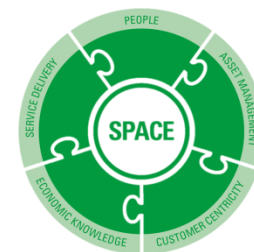


Together we deliver



Living Places



Balfour Beatty Living Places

Derby City Council LED Project

Project Ref: RCCE 0343 Client Business Case

Document Version: Draft v2

<i>Document Approval</i>				
Action	Role	Name	Signature	Date
Author:	Asset Manager	Nick Perry		09/11/15
Reviewer:	Special Projects Manager	Neil Platt		10/11/15
Approver:	Contracts Manager	Paul Slade		10/11/15

<i>Business Case Document Control</i>		
Version	Function	Date
Draft v1	Derby City Council Review	02/11/15
Draft v2	Format Changes	09/11/15

Introduction

Background

Derby City Council are looking to reduce spend across all council services, in line with reductions to revenue budgets. Derby spends £1.2m on energy for street lighting there is opportunity to reduce revenue costs by investing in energy efficient LED technology.

Purpose of this document

This report has been created to provide the case for the introduction of LED (Lighting Emitting Diodes) technology to the Lighting Asset Infrastructure to reduce the impact of future energy costs and is subject to the Council's successful procurement of funding.

Need for a business case

The current energy market is changing and there are a combination of factors that are likely to increase energy prices. Use of gas power stations as a percentage of the UK's total generating capability is increasing at a time when there is also more demand for gas across Europe and Asia¹ creating supply issues leading to upward price pressures. The newly agreed Hinckley C power station is a further example of the upward trend where the wholesale electricity price has been guaranteed at £92.50/MWh (megawatt hours) compared to a current price today of nearer £45.00/MWh² and the majority of the difference in cost will come from consumers.

The Department of Energy and Climate Change (DECC) have projected energy price increases based on 3.7% annual inflation. This would mean that the cost of energy would increase by 78.82% by 2032.



¹The ofgem web site "Understanding energy prices in Great Britain" <https://www.ofgem.gov.uk/gas/retail-market/monitoring-data-and-statistics/understanding-energy-prices-great-britain>

²BBC News article - Hinckley Point - <http://www.bbc.com/news/uk-england-somerset-34588546>

It is evident from DECC predictions and from Derby City's experience of changes to the price of electricity over the last decade that energy inflation is set to rise substantially over the next 10 years. Without additional investment to bring down the running costs, street lighting energy spend will have a serious impact of the council's revenue budget.

The need for a business case is due to the fact the current level of investment in energy efficient equipment is insufficient to mitigate asset growth and the ever increasing unit costs of energy.

