County of Fairfax, Virginia

To protect and enrich the quality of life for the people, neighborhoods and diverse communities of Fairfax County

January 9, 2024

DATA CENTERS
Report and Recommendations

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INTRODUCTION

On May 9, 2023, the Board of Supervisors (Board) approved a Board Matter that recognized data centers as an evolving industry that merits further research and analysis.[1] The Board Matter directed staff to provide a report with research, findings, and recommendations on topics including environmental issues and mitigation; locational guidelines for siting facilities; how data centers should be permitted; and where any new guidelines should be located, including the Comprehensive Plan and the Zoning Ordinance.

Research has included a review of written materials, site visits, and meetings with stakeholders and the community. In addition, staff engaged Clarion Associates for background research; Clarion's report is provided as Attachment 3. Engagement with key stakeholders was critical for staff to understand the data center industry in Northern Virigina and to collect feedback from the

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[1] Board's Board Matter: "Guidelines for Data Centers" https://www.fairfaxcounty.gov/planning-development/sites/planning-development/files/assets/documents/pdf/5-9-2023-board-matter.pdf

variety of interests. In addition to hosting a general community input session, over 20 meetings were held with various stakeholders, including representatives of the following:

- Dominion Energy
- Fairfax Water
- Virginia Department of Environmental Quality
- Fairfax County Environmental Quality Advisory Committee (EQAC)
- Fairfax County Tree Commission
- Nature Forward
- Sierra Club
- Faith Alliance for Climate Solutions
- Various data center consultants

- Noise consultant
- Amazon
- CoreSite
- Stack Infrastructure
- Data Center Coalition
- Fairfax County's Land Use Attorneys Work Group
- Northern Virginia Building Industry Association (NVBIA)
- Northern Virginia Commercial Real Estate Development Association (NAIOP)

A project webpage and email address for public comment were created. Presentations were also provided to the Board's Land Use Policy Committee on October 17, 2023, and the Planning Commission's Land Use Process Review Committee on October 26, 2023.[2]

This report is intended, in part, to address questions and feedback that have been shared by the community and industry. It is based on the work of an interagency staff team consisting of staff from the Planning, Zoning Administration, and Zoning Evaluation Divisions within the Department of Planning and Development, the Office of Environmental and Energy Coordination, the Northern Virginia Soil and Water Conservation District, the Operations and Building Divisions in Land Development Services, and the Stormwater Management and Wastewater Management Divisions in the Department of Public Works and Environmental Services.

RESEARCH TOPICS

Information is presented below according to seven topic areas: land use and site design; energy demand; water demand; water quality; air quality; noise; and building design. Each topic area includes a summary of current regulations and guidelines followed by a discussion of research and recommendations. These sections are followed by a summary of recommendations for the Board's consideration.

A data center is a facility that houses computer servers and their network connections. This report focuses on data centers as a principal land use, not those cases where an accessory server

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[2] Project webpage with information about the community input session, and Board and Planning Commission committee meetings: https://www.fairfaxcounty.gov/planning-development/data-centers

room is located within another business facility or office. Data centers can be developed as stand-alone buildings or as part of a complex that may include other uses. The growth of digital data has expanded exponentially in recent years, resulting in a rapid increase in data center facilities that is anticipated to continue. This growth is needed to support the increased online population as well as business applications in all sectors, including finance, entertainment, healthcare, and education. Major factors contributing to data center growth in Northern Virginia include the long history of a robust fiber optic network in the area and reliable electric power.

Some of the benefits that data centers bring are job creation with good wages, few impacts to transportation systems or schools, and positive tax revenues. Individual businesses can benefit from the scale of cloud computing services where they share in the use of data center resources. Data centers are designed with optimal cooling and other systems to support computer servers and for 99.999% reliability. Data centers can provide better computer processing, storage, data security, and energy efficiency than if each individual business were to manage its own servers. However, data centers are industrial uses that may affect surrounding uses (through noise and visual impacts), or affect energy demand and associated greenhouse gas emissions, air quality, and water supplies.

1. Land Use and Site Design

Current Regulations and Guidelines
The Zoning Ordinance[3] currently[4] allows data centers in the zoning districts shown in Table 1 below.[5] These districts are currently located across the County, with industrial districts primarily in the western portion of the County along Route 50 and Route 28, in the Herndon and Reston areas along the Dulles Toll Road, in the Merrifield/Mosaic areas between I-66 and Route 50, near the intersection of I-495 and I-395, and along I-95 in the southern portion of the County. Zoning districts can be viewed by using the Zoning District Analyzer or JADE.[6] Additionally, the locations of existing, approved, and proposed data centers with surrounding zoning districts are identified in Attachment 1. As shown on these maps, existing data centers are located in the I-3, I-4, I-5, and PTC Districts, and pending data center applications are in the I-5 and PDC Districts.[7]

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[3] Zoning Ordinance: https://online.encodeplus.com/regs/fairfaxcounty-va/index.aspx
[4] Before the new Zoning Ordinance (re-adoption effective May 10, 2023), starting in 2000, data centers were considered by interpretation to be telecommunication facilities which were allowed by right in all C and I districts, in all P districts when shown on an approved development plan, and with SE approval in all R districts. Par. 5 of Sect. 9-101 and Sect. 9-102.
[5] Abbreviations used in the table: SF – square feet; GFA – gross floor area; FAR – floor area ratio.
[6] Zoning District Analyzer:
https://fairfaxcountygis.maps.arcgis.com/apps/webappviewer/index.html?id=e64b68aa834d46b0ad0e6cd4d831f843
or JADE:
https://www.fairfaxcounty.gov/GeoApps/Jade/Index.html?configBase=https://www.fairfaxcounty.gov/GeoApps/Geocortex/Essentials/REST/sites/Jade/viewers/Jade/virtualdirectory/Resources/Config/Default
[7] Pending (in-progress) data centers include those with site plan and building permit approval for at least one building.

Zoning District	By Right	Special Exception (SE)
C-3 (Office) C-4 (High Intensity Office)	Up to 40,000 SF of GFA; larger if repurposing a building existing on May 10, 2023	Required for larger size; or for increase in height or FAR
I-2 (Low Intensity Industrial) I-3 (Light Intensity Industrial)	Up to 80,000 SF of GFA; larger if repurposing a building existing on May 10, 2023	Required for larger size; or for increase in height or FAR
I-4 (Medium Intensity Industrial) I-5 (General Industrial) I-6 (Heavy Industrial)	Yes (limited by district height of 75 feet and FAR of 0.5)[8]	Required for increase in height or FAR
PRC (Town Center, Convention/Conference Center) PDC (Planned Development Commercial) PTC (Planned Tysons Corner Urban)	Yes, if shown on the development plan	n/a

Table 1: Current Zoning Permissions

Setbacks vary according to the zoning district. In the I-4, I-5, and I-6 Districts, the front setback must equal the building height (but be at least 40 feet) and there are no minimum side and rear setbacks. In addition to building setbacks, the Zoning Ordinance requires transitional screening and barriers on the lot of a more intense use when it is located next to a less intense use, as prescribed in Table 5108.2.[9] Transitional screening yards are required to be 25, 35, or 50 feet wide and planted with trees and shrubs in accordance with Zoning Ordinance standards. Currently, a data center is required to provide a 35-foot transitional screening yard when located next to single-family detached or attached dwellings, or a 25-foot transitional screening yard when located next to certain other uses, such as multifamily dwellings, religious assemblies, and child care centers. Under the proposed Zoning Ordinance amendment for Landscaping and Screening, the transitional screening requirements would be the same for most industrial uses, including data centers, and would require 50 feet of screening (the maximum) next to all residential uses and 25 feet next to most public, institutional, and community uses and commercial uses.[10]

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[8] FAR is also subject to the provisions of the Route 28 Highway Transportation Improvement District, and the Dulles Phase I and Phase II Transportation Improvement Districts.

[9] Transitional screening and barriers: https://online.encodeplus.com/regs/fairfaxcounty-va/doc-viewer.aspx#secid-3017

[10] Webpage for the proposed Landscaping and Screening Zoning Ordinance amendment: https://www.fairfaxcounty.gov/planning-development/zoning-ordinance/landscaping-screening

Appendix 12 of the Land Use Element of the Comprehensive Plan's Policy Plan includes guidelines for certain uses, including data centers, that propose higher intensities than what is shown on the Comprehensive Land Use Plan Map.[11] The guidance in this Appendix applies during the review of a rezoning or SE and provides an option for higher-intensity development in designated industrial areas, while ensuring proposals are compatible with surrounding uses and can be supported by existing infrastructure. The criteria used to review such proposals are organized into five topic areas: transportation, mitigation of noise and other impacts, building design, lot size and parcel consolidation, and site design. The use of this option for additional intensity is not meant to supersede any site-specific Plan guidance for intensity and applies only to areas with a baseline Plan recommendation for industrial use.

Research and Recommendations
As outlined above, data centers are currently allowed by right in certain zoning districts. However, as further discussed under the topic areas below, data centers have the potential for impacts to surrounding uses, environmental resources, and infrastructure, and the SE process may provide for a more site- and application-specific review of impacts and mitigations. As indicated in subsection 4102.1.F(1) of the Zoning Ordinance, the SE process is appropriate for certain uses which by their nature or design can have an undue impact upon or be incompatible with other uses of land. Requiring SE approval for data centers in the C-3, C-4, and I-2 through I-6 Districts would allow the Board to consider land use impacts and mitigations through a public process. In the Planned Districts—where the use is allowed if represented on the approved development plan—the current standards could remain because the current process provides for an in-depth, site-specific review. However, the Board could consider clarifying the requirement for a data center to be specifically shown on the development plan, including its location, size, height, and setbacks.

While data centers could continue to be allowed by right with additional standards or conditions, some of the recommendations included in this report—such as reviewing building design and noise studies and encouraging increased open space, tree planting, and stormwater treatment—may be more appropriately and effectively implemented through an SE review in accordance with SE standards in the Zoning Ordinance and guidelines in the Comprehensive Plan. Applications for rezoning are reviewed for conformance with the applicable guidelines in the Comprehensive Plan, and SEs must be found to be in harmony with the Plan. The SE review process also allows for consideration of flexibility through Board modification of standards where appropriate.

