

Agenda Item No. 7(e)

DERBYSHIRE COUNTY COUNCIL

CABINET

4 April 2017

Report of the Strategic Director – Economy, Transport and Communities

**STREET LIGHTING SERVICE INVEST-TO-SAVE PROPOSAL FOR THE
PRINCIPAL ROAD NETWORK (HIGHWAYS, TRANSPORT AND
INFRASTRUCTURE)**

(1) **Purpose of Report** To seek approval for an invest-to-save proposal to extend the existing project for installation of LED lighting on residential roads to the principal road network and to use the framework supply and installation contractors for the whole network.

(2) **Information and Analysis**

Background

On 21 October 2014, Cabinet approved a £23m invest-to-save proposal to introduce LED lights and dimming to improve the whole life costing of 68,000 street lights in the height range 5 metres (m) to 6m. In general, these lights cover the residential network and represent 78% of the Council's street lighting asset. The project, when fully implemented, will result in fewer failed lamps and provide additional savings to future energy budgets of around £1.2m per year on current energy prices, and 6,000 tonnes of carbon.

In order to facilitate the £23m invest-to-save project, two framework contracts for the supply and installation of LED lights were developed, and approved by Cabinet on 14 June 2016 (Minute No. 191/16 refers). Works on the county-wide roll out of LEDs started in December 2016 and is expected to take around three years to complete.

The decision to concentrate on the residential network only was based on the LED technology at the time of starting the investigation and procurement process in late 2014. LED lights were efficient enough to make savings at the 5m and 6m column heights found on residential roads while still providing the required levels of lighting at the road surface. However, the same could not be said at that time for lights fixed to higher columns at 8m height and above that are typical for the principal road network and a good economic case could not therefore be made.

LED technology has developed considerably in the last two years, with the effect that lights now need a third less energy to achieve the same levels of light at the road surface. This means that the reduced energy consumption, coupled with lower costs as manufacturing costs have come down, has helped to make the economic case for investing in LED replacements for the principal network.

Around 2,460km of carriageway are classed as part of the Council's principal network, with 870km of this network having street lights. This is primarily in the height range 8m and above, and represents the remaining 22% of the overall street lighting asset across the County.

As well as delivering year on year operational savings, reduced maintenance requirements would also support better transport infrastructure through reduced traffic disruption on the principal network.

Many other Highway Authorities are also investing in LED technology for their street lights. Notably, Birmingham and Sheffield have recently completed a 5 year Private Finance Initiative to introduce over 150,000 LED street lights. Other authorities including Lancashire, Leicestershire and Nottinghamshire, many Yorkshire and Greater Manchester Councils are in the process of installing LED lights, and it is estimated that around 250,000 LED lights have already been installed in surrounding authority areas.

Principal Network Invest-to-Save LED Proposal

As referred to above, in the last two years LED technology has developed and the cost and energy consumption of LED street lights is falling. All the while, energy prices continue to increase. An investment of £11.2m, including £2.4m from Local Transport Plan (LTP) funding over three years, to install LED street lights in the height range 8m to 12m, would produce combined energy and maintenance savings of £574,000 per year after financing costs (assuming 0% inflation). This would result in a potential payback period (post-financing) of 9 years 7 months (assuming 2.5% energy inflation and 1.75% general inflation).

The project would include the following for street lights from 8m to 12m height range located primarily within the principal road network.

- Replacement of existing lights with LED on 11,198 columns.
- Replacement of 5,755 out of design life 8m, 10m and 12m high columns including installation of an LED light.
- Replacement of 1,262 private electricity connections owned and maintained by DCC required in line with safety requirements and British Standards. These are generally located in areas where the District Network Operators (DNO's) have no suitable apparatus in the vicinity.

- Utilisation of dimming technology in association with the installation of LEDs, where practicable through risk assessment, so as to reduce light levels and energy consumption during the period of low highway usage.

In total, this represents 16,953 street lights mainly located on bus routes and within the principal network which would be converted to LEDs, representing the remaining 22% of the Council's street lighting stock.

Dimming technology will be applied where appropriate to cut down the levels of energy required, typically between midnight and 5am when traffic levels are low. Most people do not see any reduction in light levels. However, this is not appropriate for all locations and would not be used in the following areas unless well evidenced risk management identified that a level of lighting appropriate to a reduced highway usage could be introduced:

- In town centres.
- Locations with a significant night-time traffic accident record.
- Areas with an above average record of crime.
- Areas provided with CCTV, local authority or police surveillance equipment.
- Areas with sheltered housing and other residences accommodating vulnerable people.
- Areas with a 24hr operational emergency services site, including hospitals and nursing homes.
- Formal pedestrian crossings and where there are potential hazards on the highway (roundabouts, central carriageways islands, chicanes, speed humps, etc).

In many cases, replacement will be on a like-for-like basis, but in order to ensure that appropriate levels of light will be maintained, some design work will be required for the areas highlighted above.

The procurement process for the supply and installation frameworks for the current contract for the residential network included provision for the materials and installation support required to deliver this extended project. The contracts were advertised through the Official Journal of European Union (OJEU) process to include this additional work, and would therefore be suitable for the installation of LED lights in the height range 8m to 12m. It is expected that both projects could be completed close to the original residential scheme timeframe of three years.

Proposed strategy for delivery

Delivery of the invest-to-save project for 5m and 6m LED lights began on 5 December 2016, using external framework support contracts. The County Council is working with five contractors and 13 LED suppliers and has developed a programme of implementation over the next three years.

The LED and dimming invest-to-save project on 8m to 12m lights would be introduced into the existing programme with the support contracts providing additional support to maintain the three year implementation in the majority of locations. Due to the design requirement identified above, and the additional traffic management these locations would require, it might not always be possible to complete all works in an area in one go, however, delays to completion would be kept to a minimum.

The Council's own Street Lighting Maintenance Team is currently working to clear a backlog of reported street light faults. As the existing invest-to-save project develops, these are anticipated to reduce, potentially releasing capacity for the internal workforce to contribute to project implementation.

In areas where LEDs at 5m and 6m have already been replaced, an additional programme of works for 8m, 10m and 12m replacements would be developed to catch up with the remaining areas.

The LED framework support contractors would target areas where lamps should have been changed prior to 2014-15 as these areas currently have the highest incidents of random failure.

In order to address road and community safety concerns raised regarding the number of street light outages, all reported street light faults will continue to be repaired whilst the project is fully implemented.

Failed lamps on columns that are within their design life would be replaced with LED lights to the same specification as that which could be used within the main programme. This would ensure that invest-to-save benefits from the approved funding were still achieved whilst, at the same time, assisting to address the number of street light failures not being repaired.

The street lighting asset management system will be updated to record lights replaced so as to ensure that the planned support contractor replacements were reduced accordingly. Repairs to an area will be suspended whilst support contractors are installing the bulk of LED light replacements.