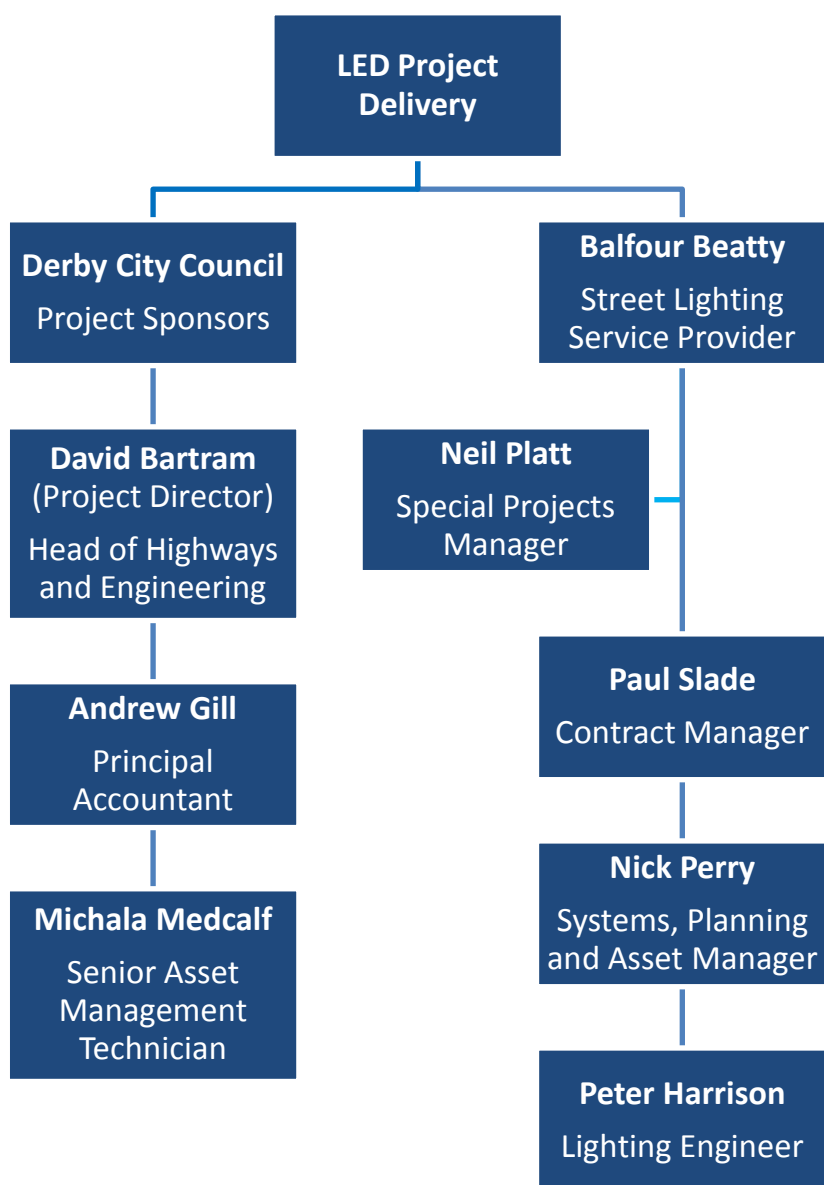
Demand - The demand for energy not only drives the whole energy market, but is possibly one of the largest factors affecting its price. Energy demand comes from more than just domestic consumers; it comes from across all industries; energy generation, fuel and manufacturing.

Electricity prices - The electricity price is set to increase for the foreseeable future. This is partly due to the fact that many of the UK's coal fired electricity generation plants have closed down due to the EU's Large Combustion Plant Directive (which aims to see a third shut down by the end of 2015) and a move to cleaner gas fired stations and renewables.

Project team and governance

In order to deliver the success in this project across various stages of planning, development and implementation, a project team and governance structure has been established which, identifies appropriate resources for the following roles and activities:

- Senior management responsible for securing the approval of and implementation of the project
- A project director to oversee the project along with a manager to undertake the day to day project management tasks
- Representatives with specialist technical knowledge who can provide or review technical data
- Finance representatives as necessary given the proposed scope and requirements of the chosen solution.



Strategic Context

Overview

The Authority has published a strategy for streetlighting and asset management³ which is integral to showing that street lighting assets are well managed and that innovation is a key part of the policy Derby City Council has in place. This document is critical to the proper presentation of the council's goals with the Department for Transport and provides for better positioning with regards to future cases for investment and improved banding for any available funding.

Authority's strategic objectives

The key strategic aims of the project are aligned with the overall strategy of the Authority with regards to street lighting and asset management. Below is a brief outline of how the objectives of this project are aligned with overall strategic goals:

Derby City Council Strategic Objective	How street lighting meets objective
Climate Change	Replacement of assets with LED lanterns will reduce energy consumption and carbon emissions in line with section 4.1 of the Street Lighting Strategy
The Derby Plan	Investment in the LED project will reduce revenue budget requirements in the long term that will allow Derby City Council invest in other key parts of the Derby Plan including for future generations ⁴ . Street lighting contributes significantly to the following aims: <ul style="list-style-type: none"> • Thriving sustainable economy • Good health and well being • Being safe and feeling safe • A strong community • An active cultural life.
Local Transport Plan	The Local Transport Plan (LTP3) sets out our strategies, targets and spending programmes for transport provision in Derby over the next 15 years from April 2011 to March 2026. Street lighting forms part of this strategy and this project will support the goals of that strategy through providing enhanced asset management and improving the value of the asset.

