Committees: Streets and Walkways Sub-Committee Projects Sub	**Dates:** 27 Sept 2016 11 Oct 2016
Subject: Issue Report: Street Lighting Replacement Project	**Public**
Report of: Director of the Built Environment	**For Decision**

Summary

• Dashboard:

Project Status: Green
Timeline: Gateway 5 in February 2017
Total Estimated Cost: £4m
Spend to date: £77,826
Overall project risk: Amber

• Last Gateway approved: 3/4 (April 2016)

• Progress to date including resources expended:

The majority of the City's street lighting stock is now over 30 years old and is reaching the end of its serviceable life. Maintenance costs are accelerating, energy costs are high and rising, and the Government's carbon tax on energy has further added to the cost of lighting the highway. To address this issue, a technical equipment evaluation of a Light Emitting Diode (LED) solution for street lighting has been underway for some time to understand the reliability of the equipment and evaluate the potential savings should the City install it.

In addition, the system the City uses to trigger and control its street lighting has also reached the end of its useful life and has become vulnerable to system failure. The supplier of this equipment is pressing for its urgent replacement at a cost of around £660k, but there are significant risks associated with having a major commitment to a small contractor maintaining a bespoke system that's unique to the City, and is reliant on a network of 16 UK Power Networks (UKPN) transformers based around the City.

• Summary of issues:

Street lighting & Smart City

In response to the Gateway 3/4 report, Members asked for further information from officers regarding how this project might interface with other similar corporate initiatives such as the Joint Command & Control Room (JCCR), and equally how the project would help deliver the City's broader Smart City objectives.

This report summarises that position, explaining how the technology used to

create a radio frequency (RF) mesh to send signals to control the street lights can also be used to send and receive other small packets of data from other sensors placed around the City.

Although the function, selection and provision of those sensors is outside the scope of this project, creating a network to facilitate them is a clear benefit. The RF mesh has the potential to enable data to be made available centrally for the JCCR and Safer Communities project under the One Safe City programme, as well as providing an opportunity to develop move efficient services in monitoring air quality & noise pollution, transportation and refuse collection needs.

Equally this report summaries how the technology used for street lighting is separate to the 4G wireless concession tender and City wifi provision, and that these projects can be moved forward separately but in parallel.

UK Power Networks

This report also updates Members on a key development with UKPN around our current street lighting operation that highlights the need to progress this project as quickly as possible.

UKPN have said that due to a lack of equipment, experience and funding, as well as the unique nature of the City's bespoke system, they are unable to support the transformers that are vital to the existing Cyclocontrol system, and that if and when the system fails, they may not have the ability to repair it.

Such a failure would mean the City would be unable to switch on and off its street lights, and those lights would have to be fixed on 24/7.

Conclusion

As the 'Do Nothing' option on this project would seem to expose the City to significant and increasing financial and reputational risk, the clear solution is to ensure that a wireless Control Management System solution becomes a key deliverable of the project. In doing so, it also provides the technology platform to support the City's wider Smart City objectives of using sensor technology to capture new data and delivery improved services.

• Proposed way forward :

It is now proposed to seek final costs for the project (including tenders where appropriate) so that a Gateway 5 report can be brought forward early in 2017. That report will present the final cost / benefit assessment of switching to LED street lighting, controlled by a central management system using a radio frequency mesh, and will seek final approval to start.

In the meantime we will explore a temporary fallback position with UKPN regarding their transformers to minimise the risk of a major lighting issue developing from a unit failure, albeit such a position may not prove feasible.

Recommendations

It is recommended that Members:

- Agree the approach outlined above, with the project moving to Gateway 5.

Main Report

1. Issue description	**Integration with Smart City** Background The current Cyclocontrol system for street lights (which uses the power supply itself to switch them on and off) is life expired, no-longer fit for purpose and requires considerable investment to upgrade. Previous equipment trials to replace it have failed due to the problems caused by the City's canyon effect and the need to reach street lights in narrow alleyways. Through a series of trials with three separate suppliers, officers have now successfully tested low spectrum Radio Frequency (RF) technology that not only solves this problem, but also creates wider opportunities for the Smart City. Technical scope The system works by sending out an RF signal from a small number of 'access points', aiming to reach the node contained in each & every street light. Each node has its own ip (internet protocol) address & acts as a relay to every other node, thereby creating the 'mesh'. The mesh network is automatically self-forming and self-healing (ie if one node fails, the mesh reforms around it). RF technology is also strong enough to send signals through buildings as well as around them, solving the canyon and alleyway problem. It allows two way communication; to get data (eg energy use), to send a command (eg switch on) or send a notification (eg light failed). That communication can be via desk-top or mobile device, with secure access available for authorised users (that could include the City Police & JCCR). Networking standards are designed to allow compatibility & interoperability with different devices, and the mesh concept is also scalable, with bandwidth available to accept new devices. Street lighting concept In the street lighting perspective, use of this equipment will enable: • Active fault reporting; the units will tell us when they're not

working and why, establishing an optimised asset management regime with depreciation modelling and whole-life costing to save maintenance and scouting costs
- Comprehensive energy management information; this means real-time metered supplies (rather than estimates), reducing energy bills & carbon tax payments
- Each street light is individually controlled; having unique ip addresses allows each individual light to be given its own lighting profile to better meet local needs and reduce energy costs
- Real-time adaptive lighting control; each unit can be switched on / off / dimmed in real time, either:
    - automatically via a programme
    - in response to an instruction (eg a police incident or planned event)
    - in conjunction with a sensor (eg measuring daylight or movement)

