

## **BERWICK STREET LIGHTING CONCEPT**

March 10, 2017

This report provides a conceptual design for new street lighting in the central downtown area bounded by Sullivan Street, Wilson Street, and School Street. The intent of this report is to provide a suggested pattern for new decorative street lights that can serve as a guideline for future development. As such, it is not represented as a definitive, final lighting solution. It must be understood that finalized construction plans will require a detailed survey of existing conditions as well as an engineering analysis of lighting performance.

### **I. SUMMARY OF SURVEY FINDINGS**

The concept street lighting plan utilizes lighting poles and luminaires that are similar to those that were recently provided for the bridge between Berwick, Maine and Somerville, New Hampshire. The luminaires include full shielding skirts that provide significant shielding of fixture brightness, and limits light pollution. The proposed lighting poles facilitate modifications when necessary and the easy addition of amenities such as banner arms, signs, planting containers, etc. after the installation of the lighting poles.

The estimated construction cost for the full concept lighting plan is \$533,500. The concept lighting solution shown for the entire downtown area bounded by Sullivan, School and Wilson Streets includes 48 new lighting poles. It is suggested, however, that consideration be given to having private developers be responsible for providing new lighting as development projects are brought forward. This would require the adoption of lighting standards to be written into the Berwick Town Ordinance.

With the implementation of new street lighting, the existing *Central Maine Power Company* street lights that are mounted on utility poles could be eliminated. This would save approximately \$3,600 each year in lease charges if all of the existing *CMP* leased lights within the concept plan area were to be removed.

### **II. LEGAL CONSIDERATIONS**

There are several aspects to consider regarding the legal responsibilities associated with municipalities providing street and sidewalk lighting. It is therefore advisable to consult legal counsel to fully understand the ramifications of providing new, or modifying existing, street and sidewalk lighting. While existing street and sidewalk lighting that has been in place for a significant time may not meet the current recommended lighting standards published by technical societies such as the *Illuminating Engineering Society of North America (IESNA)*, or by organizations such as the *American Association of State and Highway and Transportation Officials (AASHTO)*, in many cases such lighting may be considered as an acceptable existing condition. When a municipality undertakes the provision of new street and sidewalk lighting, or the modification of existing lighting, it is the responsibility of the municipality to meet current applicable lighting standards. When municipalities are made aware of the applicable standards and elect to provide lighting that is not in conformance with these standards, it may be considered

negligence in the event of an accident that is found to be impacted by the substandard lighting conditions.

### III. PURCHASE AND INSTALLATION CONSIDERATIONS

The concept lighting plan submitted with this report suggests the type and location of new street and sidewalk lights. While it may be appropriate for Berwick to purchase and install all of the suggested lighting, it may be appropriate to consider other means for implementing the full concept plan. One such approach might be to have the Town consider providing the new lighting at street intersections, and having future property developers be responsible for providing the new lighting along street sections where new construction occurs. In this case, the new lighting being provided as part of development projects would want to meet street and sidewalk lighting standards adopted the Town for consistency and safety's sake. For this approach, the Town should develop street and sidewalk lighting standards that include requirements for lighting poles and luminaires, as wells as requirements for installation and performance standards.

### IV. ELECTRICAL SERVICE OPTIONS FOR LIGHTING

Currently, a majority of street and sidewalk lights throughout the Town of Berwick are leased from the *Central Maine Power Company (CMP)*. The lease structure offered by *CMP* includes a monthly charge based on the luminaire type, lamp type, and lamp wattage. The leased luminaires within the downtown concept lighting area include the following types of luminaires:

- Refractor Type Roadway Luminaire with a 250 Watt High Pressure Sodium Lamp
- Refractor Type Roadway Luminaire with a 100 Watt High Pressure Sodium Lamp
- Cut-Off Type Roadway Luminaire with a 100 Watt High Pressure Sodium Lamp
- Cut-Off Type Roadway Luminaire with a 50 Watt High Pressure Sodium Lamp
- Cut-Off Type Roadway Luminaire with a 250 Watt Metal Halide Lamp
- Cut-Off Type Roadway Luminaire with a 400 Watt Metal Halide Lamp



