth PROJECT No. : 1200410			EASTING NORTHING ELEVATION CHECKED BY TERMINATIO	, N REASC	: 0.0 n : 0.0 n : 0.00 : LD ON : Refu	n n m OD sal		Remark: Test refused o	n tip resi	stance.	SHEET STATUS TEST DATE PLOT DATE METHOD	: 1 OF 1 : Final : 20/10/2020 : 26/10/2020 : ISO 22476-	1:2012
E Corrected Cone Resistance, q, (M 0 5 10 0 100 200 300 100 200 300 Sleeve Friction Resistance, f, (kF	IPa) 15	Fines Content 1. R&W 99 and NCEER 2001 2. Suzuki et al. (1998) 3. Boulanger and Kriss (2014) 0. 25 50	, FC (%) 75 1(Undrained Shea = $(\mathbf{q}_{-} \bullet_{\infty})/N_{\mathbf{q}_{+}}$ where = $(\mathbf{q}_{-} \bullet_{\infty})/N_{\mathbf{q}_{+}}$ where = $(\mathbf{q}_{-} \bullet_{\infty})/N_{\mathbf{q}_{+}}$ where 100	ar Strength, s _u (kl N _u = 20 N _u = 17.5 e N _u = 15 200	Pa)	Sensitivity, S Schmetmann78; R&L86 Mayne (2007) 12.5 25	37.5	1. May 1. May 2. May	Unit Weight, Y (k me (2007) me (2007) 12 16	:N/m ³) 20 24	Graphic Log
Image: state of the state													
CONE ID : S15-CFIP.1858 TES CONE MODEL : Subtraction APF CONE AREA : 15cm ² RIG CONE AREA : 0.79 OPE FILTER POSITION : u2 FRIC FILTER TYPE : HDPE WE	ET TYPE PLICATION CLASS ERATOR CTION REDUCER ATHER	: TE2 2 CPT 017 - Griffen RS None Raining & Mild	Transducer Tip Sleeve Pore Pressure 2 X-Y Inclinometer	CPTU ZE Pre 205 mV 204 mV 245 mV 2633 mV	RO VALUES Post 203 mV 203 mV 236 mV 2656 mV	Difference -0.022 MPa -0.001 kPa -0.002 kPa	COHESIVE S Term based on me Extremely low stren Very low strength Low strength	OILS (Clays & Silts) Rol asurement su (kPa) gth <10 10-20 20-40	bertson et al Term ba Medium High stre Very hig Extreme	. 1986 Zones 1-6 a sed on measureme strength ength h strength ly high strength	and Zone 11 ent su (kPa) 40-75 75-150 150-300 >300	Groundw Level ⊮∭ Dissipatior	ater n Test





															CF	PT LOG 02
SITE	INVE	STIGATIC	DN Working with										PointID		23	
CLIE PRO LOCAT PROJE	NT : JECT : ION : CT No. :	Soiltechnics Lossiemouth Lossiemouth 1200410	ו		EASTING NORTHING ELEVATION CHECKED B TERMINATIC	Y DN REAS(: 0.0 r : 0.0 r : 0.00 : LD : Refu	n n m OD sal			Remark: Test refused	on tip resi	stance.	SHEET STATU TEST D PLOT D METHO	: 1 OF S : Final ATE : 20/10 ATE : 26/10 D : ISO 2	1 /2020 /2020 2476-1:2012
Depth (m) Elevation (m)	0 0 10	Corrected Cone Resistance 5 10 1 200 3 Sleeve Friction Resistance	20, q _t (MPa) 15 20 100 400 500 26, f _s (kPa)	Non-normalized Soil Beh Robertson	aviour Type Index, I _{SBT} (2010) 	1. Ro 2. Je 3. Ro	5. & Wride 98 ff. & Davies 93 bertson 2012	PT N ₆₀	40 45 50	1. Baid 2. Jam 3. Kulh	Relative Density i et al. (1986); Al-Homoud & iolkowski et al. (2001) awy & Mayne (1990)	γ, D _r (%) Wehr (2006) 75	100 0	Friction A 1. Senneset et al. (1988 & 2. Robertson & Campanella 3. Kulhawy & Mayne (1990 20	ungle, ∳' (deg) 1989): Mayne & Campanella ((1983)) 40 60	a (2005) bi diab gi a (2005) bi diab gi a bi diab gi a bi diab gi a bi diab gi a bi diab gi a bi diab gi diab diab gi diab gi diab diab gi diab diab diab gi diab diab diab diab diab diab diab dia
			5	Dense sand to gravelly sand Sands: closin samts to sing argued Sands: closin samts to sing argued mixturgs: sity sand p sand y sit	Silt mixtures: clavey stilt& stilty clay Clays clay to stilty clay Clays clay to stilty clay Clay - reganic soil						2					
33 4 4 4 5 5 5 6 6 7 7 7 7 7 7		erminated at 2.93 m lefusal 														
CONE ID CONE MO CONE ARI CONE ARI FILTER PO FILTER TY	DEL EA EA RATIO DSITION (PE	: S15-CFIP.1858 : Subtraction : 15cm ² : 0.79 : u2 : HDPE	TEST TYPE APPLICATION CLASS RIG OPERATOR FRICTION REDUCER WEATHER	: TE2 : 2 : CPT 017 - Griffen : RS : None : Raining & Mild	Transducer Tip Sleeve Pore Pressure 2 X-Y Inclinometer	CPTU ZI Pre 204 mV 203 mV 242 mV 2346 mV	ERO VALUES Post 203 mV 203 mV 234 mV 2362 mV	Difference -0.011 MPa 0 kPa -0.002 kPa	GRANULA Description Clays Silt mixtures Sand mixtures Sands Gravelly cand	AR SOILS (S SBT Index, I 2.95-3.60 2.60-2.95 2.05-2.60 1.31-2.05 <1.31	Cands & Gravels) Ro c Description S Very Loose Loose Medium Dense Dense	Debertson et al. PT N value, NSPT 0 - 4 4 - 10 10 - 30 30 - 50 50	1986 Zones 7 Description Very Loose Loose Medium Dense Dense	7-10 and Zone 12 Relative Density Dr (%) 0 - 15 15 - 35 35 - 65 65 - 85	- Grour - Level - IIII Dissipa	ndwater ation Test

				11. I											CPT L	OG 03
SITE	INVE	STIGATIC	Working with									Poi	ntID	23		
CLIE PRO LOCAT PROJE	NT : JECT : 10N : I CT №. : /	Soiltechnics Lossiemouth 1200410	١		EASTING NORTHING ELEVATION CHECKED BY TERMINATIO	Y N REASO	: 0.0 r : 0.0 r : 0.00 : LD ON : Refu	n n m OD ısal		Remarl Test re	k: fused on	tip resistan	ce. S T P M	HEET TATUS EST DATE LOT DATE IETHOD	: 1 OF 1 : Final : 20/10/2020 : 26/10/2020 : ISO 22476)) -1:2012
Depth (m) Elevation (m)	0 0 100	Corrected Cone Resistance 5 10 200 30 Sleeve Friction Resistance	ze, q, (MPa) 15 20 10 400 500 ze, f _s (kPa)	Fines Conter 1. R8W 98 and NCER 2001 2. Social et al. (1998) 3. Boulanger and leftss (2014) 0. 25 50	nt, FC (%)		Undrained She $u_{ij} = (\mathbf{q}_{ij} - \boldsymbol{\sigma}_{ijk})/N_{ki}$, when $u_{ij} = (\mathbf{q}_{ij} - \boldsymbol{\sigma}_{ik})/N_{ki}$, when $u_{ij} = (\mathbf{q}_{ij} - \boldsymbol{\sigma}_{ik})/N_{ki}$, when 100	en Strength, s _u (kl e N _e = 20 re N _e = 17.5 re N _e = 15	Pa)	Si . Schmertmann78; R& 2. Mayne (2007) 12. 5	ensitivity, S _t L86 25	37.5	1. Mayne (20 1. Mayne (20 2. Mayne (20 50 8 12	Unit Weight, Y (k Y bulk Y bulk Y bulk Y bulk	N/m ³)	Graphic Log
			5													
		rminated at 2.93 m 														
CONE ID CONE MC CONE AR CONE AR FILTER PC FILTER T	DDEL EA EA RATIO OSITION YPE	: S15-CFIP.1858 : Subtraction : 15cm ² : 0.79 : u2 : HDPE	TEST TYPE APPLICATION CLASS RIG OPERATOR FRICTION REDUCER WEATHER	: TE2 : 2 : CPT 017 - Griffen : RS : None : Raining & Mild	Transducer Tip Sleeve Pore Pressure 2 X-Y Inclinometer	CPTU ZE Pre 204 mV 203 mV 242 mV 2346 mV	ERO VALUES Post 203 mV 203 mV 234 mV 2362 mV	Difference -0.011 MPa 0 kPa -0.002 kPa	COHESIVE Term based on me Extremely low stre Very low strength Low strength	SOILS (Clays & easurement ngth	k Silts) Rober su (kPa) <10 10-20 20-40	rtson et al. 1986 Term based o Medium streng High strength Very high stre Extremely high	5 Zones 1-6 and Z n measurement gth ngth h strength	one 11 su (kPa) 40-75 75-150 150-300 >300	- ∡ Groundv Level -⊪∥ Dissipatio	vater on Test



												CPT LOG 01
SIT	E	INVESTIG		g with:	nical consultants					PointID	24	
CL PF LOC PR		NT : Soilte ECT: Lossie ON : Lossiemo TNo. : 1200410	chnics emouth ^{uth}		EASTING NORTHING ELEVATION CHECKED BY TERMINATIO	, N REASON	: 0.0 m : 0.0 m : 0.00 m OD : LD N : Refusal		Remark: Test refused on tip res	istance.	SHEET : 1 STATUS : Fi TEST DATE : 20 PLOT DATE : 26 METHOD : IS	OF 1 hal /10/2020 /10/2020 O 22476-1:2012
Depth (m)	Elevation (m)	Corrected (0 5 0 0.5 Sleeve Fri 0 100	tione Resistance, qt (MPa) 10 15 1 1 1.5 	20 Friction Ratio, R _r (*	%) In Situ P Porewa 6 8 -300 0	ore Pressure, u ₀ (er Pressure, u ₂ (k 300 600	kPa) Inclination (°) (Pa) 1	Pore Pressure 2 15 -0.6 -0.1 0.4	e Ratio, B _q Soil E Robertsc	Sehaviour Type: n et al. 1986 qc Rf 5 6 7 8 9 10 1	60 94 1	al Description
	- 1 - 1 -										Low strength sandy SILT to 0.60 Medium dens (9) 1.30 Dense gravel	becoming high strength clayey SILT (6) e becoming dense SAND y SAND to SAND (10)
2		2				+ 					1.70 X Medium dens X 2.80 X 2.92	e SAND to silty SAND (8)
3		— — — Terminated at Refusal — — — — — — — — — —	2.92 m — — — — — — — — — — — — — — — — — —									
5		 				+ +						
- - 7_ - -		 				 + 						
8												
CONE CALIE CONE CONE CONE	E ID BRATIC MODE AREA AREA	: S15-CFIP.1856 N DATE : 26/07/2020 EL : Subtraction A : 15cm ² RATIO : 0.79 ITION : u2	TEST TYPE APPLICATION CLASS RIG OPERATOR FRICTION REDUCER WEATHER	: TE2 : 2 : CPT 017 - Griffen : RS : None : Rainian & Mild	Transducer Tip Sleeve Pore Pressure 2	CPTU ZEF Pre 203 mV 203 mV 239 mV	Image: Non-State Image: Non-State<	METHOD: Robertson e 1 - Sensitive fine grained m 2 - Organic material 3 - CLAY	at al. 1986 qc Rf aterial 5 - Clayey SILT to stity C 6 - Sandy SILT to clayey 7 - Sity SAND to sandy 6 - Sandy SILT to clayey	LAY 9-5 SILT 10- SILT 11-	Gravely SAND to SAND	Groundwater Level ≝Dissipation Test
FILTE	R TYP	E : HDPE	GROUNDWATER DEPT	H : Assumed for calculation purpo	ses.	2240 MV	2200 1110			12-		

														CPT	LOG 02
SITE	INVE	STIGATIC	Working with	Solitech environmental and geotechi								PointID		24	
CLIE PRO LOCATI PROJEC	NT : JECT : ION : CT No. :	Soiltechnics Lossiemouth Lossiemouth 1200410	ו		EASTING NORTHING ELEVATION CHECKED B TERMINATIO	Y DN REAS	: 0.0 (: 0.0 (: 0.00 : LD ON : Refu	n n ⊨m OD ısal			Remark: Test refused on tip re	esistance.	SHEET STATUS TEST D/ PLOT D/ METHOI	: 1 OF 1 : Final ATE : 20/10/202 ATE : 26/10/202 O : ISO 2247	20 20 6-1:2012
Depth (m) Elevation (m)	0 0 10	Corrected Cone Resistance 5 10 10 200 3 Sleeve Friction Resistance	20, q _t (MPa) 15 20 00 400 500 20, f _s (kPa)	Non-normalized Soil Bel Robertso	haviour Type Index, I _{SBT} h (2010)	1. R 2. Je 3. R 5. 0 5	xb. & Wride 98 ff. & Davies 93 xbertson 2012 10 15 20	SPT N ₆₀	40 45 50	1. Baid 2. Jam 3. Kulh	Relative Density, D, (%) ii et al. (1986); Al-Homoud & Wehr (2006) iidokowski et al. (2001) awy & Mayne (1990) 25 50 75	100 0	Friction An 1. Senneset et al. (1988 & 15 2. Robertson & Campanella (3. Kulhawy & Mayne (1990) 20	Igle, ♦' (deg) 1983): Mayne & Campanella (2005) 1983) 40 60	08 Graphic Log
	MA			Dense sand to gravely sand Dense sand to gravely sand Sands: Qaan Supus to Wux sands Cands: sily sand to sand	Silt mixtures: clayery sitely silty clay										
		erminated at 2:92 m Refusal I													
CONE ID CONE MO CONE ARE CONE ARE FILTER PO FILTER TY	DEL EA EA RATIO OSITION (PE	: S15-CFIP.1858 : Subtraction : 15cm ² : 0.79 : u2 : HDPE	TEST TYPE APPLICATION CLASS RIG OPERATOR FRICTION REDUCER WEATHER	: TE2 : 2 : CPT 017 - Griffen : RS : None : Raining & Mild	Transducer Tip Sleeve Pore Pressure 2 X-Y Inclinometer	CPTU Z Pre 203 mV 203 mV 239 mV 2246 mV	ERO VALUES Post 204 mV 203 mV 231 mV 2208 mV	Difference 0.011 MPa 0 kPa -0.002 kPa	GRANULA Description Clays Sitt mixtures Sand mixtures Sands Gravelly cand	AR SOILS (5 SBT Index, I 2.95-3.60 2.60-2.95 2.05-2.60 1.31-2.05 <1.31	Sands & Gravels) Robertson et Robertson et c Description SPT N value, NSF Very Locse 0 - 4 10 Locse 4 - 10 Medium Dense 10 - 30 Dense 30 - 50 Very Dense 50	al. 1986 Zones 7 Description Very Loose Loose Medium Dense Dense	7-10 and Zone 12 Relative Density Dr (%) 0 - 15 15 - 35 35 - 65 65 - 85 >95	Groundwa Level ∭ Dissipation	ter Test

				11. 1											CPT L	.OG 03
SITE	INVE	STIGATIC	DN Working with	Solitech environmental and geotechn								Poi	intID	24		
CLIE PRO LOCAT PROJE	NT : JECT : 10N : CT No. :	Soiltechnics Lossiemouth Lossiemouth 1200410	า		EASTING NORTHING ELEVATION CHECKED BY TERMINATIO	Y N REASO	: 0.0 n : 0.0 n : 0.00 : LD ON : Refu	n n m OD sal		Remai Test re	rk: efused on	tip resistan	ce.	SHEET STATUS TEST DATE PLOT DATE METHOD	: 1 OF 1 : Final : 20/10/2020 : 26/10/2020 : ISO 22476)) -1:2012
Depth (m) Elevation m)	0	Corrected Cone Resistant 5 10 0 200 3 Sleeve Friction Resistant	ze, q, (MPa) 1520 00 400500 ze, f _s (kPa)	Fines Conter 1. R&W 98 and NCEER 2001 2. Suzuki et al. (1995) 3. Boulanger and Idriss (2014)	t, FC (%)		Undrained She $v_{1} = (q_{1} - \sigma_{v_{2}})/N_{v_{1}}$, where $v_{1} = (q_{1} - \sigma_{v_{2}})/N_{v_{2}}$, where $v_{2} = (q_{1} - \sigma_{v_{2}})/N_{v_{2}}$, where 100	ar Strength, s _u (k N _u = 20 N _u = 17.5 e N _u = 15	Pa)	- 1. Schmertmann78; R - 2. Mayne (2007)	Sensitivity, S _t &L86	27.5	1. Mayne (2 1. Mayne (2 2. Mayne (2	Unit Weight, Y (k Y bulk 007) 007) 007)	xN/m³)	Graphic Log
	M								300 0 							
		erminated at 2.92 m refusal 														
CONE ID CONE MC CONE AR CONE AR FILTER PC FILTER T	DDEL EA EA RATIO OSITION YPE	: S15-CFIP.1858 : Subtraction : 15cm ² : 0.79 : u2 : HDPE	TEST TYPE APPLICATION CLASS RIG OPERATOR FRICTION REDUCER WEATHER	: TE2 : 2 : CPT 017 - Griffen : RS : None : Raining & Mild	Transducer Tip Sleeve Pore Pressure 2 X-Y Inclinometer	CPTU ZF Pre 203 mV 203 mV 239 mV 2246 mV	ERO VALUES Post 204 mV 203 mV 231 mV 2208 mV	Difference 0.011 MPa 0 kPa -0.002 kPa	COHESIN Term based on Extremely low s Very low streng Low strength	VE SOILS (Clays n measurement strength gth	& Silts) Robe su (kPa) <10 10-20 20-40	rtson et al. 1986 Term based o Medium stren High strength Very high stre Extremely hig	<u>6 Zones 1-6 and 2</u> in measurement gth ingth h strength	Zone 11 su (kPa) 40-75 75-150 150-300 >300	Ground Level ™ Dissipatio	vater on Test



		CPT LOG 01
SITE INVESTIGATION Working with:		PointID 25
CLIENT : Soiltechnics PROJECT: Lossiemouth LOCATION : Lossiemouth PROJECT No. : 1200410	EASTING: 0.0 mNORTHING: 0.0 mELEVATION: 0.00 m ODCHECKED BY: LDTERMINATION REASON: Refusal	Remark: Test refused on tip resistance.SHEET: 1 OF 1 STATUSSTATUS: Final TEST DATE: 20/10/2020 PLOT DATEPLOT DATE: 26/10/2020 METHOD: ISO 22476-1:2012
$ \begin{array}{ c c c c c c c } \hline & & & & & & & & \\ \hline & & & & & & \\ \hline & & & &$	In Situ Pore Pressure, u ₀ (kPa) Inclination (°) Pore Pressure, u ₂ (kPa) 6 8 -300 0 300 600 900 -5 0 5 10 15 -0.6 -0.1	essure Ratio, B _q Soil Behaviour Type: Robertson et al. 1986 qc Rf
		High strength sandy SILT to clayey SILT (6) with a layer of gravelly sand Dense locally very dense SAND (9)
2 - 2 3 3 Terminated at 3.01 m Refusal		· · · · · · · · · · · · · · · · · · ·
CONE ID : \$15-CFIP.1858 TEST TYPE : TE2 CALIBRATION DATE : 26/07/2020 APPLICATION CLASS : 2 CONE MODEL : Subtraction RIG : CPT 017 - Griffen CONE AREA : 15cm ² OPERATOR : RS CONE AREA RATIO :0.79 FRICTION REDUCER : None FILTER POSITION : u2 WEATHER : Raining & Mild	CPTU ZERO VALUES METHOD: Rober Transducer Pre Post Difference Tip 204 mV 203 mV -0.011 MPa Sleeve 203 mV 203 mV 0 kPa Pore Pressure 2 239 mV 231 mV -0.002 kPa X-Y Inclinometer 2 207 mV 209 mV -0.002 kPa	tson et al. 1986 qc Rf ained material 5 - Clayey SILT to silty CLAY 9 - SAND 6 - Sandy SILT to clayey SILT 10 - Gravely SAND to SAND 7 - Silty SAND to sandy SILT 11 - Very stiff fine grained AY 8 - SAND to silty SAND 12 - SAND to clayey SAND

	IGITI											CPT L	OG 02
SITE	INVESTIGATI									PointID	2	5	
CLIENT : Soiltechnics PROJECT : Lossiemouth LOCATION : Lossiemouth PROJECT No. : 1200410					EASTING: 0.0 mRemark:NORTHING: 0.0 mTest refused on tip resELEVATION: 0.00 m ODCHECKED BY: LDTERMINATION REASON: Refusal					esistance. PLOT DATE : 1 OF 1 STATUS : Final TEST DATE : 20/10/2020 PLOT DATE : 26/10/2020 METHOD : ISO 22476-1:201			
Depth (m) Elevation (m)	Corrected Cone Resista 0 5 10 0 100 200 Sleeve Friction Resista	Non-normalized Soil Beh Robertson	SPT N _{e0} (2010) Index, I _{SBT} SPT N _{e0} 1. Rob. & Wride 98 2. Jeff. & Davies 93 3. Robertson 2012 3. Kulhawy				Relative Density, D, (%) di et al. (1986); Al-Hornoud & Wehr (2006) hidkowski et al. (2001) hawy & Mayne (1990) 25 50 75	Friction Angle, - 1. Senneset et al. (1988 & 1989); - 2. Robertson & Campanella (1983 - 3. Kulhawy & Mayne (1990) - 3. 40	Friction Angle, ♦' (deg) nnest et al. (1988, & 1989); Mayne & Campanella (2005) bartisch & Campanella (1983) hawy & Mayne (1990)				
	Terrhinated at 3.01 rr Refusal		0 1 2 pues fills spues di pues d	3 4 Image: Sign of the second secon									
CONE ID CONE MOD CONE ARE/ CONE ARE/ FILTER POS FILTER TYP	: S15-CFIP.1858 DEL : Subtraction A : 15cm ² A RATIO : 0.79 SITION : u2 DE : HDPE	TEST TYPE APPLICATION CLASS RIG OPERATOR FRICTION REDUCER WEATHER	: TE2 : 2 : CPT 017 - Griffen : RS : None : Raining & Mild	Transducer Tip Sleeve Pore Pressure 2 X-Y Inclinometer	CPTU ZER Pre 204 mV 203 mV 239 mV 2075 mV	O VALUES Post Diffe 203 mV -0.0 203 mV 0 kF 231 mV -0.0 2097 mV -0.0	erence 11 MPa 20 kPa	AR SOILS (5 SBT Index, 1 2.95-3.60 2.60-2.95 2.05-2.60 1.31-2.05 c1 31	Sands & Gravels) Robertson et al lc Description SPT N value, NSPT Very Losse 0 - 4 Losse 4 - 10 Medium Dense 10 - 30 Dense 30 - 50 Very Dense >Ef	I. 1986 Zones 7- Description Very Loose Loose Medium Dense Dense	ID and Zone 12 Relative Density Dr (%) 0 - 15 15 - 35 35 - 65 65 - 85	Groundwater Level I Dissipation Te	r est

						,										CPT L	OG 03
SI	TE	INVE	STIGAT	ION Working wit	SOIICECC environmental and geotechr								Poin	tID	25		
CLIENT : Soiltechnics PROJECT: Lossiemouth LOCATION : Lossiemouth PROJECT No. : 1200410						EASTING: 0.0 mRemark:NORTHING: 0.0 mTest refuseELEVATION: 0.00 m ODCHECKED BYCHECKED BY: LDTERMINATION REASON: Refusal					: used on	tip resistance	SHEET : 1 OF 1 STATUS : Final TEST DATE : 20/10/2020 PLOT DATE : 26/10/2020 METHOD : ISO 22476-1:2012				
Depth (m)	Elevation (m)	0 1	Corrected Cone Resid 5 10 00 200 Sleeve Friction Resid	stance, q, (MPa) 15 2 300 400 50 stance, f _s (kPa)	Fines Conte 1. R&W 98 and NCEER 2001 2. Suzuki et al. (1998) 3. Boulanger and Idriss (2014) 0 25 50	nt, FC (%)	LB. s BE. s UB. s	Undrained She $u = (q_t - \boldsymbol{\sigma}_{w_t})/N_{tr}$, wher $u = (q_t - \boldsymbol{\sigma}_{w_t})/N_{tr}$, wher $u_t = (q_t - \boldsymbol{\sigma}_{w_t})/N_{tr}$, where 100	e N _e = 20 re N _e = 17.5 re N _e = 15 200	Pa)12. 300 0	Se Schmertmann78; R&L Mayne (2007) 12.5	nsitivity, S _t 86 25	37.5 50	1. Mayne (20 1. Mayne (20 2. Mayne (20 8 12	Unit Weight, Y (k Y bulk _	:N/m ³) 20	Graphic Log
1- 2-	+ + + + + - - - - - - - - - - - - - - -					 	Letterhey Low										XXXX
3- 4-	+ 		Terrhinated at 3.01 m Refusal			 			 							¥	
5- 6-		- - - - - - - - - - -							 		 						
7- 8-		- - - - - - - - - -									 						
9-	+9 + +	- 				 								20nes 1-6 and Z			
CC CC CC FIL FIL	INE ID INE MO INE ARI INE ARI INE ARI ITER PO	DEL EA EA RATIO DSITION 'PE	: S15-CFIP.1858 : Subtraction : 15cm ² : 0.79 : u2 : HDPE	IEST TYPE APPLICATION CLASS RIG OPERATOR FRICTION REDUCER WEATHER	: 1E2 : 2 : CPT 017 - Griffen : RS : None : Raining & Mild	Transducer Tip Sleeve Pore Pressure 2 X-Y Inclinometer	204 mV 203 mV 239 mV 2075 mV	-RO VALUES Post 203 mV 203 mV 231 mV 2097 mV	Difference -0.011 MPa 0 kPa -0.002 kPa	Term based on me Extremely low strer Very low strength Low strength	asurement Igth 1 2	su (kPa) <10 0-20 0-40	Term based on Medium strength High strength Very high streng Extremely high st	measurement h gth strength	su (kPa) 40-75 75-150 150-300 >300	-	water on Test





			CPT LOG 02
SITE INVESTIGATION Working with	Seconical consultants	Poi	ntID 26
CLIENT : Soiltechnics PROJECT : Lossiemouth LOCATION : Lossiemouth PROJECT No. : 1200410	EASTING: 0.0 mNORTHING: 0.0 mELEVATION: 0.00 m ODCHECKED BY: LDTERMINATION REASON: Refusal	Remark: Test refused on tip resistan	Ce. SHEET : 1 OF 1 STATUS : Final TEST DATE : 20/10/2020 PLOT DATE : 26/10/2020 METHOD : ISO 22476-1:2012
E 5 10 15 20 0 5 10 15 20 0 100 200 300 400 500 Sleeve Friction Resistance, f_s (kPa) 0 1 1 0 1	Alized Soil Behaviour Type Index, I _{SST} Robertson (2010) 2 3 4 5 0 5 10 15 20 25 30 35 40	Relative Density, Dr, (%) 1. Baid et al. (1980); Al-Hernoud & Wehr (2006) 2. Jamolikowski et al. (2001) 3. Kulthowy & Mayne (1980) 45. 50 0 25 50 75 1	Friction Angle, ♦' (deg) 0 1. Sameet et al. (1988 & 1989) Mayne & Campanella (2005) 0 2. Robertson & Campanella (1953) 0 3. Kulhawy & Mayne (1999) 0 00 0 20 40 60 80
2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	A Sandar Gamos repaired for the first stands - - -	22 30 10 10 10 10 10 10 10 10 10 10 10 10 10	
Image: Constraint of the constr			
		RANULAR SOILS (Sands & Gravels) Robertson et al. 1986 a ptin SBT Index, lc Description SPT N value, NSPT Description	Zones 7-10 and Zone 12 Jipion Relative Density DP (%)
CONE MODEL : Subtraction APPLICATION CLASS : 2 CONE AREA : 15cm ² RIG : CPT 017 - G CONE AREA RATIO : 0.79 OPERATOR : RS FILTER POSITION : u2 FRICTION REDUCER : None FILTER TYPE : HDPE WEATHER : Raining & M	Transducer Pre Post Difference Clays Sriffen Tip 204 mV 202 mV -0.022 MPa Sitt mi Sleeve 202 mV 205 mV 0.002 kPa Sitt mi Pore Pressure 2 28 mV 203 mV -0.004 kPa Sands Iild X-Y Inclinometer 1980 mV 1993 mV Sands Graws	2.95-3.60 Very Loose 0 - 4 Very Loose vtures 2.60-2.95 Loose 4 - 10 Loose vitures 2.05-2.60 Medium Dense 10 - 30 Mediu 1.31-2.05 Dense 30 - 50 Dense Vsand -1.31 Very Dense >50 Very	0 - 15 15 - 35 m Dense 35 - 65 ⇒ 65 - 85 Dense - 85

				112 1											CPT L	.OG 03
SITE	INVE	STIGATIO	DN Working with									Poi	ntID	26		
CLIENT : Soiltechnics PROJECT : Lossiemouth LOCATION : Lossiemouth PROJECT No. : 1200410					EASTING: 0.0 mNORTHING: 0.0 mELEVATION: 0.00 m ODCHECKED BY: LDTERMINATION REASON: Refusal					Remark: Test refused on tip resistance. SHEET : 1 OF 1 STATUS : Final TEST DATE : 20/10/2020 PLOT DATE : 26/10/2020 METHOD : ISO 22476-1:20)) ;-1:2012	
Depth (m) Elevation (m)	0 0 1	Corrected Cone Resistant 5 10 00 200 3 Sleeve Friction Resistant	ce, q _t (MPa) 15 20 100 400 500 ce, f _s (kPa)	Fines Conter 1. R&W 99 and NOEER 2001 2. Suzuki et al. (1998) 3. Boulanger and Idriss (2014) 0. 25 50	ıt, FC (%) 75 1	LB. s. BE. s. UB. s	Undrained She $_{u}^{u} = (q_{c} - \boldsymbol{\sigma}_{uc})/N_{uc}$, wher $_{u}^{u} = (q_{c} - \boldsymbol{\sigma}_{uc})/N_{uc}$, wher $_{v}^{u} = (q_{c} - \boldsymbol{\sigma}_{uc})/N_{uc}$, wher 100	ar Strength, s _u (k e N _e = 20 e N _e = 17.5 e N _e = 15 200	Pa)		Sensitivity, S _t &L86 25	37.5	1. Mayne (20 1. Mayne (20 2. Mayne (20 50 8 12	Unit Weight, Y (k Y buik 07) 07) 16	N/m³) 20	Graphic Log
		Terminated at 3.43 m Refusal														
CONE ID CONE MC CONE AR CONE AR FILTER PC FILTER T	DDEL EA EA RATIO OSITION YPE	: S15-CFIP.1858 : Subtraction : 15cm ² : 0.79 : u2 : HDPE	TEST TYPE APPLICATION CLASS RIG OPERATOR FRICTION REDUCER WEATHER	: TE2 : 2 : CPT 017 - Griffen : RS : None : Raining & Mild	Transducer Tip Sleeve Pore Pressure 2 X-Y Inclinometer	CPTU ZE Pre 204 mV 202 mV 238 mV 1980 mV	ERO VALUES Post 202 mV 205 mV 223 mV 1993 mV	Difference -0.022 MPa 0.002 kPa -0.004 kPa	COHESIN Term based on Extremely low s Very low streng Low strength	VE SOILS (Clays n measurement strength gth	<u>& Silts) Robe</u> su (kPa) <10 10-20 20-40	Term based o Medium stren High strength Very high stre Extremely hig	5 Zones 1-6 and 2 n measurement gth ngth h strength	cone 11 su (kPa) 40-75 75-150 150-300 >300	Groundy Level	water on Test







CPT LOG 02

														CPT LOG 03		
SI	TE	INVE	STIGATIO	DN Working wit								PointIE	⁾ 27	,		
CLIENT : Soiltechnics PROJECT : Lossiemouth LOCATION : Lossiemouth PROJECT No. : 1200410						EASTING : 0.0 m Remark: NORTHING : 0.0 m Test refused on f ELEVATION : 0.00 m OD CHECKED BY : LD TERMINATION REASON : Refusal Image: Comparison of the second sec						tip resistance.	SHEET : 1 OF 1 resistance. STATUS : Final TEST DATE : 20/10/2020 PLOT DATE : 26/10/2020 METHOD : ISO 22476-1:2012			
Depth (m)	Elevation (m)	0 0 1	Corrected Cone Resista 5 10 00 200 Sleeve Friction Resista	nce, q, (MPa) 15	Fines Conte 1. R&W 98 and NCEER 2001 2. Skcziki et al. (1998) 3. Boulanger and Idriss (2014) 0 25 500	nt, FC (%) 75 1		Undrained She $s_u = (q_t - \boldsymbol{\sigma}_{cu})/N_{tc}$, where $s_u = (q_t - \boldsymbol{\sigma}_{cu})/N_{tc}$, where $s_u = (q_t - \boldsymbol{\sigma}_{cu})/N_{tc}$, where 100	ar Strength, s _u (k e N _u = 20 e N _u = 17.5 e N _u = 15 200	Pa)	Sensitivity, S _t Schmertmann78; R&L86 Aleyne (2007) 12.5 25	37.5 50 8	Unit Weight, Y 1. Mayne (2007) 1. Mayne (2007) 2. Mayne (2007) 12 16	(kN/m ³) ^{Ak} 20 24		
1. 2. 3.		A C						- Heh								
4 5	+ 4 5 5		Ferminated at 3.77 m Refusal													
6 [.] 7 [.]		- - - - - - - - - - - -														
8- 9-																
			: S15-CFIP.1858 : Subtraction	TEST TYPE APPLICATION CLASS	: TE2 : 2	Transducer	CPTU Z Pre	ERO VALUES Post	Difference	COHESIVE S	OILS (Clays & Silts) Rob	ertson et al. 1986 Zon Term based on me	nes 1-6 and Zone 11 easurement su (kPa)	Groundwater		
CC CC FIL FIL	NE AR NE AR TER PO	EA EA RATIO OSITION YPE	: 15cm ² : 0.79 : u2 : HDPE	RIG OPERATOR FRICTION REDUCER WEATHER	: CPT 017 - Griffen : RS : None : Raining & Mild	Tip Sleeve Pore Pressure 2 X-Y Inclinometer	206 mV 205 mV 238 mV 2061 mV	202 mV 202 mV 225 mV 2111 mV	-0.043 MPa -0.002 kPa -0.003 kPa	Extremely low strength Very low strength Low strength	gth <10 10-20 20-40	Medium strength High strength Very high strength Extremely high stre	40-75 75-150 150-300 ength >300	비비 Dissipation Test		







CPT LOG 02

																CPT I	LOG 03
SI	TE	INVI	ESTIGATIO	→ → Working wit									PointID	1	28		
CLIENT : Soiltechnics PROJECT: Lossiemouth LOCATION : Lossiemouth PROJECT No. : 1200410					EASTING NORTHING ELEVATION CHECKED B TERMINATIC	EASTING: 0.0 mReNORTHING: 0.0 mTesELEVATION: 0.00 m ODCHECKED BY: LDTERMINATION REASON: Refusal						tip resistance. SHEET : 1 OF 1 STATUS : Final TEST DATE : 20/10/2020 PLOT DATE : 26/10/2020 METHOD : ISO 22476-1:2012					
Depth (m)	Elevation (m)	Corrected Cone Resistance, q, (MPa) 0 5 10 15 20 2 Stocki et 0 100 200 300 400 500 Sleeve Friction Resistance, f _s (kPa) 0 25			Fines Cont 1. R&W 98 and NCER 250 2. Suzuki et al. (1988) 3. Boulanger and Idriss (2014 0 25 5	ent, FC (%)	t, FC (%) Undrained Shea EB. s _i = (q - ♥)N ₀ , where UB. s _i = (q - ♥)N ₀ , where UB. s _i = (q - ♥)N ₀ , where			Pa)12.	Sensitivity, S _t Schmertmann78; R&L66 Mayne (2007) 12.5 25 37.5		Unit Weight, Y (kN/m ²)		/m³) 20	Graphic Log	
1								Misburn									
4 5 6 7 8 9			Terminated at 3:87 m Refusal														
	DNE ID DNE MO DNE AF DNE AF TER P TER T	DDEL EA CEA RATIO OSITION YPE	: S15-CFIP.1858 : Subtraction : 15cm ² : 0.79 : u2 : HDPE	TEST TYPE APPLICATION CLASS RIG OPERATOR FRICTION REDUCER WEATHER	: TE2 : 2 : CPT 017 - Griffen : RS : None : Raining & Mild	Transducer Tip Sleeve Pore Pressure 2 X-Y Inclinometer	CPTU Z Pre 203 mV 202 mV 230 mV 2105 mV	ERO VALUES Post 204 mV 204 mV 231 mV 2198 mV	Difference 0.011 MPa 0.001 kPa 0 kPa	COHESIVE S Term based on me Extremely low strer Very low strength Low strength	SOILS (Clays & Silts) asurement su (kF agth <10 10-20 20-40	Robertson et Pa) Term b Mediur High s Very h Extrem	al. 1986 Zone based on mea m strength trength igh strength nely high strength	es 1-6 and Zor asurement ngth	su (kPa) 40-75 75-150 150-300 >300	-	lwater ion Test




														CP	T LOG 02
SITE INV	ESTIGATIC	DN Working with										PointID		29	
CLIENT PROJECT LOCATION PROJECT No.	: Soiltechnics : Lossiemouth : Lossiemouth : 1200410	ו		EASTING NORTHING ELEVATION CHECKED B TERMINATIO	Y DN REAS(: 0.0 : 0.0 : 0.00 : LD ON : Refi	m m) m OD usal			Remark: Test refused	d on total p	essure.	SHEET STATUS TEST D PLOT D METHO	: 1 OF 5 : Final ATE : 20/10/2 ATE : 26/10/2 D : ISO 22	1 2020 2020 2476-1:2012
Depth (m) Elevation (m) 0 0	Corrected Cone Resistance 5 10 100 200 30 Sleeve Friction Resistance	ze, q _t (MPa) 1520 10400500 ze, f _s (kPa)	Non-normalized Soil Beh Robertson	aviour Type Index, I _{SBT} (2010)	1. Ro 2. Jel 3. Ro	b. & Wride 98 ff. & Davies 93 bertson 2012	SPT N ₆₀	40 45 50 0	1. Baldi 2. Jamic 3. Kulha	Relative Densi et al. (1986); Al-Homoud olkowski et al. (2001) awy & Mayne (1990)	ity, D _r (%) & Wehr (2006) 75	100 0	Friction A 1. Senneset et al. (1988 & 1 2. Robertson & Campanella 3. Kulhawy & Mayne (1990) 20	ngle, \ (deg) 969): Mayne & Campanella (; (1983)	2005) J J J J J J J J J J J J J J J J J J J
			Dense sand to gravely sand Dense sands to gravely sand Sands. Why sands to slity sand Sands. Why sands to slity sand Sand mixtures: slity sold p sandy slit	Clay						22 30 10 100000 1000000					
	Terminated at 4.81 m Refusal														
CONE ID CONE MODEL CONE AREA CONE AREA RATIO FILTER POSITION FILTER TYPE	: S15-CFIP.1858 : Subtraction : 15cm ² : 0.79 : u2 : HDPE	TEST TYPE APPLICATION CLASS RIG OPERATOR FRICTION REDUCER WEATHER	: TE2 : 2 : CPT 017 - Griffen : RS : None : Raining & Mild	Transducer Tip Sleeve Pore Pressure 2 X-Y Inclinometer	CPTU ZF Pre 206 mV 203 mV 254 mV 2312 mV	ERO VALUES Post 198 mV 203 mV 207 mV 2254 mV	5 Difference -0.087 MPa 0 kPa -0.012 kPa	GRANULAR Description Clays Silt mixtures Sand mixtures Sands Gravelly sand	SOILS (Si SBT Index, Ic 2.95-3.60 2.60-2.95 2.05-2.60 1.31-2.05 <1.31	ands & Gravels) F Description Very Loose Loose Medium Dense Dense Very Dense	Robertson et al. SPT N value, NSPT 0 - 4 4 - 10 10 - 30 30 - 50 >50	1986 Zones 7 Description Very Loose Loose Medium Dense Dense Very Dense	-10 and Zone 12 Relative Density Dr (%) 0 - 15 15 - 35 35 - 65 65 - 85 >85	Ground Level 	dwater ion Test

INI C														CPT	LOG 03
SITE INVES	TIGATION	Working with									P	ointID	29	Ð	
CLIENT : So PROJECT : Los LOCATION : Los PROJECT No. : 120	Diltechnics Dissiemouth Siemouth 0410			EASTING NORTHING ELEVATION CHECKED BY TERMINATIO	/ N REASC	: 0.0 n : 0.0 n : 0.00 : LD ON : Refu	n n m OD sal		Rema Test	ark: refused on	total pres	sure.	SHEET STATUS TEST DAT PLOT DAT METHOD	: 1 OF 1 : Final E : 20/10/20 E : 26/10/20 : ISO 2247	20 20 76-1:2012
Depth (m) Depth (m) 100 100 100 100 100 100 100 10	prrected Cone Resistance, c 10 200 300 leeve Friction Resistance, f,	15 20 400 500 (kPa)	Fines Conter 1. R&W 99 and NOEER 2001 2. Suzuki et al. (1998) 3. Boulanger and Idriss (2014) 0 25 50	ıt, FC (%) 75 1	LB. s. BE. s. UB. s.	Undrained She: = $(q_c - \sigma_{w_0})/N_{w_c}$, where = $(q_c - \sigma_{w_0})/N_{w_c}$, where = $(q_c - \sigma_{w_0})/N_{w_c}$ where 100	ar Strength, s _u (k e N _u = 20 e N _u = 17.5 e N _u = 15 200	Pa) - - 300 (1. Schmertmann78, 2. Mayne (2007) 12.5	Sensitivity, S _t R&L86 25	37.5	1. Mayne 1. Mayne 2. Mayne	Unit Weight, 1 (2007) (2007) (2007)	r (kN/m ³) ^{bulk} 20	Graphic Log
1 -1 2 -2 3 -3 4 -4 5 -5 7 -7 8 -8 9 -9 -1 -1	rated at 4.81 m														
CONE ID : S1: CONE MODEL : Sul CONE AREA : 15: CONE AREA RATIO : 0.7 FILTER POSITION : u2 FILTER TYPE : HE	5-CFIP.1858 T btraction A cm ² F 79 C PPE N	EST TYPE APPLICATION CLASS RIG DPERATOR FRICTION REDUCER VEATHER	: TE2 : 2 : CPT 017 - Griffen : RS : None : Raining & Mild	Transducer Tip Sleeve Pore Pressure 2 X-Y Inclinometer	CPTU ZE Pre 206 mV 203 mV 254 mV 2312 mV	RO VALUES Post 198 mV 203 mV 207 mV 2254 mV	Difference -0.087 MPa 0 kPa -0.012 kPa	COHE: Term based Extremely low Very low stree Low strength	SIVE SOILS (Clay on measurement w strength ength	s & Silts) Robe su (kPa) <10 10-20 20-40	Term based Medium stre High strengt Very high st Extremely h	86 Zones 1-6 and on measuremen ength th rength igh strength	t su (kPa) 40-75 75-150 150-300 >300	- Grour - Level - III Dissipa	ndwater ation Test







			112 1											CPT	LOG 03
SITE	INVESTIGATIO	Working with	Solitech environmental and geotechni								P	ointID	30)	
CLIE PRO LOCAT PROJE	NT : Soiltechnics JECT : Lossiemouth ON : Lossiemouth CT No. : 1200410	ו		EASTING NORTHING ELEVATION CHECKED BY TERMINATIO	Y N REASO	: 0.0 n : 0.0 n : 0.00 : LD ON : Refu	n n m OD sal		Rema Test i	ark: refused on	total pres	sure.	SHEET STATUS TEST DAT PLOT DAT METHOD	: 1 OF 1 : Final E : 20/10/20 E : 26/10/20 : ISO 224)20)20 76-1:2012
Depth (m) Elevation (m)	Corrected Cone Resistance 0 5 10 0 100 200 30 Sleeve Friction Resistance	ze, q _t (MPa) 15	Fines Conter 	- t, FC (%) 75 1		Undrained She $v_{1} = (q_{1} - \boldsymbol{\sigma}_{v_{0}})/N_{u_{1}}$, where $v_{1} = (q_{1} - \boldsymbol{\sigma}_{v_{0}})/N_{u_{1}}$, where $v_{2} = (q_{1} - \boldsymbol{\sigma}_{v_{0}})/N_{u_{2}}$, where 100	ar Strength, s _u (kl N _u = 20 N _u = 17.5 e N _u = 15 200	Pa)	1. Schmertmann78; 2. Mayne (2007)	Sensitivity, S _t R&L86	37 5	1. Mayne 1. Mayne 2. Mayne	Unit Weight, y (2007) (2007) (2007)	r (kN/m ³)	6 Graphic Log
	Terminated at 5.36 m Refusal														
CONE ID CONE MO CONE AF CONE AF FILTER P FILTER T	: S15-CFIP.1858 DDEL : Subtraction EA : 15cm ² REA RATIO : 0.79 OSITION : u2 YPE : HDPE	TEST TYPE APPLICATION CLASS RIG OPERATOR FRICTION REDUCER WEATHER	: TE2 : 2 : CPT 017 - Griffen : RS : None : Raining & Mild	Transducer Tip Sleeve Pore Pressure 2 X-Y Inclinometer	CPTU ZI Pre 204 mV 205 mV 220 mV 2063 mV	ERO VALUES Post 200 mV 201 mV 222 mV 2045 mV	Difference -0.043 MPa -0.003 kPa 0 kPa	COHESI Term based of Extremely low Very low stren Low strength	IVE SOILS (Clay: n measurement strength gth	s & Silts) Robe su (kPa) <10 10-20 20-40	Term based Medium stre High strengt Very high st Extremely h	86 Zones 1-6 and on measuremenength th rength igh strength	t su (kPa) 40-75 75-150 150-300 >300	- Groun Level III Dissipa	ndwater ation Test



														1	CPT LOG 01
Sľ	TE	INV	'ESTIGA'		Norking with:								PointID	31	
C P LC PF		NT JECT ON CT №.	: Soiltechr : Lossiem : Lossiemouth : 1200410	nics outh			EASTING NORTHING ELEVATION CHECKED BY TERMINATIO	Ý N REASO	: 0.0 n : 0.0 n : 0.00 : LD N : Refu	า า m OD sal		Remark: Test refused on tota	l pressure.	SHEET: 1STATUS: FiTEST DATE: 20PLOT DATE: 26METHOD: IS	OF 1 nal)/10/2020)/10/2020 O 22476-1:2012
Depth (m)	Elevation (m)	0	Corrected Cone F 5 0.5 Sleeve Friction F 100 2	Resistance, q _t (MPa) 10 1: 1 1. Resistance, f _s (kPa) 200 30	5 <u>20</u> 5 <u>20</u> 5 <u>20</u> 20 <u>20</u> 20 <u>20</u>	Friction Ratio, R _r	(%) In Situ F Porewa 6 8 -300 0	Pore Pressure, u ter Pressure, u ₂ 300 6	, (kPa) (kPa)	Inclination (°) 	Pore Pressu	re Ratio, B _q S _X Robe	bil Behaviour Type: rtson et al. 1986 qc Rf 4 5 6 7 8 9 10 1	60 Mater 1	al Description
1-	- - - 							 						O.30 High strength O.30 High strengt	sandy SILT to clayey SILT
2-								 						Medium dens to SAND (10)	e to dense gravelly SAND with a layer of clay ravelly SAND to SAND (10)
3-						- f = -' - =' - = - - f = - 		— — ¦— — - 						0	
5-		- - - - -	Terminated at 4.59 r Refusal	1				 		↓ ↓ ↓ ↓					
6- 7-			 					 					$\begin{array}{c} + + + + + + + + + + + + + + + + + + +$		
8-		- - - 						 							
9-	-9	- - - - - -	 					 							
CON CAL CON	IE ID IBRATIC IE MOD	ON DATE	: S15-CFIP.1858 : 26/07/2020 : Subtraction	TEST TYPE APPLICATION C RIG	: TE2 CLASS : 2 : CPT	017 - Griffen	Transducer	CPTU ZE Pre 203 mV	ERO VALUES Post 196 mV	Difference	METHOD: Robertson 1 - Sensitive fine grained r	et al. 1986 qc Rf material 5 - Clayey SILT to si	ilty CLAY 9-	SAND	Groundwater Level
CON CON FILT	IE ARE/ IE ARE/ ER POS ER TYP	A A RATIO SITION PE	: 15cm ² : 0.79 : u2 : HDPE	OPERATOR FRICTION REDU WEATHER GROUNDWATE	: RS JCER : None : Raini R DEPTH : Assu	ng & Mild med for calculation purp	Sleeve Pore Pressure 2 X-Y Inclinometer	203 mV 230 mV 1860 mV	199 mV 205 mV 1794 mV	-0.003 kPa -0.006 kPa	3 - CLAY 4 - Silty CLAY to CLAY	7 - Sitty SAND to sa	ndy SILT 11	- Very stiff fine grained - SAND to clayey SAND	메 Dissipation Test

