TOWN OF BELMONT HIGH SCHOOL

MODULE 3: PREFERRED SCHEMATIC REPORT **REVISION #1**

SUBMISSION DATE: FEBRUARY 16, 2018
REV.1 SUBMISSION DATE: APRIL 12, 2018

PERKINS+WILL

BELMONT HIGH SCHOOL

MARAUDERS

ACKNOWLEDGEMENTS /

We wish to thank the following individuals and organizations for their contributions and assistance to this Feasibility Study.

MASSACHUSETTS SCHOOL BUILDING AUTHORITY

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Jess Deleconio, Senior Project Coordinator

BELMONT HIGH SCHOOL BUILDING COMMITTEE

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Nitsch Engineering

LANDSCAPE DESIGN

Warner Larson

STRUCTURAL ENGINEERS

Engineers Design Group, Inc

HVAC / ELECTRICAL ENGINEERS

BALA Consulting Engineers

PLUMBING / FIRE PROTECTION ENGINEERS

Architectural Engineers, Inc

GEOTECHNICAL ENGINEERS

McPhail Associates LLC

HAZARDOUS MATERIALS

Universal Environmental Consultants

FOOD SERVICE CONSULTANT

Crabtree Mcgrath Associates

CODE CONSULTANT

Code Red Consultants

TRAFFIC CONSULTANT

Nelson\Nygaard Consulting Associates

COST ESTIMATING CONSULTANT

PM&C

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Lund Associates

SURVEY CONSULTANT

Samiotes Consultants, Inc.

TECHNOLOGY CONSULTANT

Edvance Technology Design

HARDWARE CONSULTANT

Campbell-McCabe, Inc.

ACOUSTICAL CONSULTANT

Acentech

SUSTAINABILITY CONSULTANT

AKF Group / In Posse

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3.3.1 INTRODUCTION

3.3.1 - INTRODUCTION

A. PROCESS OVERVIEW

This report summarizes the proceedings of the BHS Building Committee, the Town of Belmont, the Belmont School District, and the BHS Design Team, following the submission of the Preliminary Design Program (PDP). This Preferred Schematic Report (PSR) documents the numerous meetings, studies to space programming document, PDP findings, and the development of building options performed in the service of assisting the Building Committee Board members along with members of the community in their decision making process. During the PSR phase, nearly all the public meetings scheduled by the Building Committee scheduled were joint meetings of the Belmont High School Building Committee, School Committee and Board of Selectmen.

The Preliminary Design Program was submitted to the MSBA on December 13, 2017. The submission was followed by an Belmont High School Building Committee (BHSBC) meeting where community and board members expressed the desire for further traffic assessment of the site design options. The Committee proceeded to commission a full traffic study for the site. The results of this study were presented to the BHSBC in January 2018 by Nelson\ Nygaard Consulting Associates.

A series of interactive workshops were conducted throughout the PSR phase including a Belmont HS faculty workshop on December 13th, a Belmont community workshop on December 14th, and a Chenery MS faculty workshop on January 8th. The intent of these workshops were to bring the groups up to date and summarize the current design process, discuss how innovative educational programming can support future-ready environment, and build consensus around future pedagogy through interactive group exercises.

At the January 11th BHSBC meeting, the design team introduced for discussion an update to the PDP site strategy matrix that would allow the committee members to evaluate and provide pro/con criteria for each of the site design options, the substance of which was open for discussion. The updated matrix addressed the committee's previous concerns and the outcome provided revised site designs for options 2.1, 2.3, 2.4 and 3.1 to be considered for the PSR. This process proved to be a very useful tool for distilling the information gathered and presented about the options.

The Design Team presented revised site strategies at the January 16th, 2018 BHSBC meeting, showing updates to the 2.1, 2.3, 2.4 and 3.1 building schemes including detailed building plans, building massing on the site, site plans, site circulation diagrams, athletic field limitations, and parking count distribution.

After a long and thoughtful deliberation within the Town - taking place at the open BHSBC meetings, in the town newspapers, social media, and at town events - the Belmont High School Committee and the Building Committee voted on the configuration and preferred option on January 23rd, 2018. First the School Committee voted on the configuration to be 7-12 with an unanimous vote to accommodate space for increased enrollment forecasts. Following the School Committee vote, the Building Committee selected Option C.2.4 as the preferred site option with a unanimous vote, which includes maintaining/renovating the existing pool, large fieldhouse gym, and small gym. The result of the vote thereby removed Options 2.1, 2.3 and 3.1 from consideration, as well as two other grade configurations: 9-12 and 8-12.

The design team continued to refine the remaining design options. On January 30, 2018, a meeting was held with the BHSBC Subcommittee on building operation and systems, to develop sustainable strategies for the new High School in order to determine the Town's priorities. The Design Team introduced core concepts of sustainability and showed how they might become integral to student life at the high school as well as providing long term benefits to the district by presenting Zero Net Energy strategies for potential building systems (MEP, FP, IT, Civil) that could service the new project and the process it would take to achieve and/or maximize these sustainable goals. During the ensuing discussion, it came to light that the extent of air-conditioning was a prime concern and should be considered among the highest priorities of any sustainable strategy. The operations subcommittee voted to move forward with the most recent LEED-S (Leadership in Energy and Environmental Design for Schools) as the sustainable green program that will record and rate all the energy efficiency / sustainability components of the project.

The Design Team continued to develop both the site and building design for Option 2.4 (Renovation Addition), and presented progress at the joint meeting of the a joint meeting of the BHSBC, SC and BOS on February 01, 2018.

During the February 13th joint meeting of the BHSBC, SC and BOS, the attendees voted to approve the material presented for inclusion in the PSR to MSBA on February 16, 2018.

A. PROCESS OVERVIEW

PSR TIMELINE

December 13, 2017

PDP submission to MSBA

December 13, 2017 : BHS Faculty Workshop

Design Workshop with Belmont HS Faculty: Discussion on design options, working group activities on design solutions.

December 14, 2017 : BHSBC Meeting #32

Community Design Workshop: Discussion on design options, working group activities on design solutions.

December 19, 2017 : Steering Group Meeting

Review content and deliverables for PSR, review Design Workshop comments.

January 2, 2018 : Steering Group Meeting

Review MSBA PDP comments, review development of floor plans for PSR options.

January 8, 2018 : CMS Faculty Workshop

Design Workshop with Chenery Middle School Faculty : Discussion on design options, working group activities on design solutions.

January 9, 2018 : Steering Group Meeting

Review MSBA PDP comments, review development of floor plans for design options, review the 01/11/18 traffic presentation, prepare for 01/16/18 BC meeting.

January 9, 2018 : BHSBC Meeting #33

Presentation of School Department work on district configuration studies and how High School configuration affects entire K-12 district.

January 11, 2018 : BHSBC Meeting #34

Traffic presentation on PSR options

January 16, 2018 : Steering Group Meeting

Review progress information on district solutions, prepare for BC decision meeting 1-23-18.

January 16, 2018 : BHSBC meeting #35

Discussion on design options incorporating feedback from Design Workshop, discussion on District configurations impact.

January 23, 2018 : Steering Group Meeting

Review progress information on district solutions, prepare for Building Committee decision meeting that evening.

January 23, 2018 : BHSBC Meeting #36

Committee vote on grade configuration and preferred site design option.

January 30, 2018 : Steering Group Meeting

Review major building systems and NZE strategies

January 31, 2018 : BHS Faculty Workshop

Mash Up Exercise: Examine dynamic program adjacencies with Belmont High School faculty.

February 01, 2018 : BHSBC Meeting #37

Review PSR content and updates to preferred design option.

February 06, 2018, 2018 : Steering Group Meeting

Review and take action on PSR materials.

February 13, 2018 : BHSBC Meeting #38

Committee reviews PSR, votes for approval of PSR.

February 16, 2018

PSR submission to MSBA

3.3.1 - INTRODUCTION

B. PROJECT SCHEDULE UPDATE

The project schedule remains the essentially the same as that submitted with the Preliminary Design Program and as summarized below.

Submit Preferred Schematic Design to MSBA	February 21st, 2018
Projected MSBA Board of Directors Approval to proceed to Schematic Design	April 10th, 2018
Submit Schematic Design to MSBA	July 11th, 2018
Projected MSBA Board of Directors Approval of Schematic Design and Project Scope Budget Agreement	August 29th, 2018
Town of Belmont Debt Exclusion Ballot for Project Funding	November 6th, 2018
Design Development Complete	June 2018
Construction Documents Complete	December 2019
Anticipated Start of Construction	April 2020
Substantial Completion	October 2023

It is anticipated that the project will use the Construction Manager at Risk (149A CM-R) delivery method. During the Schematic Design phase, a detailed procurement and construction schedule will be developed. This will include construction phasing plans and will investigate the possibly of early works packages in advance of the final construction documents.

3.3.1 - INTRODUCTION

C. EXISTING CONDITIONS SUMMARY

D. ALTERNATIVES SUMMARY

C. EXISTING CONDITIONS SUMMARY

TRAFFIC: At the January 11th BHSBC open meeting, Nelson Nygaard discussed several existing transportation and parking issues that inhibit the ability of students, parents, teachers, and staff to access the school safely and efficiently. These issues include high demand for parking during school hours, long traffic queues in all directions during peak pickup/drop-off periods, dangers for people crossing by foot and by bike across routes with high speeds, and vehicular traffic queues, and unwanted parking spillover from vehicles not accommodated on-site onto neighboring residential streets. Anticipated school population growth could compound these issues if not effectively mitigated. Belmont High School is expected to grow from its current enrollment of 1,300 students to about 1,450 students by 2024. In addition, Belmont Public Schools has considered enrolling seventh- and eighth-grade students at Belmont High School to ease population pressures at other schools in the district. This information is to set a baseline for potential future solutions and/ or mitigation measures.

More detail on the findings, refer to the traffic report found in Section 3.3.2 Evaluation of Existing Conditions.

ZONING: The Dover Amendment (MGL Chapter 40A Section 3) provides an exemption from some zoning regulations for educational facilities (among others), but permits reasonable regulation related to a building's height and mass, along with yard sizes, lot area, set backs, open space, parking, lighting, and building coverage requirements.

The Belmont High School Building Committee has arranged for meetings with the planning board and the TAC (Traffic Advisory Committee). Planning board meetings are scheduled to take place on April 10th and June 5th of 2018 to review the project status and provide input. The team is scheduled to meet with the TAC and their consultant BSC group on Febuary 8th, 2018 and March 8th, 2018 to review existing traffic and circulation (bike, pedestrian, etc.) conditions and proposed solutions.

ALTERNATIVES SUMMARY

As noted in the PDP, 22 original options were presented to the Building Committee, administration and community members. They consisted of the following:

I. BASE REPAIRS ONLY

II. RENOVATION AND ADDITION

- **Option 2.1:** Major renovation minor addition (9-12/ 8-12/ 7-12)
- **Option 2.2:** Minor renovation major addition (9-12/ 8-12/ 7-12)
- **Option 2.3:** Minor renovation major addition (9-12/ 8-12/ 7-12)
- **Option 2.4:** Minor renovation major addition (9-12/ 8-12/ 7-12)
- **Option 2.5**: Minor renovation major addition (9-12/ 8-12/ 7-12)

III. NEW CONSTRUCTION

- **Option 3.1:** New construction West of BHS (9-12/ 8-12/ 7-12)
- **Option 3.2**: New construction West of stadium (9-12/ 8-12/ 7-12)

After the Building Committee vote, three were eliminated for the following reasons:

Option 2.2: Consolidated with Option 2.1 option.

Option 2.5: Separating the field house from the general educational facility was not desirable. The proposed building location was too close to the East side of the site - making traffic, parking, and circulation too challenging to develop.

Option 3.2: Required moving a newly constructed stadium and an ice rink, which is not part of our project. Due to cost and schedule, this option was eliminated.

The remaining 13 options were presented and noted as follows:

I. BASE REPAIRS ONLY

II. RENOVATION AND ADDITION

- **Option 2.1:** Major renovation minor addition (9-12/ 8-12/ 7-12)
- **Option 2.3:** Minor renovation major addition (9-12/ 8-12/ 7-12)
- **Option 2.4:** Minor renovation major addition (9-12/ 8-12/ 7-12)

III. NEW CONSTRUCTION

- **Option 3.1:** New construction on West side of BHS.

As noted previously, the Design Team had been working on multiple schemes on the existing site in order to fully explore the range of options that the site presented. During this period of study, the team developed a more viable design site option for the 2.3, 2.4, and 3.1 schemes based on feedback from the community and the building

E. PREFERRED SOLUTION SUMMARY

committee. These new options were presented to the Building Committee on January 16, 2018 and at this meeting the BHSBC allowed the design team to move forward with these updated site schemes.

The list of modified options are composed as follows:

- Option 2.3; Minor Renovation and Addition to existing building (grades 9-12 / 8-12 / 7-12)
- Option 2.4; Minor Renovation and Addition to existing building (grades 9-12 / 8-12 / 7-12)
- Option 3.1; New Construction to the west of existing building (grades 9-12 / 8-12 / 7-12)

At the January 23, 2018 BHSBC meeting prior to the PSR submission, Options 2.1, 2.3, and 3.1 were removed from further consideration by Building Committee vote. And as noted previously, at the same meeting the School Committee voted to remove the 9-12 and 8-12 grade configuration from further consideration, leaving only an 7-12 grade configuration, thus reducing the options to one:

- Option C.2.4: Minor Renovation and Major Addition to existing building (grades 7-12)

COSTING: Consideration and selection of the preferred options by the Building Committee could not be completed without a thorough evaluation of the cost implications of each. Given the early stage of the design process, the costing process would not involve producing a true budget, but a level 2 comparative cost analysis of each of the options. In order to ensure the most thorough analysis, Daedalus Projects, Inc. and the Design Team with PM&C, each prepared a cost analysis for each option that were reconciled and presented to the Building Committee.

Each site consideration includes all athletic fields to ensure that the sites remained roughly equivalent in athletic program amenities to the existing program with the notable exception of tennis courts.

In summary, the Comparative Cost Analysis indicated the existing BHS building site to be the least costly option, but does not satisfy the new selected grade configuration of 7-12.

The following summary includes Project Costs with both hard and soft costs. Option 2.1 a is considered in response to the MSBA PDP letter and was reviewed by the BHSBC, cost estimator, OPM for content, project duration, and cost. The information was presented in a joint meeting with BHSBC, SC, BOS and is referenced in this section only. More detailed information on all other options can be found in Section 3.3.3 Final Evaluation of Alternatives and in Section 3.3.4 Preferred Solution.

- Option 1.0: $111.5 million
- Option 2.1: $302.1 million
- Option 2.1 a: $279.8 million
- Option 2.3: $307.3 million
- Option 2.4: $307.2 million
- Option 3.1: $293.8 million

SUSTAINABILITY: The MSBA sustainability program is required of all their funded projects, with emphasis placed on reducing energy and water consumption. The MSBA requires that all core program projects be registered with USGBC LEED-S Version 4 or Northeast CHPS Version 3, and comply with a series of options, two of which allowed for an additional 2% of reimbursement provided higher targets were met for sustainability. The Design Team is working with LEED due to it's familiarity and higher level of development.

During the PDP phase, the Design Team organized a joint meeting with BHSBC, BOS and SC on December 07, 2017 where a number of potential objectives and strategies were outlined, with the intent of clarifying those that most aligned with the Town's needs. On January 30, 2018, the design team met with the BHSBC's Subcommittee on Building Operation and Systems and introduced core concepts of sustainability and showed how they might become integral to student life at the high school as well as providing long term benefits to the district by presenting Zero Net Energy strategies for potential building systems (MEP, FP, IT, Civil) that could service the new project and the process it would take to achieve and/or maximize these sustainable goals. During the ensuing discussion, it came to light that the extent of air-conditioning was a prime concern and should be considered among the highest priorities of any sustainable strategy. The subcommittee voted to move forward with the most recent LEED-S (Leadership in Energy and Environmental Design for Schools) as the sustainable green program that will record and rate all the energy efficiency / sustainability components of the project.

3.3.1 - INTRODUCTION

E. PREFERRED SOLUTION SUMMARY

PREFERRED SOLUTION SUMMARY

In order to assist the BHSBC in their decision making process, the design team worked with the committee to develop a matrix that would allow for each site option to be weighed according to a series of criteria agreed upon by all. These ranged from delivery of educational program to traffic to impact to neighbors and scheduling, with each Board member selecting their preferred option and grade configuration by open vote, the results adding up to a higher ranked option. This matrix distilled the concerns that had been raised by the Board member themselves as well as those of the Town residents and neighbors who spoke at the many Town meetings passionately in favor of one option or another.

This matrix, in conjunction with the Comparative Cost Analysis, provided the means for the Committee to make a decision about which option to proceed with, though in the end the proposed preservation of the existing pool / fieldhouse and siting advantages of Option C.2.4, proved itself most advantageous to the Town of Belmont, and was selected on January 23, 2018 as the preferred solution by a unanimous vote.

After the preferred selection, the Design Team continued to develop the plans, making revisions to the location of the academic neighborhoods and common program that would allow for public access without traveling through the more private areas of the school. Due to construction phasing issues, the team recommended that the lower school grades be located to the East of the existing Fieldhouse/ pool, organized vertically, thereby minimizing the concerns of disrupting existing educational programs.

The design of the overall site continued to be organized to maintain current athletic field activities and increased parking count, as well as the parent drop off and public access to off hours community areas in the school.

Among the issues raised, during BHSBC meetings after the preferred solution vote, was concern for the height of the building, noise mitigation from the MBTA rail line, improved traffic conditions and pedestrian / bike safety into and throughout site. Traffic review will continue to be addressed in the Schematic Design phase.

F. MSBA PDP REVIEW

On January 18, 2018, the MSBA released comments from their review of the Preliminary Design Program.

Massachusetts School Building Authority

Deborah B. Goldberg
Chairman, State Treasurer

James A. MacDonald
Chief Executive Officer

John K. McCarthy
Executive Director / Deputy CEO

January 18, 2018

Mr. Jim Williams, Chair
Belmont Board of Selectmen
Office of the Board of Selectmen
455 Concord Avenue, 2nd Floor
Belmont, MA 02478

Re: Town of Belmont, Belmont High School

Dear Mr. Williams:

The Massachusetts School Building Authority (the "MSBA") is forwarding review comments for the Module 3 Feasibility Study Preliminary Design Program submission for the Belmont High School project in the Town of Belmont, received by the MSBA on December 5, 2017.

Responses to the attached comments shall be forwarded to Jess Deleconio (Jess.Deleconio@MassSchoolBuildings.org) through the Owner's Project Manager. Please review and return responses within 14 days of receipt of this letter.

If you have any questions or comments, please do not hesitate to contact Karl Brown (Karl.Brown@MassSchoolBuildings.org).

Sincerely,

Mary Pichetti
Director of Capital Planning

Cc: Legislative Delegation
Patrice Garvin, Belmont Town Administrator
Phyllis Marshall, Assistant Town Administrator
Floyd S. Carman, Belmont Treasurer & Collector
Lisa Fiore, Chair, Belmont School Committee
John P. Phelan, Superintendent, Belmont Public Schools
William D. Lovallo, Chair, Belmont High School Building Committee
Richard Marks, Owner's Project Manager, Daedalus Projects, Inc.
Thomas Gatzunis, Owner's Project Manager, Daedalus Projects, Inc.
Brooke Trivas, Designer, Perkins+Will
File: Letters 10.2 (Region 4)

40 Broad Street, Suite 500 • Boston, MA 02109 • Tel: 617-720-4466 • www.MassSchoolBuildings.org

ATTACHMENT A
MODULE 3 – PRELIMINARY DESIGN PROGRAM REVIEW COMMENTS

District: Town of Belmont
School: Belmont High School
Owner's Project Manager: Daedalus Projects, Inc.
Designer Firm: Perkins+Will
Submittal Due Date: December 13, 2017
Submittal Received Date: December 13, 2017
Review Date: December 13, 2017 - January 12, 2018
Reviewed by: A.Waldron, K.Brown, J.Jumpe

MSBA REVIEW COMMENTS

The following comments[1] on the Preliminary Design Program (PDP) submittal are issued pursuant to a review of the project submittal document for the proposed project presented as a part of the Feasibility Study submission in accordance with the MSBA Module 3 Guidelines.

ITEMS REQUIRING IMMEDIATE ACTION:

The December 15, 2017 cursory review email identified several items in the Educational Program that require additional elaboration as detailed below in section 3.1.2. The District was requested to provide those items while this review is in process, and as noted below, MSBA required a revised Educational Program that includes those clarifications in the District's response to the cursory review (note that this revised Educational Program was provided to MSBA on January 16, 2018. MSBA will provide supplemental review comments for this document after it is reviewed).
As detailed below in section 3.1.6 Preliminary Evaluation of Alternatives, MSBA requests that the District/design team include an add/reno option for consideration in the following PSR submittal that includes the minimum renovation and addition required to meet current code and comply with the educational program.

3.1 PRELIMINARY DESIGN PROGRAM

Overview of the Preliminary Design Program Submittal	Complete	Provided; *Refer to comments following each section*	Not Provided; *Refer to comments following each section*	Receipt of District's Response; *To be filled out by MSBA Staff*
OPM Certification of Completeness and Conformity	☒	☐	☐	☐
Table of Contents	☒	☐	☐	☐

[1] The written comments provided by the MSBA are solely for purposes of determining whether the submittal documents, analysis process, proposed planning concept and any other design documents submitted for MSBA review appear consistent with the MSBA's guidelines and requirements, and are not for the purpose of determining whether the proposed design and its process may meet any legal requirements imposed by federal, state or local law, including, but not limited to, zoning ordinances and by-laws, environmental regulations, building codes, sanitary codes, safety codes and public procurement laws or for the purpose of determining whether the proposed design and process meet any applicable professional standard of care or any other standard of care. Project designers are obligated to implement detailed planning and technical review procedures to effect coordination of design criteria, buildability, and technical adequacy of project concepts. Each city, town and regional school district shall be solely responsible for ensuring that its project development concepts comply with all applicable provisions of federal, state, and local law. The MSBA recommends that each city, town and regional school district have its legal counsel review its development process and subsequent bid documents to ensure that it is in compliance with all provisions of federal, state and local law, prior to bidding. The MSBA shall not be responsible for any legal fees or costs of any kind that may be incurred by a city, town or regional school district in relation to MSBA requirements or the preparation and review of the project's planning process or plans and specifications.

F. MSBA PDP REVIEW

Overview of the Preliminary Design Program Submittal	Complete	Provided; *Refer to comments following each section*	Not Provided; *Refer to comments following each section*	Receipt of District's Response; *To be filled out by MSBA Staff*
3.1.1 Introduction	☒	☐	☐	☐
3.1.2 Educational Program	☐	☒	☐	☐
3.1.3 Initial Space Summary	☐	☒	☐	☐
3.1.4 Evaluation of Existing Conditions	☐	☒	☐	☐
3.1.5 Site Development Requirements	☐	☒	☐	☐
3.1.6 Preliminary Evaluation of Alternatives	☐	☒	☐	☐
3.1.7 Local Actions and Approvals Certification(s)	☐	☒	☐	☐
3.1.8 Appendices	☒	☐	☐	☐

3.1.1 INTRODUCTION

	Provide the following Items	Complete; *No response required*	Provided; *District's response required*	Not Provided; *District's response required*	Receipt of District's Response; *To be filled out by MSBA Staff*
1	Summary of the Facility Deficiencies and Current S.O.I.	☐	☒	☐	☐
2	Date of invitation to conduct a Feasibility Study and MSBA Board Action Letter	☒	☐	☐	☐
3	Executed Design Enrollment Certification	☒	☐	☐	☐
4	Narrative of the Capital Budget Statement and Target Budget	☒	☐	☐	☐
5	Project Directory with contact information	☒	☐	☐	☐
6	Updated Project Schedule	☒	☐	☐	☐

MSBA Review Comments:

#1) As noted in the December 15, 2017 cursory review email, provide a brief summary of the facility deficiencies identified by the District in the Statement of Interest.

No further review comments for this section.

3.3.1 - INTRODUCTION

F. MSBA PDP REVIEW

3.1.2 EDUCATIONAL PROGRAM

Provide a summary and description of the existing educational program, and the new or expanded educational vision, specifications, process, teaching philosophy statement, as well as the District's curriculum goals and objectives of the program. Include description of the following items:

	Provide the following Items	Complete; *No response required*	Provided; *District's response required*	Not Provided; *District's response required*	Receipt of District's Response; *To be filled out by MSBA Staff*
1	Grade and School Configuration Policies	☒	☐	☐	☐
2	Class Size Policies	☒	☐	☐	☐
3	School Scheduling Method	☐	☒	☐	☐
4	Teaching Methodology and Structure				
	a) Administrative and Academic Organization/Structure	☐	☐	☒	☐
	b) Curriculum Delivery Methods and Practices	☒	☐	☐	☐
	c) English Language Arts/Literacy	☒	☐	☐	☐
	d) Mathematics	☒	☐	☐	☐
	e) Science	☒	☐	☐	☐
	f) Social Studies	☒	☐	☐	☐
	g) World Languages	☒	☐	☐	☐
	h) Academic Support Programming Spaces	☒	☐	☐	☐
	i) Student Guidance and Support Services	☐	☐	☒	☐
5	Teacher Planning and Professional Development	☒	☐	☐	☐
6	Pre-kindergarten	☒	☐	☐	☐
7	Kindergarten	☒	☐	☐	☐
8	Lunch Programs	☒	☐	☐	☐
9	Technology Instruction Policies and Program Requirements	☒	☐	☐	☐
10	Media Center/Library	☒	☐	☐	☐
11	Visual Arts Programs	☒	☐	☐	☐
12	Performing Arts Programs	☒	☐	☐	☐
13	Physical Education Programs	☒	☐	☐	☐
14	Special Education Programs	☒	☐	☐	☐
15	Vocation and Technology Programs				
	a) Non-Chapter 74 Programming	☒	☐	☐	☐
	b) Chapter 74 Programming	☒	☐	☐	☐
16	Transportation Policies	☒	☐	☐	☐
17	Functional and Spatial Relationships	☐	☐	☒	☐
18	Security and Visual Access Requirements	☒	☐	☐	☐

F. MSBA PDP REVIEW

MSBA Review Comments:

The December 15, 2017 cursory review email identified the following items in the Educational Program that require additional elaboration (note that a revised Educational Program was provided to MSBA on January 16, 2018. MSBA will provide supplemental review comments for this document after it is reviewed).

#3) Provide a description of the current and proposed school scheduling method.

#4a,4i) Provide a detailed description of the following (both existing and proposed):

- *Administrative and academic organization/structure (e.g., academies, departments, houses, grade based cohorts, teams, rooms, assignment policies, teams, etc.)*
- *Student Administrative Guidance and Support Services*
- *Teaching Methodology*

#17) Elaborate on the following (both existing and proposed):

- *Functional and spatial relationships*
- *Key programmatic adjacencies*

No further review comments for this section.

3.1.3 INITIAL SPACE SUMMARY

	Provide the following Items	Complete; *No response required*	Provided; *District's response required*	Not Provided; *District's response required*	Receipt of District's Response; *To be filled out by MSBA Staff*
1	Space summary; one per approved design enrollment	☐	☒	☐	☐
2	Floor plans of the existing facility	☒	☐	☐	☐
3	Narrative description of reasons for all variances (if any) between proposed net and gross areas as compared to MSBA guidelines	☒	☐	☐	☐

MSBA Review Comments:

1) The MSBA has performed an initial review of the space summary and offers the following:

- *Study Enrollment Options:*
  - *Option 1: 2,215 students in grades 7-12*
  - *Option 2: 1,845 students in grades 8-12*
  - *Option 3: 1,470 students in grades 9-12*

General comment applicable to all space categories below - note that all new construction must comply with the MSBA standards for eligibility, whether in a new building or an addition / renovation project. The MSBA considers it critical that the Districts and their Designers aggressively pursue design strategies to achieve compliance with the MSBA guidelines for all proposed projects in the new program and strive to meet the gross square footage allowed per student and the core classroom space standards, as outlined in the guidelines. The MSBA also

considers its stance on core classroom space critical to its mission of supporting the construction of successful school projects throughout the Commonwealth that meet current and future educational demands. The MSBA does not want to see this critical component of education suffer at the expense of larger or grander spaces that are not directly involved in the education of students.

- **Core Academic** – *Proposed programmatic spaces appear to exceed the MSBA guidelines. This is due to additional classrooms above guideline, additional small group seminar areas, and ELL spaces. Per the information provided, the submittal proposes the following spaces:*

Anticipated Core Academic Spaces*	Grades 7-12 Option	Grades 8-12 Option	Grades 9-12 Option
General Classrooms	85	70	63
Teacher Planning	8 (MS) + 6 (HS)	4 (MS) + 6 (HS)	6 (HS)
Small Group Seminar	6	5	4
Science Classroom/Lab	20	16	12
Prep Room	10	8	6
Central Chemical Storage Room	1	1	1
ELL	2	2	1

**Provide proposed scheduling information specific to these spaces.*
***The MSBA will rely on the District's Educational Program and additional information to understand how proposed spaces that are unique to the District will be utilized in the proposed project.*

The MSBA calculates all three enrollment options as having a utilization rate in the 71-77% range. Provide an explanation for why additional classrooms above guidelines are proposed. The MSBA targets a utilization rate of 85% and will look for the District to find efficiencies in future submittals.

- **Special Education** – *Proposed programmatic spaces appear to exceed the MSBA guidelines. Note that the Special Education program is subject to approval by the Department of Elementary and Secondary Education ("DESE"). The District should provide the required information required with the Schematic Design submittal. Formal approval of the District's proposed Special Education program by the DESE is a prerequisite for executing a Project Funding Agreement with the MSBA.*
- **Art & Music / Voc- Tech** – *Combined proposed programmatic spaces in these categories appear to exceed the MSBA guidelines for the 9-12 options and appear to be below the MSBA guidelines for the 7-12 and 8-12 options. Confirm that no Chapter 74 programs are being proposed. Given the relatively low utilization rate in the Core Academic category as noted above, the MSBA will look for continued efficiency refinements in future submittals within all educational capacity-generating spaces, including "specials" in the Art/Music and Voc-tech categories. No further preliminary comments.*
- **Health & Physical Education** – *Proposed programmatic spaces appear to exceed the MSBA guidelines, in both the new construction and the addition/renovation options. The proposed existing gymnasium area is 30,183 nsf. For new building options, the submittal proposes the MSBA maximum allowable gymnasium area of 18,000 nsf, as well as various PE Alternatives spaces. Depending on the District's preferred option and grade configuration selected in the*

F. MSBA PDP REVIEW

following submittal, any area in excess of MSBA space guidelines will be considered ineligible for reimbursement (refer to the attached Memorandum which presents MSBA policy regarding auditorium and gym spaces beyond those included in the guidelines). No further preliminary comments.

- **Media Center** – *Proposed programmatic spaces appear to align with the MSBA guidelines. No further preliminary comments.*
- **Auditorium/Drama** – *Proposed programmatic spaces appear to exceed the MSBA guidelines, based on providing auditorium / drama spaces for the entire design enrollment including the middle school grades. This overage is due to a larger stage area and the inclusion of a 3,000 nsf Black Box Theatre in each option. Although the MSBA does not take issue with these added spaces, the overall nsf of this category should comply with MSBA's guidelines for each design enrollment. Depending on the District's preferred option and grade configuration selected in the following submittal, any area in excess of MSBA space guidelines will be considered ineligible for reimbursement (refer to the attached Memorandum which presents MSBA policy regarding auditorium and gym spaces beyond those included in the guidelines). No further preliminary comments.*
- **Dining & Food Service** – *Proposed programmatic spaces appear to align with the MSBA guidelines. No further preliminary comments.*
- **Medical** – *Proposed programmatic spaces appear to align with the MSBA guidelines for the 9-12 options and exceed guidelines for the 8-12 and 7-12 options. This overage appears to result from inherent inefficiencies relating to separating medical spaces between middle school and high school students. The MSBA will evaluate the eligibility for funding for areas in excess of the guidelines in future submittals. No further preliminary comments.*
- **Administration & Guidance** – *Proposed programmatic spaces appear to exceed the MSBA guidelines. MSBA will evaluate the eligibility for funding for areas in excess of the guidelines in future submittals. No further preliminary comments.*
- **Custodial & Maintenance** – *Proposed programmatic spaces appear to exceed the MSBA guidelines. This overage is due to the inclusion of a 150 nsf maintenance equipment area. MSBA will evaluate the eligibility for funding for areas in excess of the guidelines in future submittals. No further preliminary comments.*
- **Other** –*For each option, this category contains: District Offices, Technology Offices and associated conference room, Metco Classroom and office, BEA Office, Food Service Director Office, District Nurse Office, Resource Officer, and School Store. In the subsequent PSR submittal, the District must fully describe the function, intended users and scheduling of each of these spaces. Confirm that the Food Service Director Office is a District wide space. If it is not, reallocate this area to the Dining and Food Service category. MSBA will evaluate the eligibility for funding for areas in excess of the guidelines in future submittals. Note that all area associated with any District function in any option will be ineligible for reimbursement.*

  Addition/ Renovation options also include the renovation of the existing 9,067 nsf area associated with the pool. Costs associated with pool and associated pool support spaces and systems must be itemized in each cost estimate moving forward in the MSBA process. Per 963 CMR 2.16(5), any work associated with this renovated pool & support space will be

Module 3 – PDP Review Comments (Revised 1.25.16) 6

considered ineligible for reimbursement, and, MSBA will not support a project that includes a newly constructed swimming pool.

Note that upon selection of a preferred solution, the District may be required to adjust spaces/square footage that exceeds the MSBA guidelines and is not supported by the Educational Program provided. No further preliminary comments.

No further review comments for this section.

3.1.4 EVALUATION OF EXISTING CONDITIONS

	Provide the following Items	Complete; *No response required*	Provided; *District's response required*	Not Provided; *District's response required*	Receipt of District's Response; *To be filled out by MSBA Staff*
1	Confirmation of legal title to the property.	☒	☐	☐	☐
2	Determination that the property is available for development.	☒	☐	☐	☐
3	Existing historically significant features and any related effect on the project design and/or schedule.	☐	☒	☐	☐
4	Determination of any development restrictions that may apply.	☒	☐	☐	☐
5	Initial Evaluation of building code compliance for the existing facility.	☒	☐	☐	☐
6	Initial Evaluation of Architectural Access Board rules and regulations and their application to a potential project.	☒	☐	☐	☐
7	Preliminary evaluation of significant structural, environmental, geotechnical, or other physical conditions that may impact the cost and evaluations of alternatives.	☐	☒	☐	☐
8	Determination for need and schedule for soils exploration and geotechnical evaluation.	☐	☒	☐	☐
9	Environmental site assessments minimally consisting of a Phase I: Initial Site Investigation performed by a licensed site professional.	☐	☒	☐	☐
10	Assessment of the school for the presence of hazardous materials.	☐	☒	☐	☐
11	Previous existing building and/or site reports, studies, drawings, etc. provided by the district, if any.	☒	☐	☐	☐

MSBA Review Comments:

3) The submittal includes a letter from the Belmont Historic District Commission (dated November 21, 2017) in which the town describes the landscaped area including the Clay Pit Pond and the 1910/1932 White Memorial Field House two-story brick structure (currently used as team locker rooms and DPW Park maintenance equipment) as historic. Include in the schedule submitted with the schematic design, the timeline associated with filing with the

F. MSBA PDP REVIEW

Massachusetts Historical Commission ("MHC") and obtaining MHC approval prior to construction bids. The District should keep the MSBA informed of any decisions and/or proposed actions and should confirm that the proposed project is in conformance with Massachusetts General Law 950, CRM 71.00.

7) The existing conditions analysis notes that the Clay Pit Pond & surrounding landscaped area are classified as a wetlands area (which includes the associated buffer area requirements), and is considered to be "Protected Open Space". This area is also located in Zone AE, within the 100 year, 1% annual flood plain zone. In the District's response to this review, provide a summary description how this may affect site development and costs for this project.

In addition, list any development restrictions (if any) and potential added costs associated with the following site conditions described in the submittal:

- *building adjacent to the existing MBTA Fitchburg rail line along the northern site border,*
- *the existing multi-generational walking path and amenities around the pond,*
- *the onsite future Belmont community path parallel to the rail line, and*
- *the potential future pedestrian connecting underpass at Alexander St./ MBTA Fitchburg rail line.*

8) The report provided by McPhail Associates indicates the use of previous borings and foundation recommendations from the construction of the existing Belmont High School, and that additional testing should be done during the PSR phase to identify specific pile types required. Provide any updated information in the subsequent Preferred Schematic Report ("PSR") submittal.

9) The Phase 1 assessment identified two Recognized Environmental Conditions (one associated with the site's historical use as a landfill, the other with the presence of an abandoned Underground Storage Tank near the hockey rink). However, this Phase 1 report does not state definitively whether (or not) additional Phase 2 geo-environmental investigations are recommended. In response to these comments, clarify and describe any future potential site investigations in this regard. Additionally, MSBA notes that all costs associated with abatement of contaminated soil from any source, and abatement of underground storage tanks must be itemized in the cost estimates for the following Schematic Design submittal as ineligible for MSBA reimbursement.

10) MSBA notes that all costs associated with the removal of asbestos containing floor and ceiling tiles are categorically ineligible for MSBA reimbursement. Additionally, the project team should be aware of the current policies associated with MSBA's participation in the abatement and removal of hazardous materials.

No further review comments for this section.

3.1.5 SITE DEVELOPMENT REQUIREMENTS

	Provide the following Items	Complete; *No response required*	Provided; *District's response required*	Not Provided; *District's response required*	Receipt of District's Response; *To be filled out by MSBA Staff*
1	A narrative describing project requirements related to site development to be considered during the preliminary and final evaluation of alternatives.	☐	☒	☐	☐
2	Existing site plan(s)	☒	☐	☐	☐

3.3.1 - INTRODUCTION

F. MSBA PDP REVIEW

MSBA Review Comments:

1)In the District's response to these comments, for each option considered for further evaluation, describe how the proposed building massing, major educational spaces and classroom areas are configured on the site in response to solar orientation and views to the exterior. Describe any limitations in this regard that may affect the proposed design(s), how these limitations could be mitigated, and how these limitations may determine the District's selection of a preferred option. Describe any intended sun control or shading devices that may respond to the proposed orientation; i.e. window configuration, exterior louvers, shading devices, roof overhangs, interior deflecting shelves, etc.

In response to these comments, describe how the onsite number of parking spaces for each of staff, student drivers, and visitors will be determined. Describe whether the required parking will be determined by school needs, after-hours athletic/performance needs, and/or local zoning requirements. In addition, provide a timeline associated with the needed permits, filings, and reviews discussed in this section.

The MSBA notes that the existing historic White Memorial Field House is proposed to be demolished and replaced with athletic parking adjacent to the skating rink. Describe whether this proposed parking area is functionally associated with the skating rink, or how this may be associated with the educational operation of the school (eligibility of MSBA funding for this scope of work will be determined in the Project Scope and Budget phase of the Feasibility Study).

No further review comments for this section.

3.1.6 PRELIMINARY EVALUATION OF ALTERNATIVES

	Provide the following Items	Complete; *No response required*	Provided; *District's response required*	Not Provided; *District's response required*	Receipt of District's Response; *To be filled out by MSBA Staff*
1	Analysis of school district student school assignment practices and available space in other schools in the district	☒	☐	☐	☐
2	Tuition agreement with adjacent school districts	☐	☒	☐	☐
3	Rental or acquisition of existing buildings that could be made available for school use	☒	☐	☐	☐
4	Code Upgrade option that includes repair of systems and/or scope required for purposes of code compliance; with no modification of existing spaces or their function	☒	☐	☐	☐
5	Renovation(s) and/or addition(s) of varying degrees to the existing building(s)	☐	☒	☐	☐
6	Construction of new building and the evaluation of potential locations	☐	☒	☐	☐
7	List of 3 distinct alternatives (including at least 1 renovation and/or addition option) are recommended for further development and evaluation.	☐	☒	☐	☐

F. MSBA PDP REVIEW

MSBA Review Comments:

(General comment about the District's Preliminary Evaluation of Alternatives)

As stated in the enrollment letter, the MSBA's study enrollment recommendations assume full utilization of all school facilities. Accordingly, the District will be required to determine the enrollment capacity of each existing facility anticipated to remain in service if a grade reconfiguration is determined to be the Preferred Solution. The District will be required to demonstrate in the Preferred Schematic Report that any reconfiguration proposed as the District's Preferred Solution has been approved by the School Committee and other necessary District officials. Further, the MSBA will require a written plan from the District describing the process for determining local support for potential grade reconfiguration.

Note that these recommendations do not represent an affirmation by the MSBA for approval of any of these options, and are intended only to provide a framework to inform the feasibility study to be conducted as a mean of determining the most cost effective and educationally sound solution to be agreed upon by the District and the MSBA.

2) The submittal notes that the District has removed themselves as a member town from the Minuteman Regional Vocational Technical School District, and will be seeking alternative vocational programming for their students, including continuing to send students as "Out of District" students. In response to these comments, confirm that no Chapter 74 programming is being proposed for this project.

5) Option 2.1 is the only addition/renovation option recommended for further evaluation that maintains more than field house and pool functions of the existing school, although it is unclear how much is retained other than the auditorium. The submittal notes that the 'entire building structure- including caissons, foundations, concrete floor, roof slabs, and concrete beams- would remain and be reused'. This implies that exterior envelope and all interior partitions would be demolished, as well as all systems in the building. Based on the submitted options, the MSBA has concerns that keeping the spaces ineligible for MSBA funding such as the pool and field house may be limiting the District's choice of options (please clarify). For the following PSR submittal, the MSBA asks that the District / design team include an add/reno option for evaluation for the selected grade configuration that includes the <u>minimum</u> renovation and addition required to meet current building code and comply with the necessary educational program meeting MSBA space guidelines; i.e., bringing any "existing-to-remain" portions of the building up to code, modifying partition locations only as needed, re-assigning space locations to meet the program, and any building addition required to provide MSBA space guideline area.

Documents in the following submittal should include floor plans that clearly delineate new, renovated and existing-to-remain areas.

6) All options for the project are located on the existing High School site due to a lack of alternate sites in the community of the size required for this project (no alternate sites are under consideration). No response required.

7) See comment 5.

No further review comments for this section.

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3.3.1 - INTRODUCTION

F. MSBA PDP REVIEW

3.1.7 LOCAL ACTIONS AND APPROVAL

	Provide the following Items	Complete; *No response required*	Provided; *District's response required*	Not Provided; *District's response required*	Receipt of District's Response; *To be filled out by MSBA Staff*
1	Certified copies of the School Building Committee meeting notes showing specific submittal approval vote language and voting results, and a list of associated School Building Committee meeting dates, agenda, attendees and description of the presentation materials	☒	☐	☐	☐
2	Signed Local Actions and Approvals Certification(s):				
	a) Submittal approval certificate	☒	☐	☐	☐
	b) Grade reconfiguration and/or redistricting approval certificate (if applicable)	☐	☐	☒	☐
3	***Applicable for Districts proposing grade reconfiguration and/or redistricting /consolidation*** Provide the following items to document approval and public notification of school configuration changes associated with the proposed project				
	a) A description of the local process required to authorize a change to the existing grade configuration or redistricting in the district	☐	☐	☒	☐
	b) A list of associated public meeting dates, agenda, attendees and description of the presentation materials	☐	☐	☒	☐
	c) Certified copies of the governing body (e.g. School Building Committee) meeting notes showing specific grade reconfiguration and/or redistricting, vote language, and voting results if required locally	☐	☐	☒	☐
	d) A certification from the Superintendent stating the District's intent to implement a grade configuration or consolidate schools, as applicable. The certification must be signed by the Chief Executive Officer, Superintendent of Schools, and Chair of the School Committee	☐	☐	☒	☐

MSBA Review Comments:

2b, 3a-d) In the event that the District selects a grade configuration / preferred option in the PSR phase of the feasibility study that is not the current high school 9-12 configuration (i.e. the 7-12 and 8-12 configurations described in the Study Certification), the PSR submittal should include the appropriate documentation associated with grade reconfiguration noted above in (3.1.7) 2b and 3a-d.

No further review comments for this section.

F. MSBA PDP REVIEW

3.1.8 APPENDICES

	Provide the following Items	Complete; *No response required*	Provided; *District's response required*	Not Provided; *District's response required*	Receipt of District's Response; *To be filled out by MSBA Staff*
1	Current Statement of Interest	☒	☐	☐	☐
2	MSBA Board Action Letter including the invitation to conduct a Feasibility Study	☒	☐	☐	☐
3	Design Enrollment Certification	☒	☐	☐	☐

MSBA Review Comments:

No review comments for this section.

Additional Comments:

The MSBA issues project advisories from time to time, as informational updates for Districts, Owner's Project Managers (OPM's), and Designers in an effort to facilitate the efficient and effective administration of proposed projects currently pending review by the MSBA. The advisories can be found on the MSBA's website. In response to these review comments, please confirm that the District's consultants have reviewed all project advisories and they have been incorporated into the proposed project as applicable.

End

3.3.1 - INTRODUCTION

F. MSBA PDP REVIEW

MEMORANDUM

TO:	Board of Directors, Massachusetts School Building Authority
FROM:	Maureen G. Valente, Chief Executive Officer John K. McCarthy, Executive Director, Deputy Chief Executive Officer
SUBJECT:	Staff Recommendation for policy revisions to allow for auditorium and gymnasium spaces in excess of the MSBA Space Summary Guidelines at the district's sole expense
DATE:	November 2, 2016

Based upon review of project data and discussions with the Board of Directors, staff is recommending a policy revision to the Massachusetts School Building Authority (the "MSBA") space guidelines specifically for Auditorium and Gymnasium related spaces that are in excess of those included in the MSBA space summary guidelines.

Background

Based on project reviews in late fall 2015, the Board of Directors requested that staff provide information regarding the potential to revise the policies for space guidelines to allow for requests by districts for spaces in excess of the MSBA's guidelines at the district's sole expense. Staff presented an overview of current policies and practices at the March 16, 2016 Board of Directors meeting and followed with additional information regarding potential revisions at the March 30, 2016 Board of Directors meeting.

Based on the discussions and input received from the Board members, staff has prepared a Potential Revised Policy, included as Attachment A, which will allow districts to include spaces in excess of the MSBA's space summary guidelines at the district's sole expense for two program areas: auditorium and gymnasium. Staff has received favorable feedback regarding this proposed revision to the MSBA's policies, and as noted at the September 29, 2016 Board of Directors meeting and further reviewed at the October 19, 2016 Facilities Assessment Subcommittee meeting, staff have prepared this recommendation to revise the MSBA's policy for the Board of Directors approval.

Recommendation

Specific details are set forth in Attachment A: Potential Revised Policy – Auditorium and Gymnasium spaces above guidelines requested to support community use at district's sole expense.

Key features of the policy revision include:

F. MSBA PDP REVIEW

- Areas in excess of the MSBA guidelines will be at the sole expense of the district;
- Community support must be demonstrated prior to MSBA approval of a district's proposed project scope and budget;
- The MSBA will exclude from its grant the cost of the total gross square foot ("gsf") above guidelines for these areas as shown below in the sample calculation. This amount will not change over the term of the grant even if the bids come in at a lower amount.

- High Schools:
  - Upper limits on allowable nsf in excess of guidelines include:
    - The district may choose to build an auditorium in excess of MSBA guidelines, but no more than 13,300 net square foot ("nsf") (based upon an upper limit of 1,000 seats). The MSBA funding limit will vary depending on the agreed-upon design enrollment but will not exceed 10,400 nsf; and
    - The district may choose to build a gymnasium and related spaces in excess of MSBA guidelines, but in no event shall the gymnasium exceed 18,000 nsf. The MSBA will participate in a gymnasium of up to 12,000 nsf unless adjusted by the MSBA to increase teaching stations for enrollment and/or the educational plan.

- Middle Schools/Elementary Schools:
  - Upper limits on allowable nsf in excess of guidelines include:
    - The district may choose to build an auditorium even though the MSBA space guidelines do not include an auditorium and no portion of the design and construction of an auditorium will be reimbursed, including the stage, regardless of whether the district chooses not to include a stage in its cafetorium or gymnasium. If the district chooses to build an auditorium, the auditorium cannot be larger than 13,300 nsf; and
    - The district may choose to build a gymnasium and related spaces in excess of MSBA guidelines, but in no event shall the gymnasium itself exceed 12,000 nsf. The MSBA will participate in a gymnasium up to no more than 6,000 nsf, unless adjusted by the MSBA to increase teaching stations for enrollment and/or the education plan.

- Sample Calculation for Auditorium space in a high school in excess of guidelines at the district's sole expense:

Total net square footage (nsf) requested by the District	13,300 nsf
Total nsf for Auditorium Category allowed as eligible by MSBA space guidelines	10,400 nsf
Excess net square footage equals District request minus net	2,900 nsf

2

square footage allowable by MSBA space guidelines	
Gross square foot (gsf) exclusion = Excess net square feet times the project's grossing factor. For illustration purposes, project's sample grossing factor is 1.5	2,900 nsf x 1.5 = 4,350 gsf
Total cost of exclusion = Gross square foot times the project's total construction cost/square foot. For illustration purposes, project's total construction cost/square foot is $375 per square foot.	4,350 gsf x $375/gsf = $1,631,250
Total cost of exclusion	$1,631,250

Recommendation

MSBA staff is recommending a policy revision to the MSBA space guidelines specifically for Auditorium and Gymnasium related spaces that are in excess of those included in the MSBA space summary guidelines. This recommendation would be effective for districts that are approved to proceed into schematic design on or after January 1, 2017.

3.3.1 - INTRODUCTION

G. DISTRICT RESPONSE

On February 02, 2018, the District issued their responses to the MSBA. Additional responses not due until the delivery of the PSR can be found within the PSR submittal.

ATTACHMENT A
MODULE 3 – PRELIMINARY DESIGN PROGRAM REVIEW COMMENTS

District: Town of Belmont
School: Belmont High School
Owner's Project Manager: Daedalus Projects, Inc.
Designer Firm: Perkins+Will
Submittal Due Date: December 13, 2017
Submittal Received Date: December 13, 2017
Review Date: December 13, 2017 - January 12, 2018
Reviewed by: A.Waldron, K.Brown, J.Jumpe
BELMONT RESPONSE: February 1, 2018

MSBA REVIEW COMMENTS

The following comments[1] on the Preliminary Design Program (PDP) submittal are issued pursuant to a review of the project submittal document for the proposed project presented as a part of the Feasibility Study submission in accordance with the MSBA Module 3 Guidelines.

MSBA TEAM,
Below, please find in red our team's response for each issue outlined by the MSBA with attachments as required. All attachments will be clearly labeled with a DOCUMENT number provided herein. Let us know if you require any additional information from the team. Thank you. Thank you for your detailed attention to the Belmont High School project.

ITEMS REQUIRING IMMEDIATE ACTION:

The December 15, 2017 cursory review email identified several items in the Educational Program that require additional elaboration as detailed below in section 3.1.2. The District was requested to provide those items while this review is in process, and as noted below, MSBA required a revised Educational Program that includes those clarifications in the District's response to the cursory review (note that this revised Educational Program was provided to MSBA on January 16, 2018. MSBA will provide supplemental review comments for this document after it is reviewed).
As detailed below in section 3.1.6 Preliminary Evaluation of Alternatives, MSBA requests that the District/design team include an add/reno option for consideration in the following PSR submittal that includes the minimum renovation and addition required to meet current code and comply with the educational program.

3.1 PRELIMINARY DESIGN PROGRAM

[1] The written comments provided by the MSBA are solely for purposes of determining whether the submittal documents, analysis process, proposed planning concept and any other design documents submitted for MSBA review appear consistent with the MSBA's guidelines and requirements, and are not for the purpose of determining whether the proposed design and its process may meet any legal requirements imposed by federal, state or local law, including, but not limited to, zoning ordinances and by-laws, environmental regulations, building codes, sanitary codes, safety codes and public procurement laws or for the purpose of determining whether the proposed design and process meet any applicable professional standard of care or any other standard of care. Project designers are obligated to implement detailed planning and technical review procedures to effect coordination of design criteria, buildability, and technical adequacy of project concepts. Each city, town and regional school district shall be solely responsible for ensuring that its project development concepts comply with all applicable provisions of federal, state, and local law. The MSBA recommends that each city, town and regional school district have its legal counsel review its development process and subsequent bid documents to ensure that it is in compliance with all provisions of federal, state and local law, prior to bidding. The MSBA shall not be responsible for any legal fees or costs of any kind that may be incurred by a city, town or regional school district in relation to MSBA requirements or the preparation and review of the project's planning process or plans and specifications.

G. DISTRICT RESPONSE

Overview of the Preliminary Design Program Submittal	Complete	Provided; *Refer to comments following each section*	Not Provided; *Refer to comments following each section*	Receipt of District's Response; *To be filled out by MSBA Staff*
OPM Certification of Completeness and Conformity	☒	☐	☐	☐
Table of Contents	☒	☐	☐	☐
3.1.1 Introduction	☒	☐	☐	☐
3.1.2 Educational Program	☐	☒	☐	☐
3.1.3 Initial Space Summary	☐	☒	☐	☐
3.1.4 Evaluation of Existing Conditions	☐	☒	☐	☐
3.1.5 Site Development Requirements	☐	☒	☐	☐
3.1.6 Preliminary Evaluation of Alternatives	☐	☒	☐	☐
3.1.7 Local Actions and Approvals Certification(s)	☐	☒	☐	☐
3.1.8 Appendices	☒	☐	☐	☐

3.1.1 INTRODUCTION

	Provide the following Items	Complete; *No response required*	Provided; *District's response required*	Not Provided; *District's response required*	Receipt of District's Response; *To be filled out by MSBA Staff*
1	Summary of the Facility Deficiencies and Current S.O.I.	☐	☒	☐	☐
2	Date of invitation to conduct a Feasibility Study and MSBA Board Action Letter	☒	☐	☐	☐
3	Executed Design Enrollment Certification	☒	☐	☐	☐
4	Narrative of the Capital Budget Statement and Target Budget	☒	☐	☐	☐
5	Project Directory with contact information	☒	☐	☐	☐
6	Updated Project Schedule	☒	☐	☐	☐

MSBA Review Comments:

#1) As noted in the December 15, 2017 cursory review email, provide a brief summary of the facility deficiencies identified by the District in the Statement of Interest.
See attached Document #1- Summary of Facility Deficiencies/ PSR Section 3.3.2 a/b

No further review comments for this section.

3.3.1 - INTRODUCTION

G. DISTRICT RESPONSE

3.1.2 EDUCATIONAL PROGRAM

Provide a summary and description of the existing educational program, and the new or expanded educational vision, specifications, process, teaching philosophy statement, as well as the District's curriculum goals and objectives of the program. Include description of the following items:

	Provide the following Items	Complete; *No response required*	Provided; *District's response required*	Not Provided; *District's response required*	Receipt of District's Response; *To be filled out by MSBA Staff*
1	Grade and School Configuration Policies	☒	☐	☐	☐
2	Class Size Policies	☒	☐	☐	☐
3	School Scheduling Method	☐	☒	☐	☐
4	Teaching Methodology and Structure				
	a) Administrative and Academic Organization/Structure	☐	☐	☒	☐
	b) Curriculum Delivery Methods and Practices	☒	☐	☐	☐
	c) English Language Arts/Literacy	☒	☐	☐	☐
	d) Mathematics	☒	☐	☐	☐
	e) Science	☒	☐	☐	☐
	f) Social Studies	☒	☐	☐	☐
	g) World Languages	☒	☐	☐	☐
	h) Academic Support Programming Spaces	☒	☐	☐	☐
	i) Student Guidance and Support Services	☐	☐	☒	☐
5	Teacher Planning and Professional Development	☒	☐	☐	☐
6	Pre-kindergarten	☒	☐	☐	☐
7	Kindergarten	☒	☐	☐	☐
8	Lunch Programs	☒	☐	☐	☐
9	Technology Instruction Policies and Program Requirements	☒	☐	☐	☐
10	Media Center/Library	☒	☐	☐	☐
11	Visual Arts Programs	☒	☐	☐	☐
12	Performing Arts Programs	☒	☐	☐	☐
13	Physical Education Programs	☒	☐	☐	☐
14	Special Education Programs	☒	☐	☐	☐
15	Vocation and Technology Programs				
	a) Non-Chapter 74 Programming	☒	☐	☐	☐
	b) Chapter 74 Programming	☒	☐	☐	☐

G. DISTRICT RESPONSE

16	Transportation Policies	☒	☐	☐	☐
17	Functional and Spatial Relationships	☐	☐	☒	☐
18	Security and Visual Access Requirements	☒	☐	☐	☐

MSBA Review Comments:

The December 15, 2017 cursory review email identified the following items in the Educational Program that require additional elaboration (note that a revised Educational Program was provided to MSBA on January 16, 2018. MSBA will provide supplemental review comments for this document after it is reviewed).
#3) Provide a description of the current and proposed school scheduling method.
Submitted to MSBA on January 16, 2018 / hand delivered.
#4a,4i) Provide a detailed description of the following (both existing and proposed):

- *Administrative and academic organization/structure (e.g., academies, departments, houses, grade based cohorts, teams, rooms, assignment policies, teams, etc.)*
- *Student Administrative Guidance and Support Services*
- *Teaching Methodology*

Submitted to MSBA on January 16, 2018 / hand delivered.