A new appendix to the Land Use Element of the Policy Plan could be created with updated performance criteria that would apply in the review of all data centers undergoing a rezoning or SE review, not just those seeking additional intensity. As shown on the maps in

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[11] Land Use Appendix 12: https://www.fairfaxcounty.gov/planning-development/sites/planning-development/files/assets/compplan/policy/landuse.pdf#page=39

Attachment 1, some industrial districts are close to residential districts. Revised guidelines in a new Policy Plan appendix and SE standards in the Zoning Ordinance could bolster existing guidelines and regulations. These could address land use compatibility with existing and planned uses for the property and surrounding properties, including the size of the proposed data center, and the distance of the proposed building and generators from surrounding development. Setbacks and buffering can serve to minimize visual, noise and other impacts; therefore, guidelines could encourage enhanced buffering for data centers near residential development, other noise-sensitive uses, and environmentally sensitive areas.

As industrial uses, data centers are currently allowed in industrial zoning districts, and Appendix 12 of the Policy Plan provides guidelines for additional intensity in areas that are planned for industrial use; however, additional investigation may be warranted for consideration of data centers in areas that are planned in the Comprehensive Plan for future residential or mixed use. Although this report is focused on the potential impacts of larger data centers, smaller data centers with upgraded equipment and design features may be appropriate in areas not planned for industrial use if they meet certain performance criteria.

Additionally, as discussed below, due to the energy demands of data centers, they are typically located near a substation that is connected to major transmission lines. To reduce the need for new transmission lines and substations, a new Plan appendix could include consideration of the distance from and availability of a substation and transmission lines to serve a proposed data center.

2. Energy Demand

Current Regulations and Guidelines
The Zoning Ordinance does not include regulations for energy use and efficiency. As noted above, data centers are typically located close to an electrical substation, which is considered a light utility facility under the Zoning Ordinance and is allowed by right in the I-3 through I-6 Districts; with SE approval in all other conventional zoning districts; and in planned districts if shown on the development plan or with SE approval. When a substation is located in a residential area, the Zoning Ordinance requires a finding that there is no alternative site in a commercial or industrial district. Substations are also subject to the 2232 review process for public facilities.[12] Data centers also need to be located close to electrical transmission lines which, if over 138kv and approved by the Virginia State Corporation Commission (SCC), are not subject to the Zoning Ordinance.[13]

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[12] The public facility 2232 process is summarized at: https://www.fairfaxcounty.gov/planning-development/public-facilities-review/process
[13] If the voltage exceeds 138kv, SCC approval satisfies the requirements of local zoning and Virginia Code Sect. 15.2-2232 for the transmission line. Virginia Code Sect. 56-46.1(F). The locality retains jurisdiction to enforce local zoning over "associated facilities." For any transmission line of 138kv and associated facilities, a public utility must either obtain a certificate of public necessity from the SCC or obtain approval under 15.2-2232 and the local zoning ordinance where the transmission line will be located. Virginia Code Sect. 56-265.2(A)(2).

Starting on January 18, 2024, the newly approved 2021 Virginia Energy Conservation Code (VECC)[14] will require data centers to comply with "ASHRAE 90.4 - Energy Standard for Data Centers," which will include several changes to the design and construction of these facilities. Prior to the 2021 VECC, there were no specific enforceable requirements for energy conservation related to data centers. With the adoption of the 2021 VECC, a new data center will be treated like any other commercial building for the purpose of energy conservation. ASHRAE 90.4 is a performance-based standard and will encourage a more efficient design, presumably leading to less energy usage.

The Environment Element of the Comprehensive Plan encourages the design and construction of new buildings and associated landscapes to use energy and water resources efficiently and to minimize short- and long-term negative impacts on the environment and building occupants. The Comprehensive Plan also recommends that development within designated Industrial Areas incorporate green building practices sufficient to attain certification through LEED-NC, -CS or equivalent. Additional recommendations exist within the Comprehensive Plan guidance for certain Suburban Centers, Transit Station Areas (TSAs), and other development centers. The Environment Element does not contain existing guidance for the evaluation or consideration of energy demand.

Research and Recommendations
Data center operations rely on large amounts of electricity from the electrical grid. Although there is not a consistent correlation between square footage and energy demand (expressed in megawatts, MW), a data center of about 400,000 square feet would likely have a capacity of 48 to 60 MW. Also, with the advent of more powerful computer chips, future data centers may need even more energy. For comparison, the energy demand for 250 homes is approximately 1 MW, the Fairfax County Government Center uses about 2 MW, a typical hospital uses 3 to 4 MW, and the Noman Cole wastewater treatment facility uses 5 to 6 MW. As discussed below, the large energy demand of data centers poses several concerns: a) the availability and reliability of energy for existing and planned development; b) the potential need for clearing and construction of new major transmission lines and substations and related costs relayed to rate-payers; c) potential water quality and air quality impacts of large numbers of diesel backup generators (see Water Quality and Air Quality sections below); and d) increases in greenhouse gas (GHG) emissions.

Availability and reliability: Most of Fairfax is served by Dominion Energy, and a portion of the western part of the County is served by the Northern Virginia Electric Cooperative (NOVEC). Both Dominion and NOVEC purchase power from the Pennsylvania-New Jersey-Maryland Interconnection (PJM), the regional transmission organization. Concerns have

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[14] Land Development Services Technical Bulletin, No: 23-07:
https://www.fairfaxcounty.gov/landdevelopment/sites/landdevelopment/files/assets/documents/23-07-adoption-2021-virginia-uniform-statewide-building-code-usbc.pdf?utm_medium=email&utm_source=govdelivery

been raised by the public that the uniquely large energy demands of data centers could present a challenge in planning for reliable power to all customers. However, in meetings with staff, Dominion has indicated that data center growth does not pose a risk in terms of reliability to residential and other customers. Dominion has also stated that PJM has sufficient power available, and the risks of inadequate transmission capacity would be borne by the data center customer. While the planning for power infrastructure falls to PJM and the utility companies, with regulation by the SCC, land use approvals for data centers are the purview of the County. Therefore, staff recommends that the County pursue discussions with Dominion and NOVEC on enhancing coordination on data center applications through the review of energy capacity analyses. Communication about proposed data centers could facilitate planning for utility service and inform County land use decisions. Energy capacity analyses would allow an assessment of regional power supplies into the future and a common understanding of the power demands of data centers. The growth in data centers and their associated electricity load could be compared against the ability of the existing infrastructure to satisfy those forecast load demands to identify needed transmission infrastructure upgrades, and potential reliability issues, including the timeframe and duration of any electricity delivery shortages. The analyses could also state whether electricity constraints may impact other electricity customers.

Transmission lines and substations: Because of their energy demands, data centers need to be located near a substation that is near a major transmission line. If sufficient substation and transmission line infrastructure does not exist, the utility company will have to plan for and construct the necessary infrastructure to serve its customers. Construction of substations and transmission lines usually involves land clearing. Once constructed, the utilities can have visual and noise impacts and, depending on their location, impacts on natural resources and environmentally sensitive areas. Although utility infrastructure is usually separate from a data center project, and the infrastructure is part of the larger grid that supports other customers, the need for certain infrastructure can be directly attributed to data center development. Therefore, when a proposed data center is proposed, related needs for utility infrastructure and its impacts should be evaluated as part of the new coordination process suggested above. Dominion has indicated that the costs of infrastructure projects are absorbed across the system's customers, with some of the costs covered by PJM as well. Because of the need for proximity, some data center developers seek land near existing transmission lines or include enough land area to support a substation. A substation typically has a 300 MW capacity, so a data center campus may need to provide a new substation. Data center developers may coordinate with the utility company in various ways to facilitate the development of a new substation, if needed, including selling or donating land. As noted above, a new Plan appendix could include consideration of the distance from and availability of a substation and transmission lines to serve a proposed data center.

Greenhouse gas emissions: Increased electricity demand also increases GHG emissions, which may make it harder to meet the state and County GHG emission reduction goals:

- o The [Virginia Clean Economy Act](#) (VCEA) establishes mandatory renewable portfolio standards for Dominion Energy to deliver electricity from 100% renewable sources by 2045 and Appalachian Power by 2050.
- o Fairfax County's [Community-wide Energy and Climate Action Plan](#) (CECAP) sets a goal for the entire community to be carbon neutral by 2050. Based on the 2020 GHG inventory, 48% of emissions come from the use of energy in buildings (25% commercial plus 23% residential).

Approximately 25% of GHG emissions in Fairfax County comes from commercial buildings. Fairfax County community-wide GHG emissions have decreased by 30% between 2005 and 2020, despite a 12% growth in population.[15] This decline in GHG emissions reflects a strong and consistent effort across multiple sectors, especially increased energy efficiency and conservation in residential and commercial buildings, cleaner vehicles travelling fewer miles, and a greener electric grid. Strategies to reduce energy use and related GHG emissions include improving energy efficiency and transitioning to clean, renewable energy.

Energy Efficiency: A review of best practices indicates that data centers can improve energy efficiency with current technology. Data centers typically measure their power utilization efficiency (PUE), which is the total facility power including cooling systems divided by IT equipment power. The PUE is a performance metric, with a PUE of 1.1 to 1.3 or less representing an efficient facility. To promote energy efficiency, a PUE standard or another performance metric could be included in the new appendix in the Policy Plan for data centers undergoing rezoning or SE review. The ability for staff to review this standard would need to be considered. Additionally, given the substantial energy demands of data centers, proposed data centers could be encouraged to achieve LEED-Data Center Silver certification or greater. Under Section C405.12 of the 2021 Virginia Energy Conservation Code, data centers will be required to monitor their energy consumption. The County could pursue partnerships with data center operators for the voluntary sharing of that information with the County, which could assist in measuring the achievement of CECAP goals.

