

# TRISTAN DA CUNHA

Design for a new sustainable community

DRUw | Welsh School of Architecture



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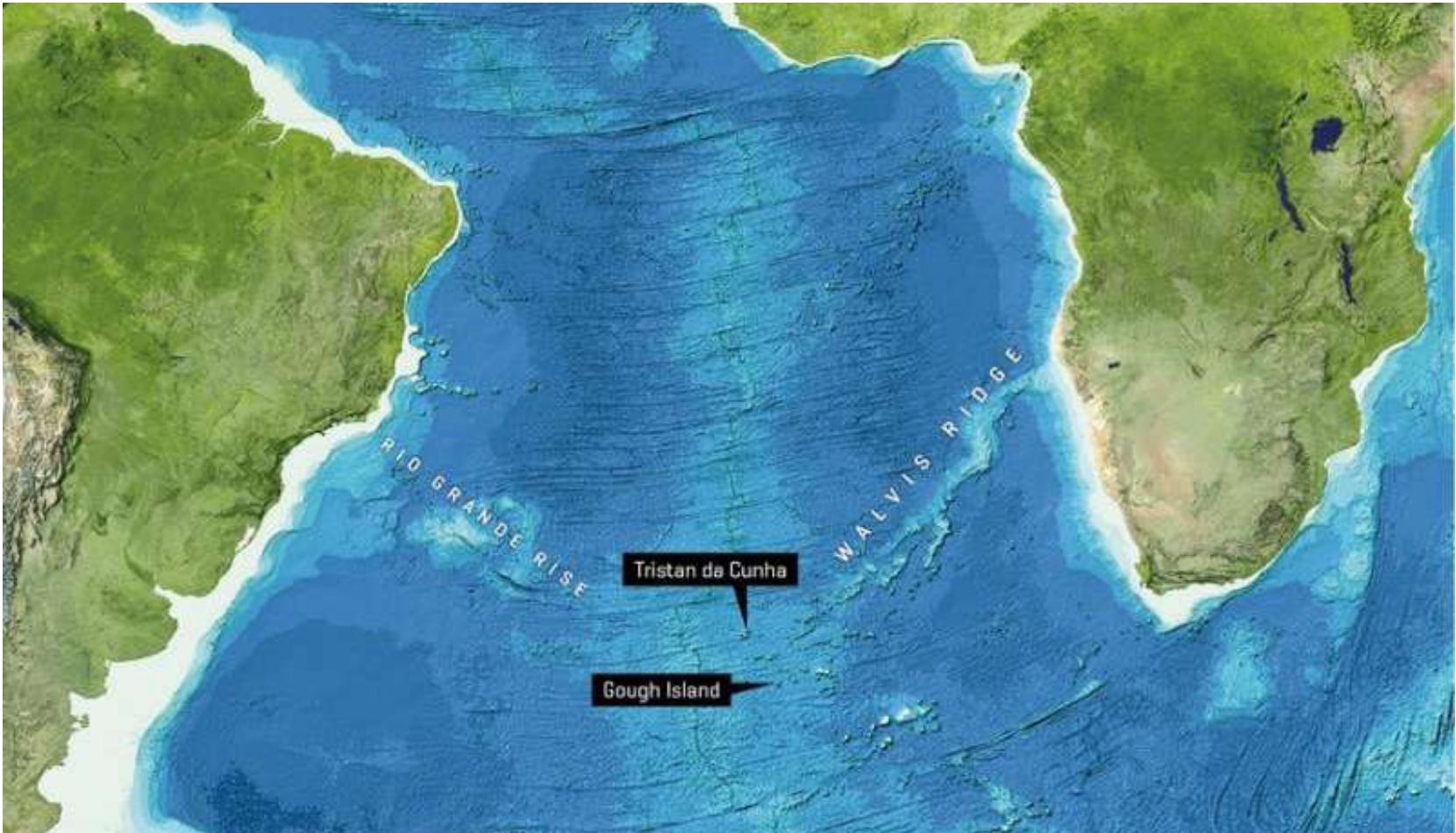


## Project Details

Title		Designing a More Sustainable Future for Tristan da Cunha's Community
Principal Investigator		Professor Wayne Forster, DRUw, Welsh School of Architecture, Cardiff University in partnership with Neil MacOmish, Scott Brownrigg
Output No		XXXXX
Output Type		Design output (RIBA Two Stage Competition)
Date of Output		2015
Client		RIBA Competitions on behalf of the Government of Tristan da Cunha
Function		Design for a sustainable settlement
Location		Tristan da Cunha
Funding		£6,243,000 (estimated)

*in collaboration with the  
following design team*

Project Management		MACE
Structural consultant		Arup, Cardiff







## STATEMENT ABOUT THE RESEARCH CONTENT AND PROCESS

### *Description*

The scope of this competition embraces a wide field of design expertise, and it was suggested that entrants should assemble a team with appropriate skill sets to address the following opportunities in their proposed solutions. It consisted of a wide-ranging approach to ensure the future of this remote settlement within the particular and specific geographical and cultural context. The clients brief was to address issues that would lead to a self-sustaining way of life:-

- Address the problems of existing public buildings and residential building stock and to make proposals that will address, if not eliminate issues of poor construction and fundamentally reduce energy consumption.
- Water and energy resources - Entrants were asked to submit proposals to overcome and fundamentally improve methods of water management including rainfall capture, retention, storage, recycling etc. Entrants were also requested to advance proposals to achieve the Island's ambition that at least 30-40% of its energy needs are met by renewable means within the next 5 years.
- Proposals were also intended to take into account the need for training facilities for inhabitants in a possible range of new economic activities.

### *Methods*

- Literature review
- Precedent studies
- Design with climate
- Design with emphasis on hand drawing and the use of physical models



### *Questions*

- How to design for a sustainable settlement on one of the most remote and poorly connected places on earth.
- How to design with climate to enhance human comfort and to take advantage of the potential for passive design.
- How to design for the specific character of place.
- How to design for a construction process determined by scarce local resources and logistical difficulties of imported material and labour.
- How to effectively disseminate all of the above.

### *Dissemination*

See competition website <<http://www.ribacompetitions.com/tristan/index.html>>



## STATEMENT OF SIGNIFICANCE

RIBA Competition Shortlisted (see above)

The first anonymous phase of the competition attracted 37 entries from architect-led design teams based in Australia, Brazil, Canada, China, Germany, Italy, Japan, New Zealand, Russia, Spain, Switzerland, Turkey, United Kingdom and the United States of America.

'The Judging Panel met to review the anonymous submissions in June 2015 when the Tristan da Cunha Administrator and Head of Government was in the UK. As well as HH Alex Mitham, the Panel also comprised Laura Benyohai (Tristan da Cunha & Pitcairn Desk Officer, Foreign and Commonwealth Office) Chris Carnegy (Tristan da Cunha, UK representative), Jim Kerr (Tristan da Cunha, UK adviser) and John Whiles (Jestico + Whiles, acting as the RIBA Architect Adviser). The Panel identified a long-list of 15 schemes for further consideration. These were presented by Alex Mitham to the Island Council for their final selection of the shortlist on his return to Tristan in July 2015. The Island Council was delighted by the interest shown in Tristan by design teams from around the globe, together with the myriad ideas contained within the phase one design proposals.'<sup>1</sup>

Anonymity was lifted following selection of the shortlist with the authors of schemes duly identified. The five short-listed teams were invited to develop their design ideas during the latter part of 2015 in response to general and scheme specific feedback arising from the phase one assessment.

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1 <http://www.ribacompetitions.com/tristan/index.html>



## 1. INTRODUCTION

'Tristan da Cunha, is both a remote group of volcanic islands in the south Atlantic Ocean and the main island of that group. It is the most remote inhabited archipelago the world, lying approximately 1,511 miles (2,432 km) off the coast of Cape Town in South Africa, 1,343 miles (2,161 km) from Saint Helena and 2,166 miles (3,486 km) off the coast from the Falkland Islands. The territory consists of the main island, Tristan da Cunha, which has a diameter of roughly 11 kilometres (6.8 mi) and an area of 98 square kilometres (38 sq mi), the smaller, uninhabited Nightingale Islands, and the wildlife reserves of Inaccessible Island and Gough Island. As of October 2018, the main island has 250 permanent inhabitants who all carry British Overseas Territories citizenship.'

<sup>1</sup>

This is the context for the challenge of designing for one of the most remote and climatically challenged islands in the world. The brief therefore asks for a holistic approach to sustainability in all its dimensions.