³See document "Street Lighting Strategy 2015-16" issue 2.0/2015 section 7.0 by Michala Medcalf

⁴See document "Derby City Partnership - The Derby Plan 2011 - 2026 A Vision for Derby's future: 2011"

	Street lighting is an integral part of LTP3 with appropriate, well maintained lighting impacting on many of the aims and objectives, which are underpinned by the five key national transport goals ⁵
Procurement Strategy	Reduction in costs through reduced energy bills and best value
Asset Management Strategy	The LED replacement project will reduce the requirement for reactive maintenance and will support the goals set out in section 13.3 of the highways asset management strategy ⁶

External drivers for change

The street lighting industry has gone through significant changes over a relatively short period of time and many local authorities have had little time to adjust. Therefore, street lighting is high on the agenda of many local authorities as a potential area for change and making efficiency savings.

Those main drivers for change are:

EU Policies

- Greenhouse gas emissions 20 per cent lower than 1990 levels by 2020.

UK Government Policies

- Reducing the UK's greenhouse gas emissions by 80 per cent by 2050
- CRC Energy Efficiency Scheme
- ISO 50001 – Energy Management, ISO 14000 – Environmental Management.

Regional Local Policies and Agreements

- Meeting the requirements for reduced carbon emissions from The Derby Plan
- Reduce transport's emissions as defined in The Local Transport Plan (LTP3)
- Assist with the goal of reducing CO₂ emissions by 17% by 2020⁷

⁵See document "Derby Local Transport Plan, LTP3 2011-2026 - Part 1 Strategy"

⁶See www.derby.gov.uk- "Highway Asset Management Strategy 2014-15" document for details

⁷Derby City Council is committed to reducing CO₂ emissions by 17% by 2020, based on the UK's commitment under the Climate Change Act 2008. Government figures have shown that in Derby, city-wide carbon emission have fallen by 14% (based on 2005-2011 figures) (from Street Lighting Strategy 2015-16)

Market

- Increasing fuel prices
- Green taxes
- Energy security.

Authority objectives.

DCC Objective	Comments
Reduce energy consumption	The project reduces energy consumption for the street lighting estate ⁸ from 3,614,465 kWh to 737,550 kWh representing an 80% reduction in our energy consumption for the selected assets
Reduce carbon emissions	Conversion to LED lighting will reduce street lighting carbon emissions ⁹ from a base case projection of 1,657 tonnes to 603 tonnes (a reduction of 63.6%). With the additional introduction of variable lighting (dimming), carbon can be brought down a further 265 tonnes to 338 tonnes (a total of 79.6% reduction) dependent on the regimes.
Reduce the future impact of energy costs and other associated costs	The total predicted savings of £307,054 based on current energy and carbon costs indicate the benefits of such investment against predicted rising energy costs.
Improve lighting control and performance	Use of CMS or fixed profile lighting equipment will ensure that lighting can be profiled to actual road usage to generate energy savings captured above.

Current condition

The current PFI streetlighting contract has been in place since 2007 with Balfour Beatty and is due to continue through until 2032 and includes street lights, traffic signs, beacons, subways and bollards. The contract has already completed the core investment period that installed 20,225 new streetlights and a further phase is due to replace another 2,076 streetlights in 2022.

