

## **EEDA Connecting Communities Competition**

### **Budgetary Proposal for Stourhead Broadband Scheme**

**Date: April 16<sup>th</sup> 2003**

**For the attention of:**

**Rowan Sylvester-Bradley - Broadband Project Coordinator**

**Submitted by: Faisal Ahmed**

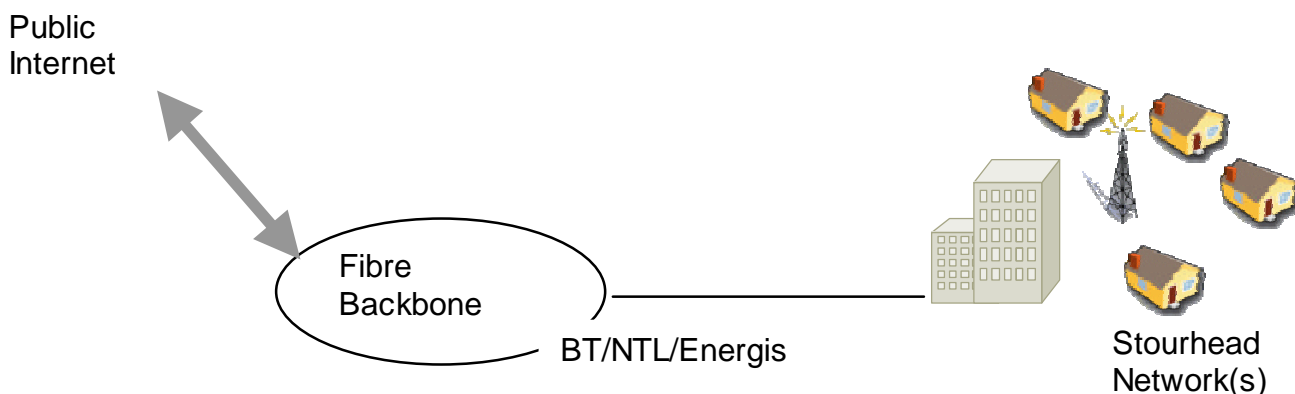
1. Introduction.....	2
2. UK Broadband Background.....	3
4. Local Wireless Network.....	4
5. Wireless Technologies.....	7
6. UKB Turnkey Solution .....	9
7. Services and Customer Premise Equipment .....	10
8. Network Support and Maintenance.....	12
9. Billing Administration.....	12
10. Sustainability.....	12
11. UKB preferred Vendor Description .....	12
Appendix 1 – detailed costings .....	13
Appendix II – Ownership models.....	14
Appendix III – Higher speed access, and adding more customers.....	15
Appendix IV - Project planning, implementation and milestones.....	16

# 1. Introduction

UK Broadband Limited (UKB) is a wireless network operator providing data connectivity services to business-focused ISPs, Systems Integrators, business users and community networks. The mission of the company is to deploy the latest technologies to address the high-speed data needs of its customers.

Stourhead Broadband (SHB) are looking for a cost-effective broadband solution to help build the infrastructure of the villages and provide a higher quality of life. This document provides budgetary pricing and high-level design for SHB as part of their bid to EEDA's *connecting communities competition*. The budgetary pricing covers network design, integration, network maintenance support and billing. This document does not represent a definitive proposal for the design and installation of the network.

It is understood that SHB require a fully out sourced service whereby UKB provides total management and operation of the network. This proposal, however, assumes that SHB will ultimately retain ownership of the network infrastructure with UKB managing it on behalf of the community.



This budgetary proposal covers the key areas of:

- Backhaul Internet connectivity
- Local wireless network
- Customer premise equipment
- Point to point links between villages
- Network support and maintenance
- Subscriber management and billing

This proposal assumes that antennas can be sited on the buildings at the proposed sites without the requirement of planning consent under the Town and Country Planning Act. Therefore, no cost for planning application has been built into this proposal. In addition we assume that full and unhindered access will be given to our engineers, both at the time of installation and at any such time after that when access may be needed to either site.