IN SITU	216					CPT LOG 02
SITE INVESTIGATION Working with	SOIICECNN environmental and geotechnical co				PointID	31
CLIENT : Soiltechnics PROJECT : Lossiemouth LOCATION : Lossiemouth PROJECT No. : 1200410	E. N E C T	EASTING NORTHING ELEVATION CHECKED BY FERMINATION REAS	: 0.0 m : 0.0 m : 0.00 m OD : LD ON : Refusal	Remark: Test refused on total p	ressure. SHEET TEST D PLOT D METHO	: 1 OF 1 S : Final ATE : 20/10/2020 PATE : 26/10/2020 PD : ISO 22476-1:2012
E G S 10 15 20 0 5 10 15 20 20 20 20 20 20 20 500	Non-normalized Soil Behaviour Robertson (2010	ur Type Index, I _{S6T} 10) - 3, R - 3, R - 5, 0, 5	SPT N ₆₀ tab & Wride 98 fif. & Davies 93 doentson 2012 10, 15, 20, 25, 30, 35, 40, 45, 50, 0	Relative Density, D, (%) 1. Badi et al. (1996); Al-Hornoud & Wehr (2006) 2. Jaminikowski et al. (2011) 3. Kulhawy & Mayne (1990) 25 50 75	Friction A 	ngle, 🍦 (deg) 1992): Mayne & Campanelia (2005) 1(1955) 40. 60. 80
Image: Construction register to operating of the second	0 1 2 3 The field of the second of the seco	3 4 5 0 5 Image: state st				
CONE ID : S15-CFIP.1858 TEST TYPE CONE MODEL : Subtraction APPLICATION CLASS CONE AREA : 15cm² RIG CONE AREA RATIO : 0.79 OPERATOR FILTER POSITION : u2 FRICTION REDUCER FILTER TYPE : HDPE WEATHER	: TE2 : 2 Ti : CPT 017 - Griffen Ti : RS S : None P : Raining & Mild X	CPTU Z Transducer Pre Tip 203 mV Sleeve 203 mV Pore Pressure 2 230 mV X-Y Inclinometer 1860 mV	CERO VALUES GRANULAR Post Difference Difference 196 mV -0.076 MPa Silt midures 205 mV -0.003 kPa Silt midures 1794 mV -0.006 kPa Sands 1794 mV -0.006 kPa Graditures	SOILS (Sands & Gravels) Robertson et al. SBT Index, Ic Description SPT In Value, NSPT 2.95-3.60 Very Losse 0 - 4 2.062-25 Losse 4 - 10 2.05-260 Medium Dense 10 - 30 1.312-205 Dense 30 - 50 1.311 Very Dense 550	1986 Zones 7-10 and Zone 12 Description Relative Density Dr (%) Very Loose 0 - 15 Loose 15 - 35 Medium Dense 35 - 65 Dense 65 - 85 Very Dense >85	Groundwater Level ≪∭Dissipation Test

											_			CPT L	_OG 03
SITE	INVESTIGAT										P	PointID	31		
CLIE PRO LOCAT PROJE	NT : Soiltechnie JECT: Lossiemou ION : Lossiemouth CT No. : 1200410	cs uth		EASTING NORTHING ELEVATION CHECKED B ^N TERMINATIO	Y IN REASC	: 0.0 n : 0.0 n : 0.00 : LD DN : Refu	n n m OD sal		Rem Test	ark: refused on	total pres	ssure.	SHEET STATUS TEST DATE PLOT DATE METHOD	: 1 OF 1 : Final : 20/10/202 : 26/10/202 : ISO 22476	0 0 5-1:2012
Depth (m) Elevation (m)	Corrected Cone Resi 0 5 10 0 100 200 Sleeve Friction Resi	stance, q, (MPa) 15	Fines Conter 1. R&W 98 and NCER 2001 2. Sucraid et al. (1998) 3. Boulanger and Idriss (2014) 0 25 50	rt, FC (%) 75 1	LB. s, BE. s, UB. s	Undrained She = $(\mathbf{q} - \boldsymbol{\sigma}_{w})/N_{e}$, wher = $(\mathbf{q} - \boldsymbol{\sigma}_{w})/N_{e}$, wher = $(\mathbf{q} - \boldsymbol{\sigma}_{w})/N_{e}$, when 100	ar Strength, s _u (k a N _u = 20 b N _u = 17.5 e N _u = 15 200	Pa)		Sensitivity, S _t ; R&L86 25	37.5	1. Mayn 1. Mayn 2. Mayn 50 8	Unit Weight, Y (e (2007) e (2007) 12 16	kN/m³)	Graphic Log
□ □ □ − 1 − 2 − 3 − 3 − 4 − 4 − 5 − 6 − 6 − 7 − 7 − 8 − 9 − 9 −	Terminated at 4.59 m Refusal														
	: S15-CFIP.1858	TEST TYPE	†	<u>.</u>		ROVALUES		COHES	IVE SOILS (Clay	/s & Silts) Robe	ertson et al. 19	† 986 Zones 1-6 an	d Zone 11	Cround	1
CONE MO CONE ARI CONE ARI FILTER PO FILTER TY	DEL : Subtraction EA : 15cm ² EA RATIO : 0.79 DSITION : u2 'PE : HDPE	APPLICATION CLASS RIG OPERATOR FRICTION REDUCER WEATHER	: 2 : CPT 017 - Griffen : RS : None : Raining & Mild	Transducer Tip Sleeve Pore Pressure 2 X-Y Inclinometer	Pre 203 mV 203 mV 230 mV 1860 mV	Post 196 mV 199 mV 205 mV 1794 mV	Difference -0.076 MPa -0.003 kPa -0.006 kPa	Term based o Extremely low Very low stren Low strength	n measurement strength ngth	su (kPa) <10 10-20 20-40	Term based Medium str High streng Very high s Extremely h	d on measuremen ength gth trength nigh strength	nt su (kPa) 40-75 75-150 150-300 >300	Level	on Test



												CPT LOG 01
si	TE	INVESTIGA		soiltech						PointID	32	
CI PI LO PR		NT : Soiltech JECT : Lossiem ION : Lossiemouth CT No. : 1200410	nics nouth		EASTING NORTHING ELEVATION CHECKED BY TERMINATIO	, N REASON	: 0.0 m : 0.0 m : 0.00 m OD : LD I : Refusal	Ra Te	emark: est refused on tip resis	stance.	SHEET: 1STATUS: FTEST DATE: 2PLOT DATE: 2METHOD: IS	OF 1 nal 0/10/2020 6/10/2020 60 22476-1:2012
Depth (m)	Elevation (m)	Corrected Cone 0 5 1 0 0.5 Sleeve Friction 0 100	Resistance, q, (MPa) 10 15 1 1.5 - 1 1.5 - - Resistance, f_s (kPa) 300 - -	-20 -20 -2 500 0 2 4) In Situ P Porewat 6 8 -300 0	ore Pressure, u ₀ (l er Pressure, u ₂ (k 300 600	kPa) Inclination (°) — — Pa) 1 — 0 900 -5 0 5 10	Pore Pressure Ra	tio, B _q Soil Be Robertsor - 0.9 1.4 1 2 3 4 4	ehaviour Type: i et al. 1986 qc Rf 5 6 7 8 9 10 11	boj ji Mate Boj ji Mate	ial Description
- - - 1	+ · · · · · · · · · · · · · · · · · · ·										X 0.20 Medium strei Dense grave 0 1.00 Medium den. (10) utilh low	ngth silty CLAY to CLAY (4) Ily SAND to SAND (10) se gravelly SAND to SAND
2-	2	Terminated at 2 47	- 			+ 					(10) With lays 	ravelly SAND to SAND (10) /
3		Refusal										
4	4 											
	- - 											
	+ + 					+ 						
8						 +						
		- - - : S15-CFIP.1858	 TEST TYPE :	TE2					 			
CALI CON CON FILTE FILTE	BRATIC E MOD E ARE/ E ARE/ ER POS ER TYP	ON DATE: 26/07/2020 DEL : Subtraction A : 15cm ² A RATIO : 0.79 SITION : u2 PE : HDPE	APPLICATION CLASS : RIG : OPERATOR : FRICTION REDUCER : WEATHER : GROUNDWATER DEPTH :	2 CPT 017 - Griffen RS None Raining & Mild Assumed for calculation purpose	Transducer Tip Sleeve Pore Pressure 2 X-Y Inclinometer	Pre 203 mV 204 mV 228 mV 2541 mV	Post Difference 203 mV 0 MPa 200 mV -0.003 kPa 224 mV -0.001 kPa 2535 mV	1 - Sensitive fine grained material 2 - Organic material 3 - CLAY 4 - Sitiy CLAY to CLAY	5 - Clayey SILT to silty CL 6 - Sandy SILT to clayey S 7 - Silty SAND to sandy SI 8 - SAND to silty SAND	AY 9 - S. ILT 10 - C LT 11 - V 12 - S	AND Gravelly SAND to SAND /ery stiff fine grained SAND to clayey SAND	Level

						•										CF	ንT LOG 02
SIT	E	INVE	STIGAT		SOIICECN environmental and geotechr									PointID		32	
CL PR LOC PRC		NT : IECT : ON : CT №. :	Soiltechnie Lossiemouth 1200410	cs uth		EASTING NORTHING ELEVATION CHECKED B TERMINATIO	Y DN REAS(: 0.0 : 0.0 : 0.00 : LD ON : Ref	m m) m OD usal			Remark: Test refused	d on tip resi	stance.	SHEET STATUS TEST D. PLOT D METHO	: 1 OF ; : Final ATE : 20/10 ATE : 26/10 D : ISO 2	: 1)/2020)/2020 22476-1:2012
Depth (m)	Elevation (m)	0 1	Corrected Cone Resi 5 10 00 200 Sleeve Friction Resi	stance, q, (MPa) 15	0 Non-normalized Soil Bef Robertsoi	naviour Type Index, I _{sвт} n (2010) 3 4		ob. & Wride 98 ff. & Davies 93 obertson 2012 10 15 20	SPT N ₆₀ 25 30 35	5 40 45 50	1. Baid 2. Jam 3. Kult	Relative Densi di et al. (1986); Al-Hornoud licilkowski et al. (2001) nawy & Mayne (1990) 25 50	ity, D _r (%) & Wehr (2006) 75	100 0	Friction A 1. Senneset et al. (1988 & 1 2. Roberton & Campanella 3. Kulhawy & Mayne (1990) 20	ıgle, ∳' (deg) 989): Mayne & Campanelli (1983) 40 60	a (2005) 50 30 80 80
	1				bense sand to gravely sand 	Lurtes: ciayey silit& sility ciay						Loose -			 		
3	4		Ferminated at 2.47 m Refusal														
	8												 		 		
CONE CONE CONE FILTE FILTE	E ID E MOE E ARE E ARE R PO R TYP	DEL A A RATIO SITION PE	S15-CFIP.1858 : Subtraction : 15cm ² : 0.79 : u2 : HDPE	TEST TYPE APPLICATION CLASS RIG OPERATOR FRICTION REDUCER WEATHER	: TE2 : 2 : CPT 017 - Griffen : RS : None : Raining & Mild	Transducer Tip Sleeve Pore Pressure 2 X-Y Inclinometer	CPTU Z Pre 203 mV 204 mV 228 mV 2541 mV	ERO VALUES Post 203 mV 200 mV 224 mV 2535 mV	S Difference 0 MPa -0.003 kPa -0.001 kPa	GRANULA Description Clays Silt mixtures Sand mixtures Sands Compliances	AR SOILS (S SBT Index, I 2.95-3.60 2.60-2.95 2.05-2.60 1.31-2.05 c1 21	Sands & Gravels) F lc Description Very Loose Loose Medium Dense Dense	Robertson et al. SPT N value, NSPT 0 - 4 4 - 10 10 - 30 30 - 50	1986 Zones 7 Description Very Loose Loose Medium Dense Dense	7-10 and Zone 12 Relative Density Dr (%) 0 - 15 15 - 35 35 - 65 65 - 85	Grour - ∠ Grour Level	ndwater I ation Test

CPT LOG 03 IN SITU soiltechnics PointID 32 SITE INVESTIGATION Working with: CLIENT : Soiltechnics EASTING : 0.0 m Remark: SHEET : 1 OF 1 STATUS NORTHING : 0.0 m Test refused on tip resistance. : Final **PROJECT:** Lossiemouth : 0.00 m OD TEST DATE : 20/10/2020 **ELEVATION** LOCATION : Lossiemouth CHECKED BY PLOT DATE : 26/10/2020 ·ID PROJECT No. : 1200410 **TERMINATION REASON: Refusal** METHOD : ISO 22476-1:2012 Unit Weight, y (kN/m³) Fines Content, FC (%) Undrained Shear Strength, s, (kPa) Sensitivity, S Corrected Cone Resistance, q, (MPa) Graphic Log ----- **Y** bulk . R&W 98 and NCEER 2001 1. Schmertmann78; R&L86 2. Mayne (2007) 10 15 LB. $s_u = (q_t - \sigma_{v_0})/N_{kt}$, where $N_{kt} = 20$ BE. $s_u = (q_t - \sigma_{v_0})/N_{kt}$, where $N_{kt} = 17.5$ 1. Mayne (2007) 1. Mayne (2007) 2. Mayne (2007) Depth (m) 3. Boulanger and Idriss (2014) <u>lo</u> 100 200 300 400 - 500 Шeх Ш Sleeve Friction Resistance, fs (kPa) 100 200 300 0 12.5 37.5 12 25 50 75 100 0 25 50 8 16 20 24 igh :0 . Ò .0. 0 Ö + 0. ö. 2---2 0 Ó Terminated at 2.47 m Refusal 3----3 Ŧ 4---/ + 5-+ 6. -6 1 7----7 8---8 9---9 COHESIVE SOILS (Clays & Silts) Robertson et al. 1986 Zones 1-6 and Zone 11 CONE ID : S15-CFIP.1858 TEST TYPE : TE2 CPTU ZERO VALUES Groundwater <u></u> Level CONE MODEL Subtraction APPLICATION CLASS : 2 Transducer Pre Post Difference su (kPa) Term based on measurement su (kPa) Term based on measurement : CPT 017 - Griffen 0 MPa CONE AREA : 15cm² RIG Tip 203 mV 203 mV Extremely low strength <10 Medium strength 40-75 CONE AREA RATIO : 0.79 OPERATOR : RS Sleeve 204 mV 200 mV -0.003 kPa 10-20 High strength 75-150 Very low strength FILTER POSITION : u2 FRICTION REDUCER : None Pore Pressure 2 228 mV 224 mV -0.001 kPa Low strength 20-40 Very high strength 150-300 I Dissipation Test FILTER TYPE : HDPE WEATHER : Raining & Mild X-Y Inclinometer 2541 mV 2535 mV Extremely high strength >300





IN SITU	10 July 1			CPT LOG 02
SITE INVESTIGATION Working wif	SOIICECNNICS environmental and geotechnical consultants th:		Poir	3 3
CLIENT : Soiltechnics PROJECT : Lossiemouth LOCATION : Lossiemouth PROJECT No. : 1200410	EASTING NORTHING ELEVATIO CHECKED TERMINAT	: 0.0 m G : 0.0 m N : 0.00 m OD BY : LD TON REASON : Refusal	Remark: Test refused on tip resistand	SHEET : 1 OF 1 STATUS : Final TEST DATE : 20/10/2020 PLOT DATE : 26/10/2020 METHOD : ISO 22476-1:2012
E Corrected Cone Resistance, q1 (MPa) 0 5 10 15 2 0 10 200 300 400 50 0 10 200 300 400 50 0 Sleeve Friction Resistance, f4 (kPa) 10 50 50	Non-normalized Soil Behaviour Type Index, I _{st} Robertson (2010)	SPT N ₆₀ 	Relative Density, D, (%) 1. Bald et al. (1986); Al-Homoud & Wehr (2006) 2. Jamökovski et al. (2001) 3. Kulhawy & Mayne (1990) 0. 25 E0 75 10	Friction Angle, ♦' (deg) 0
A III 5 Decent modern to should be region of the should be should be should be region of the should be region of	0 1 2 3 4			
CONE ID : \$15-CFIP.1858 TEST TYPE CONE MODEL : Subtraction APPLICATION CLASS CONE AREA : 15cm² RIG CONE AREA RATIO : 0.79 OPERATOR FILTER POSITION : u2 FRICTION REDUCER FILTER TYPE : HDPE WEATHER	: TE2 : CPT 017 - Griffen : RS : None : Raining & Mild : Transducer Tip Sleeve Pore Pressure X-Y Inclinomet	CPTU ZERO VALUES GRANULA Pre Post Difference 203 mV 201 mV -0.022 MPa 201 mV 201 mV 0 kPa 2 228 mV 220 mV -0.002 kPa er 2448 mV 2433 mV Gravely sand	R SOILS (Sands & Gravels) Robertson et al. 1986 Z SBT Index, Ic Description SPT N value, NSPT Description 2.95-3.60 Very Loose 0 - 4 Very Loose 0 - 4 2.60-2.95 Loose 4 - 10 Loose Loose 2.05-2.60 Medium Dense 10 - 30 Medium 1.31-2.05 Dense 30 - 50 Dense	Prices 7-10 and Zone 12 Groundwater ion Relative Density Dr (%) cse 0 - 15 15 - 35 Level 10ense 35 - 65 65 - 85 41 Dissipation Test

SITE INVESTIGATION Working with:	al consultants	PointID 33
CLIENT : Soiltechnics PROJECT : Lossiemouth LOCATION : Lossiemouth PROJECT No. : 1200410	EASTING: 0.0 mRemark:NORTHING: 0.0 mTest refused onELEVATION: 0.00 m ODCHECKED BY: LDTERMINATION REASON: RefusalImage: Comparison of the second s	tip resistance. SHEET : 1 OF 1 STATUS : Final TEST DATE : 20/10/2020 PLOT DATE : 26/10/2020 METHOD : ISO 22476-1:2012
E 5 10 15 20 20 3 Boulanger and Miss (2014) 0 5 10 15	FC (%) Undrained Shear Strength, s _u (kPa) Sensitivity, S ₁ LB s _u = (q - • u)Nu, where Nu = 20 1. Schmertmann?e: R&L&6 BE s _u = (q - • u)Nu, where Nu = 20 2. Mayne (2007) 75 100 100 200 300 1.25 25	Unit Weight, y (kN/m ³) <u>1. Mayne (2007)</u> <u>2. Mayne (2007)</u> <u>37.5</u> 50 8 12 16 20 24
u u		37.3 50/18 12 16 20 24 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
CONE ID : S15-CFIP.1858 TEST TYPE : TE2 CONE MODEL : Subtraction APPLICATION CLASS : 2 CONE AREA : 15cm ² RIG : CPT 017 - Griffen CONE AREA RATIO : 0.79 OPERATOR : RS FILTER POSITION : u2 FRICTION REDUCER : None	CPTU ZERO VALUES COHESIVE SOILS (Clays & Silts) Robe Transducer Pre Post Difference Tip 203 mV 201 mV -0.022 MPa Sleeve 201 mV 201 mV 0 kPa Pore Pressure 2 228 mV 220 mV -0.002 kPa	rtson et al. 1986 ∠ones 1-6 and ∠one 11 Term based on measurement su (kPa) Medium strength 40-75 High strength 75-150 Very high strength 150-300 III Dissipation Test



												CPT LOG 01
si	ΓE	INVESTIGA		solltech						PointID	34	
CI PI LO PR		NT : Soiltech JECT : Lossiem ON : Lossiemouth CT No. : 1200410	nics nouth		EASTING NORTHING ELEVATION CHECKED BY TERMINATIO	/ N REASON	: 0.0 m : 0.0 m : 0.00 m OD : LD : Refusal		Remark: Test refused on inclina	ation.	SHEET: 1STATUS: FiTEST DATE: 20PLOT DATE: 26METHOD: IS	OF 1 nal)/10/2020)/10/2020 O 22476-1:2012
Depth (m)	Elevation (m)	Corrected Cone 0 5 0 0.5 Sleeve Friction 0 100	Resistance, q, (MPa) 10 15 1 1.5 1 1.5 Resistance, f _s (kPa) 200 300	20 2 500 0 2 4	6) In Situ P Porewa 6 8 -300 0	ore Pressure, u ₀ (kl ter Pressure, u ₂ (kP 300 600	Pa) Inclination (°) — — — Pa) 1 — — 900 -5 0 5 10	Pore Pressu 2 15 -0.6 -0.1 0.4	re Ratio, B _q Soil Roberts 4 0.9 1.4 1 2 3 4	Behaviour Type: on et al. 1986 qc Rf 5 6 7 8 9 10 1	60 1	al Description
											0.30 Medium strer sandy SILT to Dense locally to SAND (10)	gth becoming high strength clayey SILT (6) very dense gravelly SAND with layers of clay
2		Terminated at 1.74										
4												
6- - - - 7-												
8												
CON CALI CON CON CON FILTE	E ID BRATIC E MODI E AREA E AREA E AREA	: S15-CFIP.1858 DN DATE : 26/07/2020 EL : Subtraction A : 15cm ² A RATIO : 0.79 SITION : u2 E : UDDE	TEST TYPE APPLICATION CLASS RIG OPERATOR FRICTION REDUCER WEATHER CROUNDWATER DETET	: TE2 : CPT 017 - Griffen : RS : None : Raining & Mild	Transducer Tip Sleeve Pore Pressure 2 X-Y Inclinometer	CPTU ZERO Pre F 203 mV 2 202 mV 2 228 mV 2 2369 mV 2	DVALUES Post Difference 203 mV 0 MPa 193 mV -0.006 kPa 213 mV -0.004 kPa 2358 mV	METHOD: Robertson 1 - Sensitive fine grained r 2 - Organic material 3 - CLAY 4 - Sitty CLAY to CLAY	et al. 1986 qc Rf material 5 - Clayey SILT to silly (6 - Sandy SILT to clayer 7 - Silty SAND to sandy 8 - SAND to silty SAND	LLAY 9-5 ySILT 11- SILT 11- 12-	SAND Gravely SAND to SAND Very stiff fine grained SAND to clayey SAND	Groundwater Level ଐ Dissipation Test

					217 I											С	PT LOG 02
Sľ	TE	INVE	ESTIGATIO											PointID		34	
C P LC PF	LIE RO DCAT ROJE	NT : JECT : ION : CT No. :	Soiltechnics Lossiemouth 1200410	s h		EASTING NORTHING ELEVATION CHECKED B TERMINATIC	Y DN REAS	: 0.0 r : 0.0 r : 0.00 : LD ON : Refu	n n m OD ısal			Remark: Test refused	l on inclina	tion.	SHEET STATUS TEST D PLOT D METHO	: 1 O ; : Fina ATE : 20/1 ATE : 26/1 D : ISO	F 1 J 0/2020 0/2020 22476-1:2012
Depth (m)	Elevation (m)	0	Corrected Cone Resistan 5 10 1 1 1 100 200 3 Sleeve Friction Resistan	ice, q _t (MPa) 15 20 300 400 500 ice, f _s (kPa)	Non-normalized Soil Beh Robertsor	aviour Type Index, I _{SBT} (2010) 3 4	1. Ro 2. Je 3. Ro 5 0 5	5 xb. & Wride 98 ff. & Davies 93 xbertson 2012 10 15 20	PT N ₆₀ 25 30 35	40 45 5	1. Bala 2. Jam 3. Kull	Relative Densii di et al. (1996); Al-Homoud & niolkowski et al. (2001) hawy & Mayne (1990) 25 50	ty, D _r (%) & Wehr (2006) 75	100 0	Friction Al 1. Senneset et al. (1988 & 1 2. Robertson & Campanelia 3. Kulhawy & Mayne (1990) 20	ıgle, ∳' (deg) 989): Mayne & Campanı (1983) 40 60	ella (2005) jui ella (2005) 80
1-					sand to gravelly sand	Jay <mark>y</mark> sift & sift or cla <mark>rva</mark> ays: clay to sitty clay 						Loose -		e e e e e e e e e e e e e e e e e e e	 		× ×
2- 3-			Terminated at 1.74 m Refusal		Dense Dense Sands: qear Sands: qear Sand mixturgs: s	Silt mixtures:						+ 					
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CO CO CO FIL FIL	NE ID NE MO NE AR NE AR TER PO TER TY	DDEL EA EA RATIO OSITION (PE	: S15-CFIP.1858 : Subtraction : 15cm ² : 0.79 : u2 : HDPE	TEST TYPE APPLICATION CLASS RIG OPERATOR FRICTION REDUCER WEATHER	: TE2 : 2 : CPT 017 - Griffen : RS : None : Raining & Mild	Transducer Tip Sleeve Pore Pressure 2 X-Y Inclinometer	CPTU Z Pre 203 mV 202 mV 228 mV 2369 mV	ERO VALUES Post 203 mV 193 mV 213 mV 2358 mV	Difference 0 MPa -0.006 kPa -0.004 kPa	GRANUL Description Clays Silt mixtures Sand mixtures Sands	AR SOILS (\$ SBT Index, 2.95-3.60 2.60-2.95 2.05-2.60 1.31-2.05	Sands & Gravels) R Ic Description Very Loose Loose Medium Dense Dense	Bobertson et al. SPT N value, NSPT 0 - 4 4 - 10 10 - 30 30 - 50	1986 Zones Description Very Loose Loose Medium Dense Dense	7-10 and Zone 12 Relative Density Dr (%) 0 - 15 15 - 35 35 - 65 65 - 85	-	undwater el pation Test

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Sľ	TE	INVESTIGATION Working w	Solitech environmental and geotechr								PointID	34		
C P LC PF	LIEI RO. CATI	NT : Soiltechnics JECT: Lossiemouth ION : Lossiemouth CT No. : 1200410		EASTING NORTHING ELEVATION CHECKED B ^Y TERMINATIO	Y IN REASO	: 0.0 r : 0.0 r : 0.00 : LD ON : Refu	n n m OD sal		Remark: Test refu	sed on inclir	nation.	SHEET STATUS TEST DATE PLOT DATE METHOD	: 1 OF 1 : Final : 20/10/2020 : 26/10/2020 : ISO 22476-	1:2012
Depth (m)	Elevation (m)	Corrected Cone Resistance, q, (MPa) 0 5 10 15 0 100 200 300 400 5 Sleeve Friction Resistance, f, (KPa) Sleeve State 5 5	Fines Conte 1. R&W 98 and NCEER 2001 2. Suzuki et al. (1998) 3. Boulanger and Idriss (2014) 0 25 50	nt, FC (%)	LB. s BE. s UB. s	Undrained She $_{u} = (\mathbf{q}_{c} - \boldsymbol{\sigma}_{uo})/N_{uo}$, when $_{u} = (\mathbf{q}_{c} - \boldsymbol{\sigma}_{uo})/N_{uo}$, when $_{u} = (\mathbf{q}_{c} - \boldsymbol{\sigma}_{uo})/N_{uo}$, when 100	ar Strength, s _u (k e N _e = 20 e N _e = 17.5 e N _e = 15 200	Pa)	Sense Schmertmann78; R&L86 Mayne (2007) 12.5	sitivity, S _t 25 37.5		Unit Weight, Y (k (2007) (2007) (2007) 12 16	:N/m³) 20 24	6 Graphic Log
	+ + + + 				Extrembly Low	H H								X 0 0
2		Terminated at 1.74 m												
8- - - 9- - - - - - - - - - - - - - - -				 										
CO CO CO FIL FIL	NE ID NE MOI NE ARE NE ARE FER PC FER TY	: S15-CFIP.1858 TEST TYPE DEL : Subtraction APPLICATION CLAS: EA : 15cm ² RIG EA RATIO : 0.79 OPERATOR DSITION : u2 FRICTION REDUCEF 'PE : HDPE WEATHER	: TE2 5 : 2 : CPT 017 - Griffen : RS ₹ : None : Raining & Mild	Transducer Tip Sleeve Pore Pressure 2 X-Y Inclinometer	CPTU ZE Pre 203 mV 202 mV 228 mV 2369 mV	ERO VALUES Post 203 mV 193 mV 213 mV 2358 mV	Difference 0 MPa -0.006 kPa -0.004 kPa	COHESIVE S Term based on mea Extremely low stren Very low strength Low strength	OILS (Clays & S asurement su gth <′ 10 20	ilts) Robertson e u (kPa) Term 10 Medi -20 High -40 Very Extre	et al. 1986 Zones 1-6 and n based on measuremen ium strength strength high strength emely high strength	Zone 11 t su (kPa) 40-75 75-150 150-300 >300	Groundwa Level ™∭ Dissipation	ater 1 Test





APPENDIX C

Magnetometer Data

	NSITU soiltechnics PointID																
Sľ	TE	INVE	STIGATIO		SOIITECI								PointID		01		
C P LC PF		NT : JECT : ON : CT №. :	Soiltechnics Lossiemouth 1200410	h		EASTING NORTHING ELEVATION CHECKED TERMINATI	N BY ION REAS	: 0.0 m : 0.0 m : 0.00 r : LD ON : Refus	m OD sal		Remark Test ref	: used on tip re	esistance.	SHEET STATU TEST D PLOT D METHO	: 1 S : Fii DATE : 19 DATE : 23 DD : IS	OF 1 nal /10/2020 i/10/2020 O 22476-1	1:2012
ipth (m)	evation)		Magnetic Field X (nT)		Magnetic Field Y (n)		Magnetic Field 2	2 (nT) -		Magne	tic Field Total (nT)		Ma	agnetic Field Gra	dient (nT/cm)	
De	<u>ٿ</u> ڙ	-50000 -25 -	000 0	25000 50000 -50000	-25000 0	25000 50000 -10	00000 -50000	0	50000	100000 0	25000	50000	75000 100000	-500 -250	0	250	500
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			S15-CEIP 1858		· TE2	<u> </u>	CPTI 7	ERO VALUES	<u> </u>	Ι		1	. 1			<u></u>	1
CO CO CO FIL FIL	NE MO NE ARE NE ARE TER PO TER TY	DEL EA EA RATIO DSITION PE	: Subtraction : 15cm ² : 0.79 : u2 : HDPE	APPLICATION CLAS RIG OPERATOR FRICTION REDUCE WEATHER	S : 2 : CPT 017 - Griffen : RS R : None : Raining & Mild	Transducer Tip Sleeve Pore Pressure 2 X-Y Inclinomete	Pre 209 mV 208 mV 2 282 mV er 2463 mV	Post 203 mV 204 mV 242 mV 2473 mV	Difference -0.065 MPa -0.003 kPa -0.01 kPa								

	MAG LOG PointID Necting with: PointID 02														
SI	TE		ESTIGATIO		SOIICECI rith:							PointID	02	2	
C P LC Pf	LIE RO DCAT ROJE	NT : JECT : 10N : CT No. :	Soiltechnics Lossiemouth 1200410	h		EASTING NORTHING ELEVATION CHECKED E TERMINATI	I 3Y ON REASO	: 0.0 m : 0.0 m : 0.00 m OD : LD N : Refusal		Remai Test re	rk: efused on tip r	esistance.	SHEET STATUS TEST DAT PLOT DAT METHOD	: 1 OF : Final E : 19/10/2 E : 23/10/2 : ISO 22	l :020 :020 476-1:2012
əpth (m)	evation		Magnetic Field X (nT)		Magnetic Field Y (nT		ŗ	Magnetic Field Z (nT)		Mag	netic Field Total (nT)		Magneti	c Field Gradient (n	Г/cm)
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2- 3- 4- 5- 6- 7- 8- 9-	2 3 		Implicated at 1.89 m Refusal I												
CC CC CC FIL FIL	NE ID NE MC NE AR NE AR TER P TER T	DDEL REA REA RATIO OSITION YPE	: S15-CFIP.1858 : Subtraction : 15cm ² : 0.79 : u2 : HDPE	TEST TYPE APPLICATION CLAS RIG OPERATOR FRICTION REDUCE WEATHER	: TE2 SS : 2 : CPT 017 - Griffen : RS R : None : Raining & Mild	Transducer Tip Sleeve Pore Pressure 2 X-Y Inclinometer	CPTU ZEF Pre 207 mV 205 mV 255 mV r 2413 mV	RO VALUES Post Difference 205 mV -0.022 MP 204 mV -0.001 kPa 243 mV -0.003 kPa 2404 mV -0.003 kPa	a						

											MAG LOG
Sľ	TE	INVESTIGATIO	Working with						PointID	03	
C P LC PF		NT : Soiltechnics JECT: Lossiemouth ION : Lossiemouth CT No. : 1200410	1		EASTING NORTHING ELEVATION CHECKED B TERMINATIO	: 0.0 : 0.0 : 0.0 SY : LD DN REASON : Re	m m 0 m OD fusal	Remark: Test refused on t	ip resistance.	SHEET : 1 STATUS : F TEST DATE : 1 PLOT DATE : 2 METHOD : IS	OF 1 'inal 9/10/2020 3/10/2020 SO 22476-1:2012
ath (m)	vation	Magnetic Field X (nT)		Magnetic Field Y (nT)		Magnetic Fie	ld Z (nT)	Magnetic Field Total	(nT)	Magnetic Field G	radient (nT/cm)
Dep	Ē€	-50000 -25000 0 2	5000 50000 -50000	-25000 0 2	5000 50000 -100	0000 -50000 0	50000 100000	0 25000 50000	75000 100000 -5	00 -250 0	250 500
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2-	+ + + + 2							 			
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5-	+ - - - 5							 			
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7-	+ + + + 										
9-	9 										
CO CO CO FIL FIL	NE ID NE MO NE ARI NE ARI TER PO TER TY	: S15-CFIP.1858 DEL : Subtraction EA : 15cm ² EA RATIO : 0.79 SITION : u2 PE : HDPE	TEST TYPE APPLICATION CLASS RIG OPERATOR FRICTION REDUCER WEATHER	: TE2 : 2 : CPT 017 - Griffen : RS : None : Raining & Mild	Transducer Tip Sleeve Pore Pressure 2 X-Y Inclinometer	CPTU ZERO VALUE Pre Post 206 mV 204 mV 205 mV 204 mV 249 mV 249 mV 2341 mV 2324 mV	S Difference -0.022 MPa -0.001 kPa 0 kPa				

	N SITU soiltechnics MAG LOG																				
S	TE	INVES	TIGATIC	DN Work	ing with:		tech									PointID)	04			
C F L	PRC OCAT ROJE	NT : So JECT : Lo ION : Loss CT No. : 1200	biltechnics siemout 1410	; h				EASTING NORTHIN ELEVATI CHECKE TERMINA	G ON D BY ATION RE	: 0.0 : 0.0 : 0.0 : LD ASON : Re) m) m)0 m OD fusal			Remark: Test refused	d on tip re	sistance.	S S F M	SHEET STATUS TEST DATE PLOT DATE METHOD	: 1 OF : Final : 19/10/2 : 23/10/2 : ISO 224	1 2020 2020 476-1:20	012
oth (m)	/ation	N	lagnetic Field X (nT)			Magne	etic Field Y (nT)			Magnetic Fie	əld Z (nT)			Magnetic Fie	ld Total (nT)			Magnetic	Field Gradient (n	T/cm)	
Dep	Elev Elev	-50000 -25000	0	25000 50000	-50000 -2	5000	0 :	25000 50000	0 -100000 -5	0000 0	50000	100000 0) 250	00 500	000	75000 10	00000 -500	-250	0	250	500
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5			ated at 4.26 m												·						
C C C F I FI	ONE ID ONE M ONE AF ONE AF LTER F LTER T	: S1: DDEL : Sui REA : 15c REA RATIO : 0.7 OSITION : u2 YPE : HD	5-CFIP.1858 otraction m ² 9 PE	TEST TYPE APPLICATION RIG OPERATOR FRICTION RE WEATHER	I CLASS : DUCER :	TE2 2 CPT 017 - RS None Raining & I	Griffen Vild	Transducer Tip Sleeve Pore Pressu X-Y Inclinom	CP1 Pre 207 m 205 m ire 2 262 m ieter 2049	FU ZERO VALUE Post IV 198 mV IV 201 mV IV 226 mV mV 2081 mV	ES Difference -0.098 MPa -0.003 kPa -0.009 kPa	a									

	NSITU soiltechnics MAG LOG																				
SI	TE		STIGA		- N Wor	kina with:										Po	intID		05		
C P LC PI	LIE RO DCAT ROJE	NT : JECT : ION : CT No. :	Soiltecl Lossier Lossiemout 1200410	hnics mouth					EASTING NORTHIN ELEVATI CHECKE TERMINA	G ON D BY ATION REA	: 0. : 0. : 0. : LI ASON : R	0 m 0 m 00 m OD 0 efusal		Rema Test	ark: refused on	tip resistar	ice.	SHEET STATUS TEST D PLOT D METHO	: 1 S : Fir ATE : 19 ATE : 23 D : IS	OF 1 ial /10/2020 /10/2020 O 22476-1:	:2012
pth (m)	svation)		Magnetic Fie	eld X (nT)			Magne 	tic Field Y (nT)			Magnetic F	ield Z (nT)		Ma	gnetic Field Tot	al (nT)		Ma	gnetic Field Gra	Jient (nT/cm)	
Del	Ē	-50000 -2	5000 0	25	000 50000	-50000 -2	25000	0	25000 50000	-100000 -50	0000 0	50000	100000 0	25000	50000	75000	100000 -5	500 -250	0	250	500
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CC CC CC FIL FIL	NE ID NE MC NE AR NE AR TER P(TER T)	DEL EA EA RATIO DSITION 'PE	: S15-CFIP.18 : Subtraction : 15cm ² : 0.79 : u2 : HDPE	58	TEST TYPE APPLICATIC RIG OPERATOR FRICTION R WEATHER	EDUCER	TE2 2 CPT 017 - RS None Raining & I	Griffen Mild	Transducer Tip Sleeve Pore Pressu X-Y Inclinom	CPT Pre 207 m ¹ 205 m ¹ re 2 247 m ¹ eter 2313 n	U ZERO VALU Post V 197 mV V 199 mV V 214 mV nV 2320 m	JES Difference -0.108 MPa -0.004 kPa -0.008 kPa V									

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SI	TE	INVESTIGATIO	Working with							PointID	06	j.		
C P LC Pf		NT : Soiltechnics JECT: Lossiemouth ON : Lossiemouth CT No. : 1200410	1		EASTING NORTHING ELEVATION CHECKED E TERMINATIO	: (: (: (3Y : L ON REASON : F	0.0 m 0.0 m 0.00 m OD LD Refusal	Remark: Test refuse	ed on tip resi	stance.	SHEET STATUS TEST DATE PLOT DATE METHOD	: 1 OF 1 : Final : 19/10/202 : 23/10/202 : ISO 22476	0 0 5-1:2012	
pth (m)	evation)	Magnetic Field X (nT)		Magnetic Field Y (nT)		Magnetic	5 Field Z (nT)	Magnetic F	ield Total (nT)		Magnetic	Field Gradient (nT/cm	1)	
Dep	ЭЩ	-50000 -25000 0 2	5000 50000 -50000	-25000 0	25000 50000 -10	0000 -50000	0 50000 100000	0 25000 5	0000 75	000 100000 -	500 -250	0 2	250 500	
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CC CC CC FIL FIL	NE ID NE MO NE ARE NE ARE TER PC TER TY	: S15-CFIP.1858 DEL : Subtraction A : 15cm ² A RATIO : 0.79 SITION : u2 PE : HDPE	TEST TYPE APPLICATION CLASS RIG OPERATOR FRICTION REDUCER WEATHER	: TE2 : 2 : CPT 017 - Griffen : RS : None : Raining & Mild	Transducer Tip Sleeve Pore Pressure 2 X-Y Inclinometer	CPTU ZERO VAI Pre Post 208 mV 204 m 206 mV 204 m 245 mV 254 m 2358 mV 2354	LUES Difference N − 0.043 MPa N − 0.001 kPa N 0.002 kPa mV							

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SI	TE	INVE	ESTIGATIO		SOII with:										PointID		07		
P P	LIE RO DCAT ROJE	NT JECT ION CT No. :	Soiltechnics Lossiemouth 1200410	h			EASTING NORTHING ELEVATION CHECKED TERMINAT) N BY ION REAS	: 0.0 r : 0.0 r : 0.00 : LD : N : Refu	m m ⊨m OD ısal		F	Remark: Fest refused	l on tip resi	stance.	SHEE STATI TEST PLOT METH	T : ⁷ JS : I DATE : ⁷ DATE : 2 OD : I	OF 1 Final 19/10/2020 23/10/2020 SO 22476	-1:2012
(m)	ation		Magnetic Field X (nT)		Magne	etic Field Y (nT)			Magnetic Field	l Z (nT)			Magnetic Fiel	d Total (nT)		٩	Magnetic Field C	∂radient (nT/cm)	
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C P LC PF		NT : JECT : ON : CT No. :	Soilte Lossie Lossiemc 1200410	chnic emou	s th						EASTIN NORTH ELEVA CHECI TERMI	NG HING TION KED B NATI(3Y ON REA	: : : : : : : : : : : : : : : : : : :	0.0 m 0.0 m 0.00 r LD Refus	m OD			Rema Test	ark: refused or	ו tip resi	istance.		SHEET STATUS TEST D. PLOT D METHO	3 : I ATE : ATE : D :	1 OF 1 ⁻ inal 19/10/202 23/10/202 ISO 2247(0 .0 3-1:2012
(m) u	ation		Magnetic	Field X (nT))			Maç	gnetic Field	í Y (nT)				Magn	etic Field Z	<u> (</u> nT)			Ma	agnetic Field To	tal (nT)			Mag	jnetic Field (Gradient (nT/cm	1)
Dept	(m)	-50000 -2	:5000	0	25000	50000	-50000	-25000	0	25	5000 5	0000 -100	0000 -50	000	0	5000	0 10000	0 00	25000	50000	75	000 10	0000 -500	-250	(0 2	250 500
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CO CO CO FIL FIL	NE ID NE MOE NE ARE NE ARE TER PO TER TYF	DEL A A RATIO ISITION PE	: S15-CFIP. : Subtraction : 15cm ² : 0.79 : u2 : HDPE	1858 n	TES APPI RIG OPE FRIC WE/	TYPE ICATION RATOR TION RE	I CLASS	: TE2 : 2 : CPT 017 : RS : None : Raining	7 - Griffen & Mild		Transduo Tip Sleeve Pore Pre X-Y Inclii	cer essure 2 nometer	CPTL Pre 208 mV 204 mV 265 mV 2231 m	U ZERO V Pos V 199 V 201 V 229 nV 225	/ALUES st 3 mV 1 mV 3 mV 35 mV	Difference -0.098 MF -0.002 kP -0.009 kF) Da a a										

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SI	TE	INVE	STIGATIC		solit with:										PointID		09		
C F L(RO CAT ROJE	NT : JECT : 10N : CT No. :	Soiltechnics Lossiemouth 1200410	h			EASTING NORTHIN ELEVATIC CHECKED TERMINA	G IN I BY FION REAS	: 0.0 : 0.0 : 0.00 : LD SON : Refu	m m) m OD usal			Remark: Test refuse	d on tip res	istance.	SHEI STAT TEST PLO MET	ET : I'US : I'DATE : I'DATE : HOD :	1 OF 1 Final 19/10/202 23/10/202 ISO 2247(0 0 3-1:2012
th (m)	ation		Magnetic Field X (nT)		Magnetic	Field Y (nT)			Magnetic Field	d Z (nT)			Magnetic Fie	eld Total (nT)			Magnetic Field	Gradient (nT/cm	i)
Dep	Ĵ. E	-50000 -2	5000 0 :	25000 50000 -5000	00 -25000	0 25	5000 50000	-100000 -5000	0 0	50000	100000	0 2	5000 50	000 75	000 100000	-500 -	250	0 2	50 500
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5	TE				ing with [®]	SOILte	3ch								Po	intID		10		
C F LQ P		INT JECT	Soiltechnics Lossiemouth 1200410	h				EASTING NORTHIN ELEVATIO CHECKEI TERMINA	IG DN D BY TION REA	: 0.0 : 0.0 : 0.0 : LE .SON : Re	0 m 0 m 00 m OD 0 efusal		Rem Test	ark: refused on t	ip resistan	ice.	SHEE STAT TEST PLOT METH	T : TUS : T DATE : T DATE : HOD :	1 OF 1 Final 19/10/20 23/10/20 ISO 2247	20 20 76-1:2012
oth (m)	vation		Magnetic Field X (nT)			Magnetic F	ield Y (nT)			Magnetic F	ield Z (nT)		М	agnetic Field Total	(nT)			Magnetic Fiel	/d Gradient (nT/c	sm)
aad 1 2 3 4 5 6 7 8 8 9	<u>a</u> <u>a</u> <u>a</u> <u>b</u> <u>b</u> <u>b</u> <u>b</u> <u>b</u> <u>b</u> <u>b</u> <u>b</u> <u>b</u> <u>b</u>		25000 0 2 														-500			
	DNE ID DNE M DNE AF DNE AF TER P	DDEL REA REA RATIO OSITION YPE	: S15-CFIP.1858 : Subtraction : 15cm ² : 0.79 : u2 : HDPE	TEST TYPE APPLICATION RIG OPERATOR FRICTION REI WEATHER	: T CLASS : 2 : C : F DUCER : N : F	E2 2 PT 017 - Griffi RS None Raining & Mild	en	Transducer Tip Sleeve Pore Pressul X-Y Inclinom	CPTU Pre 206 mV 203 mV re 2 250 mV eter 2483 m	J ZERO VALU Post 202 mV 202 mV 202 mV 244 mV V 2473 m	ES Difference -0.043 MPa -0.001 kPa -0.001 kPa V				i	I		<u>:</u>	<u>.</u>	:

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SIT	EIN	VESTIG	ATIO	N Worl	king with	SOIL	end geotec	hnical consults	S								Poil	ntid		11		
CL PR LOC PRC		CT: Lossiemou : Lossiemou No. : 1200410	hnics mouth					EAST NORT ELEV CHEC TERN	ING THING ATION XED BY INATIO	Ý N REAS	: 0.0 : 0.0 : 0.0 : LD SON : Re) m) m 00 m OD) flusal		R	Remark: Test refuse	ed on tip r	esistan	ce.	SHEE STAT TEST PLOT METH	T US DATE DATE IOD	1 OF 1 Final 19/10/202 23/10/202 ISO 2247	0 0 5-1:2012
(m)	tion	Magnetic Fi	eld X (nT)			Magnetic	c Field Y (nT	")			Magnetic Fie	eld Z (nT)			Magnetic F	Field Total (nT)				Magnetic Field	d Gradient (nT/cn	ו)
Depth	-5000	00 -25000 0	25(000 50000	-50000 -:	25000	0	25000	50000 -1000	000 -50000	0 0	50000	100000 0	2500	0 5	0000	75000	100000 -50	00 -2	:50	0 :	250 500
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7-	7	Terminated at 6.	55 m		- - - -	 _ 	 _ +	 		 	 	 +		 						 		
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CONE CONE CONE FILTE FILTE	E ID E MODEL E AREA E AREA RA E AREA RA E POSITIO E TYPE	: S15-CFIP.18 : Subtraction : 15cm ² ATIO : 0.79 ON : u2 : HDPE	358	TEST TYPE APPLICATIO RIG OPERATOR FRICTION RI WEATHER	N CLASS	TE2 2 CPT 017 - Gi RS None Raining & Mi	riffen ild	Transd Tip Sleeve Pore P X-Y Inc	ucer ressure 2 linometer	CPTU Z Pre 206 mV 204 mV 247 mV 2163 mV	ZERO VALUE Post 200 mV 198 mV 253 mV 2165 m\	ES Difference -0.065 MPa -0.004 kPa 0.001 kPa /										

