Weston & Sampson[SM]

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REPORT

November 2020

CITY OF
Melrose
MASSACHUSETTS

Salt Shed Assessment Report

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1.0 INTRODUCTION

Within the following report, Weston & Sampson provides an assessment of the City's existing salt shed located at 72 Tremont Street, and performs an alternatives analysis that describes and compares the benefits and disadvantages between three different salt shed designs. Weston & Sampson also investigates the possible addition of salt shed accessories that include a portable loading ramp, brine spray system, and lean-to canopy, which all provide potential benefits to the DPW snow fighting operations.

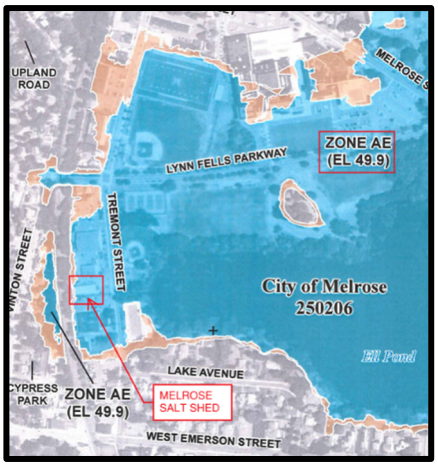
After observing the existing salt shed, it was determined the re-use or renovation of the existing salt shed is not recommended due to the amount and nature of the deficiencies needed to be addressed. Additional details on the Structural Engineer's existing salt shed assessment are provided in the existing conditions memo, found in Appendix A.

The DPW yard is located approximately 200 ft west of Ell Pond and falls within the 100-year flood plain as defined by the most recent FEMA Flood Insurance Rate Map. Since the City may construct a new salt shed to replace the existing salt shed, Weston & Sampson reviewed the applicable regulations regarding the construction of new structures within a flood hazard area, and provides a summary describing how these regulations may affect the replacement of the existing salt shed. The summary of Weston & Sampson's findings can be found in Section 2 of this report.

To date, Weston & Sampson has conducted multiple meetings and site visits with the City and has performed observations, wetland delineation, and site survey at the City Yard. The alternatives selected for analysis herein are based on the information gathered at the Melrose site, along with extensive experience by the Weston & Sampson project team with salt sheds, DPW operations and facility design.

The three salt shed replacement alternatives that were considered include a new gable salt shed, fabric salt shed, and a high arch gambrel style salt shed structure. Each option would meet the property line setbacks and height restrictions for the Rail Corridor Overlay District as described in the Melrose Zoning Ordinance, and as shown on the zoning map found in Appendix D. Summaries and estimated construction costs for each alternative are provided in Section 3 below. The costs that are provided in this report are preliminary concept level estimates and will need to be verified through the ongoing design process and geotechnical evaluation.

2.0 FLOOD PLAIN ASSESSMENT



The Melrose DPW yard is located at 72 Tremont Street, which is approximately 200 ft West of Ell Pond. The land around Ell Pond is associated with a 100-year flood plain with an elevation of 49.9 ft according to the most recent FEMA Flood Insurance Rate Map dated 2018. A copy of the flood map can be found in Appendix E.

According to the current Massachusetts Building Code, 780 CMR 9th edition, the design and construction of buildings located within flood hazard areas shall be in accordance with ASCE 24-14. ASCE provides minimum elevations for the lowest floor of buildings relative to the base flood elevation corresponding to the flood class design of the building.

Flood Design Class 1 applies to buildings or structures that normally are unoccupied and pose minimal risk to the public or minimal disruption to the community should they be damaged or fail due to flooding. Examples include temporary structures, accessory storage buildings and minor storage facilities. It is Weston & Sampson's opinion that the Melrose salt shed falls under the above definition of a Flood Design Class 1, allowing the new salt shed to match the existing finished floor elevation of approximately 47.75 ft, which is below the 100 year flood elevation of 49.9 ft, provided that the salt shed is constructed from flood damage-resistant materials such as concrete or pressure treated wood. An existing conditions plan showing the location of the existing salt shed relative to the 49.9 ft flood plain elevation can be found in Appendix B.

All three of the following salt shed options are designed with flood damage-resistant materials that meet the requirement for new structures built within flood hazard zones. It is recommended that the city pursues additional measures to address a potential flood, such as the deployment of sandbags or a water-gate flood barrier to provide protection for the salt shed end entrance.

3.0 SALT SHED REPLACEMENT COMPARISON

For the replacement of the existing salt shed, three distinctive design options were considered. Below are descriptions and summaries for each option.

3.1 Option 1 - Gable End Salt Shed

The gable end structure is a wood building with a metal roof similar in design to the existing salt shed. The structure would match the 100 ft by 40 ft footprint of the existing salt shed with an overall building height of approximately 30 ft. The front of the shed will have a 16 ft wide by 20 ft tall opening in the front of the shed matching the existing salt shed. The structure includes 6 ft tall pressure treated wood push walls and provides a storage capacity of approximately 1,200 tons of salt when fully loaded. The estimated initial capital costs for this structure is approximately $1,008,600 which includes construction contingency. For a detailed breakdown of the estimated concept level costs see Appendix C. The expected useful life span for this salt shed design is approximately 35 years based on information provided by the salt shed supplier and industry standards.

The gable end salt shed design would provide the following benefits and disadvantages, compared to the other two salt shed options, as described below:

Benefits

- Provides a solid wood structure with a metal roof which is more durable than the fabric structure.

Disadvantages

- Roof trusses are more prone to damage by loaders due to low height, which will lead to more maintenance costs associated with the ownership of this style of salt shed throughout the life of the shed. Similar damage can be seen in the existing salt shed.
- The 6 ft tall wood push walls require the building footprint to be larger than the high arch gambrel salt shed to achieve the minimum storage capacity of 1,200 tons of salt.
- Requires the highest initial capital cost.
- Requires salt deliveries to be dumped outside of the salt shed, which requires double handling of the product to load it into the salt shed. This also increases the possibility of residual salt being left behind outside the structure, which can enter the stormwater system.