## 2. UK Broadband Background

### Company Introduction

UK Broadband Ltd, a private limited company based in Cambridge UK, is a provider of telecoms network services and consultancy. UK Broadband Ltd:

- Designs, implements and operates Broadband wireless networks which provide high availability services for Enterprise customers.
- Addresses its target markets through wholesale and partnership agreements with System Integrators, ISPs, resellers and other partners. Our ISP partners currently include ClaraNet (<http://www.clara.net/>), Mistral Internet (<http://www.mistral.net/>), Onyx Internet (<http://www.onyx.net/>), Nildram ([www.nildram.net](http://www.nildram.net/)) and Legend Internet (<http://www.legend.net.uk/>).
- Delivers business benefits to our partners and customers in the key areas of price, speed of provisioning and service flexibility.
- Utilises the most appropriate technologies to deliver solutions including wireless Point-to-Point and Point-to-Multipoint systems.
- Provides community networks with network design, integration and broadband services.

### Company Name and Registered Office

UK Broadband Limited  
St John's Innovation Centre  
Cowley Road  
Cambridge  
CB4 0WS

Telephone: +44 (0)1223 42 22 28  
Facsimile: +44 (0)1223 42 08 44  
Website: [www.ukbroadband.net](http://www.ukbroadband.net)

### Registration and Company Number

Company Number: 04316315  
VAT Registration Number: GB 797 4115 93

### Key Personnel

**Paul Archer**, CEO, 36, has over twelve years of experience in the networking industry including software engineering, product marketing and business management for blue-chip vendors such as Madge Networks and 3Com Corporation. Paul holds a first class honours degree in Electronics from the University of Bristol and an MBA from Henley Management College.

**Steve Blair**, CTO, 43, has worked for companies such as Deutsche Bank, CityReach International, Wayport, Sun Microsystems, Dell Computer, SynOptics Communications, and Tivoli Systems (now IBM). He is also holder of several International Patents in Internet Security and Internet Operations.

**Faisal Ahmed**, Director, Sales and Marketing, 36, has enjoyed sales success at both early stage ventures and major multi-nationals such as Nortel Networks. Faisal has a BSc in Electrical Engineering from Manchester University and a Masters in Computer Science from Cambridge University.

**Duncan Wall**, Director, Operations, 32, brings intimate knowledge of wireless technology, telecoms operations and project management, applying these skills diligently to ensure the delivery of world-class connectivity for UK Broadband's customers.

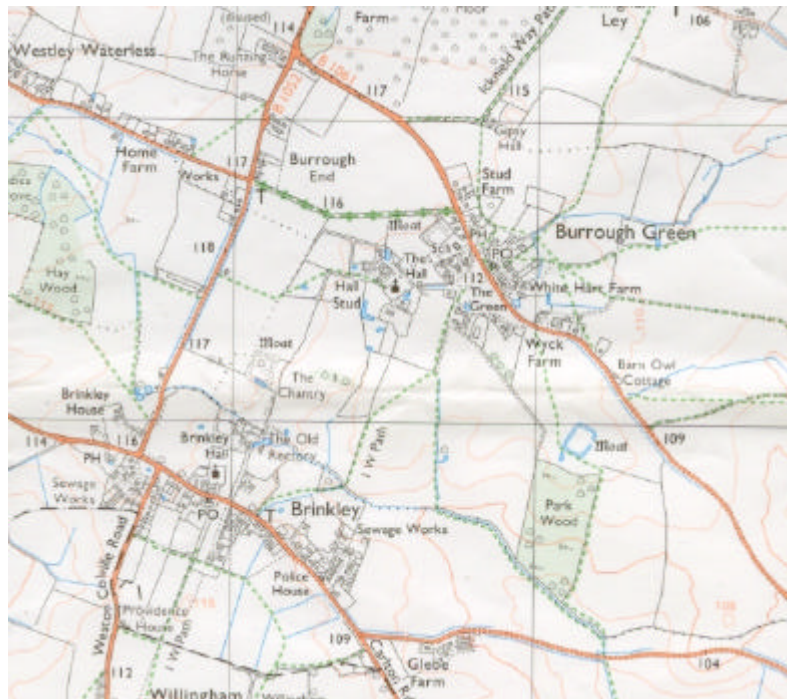
**Leo Smith**, Chief Technical Architect, 52 founder member of Unipalm, which spawned Pipex, Leo went onto set-up Electric Mail - a company specializing in Internet integration and online hosting which was later acquired by Kewill Information Systems. Leo has a Masters in Electrical Science from Trinity College, Cambridge.