#17) Elaborate on the following (both existing and proposed):

- *Functional and spatial relationships*
- *Key programmatic adjacencies*

Submitted to MSBA on January 16, 2018 / hand delivered.

No further review comments for this section.

3.1.3 INITIAL SPACE SUMMARY

Provide the following Items		Complete; *No response required*	Provided; *District's response required*	Not Provided; *District's response required*	Receipt of District's Response; *To be filled out by MSBA Staff*
1	Space summary; one per approved design enrollment	☐	☒	☐	☐
2	Floor plans of the existing facility	☒	☐	☐	☐
3	Narrative description of reasons for all variances (if any) between proposed net and gross areas as compared to MSBA guidelines	☒	☐	☐	☐

MSBA Review Comments:

1) The MSBA has performed an initial review of the space summary and offers the following:

- *Study Enrollment Options:*
  - *Option 1: 2,215 students in grades 7-12*
  - *Option 2: 1,845 students in grades 8-12*

- *Option 3: 1,470 students in grades 9-12*

General comment applicable to all space categories below - note that all new construction must comply with the MSBA standards for eligibility, whether in a new building or an addition / renovation project. The MSBA considers it critical that the Districts and their Designers aggressively pursue design strategies to achieve compliance with the MSBA guidelines for all proposed projects in the new program and strive to meet the gross square footage allowed per student and the core classroom space standards, as outlined in the guidelines. The MSBA also considers its stance on core classroom space critical to its mission of supporting the construction of successful school projects throughout the Commonwealth that meet current and future educational demands. The MSBA does not want to see this critical component of education suffer at the expense of larger or grander spaces that are not directly involved in the education of students.

- **Core Academic** – *Proposed programmatic spaces appear to exceed the MSBA guidelines. This is due to additional classrooms above guideline, additional small group seminar areas, and ELL spaces. Per the information provided, the submittal proposes the following spaces:*

Anticipated Core Academic Spaces*	Grades 7-12 Option	Grades 8-12 Option	Grades 9-12 Option
General Classrooms	85	70	63
Teacher Planning	8 (MS) + 6 (HS)	4 (MS) + 6 (HS)	6 (HS)
Small Group Seminar	6	5	4
Science Classroom/Lab	20	16	12
Prep Room	10	8	6
Central Chemical Storage Room	1	1	1
ELL	2	2	1

**Provide proposed scheduling information specific to these spaces.*
***The MSBA will rely on the District's Educational Program and additional information to understand how proposed spaces that are unique to the District will be utilized in the proposed project.*

The MSBA calculates all three enrollment options as having a utilization rate in the 71-77% range. Provide an explanation for why additional classrooms above guidelines are proposed. The MSBA targets a utilization rate of 85% and will look for the District to find efficiencies in future submittals. \

Below is a link to the spreadsheet used to calculate 85% utilization for all classes, 9-12. It includes art and ELL rooms by the district. It is based on the assumption that a classroom is in use 6 out of 7 periods/day. *It does not occur for all classrooms simultaneously – it is divided throughout the day. In other words, all the rooms are not going to be unused at the same time – each room will be unused one period/day (per the 85% utilization guideline) but it will not be the same period for each room. While the open room may not be used as a traditional classroom at that time it will be used for teachers' prep, small group discussions, free study time etc…"*

SEE LINK TO THE SPREADSHEET:
https://docs.google.com/spreadsheets/d/1S20d4eLeGs6ZduPp3-FbjRdl9BDrrPugX3AYIg6P9EQ/edit?usp=sharing

G. DISTRICT RESPONSE

Special Education – *Proposed programmatic spaces appear to exceed the MSBA guidelines. Note that the Special Education program is subject to approval by the Department of Elementary and Secondary Education ("DESE"). The District should provide the required information required with the Schematic Design submittal. Formal approval of the District's proposed Special Education program by the DESE is a prerequisite for executing a Project Funding Agreement with the MSBA.*

To be submitted to DESE during Schematic Design Phase.

- **Art & Music / Voc- Tech** – *Combined proposed programmatic spaces in these categories appear to exceed the MSBA guidelines for the 9-12 options and appear to be below the MSBA guidelines for the 7-12 and 8-12 options. Confirm that no Chapter 74 programs are being proposed. Given the relatively low utilization rate in the Core Academic category as noted above, the MSBA will look for continued efficiency refinements in future submittals within all educational capacity-generating spaces, including "specials" in the Art/Music and Voc-tech categories. No further preliminary comments.*

  The Belmont Public Schools will not seek Chapter 74 Programming for the Belmont High School Building Project with the MSBA.

- **Health & Physical Education** – *Proposed programmatic spaces appear to exceed the MSBA guidelines, in both the new construction and the addition/renovation options. The proposed existing gymnasium area is 30,183 nsf. For new building options, the submittal proposes the MSBA maximum allowable gymnasium area of 18,000 nsf, as well as various PE Alternatives spaces. Depending on the District's preferred option and grade configuration selected in the following submittal, any area in excess of MSBA space guidelines will be considered ineligible for reimbursement (refer to the attached Memorandum which presents MSBA policy regarding auditorium and gym spaces beyond those included in the guidelines). No further preliminary comments.*

  Memo has been reviewed and acknowledged.

- **Media Center** – *Proposed programmatic spaces appear to align with the MSBA guidelines. No further preliminary comments.*

  Acknowledged.

- **Auditorium/Drama** – *Proposed programmatic spaces appear to exceed the MSBA guidelines, based on providing auditorium / drama spaces for the entire design enrollment including the middle school grades. This overage is due to a larger stage area and the inclusion of a 3,000 nsf Black Box Theatre in each option. Although the MSBA does not take issue with these added spaces, the overall nsf of this category should comply with MSBA's guidelines for each design enrollment. Depending on the District's preferred option and grade configuration selected in the following submittal, any area in excess of MSBA space guidelines will be considered ineligible for reimbursement (refer to the attached Memorandum which presents MSBA policy regarding auditorium and gym spaces beyond those included in the guidelines). No further preliminary comments.*

  Memo has been reviewed and acknowledged.

- **Dining & Food Service** – *Proposed programmatic spaces appear to align with the MSBA guidelines. No further preliminary comments.*

  Acknowledged.

  Medical – *Proposed programmatic spaces appear to align with the MSBA guidelines for the 9-12 options and exceed guidelines for the 8-12 and 7-12 options. This overage appears to result from inherent inefficiencies relating to separating medical spaces between middle school and high school students. The MSBA will evaluate the eligibility for funding for areas in excess of the guidelines in future submittals. No further preliminary comments.*

  Acknowledged.

- **Administration & Guidance** – *Proposed programmatic spaces appear to exceed the MSBA guidelines. MSBA will evaluate the eligibility for funding for areas in excess of the guidelines in future submittals. No further preliminary comments.*

  Acknowledged.

- **Custodial & Maintenance** – *Proposed programmatic spaces appear to exceed the MSBA guidelines. This overage is due to the inclusion of a 150 nsf maintenance equipment area. MSBA will evaluate the eligibility for funding for areas in excess of the guidelines in future submittals. No further preliminary comments.*

  Acknowledged.

- **Other** –*For each option, this category contains: District Offices, Technology Offices and associated conference room, Metco Classroom and office, BEA Office, Food Service Director Office, District Nurse Office, Resource Officer, and School Store. In the subsequent PSR submittal, the District must fully describe the function, intended users and scheduling of each of these spaces. Confirm that the Food Service Director Office is a District wide space. If it is not, reallocate this area to the Dining and Food Service category. MSBA will evaluate the eligibility for funding for areas in excess of the guidelines in future submittals. Note that all area associated with any District function in any option will be ineligible for reimbursement.*

  To be submitted in the PSR Document.
  PSR COMMENTS 2.16.18/ The spaces noted in the OTHER CATEGORY and as defined above are for the Districts use. The Town of Belmont understands that these spaces will be evaluated by the MSBA team and discussed with the Town of Belmont for eligibility. The METCO Spaces are noted in the Educational Program within this PSR Document.

  Addition/ Renovation options also include the renovation of the existing 9,067 nsf area associated with the pool. Costs associated with pool and associated pool support spaces and systems must be itemized in each cost estimate moving forward in the MSBA process. Per 963 CMR 2.16(5), any work associated with this renovated pool & support space will be considered ineligible for reimbursement, and, MSBA will not support a project that includes a newly constructed swimming pool.

  Acknowledged.

G. DISTRICT RESPONSE

Note that upon selection of a preferred solution, the District may be required to adjust spaces/square footage that exceeds the MSBA guidelines and is not supported by the Educational Program provided. No further preliminary comments.

No further review comments for this section.

3.1.4 EVALUATION OF EXISTING CONDITIONS

	Provide the following Items	Complete; *No response required*	Provided; *District's response required*	Not Provided; *District's response required*	Receipt of District's Response; *To be filled out by MSBA Staff*
1	Confirmation of legal title to the property.	☒	☐	☐	☐
2	Determination that the property is available for development.	☒	☐	☐	☐
3	Existing historically significant features and any related effect on the project design and/or schedule.	☐	☒	☐	☐
4	Determination of any development restrictions that may apply.	☒	☐	☐	☐
5	Initial Evaluation of building code compliance for the existing facility.	☒	☐	☐	☐
6	Initial Evaluation of Architectural Access Board rules and regulations and their application to a potential project.	☒	☐	☐	☐
7	Preliminary evaluation of significant structural, environmental, geotechnical, or other physical conditions that may impact the cost and evaluations of alternatives.	☐	☒	☐	☐
8	Determination for need and schedule for soils exploration and geotechnical evaluation.	☐	☒	☐	☐
9	Environmental site assessments minimally consisting of a Phase I: Initial Site Investigation performed by a licensed site professional.	☐	☒	☐	☐
10	Assessment of the school for the presence of hazardous materials.	☐	☒	☐	☐
11	Previous existing building and/or site reports, studies, drawings, etc. provided by the district, if any.	☒	☐	☐	☐

MSBA Review Comments:

3) The submittal includes a letter from the Belmont Historic District Commission (dated November 21, 2017) in which the town describes the landscaped area including the Clay Pit Pond and the 1910/1932 White Memorial Field House two-story brick structure (currently used as team locker rooms and DPW Park maintenance equipment) as historic. Include in the schedule submitted with the schematic design, the timeline associated with filing with the Massachusetts Historical Commission ("MHC") and obtaining MHC approval prior to construction bids. The District should keep the MSBA informed of any decisions and/or proposed

actions and should confirm that the proposed project is in conformance with Massachusetts General Law 950, CRM 71.00.

~~***Clarification to be submitted in the PSR Document.***~~

As noted in MSBA comments, this will be submitted in the Schematic Design Phase not PSR.

7) The existing conditions analysis notes that the Clay Pit Pond & surrounding landscaped area are classified as a wetlands area (which includes the associated buffer area requirements), and is considered to be "Protected Open Space". This area is also located in Zone AE, within the 100 year, 1% annual flood plain zone. In the District's response to this review, provide a summary description how this may affect site development and costs for this project.

FEMA flood mapping indicates that the Zone AE area is in close proximity to Clay Pit Pond. The current schemes under consideration does not include the construction of any structure or critical facility with the Zone AE. The Zone AE would remain open space and available for flood storage as required.

In addition, list any development restrictions (if any) and potential added costs associated with the following site conditions described in the submittal:

- *building adjacent to the existing MBTA Fitchburg rail line along the northern site border,*
  At this time the project team does not anticipate any additional cost to the project. All proposed work is within the project site boundary.

- *the existing multi-generational walking path and amenities around the pond,*
  The multi-generation path is a separately funded project being implemented by the Town of Belmont. The portion that runs along the north side of Claypit Pond will be an important component of the school's circulation needs for emergency access to the building, access to the fields and pedestrian circulation through the site. Only the portions of this pathway that are required to meet the school's circulation needs may be incorporated into the school project construction due to their integrated nature with the site design.The site plan has been designed to accommodate the multi-generational path and the community path at no additional cost to the project.

- *the onsite future Belmont community path parallel to the rail line, and*
  Site improvements for the school site design are being developed to leave sufficient space where existing on-site conditions do not preclude the Community Path to be constructed as a separately funded project. No cost impact to the school project is anticipated to accommodate this separate project.

- *the potential future pedestrian connecting underpass at Alexander St./ MBTA Fitchburg rail line.*
  No impact to project cost. The underpass is not part of the project scope.

8) The report provided by McPhail Associates indicates the use of previous borings and foundation recommendations from the construction of the existing Belmont High School, and that additional testing should be done during the PSR phase to identify specific pile types required. Provide any updated information in the subsequent Preferred Schematic Report ("PSR") submittal.

G. DISTRICT RESPONSE

9) The Phase 1 assessment identified two Recognized Environmental Conditions (one associated with the site's historical use as a landfill, the other with the presence of an abandoned Underground Storage Tank near the hockey rink). However, this Phase 1 report does not state definitively whether (or not) additional Phase 2 geo-environmental investigations are recommended. In response to these comments, clarify and describe any future potential site investigations in this regard. Additionally, MSBA notes that all costs associated with abatement of contaminated soil from any source, and abatement of underground storage tanks must be itemized in the cost estimates for the following Schematic Design submittal as ineligible for MSBA reimbursement.

During Schematic Design, investigations will be conducted to determine subsurface conditions in areas of future site development (building foundations, utilities, site improvements), and in areas that will be impacted by demolition and removal of existing structures and utilities. The goal of these investigations will be to obtain site-specific data on both geotechnical and environmental conditions that would impact project design, construction, and cost. Explorations will be performed to provide representative data as required by the Massachusetts Building Code and Massachusetts Contingency Plan (MCP). Specifically, we anticipate:

- ***test borings will be drilled within the future building footprint to inform foundation design;***
- ***explorations will be conducted within future utility alignments and roadways for their design;***
- ***soil samples retrieved from explorations will be tested, as appropriate, to determine engineering properties and/or chemical constituents;***
- ***representative analytical soil testing will be performed in areas where soils will be generated by project construction and require off-site disposal; and***
- ***as appropriate, explorations, sampling, and testing will be conducted to determine the nature and extent of contamination and to provide data to maintain MCP regulatory compliance.***

The area near the hockey rink will be investigated to determine the presence, condition, and configuration of the underground storage tank presumed to be present. If an underground storage tank exists and it is not in consumptive use or found to be impaired, it will be removed in accordance with applicable regulations. It is understood that all costs associated with abatement of contaminated soil from any source and abatement of underground storage tanks must be itemized in the Schematic Design submittal cost estimates as ineligible for MSBA reimbursement.

The subsurface exploration activities are expected to begin in the Spring/Summer of 2018.

10) MSBA notes that all costs associated with the removal of asbestos containing floor and ceiling tiles are categorically ineligible for MSBA reimbursement. Additionally, the project team should be aware of the current policies associated with MSBA's participation in the abatement and removal of hazardous materials.

Acknowledged.

No further review comments for this section.

3.1.5 SITE DEVELOPMENT REQUIREMENTS

	Provide the following Items	Complete; *No response required*	Provided; *District's response required*	Not Provided; *District's response required*	Receipt of District's Response; *To be filled out by MSBA Staff*
1	A narrative describing project requirements related to site development to be considered during the preliminary and final evaluation of alternatives.	☐	☒	☐	☐
2	Existing site plan(s)	☒	☐	☐	☐

MSBA Review Comments:

1)In the District's response to these comments, for each option considered for further evaluation, describe how the proposed building massing, major educational spaces and classroom areas are configured on the site in response to solar orientation and views to the exterior. Describe any limitations in this regard that may affect the proposed design(s), how these limitations could be mitigated, and how these limitations may determine the District's selection of a preferred option. Describe any intended sun control or shading devices that may respond to the proposed orientation; i.e. window configuration, exterior louvers, shading devices, roof overhangs, interior deflecting shelves, etc.

See attached Document #2- Summary of Solar Orientation, Views, Sun Control, Shading

In response to these comments, describe how the onsite number of parking spaces for each of staff, student drivers, and visitors will be determined. Describe whether the required parking will be determined by school needs, after-hours athletic/performance needs, and/or local zoning requirements. In addition, provide a timeline associated with the needed permits, filings, and reviews discussed in this section.

The Town of Belmont has exercised its rights under the Dover Amendment for all of its previous school projects and will continue this practice for the High School Project. We have already begun discussions with the local regulatory officials and the Planning Board. The Site Plan review will be conducted with the Planning Board during the Schematic Design. We do not anticipate the need for any Zoning Variances for this project. The number of parking spaces required will be based on the demands for Faculty, Staff, Students and Visitors. The anticipated timeline will follow the normal by-right permitting process. No special hearings or Town Meetings are anticipated. Actual Building permits will be issued at the completion of the Construction Document Phase once a contractor is engaged.

The MSBA notes that the existing historic White Memorial Field House is proposed to be demolished and replaced with athletic parking adjacent to the skating rink. Describe whether this proposed parking area is functionally associated with the skating rink, or how this may be associated with the educational operation of the school (eligibility of MSBA funding for this scope of work will be determined in the Project Scope and Budget phase of the Feasibility Study).

The proposed parking adjacent to the Skating Rink will serve two purposes. It will be used for school parking during normal daily activities. It will also serve the needs of the skating rink, and other school athletic activities during non-school hours for players, coaches, staff, and some spectators.

G. DISTRICT RESPONSE

No further review comments for this section.

3.1.6 PRELIMINARY EVALUATION OF ALTERNATIVES

	Provide the following Items	Complete; *No response required*	Provided; *District's response required*	Not Provided; *District's response required*	Receipt of District's Response; *To be filled out by MSBA Staff*
1	Analysis of school district student school assignment practices and available space in other schools in the district	☒	☐	☐	☐
2	Tuition agreement with adjacent school districts	☐	☒	☐	☐
3	Rental or acquisition of existing buildings that could be made available for school use	☒	☐	☐	☐
4	Code Upgrade option that includes repair of systems and/or scope required for purposes of code compliance; with no modification of existing spaces or their function	☒	☐	☐	☐
5	Renovation(s) and/or addition(s) of varying degrees to the existing building(s)	☐	☒	☐	☐
6	Construction of new building and the evaluation of potential locations	☐	☒	☐	☐
7	List of 3 distinct alternatives (including at least 1 renovation and/or addition option) are recommended for further development and evaluation.	☐	☒	☐	☐

MSBA Review Comments:

(General comment about the District's Preliminary Evaluation of Alternatives)

As stated in the enrollment letter, the MSBA's study enrollment recommendations assume full utilization of all school facilities. Accordingly, the District will be required to determine the enrollment capacity of each existing facility anticipated to remain in service if a grade reconfiguration is determined to be the Preferred Solution. The District will be required to demonstrate in the Preferred Schematic Report that any reconfiguration proposed as the District's Preferred Solution has been approved by the School Committee and other necessary District officials. Further, the MSBA will require a written plan from the District describing the process for determining local support for potential grade reconfiguration.

Note that these recommendations do not represent an affirmation by the MSBA for approval of any of these options, and are intended only to provide a framework to inform the feasibility study to be conducted as a mean of determining the most cost effective and educationally sound solution to be agreed upon by the District and the MSBA.

See attached Document #3- Utilization/reconfiguration of existing facilities summaries.

2) The submittal notes that the District has removed themselves as a member town from the Minuteman Regional Vocational Technical School District, and will be seeking alternative vocational programming for their students, including continuing to send students as "Out of District" students. In response to these comments, confirm that no Chapter 74 programming is being proposed for this project.

The Belmont Public Schools will not seek Chapter 74 Programming for the Belmont High School Building Project with the MSBA.

5) Option 2.1 is the only addition/renovation option recommended for further evaluation that maintains more than field house and pool functions of the existing school, although it is unclear how much is retained other than the auditorium. The submittal notes that the 'entire building structure- including caissons, foundations, concrete floor, roof slabs, and concrete beams- would remain and be reused'. This implies that exterior envelope and all interior partitions would be demolished, as well as all systems in the building. Based on the submitted options, the MSBA has concerns that keeping the spaces ineligible for MSBA funding such as the pool and field house may be limiting the District's choice of options (please clarify). For the following PSR submittal, the MSBA asks that the District / design team include an add/reno option for evaluation for the selected grade configuration that includes the minimum renovation and addition required to meet current building code and comply with the necessary educational program meeting MSBA space guidelines; i.e., bringing any "existing-to-remain" portions of the building up to code, modifying partition locations only as needed, re-assigning space locations to meet the program, and any building addition required to provide MSBA space guideline area.

Documents in the following submittal should include floor plans that clearly delineate new, renovated and existing-to-remain areas.

See attached Document #4- Option 2.1 Clarification of Scope

- **Option 2.1 Plans/ clarifying scope of work**
- **Option 2.1 Phasing Plan**
- **Option 2.1 Costing Memo from Peter Bradley PMC**

See ADDENDA #1 Option 2.1a Light Touch Major Renovation Minor Addition.

6) All options for the project are located on the existing High School site due to a lack of alternate sites in the community of the size required for this project (no alternate sites are under consideration). No response required.

Acknowledged.

7) See comment 5.

No further review comments for this section.

3.1.7 LOCAL ACTIONS AND APPROVAL

Provide the following Items	Complete; *No response required*	Provided; *District's response required*	Not Provided; *District's response required*	Receipt of District's Response; *To be filled out by MSBA Staff*

G. DISTRICT RESPONSE

1	Certified copies of the School Building Committee meeting notes showing specific submittal approval vote language and voting results, and a list of associated School Building Committee meeting dates, agenda, attendees and description of the presentation materials	☒	☐	☐	☐
2	Signed Local Actions and Approvals Certification(s):				
	a) Submittal approval certificate	☒	☐	☐	☐
	b) Grade reconfiguration and/or redistricting approval certificate (if applicable)	☐	☐	☒	☐
3	***Applicable for Districts proposing grade reconfiguration and/or redistricting /consolidation*** Provide the following items to document approval and public notification of school configuration changes associated with the proposed project				
	a) A description of the local process required to authorize a change to the existing grade configuration or redistricting in the district	☐	☐	☒	☐
	b) A list of associated public meeting dates, agenda, attendees and description of the presentation materials	☐	☐	☒	☐
	c) Certified copies of the governing body (e.g. School Building Committee) meeting notes showing specific grade reconfiguration and/or redistricting, vote language, and voting results if required locally	☐	☐	☒	☐
	d) A certification from the Superintendent stating the District's intent to implement a grade configuration or consolidate schools, as applicable. The certification must be signed by the Chief Executive Officer, Superintendent of Schools, and Chair of the School Committee	☐	☐	☒	☐

MSBA Review Comments:

2b, 3a-d) In the event that the District selects a grade configuration / preferred option in the PSR phase of the feasibility study that is not the current high school 9-12 configuration (i.e. the 7-12 and 8-12 configurations described in the Study Certification), the PSR submittal should include the appropriate documentation associated with grade reconfiguration noted above in (3.1.7) 2b and 3a-d.

To be submitted in the PSR Document.

See 3.3.5.A Local Actions & Approvals Certification, Appendix.A Grade Configuration Presentations.

No further review comments for this section.

3.3.1 - INTRODUCTION

G. DISTRICT RESPONSE

3.1.8 APPENDICES

Provide the following Items		Complete; *No response required*	Provided; *District's response required*	Not Provided; *District's response required*	Receipt of District's Response; *To be filled out by MSBA Staff*
1	Current Statement of Interest	☒	☐	☐	☐
2	MSBA Board Action Letter including the invitation to conduct a Feasibility Study	☒	☐	☐	☐
3	Design Enrollment Certification	☒	☐	☐	☐

MSBA Review Comments:

No review comments for this section.
Complete.

Additional Comments:

The MSBA issues project advisories from time to time, as informational updates for Districts, Owner's Project Managers (OPM's), and Designers in an effort to facilitate the efficient and effective administration of proposed projects currently pending review by the MSBA. The advisories can be found on the MSBA's website. In response to these review comments, please confirm that the District's consultants have reviewed all project advisories and they have been incorporated into the proposed project as applicable.

End

We confirm that the District's consultants have reviewed all project advisories and they have been incorporated into the proposed project as applicable

G. DISTRICT RESPONSE / Document #1

DOCUMENT # 1

3.3.1 - INTRODUCTION

G. DISTRICT RESPONSE / Document #1

3.1.1 - INTRODUCTION

A. SUMMARY OF FACILITY DEFICIENCIES

On March 3rd, 2015 the Town of Belmont submitted to the MSBA a Statement of Interest (SOI) that identified priorities related to facility deficiencies along with the need to address the increasing population at the Belmont High School and the district overall. The Belmont High School opened in 1970 and was constructed as a new building on a vacant site. There have been no additions or major renovations since the facility opened. The existing infrastructure contains original equipment with the exception of replacement of all HVAC units on the roof of the building.

The increase in the Belmont Public School's enrollment is a major concern for the district. A district wide master planning facilities study was prepared in 2004 which addressed the Belmont Public School's (BPS) enrollment. BPS has seen a recent increase of 531 students and is projected to see at least a total of 725 new students over a ten-year period. This projection does not take into account two potential building projects within the town which, when completed, would bring over 400 units of living space (via apartments and condominiums) to Belmont. Additionally, the district is experiencing an increase in international students. It is difficult to project the increase in international student population in the future. The international student population is creating the need for additional spaces in the High School Facility.

The 2004 Master plan identified significant deficiencies with respect to the mechanical, plumbing, and electrical systems, resulting in subpar energy efficiencies, substandard air quality, and high energy costs. All components of the building's mechanical and electrical systems require constant service, as they have reached the end of their useful life. The boilers are oil-fired steam, feeding roof mounted air handling units directly and supplying hot water via converters to unit ventilators on the periphery of the building. The steam system is very difficult to control. The building's electrical system is also original to the construction, with the exception of some minor updates to the telephone and data network made due to changing technologies. The power distribution system is beyond its expected useful life. As components fail in the facility replacement parts are becoming scarcer with time. A full report of the building deficiencies are contained in the Section 3.1.4.

In addition to addressing the BHS Building Deficiencies the MSBA has allowed the Town to review three grade configurations in order to best support the district's needs (see item D below).

The entire team including the Building Committee, OPM and Designer has developed an extensive and very inclusive, community driven and engaged process to solicit feedback, show the PDP development, to inform the students, staff, parents, and overall Belmont Community (see the Project Directory for the full list of Committee, regulatory, and community outreach meetings conducted during the PDP).All the meetings were publicly advertized and many were shown on the local cable television. The contents of all of the meetings including agendas, meeting minutes, and presentations are uploaded to the Belmont High School website for reference.

The complete Statement of Interest can be found in Appendix A.

BUILDING CODE

The Belmont High School having been constructed in 1970, with minimal renovations since, has numerous areas where compliance with the current building code (780 CMR 9th Edition, Massachusetts State Building Code) is not achieved. Notable areas of noncompliance include the lack of a sprinkler system, insufficient protection of exit stair enclosures, and inaccessible areas and building features that do not comply with 521 CMR, Architectural Access Board Rules and Regulations. Based on lack of system and envelope upgrades, there are also substantial areas of improvement for compliance with the current energy usage requirements for the 2015 International Energy Conservation Code.

ACCESS CODE

Compliance with the accessibility provisions of 521 CMR and the Americans with Disabilities Act is deficient in many areas throughout the existing high school including the following key elements:

- A majority of the toilet rooms are not accessible. Signed accessible toilet rooms are not fully compliant (e.g. door clearances, toilet paper dispenser locations, etc.).
- The elevator is not accessible based on the size of the cab and locations of controls/signage
- The courtyard has no accessible access or means of egress
- The theater is not provided with accessible seating. An accessible route is also not provided from the theater seating to the stage.
- The tiered lecture hall is not provided with accessible seating
- Gymnasium bleacher seating on the mezzanine is not accessible
- Locker rooms are not accessible

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- Numerous instances of non-accessible door hardware with knobs
- Many cross-corridor door opening widths are less than the required 32" minimum
- Stairs are generally not compliant as they have abrupt nosings, and non-compliant handrails due to shape, no extensions, etc.

CIVIL

Storm Drainage: Record drawings from the Belmont High School 1968 plans indicate that the stormwater from the site appears to be collected by three separate drainage systems and flow to Claypit pond. There appear to be no stormwater quality measures implemented on the site and no known detention, retention, or infiltration systems.

Site Utilities: The existing building is served by a network of existing utilities including water, sewer, gas, and electrical as documented in the 1968 record drawings.

The sewer system for the school is currently serviced by five sewer services connecting to the 24-inch sewer main in the school driveway. An existing 6-inch water service connects to the 8-inch water main that loops through the site north of the building. The existing 3.5-inch gas service connects to the 6-inch gas main in Concord Avenue. The existing electrical service is underground and comes from an electrical substation building east of the school, adjacent to the softball field.

Pavement: Pavement was assessed during the 2017 site visit. Images from google street view suggests that the parking lot was resurfaced in 2013. The asphalt pavement the parking lot, front drive, and walkways adjacent to the school were observed to be in fair condition with some cracking and degradation. The pavement in the driveway to the rear of the school was in poor condition. Curbing on the site is granite, and bituminous concrete in the southwest parking lot. Bituminous concrete curbing appears to be in fair condition. Granite curbing appears to be in good condition. It is possible that the existing curb material is suitable for reuse.

LANDSCAPE

Warner Larson Landscape Architects visited the site on August 28, 2017 to observe existing site conditions and prepared a Landscape Existing Conditions Report which was submitted on October 10, 2017 for inclusion in the PDP. In addition to information collected during our site visit, we subsequently reviewed other existing conditions documentation provided by Perkins + Will and other sources. That report excluded utilities and drainage which were reviewed separately by Nitsch Engineering.

There have been no substantive changes or updates to the Landscape Existing Conditions Report submitted on October 10, 2017 that might impact the final evaluation of alternatives. The reader should refer to the Landscape Existing Conditions Report included in the PDP submission to reference any specifics regarding the existing conditions analysis.

ARCHITECTURAL

The existing Belmont High School was designed and built in its entirety from 1969 to 1970 as a new public high school facility for the town of Belmont located near Clay Pit Pond. Currently, the facility is still owned and run as a high school. The building has been fairly maintained over the past 47 years, but the building enclosure systems and finishes are at the end of their useful life for both exterior and interior.

Much of the interior within the High School have generally not been updated (with exception to the Media Center), leading to worn ceilings, walls, and floors with moderate to minimal damage. At the same time, exterior precast Concrete Lintels, Precast Concrete Columns and Concrete Platforms show signs of deterioration/crumbling around entire exterior perimeter.

STRUCTURAL

Based on visual observations by the Engineers, the school structure is currently performing well. Signs of water leaks were observed at a few locations. Water infiltration through the slab–on-grade in the Field House was noted. Some cracks in the interior masonry walls and through the floor finishes were observed at some locations, as well as in the masonry façade. There was no evidence of foundation settlement, nor was there evidence of undue vibrations due to footfall on the floor slab.

FOOD SERVICE

The existing kitchen and serving facilities were built at least forty years ago and have exceed their design capacity and useful life expectancy. A new facility sized for the future student body will offer a space better able to serve the population by providing greater cooking capacity, increased circulation in the servery, and

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diverse serving station options more in line with current trends. Additionally the design will observe all health department related codes to bring the facility up to compliance.

All storage and cooking equipment should be evaluated and considered for replacement. New gas and electrical equipment shall be selected that meets the performance demands and provides the highest level of energy efficiency available.

HVAC

The heating system for the building includes steam boilers and steam piping that are original to the building construction (47+ years old). The original No. 4 oil burners were replaced in 2011-2012 with dual fuel burners capable of burning No. 2 fuel oil and natural gas. Natural gas is typically used. The boilers have been re-tubed several times to keep them in working order. The steam piping is at the end of its expected life. Steam traps require regular servicing.

Steam is piped to rooftop units, some unit ventilators and a steam convertor in the boiler room. The steam convertor provides heating hot water to most of the classroom unit ventilators and to cabinet heaters. Steam and hot water piping are distributed through a pipe tunnel/trench from the boiler room through the first two segments of the building. Access to this confined space is extremely limited. Replacement of this piping will most likely involve rerouting above ceilings and in corridors.

The unit ventilators in classrooms are also original equipment. These units have mechanical damper linkages and pneumatic controls, which requires continuous maintenance.

Automatic temperature controls are pneumatic and are also original installation with the exception of the air compressors. Maintenance requires specialized technicians that have knowledge of pneumatic systems, which is in large part an obsolete technology.

Rooftop air handling units were replaced in 2004 and 2008. The older units are within 2 to 5 years of their normal life expectancy.

There is no central cooling system in the building. Some rooftop units have self-contained DX cooling, including interior classrooms, the library, administration, and some other areas.

The pool is heated and ventilated by two air handling units. There is no dehumidification system. An exhaust system was added to exhaust low near the pool deck to help limit the buildup of chloramines and also provides negative pressurization for the pool. The system is ducted through the exterior wall to an exhaust fan that is mounted on grade. A pool water UV filter system was added in 2014.

There have been some improvements and upgrades to the mechanical systems in recent years including new dual fuel burners for the boilers and replacement of the rooftop units and roof exhaust fans plus other small-er improvements. However, other systems and equipment that are original, such as the boilers, steam and hot water piping, unit ventilators, and automatic temperature controls have all exceeded their typical expected useful life and are in need of replacement.

The building structure has sprayed-on fire proofing that contains asbestos, which makes it difficult to do any work in the building that requires routing systems above the ceilings.

FIRE PROTECTION

The existing building is not equipped with an automatic fire suppression system.

PLUMBING

In general, the plumbing systems and fixtures appear to be original to the building. These systems, while continuing to function, have served their useful life. Most of the systems could continue to be used with maintenance and replacement of failed components as they age.

All plumbing fixtures are in working condition. Attempts have been made to make bathroom fixtures accessible; however, most fixtures do not meet current accessibility codes. In general, the fixtures appear to have served their useful life. Water conservancy is governed by provisions of the Plumbing Code. The code does not mandate that plumbing fixtures be upgraded. However, where new fixtures are to be installed, as will be the case with any renovations to the existing high school, new fixtures need to be of the water conserving types with lead free faucets and be supplied with lead free water piping systems.

Domestic hot water is supplied by larger steam-fired heaters and scattered electric water heaters throughout the various wings of the building. The larger water heaters have served their useful life and should be replaced.

Sanitary and roof drainage piping systems are made of cast iron. Where visible, the piping systems appear to be in fair condition.

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There are areas where new piping has been installed.

Rainwater from flat roof areas are collected in roof drains that appear to be in good condition and were clear of debris. Internal storm water piping was not visible.

The natural gas service to the school is fairly new and in good condition. This system could stay and be re-used in a renovation. A separate gas service was brought over to the cafeteria kitchen and is capped in place outside the building. This could also be re-used.

The Boy's and Girl's locker rooms and shower areas are older and in fair condition. The shower area layouts do not meet current ADA requirements.

The cafeteria kitchen plumbing equipment is older and in need of replacement. The interior grease trap does not appear to be used or maintained.

The science labs have sinks that do not empty into an acid neutralization system as they should. The waste from these labs currently leaves the building and ties into the town sewer system without being treated. This condition needs to be corrected.

ELECTRICAL

The majority of electrical systems are in excess of 40 years of age and have reached the end of their service life.

Main electric service and distribution, there is little or no physical or electrical capacity to add onto existing system/equipment. Repairs and/or additions to existing service and distribution equipment will require significant rework of existing facilities to suit new equipment and meet code. Working clearances and systems foreign to electrical installations create code violations and safety hazards for school and service personnel.

Existing lighting throughout the building consist of luminaires original to the building. Lamp sources are primarily fluorescent with the exception of the field house and pool where LED luminaires have been installed. The age of the fixtures present serviceability and maintenance issues, energy inefficiencies as well as poor quality light levels and visual comfort.

Lighting controls consist of local switching. There is no use of occupancy/vacancy or day lighting controls. Energy codes require automatic controls for interior and exterior lighting.

A new fire alarm system was recently installed. The system provides complete voice audio/visual, manual pull stations and 100 percent smoke detector coverage.

Emergency power system consists of an exterior 180kW diesel-fired generator manufactured by Kohler. The generator primarily serves the building's emergency lighting system and would not have capacity to serve additional loads. The existing distribution system does not meet current code requirements for separation of life safety and non-life safety systems.

The majority of spaces throughout the building have receptacles that are original to the building, device quantities are minimal.

AUDIOVISUAL

During our site visit to Belmont High School on August 28, 2017, the existing audiovisual systems were reviewed. The technology being used in the school is outdated and does not support current standards. For this reason, these systems have reached the end of their serviceable lives. Additionally, there did not appear to be standardization in the system components used from room to room that would simplify work for technical staff.

New audiovisual presentation systems, consisting of video displays/projection and sound systems for audio playback (and voice reinforcement in larger spaces) are recommended for the Auditorium, Music Classrooms, Cafeteria, Classrooms, Lecture Hall, and Book Rooms. New sound systems are recommended for the Gymnasium, Natatorium, and Field House. Additionally, a video wall in the Entry Hall can be used to display electronic artwork, and can also be used to display other images and announcements.

TECHNOLOGY

Structured Cabling Systems: There is a district-wide fiber backbone connecting all facilities. The fiber network handles general data as well as Phone (VoIP) and security for the school district and the Town. Any future project must take into consideration the requirement for continued connectivity between and among facilities. The high school MDF is located off the Tech Office on the second floor. The fiber enters the building underground on The Theater/parking lot side of the building and is routed internally to the MDF. Horizontal cabling from the MDF and IDFs to endpoint is Category 5. The Cat5 and cabling represents a bottleneck on the existing network and therefore has reached the end of its serviceable life. Any future project should include the installation of horizontal cabling based on current

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standards at the time of design, 20GbE backbone and dedicated MDF/IDF rooms with proper power and environmental treatments.

Data and Voce Communication System: The wireless hardware is Alcatel-Lucent. The controller is at the high school with a backup controller at Chenery Middle School. Most APs within the school are mounted based on availability of data outlets because of the difficulty in adding cabling due to building/ceiling conditions. The second floor MDF is the centralized management point for all data communications for the high school, the school district and the town. IDFs are equipped with Alcatel-Lucent OS6450 Switches, stacked. Any future project should provide updated networking hardware for the MDF and IDFs based on current technology, with special attention paid to maintaining the functionality of the school-district and town wide network and services. VoIP is server-based NEC Univerge SV8300. The server is located in the high school MDF. The system is 10-12 years old. Any future project should expand upon the NEC VoIP platform, upgrade to the newest technology, and consolidate systems as much as possible.

Distributed Communication System: The Intercom system is a Simplex 5100 Series Building Communication System. The master clock system is a Simplex 2350 Master Time System. The intercom main equipment is located in the Main Office. The master clock system is located in the TELCO demark, mounted on the voice termination wallboard. Any future project should provide a new system based on current technology.

GEOTECHNICAL

The report provided by McPhail Associates in PDP indicates the use of previous borings and foundation recommendations from the construction of the existing Belmont High School, and that additional testing should be done during the PSR phase to identify specific pile types required. Provide any updated information in the subsequent Preferred Schematic Report ("PSR") submittal.

The Phase 1 Assessment identified two Recognized Environmental Conditions (one associated with the site's historical use as a landfill, the other with the presence of an abandoned Underground Storage Tank near the hockey rink). However, this Phase 1 report does not state definitively whether (or not) additional Phase 2 geo-environmental investigations are recommended. In response to the comments, clarify and describe any future potential site investigations in this regard.

Additionally, MSBA notes that all costs associated with abatement of contaminated soil from any source, and abatement of underground storage tanks must be itemized in the cost estimates for the following Schematic Design submittal as ineligible for MSBA reimbursement.

During Schematic Design, investigations will be conducted to determine subsurface conditions in areas of future site development (building foundations, utilities, site improvements), and in areas that will be impacted by demolition and removal of existing structures and utilities. The goal of these investigations will be to obtain site-specific data on both geotechnical and environmental conditions that would impact project design, construction, and cost. Explorations will be performed to provide representative data as required by the Massachusetts Building Code and Massachusetts Contingency Plan (MCP). Specifically, we anticipate:

- test borings will be drilled within the future building footprint to inform foundation design;
- explorations will be conducted within future utility alignments and roadways for their design;
- soil samples retrieved from explorations will be tested, as appropriate, to determine engineering properties and/or chemical constituents;
- representative analytical soil testing will be performed in areas where soils will be generated by project construction and require off-site disposal; and
- as appropriate, explorations, sampling, and testing will be conducted to determine the nature and extent of contamination and to provide data to maintain MCP regulatory compliance.

The area near the hockey rink will be investigated to determine the presence, condition, and configuration of the underground storage tank presumed to be present. If an underground storage tank exists and it is not in consumptive use or found to be impaired, it will be removed in accordance with applicable regulations. It is understood that all costs associated with abatement of contaminated soil from any source and abatement of underground storage tanks must be itemized in the Schematic Design submittal cost estimates as ineligible for MSBA reimbursement.

The subsurface exploration activities are expected to begin in the

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Spring/Summer of 2018.

HAZARDOUS MATERIAL

Universal Environmental Consultants (UEC) conducted a thorough and detailed hazardous materials identification analysis at the High School, Belmont, MA, which include the following services as part of the feasibility study of he school:

- Asbestos Containing Materials inspection and sampling;
- Polychlorinated Biphenyls Electrical Equipment and Light Fixtures inspection;
- PCB's Caulking inspection;
- Mercury in Rubber Flooring inspection and sampling;
- Airborne Mold inspection and sampling;
- Radon Sampling;
- Underground Storage Oil Tanks inspection.

Please refer to the PDP for the full report.

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DOCUMENT # 2

3.3.3 - FINAL EVALUATION OF ALTERNATIVES

OPTION 1 - C. CONCEPT DRAWING

ENVELOPE- Limited thermal and vapor performance upgrades would be executed making meeting the schools performance goals difficult

ORIENTATION- The orientation is fixed making optimized daylighting challenging for existing east and west facing learning environments.

SKIN TO VOLUME RATIO- The skin to volume ratio of the base repair scheme is fixed.

WINDOW TO WALL RATIO- The window to wall ratio of the base repair scheme is fixed making daylighting and heat gain optimization challenging.

PV POTENTIAL- The ability to retrofit the existing roof structure is challenged by the placement of existing mechanical equipment and shafts as well as the roof's structural capacity.

SITE ENVIRONMENTAL PERFORMANCE- This scheme allows for one large geo-exchange field but allows limited performative landscape to deal with storm water quality and quantity due to the position of the existing road.

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3.3.3 - FINAL EVALUATION OF ALTERNATIVES

OPTION 2.1 - C. CONCEPT DRAWING

ENVELOPE – Select thermal and vapor performance upgrades would be executed in areas with substantial renovation, the finite scope of façade reconstruction and the existence of brick cavity walls with limited existing insulation makes meeting the schools performance goals difficult.

ORIENTATION- The orientation is fixed for the majority of the building making optimized daylighting challenging for existing east and west facing learning environments. Added spaces will build over and to the west of the existing structures with public spaces oriented to the south and most new teaching spaces receiving glare free light from the north

SKIN TO VOLUME RATIO- The skin to volume ratio of the major renovation minor addition scheme is the least efficient in that it stretches the building out to its least concise footprint.

WINDOW TO WALL RATIO- The window to wall ratio of the base repair scheme will attempt to achieve 30-40 glazing balancing heat gain with effective daylighting.

PV POTENTIAL- The ability to retrofit the existing roof structure is challenged by the placement of existing mechanical equipment and shafts as well as the roof's structural capacity. Over-built structure may be able to accommodate a more flexible arrangement of panels.

SITE ENVIRONMENTAL PERFORMANCE- This scheme allows for one contiguous but smaller geo-exchange field due to the expanded building footprint but allows for more performative landscape adjacent to the pond allowing outdoor teaching space to overlap with site sustainable strategies at the water edge.

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3.3.3 - FINAL EVALUATION OF ALTERNATIVES

OPTION 2.3 - C. CONCEPT DRAWING

ENVELOPE – Aggressive performance will be pursued in the new wall make-up including a goal of R-28 and minimized thermal bridging with the intent of minimizing air and vapor movement

ORIENTATION- This scheme orients the majority of teaching spaces to the north with the intent of eliminating glare and the majority of public and common spaces to the south.

SKIN TO VOLUME RATIO- The skin to volume ratio of the minor renovation- major addition schemes are similar and attempt to form a concise footprint while maximizing daylight.

WINDOW TO WALL RATIO- The window to wall ratio of the scheme will attempt to achieve 30-40 glazing balancing heat gain with effective daylighting.

PV POTENTIAL- This scheme stacks in massing to the north creating roof surfaces that do not shade themselves and optimizes roof top yield by orienting itself in the east-west direction.

SITE ENVIRONMENTAL PERFORMANCE- This scheme allows for one contiguous large geo-exchange field and allows for more performative landscape adjacent to the pond allowing outdoor teaching space to overlap with site sustainable strategies at the water edge.

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3.3.3 - FINAL EVALUATION OF ALTERNATIVES

OPTION 2.4 - C. CONCEPT DRAWING

ENVELOPE – Aggressive performance will be pursued in the new wall make-up including a goal of R-28 and minimized thermal bridging with the intent of minimizing air and vapor movement

ORIENTATION- This scheme orients the majority of teaching spaces to the south and north with the intent of eliminating glare to the north and shading for glare control to the south. Public spaces will be day lit from above and through borrowed light

SKIN TO VOLUME RATIO- The skin to volume ratio of the minor renovation- major addition schemes are similar and attempt to form a concise footprint while maximizing daylight.

WINDOW TO WALL RATIO-The window to wall ratio of the scheme will attempt to achieve 30-40 glazing balancing heat gain with effective daylighting.

PV POTENTIAL- This scheme creates a simple continuous roof surface that does not shade its selves and optimizes roof top yield by orienting itself in the east-west direction.

SITE ENVIRONMENTAL PERFORMANCE- This scheme allows for one contiguous large geo-exchange field and allows for more performative landscape adjacent to the pond allowing outdoor teaching space to overlap with site sustainable strategies at the water edge.

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3.3.3 - FINAL EVALUATION OF ALTERNATIVES

OPTION 3.1 - C. CONCEPT DRAWING

ENVELOPE– Aggressive performance will be pursued in the new wall make-up including a goal of R-28 and minimized thermal bridging with the intent of minimizing air and vapor movement

ORIENTATION- This scheme orients the majority of teaching spaces to the south and north with the intent of eliminating glare and the majority of public and common spaces to the south.

SKIN TO VOLUME RATIO- The skin to volume ratio of the new construction scheme is the most efficient but will rely on daylighting internal spaces from above which may conflict with PV placement.

WINDOW TO WALL RATIO- The window to wall ratio of the new construction scheme will attempt to achieve 30-40 glazing balancing heat gain with effective daylighting.

PV POTENTIAL- - This scheme creates a simple continuous roof surface that does not shade its selves and optimizes roof top yield by orienting itself in the east-west direction.

SITE ENVIRONMENTAL PERFORMANCE- This scheme also allows for one contiguous large geo-exchange field and allows for more performative landscape adjacent to the pond allowing outdoor teaching space to overlap with site sustainable strategies at the water edge. It also places the building mass close to the existing ice rink allowing for potential future synergies in energy and waste heat use.

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DOCUMENT # 3

BELMONT PUBLIC SCHOOLS
Belmont, Massachusetts

TO:	Massachusetts School Building Authority	**DATE:**	January 25, 2018
FROM:	John P. Phelan Superintendent of Schools	**RE:**	School Committee Minutes

Attached please see the Belmont School Committee Minutes of January 23, 2018.

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BELMONT SCHOOL COMMITTEE/BELMONT HIGH SCHOOL BUILDING COMMITTEE JOINT MEETING34
MINUTES
WELLINGTON ELEMENTARY SCHOOL CAFETERIA
JANUARY 23, 2018

Present:
Dr. Lisa Fiore, Chair
Ms. Susan Burgess-Cox, Secretary
Ms. Kate Bowen
Mr. Thomas Caputo
Mr. Murat Bicer
Ms. Andrea Prestwich
Mr. John Phelan, Superintendent
Ms. Janice Darias, Assistant Superintendent for Curriculum & Instruction
Mr. Anthony DiCologero, Director of Finance, Business and Operations

Also in attendance:
William Lovallo, Belmont High School Building Committee Chair
Patricia Brusch, Belmont High School Building Committee Member
Joel Mooney, Belmont High School Building Committee Member
Diane Miller, Belmont High School Building Committee Member
Chris Messer, Belmont High School Building Committee Member
Jamie Shea, Belmont High School Building Committee Member
Robert McLaughlin, Belmont High School Building Committee Member
Joseph DeStefano, Belmont High School Building Committee Member
Emma Thurston, Belmont High School Building Committee Member
Adam Dash, Board of Selectmen Chair
Phyllis Marshall, Assistant Town Administrator
Daniel Richards, Belmont High School Principal

1. **CALL TO ORDER**

School Committee Chair Dr. Lisa Fiore called the School Committee meeting to order at 7:06 p.m.

Belmont High School Building Committee Chair Bill Lovallo called the Belmont High School Building Committee meeting to order at 7:06 p.m.

2. **COMMENTS FROM BELMONT RESIDENTS**

Chair Bill Lovallo provided an overview of the agenda and then invited members of the audience to ask questions or voice any concerns. Some members of the community expressed concerns about the impact on the students in lower grades depending on which grade configuration option was chosen for the project. Other members expressed concerns about the potential cost.

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3. **PROJECT COSTS**

Chair Lovallo discussed how the costs are derived. Costs are derived from the square footage of the design. The numbers tend to be high for public schools due to the economy and prevailing wages for public projects. The square footage is controlled by MSBA and they do not allow for reduced square footage. In addition to construction costs, there are related fees for furniture, technology, etc.

4. **SUB-COMMITTEE ON BUILDING SYSTEMS AND OPERATIONS**

Chair Lovallo had previously asked for recommendations on subcommittees. Members of the subcommittee will meet approximately six times between now and July with one full design workshop. That subcommittee will report back to the regular Building Committee.

5. **PRELIMINARY SITE DESIGN UPDATES**

Chair Lovallo invited Brooke Trivas of Perkins and Wil to speak on the preliminary site design options. Brooke provided an overview of each of the design options explaining the pros and cons of each. The four options to be considered are:

C.2.1 – Major Renovation/Minor Addition
C.2.3 – Minor Renovation/Major Addition
C.2.4 – Minor Renovation/Major Addition
C.3.1 – New Construction

Brooke Trivas noted the MSBA will not take part in a project that includes the addition of a pool so if the decision is to continue to have a pool, the current one would need to be saved but could be renovated. The building committee is working with Superintendent Phelan and Athletic Director Jim Davis on the placement of athletic fields. Member of the School Committee and Building Committee discussed the different options and asked questions.

4. **SELECTION OF GRADE CONFIGURATION (SCHOOL COMMITTEE)**

Superintendent Phelan presented an overview of the different grade configurations and process used to determine which grade configurations were best. Belmont asked the MSBA to explore different options based on the increasing enrollment taking place over the past several years. The total number of students enrolled in Belmont during the 2016-17 school year was 4408 with a projection of 4888 for 2024-25.

Superintendent Phelan explained the impact of the different grade configurations. With a 9-12 the middle school and elementary enrollment and space issues would not be addressed; with an 8-12 the high school and middle school would have more space but the elementary space issues would not be addressed; with a 7-12 all levels would be have increased space to accommodate enrollment.

Superintendent Phelan also provided an overview of a K-6 grade configuration option. This option would allow for 6 classes per grade in grade 6 at the Chenery, 4 classes per grade at the Wellington, 3 classes per grade at the Winn Brook, 2 classes per grade at the Butler, and 2 classes per grade at the Burbank. This configuration would cause a shortage of 204 total seats across those schools.

The 9-12, 8-12, 7-12 grade configuration options would all fit on the current high school site location. The grade configuration that fits the district's need best is 7-12. Superintendent Phelan stated his recommendation to the Belmont School Committee is that the district would be best served by a 7-12 configuration.

Belmont High School Building Committee Chair Bill Lovallo requested the Belmont High School Building Committee members leave the table while the School Committee discussed the grade configuration options.

On a motion offered by Tom Caputo and seconded by Murat Bicer, it was

VOTED unanimously by the six School Committee members to accept the recommendation of Superintendent Phelan for a 7-12 grade configuration for the Belmont High School project.

On a motion offered by Murat Bicer and seconded by Tom Caputo, it was

VOTED unanimously to adjourn the School Committee meeting at 9:18 p.m.

5. **SELECTION OF PREFERRED SOLUTION (BUILDING COMMITTEE)**

The Belmont High School Building Committee returned to the meeting.

On a motion offered by Robert McLaughlin and seconded by Joel Mooney, it was

VOTED unanimously by the 11 Belmont High School Building Committee members to approve Option C.2.4 for the Belmont High School site design.

6. **FUTURE BUSINESS**

Upcoming Meetings:

February 6, 2018
Finance Subcommittee Meeting
SAB Conference Room – 7:30 a.m.

February 6, 2018
School Committee Meeting
CMS Community Room – 7:00 p.m.

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7. **ENCLOSURES**

Strategic Plan
Important Dates for School Committee

8. **ADJOURN**

Respectfully submitted by_____
Susan Burgess-Cox, Secretary

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BPS ELEMENTARY AND MIDDLE SCHOOLS PLANNING STUDY

The charge of this study is to identify short & long term options for Belmont Public Schools elementary and middle years in the context of the ongoing high school study. Three grade configuration options are being considered for the high school: 9 - 12; 8 - 12 and 7 - 12.

How can the elementary and middle schools best serve the students and community to complement the secondary grade configurations?

Anticipated Design Enrollment – 360 students / grade level = 3,240 students K-8 + PreK

Assumptions:

Capacity of the existing school buildings is an important component of the analysis. Criteria used for determining the long term capacity includes the following assumptions:

- Modular classrooms are seen as short term solutions and are not included in building capacity numbers
- All schools contain appropriate learning environments for art, music and physical education
- All schools contain appropriate learning environments for Special Education including pull out and support spaces
- All schools contain appropriate learning environments are provided for English Learners (EL's) including pull out and support spaces
- Classroom capacities may vary based on room sizes
- To the extent possible, a maker / innovation lab space will be provided in elementary schools
- LABBB Collaborative spaces will remain, with anticipated continued population growth
- Community rooms at Chenery and Wellington will remain
- Belmont After School Enrichment Collaborative (BASEL) will remain at all elementary schools and middle school

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Class Sizes Guidelines

Grade	Belmont Class Size Guidelines	MSBA Class Size Guidelines
K	18-22	18
1	19-23	23
2	19-23	23
3	20-24	23
4	20-24	23

Maker / Innovation Lab Space - Ideally each elementary school would have a maker / innovation lab space. In the short term, space is not available for this program space. Currently none of the elementary schools have a maker / innovation lab space.

English Learners (EL's) – Current enrollment (October 2017): 319 students in PreK-8 with anticipation of continued growth.
Level 1 and 2 students are often best served in small group settings or pull-out spaces, outside the classroom. Often these rooms have been space-mined out of inappropriate spaces and closets. Students at all levels (1 – 5) are assisted with both push-in and pull out services.

Appropriately provided numbers of, properly sized and appointed rooms are both short and long term goals.

Special Education (SPED) – although much of the delivery of services in accomplished with specialists "pushing in" to classrooms, some students do require "pull out" services. Often these have been space-mined out of inappropriate spaces and closets.

Appropriately provided numbers of, properly sized and appointed rooms are both short and long term goals.