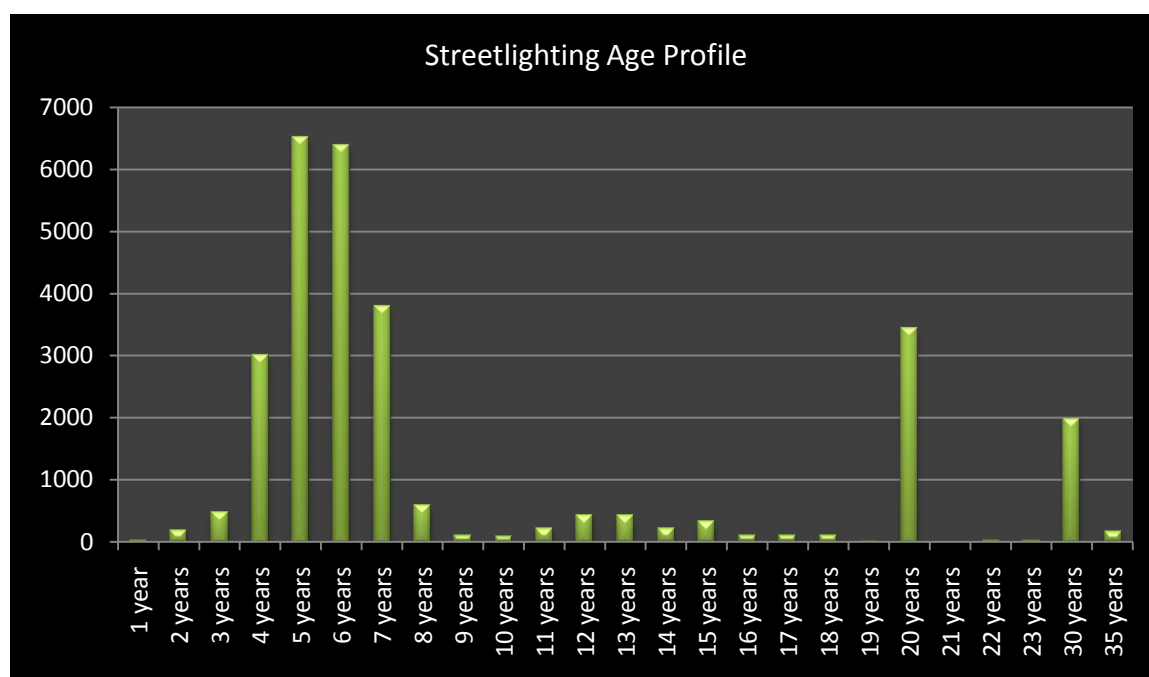
⁸ All figures are based on the annual energy cost for the lanterns under consideration only and not for the full asset inventory. There are 14,289 residential assets under consideration which represents 49.4% of the total street light assets in the city. Total annual consumption for all assets is currently 11,176,561 kWh based on 28,899 streetlights

⁹ CO₂ conversion rates taken as 0.4585kg per kWh from Defra/DECC guidance 2015 spreadsheet produced by Ricardo-AEA from <http://www.ukconversionfactorscarbonsmart.co.uk/>

LED Project – Business Case

All assets are currently being maintained to the standards set out in the PFI contract and include regular bulk change and clean operations (to various cycles depending on the lamp type), visual inspections and electrical testing.

The current age profile of street lighting assets is shown below. The large majority of assets are between 4 and 8 years old from the PFI replacement programme with a smaller number that were considered suitable for replacement in a second phase or added to the contract at a later date.



The recent introduction of a £1.4 million 'Invest to Save' Street Lighting Energy Reduction Project¹⁰ to install a Central Management System (CMS) which can control and adjust the light output on all high energy usage equipment is just one approach the council has made to deliver sustainable financial savings associated with street lighting.

Other energy saving projects that have recently been implemented include small scale part night schemes in appropriate locations including parks and retail estates and also the replacement of lit bollards with unlit bollards which save both energy and maintenance costs.

Consumption for all streetlighting assets for 2014/15 is 11,176,561 kWh which at current electricity rates¹¹ costs £1,144,480 per annum. Streetlighting represents 12% of Derby City Council's total annual energy budget.