Renewables: Regarding the use of clean, renewable energy sources, data centers rely on the power grid and are not able, at this time, to generate sufficient power onsite through solar or other renewable sources. As previously noted, a data center of about 400,000 square feet would likely have a capacity of 48 to 60 MW. With current solar panel technology, approximately 5 acres of solar panels would be needed to produce 1 MW of power. Therefore, a 48 MW data center would need at least 260 acres of solar panels to be self-sufficient. Nevertheless, data centers should be encouraged to install onsite solar and invest in offsite renewable energy. Some data center operators have sustainability goals. For example, Meta states that they have maintained net zero GHG in global operations since

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[15] [Community-Wide Greenhouse Gas Emissions Inventory Summaries](#), MWCOG: https://www.mwcog.org/documents/2022/12/27/community-wide-greenhouse-gas-emissions-inventory-summaries-featured-publications-greenhouse-gas/

2020, primarily by purchasing 100% renewable energy. Meta has an additional goal to reach net zero emissions across its value chain by 2030.[16] Amazon states that it is the world's largest corporate purchaser of renewable energy and is on target to power its operations with 100% renewable energy by 2025 and to reach net-zero carbon emissions by 2040.[17]

3. Water Demand

Current Regulations and Guidelines
The Zoning Ordinance does not regulate water demand. The Environment Element of the Comprehensive Plan Policy Plan provides limited recommendations on water demand topics through the discussion of water conservation for buildings sufficient to attain certification through LEED-NC, -CS, or equivalent. A majority of water-related recommendations in the Comprehensive Plan Policy Plan are related to exterior stormwater management mitigation and best practices.

Research and Recommendations
The amount of water used by a data center depends on the type of cooling system used. There are reports of data centers in other jurisdictions that use large amounts of water. However, since water demand is highly variable according to the technology used onsite and the climate of the area, the analysis in this report relies primarily on water use data and recommendations provided by Fairfax Water, which are included in Attachment 2.

Fairfax Water reviewed water use by data centers located on Sunrise Valley Drive and found that they use an average of approximately 38,000 gallons per day (gpd) which equals about 90 to 100 gallons/1,000 square feet. This is higher than the planning values Fairfax Water uses for office uses (60 gallons/1,000 square feet), but lower than retail (140 gallons/1,000 square feet) or hotel (180 gallons/1,000 square feet). Fairfax Water also compared water usage information from the Prince William County Service Authority and Loudoun Water and found comparable average water usage by data centers. Fairfax Water has concluded that with its periodic planning process, it is well prepared to address overall water supply needs.

Typically, it has been reported that air cooling systems use more energy but less water, while evaporative cooling systems use more water and less energy. However, not all data centers with evaporative cooling systems use large amounts of water. Techniques that data centers may use to reduce water consumption include, but are not limited to, rainwater harvesting and closed-loop cooling systems. The direct evaporative cooling systems being employed by newer data centers do not require chillers or cooling towers and the water usage is reported as approximately ten percent of older evaporative cooling systems. For example, Amazon has indicated that its typical data centers (250,000 square feet) use an average of approximately three million gallons of water per year, which equals only 8,220 gpd. [While recent articles

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[16] Meta sustainability: https://sustainability.fb.com/2023-sustainability-report/
[17] Amazon: https://sustainability.aboutamazon.com/products-services/the-cloud?energyType=true

regarding a proposed Amazon data center campus in central Virginia reported a projected use of approximately 21 million gallons per building per year based on 640,000 gpd, Amazon has indicated this report is a miscalculation because the 640,000 gpd is the peak day demand, with an estimated average number of ten peak days per year.] According to industry sources, a data center with direct evaporative cooling systems in Virginia only needs to use water during the hot summer months.

Some data center companies have goals to reduce their water demand. For example, both Meta and Amazon have a water positive goal to return more water to communities than they use in data center operations by 2030.[18] One approach to reducing water usage is to use recycled or reclaimed water systems for non-potable water uses, such as industrial cooling. Loudoun Water operates such a system serving over 50 data centers. Fairfax has a reclaimed water system available in the Lorton area, but to date, no data centers are using that system.[19]

Based on this information, staff has not identified any potential Comprehensive Plan or Zoning Ordinance amendments related to water demand at this time. As Fairfax Water noted, it is possible that the declining per capita and per employee water use trends could change; therefore, staff recommends that monitoring of data centers and coordination with Fairfax Water continue, and the issue of water demand be revisited on a regular basis.

4. Water Quality

Current Regulations and Guidelines
Stormwater runoff: The County's Stormwater Management Ordinance (Chapter 124 of the County Code[20]) is designed to mitigate stormwater runoff impacts from all impervious cover regardless of land use type. Runoff from a data center building is no different than runoff from any other building. Additionally, development that requires a site plan and occurs within the Water Supply Protection Overlay District[21] must provide water quality control measures designed to reduce the projected phosphorus runoff pollution by one-half for the proposed use. Stormwater impacts can also be mitigated by other measures, such as preservation of open space, floodplain protection, and landscaping and screening as required

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[18] Meta: https://datacenters.atmeta.com/wp-content/uploads/2023/10/Water-Stewardship.pdf; Amazon: https://www.aboutamazon.com/news/aws/aws-water-positive-by-2030
[19] Fairfax reclaimed water system: https://www.fairfaxcounty.gov/publicworks/wastewater/water-reuse
[20] Chapter 124: https://library.municode.com/va/fairfax_county/codes/code_of_ordinances?nodeId=THCOCOFAVI1976_CH124STMAOR
[21] WSPOD: https://online.encodeplus.com/regs/fairfaxcounty-va/doc-viewer.aspx?tocid=001.004.004.005#secid-2542

under the Zoning Ordinance, as well as tree preservation as required under the Tree Conservation Ordinance (Chapter 122 of the County Code[22]).

Additionally, to ensure that stormwater is appropriately managed (water quality and water quantity), the Comprehensive Plan promotes site design and low-impact development (LID) techniques that reduce stormwater runoff volumes and peak flows; increase groundwater recharge; and increase the preservation of undisturbed areas. Developments are expected to optimize stormwater management and water quality controls through the use of innovative infiltration techniques, nonstructural BMPs and bioengineering practices, and infiltration landscaping. The Environment Element of the Comprehensive Plan Policy Plan also identifies Environmental Quality Corridors (EQCs) as an integrated network of ecologically valuable land and surface waters that should be protected and enhanced for the present and future residents of Fairfax County. The policy categorizes characteristics of EQCs including habitat quality, connectivity, pollution reduction capabilities, hydrology, stream buffering, and stream protection; the policy recognizes that EQCs are delineated through the entitlement process based on policy criteria. The Plan also recommends protecting and restoring the ecological integrity of streams and protecting the Chesapeake Bay from the avoidable impacts of land use activities.[23]

Diesel tanks for backup generators (spills): Federal, state, and County regulations address the fuel storage tanks for backup generators:
- o Virginia Department of Environmental Quality (DEQ) requirements – Aboveground Storage Tanks | Virginia DEQ[24]
- o Fairfax County Fuel Storage Tank requirements – Fuel Storage Tanks | Planning, Permitting and Construction (fairfaxcounty.gov)[25]

Research and Recommendations
Water quality impacts can include: a) cooling system discharges to the wastewater system; b) spills or leaks from diesel tanks; and/or c) stormwater runoff.

Cooling systems: According to data center industry sources, most newer interior cooling systems utilized by data centers, even those that use water, do not have cooling towers that discharge to wastewater or stormwater systems. However, for those that do have cooling

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[22] Chapter 122:
https://library.municode.com/va/fairfax_county/codes/code_of_ordinances?nodeId=THCOCOFAVI1976_CH122TRCOOR

[23] Objective 2, 3 and 9: Fairfax County Comprehensive Plan, 2017 Edition, Policy Plan, Environment:
https://www.fairfaxcounty.gov/planning-development/sites/planning-development/files/assets/compplan/policy/environment.pdf

[24] VDEQ storage tank requirements: https://www.deq.virginia.gov/our-programs/land-waste/petroleum-tanks/aboveground-storage-tanks

[25] County storage tank requirements: https://www.fairfaxcounty.gov/plan2build/fuel-storage-tanks#:~:text=Tank(s)%20capacity%20of%20500,and%20plan%20reviews%20may%20apply

towers, evaporative cooling concentrates salts in the water that must be periodically discharged to the wastewater system. Even if no other chemicals are added to the system, the discharge has concentrated sodium, a constituent of concern in drinking water. If the facility is in the sewer collection area of the Upper Occoquan Service Authority (UOSA), the treated wastewater discharges to the Bull Run River upstream of the Occoquan Reservoir, which is a potable water source. Although this is true of any commercial or industrial use that employs a cooling tower, the extensive cooling systems needed by data centers heighten the potential concern. Currently, the County prohibits the use of bromide as a treatment additive in cooling water systems that discharge to UOSA based on direction from UOSA.

As noted in the attached comments from Fairfax Water, their facility for treatment of raw water from the Occoquan Reservoir is not designed to remove salts or other emerging contaminants of concern. Although the federal Environmental Protection Agency (EPA) set a health advisory of 20 mg/L for sodium levels in potable water,[26] an advisory is not an enforceable federal standard and the UOSA pre-treatment requirements do not include a standard for sodium. Consideration could be given to establishing Comprehensive Plan guidance to encourage data centers to monitor their discharges and, if needed, provide for pre-treatment. Additionally, to reduce the potential for impacts to potable water, within the UOSA service area, the Plan could encourage the use of non-chemical/non-water-based cooling systems or systems that do not discharge to the wastewater or stormwater systems.

Diesel tanks for backup generators (spills): Typically, depending on the size of the generator, about 5,000 to 15,000 gallons of diesel fuel are stored in individual, above-ground, double-walled tanks below each generator to provide sufficient fuel for 24 to 72 hours. Existing state regulations include procedures to prevent pollution of state waters, lands, and storm drain systems from the discharge of fuel from aboveground storage tanks that are 25,000 gallons or more. Further analysis could be done to determine whether these existing regulations could be enhanced. Consideration could also be given to including SE standards in the Zoning Ordinance (or amending another chapter of the County Code) for tanks smaller than 25,000 gallons for proper surface grading, berms, or other additional containment practices to protect surface water and ground water by ensuring that if the tank were to fail or if a spill were to occur during filling, the fuel does not enter the stormwater system or open space areas.