Any street lighting in rural and non-residential areas at the end of its life would be reviewed in line with current industry standards and the Council's risk assessment criteria, to determine if it is still delivering effective road and community safety benefits. If this is not the case, local consultation will take place with a view to the lighting being permanently switched off and the lighting columns removed.

LED Technology

LEDs became of interest to the street lighting market because of the potential for energy saving. Initially, the savings were small and the units large and expensive when compared to conventional technologies.

LED street lights use a blue LED to which yellow phosphors are applied to create 'white' light. LEDs contain no lead or mercury and do not release toxic substances when damaged unlike sodium lighting.

Colour temperature defines the colour appearance of a white LED. Correlated colour temperature (CCT) is defined in degrees Kelvin (K); a warm light is classed as around 3,000K, moving to neutral white at around 4,000K, and to cool white, at 5,000K or more.

The first LED street lights used in the UK had a CCT of 6,000K. This "cool white" is considered comparative to that of daylight, but contains a significant level of blue light that is not found in indoor lighting or the orange sodium street lights that are so common across the County.

Where these were installed, they enabled sufficient energy savings to be made to show a significant reduction in ongoing energy costs and repay the capital investment. However, some members of the public expressed concern at the blue content and research projects considered possible impacts on the production of the hormone melatonin which regulates sleep patterns.

Over the last four years, research and development of LED has enabled a reduction of CCT to a more 'neutral white' of 4,000K, whilst maintaining energy savings. 4,000K is considered to be similar to moonlight. Most local authorities adjacent or near to Derbyshire which provided information are now using 4,000K in their LED street lighting installations.

As development progresses it is anticipated that CCT of LED street lights may be reduced still further to a 'warm white' of 3,000K in line with what might be expected from compact fluorescent or tungsten filament lamps within the home. However, the colour correction is achieved by coating the LED with phosphor, which currently results in at least a 14% increase in energy consumption. This would reduce savings by around £200,000 per year.

Twenty local authorities were contacted and whilst most local authorities had chosen 4,000K, two of 20 local authorities who expressed an opinion indicated that they have selected 3,000K due to the aesthetic similarities to conventional light sources.

Possible Health and Environmental Concerns with LED street lights

The Cabinet reports for the residential LED replacement project included an Equality Impact Assessment (EIA) carried out in 2014. It concluded that, while

there was some concern from consultees at the time of possible detrimental effects of the blue light in LEDs for health and ecology, there was little supporting evidence to suggest that this was particular to street lighting as opposed to other sources in everyday life such as TVs and computer screens.

The Authority therefore undertook to monitor the project through investigating complaints or concerns about the LEDs once installed and to consider new research findings in to this emerging technology provided that it was published in a scientifically or governmentally recognised, peer-reviewed scientific journal and/or undertaken by recognised and respected individuals or teams of scientists.

A small number of complaints have been received following the installation of the 8,000 LEDs to date. These have related either to perceived glare or a feeling that the light levels had dropped as a result of the installation. In some cases it has been possible to carry out local adjustments to improve the situation, but not all complainants could have been satisfied. Details are included in Appendix 4.

A number of publications have been reviewed that have been published since the original Equality Impact Assessment in 2014. These are considered in more detail in Appendices 1, 2 and 4. Studies carried out by Public Health England and the British Medical Journal (BMJ) are considered to fall into the well-respected and recognised sources that seem to support the introduction of LED street lighting, albeit with some caution around implementation. Public Health England recognises that there are some concerns about LED lighting which can also be equally applicable to other forms of lighting. The study carries recommendations for flicker rates but, crucially, not for maximum CCT levels other than to reduce CCT to unspecified levels to minimise the potential adverse effects on melatonin production and sleep patterns. A BMJ report found little evidence that LEDs have any impact on road collisions or crime. The Bat Conservation Trust acknowledges that there may be some effects on bat feeding, but recommends CCTs of less than 4,200K to reduce these impacts.

However, representations have been made using reports from other bodies that LEDs do, in fact, have an adverse impact on humans and ecology. The American Medical Association claims that poorly-designed and blue-rich LEDs have a detrimental effect on a number of factors, including road accidents, sleep patterns and ecology. The guidance seems to be focused on improving the design of LEDs rather than stopping them; as a result, Montreal is adopting 3,000K lighting across the city, although Toronto and Seattle are sticking to 4,000K and 4,100K lighting. The University of Exeter has published research that predatory spiders and beetles were drawn to grassland patches lit by LEDs, but it should be pointed out that the vast majority of the County

Council's LED street lights will be aimed at roads and footways, not grassed verges.

Claims of increased accidents do not appear to be borne out. Evaluations from trial locations in Derbyshire, where LED lights were installed around three years ago, have indicated a reduction in community safety concerns and also a reduction in night-time road safety concerns. A trial LED lighting scheme was installed in 2014 on the principal network at M1 Junction 29. A review of 3 year night-time collision data indicates a 50% reduction in collisions post implementation. LED lights have also been installed on the principal network through LTP funding and early indications suggest that no increase in night-time collisions has been observed post implementation. In Nottinghamshire, LED lighting has been installed at three accident remediation sites with a notable drop in accident rates, with no collisions recorded in the past year.

Conclusions

It is acknowledged that there is sometimes conflicting evidence, from a variety of sources, about the possible impacts of LEDs. UK-based publications from respected sources, such as Public Health England and the BMJ, are more positive about LEDs than some of the other reports considered as part of this report.

The County Council faces significant cuts to many services if it is to meet the budget savings set out over the next few years. Street lighting is making a significant contribution towards these savings and with 4,000K LEDs installed across the County's lighting stock these budget cuts can be achieved. It needs to be acknowledged that some reports and guidance would suggest that 3,000K LEDs would offer a system with fewer possible health and environmental impacts, but this is not proven to be the case and would involve a shortfall of at least 14% on the targeted savings.

However, developments in LED technology mean that costs are reducing and efficiencies increasing all the time, and it is possible that LEDs with a CCT below 4,000K could be sourced during the three years of the project without affecting the financial targets for savings. If this is the case, a further report will be brought to Cabinet.

(3) **Financial Considerations** A whole life cost model has been developed for the street lighting project which compares the cost of continuing with the maintenance and replacement of traditional lamps (i.e. the traditional solution) with the cost of fitting most street lights with LED lights and replacing columns where necessary (i.e. the LED solution). This is shown in Appendix 3.

The invest-to-save funds would be met through borrowing without the use of reserves, but would be supplemented by £2.4m of LTP grant funding over 3

years (£0.8m from each of 2017-18, 2018-19 and 2019-20 LTP grant allocations).

Analysis demonstrates that net nominal savings over a 20 year period, after financing costs are taken into account, range between £15m with modest energy price inflation of 2.5% and in excess of £35m for 10% energy inflation. Average annual savings range between £0.75m and £1.78m depending on the level of energy inflation. The length of time taken to recover the initial capital expenditure (post-financing) or payback period ranges from 9 years and 7 months to 8 years and 2 months.

