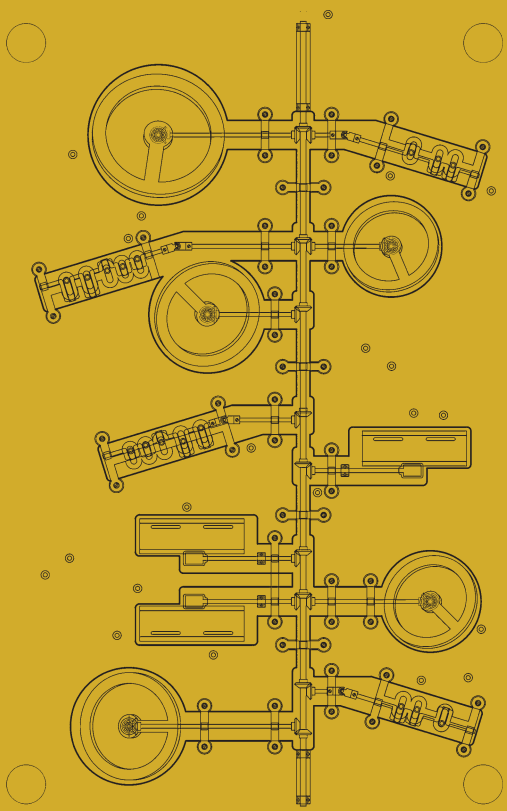
Bartlett Design Research Folios

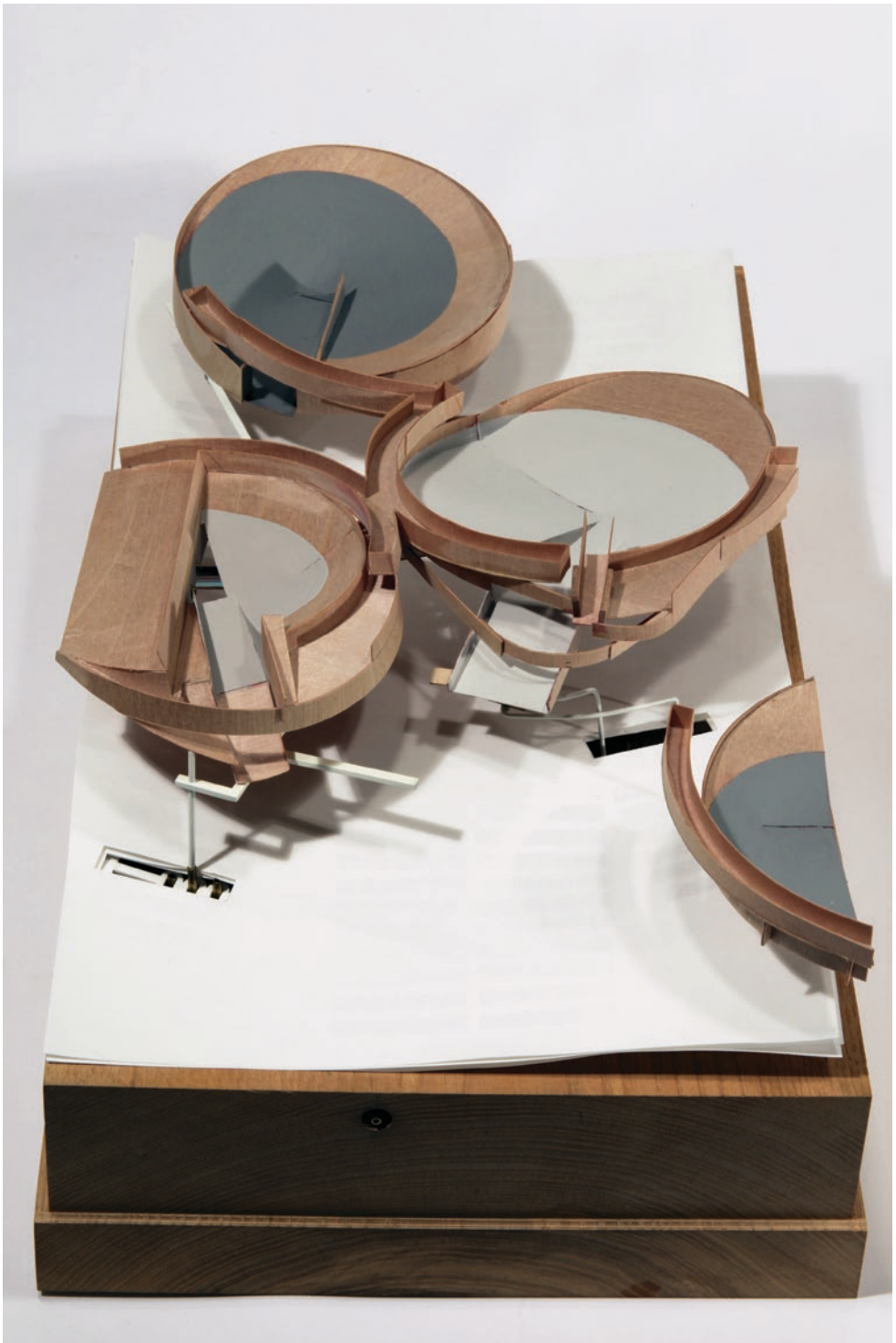
Envirographic and Techno Natures



by Smout Allen

Project Details

Practice:	Smout Allen
Designers:	Mark Smout and Laura Allen Mark Smout and Laura Allen contributed equally to this project through their joint practice, Smout Allen.
Title:	Envirographic and Techno Natures
Output type:	Design
Exhibition:	*Landscape Futures: Instruments, Devices and Architectural Inventions*
Venue:	Center for Art and Environment, Nevada Museum of Art, Reno, USA
Dates:	13 August 2011 – 19 February 2012
Funding:	Graham Foundation; Andy Warhol Foundation; Nevada Museum of Art; Southern California Institute of Architecture (SCI-Arc); University of Manitoba; Bartlett School of Architecture Research Fund
Fabrication team:	Johan Hybschmann, Kyle Buchanan, Sandra Youkhana, Jon Kaminsky, Amy Hiley, Ioana Barbantan, Janinder Bhatti and Richard Stonehouse, with assistance from the Bartlett School of Architecture Workshop and Chris Martin at the Nevada Museum of Art
Other exhibitors:	David Benjamin and Soo-in Yang (The Living), David Gissen, Mason White and Lola Sheppard (Lateral Office), Chris Woebken and Kenichi Okada, and Liam Young



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Statement about the Research Content and Process

Description

This environmental architectural design research examines climatic and geographic processes. It focuses on how conservation landscapes – such as Lanzarote and the River Severn Estuary – enable the production of environmental architecture, especially focusing on the potential for hydrological technologies to reflect the specific qualities of the site, and to generate new experiences of a conservation area, and sustainable design. This architectural approach exposes the distinct cultural, geographical and geomorphological qualities of the landscape, and offers new modes of 'conservation' to the visitor. In the Lanzarote and the River Severn examples architecture is conceived as an active component of the landscape.

Questions

1. **How do landscape management and resource preservation provide access to new sustainable architectures and experimental environmental technologies?**
2. **How do these technologies and design interventions reflect the specific cultural context of occupation of protected landscapes?**
3. **How can the hydrological qualities of the site be expressed as a sustainable architectural design response?**
4. **How do these architectural interventions allow users to reinterpret and experience landscape in previously unimagined ways and how do they function?**

1 ***(previous page)*** **Instant Islands for the Severn Estuary. Model constructed from wood, paper, paint, glass and Perspex. 350mm × 180mm**

2 ***(previous page)*** **Envirographic Instrument: Water sampling at Frampton on Severn, Gloucestershire**

Methods

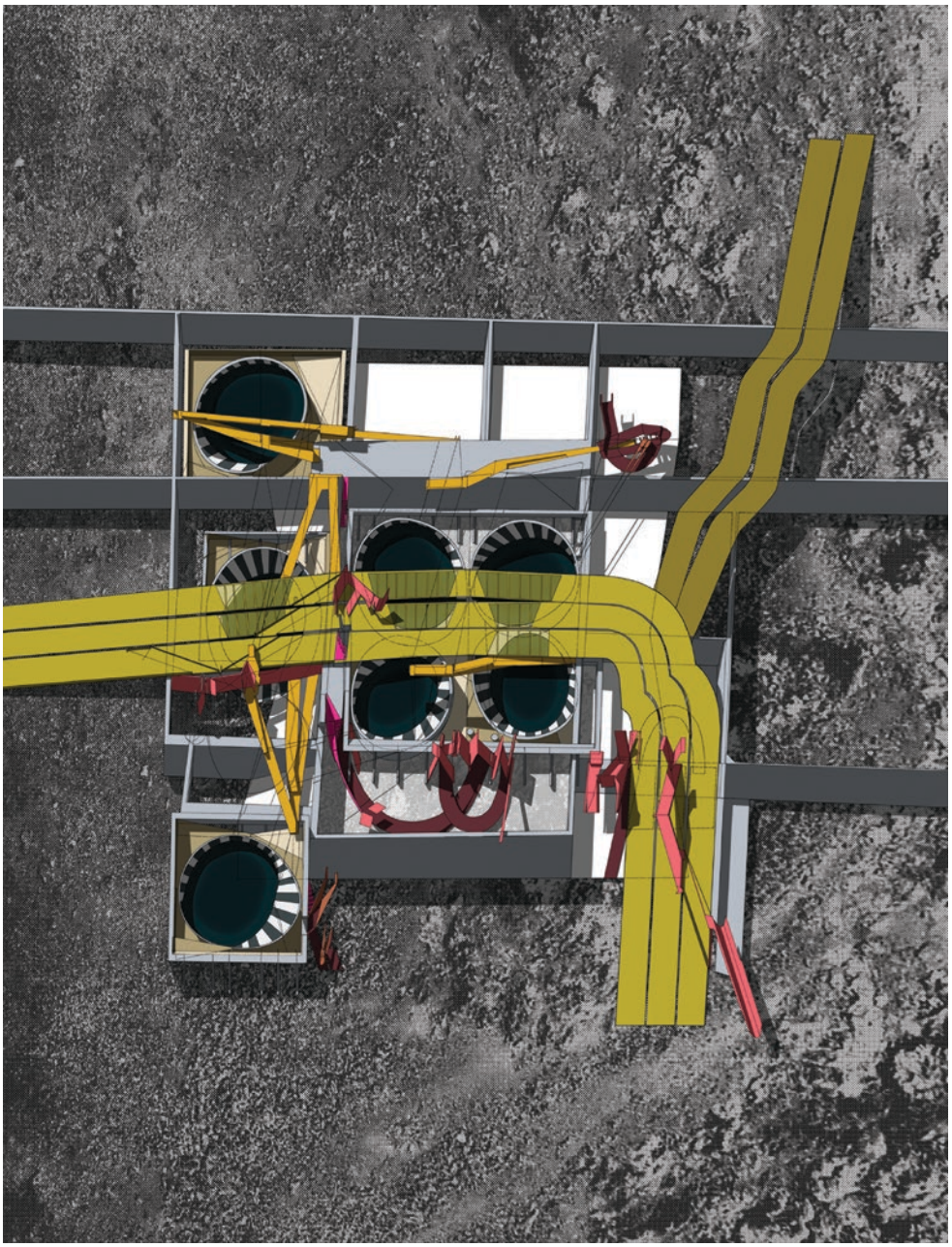
1. **Understanding landscape management and preservation of resources.**
2. **Testing technological interventions with the site which enhance the sustainability issues.**
3. **Generating experimental technologies and design interventions that engage with the specific cultural contexts of occupation in the land.**
4. **Prototyping hydrological responses.**

Dissemination

The work has been exhibited in Los Angeles, London, Reno and Winnipeg. It has been published in one book and two journal articles; reviewed in *Architectural Review*, *Flaunt* and *Blueprint*; and presented in six invited talks in the US and UK.