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SCHOOLS ANALYSIS FOR CAPACITY AND PROGRAM

The following is a capacity analysis by school including rationale for recommendations. Note that this analysis **does not attempt** to create a similar number of grade level classrooms (sections) within individual schools.

Burbank Elementary School, current population: 374 students (BPS 11/17)

- K classrooms - range in size from 924 – 984 sf ea. vs. current MSBA Guidelines of 1,200 sf = approximately 20% under current MSBA Guidelines. Recommendation: target 15 students per K classroom.
- General education classrooms - range in size from 836 – 1200 sf ea. vs. current MSBA Guidelines of 900 - 1,000 sf, within guidelines with (1) CR 10% below current MSBA Guidelines. Recommendation: target 23 students per classroom.
- Currently 11 classrooms - Assume 9 grade level classrooms, with one reassigned to a maker space and one reassigned to Special Education.
- Library is oversized and may be able to provide additional space for SPED and EL pullout / support
- Cafeteria is sufficient size for the current population
- Gymnasium is sufficient size for the current population
- Burbank Capacity:
    - 9 CR @ 23 = 207
    - 4 K @ 15 = 60
    - Total 267

Note: this results in a 2 section school in a K-4 grade configuration; or 3 sections in a K-3 grade configuration.

Butler Elementary School, current population: 388 students (BPS 11/17)

- K classrooms - range in size from 840 – 1,080 sf ea. vs. current MSBA Guidelines of 1,200 sf, one room is approximately 30% under current MSBA Guidelines. Recommendation: target 13 students for the undersized classroom and 17 for (2) K classrooms.
- General education classrooms - range in size from 690 (1) – 926 sf ea. vs. current MSBA Guidelines of 900 - 1,000 sf, most rooms are within guidelines with (1) CR 30% below current MSBA Guidelines. Recommendation: target 23 students per classroom.
- Currently 12 classrooms - Assume 10 grade level classrooms, with one small classroom reassigned to a maker space and one reassigned to Special Education.
- Library is slightly undersized for the current population

G. DISTRICT RESPONSE / Document #3

- Cafeteria is sufficient size for the current population
- Gymnasium is somewhat undersized for the current population
- Butler Capacity:
  - 10 CR @ 23 = 230
  - 1 K @ 13 = 13
  - 2K @ 17 = 34
  - Total 277

Note: this results in a 2 ½ section school in a K-4 grade configuration; or 3+ sections in a K-3 grade configuration.

Wellington Elementary School, current population: 626 students (BPS 11/17)

- PreK Classrooms - 1,050 sf ea. vs. current MSBA Guidelines of 1,200 sf, Recommendation: target 13 students (integrated PreK)
- K classrooms - 1,050 sf ea. vs. current MSBA Guidelines of 1,200 sf, approximately 12% under current MSBA Guidelines. Recommendation: target 16 students per classroom
- General education classrooms - 864 sf ea. vs. current MSBA Guidelines of 900 - 1,000 sf, approximately 10% under current MSBA Guidelines. Recommendation: target 21 students per classroom.
- Currently 20 classrooms - Assume 19 grade level classrooms, with one reassigned to a maker space.
- Library is approximately 20% undersized for the population
- Cafeteria is approximately 20% undersized for the population
- Gymnasium is somewhat undersized for the population
- Wellington Capacity:
  - 4 PreK @ 13 = 52 (full day)
  - 5 K @ 16 = 80
  - 19 CR @ 21 = 399
  - Total 531

Note: this results in a slightly less than 5 section school in a K-4 grade configuration; or 6 sections in a K-3 grade configuration.

Winn Brook Elementary School, current population: 490 students (BPS 11/17)

- K classrooms - range in size from 1,120 – 1,250 sf ea. vs. current MSBA Guidelines of 1,200 sf, Recommendation: target 18 for K classrooms.
- General education classrooms - range in size from 890 – 950 sf ea. vs. current MSBA Guidelines of 900 - 1,000 sf. Recommendation: target 23 students per classroom.

- Currently 17 classrooms - Assume 15 grade level classrooms, with one reassigned to a maker space and one reassigned to Special Education.
- Library is approximately 25% oversized and could provide additional space for SPED and EL pullout / support
- Cafeteria is approximately 30% undersized for the current population
- Gymnasium is somewhat undersized for the current population
- Winn Brook Capacity:
    - 4 K @ 18 = 72
    - 15 CR @ 23 = 345
    - Total 417

Note: this results in a slightly less than 4 section school in a K-4 grade configuration; or slightly less than 5 sections in a K-3 grade configuration.

Chenery Middle School, current population: 1,422 students (BPS 11/17)

- Typical classrooms at 840 sf vs. current MSBA Guidelines of 850 sf to 950 sf, Recommendation: target 23 students per classroom
- Science labs – 1,030 – 1,080 sf vs. current MSBA Guidelines of 1,200 sf, Recommendation: target 21 students per classroom
- Grade 5 classrooms 14
- Grade 6 classroom 9
- Grade 6 science rooms 3
- Grade 7 classrooms 9
- Grade 7 science rooms 3
- Grade 8 classrooms 9
- Grade 8 science rooms 3

Total 50

Chenery Capacity:
50 x .95 utilization rate = 47.5, say 48 x 23 students / room = 1,104

Total Right Sized Capacity PreK-8

- Burbank 267
- Butler 277
- Wellington 531
- Winn Brook 417
- Chenery 1,104

Total 2,596 vs. 3,240 anticipated = delta 644

644 / 23 per class = 28 classrooms

G. DISTRICT RESPONSE / Document #3

OPTIONS DISCUSSION

Right Sizing of Schools is set as a goal for the long-term of Belmont Public Schools. The term "right sizing" of schools is used to describe matching the number of classrooms and resulting student capacities with the capacity of the core spaces and non-core academic spaces, such as: Gym, cafeteria, library, music and art, as well as properly provide for special education EL and other student service needs. Right sizing may have slightly different implications at each school.

Note: options discussed below do not take into account after school program, (BASEL) needs.

Option 1 (K - 4, 5 - 8, 9 - 12)

Maintains the status quo of buildings and grade configurations. This option does not satisfy the population needs for grades PreK-8. Building additions would be need at all schools except Wellington to serve the anticipated populations.

Option 2 (K – 4, 5 – 7, 8 – 12)

The high school project would configure as an 8 - 12 secondary school. The right sizing of Chenery would reduce the grades served to grades 5 – 7. All elementary schools would remain PreK - 4 or K – 4. An increase of approximately 308 student seats would be needed for the K – 4 elementary level. As noted previously, this analysis is referring to the number of students without regard to the number of grade level classrooms/strands within individual schools or school size. Once a long term approach is agreed to, an analysis of numbers of classrooms at each school will be reviewed.

In addition to the number of classrooms needed is the issue of number of sections per school. Having a balance of sections may result in the need for more classrooms.

At that stage, it is likely that more than 308 student seats would result in proposed projects. This option can take a number of paths with changes at multiple schools:

Component Options that could be considered: these component options can be mixed and matched to achieve the needed capacity. It should be

noted that some options include a need to “increase the core”. This could mean cafeterias, gym, administration, art, music etc. At some schools this may be difficult.

A. Removal of PreK from Wellington (+84 students), reassign PreK to an alternate location
B. 6 classroom addition to Butler plus the need to increase the core (+138 students)
C. 6 classroom addition to Burbank plus the need to increase the core (+138 students)
D. Large addition or replacement at Winn Brook including core (+308 students), Article 97 maybe required

Option 2 (& 3) (by school) (K – 4, 5 – 7, 8 – 12)

- Burbank - right size existing to 270 students + component option C from above
- Butler - right sized existing school to 280 students + component option B from above
- Wellington – right size existing school to 530 students + component option A from above; It should be noted that although a relatively new building, many spaces were designed smaller than current MSBA Guidelines including: PreK & K classrooms; general classrooms; cafeteria, library and gym. Although already on a very tight site, the small core spaces limit the ability to support additional population. Even removal of the PreK classrooms and conversion to grade level classrooms might overstress core and support spaces.
- Winn Brook – right size existing school to 420 students + component option D from above
- Chenery – designed as a middle school, would remain a middle school but serve grades 6 – 8.

Option 4 (& 5) (by school) (K – 3, 4 – 6, 7 – 12)

The high school project would configure as a 7 - 12 secondary school. This allows for the five buildings to be “right sized”. In doing so, the total classroom count could accommodate the entire PreK – 6 population. Another exercise will be conducted to review the number of grade level sections possible at each school.

- Burbank - right size existing school to 270 students
- Butler - right size existing school to 280 students

G. DISTRICT RESPONSE / Document #3

- Wellington – right size existing school to 530 students. It should be noted that although a relatively new building, many spaces were designed smaller than current MSBA Guidelines including. See notes on Wellington from Option 2
- Winn Brook – right size existing school to 420 students.
- Chenery – designed as a middle school, Chenery has academic and support spaces that may not be needed in an upper elementary school. Science labs and tech-ed spaces can be repurposed for grades 4 – 6. In addition, the classroom use utilization rate would change from .95 to close to 1.0 yielding additional population capacity. A 100% classroom utilization rate would yield a 1,127 student capacity.

This option will also require a review of number of classrooms by school and a balance of sections per school.

Option 6 (K – 5, 6 – 8, 9 – 12)

The high school project would configure as a 9 - 12 secondary school. The right sizing of Chenery would put the 5th grades back into the elementary schools. Right sizing of each of elementary schools results in the need for 28 additional grade level general education classrooms plus special education and the full complement of core and support spaces. A new elementary school would be needed to accommodate this need.

The smaller schools: Burbank and Butler would likely have difficulty absorbing the 5th grade. They would result in 2 section schools which may not be desirable.

Although some classrooms may be able to be added to some schools, see component options above, it would still require a new (be it smaller) elementary school building.

Note that the older school buildings: Burbank, Butler and Winn Brook require varying levels of renovation and refreshing of existing facilities regardless if they reconfigure grades or not, due to their age and current condition.

- Burbank - right sized existing school to 270 students
- Butler - right size existing school to 280 students
- Wellington – right size existing school to 530 students. It should be noted that although a relatively new building, many spaces were designed smaller than current MSBA Guidelines. See notes on Wellington from Option 2
- Winn Brook – right size existing school to 420 students.

3.3.1 - INTRODUCTION

G. DISTRICT RESPONSE / Document #3

- **New, large elementary school to serve 660 students**, approximately 98,000 gsf
- Chenery – designed as a middle school, would remain a middle school but serve grades 6 – 8.

G. DISTRICT RESPONSE / Document #4

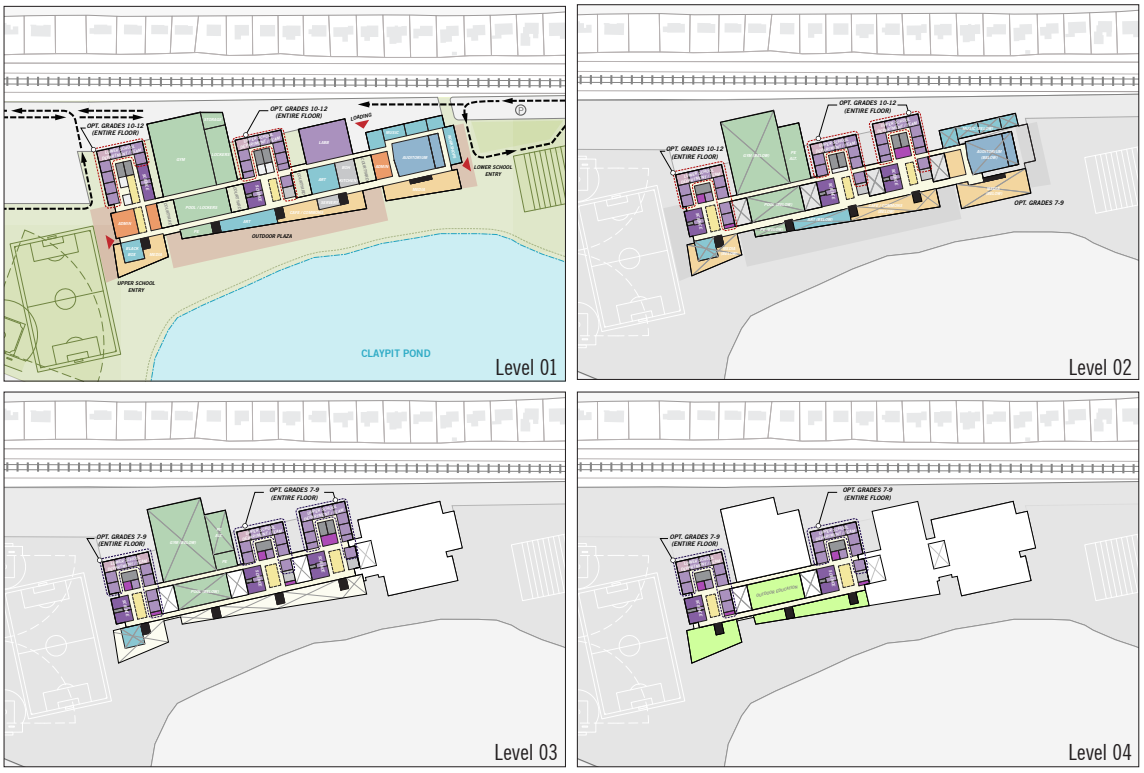
DOCUMENT # 4

OPTION 2.1 CLARIFICATION OF SCOPE

3.3.1 - INTRODUCTION

G. DISTRICT RESPONSE / Document #4

II. MAJOR RENOVATION / MINOR ADDITION / C.2.1



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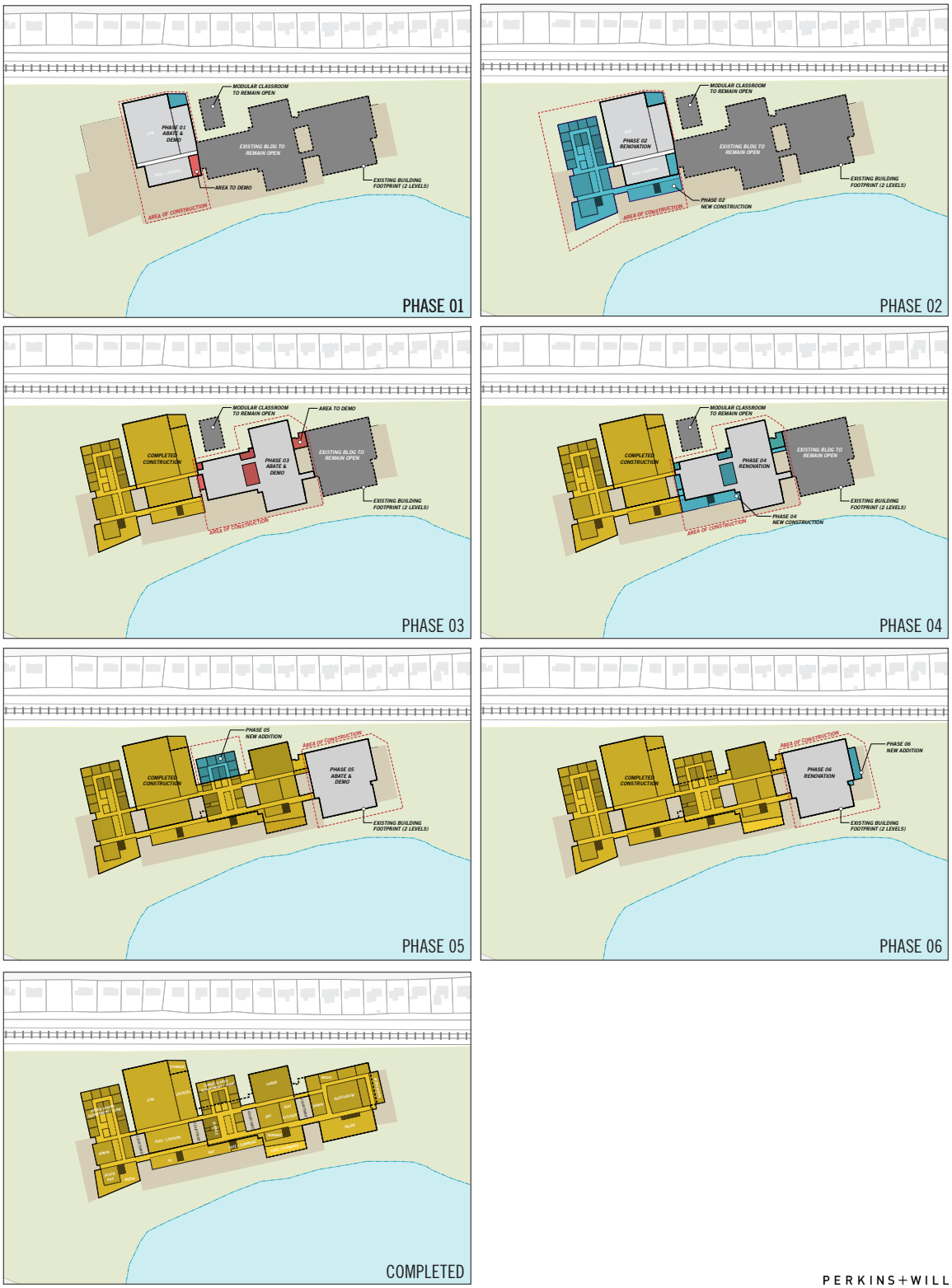
G. DISTRICT RESPONSE / Document #4

II. MAJOR RENOVATION / MINOR ADDITION / C.2.1

Demolition
Renovation
Addition
Complete

BUILDING PHASE DIAGRAMS **48 MONTHS CONSTRUCTION DURATION**



PERKINS+WILL

PM&C

Partnering for better results

January 29th, 2018

Re: Belmont High School Renovation Costs

Brooke Trivas
Practice Leader, Principal
Perkins + Will
225 Franklin Street,
Suite 1100
Boston, Ma. 02110

Dear Brooke,

In response to your query about the renovation costs for Option 2.1 at the Belmont HS project I offer the following information:

Firstly I will deal with renovation costs generally and then touch on some of the specific constraints and cost drivers associated with Option 2.1.

General Renovation costs:

The question about renovations costs and how they compare with all new construction is one that is raised by most school projects that we are involved with when comparing options early in the design stage and specifically the question "why does renovation cost more or the same as new?" will get asked. To many this would seem to be counter-intuitive and to answer this question one must look at not just the direct costs of the renovation but also the indirect costs. Generally speaking the direct costs of a renovation project will be less on a SF basis than a new construction project (in Belmont we have been reporting Option 2.1 direct renovation costs in the $250 per SF range versus $320 per SF for all new construction). However when looking at Belmont High School and other such projects, the indirect costs are factored in such as the longer construction duration associated with renovation which will increase General Conditions and General Requirements, phasing costs associated with temporary construction measures, temporary utilities, and multiple phase mobilizations etc. then we typically see the total renovation costs trend towards the cost of a new school.

Part of this discussion is also whether or not the $250 per SF renovation costs number reported is reasonable. The way we approach building up a renovation cost estimate with preliminary design information is to think about what you end up saving in a renovation project and how this affects cost. The elements saved are typically the foundations, the superstructure, the exterior closure and the interior partitions – most renovation projects will replace the roof, replace all interior finishes, interior specialties and will require a full replacement of the Mechanical, electrical, plumbing, FP and electrical systems. If we start with the assumption that there no off-setting costs associated with elements that are being saved this should result in a typical savings of +/-$150 per SF when comparted to a new project. However current seismic and energy codes will require modifications to the existing structure and the foundations as well as replacement of the exterior windows, doors and the thermal properties of the existing envelope will typically need to be addressed. In addition the existing interior partitions, even if no modifications to room layouts are pursued, will need modified to address seismic concerns, facilitate door opening modifications for MAAB upgrades etc. So typically once these additional off-setting costs are factored in and the costs to perform the selected interior demolition are also added then the $150 per SF cost saving ends up being more like $100 per SF which would put a typical renovation cost in the $220 per SF range (direct costs with no markups applied).

20 downer avenue; suite 1C . hingham, ma . 02043 . 781.740.8007 . www.pmc-ma.com

G. DISTRICT RESPONSE / Document #4

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Option 2.1 Specific Cost Drivers:

There are, however, other constraints specific to Option 2.1 that add additional costs and further reduce the variance between new costs and renovation costs. The main driver here is the fact that significant portions of the new addition are stacked on top of the existing building and since the existing structure does not have the capacity to support these additional loads it will require the need to thread new load bearing elements through the additional structure requiring openings in the existing structure, reinforcing of the existing frame and new foundations to support additional structural elements. Also all the existing fireproofing contains asbestos which will require the fireproofing being removed and replaced with new fireproofing. There are interior relocations considered to be reconfigured either due to added program spaces due to the increased population or due to the new structural elements introduced which further reduces the savings one would expect by maintaining the interior partitions. Once these additional costs are factored in this pushes the renovation direct costs closer to $250 per SF and then once the indirect expenses discussed above are included the gap between renovation costs and new construction costs then becomes much closer.

We hope this memo helps to clarify the costs associated with the Major Renovation/ Minor Addition Option 2.1.

Please let us know if you have any further questions.

Regards,

Peter Bradley

President

20 downer avenue; suite 1C . hingham, ma . 02043 . 781.740.8007 . www.pmc-ma.com

3.3.1 - INTRODUCTION

G. DISTRICT RESPONSE / Addenda #1

MSBA PDP REVIEW COMMENTS AND DISTRICT REPLY

	Provide the following Items	Complete; *No response required*	Provided; *District's response required*	Not Provided; *District's response required*	Receipt of District's Response; *To be filled out by MSBA Staff*
1	Analysis of school district student school assignment practices and available space in other schools in the district	☒	☐	☐	☐
2	Tuition agreement with adjacent school districts	☐	☒	☐	☐
3	Rental or acquisition of existing buildings that could be made available for school use	☒	☐	☐	☐
4	Code Upgrade option that includes repair of systems and/or scope required for purposes of code compliance; with no modification of existing spaces or their function	☒	☐	☐	☐
5	Renovation(s) and/or addition(s) of varying degrees to the existing building(s)	☐	☒	☐	☐
6	Construction of new building and the evaluation of potential locations	☐	☒	☐	☐
7	List of 3 distinct alternatives (including at least 1 renovation and/or addition option) are recommended for further development and evaluation.	☐	☒	☐	☐

MSBA REVIEW COMMENTS

"5) Option 2.1 is the only addition/renovation option recommended for further evaluation that maintains more than field house and pool functions of the existing school, although it is unclear how much is retained other than the auditorium. The submittal notes that the 'entire building structure- including caissons, foundations, concrete floor, roof slabs, and concrete beams- would remain and be reused'. This implies that exterior envelope and all interior partitions would be demolished, as well as all systems in the building. Based on the submitted options, the MSBA has concerns that keeping the spaces ineligible for MSBA funding such as the pool and field house may be limiting the District's choice of options (please clarify). For the following PSR submittal, the MSBA asks that the District / design team include an add/reno option for evaluation for the selected grade configuration that includes the minimum renovation and addition required to meet current building code and comply with the necessary educational program meeting MSBA space guidelines; i.e., bringing any "existing-to-remain" portions of the building up to code, modifying partition locations only as needed, re-assigning space locations to meet the program, and any building addition required to provide MSBA space guideline area.

Documents in the following submittal should include floor plans that clearly delineate new, renovated and existing-to-remain areas."

DISTRICT REPLY TO MSBA REVIEW COMMENTS

Option 2.1a is a response to the request by MSBA to provide to the Town of Belmont a 'light touch renovation, addition' option. The MSBA suggested that existing spaces should be re-purposed to the fullest extent possible irrespective of being undersized from the approved educational program.

2.1a herein represents this work (site plan and floor plans) developed in order to understand the utilization of existing spaces and addition against the approved proposed interior and exterior programs. It should be noted that most spaces remain in their existing location without the alteration of demising interior walls and square footage, with the exception of science. As a result of this 'light touch renovation', it should be acknowledged that the following rooms, noted in the chart on the following page are undersized relative to the Approved Education program as developed by the Town of Belmont.

The Belmont High School Building Committee with the School Committee and Board of Selectmen reviewed all aspects of the 2.1a related to educational program project duration and impact to athletic program and determined that this renovation addition option did not meet the education vision and education program as defined by the town of Belmont.

G. DISTRICT RESPONSE / Addenda #1

OPTION 2.1A LIGHT TOUCH MAJOR RENOVATION / MINOR ADDITION

BELMONT HIGH SCHOOL	PROPOSED/ GRADES 7-12 / 2,215 Students						
	Undersized Spaces in Existing to Remain/Renovated				Approved Educational Program		
ROOM TYPE	ROOM NFA[1]	# OF RMS	area totals		ROOM NFA[1]	# OF RMS	area totals
Classroom - General (HS/33, MS/48, Wellness/ 4)	779	37	28,824		850	85	72,250
Classroom	*712*	*1*	*712*				
Classroom	*723*	*1*	*723*				
Classroom	*738*	*1*	*738*				
Classroom	*739*	*1*	*739*				
Classroom	*739*	*1*	*739*				
Classroom	*740*	*1*	*740*				
Classroom	*742*	*1*	*742*				
Classroom	*742*	*1*	*742*				
Classroom	*744*	*1*	*744*				
Classroom	*746*	*1*	*746*				
Classroom	*747*	*1*	*747*				
Classroom	*748*	*1*	*748*				
Classroom	*749*	*1*	*749*				
Classroom	*750*	*1*	*750*				
Classroom	*750*	*1*	*750*				
Classroom	*751*	*1*	*751*				
Classroom	*752*	*1*	*752*				
Classroom	*754*	*1*	*754*				
Classroom	*755*	*1*	*755*				
Classroom	*760*	*1*	*760*				
Classroom	*760*	*1*	*760*				
Classroom	*780*	*1*	*780*				
Classroom	*782*	*1*	*782*				
Classroom	*784*	*1*	*784*				
Classroom	*784*	*1*	*784*				
Classroom	*785*	*1*	*785*				
Classroom	*786*	*1*	*786*				
Classroom	*787*	*1*	*787*				
Classroom	*788*	*1*	*788*				
Classroom	*804*	*1*	*804*				
Classroom	*830*	*1*	*830*				
Classroom	*831*	*1*	*831*				
Classroom	*975*	*1*	*975*				
Classroom	*1164*	*1*	*1164*				
Classroom (formerly English Writing Lab)	*883*	*1*	*883*				
Classroom (formerly Computer Lab)	*552*	*1*	*552*				
Classroom (Formerly Language Computer Lab)	*869*	*1*	*869*				
ELL (full size classroom with partition)	876	1	876		1,000	2	2,000
Self-Contained SPED	794	4	3,176		850	10	8,500
SPED Secretary	100	1	100		150	1	150
Self contained SPED	814	1	814		850	4	3,400
Art Workroom w/ Storage & kiln	219	1	219		425	2	850
PE Alternatives	1,632	1	1,632		3,000	1	3,000
Locker Rooms - Boys / Girls w/ Toilets	10,792	1	10,792		12,404	1	12,404
Media Center / Reading Room	6,184	1	6,184		13,744	1	13,744
Controls / Lighting / Projection	27	1	27		200	1	200
Black Box (Repurposed Lecture Hall)	2,100	1	2,100		3,000	1	3,000
Cafeteria / Student Lounge / Break-out	7,193	1	7,193		11,075	1	11,075
Kitchen	2,495	1	2,495		3,515	1	3,515
Staff Lunch Room	740	1	740		804	1	804
Medical Suite Toilet	20	2	39		60	4	240
Nurses' Office / Waiting Room	103	2	205		250	2	500
General Office / Waiting Room / Toilet	20	2	39		450	2	900
Principal's Office w/ Conference Area	20	2	39		375	2	750
Principal's Secretary / Waiting	103	2	205		125	2	250
Conference Room	103	2	205		225	2	450
Guidance Storeroom	20	2	39		100	2	200
Career Center	103	2	205		704	1	704
Teachers' Work Room	494	1	494		1,108	1	1,108
Receiving and General Supply	138	1	138		704	1	704
Technology Director Office	235	1	235		400	1	400
School Store	61	1	61		125	1	125
Resource Officer	39	1	39		120	1	120

3.3.1 - INTRODUCTION

G. DISTRICT RESPONSE / Addenda #1

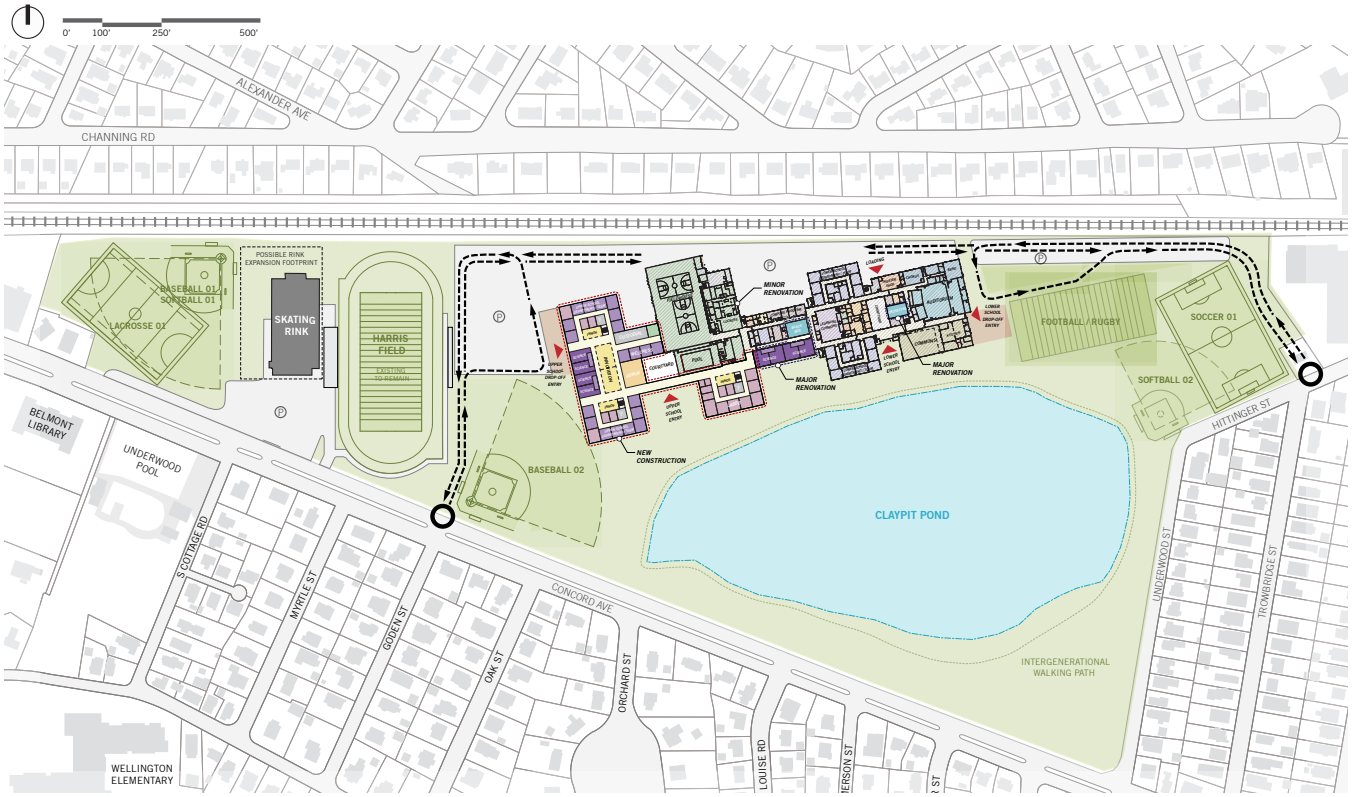
OPTION 2.1 A LIGHT TOUCH MAJOR RENOVATION MINOR ADDITION

Construction Cost: $223,821,117

Project Cost: $279,776,396

Project duration: 60 months

The site plan indicates a loss of the soccer field which is essential to the Belmont High School athletic programs.



PROS

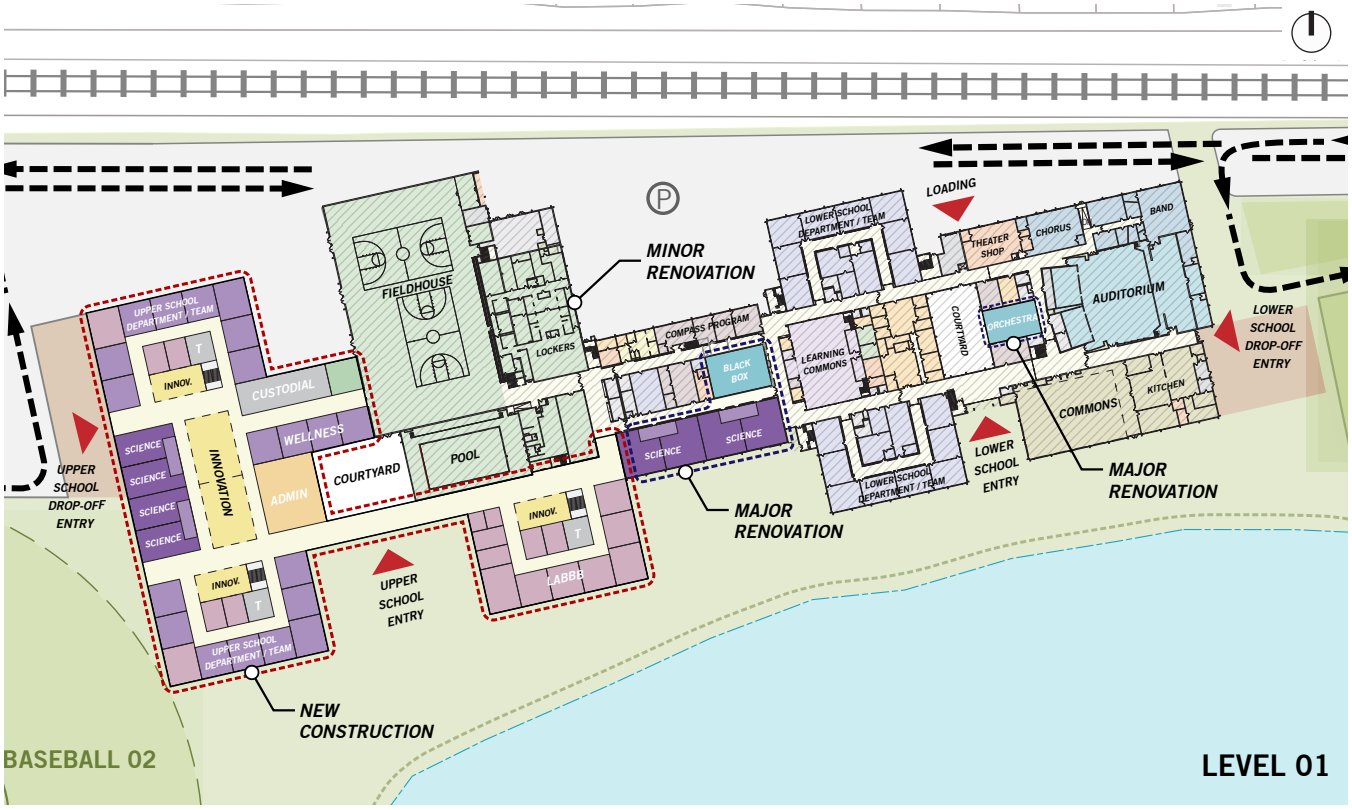
- High school will meet building codes and ADA compliance.
- High School will have new building systems including: HVAC, Plumbing, Electrical, Technology, and AV.
- Hazardous Materials will be Abated.
- Improvements to vehicular, pedestrian and bike circulation.
- New two story addition to accommodate programs not in the renovated areas of the existing facility.
- Reduced project costs due to lack of program compliance.

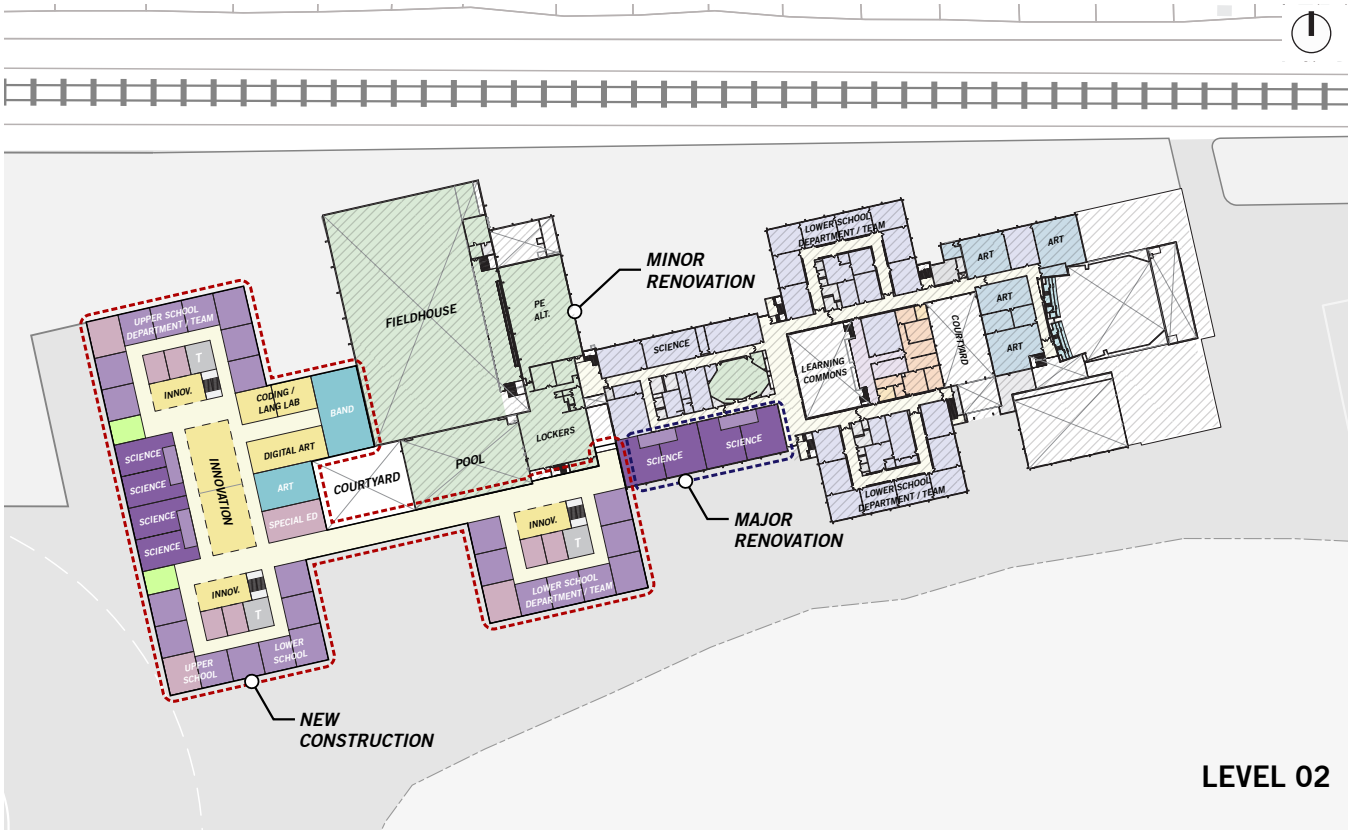
CONS

- Multiple construction phasing will result in academic disruption, additional costs, and longer schedule.
- Multiple phasing will impact athletic field use.
- Partial educational compliance, multiple major spaces will be undersized (see chart).
- Two story new addition location removes a soccer field from the exterior program.
- Administration will not be located adjacent to major entries.
- Educational Vision for teaming, interdisciplinary learning, break-out areas etc…are not achieved.
- Belmont's sustainability vision cannot be realized.

G. DISTRICT RESPONSE / Addenda #1

OPTION 2.1 A LIGHT TOUCH MAJOR RENOVATION MINOR ADDITION





3.3.1 - INTRODUCTION

G. DISTRICT RESPONSE / Addenda #1

OPTION 2.1 A COST ESTIMATE

The following cost estimate conducted by the designer is reviewed and approved by the OPM.

PM&C

Belmont High School
Design Options - GRADES 7-12
Belmont, MA

09-Feb-18

PSR Estimate

MAIN CONSTRUCTION COST SUMMARY

		Gross Floor Area	$/sf	Estimated Construction Cost
OPTION C2.1A MAJOR RENOVATION + MINOR ADDITION				
MINOR RENOVATIONS TO EXISTING SCHOOL		239,530	$235.00	$56,289,550
MAJOR RENOVATIONS TO EXISTING SCHOOL		17,590	$297.04	$5,224,934
ADDITIONS		164,620	$320.53	$52,765,649
REMOVE HAZARDOUS MATERIALS				$7,100,000
TRAFFIC MITIGATION at CONCORD AVE				$2,000,000
SITEWORK				$14,209,864
SUB-TOTAL		421,740	$326.24	$137,589,997
DESIGN AND PRICING CONTINGENCY	15%			$20,638,500
ESCALATION	12%			$18,987,420
SUB-TOTAL		421,740	$420.20	$177,215,917
GENERAL CONDITIONS (60 MTHS SCHEDULE)				$12,000,000
GENERAL REQUIREMENTS	5.00%			$8,860,796
BONDS	0.75%			$1,329,119
INSURANCE	1.10%			$1,949,375
PERMIT				Waived
CM FEE	3%			$5,316,478
CM/GMP CONTINGENCY	2%			$3,544,318
PHASING PREMIUM	7.0%			$12,405,114
Temporary Classrooms				$1,200,000
TOTAL OF ALL CONSTRUCTION		421,740	$530.71	**$223,821,117**

Belmont High School PSR Estimate 2.9.18 GR 7-12 C2.1A ONLY Page 1 PMC - Project Management Cost

G. DISTRICT RESPONSE / Addenda #1

OPTION 2.1 A COST ESTIMATE

PM&C

Belmont High School
Design Options - GRADES 7-12 09-Feb-18
Belmont, MA

PSR Estimate

This PSR cost estimate was produced from drawings, narratives and other documentation prepared by Perkins + Wills Architects Inc. and their design team received January 12, 2018. Design and engineering changes occurring subsequent to the issue of these documents have not been incorporated in this estimate.

This estimate includes all direct construction costs, construction manager's overhead, fee and design contingency. Cost escalation assumes start dates indicated.

Bidding conditions are expected to be public bidding under Chapter 149a of the Massachusetts General Laws to pre-qualified construction managers, and pre-qualified sub-contractors, open specifications for materials and manufactures.

The estimate is based on prevailing wage rates for construction in this market and represents a reasonable opinion of cost. It is not a prediction of the successful bid from a contractor as bids will vary due to fluctuating market conditions, errors and omissions, proprietary specifications, lack or surplus of bidders, perception of risk, etc. Consequently the estimate is expected to fall within the range of bids from a number of competitive contractors or subcontractors, however we do not warrant that bids or negotiated prices will not vary from the final construction cost estimate.

ITEMS NOT CONSIDERED IN THIS ESTIMATE

Items not included in this estimate are:

- Relocation of Town wide fiber system
- Land acquisition, feasibility, and financing costs
- All professional fees and insurance
- Site or existing conditions surveys investigations costs, including to determine subsoil conditions
- All Furnishings, Fixtures and Equipment
- Items identified in the design as Not In Contract (NIC)
- Items identified in the design as by others
- Owner supplied and/or installed items as indicated in the estimate
- Utility company back charges, including work required off-site
- Work to City streets and sidewalks, (except as noted in this estimate)
- Construction contingency (GMP Contingency is included)
- Contaminated soils removal

3.3.2 EVALUATION OF EXISTING CONDITIONS

3.3.2 - EVALUATION OF EXISTING CONDITIONS

A. INTRODUCTION

Additional traffic analysis was performed since the PDP submission, as new information was necessary in analyzing the Options.

In the absence of new additional information about the existing conditions of the high school property, a brief summary is presented below of the design team's findings, with the traffic report following. Please refer to the (PDP) Preliminary Design Program report for a detailed and thorough analysis of the existing conditions.

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BUILDING CODE

The Belmont High School having been constructed in 1970, with minimal renovations since, has numerous areas where compliance with the current building code (780 CMR 9th Edition, Massachusetts State Building Code) is not achieved. Notable areas of noncompliance include the lack of a sprinkler system, insufficient protection of exit stair enclosures, and inaccessible areas and building features that do not comply with 521 CMR, Architectural Access Board Rules and Regulations. Based on lack of system and envelope upgrades, there are also substantial areas of improvement for compliance with the current energy usage requirements for the 2015 International Energy Conservation Code.

ACCESS CODE

Compliance with the accessibility provisions of 521 CMR and the Americans with Disabilities Act is deficient in many areas throughout the existing high school including the following key elements:

- A majority of the toilet rooms are not accessible. Signed accessible toilet rooms are not fully compliant (e.g. door clearances, toilet paper dispenser locations, etc.).
- The elevator is not accessible based on the size of the cab and locations of controls/signage
- The courtyard has no accessible access or means of egress
- The theater is not provided with accessible seating. An accessible route is also not provided from the theater seating to the stage.
- The tiered lecture hall is not provided with accessible seating
- Gymnasium bleacher seating on the mezzanine is not accessible
- Locker rooms are not accessible
- Numerous instances of non-accessible door hardware with knobs
- Many cross-corridor door opening widths are less than the required 32" minimum
- Stairs are generally not compliant as they have abrupt nosings, and non-compliant handrails due to shape, no extensions, etc.

B. PDP SUMMARY UPDATE

CIVIL

Storm Drainage: Record drawings from the Belmont High School 1968 plans indicate that the stormwater from the site appears to be collected by three separate drainage systems and flow to Claypit pond. There appear to be no stormwater quality measures implemented on the site and no known detention, retention, or infiltration systems.

Site Utilities: The existing building is served by a network of existing utilities including water, sewer, gas, and electrical as documented in the 1968 record drawings.

The sewer system for the school is currently serviced by five sewer services connecting to the 24-inch sewer main in the school driveway. An existing 6-inch water service connects to the 8-inch water main that loops through the site north of the building. The existing 3.5-inch gas service connects to the 6-inch gas main in Concord Avenue. The existing electrical service is underground and comes from an electrical substation building east of the school, adjacent to the softball field.

Pavement: Pavement was assessed during the 2017 site visit. Images from google street view suggests that the parking lot was resurfaced in 2013. The asphalt pavement the parking lot, front drive, and walkways adjacent to the school were observed to be in fair condition with some cracking and degradation. The pavement in the driveway to the rear of the school was in poor condition. Curbing on the site is granite, and bituminous concrete in the southwest parking lot. Bituminous concrete curbing appears to be in fair condition. Granite curbing appears to be in good condition. It is possible that the existing curb material is suitable for reuse.

LANDSCAPE

Warner Larson Landscape Architects visited the site on August 28, 2017 to observe existing site conditions and prepared a Landscape Existing Conditions Report which was submitted on October 10, 2017 for inclusion in the PDP. In addition to information collected during our site visit, we subsequently reviewed other existing conditions documentation provided by Perkins + Will and other sources. That report excluded utilities and drainage which were reviewed separately by Nitsch Engineering.

There have been no substantive changes or updates to the Landscape Existing Conditions Report submitted on October 10, 2017 that might impact the final evaluation of alternatives. The reader should refer to the Landscape Existing Conditions Report included in the PDP submission to reference any specifics regarding the existing conditions analysis.

ARCHITECTURAL

The existing Belmont High School was designed and built in its entirety from 1969 to 1970 as a new public high school facility for the town of Belmont located near Clay Pit Pond. Currently, the facility is still owned and run as a high school. The building has been fairly maintained over the past 47 years, but the building enclosure systems and finishes are at the end of their useful life for both exterior and interior.

Much of the interior within the High School have generally not been updated (with exception to the Media Center), leading to worn ceilings, walls, and floors with moderate to minimal damage. At the same time, exterior precast Concrete Lintels, Precast Concrete Columns and Concrete Platforms show signs of deterioration/crumbling around entire exterior perimeter.

STRUCTURAL

Based on visual observations by the Engineers, the school structure is currently performing well. Signs of water leaks were observed at a few locations. Water infiltration through the slab–on-grade in the Field House was noted. Some cracks in the interior masonry walls and through the floor finishes were observed at some locations, as well as in the masonry façade. There was no evidence of foundation settlement, nor was there evidence of undue vibrations due to footfall on the floor slab.

FOOD SERVICE

The existing kitchen and serving facilities were built at least forty years ago and have exceed their design capacity and useful life expectancy. A new facility sized for the future student body will offer a space better able to serve the population by providing greater cooking capacity, increased circulation in the servery, and diverse serving station options more in line with current trends. Additionally the design will observe all health department related codes to bring the facility up to compliance.

All storage and cooking equipment should be evaluated and considered for replacement. New gas and electrical equipment shall be selected that meets the performance demands and provides the highest level of energy efficiency available.

3.3.2 - EVALUATION OF EXISTING CONDITIONS

B. PDP SUMMARY UPDATE

HVAC

The heating system for the building includes steam boilers and steam piping that are original to the building construction (47+ years old). The original No. 4 oil burners were replaced in 2011-2012 with dual fuel burners capable of burning No. 2 fuel oil and natural gas. Natural gas is typically used. The boilers have been re-tubed several times to keep them in working order. The steam piping is at the end of its expected life. Steam traps require regular servicing.

Steam is piped to rooftop units, some unit ventilators and a steam convertor in the boiler room. The steam convertor provides heating hot water to most of the classroom unit ventilators and to cabinet heaters. Steam and hot water piping are distributed through a pipe tunnel/trench from the boiler room through the first two segments of the building. Access to this confined space is extremely limited. Replacement of this piping will most likely involve rerouting above ceilings and in corridors.

The unit ventilators in classrooms are also original equipment. These units have mechanical damper linkages and pneumatic controls, which requires continuous maintenance.

Automatic temperature controls are pneumatic and are also original installation with the exception of the air compressors. Maintenance requires specialized technicians that have knowledge of pneumatic systems, which is in large part an obsolete technology.

Rooftop air handling units were replaced in 2004 and 2008. The older units are within 2 to 5 years of their normal life expectancy.

There is no central cooling system in the building. Some rooftop units have self-contained DX cooling, including interior classrooms, the library, administration, and some other areas.

The pool is heated and ventilated by two air handling units. There is no dehumidification system. An exhaust system was added to exhaust low near the pool deck to help limit the buildup of chloramines and also provides negative pressurization for the pool. The system is ducted through the exterior wall to an exhaust fan that is mounted on grade. A pool water UV filter system was added in 2014.

There have been some improvements and upgrades to the mechanical systems in recent years including new dual fuel burners for the boilers and replacement of the rooftop units and roof exhaust fans plus other small-er improvements. However, other systems and equipment that are original, such as the boilers, steam and hot water piping, unit ventilators, and automatic temperature controls have all exceeded their typical expected useful life and are in need of replacement.

The building structure has sprayed-on fire proofing that contains asbestos, which makes it difficult to do any work in the building that requires routing systems above the ceilings.

FIRE PROTECTION

The existing building is not equipped with an automatic fire suppression system.

PLUMBING

In general, the plumbing systems and fixtures appear to be original to the building. These systems, while continuing to function, have served their useful life. Most of the systems could continue to be used with maintenance and replacement of failed components as they age.

All plumbing fixtures are in working condition. Attempts have been made to make bathroom fixtures accessible; however, most fixtures do not meet current accessibility codes. In general, the fixtures appear to have served their useful life. Water conservancy is governed by provisions of the Plumbing Code. The code does not mandate that plumbing fixtures be upgraded. However, where new fixtures are to be installed, as will be the case with any renovations to the existing high school, new fixtures need to be of the water conserving types with lead free faucets and be supplied with lead free water piping systems.

Domestic hot water is supplied by larger steam-fired heaters and scattered electric water heaters throughout the various wings of the building. The larger water heaters have served their useful life and should be replaced.

Sanitary and roof drainage piping systems are made of cast iron. Where visible, the piping systems appear to be in fair condition. There are areas where new piping has been installed.

Rainwater from flat roof areas are collected in roof drains that appear to be in good condition and were clear of debris. Internal storm water piping was not visible.

The natural gas service to the school is fairly new and in good condition. This system could stay and be re-used in a renovation. A separate gas service was brought over to the cafeteria kitchen and is capped in place outside the building. This could also be

re-used.

The Boy's and Girl's locker rooms and shower areas are older and in fair condition. The shower area layouts do not meet current ADA requirements.

The cafeteria kitchen plumbing equipment is older and in need of replacement. The interior grease trap does not appear to be used or maintained.

The science labs have sinks that do not empty into an acid neutralization system as they should. The waste from these labs currently leaves the building and ties into the town sewer system without being treated. This condition needs to be corrected.

ELECTRICAL

The majority of electrical systems are in excess of 40 years of age and have reached the end of their service life.

Main electric service and distribution, there is little or no physical or electrical capacity to add onto existing system/equipment. Repairs and/or additions to existing service and distribution equipment will require significant rework of existing facilities to suit new equipment and meet code. Working clearances and systems foreign to electrical installations create code violations and safety hazards for school and service personnel.

Existing lighting throughout the building consist of luminaires original to the building. Lamp sources are primarily fluorescent with the exception of the field house and pool where LED luminaires have been installed. The age of the fixtures present serviceability and maintenance issues, energy inefficiencies as well as poor quality light levels and visual comfort.

Lighting controls consist of local switching. There is no use of occupancy/vacancy or day lighting controls. Energy codes require automatic controls for interior and exterior lighting.

A new fire alarm system was recently installed. The system provides complete voice audio/visual, manual pull stations and 100 percent smoke detector coverage.

Emergency power system consists of an exterior 180kW diesel-fired generator manufactured by Kohler. The generator primarily serves the building's emergency lighting system and would not have capacity to serve additional loads. The existing distribution system does not meet current code requirements for separation of life safety and non-life safety systems.

The majority of spaces throughout the building have receptacles that are original to the building, device quantities are minimal.

AUDIOVISUAL

During our site visit to Belmont High School on August 28, 2017, the existing audiovisual systems were reviewed. The technology being used in the school is outdated and does not support current standards. For this reason, these systems have reached the end of their serviceable lives. Additionally, there did not appear to be standardization in the system components used from room to room that would simplify work for technical staff.

New audiovisual presentation systems, consisting of video displays/projection and sound systems for audio playback (and voice reinforcement in larger spaces) are recommended for the Auditorium, Music Classrooms, Cafeteria, Classrooms, Lecture Hall, and Book Rooms. New sound systems are recommended for the Gymnasium, Natatorium, and Field House. Additionally, a video wall in the Entry Hall can be used to display electronic artwork, and can also be used to display other images and announcements.

TECHNOLOGY

Structured Cabling Systems: There is a district-wide fiber backbone connecting all facilities. The fiber network handles general data as well as Phone (VoIP) and security for the school district and the Town. Any future project must take into consideration the requirement for continued connectivity between and among facilities. The high school MDF is located off the Tech Office on the second floor. The fiber enters the building underground on The Theater/parking lot side of the building and is routed internally to the MDF. Horizontal cabling from the MDF and IDFs to endpoint is Category 5. The Cat5 and cabling represents a bottleneck on the existing network and therefore has reached the end of its serviceable life. Any future project should include the installation of horizontal cabling based on current standards at the time of design, 20GbE backbone and dedicated MDF/IDF rooms with proper power and environmental treatments.

Data and Voce Communication System: The wireless hardware is Alcatel-Lucent. The controller is at the high school with a backup controller at Chenery Middle School. Most APs within the school are mounted based on availability of data outlets because of the difficulty in adding cabling due to building/ceiling conditions. The second floor MDF is the centralized management point for all data communications for the high school, the school

district and the town. IDFs are equipped with Alcatel-Lucent OS6450 Switches, stacked. Any future project should provide updated networking hardware for the MDF and IDFs based on current technology, with special attention paid to maintaining the functionality of the school-district and town wide network and services. VoIP is server-based NEC Univerge SV8300. The server is located in the high school MDF. The system is 10-12 years old. Any future project should expand upon the NEC VoIP platform, upgrade to the newest technology, and consolidate systems as much as possible.

Distributed Communication System: The Intercom system is a Simplex 5100 Series Building Communication System. The master clock system is a Simplex 2350 Master Time System. The intercom main equipment is located in the Main Office. The master clock system is located in the TELCO demark, mounted on the voice termination wallboard. Any future project should provide a new system based on current technology.

GEOTECHNICAL

The report provided by McPhail Associates in PDP indicates the use of previous borings and foundation recommendations from the construction of the existing Belmont High School, and that additional testing should be done during the PSR phase to identify specific pile types required. Provide any updated information in the subsequent Preferred Schematic Report ("PSR") submittal.

