



May 24, 2022

**Medway Planning & Economic Development Board
Meeting**

Battery Energy Storage System (BESS)
ARUP Reports

- Medway BESS Siting Guidelines, 5-20-22
- Medway GRID EFSB Technical Review, 5-20-22

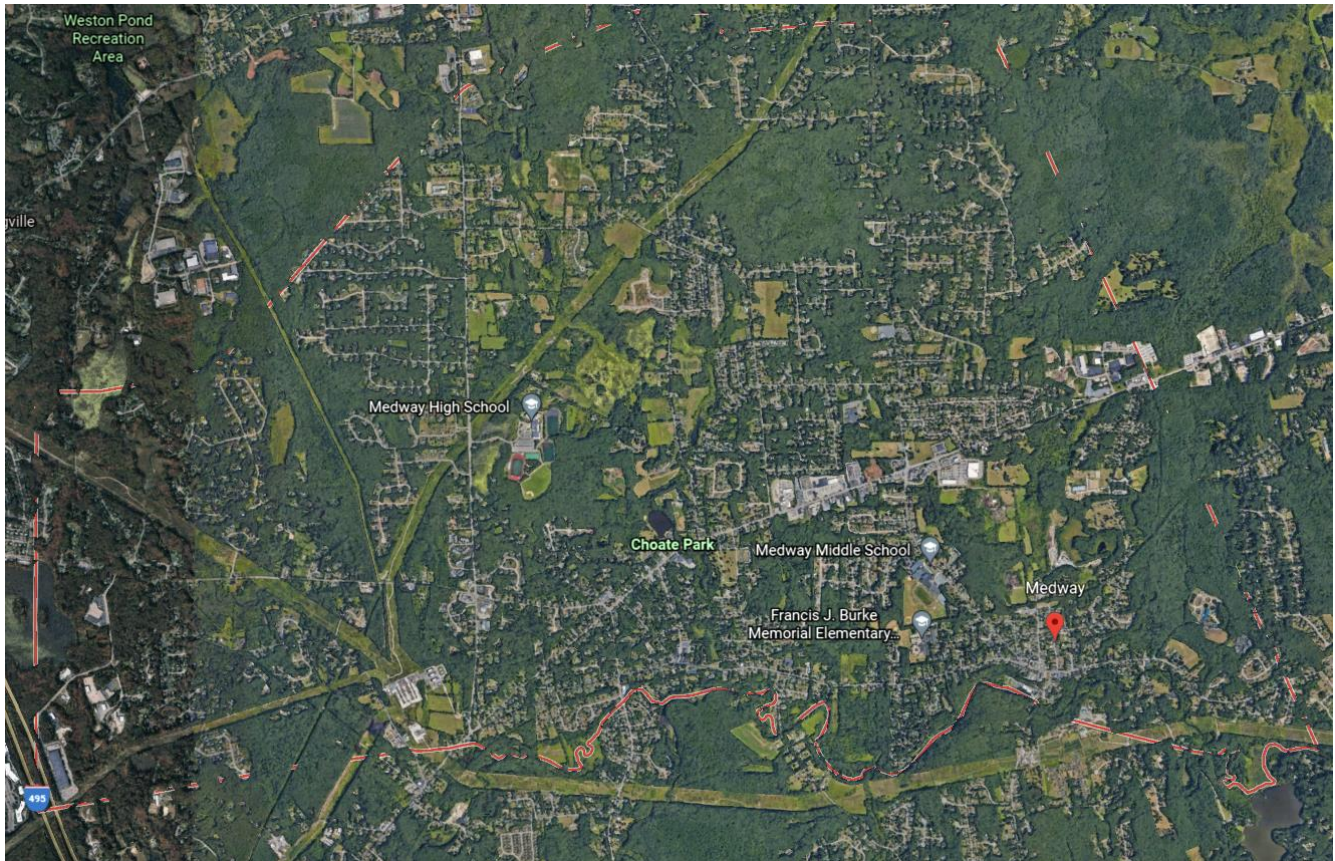
Town of Medway

Battery Energy Storage Consulting

Guidance for BESS Siting

Reference:

Rev | May 20, 2022



This report takes into account the particular instructions and requirements of our client. It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

Job number 285384-00

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1. Introduction

As part of the Town of Medway's ongoing efforts to enhance their knowledge of Battery Energy Storage Systems (BESS), this report has been prepared to summarize guidelines and technical information related to the siting of BESS facilities. The objective of the report is to provide technical information related to BESS siting which the Town can reference when considering how to implement BESS within their community. The Town is advised to carefully consider how the information provided in this memorandum could be modified to suit local conditions, comprehensive plans, and existing land use and zoning provisions. This information includes National and Federal Code reviews, Massachusetts state regulations, similar projects, and industry-leading manufacturers.

Although this report provides technical information, it builds off other work that has been performed and is not intended to be a complete reference. BESS installations are highly configurable and can be coordinated to provide stakeholders with a multitude of benefits. Like all energy infrastructure improvements, BESS units do have challenges that should be considered during the design and planning phases.

The report serves primarily as a review of lithium-ion (li-ion) batteries but will also touch on other battery chemistries where relevant to provide context.

2. Setback Distances and Separations

BESS to be installed shall be setback from buildings and property lines, hazardous materials a minimum distance. The setbacks shall be determined by the most restrictive of the following:

1. A minimum of 10 feet as described in NFPA 855
2. As defined in the Town of Medway Zoning Bylaw Section 6, Table 2 Dimensional and Density Regulation

The Zoning Board of Appeals may increase the minimum setback distance as appropriate based on site-specific considerations and technological innovations in the design of BESS systems.

BESS equipment separation shall be 3 feet, unless specifically approved by UL 9540A large-scale test results, as described in NFPA 855.

3. Noise Control

BESS facilities would be required to comply with the existing requirements within Medway Zoning Bylaw 7.3 Environmental Standards, D.2 which imparts restrictions on continuous noise measured both at the property line and at select Sensitive Receptors, as defined by the zoning bylaw. A site-specific noise study and evaluation could be used to evaluate compliance with Medway Zoning Bylaws. The noise study could be requested by the Town of Medway prior to zoning approval of a BESS project and should be in accordance with the provisions outlined in the Town of Medway Zoning Bylaw, Section 7.3.

Noise studies generally begin with noise measurements taken at the site to collect information on the ambient or baseline noise level. The expected noise generated is then calculated for the specific equipment to be located on site and compared against zoning regulations. It should be noted that the term "ambient noise" is defined within Medway Zoning Bylaw 7.3 Environmental Standards, D.2.

Potential sources of noise generation associated with BESS facilities include:

- **BESS cooling fans.** The primary source of noise generated by the facility when it is operational is the mechanical cooling fans that serve BESS containers. These fans are similar in size and operation to standard mechanical Heating, Ventilation and Air Conditioning (HVAC) units provided for buildings and are expected to generate similar levels of noise. Each outdoor BESS container would be expected to contain its own exhaust fan on the roof or sides of the container.
- **Electrical support infrastructure.** Electrical equipment will be needed to support BESS facilities. Electrical support equipment include transformers, substations, and the BESS units themselves.

Common methods to provide noise control for BESS and electrical facilities are described below.

- **Barriers or walls.** Barriers such as walls, deflectors, or noise-absorbing panels can be placed between noise-generating equipment and adjacent properties or locations where noise is a concern.
- **Separation distance.** Move noise-generating equipment away from sensitive receptors.
- **Site Location.** Locating BESS facilities within existing areas with high ambient noise levels will lessen the impact of a BESS facility on its surroundings.

Two common examples of noise barriers include product solutions and stick-built solutions.

- Product solutions are manufacturer-provided noise barriers designed to be placed between noise sources and sensitive receptors. Barriers typically are provided with absorptive materials or lightweight modular panels or louvers. An example of a product solution noise barrier is shown in **Figure 1**.



Figure 1: Example of Product Solution Noise Barrier¹

¹ Figure courtesy of <https://noisebarriers.com/barrier-walls.html>

- Stick-build solutions are constructed in-field and generally involve concrete, brick, or block wall construction that is designed to have low-performance sound transmission required to adequately isolate noise from the equipment to the surrounding environment. Weather-resistant sound absorbing material is normally provided on the interior wall face to control noise buildup within the enclosure or behind the barrier. Where Product solutions build this into the product, stick-built generally provide these materials on the inside of the walls. An example of a stick-built noise barrier is shown in **Figure 2**.