## 4. Local Wireless Network

Local areas shown below:



Wrattling, Kedington Hundon and Barnardiston



Brinkley and Borough Green



Wickhambrook Area



Thurlows and Bradleys

Coverage is planned for Great Bradley, The Thurlows (including Little Thurlow Green) Great Wratting, Hundon, Barnardiston and Brockley Green, and Borough Green, Brinkley and Wickhambrook.

Kedington has not been included, as it seems that this is within ADSL reach of the Haverhill exchange: If this proves not to be the case it can be included by extending from Brockley Green with a point to point radio link.

Little Bradley is not included due to the high cost of providing an access point and the low population levels. It is possible that judicious placing of Great Bradley access points might allow little Bradley customers to access the network using external antennae.

UKB suggests designing the local wireless networks using outdoor 2.4GHz wireless access nodes, sited to cover each village. Each access node covers a radius of approximately 300m. A mixture of 'dark copper' and Megastream links would be used to connect the villages together, as the terrain does not favour point to point radio links between major population centres without use of some of the communications towers in the area, which are under consideration, but may not prove any less expensive.

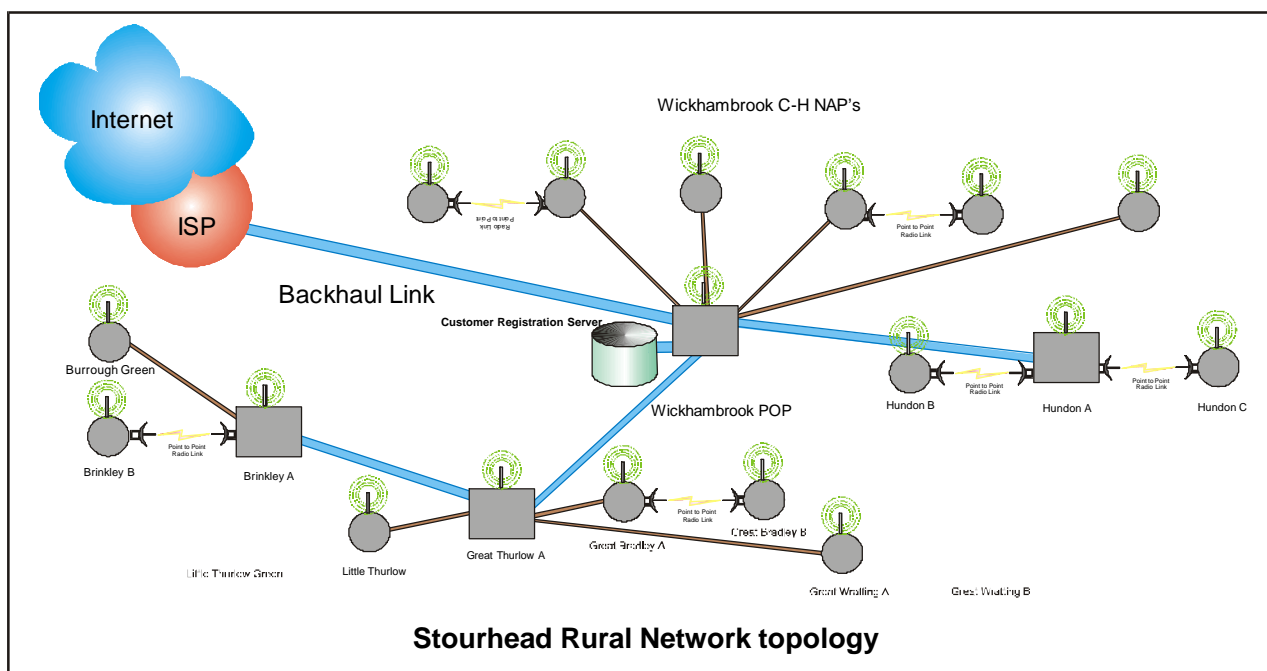
Where appropriate either BT Megastreams for inter exchange traffic, or BT copper lines, (these being deemed entirely adequate - generally between 512Kbps and 2Mbps depending on copper lengths) in a single exchange area will be utilised for the low levels of traffic from outlying nodes. This local wireless and land line based network will be connected to the Internet via a leased line terminated at a friendly site in either Wickhambrook or Thurlow. Currently Wickhambrook is shown because it is both the largest population centre under consideration, and is the centre of the whole area bounded by the Cambridge,

Haverhill and Forest Heath ADSL equipped exchanges, and therefore a suitable centre for networking the whole of the West Suffolk area bounded by these exchanges.