Statement of Co-authorship

The authors are jointly responsible for all conceptual and design authorship. Additionally, Allen led on project development through drawing, and Smout led on technology, fabrication and manufacturing.



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Introduction

This environmental architectural design research examines themes of climatic and geographic processes. It focuses on how conservation landscapes enable the production of environmental architecture, especially focusing on the potential for hydrological technologies to reflect the specific qualities of the site, and to generate new experiences of a conservation area, and sustainable design. Two landscapes were the site for these explorations; the Spanish island of Lanzarote, and the River Severn and Severn Estuary. The designs concentrate on their natural resources and their use and preservation. These architectural proposals expose the distinct cultural, geographical and geomorphological qualities of the landscapes, and offer new modes of 'conservation' to the visitor. In these sites architecture is conceived as an active component of the landscape. [fig. 4]

Neo-natures

Three designs – 'Ground Cloud', 'River Reversed' and 'Current Accumulator' [fig. 3] – propose a technological topography interposed into the lava fields and ash pit sites that dominate the island of Lanzarote. Lanzarote is the most easterly of the Canary Islands, sitting in the Atlantic 120km off the African coast. As a whole island UNESCO Biosphere Reserve, Lanzarote benefits from its association with the Man and Biosphere Programme (MAB), which informs governmental strategies towards the island's use of its natural resources. The island's vulnerability to the effects of climate change threatens its unique biodiversity and its ability to manage the consequences of mass tourism. [fig. 5]

Each design uses and adapts emerging and dormant environmental technologies and vernacular processes, imagining and re-establishing the surrounding environment as an energy source for the architecture that inhabits them.

Envirographic techno-natures

The project is inspired by the complex arguments of providing 'clean energy' for the UK. (The UK has committed to reducing its greenhouse gas emissions by 80 per cent by 2050 and producing 15 per cent of energy from renewable sources by 2020. In order to meet the 80 per cent target, it will be necessary to produce largely zero-carbon electricity by 2030). This 'clean energy' comes at the potential detriment of natural habitats of scientific and local significance. The project takes the form of photographic site studies followed by the design of instruments which were used on a field study trip to the River Severn. The Severn is a natural resource that has for centuries been a source of food, water, communication and power for the communities through which it flows. It forms a kind of living infrastructure fused to the built environment through the engineering of canals, bridges, water and, particularly for this project, the potential of hydropower.

4

3 ***(previous page)***
Current Accumulator. Environmental architectural design for Lanzarote. Drawing in pencil and ink on a halftone print with digital colour overlays. 841mm × 594mm

4
Fundación César Manrique, Lanzarote

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6

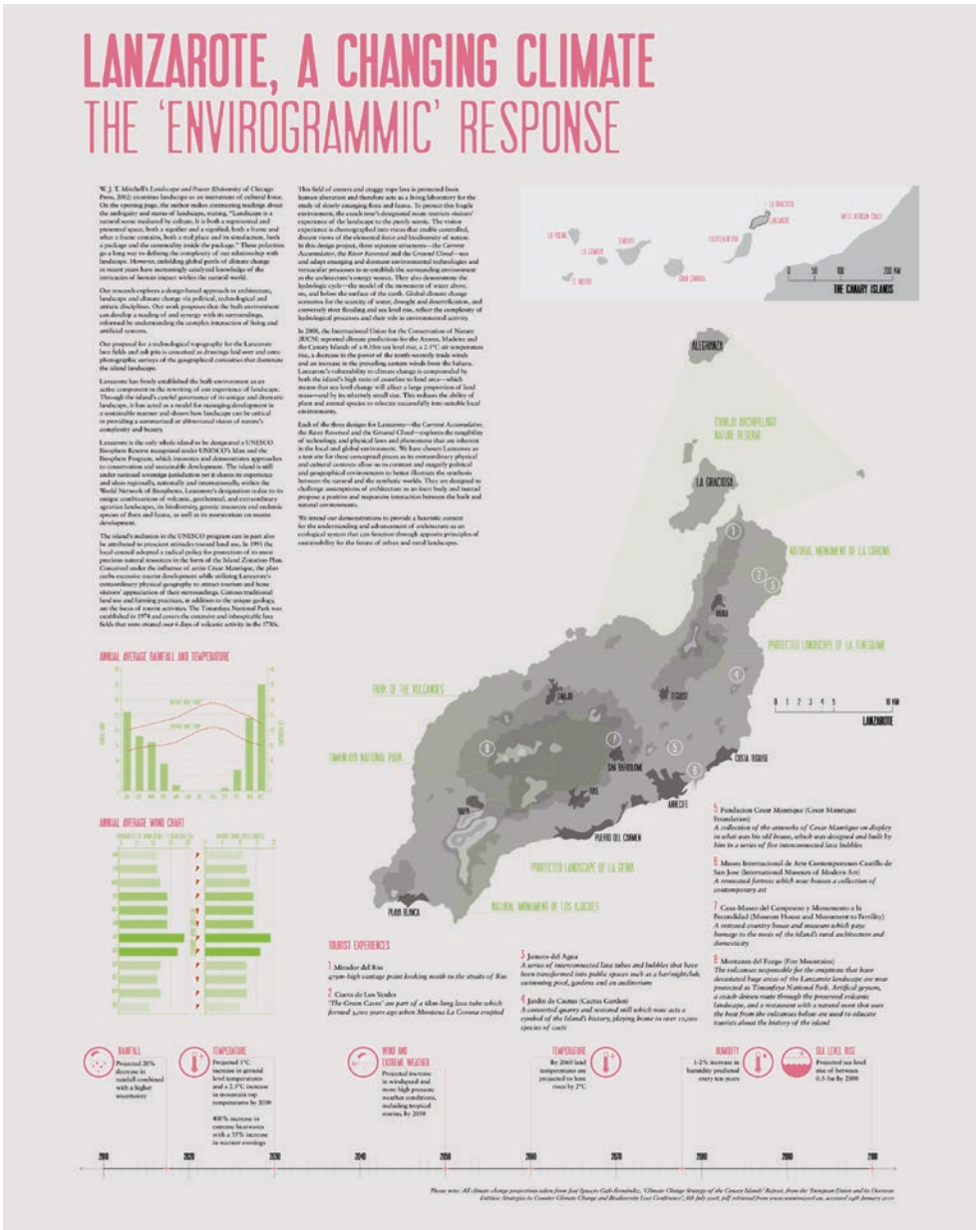
Field studies informed the design of two architectural proposals – the 'Instant Islands' and the 'Severn Lesser Bore Maker' – which were conceived when the latest in a long history of hydropower proposals for the Severn Estuary were under consideration. Both proposals are sited in an imagined landscape where the natural tidal processes and specifically the tidal bore would be interrupted by the construction of a hydropower barrage across the river. [fig.1 & 2]

Aims and Objectives

This research examines how specific conservation landscapes generate the conditions for experimental modes of sustainable architectural design. It sets out to examine:

1. How specific protected geological/ land resources of a site inform sustainable architectural technologies.
2. How these technologies reflect specific human cultural qualities of the site.
3. How hydrological modes of energy reflect these conservation sites, and generate site-specific architecture.
4. How these enable new experiences of the landscape by visitors/users/ tourists.

6
Jameos del Agua (by architect Cesar Manrique, 1968) is a series of interconnected lava tubes and bubbles that has been transformed into public spaces, including a bar and nightclub, swimming pool, gardens and an auditorium. The site is one of the seven Centers of Art, Culture and Tourism (CACT) which protect the island's natural and cultural heritage.



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7
Poster produced for *Landscape Futures* at the Nevada Museum of Art, Reno, 2012

Questions

1. How do landscape management and resource preservation provide access to new sustainable architectures and experimental environmental technologies?
2. How do these technologies and design interventions reflect the specific cultural context of occupation of protected landscapes?
3. How can the hydrological qualities of the site be expressed as a sustainable architectural design response?
4. How do these architectural interventions allow users to reinterpret and experience landscape in previously unimagined ways and how do they function?

Context

Site-specific conservation conditions

a. Lanzarote

Site-specific climates and their role in environmental design: Despite the island's relatively small size, there are five distinct microclimates from coast to coast that range from sub-tropical to semi-desert. Moreover, seasonal shifts in wind direction replace the cooling north-easterly trade winds with the hot and dry 'Calima' from Africa, which regularly causes temperatures to peak and smothers the island in a fog of Saharan sand. The design harnesses and reveals these varied conditions.

The harsh climate has generated unique agrarian landscapes which are themselves a tourist attraction (Thomas 2004).

Cultural knowledge: Cesar Manrique, artist and architect (1919–1992), was key in identifying and reinterpreting the experience of Lanzarote's natural landscape via architectural and sculptural form. In 1972 he compiled a photographic inventory of the significant aspects of Lanzarote's traditional architecture in which he made taxonomic connections that allied vernacular architectural form directly with the island's geological topography (Manrique 1974).

His subsequent strategies to develop Lanzarote's significant geographical sites as tourist destinations led to the design, over a 20-year period, of the seven Centers of Art, Culture and Tourism (CACT) sites. [fig. 6] These sites use architecture as a demonstration and augmentation of the aesthetic qualities of the geological landscape and greatly contribute to its reputation as a holiday paradise. Manrique's aim was to protect the island's natural environment from development; to create an environment that is a prototype for eco-tourism. He was also pivotal in the implementation of the Island Zonation Plan (PIO 1991), by which the island's council, the Cabildo de Lanzarote, imposes strict and prescriptive policies on building and the spread of mass tourism on the island.

UNESCO designation: Lanzarote is established as an experimental territory for sustainable tourism, an approach derived from both environmental and aesthetic principles (see Jimenez 2012). In 1993 it was designated a UNESCO whole island biosphere and classified under its Man and Biosphere (MAB) programme. This categorisation relates to the conditions that enable sustained economic development and land use consistent with the conservation of natural resources and ecosystems. [fig. 7]

b. Severn

The Severn proposals are inspired by the complex arguments for and against harnessing the River Severn's tidal power as an energy resource, and informed by the Severn's critical relationship to natural ecologies and local communities along its banks. The river provides water for domestic, agricultural and industrial use. It enables commerce via ports in the estuary and upstream such as Bristol and Sharpness.

The river's large tidal range has generated a long history of unbuilt barrage and lagoon proposals to harness it for tidal power, beginning in 1849 when engineer Thomas Fulljames proposed a barrier form Beachley to Aust (see fig.19). Following a government feasibility study during 2008–10, a number of publicly funded projects have looked at a range of tidal technologies in several locations. Since these design projects were conceived, new proposals have been initiated by Hafren Power who have restarted consultations for an 18km barrage between Brean in England and Lavernock Point in Wales (Hafren 2012). [fig. 8]

8

8
The Severn tidal bore is the second highest in the world and a spectacular natural phenomenon, traveling upstream as far as 40km at an average speed of 16km per hour and often reaching up to 2m in height. The best times to view the Severn Bore are during the highest tides around the autumn and spring equinoxes. It can be seen along the lower lengths of the river, downstream of Gloucester, and is best viewed at one of four viewing points between Sharpness and Maisemore.