¹⁰ Report to Cabinet dated 11th September 2013

<https://cmis.derby.gov.uk/cmisis5/MeetingsCalendar/tabid/73/ctl/ViewMeetingPublic/mid/410/Meeting/7453/Committee/1768/Default.aspx>

¹¹ Current rate of 9.803p/kWh plus feed in tariff of 0.437p/kWh

Technical Options (Long List)

Alternative Solutions – In scope Items

Type	Description	Project Cost	Annual Energy Cost at Completion ¹²	Annual Energy Saving	Payback
Do nothing	No further investment	£0	£383,684	£0	N/A
Part night switching	The fitting of a part night photocell that switches off all in scope items from midnight until 5am	£435,000	£213,727	£169,957	3 years
Permanent switch off (de-illumination)	A visit to switch off each lantern at the isolator for the first year plus the remove and disconnection of the column in the second year ¹³	£3,741,000	£0	£383,684	10 years
CMS Dimming (55% COSMO max from 8pm to 5am)	Supply and fit of a CMS node, dimmable ballast and the associated base stations. This includes the on-going maintenance charge for the remainder of the project.	£3,414,218	£252,483	£131,201	26 years
Fitting of LED lanterns (subject of this project)	Supply and fit of a LED lantern including all admin, contract fees and maintenance charges.	2,838,670	£76,630	£307,054	10 years

Do Nothing

With continuing reductions in revenue budgets and further cuts to highways budgets expected in the November, Derby City Council needs to seek innovative solutions to reduce current energy spend. This solution will cost £307k per annum more than the proposed LED case and due to the upward trend in energy costs it was considered that doing nothing was not an option.

¹²This is the annual energy cost for the lanterns under consideration only and not for the full asset inventory. There are 14,289 residential assets under consideration which represents 49.4% of the total street light assets in the city.

¹³Requires DfT approval and likely loss of funding

Part Night Switching

Although the speed of payback is attractive, this is reducing service levels to the people of Derby. This only attracts £169k annual saving. Part night switching would lead to increased failures as the number of power cycles and thermal cycles determines lamp and ballast failures for this type of lantern and part night switching would double these cycles. There would have to be significant stakeholder consultation before project commencement and savings would be mitigated by additional costs from higher failure rates. Due to the additional likelihood of failures and significant consultation required this was not deemed suitable for further consideration.

Permanent Switch Off (De-illumination)

Although attracting the maximum energy saving this would be a very drastic step. The permanent removal of 60% of Derby's units so close to the completion of a full PFI renewal would need to be very carefully considered. This has been costed to include removal and disconnection to align with the requirements of the DNO in regards to inactive equipment connected to the network. This option would pay-back in the same time length as the proposed LED option but would likely attract additional penalties not considered as the Department for Transport has already indicated that it could lead to a reduction in revenue support and possible removal of PFI payments¹⁴ by removing capital assets and so was not considered a suitable option.

CMS Dimming 55% from 8pm to 5am

The savings possible are restricted by the 55% maximum dim of the 45w COSMO lamp. The increased network size would require a minimum of 3 extra base stations. The 26 year payback rules this out as an option however going to a part night profile would save a further £55K and reducing the payback to 16 years and would mitigate some of the associated risks. This option provides a possible innovative way forward but was not considered as the introduction of part night to make the solution more viable would introduce similar additional failures as the standard part night option.

LED Solution

This represents the best value option when considering the delivery of service to residents and investing in the network. It will reduce revenue spend by £307k per annum and will not require lights to be switched off - this option is "doing more for less". The investment will be future proofed by allow changes to LED modules as they become more efficient.

¹⁴Email from Louise Ivison (Senior Policy Advisor – Local Roads, Local Transport Funding, Growth and Delivery) to Raj Veerasekaran dated 28 July 2015 cc: Michala Medcalf

Technical Options

Solutions that significantly reduced the service or would lead to reduced funding were discounted and the LED solution was the only one that combined the best value for money with a payback equal to other less attractive options.

Sensitivities

A number of evaluations were made regarding the sensitivities of the options considered which included the following

- Price of electricity
- Expected life cycle of selected equipment
- Carbon costs
- Failure rates

These are expanded in more detail below.

