

**PLANNING COMMISSION WORK SESSION**  
**Wednesday, September 3, 2025 @ 6 PM**  
**Town Hall – 2<sup>nd</sup> Floor, East Conference Room**

**AGENDA**

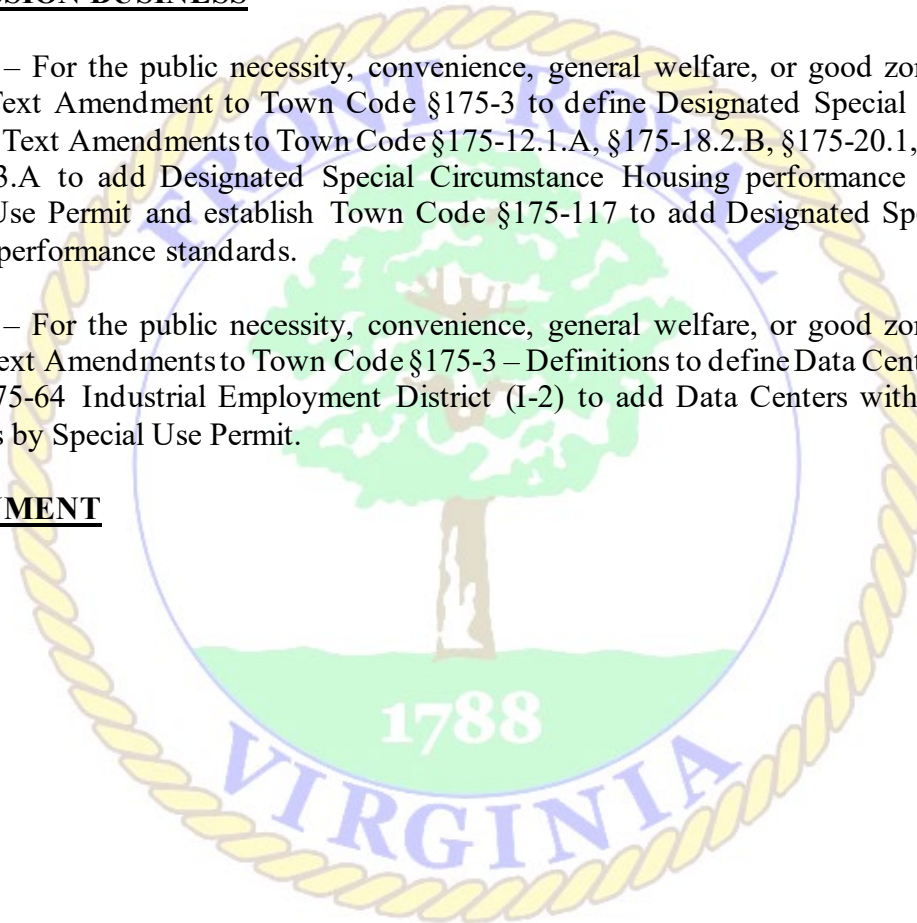
**CALL TO ORDER**

**ROLL CALL**

**WORK SESSION BUSINESS**

1. 2500320 – For the public necessity, convenience, general welfare, or good zoning practice, Zoning Text Amendment to Town Code §175-3 to define Designated Special Circumstance Housing. Text Amendments to Town Code §175-12.1.A, §175-18.2.B, §175-20.1, §175-30, and §175-37.3.A to add Designated Special Circumstance Housing performance standards by Special Use Permit and establish Town Code §175-117 to add Designated Special Purpose Housing performance standards.
2. 2500345 – For the public necessity, convenience, general welfare, or good zoning practice, Zoning Text Amendments to Town Code §175-3 – Definitions to define Data Centers and Town Code §175-64 Industrial Employment District (I-2) to add Data Centers with performance standards by Special Use Permit.

**ADJOURNMENT**



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## 175-3 - DEFINITIONS

For the purpose of this chapter, certain words and terms are herein defined as follows:

**Designated Special Circumstance Housing** - Residential accommodations that are specifically utilized to meet the needs of housing for individuals that fall in one of the following categories; a) Individuals with Developmental Disabilities, b) Veteran's Housing, c) Emergency Family Housing, d) Shelter for Domestic Abuse Victims, e) Shelter for At-Risk Children.

**Individuals with Developmental Disabilities** - Specialized living arrangements designed to help individuals with developmental disabilities transition from institutional settings or other environments into more independent, community-based living situations.

**Veterans' Housing** - Living arrangements designed to provide veterans with a safe, stable environment while they transition from military service to civilian life or while they wait for more permanent housing solutions.

**Emergency Family Housing** - Short-term housing, immediate shelter provided to individuals or families who are experiencing a crisis or urgent need for a place to stay.

**Shelter for Domestic Abuse Victims** - Shelter for domestic abuse victims refers to short-term, safe housing provided to individuals who are escaping situations of domestic violence or abuse.

**Shelter for At-Risk Children** - Shelter for children at risk generally refers to short-term housing or care provided to children who are in immediate danger or facing circumstances that put their safety, well-being, or development at risk.

**DSCH Temporary Housing** – 1 year or less

**Congregate Living** - Residential arrangement where multiple unrelated individuals of nine (9) or more persons live together in a shared housing environment, typically with some level of support or shared services. It is regulated separately from single-family homes or traditional apartment units due to its unique characteristics.

### 175-12.1 USES PERMITTED BY SPECIAL PERMIT (R-1)

- A. The following uses are permitted within the R-1 District only by approval of a special use permit, except as prohibited or restricted by separate restrictions of record that may pertain to property within the R-1 District:

RESIDENTIAL:

Designated Special Circumstance Housing

COMMERCIAL:

Bed and Breakfasts, as set forth in Section 175-107.2.

Day care, and day-care facilities as set forth in the Town Code Section 175-107.1.

INDUSTRIAL:

ORGANIZATIONAL:

Community Centers.

Fire and Rescue Squads and Police Stations.

MISCELLANEOUS:

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Any use permitted under Section 175-12, or specifically listed above under this subsection, that proposes to occupy a building or structure that exceeds the height requirements of Section 175-17, subject to the requirements of Section 175-136. Additional heights approved by a special use permit shall be required to increase the required setback and yard area requirements by an equivalent distance from each property line.

Such other uses as determined similar to one (1) or more enumerated uses by the Zoning Administrator.

(Ord. of 7-28-08; Ord. of 6-22-15)

### **175-20.1 USES PERMITTED BY SPECIAL PERMIT (R-2)**

The following uses are permitted within the R-2 District only by approval of a special use permit, except as prohibited or restricted by separate restrictions of record that may pertain to property within the R-2 District:

#### **RESIDENTIAL:**

Designated Special Circumstance Housing

#### **COMMERCIAL:**

Bed and Breakfast Uses set forth in Town Code Section 175-107.2.

Day care, and day-care facilities as set forth in the Town Code Section 175-107.1.

Nursing homes, as set forth in Section 175-107.

#### **INDUSTRIAL:**

#### **ORGANIZATIONAL:**

Fire and Rescue Squad and Police Stations.

Public Libraries.

Community Center (public).

#### **MISCELLANEOUS:**

Any use permitted under Section 175-20, or specifically listed above under this subsection, that proposes to occupy a building or structure that exceeds the height requirements of Section 175-26, subject to the requirements of Section 175-136. Additional heights approved by a special use permit shall be required to increase the required setback and yard area requirements by an equivalent distance from each property line.

Such other uses as determined similar to one (1) or more enumerated uses by the Zoning Administrator.

(Ord. of 7-28-08; Ord. of 6-22-15)

### **175-30 USES PERMITTED BY SPECIAL PERMIT (R-3)**

The following uses are permitted within the R-3 District only by approval of a special use permit, except as prohibited or restricted by separate restrictions of record that may pertain to property within the R-3 District:

#### **RESIDENTIAL:**

Apartments as set forth in Section 175-113.

Townhouses on sites over one (1) acre, as set forth in Section 175-112.

Designated Special Circumstance Housing

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COMMERCIAL:

Bed and Breakfast Uses set forth in Town Code Section 175-107.2.

Community Centers (public).

Conversion of a structure originally designed and intended for occupancy as a single-family dwelling into a structure with more than one (1) dwelling.

Day care, and day-care facilities as set forth in the Town Code Section 175-107.1.

Nursing homes, as set forth in Section 175-107.

INDUSTRIAL:

ORGANIZATIONAL:

Art galleries and museums.

Fire and Rescue Squad and Police Stations.

Public Libraries.

Community Center (public).

MISCELLANEOUS:

Any use permitted under Section 175-29, or specifically listed above under this subsection, that proposes to occupy a building or structure that exceeds the height requirements of Section 175-36, subject to the requirements of Section 175-136. Additional heights approved by a special use permit shall be required to increase the required setback and yard area requirements by an equivalent distance from each property line.

