

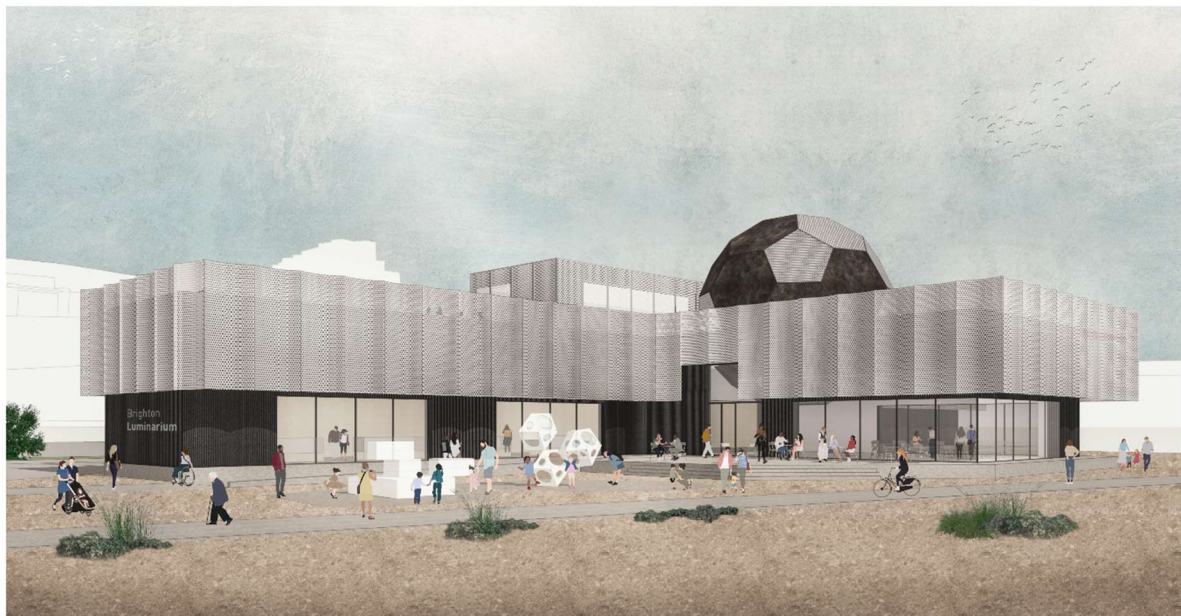
BRIGHTON LUMINARIUM

A Science & Technology
Discovery Centre at
Black Rock, Brighton

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B r i g h t o n L u m i n a r i u m

A Science & Technology Discovery Centre at Black Rock, Brighton

*We propose that a science & technology discovery centre, called the **Brighton Luminarium**, is built at the Black Rock site on Brighton's sea front, immediately west of the Brighton Marina.*

Executive Summary

The theme of the Brighton Luminarium is Light. The centre will tell the stories of local Victorian pioneer inventors (such as Magnus Volk, who introduced electric lighting to the Royal Pavilion in 1883), how the quantum nature of light creates the colours that we see all around us (and how that is used to develop the next generation of ultra-fast quantum computers in Brighton), and how astronomers study distant light to understand our place in the Universe.

We are confident that this proposal will be a success for the following reasons:

- The Brighton Luminarium would be a major tourist attraction. Over 20 million people visit UK science centres each year, yet the nearest to Brighton is a 45-minute drive away.
- It will be a unique attraction to showcase Brighton, consisting of the first Quantum Museum in the world. Innovative architecture, exhibits and interactives will create a memorable and exciting day out for tourists, families and school groups alike.
- Based on visitor numbers at similar venues around the UK (see table on page 8), we would expect at least 300,000 visitors to the Brighton Luminarium per annum.
- Brighton's Palace Pier, 2km away from Black Rock, is the most popular UK attraction outside London, with almost 5 million visitors each year.
- Volk's Electric Railway, a popular heritage attraction with over 150,000 journeys each year, would act as an accessible link between the Luminarium, Palace Pier & Aquarium.
- The Brighton Luminarium would support science teaching in schools and colleges, providing curriculum enriching activities in state-of-the-art classrooms for all ages.
- The classrooms would be available for hire as event venues outside of school hours.

The proposing team are in the process of setting up a charity, **Brighton Luminarium**, to raise funds, develop, build and operate the centre.