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1 [https://en.wikipedia.org/wiki/Tristan\\_da\\_Cunha](https://en.wikipedia.org/wiki/Tristan_da_Cunha)





## 2. AIMS AND OBJECTIVES

In this project we aimed to build on the sense of community that exists on the island but to more successfully exploit the dimensions of climate and natural and renewable resources that could be harnessed, filtered and where possible enhanced to provide environmental comfort and delight.

The distinctive hallmarks of the island's built heritage rests on two significant factors. Firstly, in the power to unite structures with its setting and make it feel part of the landscape – and secondly, the capacity of its inhabitants to collaborate and co-operate in the act of building and habitation in a way embodying Heidegger's 'building dwelling'.

The proposals in both stages of the competition are therefore reinforced and enhanced by further analysis and deeper understanding of these traditional methods. This can be witnessed in the response to siting, topography, climate and nature developed and practised through the tacit and deep knowledge of the unique place that the islanders have chosen as home.

### 3. QUESTIONS

- How to design for a sustainable settlement on one of the most remote and poorly connected places on earth.
- How to design with climate to enhance human comfort and to take advantage of the potential for passive design.
- How to design for the specific character of place.
- How to design for a construction process determined by scarce local resources and logistical difficulties of imported material and labour.
- How to effectively disseminate all of the above.
- How to map place in a meaningful way using predominantly desk-top techniques
- How to effectively disseminate all of the above.



## 4. CONTEXT

Tristan da Cunha, because of a combination of geography and remoteness presents one of the most singular contexts to define and respond to architecturally. 'Life on Tristan, as in any farming/fishing community, is ruled largely by the weather. Daily life involves tending to livestock and crops in a timeless routine, mixed with seasonal activities such as shearing, digging, planting and harvesting. The Islanders rely to a great extent for their food on their own stock, poultry and crops. Potatoes are the main crop, grown at the Patches about two miles from the settlement. Other vegetables are also grown privately.

In many ways, the Government and community can be considered as being synonymous within the context of life on Tristan. The Government is the principal employer on Tristan, with a work force of approximately 140 spread across 11 departments which include Agriculture, Conservation, Education, Finance, Fishing, Medical, Post Office & Tourism, Public Works and Telecommunications. All services (fuel, car repairs, plumbing etc.) are provided by the appropriate government department that are open to the public during working hours Monday to Friday. The Government-owned Island Store imports and sells a limited variety of foodstuffs, household equipment and clothing. There are no other shops or restaurants. The only (again, Government run) pub is housed within The Prince Philip Hall, which is the social hub of the island and contains a hall that is used for occasional dances and indoor sport.

Fishing and related activities are the second major source of employment on the Island. There are 12 small island fishing boats each with a two man crew, and if it is a fishing day the men will excuse themselves from the 'Government' work and go fishing. Losing 24 men from the Government each fishing day is a considerable drain on the limited resource base.



Tristan's primary source of income is generated via a royalty agreement with a South African-based company which operates the lobster fishery under the terms of an exclusive concession granted by the Island. Tristan da Cunha Rock Lobster has been certified as a sustainable seafood by the Marine Stewardship Council. Product is exported to the US, Australian, EU and Japanese markets. The company ship fishes around all the islands, whilst the fleet of small island boats also fish around Tristan and catch lobster for processing in the factory, which provides permanent employment for 9 Islanders. In addition to the royalty and employment, the fishing company also provides vital power generation for the Island and a limited passenger (just 12 berths, 8 times a year) and cargo service to Cape Town. The island now has a satellite tracking system to monitor vessels that enter the Island's Exclusive Economic Zone, with recourse to Royal Navy assets in the region to deter illegal fishing within its waters. Product is exported to the US, Australian, EU and Japanese markets.

Other small sources of revenue include interest from a reserve fund, the sale of stamps, coins and handicraft souvenirs, together with modest income from tourism and visitor accommodation. This helps finance government activities such as the provision of free healthcare and education, with additional financial support from the UK government.

Tristan's economy is however shrinking and the cost of living continues to rise. Large capital projects require overseas funding - for example, the European Union recently funded new electrical and water reticulation systems for the Island. In order to avoid becoming reliant on budgetary aid from the UK, it is critical that cost-effective long-term solutions are found to improve the community, to make buildings energy efficient and reduce the living costs of the Island's population'.













### *The Government Buildings*

Entrants are invited to propose their approach to replacing or refurbishing the Administration Office, Island Store, Agriculture, PWD, Telecommunications, Conservation, and Fisheries Departments. These should be kept within the footprint of the Settlement and bear in mind the constraints set out below.

### Dwellings (120)

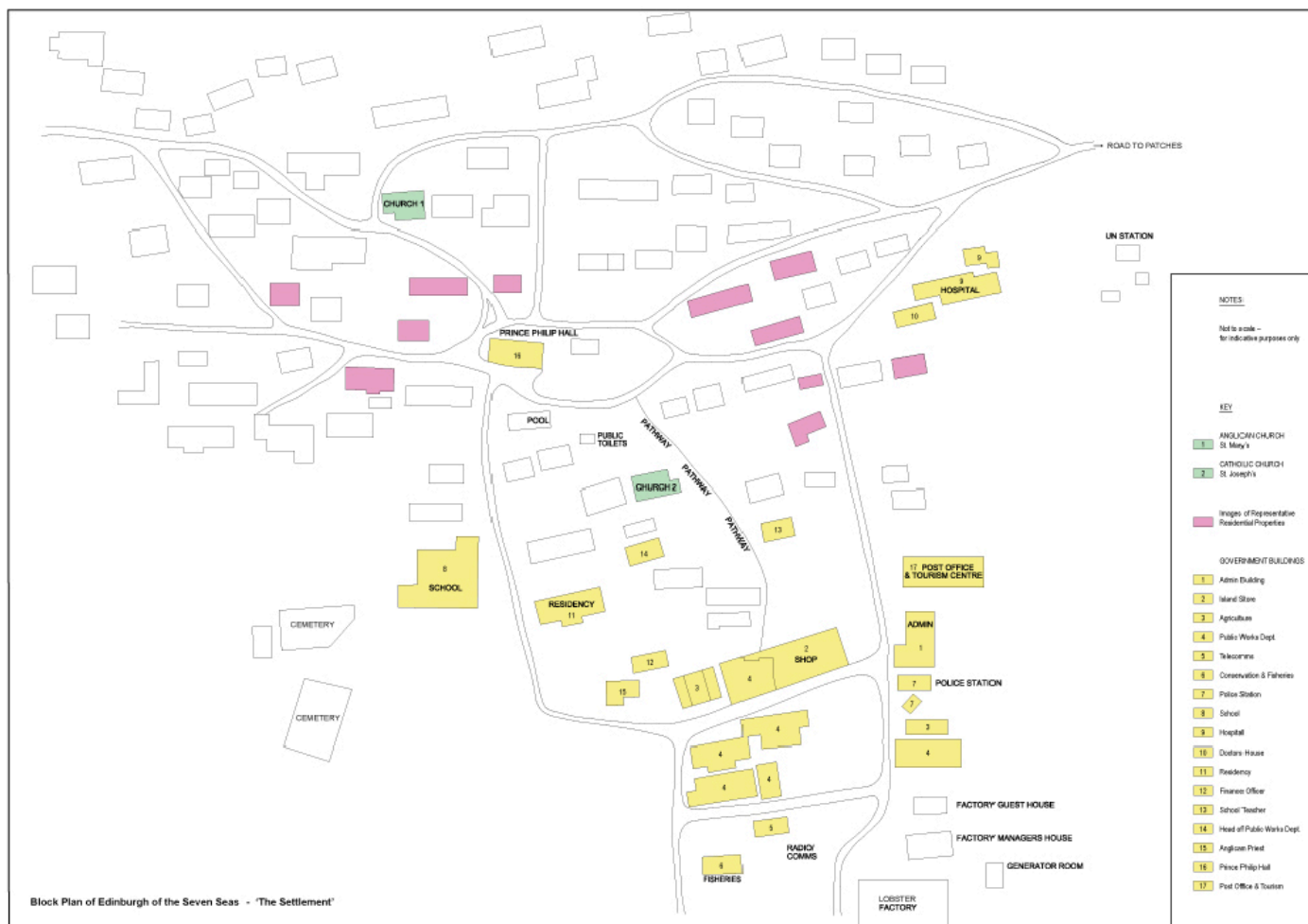
- Construction of the houses is variable, but lack of insulation, lack of central heating, the maritime damp and mould are common complaints.
- Entrants are invited to make proposals that will address, if not eliminate these issues and fundamentally reduce energy consumption.