The Network as designed could be extended readily to cover other areas in the Stetchworth area, and at more cost (due to the need to use Megastreams, into the areas covered by the Lidgate/Ousden exchanges, and the Cowlinge Exchange, as well as other villages towards Bury St Edmunds.

In addition, it is possible that other community projects nearby may be able to share the costs of the backhaul, and registration servers, subject to contract and successful grant applications. For example, aggregation of backhaul costs with nearby EEDA projects such as Lark Valley Broadband and South Suffolk Broadband.

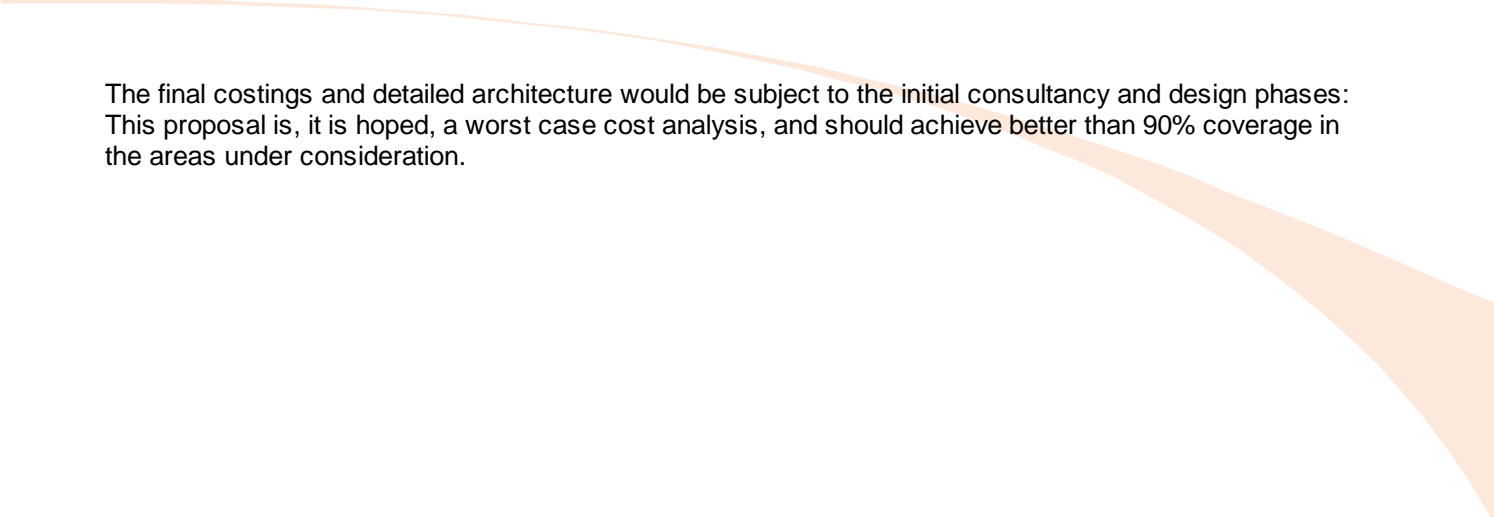
A logical network diagram is shown below



## 5. Wireless Technologies

The advantages of 2.4GHz include low cost, benefiting from the economies of scale from mass wireless LAN deployment. Also, the 2.4GHz spectrum can be used for commercial purposes without the requirement for a Wireless Telegraphy Act license. The unregulated 2.4GHz band consists of a single spectrum band from 2400MHz to 2483.5MHz and in the UK the maximum emitted output power from any antenna is 100mW EIRP. This power level limits the distance that 2.4GHz equipment can transmit to around 2.5Km with good line of sight using high-gain antennas. Using standard access points and low gain antennas, the distance reduces to around 300m.