Approval for £11.088m was requested for this project at Cabinet on 27 January 2017 in the report on the Prudential Code for Capital Finance, Capital Programme Approvals and Treasury Management Strategy. This amount was based on modelling undertaken in July 2016 and the data available at that time. The model has since been revised based on the latest available data, as of January 2017. As a result, the number of columns assessed at over 30 years old and requiring replacement has increased and the costs associated with traffic management have also risen. As a result, the total capital now required for the project has increased to £11.2m.

(4) **Legal Considerations** As the Highway Authority, the Council has a power, rather than a duty, under the Highways Act 1980, to provide and maintain road/street lighting. Where it is provided, it must be to the standards set in the Council's street lighting policy. In exercising its powers in respect of the extent operation and maintenance of lighting, a highway authority should act reasonably.

The Highway Authority also has a duty under Section 17 of the Crime and Disorder Act 1998 to exercise its function with due regard to their effect on crime and disorder in its area.

(5) **Equality and Diversity Considerations** An EIA was included as part of the previous invest-to-save proposal considered by Cabinet on 21 October 2014, and, for completeness, is attached as Appendix 4. Additional information as a result of a review of publications available since the EIA was published is also included in the Appendix, along with an assessment of the few complaints received following over 8,000 installations.

When considering the proposal in this report Members should have due regard, to protecting and providing for, the welfare and interests of persons who share a relevant protected characteristic (age, disability, gender reassignment, marriage and civil partnership; pregnancy and maternity, race, religion or belief, sex and sexual orientation).

(6) **Human Resources Considerations** The delivery of an invest-to-save project would require the in-house street lighting team to be supported through external contract arrangements to ensure lights and lighting column replacements are implemented within a three year period. It is proposed that two additional posts, one Grade 10 and one Grade 4 would need to be established, and appointed to on a fixed term contract, for the duration of the implementation to assist with:

- The design of LED lighting at conflict areas highlighted in the main body of this report.
- Evaluations and consultation of locations where lighting may no longer provide defined benefits.
- Prioritising of implementation work to reflect necessary reactive LED replacements.
- Responding to customer enquiries and concerns
- Validation of implementation and operation of LED equipment.

These posts would be subject to evaluation and a report submitted to the Cabinet Member for Highways, Transport and Infrastructure.

(7) **Environmental Considerations** All artificial lighting impacts on the night time habits of nocturnal creatures such as bats, moths, insects and invertebrates.

Sodium lights emit a significant proportion of light upwards into the night sky; light pollution has been identified as a possible contributing factor to a decline in the population of some moth species in Britain and also reduces our ability to see the night sky.

LED lights, to be used within this proposal, do not produce wavelengths attractive to flying insects, would incorporate technologies which significantly reduce the amount of unwanted upward light and would also limit light outside the ribbon of the road, thereby reducing the impact on the rural environment. Peer-reviewed research findings on the impacts of artificial lighting on nocturnal creatures will continue to be monitored and evaluated to identify, and, where practicable, limit future impacts.

LED lights installed in the vicinity of the Chesterfield Observatory were well received with the manager commenting that they perceived an improvement in night-sky visibility.

Recent peer-reviewed publications are considered in Appendix 2.

(8) **Health Considerations** Monitoring and evaluation of research relating to the use of LED lights is ongoing to identify if there are issues relating to impacts on health. This currently includes:

- Enquiries about glare or other health and wellbeing related concerns.
- Pedestrian, cyclist and motor vehicle driver concerns about glare or other new lighting system issue.
- Enquiries by other stakeholders e.g. environmental groups, health groups, residents associations, business groups, voluntary groups and charities about health impacts of the LED implementation.
- New research findings on LED street lighting and health and wellbeing published in a scientifically and/or governmentally recognised peer-reviewed scientific journal and/or undertaken by a recognised and respected individual/team of scientists.

The enquiries received so far suggests that LED lights have been well received and are resulting in a reduction of concern when compared to the introduction of other light sources.

Recent peer-reviewed publications are considered in Appendix 1.

(9) **Property Considerations** The Council's Street Lighting Team utilises existing Council facilities in Chesterfield, Denby and Chapel-en-le-Frith to deliver services.

The property in Chesterfield on Turnoaks Business Park is leased and is the main stores for street lighting equipment. Any investment in LED technology would mean that a reduced stock would be required to be held in future providing an opportunity to review the need to lease a property of that size.

(10) **Social Value Considerations** LED street lights typically have a reduced maintenance liability when compared to conventional light sources, therefore, supporting better transport infrastructure through reduced traffic disruption on the principal network. Reductions in energy and carbon consumption from street lighting will support a sustainable environment. The Authority cannot afford to continue maintaining its existing street lighting stock and the reduced costs of LED will support the budget reduction aims of the service.

In preparing this report the relevance of the following factors has been considered: prevention of crime and disorder and transport considerations.

(11) **Key Decision** Yes.

(12) **Call-In** Is it required that call-in be waived in respect of the decisions proposed in the report? No.

(13) **Background Papers** Held on file within the Economy, Transport and Communities Department. Officer Contact Details – Debbie Anderson extension 38670.

(14) OFFICER'S RECOMMENDATIONS That Cabinet:

- 14.1 Approves the invest-to-save proposals for the introduction of LED lights and dimming identified within the report to improve the whole life costing of street lights in the height range 8m to 12m.
- 14.2 Approves the use of the existing LED supply and installation frameworks to carry out these works.
- 14.3 Notes that there will be ongoing monitoring and evaluation of any issues raised by residents following installation of LEDs and of new research to identify any impact on health and the environment.
- 14.4 Authorises the Cabinet Member for Highways, Transport and Infrastructure to consider a future report seeking approval to establish additional posts on a fixed term basis to assist in the delivery of the invest-to-save project.
- 14.5 Approves the amendment of the 2017-18 Capital Programme to increase the budget for the LED principal Network project from £11.088m to £11.20m, noting that this will be funded by additional borrowing of £0.112m.

Mike Ashworth
Strategic Director – Economy, Transport and Communities

APPENDIX 1 – HEALTH CONSIDERATIONS

Health concerns were identified and evaluated in the previous cabinet report of 21 October 2014. Further research information is evaluated as follows:

Excessive glare of LED light sources

All light sources produce glare. After the installation of over 8,000 LED lights within Derbyshire, feedback from residents indicates that glare concerns affect a small number of individuals, primarily due to the orientation and proximity of their property to the road and street lights.

The LED unit is recessed into the head of the light reducing direct visibility to road users and removing all upward light, something Derbyshire has not been able to achieve with other light sources without significant impact to energy consumption. Mounting these units at zero degrees to the horizon further reduces glare to road users.