9 *(overleaf)*
Prototype 'Meniscus' model: An experimental model topography designed as an investigation of refraction, reflection and surface tension, through a careful composition of translucent and reflective materials. Light is directed through the meniscus of water, a bi-convex lens and via a large refractive solid suspended below a notional horizon.

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10
Maquettes for the 'Meniscus' models transparent block. The form was eventually used to create a negative mould for a positive, clear resin cast.

11
The deep resin cast block acts as a transparent and refractive solid upon which the rest of the model is mounted.

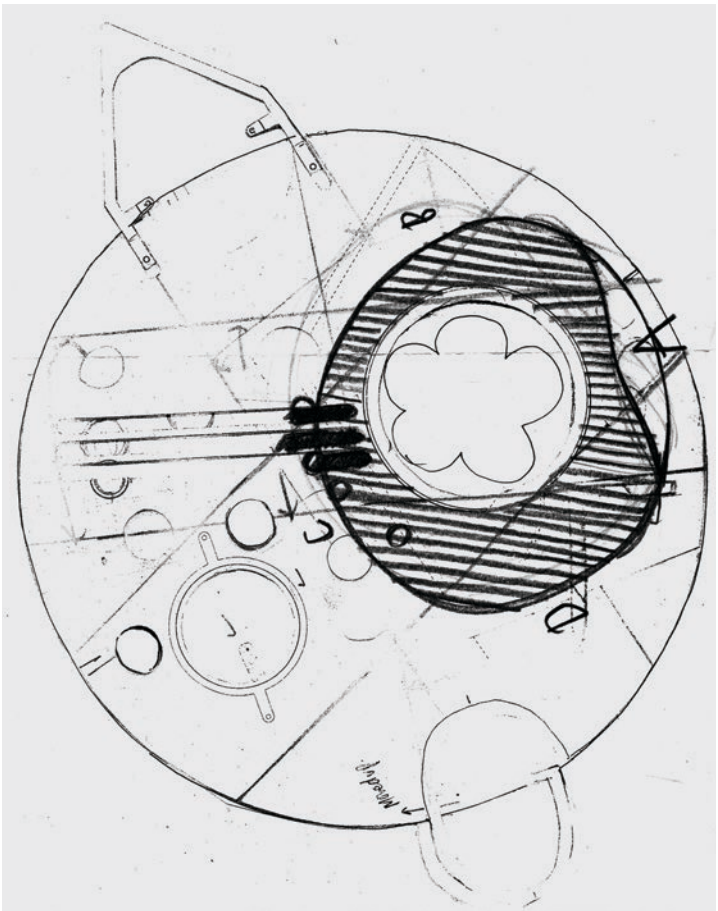
However, environmentalists have also made strong arguments against the construction of a tidal barrage. These arguments point to the loss of significant ecosystems, bird and fish habitats, and the danger to river and marsh flora and fauna caused by altering the flow of the river flow and the levels of the high and low tides.[1] Rotating turbines in the river flow also pose a danger to fish. Although a barrage would offset its 'material' cost (from procurement of aggregates and construction emissions) within its lifetime, environmentalists argue that this renewable energy source is less sustainable than it might seem. The barrage's cyclical energy output would require significant 'load-following' via the construction of dedicated coal-fired power stations (see Friends of the Earth Cymru 2007).

Demonstrating ecological and climate change information

The demonstration of climatic and ecological information in data form can be problematic in relation to its interpretation both by the scientific community and by lay audiences. Architecture and other art forms can be critical in translating the relevance of scientific information (see Hamblyn and Callanan 2011). Visual demonstrations, working models, scaled representations and mock-ups in a simplified format can reveal or provide a more powerful expression than numeric statistical information. [fig. 9–12]

In 2008, the International Union for the Conservation of Nature (IUCN) reported devastating climate predictions for Lanzarote. Its vulnerability to climate change is compounded both by the island's high ratio of coastline to land area – which means that sea level change will affect a large proportion of landmass – and by its relatively small size. This reduces the ability of plant and animal species to relocate successfully into suitable local environments. Each of the three designs for Lanzarote – the Current Accumulator, the River Reversed and the Ground Cloud – explore the tangibility of technology, and physical laws that are inherent in the local and global environment. The designs use visual languages to describe the climate and environmental science to both specialists and lay audiences: for instance, viewers are able to observe the change of states of water from ephemeral vapour to flowing river and back again, and to see this manifest in lichen speciation, heat haze and power generation. [fig. 13]

1. The Severn Estuary and large areas of the river are protected under both the Habitats Directive and Birds Directive as Special Protected Areas (SPAs) and Sites of Community Importance (SCIs) designated by the Europe-wide network of 'Natura 2000' legislation.



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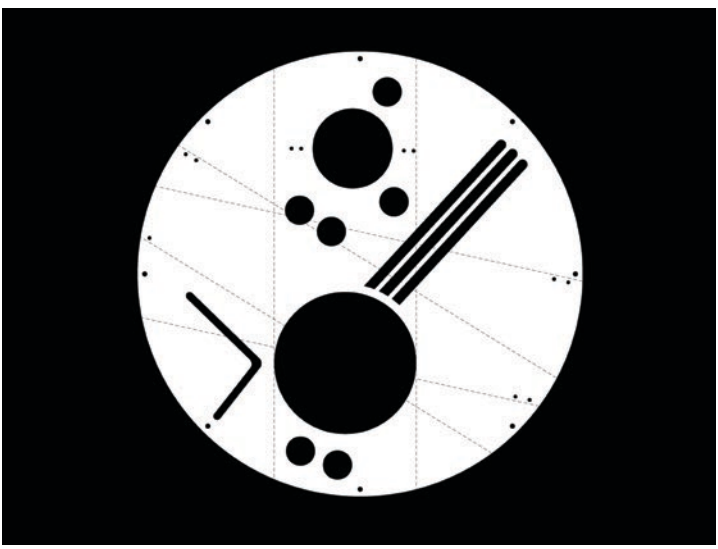

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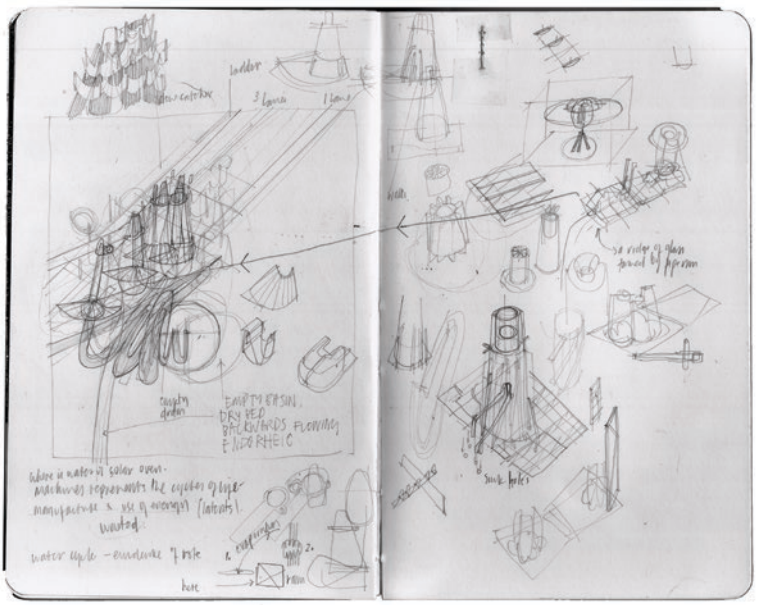
12
Sketch designs for the 'Meniscus' model, in particular the model's surface topography which integrates both glass and water lenses and calibration devices



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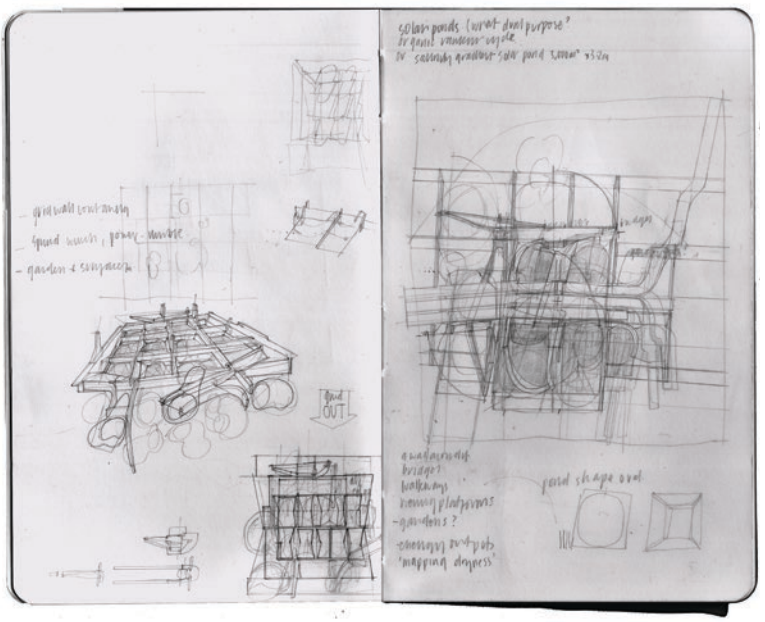
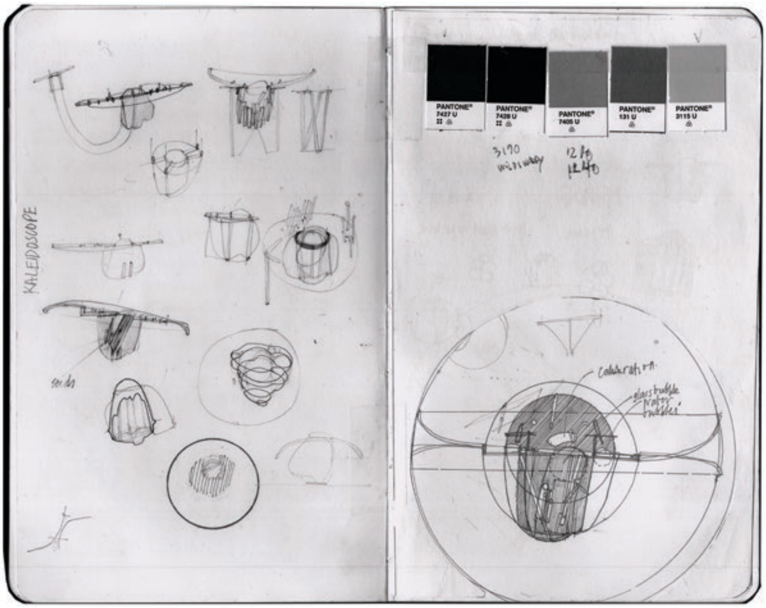