Our initial goal is to raise ~£50k, and funding opportunities are currently being investigated.

This initial funding will allow us to:

- Employ project management.
- Collate the high-level requirements for the centre.
- Initiate fundraising and write grant applications.
- Produce accurate cost estimates.

Funding required for the completion of the project is expected to be £12M (as detailed in the *financial considerations* section below). This covers the cost of developing detailed architectural plans, planning applications, surveying works, construction of the building and installing the infrastructure required to operate the centre. This cost includes equipment and furnishings and will enable heritage and other artefacts to be acquired and displayed throughout the centre. Preliminary discussions with local company Pebblebeach Fundraising have shown that this is feasible.

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Overview

We propose that a science & technology discovery centre, called the Brighton Luminarium, is built at the Black Rock site on Brighton's sea front, immediately west of the Brighton Marina. The Brighton Luminarium will be a unique attraction that will showcase Brighton with innovative architecture, exhibits and interactives, and will create a memorable and exciting day out for tourists, local families, and school groups alike. The Luminarium will consist of three primary zones with the overarching theme being **Light**.

The Brighton Luminarium will consist of the following areas:

- **The Pioneer zone** will explore the achievements of Brighton's engineering visionaries, including Magnus Volk and other inventors. Many visitors would travel to the venue via Volk's Electric Railway, and there is the possibility of an integrated train station within the Luminarium, that would allow visitors to disembark directly into the centre.
- **The Astronomy zone**, including a planetarium, would present visitors with the latest astronomical discoveries and stunning images of our Universe. The planetarium dome will be in the shape of a buckyball, to acknowledge Sir Harry Kroto being awarded the Nobel Prize for Chemistry in 1996 for the discovery of the carbon-60 molecule at the University of Sussex in Brighton.
- **The Quantum zone** will be the first quantum museum in the world, and will contain a Quantum arcade, where modern arcade-style games will introduce quantum physics to visitors in a fun and engaging way.
- **An outdoor play area** would allow children to play with large interactive activities, like those at the Observatory Science Centre in Herstmonceux.
- **Classrooms** will allow school groups to attend syllabus-linked workshops and would be available for hire for corporate or community events outside of school hours.
- **An exhibitions & performance space** will host a variety of temporary exhibitions and events (e.g. Brighton Fringe, etc), from photographic exhibitions to open-air theatre.
- **Toilet facilities, a shop** (selling relevant toys and gifts) **and a café** offering sea views with outdoor seating would be included, becoming a destination in their own right.