CUT-OFF ROADWAY LIGHT



REFRACTOR ROADWAY LIGHT

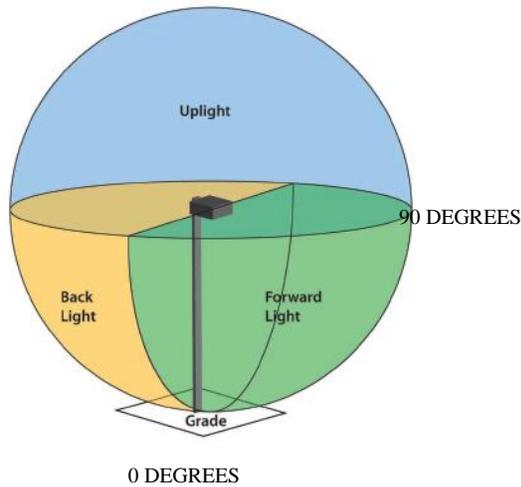
**Fig. 1** *CMP* Leased Roadway Lights

An alternate means of serving roadway lighting is to provide *CMP* metered services. When a municipality elects to provide their own lighting poles and luminaires they can be connected to an electrical service that is metered by *CMP*. This option results in a monthly *CMP* bill that includes a service charge, as well as an energy use charge. Since the municipality owns the lights, all maintenance must be performed by the municipality.

A third option for electrical service that has recently been made available is that of direct, unmetered connection of street and sidewalk lighting that is owned by a municipality to existing *CMP* service wiring. For this option *CMP* charges a monthly rate for electrical use only according to the number and wattage of lamps that are connected. As is the case with metered service, all maintenance of lighting equipment must be performed by the municipality.

## V. LUMINAIRE CLASSIFICATION

The *IESNA* publishes a recommended tool for classifying the performance of an exterior luminaire in terms of its ability to avoid unacceptable amounts of light spill and light pollution, and to minimize glare. The classification is based on an evaluation of light emitted from a luminaire at various angles in front, behind and above the fixture (see Fig. 2).



**Fig. 2** Luminaire Classification Zones

Within the forward and backlight zones the lumen output of a luminaire is rated in three groups of angles. Low angles are those between 0 degrees (straight down) and 30 degrees. The medium angles are those between 30 degrees and 60 degrees. The high angles are those between 60 degrees and 90 degrees.

Within the uplight zone the lumen output of a luminaire is rated in four groups of angles. Forward and backlight very high angles are those between 80 degrees and 90 degrees. Low uplight angles are between 90 degrees and 100 degrees. High uplight angles are above 100 degrees.

The classification of luminaires according to lumen output per zones is used to rate fixtures according to three performance factors: 1) the potential for excessive backlight trespass; 2) the potential for excessive light pollution; and 3) the potential for excessive glare. Each of these performance factor is rated in a scale of 0 to 5, with 0 being the best performance, and 5 being the worst. Fig. 3 lists the performance rating for the potential of a luminaire to result in excessive backlight trespass. The ratings are listed at three output zones (backlight low angles, backlight medium angles, and backlight high angles). A maximum allowable lumen output is listed for each of the 0 to 5 ratings according to the output zones.

		Maximum Lumen Output					
Secondary Solid Angle		B0	B1	B2	B3	B4	B5
Backlight / Trespass	BH	110	500	1000	2500	5000	>5000
	BM	220	1000	2500	5000	8500	>8500
	BL	110	500	1000	2500	5000	>5000

**Fig. 3** Backlight/Trespass Performance Rating

Fig. 4 lists the performance rating for the potential of a luminaire to result in excessive light pollution, or skyglow. The ratings are listed at four output zones (backlight very high angles, forward very high angles, upright low angles, and upright high angles). As is the case for the light trespass ratings, a maximum allowable lumen output is listed for each of the 0 to 5 ratings according to the output zones.