13b

13
Sketchbook studies for the Meniscus model and each of the Lanzarote proposals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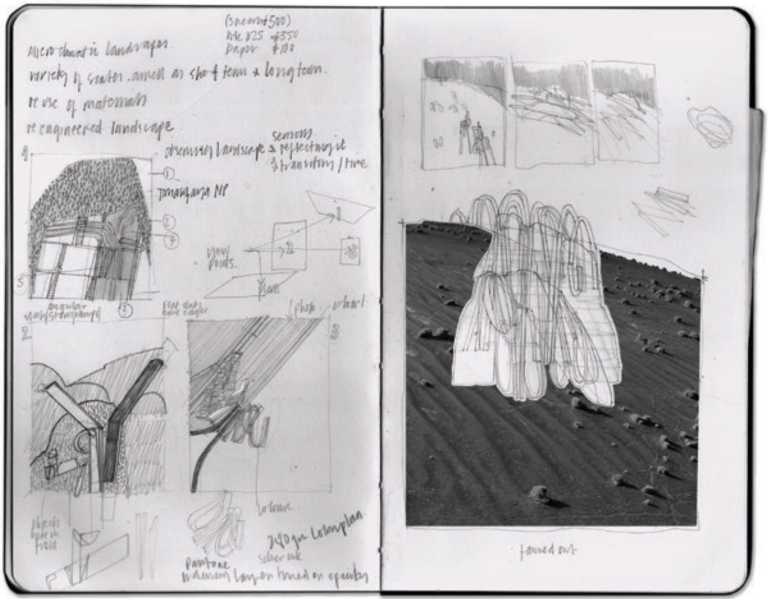

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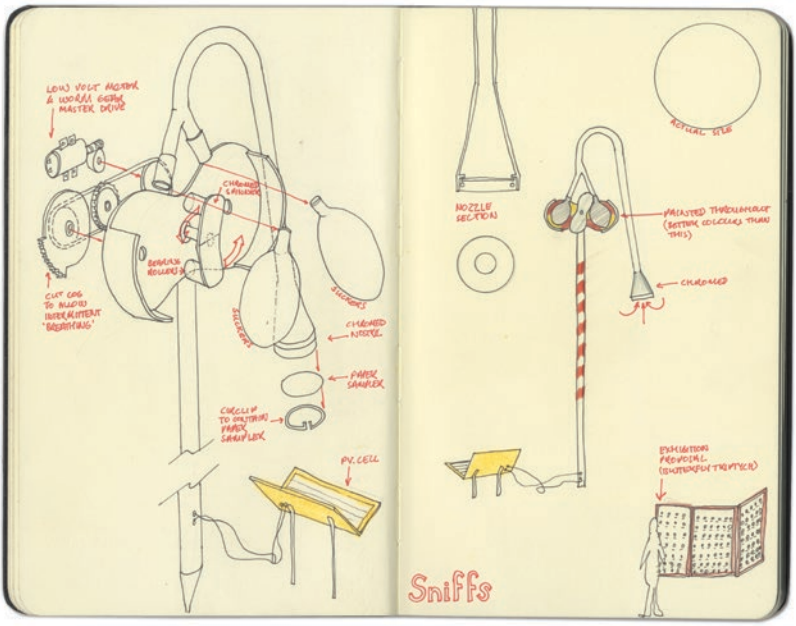

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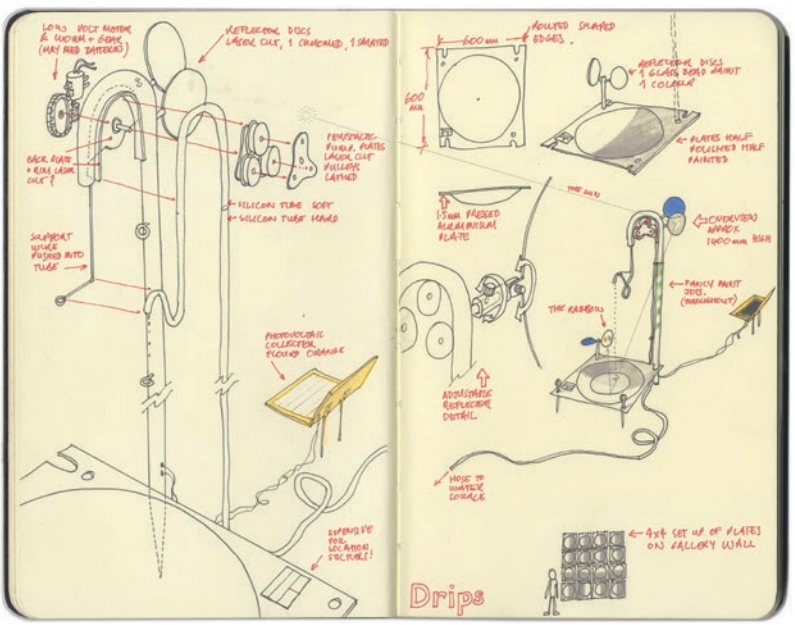


14b

14
Sketchbook studies of the Envirographic instrument design

Methods

Understanding landscape management and preservation of resources

Envirographic Instruments:

A pair of 'envirographic' instruments were designed that borrow from the visual language and instrumentation techniques of environmental and landscape surveying equipment such as the Astrium 'eNose', which samples air in extraterrestrial environments, and evaporation pans, which are used in meteorological surveys to integrate the effects of several climate factors. They aim to contribute to our understanding of site conditions by measurement and observational analysis. The instruments were used in a study trip in July 2011 from the Severn's source in the Cambrian Mountains of mid Wales through to the Severn Estuary and the Bristol Channel, where they were deployed to taste, smell and record measurable as well as ephemeral and ambient qualities of the environment. The river undergoes constant monitoring and analysis for water quality, flow rate and level, as well as biota. [fig. 14–17]

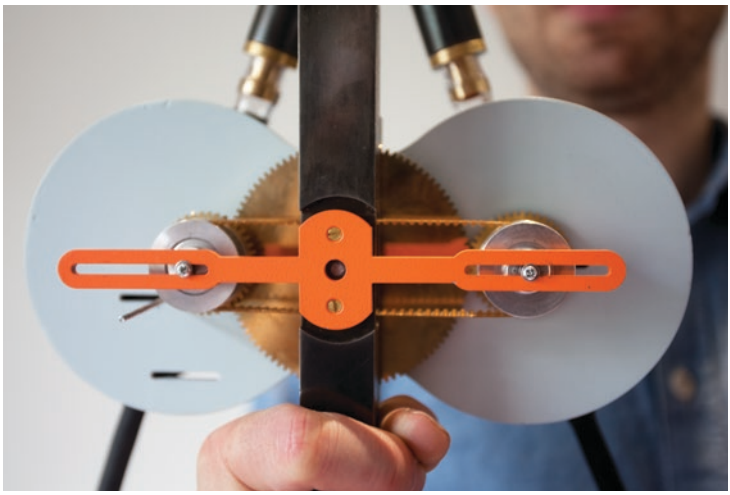
The Envirographic Instruments critique the way in which sites are interpreted and the way measurements are used to provide definitions that prescribe landscape types, their resulting designation and their subsequent use. They attempt to show how environmental phenomena and ecological scenarios can be visualised in data form and vice versa. Documentation of their design and use forms a significant element of the project. [fig. 18]

Generating experimental technologies and design interventions that engage with the specific cultural contexts of occupation in the land

a. British landscape designations

A wide range of statutory and non-statutory conservation designations protect a substantial area of the Britain, its wildlife, natural landscapes and cultural artefacts by informing local and national policy making. These designations include those that aim to quantify the values of natural space and the qualities of natural beauty that are both aesthetic and cultural, for instance, in relation to industrial heritage sites, and bucolic agricultural landscapes.

The Instant Islands project is sited at Newport Wetlands, a Royal Society for the Protection of Birds (RSBP) reserve established in 2000 to overset the depletion in tidal wetlands wildlife habitats that resulted from the construction of the Cardiff Bay Barrage. The Severn Lesser Bore Maker is sited at Garden Cliffs, Westbury on Severn, a geological Site of Special Scientific Interest (SSSI). [fig. 20]



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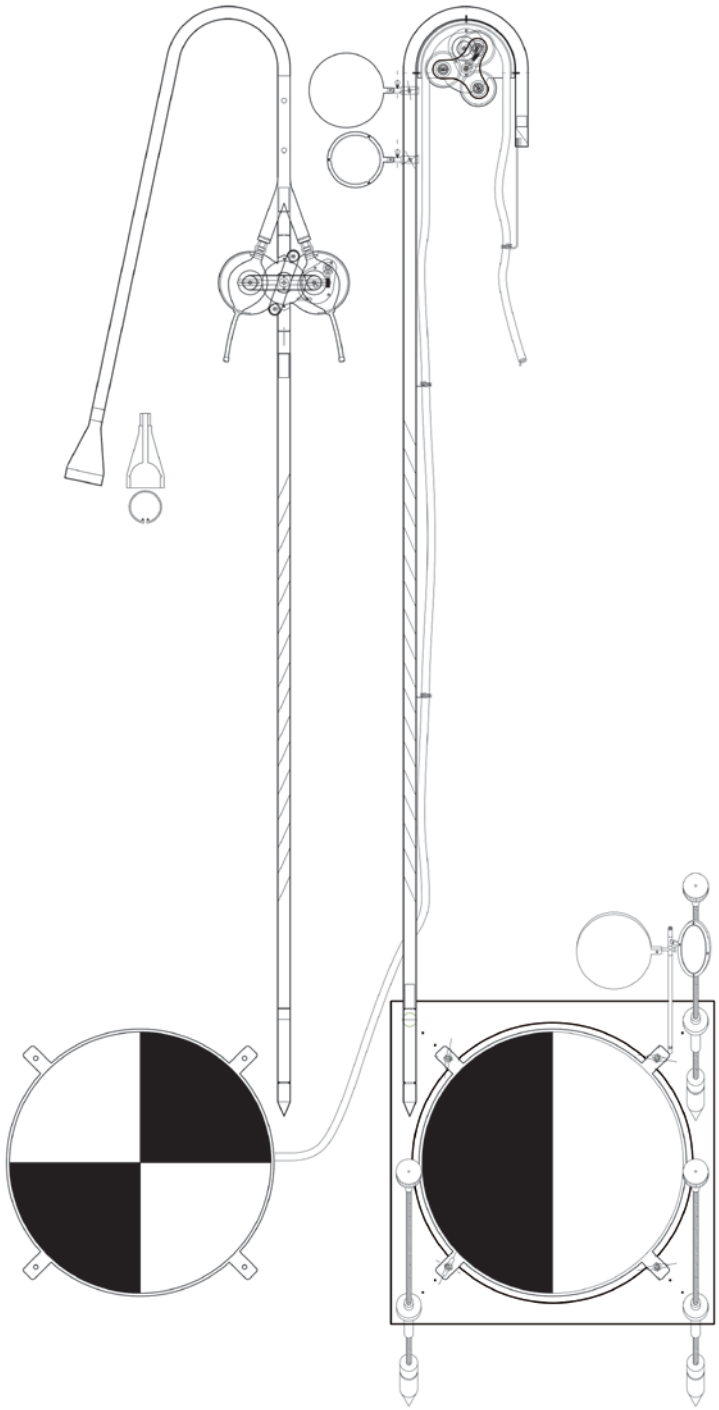
15
Front and rear detail of the Air instrument showing twin gland arrangement

16
Envirographic Instrument: Air and Water
Technical drawing



17a

17
Field studies. Setting up the instruments in landscapes adjacent to the River Severn

17b

18 *(overleaf)*
Photographic surveys of the Envirographic Instruments at selected sites of interest along the River Severn. Commissioned by the Nevada Museum of Art