Glare from LED lights is noted to be of greater concern in locations where the property is below the level of the road and to some bungalows. Adjustments to a small number of lights has been made after ensuring this has no detrimental effect on the illumination of the road. It is also noted that closed curtains significantly reduce glare perception.

Blue Light

Research by Philips Lighting found that Correlated Colour Temperature (CCT) of 17,000K was the optimum level to stimulate a change in circadian rhythm in the human body. The body's sensitivity will therefore have little difference in response to CCTs of 4,000K or lower.

A mid-range light colour of 4,000K with a colour rendering index greater than 80 is currently being used in Derbyshire and by many other nearby Councils currently implementing an LED invest-to-save project. It is felt that this CCT currently provides the best balance between the need to keep energy consumption to a minimum whilst limiting the amount of blue light emitted. The light from street lighting on a bedroom window is normally limited to around 1 lux and in the most extreme cases 10 lux, at 4,000K these levels are unlikely to impact on circadian rhythm. It is more likely that changes to sleep patterns are attributed to TV screens, mobile phones and tablets being used in the hours before sleep.

The Council has established a framework of manufacturers for the supply of LED luminaires. The specification for this framework encourages discussion to allow the Council to achieve technology and development improvements. It is envisaged that, as the technology develops, the Council will be able to take advantage of lower CCTs, further limiting the amount of blue light emitted, without reduction to savings.

Flicker

Flicker is present in some light sources which could, potentially, distort the visual field and be problematic to some health conditions such as epilepsy and migraine. The flicker frequency of LED lights supplied by manufacturers on the council's procurement framework have been modulated away from frequencies likely to cause concern.

In addition to those previously reviewed, the optical safety and health implications of LED was reviewed and considered in the following reports:

(AMA) Human and Environmental Effects of Light Emitting Diode (LED) Community Lighting, American Medical Association report 06-2016.

This report raised concerns of the optical design of some products and noted a potential for discomfort and disability glare from high intensity, blue-rich LED although does not quantify this.

(PHE) Human responses to lighting based on LED lighting solutions, Public Health England CRCE-RDD 01-2016. Commissioned by the Chartered Institution of Building Services Engineers and the Society of Light and Lighting.

This report highlights the need for well-designed products and concludes that the science is not yet mature enough to state a threshold CCT that should not be exceeded.

(BMJ) The effect of reduced street lighting on road casualties and crime in England and Wales; Controlled interrupted time series analysis British Medical Journal 06-2015.

This study found little evidence of harmful effects of switch off, part night lighting, dimming, or changes to white light/LEDs on road collisions or crime.

Reduced street lighting at night and health: A rapid appraisal of public views in England and Wales, Faculty of Public Health and Policy, London School of Hygiene and Tropical Medicine 2015.

The report highlights the need for further research but concludes that there is little direct impact from lighting reduction on health however there are symbolic effects to be considered. The wellbeing impacts of reduced street lighting at night may reflect, not darker streets, but the fact that a public good has been removed.

(IET) Local Authority Guide to Emerging Transport Technology, the Institution of Engineering and Technology 2014.

This report indicates that new technologies have the potential to introduce new procurement and cost models and reduce overall spend, dimming street lights at quieter periods can considerably reduce energy consumption without compromise on safety levels.

The indications of these reports are that the intensities used within LED street lighting are insufficient to cause harm, provided they are used properly and that considerations are given to mitigating specific concerns raised by individual residents.

A criticism of the methodology of the Public Health England report has been received by the County Council, but is considered that the methodology used and conclusions reached are appropriate based upon the information available at the time.

The report also concludes that LEDs present valid energy efficient options for lighting and that issues and concerns relevant to LED light sources equally apply to other forms of artificial light.

Criticisms of LED technologies appear to centre round an initial dislike of, and continued annoyance with, the light colour and light effect resulting from light escaping through or past curtains and blinds. Even low levels of light less than 1 lux can appear quite bright in a dark bedroom when the eye is fully adjusted to the dark.

Dimming

Appropriate light levels for road lighting are determined from British Standards dependant on average daily traffic flows, road hierarchy, ambient lighting levels and night-time collision and crime data. Traffic flows differ during the day with peak flows generally experienced during the morning and evening rush hour periods. Outside these times traffic volumes drop and between midnight and 05:00am may be very low indeed.

Initial trials of dimming suggested that small changes in light levels in street lights are not noticeable to most people and this technology is now incorporated into the majority of LED street lights installed with operation between hours of lower traffic usage. It is however considered that dimming may be less appropriate at conflict areas within the highway, these areas are described within the main body of the report and will require a design risk assessment to determine whether or not dimming is appropriate.

The Council has not received any enquiries or concerns relating to dimming technologies currently installed within Derbyshire.

APPENDIX 2 - ENVIRONMENTAL CONSIDERATIONS

Environmental concerns were identified and evaluated in the previous Cabinet report of 21 October 2014. Further research information is evaluated as follows:

Unlike sodium lights, LED lights emit a broad spectrum of light, some of which falls within the blue range. Whilst this enables human beings to discern columns much more effectively, research indicates the wavelengths may impact on the breeding and feeding habits of some nocturnal creatures.

The majority of LED street lights, to be used in Derbyshire, have been designed to reduce or removal upward light as compared to sodium lights and also allow the light to be better targeted towards the road. This reduces the overall energy required and also reduces light spill outside the ribbon of the road.

In addition the dimming of lights during periods of low usage has been suggested by the University of Essex as further mitigating these concerns.

The following reports provide further evaluation of these concerns:

Bats and Lighting – an Overview of current evidence and mitigation, Bats and Lighting Research Project, University of Bristol 2014.

Guidance Notes for the reduction of obtrusive Light, Institution of Lighting Professionals, GN01:2011.

Artificial lighting and wildlife, Interim Guidance: Recommendation to help minimise the impact of artificial lighting Bat Conservation Trust 2014
Artificial Light in the Environment, the Royal Commission on Environmental Pollution 2009.

These reports recommend new technologies which permit using only the minimum of light necessary for the location, limiting the spread of light onto surrounding vegetation and varying light levels appropriate to usage. These technologies are incorporated into LED lights to be used in this project.

APPENDIX 3 – FINANCIAL ASSESSMENT

Assumptions The traditional solution assumes that the current 4 year lamp replacement cycle continues without switching to LED lights. However, as many columns are old it is assumed that the operating costs will include the replacement of a small percentage of defective columns each year. At the same time these will be fitted with LEDs. There will be energy reductions associated with the increasing proportion of LEDs in the traditional solution and this has been accounted for in the analysis. Current budget information was used to provide energy and maintenance costs.