Cemetery, subject to the provisions in Section 175-107.4.

Lodging houses, rooming houses and boarding houses.

Such other uses as determined similar to one (1) or more enumerated uses by the Zoning Administrator.

(Ord. of 7-28-08; Ord. of 7-23-12; Ord. of 6-22-15; Ord. of 5-1-23)

## **175-153 Performance Standards for Designated Special Circumstance Housing**

The following provisions shall apply to Designate Special Circumstance Housing (DSCH):

- A. All DSCH in residential zoning districts shall be restricted to not more eight (8) individuals along with one or more staff members. Congregate Living with one or more staff members may be approved in R-2 and R-3 residential areas via SUP on a case-by-case basis as state and local laws and regulations allow. Case-by-case evaluation includes type/size of home, acceptable number of residents, location, zoning district and other mitigating factors considered in the SUP application.
- B. All DSCH facilities shall be licensed by the appropriate state agency(s). The Virginia Department of Social Services (VDSS) oversees the licensing of shelters that provide services to adults and families, including domestic violence shelters.
- C. DSCH operations in residential districts shall be restricted to structures that are permitted by right in the respective residential district in question, or any facilities which are currently in existence as a nonconforming use.
- D. Any newly constructed DSCH facilities shall comply with all of the standards that exists in the residential zoning district where the structure will be located.

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- E. All SPH in residential zoning districts shall be required to submit a management plan addressing staffing, resident services, security, and community engagement. This shall include; (1) A plat of the parcel and all buildings and structures thereon, both permanent and temporary; (2) Access control points and any fencing and screening for the parcel and all buildings and structures; (3) The use and occupancy of each room or space inside a building or structure, including accommodations for sleeping, accommodations for sanitary health and hygiene (e.g. sinks, toilets, latrines, showers, or washing stations); and accommodations for food preparation; (4) The size of emergency ingress points, egress points, and evacuation routes; (5) Smoke alarms, carbon monoxide alarms, and fire extinguishers; and (6) An operations information statement that shall include, at minimum, the following: a. The name of the operating entity, its articles of incorporation or similar organizational document and its bylaws, if any, and a statement of the operating entity's experience providing emergency housing, transitional housing, permanent supportive housing, or social service delivery; b. Anticipated dates, days, and hours of operation; c. Maximum intended number of overnight occupants, which shall at all times be in compliance with all applicable provisions of building, fire, health, and zoning codes; d. List of requirements for admission of occupants; e. Description of each staff position, qualifications necessary for each position, and a statement of the anticipated number of staff serving in such positions; f. Statement of intention, or not, to provide occupants meals, minor medical care, job counseling, and services to help occupants transition to more permanent housing, and if so, whether provision of each will be on or offsite, E. Pet care plan as required. After SUP approval, any changes to the management plan must be submitted to Front Royal Planning and Zoning for impact assessment.
- F. The SUP applicant must submit a plat of the property showing the existing conditions and location of the proposed parking and any anticipated parking waivers.
- G. DSCH use of the property shall not change the general exterior appearance of the dwelling unit or change the character of the neighborhood.
- H. In assessing the request for a special use permit to operate in residential zoning districts, the Council shall consider and may require the availability of safe on-site drop-off and pickup areas, outdoor play areas, fenced play areas, and pet accommodations. The Council shall also consider the nature and suitability of the proposed facility, the size, location and characteristics of the grounds or yard, the safety of the occupants at the facility, parking, the effects on nearby property and residents, and such other factors which the Council deems pertinent in assessing the suitability of any proposed DSCH operation in a residential zoning district.

## INDUSTRIAL EMPLOYMENT DISTRICT (I-2)

Blue-is what has been added since the last work session.

Red is the new proposed text relating to data centers which was reviewed during the last meeting

### 175-64 STATEMENT OF INTENT (I-2)

The I-2 Industrial Employment District is designed to:

- A. Enable the establishment of industrial and employment uses and structures in appropriate locations of the town.
- B. Prevent land or structures from being used in a manner so as to create any dangerous, injurious, noxious or otherwise objectionable risk of fire, explosion, radioactivity or other hazardous condition; noise or vibration, smoke, dust, odor or other form of air pollution; electrical or other disturbance, glare or heat; liquid or solid waste; or other condition that would detract from the residential and commercial desirability of the adjoining areas.
- C. Provide controls and standards for the **establishment** of industrial and employment uses and structures in keeping with the purposes of this Article and the Front Royal Comprehensive Plan.
- D. **Establish standards and guidelines for the construction, use and operation of Data Centers.**

### 175-65 USE REGULATIONS (I-2)

- A. Subject to the standards and requirements set forth in this Chapter, except as prohibited or restricted by separate restrictions of record that may pertain to property within the I-2 District, the following uses of land and buildings are permitted by-right in the I-2 District:

#### RESIDENTIAL:

Caretaker quarters.

#### COMMERCIAL:

Automobile and truck sales lots and leasing agencies, in accordance with Section 175-44.E.

Automobile garage (auto repair).

Automobile service stations (gas stations).

Business Offices.

Coal and wood yards, lumberyards and feed/seed stores.

Commuter parking facilities.

Contractor's offices, display rooms and storage.

Furniture stores.

Lumber and building supply.

Professional Offices.

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Technology Business.

Veterinary hospitals.

INDUSTRIAL:

Distribution facilities.

Light Manufacturing.

Woodworking and upholstery shop.

Wholesale.

ORGANIZATIONAL:

Laboratory, pharmaceutical and/or medical.

Schools.

MISCELLANEOUS:

Accessory uses, structures and buildings.

Home occupations.

Open Space.

Public facilities.

Public parks and playgrounds.

Public utilities.

Signs, as set forth in Section 175-106.

Special childcare services.

Such other uses as determined similar to one (1) or more enumerated uses by the Zoning Administrator.

- B. The following uses are permitted within the I-2 District only by approval of a special use permit, except as prohibited or restricted by separate restrictions of record that may pertain to property within the I-2 District:

RESIDENTIAL:

COMMERCIAL:

Airport (including heliports).

Assembly Halls.

Barber and beauty shops.

Catering Services.

Clubs.

Daycare and daycare facilities.

Kennels.

Recreation facility, commercial.

Restaurant, including drive-in restaurants.

Retail Stores.

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INDUSTRIAL:

Automobile Graveyard.

Data Center (subject to the supplemental provisions prescribed in Section 175-70.J & 175-74)

Hazardous Material Storage.

Heavy Manufacturing.

Medium Manufacturing.

Scrap metal processing.

ORGANIZATIONAL:

MISCELLANEOUS:

Any use permitted under Section 175-65.A, or specifically listed above under this subsection, that proposes to occupy a building or structure that exceeds the height requirements of Section 175-67, subject to the requirements of Section 175-136. Additional heights approved by a special use permit shall be required to increase the required setback and yard area requirements by an equivalent distance from each property line.

Communications Towers and cable television facilities, with wireless telephone (cell phone) communications tower subject to the supplemental provisions prescribed in Section 175-110.4.

Conservation Areas.

Mini-warehouses.

Parking Structures.

(Ord. of 6-26-00; Ord. of 4-14-03; Ord. of 7-25-05; Ord. of 9-26-05; Ord. of 7-28-08; Ord. of 2-28-11; Ord of 6-22-15; Ord. of 3-28-16)

## **175-66 AREA REGULATIONS (I-2)**

- A. *Minimum lot size:* Twenty thousand (20,000) square feet.
- B. *Minimum lot width:* Eighty (80) feet.
- C. *Minimum district size:* Ten (10) acres.

## **175-67 MAXIMUM HEIGHT OF BUILDINGS (I-2)**

- A. *All buildings/structures:* Seventy-five (75) feet, except as provided for in Section 175-65.B.
- B. *Exemptions to height requirements:*
  - 1. Chimneys and flues.
  - 2. Cooling towers.
  - 3. Flagpoles.
  - 4. Radio and communications towers.
  - 5. Parapet walls up to four (4) feet above the height of the building on which the wall rests.
  - 6. Water towers.
  - 7. Elevator towers.

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## **175-68 MINIMUM YARD DIMENSIONS (I-2)**

### **A. All structures:**

1. Front: Twenty-five (25) feet.
2. Side: Ten (10) feet.
3. Rear: Zero (0).
4. Corner side: Twenty-five (25) feet.

### **B. Transitional requirements, when adjoining a residential district:**

1. Side: Forty (40) feet.
2. Rear: Forty (40) feet.
3. All transitional yards shall be landscaped in accordance with Section 148-44.