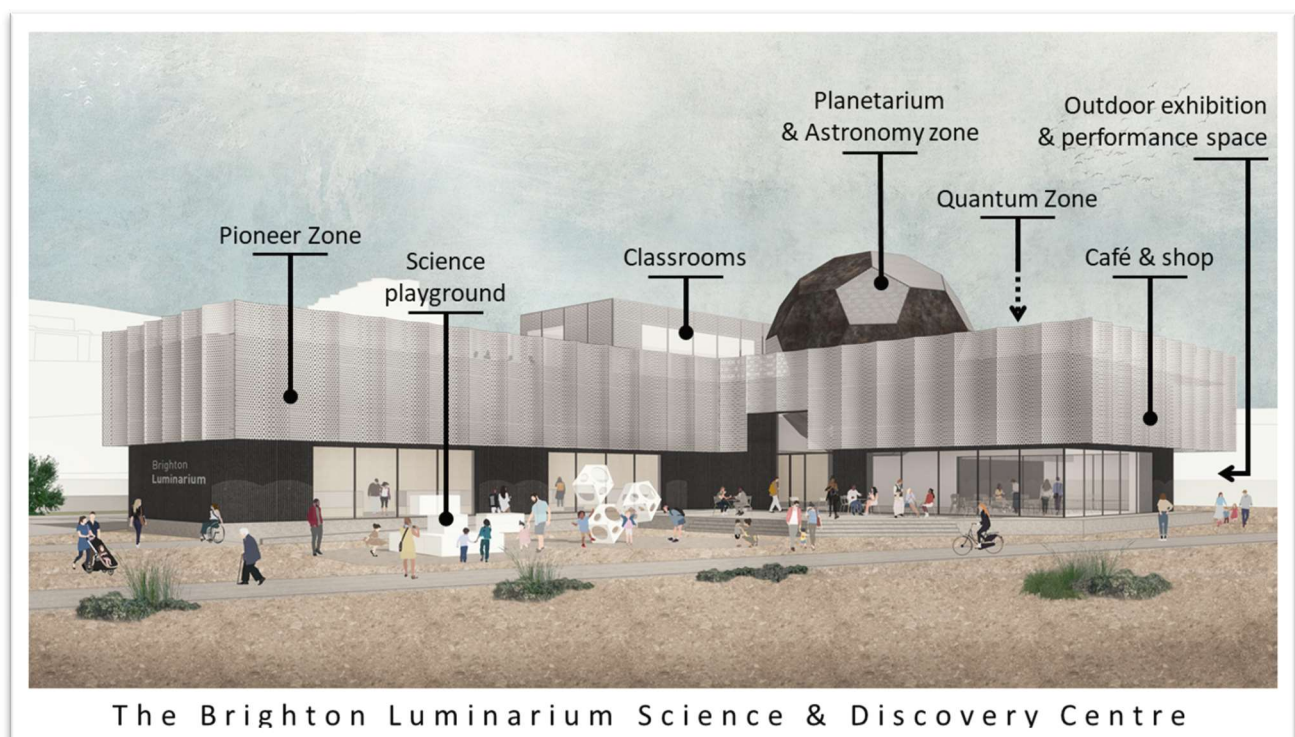
Motivation

Science centres have a proven track record of being popular and commercially successful across the UK (see the tables on page 8 and 10), with visitors consisting of school groups and local, national and international tourists.

A science centre in Brighton will:

- Be a major tourist attraction, attracting over 300,000 visitors per year (as do other science centres across the country) with unique, inspiring architecture.
- Benefit local school children, especially those in the socio-economically deprived coastal communities, by supporting their learning with syllabus-linked educational activities. Novel demonstrations and activities using specialist equipment that is rarely available in schools (such as expensive thermal cameras) will help inspire the next generation to study science and technology subjects.
- Provide a unique venue hire and conference facility.
- Showcase and promote Brighton's scientific, digital & creative industries.
- Raise awareness of Brighton's world-leading scientific research at its two universities (including Nobel Prize winning research), and the city's forward-looking ethos.
- Regenerate the Black Rock area.
- Attract visitors from other nearby attractions, such as Brighton's Palace Pier just 2km away (the 5th most visited attraction in the UK, with 4.9M visitors in 2019) and the Volk's Electric Railway (with over 150,000 journeys per year).

The addition of a new year-round tourist destination in Brighton will also help the city reach a critical number of attractions required to encourage the large number of day and weekend visitors to stay longer in Brighton, thus benefitting the wider local economy.



The Vision

The vision is for a science & technology discovery centre to be built in Brighton at the Black Rock sea-front site by the marina, called the **Brighton Luminarium**. It will be a unique attraction that will showcase Brighton, and will include the world's first Quantum Museum. Innovative architecture, exhibits and interactives, will create a memorable and exciting day out for tourists, families and school groups alike.

The theme of the Brighton Luminarium is Light. The centre will tell the stories of local Victorian pioneer inventors (such as Magnus Volk who introduced electric lighting to the Royal Pavilion in 1883, and others who developed cinematic projection), how the quantum nature of light creates the colours that we see every day (and how that is being used to develop the next generation of ultra-fast quantum computers in Brighton), and how astronomers study distant light to understand our place in the Universe.



Worldwide, science centres and planetaria have unique and futuristic architectural designs, such as the conic structure at the Royal Observatory in Greenwich, London.

The centre will contain a range of hands-on exhibits for visitors to interact with, developed by experts from the Volk's Electric Railway Association, academics at the Department of Physics & Astronomy at the University of Sussex (which has a well-established outreach program run by members of the Brighton Luminarium team), and constructed by Science Projects Ltd, a non-profit organisation whose interactive award-winning exhibits are in science centres around the world.

The Pioneer zone will be the first stage in the journey of discovery, exploring how the achievements and legacy of the Victorian inventors of Brighton and Hove have helped change our world along the theme of light.