18a

18b

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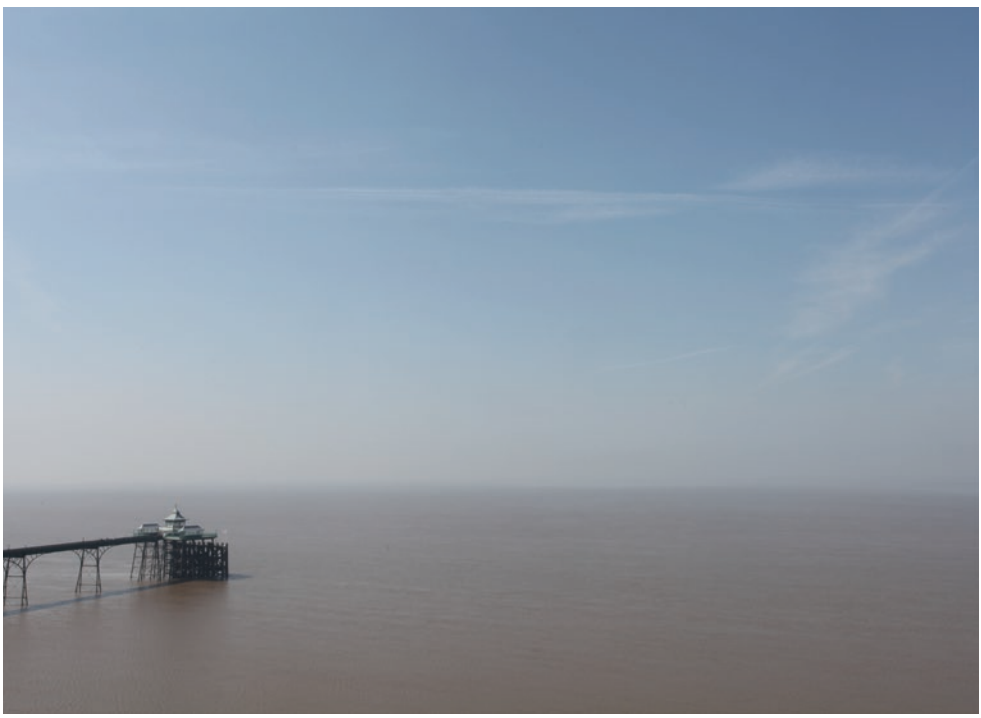

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19
This banana plantation greenhouse in northern Lanzarote is a rare example of intensive farming which is generally impractical due to its excessive irrigation demands.

b. Responses to Cesar Manrique and the Zonation plan

The project responds to Manrique's photographic techniques of recording human-nature relations. In addition, it recognises that Manrigue's use of architecture as a demonstration and augmentation of the aesthetic qualities of geological landscape was pivotal in the implementation of the Island Zonation Plan, which controls the development of Lanzarote's built environment by imposing strict and prescriptive polices on building and the spread of mass tourism. The Plan led to the UNESCO MAB designation, which further supports and controls whole-island development strategies by imposing a moratorium of hotel development and supporting mechanisms for eco-tourism.

c. Potential of landscape as a resource

In the context of Lanzarote and the Severn, the identity and value of the landscape is measured by a combination of aesthetics and utility. The Severn River and Estuary provide water for drinking, agricultural irrigation and industrial uses. The river is canalised and locked to provide transport by water and to support commerce. It may also soon become the site for energy production from tidal power.

The potential of landscape as a productive resource for local communities is historically anchored. However, the environments of Lanzarote and the Severn both integrate and intertwine practical performance qualified by aesthetic values, which is a more recent development. In Lanzarote, thousands of acres of land are covered with a black layer of volcanic ash sculptured into hollows and surrounded by ridges of semicircular lava brick walls. This tourist curiosity is an agricultural necessity. The dry farming technique cuts water loss by as much as 75 per cent to nurture plant growth in otherwise inhospitable environments. The process uses volcanic stone mulch (Pearce, Sep 2006) called 'picon', of which there is a limited supply. It is predicted that the resource will be depleted in 15 years and this will have a marked effect on both agricultural and tourist industries. [fig. 19 & 21]

Prototyping hydrological responses

a. Hydrological technologies and sustainable processes

The Lanzarote designs adopt technologies that exploit climatic conditions in the transformation of environmental energy and natural resources. These are used in a way that makes the surrounding environment visible and demonstrates meteorological processes. They particularly demonstrate aspects of the hydrological cycle – the model of the movement of water above, on, and below the surface of the earth – and its role in environmental activity.

Fog nets: Air dehumidifying technologies known as fog collectors and fog fences (Marzol et al. 2010) can be deployed in arid or semi-arid territories with onshore prevailing winds that flow air currents over steeply rising inland topographies. These technologies provide water for agricultural and reforestation programmes where the topography and fog density is at an optimum. The most common form of fog collector is a mesh curtain that intercepts windblown fog droplets and transfers them by gravity into a reservoir at a lower level; each collector can provide water in substantial quantities (4.5–5.5litres per m^2 per day, cf. fogquest.org[2]). Trialling began in the Haria region of Lanzarote in 2003 (Pearce, Aug 2006) but the island's council has not sustained funding forthe project.

In the Ground Cloud design [fig. 23 & 24] an array of nets is distributed up the hillside in tensioned frames. These frames are initially structured and stable, and collect dew as night falls. When air temperature, weight, humidity and engineered intolerances conspire, the frames 'fail' and shake and jerk into new configurations. A cloud of droplets is instantly airborne and an 'atmosphere' of vapour is momentarily created. Microclimates and even verdant environments are created where the moisture falls. The slopes are inhabited by the island's endemic species of lichen as microclimates of accelerated speciation are established.

Solar ponds: Dynamic ocean topography is the model of currents flowing in complex patterns around the globe. This movement, influenced by many factors such as wind, heat, salinity, gravitational pull and the topography of the sea bottom, affects climate, biodiversity and the environment even far inland. Lanzarote is affected by the Canary Current, a cool and nutrient-rich branch of the North Atlantic Current that is responsible for the enhancement of West African fisheries. Solar energy can be harnessed for power generation via solar ponds that act like miniaturised oceans and exploit extreme gradients of salinity and temperature to generate power. This energy source is typically used in developing countries to power local industry on a small scale.

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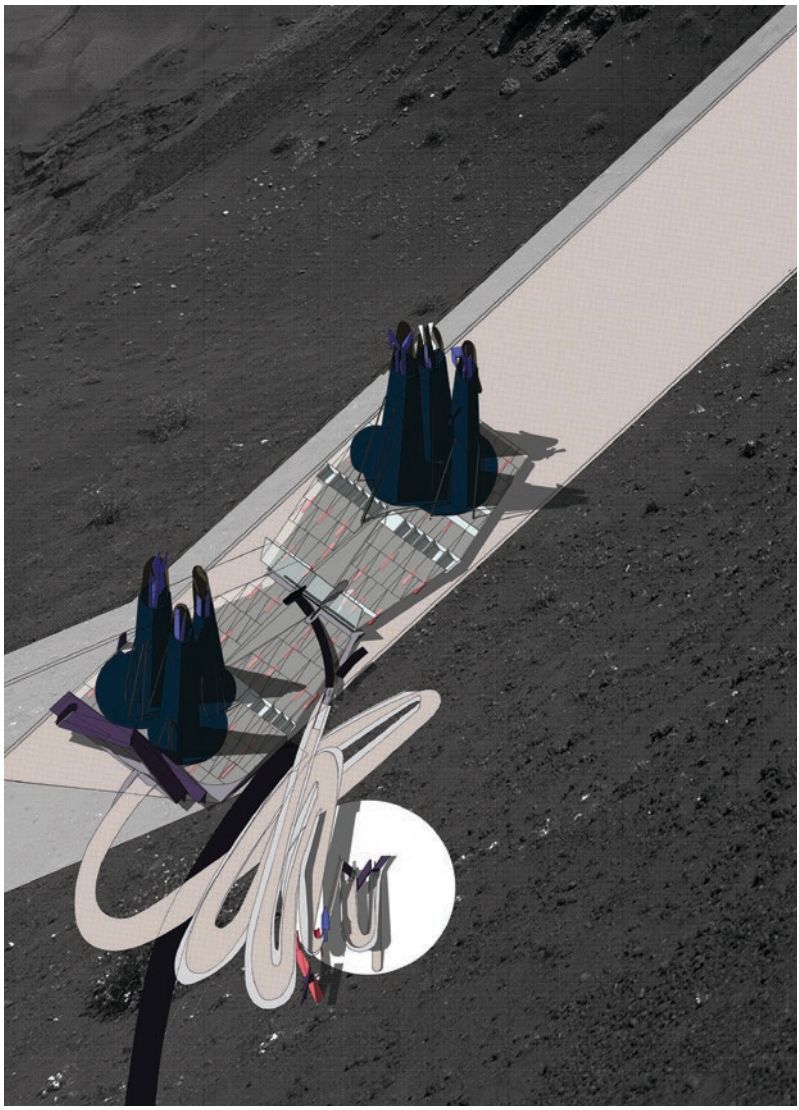
Poster produced for *Landscape Futures* at the Nevada Museum of Art, Reno, 2012

	SCHEME	POTENTIAL SUPPLY	ESTIMATED COST	SHORTLISTED IN 2009
01	Outer Barrage: Minehead to Aberthaw	7.5% UK demand	£31-34.1 billion	No. Challenges outweigh benefits &cost; expensive for UK taxpayers
02	Tidal Fence: Minehead to Aberthaw	3.1 TWh/year	£6.3-6.9 billion	No. Too many unknowns
03	Tidal Reef: Minehead to Aberthaw	11.0 TWh/year 1% UK demand	£18.7-19.8 Billion	No. Technologies too under developed
04	Offshore Tidal Lagoon: South of Hinkley	2.48 TWh/year	£3.5-3.8 billion	No. Too expensive to make the scheme viable
05	Middle Barrage: Hinkley to Lavernock Point	5.31% UK demand	£13.5-26.9 billion	No. Electricity generation does not outweigh habitat loss & costs
06	Onshore Tidal Lagoon: Bridgewater Bay Hinkley Point to Wenson	2.6 TWh/year	£3.4-4.1 billion	Yes. Best performing lagoon &environmental benefits
07	Middle Barrage: 'Cardiff to Weston' Brean Down to Lavernock Point	4.8% UK demand	£19.6-22.2 billion	Yes. Huge renewable electrical & positive long term benefits
08	Tidal Fence: Brean Down to Lavernock Point	Unknown	Unknown	No.
09	Outboard Tidal Lagoon: Puxstones Flats	Unknown	Unknown	No
10	Onshore Tidal Lagoon: English Grounds	Unknown	Unknown	No
11	Onshore Tidal 'Fleming Lagoon' Newport to Severn Crossing	2.1 TWh/year	£4.1-4.9 billion	Yes. Lower environmental impacts than the barrage schemes
12	Inner Barrage: 'Shoots Barrage' Severn Crossing	1.7 TWh/year	Unknown	Yes. Low unit costs of energy & contributes to renewable goals
13	Inner Barrage: 'Beachley Barrage'	1.7 TWh/year	£2.1-2.5 billion	Yes. Low unit costs of energy & lower environmental impact