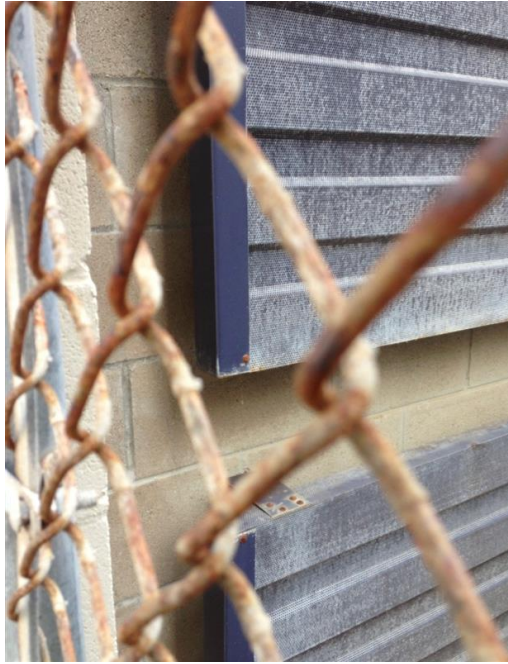


Figure 2: Example of Stick-Built Noise Barrier Solution²

The height of noise barriers is typically determined as a function of distance. The closer the noise-generating equipment is to property lines or other sensitive receptors, the taller the noise barrier will need to be in order to reduce noise generation at the point of measurement.

4. Feasibility of Electrical Interconnection

BESS facilities to be located and laid out to facilitate interconnection with the local utility or facility. Wherever possible incoming electrical feeders and connections should be below-grade. Below-grade connections result in higher overall levels of resiliency as above-ground connections could be impacted by storms, wind, and other environmental factors.

5. Vegetation Control

NFPA 855 requires the area for 10 feet surrounding BESS equipment to be cleared of combustible vegetation. The exception to this is for single specimens of trees, shrubs, or plants that may burn but would not otherwise lead to the uncontrolled spread of fire.

Acceptable ground coverings include well-manicured and maintained green grass or other types of non-combustible surfaces.

² Figure courtesy of Arup US, Inc.

6. Security and Impact Protection

BESS Facility shall comply with the National Electrical Code (NFPA 70) to limit access to authorized personnel. Equipment with voltage ratings above 1000 VAC shall have a physical barrier (e.g. fences, wall, equipment enclosures) which limits access to authorized personnel while adhering to regulations. Where the BESS components are susceptible to impacts from a vehicle, or equipment mitigation measures must be proposed to protect the BESS Facility.

Memorandum

To	Town of Medway
Date	May 20, 2022
Copies	
Reference number	285384-00
From	Geoff Gunn, P.E. Justin Roy, P.E. Mike Lepisto, P.E. Victoria Grimes, P.E.
File reference	Rev
Subject	Town of Medway BESS – Medway Grid EFSB Submission Technical Review

1. Introduction

As part of the Town of Medway’s ongoing efforts to enhance their knowledge of Battery Energy Storage Systems (BESS), this report has been prepared to summarize findings and comments on the BESS application submitted to the Massachusetts Energy Facilities Siting Board (EFSB) by Medway Grid, LLC, the developer seeking to design and install a 250 MW / 500 MWh BESS facility in the Town of Medway on a section of land comprising approximately 10.6 acres of land nearby the existing NSTAR Electric Company d/b/a Eversource Energy (Eversource) substation.

The objective of this memorandum is to provide high-level comments and findings on Medway Grid’s EFSB application as of March 9, 2022, and how it relates to technical BESS information discussed with the Town of Medway throughout the life cycle of this BESS project. Findings are grouped into three buckets:

1. Key Findings
2. Technical Considerations
3. Zoning Considerations

The Town is advised to carefully consider how the information provided in this memorandum could be utilized to suit local conditions, comprehensive plans, and existing land use and zoning provisions for Medway Grid’s BESS project.

