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# Williamsburg Field Site Evaluation Workgroup Report

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February 28, 2017

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## Section I. Introduction and Summary

### WFWG Charge

In September 2013, the Arlington County Board requested the County Manager initiate a Williamsburg Field Site Evaluation Work Group (WFWG) “to lead a robust community process to evaluate whether or not to light the Williamsburg synthetic fields.” (WFWG Charge, Appendix A).

“Included in that evaluation, although not limited to these topics, shall be whether the environmental, noise and light spillage impacts of, for the first time, lighting one or two fields at Williamsburg can be mitigated sufficiently to preserve the character of the neighborhood and provide a reasonable quality of life to the nearest neighbors – both those whose property abuts the Williamsburg property and those who live across N. 36th Street from the site.”

**Considerations.** The Charge also lays out the following areas of consideration for the Work Group:

- Impacts to programs and uses:
  - Impacts to current level of public services provided to County residents
  - Analysis and mitigation of impacts on the surrounding neighborhood
  - Opportunities to combine multiple priority programs and uses on the fields
  - Hours of operations
  - Compliance and enforcement of permitted use
- Site considerations:
  - Impacts to undisturbed natural areas
  - Compatible with neighborhood context and surroundings
  - Sufficient open/recreational space to support site uses and community needs
- Fiscal and Timing Considerations:
  - Added costs due to complicated construction, phasing, mitigation of impacts, and/or maintenance of existing county programs and uses
  - Ability to complete a project within the necessary timeframe

**Members.** The Board appointed the members listed below to the WFWG in July 2015. Two members resigned in summer of 2016 and were not replaced. Additionally, Gail Harrison, an adjoining homeowner, served as a de-facto alternate, sitting in for various WFWG members who could not make meetings, and thereby participated vigorously throughout the process.

**FIGURE 1: WORKGROUP MEMBERS**

<b>Name</b>	<b>Group Representing</b>
Erik Gutshall, Chair	Planning Commission
Steve Severn	Sports Commission
Bill Ross	Parks and Recreation Commission
John Seymour	E2C2
Ruth Shearer	Williamsburg Civic Association
Gregg Kurasz	Rock Spring Civic Association
David Friedman	Yorktown Civic Association
Larry Suiters	Resident whose property abuts the fields
Joe Delogu	Resident whose property abuts the fields
Roy Gamse	Resident whose property abuts the fields
Charles Trabandt	Resident whose property is across the street
Elizabeth Kirby	Resident whose property is across the street
Justin Wilt	Arlington Soccer Association
Susan Wallace	Arlington Women’s Soccer League
Eileen Raicht-Gray	Arlington Coed Kicks Soccer League
Maury Wray Bridges*	Discovery Elementary School PTA
Chris Munson*	

\*These members resigned from the WFWG and were not replaced.

### Musco's Proposal

**LED v. HID.** Musco Lighting (Musco), Arlington County’s sole-source athletic field lighting contractor, offers two source options to light the Williamsburg fields: HID (High Intensity Discharge) and LED (Lighting Emitting Diode). HID has been the primary source for sports lighting for several decades and is found throughout the County. LED is newer technology which has been installed in several sports courts in Arlington but not yet for athletic fields.

**Spill and Glare.** While both sources are suitable for the application of sports lighting, Musco recommends LED lighting for the Williamsburg fields over HID for its greater ability to control the negative impacts of lighting, namely spill and glare. *Spill*, measured in foot-candles, is the illumination of a surface beyond the intended target. *Glare*, which can be theoretically modeled in candelas, but not actually measured in the field, is the luminous intensity experienced when looking directly into a light. Given the proximity of neighboring homes to the fields, Musco determined that LED lights were the best choice to mitigate the potential impacts of light pollution off the WMS property.

**Heights.** Musco therefore provided three separate LED proposals with 80-foot, 70-foot and 68-foot pole heights. The height of the pole is also critical to mitigating light pollution, with taller mounting heights allowing the fixtures to be aimed more directly at the field, resulting in less spill and glare off the field. Lower heights require the fixtures be aimed more horizontally, creating more opportunity for the lights to spill off the property and increasing the direct viewing angles for the glare.

**Proposed Configuration.** Musco recommends the following installation specifications:

- 6 poles
- 80-foot height from average site elevation (ASE)
- Average illumination of 30 fc (foot-candles) on the field
- 5700K (Kelvin) color temperature – bluish white

In response to a query from the WFWG, Musco provided an alternative proposal for 4500K LED lights in January 2017, late in the process, and therefore, with insufficient opportunity for the WFWG to examine the implications of lower Kelvin LED lights.

### WFWG Process

**Consensus-seeking.** While the WFWG Chair sought to facilitate the process through a consensus-seeking model, from the outset representatives of the Williamsburg neighbors on the WFWG were unanimous in their opposition to lighting the fields. This opposition intensified as neighbors voiced frustration with their perceived inability to get direct answers to their questions from Musco. Further, the remaining representatives on the WFWG who were open to a process that could recommend lighting one or both fields constituted a clear minority of the WFWG. Nevertheless, in accordance with Arlington’s Participation Leadership and Civic Engagement (PLACE) Framework for Civic Relationships, the WFWG was able to proceed with its charge, operating largely with consensus and always with good humor and mutual respect. However, this final report presents two distinctly different recommendations for the County Board – one *Open to Lighting* (Section II) and one *Opposed to Lighting* (Section III).

**Meetings.** The WFWG met from August 2015 through April 2016 in the fact-finding phase, took a hiatus from April through August 2016 and then concluded its deliberation, presentation of results, and report writing from September 2016 through February 2017. In summary, the WFWG conducted:

- 17 WFWG Meetings
- 1 Meeting with WFWG Board Liaison
- 7 WFWG Subcommittee Meetings
- 2 Field Tours (One Arlington Lighted field tour and One Vienna Field Tour)
- 1 Onsite evening visit with Musco to take light readings
- 1 Site Tour of the Neighborhood
- 1 Community Open House
- 4 Commission Presentations (Long Range Planning Committee, Planning Commission, Parks & Rec Commission, Sports Commission)
- 1 County Board Work Session

**Fact Finding.** To date, the WFWG has documented over 100 questions and answers in a Fact-Finding Request Matrix (Appendix B). These items include a broad swath of nuanced, highly

technical, complex and often controversial topics related to the installation, operation and maintenance of athletic field lighting.

Often, every answer elicited yet more detailed questions probing to uncover the best available information on the subject. In fact, the need for information and the time required to obtain it prompted the WFWG to request an extension from the County Board in the time allotted to complete the charge. The Board granted the request, but even still, by September 2016, the WFWG had to move forward with admittedly imperfect information.

### Summary of Findings

The *Open to Lighting* and *Opposed to Lighting* Sections of this report not only draw different conclusions from the vast array of information collected in this process, but, not surprisingly, also place greater emphasis on the facts that support the recommendation being made. Below is an attempt to present an objective summary of the WFWG findings, indicating whether the finding is generally supported by all or a subset of the WFWG. Undoubtedly, this summary does not capture every detail presented in Sections II and III of this report, but hopefully helps to illustrate where there is consensus and the points of departure where there is not.

Topic	Open to Lighting	Opposed to Lighting
Neighborhood Character	Consensus: <ul style="list-style-type: none"> <li>• WMS is zoned S-3A; surrounding neighborhood R-10 and R-20 – No Commercial or Multi-family uses</li> <li>• Dark and quiet at night</li> <li>• Abundant wildlife in wooded setting</li> <li>• Already experienced increased intensity of use with Discovery ES addition, increased enrollment at WMS, and conversion to synthetic turf</li> </ul>	
	<ul style="list-style-type: none"> <li>• Hard to measure, not quantifiable, subjective</li> <li>• Not black and white: night field use is additive to other uses, not total silence.</li> </ul>	<ul style="list-style-type: none"> <li>• Clanton Report: effects cannot be mitigated to protect neighborhood character</li> <li>• Lighting inconsistent with national/ international standards for residential neighborhoods (e.g., Model Lighting Ordinance)</li> </ul>
<b>Lighting Design</b>		
Pole Height	Consensus: <ul style="list-style-type: none"> <li>• Zoning Administrator has determined that maximum height of light poles currently allowed in S-3A is 68'; proposed height of 80' would require a Zoning Ordinance Amendment (ZOA).</li> </ul>	
	<ul style="list-style-type: none"> <li>• ZOA is appropriate to achieve optimum lighting configuration</li> </ul>	<ul style="list-style-type: none"> <li>• Neighbors do not support ZOA as this height violates the</li> </ul>



Williamsburg Field Site Evaluation Workgroup (WFWG)  
Section I. Introduction and Summary

Topic	Open to Lighting	Opposed to Lighting
		purpose of S-3A zoning, which is “to encourage the retention of certain properties in a relatively natural state”
Spill and Glare	<ul style="list-style-type: none"> <li>• Musco would be under contractual obligation to achieve the design specifications of no spill at the property line</li> <li>• Health effects from glare are unlikely with proper lighting design</li> </ul>	<ul style="list-style-type: none"> <li>• Clanton: using Musco’s own calculations, glare will be 2-3 times national &amp; international standards</li> <li>• Compliance difficult to measure; relies on complaints from neighbors</li> <li>• “Eye-aching” glare experienced by WFWG members at Musco-LED-lighted Glyndon Park and reported by neighbors of Musco installation at Capital University in Bexley, Ohio.</li> </ul>
Color Temperature	<ul style="list-style-type: none"> <li>• 5700K yields the best energy efficiency and spill/glare control</li> <li>• Successful in many applications across the country</li> </ul>	<ul style="list-style-type: none"> <li>• Numerous potential adverse health and environmental effects from 5700K</li> </ul>
Foot-Candles	<ul style="list-style-type: none"> <li>• May be possible to dim the lights on all or part of the fields sometimes</li> </ul>	<ul style="list-style-type: none"> <li>• Musco says impact of dimming on spill and glare would be minimal</li> </ul>
Photometric Data	<ul style="list-style-type: none"> <li>• Musco cannot be compelled to release proprietary data</li> </ul>	<ul style="list-style-type: none"> <li>• Other lighting manufacturers provide data</li> <li>• Without data criteria compliance cannot be independently verified</li> </ul>
<b>Public Health</b>		
AMA Report	Consensus: <ul style="list-style-type: none"> <li>• 2016 AMA recommendation that street lights be limited to no higher than 3000K, warning that exposure to High-Kelvin LED lights is associated with reduced sleep time, nighttime awakenings, impaired daytime functioning and obesity.</li> </ul>	
	<ul style="list-style-type: none"> <li>• Research was on street lights, not athletic field lights</li> </ul>	<ul style="list-style-type: none"> <li>• Major contributors to the 2016 AMA report on LED lights, agree that 5700K should not be used on neighborhood athletic fields</li> </ul>
Effects of Blue Light	Consensus:	

Topic	Open to Lighting	Opposed to Lighting
	<ul style="list-style-type: none"> <li>This is an emerging area of research and as of yet there are no definitive studies or scientific consensus directly linking sports lighting to adverse health affects</li> </ul>	<ul style="list-style-type: none"> <li>Risk of glare and other health effects for users of the fields because pole locations do not meet USSF safety standards</li> <li>PHD report assumes that Musco will effectively control light spill and glare, which can't be verified</li> <li>Weight of scientific evidence is more than suggestive; serious concerns about precisely the kinds of lighting proposed</li> </ul>
<b>Adverse Impacts</b>		
Noise	Consensus: <ul style="list-style-type: none"> <li>DPR is exempt from noise ordinance</li> <li>Enforcement based on quantitative decibel readings not realistic</li> <li>Nuisance noise comes from both the field and parking lot</li> </ul>	
Traffic	Consensus: <ul style="list-style-type: none"> <li>DES traffic study calculates approx. 125 to 150 vehicle trips over 3-hour window of time</li> <li>While DES analysis determined no significant impact to road network, it does not analyze quality of life impacts</li> </ul>	<ul style="list-style-type: none"> <li>Mitigation not enforceable</li> <li>Extension of daytime noise levels into the evening is intrusive</li> </ul>
Environmental Impacts	Consensus: <ul style="list-style-type: none"> <li>Environmental Assessment (EA) is required by County before proceeding with installation</li> </ul>	

Williamsburg Field Site Evaluation Workgroup (WFWG)  
Section I. Introduction and Summary

Topic	Open to Lighting	Opposed to Lighting
	<ul style="list-style-type: none"> <li>EA will be heard by E2C2 after the WFWG has concluded</li> </ul>	
	<ul style="list-style-type: none"> <li>Plant more trees as mitigating buffer</li> </ul>	<ul style="list-style-type: none"> <li>Mature trees/canopy will need to be removed to install pole S3</li> <li>Wildlife habitat will be degraded by loss of canopy</li> <li>AMA: High Kelvin lights associated with adverse impacts on wildlife</li> </ul>
Field Utilization		
Model	Consensus: <ul style="list-style-type: none"> <li>Data on field utilization not straight-forward; depends on criteria used to query DPR database</li> <li>Gaps in data</li> <li>Developed model to allow for common platform to run different scenarios based on multiple criteria</li> </ul>	
	<ul style="list-style-type: none"> <li>Should consider person-hours gained not just field hours</li> </ul>	<ul style="list-style-type: none"> <li>Should include benefit to APS users</li> </ul>
Capacity	<ul style="list-style-type: none"> <li>Fundamental need for additional capacity on rectangular fields not part of WFWG charge</li> </ul>	<ul style="list-style-type: none"> <li>Additional capacity can be better added County-wide by converting more grass fields to synthetic turf, including grass fields already lit and/or construction of a new lighted field at Long Bridge Park.</li> </ul>
Mitigation		
Scheduling	Consensus: <ul style="list-style-type: none"> <li>Having lights on 7 days a week until 11pm not an option</li> </ul>	
	<ul style="list-style-type: none"> <li>curfews, days per week, youth v. adult, seasonal, staggered start times</li> </ul>	<ul style="list-style-type: none"> <li>Curfews can be altered by later decisions of County Manager or DPR.</li> <li>Mitigation cannot be successful where fields were not designed for lights to begin with</li> </ul>
Buffers	<ul style="list-style-type: none"> <li>Remove invasives, plant more trees per Rock Spring NC Plan</li> <li>Physical barriers like berms, fences, blinds</li> </ul>	<ul style="list-style-type: none"> <li>80' high lights too tall for barriers</li> <li>Many newly planted trees along western edge of WMS fields are</li> </ul>

Topic	Open to Lighting	Opposed to Lighting
		dead or dying. Those that survive will take many decades to provide effective screening. <ul style="list-style-type: none"> <li>• APS' efforts to remove invasive species threatening existing trees have failed.</li> </ul>
Lighting controls	<ul style="list-style-type: none"> <li>• Dimmers</li> <li>• Color Temp (CCT)</li> </ul>	<ul style="list-style-type: none"> <li>• Musco has stated that, while possible, these would have negligible to negative impacts on light spill, glare, cost and energy efficiency.</li> </ul>
Memorandum of Agreement (MOA)	<ul style="list-style-type: none"> <li>• Used successfully at Greenbrier</li> <li>• Includes standing committee with neighborhood reps</li> </ul>	<ul style="list-style-type: none"> <li>• Doesn't fundamentally address adverse impacts</li> </ul>

### Field Utilization Model

The WFWG developed an Excel spreadsheet Field Utilization Model to calculate the hours of field usage at WMS under natural grass, unlit synthetic turf, and lit turf scenarios. The model is based on DPR-provided FY13 data for grass fields and CY16 data for unlit turf. For lit turf, the model calculates the hours per field per year gained under scenarios with user-selected variables for:

- Season
- Utilization Factor – percentage of time a field will actually be scheduled out of the total time the field is theoretically available
- Curfew times
- Mean sunset
- Exit time – time field must remain lit to allow users to exit safely
- Time on before sunset to allow uninterrupted play.

The results of various selected scenarios are presented in Appendix C.

## Section II. Open to Lighting

### Introduction & Background

Very early in the Williamsburg Field Site Evaluation Workgroup (WFWG) process, it became clear that the working group was split into two sides – those “Opposed to Lights” and those “Open to Lights.” This section of the report looks at the issues from the Open to Lights standpoint.

This process is about seeking a balance between the needs and interests of the immediate community with those of the broader Arlington Community. Arlington-area sports group participants young and old are keen on accessing the new fields at Williamsburg during evening hours, whereas many of the neighbors of those fields feel that the additional levels of noise and lights and general activity will further degrade their quality of life and negatively impact their state of being, despite any and all possible mitigation measures that have been proposed so far.

In many ways this is a classic land use issue related to growth in Arlington. Should growth in the County adversely impact a given set of residents? Or, flipped around, should a small number of residents inhibit growth that benefits a far larger number of residents?

The Opposed to Lights group, comprised of immediate neighbors of the fields at Williamsburg, feel that their situation is different from others (for instance, Greenbrier Park), in that the proposed action installs lights at the fields where formerly none existed. (By contrast, Greenbrier Park had lights prior to the fairly recent park upgrade that upgraded & increased the lighting, moved and expanded fields, and general expanded uses at the park, and at that time brought the local community into the process.) However, at every field location in Arlington that currently has lights, this same process happened at some point in the past: lights were proposed, deliberations ensued, and eventually lights were installed. This is simply Williamsburg’s time to go through this process – just like many other fields in Arlington have in the past.

Working group members who are open to the prospect of lighting the fields at Williamsburg feel that, among other things, doing so benefits the community at large. This is supported by the statement “Every Park for Every Body,” a view recently expressed in another Arlington community planning process involving the Four Mile Run Valley. The essence is that every County facility belongs to Arlington, not just to the local community that may consider that facility as “theirs.”

From a high-level perspective involving Arlington sports user groups, the Arlington Sports Commission developed a position statement that acknowledges all of the different stakeholders involved and focuses on the interests of all County residents while also taking seriously the inputs of immediate neighbors for a given project:

The Sports Commission recognizes that any facility development or planning process in Arlington requires input from a variety of stakeholders. Many different parties claim interest in any given process, and typically there are several different outcomes possible in each process. The Sports Commission respectfully recognizes those varying opinions, and it also seeks to reinforce the notion that the entire Arlington community has primary “ownership” of public facilities. It is clear that the inputs of immediate neighbors (those physically close to the facility) need to be considered seriously. Those inputs may suggest the need for specific measures aimed at satisfying those immediately impacted by the facility. However, it is important not to lose sight of the needs and desires of the overall Arlington community, which merit strong consideration. Ideally all parties are in agreement, but when this is not the case, the Sports Commission believes that Arlington County facilities, and the planning processes that produce them, need to represent the interests of all County residents. – Arlington Sports Commission, Adopted 2016

In trying to work with the working group Charge that provides direction to the group, members sought to conduct “a robust community process to evaluate whether or not to light the Williamsburg synthetic fields” and...

Included in that evaluation, although not limited to these topics, shall be whether the environmental, noise and light spillage impacts of, for the first time, lighting one or two fields at Williamsburg can be mitigated sufficiently to preserve the character of the neighborhood and provide a reasonable quality of life to the nearest neighbors

In a nutshell, the discussion within the working group essentially started with a strongly stated opposition to lighting expressed by a large number of working group members (the immediate neighbors). Due to the composition of the working group, the group discussion as a whole has been tilted towards a “No lights” position from the outset. Members of the working group who are in the Open to Lights category understand the neighbors’ concerns and they appreciate the history that the community has dealt with in getting to this point in the process. The Open to Lights group seeks a broader discussion that does not start with “No lights,” and instead allows full and thorough consideration of the many options that, in some combination, might yield sufficient mitigation so that neighbors and County sports groups can co-exist during evening hours at Williamsburg. Even if a thorough discussion of all possibilities were to result in a finding that no combination of mitigation measures could effectively protect the neighbors from the activities on and around the fields, it is believed that County residents will be more fully satisfied that the WFWG has process worked and that, as a group, we have done our best to explore all options.

### Capacity Issues Are Crippling Youth Sports

So why would lights at Williamsburg be helpful? Simply put, all Arlington sports user groups are growing, while recreational facility development in Arlington is not keeping pace.

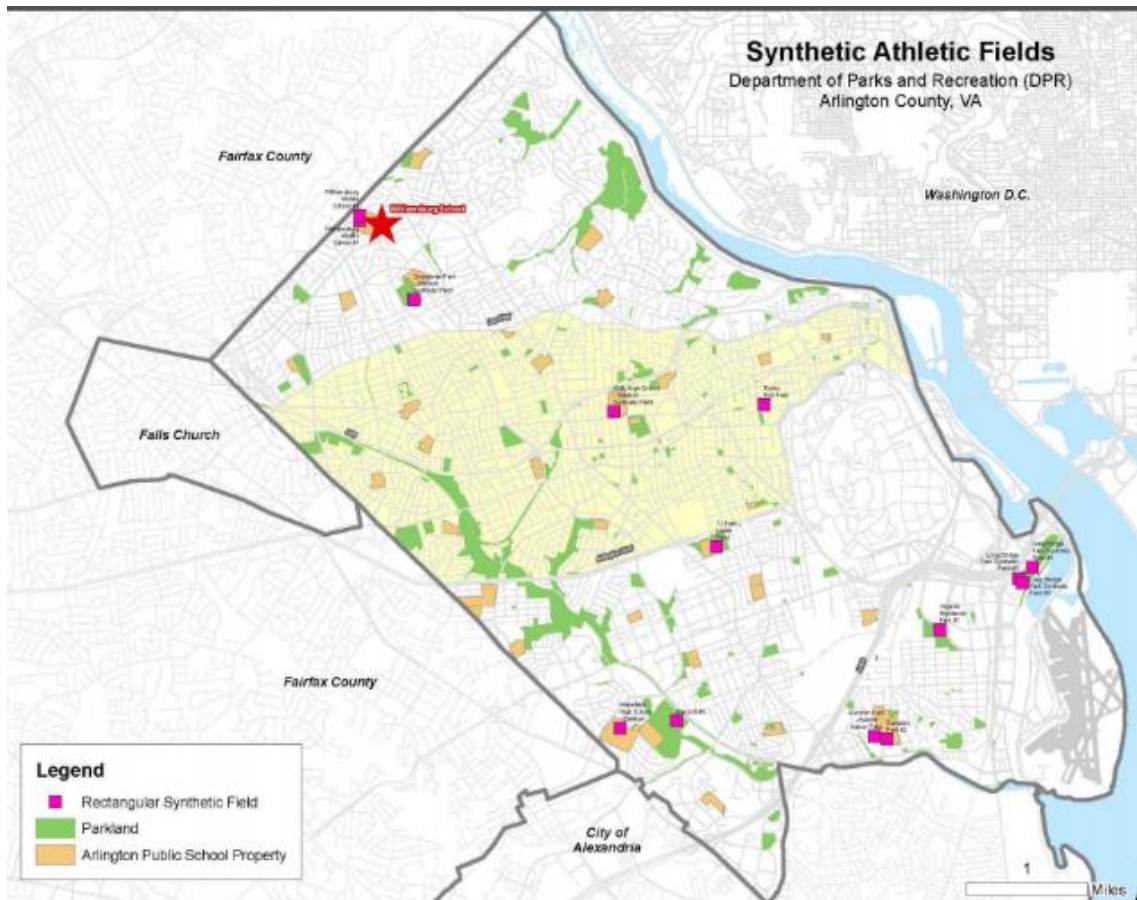
Unfortunately, there are some that suggest that more fields aren’t needed. The Opposed to Lights group references the “statistically valid survey results” that came from the 2016 POPS surveys supporting the County’s Public Spaces Master Plan process. In those results, sports fields were not seen

as the top need expressed by survey respondents (rectangular sports fields were typically ranked behind things like hiking trails and natural areas & wildlife habitats. However, reading the complete results of the POPS survey, combined with other evidence on actual facility usage and demand which has been revealed during the other fact-finding of the POPS process, shows a strong additional need for virtually all public space facilities, including rectangular fields, diamond fields, swimming pools, trails, natural resource areas, etc.