## **175-69 LOT COVERAGE (I-2)**

### **A. Maximum building coverage:** Fifty percent (50%).

### **B. Maximum impervious surface coverage:** Seventy-five percent (75%).

## **175-70 PERFORMANCE STANDARDS (I-2)**

The following performance standards shall apply to all uses within the I-2 Industrial Employment District:

### **A. Vibration:**

1. No continuous, frequent or repetitive vibrations shall be produced which are discernible to a person of normal sensitivities, without instruments, on land that is not zoned for industrial uses.
2. Vibrations from temporary construction and vehicles leaving the property (such as trucks or trains) are excluded. Vibrations from on-site equipment or vehicles that remain primarily on-site are included.
3. Vibrations of no more than five (5) minutes in any one (1) day between the hours of 7:00 a.m. and 7:00 p.m. shall not be deemed continuous, frequent or repetitive.

### **B. Glare:** Any operation or activity producing intense light or glare shall be performed in such a manner as not to create a glare effect across lot lines. Direct illumination from any source shall be screened from adjoining properties.

### **C. Heat:**

1. Heat from an industrial use shall not at any time cause a temperature increase in the air on any adjacent property in excess of ten degrees Fahrenheit (10° F.).
2. Heat from an industrial use shall not at any time cause a temperature increase in a stream, wetland, lake or any other body of water, at or beyond the property line of the lot on which it is located, that would have an adverse effect on any aquatic life.

### **D. Liquid or Solid Wastes:**

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1. No industrial use shall result in the discharge of liquid or solid waste into any public sewer, private sewage system, public waters or into the ground except in compliance with applicable federal, state or local laws governing such discharge.
  2. There shall be no accumulation outdoors of solid wastes conducive to the breeding of rodents or insects.
  3. All discharges into any public sewer shall comply with the provisions of Section 134-2 et seq.

E. *Smoke and Particulate Matter:*

1. Open storage and open processing operations, including on-site transportation movements which are the source of windborne dust or other particulate matter or which involve dust or other particulate air contaminant generating equipment (such as used in paint spraying, grain handling, sand or gravel processing or sandblasting) shall be conducted so that dust and other particulate air contaminants are not transported in visible quantities across the boundary line of the tract on which the industrial use is located.
2. All industrial uses shall comply with state and federal air pollution control regulations.

F. *Toxic and Hazardous Materials:*

1. All toxic and hazardous materials used in industrial operations shall be registered with the Front Royal Fire Department for purposes of safety.
2. Activities involving the storage or use of materials or products which decompose by detonation shall be registered with the Front Royal Fire Department.
3. Explosives shall be stored, used and manufactured in accordance with applicable state and federal regulations.

G. *Odor:*

1. No continuous, frequent or repetitive emission of odors or odor-causing substances of such intensity and character as to be detrimental to the health and welfare of the public or neighboring landowners or to interfere with the comfort of the public or neighboring landowners at or beyond the property line shall be permitted. Any such odor or odor causing activity or substance shall be removed, stopped or so modified as to remove the odor.
2. An odor which is evident no more than once in any one (1) day for a period not exceeding five (5) minutes shall not be deemed as continuous, frequent or repetitive within the meaning of these regulations.

H. *Noise:*

1. No industrial activity shall generate noise that tends to have an annoying or disruptive effect upon uses located beyond the property boundary.
2. Where technical evidence of violation is warranted, sound levels shall be measured at locations specified in Section 175-71 with a sound level meter and associated octave band filter, manufactured in accordance with the American Standards Association. Measurements shall be made using the flat network of the sound level meter. No sound pressure level shall exceed the decibel levels in the octave bands shown herein.
3. Maximum permitted sound levels (in decibels):

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| Octave Band Cycles<br>Per Second | Maximum Permitted<br>Sound Level<br>in Decibels |
|----------------------------------|-------------------------------------------------|
| 0 to 75                          | 72                                              |
| 75 to 150                        | 67                                              |
| 150 to 300                       | 59                                              |
| 300 to 600                       | 52                                              |
| 600 to 1200                      | 46                                              |
| 1200 to 2400                     | 41                                              |
| 2400 to 4800                     | 38                                              |
| Above 4800                       | 35                                              |

4. Noise resulting from temporary construction activity between the hours of 7:00 a.m. and 7:00 p.m. shall be exempt from this section.
- I. *Screening:*
1. Except where otherwise specifically approved in the Town Code, permitted uses shall be conducted wholly within a completely enclosed building.
  2. Outdoor storage, outdoor display or outdoor sale of goods shall only be permitted when each of the following standards are met:
    - a. Outdoor storage, outdoor display, or outdoor sale of goods shall be used in direct association with the primary use or uses of the property.
    - b. Outdoor storage, outdoor display and/or outdoor sales shall be screened to obstruct view from any adjacent public street. A screen may consist of a building, solid masonry wall, uniformly painted solid board fence or landscaping. The height of the screening shall be six feet (6') feet unless an alternative height is approved by the Planning Commission during the review of a site plan.
  3. The following types of outdoor display and/or outdoor sales shall be exempt from the requirements of Section 175-70.I.2.b:
    - a. Motor vehicles.
    - b. Power operated machines designed for outdoor labor, such as farming, construction or lawn maintenance, as well as large equipment, products, and materials designed to be kept outdoors.
    - c. Plants and other landscaping products typically sold with plants.
    - d. Temporary or seasonal activities, such as but not limited to, peddlers and itinerant merchants that have obtained approval from the Town.
    - e. Pre-manufactured buildings.
    - f. Vending machines.
    - g. General products, goods, merchandise, and/or materials, provided that: (i) no more than two hundred (200) square feet of area is used, and (ii) outdoor display and/or sales are

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restricted from the evening and night hours from 8:00 p.m. to 5:00 a.m., except that general products, goods, merchandise, and/or materials may be kept outdoors if located under a roofed structure.

4. All sites and parking areas shall be landscaped in accordance with the provisions of Sections 148-46, 148-47 and 148-48.
5. Automobile graveyards and junkyards, including those in existence at the time of the adoption of this chapter, shall completely screen, on any side open to view from a public road, the operation or use by a solid masonry wall, a uniformly-colored solid fence or dense evergreen plantings at least six (6) feet in height at the time of planting.

**J. Data Center Performance Standards:**

1. As a “Large Industrial Facility Utility User” data centers shall be subject to application requirements and performance standards intended to mitigate adverse impacts on adjacent properties, infrastructure, and natural resources. These standards shall address, at a minimum, operational noise, visual buffering, stormwater management, energy infrastructure, and emergency power systems. Whenever possible, innovative resource (power, water, etc.) protection implantations are encouraged. Application requirements will include:

- a. Data Center Utility Impact Analysis.
- b. Data Center Physical Impact Analysis.
- c. Data Center Environmental Impact Analysis.
- d. Data Center Impact Analysis requirements can be found in section 175-74.

**2. Minimum Setback Requirements:**

- a. Adjacent to residential zoning districts: minimum setbacks shall be at least 200 feet.
- b. Adjacent to Planned Neighborhood Development (PND) zoning districts: minimum setbacks shall be at least 150 feet.
- c. Adjacent to commercial and industrial zoning districts: minimum setbacks shall be at least 25 feet.
  1. Adjacent to public streets, railways and other rights-of-way: minimum setbacks shall be at least 40 feet.
  2. Adjacent to Agriculture and Open Space Preservation District (A1) shall be no less than 100 ft.
  3. Unless otherwise specified by zoning districts of the Town of Front Royal, setbacks for property that adjoins the corporate limits of the town shall have a setback or no less than 200 ft.
  4. Between buildings: Within a common scheme of development where individual lots or building sites are to be sited, the minimum setback between buildings on adjacent lots or building sites shall be at least 25 feet.

**3. Perimeter Buffers:**

1. All buffers shall be inclusive of required setbacks.
2. Buffer yard plantings shall be designed to minimize visual impacts from adjacent public streets and properties not in common ownership. Notwithstanding the requirements of this

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section, use of natural topography and preservation of existing vegetation, supplemented by new vegetation and security fencing. All new trees shall be at least 6 feet tall at time of planting and achieve a height of at least 25 feet at maturity.

3. A perimeter buffer shall be established and maintained with a minimum width of twenty-five feet along the perimeter of each Data Center Campus. In addition, additional plantings within the setback area but spread outside of the separately landscaped perimeter buffer shall be installed and maintained by the campus owner.

#### 4. Open Spaces

- a. A minimum of thirty (30) percent open space (permeable surface area) shall be maintained for each campus or contiguous group of parcels in common ownership within the lot, including undeveloped land, wetlands, steep slopes, stormwater best management practice features, open areas, landscape buffers, and land used primarily for resource protection or recreational purposes.
- b. The on-site open space requirement may be reduced to 20% on a parcel where all stormwater best management practices are designed where all volume and nutrient treatment occurs on site without the purchase of offsite nutrient credits.

#### 5. Noise Standards

**Technical Note:** Unlike other sources of noise, data centers generate a continuous, mechanical sound profile primarily from industrial-scale cooling systems, power infrastructure, and ventilation equipment which may persist 24 hours a day. Because this noise is largely constant and not intermittent, it presents unique challenges to nearby residential areas and requires separate regulation from most general noise provisions. These standards aim to protect public health, residential quality of life, and nighttime peace while allowing for the lawful operation of data center facilities.