### Water

- Entrants are asked to submit proposals to overcome and fundamentally improve methods of water management including rainfall capture, retention, storage, recycling etc.

### Energy

- It is understood that there has been no research undertaken on how the Island's natural resources, weather, or sea can be embraced to generate energy.
- Entrants are requested to advance proposals to achieve the Island's ambition that at least 30-40% of its energy needs are met by renewable means within the next 5 years.









## 5. METHODS

### *Literature review and precedent studies*

For the purposes of this research the idea of how lessons may be drawn from the vernacular and employed in a contemporary way are central to the proposals. In addition, the work of architects and landscape architects who have successfully integrated architecture and topography are influential. We are interested in how Sverre Fehn mediates between site and building and in the way in which Charles Morre and Lawrence Halprin saw and made architecture and landscape a single tradition at Sea Ranch in California.

The ideas of the vernacular (Rappaport) do not rest entirely on the orthodox, and more widely understood physical and technological principles also engage with perhaps the more crucial cultural aspects architectural design.

### *Building on the past – the ‘genius’ of loci*

The distinctive hallmarks of the island’s built heritage rests on two significant factors. Firstly in the power to unite structures with its setting and make it feel part of the landscape – and secondly, the capacity of its inhabitants to collaborate and co-operate in the act of building and habitation in a way embodied in Heidegger’s ‘building dwelling’.

The proposals in this second stage of the competition are therefore reinforced and enhanced by further analysis and deeper understanding of these traditional methods. This can be witnessed in the response to siting, topography, climate and nature developed and practised through the tacit and deep knowledge of the unique place that the islanders have chosen as home.



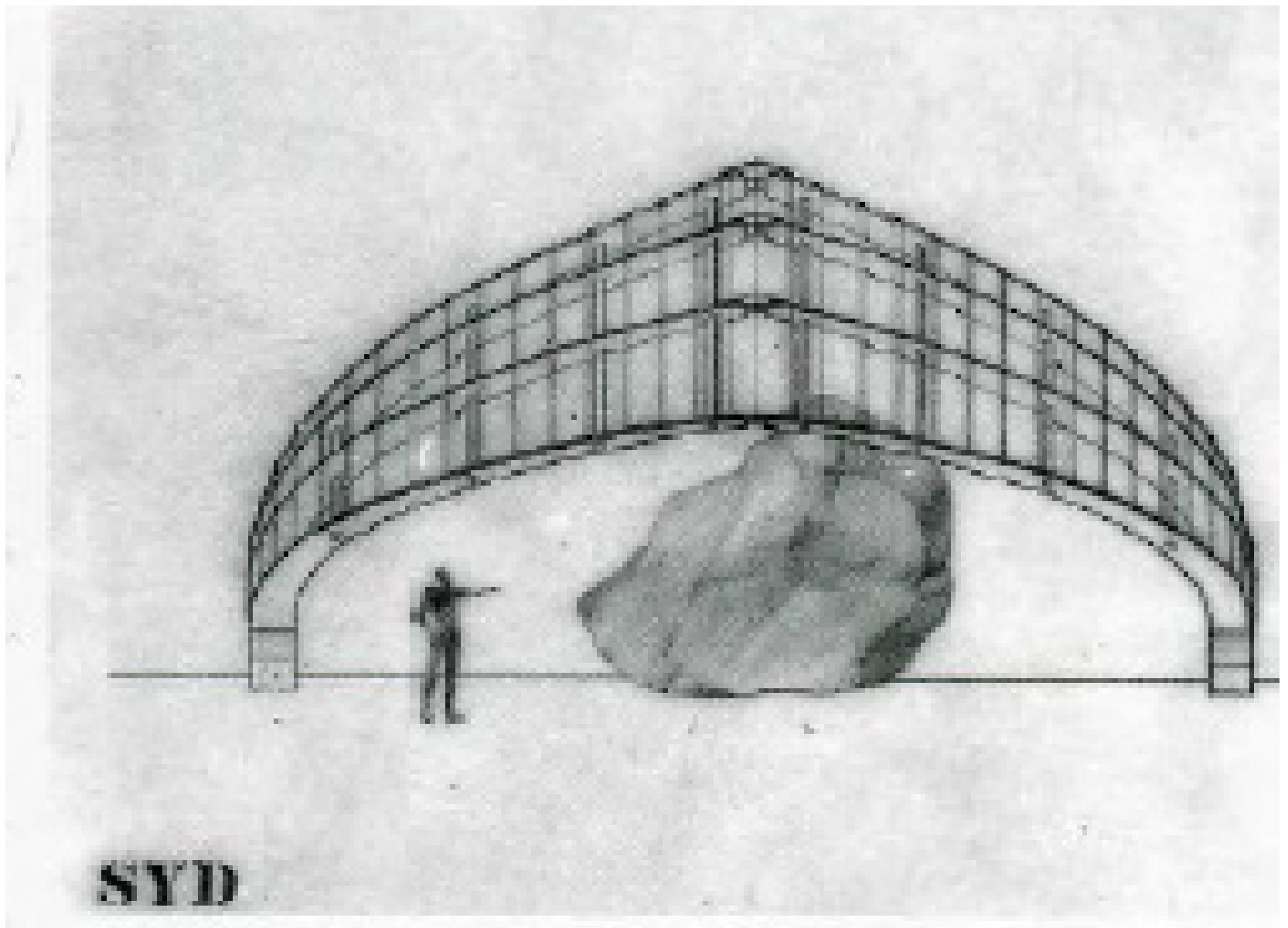
### *Resource and resourcefulness*

The Tristan da Cunha 'vernacular' is founded on a need to harness resources of the island through native wit and intelligence to create a sustainable way of life: this is often referred to as Genius loci: the cultural and phenomenological strands of the vernacular.

Tristan has a historically rooted and contemporary culture of fishing and boat building, both as a skill and craft but also a necessity to life on the island. The act of building a boat brings together the community to utilise the islanders craft abilities, simultaneously creating a heart and hub of activity. And for us, the long upturned boats along the road curving up from the harbour reiterate the language of Tristan's built forms, streamlined against a prevailing wind current offering protection and shelter.

Like Sverre Fehn (see images), for us, the upturned boat metaphor assumes critical importance both symbolically as well as tectonically. Fehn argued that to build on land without acknowledging the concept of the sea is to build without the limitations of the world around. Designing from a great distance these thoughts seem to us to be particularly relevant for those who have made the island their home – they are intimately approximate to the margins between earth and sea and the vessel is part of this. At a more practical level the boatbuilding technology and concomitant skills and ways of collaborative working will become a touchstone for the project and of its construction.

The relationship between all elements of the natural and built environment for a sustainable development, 'design must go beyond aesthetics and include the social, environmental and economic aspects of the development, including its construction, operation and management, and its relationship to its surroundings'.





### *Siting and topography*

Edinburgh of the Seven Seas is more than a random collection of crofts and cottages clustered around a transit point. Whilst appropriate sites for such a settlement are narrowly limited, the form is founded on the fundamental pragmatic (vernacular) need for community but also for an inimitable respect for the individual within community – primary, independent and self-situated in a wider congregation. This results in clusters of dwellings on individual plots all within easy reach of communal facilities but which also acknowledge challenging climatic conditions.

### *Climate and weather*

The building form is a direct response to climate and weather. We refer to both for whilst the former can be 'read' from published data and used to inform design we are also acutely aware that people experience and 'sense' weather – particularly in its extremes. The reason that buildings are customarily sited East – West, face the sun (when present) and are gabled with cyclopean stone reminiscent in size and precision of Machu Pichu is no mystery. However, it is the combination of building form and the modification of landscape that hammers home the very real need for modification of climate through intelligent design to provide effective shelter.