1.1 Scope of Review

Arup’s review is based on the documents posted to the EFSB’s website on February 25, 2022, in support of the Medway Grid consolidated docket to construct a 250 MW Battery Energy Storage System in Medway, MA. Documents posted to the EFSB website after this date were not included in the review.

The comments and findings documented above were prepared for the use of the Town of Medway for review purposes with generally accepted engineering practices as they relate to BESS facilities and technology. Arup did not review detailed design documents for the Medway Grid project. We expect these to be reviewed at the local Town of Medway level during the local permitting process (building, electrical, mechanical, conservation commission, fire). Detailed design drawings were not provided as part of the Medway Grid EFSB application.

2. Key Findings

The following section documents the key findings from Arup’s review of Medway Grid’s EFSB submission.

1. In the EFSB submission attachment titled “2. D.P.U. 22-18 Chapter 40A Petition,” Medway Grid has provided a table listing four (4) Town of Medway Zoning bylaws the project is intending to seek an exemption on as part of the EFSB process. This table is provided in **Figure 1** below for reference.

The following table summarizes the individual zoning exemptions requested:

LIST OF ZONING EXEMPTIONS SOUGHT

Provision	Description	Zoning Relief	Rationale for Seeking Exemption
§§ 5.1(A), 5.2(A), 5.2(B), 5.4, Table 1: Schedule of Uses	Proposed use not allowed in ARII district	None available	Zoning Bylaw expressly prohibits the granting of use variances and, therefore, an exemption from the operation of the prohibition in Sections 5.1(A), 5.2(A), 5.4, and Table 1: Schedule of Uses is <i>per se</i> required.
§6.1; Table 2 of the Town Zoning Bylaw	Proposed height not allowed in ARII district	None available	Zoning Bylaw states that structures in the AR-II zone may not exceed 35’ in height. There are some components of the project substation that meet the definition of structures and will exceed this height limit
6.2 (c)	Lot “shape factor”	Variance	The Bylaw requires a lot “shape factor” of 22 or less. Given the size and shape of the Site, the “shape factor” may exceed the maximum permitted. It is difficult/impossible to demonstrate the existence of unique conditions for grant of a variance and even if granted they are susceptible to appeal. To avoid the legal uncertainty, potential for adverse interpretations, delay, burden and undue expense associated with obtaining a variance, the Company requests an exemption.
§ 7.3 Hazards	Uses that produce excessive noise are prohibited	Variance	Even with design to reduce noise sources and additional noise mitigation, whether sound emitting during the construction and operation of the Project is “excessive” or constitutes a “nuisance or hazard” is subjective. To ensure the Company’s compliance with Section 7.3 a variance would be required. To avoid the legal uncertainty, potential for adverse interpretations, delay, burden and undue expense associated with obtaining a variance, the Company requests an exemption.

Figure 1: List of Zoning Exemptions Sought

- a. We recommend that the Town of Medway review the zoning exemptions with respect to Town of Medway zoning requirements.
 - b. Relating to Zoning Exemption #3, Medway grid is seeking relief or waiver for a restriction related to a maximum height of 35 feet per the Town of Medway zoning bylaw, specifically around the project substation area. The following findings relate to this exception request:
 - i. It does not appear from the BESS site layout that the 345 kV transformer onsite is surrounded by blast walls. Typical blast walls exceed 30 feet in height.
 - ii. Given the projected voltage level of the substation, we expect the following to exceed the 35 feet:
 1. The bushings of the transformer on the high voltage side can reach 15 feet in length excluding the height of the transformer itself which could be in the range of 20 feet with concrete pedestal. There is limited engineering and design configurations available to limit this height.
 2. The 345 kV three phase lines leaving the transformer bushings are connected to a circuit breaker before they typically traverse via an overhead line gantry dropper where thereafter the lines further traverse into underground cables. The gantry at this voltage level may exceed 35 feet. An option in typical substation design includes using a gas insulated switchgear (GIS) for a more compact design overall that can limit height of the gantry at a 30%+ increase.
 3. Overall, the design approach proposed by Medway Grid for the substation is considered standard and typical for utility applications of similar voltage levels.
 - c. We recommend that a detailed third-party review be completed on the noise study supporting Medway Grid's request for noise zoning exemption.
2. The Medway Grid petition lists the permits and regulatory reviews that will be sought for the project in Table 3-1 (shown below in **Figure 2**). The following findings and comments are related to those attributed to Local regulation from the Town of Medway.

