
2015 ANNUAL REPORT ON THE ENVIRONMENT

CHAPTER IX

**NOISE, LIGHT
POLLUTION AND
VISUAL POLLUTION**

IX-1. NOISE

A. OVERVIEW

Noise is a byproduct of our everyday lives, and noise that one group finds tolerable may be considered noise pollution to another. To some, sounds coming from an airport are the sounds of the economy working and growing, while others feel that this noise deprives them of their privacy and quiet.

Recent studies suggest a growing intolerance among residents and communities for noise associated with airports, traffic, construction and athletic events, etc. The impacts of noise on a community include:

- Diminished privacy and quiet at home or at an outdoor recreation event, vacation or rest site (private cabin at the lake, river or beach).
- Interrupted sleep.
- Interrupted entertainment and conversation.
- Interruptions at work or school.
- Property damage such as broken windows.

Any regulation of noise pollution must be based on scientific findings and not solely on human perception. Noise is measured by scientific instruments that receive the sound and determine its location and intensity as it radiates from the source. The resulting intensity levels and locations allow for noise levels to be regulated when society calls for abatement.

In response to an EQAC recommendation for the development and distribution of educational materials to the public regarding noise issues, county staff has established a website containing information and links addressing noise issues. The site is available at www.fairfaxcounty.gov/dpz/environment/noise/. For an explanation of how sound is measured and perceived, see this website.

In the next sections of this report some key noise pollution concerns will be addressed, followed by recommendations to alleviate their impacts.

B. AIRPORT NOISE

1. Operations and Associated Noise Impacts at Ronald Reagan Washington National Airport and Washington Dulles International Airport

a. Overview

Fairfax County is served by Ronald Reagan Washington National Airport (Reagan Washington National) and Washington Dulles International Airport (Dulles). Reagan Washington National and Dulles are vital to the region's overall economy, connecting the Washington area with 140 domestic and international destinations. At Reagan Washington National, most flights are short to mid-range jet aircraft flights operated by major airlines, but at Dulles, all types and sizes of aircraft are found. On a typical day, over 5,000 airplanes will fly in the skies over the Washington region. Approximately 2,000 of these flights operate to/from Reagan Washington National and Dulles airports. The remaining flights use Baltimore Washington International or Andrews Air Force Base, or are transitioning the area at higher altitudes.

According to the Metropolitan Washington Airport Authority's website, in 2014, total operations at Dulles decreased from their 2013 level by six percent, dropping from 307,816 to 289,382. During the same year, operations at Reagan Washington National remained relatively steady, dropping less than one percent from 292,656 to 283,180.

Flight operations on a typical day at Dulles Airport have been decreasing from a range of 1,000 to 1,200 to a range of 800 to 1,000 since 2010, with weekday operations typically exceeding weekend day operations by several hundred flights. Most flights operate between 7:00 A.M. and 10:00 P.M., with many flights in some hours and a relatively small number in other hours. Peaks are typically at 7 A.M., 12 P.M., 5 P.M. and 8 P.M., with low times at 10 A.M., 2 P.M., 6 P.M. and between 10 P.M. and 6 A.M.

Reagan Washington National has historically had fewer flight operations than Dulles, but the difference in flight operations has been narrowing since 2010 as Reagan Washington National has steadily gained and Dulles has lost flights. Reagan Washington National now has almost 800 flights on a typical day, approaching the low end of the Dulles level. Weekday operations are typically greater than weekend day operations. Most flights occur between 7 A.M. and 10 P.M., with a fairly consistent number of scheduled operations for each hour within this period.

Because Reagan Washington National is located near centers of political power and residential areas, aircraft at National are subject to several restrictions. There are four No Fly zones, which are the U.S. Capitol, the National Mall, the White House

and the Vice President's house at the Naval Observatory. Under the Federal Aviation Administration's (FAA's) High Density Rule, carriers are limited, with some exceptions, to 37 scheduled operations per hour and the commuter carriers to 13 scheduled operations per hour. In addition, Reagan Washington National has one of the strictest noise regulations in place at any major airport in the United States. All aircraft operating between 10:00 P.M. and 7:00 A.M. (with a half hour grace period) must satisfy the airport's nighttime noise limits or face monetary fines of \$5,000 maximum per violation. See Section 4 below for an explanation of the Nighttime Noise Rule. There are typically five to 10 noise violations each year; in 2014 there were five, down from 11 in 2013.

b. Actions by the Federal Aviation Administration

The Federal Aviation Administration Modernization and Reform Act of 2012 includes several sections that impact how the Federal Aviation Administration handles aviation noise, two of which could potentially impact noise guidelines for Dulles and Reagan Washington National Airports. One of these sections, which discusses the acceleration of NextGen technologies through the use of two new Categorical Exclusions under the National Environmental Policy Act, is still under review. The other section, which takes effect in 2016, will prohibit the operation of small jet aircraft not complying with stage 3 noise levels.

At the meeting of the International Civil Aviation Organization in 2013, stricter noise standards for new aircraft were established, which will further reduce noise from aircraft using Dulles or Reagan Washington National Airports. The new standard will apply to new large aircraft types certified after 2017 and to smaller aircraft after 2020.

In addition, the FAA launched the Aviation Sustainability Center, which is a team of universities that will conduct research and development on NextGen environmental goals, including noise. One of the research projects is a multi-year effort to update the scientific evidence on the relationship between aircraft noise exposure and its effects on communities around airports by conducting a national survey on aircraft noise perceptions in 20 such communities across the nation. Survey data will be used to create a dose-response curve for day-night average sound level and annoyance. The agency will then analyze the results to determine whether to update its methods for determining exposure to noise.

A new tool, the Aviation Environmental Design Tool, was made available for purchase by airports in 2012 to assist in preparation of environmental analyses under the National Environmental Policy Act. Neither Dulles nor Reagan Washington National Airport has needed to purchase the AEDT, as these airports rely on consultants who do not need assistance in preparing the analyses.

c. Noise Monitoring

The Metropolitan Washington Airports Authority (MWAA), which operates both Reagan Washington National and Dulles Airports, has historically monitored aircraft and community noise around the clock at 32 locations in the Washington metropolitan area. The monitoring equipment has evaluated different sound events and has separated those events likely to have been caused by aircraft from the remaining events, which have been attributed to the community. The Metropolitan Washington Council of Governments' Aviation Policy Committee and the Airports Authority selected the monitoring sites from recommendations offered by the local governments. Due to the age of the monitoring system, the system had become unreliable and has been replaced and frequently updated.

The latest version, introduced in fall 2014 and called IAD WebTrak and DCA WebTrak, for Dulles Airport and Reagan Washington National, respectively, is described under Paragraph ii below (Noise Measurement Reporting). MWAA monitors aircraft movements and noise levels in communities; it also works with the community and representatives from the airport and airlines, elected officials and the Federal Aviation Administration to address noise concerns. It does not, however, have the authority to change flight plans. FAA is solely responsible for aircraft flight patterns at the two airports.

When a fourth runway was constructed at Dulles Airport in 2008, EQAC was concerned that the new runway configuration would change noise impacts to the community. EQAC recommended that MWAA staff review and analyze noise patterns to see whether operational changes would need to be considered. In order to accurately assess noise impacts, MWAA staff felt it was necessary to wait until two years of reliable data was available, with all four runways fully operational. In 2014, MWAA had the requisite data, made the analysis and found no significant change in aircraft noise recorded by any of the monitors serving Dulles. Therefore, MWAA saw no need for an evaluation to consider operational changes.

i. Monitoring Station Locations

The new monitoring system, which included 40 monitors, became operational at the end of 2008. The original intent was to monitor noise at 40 locations throughout the metropolitan Washington area, with 20 sites for Reagan Washington National and 20 for Dulles, including 15 locations in Fairfax County. Seven of the original 40 monitors are not currently in use, including three in Fairfax County. One that had been sited at Great Falls Elementary School to monitor Reagan Washington National Airport noise was decommissioned in 2011, and two that had been sited at Floris Elementary and London Towne Elementary to monitor Dulles Airport noise were decommissioned in 2014. These monitors were no longer operational because they had been subjected to repeated vandalism, and funds were not available to

replace them. The active Fairfax County monitors are listed below, with the site numbers used by MWAA to report data in the “Annual Aircraft Noise Report:”

Monitoring locations serving primarily Reagan Washington National:

- Langley Forest, Site #3.
- Marlan Forest, Site #11.
- North Mount Vernon, Site #19.
- Springfield, Site #9.

Monitoring locations serving primarily Dulles:

- Armstrong Elementary School, Site #36.
- Crossfield Elementary School, Site #35.
- Cub Run Elementary School, Site #21.
- Chantilly Post Office, Site #25.
- Pleasant Valley Golf Course, Site #16.
- Union Mill Elementary School, Site #29.
- Virginia Run Elementary School, Site #37.
- Westfield High School, Site #34.

In the *2012 Annual Report on the Environment*, EQAC noted that there was no plan to replace the decommissioned monitoring station at Great Falls Elementary, as there were few complaints about noise at that site. EQAC had recommended that the monitor be placed in a different location in the county that experienced more noise and complaints. However, MWAA reported that the monitor had been destroyed, and MWAA has no funds for a replacement. In 2015, MWAA also reports that there are no funds to replace damaged monitors at Floris or at London Towne Elementary Schools.

ii. Reporting Noise Measurements

The most recent upgrade to the Noise Monitoring System was introduced in fall 2014. Called IAD WebTrak (serving Dulles) and DCA WebTrak (serving Reagan Washington National), and using the former noise monitors, it measures sound at each of the monitors. The measurements are displayed on public portals on an interactive map on which all of the monitors and aircraft are displayed as icons, with a one-hour delay. As each airplane icon approaches each noise monitor icon, a number flashes, representing the aggregate sound measurement at that monitor. WebTrak can be accessed from the home page of the MWAA website, www.MWAA.com, by searching either IAD or DCA “WebTrak” from the box at the top right of the page, then clicking on the “WebTrak” link at the bottom of the WebTrak page.