Preference rankings in a survey, while useful, do not translate to appropriate policy choices of one type of public space facility over another. The POPS results are not a fair indicator of the adequacy of field space in the County.

So let's look at rectangular sports fields in the County. As the Williamsburg process focuses on synthetic playing fields, let's examine where those fields exist in Arlington.

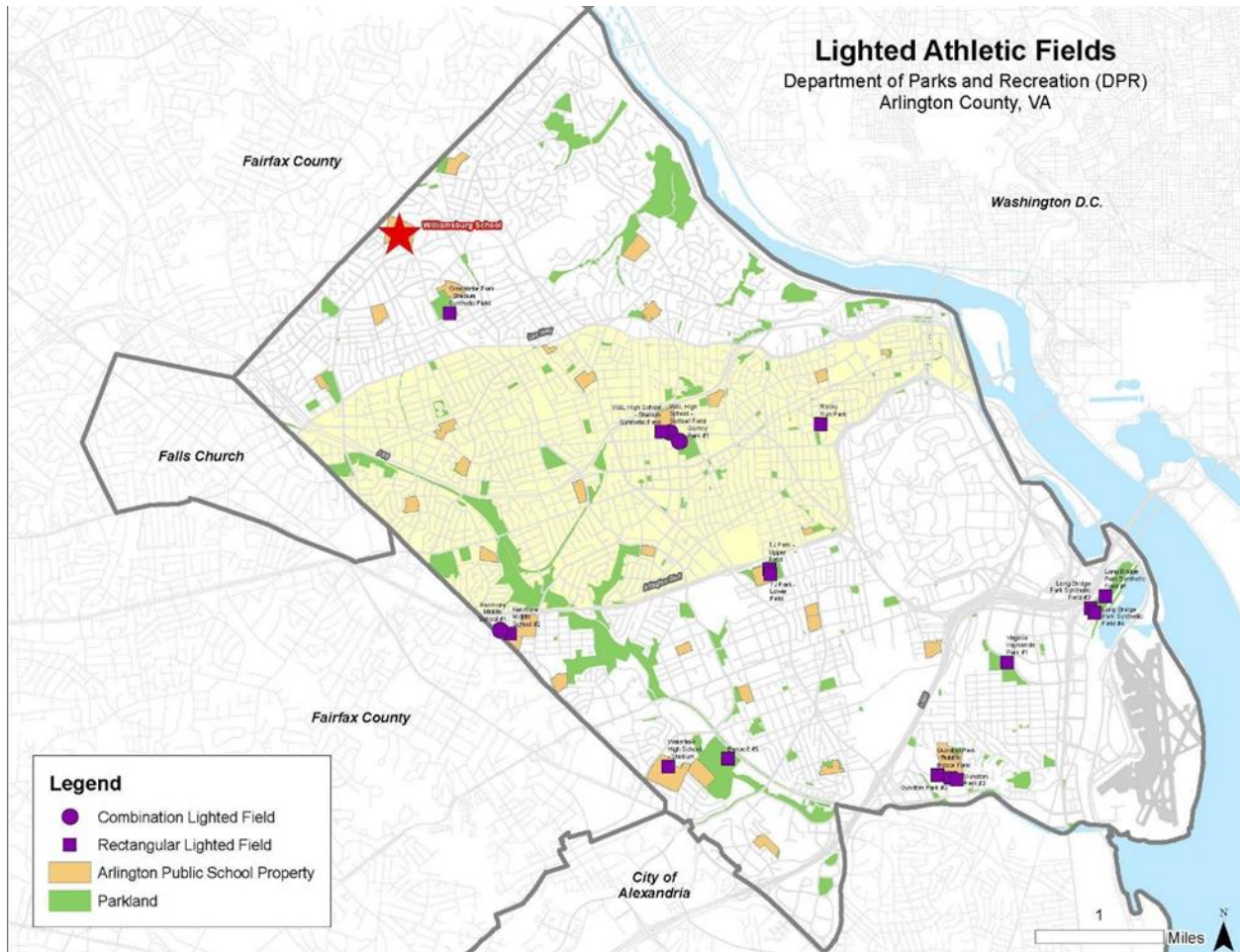
**FIGURE 2: SYNTHETIC FIELDS CHART**



As shown, the vast majority of Arlington's synthetic turf fields are in central and south Arlington. In the northern third of the County there are few synthetic facilities. As a side note, this seems true regarding all sorts of recreational facilities in Arlington; there are simply fewer of them in the northern third of the County.

As the WFWG process explores the possibility of lighting a synthetic field in Arlington, let's now look at where lighted synthetic rectangular fields exist. Almost all of the lighted rectangular fields are in central and south Arlington.





**FIGURE 3: LIGHTED FIELDS CHART**

To be specific, the northern third of Arlington has exactly one lighted rectangular field – Greenbrier Park. Lighting the Williamsburg fields alone would triple that inventory of such space in the northern tier of Arlington.

A key question to ask when siting any type of County facility is whether the facility is located close to the population that uses it. One of the metrics employed in the ongoing POPS process assesses facilities by their proximity to users. So does the existence of one lighted turf field in north Arlington correlate with the locations of user group populations? No, not in the least.

Here is one snapshot of the current inadequacy of facilities in the area: 25% of all Arlington Recreational soccer players – that’s about 1,500 kids - live within 1.5 miles of Williamsburg Middle School.... yet just a small fraction plays there. Instead, most spend time in traffic, driving to & from practices & games located elsewhere in the County. Wouldn’t it be nice to reduce some of that traffic and serve the local populations closer to home?

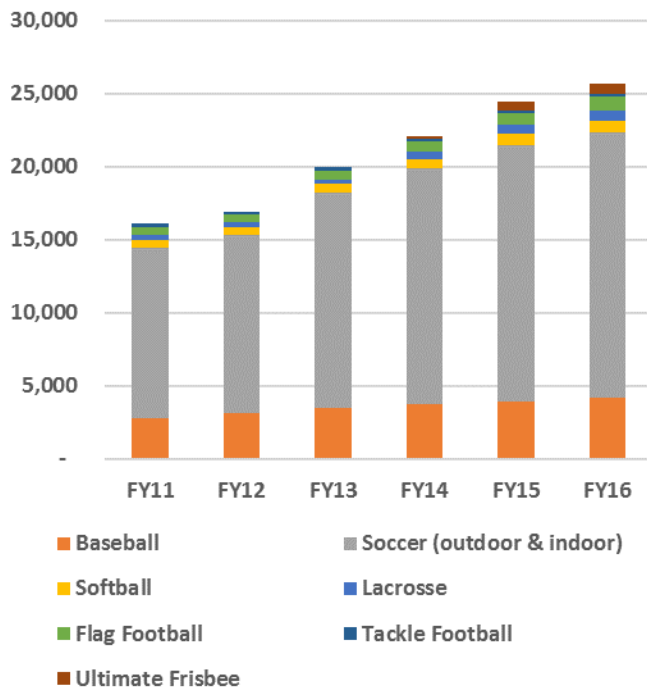


Sports user groups often receive complaints and requests from north Arlington parents that ask for facilities closer to home. Usually there is little to be offered. Is this a chance to change things? Throughout Arlington, sports groups are growing as the general population increases. That means they will continue to grow for years to come.

APS estimates a 20% increase in school age children within the next 10 years. Those kids will need places to do everything associated with being kids, including places to play.  
[\(https://www.apsva.us/statistics/enrollment-projections/\)](https://www.apsva.us/statistics/enrollment-projections/)

Youth sports groups have been growing steadily and that growth is expected to continue. Adult sports groups have seen flat or slightly declining participation in recent years. This appears poised to change soon, as new adult sports initiatives seem to be gaining traction and are growing apace. For example, the County’s adult drop-in soccer program is extremely popular, sells out each season, and will expand in the near term. Other adult programming evolutions are expected to yield increased amounts of adult participation as well.

**Consistent Annual Outdoor Youth Sports Growth - Participation**



**FIGURE 4: OUTDOOR YOUTH SPORT GROWTH**

Existing fields across Arlington (both natural grass and artificial turf) are heavily used. Many grass fields are used beyond existing use standards, impacting the quality of those fields and increasing maintenance needs that further stretch limited maintenance funding.

Converting natural grass fields to artificial turf does yield significant increases in playing time each year, both due to the ability to use the fields when wet as well as the ability to play on the fields year ‘round. Bermuda grass fields (the best natural grass fields in the County) have “no play” rest periods during the Winter and Summer that put those fields out of use for many weeks each year. As we know, converting a field to turf is not inexpensive, typically running somewhere in the \$800,000 to \$1,200,000 range, depending on various factors. The County has committed to a number of such conversions in the CIP, but thus far no field (after Williamsburg) has been specifically identified as a candidate for a conversion and the schedule has actually slipped; the County is behind on conversions at this point in time. Ideally we would pursue both turf conversions and, where appropriate, field lighting, all in order to increase the total inventory of play spaces and times those spaces are available for children and adults in Arlington.



**FIGURE 5: LBP SKILLS SESSION PICTURE**

Here’s an example of how crowded fields are lately. This picture shows all of the participants at a Monday Night Skills Soccer Training session. All of these players and coaches fill 2 fields at Long Bridge Park pretty thoroughly. There are over 100 players per field (note that, for these age groups, a team typically fields anywhere from seven to eleven players at a time). Is this density of use optimal from a developmental standpoint? No, not close. And the story is similar for many other sports groups. For youth soccer, the ideal practice scenario would put one team on half of a field appropriately sized for the team’s age group. Unfortunately, youth soccer had to abandon any such ideal practice scenario many years ago due to field availability issues. As a result, given the constraints of Arlington County’s field inventory, many sports groups have to make do and put more kids on any given field than is truly appropriate.

So how can this issue be resolved? Program participation can be limited or shrunk, such that more and more children are turned away and told “no, you can’t play.” On the other hand, more fields or play spaces can be developed. In Arlington, this is tough given the growth and land use seen around the County, and this can also be a pricey solution.

Another option involves lighting existing fields. Lighting fields can help alleviate crowding by increasing the number of hours a given field can be used each day. As an example, for youth soccer, if the 10 most-used, non-lighted fields were lighted, we estimate a gain of up to 3,157 hours of \*added\* play time that would be available during Spring and Fall seasons (11 weeks each).

### Benefits of Lights at Williamsburg + Mitigation Options

Specific to the fields at Williamsburg, the positive impact of lighting these fields can best be stated by expressing the number of “person/hours” gained by lighting the fields.

“Person/hours” is a true measure of overall social impact. Take the number of hours of play time newly made available by lighting the fields and then multiply those hours by the number of players benefitting from that extra time. One ends up with a quantitative expression of the value derived from lighting the fields. This is based on assumptions of hours available (varying based on different curfews each night) and the number of players playing on the fields during those hours.

Curfew Time	Hours gained per field with lights	Number of full size fields	People per field (low capacity)	People per field (high capacity)	Person/hours gained (low capacity)	Person/hours gained (high capacity)
9pm	293	2	30	100	17,580	58,600
10pm	532	2	30	100	31,920	106,400
11pm	779	2	30	100	46,740	155,800

**FIGURE 6: WMS PERSON/HOURS**

For example, if you look at the table above, it is estimated that, with a 10pm curfew, we would gain up to 106,400 people/hours per year.

For this example, let’s assume a 10pm curfew every night of the week is deemed not workable. Let’s assume some nights have earlier curfews, and maybe there are other factors further limiting field use. Even if you cut the person / hours figure in half to accommodate different curfews and other mitigation measures, etc., you see that we still get over 50,000 people / hours of added capacity from lighting the fields. That’s a significant benefit for some Arlingtonians!

So what mitigation measures might work? The working group has talked through some of the various possible measures that have been identified, and it is possible that still others exist that are yet to be uncovered. For this discussion mitigation measures have been grouped by type or category, and they

include:

### Environmental Options

- Plant denser tree, hedge & groundcover between the end of the Western end of the fields and the immediate neighbors along that side of the fields
- Consider physical buffer options such as walls or sound barrier panels and/or earthen berms
- Coordinate a package discount for neighbors who want to put up fences
- Develop grant program for neighbors to purchase internal mitigation such as blinds, shades, white noise devices, and other solutions

### Lighting Specific Options

- Phase lights settings so that less bright lighting is closest to neighbors, reducing light spillage even more. This could include selective lighting (at certain times) of only the cross-width fields furthest from the woods along the Western side, leaving the cross-width fields closest to residents, dark at those times.
- Lower light intensity, color or temperature based on data to reduce light impact. Some of these were briefly discussed earlier in the process. There may be more options to examine in this area.
- Initially the lighting vendor's "best case option" discarded the possibility of using HID lighting (as is used at many other County fields). Is this something to revisit in the interest of compromise?

### Scheduling Options

- Suggest or even mandate carpooling for evening time field users. Note that carpooling is already a common practice in the youth sports world, particularly amongst families with players in the same program and / or on the same team
- Limit evening hours to 9pm or 10pm or some other time (11pm is the County standard for lighted fields)
- Adjust field closure times for various weekdays and on weekends
- Seasonal restrictions (e.g.; limited lighting during winter and summer months)
- Limit special events after 6pm (11pm is County standard for lighted fields)
- Limit for only youth play (assuming youth are quieter)
- Limit for only adult play (adults bring fewer spectators)
- Limit field use to affiliated leagues; vet users of the field and avoid unruly rental groups
- Vary weekday curfew times (e.g.; no more than 2 – 3 nights to 10:30)
- Staggered start times (practices/games); this can help with traffic and noise spikes
- For evening activities, have a "no whistles" policy to help limit noise issues

## Partnership Options

- Develop a “Williamsburg Fields Partnership” group to coordinate ongoing communication
- This group to meet regularly to discuss operational concerns and issues and to interface directly with user groups and staff as needed
- Develop a Hotline for residents to provide feedback directly to user groups regarding issues and concerns
- Facilitates communication with programmed groups. In turn, programmed groups are easier to identify and work with compared to un-programmed users (i.e. those who may jump on the fields (assuming they are not lighted) in marginal or no-light situations after permitted users have left.
- Increases accountability and reduces the distrust factor involving APS, DPR, etc.
- Implement a “good neighbor” communication plan for use by all user groups. Educate users about how to minimize their impacts on communities hosting activities. Raise awareness of issues like traffic, parking, noise, and more.
- Develop an “MOA with teeth” to lay out the operational terms for the fields and provide an increased measure of accountability and trust for all involved
- Schedule a Field Monitor to provide in-person education and mitigation assistance. This person would be in place whenever DPR permits the use of the field (i.e. not during school day use, but during evenings and weekends when sports groups are onsite). The Monitor can ensure lights are turned off when they should be.

One thing is clear to the entirety of the working group: Having lights on 7 days a week until 11pm each day at Williamsburg makes no sense. That’s not workable in any scenario. However, some mix of mitigation measure, likely including lights with earlier curfews and a blend of other measures, may result in a manageable impact on local residents while also allowing many residents to enjoy the benefits of added time on the fields.

Of course, mitigation is itself not cut and dried. There’s a lot of opinion at play. Remember the Charge’s reference to mitigation: Of course, mitigation is itself not cut and dried. There’s a lot of opinion at play. Remember the Charge’s reference to mitigation:

Explore “whether the .... impacts of ... lighting one or two fields at Williamsburg can be mitigated sufficiently to preserve the character of the neighborhood and provide a reasonable quality of life...”

The tough part about discussing potential mitigation measures is the highly subjective nature of the issues at hand, including things like “quality of life”, “character of the neighborhood”, “annoyance”, “bother” and so on. While a few characteristics can be measured (i.e. light levels at a specific point, the color temperature of the lights, etc.), much of the discussion centers on things that cannot be measured accurately and are thus subject to individual interpretation.

How do you quantify the annoyance factor of activity on a nearby sports field? How do you concretely express the benefits that accrue to the players who engage in a sports activity, and thus how can you express the value the community derives by providing that opportunity? These are just a couple examples showing the challenges the working group faces in trying to discuss this overall topic in general and specific mitigation measures in particular.

Another point to consider is that the potential evening use of the fields won't happen in a vacuum. It is not as if the neighborhood goes completely dormant when school lets out in the afternoon. A variety of activities happen in the late afternoons and evenings, and those impact the neighborhood in many of the same ways that have been posed as concerns in this group's discussions. There are events specific to the elementary school and the middle school. There are school facility uses by other sports groups (i.e. the County's basketball program). Even working groups use the school facilities and generate some amount of activity. So with all of this going on, one must look at the field use activity in an additive sense, not in a black and white, "either there is silence or there is field use" context. This further heightens the subjective nature of the deliberations, especially when the question is one of "when is the activity level too high, and when does it become too much?"

There are examples demonstrating that mitigation measures can and do work in Arlington. For example, after an initial period of adjustment, various mitigation measures are used with a high degree of success at Greenbrier Park, which is another busy sports facility situated in the middle of a neighborhood in north Arlington. Those measures include:

- Limit the number of special events per year
- Onsite coordination of APS and County special events to reduce impacts on community
- Limit the number of evenings for the lights to extend to 10:30pm or 11pm
- Adjust starting times to reflect a 9:00am start on weekends as opposed to 8:30am starts in other locations
- Adjust hours according to seasonal use
- Create a Standing Committee to address community use issues
- Onsite facility monitor is assigned when synthetic fields are in operation during the evenings and weekends

### Somewhat Unique Hindrance – Substantial Distrust of Arlington County and County Agents

All in the working group recognize and appreciate the considerable challenges that the field neighbors have faced in recent years. The middle school continues to grow and evolve, the elementary school was constructed and began operations, and the share playing fields went from serving as grass play fields to construction staging area and again to hosting sports and school activities of different types.

Throughout these processes it is clear that a substantial level of distrust exists between the neighbors and any County entity, especially APS and DPR. When the example is raised of the Greenbrier experience and the MOA that is in place governing activities at the park, Williamsburg neighbors had stated clearly that they would not trust that sort of agreement. They see it as unenforceable and thus not worthy of consideration; there is a fear that terms stated in the MOA may be changed based on the



County's whim, and that the neighbors would have no recourse and no real way to push back. A curfew set initially at 9:30pm could suddenly be changed to allow play until 11pm, for example. This vision terrifies the neighbors, and the working group understands those fears.

This is one of the most difficult factors that the working group has had to work with. The "water is poisoned" (as the then Planning Commission Chair stated in December 2016) by previous County actions or in-actions, and this history very much affects how the neighbors evaluate present day options and measures that, when seen in a different light, might seem more workable.

The Open to Lights approach includes two related measures that seek to address the distrust factor. They involve the development of direct partnerships to improve operational oversight and a revised approach that produces a MOA with a greater trust factor.

Partnership Item 1: A " Williamsburg Fields Partnership" standing committee should be created to serve as a communications hub for everything related to lighting and related uses of the fields. This group should facilitate direct communication between user groups and the neighbors, and ideally be chaired by a neutral (non-County government) party. The composition could include representatives from local neighborhoods, the two schools involved, DPR, the Sports Commission, and sports user groups, among others. This committee can review issues and resolve problems before they get too large. This group provides a direct sense of accountability that hopefully offsets some amount of the unease and distrust felt by the neighbors. Note: The Williamsburg Fields Partnership group should be available starting with the beginning of the construction plan review process, to help ensure that every aspect of the construction and installation process is up to par.

Partnership Item 2: In support of the Partnership group noted above, a new type of a Memorandum of Agreement (MOA) should be created. The type of MOA used for Greenbrier is seen as being somewhat toothless, and the Williamsburg neighbors view such an instrument as essentially worthless; the feeling is that the County could impose sudden changes (for instance, pushing curfew times later in the evening) without there being any recourse for the neighbors.

This "new style" MOA should lay out conditions related to lighting construction and operations. The MOA is the keeper of mitigation measures and discussions. The MOA should also explain how and when any changes to the MOA can be made, and what types of notice are required in each case. The goal is not to cede complete control of the facility to the neighborhood; that's not workable from many angles. Rather, the intent is to provide a framework that puts the neighbors more at ease by creating a trustworthy framework for operating the facility. Does this sort of MOA exist in Arlington? We don't know, but we are keen to make it happen.

### Health Effect of LED Lights – No Consensus

As with many new technologies, people may deploy the technologies when they first show promise, only to find out later that everything is not as rosy as it first appeared. There are working group members who feel that this is very much the case with LED field lighting. LED field lighting is a fairly new technology, one that has seen increased use around the country only within the past 10 to 15 years, so

we are in the early days of developing experience with the technology. Arlington County has no direct experience with this form of field lighting, and it has certainly seen some concerns raised about LED street lights in recent years.

A significant difference between street lights and field lights is the fact that the field lighting solution proposed for Williamsburg employs shields. LED streetlights are unshielded, meaning that the light is less controlled and impacts humans directly. In short, unshielded LED lights are seen as more harmful, and their light is less controllable as well.

Instead, the LED light fixtures proposed for the fields at Williamsburg are shielded light fixtures. The main reason for using shielding in these fixtures is to provide a higher degree of aiming and control of where the light goes and does not go. Luckily, a byproduct of having shielding is an increased level of safety for those using the spaces lit by these fixtures.

Still, there are some in the medical community who have expressed real concerns about the health effects associated with LED field lights. Some on the working group have focused extensively on some recent studies that suggest that LED field lights are unsafe. The focus of the safety concerns encompasses both field users and nearby neighbors. In order to educate themselves, the WFWG sought outside opinions. Unfortunately, consensus was not seen, as there appears to still be too much grey area. There are studies expressing concerns about LED lighting and there are studies claiming that no conclusive evidence yet exists to support concerns about LED lighting. Which view is right? Is it too early to know conclusively?

The working group reviewed several studies, and the group also sought an opinion from the County's Public Health Director, Dr. Rueben Varghese. The assumption is that the County's chief medical officer would not wish to risk County citizens' health if clear dangers were recognized.