- a. Noise standards are measured in bands and across total audible spectrum. Noise is measured prior to construction and the post construction operational phase of data center.

1. Low-frequency core audio band: Sound in the range of 10 Hz to 250 Hz, dB(C).
2. High-frequency core audio band: Sound in the range of 2,000 Hz to 8,000 Hz, dB(A).

Note: Mid frequency core audio band is not specified above in 1 or 2 since it doesn't typically create tonal or vibration-related issues. It is however captured within both A-weighted and C-weighted measurements specified later in this section. The specified high and low frequencies are the most common culprits in nuisance or environmental complaints, especially from data centers (cooling fans, HVAC, etc.)

3. Overall level and total noise in dB(A): Sound across 10 Hz to 20000 Hz.
4. Overall level and total noise in dB(C): Sound across 10 Hz to 20000 Hz

Note: dB(A): A-weighted decibel scale (emphasizes frequencies heard by humans) and dB(C): C-weighted decibel scale (captures low-frequency noise).

5. Any noise which emanates from operation or other activity associated with any data center or research, development, or light manufacturing facility, or their accessory uses shall be limited to a "Equivalent Continuous Sound Level (LEQ)" in A-

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weighted decibels of 59 dB(A) (+/- 1.5 dB) and C- weighted decibels 65 dB(C) (+/- 1.5 dB) during the day (7:00 a.m. until 9:00pm) and 52 dB(A) (+/- 1.5 dB) and 58 dB(C) (+/- 1.5 dB) during the night (9:00pm through 7:00 a.m.). LEQ shall be measured over a minimum 15-minute interval for both daytime (7:00 a.m. to 9:00 p.m.) and nighttime (9:00 p.m. to 7:00 a.m.) periods. If the total spectrum measurement yields a 15dB difference between dB(A) and dB(C), additional analysis to identify any spectral peaks is required.

6. Measurements shall be taken at the campus boundaries, using calibrated sound level meters conforming to ANSI S1.4 Type 1 or Type 2 standards, with the meter set to "Slow" response and utilizing A-weighting (dB(A)) and C-weighting (dB(C)) as appropriate. Environmental noise levels shall be tested prior to construction and in the post construction operational phase.
7. A differential analysis across 10 Hz to 8000 Hz band utilizing dB(A) and dB(C) total band measurements shall be conducted. That differential shall not exceed:
  - a.  $\leq 15\text{dB} \pm 1.5\text{ dB}$  Daytime
  - b.  $\leq 20\text{dB} \pm 1.5\text{ dB}$  Nighttime
8. Utilizing dB(A) and dB(C) total band measurements, a 1/3 Octave Band Analysis shall not detect tonal components and frequency-specific noise:
  - a. A 1/3-octave band has a sound pressure level  $\geq 5\text{ dB}$  higher than the levels in the adjacent bands (on either side).
  - b. A narrowband spectral peak that stands out significantly from the background spectrum and can be clearly heard as a hum, whine, buzz, or tone.
9. Frequency-Specific Adjustments
  - a. If a noise source contains tonal components (i.e., pure tones) in the low- or high-frequency range, the following penalties apply:
    1. +5 dB penalty if the noise has distinct tonal components at 250 Hz or less (e.g., industrial fans).
    2. +3 dB penalty if the noise has tonal components above 250Hz (e.g., squeals).
    3. These measurement penalties are added to the measured A-weighted Equivalent Continuous Sound Level (LEQ) value for analysis.
10. Sound measurements equipment standards
  - a. Measurements must be taken using calibrated sound level meters complying with ANSI S1.4 Type 1 or Type 2 standards:
    1. At the campus boundary
    2. With the meter set to "Slow" response
    3. With A-weighting and C-weighting applied for respective limits
    4. Wind screening, weather condition controls, and height of measurement mic (e.g., 1.5 m above ground) shall be used for measurement equipment set-up.

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11. Sound Exemptions would include:

- a. Construction work (governed by existing noise ordinance)
- b. Emergency operations

12. Generator testing

- a. Generator testing shall be conducted between 7:00 a.m. until 7:00 p.m. unless testing at a time outside of this range is required by the Department of Environmental Quality.
- b. The sound study shall be specific to the proposed site layout and building type, scale, and height shown on the site plan and shall evaluate (i) the noise conditions at the site prior to project development at set locations as determined by the Town and (ii) provide model- predicted noise conditions resulting from the proposed project post-development.
- c. The sound study shall include recommendations for mitigation measures, and which mitigation measures, if applicable, should be incorporated into conditions of issuance of site plan approval, or to issuance of building permit(s).

13. Post-development noise

- a. Noise conditions at and/or within the lot will be evaluated and compared to all local code requirements within sixty (60) days after the issuance of the/a occupancy permit for each phase and/or campus facility, and annually thereafter for a period of ten (10) years. Said evaluations shall be conducted by the campus operator at a time(s) generally known for peak data center cooling operations.
- b. Backup generators shall be housed in an interior acoustically controlled structure for noise abatement.

14. Where no residential or noise-sensitive receptors are present or reasonably foreseeable within 1000 feet of a data center campus, and where site-specific conditions mitigate off-site sound transmission, noise limits may be relaxed on a case-by-case basis, subject to acoustic assessment and review.

15. Any noise testing that reveals anomalous or out-of-specification results may necessitate additional analysis, further testing, and/or the implementation of appropriate mitigation measures to ensure compliance with applicable standards and performance requirements.

**6. Quantitative Vibration Limits**

- a. No use, operation or activity shall cause or create earth borne vibrations in violation of the below vibration standards as measured at the Data Center campus boundary.
- b. All measurements shall be taken prior to construction and post construction operational phase for comparative analysis and baseline vibration establishment.
- c. Continuous Vibration (Steady-State Sources):
  - 1. The peak particle acceleration shall not exceed the baseline measurement:
    - a. § 0.002 g for frequencies  $\leq 50$  Hz

- 
- b. § 0.001 g for frequencies > 50 Hz
  - c. Impulse or Intermittent Vibration:
    - 1. For single events occurring less than once every 5 minutes, vibration levels may not exceed § 0.01 g peak acceleration
  - d. Measurement Protocol, all measurements shall be:
    - 1. Taken at the campus boundary line adjacent to data center
    - 2. Conducted using ANSI S2.47-1990 or ISO 2631 compliant vibration meters
    - 3. Recorded as peak acceleration (g), with frequency analysis
  - e. Measurements shall be made during the loudest expected operational periods, including emergency generator testing, peak cooling demand, or routine maintenance cycles.
  - f. Exemptions:
    - 1. Temporary construction-related vibration is exempt, provided it complies with applicable construction noise and hours-of-operation rules.
    - 2. Where no residential or vibration-sensitive receptors are present or reasonably foreseeable within 1000 feet of a data center campus, and where site-specific conditions mitigate off-site vibration transmission, vibration limits may be relaxed on a case-by-case basis, subject to vibration assessment and review.

## 7. Outdoor Lighting Standards

- a. Lighting standards apply to all new data centers in Front Royal, as well as expansions or renovations involving exterior lighting.
- b. A photometric Lighting Plan must accompany site/subdivision plan or building permit applications, showing:
  - 1. Fixture locations & mounting heights.
  - 2. Full manufacturer's specs (cutoff, wattage, CCT, shielding).
  - 3. Calculated illuminance (fc) over the site and at all campus property lines.
  - 4. Light trespass values extending to adjacent residential or commercial zones.
- c. Fixture Requirements
  - 1. Fixtures  $\geq 3,000$  lumens must be full-cutoff, horizontal, and shielded to avoid upward glare.
  - 2. Private security lighting is allowed if motion-activated and  $\leq 30$  minutes per activation.
  - 3. Mounting Heights
  - 4. Pole lights: Max 25 ft in industrial zones.
  - 5. Wall-mounted lights: Max 20 ft above finished grade.
  - 6. Color Temperature & Efficiency
  - 7. Correlated color temperature (CCT)  $\leq 3,000$  K.

- 
8. Minimum efficacy 110 lm/W.
  9. LED or energy-efficient equivalent mandatory.
- d. Illuminance Limits
    1. Entries/loading zones:  $\leq 10$  fc.
    2. Parking areas:  $\leq 5$  fc average.
    3. Drive aisles/internal roads:  $\leq 3$  fc.
    4. Perimeter fencing:  $\leq 1$  fc.
    5. At campus property lines:  $\leq 0.2$  fc (adjacent residential);  $\leq 0.5$  fc (adjacent non-residential).
  - e. Controls & Dim-Down Requirements
    1. Dimming  $\geq 50\%$  within 30 minutes of facility close (unless lighting supports active operations).
    2. Photocells or timeclocks required.
    3. Occupancy sensors in low-traffic/service areas.
  - f. Prohibitions
    1. No exposed floodlights, cobra heads, uplighting, colored or flashing lights (unless emergency).
    2. No light trespass or glare onto surrounding public roads.
    3. Exceptions (Special Exception Only)  
Security lighting exceeding standard limits may be approved if:
      - a. Motion-activated or timed.
      - b. Proved no glare or boundary trespass.
  - g. Compliance Verification
    1. Prior to Certificate of Occupancy, the applicant must submit:
      - a. Field measurements from a lighting engineer, or
      - b. Engineer certificate attesting full compliance.