Price of energy -	The project payback is primarily based around the energy saving created from more efficient assets and so is directly influenced by this key criteria. If the price of energy decreases then the payback period cannot be achieved. Energy cost per kWh has increased by an average of 8% per annum since the PFI contract started (in 2007) and is projected to increase by 78% by 2032 so this was discounted as a risk.
Asset lifecycle -	Any unexpected or additional costs would have an impact on the payback period and this would have been a factor for the CMS option. This is one of the reasons that this option was discounted. The LED solution includes the full risk in the asset remaining with the service provider (Balfour Beatty) for the lifetime of the PFI until 2032 and includes a transferrable insurance backed guarantee for the new equipment. Due to the level of guarantee provided and the existing PFI contract already transferring asset risk this was discounted as a problem.
Carbon costs -	The project payback was based on energy savings created from more efficient assets coupled with dimming controls and any carbon savings were not included in the payback calculations. It was not considered likely that carbon costs would decrease so this was not seen as a risk to the proposed solution.
Failure rates -	The LED solution includes the full risk for the new assets remaining with the service provider for the duration of the PFI contract. Any failures would be the repaired at the service providers cost.

Qualitative Appraisal

A number of additional factors were considered when looking at possible solutions and each was compared against the Technical Options (Long List). These included the following:

- Vehicle safety
- Pedestrian safety
- Crime and Security
- Visual Impact and Light Pollution

Vehicle safety -	The assets selected for this proposal are all in residential areas and do not include traffic routes. The road speed is typically at the lower end of the spectrum with mainly 30mph roads. Whilst there is some anecdotal evidence that traffic slows down when lighting is lower or removed it was considered a negative factor when looking at switch off options and if they had been selected then it would have required further consultation and study.
Pedestrian safety -	The switch off options would have had a significant effect on pedestrians and no large urban areas in the UK have considered switch off in cities without a great deal of negative reaction from residents.
Crime and Security -	The switch off options would have had a significant effect on pedestrians and no large urban areas in the UK have considered switch off without a great deal of negative reaction from residents.
Visual Impact -	The switch off options would have had a significant effect on the night time street scene. This would have had the positive effect of reduced light pollution but would have been seen as negative due to the lighting being removed. The LED option and the CMS option both would have had the advantage of appearing to offer lighting throughout the night with the LED technology having a significantly greater range of dimming available than the Cosmopolis lamps.

Preferred Solution

Technical Detail

To supply, install and commission

- 4,679 dimmable LED lanterns to replace existing 45w Cosmo Iridium SGS252 Lanterns
- 9,610 dimmable LED lanterns to replace existing 65w Cosmo Iridium SGS252 Lanterns

The project was based on initially matching a wide range of currently available LED lanterns to a number of selected existing street layouts using the original PFI designs to ensure the solution chosen was a good match for the range of different types of streets found in Derby. This street selection included single sided streetlighting, staggered streetlighting, straight roads, complex junctions with multiple lantern types and footpaths.

Each LED lantern was evaluated to ensure that the lighting levels were matched to be comparable to the existing lighting on the road and a number of lanterns were rejected at this stage for non-compliance or poor performance.

Each street was then evaluated based on current British Standards and a suitable lighting level was selected based on the traffic on the road. This lighting level was then used to model the project and allow the best option from a shortlist to be selected based on performance and price.

The selected lanterns were then finally matched based on the original optic settings and wattages for the existing lanterns to ensure an accurate match to give the best overall lighting.

The equipment chosen was the Aria LED lantern by OrangeTek. A number of different variants of the lantern will be required to meet the project requirements as shown below.

Lantern	Quantity
Aria 20w MLE S4	39
Aria 20w MLE S5	2041
Aria 40w MLE S4	1078
Aria 40w MLE S5	7750
Aria 20w NLE S4	165
Aria 20w NLE S5	2434
Aria 40w NLE S4	28
Aria 40w NLE S5	754

The lanterns will be installed using a control driver that will have a pre-set dimming cycle that will have the following profile:

- 100% light output from switch on until 8pm
- 70% light output from 8pm until 11pm
- 40% light output from 11pm until 6am
- 70% light output from 6am until switch off

This profile has been selected to achieve the payback options outlined in the Financial Detail section below and has been tested to ensure the light levels meet the expected target levels designed as part of the evaluation process. Holloway Road was selected as a trial site and has been in operation using the selected equipment and profile since June 2015 with no reported problems or complaints from residents.