The studies split in their opinions, and Dr. Varghese surmised that, as described, and with appropriate mitigation measures in place, the lighting solution should not present an adverse public health risk. Despite health concerns raised by neighbors, the actual detrimental effects have not been proven for the type of installation being proposed. To the extent there are some health risks, they can be minimized because of assurances by the vendor that there will be no light spill or glare. - Arlington County Public Health Division

Other salient points arose from various studies, including:

- "Natural eye defense mechanisms" will protect the retina from overexposure to blue light from 5700K LED lights
- Health effects from glare are unlikely with proper lighting design
- Players and coaches may experience sleep delay, but it is expected to be short-lived because exposure is not that frequent
- Nighttime play creates more opportunity for healthful exercise for the youth and adults who will play at night
- No studies have explicitly evaluated the health effects of outdoor sports field lighting



- Studies that suggest potential negative effects on melatonin or sleep levels focused on longer term exposure in indoor lighting situations
- A much-discussed recent American Medical Association (AMA) study concerns street lighting, not field lighting. That report recommends color temperatures of no more than 3000K for street lighting installations, and/or additional protective shielding is recommended for these settings.
- The AMA study does not specifically address the length of exposure time that would be considered worrisome

Clearly, all involved want to ensure the safety of field users and field neighbors. At this time, there is not agreed-upon and conclusive evidence confirming that LED field lights are harmful. Of course, as with any new technology or experience that is new to Arlington County, this topic should continue to be monitored as the knowledgebase evolves.

### Based on What is Known at this Time, We Should Move Forward with Exploring Lighting the Fields at Williamsburg

Despite some of the divisions evident in the working group, there are several areas where the Open to Lights group believes all working group members are in agreement:

- The fields at Williamsburg should not be lit seven days a week until 11pm each evening. That makes no sense given the proximity of the fields to residences. There are other locations in the County better suited for such hours.
- The County's resident base continues to grow, yet the field inventory does not. This creates a field availability crisis that all agree needs attention.
- County youth (and adults) deserve quality play spaces in sufficient numbers to serve the local population
- The neighborhood has already been through a lot of change and unhappiness during recent school projects. Patience is overworked and trust is rare.
- Sports participants are neighbors, too. It is fair to ask user groups to conduct themselves in ways that minimize impacts on the local communities.
- If LED lights are selected for installation at Williamsburg (or any other facility in Arlington), the technology should continue to be reviewed with respect to evaluating health concerns. It seems logical that Arlington County should strive to ensure that citizens won't be adversely affected by any technologies implemented by the County, and that if a given technology is worthy of review, the County should develop a vigorous review process in order to evaluate the efficacy and safety of the technology.

- Should lights be approved, all desire a lights installation process that does not harm the playing fields, the geothermal systems, and the surrounding vegetation (and indeed the surrounding neighborhood) as much as possible. A complete and thorough construction plan should be made available prior to commencing the installation process. The Charge directs the WFWG to evaluate construction impacts on the environment and the cost of mitigating damage caused by installing and operating the lights before the WFWG's recommendation is provided to the Board.
- It is expected that various mitigation measures can have a positive impact in reducing the intrusiveness of lights and noise and other factors related to nighttime activity on the fields. Whether those measures can yield sufficient relief to make the situation livable for the neighbors is the open question.

With those factors understood, this decision requires balancing various needs and factors, including:

- The need for more recreational field space and time across Arlington
- A specific interest in developing north Arlington facilities as expressed by north Arlington residents
- A net decrease in traffic in Arlington by providing facilities closer to users' homes
- A general desire to leverage the County's investment in synthetic turf by lighting the fields and getting more hours of use
- The neighbors' need for appropriate levels of peace and quiet and protection from potential adverse health effects
- Respect for changes already imposed on the neighbors by other recent projects
- Concerns about possible health issues (complicated by the relative newness of LED technology)
- Recognition of the neighbors' distrust of Arlington County as a severely limiting factor

At the end of the day, this process pits the rights of a number of residents who live close to the fields versus the public demand for recreational facilities, particularly in north Arlington. Can both co-exist reasonably comfortably? That's what we wish to explore further.

## Section III. Opposed to Lighting

### Introduction

The signatories to this report constitute a majority of the WFWG. We would like to thank the County Board, especially liaisons Libby Garvey (July 2015 – March 2016) and Christian Dorsey (March 2016 – present), WFWG Chair Erik Gutshall and staff for their diligence, patience and assistance as the group worked to understand the complex technical issues raised during our discussions and develop the data required to make an informed recommendation.

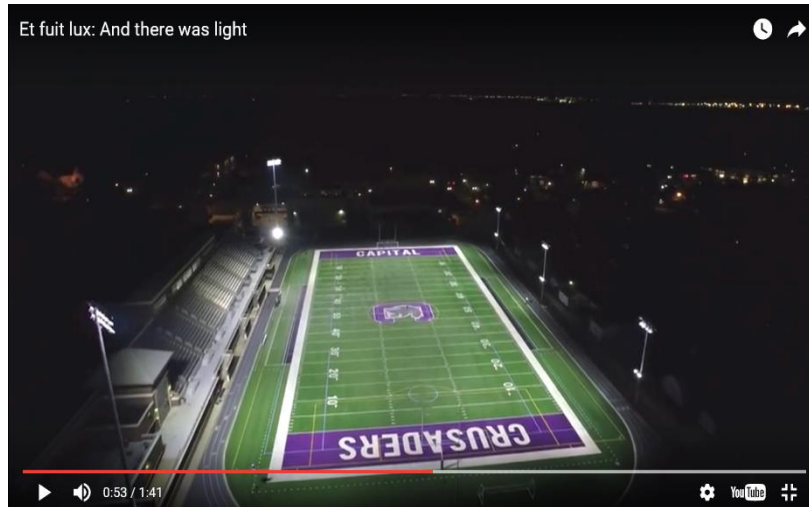
At the joint Work Session on January 24, 2017, several County Board members expressed interest in creating a framework with consistent and neutral criteria to guide County-wide decision-making on locations that are that are suitable or unsuitable for field lights. At the conclusion of our report, we provide what we believe to be appropriate neutral criteria to guide future field-lights siting decisions. Application of those criteria to the Discovery Elementary and Williamsburg Middle School (DES/WMS) site shows quite clearly that sports field lighting is entirely inappropriate in the Williamsburg setting. Moreover, using the test set forth in the County's charge, it is also clear that any fair and full consideration of the "environmental, noise and light spillage effects" of field lighting demonstrates that its introduction will neither "preserve the character of the neighborhood" nor "provide a reasonable quality of life to nearest neighbors."

The proposal to introduce field lighting "for the first time" into this residential setting would severely impair long-standing neighborhood expectations of quiet enjoyment of the nighttime. In particular, the proposal to light two side-by-side fields doubles the impact of lighting one of Arlington's darkest, quietest, and least developed residential neighborhoods.

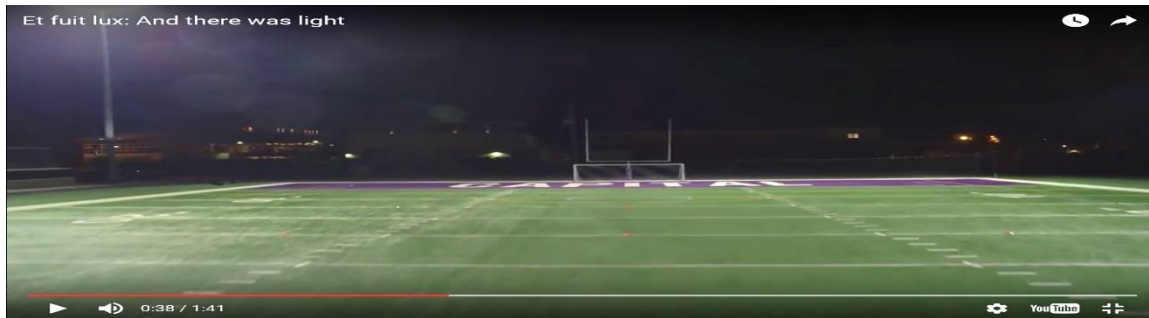
If this action were taken, no other residential neighborhood in Arlington could depend on the County's Zoning Ordinance to protect them from rapid urbanization.

The images reproduced below show the intensity of glare reflected from the surface of recently-installed field lights at an Ohio site similar to Williamsburg. The glare alone -- even in the absence of the absence of the very significant noise, traffic and human health effects discussed in this report -- would transform the neighborhood from a peaceful, wooded, suburban community into a harshly-lighted, bustling urban one.

Bedroom windows near WMS would offer a view similar to what one would see when sitting in the lower section of the bleachers in the photo below.



As depicted in following image, glare from the turf on two lighted fields (146,000 square feet or nearly 3.4 acres) would radically alter the DES/WMS neighborhood, dominate surrounding neighbors' first floor living spaces, and preclude peaceful evening enjoyment of their yards.



Lighting proponents implicitly acknowledge adverse lighting effects but speculate that neighbors' concerns about quality of life, health, safety and environmental impacts might be ameliorated after-the-fact. That is, after a hypothetical Board decision approving lights, proponents suggest Musco might offer new, more "favorable" proposals and introduce potentially significant design changes to address light pollution, health and environmental concerns. Such an approach would do nothing to remedy Musco's unwillingness to permit verification of its projected impacts, would reinforce rather than redress the process flaws that have plagued the Williamsburg lights issue, and would effectively negate the results of an 80-week-long effort by concerned WFWG members. It would fundamentally compromise the integrity of this public process and discourage civic-minded residents elsewhere from participating in similar groups.

The report below speaks to these issues.

## Character of the Neighborhood: Quiet, Residential, Dark at Night, With Homes Unusually Close to Fields

All Arlington neighborhoods are unique and vary significantly in their density, commercial/residential mix, housing type and zoning, among other characteristics. Residents of the neighborhood surrounding the school property do not claim that they merit special treatment compared with other neighborhoods in the County. But the entire purpose of land use planning is to establish and protect permitted uses that best reflect community character and prohibit those that interfere unduly with neighbors' expectation of quiet enjoyment.

The proposal at issue here would introduce intense sports-stadium lighting into a neighborhood that has never hosted nighttime athletic events. It would expose neighbors to levels of evening disruption that were never anticipated when they purchased their homes and undermine Arlington's long-standing goal – emphasized repeatedly in its General Land Use Plan – to “retain the predominantly residential characteristic of the County.” As then-County Board Chairman Chris Zimmerman explained in joining with other Members to reject a proposal to install field lights adjacent to residential neighborhoods elsewhere in Arlington:

“Not every location in the County is equal. The whole point of zoning and land use planning is to provide for different intensities of use at different locations . . . . As a property owner, you should have some idea of what to expect. It's inherent in our land use planning that the uses of our property is restricted. This gives us a reasonable expectation of what goes on next to us. Lights by their nature do have an inherently intrusive impact.” (Arlington County Board Hearing, March 5, 2011.)

Any careful examination of the DES/WMS site, which is dedicated to serving the needs of small children, reveals that it is a wholly inappropriate host for stadium lighting. The neighborhood surrounding the DES/WMS property lies within one of the least densely populated, most stringently zoned area within Arlington (R-10, R-20). The County's Zoning Ordinance forbids businesses of any kind as well as apartments in the DES/WMS neighborhood. Only single family homes are permitted and none may be taller than 35'. Zoning is often a major consideration when residents select their homes, with decisions frequently hinging on whether they wish to live in a bustling urban corridor or on a quiet residential street.

Homes in the neighborhood are unusually close to the fields, merely 75' from the goal line of the larger athletic field. Homes are equally close to the entrance to and exit from the DES parking lot. One of Musco's poles (S3) is closer to a home than the pitcher is to the batter in a baseball game. Proximity matters. The intensity of noise and light received is inversely proportional to the square of the distance from the source. Thus a home that is 75' away from the soccer fields receives four times the intensity of noise and light as a house that is 150' away and sixteen times the intensity received by a house that's 300' away.

Topography is also important. Light and noise are more likely to disturb neighbors if the fields are located at ground level or above neighboring homes. In contrast, the impacts of noise and light are

diminished when lighted fields are recessed. Unfortunately, the WMS/DES fields sit on a plateau that rises above homes on streets that are directly south and to the east of the fields and at eye level with homes that are immediately to the west and north of them. Thanks to the topography of the site, the school buildings and/or fields are visible in all directions from many blocks away.



The setting is quiet and dark at night as shown in the above photo of the fields taken from the DES parking lot.

On clear nights, dark sky views are plainly visible above the athletic fields as well as neighboring properties. In its “Streetlight Policy and Planning Guide” Arlington committed to comply with “dark sky” standards to minimize light pollution and “reduce development impact on the nocturnal environment.” Important natural values are also apparent during the day when students, visitors and neighbors enjoy the scenic vista shown below.



The neighborhood is unusually quiet at night. Background nighttime noise readings taken by a near neighbor shortly after the WFWG began its work registered at 27 decibels (dB) – the same as crickets chirping.

Abundant wildlife inhabits the area surrounding the two schools. Appendix E contains photographs and a list of dozens of observed species of wildlife that live in the neighborhood. Little Brown Bats,

Barred Owls and Fireflies, animate the dark woods and sky bordering the soccer fields. Light and darkness are natural cues they depend upon to survive.

The sports fields at DES/WMS can be accessed only by traveling on narrow neighborhood streets. The DES/WMS property is not served by mass transit. Thus, the only realistic transportation option for residents from elsewhere in the County is to arrive at and depart from the fields by car.

All of these neighborhood nighttime qualities – darkness, quiet, homes harmonizing with their natural surroundings, lightly traveled streets at night, the presence of wildlife marking the natural world – would be lost through the installation and operation of stadium lights on poles the height of an eight-story building.

### Impacts Recently Absorbed by Neighborhood to Meet Community Needs

Residents believe it would be difficult to find another neighborhood that has absorbed more change since 2013 for the sake of the community than the one bordering WMS/DES.

Construction of the new elementary school, with a high-school-sized gym, and the siting of 28 relocatable classrooms at the middle school have caused the total school population to double to over 2,000 students, teachers, staff and volunteers. During DES construction, rules to protect neighbors from unduly disruptive construction impacts (e.g., construction start and end times, restrictions on street parking, buffer zone maintenance, nuisance dust and storm water releases) were violated, sometimes modified and then violated again.

The influx of traffic associated with the opening of DES and increased population at WMS now requires residents of Harrison, Jefferson (3500 block) and 36<sup>th</sup> Streets, to schedule trips into and out of the neighborhood to avoid the crush of two morning drop-off and two afternoon pick-up times. The intersection at Harrison Street and Williamsburg Boulevard has become increasingly congested, particularly in bad weather.

The replacement of grass with synthetic turf on the playing fields has greatly increased daytime field activity, resulting in a corresponding increase in noise levels as sound, previously absorbed by grass, bounces off of new structures and synthetic surfaces. On Saturday mornings, players frequently gather on-site before 8 am, with continuous high noise levels measured at neighboring homes spiking above 60 decibels (dB) as many as a dozen times a minute. These noise levels, which are disturbing during the day, would be intolerable at night, when the Arlington noise ordinance specifies a maximum noise level of 55dB for private property.

The only quiet time in the neighborhood is now limited to the period after sundown. Field lights would result in a final – highly deleterious – effect arising from construction and crowding on the school property. The neighbors cannot, in light of this history, be fairly characterized as unconcerned or uncompromising. Rather they are community-minded residents of an Arlington neighborhood that has absorbed major change to address the needs of children and young families in the County. They ask that the remaining remnant of neighborhood peace and quiet – their night times – be preserved.



## Lighting Effects from Intense Blue-White LED Lights on 80' High Poles

### A. Musco's "Best Case Proposal"

The only proposal from Musco Lighting, the County's sole-source vendor, that the WFWG has had the opportunity and the independent expertise to analyze calls for six 80' poles, which would be well above the 68' maximum height limit mandated by Arlington's Zoning Ordinance and more than double the height limit applicable to homes in the adjacent neighborhood. Such exceedingly tall structures violate the purpose of S-3A zoning, which is "to encourage the retention of certain properties in a relatively natural state" and the goal of height limitations themselves – to preserve scenic vistas and promote harmony in the construction and design of public facilities and ancillary structures.

The photos below show that 80' tall poles would dwarf homes located only a few yards away. The lighted pole on the right shows that, contrary to Musco's claims, glare affecting neighbors would not be the equivalent of a single low beam headlight, but that of a stadium-sized 21-luminaire array.



As the County Board is doubtless aware, in late January 2017 Musco submitted a proposal to reduce the color temperature (CCT) of field lights from its previous "best case" of 5700 Kelvin (5700K) to 4500K. It did so despite its past insistence – over 15 months – that "warmer" LED lights would increase adverse lighting effects. The neighbors, the County, and the Working Group as a whole do not have the time or professional expertise to critique this proposal, particularly in light of Musco's continued refusal to release the photometric data underlying its projections.

However, Musco's new proposal does not materially alter the neighbors' longstanding concerns about the lights. Musco's plans for either 5700K or 4500K would introduce more intense blue wavelength LED light than arrays at any other rectangular field in Arlington, including at Long Bridge Park. We note that LED street lights that have been installed in parts of Arlington typically produce light levels 1/20 – 1/30 of those generated by sports-field lights. Because LED lights consist of tiny, very intense point sources, blue-rich street lights have generated complaints about glare and eye irritation from residents of affected neighborhoods in the County. As a result of these complaints and other issues, Arlington recently convened a Streetlight Management Plan Advisory Panel to examine LED lighting in greater detail and to ensure that lighting types and intensities are appropriate for different County settings.



Interestingly, Arlington’s new Street Lighting Master Plan (2106) reviews at length and with approval a report prepared by Clanton & Associates (a prominent national lighting expert, as discussed below) on the introduction of LED lights in Seattle. In their report, Clanton & Associates cautioned that:

“public preference typically favors warm white light or the lower color temperatures such as 3500K. Ignoring this in favor of higher efficiencies, manufacturers’ marketing media push higher color temperature 5000K or 6000K light sources to gain a competitive edge. This results in installations that produce light very efficiently, but within a spectrum that can affect brightness perception, color rendering, discomfort glare, circadian rhythm, and possible other health issues.”

Although we are heartened by the County’s recognition that intense blue-wavelength LED lighting technology requires further careful study, we are concerned that highest intensity recreational LED sports lighting is being proposed by a County vendor in the face of considerable controversy, locally and nationwide, about its propriety and safety. Indeed, a review of Musco’s proposal here reveals significant adverse lighting effects.

#### **B. Independent Study by Clanton & Associates.**

Frustrated that many of their questions about lighting effects were not answered by either Musco or County staff, neighbors contracted with a highly regarded national and international lighting expert – Nancy Clanton of Clanton & Associates – to review Musco’s submissions. Ms. Clanton is a former chair of the Board of Trustees of the Illuminating Engineering Society of North America (IESNA) and “Lifelong Member” of the International Dark Sky Association (IDA). She co-chaired the joint IDA/IESNA committee that developed the Model Lighting Ordinance. That Ordinance has been adopted by numerous jurisdictions to promote quality and sustainable lighting design.

Ms. Clanton, whose full report is attached at Appendix B, concluded that the impacts of lighting the DES/WMS fields cannot – using the language of the County’s charge – “be mitigated sufficiently to protect the character of the neighborhood and provide a reasonable quality of life to the nearest neighbors.” Most importantly, Ms. Clanton concluded that Musco’s best- case proposal – which would require a zoning amendment to accomplish a change in the maximum permissible height of structures – would still expose nearby residents to high levels of glare that significantly exceed national and international standards. Levels predicted in the case of Musco’s 5700K proposal exceed 5,000 candelas at the residential property line, more than twice the levels recommended for intrinsically dark residential neighborhoods by the IESNA and the International Commission on Illumination (CIE).

Even Musco’s last minute alchemy with an entirely new lighting scheme fails to achieve generally recognized standards for glare in intrinsically dark residential neighborhoods. Levels predicted in the case of the vendor’s 4500K proposal still significantly exceed glare levels recommended by IESNA and CIE. Moreover, these high predicted levels of glare likely underestimate effects that would be experienced by nearby neighbors because those projections do not account for: (1) reflected glare from moisture in the ambient air during Arlington’s humid summers; (2) glare reflected from the

synthetic turf and numerous school structures; (3) the particular sensitivity of children with vision-related medical conditions; and (4) the more severe effects of glare on the aging eye, as acknowledged in Arlington's current Streetlight Policy and Planning Guide (2006).

Perhaps even more significant, unlike other lighting vendors, Musco does not disclose photometric data (the luminaire light distribution measured in a photometric laboratory that is essential to replicate and thereby verify Musco's projections of glare and spill) and thus no independent evaluation of the company's lighting calculations can be performed. For this reason, Ms. Clanton expressed her concern that Musco's projections may underestimate levels of nighttime obtrusive light experienced by neighbors and cautioned that the fields should not be lighted absent "criteria compliance independently verified and calculated with photometric data provided by Musco."

The data Musco have provided, however, reveal that harmful direct-lighting effects will likely arise on the field, as well as in the surrounding neighborhood. As discussed more fully herein, Ms. Clanton highlighted the recent concerns raised by the American Medical Association (AMA) and other health and scientific bodies about human health effects potentially caused by the very intense levels of lighting from high Kelvin LED fixtures.

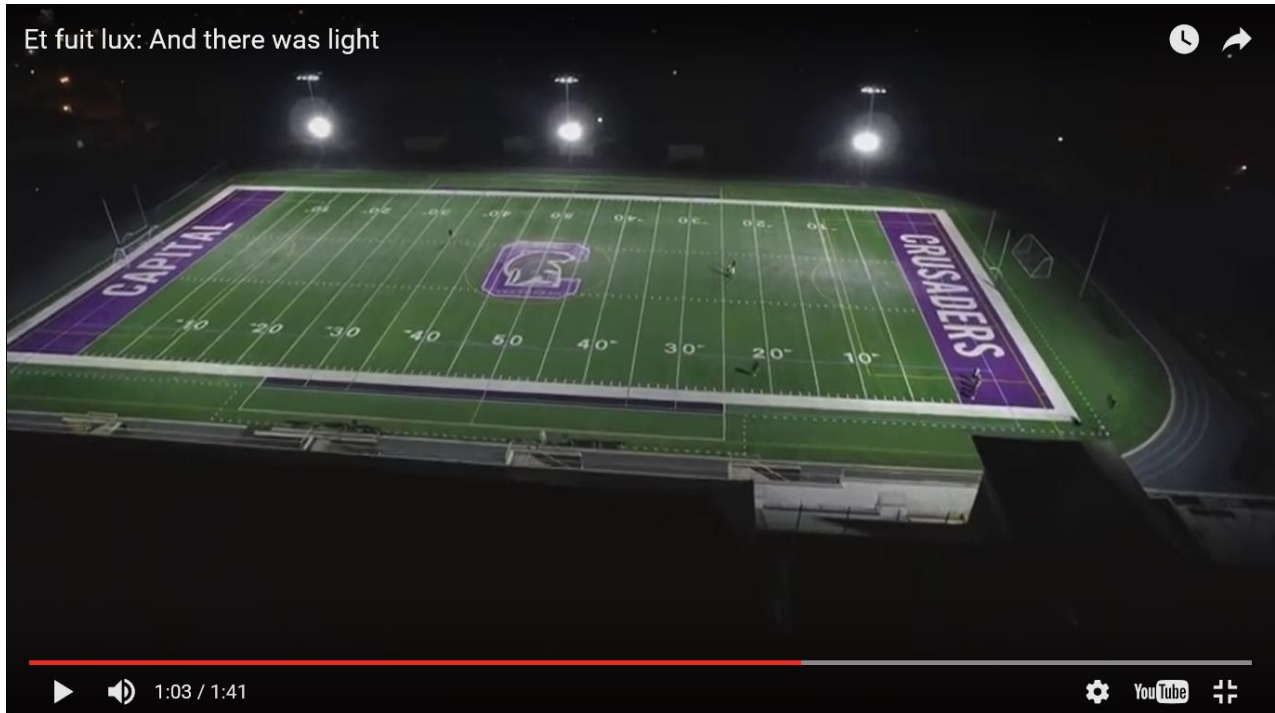
### **C. Player Safety and Neighbors' Direct Experience with Painful Glare from LED Lights**

The U.S. Soccer Foundation has established "Lighting Standards" (drafted by Musco) that are "strongly recommended" as a guide to the design and installation of "safe, effective lighting systems." These standards address, among other criteria, critical glare angles to protect player safety. However, none of Musco's proposed pole locations comply with national and international safety standards to prevent harmful glare. All proposed pole locations fail safety standards for side-to-side play, while locations of the S3 and S4 poles fail standards for full-field play. This means that players facing the corners when playing full-field, and players facing half-field goals from the middle and sides of the playing area, will be exposed to excessive glare. It is instructive that Musco has refused to document compliance of its proposed pole locations with critical glare standards for field lights proposed for the DES/WMS fields.