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SI	SITE INVESTIGATION Working with:											Poir	12						
CLIENT : Soiltechnics PROJECT: Lossiemouth LOCATION : Lossiemouth PROJECT No. : 1200410							EASTING NORTHIN ELEVATIO CHECKEI TERMINA	EASTING : 0.0 m NORTHING : 0.0 m ELEVATION : 0.00 m OD CHECKED BY : LD TERMINATION REASON : Refusal					Remark: Test refused on tip resistance.			SHEET : 1 OF 1 STATUS : Final TEST DATE : 19/10/2020 PLOT DATE : 23/10/2020 METHOD : ISO 22476-1:2012			
(m) r	ation	Magnetic Field X (nT)				Magnetic Field Y (n	T)		Magnetic Field Z (nT)			Magnetic Field Total (nT)				Magnetic Field Gradient (nT/cm)			
Dept	(m) (m)	-50000 -2	5000 0	25000 50000	-50000 -25000	0	25000 50000	-100000 -5000	0 0	50000	100000 0	25000	50000	75000	100000 -500	-250	0	250 500	
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CC CC CC FIL FIL	DNE ID DNE MO DNE ARI DNE ARI DNE ARI TER PO	DEL EA EA RATIO DSITION 'PE	: S15-CFIP.1858 : Subtraction : 15cm ² : 0.79 : u2 : HDPE	TEST TYPE APPLICATION RIG OPERATOR FRICTION RE WEATHER	: TE2 I CLASS : 2 : CPT : RS DUCER : Non : Rain	017 - Griffen e ing & Mild	Transducer Tip Sleeve Pore Pressur X-Y Inclinome	CPTU 7 Pre 204 mV 200 mV e 2 257 mV eter 2455 mV	ZERO VALUE Post 199 mV 198 mV 236 mV 231 mV	S Difference -0.054 MPa -0.001 kPa -0.005 kPa			· · · · · · · · · · · · · · · · · · ·		I				
		ISITI								F			N	AG LOG					
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SI	TE	INVESTIGATIC	N Working with								PointID		13						
C P LC Pf		NT : Soiltechnics JECT: Lossiemouth ON : Lossiemouth CT No. : 1200410	1		EASTING NORTHING ELEVATION CHECKED E TERMINATIO	3Y ON REASON	: 0.0 m : 0.0 m : 0.00 m OD : LD : Refusal		Remark: Test refused	on tip resis	tance.	SHEET STATUS TEST DA PLOT DA METHOD	: 1 OF : Final ATE : 19/10, ATE : 23/10, D : ISO 2	1 /2020 /2020 2476-1:2012					
th (m)	ation	Magnetic Field X (nT)		Magnetic Field Y (nT)		Magi	netic Field Z (nT)		Magnetic Field	Total (nT)		Magi	netic Field Gradient	(nT/cm)					
Dept	(Lec	-50000 -25000 0 2	5000 50000 -50000	-25000 0	25000 50000 -10	0000 -50000	0 50000	100000 0	25000 5000	0 7500	00 100000 -	500 -250	0	250 500					
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CC CC CC FIL FIL	+ NE ID NE MO NE ARI NE ARI TER PO TER TY	: S15-CFIP.1858 DEL : Subtraction EA ATIO : 0.79 SITION : u2 PE : HDPE	TEST TYPE APPLICATION CLASS RIG OPERATOR FRICTION REDUCER WEATHER	: TE2 : 2 : CPT 017 - Griffen : RS : None : Raining & Mild	Transducer Tip Sleeve Pore Pressure 2 X-Y Inclinometer	CPTU ZERO Pre Pc 206 mV 19 203 mV 19 245 mV 20 2675 mV 26	VALUES st Difference 3 mV -0.141 MPa 6 mV -0.005 kPa 8 mV -0.009 kPa 81 mV	<u>†</u>			†								

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Sľ	TE	INVE	STIGATIO	DN Work	king with:	SOII1 environmenta									Po	intID		14		
C P LC PF		NT : 5 JECT : 1 ION : L CT No. : 1	Soiltechnics ossiemout 200410	s h				EASTING NORTHIN ELEVATIO CHECKE TERMINA	; JG ON D BY ATION REA	: 0.1 : 0.1 : LE SON : Re	0 m 0 m 00 m OD 0 efusal		Rema Test r	ark: refused on ti	p resistar	nce.	SHEET STATU TEST D PLOT D METHO	: 1 S : Fii DATE : 19 DATE : 23 DD : IS	OF 1 nal 3/10/2020 3/10/2020 50 22476-1	:2012
(m)	ation		Magnetic Field X (nT)			Magnet	ic Field Y (nT)			Magnetic F	ield Z (nT)		Ма	gnetic Field Total (nT)		Ma	agnetic Field Gra	adient (nT/cm)	
Dept	(m) Elexi	-50000 -2500) 0	25000 50000	-50000 -2	25000	0	25000 50000) -100000 -50(000 000	50000	100000 0	25000	50000	75000	100000 -	-500 -250	<u> </u>	250	500
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CC CC CC FIL FIL	ne ID Ne Mo Ne Are Ne Are Ter Po Ter Ty	EA RATIO : DSITION : (PE :	S15-CFIP.1858 Subtraction 15cm ² 0.79 u2 HDPE	TEST TYPE APPLICATIO RIG OPERATOR FRICTION RE WEATHER	N CLASS : : : : : : : : : :	TE2 2 CPT 017 - C RS None Raining & N	∂riffen 1ild	Transducer Tip Sleeve Pore Pressu X-Y Inclinom	CPTL Pre 202 mV 201 mV ire 2 226 mV ieter 2889 m	J ZERO VALU Post / 193 mV / 196 mV / 214 mV IV 2908 m	ES Difference -0.098 MPa -0.004 kPa -0.003 kPa									

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SI	TE	INVESTIGATIO		SOIICECN environmental and geotechr th:						F	ointID	1	5	
C P LC PF		NT : Soiltechnics JECT: Lossiemout ON : Lossiemouth CT No. : 1200410	h		EASTING NORTHING ELEVATION CHECKED E TERMINATI	I BY ON REASO	: 0.0 m : 0.0 m : 0.00 m OD : LD N : Refusal		Remark: Test refused	on tip resist	ance.	SHEET STATUS TEST DAT PLOT DAT METHOD	: 1 OF 1 : Final E : 19/10/2 E : 23/10/2 : ISO 224	I :020 :020 476-1:2012
h (m)	ation	Magnetic Field X (nT)		Magnetic Field Y (nT)		ľ	Magnetic Field Z (nT)		Magnetic Field	Total (nT)		Magnet	ic Field Gradient (n⊺ 	Г/cm)
Dept	(m) (m)	-50000 -25000 0	25000 50000 -50000	-25000 0	25000 50000 -10	00000 -50000	0 50000	100000 0	25000 50000	75000	100000 -5	600 -250	0	250 500
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CC CC CC FIL FIL	NE ID NE MO NE ARE NE ARE TER PC TER TY	: S15-CFIP.1858 DEL : Subtraction EA : 15cm ² EA RATIO : 0.79 SITION : u2 PE : HDPE	TEST TYPE APPLICATION CLASS RIG OPERATOR FRICTION REDUCER WEATHER	: TE2 : 2 : CPT 017 - Griffen : RS : None : Raining & Mild	Transducer Tip Sleeve Pore Pressure 2 X-Y Inclinometer	CPTU ZEF Pre 202 mV 201 mV 2 232 mV r 2373 mV	Post Difference 196 mV -0.065 MPa 196 mV -0.004 kPa 240 mV 0.002 kPa 2378 mV							

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SI	TE	INVE	STIGATIO	DN Working	soll g with:	LECN al and geotechnic								PointID		16		
C P L(NT : JECT : ION : CT No. :	Soiltechnics Lossiemout Lossiemouth 1200410	h	-		EASTING NORTHING ELEVATION CHECKED TERMINAT	; N BY ION REAS	: 0.0 : 0.0 : 0.0 : LD SON : Re) m) m)0 m OD) fusal		Remark Test ref	:: used on tip res	sistance.	SHEE STAT TEST PLOT METH	T : US : DATE : DATE : IOD :	1 OF 1 Final 20/10/2020 23/10/2020 ISO 22476-1:2	2012
(m) r	tion		Magnetic Field X (nT)		Magn 	etic Field Y (nT)			Magnetic Fi	eld Z (nT)		Magne	tic Field Total (nT)			Magnetic Field	Gradient (nT/cm)	
Dept	Eleva (m)	-50000 -2	5000 0	25000 50000 -50	000 -25000	0 2	5000 50000 -1	100000 -5000	0 0	50000	100000 0	25000	50000 7	5000 100000	-500 -2	250	0 250	500
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CC CC CC FIL FIL	ONE ID ONE MO ONE ARI ONE ARI TER PO	DEL EA EA RATIO OSITION (PE	: S15-CFIP.1858 : Subtraction : 15cm ² : 0.79 : u2 : HDPE	TEST TYPE APPLICATION C RIG OPERATOR FRICTION REDU WEATHER	: TE2 LASS : 2 : CPT 017 - : RS JCER : None : Raining &	Griffen Mild	Transducer Tip Sleeve Pore Pressure 2 X-Y Inclinomete	CPTU 2 Pre 206 mV 203 mV 2 262 mV er 2554 mV	ZERO VALUE Post 201 mV 202 mV 231 mV 2535 mV	ES Difference -0.054 MPa -0.001 kPa -0.008 kPa								

				212							MAG LOG
Sľ	TE	INVESTIGATIO	DN Working wit!						PointID	17	
C P LC PF		NT : Soiltechnics JECT: Lossiemouth ON : Lossiemouth CT No. : 1200410			EASTING NORTHING ELEVATION CHECKED BY TERMINATIO	: 0.0 : 0.0 : 0.0 Y : LC N REASON : Re) m) m)0 m OD) efusal	Remark: Test refused on tip	resistance.	SHEET : 1 STATUS : Fi TEST DATE : 20 PLOT DATE : 2 METHOD : IS	OF 1 inal 0/10/2020 3/10/2020 SO 22476-1:2012
ath (m)	vation	Magnetic Field X (nT)		Magnetic Field Y (nT)		Magnetic F	ield Z (nT)	Magnetic Field Total (nT)		Magnetic Field Gr	adient (nT/cm)
Dep	(n) Elev	-50000 -25000 0 2	25000 50000 -50000	-25000 0	25000 50000 -1000	000 -50000 0	50000 100000	0 25000 50000	75000 100000 -	500 -250 0	250 500
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CO CO CO FIL FIL	NE ID NE MOI NE ARE NE ARE TER PC TER TY	: S15-CFIP.1858 DEL : Subtraction A : 15cm ² A RATIO : 0.79 SITION : u2 PE : HDPE	TEST TYPE APPLICATION CLASS RIG OPERATOR FRICTION REDUCER WEATHER	: TE2 : 2 : CPT 017 - Griffen : RS : None : Raining & Mild	Transducer Tip Sleeve Pore Pressure 2 X-Y Inclinometer	CPTU ZERO VALU Pre Post 207 mV 205 mV 205 mV 207 mV 252 mV 241 mV 2422 mV 2496 m'	ES Difference -0.022 MPa 0.001 kPa -0.003 kPa		:I		

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SI	TE	INVESTIGATIO	Working with						PointID	18	
C P LC PF		NT : Soiltechnics JECT: Lossiemouth ON : Lossiemouth CT No. : 1200410	1		EASTING NORTHING ELEVATION CHECKED BY TERMINATION	: 0.(: 0.(: 0.(: LE I REASON : Re) m) m 00 m OD) sfusal	Remark: Test refused on tip re	sistance.	SHEET : 1 OF STATUS : Final TEST DATE : 20/10 PLOT DATE : 23/10 METHOD : ISO 2	1)/2020)/2020)/2020 22476-1:2012
(m) ti	ation	Magnetic Field X (nT)		Magnetic Field Y (nT)		Magnetic Fi	ield Z (nT)	Magnetic Field Total (nT)		Magnetic Field Gradien	t (nT/cm)
Dept	(m) (m)	-50000 -25000 0 2	25000 50000 -50000	-25000 0	25000 50000 -10000	0 -50000 0	50000 100000	0 25000 50000	75000 100000 -	500 -250 0	250 500
1-	+ + + + +										
2-	2					 ++					 ++
-3-	+ - - - 	-							_ <u>+</u>		
4-	4	Refusal									
5-							 +				 +
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7-	+ - 7			-++		 ++	+			+	 +
8-				 					 -	<u> </u>	
9-	9						 				
	+										
CC CC CC FIL FIL	ne ID Ne Moi Ne Are Ne Are Ter Po Ter Ty	: S15-CFIP:1858 DEL : Subtraction EA : 15cm ² EA RATIO : 0.79 SITION : u2 PE : HDPE	TEST TYPE APPLICATION CLASS RIG OPERATOR FRICTION REDUCER WEATHER	: TE2 : 2 : CPT 017 - Griffen : RS : None : Raining & Mild	Transducer Tip Sleeve Pore Pressure 2 X-Y Inclinometer	CPTU ZERO VALU Pre Post 201 mV 206 mV 202 mV 205 mV 237 mV 240 mV 2333 mV 2338 m\	ES Difference 0.054 MPa 0.002 kPa 0.001 kPa /				

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	TE										PointID		19	
P P		NT : Soiltechnic JECT: Lossiemouth ION : Lossiemouth CT No. : 1200410	s th	uı.	EASTING NORTHING ELEVATION CHECKED E TERMINATIO	BY EASON :	0.0 m 0.0 m 0.00 m OD LD Refusal		Remar Test re	k: fused on tip re	sistance.	SHEET STATUS TEST DA PLOT DA METHOI	: 1 OF : Final ATE : 20/10/2 ATE : 23/10/2 D : ISO 22	1 2020 2020 :476-1:2012
(m) ti	ation	Magnetic Field X (nT)		Magnetic Field Y (nT)		Magne	tic Field Z (nT)		Magr	etic Field Total (nT)		Mag	netic Field Gradient (r	ıT/cm)
Dept	(Lec	-50000 -25000 0	25000 50000 -50000	-25000 0	25000 50000 -10	0000 -50000	0 50000	100000 0	25000	50000	75000 100000	-500 -250	0	250 500
1-	+ + + + + + -					 			 	·+	\ 			
2-	+ + 2 +					 			 	· _ + (
3-	3	Terminated at 2.74 m				<u> </u>								
4 5 6 7 8														
		: S15-CFIP.1858		. TE2	<u> </u>			<u>†</u>				<u>† </u>		
CC CC FIL FIL	NE MO NE ARI NE ARI TER PO TER TY	EACH THOSE DEL Subtraction EA : 15cm ² EA RATIO : 0.79 SITION : U2 /PE : HDPE	APPLICATION CLASS RIG OPERATOR FRICTION REDUCER WEATHER	: CPT 017 - Griffen : CPT 017 - Griffen : RS : None : Raining & Mild	Transducer Tip Sleeve Pore Pressure 2 X-Y Inclinometer	Pre Post 198 mV 204 200 mV 204 249 mV 249 2469 mV 247	Difference mV 0.065 MPa mV 0.003 kPa mV 0 kPa 5 mV							

				210 J							MAG LOG
SI	TE	INVESTIGATIC	DN Working with						PointID	20	
C P LC PI		NT : Soiltechnics JECT: Lossiemouth ON : Lossiemouth CT No. : 1200410	י <u>י</u>		EASTING NORTHING ELEVATION CHECKED B TERMINATIC	: 0.0 : 0.0 : 0.00 Y : LD DN REASON : Ref	m m 0 m OD usal	Remark: Test refused on tip re	sistance.	SHEET : STATUS : TEST DATE : PLOT DATE : METHOD :	1 OF 1 Final 20/10/2020 23/10/2020 ISO 22476-1:2012
oth (m)	vation	Magnetic Field X (nT)		Magnetic Field Y (nT)		Magnetic Fiel	d Z (nT)	Magnetic Field Total (nT)		Magnetic Field	Gradient (nT/cm)
Dep	⊞e)	-50000 -25000 0 2	25000 50000 -50000	-25000 0	25000 50000 -100	0000 -50000 0	50000 100000 0	25000 50000	75000 100000 -54	00 -250	0 250 500
1 2 3 4 5		-50000 -25000 0 2									
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7 8 9											
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CC CC CC FIL FIL	INE ID INE MO INE ARE INE ARE TER PO TER TY	: S15-CFIP.1858 DEL : Subtraction EA : 15cm ² A RATIO : 0.79 SITION : u2 PE : HDPE	TEST TYPE APPLICATION CLASS RIG OPERATOR FRICTION REDUCER WEATHER	: TE2 : 2 : CPT 017 - Griffen : RS : None : Raining & Mild	Transducer Tip Sleeve Pore Pressure 2 X-Y Inclinometer	CPTU ZERO VALUES Pre Post 207 mV 203 mV 205 mV 203 mV 260 mV 240 mV 2274 mV 2415 mV	S Difference -0.043 MPa -0.001 kPa -0.005 kPa	<u> </u>			

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SI	TE													PointID		21		
P P		NT : JECT : 10N : CT No. :	Soiltechnics Lossiemouth 1200410	h			EASTING NORTHING ELEVATION CHECKED I TERMINATI	N BY ION REAS	: 0.0 : 0.0 : 0.00 : LD ON : Ref	m m 0 m OD usal		Remari Test re	k: fused on tip	resistance.	SHEET STATU TEST I PLOT I METHO)F 1 al 10/2020 10/2020) 22476-1:2(012
pth (m)	evation		Magnetic Field X (nT)		Magnetic F	Field Y (nT)			Magnetic Fiel	d Z (nT)		Magn	etic Field Total (nT)		м	agnetic Field Gradi	ent (nT/cm) —	
De		-50000 -2	25000 0 · · · · · · · · · · · · · · · · ·	25000 50000 -50000 	-25000	0 250	000 50000 -10 	00000 -50000 	000	50000	100000 0 	25000	50000	75000 10000			250	500
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	DNE ID DNE MO DNE AF DNE AF DNE AF TER P	DDEL EA EA RATIO OSITION YPE	S15-CFIP.1858 Subtraction 15cm ² 0.79 u2 HDPE	TEST TYPE APPLICATION CLA RIG OPERATOR FRICTION REDUCI WEATHER	: TE2 SS : 2 : CPT 017 - Grif : RS ER : None : Raining & Mild	fen	Transducer Tip Sleeve Pore Pressure 2 X-Y Inclinomete	CPTU Z Pre 207 mV 204 mV 2 255 mV r 2500 mV	ERO VALUE Post 205 mV 205 mV 236 mV 2541 mV	S Difference -0.022 MPa 0.001 kPa -0.005 kPa	<u>+</u>	!			<u>† !</u>			

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	TE				SOI	Itech								Po	ointID	22)		
P P		NT : JECT : ION : CT No. :	Soiltechnics Lossiemouth 1200410	n	with.		EASTING NORTHIN ELEVATIC CHECKEL TERMINA	IG DN D BY TION REAS	: 0.0 r : 0.0 r : 0.00 : LD SON : Refu	m m ⊢m OD usal		Rem Test	ark: refused on t	ip resistar	nce.	SHEET STATUS TEST DAT PLOT DAT METHOD	: 1 OF : Final E : 20/10/2 E : 23/10/2 : ISO 22	1 2020 2020 476-1:201:	2
(m)	ation		Magnetic Field X (nT)		Mag	netic Field Y (nT)			Magnetic Field	I Z (nT)		М	agnetic Field Total	(nT)		Magneti	Field Gradient (r	T/cm)	
Dept	(m)	-50000 -2	25000 0 2	25000 50000 -5000	0 -25000	0	25000 50000	-100000 -5000	0 0	50000	100000 0	25000	50000	75000	100000 -50	00 -250	0	250	500
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CC CC CC FIL FIL	DNE ID DNE MO DNE ARI DNE ARI TER PO TER TY	DEL EA EA RATIO DSITION 'PE	: S15-CFIP.1858 : Subtraction : 15cm ² : 0.79 : u2 : HDPE	TEST TYPE APPLICATION CL. RIG OPERATOR FRICTION REDUC WEATHER	: TE2 ASS : 2 : CPT 017 : RS CER : None : Raining &	- Griffen & Mild	Transducer Tip Sleeve Pore Pressur X-Y Inclinome	CPTU Pre 205 mV 204 mV re 2 245 mV eter 2633 mV	ZERO VALUES Post 203 mV 203 mV 236 mV 2656 mV	Difference -0.022 MPa -0.001 kPa -0.002 kPa									

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SI	TE	INVESTIGA		ing with:	Itechr ntal and geotechnical								PointID		23		
C P LC Pf		NT : Soiltechr JECT: Lossiem ON : Lossiemouth CT No. : 1200410	nics outh			EASTING NORTHING ELEVATION CHECKED E TERMINATI	3Y ON REASON	: 0.0 m : 0.0 m : 0.00 m OE : LD : Refusal)		Remark: Test refused	d on tip resis	stance.	SHEET STATU TEST I PLOT I METHO	· : 1 S : F DATE : 2 DATE : 2 DATE : 2 DD : 1	OF 1 'inal !0/10/2020 !3/10/2020 SO 22476-	-1:2012
(m)	ation	Magnetic Field) 	< (nT)	Mag	netic Field Y (nT)		Ma	gnetic Field Z (nT)			Magnetic Fiel	ld Total (nT)		M	agnetic Field G	radient (nT/cm)	
Dept	(IIek	-50000 -25000 0	25000 50000	-50000 -25000	0 250	000 50000 -10	0000 -50000	0 5	0000 100000	0 25	5000 500	00 750	000 100000	-500 -250	0 0	25/	0 500
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CC CC CC FIL FIL	NE ID NE MOI NE ARE NE ARE TER PC TER TY	: S15-CFIP.1858 DEL : Subtraction A : 15cm ² A RATIO : 0.79 SITION : u2 PE : HDPE	TEST TYPE APPLICATION RIG OPERATOR FRICTION RE WEATHER	: TE2 N CLASS : 2 : CPT 017 : RS :DUCER : None : Raining &	- Griffen	Transducer Tip Sleeve Pore Pressure 2 X-Y Inclinometer	CPTU ZERC Pre F 204 mV 2 203 mV 2 242 mV 2 2346 mV 2	0 VALUES lost Differe 03 mV -0.011 03 mV 0 kPa 34 mV -0.002 362 mV	nce MPa kPa	<u>.</u>			I			<u> </u>	

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					S		chnical co	ICS								PointID		24		
C P LC Pf		NT : JECT : ION : CT No. :	Soiltechnics Lossiemouth 1200410	JIN Workin	g with:		EA NG EL CH TE	ASTING ORTHING LEVATION HECKED ERMINATI	N BY ION REAS	: 0.0 (: 0.0 (: 0.00 : LD SON : Refu	m m) m OD usal			Remark: Test refuse	d on tip res	istance.	SHE STA TES PLO MET	ET : TUS : T DATE : T DATE : HOD :	1 OF 1 Final 20/10/2020 23/10/2020 ISO 22476	0 0 5-1:2012
(m)	ation		Magnetic Field X (nT)			Magnetic Field Y	(nT)			Magnetic Field	d Z (nT)			Magnetic Fie	eld Total (nT)			Magnetic Field	Gradient (nT/cm)
Dept	(n) Elexi	-50000 -2	5000 0 2	5000 50000 -50	0000 -25000	0	25000	50000 -1	00000 -5000	0 0	50000	100000	0 2	5000 500	000 7	5000 100000	-500 -	-250	0 2	50 500
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CC CC CC FIL FIL	DNE ID DNE MO DNE ARI DNE ARI TER PO TER TY	DEL EA EA RATIO DSITION (PE	: S15-CFIP.1858 : Subtraction : 15cm ² : 0.79 : u2 : HDPE	TEST TYPE APPLICATION C RIG OPERATOR FRICTION REDU WEATHER	: TE2 CLASS : 2 : CP1 : RS UCER : Nor : Rair	2 F 017 - Griffen ne ning & Mild	Tr: Tip Slo Pc X-	ransducer p leeve ore Pressure 2 -Y Inclinomete	CPTU 2 Pre 203 mV 203 mV 2 239 mV r 2246 mV	ZERO VALUES Post 204 mV 203 mV 231 mV 2208 mV	Difference 0.011 MPa 0 kPa -0.002 kPa									

				10	•						MAG LOG
SI	TE	INVESTIGATIO	DN Working with	SOIICECN environmental and geotechni					PointID	25	
C P LC PI		NT : Soiltechnics JECT: Lossiemouth ION : Lossiemouth CT No. : 1200410	1		EASTING NORTHING ELEVATION CHECKED B TERMINATIC	: 0.0 : 0.0	m m 0 m OD fusal	Remark: Test refused on tip re	esistance.	SHEET : 1 STATUS : F TEST DATE : 2 PLOT DATE : 2 METHOD : 1	OF 1 iinal !0/10/2020 !3/10/2020 SO 22476-1:2012
(m)	ation	Magnetic Field X (nT)		Magnetic Field Y (nT)		Magnetic Fi	eld Z (nT)	Magnetic Field Total (nT) 		Magnetic Field G	iradient (nT/cm)
Dept	Ű.	-50000 -25000 0 2	5000 50000 -50000	-25000 0	25000 50000 -100	0000 -50000 0	50000 100000 (0 25000 50000	75000 100000 -5	00 -250 0	250 500
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CC CC CC FIL FIL	DNE ID DNE MO DNE ARE DNE ARE TER PO TER TY	: S15-CFIP.1858 DEL : Subtraction EA : 15cm ² EA RATIO : 0.79 SITION : u2 'PE : HDPE	TEST TYPE APPLICATION CLASS RIG OPERATOR FRICTION REDUCER WEATHER	: TE2 : 2 : CPT 017 - Griffen : RS : None : Raining & Mild	Transducer Tip Sleeve Pore Pressure 2 X-Y Inclinometer	CPTU ZERO VALU Pre Post 204 mV 203 mV 203 mV 203 mV 239 mV 231 mV 2075 mV 2097 mV	ES Difference -0.011 MPa 0 kPa -0.002 kPa				

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	TE		Norking with						PointID	26	
P P		NT : Soiltechnics JECT: Lossiemouth ION : Lossiemouth CT No. : 1200410		1.	EASTING NORTHING ELEVATION CHECKED B TERMINATIC	: 0.0 : 0.0 : 0.00 Y : LD N REASON : Ref	m m) m OD usal	Remark: Test refused on tip r	esistance.	SHEET : STATUS : TEST DATE : PLOT DATE : METHOD :	1 OF 1 Final 20/10/2020 23/10/2020 ISO 22476-1:2012
h (m)	ation	Magnetic Field X (nT)		Magnetic Field Y (nT)		Magnetic Fiel	d Z (nT)	Magnetic Field Total (nT)		Magnetic Field	l Gradient (nT/cm)
Dept	(Elex	-50000 -25000 0 2	5000 50000 -50000	-25000 0	25000 50000 -100	000 -50000 0	50000 100000 0	25000 50000	75000 100000 -5	00 -250	0 250 500
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2			++ !	- 		+					
3		Terminated at 3.43 m									
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	DNE ID DNE MC DNE AR DNE AR DNE AR TER P(: S15-CFIP.1858 DEL : Subtraction EA : 15cm ² EA RATIO : 0.79 DSITION : u2 /PE : HDPE	TEST TYPE APPLICATION CLASS RIG OPERATOR FRICTION REDUCER WEATHER	: TE2 : 2 : CPT 017 - Griffen : RS : None : Raining & Mild	Transducer Tip Sleeve Pore Pressure 2 X-Y Inclinometer	CPTU ZERO VALUE: Pre Post 204 mV 202 mV 202 mV 205 mV 238 mV 223 mV 1980 mV 1993 mV	S Difference -0.022 MPa 0.002 kPa -0.004 kPa	i			

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SI	TE	INVESTIGATIO	N Working wit						PointID	27	
C P LC Pf		NT : Soiltechnics JECT: Lossiemouth ON : Lossiemouth CT No. : 1200410	י ז		EASTING NORTHING ELEVATION CHECKED B TERMINATIC	: 0. : 0. : 0. :Y : LE DN REASON : Re	0 m 0 m 00 m OD 0 efusal	Remark: Test refused on tip res	istance.	SHEET : STATUS : STAT	1 OF 1 Final 20/10/2020 23/10/2020 ISO 22476-1:2012
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IN SITU SITE INVESTIGATION

Unit 23 Hastings Innovation Centre, Highfield Drive St. Leonards on Sea, East Sussex, TN38 9UH, U.K.

Company No.: 6339499 VAT No.: 922 3561 41

Appendix C – Hydrology and Flood Risk Assessments



Date:	15 th December 2020	Version:	1.0
То:	David Mitchell, Beaver Bridges Ltd.		
From:	Gordon Falconer, cbec eco-engineering UK Ltd		
Project:	Lossiemouth East Beach Footbridge Replacement		
Subject:	Hydrological and Flood Risk Assessments		

1. INTRODUCTION

1.1 SITE DESCRIPTION

The town of Lossiemouth in Moray has several beaches, popular for tourism and recreation. One of the main beaches, adjacent to shops and restaurants, is Lossiemouth East Beach. Access to this beach is over the River Lossie, and has been difficult for pedestrians for over a year, since the existing footbridge was deemed unsafe as a result of flood damage/aging.

There are two proposed locations for the replacement footbridge to East Beach, shown in Figure 1.1.

- 1) The location of the existing footbridge (323748E, 870409N)
- 2) From opposite shops on Seatown Road at a historic bridge abutment (323724E, 870636N)



Figure 1.1: Aerial view of Lossiemouth showing the River Lossie, East beach and the two proposed access bridges.



The following sections contain a hydrological assessment of still water levels (tide level plus storm surge) and fluvial flows/levels in the River Lossie and a flood risk assessment (FRA). These analyses are based on topographic/bathymetric survey and tide tables, SEPA guidance and hydraulic modelling.

1.2 APPROACH

The proposed bridge may be subjected to high tide and storm surge from the Moray Firth and high fluvial flood levels from the River Lossie at either location. This assessment will look at a combined tidal and fluvial event for a range of coastal events and both the 200 year and 200 year + climate change fluvial events. Both fluvial and tidal climate change allowances were taken from SEPA technical guidance¹. Fluvial flows were computed using UK industry standard FEH approaches (section 2.1) and Tidal still water levels (SWL) were taken from the SEPA and EA Flood and Coastal Erosion Risk Management Programme document². To aid the analysis, a topographic/bathymetric survey of the site was conducted by cbec in October 2020 and a Digital Elevation Model (DEM) was generated in AutoCAD civil 3D 2019 (Figure 1.2). This data along with LiDAR was used as the basis for all analysis carried out in this study.

¹ SEPA, Climate change allowances for flood risk assessment in land use planning, April 2019.

² DEFRA, SEPA, EA Coastal Flood Boundary Conditions for UK Mainland and Island, SC060064/TR2: Design Sea Levels

RIVER LOSSIE, LOSSIEMOUTH - DEM





Figure 1.2: Topographic survey carried out by cbec in October 2020



2. ANALYSIS

2.1 HYDROLOGICAL ASSESSMENT

The River Lossie flows through hydrometric area 7 (Findhorn group) before entering the Moray Firth at Lossiemouth. There is a gauge (7003 – Lossie at Sherrifmills) located on the River Lossie upstream of Elgin and a hydrological assessment point (HAP) was chosen to generate catchment descriptors at the tidal limit where the River Lossie flows under the B9103 (Table 2.1).

Table 2.1 Catchment description

Source	Reach Name	OS grid reference	Description	HAP Catchment area (km²)
FEH web portal (HAP1)	River Lossie	NJ 25300 67200	Tidal boundary under the B9103	270.55
Gauge 7003 Lossie at Sherrifmills	River Lossie	NJ 194 626	Upstream of Elgin	216

Hydrology was computed using UK standard methodologies as recommended by SEPA and the EA, following FEH guidelines. Final design flows used in this analysis are shown in Table 2.2 with all methods used and hydrolical audit sheets found in Appendix A.

Table 2.2 Final design peak flows

Return period	Annual	River Lossie
(years)	Exceedance Probability (AEP)	Tidal Boundary (m³s)
200	0.5	168.83
200 (+37%CC)	0.5 (+37%CC)	231.30

2.2 EXPECTED WATER LEVELS AND VELOCITIES

As discussed, the proposed bridge may be subjected to high tide and storm surge from the Moray Firth and fluvial flood flows from the River Lossie at either Location. For bridge proposal 1) the ground level on the Seatown side is a gap in the embankment at 3.70 mAOD; for bridge proposal 2) the ground level at the Lossiemouth side is at 3.38 mAOD.

The relevant current high tide levels according to Admiralty Tide Charts at Burghead (8 miles West of Lossiemouth) are tabulated below (Table 2.3):

Table 2.3: High tide levels – Admiralty Tide Charts at Burghead

Tide	Level [mAOD]
Highest astronomical tide (HAT)	2.6
Mean High Water Spring tide (MHWS)	2.0



However, extreme sea levels occur when adverse weather conditions combine with high tides, so the effects of weather are combined with tide levels to give still water levels (SWL) for flood design purposes. The SEPA and EA Flood and Coastal Erosion Risk Management Programme document³: suggests a SWL (combined tide and storm surge) of 3.35 m AOD for the Moray Firth.

In addition, SEPA guidance¹ suggests that tide levels in the area may rise as a result of climate change by 0.89 m.

Fluvial flows is the Lossie, were computed using UK industry standard FEH approaches as 168.83 m³/s for the 200 year return period flood and the expected fluvial uplift as a result of climate change is 37%. Channel slope over the topographic survey extent is 0.0013 and the substrate is sand and boulders (Manning n = 0.025). A 2D shallow water equation hydraulic model was developed using surveyed bathymetry and fluvial boundary conditions at the upstream end, and tidal boundary conditions at the downstream end to investigate the effect of high fluvial flows combined with the effects of tide.

A joint probability study of fluvial, tidal and storm levels is not scoped for as part of this study. A joint 200 year return period storm surge, high tide and 200 year fluvial event is a much rarer occurrence than a 200 year event and so we include in the analysis a 200 year fluvial flood plus highest astronomical tide, and a 200 year plus climate change fluvial event and highest astronomical tide plus climate change uplift. The return period of this event was not computed in this study, but the coincidence of the 200 year fluvial event peak and HAT is likely to be higher than a 200 year return period.

Table 2.1 details the following key expected water levels:

- 200 year tidal/storm still water level (SWL)
- 200 year tidal/storm SWL plus allowance of tidal uplift as a result of climate change
- 200 year fluvial flow in the River Lossie combined with highest astronomical tide (HAT)
- 200 year fluvial flow in the Lossie plus 37% allowance for fluvial climate change combined with HAT with allowance for tidal climate change (+0.89 m)

Wave analysis is not part of the scope of this study.

Condition	Level at existing bridge [mAOD]	Level at proposed alternative bridge [mAOD]
200 year RP tidal/storm SWL	3.35	3.35
200 year RP tidal/storm SWL+climate uplift	4.24	4.24
200 year RP fluvial + HAT	2.69	2.64
200 year RP fluvial + 37% cc + HAT + cc	3.55	3.52

Table 2.4: Tabulated results

³ DEFRA, SEPA, EA Coastal Flood Boundary Conditions for UK Mainland and Islands, SC060064/TR2: Design Sea Levels



In addition, for bridge scour and safety assessments, the fluvial flow velocities for the 200 year fluvial flood were computed with hydraulic modelling. At HAT, these are around 0.54 m/s for the existing bridge location (1) and 0.80 m/s for the proposed alternative bridge location (2). The critical condition for high velocity in the Lossie is low tide but high discharge because this condition increases water surface slope. These critical velocities were computed using normal depth assumptions in the channel. Maximum velocity at low tide and 200 year + climate change fluvial event is 1.10 m/s at the existing bridge (1) and 2.50 m/s at the proposed alternative bridge location (2).

Extents under water are shown in Figure 2.1 to Figure 2.4.

In these figures the brown polygon is the hydraulic model extent, red and green lines mark the two bridge positions, and black lines indicate survey breaklines such as channel toe, walls etc. The blue shading is the area within the topographic survey extent/combined LiDAR that is predicted to be underwater at each condition and hydraulically connected to the channel.

Figure 2.5 shows the computed velocities in the channel for the 200 year + climate change fluvial flood occurring at low tide.



Figure 2.1: Water level at 200 year tidal/surge SWL





Figure 2.2: Water level at 200 year plus climate change tidal/surge SWL



Figure 2.3: Water level at 200 year fluvial flood in Lossie combined with HAT





Figure 2.4: Water level at 200 year + climate change fluvial flood in Lossie combined with HAT adjusted for climate change



Figure 2.5: Critical velocity condition of 200 year plus climate change fluvial flood in Lossie combined with low tide (normal depth). Peak at existing bridge location (red line) is 1.10 m/s; peak at second bridge location (green line) is 2.50 m/s.



2.3 FLOOD RISK ASSESSMENT

2.3.1. Introduction

As part of this study, a preliminary Flood Risk Assessment (FRA) has been completed, assessing any flood risk concerns raised by the proposed bridge development with Scottish Planning Policy.

This assessment is a comprehensive risk based assessment of potential flooding from both fluvial and coastal flood risk. The assessment also identifies and examines residual risk to the site and any neighbouring properties. The aim of this report is primarily to consider flood risk and satisfy requirements under SPP.

Data and information have been obtained from the following sources:

- Scottish Environment Protection Agency (SEPA),
- Findhorn, Nairn and Speyside: Flood Risk Management Strategy 2015;
- Findhorn, Nairn and Speyside: Local Flood Risk Management Plan (2016);
- Moray Council Strategic Flood Risk Assessment: Proposed Plan;
- Hydraulic model results.

2.3.2. <u>Development proposals</u>

There are two proposed locations for the East Beach footbridge as shown in Figure 2.6.



Figure 2.6: Aerial view of Lossiemouth showing the River Lossie, East beach and the two proposed access bridges.

- 1) The location of the existing bridge (323748E, 870409N)
- 2) From opposite shops on Seatown Road at a historic bridge abutment (323724E, 870636N)



2.3.3. Planning policy

FINDHORN, NAIRN AND SPEYSIDE: FLOOD RISK MANAGEMENT STRATEGY 2015;

SEPA's Flood Risk Management Strategy for the Findhorn, Nairn and Speyside districts, the first encompassing the River Lossie, was published in December 2015. Lossiemouth is identified as a Potentially vulnerable Area (PVA) under PVA 05/01 which includes Burghead to Lossiemouth. Flooding is mainly limited to seafront properties in this document however it is expected to be underestimated as wave action is not included. The current number of properties at risk of coastal flooding in Lossiemouth is 70 (30 residential and 40 non-residential). A list of flood events effecting Lossiemouth can be found below, demonstrating its vulnerability to both coastal and fluvial flooding;

- **1829** Great Muckle spate of August,
- **1852** Combined fluvial and coastal event resulted flooding along the river Lossie along with harbour flooding at Lossiemouth due to high waves,
- 1983 Coastal flooding on shore street,
- 2012 and 2013 Coastal flooding leading to the evacuation of homes in Lossiemouth.

The River Lossie most recently flooded in 2002 however there was no flooding in Lossiemouth and partially built flood defences in Elgin protected the town.

FINDHORN, NAIRN AND SPEYSIDE: LOCAL FLOOD RISK MANAGEMENT PLAN (LFRMP)(INTERIM REPORT) 2019;

Moray Council released their LFRMP in June 2016 in response to SEPA's Strategies outlined the previous year (Section 4.1) and produced an interim report in 2019. The documents lay out the Council's general objectives concerning flood risk to Lossiemouth which includes strategic mapping and modelling of coastal environments. At the time this interim report was written the modelling was not complete however it was due to be completed in 2019.

MORAY COUNCIL STRATEGIC FLOOD RISK ASSESSMENT - MORAY LOCAL DEVELOPMENT PLAN

Moray Council produced this report in December 2018 and is in the process of preparing its MLDP for 2020. The plan states that Lossiemouth is at risk from both coastal and fluvial flooding and areas in close proximity to the coast are at risk from inundation from the sea and will require to incorporate adequate protection measures.

SCOTTISH PLANNING POLICY

Scottish Planning Policy (SPP) seeks to reduce the impact of flooding on new developments, by expecting developers and planning authorities to err on the side of caution in decision making whenever flooding in an issue.

Although the site of interest lies within the functional floodplain (Medium – High risk of flooding), the nature of the design means it cannot be relocated to an area of lower flood risk. The policy states that a precautionary approach to flood risk from all sources must be used, considering the predicted effects of climate change.

2.3.4. Assessment of flood risk

The nature of this bridge development, connecting Lossiemouth to East Beach, means the bridge has to be built in an area of high flood risk. Following the guidelines stated in section 2.3.3, a precautionary approach has been adopted when reviewing flood risk to the proposed bridge locations.



Assessing SEPA flood maps in **Figure 2.7** it is evident that both proposed bridge locations are at risk from both fluvial and coastal flooding with neither being at a lower risk to the other. A JBA assessment into the Lossiemouth Breakwater⁴ looked further into wave action and coastal flooding around Lossiemouth however this report did not include any fluvial flood risk information. Similarly, Jacobs carried out a Lossiemouth Coastal Flood Study⁵ however this focused on coastal flooding to Lossiemouth and did not look at the combined effects of flooding from the River Lossie.



Figure 2.7: SEPA flood map, ©Crown Copyright. SEPA License Number 100016991.

The analysis carried out provided water levels at both proposed bridge locations (Table 2.5). The data shows that there are minimal differences in water levels between the two locations for the range of events modelled. However, this analysis does not take into consideration wave action and while location 1 (existing bridge) may exhibit marginally higher water levels, it's orientation may protect it from waves more when compared with Location 2 (opposite shops on Seatown Road). Similarly, the analysis showed that velocities around bridge location 1 were lower than those at location 2 as discussed in Section 2.2.

The entrance elevation to bridge location 1 is approximately 3.7 mAOD and location 2 is approximated 3.38 mAOD, however, location 1 has the potentially to extend the bridge further onto the bank where the path varies between 3.7 - 3.9 mAOD, adding safer levels for access.

⁴ JBA, Lossiemouth Breakwater Assessment, January 2015 ⁵ Jacobs, Lossiemouth Coastal Flood Study, October 2018



Table 2.5: Tabulated results

Condition	Level at existing bridge [mAOD]	Level at proposed alternative bridge [mAOD]
200 year RP tidal/storm SWL	3.35	3.35
200 year RP tidal/storm SWL+climate uplift	4.24	4.24
200 year RP fluvial + HAT	2.69	2.64
200 year RP fluvial + 37% cc + HAT + cc	3.55	3.52

2.3.5. Mitigation options and future analysis

This preliminary flood risk assessment assesses still water levels from a range of flood events. It is not possible to produce a full, comprehensive flood risk assessment until final locations/ designs are agreed and developed, however, at this stage there are further analysis/considerations which may benefit the subsequent design phase of works;

- Wave analysis was not taken into consideration during this analysis. We would recommend that this is undertaken for the final proposed design. Data is available from the Moray Firth Directional Waverider buoy⁶ which was first deployed in August 2008 and is due to end in 2023.
- SEPA recommends a freeboard of 600 mm added to the still water levels when considering mitigation against a coastal flood event. Using our model results this would produce a deck level of 4.84 mAOD which is approximately 1m higher than the entrance path to the bridge at location 1 (existing bridge).
- SEPA guidance⁷ recommends that, where a development is a replacement for an existing development of the same type, opportunities for betterment should be explored.
- Investigate any flood risk modelling and mapping provided under the LFRMP

2.3.6. <u>Conclusions</u>

This preliminary flood risk assessment has demonstrated a range of events which could be used to assess flood risk to the proposed footbridges. These water levels combine both fluvial and coastal flooding for a number of events with differing likelihood. A fully comprehensive FRA would be needed to identify which values are to be used at detailed design stage, however, it is believed that location 1 (existing bridge location) would be the preferential bridge location when considering flood risk. As the design is for a footbridge there will be no change to flood risk from surface or ground water and although the bridge will cross the River Lossie, due to the location of the design and fact there is an existing bridge in its location, it is not expected to have any differing effects on fluvial or coastal flood risk.

⁶ http://wavenet.cefas.co.uk/Map

⁷ SEPA. SEPA Flood Risk Standing Advice for Planning Authorities and Developers, November 2020.


APPENDIX A

HYDROLOGICAL ASSESSMENT AUDIT



The River Lossie flows through hydrometric area 7 (Findhorn group) before entering the Moray Firth at Lossiemouth. There is a gauge (7003 – Lossie at Sherrifmills) located on the River Lossie upstream of Elgin and a hydrological assessment point (HAP) was generated at the tidal limit where the River Lossie flows under the B9103 (Table 2.1).

Source	Reach	OS grid reference	Description	HAP Catchment area
	Name			(km²)
FEH web portal	River	NJ 25300 67200	Tidal boundary under	270.55
(HAP1)	Lossie		the B9103	
Gauge 7003	River	NJ 194 626	Upstream of Elgin	216
Lossie at	Lossie			
Sherrifmills				

Table 2.6 Catchment description

FEH Statistical method

FEH statistical method is considered a reliable assessment method for ungauged catchments. It is a feature of Flood Modeller Pro and is based solely on catchment descriptors. After an initial storm duration is input, the software creates a critical storm duration which can then be used to find the critical flood flows. For the River Lossie this critical storm duration was 21.5 hrs and this value was used to generate the tabulated flows.

Revitalised Flood Hydrograph 2 (ReFH 2.3)

ReFH 2.3 uses solely catchment descriptors for input and produces peak flows and hydrographs. It is understood that the robustness of flow estimates using this method are limited due to issues with the underlying rainfall depth-duration- frequency (DDF) model in certain parts of Scotland such as Moray. For this reason, a precautionary approach was taken when considering the results from this method. Similar to the FEH statistical approach, the critical storm duration of 21.5 hrs was used to generate flow estimates.

Single Site analysis

A single site analysis was carried out on the River Lossie gauge (7003 Lossie at Sherrifmills). This method uses gauged data to produce flow estimates for a range or return intervals and station fittings. For this analysis, the Generalised Logistic L-Median fitting method was used as is recommended in the FEH handbook for UK flood data. As the gauge is located upstream of Elgin, flows were linearly scaled from the gauge to the HAP (The tidal boundary where the Lossie flows under the B9103) using catchment area.

Results from the methods discussed are tabulated in Table 2.7 and audit forms from each method are provided in Appendix C:



Return period (years)	Annual Exceedance Probability (AEP)	River Lossie Tidal Boundary (m³s) ReFH 2.3	River Lossie Tidal Boundary (m ³ s) FEH statistical approach	River Lossie Tidal Boundary (m³s) Single Site analysis
200	0.5	85.95	168.83	222.99
200 (+37%CC)	0.5 (+37%CC)	117.75	231.30	305.50

Table 2.7 Design peak flows – Pooling group and ReFH 2

The different methods offer a wide range of flow estimates, it is therefore crucial to review each method for site suitability before choosing the final design flows.

Revitalised Flood Hydrograph 2 (ReFH 2.3)

The ReFH 2.3 methodology is recommended for producing peak flows at ungauged catchments throughout the UK. There are, however, limitations in its reliability across parts of Scotland, particularly the North East of Scotland including Moray. For this reason, it is not deemed as suitable for use in this study and was discounted.

Single Site analysis

Gauged data is often regarded as the most reliable method of calculated flow estimates across the UK however there are significant limitations in this when looking at peak flood flows such as the 200 year return period. Although the Sherrifmills gauge has a reasonable length of record, it experiences *'significant bypassing'* at higher flows (4 times in 10 years). Flow gauging has been carried out at the site using both Current meter and ADCP however these are only up to 64 m³s (approximately 1.3 times QMED). Flows above this have been estimated using modelled floodplain flows. The flows shown in Table 2.7 are extremely high and it is therefore down to professional judgement to discount these flows in this study.

FEH Statistical method

The FEH statistical method is often regarded as the most suitable method for hydrological estimation in Scotland for ungauged catchments. It tends to provide conservative flood estimations, especially when the critical storm duration is applied as is the case in this study. As the gauge was deemed as unsuitable, the catchment was treated as ungauged and the FEH statistical method was adopted for flow estimation in the River Lossie catchment. The final design peak flows are tabulated in Table 2.8.

