Technical Note

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Subject	Strategic Environmental Assessment & Preliminary Engineering Services Preliminary Assessment Report - Tunnels Summary Note	Project Name	Access to Argyll and Bute (A83)
		Project No.	A83AAB
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Originator	P.WRIGHT	Checker	A. SMITH
Reviewer	D. ROBERTSON	Approver	D. ROBERTSON

1. Introduction

1.1.1 This technical note summarises a preliminary assessment of various tunnel options which could be considered to deliver possible road alignments across 15 proposed route corridors. The note discusses the general principles of tunnel design and construction, tunnel configuration, the implications of geology and geotechnics on tunnel construction, operational aspects and costs.

1.1.2 Tunnels have been considered to satisfy proposed road alignments within the route corridors to overcome challenging topography. These tunnels are summarised in Table 1 and have been assessed with commentary provided in the summary tables within the Preliminary Assessment Report.

1.1.3 Tunnels have also been considered to facilitate fixed-link crossings (i.e. crossings under water bodies) as summarised in Table 2; these tunnels have been subject to a conceptual assessment only, with the exception of the potential crossing of Loch Fyne. Further commentary is provided in Section 7 of this technical note.

Table 1: Summary of potential tunnels to satisfy proposed road alignments.

Route Corridor	Tunnel	Approximate Length	Approximate max. Depth	Approximate Gradient
1	Rest & Be Thankful (2 variants)	1200m 2900m	75m 100m	3.8 – 4.8%
2	Glen Kinglas (2 variants)	7350 – 7700m	150m	3.9 – 4.0%
3	Glen Fyne	9300m	200m	4%
4, 5	Loch Long bridge, east approach (3 variants)	370 – 390m	35m	3.7 – 4.5%
	Loch Long bridge, west approach (Bridge to Glen Finart)	4500m	500m	1.9%
4,5	Loch Long bridge, west approach (Bridge direct to Whistlefield)	6700m	500m	3%
4,5,10	Larach Hill (Glen Finart to Whistlefield) (2 variants)	3070 – 3610m	200 – 300m	0.75 – 0.85%
5, 7, 11	B836 – Loch Striven west	1450m	50m	0.5%
5, 7, 9, 11	Ballochandrain	4400m	260m	2.8%
10	West of Loch Long (South)	1680m	75m	3.2%
	West of Loch Long (North)	1870m	250m	2.6%
12	Inveruglas to Butterbridge	8100m	600m	2.1%
13	Glen Loin	4000m	550m	3.5%
14	Coilessan Glen	5600m	300m	2.8%
	Gleann Beag / Hell's Glen	2000m	100m	2.5%
15	Arrochar to Butterbridge	7000m	700m	2.3%

Table 2: Summary of tunnels considered to facilitate fixed-link crossings.

Route Corridor	Waterbody	From	To	Approximate depth to bed
4, 5	Loch Long	Garelochhead	Rubha nan Eoin	70 – 80m
6, 7	Firth of Clyde	Cloch Point	Dunoon	65m
5, 7, 9, 11	Loch Fyne	Otter Ferry	Achnaba	50 – 60m
8a, 8b, 9	Firth of Clyde	Portencross	Little Cumbrae	50 – 60m
8a, 8b, 9	Firth of Clyde	Little Cumbrae	Rubh'an Eun, Bute	115m
8a, 9	Kyles of Bute	Rhubodach, Bute	Colintraive	20m
8b	Rothesay Bay	Ardyne Point	Ardmaleish	30 – 40m
10, 11	Loch Long	Cove	Strone	50 – 60m
10, 11	Gare Loch	Rhu	Rosneath	20m

Note: Approximate depth to bed level derived from review of online nautical charts (http://fishing-app.gpsnauticalcharts.com/i-boating-fishing-web-app/fishing-marine-charts-navigation.html#11.49/55.9102/-4.9190).

2. Tunnel Construction

2.1.1 In general terms tunnels are constructed by the excavation of soil or rock at an advancing tunnel face and the installation of support as necessary to ensure that the excavated hole does not collapse or deform excessively during the design lifetime of the tunnel, normally 120 years.

2.1.2 Two fundamental methods are typical for tunnel construction of the type required:

- By conventional mining where versatile mining equipment such as excavators and road-headers are used to excavate the tunnel in self-supporting soils and rocks or alternatively, where hard rock is the tunnel medium, mining with explosives may be appropriate; termed “drill and blast”.

- By using a Tunnel Boring Machine (TBM), a large normally cylindrical machine which excavates a whole circular face of rock or soil using cutting tools mounted on a rotating disc. TBMs come in many forms and are usually designed and manufactured specifically for the project to negotiate the expected geotechnical conditions.

2.1.3 The support of the tunnel, as the face advances, is accomplished by a number of possible methods, depending on the nature and strength of the ground, and the tunnelling technique. If the ground is not self-supporting (e.g. comprising gravel, sand or silt), it must be immediately supported using a precast circular segmental lining installed immediately behind the TBM. Soil such as a stiff clay, soft rock, or extensively fractured or weathered hard rock, which may be self-supporting for a short time can be supported using steel arches, or by spraying rapid-setting concrete onto the exposed ground to form a structural arch or cylinder. A tunnel in more competent rock may be mined and be completely self-supporting, or the rock may be secured by installing steel rock bolts or anchors radially from the tunnel into the rock; this may be supplemented by spraying a relatively thin layer of rapid-setting concrete, to form a “sprayed concrete lining” (SCL).

2.1.4 In addition to the above, specialised tunnelling techniques can be employed where tunnels are required to facilitate crossing of a water body. Such tunnels can be formed by casting a number of huge hollow boxes, floating them to the tunnel site, and connecting them together by sinking them in sequence into a pre-prepared dredged trench. This is called an “immersed tube tunnel” and is suitable in relatively shallow depth of water and where the ground can be dredged. Finally, a “submerged floating tube” (SFT) is a concept where the huge sections of tunnel are joined together and float above the bed of the water body, below ship draughts, and tethered to the bed using cables.

2.1.5 It is assumed that the tunnels considered to satisfy proposed road alignments as summarised in Table 1 would be constructed in high strength moderately intact rock. The traditional techniques of conventional mining using drill-and-blast or using road-headers are applicable, with rock support using rock bolts and SCL, normally resulting in a horseshoe-shaped tunnel. Alternatively, a TBM could be used which would result in a circular tunnel with a relatively thick concrete segmental lining.

2.1.6 In most cases, the softer drift and scree material at likely portal locations for each tunnel would need to be excavated by conventional excavation and made stable using geotechnical improvement methods such as soil nailing, grouting or retaining walls, before the tunnel can be advanced.

2.1.7 The fixed link crossings considered are assumed to be excavated by TBM, boring under the loch bed, or for the shallower crossings, using the immersed-tube option. Submerged floating tunnels are less feasible for the fixed-link crossings due to shipping and submarine activity.

3. Design

3.1.1 At this stage, tunnels have been considered on the basis of these being single carriageway bi-directional tunnels with traffic travelling in both directions in a single tunnel bore. Such a configuration may not economically satisfy the required tunnel standards and good practice, specifically in terms of ventilation and fire safety regulation.

3.1.2 Following a series of disastrous fires in European tunnels during the 1990s, the EU issued directive 2004/54/EC, which was developed in the UK as the Road Tunnel Safety Regulations in 2007, and in turn mirrored by UK Highway Standards BD78/99 (now superseded) and CD352 (current). These provide the framework for road tunnel design. The Regulatory Reform (Fire Safety) Order 2005 is also relevant as it contains specific legal requirements. Other national and international standards and guidelines exist for the structural design and construction safety aspects of tunnels.

3.1.3 For long single bore tunnels mined at substantial depth there exists a challenge regarding the safety of the tunnel mining personnel in the event of a fire, flood or collapse; this can be managed with refuges and other mitigations but it makes the tunnelling more costly. In addition, the operational safety of the tunnel depends on a ventilation system that can protect all tunnel users in the event of a fire. In dual carriageway twin bore tunnels, provided congested traffic conditions can be avoided, this is accomplished by pushing smoke and heat out of the tunnel in the direction of traffic and providing cross-passages to the other carriageway (in the other tunnel bore) for escape. In bi-directional tunnels however, in case of fire there has to be some alternative means to keep the smoke away from oncoming traffic, i.e. semi-transverse ventilation will be the minimum required system which features a duct located under the tunnel soffit, and running along the length of the tunnel, connected to intermediate ventilation shafts in long tunnels. Fire suppression systems along the entire length of the tunnel may also be a requirement.

3.1.4 A means to escape from any incident, preferably to free air, is also required. In a twin bore tunnel, escape can be facilitated through the other tunnel bore. Within a single bore, intermediate shafts may be required to facilitate escape as well as ventilation; however, deep shafts more than a few tens of metres deep are not practical to evacuate from on foot and would need lifts to be provided as well as a safe refuge at both the shaft base and head, and a means to remove people safely from the safe refuge for sending onwards to a welfare centre.

3.1.5 The only other alternative for a bi-directional tunnel within a single bore is a parallel escape bore alongside the main bore with cross passages to this bore at frequent intervals, and space for a rescue vehicle in the bore. If an escape bore was being provided then it is likely to be more effective to adopt a twin bore dual carriageway configuration.

3.1.6 For very low traffic levels, the fire risk is also very low and single carriageway bi-directional tunnels can be constructed in such circumstances; however, for the traffic levels identified for this project, single carriageway bi-directional tunnels that are safe, practicable, and can be economically constructed, are at the margins of practicability. Furthermore, tunnels would have to accommodate use by vehicles carrying hazardous (flammable) materials or goods; this has implications for tunnel design in relation to design fire size, ventilation requirements and ultimately the tunnel configuration, depending on traffic figures and risk profile. Accordingly, it is considered that dual carriageway twin bore tunnels may be more appropriate.