Stormwater runoff: Regarding stormwater runoff, data centers are similar to other nonresidential uses with expansive impervious surfaces. With the provisions in place to address stormwater runoff as described above, in staff's opinion no additional recommendations are necessary for data centers. However, in general, water quality on industrial sites would benefit from site designs that include green roofs, increased open space and native tree and plant vegetation. Projects subject to rezoning or SE review should be

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[26] EPA advisory on sodium: https://www.epa.gov/sites/default/files/2014-09/documents/support_cc1_sodium_dwreport.pdf

encouraged to exceed minimum requirements for open space, tree preservation and planting, and stormwater treatment.

5. Air Quality

<u>Current Regulations and Guidelines</u>
The Zoning Ordinance does not directly regulate air quality. Through the Comprehensive Plan, the County seeks to preserve and improve air quality and expects that state-of-the-art technologies will be applied to minimize emissions from stationary sources of air pollution.[27]

For data centers, backup generators are the source of air pollutants that are a concern, and these emissions are regulated by DEQ. DEQ monitors criteria air pollutants across the state, in accordance with the Clean Air Act, a federal law that provides for the protection of human health and the environment. Data center projects require Minor New Source Review (NSR) permits from DEQ for their backup generators, which are powered by diesel fuel. Minor NSR permits in Northern Virginia receive stricter scrutiny due to non-attainment of air quality standards in the Washington, DC region. Over the past decades, the EPA has developed a tiered regulatory system that applies to backup generators (non-road diesel engines):[28]
o Tier I – phased in from 1994 to 1997
o Tier II – phased in from 2000 to 2005
o Tier III – phased in from 2006 to 2008 for smaller engines with 50 to 750 hp
o Tier IV – phased in from 2008 to 2015 and requires a 90% reduction of certain emissions with reductions made possible through newer control technologies.

<u>Research and Recommendations</u>
Potential pollutants released into the air from generator use include nitrogen oxides (NO_X), particulate matter (PM_{10} and $PM_{2.5}$), carbon monoxide (CO), volatile organic compounds (VOC), and sulfur dioxide (SO_2), all of which are regulated by DEQ. DEQ maintains 36 monitoring sites across the Commonwealth to measure air pollutants. One air quality monitoring station is located in Loudoun County and two are located in Fairfax County:
o Broad Run High School: Ashburn, Loudoun County, Virginia - Pollutants measured: O_3, NO_2, and $PM_{2.5}$
o Franconia District Park: Franconia, Fairfax County, Virginia - Pollutants measured: SO_2, O_3, $PM_{2.5}$, and PM_{10}
o 6831 Backlick Road: Springfield, Fairfax County, Virginia - Pollutants measured: CO, NO_2, and $PM_{2.5}$

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[27] Objective 1: Fairfax County Comprehensive Plan, 2017 Edition, Policy Plan, Environment, Amended through 6-28-2022, Pages 2-5
[28] EPA: https://www.epa.gov/regulations-emissions-vehicles-and-engines/regulations-emissions-heavy-equipment-compression

Due to the current and expected growth of the data center industry in Northern Virginia, additional monitoring may be beneficial in tracking air quality near large numbers of data centers.

Along with lower emissions, Tier IV generators provide increased fuel efficiencies, incorporate modern pollution-control technologies, require less maintenance, and reduce operating costs. These emission reductions are typically achieved by using advanced exhaust gas after-treatment technologies, with most Tier IV engine families using urea-selective catalyst reduction filters (SCR) for emissions control. The use of diesel generators for backup is the current industry standard. Until cleaner alternatives become more available, staff recommends that the Comprehensive Plan encourage the use of Tier IV generators and state-of-the-art technology to reduce GHG emissions.

Renewables: As energy providers are able to produce more power from renewable sources, air pollutants and GHG emissions from non-renewable sources will decrease over time. Dominion does not allow commercial consumers to choose the generating source for the power they consume, since all types of energy sources are placed into the entire grid; however, as noted above under Energy Demand, data center operators should be encouraged to invest in renewable energies to offset their carbon footprint. Through the Virginia Clean Economy Act, Dominion Energy Virginia and Appalachian Power are required to retire electric generating units located in the Commonwealth that emit carbon as a by-product of combusting fuel to generate electricity; the utilities are also required to construct, acquire, or enter into agreements to purchase generating capacity located in the Commonwealth using energy derived from sunlight or onshore wind.[29]

6. Noise

Current Regulations and Guidelines
The Fairfax County Noise Ordinance (Chapter 108.1 of the County Code) regulates sound generation for all uses, including data centers. Among other standards, the Noise Ordinance limits the maximum sound levels that can be generated when the sound is measured at the property boundary or at any point within another property affected by the sound. The standards in the table below apply according to the use and zoning district of the property impacted by the noise (not the property generating the noise).[30]

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[29] Virginia House of Delegates Bill 1526, adopted as the Virginia Clean Economy Act
[30] Section 108.1-4-2 of the Noise Ordinance:
https://library.municode.com/va/fairfax_county/codes/code_of_ordinances?nodeId=THCOCOFAVI1976_CH108.1NOOR

Maximum Sound Levels			
Use and Zoning District Classification	Time of Day	Continuous Sound (dBA)	Impulse Sound (dB)
Residential areas in residential districts	7 a.m. to 10 p.m.	60	100
Residential areas in residential districts	10 p.m. to 7 a.m.	55	80
Nonresidential areas in residential districts	All	60	100
Mixed use area	7 a.m. to 10 p.m.	65	100
Mixed use area	10 p.m. to 7 a.m.	60	80
Commercial districts	All	65	100
Industrial districts	7 a.m. to 10 p.m.	72	120
Industrial districts	10 p.m. to 7 a.m.	65	100

Table 2: Noise Ordinance Standards

Section 108.1-5-1(g) of the Noise Ordinance exempts the operation of backup generators during power outages from storms or other emergencies as well as the testing and maintenance of generators between 7 a.m. and 9 p.m. for up to two hours per day. Separately, DEQ does not allow for generator testing between 7 a.m. and 5 p.m. from May 1 to September 30 to minimize impacts on air quality from ozone. Therefore, during those months, generator testing would be limited to the evening hours from 5 p.m. to 9 p.m.

To reduce noise impacts, a use standard for data centers in the Zoning Ordinance requires all equipment for cooling and backup generators to be contained within an enclosed building, except in the I-4, I-5, and I-6 Districts.[31]

The Environment Element of the Comprehensive Plan Policy Plan currently provides guidance and recommendations only for transportation-related noise, such as motor vehicle and airport-related noise. There are no other policies for non-transportation-related noise uses.

Research and Recommendations
Noise from data centers, which can be significant if not mitigated, is primarily generated by two sources: the cooling systems and the backup generators. The potential impacts vary considerably according to the type of equipment, location (proximity to residential or other noise-sensitive uses), site design, and the mitigation measures employed. Related infrastructure such as electric substations may also generate noise.

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[31] Subsection 4102.6.A(1) of the Zoning Ordinance: https://online.encodeplus.com/regs/fairfaxcounty-va/doc-viewer.aspx#secid-2854

Data centers require substantially more cooling as compared to other uses due to the heat produced from densely packed servers. To provide context, a data center server room might require 100 tons of cooling (per 10,000 square feet, using a median total heat number) as compared to a shopping mall which would require 40 tons, or an office which would need 29 tons. Cooling systems generate a continuous noise, and concerns have also been noted in articles about the low frequency of the noise generated by certain cooling equipment. Generally, the sound from lower frequencies propagates farther than that from higher frequencies and may be felt, even if it is not audible. As noted above, the use of diesel generators for backup is the current industry standard. To provide for backup in the case of power interruption, data centers have large numbers of generators as compared to other uses. For example, a hospital would typically have three to five backup generators, while a data center typically has over 20 generators.[32] Although the generators are only for emergencies, each one needs to be tested and maintained, requiring a runtime of about five to 15 minutes per generator each month. It appears that in the past, the emergency use of backup generators in Fairfax and surrounding areas has been infrequent. One data center representative indicated that backup generators are typically used for emergency purposes a few hours each year while another stated that the generators are typically used for about 53 total hours per facility per year. Consideration could be given to amending the Noise Ordinance for uses such as data centers with large numbers of backup generators to remove the exemptions for testing and maintenance of generators, as well as the full emergency use of backup generators.

A review of noise studies submitted as part of rezoning or SE applications for data center projects in Fairfax County indicated that measures were consistently needed to reduce the potential noise to comply with the Noise Ordinance. A variety of measures were proposed in those cases, including upgraded equipment, sound-attenuating enclosures for generators, acoustical barriers and louvers, silencers on air handling equipment, attenuators on both the intake and exhaust for generators, and the location of the mechanical yard. Given the need for noise mitigation and the variety of options that may be tailored for each site and facility, consideration could be given to providing guidelines in the Comprehensive Plan for the review of noise studies for projects undergoing rezoning or SE review and for amending the Zoning Ordinance to include noise study submission requirements for zoning applications. Noise studies could be submitted as part of a rezoning or SE application and updated pre-construction (prior to building permit approval) and post-construction (prior to issuance of a Nonresidential Use Permit) to demonstrate compliance with the Noise Ordinance. The noise modeling could address the worst-case scenario, including all cooling equipment at full operational load, as well as the maximum number of generators that may be tested at one time. In addition, the noise modeling could address the emergency use of backup generators

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[32] The number of generators varies according to the energy demand of the data center. For example, one data center in Fairfax with approximately 400,000 square feet of gross floor area has 20 generators with a total capacity of about 45 MW. Another campus project with over 2 million square feet is planned to have over 100 generators with a total capacity of about 259 MW.

and include the frequency octave band limits. Comprehensive Plan guidance could be considered for noise studies to include particular attention to impacts on residential uses and sensitive habitats. Noise mitigation equipment could be considered to avoid noise impacts to both the human environment and the habitats of local fauna.

As previously noted, the Zoning Ordinance requires all equipment for cooling and backup generators for data centers to be contained within an enclosed building, except in the I-4, I-5, and I-6 Districts.[33] The exemption of these industrial districts recognized other industrial uses allowed in those districts. However, given the potential noise impacts from data centers because of their unique cooling requirements and use of generators, consideration could be given to requiring equipment enclosures for all data centers and other similar industrial uses.