By the final quarter of 2003, it is expected that 5.8GHz spectrum will also be available for unlicensed wireless network operations. The benefits of 5.8GHz include the increased power permitted (2W) and the amount of spectrum available. This allows for more throughput and for more channels of operation. The equipment for use in this band will support Dynamic Frequency Allocation meaning that interference from other users of the band can be detected and avoided automatically. The downside is that 5.8GHz equipment is more expensive. It is recommended that 5.8GHz equipment be used for the backbone network primarily for point-to-point links between villages where range required is above 2-3Km and if there are challenges with respect to line of sight.



The final costings and detailed architecture would be subject to the initial consultancy and design phases: This proposal is, it is hoped, a worst case cost analysis, and should achieve better than 90% coverage in the areas under consideration.

## 6. UKB Turnkey Solution

The details below are designed to provide an estimated cost of designing and installing the core network described above. The network would initially be capable of serving 200 users based on the number of access nodes implemented and a leased line capability of 2Mbps.

<b>Network Build Components</b>
Network Design and Detailed Project Planning
Network Access Nodes and Pt-Pt links (Includes cables, antennas, mounting, network interconnect and installation)
Subscriber Management System
2Mbps Backhaul and ISP connectivity <ul style="list-style-type: none"><li>- IP Transit</li><li>- DNS</li><li>- SMTP relay</li><li>- News</li></ul>
<b>Total Cost £108.5k</b>
<b>Annual Recurring Cost £57k</b>

Note that no provision has been made for fees associated with locating equipment on towers or buildings. It is understood from SHB that access to public or community buildings will be relatively easy for locating wireless equipment.

The costs associated with the various elements are further broken down in Appendix I

It is understood from SHB that they wish to retain ownership of the network and customer premise equipment but wish to engage UKB as an operator of the network. UKB differentiates itself from other suppliers not only through technical excellence but also flexibility of approach.

If SHB are successful with their EEDA application and chose UKB to build and operate their network, UKB will commence build at a cost of £108.5K (first year CAPEX) plus £57K (first year OPEX). We would also expect 50 residential pre-orders (of value 29.99/month as detailed in the table in section 7) prior to build.

On an on-going basis, UKB will work with SHB to achieve and exceed the network sustainability level of 160 users (see section 10).

## 7. Services and Customer Premise Equipment

The CPE will consist of a wireless bridge such as a LinkSys WET11 or a SmartBridges AirPort. If the unit is within range of the local access node, no further equipment will be needed and the presentation from the wireless bridge is as a standard 10/100 Ethernet RJ-45 port. This is assumed to be a self-install operation.



Figure 6.1 SmartBridge Air Port – self-install



Figure 6.2 Patch panel antenna – may require engineer install



Figure 6.3 Grid antenna – extends range from Access Point – will require engineer install

A range extender antenna may be required (as in Figure 6.2 and 6.3), in which case this may necessitate an installation engineer and increased installation costs.

An optional Residential Gateway unit such as the Orinoco RG-1100 can be supplied. This will provide the user with basic firewall service and also IP address translation to serve an indoor LAN with multiple IP addresses mapped onto the user's single address. This would present an additional cost of approximately £200 to the subscriber (on top of subscription charges).

Possible products and services are detailed in the table overleaf. This table also includes UKB proposed CPE and installation costs.

Note: BT ADSL is an asymmetric service offering 512Kbps (512Kbps down and 256Kbps up) at 50:1 contention

Broadband Data Service	Standard Residential	SOHO	Small Business
Monthly price	£29.99	£39.99	£150
Initial set up fee, including CPE <sup>1</sup>	£150 (self install) £250 (engineer install)	£150 (self install) £250 (engineer install)	£250
IP Address	DHCP	DHCP	Static
Speed of service <sup>2</sup>	512K symmetrical	512K symmetrical	1M symmetrical
Contention ratio <sup>3</sup>	50:1	25:1	10:1

<sup>1</sup> It is possible that these costs could be amortised or reduced if a longer period initial contract with prepayment were to be taken up by the customer. These costs reflect the effective cost to the network provider.