Return period (years)	Annual Exceedance Probability (AEP)	River Lossie (m³/s)
200	0.5	168.83
200 (+37% CC)	0.5 (+CC)	231.30

Table 2.8 Final design peak flows



APPENDIX B

HYDRAULIC MODEL SETUP



There was only a short stretch of bathymetry data available for the study, and so only an approximate hydraulic model could be created to estimate fluvial water levels and velocities. No other appropriate flood model for the mouth of the Lossie could be found in the literature. A fully 2D model was created at 5 m resolution from the bathymetry and tied into 5 m LiDAR made available by Moray Council. This model used a steady tidal boundary condition (estimated SWL or SWL+climate uplift) or normal depth assumptions (only for the low tide, high fluvial flow case) at the beach end of the model. Model inlet conditions on the Lossie were the peak 200 year and 200 year plus climate change flows. Model runs were steady state. Channel toe and embankments were breaklined in AutoCAD Civil 3D and a hydraulic mesh created in Aquaveo SMS v11.1. This hydraulic mesh can be solved using either TUFLOW FV, or SRH-2D. Both solvers have been shown to be equivalent for this type of study. SRH-2D v3.2 is a free solver, benchmarked against many similar cases worldwide, and was chosen for this study to keep costs to a minimum. Frictions in the model were set at n = 0.025 (appropriate for sand with some cobbles/boulders), n = 0.02 for paved surfaces and n = 0.5 for buildings. No structures were modelled (i.e. neither of the two proposed bridges were modelled because details of their designs were not available at time of writing).



APPENDIX C

HYDROLOGICAL AUDIT SHEETS



FEH Statistical approach

Flood Modeller

HYDROLOGICAL DATA

Catchment: Lossie

Easting : 325300 Northing : 867200 Area : 270.547 km2 DPLBAR : 30.980 km DPSBAR : 74.400 m/km PROPWET : 0.420 SAAR : 813.000 mm Urban Extent : 0.007 С : -0.017 d1 : 0.440 d2 : 0.409 : 0.295 d3 : 0.253 е : 2.306 f SPR : 32.500 %

Summary of estimate using Flood Estimation Handbook rainfall-runoff method

Estimation of T-year flood

Unit hydrograph time to peak : 11.851 hours

Instantaneous UH time to peak : 11.601 hours

Data interval : 0.500 hours



Design storm duration	: 21.500 hours
Critical storm duration	: 21.485 hours
Return period for design	flood: 200.000 years
requires rain return peri	od : 246.667 years
ARF	: 0.923
Design storm depth	: 105.947 mm
CWI	: 117.300
Standard Percentage R	unoff : 32.500 %
Percentage runoff	: 39.154 %
Snowmelt rate	: 0.000 mm/day
Unit hydrograph peak	: 5.023 (m3/s/mm)
Quick response hydrograp	h peak : 162.903 m3/s
Baseflow	: 5.926 m3/s
Baseflow adjustment	: 0.000 m3/s
Hydrograph peak	: 168.829 m3/s
Hydrograph adjustme	nt factor : 1.000

Flags

=====	
Unit hydrograph flag	: FSRUH
Tp flag	: FEHTP
Event rainfall flag	: FEHER
Rainfall profile flag	: WINRP
Percentage Runoff flag	: FEHPR
Baseflow flag	: F16BF
CWI flag	: FSRCW
*****	******



Single site analysis



Figure 2.8: AMAX data from the Sherrifmills gauge.



Figure 2.9: Flood frequency curve from single site analysis of the Sherrifmills gauge.





Figure 2.10: POT data from the Sherrifmills gauge.



ReFH 2.3 analysis

UK Design Flood Estimation

Generated on Tuesday, December 15, 2020 6:38:11 PM by gordon Printed from the ReFH2 Flood Modelling software package, version 3.0.7275.28566

Summary of estimate using the Flood Estimation Handbook revitalised flood hydrograph method (ReFH2)

Site details

Checksum: 3054-CDAF

Site name: River Lossie Easting: 325300 Northing: 867200 Country: Scotland Catchment Area (km²): 270.55 Using plot scale calculations: No Model: ReFH2.3 Site description: None

Model run: 200 year

Summary of results

Rainfall - FEH 2013 mode (mm):	104.61	Total runoff (ML):	4030.10
Total Rainfall (mm):	72.68	Total flow (ML):	10511.37
Peak Rainfall (mm):	4.45	Peak flow (m ³ /s):	87.56

Parameters

Where the user has overriden a system-generated value, this original value is shown in square brackets after the value used.

* Indicates that the user locked the duration/timestep

Rainfall parameters (Rainfall - FEH 2013 model)

Name	Value	User-defined?
Duration (hh:mm:ss)	21:30:00 [11:00:00]	Yes
Timestep (hh:mm:ss)	00:30:00 [01:00:00]	Yes
SCF (Seasonal correction factor)	0.75	No
ARF (Areal reduction factor)	0.92	No
Seasonality	Winter	No
Loss model parameters		
Name	Value	User-defined?
Cini (mm)	76.87	No
Cmax (mm)	564.2	No
Use alpha correction factor	No	No
Alpha correction factor	n/a	No
Routing model parameters		
Name	Value	User-defined?



Tp (hr)	6.32	No
Up	0.65	No
Uk	0.8	No
Baseflow model parameters		
Name	Value	User-defined?
BF0 (m ³ /s)	2.76	No
BL (hr)	62.93	No
BR	1.66	No
Urbanisation parameters		
Name	Value	User-defined?
Urban area (km²)	5.68	No
Urbext 2000	0.01	No
Impervious runoff factor	0.7	No
Imperviousness factor	0.4	No
Tp scaling factor	0.75	No
Depression storage depth (mm)	0.5	No
Exporting drained area (km ²)	0.00	Yes
Sewer capacity (m³/s)	0.00	Yes



Time series data

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m ³ /s)	Baseflow (m³/s)	Total Flow (m³/s)
00:00:00	0.333	0.000	0.047	0.000	2.741	2.741
00:30:00	0.380	0.000	0.054	0.015	2.719	2.734
01:00:00	0.434	0.000	0.062	0.062	2.698	2.761
01:30:00	0.496	0.000	0.071	0.146	2.678	2.825
02:00:00	0.566	0.000	0.082	0.273	2.660	2.933
02:30:00	0.645	0.000	0.094	0.449	2.643	3.092
03:00:00	0.736	0.000	0.108	0.680	2.629	3.309
03:30:00	0.839	0.000	0.125	0.977	2.618	3.595
04:00:00	0.956	0.000	0.143	1.347	2.611	3.958
04:30:00	1.089	0.000	0.165	1.803	2.610	4.412
05:00:00	1.241	0.000	0.191	2.356	2.614	4.970
05:30:00	1.412	0.000	0.220	3.019	2.626	5.645
06:00:00	1.606	0.000	0.255	3.807	2.646	6.454
06:30:00	1.825	0.000	0.295	4.738	2.677	7.416
07:00:00	2.072	0.000	0.342	5.803	2.720	8.523
07:30:00	2.351	0.000	0.398	7.013	2.777	9.790
08:00:00	2.663	0.000	0.462	8.394	2.849	11.243
08:30:00	3.012	0.000	0.538	9.973	2.939	12.912
09:00:00	3.398	0.000	0.626	11.784	3.049	14.834
09:30:00	3.816	0.000	0.727	13.866	3.183	17.049
10:00:00	4.243	0.000	0.839	16.264	3.343	19.607
10:30:00	4.454	0.000	0.915	19.029	3.534	22.563
11:00:00	4.243	0.000	0.904	22.200	3.760	25.960
11:30:00	3.816	0.000	0.836	25.775	4.027	29.802
12:00:00	3.398	0.000	0.766	29.703	4.338	34.041
12:30:00	3.012	0.000	0.696	33.909	4.697	38.607
13:00:00	2.663	0.000	0.629	38.317	5.108	43.425
13:30:00	2.351	0.000	0.566	42.847	5.572	48.419
14:00:00	2.072	0.000	0.507	47.413	6.089	53.502
14:30:00	1.825	0.000	0.452	51.922	6.660	58.582
15:00:00	1.606	0.000	0.403	56.274	7.283	63.557
15:30:00	1.412	0.000	0.358	60.363	7.955	68.318
16:00:00	1.241	0.000	0.317	64.080	8.672	72.752
16:30:00	1.089	0.000	0.281	67.310	9.429	76.739
17:00:00	0.956	0.000	0.248	69.938	10.219	80.157
17:30:00	0.839	0.000	0.219	71.881	11.033	82.914



18:00:00	0.736	0.000	0.193	73.126	11.863	84.989
18:30:00	0.645	0.000	0.170	73.720	12.699	86.419
19:00:00	0.566	0.000	0.150	73.722	13.535	87.257
19:30:00	0.496	0.000	0.132	73.197	14.361	87.558
20:00:00	0.434	0.000	0.116	72.207	15.174	87.381
20:30:00	0.380	0.000	0.102	70.816	15.965	86.781
21:00:00	0.333	0.000	0.089	69.083	16.732	85.815
21:30:00	0.000	0.000	0.000	67.067	17.470	84.537
22:00:00	0.000	0.000	0.000	64.797	18.175	82.973
22:30:00	0.000	0.000	0.000	62.308	18.846	81.154
23:00:00	0.000	0.000	0.000	59.660	19.479	79.138
23:30:00	0.000	0.000	0.000	56.912	20.073	76.985
24:00:00	0.000	0.000	0.000	54.109	20.628	74.738
24:30:00	0.000	0.000	0.000	51.278	21.144	72.422
25:00:00	0.000	0.000	0.000	48.433	21.619	70.052
25:30:00	0.000	0.000	0.000	45.584	22.055	67.639
26:00:00	0.000	0.000	0.000	42.742	22.452	65.194
26:30:00	0.000	0.000	0.000	39.915	22.810	62.725
27:00:00	0.000	0.000	0.000	37.114	23.130	60.243
27:30:00	0.000	0.000	0.000	34.345	23.411	57.756
28:00:00	0.000	0.000	0.000	31.618	23.656	55.274
28:30:00	0.000	0.000	0.000	28.992	23.864	52.856
29:00:00	0.000	0.000	0.000	26.479	24.038	50.517
29:30:00	0.000	0.000	0.000	24.076	24.178	48.254
30:00:00	0.000	0.000	0.000	21.779	24.287	46.067
30:30:00	0.000	0.000	0.000	19.590	24.366	43.957
31:00:00	0.000	0.000	0.000	17.511	24.417	41.928
31:30:00	0.000	0.000	0.000	15.545	24.441	39.986
32:00:00	0.000	0.000	0.000	13.698	24.440	38.138
32:30:00	0.000	0.000	0.000	11.979	24.416	36.395
33:00:00	0.000	0.000	0.000	10.401	24.370	34.771
33:30:00	0.000	0.000	0.000	8.975	24.305	33.279
34:00:00	0.000	0.000	0.000	7.708	24.222	31.931
34:30:00	0.000	0.000	0.000	6.594	24.125	30.719
35:00:00	0.000	0.000	0.000	5.609	24.015	29.624
35:30:00	0.000	0.000	0.000	4.743	23.893	28.636
36:00:00	0.000	0.000	0.000	3.985	23.762	27.747
36:30:00	0.000	0.000	0.000	3.324	23.622	26.946
37:00:00	0.000	0.000	0.000	2.751	23.476	26.226



37:30:00	0.000	0.000	0.000	2.256	23.323	25.579
38:00:00	0.000	0.000	0.000	1.831	23.166	24.996
38:30:00	0.000	0.000	0.000	1.468	23.004	24.472
39:00:00	0.000	0.000	0.000	1.161	22.840	24.000
39:30:00	0.000	0.000	0.000	0.901	22.673	23.574
40:00:00	0.000	0.000	0.000	0.685	22.504	23.189
40:30:00	0.000	0.000	0.000	0.507	22.334	22.840
41:00:00	0.000	0.000	0.000	0.362	22.163	22.524
41:30:00	0.000	0.000	0.000	0.246	21.991	22.237
42:00:00	0.000	0.000	0.000	0.157	21.820	21.977
42:30:00	0.000	0.000	0.000	0.090	21.649	21.739
43:00:00	0.000	0.000	0.000	0.044	21.478	21.522
43:30:00	0.000	0.000	0.000	0.015	21.309	21.323
44:00:00	0.000	0.000	0.000	0.001	21.140	21.142
44:30:00	0.000	0.000	0.000	0.000	20.973	20.973
45:00:00	0.000	0.000	0.000	0.000	20.807	20.807
45:30:00	0.000	0.000	0.000	0.000	20.642	20.642
46:00:00	0.000	0.000	0.000	0.000	20.479	20.479
46:30:00	0.000	0.000	0.000	0.000	20.317	20.317
47:00:00	0.000	0.000	0.000	0.000	20.156	20.156
47:30:00	0.000	0.000	0.000	0.000	19.996	19.996
48:00:00	0.000	0.000	0.000	0.000	19.838	19.838
48:30:00	0.000	0.000	0.000	0.000	19.681	19.681
49:00:00	0.000	0.000	0.000	0.000	19.525	19.525
49:30:00	0.000	0.000	0.000	0.000	19.371	19.371
50:00:00	0.000	0.000	0.000	0.000	19.218	19.218
50:30:00	0.000	0.000	0.000	0.000	19.065	19.065
51:00:00	0.000	0.000	0.000	0.000	18.915	18.915
51:30:00	0.000	0.000	0.000	0.000	18.765	18.765
52:00:00	0.000	0.000	0.000	0.000	18.616	18.616
52:30:00	0.000	0.000	0.000	0.000	18.469	18.469
53:00:00	0.000	0.000	0.000	0.000	18.323	18.323
53:30:00	0.000	0.000	0.000	0.000	18.178	18.178
54:00:00	0.000	0.000	0.000	0.000	18.034	18.034
54:30:00	0.000	0.000	0.000	0.000	17.891	17.891
55:00:00	0.000	0.000	0.000	0.000	17.750	17.750
55:30:00	0.000	0.000	0.000	0.000	17.609	17.609
56:00:00	0.000	0.000	0.000	0.000	17.470	17.470
56:30:00	0.000	0.000	0.000	0.000	17.332	17.332



57:00:00	0.000	0.000	0.000	0.000	17.194	17.194
57:30:00	0.000	0.000	0.000	0.000	17.058	17.058
58:00:00	0.000	0.000	0.000	0.000	16.923	16.923
58:30:00	0.000	0.000	0.000	0.000	16.789	16.789
59:00:00	0.000	0.000	0.000	0.000	16.657	16.657
59:30:00	0.000	0.000	0.000	0.000	16.525	16.525
60:00:00	0.000	0.000	0.000	0.000	16.394	16.394
60:30:00	0.000	0.000	0.000	0.000	16.264	16.264
61:00:00	0.000	0.000	0.000	0.000	16.135	16.135
61:30:00	0.000	0.000	0.000	0.000	16.008	16.008
62:00:00	0.000	0.000	0.000	0.000	15.881	15.881
62:30:00	0.000	0.000	0.000	0.000	15.755	15.755
63:00:00	0.000	0.000	0.000	0.000	15.631	15.631
63:30:00	0.000	0.000	0.000	0.000	15.507	15.507
64:00:00	0.000	0.000	0.000	0.000	15.384	15.384
64:30:00	0.000	0.000	0.000	0.000	15.262	15.262
65:00:00	0.000	0.000	0.000	0.000	15.142	15.142
65:30:00	0.000	0.000	0.000	0.000	15.022	15.022
66:00:00	0.000	0.000	0.000	0.000	14.903	14.903
66:30:00	0.000	0.000	0.000	0.000	14.785	14.785
67:00:00	0.000	0.000	0.000	0.000	14.668	14.668
67:30:00	0.000	0.000	0.000	0.000	14.552	14.552
68:00:00	0.000	0.000	0.000	0.000	14.437	14.437
68:30:00	0.000	0.000	0.000	0.000	14.323	14.323
69:00:00	0.000	0.000	0.000	0.000	14.209	14.209
69:30:00	0.000	0.000	0.000	0.000	14.097	14.097
70:00:00	0.000	0.000	0.000	0.000	13.985	13.985
70:30:00	0.000	0.000	0.000	0.000	13.874	13.874
71:00:00	0.000	0.000	0.000	0.000	13.765	13.765
71:30:00	0.000	0.000	0.000	0.000	13.656	13.656
72:00:00	0.000	0.000	0.000	0.000	13.548	13.548
72:30:00	0.000	0.000	0.000	0.000	13.440	13.440
73:00:00	0.000	0.000	0.000	0.000	13.334	13.334
73:30:00	0.000	0.000	0.000	0.000	13.229	13.229
74:00:00	0.000	0.000	0.000	0.000	13.124	13.124
74:30:00	0.000	0.000	0.000	0.000	13.020	13.020
75:00:00	0.000	0.000	0.000	0.000	12.917	12.917
75:30:00	0.000	0.000	0.000	0.000	12.815	12.815
76:00:00	0.000	0.000	0.000	0.000	12.713	12.713



76:30:00	0.000	0.000	0.000	0.000	12.613	12.613
77:00:00	0.000	0.000	0.000	0.000	12.513	12.513
77:30:00	0.000	0.000	0.000	0.000	12.414	12.414
78:00:00	0.000	0.000	0.000	0.000	12.316	12.316
78:30:00	0.000	0.000	0.000	0.000	12.218	12.218
79:00:00	0.000	0.000	0.000	0.000	12.121	12.121
79:30:00	0.000	0.000	0.000	0.000	12.025	12.025
80:00:00	0.000	0.000	0.000	0.000	11.930	11.930
80:30:00	0.000	0.000	0.000	0.000	11.836	11.836
81:00:00	0.000	0.000	0.000	0.000	11.742	11.742
81:30:00	0.000	0.000	0.000	0.000	11.649	11.649
82:00:00	0.000	0.000	0.000	0.000	11.557	11.557
82:30:00	0.000	0.000	0.000	0.000	11.466	11.466
83:00:00	0.000	0.000	0.000	0.000	11.375	11.375
83:30:00	0.000	0.000	0.000	0.000	11.285	11.285
84:00:00	0.000	0.000	0.000	0.000	11.196	11.196
84:30:00	0.000	0.000	0.000	0.000	11.107	11.107
85:00:00	0.000	0.000	0.000	0.000	11.019	11.019
85:30:00	0.000	0.000	0.000	0.000	10.932	10.932
86:00:00	0.000	0.000	0.000	0.000	10.845	10.845
86:30:00	0.000	0.000	0.000	0.000	10.759	10.759
87:00:00	0.000	0.000	0.000	0.000	10.674	10.674
87:30:00	0.000	0.000	0.000	0.000	10.590	10.590
88:00:00	0.000	0.000	0.000	0.000	10.506	10.506
88:30:00	0.000	0.000	0.000	0.000	10.423	10.423
89:00:00	0.000	0.000	0.000	0.000	10.340	10.340
89:30:00	0.000	0.000	0.000	0.000	10.259	10.259
90:00:00	0.000	0.000	0.000	0.000	10.177	10.177
90:30:00	0.000	0.000	0.000	0.000	10.097	10.097
91:00:00	0.000	0.000	0.000	0.000	10.017	10.017
91:30:00	0.000	0.000	0.000	0.000	9.938	9.938
92:00:00	0.000	0.000	0.000	0.000	9.859	9.859
92:30:00	0.000	0.000	0.000	0.000	9.781	9.781
93:00:00	0.000	0.000	0.000	0.000	9.704	9.704
93:30:00	0.000	0.000	0.000	0.000	9.627	9.627
94:00:00	0.000	0.000	0.000	0.000	9.551	9.551
94:30:00	0.000	0.000	0.000	0.000	9.475	9.475
95:00:00	0.000	0.000	0.000	0.000	9.400	9.400
95:30:00	0.000	0.000	0.000	0.000	9.326	9.326



96:00:00	0.000	0.000	0.000	0.000	9.252	9.252
96:30:00	0.000	0.000	0.000	0.000	9.179	9.179
97:00:00	0.000	0.000	0.000	0.000	9.106	9.106
97:30:00	0.000	0.000	0.000	0.000	9.034	9.034
98:00:00	0.000	0.000	0.000	0.000	8.962	8.962
98:30:00	0.000	0.000	0.000	0.000	8.891	8.891
99:00:00	0.000	0.000	0.000	0.000	8.821	8.821
99:30:00	0.000	0.000	0.000	0.000	8.751	8.751
100:00:00	0.000	0.000	0.000	0.000	8.682	8.682
100:30:00	0.000	0.000	0.000	0.000	8.613	8.613
101:00:00	0.000	0.000	0.000	0.000	8.545	8.545
101:30:00	0.000	0.000	0.000	0.000	8.477	8.477
102:00:00	0.000	0.000	0.000	0.000	8.410	8.410
102:30:00	0.000	0.000	0.000	0.000	8.344	8.344
103:00:00	0.000	0.000	0.000	0.000	8.278	8.278
103:30:00	0.000	0.000	0.000	0.000	8.212	8.212
104:00:00	0.000	0.000	0.000	0.000	8.147	8.147
104:30:00	0.000	0.000	0.000	0.000	8.083	8.083
105:00:00	0.000	0.000	0.000	0.000	8.019	8.019
105:30:00	0.000	0.000	0.000	0.000	7.955	7.955
106:00:00	0.000	0.000	0.000	0.000	7.892	7.892
106:30:00	0.000	0.000	0.000	0.000	7.830	7.830
107:00:00	0.000	0.000	0.000	0.000	7.768	7.768
107:30:00	0.000	0.000	0.000	0.000	7.706	7.706
108:00:00	0.000	0.000	0.000	0.000	7.645	7.645
108:30:00	0.000	0.000	0.000	0.000	7.585	7.585
109:00:00	0.000	0.000	0.000	0.000	7.525	7.525
109:30:00	0.000	0.000	0.000	0.000	7.465	7.465
110:00:00	0.000	0.000	0.000	0.000	7.406	7.406
110:30:00	0.000	0.000	0.000	0.000	7.348	7.348
111:00:00	0.000	0.000	0.000	0.000	7.290	7.290
111:30:00	0.000	0.000	0.000	0.000	7.232	7.232
112:00:00	0.000	0.000	0.000	0.000	7.175	7.175
112:30:00	0.000	0.000	0.000	0.000	7.118	7.118
113:00:00	0.000	0.000	0.000	0.000	7.062	7.062
113:30:00	0.000	0.000	0.000	0.000	7.006	7.006
114:00:00	0.000	0.000	0.000	0.000	6.950	6.950
114:30:00	0.000	0.000	0.000	0.000	6.895	6.895
115:00:00	0.000	0.000	0.000	0.000	6.841	6.841



115:30:00	0.000	0.000	0.000	0.000	6.786	6.786
116:00:00	0.000	0.000	0.000	0.000	6.733	6.733
116:30:00	0.000	0.000	0.000	0.000	6.679	6.679
117:00:00	0.000	0.000	0.000	0.000	6.627	6.627
117:30:00	0.000	0.000	0.000	0.000	6.574	6.574
118:00:00	0.000	0.000	0.000	0.000	6.522	6.522
118:30:00	0.000	0.000	0.000	0.000	6.471	6.471
119:00:00	0.000	0.000	0.000	0.000	6.419	6.419
119:30:00	0.000	0.000	0.000	0.000	6.368	6.368
120:00:00	0.000	0.000	0.000	0.000	6.318	6.318
120:30:00	0.000	0.000	0.000	0.000	6.268	6.268
121:00:00	0.000	0.000	0.000	0.000	6.218	6.218
121:30:00	0.000	0.000	0.000	0.000	6.169	6.169
122:00:00	0.000	0.000	0.000	0.000	6.120	6.120
122:30:00	0.000	0.000	0.000	0.000	6.072	6.072
123:00:00	0.000	0.000	0.000	0.000	6.024	6.024
123:30:00	0.000	0.000	0.000	0.000	5.976	5.976
124:00:00	0.000	0.000	0.000	0.000	5.929	5.929
124:30:00	0.000	0.000	0.000	0.000	5.882	5.882
125:00:00	0.000	0.000	0.000	0.000	5.835	5.835
125:30:00	0.000	0.000	0.000	0.000	5.789	5.789
126:00:00	0.000	0.000	0.000	0.000	5.743	5.743
126:30:00	0.000	0.000	0.000	0.000	5.698	5.698
127:00:00	0.000	0.000	0.000	0.000	5.653	5.653
127:30:00	0.000	0.000	0.000	0.000	5.608	5.608
128:00:00	0.000	0.000	0.000	0.000	5.564	5.564
128:30:00	0.000	0.000	0.000	0.000	5.520	5.520
129:00:00	0.000	0.000	0.000	0.000	5.476	5.476
129:30:00	0.000	0.000	0.000	0.000	5.433	5.433
130:00:00	0.000	0.000	0.000	0.000	5.390	5.390
130:30:00	0.000	0.000	0.000	0.000	5.347	5.347
131:00:00	0.000	0.000	0.000	0.000	5.305	5.305
131:30:00	0.000	0.000	0.000	0.000	5.263	5.263
132:00:00	0.000	0.000	0.000	0.000	5.221	5.221
132:30:00	0.000	0.000	0.000	0.000	5.180	5.180
133:00:00	0.000	0.000	0.000	0.000	5.139	5.139
133:30:00	0.000	0.000	0.000	0.000	5.098	5.098
134:00:00	0.000	0.000	0.000	0.000	5.058	5.058
134:30:00	0.000	0.000	0.000	0.000	5.018	5.018



135:00:00	0.000	0.000	0.000	0.000	4.978	4.978
135:30:00	0.000	0.000	0.000	0.000	4.939	4.939
136:00:00	0.000	0.000	0.000	0.000	4.900	4.900
136:30:00	0.000	0.000	0.000	0.000	4.861	4.861
137:00:00	0.000	0.000	0.000	0.000	4.822	4.822
137:30:00	0.000	0.000	0.000	0.000	4.784	4.784
138:00:00	0.000	0.000	0.000	0.000	4.746	4.746
138:30:00	0.000	0.000	0.000	0.000	4.709	4.709
139:00:00	0.000	0.000	0.000	0.000	4.671	4.671
139:30:00	0.000	0.000	0.000	0.000	4.635	4.635
140:00:00	0.000	0.000	0.000	0.000	4.598	4.598
140:30:00	0.000	0.000	0.000	0.000	4.561	4.561
141:00:00	0.000	0.000	0.000	0.000	4.525	4.525
141:30:00	0.000	0.000	0.000	0.000	4.490	4.490
142:00:00	0.000	0.000	0.000	0.000	4.454	4.454
142:30:00	0.000	0.000	0.000	0.000	4.419	4.419
143:00:00	0.000	0.000	0.000	0.000	4.384	4.384
143:30:00	0.000	0.000	0.000	0.000	4.349	4.349
144:00:00	0.000	0.000	0.000	0.000	4.315	4.315
144:30:00	0.000	0.000	0.000	0.000	4.281	4.281
145:00:00	0.000	0.000	0.000	0.000	4.247	4.247
145:30:00	0.000	0.000	0.000	0.000	4.213	4.213
146:00:00	0.000	0.000	0.000	0.000	4.180	4.180
146:30:00	0.000	0.000	0.000	0.000	4.147	4.147
147:00:00	0.000	0.000	0.000	0.000	4.114	4.114
147:30:00	0.000	0.000	0.000	0.000	4.081	4.081
148:00:00	0.000	0.000	0.000	0.000	4.049	4.049
148:30:00	0.000	0.000	0.000	0.000	4.017	4.017
149:00:00	0.000	0.000	0.000	0.000	3.985	3.985
149:30:00	0.000	0.000	0.000	0.000	3.954	3.954
150:00:00	0.000	0.000	0.000	0.000	3.922	3.922
150:30:00	0.000	0.000	0.000	0.000	3.891	3.891
151:00:00	0.000	0.000	0.000	0.000	3.860	3.860
151:30:00	0.000	0.000	0.000	0.000	3.830	3.830
152:00:00	0.000	0.000	0.000	0.000	3.800	3.800
152:30:00	0.000	0.000	0.000	0.000	3.769	3.769
153:00:00	0.000	0.000	0.000	0.000	3.740	3.740
153:30:00	0.000	0.000	0.000	0.000	3.710	3.710
154:00:00	0.000	0.000	0.000	0.000	3.681	3.681



154:30:00	0.000	0.000	0.000	0.000	3.652	3.652
155:00:00	0.000	0.000	0.000	0.000	3.623	3.623
155:30:00	0.000	0.000	0.000	0.000	3.594	3.594
156:00:00	0.000	0.000	0.000	0.000	3.566	3.566
156:30:00	0.000	0.000	0.000	0.000	3.537	3.537
157:00:00	0.000	0.000	0.000	0.000	3.509	3.509
157:30:00	0.000	0.000	0.000	0.000	3.482	3.482
158:00:00	0.000	0.000	0.000	0.000	3.454	3.454
158:30:00	0.000	0.000	0.000	0.000	3.427	3.427
159:00:00	0.000	0.000	0.000	0.000	3.400	3.400
159:30:00	0.000	0.000	0.000	0.000	3.373	3.373
160:00:00	0.000	0.000	0.000	0.000	3.346	3.346
160:30:00	0.000	0.000	0.000	0.000	3.319	3.319
161:00:00	0.000	0.000	0.000	0.000	3.293	3.293
161:30:00	0.000	0.000	0.000	0.000	3.267	3.267
162:00:00	0.000	0.000	0.000	0.000	3.241	3.241
162:30:00	0.000	0.000	0.000	0.000	3.216	3.216
163:00:00	0.000	0.000	0.000	0.000	3.190	3.190
163:30:00	0.000	0.000	0.000	0.000	3.165	3.165
164:00:00	0.000	0.000	0.000	0.000	3.140	3.140
164:30:00	0.000	0.000	0.000	0.000	3.115	3.115
165:00:00	0.000	0.000	0.000	0.000	3.090	3.090
165:30:00	0.000	0.000	0.000	0.000	3.066	3.066
166:00:00	0.000	0.000	0.000	0.000	3.042	3.042
166:30:00	0.000	0.000	0.000	0.000	3.018	3.018
167:00:00	0.000	0.000	0.000	0.000	2.994	2.994
167:30:00	0.000	0.000	0.000	0.000	2.970	2.970
168:00:00	0.000	0.000	0.000	0.000	2.947	2.947
168:30:00	0.000	0.000	0.000	0.000	2.923	2.923
169:00:00	0.000	0.000	0.000	0.000	2.900	2.900
169:30:00	0.000	0.000	0.000	0.000	2.877	2.877
170:00:00	0.000	0.000	0.000	0.000	2.854	2.854
170:30:00	0.000	0.000	0.000	0.000	2.832	2.832
171:00:00	0.000	0.000	0.000	0.000	2.809	2.809
171:30:00	0.000	0.000	0.000	0.000	2.787	2.787
172:00:00	0.000	0.000	0.000	0.000	2.765	2.765



Appendix

Catchment descriptors

Name	Value	User-defined value used?
Area (km²)	270.55	No
ALTBAR	169	No
ASPBAR	2	No
ASPVAR	0.34	No
BFIHOST	0.62	No
BFIHOST19	0.63	No
DPLBAR (km)	30.98	No
DPSBAR (mkm-1)	74.4	No
FARL	0.98	No
LDP	56.2	No
PROPWET (mm)	0.42	No
RMED1H	9	No
RMED1D	37.1	No
RMED2D	47.5	No
SAAR (mm)	813	No
SAAR4170 (mm)	871	No
SPRHOST	32.5	No
Urbext2000	0.01	No
Urbext1990	0.01	No
URBCONC	0.86	No
URBLOC	0.41	No
DDF parameter C	-0.02	No
DDF parameter D1	0.44	No
DDF parameter D2	0.41	No
DDF parameter D3	0.3	No
DDF parameter E	0.25	No
DDF parameter F	2.31	No
DDF parameter C (1km grid value)	-0.01	No
DDF parameter D1 (1km grid value)	0.41	No
DDF parameter D2 (1km grid value)	0.35	No
DDF parameter D3 (1km grid value)	0.28	No
DDF parameter E (1km grid value)	0.25	No
DDF parameter F (1km grid value)	2.25	No



Specialist Services and Expertise for Water Resources and the Environment

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Appendix D – Sediment Movement Study



LOSSIEMOUTH EAST BEACH FOOTBRIDGE REPLACEMENT

SEDIMENT MOVEMENT STUDY

Prepared for

Beaver Bridges Ltd

Prepared by

cbec eco-engineering UK Ltd

December 2020

cbec Project #: 20-1032

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Client: Beaver Bridges Ltd Project Name: Lossiemouth East Beach Footbridge Replacement Project Reference: 20-1032 Document Type: Draft

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Services provided pursuant to this agreement are intended solely for the use and benefit of Beaver Bridges Ltd. No other person or entity shall be entitled to rely on the services, opinions, recommendations, plans or specifications provided pursuant to this agreement without the express written consent of cbec eco-engineering UK Ltd., The Green House, Beechwood Park North, Inverness, IV2 3BL.



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1. INTRODUCTION

cbec eco-engineering UK Ltd (cbec) was contracted by Beaver Bridges Ltd to conduct environmental studies of potential factors influencing the design of the proposed replacement bridge at Lossiemouth East Beach, on the River Lossie at Lossiemouth, Moray. This document presents a study undertaken to assess the potential implications of sediment movement on the proposed replacement bridge. Specifically, this study assesses:

- The current sediment dynamics along the River Lossie valley and potential factors that can further influence the bridge stability.
- How sediment dynamics have changed over time, their rates of change in terms of river morphology, and, associated factors that can have caused the failure of the old footbridge and can impact the long-term stability of the alternative proposed bridge.
- The potential impact of morphodynamic changes on the foundation stability for the two bridge replacement options.

2. APPROACH

2.1 HISTORICAL SEDIMENT DYNAMICS

A desk-based assessment of historical sediment mobility historic was undertaken using a combination of (1) a series of historical maps made publicly available by the National Library of Scotland (NLS)¹ for the period between 1747 and 1957 and, (2), aerial images made publicly available by the Google Earth for the period 2007-2020. Data from the National River Flow Archive (2020) and literature review were also used. Together, this sequence of maps, aerial images and flow data permit a long-term understanding of changes in river planform, sediment dynamics and land cover, which provide a timeline to unravel sediment movement within the recent Anthropocene period, that is, the geological epoch dating from the commencement of significant human impact on Earth's geology to today. A detailed description of the methods and results of this historic assessment is provided as Appendix B ('Historic Sediment Dynamics').

2.2 CURRENT SEDIMENT DYNAMICS

A geomorphological walkover ('fluvial audit') to characterise geomorphic and built elements along the valley floor was undertaken in October 2020 by two experienced geomorphologists on a \approx 4.4 km length of the river. The survey is considered sufficient to interpret both fluvial processes upstream to the limit of the tidal influence at Arthur's Bridge at OS NGR NJ 2535 6720, and coastal processes related to the dune area to the north of the channel at OS NGR NJ 23940 70768. A detailed description of the methods and results of this geomorphological walkover is provided as Appendix A ('Geomorphic Walkover Survey').

2.3 FOOTBRIDGE OPTIONS APPRAISAL

Based on the current and historic sediment movement assessments, the two footbridge replacement locations proposed by Moray Council² are analysed in terms of propensity for foundational instability resulting from sediment accumulation (bridge overloading) and removal (bridge scour). The two

¹ National Library of Scotland (NLS) can be accessed at https://www.nls.uk/.

² Moray Council (2020). Lossiemouth East Beach Footbridge Replacement Site Plan. Available in Appendix C ('Proposed Bridge Locations').



options for the bridge replacement are the actual footbridge and another section just upstream of the Old Harbour.

3. SEDIMENT MOVEMENT STUDY: MAIN FINDINGS

3.1 HISTORIC ASSESSMENT: 1747 – 1957

The river centreline migration rate between the late 1800s (1865-1870) and the present (2019) varies from ≈ 0.2 m yr⁻¹ (at the footbridge) to ≈ 0.4 m yr⁻¹ upstream of the Old Harbour (in the location of the alternative proposed bridge). Similarly, the centreline migration rate to the west between 1957 and the present varies from ≈ 0.1 m yr¹ near the footbridge to ≈ 0.4 m yr⁻¹ near the Old Harbour.

These rates and dates indicate that the average centreline migration rate has slowed in the more recent years (1957-2019) adjacent to the current footbridge cross-section but increased slightly in the alternative section proposed for the new footbridge (near the Old Harbour). They also indicate that the preferential areas of scour and deposition in the valley have varied over time. This variation of sediment dynamics within the channel might have been enhanced by dune migration which may be one of the sources of instability that undermined the existing footbridge (although further investigation would be required to test this hypothesis). While scour related to the migrating channel may have reduced the foundation's stability, in-migration of large volumes of sand below the bridge may also have assisted in causing overloading.

In the literature, Smith (1982)³ supports that the Lossiemouth coastline evolution is linked to a shoreline regression (i.e., sedimentation of clastic sediments towards the continent), with an increase of sand in dune formation. Their report also highlights that the western portion is currently the most dynamic one, including a seasonal accumulation of sand from the outer to the inner shoreline. In addition, Dargie (2001)⁴ classified 10.5 ha of the East Lossiemouth area as 'mobile dunes', reinforcing the potential of dune migration as a relevant process in the local landscape dynamics. However, although these reports suggest that the western area near the River Lossie outlet has mobile dunes and an inward seasonal sand accumulation, the scale of their studies is too large to allow a definition of the extent and magnitude of this process in the current river geometry. Therefore, this is still a hypothesis requiring further field investigation.

3.2 HISTORIC ASSESSMENT: 2007 – 2019

Analysis of aerial imagery supports a large variation in river width related to diurnal and seasonal tidal levels rather than upstream changes in river discharge (Table 3.1). Overall, the river width is considerably narrower in the section of the alternative proposed bridge location than in the current one, which might be linked to a lateral constriction in the Old Harbour area resulting from the historical dune and river channel centreline migration.

³ Smith, J.S. (1982). Lossiemouth (East). In: Ritchie, W. (1982). Northeast Scotland coastal field guide and geographical analysis. Available at https://apps.dtic.mil/sti/pdfs/ADA134861.pdf

⁴ Dargie, T. (2001). Sand dune vegetation survey of Scotland: Moray Firth, vol. 1. Available at https://bit.ly/2IEWfk1



Table 3.1: Mean discharge, catchment daily rainfall recorded in the nearby gauge station (7003-Lossie at Sheriffmills) and river width identified at the current River Lossie footbridge and at the alternative proposed footbridge, near the outlet. Hydrologic data were collected from National River Flow Archive website and the aerial images from Google Earth (made available by Maxar Technologies).

Date	Discharge (m³/s)	Precipitation (mm)	River width (m) at location of current bridge	River width (m) at alternative proposed location
03/02/2007	2.3	0	127.2	47.6
09/05/2008	1.5	0	110.7	39.6
24/03/2014	1.0	0	25.1	23.4
20/05/2014	0.8	3.8	21.4	12.0
26/06/2016	1.9	3.4	33.4	11.3
12/05/2017	0.89	0.2	95.1	39.7
09/02/2018	2.5	-	50.7	16.9
27/04/2018	1.3	-	103.3	33.8
25/06/2018	0.8	-	103.3	48.0
07/01/2019	1.0	-	111.6	45.5
06/02/2019	3.1	-	112.3	49.8
08/07/2019	1.0	-	33.6	11.8

3.3 GEOMORPHIC SURVEY

The geomorphic field survey confirmed that the River Lossie near its outlet is controlled by a combination of fluvial and tidal influences, and, potentially, by dune migration. Understandably, the tidal influence decreases upstream. Observed river geometries (i.e., width, slope, and depth) arise because of fluvial and tidal hydraulic forces in combination with a sediment supply derived both from the upstream catchment driven by fluvial processes and from the coastal sand dune migration driven by aeolian (wind-blown) processes. Evidence for dune migration by wind-blown is partly supported by the historic assessment undertaken within this report (Appendix A). In terms of active and stable sediment deposits, this reach combines large active sandbars within the channel and in the coastal area, with stable fluvial island and floodplains upstream from the coastal zone.

3.4 BRIDGE OPTIONS APPRAISAL

The following morpho-dynamic characteristics have been noticed in the location proposed for the footbridges:

- Current footbridge location: a reduction in the river centreline migration rate (from ≈ 0.2 m yr⁻¹ to ≈ 0.1 m yr¹) in the recent decades (1957-2019) compared to the longer timeframe (1870 to present), and a larger diurnal/seasonal variation (93.6 m) in river width due to tidal influence in recent years (2007-2019) than the alternative footbridge area.
- Alternative footbridge location: a steady river centreline migration rate (≈0.4 m yr⁻¹) from 1870 to present, and a smaller diurnal/seasonal variation (38.5 m) in river width due to tidal influence in recent years (2007-2019) than the current footbridge area.

These results indicate that the regular increase in river width during tidal rises appears to result in a larger spatial occurrence of scour in the vicinity of the current footbridge locations than in the vicinity



of the alternative location, but deeper in the latter. This narrower width (possibly related to river constriction by dune migration) is presumed to have produced higher scour depths because of deeper water levels (therefore, shear stress) at the thalweg of the alternative proposed bridge area. However, further assessment is required to test this hypothesis, given that no thalweg measurements are available.

4. CONCLUSION

In addition to the potential influence of fluvial scour in undermining the bridge piers, sand accumulation (overloading) has likely been an active factor in the River Lossie outlet as whole. However, overall, in evaluating the dynamic nature of both the dunes and riverbed within the area of the proposed footbridge relocation, there appears to be a lower risk of failure due to sediment dynamics at the site of the existing footbridge than the alternative one. This conclusion is based on apparently lower rates of channel migration and a wider channel that appears to facilitate broader rather than more focused scour associated with tidal fluctuations.

Please note that the field- and desk-based assessment conducted here provides an analysis of sediment movement based on historic assessment; future sediment dynamics, particularly under conditions of climate change and sea-level rise, may vary from that discussed.



APPENDIX A

History of Sediment Dynamics



HISTORY OF SEDIMENT DYNAMICS

This historic assessment of sediment mobility can be grouped within two historical ranges. The first time range comprises a period between 1747 and 1957, representing a series of historical maps made publicly available by the National Library of Scotland (NLS)⁵. The second time range is more recent (2007-2020), and is composed of aerial images made publicly available by Google Earth. Together, this sequence of maps and aerial images permit a long-term understanding of changes in river planform, sediment dynamics and land cover, which provide a timeline to assess sediment movement.

HISTORIC ASSESSMENT: 1747 – 1957

The oldest maps of the study area were produced by William Roy (Roy Highlands maps) in 1747-1752, and chronologically followed by those of James Dorret (1750), Aaron Arrowsmith (1807), and, later, Ordnance Survey (OS) maps (editions in 1896, 1900, 1923, 1872, 1903, 1905, 1957, 1965, and 1968).

In the Roy Highlands maps (1747-1752), the Lossiemouth peninsula is portrayed with the least humanaltered landscape of all records available, reflecting a pre-industrial revolution Scottish landscape with possible farming human-induced changes (Figure A1). From large-scale maps, the River Lossie at that time shows similarities to its current planform in that the dominant flow direction is to the north, with a significant change to north-west at the coastal interface. Morphologically, it is noticeable that the River Lossie in 1747-1752 has a well-defined meandering planform throughout the mapped reaches. Some features (e.g. coastline sand beaches and dunes) seem overrepresented by the Roy maps and caution must be taken when comparing this map with more recent data.

⁵ National Library of Scotland (NLS) can be accessed at https://www.nls.uk/.





Figure A1: Roy Highlands maps (1747-1752, above), and aerial images of Maxar (2020, below). These figures represent a similar extent of the landscape with a time difference of 268-273 years.



The next high-quality map was surveyed by the Ordnance Survey (OS) in 1865-1870 (and published in 1905) (Figure A2 and Figure A3). It shows an intensification of development with infrastructure such as Arthur's Bridge at the upstream extent of the study area, and an increase in housing, canal infrastructure and other anthropogenic interventions.

Similar to the current planform, the predominant river channel morphology in most of the upstream reach (i.e. before flowing to the north-west adjacent to the coastal dunes) shows lower sinuosity, with a narrower cross-sectional geometry. There are no significant changes in the river channel centreline from 1865-1870 to present.

However, in the north-west flowing reach, the position of highly dynamic depositional features (e.g. sandbars) within the channel and the spatial distribution of river geometry do not resemble present characteristics. For example, at the location of the current footbridge, the channel cross-sectional width varies from 21 m (in 1865-1870) to 32 m (present). Although in large-scale the dunes and shoreline have remained as they are currently, the river channel centreline and the dunes separating the river from the sea at the outlet were further east. In the location of the current footbridge, the channel centreline was \approx 28 m further right from its present position (2020). In a downstream cross-section (113 m) from the current footbridge, the change in the river channel centreline was even higher: \approx 68.5 m towards the river left from its past position in 1865-1870. These distances provide a river channel centreline migration rate of \approx 0.2 m yr⁻¹ at the footbridge and \approx 0.4 m yr⁻¹ at the downstream cross-section. These centreline migrations are likely to be a response to dune migration in the same direction (NW) over time, causing the associated footbridge issues.

These differences in planform location demonstrate that the alluvial channel near the sea has been more mobile over the last three centuries than its upstream reach. Because the quality of details in these maps is superior to that of Roy Highlands (1747-1752), it is not possible to directly compare the these data, but it is likely that anthropogenic pressures, and in particular the development of Lossiemouth itself, have historically impacted sediment dynamics within the lower River Lossie.

Another important record in the 1865-1870 map is the presence of the Spynie Canal (in the left margin) and of the Inness Canal (right margin) near the River Lossie. The creation of the Canal allowed the once extensive Spynie Loch to be drained and the resulting dry area made available for agriculture (see Figure A1). The Spynie Canal was damaged by inundation during the Great Flood of 1829 but was later repaired with dikes thrown up along the canal's banks. The Innes Canal was built at the same time (i.e. in the early 19th century) for farming purposes.




Figure A2: Downstream reach where the river flows to the NW. Note the river changes near the old harbour (last fluvial area near the sea) and in sandbars along the channel. The first map is an OS map surveyed in 1865-1870 (published in 1905), and the second map is an aerial image of Maxar from 2020.





Figure A3: Upstream study reach with the river flowing to the N-NW. Note that the river planform has remained largely unchanged from 1865-1870 to the present.

The subsequent maps (OS surveyed published in 1957, and more recent maps) show a channel centreline that is much closer to the current planform near the river outlet (Figure A4). However, it also shows a spatial distribution of sandbars and channel boundaries that does not fit the current morphology. Those changes are more visible in the section near the footbridge and in the Old Harbour, and, together, they reinforce the existence of a highly dynamic channel in human timescales (i.e., decadal).

In this area, the distance of the centreline from the footbridge, which serves as a static reference point, highlights these changes in the river planform over time. Near the current footbridge, there was a change in the river centreline of \approx 6 m (an averaged migration rate of \approx 0.09 m yr⁻¹. In the area in front of the Old Harbour, there were changes in the river centreline varying from 8 to 27 m (an averaged migration rate of \approx 0.12 m yr⁻¹ and \approx 0.42 m yr⁻¹, respectively). The area in front of the Old Pier remained constant over time.





Figure A4: Downstream reach in 1957 map (top) and the status (bottom) in 2020. Note that the distribution of the channel sandbars are very different.

HISTORIC ASSESSMENT: 2007 - 2020

Free satellite images from the outlet of the River Lossie were taken by Maxar Technologies on 03/02/2007, 09/05/2008, 24/03/2014, 20/05/2014, 26/06/2016, 12/05/2017, 09/02/2018, 27/04/2018, 25/06/2018, 07/01/2019, 06/02/2019, 08/07/2019, 14/10/2019, 25/10/2019, 20/02/2020, and 30/05/2020. These images can be accessed on the Google Earth platform. In combination with these images, hydrologic data collected from National River Flow Archive is used to provide a more robust analysis.

Overall, the main features observed in the sequence of photographs are:

- River Lossie width changes significantly between dry (April to August) and wet seasons (September to March), although this is due largely to tidal (rather than precipitation) variations (Table A1).
- These data also suggest that the river is narrower in cross sectional geometry in the alternative proposed site for the bridge than in the location of the existing footbridge.