The Phase 1 Assessment identified two Recognized Environmental Conditions (one associated with the site's historical use as a landfill, the other with the presence of an abandoned Underground Storage Tank near the hockey rink). However, this Phase 1 report does not state definitively whether (or not) additional Phase 2 geo-environmental investigations are recommended. In response to the comments, clarify and describe any future potential site investigations in this regard. Additionally, MSBA notes that all costs associated with abatement of contaminated soil from any source, and abatement of underground storage tanks must be itemized in the cost estimates for the following Schematic Design submittal as ineligible for MSBA reimbursement.

During Schematic Design, investigations will be conducted to determine subsurface conditions in areas of future site development (building foundations, utilities, site improvements), and in areas that will be impacted by demolition and removal of existing structures and utilities. The goal of these investigations will be to obtain site-specific data on both geotechnical and environmental conditions that would impact project design, construction, and cost. Explorations will be performed to provide representative data as required by the Massachusetts Building Code and Massachusetts Contingency Plan (MCP). Specifically, we anticipate:

- test borings will be drilled within the future building footprint to inform foundation design;
- explorations will be conducted within future utility alignments and roadways for their design;
- soil samples retrieved from explorations will be tested, as appropriate, to determine engineering properties and/or chemical constituents;
- representative analytical soil testing will be performed in areas where soils will be generated by project construction and require off-site disposal; and
- as appropriate, explorations, sampling, and testing will be conducted to determine the nature and extent of contamination and to provide data to maintain MCP regulatory compliance.

The area near the hockey rink will be investigated to determine the presence, condition, and configuration of the underground storage tank presumed to be present. If an underground storage tank exists and it is not in consumptive use or found to be impaired, it will be removed in accordance with applicable regulations. It is understood that all costs associated with abatement of contaminated soil from any source and abatement of underground storage tanks must be itemized in the Schematic Design submittal cost estimates as ineligible for MSBA reimbursement.

The subsurface exploration activities are expected to begin in the Spring/Summer of 2018.

HAZARDOUS MATERIAL

Universal Environmental Consultants (UEC) conducted a thorough and detailed hazardous materials identification analysis at the High School, Belmont, MA, which include the following services as part of the feasibility study of he school:

- Asbestos Containing Materials inspection and sampling;

B. PDP SUMMARY UPDATE

- Polychlorinated Biphenyls Electrical Equipment and Light Fixtures inspection;
- PCB's Caulking inspection;
- Mercury in Rubber Flooring inspection and sampling;
- Airborne Mold inspection and sampling;
- Radon Sampling;
- Underground Storage Oil Tanks inspection.

Please refer to the PDP for the full report.

3.3.2 - EVALUATION OF EXISTING CONDITIONS

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In order to better inform the site planning of immediate Belmont High School project site and adjacent and immediate traffic patterns the Traffic Consultant/ Nelson Nygaard conducted further analysis which is contained in the PSR. The planning issues around the safest and most efficient travel patterns as it relates to vehicular, pedestrian, bike, bus circulation, traffic etc…were further analysis. The further traffic studies and subsequent site plans were presented to the steering committee, regulatory personal, and at a community forum to garner the feedback and input from diverging constituents.

Town of Belmont

Belmont High School Traffic Study – Existing Conditions and Recommendations Report

January 2018

NELSON
NYGAARD

C. TRAFFIC REPORT

BELMONT HIGH SCHOOL TRAFFIC STUDY - EXISTING CONDITIONS AND BUILD RECOMMENDATIONS
TOWN OF BELMONT

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EXISTING CONDITIONS

Introduction

Belmont High School is a 224,000-square-foot facility, built in 1970, serving about 1,350 high school students located in central-eastern Belmont. The school site is bordered by the MBTA commuter rail tracks on the north and Claypit Pond and Concord Avenue on the south. Enrollment ranges from about 300 to 350 students in each grades 9-12. There are about 140 full-time staff employed at the school. In addition to academic facilities, the campus contains a variety of athletic facilities, including a football field and running track, three baseball diamonds, two soccer fields, ten tennis courts, an ice rink, and surface parking areas for students, teachers, and staff.

Several current transportation and parking issues inhibit the ability of students, parents, teachers, and staff to access the school safely and efficiently. These issues include high demand for parking during school hours, long traffic queues in all directions during peak pickup/drop-off periods, dangers for people crossing by foot and by bike across routes with high speeds, and vehicular traffic queues, and unwanted parking spillover from vehicles not accommodated on-site onto neighboring residential streets. Anticipated school population growth could compound these issues if not effectively mitigated. Belmont High School is expected to grow from its current enrollment of 1,300 students to about 1,450 students by 2024. In addition, Belmont Public Schools has considered enrolling seventh- and eighth-grade students at Belmont High School to ease population pressures at other schools in the district. The following report documents and analyzes the existing transportation and parking issues at Belmont High School and its immediate environs, in order to set a baseline for potential future solutions and/or mitigation measures.

This report contains observations and analyses of the following:

- School operations
- Vehicular access
- Parking inventory and utilization
- Walking, biking and transit facilities and observations
- Safety analysis
- Existing traffic performance analysis

School Operations

School is in session each day between 7:35 am and 2:25 pm except for Wednesdays, which conclude at 1:25 pm.[1] The High School's schedule is divided into flexible 25-minute blocks, called "MODs," and students are generally expected to be on campus between 8:00 a.m. and 2:00 p.m. The school is an open campus. However, most students arrive at 7:35 a.m. and depart at 2:25 p.m. Seniors are permitted, by school policy, to leave campus during this time if they have met the required academic criteria for the privilege. Juniors also have access to this policy, however only on their second semester.

All students must register their vehicle with the main office by fully completing a parking agreement. A parking sticker is then issued and should be displayed attached to the rear windshield on the passenger's side of the vehicle. Parking in the student spaces is on a first-come, first-serve basis through the

[1] http://www.belmont.k12.ma.us/bps/bhs/News-Events-Schedules

December break. After December break, only seniors who have won parking passes in a school-wide lottery are allowed to park on campus. Students driving vehicles to school must park them in the student parking lot located at the east end of campus near the tennis courts. The field house parking lot, located immediately north of the School building, is for faculty use only during the school day.

According to conversations with the Belmont Police Department, the High School after-school activities most responsible for parking spillover on residential streets near campus are varsity football and varsity soccer games during the fall, in which there are eight and nine home games per season, respectively.

Students may purchase a bus pass subject to the availability of space and distance from school. School bus service is available to any student paying the fee, but few High School students use the service, most of them 9th graders who are not eligible for driver's licenses. Belmont schools have staggered schedules, and as a result, high school students are picked up and dropped off earliest, followed by middle school and elementary school students.

The annual fee for busing is $575 per student.[2] An initial transportation fee is $287.50 per pupil, payable by check or online.[3] All students who live less than 2.0 miles from their assigned school are required to pay the busing fee. All students requiring bus service, regardless of grade or distance from school, must register for busing online. School bus routes, as of 2017, are shown in Figure 1.

Figure 1 School Bus Route Information[4]

Route	Start Time	First Stop	Last Stop
1 – AM only	6:45 AM	927 Concord Avenue	375 Acorn Park Drive
2 – AM only	6:45 AM	422 Trapelo Road	School & Elm
2 – PM only	2:50 PM (1:50 PM Wednesdays only)	Marlboro & Unity	Trapelo & Hull
3 – PM only	2:40 PM (1:50 PM Wednesdays only)	Trapelo & Waverley	Brookside & Lorimer
4 – AM only	6:45 AM	1 Fletcher Road	Pleasant & Stella
6 – AM only	6:45 AM	Lorimer & Vernon	Waverley & Shean

Source: Belmont Schools

Following established Belmont Police Department practice, there are no crossing guards dedicated to the High School, under the expectation that high school students can navigate the Concord Avenue crossings independently. One crossing guard is dedicated to Burbank Elementary School at Concord Avenue & Baker Street.

In 2015, the Town of Belmont commissioned an Enrollment Study from Symmes Maini & McKee Associates. The study outlined enrollment projections through 2024 and anticipated 1,298 students by the 2017-2018 school year (Figure 2). Recent enrollment of about 1,350 in the current school year indicates that the High School is exceeding these enrollment targets by between two and three years, a trend that may cause traffic impacts from school population growth to similarly outpace earlier estimates.

[2] Fee waivers are available for families with financial need.

[3] http://www.belmont.k12.ma.us/bps/bus-faq

[4] http://www.belmont.k12.ma.us/bps/Portals/0/docs/publications/Bus-Routes-2017-2018.pdf

Figure 2 School Enrollment Projections, 2014- 2024

Year	Total Enrollment
2014-2015	1,235
2015-2016	1,263
2016-2017	1,286
2017-2018	1,298
2018-2019	1,330
2019-2020	1,341
2020-2021	1,382
2021-2022	1,409
2022-2023	1,413
2023-2024	1,437

Source: Belmont Public Schools, Belmont Enrollment Study, p. 42

Existing Vehicular Access and Traffic Operations

Belmont High School's vehicular access/egress pattern is designed such that all traffic entering the campus has a single point of access, at the intersection of Hittinger & Underwood Streets, and two points of egress, either at the High School's driveway at Concord Avenue, on the west side of the Claypit Pond, or via Hittinger & Underwood Streets.

Vehicle queues were observed during the morning traffic peak on October 2, 2017, between about 6:50 a.m. to 7:50 a.m., in the following locations:

- Brighton Street in the southbound direction, between the MBTA tracks and Hittinger Street., for vehicles turning right onto Hittinger Street
- Concord Avenue in the westbound direction, between the High School's egress driveway and Goden Street, for vehicles turning around the block to access destinations east of the High School (no left turn is permitted from the driveway onto Concord Avenue.)
- Concord Avenue in the eastbound direction, between Emerson Street and Underwood Street, for vehicles turning left onto Underwood Street

To get an up-to-date understanding of traffic volumes and congestion points in the vicinity of Belmont High School, turn movement counts (TMC's) were performed at the following six intersections:

- Blanchard Road at Hittinger Street (Two-way stop control)
- Concord Avenue at Underwood Street (Uncontrolled)
- Concord Avenue at High School Driveway/Orchard Street (Two-way stop control)
- Concord Avenue at Goden Street (Two-way stop control)
- Concord Avenue at Leonard Street / Common Street (Uncontrolled)
- Concord Avenue at Blanchard Road / Griswold Street (Signalized)

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TMCs collected at these intersections recorded traffic movements during AM and PM peaks for motor vehicles, bicycles, and pedestrians. TMC's were counted on Thursday, September 28, 2017, from 6:30 to 8:30 a.m. and 1:30 p.m. to 3:30 p.m. with 15-minute reporting intervals, to coincide with peak pickup and dropoff periods at the High School's typical bell schedule. AADT's were counted between September 27 and 28, 2017, for a 48-hour period with hourly reporting intervals. These counts were conducted at Concord Avenue, west of Underwood Street, and Brighton Street, north of Hittinger Street.

Traffic counts revealed that there is a roughly even split between vehicles entering the High School via Underwood Street (56%) and those entering via Hittinger Street (44%). Nearly nine out of ten (89%) of vehicles exit the High School via the main driveway onto Concord Avenue, where all vehicles are required to make a westbound right turn. Of these vehicles exiting onto Concord Avenue, half (44.5%) continue west to Belmont Town Center, while the other half turn left onto Goden Street, presumably to reach destinations east of the High School. Just 11% perform a loop in the primary student parking lot before exiting east via Underwood & Hittinger Streets to Brighton Street and points north. These access and egress patterns are shown in Figure 8.

The six study intersections above were evaluated for Level of Service (LOS) analysis. The following figures display AM and PM peak turning movements for each mode at each of these intersections. Due to the unique geometry of intersection 6, turning movements are included in a separate exhibit (Figures 4 to 6).

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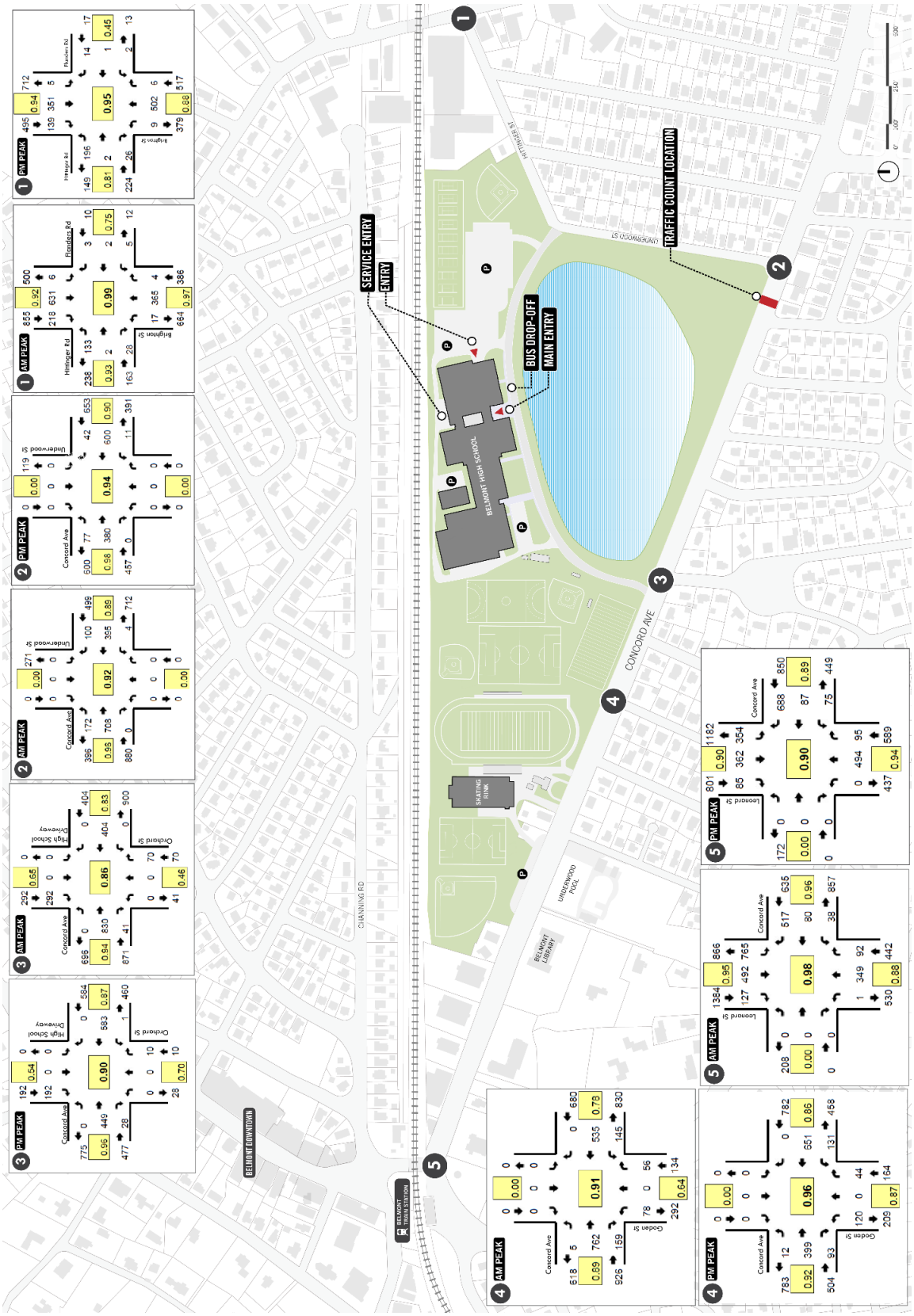

Figure 3: AM and PM Peak Motor Vehicle Turning Movements

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Figure 4: Concord at Blanchard AM and PM Peak Motor Vehicle Movements

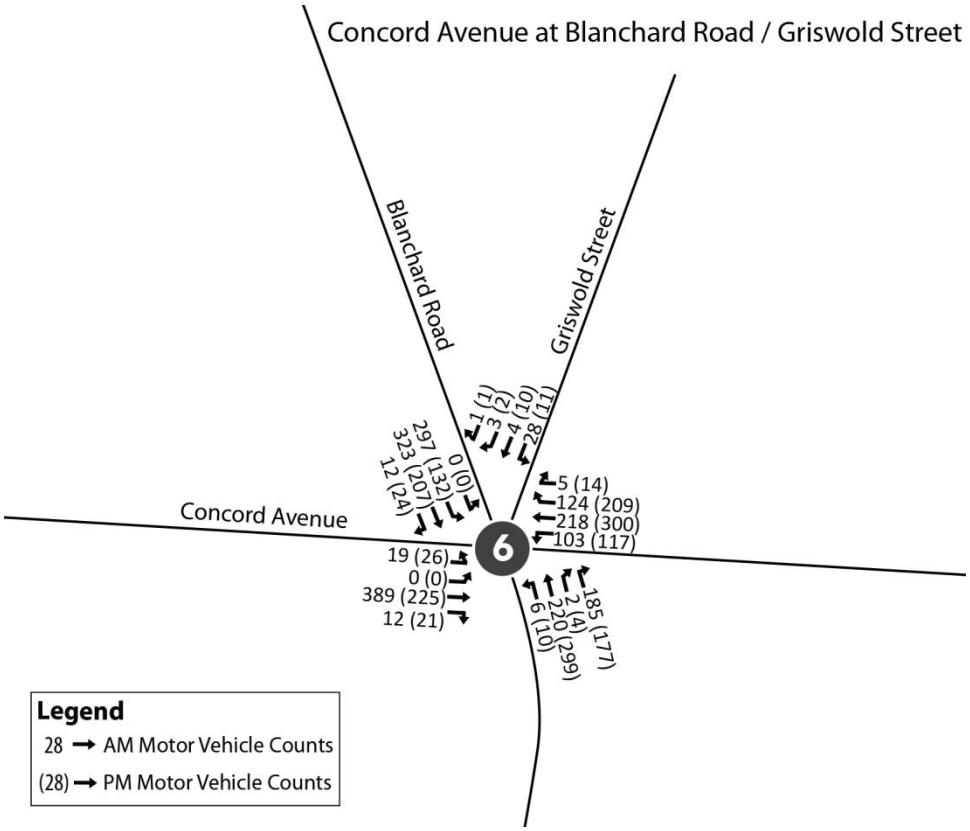

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Figure 5: Concord at Blanchard AM and PM Peak Bicycle Movements

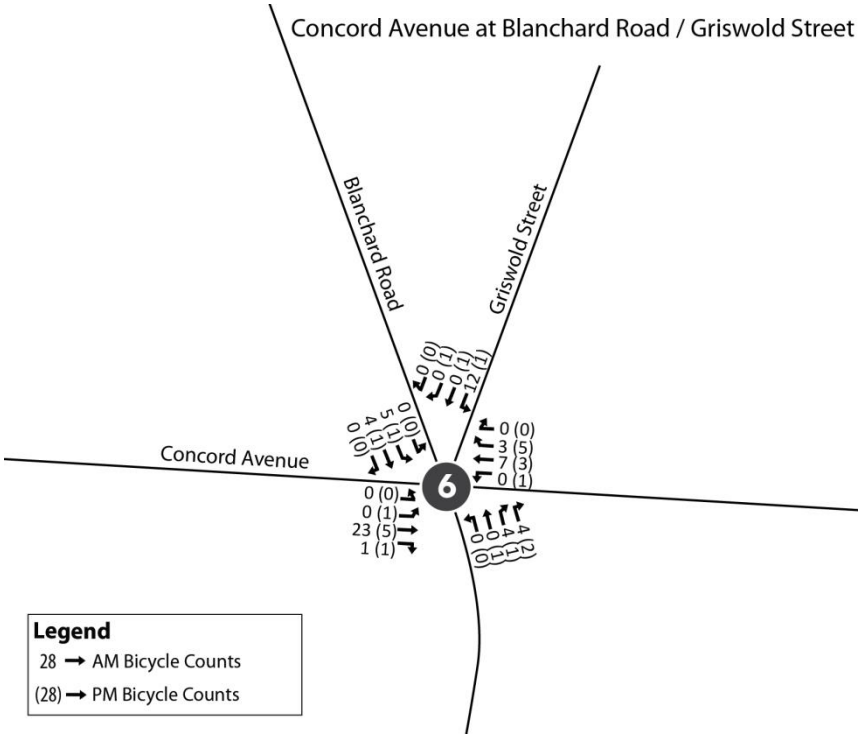

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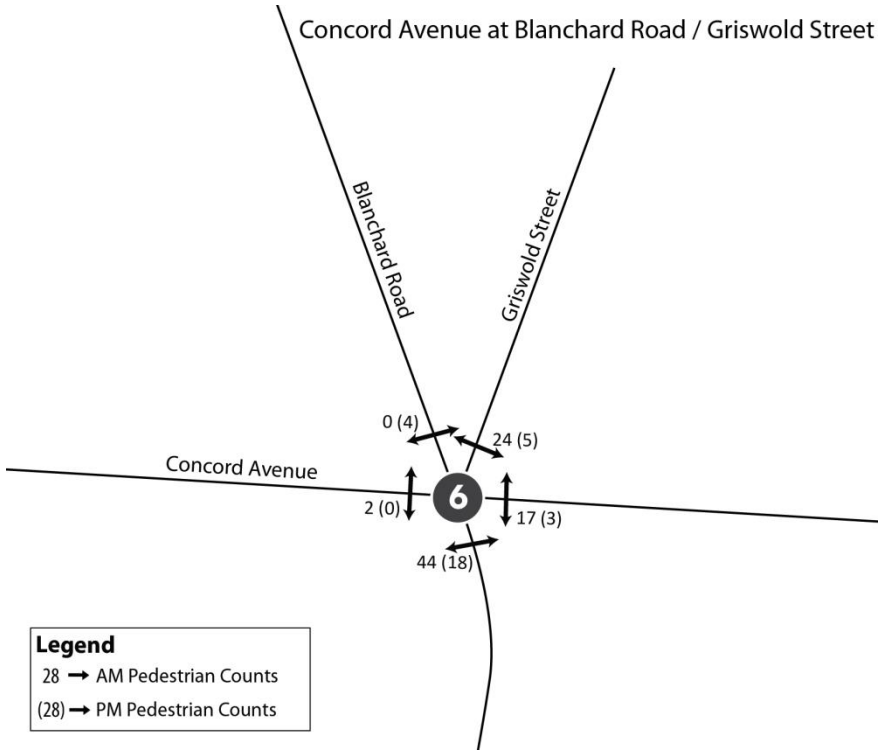
Figure 6: Concord at Blanchard AM and PM Peak Pedestrian Movements



Using these observed turning movement counts, vehicular Level of Service and delay was calculated according to Highway Capacity Manual methods for each intersection. Results from this analysis are displayed in the table below. The majority of study intersections operate at an acceptable LOS D or above. While LOS D and C represent moderate amounts of delay, they are within a reasonable expectation of operations at urban intersections.[5] Leonard Street and Concord Avenue, however, operates at LOS F during both AM and PM periods, indicating a failure to accommodate the observed levels of traffic. Concord Avenue at Goden Street also operates at LOS F during the PM peak, indicating that vehicles often queue at the Goden Street stop sign before turning left or right onto Concord Avenue.

Detailed descriptions of modeled traffic operations for each intersection are as follows:

- **Leonard Street / Concord Avenue / Common Street:** This intersection experiences extreme delay and queueing during both AM and PM observed periods. Due to the uncontrolled nature of the intersection, lack of a roundabout configuration, and the platooning effect of traffic patterns, one more approaches to the intersection are regularly

[5] The Level of Service metric consists of an average of all approaches at a signalized intersection. For unsignalized intersections, Level of Service may provide less reliable estimates of vehicular delay than other models.

forced to wait for upwards of 60 seconds prior to passing through the intersection. Each approach to the intersection experiences this effect in intervals. The westbound approach often experiences massive queueing when multiple left turning vehicles are forced to wait for a gap in cross traffic, forcing the larger volumes of right turning vehicles to wait for clearance. A similar effect occurs on the southbound approach, where multiple right turn or through vehicles stack up and prevent the larger volumes of left turning vehicles from proceeding freely.

- **Concord Avenue / Goden Street:** This intersection operates freely on both Concord Avenue approaches. However, during the AM peak queue occasionally form for vehicles turning left or right out of Goden Street, particularly when left turning vehicles must wait for an adequate gap. This effect also exists during the PM peak with even greater severity, forcing vehicles at the Goden Street approach to wait upwards of 50 seconds before completing their turns.
- **Concord Avenue / Site Driveway:** This intersection operates without significant delay. Vehicles exiting the site driveway are only allowed to turn right and almost always find a sufficient gap in Concord Avenue traffic to complete their turns with delay.
- **Concord Avenue / Underwood Street:** This intersection operates without perceptible delay during AM and PM periods. As Underwood Street is a one-way northbound corridor, vehicles turning right onto it from Concord Avenue face no delay. Eastbound vehicles turning left onto Underwood Street rarely have trouble finding an acceptable gap to make their turns, resulting in little delay.
- **Concord Avenue / Blanchard Road / Griswold Street:** This intersection is a signalized intersection with dedicated phases for each main approach. The Griswold Street approach is not signalized and operates with stop control. The intersection does experience moderate delay during both AM and PM peaks, but overall achieves LOS D, indicating an acceptable level of service for an urban arterial intersection.
- **Blanchard Road / Hittinger Street:** This intersection is stop-controlled at Hittinger Street and operates freely along Blanchard Road. While queue do form along Hittinger Street, particularly when vehicles attempt to turn left onto Blanchard Road, overall delay is within acceptable limits, indicating LOS D during the morning period and LOS C during the PM period.

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-

Figure 7 AM and PM Motor Vehicle Level of Service and Delay

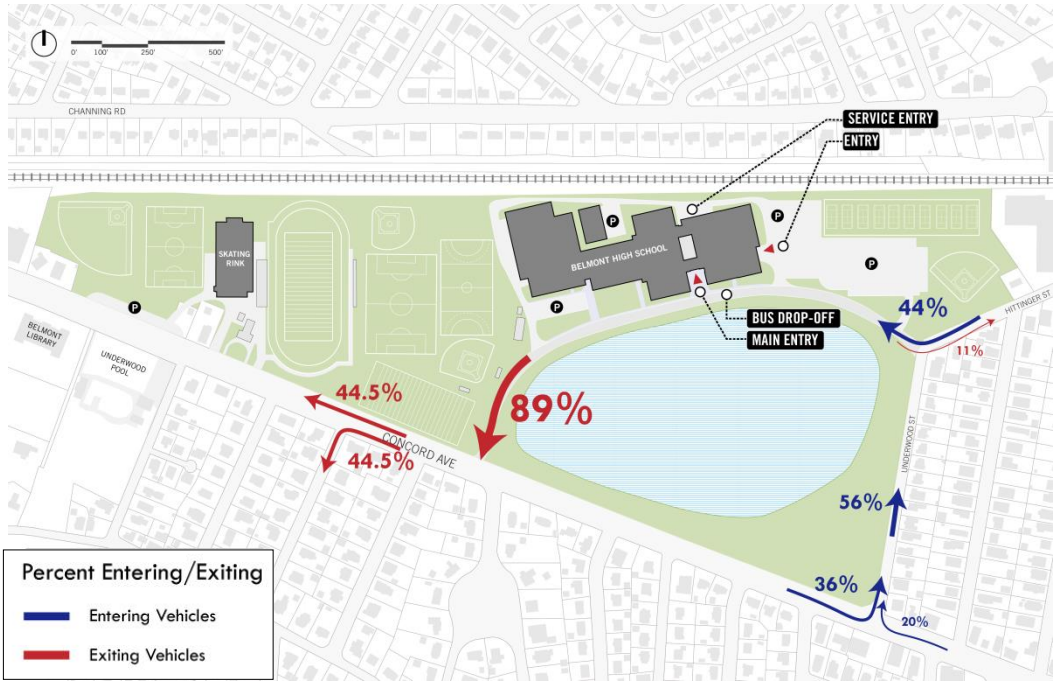
Intersection Name	AM LOS	AM Delay	AM Avg Queue (Worst Approach)	PM LOS	PM Delay	PM Avg Queue (Worst Approach)
Leonard Street / Concord Avenue / Common Street	F	68.8	743 (SB)	F	72.4	616 (WB)
Concord Avenue / Goden Street	D	34.3	74 (NB)	F	52.8	143 (NB)
Concord Avenue / Site Driveway	A	7.7	61 (SB)	A	7.3	61 (SB)
Concord Avenue / Underwood Street	A	8	154 (EB)	A	5.3	66 (EB)
Concord Avenue / Blanchard Road / Griswold Street	D	42.1	381 (EBT)	D	45.8	524 (WBT)
Blanchard Road / Hittinger Street	D	26.3	82 (EB)	C	19.5	64 (EB)

Given these operational characteristics, the majority of study area intersections are operating within expected limits of their capacity, with a Level of Service of "D" or better. The intersection of greatest concern is Leonard Street at Concord Avenue, which experiences extreme delay and queueing, creating a safety and efficiency barrier of access for all users.

3.3.2 - EVALUATION OF EXISTING CONDITIONS

C. TRAFFIC REPORT

Figure 8 Vehicular Access/Egress Patterns



Source: Nelson\Nygaard

Qualitative site observations[6] showed that congestion in and around the High School results not only from vehicles dropping off students, but from the dozens of campus affiliates wishing to park on-site. In particular, long queues on Underwood and Hittinger Streets result from conflicts between vehicles entering the High School entryway, from either Underwood or Hittinger, and vehicles that exit the High School campus after drop-off by making a left turn in the eastbound direction on the school drive from the student parking lot to exit via Hittinger.

Drop-off issues are more critical during the morning drop-off peak, while in the afternoon pick-up peak many students finish at staggered times due to after school activities. During stakeholder meetings, it was also reported that there is not a formally designated curb area for student drop-off and pick up; rather, students typically wait where their parents typically wait for them. Stakeholders consider this to be a safety concern. In the morning, the majority of students were observed being dropped off on the school's driveway, near the main building entrance, with a smaller number being dropped off at the building's eastern entrance from the faculty/staff lot.

The narrow period of access and egress observed also poses a challenge, with the majority of drop-off traffic occurring during a concentrated 20-minute span of about 7:18 – 7:38 a.m., in advance of the typical first period bell at 7:35 a.m. This generates longer queues and driver frustration, which can lead to impatient and dangerous maneuvers. Of the total vehicular counts

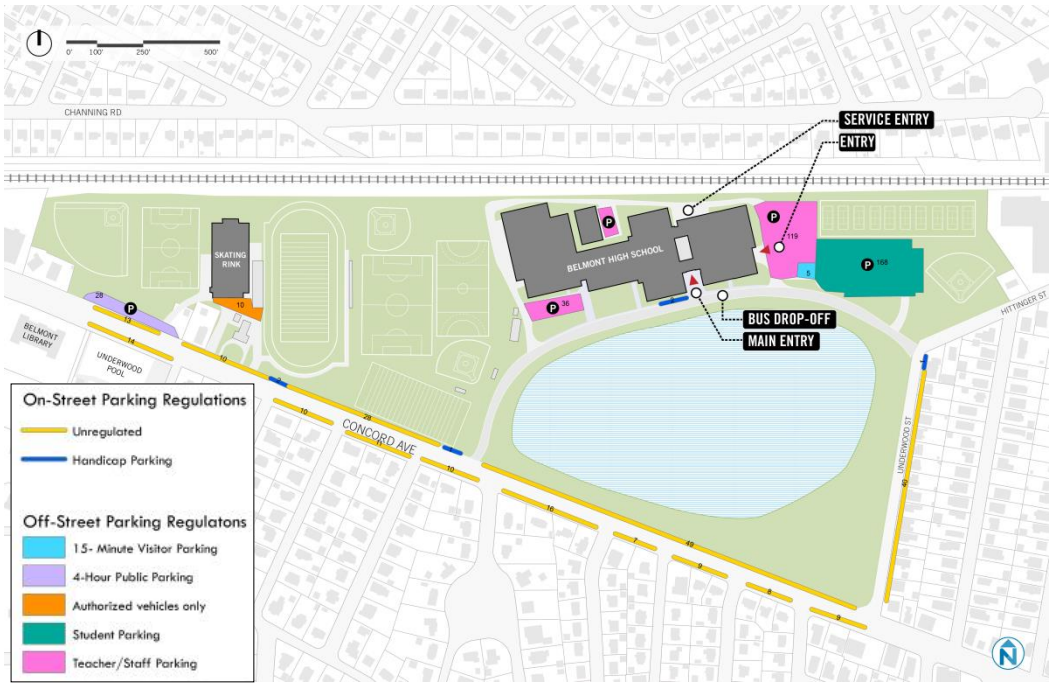
[6] Recorded on October 2, 2017, between about 6:50 a.m. and 7:50 a.m.

collected, the overall morning peak of general commuter traffic on Concord Avenue occurred within the span of 7:15 – 8:15 a.m.

Existing Parking

There are 168 spaces allocated to students and 155 spaces dedicated to faculty and staff. In addition, there are five visitor spaces in the main faculty/staffing parking area, and two on-street disabled spaces located along the High School's main driveway. There are two off-street parking areas west of the football stadium, adjacent to Concord Avenue: one is a 28-space public parking facility just east of Concord Avenue, regulated with a 4-hour time limit, and the other is reserved for authorized service vehicles just south of the skating rink. During data collection, users were observed walking from the public parking lot towards the Belmont Town Center, indicating that, during the daytime, this lot is likely not utilized by High School affiliates. In total, there are 368 off-street spaces in campus parking facilities, and 229 on-street spaces located nearby on Concord Avenue or Underwood Street. Parking inventory is shown in Figure 9.

Figure 9 Parking Inventory



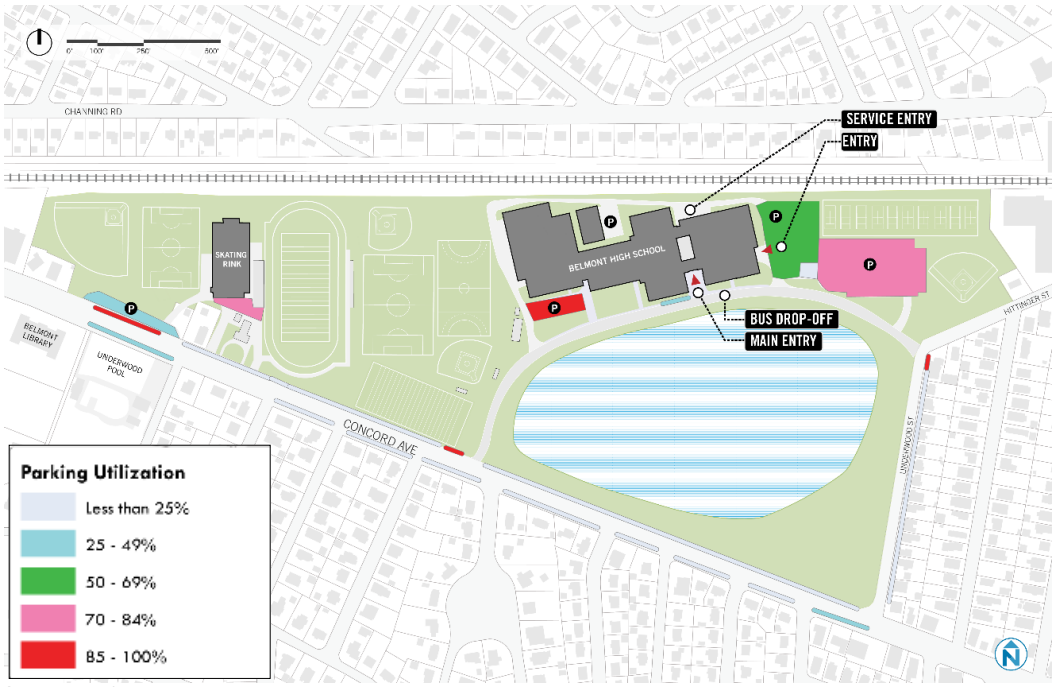
Source: Nelson\Nygaard

The project team conducted parking utilization counts on October 2, 2017, at 10 a.m – a time selected to represent peak accumulation once most affiliates have travelled to campus. Utilization counts showed that during peak occupancy, the High School's core parking facilities are about 76% full, with 251 vehicles parked in 330 available spaces. Demand in the student parking lot at the eastern end of campus approached 85% utilization, a threshold indicating it is functionally full, i.e. it might be difficult but not impossible to find a parking space. However, significant capacity remains unoccupied in the eastern faculty/staff lot, which has utilization of less than

70%. On-street spaces on Concord Avenue and Underwood Street remain under-utilized, with utilization rarely exceeding 25% on these segments. Parking utilization in and around campus is shown in Figure 10.

The Belmont School District operates eight school buses, which are parked at the High School in the easternmost portion of the student parking lot during the school day. High School stakeholders are evaluating whether school buses will continue to be stored in this location.

Figure 10 Parking Utilization



Source: Nelson\Nygaard

Existing Walking and Biking Access

Walking and biking are popular means of accessing Belmont High School. The High School is accessible by on-street bike lanes on Underwood Street and on Concord Avenue, between Leonard Street and the Cambridge line. The High School is connected to a nearly complete network of sidewalks along Concord Avenue and Underwood Streets, along with two high-visibility pedestrian crossing signals at Concord Avenue & Orchard Street (Figure 11) and Concord Avenue & Cottage Road. The only significant gap in the sidewalk network exists on the north side of Hittinger Street, adjacent to the off-street parking area of the industrial facility that occupies a large property between Brighton Street and Trowbridge Street. In addition, a multiuse trail running parallel to the MBTA tracks, known as the "Fitchburg Cutoff Bikepath," runs from Alewife Station to the campus, terminating at the intersection of the tracks and Brighton Street, roughly 200 feet north of the intersection of Brighton & Hittinger. This off-street path provides walking and biking access not only to the Alewife "T" station but also to other destinations in Cambridge and Somerville. An off-street recreational path also exists around the circumference of

Claypit Pond, just south of the High School, although this path does not currently offer direct or accessible connections to nearby on-street bike or pedestrian facilities.

Figure 11 Pedestrian Crossing Signal at Concord & Orchard

Source: Nelson\Nygaard

In site observations conducted during the AM peak period[7] of October 2, 2017, the project team counted roughly 250 people walking (Figure 16) and 100 people biking to the campus (Figure 15), comprising almost a quarter of all affiliates. The heaviest volumes of people walking were observed crossing Concord Avenue at Orchard Street into the High School's driveway (about 200 people walking observed), crossing Concord Avenue at Underwood Street (about 25 people walking), and crossing Brighton Street onto Hittinger (about 25 pedestrians). About 30 people bike to the High School via each intersection, as shown in Figure 15

In discussions with campus stakeholders, the most commonly cited walking access issue was that students frequently cross the MBTA tracks at a location immediately north of the baseball field, indicated on

[7] Approximately 6:50 a.m. – 7:50 a.m. on October 2, 2017.

Source: Nelson\Nygaard

Figure 13, to connect with Alexander Avenue, Sherman Street, and other destinations in northern Belmont. Stakeholders noted that affiliates had previously cut a hole in the chain-link fence between the campus and the railroad tracks so that baseball players could retrieve foul balls. In addition to presenting a serious safety issue in which students are exposed to the risk of fatal collisions with oncoming rail traffic while crossing the tracks, this problem highlights the need for enhanced walking connections between the High School and neighborhoods in northern Belmont. Under existing conditions, there are no points of access between Concord Avenue and northern Belmont neighborhoods between Leonard Street and Brighton Street, a distance of over three-quarters of a mile.

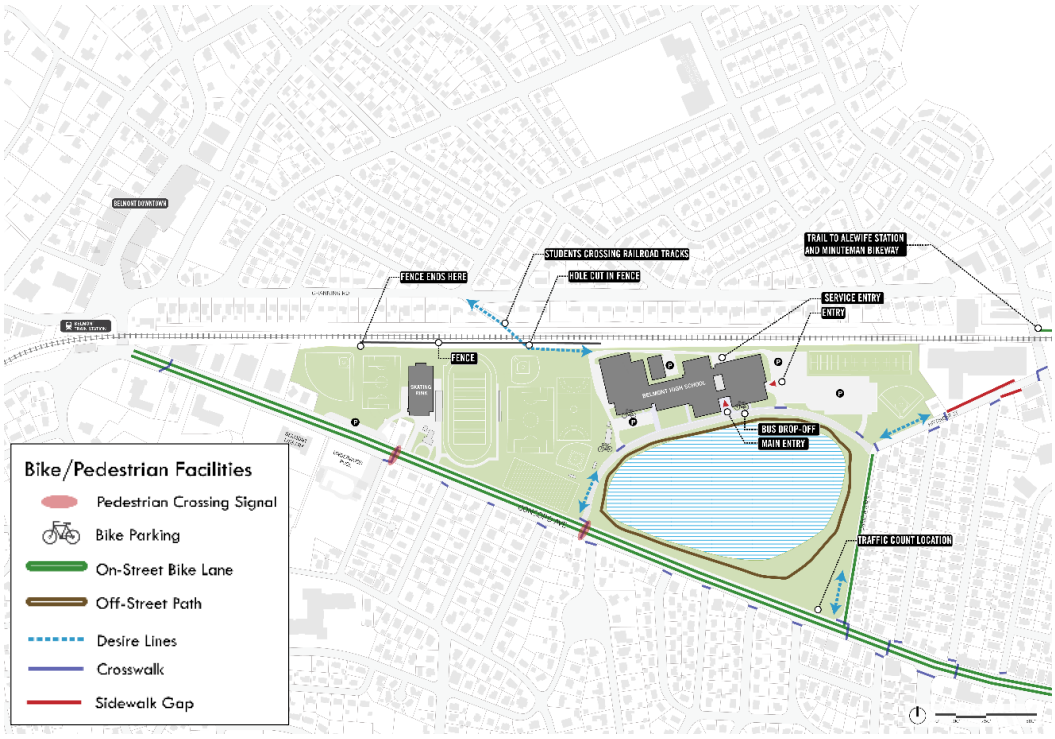
Other stakeholders expressed concern over the lack of connection between the sidewalks on Concord Avenue and Underwood Street and the off-street path encircling the Claypit Pond. If present, the off-street path could provide additional utility for bikes and pedestrians on the east side of the High School's driveway or the west side of Underwood Street.

Bike racks in and around campus had high utilization during the site observation period described above (Figure 12). The high demand for bike parking on campus is evidence of the need for additional bike parking and enhanced biking access and safety improvements.

Figure 12 Full Bike Racks at Belmont High School

Source: Nelson\Nygaard

Figure 13 Campus Bike and Pedestrian Access



Source: Nelson\Nygaard

Crash Propensity Analysis

The project team mapped and analyzed Belmont Police Department crash data from the last five years, 2012-2017. These data indicated that several locations on Concord Avenue have a high propensity for vehicle crashes, particularly those involving people walking and biking. The locations with the highest propensity for crashes in this period were Concord Avenue & Leonard Street/Common Street, Concord Avenue between Leonard Street and Cottage Road (mid-block), and Brighton & Hittinger Streets. Each of these locations have featured at least 10 crashes in the five-year period. The full results of the crash propensity analysis are shown in **Error! Not a valid bookmark self-reference.**. According to MassDOT, neither Brighton Street/Blanchard Road nor Concord Avenue are listed among the Top 200 intersection clusters in any survey period between 2002 and 2014. These corridors are also not among those eligible for Massachusetts Highway Safety Improvement Program (HSIP) funding.

3.3.2 - EVALUATION OF EXISTING CONDITIONS

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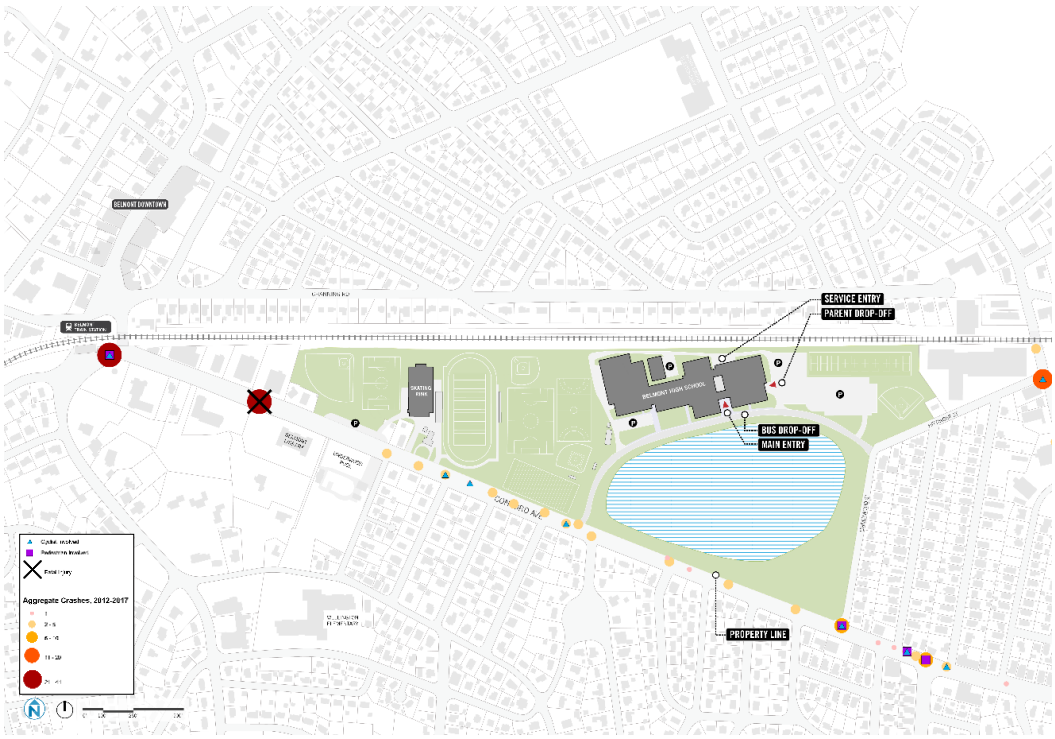
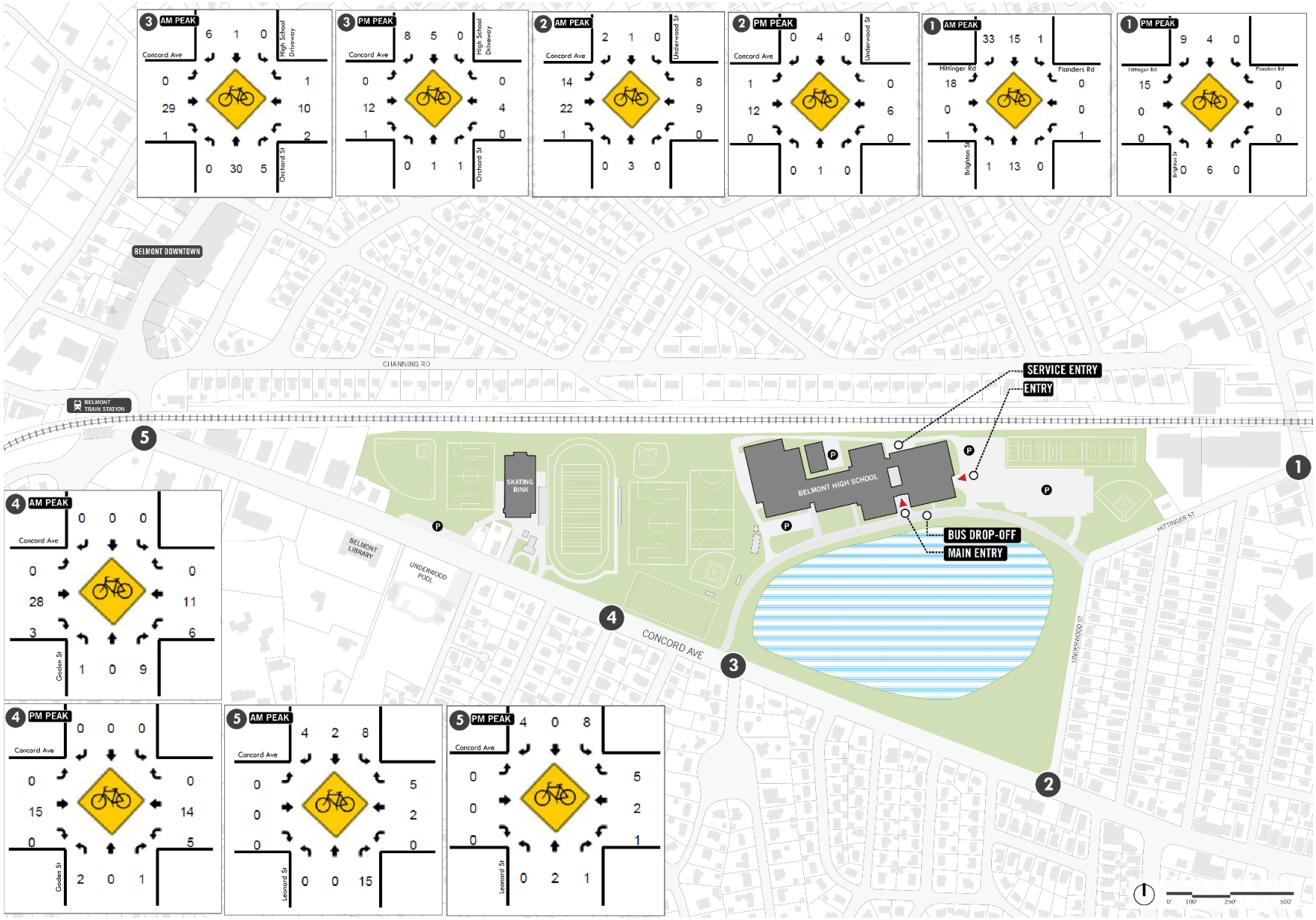
Figure 14 Crash Locations and Propensity



Sources: Belmont Police Department

Figure 15: AM and PM Peak Bicycle Turning Movements



3.3.2 - EVALUATION OF EXISTING CONDITIONS

C. TRAFFIC REPORT

Figure 16: AM and PM Peak Pedestrian Movements

Existing Transit Access

Four MBTA bus transit routes operate within walking distance of the campus, routed primarily along Concord Avenue and Brighton Street (Figure 17). Stakeholders report that teachers and staff make use of MBTA services to access campus but a ride survey has not been completed to objectively document this mode share. Through METCO, a statewide voluntary school desegregation program, Belmont High School currently receives 43 students from the City of Boston that board and alight at MBTA bus stops at Concord Avenue & Orchard Street.

A high-visibility pedestrian crossing signal at this intersection helps these students safely cross Concord Avenue into the campus. While bus stops exist within the vicinity of campus, none has bus stop amenities such as benches, shelters, lighting, or real-time travel information, which may encourage campus affiliates to take transit. Belmont High School can also be accessed via MBTA's Fitchburg Line, with a 15-minute walk along Concord Avenue to the west. Alternatively, campus affiliates can access the school via "T" subway service on the Red Line at Alewife Station, with a 9-minute bike ride on the Fitchburg Cutoff Bikepath that connects to Hittinger Street.

Figure 17 Transit Access near Belmont High School

Source: MBTA

FUTURE SCENARIOS

No Build Scenario Conditions

The No Build Scenario assumes no implementation of the planned school expansion. A 1% annual growth rate is applied to current traffic volumes with an analysis year of 2021. No transportation

improvements are added in this scenario. This results in somewhat worsened conditions throughout the study area, as summarized in the table and figure below.

- Level of Service decreases from LOS D to LOS E at Concord Avenue and Blanchard Road
- Queues lengthen somewhat at Goden Street and Concord Avenue and Hittinger Street and Brighton Avenue

Figure 18 No Build Scenario AM Peak Level of Service

Figure 19 No Build Scenario AM Peak Results

	Existing Conditions			No Build Scenario		
Intersection Name	**AM LOS**	**AM Delay**	**AM Avg Queue (Worst Approach)**	**AM LOS**	**AM Delay**	**AM Avg Queue (Worst Approach)**
Leonard Street / Concord Avenue / Common Street	F	68.8	743 (SB)	F	63.5	728 (SB)
Concord Avenue / Goden Street	D	34.3	74 (NB)	F	96.1	149 (NB)
Concord Avenue / Site Driveway	A	7.7	61 (SB)	B	13.5	89 (SB)
Concord Avenue / Underwood Street	A	8	154 (EB)	A	5.3	98 (EB)
Concord Avenue / Blanchard Road / Griswold Street	D	42.1	381 (EBT)	E	55.4	409 (SB)
Blanchard Road / Hittinger Street	D	26.3	82 (EB)	F	66.7	133 (EB)

Build Scenario Conditions

The Build Scenario assumes implementation of the planned school expansion with a series of associated transportation improvements in order to determine potential impacts and possibilities for mitigation. All build scenarios assumed that all students, including the 7th and 8th grades added by the school expansion and the new high school students, arrive during the same peak hour. These scenarios also assume a background growth rate of 1% annually with a build year of 2021. Three build scenarios were analyzed to evaluate various circulation configurations, as follows:

- **Scenario 2.1:** This scenario assumes a primary entrance-only driveway to the site opposite Orchard Street at Concord Avenue, without a curb cut allowing through traffic from Orchard Street. A primary exit-only driveway is aligned with Goden Street at Concord Avenue which allows right turn and through movements, but no left turns onto Concord Avenue. This intersection is stop controlled. An entrance and exit driveway is also available at Hittinger Street and Trowbridge Street, which is also stop controlled. Figure 18 below displays the circulation pattern analyzed in this scenario.
    - The large amount of vehicles exiting the school via the Goden Street driveway creates significant queueing for both northbound and southbound traffic
    - Queues at Hittinger and Brighton remain lengthy

Figure 20 Scenario 2.1 AM Peak Level of Service

- **Scenario 2.4:** This scenario assumes a primary entrance and exit driveway is located on Concord Avenue at Goden Street. The intersection of Concord Avenue and Goden Street

is stop controlled, with free-flowing traffic on Concord Avenue. A secondary entrance and exit driveway is located on Hittinger Street at Trowbridge Street. Figure 19 below displays the circulation patter analyzed in this scenario.

- The large amount of vehicles accessing the school via the Goden Street driveway creates significant queueing for both northbound and southbound traffic
- Queues at Hittinger and Brighton remain lengthy

Figure 21 Scenario 2.4 AM Peak Level of Service

- **Scenario 2.4 with Goden Street Signal:** This scenario assumes a primary entrance-only driveway at Concord Avenue opposite Oak Street, without a curb cut allowing through traffic from Oak Street. A primary entrance and exit driveway is located on Concord Avenue at Goden Street, where a traffic signal is implemented to alleviate safety issues and prevent lengthy queueing on Goden Street as vehicles wait to turn left onto Concord Avenue. A secondary entrance and exit driveway is located on Hittinger Street at Trowbridge Street. Figure 19 below displays the circulation patter analyzed in this scenario.
  - Implementation of the signal at Goden Street shortens queues for southbound and northbound traffic while improving safety conditions. LOS at the intersection improves from F in the No Build and 2.4 without signal scenarios to C.
  - Residents on Goden Street have a safer, easier way to make left turns onto Concord Avenue
  - During off-peak hours, the signal can be taken out of operation to avoid undue delay times at the Goden Street intersection
  - Queues remain an issues at the intersection of Hittinger and Brighton

Figure 22 Scenario 2.4 with Goden Street Signal AM Peak Level of Service

Intersection analysis results for each build scenario are summarized in the table below for the AM peak (the worst condition observed throughout the day).

Figure 23 Build Scenario AM Peak Results

	Scenario 2.1			Scenario 2.4			Scenario 2.4 with Goden Street Signal		
Intersection Name	**AM LOS**	**AM Delay**	**AM Avg Queue (Worst Approach)**	**AM LOS**	**AM Delay**	**AM Avg Queue (Worst Approach)**	**AM LOS**	**AM Delay**	**AM Avg Queue (Worst Approach)**
Leonard Street / Concord Avenue / Common Street	F	62.5	743 (SB)	F	65.8	738 (SB)	F	67.1	734 (SB)
Concord Avenue / Goden Street	F	93.2	250 (SB)	F	104.7	249 (SB)	C	26.2	186 (NB)
Concord Avenue / Site Driveway	A	3.5	-	A	3.5	-	A	3.7	-
Concord Avenue / Underwood Street	A	9.0	140 (EB)	B	11.6	79 (EB)	A	3.8	28 (WB)
Concord Avenue / Blanchard Road / Griswold Street	E	62.6	768 (WBT)	E	68.2	787 (WBT)	E	66.9	773 (WBT)
Blanchard Road / Hittinger Street	F	150.3	204 (EB)	F	185.7	225 (EB)	F	137.9	203 (EB)
Hittinger Street / Trowbridge Street / Site Driveway	F	57.7	78 (NB)	F	87.5	69 (NB)	F	59.6	77 (NB)

The results in Figure 20 indicate that Scenario 2.3 provides significant improvements to delay at Concord Avenue and Goden Street when compared with Scenario 2.1 due to implementation of a traffic signal. Furthermore, implementation of this traffic signal provides improvement when compared with the existing condition at this intersection, which currently operates at LOS D with 34.3 seconds of delay without a traffic signal (see Figure 7). All other intersections operate with similar levels of service across both analyzed build scenarios.