## 8. Water Cooling Standards

- a. No permitted or accessory use described in the underlying zoning district shall be permitted to permanently utilize potable water for industrial cooling, including but not limited to a data center cooling.
- b. Shall not apply to water requirements of domestic water (drinking water and sanitary facilities for employees and occupants) and fire suppression standards.
- c. Temporary potable water for industrial cooling may be provided through a Water Service Agreement approved by the Town Council to bridge initial water requirements while an industrial reuse water cooling system is constructed.

- 
- d. Where possible, the prioritization of cooling technologies that significantly reduce water consumption (e.g., dry cooling, hybrid cooling, or air-cooled chillers) is encouraged.
  - e. The cooling systems proposed shall reflect a good-faith effort to incorporate resource-efficient technologies

#### 9. Building Height Standards

- a. The maximum height shall be no more than seventy-five (75) feet.
- b. The height limitation shall not apply to parapets, screening, spires, belfries, cupolas, roof-mounted antennas or communications towers, air cooling ventilation equipment, ventilators, or other appurtenances usually required to be placed on the roof level and not intended for human occupancy, which shall be subject to the exception stated in Town Code.
- c. A special exception may be permitted via the Special Use Permit process.

#### 10. Building Size Standards

- a. The maximum size of an individual building is 100,000 square feet. A special exception is required to exceed this size. A special exception may be permitted via the Special Use Permit process.

#### 11. Differentiated Surfaces Standards

- a. Any building facade visible from adjacent properties or public streets shall incorporate a differentiation that breaks the mass of the facade every 100 horizontal linear feet and no less frequent than 3 times the average height of the building by changes in at least two of the following design elements: building height, facade step-back or recesses (minimum 2 1/2 feet depth), fenestration, facade materials, pattern, texture, color, or use of accent materials. All visible facades of a building must be consistent in terms of design, materials, details, and treatment.
- b. Windows, doors, or similar fenestration design features such as faux windows must be distributed horizontally and vertically across the facade and comprise a minimum of 15% of each visible building facade. A green-wall treatment may be provided to meet up to half of the required 15% area.
- c. The following elements shall be included in the building design:
  - 1. A main entrance feature that is differentiated from the remainder of the facade;
  - 2. High albedo or light-colored roof;
  - 3. Enclosures for on-site generators; and
  - 4. Shrouds for any exhaust stacks.

#### 12. Building facade material requirements

- a. Primary facade materials shall be limited to one or more of the following: tinted textured masonry block, pre-cast concrete, tilt-up concrete panels, brick or stone veneer, glass (clear or architectural panels), stucco and external insulation finish system that simulates a stucco appearance, metal panel systems, structural metal siding, or smooth-faced concrete blocks. All metal panels shall be fully engineered, architectural quality systems.
- b. Accent or trim building materials may include any of the primary facade materials, wood, fiber cement, vinyl, or composite trim.
- c. Data Center Parking Standards

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### 13. Parking

- a. Small data center: 1 parking space/1,000 square feet.
- b. Large Data Center: 4 parking spaces for the first 4,000 square feet and a maximum of 1 parking space for every additional 6,000 square feet.

### 14. Additional testing and evaluations

- a. Additional testing, analysis, or documentation may be required if the application or testing contains ambiguities, inconsistencies, or lacks sufficient detail to assess compliance with applicable standards.

## 175-71 LOCATIONS FOR DETERMINATION OF PERFORMANCE STANDARDS (I-2)

Measurements may be made at ground level or at habitable levels of buildings. Measurements shall be made at the property boundary of the parcel where the industrial use is located.

## 175-72 ADMINISTRATION AND ENFORCEMENT OF PERFORMANCE STANDARDS (I-2)

- A. Before a building permit or zoning permit shall be issued or construction commenced on any uses in this district or a permit issued for a new use, the development plans shall be submitted to the Zoning Administrator for review. Sufficient detail shall be provided on said plans to show compliance with the substantive provisions of this chapter and compliance of the operations and processes to the performance standards.
- B. Determinations of a violation shall be made pursuant to a test using either the senses of the Zoning Administrator and a second municipal official/employee, or using equipment before notice of violation is issued. The operator of an industrial use shall be given written notice of the time and place of the test and given a reasonable opportunity to witness the test.
- C. The Zoning Administrator will notify landowners and business operators/tenants in writing of violations and will then seek compliance. When notified of a violation, a landowner or tenant will have the opportunity to demonstrate that the operation predates the application of this Article and is therefore a valid nonconforming use. A finding of violation may be appealed to the Board of Zoning Appeals and then to the courts.
- D. If a violation exists and the operator fails to take satisfactory action within two (2) weeks, the Zoning Administrator shall take or cause to be taken such action as is appropriate to cause correction of such violation. Failure to obey lawful orders concerning correction of such violation shall be punishable as provided generally for violations in the Zoning Ordinance and in other laws or regulations affecting the case.

## 175-73 OFF-STREET PARKING AND LOADING (I-2)

- A. *Parking space requirements:*
  1. Industrial uses/manufacturing/distribution areas: One (1) space per employee and one (1) space for every vehicle used on site, plus one (1) space per delivery/loading bay.
  2. Automobile garages: Two (2) spaces per service bay, or two (2) spaces for every three hundred sixty (360) square feet. Every such facility shall have a minimum of three (3) spaces.
  3. Industrial uses/office component: One (1) space per three hundred (300) square feet of office area.
  4. Other uses not specifically enumerated: See Section 175-104.

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- B. *Location:* Minimum setback for loading areas, driveways and parking: Five (5) feet from side and rear property lines for parking areas with fewer than fifteen (15) spaces and five (5) feet from front property line except where driveway entrance is located. All parking areas with fifteen (15) or more spaces shall meet the requirements of Section 148-48.
- C. *Loading space requirements:*
1. Number: One (1) space for first ten thousand (10,000) square feet of gross floor area, plus one (1) space for each additional forty thousand (40,000) square feet or fraction thereof. For purposes of this section, gross floor area shall include gross outdoor storage areas, covered or uncovered.
  2. Size of space: Minimum twelve (12) feet wide and fifty-five (55) feet in length, with a minimum clear height of fifteen (15) feet.

## **175-74 Data Center Impact Analysis (I-2)**

### **Required Utility Impact Analysis (UIA)**

Applicants must include a UIA certified by a Professional Engineer, containing:

1. **Electrical System Impacts**
  - a. Projected peak & average load (MW).
  - b. Power delivery plan (e.g., Dominion Energy service connections, Rappahannock Electric CoOp and Front Royal Power). Impact shall include Backup generator plans.
  - c. Grid impact assessment: load studies, reliability analysis.
  - d. Utility coordination documentation verifying capacity or required upgrades.
  - e. Statement on cost/responsibility for infrastructure enhancements (e.g., private vs. public).
2. **Water & Wastewater Assessment**

If applicable:

  - a. Daily and peak water usage (gallons/day).
  - b. Cooling technology description (closed-loop, evaporative, reuse).
  - c. Impact analysis on municipal water/wastewater systems.
  - d. Water treatment plan for recycled water and other fluids.
  - e. Correspondence from the Town of Front Royal/Public Works on capacity & fees.
3. **Telecommunications Infrastructure**
  - a. Summary of fiber/broadband needs and planned connectivity.
  - b. Confirmation from providers regarding availability and capacity.
4. **Sustainability & Efficiency Measures**
  - a. Energy-efficiency features, including Power Use Effectiveness (PUE) targets.
  - b. On-site renewable energy or offset strategies.
  - c. Noise and heat mitigation strategies (e.g., screening, sound dampening, limited generator testing hours).
5. **Review Criteria:**
  - a. Adequate utility capacity and service availability.
  - b. Whether infrastructure upgrades are funded by the developer, not taxpayers.
  - c. Environmental/sustainability mitigations and community impacts (noise, heat, water use).