- The tidal influence on the channel width is supported by a comparison between daily mean flow discharge (m³/s) and catchment daily rainfall (mm) recorded in the nearby gauge station ≈14 km upstream of the River Lossie outlet (data recorded by National River Flow Archive).
- Diurnal range in high and low tides are expected to impact in sediment transport. During base level rise (in this case, the sea where the river flows to), there is a reduction in water slope, which impacts directly on stream power by reducing the competence to transport sediment, therefore, promoting sediment deposition. On the contrary, during stages of base level fall, stream power increases because of higher water slopes. Consequently, river competence to transport coarser particles increases, promoting erosion in a reach scale during diurnal tidal variations.
- In addition to this alternating erosional process, the change in river geometry (width, depth and slope) resulting from the diurnal rise and fall of base level may also expose sand bars to entrainment during high tides and deposition during the falling stages. This exposure-hiding effect generates an additional factor of complexity to sediment dynamics.
- This combined effect of base level fall and rise on river width and stream power produce a trade-off between erosion and deposition over time.



Table A1: Mean discharge, catchment daily rainfall recorded in the nearby gauge station (7003-Lossie at Sheriffmills) and river width identified at the current River Lossie footbridge and at the alternative proposed footbridge, near the outlet. Hydrologic data were collected from National River Flow Archive website and the aerial images from Google Earth (made available by Maxar Technologies).

Date	Discharge (m³/s)	Precipitation (mm)	River width (m) at location of current bridge	River width (m) at alternative proposed location
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09/05/2008	1.5	0	110.7	39.6
24/03/2014	1.0	0	25.1	23.4
20/05/2014	0.8	3.8	21.4	12.0
26/06/2016	1.9	3.4	33.4	11.3
12/05/2017	0.9	0.2	95.1	39.7
09/02/2018	2.5	-	50.7	16.9
27/04/2018	1.3	-	103.3	33.8
25/06/2018	0.8	-	103.3	48.0
07/01/2019	1.0	-	111.6	45.5
06/02/2019	3.1	_	112.3	49.8
08/07/2019	1.0	-	33.6	11.8



Aerial images (page 1 of 3) showing the variation in wetted channel width due to tidal influence at the mouth of the river





Aerial images (page 2 of 3) showing the variation in wetted channel width due to tidal influence at the mouth of the river





Aerial images (page 3 of 3) showing the variation in wetted channel width due to tidal influence at the mouth of the river







Aerial images showing the River Lossie upstream of the study reach, taken during both low and high tide.



APPENDIX B

Current Sediment Dynamics



CURRENT SEDIMENT DYNAMICS

GEOMORPHIC SURVEY

cbec conducted a geomorphological walkover ('fluvial audit') to characterise geomorphic and built elements along the valley floor as part of the Sediment Movement Study. The survey included a length of the River Lossie sufficient to interpret fluvial process (i.e. upstream to the limit of the tidal influence at Arthur's Bridge at OS NGR NJ 2535 6720) and the dune area to the north of the channel (at OS NGR NJ 23940 70768).

Location

The walkover was conducted along the River Lossie, covering a total distance of ≈4.4 km, between OS NGR NJ 2535 6720 (upstream extent) and NJ 23940 70768 (downstream extent).

<u>Method</u>

A fluvial audit of the reach was carried out in October 2020. The entire length of the reach was walked by two surveyors. Locations and characteristics of physical features were recorded using a hand-held, GPS-enabled tablet and camera. The data were subsequently transformed into GIS format to allow visualisation and further analysis. The types of features and characteristics recorded are listed below.

- **Reach scale channel morphology** (using a classification scheme that draws on aspects of other recognised procedures Montgomery and Buffington 1997; Brierley and Fryirs, 2000; SEPA, 2012).
- **Sediment sources/ storage** (e.g. tributaries, bank erosion, within-channel storage in barforms), noting dominant sediment sizes.
- Indicators of the sediment transport regime (e.g. the form, texture and vegetation cover of bar features and bed forms).
- **Vegetation** both in-channel vegetation (e.g. 'large woody material', macrophytes) and riparian/bankside cover, as well as invasive alien species.
- **River engineering pressures** (e.g. culverts, bank protection, canalisation/ realignment, embankments, hydraulic structures, bridge crossings, etc.).

To facilitate analysis, the survey was divided into three river reaches as a means of providing spatial units within which further examination of physical processes could be undertaken and compared.

The three reaches surveyed are summarised in Table B1. These reaches represent distinct hydrodynamic environments, with sediments associated to varying sources and controlling factors.



Table B1: Studied reaches, their description and length.

Reach ID	Description	Length (m)	Sediment dynamics
1	River Lossie from the Arthur's bridge (OS NGR NJ 2535 6720) to the beginning of the river change to the more alluvial channel (OS NGR NJ 25512 68262).	1.2 km	Fluvial processes, gravel-sand dominated,
2	From the upstream extent of the more alluvial channel (OS NGR NJ 25512 68262) to the upstream extent the major tributary of river right (OS NGR NJ 25207 69133).	1 km	Transitional between fluvial and coastal processes
3	From the upstream extent of the major tributary of river right (OS NGR NJ 25207 69133) to the river outlet (OS NGR NJ 23940 70768).	2.2 km	Coastal processes, sand dominated

In Reach 1, there is a prevalence of fluvial activity in sediment transport, sediment sources are exclusively from upstream and the river channel is supply limited (i.e. there is more stream power than sediment available). In comparison, Reach 3 is marked by a tidal influence on sediment transport and sediment source. Along Reach 3, both aeolian and coastal processes are major factors, defining a transport-limited channel (i.e. there is more sediment available than the river is capable of transporting). This is evident through the presence of a shifting mosaic of barforms throughout the reach, which is absent from Reach 1. Reach 2 is more reflective of a transport dominated reach, acting as a transitional zone between Reaches 1 and 3.

According to the British Geological Survey⁶map (scale 1:50,000), River Lossie in Reaches 1 and 2 flows over an alluvial cover of clay, silt, sand, and gravel from fluvial activity. The hillslopes surrounding those reaches are Storm Beach Deposits associated to shallow-marine environment (i.e. forming beaches and bars in a coastal setting). Besides the surface geology explained earlier, the River Lossie in Reach 3 flows through a setting of Marine Beach Deposit related to shorelines. The bedrock geology in all Reaches is part of the Kingsteps Sandstone Formation, a Sedimentary Bedrock formed during the Devonian Period.

The soil in each of the river reaches (OS map⁷, scale 1:250,000) has been classified as Humus-iron podzols evolved from beach terraces with gentle slopes. The land use map⁸ shows that Reach 1 has arable land including rotation grass (in the right margin, near the upstream extent) that transitions to forests and woodland downstream, and along the river left. In addition, the there is also a small section classified as heathland and moorland or rough hill pasture in Reach 1. In Reach 2, there are forests

⁶ Available at https://mapapps.bgs.ac.uk/geologyofbritain/home.html.

⁷ Soils of Scotland, 1:250,000. Available at James Hutton Institute

 $https://www.hutton.ac.uk/sites/default/files/files/soils/Soil250k_3_Northern_Scotland_full.pdf$

⁸ National Library of Scotland, available at https://maps.nls.uk/projects/landuse/#zoom=14&lat=57.6935&lon=-3.2559



and woodland only. In Reach 3, there are forests and woodlands in the upstream areas, transitioning to a heathland and moorland or rough hill pasture towards the river outlet.

An overview map of the reaches is presented on the following page. Information on existing engineering pressures and sediment dynamics within the surveyed reaches is presented in the subsequent maps, tables, and photographs.



River Lossie and the Reaches studied in this report



Physical Character and Engineering Pressures of Reach 1.



Physical Character and Engineering Pressures of Reach 1.

Lossiemouth East Beach Footbridge Replacement 15/12/20

Fluvial Audit Survey Outputs from Reach 1.

Location	Reach 1		
Length (m)	1.2 km		
Setting	The River Lossie flows through an unconfined valley setting with a broad floodplain consisting or grasses, scattered trees, coniferous plantation, and gorse. In the left margin, near the bridge there is a wide occurrence of well-rounded gravel layers, probably related to the Storm Beach Deposits of a previously existing shallow-marine environment.		
Morphological pressures	 The River Lossie has a canalised channel (Inness Canal) flowing near the right margin. This canalised channel joins the mainstem near the downstream extent of Reach 2. The upstream extent of Reach 1 is marked by Arthur's bridge. 		
Physical behaviour and characteristics	• Channel bed morphology is a combination of pool-riffle and slow-glide features. Near the middle of the reach, it transitions to a typical pool-riffle morphology.		
	• The river substrate and floodplain deposits are gravel-dominated with fines in the upstream part and transitions to a fine-dominated bed further downstream. The floodplain at this reach is made of brown sandy sediments generally covered by dark organic matter. This area has been classified by the BGS (scale 1:50,000) as alluvium.		
	• The floodplain width increases slightly towards the downstream extent (≈5 m), indicating a less steep, lower energy site than upstream.		
	 Sedimentary features near Arthur's bridge show rounded pebbles with coarse sand as matrix, typical of ancient alluvial/marine deposits. These sedimentary features represent Storm Beach Deposits in the BGS map (1:50,000), which comprise a low rounded ridge of coarse materials (gravels, cobbles, and boulders) piled up by very powerful storm waves at the inland margin of a beach, above the level reached by normal spring tides. These deposits are now ≈ 16 m above modern sea level and is ≈ 6m higher than the current riverbed. 		
	 Large Wood Debris (LWD) are present a few metres upstream and downstream of Arthur's bridge. 		
	• Moderate to severe bank erosion has been noticed in the river left and right from the middle of the reach to further downstream.		
	• The valley vegetation is a mix of grasses, scattered trees, coniferous plantation, and gorse. The floodplain is predominantly grasses, arable land, and gorse.		





Typical vegetation along the river valley in Reach 1, likely correlating to distinct sedimentary environments, i.e. floodplain with grasses and gorses, and ancient marine deposits/river terraces with coniferous plantation.



Bank erosion along the left bank. Note the existence of a pool-riffle morphology, and scattered trees with grasses along the valley.



Sedimentary characteristics of the floodplain deposits in Reach 1. The soil within this reach has been classified as Humus-iron podzols evolved from beach terraces with gentle slopes (James Hutton Institute, 2020; scale 1: 250,000).



Ancient fluvial deposit primarily made of gravel to cobble sized clasts and supported by a coarse sand matrix. The BGS suggest these to be Storm Beach Deposits associated to shallow-marine environment (i.e. forming beaches and bars in a coastal setting).





Physical Character and Engineering Pressures of Reach 2.



Physical Character and Engineering Pressures of Reach 2.

Fluvial Audit Survey Outputs from Reach 2.

Location	Reach 2		
Length (m)	1 km		
Setting	The River Lossie flows through an unconfined valley setting with a wide floodplain consisting of grasses, scattered trees, coniferous plantation, and gorse. This reach marks a transition from fluvial to tidal processes in sediment dynamics, including changes in substrate size, and river morphology.		
Morphological pressures	 The River Lossie has a canalised channel flowing near the right margin (Inness Canal). This canalised channel joins the main stem a few metres, near the downstream extent of Reach 2. According to the Aberdeenshire Council, this canal was built c.1808 for farming purposes. Poaching due to human activity has been recorded in the river left. 		
Dhusiaal			
Physical behaviour and characteristics	 Channel morphology is mostly pool-riffle near the upstream extent. Downstream from it, it transitions to a plane-bed/pool-riffle river morphology. 		
	• The river and floodplain substrate are composed of sand with gravel in the upstream part and transitions to a sand-dominated bed further downstream. According to the British Geological Survey map (scale 1:50,000), River Lossie in Reach 2 flows through an alluvial corridor of clay, silt, sand, and gravel. The hillslopes surrounding are Storm Beach Deposits associated to shallow-marine environment (i.e. forming beaches and bars in a coastal setting), and the bedrock geology is part of the Kingsteps Sandstone Formation.		
	• The valley vegetation is a mix of grasses, scattered trees, coniferous plantation, and gorse. In the floodplain, grasses, gorse, and scattered trees dominate, whereas in the hillslopes there is a prevalence of scattered trees, and coniferous plantation. In Reach 2, there are forests and woodland only (OS map, scale 1:250,000).		
	Moderate to severe bank erosion occurs in the river left.		
	• The floodplain at this reach has multiple indicators of stability, including vegetation cover, and large amount of cohesive material (e.g. clay) as matrix.		
	• The floodplain at the downstream extent is ≈40 m wider than upstream extent. The river width at the downstream extent is ≈24 m wider in than the upstream extent as the influence of the tidal flow prism becomes dominant.		
	• On the other hand, small and shallow sandbars located within the channel are active, as attested by their absence of stable factors (e.g. vegetation and clary minerals).		
	• A small low energy tributary crosses the floodplain in a meandering planform before joining the main stem in the left margin.		
	• This small tributary exposes part of the basal sedimentary units of the floodplain. This unit is made primarily of gravel-cobble substrate. In areas of even lower energy, the tributary has fines (clay to sand) as substrate.		











Physical Character and Engineering Pressures of Reach 3.

cbec eco engineering 07 - RIVER LOSSIE - SEDIMENT DYNAMICS \mathbb{A} Project no.19 - 20-1032 **Erosional Features** CLIENT **BEAVER BRIDGES** Substrate Vegetation Date NOVEMBER 2020 CL PROJECT LOSSIEMOUTH FOOTBRIDGE Drawn Bank Erosion Fines Marsh CL Designed Scale @ A4 - 1:15,000 Fines/Gravel Grasses **Depositional Features** 600 400 British National Grid: GCS OSGB 1936 Gravel/Fines Gorse <50% stabilised USDA USGS AeroGRID IGN and ••••• Scattered Trees Reach extent Active ------ Fully stabilised Tributary Coniferous Plantation - LWD

Physical Character and Engineering Pressures of Reach 3.

Lossiemouth East Beach Footbridge Replacement 15/12/20

Fluvial Audit Survey Outputs from Reach 3.

Location	Reach 3	
Length (m)	2.2 km	
Setting	The River Lossie flows through an estuary setting consisting of a broad dune complex consisting of grasses, scattered trees, coniferous plantation, marsh, and gorse. At the downstream extent it joins the sea. This reach is marked by tidal processes in sediment dynamics, and large influence of windblown sand movement and fine particles within the channel (sandbars).	
Morphological pressures	• There are two culverts with associated bridges entering the river left. These culverts were built to transfer the waters from the Spynie Canal to the River Lossie.	
	• An embankment is present along 220 m in the river left near the Seatown and Clifton Roads.	
	 The footbridge to be replaced is one of the morphological pressures in the area. It is ≈ 200 m wide and crosses the river and dunes. 	
	• Concrete hard bank protection in the river left occurs along an approx. 410 m extent. There is also concrete protection along ≈190 m by the Old Pier.	
	 Rip-rap bank protection is present in the river left extending for ≈185 m. 	
Physical behaviour and characteristics	• Channel morphology is transitional plane-bed/ pool-riffle through the reach.	
	• The river substrate is composed of fines in the upstream part and transitions to a fines/gravel dominated bed further downstream. Sediments in the floodplain/beach complex get finer downstream as coastal dune processes attain dominance over fluvial sediment transport processes.	
	• Sediment dynamics are very complex, with stable vegetated floodplains and several active sandbars within the channel.	
	• The vegetation is a mix of grasses, scattered trees, coniferous plantation, marsh, and gorse.	
	• Tidal influence on river hydraulics is likely to impact sediment transport through this reach due to variations in bed and bank shear stress.	
	• Another geomorphic controlling factor - together with hillslope processes - is the wind activity that feeds sand into the river channel and promotes dune migration around the location of the current footbridge. Dune migration has been supported by the historic assessment provided in Appendix A of this report.	







Ephemeral channels in the river left. Also, note the stable island within the channel.



Sediment characteristics in the floodplain. The material is fine gravel supported by coarse to fine sand. The soil in the area has been classified as Humus-iron podzols evolved from beach terraces with gentle slopes (James Hutton Institute, 2020; scale 1: 250,000).



Side channel with fine sediments in the bed. Note that gravel is being released to the channel from the ancient deposits.



Uppermost part of the river reach where stable fluvial islands are still present. Note a lack of visible sandbars.



Upstream extent of the reach showing a reduction in in-channel features, also illustrating the spatial change in vegetation.


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APPENDIX C

Proposed Bridge Locations



Map showing the potential locations of the replacement footbridge.



Specialist Services and Expertise for Water Resources and the Environment

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Appendix E - Preliminary Ecological Appraisal

East beach footbridge, Lossiemouth

Preliminary ecological appraisal – survey report

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Summary

A replacement footbridge is required between Lossiemouth town and the east beach. A preliminary ecological appraisal of the site was carried out in October 2020.

The bridge will replace an existing footbridge and will link an urban area to an area of sand dune habitat. The bridge will cross the River Lossie, which is tidal at this point. There are areas of sand dune with marram grass and small patches of salt marsh habitat in the immediate vicinity of the bridge. These are two habitats which are included on the Scottish Biodiversity List and therefore damage to the habitats should be avoided if possible and the site footprint kept as small as possible.

Otter have been sighted within the river and are likely to pass through. However, there is no suitable resting place habitat for them close to the bridge. Work should be undertaken in a manner which avoids disturbance to otter passing through the site.

The bridge itself provides no bat roost habitat as it is very open, with no crevices or cracks which could be used for roosting.

A wide range of bird species are present in the surrounding area, but the area closest to the bridge is unlikely to be suitable for nesting. However, if possible, works should avoid the bird nesting season and if this is not possible, a check for nesting birds should be undertaken prior to works commencing.

If pile driving is likely to be required, then an additional assessment should be undertaken to establish likely impacts on migratory fish and marine mammals in the adjacent area.

1 Introduction

The client, Beaver bridges, has been commissioned to design a replacement footbridge at this site. The work proposed will involve removing the existing bridge and installing a replacement. The site location is at the centre of the map in Appendix 1.

A walkover survey of the site was undertaken on October 14th, 2020 by Tamsin Morris, Chartered Ecologist. The survey included an extended Phase 1 survey to assess the type and condition of wildlife habitats in the surrounding area and a search for signs of any relevant protected species.

1.1 Objectives

The survey aimed to assess the habitats present in the area surrounding the proposed new bridge and whether they would be impacted by the development. It also aimed to establish whether the area contained any protected species which may be affected by the development. The survey also aimed to establish any ecological constraints which may need to be mitigated as part of an Ecological Impact Assessment process.

1.2 Relevant legislation

There are several relevant pieces of legislation which could affect this development. These include:

- The Wildlife and Countryside Act 1981 (as amended) was the main source of wildlife law in the UK. It has since been amended by the Nature Conservation (Scotland) Act 2004 and the Wildlife and Natural Environment (Scotland) Act 2011. This legislation provides protection to a range of species, including birds, plants and animals.
- The Nature Conservation (Scotland) Act 2004 sets out the requirement to produce a Scotland list of Biodiversity Action Plan habitats of principal importance.
- The EU Habitats and Birds Directives provide protection to a range of species and areas. They are translated into Scottish law via the Conservation (Natural Habitats etc) Regulations 2004 and the Wildlife and Countryside Act 1981 (as amended). This legislation provides protection to specific species such as otter and specific sites, such as Spey Bay and the Moray Firth.

2 Site assessment

2.1 Methods – habitat assessment

An area surrounding the bridge of approximately 250m in all directions was surveyed on foot. This involved walking upstream and downstream from the bridge and crossing the remaining area in a zig zag manner to assess habitats, where this did not involve accessing private land. The bridge itself was also examined to see if it provided potential bat roost habitat. The bridge was not crossed, but both pillars / banks were walked. The survey took

place on a sunny day, starting at high tide and working through until just before low tide. Habitats were recorded according to the JNCC Phase 1 system (JNCC, 2010).

2.2 Methods – desk based assessment

Nature Scot's SiteLink website (https://sitelink.nature.scot/home) was used to check for protected areas within the vicinity of the site and the National Biodiversity Network Atlas website (https://nbnatlas.org/) was used to check for records of some species in the local area.

A search was also commissioned by the local biological records centre (NESBReC) for records within a 500metre radius of the current bridge location. The results of that search are included as Appendix 2 of this report.

2.3 Constraints

The bridge itself was not crossed as it is not longer safe for pedestrian access. The central part of the structure was examined using binoculars from both banks and it appears to have a similar construction throughout. A number of private houses are present within the adjacent area and the gardens of these houses were not entered or surveyed.

3 Baseline ecological conditions

3.1 Site context

The site is located between an urban area and open dunes. The bridge spans the River Lossie where it joins the sea and the river is tidal within this section. The left bank contains houses, car parks etc and is heavily modified, whilst the right bank is unmodified, but very mobile sand dune habitat.

3.2 Designated sites

The following designated sites are located within a 5 kilometre radius of the bridge:

The Moray Firth Special Area of Conservation (SAC) has its western boundary adjacent to the left bank of the River Lossie as it enters the sea, so is located approximately 850 metres to the north of the bridge. The Moray Firth is designated for its subtidal sand banks and bottlenose dolphin (*Tursiops truncates*) population. The Lossiemouth East Quarry Site of Special Scientific Interest (SSSI) is located approximately 200 metres to the north-west of the bridge. The quarry area is designated for its geological and palaeontological features. The Lossiemouth shore SSSI is located approximately 1 kilometre to the north-west of the bridge and is designated for its geological features. The Loch Spynie Special Protection Area (SPA) and SSSI is located approximately 3.5km to the south of the site and is designated for its freshwater habitats, woodland, breeding bird assemblage and greylag goose (*Anser anser*) population. The SAC is designated for its geomorphology, its fen, shingle, saltmarsh and wet woodland habitats, its plant assemblage and the presence of the small blue (*Cupido minimus*) and dingy skipper (*Erynnis tages*) butterflies.

The NESBReC search highlighted that the Lossiemouth and Spey Bay area are included on a list known as the Study of Environmentally Sensitive Areas for ornithology and

geomorphology. This is a list of locally important sites, which was compiled in the 1980s by the former Grampian Regional Council.

3.3 Phase 1 habitats present on the site

The following habitats were recorded. These are shown on the map in Appendix 1.

3.3.1 Improved grassland

There are areas of improved grassland between the river and the road on the left bank and in amongst the buildings within the town. These are predominantly areas for recreational / amenity use and contain very little plant diversity.

Within the the areas of improved grassland on the left bank, there are some patches of ornamental shrubs. This have been planted for visual / amenity value and contain a mix of non-native 'garden' species, such as Escalonia, Cotoneaster, Rosa rugosa and palms.

3.3.2 Dune grassland

Immediately adjacent to the river, along the left bank where building work has 'stabilised' the dune system, a narrow strip of dune grassland has developed. This contains a diverse mix of species, including lyme grass (*Leymus arenarius*) frosted orache (*Atriplex lacinata*), sea plantain (*Plantago maritima*), sea aster (*Aster tripolium*) and dwarf mallow (*Malva neglecta*).

3.3.3 Open water and saltmarsh / dune interface

The river is tidal at this point and during high tide extends across a large area, including beneath the bridge. Areas which are exposed except at high tides contain swards of common saltmarsh grass (*Puccinellia maritima*) which grade into open dune and dune grassland areas on the right bank.

3.3.4 Open dune

On the right bank, there is an area of open dune between the river's edge and the sea. This is a reasonably narrow strip of yellow open dune, which is dominated by marram grass (*Ammophila arenaria*), although lyme grass, catsear (*Hypochaeris radicata*), sea rocket (*Cakile maritima*) and occasional Scots pine seedlings (*Pinus sylvestris*) are also present.

3.3.5 Broad leaved semi natural woodland

Adjacent to Prospect Terrace, to the north-east of the bridge, within the area of the Lossiemouth East Quarry SSSI there is a strip of broad-leaved woodland. This is dominated by mature sycamore (*Acer pseudoplatanus*) trees, but also contains gorse (*Ulex europaeus*), ivy (*Hedera helix*) and stands of rosebay willowherb (*Chamerion angustifolium*).

There is also a short section of woodland at the upstream end of the Spynie canal, where ash (*Fraxinus excelsior*) and sycamore trees have grown up, interspersed with ivy and gorse scrub and some garden escapees such as Leylandii trees.

3.3.6 Unimproved neutral grassland

Adjacent to the Spynie canal, on the left bank there is a narrow strip of grassland which is reasonably diverse and has probably never been agriculturally improved (although the nutrient loading within the canal waters may be quite high). It includes species such as yarrow (*Achillea millefolium*), ribwort plantain (*Plantago lanceolata*), cocksfoot (*Dactylis glomerata*), nettles (*Urtica dioica*) and ragwort (*Senecio jacobaea*).

3.3.7 Broad-leaved plantation

On the right bank of the Spynie canal, a number of small trees have been planted. These included alder (*Alnus glutinsoa*), holly (*llex aquifolium*) and birch (*Betula pendula*) as well as some more garden type species such as cotoneaster, buddleia and snowberry (*Symphoricarpus albus*).

3.3.8 Dense scrub

Further upstream on the left bank of the Spynie canal there is an area of dense gorse. It was not possible to enter into this area due to the dense cover and steep slopes.

3.4 Species

The site has the potential to provide habitat for a range of protected species, including bats, otter, badgers and birds.

3.4.1 Bats

The bridge does not provide suitable bat roost habitat due to its construction and the extent of deterioration. There are no enclosed holes or crevices within the structure – whilst there are narrow gaps between slats and supporting beams, none of these gaps have a 'back', so they do not provide suitable shelter in the same way as a crevice or hole could. The deterioration of the bridge also means that many of these gaps are now wider than when originally constructed and so light can be clearly seen through the gaps. The extent of movement on the bridge when it was in use would also deter bats.

The bridge is considered to have negligible bat roost potential and therefore further bat surveys are not required.

3.4.2 Other mammals

The river does not provide suitable habitat for watervole (*Arvicola amphibius*) as it is reasonably fast flowing and tidal in this section. The left bank has extensive human activity and the right bank is mobile sand dune, which would not be suitable for creating burrows. No field signs of watervole were detected.

The river is likely to be used by otter and there are anecdotal otter sightings in the water at this site. No field signs of otter were found within the survey area and there is no suitable habitat within the survey area for otter resting places, due to the mobility of the sediment.

Otter should be expected to be passing through but are unlikely to use either bank for resting.

Red squirrel (*Sciurus vulgaris*) will occur within the large coniferous woodland area to the east of the site. The search on NBN Atlas and the NESBReC search highlighted sightings of squirrel close to the caravan park and amongst the houses and they will be likely to pass through the area closer to the bridge occasionally. However, there are no suitable trees for use as dreys close to the bridge site.

Pine marten (*Martes martes*) are also likely to use the woodland area, though no field signs were found and they would not be expected to use this area due to the mobile sand dunes, high water levels and extent of human disturbance.

No field signs of badger (*Meles meles*) were found and they would not be able to create a sett within the mobile sand ground conditions. A brown hare (*Lepus europaeus*) record from within the town was included within the NESBReC search data, but this was from 1970 and it is unlikely that brown hare would use such an urban habitat area.

3.4.3 Amphibians

There are no ponds close to the site. Great crested newts (*Triturus cristatus*) have not been recorded from the Lossiemouth area (the nearest records are currently from Fife and Nairn), therefore they would not be expected to be found at this site.

3.4.4 Birds

The small areas of shrubs will provide some habitat for perching birds, but the extent of human disturbance means they are unlikely to be used for nesting. The large gorse area near the caravan park will also be used by perching birds and will be suitable for some nesting.

The salt marsh / sand dune areas will provide habitat for a wide range of freshwater, wading and coastal birds. Widgeon (*Anas penelope*), heron (*Ardea cinerea*), ringed plover (*Charadrius hiatula*), redshank (*Tringa tetanus*) oystercatcher (*Haematopus ostralegus*), mallard (*Anas platyrhynchos*), herring (*Larus argentatus*) and black backed gulls (*Larus marinus*) were all seen during the survey. The NESBReC search also highlighted sightings of dunlin (*Calidris alpina*) and bar-tailed godwit (*Limosa lapponica*).

Most of these species are unlikely to nest or breed close to the footprint of the bridge as the left bank is too heavily disturbed and the right bank is too mobile and at risk of inundation. However, nesting is a possibility in these areas and so ideally any development works should take place outwith the bird breeding season.

3.4.5 Plants

No nationally rare plants were noted on the site. However, coastal salt marsh and coastal sand dunes are habitats listed in the Scottish Biodiversity List, therefore public authorities should try to protect and enhance this habitat.

3.4.6 Invertebrates

The substrate within the river is unsuitable for pearl mussel as it is very mobile and dominated by sand.

The intertidal areas are likely to contain a range of mud-dwelling invertebrates which provide a food source for wading birds such as redshank.

The flowering plants within the grassland areas will also provide a nectar source for a number of invertebrate species, including butterflies such as the dingy skipper.

3.4.7 Fish

The Lossie river system provides habitat for a range of freshwater fish species, including salmon (*Salmo salar*) and trout (*Salmo trutta*). The substrate around the bridge is too sand dominated and mobile to be used for spawning, however, fish can be expected to be passing through and around the area by the bridge.

3.4.8 Seals

There have been anecdotal sightings of grey (*Halichoerus grypus*) and common (*Phoca vitulina vitulina*) seals at and around Lossiemouth beach, although only one sighting has been recorded with NESBReC – however this is likely to be due to a lack of sightings being reported, rather than an absence of sightings. The site is not a designated seal haul out under the Protection of Seals (Designation of Haul-out Sites) (Scotland) Order 2014.

3.4.9 Invasive species

No invasive species were recorded at the site, although there are a number of non-native garden species planted within the amenity / urban areas.

4 Ecological constraints and opportunities - habitats

4.1 Potential constraints

The surrounding salt marsh and dune grassland areas are habitats which the Scottish Biodiversity List identifies as requiring conservation action and / or where negative impacts should be avoided.

There are a number of designated sites in the surrounding area. The works are not considered to have an impact on the sites designated for their geological features. There is potential for the work to have an indirect impact on Spey Bay SAC through the increase in foot traffic accessing this area. However, as a bridge has been in place at this site for a number of years, and has only recently been removed from use, it is not considered that replacing the bridge will increase this disturbance beyond historic levels. Spey Bay SAC is also accessible from a number of other pedestrian routes, therefore access via this footbridge is not the only potential source of disturbance.

The bridge site is outwith the Moray Firth SAC sub tidal sandbank areas and the work should not have an impact on the distribution or movement of these features within the firth.

The habitats at Spynie Loch should not be affected by the work as it is upstream of the proposed work site.

4.2 Mitigation measures

The proposed works to replace the bridge will have an impact on their immediate footprint which encompasses the saltmarsh and dune habitat. Efforts should therefore be made to limit the footprint of the work area as much as possible. For example, if a site compound is required, it should be established on the existing hard standing areas, not on the grassland areas. This will help to minimise any damage to this habitat.

5 Ecological constraints and opportunities - species

5.1 Otter

5.1.1 Potential constraints

The river will be used by otter travelling between feeding sites. There is no suitable resting place habitat within the area surrounding the bridge, therefore the works should have no

impact on otter. However, as otter are likely to be passing through, construction methods should take this into account to avoid any accidental disturbance.

5.1.2 Mitigation measures

To avoid any disturbance to otter using the river, the following construction methods should be followed:

Works in the vicinity of the river should not take place during the hours of darkness or within 2 hours after sunrise and 2 hours before sunset. Any exposed pipe systems should be capped when workers are off site, and exit ramps will be provided on any exposed trenches or holes that are left overnight.

All personnel working on the site should be informed about the presence of otter on the site and the mitigation actions that have been taken. This can take the form of a 'toolbox talk' to all personnel.

5.2 Birds

5.2.1 Potential constraints

The grassland and dune areas have the potential to provide some nesting habitat for birds and the site is also within 5km of a SPA designated for bird populations. There is also potential for some nesting of small bird species in the end of the current bridge where it joins the right bank and is more sheltered. However, the instability of the dune habitat and the extent of human disturbance on the left bank is likely to discourage most birds from nesting in the immediate vicinity of the bridge.

5.2.2 Mitigation measures

Ideally, work should avoid the main bird breeding season (Feb – July). However, if this is not possible, the site should be checked for the presence of nesting birds before works commence.

5.3 Fish

5.3.1 Potential constraints

The river will be used by a range of fish species, but the bridge site does not contain suitable habitat for spawning salmon or trout.

5.3.2 Mitigation measures

If pile driving is required, particularly underwater, this has the potential to cause disturbance to migrating fish and a separate risk assessment should be undertaken.

5.4 Marine mammals

5.4.1 Potential constraints

The Moray Firth is home to a population of bottlenose dolphins and also to harbour porpoises (*Phocoena phocoena*). Marine mammals can be disturbed by the underwater sounds created by pile driving.

Seals are also likely to be sighted in the area and may haul out on the sand banks at the beach.

5.4.2 Mitigation measures

If pile driving is required, this has the potential to cause disturbance to marine mammals in the surrounding area and therefore an additional risk assessment should be completed, taking into account the timing, location and extent of pile driving required.

It is an offence to intentionally or recklessly kill, injure or take a seal at any time of year and it is also an offence to harass seals at a designated haul out. Although the Lossiemouth beach is not a designated haul out, the increase in movement of people and dogs as a result of reinstating the bridge could result in increased disturbance of any seals which have hauled out on the beach. As the bridge is a replacement, and as the beach appears to be used by surfers, any seals which do haul out may well be habituated to disturbance. However, the longer the bridge is out of use, the greater the chance that more seals will start to use the beach and could be at risk of disturbance from people using the bridge to access the beach.

During construction, work should stop if seals come close to the site, or start to use it to haul out. Work should only resume once the seal has left the area, to avoid any risk of accidental injury.

6 Water environment

In order to avoid any potential pollution of the river, care should be taken to minimise the risk of accidental pollution events. Authorisation from SEPA will be required for the works.

7 Additional requirements

The following additional actions should be undertaken prior to works taking place:

• If the work takes place during the bird breeding season, the site footprint should be checked for nesting birds.

8 Conclusions

The proposed works are in an area which has significant human disturbance. The dune and saltmarsh grasslands are an important habitat, and damage to these areas should be kept to a minimum. A range of bird species use the area, but are relatively unlikely to nest close to the bridge. However, any disturbance of breeding should be avoided by either timing the works outwith the breeding season or checking the ground prior to commencing work.

References

Joint Nature Conservation Committee 2010. Handbook for Phase 1 habitat survey.

Appendix 1 - phase 1 habitat map of site

Appendix 2 – NESBReC search results





NESBReC

Specialist Services Team Aberdeenshire Council Woodhill House Westburn Road Aberdeen Tel: 01467 537221 nesbrec@aberdeenshire.gov.uk

Tamsin Morris Walking The Talk tamsin@walking-the-talk.co.uk

16 December 2020

Dear Tamsin

NESBReC report - River Lossie, Bridge at Lossimouth

Please find below the results of the data search you requested from NESBReC. The search was carried out with a 500m radius from NJ 23780 70462.

Results table:

Ref no	Data set	Interest	Locality	Grid Ref	Proposal
20201216	Designated Species	ANNEX 1 Bar-tailed Godwit (Limosa lapponica) UK BAP Common Seal (Phoca vitulina) Brown Hare (Lepus europaeus) Eurasian Red Squirrel (Sciurus vulgaris) SBL S2 Dunlin (Calidris alpina)	Lossiemouth	NJ 23780 70462	data search
	geological conservation review sites	Lossiemouth, East Quarry - Permian-Triassic Reptilia			
	SSSI	Lossiemouth East Quarry - GEOLOGICAL			
	*SESA geology	G37:Lossiemouth East Quarry - One of Britain's most important vertebrate fossil sites, yielding Triassic reptiles including early dinosaur.			
	*SESA geomorphology	GM2:Lossie-Spey Bay - A complex current and geological recent set of shingle bars with intervening swales. Both the Spey and Lossie spits at the respective river moth are of great interest physiographically because of their dynamic nature.			
	*SESA ornithology	O39:Lossiemouth - Passage and wintering waders and wildfowl.			

*SESA stands for 'Study of Environmentally Sensitive Areas'. These are lists of locally important sites identified during the 1980s by the former Grampian Regional Council.

Maps showing all the search results are included below.

Yours sincerely

D Caffrey GIS Project Officer

PLEASE READ THE FOLLOWING NOTES:

- 1) Search was done to within 500 metres of the area of interest. This is indicated on the map by a broken line around the site.
- 2) Search areas or centroids are highlighted in red.
- 3) The dots on any maps depicting the locations of a species are positioned at the centre of a square representing the resolution of the recorded grid reference. Care should be taken over interpretation
- 4) Due to the limits of the map display function, all records may not be visible on the species maps. However, all species are listed in the relevant table above the map and a full list of records can be supplied in Excel format.
- 5) Scientific names are only used to identify species on maps when no common name is in general accepted usage.
- 6) For maps without a key, the relevant information is provided in the table.
- 7) The ownership of the data within this report remains with the original recorder and is subject to the laws defining Intellectual Property Copyright.
- 8) This report and the data held within it are to be used solely for those purposes described under the terms of any agreement between the applicant and NESBReC.
- 9) Some, or all of the data held within this report may be of a sensitive or confidential nature. Such information will be marked as such and if required an appropriate contact for further correspondence will be given (otherwise NESBReC should be contacted).
- **10**) Although NESBReC makes every possible effort to ensure that the data it provides is accurate and up to date, this report should only be considered to represent the most recent version of each dataset as available at the time of the search.
- 11) NE LBAP Locally Important Species are species that are not on existing designated species lists but have been identified as important in the local context.

For designated species, the following abbreviated sub-headings are used to describe different levels of importance:

Protection of Badgers Act (1992)

ANNEX 1, 2.1, 2.2 – EC Birds Directive UK BAP - UK BAP list of Priority Species

- SBL S2 Scottish Biodiversity List: International Obligations
- SBL S3 Scottish Biodiversity List: Nationally Rare at UK level, found in only 1-15 10km squares
- SBL S5 Scottish Biodiversity List: Present in 5 or fewer 10km squares or sites in Scotland
- SBL 54 Scottish Biodiversity List: Present in 5 of rewer rowin squares of sites in Scotland SBL S5 - Scottish Biodiversity List: Decline of 25% or more in Scotland in last 25 years

Note, a species may be designated under several of these lists, but will only be listed under its highest level designation within this report. The ranking order used here is Protection of Badgers Act (1992), ANNEX 1, ANNEX 2.1, UK BAP, ANNEX 2.2, SBL S2-SBL S5.

20201216	Designated Species	ANNEX 1	Lossiemouth	NI 23780 70462	data search
20201210	Designated Species	ANNEAT	Lossiemouui	NJ 23780 70402	uata search
		Bar-tailed Godwit (Limosa lapponica)			
		UK BAP			
		Common Seal (Phoca vitulina)			
		Brown Hare (Lepus europaeus)			
		Eurasian Red Squirrel (Sciurus vulgaris)			
		SBL S2			
		Dunlin (Calidris alpina)			
1	1				







20201216	SESA geology	G37:Lossiemouth East Quarry - One of Britain's	Lossiemouth	NJ 23780 70462	data search
		most important vertebrate fossil sites, yielding			
		Triassic reptiles including early dinosaur.			



20201217	OEG A		T · 4	NI 22790 70462	1.4 1
20201216	SESA	GM2:Lossie-Spey Bay - A complex current and	Lossiemouth	NJ 23780 70462	data search
	geomorphology	geological recent set of shingle bars with			
		intervening swales. Both the Spey and Lossie spits			
		at the respective river moth are of great interest			
		physiographically because of their dynamic nature.			





Appendix F - Existing Footbridge Closure Notice

Lossiemouth East Sands Footbridge

Closure in the Interest of Public Safety on 24.7.19

Introduction

The town of Lossiemouth is located to the west of the mouth of the River Lossie into the Moray Firth. Beyond the river estuary lies the attractive East Sands beach, popular with locals and tourists alike, with the West Sands beach located to the other side of the town. The more tourist-based shops (cafes, icecream shops, bucket and spade shops etc.) are also located at the east side of the town, fronting onto the River. For many years the town has relied on a footbridge to access the popular beach.

NOTE: This report has been produced to reflect the evidence upon which the closure decision on 24.7.19 was based. It is not warranted and may not be relied upon for any other purpose. For the purposes of future repair or use independent advice on the structure should be sought.

The Bridge

Lossiemouth East Sands Footbridge is a multi-span steel through truss, supported on timber pile piers. These have been driven into the sand river-bed, to provide a stable footing. The deck on the bridge is of timber planks, spanning between the bottom chords of the two trusses. There are also transverse and diagonal steel angles tying the bottom chords of the trusses together. The transverse ties extend outwards, with steel angles extending up from the outer ends to provide lateral restraint to the top chords.

The bridge is a considerable number of decades old, with a number of the trusses believed to have been reused from the previous bridge (dating from 1913). The current bridge is understood to have been built in its current location 1918.

Ownership of the bridge is not known, although it has been demonstrated to be not in Council Ownership.

Glossary of a Truss



General Condition of the Bridge

On inspection it was evident that there has been no maintenance undertaken on the bridge for a significant period of time.

- The paint system has entirely broken down and the steel elements are heavily corroded.
- The top chord is of steel angle, with the vertical leg in better condition, with a maximum of around 25% section loss in the worst areas. However, the horizontal leg is more severely damaged with up to 95% missing in some areas. Where these areas of section loss coincide, the chord has around 40% of its section remaining.
- The bottom chords are severely corroded, they are partially hidden by the timber decking, but an estimate of section loss would be approximately 70%.
- A significant number of the truss ties are broken, with a few missing entirely. Those that remain have substantial section loss, up to 80% or more in places.
- All riveted connections and connection brackets are severely corroded, with over 90% section loss in some places. There is a minimum of 50% loss in almost all connection areas.
- Although a substantial proportion of the steel elements have corroded away, the remaining material has until now been sufficient to carry the loading which the bridge carries.
- The pile piers appear to be in good condition.
 - The areas below low tide level should be fine as they are in a salty environment (salt acts as a preservative on wood) and being always submerged, there is very little oxygen to encourage rot.
 - The areas above high tide level are generally dry other than during rain. The area most likely to suffer rot is the end-grain at the top of the piles, and rot was not visible at the time of inspection.
 - The area between high and low tide levels is the area of possible concern, as this environment has been known to encourage microbial degradation of timber piles, which can occur from the inside, so no signs are visible until the pile fails. However, if the pile were to fail this would most likely be during a storm event, rather than under pedestrian loading (as the force of storm water flowing across the piles is much greater than the force of people on the bridge). As such, the public risk posed by the piles is considered very low.

Timeline Leading to Closure of the Bridge

Following reports of concerns from members of the public on Wednesday 24th July, officers from Building Standards went to the site around 15:30 along with the council's Senior Bridge Engineer who is a qualified civil engineer specialising in structures.

Under S.29 of the Building (S) Act 2003 the council must act where a building/structure is considered to constitute a danger to the public. The council must carry out such work it considers necessary to prevent access to the dangerous structure and do what is necessary to protect the public.

On arrival at site, it became clear that there had been a significant change in the bridge which was seen to be leaning to the side and after inspection, assessment of the defects and liaison with Grampian Police and the Council's Consultancy, Building Standards, Legal and Roads officers at 17:15 a decision was taken that the bridge was unsafe for normal use and had to be closed to ensure the safety of the public. That is a decision made by the Principal Building Standards Officer.

The council's Emergency Response Co-Ordinator then took responsibility for making the arrangements to clear the beach. This process began at 17:35. Following an onsite dynamic risk assessment, based on observations at the time, and on an outline qualitative assessment of the new load-paths within the damaged structure, pedestrians were permitted to exit the beach in a controlled manner in small groups and no further access across the bridge was permitted. Clearance was completed by 18:30. Signs were placed on both sides of the bridge and at other points from which walkers commonly take access along Lossie East Beach.

Problem Posing a Risk to Public Safety

On Wednesday 24th July 2019 Moray Council was informed, from a number of local sources that on Tuesday 23rd July, at approximately 17:30, when a crowd of pedestrians was crossing the middle span of the three higher spans over the navigation channel there was an audible "PING" noise. The bridge dropped noticeably towards the downstream side, and a piece of the steel truss was observed to drop into the River below.

On inspection on the afternoon of Wednesday 24th July it is clear that:

- The middle of the three higher spans is now distorted with a substantial lean towards the downstream side.
- All the ties on this section of the downstream truss appear to now be broken or missing.
 - The attached photographs show each of the broken ties. It is noted that the broken ends of the ties do not align, due to the distortion in the bridge after the failure.
 - In the picture with the hand visible, the broken end is dark, rather than rusty red, suggesting that it is a recent break which has only occurred within the past few days. It appears that it was this last remaining tie that failed on the 23rd.
 - The failure of the ties prevents the steel elements from acting as a Truss, meaning the bridge has structurally failed.
 - Fortunately an alternative load path is available, with the top chord and bottom chord on this side of the bridge both now acting in tension, meaning this side of the bridge is now acting as a suspension bridge, with the compression struts now acting as ties to share the load between the two chords.
 - \circ $\;$ The upstream side of the same span is still acting as a truss.

This is a problem because:

- The bridge was never design to act as a suspension bridge, and the sections and connections are not of the correct type or arrangement for this to work reliably or safely.
- Suspension bridges are flexible in their nature, hence the noticeable "bounciness" now apparent in this span of the bridge.
- As the elements of the bridge are generally of stiff steel angles (rather than flexible cables usually used for suspension bridges) they will likely suffer from fatigue as the bridge "bounces" which will lead to a relatively rapid reduction in their strength
- As the elements of the bridge are so heavily corroded, their strength is already greatly reduced, so further weakening by fatigue action may cause further failure quite rapidly.
- As a suspension structure, there is now no further alternative load path available, and if there is a further failure, this will almost certainly result in sudden collapse.
- Unfortunately the most likely time for such a sudden collapse to occur is when the bridge is most heavily loaded, i.e. when the largest number of people are crossing it.
 - A sudden unexpected fall into cold water carries a high risk of panic which often can lead to drowning.
 - People falling will be surrounded by sharp broken pieces of the bridge, and the risk of injury is quite high.
 - At low tide the water is relatively shallow and falling people may be injured when they hit the river bed.
 - The nearby timber piles also pose a hazard as people may strike their head as they fall, which could cause unconsciousness, potentially leading to drowning.
- The upstream site truss has been deformed sideways by the distortion of the bridge. This is twisting it out of alignment, adding additional stress to already weakened elements.

Why Did it Fail Now?

- We are in the middle of a heat-wave. This means that the steel of the bridge expands, introducing additional stress into the weakened steel.
- The hot weather, in the middle of the summer holidays, has increased the number of users on the bridge, leading to a peak in loading, introducing additional stress into the weakened steel. Indeed on the day before the closure, in excess of 3800 users were reported to have crossed the bridge, a much higher number than is the norm.
- Several persons were jumping from the bridge into the water below when the tie failed. When people jump from the bridge it is felt to vibrate, and it is likely that this also introduced additional stress into the weakened steel.

This combination of factors, all arising from the hot weather in the summer holidays have contributed together to the failure of the bridge.