<sup>2</sup> It is currently envisaged that no restriction on individual users' bandwidth will be applied unless the network becomes overly congested. The initial costings cover up to 200 users at a contention ratio of 50:1 into a 2Mbps backhaul, each user being allocated 512kbps 'virtual' bandwidth. Apart from the very remote copper fed nodes, the effective bandwidth of the radio network at any given point is never less than 2Mbps, which means that upgrading the backhaul alone to 4Mbps, should allow up to 400 domestic customers overall.

Part of the service guarantees will include an 'anti-congestion' guarantee, that will ensure contractual upgrades to any links that are seen to be congested by *valid network use* – however abuse of the network will be dealt with by e.g. suspension of offending accounts etc.

Users who regularly and routinely exceed their bandwidth allocations will be given the option to upgrade to a more expensive service, or face suspension from the network. In practice most bandwidth abuse is either down to intentional abuse, genuine business need, or unintentional abuse which is quickly corrected.

<sup>3</sup> The contention ratio represents a design and upgrade target: In practice it is likely that technical means to restrict the network to these ratios will NOT be undertaken, unless it proves necessary. See above.

## 8. Network Support and Maintenance

### Network Maintenance and Support

UKB will provide 24x7 support for all network related problems. 4-hour-on-site response. This excludes all desktop related problems. Includes network monitoring and management as well as spares management.

### First Line Technical Support

It is envisaged that first level support will be handled locally within the community. UKB will ensure relevant training of local volunteers. Experience shows that apart from providing access to informational type resources, no ISP is able to deliver at an affordable price support to cover the multiplicity of problems encountered by users trying to set up and network their own equipment. The best methodologies available actually seem to be self-help groups, where those who have some experience and knowledge of the typical problems, backed up by training and assistance at a limited level, and access to information from UK Broadband and associated service providers.

## 9. Billing Administration

UKB will undertake all billing and subscriber management services. In practice users will be able to register online via other Internet access routes, and pre-programmed kit will be despatched for self installs, or if assisted installs are required, other arrangements with suitable installation firms will be arranged.

## 10. Sustainability

In order to sustain Stourhead's community network after the initial network build, a minimum of 160 residential users are required at a subscription rate of £29.99/month. UKB will work closely with SHB to ensure that this level is achieved and exceeded by Q404.

## 11. UKB preferred Vendor Description

UK Broadband proposes to use wireless equipment from the Proxim Corporation ([www.proxim.com](http://www.proxim.com)). We are not however restricted to using Proxim equipment and have access to a wide range of leading suppliers including WILAN ([www.wilan.com](http://www.wilan.com)), Avaya ([www.avaya.com](http://www.avaya.com)) and Cisco ([www.cisco.com](http://www.cisco.com)). We design networks based on what is most appropriate and cost-effective.

The selected Access Point model is the AP2000. This was chosen for the following reasons:

- Reliability
- Proven Technology
- Off the shelf product providing sustainability in supply
- Easy migration path to new technology such as 5GHz
- Security
- Ease of use and management capabilities

Proxim Corporation is a leading provider of high-performance wireless local area networking (WLAN) and wireless wide area networking (WWAN) products. The company holds leading shares in the fast-growing markets for 802.11b, 802.11a, and license-exempt fixed wireless networking systems. Proxim's systems securely connect networks within buildings as well as between locations up to 40 miles apart, providing enterprises, service providers, and consumers with unprecedented networking capacity and mobility.

## Appendix 1 – detailed costings

# Stour Head project

Village	Local POP	Copper 5Ghz			2.5Ghz fed node.	Capex	Recurring	Population	custon
		Megastream fed node	fed node	fed node					
Wickhambrook	1	0	4	2	£28,680.00	£25,430.00	2000		
Hundon			1	2	£12,865.00	£8,304.75	1430		
Brockley Green			1		£3,345.00	£1,083.75	20		
Barnardiston			1		£3,345.00	£1,083.75	140		
Great Thurlow		1		2	£12,865.00	£8,304.75	250		
Little Thurlow			1		£3,345.00	£1,083.75	180		
Thurlow green				1	£1,550.00	£232.50	60		
Great Bradley			1	1	£4,895.00	£1,316.25	360		
Great Wratting			1	1	£4,895.00	£1,316.25	220		
Brinkley		1		1	£11,315.00	£8,072.25	380		
Burrough green			1		£3,345.00	£1,083.75	340		
					£0.00	£0.00			
Consultancy man days	15				£6,000.00				
Implementation days	60				£12,000.00				
TOTALS					£108,445.00	£57,311.75	5380		
Cost per head					£20.16	£10.65			
Cost per customer					£201.57	£106.53			
Break even(recurring)					159				