These aggregate measurements are updated every second and are shown as an A-weighted decibel level.¹ The dBA levels emulate the changes in sound pressure as perceived by the human ear, and indicate all aircraft and community noise contributions including vehicle traffic, lawnmowers, etc. While this number accurately measures total perceived sound at that second, it must be recalculated to be displayed as DNL, the day-night annual average sound level, in “A” weighted decibels to reflect the effect on the community. This 24-hour average takes into account the maximum levels of noise, the duration of each noise event and the time each noise event occurred. Events occurring between 10:00 PM and 7:00 AM are increased by 10 dB to account for increased annoyance normally associated with nighttime noise. The aggregate number, representing total perceived sound, must further be separated into those events likely to have been caused by an aircraft from the remaining events, which are attributed to the community.

This kind of detailed noise reporting was presented by MWAA from 2010 through 2014 in its Annual Aircraft Noise Report, which provided three DNL values for each noise monitor for each month: total DNL, aircraft DNL and community DNL. Annual Aircraft Noise Reports from 2010-2014 can be accessed from the home page of the MWAA website, www.MWAA.com, by searching “Noise Report” from the box at the top right of the page.

Data from the reports enable comparisons of DNL noise among communities. For example, a review of the 2014 Annual Aircraft Noise Report shows that, of the 12 monitoring stations in Fairfax County, the highest levels of aircraft noise were recorded at Westfield High School, Site #34. That monitor, which reported reliable data for all 12 months, recorded levels of aircraft noise averaging DNL 58 dBA over 12 months. The consistently high level of community noise at that site raised the total noise level to a range from DNL 61 to 64 dBA.

Regarding the reporting format to be used by WebTrak, MWAA is reviewing options and has not yet decided on a format or frequency of reporting. EQAC recommends that MWAA continue its format of reporting quarterly summaries of the three DNL levels, aircraft, community and total. This recommendation will be discussed further in the “Comments and Ongoing Concerns” section below.

d. Noise Complaints

To register complaints by phone, call the Noise Complaint Telephone Center at Dulles, 703-572-8215, or Reagan Washington National, 703-417-1204.

¹ For information about A-weighted noise and the DNL noise metric, see the county’s “Noise Basics” website at www.fairfaxcounty.gov/dpz/environment/noise/noisebasics.htm.

Complaints about aircraft noise from Reagan Washington National in 2014 totaled 1,286, a huge increase from the 299 received in 2013 and a significant increase from the 892 received in 2012. Much of the increase in complaints during 2014 was associated with aircraft noise during the late night or early morning hours, between 10:00 PM and 7:00 AM. Complaints for Dulles in 2014 totaled 435, a drop from 630 in 2013 but an increase from the 274 received in 2012. MWAA notes that perception of noise is indeed subjective, since the number of callers with complaints can vary widely from year to year even though the actual aircraft noise and associated flight paths do not change. Moreover, while one person filed 139 of the 435 complaints for Dulles, his neighbors may not have filed any complaints.

Resources: Metropolitan Washington Airports Authority website, www.mwaa.com; Federal Aviation Administration Noise Ombudsman, available at 202-267-3521 or 9-AWA-NoiseOmbudsman@faa.gov.

2. Construction Projects at Dulles International Airport

On October 14, 2005, the Federal Aviation Administration published a Record of Decision for the construction of new runways, terminal facilities and related facilities at Dulles Airport. The publication of this document completed the lengthy Environmental Impact Statement process for this project, providing the Metropolitan Washington Airports Authority with the approval needed to proceed. Two new runways have been authorized: a north-south oriented runway to be constructed parallel to and 4,300 feet west of the westernmost of two existing north-south runways and a runway roughly oriented east-west that will be constructed parallel to and 4,300 feet south of the existing east-west runway.

The new north-south runway, a concrete strip 9,400 feet long and 150 feet wide, was opened for use in November 2008. The entire project included the new runway, a parallel taxiway, connector taxiways and cross-field taxiways that connect to the terminal and existing airfield areas. With this new runway available to handle traffic, the middle north-south runway was taken out of operation for maintenance purposes when scheduling allowed during the second half of 2009 and on through 2010. In 2011, another major maintenance project continued the disruption, concentrating flights, and noise, on the three available runways.

Construction dates for the fifth runway will be set in the future.

There are many other projects under way at Dulles Airport, including:

- Improvements to the airport roadway system and connections to Route 28 and the Dulles Access Road.
- Rail to Dulles.

3. Part 150 Noise Compatibility Planning for Ronald Reagan Washington National Airport

Portions of the following discussion have been excerpted and modified slightly from the website of the Metropolitan Washington Council of Governments.

MWAA prepared a major update of the Noise Compatibility Study for Reagan Washington National. This study, conducted in accordance with the provisions of FAA's "Part 150" process, was designed to forecast future noise contours at Reagan Washington National and to propose abatement and mitigation actions to reduce community noise impacts. A study report containing a series of recommended noise abatement and mitigation measures was released in September 2004. Noise abatement recommendations included, among other things: the application of improved technology to keep arriving and departing aircraft over the Potomac River up to their designated turning points; an improved distribution of turning points from the Potomac River between five and ten miles south of the river; and the improvement of the airport's noise monitoring and flight tracking system. In October 2004, the Fairfax County Board of Supervisors endorsed staff comments concerning these recommendations; the comments were generally supportive of the noise abatement recommendations but recommended a follow-up assessment of the effectiveness of these measures.

Because of the importance of this issue to the community, COG's Committee on Noise Abatement and Aviation at National and Dulles Airports (later known as the Aviation Policy Committee) partnered with MWAA throughout the process of development of the noise abatement and mitigation recommendations. A Part 150 Study Advisory Committee was established to assist and advise the Airport Authority in this study; indeed, the Advisory Committee's recommendations were incorporated into the Part 150 Study document. In all, the Part 150 Study recommended eight noise abatement measures (measures designed to reduce noise impacts) and six noise mitigation measures (measures taken to promote compatibility with and awareness of noise impacts). The recommended noise abatement measures were:

- Efforts supporting the use of advanced navigation technology.
- Two measures addressing the dispersal of flight paths in the area between five and ten miles south of the airport.
- Revision to the Airport Facility Directory reflecting current noise abatement procedures.
- Phasing out of "hushkitted" Stage 3 aircraft.
- Updating the airports' noise monitoring and flight tracking system.
- Establishing a system to report airline compliance with noise abatement measures.
- Enhancement of the noise complaint system.

Five of the six mitigation measures were directed toward neighboring localities (e.g., disclosure of noise impacts; building code modifications; noise overlay zoning) and the sixth recommended an expanded MWAA airport noise information program.

MWAA submitted the Part 150 study to FAA, and FAA completed its review of, and issued a Record of Approval for, the Noise Compatibility Program in early 2008. Four of the eight proposed noise abatement measures were approved, and all six of the mitigation measures were approved with the acknowledgment that these measures were beyond the authority of FAA. Four noise abatement measures were disapproved for the purposes of Part 150—in disapproving these measures, FAA noted that the noise exposure model and noise compatibility program for the airport showed “no present or forecasted incompatible land uses within the DNL 65 dB” contour. Effectively, FAA is supporting the use of agency funds only for noise abatement projects that support actions that would be applied in areas inside the DNL 65 dBA contour, with the recognition that MWAA or Air Traffic Control could pursue similar or supportive actions at their discretion (and in the case of noise monitoring and flight tracking, at MWAA’s expense). As noted in FAA’s Record of Approval, a working group had been formed to develop advanced navigation procedures for arrivals and departures and to encourage the use of this technology, and MWAA has updated the noise monitoring and flight tracking system.

Nevertheless, EQAC continues to share the concerns of communities both north and south of Reagan Washington National regarding noise impacts associated with airport operations and holds that noise impacts do not stop at the DNL 65 dBA model contour shown in the Part 150 study. The DNL 65 dBA contour for Reagan Washington National encompasses a relatively small area that is located largely on airport property and within the Potomac River; some commercial, industrial and governmental areas are also located within this area, as is park land. No residences are located in areas that are currently exposed to, or that are projected to be exposed to, noise impacts of DNL 65 dBA or above. However, there have been significant concerns about airport noise impacts well outside this area, and operational noise abatement procedures have been established to minimize such impacts both north and south of the airport. In the past, deviations to noise abatement procedures north of the airport were documented by the McLean Citizens Association in collaboration with Congressman Wolf’s office. While these impacts have occurred well beyond the DNL 65 dBA contour, they have had a significant and adverse impact to residents of the area.

4. Reagan Washington National Airport Nighttime Noise Rule Information

Reagan Washington National Airport has a long history of nighttime noise restrictions between 10 p.m. and 7 a.m. The restrictions are not a curfew on flights, but rather a prohibition for certain types of aircraft for which their designs and weights would make them more prone to higher noise levels on takeoff or landing.

The Nighttime Noise Rule was implemented in 1981, when aircraft were generally much louder than today’s jets and when Reagan Washington National was operated by the Federal Aviation Administration. The rule was one of the first of its kind in the nation, and it helped usher in federal requirements for quieter aircraft. While these laws require airlines to fly quieter planes, they also prohibit individual airports from

creating noise rules. But because the rule at Reagan Washington National already existed, it has been allowed to remain in effect.

MWAA enforces the Nighttime Noise Rule based on noise-related data provided by FAA's standard certification processes for aircraft operating with all available engines. This method allows airlines and pilots to determine, in advance of a flight, whether the particular aircraft – based on design, weight and engine type – will comply with the rule.

5. The Aviation Policy Committee/Aviation Policy Liaison

The Metropolitan Washington Council of Governments' Aviation Policy Committee was discontinued effective January 2011, and oversight for regional aviation policy was returned to the COG board. The Honorable Mary Hynes, then Vice Chair of the Arlington County Board, served as Aviation Policy Liaison from January 2011 to January 2014, when the position was discontinued.

Concerns regarding airport noise issues for commercial flights should be directed to MWAA. MWAA maintains an on-line tracking and reporting system, as well as a telephone number, for airport noise complaints for [Reagan Washington National](#) and [Dulles Airports](#).

6. Helicopter Noise

Recognizing both the vital need for helicopters in the Washington metropolitan area and community concerns with the associated noise, COG held a Helicopter Noise Forum in September 2010. The forum included presentations from officials from FAA and the Military District of Washington and participation from local elected officials and stakeholders, who expressed interest in identifying improved means for community input regarding helicopter noise. In response, COG asked its Aviation Policy Liaison to work with local elected officials, community members and officials from FAA, the Military District of Washington and other agencies to improve community understanding of the region's helicopter system and flight rules and to work towards a solution that aggregates community noise concerns and is able to trouble shoot to address "hot spots."

To that end, Aviation Policy Liaison Mary Hynes convened a second forum on helicopter noise in February 2011. Representatives from FAA explained that helicopter flights in the Washington region are under their tight control and are provided airspace only for military, police, news media and medical missions; there are no "joy rides" in the Washington metropolitan area. While defending the value of every helicopter flight, FAA noted that it also tries to mitigate the resulting noise by allowing higher altitude flights when possible. Noise was expected to have been reduced in March 2012, when Advanced Navigational procedures as recommended in the Part 150 Plan were scheduled to have gone into effect. Another noise mitigation policy supported by FAA is the Fly Neighborly Program devised by the Helicopter Association

International for all civilian, military and government flights. A community noise portal that could manage helicopter noise complaints and pinpoint “hot spots” was suggested as a tool to alleviate community concerns. Liaison Hynes noted that, although funds were not currently available to purchase such a system, COG is continuing to look for funding opportunities.

In the couple of years following the second forum, according to Liaison Hynes, there were fewer community complaints about helicopter noise, suggesting that the helicopter noise forums, combined with the two noise mitigation policies, appear to have been effective.

C. HIGHWAY NOISE

1. Background

As the Washington metropolitan area continues to grow, so does traffic and traffic-related noise, degrading quality of life, especially in residential areas adjacent to these roadways.

Noise has become an important environmental consideration for highway planners and designers. The U.S. Department of Transportation and state transportation agencies are charged with the responsibility of optimizing compatibility of highway operations with environmental concerns. Highway noise has been addressed by numerous investigations, including distinguishing among different sources of noise at receptor locations, studying noise perception by the human ear and calculating highway noise reference energy mean emission levels. In addition, the effects of site geometry, meteorology, ground surface conditions and barriers on noise propagation are estimated and considered. While the study of noise and its perception has become more sophisticated, there is still a need for precise, uniform noise measurement procedures for assessing impacts of traffic noise in the vicinity of roadways, as well as a need for effective cost-efficient noise barriers.

When measurements indicate that noise abatement is required, the following procedures are options:

- The construction of barriers/walls or raised berms.
- The provision of landscaping/vegetation.
- The provision of acoustical design techniques.

In densely populated areas such as Fairfax County, noise barrier walls remain one of the most reasonable and feasible measures to abate traffic noise upon adjacent residential properties.

2. State Policy

Virginia adopted its original noise abatement policy in 1989. The policy established criteria for providing noise protection in conjunction with proposed highway projects in the state. Implementation of the policy has aided in the construction, or construction approval, of more than 100 federally-funded sound barriers. Experience with this policy created considerable feedback from residents and elected officials. As a result, the Commonwealth Transportation Board decided to evaluate the policy for possible changes. The major source of information used was a survey of 15 state departments of transportation in the eastern U.S. The culmination of this process was the adoption of changes to the state policy in November 1996, which became effective in January 1997. The three key changes to the policy were: to raise the cost-effectiveness ceiling from \$20,000 per protected receptor to \$30,000 per protected residential property based on other states' practices; to clarify that Virginia will not participate in any retrofit project along an existing highway when not in conjunction with an improvement for that highway; and to add the possibility for third party funding of the amount above Virginia Department of Transportation's \$30,000 ceiling if the abatement measure otherwise satisfies the criteria. The State Noise Abatement Policy was revised again effective July 13, 2011 to comply with the Federal Highway Administration's noise abatement regulations. The policy now establishes a reasonableness criterion (cost effectiveness) for a sound barrier of 1,600 square feet per noise receptor (rather than a cost figure), a noise reduction design goal of at least seven decibels, consideration of balconies as an outdoor usage area and elimination of third party funding (except for aesthetics). The policy of not considering noise impacts beyond 500 feet from the roadway in determining the need for noise abatement will be continued. More information about the state's noise abatement policy can be viewed at the Virginia Department of Transportation website: www.viriniadot.org/projects/pr-noise-walls-about.asp.

3. State Projects in Fairfax County

The potential noise impact of the I-495 High Occupancy Toll Lanes Project, which has added a total of four new lanes for a 14-mile stretch between the Springfield interchange and the American Legion Bridge, was assessed in accordance with Federal Highway Administration and VDOT guidelines. To determine the degree of impact of highway traffic noise, traffic noise levels during the loudest hour of the day were determined for the existing (1998) conditions and the design-year (2020) no-build and build conditions. Noise levels for the design-year no-build scenario are expected to increase on average by approximately 1 dB because of an increase in projected traffic volumes and the mix of heavy trucks during the loudest hour. In comparison, noise levels for the build scenario were estimated to increase an average of approximately 4 dB, with noise impacts in some areas increasing up to 19 dB and in others actually decreasing. The majority of impacted residences would be exposed to design-year traffic noise levels that approach or exceed an average of 67 dBA during the loudest hour of the day. Noise barriers were recommended for construction consistent with the state's feasibility and reasonableness criteria:

- Noise barriers must be physically feasible and capable of providing at least five decibels of noise reduction, and for projects considered as of July 2011, at least seven.
- The noise barriers must meet VDOT's cost-effectiveness criterion of a maximum of \$30,000 per protected or benefited dwelling unit, unless additional funding is provided by a third party. For projects being considered after July 2011, a barrier must meet a reasonableness criterion of 1,600 square feet per noise receptor (rather than a cost figure).
- Noise barriers under consideration after July 2011 may include balconies as an outdoor usage area, and third party funding may no longer be used, except for aesthetics.

Recommendations from the study led to subsequent approval of nine new sound barrier systems, as well as the replacement/enhancement/extension of eight previously existing sound walls that needed to be removed in order to widen the highway. Sound walls, therefore, have been constructed to protect almost all residential areas on both sides of the highway adjacent to the 14-mile stretch of the project, with gaps where walls could not be built because of terrain or access issues, or, in a few cases, where a proposed barrier was not approved because it did not meet the criterion of either sound reduction or cost-effectiveness.

The study also estimated the impact of highway traffic noise on non-residential areas such as parks, schools, places of worship and recreation areas. Reasonableness for these areas was determined during final design on a case-by-case basis with respect to the type and duration of activity, size of the affected area, severity of impact, total cost and the amount of noise reduction.

Barriers constructed by VDOT since the early 1990s in Fairfax County have consisted of a solid wall of absorptive concrete that breaks the line of sight between vehicles and homes. Although noise barriers can have a maximum decibel reduction of 20 dBA, most only provide a reduction of 10-12 dBA. Walls for the I-495 Express Lanes Project are now complete with the erection of walls at the intersection of I-495 and Georgetown Pike in December 2013. Barriers look similar to those sound walls built in the past in Fairfax County, with heights ranging from about seven to 39 feet.

Noise barrier systems have been completed on the following federal-aid projects in Fairfax County during FY2014-15:

- Four new noise barrier systems on the Dulles Connector Road from Chain Bridge Rd. to I-66 (VDOT Project # 0267-029-919, C501; UPC 98232).
- Two replacement and three new noise barrier systems on the I-66 from Haycock Rd. to Lee Highway (VDOT Project No. 0066-96A-113, C501; UPC 78828).

- Four new noise barrier systems on the I-95 Express Lanes (VDOT Project No. 0095-969-074, C501 / UPC 103106) were completed.
- Traffic noise studies to assess impacts and determine whether noise barriers are warranted are presently under way for the following VDOT projects:
 - Jones Branch Drive Connector over I-495 (administered by Fairfax County).
 - Route 7 bridge replacement and widening over the Dulles Airport Access and Toll Road
 - Route 7 corridor improvements from Reston Avenue to Jarrett Valley Drive.
 - Route 28 corridor improvements from I-66 to Westfields Blvd.
 - I-66 corridor improvements from I-495 to U.S. Route 15 in Prince William County.

Noise barriers are also under consideration for the Richmond Highway improvement project between Telegraph Road and Mount Vernon Memorial Highway (VDOT Project No. 0001 029 938, P101/UPC 99181). A final noise analysis is currently pending to determine if they will be warranted.

D. METRO YARD NOISE

The Metro Service and Inspection Yard, located near the West Falls Church Metro station, services trains using a short-radius loop track. As the trains move along the track, “wheel squeal” is generated; this noise impact is extremely irritating to residents in nearby neighborhoods. An expansion of this yard had been proposed by the Washington Metropolitan Area Transit Authority in order to provide support for operations on the newly-opened Silver Line, and as part of the expansion, the Federal Transit Authority required a sound box to be built over the noisiest portion of the loop track.

The sound box was completed in summer 2014 and met its development condition of DNL 55 dBA as well as requirements of the county’s noise ordinance (Chapter 108.1 of the Fairfax County Code)--a requirement of a maximum noise level of 55 dBA and also maximum noise thresholds in specific frequency-based octave bands.

A forum for ongoing discussion with the adjacent residential community was established, requiring WMATA to meet when requested (but not more than twice a year) with a Communications Committee comprised of representatives of nearby homeowners. In addition, a dedicated telephone contact number for the West Falls Church rail yard has been provided to the Dranesville District Supervisor’s office and to members of the Communications Committee to enable them to report concerns regarding the operation of the West Falls Church rail yard. Residents have complained about loudspeaker noise and wheel squeal from another loop, and the Department of Planning and Zoning has been working with WMATA to resolve these outstanding issues. An opportunity to address the noise will come when WMATA is actively working on that loop.

E. TYSONS NOISE STUDY

The following summary has been provided by the Department of Planning and Zoning:

As reported in the 2012 *Annual Report on the Environment*, the Comprehensive Plan recommends that an area-wide study of noise levels along Tysons' major transportation corridors be undertaken. The Comprehensive Plan specifies that the noise study should define noise contours with current noise levels and future noise levels based on a minimum 20-year traffic volume projection for the roadway and other transportation noise sources.

A contract was awarded in June 2011 to Phoenix Noise and Vibration to complete a study of transportation generated noise for the Tysons Corner Urban Center. The Tysons Corner Areawide Urban Center Transportation Noise Study was completed by the consultant in December 2012. The study focused on all major roadways, within and bordering the urban center, with a posted speed limit of 35 mph or greater. The study provided noise contours for both ground level and vertical estimates of existing and projected transportation generated noise in this area. Staff continues to rely on the findings of this study as a resource for determining the need for more detailed, site-specific noise studies. Several such studies have been performed in conjunction with individual zoning applications in Tysons, leading to proffered commitments to appropriate levels of noise mitigation.

F. FAIRFAX COUNTY NOISE ORDINANCE REVISIONS

Much of the following summary has been provided by the Department of Planning and Zoning:

The Board of Supervisors requested staff to review and revise the Noise Ordinance to better address the methodology used in noise measurements; to consider the appropriateness of establishing daytime and nighttime noise levels to protect the community; and to add other objective criteria to regulate noise within the county. On December 3, 2013, the board adopted a new Excessive Sound Generation in Residential Areas and Dwelling Ordinance (Article 6 of Chapter 5 of the County Code), which gave the police the ability to address certain sound that is generated in a residential dwelling or residential area that is plainly audible and discernible inside another person's dwelling with doors and windows closed. The recent amendment to Article 6 was intended to be an interim step until more comprehensive amendments would be adopted. On February 14, 2014, staff presented a proposed new draft Noise Ordinance to the board's Development Process Committee.

The overall goal of the proposed Noise Ordinance is to minimize nighttime noise and guarantee residents a certain level of quietness within their homes. The proposed new Noise Ordinance would replace both the existing Noise Ordinance and the existing Excessive Sound Generation in Residential Areas and Dwelling Ordinance. Among other things, the new Noise Ordinance would prohibit certain noises and would exempt certain other noise.

In order to obtain feedback on the proposed new Noise Ordinance, three public meetings were held, stakeholder meetings were held, interested organizations were notified and public comments were received on-line. The number and variety of public comments received was expansive, with two of the more controversial issues being noise from dog parks and athletic activities on Fairfax County Public Schools grounds, and there was not a clear consensus on the issues. On June 10, 2014, staff presented a summary of all comments received to the board's Development Process Committee. Staff was directed to prepare a range of options on how the proposed amendment could be advertised to give the board maximum flexibility given the diversity of the public comments. Staff presented options to the board at the September 30, 2014 Development Process Committee meeting. A second public hearing was held on May 12, 2015, and in June staff proposed text that would potentially address some of the issues raised by the speakers. Additional information about dog parks and efforts to reduce noise from athletic events on school property was also provided by staff. It was the consensus of the Development Process Committee that additional time was needed to address the issues, and a workshop to discuss the proposed Ordinance was held September 11, 2015. With this additional information, the board was scheduled to make its decision on the proposed Noise Ordinance at its November 17, 2015 meeting. EQAC will report further on the revision of the county's Noise Ordinance in its next Annual Report.

G. STEWARDSHIP

The Fairfax County Restoration Project, a public-private partnership, launched in spring 2010 with its initial focus on restoration of areas negatively impacted by the I-495 Express Lanes Project. It has worked with VDOT to modify VDOT's landscaping plans to include restoration of cloverleaf areas and areas inside and outside the sound walls. Vegetation planted inside and outside the sound walls will provide many benefits, including reduction in storm water runoff, habitat for pollinators, birds and small mammals and visual relief for both motorists and residents.

In recognition of its many projects already under way in different parts of the county, the FCRP was awarded a 2011 Environmental Excellence Award (see Appendix C). Anyone interested in joining the efforts should contact the FCRP through its website at www.fcrpp3.org.

H. COMMENTS AND ONGOING CONCERNS

1. Continue to support airport noise-compatible land use planning near airports in the county through the implementation of policies and regulations that reference the most current airport noise contour projections for the airports and that are at least as stringent as federal noise compatibility guidelines.
2. Staff should continue to review all airport and highway studies that require Environmental Assessments or Environmental Impact Statements under the National Environmental Policy

Act for consistency with county policies addressing transportation-related noise and mitigation and report its findings to the board. In turn, the Board of Supervisors should, when appropriate, adopt resolutions with specific requests and/or recommendations and transmit these to the Metropolitan Washington Airports Authority, Federal Aviation Administration, Commonwealth Transportation Board, Virginia Department of Transportation and other state and federal agencies as applicable.

3. Encourage the retention and planting of noninvasive vegetation to provide visual shielding of residents from highways. Where possible, support the provision of vegetated areas adjacent to highways that are wide enough and dense enough to provide noise reduction benefits to residential areas near the highways. Where feasible and appropriate, pursue such approaches in lieu of noise walls.

I. RECOMMENDATION

1. EQAC recommends that the Board of Supervisors request to MWAA that quarterly summaries from MWAA's WebTrak system be displayed in three formats (Total DNL, Aircraft DNL and Community DNL), together with the interactive data, on the MWAA website. The quarterly summaries should be provided as promptly as possible, ideally within a month of the quarter's end (e.g., by the end of April, July, October and January).

REFERENCES

Fairfax County Virginia Noise website: www.fairfaxcounty.gov/dpz/environment/noise/

Federal Aviation Administration, 2007, Ronald Reagan Washington National Airport, Volume 1, FAR Part 150 Noise Exposure Maps and Noise Compatibility Program.

Federal Aviation Administration, June 29, 2015 letter from Rebecca Cointin to Noel Kaplan, Fairfax County Department of Planning and Zoning.

Metropolitan Washington Airports Authority, July 13, 2015 letter from Mike Jeck to Noel Kaplan, Fairfax County Department of Planning and Zoning.

Metropolitan Washington Airports Authority website: www.mwaa.com

Metropolitan Washington Council of Governments website: www.mwcog.org

Tysons Corner Areawide Urban Center Transportation Noise Study of December, 2012 published by Phoenix Noise and Vibration for Fairfax County Department of Planning and Zoning

Virginia Department of Transportation, September 4, 2015 letter from John C. Muse to Fred Selden, Director, Fairfax County Department of Planning and Zoning.

IX-2. LIGHT POLLUTION

A. OVERVIEW

Light pollution is a general term used to describe light output, primarily from exterior (outdoor) sources, in commercial, residential and roadway settings that is excessive in amount and/or that causes harmful glare to be directed into the path of travel or into residential neighborhoods. Light pollution is thus both a safety issue and a quality of life issue. With the increasing urbanization of Fairfax County, exterior (outdoor) lighting and light pollution in its many forms have become pressing issues to our communities. In the past, Fairfax County had some regulations regarding exterior lighting, but they were minimal and out of date. A major effort was undertaken in 2002 to write a totally new and modern Outdoor Lighting Ordinance that took into account the numerous advances that have been made in lighting technology in recent years. This highly successful effort utilized several workshops, in which EQAC and a number of local experts participated, and came to fruition in the early summer of 2003 with the adoption of the new Outdoor Lighting Ordinance. It is regarded by experts in the outdoor lighting community as being one of the best such ordinances in the mid-Atlantic region and has been cited and largely copied by localities in Connecticut, Illinois and California. However, there are a few areas that could not be adequately addressed by the new ordinance, since suitable standards and convenient measurement technology were not available. This report will focus on these areas.

B. RESPONSE OF THE HUMAN EYE TO LIGHT

To put the following sections in proper context it is helpful to briefly review how the human eye perceives and reacts to light. The various cells of the retina of the eye contain what are called visual pigments. These pigments, in the fully dark-adapted condition, are complex proteins consisting of two linked components. The pigments respond to light by “bleaching” (actually the dissociation of the two protein moieties). The brighter the light, the greater is the bleaching and the longer the regeneration time. The greater the bleaching, the lower is the sensitivity of the retinal cells. The retina contains three types of sensory cells:

- The rods which are most numerous toward the periphery of the retina and contain the visual pigment rhodopsin. They are useful primarily in low light and provide monochromatic images.
- Three types of cones, mostly concentrated in the central portion of the retina, which provide color vision. They contain respectively photopsin I (erythrolabe), photopsin II (chlorolabe) and photopsin III (cyanolabe). Their peak sensitivities are in the red, green and blue portions of the light spectrum just like the sensor chip in a digital camera. (George Wald received the 1967 Nobel Prize in Medicine for his work on the three kinds of cone photopsins.)

- The spidery retinal ganglion cells, containing the visual pigment melanopsin. These cells perform two different functions: (1) control of the size of the pupil of the eye in response to light and (2) as the control that resets the body's day-night cycle clock. Prolonged exposure of melanopsin to bright lights during normally dark periods of the evening and night can result in significant disturbances of the sleep-wake cycle.

C. ISSUES AND PROBLEMS

The main issues and problems of exterior lighting and light pollution may be summarized as follows:

1. Glare

Glare, as defined by the Illuminating Engineering Society of North America, falls into three main categories:

- Disability glare – Disability glare (sometimes less accurately referred to as veiling luminance) is caused by overly bright light sources that shine directly into one's eyes and is dangerous because it is blinding (i.e., it totally overloads the eye's light sensor cells).
- Discomfort glare – Discomfort glare may not necessarily reduce the ability to see an object, but it produces a sensation of discomfort due to high contrast or non-uniform distribution of light in the field of view.
- Nuisance or annoyance glare – Nuisance glare is that which causes complaints such as: "The light is shining in my window."

Glare is a significant and pervasive problem that seriously impairs both safety and quality of life. Glare demands attention in that one's eyes are naturally attracted to bright light, and at night this destroys the eye's dark adaptation (the eye's sensitivity to lower light levels), which is a serious hazard for both drivers and pedestrians.

Obtrusive lighting by commercial establishments to attract attention is a serious problem as is selection of inappropriate fixtures for exterior residential lighting. A major problem is the high intensity lighting of sports facilities, such as ball fields and tennis courts, adjacent to residential neighborhoods. Glare and excessive illumination (which are two separate problems) cast into surrounding residential neighborhoods not only detracts from the quality of life but can make it difficult for pedestrians and homeowners to see their surroundings.

2. Light Trespass

Light trespass is the poor control of outdoor lighting such that it crosses property lines and detracts from the property value and quality of life of those whose property is so

invaded. It is particularly common when obtrusive commercial or recreational lighting is immediately adjacent to residential neighborhoods or when a homeowner uses inappropriate fixtures, light levels and lighting duration, often in the interest of “security.” It is generally categorized in two forms:

- Adjacent property is illuminated by unwanted light.
- Excessive brightness (often called “glare”) occurs in the normal field of view.

Both of these forms may be present in a given situation. Illumination, that is, the amount of light energy falling on a surface, is readily measured by simple hand held instruments and is expressed in foot candles. Light levels of 0.5 foot candles at the property line of the property producing the illumination are regarded as a reasonable limit in residential areas. Illumination levels above that are regarded as excessive light trespass onto adjacent properties.

Glare or excessive brightness is a more complex and difficult-to-measure phenomenon. It is experienced when the light producing source (the bulb) is directly visible, but also depends on the luminance of the source and on the contrast between that source and the surrounding background. For example, even a very bright light source viewed against a noonday sky doesn't seem particularly glaring or objectionable, but the same source viewed against a night sky is very objectionable and seems so bright as to be almost painful. One of the problems in addressing this kind of light trespass, or more properly glare trespass, is that there have not been good standards for acceptable limits, and instruments to measure this kind of glare are necessarily complex and difficult to operate.

3. Security

Much outdoor lighting is used in the interest of providing security. These safety concerns often result in bad lighting rather than real security. One reason often cited for today's bright lights is that high wattage is needed to deter crime. However, studies have shown that if light is overly bright with excessive glare it makes it easier for a person to hide in the deep shadows created by objects in the harsh glaring light. This might actually encourage crime rather than discourage it. The debate as to whether or not additional light provides more safety has been emotional rather than factual. The few rigorous studies that have been done reveal no connection between higher lighting levels and lower crime rates. This may be due to people with nefarious intent taking more risks in better lit areas. For example, the National Institute of Law Enforcement and Criminal Justice found no statistically significant evidence that lighting impacts the level of crime (Uppgren, 1996). Thus, the supposed correlation between a high level of security lighting and reduced crime appears to be nothing more than a popular myth.

4. Urban Sky Glow

Urban sky glow is brightening of the night sky due to manmade lighting that passes upward with the light rays reflected off of submicroscopic dust and water particles in the atmosphere. Although urban sky glow was first noted as a problem by the astronomical community, it is by no means any longer solely an astronomical issue. With the increasing urbanization of many areas of the U.S., all residents in those areas are now being affected. In Fairfax County, which is now a mostly urban county, improper lighting has seriously degraded the darkness of our local night skies into a pallid luminescence that many of our residents find objectionable.

5. Energy Usage

Smart lighting techniques, which direct all of the light generated onto the target area, reduce energy consumption and hence the use of fossil fuels. Several engineering estimates suggest that at least 30 percent of outdoor lighting is being wasted through light energy spilling upward and outward rather than being directed downward onto the target area. Also, many installations are greatly over-illuminated as well as being lighted for unnecessary durations, further compounding the energy wastage. Inefficient lighting incurs both direct financial costs and hidden environmental costs. It has been estimated by national organizations studying light pollution that in excess of \$8 billion of electricity is being wasted annually on obtrusive and inefficient outdoor lighting (see data from Virginia Outdoor Lighting Task Force and the International Dark-Sky Association). Since electricity generation in the eastern part of the country is mostly from fossil fuels, every unnecessary kilowatt of electrical energy generated also produces air pollution, unnecessary greenhouse gases and acid rain.

D. CURRENT COUNTY STANDARDS AND REGULATIONS

In EQAC's view, Fairfax County now has a generally excellent ordinance that prescribes limits for the maximum wattage of light sources and for the amount of illumination and glare in commercial and residential districts. However, existing installations that were noncompliant under the new ordinance are allowed under state law to continue until such time as the fixture requires replacement. Also, these standards do not cover roadways that are under the jurisdiction of the Virginia Department of Transportation, and a number of these roadway fixtures represent a continuing source of glare and light pollution.

EQAC also has concerns about the following issues:

- While individual light fixtures may be compliant with the ordinance, their number, spacing and arrangement may create illumination that exceeds reasonable county standards and regulations.

- When the lighting ordinance was created, an attempt was made to allay concerns of builders who use work lights on the open floors of buildings under construction. The ordinance specified that the light bulbs used around the perimeters of open floors must have frosted, rather than clear glass. However, a dozen years of experience has shown conclusively that this method does not eliminate the excessive brightness that is so distressing to nearby neighbors and that creates a definite safety hazard to nearby motorists. It is EQAC's view that ordinance amendments are urgently needed to correct this problem.

The first two recommendations provided by EQAC at the end of this section of the report address these issues.

Fairfax County's Policy Plan: The Countywide Policy Element of the Comprehensive Plan (2013 Edition) recognizes the nuisance of light emissions arising from increasing urbanization and recommends that efforts be made to avoid creating sources of glare that interfere with residents' and/or travelers' visual acuity. To put this into practice, the county's Zoning Ordinance contains standards for illumination limits. However, the issue of glare, as opposed to illumination level, has only recently been addressed adequately. EQAC has recently collaborated with the Park Authority in conducting a study of glare in athletic field lighting and the scientific limitations on its control. That study provides a basis for addressing glare from all sources.

E. ADDRESSING THE PROBLEM

While the 2003 ordinance very adequately addresses new and replacement installations of outdoor lighting and fixtures in commercial and residential districts, much roadway lighting remains a problem because it is prescribed by VDOT, which is not subject to local control. A recently passed Virginia law and policy to use henceforth only fully shielded fixtures will eventually mitigate these problems as older fixtures are replaced. Ensuring that new residential installations meet code requirements represents a potentially significant compliance problem and will require that both review and inspection personnel be fully aware of the new code requirements and diligent in the application and enforcement of them. In addition, the 2003 ordinance has been under review to include some modifications that will further reduce adverse effects of improper lighting. In 2010, staff coordinated with a work group consisting of representatives from the International Dark Skies Association, developers, the lighting industry, county residents and staff from the Fairfax County Park Authority and Fairfax County Public Schools to discuss potential revisions to the outdoor lighting provisions. In addition, staff has discussed the potential changes with the Northern Virginia Building Industry Association. This item is on the 2015 Zoning Ordinance Amendment Work Program and it is anticipated that this amendment will be scheduled for public hearings in early 2016.

One of the most common street lights in use, the drop-lens, cobra-head fixture, uses 150-watt bulbs. A fixture with reflective backing and shielding can direct all light below the horizontal plane with the same illumination of streets and homes and use only 100 watt

bulbs. The same possibility exists with the popular 175 watt unshielded mercury vapor lamp. Both the 150-watt cobra-head fixture and the 175-watt mercury vapor lamp cast light laterally as well as down. As a result, substantial glare is often cast directly into the eyes of drivers. This glare destroys drivers' dark adaptation, creating potential safety hazards. In many cases the driver is not able to see the roadway as well as he or she would with lower-wattage properly shielded lights, and in many cases his/ her vision is made much worse. Because they cut down on glare, shielded fixtures not only are safer for drivers, but, according to experts (see references), actually make it easier for pedestrians and home owners to see their surroundings.

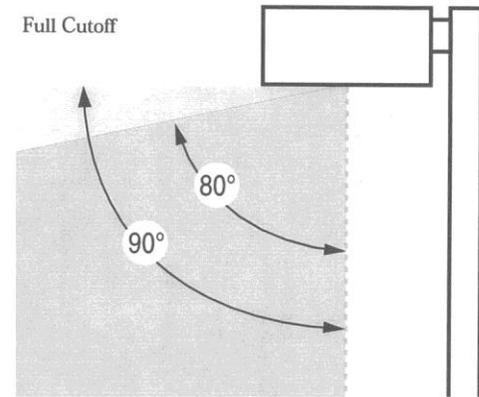
By redirecting this wasted energy, lower wattage lights provide the same amount of illumination in the areas where it is needed. These fixtures have reflective backing and full cut-off shielding to direct all light below the horizontal plane, with 90 percent of the light directed below an angle of 20 degrees from the horizontal. For example, a 50-watt metal halide lamp with a reflective shield will provide as much illumination below the horizontal plane as the 150-watt cobra-head fixture or the 175-watt unshielded mercury vapor lamp. These newer types of fixtures, which are recommended by the Illuminating Engineering Society of North America, are widely available and direct all light below the horizontal plane, thereby eliminating lateral glare (see Figure IX-2-1). It is estimated that it takes only three years of energy savings to recoup the initial investment in these fixtures. The lower wattage fixtures provide energy savings, improved driver safety, better visibility for pedestrians and an improved ambiance and security for neighborhoods. Several municipalities, such as Tucson, Arizona, San Diego, California and Sanibel Island, Florida, have adopted street lighting ordinances requiring these newer fixtures.

Most security lighting is overdone, with high wattage lights burning from dusk to dawn. As noted earlier, constant levels of illumination tend to be largely ignored because they are commonplace, and they waste a huge amount of energy. The large amount of glare produced by high intensity sources creates shadows that provide hiding places for intruders. Moreover, the constant glare and light trespass onto adjacent properties is a major source of annoyance to their occupants. On the other hand, lights that are activated by motion within a controlled area attract immediate attention and, at the same time, use very little energy and create intrusion on adjacent properties only when such attention is desired. For example, if one is using 300 watts of security lighting for an average of 10 hours each night and converts to an infrared motion sensor control that turns on the lights only when there is motion in the controlled area, energy cost is reduced to almost nil. In addition, the cost of the added sensor-control hardware can be recovered in as little as two to four months due to the energy saving. At the same time, security is increased rather than decreased and glare and light trespass onto adjacent properties is largely eliminated.

Glare is a significant and pervasive problem, but in some cases it can be solved by installing "full cut-off" (i.e., light fixtures fully enclosed on their sides) or in some cases using supplementary shielding panels, to prevent light trespass onto adjacent residential properties. Where it is not possible to completely eliminate glare through the use of shielded fixtures, inexpensive motion detector controls can limit the harsh light to only a

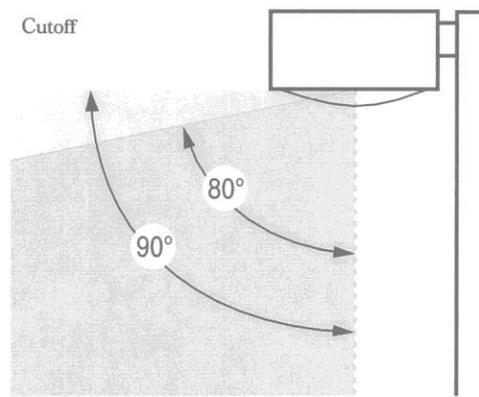
Figure IX-2-1

Effects of Cut-off and Non Cut-off Luminaires



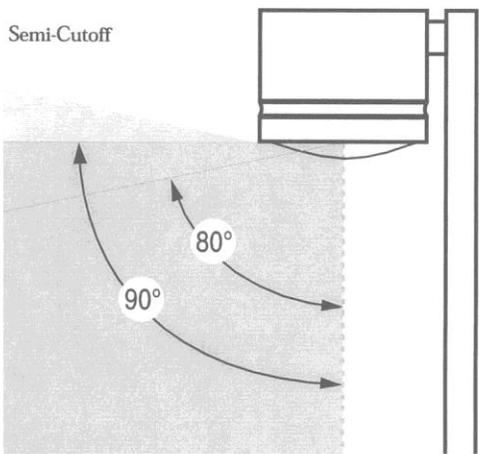
ALLOWS:

- No light at 90 degrees
- 100 cd per 1000 Lamp Lumens at 80 degrees



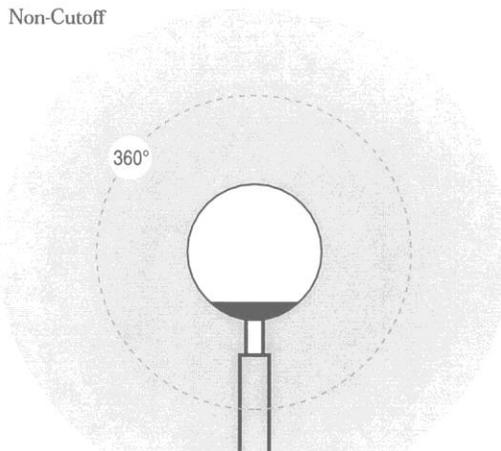
ALLOWS:

- 25 cd per 1000 Lamp Lumens at 90 degrees
- 100 cd per 1000 Lamp Lumens at 80 degrees



ALLOWS:

- 50 cd per 1000 Lamp Lumens at 90 degrees
- 200 cd per 1000 Lamp Lumens at 80 degrees



ALLOWS:

- Unrestricted distribution of light at any angle

(Sources: Paulin, Douglas, *Full Cutoff Lighting: The Benefits*, IESNA website, and Shaflik, Carl, *Environmental Effects of Roadway Lighting*, Information Sheet Number 125, International Dark-Sky Association, Tucson, Arizona, August 1997.)

few minutes when it is really needed. However, glare like that experienced from high-intensity sources, like those used to light athletic fields, is a result of the background contrast ratio which is not subject to human control. A light seen against a very dark sky seems very intense and intrusive, but if seen against a day time sky seems hardly noticeable. One can readily prove this by viewing a full moon at, say, 2 or 3 o'clock in the morning when it appears as an intense disc so bright that it shows no features. However, the same moon viewed at, say, 9 or 10 o'clock the next morning is a very pale appearing disc with only slight contrast against the day light sky and shows an extensive array of features. This effect is due to the great difference in contrast with the background against which it is viewed. The mathematical difference between the source and the background is known as the source to background contrast ratio.

Light trespass is a term of relatively recent origin and denotes (1) glare that is generated by sources on one property that lie within the normal field of view of the occupants of another property and (2) light that spills over the boundaries of one property onto another, thereby producing unwanted illumination. Increasingly, such light intrusions are being regarded as trespass violations every bit as serious as physical trespass of a person onto the property of another. Such problems can now be readily avoided by the selection of proper fixtures, intensity levels and the use of timers and sensors/controllers.

Sky glow is also readily addressed by the selection of properly designed modern fixtures for new installations and phased retrofit of current inadequate installations. The cost of such retrofits is normally recoverable within a reasonable time period (usually estimated at about three years) through efficiently placing all of the light onto the desired area and the resulting lower energy usage.

Adherence to the following four principles will do much to mitigate or eliminate light pollution.

- Always illuminate with properly shielded fixtures that prevent the light source itself, and the resultant glare, from being directly visible. This is done by using cutoff fixtures or supplementary shielding that keeps all of the illumination below the horizontal plane and directed onto the target area.
- Do not over-illuminate. Never use more illumination than needed for the task at hand. Using a 400 watt floodlight to illuminate a small parking area or a flag at night is overkill and wastes a great deal of energy. A properly shielded and adjusted 250 watt luminaire (light source + fixture) can illuminate an area just as effectively as an older style 1,000 watt light source.
- Always aim lighting downward, keeping all of its distribution within the property lines and below the horizontal plane so that it is not a source of glare. Light trespass onto adjacent properties is unnecessary, inconsiderate and potentially illegal.
- Do not burn lighting all night long with the intention of improving security. Using infrared motion sensor-controlled lighting that comes on instantly when there is motion

in the designated area is far more effective as a security measure. That rapid change from dark to light draws the immediate attention of everyone in the surrounding area, including security and law enforcement personnel on patrol, and may well be unsettling enough to cause illicit intruders to immediately flee. Lighting that stays on all night draws no special attention and is an enormous waste of energy.

F. PUBLIC AGENCY RESPONSIBILITIES

The responsibility for ensuring compliance with glare and illumination standards for residences and other private property lies primarily with the county's Department of Code Compliance. Enforcement activity dealing with light is complaint-driven and amounts to about 0.5 percent of total complaints. The county does not respond to anonymous complaints. Complaints are either filed by individuals directly with the Department of Code Compliance or are forwarded by the staff of a member of the Board of Supervisors. The causes of the complaints have usually been fast food or other commercial establishments, security lighting for residences, athletic facilities (e.g., ball fields, driving ranges), or churches. The inspectors typically resolve violations with informal enforcement such as a verbal warning that there is a violation and how it may be remedied. A written notice of violation or civil action can be used if needed. Beyond the general glare standards, the county frequently is able to impose additional "before-the-fact" restrictions through development conditions when rezoning, special permit and special exception processes come into play.

The Fairfax County Park Authority and the Fairfax County Public Schools are the two largest users of recreational and sports field lighting in the county. Parks and schools by their very nature are usually located in the midst of residential communities where their outdoor lighting, if inadequately designed, can seriously impact the surrounding residents. Schools, particularly high schools, often have sports practice sessions extending into the early evening hours and games that begin after the dinner hour and run into the later evening hours. In addition, schools of all categories often have "security" lights that burn from dusk to dawn, although they could be better served by motion-detector activated lights. Our park system, faced with increasing demand for team athletic facilities, will necessarily have to turn to synthetic turf and lighting during the evening to enable greater use of its existing fields. It is the responsibility of both organizations to use the best designs and equipment in addressing these needs in order to minimize adverse impacts on the surrounding neighborhoods and to ensure that lighting will not diminish either property values or quality of life. To this end, the Park Authority has recently published an extensive guidance handbook (with collaboration from EQAC) for athletic field lighting design.

During the recent renovation of McLean Central Park, all of the walkway and path lighting fixtures were changed to ones using LED (Light Emitting Diodes) light sources. This was done as a beta-test of this technology which should offer significant cost savings in both operation and maintenance. The test results have been so satisfactory that the Park

Authority is planning to require the use of LED lighting for paths and walkways as a revised standard.

One of the most onerous sources of light pollution is the obtrusive lighting of commercial and industrial facilities, particularly commercial retail and service establishments. While their desire to attract attention to themselves is understandable, abusive excesses degrade the overall ambience of our commercial areas and materially degrade the quality of life in adjacent residential neighborhoods. This is of particular concern in the case of “by-right” development, where there are no public hearings (e.g., Planning Commission, Board of Zoning Appeals, Board of Supervisors) at which adjacent property owners and neighborhoods can register their concerns and see approval conditioned on appropriate restrictions. In such “by-right” cases, the initial responsibility would necessarily fall almost entirely upon the Land Development Services function of the Department of Public Works and Environmental Services, which reviews all proposed plans before a building permit is issued and subsequently conducts inspections to ensure that the work is in compliance with regulations. Evaluation of plans for compliance would add a small amount of effort to the review process but would add only a negligible amount to the inspection process.

At this time, the county has no formal policies regarding street lighting. Some neighborhoods within the county prefer to have local streets lighted, while others do not. Whether or not the county provides street lighting is often driven by budget priorities, and, unless there is a demonstrable public safety need, the priority for retrofitting an established community is usually low. More often, street lighting is addressed in the overall planning of new subdivisions. In these cases, the Land Development Services function of DPWES would have responsibilities for both reviewing the plan and inspecting the implementation of it.

Responsibility for the lighting of main roadways is under the jurisdiction of the Virginia Department of Transportation. Historically, local communities and neighborhoods have had to deal directly with VDOT or through their local supervisor’s office over roadway lighting issues. It has proven very difficult to influence VDOT’s choice of fixtures and technical standards, even when it can be demonstrated that their proposed implementation will result in unacceptable levels of glare and light trespass in adjacent residential neighborhoods. However, quite recently, encouraging headway has been made in getting VDOT to recognize the severity of the problem and to take some limited first steps to address it. As reported to EQAC by VDOT, all VDOT construction projects involving new lighting or replacement of existing highway lighting will eventually be upgraded to “night-friendly” cobra-style lighting. The same standard will apply to VDOT’s commuter parking lot maintenance contracts. VDOT is also conducting a pilot program to install LED lighting along I-395 and I-495.

G. PUBLIC EDUCATION AND AWARENESS NEEDS

The general public needs awareness of the sources and problems of light pollution and of the methods by which these can be best addressed. The county staff has prepared an excellent and very informative 16 page booklet to explain the Outdoor Lighting Ordinance (available at www.fairfaxcounty.gov/DPZ/Zoning/lightingbrochure.PDF). It can also be made available in printed version to individuals, homeowners groups and community associations directly through appropriate county offices and through the district offices of the members of the Board of Supervisors. The complete ordinance in convenient form is available on the Fairfax County website at www.fairfaxcounty.gov/DPZ/Zoningordinance/articles/Art14.PDF. In addition, the International Dark Sky Association and the Illuminating Engineering Society of North America maintain websites with a variety of technical information on lighting issues and technology.

The county's 16 page booklet provides much of the information that architects, contractors and electricians need to familiarize themselves with our lighting codes and specifically what is not permitted (e.g., unshielded security lights, angle-directed post or building mounted fixtures, wall packs without shielding or baffling, excessive wattage or unshielded floodlights, light-trespass onto other properties, etc.) and what practices are recommended. County review and inspection personnel should make sure that members of the development, contractor and building management communities with whom they deal will be fully aware from the outset of the revised standards in the new ordinance and how best to address them.

H. CONCLUSIONS

The principal means to prevent poor exterior lighting practices is a comprehensive code or ordinance, because this provides well thought out standards for, and enforceable legal restrictions on, specific lighting practices that affect the community and its quality of life. Numerous jurisdictions have adopted codes and ordinances that have proven very effective in reducing light pollution and preventing light trespass. A properly conceived and well written code permits all forms of necessary illumination at reasonable intensities, but requires shielding and other measures to prevent light pollution and light trespass. A good code applies to all forms of outdoor lighting, including streets, highways and exterior signs, as well as lighting on dwellings, parks, schools, commercial and industrial buildings, parking areas and construction sites. A good code also provides for reasonable exceptions for special uses within acceptable time periods and subject to effective standards.

In EQAC's opinion, Fairfax County's recently adopted Outdoor Lighting Ordinance is an outstanding example of such a code. As the county has gained experience with the application of the new ordinance, some areas have been identified where adjustments and fine-tuning are needed. A task force, under the leadership of the Department of Planning and Zoning, has been developing specifications for the revisions needed. As noted earlier

in this chapter, EQAC sees a need for improvement to address multiple lighting fixture arrangements and work lights on the open floors of buildings under construction.

The Fairfax County Park Authority has had a continuing need to increase the hours of use of its existing sports fields by installing lights to illuminate them. Aware of its special responsibility to ensure that such lighting systems minimize adverse impacts on adjacent residential properties, it has prepared extensive specifications for lighting of athletic fields designed to reduce spill light and glare to an achievable minimum. The results with a test rectangular field that was outfitted with lights and artificial turf have been very informative. While the illumination of the field surface is excellent and the illumination at the property line with respect to light spillover meets the Park Authority's stringent standards, the glare from the fully exposed, 1,500 watt lamps on 70 foot poles facing a residential neighborhood is intense (in the range of 12,000 lumens at 200 feet). A second field outfitted with an advanced model of fixtures of the same type shows no improvement in glare. The Park Authority has conducted a recent special study that reveals the glare problem is primarily governed by fundamental laws of nature over which humans have no real control. However, the Park Authority's carefully worked out specifications minimize adverse impacts to the extent humanly possible. This same concern applies equally to Fairfax County Public Schools, which also uses both lighted sports fields (mainly in high schools) and "security" lighting.

The county (the Board of Supervisors and all relevant county staff groups) needs to work closely with VDOT to achieve better lighting practices on roadways within Fairfax County that are under VDOT jurisdiction. Current VDOT lighting and proposed new installations are regarded as being very intrusive by adjacent neighborhoods. However, it should be noted that a newly enacted law requiring the commonwealth to acquire only shielded fixtures should materially improve VDOT practices in this regard on new installations and as old fixtures are replaced.

Much of the security lighting, both residential and commercial, in Fairfax County is poorly conceived, excessive in intensity and improperly directed and controlled. These deficiencies could be corrected at relatively low initial costs that would be rapidly recovered through the energy savings realized. This will require considerable public education to familiarize the using public with the issues and the available technology.

Much lighting in residential neighborhoods uses old style fixtures (or new but poorly designed ones) that cause excessive glare and light trespass onto adjacent properties. The new comprehensive ordinance and an intensive public awareness campaign should be used to address correction of these problems. Single family dwellings especially need to be brought into compliance with the spirit and provisions of the revised ordinance, for that is where the majority of us live and where our quality of life is most affected by intrusive lighting.

Poor lighting design, particularly in commercial areas, is contributing to excessive and highly objectionable sky glow. The new ordinance and retrofitting or adjustment of fixtures can eliminate the worst of this effect.

I. COMMENTS AND ONGOING CONCERNS

1. In response to recommendations in earlier EQAC Annual Reports on the Environment, the Fairfax County Park Authority commissioned several studies of sports field lighting design and technology. The Park Authority issued a set of specifications, dated November 2006, for new athletic field lighting installations that addressed most of the issues adequately except for glare. The Park Authority then commissioned a special study of the glare problem. The Park Authority Director of Planning and Development requested EQAC to collaborate with his staff to develop this study. The final document, based on the underlying science, reveals that much of the glare problem is dependent on source-to-background contrast ratio, which is a fundamental law of nature and not under the control of humans.
2. The earlier EQAC Annual Report recommendations that the Department of Planning and Zoning undertake some needed revisions of the Outdoor Lighting Ordinance has come to fruition in the form of several meetings of a task force of stakeholders to develop specifications for such revisions.
3. The scheduled revisions have been expanded to include consideration of light emitting diode lamps. The Park Authority has recently begun to use these for walkway lighting due to their much lower operating and maintenance costs. Some of these revisions are soon to be in final form.
4. EQAC continues to support that the Board of Supervisors work with VDOT and Virginia elected officials to eliminate unnecessary roadway lighting and whenever possible to accelerate replacement of existing poorly designed fixtures under the control of VDOT with full cut-off fixtures.
5. Adherence to four principles will do much to mitigate or eliminate lighting problems:
 - Always illuminate with properly shielded fixtures that prevent the light source, and the resultant glare, from being directly visible.
 - Never use more illumination than needed for the task at hand.
 - Always aim lighting downward, keeping its distribution within property lines and below the horizontal plane so it is not a source of glare.
 - Do not burn lighting all night long to provide security; instead use motion detector lighting, which burns only for motion in the designated area.
6. Ongoing evaluation of the Fairfax County Outdoor Lighting Ordinance, supported by extensive field observations, has identified four areas where the ordinance is in need of additions or amendments. These items are summarized in the recommendations below and drafting of the necessary revisions should be included in the Zoning Ordinance Amendment Work Program.

7. It should be noted that residential communities desire that schools and parks be located convenient distances from residences in order for children to have convenient pedestrian access to such facilities. Thus, it will never be possible to completely avoid some lighting problems.

J. RECOMMENDATIONS

1. The number and spacing of lighting fixtures, either as long lines or grids, may create unacceptable illumination. The county's lighting ordinance should therefore be amended where such unacceptable levels of illumination would constitute violations under the ordinance. Examples would be a string of lights along a driveway or walkway, an array of drop lens lights, or excessive lights in a parking lot.
2. The commonly used work lights placed in buildings under construction, especially before exterior walls are in place, are a serious annoyance to nearby local residents and a definite safety hazard to motorists on nearby roadways. It is EQAC's view that ordinance amendments are urgently needed to correct this problem.
3. Security lighting utilizing motion detectors needs to be provided with an automatic cutoff following a brief period after motion has ceased. An amendment to the county's lighting ordinance should be pursued to address this problem.
4. Security lighting at schools needs to be carefully re-evaluated since it is often excessive, is usually operating from dusk to dawn and constitutes a serious impairment for the quality of life for the adjacent neighborhood. EQAC recommends that the Board of Supervisors request that the School Board address this concern.

LIST OF REFERENCES

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Some Lighting Myths, Information Sheet Number 42, International Dark-Sky Association, Tucson, Arizona, January 1991.

Fairfax County, Virginia, Policy Plan: The Countywide Policy Element of the Comprehensive Plan, 2007 Edition.

Fairfax County, Virginia, Zoning Ordinance (Chapter 112 of the Fairfax County Code).

Illuminating Engineering Society of North America website, www.ies.org (There are numerous subsidiary and related websites).

International Dark-Sky Association website, www.darksky.org/.

National Electrical Manufacturers Association website, www.nema.org/
(Particularly see their White Paper on Outdoor Lighting Code Issues.)

Virginia Outdoor Lighting Taskforce website, www.volt.org/.

VIII-3. VISUAL POLLUTION AND URBAN BLIGHT

A. OVERVIEW

Historically, the term “pollution” has referred primarily to the fouling of air, water and land by wastes or from the byproducts of human activities. In recent years it has come to signify a wider range of disruptions to environmental quality. Both noise pollution and light pollution issues have been addressed earlier in this chapter. This section focuses on visual pollution and urban blight issues, with an emphasis on roadside signs (i.e., signage that is excessive in amount and inappropriate in placement). Additional aspects of visual pollution include such things as proliferation of billboards, litter, dumps, junkyards and the like.

B. ROADSIDE SIGNS

Unnecessary roadside signs, almost always placed as some kind of advertising, have been called "visual pollution," "sky trash," "litter on a stick" and "the junk mail of American roadways." Uncontrolled signs are examples of the types of visual pollution that can destroy the distinctive character of our communities and countryside.

Signs in the public rights-of-way have been around for as long as there have been public rights-of-way, but the numbers have spiraled out of control in recent years. Between fields of “popsicle-stick” signs for homebuilders and politicians and signs for weight loss, work-at-home businesses, painting, hauling and other signs plastered on every available traffic sign and utility pole, everyone in Fairfax County has something to dislike about the proliferation of signs.

Communities can regain control of their visual environment, preserve their distinctive character and protect natural beauty and the environment by enacting and enforcing ordinances that control signage. Reducing sign blight helps communities reclaim local beauty and character. Excellent alternatives to large intrusive signs, such as wayfinding signs, logo signs and tourist-oriented directional signs, can help people locate local businesses and are minimal in their visual impact.

Sign regulations developed with community input encourages business owners to erect less intrusive signs that reflect an area's spirit, contributing to civic pride and helping to revitalize commercial districts. Regulations should encourage signs that quickly communicate their message, complement their surroundings and enhance the visual character of the community. Attractive on-premise signs can help encourage residents and business owners to work together to improve and revitalize local appearance.

For many years, EQAC had issued recommendations regarding illegal signs, including support for an agreement between Fairfax County and the Virginia Department of Transportation (VDOT) regarding removal of illegal signs from highway rights-of-way.

In February 2013, the Board of Supervisors (BOS) directed the county executive to enter into an agreement with the Commonwealth of Virginia allowing for the removal of illegal signs in the public rights-of-way by the county. That agreement included an initial phase and a second phase of an enforcement program. During the initial phase, county staff was to educate the public and business groups about the sign removal agreement. This effort had the Department of Code Compliance working in coordination with the Sheriff's Office, Office of Public Affairs and VDOT's public affairs staff.

On July 1, 2013, the Community Labor Force of the Sheriff's Office began a countywide cleanup of illegally posted signs in the rights-of-way on the major roadways in the county. Details of this program are available at

<http://www.fairfaxcounty.gov/signs/signremovalprogram.htm>.

It was estimated that the cost of this program will be \$150,000 on an annual basis. Community Labor Force crews will remove all signs located in the designated public rights-of-way between Tuesdays and Fridays. Special event signs are only permitted from Saturday through Monday. If they are present during the weekdays, they will be subject to removal. These signs will then be stored at a county facility for five days, which will allow the owner of each sign to reclaim it, as required by Va. Code Ann. §33.1-375.1(D). After this five day period, unclaimed signs would be destroyed.

Feedback from the BOS to staff at its Development Process Committee meetings in both September 2014 and June 2015, after both the first and second full year of operations, continued to be positive. At those meetings, staff's evaluations of the program indicated that collection operations were at capacity for the one Community Labor Force crew being utilized. Based on a request by the BOS to evaluate of the feasibility of expanding the current program, in June 2015 staff advised the board that current resources were available to create a second collections crew. The BOS approved that expansion option and requested that staff: review current collection and complaint trends; develop a strategy for both increasing major road segments for collection and increasing collection frequency on problematic roads; and further advise the BOS as the second crew operation is implemented. The BOS also endorsed a pilot "robo-call" program to advise violators by phone, but asked staff for further details prior to implementation.

At the June 2015 Development Process Committee Meeting, county staff noted that the community labor force removed 14,000 signs in the first year of operations and is on pace to remove over 22,000 signs within the second year. With the committee's concurrence, staff will prepare a portfolio response to be sent to the committee to further address these matters.

C. RELATED INFORMATION

The Fairfax County Department of Code Compliance provided the following information for 2014:

- Total number of zoning complaints received in 2014: 3,393 (2013 data: 3,607)
- Number of sign-related zoning complaints received in 2014: 234 (2013 data: 343)
- Number of lighting-related zoning complaints received in 2014: 27 (2013 data: 27)

The Fairfax County Police Department provided information about littering and related complaints that were handled by the department during 2014 (data for 2013 provided for comparison):

Table IX-3-1: Littering and Related Complaints Fairfax County Police Department, 2013 and 2014 data		
Citations	Number in 2013	Number in 2014
Dumping: Dump trash/etc. on hwy./private property	1	1
Traffic: Leaking contents; uncovered loads	37	36
Z-dump trash on hwy./right of way	1	1
Arrests		
Dumping trash, comp. animal, etc. on hwy./property	15	40
Dumping: Dump trash/etc. on hwy./private property	141	109

The Alice Ferguson Foundation provided information about the 27th Annual Potomac River Watershed Cleanup with 16,521 volunteers removing 285 tons of trash from 411 sites throughout the watershed. In Fairfax County, 1,643 volunteers removed 37.5 tons of trash from 77 sites. Additional activities of the Alice Ferguson Foundation are highlighted in the Solid Waste chapter of this report.

For over 30 years, Clean Fairfax Council has been working to make Fairfax County clean, green and sustainable. In the last three years, its community cleanups have yielded 975 cubic yards of trash. It has presented sustainability workshops to over 50 groups, and visited 39 schools. All of this was accomplished by the equivalent of 1.25 full time employees and upwards of 7,000 volunteer hours.

D. COMMENT

1. EQAC applauds the county's efforts to enter into, and begin to implement, a legal agreement with the Virginia Department of Transportation that addresses removal of illegal signs from highway rights-of-way. Further, EQAC supports the plan noted by the county to increase the number of crews performing collections. EQAC intends to follow the results from this program and to provide further input regarding both the county staff's analysis of its successes and/or failures and staff's recommendations about retention of and possible modifications to the program.

REFERENCES

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E-mail from Jessica LaBlanc, Fairfax County Police Department, to Noel Kaplan, EQAC. Information for 2014 Report. July 8, 2015.

E-mail from Tim Murphy, Alice Ferguson Foundation, to Noel Kaplan, EQAC. Environmental Quality Advisory Council's Annual Report on the Environment: Information Requests for the 2015 Report. June 22, 2015.

E-mail from Jennifer Cole, Clean Fairfax, to Noel Kaplan, EQAC. Environmental Quality Advisory Council's Annual Report on the Environment: Information Requests for the 2015 Report. June 20, 2015.

Memorandum to Board of Supervisors. Summary Notes from the June 9, 2015 Development Process Committee Meeting. July 23, 2015.