Photographs of the damaged ties



Broken tie, ends out of alignment due to distortion



Broken tie, with missing central section



Broken tie, with missing central section



Broken tie, with dark area, failed in last few days



Broken tie, ends out of alignment due to distortion Broken tie, ends out of alignment due to distortion







Broken tie, ends out of alignment due to distortion Broken tie, ends out of alignment due to distortion

Appendix G - Bridge Survey Comments

Q2 Comments

Answered: 324 Skipped: 650

Lossiemouth East Beach Bridge Replacement

SurveyMonkey

#	RESPONSES	DATE
1	The bridge has been in its present position for my whole lifetime. Photographed and painted by so many people. Please keep it there.	11/30/2020 8:26 PM
2	I think esplanade would be to busy with traffic. Kero where it is roughly	11/30/2020 8:04 PM
3	present position is near parking. wouldnt want the streets clogged with people parking up for the day and stopping passing trade to the shops.	11/30/2020 7:22 PM
4	I like the way it looks and just want it replaced.	11/30/2020 5:30 PM
5	From the Esplanade would create horrendous parking problems in an already congested area.	11/30/2020 3:59 PM
6	The bridge is fine if able to be repaired, just need functional bridge to allow safe access to beach.	11/30/2020 3:26 PM
7	The point of access of the replacement bridge could be from either spots. It would surely be sensible to use the most economical starting point.	11/30/2020 11:27 AM
8	I would like the bridge to remain in the same location for a few reasons - safety, longevity, logistics and tradition. While I'm no expert on currents, the speed of the river at the esplanade side makes me wonder about how long a bridge could withstand the water. Also, with bridge jumping being popular with youths for decades, they could be jumping into very deep and very fast flowing waters without knowing the dangers. Having grown up in Lossiemouth, the bridge in its current location has also been an iconic part of the landscape and much loved by locals and visitors alike. Being close to the public car park, it also makes it easy access for visitors - to move it to the esplanade side could cause a lot of problems with traffic.	11/30/2020 11:21 AM
9	The present sighting is near enough the esplanade to be easily accessible whilst spreading out gluts of people at busy times. It has a car park nearby. Parking on the esplanade can be very difficult at the best of times. It is also aesthetically pleasing where it is.	11/30/2020 9:33 AM
10	Traffic concerns on esplanade	11/30/2020 9:17 AM
11	It's a footbridge, copy and paste!	11/30/2020 6:28 AM
12	Better for parking. Also get too congested if placed on esplanade.	11/30/2020 6:10 AM
13	It's such an iconic view - it would be unthinkable to change its position.	11/30/2020 12:32 AM
14	The local & wider community love this beach. We need a bridge to access it safely.	11/29/2020 11:58 PM
15	Keep it where it had always been	11/29/2020 11:27 PM
16	Present position is the only option which makes sense.	11/29/2020 10:48 PM
17	Car parking easier from original position, also esplanade footfall would be too much and views would be diminished from esplanade if built there	11/29/2020 10:40 PM
18	Who knows how things will change since the collapse of the breakwater	11/29/2020 10:34 PM
19	Needs to be disabled friendly	11/29/2020 10:33 PM
20	Wouldn't be the same if the bridge wasn't in the place, and also parking is better there.	11/29/2020 10:18 PM
21	The present position provides a degree of protection, of placed at the esplanade there will need to be work to sort the breakwater.	11/29/2020 10:15 PM
22	Parking and ease of access is prevelant and is at present at the correct location for that.	11/29/2020 10:11 PM
23	We need the bridges	11/29/2020 9:48 PM
24	As part of the project the present car park near bridge and signage for bridge should be included in the refurbishment	11/29/2020 9:35 PM
25	As long as the bridge has access to parking near by and public toilets without having to walk too far this would be great \hbox{III}	11/29/2020 8:44 PM
26	The bride is fine where it is it has parking at that point too if moved could cause more congestion	11/29/2020 8:11 PM
27	Asap preferred!!	11/29/2020 8:05 PM
SurveyMonkey

28	Build the best option quickest	11/29/2020 8:03 PM
29	There is already car parking close to this bridge and it will keep traffic away from an already busy sea front (ie beside mieles etc) and also could the lossie raft race take place if the bridge is moved?!?	11/29/2020 7:38 PM
30	In the same place incase we are left with 2 because money runs out to dismantle the only bridge I've known	11/29/2020 7:37 PM
31	With the way the beach changes by tidal movements, I think that it is better where it is.	11/29/2020 7:31 PM
32	Disabled access on the beach	11/29/2020 7:17 PM
33	If the bridge connects to the esplanade, then more, free , parking should be available close to the bridge	11/29/2020 7:09 PM
34	Any other position would cause a gridlock.	11/29/2020 6:52 PM
35	As lo g as there is a bridge location doesn't really matter	11/29/2020 6:49 PM
36	If you have it installed at the esplanade there will be too munch traffic and no parking, unless the esplanade it non traffic, so the logical position is it current/original.	11/29/2020 6:23 PM
37	Absolutely from where the shops are. It's a pain to walk over to where the bridge currently is. Although, any bridge will do!!	11/29/2020 6:12 PM
38	A bridge is a bridge as long as there is one that can be used.	11/29/2020 6:04 PM
39	It would be my preference for the bridge to remain in the same area as the current one. This would allow the car park park to be used to its full potential rather than in Clifton Road at the esplanade.	11/29/2020 5:47 PM
40	From a point of view of best position to benefit local retail the esplanade is ideal position. However looking at a parking prospective having it in the same place as original would be the choice. Not likely to happen but what would be good is if they installed a wooden decking area with seating on the beach side of the bridge a bit like a wooden pier. This would give disabled better access to enjoy the beach	11/29/2020 5:44 PM
41	It will be better protected from storm damage at the original place. That is probably why the original briggie has lasted so long.	11/29/2020 5:25 PM
42	Makes more sense to come of the main esplanade	11/29/2020 5:20 PM
43	Keeping it where it is would be ideal dur to the postioning of the car park.	11/29/2020 5:14 PM
44	Don't think a new one should be built. It should become a wildlife haven.	11/29/2020 5:11 PM
45	Near to current bridge taking into account the need for parking	11/29/2020 5:10 PM
46	And dredge the mouth off the riverup to the bridge and other side aswell	11/29/2020 4:39 PM
47	Current position has the small car park nearby and keeps rubbish from Esplanade to a minimum. If on Esplanade all the visitors will take their ice creams etc over the bridge, drop them into the water or onto the beach as they arrive. Plus parking will be a nightmare. NB Also better for watching the raft race from in current position.	11/29/2020 4:37 PM
48	Traffic & pedestrians is bad enough let alone putting the bridge from the esplanade	11/29/2020 4:36 PM
49	It's such an iconic bridge that everyone recognises and photographs that a replica would be wonderful	11/29/2020 4:30 PM
50	Surely health & safety wouldn't allow a bridge from the esplanade!!	11/29/2020 4:28 PM
51	Better for use of local facilities.	11/29/2020 4:25 PM
52	The position of the bridge should be governed by data - economic, environemental, cost of construction and redevelopment of access - with the best opton being the one that provides best value for money.	11/29/2020 4:24 PM
53	It might be easier for those with young children or the elderly if the position was shifted to the esplanade. However, we just want a bridge so we can get back to the beach.	11/29/2020 4:22 PM

SurveyMonkey

54	I feel the promenade is busy enough in the summer without adding more vehicles.	11/29/2020 4:19 PM
55	Original bridge was from the esplanade and was washed away!	11/29/2020 4:17 PM
56	don't know the reason for moving the bridge from the esplanade to the current position but that should be taken into consideration	11/29/2020 4:17 PM
57	Just build a bridge	11/29/2020 4:15 PM
58	Previous history suggests bridge from esplanade would be mire more vulnerable to waves, tidal erosion etc. Also its good to encourage people to park and or walk further away from esplanade.	11/29/2020 4:14 PM
59	Everything is set up for the bridge in its present position- parking etc	11/29/2020 4:13 PM
60	Anywhere is better than nothing so the quicker it is completed the better	11/29/2020 4:11 PM
61	Whichever is most cost effective	11/29/2020 4:02 PM
62	Why change where it is, the present position is where it should be	11/29/2020 4:02 PM
63	Parking wise, at least there is a small car park near the present bridge. The esplanade is chaos enough now, people wouldn't use the existing car park as much, I don't think, so it would cause more issues on the esplanade.	11/29/2020 4:01 PM
64	I prefer this position as there is better access to parking.	11/29/2020 4:00 PM
65	Its near Carparking just now Logical place keros the image of such an Iconic Bridge and view	11/29/2020 3:58 PM
66	Replacement bridge in current position would ensure that the sea front area would not be over run with people and traffic. This area is can get busy and a bridge from there would cause chaos	11/29/2020 3:56 PM
67	I live in elgin. I feel there is more room for parking and foot traffic where it is.	11/29/2020 3:53 PM
68	Not enough parking at esplanade	11/29/2020 3:52 PM
69	Looking forward to having a crossing again, the people of Lossiemouth and others have missed it.	11/29/2020 3:52 PM
70	Please dont take too long, we all miss the beach.	11/29/2020 3:50 PM
71	I think if position moved to esplanade it may cause issues in the summer months if tourists are unaware if alternative car parking. Too many children in the area for an increase in cars.	11/29/2020 3:48 PM
72	It is very sheltered where it currently is and am concerned moving it will cause difficulties with erosion.	11/29/2020 3:44 PM
73	The current wooden footbridge is picturesque and is a historic feature of the town. I would prefer if the new bridge did not obscure the old bridge, and that it should be located far away from the old one.	11/29/2020 3:43 PM
74	Our household feel a rebuild at present position is best for traffic control, parking and safety for pedestrians	11/29/2020 3:25 PM
75	The best place according to the bridge engineers	11/29/2020 3:20 PM
76	It should be situated in the same site. The car park is convenient and there are better facilities to get cleaned up.	11/28/2020 11:28 PM
77	Whatever is going to last longest	11/28/2020 9:56 PM
78	I believe a bridge from the esplanade will lead to higher more casual footfall on the beach leading to higher pollution. This will be mainly due to wrappers and other litter being brought from the stores along that road.	11/28/2020 8:22 PM
79	If the present bridge could be preserved and the new bridge built on the east side. The old bridge represents Lossiemouth. If the old bridge would have to go the esplanade option is preferred.	11/28/2020 8:10 PM
80	It is iconic in its present position	11/28/2020 6:47 PM
81	old bridge has been around in it's present position with no problems. At esplanade i feel it	11/28/2020 6:44 PM

	would cause so many problems being so near to main road.	
82	Would be a nice change	11/28/2020 6:44 PM
83	Clifton Road is already congested with traffic so if a bridge is sighted there then parking restrictions will have to be adopted.	11/28/2020 6:43 PM
84	A car park is available next to the current bridge. The esplanade area is already too congested with traffic for access to the beach to come from there.	11/27/2020 3:32 PM
85	You wouldnt move the forth railway bridge so it started in kirkcaldy! Keep the bridge where it is!	11/27/2020 7:12 AM
86	The sooner the better, we miss it!	11/27/2020 6:47 AM
87	I dont mind where the bridge is, it would be great to have it back. Would traffic increase though at the esplanade,.both car and people, that would be my only concern	11/26/2020 10:46 PM
88	Position of bridge should stay, but considerations should be made to make it taller to incorporate a bungee jumping facility	11/26/2020 9:56 PM
89	same location may be slightly more expensive but would avoid major added conjestion at esplanade area.	11/26/2020 7:29 PM
90	Looking forward to Lossie having a bridge again so locals and visitors alike can enjoy the beach and all the town has to offer.	11/25/2020 2:30 PM
91	This allows easy access to the beach from a large car parking area. The Esplanade has limited street parking which could cause difficulty for the flow of traffic along the A941.	11/25/2020 10:42 AM
92	Cheapest and easiesr	11/24/2020 3:43 PM
93	Style will be changing but the location should stay traditional	11/24/2020 8:43 AM
94	More parking facilities for beach users rather than clogging up the esplanade which is already full and extremely busy on a hot day	11/23/2020 10:06 PM
95	Need to consider there is already some parking facility near east beach so it would be less congestion to the already congested riverside opposite the shops	11/23/2020 9:57 PM
96	A bridge from the esplanade will increase traffic and reduce parking beside the shops, it will also be more dangerous as closer to the sea, children will always want to jump off the bridge, they have done it for generations and will continue to do so, there is already parking beside the original bridge and traffic less busy there	11/23/2020 9:45 PM
97	There are compelling aesthetic reasons for a new bridge ok the current position. The view from Lossie promenade across to the dunes would be much depleted if a bridge was built there. And then there are the traffic pressures. It seems such an obvious decision to replace it where it is currently.	11/23/2020 8:46 PM
98	Car parking near present position. Esplanade site may cause parking problems on busy sunny days	11/23/2020 8:39 PM
99	A bridge that is is keeping with the surroundings	11/23/2020 8:17 PM
100	Bridge from Esplanade would cause major traffic issues. Also, you would not have the iconic view as it is now.	11/23/2020 5:16 PM
101	It has to go in it's present position for car parking and for the Lossie raft race, which brings a lot of revenue to local businesses and Charities, if it was moved to the Esplanade there is insufficient parking available and there would be no raft race.	11/23/2020 3:39 PM
102	Solid structure please, design that follows landscape and will not spoil a photo.	11/23/2020 3:08 PM
103	Really would like a bridge , however I think the esplanade would be a better option . Although I presume this would depend on costing regarding moving sand. However what ever they do it needs to be one for the long haul .	11/23/2020 12:49 PM
104	The current location is better for parking etc, and with a car park close by it makes more sense to keep it where it is. The bridge will also be better protected in bad weather.	11/23/2020 11:49 AM
105	Pedestrianise the front from Example in the War Memorial except for buses and residents access/deliveries.	11/22/2020 5:44 PM

106	Best to have the bridge where there is adequate parking. The esplanade.is busy enough with traffic and families at the shops on warm days, there is not room for additional parking along the front to cater for busy days and it will become dangerously congested.	11/22/2020 4:12 PM
107	The present look and location is iconic - very much a key characteristic of Lossie. All I have spoken to favour the present location with a similar looking bridge.	11/21/2020 8:25 PM
108	If the decision is taken to replace the bridge in its present position I would hope that it is done sympathetically to reflect the existing iconic Lossiemouth attraction.	11/21/2020 10:56 AM
109	Putting bridge back at esplanade not a good idea due to swell and current I feel that it would be an accident waiting happen with kids jumping of bridge.	11/21/2020 9:08 AM
110	Keep the bridge in the same place or just next to where it currently is	11/20/2020 9:58 PM
111	Easier to get to the toilets and shops	11/20/2020 6:04 PM
112	I think a bridge from the esplanade would cause a bottleneck with parking etc. For me the present position is the best location Location	11/20/2020 4:55 PM
113	The bridge is important for the Lossie community and tourists who visit the area	11/19/2020 9:31 PM
114	The bridge is protected by the dunes in the present position. If the bridge is placed at the esplanade it will get eroded faster due to stormy weather and sea states. Also, you will have to think of the depth of the water changes a lot next to the Esplanade due to two different types of currents both meeting from the river and the sea. This means if the bridge is built in current placement it will be more protected and will last longer.	11/19/2020 9:13 PM
115	Near parking for access to the east beach, and shorter.	11/19/2020 8:53 PM
116	Has there been any thoughts on how to keep east beach clean? Need to be careful it doesn't get ruined	11/19/2020 8:44 PM
117	New bridge please. Expedite a decision!!! Please, please don't let this drag on and on through committee after committee.	11/19/2020 8:39 PM
118	The area in front of the esplanade is well used by paddle boarders and other water sports, a bridge would prevent this	11/19/2020 8:03 PM
119	The current siting of the bridge allows use of the sheltered corner of the estuary in favour of watersports	11/19/2020 7:33 PM
120	Please build a nice bridge. Something arty, a sculpture. It'll be a landmark so please make sure it's nice	11/19/2020 6:42 PM
121	We use the area between the bridge and the Esplanade for Paddlebaod sessions would be good to keep this clear.	11/19/2020 6:36 PM
122	This will leave the esplanade clear to foot traffic.	11/18/2020 7:00 PM
123	The current location for the bridge was never an issue before. It has been at the esplanade before and was moved. Putting it back there will just make traffic congestion especially in the summer horrendous. Parking will also be made even worse on a road which is already extremely busy. Due to to current restrictions with COVID surely a bridge where there is more space and the ability to keep more of a distance from others, if necessary, would be more advantageous. Whatever the decision I hope it's made soon. We miss East Beach!!	11/18/2020 6:16 PM
124	A bridge from opposite Examples would cause traffic and pedestrian chaos as well as the structure being more susceptible to storms.	11/18/2020 4:53 PM
125	The Esplanade is very busy with pedestrians and even more so vehicles, I believe this would be compounded by the bridge moving location to the Esplanade. I think it would encourage people to attempt to park near the bridge and make the street a nightmare. The bridge has worked well in its current location for years, where is it close to a car park and gives access to locals who only want to access the beach without going to the busy Esplanade.	11/17/2020 8:59 PM
126	The bridge running from the esplanade, if possible, would be a great boost for local businesses.	11/17/2020 3:15 PM
127	Sooner the better. At least in time for next summer.	11/16/2020 4:26 PM

Loss	iemouth East Beach Bridge Replacement	SurveyMonkey
128	I personally don't think it would be a great idea to positioning the bridge at the Esplanade due to people's mobility and car traffic. It is very busy during with the car traffic and crowded area with people the summer and a health and safety consideration must be taken.	11/16/2020 12:18 PM
129	Its just makes so much more sense. A shorter path directly from local businesses and it Will look beautiful in tourism photos!	11/16/2020 10:43 AM
130	Seems more appropriate to have it from esplanade	11/15/2020 10:43 PM
131	Feel bringing bridge into Pitgavny Rd. would caused parking problems. Park already in place in present position.	11/15/2020 5:17 PM
132	More parking beside where the bridge is now. There's a lot of folk drive to the beach.	11/14/2020 8:57 PM
133	I think it should stay in its current location as it's very convenient having the car park there and will ease congestion in the town also I believe it will help alleviate any littering from people having ice creams and food then directly going to the beach.	11/14/2020 12:36 PM
134	If the bridge were replaced from the esplanade there would most probably be issues with litter. People would most likely not have finished their ice cream or snacks by the time they got to the bridge and would bring litter to the beach and not take it back. Litter was already a problem and it would most likely be exacerbated by the relocation of the bridge. Parking for the east beach is convenient in its current location. Water sports enthusiasts and the surf school use the bridge and carry their equipment over. Making this journey longer may be a slight inconvenience. Perhaps the bridge could go beside the canal to reduce the distance from the car park. I think aesthetically the bridge would look better at the esplanade which in turn would help Lossiemouth become an iconic beach town but in reality the functionality of replacing it in its current location would serve the beach and it's users more favourably.	11/14/2020 9:41 AM
135	Would like it to be placed near the toilets for easy use for the people on the beach.	11/14/2020 8:39 AM
136	I was told the last bridge in previous position was damaged by wild weather due to be in a more 'open' location.	11/14/2020 7:37 AM
137	Be nice at the Esplanade but makes more sense for parking to leave it where it is !	11/14/2020 4:53 AM
138	I think having the bridge on the esplanade would cause lots of parking problems and congestion in a place where it is already tricky in summer months and busy periods.	11/13/2020 10:11 PM
139	Closer to carpark	11/13/2020 9:15 PM
140	Parking and traffic is congested at the hight of the summer season by the esplanade. By keeping the bridge in the present position will allow cars to park at the riverside or in moray Street. The first crossing that was built to access the beach was from the esplanade, which was constantly damaged by tide so was moved to its present position. Makes sense to keep the crossing where it is.	11/13/2020 8:46 PM
141	In the nicest possible way. Any beach will be a positive.	11/13/2020 7:55 PM
142	If the bridge goes from the Esplanade, there will be more cars parked there, perhaps for the full day. Parking is scarce on a sunny day anyway and I think additional parked cars would have a detrimental effect on the shops. There is a car park by the current bridge all ready. Also, 100 years ago, a bridge was washed away from an Esplanade site, whereas the current site is more sheltered.	11/13/2020 7:44 PM
143	if the bridge were moved to the esplanade, would if not cause significant congestion issues?	11/13/2020 5:37 PM
144	Just need a bridge so this beautiful resource can be enjoyed again	11/13/2020 4:11 PM
145	If the bridge is placed on the esplanade, it will cause a problem with parking. So as long as this is considered, I don't care where the bridge goes!	11/13/2020 3:38 PM
146	I hope that a temporary bridge can be put up in the interim p	11/13/2020 1:41 PM
147	The prevailing wind means the current position offers some shelter from the dunes to those crossing, it's one reason it was moved from the esplanade in early 1900's	11/13/2020 12:48 PM
148	Please can it be architecturally amazing to show off local engineering.	11/13/2020 11:49 AM
149	Would be lovely for the old bridge to be closed off but left where it is, it's a piece of history and would be a shame for it to go	11/13/2020 11:43 AM

150	Parking would be a huge issue if the bridge was on esplanade. That road is already chaotic on nice days due to number of customers parking to visit the 2 ice cream shops and 3 restaurants on that section of Clifton Road.	11/12/2020 5:46 PM
151	A bridge from the esplanade would have to take into account the landward movement of the dunes. Plus, any off street parking is closer to the existing bridge.	11/12/2020 4:42 PM
152	There is some degree of parking where it is located at present, if its moved there will be total chaos with parking which will cause safety issues for pedestrians especially children.	11/12/2020 3:50 PM
153	Prime reason for this response is better parking available nearby, and also more sheltered from sea.	11/12/2020 12:48 PM
154	Putting the bridge back were it is ,will allow for parking close by and prevent the esplanade from becoming congested	11/12/2020 12:28 PM
155	I think parking would be a concern if the bridge were to be sited on the esplanade	11/12/2020 12:16 PM
156	The bridge is placed well between the esplanade and the caravan park. There is also a car park near by. I would worry that moving the bridge near the esplanade would cause a lot of extra traffic in an area that gets very busy already as people will try and park as close as possible and they won't necessarily use the harbour car park. The only bonus would be being closer to the shops to grab ice creams but people have happily walked up to now so don't see the need to move it	11/12/2020 12:01 PM
157	Considering parking & congestion the current position has significant advantages	11/12/2020 11:57 AM
158	For parking and to ease congestion at the esplanade, the new bridge should stay in the same location	11/12/2020 11:54 AM
159	Due to the available car parking for visitors and locals alike, I feel the best place is in the present position. The fact that it stood so long also indicates that it was a good foundation for weather, tides etc.	11/12/2020 11:39 AM
160	Really miss using this beach!	11/12/2020 11:36 AM
161	It makes more sense where it is because of parking. People are inherently lazy and will park as close as possible, so if it was on the Esplanade parking could get ridiculous especially on nice days.	11/12/2020 11:29 AM
162	It brings back so many memories	11/10/2020 11:32 PM
163	Certainly would be of a benefit to public if bridge was adjacent to esplanade and may attract more business for the wee shops adjacent.	11/10/2020 1:27 PM
164	The close proximity of the car park to the current bridge is ideal for anyone driving to the beach: family day out with kids & kit to carry, watersports enthusiasts etc.	11/10/2020 11:46 AM
165	I think both options have pros and cons and I will be happy to see access to the beach wherever the bridge is placed. I think the bridge from the esplanade would tie the beach to the rest of the esplanade making access to the local shops and restaurants easier. I think this connection to the esplanade would make visiting the beach more even more enjoyable than in the existing location. My concern would be a lack of parking, especially disabled parking.	11/10/2020 12:35 AM
166	Worried about parking at option 2 & children running across road to ice cream shop if bridge put at esplanade	11/9/2020 5:14 PM
167	Need more information to make a decision	11/9/2020 4:20 PM
168	The Esplanade would be my preference as long as it doesn't create problems for parking/access.	11/9/2020 3:18 PM
169	Concern about the Esplanade parking is the only drawback to this option as it should be cheaper.	11/9/2020 3:16 PM
170	I fear that moving the bridge to the esplanade causes even more parking issues there.	11/9/2020 10:47 AM
171	The time for surveys is past. Action is required	11/9/2020 10:18 AM
172	Whatever works best	11/9/2020 8:59 AM

SurveyMonkey

173	Personally I think the bridge should be left where its presently at .there's a carpark not far from it ,moving it to the esplanade would create a influx of traffic trying to park on the main road	11/9/2020 3:58 AM
174	I think the new bridge should mimic the old bridge as far as possible.	11/9/2020 3:48 AM
175	Whatever is the safest and cost effective	11/8/2020 10:46 PM
176	What was the original reason for the bridge to be placed where it stands at present ? This should be a factor in the decision	11/8/2020 10:24 PM
177	For safety	11/8/2020 7:57 PM
178	or built as Near the present to the present bridge bridge foundations as possible	11/8/2020 5:06 PM
179	Seems to be the best place in my opinion	11/8/2020 9:55 AM
180	Such an iconic bridge should be rebuilt where it is.	11/8/2020 8:41 AM
181	All the car parking is over that way, esplanade/Clifton Road parking is limited at best of times.	11/8/2020 8:22 AM
182	The bridge is much safer where it is. Too much underwater turbulence/currents in the river at that point of the esplanade, far too dangerous and accident waiting to happen in my opinion.	11/8/2020 12:28 AM
183	Too near mouth of river if moved to esplanade also thought needs to be given to the problem with parking which already is terrible at the esplanade.	11/7/2020 9:43 PM
184	the esplanade is summer is busy enough. If the bridge is moved with traffic moving through it will be an accident waiting to happen. there's also a car park close to the current location. moving the bridge would cause more vehicle traffic and congestion	11/7/2020 8:55 PM
185	Time the bridge was back.	11/7/2020 8:17 PM
186	Just love the design and position as the bridge stands	11/7/2020 7:49 PM
187	The main photos of Lossie are the beautiful ones of the bridge, if it was moved these would not be possible, and lossie would lack in beauty.	11/7/2020 5:11 PM
188	The current Bridge has been put there for a reason. The swell from esplanade during very high tide would make the bridge unusable or damaged. I can not understand any reason for moving it. Please let logic prevail.	11/7/2020 5:08 PM
189	The bridge in its current position allows quiet, uncongested crossing where Parkin is also available. Putting a new bridge on the esplanade where it already gets highly busy in the height of Summer when most people cross the bridge to the beach would most likely create a congestion of people, cars, as well as distruption to the seals who come there and surfers who use that place to cross.	11/7/2020 4:33 PM
190	Protected more from elements; has large parking area opposite; safer than having large numbers of public coming straight on to esplanade + traffic; congestion if by esplanade; the esplanade is a place for relaxation, walking, sitting and admiring the view, not having swathes of visitors/members of the public (just think of the numbers we had in the summer the bridge was closed) going to and fro; ** it is also close to where seals often come and rest on the sand and large numbers of people in that proximity would be damaging	11/7/2020 4:26 PM
191	To have any replacement bridge would be wonderful as long as it is safe and sustainable.	11/7/2020 4:17 PM
192	There is a car park available at its present position	11/7/2020 4:17 PM
193	It is in the ideal place. Crossed it every time I come to visit.	11/7/2020 4:06 PM
194	Bridge from the explanade would be preferable but only if there is adequate car parking infrastructure built into the design otherwise build a replacement bridge in its present position.	11/7/2020 3:04 PM
195	Esplanade is falling intonthe river and would not support a bridge, huge extra funding would be required. The shops in and around the esplanade would be advesrely affected by lazy people parkingnas close as they could to a new brudge from thenesplande. Replace or repair the bridge inthe existing locationthey knew what they were doing when they built it there.	11/7/2020 3:02 PM
196	Esplanade. Example; I'm on the beach and want an ice cream? I can cross the bridge, get my family ice cream and return back over the bridge. In the current (old bridge) location it wasn't as feasible. Seems small, but I think legitimate.	11/7/2020 3:00 PM

Lossiemouth East Beach Bridge Replacement SurveyMonkey The current bridge has nearby car parking, a bridge on the esplanade might attract more people 197 11/7/2020 2:11 PM to use the shops on entering/exiting the bridge which might support local business but I still prefer the current bridge location. I think it creates a longer crossing that has a greater impact. 198 I don't think it matter to anyone where the bridge is, so longneck as we can actually get on and 11/7/2020 1:51 PM get it built so we can all access that beautiful beach again! The current position allows the beauty of the bridge to be appreciated from many vantage 11/7/2020 1:43 PM 199 points. It's practical as there is good parking nearby but within easy walking distance if the Clifton Road shops and cafes. Putting the new bridge over from Clifton Road would undoubtedly increase traffic and congestion there. I understand the original bridge was there but was replaced after only a few year by the current bridge. That leads me to suspect there were difficulties with that location. It may be more likely to be damaged by big storm waves coming in the river mouth. Even the general wear and tear of the tides would likely be greater there. 200 Great where it is 11/7/2020 12:57 PM 201 Few towns are as fortunate as Lossie in having a beautiful beach either side of the town. In the 11/7/2020 12:48 PM present position the Bridge is as iconic to the East in Lossie as the Lighthouse is to the West. It is also ideally placed with a large car park already in place thus keeping cars away from an already congested Clifton road. 202 It is better access to shops 11/7/2020 11:00 AM 203 Keep bridge where it is 11/7/2020 10:10 AM 204 Better for parking, to reduce traffic in the esplanade and to maintain its iconic location. 11/7/2020 10:02 AM Get it done ASAP, we are all desperate for it to be back...... 205 11/7/2020 10:01 AM 206 Ease of access to the bridge. The shops on the esplanade would benefit greatly. 11/7/2020 9:57 AM 207 The bridge should stay where it is for safety reasons. The river around the esplanade is 11/7/2020 9:46 AM particularly dangerous and there have been drownings there in the past. It is iconic where it is and part of our heritage and my childhood. I am concerned about increased traffic on Clifton road if it is moved and that may cause bad congestion there. Although there is much to recommend the Esplanade placement, the problems of traffic and 208 11/7/2020 9:36 AM visitor numbers has made me opt for a replacement on the present site. This will allow the Moray St car park to be used, and for visitors to filter towards the shops and restaurants rather than focusing on that area. 209 The sooner the better 11/7/2020 9:28 AM No parking if from Esplanade. Congested enough as it is in summer . Parking for ice cream!! 11/7/2020 9:19 AM 210 Purpose built car park at existing bridge. Also heavy swell when high tide and northly wind/gale that would put bridge in danger. Existing bridge there was washed away. New bridge just round the bend of the river near or on existing bridge site would be ideal. Seemingly there was a vote for the esplanade a couple years ago but it was never published. Just the local business people I believe. I and many many others never even knew about it till it was done !! It should stay in its current and iconic position 211 11/7/2020 9:19 AM 212 With climate.change to put back on esplanade where it was washed away bu high tides would 11/7/2020 9:14 AM be too risky of the same occurring. The traffic on clifton Road is too congested in the summer to encourage beach users to park there too. If you were to begin building by the esplanade it would most likely collapse as it is already unstable and in poor repair. Making the esplanade option a far more expensive one than replacing in its current position . 213 I fell if the bridge is at the esplanade it will become very overcrowded. It already get very busy. 11/7/2020 9:00 AM This would make it difficult for people with nervous dogs to take them on to the beach. Also not everyone likes dogs. It would also be difficult for surfers with their large boards to get through the crowds too. 214 Preferably An aesthetics pleasing bridge. But I really don't mind where it goes! 11/7/2020 7:43 AM The esplanade will become congested if the bridge is built there. 215 11/7/2020 7:01 AM 216 If from Esplanade I feel the shops/restaurants will benefit more as people can easily go back 11/7/2020 6:12 AM

and forth if required for food/drink. The originally placing is a bit of a walk I believe for a "quick nip".

217	The Esplanade is always busy with traffic ad people buying ice cream!	11/7/2020 6:02 AM
218	Lossiemouth would never be the same if the bridge was moved being where it is brings many memories back to me of my late husband	11/7/2020 3:48 AM
219	Think it best replaced where it is now as parking would be an issue	11/7/2020 2:28 AM
220	Just replace it in same place	11/7/2020 1:05 AM
221	Think existing site the best route and will avoid excess traffic traffic in an already busy area	11/7/2020 1:01 AM
222	Can't change the position of one of the most iconic and photographed bridge in the north east of Scotland	11/7/2020 12:50 AM
223	Because this is the most sensible place to put the bridge that's why it was put there in the first place. So don't wast any more time or money on feasibility studies just get on with it. It is as simple as that. And please give us somthing to look forward to after this horrible pandemic is over.	11/7/2020 12:04 AM
224	Important to maintain this historic land mark where it is	11/6/2020 11:50 PM
225	Current position is perfect	11/6/2020 11:14 PM
226	There is so much debate on replacing at the current location. But, I feel it's more to do with fear of change. Please don't build a like for like bridge. Please build one with decent access for less able people, ensure their is adequate space allocated for bins and collection.	11/6/2020 10:53 PM
227	In the current position the bridge is nearer to the carpark. Feel it would make the esplanade very busy.	11/6/2020 10:38 PM
228	The current bridge position is part of that very special view from the esplanade and from the road above.	11/6/2020 10:08 PM
229	From all I have spoken to - including shopkeeper , the present position with a similar shape to the old bridge is the definite preference . Might be worth considering, questionnaire in northern Scot	11/6/2020 10:07 PM
230	Something fitting and floodlit not an ugly monstrosity	11/6/2020 10:01 PM
231	We need a bridge	11/6/2020 9:45 PM
232	Leaving the old bridge in situ will maintain the picturesque views of Lossiemouth we have all become accustomed to.	11/6/2020 9:16 PM
233	A bridge from the Esplanade to the East Beach didn't work decades ago and now that there's tidal erosion, more traffic, plus it's the main bus route, it doesn't seem sensible to cause even more congestion in that area. A foot-bridge further up river makes far more sense, particularly when dangerous cross waters closer to the sea are taken into consideration.	11/6/2020 9:08 PM
234	The original bridge is iconic and should be left alone. Repaies maybe required if money available	11/6/2020 8:50 PM
235	This has been way to long	11/6/2020 8:44 PM
236	Parking at the esplanade is always difficult and would be even worse if the new bridge is from there. There is a large car park already at Seatown next to the current bridge. This is a far safer option.	11/6/2020 8:44 PM
237	Would create to much congestion on the other side which is already busy and on a main road	11/6/2020 8:24 PM
238	I'd like to see the existing bridge preserved.	11/6/2020 8:23 PM
239	If the bridge is moved to the esplanade then the lack of parking there could lead to conflict between business and beach goers over parking spaces	11/6/2020 8:11 PM
240	Current site of bridge is close to car park making it more accessible for visitors. East beach bridge is a well recognised iconic feature of Lossie where it is now.	11/6/2020 8:05 PM
241	The parking is easier where the bridge is currently & if the bridge was moved I believe it will	11/6/2020 8:02 PM

	cause congestion which will lead to accidents.	
242	There is not enough parking at the esplanade if the bridge goes there	11/6/2020 8:01 PM
243	Obvious place for new bridge	11/6/2020 7:57 PM
244	I would be concerned that using the esplanade for the site would create major parking problems and increased traffic / pedestrians in what is already a very busy area on nice days. The present site has a large car park nearby. I don't think the station car park is big enough to cope.	11/6/2020 7:56 PM
245	Where the current bridge is located is certainly the best option for me	11/6/2020 7:49 PM
246	Maybe don't replace the bridge as the sand dunes is a good and safe place for birds to live, there has been a few new verities arrived since the bridge closed.	11/6/2020 7:48 PM
247	It is the most obvious choice.	11/6/2020 7:45 PM
248	I'd be happy with a bridge that takes account if engineering issues as well as the aesthetics. Don't spend more money building it in one spot, if there is a more appropriate engineering position.	11/6/2020 7:31 PM
249	Makes more sense to keep it where the current bridge is because of the parking situation in lossie	11/6/2020 7:28 PM
250	Ebb and flow of tides can be strong and treacherous making esplanade location unviable. Promenade unable to cope with any further congestion of people and cars. There is a car park at present position giving all easy access.	11/6/2020 7:27 PM
251	Maybe safer to keep it away from the pubs on the front	11/6/2020 7:17 PM
252	While at it, make the parking outside the shops disabled only and double yellow the other side $\ensuremath{\mathbb{I}}$	11/6/2020 7:17 PM
253	Easy parking where the existing bridge is sited	11/6/2020 7:15 PM
254	The bridge works where it is, isn't intrusive and fitted with the environment. Just repair the damned bridge as it was!	11/6/2020 7:14 PM
255	Has a large impact on the community around with the East Beach being unavailable to anyone. There are a lot of local businesses that rely on tourist coming to Lossiemouth, with this year local businesses need ad much support as possible.	11/6/2020 7:13 PM
256	Just want people to enjoy the lovely beach	11/6/2020 7:11 PM
257	I think its fine where it is, near a car park but away from the main road traffic	11/6/2020 7:09 PM
258	I personally think that a new bridge from the esplanade would be the best option for businesses in that area.But what can we do about the old bridge? Leave it to rot or pay to dismantle.	11/6/2020 7:08 PM
259	Esplanade would require enormous fundingit's is being undercut by the river.	11/6/2020 7:06 PM
260	Leave it where it is! We believe that it should be replaced exactly where it is for several reasons Firstly it is an iconic feature of Moray where it stands. It is stunning. easily accessible and parking close by. Secondly to move it would mean the road along the esplanade would need to be either closed off or made one way, the increase in traffic would be huge. Thirdly, it would be catastrophic for the businesses along Clifton Road as people would not be able to stop due to parking congestion. Lastly, the state of the esplanade and the breakwater is hugely concerning and cannot be ignored. If we can. let's keep the bridge where it is for the good of everyone in Lossie please.	11/6/2020 7:06 PM
261	I think from the esplanade will be best for local businesses as long as there is good signage to the existing car parks as it will be a nightmare along the front for parking for locals needing to just nip to the pharmacy or the shops. There may need to be a time restriction on some areas of parking along the seafront.	11/6/2020 6:49 PM
262	I think it would be a better option for the community to thrive and also be beneficial to all businesses in Lossiemouth. Parking will probably be highlighted as an issue however I don't see it being a problem, people will use proper car parks and the street as they do now. Thanks and the best of luck in building the bridge and thanks for making Lossiemouth great again.	11/6/2020 6:49 PM

SurveyMonkey

263	Likely to generate increased income to shops opposite the esplanade	11/6/2020 6:40 PM
264	It's an iconic view, which the bridge enhances. That it has stood there for so long also proves it's a practical location.	11/6/2020 6:36 PM
265	As an Auld Lossie Loon I would would prefer the existing span to be maintained BUT of course expenditure must be taken into consideration. The main object is a replacement wherever.	11/6/2020 6:23 PM
266	Wide enough for disabled access and carrying a stretcher/ambulance trolley across.	11/6/2020 6:22 PM
267	There is plenty of parking at the present location. The esplanade would be a nightmare with people trying to park if the bridge was from the esplanade	11/6/2020 6:15 PM
268	Better access , shorter	11/6/2020 6:05 PM
269	I think the effects of traffic should be a big consideration if the bridge is to go from the esplanade	11/6/2020 5:56 PM
270	get it done as soon as.	11/6/2020 5:56 PM
271	From the esplanade would be a lot better	11/6/2020 5:51 PM
272	This bridge is part of our town, it was built in its current position for a reason and should remain so, environmentally it is in the best position and an iconic feature of Lossie. Please do not move our bridge, to move it would cause traffic chaos on Clifton road and there is plenty parking where it is. Thank you	11/6/2020 5:42 PM
273	Look forward to getting across when we have a bridge	11/6/2020 5:37 PM
274	There was previously a bridge from the Esplanade which did not last. It seems to make more sense to build one alongside the current position. Also there would not be enough parking beside the esplanade it is already to busy with people going to the ice cream shops.	11/6/2020 5:30 PM
275	It's an iconic image/view from Prospect Terrace to The Esplanade. It won't be so noticeable if it starts from the Esplanade.	11/6/2020 5:29 PM
276	Leave it where most people associate with it.	11/6/2020 5:27 PM
277	Where is it now is near a car parking area and it's not too far to walk round to the shops. It would save congestion on the main street and with the ice cream shops there it is always busy, children!, so less traffic	11/6/2020 5:20 PM
278	Could it be moved east down towards the east, and use parking where the old hospital area was situated.	11/6/2020 5:14 PM
279	If you put it at the esplanade and kids jump in when the tide is going out thay will get washed down river very quickly.	11/6/2020 5:13 PM
280	It's already taken too long. Needs to be done in a timely manner.	11/6/2020 5:07 PM
281	 The bridge has provided a unique photo opportunity from Prospect Terrace for decades. Along with the Lighthouse it is THE image which defines Lossie. Located from the esplanade it will simply look cluttered and unsightly, obscuring the view of Seatown from Clifton Road also. Clifton Road is already congested at the height of the tourist season. It will become completely overwhelmed if additional traffic park up to access the bridge from the Esplanade. 	11/6/2020 4:57 PM
282	Will avoid people parking on the sea town road and use the car park in the original position.	11/6/2020 4:56 PM
283	Traffic congestion would be unbearable on Clifton Road if the new bridge was from the esplanade.	11/6/2020 4:55 PM
284	So much easier access, closer to toilets, only problem is the parking.	11/6/2020 4:53 PM
285	I think this location will bring more business as people will have to pass the shops etc	11/6/2020 4:47 PM
286	Hopefully will minimise people leaving rubbish in the beach as many won't walk from Esplanade round to bridge.	11/6/2020 4:46 PM
287	Safer for parking at the east beach there will be too much cars on whe esplanade its bad enough just now dangerous as well too near the sea	11/6/2020 4:42 PM
288	A bridge from the esplanade is a terrible idea. It would cause a nightmare for traffic and parking	11/6/2020 4:38 PM

congestion and a major hazard for pedestrians crossing the road. Also a bridge from the esplanade is very vulnerable to storm. I remember in the 70s or early 80s when a lot of money was spent on a new breakwater from the old pier up to the dunes and towards the bridge. The new breakwater was completely destroyed in the first bad storm that hit it!

289	Current position is adjacent to ample parking. If it was built at the esplanade this would put more pressure on the parking for shops/restaurants which is already very busy in summer	11/6/2020 4:38 PM
290	Needs doing as soon as possible.	11/6/2020 4:31 PM
291	Not sure why it was removed from the Esplanade in 1918?	11/6/2020 4:26 PM
292	From the esplanade will cause so many problems with parking. If this is the chosen option, considerations for parking will have to be factored in.	11/6/2020 4:19 PM
293	Be great to have CCTV at bridge, due to a rise in vandalism, rubbish & drinking in Lossiemouth.	11/6/2020 4:16 PM
294	Sooner the better. We need our bridge.	11/6/2020 4:16 PM
295	I'm concerned with both parking and the likely hood of increased rubbish on the beach of the bridge was accessed via the esplanade.	11/6/2020 4:15 PM
296	The bridge should remain in situ, the implications of moving it would be detrimental to the business community, there are also implications for the roads and it is unlikely the existing road could remain as it is along the esplanade. It is an iconic feature of our community and should remain such as it is.	11/6/2020 4:15 PM
297	This position prevents localised overcrowding which could lead to a road safety hazard. It allows folk to enjoy the esplanade while those who want access to the beach can do so from around the corner near to the parking area.	11/6/2020 4:14 PM
298	If the bridge is built from esplanade parking on Clifton Road may well be, at best, problematic.	11/6/2020 4:14 PM
299	Wheelchair friendly	11/6/2020 4:11 PM
300	The bridge has always been a feature and where it currently is brings a lot of people to Lossie for photographic opportunities. Hope they are also going to keep a traditional design and not install an eyesore like the bridge by the Cathedral. The design is not in keeping with the surroundings which are old!	11/6/2020 4:10 PM
301	Best for shops etc	11/6/2020 4:08 PM
302	How about TWO bridges, one at the current location serving Seatown car park, and one into the esplanade to serve the shops	11/6/2020 4:06 PM
303	The present spot is the safest option . When people are leaving bars after the consumption of alcohol a bridge at the Esplanade would no doubt lead to a tragedy with people accessing the beach late at night whereas with it at the present location the chances of people going to the beach on a whim induced by alcohol would be as low as practicable.	11/6/2020 4:00 PM
304	Where it is is good as nearer to all the parking I think. There would be traffic and parking issues maybe if on the Esplenade. \blacksquare and Co, you are doing an amazing job wherever you put it. Well done. From the \blacksquare \blacksquare x	11/6/2020 3:59 PM
305	Traffic problems with other option!	11/6/2020 3:55 PM
306	It's need to be wider than the previous bridge to allow for buggies and dogs	11/6/2020 3:54 PM
307	The esplanade would cause even more traffic and parking problems, being disabled I struggle to get to the chemist etc, this would make it much worse, and unsafe for pedestrians who seem to ignore traffic on a hot day.	11/6/2020 3:53 PM
308	I know the bridge location has changed in the past and cost is a factor but the current bridge position is good, is relatively sheltered side extreme winds and looks gorgeous. Nuff said.	11/6/2020 3:53 PM
309	Convenient car park close by.	11/6/2020 3:51 PM
310	From an economic standpoint, this seems to be the logical way forward. It would ease construction issues and can easily use the existing Car Parking for users.	11/6/2020 3:49 PM
311	I think a bridge from the shop area across would cause congestion as people do not want to	11/6/2020 3:45 PM

	walk from the car parks	
312	Please ensure that the new bridge is wide enough for two pram/wheelchairs to pass on the bridge.	11/6/2020 3:44 PM
313	Such an iconic bridge needs to be replaced as close to original location as possible, thanks	11/6/2020 3:38 PM
314	The esplanade will allow more access to the rest of Lossiemouth rather than being on the edge	11/6/2020 3:37 PM
315	The front would be too congested and visual eyesore. Existing position is the best.	11/6/2020 3:34 PM
316	Concerned about parking	11/6/2020 3:24 PM
317	Waist if a great beach without a bridge !!!	11/6/2020 3:24 PM
318	Parking along the Esplanade is bad enough. Will be much worse if the bridge is there plus the added danger of people crossing the road between parked cars to get to the bridge.	11/6/2020 3:22 PM
319	A bridge from the Esplanade would be closer to my home and therefore would be preferred but I don't feel strongly enough about it, just having a bridge would be really good :)	11/6/2020 3:21 PM
320	Think car parking would be a major problem if you move the bridge to the esplanade	11/6/2020 3:10 PM
321	The current location is iconic, near to car parking and safe, moving it to the esplanade will ruin the view and create traffic chaos and ruin the esplanade ,it will also damage businesses on the esplanade	11/6/2020 2:50 PM
322	Prevents overcrowding on esplanade. Current Car Park works well for those doing water sports from East Beach as well. More protection for bridge from dunes if Northerly storms.	11/6/2020 2:49 PM
323	Keeping it in the present position will keep footfall in other areas of the town rather than just concentrating it around the esplanade.	11/6/2020 2:35 PM
324	Every Seafarer I have spoken to had warned against a Bridge at the Esplanade . The present Bridge has survived over a hundred years. That will not be the case should it be built at the Esplanade because of the force of the waves at times.	11/6/2020 1:56 PM

Appendix C – Tender Evaluation (Confidential appendix)

Appendix D – Risk Register (Confidential appendix)

Appendix E – Community Engagement

A & D S



Lossiemouth Connects Design Priorities Workshop

14th of November 2019

Workshop Summary

Introduction

In September 2019 Architecture and Design Scotland (ADS) were asked to assist Moray Council to facilitate a community conversation regarding the future of the recently closed Lossiemouth Seatown Bridge.

The conversation took place on the afternoon of 14th November, 2019 at Lossiemouth Town Hall. The Council and Scottish Government took part. This is a report of the key priorities as expressed on the day.

Place, Parts, Process approach to Priorities

At this event, we brought together local people and organisations to explore the power of collaboration in shaping places. We looked at what's happening in Lossiemouth and identified community priorities and opportunities associated with the footbridge link.

We explored the potential to further connect people, projects and assets and to develop shared sense of place through a collaborative approach.

During this workshop session, we invited participants to share their views on what is already happening and what is missing in the area. ADS facilitated a discussion to help stakeholders to prioritise the actions required to maximise the benefits of a re-instated footbridge. They shared ideas for new projects and ways to connect local energy and resources in Lossiemouth and the wider area.

The workshop told us about how local actions and assets link to the physical qualities of the Moray shoreline, and the ways they come together to make Lossiemouth a great place to live, work and play.

Methodology



From our work across Scotland, we advocate the importance of stakeholders agreeing their priorities as early as possible. We use a PPP (Place, Parts, Process) approach:

- Place relates to vision, status, and role of the investment.
- Parts includes the physical elements or 'hardware' necessary.
- Process is everything from governance to consultation, from briefing to design, from maintenance to promotion.

Three tables of mixed stakeholders went through a sequential discussion of their Place Priorities as follows.





Place Discussion

We asked the groups to think about what the bridge means to them, and why it matters. This meant discussing what its role was in the past, and what might it do, deliver, and stimulate in the future.

Participants talked about local pride and the bridge's regional, national, even international significance. We challenged people to voice what they saw as the 'vision' for the bridge in the life of Lossiemouth and beyond.

"Lossiemouth is the jewel of Moray. Without the bridge it loses its sparkle!"

Workshop Participant

The above word cloud shows the themes that emerged regarding context, community life, and business/tourism opportunities.

Place Review

We asked each participant group to 'boil down' these place elements. Coming out as most important were:

- Wellbeing
- Part of family and community life. An intergenerational asset
- Iconic 'USP' for the town and region
- Catchy name competition might reinvigorate interest
- Domestic and International appeal
- Public safety
- Connectivity between beaches and town, and to wider network of trails
- All weather amenity
- All year potential
- Twinnable asset worthy of promotion
- A statement of future commitment and confidence!









overtising leverage lcon solar Disabled materials Iconic setting Affordable advertising powered Position assess parking Car heritage disposal facilities Lighting all Safety catered Flood Tidal History Ownership enough Promote Emergency Protect Breakwater infrastructure wildlife tourist Elderly design part connections Waste planned options approach Funding proofed slats Climate ור paths de nterpretation associatedneeds inks campervans other riverAccessible **Eco-friendly** Showers Designed trail same Future maintenance OCa counters conversation

Parts Discussion

Moving on the workshop then discussed the physical form of the project

- What stuff do we need to deliver?
- Connections
- Ancillary hardware/investments/ considerations?
- Opportunities

We encouraged people to say what they needed 'physically' from the bridge. What elements must it have? We probed if it needed any special adaptations or attributes? We also asked the stakeholders to consider what other things should be delivered at same time in terms of links, lighting, signage, or equipment.