3.1.7 Typical examples of cross-sections appropriate for single, TBM-driven and twin bore highway tunnels are illustrated in Figures 1 to 3.

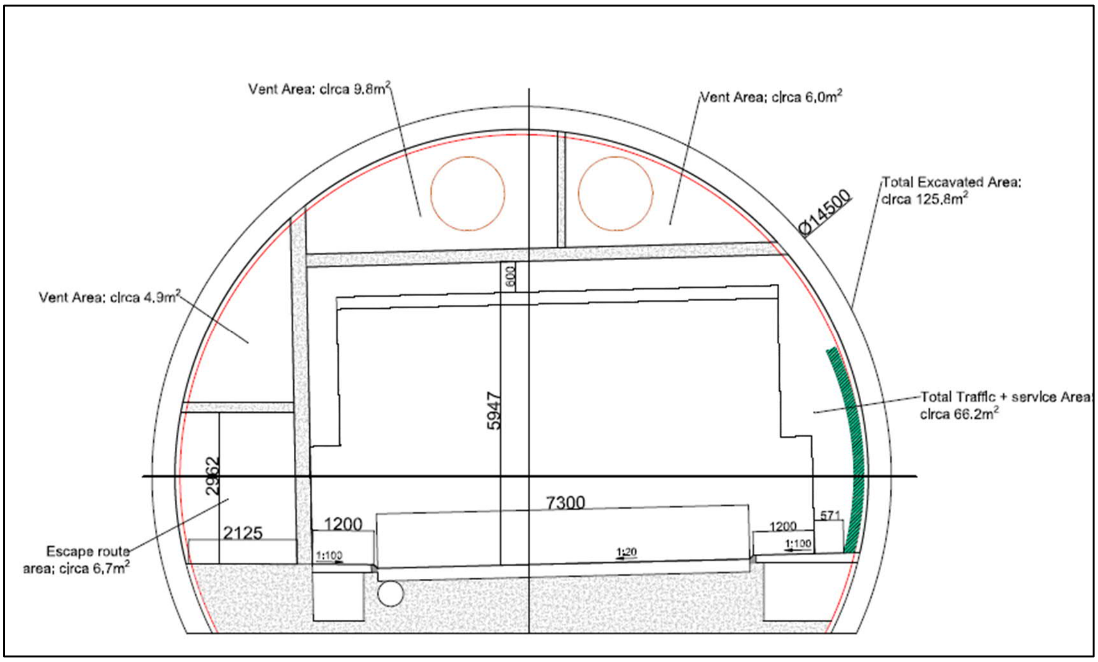


Figure 1: Indicative cross section for a typical single bore highway tunnel.

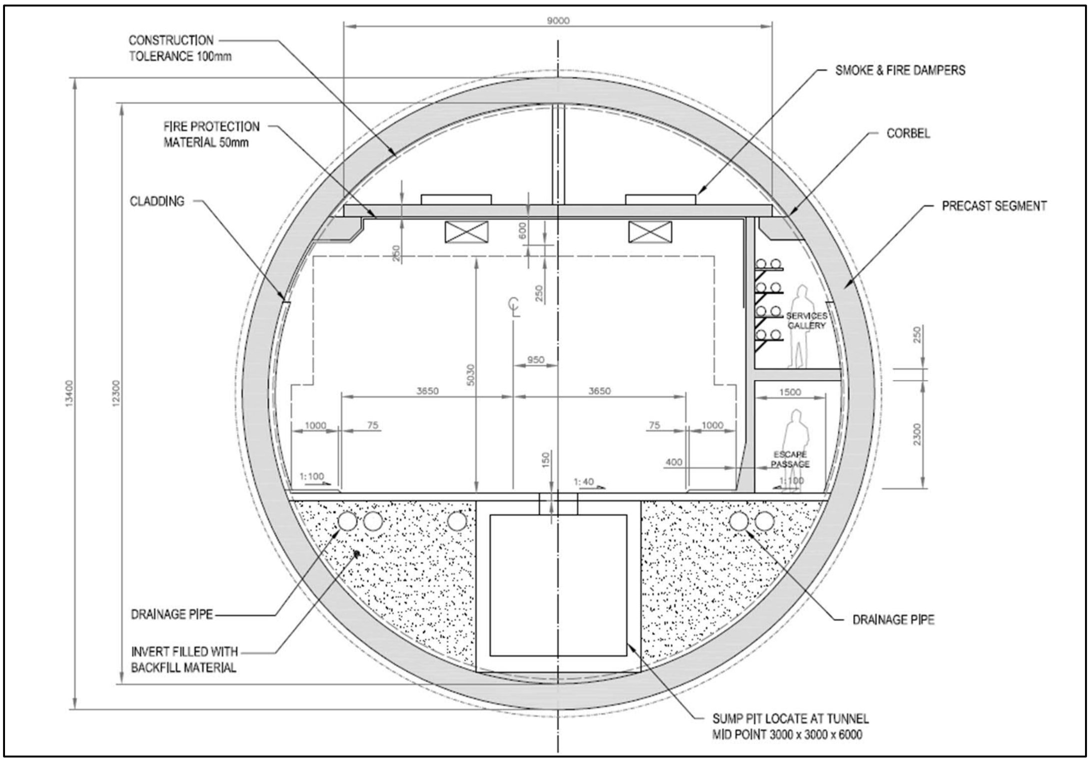


Figure 2: Indicative cross section for a typical single bore TBM-driven tunnel (courtesy of TFL/Jacobs – Galleons Reach feasibility).

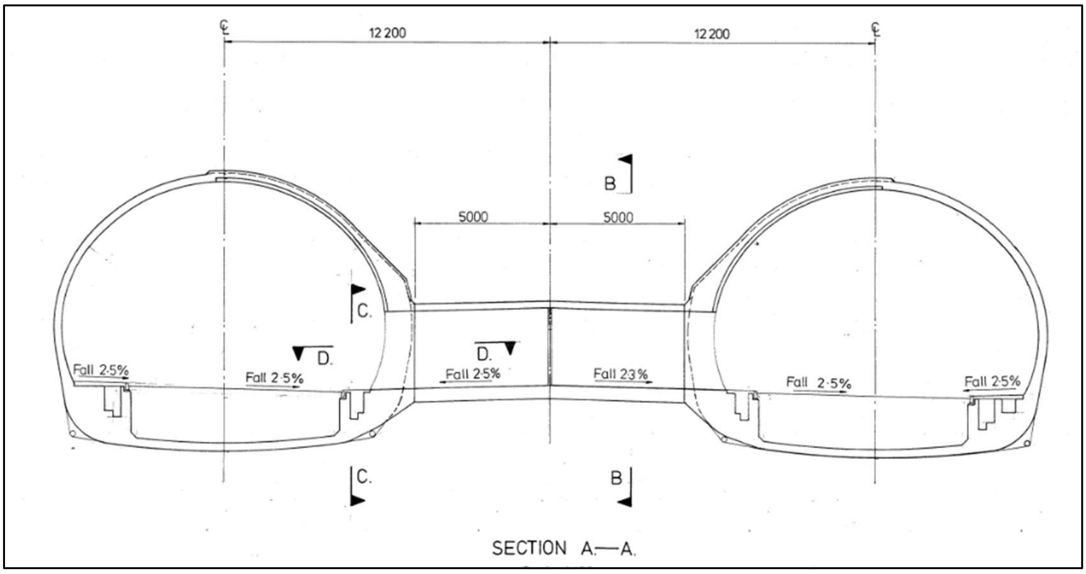


Figure 3: Indicative cross section for a typical twin bore highway tunnel (courtesy of Highways England – Southwick Tunnel).

4. Implications of Geology and Geotechnics on Tunnel Construction

4.1.1 Generally, the geology of the area consists of bedrock belonging to the Southern Highland Group, which are generally metamorphic schists, with volcanic intrusions, typically of granitic rock. Such bedrock, although hard, lends itself to excavation by drill-and-blast as well as excavation by TBM. The metamorphic schistosity (the rock fabric due to alignment, layering and deformation of minerals, a result of the effects of pressure and temperature) is likely to generate rock blocks, wedges or debris which may fall within the newly formed excavation but these can be secured by ground support methods such as rock bolts, steel arch ribs, and sprayed concrete, or a combination of such methods. In turn, support can be further enhanced by combination of good geological interpolation, probing ahead of the excavation face and revision of tunnel support compared with sections previously supported as construction advances.

4.1.2 In certain areas the presence of igneous intrusions, faults and possible rock-bursting could make rock excavation more difficult, requiring more support from the toolkit of ground support methods. TBMs, particularly if stopped for a period of time, may also become entrapped in a squeezing rock mass. An additional issue for TBMs, particularly in rocks with high silica content (e.g. granitic rock), is the abrasivity which could cause accelerated wear on the cutting tools and mucking system of the TBM.

4.1.3 Significant thicknesses of drift deposits including scree and rock-fall debris which have fallen down the mountain over the millennia can be found on the flanks of the mountains where many tunnel portals are proposed.. These deposits are likely to require specific stabilising measures during excavation for tunnel portals, e.g. soil nailing, retaining structures, etc.

4.1.4 In some locations the tunnel portals may be susceptible to landslide hazard; this is of particular importance for any tunnel options developed within the route corridor through Glen Croe. Accordingly, additional protection and/or mitigation measures may be required; however, it would be preferable to site tunnel portals out with areas subject to landslide hazard.