As noted above, the maximum sound levels apply to all uses, whether that be the cooling system for an office building, the trucking associated with a freight distribution facility, or a contractor's storage yard. It has been suggested that lower sound levels should apply to data centers; however, staff does not have information that the dBA for a data center should be regulated differently from that for other uses. On the other hand, further research and consideration could be given to establishing standards for lower frequencies, perhaps measured as dBC.[34]

7. Building Design

Current Regulations and Guidelines
The Zoning Ordinance does not currently have any regulations regarding the architectural design of data centers. Architectural design standards are included in the Ordinance for large retail sales establishments and goods distribution hubs when approved by SE, to minimize the impacts of building bulk through variations in roof lines and setbacks, landscaping, and enhanced architectural treatments such as windows. Standards are also included for self-storage facilities in certain zoning districts to require that storage bay doors or lighted hallways not be visible from the outside, and the building must be multistory and office-like in appearance. The I-4, I-5, and I-6 Districts limit the maximum building height to 75 feet and the FAR to 0.5, without SE approval. For projects undergoing rezoning or SE review, Appendix 12 of the Policy Plan specifies criteria for building design, including the need for high-quality design and materials that complement the architecture of surrounding uses. Loading areas should be screened, and visual impacts should be minimized by avoiding undifferentiated facades and providing variation in height, fenestration, materials, patterns, textures, colors, and accent materials.

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[33] Subsection 4102.6.A(1) of the Zoning Ordinance: https://online.encodeplus.com/regs/fairfaxcounty-va/doc-viewer.aspx#secid-2854
[34] Generally, dBA is intended to match typical human hearing; dBC does not have the weighting applied for dBA and may be more appropriate for consideration of low frequencies.

Research and Recommendations

The development of large data centers raises concerns regarding building design and aesthetics because of their bulk and height. They are typically constructed of concrete with minimal fenestration. Larger data centers are often 75 feet in height or more. Also, data centers have related equipment, which, in addition to backup generators, may include water towers and electrical substations.

As identified in the attached report from Clarion Associates, certain other jurisdictions have or are in the process of adopting zoning standards for building design, including Prince William and Loudoun Counties, and Atlanta, Georgia. Similar to the Comprehensive Plan guidance, the standards are intended to provide for variation and interest in design, such as requiring façade changes for height, recesses, fenestration, building and accent materials, and a defined main entrance, as well as mechanical screening.

Given the potential impacts of the bulk of larger data centers, the current guidelines for building design in Appendix 12 of the Policy Plan could be reviewed and considered for all data centers undergoing rezoning or SE review to improve the view of the data center and related equipment from public roads and nearby residential uses. Additionally, submission requirements for rezoning or SE applications could be added to the Zoning Ordinance for architectural elevations (for consideration of the large massing and scale impacts), proposed materials and color palette, and provision of sight line studies with renderings or perspectives from surrounding roads and residential areas.

SUMMARY OF RECOMMENDATIONS FOR GUIDELINES AND STANDARDS

Below is a summary of the recommendations included in the text of this report. These recommendations are presented for Comprehensive Plan guidelines and Zoning Ordinance standards that could be established for data centers to be approved by SE in conventional zoning districts and rezoning/development plan approval in planned districts, where permitted. As previously noted, data centers could continue to be allowed by right; however, some of the recommendations, such as a review of noise studies and building design and encouraging increased open space, tree planting, and stormwater treatment, may be more effectively implemented through an SE review. The SE review process would ensure a robust County review with careful consideration of potential impacts and allow for public hearings to solicit community feedback.

1. Land Use and Site Design

Zoning Ordinance:

- Consider revising permissions to require SE approval for data centers, regardless of size, in the C-3, C-4, and I-2 through I-6 Districts. In addition to recommendations included below under other topic areas, standards for special exception review should include the

consideration of the size of a proposed data center and its distance (buildings and generators) from surrounding existing and planned residential development.

- Where data centers are allowed in the Planned Districts, add a standard to clarify that the use must be specifically identified on the approved development plan, including the location, size, height, and setbacks.

Comprehensive Plan:
- Create a new appendix to the Land Use Element of the Policy Plan for data centers with updated performance criteria. The new appendix should include guidelines that would be utilized in the review of all data centers through the rezoning or special exception process, not just those seeking additional intensity in industrial areas. The guidelines could include consideration of compatibility with future planned uses for the property and surrounding properties.
- Consider recommendations for enhanced buffering for data centers located near residential, noise sensitive uses, and environmentally sensitive areas.
- Consider guidelines for distances from existing or planned substations or transmission lines that can service the data center.

2. Energy Demand

Zoning Ordinance:
- Add zoning application submission requirements for rezoning and SE applications for assessments of future energy needs that will be used in staff's review in accordance with Comprehensive Plan guidelines.

Comprehensive Plan:
- Consider adding an energy performance standard like PUE to promote energy efficiency data centers undergoing rezoning or SE review.
- Encourage LEED-Data Center Silver certification or greater for data centers undergoing rezoning or SE review.
- Encourage data centers to install onsite solar and invest in offsite renewable energy to offset their energy demand and carbon footprint for data centers undergoing rezoning or SE review.

Other Recommendations:
- Establish a new process for coordination with Dominion and NOVEC about proposed data centers during the review of zoning applications, which may include assessments of future energy needs as it relates to existing and planned power infrastructure.
- Pursue partnerships with data center operators for the voluntary sharing of facility energy consumption to assist the County in measuring the achievement of CECAP goals.

3. **Water Quality**
   <u>Zoning Ordinance:</u>
   - Consider adding SE standards in the Zoning Ordinance (or amending another chapter of the County Code) for fuel tanks smaller than 25,000 gallons for proper surface grading, berms, or other additional containment practices to protect surface water and ground water by ensuring that if the tank were to fail or if a spill were to occur during filling, the fuel does not enter the stormwater system or open space areas.

   <u>Comprehensive Plan:</u>
   - Encourage data centers to address potential water quality concerns through the monitoring of cooling system discharge into the wastewater system and, if needed, providing pre-treatment.
   - To avoid potential impacts on potable water, within the UOSA service area, encourage the use of cooling systems that do not discharge to the wastewater or stormwater systems, or non-chemical and non-water-based cooling systems.
   - Encourage projects subject to rezoning or SE review to exceed minimum requirements for open space and tree preservation and planting.

4. **Air Quality**
   <u>Comprehensive Plan:</u>
   - Encourage data centers undergoing rezoning or SE review to minimize air quality impacts through a variety of approaches:
     - Apply state of the art technology to minimize air pollution from backup generators.
     - Encourage the use of Tier IV backup generators, and replacement of existing Tier II generators with Tier IV generators.

   <u>Other Recommendations:</u>
   - Request DEQ to install additional air quality monitoring stations in Fairfax County.

5. **Noise**
   <u>Zoning Ordinance:</u>
   - Consider adding zoning application submission requirements for data centers undergoing rezoning or SE review to quantify the increase in noise on adjacent uses, support review in accordance with Comprehensive Plan guidelines, and demonstrate compliance with the Noise Ordinance.
   - Consider expanding the current Zoning Ordinance equipment enclosure requirement to apply in all zoning districts where data centers and other similar industrial uses are allowed.

Noise Ordinance:
- Consider amending the Noise Ordinance to remove exemptions for uses with large numbers of backup generators and require the testing and maintenance as well as the full emergency use of backup generators to comply with the Noise Ordinance standards.

Comprehensive Plan:
- Noise studies for projects undergoing rezoning or SE review could include an evaluation of impacts on residential uses and sensitive habitats. Noise mitigation equipment should be considered to avoid noise impacts to both the human environment and the habitats of local fauna.
- Consider amending the Plan to recommend that data center proposals evaluate and mitigate potential noise impacts:
  - Noise studies could be submitted as part of a rezoning or SE application, for pre-construction (prior to building permit approval) and post-construction (prior to issuance of a Nonresidential Use Permit) to quantify the increase in noise on adjacent uses and demonstrate compliance with the Noise Ordinance.
  - Noise modeling could address the worst-case scenario, including all cooling equipment at full operational load, as well as the maximum number of generators that may be tested at one time.
  - Noise modeling could also address the backup use of backup generators.
  - Noise modeling could include the frequency octave band limits.

Other Recommendations:
- Conduct additional research on establishing standards for lower frequencies in the Noise Ordinance.

6. **Building Design**
   Zoning Ordinance:
- Consider adding submission requirements for rezoning and SE applications to include:
  - Architectural elevations (to address the large massing and scale of data centers)
  - Materials and color palette
  - Sight line studies, including renderings or perspectives from the right-of-way and nearby residential uses.

Comprehensive Plan:
- Review the current guidelines for Building Design in Appendix 12 and consider applying them to projects undergoing rezoning or SE review, including consideration of façade variation, a defined entrance feature, screening of equipment, and other techniques to improve the view of the building from public roads and nearby residential uses.

NEXT STEPS

Data centers are important facilities to support the modern, digital world – particularly in the Northern Virginia region where data center infrastructure is significant. Given their unique characteristics, careful consideration of their location, design, and impacts (including potential mitigation measures) is needed to ensure that data centers are compatible with the surrounding community. This report presents research and related recommendations for possible amendments to the Comprehensive Plan, Zoning Ordinance, Noise Ordinance, and potentially other chapters of the County Code. While staff will use these considerations in the review of any data center entitlement applications in the context of our current guidelines and regulations, staff recommends that the Board direct staff to begin work on amendments to the Comprehensive Plan, Zoning Ordinance, and other chapters of the County Code to facilitate implementation of the recommendations as outlined above and any others the Board might recommend.

Additionally, staff would support future direction from the Board on a closer evaluation of legislative authority for related topics in which the County currently lacks sufficient regulatory authority. Examples of this could include addressing energy efficiency (e.g., PUE), salinity in water discharges, and air quality.

The County's One Fairfax policy would provide the framework to consider equity in the development of any future amendments to the Comprehensive Plan, the Zoning Ordinance, or other chapters of the County Code. This could include enhanced outreach to ensure diverse perspectives are heard and respected. An equity impact analysis could include consideration of the location of vulnerable areas within the County and their relationship to potential data center locations.