RECOMMENDATIONS

Given the results of the existing conditions and build scenario analyses, signalization of the Concord Avenue and Goden Street intersection is recommended. Adding a signal at this location will improve safety for pedestrians reaching the school site, reduce delay for residents traveling northbound, and improve overall delay at the intersection when compared with alternatives without a signal. A series of additional transportation improvements to alternative transportation modes and internal site circulation will further improve conditions in the build scenarios.

In order to further reduce impacts from the school site expansion, the following recommendation measures should be considered:

1) Site access at Concord Avenue and Goden Street should be signalized
    a) Signalization will reduce queues on Goden Street
    b) Allowing left turns at all approaches will eliminate U-turns on Concord Avenue, improving safety conditions
    c) Signalization makes walking to school safer and easier
2) Implement two full access site driveways (one at Goden Street and one at Trowbridge Street) to improve internal site circulation
    a) Multiple driveways distribute traffic more evenly to reduce queuing while entering and exiting the site
    b) Fire and safety access is improved when multiple driveways are available
3) Provide dropoff loops internal to the site to prevent queues from spilling onto neighboring streets
4) Improve walking, biking and transit access
    a) Add a new walk/bike only gateway on Concord Avenue
    b) Signalization of Goden Street improves walk and bike access at this intersection
    c) Improve the walk/bike entry at Underwood Street and Hittinger Street
5) Improve overall bicycle access
    a) Gateway improvements (as previously listed) improve bicycle entry to the site
    b) New connections to the proposed multi-use path enhance access
    c) Implement the cross-campus bike path to improve internal site bicycle access
6) Add on-site parking near the skating rink/stadium to mitigate gameday spillover onto residential streets
7) Proposed circulation patterns reduce queues at key intersections of Concord/Goden, Concord/Underwood, and Underwood/Hittinger
8) Impacts to Hittinger/Brighton are neutral when compared with the No Build scenario

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9) Emergency vehicle circulation is improved

The following set of figures illustrate the key recommendations and outcomes as outlined in the list above.

Figure 24 Measure 1: Signalized Intersection at Concord and Goden

Figure 25 Measure 2: Two full-access site driveways reduce delays

3.3.2 - EVALUATION OF EXISTING CONDITIONS

C. TRAFFIC REPORT

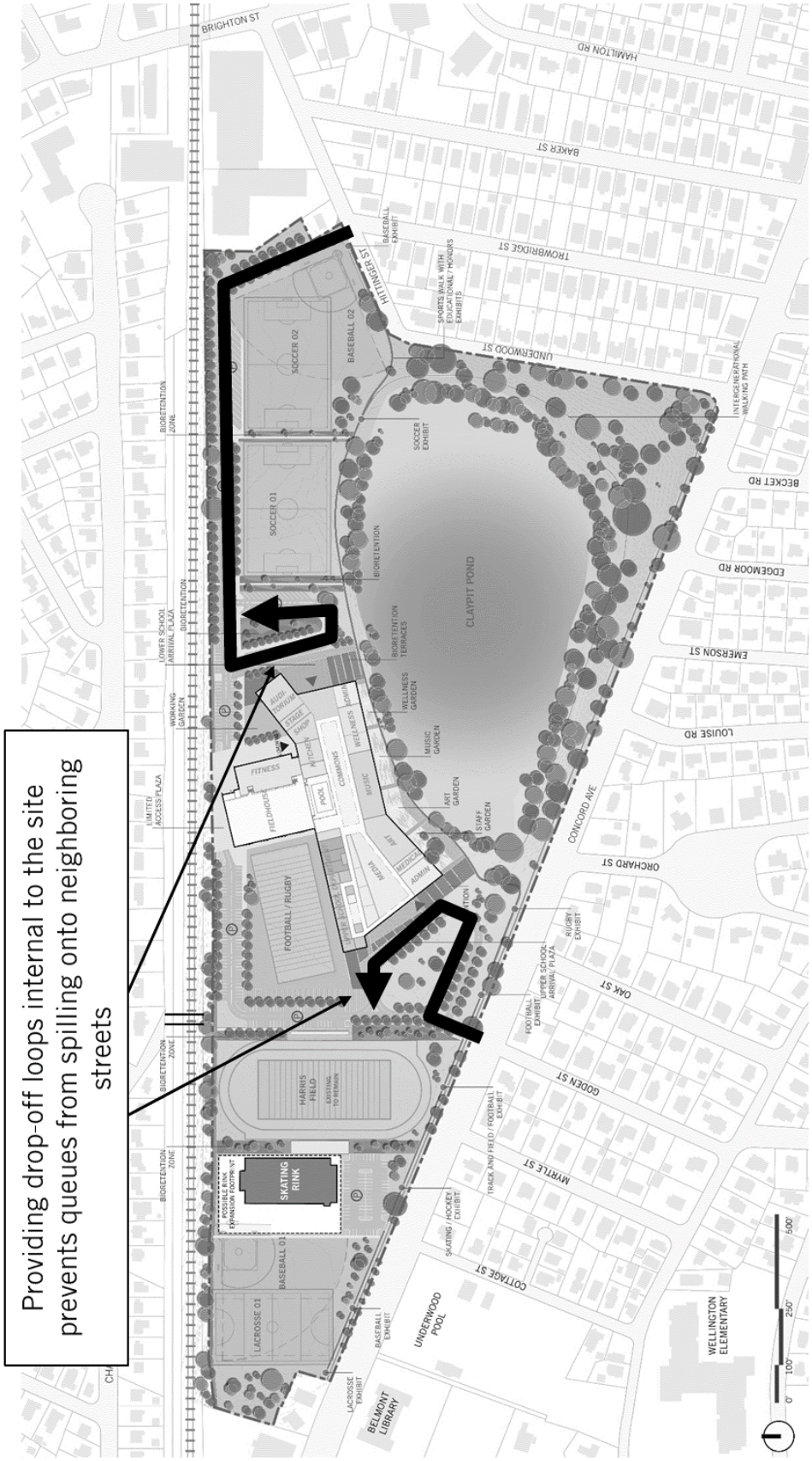

Figure 26 **Measure 3: Internal drop-off loops**

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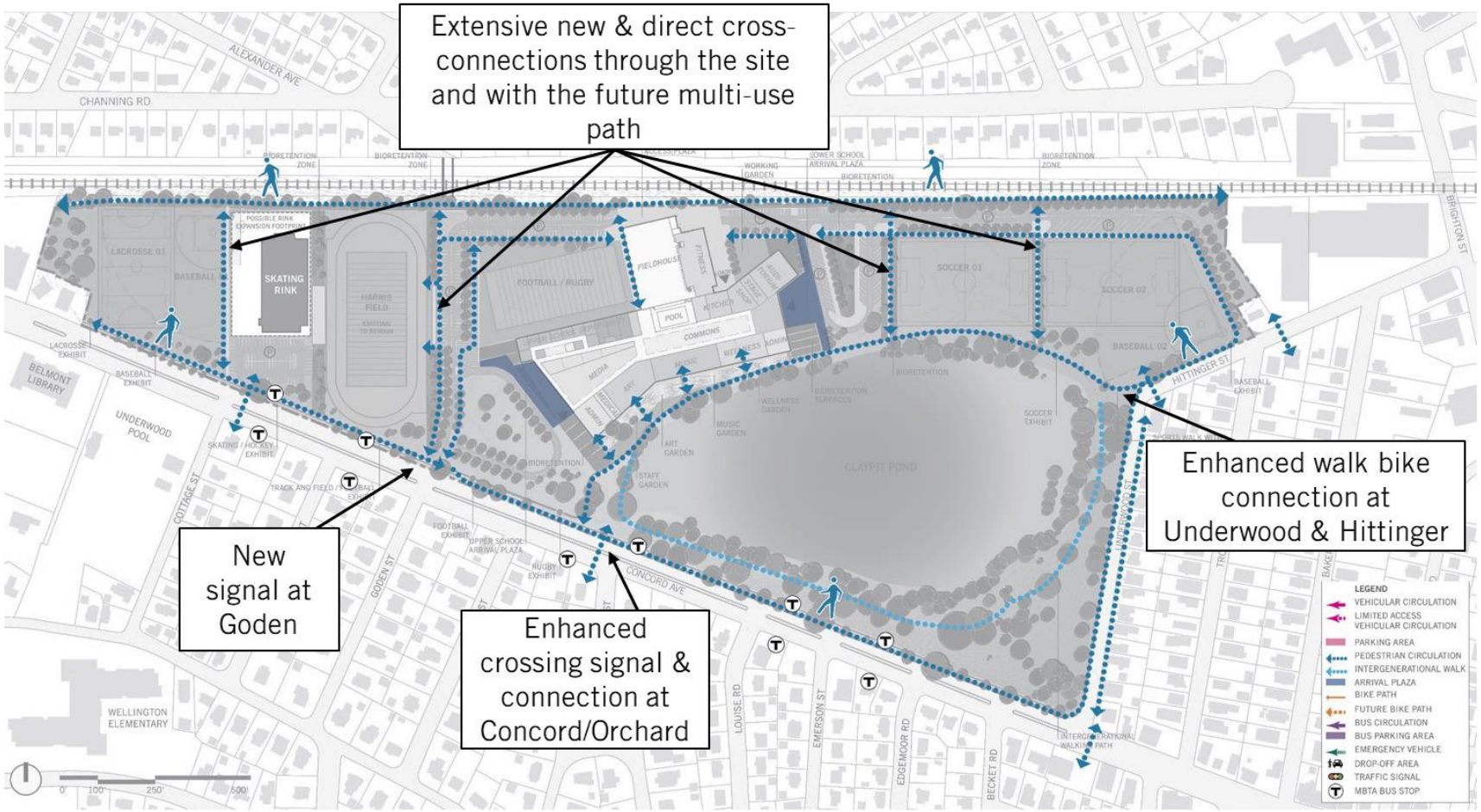
Figure 27 Measure 4: Enhanced Pedestrian Circulation



3.3.2 - EVALUATION OF EXISTING CONDITIONS

C. TRAFFIC REPORT

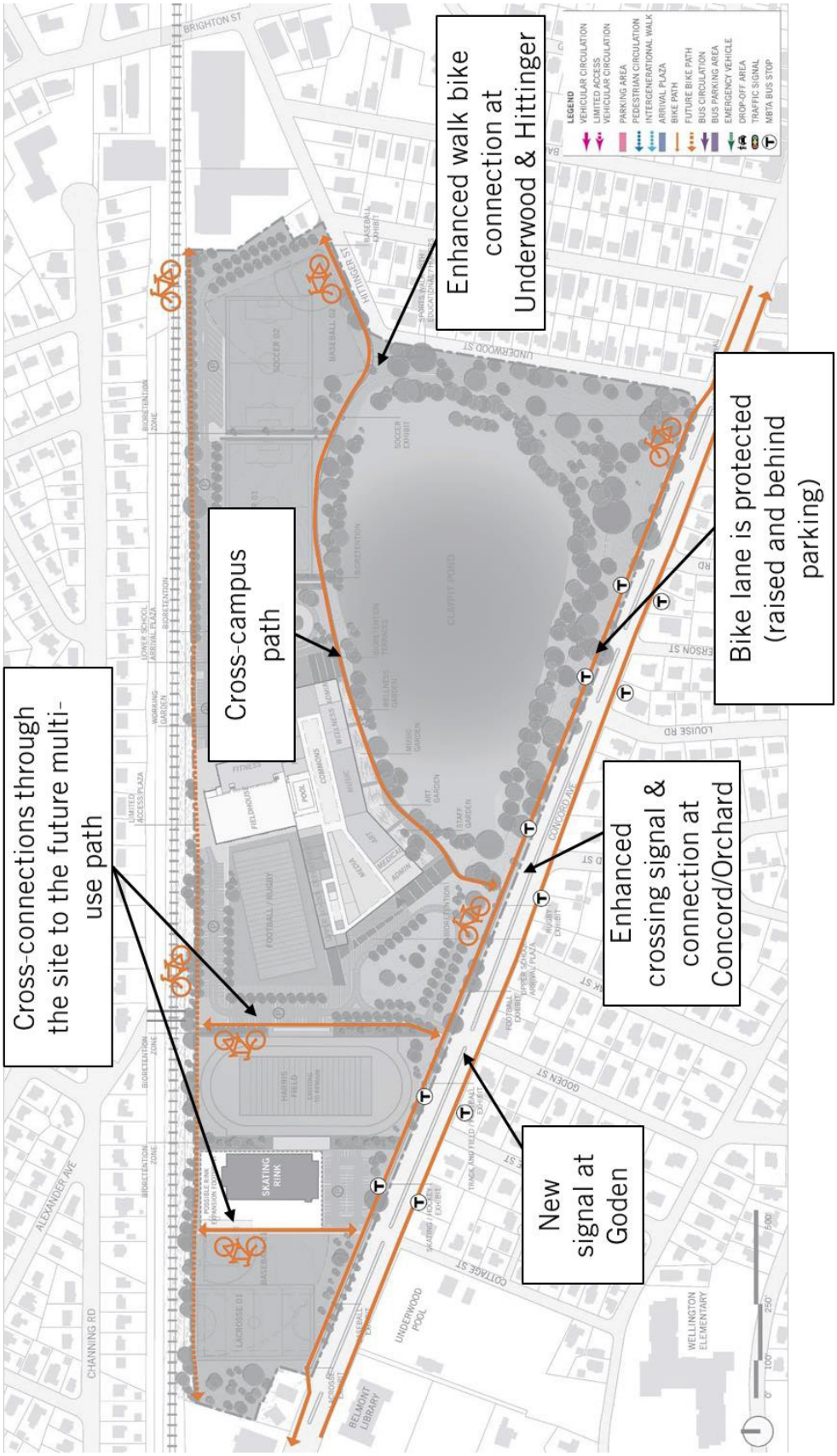


Figure 28 **Measure 5: Enhanced Bike Circulation**

Figure 29 **Measure 6: Mitigating spillover parking effects**

3.3.2 - EVALUATION OF EXISTING CONDITIONS

C. TRAFFIC REPORT

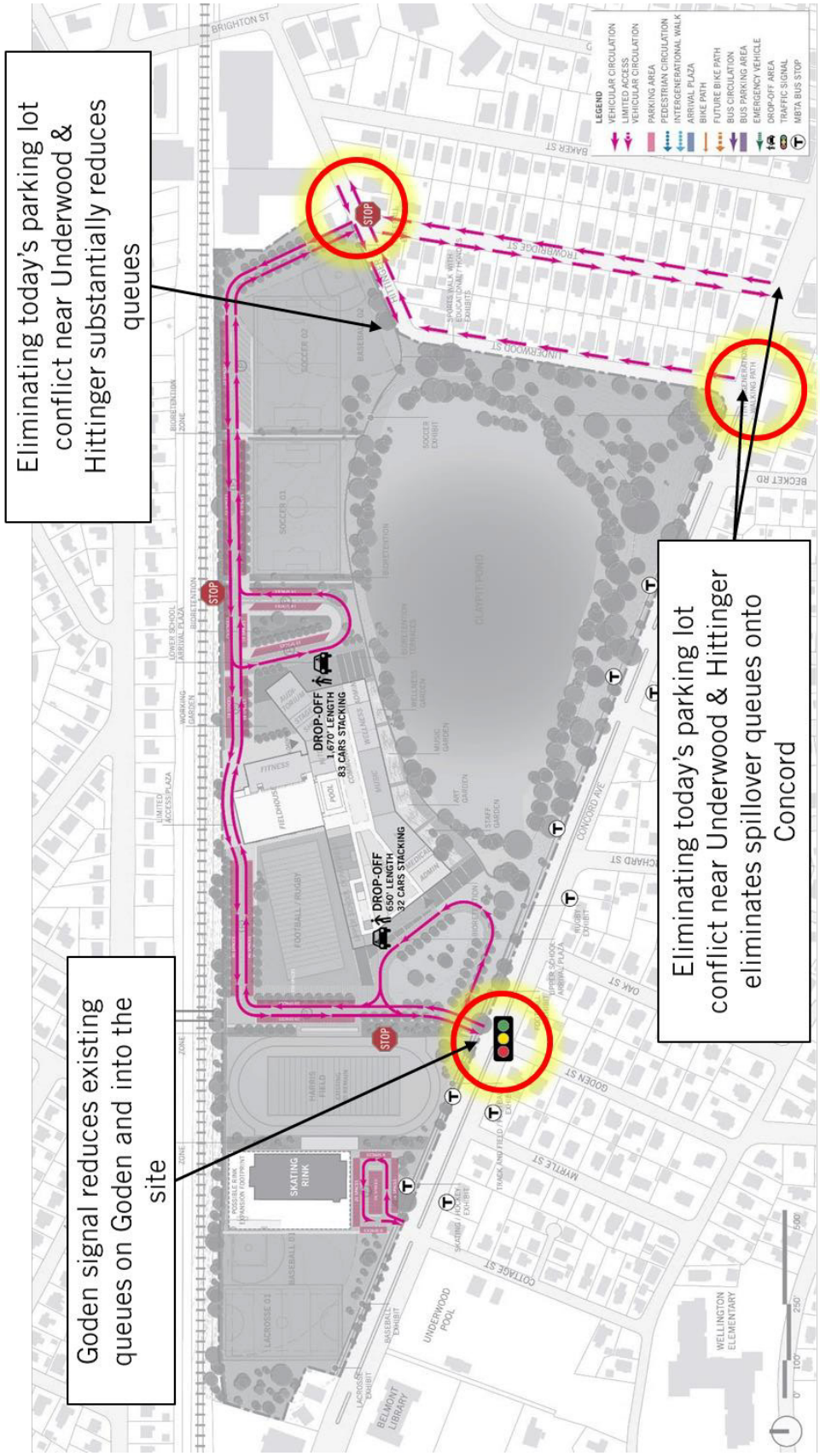


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Figure 30 **Measure 7: Reduced delays & queues at all intersections**

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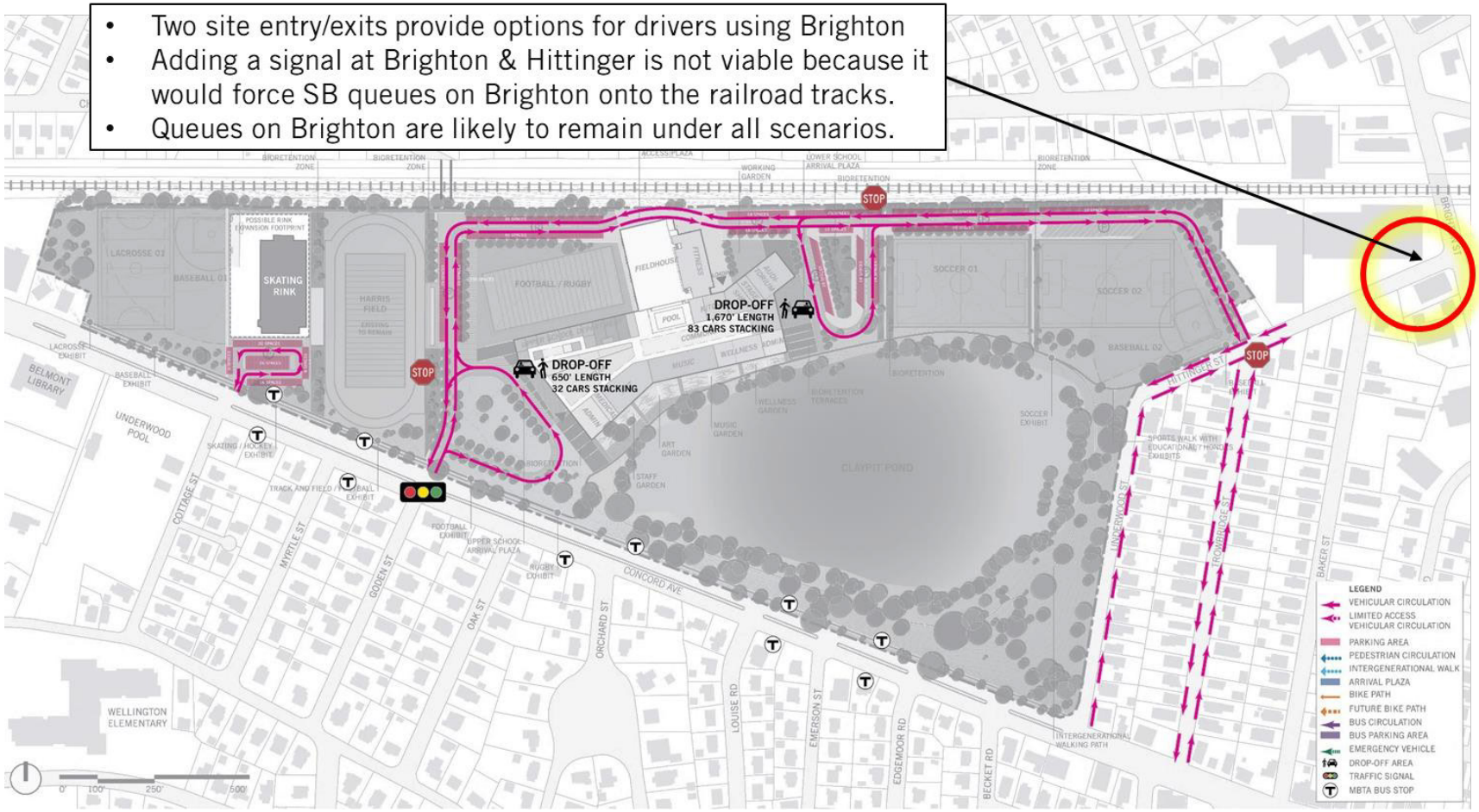
Figure 31 Measure 8: Neutral impacts on Hittinger at Brighton



3.3.2 - EVALUATION OF EXISTING CONDITIONS

C. TRAFFIC REPORT

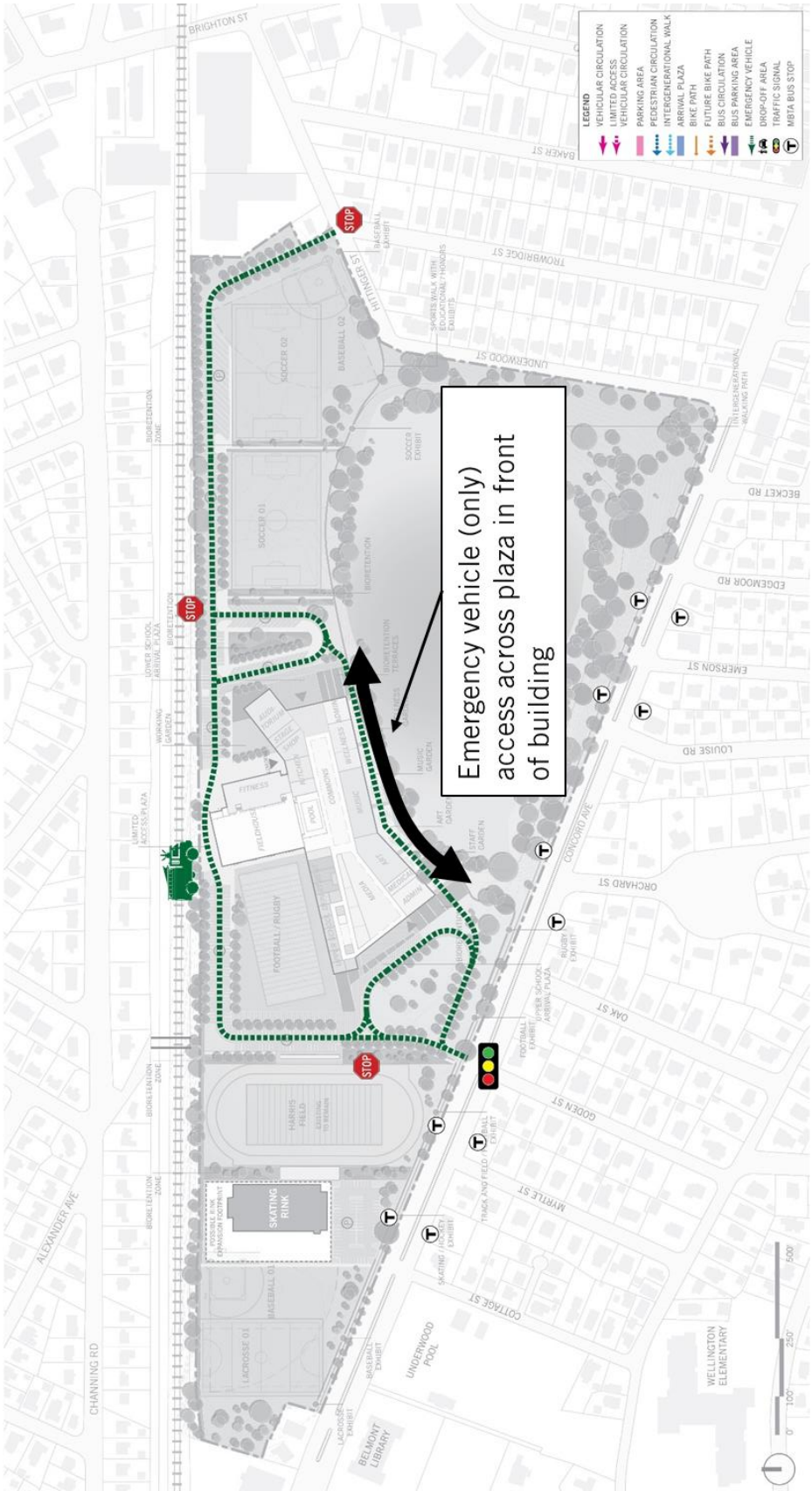


Figure 32 **Measure 9: Enhanced Emergency Vehicle Circulation**

3.3.3 FINAL EVALUATION OF ALTERNATIVES

OPTION 3.1

Prospective Site Analysis A
Construction Impact B
Concept drawings C
Structural Systems D
Site Utilities E
Building Systems F
Cost Estimates G
Permitting Requirements H
Design & Construction Schedule I
Preliminary Design Pricing J
Qualitative Matrix K

OPTION 2.3

Prospective Site Analysis A
Construction Impact B
Concept drawings C
Structural Systems D
Site Utilities E
Building Systems F

OPTION 2.4

Prospective Site Analysis A
Construction Impact B
Concept drawings C
Structural Systems D
Site Utilities E
Building Systems F

OPTION 1

Prospective Site Analysis A
Construction Impact B
Concept drawings C
Structural Systems D
Site Utilities E
Building Systems F

OPTION 2.1

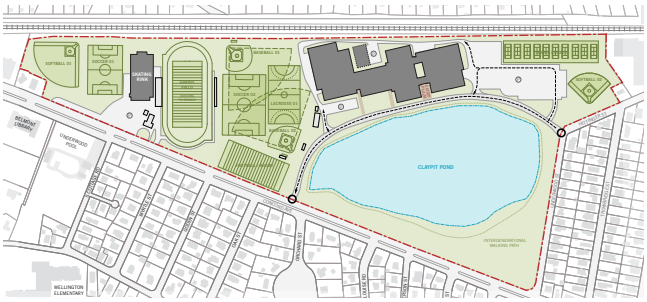
Prospective Site Analysis A
Construction Impact B
Concept drawings C
Structural Systems D
Site Utilities E
Building Systems F

3.3.3 - FINAL EVALUATION OF ALTERNATIVES
INTRODUCTION

The five final options consisted of the following:

1. OPTION 1: Base repair only
2. OPTION 2.1: Major renovation minor addition
3. OPTION 2.3: Minor renovation major addition
4. OPTION 2.4: Minor renovation major addition
5. OPTION 3.1: New construction

The decisions that lead to the determination of the final five options have been reviewed in Section 3.3.1 Introduction.



OPTION 1

OPTION 2.1

OPTION 2.3

OPTION 2.4

OPTION 3.1

OPTION 1 - BASE REPAIR ONLY

SUMMARY

The Base Repair Option retains the building as it is currently configured. The existing Belmont High School requires significant systems upgrades. While well maintained, most of the existing systems have not been upgraded or replaced since the building was constructed in 1970 (over 47 years ago).

The required upgrades in the Base Repair Option include, but are not limited to, interior finishes, replacement of windows, envelope repair, replacement of all MEP systems, and life safety. Upgrades that bring the building up to current accessibility standards are also required effecting all communicating stairs, egress stairs, ramps, door hardware, casework, elevators and signage as well as other architectural systems. The existing building requires replacement of all hardware, lighting fixtures and built-in casework. It should be noted that if any repairs, renovations, additions, or change of occupancy are made to the existing structures, a check for compliance with 780 CMR, Chapter 34 "Existing Building Code" (Massachusetts Amendments to The International Existing Building Code 2015) of the Massachusetts Amendments to the International Building Code 2015 (IBC 2015) and reference code "International Existing Building Code 2015" (IEBC 2015) is required. The intent of the IEBC (and the related Massachusetts Amendments to IEBC) is to provide alternative approaches to alterations, repairs, additions and/or a change of occupancy or use without requiring full compliance with the code requirements for new construction.

The current square footage of the existing Belmont High School is 257,120 square feet, which is too small to accommodate even the smallest MSBA program requirement for grades 9-12. The developed summary indicates a Gross Square Footage for grades 9-12 of 343,494 GSF which is 86,374 GSF over the existing BHS building. As a result, it can be stated that this option does not solve either the educational or capacity requirements for the grade configuration approved by the Belmont School Committee. Much of the teaching space that exists is severely compromised by its proximity to the existing, highly used MBTA commuter rail line to the north of the site. This adjacency, which produces noise, vibration, particulate and safety issues cannot be overstated as it has a significant influence on any option's academic evaluation.

SITE STRATEGY

Site circulation and building position for the Base Repair Option would remain unchanged with a single access point into the site from the east and a single exit to the west. With added bus and drop-off traffic due to the changing grade configuration the renovation and associated site work would do little to alleviate current traffic issues related to school vehicular circulation.

The existing playing field s are currently constrained by the drop-off road and required parking, many are configured in sub-optimal orientation. Given the road and parking constraints it would be difficult to reorient them for safer game play.

The construction phasing of the Base Repairs Option would require significant moving of students around the existing facility to complete the phased renovations at the BHS Facility. Given the constraints of the existing building, the intensity of athletic and recreational site use and the absence of available swing space in the Town of Belmont to accommodate all of the school's population, it could be anticipated that modular classrooms would need to be employed to house students during the multi-year construction period. Finding available space on site for modular classrooms would likely displace athletic and recreational programming.

SUSTAINABILITY AND BUILDING PERFORMANCE

The following sustainability and resiliency attributes have been considered in evaluating this option:

ENVELOPE- Limited thermal and vapor performance upgrades would be executed making meeting the community's performance goals difficult. Exploring over-cladding or skin replacement would still produce significant thermal bridging.

ORIENTATION- The orientation is fixed making optimized daylighting challenging for existing east and west facing learning environments.

SKIN TO VOLUME RATIO- The skin to volume ratio of the base repair scheme is fixed.

WINDOW TO WALL RATIO- The window to wall ratio of the base repair scheme is fixed making daylighting and heat gain optimization challenging.

PV POTENTIAL- The ability to retrofit the existing roof structure is challenged by the placement of existing mechanical equipment and shafts as well as the roof's structural capacity.

SITE ENVIRONMENTAL PERFORMANCE- This scheme allows for one large geo-exchange field but allows limited performative landscape to deal with storm water quality and quantity due to the position of the existing road.

3.3.3 - FINAL EVALUATION OF ALTERNATIVES

A. PROSPECTIVE SITE ANALYSIS - OPTION 1

SITE

This narrative provide an analysis of the option including natural site limitations, building footprint(s), athletic fields, parking areas and drives, bus and parent drop-off areas, site access, and surrounding site features. This narrative excludes temporary site facilities, phasing implications, site drainage, utilities and permitting requirements addressed separately.

Harris Field including the track and supporting facilities are existing to remain. Spatial accommodations have been made in the site planning for the school project to accommodate a multi-modal community path along the north property line abutting the MBTA right-of-way and a multigenerational path around Clay Pit Pond – both with separate funding and implementation timelines. The school building project site design is anticipated to incorporate the portion of the multigenerational path that connects across the north side of Clay Pit Pond, as that will serve as a vital link between the school's site program elements and circulation through the campus.

The existing school building is located on higher ground north of Claypit Pond towards the rear (north) of the site. The primary vehicular (car and bus) circulation and drop-off is a one-way loop from east (Hittinger Street) to west (Concord Avenue). The main pedestrian entrances are the south sides of the building. Buses drop off and pick up students along the south side of the building. The site has three primary parking areas. The largest parking lot (292 spaces) is located to the east of the school building. Small lots are located to the south (36 spaces) and north (21 spaces) of the building. Nine buses currently park along the far east side of the east parking lot. All parking areas contain accessible parking.

Most of the school's athletic facilities are located west of the school building including two baseball fields (varsity is played on Grant Memorial Field which includes bleacher seating, dugout shelters and a prominent gateway) with rectangular field layouts (for soccer and field hockey) overlapping their outfields, a rugby/football practice field and Harris Field which includes a running track and synthetic turf field, home and away bleachers and sports lighting. An indoor skating rink in poor condition and a football field house separate these fields from the varsity softball field further west with lighting and a soccer/lacrosse field overlapping the outfield. Ten tennis courts are located adjacent to the east parking area and the junior varsity softball field is located further east of the primary east parking area.

A. PROSPECTIVE SITE ANALYSIS - OPTION 1

BASE REPAIRS

The Base Repairs option addresses the deteriorated physical conditions and code non-compliance. Site repairs are limited to repairing deficient areas and extending the life cycle of the site materials without any changes to the site layout. Areas on non-code compliance will be addressed to meet current minimum code. Scope of repairs includes but is not limited to pulverizing, blending and repaving all vehicular asphalt paving, replacement of all curbing, manhole rim resetting, parking/traffic striping, walkway pavement replacement in kind (asphalt and concrete). Code compliance includes the addition of accessible walks to all exterior doors and to each athletic field, adding pedestrian guardrails and handrails where required and installation of accessible ramps and curb cuts.

3.3.3 - FINAL EVALUATION OF ALTERNATIVES

B. CONSTRUCTION IMPACT - OPTION 1

Option 1 would require major renovations within the existing occupied school and would be undertaken in 3 or 4 phases. Modular classrooms would also be required on site to provide necessary swing space during renovations. The anticipated construction schedule is 48 months.

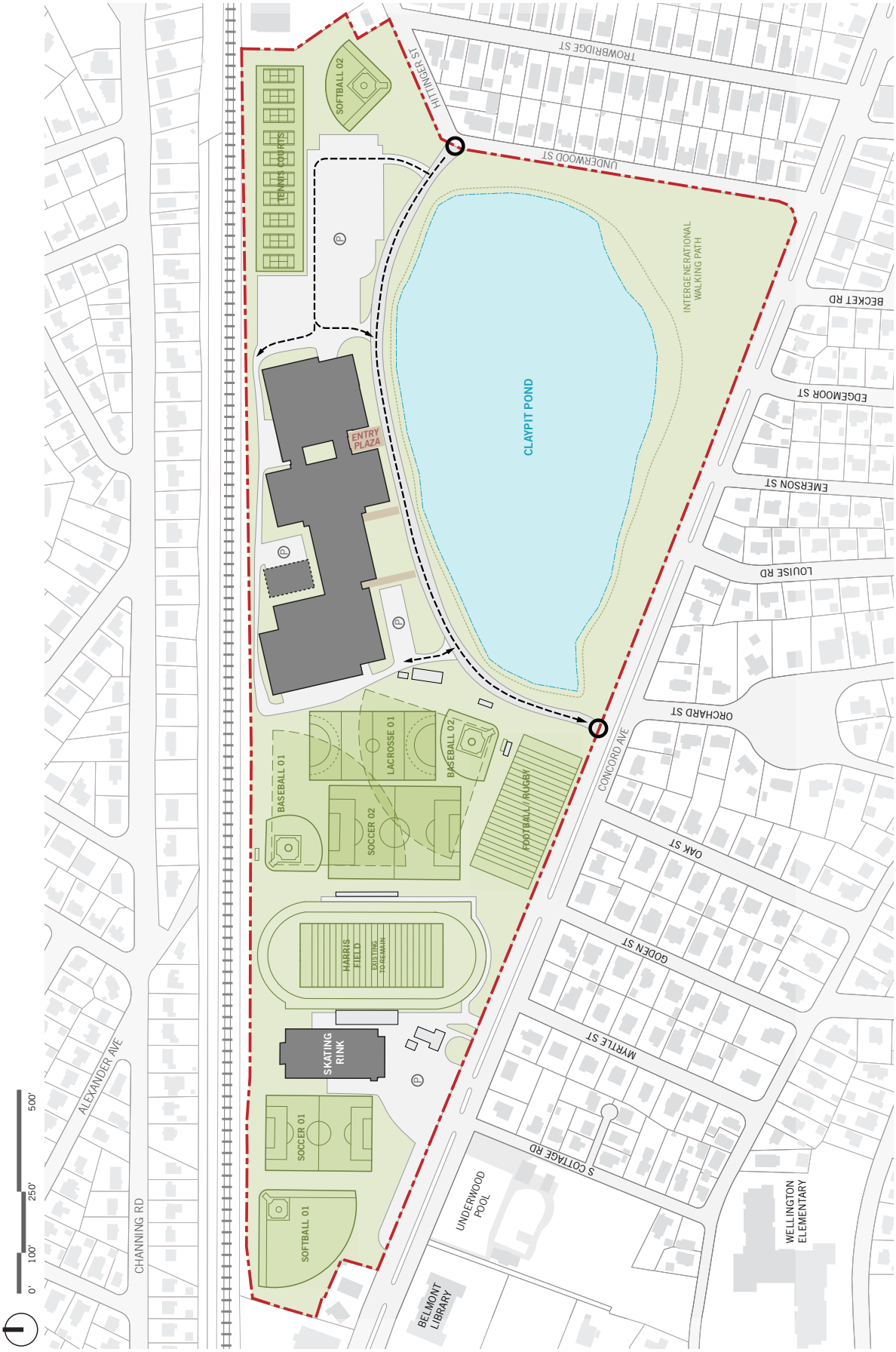
Work under this would be very disruptive to students and staff. Students would be forced to move three to four times to accommodate the multiple construction phases. Disruption from noise, dust, odors and construction traffic could be anticipated.

The detailed plan for phasing and swing space would be determined during schematic design to best coordinate with the educational programs to minimize the impact on students and staff.

OPTION 1 - I. DESIGN AND CONSTRUCTION SCHEDULE

Anticipated MSBA Approval of PSR	April 10th, 2018 (MSBA Board Meeting)
Anticipated MSBA Approval of SD	August 29th, 2018 (MSBA Board Meeting)
Special Town Meeting/Ballot Vote	November 2018
Design Development Complete	November 2018 - April 2019
Construction Documents Complete	May 2019 – January 2020
Bid and Award	February 2020 - March 2020
Construction (multiple phases)	April 2020 – March 2024 (48 months)

C. CONCEPT DRAWING - OPTION 1/ Site

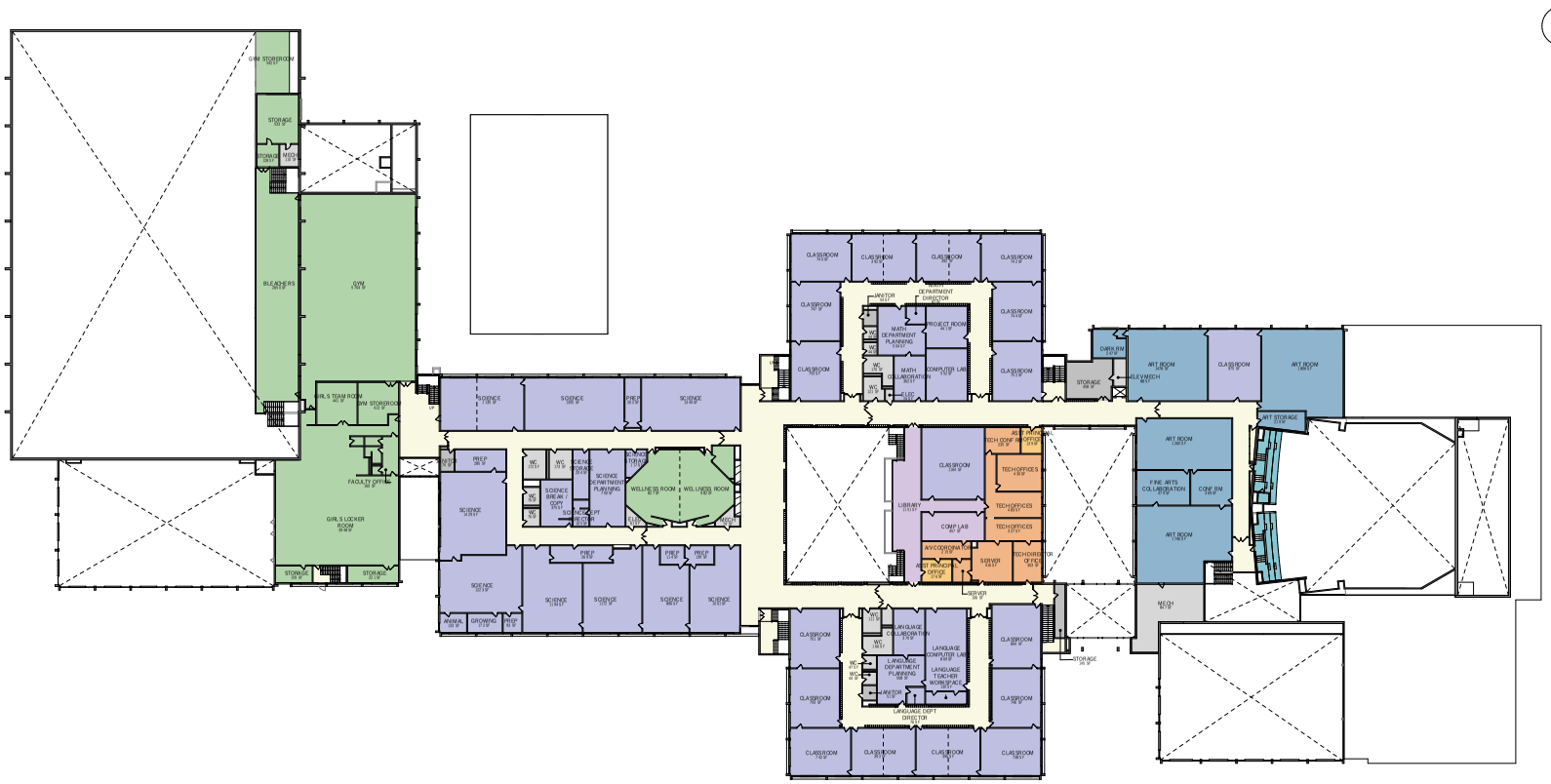


3.3.3 - FINAL EVALUATION OF ALTERNATIVES

C. CONCEPT DRAWING - OPTION 1/ Architectural

3.3.3 BELMONT HIGH SCHOOL : LEVEL 01 FLOOR PLAN

3.3.3 BELMONT HIGH SCHOOL OPTIONS : LEVEL 02 FLOOR PLAN



LEVEL 02

BELMONT HIGH SCHOOL
Structural Narrative
Base Repair Only

January 22, 2018

PROPOSED SCHEME – Base Repair Only

The proposed scheme will require repairs and only minor renovations and upgrades to the existing school triggered by requirements for compliance with the International Existing Building Code. All of the proposed renovations will essentially be Architectural in nature and will require no major reconfiguration of the structure. The proposed scheme requires replacement of all mechanical equipment, and renovations related to ADA requirements.

PRIMARY STRUCTURAL CODE ISSUES RELATED TO THE EXISTING STRUCTURE

Based on the proposed scope, we would recommend following the compliance requirements of the Prescriptive Compliance Method since it will be the most cost effective method for this proposed scheme. If there is no reconfiguration of demising walls or spaces then there is no requirement to clip masonry walls since the work area as defined in the International Existing Building Code is less than 50% of the aggregate floor area of the building

PROPOSED STRUCTURAL SCHEME

The proposed scheme does not call for any reconfiguration of the existing structure. The structural scope is essentially what is triggered by following the compliance requirements of the Prescriptive Compliance Method.

Based on the scope of the proposed scheme, no structural upgrades are triggered or required.

The replacement mechanical units can be supported on the existing framing, if the proposed units are lighter in weight than the existing units. Some of the mechanical equipment may be required to be supported on dunnage platforms. Allow for costs for reinforcement of the roof structure as a percentage of the cost of the mechanical units.

For the renovations related to ADA requirements new ramps will be required on grade and on supported floors, it is possible that a new elevator may be required. The ramps on grade will be a minimum of 12” thick reinforced structural slabs supported on piles. For the ramps on supported floor, the existing framing would require to be reinforced. Pits for any proposed elevator would have to be supported on piles.

E. SITE UTILITIES - OPTION 1

SITE UTILITIES

Storm Drainage

Record drawings from the Belmont High School 1968 plans indicate that the stormwater from the site appears to be collected by three separate drainage systems and flow to Claypit pond. There appear to be no stormwater quality measures implemented on the site and no known detention, retention, or infiltration systems. To address stormwater quality, new water quality units, similar to Stormceptors would be installed prior to each of the three outfalls. Do to the size of the lines leading to the outfalls, the water quality units would need to be installed in an offline configuration, which requires at least two additional manholes and associated piping per unit.

Sewer

The sewer system for the school is currently serviced by five sewer services connecting to the 24-inch sewer main in the school driveway. Sanitary sewer flows from portions of the cafeteria (pot sinks, dish washers, floor drains, etc.) would need to be separated out from the other flows and directed through a new 10,000-gallon external grease trap. The grease trap would need to be vented, with the vent running back to the school and up to the roof. Additional piping and at least one new sewer manhole would be required to direct flows from the grease trap back to the sanitary sewer main.

Water

A new 6-inch fire service to the mechanical room from the existing water main that loops through the rear of the school site would need to be installed. The new service would be approximately 80 feet in length.

Three new fire hydrants would be installed along the front of the school to provide sufficient hydrant coverage for the fire department. Approximately 1,000 linear feet of new 6-inch water main would need to be installed along the front of the school to serve those new hydrants.

Natural Gas

The existing gas service would be maintained in place unless the mechanical renovations require the line size to be increased. If a new, larger gas service is required, it would be installed along the same route as the existing line.

Electrical

The existing electrical conduits would be maintained. If required, new conductors could be installed in the existing conduits.

Pavement

Full-depth reconstruction of the access drive at the rear of the school would be required as part of any major renovation. The remaining site pavement would be milled and overlaid.

PRELIMINARY PERMITTING CONSIDERATIONS

Wetlands Protection Act (310 CMR 10.00)

A Notice of Intent would need to be filed with the Town of Belmont Conservation Commission for any work within 100-feet of Clay Pit Pond. In addition, a Stormwater Pollution Prevention Plan (SWPPP) would need to be prepared and an application filed with the Environmental Protection Agency under the National Pollutions Discharge Elimination System (NPDES) program for the construction related activities. Erosion control measures will need to be installed and maintained in good working order around the perimeter of the site.

Flood Plain

Based on the Flood Insurance Rate Map (FIRM), Community Panel Number 25017C0418E dated June 4, 2010, the portions of the existing High School site are located within Zone X (Areas determined to be outside the 0.2% annual chance floodplain). There is no regulatory requirement for working within a Zone X. The Zone AE, which is associated with the 100-year flood area, is located in close proximity to the banks of Clay Pit Pond. None of the existing building or any critical infrastructure is currently understood to be within the Zone AE.

3.3.3 - FINAL EVALUATION OF ALTERNATIVES

F. BUILDING SYSTEMS / PFP - OPTION 1

FIRE PROTECTION

A. To comply with current codes, this building will require a complete sprinkler system installation per the Massachusetts State Building Code, Chapter 34. The Fire Protection system would be designed to meet the requirements of NFPA 13 "Installation of Sprinkler Systems" and Chapter 9 of the Massachusetts State Building Code, 780 CMR, "Fire Protection Systems".

B. A new dedicated 8" sprinkler service, connected to the town water system in the street, should be brought into the building. The exact entrance location will need to be coordinated with the Architect. As the sprinkler service enters the building a Massachusetts approved double check valve backflow preventer assembly, complete with OS&Y valves on the inlet and outlet, will be required.

C. The alarm check valve for the sprinkler system will be installed on the riser after the double check valve assembly in the water service entrance room. The alarm check valve will be complete with a standard trim package including pressure gauges, retard chamber, 2" main drain, water flow indicator and supervisory switches.

D. The main feeds out to the system from the alarm check valve will extend out to the building through the first floor ceiling space. The piping will then extend to all areas of the building so that each section of the building and each floor can be divided into separate zones.

E. Due to the building being only two stories the Massachusetts State Building Code does not require a standpipe system throughout the School. However, regulations governing Auditoriums and Stages will require standpipes at each side of the backstage areas.

F. The sprinkler system risers will feed the sprinkler system at each floor level. Each floor will be a separate zone. The floor control assembly off of the standpipe which feeds each floor will contain a flow switch and tamper switch. An inspector's test connection will be installed on the floor control valve station. If the stage is greater than 1,000 square feet then the fire department valves are located on each side of the stage.

G. Sprinkler heads throughout the facility where gypsum or suspended ceiling are installed will be glass bulb, quick response, chrome plated semi-recessed type. In areas where no ceilings are installed brass upright sprinklers will be installed. Where upright sprinklers are subject to potential damage, such as in storage rooms, protective cages will be installed. In areas where it is not possible to run piping above the ceiling the use of sidewall sprinkler heads would be recommended.

H. Sprinkler piping for the system will be as follows: Piping 2" and smaller shall be schedule 40 black steel with cast iron fittings with threaded joints. Piping 2 ½" and larger shall be Schedule 10 black steel with malleable iron fittings with rolled grooved joints.

I. All tamper and flow switches installed on the sprinkler system will be connected to the buildings fire alarm system. Each tamper and flow switch will be a dedicated point on the fire alarm system.

J. The exterior fire department connection for the sprinkler system will be a flush type mounted on the exterior of the building within 100' of a fire hydrant. Final location of this connection will be coordinated with the Belmont Fire Department. An additional fire hydrant may need to be added on the site to be within the required distance of this connection.

K. The hydraulic requirements for the building will be as follows:

   a. Light Hazard - All offices, corridors and the auditorium hydraulically calculated to deliver 0.1 gpm per square foot over the most remote 1,500 square feet.

   b. Ordinary Hazard - All storage rooms and mechanical rooms hydraulically calculated to deliver 0.15 gpm per square foot over the most remote 1,500 square feet.

   c. Ordinary Hazard Group II - The stage area hydraulically calculated to deliver 0.2 gpm per square foot over the most remote 1,500 square feet.

PLUMBING

A. Plumbing Fixtures

1) The majority of water closets, urinals and lavatories in the building are old and not current water conserving type. Removal of all fixtures is recommended as

F. BUILDING SYSTEMS / PFP - OPTION 1

the existing fixtures have reached the end of their serviceable life. Water closets should be replaced with new low-flow flush valve fixtures (1.6 gpf or less). Urinals should be replaced with 0.25 gpf fixtures. Lavatories should be replaced and new low-flow type faucets (0.5 gpm or less) added with temperature limit stops which will deliver water with a maximum temperature of 110°F. ADA requirements will also need to be met during a renovation to the toilet rooms.

2) The state plumbing code dictates the number of plumbing fixtures required in a building. Minimum plumbing fixture requirements will be determined once the total occupancy numbers for the building have been established based on the final plan layout.

B. Domestic Cold Water System

1) The 6" water line that enters the building is the original service to the building. Although the 6" line which feeds the domestic water service appears to be adequate to meet the current building water requirements, this would be a good time to bring in a new 6" dedicated domestic water service since a new 8" service would be brought in to feed the proposed sprinkler system. The installation of a water meter on the new service would also be recommended.

C. Domestic Hot Water System

1) The existing steam water heaters serving the larger portions of the building are original to the building and have passed their useful life expectancy. Also with the use of these steam water heaters the boilers are required to operate during the summer months to allow hot water to be created for the building. It is recommended to install new gas-fired storage type water heaters in the same locations as the existing. It is also recommended that redundant water heaters be included in the new system design. This would allow the system to continue to deliver hot water if one of the water heaters were to need service. The water heaters would be sized to serve the existing fixtures as well as any planned additions to the building.

2) The existing electric water heaters serving the various wings of the building are older and have passed their useful life expectancy. These should be replaced with new electric water heaters of similar size.

D. Sanitary and Vent System

1) The sanitary system in the existing building appears to be in good condition but replacement may be required as a consequence of a possible fixture count change and probable relocation of fixtures in the renovation plan. Any new piping would connect to the existing waste and vent piping at a convenient pOINT TO BE DETERMINED BY FURTHER INVESTIGATION.

E. Storm Drainage

1) The existing building roof drainage appears to be in good condition and no replacement is required. The roof itself appears to be in good condition and leaks around the roof drains themselves have not been reported.

2) Backwater valves should be installed on all interior storm system piping originating from roof drains on lower roof sections as per the state plumbing code.

3) Opportunities for the management and /or re-use of the storm water drainage should be explored with the civil engineer to determine if there could be any benefit to the school.

F. Natural Gas System

1) Currently the existing gas service is more than adequate to meet the school's demand requirements. Any new gas-fired kitchen equipment can be connected to the new capped gas service located just outside of the building near the kitchen.

G. Insulation

1) The insulation that currently exists should be tested to determine the extent of any hazardous materials. The insulation should be removed and replaced with new fiberglass insulation with an all service jacket. Piping which is not currently insulated should have new insulation installed.

2) Insulation will also need to be provided on waste piping and water piping below handicapped lavatories and sinks.

H. Hose Bibbs and Wall Hydrants

1) During any renovation done to the building, the existing hose bibbs in the toilet rooms should be removed and new wall mounted hose bibbs with an integral vacuum breaker and removable tee handle installed.

I. Cross Connection Control

1) As stated previously, the existing hose bibbs and wall hydrants do not have backflow prevention devices. Backflow devices will be integral to all new hose bibbs and wall hydrants installed during the renovation.

2) All service sink faucets installed during a renovation will also have integral vacuum breakers.

3) A new reduced pressure backflow preventer assembly should also be installed on the existing 6" domestic water (or on a new service if this is the preferred option) service to further protect the town's domestic water system.

J. Boys, Girls and Pool Locker Room/Shower Areas

1) All locker room/shower areas should be completely renovated. Floor drains within any new shower stalls should be arranged so that the water from one shower does not enter into the adjacent shower area. New shower valves should be installed with code compliant shower heads. Master mixing valves should be installed at each shower location. Valves shall be provided with limiting stops set to a maximum water temperature delivery of 112°F.

2) All plumbing fixtures will be replaced as discussed in the "Plumbing Fixture" section of this report.

K. Kitchen

1) If kitchen renovations include the addition of new or replaced gas-fired equipment, this equipment can be connected to the new gas service located outside the building as noted above.

2) Any new gas equipment would be fed by gas piping connecting to a master shut-off valve that would be interconnected with the kitchen hood and exhaust system. Gas would only operate as long as the kitchen hood exhaust system is operating.

3) Additional floor sinks and/or floor drains would be added to any new equipment design to ensure proper drainage throughout the kitchen.

4) A new three-compartment sink with new grease trap should be included per state code requirements.

5) A new dishwasher with accompanying grease trap should also be provided per state code requirements.

6) A new exterior grease trap, located underground, outside of the kitchen portion of the building will also need to be considered as part of any new design or renovation to the kitchen. Venting of this exterior grease trap should enter back into the school building and exit to the atmosphere above the roof.

L. Science Wing

1) If the existing science wing is to be renovated in its current location, all existing lab sinks and faucets should be replaced with new fixtures. Faucets should be low-flow type fixtures with a maximum delivery rate of 0.5 gpm.

2) The lab waste system should be removed in its entirety and replaced with a new polypropylene acid resistant piping system that empties into a central acid neutralization tank and system. This system would balance the pH of the lab waste and then safely discharge it into the regular sanitary waste system before it connects back to the town's sanitary waste system.