Table 3-1: List of Permits/Regulatory Reviews Required

Regulatory Authority	Permit/Review/Approval	Status and Anticipated Timeframe
FEDERAL		
Environmental Protection Agency	NPDES General Permit for Discharges from Construction Activities	Anticipate filing Notice of Intent in December 2023
STATE		
Massachusetts Energy Facilities Siting Board	Medway Grid, LLC, Pursuant to G.L. c. 164, § 69J ¼ for Approval to Construct a 250-MW BESS	Filed on February 25, 2022
Massachusetts Energy Facilities Siting Board	Medway Grid, LLC, Pursuant to G.L. c. 164 § 72 for Approval to Construct a new 345kV Transmission Line	Filed on February 25, 2022
Massachusetts Department of Public Utilities	Medway Grid, LLC, Pursuant to G.L. Chapter 40A§ 3 for Comprehensive Zoning Exemption	Filed on February 25, 2022
Massachusetts Environmental Policy Act (MEPA) Office	Expanded Environmental Notification Form (EENF) and Environmental Impact Report pursuant to 309 CMR 11.03(7)(1)	Filed EENF on January 28, 2022
Massachusetts Historic Commission	Project Notification Form	MHC Review in Process (since Dec. 3, 2021)
LOCAL		
Medway Conservation Commission	Wetlands Protection Act Order of Conditions Local Wetland Bylaw Order of Conditions Land Disturbance Permit	Anticipate filing Notice of Intent by September 2022
Medway Inspectional Services Department	Building Permit Electrical Permit Mechanical Permit Demolition Permit	Anticipate applications to be submitted by December 2022
Medway Fire Department	Above Ground Storage Tank Removal Permit	Anticipate filing December 2022
Medway DPW	Street Opening Permit	Anticipate filing December 2022

Figure 2: Medway Grid EFSB Petition Table 3-1

- a. Table 3-1 of the EFSB application, List of Permits/Regulatory Reviews does not include the Fire Permit issued by the Medway Fire Department to install and operate energy storage systems having capacities greater than the capacities listed in Table 51.3.1 of 527 CMR 1.0, the Massachusetts Comprehensive Fire Safety Code. A Fire Permit is required per Table 1.12.8.32 of 527 CMR 1.00. The proposed Medway Grid BESS system exceeds the threshold capacity that would require a permit.

The Fire Permit is the key channel that will be used to document facility compliance with safety standards including 527 CMR and NFPA 855. UL 9540A failure test data

- b. A draft copy of the Emergency Response and Operations Plan has been provided as an attachment to the EFSB submission. Medway Grid notes that the project team has been working with the Medway Fire Department to seek input into this plan. We recommend conferring with the Medway Fire Department to better understand the steps that have been taken to this point. The Emergency Response and Operations Plan will be incorporated into the Fire Department Permit approval for the project.
- c. Section 5.0 on Battery Safety notes that the BESS system is in compliance with both UL 9540, a listing applicable to the BESS system, as well as UL 9540A, failure testing. **It is strongly recommended that the Town of Medway requests that Medway Grid provide the appropriate UL 9540 listing and UL 9540A test data as part of the required Fire Permit per 527 CMR Table 1.12.8.32.**

UL 9540A test data will inform critical design requirements, including separation distances between BESS arrays (arrays are groupings of battery modules), BESS outdoor containers, and nearby life safety adjacencies such as lot lines, buildings, or other combustible materials. Site compliance cannot be confirmed at this point without the UL 9540A testing data, highlighting the criticality of the facility developer and BESS manufacturer providing the appropriate UL 9540A test data as part of the required Fire Permit.