If requested, staff is available to present these recommendations at an upcoming Land Use Policy Committee meeting. Questions and comments can be directed to Carmen Bishop at 703-324-1314, and Katie Hermann at 703-324-1280, or by email to ffx-data-centers@PublicInput.com.

ATTACHMENTS

1. Data Center Maps
2. Fairfax Water Comments
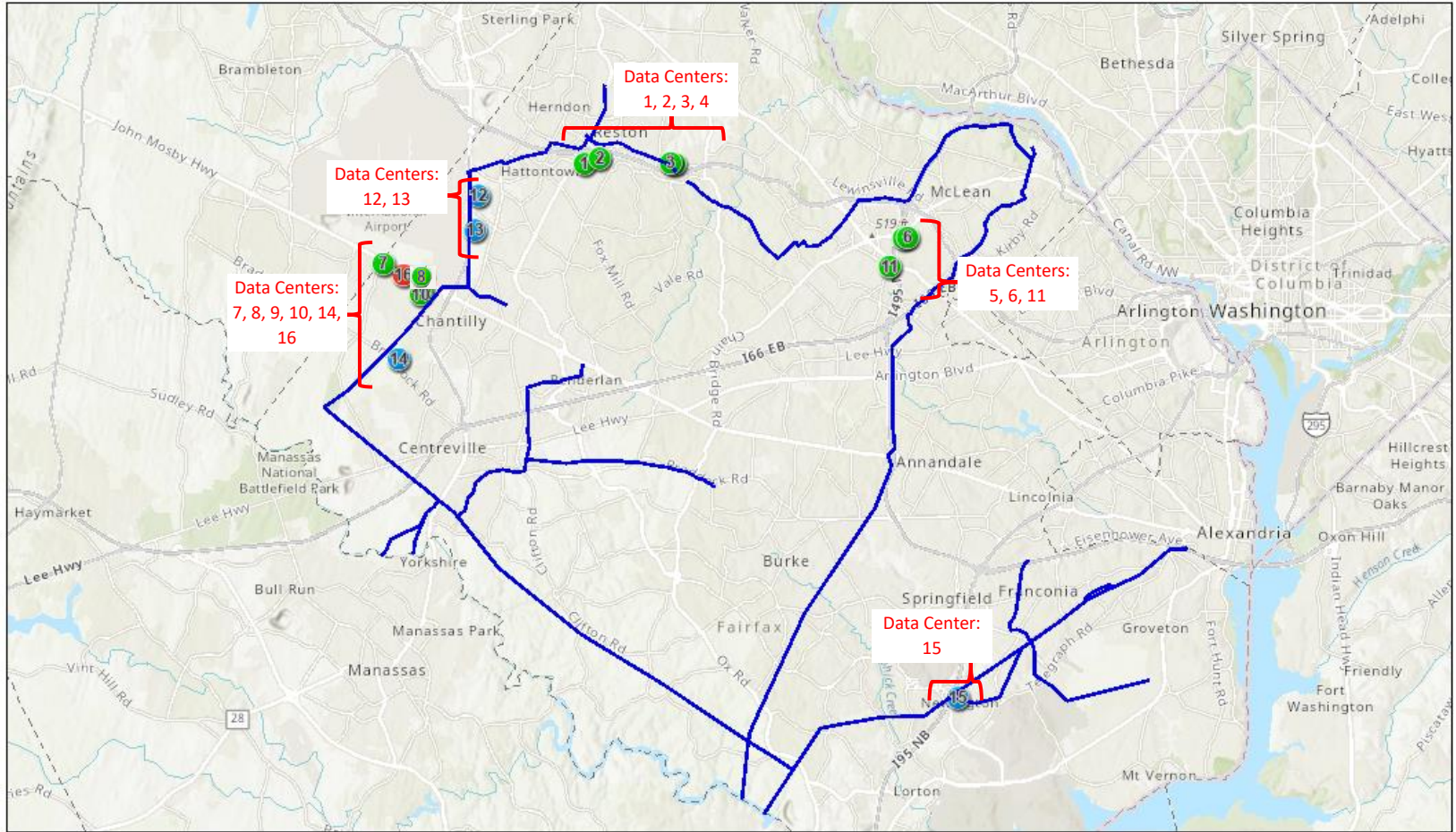3. Clarion Report

Attachment 1: Data Center Maps

Fairfax Data Centers

	Name	Address	Tax Map	Zoning District	Square Feet of Gross Floor Area	Zoning Case or By Right
Existing						
1[1]	Coresite VA3	12379A Sunrise Valley	17-3 ((1)) 32A	I-5	332,957 (existing) 943,600 (total approved by SE)	RZ 2017-HM-032 & SE 2017-HM-030; Rezoning & increase in FAR
2	Coresite 12100 SV & 12098 SV	12098 Sunrise Valley	17-3 ((8))(3A) 1A	I-4	423,341 (existing)	SE 2011-HM-019 for increase in FAR
3	Faraday Building	1807 Michael Faraday	18-3 ((5)) 10	I-5	30,609 (existing	By right
4	Digital Realty/Lemur Properties	1780 Business Center	18-3 ((8)) 9A	I-3/I-4	264,888 (existing)	By right
5	Elias DC Assets	1764A Old Meadow	29-4 ((6)) 97F	PTC	69,089 (existing)	Pre-existing use before rezoning to PTC under RZ -2014-PR-021
6	Roosevelt Building	1755 Old Meadow	29-4 ((6)) 105	PTC	72,546 (existing)	Pre-existing use before rezoning to PTC under RZ -2014-PR-021
7	Lafayette Business Data Center	4030 Lafayette Center	33-2 ((1)) 10D	I-4	145,409 (existing)	By right
8	AWS Virginia Mallory	3980 Virginia Mallory / 14501 Avion	34-1 ((3)) 13	I-5	542,942 (existing) 768,392 (approved by site plan)	By right
9	AWS Westfax B	4100 Westfax	34-3 ((9)) 3A	I-5	95,000 (existing)	By right
10	AWS Westfax A	4101 Westfax	34-3 ((9)) 4	I-5	95,000 (existing)	By right
11	Equinix	7990 Quantum	39-2 ((1)) 13D	I-3	202,500 (existing)	By right
In Progress[2]						
12	Renaissance Technology Park	13860 Redskin	24-2 ((14)) 1 - 6	I-5	2,136,040 (approved by SE) 2,130,000 (approved by site plan)	SE-2021-SU-00017 for increase in height
13	Perspecta Datacenter Campus/AWS	13600 EDS	24-4 ((1)) 6B7, 6B8	I-5	1,046,632 (approved by site plan)	By right

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[1] Numbers correspond to maps

[2] In progress includes projects where any necessary zoning entitlement has been approved, or for by right projects, a site plan has been approved, but a certificate of occupancy has not been issued.

	Name	Address	Tax Map	Zoning District	Square Feet of Gross Floor Area	Zoning Case or By Right
14	Parkstone Tech Park	5140 Parkstone	43-4 ((6)) 37B	PDC	500,000 (approved by RZ) 419,410 (approved by site plan)	RZ-2021-SU-003
15	AWS Loisdale Station	7951 and 7961 Loisdale	99-2 ((1)) 8A	I-5	240,000 (approved by RZ/SE) 235,422 (approved by site plan)	RZ-2021-LE-015 & SE-2021-LE-010; Rezone & increase in height
Proposed						
16	Chantilly Premier	None	33-2 ((1)) 6 pt	I-5 (proposed)	402,000 (proposed)	RZ-2022-SU-00019 & SE-2022-SU-00038; Rezone & increase in height

Data Centers:
1, 2, 3, 4

Data Centers:
12, 13

Data Centers:
7, 8, 9, 10, 14, 16

Data Centers:
5, 6, 11

Data Center:
15

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Data Centers

● Existing (11)

● In Progress (4)

● Proposed (1)

—— Electric Lines

1:288,895

0   2   4   8 mi

0   3   6   12 km
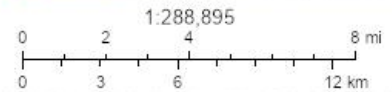
Esri, NASA, NGA, USGS, County of Prince William, Fairfax County, VA, VGIN,
Esri, HERE, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA

County of Prince William, Fairfax County, VA, VGIN, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, USDA | Esri, NASA, NGA, USGS | Fairfax County Government | dwhite | Fairfax County, Virginia; Office of the County Executive; One Fairfax | Fairfax

Dulles International Airport

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	PRM		PDH-5		I-4		R-8	Development Centers
	PDC		PDH-4		I-3		R-5	Large Institutional Land Area
	PDH-20		PDH-3		C-8		R-3	Suburban Center
	PDH-16		PDH-2		C-6		R-2	
	PDH-12		I-6		R-20		R-1	
	PDH-8		I-5		R-12		R-0	