4.1.5 Ground investigation will be required to investigate ground conditions along the proposed length of the tunnel, particularly to gather information on bedrock properties. Investigations would also be required to inform an assessment of ground conditions at tunnel portal locations to allow appropriate design of excavations and an assessment of protective or mitigating measures required.

5. Operations and Maintenance

5.1.1 There is a need for regular inspection and maintenance of road tunnels. A tunnel manager, tunnel safety officer and a tunnel design & safety consultative group (TDSCG) must be set up early in the design process and continue through operation. It should be considered whether there would be a tunnel operations centre adjacent to a tunnel portal, or whether it would be appropriate to have a smaller unmanned facility at the tunnel portal, and manage the tunnel operations from a remote site, which perhaps manages a number of other trunk road facilities.

5.1.2 A sufficient power supply is required to allow operation of the tunnel ventilation system, lighting and all safety and monitoring systems, particularly those required in the event of an emergency incident.

5.1.3 The use of the tunnel by vehicles carrying potentially hazardous materials or dangerous goods (such as fuel tankers) is largely dependent on the fire safety and ventilation designed for the particular tunnel, as well as traffic figures and risk profile; it may have to be specifically dimensioned to cater for a larger design fire size. The risk profile associated with steeper gradients may mean that dangerous goods vehicles need to be escorted through the tunnel in a convoy while restraining any other type of traffic. It should be noted that a twin bore dual carriageway tunnel configuration is considered likely to result in fewer road traffic accidents (due to no bi-directional traffic flow), theoretically attracting a lower risk of emergency incidents.

5.1.4 For a twin bore dual carriageway configuration, vehicle crossovers and possibly lay-bys may need to be provided at intervals if practicable, as per recommendation from the European Directive EUD 2004/54 EC. However, the tunnels less than 1km in length are unlikely to require such provision. Bi-directional tunnels longer than 1.5km may also need lay-bys.

5.1.5 The development of any tunnel design should be informed by consultation with emergency services and other relevant stakeholders to ensure that appropriately robust measures in the event of an emergency incident are put in place.

6. Costs

6.1.1 Tunnel costings are complex to develop, particularly at conceptual design stages, as costs depend on many factors, such as the soil/rock type and associated risks, the setting (e.g. urban, rural, mountainous), and tunnel configuration, diameter and length. For road tunnels there are additional costs which need to be estimated such as the extent of tunnel systems including ventilation; fire management, suppression and escape; information and signage; and the provision of electricity to the site to power the tunnel systems and excavation equipment. These costs extend beyond construction and into the operational phase.

6.1.2 The most appropriate approach for estimating the cost for tunnels is based on a report prepared by the British Tunnelling Society – Infrastructure UK Cost Study Tunnels; October 2010. The report provides a data base for different tunnel types, sizes, methods of construction and ground excavated, based on projects in the UK and Europe. For this study the road tunnels presented in the data have been analysed and indexed to September 2020 prices.

6.1.3 Costs have been calculated for tunnels excavated by conventional Drill and Blast (D&B) or mined with a relatively thin structural lining, and for TBM construction which involves the placement of precast tunnel lining segments behind the TBM. Costing has considered twin bore alignments as well as single bore bi-directional alignments. As is normal practice for early stages of scheme development, the cost basis is from the tunnel construction component of similar reference projects rather than a priced component breakdown. Estimates for this project are based on excavation quantities and representative costs of tunnel components; shafts, portals, M&E systems, drainage and road, preliminaries and design as well as adding a standard allowance for optimism bias appropriate for the level of detail known based on the Treasury Green Book.

7. Fixed Link Crossings

7.1.1 The assessment summary tables included within the Preliminary Assessment Report provide commentary in relation to tunnels considered to satisfy proposed road alignments within the eleven route corridors (as summarised in Table 1), typically to overcome challenging topography. Reference should be made to the summary tables for details.

7.2.1 A conceptual assessment has been undertaken to consider the suitability of tunnels to facilitate fixed-link crossings, i.e. crossings beneath water bodies, within the eleven route corridors (as summarised in Table 2). Generally, tunnel alignment design for the fixed-link crossings is challenging as the gradients within the tunnel and along the approaches should be optimally no more than 4%. The topography on land and the bathymetry (depth to sea bed) makes keeping below this gradient difficult without significantly extending the tunnel length and complexity. For construction safety reasons it is more likely that these tunnels would be constructed by Tunnel Boring Machine, or in shallower water an Immersed Tube technique could be feasible.

7.2.2 General commentary on fixed-link crossings is provided below while more detailed input specifically in relation to a potential tunnel beneath Loch Fyne is discussed in the assessment summary tables included within the Preliminary Assessment Report. A tunnel beneath Loch Fyne at this location is considered feasible due to more favourable shoreline topography, moderate depth to the bed of Loch Fyne, and the extent of shallower water adjacent to the shorelines, particularly the Oitir spit.

Route Corridors 4/5: Loch Long - Garelochhead to Rubha nan Eoin

7.2.3 In this potential crossing location Loch Long is 70-80m deep. In order for a road tunnel to go that deep, starting near the A814/B872 roundabout above Garelochhead, a fairly steep gradient would be required. For the alignment considered, this would be somewhat steeper than optimum. On the western side the topography is even more difficult and it is proposed that the tunnel would continue to Glen Finart, with rock cover of some 400m. The length of the crossing would be approximately 7km. For a single carriageway option, 3 or 4 intermediate ventilation shafts should be provided to facilitate fire management, ventilation and escape. Due to the challenging nature of providing escape facilities from such shafts, it is considered that this tunnel would be more suitable to be a dual carriageway twin bore solution.

7.2.4 A plan and profile showing the conceptual vertical alignment and topography beyond each shoreline is shown in drawing A83AAB-JAC-HML-COR_04-SK-CH-1008.

Route Corridors 6/7: Firth of Clyde - Cloch Point to Dunoon

7.2.5 In this case the loch is some 70m-80m deep at this location, but the land topography is a little more forgiving than the previous corridor considered. The crossing length considered is approximately 7km in length, and starts at an eastern portal close to the interchange of the A770 with the A78 Trunk Road. From there it descends at a reasonable 3.5% gradient for 3km under the Firth of Clyde, before ascending at a similar gradient, curving to the right and emerging to the west of Dunoon. For a single carriageway crossing some 3 intermediate ventilation/escape shafts would be required, which is challenging as the water crossing itself is about 4km in length. Alternatively, a dual carriageway twin bore tunnel would be needed.

7.2.6 A plan and profile showing the conceptual vertical alignment and topography beyond each shoreline is shown in drawing A83AAB-JAC-HML-COR_06-SK-CH-1003.

Route Corridors 8a/8b/9: Firth of Clyde - Portencross to Rubh'an Eun, Bute, (possibly via Little Cumbrae)

7.2.7 These crossings are the most challenging of all. From Portencross to Little Cumbrae the water is 50-60m deep, and for the crossing to Bute the water is approximately 115m deep. At appropriate gradients the considered alignment would be some 13km in length. One potential alignment considered was to have a section of tunnel to Little Cumbrae, then descend into tunnel again for the crossing to Bute. However, at the gradients required this not considered possible, so an alternative with reasonable gradients would be for a long, bored crossing directly from near the A78 Trunk Road south-east of Hunterston Nuclear Power Station , to the A844 north-west of Kilchattan Bay. With the two water crossings exceeding

3km the required intermediate shafts for a single carriageway crossing would be problematic, so it is considered that a dual carriageway twin bore crossing would be more appropriate.

7.2.8 A plan and profile showing the conceptual vertical alignment and topography beyond each shoreline is shown in drawing A83AAB-JAC-HML-COR_08-SK-CH-1203.

Route Corridors 8a/9: Kyles of Bute - Rhubodach, Bute to Colintraive

7.2.9 At this location the loch is less than 30m deep (and less than 10m deep for one option under Eilean Mor. In this case an immersed tube tunnel would probably be feasible, depending on the rock profile below the bed of the loch. This type of tunnel would need to be considered in further detail if this route corridor were to be taken forward.

7.2.10 Maximum length of this crossing would be approximately 1.5km and no intermediate shafts would be required.

Route Corridor 8b: Rothesay Bay – Ardyne Point to Ardmaleish

7.2.11 At this location the loch is some 30m deep, and the considered alignment starts with the eastern tunnel portal in the flat land north-east of Ardyne Point, descends at a 4% gradient under the Kyles of Bute and ascends at a slightly reduced gradient passing under Ardmaleish hill before emerging in low lying ground at the A886 west of Port Ballantyne. This would be a 4.5km long bored single carriageway tunnel crossing and would need 1 or 2 intermediate shafts for fire management and escape, which are considered feasible. Alternatively a dual carriageway twin bore tunnel could be considered.

7.2.12 A plan and profile showing the conceptual vertical alignment and topography beyond each shoreline is shown as drawing A83AAB-JAC-HML-COR_08-SK-CH-12304.

Route Corridors 10/11: Loch Long - Cove to Strone

7.2.13 In this case the loch is 50-60m deep, and due to the elevated terrain on each shore, the tunnel portals would be close to the coast in each case. The fixed link crossings considered would be about 6km in length. Both options considered start east of Cove by the B833 in the valley of the Kilcreggan Burn and descend at a gentle gradient for some 4 km under Loch Long, before ascending at a steeper but acceptable gradient, emerging on Shore Road either north or south of Strone. For a single carriageway crossing 3 intermediate ventilation/escape shafts could be required, and as the loch crossing itself is 3km this is an issue. Once again, given the escape difficulties associated with such shafts a twin bore tunnel could be more appropriate.