### *Sheltering Landscapes*

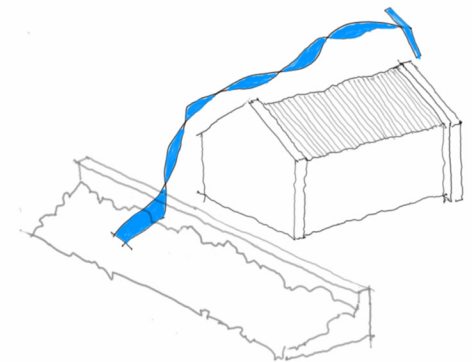
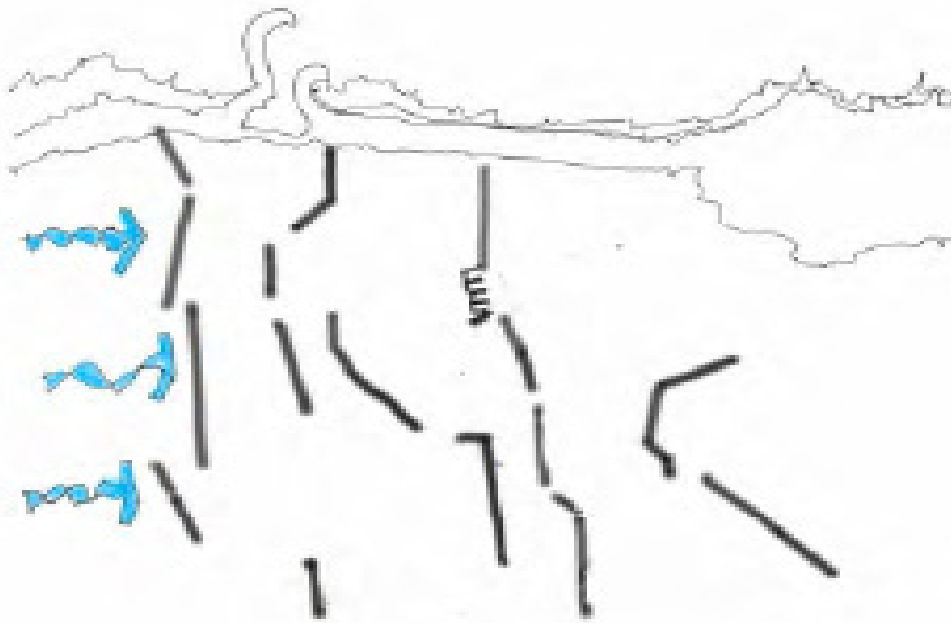
The buildings and outside spaces are currently partially protected by shelterbelts which are formed through a combination of slightly bermed bounding elements of drystone and native gorse. The proposal is to reinforce these and to introduce new ones. Strategically placed these can afford protection from wind-driven rain and the convective cooling effects of wind on the building envelope in addition to the damaging effects on building elements. These belts are also sited to reinforce the formal structures of the settlement and provide sheltered pedestrian ways (Hollow-ways) running North – South.

### *Siting, massing, and fabric*

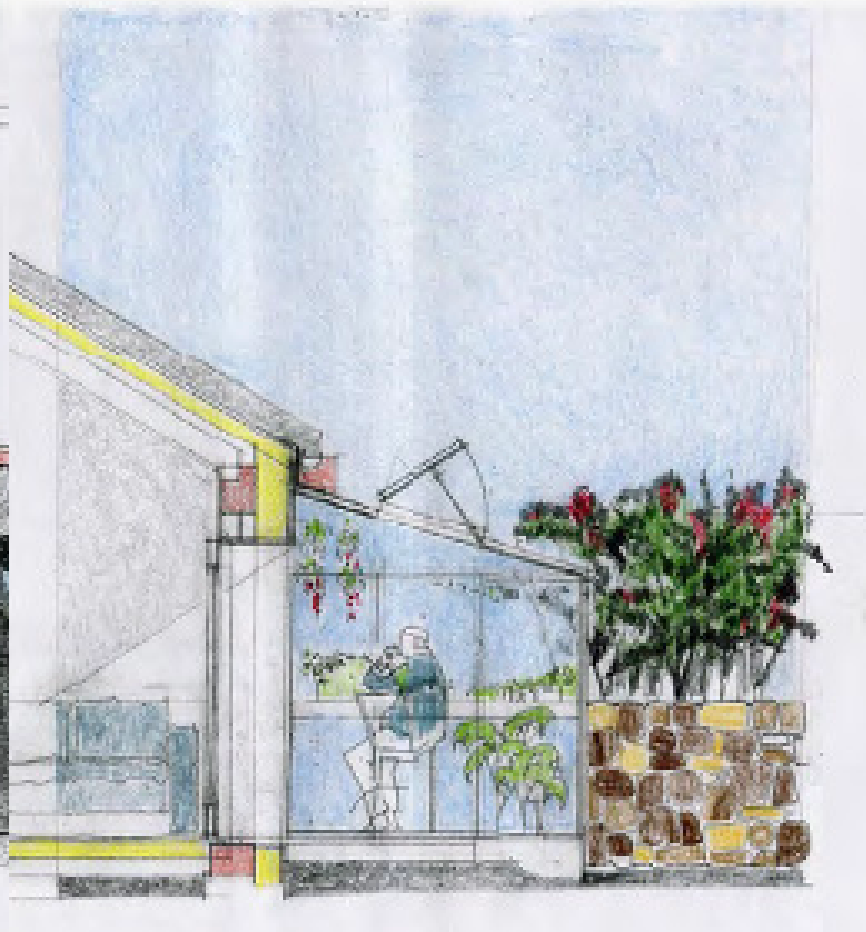
New buildings are sited traditionally with long elevations on the East – West and with short protective gables. The new Government buildings take the form of long low pavilions in echelon. They are simple skeletal structures of pre-fabricated laminated timber frames. The structural bay is generic and repeated for economy and ease of construction. Foundations are therefore minimised. These roofs provide the basis for an encampment of sheltering roofs formed into assymetric barrel vaults. The asymmetry is not mindless form making but designed to further enhance the idea of combining design with climate and functional space use.

The longer flatter Southern slope optimises the potential for daylight whilst the steeper Northern slope can enable openings that are shaded in summer and can benefit from some judicious passive solar gain in winter (see images). Weather protecting elements chosen will be thin skin waterproofing materials chosen for ease of transportation, efficiency, wind tightness, low maintenance and buildability in terms of appropriate technology. Colour coated sinusoidal steel is used for roofs and rubber EPDM is employed for walls, all on an insulated build-up to provide what has been calculated as 'optimised' U values to suit the climatic conditions of Tristan da Cunha. (See Energy Environment and Materials).

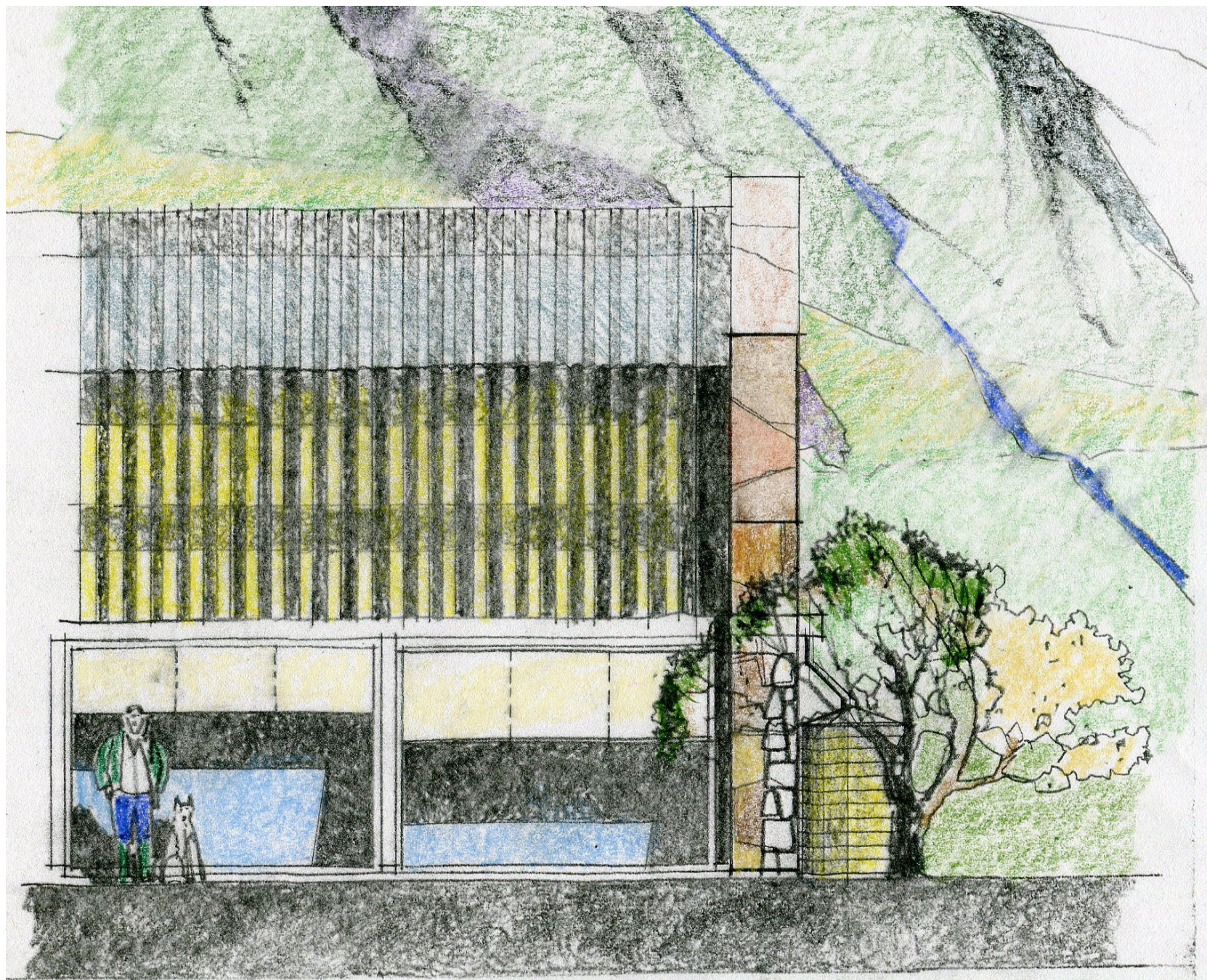
This material palette is also used for the retrofit of houses ensuring a visual coherence and continuity. Additionally the form and colour of the roofs and rainwater elements make identifiable focal points in the 'quilted' landscape and seem to us symbolic of identity, just as the colours of the longboats belong to the crews. In this way the roofs of the new and existing shelters, gather resources and provide identity. Additionally layered elements are added to further enhance and protect North facing long elevations.