3) The existing hot and cold water systems serving the science wing should also be removed in their entirety. New protected hot and cold water systems should be created to serve the renovated science wing by installing reduced pressure backflow preventers on the hot and cold water piping designated to serve this area.

4) The existing main gas piping system serving the science wing could possibly be re-used. This piping should be reconnected to the new gas service in a convenient location. Gas piping to each science classroom should feed an emergency shut-off valve located in a valve box on the wall near the classroom exit door. Piping from this valve would then feed any gas turrets within that classroom only.

5) All existing emergency showers in the science wing and

F. BUILDING SYSTEMS / PFP - OPTION 1

connections to the cold water system should be removed. A new tempered water system should be created to serve the science wing. A new gas-fired water heater should be installed somewhere within the science wing and be dedicated to the new tempered water system. Water should be stored at 140°F and a master mixing valve should be mounted nearby and set to deliver tempered water to this wing at approximately 70°F-90°F per state plumbing code requirements.

3.3.3 - FINAL EVALUATION OF ALTERNATIVES

F. BUILDING SYSTEMS / HVAC - OPTION 1

BELMONT HIGH SCHOOL

HEATING, VENTILATING, AND AIR CONDITIONING

BASE RENOVATION

A. General:

1. This description applies to the Base Renovation option where the existing building remains and is fully renovated.

2. The recommended HVAC systems assume that the existing windows will be replaced and the walls and roof areas to remain will be insulated to meet or exceed the MA energy code.

3. Heating, air conditioning and ventilation systems shall be high-efficiency systems that allow for the ability towards achieving a Net Zero Energy facility.

B. Ground Loop Geo-Exchange System:

1. A vertical borehole well field area consisting of (400) 6-inch diameter boreholes spaced 20 feet apart shall be provided. Each borehole shall be 375 to 450 feet deep. Actual depth to be determined based on thermal conductivity testing performed on a test well. The number of boreholes may be increased or decreased based on thermal testing results and/or determination of the final heating and cooling loads.

2. Provide a 1-1/4 inch supply and return pipe within each borehole with a U-bend at the bottom. Piping shall be high density polyethylene (HDPE) with DR9 wall thickness. Polyethylene pipe and fittings shall be heat fused by butt, socket, sidewall, or electrofusion in accordance with pipe manufacturer's procedures. Underground supply and return piping from boreholes shall collect to four buried circuit vaults constructed of HDPE or concrete. Supply and return circuit piping in each vault shall combine to 8 inch main header piping which shall be routed into the building.

3. Steel sleeve casings shall be provided for the upper section of each borehole down to bedrock. Each borehole shall be filled with a bentonite based thermally enhanced grout mixture.

C. Central Heating and Cooling System:

1. Central geothermal heating and cooling shall be provided by four high efficiency 300 ton (approx. nominal capacity) heat recovery chiller-heaters or (40) 30 ton modular chiller-heaters connected to the ground loop system.

2. The ground loop circulation system shall be filled with 25% propylene glycol solution and shall be served by three 1000 GPM pumps with variable frequency drives.

3. Chiller-heater condenser water shall be constant flow primary with zero pressure bypass connections to the ground loop distribution and the building heating distribution. There shall be three primary condenser water pumps at 1,000 GPM each.

4. Secondary condenser/heating pumps shall be variable flow with variable frequency drives. There shall be three secondary heating pumps at 1,000 GPM each.

5. Chilled water distribution from chiller evaporators to building distribution shall be variable primary flow with three 750 GPM pumps.

6. The building circulation loop shall consist of a four-pipe distribution. The main distribution to heating/cooling terminal units in the building shall be four-pipe. Rooftop air handling units, heat recovery air handling units, and central air handling units shall be two-pipe configuration.

7. The building loop piping system shall contain a 25% propylene glycol solution for freeze protection and corrosion protection.

8. The building terminal heating units will be designed to utilize low temperature heating supply water (130°F maximum). Heating terminal units such as fin tube radiation and heating coils may require larger surface areas due to the low water temperature. In areas with high heating loads, two-row fin-tube and heating coils may be required.

D. Exterior Classrooms - Induction Units with Displacement:

1. The system serving heating, cooling and ventilation for typical exterior classrooms shall utilize four-pipe floor mounted chilled beam induction units with displacement supply air. Four 5 ft. long units shall be provided for each typical classroom mounted along the exterior wall. Units shall be served by two 7-inch diameter primary ventilation supply air ducts.

2. The primary supply air serving each classroom shall be provided with a modulating supply air volume control terminal to control supply air when the room is occupied.

3. Systems will be interfaced to the local space vacancy sensor to reduce ventilation air and reset the space cooling and heating set point temperatures when the room is unoccupied.

4. A carbon dioxide sampling sensing system will be provided in classrooms to provide monitoring and occupied control of ventilation air.

E. Interior Classrooms and Other Spaces – Ceiling Induction Units:

1. Interior classrooms and other interior occupied spaces will be served with ventilation supply air from a rooftop heat recovery ventilation unit connected to ceiling mounted chilled beam induction terminals. Induction terminals shall be provided with four-pipe supply and return water connections.

2. Individual classrooms shall be provided with a supply air volume control terminal to control ventilation air when the room is occupied. A carbon dioxide sampling sensing system shall be provided for classrooms to monitor and control ventilation air.

F. Classroom and Interior Ventilation Systems:

1. Outside ventilation air for classrooms and interior spaces will be provided by roof mounted dedicated outside air heat recovery units (HRU).

2. The HRU's will be variable air volume and will include supply and exhaust fans with variable frequency drives, total energy recovery wheels and secondary sensible reheat wheels to allow for a low level of dehumidification control. The units will be provided with two-pipe dual temperature water connections to a single combination pre-heat and cooling coil. Changeover between hot water and chilled water supply shall be provided with the use of changeover valves connected to the hot water and chilled water systems. Each unit shall include 100% recirculation dampers for morning warm-up mode and after-hours night setback heating.

3. All unit energy recovery wheels and coils shall be sized for low face velocity to increase unit and system efficiency.

4. Variable supply air will be based on demand from classrooms and interior spaces. Return/exhaust air shall be controlled by air flow measurement and tracking of the supply and exhaust air with limited volume control terminals in the exhaust air system.

5. Corridors will be provided with ventilation air from the HRU system. Air quantities in excess of basic ventilation requirements will be provided for building exhaust makeup air as required. Corridors will not be fully air conditioned with the exception of areas that have direct solar loads.

G. Existing Gymnasium:

1. The existing heating and ventilating units in the gym shall be replaced with new HVAC units. The units shall include a hydronic coil for heating and cooling using hot water and chilled water. Units shall also include a heat recovery section with an enthalpy wheel for outdoor air heat recovery meeting the requirements of the MA energy code due to the level of outdoor air required.

2. Two units shall be provided, which shall be located indoors or outdoors depending on structural and architectural requirements. Units be provided with a round ductwork distribution exposed within the space.

3. The units shall be provided with variable frequency drives for the supply and return fans to reduce the fan speed during times of low demand. Supply, return, and outside air flow measurement and control shall be provided.

4. Provide a new H&V unit with plate heat exchanger to serve the existing locker rooms.

H. Existing Swimming Pool:

1. The existing heating and ventilating unit serving the pool shall be replaced with a new H&V unit. The unit shall include a hydronic coil for heating using hot water. The unit shall also include an air-to-air flat plate heat exchanger for exhaust air sensible heat recovery.

2. The pool deck exhaust system shall remain, and existing exterior mounted exhaust fan may be relocated if required.

3. Provide a new H&V unit with flat plate heat exchanger to serve the locker rooms.

I. Miscellaneous Areas:

1. All normally occupied areas will be air conditioned except for corridors, the kitchen, and culinary classrooms with kitchen hoods (if applicable). The kitchen and culinary areas are partially tempered by using transfer air from the commons for make-up air.

2. The Auditorium, Stage, Media Center, Cafeteria, and Administration areas, will be served by rooftop air conditioning units (RTU). Separate occupancy scheduling for each unit will provide operational flexibility.

3. Rooftop air conditioning units (RTU) will include supply fan, return fan, hot water heating coil, chilled water cooling coil, filters, and variable frequency drives. Units serving Administration, Media Center, Band/Chorus, and the Cafeteria will be variable air volume (VAV) with local variable air volume boxes for zone temperature control.

4. The Auditorium and Gymnasium units will be single zone with a variable frequency drive to modulate the supply air during periods of low demand and occupancy.

F. BUILDING SYSTEMS / HVAC - OPTION 1

5. The Auditorium, Gymnasium, Cafeteria, and Media Center systems will be provided with space carbon dioxide (CO_2) sensors to provide modulation of outside air based on occupancy demand.

J. Building Management System (BMS):

1. Provide direct digital control (DDC) BMS with local and unitary controls and web interface for remote access, alarms, and monitoring of all HVAC equipment in the building including; chillers, pumps, heat recovery units, rooftop units, fans and terminal units shall be controlled and mapped to a central monitoring station. System shall be based on the Niagara Framework open protocol for interoperability between manufacturers.

2. BMS system shall be interfaced to the building electrical and gas sub-meters. Daily, weekly, and annual energy use shall be reported for each meter.

K. Carbon Dioxide Sensing System:

1. Provide an Aircuity, or equal, carbon dioxide air sampling and sensing system consisting of room sensors, cabling, tubing, room probes, air routers, and vacuum pumps.

2. Air tubing from room sensors shall be collected through air routers to sensing stations.

3. The system shall include an information management system and shall be integration with the building management system.

4. Building management system input shall provide control input for modulating supply air terminal units or automatic dampers.

L. Electrical and BTU Metering:

1. Electrical metering shall be provided for collection of historical and real-time performance data. Separate meter groups shall be provided for the upper school areas and lower school areas consisting of meters for the measurement of lighting and plug loads for each classroom group by wing, floor or classroom type.

2. Individual metering of lighting and plug loads shall be provided for the Kitchen, Media Center, Auditorium/Stage, Gymnasium, and Administration areas.

3. Electrical metering shall be provided for each air handling system, central system pumps (by each group type), and each chiller-heater.

4. Provide BTU metering of chilled water, hot water, ground loop circulation systems and domestic hot water system.

M. Phasing Considerations:

1. Renovations are assumed to occur over three major phases, while providing for large areas of the existing building to remain occupied. Therefore, the existing boiler room must remain active and the new chiller-heater plant must be constructed to support the new construction in several phases. Approximately 900 SF of new mechanical space will need to be constructed next to the boiler room in the first phase to provide space for the new equipment.

2. Installation of the entire geothermal borehole field may be accomplished in the initial phases. The entire array may be installed in the area to the west of the building including the soccer and baseball fields, parking and drive lanes.

3. At least one steam boiler must remain active until at the last remaining segment of the steam heating system is taken off-line.

4. Construction phasing must allow for installation of the new chilled water and hot water distribution while the existing steam distribution is phased out. The existing steam distribution must also remain active to provide continued serve areas that have not been renovated.

F. BUILDING SYSTEMS / Electrical - OPTION 1

Belmont High School

ELECTRICAL

Option 1 Base Repair Only
(Renovation Only)

A. Existing Electric Services:

1. The intent is that upon completion of all renovations, there will be new services throughout the entire renovated facility.

2. The Main Electric Room housing the main electric switchboard is located adjacent the Boiler Room, these rooms are located at the northwest corner of the facility adjacent the Fieldhouse.

3. Scope will include maintaining and/or providing new feeders from this location to existing panelboards and mechanical equipment to be kept operational during renovation and new construction.

B. New Main Electric Service:

1. A new primary service will be provided from utility company primary services via an underground ductbank and manhole system to a new utility company pad mounted transformer.

2. Secondary service from the new pad mounted transformer will be underground to a new main switchboard at 480/277 volt, 3-phase, 4-wire. Switchboard will be located in a new main electric room.

C. New Emergency Distribution System:

1. Natural gas/diesel (fuel source to be determined) emergency generator will power emergency egress lighting and exit lighting in corridors, assembly areas, and stairwells. Miscellaneous systems such as kitchen walk-in coolers and freezers, telephone system, security system, district and school IT head-end equipment, fire alarm system, one boiler, one water heater, and associated circulator pumps and controls.

2. Separate automatic transfer switches shall be provided for emergency and non-emergency loads.

3. To be determined, in addition to the equipment and systems listed above, the following equipment and systems will be fed from the generator.

   a. Additional lighting in Gymnasium, Cafetorium, Kitchen, and associated toilets and corridors.

   b. HVAC ventilation equipment (no air-conditioning) associated with the areas noted above.

   c. Receptacles in Gymnasium and Cafetorium.

   d. Cooling equipment for school and district IT equipment.

4. A portable generator connection will be provided to meet National Electric Code Article 700 requirements to have a portable generator available while servicing the building generator.

D. Sustainable Design Intent LEED 4.0:

1. Sustainable Design Intent compliance will include:

   a. Advanced measurement and verification of air conditioning, fans, lighting, and receptacle power via electronic sub-meters equal to E-Mon, D-Mon Class 2000 3-phase kWh and demand meters. Measurement and verification metering will be monitored by the Building Management System (BMS).

   b. Plug and process load reductions through the use of vacancy/occupancy sensor controls for local convenience outlets in classrooms, offices, library and resource rooms. Open areas such as Media Center, Auditorium and Kitchen will be equipped with relay panels controlled via the lighting control system, to reduce loads on a time schedule basis.

   c. High efficiency lighting systems include LED luminaires throughout the building.

   d. Advanced lighting controls include a low voltage lighting control system with time schedule control for common areas, vacancy/occupancy sensors, and photocells for daylight harvesting.

   e. Exterior building mounted and pole top luminaires will be LED type with full cut-off distribution.

   f. Empty conduits and space provisions will be provided for future photovoltaic (PV) installations.

   g. Empty conduit provisions will be provided for future green vehicles charger stations based on two percent of the available parking.

E. Lighting:

1. New luminaires will be provided throughout all renovated areas as well as new construction. Luminaires will be LED. All luminaires will be suitable for respective utility rebate incentives.

2. Exterior building mounted, roadway, walkway, and parking luminaires will be full cutoff LED type. All exterior lighting will be controlled via the building low voltage lighting control system.

F. Lighting Controls:

1. A low voltage lighting control system will be provided for common areas such as corridors and other areas not controlled by occupancy sensors.

2. Manual low voltage override switches to override the time of day lighting control schedules shall be provided. Override switches will permit extension of lighting control program as well as ON-OFF override for exiting the facility.

3. Lighting program for time of day schedules shall permit all lighting, including exterior to be turned off during non-occupied hours, reducing sky glow and light trespass. Activation of either fire alarm or intrusion detection system shall override the lighting program.

F. BUILDING SYSTEMS / Electrical - OPTION 1

4. Vacancy and occupancy sensors will control lighting in most spaces including classrooms, offices, and utility type spaces.

5. Daylight harvesting will be employed in all perimeter classrooms, offices, and other spaces with substantial daylight utilizing daylight sensors in each space.

G. Auditorium:

1. A professional theatrical lighting system will be provided including complete dimming system with portable dimming controls. Power and control wiring will be provided for all Auditorium and Stage equipment including electric winches, projection screens, and lifts.

H. Convenience Power:

1. Safety type duplex receptacles will be provided throughout the building in quantities to suit space programming.

2. Plug load reduction will be achieved by receptacles controlled via occupancy sensors in classrooms, offices, and staff spaces, and circuits routed via relay panels, controlled via lighting control system time schedule for open areas such as Commons/Café, Kitchen and culinary areas.

I. Fire Alarm:

1. Existing automatic, fully supervised, analog addressable, voice evacuation system will be maintained and utilized where applicable.

J. Technology per Technology Section.

K. Integrated Intrusion, Access Control, CCTV, and Alarm System:

1. Intrusion alarm system will provide magnetic switches on perimeter doors, motion sensors in all perimeter rooms on first floor with susceptible access from grade. Motion sensors will be provided in first, second, and third floor corridors. System will have secure-access zoning. Zoning will be provided to suit all proposed off hours usage including community programs.

2. CCTV coverage will be provided at main and secondary entries as well as other entries to be used by students, staff or for off hours community programs, including but not limited to gymnasium, cafeteria and all interior corridors.

3. Exterior CCTV coverage will be provided to cover the entire perimeter of the building.

4. Access control via card access system will be provided at all exterior doors.

5. CCTV system will be IP based with minimal 30 day recording capacity. System will be web based to allow viewing by Belmont Police Department.

3.3.3 - FINAL EVALUATION OF ALTERNATIVES

F. BUILDING SYSTEMS / Information Technology - OPTION 1

Structured Cabling System:

The School Department is responsible for the fiber network for both the schools and the Town (including the light department and TV Studio). The fiber network handles general data as well as Phone (VoIP) and security for the school district and the Town. There are three centralization points for the fiber – the high school, Chenery Middle School, and the Town Library. Internet services and wireless controllers in the existing high school MDF provide connectivity at all the school facilities and the Town. These systems must remain operational during construction. Therefore, the MDF and the existing district fiber must be protected during construction.

A new MDF will be created. The existing MDF area could also be renovated. In either case, the MDF will be the central location of all head end equipment including but not limited to servers, storage, switch electronics, security equipment, video equipment, telephone system, public address system and security system. It will be a dedicated space with proper ventilation, environmental treatment and emergency power. The new MDF will be built-out or renovated during an early phase of construction. The district fiber will be re-routed or extended to the new MDF location. Existing Telco lines, which terminate in the Main Office area will need to be protected and re-routed or extended. Temporary cabling and services may be necessary to maintain functionality of existing systems during demo work.

New IDFs will be created. The IDF locations will serve as intermediate closets for local cabling and equipment. The IDFs will be dedicated spaces with proper ventilation, environmental treatment and emergency power. Each closet will connect to the MDF with backbone cabling. IDFs will be built-out and come on line in conjunction with construction phasing. Existing IDFs will be brought offline in conjunction with construction phasing. Temporary cabling and services may be necessary to maintain functionality of existing systems during demo work.

Equipment racks will be installed in the MDF and IDFs for patch panels and network hardware. Two-post and four-post racks will be provided. Racks will be 19" EIA floor mount racks with wide floor mounting flanges, vertical cables guides and horizontal cable managers. Power for rack equipment will be installed in cable tray above the racks. Power will consist of both 20A and 30A twist-lock receptacles.

The existing Category 5 horizontal cabling will be replaced. The new data cabling infrastructure will be based on a Category 6A, or most up to date standard at the time of bid. The data channel will be comprised of the passive components including cabling, connectors, patch panel port, and patch cords capable of supporting 10 Gigabit per second networking. Category 6A data cabling will be provided to all equipment requiring data and voice connectivity, including but not limited to data outlets, voice outlets, video surveillance cameras, access control network connections, and other related equipment. This cabling will support computer network requirements, wireless connectivity, telephone system (VoIP) and IP-based security needs. Cabling will terminate in the MDF or one of the IDFs. Temporary cabling may be necessary to maintain functionality of existing systems during demo work.

The existing fiber backbone within the school will be replaced. The new fiber backbone will connect the MDF and all IDFs. It will consist of twelve strands of multi-mode and six strands of single-mode fiber optic cables. All multimode fiber optic cables will use multimode, graded-index fibers with 50-micron cores only. Fiber will be laser-enhanced and guaranteed for transmission distances in 10 Gigabit Ethernet of up to 500 Meters. All single-mode fiber optic cables will be OS2, tight buffered, high flexibility. Temporary cabling and services may be necessary to maintain functionality of existing systems during demo work.

Data and Voice Communication Systems:

Updated networking hardware will be provided for the MDF and IDFs consisting of network switch electronics for the data and voice communication systems, distributed communication system, audio-video communication system, security system, wireless LAN and other Owner equipment. Components will consist of PoE+ chassis and power supplies, 10/100/1000 PoE+ modules, fiber transceivers, patch cables and UPS equipment. The switches will be fully configured according to network requirements and VLANs will be created according to best practice and equipment requirements. Backbone will be 10Gb minimum.

Updated VoIP server and hardware will be provided. The existing NEC 8300 will be upgraded to the 9300 platform, or current standard at the time of bid. Several elementary schools in the district depend on the existing VoIP system

F. BUILDING SYSTEMS / Information Technology - OPTION 1

for connectivity, so it must remain operational during construction. The new system must be compatible with existing VoIP equipment in the district.

Audio/Visual Communication System

Digital signage will be provided in gathering areas and large group instruction spaces. The system will consist of LED displays, media players, and a server or cloud based digital signage solution.

Classrooms and general instruction spaces will be equipped with a local audio system consisting of ceiling speaker, amplification, wireless microphones and auxiliary inputs. There will be an input available for FM assistive listening systems.

Distributed Communication System

The existing Simplex Building Communication System will be replaced with a new system. The new system should be built-out with the new MDF during an early phase of construction so that newly renovated or constructed areas can come online. The new distributed communication system will consist of a fully operational IP platform public address system for district and school internal communications system incorporating school safety notifications and general communications. It will provide complete internal communications using state of the art IP technology with two-way loud speaker internal communication, bell event notification, emergency announcements that will override any pre-programmed zones assuring that all emergency/lockdown announcements are heard at all locations, and atomic time synchronization. The system will connect directly to the high school's LAN and have the future capability of expanding to connect to other intercom systems in the school district over the WAN for district-wide, emergency, and live voice announcements in the future (additional hardware will be required at the other school facilities for this feature). Configuration of zoning, bell schedules, calendars, and emergency sequences will be accomplished using a browser-based interface.

ACENTECH

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BELMONT HIGH SCHOOL FEASIBILITY STUDY AUDIOVISUAL SYSTEMS, OPTION 1

SUBMITTED TO: PERKINS + WILL

CONSULTANT: ACENTECH

JANUARY 23, 2018

ACENTECH PROJECT NO. 629341

We visited Belmont High School on August 28, 2017 with the school and the entire design team to assess the existing conditions at the school. The following are our comments related to the audiovisual systems for the school.

BACKGROUND

Acentech is an independent consulting firm specializing in architectural acoustics, noise and vibration control, and the design of advanced sound, audiovisual, multimedia, and videoconferencing systems. In order to provide unbiased consulting and design services, Acentech does not sell or install equipment and does not represent any dealer, distributor, or manufacturer.

ROOM SCHEDULE

Unless otherwise noted, the focus of this project is limited to the following spaces and/or systems.

- Auditorium
- Music Classrooms
- Cafeteria
- Entry Hall
- Classrooms (including Art Classrooms)
- Lecture Hall (aka Little Theater)
- Book Rooms
- Gymnasium
- Natatorium
- Field House

EXISTING CONDITION EVALUATION

During our site visit, the existing audiovisual systems were reviewed. In general, the technology being used in the school is outdated and does not support current standards. Additionally, there did not appear to be consistency in the system components from room to room. Standardization is generally desirable so that technical staff can more easily troubleshoot and correct any problems with the systems, and also so that they can stock common replacement parts (such as projector lenses and filters).

Consistency from system to system also allows them to be easier for the end users. If an end user needs to use the audiovisual system in a space that they do not typically use, the user can feel comfortable and confident that they will understand how to use the system in that room since it will be exactly the same as the one they typically use.

In all of the classrooms that we observed, the video projection systems included analog video (VGA) connections, but not digital video (HDMI). Analog video systems are rapidly being phased out. Fewer source

devices support this connectivity, and the cost to support the older technology is increasing due to low supply of the components needed to support this. While some adapters allow users to connect digital video sources to analog displays (projectors and video display panels), the adapters are not reliable and do not always work.

Portable assistive listening systems were observed in some classrooms. These portable systems ("Redcat Lightspeed") are generally used for speech amplification. They do not typically connect to the audiovisual systems. In spaces with installed amplified sound systems, assistive listening systems are required in order to comply with the ADA (Americans with Disabilities Act). Further information about this requirement is listed later in this report.

It did not appear that audiovisual control system interfaces were used in most of the systems we observed. A control system interface (either as a touch screen control panel, or a button panel) will make the audiovisual system easier to use for the end user. The controls will always be available and in the same location (will not need to look for remote controls that can easily be lost).

The existing audiovisual equipment rack for the Auditorium is located on the downstage left corner. It is located next to electrical equipment and lighting dimmer racks. Unless the dimmer racks are using newer technologies, locating these racks in close proximity to one another should be avoided. Electrical "noise" (RF) from the lighting dimmers can create interference and create audible hum or buzz in the sound system.

Finally, current audiovisual system technologies allow the systems to connect to the data network. This allows the systems to automatically alert technicians about problems. For example, a system can alert a technician when a video projector's lamp has been used for a set number of hours. This allows the technician to know ahead of time that the lamp will need to be replaced soon, and give them time to order replacement parts before the lamp no longer works.

BUDGET SUMMARY

This report describes the functionality of the proposed audiovisual systems and does not include cost estimates. A programming meeting with key users is recommended to confirm the features described in this report, and a more accurate narrative and budget can be developed to cover this. Please note that audiovisual technology cost estimates do not cover construction items traditionally carried in the mechanical and electrical engineers' budgets. These items include, but are not limited to, conduit, junction boxes, structural supports, electrical power, and data network cabling.

TOTAL COST OF OWNERSHIP

The total cost of ownership of the audiovisual systems, in addition to the installation costs of the systems, includes several on-going costs:

Support Staff Costs:
The increase in the use of audiovisual systems carries with it the need to provide additional support for the users of the systems. This is balanced by network tools that allow support staff to work more efficiently. Specifically, the network-based management software will allow the staff to turn systems on and off, verify the operation of the equipment, schedule events for automatic operation, and receive automatic notification of system failures, projector lamp replacement, etc., without visiting the room. Without a detailed study of the current and anticipated support staff requirements, it is not possible to predict the staffing costs following the completion of the project; however, AV system management software is key to minimizing the support staff costs.

AV System Service:
The installation contract should require the installing contractor to provide a service contract for all systems for an additional three years beyond the initial one-year P&L warranty. The cost of a service contract for the period following the expiration of the initial contract is likely to be approximately 10% of

the cost of the initial installation per year. In addition, there will be charges associated with the actual repair of equipment that may fail during the life of the service contract.

Equipment Replacement:
The useful life of audiovisual system equipment varies with the type of equipment. In general, the useful life of most AV equipment is 5 - 10 years. Replacing individual items of equipment will be necessary during the life of the systems. Complete upgrades of the systems may be appropriate after ten years, as much because of the progress of technology and because of equipment usable life.

INFRASTRUCTURE VS. EQUIPMENT

The distinction between infrastructure and equipment must be emphasized: Infrastructure is part of the building construction including, but not limited to, conduit, raceways, junction and device boxes, and is not outlined in this program. Other infrastructure provisions, such as electrical power and grounding specified exclusively for audiovisual systems cabling and equipment may be required and should be carried in the electrical budget. Properly designed AV infrastructure allows for not only the installation of the initially specified equipment, but for the evolution of the systems over many years. If proper infrastructure is provided, additional capabilities and equipment can be added later as technology progresses.

Equipment refers to the devices that can be connected through the infrastructure. Equipment includes microphones, loudspeakers, mixers, signal processing gear, video projectors, flat panel displays, cameras, AV control systems, equipment racks, and many other devices that comprise an AV system. One thing is certain – equipment will change over the life of the room as user needs and technology change. For this reason, infrastructure is the key to the long-term success of a thoughtfully conceived AV design project because it governs what can and cannot be easily installed in the future.

EQUIPMENT NOTES AND DEFINITIONS

This program is not a technical specification and is insufficient to bid or build an AV system. Except where useful to illustrate a standard of performance or a specific user requirement, equipment manufacturers and model numbers are not used.

- Permanently installed refers to equipment that is part of the room systems and cannot easily be removed for use elsewhere.
- Portable refers to equipment that is available for connection at one or more locations, but is not hard-wired to the system. Portable equipment can be disconnected by the user or technical personnel and stored or used with systems elsewhere in the facility.
- Future Provisions refers to equipment that may be purchased and used or installed at a future date.
- Options refer to equipment or systems that are not at this point considered to be central to the needs of the Owner but may be chosen if desired. Optional equipment is not included in the budget estimate totals.
- OFE (Owner Furnished Equipment) refers to equipment that is either already owned by the Owner, or may be purchased in the future as needs arise. FBO (Furnished by Others), or “by others” refers to any service or equipment (e.g. lighting) required but not a part of the AV system design or installation.

SYSTEM CLASSIFICATIONS:

Presentation Systems
Presentation systems are the source, routing, and display devices that provide highly intelligible communication of speech, music, information, and graphics to groups of people. This includes equipment such as microphones, loudspeakers, video projectors, plasma displays, computers, and the interfacing, mixing, routing, and control equipment that connects these devices together and allows the user to select the appropriate sources and operate the system.

Assistive Listening Systems
Permanently installed Assistive Listening Systems (ALS) are required by the ADA (Americans with Disabilities Act), a 1990 federal law that forbids discrimination against persons who are handicapped. A

2010 revision states, “In each assembly area where audible communication is integral to the use of the space, an assistive listening system shall be provided” in the following quantities and versions:

Receivers for Assistive Listening Systems

Capacity of Seating in Assembly Area	Minimum Number of Required Receivers	Minimum Number of Required Receivers Required to be Hearing-aid Compatible
50 or less	2	2
51 to 200	2, plus 1 per 25 seats over 50 seats[1]	2
201 to 500	2, plus 1 per 25 seats over 50 seats[1]	1 per 4 receivers*
501 to 1000	20, plus 1 per 33 seats over 500 seats[1]	1 per 4 receivers*
1001 to 2000	35, plus 1 per 50 seats over 1000 seats[1]	1 per 4 receivers*
2001 and over1	55 plus 1 per 100 seats over 2000 seats[1]	1 per 4 receivers*
		1 “Or Fraction thereof”

The term “assembly area” includes facilities used for entertainment, educational, or civic gatherings. Additionally, courtrooms are required to support Assistive Listening systems regardless of whether or not an installed sound system exists.

Audiovisual Control System

Audiovisual (AV) control systems are required to centralize the operation of the various functions of the AV system. This includes environmental controls such as lighting presets and shade and drape controls, as well as audiovisual functions such as system and projector power, source device selection and media transport controls, audio volume controls, and many other operational functions identified by the design team before the equipment is installed.

Advanced functions of the AV control system may include multi-level password protection for system operation to prevent unauthorized use, control of automatic system shut-down sequences (to reduce unnecessary wear and tear), and a help system interface for user experiencing technical problems (see below).

Remote Management

Permanently-installed AV control systems can be connected to the Owner LAN to enable remote control and diagnostics of the AV systems. An asset management hardware / software suite allows monitoring and operation of AV systems via the Owner’s LAN. These products allow technical personnel to operate audiovisual systems in remote locations from any computer with a web browser. The features of remote management systems include:

- Real-time monitoring of system status, including notification of imminent problems in certain devices before they fail.
- Mobile management.
- A method of asset management by tracking equipment usage in real time.
- Will integrate with other control system hardware/software.

Video Conferencing/Distance Learning

Videoconferencing equipment (HD CODECs, software codecs, cameras, echo cancellers, telephone interfaces and related devices) is equipment specifically designed to transmit and receive audio and video signals over local and wide area networks. This capability is not currently planned for this project.

Broadcast Systems

Broadcast quality equipment and systems generally refer to audio and video devices (cameras, recorders, and editing equipment) of the highest quality, specifically designed for the recording, editing, and production at the commercial level, such as in network television studios. Broadcast equipment is an order of magnitude more expensive than “professional” quality equipment, and is not planned for this project.

PROPOSED AUDIOVISUAL SYSTEM DESCRIPTIONS

AUDITORIUM

The auditorium will be used for live music and theater performances, multimedia presentations with audio and video, lectures, and panel discussion. It is anticipated that the following will be required:

Sound System

- Microphones:
  - Wired Microphones: The system will include a stereo microphone that is hung in the room and used for audio recordings. Another microphone will be permanently installed over the stage/performance area and used for backstage monitoring. A gooseneck microphone will be provided for connection to a lectern (lectern, by others). Connections for wired microphones will be available at the sides of the stage, above the stage performance area, and along the side walls of the seating area.
  - Wireless Microphones: The system will include 4 wireless microphone systems. Each will include an interchangeable handheld and lavalier (clip-on) microphone transmitter.
- Audio Mixers: The system will operate in one of two microphone mixing modes; automatic or manual. These modes will be selectable from a control panel.
  - Automatic Microphone Mixing Mode: This mode will allow an end-user to simply connect a microphone to the system at one of multiple designated microphone receptacle locations. Master volume control will be accessible from the control panels. This will be the system's default setting and will be used for presentations, movies, and lectures.
  - Manual Microphone Mixing Mode: For events when more complex operation of the sound system is required, the automatic microphone-mixing can be bypassed and the system can be run by a trained operator. Volume levels of microphones and other audio playback sources will be controlled from a 32-channel digital mixing console; providing a flexible variety of audio outputs that can be used for special effects, recording, and speech reinforcement. The mixing console will be permanently located at a "tech position" within the house. The mixing location will require ample space for operation of the console and other items such as scripts required for rehearsals or performances. The mixing console will connect to the IT network and will have the capability of being controlled from an Owner-furnished tablet computer (such as an Apple iPad) that is connected via Wi-Fi to the same IT network.
- Audio Recorder: An audio recorder will used for recording events from the stereo microphone. The recorder will be capable of connecting to the IT network and can upload recorded audio tracks to another computer or server. The USB connection will allow recordings to be transferred to a thumb drive.
- Audio Signal Processing: A digital audio signal processor will be used for automatic microphone mixing, and equalizing the loudspeakers. The signal processor will be expandable so that, if required, additional input and output capacity can be added to the system in the future.
- Production Communications: A two-channel intercom system will be used for communication between production crew members at control locations, and the backstage spaces. AV connection panels within the performance space will include receptacles for the connection of intercom belt-

packs. Wall-mounted speaker stations will be located in the music classrooms and other backstage spaces. The system will be provided with eight dual-channel belt-packs, headsets, and cables.

- Loudspeakers:
  - Installed Auditorium System: The loudspeaker system will provide uniform audio coverage through the audience area allowing the system to provide high levels of speech intelligibility and musical clarity.
  - The loudspeaker configuration will consist of a central loudspeaker cluster above and in-line with the primary stage area. It will be used for speech reinforcement and playback of audio. Supplementary "delay" loudspeakers will be provided to cover the rear seating areas. Front-fill loudspeakers will be used in the stage apron. Subwoofers will also be provided. Left and right loudspeakers will be used for stereo audio playback, and for sound effects; which can be panned across the left, center, and right loudspeakers. Amplifiers will be provided to power the loudspeakers.
  - Control Room: A pair of wall-mounted loudspeakers will be installed in the Control Booth and will be used by technicians in the booth to monitoring audio from the stage performance/event. Amplifiers will be provided to power the loudspeakers.
  - Portable: Four portable self-powered loudspeakers will be provided for use on stage as "wedge" monitor loudspeakers. These loudspeakers can also be used in the house or on stage as sound effects speakers. Additionally, the loudspeakers will slant for use as a "wedge" or fold back monitor loudspeaker for use on stage.
  - Backstage and Front of House: In addition to the Auditorium's loudspeakers, ceiling-mounted loudspeakers will be provided in backstage areas, dressing rooms, etc. for audio monitoring (for cues, etc.). Amplifiers will be provided to power the loudspeakers.
- Assistive Listening System: An FM-based wireless assistive listening system will be included to meet the requirements of the Americans with Disabilities Act. Portable receivers (i.e., headphones) will be stored centrally and issued to participants as required. These receivers are intended to be used by patrons with hearing impairments.

Display System

- Video Projector: The system will display computer and motion video using a high brightness video projector with appropriate lens. The projector will be installed at the rear of the Auditorium in the control booth.
- Projection Screen: A motorized video projection screen with a high-contrast screen material will hang from above the stage.
- AV Sources: AV sources will include an Owner-furnished computer. Inputs for portable AV devices, such as a laptop computer or portable audio player, will be available at three locations (one on one side of the stage, one at the in-house audio mix location, and one in the Control Booth).
- Video Cameras: A high-definition video camera with integral pan/tilt head will be installed in the Theater. In addition, a night vision camera will also be provided for viewing of dark scenes. The cameras will be used to feed images of events in the space to backstage and front-of-house areas with video displays. Control of the cameras will be via presets on the touchscreen control panel.
- Video Routing and Processing: A matrix type switcher will be used to route video and audio sources to the displays and sound system. This will include video signal transmitters and receivers that are needed to send digital video signals longer distances. It will support playback and distribution of digital and analog video formats and the transport system will be compatible with newer generation 4K sources. Fiber optic transmitter outputs will be provided to send signals to the backstage areas with video displays, such as the Music Classrooms.

System Control

The control system will be used to simplify the operation of the audiovisual system by unifying the operation under one platform and user interface. The user interface will consist of three 10" LCD touch screens (one at the side of the stage, one at the in-house audio mix location, and one in the Control Booth). The control panels will be able to control all functions of the audiovisual system; including source selection and media transport controls, volume control, and can interface with other operational functions including lighting and HVAC.

Miscellaneous
Miscellaneous equipment will include a floor-standing and lockable equipment rack(s), AC power distribution, and sequencers in the racks, custom connection panels at the stage/performance area and house mix position, audio press feed connections to locations within the room, and all cable, connectors, and additional hardware and labeling required to install the system.

MUSIC CLASSROOMS
The Music Classrooms will include the Band Room and Chorus Room. These spaces will be used for musical instruction and rehearsal for choir, jazz band, orchestra, and band groups. Each audiovisual system will comprise the following sub-systems:

Sound System
- Microphones: A stereo microphone will be provided and will hang from the ceiling. This microphone will tie into the AV system and can be used for recording performances.
- Audio Signal Processing: A digital audio signal processor will be used for signal routing and equalizing the loudspeakers.
- Audio Recording: A network USB/SD audio recorder will be provided.
- Loudspeakers: Wall-mounted loudspeakers will be wall-mounted at the front of the room for program audio playback. Amplifiers will be provided to power the loudspeakers.
- Assistive Listening System: An FM-based wireless assistive listening system will be included to meet the requirements of the Americans with Disabilities Act. Portable receivers (i.e., headphones) will be stored centrally and issued to participants as required. These receivers are intended to be used by patrons with hearing impairments.

Display System
- Video Projector: The system will display computer and motion video using short-throw, 3,300 ANSI lumen video projectors (1280 x 800 WXGA resolution). The projectors will be installed on the wall above the whiteboard/projection screens in each room (whiteboard material to be provided by Others). Note that the whiteboard material should be of a projection quality and should not create reflections or hot spots from the projector.
- AV Sources: AV sources will include connectivity for an Owner-furnished computer. Inputs for portable AV devices, such as a laptop computer or portable audio player, will be available at locations at the front of the room. An overflow audio and video feed from the Auditorium will also be provided.
- Video Routing and Processing: A matrix type switcher will be used to route video and audio sources to the display and sound system. This will include video signal transmitters and receivers that are needed to send digital video signals longer distances. It will support playback and distribution of digital and analog video formats and the transport system will be compatible with newer generation 4K sources.

System Control
The control system will be used to simplify the operation of the audiovisual system by unifying the operation under one platform and user interface. The user interface will consist of a 7”LCD touch screen at the presentation area. The control panel will be able to control all functions of the audiovisual system; including source selection and media transport controls, and volume control. Control system processing will be embedded in the video matrix switch.

Miscellaneous
Miscellaneous equipment will include a floor-standing and lockable equipment rack, AC power distribution and sequencers in the racks, custom connection panels, and all cable, connectors, and additional hardware and labeling required to install the system.

CAFETERIA
The Cafeteria will include seating for a large number of students. An audiovisual system will be provided for lectures and will serve as an area to view and hear overflow AV feeds from the Auditorium. The audiovisual system will comprise the following sub-systems:

Sound System

- Microphones:
  - Wired Microphones: Connections for wired microphones will be available.
  - Wireless Microphones: The system will include a wireless microphone system. This will include lavalier (clip-on) microphone transmitter.
- Audio Signal Processing: A digital audio signal processor will be used for automatic microphone mixing and equalizing the loudspeakers.
- Loudspeakers: The loudspeaker configuration will consist of distributed ceiling-mounted loudspeakers and will be used for program audio and speech reinforcement. Amplifiers will be provided to power the loudspeakers.
- Assistive Listening System: An FM-based wireless assistive listening system will be included to meet the requirements of the Americans with Disabilities Act. Portable receivers (i.e., headphones) will be stored centrally and issued to participants as required. These receivers are intended to be used by patrons with hearing impairments.

Video System

- Video Displays: Two wall-mounted video display panels will be provided to display computer and motion video. These can be used for digital signage with owner provided PC, local AV presentations, or overflow video feeds from the auditorium.
- AV Sources: Inputs for portable AV devices, such as a laptop computer or portable audio player, will be available at one location in the Cafeteria area.
- Video Routing and Processing: A matrix type switcher will be used to route video and audio sources to the display and sound system. This will include video signal transmitters and receivers that are needed to send digital video signals longer distances. It will support playback and distribution of digital and analog video formats and the transport system will be compatible with newer generation 4K sources.

System Control

The control system will be used to simplify the operation of the audiovisual system by unifying the operation under one platform and user interface. The user interface will consist of a 7” LCD touch screen. The control panel will be able to control all functions of the audiovisual system; including source selection and media transport controls, and volume control.

Miscellaneous

Miscellaneous equipment will include a floor-standing and lockable equipment rack, AC power distribution and sequencers in the racks, custom connection panels, and all cable, connectors, and additional hardware and labeling required to install the system.

Entry Hall

The Entry Hall is a public area where large murals are hung. A digital video wall will be used to display electronic artwork, and can also be used to display other images and announcements. The audiovisual system will comprise of the following sub-systems:

Display System:

- Video Display: The system will display computer and motion video using a wall-mounted video wall consisting of nine (9) x 55" video display panels arranged in a 3 x 3 grid. The overall image size will be approximately 81" high x 143.5" wide.
- AV Sources: Inputs for portable AV devices, such as a laptop computer, will be available at a wall-mounted receptacle panel in the main office area of the school. An Owner-furnished computer will connect to the system.
- Video Routing: A switcher will be used to route video and audio sources to the display and sound system. This will include video signal transmitters and receivers that are needed to send digital video signals longer distances. The video routing equipment will be compliant with newer generation digital video sources (4K).

System Control:
The control system will be used to simplify the operation of the audiovisual system by unifying the operation under one platform and user interface. The user interface will consist of a wall-mounted 7" LCD touch screen. It will be able to control all functions of the audiovisual system; including source selection and media transport controls.

Miscellaneous:
Miscellaneous equipment will include an equipment rack, AC power distribution and sequencing, custom connection panels, and all cable, connectors, and additional hardware and labeling that are required to install the system.

CLASSROOMS
The classrooms (including the art classrooms) will be used for lectures and presentations. The audiovisual systems will each comprise of the following sub-systems:

Sound System
- Loudspeakers: A pair of wall-mounted loudspeakers will be used for program audio playback. Amplifiers will be provided to power the loudspeakers.
- Assistive Listening System: An infrared-based wireless assistive listening system will be included to meet the requirements of the Americans with Disabilities Act. Portable receivers (i.e., headphones) will be stored centrally and issued to participants as required. These receivers are intended to be used by patrons with hearing impairments.

Display System
- Video Projector: The system will display computer and motion video using a wall-mounted short-throw video projector (1920 x 1200 WUXGA minimum resolution). The projector will display content on a wall-mounted white board suitable for projection (white board, by Others).
- AV Sources: AV sources will include inputs for portable AV devices, such as a laptop computer or portable audio player. It will be available at the front of the room on a wall-mounted receptacle panel.

System Control
The control system will be used to simplify the operation of the audiovisual system by unifying the operation under one platform and user interface. The user interface will consist of a wall-mounted button panel. It will be able to control all functions of the audiovisual system; including source selection, volume control, and power.

Miscellaneous
Miscellaneous equipment will include custom connection panels, and all cable, connectors, and additional hardware and labeling required to install the system.

LECTURE HALL (AKA LITTLE THEATER)
The Lecture Hall will be used for multimedia presentations with audio and video, lectures, panel discussions, and community events.

Sound System
- Microphones:
  - Wired Microphones: A gooseneck and handheld microphone will be provided for connection to a lectern (lectern, by others). Connections for additional wired microphones will be available.
  - Wireless Microphones: The system will include a wireless microphone system. The system will include handheld and lavalier (clip-on) microphone transmitters.
- Audio Signal Processing: A digital audio signal processor will be used for automatic microphone mixing and equalizing the loudspeakers.
- Loudspeakers: Loudspeakers will be provided for speech reinforcement and audio playback. Amplifiers will be provided to power the loudspeakers.

- Assistive Listening System: An FM-based wireless assistive listening system will be included to meet the requirements of the Americans with Disabilities Act. Portable receivers (i.e., headphones) will be stored centrally and issued to participants as required. These receivers are intended to be used by patrons with hearing impairments.

Display System:

- Video Projector: The system will display computer and motion video using a high-brightness video projector (1920 x 1200 WUXGA minimum resolution).
- Projection Screen: A motorized video projection screen with a high-contrast screen material will hang from the presentation wall.
- AV Sources: AV sources will an Owner-furnished computer. Inputs for portable AV devices, such as a laptop computer or portable audio player, will be available at two locations at the front of the room.
- Video Cameras: One high-definition video camera with integral pan/tilt head will be installed in the Lecture Hall on the rear wall. Control of the camera will be via presets on the touchscreen control panel.
- Video Routing and Processing: A matrix type switcher will be used to route video and audio sources to the display and sound system. This will include video signal transmitters and receivers that are needed to send digital video signals longer distances. It will support playback and distribution of digital and analog video formats and the transport system will be compatible with newer generation 4K sources.

System Control

The control system will be used to simplify the operation of the audiovisual system by unifying the operation under one platform and user interface. The user interface will consist of a 10" LCD touch screen at the presentation area. The control panel will be able to control all functions of the audiovisual system; including source selection and media transport controls, volume control, and can interface with other operational functions including lighting and HVAC. Control system processing will be embedded in the video matrix switch.

Miscellaneous

Miscellaneous equipment will include a floor-standing and lockable equipment rack, AC power distribution and sequencers in the racks, custom connection panels, and all cable, connectors, and additional hardware and labeling required to install the system.

Book Rooms

The Book Rooms will be used for workgroups and tutorial sessions. The audiovisual systems will each comprise of the following sub-systems:

Sound System

- Loudspeakers: A pair of wall-mounted loudspeakers will be used for program audio playback. Amplifiers will be provided to power the loudspeakers.
- Assistive Listening System: An infrared-based wireless assistive listening system will be included to meet the requirements of the Americans with Disabilities Act. Portable receivers (i.e., headphones) will be stored centrally and issued to participants as required. These receivers are intended to be used by patrons with hearing impairments.

Display System

- Video Display Panel: The system will display computer and motion video using a wall-mounted video display panel.
- AV Sources: AV sources will include inputs for portable AV devices, such as a laptop computer or portable audio player. It will be available at the front of the room on a wall-mounted receptacle panel.

System Control

The control system will be used to simplify the operation of the audiovisual system by unifying the operation under one platform and user interface. The user interface will consist of a wall-mounted button

panel. It will be able to control all functions of the audiovisual system; including source selection, volume control, and power.

Miscellaneous
Miscellaneous equipment will include custom connection panels, and all cable, connectors, and additional hardware and labeling required to install the system.

GYMNASIUM
The Gymnasium will be used for practice, large games, presentations, and events. The audiovisual system will comprise of a number of sub-systems that include the following:

Sound System
- Microphones: The system will include one wireless handheld microphone transmitter. Connections for wired microphones will be available at wall-mounted receptacle panels and on a portable equipment rack.
- Audio Processing and Mixing: A digital audio signal processor will be used for automatic microphone mixing, and equalizing the loudspeakers. An 8-channel audio mixer in the portable equipment rack will be used to mix microphones and other audio sources.
- Loudspeakers: Distributed ceiling-mounted loudspeakers will be provided for speech reinforcement and program audio playback. Loudspeakers will be zoned so that they can be used over the entire Gymnasium floor, or over the individual courts (please note that we not anticipate sufficient acoustical isolation between the courts, and it is not recommended to use the two courts simultaneously for different audio playback or reinforcement). For larger events and games, additional loudspeakers will be used to provide coverage to the bleacher seating area. Amplifiers will be used to power the loudspeakers.
- Assistive Listening System: An FM or infrared based wireless assistive listening system will be included to meet the requirements of the Americans with Disabilities Act. Portable receivers, intended for use by patrons with hearing impairments, will be stored centrally and issued to participants as required. Inductive neck loop adapters will be provided along with the receivers for compatibility with telecoil-enabled hearing aids.

System Control
The control system will be used to simplify the operation of the audiovisual system by unifying the operation under one platform and user interface. The user interface will consist of one wall-mounted 5” LCD touch screen, and an additional 5” LCD touch screen in the portable equipment rack. The control panel will be able to control all functions of the audiovisual system; including source selection and media transport controls, and volume control.

Miscellaneous:
Miscellaneous equipment will include a floor-standing and lockable equipment rack, a portable equipment rack for use during events and games, AC power distribution and sequencers in the rack(s), custom connection panels, and all cable, connectors, and additional hardware and labeling required to install the system.

NATATORIUM
The Natatorium will be used for recreation and competitions. The audiovisual system will comprise of a number of sub-systems that include the following:

Sound System
- Microphones: The system will include one wireless handheld microphone transmitter. Connections for wired microphones will be available on a wall-mounted receptacle panel in the teacher’s office.
- Audio Processing and Mixing: A digital audio signal processor will be used for automatic microphone mixing, and equalizing the loudspeakers.
- Loudspeakers: Distributed weatherized ceiling-mounted loudspeakers will be provided for speech reinforcement and program audio playback.

- Assistive Listening System: An FM or infrared based wireless assistive listening system will be included to meet the requirements of the Americans with Disabilities Act. Portable receivers, intended for use by patrons with hearing impairments, will be stored centrally and issued to participants as required. Inductive neck loop adapters will be provided along with the receivers for compatibility with telecoil-enabled hearing aids.

System Control

The control system will be used to simplify the operation of the audiovisual system by unifying the operation under one platform and user interface. The user interface will consist of one wall-mounted 5" LCD touch screen. The control panel will be able to control all functions of the audiovisual system; including source selection and media transport controls, and volume control.

Miscellaneous:

Miscellaneous equipment will include a floor-standing and lockable equipment rack, AC power distribution and sequencers in the rack(s), custom connection panels, and all cable, connectors, and additional hardware and labeling required to install the system.

FIELD HOUSE

The Field House will be used for practice, large games, presentations, and events. The audiovisual system will comprise of a number of sub-systems that include the following:

Sound System

- Microphones: The system will include one wireless handheld microphone transmitter. Connections for wired microphones will be available at wall-mounted receptacle panels and on a portable equipment rack.
- Audio Processing and Mixing: A digital audio signal processor will be used for automatic microphone mixing, and equalizing the loudspeakers. An 8-channel audio mixer in the portable equipment rack will be used to mix microphones and other audio sources.
- Loudspeakers: Distributed ceiling-mounted loudspeakers will be provided for speech reinforcement and program audio playback. Loudspeakers will be zoned so that they can be used over the entire Field House floor, or only over the smaller sections. For larger events and games, additional loudspeakers will be used to provide coverage to the bleacher seating area. Amplifiers will be used to power the loudspeakers.
- Assistive Listening System: An FM or infrared based wireless assistive listening system will be included to meet the requirements of the Americans with Disabilities Act. Portable receivers, intended for use by patrons with hearing impairments, will be stored centrally and issued to participants as required. Inductive neck loop adapters will be provided along with the receivers for compatibility with telecoil-enabled hearing aids.

System Control

The control system will be used to simplify the operation of the audiovisual system by unifying the operation under one platform and user interface. The user interface will consist of one wall-mounted 5" LCD touch screen, and an additional 5" LCD touch screen in the portable equipment rack. The control panel will be able to control all functions of the audiovisual system; including source selection and media transport controls, and volume control.

Miscellaneous:

Miscellaneous equipment will include a floor-standing and lockable equipment rack, a portable equipment rack for use during events and games, AC power distribution and sequencers in the rack(s), custom connection panels, and all cable, connectors, and additional hardware and labeling required to install the system.

ARCHITECTURAL, MECHANICAL, AND ELECTRICAL CONSIDERATIONS

1. Architectural: The following items should be considered for proper coordination between audiovisual system components and other trades:
   a. Loudspeaker coverage must not be obstructed.

b. Structure will be necessary to ensure that loudspeakers and the projection screen can be ceiling-mounted at recommended locations.
c. Antennas for the assistive listening system and wireless microphones will be mounted on the wall.
d. Wall-mounted connection panel locations will require coordination.
e. Ceiling-mounted video projectors must be free from vibration.

2. AV Equipment Racks:
   a. Equipment racks will require coordination for space and cooling/airflow requirements. This will include floor-standing equipment racks, and any small equipment racks that may be installed within millwork.
      i. Floor-standing AV equipment racks shall be fixed in position and will require front access for day-to-day operational needs. They will also require rear access for service. Clearances must be maintained around the AV equipment racks (36") to comply with the requirements of the Americans with Disabilities Act.
      ii. AV equipment rack rooms may require oversized doors.
3. Auditorium Mixing Console:
   a. The Control Booth's mixing position will require ample space for operation of the console and other items such as scripts required for rehearsals or performances. The audio console is 48" wide by 36" deep.
   b. Control Booth:
      i. Please note the following guidelines:
         1. Coordination will be required with the acoustical consultant to maintain proper acoustical isolation between the Auditorium and the Control Booth.
         2. The glass in front of the video projector should be low iron. It should also be tilted between 2 and 5 degrees. Coordinate direction of tilt with the acoustical consultant.
4. Video Projection:
   a. In order to optimize the viewing experience and achieve the minimum recommended video display contrast ratio, ambient lighting within the spaces with projection will need to be reviewed. Additionally, overhead lighting should be zoned so that lighting areas directly above the projection screen surfaces can be switched off during presentations.
   b. Whiteboards & marker boards that are used as a projection surfaces shall be of projection quality so that they minimize reflections and projection hotspots.
5. Blocking will be required at all wall-mounted video display panel and loudspeaker locations.
6. Mechanical/Electrical: The following items should be considered for proper coordination between the audiovisual system components and other trades:
   a. The AC power system will be designed and specified by the electrical engineer and will include a dedicated power panel, transient voltage surge suppression, and AC outlets.
   b. Electrical outlets will be required at the equipment racks, mix location floor-box, and wall-mounted receptacle panels.
   c. IT data drops are strongly recommended at the equipment racks and all AV receptacle panels.
   d. If lighting control is desired from the audiovisual system control touch panel, the lighting system will require an interface for communication with the control system.
   e. Equipment Rack Locations:
      i. AC power requirements and heat loads will need to be considered at each equipment rack and video projector location.

* * * * * *

End of Feasibility Study

3.3.3 - FINAL EVALUATION OF ALTERNATIVES

OPTION 2.1 - MAJOR RENOVATION / MINOR ADDITION

SUMMARY

Option 2.1 proposes a phased renovation and addition expanding both adjacent to as well as above the existing high school to create a new 7-12 High School. In the first phase, a new addition would be constructed off the northwest edge of the existing high school building. The addition would include upper school administration, science labs and general classrooms, as well as a black box theater, an alternative PE space, as well as supporting mechanical space. The upper grades would occupy this new addition enabling a series of renovations to be executed all of which would happen while the building is occupied making disruption and safety critical issues to be mitigated. The substantial first phase will enable the school to be renovated without the need for modular classroom space on an already densely utilized site. The entire existing building structure - including caissons, foundations, concrete floor, roof slabs, and concrete beams would remain and be reused but a new structural system would be required where additional floor levels are added. It is important to note that the existing fireproofing contains asbestos which will require the fireproofing to be removed and replaced with new fireproofing. There are interior functions that would be reconfigured due to added program spaces, increased population and due to disruption of new structural elements. These necessary alterations further reduce the savings one would expect by maintaining the interior planning layout. Substantial portions of the existing building would be renovated as configured including shared common amenity spaces such as the large auditorium, the large gymnasium, and commons. With each renovation phase, new common learning spaces will be layered on the pond side of the existing building allowing for clear wayfinding and a stronger connection between informal learning environments and the exterior.