3.2 Option 2 - Fabric Structure

The fabric structure salt shed is made from a galvanized steel frame wrapped in a heavy-duty fabric that sits on top of a 6 ft tall concrete block wall. To provide additional protection from the salt environment, the entire steel framework is galvanized after fabrication, providing a stronger zinc coating that prevents the steel frame from rusting in the corrosive environment of the salt shed. The fabric salt shed would have a 16 ft wide by 20 ft tall opening in the front to match the existing shed. The fabric salt shed would match the 100 ft by 40 ft footprint of the existing shed with an overall height of approximately 31 ft. The fabric salt shed structure would hold approximately 1,200 tons of salt when fully loaded. The estimated initial capital cost for this structure is approximately $705,900. For a detailed breakdown of the estimated conceptual costs see Appendix C. The expected useful life span for steel frame and concrete block wall is approximately 35 years, with periodic replacement of the fabric cover, based on information provided by the salt shed supplier.

The fabric structure salt shed design would provide the following benefits and disadvantages, compared to the other two salt shed options:

Benefits

- Lowest initial capital cost.
- Requires less soil excavation because the concrete block walls do not require a full depth foundation.
- The sidewalls are constructed with concrete block walls which are very durable.

Disadvantages

- The steel superstructure is more prone to damage from equipment due to the low height, which will lead to more maintenance costs associated with the ownership of this style of salt shed. Small rips in the salt shed fabric, if gone unnoticed, can lead to extensive damage causing the need for the replacement of the entire fabric cover.
- The fabric cover of the salt shed will need periodic replacement. The manufacturer states that the cover may need to be replaced every 15-20 years if it is not accidentally damaged earlier from DPW operations. The manufacturer estimates that the replacement of the fabric cover would cost around $10,000 which includes materials and labor.
- The 6 ft tall concrete block push walls require the building footprint to be larger than the high arch gambrel salt shed to achieve the minimum storage capacity of 1,200 tons of salt.
- The fabric salt shed could be designed to accommodate solar panels in the future, however every time the fabric cover needs to be replaced the solar panels would need to be taken down to allow the cover to be removed and replaced, which would add additional costs above the $10,000 replacement cost for the fabric cover.

3.3 Option 3 - High Arch Gambrel Salt Shed

A high-arch gambrel salt shed is a wood structure with a metal roof provided with 12 ft tall pressure treated wood push walls with an overall building height of approximately 40 ft. The high arch gambrel salt shed would have a footprint of 72 ft by 40 ft, which is approximately 28 ft shorter than the existing salt shed building, with a salt storage capacity of approximately 1,300 tons when fully loaded. The high arch gambrel would provide an interior vertical clearance of 30 ft including a 16 ft wide and 30 ft tall entrance way. The estimated initial capital cost for this structure is approximately $911,800. For a detailed breakdown of the estimated conceptual costs see Appendix C. The expected useful life span for this salt shed design is greater than 35 years, based on information from the salt shed supplier and industry standards.

The high arch gambrel salt shed design would provide the following benefits and disadvantages, compared to the other two salt shed options:

Benefits

- The 30 ft interior clearance provided by the high arch gambrel greatly reduces the risk of damage to interior roof trusses, which minimizes the potential for future maintenance due to damage throughout the life span of the structure.
- The 30 ft interior clearance allows salt deliveries to be dumped directly into the salt shed, which would lead to annual savings by eliminating the need for double handling of product, and reduces the potential for salt run-off leaving the site.
- The 12 ft tall push walls allow the structure to store the required 1,200 tons of salt within a much smaller building footprint. The reduced footprint would provide approximately 1,100 square feet of additional yard area that the DPW could allocate for another purpose, which would help alleviate some of the operational constraints that are associated with having a crowded yard area.
- The reduced footprint would allow for the possible addition of a lean-to canopy off the rear of the salt shed, which would provide an additional covered storage area to be utilized by the DPW. The addition of the rear lean-to is estimated to cost approximately $65,000.

Disadvantages

- The high arch gambrel salt shed would require a more expensive initial capital cost compared to the fabric structure.

4.0 SALT SHED ASSESSORIES

4.1 Brine Spray System - $50,200

In discussions with the DPW, a product called Magic Minus Zero is used to treat the salt stored in the salt shed. Treating the salt with this product allows the DPW to reduce the amount of salt applied to the roads during a snow storm, as this product allows the salt to stay on the road better by reducing bounce and scatter. The product also helps to melt the ice at lower temperatures. The addition of a brine spray system would reduce the amount of time it takes to treat the salt with the Magic Minus product.

4.2 Portable Loading Ramp - $52,700

Loading ramps allow operators to see into the back of plow trucks, allowing them to load salt more accurately into the sander bodies, reducing the potential for losing salt during the loading process.

Currently the Melrose DPW yard does not have a loading ramp. Due to the tight working areas on the site, it does not make sense to install a permanent loading ramp, as it would not be used during the non-snow fighting season and would take up valuable space. Weston & Sampson investigated the possibility of providing a portable loading ramp that could be installed at the beginning of the snow fighting season and taken down during the rest of the year. A possible solution was found in a product sold by Nation Ramps, as shown in the picture to the right. The addition of this ramp would be beneficial to the salt loading operations performed by the DPW.

4.3 Lean-to Canopy - $65,100

With the high arch gambrel option there is the possibility to install a rear facing lean-to canopy like what is shown in the picture on the right. The addition of the canopy would allow the additional space, provided by the reduced footprint of the high arch gambrel, to be under a roof that would provide protection from the elements for equipment or materials.

5.0 CONCLUSION

After analyzing and discussing the various salt shed replacement options with the DPW, it is recommended that the City replace the existing salt shed with a high-arch gambrel style salt shed, as this design provides the most benefits for the City and DPW operations. This design requires the least amount of maintenance, reduces operational costs, and provides additional yard space which allows flexibility for the use and operation of the DPW yard. The estimated total base project cost for the high arch gambrel salt shed is approximately $986,800, excluding the addition of a portable loading ramp, brine spray system, and a rear canopy lean-too. This cost includes the approximate $911,800 construction cost mentioned above, along with additional design, construction administration services, and contingency as detailed in Appendix C. The additional design costs would only apply if ground improvements are required on the site. During our site walk it was mentioned that the facility was built over a buried peat layer associated with former wetlands in the area, which would require the design and installation of ground improvements, such as rammed aggregate piers. This will be verified during the geotechnical investigation. For early planning purposes, an allowance for a ground improvement program is included in the concept level cost estimates for all structures.