7.2.14 A plan and profile showing the conceptual vertical alignment and topography beyond each shoreline is shown in drawing A83AAB-JAC-HML-COR_11-SK-CH-1206 for Route Corridor 10 and drawing A83AAB-JAC-HML-COR_11-SK-CH-1205 for Route Corridor 11.

Route Corridors 10/11: Gare Loch - Rhu to Rosneath

7.2.15 Gare Loch at the proposed crossing location is 20-30m deep. However the gradients of a bored tunnel alignment are hampered by the rising ground either side and a straight east to west alignment cannot be accomplished with compliant gradients.

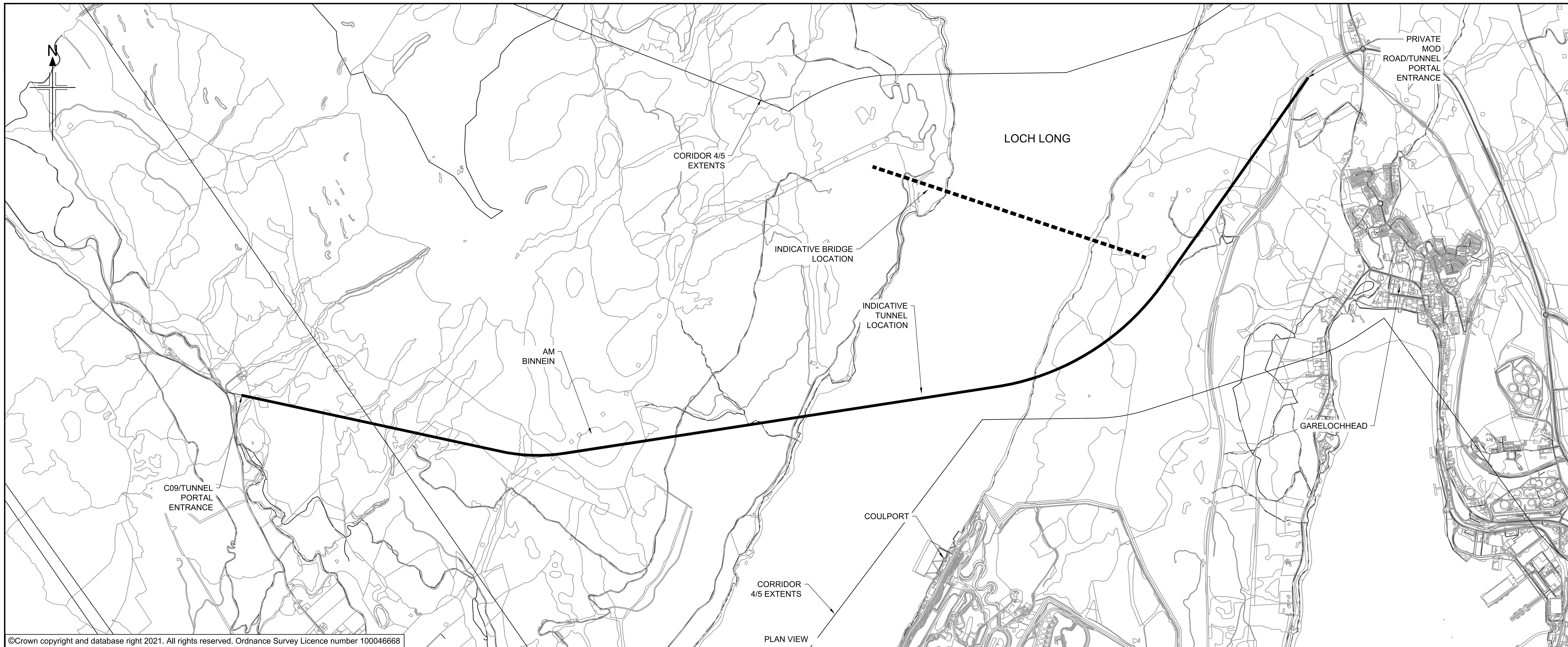
7.2.16 A plan and profile showing the conceptual vertical alignment and topography beyond each shoreline is shown in drawing A83AAB-JAC-HML-COR_11-SK-CH-1207.

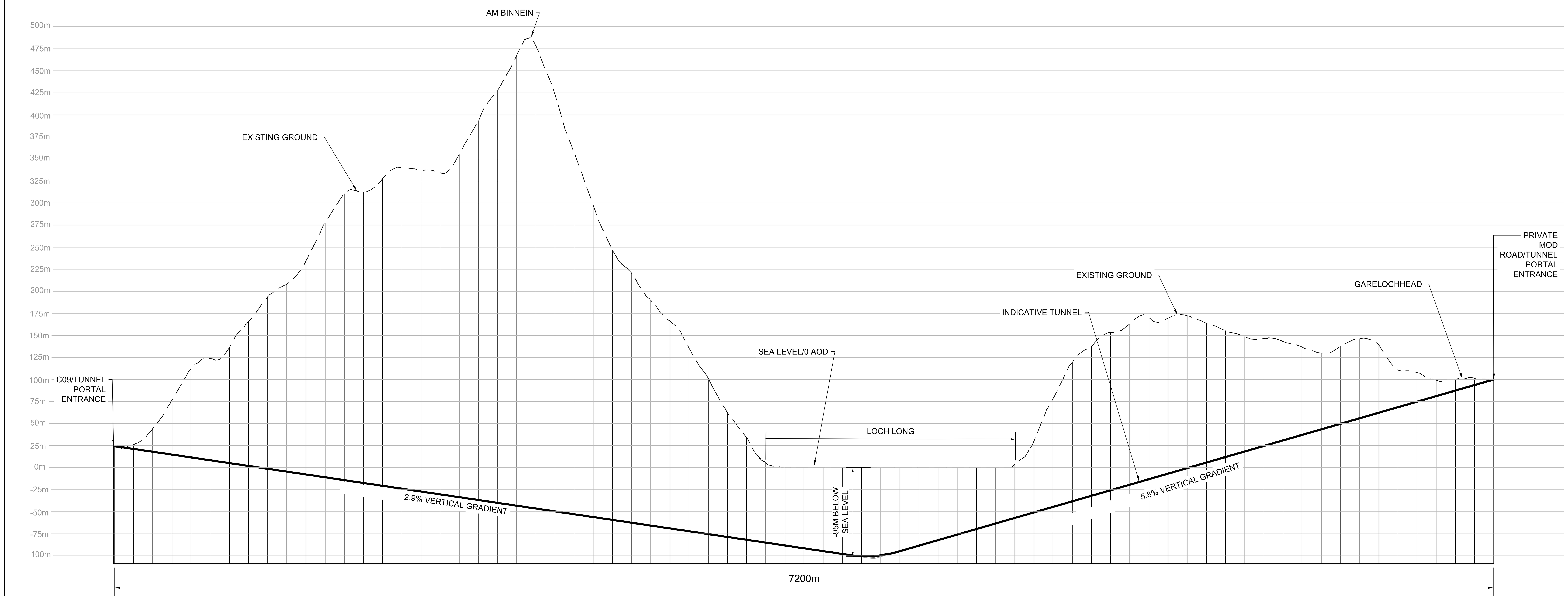
7.2.17 Topographic data and particularly bathymetry used in this conceptual study of the fixed-link crossings has limited accuracy and the above conceptual alignments are not necessarily the best alignments, but illustrate the possibilities and drawbacks of constructing fixed-link tunnels in the locations identified.

8. Summary

8.1.1 This document has summarised the main issues affecting tunnelling and tunnelling routes associated with the future development and routing of the A83 to Argyll and Bute.

8.1.2 In short, these tunnels are feasible and can be constructed by traditional methods of drill-and-blast or by TBMs. Although tunnels can considerably shorten journeys by road in mountainous terrain or by crossing water bodies, road tunnels are expensive to construct and to operate, partly because of the resources required to tunnel and partly due to the health and safety obligations, particularly in respect of fire safety and associated ventilation and escape provision. Single carriageway bi-directional tunnels make these issues particularly difficult to solve, and it may be more feasible to progress any future tunnel design on the basis of dual-carriageway twin-bore tunnels, despite possible extra expenditure.





SECTION VIEW - H1:500, V1:100

NOTES

1. DRAWING IS NOT TO SCALE.
2. ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE STATED.
3. LONG SECTION HAS BEEN EXAGGERATED AND USES A HORIZONTAL 1:500 AND VERTICAL 1:100 SCALE.
4. HORIZONTAL SCALE LINES ARE AT 25m INTERVALS AND VERTICAL AT 100m INTERVALS.
5. TUNNEL AND STRUCTURE LOCATIONS ARE INDICATIVE AND HAVE BEEN DEVELOPED AT A HIGH LEVEL TO ASSIST IN THE ACCESS TO ARGYLL & BUTE (A83) PRELIMINARY ASSESSMENT.
6. THE TUNNEL ALIGNMENT SHOWN IS INDICATIVE. DUE TO LACK OF DETAILED BATHYMETRIC DATA THE SEA-BED DEPTH IS NOT SHOWN ON THE SKETCH. AN ESTIMATE OF MINIMUM TUNNEL DEPTH HAS BEEN INFORMED BY NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION (NOAA) RASTER NAVIGATIONAL CHARTS FOUND AT HTTP://FISHING-APP.GPSNAUTICALCHARTS.COM. A NOMINAL TUNNEL COVER DEPTH OF 15 METRES HAS ALSO BEEN INCLUDED.