**NOTE 1:** A 10% customer to population level has been assumed in preparing the customer related costings.

**NOTE 2:** The cost-per-customer and cost-per-head breakdown of certain areas do not fairly reflect the fact that e.g. : is shared between more than the site to which its cost has been ascribed. Therefore these figures should **not** be taken

**NOTE 3:** The Backhaul, customer server and ISP costs are amalgamated into the POP costs. These are available for

**NOTE 4:** The annual recurring costs are mostly BT rentals for the various links, plus a maintenance contract for UK network. These are all payable quarterly in advance, which needs to be taken into account in cash flow calculations.

## Appendix II – Ownership models

As discussed in the UK Broadband White Paper, there are advantages and disadvantages to owning the network, or having a stake in it, not the least of which is the responsibility to ensure its viability by attracting sufficient customers, and the legal liabilities involved in its potential abuse. On the other hand, money that has been provided to develop the community should not pass directly into the hands of profit making entities.

This also to an extent is associated with another misgiving – what will the ultimate future of the EEDA funded networks be?

We think that this is a potential tangle of interests and conflicts, and that some hard thinking should be undertaken before committing to any price/ownership models.

However some salient facts emerge fairly quickly.

(i) No service provider – UK Broadband, or other entity, can guarantee support and development of a network which fails to achieve cash flow neutrality.

(ii) Any service provider whose sole derived benefit from a network is a fixed price retainer for its management, will have any financial resource, or financial interest, in extending it.

(iii) A network that fails to achieve operational profitability is essentially worthless, unless some potential purchaser thinks it can be made so. In effect, no contractual guarantees are worth the paper they are written on if whatever organisation that is running the network fails to achieve viability. That organisation, and the network with it, is likely to cease to exist.

(iv) Conversely, if it does achieve positive cash flow, the network is valuable, and the profits are available to its owners. If these are a rural community, these might be available to that community: If a service provider, then they are available to extend and upgrade the network, or repay its won investment in the network as such.

(v) It is extremely unlikely that any of the rural networks will stay independent in the long term. Economies of scale will dictate that the larger ones absorb the smaller ones in due course – as this is a more efficient way to run them – or the smaller ones simply vanish as other competing networks take over their area. Ultimately, if any network proves a success, it – or its customers – will become a prime target for a large carrier with investment to spend on either acquiring the network, or its customers by simply undercutting on price for as long as it takes to force the competing network out of business, since the market demand will now have been proven by the rural network. In such a case the potential acquirer will offer such price as reflects what they would have to invest to capture the income stream themselves. Experience shows this is the time to sell. Hopefully the original investment might be recouped but as the costings show, this network is expensive to set up and maintain, and the target population not large. In short, without EEDA funding, it would remain almost zero priority with BT, and even with it, it is touch and go as to whether with good marketing it can attract enough customers to become profitable in any sense, though it looks as if it will at least achieve *viability* fairly quickly.

A potential solution that has been floated by UK broadband, which we think – subject to further consultation both within UK broadband, and the rural communities themselves – is worth consideration would be for UK Broadband to set up a separate entity “East Anglian Rural Networks” in which UK Broadband would take a majority stake, but each community network would have an equity stake, via their own charitable organisations, commensurate with the value of the grant funding acquired by them to construct the network(s).

What this achieves is of potential benefit to all parties.