The neighbors' direct experience with Musco's LED lights has also been troubling. In October 2015, DPR arranged for WFWG members to visit Glyndon Park in Vienna, VA, where High-Kelvin Musco LED lights had recently been installed on a baseball field. Neighbors were surprised by the amount of spill and glare from the lights, experiencing painful retinal burn while walking around the perimeter as well as standing on the field. This burn persisted into the next day. Significant light spill also illuminated portions of Glyndon Park at distances comparable to those between neighboring homes and the WMS fields.

Musco referred the WFWG to 18 other soccer and football fields where it has installed similar LED lights. Neighbors' subsequent contacts with individuals at those sites revealed that nearly all of the locations involved field lights that are much farther away from residences, were installed as upgrades for older (more-polluting) lights, or were constructed in valleys, well below the elevation of the closest homes. Indeed, the only such Musco LED site bearing any similarity to the DES/WMS fields is at Capital University in Bexley, OH. Work Group members were informed that neighbors of that field have

continually complained that glare shines through their upper-floor windows and is visible from blocks away. For example, a retired professor of pediatric nursing from Ohio State University now drives and walks out of her way to avoid the glare from the Bexley field and complains: “There is no way they (Musco) can say there is no ‘eye aching glare’ from that field.” Below is an image from a Musco promotional video showing almost no glare reaching structures on the far side of the field, only dimly lit garage fronts, barely visible between the three light poles. (Note: this dimming is partly the result of the aperture of the camera closing when photographing the brightly-lighted field. This effect, as seen in promotional videos is often misleading.)



Below is a photograph of one of the garages and a nearby house that are located 70 and 135 feet beyond the side line at 50-yard marker of the Bexley field. The garage is approximately the same distance as the closest neighboring home is to the fields at DES/WMS). The windows at homes abutting the DES/WMS fields are closer to the fields than the windows seen in the residence below.



In sum, significant technical questions have been raised about the Musco proposal and those questions remain unresolved. What is clear, however, is that Musco’s data alone show that glare will be excessive – both on and off the fields. Musco’s unwillingness throughout the WFWG public process to release its underlying photometric data obviously does nothing to assuage these concerns

and instead creates greater uncertainty about light levels and effects that neighbors, and their successors, will be expected to live with in perpetuity.

### Human Health Risks to Youth and Adults

Musco asserts there will be no adverse health effects from 4500-5700K LED lights on the DES/WMS fields. Yet, in June 2016, the AMA's Council on Science and Public Health recommended that street lights be limited to no higher than 3000K (vs. the 4500-5700K proposed at DES/WMS), warning that exposure to High-Kelvin LED lights is associated with reduced sleep time, nighttime awakenings, impaired daytime functioning and obesity. Studies showing reduced sleep time describe a delay such that exposure to blue-white LED light at 8 or 9 pm, could disrupt sleep at 11 or 12 pm. (See Appendix C). The AMA also warned of potentially serious impacts of glare especially among the elderly, individuals with cataracts, and children with implants and other vision-related medical conditions.

Arlington's Environmental and Energy Conservation Commission (E2C2), in its 2016 White Paper entitled "White Paper on Mitigating Light Pollution in Arlington County Projects," responded to concerns raised by medical authorities and anecdotal reports of adverse lighting effects from Arlington's LED street lights by recommending that County luminaires should minimize blue light emissions and that warm white LEDs with CCTs less than 3000K be used. The IDA also now refuses to certify as "dark sky" compliant any luminaire with a CCT greater than 3000K.

Proponents of DES/WMS lights argue that the AMA recommendations on street lighting are not relevant to athletic field lights. In its response to the Work Group, Musco also has characterized these studies as "lots of hype being made about something that MIGHT exist." (Emphasis in the original statement.) In contrast to Musco's dismissal, leading medical and lighting experts point out that light levels on athletic fields are typically 20 to 30 times greater than street light levels, which make the AMA recommendations entirely relevant here. They include lighting expert Nancy Clanton, who noted that the "AMA Council's advice must be taken seriously" in deciding on field lights like those proposed at DES/WMS, a view supported by Jefferson Medical College Professor Dr. George Brainard, a leading authority on health effects of LED lights.

Dr. Brainard and Dr. Mario Motta, both co-authors of the 2012 AMA Report on health effects of exposure to blue-rich (LED) light at night and major contributors to the 2016 AMA report on LED lights, replied to Work Group members' questions by agreeing that 5700K LED lights should not be used on neighborhood athletic fields. Dr. Brainard replied to a WFWG member's inquiry by stating, "My opinion is that a 5700 CCT is not appropriate." [5700 CCT= 5700K]. Dr. Motta said similarly, "You want 3000K [LED] or below, otherwise [you] have very harsh glary lighting, hard on the eyes."

Proponents of lights at WMS cite the report by the Arlington Public Health Department (PHD) which, in general, downplayed the health risks of LED lights (though it acknowledges the risk of some sleep impacts). But the PHD report is premised on its repeated explicit assumption that Musco's design will effectively control light spill and glare. However, Musco's own predictions of glare exceed generally recognized standards and Musco's claims regarding negligible light spill cannot be independently verified because the vendor refuses to provide the requested photometric data. Based on reports from neighbors of the Ohio field where Musco's high Kelvin lights have been installed, and neighbors'

direct observations at the Vienna field, Musco's representations denying adverse lighting impacts have been shown to be contrary to real world experience. Thus, there are reasons to give little weight to PHD's conclusions.

The weight of scientific evidence showing adverse health effects from the kind of high Kelvin LED lights proposed by Musco is more than suggestive, more than "hype," using Musco's characterization. National and international science bodies responsible for protecting public health have raised serious concerns about precisely the kinds of lighting proposed for the WMS/DES site. Their calls for caution should be taken seriously by the County.

### Environmental Impacts from Installing and Operating Intense Blue-White LED Lights

The Musco proposal will not only adversely affect public health and neighborhood quality of life, but the natural environment as well. We were surprised and disturbed that the original draft Environmental Assessment/Environmental Checklist prepared by DPR claimed that (1) no trees, ground cover, or vegetation would be disturbed, (2) there will be minimal disturbance of the ground surface to install pre-cast concrete for the light poles, and (3) there will be minimal effect on night flying insects and the bats and birds that are dependent on them.

Those claims show no real understanding or appreciation of the setting. Neighbors have provided compelling photographic evidence of the abundance and variety of healthy local fauna as well as the natural harmony that exists between the green space at the schools and the wooded area that surround them. These are viewed by the neighborhood as irreplaceable natural assets.

Scientific bodies have warned with increasing urgency of environmental threats presented by high Kelvin LED lights. For example, the June 2016 AMA summary of the human health and environmental dangers of LED lights warned that "60% of animals are nocturnal and are potentially adversely affected by exposure to nighttime electrical lighting. Many insects need a dark environment to procreate. Other environmentally beneficial insects are attracted to blue-rich lighting, circling under them until they are exhausted and die." Both the AMA and the IDA have noted that the alteration of ambient light in the nighttime causes otherwise suitable habitats to be avoided or underused, thus placing entire eco-systems at risk. Stadium lighting spanning 3.4 acres would have a significant negative impact on the local ecosystem, which is naturally dark at night and therefore provides a normal day/night cycle for resident species.

Musco’s proposal also presents a direct and immediate threat to the vegetative buffer between the fields and neighboring homes and to the scenic vista enjoyed by community members and those who attend, work at, and visit the elementary and middle schools. For months, neighbors expressed increasing concern that the installation of pole S3 along the western edge of the sports field might damage existing mature trees. For this reason, they enlisted Michael Galvin, Director of SaveATree Consulting and President of the American Society of Consulting Arborists, to review Musco’s plans and visit the site. Galvin concluded that, at a minimum, one to two mature trees and 55 linear feet of tree canopy must be removed for construction, operation and maintenance of light pole S3, resulting in impacts on the wooded buffer between the fields and nearby homes. (A copy of Mr. Galvin’s report is provided at Appendix D.)



**CANOPY ABOVE S3 LOCATION**

Neighbors subsequently learned of facts suggesting that the construction and installation effects may be even more severe. Recently the location for the S3 pole initially provided to Mr. Galvin, and communicated by DPR to the County Arborist and R.E. Lee Electrical Company (Lee), was determined to be incorrect. The correct location, using measurements provided in Musco’s illumination summaries, is much closer to the trees. The photo (left) below shows the canopy directly above the actual pole location. Branches and limbs shown in the photograph extend over the NW corner of the larger athletic field (Field 1). A second photograph (right) shows that the trunks as well as branches of nearby trees bend sharply to the east, directly over areas to be illuminated by Musco. The canopy is relatively sparse, with few branches or limbs to sustain the trees if those that extend over the fields are removed.



**TREES NEAREST S3 BEND EAST OVER FIELDS**

The neighbors are also deeply concerned about the potential adverse effects and damage to the entire DES/WMS property resulting from installation, operation, and maintenance of the field lights. These concerns were intensified after they reviewed a video (link provided at Appendix E) showing installation of Musco LED lights like those proposed for DES/WMS at Art Crate Field in Washington State and a Musco LED “Installation Instructions” (also provided at Appendix E.) All of Musco’s promotional videos featuring installation of poles and lights are filmed at sites that are flat, where mature trees either do not exist or are far from pole locations, where the fields themselves are removed from buildings and infrastructure that could be harmed, and where existing synthetic turf and other playing surfaces are immune from damage caused by the weight of construction materials and heavy equipment. The DES/WMS site is entirely unlike those highlighted in Musco’s videos.

The WFWG Charge specifically directed the group to examine the “added costs due to complicated construction, phasing (and) mitigation of impacts . . .” Given the cramped spaces surrounding the two DES/WMS sports fields, the very limited access available along the fields’ perimeter because of existing structures, fixtures, infrastructure and established vegetation, the danger to school property, including the newly installed synthetic turf and underlying geothermal system is great. The costly and complicated



installation and maintenance of the six poles and arrays undeniably represent significant threats to the environment, school property, and neighbors' quiet enjoyment of their homes.

For example, Musco's LED "Installation Instructions" brochure documents the need for 18-wheel tractor trailers to deliver the light poles, pre-cast concrete bases, lighting fixtures, crossbars and lighting control cabinets and other materials to locations on the site where they will be installed. It also documents the need for trenching and concrete backfill equipment at each of the pole locations and heavy vehicles to lift the lighting equipment into place. The lighting array displayed on the brochure's cover shows a 12-luminaire array. The S3 and S4 arrays at DES/WMS would be nearly twice as large (21 luminaires). Below are examples of equipment required as shown in Musco's LED "Installation Instructions."



The video taken at Art Crate Field shows only a small portion of the equipment (e.g., excluding poles and pre-cast concrete bases) that would need to be staged on-site at DES/WMS. The film clip also documents the substantial clearance behind the arrays that will be required for operation and maintenance of the fixtures and structures supporting them.

After reviewing these materials, WFWG neighborhood representatives concluded that Musco's concrete bases, poles, lighting arrays and other equipment, as well as the heavy vehicles required to transport and install them, could not be used on the DES/WMS site without causing significant damage to the existing baseball diamond and outfield, surrounding fixtures, the Western wooded area, and the infrastructure adjacent to and possibly beneath the turf fields.

In response to concerns voiced by WFWG neighborhood representatives, on January 4, 2017, DPR forwarded an 8-sentence report prepared by a subcontractor of Musco, R.E. Lee Electrical (Lee), the entity that would install the poles. Lee stated that it had visited the site, developed an [exceedingly brief] installation plan outlined therein, and concluded there would be no negative impacts on the WMS property and it would only require the pruning of a single tree adjacent to the S3 light pole.

By almost any standard, however, the Lee installation plan is best described as cursory and dismissive of neighbors' expressed concerns. Its conclusions are premised on access to the site from a small 6' wide gate behind the backstop of the baseball field adjacent to upper Harrison St. and the movement of 18-wheel semis loaded with steel poles, 3-ton chains, concrete bases, fixtures and other materials as well as heavy lifting equipment across the infield and outfield. Heavy equipment and materials will also need to

be moved on/or around the synthetic turf, along the 8- foot-wide sidewalk that runs between the eastern edge of field 2, and relocatable classrooms adjacent to the middle school building. Many tons of materials and heavy equipment would also need to traverse the edge of the Western wooded area, destroying all or most of the 3 dozen trees planted in that area as part of an effort to mitigate the impact of installing the synthetic turf. The site of the S3 pole is sloped, as is the approach to it from the baseball diamond, increasing the likelihood that it will not be possible to excavate the pole location and install the pre-cast base and concrete backfill without causing significant damage to the turf, the surrounding trees, or both. The S4 pole is also located on a slope which is probably inaccessible except by driving heavy equipment across the turf on field 2 because of the topography, the inability of the sidewalk to bear the weight of the equipment, and the severe space constraints between the field and adjacent relocatable classrooms.

Immediately after the January Joint Work Session with the Board, neighborhood representatives spoke with the County Arborist and the DPR staff member who conducted the site visit with Lee. They learned that neither staff nor Lee were informed of the specifications of the S3 lighting array, including the amount of clearance required for its installation, operation and maintenance. In addition, incorrect information was provided to Lee and the County Arborist concerning the location of the S3 pole, which is much closer to mature trees than had been assumed. (A copy of a letter to the County Board documenting the above conversation is provided in Appendix F.)

In short, the lighting proposal as currently designed will have significant adverse environmental impacts, the full magnitude of which are not yet known and which might not become fully apparent until many years after lighting is installed. At the very least, adverse ecological effects from the introduction of intense artificial light into an historically dark setting are likely to be severe and will be further aggravated by inevitable degradation of the Western wooded area as a result of construction, installation and maintenance activities.

### Traffic – A Large Increase, Disruptive to Families, Especially Children in Need of Sleep

In addition to direct lighting effects, the proposal to light the DES/WMS fields has implications for local traffic patterns. The neighborhood is served solely by small neighborhood streets, already taxed by the additional daytime demands arising from the new elementary and larger middle school. Nighttime outdoor athletic activities and events on lighted fields would introduce much greater vehicle numbers onto formerly dark, quiet streets.

To place traffic estimates in context, an average of 84 vehicle trips was counted between 7 and 12 pm in late September 2012, versus an average 181 vehicle trips during the same evening hours in June 2016. In both cases nearly half of the total trips were counted between 7 and 8 pm, when field lights are often unnecessary. Department of Environmental Services' Transportation Division (ATD) traffic engineers estimate additional traffic on 36<sup>th</sup> Street due to lighting the fields at an additional 71 cars and 125 – 150 vehicle trips per night.

It is not possible, however, to reconcile ATD's traffic projections with ASA's projection of 58,000-106,000 person hours gained with 9 and 10 pm curfews with ATD's projection of just 71 added cars per night. At



the higher end of ASA's range, assuming a 10pm curfew, neighbors estimate more than 800 additional one-way trips. At the middle of ASA's projected range (65 individuals per field), again assuming a 10 pm curfew, neighbors estimate more than 520 additional one-way trips and double that number of headlights shining into bedroom windows. Realistically, in view of the potential attraction afforded by two adjacent fields, neighbors are justifiably concerned that the DES/WMS site might become a major venue for nighttime special events and tournaments extending until 10:30 or 11 pm. ASA estimates of player hours gained rise under such circumstances to nearly 156,000 per year.

Such a dramatic increase in nighttime traffic would be accompanied by a significant increase in noise and glare. As previously discussed, proximity produces an exponential increase in the intensity of noise as well as light received at neighboring homes. Cars entering and exiting the DES parking lot pass within a few yards of homes on 36<sup>th</sup> Street. Noise arising from cars parked on the street and in the DES parking lot includes the voices of people entering and exiting the fields, lock indicators going off, car alarms being triggered, engines starting and horns honking late into the night. Noise from car horns is a particular problem at DES because the entrance and exit to the parking lot are placed in unexpected locations. Their siting was determined by traffic planners' decision to create a counter-clockwise movement of cars during DES drop-off and pick-up times. As a result, drivers using the parking lot at night often become confused, honking their horns as they meet face-to-face with cars accelerating towards them from the opposite direction. The unfortunate result of increased the traffic and parking configuration is that both noise and light increasingly invade neighbors' homes at night, keeping young children from falling asleep and waking them up when they are sleeping.

### Disturbing and Harmful Noise Levels

Noise is of particular concern to the neighbors because of the unusual proximity of the homes to the fields and the presence in the neighborhood of children and others with medical conditions that require them to get lots of sleep.

Arlington recently amended its Noise Ordinance, acknowledging that "exposure to noise has deleterious effects on humans, animals and property" and can lead to "inability to sleep, increased irritability, and stress" among other adverse health consequences. In its new Ordinance, the County recognized, as does nearly every jurisdiction, that humans are far more sensitive to nighttime noise than to daytime noise. Accordingly, it established a nighttime maximum noise level of 55dB – much lower than the daytime level. At the same time, however, the County granted an exemption for athletic activities approved or authorized by DPR. Thus, noise levels that would be enforceable Ordinance violations if coming from a party at the home of a neighbor 25 yards from another neighbor are not enforceable when they come from the field 25 yards from a neighbor's property. In addition, the design of the two adjacent fields results in an amplification of sound as competitors, coaches and spectators often must shout to be heard over their counterparts on the neighboring field.

Neighbors routinely measure daytime noise levels from the athletic fields at more than 60dB, with intermittent noise levels over 70dB. The decibel scale is logarithmic, thus noise readings of 60dB and 70dB have ten to one hundred times the audio power of readings of 50dB. To put these readings in context, 60dB represent more than 1,000 times the audio power and 70dB represent over 10,000

times the audio power of current background noise levels of 27dB. Neighbors have no reason to believe that athletic field noise levels would be any lower during the nighttime and, given the exuberance that typically accompanies nighttime events, levels could be expected to be greater. In fact, DPR's insistence on a blanket exemption from otherwise applicable noise limits reflects its recognition that athletic events cannot be conducted in compliance with the Ordinance.

Like the direct effects of lighting, noise too has been found to disturb sleeping patterns. A recent report by the Parliamentary Assembly, Council on Europe on "Noise and Light Pollution" found that "high sound volumes, for all people, are always synonymous with nervous fatigue and sleep disorders (when noise occurs during the night)." The Assembly also found that "noise hampers communication, memorization and work" and that "difficulties and backwardness at school are very evident among children living in noisy environments." One researcher at the University of Virginia concluded that "sleep disorders can impair children's IQs as much as lead exposure."

Based on their current experience with daytime noise levels, neighbors are deeply concerned about the extension of that noise into the night, when – given the unusual proximity of homes to the fields – its intrusive effects will be felt more deeply. Again, imagine how close the pitcher and batter are to one another during a baseball game. Because athletic events are by their nature very noisy, neighbors and others urge the County Board to restrict those events to the daytime and not expose local residents to even more athletic-field noise, together with disturbing noise coming from hundreds of automobiles entering and exiting nearby parking areas.

### Field Capacity: Alternatives Could Generate More Capacity without Harming Residential Neighborhoods

Lighting proponents' argument, reduced to its essence, is that the neighbors' desire for peace and quiet must yield to the sports enthusiasts' desire for a modestly richer sports environment. While Arlington may benefit from additional rectangular field capacity, field space demand is largely driven by the rising number of very young children entering our schools. The 17 most heavily utilized rectangular fields in the County are natural-grass fields primarily located at elementary schools and small community parks. The needs of young children can best be met by installing organic synthetic turf where possible on these fields (as was done at Williamsburg), not by introducing lights into historically dark residential neighborhoods.

DES/WMS neighbors are well aware that the conversion of fields from grass to organic synthetic turf does sacrifice the natural quality of the affected spaces and also leads to increased utilization during the day. However, no option to provide additional field capacity for children can be achieved with zero impacts and safe synthetic turf is among the most widely-acceptable choices.

The advantage of converting grass fields to safe synthetic turf is even greater at fields located on APS school property since this provides students with more opportunity for outdoor play, augmenting DPR gains. Unlike lighting proponents, the neighbors believe that – in making investment decisions for limited fields space – the County should consider gains to school children and others who do not

belong to organized sports user groups but nevertheless benefit from upgrading grass fields to synthetic turf.

Appendix G shows in detail the combined increase in hours by APS and DPR for the two Williamsburg fields using the WFWG Field Utilization Model of DPR use, conservative assumptions for DPR utilization, and APS Facilities Director James Meikle's estimates for APS use. It shows realistic actual additional use of the fields by DPR and APS of over 1400 hours from converting from grass to synthetic turf, whereas adding lights would add only about 500 hours with a 9 pm curfew and about 300 more assuming a 10 pm curfew. Importantly, these estimates of actual increased play on the fields are based on realistic field utilization estimates, not theoretical but unattainable capacity that assumes equal utilization rates late at night as during the day. They also recognize that utilization rates in summer and winter are lower than peak spring and fall seasons. Provided action is taken to reject lights at DES/WMS, thereby clearly severing any automatic link between installation of synthetic turf and introduction of field lights, major capacity gains can be achieved from non-controversial conversions from grass to turf with few negative impacts on the local community.

Demand is also spurred by the recent rapid growth in the number of elite youth travel teams organized by ASA. When scheduling fields reserved through DPR, ASA grants first priority to travel teams. For example, the ASA photograph of children at Long Bridge Park, depicted in Section 2 of this report, shows participants in ASA-sponsored travel team skills training sessions. Two things are worth noting about this photograph. First, the number of children – slightly over 100 per field – is almost exactly the number of individuals ASA estimates would be using each of the DES/WMS fields in order to reach its projection of 106,400 person hours gained. Thus, what is portrayed as overcrowding at Long Bridge is applauded as a benefit in the form of person hours gained at DES/WMS. Second, travel teams exist because parents wish to give their children the opportunity to compete in elite regional, state-wide and national tournaments, demonstrating the means and willingness to travel significant distances to achieve this goal.