LEGEND

INDICATIVE TUNNEL LOCATION

INDICATIVE BRIDGE LOCATION

P01	15/03/21	FOR INFORMATION	MB	RC	DR	DR
Rev	Rev. Date	Purpose of revision	Orig	Check'd	Rev'd	Apprv'd

Jacobs AECOM

Client: TRANSPORT SCOTLAND CÒMHDHAIL ALBA

Project: ACCESS ARGYLL & BUTE [A83]

Drawing title

PRELIMINARY ASSESSMENT

CORRIDOR 4/5 INDICATIVE TUNNEL SKETCH

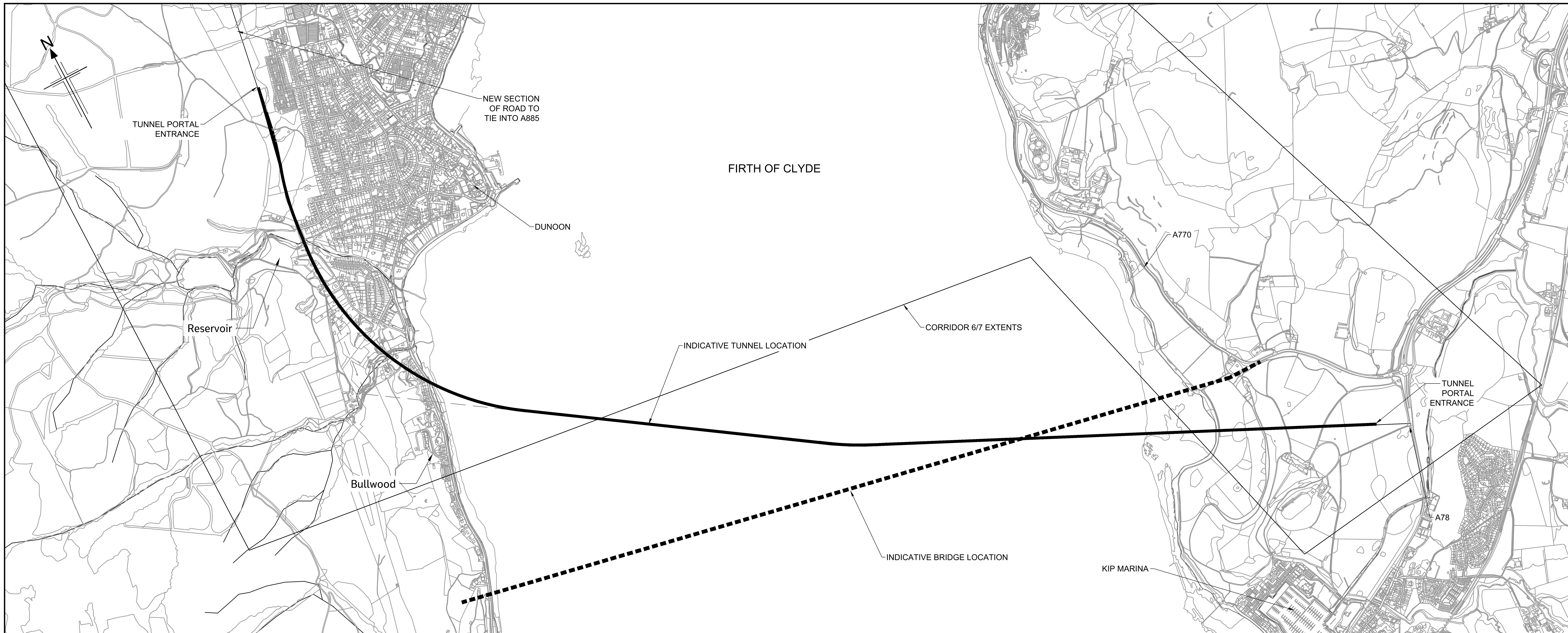
LOCH LONG CROSSING

SHEET 1 OF 1

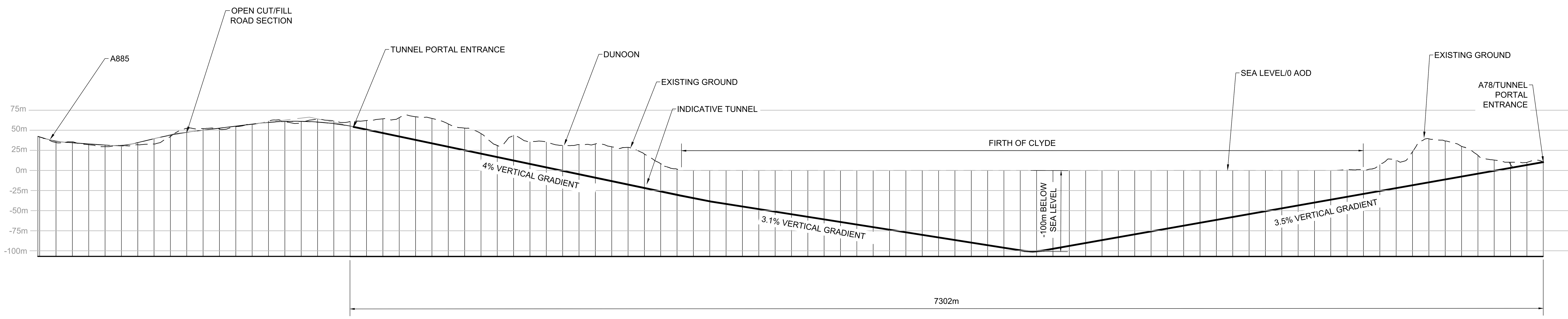
Drawing status	S2 - SUITABLE FOR INFORMATION	Suitability S2
Scale	NTS	DO NOT SCALE
Jacobs No.	A83AAB	Rev P01
Client No.		

Drawing number

A83AAB-JAC-HML-COR_04-SK-CH-1008



PLAN VIEW



SECTION VIEW - H1:500, V1:100

NOTES

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LEGEND

INDICATIVE TUNNEL LOCATION
INDICATIVE BRIDGE LOCATION

Rev	Rev. Date	Purpose of revision	Orig	Check'd	Rev'd	Apprv'd
P01	15/03/21	FOR INFORMATION	MB	RC	DR	DR

Jacobs. AECOM

Client

TRANSPORT SCOTLAND
CÒMHDHAIL ALBA

Project

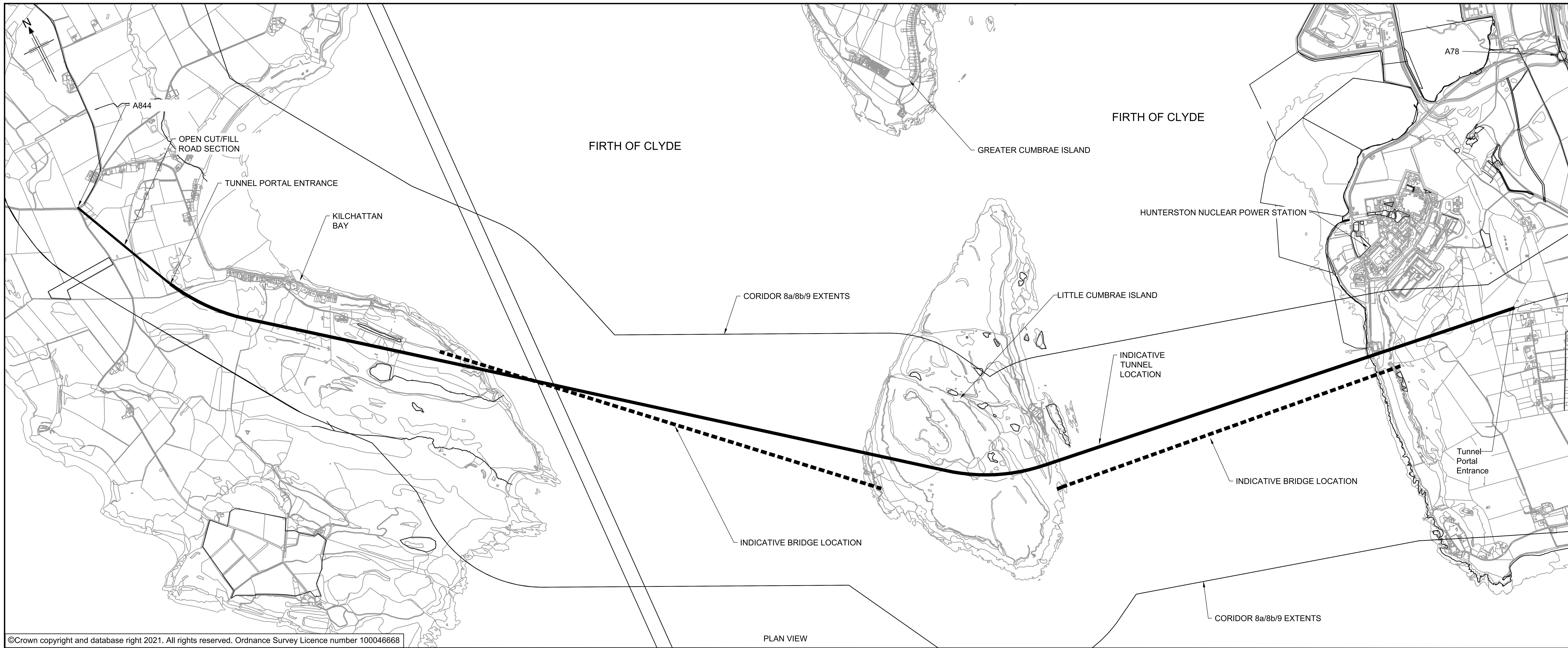
ACCESS ARGYLL & BUTE [A83]