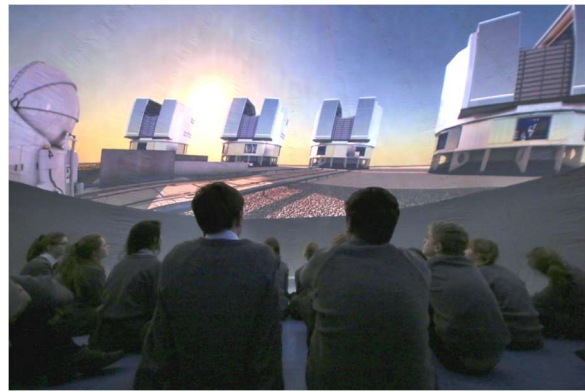
Arguably the most famous is Magnus Volk (1851-1937), whose railway still operates to this day along Brighton's sea front to the west of the Black Rock site. Having opened in 1883, it is the oldest working electric railway in the world. The railway would serve to link the Brighton Luminarium at Black Rock with the popular attractions of the Aquarium and Palace Pier, and there is the possibility of having an end-of-the-line station within the Brighton Luminarium itself, allowing visitors to disembark directly into the centre.



The Volk's Electric Railway has travelled along Brighton's sea front for almost 140 years.

Inside the Pioneer Zone, visitors will marvel at the works of local Victorian inventors, with exhibits including telephones, X-ray machines, railways, fire alarms, electric cars, photography, colour film and projection, and many others. An array of clocks made by local clockmakers will show times in different parts of the world, while simulators will allow children to drive a Volk's railway train, use early telephones, fire alarms and early projectors.

The Astronomy zone will be dominated by a large planetarium surrounded by exhibition space. Planetaria are unique and popular cinema-like domes onto which views of the stars and planets are projected, allowing visitors to be taken on immersive journeys. Planetaria are usually the most profitable part of any science centre. While flying through space to explore our universe remains the most popular topic, the flexibility of modern digital projectors allows a vast range of subjects to be explored, such as the microscopic world of human cells or even visualising dinosaurs! These domes are



The University of Sussex's mobile (inflatable) planetarium has a capacity of 32 people and is used in schools and at public events.

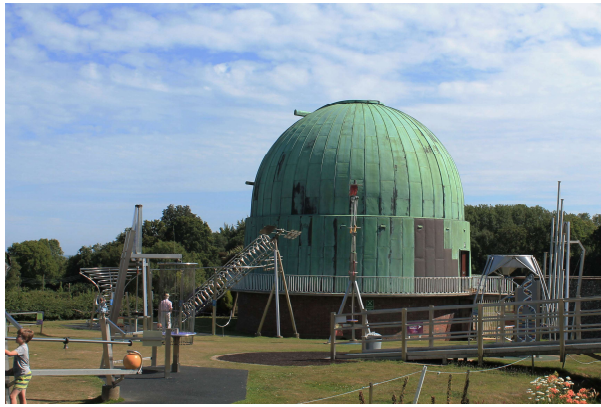
often called “digital theatres” to reflect on how artists worldwide are using planetarium domes as a novel digital canvas. The contents of the Astronomy zone will be developed by education experts at both the Department of Physics & Astronomy at the University of Sussex and the Observatory Science Centre (site of the former Royal Greenwich Observatory) in nearby Herstmonceux, and a display of historical astronomical instruments loaned from the OSC will ensure a seamless connection from the Pioneer Zone.

The planetarium will be constructed in the shape of a carbon-60 molecule, to recognise the discovery of this important football-shaped molecule at the University of Sussex in 1985 by Sir Harry Kroto, another local pioneer, who received the 1996 Nobel Prize in Chemistry for this work. Developing novel applications for carbon-60 is an active area of research worldwide.

The Quantum zone is motivated by the world-leading research being carried out in quantum physics at the University of Sussex, where scientists are paving the way for the next generation of ultra-fast quantum computers and are developing a range of quantum sensors with health and security applications. This zone will explore the potential of this futuristic technology, showcasing the latest innovations and containing the Quantum Arcade, where modern arcade-style games will be used to explain scientific concepts about quantum physics in a fun and engaging way. Appreciating that light exists beyond what is visible to the human eye is part of the GCSE school syllabus, and interactive exhibits (such as thermal cameras) will allow children to explore such usually invisible light.