DESIGN STRATEGY

This option proposes two separate entry and exit points to the site helping to disperse traffic congestion during the drop-off and pick-up periods. It also provides separate building entry points allowing for a sensitivity to scale for lower and upper grades. Even with a vertical expansion component this option will not maintain the current athletic programming accommodated on the high school site today. With limited space available in town for additional fields this will stress the scheduling of athletics and likely require unrealistic timeframes for practices and games. Athletic fields are split on either side of the existing buildings making their maintenance and use less efficient. The intensity of athletic use, expanded parking needs and drop-off requirements required to mitigate major off-site traffic issues were the factors that drove vertical expansion to be explored in this option. While the cost premium for this expansion is recognized it is needed to accommodate the most basic site functionality.

SUSTAINABILITY AND BUILDING PERFORMANCE

The following sustainability and resiliency attributes have been considered in evaluating this option:

ENVELOPE – Select thermal and vapor performance upgrades would be executed in areas with substantial renovation, the finite scope of façade reconstruction and the existence of brick cavity walls with limited existing insulation makes meeting the schools performance goals difficult.

ORIENTATION- The orientation is fixed for the majority of the building making optimized daylighting challenging for existing east and west facing learning environments. Added spaces will build over and to the west of the existing structures with public spaces oriented to the south and most new teaching spaces receiving glare free light from the north

SKIN TO VOLUME RATIO- The skin to volume ratio of the major renovation minor addition scheme is the least efficient in that it stretches the building out to its least concise footprint.

WINDOW TO WALL RATIO- The window to wall ratio of the base repair scheme will attempt to achieve 30-40 glazing balancing heat gain with effective daylighting.

PV POTENTIAL- The ability to retrofit the existing roof structure is challenged by the placement of existing mechanical equipment and shafts as well as the roof's structural capacity. Over-built structure may be able to accommodate a more flexible arrangement of panels.

SITE ENVIRONMENTAL PERFORMANCE- This scheme allows for one contiguous but smaller geo-exchange field due to the expanded building footprint but allows for more performative landscape adjacent to the pond allowing outdoor teaching space to overlap with site sustainable strategies at the water edge.

A. PROSPECTIVE SITE ANALYSIS - OPTION 2.1

SITE

This narrative provide an analysis of the option including natural site limitations, building footprint(s), athletic fields, parking areas and drives, bus and parent drop-off areas, site access, and surrounding site features. This narrative excludes temporary site facilities, phasing implications, site drainage, utilities and permitting requirements addressed separately. All addition renovation and new building options include complete reconstruction of the site east of Harris Field to accommodate the site program requirements except tennis which will be accommodated at other existing courts in Town.

Harris Field including the track and supporting facilities are existing to remain. Spatial accommodations have been made in the site planning for the school project to accommodate a multi-modal community path along the north property line abutting the MBTA right-of-way and a multigenerational path around Clay Pit Pond – both with separate funding and implementation timelines. The school building project site design is anticipated to incorporate the portion of the multigenerational path that connects across the north side of Clay Pit Pond, as that will serve as a vital link between the school's site program elements and circulation through the campus.

The existing school building is located on higher ground north of Claypit Pond towards the rear (north) of the site. The primary vehicular (car and bus) circulation and drop-off is a one-way loop from east (Hittinger Street) to west (Concord Avenue). The main pedestrian entrances are the south sides of the building. Buses drop off and pick up students along the south side of the building. The site has three primary parking areas. The largest parking lot (292 spaces) is located to the east of the school building. Small lots are located to the south (36 spaces) and north (21 spaces) of the building. Nine buses currently park along the far east side of the east parking lot. All parking areas contain accessible parking.

Most of the school's athletic facilities are located west of the school building including two baseball fields (varsity is played on Grant Memorial Field which includes bleacher seating, dugout shelters and a prominent gateway) with rectangular field layouts (for soccer and field hockey) overlapping their outfields, a rugby/football practice field and Harris Field which includes a running track and synthetic turf field, home and away bleachers and sports lighting. An indoor skating rink in poor condition and a football field house separate these fields from the varsity softball field further west with lighting and a soccer/lacrosse field overlapping the outfield. Ten tennis courts are located adjacent to the east parking area and the junior varsity softball field is located further east of the primary east parking area.

BUILDING FOOTPRINT

In Option C 2.1, building additions expand the existing building footprint primarily to the west and south.

ATHLETIC FIELDS

The athletic fields except Harris Field are reconfigured as follows:

- One softball and baseball combination field overlap with a soccer/field hockey field west of the rink.
- One softball and baseball combination field overlap with a soccer field between the new Goden Street entrance and the new building addition.
- Football/rugby field and a lacrosse/soccer field are located at the east side of the site.

TRAFFIC CIRCULATION

The driveway between the building and Clay Pit Pond is eliminated, and a new 2-way driveway is located around the rear of the building with new access points across from Trowbridge and Goden Streets. Building entrances to the upper and lower school program have separate entrances and drop off loops at the east and west ends of the building. The multigenerational path connecting along the north side of the pond links the site and building program elements and provides pedestrian, bicycle and emergency vehicle access through the site.

PARKING

This site plan meets the school's parking need for 420-430 space. Parking is redistributed with a large lot between the school building and Harris Field with the remaining parking spaces located along the driveway across the north side of the site between the MBTA rail line and the rest of the school campus.

3.3.3 - FINAL EVALUATION OF ALTERNATIVES

B. CONSTRUCTION IMPACT - OPTION 2.1

Option 2.1 would require major renovations within the existing occupied school and would be undertaken in 2 or 3 phases. Modular classrooms may be required on site to provide necessary swing space during renovations. Scheduling work over summer or holiday breaks may alleviate some of the disruption but would need to be carefully managed. The anticipated construction schedule is 48 months.

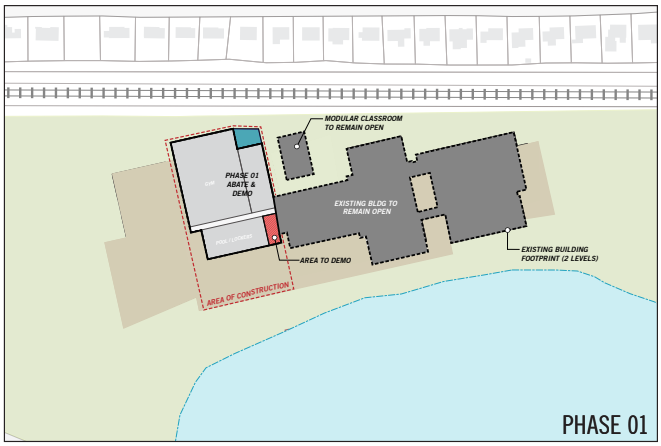
Work under this would be very disruptive to students and staff. Students would be forced to move two to three times to accommodate the multiple construction phases. Disruption from noise, dust, odors and construction traffic could be anticipated.

The detailed plan for phasing and swing space would be determined during schematic design to best coordinate with the educational programs to minimize the impact on students and staff.

I. DESIGN AND CONSTRUCTION SCHEDULE - OPTION 2.1

Anticipated MSBA Approval of PSR	April 10th, 2018 (MSBA Board Meeting)
Anticipated MSBA Approval of SD	August 29th, 2018 (MSBA Board Meeting)
Special Town Meeting/Ballot Vote	November 2018
Design Development Complete	November 2018 - April 2019
Construction Documents Complete	May 2019 – January 2020
Bid and Award	February 2020 - March 2020
Construction (multiple phases)	April 2020 – March 2024 (48 months)

B. CONSTRUCTION IMPACT - OPTION 2.1 / Phasing Diagrams



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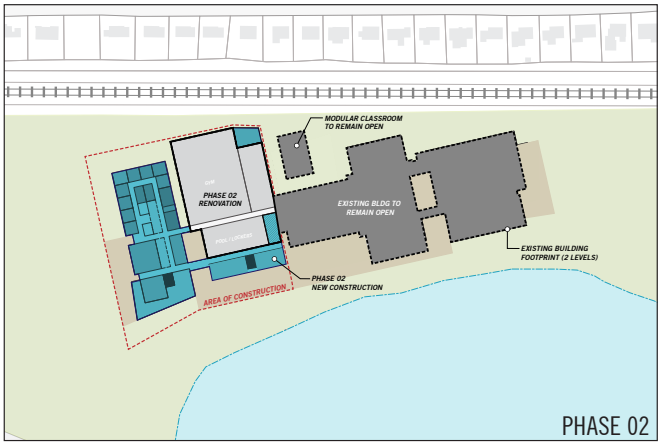

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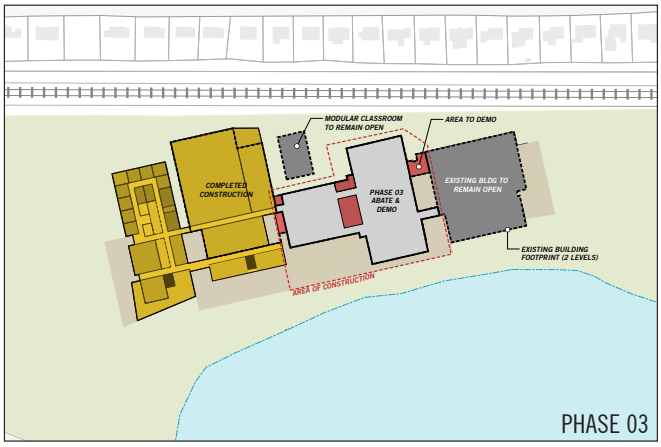

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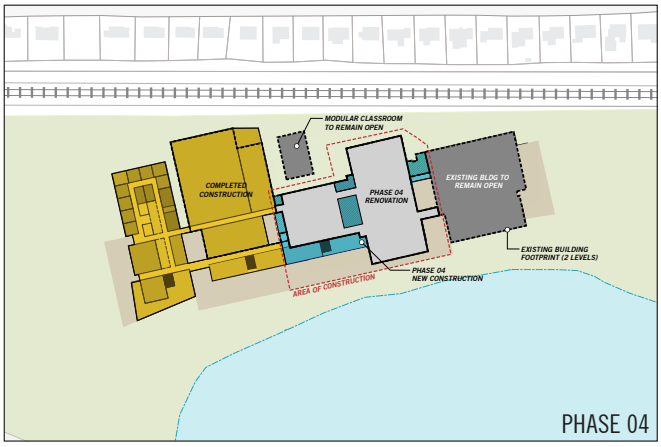

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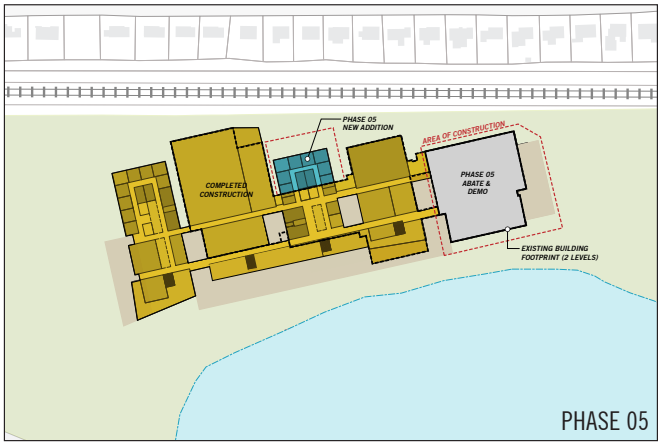

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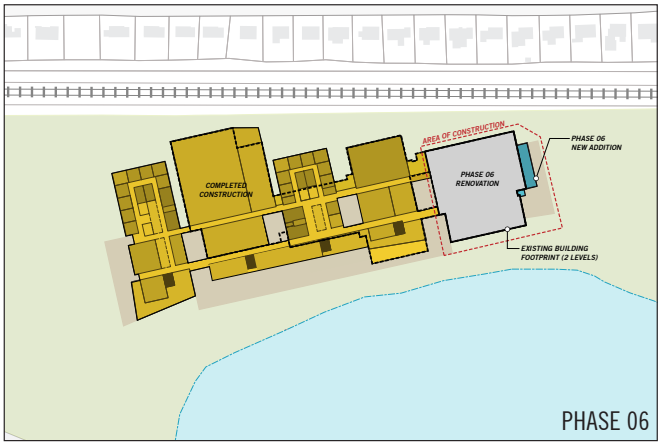

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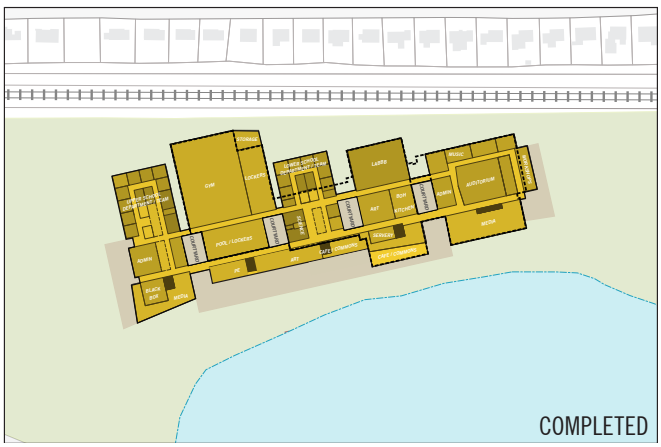
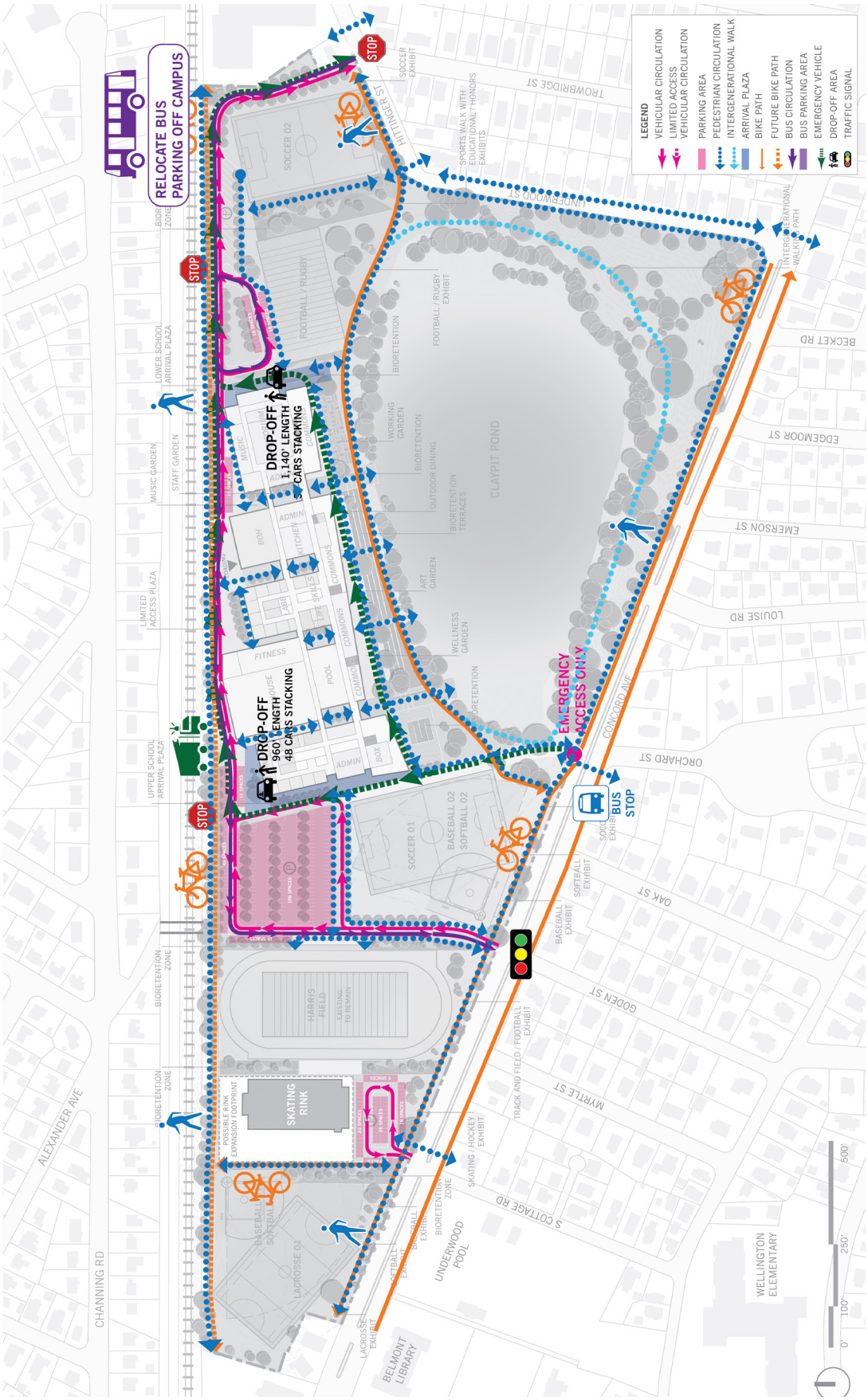

COMPLETED

Demolition
Renovation
Addition
Complete

3.3.3 - FINAL EVALUATION OF ALTERNATIVES

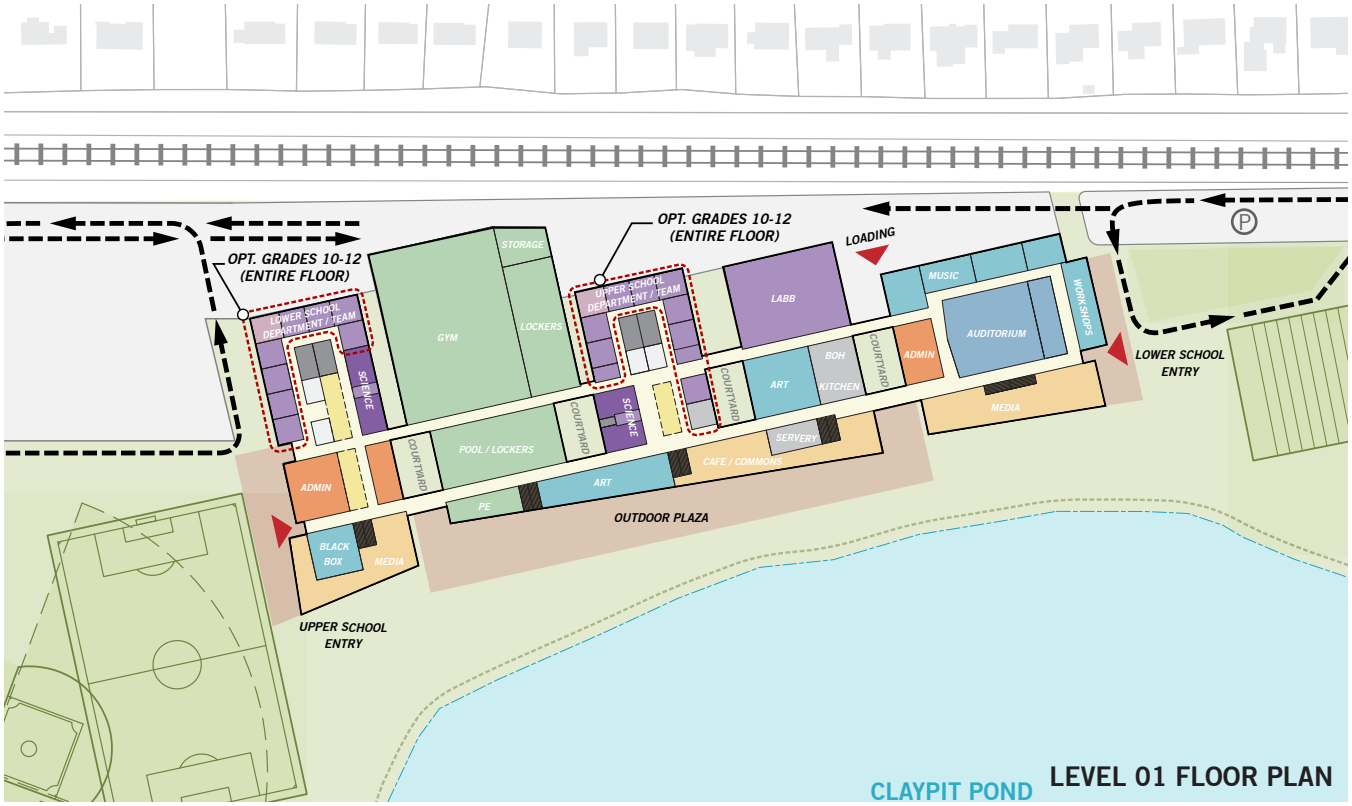
C. CONCEPT DRAWING - OPTION 2.1 / Site

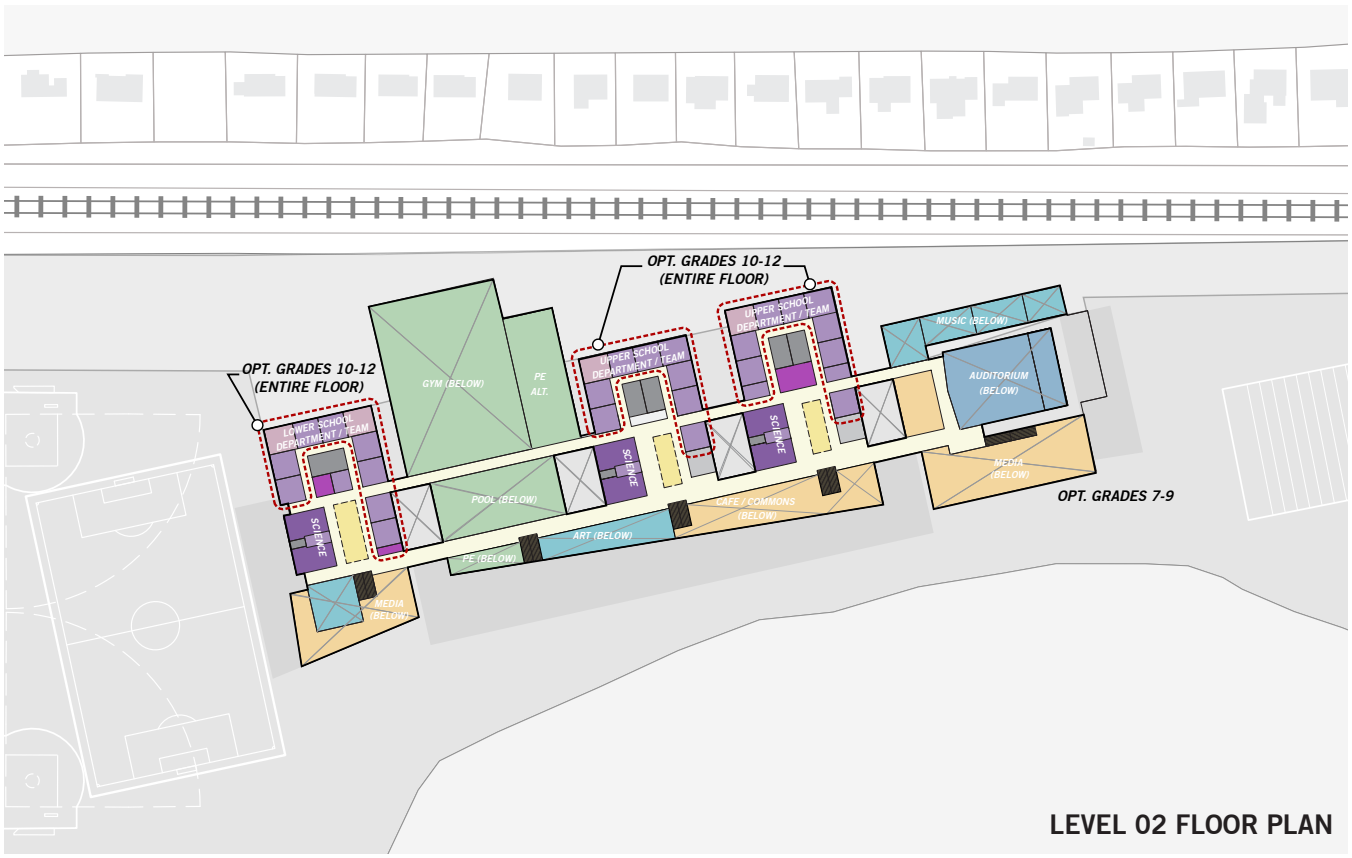
C. CONCEPT DRAWING - OPTION 2.1 / Traffic Site Plan



3.3.3 - FINAL EVALUATION OF ALTERNATIVES

C. CONCEPT DRAWING - OPTION 2.1 / Architectural

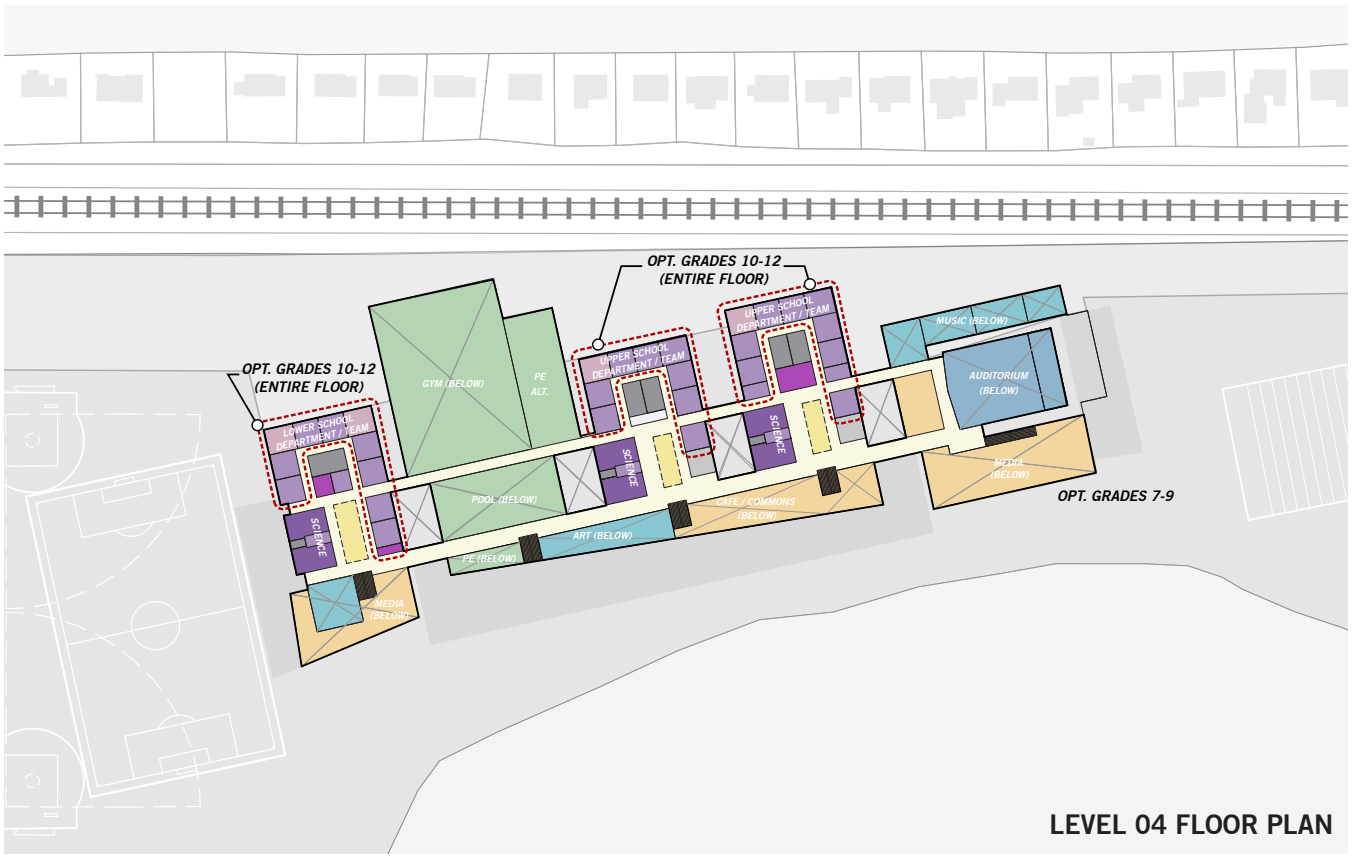




C. CONCEPT DRAWING - OPTION 2.1 / Architectural

Core Academic
Art & Music
Admin./ Guidance
Health & PE
Media Center
Auditorium & Drama
Dining/ Food Service
Medical
Circulation
Custodial/ Maint.
District Offices
Special Education

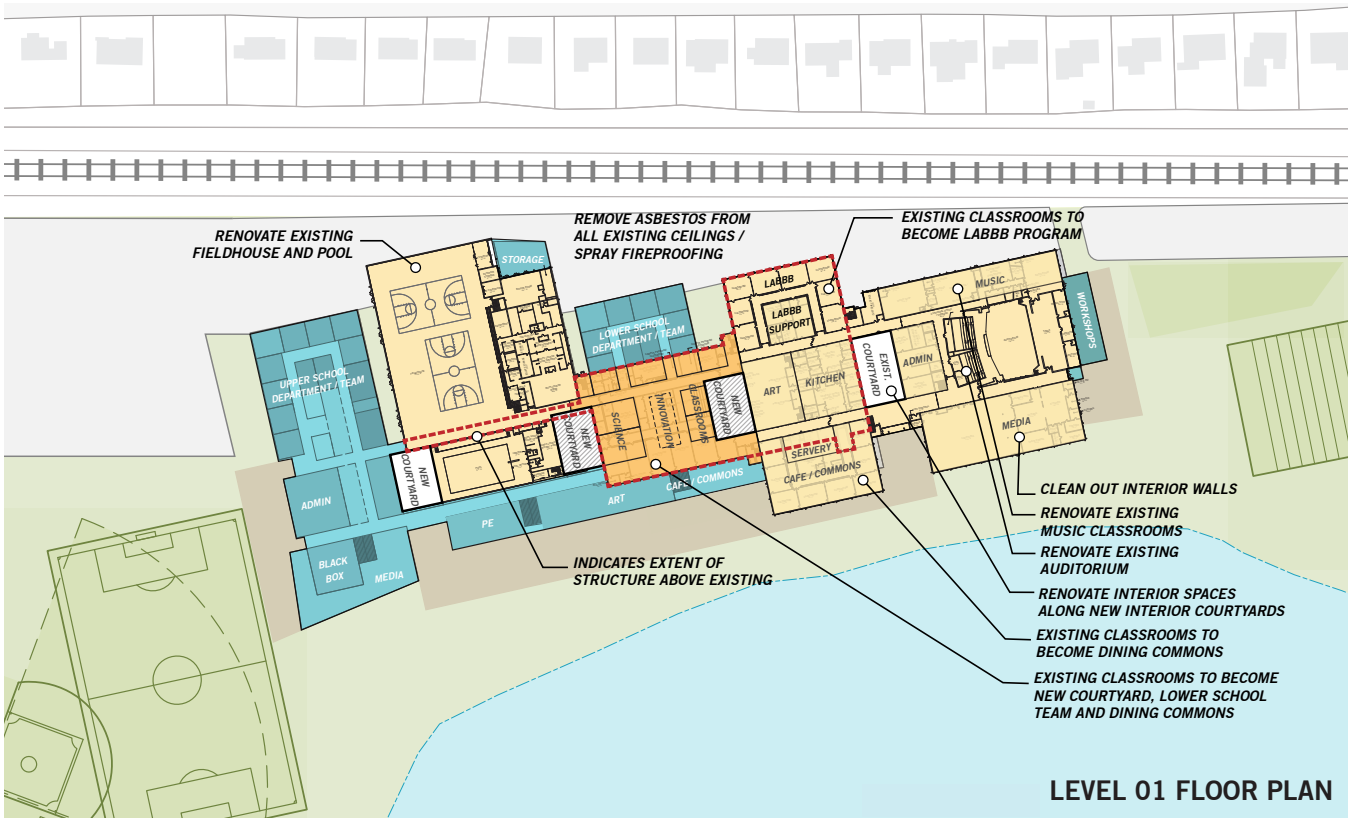
LEVEL 03 FLOOR PLAN

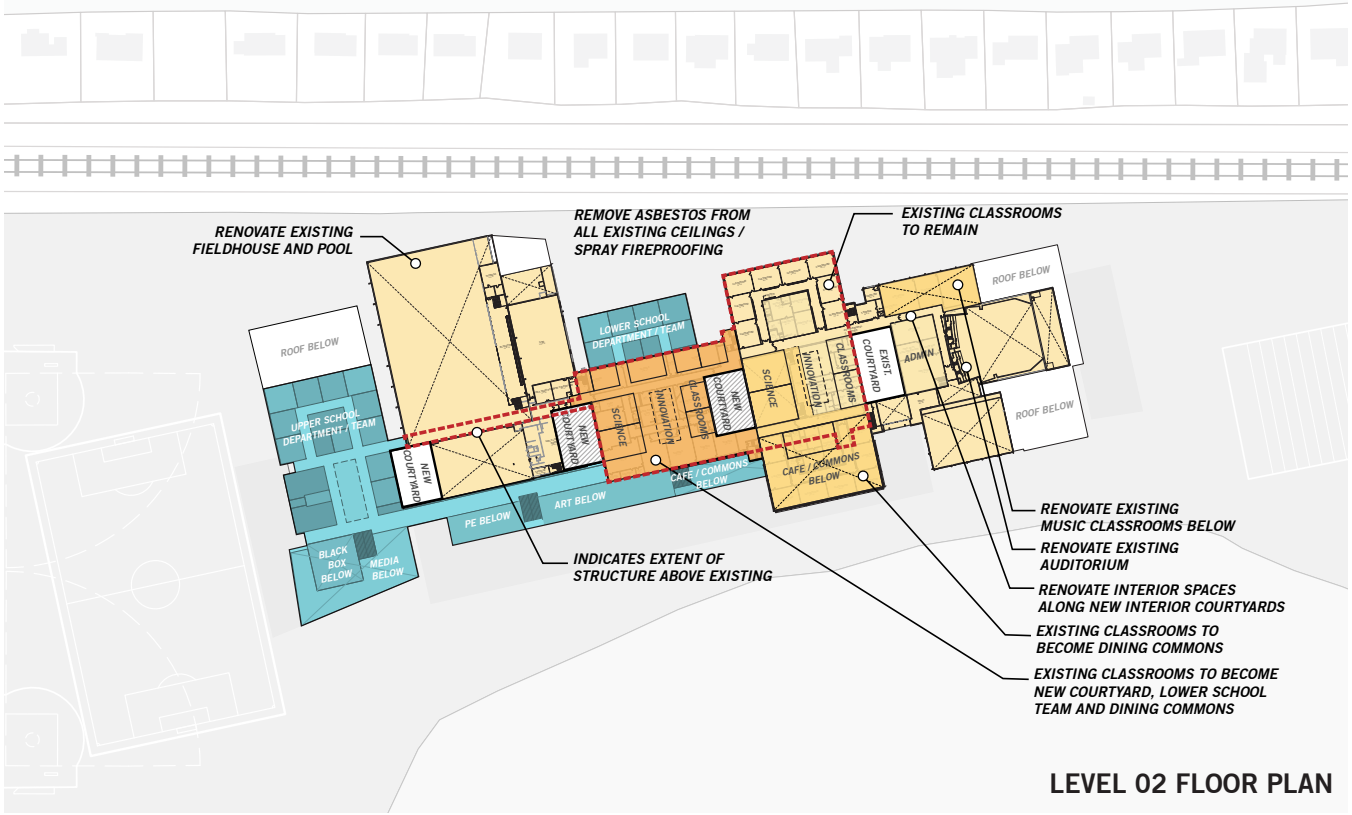


LEVEL 04 FLOOR PLAN

3.3.3 - FINAL EVALUATION OF ALTERNATIVES

C. CONCEPT DRAWING - OPTION 2.1 / New, Renovated, and Existing to Remain Areas





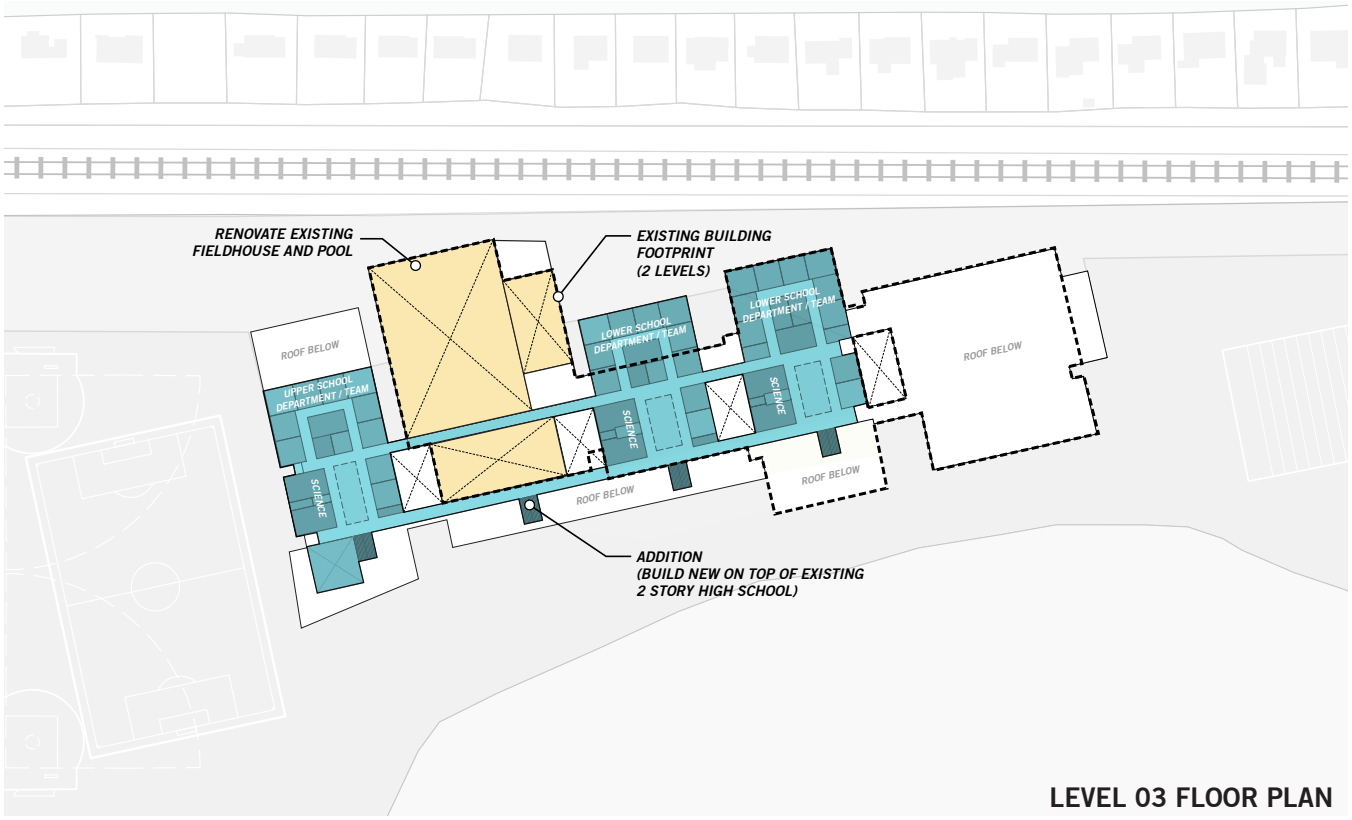
Demolition

Minor Renovation (Maintain Existing Facade and Floor Slabs)

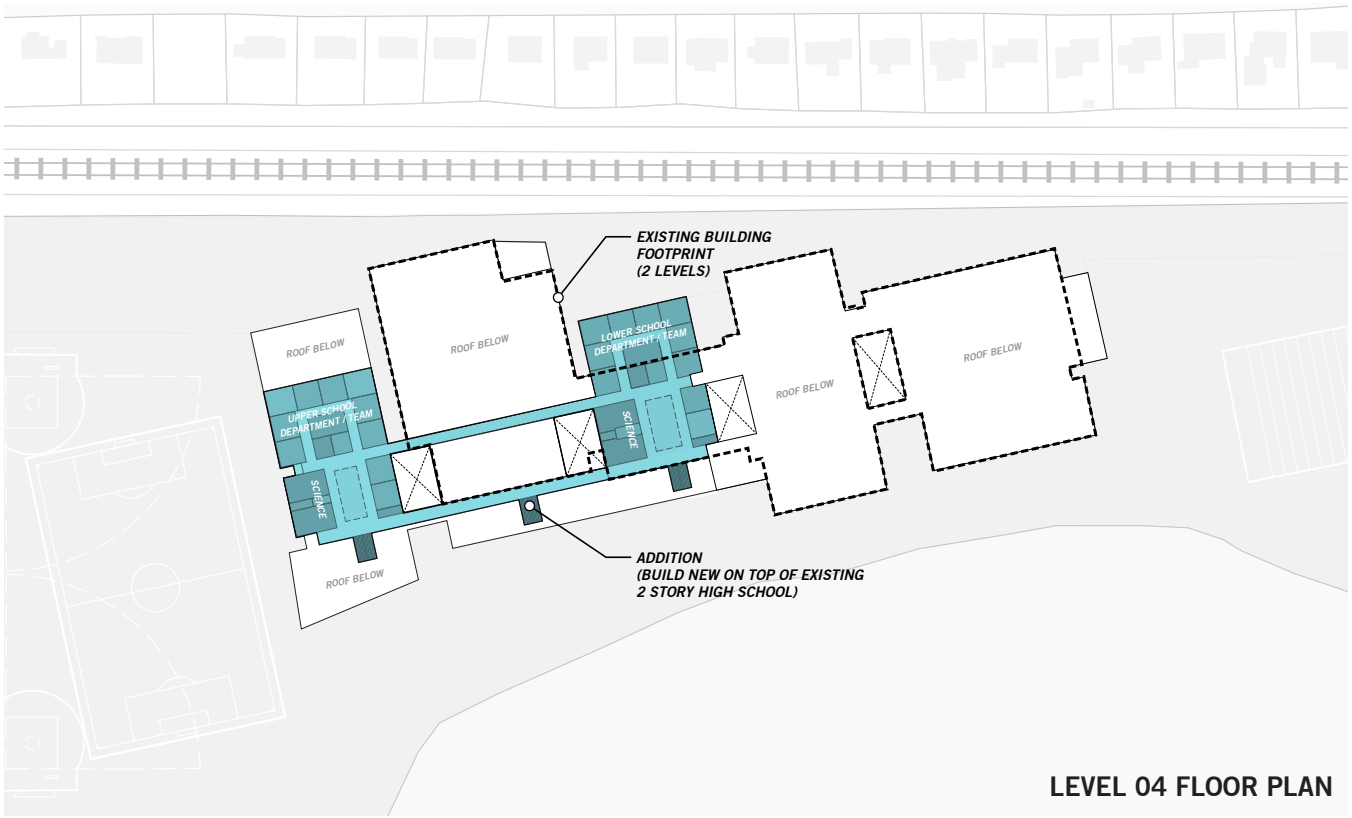
Moderate Renovation (Maintain Existing Facade, Alterations to Existing Floor Slabs)

Major Renovation (Alterations to Existing Facade and Floor Slabs)

Addition



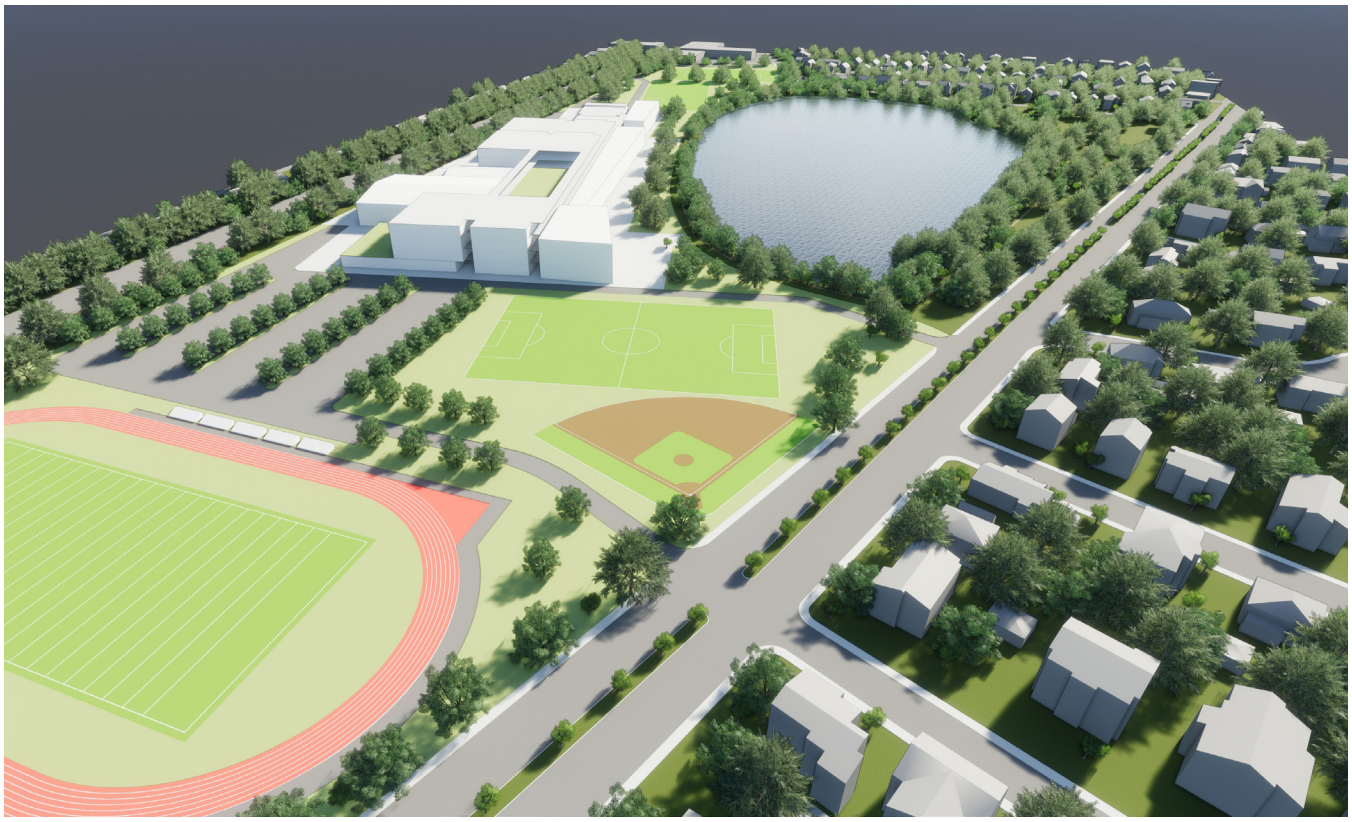
LEVEL 03 FLOOR PLAN

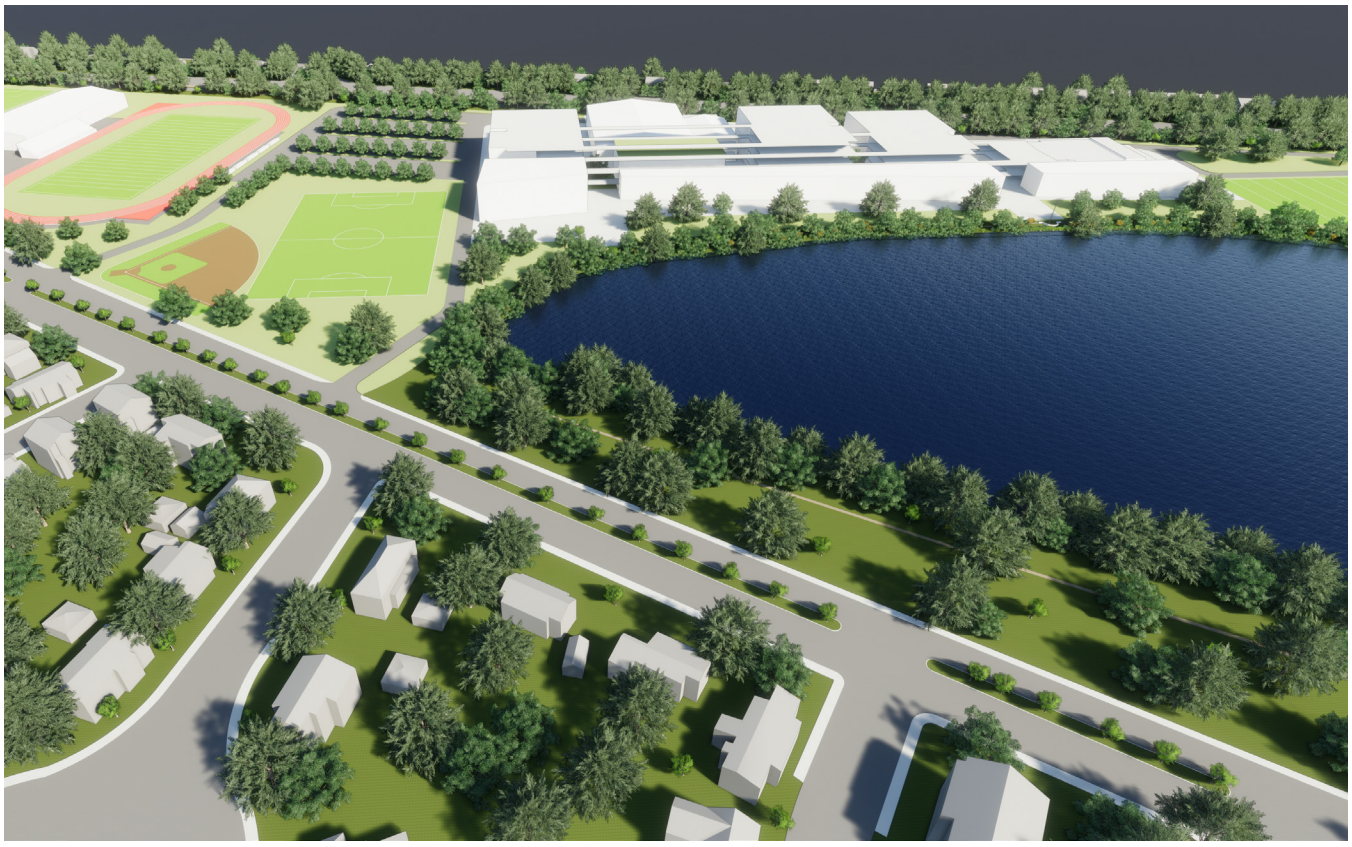


LEVEL 04 FLOOR PLAN

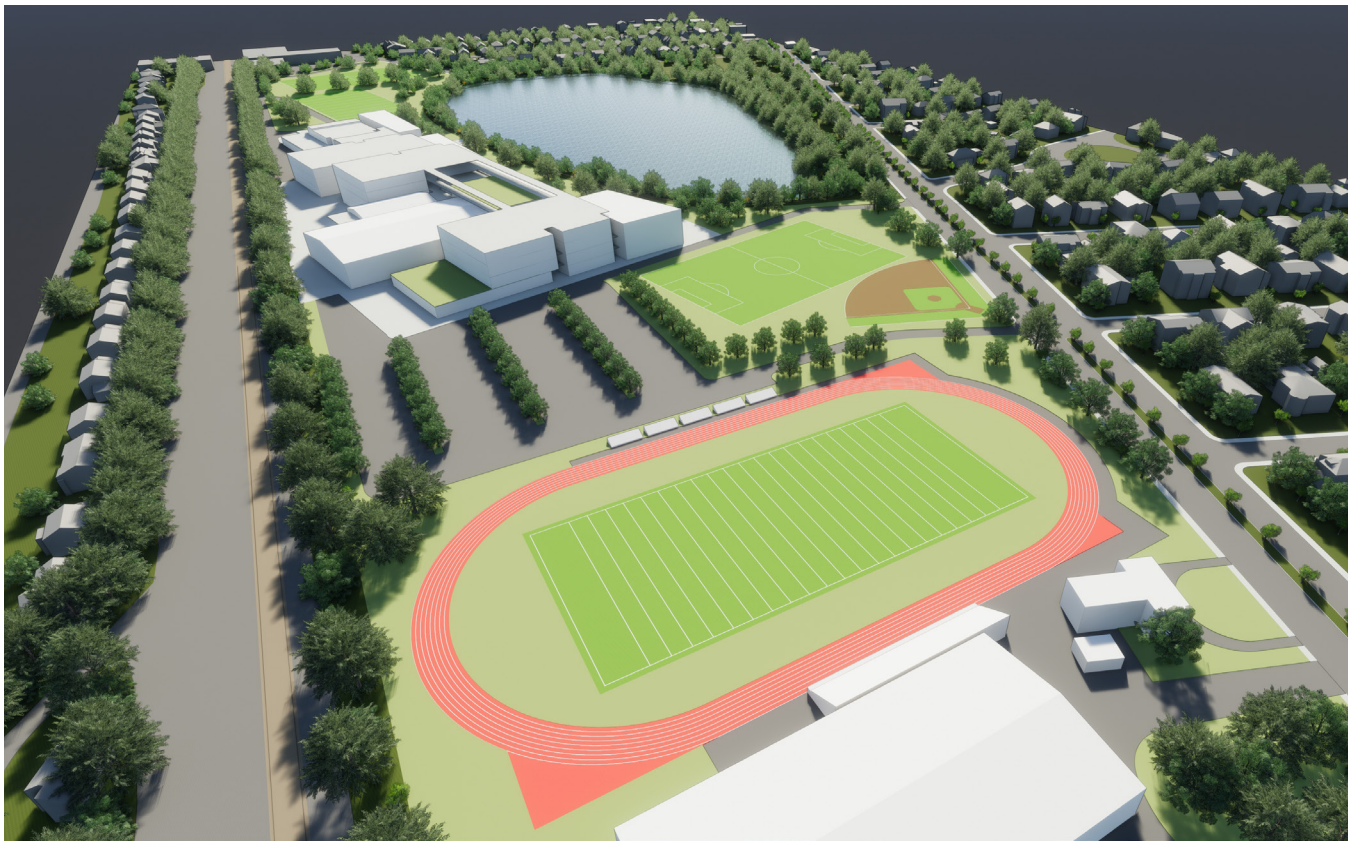
3.3.3 - FINAL EVALUATION OF ALTERNATIVES

C. CONCEPT DRAWING - OPTION 2.1





C. CONCEPT DRAWING - OPTION 2.1



BELMONT HIGH SCHOOL
Structural Narrative – Option 2.1
Major Renovations and Minor Addition to the Existing School

January 22, 2018

PROPOSED SCHEME

The proposed scheme calls for phased renovations and additions to the existing school. In the first phase, an addition will be constructed at the northwest corner of the existing building. The addition will house the upper school administration, science laboratories and general classrooms, as well as a black box theatre, an alternative PE space, upper school cafeteria, and kitchen and mechanical spaces. The next phase would require a total gut renovation of the existing building. In this case, the existing building will have to essentially meet the requirements of the Code for New Construction. This will require the addition of a new lateral load resisting system in the form of braced frames and/or masonry shear walls. Modifications will be required to the existing column foundation receiving braced frames; and, new tie beams will be required to connect the existing column foundations at the locations of existing slabs-on-grade.

PRIMARY STRUCTURAL CODE ISSUES RELATED TO THE EXISTING STRUCTURE

If any repairs, renovations, additions or change of occupancy or use are made to the existing structure, a check for compliance with 780 CMR, Chapter 34 “Existing Structures” (Massachusetts Amendments to The International Existing Building Code 2015) of the Massachusetts Amendments to the International Building Code 2015 (IBC 2015) and reference code “International Existing Building Code 2015” (IEBC 2015) is required. The intent of the IEBC and the related Massachusetts Amendments to IEBC is to provide alternative approaches to alterations, repairs, additions and/or a change of occupancy or use without requiring full compliance with the code requirements for new construction.

The IEBC provides three compliance methods for the repair, alteration, change of use or additions to an existing structure. Compliance is required with only one of the three compliance alternatives. Once the compliance alternative is selected, the project will have to comply with all requirements of that particular method. The requirements from the three compliance alternatives cannot be applied in combination with each other.

The three compliance methods are as follows:

1. Prescription Compliance Method.
2. Work Area Compliance Method.
3. Performance Compliance Method.

Comment
The approach is to evaluate the compliance requirements for each of the three methods and select the method that would yield the most cost effective solution for the structural scope of the project. The selection of the compliance method may have to be re-evaluated after the impact of the selected method is understood and after analyzing the compliance requirements of the other disciplines, Architectural, Mechanical, Fire Protection, Electrical and Plumbing.
Since portions of the existing building are considered un-reinforced masonry bearing wall structures, the analysis and reinforcement of the existing structure would be governed by the requirements of Appendix A1 “Seismic Strengthening Provisions for Un-reinforced Masonry Bearing Wall Buildings” in the IEBC.