Drawing title

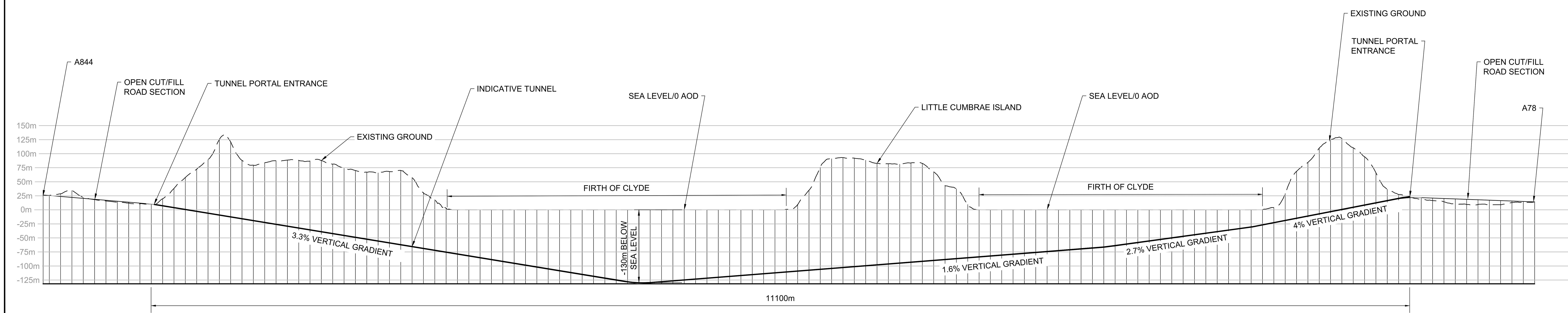
PRELIMINARY ASSESSMENT
CORRIDOR 6/7 INDICATIVE TUNNEL SKETCH
FIRTH OF CLYDE CROSSING
SHEET 1 OF 1

Drawing status	S2 - SUITABLE FOR INFORMATION		Suitability S2
Scale	NTS	DO NOT SCALE	
Jacobs No.	A83AAB		Rev P01
Client No.			

Drawing number
A83AAB-JAC-HML-COR_06-SK-CH-1003



PLAN VIEW



SECTION VIEW - H1:500, V1:100

NOTES

1. DRAWING IS NOT TO SCALE.
2. ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE STATED.
3. LONG SECTION HAS BEEN EXAGGERATED AND USES A HORIZONTAL 1:500 AND VERTICAL 1:100 SCALE.
4. HORIZONTAL SCALE LINES ARE AT 25m INTERVALS AND VERTICAL AT 100m INTERVALS.
5. TUNNEL AND STRUCTURE LOCATIONS ARE INDICATIVE AND HAVE BEEN DEVELOPED AT A HIGH LEVEL TO ASSIST IN THE ACCESS TO ARGYLL & BUTE (A83) PRELIMINARY ASSESSMENT.
6. THE TUNNEL ALIGNMENT SHOWN IS INDICATIVE. DUE TO LACK OF DETAILED BATHYMETRIC DATA THE SEA-BED DEPTH IS NOT SHOWN ON THE SKETCH. AN ESTIMATE OF MINIMUM TUNNEL DEPTH HAS BEEN INFORMED BY NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION (NOAA) RASTER NAVIGATIONAL CHARTS FOUND AT HTTP://FISHING-APP.GPSNAUTICALCHARTS.COM. A NOMINAL TUNNEL COVER DEPTH OF 15 METRES HAS ALSO BEEN INCLUDED.

LEGEND

INDICATIVE TUNNEL LOCATION

INDICATIVE BRIDGE LOCATION

Rev	Rev. Date	Purpose of revision	Orig	Check'd	Rev'd	Apprv'd
P01	15/03/21	FOR INFORMATION	MB	RC	DR	DR

Client

Project

Drawing title

PRELIMINARY ASSESSMENT

CORRIDOR 8A/8B/9 INDICATIVE TUNNEL SKETCH

FIRTH OF CLYDE CROSSING

SHEET 1 OF 1

Drawing status: S2 - SUITABLE FOR INFORMATION

Suitability: S2

Scale: NTS — DO NOT SCALE

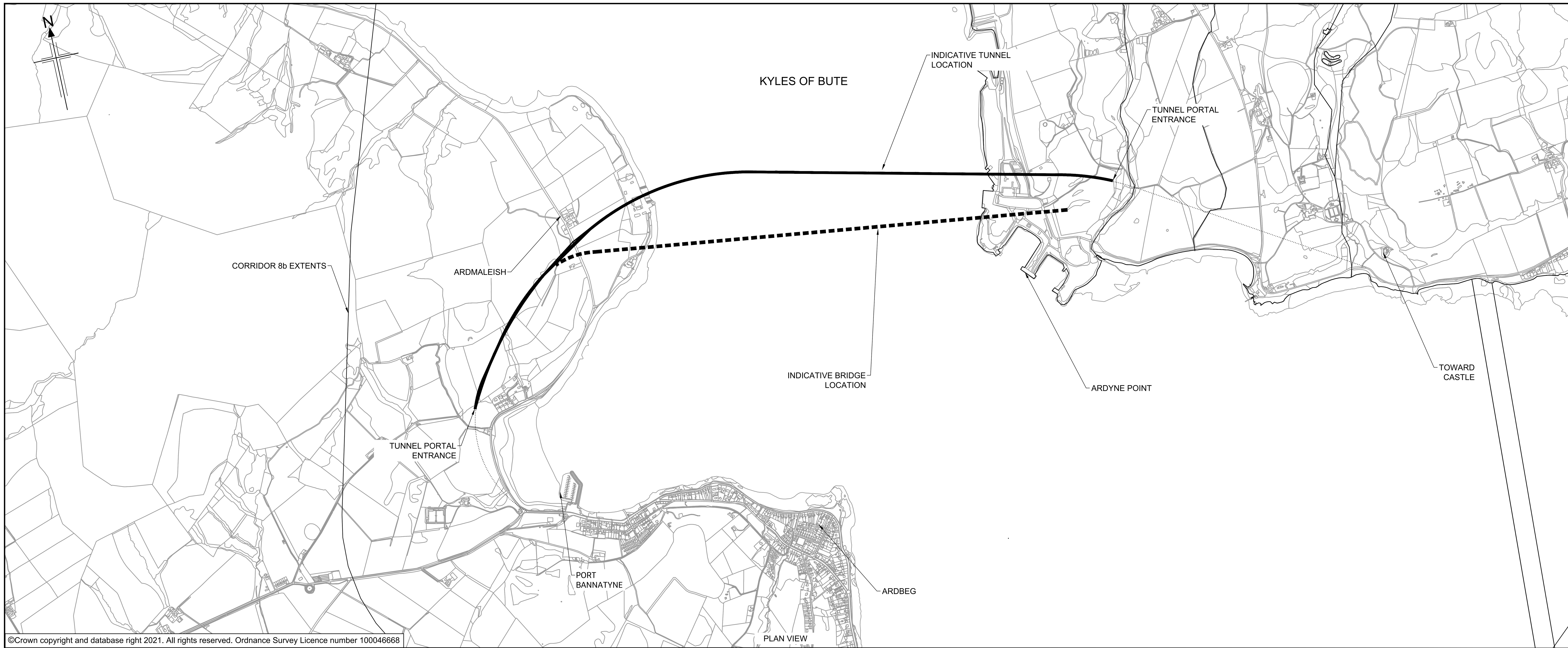
Jacobs No.: A83AAB

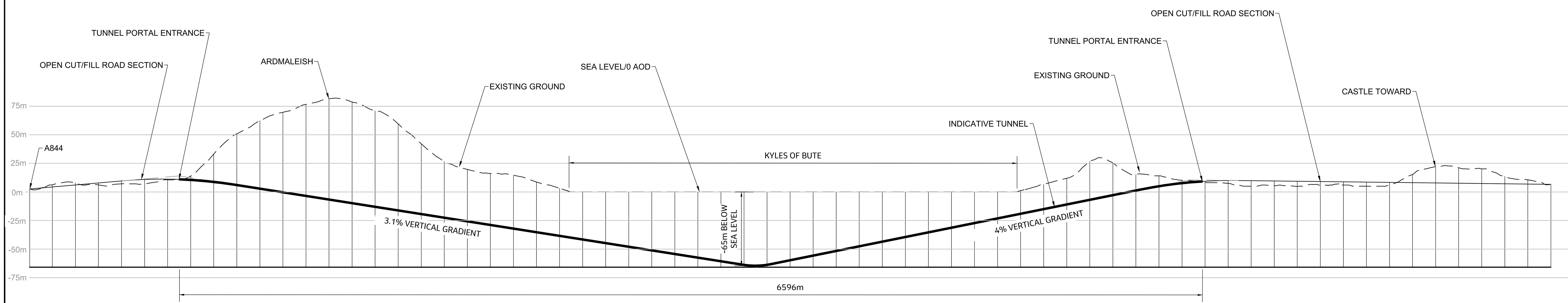
Client No.:

Rev: P01

Drawing number

A83AAB-JAC-HML-COR_08-SK-CH-1203





SECTION VIEW - H1:500, V1:100

NOTES

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LEGEND

INDICATIVE TUNNEL LOCATION

INDICATIVE BRIDGE LOCATION

Rev	Rev. Date	Purpose of revision	Orig	Check'd	Rev'd	Apprv'd
P01	15/03/21	FOR INFORMATION	MB	RC	DR	DR

Jacobs. AECOM

Client

TRANSPORT SCOTLAND
CÒMHDHAIL ALBA

Project

ACCESS ARGYLL & BUTE [A83]