The word cloud above shows that resilience, sustainability, accessibility, and climate readiness came through in the discussion strongly as did usability for locals and tourists alike. Low maintenance solutions were advocated.







Parts Review

So, in summary what were the key 'parts' essential to incorporate in this project?

- Playabilty of the design
- Safety
- Sustainable material
- Accessible to all (including dogs)
- Built in capacity
- Business links
- Trail links
- Interpretation and links to heritage
- Innovative
- Lighting opportunities
- Future proofed
- Bridge as Gateway feature and signpost
- Outdoor classroom





Process Discussion

The process part of the workshop focused on how the project should be delivered. Looking at, amongst many other things:

- Governance
- Procurement and delivery
- Maintenance and Management
- Community and Business Models

Given local concerns regarding timescales, ownership, and stewardship we allowed a little more time for our discussion around processes. What became very clear, from a wide ranging set of considerations, was that 'certainty' was lacking and that this was causing real concern to both Moray Council and the wider community. We asked what things 'need' to be done to take control of the current situation. Beyond the bridge itself, there was considerable interest in engaging as many people as possible in the process, in a wide variety of associated activities.

In short, what are the processes needed to 're-make' the place? As the wordcloud (above) shows, communication with the community was key, as was certainty in the timescales. But more crucially, the community needed involvement from the very beginning in the governance process to provide trust in the process.

Process Review

Key 'process' elements were seen as:

- Communications strategy
- Budget
- Timeline-'meanwhile' uses,long-term, and long,long term
- Underwriting of risk
- Activities and events calendar
- Youth involvement
- Embrace sensitivities
- Clear business case
- Ownership and stewardship clearly established
- Sustainable ownership and management
- Board and steering group required





Priorities Discussion

Taking into account the outputs from the Place, Parts, and Process discussions the workshop then focused on what were the key priorities and tasks in the short, medium and longer term and including consideration of:

- Roles
- Timelines
- `Non-negotiables'

There is a strong desire to set out a 'route map' of allocated tasks and actions based on the priorities emerging from the Place Parts Process discussion. These are the key 'must dos', 'must haves', and 'must knows'. This ensures that stakeholders and those charged with delivering the project will be 'singing from the same hymn sheet' and will have a firm foundation to progress through the various stages of project delivery, engendering community and business confidence, as well as clear success criteria.



Key tasks and Next steps

Wrapping up the workshop the priorities seem to fall into the following:

- Answer 'will this get done'?
- Moray Council to take the lead in terms of ownership and delivery. Proposal to be submitted to council in December 2019.
- Who are key people? Core steering Group and wider Stakeholders group to be established in early 2020.
- Critical path to be developed.
- Meanwhile-uses plan
- Management and communication
- Options appraisal Spring 2020.
- Business case
- Post-build priorities (testing,marketing,and events). Build the loyalty
- Responsibility for old if new is chosen as part of Council decision.
- A realistic understanding of timescales (years not months)



Concluding Thoughts

Stephen Cooper, Head of Direct Services, Moray Council

"The workshop builds a good foundation for moving forward. The key elements for me were as follows: Ownership position now defined; Output from the workshop will support content of committee report to Moray Council; Expectation of community engagement (critical for shared ownership/stewardship of the project); Realistic timescales embraced; The 3 Ps approach (Place , Parts, and Process leading to Priorities) will provide a reference document for influencing project specification and future community engagement"

David Cowan, Head of Regeneration, Scottish Government

"A good workshop in my view and general consensus on ownership and wider 'place' approach and next steps. Some acceptance too of the timeframe although that will continue to be an issue."

Iain Morrison, Tourism, Scottish Government.

" The key element from my perspective was an acceptance of the potential timescale (and work that can be done in that period to support/build on Lossiemouth's tourism offer)."



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Review of Comments Lossiemouth East Beach Footbridge Replacement Survey



Background

In November and December 2020, on behalf of Moray Council and the Scottish Government, the Lossiemouth Community Development Trust (the Trust) was tasked with carrying out a survey of public option regarding the replacement footbridge at East Beach in Lossiemouth. The Trust carried out an electronic survey with an accompanying paper option to gauge public opinion. There were 972 electronic and 376 paper responses from the 4000 distributed in the Town. The results are shown below:-

Option	Location	Electronic	Paper
Α.	Seatown Bridge	550(56%)	296(79%)
В.	Esplanade Bridge	217(22%)	44(12%)
С.	No Preference	205(22%)	36(9%)
Total		972	376

The survey also gave the participants the opportunity to make any comments they had regarding the project. This report summaries the key points which came through these comments. Over 300 comments were received on the electronic survey

Key Themes from Comments

Following a review of the comments there were a number of key themes which came though the majority of them. The top 8 themes are highlighted below with a short summary of what that theme is.

• Theme 1: Increased Traffic

Traffic was a common theme through a number of responses. This was in particular reference to the potential increased traffic along Clifton Road if a footbridge was to be built at the Esplanade. It is felt that traffic in an already congested site would cause an interaction issue between cars and pedestrians.

• Theme 2: Parking

Parking was a significant theme through the responses and was a direct link to the traffic issues. The theme around people now parking close to the footbridge and not at the existing carpark came through in most responses with regards to the Esplanade location. Most felt that the existing location area would have minimal to no impact on parking.

• Theme 3: Access for All

With the current footbridge width being small a number of comments were raised about ensuring that there was both disabled access across the footbridge and at the beach end. Width of the bridge was also mentioned to ensure that there is space to pass

• Theme 4: Protection from weather and currents at Esplanade

Questions were raised about the reason for the old footbridge being moved to its current location. A number of comments raised concerns about the possible increase risk of the footbridge to flooding, along with the stronger currents and waves at the esplanade location and possible collapse and if a design could be produced to ensure the longevity of the footbridge



• Theme 5: Better access to shops

It was highlighted by a number of comments that the proposed location of the Esplanade would add increased opportunity for business development and existing business as it is close to the shops. It was also highlighted that is was also close to other facilities such as Bins and toilets.

• Theme 6: Pedestrian concerns at Esplanade

Concerns were raised about the increased number of people in and around the Esplanade on top of the already congested areas during peak tourist season with people walking around the town visiting the harbour and shops if the footbridge were to be built at this location. Concerns were raised about the increase litter

• Theme 7 Anti-social Behaviour

Comments were made about the risk of anti-social behave on the footbridge such as vandalism as well as using the structure as a possible location to jump in to the river. Concerns were raised that the Esplanade location posed more risk due to currents and waves.

• Theme 8: Aesthetics of the structure

The shape and form was a very common concerns. It was evident that the community felt the bridge was both and import feature in the landscape and form many photo opportunity. It was also apparent that the footbridge was an important structure to the community and that the shape and form should respect the landscape it is being placed in



Q1 How dic	l you hear	about this	event?
------------	------------	------------	--------

ANSWER CHOICES	RESPONSES
Website	6.30% 24
Social Media	66.40% 253
Word of Mouth	17.06% 65
Email	2.10% 8
Other (Please specify)	8.14% 31
TOTAL	381

#	OTHER (PLEASE SPECIFY)	DATE
1	Northern scott	3/9/2021 8:39 AM
2	Local Co-Op	3/8/2021 8:32 AM
3	Local church	3/7/2021 4:48 PM
4	Purely by chance !!	3/7/2021 2:20 PM
5	Purely by chance, came across it on social media. Not a great deal of info initially around the town for residents.	3/7/2021 2:08 PM
6	Newspaper	3/7/2021 1:26 PM
7	1	3/7/2021 12:07 AM
8	Fsmily	3/6/2021 5:59 PM
9	Local newspaper website (The Northern Scot)	3/6/2021 4:25 PM
10	Paper copy through door	3/6/2021 2:27 PM
11	Live locally	3/5/2021 5:56 PM
12	printed copy at CO-OP	3/5/2021 4:49 PM
13	Shop window	3/5/2021 12:29 AM
14	Northern Scot	3/4/2021 10:32 AM
15	Northern Scot	3/3/2021 11:33 PM
16	Leaflet in COOP	3/3/2021 5:10 PM
17	Leaflet in Coop	3/3/2021 11:26 AM
18	leaflet	3/3/2021 11:23 AM
19	Leaflet	3/3/2021 11:21 AM
20	Unique shop window	3/3/2021 7:31 AM
21	local shop	3/2/2021 5:08 PM
22	Family resident in Lossiemouth	3/2/2021 5:04 PM
23	We own a static caravan for our own use on Lossiemouth bay caravan park and spend all summer here my family also.	3/2/2021 2:22 PM
24	Leaflet	3/2/2021 12:37 PM
25	Leaflet @ Co-op in Lossie	3/2/2021 10:24 AM
26	Press & Journal	3/2/2021 8:43 AM
27	I was on LCDT committee	3/1/2021 11:01 PM
28	friends	3/1/2021 8:55 PM
29	Leaflet in Lossie Coop	3/1/2021 6:05 PM
30	Member of the LCDT	3/1/2021 5:04 PM
31	Lossiemouth Community Development Trust	3/1/2021 12:52 PM

Q2 Please provide you comments on the preferred option.

Answered: 321 Skipped: 60

#	RESPONSES	DATE
1	As a life-long resident of Lossiemouth I strongly oppose the 'preferred option' for the new bridge to be situated on the esplanade. First of all aesthetically it looks horrendous, completely ruining the open aspect presently enjoyed. The original position is so much more pleasing to the eye, and especially if viewed from Prospect Terrace. It's an iconic view and along with the Lighthouse and west beach view defines our town. Even more important se the practical considerations. The inevitable additions like volume of traffic on the esplanade to accommodate people accessing the bridge would be intolerable, whereas in the original location there is a ready made parking area. Also, the esplanade is in a sorry state of decline, and I can only assume the additional costs incurred to accommodate this huge structure would bump up the cost considerably. Opinion in the town definitely favours the original location, a fact borne out by the most recent survey. In my opinion going with the esplanade choice is a huge mistake in the making. The cheapest choice doesn't make it the Best choice. Can I also apologise for any errors in my submission, the format of this survey, makes it impossible to review your written submission before sending?	3/9/2021 10:40 AM
2	Looks like you have made your choice, so I'll go with it. The one from the esplanade.	3/9/2021 10:16 AM
3	Church Street	3/9/2021 9:09 AM
4	Option 3. Next to current bridge	3/9/2021 9:05 AM
5	Cheap option in the wrong place that will bring lossie to halt in the summer. Relatives from Lossie extremely unhappy with choice	3/9/2021 8:52 AM
6	Short sighted. The esplanade will fill with day trippers stopping passing trade to shops and resteraunts. In the too distant future that part of the beach will become an island unless the river is dredged, they moved it originally after 10 years as it became unusable in the weather.	3/9/2021 8:39 AM
7	Option 5 - Balance between encouraging use of the local businesses at the promenade carparking facilities. The west beach is a major tourist attraction for Lossiemouth. The regeneration of the promenade requires completion if option 4 or 5 is chosen due to increased used. The path is currently a major trip hazard.	3/9/2021 5:03 AM
8	There are no rights or wrongs, but it will be shorter and therefore cheaper, but possibly higher risk because of the river hydraulics and fluvial geomorphology. Access for construction will be tricky and the town side abutment condition is not known. It is not, however, a thing of great beauty - more utility. The graphic shows a pathway continuing eastwards - is that actually in the plan?	3/8/2021 10:29 PM
9	I think having it cross from the esplanade makes a lot of sense	3/8/2021 10:11 PM
10	Original position	3/8/2021 9:31 PM
11	Not very keen have the Clifton road being closed off	3/8/2021 9:23 PM
12	The shorter span is a financial choice. The sea wall is eroding and will at some stage need to be rebuilt at great cost which in the end will make this option the most expensive	3/8/2021 11:20 AM
13	The bridge is iconic where it is therefore it should be replaced where it currently is Better parking There would be too much congestion where it is proposed by traffic deliveries etc Also the people of Lossiemouth have already spoken & been listened too & the choice was to put new bridge where old bridge is currently	3/8/2021 11:04 AM
14	The East Beach is popular for its size, safety and situation and is a valuable asset to Lossiemouth and the area as a whole. For over a century it has been accessed by an iconic footbridge which appears in many publications associated with the Moray coast. This now needs to be replaced. A short term solution is not realistic and careful consideration must be given to the location of a replacement bridge. The lifespan of the breakwater and material state of the foundations to the esplanade make them unsuitable for locating the bridge there, and anyway that would increase traffic and footfall and need for parking in this area. There is a small car park at Station Park suitable for present short term use, and larger ones are at the bottom of Church Street and by Seatown mobile home site. The Church Street park has been the most used for access to the bridge and many users of the bridge stay at the adjacent mobile home site. Option 5 from Seatown Road meets all requirements and is my preference. This option would not overshadow the old structure which could remain as a feature to Lossiemouth.	3/8/2021 10:39 AM

15	I think it should stay where it is	3/8/2021 10:04 AM
16	Option 3 seems a better option for longevity and safety for the bridge and the public	3/8/2021 9:59 AM
17	Whilst this is the cheapest option I believe it to be the worst of the 3 presented, this is on the basis of congestion and pedestrian safety,	3/8/2021 9:04 AM
18	I feel that option 4 would best suit the town, assuming that the esplanade can be fixed up as well as it is in a poor state of disrepair at the moment. It would be great to see a small section of Clifton Road pedestrianised so that a cafe culture could be introduced, also allowing kids and families peace of mind from 'boy' racers. Take a look at the seafront, the blue mural is looking very tired as is a lot of the seafront, not a great welcome to visitors when they are eventually allowed to return Option 4 is my preferred choice, however ANY bridge would be just fine for me	3/8/2021 8:32 AM
19	Option 3 preferred as better protection against the sea with protection from the sand dunes and strong tides. Many people enjoy sitting by the sea front enjoying the peaceful view. The road is busy and parking will be a problem to get to the shops for Lossie best ice cream shops. Worth asking the local fishermen the history of the tides.	3/7/2021 10:10 PM
20	As close to or replace existing bridge	3/7/2021 10:07 PM
21	Would love to see the bridge remain where it is. It will cause so much congestion on the esplanade otherwise. Why change something that's worked well for many years.	3/7/2021 9:52 PM
22	Looks good to me	3/7/2021 8:59 PM
23	I couldn't use the virtual exhibition so have no idea what the preferred option is	3/7/2021 6:58 PM
24	I believe the bridge should be rebuilt in the same position it is currently. It is the safest option, better for roads, traffic and an iconic part of Lossie's tourist industry.	3/7/2021 6:48 PM
25	Option 3 the bridge a new one alongside existing	3/7/2021 5:31 PM
26	Seatown road version will cause least congestion after its conctruction	3/7/2021 4:48 PM
27	Option 3 would be best for Lossiemouth, Esplanade option would be a disaster for that area	3/7/2021 3:28 PM
28	I believe the bridge should remain where it is at seatown. i am totally opposed to it being moved to the esplanade. I have lived in Lossiemouth for 83 years and have seen the dangers of this part of the river. The first big gale and tide will make it dangerous and children have jumped off the bridge for all my lifetime. The currents there are dangerous and people have drowned in that particular part of the river. ha. There is also the awful state of our breakwater and the harbour wall. I have watched it disintegrate over the years and the moray council have done nothing.as for parking. where on earth will all the people park, it is bad enough parking at the shops there now.	3/7/2021 3:07 PM
29	Seatown	3/7/2021 2:52 PM
30	Option 3 - agree with all positives - similar to existing bridge.	3/7/2021 2:39 PM
31	Seaton Road 1st 2nd by original bridge	3/7/2021 2:20 PM
32	The current polace is the obvious choice, repair or replace. The esplanade is great for ice creams, but too far away from car parks and public conviences. Although apparently not asked, the Seatown road option is 2nd best, near car parks, near conveniences and near the ice cream shops. Didn't the original esplanade bridge wash away?	3/7/2021 2:08 PM
33	I prefer the option 3	3/7/2021 1:59 PM
34	I think the preferred option is the worst option. There is very little parking there and from spring to autumn it is chaos with traffic coming to the 2 ice cream shops and restaurants. Also the preferred option doesn't seem to take into account high tides as that part of the beach is often cut off from the rest of the beach at very high tides. Also the general condition of the esplanade is poor, with uneven slabs and erosion underneath that I wonder about the lifespan of the current esplanade.	3/7/2021 1:26 PM
35	Option 5, I feel would be the preferred option, reason being, it would remove some of the congestion, that would occur at the Esplanade site.	3/7/2021 12:58 PM
36	Option 3 is by a country mile the best. And why have you such a small box for feedback - it's	3/7/2021 12:34 PM

	unhelpful to not see all of my text.	
37	Concerned about impact on parking on Clifton Road.	3/7/2021 12:22 PM
38	Option 3. Some concerns it may be so wide that motor cycles etc can gain access.	3/7/2021 12:09 PM
39	Preferred option is bridge should be built in seatown.	3/7/2021 11:42 AM
40	We prefer it due to cost and accessibility.	3/7/2021 11:39 AM
41	No. It may be cheapest but will have a negative impact in town. Politically its in your interest to get Holyrood to stump up the extra \pounds 0.5m fir the next option up.	3/7/2021 10:44 AM
42	Option 3. I was under the impression this had already been voted on and agreed. It is the best option by far. A bridge from the Esplanade would be lucky to still be standing in months let alone decades given the current tides and rising water levels. oPYIONO	3/7/2021 10:39 AM
43	I don't agree with the preferred option. The bridge is very open to the tides which may cause issues with the bridge. It would be a dangerous place if youngsters were to jump off as it's very near the mouth of the river. The esplanade will become over crowded as most people will try to park there rather than walk to the car park	3/7/2021 10:36 AM
44	I like it	3/7/2021 10:13 AM
45	Option 5	3/7/2021 10:04 AM
46	Completely disagree with this option, bridge should be located at existing site. After nearly two years of discussions it must be obvious that from a safety,roadway and parking perspective the existing location is the only sensible solution! This is much too important for the future of Lossiemouth to allow only financial criteria to influence a decision.	3/7/2021 9:59 AM
47	Option 4, more aesthetically pleasing.	3/7/2021 9:58 AM
48	Option 4 is most cost effective and the best fit for economic and social benefit	3/7/2021 9:58 AM
49	Option 4 so less distribution to locals on church street.	3/7/2021 9:46 AM
50	We like the idea of it being on the front, easily accessible, good for local traders and quite a bit of savings compared to other options.	3/7/2021 9:34 AM
51	As a resident of Clifton Road, I live above Rizza's Ice Cream shop, the preferred option would make parking a even bigger nightmare than it is already. Throughout the summer it is almost impossible to park close to my home to unload shopping. I would love to see parking improved, why not take away the pavement along the riverside of the road and have cars parking nose in like the beach boulavard in Aberdeen? That would almost double the parking and people would still have a pavement to walk on the esplanade	3/7/2021 9:24 AM
52	Keep bridge where it is now	3/7/2021 9:10 AM
53	Should stay where it is nowle	3/7/2021 8:58 AM
54	Bridge in existing space, the parking around the esplanade is already dangerous at the first hint of nice weather this will only make it worse.	3/7/2021 8:34 AM
55	Option 5 feel its the middle option that would carry the most benefits. Not to far from car park and close to amenities.	3/7/2021 7:16 AM
56	5 seatown	3/7/2021 7:09 AM
57	Looks great and seems to be preferable in the 21st century.	3/7/2021 5:05 AM
58	The preferred option if it was the first access built to the beach is sensible. However there is a iconic stature to the existing location and an strong emotional connection from the community and wider in Scotland. Time and again when an iconic landmark fails, I feel the selection criteria has not taken two things into account, emotional connection but from a engineering safety perspective this design is not ALARP, you have traded cost and safety. There will be increased likelihood of pedestrians being hurt by the concentration of increased traffic. Not only have you chosen the cheapest but you also have added a commercial aspect of connecting existing retail. Again you are trading cost/commercial aspects ahead of public safety.	3/7/2021 12:07 AM
59	Seatown bridge, bridge from esplanade won't last	3/6/2021 11:19 PM

60	It will only be a good option if something is done to then deal with the traffic on Clifton Road, at the moment on a beautiful summer day it is heaving, people walking everywhere and the road is so busy so if the route to the beach is also there it will greatly increase the traffic. I know there are two car parks which could be used but ultimately many will not use them as they'll want to park as close to their destination as possible	3/6/2021 10:22 PM
61	The idea of making that area busier with vehicular traffic is concerning.	3/6/2021 9:14 PM
62	I understand cost is important. But I feel next to old one would continue the iconic look it's famous for.	3/6/2021 9:14 PM
63	Parking at the esplanade is a nightmare already and too many lazy people won't walk round from car park. Esplanade is falling to bits so will have to be upgraded to cope adding to cost . Breakwater is also in a sorry state and not up to job of protecting bridge in new position. Not to mention the iconic side of the bridge at moment . So I think bridge should be rebuilt where it is now.	3/6/2021 8:30 PM
64	Original position with car park nearby	3/6/2021 8:25 PM
65	2	3/6/2021 8:15 PM
66	I think it's the wrong option for the wrong reasons. It will be exposed to all poor weather, making a mockery of the design openness, it concentrates all traffic to one area of the town and it is as far away from the caravan/holiday park as is possible. This will not increase footfall for local business, it'll drive people away	3/6/2021 7:59 PM
67	Need one where the existing bridge is. I fear if its moved to where the shops is people will park there and shops will lose custom	3/6/2021 7:15 PM
68	Seatown is preferred option as parking is easier as won't cause issues unlike if on the Esplanade.	3/6/2021 7:03 PM
69	I have no preferred option, I am happy with what the majority of residents want	3/6/2021 6:55 PM
70	New bridge to stay where it is the parking issues will be huge if we move it to the front	3/6/2021 5:59 PM
71	where the old bridge is	3/6/2021 5:39 PM
72	It should preferably be where the current bridge is. The option to seatown road is a possibility. It should definitely NOT be on to clifton road opposite Mieli's. This would be a disaster for drivers and pedestrians on Clifton road. Also in the 70s a small fortune was spent to put a new breakwater on the beach, in line with the pier. It did not last one year and was washed away in the first big storm.	3/6/2021 4:43 PM
73	Preferred by whom? I don't think it's a suitable site, due to lack of sufficient local parking. Station Park car park and Clifton Road at Esplanade are busy enough on a normal summer day without hordes of people accessing the beach. Large parking area at Seatown near canal will be underused because a lot of people simply won't walk any distance.	3/6/2021 4:25 PM
74	Option 4	3/6/2021 4:15 PM
75	I would choose the preferred option of a new bridge from The Esplanade.	3/6/2021 4:05 PM
76	Bridge at the Esplanade	3/6/2021 3:26 PM
77	I do not approve of that location, especially considering the storms we have had in the recent past.	3/6/2021 2:27 PM
78	Where the old bridge is at the moment.	3/6/2021 1:59 PM
79	Wrong location - wind and tide damage. Esplanade itself is crumbling into the Lossie. Cheapest is not always best – the community deserves a Briggie that will last another 100+ yrs and not one that will be impacted by wind and tide as that location is adversely prone to be. It is also not the location the respondents to your previous survey published in Dec 2020 wanted the bridge to be. Clifton Road cannot cope with further increase in traffic and already has traffic calming measures in place. People are inherently lazy – they already double park to get an ice cream can only imagine what it would be like on a fantastic summer day with 2000+ on the beach. The existing location gives space for thinning out of footfall with no issues on footpath even on the busiest days – the car park being down a bank which allows the slower walkers to fall a bit behind the quicker. What price to the businesses at the Pitgaveny Street	3/6/2021 1:00 PM

	End of Clifton Road, here will be no avaibale parking for the services they provide to the community with a bridge on the Esplandae - one of whom is the only dentist in the town, we also have hairdressser and physio as well as clothing sales in a hub type location.	
80	Option 4 - to the Esplanade, could provide easier link between the beach and local shops - increasing footfall and adding to local economy	3/6/2021 11:20 AM
81	Option 3. I don't believe that the esplanade is safe and will need extensive work to make it safe. Corner also about the safety and age of the breakwater and potentially a bridge on the esplanade may not survive high tides and break water. Finally traffic on Clifton road would have to be managed and older folk may struggle to get to local shops etc	3/6/2021 11:06 AM
82	I think that having the bridge crossing from the promenade will incur alot of congestion on Clifton Road and may be a danger aspect when pubs in the area come out and drunk people decide it might be fun to jump from the bridge.ide to	3/6/2021 10:59 AM
83	Disagree with this option. Bridge should be near the old bridge. The view is iconic.	3/6/2021 10:57 AM
84	Sad to see you are even considering moving bridge to the esplanade side. Traffic, parking will impact houses and businesses on the front.	3/6/2021 10:41 AM
85	Agree with the preferred. Will increase footfall for local shops	3/6/2021 9:33 AM
86	bridge needs to go where current bridge is. for all the reasons previously given. parking issues, congestion on clifton road etc	3/6/2021 8:34 AM
87	I think either running parallel to the current bridge or the one going from the corner at Seatown are the better options because they're closer to the current car park. If the option closest to the shops was chosen it would create so much congestion with people trying to park there and make it less safe for cyclists and pedestrians. It also has the potential to create more litter onto the beach. Generally, as it was, people have finished their snack by the time they get to the beach and have binned it before crossing the bridge.	3/6/2021 8:28 AM
88	On its present place	3/6/2021 8:25 AM
89	Good location and good design	3/6/2021 8:25 AM
90	I am concerned about the distance from parking facilities and safety because the road is so close. I feel the Seatown option would serve the town better.	3/6/2021 8:06 AM
91	To make such a decision based on cost is crazy. The residents of this town know what is best for this town. There are legitimate concerns about the esplanade site. The tides are fast moving and the breakwater has a limited life expectancy. The esplanade is old and also decaying. The bridge must remain in its current place. The congestion in Clifton Road will be unacceptable and have a negative effect on businesses. Il	3/5/2021 11:18 PM
92	New Bridge should stay in its current location	3/5/2021 11:14 PM
93	Would prefer the option that puts the new bridge next to existing one. Prevents congestion on esplinard by making use of east beach car park.	3/5/2021 9:42 PM
94	Replace where bridge is	3/5/2021 9:13 PM
95	Option 3	3/5/2021 8:24 PM
96	Would prefer for the bridge to be built alongside the existing one. There is better parking in this area and the previous bridge from the promenade was unsuccessful.	3/5/2021 8:20 PM
97	Option 4 preferred	3/5/2021 5:56 PM
98	will connect the amenities the cost is good lets go for it	3/5/2021 4:49 PM
99	Present position	3/5/2021 4:01 PM
100	Option 3	3/5/2021 3:59 PM
101	I prefer the Esplanade option. It will be a real focal point for locals and visitors alike, close to local amenities and services, and attract much needed tourism to the area - not just in summer, but with imaginative marketing, as a year round destination.	3/5/2021 3:18 PM
102	Crazy - parking on Clifton Road not easy at best of times, much easier access at current position of bridge.	3/5/2021 2:28 PM

103	My preferred option would be option 2 as I disagree with moray council on there choice as I think it would spoil the look of the beach from the promenade also with the width of the new bridge u are going to get bikers zooming across it as they used to do with the old bridge even though it is narrow the old bridge just needs upgrading and for some firm engaged to maintain it year by year which would work out a lot cheaper than a new bridge as everyone I spoke to who lives in the seatown as I do would be much happier with that option	3/5/2021 12:43 PM
104	I do not agree with its location	3/5/2021 12:26 PM
105	Option 4 would be a nightmare trying to park, I prefer option 3, although costly it would be nearest to the existing car park, and would not cause any traffic jam.	3/5/2021 11:01 AM
106	Seems to be solely based on cost, I would prefer option 5 as a more equitable solution to residents in Clifton Road and the visitors to the caravan site.	3/5/2021 10:59 AM
107	Option 2 Seatown Road my preferred option. I needed more info on why 1 was your choice other than cost?? 2 may well be costlier than 1 but by far the most sensible site in terms of pedestrian safety, traffic flow along Clifton Road, it is closer to the large ready made car park, still very close to the promenade amenities and will have less detrimental effect on river flow in the future.	3/5/2021 9:37 AM
108	Prefer the minimalist option, just replacing it as it was and keeping the heritage of the area intact. It's true it will need replacing again sooner than the other options, but I believe it would be possible to find the money again, particularly if an ongoing fund was started. The other options were too much and some were downright ugly. The structure should be composed mainly of wood and have a minimum span and be unobtrusive.	3/5/2021 8:17 AM
109	Option 4	3/5/2021 7:23 AM
110	Increased conjestion on Clifton Road, danger of children running across the road for ice cream. It.may be the cheapest option but could work put the most expensive in the end due to the edplanade requiring work.e	3/5/2021 12:29 AM
111	Moray council	3/5/2021 12:17 AM
112	Option 3 alongside current location	3/4/2021 10:47 PM
113	I like the concept but am concerned that having two bridges up would ruin the view. I would be interested to see a concept view from Prospect terrace.	3/4/2021 9:30 PM
114	I am worried about the state of the Esplanade, will it hold the weight of the bridge, and of the sea wall which is known to be in very poor condition with a very limited life span. The unknown future of Station Park is also a concern for the preferred location. The limited parking on the esplanade is also a concern.	3/4/2021 8:53 PM
115	I am desperate to see a bridge built and weary of the very slow speed of development. I would prefer the sea town option.	3/4/2021 7:55 PM
116	This location seems very exposed to the wind and tides compared to the existing location. I think it will feel more risky to cross in bracing weather. It reaches the Esplanade at a point where there is a lot of footfall anyway. I think the location further along would be better.	3/4/2021 7:11 PM
117	I'd like to know if there is anything in the plans about removing the old bridge? To leave it to rot would cause an eyesore and a danger. I hope sufficient advance planning is put in place to deal with parking issues, and not just choosing the cheapest option.	3/4/2021 6:46 PM
118	I prefer replacing the old bridge in situ	3/4/2021 6:43 PM
119	Why move it to a main busy road? It would be much better left where the old one is and keep its its historic picturesque view	3/4/2021 5:08 PM
120	Prefer option 4 but think option 3 based on cost	3/4/2021 4:14 PM
121	As close to the old bridge seems to make sense. If it really has to go to the the esplanade then something should be put in place to stop beach goers parking on the road	3/4/2021 3:12 PM
122	The Bridge should go back where it was, near parking for families carrying things.	3/4/2021 2:12 PM
123	Option 4. When I saw the photo it looked so ugly and spoils the whole view. There would be too much congestion, parking problems, dangerous if people wandered around area. Safety of	3/4/2021 2:08 PM

	the public. The only thing going for it is it is the cheapest option. All the negatives listed.	
124	I think basing the choice on costing is a poor decision. Buy cheap, buy twice is my experience. I'm not convinced that siting a bridge in a location that has previously proven perilous to the structure is a good idea, especially during an ongoing, and escalating climate emergency with dramatic, unprecedented climatic events. Take heed from the learnings from over 100 years ago, and site the bridge in the existing sheltered area, rather than the area most likely to be battered by winds and waves. Perhaps the cost of this option could be reduced if the foundations of the existing bridge can be used? Not the 'do minimum' approach, where we paint over the cracks, but an option which allows the structurally sound parts of the old bridge to breathe life into the new bridge, saving money, but offering a sheltered location.	3/4/2021 12:26 PM
125	*your, the preferred option does not set out what it does with the existing structure	3/4/2021 10:32 AM
126	I think the Seatown or the Esplanade would be a good option however I understand that there is a preferred option already in mind which is the Esplanade one. Although I recognise the easy way to reach the amenities and shops located at Clifton Road, I strongly believe this must be reviewed. There is already a big issue in parking at Clifton Road during busy periods, including cars being parked on private car parking without contentment and even worse, cars are parked on pedestrian crossing. Unless there is a VERY GOOD parking planning in place, I would not be in favor of the Esplanade bridge simple because of car parking conditions and nothing else. I think the bridge is viable there and fits the environment from a practical and aesthetical ways. I reside in Clifton Road (in the Promenade area) and I saw how people has not abide the rules and ethics are something unknowing for many of them. Another factor to be considered is that shops are going to be busy with people outside, the number of pedestrian will be massively increased. Again, please highly consider the car parking/pedestrian use of the space and though car parking regulation.	3/4/2021 9:33 AM
127	Over 60% of people surveyed preferred the exisiting location. I think people will park on the Esplanade rather than in the car park which will have a negative impact on the shops there as the parking spaces will be filled all day rather than by passing trade. An earlier bridge was washed away from that location!	3/3/2021 11:33 PM
128	I like option 5 as close to toilets and closer to car park but cost wise option 4 seems to make more sense	3/3/2021 10:19 PM
129	The preferred option I think is a good placement for the bridge. It will make access to the beach and shops alot easier and feel more connected compared with where the old bridge is situated	3/3/2021 10:14 PM
130	Stick to original site. Esplanade has potential traffic issues, plus tidal damage etc.	3/3/2021 8:15 PM
131	Should be situated where the old bridge is. Parking will be a nightmare	3/3/2021 6:49 PM
132	Happy to get back on beach	3/3/2021 6:25 PM
133	The original area would be best option	3/3/2021 6:05 PM
134	I approve of the option chosen but there must be strict parking controls put in place in front the old granary restaurant in front of Miele's shop, Rizza's etc.	3/3/2021 5:10 PM
135	Seems more accessible & a replacement bridge is needed	3/3/2021 4:41 PM
136	FB page	3/3/2021 4:11 PM
137	Happy to have access to beach reinstated	3/3/2021 4:05 PM
138	I would prefer where it is now!	3/3/2021 2:42 PM
139	My option would be 3- a new bridge where the old one is. To put a bridge near the esplanade gives rise to traffic and parking problems during times of congestion - this is a busy stretch on non-sunny days. Too easy an access to the beach from the pubs etc will only encourage drinkers to access the bridge/beach late at night risking their safety. The tidal water is unpredictable and the reason it is at Seatown is because previous bridges were destroyed - heed the lesson of history.	3/3/2021 11:49 AM
140	Option 4 best one for everyone	3/3/2021 11:26 AM
141	Option 4 - cheapest	3/3/2021 11:25 AM
142	Option 4 - cheapest and with maximum visibility	3/3/2021 11:23 AM
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143	Appears to be most suitable for everyone	3/3/2021 11:21 AM
144	I don't think that location is the best option, where the current bridge is is much better due to there being a car park there already, putting the bridge on the esplanade will add massive congestion issues	3/3/2021 10:34 AM
145	New bridge at seatown	3/3/2021 10:28 AM
146	Replace existing bridge at present location with minimum re-development of the area other than an upgrade of present facilities	3/3/2021 10:20 AM
147	Option 4 looks perfect as it is closer to public transport and to public conveniences which is good for out of town visitors to the beach, also the proximity of local shops is good from a business point to possibly generate more income. There is also the historic factor - the original crossing was situated here	3/3/2021 8:45 AM
148	Option 5 would be a suitable choice as its a mix of the best attributes of both the other bridge options.	3/3/2021 7:32 AM
149	option no. 5	3/3/2021 7:31 AM
150	no.5 best for traffic flow	3/2/2021 11:33 PM
151	Least favoured option by myself and local community. Traffic will be a nightmare. Parking will be a nightmare. Infrastructure at promenade will need upgrading has this been factored in? The area of promenade will become too busy - it gets pretty busy as it is danger for kids crossing the road to ice cream shop etc. I like sitting with my family to eat ice cream in the steps at proposed start point - the new bridge will stop us doing that and will ultimately spoil the view. Concerned the end point in east beach is prone to erosion has this been factored in?	3/2/2021 10:42 PM
152	Option 3 or option 5. I think 3 is the best option, car parking nearby, close to the iconic old bridge which will fall into disrepair and probably need removed. Sheltered spot so safer to cross at that point. I consider access from esplanade on Clifton Road as a potential nightmare for traffic and pedestrians crossing. Attempts to restrict this would probably impact on residents vehicular access in the area, increase inconsiderate parking in the area and see traders impacted if there is no short stay parking.	3/2/2021 9:44 PM
153	Not happy with preferred option. Would much prefer option 3 to replace existing bridge same location	3/2/2021 9:22 PM
154	Me personally would love to see the new bridge going up on the front but only if they didn't pedestrianise the road in which will kill the front businesses if there's no option then go back to the remaining bridge and like for like access there with the car park close by ?! We have to think out the box here this is a huge step in Lossiemouth community of people and the well-being of a successful village and holiday town but could be destroyed over night if the correct decision is not made.	3/2/2021 8:54 PM
155	Option 3	3/2/2021 8:52 PM
156	Where are customers from surrounding business now going to park? It is already full on most occasions where the beach is not available to access and will be dangerous and overwhelmed to people that enjoy the esplanade because of people parking to get to the beach. My parents are disabled and struggle to walk the short distance from they can park if they get a space are people of Lossiemouth in the same need supposed to just not use this part of town now as for definately they will not get parked at the height of summer.	3/2/2021 8:11 PM
157	Keep the bridge in it's current location	3/2/2021 8:01 PM
158	Option 3 is my choice	3/2/2021 7:42 PM
159	Concerns over rise in vehicles, parking issues and traffic at the preferred new site. Perhaps the road could be blocked off and turned into pedestrians only. Much prefer the option of a new bridge at the existing site despite the additional costs.	3/2/2021 7:11 PM
160	Will the old bridge be removed or will it be retained as a feature. Will there not be a cost associated with this. I can not see that costing in the design options. I do think the option on the Esplanade siting is good as it is closer to amenities . I wondered if more parking would be provided , or if you would make do with the existing arrangements. I hope that more facilities	3/2/2021 6:50 PM

for visitors will be put in place. Extra dog mess bins are always required. will there be new bins placed on the sandbar now ?

161	Absolutely not. It is on a main road with a sea wall in poor condition. A definite no from me.	3/2/2021 6:41 PM
162	Terrible it should be were it originally was not where problems will be created at shop end	3/2/2021 6:34 PM
163	Want the bridge to stay where it is and keep Clifton road open to traffic as closing it off bad news for business bad news for elderly popping down for an ice cream and bad news for the bus route let's face it Clifton road brings all Lossiemouth together	3/2/2021 5:28 PM
164	The east beach option is the best option for the people and Visitors to Lossiemouth. Great beach access for all users. Lossiemouth is one of the best Surf beaches in Scotland and should be used to morays councils ability to push it forward as a go to town for surfing. Improve the shops and lower rents for Cafes and shops, gift shops, take a visit to Newquay, see how they do it. It could be the best thing Moray council could do. The "Staycation" is going to be big for the next few years as tourism abroad recovers time to take a grab at that big chunky wedge that Surfing brings to coastal Resort's. best	3/2/2021 5:21 PM
165	Option 3 provides safe access to the beach with nearby parking. The dunes provide shelter from strong winds. The current is not so treacherous at this part of the river. es shelter	3/2/2021 5:08 PM
166	Option 3 good position	3/2/2021 5:04 PM
167	Good option	3/2/2021 4:26 PM
168	Option 4	3/2/2021 4:09 PM
169	Parking will be an issue if the bridge is anywhere else apart from where it was. That road is already a nightmare in the nice weather without adding additional traffic.	3/2/2021 4:05 PM
170	Poor. It concerns me that Clifton Road would have to be pedestrianised, and that increased costs would be incurred if the esplanade needed repair in t of a flood	3/2/2021 4:03 PM
171	Option 3, local seatown to beach	3/2/2021 3:48 PM
172	I don't believe the option of taking the bridge over from the esplanade is a good idea. I can see some benefits but I believe these are outweighed by the problems likely to arise in the future. On the esplanade side the street is very likely to be pedestrianised which will have a serious knock-on effect on the businesses there. Unfortunately, immaterial of any nearby parking provision, many people simply won't park and walk. Pedestrianisation could cause rat-runs to the detriment of people in other parts of the town whereas very few actual dwellings are affected meantime with the bridge where it is. The breakwater is in a very poor state of repair and Moray Council is unlikely to rebuild or even repair it. That could destabilise the area at the other end of a bridge. This is also a fairly dangerous area of water at certain times of the tide and, although safety rails will be adequate, it's very likely that some adventurous youngsters would dive off the bridge into the water with serious consequences. Obviously that could happen at the other site but the currents are less fierce there. A compromise may be taking the bridge across from where the toilet block is but it has worked perfectly well on the current site for all those years does it really need to be moved?	3/2/2021 3:38 PM
173	Replace on line of old bridge	3/2/2021 3:02 PM
174	This is the cheapest however will require upgrading of the esplanade wall potentially at additional cost. I question the long term viability and protection of the sea side of the bridge as it will be vulnerable to sand, sea and dune movement / erosion and lacks a degree of protection. I understand that this is not the public choice from previous informal surveys. I do not agree with this as the preferred choice and would recommend option 3. There is arguably a logical reason why the bridge has withstood time in its current location.	3/2/2021 2:38 PM
175	Would prefer if new bridge was situated nearer the existing bridge	3/2/2021 2:22 PM
176	A pdf would have been far easier to look at and more accessible. The souvenir stalls sound completely tacky as does the advertising boards. It's 2021 not Blackpool in the 80s. No one wants lots of takeaway stands with all the associated litter. There are too many fast food venues already. Why not concentrate on the bridge and the engineering and make it beautiful. Engineering historically made the area affluent and good engineering lasts.	3/2/2021 2:07 PM
177	Same as original bridge.	3/2/2021 1:51 PM

178	Preferred would be like for like but this isn't offered so option 3.	3/2/2021 1:41 PM
179	Think the Esplanade is wrong location.	3/2/2021 1:33 PM
180	Existing position	3/2/2021 1:09 PM
181	Looks very good	3/2/2021 12:51 PM
182	Option 4	3/2/2021 12:37 PM
183	The preferred option will kill local businesses that are situated on the esplanade as if the road becomes pedestrianised, customers will not have access to parking which can have a huge impact on accessibility.	3/2/2021 12:09 PM
184	Bridge looks nice only concern I would have would be if the bridge was thear would be parking and cars going up and down the street looking for a place to park	3/2/2021 11:53 AM
185	Please leave new bridge where it is now.	3/2/2021 11:47 AM
186	No 2	3/2/2021 11:33 AM
187	That was my favourite option too. It's aesthetically pleasing and easily accessible.	3/2/2021 11:27 AM
188	When you are replacing an iconic bridge such as this you need to be ambitious with you design and I d not see this with the preferred option. chosen because of cost rather than suitable position. I worry about the crumbling sea defenses nearby and will we then have to spend extra several million on these just to protect the new bridge. I feel closer to the existing position would be better for the aesthetics of any replacement especially when viewed from further afield. Also much better for parking which is critical to and decision as the majority of users would drive to use the beach access.	3/2/2021 10:40 AM
189	The existing bridge should be replaced with a wider footpath as it is in a protected position with good parking facilities nearby.	3/2/2021 10:33 AM
190	Option 1 Do-nothing, better for wildlife and reduced littering on the beach	3/2/2021 10:24 AM
191	My preferred option would be at the location of the existing bridge - option 3. Appreciate the design has not been fully carried out but the option preferred in the presentation would be unusable at high tides. The end point on the beach is too exposed to the sea and would be subject to the influences of both sea and river. A bridge at the existing location only has to worry about the river. Also the dunes at the beach end are the most dynamic and everchanging. They can almost disappear at times and then reform at the size depicted on the	3/2/2021 10:11 AM
	presentation. I am a Lossiemouth resident of 53 years and stayed ate the river mouth area for over 30 years.	
192	presentation. I am a Lossiemouth resident of 53 years and stayed ate the river mouth area for over 30 years. Option 3. Otherwise it will create too much 'traffic'	3/2/2021 9:58 AM
192 193	presentation. I am a Lossiemouth resident of 53 years and stayed ate the river mouth area for over 30 years. Option 3. Otherwise it will create too much 'traffic' Not keen on this position as it is remote from the carparking	3/2/2021 9:58 AM 3/2/2021 9:38 AM
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	have an issue with, and have not had an issue with for the last 100 years. Cheapest is not always the best option. An additional thing to note is, as you say in the cons list is pedestrian safety. Have you factored in the costs of guard rails to the esplanade? Along with the life costs of these too? Option 3 is by far the superior option. It is an existing location, so there are no new long term issues that you need to be worried about. It will be no worse than it was before. Have you considered using parts of the existing bridge that are still in good condition? Sourcing local help and contracts rather than outsourcing? You list a con as " existing footway from car park is narrow" again, no worse than it was before, and I think people have managed over the last ten decades or so. Also, I come from just outside of London your road traffic is laughably minimal. The road in question is not a through road either. The council really needs to reconsider their preferred option for a new bridge, and not just choose it because it's the cheapest. I once chose a cheap fork for my mountain bike Fast forward to a week later and I had a £1500 dentist bill. You buy cheap, you pay twice.	
201	The preferred option in my opinion is a no go due to the impact on the Esplanade it should be replaced by the present bridge close to an existing car park.	3/2/2021 8:06 AM
202	Not a good choice as no nearby parking. Will cause congestion.	3/2/2021 7:57 AM
203	The bridge from the esplanade would be disastrous and we would be back in the same situation in no time with no beach access after a few rough and high tides wreck the bridge or completely undermine the foundations. The congestion on Clifton Road will be unmanageable. The Seatown option is much better where the old bridge is: less tidal, car parking, pedestrian safety. Going for a cheap option will cost more in no time.	3/2/2021 7:51 AM
204	Option 3 . Parking on the esplanade is already a joke and for us the residents who live on the front this means when it comes to us wanting to park outside our homes we will not be able to with ease. There is already parking less than 50 meters from the original bridge and is perfectly located for everyone with no steps between the current car park and original bridge.	3/2/2021 7:33 AM
205	I would like the existing bridge to either be repaired or a new one built in its stead. Parking on the beach front is a nightmare for residents and building a bridge on the esplanade will only add to this. The noise will be a misery for local residents. Please repair or replace the existing bridge.	3/2/2021 7:31 AM
206	The proposed bridge from the esplanade would be a great boost for local businesses	3/2/2021 7:23 AM
207	Keep the bridge where it is!	3/2/2021 7:11 AM
208	Think bad idea with the swell under there at high tide going be disastrous when they jump of bridge like they do straight into difficulty. Parking will be a nightmare too.	3/2/2021 7:01 AM
209	Wrong place, too busy and poor parking in this area already. Also will this be accessible at high tide? People in moray have said they want the new Bridge situated where the old one is. Are you listening to them? Personally option 3 or 5 would be my preferred choice.	3/2/2021 6:44 AM
210	I think its a mistake to install in this location. Increased traffic down an already busy street will deter residents rather than encouraging. Also, kids will jump off this bridge into the fast flowing currents into the mouth of the river. The bridge shouldn't be in this location unless further infrastructure is installed.	3/2/2021 6:26 AM
211	Esplanade appears to have been picked as cheaper option, does look good though & good access. But the negatives tide risk, damage, traffic, parking is not addressed in why this is picked & if concerns unwarranted., and what could the hidden cost be of the existing walls being made good to use is indeed if it cannot support the bridge relocation this is a big concern if cost is picking this option, as it could actually be the most expensive Actually like the new Seatown option if funding could be got - as wide access for all, nearer the car park. Tide less impactful. Indeed options at seaton seems to have less disadvantages (other than cost) and gives closer access to beach than esplanade option which seems to have higher negative traffic/tide/parking issues. Ultimately think we just need a good & usable bridge asap, whichever location is deemed best to last long term.	3/2/2021 6:05 AM
212	I feel the best place for the bridge is where it currently exists.	3/2/2021 4:45 AM
213	Number 1	3/1/2021 11:50 PM
214	I love the location but not a fan of the design at all. It starts well into the pathway. And beach side, it goes on far too much onto the beach and the black either side is really unsightly	3/1/2021 11:34 PM