The LED solution assumes that 16,953 lights will be replaced with LEDs over a three year period commencing in 2017. In addition, 5,755 old columns will also need to be replaced as it is not cost effective to put a new LED light with a life expectancy in excess of 25 years on a column that is already past its design life. The financial analysis is based on a three year transition period during which the proportion of LED lights increases until by the end of 2019/20 all 16,953 street lights will have been replaced with LEDs. It is assumed that maintenance costs will be minimal and will include an annual structural inspection. It is also assumed that dimming savings will be achievable. The total capital requirement to replace lights and columns has been estimated at £11.2m.

Sensitivities

Sensitivity analysis was undertaken by assigning different values to key variables such as borrowing costs, general and energy inflation and capital expenditure with the outputs analysed to identify which variable had the most impact on future costs/savings.

This showed that the extent of costs/savings was most sensitive to the degree by which future energy prices rise. Therefore, the outputs from the model are based on varying future energy prices, with future energy indexation at 2.5%, 5%, and 10%. Note that the actual energy price inflation experienced by the Council over the last four years was 11% p.a. and the forecast is for rises of 10% p.a. until 2020.

Key financial outputs

Costs and savings have been evaluated over 20 years commencing on 1 April 2017 as this was considered to be a prudent approach for lights that are expected to have a design life of 25 years. For modelling purposes, the project is assumed to be financed using a 20 year loan from the Public Works Loan Board (PWLb) on an annuity basis.

The following table shows the savings that could be achieved over 20 years by the Council for different energy inflation rates if an LED solution is implemented:

Energy Inflation	Net nominal savings / (cost) after financing costs (annuity basis)	Annual saving in 1 st full year of operation in 2020/21 (post financing)	Average annual saving (post financing)	Payback period (post-financing)
0%	£11.5m	£0.60m	£0.57m	10yrs 3mths
2.5%	£15.0m	£0.65m	£0.75m	9yrs 7mths
5%	£19.8m	£0.70m	£0.99m	9yrs 1mths
10%	£35.5m	£0.82m	£1.78m	8yrs 2mths

This shows that net nominal savings after financing costs are taken into account range between £11.5m given no energy price inflation and in excess of £35m for 10% energy inflation. By the time all LED lights are installed, operational savings will be £0.6m or more per annum. Average annual savings range between £0.57m and £1.78m depending on the level of energy inflation. The length of time taken to recover the initial capital expenditure (pre-financing) or payback period ranges from 10 years and 3 months to 8 years and 2 months.

Furthermore, if the debt charges are profiled to match the drawdown of funds there will be additional savings in the early years.

The above analysis is indicative and is based on an estimate of the expected costs of purchasing and installing LED lights. Only when the procurement process commences will there be a better indication of the annual cost savings and the impact on budgets.

APPENDIX 4 - EQUALITIES IMPACT ANALYSIS

Included in Appendix 4 is the original Equality Impact Analysis from October 2014. The monitoring recommendations in that analysis acknowledged that there would be further studies of LED lighting systems as the technology evolved. The studies, reports and guidance that have been reviewed are included in appendices 1 and 2. The EIA also recommended consideration of customer feedback and complaints. A review of information since 2014 indicates feedback has been generally positive, however, of the 8,000 LED lights installed there have been a small number of enquiries relating to concerns raised within the previous report:

- Three enquiries related to glare perceived from lights or light shining onto residential properties. The number of these enquiries is noticeably less than encountered with the implementation of other light sources. In some locations it has not been possible to fully satisfy the resident concern without impacting on the light levels on the road. Alteration to the installed lighting has been carried out where the light is within a short distance of the property, usually 1m-2m and has been evaluated as particularly intrusive to the property occupier.
- Seven enquiries were concerned that light levels had reduced, evaluation indicated, at five of these locations, levels provided were appropriate for the usage of the road, however, there was a reduction of light spill into the adjoining gardens and into the night sky due to the greater control of the LED unit and the need to reduce light levels to the minimum practicable to light the road, residents therefore perceiving a greater contrast between the night sky and the light level on the road. There were two locations in cul-de-sacs where it was determined that some adjustment of the unit would provide a better distribution of light onto the road and turning area.

Derbyshire County Council

Equality Impact Analysis Record Form 2014



Department	Economy, Transport & Environment
Service Area	Street Lighting
Changes or proposals	Changes to the street lighting maintenance policy and the possible introduction of LED lighting with dimming to deliver sustainable revenue budget reductions
Chair of Analysis Team	Peter Booth - Head of Commercial Services
Date of Analysis	15 September 2014
Version	02

1. Prioritising what is being analysed

a. Description of current service arrangements

The Council maintains 89,000 street lights and the outturn energy cost for 2013/14 was £3,142,000. Laser, the largest local authority energy purchasing group buying for 110 local authorities has identified that energy costs are likely to rise by a further 80% by 2020. This would mean that the Council's energy bill would be approximately £5.5 million, significantly increasing the cost of maintaining street lighting.

Energy reduction initiatives have been introduced or trialled to seek to reduce the amount of energy used in the provision of street lighting. These have included the introduction of a Part Night Lighting policy in 2012, utilisation of energy efficient equipment, trials of LED lighting and dimming.

Part Night Lighting has been well supported in the rural communities of Derbyshire but from consultation carried out at the time, urban communities had more concern and identified a need for alternatives to switching off to be considered.

LED lighting trials in Derbyshire have also been well received. Although 5 concerns of glare have been raised, these have been resolved satisfactorily through changes to product design.

Trials of dimming have also been carried out, and to date no comments or concerns have been raised.

The Council has set challenging carbon reduction targets. Street lighting accounts for 20% of the total carbon the Council generates and has been targeted to reduce carbon by 34% by 2020, assisting to demonstrate the Council's sustainability leadership.

Street lighting is an important part of the Council's sustainable transport policy and service provision impacts on most communities in the County apart from the more rural parts in the west. The greatest street lighting provision is down the urbanized eastern side of the County.

b. Details of proposals or changes

The proposal is to replace the current planned maintenance policy with a reactive maintenance policy whereby lamps are not replaced routinely, and failed lamps which are not in defined priority areas would only be repaired if resources were available.

To mitigate the increased number of street light faults it is proposed to replace lights with LED and, where appropriate through risk assessment, dimming. This would assist in the reduction of energy usage and carbon generation from service provision. Dimming in conjunction with low energy lights will enable the level of lighting to be reduced during the night when highway usage is at a minimum. Risk management will be utilised to establish locations where dimming would not be appropriate, however, dimming to 50% of illumination is considered to allow safe use, of both pavements and highways, and is not usually perceptible to the human eye.