Smart City Vision

The street lighting mesh creates a canopy that can carry more than just street light information. It also creates an intelligent asset platform for a multitude of other uses.

That platform is deliberately designed to be an open one:

- enabling the Smart City agenda
- generating 'Big Data' for joined up services
- providing the opportunity for more efficient services & savings
- facilitating innovation, particularly for SMEs
- creating the potential for revenue-generating 3rd party access

It will offer a complementary network to the existing high spectrum wifi, mobile phone & fibre networks, but in the long-term it may be better suited to support certain Smart City functions, in particular low cost sensor technology.

Wider opportunities

The key Smart City opportunity lies with integrating sensor technology with the RF mesh; every sensor has its own unique ip address and uses the mesh to gather, transmit and report information in a simple, reliable and joined up fashion.

In discussion with the potential mesh suppliers, other departments and officers, the potential data gathering opportunities of this intelligent asset platform could include:

- Noise, enabling a better understanding of background noise levels in the City, as well as real time monitoring of

	potential noisy locations such as night clubs and building sites • Air quality, generating data at a more localised level than currently available • Security / crime & disorder / anti-social behaviour, sensing and flagging untypical activity in specific locations • Transport, covering the volume and speed of vehicle movement, as well as the number of cycle and pedestrian activities • Parking, making it possible to monitor the availability of parking bays, particularly important for disabled drivers • Environmental monitoring, from wind measurement around tall buildings to weather and temperature information for gritting and resurfacing • Health & Safety, checking for air quality, toxic fumes and fire in our underground confined spaces & pipe subways • Refuse collection, triggering a reactive response when bins are full • Potential licensed 3rd party access to the mesh network, such as to UKPN for energy readings Using this approach, data collected via the RF mesh can be presented together in a simple but comprehensive dashboard, allowing tailored access to individual systems, as well as joined up oversight of the City's environment. This is ideal for joined up functions such as the JCCR, and fully enables the 'Internet of Things' concept of machine-to-machine communication to enhance City services. **<u>UK Power Networks</u>** The City's bespoke Cyclocontrol system for triggering and controlling its street lighting works by sending a pulse along the electrical wire from one of 16 UKPN substations spread around the City to trigger the street lights on and off. Other systems such as timers, photocells and 'line of sight' control systems are used elsewhere, but the City committed to Cyclocontrol 30+ years ago as it promised a more efficient and effective method of control to overcome its combination of urban canyon effect and narrow streets & alleyways. However, similarly to the street lights themselves, that Cyclocontrol system has also started to reach the end of its useful life and has become vulnerable to system failure. The supplier of this equipment (Energy Controls) has been pressing for its urgent replacement at a cost of around £660k, but in investigating this option, UKPN have come to the conclusion that due to a lack of equipment, experience and funding, as well as the unique nature of the City's bespoke

	system, they are unable to continue to support the transformers that are vital to the system. That means that if and when a transformer fails, UKPN may not have the ability to repair it, which would mean the City losing its ability to switch on and off its street lights in the vicinity of that substation. In other words, street lights would have to be on 24/7, which would not only attract criticism about wasting energy, but would also have a significant impact on the City's energy bill. Officers are actively working with UKPN to see what short term alternatives might be used should this scenario happen. These are likely to involve revisiting alternatives previously discounted, such as the costly and time-consuming retro-fitting of photocells directly onto streetlights across a widespread area. However, beyond the next 2-3 years, the risk of major UKPN transformer failure is likely to become significant, which reinforces the case to shift to a wireless CMS system and make this a key deliverable of the overall street lighting project.
2. Last approved limit	A total of £77,826 (of the originally agreed £100k budget) has been used in reaching Gateway 4, leaving £22,173 remaining. From the current equipment trials, as well as an initial assessment of the condition of the City's lighting infrastructure (wiring, brackets etc), the cost of replacing the City's street lighting stock has been estimated to be approximately £4m (including staff, installation and CMS costs), with payback expected to be around seven years from full implementation.
3. Options	It is now proposed to bring forward a Gateway 5 report early in the new year. This report will present the final cost / benefit assessment of switching to LED street lighting, controlled by a central management system using a radio frequency mesh, and it will also seek final approval to start.

Appendices

N/A	

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