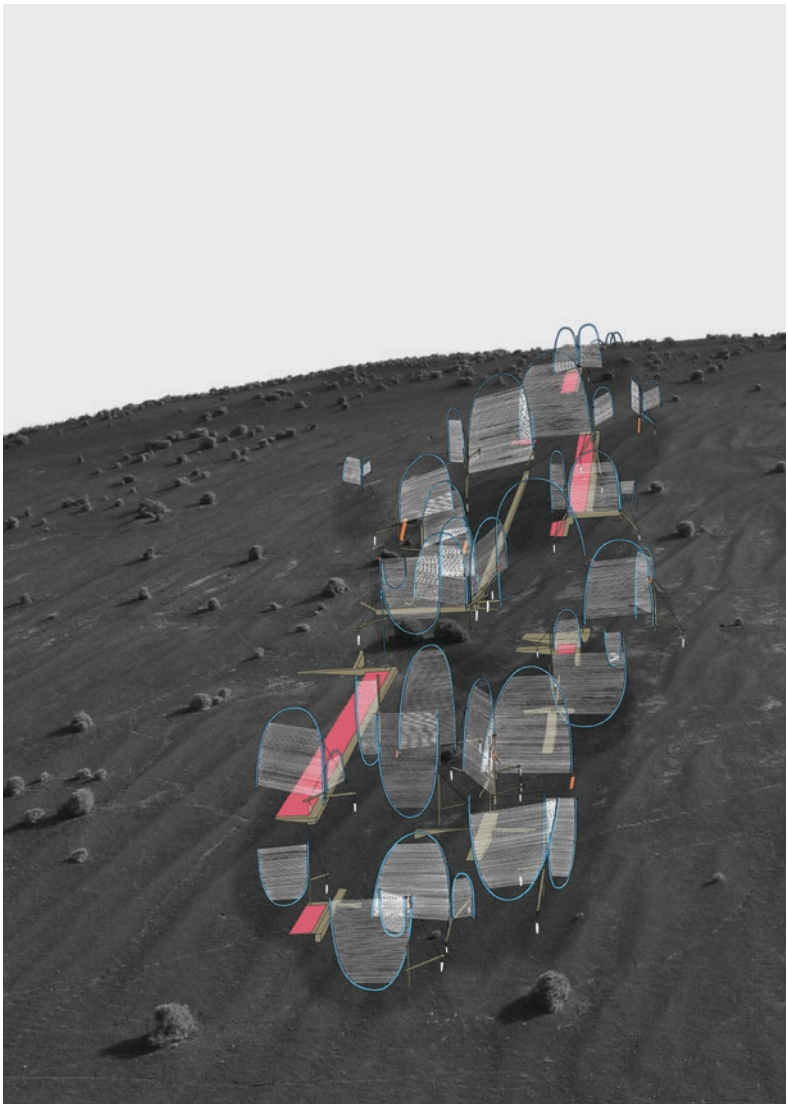
21

21
Le Geria vineyards, which cover approximately 50km of the island, are formed by thousands of semi-circular hollows, a dry farming technique called *enarenado* which is unique to Lanzarote. The technique is designed to capture and retain as much of the island's scarce water supply as possible. Each 'socos' hollow harbours an individual vine planted below the thick layer of porous black volcanic gravel known as *lappili* or *picon* which absorbs humidity and preserves moisture from morning dew by preventing evaporation.



22

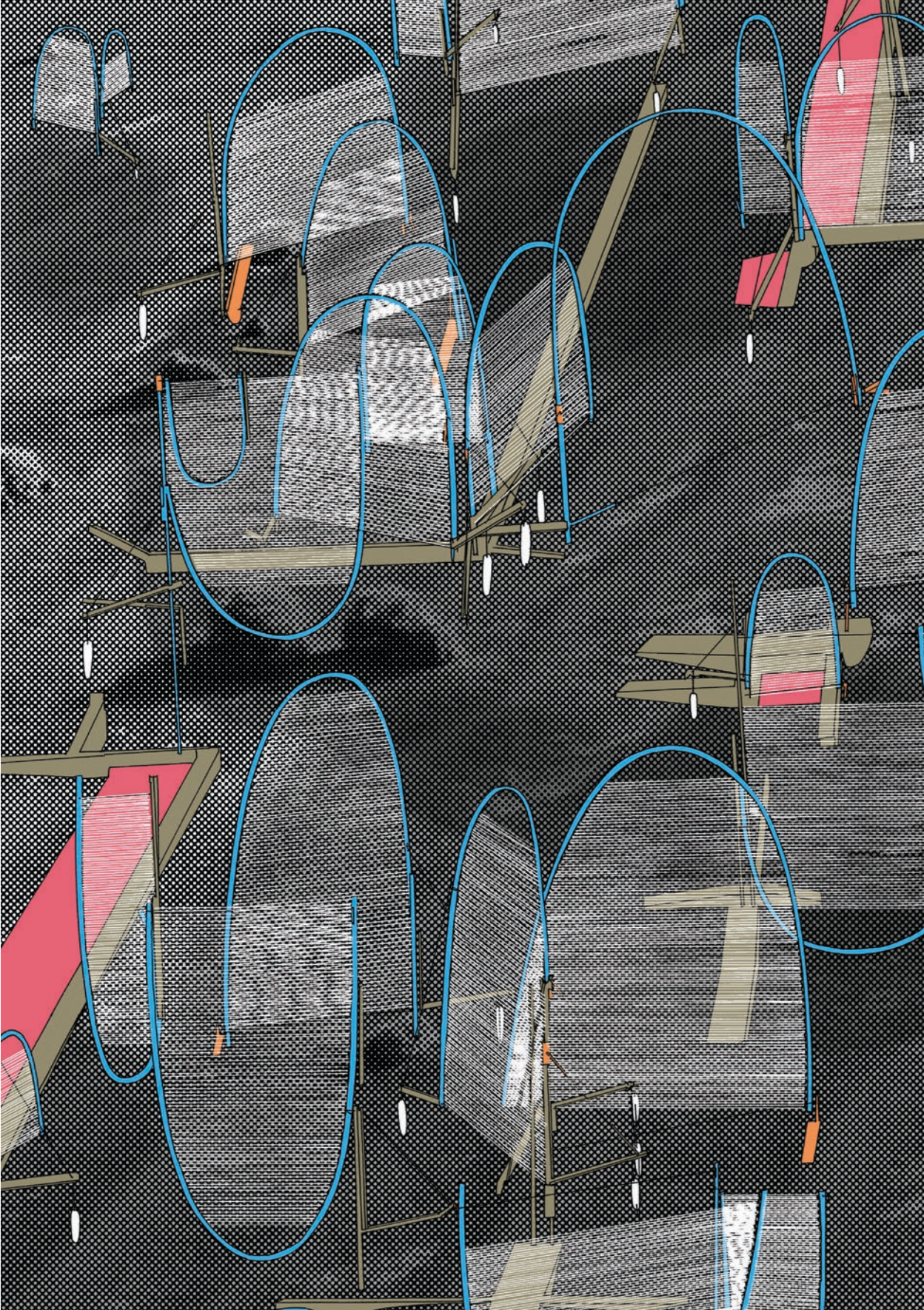
22
River Reversed.
Drawing pen and ink on halftone print with digital colour processes.
594mm × 841mm



23

23
Ground Cloud. Fog collecting nets are arranged on frames clustered upon the barren landscape. Pen and ink on halftone print with digital colour processes. 594mm × 841mm

24
Detail of Ground Cloud. Unlike that of other Canary Islands, Lanzarote's topography is too low for it to take full advantage of the 'sea of clouds' that can provide orographic precipitation, but around the northern hills, airborne water moisture can be harnessed by means of fog nets suspended high against prevailing winds.



In the Current Accumulator design [fig. 25] a landscape of saltwater solar ponds is connected by a network of cables and large tensioned armatures that store and transfer power. This is then gradually released as a continuous momentum acting upon the surrounding landscape.

Desalination: Lanzarote is a dry island, with no river or subterranean water sources. The island's indigenous architecture employs numerous techniques such as run-off collection systems and cisterns, and banked fields, cross terracing and check dams preserve water from rainfall. However, these methods are insufficient to provide water for the island's current population, swollen by tourism. Instead the island relies on imports of bottled water and desalinated seawater to provide a mains supply. Desalination is extremely costly, energy hungry and an unsustainable process. In Lanzarote 97 per cent of the water is delivered.

The River Reversed design [fig. 22 & 26] references the closed hydrological phenomena of 'endorheic' or salt lakes, where topography prevents drainage out to sea, and where instead the basin loses water by evaporation. It adopts the environmental technology of solar chimneys, where the updraft tower, more commonly used to provide ventilation, condenses water extracted by evaporation from a glass-covered saline pond. The tower has a reflective internal surface to multiply available light while absorbing radiation on its external surface to minimise heat loss through its mass. The chimney therefore superheats the moisture-laden air to vastly increase the volume of air passing through the system and therefore the quantity of condensate collected.

The surrounding landscape becomes a basin to the technological process. The emerging flow of fresh water is directed into a culvert cut from the surrounding rock landscape that transforms it into an artificial river flowing in a compressed meander through the site. The river is exposed to the sun's heat, while it also seeps into the concrete structure – the torrent becomes a stream, then a trickle, fractioning out minerals along its journey. Eventually just as the course reaches the basin the river is a dry, representing in reverse the hydrological cycle from rainfall to ocean. [fig. 27]

b. Post-barrage designs

Two design propositions are envisaged to provide environments that replicate and augment territories lost or altered by the diminished tidal flow of the river. [fig. 28]

The Instant Islands scheme provides a landscape of platforms that sit in the previously intertidal river shallows and mudflats on which migratory wading birds would have fed and wintered. The platforms are designed to contain silt which is scooped up from the flow of the river via a series of gates, jets and channels and settled in the platform's shallow bowl. The mud and silt habitats can be flushed out on a seasonal basis. [fig. 29–32]

1. FogQuest is a Canadian charitable organisation that runs rural water projects in sites where conventional sources of water are unavailable (www.fogquest.org).

A walkway meanders throughout the platform landscape allowing visitors to observe the birds as well as revealing the hydrodynamic force of the river and the mechanisms by which it is controlled. [fig. 33–36]

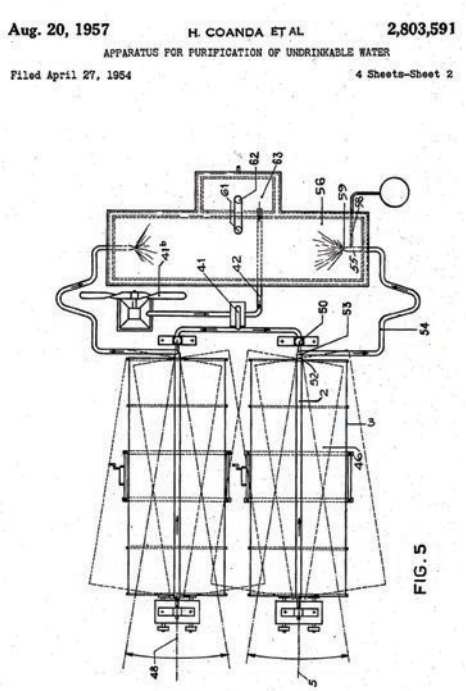
The Severn Lesser Bore Maker attempts to recreate the spectacle and sensation of the Severn Bore with the aim of sustaining the touristic curiosity of natural phenomena. A bore producing tidal surge would be substantially reduced or even entirely lost if barrage or lagoon projects are put in place across the Severn Estuary. [fig. 37]

The Bore Maker is sited at the 30-metre mudstone Garden Cliffs at Strand, which are the highest feature along the river course. This vantage point is used to attain a panoramic viewpoint over the landscape. The height of the cliff is exploited to provide a head of water to activate the artificial bore process.