LEDs and dimming are being utilised by an increasing number of local authorities to reduce the cost of service provision without the need to restrict availability through switching off as with Part Night Lighting. This could provide a more acceptable energy reduction option within urban areas of Derbyshire.

c. Rationale for proposed changes

There is a need to reduce energy usage associated with street lighting provision to assist the Council in achieving required budget reductions. The service can also significantly contribute to the Council's carbon reduction target. In seeking to achieve these objectives the following community benefits of street lighting will be considered:

- Contributing to the reduction of night time personal injury accidents
- Reducing street crime
- Reducing fear of street crime
- Promoting sustainable transport by promoting the use of public transport, cycling and walking
- Facilitating social inclusion by providing the freedom to walk along and use streets after dark

- Promoting economic development by supporting the 24-hour leisure economy and distribution
- Facilitating lifelong learning by providing after dark access to educational facilities
- Assisting the emergency services to identify locations and carry out their duties (without modern street lighting the time taken to attend an incident could be increased)

Existing equipment is primarily based on a Low Pressure Sodium (SOX) light source. The characteristics of this light source are such that the light does not remain stable when the voltage is varied and cannot therefore be dimmed.

Trials of LED lighting have shown increased efficiency and energy reduction over conventional light sources during the last 3 years, with energy saving of 60% now being achievable. Several different styles of lights have been trialled, some units have led to perceived concerns of glare when the light source can be viewed and some ability to shield direct view of the LED is considered important.

Trials of dimming have taken place in Derbyshire over the last three years and these have not resulted in any concerns from service users regarding either the utilisation of the technology or the reduced lighting levels applied.

The use of dimming would also assist to reduce glare from LED lights.

Of the LED lights currently installed premature failures have been approximately 2% and in connection with the control equipment not the LED. Failures at this level in addition to the extended lifetime expectations of LED (approximately 25 years) would deliver continuing savings in future maintenance activities.

Manufacturers of LED street lights are indicating that improvements to product manufacturing processes and components may reduce premature failures to below 1% within 12 months without increasing production costs. This is much less than the 10% anticipated early failure rate of conventional lamps.

2. The team carrying out the analysis

Name	Area of expertise/ role
(Chair) Peter Booth	Head of Commercial Services
Debbie Anderson	Street Lighting Manager
Ray Holmes	Street Lighting Designer
Alison Chandler	Community Safety
Neill Bennett	Consultation Data Analysis
Vicky Fox	Performance and Engagement
Simon Tranter	Principal Engineer Traffic and Safety
Jennie Hodgkinson	Senior Communications Officer

3. Existing information and consultation based feedback

a. Sources of data and consultation used

Source	Reason for using
Public consultation on the proposed service change and possible investment into LED and dimming	To evidence public reaction to proposed changes
Dimming trial sites utilised in Derbyshire	To evidence any concerns raised by service users regarding the utilisation of the technology or the reduced lighting levels applied
LED sites within Derbyshire	To evidence any concerns raised by service users regarding the utilisation of the technology and change of light source
Consultation outcomes identified in the EIA for the Part Night Lighting policy introduction	Identification of the main concerns of service users in the reduction of street lighting provision
Durham County Council Cabinet Report November 2013 and supporting EIA. Seeking approval of a revised street lighting policy which included utilisation of dimming	Provides evidence outcomes of consultation with service users on policy change including dimming in a similar shire county. An EIA supporting the Cabinet report identifies the impacts on characteristic groups in County Durham
Trafford LED Street Lighting Programme Health Impact Assessment	Provides a balanced assessment of the potential health and wellbeing impacts of implementing LED street lighting which can be dimmed
CELMA Optical Safety of LED Lighting	Research document to evidence the potential effects of optical radiation on eyes and skin
Effects of light-emitting diode radiations on human retinal pigment epithelial cells	Research document to evidence the potential effects of optical radiation on eyes
Scientific Committee on Emerging and Newly Identified Health Risks (SCENHIR) health effects of artificial light March 2013	Research document to evidence the potential health effects of artificial light
The potential of outdoor lighting for stimulating the human circadian system	Research document to evidence the potential health effects of artificial light
Effects of exterior lighting on human health	Research document to evidence the potential health effects of artificial light
British Standard BS5489, Code of Practice for the design of road lighting -	This industry standard provides for the ability to vary the lighting provision of a

Source	Reason for using
Part 1: Lighting of road and public amenity areas	road where demand varies during the course of the night. Dimming technology allows road lights to be dimmed during periods of lower traffic usage
Institution of Lighting Professionals Guidance Notes for the Reduction of Light Pollution	Identifies ways of reducing obtrusive light by the use of equipment specifically designed to minimise the upward spread of light near to, or above the horizontal
Institution of Lighting Professionals Code of Practice for Variable Lighting Levels for Highways	Best practice guidance on the use of dimming in street lighting
Institution of Lighting Professionals Lighting for Subsidiary Roads	Identifies the needs of pedestrians and other non-vehicular road users' dependant on the type of lamp as well as the class of road and how reductions in lighting levels can be applied
Campaign to Protect Rural England (CPRE) report Shedding Light	To contribute to the understanding of how local authorities are approaching LED lights and dimming
International Dark-Sky Association report on Visibility, Environmental, and Astronomical Issues Associated with Blue-Rich White Outdoor Lighting	To contribute to the understanding of the impacts of outdoor lighting on the environment
Neighbourhood and Home Watch Network and Suzy Lamplugh Trust Street Lighting and Perceptions of Safety Survey November 2013	To contribute to the understanding of public perceptions on the need for street lighting
A review of the impact of artificial lighting on invertebrates	To contribute to the understanding of the impacts of outdoor lighting on the environment
Guidance for Employers on the Control of Artificial Optical Radiation at Work Regulations (AOR) 2010	Research document to evidence the potential health effects of artificial light

4. Known impact on different protected characteristic groups

- a. From existing data and information – who is likely to be adversely affected, how, and to what degree? Will anyone gain or benefit from the proposals?

Protected Group	Findings
Age including children and families, older people	Consultation outcome for the EIA produced by Durham County Council identified a potential for increased fear of crime being a high concern to older people
Disabled people including mobility, sensory, learning, mental health, HIV, and	Quality and level of lighting can affect those with some disabilities – consultation by Durham that identified replacing old yellow lighting with whiter light source can help individuals with cataracts. Research by CELMA

Public

also include carers and relatives	indicates that some light sensitive conditions, such as Age-related Macular Degeneration (AMD), may be aggravated by high intensity blue light. Disabled people in previous consultations have expressed concern over the potential for slips, trips and falls in areas of lower lighting levels
Gender (Sex) including men and women, boys and girls	Females could have personal safety concerns at reduced levels of lighting when walking alone during the hours dimming would be applied
Gender reassignment – including impact if any on Transgender people	Possible community safety concerns that reduced light levels could increase the potential for ‘hate crime’ in known areas for anti-social behaviour
Marriage and civil partnership – also include impacts on lone parents and unmarried couples	No identified impacts
Pregnancy and maternity – including new mothers/ parents	Concern that reduced lighting levels may impact on late night/early morning travel for maternity care
Race – including all racial groups, including impact if any on Gypsies and Travellers	Possible community safety concern that reduced light levels could increase the potential for ‘hate crime’ in known areas for anti-social behaviour
Religion and belief including non-belief, including religious minority communities, Humanists	Possible community safety concern that reduced light levels could increase the potential for ‘hate crime’ in known areas for anti-social behaviour
Sexual orientation – including the impact, if any, on LGB people	Possible community safety concern that reduced light levels could increase the potential for ‘hate crime’ in known areas for anti-social behaviour