In addition to the salt shed structure itself, the additional options discussed above should be considered to optimize operations. The loading ramp would provide better visibility to the loader operator, minimizing the potential for losing salt while transferring into the back of plow trucks. The brine spray system would allow the City to mix the Magic Minus Plus product with the salt more efficiently, saving on operational costs. The lean-to canopy would allow the DPW to store additional equipment under cover, which provides protection from the weather for equipment currently stored outdoors. With the addition of these recommended accessories, the total estimated project cost would be approximately $1,154,700, which is in addition to the design cost already allocated. (see Appendix C for more details).

APPENDIX A

Existing Salt Shed Assessment Memo

November 13, 2020

Jamie Fair, P.E.
Facilities Senior Team Leader
55 Walker Brook Drive, Reading, MA

Dear Jamie,

The Melrose DPW Salt Shed is a timber framed structure with timber columns, walls, and prefabricated trusses. The building is approximately 40ft Wide by 100ft Long and approximately 30ft High. The structure was built in 1974 and is used is to store and treat salt. The structure appears to have gone through a number of repairs throughout its lifetime. The following structural deficiencies were identified.

1. Damaged Metal Roofing (A number of holes leading to water intrusion)
2. Damaged Louvers at front and rear of the building
3. Checking/splitting in timber siding, holes in siding
4. Painted timber siding is peeling/chipping
5. Bowing of timber siding at base of walls
6. Trim at roof level is deteriorating or missing (Some trim has been replaced)
7. Corrosion in steel connections at that joining the timber columns to the foundation
8. Minor spalling in concrete foundations
9. Damaged prefabricated timber trusses (Some chords of the trusses have been sistered)
10. Damaged/missing truss bracing
11. Timber push wall are significantly deteriorated
12. Rotting/abrasion damage to interior wall panels
13. Abrasion damage to exterior kickers
14. Entire backwall of building is bowing and/or had completely failed.
15. Damaged exterior lights
16. Damaged Lintel at front of building

The list above outlines structural items that should be addressed as soon as practical and the trusses and bracing shall be investigated further as this is potentially a hazardous condition. Note that the evaluation is based on visual observation from the ground level. No structural calculations were performed. Photos outlining some of these deficiencies are attached below. Considering the amount and nature of the deficiencies, it is our recommendation to completely replace the structure in lieu of trying to repair/address all these issues. We recommend follow-up site visits by a design professional every three to six months to monitor deterioration.

Please reach out with any questions, westernc@wseinc.com, 508-698-3034 x7427.

Thanks,

Connor Western, P.E.
Senior Project Engineer

cc. Nate Seifert, P.E., Structural Buildings Group, Team Leader

Photo 1: Sistered/damaged timber trusses and bracing

Photo 2: Corroded steel foundation connection at entrance

Photo 3: Holes in metal roof with plywood repair. Replaced bracing and wall panel

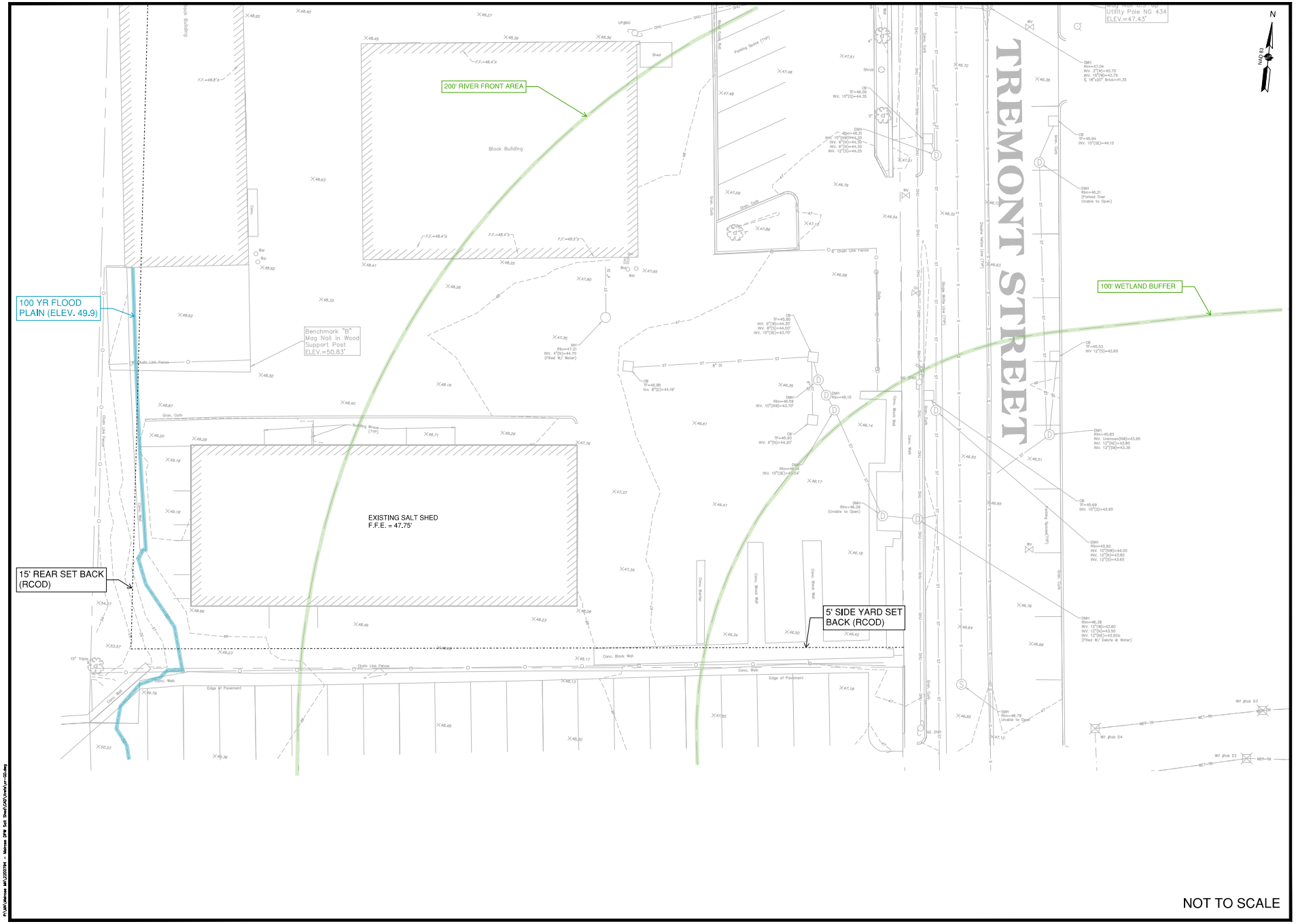
Photo 4: Typical deteriorated/damaged exterior wall panel

