Energy · Quality · Controllability℠

Horticultural Lighting V3.0
Draft 2

August 11, 2022

Agenda

- Introduction
- Webinar Logistics
- V3 Overview and Timeline
- V3 Baseline Requirement Proposal
- V3 Topic Review
  - Application Information
  - Controllability
  - LM-79 & TM-33 Reporting
  - Surveillance Testing
- Q&A

Introductions

Presenters

Kasey Holland
Technical Manager

Adrian Martin
Technical Analyst

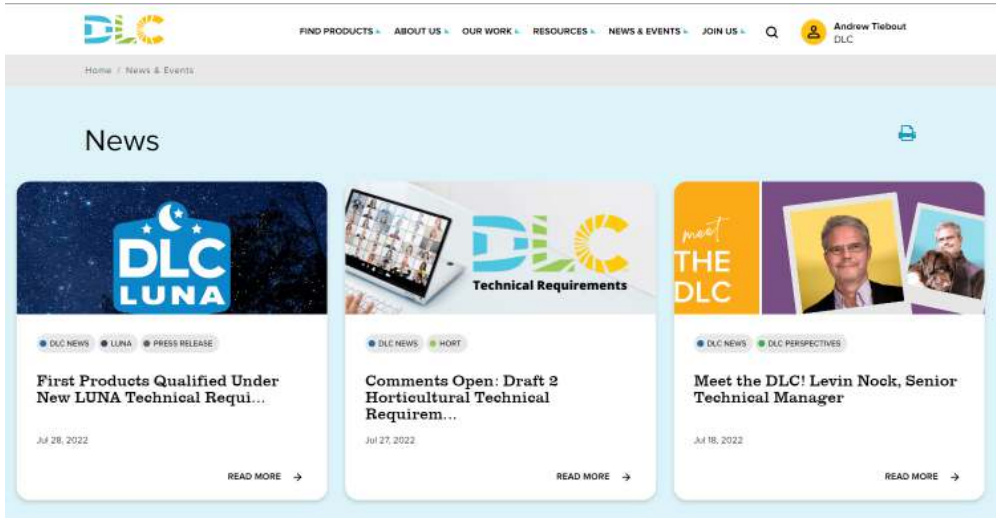
Andrew Tiebout
Project Manager of Technical Development

Q&A Support

Leora Radetsky
Senior Research Scientist

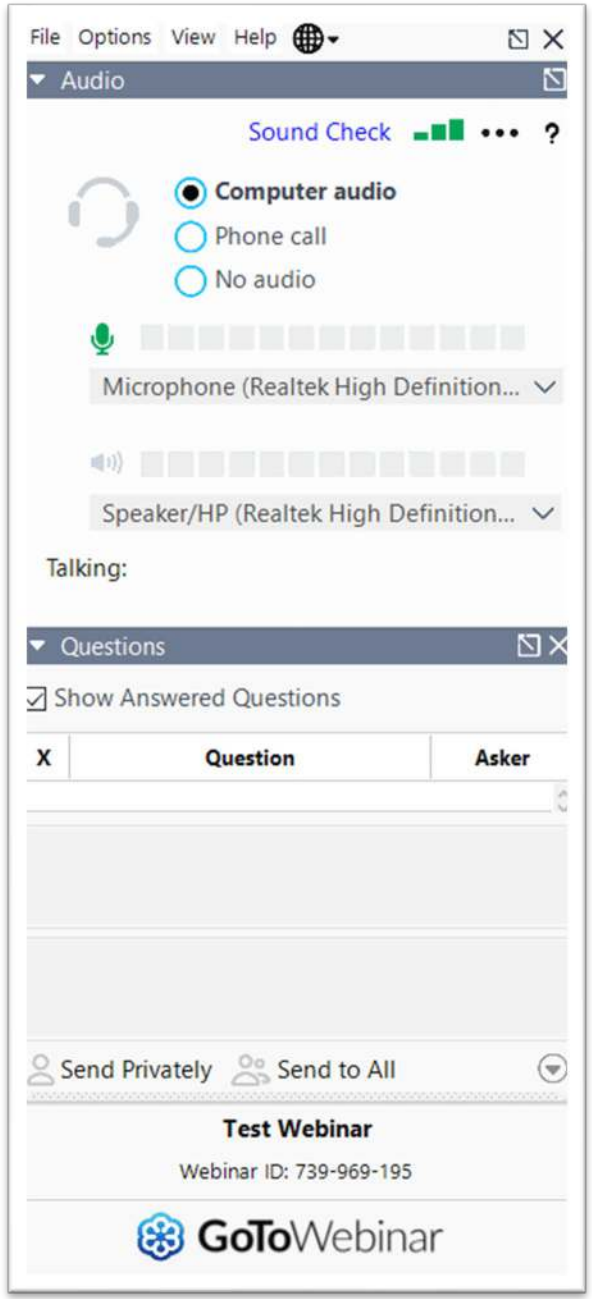
Webinar Logistics

- **Slides and recorded webinar will be posted** on the *DLC News & Events* page at www.designlights.org shortly after today's presentation
- All attendees are automatically muted
  - If you experience technical issues, please use the Chat feature to let us know



Questions and Answers

- We will leave **15 minutes** after the presentation to answer questions. Please enter your Questions pane in GoToWebinar.
  - DLC technical support team will answer questions as they come in via the Questions pane
  - Some questions will be answered aloud (anonymously) at the end during the Q&A session



Comment Forms

All comments must be submitted using DLC Comment Forms. Please download the Comment Form and submit the completed forms to comments@designlights.org

	Comment Form Instructions
Document:	Technical Requirements for Horticultural Lighting V3.0
Version:	Draft 2 of Hort V3.0
Comments Due:	Close of business, Wednesday, September 7, 2022
Instructions and Background:	**Please follow these steps to ensure your comments are received and considered by the DLC:** 1. Enter your Organization, Name, Email Address, and Phone Number in Row 8 of this worksheet. 2. There are three (3) new sections included in this release: Application Information Requirements, Controllability Requirements, and the Surveillance Testing Policy. Navigate to the tab at the bottom of this worksheet corresponding to the section of the Hort V3.0 draft on which you'd like to comment. Comments to Hort V3.0 that are not related to a specific section or topic may be added at the "General Comments" tab. 3. After your review of the draft documents, please consider each Key Question in Columns B, C, and D and submit your answer in Column D and potential solutions in Column E. Comments to the Technical Requirements that are not related to a specific Key Question may be added to the remainder of each worksheet. Please enter the line number of the draft corresponding to your comment into Column B starting on Row 16. 4. Save this Excel file with your comments and include your organization name appended to the end of the filename (for example: "DLC_Hort-V3.0Draft1_CommentForm_AcmeLightingCo"). 5. Email the file to **comments@designlights.org** by close of business, **Thursday, May 12, 2022.**