### **B. Data Center Physical Impact Analysis**

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## **Purpose**

To ensure new data centers can integrate within the surrounding environment by evaluating their physical impacts to include:

1. Noise.
2. Traffic.
3. Visual appearance.
4. Heat.
5. Site development as part of the review process.

## **Physical Impact Analysis (PIA) Required**

Applicants must submit a Physical Impact Analysis (PIA), prepared by a qualified engineer, architect, or planner, as part of the zoning or site plan application. The PIA shall include the following:

### **1. Noise Impact Study**

- a) Assessment of projected operational noise (e.g., cooling units, generators) at campus property boundaries.
- b) Description of generator testing schedules and backup systems.
- c) Comparison to Town noise ordinance thresholds (in dBA).
- d) Mitigation measures: sound walls, enclosures, operational limits.

### **2. Heat and Air Emissions Impact**

- a) Analysis of waste heat discharge from servers and HVAC systems.
- b) Evaluation of any thermal plumes or heat impacts on adjacent properties or ecosystems.
- c) Description of cooling system emissions (water vapor, particulates if using evaporative or diesel systems).
- d) Heat mitigation strategies: green roofs, heat exchangers, landscaping, exhaust redirection.

### **3. Traffic and Access Impact**

- a) Description of construction and operational traffic volumes, including truck deliveries, equipment servicing, employee vehicles.
- b) Peak trip generation analysis using Institute of Transportation Engineers (ITE) standards (Land Use 770: Data Center).
- c) Truck routing and site access plans.
- d) Traffic mitigation strategies: turn lanes, signalization (if warranted).
- e) Coordination with Town and VDOT if applicable.

### **4. Visual and Aesthetic Impact**

- a) Rendered site elevations or photomontages showing the facility from public roads and adjacent uses.
- b) Analysis of height, scale, and bulk compared to surroundings.
- c) Screening plans: landscaping, fencing, architectural treatments.
- d) Exterior lighting plan demonstrating compliance with dark sky standards.

### **5. Vibration and Ground Impact (if applicable)**

- a) Analysis of potential vibration impacts from generators, cooling towers, or mechanical systems.
- b) Mitigation strategies: vibration dampers, equipment pads, sound-absorbing materials.

### **6. Land Use Compatibility Assessment**

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- a) Assessment of how the facility aligns with adjacent zoning, comprehensive plan, and surrounding land uses.
  - b) Identification of sensitive uses nearby (residential, schools, parks, trails).
  - c) Compatibility strategies: setbacks, buffering, hours of operation, community engagement.

**7. Review Criteria**

The Zoning Administrator and Planning Commission shall evaluate the PIA for:

- a) Conformance with Town noise and lighting regulations.
- b) Adequacy of visual screening and building orientation.
- c) Impacts on neighboring land uses and mitigation adequacy.
- d) Safe and sufficient traffic circulation and site access.
- e) Compliance with sustainability and resiliency goals in the Town's Comprehensive Plan.

**8. Conditions of Approval**

- a) Approval of a zoning permit or site plan for a data center shall be contingent upon satisfactory mitigation of any significant physical impacts identified in the PIA.
- b) Noise testing, generator operation logs, or traffic monitoring may be required as conditions of approval.

**9. Enforcement and Monitoring**

- a. The Town shall require a post-construction physical impact audit to verify compliance with approved mitigation measures.
- b. Violations of approved physical performance standards may result in fines, operating restrictions, or permit revocation.

**C. Data Center Environmental Impact Analysis**

**Purpose**

To evaluate and mitigate the potential environmental impacts of data center development—particularly land disturbance, air and water quality degradation, and energy and carbon intensity, in a manner that protects the Shenandoah Valley's natural resources and supports sustainable land use in the Town of Front Royal.

**Required Environmental Impact Analysis (EIA)**

Applicants shall submit an Environmental Impact Analysis (EIA) prepared by a qualified environmental consultant, certified engineer, or licensed planner. The EIA must be submitted as part of the rezoning application package:

**1. Land Disturbance and Soil Impact Assessment**

- a) Total area of grading, clearing, and impervious surface coverage.
- b) Soil erosion potential and slope stability (per NRCS classification).
- c) Mitigation measures: erosion & sediment control plan, phased clearing, vegetated buffers.

**2. Stormwater, Wastewater and Water Quality Analysis**

- a) Stormwater runoff projections under pre- and post-development conditions.
- b) Identification of potential pollutants of concern (e.g., heated discharge, oils, sediment).
- c) Description of Best Management Practices (BMPs) and green infrastructure used (e.g., bioswales, retention basins).
- d) Compliance with VA DEQ stormwater regulations and Town stormwater ordinance.
- e) Impacts on nearby surface waters or floodplains (e.g., Shenandoah River tributaries).

- 
- f) **Plans for treatment of waste water from industrial processes.** **Waste water** must be treated to applicable EPA standards either on site or removed for treatment elsewhere before release.
- 3. **Air Quality and Emissions Impact**
    - a) Estimation of greenhouse gas emissions, diesel generator emissions (NOx, PM2.5, CO2).
    - b) Identification of airborne pollutants during construction and backup power use.
    - c) Mitigation plans: generator testing limits, air filtration, clean diesel or battery backup.
  - 4. **Energy and Carbon Intensity Analysis**
    - a) Projected annual energy consumption and Peak Load in Mega Watts (MW).
    - b) Use of renewable energy sources, energy efficiency measures Power Use Effectiveness (PUE) targets, server cooling efficiency).
    - d) Carbon offset strategies, if applicable.
    - e) Leadership in Energy and Environmental Design (LEED) or equivalent sustainability certification plans (if proposed).
  - 5. **Ecological and Habitat Impact Assessment**
    - a) Description of site's pre-development vegetation, habitat, and biodiversity.
    - b) Inventory of wetlands, streams, or critical habitats based on field survey or state/federal datasets.
    - c) Documentation of compliance with the Chesapeake Bay Preservation Act, if applicable.
    - d) Wildlife impact mitigation (e.g., tree preservation, fencing, lighting restrictions for nocturnal species).
  - 6. **Hazardous Materials and Spill Prevention Plan**
    - a) Identification of onsite fuel or chemical storage (e.g., diesel, refrigerants, batteries).
    - b) Spill containment and response strategies.
    - c) Emergency environmental response procedures and coordination with Fire & EMS.
  - 7. **Facility Life Cycle Plan**
    - a) A facility life cycle plan shall be included prior to approval of site plan.
    - b) Comprehensive planning to provide information needed to make sound decisions about facility project planning and base development.
    - c) Design
      - a. The materials, technologies, and types of systems chosen that have a direct and life-long impact on operation, maintenance, repair, and dispose of the facility.
    - d) Restoration or Disposal
      - a. Plans for the repurposing, demolition and rehabilitation of land after end of use of facility.
  - 8. **Review Standards**

The Zoning Administrator, Town Council (Town Engineer), and Planning Commission shall evaluate the EIA to determine:

- a) Whether proposed mitigation sufficiently reduces impacts to soil, air, water, and habitat.
- b) If the project complies with Town ordinances, State DEQ standards, and federal Clean Water/Air Acts.

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- c) The project's alignment with sustainable development goals of the Town Comprehensive Plan.

#### **9. Conditions of Approval**

Approval of any zoning, site plan, or zoning permit for a data center is contingent upon:

- a) Town verification of compliance with applicable stormwater, erosion, and pollution control measures.
- b) Developer commitment to implement all environmental mitigations identified in the approved EIA.
- c) Provision of updated documentation if project changes increase environmental footprint.

#### **10. Post-Construction Monitoring**

For major facilities, the Town may require annual post-construction reporting, submitted to Planning and Zoning on:

- a) Actual energy use and carbon emissions vs. projected.
- b) Groundwater or surface water sampling.
- c) Long-term maintenance of stormwater Best Management Practices (BMPs) and erosion controls.

### **Additions to Definitions**

**ANSI S1.4:** A standard that specifies the performance requirements for sound level meters, including different types of meters used for measuring sound levels in various environments.

**Large Industrial Facility Utility User:** Refers to a business or organization that consumes or discharges a significant volume of utilities such as electricity, natural gas, or water due to large-scale industrial operations.

**DATA CENTER:** A use where digital information is processed, transferred, and/ or stored, occupying 10,000 square feet or more, where the majority of space is occupied by computers, servers, telecommunications and related equipment (including supporting equipment).

**SMALL DATA CENTER:** A use where digital information is processed, transferred, and or stored, occupying less than 10,000 square feet, where the majority of space is occupied by computers, servers, telecommunications and related equipment (including supporting equipment).

**Data Center Campus (Campus):** Land occupied and maintained by Data Center

**Decibel Audible (dB(A)):** Weighted power measurement for noise that filters high and low frequencies not of concern to human hearing

**Decibels Relative to the Carrier (dB(C)):** A measurement that expresses the power ratio of a noise signal to a carrier signal in decibels. It indicates how much weaker or stronger the noise is compared to the carrier, with positive values showing stronger noise and negative values indicating weaker noise.

**g:** Refers to the unit of acceleration due to gravity, which is approximately  $9.8 \text{ m/s}^2$ . It is used to measure the magnitude of vibration, with higher g values indicating greater levels of acceleration and potential impact.