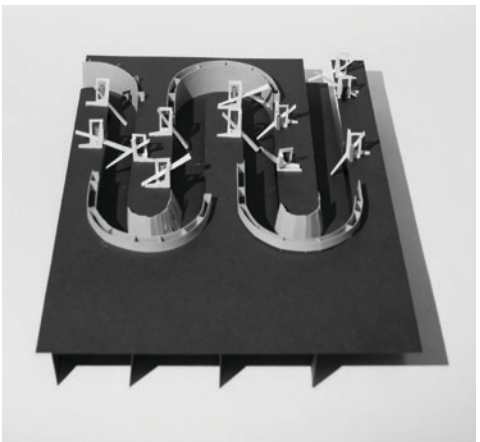
The Bore Maker is experienced by walking a series of pathways at the river level among a field of tilting platforms. [fig. 38 & 39] Turbines that sit in the river flow harness energy and this power is used to pump water from the river to the land to be stored in cisterns at the highest point on the shore. Water is held in large cisterns which are housed in tipping cradles. When sufficient water is stored the cistern cradle is overturned and the water released in a rapid flow. This energy is used to drag the river platforms down below the water. From the pathways the river appears to begin to swell and its turbulent surface evokes the power and lost performance of the bore.

c. Testing how these produce new 'envirogram' experiences of the land for users

Farming, salt production and fishing were Lanzarote's main socio-economic activities until the arrival of tourism in the 1960s. From this point the island has moved from a landscape of subsistence into an object of geographical and geological demonstration and spectacle. Productivity is overwritten as the island is conceptually reconstructed via model tourist initiatives towards a future of eco-tourism where the appeal of sunshine and beaches is exchanged for ecology, geology and culture.



28a



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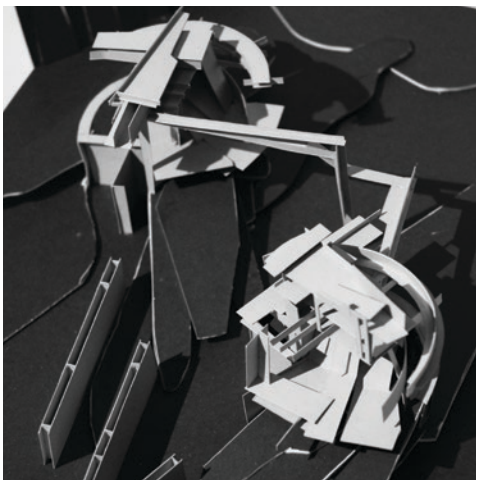


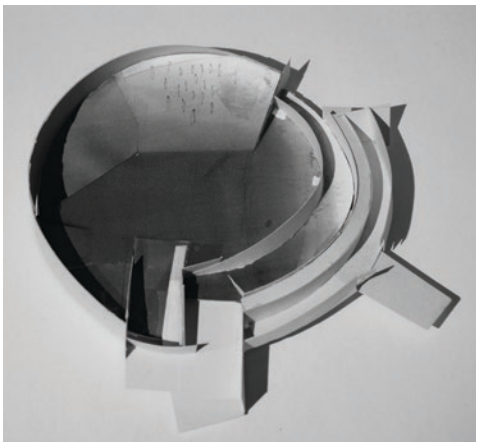
28c

28d

25 (*page 42*)
Current Accumulator detail. The solar ponds slowly shift, rise, fall and rotate, mimicking the flows and cycles of ocean water and at the same time illustrating the potential of environmental forces.

26 (*page 44*)
River Reversed detail showing the collection basin and artificial river course

27 (*page 45*)
Henri Coanda's 'Apparatus for the purification of undrinkable water', which he devised and patented in the 1950s but which was never adopted for use.



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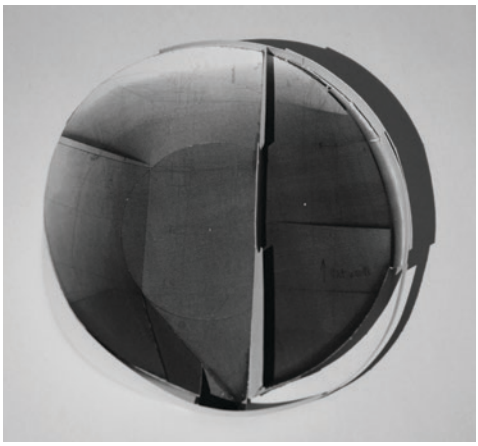

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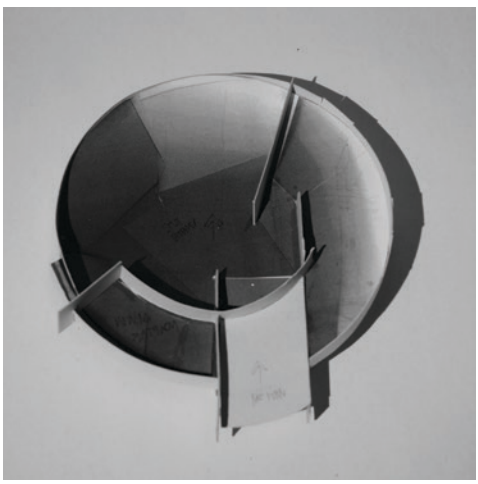

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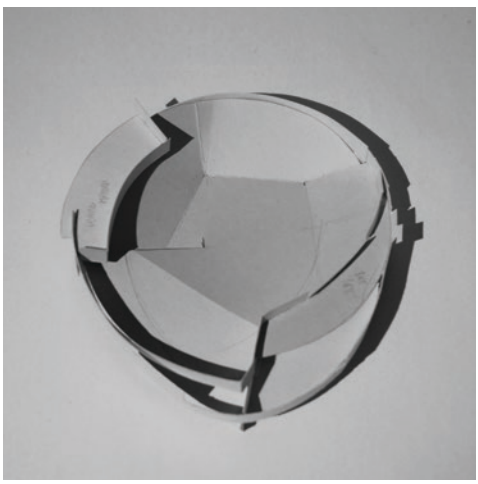
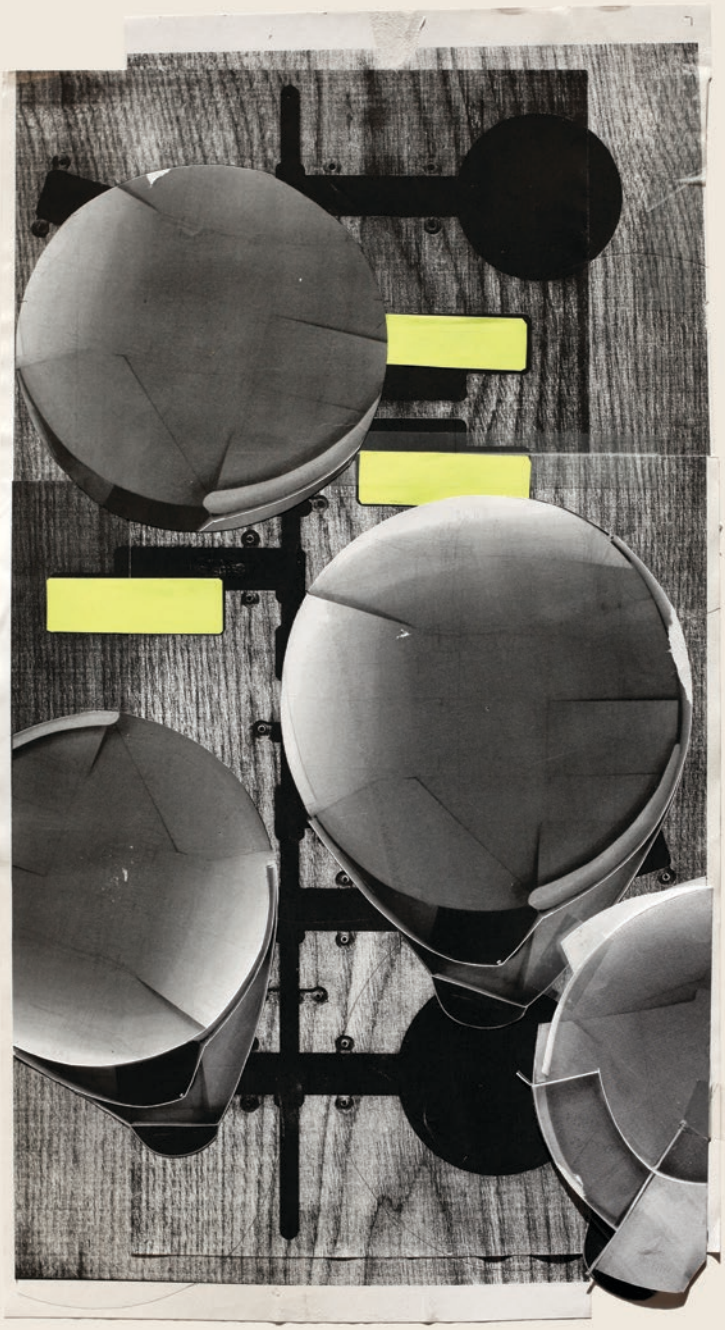


29d

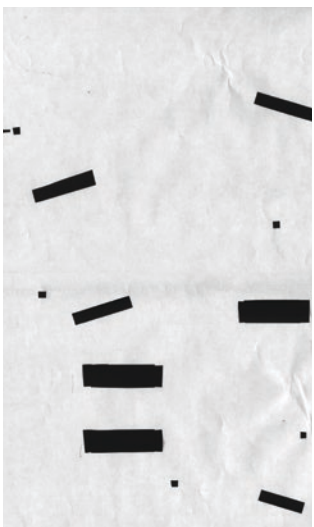
28
Modelling responses to the post-barrage environments using weirs, canals, culverts and lock gates to explore flow

29
Modelling to evolve the circular pan design. Gates and sluices control water flow into 15–20 metre diameter deep reservoirs and shallower pans where estuarine silt ecologies can be generated.

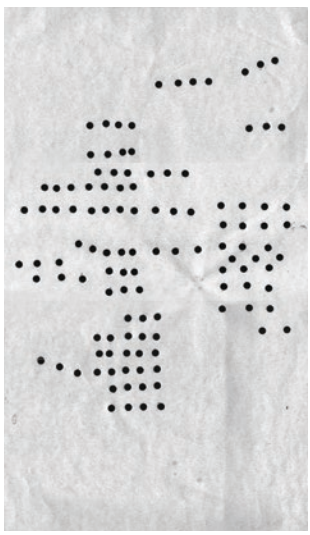


31

30 & 31
The design process includes collage and composition studies via photocopy and montage that are interpreted into the dynamic model for the Instant Islands proposal.