Stories of significant people will be told throughout these key zones, to engage with visitors and inspire the next generation. Not only will visitors learn about the Victorian pioneers of the past, but through a variety of public events, they will also get the opportunity to meet the astronomers and quantum physicists of the present, who are making new discoveries here in Brighton. Stories will be told of scientists and inventors from a diverse range of genders, ethnicities, ages, disabilities and backgrounds, providing role models to all visitors, no matter what their background.

Classrooms for school visits will be included in the centre, as school and other educational groups from Brighton and beyond will make up a significant number of visitors. A programme of events will be developed and delivered to schools which will be closely linked to their school syllabus. Out of school hours (evenings, weekends, and school holidays), the classrooms will be used for adult evening courses, as indoor public performance spaces, or hired out for corporate or community functions.



An outdoor play area around the astronomical observatories at the Observatory Science Centre, Herstmonceux, East Sussex.

An outdoor children's play area consisting of large, physical, hands-on activities, will enable children to explore scientific themes through play, as does the play area at the Observatory Science Centre. Such play areas also encourage repeat visits.

Additional exhibition & performance spaces will also form part of the Brighton Luminarum, both outside and in. These will enable a variety of visiting exhibitions, both arts and science, that can be updated on a regular basis (e.g. photographic exhibitions), which will encourage repeat visitors at minimal cost.

The centre will be fully accessible to visitors who have a wide variety of additional needs, such as those with limited mobility, impaired sight or hearing, with a changing places toilet facility provided. Dedicated quiet opening hours will provide a calm and relaxed environment for those (especially children) with sensory sensitivities.

Landscaping around the centre will be sensitive to the natural environment, with light pollution minimised. The shop & café will be positioned so that they are readily accessible to all visitors to the area, especially those attending motor vehicle rallies, the marathon, London to Brighton cycle rides and other events regularly held on Madeira Drive.

Visitor Popularity

Over 20 million people visit UK science centres each year (examples can be seen in the table on the following page), and they are popular with all ages and social economic groups. Visitors to the Brighton Luminarum will predominantly consist of the following audiences:

- School & college groups, visiting to take part in syllabus-linked activities.
- Local people and families who live in Brighton.
- Local, national and international tourists who are visiting Brighton and the surrounding areas.

School groups are frequent visitors to science centres, which offer educational programmes that support the teaching of the school science curriculum. Science centres inspire visitors with a sense of wonder, encouraging students into further study of science and technology subjects through the use of novel demonstrations and activities, often using specialist equipment that is rarely available in schools (such as expensive thermal cameras).

The nearest public science centres to Brighton are:

- The Observatory Science Centre, Herstmonceux, 22 miles east of Brighton.
- The South Downs planetarium, a small science centre in Chichester, 28 miles west of Brighton featuring a mechanical planetarium from the 1970's.
- The Royal Observatory Greenwich in London, 45 miles to the north.
- The Winchester Science Centre, 50 miles west.

Note that both the Royal Observatory Greenwich and the Winchester science centres have a large digital planetarium.

Engaging with the local community

The Brighton Luminarium will be embedded within the local community in a number of ways. School and educational groups will visit the centre daily throughout the school year, taking part in workshops that link directly to their school curriculum. Adult education courses will be offered, and community groups will also use the classrooms, with local artists providing a range of temporary exhibitions at the centre. Local volunteers will be involved in the project from the outset, helping with the selection of artefacts for display in the Pioneer zone, and once opened, will lead tours and assist visitors around the centre, gaining valuable skills.

The Astronomy and Quantum Zones will engage the local community with students studying at the University of Sussex, and members of local astronomy societies will support regular public events, as they already do for events at the University of Sussex (e.g., Stargazing Live). Knowledgeable university students will also be employed over the summer to cater for the busy holiday seasons, which will greatly boost their experience and employability, especially for those interested in pursuing a career in teaching on the completion of their degrees.

Financial considerations

We expect the construction and development of the Brighton Luminarium to be covered by grants and charitable donations. As an example, the 120 seater planetarium at the Royal Observatory Greenwich cost £3M to construct in 2006 (building and full internal fitting) and was part of a wider £15M redevelopment of the site. All funding was raised through grants, with the majority of the cost of the planetarium being met by the Peter Harrison Foundation.

Details of selected UK Science centres and planetaria. Note how long these science centres have been operating for, confirming the long-term financial viability of such ventures.