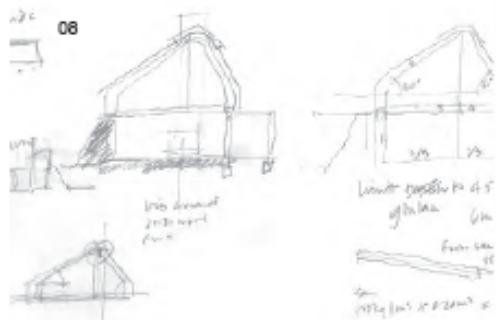
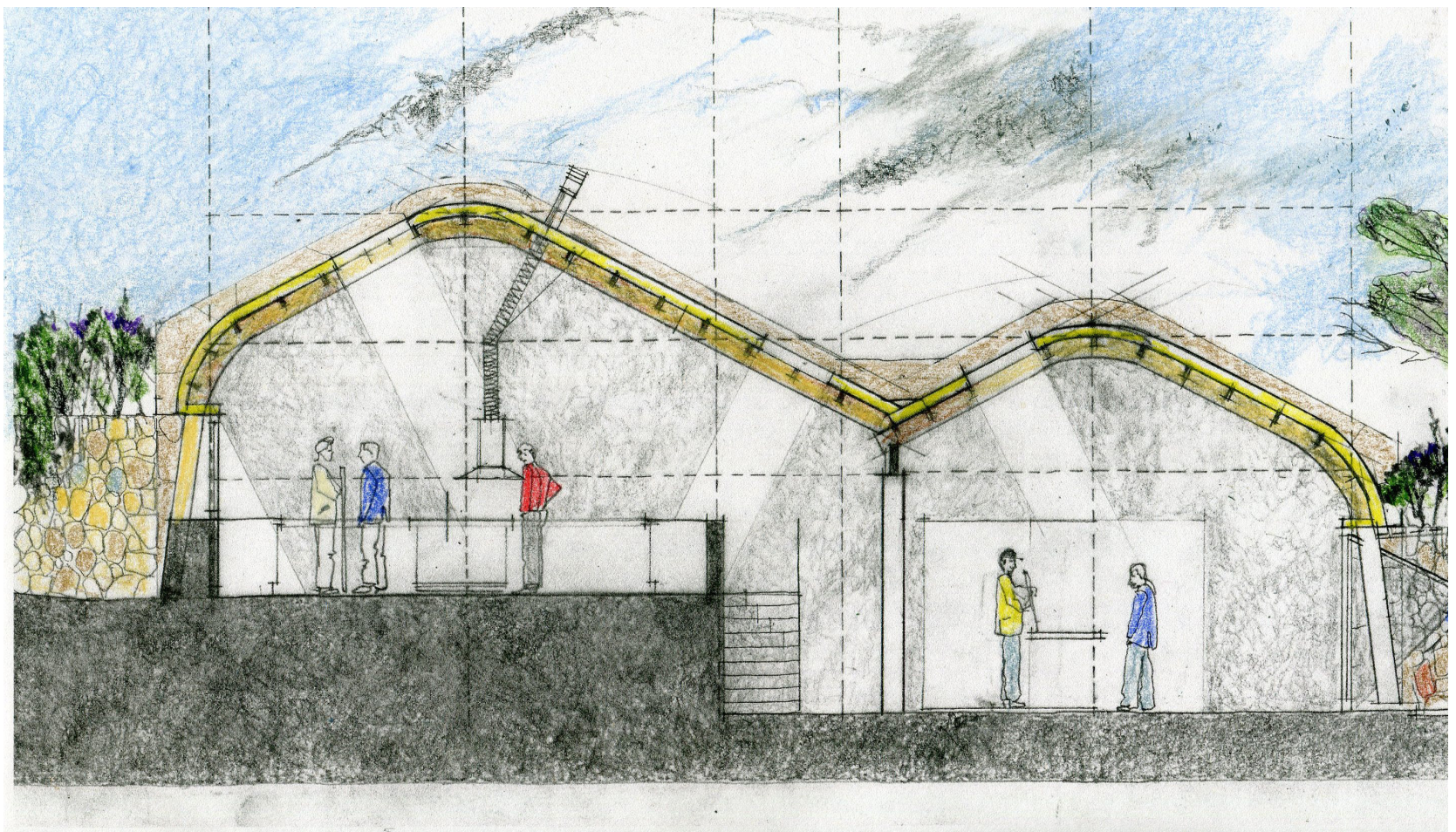












### *Energy and resources*

Having established that a fabric first strategy would be the most effective method, the team undertook a series of simulations to establish some benchmark values. The weather data supplied was compiled onto a working weather file to run through thermal modelling analysis software and from this we were able to draw a number of conclusions.

The average temperature is relatively mild compared to the typical UK climate with a peak of 23.5°C and minimum of 5.5°C. Therefore, properties are likely to be heated only and not require any form of air conditioning. A thermal model was created and the test weather file was utilized to calculate the estimated heating energy consumption for a sample property. A range of U-values were tested to seek the optimal performance which can be seen in Graph 2. It is clear that there is a good relationship between improved U-values compared to the annual energy consumption, see Graph 2. However, there is a plateau in terms of the cost performance (see Graph 3), and it appears that a U-value of 0.3 is the optimal solution in terms of reducing energy demand vs costs of the insulating material.

### *Renewable Energy*

The overall aim of the scheme is for the islanders to head towards being self-sufficient in terms of their energy needs. Currently wind energy is proposed due to the predictable and constant wind the island experiences, however we propose a dual approach in terms of considering wind alone, and wind plus an element of photovoltaic panels. Below the calculation shows how much PV is required to meet demand for the whole settlement, how many vortex bladeless turbines would be required to supply the whole settlement and then a mixed scenario where PV supplies domestic demand, and vortex bladeless turbines supply the civic demand.