Photo 5: Failed/missing back wall panel

Photo 6: Damaged trim work and damaged louvers

APPENDIX B

Existing Conditions Site Plan



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No.	Date	Dr.By	Ck.By	App.By	Description
		A	P	P	R O V E D

REGISTERED PROFESSIONAL ENGINEER

DATE

MELROSE DEPARTMENT OF PUBLIC WORKS
72 TREMONT ST, MELROSE, MA 02176

SALT SHED REPLACEMENT PROJECT

CADD NO.	SCALE:	CONTRACT:	JOB NO. 2200794	DR.BY TJC	DSN.BY TJC	CHK.BY ZDW	APP.BY JRF
	-	-					

FILE NO.

SHEET OF

P:\MA\Melrose MA\2200794 - Melrose DPW Salt Shed\CAD\Civil\Civil-02.dwg

APPENDIX C

Conceptual Cost Estimates

Melrose Salt Shed Conceptual Total Project Cost Estimate
11/20/2020
New Gable End Salt Shed - 6' Tall Wood Push Walls
(40' x 100' / 4000 SF , Stores Approx. 1,200 Tons of Salt Completely Full)

CONSTRUCTION			
Item		**Cost**	**Source**
SALT SHED BUILDING COSTS			
Concrete Footings	$	27,396	Estimate derived from AST pricing information
Wall Panel & Bracing	$	113,798	Estimate derived from AST pricing information
Trusses	$	116,959	Estimate derived from AST pricing information
Plywood Roof	$	21,074	Estimate derived from AST pricing information
Trim	$	8,429	Estimate derived from AST pricing information
Paint	$	12,644	Estimate derived from AST pricing information
Metal Roof (FSB)	$	60,700	Estimate derived from AST pricing information
Salt Shed Building Sub Total	$	361,000	
ADDITIONAL CONSTRUCTION COSTS			
Demo Existing Salt Shed	$	28,000	Shrewsbury Bid results
Soil Disposal Allowance	$	50,600	Assumes soil disposed at off site as daily cover at landfill, not contaminated
Dewatering	$	10,000	Allowance, groundwater not contaminated
Additional site development/grading allowance	$	20,000	Allowance
Excavation and backfill of foundations	$	25,000	From Raynham
Subbase preparations	$	10,000	From Raynham
Pavement	$	30,000	Assumes 9,000 sqft of paving, 5-inches thick (3" base, 2" top), $110 per ton
Gravel Borrow	$	14,000	Assumes 14-inches beneath pavement at 35$ CY
Ground Improvements	$	120,000	Shrewsbury Bid results
Electrical Work (FSB)	$	24,000	Shrewsbury Bid results
Additional Construction Cost Sub Total	$	331,600	
Subtotal Construction Cost	$	692,600	
MARK UPS			
Bonds & Insurance	$	18,492	Assume 2.67% (based from Raynham)
General Conditions/Supervision	$	39,547	Assume 5.71% (based from Raynham)
Contractor Overhead and Profit	$	76,186	Assume 11% (based from Raynham)
Design and Estimating Contingency 10%	$	69,260	Allowance to account for items that may come up during design
ENR Adjusted 1.51% (October 2020 - April 2021)	$	13,531	One year of inflation estimate
Subtotal of Mark Ups	$	217,017	
Subtotal Construction Cost with Mark Ups	$	909,617	Excludes Construction Contingency
10% Construction Contingency	$	90,962	Allowance for unexpected items that may come up during construction
Electrical Back Charge By Power Company	$	8,000	(if needed)
TOTAL CONSTRUCTION COST ESTIMATE	**$**	**1,008,578**	**Includes Contingency and Back Charge**

Add Brine Spray System			
Ceiling Mounted Brine Spray System	$	40,000	Allowance based on quoted from GVM Calcote
Project mark up (25.5%)	$	10,200	
Total for Brine system	$	50,200	

Add Loading Ramp			
Galvanized steel Loading Ramp	$	42,000	Base on quote from Nation Ramps
Project mark up (25.5%)	$	10,710	
Total for Loading Ramp	$	52,710	

DESIGN, PERMITTING, SPECIAL SERVICES, AND CONSTRUCTION ADMINISTRATION			
Item		**Cost**	**Source**
Construction Admin	$	36,000	Allowance (excludes ground improvements and soil contamination issues)
Geotechnical Ground Improvements Design and Construction Services	$	24,000	Allowance
Brine System Ceiling Spray Design	$	5,000	Allowance
Total Design, Permitting, Special Services, Const. Admin.	$	65,000	

Owners Contingency	$	10,000	Additional funding for testing/engineering/permitting services, if needed

Total Project Cost	**$**	**1,083,578**	**See assumptions below**

Including Brine Spray System	**$**	**1,133,778**
Including loading ramp	**$**	**1,136,288**
Including both Spray System and Loading Ramp	**$**	**1,186,488**