Attraction / Science Centre	Opening year	Museum total Visitor numbers		Figures valid for the year	Public admission fee (Adults, 2021)*
		Public only	School visitors		
<i>Observatory Science Centre, Herstmoceux</i>	1995	69,000		2019	£8.75
<i>Royal Observatory, Greenwich, London, Planetarium only</i>	1953 (2007 major renovation)	201,016	42,000	2018/19	£10
<i>Winchester Science Centre</i>	2002/8	130,000	40,000	2019/20	£13 P: +£3.50
<i>We the Curious, Bristol</i>	2000	163,192	53,836	2019/20	£16 P: +£3
<i>National Space Centre, Leicester</i>	2001	327,000		2019	£15
<i>Techniquest, Cardiff</i>	1986	113,655	28,579	2019/20	£11
<i>Life Science Centre, Newcastle</i>	2000	194,000	37,000	2019/20	£15

* Additional charges for planetarium admission are indicated in the final column by "P: +£"

Possible funding sources for a science and technology discovery centre in Brighton include:

- The Heritage Lottery fund
- The Ogden Trust (an educational trust for physics)
- The Aldridge Foundation (a local educational trust)
- The Peter Harrison Foundation
- Rampion Offshore Wind Limited, owners of the offshore windfarm that is visible from Black Rock
- Corporate sponsorship opportunities (as with the Amex stadium)
- And many more, including the Sutton Trust, Gatsby Foundation, the Prince's Trust, etc

Construction and development costs

Construction and fitting-out the Brighton Luminarium will cost approximately £12M - details of how this approximate costing has been reached are presented in the table below.

We begin by assuming a similar footprint to that of the main building of the Observatory Science Centre in Herstmonceux. We plan for a 70m x 10m exhibition space, with a second-floor for classrooms of half that area, and a 12m diameter planetarium. An additional 22m x

Building & fitting-out cost approximations for the Brighton Luminarium				
	Space	Area	Cost/area	Cost
Building costs	Museum	70m x 10m	£4,200/m ²	£2.9M
	Planetarium	113m ² (12m diameter)	£4,200/m ²	£0.5M
	Classrooms	35m x 10m	£2,200/m ²	£0.8M
	Café	11m x 16m	£2,700/m ²	£0.5M
	Shop	11m x 16m	£2,000/m ²	£0.4M
	TOTAL	1,402m ²	-	£5.0M
	Economies of scale correction			£4.6M
	Additional 15% External works allowance			£5.3M
	Additional 15% Risks allowance			£6.1M
	Total building cost			£6.1M
Fitting out costs	Museum	70m x 10m	£4,000/m ²	£4.2M
	Planetarium	113m ² (12m diameter)	-	£0.5M
	Classrooms	35m x 10m	£3,000/m ²	£1M
	Café	11m x 16m	-	£0.1M
	Shop	11m x 16m	£1,000/m ²	£0.2M
	Total fitting out costs			£6M
TOTAL BUILD AND FITTING OUT COSTS				£12M

The building costs per area for a variety of uses, the economy of scale correction, and allowances are all taken from the Cost Modelling website at <https://costmodelling.com/building-costs>

Estimates for the museum fitting-out costs per area are taken from "Culture shift: the changing costs of exhibition spaces" report by Sarah Giles at <https://www.turnerandtowntsend.com/en/perspectives/culture-shift-the-changing-costs-of-exhibition-spaces/>

Classroom costs are taken from "Size and Cost Standards for new build schools under the 21st Century Schools and Education Programme." from the Welsh Government at <https://gov.wales/sites/default/files/publications/2019-01/170822atishn11410doc09.pdf>

Shop and café fitting-out cost estimates are taken from the Check-a-trade website at <https://www.checkatrade.com/blog/cost-guides/shop-fitting-cost/> and <https://www.checkatrade.com/blog/cost-guides/coffee-shop-fit-out-cost/>

16m area for a shop and café is also presumed. The approximate cost of the building has been calculated using the Cost Modelling website, which presents estimates for a wide variety of building uses, including museums and planetaria (£4,200/m²), secondary school classrooms (£2,200/m²), cafés (£2,700/m²) and shops (£2,000/m²). The cost of fitting out these spaces have originated from a wide variety of sources, as detailed in the table on page 9. Based on other planetarium refurbishments and installations around the UK (e.g. the Winchester Science Centre upgrade cost £360k), we expect fitting out of the planetarium to cost an additional £0.5M.