		Maximum Lumen Output						
		Secondary Solid Angle	U0	U1	U2	U3	U4	U5
Uplight / Skyglow	UH		0	10	100	500	1000	>1000
	UL		0	10	100	500	1000	>1000
	FVH		10	75	150			>150
	BVH		10	75	150			>150

**Fig. 4** Uplight/Skyglow Performance Rating

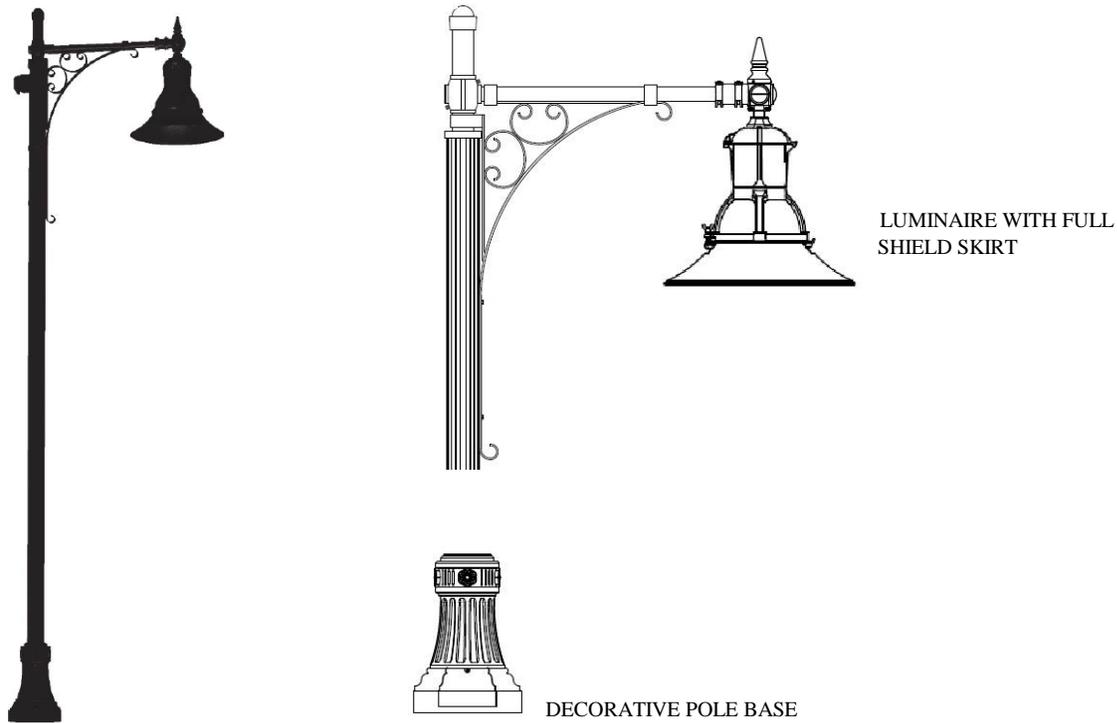
Fig. 5 lists the performance rating for the potential of a luminaire to result in excessive glare. The ratings are listed at four output zones (backlight high angles, forward high angles, backlight very high angles, and forward very high angles). Once again, a maximum allowable lumen output is listed for each of the 0 to 5 ratings according to the output zones.

		Maximum Lumen Output						
		Secondary Solid Angle	G0	G1	G2	G3	G4	G5
Glare / Offensive Light	FVH		10	250	375	500	750	>750
	BVH		10	250	375	500	750	>750
	FH		660	1800	5000	7500	12000	>12000
	BH		110	500	1000	2500	5000	>5000

**Fig. 5** Glare/Offensive Light Performance Rating

## VI. PROPOSED LIGHTING EQUIPMENT

The proposed lighting pole and luminaire have been selected to be compatible with the lighting that was previously installed across the bridge between Berwick and Somersworth, New Hampshire. The luminaire and are illustrated in Fig. 6.



**Fig. 6** Proposed Luminaire and Lighting Pole

The luminaire utilizes LED lamps that provide 4,740 output lumens. The recommended color temperature of the LED lamps is 3000K, which provides a warm-tone appearance. The luminaire includes a full skirt to shield the LED source and minimize fixture brightness/glare. The full skirt also helps to restrict light pollution by limiting the amount of light emitted above a horizontal plane. The luminaire has a superior performance rating of:

- Backlight: B1
- Uplight: U2
- Glare: G1

The proposed luminaire has utility construction that facilitates maintenance by means of quick-disconnect and replacement of internal components.