Notes/Assumptions:

1. Impervious area of the site does not increase and stormwater infiltration is not required.
2. Costs assume there are no WBE/MBE requirements.
3. Includes entire structure, MA DCAM Certified GC costs, foundation, metal roof (filed sub bid contractor), lights and electrical work (filed sub bid contractor)
4. Assumes 6' tall pressure treated heavy duty timber framed salt shed side walls.
5. Costs are conceptual for initial planning purposes and will be verified during design.
6. New salt shed will occupy the footprint of the existing salt shed, and will be a gable end structure, with power source from panel in existing DPW building.
7. Assumes ground improvements are needed
8. Assumes there are no MBTA permits or restrictions.
9. Assumes asphalt floor inside the salt shed, which is the standard .
10. Assumes competitive bid market with at least 3 separate bids submitted.
11. Assumes no additional measures are required to protect salt shed from 100 year flood

Melrose Salt Shed Conceptual Total Project Cost Estimate
11/20/2020
New Fabric Salt Shed - 6' Tall Concrete Block Push Walls
(40' x 100' / 4000 SF , Stores Approx. 1,200 Tons of Salt Completely Full)

CONSTRUCTION			
Item		**Cost**	**Source**
SALT SHED BUILDING COSTS			
Salt Shed Structure	$	190,000	Estimate provided by Iron Horse Structure
Salt Shed Building Sub Total	$	190,000	
ADDITIONAL CONSTRUCTION COSTS			
Demo Existing Salt Shed	$	28,000	Shrewsbury Bid results
Soil Disposal Allowance	$	47,100	Assumes soil disposed at off site as daily cover at landfill, not contaminated
Dewatering	$	-	Not required based on not having to dig foundations
Additional site development/grading allowance	$	20,000	Allowance
Subbase Preparation	$	10,000	From Raynham
Pavement	$	30,000	Assumes 9,000 sqft of paving, 5-inches thick (3" base, 2" top), $110 per tor
Gravel Borrow	$	14,000	Assumes 14-inches beneath pavement at 35$ CY
Ground Improvements	$	120,000	Shrewsbury Bid results
Electrical Work (FSB)	$	24,000	Shrewsbury Bid results
Additional Construction Cost Sub Total	$	293,100	
Subtotal Construction Cost	$	483,100	
MARK UPS			
Bonds & Insurance	$	12,899	Assume 2.67% (based from Raynham)
General Conditions/Supervision	$	27,585	Assume 5.71% (based from Raynham
Contractor Overhead and Profit	$	53,141	Assume 11% (based from Raynham)
Design and Estimating Contingency 10%	$	48,310	Allowance to account for items that may come up during design
ENR Adjusted 1.51% (October 2020 - April 2021)	$	9,438	One year of inflation estimate
Subtotal of Mark Ups	$	151,373	
Subtotal Construction Cost with Mark Ups	$	634,473	Excludes Construction Contingency
10% Construction Contingency	$	63,447	Allowance for unexpected items that may come up during construction
Electrical Back Charge By Power Company	$	8,000	(if needed)
TOTAL CONSTRUCTION COST ESTIMATE	**$**	**705,920**	**Includes Contingency and Back Charge**

Add Brine Spray System			
Ceiling Mounted Brine Spray System	$	40,000	Allowance based on quoted from GVM Calcote
Project mark up (25.5%)	$	10,200	
Total for Brine system	$	50,200	

Add Loading Ramp			
Galvanized steel Loading Ramp	$	42,000	Base on quote from Nation Ramps
Project mark up (25.5%)	$	10,710	
Total for Loading Ramp	$	52,710	

DESIGN, PERMITTING, SPECIAL SERVICES, AND CONSTRUCTION ADMINISTRATION			
Item		**Cost**	**Source**
Construction Admin	$	36,000	Allowance (excludes ground improvements and soil contamination issues)
Geotechnical Ground Improvements Design and Construction Services	$	24,000	Allowance
Brine System Ceiling Spray Design	$	5,000	Allowance
Total Design, Permitting, Special Services, Const. Admin.	$	65,000	

Owners Contingency	$	10,000	Additional funding for testing/engineering/permitting services, if needed

Total Project Cost	**$**	**780,920**	**See assumptions below**

Including the Brine Spray System	**$**	**831,120**
Including the loading Ramp	**$**	**833,630**
Including both the Brine Spray System and Loading ramp	**$**	**883,830**

Notes/Assumptions:

1. Impervious area of the site does not increase and stormwater infiltration is not required.
2. Costs assume there are no WBE/MBE requirements.
3. Includes entire structure, MA DCAM Certified GC costs, lights and electrical FSB work (filed sub bid contractor)
4. Assumes 12' tall pressure treated heavy duty timber framed salt shed side walls and cast in-place concrete front wall; approx. 30' clearance at end entrance to allow salt trailers to exit with trailer in and allows dumping of salt deliveries inside the salt shed.
5. Costs are conceptual for initial planning purposes and will be verified during design.
6. New salt shed be located in same location as the existing salt shed, and will be a fabric style salt shed, with power source from panel in existing DPW building.
7. Assumes ground improvements are needed
8. Assumes there are no MBTA permits or restrictions.
9. Assumes asphalt floor inside the salt shed, which is the standard .
11. Assumes no additional measures are required to protect salt shed from 100 year flooc

Melrose Salt Shed Conceptual Total Project Cost Estimate
11/20/2020
New High Arch Gambrel - 12ft Tall Wood Walls
(40' x 72' / 2880 SF , Stores Approx. 1,300 Tons of Salt)