Although one-quarter of ASA's members are estimated to live within 1.5 miles of the DES/WMS fields, Yorktown High School is located just 0.9 miles away, Washington-Lee High School only 3 miles away, Quincy Park 3.2 miles away and Kenmore Middle School just 3.7 miles away from DES/WMS. Therefore, many Arlington resident players within ASA's 1.5-mile radius live closer to or nearly as close to one or more of the existing lighted venues as they do to the unlighted Williamsburg fields. Moreover, the inability of residents from Central and South Arlington to access the DES/MS fields via mass transit, major highways or adjacent heavily used roadways, raises concerns that more than offset the benefits associated with easier commutes and transportation energy savings benefiting residents of the northern third of the County.

The distribution of the County's lighted rectangular field capacity does not, in any event, appear to be out of line with demographic data showing that more than 80 percent of Arlington's population lives in Central and South Arlington, with only 17% living in the Northern third. Nor does the distribution of lighted fields appear to be inequitable when considering the distribution of County residents who are under 20-years-old, more than three-quarters of whom live in Central and South Arlington.

We also note that adult rectangular field use has declined every year since 2013 and is now below 2012 levels. DPR data show that lighted rectangular fields are almost half empty after 9pm – time periods that, as a practical matter, are primarily dedicated to adult use. Moreover, a statistically valid survey conducted by The ETC Institute shows that almost two-thirds of Arlington’s adult rectangular-field users do not want to play rectangular field sports after 9pm. This same objective survey shows that by 2:1 and 3:1 margins Arlington households are voicing greater need for natural areas, wildlife habitat, and hiking trails compared with rectangular sports fields.

Opportunities exist to meet the growing needs of children and youth who reside in the County by expanding field capacity without violating sound land use practices or imposing undue burdens on close neighbors. They include: (1) constructing new lighted fields in neighborhoods that want them (e.g., a coalition of Crystal City and Columbia Pike neighbors testified at a June 2016 County Board hearing on the Capital Improvement Plan in favor of funds for a new lighted field at Long Bridge Park); (2) installing organic synthetic turf and less-polluting field lights than those now in place at Kenmore Middle School; (3) installing organic synthetic turf on Arlington’s existing lighted grass fields; and (4) converting Arlington’s most heavily used existing unlighted grass fields to safe synthetic turf, so long as installation of turf is not automatically coupled with field lights.

Together these options would add many thousands of hours to Arlington’s current rectangular field capacity and afford children greater access for play at a time that does not interfere with their sleep hours. More than 700 hours per field would be gained (including gains to APS students as well as sports user groups) by converting the County’s 10 most heavily utilized grass fields at public schools to synthetic turf (no lights), for a combined capacity increase of over 7,000 hours. An additional 2,000-4,000 hours could be gained by converting Arlington’s four lighted grass fields to synthetic turf (note: gains at “drop in” fields benefit County residents whose schedules do not permit them to play in adult leagues). Depending on curfews and other limitations – as many as 1500 to 2000 hours per field could be gained by adding synthetic turf and lights to existing grass fields or to entirely new fields (e.g., Long Bridge) in neighborhoods that want them and/or meet the criteria outlined in Section XI below. These essentially non-controversial steps would yield a minimum of 10,500 – 13,000 hours of additional capacity, representing nearly 30-40 % increase in the County’s total rectangular field capacity compared with the status quo and 50 to 100% greater than the projected increase in student enrollment over the next decade. (Note that the actual capacity gains from replacement of grass with synthetic turf on lighted as well as unlighted fields are likely to be much larger, per the estimates provided by Ms. Gabriela Acurio, Assistant County Manager, at Appendix H of this report.)

In addition to the DES/WMS fields, other candidate fields have been identified by sports user groups, APS and County staff to expand lighted and unlighted rectangular field capacity. This in turn raises an obvious question: why not add as much capacity as possible in ways that do not harm surrounding neighborhoods instead of opting to light a site where only a minimal gain is achievable, while sparking significant controversy and damage to neighborhood character and quality of life.

## Mitigation – Some Impacts Are Impossible to Mitigate; Other Mitigation Options Are Impractical, Temporary or Unenforceable

Despite advocates' representations that neighbors have refused to discuss mitigation, the WFWG has in fact spent many hours exploring that issue. While not labeled as such, mitigation options were central to the WFWG's deliberations concerning alternative lighting scenarios and their impacts on spill and glare. Given the paucity of technical information provided by the County's contractor, neighbors were compelled to devote substantial resources to understand likely impacts and potential lighting schemes that might reduce those impacts before addressing scheduling and other measures sports enthusiasts consider to be "mitigation."

One principal difficulty with all of the lighting proposals is that the DES/WMS site was not originally planned for lighted fields. As Fairfax County recently acknowledged in its report on Athletic Field Lighting, effective mitigation is unlikely to succeed when retrofitting to place lights on fields that were not originally designed for them. In such cases, the only decision left to the governing jurisdiction is whether to light or not to light despite the inability to mitigate. In recognition of this reality and the proximity of nearby homes, Fairfax County recently decided not to light the newly installed synthetic turf at Linway Terrace in McLean, about a mile from the Williamsburg site, despite its policy linking installation of lights with synthetic turf fields.

Everything we've learned and know about the DES/WMS site underscores the conclusion reached by neighboring Fairfax County. With respect to light pollution, Musco's best-case design (a design incorporating best-available technology and requiring a zoning waiver to install very tall poles) nevertheless results in serious glare and potentially significant health effects.

High noise levels are inevitable in the evening, given the nature of adrenalin-producing competitive sports. Traffic and related neighborhood disturbance and pedestrian-safety problems will also increase. In combination, the inescapable effect of installing field lights will be to permanently alter the quiet, dark, and natural character of the neighborhood and diminish neighbors' quality of life. Despite the intentions of their proponents, suggested mitigation measures fail to mask the direct effects of lighting, much less reduce them. These proposals and their likely impacts are discussed below:

### Environmental Options

- Proposal: Plant denser tree, hedge, and ground cover in the western wooded area.

Response: A nationally prominent consulting arborist has studied the site and determined that a minimum of 1-2 mature trees and 55 linear feet of existing canopy would need to be removed to make way for Musco's S3 pole. The size and scale of equipment, materials and aerial space required to install and maintain a Musco array smaller than the S3 and S4 poles at WMS can be seen on a video of arrays being assembled and lifted into position at Art Crate Field in Washington State. Musco's LED Installation Guide leads to the conclusion that the damage to DES/WMS property, including the existing wooded area might actually be much

worse. More than a hundred young trees were planted last year along the edge of the wooded area closest to the fields. A great many of these are now dead or dying, in part because of the failure to honor promises made in connection with the DES Use Permit to remove bamboo and other invasive species. New groundcover cannot root until acres of bamboo, poison and English ivy and other vines now threatening the wooded area are permanently removed. The problem is not a lack of good faith; it is a lack of funding throughout the APS system to care for trees and remove harmful vegetation on school property.

Saplings that survive the impacts of construction and invasive species will not reach heights required to provide meaningful screening for 10-20 years.

- Proposal: Consider walls, sound barrier panels, higher fences or earthen berms.

Response: Musco's proposed poles will be the height of an 8-story building. Light will be striking neighboring properties on all sides of the school from multiple poles and lighting arrays containing as many as 21 large luminaires per pole. No one wants to live behind barrier walls high enough to protect second-story windows from 80' tall sources of glare nor, given the topography, is it possible to erect berms to block light and sound from the fields without transforming the look and feel of the school property from a scenic asset into a walled-off prison or open pitmine.

- Proposal: Develop a grant program to purchase blinds, shades, and white noise machines.

- Response: Living spaces in neighboring homes are oriented towards the fields. Neighbors' quality of life would be drastically altered if they would be unable to open windows when the weather is mild, with the entire length of their homes walled off by black-out curtains. Similarly, white-noise machines create more noise than the sound they are used to block. Engaging in normal conversation, appreciating music, movies, TV or falling asleep become difficult and in some cases not possible. The cure is as bad as or worse than the disease.

### Lighting-Specific Options

- Proposals: A variety of options are suggested from changing light settings, lowering the intensity or CCT of the light source, or reverting to a previously discarded High Intensity Discharge (HID) lighting option rejected by Musco because it cause too much light pollution. In particular, Musco submitted a last-minute LED proposal for 4500K lights and with 30-foot-candle uniformity on the fields on January 30<sup>th</sup>, just before the Board work session.
- Response: WFWG members and outside lighting engineers have spent 18 months obtaining and analyzing Musco's "best case" lighting proposal. Lighting proponents, opponents, and DPR staff do not possess the expertise to design or evaluate a brand new lighting option, and the WFWG does not have the budget, professional training or time to thoroughly analyze it. Nor do neighbors wish to pursue a lighting option Musco has determined to be inferior to the one it originally proposed. Regarding the 11<sup>th</sup>-hour 4500K proposal, Musco itself maintained for 15 months that the new proposal would be inferior to its "best case" plan,

reversing itself just two weeks after receiving a request from staff for a 4500K option. Musco had specifically stated that lowering the color temperature of the lights “increases the fixture count needed to get enough light on the playing surface, decreases energy savings, and increases spill/glare as we would be adding more fixtures.”

### Scheduling and Procedural Options

- Proposals: Nearly a dozen different types of restrictions on use of the fields have been suggested by lighting proponents.
- Response: Lighting proponents, including the Sports Commission, have recommended such measures as memoranda of agreements (MOAs) and committees (e.g., Friends of Williamsburg Field [FWF]) to govern and police field lighting construction, operations and schedules. Such approaches, however, fail to address the fundamental issue — that lighting alone, as shown herein, will itself severely and irrevocably impair neighborhood quality of life. Procedural requirements and safeguards do nothing to address glare or light spill, during hours when the fields are lit, nor to preserve neighbors’ existing peaceful enjoyment of their homes, or to prevent a significant increase in noise and traffic that are inevitable and expected consequences of field lighting. Moreover, advocates of these ideas - sports user groups, the Sports Commission and others – do not have the power to ensure that any such limitations would endure beyond their current terms in office. Such restrictions would not be legally binding and in a number of cases the advocates themselves are unsure of whether a given suggestion would lessen or increase adverse neighborhood impacts.

Proponents assume that the proposed field lights represent a public good; the fundamental question they appear to be focused on is how much of this good must be sacrificed to persuade neighbors to accept what the objective analysis reveals to be a poor public policy choice. Limitations on hours of play cannot restore damage to the environmental integrity of the western wooded area caused by installation and operation of the lights. The ability of parents to get young children to sleep on time three nights a week cannot make up for the four nights when sleep is disrupted. And scheduling children to play at night under intense blue-wavelength light levels the AMA’s top experts believe could put them at risk is a bad gamble. Lastly, there is evidence, in the form of the ETC Institute’s recent survey, that Arlington households generally feel much more acutely the need for more opportunities to connect with nature than to augment opportunities to play on rectangular sports fields.

### Framework and Criteria to Guide Policy on Athletic Field Lighting

Recent discussions have revealed that one of the most vexing problems for WFWG representatives, Advisory Commission members, and decision-makers in County government is the lack of an agreed-upon framework with consistent criteria to decide which locations are and which are not suitable for installation of rectangular, diamond and multi-purpose field lights. It is clear that decision-makers as well as, community members and leaders throughout the County are dissatisfied with the prospect of



treating each decision de novo and would prefer a more fully transparent, comprehensive, planning process with a common frame of reference, criteria, standards and comparative analysis to guide them. In recognition of this need, and drawing upon what we’ve learned from our experience serving on the WFWG, we recommend the following neutral criteria for your consideration. (An annotated version of the criteria showing how each would apply to the DES/WMS site is provided at Appendix I.)

1. Lighting should be part of the original master planning for the field. It can be very difficult to retrofit lights to existing fields in a manner that does not significantly impair the neighborhood quality of life, as the WFWG has learned.

Many of Arlington’s sports fields (Yorktown, Washington-Lee, and Wakefield High Schools) have been lighted since the 1950s and sports field lighting was planned from the outset. Lighting authorities have cautioned that, because field lights can be highly intrusive — particularly on the settled expectations of abutting neighbors — lighting should be planned with field construction to ensure that the fields are of adequate size, orientation and overall design to accommodate lights without undue adverse effects on neighbors. The Illuminating Engineering Society of North America, in its Recommended Practice for Sports and Recreational Area Lighting (IESNA RP-6-15), cautions that “lighting systems should be designed in conjunction with the facility.” Similarly, in its “White Paper on Athletic Field Lighting,” Fairfax County recently warned that, “while field orientation during the initial master planning stage may make it possible to minimize glare problems, this is unusual when retrofitting lights to existing fields.”

2. Lighted grass rectangular fields should be upgraded to lighted turf fields. Consistent with recommendation 1 above, where lights were planned as part of field construction, existing lighted grass fields typically can be upgraded to synthetic turf without undue effects on surrounding properties. Such upgrading can greatly enhance the number of hours of use. Attached at Appendix I is a memorandum prepared by then-Assistant County Manager Gabriela Acurio to County Board member Mary Hynes responding to questions raised by Ms. Hynes about County sports field use that had arisen during the County Board’s examination of a similar proposal to light a local high school’s sports fields. Ms. Hynes asked the County to summarize the increase in field playing hours arising from the County’s switch from grass to synthetic turf at the County’s lighted grass fields. Ms. Acurio responded as follows:

<u>Facility</u>	<u>Hours with Grass</u>	<u>Hours with Synthetic Turf</u>
Gunston	500	2000
VA Highlands	800	2300
Wakefield	200	1800
Greenbrier	300	1700
Washington-Lee	600	1900

As shown above, installation of synthetic turf in lieu of grass can increase playing hours at lighted grass fields by a factor of 3 to 9 times, without causing the kind of community contention and impairment of community quality of life occasioned by the installation — for the first time — of

intense sports-field lighting into residential neighborhoods. Also, DPR currently hosts at least 4 lighted Bermuda grass fields — Gunston #3, Kenmore #2, Thomas Jefferson Upper Field, and Quincy #1, fields that could be upgraded to synthetic turf.

3. Importance of Immediate Physical Setting for Sports Lighting Proposals. The CIE in its “Guide on the Limitation of the Effects of Obtrusive Light from Outdoor Lighting Installations” (CIE 150), provided guidance on the factors that should be considered by municipalities and other authorities when contemplating the siting of outdoor lighting installations. The CIE is an entity responsible for promoting international cooperation and exchange of information among member countries (including the United States) relating to the science of lighting. It has developed standards, recommendations, and guidance for outdoor lighting.

The CIE cautions that the siting of outdoor lighting must consider “the potential effects of the lighting on occupants of surrounding properties” including “changes to the amenity of an area due to the intrusion of spill light into otherwise dark areas . . . and to the direct view of bright luminaires.” The CIE has set forth the following factors as “significant influences on lighting impact” to be considered by local authorities. (CIE Report at section 2.5).

CIE factors include:

- a. The zoning of the area abutting the proposed development. According to the CIE, “[t]here is a greater potential for complaints when the area is zoned for residential development.” We note, in this regard, the considerable care shown by the County in amending its zoning ordinance to allow the installation of tall structures such as light poles at Long Bridge Park. The staff report to the proposal specifically stated that “the proposed changes have been crafted to not adversely affect neighboring properties.” The staff cautioned further that the proposed 100’ height limit “not be applied generally to all ‘P-S’ zoned properties, as many are nearer to low density residential areas.” The light poles were appropriate at Long Bridge, according to the staff, because it is a large site, intensely developed, and bounded by major roads, ramps to highways, and railroad tracks. According to the staff, the site’s “Public” designation as part of the “P-S” district also indicated that athletic facilities of this proposed size and scope were appropriate. Staff Report to Proposed Zoning Amendment (Nov. 15, 2006).
- b. “The state of development of the area . . . i.e., whether the area is sparsely settled or fully built-up.”
- c. The topography of the area surrounding the lighting installation. According to the CIE, “residential developments which are at a lower level than that of the lighting installation should be particularly considered, where a direct view of the luminaires is possible.” Thus, if nearby residences are below the level of the lights, the site should be considered a poor location for lights.
- d. Physical features at the site, such as adjacent tall buildings, trees and spectator stands, “which may be effective in restricting light spill beyond the boundaries of the development.”
- e. The presence or absence of other lighting in the immediate area and the type of lighting involved. According to the CIE, “the effect of the proposed lighting will be lessened where the

surrounding area is reasonably well-lit, e.g., arterial road lighting or lighting from adjacent commercial developments.”

4. Proximity of homes. Not surprisingly, the proximity of residences to outdoor lighting installations also significantly affects how well or badly lighting can be tolerated by neighbors. Distance from homes is an especially sensitive factor because light intensity and noise intensity both dissipate inversely proportional to the square of the distance from the source. Thus, if a home is twice as far from the source as another, it receives one-fourth the intensity of light and noise; if it is three times as far, it receives one-ninth the intensity of light and noise; if four times as far, it receives one-sixteenth the intensity of light and noise.
5. Disturbance and Harm to the Environment. Field lights, especially high intensity LED lights mounted on 80—90- foot tall poles, are large and very bulky structures and their installation — particularly at fields not designed for lights — can cause harm to both the natural environment and existing physical features. Arlington’s Urban Forestry Master Plan, for example, recommends that County development efforts enhance and improve the County’s threatened tree canopy. Arlington’s Public Spaces Master Plan urges that development not disturb existing connections between residents and natural spaces or the habitats in wildlife corridors. Sites at existing public schools and parks may also contain important scenic values that are assets to the community-at-large.

For these reasons, any consideration of field lights at a particular setting must consider the potential adverse environmental effects and disturbance, including noise pollution, at that setting arising from the construction, operation, maintenance and use of field lights.

6. Community-Wide Transportation Access. To the extent possible, preference should be given to potential sites for field lights that are accessible via mass transit and/or major highways and connecting roadways, with the objectives of placing priority on investing first in facilities that are reasonably within reach of residents who live in all parts of the County and minimizing impacts on lightly traveled neighborhood streets. Traffic can have effects on noise levels and automobile and pedestrian safety. The marginal impacts will depend on several factors, including the configuration of existing street networks, and the urban versus suburban nature of the neighborhood. Consideration of future sites should incorporate analysis of existing and potential traffic patterns, noise and other effects.

(An annotated version of the criteria applying each to the DES/WMS site is provided at Appendix L.)

### Past and Current Public Process Flaws

The preceding discussion conclusively demonstrates, we believe, that the DES/WMS fields cannot be lighted in a manner that preserves neighborhood character and quality of life. At the same time, we think it is important to identify process flaws that have plagued decision-making in the past and continue to impede a full and fair resolution of the DES/WMS lighting issue. These flaws are accompanied by lessons learned that are applicable to other neighborhoods. They have given rise to avoidable neighborhood skepticism about the objectivity of decision-making pertaining to lighting the DES/WMS fields and impeded a thorough review of some critical technical matters.

As early as 2004-2005, for example, language was inserted into the Appendix of the Public Spaces Master Plan calling for the installation of synthetic turf and lights at WMS, Swanson Middle School and H.B. Woodlawn. Despite the profound implications of such a proposal on the settled expectations of residents within numerous Arlington communities, that language was not made available to the public before it was approved, no effort was made to obtain views of affected residents, and no analysis was provided to support the recommendations.

More recently, in 2013, neighbors here were repeatedly assured during the Public Facilities Review Committee (PFRC) and Building Level Planning Committee (BLPC) meetings for the DES Use Permit that the DES/WMS fields would remain Bermuda grass and that neither synthetic turf nor lights would be installed. At the last PFRC meeting in July 2013, Chairman Charles Monfort requested staff confirmation that the fields would remain natural grass, not artificial turf, and that lights would not be installed. This assurance was provided. Six weeks later, these promises were revoked by the then-County Manager, who inserted new draft Use Permit language calling for synthetic turf and lights. This decision, too, was reached in private, with no outreach to the community.

The WFWG was created to remedy these process flaws. In supporting the creation of the WFWG and its charge, then-Chair Walter Tejada acknowledged publicly that the neighborhood had been “ambushed” in the past and, with the unanimous support of the Board, promised that future decisions must be reached with full transparency. Despite the Board’s intention to remedy past errors by creating an open, objective, and balanced analysis of the pros and cons of lighting the fields, Chairman Gutshall’s best efforts and the hard work of many able public servants at DPR, the Work Group process remained flawed:

- On January 20, 2017, after the conclusion of the Work Group’s lengthy technical discussions and reviews, Musco Lighting submitted an entirely new proposal that the vendor had previously criticized as deficient and that no one on County staff or the WFWG has the professional expertise to evaluate.
- Throughout the WFWG process, staff maintained that there were no County funds to hire an independent lighting expert to review Musco’s plan. At great expense, the neighbors contracted with a nationally recognized lighting expert to review and critique the vendor’s claims. In late August, neighbors disclosed that the report of this expert would soon be forthcoming and that they were seeking time on the agenda for WFWG’s September 21, 2017 meeting to discuss its major findings. At the September WFWG meeting, neighborhood representatives learned, for the first time, that funds had been secured for a hastily-prepared study by James A. Posey and Associates, voicing support for Musco’s claims despite Posey’s inability to access the photometric data upon which the vendor’s calculations are based. The Posey review resulted in a brief letter-report that, in reality, could not verify Musco’s projections and calculations and failed to consider several critical technical issues, including the impact of glare on abutting neighbors.
- Despite the repeatedly expressed and serious concerns of neighbors about the validity and reproducibility of Musco’s projections of lighting effects, the company has refused to disclose its

photometric data, and the County apparently has been unable to compel its sole-source vendor to supply such data for review by independent third-party experts. Accordingly, much of the information on which both the neighbors and the County relies is entirely uncorroborated.

- A report created by Musco in May 2015 but not provided to Work Group members until just before the close of business on the day the WFWG final report language was due, reinforces these concerns.
- Despite language in the WFWG charge calling for the group to evaluate environmental and other construction impacts and the cost of mitigating these, the information required to conduct such a review has not been supplied. A perfunctory eight-sentence letter provided by Lee relies on inaccurate and incomplete installation/construction information and is inconsistent with other facts, including visual evidence contained in a video showing installation of a Musco array at Art Crate Field, and with guidance contained in Musco’s own “Installation Instructions.”

The County has long placed a very high priority on transparency in its decision-making and on promoting openness and active citizen collaboration in Arlington government. At the same time, the County has taken pride in the quality of its decisions and the thoroughness with which it confronts difficult and complex technical matters.

The WFWG process has been helpful, we believe in acknowledging, if not fully resolving, some of the serious process failures that have arisen in the past. It has also provided a forum for the airing of some of the many significant potential adverse effects arising from the new lighting technology proposed for this site. Many of its members believe, however, that the process – however lengthy and well-intentioned – still fails to correct some of the past process flaws and to provide an adequately resourced and technically proficient mechanism to explore and resolve the significant adverse effects flowing from the vendor’s lighting proposals. These deficiencies, neighbors believe, underscore the need to approach decisions of this kind with an acute awareness that the risks associated with unresolved issues and unanswered questions falls entirely on them for all time.