The lighting pole is constructed of extruded aluminum, and is 18 foot tall with a cast aluminum decorative base. The pole is configured to be able to accept the addition of signage, banner arms, planters, etc. after erection without modification of the pole. The pole and luminaire are to be painted

with polyester powder-coat paint in a black color finish.

The proposed lighting pole and luminaire are as manufactured by *Holophane Lighting*:

- Luminaire: model # MPL2 P10S 30K AS BK SG 3 S DS
- Luminaire Top Fitter: model # WLDF13 200 BK
- Lighting Pole: model # NYA 18 L5J 17\_1 P05 ABG BK R210C
- Pole Bracket: model # CAM 48/1 CA BKH

## VII. LIGHTING PERFORMANCE STANDARDS

Recommended illuminance levels for streets within the concept plan area have been taken from RP-08-14, Roadway Lighting, published by the *Illuminating Engineering Society of North America*. The *IESNA* publishes recommendations for lighting of street lighting based on the street classification as dictated by traffic volume, and the classification of pedestrian conflict. The *Institute of Transportation Engineers (ITE)* in Guidelines for Residential Subdivision Street Design, identifies the following volumes of average daily traffic (ADT) for various street classifications.

Major – over 3,500 average daily traffic (ADT)

Collector – 1,500 to 3,500 average daily traffic (ADT)

Local – 100 to 1,500 average daily traffic (ADT)

The *IESNA* identifies five levels of street use classifications: Freeway, Expressway, Major, Collector, and Local. The definition of a Collector Street is:

*Roadways serving traffic between major and local streets. These are streets used mainly for traffic movements within residential, commercial, and industrial areas. They do not handle long, through trips. Collector streets may be used for truck or bus movements and give direct service to abutting properties.*

A second factor, beyond street classification, on which street illumination recommendation is based, is that of the anticipated level of pedestrian activity. The level of pedestrian activity can be established by estimating the pedestrian count during the average annual first hour of darkness.

High – over 100 pedestrians

Medium – 11 to 100 pedestrians

Low – 10 or fewer pedestrians

These volumes represent the total number of pedestrians walking on both sides of the street, plus those crossing at non-intersection locations, in a typical block (defined as a length of 200 meters).

The *IESNA* definition of a Medium degree of pedestrian conflict is:

*Areas where lesser numbers of pedestrians utilize the streets at night. Typical are downtown office areas, blocks with libraries, apartments, neighborhood shopping, industrial parks, and streets with transit lines.*

Given the statistics listed for the volume of daily traffic and the number of pedestrians, it is estimated that the streets within the concept plan area fall into the Collector Street category with a Medium degree of pedestrian activity.

Table 1 below lists the horizontal illuminance recommendations at grade for streets according to the Collector classification with intersecting Local streets, with a Medium pedestrian conflict classification.

**RECOMMENDED MAINTAINED ILLUMINANCE  
VALUES FOR STREET LIGHTING<sup>1</sup>**

**TABLE 1**

<i>Street Classification</i>	<i>Pedestrian Classification</i>	<i>Ave. Illuminance (Footcandles)</i>	<i>Illuminance Uniformity Ratio (Average-to-Minimum)</i>
Collector/Collector	Medium	0.9	4.0 to 1

<sup>1</sup> Data taken from Table 8 IESNA RP-8-00.

Table 2 below lists the luminance recommendations for streets according to the Collector classification with intersecting Local streets, with a Medium pedestrian conflict classification.

**RECOMMENDED MAINTAINED LUMINANCE  
VALUES FOR STREET LIGHTING<sup>2</sup>**

**TABLE 2**

<i>Street Classification</i>	<i>Pedestrian Classification</i>	<i>Ave. Luminance (Candela perMeter<sup>2</sup>)</i>	<i>Luminance Uniformity Ratio (Average-to-Minimum)</i>	<i>Maximum Veiling Luminance Ratio (Maximum-to-Average)</i>
Collector	Medium	0.6	3.5 to 1	0.4

<sup>2</sup> Data taken from Table 3 IESNA RP-8-14.