CONSTRUCTION			
Item		**Cost**	**Source**
SALT SHED BUILDING COSTS			
Concrete Foundations	$	21,000	Raynham Salt Shed Bid Results
Wall Panel & Bracing	$	87,000	Raynham Salt Shed Bid Results
Trusses	$	89,000	Raynham Salt Shed Bid Results
Plywood Roof	$	16,000	Raynham Salt Shed Bid Results
Trim	$	7,000	Raynham Salt Shed Bid Results
Paint	$	10,000	Raynham Salt Shed Bid Results
Metal Roof (FSB)	$	70,000	Raynham Salt Shed Bid Results
Salt Shed Building Sub Total	$	300,000	
ADDITIONAL CONSTRUCTION COSTS			
Demo Existing Salt Shed	$	28,000	Shrewsbury Bid results
Soil Disposal Allowance	$	50,600	Assumes soil disposed at off site as daily cover at landfill, not contaminated
Dewatering	$	10,000	Allowance, groundwater not contaminated
Additional site development/grading allowance	$	20,000	Allowance
Excavation and backfill of foundations	$	25,000	From Raynham
Subbase preparation	$	10,000	From Raynham
Pavement	$	30,000	Assumes 9,000 sqft of paving, 5-inches thick (3" base, 2" top), $110 per ton
Gravel Borrow	$	14,000	Assumes 14-inches beneath pavement at 35$ CY
Ground Improvements	$	120,000	Shrewsbury Bid results
Electrical Work (FSB)	$	18,000	Shrewsbury Bid results
Additional Construction Cost Sub Total	$	325,600	
Subtotal Construction Cost	$	625,600	
MARK UPS			
Bonds & Insurance	$	16,704	Assume 2.67% (based from Raynham)
General Conditions/Supervision	$	35,722	Assume 5.71% (based from Raynham)
Contractor Overhead and Profit	$	68,816	Assume 11% (based from Raynham)
Design and Estimating Contingency 10%	$	62,560	Allowance to account for items that may come up during design
ENR Adjusted 1.51% (October 2020 - April 2021)	$	12,222	One year of inflation estimate
Subtotal of Mark Ups	$	196,023	
Subtotal Construction Cost with Mark Ups	$	821,623	Excludes Construction Contingency
10% Construction Contingency	$	82,162	Allowance for unexpected items that may come up during construction
Electrical Back Charge By Power Company	$	8,000	(if needed)
TOTAL CONSTRUCTION COST ESTIMATE	**$**	**911,786**	**Includes Contingency and Back Charge**

Add Brine Spray System			
Ceiling Mounted Brine Spray System	$	40,000	Allowance based on quoted from GVM Calcote
Project mark up (25.5%)	$	10,200	
Total for Brine System	$	50,200	

Add Loading Ramp			
Galvanized steel Loading Ramp	$	42,000	Base on quote from Nation Ramps
Project mark up (25.5%)	$	10,710	
Total for Loading Ramp	$	52,710	

Add Lean-to off Rear of Canopy			
Rear canopy	$	65,050	Base on Raynham Bid results (includes GC mark up, metal roof, inflation and electrical)
Total for Canopy	$	65,050	

DESIGN, PERMITTING, SPECIAL SERVICES, AND CONSTRUCTION ADMINISTRATION			
Item		**Cost**	**Source**
Construction Admin	$	36,000	Allowance (excludes ground improvements and soil contamination issues)
Geotechnical Ground Improvements Design and Construction Services	$	24,000	Allowance
Brine System Ceiling Spray Design	$	5,000	Allowance
Total Design, Permitting, Special Services, Const. Admin.	$	65,000	

Owners Contingency	$	10,000	for additional testing/engineering/environmental services if needed

Total Project Cost	**$**	**986,786**	**See assumptions below (excludes Brine system, loading ramp and canopy)**

Including Brine Spray System	**$**	**1,036,986**
Including loading ramp	**$**	**1,039,496**
Including Lean-to canopy	**$**	**1,051,836**
Including Spray System, Loading Ramp and Canopy	**$**	**1,154,696**

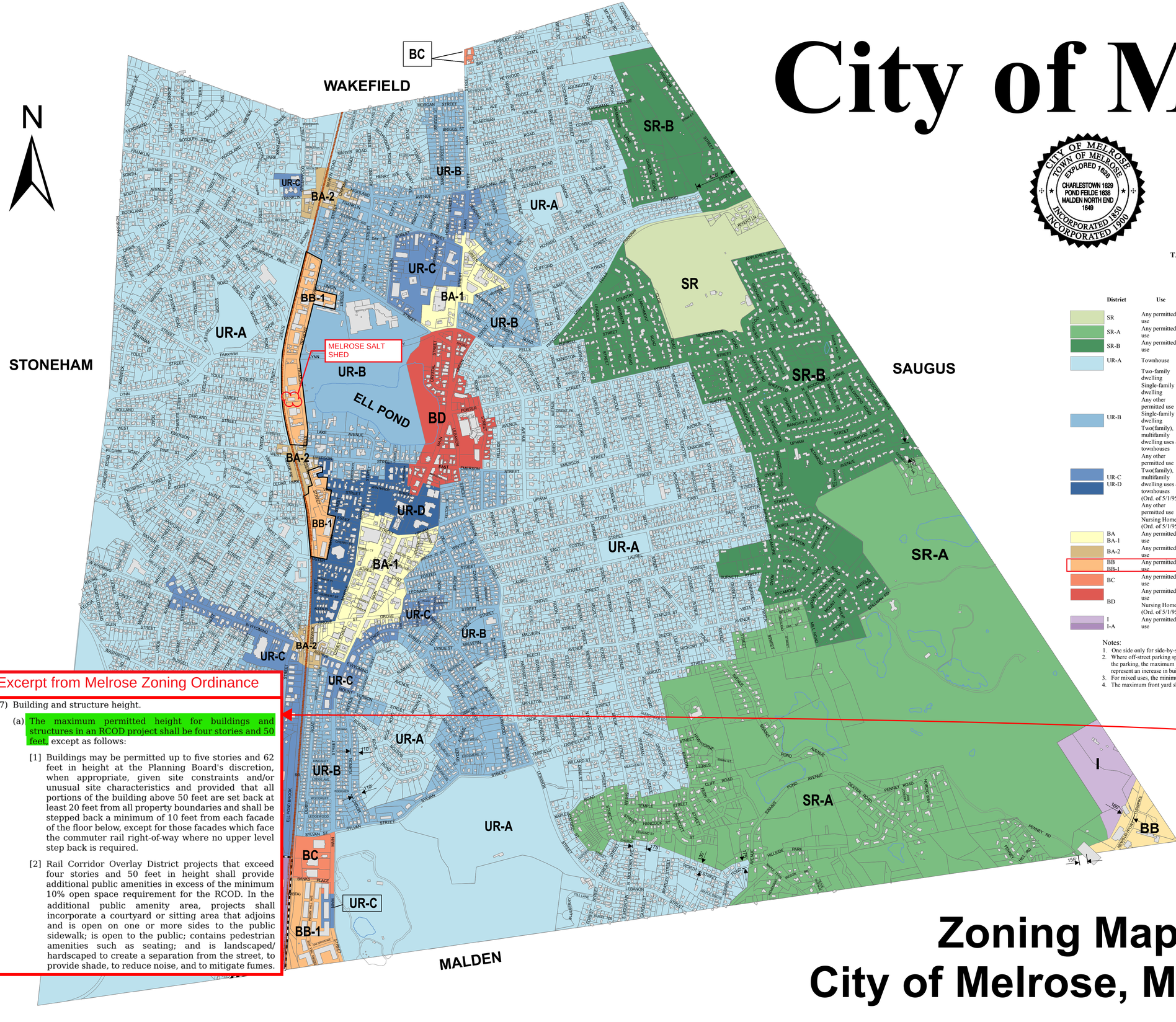
Notes/Assumptions:

1. Impervious area of the site does not increase and stormwater infiltration is not required.
2. Costs assume there are no WBE/MBE requirements.
3. Includes entire structure, MA DCAM Certified GC costs, foundation, metal roof (filed sub bid contractor), lights and electrical work (filed sub bid contractor)
4. Assumes 12' tall pressure treated heavy duty timber framed salt shed side walls , approx. 30' clearance at end entrance to allow salt trailers to exit with trailer in up position and allows dumping of salt deliveries inside the salt shed.
5. Costs are conceptual for initial planning purposes and will be verified during design.
6. New salt shed will occupy the footprint of the existing salt shed, and will be high arch gambrel style, with power source from panel in existing DPW building.
7. Assumes ground improvements are needed
8. Assumes there are no MBTA permits or restrictions.
9. Assumes asphalt floor inside the salt shed, which is the standard .
10. Assumes competitive bid market with at least 3 separate bids submitted.
11. Assumes no additional measures are required to protect salt shed from 100 year flood

APPENDIX D

Melrose Zoning Map

City of Melrose



CITY OF MELROSE
TOWN OF MELROSE
EXPLORED 1629
CHARLESTOWN 1629
POND FEILDE 1638
MALDEN NORTH END
1649
INCORPORATED 1850
INCORPORATED 1900

TABLE OF DIMENSIONAL AND DENSITY REGULATIONS

District	Use	Min. lot area (sq.ft.) or as noted	Min. frontage & lot width (ft)	Min. lot depth (ft)	front (ft)	side (ft)	rear (ft)	Max. ht (ft)	Max. stories	Max. coverage (%)	Max. floor area ratio	Min. open Space (%)
SR	Any permitted use	25,000	110	90	25	20	50	35	2 1/2	35	None	50
SR-A	Any permitted use	15,000	100	90	25	15	40	35	2 1/2	35	None	50
SR-B	Any permitted use	10,000	80	90	20	12	30	35	2 1/2	35	None	40
UR-A	Townhouse	7,500 per dwelling unit	100	90	20	10[1]	20	35	2 1/2	35	None	35
	Two-family dwelling	13,500	100	90	20	10[1]	20	35	2 1/2	35	None	35
	Single-family dwelling	7,500	75	90	20	10	20	35	2 1/2	35	None	35
	Any other permitted use	10,000	100	90	20	10	20	35	2 1/2	35	None	35
UR-B	Single-family dwelling	7,500	75	90	20	10	15	35	2 1/2	50	None	30
	Two(family), multifamily dwelling uses & townhouses	7,500 plus 3,000 for each dwelling unit more than one	100	90	20	10[1]	15	35	2 1/2	50[2]	None	30
	Any other permitted use	10,000	100	90	20	10[1]	15	35	2 1/2	50	None	20
UR-C UR-D	Two(family), multifamily dwelling uses & townhouses (Ord. of 5/1/95)	6,000 plus 1,250 for each dwelling unit more than one	100	90	20	10[1]	15	50	4	50	1	20
	Any other permitted use	7,500	75	90	20	10	15	50	4	50	1	20
	Nursing Home (Ord. of 5/1/95)	20,000	100	90	20	10	15	50	4	50	None	30
BA BA-1	Any permitted use	5,000	50	90	None[4]	None	None	50	4	None	2.0	5
BA-2	Any permitted use	5,000	50	90	None[4]	None	None	50	4	None	2.0	5
BB BB-1	Any permitted use	10,000	100	90	10	12	15	30	2	60	.75	20
BC	Any permitted use	5,000[3]	50	90	5	None	None	50	2	None	.75	10
BD	Any permitted use	5,000[3]	50	90	15	None	10	80	8	None	2.0	5
	Nursing Home (Ord. of 5/1/95)	20,000	100	90	20	10	15	50	4	50	None	30
I I-A	Any permitted use	20,000	125	100	30	20	30	50	4	25	2.0	30

Notes:
1. One side only for side-by-side two-family dwelling units; outside only for semi-detached row unit.
2. Where off-street parking spaces required by Article VIII of this ordinance are located underground and under the building served by the parking, the maximum building coverage may be increased above the percentage limit set forth in this table. This increase shall represent an increase in building area up to the area of the parking spaces which are put underground.
3. For mixed uses, the minimum lot area shall be increased by 1,000 sq.ft. for each dwelling unit.
4. The maximum front yard shall be 5 feet.

Overlay Districts

Rail Corridor Overlay District

Smart Growth Overlay District

Excerpt from Melrose Zoning Ordinance

(7) Building and structure height.