Operating costs: Income & expenditure

The operating costs for a science and technology discovery centre in Brighton can be estimated by looking at the costs involved in other, similar sized centres across the UK. Such data is publicly available on the Government's Companies House website (see table below).

As with museums and science centres across the UK, the primary source of income would be via an admission fee for visitors. Additional income streams for science centres include cafés and shops, parking fees, charitable grants and donations, corporate sponsorship and venue hire (including conferences, weddings, parties, functions, filming, etc).

Regeneration

The construction of a science centre at Black Rock represents an excellent opportunity to regenerate the area. The National Space Centre, a spin-off science centre from the University of Leicester, was the catalyst for the major regeneration of a previously run down and neglected area of Leicester, and a £100M Space Park for hi-tech industries is currently under construction around the science centre, due for completion in 2021.

Income and expenditure of science centres across the UK. Data from Companies House.						
Attraction / Science Centre	Income 2019/20	Expenditure 2019/20	Surplus			Expenditure /visitor, £ 2019/20
			2019/20	2018/9	2017/8	
<i>Winchester Science Centre</i>	£3.2M	£2.7M	£0.5M	£0.6M	£0.1M	£15.9
<i>We the Curious, Bristol</i>	£6.3M	£6.2M	£0.1M	£2.5M	-£0.1M	£28.4
<i>National Space Centre, Leicester</i>	£8.5M	£7.3M	£1.2M	£0.9M	£0.1M	£22.3
<i>Techniquest, Cardiff</i>	£4.2M	£2.3M	£1.9M	£1.6M	£0.3M	£16.3
<i>Life Science Centre, Newcastle</i>	£3.9M	£2.5M	£1.4M	£1.7M	£4.5M	£17.5
Notes:						
1. The Royal Observatory Greenwich is part of five museums that form the Royal Museums Greenwich, and the Observatory Science Centre is part of Science Projects Ltd, and data is not available from Companies House for the science centre elements alone.						
2. Figures for the Life Science Centre do not include property income and expenditure from the wider site.						

Collaborators

The following organisations are involved in the Brighton Luminarium project proposal:

- The **Volk's Electric Railway Association** ensure the running of the railway between the Aquarium and the Black Rock site and will lead the development of the Pioneer zone of the Brighton Luminarium.
- **Science Projects Limited** is an educational charity which develops and builds interactive exhibitions for science museums worldwide, and who also operates the Observatory Science Centre at the site of the old Royal Greenwich Observatory in Herstmonceux, East Sussex. Science Projects will be involved in developing and constructing interactive exhibits for the Luminarium.
- The **Observatory Science Centre in Herstmonceux, East Sussex**, is a science and technology discovery centre at the site of the old Royal Greenwich Observatory, which attracts 70,000 visitors annually. The OSC has been operating successfully for 25 years, and experts at the observatory bring a wealth of experience to the Luminarium project.
- Outreach experts at the **Department of Physics & Astronomy at the University of Sussex** will be involved in developing new exhibits for the quantum and astronomy zones. The department has a well-established science outreach programme that typically runs 100 events each year to school and college groups, as well as organising and running public events.