Electric

Data Centers Aggregated 9/8/23

In Progress

Existing

Proposed

0   0.23   0.45   0.9 mi

0   0.38   0.75   1.5 km

Fairfax County Government, dwhite, Esri, NASA, NGA, USGS, FEMA, County of Loudoun, County of Prince William, Fairfax County, VA, VGIN, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA
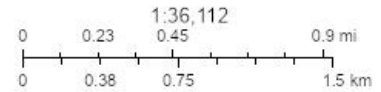
Esri, NASA, NGA, USGS, FEMA | Esri Community Maps Contributors, County of Loudoun, County of Prince William, Fairfax County, VA, VGIN, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA | Fairfax County Government |
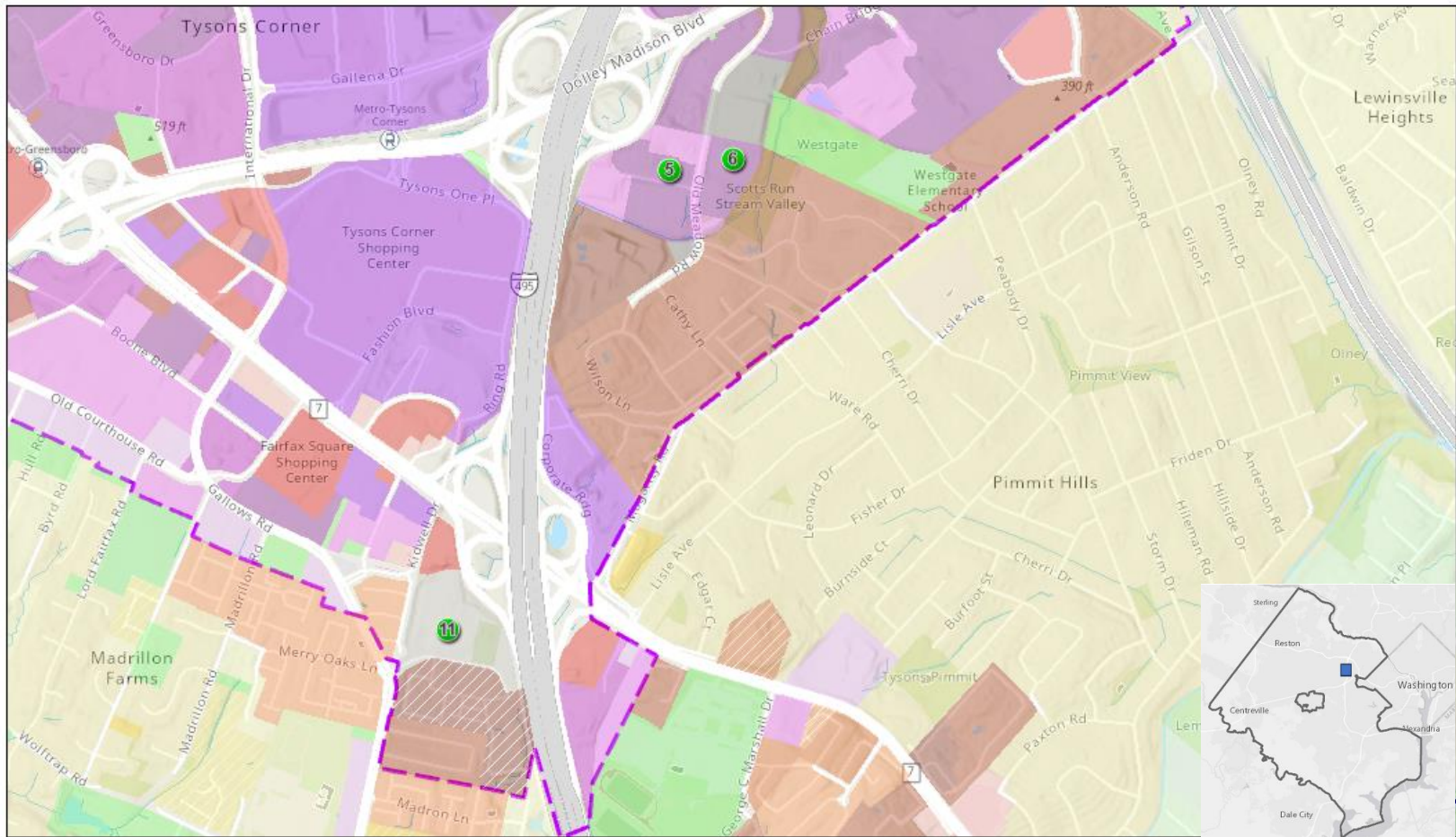
5

Dulles International Airport
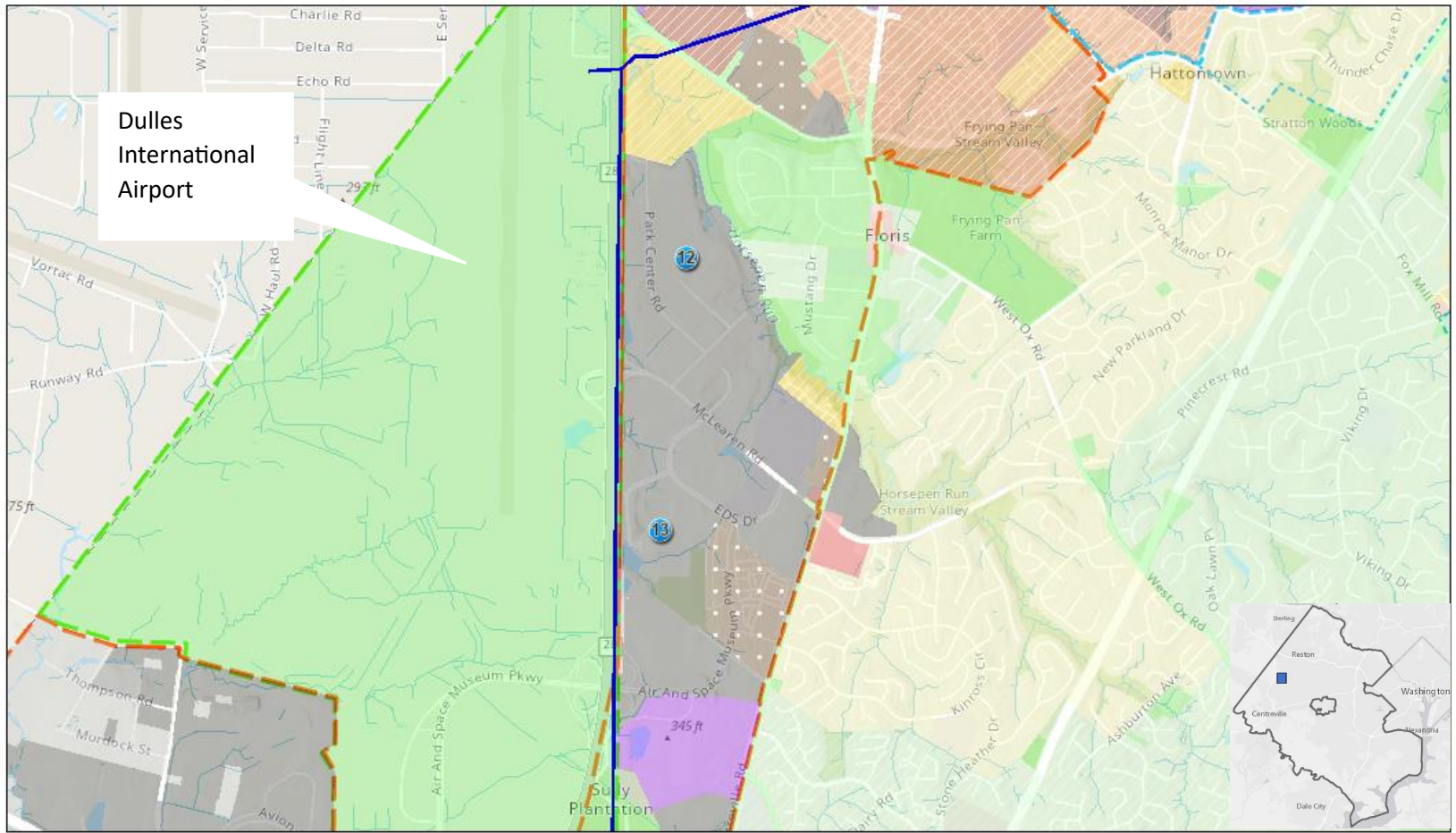
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— Electric		PDC	PDH-12	PDH-2	C-6	R-1
Data Centers Aggregated 9/8/23		PRC	PDH-8	I-5	C-5	⋯ Reston Area Boundary
● In Progress		PDH-30	PDH-5	I-4	R-12	Development Centers
		PDH-20	PDH-4	I-3	R-3	Large Institutional Land Area
PRM		PDH-16	PDH-3	C-8	R-2	Suburban Center
						Transit Station Area
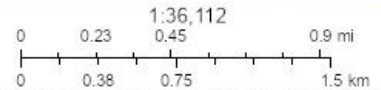
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0   0.23   0.45   0.9 mi

0   0.38   0.75   1.5 km

Fairfax County Government, dwhite, Esri, NASA, NGA, USGS, FEMA, County of Loudoun, County of Prince William, Fairfax County, VA, VGIN, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA

Esri, NASA, NGA, USGS, FEMA | Esri Community Maps Contributors, County of Loudoun, County of Prince William, Fairfax County, VA, VGIN, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA | Fairfax County Government |

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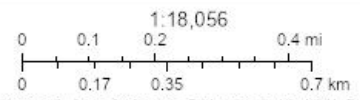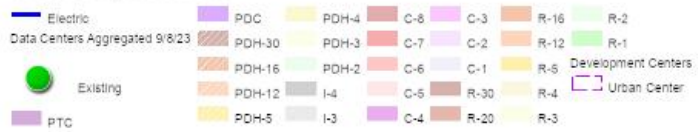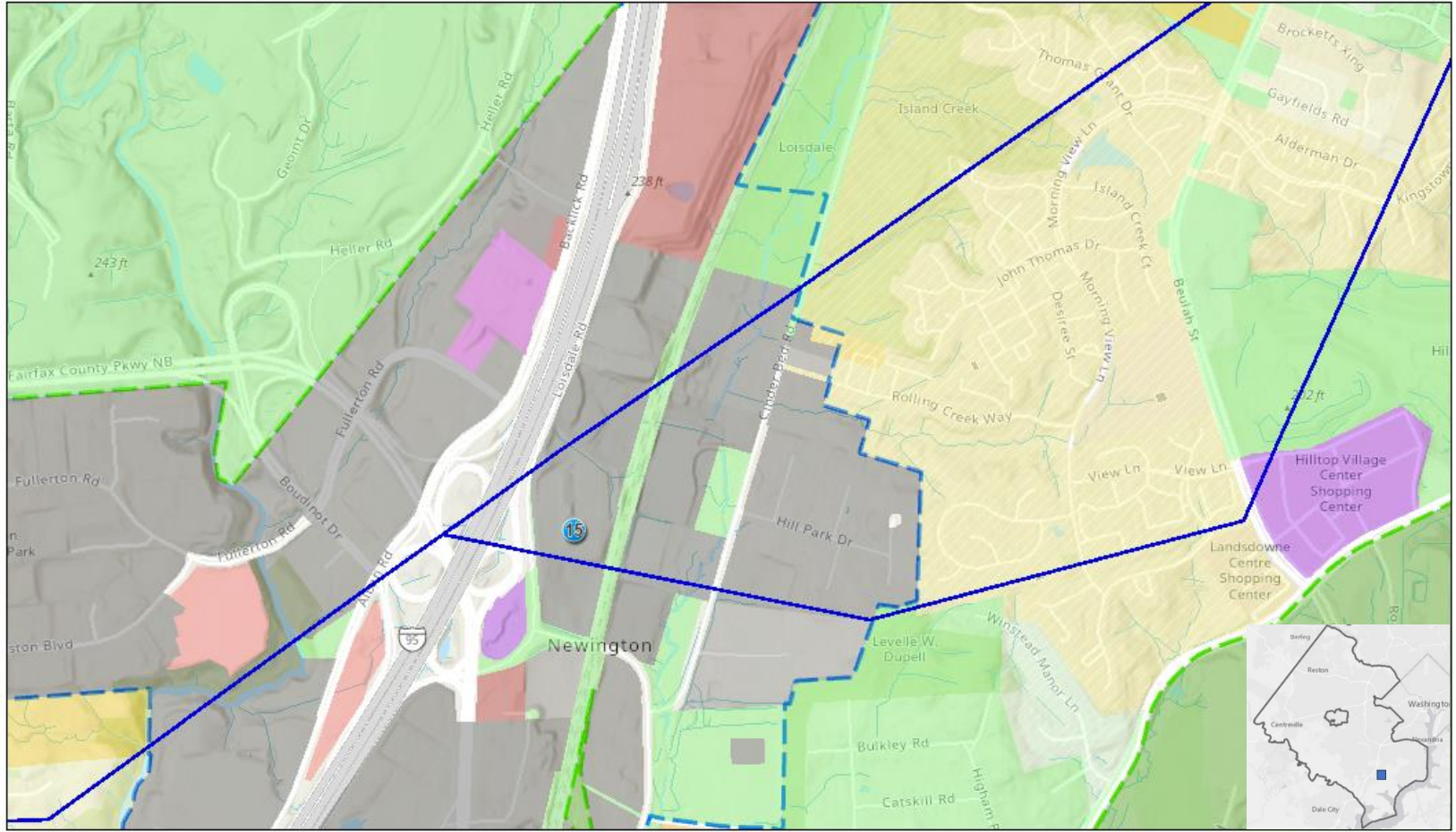| 0 | 0.23 | 0.45 | 0.9 mi |

| 0 | 0.38 | 0.75 | 1.5 km |

Fairfax County Government, County of Loudoun, Fairfax County, VA, MNCPPC, VGIN, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, dwhite, Esri, NASA, NGA, USGS, FEMA

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1:18,056

Electric		PDH-5	I-5	R-8	R-1		
Data Centers Aggregated 9/8/23		PDH-4	I-4	R-5	R-C		
		PDH-3	C-8	R-4	Development Centers		
In Progress		PDH-2	C-6	R-3	Industrial Area		
PDC		I-6	C-4	R-2	Large Institutional Land Area		

0   0.1   0.2   0.4 mi

0   0.17   0.35   0.7 km

Esri Community Maps Contributors, Fairfax County, VA, VGIN, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, Fairfax County Government, dwhite, Esri, NASA, NGA, USGS, FEMA
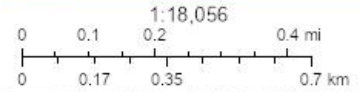
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Fairfax Water

8560 Arlington Boulevard, Fairfax, Virginia 22031

PLANNING & ENGINEERING DIVISION
Nat Atapoor, P.E., CCM
Director
(703) 289-6325

November 6, 2023

Ms. Carmen Bishop
Deputy Zoning Administrator
Ordinance Administration Section
Zoning Administration Division
12055 Government Center Parkway, Suite 807
Fairfax, VA 22035

Re: Fairfax Water Responses to Fairfax
County Staff Questions Regarding
Data Centers

Dear Ms. Bishop:

Please find the following summarizing water system impacts to assist in your response to the Board of Supervisors directive to evaluate guidelines for new data centers.

Question 1: *Do we have sufficient water and infrastructure to accommodate data centers and other projected growth?*

Response: Fairfax Water uses land use and demographic information furnished by local governments to evaluate projected water demands on the water system and plan sufficient water infrastructure system to meet the community's need. Future demands are calculated based on projected regional population and employment growth projections provided by the Metropolitan Washington Council of Governments. Projections are developed and used to evaluate the water system to meet demands, currently assessed through the year 2045. As a result of this periodic planning process, Fairfax Water remains well-prepared to address any water infrastructure needs that may be needed.

Employee water unit use in Fairfax Water's retail service area continues to decline, a long-term trend that has occurred over the past few decades and continues today. This trend is consistent with national water use trends that have documented declining per capita and per employee water use. Please note that data center water use depends on many site-specific factors, including but not limited to the type of cooling used (air/water) and facility specifics (size, equipment, cooling technology, and other factors). Given the uncertainty in site-specific factors, it's possible that a large increase in the number of data centers could, over the long term, change or reverse Fairfax Water's employee unit water use trend.

A more in-depth evaluation of this would require an assessment of data center re-development potential, data center development market viability, and land-use entitlement potential for land units under consideration for data centers. Given a comprehensive inventory of land units that could be converted to data centers in Fairfax County, a comparison of water use with Fairfax Water's projected population and employment forecasts could be estimated. Such an analysis could be useful to assess the maximum potential water demand that may be required to serve new data centers in Fairfax Water's retail service area.

Question 2: *How does the water consumption from data centers compare to other nonresidential users?*

Response: It can be difficult to directly compare data center water use with other non-residential uses. As mentioned, water consumption of data centers depends on many site-specific factors, including but not limited to the type of cooling used (air/water) and facility specifics (size, equipment, cooling technology, etc.). At the request of Fairfax County DPD staff, Fairfax Water recently reviewed data center water use for a few large data center facilities (both in the 12000 block of Sunrise Valley Drive) located in our retail service area with sufficient operating history to assess their water use. Our review determined that during calendar year 2022, data center water use for each facility was approximately 38,000 gallons per day. Based on the gross floor area of these facilities, water use averaged between 90 and 100 gallons per 1,000 square feet of area. By comparison, planning values used by Fairfax Water for other types of commercial use include:
- Retail: 140 gallons per 1,000 sq ft
- Office: 60 gallons per 1,000 sq ft
- Hotel: 180 gallons per 1,000 sq ft

Therefore, based on square footage basis, water use of data centers appears to be more than office use but less than retail and hotel use.

Question 3: *Using known water usage rates by existing and proposed data centers in the County and in other nearby jurisdictions, could Fairfax Water provide a value for typical water usage, perhaps correlated to the gross floor area of these existing data centers?*

Response: Recognizing that water consumption of data centers depends on many site-specific factors, data center water use in our region for existing operational data centers can serve as a reference point.

Consider the following:
- The Prince William County Service Authority provided information to the Prince William County Planning Department summarizing water use for 25 operating data centers in Prince William County (as of late 2021). This records review found the

average daily water consumption of a single data center building was about 18,000 gallons per day, while the maximum day consumption of a single data center building is about 88,000 gallons per day. Reference: https://www.pwcva.gov/assets/2021-10/DCOZOD%20%20Economic%20Development%20memo.pdf

- Loudoun Water operates a reclaimed water system serving over 50 data centers in Loudoun County. The water use of the reclaimed water system by these data center customers averaged 1.9 MGD in 2022, or about 37,000 gallons per day per data center. Reference: https://www.loudounwater.org/commercial-customers/reclaimed-water-program

Recognizing that many site-specific factors need to be considered, the water use review conducted by Fairfax Water (mentioned in the response to Question #2) confirmed the general water use ranges for data centers in Northern Virginia identified by our neighboring systems. Average water use on a unit basis is estimated in the response to question #3.

Question 4: *Do you anticipate any changes to water demand forecasts based on a potential increase in data centers in Fairfax?*

Response: Consistent with our long-range planning process, Fairfax Water's water demand forecasts will be adjusted over time to reflect changes in population and employee unit water use. Site-specific factors including the equipment specifics, type of cooling and other site-specific factors that impact water use vary among different facilities. Fairfax Water's long-term decline in per employee water use has continued despite dozens of existing data centers in Fairfax Water's retail service area. Currently, there is no evidence that our water demand forecast requires a change to our traditional forecasting methodology.

Question 5: *How do data centers impact the water quality of the Occoquan?*

Response: Fairfax Water is concerned with chemical use in the Occoquan watershed, particularly from commercial and industrial sources. These chemicals are discharged into the sanitary sewer system and readily pass through the municipal wastewater and water treatment process. Chemical use associated with data centers can include sodium and bromide-based chemicals (salts) designed to provide and protect water quality in the recirculating cooling water systems. A portion of the water used in these systems needs to be "blowdown" or discharged into the sanitary sewer system. Since the municipal wastewater treatment process at the Upper Occoquan Service Authority (UOSA) is not designed to remove these chemicals, they can pass through without substantial reduction and increase pollutant load into the Occoquan Reservoir, one of the two water supply sources of drinking water for Fairfax Water. Fairfax Water's water treatment plant is not designed to remove salts (and other emerging compounds such as per-and polyfluoroalkyl substances or PFAS) through the water treatment process.

Question 6: *Overall, what concerns do data centers raise for Fairfax Water and does Fairfax Water have suggested approaches to addressing those concerns?*

Response: Fairfax Water suggests that data centers within the Occoquan watershed (such as Fairfax County's sewershed treated at the UOSA plant) use non-chemical/non-water based cooling or have industrial pre-treatment permit requirements to eliminate chemical discharge to the sanitary sewer system upstream of the Occoquan Reservoir. As noted above, Fairfax Water has concerns with certain chemical uses associated with data centers that can be transmitted to the UOSA sanitary sewershed and pass through the wastewater treatment process without reduction or removal. To address potential non-point source pollutant impacts on the Occoquan Reservoir, Fairfax Water suggests: the use of stormwater management practices consistent with County and Water Supply Overlay District (WSPOD) requirements that go above and beyond Virginia Stormwater Management requirements, and the use of environmental, stream resource and tree protection management practices to reduce the impacts of runoff on the Occoquan Reservoir.

Should you have any further questions or require additional information, please do not hesitate to contact me at (703) 289-6318.

Sincerely,

Gregory J. Prelewicz, P.E.
Manager, Planning