- (a) It decouples some of the commercial risks of developing the network from UK Broadband who would act as subcontractors for the network.
- (b) It provides, via the equity stakes, a return for the not-for-profit community organisations should the network be sold at some future date.
- (c) It allows a voice on the board via non-executive directors from the rural communities to help direct the company towards network development in their particular areas, if cost benefit analysis shows this to be viable.
- (d) It would allow many communities to share the basic infrastructure – such as POP's and backhauls, to achieve better economies of scale.
- (e) It would allow the marketing of the service to be carried out under a single entity, thus giving better value for money in terms of media coverage, and preparation of marketing collateral.
- (f) It answers some of the questions that are almost unanswerable, in terms of where the network will go commercially - that cannot be predicted - but at the least the rural communities would have some say in the direction.
- (g) Potentially it allows the network to be extended into areas without EEDA funding, if a sufficiently good business case can be developed, as the larger 'for profit' company is far more likely to be able to attract investment, or obtain access to debt finance, than an independent community network.
- (h) It may be more acceptable as a commercial model to EEDA themselves, and thus enhance the chances of gaining a grant.

This idea does not yet exist as more than a potential way to organise and synchronise the various risks and benefits, and conflicts of interest that inevitably arise in public-private type partnerships, but is put forward as a topic for discussion by UK Broadband, in the hope that some modified form of the arrangement will prove an acceptable compromise allowing the various rural network projects to co-operate and achieve better value for money than entirely giving the network away, or taking on board the various problems of taking overall management and operational responsibility for it.

### **Appendix III – Higher speed access, and adding more customers**

Whilst upgrading the backhaul and Megastream links presents no problem other than a financial one, and so coping with increased numbers of customers, some potential limits do exist with respect to the ultimate bandwidth of the whole network. If individual customers want guaranteed high bandwidth, this is probably best achieved by adding in private links to the POP, either through Megastream links, or upgraded copper links etc. All things are technically possible, what is an issue is how much any given customer needs, and is prepared to pay for. The solution already uses mixed technology simply because no perfect single solution exists. As network engineers we can and will look at any business opportunity on its own merits, and if it's viable, it will be implemented.

Each radio network is capable of realistically about 6Mbps. If a customer needs more, that may mean a dedicated 5Ghz link, or dedicated Megastream. However such customers are rare outside of large corporate entities, who do not exist in profusion in the areas of interest.

As far as adding domestic and SOHO type customers goes, the overall cost provided that they lie within the area served by the network is negligible until the overall network capacity becomes strained: Then doubling at least the backhaul, and possibly one or other of the Megastream links may be necessary. This may not result in so much added capital cost if a fibre installation is carried out at the POP (with potentially four Megastreams, it would make sense to do this) but recurring costs

will be sharply increased. Balancing Megastream capacity against user load is the single most effective way to ensure profitability and viability of the network – it is *the* single largest recurring cost. Inevitably this means running the network as hard as is possible with adversely affecting more than occasionally the users access speed.

## **Appendix IV - Project planning, implementation and mile stones**

These are normally set up as part of the initial consultancy project, and experience shows that it is hard to predict how long any particular part of the network will take to build. Delays from suppliers – especially BT – are common, and some things take far less time than anticipated, and some far more.

The project would, however, be aggregated into sections each of which would be billable on demonstrable completion, with a retention of a proportion of the payment for overall completion. Probably each village network represents a billable element, as does the POP, Backhaul and customer registration mechanisms, with the overall connectivity between the sites being separately billable as this is more or less down to BT.

Subcontractor and other training would also need to be taken into account, and would feature in the initial consultancy plan.

Although the actual installation days indicated represent only two man months, the elapsed time for a project of this complexity to be fully completed is likely to be in the 4-6month range: This does not mean no one will have connectivity in this period however – once the core components are in place that should happen more quickly, but more reflects the fact that some areas will present problems – finding suitable sites, or having to re-arrange transmitters to cope with local conditions etc. as well as training for training courses, and fine tuning on the billing and other technical systems.



## About UK Broadband

Founded in January 2002 and based in Cambridge, UK Broadband Ltd is a wireless local loop service provider supplying cost-effective Broadband and Leased Line services to businesses.

We work closely with our ISP and System Integrator partners to satisfy the high-speed data needs of our mutual customers. Our knowledge of wireless technology and Broadband developments enable us to utilise state-of-the-art technology and industry best practice to help our customers achieve their business objectives. We are a key member of the Broadband Wireless Association ([www.broadband-wireless.org](http://www.broadband-wireless.org)) promoting wireless as an important part of the UK's Broadband portfolio.

Find out more at: [www.ukbroadband.net](http://www.ukbroadband.net)