Financial Detail

The financial details of the proposed solution are as follows:

- Price of £2.88m including material and labour
- Annual Energy Saving at project completion of £307k per annum (circa £6.14 over the life of the asset), energy saving of 80% and payback 9.9 yrs
- All assets fully supported and guaranteed for lifetime of PFI contract (until 2032)

Further detail can be found in Appendix 3 – Derby City Council LED Project Energy & Cost Model.

Strategic Objectives

Details of how the LED technical solution meets the Authority's Strategic Objectives can be found in the Strategic Context section.

Value for money

This project represents value for money in a number of ways:

Value Proposition	Value for Money
Strategic objectives	This LED projects aligns with Derby City objectives including reduction in energy consumption, being and feeling safe, supporting key transport goals, reducing costs and providing innovation.
Payback	A capital outlay of £2.88m can provide revenue saving of £6.14m over the life of the asset. This provides payback within ten years.
Future Risk	All operational risk to be retained by the PFI service provider. Risk of savings not being realised are mitigated by a 0% energy inflation assumption and the exclusion of carbon savings.

Asset Management Strategy	The LED replacement project will reduce the requirement for reactive maintenance and will support the goals set out in section 13.3 of the highways asset management strategy ¹⁵ whilst supporting funding application through the innovation metric.
Service improvement	This is an investment in the asset that will lead to an improvement in the number of lights out, reduction in light pollution whilst maintaining the appropriate lighting levels.

Project Risks

The table below outlines the potential project risks and how they are to be mitigated:

Hazard & Consequences	Actions to mitigate risk
Adverse Weather Conditions	Reflected in programme, PFI experience adopted in productivity rates
Access to lanterns	Reflected in programme, PFI experience adopted in productivity rates
Driver failure between year 12 and 17	All operational risk to be retained by the PFI service provider.
LED Failure	LED material failure covered by warranty, cost of labour covered by the PFI service provider.
Lantern Manufacturer unable to honour warranty	Warranty from lantern supplier backed by insurance bond to Balfour Beatty & Derby City Council's benefit.
Energy Savings not realised	0% energy inflation assumption and the exclusion of carbon savings to ensure worst case scenario is calculated for base case i.e. any energy inflation will improve savings position

Implementation

To supply, install and commission

- 4,679 dimmable LED lanterns to replace existing 45w Cosmo Mini Iridium Lanterns
- 9,610 dimmable LED lanterns to replace existing 65w Cosmo Mini Iridium Lanterns

These replacements will be matched based on a design approved table where the wattage, lighting class and optic type will be used to assign the correct type of LED lantern. We have a full inventory which falls under a PFI performance mechanism of 99% accuracy.

All the lanterns are installed on residential roads within Derby City. No permit schemes or notices are required and the work does not require any external traffic management. Balfour Beatty has installed every one of these original lanterns and columns in the period 2007-2012 and they are all standard 6m columns with post top fittings. To reduce capital costs, existing cable will be reused and lanterns will be wired on site. Works are to be certified as complete by the service provider and asset record updated.

The programme is forecast to take 15 months with a peak 1200 lanterns replaced. This programme has been sculpted to allow for seasonal impact, special events and to ensure flexibility for unforeseen circumstances. This will ensure that energy savings predictions can be met.

Lantern supplier (Orange Tek) is based 10 miles from the Derby depot. They provide a robust, energy efficient product with light distributions that maintain lighting classes whilst matching current column positions. Orange Tek lanterns are currently used on the Leicester City Council project which has converted the entire city (33,000) to LED.

Orange Tek has confirmed that they are able to supply the volumes required and has agreed to hold 4 weeks' worth of stock to be drawn down as required. Balfour Beatty will hold a maximum of 2 weeks of stock.

There is a 20 year warranty on lantern bodies and LED modules with 12 years on drivers. Although this warranty takes us past the end of the PFI contract (2032), the remaining warranty will transfer to the Derby City Council at the end of the PFI.