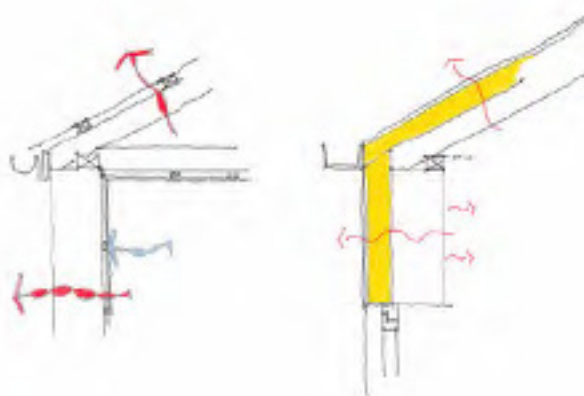
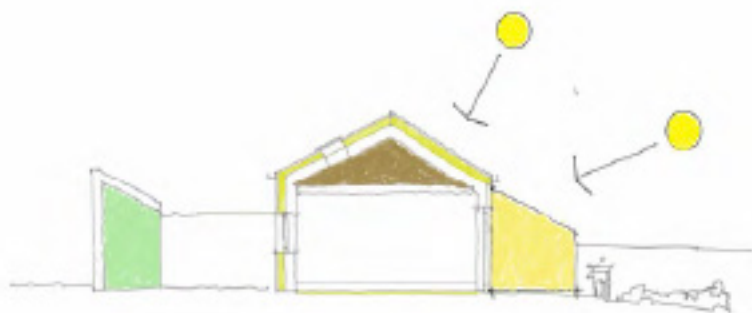
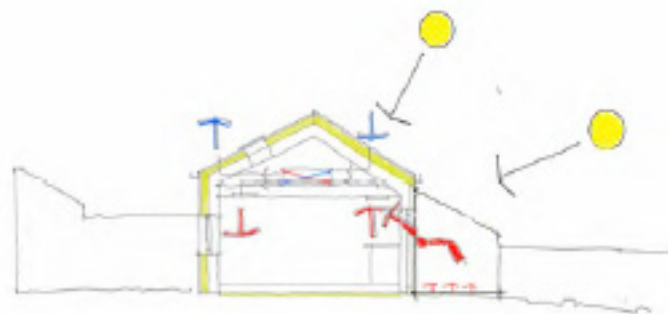
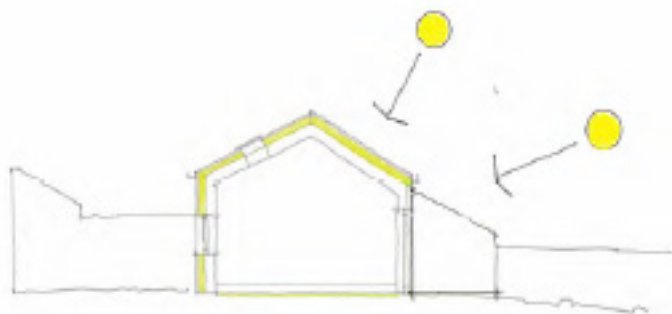
### *Suggested Scenario*

After discussion it was decided that PV should supply the domestic buildings as it has been tested and found reliable and would be easy to implement in a modular method phased in groups of dwellings at a time. Although vortex bladeless turbines are less tested they have a high power output and could be located within a reasonable proximity of the government buildings whilst in a strategic position to harness the prevailing wind.

The modular system of the PV's could be gradually introduced based on savings made from previous investment. Each dwelling would require 19m<sup>2</sup>, and the PV field could be increased in dwelling sized increments. We have suggested that PV's should be installed as a centralised PV field (as done with the existing) due to the existing infrastructure which can be expanded, however if there are issues with a centralised infrastructure there is scope to install the PV locally to the dwellings on roofs. The vortex bladeless turbines's should try to utilise the existing infrastructure of the PV arrays to save costs, however installation and infrastructure costs have been factored in in the order of cost estimate. Again, it is suggested that the turbines be phased in gradually, building by building, following the required number of turbines per building, (see table below).

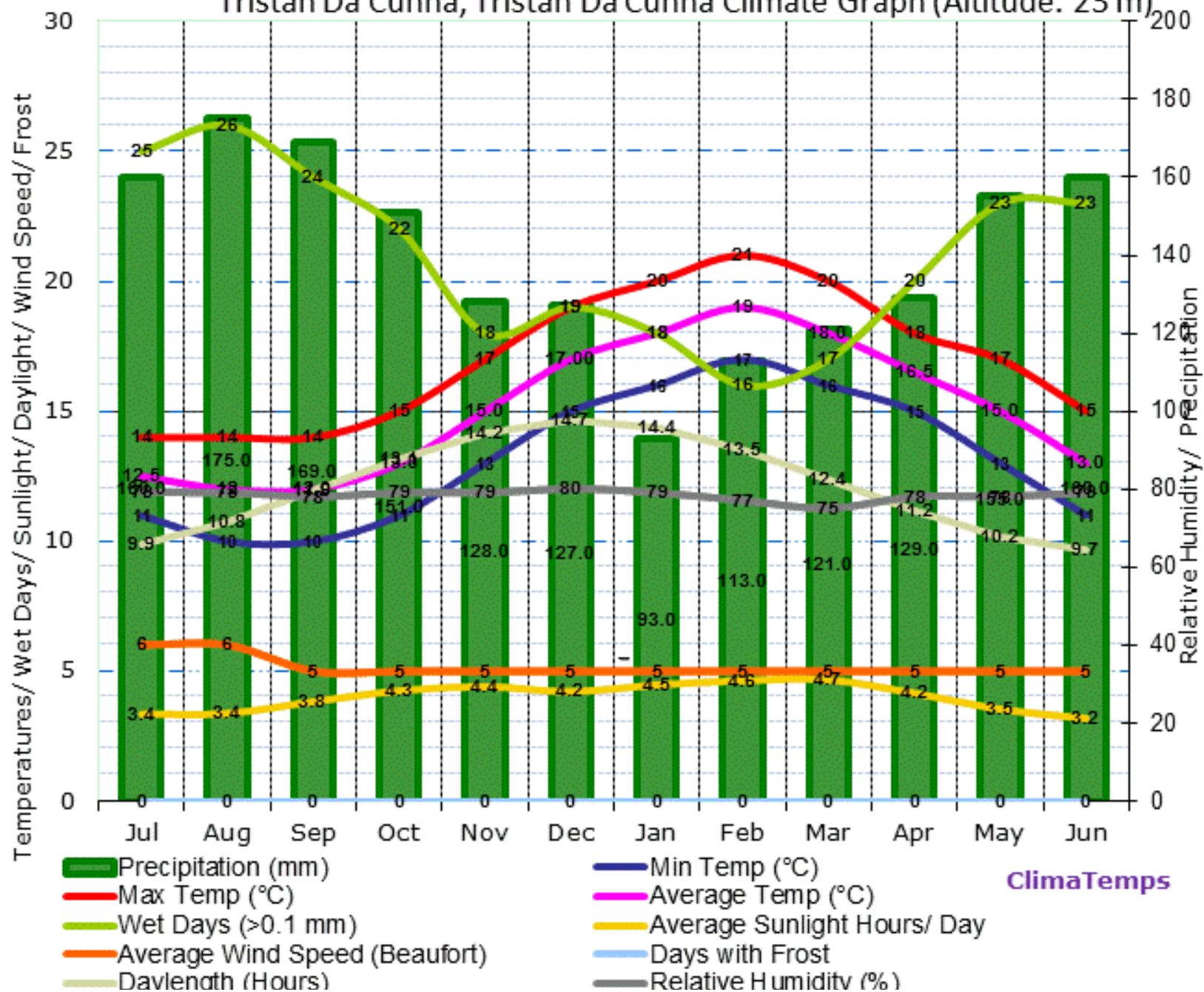
### *A range of models and particular drawing types were used*

In the first instance drawings were used to map the island to try and uncover ideas of place and dwelling. These took the form of 'atmospheric' 3Ds depicting topography, texture, colour, materiality and more orthodox maps. Abstracted maps in which either landscape elements or built form were highlighted were used to discover the relationship between land, building and climate that had been built up over two centuries of dwelling. These drawings were extended to make propositions about enhancements to the 'vernacular' strategies. These were employed by Arup to build computer models for optimized fabric performance and energy use. Finally, proposal drawings were montaged and rendered for accuracy and to also portray place based on the initial desktop studies.





Tristan Da Cunha, Tristan Da Cunha Climate Graph (Altitude: 23 m)



Having established that a fabric first strategy would be the most effective method, Arup undertook a series of simulations to establish some benchmark values.

The weather data supplied was compiled onto a working weather file to run through thermal modelling analysis software and from this we were able to draw a number of conclusions.

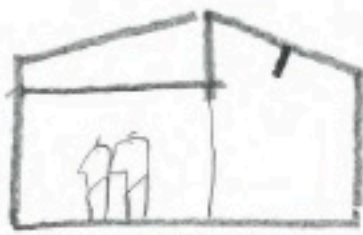
The average temperature is relatively mild compared to the typical UK climate with a peak of 23.5°C and minimum of 5.5°C. Therefore properties are likely to be heated only and not require any form of air conditioning.