**Foot candles (fc):** A unit of measurement for illuminance, which indicates how much light is received on a surface. Specifically, one foot-candle equals one lumen per square foot.

**Luminous Efficacy (lm/w):** luminous efficacy relates the luminous flux produced by a light source and the actual luminous flux emitted, i.e. how much light a light source is capable of producing and how much light it actually emits.

**Correlated color temperature (CCT):** It is essentially a gauge of how yellow or blue the color of light emitted from a light bulb appears. It's measured in the Kelvin.

**Best Management Process (BMP):** Proven and repeatable practices and workflows that represent the most effective and efficient ways to achieve organizational goals, maintain compliance, and enhance overall performance.

**Emergency Management Systems (EMS):** The immediate medical response and pre-hospital care provided by trained professionals (such as paramedics and emergency medical technicians) to individuals experiencing acute illness or injury, typically in emergency situations like accidents, cardiac arrest, trauma, or other medical crises.

**Power Use Effectiveness (PUE):** A metric used to measure the energy efficiency of a data center. It compares the total amount of power used by the facility to the power used specifically by the computing equipment (like servers, storage, and networking devices).

**\*\*This is just for informational purposes, not to go into the draft text\_lk**

## **Why Do We Need Full Spectral Analysis**

A full-spectrum 10 Hz–20 kHz analysis is the only way to capture the complete acoustic footprint of a data center. Low-frequency rumble, high-frequency tonal whines, and A-weighting blind spots can all cause measurable community impacts while appearing “compliant” on limited-band tests. Without full-spectrum data, the town risks missing violations, losing in legal disputes, and eroding public trust.

### **1. Low-frequency noise is often the biggest problem**

- Data center equipment (especially large cooling towers, chillers, and emergency generators) produces significant infrasound (below 20 Hz) and low-frequency noise (20–200 Hz) that’s not well captured by standard dBA-weighted measurements.
- Low-frequency noise travels farther, penetrates buildings more easily, and can cause annoyance, sleep disturbance, and vibration complaints even when dBA readings look compliant.
- Without analysis down to at least 10 Hz, a town could miss a noncompliance situation that still has measurable community impact.

### **2. High-frequency content matters for tonal penalties**

- Certain zoning ordinances and standards (ANSI, ISO, IEC) require penalty adjustments if noise contains tonal components (like a whine at a specific fan blade frequency).
- High-frequency tonal noise (1 kHz–10 kHz) can be more annoying than broadband noise at the same level.
- Only a full-spectrum FFT or 1/3-octave analysis up to 20 kHz can reliably detect these tonal spikes.

### 3. Compliance disputes need evidence across the spectrum

- If residents complain of “vibration” or “low rumble” while the operator claims dBA compliance, a full-spectrum measurement can reveal A-weighting blind spots.
- Courts and acoustical experts often expect complete spectral data to resolve disputes, especially if vibration or low-frequency hum is alleged.
- Having 10 Hz–20 kHz data gives the town a defensible record in case of legal challenges.

### 4. International best practice and standards

- ISO 1996-2, IEC 61672, and ANSI S1.11 all recommend wideband or full-spectrum measurements when assessing noise from industrial sources.
- ASHRAE and WHO Guidelines for Community Noise both stress that low-frequency noise needs special evaluation, not just A-weighting.
- Many modern municipal ordinances (e.g., Portland, OR; Toronto, ON) require low-frequency and full-range analysis for mechanical equipment.

### 5. Full spectrum helps in mitigation planning

- If a data center fails compliance, engineers need to know where in the spectrum the excess energy lies to design effective noise control (barriers, silencers, vibration isolation, etc.).
- A-weighted readings alone can’t show whether the problem is fan blade tones, chiller rumble, or transformer hum.

### 6. Avoiding loopholes in the ordinance

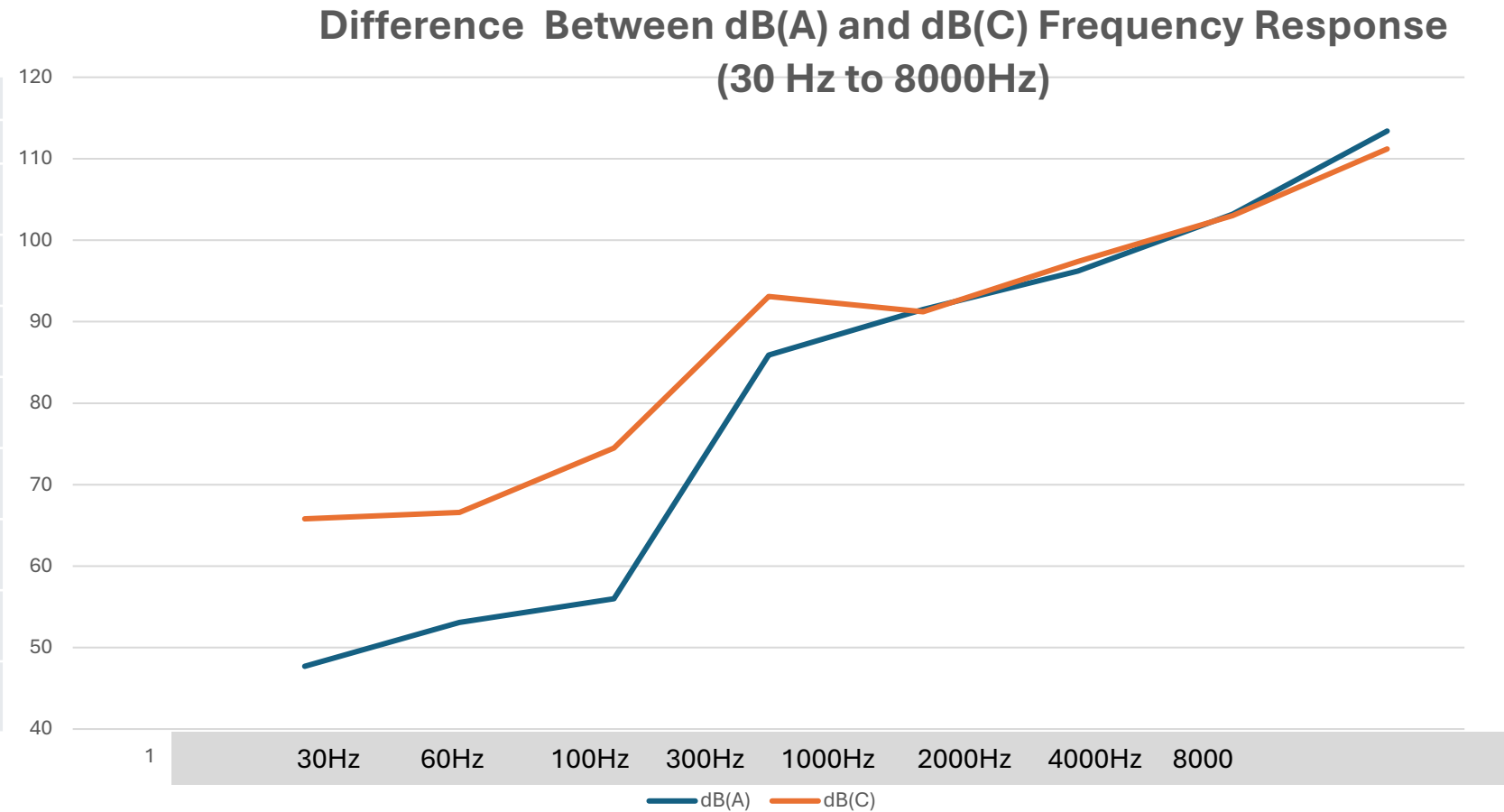
- If the ordinance specifies only dBA measurements, operators can meet the letter of the law but still produce nuisance-level noise outside the A-weighted range.
- A full-spectrum requirement closes that loophole by requiring data on all audible and near-audible frequencies.