- d. We recommend that the Town of Medway ensures the Town has the authority to act as an *approver* as opposed to a *reviewer* for the Local permits and reviews listed in Table 3-1 of the EFSB application. We further recommend that the Town of Medway review this table for additional permits or reviews that may apply based on Town-specific regulations and bylaws.
3. It is noted that decommissioning the BESS facility was not discussed in Medway Grid's EFSB petition. It is uncommon at this point in the project lifecycle for decommissioning plans to be developed, but it is recommended that the Town of Medway request more information on decommissioning if this is a topic of concern.

3. Technical Considerations

The following section documents technical considerations that were noted by Arup's review of Medway Grid's EFSB submission. Please note that the numerical assignment of findings is continued from the previous section of this memorandum.

4. The following findings and comments relate to Section 4, Environmental Impacts and Mitigation Measures, of Medway Grid's EFSB application:
 - a. Section 4.1, Air Quality/Emissions, of Medway Grid's EFSB application references "technology performance standards." It is recommended that the Town of Medway request additional information from Medway Grid on the technology performance standards as they relate to the context in Section 4.1.
 - b. Section 4.2, Water Resources/Supply, of Medway Grid's EFSB application notes that the project will include the installation of 5 hydrants for fire fighting operations. It is recommended that the Town of Medway confirm that the number and location of provided hydrants is approved by Medway Fire Department during the Fire Department Permit approval process.
5. The following findings and comments relate to Section 5, Battery Safety, of Medway Grid's EFSB application:
 - c. Section 5.1, Safety Standards, of Medway Grid's EFSB application notes that the project is in compliance with NFPA 855. It is recommended that the Town of Medway require Medway Grid to provide documentation of project compliance with NFPA 855 and 527 CMR 1.00 as part of the Fire Department Permit required by 572 CMR Table 1.12.8.32.
 - d. Section 5.1, Safety Standards, of Medway Grid's EFSB application lists UL 1973 Standard for Batteries for Use in Light Electric Rail (LER) Applications and Stationary Applications as a safety requirement standard that the BESS will adhere to. Medway Grid notes that UL 1973 "requires that an Energy Storage System (ESS) is not allowed to be an explosion hazard when exposed to an external fire source and that a single cell failure will not result in a cascading thermal runaway of cells."

UL 1973 does not test for thermal runaway of battery cells. UL 9540A would be the appropriate test methodology to determine the extent of thermal runaway propagation in a BESS.
 - e. Section 5.2, Mitigation, Hazard Control and Local Coordination, of Medway Grid's EFSB application notes that the BESS that abnormal operation is monitored and provided with automatic shutdown capabilities. It is recommended that the emergency shut down operations are reviewed as part of the Fire Department Permit required by 572 CMR Table 1.12.8.32.

4. Zoning Considerations

The following section reviews the zoning bylaw outline previously provided as part of Task 3 of this BESS consultancy project against the information included in Medway Grid's EFSB application.

The intent is to provide a relevant section of Medway Grid's EFSB package where information related to zoning is provided. We recommend that the Town of Medway review these sections to compare them against relevant zoning requirements or implications.

Table 1: BESS Zoning Considerations Comparison

Typical Zoning Content	Medway Grid EFSB Application Section, if applicable
Authority	See Medway Grid EFSB Petition Section 3.6, Table 3-1
Purpose	See Medway Grid EFSB Petition Section 8.0; Page 5 Item 5
Application	See Medway Grid EFSB Petition Page 2 Item 1
General Requirements – Building, Electrical, Mechanical, Demolition	See Medway Grid EFSB Petition Table 3-1
General Requirements – Fire	No applicable section
General Requirements – Required Documentation	No applicable section
Siting Standards	See Medway Grid EFSB Petition Section 4.0; Section 5.0
Design Standards	See Medway Grid EFSB Petition Section 5.0
Safety and Environmental Standards	See Medway Grid EFSB Petition Section 4.0; Section 5.0
Monitor and Maintenance	No applicable section
Decommissioning	No applicable section
Procedures	See Medway Grid EFSB Petition Table 3-1
Terms of Special Permit	No applicable section
Permit Time Frame and Abandonment	No applicable section
Enforcement	See Medway Grid EFSB Petition Table 3-1
Severability	No applicable section