Non-statutory

Poorer and disadvantaged communities and groups, including people who experience financial exclusion	Low income people or people who work shifts and walk/cycle to work may be adversely affected by proposed reduced lighting levels in terms of community safety
Rural communities	Dimming potentially could assist to minimise the environmental impact on rural communities of modern whiter light source such as LED's for street lighting

Impact on employees of Derbyshire County Council or prospective employees

There are no additional identified specific impacts on employees of Derbyshire County Council or prospective employees which are not identified within the statutory and non-statutory groups above

- b. From existing customer and other feedback – who is likely to be adversely affected, how and to what degree? Will anyone gain or benefit?

<i>Protected Group</i>	<i>Findings</i>
Age	Elderly residents may feel more vulnerable in areas of lower lighting levels Children may feel more vulnerable walking to and from school in areas of lower lighting levels
Disability	Partially sighted people may perceive difficulties in changes between light and dark area. RNIB data suggests over 25,000 residents of Derbyshire have some sight loss. People with mobility concerns may feel at greater risk of slips and falls in areas of lower lighting levels
Gender (Sex)	In general, females perceive a greater risk of crime in areas of lower lighting levels. Dimming provides the ability to retain a level of lighting rather than switching off some lights to deliver required budget savings
Gender reassignment	May feel more vulnerable in areas of lower lighting levels but dimming of lights may be viewed as preferable to the complete switching off of lights in urban areas during periods of low highway usage
Marriage and civil partnership	No identified impacts
Pregnancy and maternity	May possibly perceive reduced lighting levels could impact on access to maternity care
Race	May feel more vulnerable in areas of lower lighting levels but dimming of lights may be viewed as preferable to the complete switching off of lights in urban areas during periods of low highway usage
Religion and belief including non-belief	May feel more vulnerable in areas of lower lighting levels but dimming of lights may be viewed as preferable to the complete switching off of lights in urban areas during periods of low highway usage
Sexual orientation	May feel more vulnerable in areas of lower lighting levels but dimming of lights may be viewed as preferable to the complete switching off of lights in urban areas during periods of low highway usage

Non-statutory

Poorer and disadvantaged communities	Residents may feel more vulnerable in areas of lower lighting levels particularly those who walk or use public transport. Dimming would assist to retain lighting all night rather than switching some lights off to make energy and carbon savings
Rural	People in rural areas may perceive a lower standard of service provision particularly as part night lighting is already utilised in these areas. Consultation has though identified a concern regarding the environmental impacts of modern lighting on the rural environment and dimming could assist to mitigate this

Employees or prospective employees

There are no additional identified specific impacts on employees of Derbyshire County Council or prospective employees which are not identified within the statutory and non-statutory groups above

- c. Are there any **other** groups of people who may experience an adverse impact because of the proposals?

None identified

d. Gaps in data

What are your main gaps in information and understanding of the impact of your policy and services? Please indicate whether you have identified ways of filling these gaps.

Gaps in data	Action to deal with this
There were very few responses from some protected strand groups	Street lighting is present in most communities and so the effects are considered to be relevant to all groups

5. From the consultation you have carried out specifically in relation to proposed changes, what views or issues have been raised by those who have responded?

a. Please summarise the consultation which has been carried out

Consultation was carried out between 15 June and 8 August 2014 asking whether residents would support a change to the street lighting maintenance policy and the introduction of LED lighting with dimming in residential areas to assist the Authority in meeting its budget reduction and energy and maintenance reduction targets.

538 responses were received with, 288 (55%) agreeing to a change in maintenance policy, 442 (86%) respondents supporting the utilisation of dimming in certain locations at night and 467 (90%) of respondents also supported the investment in LED lights.

82 (15%) of respondents who provided comment disagreed with setting any priority for the repair of faulty street lights

b. Please summarise the feedback received. This should make clear where those who have responded have highlighted any potential adverse impact as well as their opinions on the proposals.

In total 128 comments contained concerns that the proposals to change the street lighting maintenance policy could lead to an increase in crime, the fear of crime and also in potential for personal safety concerns if street lighting failed and was not repaired promptly.

81 respondents felt that LED lights and dimming was preferable to not working at all, "why should a town have more light than anywhere else".

29 respondents, who provided comment, felt that the impact of the proposed policy change would be greater in locations where part night lighting has already been implemented.

15 respondents were concerned that dimming of street lights would increase fear of crime.

9 respondents, who provided comment, highlighted that dimming may cause irregular patterns of light on the road which could impact on personal safety and also fear of crime.

8 respondents, who provided comment, expressed concern regarding the possible impact of blue light in LED street lights on health and wildlife.

Although few, there were as many comments concerned that LED lights may be too bright as those who felt LED lights may be too dim.

Some respondents felt it made sense to plan for the future but felt that it may be a

more cost effective option to consider a rolling programme of replacement when conventional lights fail rather than a large scale replacement programme.

2 respondents also suggested that street lights be fitted with motion sensors

6. Are there any ways of avoiding or reducing likely possible adverse impact on any groups of people, what are those actions, and how will they assist?

Street lighting provides improved safety standards for all highway users and should have due consideration for night-time users. Irregular light patterns due to faulty street lights may result in some communities feeling more vulnerable. Social exclusion may occur because of fears about community safety or road safety or because poorly lit areas are less attractive to visit. The introduction of LED lights which are less likely to fail would reduce the number of faulty street lights and reduce the likelihood of irregular light patterns.

The use of dimming technology for street lighting would better assist to manage the use of modern energy efficient white light sources identified through local and national consultation as being perceived to be brighter than current lights. Dimming would reduce, at times of low highway usage, the brightness of lights and therefore provide a positive impact on controlling modern light sources. British Standards for lighting design allow for some reduction in luminance levels to recognise the better colour rendering of white light sources. Dimming to 50% of illumination is of a standard to allow safe use of both pavements and highways and is not usually perceptible to the human eye.

Research by CELMA has identified that the blue light radiance of diffuse light sources is relatively low and are considered safe but direct viewing of all light sources should be avoided especially at short distances. This research identifies that the reflexive reaction of the human eye to turn away from bright light sources is such that sufficient exposure times to cause damage are not reachable.

International Dark-sky Association document identifies blue-rich light as having an effect on the circadian function of mammals, however research shows that the levels of exposure need to be far in excess of that produced from street lighting to affect humans. Dimming in areas of low priority will reduce further any potential impacts on mammals. The use of handheld phones, tablets and computers are likely to have a greater impact on sleep patterns in humans. Light intrusion into properties and specific concerns about glare can also be reduced by the use of lights with flat glass and, where necessary, shields.