### 7. Public trust and transparency

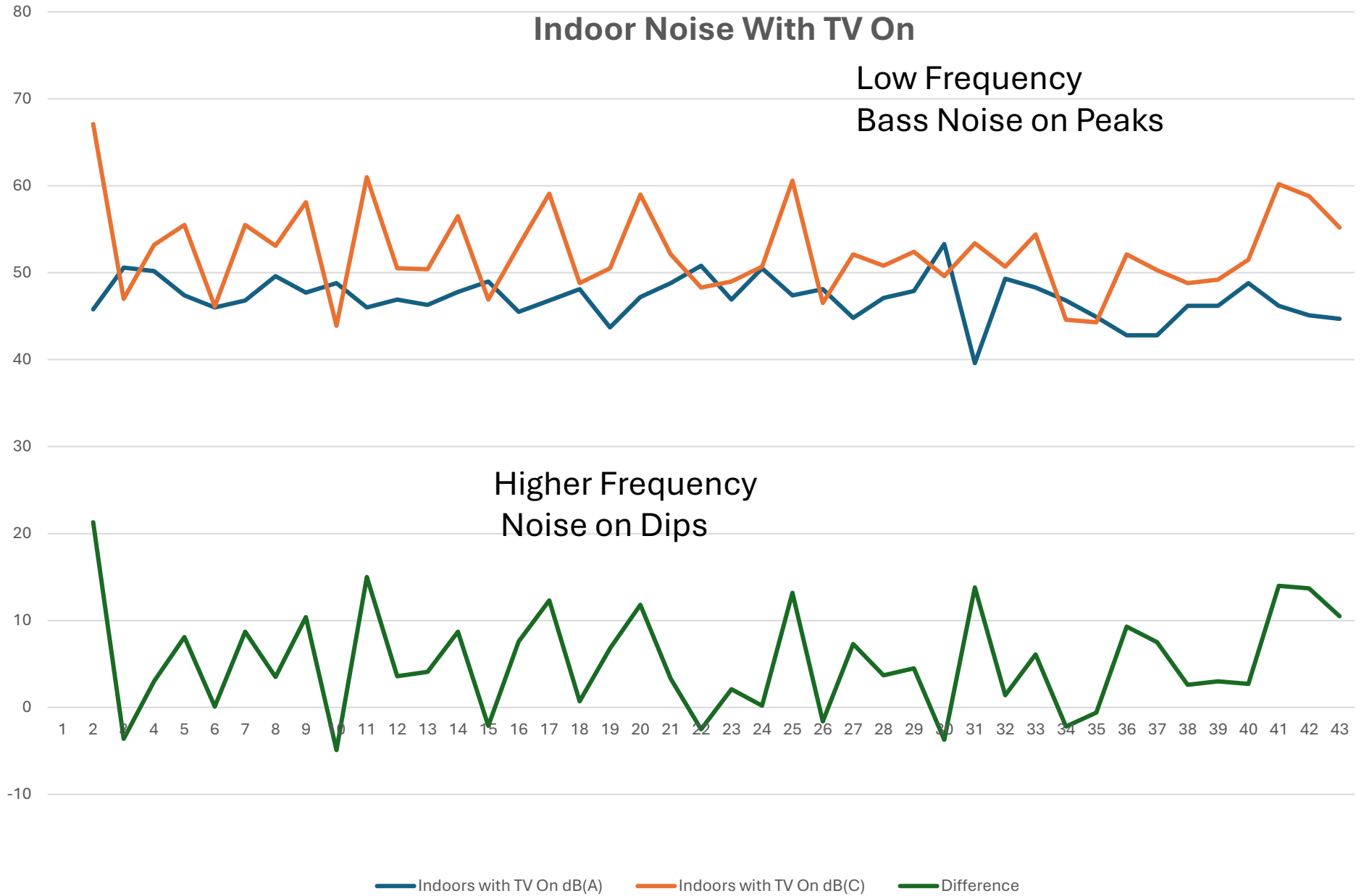
- A full 10 Hz–20 kHz record ensures that all affected frequency ranges are evaluated, making the compliance process more credible to residents.

- It avoids the perception that testing was done in a way that “filters out” problematic noise.

|                  | dB(A) |                  | dB(C) |
|------------------|-------|------------------|-------|
| 30 Hz<br>dB(A)   | 47.7  | 30 Hz<br>dB(C)   | 65.8  |
| 60 Hz<br>dB(A)   | 53.1  | 60 Hz dB(c)      | 66.6  |
| 100 Hz<br>dB(A)  | 56    | 100 Hz<br>dB(C)  | 74.5  |
| 300 Hz<br>dB(A)  | 85.9  | 300 Hz<br>dB(C)  | 93.1  |
| 1000 Hz<br>dB(A) | 91.5  | 1000 Hz<br>dB(C) | 91.2  |
| 2000 Hz<br>dB(A) | 96.2  | 2000 Hz<br>dB(C) | 97.4  |
| 4000 Hz<br>dB(A) | 103.2 | 4000 Hz<br>dB(C) | 103   |
| 8000 Hz<br>dB(A) | 113.4 | 8000 Hz<br>dB(C) | 111.2 |



| Indoors with TV On<br>dB(A) | Indoors with TV On<br>dB(C) | Difference |
|-----------------------------|-----------------------------|------------|
| 45.8                        | 67.1                        | 21.3       |
| 50.6                        | 47                          | -3.6       |
| 50.2                        | 53.2                        | 3          |
| 47.4                        | 55.5                        | 8.1        |
| 46                          | 46.1                        | 0.1        |
| 46.8                        | 55.5                        | 8.7        |
| 49.6                        | 53.1                        | 3.5        |
| 47.7                        | 58.1                        | 10.4       |
| 48.8                        | 43.9                        | -4.9       |
| 46                          | 61                          | 15         |
| 46.9                        | 50.5                        | 3.6        |
| 46.3                        | 50.4                        | 4.1        |
| 47.8                        | 56.5                        | 8.7        |
| 49                          | 46.9                        | -2.1       |
| 45.5                        | 53.1                        | 7.6        |
| 46.8                        | 59.1                        | 12.3       |
| 48.1                        | 48.8                        | 0.7        |
| 43.7                        | 50.5                        | 6.8        |
| 47.2                        | 59                          | 11.8       |
| 48.8                        | 52.1                        | 3.3        |
| 50.8                        | 48.3                        | -2.5       |
| 46.9                        | 49                          | 2.1        |
| 50.5                        | 50.7                        | 0.2        |
| 47.4                        | 60.6                        | 13.2       |
| 48.1                        | 46.5                        | -1.6       |
| 44.8                        | 52.1                        | 7.3        |
| 47.1                        | 50.8                        | 3.7        |
| 47.9                        | 52.4                        | 4.5        |
| 53.3                        | 49.6                        | -3.7       |
| 39.6                        | 53.4                        | 13.8       |
| 49.3                        | 50.7                        | 1.4        |
| 48.3                        | 54.4                        | 6.1        |
| 46.8                        | 44.6                        | -2.2       |
| 44.9                        | 44.3                        | -0.6       |
| 42.8                        | 52.1                        | 9.3        |
| 42.8                        | 50.3                        | 7.5        |
| 46.2                        | 48.8                        | 2.6        |
| 46.2                        | 49.2                        | 3          |
| 48.8                        | 51.5                        | 2.7        |
| 46.2                        | 60.2                        | 14         |
| 45.1                        | 58.8                        | 13.7       |
| 44.7                        | 55.2                        | 10.5       |



# Suburb Noise Daytime

| Outdoor Noise Residential dB(A) | Outdoor Noise Residential dB© | Difference |
|---------------------------------|-------------------------------|------------|
| 45.5                            | 62                            | 16.5       |
| 44.1                            | 57.6                          | 13.5       |
| 46.2                            | 59.9                          | 13.7       |
| 44.6                            | 58.8                          | 14.2       |
| 46.6                            | 59                            | 12.4       |
| 47.5                            | 60                            | 12.5       |
| 54.2                            | 66                            | 11.8       |
| 47.1                            | 66                            | 18.9       |
| 46                              | 60                            | 14         |
| 44.9                            | 58.5                          | 13.6       |
| 44.4                            | 58.9                          | 14.5       |
| 43.5                            | 62                            | 18.5       |
| 46.6                            | 57.8                          | 11.2       |
| 45.3                            | 59.1                          | 13.8       |
| 44.4                            | 60                            | 15.6       |
| 44.6                            | 56.6                          | 12         |
| 45.5                            | 56.6                          | 11.1       |
| 46                              | 56.7                          | 10.7       |
| 46.2                            | 55.3                          | 9.1        |
| 45.1                            | 55.3                          | 10.2       |
| 44.4                            | 54.1                          | 9.7        |
| 43.9                            | 53.8                          | 9.9        |
| 60                              | 62.2                          | 2.2        |
| 44.7                            | 54.5                          | 9.8        |
| 42.8                            | 54.2                          | 11.4       |
| 46.9                            | 53.8                          | 6.9        |
| 44.4                            | 53.1                          | 8.7        |
| 43.5                            | 53.5                          | 10         |
| 43                              | 53                            | 10         |
| 44                              | 54.1                          | 10.1       |
| 43.9                            | 53.6                          | 9.7        |
| 45.8                            | 55.7                          | 9.9        |
| 42.8                            | 54.8                          | 12         |
| 43                              | 54.2                          | 11.2       |
| 43.7                            | 53.1                          | 9.4        |
| 42.2                            | 52.6                          | 10.4       |
| 55                              | 53                            | -2         |
| 43.3                            | 53.1                          | 9.8        |
| 42.8                            | 53                            | 10.2       |
| 43.3                            | 53                            | 9.7        |
| 66.5                            | 63.6                          | -2.9       |
| 69                              | 74.5                          | 5.5        |