215	Preferr to see it replace the old on in the same site	3/1/2021 11:32 PM
216	Totally opposed to it. Whilst it sounds very appealing it will impact negatively on business. There will inevitably be the closure of Clifton Road to traffic. The consequences will also mean a rat run up the brae and down quarry road. The esplanade is not in a good way, structurally it is 50 years old and is not equipped to cope with increased football. The breakwater is in a desperate condition and is not expected to last more than a few years. It is ultimately protecting the river mouth and Clifton road. High tides will be a huge risk to that part of the river without the breakwater. Replacement will be upward of £3million. In its current position the bridge is simply iconic. It can be reached easily and does not create congestion on our busy esplanade area. It is the view of the greatest majority of our community and our views should be of primary importance. There is no costing for refurbishment of the existing bridge. Why not? This could be done and the SG funding included this option. Lastly, hugely disappointed in the lack of transparency and openness on this process. This is not the secret service but is important to our lives.	3/1/2021 11:28 PM
217	Think it is great idea for access to shops and toilets	3/1/2021 11:23 PM
218	Will ruin businesses	3/1/2021 11:17 PM
219	Option 3 is my preferred option. The other 2 new builds have some very weak negatives. Looks like the decision is being made on cost of build alone.	3/1/2021 11:02 PM
220	Seatown unless station park is to be developed then I would prefer esplanade location	3/1/2021 11:01 PM
221	Do not pedestrianised the Clifton road as this will have a massive effect on businesses	3/1/2021 10:58 PM
222	Do not close Clifton road as it will be a big effect on businesses.	3/1/2021 10:56 PM
223	Don't know yet	3/1/2021 10:55 PM
224	Do not close Clifton road as it will be a massive effect on businesses	3/1/2021 10:55 PM
225	Think we should be aloud cars on the street don't think it would be a good idea to keep lossie as it is why keep change it	3/1/2021 10:51 PM
226	The preferred option is the worst option and only based on cost. The replacement should be as close to the original bridge as possible.	3/1/2021 10:51 PM
227	Do not close Clifton road as this will be a huge affect on businesses	3/1/2021 10:48 PM
228	Do not want Clifton road closed down. Will have a big affect on businesses	3/1/2021 10:43 PM
229	Do not close Clifton road , I have worked in restaurants opposite bridge for 30 years, I think this would affect the business, if there was no parking.	3/1/2021 10:40 PM
230	Terrible idea. It will create too much traffic in that area, too many people on espalande and dangers of kids running staright across from beach to ice cream shops. Should stay in the existing position, either repair old bridge or put new one next to it.	3/1/2021 10:35 PM
231	Do not want clifton road pedestrianised	3/1/2021 10:35 PM
232	I think it's ridiculous to pedestrian Clifton road Lossiemouth will be nothing with it closed to the public our family have been in business here for 40 years and I know for a fact if this happens we will have no trade	3/1/2021 10:31 PM
233	Don't think bridge should be on Esplanade. Should be as near to where original bridge is as possible	3/1/2021 10:17 PM
234	Esplanade option	3/1/2021 10:16 PM
235	Wrong option. Clearly bridge should be in current position for road safety and parking reasons.	3/1/2021 10:04 PM
236	Less comments from local residents	3/1/2021 9:54 PM
237	I prefer option 3, a new bridge local to the existing one	3/1/2021 9:51 PM
238	Option 2	3/1/2021 9:46 PM
239	Option 2 where it comes off across from shops and Clifton road. I think it will help business thrive in lossiemouth front too.	3/1/2021 9:46 PM

240	Where it already exists.	3/1/2021 9:43 PM
241	Like It	3/1/2021 9:40 PM
242	I don't really understand how option 4 can be the preferred option as the cons seem to be quite significant. The longevity of the bridge and the safety of pedestrians should take priority over cost. Youngters every summer love to jump off the bridge into the sea, and my fear is that with unknown currents and deep water, the bridge in this location will be dangerous.	3/1/2021 9:40 PM
243	This would be my second choice. Although it is a cheaper option, I believe that positioning the bridge on the esplande would make the busiest part of the town too crowded. The fact that the sea wall is in poor condition suggests that this may become a maintenance issue longer term	3/1/2021 9:37 PM
244	I think a bridge where the existing one is would be the best option, no beach front is already busy enough. Waste ofomey anywhere else.	3/1/2021 9:37 PM
245	Please no arcades	3/1/2021 9:36 PM
246	Definitely not on the esplanade, the breakwater is already in disrepair	3/1/2021 9:28 PM
247	Wrong place, far too exposed to storms. False economy to build there.	3/1/2021 9:25 PM
248	Option 3 new bridge where it is now.	3/1/2021 9:11 PM
249	Not the right place for bridge !! High tide goes way up over this . Will cause traffic issues which will result in loss of business in the prom area . Risk to children with increased traffic on prom !! Bridge would be much better being left in position of existing bridge !! Long term cost not important .	3/1/2021 9:01 PM
250	Don't like it - the bridge MUST be in the current position. Not just because it's an icon of Lossiemouth and the Moray Coast. The Esplanade is not suitable (and needs a lot of work to it anyway) the footfall and not to mention the lack of parking on Clifton Street would not support or be a bonus to local businesses.	3/1/2021 8:55 PM
251	Option 3 - new footbridge local to existing	3/1/2021 8:51 PM
070		
252	Leave it where it is	3/1/2021 8:48 PM
252	Leave it where it is Option 3. New bridge local to the existing	3/1/2021 8:48 PM 3/1/2021 8:45 PM
252 253 254	Leave it where it is Option 3. New bridge local to the existing I would prefer the bridge to stay where it is at the moment	3/1/2021 8:48 PM 3/1/2021 8:45 PM 3/1/2021 8:39 PM
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252 253 254 255 256 257	Leave it where it is Option 3. New bridge local to the existing I would prefer the bridge to stay where it is at the moment Too little detail at this stage to make constructive comment; I feel the preferred would cause a safety problem with the road but I do not like the idea of the seafront being pedestrianised. For this reason I much prefer option 3 to keep to view from the town as similar as possible. Replace the existing bridge. The esplanade will not last before that needs replacing too.	3/1/2021 8:48 PM 3/1/2021 8:45 PM 3/1/2021 8:39 PM 3/1/2021 8:32 PM 3/1/2021 8:26 PM 3/1/2021 8:23 PM
252 253 254 255 256 257 258	Leave it where it is Option 3. New bridge local to the existing I would prefer the bridge to stay where it is at the moment Too little detail at this stage to make constructive comment; I feel the preferred would cause a safety problem with the road but I do not like the idea of the seafront being pedestrianised. For this reason I much prefer option 3 to keep to view from the town as similar as possible. Replace the existing bridge. The esplanade will not last before that needs replacing too. I think if that option was chosen then the breakwater would have to be repaired first	3/1/2021 8:48 PM 3/1/2021 8:45 PM 3/1/2021 8:39 PM 3/1/2021 8:32 PM 3/1/2021 8:26 PM 3/1/2021 8:23 PM 3/1/2021 8:23 PM
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252 253 254 255 256 257 258 259 260 261 262 263	Leave it where it is Option 3. New bridge local to the existing I would prefer the bridge to stay where it is at the moment Too little detail at this stage to make constructive comment; I feel the preferred would cause a safety problem with the road but I do not like the idea of the seafront being pedestrianised. For this reason I much prefer option 3 to keep to view from the town as similar as possible. Replace the existing bridge. The esplanade will not last before that needs replacing too. I think if that option was chosen then the breakwater would have to be repaired first Would be better where the old one is for parking Original place for bridge looks multi user friendly, and wide for on going social distancing issues Option 4 is by far the best and value for money. Either 3 or 5, parking is already a nightmare at the Esplanade, plenty of parking round by original site. Option 4 too exposed 3 or 5 are sheltered by the dunes	3/1/2021 8:48 PM 3/1/2021 8:45 PM 3/1/2021 8:39 PM 3/1/2021 8:32 PM 3/1/2021 8:26 PM 3/1/2021 8:23 PM 3/1/2021 8:23 PM 3/1/2021 8:07 PM 3/1/2021 8:05 PM 3/1/2021 8:02 PM 3/1/2021 7:57 PM 3/1/2021 7:54 PM
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	stunning place to live, work in, and visit	
268	I think there's going to be massive issues with parking with the chosen option. I worry about the bridges long term durability in that position with the river current	3/1/2021 7:37 PM
269	Looks great, cost effective	3/1/2021 7:35 PM
270	Option 4 but concerned about parking, as the road is already busy	3/1/2021 7:27 PM
271	Do not build it there! There is next to no parking compared with the current site. How do you expect people with mobility issues to walk from the market cross all the way round to the esplanade then across the bridge.	3/1/2021 7:26 PM
272	Original position	3/1/2021 6:59 PM
273	To keep bridge in the original place as plenty of parking.	3/1/2021 6:59 PM
274	Concerned the beach footing and platform of bridge is below high water line, blowing sand from the dunes would also accumulate around the walkway on the beach and possibly cover it entirely. If these issues are addressed it is a good design. Would be nice if access could be made for water sports users to the water where the old bridge is to avoid having to walk thru town with surfboards/kayaks etc	3/1/2021 6:58 PM
275	A bridge off the esplanade would cause congestion with traffic etcno car parkthe beach is known to flood at various times of the year. A new bridge in my opinion would be better round the other side to protect it from major weathers	3/1/2021 6:56 PM
276	I live in lossiemouth and find it had to belive that option 4 is the preferred option of the local population. Option 3 would be the preferred option!	3/1/2021 6:33 PM
277	Prefer option 2. Looks lovely and a perfect position	3/1/2021 6:27 PM
278	Option one, replacing original bridge.	3/1/2021 6:21 PM
279	Esplanade as being more tourism and ease	3/1/2021 6:11 PM
280	Esplanade	3/1/2021 6:06 PM
281	I think option 4 is my favourite too. The design is great, being central to Lossie, it will flow really well off the promenade and will further enhance footfall to businesses. It is also cost effective.	3/1/2021 6:05 PM
282	What is the current projected cost of a new bridge, will it come within the budget. Lack of parking and also extremely busy area already on sunny days so why add tho increasing this, when it could be placed near the old bridge, or the old foundations used.	3/1/2021 6:04 PM
283	option 4	3/1/2021 5:48 PM
284	No problem - I also heard from friends	3/1/2021 5:46 PM
285	It is not the public's preferred option. This has been totally made up probably due to it being the cheapest option. Although I do believe this is a good option. Additional work will need to be done on the beach side to raise up and reinforce the area or it will be submerged at high tide	3/1/2021 5:40 PM
286	I'm concerned about the lack of parking for this option. On a nice day the prom is already packed with cars and folk crossing back and forth to the shops and restaurants. Also the close proximity to bars which could lead to people heading onto the beach after a few drinks - not the safest. Its also a pretty fast flowing section of the river. Personally I feel the original bridge location is safer all round.	3/1/2021 5:24 PM
287	Replace existing bridge. The Esplanade would be too busy with traffic and pedestrians. Certainly the most dangerous place to build this.	3/1/2021 5:10 PM
288	The 'prefered solution' (is that option 6?) seems to me to be the best approach Pretty much bang in the middle of the 2 main car parks and ideally situated for folks to nip off the beach to access local business.	3/1/2021 5:04 PM
289	It makes financial sense to go for Option 4 as per the Scottish Government Remit. It is a pity that Option 3(Seatown) is dismissed so completly hence making it difficult for the Scottish Government to go for this option should they be willing to cover the greater expense	3/1/2021 5:04 PM
290	Bridge would be better at the same location. Far better for parking/ crowd control for tourists	3/1/2021 4:42 PM

	and for access to walks.	
291	Option 4 (esplanade) is the cost effective option and will be the focal point of the Town. Nevertheless, the esplanade and its immediate surround and the vehicle-traffic flow will require capital investment to complement the re-positioning of the bridge and to allow easy and safe access. Do the costs for this Option (4) include any expenditure on the esplanade, for example, the platform/base area adjoining the esplanade?	3/1/2021 4:40 PM
292	I love it . The position is more convenient .	3/1/2021 4:38 PM
293	Would like it in its original place	3/1/2021 3:52 PM
294	Excellent. Parking might be an issue but encourages more to walk and will connect brilliantly to shops on the esplanade	3/1/2021 3:47 PM
295	Large distance from any parking other than the already contested esplanade	3/1/2021 3:38 PM
296	Concerned the preferred option will be too exposed given the location and the way the tides and wind act at that point. There is a high likelihood the beach part of the bridge would become submerged and access/exit from the beach could prove problematic, particularly for those with accessibility issues. The increase in footfall and traffic on and near the esplanade will be dangerous unless further work is undertaken on the esplanade and parking restrictions introduced (with some spaces reserve for disabled visitors and local residents). The instability of the seawall is also concerning. Option 5 would be a better compromise - closer to public conveniences, less distance to walk from the car park (people will stop using the car park if the bridge is on the esplanade) and amenities so businesses will still benefit from the bridge being moved closer to town but not so far as to disrupt traffic and pedestrian access to the shops. Whichever option is chosen the bridge must be wide enough for wheelchair and buggy access. Associated work should be carried out to secure the riverbed that runs under the bridge. Especially if option 4 is chosen, it's the most dangerous part of the water with at least two deaths occurring there in my lifetime - people will jump off the bridge wherever it is sited, they must be prevented from doing this to avoid certain injury or danger from the rip-tides.	3/1/2021 3:34 PM
297	Overall good but major parking issues parking available by old bridge would be usable by option 5	3/1/2021 3:32 PM
298	Need to see the information presented in an intelligible format before any comment can be made	3/1/2021 3:17 PM
299	The new bridge should be where the bridge is now. If the new bridge goes on the esplanade it will be so dangerous with cars parked and traffic. It's already bad enough on a nice day!!	3/1/2021 3:02 PM
300	Will there be a narrowing of the river and if so is there an increased risk of flooding.	3/1/2021 2:29 PM
301	Facebook 'Lossiemouth community council'	3/1/2021 2:27 PM
302	I think it could lead to pedestrian congestion around and already small area.Parking is, at times, HORRENDOUS around there with inconsiderate motorists actually parking ON the pavement if theres no spaces so siting the bridge there could lead to gridlock at times.	3/1/2021 2:24 PM
303	Good Decision, but they fail to recognise that the location of this option would place it in the middle of both seatown carpark and Station park carpark. Therefore I don't really see what the issue with parking is. Thanks	3/1/2021 2:21 PM
304	Wrong option - the public and people who have to live with the bridge is replacing the existing bridge on the existing location. People going to the shops will still go to the shops.	3/1/2021 2:13 PM
305	Option 4 is the most sustainable and most beneficial option to Lossiemouth.	3/1/2021 2:05 PM
306	Best location, most cost effective, keeps in spirit with towns origins, will promote esplanade as a town focal point and ensure better buy in with community, tourists and local businesses. Properly and thoughtfully designed new bridge could become a regional architectural statement, putting Moray & Lossie even more on the map as a go-to destination than they already are!	3/1/2021 2:04 PM
307	East Beach users come from across Moray, not just the town. It's next to impossible to park on the Esplanade now, and if the bridge is sited there then spaces will be filled for several hours by people having a day at the beach. Also, excited out-of-control children will be running across the road to get an ice-cream or sweeties. Best option nearest to current, and upgrade the car park there at the same time, with additional public toilets.	3/1/2021 1:52 PM

308	Good. Parking might be a problem	3/1/2021 1:40 PM
309	I agree with your preferred option	3/1/2021 1:33 PM
310	The area where the bridge goes onto the beach was fully submerged in the last storm we had in jan/Feb. Even when there is a high tide the sea comes up to that area. It should be in the same place as the old one, where it Is less exposed to the tide.	3/1/2021 1:28 PM
311	I understand the reasons for choosing it. But it was not my preferred solution. Its furthest from the carpark, furthest from a large section of holiday makers that reside in Seatown and the caravan park. It will increase demand for parking closer to the bridge adding to congestion on the already busy road - should it be pedestrianised as a result?	3/1/2021 1:25 PM
312	What are the plans for traffic mgmt and the esplanade which is badly in need of repair	3/1/2021 1:07 PM
313	The options given look good to me. I feel option 4 is best	3/1/2021 1:06 PM
314	I like option 3, it's near the car park, if it was on the esplanade it would make that road even worse for parking and traffic	3/1/2021 12:52 PM
315	I think it is the best option for the future	3/1/2021 12:52 PM
316	Option 4, looks amazing and its a lot closer to the ice cream shops. A lot easier for everyone, specially buggies as the bridge will be shorter.	3/1/2021 12:36 PM
317	I was against the bridge going here when i first submitted my choice, but having seen the graphics and read all the information I cannot wait for the bridge to be built.	3/1/2021 12:05 PM
318	Delighted we are getting access to our beach again	3/1/2021 11:21 AM
319	I think putting the bridge on the esplanade would cause greater traffic and accessibility issues	3/1/2021 11:04 AM
320	Happy with any access to the beach	3/1/2021 10:37 AM
321	Good Loction with. Excelent shape and form	2/28/2021 7:07 PM



ANSWER CHOICES	RESPONSES	
Excellent	19.95%	76
Good	35.96%	137
Satisfactory	26.77%	102
Poor	17.32%	66
TOTAL		381

Q3 How did you find the virtual Exhibition?

#	PLEASE PROVIDE DETAILS ON YOUR CHOICE	DATE
1	Accessed with great difficult	3/9/2021 10:40 AM
2	Too long - just want to see the options.	3/9/2021 10:16 AM
3	Virtual imposable to find on the internet.	3/9/2021 9:09 AM
4	Nightmare to navigate on phone. An easier slide show with clearer options would have been better	3/9/2021 9:05 AM
5	Took several attempts to be able to see it, and then used as a slide show which would have been easier for everyone	3/9/2021 8:39 AM
6	Platform used required desktop computer / laptop access and takes too long to load. Although engaging may have impeded access to less technological savvy	3/9/2021 5:03 AM
7	Low end graphics. A decent still montage would have been more informative.	3/8/2021 10:29 PM
8	Not ideal for viewing on mobile devices. Had to download a separate app, couldn't figure out what to do at first and then the slide title covered part of the text on the slide. I think it's a cool idea, but could use a little more development for phones	3/8/2021 10:11 PM
9	Lack of prominence to the plans to Gina CR5 through exploitation of Lossie thereby ruining g it's USP .	3/8/2021 12:01 PM
10	Option 2. Far less impact on the community, continued use of the existing car park and certainly close enough to local services and businesses	3/8/2021 11:20 AM
11	Answered it Q2	3/8/2021 11:04 AM
12	See comments in section 2 above	3/8/2021 10:39 AM
13	Connection wasn't secure so couldn't watch it	3/8/2021 10:04 AM
14	Unable to see any virtual flyovers of options other than the already decided on preferred option	3/8/2021 9:59 AM
15	The virtual tour is very slow and could not be viewed properly	3/8/2021 8:32 AM
16	Keep bridge where it is.	3/7/2021 9:52 PM
17	Difficult to view on mobile	3/7/2021 8:59 PM
18	Not usable on a mobile phone.	3/7/2021 6:58 PM
19	I feel it doesn't cover all pros and cons of each option.	3/7/2021 6:48 PM
20	Esplanade area is always a high tourist foot fall, with cars continually cruising up and down trying to get parked ! Parking on the pavement next best option. The attraction is 10 fold ! 1 HOTEL 3 RESTAURANTS 2 ICREAM SHOPS SURF SCHOOL UP TO 30 SURFERS DAILY PADDLE BORDERS CANOESTS WHO NEED PARKING !!! This is a situation I see DAILY BEST OPTION IS NOT THE CHEAPEST DON'T MAKE THIS AREA IN TO A CIRCUS PLEASE	3/7/2021 2:20 PM
21	It was easy to follow.	3/7/2021 2:08 PM
22	Option 3	3/7/2021 1:59 PM
23	Option 3	3/7/2021 1:47 PM
24	I would choose a new bridge just south of the existing bridge. Or very close to the existing bridge.	3/7/2021 1:26 PM
25	It was good to see the virtual exhibition, as it allowed me to understand where the options, are being considered.	3/7/2021 12:58 PM
26	Cartoonish - real images should have been used. This survey is also poor because of this dialogue box design.	3/7/2021 12:34 PM
27	Option 5, as it is close enough to existing car park.	3/7/2021 12:22 PM
28	I would like the bridge to be built in seatown.	3/7/2021 11:42 AM

29	Very well presented, transparent that us only devuded by cost, not logic, practicality or consideration for the local community.	3/7/2021 10:44 AM
30	Option 3 - the replacement of the current bridge. Best value in the long run. by far.	3/7/2021 10:39 AM
31	Option 3 or 5	3/7/2021 10:36 AM
32	Could not access on my iPad.	3/7/2021 9:59 AM
33	I'm viewing it on an Android phone, so wasn't the best	3/7/2021 9:58 AM
34	Very informative	3/7/2021 9:34 AM
35	Safer for public use	3/7/2021 9:10 AM
36	Leave Bridge where it is	3/7/2021 8:58 AM
37	Very informative and good graphics. Took me a little bit to get used to how it worked.	3/7/2021 7:16 AM
38	Middle option best for everyone,	3/7/2021 7:09 AM
39	Not the easiest to navigate .	3/6/2021 8:30 PM
40	Virtual exhibition is a great idea, however I did have a few problems accessing it but did manage to sort it after a while.	3/6/2021 6:55 PM
41	it is the safest and most sheltered place	3/6/2021 5:39 PM
42	Replace in the position of the current brisge	3/6/2021 4:43 PM
43	Option 3 is a good crossing point close to large parking area at Seatown near canal bank, away from busy road. Also handy for holidaymakers staying at nearby caravan park. Whatever option, there is no mention of whether capital costs include dismantling and removal of existing bridge, or a least the decking and railings. Leaving the existing bridge in situ will have the same negative problems of the "Do nothing" scenario of Option 1.	3/6/2021 4:25 PM
44	Constantly needed to 'pause' the exhibition to give time to read the information. A simple click to proceed to the next slide would have worked better.	3/6/2021 4:05 PM
45	Less congestion on esplanade and there is car parking by the river side.	3/6/2021 1:59 PM
46	A bit inaccessible on my tech	3/6/2021 1:00 PM
47	It only gave example of option4	3/6/2021 11:06 AM
48	Near original bridge	3/6/2021 10:59 AM
49	Although I would love to see the bridge remain at its original location I realise that cost is the biggest factor when building. I must admit that it makes sense to have the bridge coming out onto the esplanade where local facilities are sited. May I say though that the current existing toilet facilities might be used far more once bridge is back open and could do with being upgraded especially as footfall past this will increase from walking from car park to new footbridge. Is this a point that the local community council has discussed? On a side note local business will profit due to people being able to hop over and buy ice creams, coffees etc etc.	3/6/2021 9:04 AM
50	couldn't navigate on phone. kept sticking	3/6/2021 8:34 AM
51	Difficult to access for many in the community	3/5/2021 11:18 PM
52	The slides were too large to see properly on my phone and some of the slides in the later part of the presentation were blank	3/5/2021 8:20 PM
53	explains things is simple terms	3/5/2021 4:49 PM
54	Changed slide too quickly for me!	3/5/2021 4:01 PM
55	Easy to follow bite size story boards, excellent graphics and bullet points.	3/5/2021 3:18 PM
56	Option 2 as stated above	3/5/2021 12:43 PM
57	At times it was too wordy	3/5/2021 12:26 PM

58	Difficult to maneuvre around the different boards.	3/5/2021 11:01 AM
59	Long loading times and didn't give a simple overview of the options.	3/5/2021 8:17 AM
60	Better access,	3/5/2021 7:23 AM
61	Same place as current bridge.	3/5/2021 12:29 AM
62	3D view added nothing, would be better to just view slides. PDF failed to load, error 404 Forbidden	3/5/2021 12:17 AM
63	It took at least four tries to download and when I did manage to download it was very difficult to operate	3/4/2021 7:55 PM
64	I couldn't get the virtual exhibition to load and looked at the leaflet version instead.	3/4/2021 7:11 PM
65	Could not navigate in a mobile - someone kindly screen shot each slide and posted it on social media	3/4/2021 6:43 PM
66	Very good but would have preferred the bridge in the middle of the room to have been in colour	3/4/2021 5:08 PM
67	Back where it was	3/4/2021 2:12 PM
68	Option 3 Looks so much better in the existing position. Easy access to parking, safety of general public, no congestion on Main Street. The amenities are only round the corner., within easy walking distance.	3/4/2021 2:08 PM
69	The artsteps video link would not work on my phone (Google Pixel 3a) and was poor on my laptop, causing the fans to overwork, and not loading well at all. Microsoft Sway might have been a better choice given the average internet speeds in the area. The boxes in the SurveyMonkey are also too small for comments - they don't expand vertically, meaning much scrolling for proof-checking!	3/4/2021 12:26 PM
70	Gave clear concise background information on all choices and the project	3/3/2021 11:33 PM
71	The virtual exhibition was very easy to navigate and find out all relevant information	3/3/2021 10:14 PM
72	Difficult to get into	3/3/2021 6:25 PM
73	Can be accessed from home	3/3/2021 4:41 PM
74	all clearly explaine	3/3/2021 4:11 PM
75	Once in the virtual exhibition, the images would not download. Wasted over 10 minutes. Finally accessed it but felt a distinct bias.	3/3/2021 11:49 AM
76	Replace existing bridge where it is now	3/3/2021 10:20 AM
77	Very informative display giving details of each option from a cost and demographic point of view	3/3/2021 8:45 AM
78	The 3d visuals helped to imagine what they will be like.	3/3/2021 7:32 AM
79	closer to the car park, avoiding overcrowded esplanade	3/3/2021 7:31 AM
80	see above	3/2/2021 11:33 PM
81	It was excellent!	3/2/2021 10:42 PM
82	Focussed too much on the cheaper proposals. All bridge designs should have been given the same presentation.	3/2/2021 9:44 PM
83	Couldnt access it, picked up leaflet in coop	3/2/2021 7:42 PM
84	I liked the pictures and the costings . It let you see the total cost of each option. However, I daresay your bias is evident in the pros and cons of your preferred option which is full of positivity.	3/2/2021 6:50 PM
85	There appears to be better access here for all to enjoy. Less traffic problems so a safer option for me	3/2/2021 6:41 PM
86	Straight replacement where it is now	3/2/2021 6:34 PM

87	Easy access from the promenade.	3/2/2021 5:35 PM
88	Bridge stays where it is	3/2/2021 5:28 PM
89	Easy to move around.	3/2/2021 5:21 PM
90	Easy to understand	3/2/2021 5:08 PM
91	Option 3	3/2/2021 5:04 PM
92	Not necessary to replicate an Art Gallery exhibition space	3/2/2021 4:26 PM
93	Not usable on phone or tablet	3/2/2021 4:09 PM
94	Difficult to navigate	3/2/2021 4:03 PM
95	Please do not put bridge on the esplanade! The traffic on Clifton road is already horrendously busy through weekends, and holidays. It's really dangerous and unpleasant. And have you seen the amount of rubbish that results from a high footfall in the summer? Are you going to provide provision for this? And please can we make this beach a family friendly No dogs beach. Its disgusting taking grandchildren over with dog poo every third step.	3/2/2021 3:48 PM
96	As I mentioned earlier, I believe the bridge should remain where it is or very close to where it is. Anyone participating in any water sports etc would find it handier than trying to haul canoes, paddle boards or the like across to the esplanade. Lossiemouth is famed for the view over the east beach from above showing the current bridge and could remain so if the new bridge was sited in the same place.	3/2/2021 3:38 PM
97	On line of old bridge	3/2/2021 3:02 PM
98	Wasteful of time and resources. Make a pdf which is accessible and quick to read. Total gimmick and the software looks like it's from the 1980s.	3/2/2021 2:07 PM
99	Bridge from esplanade will cause more rubbish on beach.	3/2/2021 1:51 PM
100	Couldn't access it so ended up on the PDF version. Option 4 pics are incorrect. Pros and cons very basic, descriptions and costing to brief and don't indicated what is included or not, ie do costing include planning complications and strengthening improving the poor seawall if them options were taken?	3/2/2021 1:41 PM
101	Not enough parking in the Esplanade.	3/2/2021 1:33 PM
102	Experience on mobile device limited	3/2/2021 12:51 PM
103	2	3/2/2021 11:50 AM
104	I would like the new bridge to be in the same place as old one.	3/2/2021 11:47 AM
105	I agree that the preferred option is the best.	3/2/2021 11:27 AM
106	Replace close to existing structure	3/2/2021 10:40 AM
107	The exhibition was biased towards the 4th option on the esplanade, without the replacement of the sea wall defences this option will not last as long as one up river.	3/2/2021 10:33 AM
108	better for wildlife and reduced littering on the beach	3/2/2021 10:24 AM
109	I would prefer the bridge to be sited where it is at present as it will lessen congestion on esplanade and is close to carpark	3/2/2021 9:38 AM
110	Found it difficult to locate all videos	3/2/2021 9:35 AM
111	Clunky, but got there in the end.	3/2/2021 9:05 AM
112	Having this sort of "right-on" trendy virtual exhibition brings nothing to the proposals. A simple PDF would have done the job and at much lower cost. Also, this survey does not allow for proper comment to be made. It is too brief and comment boxes, at one line, are far too small.	3/2/2021 8:43 AM
113	I would rather the bridge was situated where the old bridge currently is	3/2/2021 8:38 AM
114	Well presented	3/2/2021 8:06 AM
115	Hard to open and navigate.	3/2/2021 7:57 AM

116	Unable to read signage. Very difficult to use.	3/2/2021 7:31 AM
117	The virtual exhibition gave a clear idea of the proposal but it's in the wrong location	3/2/2021 7:11 AM
118	A bit clunky but did work.	3/2/2021 6:44 AM
119	Hood to use once navigated the control.	3/2/2021 6:05 AM
120	There is a lack of parking along the fton and to pedestrianise this area would devastate local business. There is parking in the current situ for any users.	3/2/2021 4:45 AM
121	Many have been unable to access this, a video would have been easier. How are non computer savee folks able to complete the survey.	3/1/2021 11:28 PM
122	Businesses will suffer	3/1/2021 11:17 PM
123	Nobody can be bothered with fancy nonsense but good old fashioned information is the best - Option 1. Option 2 and so on	3/1/2021 11:06 PM
124	Clearest information and visuals on the bridge I have seen	3/1/2021 11:02 PM
125	Trouble logging in then it just jumps around	3/1/2021 11:01 PM
126	You cannot pedestrianise Clifton Road. It would be awful for businesses	3/1/2021 10:55 PM
127	Same location as the current bridge, or as close as possible. It's a safer option to a return to normality for Lossiemouth.	3/1/2021 10:51 PM
128	good job needs further discuss	3/1/2021 9:54 PM
129	Good impression of final look	3/1/2021 9:40 PM
130	Option 3 - the bridge in its current location has stood the test of time. It has been well protected from rough waters by the dunes. This bridge is also an iconic part of the landscape, loved my locals and tourists alike, and has been appreciated through the generations.	3/1/2021 9:40 PM
131	I believe option 5 is the best fit for the replacement. It would have less of an impact on the already busy esplande.	3/1/2021 9:37 PM
132	Give a PowerPoint why the extra steps?	3/1/2021 9:37 PM
133	Replacement on site of existing bridge. Protected from winter storms and likely to persist for longer.	3/1/2021 9:25 PM
134	Option 3 - new footbridge local to existing	3/1/2021 8:56 PM
135	Well it is	3/1/2021 8:55 PM
136	Keep bridge where it's situated just now	3/1/2021 8:39 PM
137	Found it very difficult to navigate, like you are trying to make people not bother looking at it.	3/1/2021 8:26 PM
138	I did use my phone which said it wasn't supported. This may have been why the experience wasn't great. I couldn't read all of the information because I couldn't make it landscape.	3/1/2021 8:23 PM
139	A bit clunky	3/1/2021 7:54 PM
140	Rebuild in current location for ease.of car parking and safety from high tides and storms	3/1/2021 7:48 PM
141	It was very delicate and more annoying that just a normal report	3/1/2021 7:44 PM
142	Option 3 but demolish old bridge and replace in current location with wider access and anti motorcycle gates.	3/1/2021 7:42 PM
143	Very well put together exhibition.	3/1/2021 7:37 PM
144	Great adaptation	3/1/2021 7:35 PM
145	None as never saw the virtual exhibition	3/1/2021 7:00 PM
146	Struggled to navigate	3/1/2021 6:59 PM
147	It doesn't show clearly what the bridges will look like, absolutely useless	3/1/2021 6:33 PM

148	Could have provided view of the approach and a walk over. View of potential parking provision.	3/1/2021 6:33 PM
149	I would have chosen option 4	3/1/2021 6:05 PM
150	Link kept freezing. Also poor this is done online when many local people wont have access to this.	3/1/2021 6:04 PM
151	Well it was!	3/1/2021 5:46 PM
152	Nice visualisations, easy to understand and navigation. Did not work well on mobile device	3/1/2021 5:04 PM
153	A very good presentation in the absence of beng able to have a public exhibition.	3/1/2021 5:04 PM
154	Esplanade	3/1/2021 4:38 PM
155	Looks good but a bit annoying. Just slides please!	3/1/2021 3:47 PM
156	I couldn't see the exhibition on my mobile; it was difficult to navigate through the exhibition; unnecessarily faffy - some videos and slides would have done the job; more explanation on the background to the choices and preferred option would have been helpful too.	3/1/2021 3:34 PM
157	Monday wasted on arty-crafty presentation that obscured the information we were supposed to evaluate	3/1/2021 3:17 PM
158	Slight concern over parking, but appreciate the convenience from the esplanade	3/1/2021 2:15 PM
159	It was very easy to navigate and information was clear	3/1/2021 2:13 PM
160	Good information video, need to see final design though	3/1/2021 2:04 PM
161	Tour moved on too fast to read and consider boards, had to keep trying to go back. Sometimes it would go to the footprints when you clicked on them, but often not. Frustrating.	3/1/2021 1:52 PM
162	Why are you still using 2000's style digital presentation - how many people access this on Phone and Pads. It terms of diversity this, the presentation, fails	3/1/2021 1:33 PM
163	Would have been fine and easier to just see pictures	3/1/2021 12:52 PM
164	Very well put together	3/1/2021 12:52 PM
165	Brilliant walk through of all the points, easy to pause and look back at any slides i wanted to read or look at again. Only one small point, it does progress quite quickly & if you are not good with computers you may find it a bit difficult to pause and start on each slide.	3/1/2021 12:05 PM
166	Really enjoyed the virtual experience	3/1/2021 11:21 AM
167	New bridge in the same place as the old one	3/1/2021 11:04 AM
168	Very clear information & well presented	3/1/2021 10:37 AM



ANSWER CHOICES	RESPONSES
Lossiemouth	68.24% 260
Elsewhere in Moray	20.21% 77
Other (please specify)	11.55% 44
TOTAL	381

#	OTHER (PLEASE SPECIFY)	DATE
1	Elgin but grew up in lossie.	3/9/2021 8:52 AM
2	Lancashire	3/8/2021 1:37 PM
3	Highland	3/8/2021 9:59 AM
4	Perth, Western Australia. I am a Lossie loon.	3/7/2021 12:58 PM
5	Glasgow but we're thinking about moving to Lossie cos we've retired. Currently we're up once a month for weekends and longer. I've seen the river and dunes shift and change a lot in 33 years.	3/7/2021 12:34 PM
6	Glasgow (I am from Lossie and it is where my parents and family live).	3/7/2021 10:39 AM
7	Clackmannanshire	3/7/2021 9:58 AM
8	Alloa	3/7/2021 9:58 AM
9	NZ , I grew up in Lossiemouth and my family is there	3/7/2021 12:07 AM
10	Edinburgh but originally lossie and all my family and friends still in lossie	3/6/2021 8:25 PM
11	Just outside Lossiemouth and a frequent user of all parts of the town	3/6/2021 7:59 PM
12	Elgin	3/6/2021 7:15 PM
13	Liverpool	3/6/2021 6:55 PM
14	Aberdeen but my family live in Lossiemouth and I visit regularly	3/5/2021 8:20 PM
15	Aberdeen, but far Lossie	3/5/2021 2:28 PM
16	Linlithgow, but I have a flat in Clifton Road we use on a monthly basis.	3/5/2021 10:59 AM
17	Berkshire (moving to Lossiemouth in July21)	3/5/2021 12:17 AM
18	Strathpeffer but have static at Lossiemouth Bay Caravan Park. 😊	3/4/2021 9:50 PM
19	Ipswich Suffolk	3/4/2021 6:09 PM
20	Now live in Cullen, but was born and brought up on Lossie just beside the cross. The bridge has always been special to us Lossie folk, and where it is is perfect.	3/4/2021 5:08 PM
21	Burghead	3/4/2021 3:12 PM
22	Aberdeenshire, but I have 2 self catering cottages in Lossie	3/3/2021 11:33 PM
23	Fife	3/2/2021 5:35 PM
24	Forres	3/2/2021 5:21 PM
25	Midlothian	3/2/2021 5:04 PM
26	Hopeman	3/2/2021 4:05 PM
27	Aberdeenshire	3/2/2021 2:22 PM
28	Edinburgh, but we are frequent visitors and have been disappointed not to be able to access the beach.	3/2/2021 9:58 AM
29	Just out of lossie, Inchbroom	3/2/2021 9:35 AM
30	Kent - Family live in Lossiemouth.	3/2/2021 8:25 AM
31	Elgin	3/1/2021 11:34 PM
32	Aberdeen, but grew up in Lossie	3/1/2021 9:40 PM
33	Glasgow	3/1/2021 9:37 PM
34	england, soon to move to moray	3/1/2021 8:02 PM
35	Milton Keynes	3/1/2021 7:42 PM

36	Inverness	3/1/2021 7:27 PM
37	Elgin	3/1/2021 5:40 PM
38	Hull	3/1/2021 4:05 PM
39	Inverness	3/1/2021 3:47 PM
40	Colorado USU	3/1/2021 3:17 PM
41	Penarth, Vale of Glamorgan (family home is Lossiemouth)	3/1/2021 2:13 PM
42	Born in Lossiemouth	3/1/2021 2:04 PM
43	Edinburgh	3/1/2021 1:25 PM
44	Aberdeenshire	2/28/2021 7:07 PM



ANSWER CHOICES	RESPONSES
16 or under	1.57% 6
17 to 30	9.45% 36
31 to 50	35.43% 135
51 to 70	41.73% 159
Over 70	11.81% 45
TOTAL	381

Lossiemouth East Beach Footbridge Replacement Exhibition

Email Feedback

	Where are they to park? Making 'pedestrian only' road will definitely NOT help businesses! No parking nearby!! Enjoy the good weather We in Lossiemouth hope to soonon the East Beach!
05/03/21	 Thank you for your excellent explanatory leaflet covering the options for the replacement bridge. The lack of a bridge is a definite negative for Lossie and its businesses. I have no comment to make at this stage on the relative merits of the suggested solutions. However I was surprised that no mention is made of global warming. The prognosis that seems to be accepted is for a rise in mean sea level of 30cm by 2050 and of a metre by 2100. Given the bridge is to be designed to last until well after then, I think it sensible to give some thought to: 1. the siting and reinforcement of the bridge at either end. 2. The effect of a mean rise and the impact of the expected increased number of severe storms on the dunes themselves. (You mention the destructive power of previous storms on the harbour walls themselves in your pamphlet). It would be profligate to spend any of the suggested sums to then find the replacement bridge destroyed by a 'new' generation storm. A little further thought at this stage may well produce a more lasting solution.
05/03/21	I was interested to see the options being presented and wish to comment as follows: Whilst I love the East Beach and spent most of my formative years on holiday in Lossiemouth in a caravan the closure of the bridge actually has some benefits for the environment overall with no litter, less disturbance to the natural beauty and is accessible for the water enthusiasts on paddle boards, surf boards etc. I have sat outside the Salt Cellar this past year and just looked on in wonder at those out there catching waves and no one else to worry about. There is a lovely long beach to the west that is quite accessible to all and has plenty parking, accessibility to this beach could be improved if felt necessary to be more inclusive. So you could just leave the beach closed, if I want an ice cream it does not stop me going to Lossie. Your costs for your preferred option 4 are questionable as I don't believe they will stop at the £1.375 million. Final hydraulic design will be completed during design stages therefore your costs will likely increase. There is no mention of the argument about planning needing to be obtained as you have used elsewhere as surely the very early versions of the bridge that previously failed can't be valid. The sea wall in this area is noted to be in poor condition so again there will be additional costs associated as you will need to address this issue. It has been muted that the closure of the bridge is all down to a political angle to have the esplanade upgraded and pedestrianised, therefore I believe there will be even more costs associated with this option. I would like to see a more believable cost to this option or confirmation that these items are already built in.

	If you pedestrianise this part of town making it inaccessible by car then Lossiemouth will see a significant decline in visitors, do we never learn that if we can't just pop in we just won't come!?? I don't think your preferred option is complete and therefore inaccurate in its presentation. I will watch with interest.
07/03/21	I am emailing on behalf of my mother who is not on internet. These comments are solely hers Her preferred option is to replace the existing bridge with one in a similar location for safety reasons. Namely that coming off the esplanade will be much busier for traffic putting children and families coming to and from a bridge at higher risk. And a bridge from the esplanade would cause increased traffic chaos. Also the current state of disrepair of the esplanade is a concern. It has uneven slabs, broken concrete and erosion under it. Will this be repaired? The main reason for not liking the preferred option is the lack of parking. Whereas there's an existing car park near the existing bridge.
07/03/21	 Key Points Provides the most cost effective compliant footbridge crossing in both capital and whole life costing terms. (Yes it will be less expensive based on the provided costings but how can it be stated as being 'the most cost effective' as a final hydraulic design has not been undertaken and therefore accurate costings are not available. It may well be that option four will not be the most cost effective of the locations.) Economic and social benefit as located closer to amenities. (Yes closer to amenities but we are only talking of a very small amount of metres here. I am led to believe that actually not all businesses in close proximity to option 4 see this choice as being of economic benefit!) Better integration into the wider public realm. (It would actually site the bridge in what is already one of the most congested areas of Lossiemouth if not Moray. A pedestrian crossing has already been added at this site to help alleviate the congestion and therefore I cannot see why this location would be of benefit as it certainly does not demonstrate 'better integration'.) Final hydraulic design will be completed during the final design stages. (Why is this a key point? Surely it is obvious that a final hydraulic design would have to ensure that structures would be of sufficient size that natural flooding would not be worsened and that the design would ensure that the structure would withstand the design flood and remain traversable. However, this would apply no matter the location so why is it listed as a key point of option 4? What is actually more pertinent here is that this statement alludes to the fact that a final design stage has not been undertaken and that therefore 'New Footbridge At Esplanade Capital Costs: £1,375,00 is to a certain extent fictional in that it does not in fact reflect what the actual capital cost will be. Does The Moray Council have access to more accurate figures than they have published and

	I am of the opinion that the above 'Preferred Option: Option 4' documentation raises pertinent points about for example the costing of Option 4 and all of the
	bulleted headings and that these points deserved to be addressed.
	In addition there is nothing as listed in the business case that could not be achieved if a new bridge were to be located at any of the options. The business case is therefore not site specific.
	It would appear then that the only reason for Moray Council recommending that Option 4 be the preferred option is flawed in that it is shown as being the less expensive option when in fact all the final capital costs for all options are unknown and the least expensive option is therefore unknown.
	Even if it were assumed that Option 4 was the cheapest option, would it be the best option in the opinion of the people who will live close to and use the bridge? Certainly 63% of Lossiemouth residents have already expressed disagreement with that and I would hope that that would be reflected in the decision and in the recommendation made to the Scottish Government by The Moray Council on behalf of the people of Moray in general and of the people of Lossiemouth in particular.
	We have a great opportunity here but I sincerely hope that The Moray Council do not inadvertently ruin this opportunity by recommending the building of a bridge in a location that is both congested and unwanted. How can that ever be construed as being of 'best value'.
07/03/21	Dear Moray Council. I write to express grave concern that the survey response form regarding preferred options to the Lossiemouth footbridge is poorly designed and is bound to lead to a very limited response that will not reflect local opinion adequately. Apart from failing to list the four options to choose from, it does not ask if respondents are private individuals or local businesses.
	See for yourself at <u>https://www.surveymonkey.co.uk/r/YNGRTJQ</u> <https: r="" www.surveymonkey.co.uk="" yngrtjq=""></https:>
	After spending a lot of money producing an excellent survey and virtual exhibition, this response form is nothing short of a disaster and doesn't help to take us forward. Let's start over a gain, please - uregently!
07/03/21	My reaction to the current iconic footbridge being relocated to the esplanade is
	It beggars belief that our 100 year old pedestrian footbridge at approximately 1mtr wide is going to be replaced with a 3.5 metre bridge capable of taking the widest vehicle that is permissible to travel on our uk roads. Do people not realise the cost difference between building a 1.5 metre wide structure capable of accommodating two passing wheelchairs and a 3.5 metre construction believe me talk about wasting public or government money defies belief really. I am not a bridge expert but as someone who has developed many
	building projects, it really does not make economic sense.

	The only possible answer to this appalling decision must be purely down to cost and having total disregard to public opinion to have it rebuilt/replaced in its current position. I understand an offer was on table from a local contractor to remove the complete existing bridge in sections down to the current piling and replace it with a wider complete new bridge in galvanised steel for a fraction of these vastly inflated prices quoted to supply a 3.5 metre wide replacement . I have lived in Lossie all my life and when the bridge discussion ever arises I am quick to ask the question what do you think about the relocation and believe me never once have I heard a positive reaction everyone had the same thoughts, concerns about the breakwater,esplanade condition,congestion of traffic. It is truly just beyond comprehension that it could be relocated. Finally remember the cheapest option is not always the best one.
07/03/21	On behalf of the Lossiemouth Community Council, we write with our feedback to the proposed option indicated in the options appraisal. From the onset we welcome the Scottish government's funding of our access to the East beach, such access is absolutely essential for our community and for locals and tourism alike. It should be noted that the greatest majority of the community who took part in the initial survey, expressed a preference that the bridge should remain in situ at the Seatown. We see from the proposals that despite this preferred option, the esplanade has been identified as the favoured one Whilst we understand that cost is the defining factor, we have a duty of care in fully representing our community on issues which have been raised by the people of Lossie.
	What concerns Lossiemouth Community Council is that whichever option is chosen, it provides us with a long term, safe and easy access for users and continued retail activity for local businesses. We would, with respect, highlight the following issues raised by our community, in particular 3 of these. Firstly, that the bridge and access to the bridge, may be at risk given the life expectancy of our crumbling breakwater. You have a copy of the 2014 independent report commissioned by the Moray Council following concerns raised repeatedly by the community council. It has a life expectancy of only a few more years and the estimated cost to replace it in 2014 was between £2 and 3 million.
	attention over the decades, the structure underneath and the pavings on top are in a poor condition and have been neglected over time. It currently has limited footfall but inevitably, if the bridge is moved to the esplanade then there will be a considerable increase in individuals using it as an access route to the beach. We would hope that at some point in the future funding could be identified from the Scottish Government or some other funding source for the work required to ensure these structures are fit for purpose.

	Lastly, we were advised some 18 months ago, wrongly it seems that Clifton Road would need to be pedestrianised or a one way system put in place if the bridge is moved to this site. We predict that the volume of cars and people accessing the bridge will be significant and that congestion will become an issue, our economy has been badly hit by the bridge closure and by covid19. We do not want our businesses to suffer further and would hope that if the bridge is moved here then the council will not change their views on this matter and that every effort will be made to ensure that traffic continues to be able to travel freely on Clifton road in order to benefit local businesses.
08/03/21	I am providing feedback on the plans for a new bridge in Lossiemouth. I have viewed all the options and was a little surprised that the favoured option is smack bang in the town centre. I fully understand the reasons for this but chaos would ensue, is it a coincidence that the favoured option is the cheapest? My preferred option is option 5 the Sea town option, I would be grateful if you would take cognisance of my comments.
09/03/21	The Lossie Bridge, After reading through the printed presentation of the options etc. for the new bridge and reading all the pros and cons for the different options. It absolutely screams out that the best place for the bridge is where it is now. That is also the wish of the majority of people who live here. Not to mention the congestion at the busiest part of the town for months Let commonsense prevail!!!!! It also surprises me that designs are not already on paper to be decided on. I do hope you get this e-mail.
09/03/21	I have read the proposals and feel either option 3 or 5 would be best. As a resident in the town I feel the bridge would be best placed near to the large existing car park in Moray Street and the public conveniences. It will also allow easy access to the beach for folks surfing etc. One of my concerns for option 4 is the comment re: sea wall. It is in apparent disrepair and could cause costs to be increased. I also think the promenade by the shops would become extremely congested on sunny days
1	