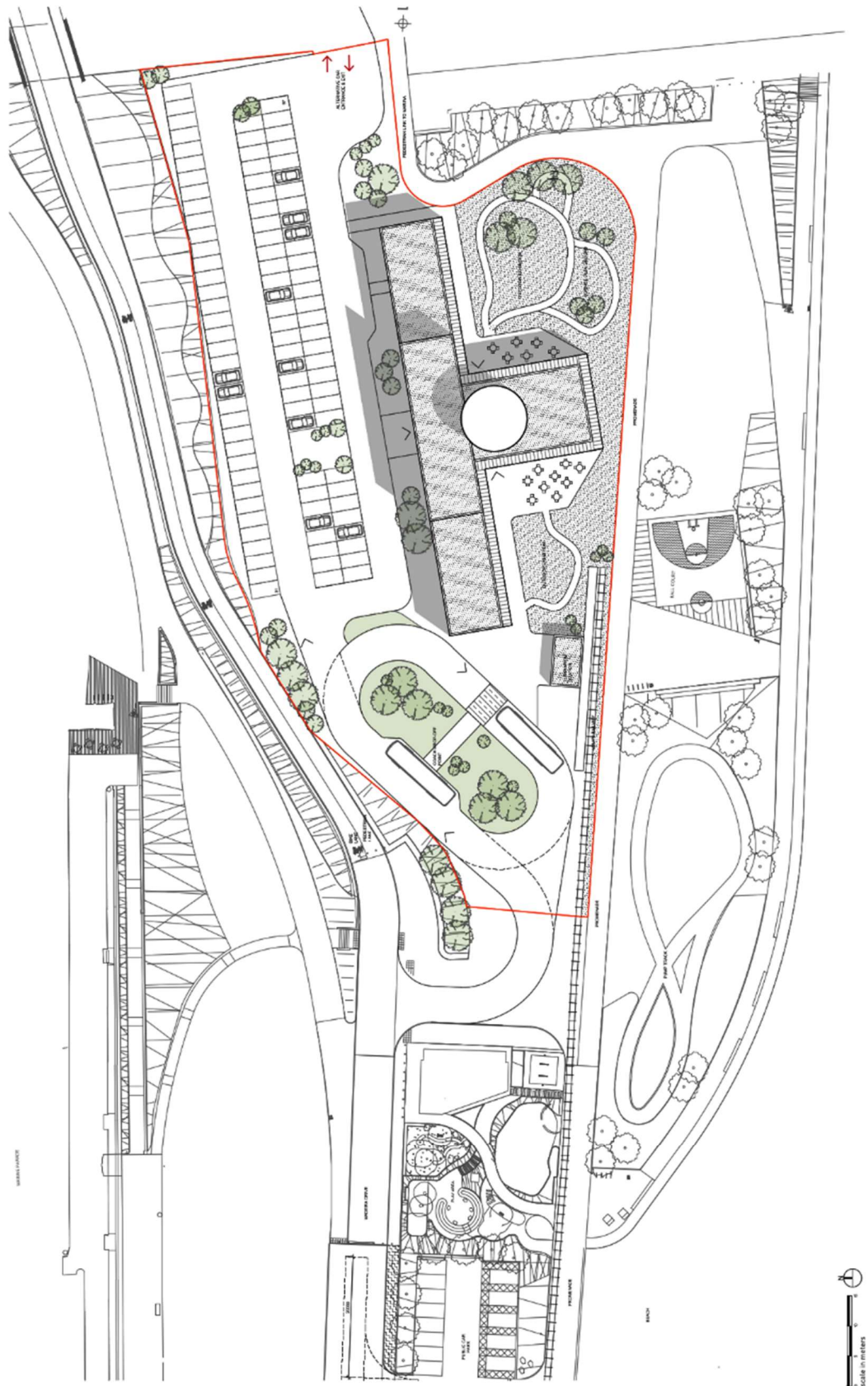
The proposing team

Darren Baskill has over 25 years' experience of organising and delivering public science events. He is a lecturer and outreach officer for the Department of Physics & Astronomy at the University of Sussex, and typically runs 100 outreach events each year for schools, colleges, and the public. He previously worked at the Royal Observatory Greenwich science centre and planetarium in London, where he initiated the highly successful Astronomy Photographer of the Year public competition and exhibition, and he was a calibration scientist for the European XMM-Newton space telescope. Darren is also a director of Ensonglopedia, a musical theatre company based in Lewes.

Stephen Pizzey is the director of Science Projects Limited, an educational charity which operates the Observatory Science Centre in Herstmonceux, and which develops and builds interactive exhibitions for science museums worldwide. Steve has great experience in setting up and running science and technology discovery centres.

Adrian Richards and **Peter Williams** are members of the Volk's Electric Railway Association, who assist in the maintenance and operation of the Volk's Electric Railway along Brighton's sea front, the world's oldest operating electric railway which opened in 1883. Adrian is also a chartered member of the Institute of Logistics and Transport.

Stephen Wilkins is the head of the astronomy research group at the University of Sussex, where he is also the director of outreach & public engagement for the Departments of Mathematics and Physics & Astronomy. He is the founder of the Curiosity Sussex charity, which organises and runs free public science fairs across Sussex and is also a trustee for Science Projects Ltd, which runs the Observatory Science Centre in Herstmonceux, Sussex.



Brighton Luminarium
Proposed Site Plan

ABIR Architects
0647.FEA.500