## Conclusion

As described above and in Appendix I, application of the neutral site-related factors recommended by the CIE show clearly that the DES/WMS site is an extremely poor candidate for sports field lighting. The effects of lighting on those living in the surrounding properties would be, by any measure, severe and disruptive. The introduction of very high light poles will itself harm the natural environment and impair the visual harmony of the neighborhood. The extraordinarily bright luminaires will cause significant acute effects (glare) affecting both players and neighbors, and may have serious and long-term adverse consequences for human health and the environment. Nighttime noise will compound these effects, including additional commotion and neighborhood disruption resulting from a surge in field-related traffic.

To the extent that unresolved questions might persist about the precise nature and extent of some of the adverse effects discussed above, we would point out that it is the applicant for a special use permit who bears the burden of demonstrating its entitlement to the permit. Thus it is the applicant that must

demonstrate that the grant of a permit will not “affect adversely the health of persons residing or working in the neighborhood” or “be detrimental to the public welfare.” Although the Work Group may not have achieved a perfect understanding of the many complex public health and technical issues raised by this permit application, the record generated over the past year and a half demonstrates quite plainly that such a showing has not been made.

For these reasons, we urge the County Board to reject the installation of lights on the Williamsburg fields and to adopt thoughtfully crafted criteria, consistent with best land use planning practices, to guide comparative analysis and decision-making on future locations proposed for sports field lights.

Respectfully submitted by:

Joseph Delogu

Gregg Kurasz

Ruth Shearer

Larry Suiters

Roy Gamse

Liz Kirby

Charles Trabandt

David Friedman

John Seymour (***Please note:*** my position does not reflect that of E2C2 which has not yet received nor reviewed the Work Group Final Report nor taken a position on this issue).

## Section IV. Follow-on Recommendations

Though not specifically charged to do so, the WFWG developed the following recommendations for further consideration outside of the immediate decision whether or not to light one or more of the rectangular fields at Williamsburg Middle School. These recommendations include key considerations to objectively evaluate multiple candidate sites for sports field lighting, specific process requests related to lighting the WMS fields, as well as several potentially county-wide issues that surfaced as part of this process.

### Key Considerations for Evaluating Potential Field Lighting

The WFWG understands that evaluating field lighting is only one aspect of a larger planning process involving decisions such as if and where to build new sport fields (rectangular, diamond, and multi-use), whether to convert existing fields to synthetic grass, and whether to light such fields. The WFWG supports the county moving towards a comprehensive planning process for field construction, improvement, and lighting.

The International Commission on Illumination (CIE) “Guide on the Limitation of the Effects of Obtrusive Light from Outdoor Lighting Installations” (CIE 150), provides guidance on several factors that should be considered when siting outdoor lighting. The CIE is an entity responsible for promoting international cooperation and exchange of information among member countries (including the United States) relating to the science of lighting. The CIE cautions that the siting of outdoor lighting must consider “the potential effects of the lighting on occupants of surrounding properties” including “changes to the amenity of an area due to the intrusion of spill light into otherwise dark areas ... and to the direct view of bright luminaries.”

Suggested considerations include:

#### 1. Lighting should be part of the original master planning for the field

It can be very difficult to retrofit lights to existing fields in a manner that does not significantly affect neighbors’ quality of life. Many of Arlington’s sports fields (Greenbrier, Washington & Lee, Wakefield) have been lighted since the 1950s and sports field lighting was planned from the outset. Lighting authorities have cautioned that, because field lights can be highly intrusive — particularly on the settled expectations of abutting neighbors — lighting should be planned with field construction to ensure that the fields are of adequate size, orientation and overall design to accommodate lights without undue adverse effects on neighbors. The Illuminating Engineering Society of North America, in its Recommended Practice for Sports and Recreational Area Lighting (IESNA RP-6-15), cautions that “lighting systems should be designed in conjunction with the facility.” Similarly, in its “White Paper on Athletic Field Lighting”, Fairfax County recently warned that, “while field orientation during the initial master planning stage may make it possible to minimize glare problems, this is unusual when retrofitting lights to existing fields.”



In addition, evaluation of lighting fields should consider the context of larger planning processes to evaluate future sports field demand compared to current capacity and the marginal gains of playing time from added lighting at various candidate fields. Understanding the extent of the benefits of additional field capacity to the broader community will allow for a more useful comparison with the negative impacts on the neighborhoods close to the lighted field.

## 2. State of development of the area

The CIE recommendations make a distinction between "...whether the area is sparsely settled or fully built-up." The zoning district of the proposed site and the surrounding neighborhood as well as the density and intensity of uses, including residential, commercial, public, and other uses help provide the context for the introduction of field lights.

## 3. Topography of the surrounding area

According to the CIE, "residential developments which are at a lower level than that of the lighting installation should be particularly considered, where a direct view of the luminaries is possible." Thus, if nearby residences are below the level of the lights, the site may be considered a less preferred location for lights.

## 4. Physical features of the site which may mitigate light spill

Features such as adjacent tall buildings, trees and spectator stands, which may be effective in restricting light spill beyond the boundaries of the development, may identify a location as a better candidate for lighting than one without such obstructions.

## 5. Presence of existing lighting in the immediate area

According to the CIE, "the effect of the proposed lighting will be lessened where the surrounding area is reasonably well-lit, e.g., arterial road lighting or lighting from adjacent commercial developments."

## 6. Proximity of homes

Not surprisingly, the proximity of residences to outdoor lighting installations also significantly affects how well or badly lighting can be tolerated by neighbors. Distance from homes is an especially sensitive factor because light intensity and noise intensity both dissipate inversely proportional to the square of the distance from the source. Thus, if a home is twice as far from the source as another, it receives one-fourth the intensity of light and noise; if it is three times as far, it receives one-ninth the intensity of light and noise; if four times as far, it receives one-sixteenth the intensity of light and noise.

## 7. Environment impacts

Arlington's Urban Forestry Master Plan, for example, recommends that County development efforts enhance and improve the County's threatened tree canopy. Thus, the impact of sports field and lighting installation, maintenance, and operation to trees should be evaluated. Also, Arlington's Public Spaces Master Plan urges that development of new or renovated sport fields and field lighting not disturb existing connections between residents and natural spaces or the habitats in wildlife corridors.

### Williamsburg Lighting Process Recommendations

The WFWG recommends the following requests be considered as the County proceeds with review of the WMS Use Permit Amendment to allow lighting one or both fields:

- 1. County staff should prepare a revised Environmental Assessment (EA) prior to the Use Permit Amendment hearing by the County Board with sufficient time to allow for review by E2C2.** Though it may be within the letter of administrative regulations to delay EA review until the County Board decides to light the fields, numerous concerns related to potential environmental impacts were raised by the WFWG but not fully evaluated. E2C2 is charged with advising the County Board specifically on these issues, and the Board would certainly benefit from such advice when deciding whether or not to light the fields. In addition, access to reasonably detailed materials concerning plans for construction, operation and maintenance of the proposed lights could inform the Environmental Assessment and permit a more thorough review by the E2C2.
- 2. The County Manager should make his recommendation and the accompanying staff report on the Use Permit Amendment available to the community well in advance of the County Board hearing.** Though the County has established guidelines and improved transparency and accountability by endeavoring to release staff reports in advance, occasionally, the County Manager's recommendation and supporting narrative are not known by the affected community until just before a County Board hearing with little time for the community to prepare. The WFWG suggests that the over two months that will elapse between the submission of this report and the County Board hearing of the Use Permit Amendment should be adequate time for staff to thoroughly review the information and provide its recommendation well in advance of the County Board hearing.
- 3. The County Board should communicate clearly to the community the remaining process leading up to the Board's decision on whether or not to light the fields.** The community respectfully requests advanced knowledge of the major milestones in the process leading up to the Use Permit Amendment hearing. These include, but are not limited to, the preparation of the EA, reviews by relevant commissions, release of staff reports, etc.

## County-wide Recommendations

**4. Consider giving priority to upgrading to synthetic turf existing natural grass fields that already have lighting.** WFWG analysis reveals that upgrading from natural grass to synthetic turf provided substantial increased hours of play at WMS. This suggests substantial opportunity to increase field capacity at sites already accustomed to lighting. Further, the group recommends upgrading older lighting with newer technologies that better control spill and glare.

**5. Establish more robust installation and maintenance procedures for vegetative buffers.** Vegetative buffers between playing surfaces and neighboring homes can significantly mitigate adverse impacts on the surrounding neighborhood. If appropriate, existing vegetative buffers should be enhanced. Invasive species (i.e., bamboo, poison ivy, English ivy, kudzu, etc.) should be eliminated and constantly managed so that vegetative buffers are prevented from degrading and are allowed to grow.

The WFWG notes that at the WMS/DES campus, the vegetative buffer along all sides of the playing fields, and especially the western boundary was affected severely by construction of the new DES and the associated fields. The western buffer remains infested by dangerous poison ivy and harmful invasive species such as English ivy and bamboo. Nearly half of the newly planted trees between the fields and homes closest to the fields have already died due to mismanagement or are being overrun by invasive species.

**6. Develop a “Good Neighbor” policy for Arlington Public Schools.** Throughout the WFWG process, neighbors recounted examples of frustration with APS related to both construction issues and post-occupancy deficiencies. Just one example was the numerous repeated requests over a period of months to have the lights at the basketball courts properly adjusted to reduce the spill onto neighboring homes. Further, apparently, APS janitorial staff members were turning on the basketball court lights late at night at the end of their shift to provide security for walking to their cars. The frustrating experience of neighbors with APS undermines community confidence that any adverse impacts from schools or other community facilities can be successfully managed, thereby eroding public support for siting of community facilities.

## Appendix A – Williamsburg Field Site Evaluation Work Group Charge

### **Williamsburg Field Site Evaluation Work Group Charge**

**Adopted July 21, 2015**

**Amended July 19, 2016**

#### **Background:**

In September 2013, the Arlington County Board requested the County Manager initiate a Williamsburg Field Site Evaluation Work Group (WFWG) **“to lead a robust community process to evaluate whether or not to light the Williamsburg synthetic fields.”** The Board directed that:

“Included in that evaluation, although not limited to these topics, shall be whether the environmental, noise and light spillage impacts of, for the first time, lighting one or two fields at Williamsburg can be mitigated sufficiently to preserve the character of the neighborhood and provide a reasonable quality of life to the nearest neighbors – both those whose property abuts the Williamsburg property and those who live across N. 36th street from the site. The members of the Working Group shall be appointed by the County Board and include, at a minimum, near neighbors, the Rock Spring Civic Association, appropriate County commissions and school and recreation field users. The working group shall conclude its work by June of 2016 in order to allow full and appropriate review of any recommendations prior to consideration of the lights question as part of the scheduled Williamsburg Use Permit Review at the September 2016 County Board meeting.

#### **Proposed Timeline:**

- County Board appoints WFWG members - July 2015.
- WFWG initial meeting July - August 2015.
- WFWG and staff establish full meeting schedule - September 2015.
- WFWG hiatus effective April 21 and will reconvene in September 2016.
- Staff will finalize Fact Finding requests discussed in April 21 meeting with County Board Liaison to the WFWG, Christian Dorsey; WFWG Chairman Erik Gutshall; WFWG representatives and County staff support. Those fact finding requests will be completed and posted three weeks prior to the WFWG reconvening in September 21, 2016. Materials will be posted on August 31.
- WFWG will commence evaluation of all information received and observation of the new Synthetic turf field operations – August 2016.
- WFWG meetings resumed - September 2016
- WFWG to draft and Review recommendations – October 2016
- WFWG prepare DRAFT report – November 2016
- WFWG to present report to relevant commissions – December 2016
- County Board to hold a Work Session to review and discuss WFWG report – January 2017
- WFWG to review and finalize recommendations – January 2017
- WFWG recommendations to County Board – February 2017

**Work Group Composition:**

- Chair – member of the Planning Commission (1)
- Sports Commission – at large representative (1)
- Parks and Recreation Commission – at large representative (1)
- E2C2 –at large representative (1)
- Rock Spring Civic Association – at large representative (1)
- Williamsburg Civic Association – at large representation (1)
- Yorktown Civic Association – at large representation (1)
- Residents whose property abuts the field (3)
- Residents whose property is across the street from the field (3)
- Arlington Soccer Association representative (1)
- Women’s soccer representative (1)
- Coed soccer representative (1)
- PTA representative (either Elementary or Middle School) (1)

The Chair of the work group will be appointed by the County Board. The Chair will work closely and collaboratively with staff to ensure that the evaluation process and recommendation are completed within the timeline that has been specified and that the County Board charge is fulfilled.

**Staffing:** County and APS staff will serve as the primary resources to the work group. A County staff project manager will work collaboratively with the Chair to facilitate the work group’s process. An interdepartmental staff team including County and APS staff will provide technical resources and information to include program data and research and analysis on expected noise and light effects associated with the Williamsburg synthetic field site.

**Study Area Description:** The Williamsburg fields are located on the campus of the Williamsburg Middle School and the new Discovery Elementary School. The fields are bounded by N. Harrison Street, 36<sup>th</sup> Street N., N. Kensington Street, 36<sup>th</sup> Road N., Kenilworth Street, two sections of Jefferson Street, and 37<sup>th</sup> Street N.

**County Board Liaison:** The County Board will appoint one of its members to serve as a liaison to this effort. Staff and the work group Chair will regularly update the County Manager and the County Board liaison on progress, discuss process issues, and keep the liaison informed on direction and policy issues.

**Policy Guidance:** The Work Group should consider existing County policies in the Noise Ordinance, Zoning Ordinance, Public Spaces Master Plan (PSMP) and any other relevant elements of the County’s Comprehensive Plan. In particular, the 2005 PSMP discusses synthetic turf fields installation and lights in Appendix F. At the September 2013 County Board meeting when considering the Use Permit request for the Elementary School #1, the County Board determined that the sentence “*All synthetic grass conversion should have existing lighting or a plan for installing ‘dark sky’ lighting as a part of the synthetic grass installation*” in the PSMP is open to interpretation about whether lights are in fact required when installing synthetic turf. This discussion by the County Board should be taken into consideration by the WFWG when reviewing the PSMP and other policies.

**Areas of Consideration for the Work Group:**

Impacts to programs and uses:

- Impacts to current level of public services provided to County residents
- Analysis and mitigation of impacts on the surrounding neighborhood
- Opportunities to combine multiple priority programs and uses on the fields
- Hours of operations
- Compliance and enforcement of permitted use

Site considerations:

- Impacts to undisturbed natural areas
- Compatible with neighborhood context and surroundings
- Sufficient open/recreational space to support site uses and community needs

Fiscal and Timing Considerations:

- Added costs due to complicated construction, phasing, mitigation of impacts, and/or maintenance of existing county programs and uses
- Ability to complete a project within the necessary timeframe

**Community Outreach:** During the course of the field site evaluation, collaboration with the community will be a high priority and take a number of different forms. Staff will work with the Chair of the work group to develop a public information plan for review and adoption by the work group. A variety of communication tools will be used, including, but not limited to:

- Williamsburg Field Site Evaluation webpage on the County's website
- E-mail
- Press releases
- Public meeting notices
- Social media

**Deliverables:** The Work Group recommendations will be publicly available for at least 10 days prior to the work session with the County Board. County Board will give full and appropriate review of the recommendations in preparation for the Williamsburg Use Permit Review of the lighting options at the December 2016 County Board meeting.

**Meetings:** Staff will work with the WFWG Chair and membership to establish a meeting schedule and agendas

Williamsburg Field Site Evaluation Workgroup (WFWG)  
Appendix B – WFWG – Fact-Finding Request – September 20, 2016

Appendix B – WFWG – Fact-Finding Request – September 20, 2016

**Williamsburg Fields Workgroup Fact Finding Requests Submitted**

#	Information Requested	Date Requested	Requestor	Source	Status	Complete?
1	MUSCO Lighting to visit the WMS site and identify 2-3 options it would recommend for lighting 1 or 2 rectangular fields and provide detailed specifications and photometric plans for each option. We seeking to understand which specific areas within the neighborhood would be impacted by light pollution (glare and spill) generated by each option.	8/10/2015	Larry Suiters	Musco	Presented in the Musco 10/21 Presentation. John Seymour's email dated January 6, 2016 Questions forward to Musco for their response	complete
2	Technical and other data County staff (Planning, DPR, etc.) posed to Bishop O'Connell during the extended period leading up to the County Board's decision to reject field lighting at O'Connell.	8/10/2015	Larry Suiters	CPHD	<a href="#">Posted on the webpage</a>	complete
3	Field-by-field utilization data, compiled from January-December 2014 External User Request Forms for use of the County's existing 16 lighted rectangular and 19 lighted diamond shaped fields. The compilations should show the share of nighttime play capacity for each field that was not utilized, the percentage of available hours used by Arlington resident versus non-resident athletic teams and the percentage of hours used by children and youth versus adult athletic teams.	8/10/2015	Larry Suiters	Not in scope of the WFWG charge. However, DPR Staff provided in a separate meeting on 1/19/16 to interested WFWG members. Presentation included countywide field utilization data for FY15.	DPR staff provided info January 2016 to illustrate countywide utilization data and answered any questions WFWG members had at that time.  <a href="#">Presentation</a>	complete
4	A list of other athletic fields / public spaces in Arlington County that have been identified by County staff and /or recommended by outside organizations for future installation of synthetic turf and lights.	8/10/2015	Larry Suiters	2003 Field Candidate Profiles Report	<a href="#">Posted on webpage</a>	complete

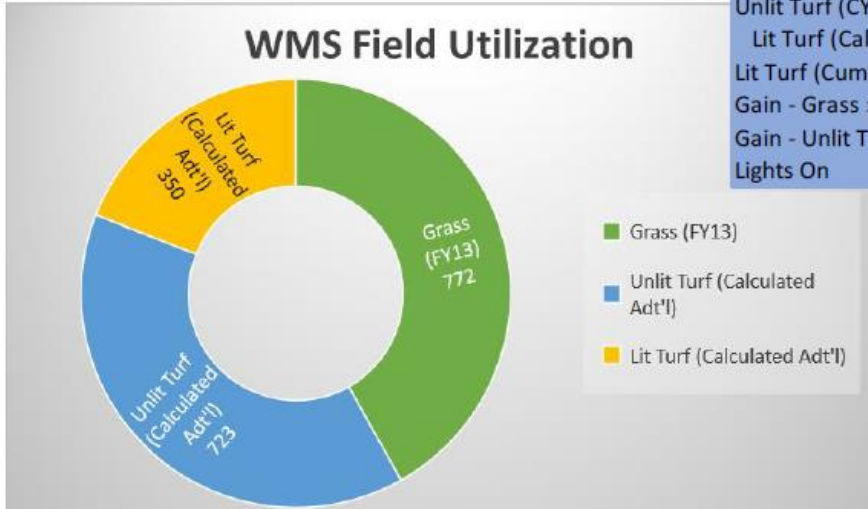


Appendix C – Field Utilization Model

# FIELD UTILIZATION MODEL

GRASS										
FY13 WMS Data	Field 1	Field 2								
DPR Scheduled (hrs/yr)	504	461								
Inclement Weather Loss Factor	20%									
TOTAL (hrs/yr)	403	369								
	*rounded to integer									
UNLIT TURF										
CY16 WMS Data	Field 1	Field 2								
DPR Scheduled (hrs/yr)	896	862								
Utilization Factor	85%	85%								
TOTAL (hrs/yr)	761	733								
	*rounded to integer									
LIT TURF										
Modeled Projection	Spring	<input checked="" type="checkbox"/> 13 wks				Summer	<input checked="" type="checkbox"/> 9 wks			Fall
	M-Th	Fr	Sa	Su		M-Th	Fr	Sa	Su	M-Th
Num Days	4	1	1	1		4	1	1	1	4
Utilization Factor	73%	73%	58%	69%		66%	66%	48%	51%	70%
Curfew	10:00 PM	10:00 PM	10:00 PM	10:00 PM		10:00 PM	10:00 PM	10:00 PM	10:00 PM	10:00 PM
Mean Sunset	8:02 PM	8:02 PM	8:02 PM	8:02 PM		8:16 PM	8:16 PM	8:16 PM	8:16 PM	6:22 PM
Exit time (minutes)	15									
Hrs Available (per day)	1.71	1.71	1.71	1.71		1.48	1.48	1.48	1.48	3.37
Hrs Used (per day)	1.25	1.25	0.99	1.18		0.98	0.98	0.71	0.75	2.36
Total (hrs/season)	65	16	13	15		35	9	6	7	123
Total Lights On (hrs/season)	119	30	30	30		74	19	19	19	205
Time on before sunset (minutes)	20									

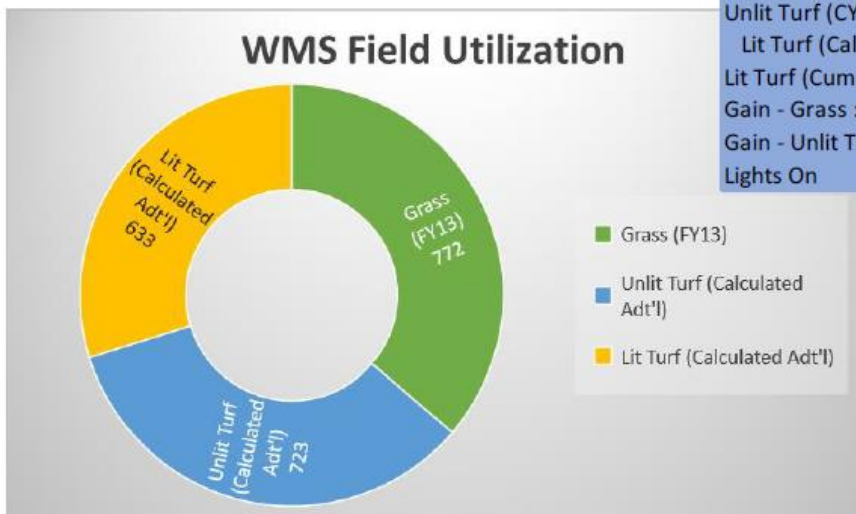
## Model Scenario - Low



	TOTAL Hrs/Yr			
	Field 1	Field 2	Total	Avg
Grass (FY13)	403	369	772	386
Unlit Turf (Calculated Adt'l)	359	364	723	361
Unlit Turf (CY16)	761	733	1494	747
Lit Turf (Calculated Adt'l)	175	175	350	175
Lit Turf (Cumulative Total)	937	908	1845	922
Gain - Grass : Unlit Turf	89%	99%	94%	94%
Gain - Unlit Turf : Lit Turf	23%	24%	23%	23%
Lights On			453	

- Prime Time only
- 9PM Curfew (8:45PM cutoff)
- Lower Utilization Factor
- No Winter Use