V3.0 Overview and Timeline

Hort Version 3.0 Goals

Accelerate energy efficiency of lighting in Controlled Environment Agriculture

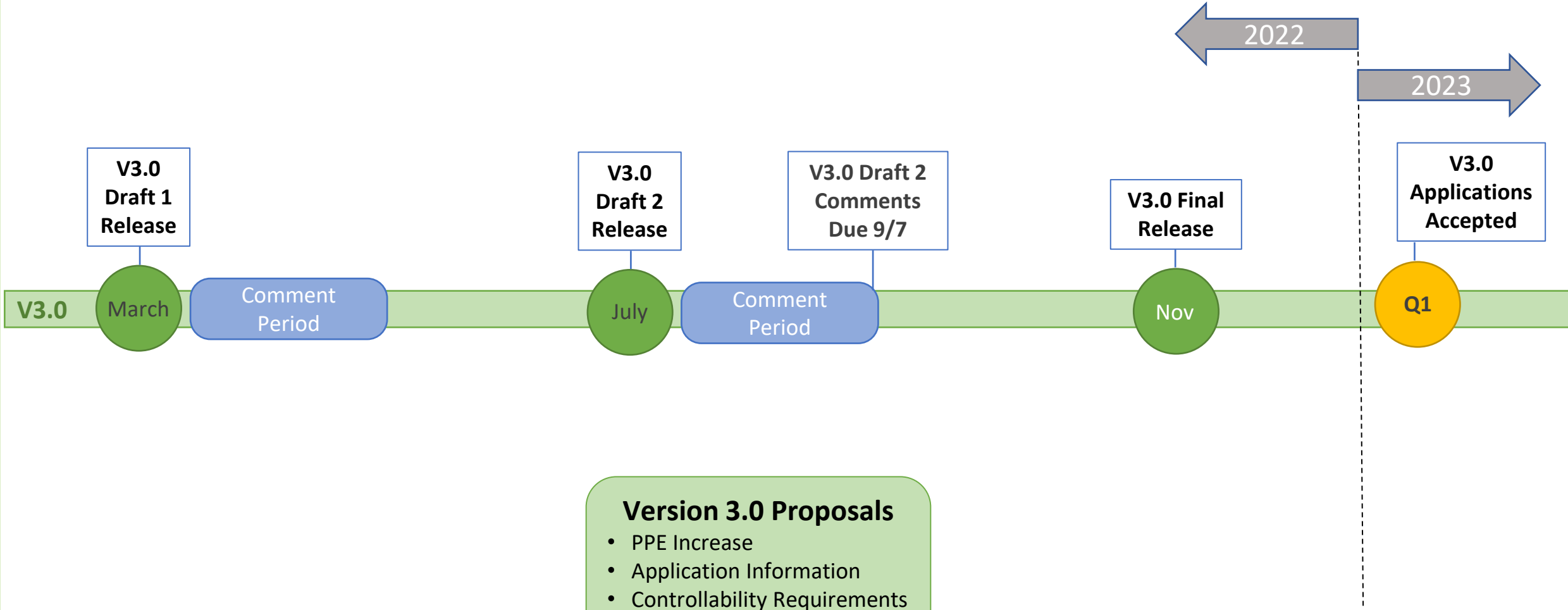
Support Energy Efficiency programs development & aid end users using the QPL to identify and select products that are eligible for rebates

Protects the integrity and value of the QPL for all stakeholders

Hort Version 3.0

- Version 3.0 is a major revision that proposes the following key updates
  - Increased Efficacy Threshold
  - Introduction of
    - Application (Intended Product Use) Information requirements
    - Controllability requirements (at the product-level)
    - New LM-79 reporting requirements
    - Surveillance Testing
- Draft 2 covers technical proposals
  - Implementation (application or fee) details will be provided before the application acceptance date (tentatively Q1 2023)

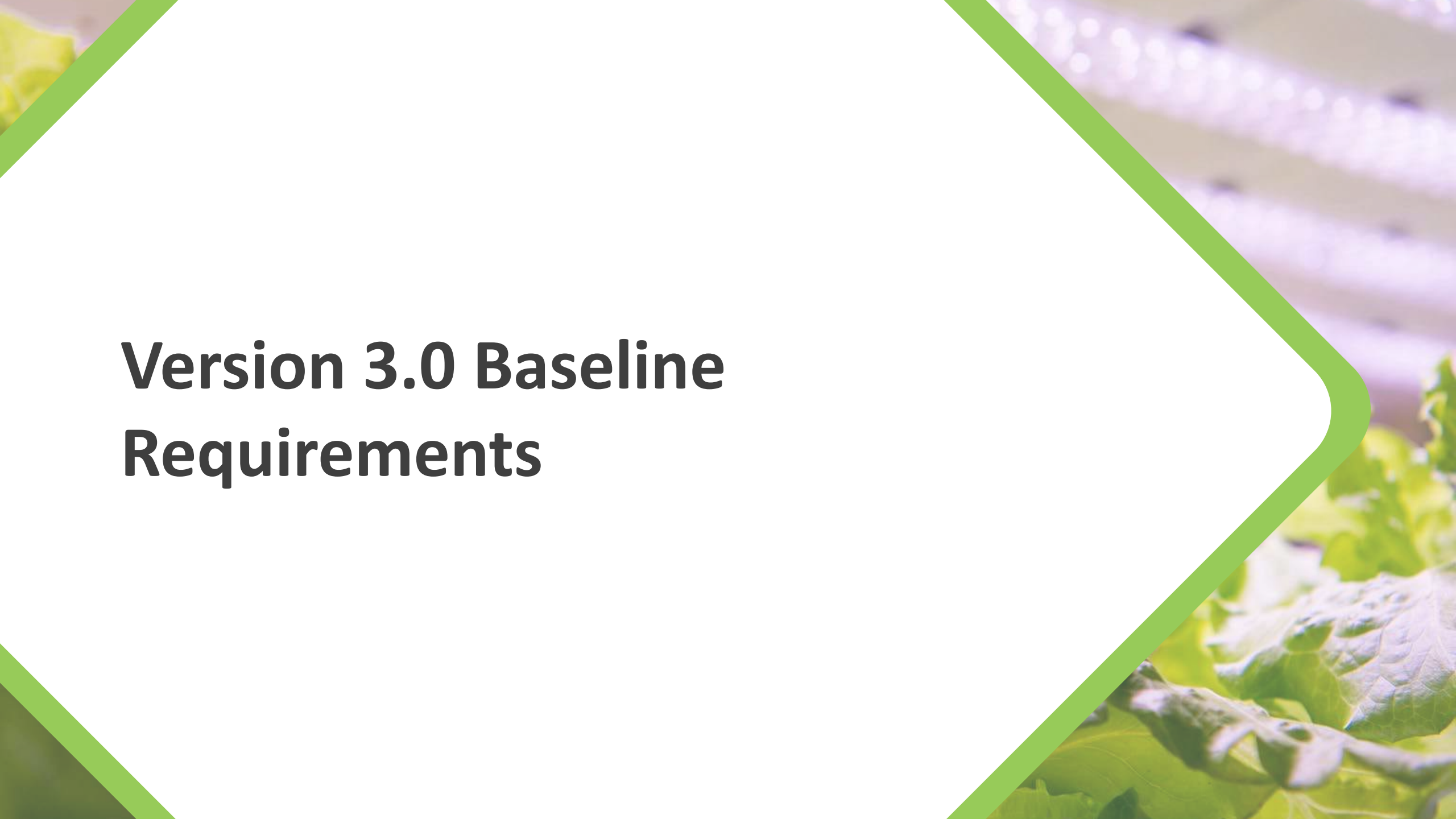
Hort Version 3 Timeline



Version 3.0 Proposals

- PPE Increase
- Application Information
- Controllability Requirements
- Surveillance Testing

Version 3.0 Baseline Requirements



Baseline Requirements

No change from Draft 1

Current requirements for Hort QPL listed products include

- Safety Certification
- Warranty
- Component lifetime
- Power Quality
- **Efficacy**

Parameter/Attribute/Metric	Requirement	Requirement Type	Method of Measurement/Evaluation
Photon Flux Maintenance, Photosynthetic (PFM_P)	Q_{90} ≥36,000 hours	Required/ Threshold	(ANSI/IES LM-80 / IES TM-21 or IES LM-84 / IES TM-28) 400-700nm range, fixture technical specification sheet, and *In-Situ Temperature Measurement Test* (ISTMT)
Photon Flux Maintenance, Far-Red (PFM_{FR})	Report time to Q_{90}	Reported	(ANSI/IES LM-80 / IES TM-21 or IES LM-84 / IES TM-28) 700-800nm range
Driver Lifetime	≥50,000 hours	Required/ Threshold	Driver technical specification sheet, fixture technical specification sheet, and *In-Situ Temperature Measurement Test* (ISTMT)
Fan Lifetime	≥50,000 hours	Required/ Threshold	Fan technical specification sheet, fixture technical specification sheet
Warranty	Fixtures: ≥5 years Lamps: ≥3 years	Required/ Threshold	Legal warranty terms & conditions
Power Factor (PF)	≥0.9	Required/ Threshold	Benchtop electrical testing or ANSI/IES LM-79
Total Harmonic Distortion, Current (THDi)	≤20%	Required/ Threshold	Benchtop electrical testing or ANSI/IES LM-79
Safety Certification	Horticultural Lighting designation by OSHA NRTL or SCC-recognized body	Required/ Threshold	ANSI/UL 8800 (ANSI/CAN/UL 8800)
Photosynthetic Photon Efficacy [1] (K_P or PPE) ($\mu mol \times J^{-1}$)	≥1.90 $\mu mol \times J^{-1}$	Required/ Threshold	(ANSI/IES LM-79) 400-700nm range

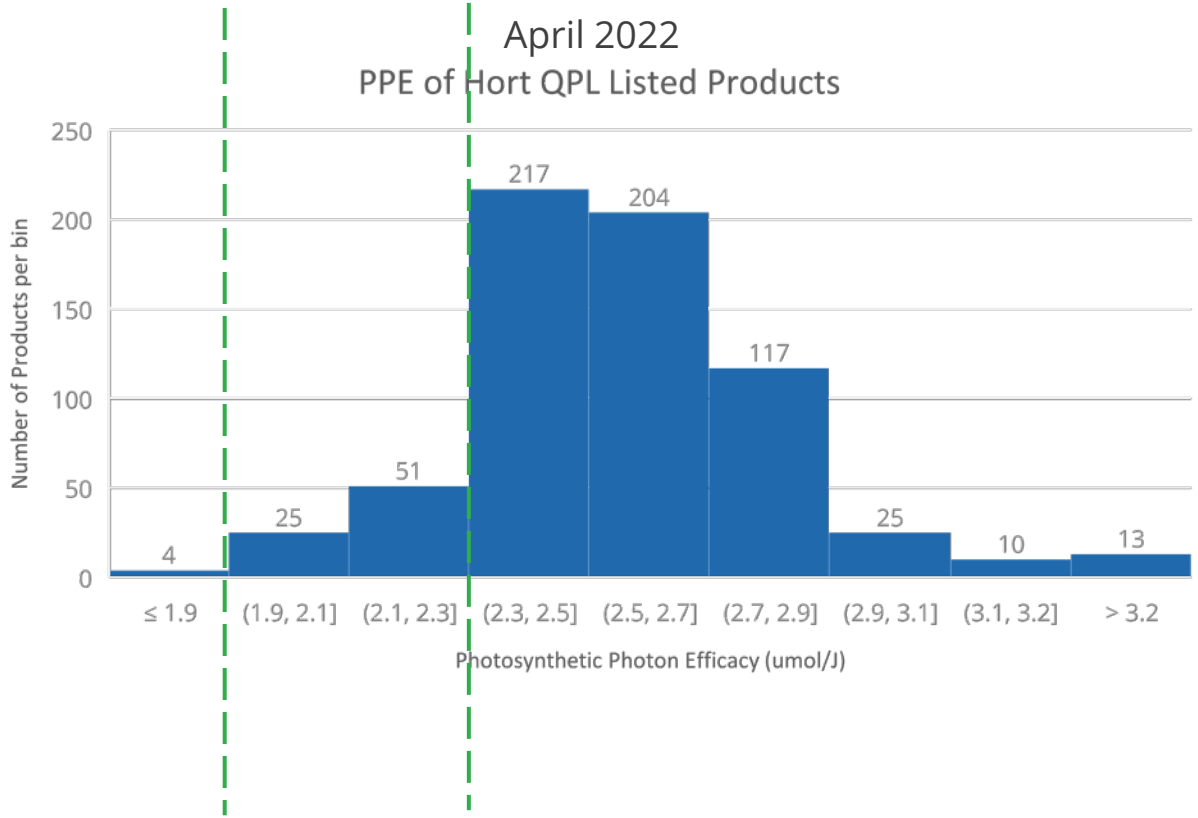
Version 3.0 draft 2 maintains PPE proposal

No Change to PPE from Draft 1

To accelerate EE in CEA, the DLC has proposed a Major Revision every 2 years to drive energy efficient lighting in CEA by increasing PPE to delist the bottom 15% of listed products

Version 2.1 Efficacy:
1.9 µmol/J

Version 3.0 Proposed Efficacy:
~2.3 µmol/J



V2.1 PPE → Proposed V3 PPE

Application (Intended Product Use) Information

Version 3.0 – Application (Intended Product Use) Information

Rationale

The current QPL is one-size-fits-all and leaves out critical intended product use information

Version 3.0 proposes to require the reporting of the intended **controlled environment** and **lighting strategy** for listed products

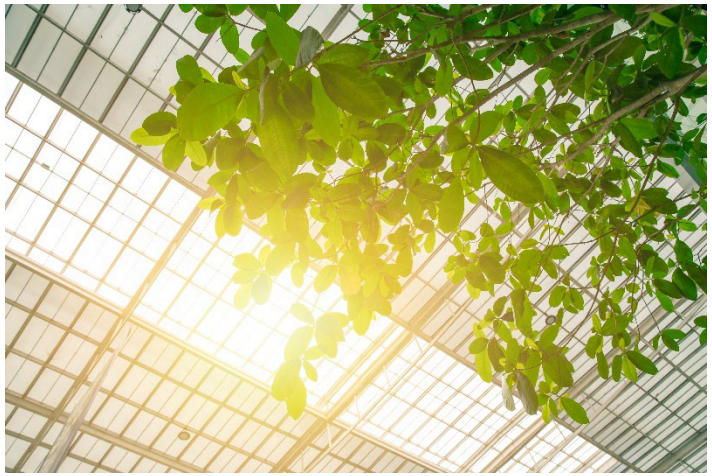
Aims to support :
Development of midstream/prescriptive EE Programs, and
Stakeholders looking to better identify and compare QPL listed products

Version 3.0 – Application Information

***Controlled Environment* Reporting Options**

- Indoor (~~Stacked or Non-Stacked~~)
- Indoor (**Single Tier or Multi-Tier**)
  - Fully enclosed controlled environments with single or multiple layers.

- Greenhouse
  - Rely on sunlight as a primary light source, but often require supplemental electric lighting



Version 3.0 – Application Information

Lighting Scheme (Duration):

Sole-Source and/or Supplemental

Products reporting to be **sole-source** shall be intended for applications where the **lighting fixture is the primary source of optical radiation**.

Products reporting to be **supplemental** shall be intended for applications where the **lighting fixture is not the primary source of optical radiation**.

Version 3.0 – Application Information

Lighting Scheme (Direction):

Top light, Intra-canopy, or Other

Products reporting to be a **Top light** shall be intended to be mounted with the emission area **facing down, toward the canopy**.

Products reporting to be an **Intra-canopy light** shall be intended to be mounted **within the canopy**.

To account for innovative technologies in this developing field, the DLC proposes an **"Other (text)"** option to support **products that do not fit within the top lighting or intra-canopy** lighting categories.

For instance, "Other (Bottom lighting)".

Version 3.0 – Application Information

Controlled Environment		Lighting Scheme		Requirement Type	Method of Measurement/Evaluation
		Direction	Duration		
Indoor	(Single Tier)	Top light, Intra-canopy, Other (text)	Sole-Source or Supplemental	Reported	Product specification sheet*
	(Multi-Tier)				
Greenhouse		Top light, Intra-canopy, Other (text)	Sole-Source or Supplemental	Reported	Product specification sheet*

To compliment reported application information, Version 3.0 draft 2 proposes to **report fixture physical dimensions** and **a representative image** ~~**(or an active link** to the product on the manufacturer's website)~~ on the QPL for all listed products.

Draft 2 maintains proposal that **a single listed product may report** that they are intended for **multiple controlled environments and lighting schemes.**

Version 3.0 – Application Information

Key Questions for Application (Intended Use) Information Requirements Section

Version 3.0 Draft 2 proposes specific controlled environments and lighting schemes to be reported on the QPL for listed products.

1. What additional information should be required and/or reported to relate listed products to the application(s) they are intended to operate in? E.g., should there be additional categorization related to product level performance, such as minimum/maximum PPF or input wattage?
2. What concerns, suggestions, or general feedback do you have related to publishing product images on the Hort QPL? Is this for all listed products?
3. The DLC has proposed Lighting Scheme (Direction) and Lighting Scheme (Duration) as nomenclature to describe how the listed products intends to deliver optical radiation to the canopy. What concerns do you have for these terms to be misleading? If concerns exist, please suggest a new term.

Answer Key Questions and submit comments to:
comments@designlights.org

Controllability

Version 3.0 – Controllability

Overview

- Draft 2 removes the proposed dimmability requirement for low PPF luminaires
- New options and terms were added for reported fields
- Rationale
  - Save energy and promote demand response with high PPF products
  - Reduce burden for low PPF products where dimming may not be appropriate
  - Promote interoperability

Version 3.0 – Controllability

Parameter/Attribute/Metric		Requirement	Requirement Type	Method of Measurement/Evaluation
Dimming Capability	**AC products with PPF ≥ 350 µmol × s^{-1}, DC products, replacement lamps**	Products shall have the ability to dim	Required	Product specification sheet
	AC Luminaires with PPF < 350 µmol × s^{-1}	Report whether the product is dimmable or non-dimmable	Reported	
Dimming Range		Report 1. Minimum Input Wattage 2. Minimum PPF 3. Default Input Wattage 4. Default PPF	Reported	Manufacturer Reported
Dimming and Control Methods		Report 1. Dimming or Control Method Designation to the Product 2. Connector / Transmission Hardware	Reported	Product specification sheet or supplemental documentation
Control Capabilities		n/a	Reported	Product specification sheet or supplemental documentation

Version 3.0 – Controllability

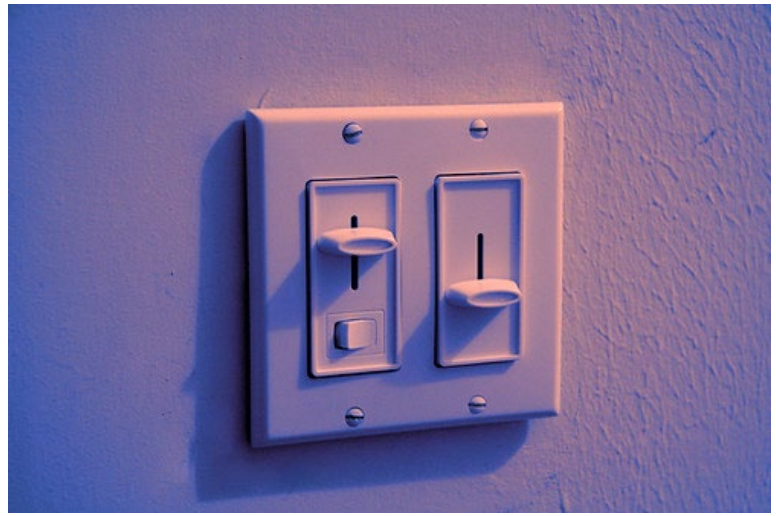
Dimming Capability

Products with PPF ≥ 350 µmol × s^{-1} **DC powered products** **Replacement lamps**	**Luminaires with PPF < 350 µmol × s^{-1}**
• Products must be capable of dimming through line voltage, low voltage or wireless signal • Product specification sheet must state that the product is dimmable	• Dimming capability is a reported metric and is not required • Product specification sheet must state whether the product is dimmable or not

Version 3.0 – Controllability

Dimming Range

- Reported values:
  - Minimum Input Wattage (in Watts)
  - Minimum PPF (in µmol × s^{-1})
  - Default Wattage (in Watts) -- ***New***
  - Default PPF (in µmol × s-1)
- All dimming range information is manufacturer reported and not checked against a specification sheet



Version 3.0 – Controllability

Dimming and Control Methods	
Dimming and Control Method Designations to the Product	**Connector / Transmission Hardware**
Protocols or methods of communication between the product and other devices / controllers	Hardware integrated into the product that enables it to physically connect with and receive signals from a controller or other device.
• All applicable options from the following tables must be reported • Must be stated on the product specification sheet or supplemental material	

Version 3.0 – Controllability

Wired Dimming and Control Method Designations to the Product

Control Type	Definition	Acceptable Terms
0-10V IEC 60929 Annex E	Wired analog low-voltage control that varies DC voltage between 0 and 10 volts (or 1 and 10 volts) to produce varying light output.	0-10V, 1-10V, 10V, 10V0
0-10V ANSI C137.1-2019 (8-Volt)		
0-10V ANSI C137.1-2019 (9-Volt)		
0-10V Other		
Phase Cut (Forward Phase)	Modification, or cutting, of the leading edge of the AC mains sinusoidal waveform to produce varying light output.	Phase-cut, forward phase, leading edge, TRIAC, magnetic low-voltage (MLV)
Phase Cut (Reverse Phase)	Modification, or cutting, of the trailing edge of the AC mains sinusoidal waveform to produce varying light output.	Phase-cut, reverse phase, trailing edge, electronic low-voltage (ELV)
DALI	Digital Addressable Lighting Interface Protocol, a wired digital communication protocol registered by the DALI alliance.	DALI
DALI2		DALI2, DALI-2
Power Over Ethernet	Power over Ethernet (PoE) products are a specific subset of DC products that comply with the IEEE 802.3 standards for carrying both power and communication signals on Ethernet cables.	Power Over Ethernet, PoE
Ethernet TCP/IP	Wired networking technology defined by IEEE 802.3 standards.	Ethernet
Ethernet Proprietary	Other wired communication protocol as specified by the manufacturer.	
Other Wired	Other wired communication protocol as specified by the manufacturer.	N/A

New

Version 3.0 – Controllability

Wireless Dimming and Control Method Designations to the Product

Modified

Control Type	Definition	Acceptable Terms
Zigbee 3.0	Wireless digital communication protocol developed by the Connectivity Standards Alliance.	Zigbee 3.0, ZB3
Zigbee – Manufacturer Specific		ZigBee
Bluetooth Sig MESH and MMDL Layers	Wireless digital communication protocol developed and maintained by the Bluetooth Special Interest Group (SIG). Product listing with both MESH and MMDL layers in Advanced Search at https://launchstudio.bluetooth.com/Listings/Search	Bluetooth SIG MESH
Bluetooth	Any Bluetooth not described above.	Bluetooth
Wi-Fi	Wireless networking protocol based on IEEE 802.11.	Wi-Fi, WIFI, IEEE 802.11, Wi-Fi Certified
EnOcean	Wireless digital communication protocol developed by EnOcean.	EnOcean
Other Wireless	Other wireless communication protocol as specified by the manufacturer.	N/A

Version 3.0 – Controllability

Connector / Transmission Hardware

Connector / Transmission Hardware		Acceptable Terms
Wired	**RJ-11**	RJ-11, RJ11
	RJ-12	RJ-12, RJ12
	RJ-45	RJ-45, RJ45
	USB	USB
	Flying Leads	Flying Leads
	Terminal Block	Terminal Block
	Other Wired	N/A
Wireless Radio		Any of the acceptable terms from the Wireless section of the previous table

New

Version 3.0 – Controllability

Control Capabilities

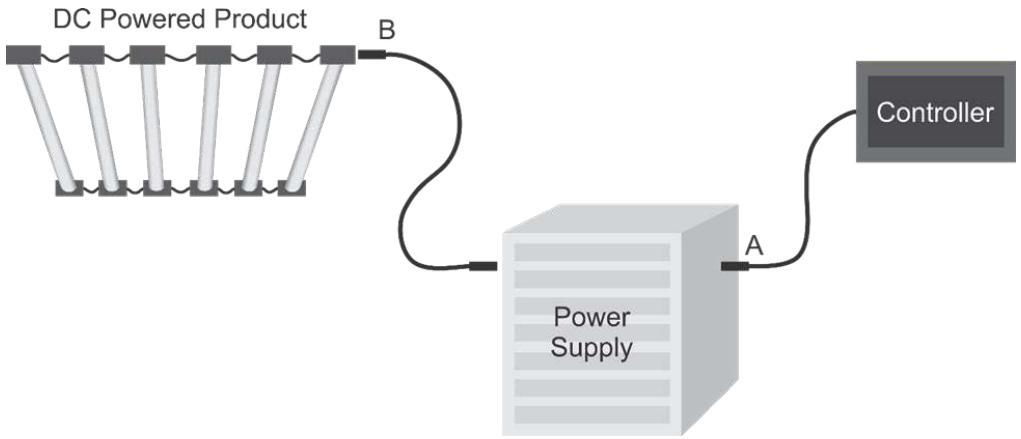
- All capabilities from this table that apply to the product must be reported
- Must be stated on specification sheet or supplemental material
- If none are applicable, this field may be left blank

Control Capabilities	Definition	Acceptable Terms
Dim to Off	The ability for a product to be turned on or off via a dimming control signal.	Dim to off, Dimming: 0%-100%
High End Trim	The capability to set the maximum light output to a less-than-maximum state of an individual luminaire/lamp at the time of installation or commissioning. High-end trim must be field reconfigurable.	High-End Trim, Task Tuning, Tuning
Energy Monitoring	The capability of a system to report the energy consumption of a luminaire/lamp.	Power/Energy Monitoring, Power/Energy Metering, Power/Energy Measurement Power/Energy Reading
Manual Dimming	A knob or other control device integrated into the fixture used for manual dimming.	Manual Dimming, Knob Dimming, Dimming Knob, Fixture Integrated Dimming

Version 3.0 – Controllability

Special Considerations for DC Products and Lamps

- All DC powered products and lamps must be dimmable
- For DC products with a specified power source, “Dimming and Control Method” refers to communication to the power source (point A)
- For DC products without a specified power source, “Dimming and Control Method” refers to communication to the product (point B)



- For lamps where the dimming or control method depends on the ballast, this field may be left blank

Version 3.0 – Controllability

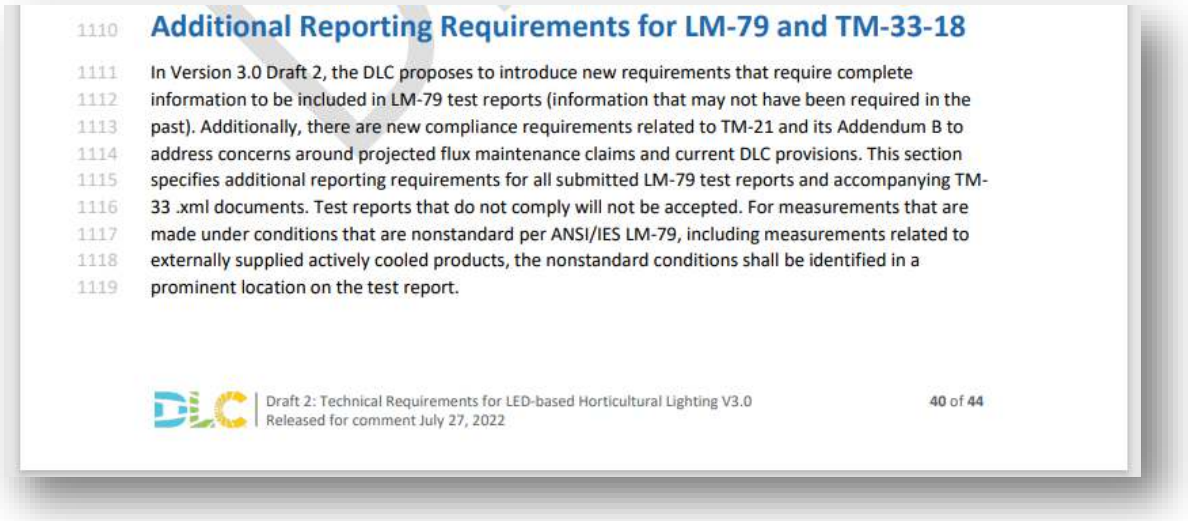
Key Questions for Controllability Requirements Section

1. Draft 2 proposes that all products qualified under V3.0 with a PPF greater than or equal to 350 µmol × s^{-1} and all DC-powered products shall be dimmable, and for AC products with PPF less than 350 µmol × s^{-1}, dimmability shall remain a reported attribute. Is it reasonable to set a requirement for dimmability based on PPF? If so, is 350 µmol × s^{-1} a reasonable threshold?
2. The DLC is also considering alternatives to the PPF threshold for dimmability discussed in question 1. Would either of the following options be preferrable? Why or why not?
    a. A wattage threshold at 150 W rather than a PPF threshold.
    b. Setting a dimmability requirement based on reported application information. For example, dimmability might be required for sole-source but not supplemental products.
3. New Dimming and Control Methods were added to Table 4 to capture the dimming and control method designations that are prominent in horticultural lighting products. Are the options provided sufficient and represented accurately?
4. Is individual addressability (i.e., the ability for each luminaire to be dimmed to a unique level using input from a single controller) a significant distinguishing feature for horticultural luminaires? If so, should the DLC support this distinction by separating Dimming and Control Method Designations in **Table 4** based on whether they support individual addressability?

Answer Key Questions and submit comments to: comments@designlights.org

Additional Reporting Requirements

Version 3.0 – Reporting Requirements



1110 **Additional Reporting Requirements for LM-79 and TM-33-18**

1111 In Version 3.0 Draft 2, the DLC proposes to introduce new requirements that require complete
1112 information to be included in LM-79 test reports (information that may not have been required in the
1113 past). Additionally, there are new compliance requirements related to TM-21 and its Addendum B to
1114 address concerns around projected flux maintenance claims and current DLC provisions. This section
1115 specifies additional reporting requirements for all submitted LM-79 test reports and accompanying TM-
1116 33 .xml documents. Test reports that do not comply will not be accepted. For measurements that are
1117 made under conditions that are nonstandard per ANSI/IES LM-79, including measurements related to
1118 externally supplied actively cooled products, the nonstandard conditions shall be identified in a
1119 prominent location on the test report.

V3 Draft 2 proposes reporting requirements for all submitted LM-79 test reports

Version 3.0 – Reporting Requirements

Only LM-79-19 version test reports will be accepted for new applications or update applications requiring a new LM-79 test report

All Tests shall be conducted at full output and test reports shall be in .pdf format including at least the following information:

Electrical Characteristics (Wattage, Input Voltage, THD, and PF)

PPF and/or PPID

Accompanying TM-33 document

Test reports containing only a partial set of LM-79 metrics will not be accepted

Version 3.0 – Reporting Requirements

No Key Questions on this topic.

If you have comments, concerns, suggestion, or general feedback on the proposal, please submit comments using the comment form to:

comments@designlights.org

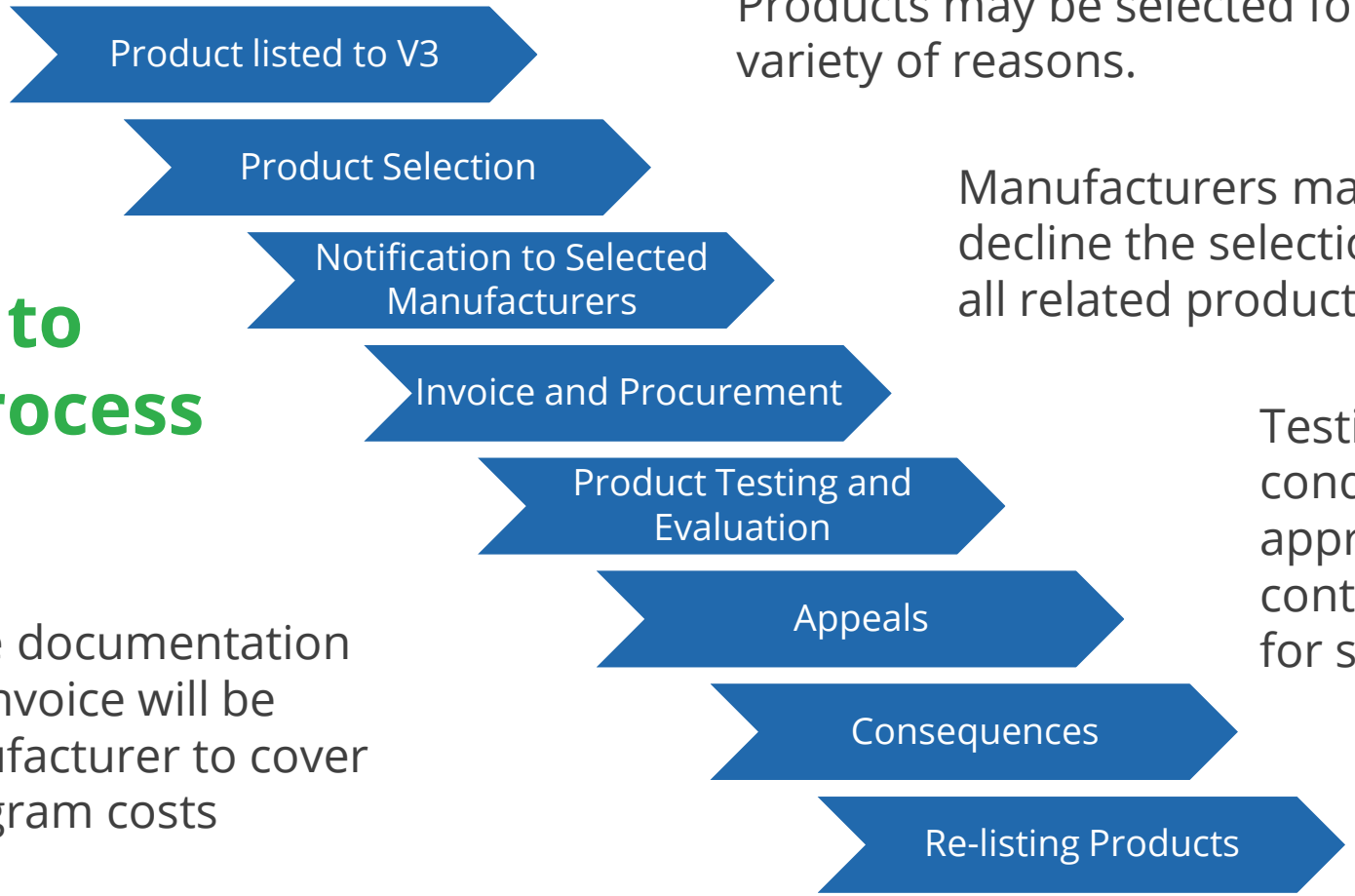
Surveillance Testing

Surveillance Testing

Objective

Protect the integrity and value of the Hort QPL for all stakeholders by actively monitoring the validity of data and other information submitted to the DLC Hort QPL

Surveillance Testing Process



Products may be selected for a variety of reasons.

Manufacturers may accept or decline the selection. If declined, all related products to be delisted.

Testing will be conducted only by pre-approved labs contracted by the DLC for surveillance testing.

No changes to proposed process

Once acceptance documentation is complete, an invoice will be sent to the manufacturer to cover surveillance program costs

Surveillance Testing Product Evaluation

Table 1 used to verify product meets the TR

Table 1: Verifying the Product Meets the Technical Requirements

Metric	Requirement(s)	Tolerance
PPE	>2.3	-5%
Power Factor	> .9	-3%
THD	< 20%	+5%

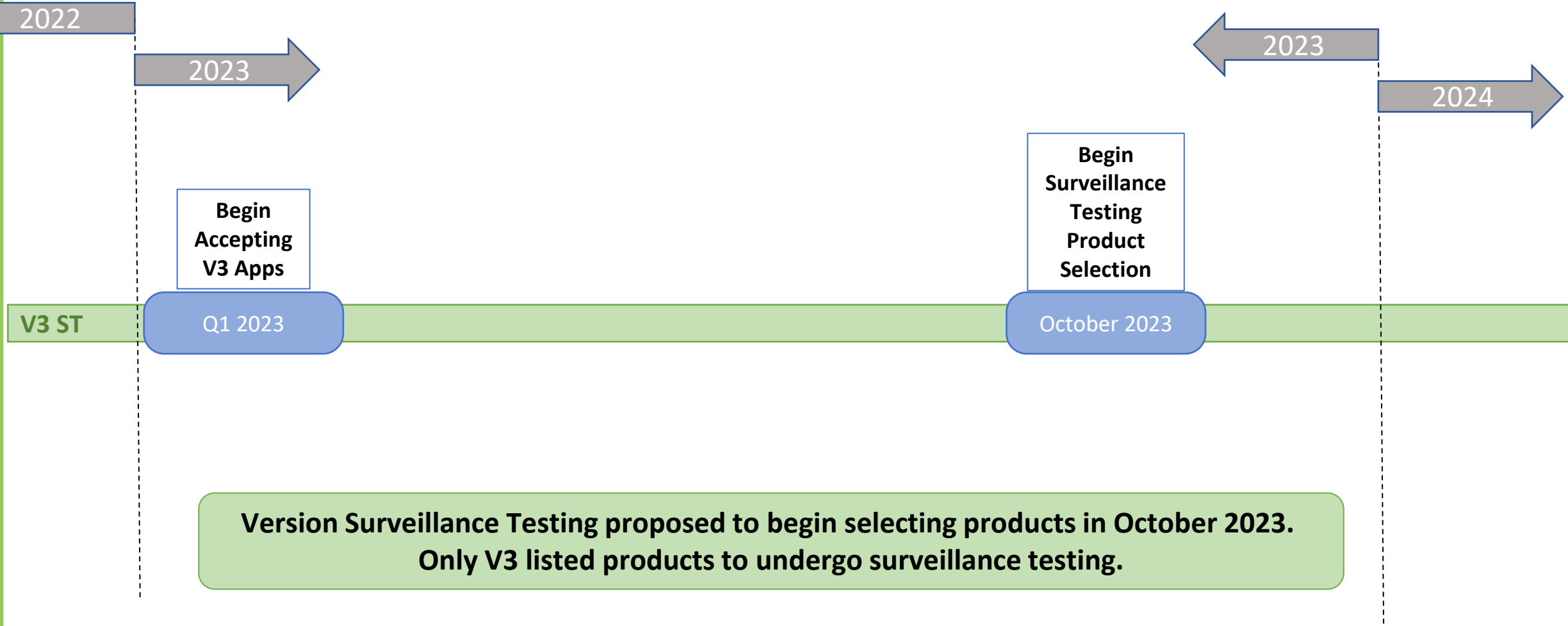
Table 2 ensures product lists accurate information on the QPL

Table 2: Verifying Accuracy of QPL Product Data

Metric	Tolerance
PPF Output	±10%
System Wattage	±12.7%
PPID	±10% zonal PPF (0-30, 0-60, and 0-90)
Spectral output	±10% within all 100nm buckets (400-500nm, 500-600nm, and 600-700nm)
Beam Angle (linear replacement lamps and 2G11 lamps only)	-5°

Table 1 & Table 2 reorganized and updated

Surveillance Testing Proposed Timeline



Version Surveillance Testing proposed to begin selecting products in October 2023. Only V3 listed products to undergo surveillance testing.

Surveillance Testing: Key Questions

Key Questions for Draft 2 Surveillance Testing Policy, Horticultural Lighting Version 3.0

Version 3.0 Draft 2 proposes surveillance testing policy requirements to actively monitor the validity of data and other information for Hort QPL listed products to protect the integrity and value of the QPL for all stakeholders.

1. How do tolerances proposed in Table 2 compare to what performance differences may occur when testing a single product at two different accredited testing labs and/or performance variations within a given product?
2. The DLC has proposed Zonal PPF and Spectral tolerances in Table 2 to help ensure consistent performance between originally qualified products and products that undergo surveillance testing after being qualified to the QPL. What concerns or considerations do you have for the Zonal PPF ranges and wavelength bands being proposed for evaluation? Are they too broad/narrow?
3. Should manufacturers have the option to replace a selected products within a family with other products from the same family for surveillance testing?
4. What additional considerations should the DLC be aware of when determining how to actively monitor the validity of data and other information for listed products?

Answer Key Questions and submit comments to:
comments@designlights.org

V3.0 Recap

Hort Version 3.0

- Version 3.0 is a major revision that proposes the following key updates
  - Increased Efficacy Threshold
  - Introduction of
    - Application (Intended Product Use) Information requirements
    - Controllability requirements (at the product-level)
    - LM-79 and TM-33 reporting requirements
    - Surveillance Testing

Question and Answers

Next Steps

- Hort V3.0
  - Six-week comment period, comments due 9/7
  - DLC will digest comments and revise draft as appropriate
  - Final Requirements expected in November 2022, effective Q1 2023

Thank you!

Comments are due **September 7**!

Send completed comment forms to:

comments@designlights.org

	Comment Form Instructions
Document:	**Technical Requirements for Horticultural Lighting V3.0**
Version:	Draft 2 of Hort V3.0
Comments Due:	Close of business, Wednesday, September 7, 2022
Instructions and Background:	**Please follow these steps to ensure your comments are received and considered by the DLC:** 1. Enter your Organization, Name, Email Address, and Phone Number in Row 8 of this worksheet. 2. There are three (3) new sections included in this release: Application Information Requirements, Controllability Requirements, and the Surveillance Testing Policy. Navigate to the tab at the bottom of this worksheet corresponding to the section of the Hort V3.0 draft on which you'd like to comment. Comments to Hort V3.0 that are not related to a specific section or topic may be added at the "General Comments" tab. 3. After your review of the draft documents, please consider each Key Question in Columns B, C, and D and submit your answer in Column D and potential solutions in Column E. Comments to the Technical Requirements that are not related to a specific Key Question may be added to the remainder of each worksheet. Please enter the line number of the draft corresponding to your comment into Column B starting on Row 16. 4. Save this Excel file with your comments and include your organization name appended to the end of the filename (for example: "DLC_Hort-V3.0Draft1_CommentForm_AcmeLightingCo"). 5. Email the file to **comments@designlights.org** by close of business, **Thursday, May 12, 2022.**

Reviewer Organization	Reviewer Name	Reviewer Email Address	Reviewer Phone #

Questions about applications and general inquiries should be sent to:

horticulture@designlights.org