A thermal model was created and the test weather file was utilized to calculate the estimated heating energy consumption for a sample property. A range of U-values were tested to seek the optimal performance which can be seen in graph 2.

From a pure engineering perspective it is clear that there is a good relationship between improved U-values compared to the annual energy consumption, see graph 2. However there is a plateau in terms of the cost performance (see Graph 3, and it appears that a U-value of 0.3 is the optimal solution in terms of reducing energy demand vs costs of the insulation materials.



The existing dwellings vary in both size and state of repair such that not all houses will require a full retrofit, and the cost of retrofit per dwelling will vary. For this reason the cost has been broken down per element in the order of cost and differences in level of retrofit are illustrated below.



1: Partial removal of ceiling  
£1,060 per dwelling



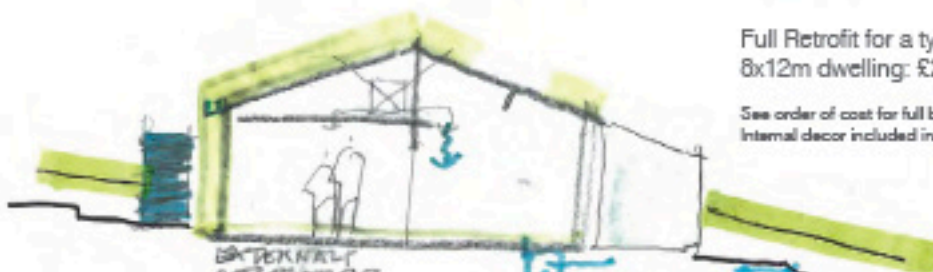
3: Green house extension  
£3,135 per dwelling



2: External Insulation and rooflight  
£16,224 per dwelling



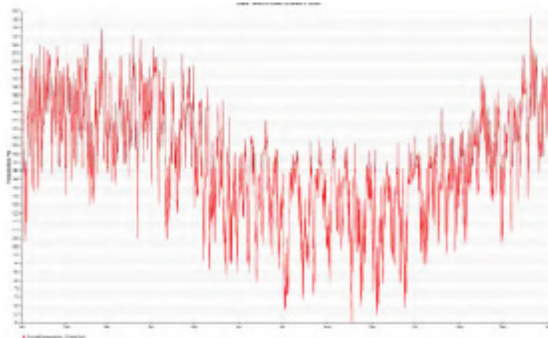
4: Heat Recovery System  
£2,125 per dwelling



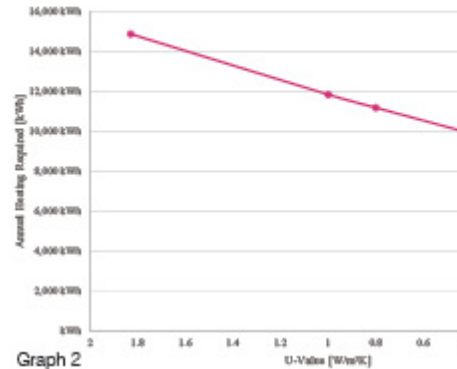
Full Retrofit for a typical  
8x12m dwelling: £23,552

See order of cost for full breakdown.  
Internal decor included in cost

Below left: Tristan weather data for analysis  
Below right: Correlation between improved U-Value and energy



Graph 1



Graph 2

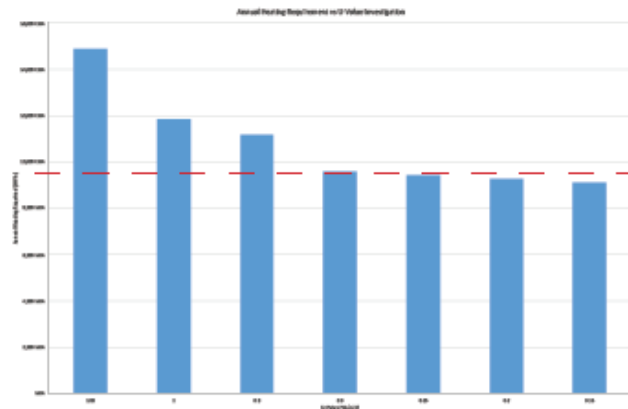
In the case of this project it is sensible to select a compromised value of 0.3 purely on the basis of logistics as anything better would have minimal energy performance improvement, but would add significant cost to the scheme.

As can be seen the energy consumption of the dwelling reduces to a plateau. It was determined that a U-Value of 0.3 W/m².K is practical and provides a 36% reduction in annual energy consumption for heating. Using this as a guide the energy reduction of the other properties has been determined in the table 1.



Above: The model was based on a typical dwelling measuring 12 x 8m.

Right: Graph 3 depicts the benefit vs. the cost of increased U-Values and 0.3W/m²K



Graph 3

## Estimates for reduced domestic and civic energy demand

Energy demand estimates for each of the dwelling types can be seen below based on the simulation of a dwelling performance with an increased U-value of 0.3. Overall a 36% saving can be made across the total domestic demand from insulating the buildings.

Table 1: Domestic energy use and reduction with increased insulation

Column1	Typical Footprint [m]	Typical Electric Consumption [kWh/m²]	Reduction with improved U-Value [kWh/m²]
Traditional Croft-style property	5x10	50-70	32-45
Renovated Property	8x12	70-150	45-96
Bungalow-style new property	8x15	100-250	64-160
Private Guest Houses	8x12	100-250	64-160
Estimated Total Consumption for All Village Properties		500,000 kWh/annum	320,000 kWh/annum

Table 2: Civic energy use based on high performance building specifications

	Building Number	Total Area (m²)	Total Benchmark (kWh/m²)	Building Energy Use (kWh/annum)
Supermarket/office/stores and internet café	1	576	165	95040
Finance and Admin offices	2	288	185	53280
Public Works Dept: Mechanical and General	3&4	456	170	77520
Public Works Dept: Workshop and stores	5	384	170	65280
Agriculture, Electric, Plumbing, Sawmill and Store	6&7	384	170	65280
Telecomms: offices and stores	8	96	96	9216
Conservation and Fisheries: offices, labs and stores	9	120	120	14400
Estimated Total for All Government Buildings				380016

### Suggested Scenario: Estimates for energy generation using mixed renewables

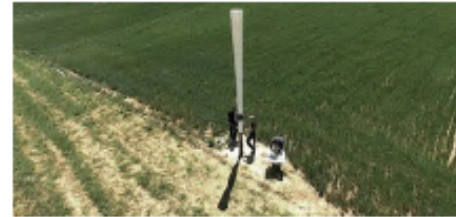
After discussion it was decided that PV should supply the domestic buildings as it has been tested and found reliable and would be easy to implement in a modular method to phase in groups of dwellings at a time. Although Vortex Bladeless is less tested it has a high power output and could be located within a reasonable proximity of the government buildings whilst in a strategic position to harness the prevailing wind.

Supplying the domestic buildings using PV: 320,000kWh

$$\frac{320,000\text{kWh per year demand}}{140.6\text{kWh per year generation}} = \text{Approx. } 2276\text{m}^2\text{Photovoltaic Panels}$$

Supplying the government buildings using Vortex Bladeless: 380,016kWh

$$\frac{380,016\text{kWh per year demand}}{8640\text{kWh per year generation}} = \text{Approx. } 44 \text{ Vortex Turbines}$$



As listed in the advantages of the PV, it is a modular system which could be gradually introduced based on savings made from previous investment. Each dwelling would require 19m<sup>2</sup> and the PV field could be increased in dwelling sized increments. We have suggested that PV should be installed as a centralised PV field (as done with the existing) due to the existing infrastructure which can be expanded, however if there are issues with a centralised infrastructure there is scope to install the PV locally to the dwellings on roofs.

The vortex Bladeless should try to utilise the existing infrastructure of the PV arrays to save costs, however installation and infrastructure costs have been factored in in the order of cost estimate. Again, it is suggested that the turbines be phased in gradually, building by building, following the required number of turbines per building in the table below.

Building Number	Description	Energy Demand (kWh/annum)	Number of Turbines required per building
1	Supermarket/office/stores and internet café	95,040	11
2	Finance and Admin offices	53,280	6
3 & 4	Public Works Dept: Mechanical and General	77,520	9
5	Public Works Dept: Workshop and stores	65,280	8
6 & 7	Agriculture, Electric, Plumbing, Sawmill and Store	65,280	7
8	Telecomms: offices and stores	9,216	1
9	Conservation and Fisheries: offices, labs and stores	14,400	2
Total			44





# NO MAN IS AN ISLAND

## Overall approach

### GENERAL LOGIC: Building on the Place

#### The main 'Island'

A person's connection with his surroundings.