(a) The maximum permitted height for buildings and structures in an RCOD project shall be four stories and 50 feet, except as follows:

[1] Buildings may be permitted up to five stories and 62 feet in height at the Planning Board's discretion, when appropriate, given site constraints and/or unusual site characteristics and provided that all portions of the building above 50 feet are set back at least 20 feet from all property boundaries and shall be stepped back a minimum of 10 feet from each facade of the floor below, except for those facades which face the commuter rail right-of-way where no upper level step back is required.

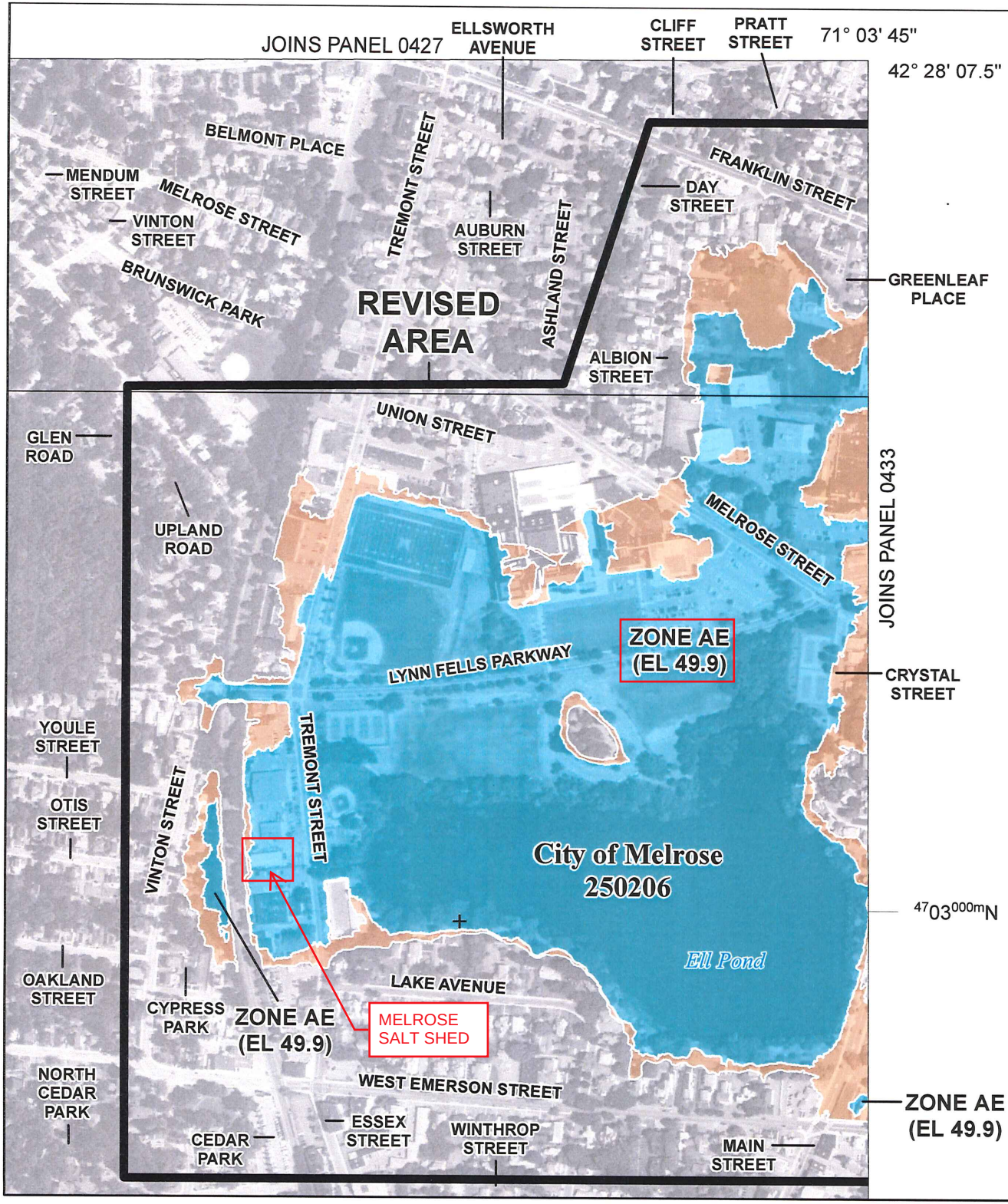
[2] Rail Corridor Overlay District projects that exceed four stories and 50 feet in height shall provide additional public amenities in excess of the minimum 10% open space requirement for the RCOD. In the additional public amenity area, projects shall incorporate a courtyard or sitting area that adjoins and is open on one or more sides to the public sidewalk; is open to the public; contains pedestrian amenities such as seating; and is landscaped/ hardscaped to create a separation from the street, to provide shade, to reduce noise, and to mitigate fumes.

Zoning Map of the City of Melrose, Massachusetts

Revised April 6, 2015 - Order -2015-90

APPENDIX E

FEMA Flood Map



SPECIAL FLOOD HAZARD AREAS

- Without Base Flood Elevation (BFE) *Zone A,V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD

- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee See Notes. *Zone X*

SCALE

Map Projection:
NAD 1983 StatePlane Massachusetts Mainland FIPS 2001 Feet:
Western Hemisphere: Vertical Datum: NAVD 88

1 inch = 500 feet 1:6,000

0 250 500 1,000 Feet

0 75 150 300 Meters

FEMA

National Flood Insurance Program

NATIONAL FLOOD INSURANCE PROGRAM
FLOOD INSURANCE RATE MAP

MIDDLESEX COUNTY, MASSACHUSETTS
All Jurisdictions

PANEL 429 OF 656

Panel Contains:

COMMUNITY	NUMBER	PANEL	SUFFIX
MALDEN, CITY OF	250202	0429	E
MEDFORD, CITY OF	250205	0429	E
MELROSE, CITY OF	250206	0429	E
STONEHAM, TOWN OF	250215	0429	E

REVISED TO REFLECT LOMR EFFECTIVE: December 3, 2018

VERSION NUMBER
2.3.2.0

MAP NUMBER
25017C0429E

EFFECTIVE DATE
JUNE 4, 2010