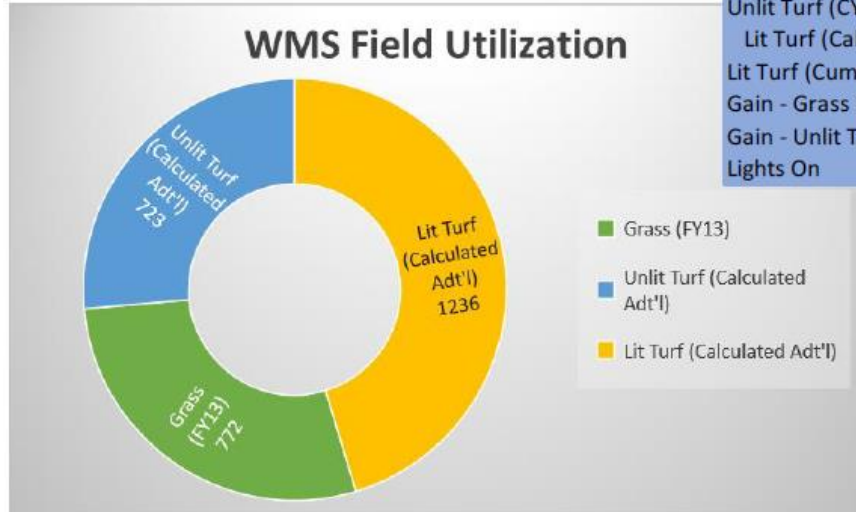
## Model Scenario - Medium



	TOTAL Hrs/Yr			
	Field 1	Field 2	Total	Avg
Grass (FY13)	403	369	772	386
Unlit Turf (Calculated Adt'l)	359	364	723	361
Unlit Turf (CY16)	761	733	1494	747
Lit Turf (Calculated Adt'l)	317	317	633	317
Lit Turf (Cumulative Total)	1078	1049	2127	1064
Gain - Grass : Unlit Turf	89%	99%	94%	94%
Gain - Unlit Turf : Lit Turf	42%	43%	42%	42%
Lights On			593	

- Prime Time only
- 10PM Curfew (9:45PM cutoff) M-Th
- 9PM F-Su
- Modest Utilization Factor (Greenbrier)
- No Winter Use

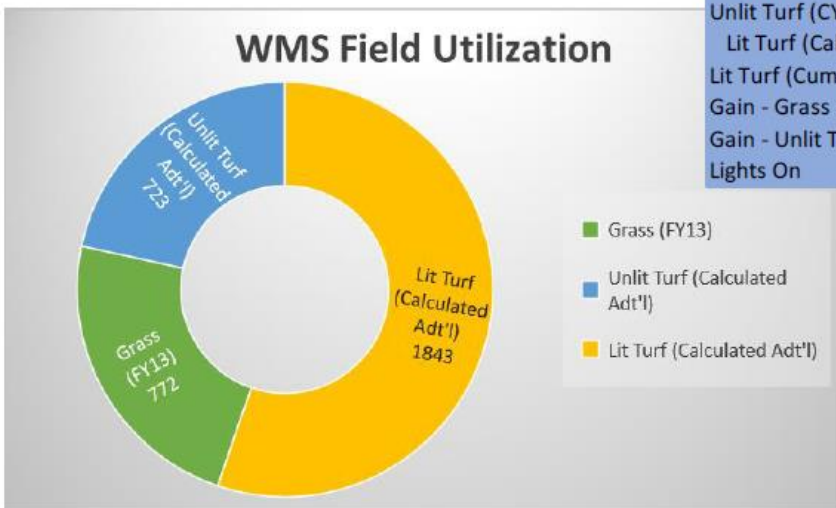
## Model Scenario - High



	TOTAL Hrs/Yr			
	Field 1	Field 2	Total	Avg
Grass (FY13)	403	369	772	386
Unlit Turf (Calculated Adt'l)	359	364	723	361
Unlit Turf (CY16)	761	733	1494	747
Lit Turf (Calculated Adt'l)	618	618	1236	618
Lit Turf (Cumulative Total)	1379	1351	2730	1365
Gain - Grass : Unlit Turf	89%	99%	94%	94%
Gain - Unlit Turf : Lit Turf	81%	84%	83%	83%
Lights On			1284	

- Prime Time only
- 10PM Curfew (9:45PM cutoff)
- Higher Utilization Factor (Gunston)
- Includes Winter

## Model Scenario - Max



	TOTAL Hrs/Yr			
	Field 1	Field 2	Total	Avg
Grass (FY13)	403	369	772	386
Unlit Turf (Calculated Adt'l)	359	364	723	361
Unlit Turf (CY16)	761	733	1494	747
Lit Turf (Calculated Adt'l)	921	921	1843	921
Lit Turf (Cumulative Total)	1683	1654	3337	1668
Gain - Grass : Unlit Turf	89%	99%	94%	94%
Gain - Unlit Turf : Lit Turf	121%	126%	123%	123%
Lights On			1518	

- Prime Time only
- 10:30PM Curfew M-F
- 10:00PM Sa-Su
- NO cutoff – assumes exit lights avail
- Highest Utilization Factors (VA-H)
- Includes Winter
- Sunset rounded to earliest ½ hour

Appendix D – Research on Exposure to Blue Light and Impacts of  
Such Exposure (Especially at Night) in Disrupting Sleep

- AMA Report: <https://www.ama-assn.org/sites/default/files/media-browser/public/about-ama/councils/Council%20Reports/council-on-science-public-health/a16-csaph2.pdf>
- Kaiser Family Foundation Study: <http://kff.org/disparities-policy/press-release/daily-media-use-among-children-and-teens-up-dramatically-from-five-years-ago/>
- Harvard Health Letter “Blue Light Has a Dark Side”:  
<http://www.health.harvard.edu/staying-healthy/blue-light-has-a-dark-side>

Appendix E – Some of the Wildlife in the Neighborhood Surrounding  
DES/WMS

Album Submitted to WFWG: <https://arlingtonva.s3.dualstack.us-east-1.amazonaws.com/wp-content/uploads/sites/17/2015/08/16.pdf>

## Appendix F – Clanton & Associates, Inc. WMS Field Lights Evaluation

Click here to view report: <https://arlingtonva.s3.dualstack.us-east-1.amazonaws.com/wp-content/uploads/sites/17/2015/08/2016-09-16-Final-WMS-Field-Lights-Evaluation-Clanton-Associates.pdf>

### **Concerned WMS Neighbors, Arlington, Virginia**

**9/16/2016**

#### **About Clanton and Associates**

Since 1981, Clanton & Associates has been designing visual environments, integrating daylight and electric light to enhance spaces, and designing light for indoor and outdoor environments with a strong commitment to environmental stewardship, minimizing energy use, sky glow and light trespass.

Nancy E. Clanton (PE, FIES, IALD, LC, LEED Fellow) is founder and president of Clanton & Associates. She obtained her Bachelor of Science degree (Architectural Engineering, Illumination Emphasis) from the University of Colorado, Boulder. She is currently a member of the National Academy of Sciences committee for the "Assessment of Solid State Lighting", was awarded the Illuminating Engineering Society of North America (IESNA) Presidential Award in 1990 and 2006, the IESNA Distinguished Service Award in 2015, and the 2013 International Clean Design Award - Helsinki.

Ms. Clanton is a lifelong member and past member of the Board of Directors of the International Dark Sky Association (IDA), Past Chair of the Illuminating Engineering Society's Board of Fellows and has served in leadership roles in numerous other professional societies concerned with lighting design. She co-chaired the joint IDA-IES committee that developed the Model Lighting Ordinance (MLO). She and her firm have worked extensively with communities nationwide to design quality and sustainable lighting systems.

Additional information about Ms. Clanton and her firm is attached at Appendix A.

#### **Scope of Work**

Nearby neighbors, whose property borders the Williamsburg Middle School soccer fields, asked Clanton & Associates to assess and comment on the light pollution, human health, environmental and energy-related impacts of the proposal to install lights on one or more of the soccer fields.

Clanton & Associates was also asked to evaluate questions and concerns raised in a May 10, 2016, memorandum (Appendix B) prepared by Mr. John Seymour, who serves on Arlington's



Environment and Energy Conservation Commission and the County Board-appointed Williamsburg Field Site Evaluation Work Group (WFWG) as well as Musco Lighting's response to Mr. Seymour's memorandum (Appendix C).

Clanton & Associates conducted the following analysis using materials available on the Williamsburg Field Site Evaluation Work Group website and other public sources, as well as background information provided by concerned neighbors.

### **Major Conclusions**

Following are our major conclusions:

Installation of the proposed 5700K LED luminaires on 80' poles, with a Class III designation is inappropriate for this neighborhood setting. It is our opinion that a decision to approve such lighting would:

- Exceed IES RP-6-15 lighting recommendations for recreational soccer fields (middle and elementary school setting with only a small seating space)
- Visually impact the nearest neighbors as a result of viewing the illuminated luminaires. Modeled glare (exceeds 2,500 cd on property line for Lighting Zone 1) per the International Commission on Illumination (CIE) 150 EI zone, and will be amplified by reflected light from the fields, and illuminated haze on high humidity evenings
- Increase human health and environmental risks based on evidence compiled and evaluated by the American Medical Association's Council on Science and Public Health for LED street lighting. Lighting levels on sports fields are typically 20 to 30 times higher than street lighting levels; thus the AMA Council's advice must be taken seriously when deciding to illuminate athletic fields close to residential homes.
- Class III lighting levels will use more energy than Class IV. The least amount of energy use would be no lighting.
- Violate Arlington County's Zoning ordinance, limiting pole heights to 68' above the average elevation of the school campus.
- Does not offer the opportunity to independently evaluate the lighting calculations provided by Musco Lighting with independent calculations since photometric data in ".ies" format is not provided.

Our opinion is for the County to obtain the approval of a majority of the neighbors who will be most directly affected, as recommended in IES RP-33-14 "Lighting for Exterior Environments". According to the concerned neighbors group, the overwhelming majority of neighbors who would be most directly affected by lights on the WMS soccer fields have signed a petition strongly opposing field lights. This joint statement of opposition is not limited to 5700K lights on



80' poles - it extends to any type of athletic field lighting regardless of color temperature, placement, number or height of the luminaires and poles. (Appendix D)

**Background (Provided to Clanton & Associates by Concerned Neighbors Group):**

The neighborhood surrounding Williamsburg Middle School/Discovery Elementary School is unusually tranquil, even by the standards of a generally quiet and leafy North Arlington residential area. The neighborhood is zoned R-10 and R-20, which allows only single family homes on a minimum of 10,000 to 20,000 square foot lots. The neighborhood contains no retail, commercial, or multi-family residential developments. It is, by any measure, a quiet and peaceful residential neighborhood.

The School property itself has historically hosted afternoon recreational soccer games, with elementary and middle school participants. The activity is wholly consistent with the residential nature of the setting, and has been conducted for decades without serious complaint or hindrance.

Consistent with long-established standards for aesthetic harmony within Arlington, the Williamsburg campus (zoned S-3A) is subject to a 68-foot height limitation measured from the average elevation of the school property. Because the soccer fields sit on an elevated portion of the Williamsburg School property, the zoning limitation will place severe restraints on the height of any structure there. Such restrictions are, in our view, particularly appropriate here because the light poles proposed by Musco will not only represent (if constructed) a major variance in Arlington's height limits, but add highly intrusive and glare-producing light. Together - the high poles and the very bright LED lights - likely will transform the overall ambience of the setting from dark, quiet and tranquil to bright, active, and quasi-urban.

It should be emphasized that residences are located much closer to fields than is typically the case for lighted sports fields. At Williamsburg, the nearest property lines are located only 25-35 yards from the nearest goal lines. Absent a showing of extraordinary need, fields being designed and constructed today for nighttime athletic use would not be placed in such a setting.

During the 2012-2103 public process required for consideration of a Use Permit for the design and construction of the Discovery Elementary School, neighbors were repeatedly assured that the soccer fields on the property would not be lighted. Rather, the fields were to be preserved as natural grass fields and no field lights would be installed. Only following the July 2013, completion of this public process did the County Manager's office propose to install synthetic turf with an expedited process to install field lights. Following the vocal opposition of neighbors and the affected civic association, the County Board deferred its decision on field lights pending review by the Williamsburg Lights Working Group. Consistently, and to date, the neighbors most directly affected have strongly opposed the lighting of the athletic fields as does the civic association that represents them.

This history is important because the effects of lights are felt through level of trust neighbors' have in the transparency and fairness of the decision process as well as the objective harm they experience. Here, it is proposed that athletic fields in an historically dark setting would be lighted for the first time in its history. The intrusion of multiple high poles radiating light levels 20-30 times higher than existing street lights, the flawed 2012-2013 administrative process and the subsequent time-consuming multi-year effort required to preserve neighbors' quality of life, would combine to magnify the negative effects of the lights.

### **The Williamsburg Fields**

From a review of the materials provided to us, it is clear that the site is difficult to light to minimize light trespass and glare because of the short distance between the fields and the houses adjacent the fields.

Below are assumptions used in our opinions:

- The light trespass spill light recommendations applicable to the soccer fields in this neighborhood are 1 lux (0.1 foot-candles) for Lighting Zone 1 per RP-33-14 typical for single family residential neighborhood.
- The light trespass glare at the property line shall be no greater than 2,500 candelas for pre-curfew and 0 candela for post curfew hours per CIE 150 "Guide on the Limitation of the Effects of Obtrusive Light from Outdoor Lighting Installations" E1 zone (LZI - **RP-33-14**)
- The lights under consideration -5700 Kelvin sports lighting -produce a light spectrum that has been associated with a variety of human health and environmental concerns.
- The fields should be classified as Class IV recreational fields using standards of the IESNA, "Sports and Recreational Area Lighting" RP-6-15. Such fields are those for competition or recreational play with no or limited provision for spectators and are generally lighted to provide a horizontal illuminance of 200 lux (20 foot-candles).

It is our opinion that the fields should not be lighted without neighborhood consensus, and criteria compliance independently verified and calculated with photometric data supplied by Musco Lighting.

1. Light trespass (illuminance) and glare (luminous intensity - and/or luminance - candela/ meter<sup>2</sup>) Light trespass (illuminance) is a measure of vertical and horizontal

illuminance falling on points along the property line. As acknowledged recently by nearby Fairfax County, "when light crosses property lines it can detract from the property value and quality of life of those whose property it is improperly directed towards. It can be particularly objectionable problem when obtrusive recreational lighting is immediately adjacent to residential neighborhoods." Fairfax County, Athletic Field Lighting and Control of Obtrusive Light Pollution (July 2010). Glare, in contrast, is generally understood as excessive brightness occurring in the normal field of view in units of maximum candela (photometric data) or candela per meter <sup>2</sup> (luminance). Thus, the same light source can produce both glare and light spill, but the perception depends on whether the light enters the eye directly or reflects *off* of objects in the field of view.

A significant feature of both light spill and glare is that they are both influenced heavily by ambient conditions. As Fairfax County noted, "glare experienced from high-intensity sources, like those used to light athletic fields, is the result of the source-to-background contrast ratio." Similarly, researchers have concluded that ambient conditions have a significant effect on how light trespass is perceived. The International Commission on Illumination, in its "Guide on the Limitation of the Effects of Obtrusive Light from Outdoor Lighting Installations" has cautioned that the "tolerable levels" of light spill and glare "will be influenced by the ambient lighting existing in that environment," which, in turn, is the product of "the degree and type of the development of the area and by the lighting in place."

As we understand from the materials provided to us, the property affected by light is "historically dark residential," the fields have never been lighted in their decades of use, and ambient levels of light at the western residential property line are low as measured by neighbors.

As with all of the data provided to us, we are not in a position to check the calculations because the vendor has not provided the photometric data. Nevertheless, Musco's modeled levels show that glare levels (candela) as currently projected are higher than recommended for sites such as the Williamsburg fields. The CIE has developed a widely accepted set of targets for maximum intensity of luminaries (glare) in different "environmental lighting zones." For lighting environments that are "intrinsically dark" (Lighting Zone E-1), the CIE Technical Report 150 has established a maximum glare measure of 2500 candela at property lines. The Illuminating Engineering Society of North American (IESNA), in its recommended practice guide "Lighting for Exterior Environments" has endorsed the CIE model. It noted that Zone E1 is appropriate for "areas with intrinsically dark landscapes", including "residential areas where inhabitants have expressed a strong desire that all light trespass be strictly limited." According to IES RP- 33-14. That description aptly describes the Williamsburg site.

Significantly, the levels of glare (worst-case aimed fixture) modeled by Musco under its best-case scenario (80' poles) greatly exceed the maximum 2,500 candela threshold. Music's data for 80' poles provided on April 14, 2016 show a maximum of 6,460 candelas at the property line - more than twice the recommended maximum. There is an additional value of

20,677 candelas close to a property line adjacent to Pole S3. The glare values along this property line have not been provided. It is our opinion that the 2,500 candela threshold is necessary here, in light of the historical darkness of the setting, the close proximity of residences, and the neighbors' strongly expressed sensitivity and opposition to light trespass and glare.

We note, in addition, that the modeling does not include glare produced through reflected light from other surfaces, or from water-vapor in the ambient air during Arlington's numerous humid spring and summer nights. Thus, total glare is likely to be greater than modeled.

In addition, some of the calculations are incomplete, including glare angles for players, and do not provide all of the information necessary to confirm compliance with generally accepted standards for glare and light trespass. Without full access to the photometric data, an independent review of the calculations cannot be done. However, from the available information provided by Musco, it appears that glare will be excessive.

Sky Glow: As noted above, we have been advised that the Williamsburg neighborhood is quite dark and that, even on the existing Williamsburg sports fields themselves, residents state that the stars are clearly visible. The lights proposed to date will clearly increase sky glow - visible light reflected by particulates in the atmosphere, which deprive residents of the opportunity to "see the night sky as their ancestors did, star-gaze and relax under a beautiful natural night sky." IES RP-33-14.

Because higher correlated color temperature (CCT) light sources have more blue light, their impact on sky glow is greater.

The lights at issue will affect sky glow both directly -by emitting light from the source itself -and by casting light upwards from the surface being illuminated (reflected light). Although we do understand that the luminaries are designed to reduce sky glow and the colored synthetic surface will absorb some of the light, some increase in sky glow is inevitable.

A paper prepared by Ian Ashdown, "Color Temperature and Outdoor Lighting," (2015) raised concerns about the adverse effects of high temperature Kelvin LED lights on sky glow, and endorsed the recommendation of the International Dark Sky Association to require a maximum of 3,000 Kelvin for luminaries to receive the IDA's Seal of Approval. Mr. Ashdown concluded that blue light is preferentially scattered and thus caused greater sky glow. In particular, Mr. Ashdown endorsed the finding of the IDA that "the case against blue light is well founded with regard to discomfort glare, circadian rhythm disruption, light scattering, sky glow, and biological disruption in wildlife."

In response to this concern, Musco Lighting noted that Mr. Ashdown published an update of his findings, in which he concluded that the spectral distribution from light

reflected from a Kentucky bluegrass sports field alleviates "the nightmare spectrum" problem to some extent. In that same update, however, Mr. Ashdown commented that "light pollution" near outdoor athletic fields can nevertheless be "a significant concern for residential neighborhoods." Significantly, Mr. Ashdown's piece and Musco's response continue to highlight the importance of reflected illuminance, whether from the fields themselves or from surrounding structures.

Human Health and Environmental Effects: We understand that the Working Group has submitted considerable documentation to the County setting forth the evidence demonstrating real health and environmental concerns associated with the types of LED lights being proposed for the Williamsburg site. We will not repeat that evidence here, but refer the reader to the very recent AMA report entitled "Human and Environmental Effects of Light Emitting Diode Community Lighting." Among other findings, the report cautions that "much has been learned over the past decade about the potential adverse health effects of electric light exposure, particularly at night. The core concern is disruption of circadian rhythmicity. With waning ambient light, and in the absence of electric lighting, humans begin the transition to nighttime physiology about dusk; melatonin blood concentrations rise, body temperature drops, and sleepiness grows." High correlated color temperature LED lighting of the kind proposed at the Williamsburg site has been found to have a disproportionate adverse effect on circadian rhythm, as well as other adverse health effects.

The responses prepared by the County and the contractor to date do not, in our view, fully address these concerns. Musco Lighting states simply that there is "lots of hype being made about something that might exist" and that more research is needed. Thus, the contractor looks to the medical community to resolve the issue. The County's medical authority, on the other hand, looks to Musco Lighting to address it -asserting that the medical risks should be minor if Musco Lighting can control light efficiently. Only an independent review can verify this. Nevertheless, we note that lighting levels from sports facilities are typically 20 to 30 times higher than the street lighting of concern to the AMA.

We must also note that all of the data provided to date are calculated, rather than measured. We do not have access to the photometric data, or the algorithms, assumptions, and spectral distributions underlying the calculations. Thus, we are in no position to check or confirm the calculations. At the very least, however, we strongly recommend that an independent evaluation be performed for illuminance, light trespass, glare (maximum candela), and sky glow calculations arising from the proposed design so that the neighbors, and the County, have a full understanding of the issue.

### Clanton & Associates Opinions

- The WMS soccer fields are Class IV fields
- The neighborhood residential properties are classified as Lighting Zone 1 per IES RP-33-14, which is consistent with Arlington County's established R-10 and R-20 zoning of the affected neighborhood.
- Light trespass should not exceed Lighting Zone 1 restrictions per IES RP-33-14 and Environmental Zone EI per CIE150: 2003.
- Any field lighting project should be consistent with recommendations from the Illuminating Engineering Society (IES), International Commission on Illumination (CIE) and International Dark Sky Association (IDA).
- Short wavelength (blue) light, similar to 5700K LED lights will increase sky glow. Indeed, any field lighting will increase sky glow.
- Glare and light trespass must be restricted so as to minimize or eliminate direct view of the lighted luminaire on neighboring properties per CIE 150:2003. Specifically, glare should not exceed 2,500 candela and light trespass should not exceed 0.1 foot-candles.
- Blue light wavelengths suppress melatonin and should be minimized or avoided
- The calculations provided by Musco Lighting do not meet all of the recommended requirements and recommendations.
- Since photometric tests are not available, independent calculations of glare (maximum candela or luminance), light trespass, reflected light, sky glow prediction and spectral distribution are not feasible.

Conclusion: As set forth above, we have examined whether the "impacts, for the first time, of lighting one or two fields at Williamsburg can be mitigated sufficiently to protect the character of the neighborhood and provide a reasonable quality of life to the nearest neighbors." It is our opinion that the proposed sports field lighting does not achieve that goal.