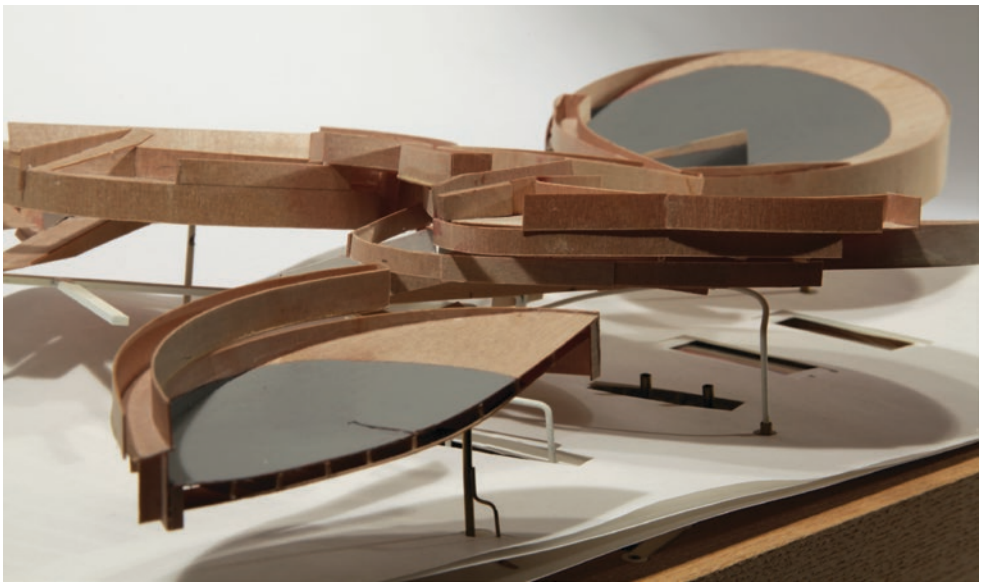
32a



32b

32c

32
Templates and cutting patterns for the paper layer which is used to represent the flow and sediment in the river



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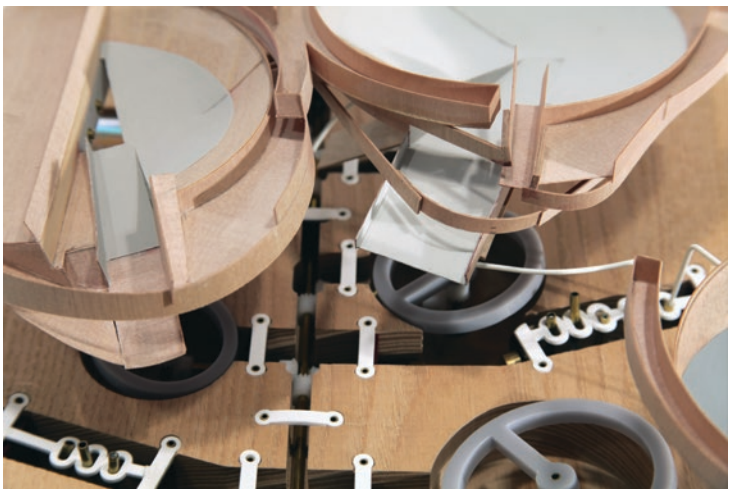
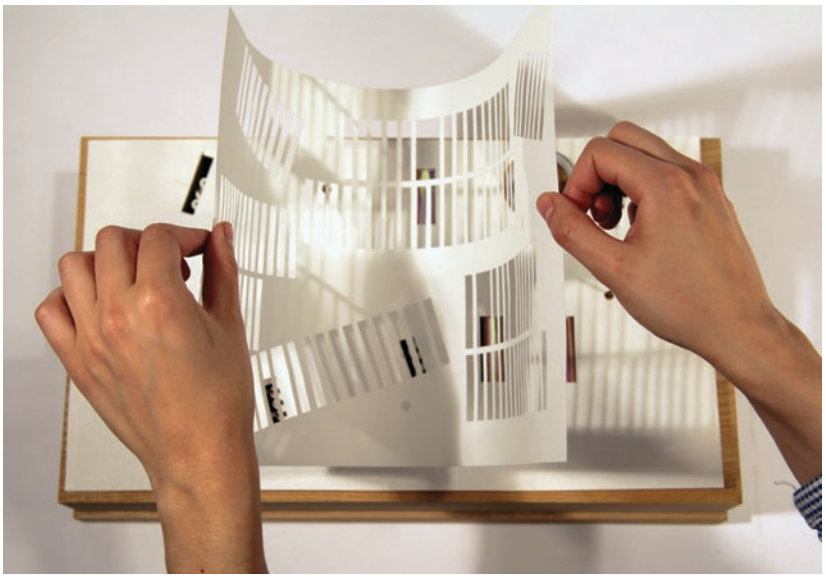


34

33
Encircling walkways, which also act as a wildlife hides, are suspended high above the river level and progress between the pans, offering views of bird activity in the captured river territories.

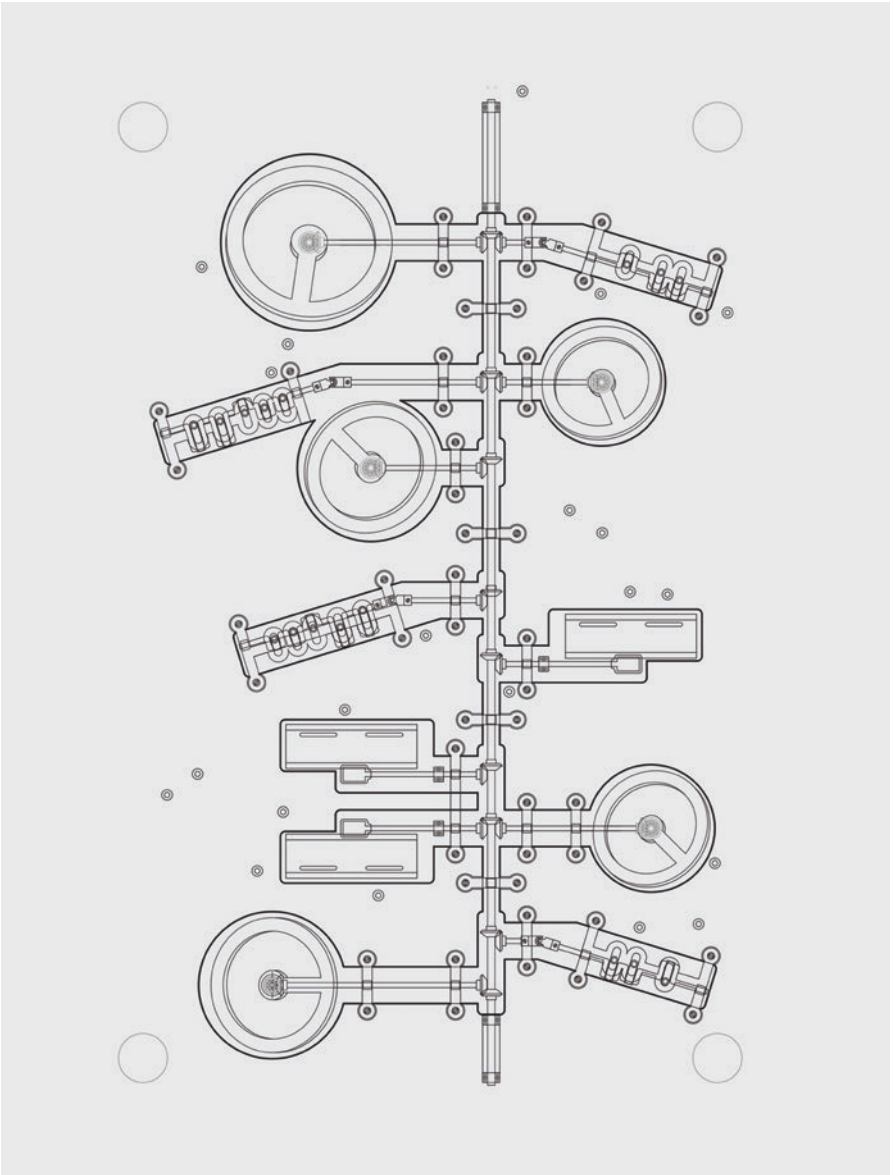
34
The model is constructed in three layers. Here the paper layer is removed revealing the relationship between the mechanisms and the architectural model.



35a

35b

35
Model photographs showing undulating paper layers which represent the river flow



36

36
Instant Island model base layer technical drawing showing mechanical elements, such as angled rotating discs and rollers which can be seen flashing through paper layers to give the impression of fluid motion.

37

38

37
Surfers. Tidal Surge Severn Estuary
Image in the public domain via Creative Commons

38
Showing the relationship between river level and the cliff-top cradles

39

39
The Severn Lesser Bore Maker model

Dissemination

Exhibitions

Group: *London Eight* at Southern California Institute of Architecture (SCI-Arc), Los Angeles, 21 Mar – 5 May 2010.
Group: *Summer Exhibition* at the Royal Academy of Arts, London, UK, 14 Jun – 22 Aug 2010.
Group: *Landscape Futures: Instruments, Devices and Architectural Inventions,* Centre for Art and Environment, Nevada Museum of Art, Reno, USA. 13 Aug 2011 – 19 Feb 2012.
Solo: *Envirographic Architecture* at the University of Manitoba, Canada, 23 Jan – 2 Mar 2012.

Invited talks

'Neo-Nature', part of the 'How to Architecture?' lecture series at the Bauhaus, Weimar, May 2010.
'Envirographic architecture', part of the RIBA Climate Change Lecture Series, at UCL, Sep 2010.
'Landscape Futures Super Workshop' at the Center for Land Use Interpretation (CLUI), Los Angeles, Oct 2010.
'Envirographic architecture' at the University of Cambridge, Nov 2011.
Flows, Systems, Atoms: Architecture in the Expanded Field, symposium at UC Berkeley, California, Feb 2012.

Journal articles

'Lanzarote, a changing climate, the "envirogrammic" response'. *Forward: The Architecture and Design Journal of the American Institute of Architecture's National Associates Committee* 111 [special issue on Landscape] (Spring 2011): 70–79.
'Neo-nature'. *Horizonte: Journal of Architectural Discourse 2* [special issue on How to *Architecture?*] (Fall 2010): 81–88.

Book chapters

'The "envirogrammic" response'. *Performative Materials in Architecture and Design.* Ed. Rashida Ng and Sneha Patel. Bristol: Intellect Books, 2013: 210–211.
'Superscript: an interview with Mark Smout and Laura Allen'. *Landscape Futures: Instruments, Devices and Architectural Inventions.* Ed. Geoff Manaugh. Barcelona: Actar, 2013: 123–138.

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Helen Thomas, 'Lanzarote, Wonderground'. *OASE Journal for Architecture 64* [special issue on *Landscape and Mass Tourism*] (Summer 2004): 90–109.

Related publications by the researcher(s)

Journal articles

pp. 50–60
Mark Smout and Laura Allen, 'Lanzarote, a changing climate, the "envirogrammic" response'. *Forward: The Architecture and Design Journal of the American Institute of Architecture's National Associates Committee* 111 [special issue on *Landscape*] (Spring 2011): 70–79.

pp. 61–70
Mark Smout with Ortrun Barghols and Michael Kraus, 'Neo-nature'. *Horizonte: Journal of Architectural Discourse 2* [special issue on *How to Architecture?*] (Fall 2010): 81–88. http://issuu.com/horizonte-architekturdiskurs/docs/horizonte-no.2/80

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pp. 71–73
Mark Smout and Laura Allen, 'The "envirogrammic" response'. *Performative Materials in Architecture and Design*. Ed. Rashida Ng and Sneha Patel. Bristol: Intellect Books, 2013: 210–211.

pp. 74–90
Mark Smout and Laura Allen with Geoff Manaugh, 'Superscape: an interview with Mark Smout and Laura Allen'. *Landscape Futures: Instruments, Devices and Architectural Inventions*. Ed. Geoff Manaugh. Barcelona: Actar, 2013: 123–138.

Related writings by others

Book chapter

pp. 92–131
Geoff Manaugh, 'Landscape futures: curator's essay'. *Landscape Futures: Instruments, Devices and Architectural Inventions.* Ed. Geoff Manaugh. Barcelona: Actar. 2013: 15–53.

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pp. 133–134
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pp. 135–137
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p. 139
A. Moret, 'London Eight: Sir Peter Cook liberates the world from the conventions of digital architecture'. *Flaunt Magazine* 109 (Apr 2010): 58.

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Bartlett Design Research Folios

ISSN 2753-9822

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