#### Habitat

First, writing connections with their existing environment (first part of survey) reveals the necessary low-impact capacity of the buildings in relation to the existing systems in the use of building and landscape.

These traditional methods are further applied and enhanced in the subsequent survey (topography, climate, etc.).

#### 'Island' in 2'

### WESTERN TRISTAN VERNACULAR

#### Buildings and Climate

Buildings and climate are mutually related. The way the buildings have evolved to create this form of organization is an indication of the climate and the way, making the most of the sun and the wind, while the climate is combined with the existing vegetation.

#### Creating Clusters

The form of the settlement is based on the functional program's need for community in such a remote place has due to an inherent response for the individual within community - privacy, independence and self-organization in a wider organization. This results in clusters of dwellings (individual plots) within easy reach of communal facilities.

#### Building Landscapes

The buildings and outside spaces are mutually related. The way the buildings have evolved to create this form of organization is an indication of the climate and the way, making the most of the sun and the wind, while the climate is combined with the existing vegetation.

#### Form

Building form has a direct response to climate and topography. The way the buildings have evolved to create this form of organization is an indication of the climate and the way, making the most of the sun and the wind, while the climate is combined with the existing vegetation.



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### 'Island' Plan

The main program's use of landscape is a modular system which allows for a modular construction process, creating building types (functional components) that have modular forms (shape, depth, etc.). These forms are then designed to be modular in the way they are built, allowing for a modular construction process.

#### Designing

Modular design has been made to be modular in the way it is built, allowing for a modular construction process. The way the buildings have evolved to create this form of organization is an indication of the climate and the way, making the most of the sun and the wind, while the climate is combined with the existing vegetation.

#### Designing

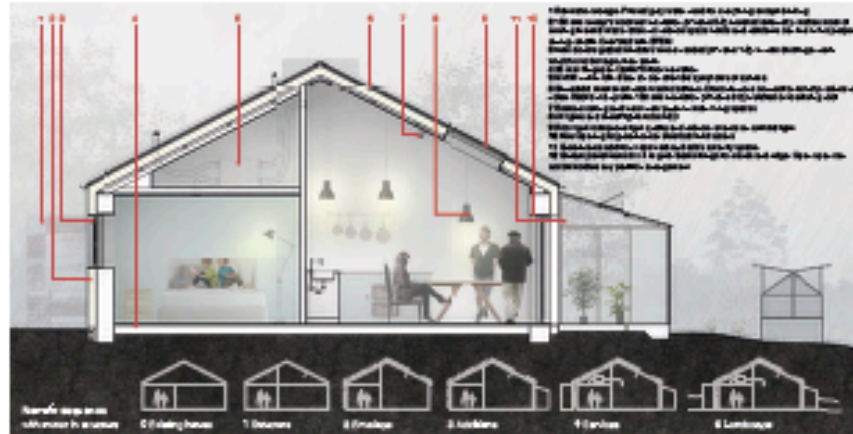
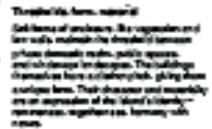
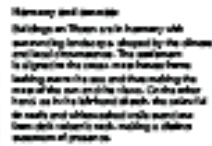
The modular system allows for a modular construction process, creating building types (functional components) that have modular forms (shape, depth, etc.). These forms are then designed to be modular in the way they are built, allowing for a modular construction process.

### General map building plan

■ dwelling  
■ construction

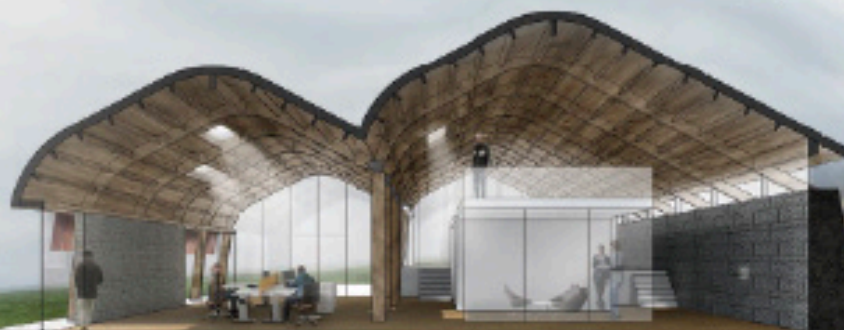
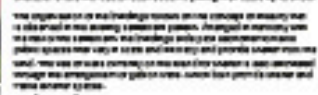
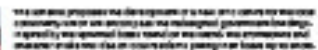


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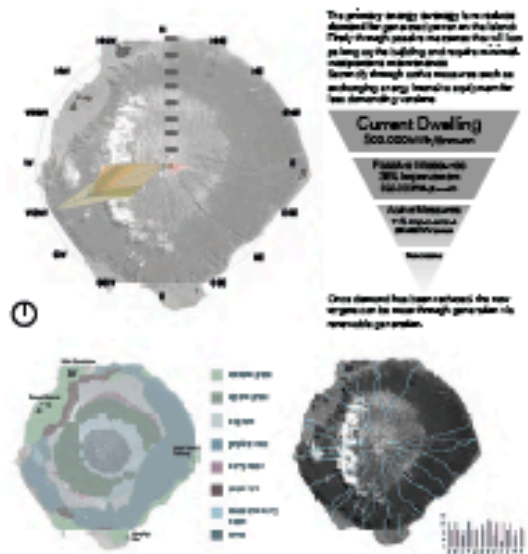
Convergence threshold

the end of the line, it is often impossible to find a quality solution. Nevertheless, it is important to be able to make a decision and to implement it, even if it is not the best. This is why it is important to have a good understanding of the problem and to be able to make a decision quickly and effectively. This is why it is important to have a good understanding of the problem and to be able to make a decision quickly and effectively. This is why it is important to have a good understanding of the problem and to be able to make a decision quickly and effectively.

## NO MAN IS AN ISLAND

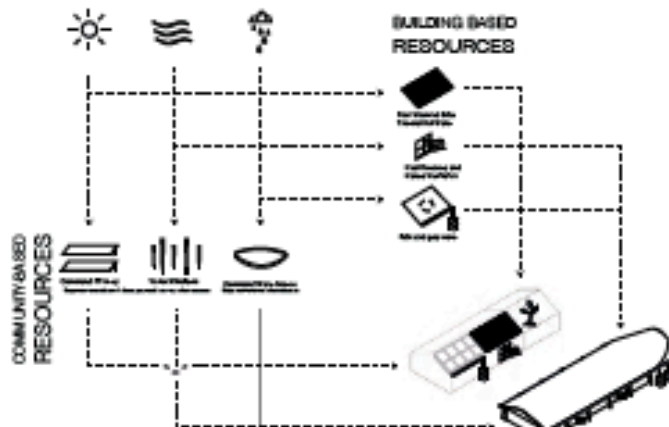
### Energy systems

URIN 17



Many of the island's measures have required already in the island's climate and could upon the measures existing on the island already. The use of dry stone walls to generate power and the use of dry stone walls to generate power are the most common measures. The use of dry stone walls to generate power is the most common measure. The use of dry stone walls to generate power is the most common measure.

### FOOD CYCLE



**CURRENT ENERGY USAGE AND TARGETS**

Currently, the island uses 500,000 kWh/annum, with an average of 1,000 kWh/annum per person. The island's energy usage is based on the following principles:

- Energy Usage:** The island's energy usage is based on the use of renewable energy sources and energy storage systems.
- Energy Targets:** The island's energy targets are based on the use of renewable energy sources and energy storage systems.

**COMMUNITY-BASED RESOURCES**

The community-based resources are based on the use of renewable energy sources and energy storage systems. These resources are used to generate electricity and heat for the island.

**BUILDING-BASED RESOURCES**

The building-based resources are based on the use of renewable energy sources and energy storage systems. These resources are used to generate electricity and heat for the island.

**ENERGY GENERATION**

The energy generation system is based on the use of renewable energy sources, such as solar and wind energy. This system is designed to generate electricity and heat.

**WATER COLLECTION**

The water collection system is based on the use of renewable energy sources, such as solar and wind energy. This system is designed to collect and store water for use in the building.

**ENERGY GENERATION**

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## 6. DISSEMINATION

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7. BIBLIOGRAPHY

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