Appendix G: Research on Exposure to Blue Light and Impacts of  
Such Exposure (Especially at Night) in Disrupting Sleep

AMA Report: <https://www.ama-assn.org/sites/default/files/media-browser/public/about-ama/councils/Council%20Reports/council-on-science-public-health/a16-csaph2.pdf>

Kaiser Family Foundation Study: <http://kff.org/disparities-policy/press-release/daily-media-use-among-children-and-teens-up-dramatically-from-five-years-ago/>

Harvard Health Letter “Blue Light Has a Dark side”: <http://www.health.harvard.edu/staying-healthy/blue-light-has-a-dark-side>



Appendix H - SavATree Report on Impacts of Installing Musco's S3 Light Pole on  
Western Wooded Area

Link to Study by Mike Galvin: [https://arlingtonva.s3.dualstack.us-east-1.amazonaws.com/wp-content/uploads/sites/17/2016/11/Mike-Galvin-Report-WMS-DES-workgroup\\_SavATree-tree-vegetation-impacts-report.pdf](https://arlingtonva.s3.dualstack.us-east-1.amazonaws.com/wp-content/uploads/sites/17/2016/11/Mike-Galvin-Report-WMS-DES-workgroup_SavATree-tree-vegetation-impacts-report.pdf)

Appendix I – Impacts of Installing Musco’s LED Lights

Link to video showing Musco LED lights being installed at Art Crate field:

<https://www.youtube.com/watch?v=EAqJBM0qm6U>

Link to Musco LED “Installation Instructions”:

[http://www.keypenparks.com/uploads/4/5/0/8/45082793/fields\\_2\\_2\\_led\\_installation\\_instructions.pdf](http://www.keypenparks.com/uploads/4/5/0/8/45082793/fields_2_2_led_installation_instructions.pdf)

## Appendix J - Letter to County Board Re: Construction Impacts on Western Wooded Area

January 30, 2017

Dear Jay, Katie, Christian, Libby and John,

We'd first like to thank you for your thoughtful comments and questions during the discussion last Tuesday evening about the impacts of installing lights on the Williamsburg (WMS) soccer fields.

Second, as soon as the Joint Work Session ended, we went over to Vincent Verweij (County Arborist) and Kurt Louis (DPR) in an effort to answer Jay's question about whether it's possible to reach a consensus on the impacts of the S3 pole (including the lighting array it's designed to support) on the trees in the Western wooded area.

During that conversation we learned that neither Vincent nor Kurt knew the specifications for the lighting array that will be placed at the top of the S3 pole, including the size and configuration of the fixtures (luminaires), the total number and length of the cross bars they would be attached to and the length, width and depth of area that would be occupied by the array with essential safety clearance for operation and maintenance. (Note: The photo at Exhibit A shows a Musco array with 18 fixtures; the array on the S3 pole would have 21.) In addition, Kurt and Vincent's findings (like those of the arborist we retained) were inadvertently based on an incorrect pole location. Everyone assumed the pole would be installed at or very near a concrete slab at the site marking the S3 electrical hook up. However, the slab is approximately 10 feet closer to the fields than the pole location specified in Musco's proposal. The true location of the pole is marked on a document provided by Musco on January 19, 2017. (A link to this document is provided at Exhibit B.) This location is significantly closer to the trees – just 7 1/2 feet from the closest mature tree, 9 1/2 feet from an even larger tree, with a root system that intertwines with a third tree that's 19 1/2 feet from the pole. The trunk of the tree 9 1/2 feet from the pole bends down over the fields. All or nearly all of the branches of the two largest trees extend over the fields. A photo looking up from the correct pole location is provided at Exhibit C, and another showing the sharp bend in the trunk of the second closest tree is provided at Exhibit D below.

Thus, Vincent's opinion and probably that provided by R.E. Lee Electrical appear to have been mistakenly based on an incorrect pole location with no consideration given to the size and shape or clearance for safety required to install, operate and maintain the array. (Musco has itself warned that the location of the array can shift in heavy winds and that engineer's must remain a safe distance behind the array when maintaining or adjusting the fixtures and cross bars.) At the conclusion of our conversation on January 24th, we believe Kurt agreed to obtain the specifications for the fixtures and array but Vincent declined to provide an updated opinion effectively until after the Board's decision on this issue is made.

We suspect that Vincent's reluctance to provide a new opinion now is based on his professional knowledge, echoed by our consulting arborist, that it's impossible to predict the full extent of the impacts without verifying the exact location of the pole (which is clearly marked on Musco's document provided at Exhibit B), the specifications for the fixtures and array, and the applicable construction, operation and maintenance plans, all of which Musco has declined to provide.

An additional issue is that Musco has not provided aiming angles necessary to know the portions of the field the S3 pole is intended to light. This information is relevant because an estimated one quarter of an acre of canopy would need to be removed between the array and the northern and southern corners of the two fields if S3 is intended to illuminate the western side of the fields.

The cost of mitigating construction impacts is a specific item the Board appropriately asked the WFWG to evaluate as part of the charge. This can be done with Musco's cooperation but without the vendor's cooperation it cannot. This information is necessary to understand the impacts of installing the lights on neighborhood character and quality of life as well as the costs to APS and/or the County associated with those impacts.

We encourage you to convey to the vendor your strong sense that the missing information must be provided.

Sincerely,

Gail Harrison  
3601 North Jefferson St.  
Arlington, VA 22207

Nedim Kirimca  
5312 36<sup>th</sup> Street North  
Arlington, VA 22207

Exhibit A: Photo of an 18 luminaire Musco array; WMS array would have 21 luminaires

## Appendix K - Incremental Benefit in Playing Time for DPR and APS from Synthetic Turf and Lights at Williamsburg Field

### OVERVIEW

This analysis estimates and projects the increased annual playing time in hours of use for DPR and APS users of the Williamsburg fields resulting from the conversion of the fields from grass to turf and then from the possible installation of lights with curfews of 9pm and 10pm. The Field Utilization Model created by WFWG Chair Erik Gutshall was used to project the DPR filed use, and APS use was estimated based on assumptions provided by Jim Meikle of APS.

The analysis shows that many more hours of actual annual use have resulted from converting the fields from grass to turf (1402 hours) than would be gained by adding lights with a 9pm curfew (510 hours) or extending the curfew to 10pm (an additional 313 hours).

### ASSUMPTIONS

For DPR use of the field, this analysis uses DPR information on:

- 2013 scheduled use of the grass fields,
- a 20% loss of use factor for grass fields due to weather,
- 2016 scheduled use of the unlit turf fields,
- utilization factors for daytime use of unlit turf fields,
- 15-minute exit (transition) time as teams leave and arrive, and
- sunset schedules.

For APS use of the field, this analysis uses information from Jim Meikle of APS on:

- # of hours per day (10)
- # of days of use (170 for turf and 136 for grass, based on 20% loss due to weather – same as DPR but independently estimated)

No use after dark was assumed because DPR takes over the fields before or just after sundown, even on the shortest day of the year.

Utilization factors provided by DPR were used for DPR use of grass and turf fields during daylight hours.

Separate utilization assumptions were applied for use of the fields after sunset, since we know that utilization factors are much lower after 9pm on weekdays and after dark on weekends, so the DPR

## Appendix K - Incremental Benefit in Playing Time for DPR and APS from Synthetic Turf and Lights at Williamsburg Field

factors would overestimate actual use at night. These utilization factors were estimated based on DPR's January 19, 2016 Field Usage Analysis report (pp. 10, 14, 16, 23, 26, 28, 30, and 32):

<u>Season</u>	<u>Mon-Thurs</u>	<u>Friday</u>	<u>Saturday</u>	<u>Sunday</u>
Spring	60%	45%	40%	45%
Summer	65%	20%	30%	40%
Fall	65%	50%	50%	50%
Winter	35%	0%	0%	0%

RESULTS

The Utilization Model with the data and assumptions for DPR use of the fields yield the following annual use for the two Williamsburg fields combined:

- Grass = 772 hours
- Unlit turf = 1494 hours
- Lit turf until 9pm = 2004hours
- Lit turf until 10pm = 2317 hours

The Utilization Model doesn't accommodate the APS field usage, but computation with APS assumptions is very straightforward:

- Grass = 2720 hours
- Unlit turf = 3400 hours
- Lit turf until 9pm = 3400 hours
- Lit turf until 10pm = 3400 hours

Combined AS and DPR usage is projected to be:

- Grass = 3492 hours
- Unlit turf = 4894 hours
- Lit turf until 9pm = 5404 hours

- Lit turf until 10pm = 5717 hours

So, the gain in annual hours of play with these assumptions is:

Gain from converting grass to turf = 1402 hours = 40%

Additional gain from adding lights until 9pm = 510 hours = 10%

Additional gain from adding lights until 10pm = 313 hours = 6%

(or a gain of 17% over unlit turf)

Appendix L - Memorandum from Assistant County Manager Gabriela Acurio to Mary Hynes

Mary,

FYI--Per your request here is the information provided by staff to your questions related to the Bishop O' Connell HS (BOCHS) use permit request:

1. What hours do we allow play on our synthetic fields?  
Staff Response: The County athletic facility lighting curfew is 11:00 p.m. Wakefield, Barcroft and Gunston facilities are all 11:00 p.m. However, there are a few locations that have community agreements in which the lighting schedules are changed during specific periods or time throughout the year or on a year round basis. The facilities in which the County lighting schedule is changed are as follows:
  - Greenbrier - 10:00 p.m., 10:15 p.m. or 10:30 p.m. depending on the time of year. During the 10:30 p.m. time period it even has a limit as to how many times it can be used until 10:30 p.m. each week during the high school sports season (3 times). There is also a parking management plan in place between APS and PRCR for this site.
  - Washington-Lee - 11:00 during the fall and spring sports seasons and 10:00 p.m. during the summer and winter seasons.
  - TJ and VA Highlands have a long standing agreement of 10:00 p.m. year round.
2. What is the distance from the lights to the single family residences at each location?  
Staff Response: Please see the attached aerials, showing distances from the fields to the property lines of nearby residences.
3. What is the height of the lights?  
Staff Response: Please see the attached spreadsheet showing the zoning ordinance requirements for heights at the selected facilities, (the second tab shows the usage restrictions for these facilities-per question #4)
4. Are there any other limitations we've added in response to neighborhoods?  
Staff Response: The limitations have been more in terms of the hours of field use - our standard is lighting until 11 pm - several have seasonal hours that are as early as 10 pm (see spreadsheet second tab).
5. How many hours of play did we add? What were the conditions under the old plan vs the new plan  
Staff Response: The table below shows the increased usage on synthetic fields at various locations.

<u>Field</u>	<u>Pre-turf</u>	<u>Post-turf</u>
Gunston	500	2000

Exhibit 7



VA Highlands	800	2300
Wakefield HS	200	1800
Greenbrier (Yorktown HS)	300	1700
W-L HS	600	1900

Another question that you have asked is what is the arrangement between the County and Bishop O'Connell HS for the use of their fields or Tuckahoe's.

Staff Response: PRCR current use of BOCHS athletic facilities include the use of their 90ft baseball diamond during the spring, summer and fall seasons, when it is not being used by BOCHS for their games and practices. In addition, the County has used the stadium for special events and the gym when needed throughout the last 23 years when we were short on space and BOCHS was not using their facility. However, there has never been a formal agreement or MOU established between the County and BOCHS for PRCR use of BOCHS facilities or BOCHS use of the athletic facilities located at Tuckahoe Park.

*Tuckahoe Usage:*

- Between March 1, 2010 and August 15 the diamond fields were used a total of 724.50 hours (not including BOCHS use).
- BOCHS used each diamond field for 232.50 hours each for practices and/or games for a total of 465 total hours used on both fields during their spring softball season. This use is Monday - Friday from 4-6 pm.
- PRCR sponsored community youth soccer leagues use the rectangular field located in the outfield areas of the two diamond fields for soccer practices and games August 15 - November 15, Monday through Friday 6:00 p.m. - Dark; Saturday and Sunday, 9:00 a.m. until Dark.
- Between the time period of August 15 and November 15 the main rectangular field at Tuckahoe Park was used a total of 457.25 hours (not including BOCHS use). BOCHS used the rectangular field for a total of 137 hours during their soccer season. This use is Monday - Friday from 4 -6 pm.

*Gabriela Acurio*

Assistant County Manager

Phone - 703-228-3120

## Appendix M - Neutral Criteria for Sports Field Lighting Decisions (Annotated to Include Williamsburg Site-Specific Information)

The following are recommended neutral criteria for use by Arlington County officials in establishing a comprehensive, community-wide land use planning process to determine, with the benefit of comparative analysis, which sites are and which sites are not suitable for installation of synthetic turf and rectangular, diamond and multi-purpose field lights.

1. Lighting should be part of the original master planning for the field. It can be very difficult to retrofit lights to existing fields in a manner that does not significantly impair the neighborhood quality of life, as the Williamsburg Working Group has learned.

Many of Arlington's sports fields (Yorktown, Washington & Lee, Wakefield) have been lighted since the 1950s and sports field lighting was planned from the outset. Lighting authorities have cautioned that, because field lights can be highly intrusive — particularly on the settled expectations of abutting neighbors — lighting should be planned with field construction to ensure that the fields are of adequate size, orientation and overall design to accommodate lights without undue adverse effects on neighbors. The Illuminating Engineering Society of North America, in its "Recommended Practice for Sports and Recreational Area Lighting" (IESNA RP-6-15), cautions that "lighting systems should be designed in conjunction with the facility." Similarly, in its "White Paper on Athletic Field Lighting", Fairfax County recently warned that, "while field orientation during the initial master planning stage may make it possible to minimize glare problems, this is unusual when retrofitting lights to existing fields."

The Williamsburg lighting proposal is a case in point. The fields were never designed for lights and abut a dark and quiet residential neighborhood. Struggling to develop a design that is even minimally adequate, the lighting vendor has prepared a number of designs for field lighting. All of them, however, violate generally accepted standards for sports field lighting. It should be emphasized that this is the case even though the vendor's "best case design" would (1) require the installation of light poles much higher than are permitted by current zoning; (2) funnel extraordinary levels of glare toward the school buildings themselves, but still expose the residential boundary to excessive levels of glare; (3) locate luminaries within critical on-field glare zones; and (4) require removal of a significant portion of the tree canopy on the residential boundary during installation.

2. Lighted grass fields should be upgraded to lighted turf fields. Consistent with recommendation 1. above where lights were planned as part of field construction, existing lighted grass fields typically can be upgraded to synthetic turf without undue effects on surrounding properties. Such upgrading can greatly enhance the number of hours of use. The memorandum (Appendix G) prepared by then Assistant County Manager Gabriela Acurio to County Board member Mary Hynes responds to questions raised by Ms. Hynes about County sports field use that had arisen during the County Board's examination of a similar proposal to light a local high school's sports fields. Ms. Hynes asked the County to summarize the increase

in field playing hours arising from the County’s switch from grass to synthetic turf at the County’s lighted grass fields. Ms. Acurio responded as follows:

<u>Facility</u>	<u>Hours with Grass</u>	<u>Hours with Synthetic</u>
Gunston	500	2000
VA Highlands	800	2300
Wakefield	200	1800
Greenbrier	300	1700
Washington-Lee	600	1900

As shown above, installation of synthetic turf in lieu of grass could increase playing hours at lighted grass fields by a factor of 3 or more times, without causing the kind of community contention and impairment of community quality of life occasioned by the installation — for the first time — of intense sports field lighting into residential neighborhoods. As I understand it from the Department of Parks and Recreation, Arlington currently hosts at least 4 lighted Bermuda grass fields — Gunston #3, Kenmore #2, Thomas Jefferson Upper Field, and Quincy #1 field. Based on Ms. Acurio’s numbers above, the installation of synthetic turf at these fields would provide additional field time that dwarfs the expected increase in field time arising from the lighting of the Williamsburg fields.

3. Importance of Immediate Physical Setting for Sports Lighting Proposals. The International Commission on Illumination (CIE) in its “Guide on the Limitation of the Effects of Obtrusive Light from Outdoor Lighting Installations” (CIE 150), provided guidance on the factors that should be considered by municipalities and other authorities when considering the siting of outdoor lighting installations. The CIE is an entity responsible for promoting international cooperation and exchange of information among member countries (including the United States) relating to the science of lighting. It has developed standards, recommendations, and guidance for outdoor lighting, among other applications.

The CIE cautions that the siting of outdoor lighting must consider “the potential effects of the lighting on occupants of surrounding properties” including “changes to the amenity of an area due to the intrusion of spill light into otherwise dark areas . . . and to the direct view of bright luminaires.” The CIE has set forth the following factors as “significant influences on lighting impact” to be considered by local authorities. (CIE Report at section 2.5). As is quite plain from even the most cursory review of the factors, their application to the Williamsburg site confirms that it is a wholly inappropriate one for sports field lighting.

CIE factors include:

- a. The zoning of the area abutting the proposed development. According to the CIE, “[t]here is a greater potential for complaints when the area is zoned for residential development.” We note, in this regard, the considerable care shown by the County in amending its zoning ordinance to allow the installation of tall structures such as light poles at Long Bridge Park. The staff report to the proposal specifically stated that “the proposed changes have been crafted to not adversely affect neighboring properties.” The staff cautioned further that the proposed 100’ height limit “not be applied generally to all ‘P-S’ zoned properties, as many are nearer to low density residential areas.” The light poles were appropriate at Long Bridge, according to the staff, because it is a large site, intensely developed, and bounded by major roads, ramps to highways, and railroad tracks. According to the staff, the site’s “Public” designation as part of the ‘P-S’ district also indicated that athletic facilities of this proposed size and scope were appropriate. (Staff Report to Proposed Zoning Amendment, Nov. 15, 2006). The Williamsburg site, in contrast, is very different from the types of sports complex sites established at Long Bridge and Barcroft. The residential community surrounding the school is zoned R-10/20, which allows only single family homes on lots of 10,000 to 20,00 square feet. No dwelling may be taller than 35’. The neighborhood contains no retail, commercial, or multifamily residential developments. By almost any measure, it stands out as an area inappropriate for sports lighting.
  
- b. “The state of development of the area . . . i.e., whether the area is sparsely settled or fully built-up.” As we have indicated throughout the Working Group process, the area proposed to be impacted by sports lighting has, throughout its history, been quiet and dark. Consistent with long-established expectations for aesthetic harmony and sensible development in Arlington, the neighborhood has remained entirely residential and is subject (including the school property) to strict limitations on the height of buildings and structures. Ambient light levels are non-detectable at the property line. On clear nights, the nighttime stars are plainly visible. The wooded area along the western edge of the property, which would be impaired by light pole installation, has long served as path used by neighbors to take walks and enjoy nature. It is clear that the construction of 80’ light poles with intense LED lights would be entirely inconsistent with the current “state of development” of the area
  
- c. The topography of the area surrounding the lighting installation. According to the CIE, “residential developments which are at a lower level than that of the lighting installation should be particularly considered, where a direct view of the luminaries is possible.” Thus, if nearby residences are below the level of the lights, the site should be considered a poor location for lights. The Williamsburg fields and the abutting homes are nearly on the same level and thus there is no possible light mitigation resulting, as is the case at Yorktown/Greenbrier or Wakefield for example, from the deeply excavated topography of the sports fields. Rather, the windows and backyards of abutting homes will be fully subject to light from the fields. There is no buffer whatsoever for homes on North 36<sup>th</sup> Street and upper Harrison Street, most of which are at a lower elevation than the Williamsburg

fields. Homes on streets below the eastern boundary of the athletic fields are also at a lower elevation than the Williamsburg fields and could be impacted.

- d. Physical features at the site such as adjacent tall buildings, trees and spectator stands, “which may be effective in restricting light spill beyond the boundaries of the development.” There is very little in the way of physical barriers to the light projected to be broadcast from the proposed 80’ poles. Although the modest deciduous tree canopy on the residential border of the property may provide some limited buffering, it is sparse and did little to mitigate light emitted from the school’s existing basketball courts. What little barrier exists is gone entirely during much of the year, when the leaves have fallen or buds have not yet broken. Moreover, the installation of the light pole closest to the western boundary almost certainly necessitate the removal of some mature trees and a significant amount of the canopy. Accordingly, there is very little in the way of physical features at the site to mitigate lighting effects and there will be less if the poles are erected.
  - e. The presence or absence of other lighting in the immediate area and the type of lighting involved. According to the CIE, “the effect of the proposed lighting will be lessened where the surrounding area is reasonably well-lit, e.g., arterial road lighting or lighting from adjacent commercial developments.” As noted, the neighborhood surrounding the school property has been historically dark. Light measurements at the residential property line have consistently been shown to be negligible or non-detectable. There are no commercial developments in the vicinity, nor any heavily lighted roadways. The location of luminaires emitting extraordinarily intense levels of light would represent an extraordinary change in baseline light levels.
4. Proximity of homes. Not surprisingly, the proximity of residences to outdoor lighting installations also significantly affects how well or badly lighting can be tolerated by neighbors. Distance from homes is an especially sensitive factor because light intensity and noise intensity both dissipate inversely proportional to the square of the distance from the source. Thus, if a home is twice as far from the source as another, it receives one-fourth the intensity of light and noise; if it is three times as far, it receives one-ninth the intensity of light and noise; if four times as far, it receives one-sixteenth the intensity of light and noise." At Williamsburg, homes are located much closer to the fields than is the case for other lighted sports fields in Arlington. At Williamsburg, the nearest property lines are located only 25-35 yards from the nearest goal lines. Given the proximity of homes to the fields (and to the lighting poles themselves), significant lighting effects on neighboring yards are inevitable.
  5. Disturbance and Harm to the Environment. Field lights, especially high intensity LED lights mounted on 80—90- foot tall poles, are large and very bulky structures and their installation — particularly at fields not designed for lights — can cause harm to both the natural environment and existing physical features. Arlington’s Urban Forestry Master Plan, for example, recommends that County development efforts enhance and improve the County’s threatened tree canopy. Arlington’s Public Spaces Master Plan urges that development not disturb existing connections between residents and natural spaces or the habitats in wildlife corridors. Sites at

existing public schools and parks may also contain important scenic values that are assets to the community-at-large.

For these reasons, any consideration of field lights at a particular setting must consider the potential adverse effects to that setting arising from the construction, installation and operation of field lights.

At the Williamsburg site, the erection of large light poles likely will have significant adverse effects on the existing tree canopy, the surrounding built environment, and the wildlife habitat. A study prepared by SavATree, for example, concluded that the erection of one pole alone would, at a minimum, require the removal of 1-2 mature trees, the cutting of 55 linear feet of tree canopy, and would further damage critical root zones. The use of heavy equipment to carry and install the poles and stadium scale luminaires and lighting arrays could cause damage to the new baseball field, synthetic fields, Discovery parking lot and adjacent, newly planted trees. In addition to these direct harms, the wildlife corridor along the western side of the soccer fields will be receiving light from several of the poles. It currently hosts a large number of light-sensitive nocturnal species. Numerous recent scientific studies have cautioned that wildlife exposure to the high levels of LED lighting has significant adverse effects on circadian rhythm patterns and overall species viability.

6. Community-Wide Transportation Access. To the extent possible, preference should be given to potential sites for field lights that are accessible via mass transit and/or major highways and connecting roadways, with the objectives of placing priority on investing first in facilities that are reasonably within reach of residents who live in all parts of the County and minimizing impacts on lightly traveled neighborhood streets. Traffic can have effects on noise levels and automobile and pedestrian safety. The marginal impacts will depend on several factors, including the configuration of existing street networks, and the urban versus suburban nature of the neighborhood. Consideration of future sites should incorporate analysis of existing and potential traffic patterns, noise and other effects.

As described above, application of the neutral site-related factors recommended by the CIE show clearly that the Williamsburg site is an extremely poor candidate for sports field lighting. The effects of lighting on those living in the surrounding properties would be, by any measure, severe and disruptive.