Whilst it may be possible to use dimming in most locations, it would not be used in the following areas unless well evidenced risk management identified a level of lighting appropriate to a reduced highway usage could be introduced:

- town centres,
- locations where there is a significant night-time traffic accident record.
- areas with an above average record of crime

- Areas provided with CCTV, local authority or police surveillance equipment
- Areas with sheltered housing and other residences accommodating vulnerable people unless there is a community need and support
- Areas with a 24hr operational emergency services site including hospitals and nursing homes
- Formal pedestrian crossings, subways and enclosed footpaths and alleyways
- Where there are potential hazards on the highway (roundabouts, central carriageway islands, chicanes, speed-humps, etc.)

There are improvements to road safety through the use of LED due to the improved colour rendition and long distance visibility, however dimming at locations where there is a significant night-time accident record or where there are potential hazards on the highway would reduce the visual acuity of drivers and would therefore be used with caution.

The fitting of motion sensors is currently being trialled in Europe but the technology within street lighting is currently a far more significant investment.

7. Main conclusions and Recommendations

Conclusions

Based on the analysis the following is believed to be of importance and should be noted by decision-makers:

From the consultation, 86% of respondents supported the use of dimming to maximise energy savings and 90% supported the use of LED lights. Comments received indicated that dimming is not appropriate for all areas and risk assessment would need to be utilised to ensure its use has been properly evaluated to avoid, as reasonably as possible, adversely impacting on the fear of crime and the potential for slips, trips and falls.

From earlier consultation on the introduction of the Part Night Lighting policy by the Council there has been a concern relating to the switching off of lighting in urban areas of the County. This recent street lighting consultation has identified concern at the suggestion that street lights in non-priority areas would not be repaired in order to achieve needed budget reductions. In urban areas the availability of some level of lighting from all street lights throughout the night is considered appropriate to achieve the identified community benefits. Use of dimming, in conjunction with LEDs, provides an opportunity to retain lighting and still achieve against energy and carbon reduction targets. The consultation outcome would suggest that this would provide a more acceptable alternative to switching off lights in urban areas.

The blue light content of LED is of concern to some respondents, although, whilst there is some perception that this may be detrimental to health, there is little supporting evidence to suggest that this is particular to street lighting, and not from other sources used in daily life. The indications are that the impact of LED street

lighting with dimming would have no greater impact on health than other modern street light sources.

The recent consultation feedback is indicative of a greater concern regarding the health impacts of street lighting not being available either through a controlled switching off policy or lights not being repaired.

Recommendations

It is recommended that:

1. The use of dimming is subject to risk assessment prior to implementation.
2. Consideration is given to utilising dimming in conjunction with LEDs for street lights in urban areas rather than implementing the use of part night lighting.
3. The use of systematic monitoring and evaluation of issues raised by residents following installation of dimming and LEDs to identify if there is any impact on health.

Monitoring options include:

- Residents' complaints/concerns about glare or other health and wellbeing related issues.
- Pedestrian, cyclist and motor vehicle driver complaints/concerns about glare or other new lighting system issue.
- Complaints/concerns expressed by other local stakeholders' e.g. environmental groups, health groups, residents' associations, business groups, voluntary groups and charities.
- New research findings on LED street lighting and health and wellbeing published in a scientifically and/or governmentally recognised peer-reviewed scientific journal and/or undertaken by a recognised and respected individual/team of scientists.

In this way, residents, users of the areas and local stakeholders are all given the chance to comment and express concerns.

8. Action planning in response to the completed analysis

Objective	Planned action	Who	When	How will this be monitored?
What you want to achieve	What you intend to do	Responsible person or department	Timing of action	Monitoring and review arrangements
Lessons learnt reviews from dimming installations to refine risk assessment criteria for new installations	Monitor feedback on installations particularly comments from representational groups to develop improved risk management	Project Team in liaison with Community Safety	As part of any implementation of dimming on the lighting network	Consideration of feedback on installations in liaison with Community Safety
Understanding of the effectiveness of dimming on modern light sources to assist and manage concern at the brightness of white light against the concerns of reduced lighting levels	<p>Determine if applied dimming regime is appropriate to all locations</p> <p>Refine options other than dimming to mitigate glare and light intrusion</p> <p>Ensure the ability to utilise improved equipment during the life of any contracts</p>	Street Lighting Team and Project Team	As part of implementation of major light replacement programmes	Six monthly reviews of any identified community issues
Review impacts of dimming application times to ensure energy reduction is being achieved in a reasonable manner	<p>Monitor community feedback to assist or refine switching times if necessary</p> <p>Monitor any changes to dimming regimes that may be applied by Distribution Network Operators</p>	Street Lighting Team in liaison with Community and Highways Safety Teams	As part of implementation of major light replacement programmes	Six monthly reviews of any identified community issues
Monitoring of any possible indirect health concerns and corrective actions	Record any concerns raised and the supporting evidence on the level of impact	Street Lighting Client in liaison with Public Health	During first year of initial equipment installation	Six monthly reviews and reporting on any issues arising

Public

	<p>Review with Public Health if any concerns raised require corrective action</p> <p>Consider equipment selection to assist or mitigate any health impacts</p>			
<p>Review findings on LED street lighting health and wellbeing published in scientific and government recognised peer reviewed journals</p>	<p>Consider any health impacts identified from LED street light replacements already implemented in major urban conurbations both in this country and internationally</p> <p>Review any benefit dimming combined with use of LEDs provided to manage community concerns regarding brightness and glare from implemented schemes in this country and internationally</p> <p>Determine any research findings identifying the level of health impacts due to exposure times to all LED source equipment utilised by the public and any areas of concern.</p>	<p>Street Lighting in conjunction with Public Health</p>	<p>On-going Research</p>	<p>Review by Street lighting and Public Health to determine if any finding outcomes require further action.</p>

9. Monitoring and review arrangements

Please outline what steps will be taken to monitor and review the implementation of proposals if they are agreed here:

Carry out further opinion surveys annually after implementation
Report on the number of residents' complaints/concerns about glare or other health concerns
Monitor any increase in the rate of road traffic accidents within areas where LED lighting with dimming has been implemented.

10. Confirmation that equality impact analysis (EIA) completed and read

Name of officer signing off EIA as completed

Date:

This Equality Impact Analysis has been read by

Name	Date	Position

Where and when published e.g. with Cabinet Report, on DCC website

Decision-making processes

Attached to report (title): Street Lighting Service Delivery Strategy

Date of report: 21 October 2014

Author of report: Debbie Anderson

Audience for report: Cabinet

Public

Web location of report:

Decision in relation to report

--

Details of follow-up action or links to further EIAs

--

Updated by:

Date: