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**MAG Dark Sky Workshop
Draft Notes
July 6, 2010**

Dennis Smith, MAG Executive Director, welcomed the group to the MAG Dark Sky Workshop and thanked them for working on this very important planning issue.

Introductions were made.

Heidi Bickart gave a presentation to kick off the Dark Sky Workshop.

Heidi Bickart stated that the purpose of the Dark Sky workshop is to gather comments from external stakeholders on the draft Pattern Outdoor Lighting Code (POLC). This document was emailed to all stakeholders 2 weeks prior to the workshop and has been made available on the MAG web site. The Dark Sky Stakeholders Group (DSSG) defined external stakeholders as: developers, the Arizona Sign Association, lighting designers, architects, biologists, environmentalists, crime professionals, car dealers, police departments, marketing professionals, and anyone else with an interest in promoting dark skies.

The DSSG, with the help of friends in the astronomy community, carefully created and facilitated the review of the POLC. Cities and towns requested that MAG invite external stakeholders to provide input on the draft code so that when they present it to their city/town council and they can say that input from these stakeholders has been provided.

Heidi Bickart explained that MAG serves as the regional agency for the metro Phoenix area. When MAG was formed in 1967, the elected officials recognized the need for long-range planning on a regional scale. They realized that many issues such as transportation, air quality and homelessness for example, transcend city boundaries.

Heidi Bickart noted that at MAG, the decision making body is the Regional Council. This Council is comprised of the highest elected officials from all of our member agencies. Management Committee is comprised of city and town managers and they provide input to the Regional Council. MAG technical committees and stakeholder groups feed into the Management Committee. It was the Regional Council that wanted MAG to form a Dark Sky Stakeholders Group. It was the Management Committee that asked staff from cities and towns to attend this group.

Heidi Bickart provided background on the Dark Sky initiative.

In the summer of 2008 the MAG Executive Director was approached by a member of the International Dark Sky Association (IDA) with a request to make a presentation to all MAG member agencies on the growing outdoor light pollution in our region. The IDA saw MAG as an efficient way to reach many jurisdictions. They offered staff from the astronomy community to help MAG form a stakeholders group and create a Pattern Outdoor Lighting Code (POLC).

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In August 2008, several members of the astronomy community attended the MAG Planners Stakeholders Group (PSG) meeting to discuss outdoor light pollution. The PSG is comprised of senior planners and planning managers.

In October of that year, Dr. Buell Januzzi, Director of the Kitt Peak Observatory, provided a report to the MAG Management Committee about issues related to outdoor light pollution in Maricopa County. He explained that outdoor light pollution creates a significant waste of electricity and money, and degrades the visibility of our night skies. This affects the world-class observatories located in the state. During the presentation, the counties, municipalities and Native American Indian communities were invited to consider revisiting the adequacy and enforcement of their respective lighting ordinances.

In December 2008, Dr. Januzzi gave the same presentation to the MAG Regional Council.

In January 2009, the MAG Management Committee approved convening a Dark Sky Stakeholders Group (DSSG). Jurisdictional managers were encouraged to send staff.

Heidi Bickart said that the purpose of this Stakeholders Group was to collect information on outdoor light pollution, review best practices in lighting codes, and to develop a draft Pattern Outdoor Lighting Code.

She said the MAG DSSG held several meetings since being established in March 2009 and has fulfilled its goal. It has created and facilitated the review of a POLC based on best practices and guidelines.

Heidi Bickart thanked astronomer Chris Luginbuhl for providing a POLC as a place to start. She said that Dan Brocius and Elizabeth Alvarez were instrumental in providing information and education on lighting codes, their benefits, and explaining what works and does not work when implementing a code.

Dan Brocius, Public Affairs Specialist with the Smithsonian Institution Whipple Observatory, gave a presentation on outdoor lighting codes. He reviewed the importance of dark sky to the astronomy industry in Arizona. He said the astronomy industry has a great economic impact to this region. He noted how important it is to point light down, not up where it is not needed. He said Pinal County is updating their Outdoor Lighting Code but it may not be as easy to implement as the MAG POLC. He said the International Energy Conservation Code (IECC) and local lighting ordinances may merge in the future.

Chris Luginbuhl, US Naval Observatory Flagstaff Station, gave a presentation on the POLC. He said there is a huge gain to be had with implementing proper lighting codes. This code is telling people what not to do with light. Control light principally through shielding -- by providing fully shielded lights. This is a strong advantage for the practical effectiveness of a code. The color of the lamp is also how light is controlled.

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Astronomers prefer a yellow light and the POLC encourages the use of yellow lighting. Using the lumens per acre approach is the simplest metric that has proven to be effective for limiting the amount of light. It is also important to recognize the lighting impact from signs at night.

Chris Luginbuhl suggested that digital billboards are presenting a problem for dark sky. The maximum brightness setting for digital billboards should be the same as conventional billboards, to avoid having a billboard sign that is too bright.

City of Mesa is looking into using LED and induction lighting for private and public spaces and asked how they fit into the POLCs standards for color. Chris Luginbuhl responded that there are different kinds of light addressed in the code and LEDs will be addressed more explicitly in the POLC. He said that induction lighting is like a fluorescent light.

Walt Laramie, Salt River Project (SRP), said he interprets the POLC to not allow white light LED. Chris Luginbuhl stated that in the POLC, white lighting, including white LEDs, is restricted to uses where white lighting is needed. Mr. Laramie said the POLC does not state that LED is not allowed for street or area lighting. Chris Luginbuhl responded that the POLC is written so that you would first determine class of lighting and then you would determine what type of lighting is useful for that class of lighting. Since LED or induction lamps are not listed for "Class 2" lighting, they are not allowed for that kind of application. LED or induction could be used for other applications like auto displays and entry ways. However, since work was begun on the POLC, LED technology and our understanding of its impact has changed considerably, and we expect to add an allowance for LEDs for class 2 lighting.

Walt Laramie noted that the POLC states that all luminaires should be full cut-off and later in the document it states that a luminaire within 50 feet of a house has to have a house side shield. He said once you attach the house side shield to the back of the luminaire it is now directing the light upward. He suggested the lit up portion of shield be flat and black.

Gordon Sheffield, City of Mesa, asked for clarification about the POLC addressing public roadway lighting. Chris Luginbuhl replied that the appropriate method to address streetlighting would be jurisdiction specific. It would be a mistake to not apply good lighting principles to all public roadway lighting.

Dan Heim, Desert Foothills Astronomy Club, said even though corporate logos are trademarked and business may not be keen about changing colors of their logo, he reminded that McDonalds changed their logo to green in Sedona.

Dan Heim said Federal Highway Administration (FHWA) termed the digital signs, Changeable Electronic Variable Message Sign (CEVMS). FHWA is currently investigating accidents caused by CEVMS and results from that study should be available by end of summer.

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Dan Heim said that recently a CEVMS was installed at the outlet mall in Anthem and it is the brightest light he can see from his home 5 miles north of outlet mall. He said he cannot read the sign until he is half a mile away from it. He thinks the brightness is excessive if he can see it from 5 miles away. CEVMS cannot be shielded. He suggests CEVMS be ramped down automatically at sunset. He thanked MAG for stating in the POLC that night luminance goes to 100nits.

Stacey Bridge-Denzak, City of Avondale, said at the Avondale Environmental Affairs meeting they asked about enforceability of the POLC and how to measure if a project was in conformance with the lighting code. Chris Luginbuhl replied there will be a second document detailing the rationale behind certain concepts in the POLC and guidance on how to effectively implement it.

Dan Heim asked if a lighting inspector would be used to enforce the POLC. Chris Luginbuhl said that is a decision to be made by each jurisdiction.

Mike Sills Trausch suggested that house side shields have a black plain finish. He said Glendale has been approached by sales people about LED lights. He suggested adding a future lighting technology component to POLC.

James Carpentier, representative for the Arizona Sign Association, said that Maricopa County has adopted 300 nits for night time setting for the lights on their signs.

City of Mesa asked why the POLC only has two lighting zones instead of 4 lighting zones as used by the Illuminating Engineering Society of North America (IESNA). Chris Luginbuhl replied that for simplicity there are only two lighting zones in the POLC. Two lighting zones can address 90 percent of all cases.

Mesa said they may have a need to create a third lighting zone for a remote residential area that is very sensitive to light. Chris Luginbuhl replied the POLC has a lighting zone for residential and it includes rural areas and urban centers where people sleep at night.

Rolf Jansen, Arizona State University, said LED is in principal, a switchable device and if it is an electronic device it should be operable in a non-continuous mode so brightness can be turned down to any needed level. Neon lights are either on or off. Operating LEDs as a continuous current device is not necessary. The manufacturer creates different settings for LEDs.

ASU astronomers have been identified as a local resource for MAG member agencies.

Apache Junction, Gilbert, Tempe and Peoria did not have any comments.

Heidi Bickart said that pending consideration and approval by the MAG Regional Council of the POLC, MAG member agencies may choose to adopt the POLC in its entirety or portions therein. Each MAG member jurisdiction may choose what is best for

them with regards to implementing the POLC. It is important to note that MAG member agencies are under no obligation to adopt any portion of the POLC. Additionally, MAG has no enforcement authority of the POLC. Having said that, the county, municipalities and Native American Indian communities are encouraged to consider revisiting the adequacy and enforcement of their respective lighting ordinances in an effort to provide quality lighting to improve visibility, save energy, and protect dark skies.

Heidi Bickart thanked everyone for attending and providing input. She provided the URL for today's workshop materials.

James Carpentier, on behalf of the Arizona Sign Association, provided the following written comments.

Arizona Sign Association (ASA) deletions are in ~~strikeout red~~.

ASA additions are in underline red.

ASA comments are in italics bold.

Section 5. Outdoor Advertising Signs.

5.2. Internally Illuminated Sign, Neon Sign, ~~Multicolor Fixed-Copy LED Sign~~ and ~~Single-Color LED Sign Standards~~.

- A. Outdoor internally illuminated signs ~~must~~ are recommended to either be constructed with an opaque background and translucent text and symbols, or with a colored background and generally LIGHTER text and symbols (Figure 5.2.A), except for registered trademarks. Lamps used for internal illumination of internally illuminated signs shall not be counted toward the lumen caps in Section 4.2.

ASA recommends that the color of the background and text not be regulated. This will be detrimental to effective, viewable and safe design. In addition the administration of the code as proposed would be subjective and difficult due to the vast variations in color.

Registered trademarks need to be exempt from recommended colors since it has been established that jurisdictions have limited authority in these circumstances.

RESPONSE: The suggested regulation of background color has been found advisable due to the large impacts on light output and potential glare. To decrease subjectivity, specific text concerning background color has been added. Registered logos are already exempted. CHANGE PARTIALLY ACCEPTED.

B. Neon signs, ~~multicolor fixed-copy LED Signs and single-color LED signs, electronic message displays~~ (Figure 5.2.B) shall be treated as internally illuminated signs for the purposes of this Code, and shall not have their luminous outputs counted toward the lumen caps in Section 4.2. ~~Any lighting extending beyond the area considered to be the sign area (as defined in the Sign Code of this jurisdiction) shall conform to all provisions~~

~~of this Code. In particular, such lighting shall be treated as Class 3 lighting (decorative) and shall conform to the lumen caps of Section 4.~~

We believe that this section is not clear and would be difficult to administer as drafted. Each jurisdiction has a methodology to measure sign area. Signs due to the typically custom nature are not easy or practical to measure lumens output. Each sign is different based upon the method of construction and materials. A light fixture that is designed and built by a manufacturer can be easily measured for the lumen output due to the same method of manufacturing for all of the same fixtures.

RESPONSE: The intent of the text referring to sign area is to be certain that any decorative elements extending beyond the sign be regulated by decorative (Class 3) standards. There is no requirement to measure lumen output of signage. NO CHANGE MADE.

5.3. ~~Multicolor Changeable Copy LED Sign Electronic Message Displays~~ Standards. Lighting for ~~multicolor changeable copy LED electronic message displays signs~~ must meet the following:

~~A. [ALTERNATIVE A] Multicolor changeable copy LED signs are not permitted.~~

[ALTERNATIVE B] ~~Multicolor changeable copy LED signs~~ Electronic Message Displays must be adjusted to prevent overly bright luminance at night: ~~electronic message displays shall include photocell technology to control and vary the intensity of lighting depending on the amount of ambient light that is present automatic controls must dusk to dawn limit night luminance to a maximum of shall not exceed 100 300~~ nits when the display is set to show maximum brightness white (100% full white mode). The applicant shall provide a written certification from the sign manufacturer that the nighttime light intensity has been factory pre-set not to exceed this level, and that this setting is protected from end-user modification by password-protected software or other method as deemed appropriate by the Planning Director.

It has been established and adopted or proposed by many jurisdictions (including Phoenix and Maricopa County) to utilize 300 nits as a reasonable and effective illumination level for electronic message displays. (This recommendation is also in line with the billboard industry standard for night time illumination levels).

All references to electronic message displays should follow industry standards and be general in nature and applicable to all electronic message displays. See the definition recommendations section below.

RESPONSE: 1) While we recognize that 300 nits has been proposed in many and adopted by a few Arizona jurisdictions, we believe this number is too high and stand by the 100 nit proposal in the POLC. It is based on the typical maximum brightness seen in current (floodlit) billboards, which has been judged acceptable by communities and the sign industry for many decades. 2) The proposed terminology appears too broad, and would include changeable displays

that do not involve lighting, such as rotating billboard panels. NO CHANGE MADE.

5.4. Curfews. Illumination for all on-site advertising signs except billboards, are applicable to both externally illuminated signs only and internally illuminated, shall be turned off at the curfew times listed in Table 5.4 or when the business closes, whichever is later. Signs subject to curfews are required to have functioning and properly adjusted automatic shut-off timers. ~~Light background (white, off white, light gray, cream or yellow) internally illuminated signs, installed legally before enactment of this code [enter date], may continue to be used and illuminated but must conform to the curfews as indicated.~~

ASA believes that to place a curfew on all signs including internally illuminated is not reasonable. This will impact the economic success of businesses since many businesses rely on signage since it is the most cost effective form of advertising as indicated by Small Business Association, see this link:

http://www.sba.gov/smallbusinessplanner/manage/marketandprice/SERV_MARKETINGFAQS.html

RESPONSE: While signs are certainly an effective form of advertising, the proposed standards to turn off signs when the businesses are closed or late at night will save considerable amounts of energy and cost for the businesses, and have minor impact on advertising effectiveness.

NO CHANGE MADE.

16.28. Nit. ~~The standard unit used to measure the brightness of a surface, such as of a sign. A unit of luminous intensity equal to one candela per square meter.~~

RESPONSE: This proposed definition is technically correct, but creates the necessity of defining more terms (luminous intensity; candela - which in turn introduces another term - steradian). This level of technical detail is unnecessary for the purposes of the POLC.

NO CHANGE MADE.

~~16.38. Sign, Multicolor Changeable Copy LED. A sign composed of LEDs of more than one color and programmable to allow changing displays.~~

~~16.39. Sign, Multicolor Fixed Copy LED. A sign composed of LEDs of more than one color with a fixed (not changeable or programmable) copy display.~~

~~16.42. Sign, Single Color LED. A sign composed of single color LEDs, including signs with fixed and changeable copy.~~

16.38. Electronic Message Display. – A sign capable of displaying words, symbols, figures or images that can be electronically or mechanically changed by remote or automatic means.

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An electronic message display needs to be defined by the general characteristics rather than the technology. This definition follows typical industry standards for a definition. In addition, this definition will cover any emerging technologies. This term should be utilized throughout the code.

RESPONSE: The POLC definitions address the specific technology only insofar as necessary to address lighting characteristics. The proposed new definition is too broad and includes technologies that change sign copy with no lighting impacts. NO CHANGE MADE.

Keith J. Krueger, Section Leader, Pinal County IDA provided the following written comments for consideration.

1. Somewhere in Sections 2 or 3, it would be a good idea to make reference to previous lighting codes that may be in effect prior to the adoption of the new code. Most jurisdictions already have some kind of light shielding requirement that is often sparsely enforced. Previous codes could be covered with a provision that looks something like this:

"Fixtures installed prior to the adoption of this code must comply with the shielding requirements of this code, or the shielding requirements of the previous code, whichever are less restrictive".

I don't think that those who have not been complying with current light codes should get a free pass through the adoption of new codes. Existing lighting should be grandfathered only to the extent that it meets the requirements of currently existing codes.

RESPONSE: Advice from MAG legal counsel is that previous (illegal) installations remain illegal, and will not receive a "free pass" through adoption of a new code. NO CHANGE MADE.

2. In section 4.1 regarding spot or flood lamps, it would be best to specify that such lamps cannot be visible from the street, or from any neighboring property, from a height of 5 feet from the ground at the property line (five feet protects the eyes of most adults from the light source). These kind of lights can be shielded and aimed to avoid light intrusion from these types of fixtures, but simply stating a 45 degree angle limit will not get the job done. This is the type of light trespass that generates the most complaints from neighbors, with good reason. To the average person light trespass is not light measured on the ground, it's light intruding on the eyes (please see point number 5).

RESPONSE: This is a difficult topic, and difficult to devise standards which are both understandable to the average user as well as practically enforceable. The goal is only to prevent obtrusive light trespass, not to completely prevent all trespass. The suggested text establishes a standard that is actually in many cases impossible to meet. Further, completely preventing visibility of such lamps usually will be unnecessary to prevent obtrusive light trespass if the lights are aimed to keep the

[high candlepower beam on the property, as the currently proposed text will do. NO CHANGE MADE.](#)

3. In section 4.3 It would be best to place some color temperature limits in the code. Simply listing lamp types makes this section prone to obsolescence, especially with LED and other types of lighting on the horizon. I would recommend a 3,000K limit for Class 2 lighting, which would allow for the use of HPS lighting. For Class 1 lighting, I would recommend a color temperature limit of 4200K, which would allow for the use of most Metal Halide lights. 4200K is the limit that Anchorage uses for its lighting.

[RESPONSE: This approach has been included, with the change to the cooler CCT limit being changed to 2200 K. CHANGE ACCEPTED.](#)

4. In sections 16.3 and 16.4 it would be good to state what the color temperature limits are for these types of lighting.

[RESPONSE: A definition for Correlated Color Temperature has been added to the definitions in Section 16. CCT standards are adequately implemented by the previous change \(see above\), and are not appropriate in the definition section. CHANGE PARTIALLY ACCEPTED.](#)

5. In section 16.18, I don't think that the definition of light trespass adequately encompasses what most people perceive to be light trespass, which is light impacting their vision. Another more encompassing definition might look something like this: "Light that has an impact across property boundaries, or on people not on the property containing the originating light source".

[RESPONSE: Advice from MAG legal counsel is to avoid standards involving subjective interpretation. The current definition of light trespass is not subjective, and in any case is not used in the POLC in such a way that the suggested change would have any substantive effect. NO CHANGE MADE.](#)