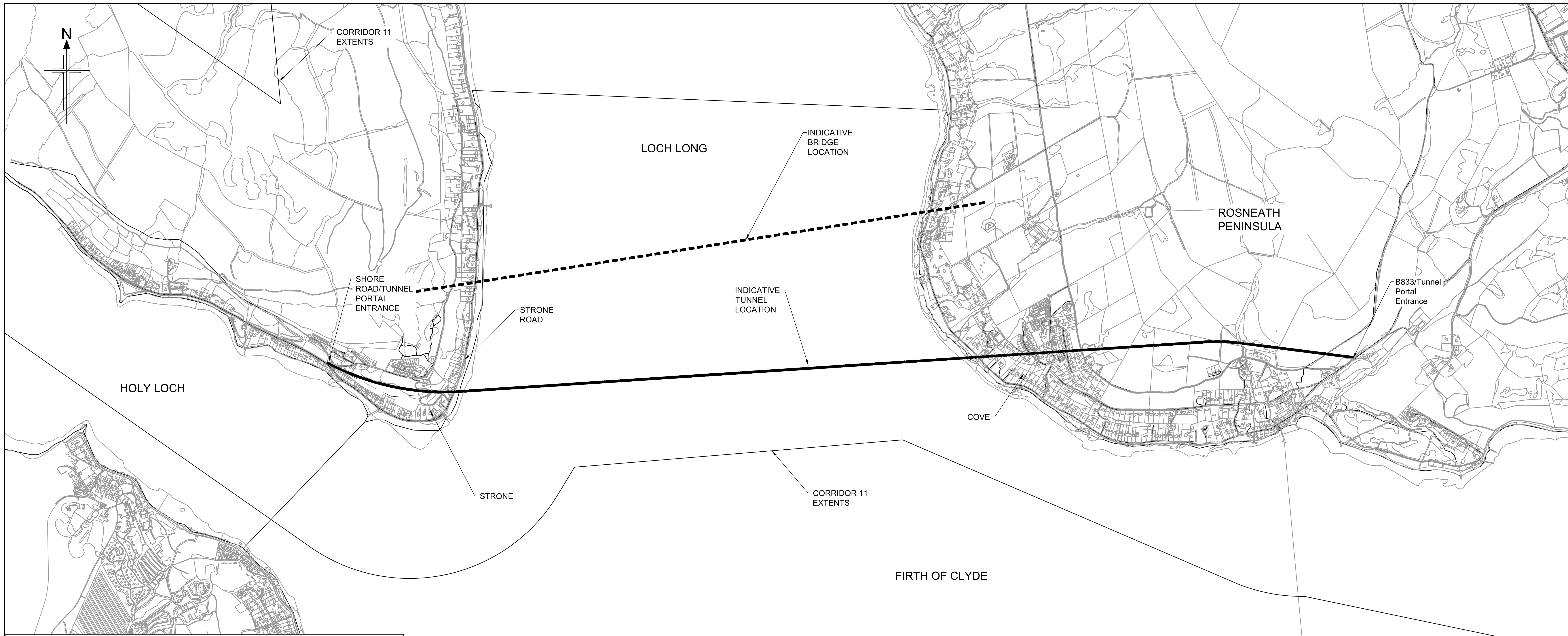
Drawing title

PRELIMINARY ASSESSMENT
CORRIDOR 8B INDICATIVE TUNNEL SKETCH
FIRTH OF CLYDE
SHEET 1 OF 1

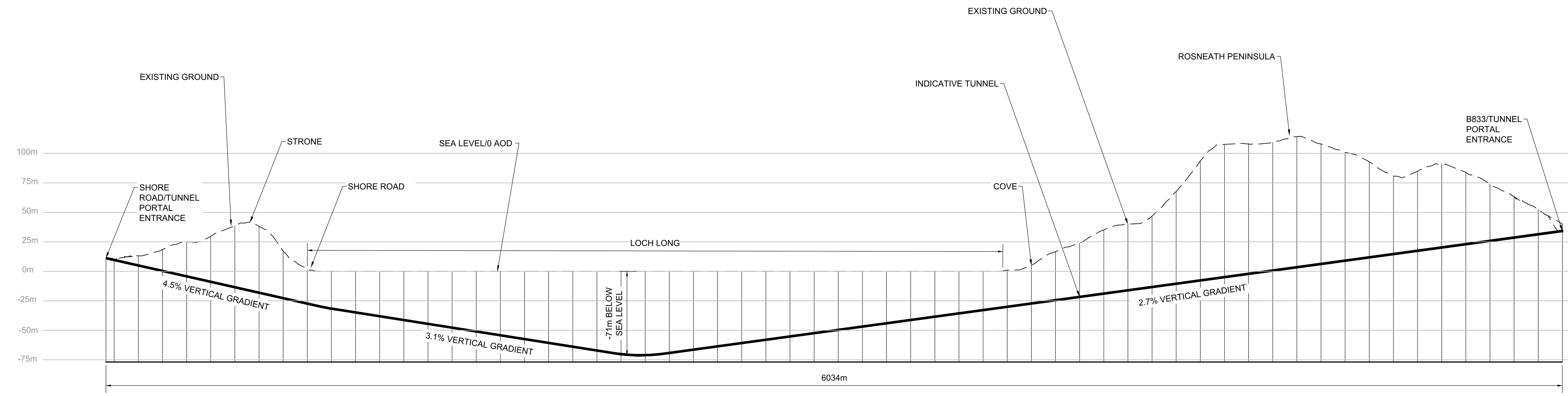
Drawing status	S2 - SUITABLE FOR INFORMATION	Suitability S2
Scale	NTS	DO NOT SCALE
Jacobs No.	A83AAB	Rev P01
Client No.		

Drawing number

A83AAB-JAC-HML-COR_08-SK-CH-1304



PLAN VIEW



SECTION VIEW - H1:500, V1:100

NOTES

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LEGEND

INDICATIVE TUNNEL LOCATION

INDICATIVE BRIDGE LOCATION

P01	15/03/21	FOR INFORMATION	MB	RC	DR	DR
Rev	Rev. Date	Purpose of revision	Orig	Check'd	Rev'd	Apprv'd