**VIII. CONCEPT LIGHTING PLAN**

Submitted separately is a conceptual street lighting plan for the project area, sheet L1 dated 02/17/17. This plan suggests locations for new street lighting poles based on an optimum spacing to meet the lighting performance criteria as nearly as is practical. Actual locations of lighting poles would have to be determined by existing street, sidewalk, crosswalk, and driveway conditions, as well as by existing underground utilities. The concept plan has been developed with the understanding that existing overhead utility lines within the concept area would be replaced with underground lines to avoid conflict with utility poles and overhead wiring.

Preliminary illuminance calculations have been conducted to determine anticipated lighting levels based on the proposed concept plan. Table 3 below lists the calculated illuminance results measured at grade.

**CALCULATED ILLUMINANCE VALUES  
FOR CONCEPT STREET LIGHTING PLAN**

**TABLE 3**

<i>Street</i>	<i>Average (Footcandles)</i>	<i>Maximum (Footcandles)</i>	<i>Minimum (Footcandles)</i>	<i>Uniformity Ratio (Average-to-Minimum)</i>
Sullivan Street	1.1	4.6	0.1	10.7 to 1
Wilson Street	1.3	4.4	0.2	6.3 to 1
School Street	1.1	4.7	0.1	10.9 to 1
Berwick Street	1.1	4.9		

**IX. CONCEPT LIGHTING PLAN ESTIMATED CONSTRUCTION COST**

Table 4 below lists an estimate of construction cost for the concept lighting plan. The costs include the provision (purchase and installation) of the new lighting poles, along with the provision of the lighting pole foundation bases, and electrical conduit and wire. The estimate does not include excavation costs nor costs associated with roadway or sidewalk repair.

**TABLE 4**

**ESTIMATED CONSTRUCTION COST  
FOR CONCEPT STREET LIGHTING PLAN**

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Lighting Poles with Luminaires	
Each: \$7,000	
Qty: 48	
Subtotal.....	\$ 360,000
Lighting Pole Foundation Bases	
Each: \$1,000	
Qty: 48	
Subtotal.....	\$ 48,000
Wiring and Conduit	
1-1/2" PVC Conduit: \$20,000	
#4 AWG Conductors: \$35,000	
Subtotal.....	\$ 55,000
Electrical Service	
Service Connections: \$12,000	
Service Equipment: \$10,000	
Subtotal.....	\$ 22,000
Contingency	
10%.....	\$ 48,500
<b>ESTIMATED TOTAL.....</b>	<b>\$ 533,500</b>

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**X. EXISTING CMP STREET LIGHTING**

The concept street lighting plan assumes that the existing leased street lighting luminaires that are presently installed on utility poles within the concept plan area would be removed when the new lighting is provided. Accordingly, the present lease charges associated with these lights would be eliminated. Table 5 below lists the lease charges that would be eliminated. The lease charges have been taken from the *CMP* list dated 4/27/15.

**TABLE 5**

**CMP MONTHLY LEASE CHARGES FOR EXISTING STREET LIGHTS  
WITHIN THE CONCEPT STREET LIGHTING AREA**

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Sullivan Street	
<i>CMP</i> Pole #2	\$30.09/month
<i>CMP</i> Pole #3	\$10.99/month
<i>CMP</i> Pole #4	\$30.09/month
<i>CMP</i> Pole #4.5	\$30.09/month
<i>CMP</i> Pole #5	\$30.09/month
<i>CMP</i> Pole #6	\$23.87/month
<i>CMP</i> Pole #9	\$10.99/month

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Wilson Street

*CMP Pole #2* \$10.99/month

*CMP Pole #4* \$10.99/month

School Street

*CMP Pole #1* \$11.29/month

*CMP Pole #2* \$17.73/month

*CMP Pole #3* \$11.67/month

*CMP Pole #4* \$11.29/month

*CMP Pole #?* \$11.26/month (two lights)

Berwick Street

*CMP Pole #141* \$17.73/month

*CMP Pole #?* \$17.73/month

ESTIMATED TOTAL ANNUAL SAVINGS

\$ 3,577.80

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