Client

Project

Drawing title

PRELIMINARY ASSESSMENT

CORRIDOR 11 INDICATIVE TUNNEL SKETCH

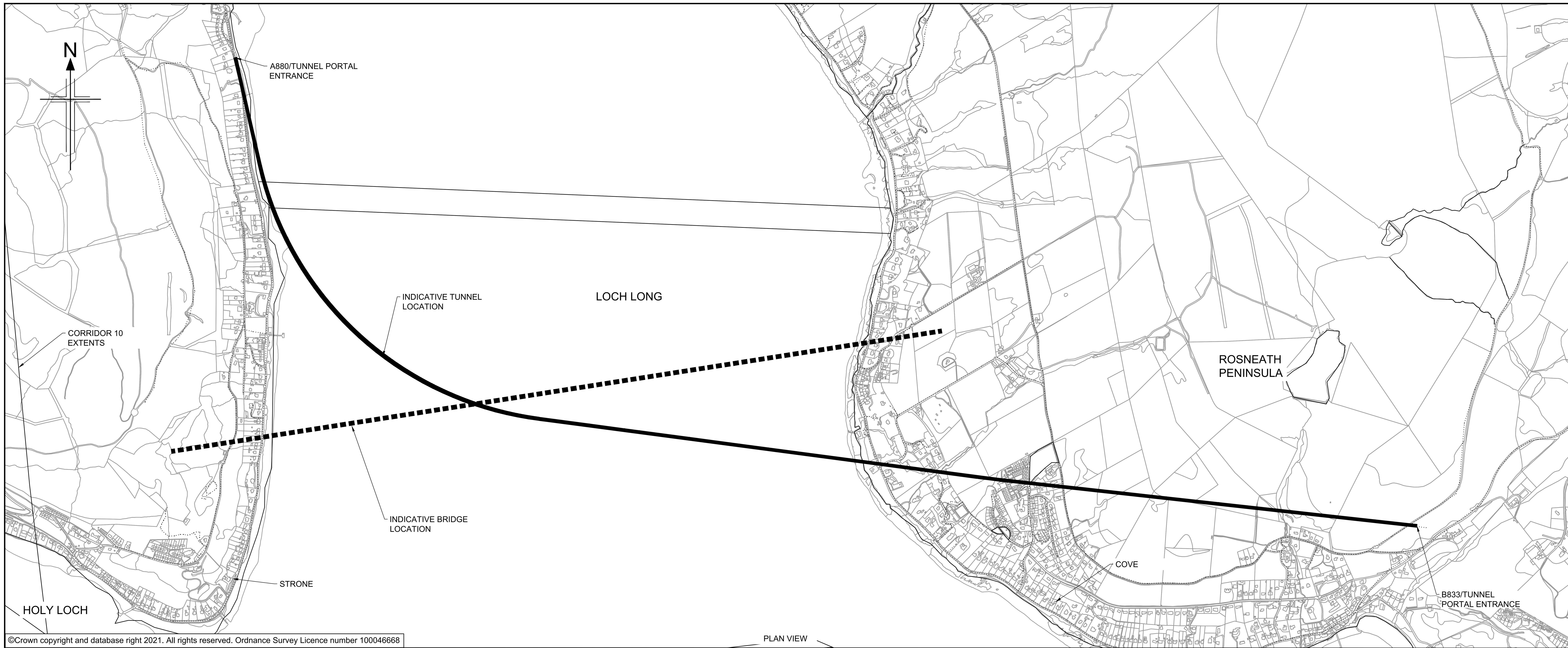
LOCH LONG CROSSING

SHEET 1 OF 1

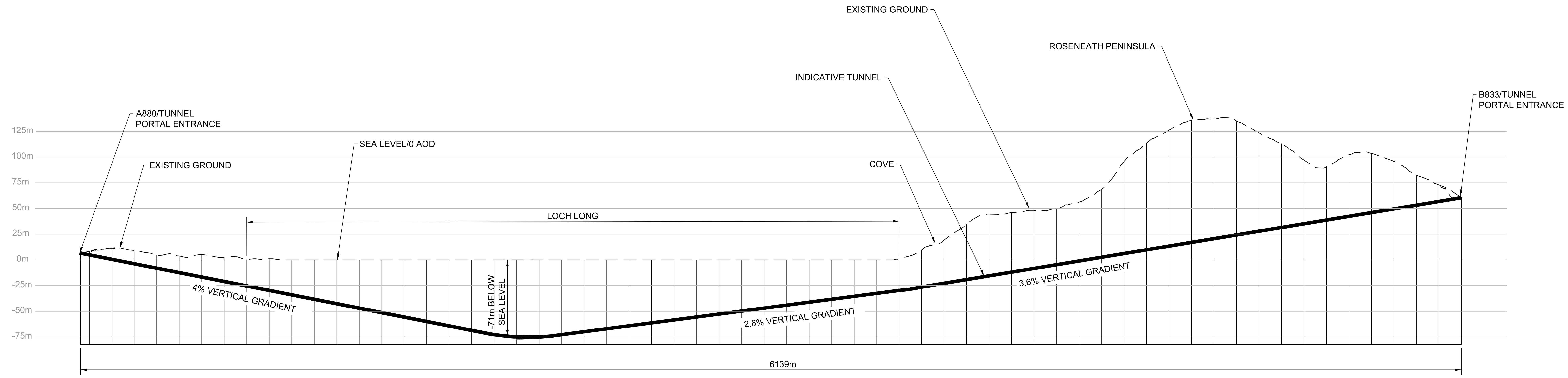
Drawing status	S2 - SUITABLE FOR INFORMATION		Suitability S2
Scale	NTS	DO NOT SCALE	
Jacobs No.	A83AAB		Rev P01
Client No.			

Drawing number

A83AAB-JAC-HML-COR_11-SK-CH-1205



PLAN VIEW



SECTION VIEW - H1:500, V1:100

NOTES

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LEGEND

INDICATIVE TUNNEL LOCATION

INDICATIVE BRIDGE LOCATION

Rev	Rev. Date	Purpose of revision	Orig	Check'd	Rev'd	Apprv'd
P01	15/03/21	FOR INFORMATION	MB	RC	DR	DR

Jacobs. AECOM

Client

TRANSPORT SCOTLAND
CÒMHDHAIL ALBA

Project

ACCESS ARGYLL & BUTE [A83]

Drawing title

PRELIMINARY ASSESSMENT

CORRIDOR 10 INDICATIVE TUNNEL SKETCH

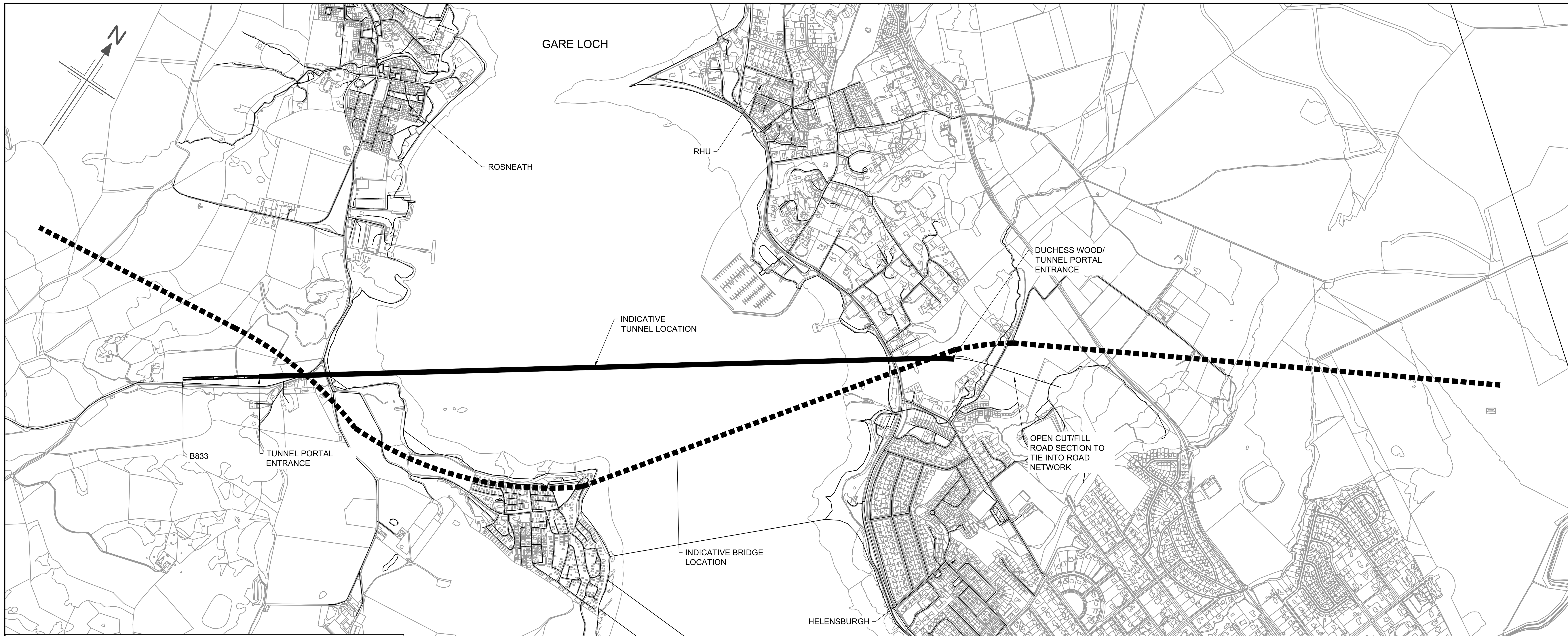
LOCH LONG CROSSING

SHEET 1 OF 1

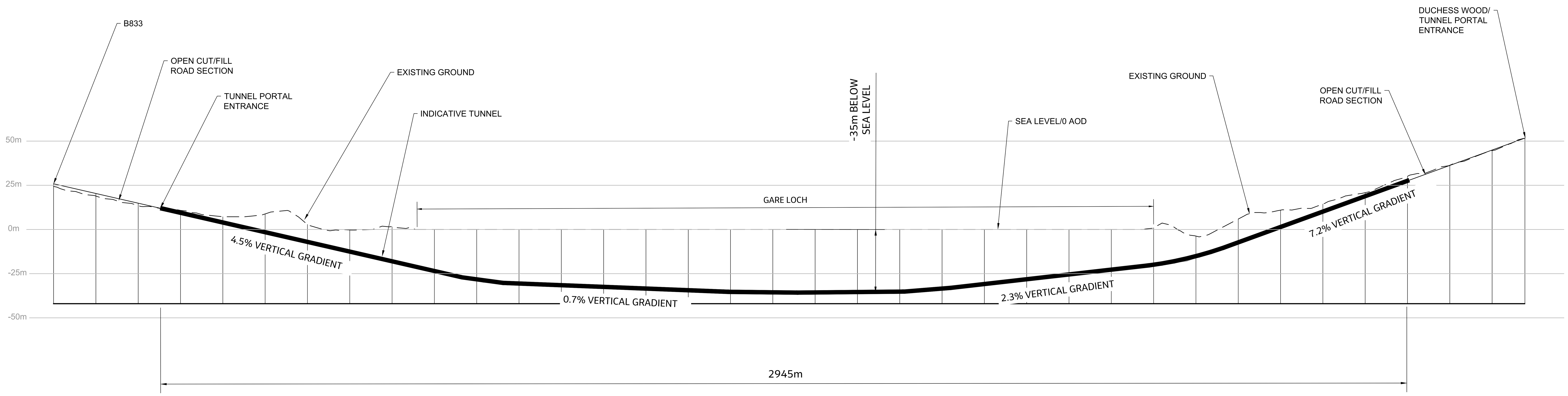
Drawing status	S2 - SUITABLE FOR INFORMATION	Suitability S2
Scale	NTS	DO NOT SCALE
Jacobs No.	A83AAB	Rev P01
Client No.		

Drawing number

A83AAB-JAC-HML-COR_11-SK-CH-1206



PLAN VIEW



SECTION VIEW - H1:500, V1:100

NOTES

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LEGEND

- INDICATIVE TUNNEL LOCATION
- INDICATIVE BRIDGE LOCATION

Rev	Rev. Date	Purpose of revision	Orig	Check'd	Rev'd	Appr'd
P01	15/03/21	FOR INFORMATION	MB	RC	DR	DR

Jacobs. AECOM

Client

TRANSPORT SCOTLAND
CÒMHDHAIL ALBA

Project

ACCESS ARGYLL & BUTE [A83]

Drawing title

PRELIMINARY ASSESSMENT
CORRIDOR 10/11 INDICATIVE TUNNEL SKETCH
GARE LOCH/FIRTH OF CLYDE CROSSING
SHEET 1 OF 1

Drawing status	S2 - SUITABLE FOR INFORMATION	Suitability S2
Scale	NTS	DO NOT SCALE
Jacobs No.	A83AAB	Rev P01
Client No.		

Drawing number

A83AAB-JAC-HML-COR_11-SK-CH-1207