D. STRUCTURAL SYSTEMS - OPTION 2.1

1. PRESCRIPTIVE COMPLIANCE METHOD

In this method, compliance with Chapter 4 of the IEBC is required. As part of the scope of this report, the extent of the compliance requirements identified are limited to the structural requirements of this chapter.

Additions
Based on the project scope, the following structural issues have to be addressed:

- All additions should comply with the code requirements for new construction in the IBC.
- For additions that are not structurally independent of the existing structure, the existing structure and its addition, acting as a single structure, shall meet the requirements of the code for new construction for resisting lateral loads, except for the existing lateral load carrying structural elements whose demand-capacity ratio is not increased by more than 10 percent, these elements can remain unaltered.
- Any existing gravity, load-carrying structural element for which an addition or its related alterations causes an increase in the design gravity load of more than 5 percent shall be strengthened, supplemented or replaced.

Alterations

- Any existing gravity, load-carrying structural element for which an addition or its related alterations causes an increase in the design gravity load of more than 5 percent shall be strengthened, supplemented or replaced.
- For alterations that would increase the design lateral loads or cause a structural irregularity or decrease the capacity of any lateral load carrying structural element, the structure of the altered building shall meet the requirements of the code for new construction, except for the existing lateral load carrying structural elements whose demand-capacity ratio is not increased by more than 10 percent, these elements can remain unaltered.

2. WORK AREA COMPLIANCE METHOD

In this method, compliance with Chapter 5 through 13 of the IEBC is required. As part of the scope of this report, the extent of the compliance requirements identified are limited to the structural requirements of these chapters.
In this method, the extent of alterations has to be classified into LEVELS OF WORK based on the scope and extent of the alterations to the existing structure. The LEVEL OF WORK can be classified into LEVEL 1, LEVEL 2 or LEVEL 3 Alterations. In addition, there are requirements that have to be satisfied for additions to the existing structure.
The extent of the renovations (includes Architectural, FP and MEP renovations) for this project will exceed 50 percent of the aggregate area of the building, thus the LEVEL OF WORK for this project would be classified as LEVEL 3 Alterations. This would require compliance with provision of Chapter 7, 8 and 9 of the IEBC. The scope of the project includes new additions to the existing structure; this would trigger compliance with provisions in Chapter 111 of the IEBC.

Level 3 Alterations

- Any existing gravity, load-carrying structural element for which an alteration causes an increase in the design gravity load of more than 5 percent shall be strengthened, supplemented or replaced.
- For alterations where more than 30 percent of the total floor area and roof areas of the building or structure have been or proposed to be involved in structural alterations within a 12 month period, the evaluation and analysis shall demonstrate that the altered building complies with the full design wind loads as per the code requirements for new construction and with reduced IBC level seismic forces.
- For alterations where not more than 30 percent of the total floor and roof areas of the building are involved in structural alterations within a 12 month period, the evaluation and analysis shall demonstrate that the altered building or structure complies with the loads at the time of the original construction or the most recent

substantial alteration (more than 30 percent of total floor and roof area). If these alterations increase the seismic demand-capacity ratio on any structural element by more than 10 percent, that particular structural element shall comply with reduced IBC level seismic forces.

- For alterations that involve structural alterations to more than 30 percent of the total floor and roof area of the building within a 12 month period, the evaluation and analysis shall demonstrate that the altered building structure complies with IBC for wind loading and with reduced IBC level seismic forces.
- For alterations where more than 25 percent of the roof is replaced for buildings assigned to seismic design category B, C, D, E or F, all un-reinforced masonry walls shall be anchored to the roof structure and un-reinforced masonry parapets shall be braced to the roof structure.

Additions

- All additions shall comply with the requirements for the code for new construction in the IBC.
- Any existing gravity, load-carrying structural element for which an addition or its related alterations cause an increase in design gravity load of more than 5 percent shall be strengthened, supplemented or replaced.
- For additions that are not structurally independent of the existing structure, the existing structure and its addition, acting as a single structure, shall meet the requirements of the code for new construction in the IBC for resisting wind loads and IBC Level Seismic Forces (may be lower than loads from the Code for New Construction in the IBC), except for small additions that would not increase the lateral force story shear in any story by more than 10 percent cumulative. In this case, the existing lateral load resisting system can remain unaltered.

3. PERFORMANCE COMPLIANCE METHOD

Following the requirements of this method for the alterations and additions may be onerous on the project because this method requires that the altered existing structure and the additions meet the requirements for the code for new construction in the IBC.

PARTICULAR REQUIREMENTS OF COMPLIANCE METHODS

For our project, in order to meet compliance with one of the two compliance methods “Prescriptive Compliance Method” or the “Work Area Compliance Method”, we have to address the following:

1. PRESCRIPTIVE COMPLIANCE METHOD

Additions

The proposed additions will be designed structurally independent of the existing structure, thus, would not impart any additional lateral loads on the existing structure.

If the proposed alterations are such that the alterations increase the design lateral loads on the existing building or cause any structural irregularity of decrease the lateral load carrying capacity of the building, the structure of the altered building shall meet the requirements of the Code for New Construction in the IBC.

If the proposed additions increase the design gravity load on portions of the existing roof members, these members would have to be reinforced and this incidental structural alteration of the existing structure would have to be accounted for in the scope of the alterations to the existing school and would trigger requirements for alterations.

Alterations

Alterations that would increase the design gravity loads by more than 5 percent on any structural members would have to be reinforced.

If the proposed alterations of the structure increase the effective seismic weight on the existing structure due to the greater snow loads from the drifted snow against any proposed addition, or, by addition of equipment on the roof, the increase of the effective seismic weight from the drifted snow and the equipment would require that the existing lateral load resisting system comply with the requirements of the Code for New Construction in the IBC and it would increase the demand-capacity ratio on certain structural elements of the existing lateral load resisting system.

2. WORK AREA COMPLIANCE METHOD

Level 3 Alterations
If the proposed structural alterations of the existing structure are less than 30 percent of the total floor and roof areas of the existing structure, we have to demonstrate that the altered structure complies with the loads applicable at the time of the original construction and that the seismic demand-capacity ratio is not increased by more than 10 percent on any existing structural element. Those structural elements whose seismic demand-capacity ratio is increased by more than 10 percent shall comply with reduced IBC level seismic forces. The percentage increase in seismic demand-capacity ratio on any particular structural element from the added snowdrift load against the proposed addition would be fairly low, thus, this would not have any major impact on the existing lateral load resisting system, though we would have to verify that the increase in seismic demand-capacity ratio on any of those particular structural elements is not greater than 10 percent.

If the proposed structural alterations of the existing structure exceed 30 percent of the total floor and roof areas of the existing structure, we have to demonstrate that the altered structure complies with the IBC for wind loading and with reduced IBC level seismic forces.

Existing anchorage of all unreinforced masonry walls have to be evaluated. If the existing anchorage of the walls is deficient, the tops of the masonry walls will require new connections to the structure.

Additions
The proposed additions will be designed structurally independent of the existing structure; thus, it would not impart any additional lateral loads on the existing structure.

Comment
The compliance requirements of the two methods, in most respects, are very similar. The Work Area Compliance Method would trigger anchorage of un-reinforced masonry walls, if re-roofing of the existing structure is included as part of the scope for this project. The Prescriptive Compliance Method would require that the existing lateral load resisting system meet the requirements of the code for new construction of the IBC, even for small increases of design lateral loads. We are required to comply with requirements of Appendix A1 of IEBC for either method, which requires anchorage of all existing masonry walls. Based on this, we would recommend the Work Area Compliance Method for the project.

Summary of Renovations to the Existing Structure
Based on the scope of the proposed scheme for renovations of the existing school, we have determined that the existing structure would essentially have to comply with the Code for New Construction which would require the addition of new lateral load resisting elements such as structural steel braced beams on masonry shear walls throughout the floor plates at every level. All of the un-reinforced masonry walls are required to be anchored to the floor and roof structure and all of the roof diaphragms have to be reinforced, to resist uplift loads per the Code for New Construction. The addition of braces will require modifications to the existing column foundations at the brace locations and will require the addition of new piles. At the locations of existing slabs-on-grade, new tie beams will be required to connect the existing column foundations.

Belmont High School
Belmont, Massachusetts

Structural Narrative
Option 2.1 - Renovations and Additions

Proposed Scheme for the Proposed Addition

SUBSTRUCTURE

FOUNDATIONS

Based on the construction of the existing school and the recommendations of the Geotechnical Engineer, the entire addition will be supported on pile foundations. The columns of the proposed structure would bear on 4 ft. – 0 in. deep reinforced concrete pile caps on structural steel piles. The exterior walls will be supported on 5 ft. – 0 in. deep grade beams spanning between pile caps with intermediate piles at 10 ft. – 0 in. on center. Based on an assumed pile capacity of 50 tons, a typical interior column in the four story classroom wings would be supported on 8 ft. – 0 in. x 8 ft. – 0 in. x 4 ft. 0 in. deep pile caps on a four pile group and a typical exterior column would be supported on 8 ft. – 0 in. x 8 ft. – 0 in. x 4 ft. 0 in. deep pile caps on a three pile group. The columns supporting the long span structure of the single story gymnasium, cafeteria, music spaces and other ancillary spaces would be supported on 8 ft. – 0 in. x 8 ft. – 0 in. x 4 ft. – 0 in. deep pile caps on three pile groups. In addition, the ground floor slab would be supported on single piles with a 2 ft. – 0 in. x 2 ft. – 0 in. x 2 ft. – 0 in. deep pile caps spaced out approximately 15 ft. – 0 in. (including interior and exterior pile caps supporting the columns.) All of the interior and exterior pile caps will be tied to the supported concrete slab.

SLAB ON GRADE

Based on the construction of the existing school and the recommendations of the Geotechnical Engineer, the lowest level of the proposed addition would be a 12 in. thick reinforced concrete slab reinforced with 6 psf reinforcing over a vapor barrier on 2 in. thick rigid insulation on compacted granular structural fill supported on piles.

SUPERSTRUCTURE

FLOOR CONSTRUCTION

Typical Floor Construction
A 5 ¼ in. light weight concrete composite metal deck slab reinforced with welded wire fabric on wide flange steel beams spanning between steel girders and columns. The weight of the structural steel is estimated to be 15 psf for the typical framing.

ROOF CONSTRUCTION

Typical Roof Construction
The roof construction would be galvanized, corrugated 1 ½ in. deep, Type 'B' metal roof deck spanning between wide flanged steel beams and girders. At locations of roof supported mechanical equipment, a concrete slab will be provided similar to the typical supported floor slab. The weight of the structural steel is estimated to be 13 psf.

Low Roof Structure above the Kitchen, Mechanical Room and the Utility Areas
The roof would be a continuation of the adjacent second floor and would be similar to the typical floor construction of 5 ¼ in. light weight concrete composite metal deck slab reinforced with welded wire fabric on wide flange steel beams spanning between steel girders and columns. This roof will be supporting the mechanical units. The units would be screened by a screen comprised of structural steel posts and beams. The weight of the structural steel is estimated to be 15 psf.

Alt. PE and Media Center Roof Framing
The roof construction would be acoustic, galvanized corrugated 3 in. deep, Type 'NA' metal roof deck spanning between long span metal joists and hollow structural steel columns. The weight of the structural steel is estimated to be 13 psf.

D. STRUCTURAL SYSTEMS - OPTION 2.1

VERTICAL FRAMING ELEMENTS

Columns
Columns would be hollow structural steel columns. Typical columns would be HSS 8 x 8 columns and the columns at the double story spaces at the Gymnasium and Lobby would be HSS 12 x 12.

Lateral Load-Resisting System
The proposed addition would be separated from the existing building by way of an expansion joint. The typical lateral load resisting system for the other parts of the school would be concentric steel braced frames comprised of hollow structural steel sections.

3.3.3 - FINAL EVALUATION OF ALTERNATIVES

E. SITE UTILITIES - OPTION 2.1

SITE UTILITIES

Storm Drainage

Stormwater from the site will continue to be directed to Clay Pit Pond. Outside of the existing stormwater outfalls into Clay Pit Pond it is expected that the entire stormwater system will have to be reconstructed so that the new stormwater system can effectively mitigate stormwater quality, rate and volumes from the project site. Runoff generated by the new parking and driveway areas would be collected in a catch-basin to manhole closed drainage system. Water quality from these areas would be addressed by directing those flows through Stormceptor water quality units (or similar). Volume and rates of stormwater from the site would then be addressed by directing these flows to subsurface infiltration systems located beneath the parking areas. The infiltration systems would consist of galleys of 36-inch perforated pipe in crushed stone bedding. Overflows from these infiltration systems would then be directed through the new closed drainage system to the existing outfalls to Clay Pit Pond.

Roof drainage from the building is not required to be treated for water quality, therefore it can be tied directly into the new closed drainage system prior to discharge from the existing outfalls. A portion of the roof drainage could be daylighted to a raingarden or stormwater demonstration area that is incorporated into the landscape design. This landscaped area would consist of an area with variable topography to direct the stormwater through it, plantings to provide treatment and nutrient uptake, walkways or boardwalks that allow students to observe the processes and possibly even hardscape stormwater features such as runnels or small falls to provide aeration.

The new and reconstructed athletic fields would have sub-drainage located below the topsoil layer, as is typical of turf field construction. The sub-drains can be connected directly into the new closed drainage system.

Sewer

This scheme does not appear to conflict with the existing sewer main which bisects the site, running west to east approximately under the sidewalk, adjacent to the existing access drive in front of the school. That existing sewer main would be maintained during construction, and new service connections from the new school would be connected to it. Lab waste flows would be directed through a pH neutralization system prior to connection to the sanitary sewer system. Flows from the cafeteria would be directed through a new, 10,000-gallon, external grease trap.

Water

It appears that portions of the new construction would conflict with the existing water main that is routed around the rear of the existing building. Approximately 2,000 linear feet of new 8-inch water main would be installed in the first phase of the construction, along the rear property line, out of the way of any future phases. New 4-inch domestic water and 6-inch fire services would be provided to the building from the new 8-inch main. Six new fire hydrants, located along the main, would also be provided as directed by the Belmont Fire Department

Natural Gas

The existing gas service conflicts with the proposed construction. A new gas service, located to the west of the proposed building would be provided from the existing gas main in Concord Avenue to the mechanical area located at the rear of the proposed building.

Electrical

Portions of the new construction conflict with the existing primary electric service. A new ductbanck consisting of four 4-inch, concrete encased conduits would be installed from the existing substation located just east of the site on Hittinger Street to the new electric room located to the rear of the proposed building.

PRELIMINARY PERMITTING CONSIDERATIONS

Wetlands Protection Act (310 CMR 10.00)

A Notice of Intent would need to be filed with the Town of Belmont Conservation Commission for any work within 100-feet of Clay Pit Pond. In addition, a Stormwater Pollution Prevention Plan (SWPPP) would need to be prepared and an application filed with the Environmental Protection Agency under the National Pollutions Discharge Elimination System (NPDES) program for the construction related activities. Erosion control measures will need to be installed and maintained in good working order around the perimeter of the site. Due to the phase nature of the construction, the perimeter controls will have to be re-installed several times over the duration of the project.

Flood Plain

Based on the Flood Insurance Rate Map (FIRM), Community

E. SITE UTILITIES - OPTION 2.1

Panel Number 25017C0418E dated June 4, 2010, the portions of the existing High School site are located within Zone X (Areas determined to be outside the 0.2% annual chance floodplain). There is no regulatory requirement for working within a Zone X. The Zone AE, which is associated with the 100-year flood area, is located in close proximity to the banks of Clay Pit Pond. None of the proposed building or any critical infrastructure is being proposed within the Zone AE.

3.3.3 - FINAL EVALUATION OF ALTERNATIVES

F. BUILDING SYSTEMS / PFP - OPTION 2.1

FIRE PROTECTION

A. General

1) A major renovation to the existing building, and a minor addition, will require a new sprinkler system to be installed.

B. To comply with current codes, this existing building and addition will require a complete sprinkler system installation per the Massachusetts State Building Code, Chapter 34. The Fire Protection system would be designed to meet the requirements of NFPA 13 "Installation of Sprinkler Systems" and Chapter 9 of the Massachusetts State Building Code, 780 CMR, "Fire Protection Systems".

C. A new dedicated 8" sprinkler service, connected to the town water system in the street, should be brought into the building. The exact entrance location will need to be coordinated with the Architect. As the sprinkler service enters the building a Massachusetts approved double check valve backflow preventer assembly, complete with OS&Y valves on the inlet and outlet, will be required.

D. The building will be protected by three types of sprinkler systems and each will protect the following areas:

- Wet sprinkler system – base building system
- Dry sprinkler system – to protect areas subject to freezing; i.e. loading docks and outdoor walkways covered by building overhangs, etc.
- Pre-action sprinkler system – to protect the MDF room

E. The alarm check valves for the wet and dry sprinkler systems will be installed on separate risers after the double check valve assembly in the water service entrance room. The alarm check valves will be complete with standard trim packages including pressure gauges, retard chamber, 2" main drain, water flow indicator and supervisory switches. The dry alarm valve will be supplied with an air compressor and associated appurtenances.

F. Fire protection piping main feeds to the fire protection systems from the alarm check valves will extend out to the building through the first-floor ceiling space. The piping will then extend to all areas of the building to provide complete sprinkler cover age throughout. Potential sprinkler zoning will be coordinated with any new fire wall layouts.

G. The fire protection design will include a combination standpipe system located in all egress stairways. These standpipes will feed the sprinkler system as well as provide a fire department hose connection at each level of the building.

H. The sprinkler system risers will feed the sprinkler system at each floor level. Each floor will be a separate zone. The floor control valve assembly at the riser that feeds each floor will contain a flow switch and tamper switch. An inspector's test connection will be installed on the floor control valve station. If the auditorium stage is greater than 1,000 square feet, fire department valves will be required on each side of the stage.

I. Sprinkler heads installed in gypsum or suspended ceilings will be glass bulb, quick response, chrome plated semi-recessed type. In areas without ceilings, brass upright sprinklers will be installed. Where upright sprinklers are subject to potential damage, such as in storage rooms, protective cages will be installed. In areas where it is not possible to run piping above the ceiling the use of sidewall sprinkler heads would be recommended.

J. The MDF room will be protected by a pre-action sprinkler system. A pre-action alarm valve with all required appurtenances will need to be located next to or near the MDF. Piping from this valve will extend into the room and connect to sprinkler heads. The piping system will be filled with compressed air. Once a sprinkler head activates, the air will discharge and open the pre-action alarm valve to allow water into the system and through the open sprinkler head.

K. Sprinkler piping for the system will be as follows:

- Piping 2" and smaller shall be schedule 40 black steel with cast iron fittings with threaded joints.
- Piping 2 ½" and larger shall be Schedule 10 black steel with malleable iron fittings with rolled grooved joints.
- Dry sprinkler systems will be supplied with Schedule 10 galvanized piping throughout.

F. BUILDING SYSTEMS / PFP - OPTION 2.1

L. All tamper and flow switches installed on the sprinkler system will be connected to the buildings fire alarm system. Each tamper and flow switch will be a dedicated point on the fire alarm system.

M. The exterior fire department connection for the sprinkler system will be a flush type mounted on the exterior of the building within 100' of a fire hydrant. The exact type of connection (storz or siamese) will be coordinated with the Belmont Fire Department. Final location and number of fire department connections will also be coordinated with the Belmont Fire Department.

N. The hydraulic requirements for the building will be as follows:

- Light Hazard - All offices, corridors and the auditorium hydraulically calculated to deliver 0.1 gpm per square foot over the most remote 1,500 square feet.
- Ordinary Hazard - All storage rooms and mechanical rooms hydraulically calculated to deliver 0.15 gpm per square foot over the most remote 1,500 square feet.
- Ordinary Hazard Group II - The stage area hydraulically calculated to deliver 0.2 gpm per square foot over the most remote 1,500 square feet.

PLUMBING

A. General

1) A major renovation to the existing building and a new addition would require that all existing plumbing systems be modified to comply with current codes.

2) All existing plumbing systems, or portions thereof, that were capable of remaining and being maintained should also be removed or modified to meet the requirements of any planned renovations.

3) All existing plumbing systems to be removed as part of the select building demolition should be removed back to the nearest point of connection of their respective system.

4) New above ground sanitary waste piping should be installed throughout remaining portions of the existing building to replace the existing older system that is currently in place.

5) New above ground domestic hot and cold water piping should be installed throughout remaining portions of the existing building to replace the existing older systems that are currently in place.

6) Install new waste outlets as required to accept HVAC condensate and sprinkler waste discharge.

B. Plumbing Fixtures

1) All water closets, urinals and lavatories in the existing building are old and not current water conserving type. Removal of all fixtures is required as the existing fixtures have reached the end of their serviceable life. Water closets should be replaced with new dual flush valve fixtures. A full flush will discharge at a rate of 1.6 gallons per flush (gpf). When only flushing liquid waste and paper, the reduced flush rate will be 1.1 gpf. Urinals should be replaced with 0.25 gpf fixtures. Lavatories should be replaced and new low-flow type faucets (0.5 gpm or less) added with temperature limit stops which will deliver water with a maximum temperature of 110°F. ADA requirements for fixture spacing, mounting heights and protection of any exposed piping will also need to be met during a renovation to the bathrooms.

2) The state plumbing code dictates the number of plumbing fixtures required in a building. Minimum plumbing fixture requirements will be determined once the total occupancy numbers for the building have been established based on the final plan layout.

C. Domestic Cold-Water System

1) The existing 6" domestic water line that enters the building is the original service to the building. Although the existing 6" domestic water service appears to be adequate to meet the current building water requirements, consideration should be given to replacing it with a new 6" dedicated domestic water service since a new 8" water service would also be brought in at this time to feed the new sprinkler system. The installation of a water meter on the new service will be provided to allow the town to be able to monitor water usage as may be required.

D. Domestic Hot Water System

1) The existing steam water heaters serving the larger portions of the building are original to the building and have passed their useful life expectancy. Also with the use

of these steam water heaters, the boilers are required to operate during the summer months to allow hot water to be created for the building. It is recommended to install new gas-fired storage type water heaters in the same locations as the existing. It is also recommended that redundant water heaters be included in the new system design. This would allow the system to continue to deliver hot water if one of the water heaters were to need service. The water heaters would be sized to provide hot water to all fixtures within the building.

2) The existing electric water heaters serving the various wings of the building are older and have passed their useful life expectancy. These should be removed. The new gas-fired water heaters should provide hot water to all fixtures that these units currently serve.

E. Sanitary Waste and Vent System

1) The sanitary system in the existing building appears to be in good condition but replacement may be required because of a possible fixture count change and probable relocation of fixtures in the renovation plan. Any new piping would connect to the existing waste and vent piping at a convenient point to be determined by further investigation.

F. Storm Drainage

1) The existing building roof drainage appears to be in good condition and no replacement is required. The roof itself appears to be in good condition and leaks around the roof drains themselves have not been reported.

2) New roof drains and storm water piping system will need to be added to the new addition. Discharge of the storm water will be coordinated with the civil engineer.

3) Backwater valves should be installed on all interior storm system piping originating from roof drains on lower roof sections as per the state plumbing code.

G. Natural Gas System

1) Currently the existing gas service is more than adequate to meet the school's demand requirements. Gas piping should be reconfigured to serve all mechanical equipment that will require gas. Any new gas-fired kitchen equipment can be connected to the new capped gas service located just outside of the building near the kitchen.

H. Insulation

1) The pipe insulation that currently exists should be tested to determine the extent of any hazardous materials. The insulation should be removed and replaced with new fiberglass insulation with an all service jacket. Domestic water and horizontal storm drainage piping that is not currently insulated should have new insulation installed.

2) Insulation will also need to be provided on waste piping and water piping below handicapped lavatories and sinks.

I. Hose Bibbs and Wall Hydrants

1) During any renovation done to the building the existing hose bibbs in the toilet rooms should be removed and new wall mounted hose bibbs with an integral vacuum breaker and removable tee handle installed. In the new addition, hose bibbs will be provided in all bathrooms and mechanical spaces. New wall hydrants will be provided on the exterior of the building and their locations coordinated with the architect.

J. Cross Connection Control

1) The existing hose bibbs and wall hydrants do not have backflow prevention devices. Backflow devices should be integral to all new hose bibbs and wall hydrants installed during the renovation.

2) All service sink faucets installed during a renovation and in the new addition will also be supplied with integral vacuum breakers.

3) A new reduced pressure backflow preventer assembly should also be installed on the existing 6" domestic water service (or on a new service if this is the preferred option) to further protect the town's domestic water system.

K. Boys, Girls and Pool Locker Room/Shower Areas

1) All locker room/shower areas should be completely renovated. Floor drains within any new shower stalls should be arranged so that the water from one shower does not enter the adjacent shower area. New shower valves should be installed with code compliant shower heads. Master mixing valves should be installed at each shower location. Valves shall be provided with limiting

stops set to a maximum water temperature delivery of 112°F.

2) All plumbing fixtures will be replaced as discussed in the "Plumbing Fixture" section of this report.

L. Kitchen

1) If kitchen renovations include the addition of new or replaced gas-fired equipment this equipment can be connected to the new gas service located outside the building as noted above.

2) Any new gas equipment would be fed by gas piping connecting to a master shut-off valve that would be interconnected with the kitchen hood and exhaust system. Gas would only operate when the kitchen hood exhaust system is operating.

3) Additional floor sinks and/or floor drains would be added to any new equipment design to ensure proper drainage throughout the kitchen.

4) A new three-compartment sink with new grease trap should be included per state code requirements.

5) A new dishwasher with accompanying grease trap should also be provided per state code requirements.

6) A new exterior grease trap, located underground, outside of the kitchen portion of the building will also need to be considered as part of any new design or renovation to the kitchen. Venting of this exterior grease trap should enter back into the school building and exit to the atmosphere above the roof.

M. Science Wing

1) The lab waste system should be removed in its entirety and replaced with a new polypropylene acid resistant piping system that empties into a central acid neutralization tank and system. This system would balance the pH of the lab waste and then safely discharge it into the regular sanitary waste system before it connects back to the town's sanitary waste system.

2) The existing hot and cold water systems serving the science wing should also be removed in their entirety. New protected hot and cold water systems should be created to serve the renovated science wing by installing reduced pressure backflow preventers on the hot and cold water piping designated to serve this area.

3) New gas piping to each science classroom should feed an emergency shut-off valve located in a valve box on the wall near the classroom exit door. Piping from this valve would then feed any gas turrets within that classroom only.

4) New emergency showers and eyewashes should be installed in each science classroom. A new tempered water system should be created to serve these fixtures. A new gas-fired water heater should be installed somewhere within the science wing and be dedicated to the new tempered water system. Water should be stored at 140°F and a master mixing valve should be mounted nearby and set to deliver tempered water to this wing at approximately 70°F-90°F per state plumbing code requirements. A tempered water return system will also be required to keep this system from becoming stagnant per state plumbing code requirements as well.

N. Pipe Materials

1) Below grade sanitary and storm drainage piping will be service weight bell and spigot cast iron with neoprene gasketed joints. Above grade sanitary and storm piping will be service weight hubless cast iron with Massachusetts approved stainless steel and neoprene no-hub connector assemblies.

2) All water supply and return piping shall be Type "L" copper.

3) All water supply and return piping insulation shall be in accordance with the Energy Code.

4) All gas piping will be threaded black steel piping up to 2 ½" size. Piping 3" and larger shall be welded.

3.3.3 - FINAL EVALUATION OF ALTERNATIVES

F. BUILDING SYSTEMS / HVAC - OPTION 2.1

BELMONT HIGH SCHOOL

HEATING, VENTILATING, AND AIR CONDITIONING

MAJOR RENOVATION / MINOR ADDITION / C.2.1

A. General:

1. This description applies to the Major Renovation / Minor Addition option (C.2.1) where large parts of the existing building remain. The existing boiler room and main electrical room also remain. New construction is built in three major phases from west to east with the existing building largely remaining in operation initially and then newly renovated parts of the building being phased in after the initial phase is complete.

2. The recommended HVAC systems assume that the existing windows will be replaced and the walls and roof areas to remain will be insulated to meet or exceed the MA energy code.

3. Heating, air conditioning and ventilation systems shall be high-efficiency systems that allow for the ability towards achieving a Net Zero Energy facility.

B. Ground Loop Geo-Exchange System:

1. A vertical borehole well field area consisting of (400) 6-inch diameter boreholes spaced 20 feet apart shall be provided. Each borehole shall be 375 to 450 feet deep. Actual depth to be determined based on thermal conductivity testing performed on a test well. The number of boreholes may be increased or decreased based on thermal testing results and/or determination of the final heating and cooling loads.

2. Provide a 1-1/4 inch supply and return pipe within each borehole with a U-bend at the bottom. Piping shall be high density polyethylene (HDPE) with DR9 wall thickness. Polyethylene pipe and fittings shall be heat fused by butt, socket, sidewall, or electrofusion in accordance with pipe manufacturer's procedures. Underground supply and return piping from boreholes shall collect to four buried circuit vaults constructed of HDPE or concrete. Supply and return circuit piping in each vault shall combine to 8 inch main header piping which shall be routed into the building.

3. Steel sleeve casings shall be provided for the upper section of each borehole down to bedrock. Each borehole shall be filled with a bentonite based thermally enhanced grout mixture.

C. Central Heating and Cooling System:

1. Central geothermal heating and cooling shall be provided by four high efficiency 300 ton (approx. nominal capacity) heat recovery chiller-heaters or (40) 30 ton modular chiller-heaters connected to the ground loop system.

2. The ground loop circulation system shall be filled with 25% propylene glycol solution and shall be served by three 1000 GPM pumps with variable frequency drives.

3. Chiller-heater condenser water shall be constant flow primary with zero pressure bypass connections to the ground loop distribution and the building heating distribution. There shall be three primary condenser water pumps at 1,000 GPM each.

4. Secondary condenser/heating pumps shall be variable flow with variable frequency drives. There shall be three secondary heating pumps at 1,000 GPM each.

5. Chilled water distribution from chiller evaporators to building distribution shall be variable primary flow with three 750 GPM pumps.

6. The building circulation loop shall consist of a four-pipe distribution. The main distribution to heating/cooling terminal units in the building shall be four-pipe. Rooftop air handling units, heat recovery air handling units, and central air handling units shall be two-pipe configuration.

7. The building loop piping system shall contain a 25% propylene glycol solution for freeze protection and corrosion protection.

8. The building terminal heating units will be designed to utilize low temperature heating supply water (130°F maximum). Heating terminal units such as fin tube radiation and heating coils may require larger surface areas due to the low water temperature. In areas with high heating loads, two-row fin-tube and heating coils may be required.

D. Exterior Classrooms - Induction Units with Displacement:

1. The system serving heating, cooling and ventilation for typical exterior classrooms shall utilize four-pipe floor mounted chilled beam induction units with displacement supply air. Four 5 ft. long units shall be provided for each typical classroom mounted along the exterior wall. Units shall be served by two 7-inch diameter primary ventilation supply air ducts.

2. The primary supply air serving each classroom shall be provided with a modulating supply air volume control terminal to control supply air when the room is occupied.

3. Systems will be interfaced to the local space vacancy sensor to reduce ventilation air and reset the space cooling and heating set point temperatures when the room is unoccupied.

4. A carbon dioxide sampling sensing system will be provided in classrooms to provide monitoring and occupied control of ventilation air.

E. Interior Classrooms and Other Spaces – Ceiling Induction Units:

1. Interior classrooms and other interior occupied spaces will be served with ventilation supply air from a rooftop heat recovery ventilation unit connected to ceiling mounted chilled beam induction terminals. Induction terminals shall be provided with four-pipe supply and return water connections.

2. Individual classrooms shall be provided with a supply air volume control terminal to control ventilation air when the room is occupied. A carbon dioxide sampling sensing system shall be provided for classrooms to monitor and control ventilation air.

F. Classroom and Interior Ventilation Systems:

1. Outside ventilation air for classrooms and interior spaces will be provided by roof mounted dedicated outside air heat recovery units (HRU).

2. The HRU's will be variable air volume and will include supply and exhaust fans with variable frequency drives, total energy recovery wheels and secondary sensible reheat wheels to allow for a low level of dehumidification control. The units will be provided with two-pipe dual temperature water connections to a single combination pre-heat and cooling coil. Changeover between hot water and chilled water supply shall be provided with the use of changeover valves connected to the hot water and chilled water systems. Each unit shall include 100% recirculation dampers for morning warm-up mode and after-hours night setback heating.

4. Variable supply air will be based on demand from classrooms and interior spaces. Return/exhaust air shall be controlled by air flow measurement and tracking of the supply and exhaust air with limited volume control terminals in the exhaust air system.

5. Corridors will be provided with ventilation air from the HRU system. Air quantities in excess of basic ventilation requirements will be provided for building exhaust makeup air as required. Corridors will not be fully air conditioned with the exception of areas that have direct solar loads.

G. Existing Gymnasium:

1. The existing heating and ventilating units in the gym shall be replaced with new HVAC units in Phase 02. The units shall include a hydronic coil for heating and cooling using hot water and chilled water. Units shall also include a heat recovery section with an enthalpy wheel for outdoor air heat recovery meeting the requirements of the MA energy code due to the level of outdoor air required.

2. Two units shall be provided, which shall be located indoors or outdoors depending on structural and architectural requirements. Units be provided with a round ductwork distribution exposed within the space.

3. The units shall be provided with variable frequency drives for the supply and return fans to reduce the fan speed during times of low demand. Supply, return, and outside air flow measurement and control shall be provided.

4. Provide a new H&V unit with plate heat exchanger to serve the existing locker rooms.

H. Existing Swimming Pool:

1. The existing heating and ventilating unit serving the pool shall be replaced with a new H&V unit in Phase 02. The unit shall include a hydronic coil for heating using hot water. The unit shall also include an air-to-air flat plate heat exchanger for exhaust air sensible heat recovery.

2. The pool deck exhaust system shall remain, but the existing exterior mounted exhaust fan shall be relocated to the roof due to the Phase 02 construction. Exhaust duct shall be extended up through the building in a ne duct shaft.

3. Provide a new H&V unit with flat plate heat exchanger to serve the new locker rooms.

I. Miscellaneous Areas:

1. All normally occupied areas will be air conditioned except for corridors, the kitchen, and culinary classrooms with kitchen hoods (if applicable). The kitchen and culinary areas are partially tempered by using transfer air from the commons for make-up air.

2. The Auditorium, Stage, Media Center, Cafeteria, and Administration areas, will be served by rooftop air conditioning units (RTU). Separate occupancy scheduling for each unit will provide operational flexibility.

3. Rooftop air conditioning units (RTU) will include supply fan, return fan, hot water heating coil, chilled water cooling coil, filters, and variable frequency drives. Units serving Administration, Media Center, Band/Chorus, and the Cafeteria will be variable air volume (VAV) with local variable air volume boxes for zone temperature control.

4. The Auditorium and Gymnasium units will be single zone with a variable frequency drive to modulate the supply air during periods of low demand and occupancy.

5. The Auditorium, Gymnasium, Cafeteria, and Media Center systems will be provided with space carbon dioxide (CO_2) sensors to provide modulation of outside air based on occupancy demand.

6. Areas such as the Cafeteria, Black Box, parts of the Media Center, main lobby and open group learning spaces may alternatively be provided with a radiant floor cooling and heating system. System shall include connections to the hot water and chilled water piping, circulation pumps, circuit headers, controls, and under-slab PEX piping distribution.

J. Building Management System (BMS):

1. Provide direct digital control (DDC) BMS with local and unitary controls and web interface for remote access, alarms, and monitoring of all HVAC equipment in the building including; chillers, pumps, heat recovery units, rooftop units, fans and terminal units shall be controlled and mapped to a central monitoring station. System shall be based on the Niagara Framework open protocol for interoperability between manufacturers.

2. BMS system shall be interfaced to the building electrical and gas sub-meters. Daily, weekly, and annual energy use shall be reported for each meter.

K. Carbon Dioxide Sensing System:

1. Provide an Aircuity, or equal, carbon dioxide air sampling and sensing system consisting of room sensors, cabling, tubing, room probes, air routers, and vacuum pumps.

2. Air tubing from room sensors shall be collected through air routers to sensing stations.

3. The system shall include an information management system and shall be integration with the building management system.

4. Building management system input shall provide control input for modulating supply air terminal units or automatic dampers.

L. Electrical and BTU Metering:

1. Electrical metering shall be provided for collection of historical and real-time performance data. Separate meter groups shall be provided for the upper school areas and lower school areas consisting of meters for the measurement of lighting and plug loads for each classroom group by wing, floor or classroom type.

2. Individual metering of lighting and plug loads shall be provided for the Kitchen, Media Center, Auditorium/Stage, Gymnasium, and Administration areas.

3. Electrical metering shall be provided for each air handling system, central system pumps (by each group type), and each chiller-heater.

4. Provide BTU metering of chilled water, hot water, ground loop circulation systems and domestic hot water system.

M. Phasing Considerations:

1. Construction of the new facility is in three major phases (Phases 02, 04 and 06). Phase 02 of construction allows for the existing building to remain occupied, while a large part of the new construction is completed. Therefore, the existing boiler room must remain active and the new chiller-heater plant must be constructed to support the new construction in several phases.

room in the first phase to provide space for the new equipment. One of the steam boilers may also be phased out and demolished in this first phase.

2. Installation of the entire geothermal borehole field may be accomplished in Phase 02. The entire array may be installed in the area to the west of the building including the soccer and baseball fields, parking and drive lanes.

3. At least one steam boiler must remain active until at least the start of Phase 05 to provide continued steam service to the Auditorium and surrounding areas. An active steam supply and condensate return line to the Auditorium end of the building must be maintained through Phase 04.

4. The existing gym and pool areas will be renovated in Phase 02, including replacement and upgrade of the existing HVAC equipment.

5. Completion of the new central chiller-heater plant construction may begin in Phase 05 with the removal of the remainder of the existing boiler plant.

F. BUILDING SYSTEMS / Electrical - OPTION 2.1

Belmont High School

ELECTRICAL

2.1 Major Renovation / Minor Addition

A. Existing Electric Services:

1. Based on the proposed renovation/addition scope to maintain the Field House and Pool, existing services will be required to be maintained to deal with construction phasing and maintaining existing systems while renovations and new additions are completed.

2. The intent is that upon completion, there will be new services throughout the entire renovated facility and new additions.

3. The Main Electric Room housing the main electric switchboard is located adjacent the Boiler Room, these rooms are located at the northwest corner of the facility adjacent the Fieldhouse.

4. Scope will include maintaining and/or providing new feeders to existing panelboards and mechanical equipment to be kept operational during renovation and new construction.

5. Coordinate with Utility Company for the relocation of any utility poles and overhead pole lines associated with new construction and scheduled demolition of the existing school building.

6. All existing services shall be maintained for the complete operation of existing school building until the scheduled date of demolition of the existing building. Upon substantial completion, coordinate with the respective utility company and include all work required for the removal of all existing utility services that become abandoned including power, telephone, cable TV, and fire alarm services.

7. Include the removal of all existing roadway, parking, and walkway lighting structures. At the scheduled time of demolition of the existing buildings include disconnecting all services and making safe the existing structure for complete demolition.

8. Include maintaining the operation of existing site equipment such as irrigation pumps. Provide new services to all equipment affected by new construction.

B. New Main Electric Service:

1. A new primary service will be provided from utility company primary services via an underground ductbank and manhole system to a new utility company pad mounted transformer.

2. Secondary service from the new pad mounted transformer will be underground to a new main switchboard at 480/277V, 3-phase, 4-wire. Switchboard will be located in a new main electric room.

3.3.3 - FINAL EVALUATION OF ALTERNATIVES

F. BUILDING SYSTEMS / Electrical - OPTION 2.1

C. New Normal Distribution System:

1. Main switchboard will be provided with surge protection (SPD) and ground fault protection on main and feeder devices.

2. Surge protection will be provided in all 120/208V panelboards.

D. New Emergency Distribution System:

1. Natural gas/diesel (fuel source to be determined) emergency generator will power emergency egress lighting and exit lighting in corridors, assembly areas, and stairwells. Miscellaneous systems to include the following:

   a. Kitchen walk-in coolers and freezers.

   b. Telephone system.

   c. Security system.

   d. District and school IT head-end equipment (located in the MDF Room).

   e. Cooling equipment for school and district IT equipment.

   f. Fire alarm system.

   g. Circulator pumps and controls.

2. Separate automatic transfer switches shall be provided for emergency and non-emergency loads.

3. In addition to the equipment and systems listed above, the following equipment and systems will be fed from the generator.

   a. Additional lighting in Gymnasium, Cafeteria, Kitchen, and associated toilets and corridors.

   b. HVAC ventilation equipment (no air-conditioning) associated with the Gymnasium, Cafeteria, Kitchen, and associated toilets and corridors.

   c. Receptacles in Gymnasium and Cafeteria.

4. Generator will be ground mounted at the exterior of the building in a self-contained sound attenuated enclosure with an integral base mounted fuel tank (if diesel). Generator will be mounted on an elevated concrete platform for survivability.

5. Emergency panels will be located in new two-hour rated electric closets.

6. Non-emergency (standby) loads will be located in separate closets via separate automatic transfer switch and panelboards.

7. Emergency feeders run outside two-hour electric rooms and shafts and not in or under floor slab will utilize MI Cables.

8. A portable generator connection will be provided to meet National Electric Code Article 700 requirements to have a portable generator available while servicing the building generator.

E. Sustainable Design Intent LEED 4.0:

1. Sustainable Design Intent compliance will include:

a. Advanced measurement and verification of air conditioning, fans, lighting, and receptacle power via electronic sub-meters equal to E-Mon, D-Mon Class 2000 3-phase kWh and demand meters. Measurement and verification metering will be monitored by the Building Management System (BMS).

b. Plug and process load reductions through the use of vacancy/occupancy sensor controls for local convenience outlets in classrooms, offices, library and resource rooms. Open areas such as Media Center, Auditorium and Kitchen will be equipped with relay panels controlled via the lighting control system, to reduce loads on a time schedule basis.

c. Advanced lighting controls include a low voltage lighting control system with time schedule control for common areas, vacancy/occupancy sensors, and photocells for daylight harvesting.

d. Empty conduit provisions will be provided for future green vehicles charger stations based on two percent of the available parking.

e. Empty conduits and space provisions will be provided for photovoltaic (PV) installations. Include conduits and space provisions for inverters at a minimum of three locations on Level 3 and/or Level 4 electric closets.

F. Lighting:

1. New luminaires will be provided throughout all renovated areas as well as new construction. Luminaires will be dimmable LED. All luminaires will be suitable for respective utility rebate incentives.

2. Exterior building mounted around the entire building including all canopies, all entry drives, parking areas, and all walkways will be full cutoff LED type. All exterior lighting will be controlled via the building low voltage lighting control system.

3. Athletic field lighting will be provided at the Softball and Baseball fields.

G. Lighting Controls:

1. A low voltage lighting control system will be provided for common areas such as corridors and other areas not controlled by occupancy sensors.

2. Manual low voltage override switches to override the time of day lighting control schedules shall be provided. Override switches will permit extension of lighting control program as well as ON-OFF override for exiting the facility.

3. Lighting program for time of day schedules shall permit all lighting, including exterior to be turned off during non-occupied hours, reducing sky glow and light trespass. Activation of either fire alarm or intrusion detection system shall override the lighting program.

4. Vacancy and occupancy sensors will control lighting in most spaces including classrooms, offices, and utility type spaces. In addition, all spaces will be provided with local low voltage dimmable switching.

5. Daylight harvesting will be employed in all perimeter classrooms, offices, and other spaces with substantial daylight utilizing daylight sensors in each space.

H. Auditorium:

1. A professional theatrical lighting system will be provided.

I. Convenience Power:

1. Safety type duplex receptacles will be provided throughout the building in quantities to suit space programming.

2. Plug load reduction will be achieved by vacancy/occupancy sensors in classrooms, offices, and staff spaces, and circuits routed via relay panels, controlled via lighting control system time schedule for open areas such as Commons/Café, Kitchen and culinary areas.

J. Fire Alarm:

1. Existing automatic, fully supervised, analog addressable, voice evacuation system will be maintained and utilized where applicable.

   a. Manual pull stations (with tamperproof covers if applicable), at points of egress, and other locations as required to meet code.

   b. Audible/visual units in corridors, classrooms, and throughout the building to meet code.

   c. Visual only units in conference rooms, meeting rooms and small toilets.

   d. Smoke detectors in corridors, stairwells, electric, and telecommunications rooms, elevator lobbies, and elevator machine rooms.

   e. Smoke duct detectors in HVAC units over 2,000 CFM, and within five feet of smoke dampers including connections to all smoke/fire dampers.

   f. Connections to all Fire Protection devices and Kitchen hood.

   g. Connections to audio/visual systems, sound systems, and dimmed lighting controls.

   h. Remote annunciator at main entrance and secondary entrances as directed by Belmont Fire Department.

   i. 24 VDC magnetic hold open devices at smoke doors.

   j. Master box and exterior beacon (quantity of beacons per Belmont Fire Department.

   k. Wiring will be fire alarm MC cable.

K. Technology per Technology Section.

F. BUILDING SYSTEMS / Electrical - OPTION 2.1

L. Integrated Intrusion, Access Control, CCTV, and Alarm System:

1. Intrusion alarm system will provide magnetic switches on perimeter doors, motion sensors in all perimeter rooms on first floor with susceptible access from grade. Motion sensors will be provided in first, second, and third floor corridors. System will have secure-access zoning. Zoning will be provided to suit all proposed off hours usage including community programs.

2. CCTV coverage will be provided at main and secondary entries as well as all other perimeter entries to be used by students and staff on a daily basis and for off hours community programs, including Gymnasium and Cafeteria entries.

3. Exterior CCTV coverage will be provided to cover the entire perimeter of the building.

4. Access control via card access system will be provided at all exterior doors.

5. CCTV system will be IP based with minimal 30 day recording capacity. System will be web based to allow viewing by Belmont Police Department.

3.3.3 - FINAL EVALUATION OF ALTERNATIVES

F. BUILDING SYSTEMS / Information Technology - OPTION 2.1

Structured Cabling System:

The School Department is responsible for the fiber network for both the schools and the Town (including the light department and TV Studio). The fiber network handles general data as well as Phone (VoIP) and security for the school district and the Town. There are three centralization points for the fiber – the high school, Chenery Middle School, and the Town Library. Internet services and wireless controllers in the existing high school MDF provide connectivity at all the school facilities and the Town. These systems must remain operational during construction. Therefore, the MDF and the existing district fiber must be protected during construction.

A new MDF will be created. The MDF will be the central location of all head end equipment including but not limited to servers, storage, switch electronics, security equipment, video equipment, telephone system, public address system and security system. It will be a dedicated space with proper ventilation, environmental treatment and emergency power. The new MDF will be built-out and cutover during an early phase of construction. The district fiber will be re-routed or extended to the new MDF location. Existing Telco lines, which terminate in the Main Office area will need to be protected and re-routed or extended. Temporary cabling and services may be necessary to maintain functionality of existing systems during demo work.

New IDFs will be created. The IDF locations will serve as intermediate closets for local cabling and equipment. The IDFs will be dedicated spaces with proper ventilation, environmental treatment and emergency power. Each closet will connect to the MDF with backbone cabling. IDFs will be built-out and come on line in conjunction with construction phasing. Existing IDFs will be brought offline in conjunction with construction phasing. Temporary cabling and services may be necessary to maintain functionality of existing systems during demo work.

Equipment racks will be installed in the MDF and IDFs for patch panels and network hardware. Two-post and four-post racks will be provided. Racks will be 19" EIA floor mount racks with wide floor mounting flanges, vertical cables guides and horizontal cable managers. Power for rack equipment will be installed in cable tray above the racks. Power will consist of both 20A and 30A twist-lock receptacles.

The existing Category 5 horizontal cabling will be replaced. The new data cabling infrastructure will be based on a Category 6A, or most up to date standard at the time of bid. The data channel will be comprised of the passive components including cabling, connectors, patch panel port, and patch cords capable of supporting 10 Gigabit per second networking. Category 6A data cabling will be provided to all equipment requiring data and voice connectivity, including but not limited to data outlets, voice outlets, video surveillance cameras, access control network connections, and other related equipment. This cabling will support computer network requirements, wireless connectivity, telephone system (VoIP) and IP-based security needs. Cabling will terminate in the MDF or one of the IDFs. Temporary cabling may be necessary to maintain functionality of existing systems during demo work.

The existing fiber backbone within the school will be replaced. The new fiber backbone will connect the MDF and all IDFs. It will consist of twelve strands of multi-mode and six strands of single-mode fiber optic cables. All multimode fiber optic cables will use multimode, graded-index fibers with 50-micron cores only. Fiber will be laser-enhanced and guaranteed for transmission distances in 10 Gigabit Ethernet of up to 500 Meters. All single-mode fiber optic cables will be OS2, tight buffered, high flexibility. Temporary cabling and services may be necessary to maintain functionality of existing systems during demo work.

Data and Voice Communication Systems:

Updated networking hardware will be provided for the MDF and IDFs consisting of network switch electronics for the data and voice communication systems, distributed communication system, audio-video communication system, security system, wireless LAN and other Owner equipment. Components will consist of PoE+ chassis and power supplies, 10/100/1000 PoE+ modules, fiber transceivers, patch cables and UPS equipment. The switches will be fully configured according to network requirements and VLANs will be created according to best practice and equipment requirements. Backbone will be 10Gb minimum.

Updated VoIP server and hardware will be provided. The existing NEC 8300 will be upgraded to the 9300 platform, or current standard at the time of bid. Several elementary schools in the district depend on the existing VoIP system for connectivity, so it must remain operational during

F. BUILDING SYSTEMS / Information Technology - OPTION 2.1

construction. The new system must be compatible with existing VoIP equipment in the district.

Audio/Visual Communication System

Digital signage will be provided in gathering areas and large group instruction spaces. The system will consist of LED displays, media players, and a server or cloud based digital signage solution.

Classrooms and general instruction spaces will be equipped with a local audio system consisting of ceiling speaker, amplification, wireless microphones and auxiliary inputs. There will be an input available for FM assistive listening systems.

Distributed Communication System

The existing Simplex Building Communication System will be replaced with a new system. The new system should be built-out with the new MDF during an early phase of construction so that newly renovated or constructed areas can come online. The new distributed communication system will consist of a fully operational IP platform public address system for district and school internal communications system incorporating school safety notifications and general communications. It will provide complete internal communications using state of the art IP technology with two-way loud speaker internal communication, bell event notification, emergency announcements that will override any pre-programmed zones assuring that all emergency/lockdown announcements are heard at all locations, and atomic time synchronization. The system will connect directly to the high school's LAN and have the future capability of expanding to connect to other intercom systems in the school district over the WAN for district-wide, emergency, and live voice announcements in the future (additional hardware will be required at the other school facilities for this feature). Configuration of zoning, bell schedules, calendars, and emergency sequences will be accomplished using a browser-based interface.

3.3.3 - FINAL EVALUATION OF ALTERNATIVES

F. BUILDING SYSTEMS / Audiovisual - OPTION 2.1

ACENTECH

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BELMONT HIGH SCHOOL FEASIBILITY STUDY
AUDIOVISUAL SYSTEMS, OPTION C.2.1

SUBMITTED TO: PERKINS + WILL

CONSULTANT: ACENTECH

JANUARY 23, 2018

ACENTECH PROJECT NO. 629341

We visited Belmont High School on August 28, 2017 with the school and the entire design team to assess the existing conditions at the school. The following are our comments related to the audiovisual systems for the school.

BACKGROUND

Acentech is an independent consulting firm specializing in architectural acoustics, noise and vibration control, and the design of advanced sound, audiovisual, multimedia, and videoconferencing systems. In order to provide unbiased consulting and design services, Acentech does not sell or install equipment and does not represent any dealer, distributor, or manufacturer.

ROOM SCHEDULE

Unless otherwise noted, the focus of this project is limited to the following spaces and/or systems.

- Auditorium
- Music Classrooms
- Cafeteria
- Entry Hall
- Classrooms (including Art Classrooms)
- Lecture Hall (aka Little Theater)
- Book Rooms
- Gymnasium

EXISTING CONDITION EVALUATION

During our site visit, the existing audiovisual systems were reviewed. In general, the technology being used in the school is outdated and does not support current standards. Additionally, there did not appear to be consistency in the system components from room to room. Standardization is generally desirable so that technical staff can more easily troubleshoot and correct any problems with the systems, and also so that they can stock common replacement parts (such as projector lenses and filters).

Consistency from system to system also allows them to be easier for the end users. If an end user needs to use the audiovisual system in a space that they do not typically use, the user can feel comfortable and confident that they will understand how to use the system in that room since it will be exactly the same as the one they typically use.

In all of the classrooms that we observed, the video projection systems included analog video (VGA) connections, but not digital video (HDMI). Analog video systems are rapidly being phased out. Fewer source devices support this connectivity, and the cost to support the older technology is increasing due to low supply of the components needed to support this. While some adapters allow users to connect digital video sources

to analog displays (projectors and video display panels), the adapters are not reliable and do not always work.

Portable assistive listening systems were observed in some classrooms. These portable systems ("Redcat Lightspeed") are generally used for speech amplification. They do not typically connect to the audiovisual systems. In spaces with installed amplified sound systems, assistive listening systems are required in order to comply with the ADA (Americans with Disabilities Act). Further information about this requirement is listed later in this report.

It did not appear that audiovisual control system interfaces were used in most of the systems we observed. A control system interface (either as a touch screen control panel, or a button panel) will make the audiovisual system easier to use for the end user. The controls will always be available and in the same location (will not need to look for remote controls that can easily be lost).

The existing audiovisual equipment rack for the Auditorium is located on the downstage left corner. It is located next to electrical equipment and lighting dimmer racks. Unless the dimmer racks are using newer technologies, locating these racks in close proximity to one another should be avoided. Electrical "noise" (RF) from the lighting dimmers can create interference and create audible hum or buzz in the sound system.

Finally, current audiovisual system technologies allow the systems to connect to the data network. This allows the systems to automatically alert technicians about problems. For example, a system can alert a technician when a video projector's lamp has been used for a set number of hours. This allows the technician to know ahead of time that the lamp will need to be replaced soon, and give them time to order replacement parts before the lamp no longer works.

BUDGET SUMMARY

This report describes the functionality of the proposed audiovisual systems and does not include cost estimates. A programming meeting with key users is recommended to confirm the features described in this report, and a more accurate narrative and budget can be developed to cover this. Please note that audiovisual technology cost estimates do not cover construction items traditionally carried in the mechanical and electrical engineers' budgets. These items include, but are not limited to, conduit, junction boxes, structural supports, electrical power, and data network cabling.

TOTAL COST OF OWNERSHIP

The total cost of ownership of the audiovisual systems, in addition to the installation costs of the systems, includes several on-going costs:

Support Staff Costs:
The increase in the use of audiovisual systems carries with it the need to provide additional support for the users of the systems. This is balanced by network tools that allow support staff to work more efficiently. Specifically, the network-based management software will allow the staff to turn systems on and off, verify the operation of the equipment, schedule events for automatic operation, and receive automatic notification of system failures, projector lamp replacement, etc., without visiting the room. Without a detailed study of the current and anticipated support staff requirements, it is not possible to predict the staffing costs following the completion of the project; however, AV system management software is key to minimizing the support staff costs.

AV System Service:
The installation contract should require the installing contractor to provide a service contract for all systems for an additional three years beyond the initial one-year P&L warranty. The cost of a service contract for the period following the expiration of the initial contract is likely to be approximately 10% of the cost of the initial installation per year. In addition, there will be charges associated with the actual repair of equipment that may fail during the life of the service contract.

Equipment Replacement:

The useful life of audiovisual system equipment varies with the type of equipment. In general, the useful life of most AV equipment is 5 - 10 years. Replacing individual items of equipment will be necessary during the life of the systems. Complete upgrades of the systems may be appropriate after ten years, as much because of the progress of technology and because of equipment usable life.

INFRASTRUCTURE VS. EQUIPMENT

The distinction between infrastructure and equipment must be emphasized: Infrastructure is part of the building construction including, but not limited to, conduit, raceways, junction and device boxes, and is not outlined in this program. Other infrastructure provisions, such as electrical power and grounding specified exclusively for audiovisual systems cabling and equipment may be required and should be carried in the electrical budget. Properly designed AV infrastructure allows for not only the installation of the initially specified equipment, but for the evolution of the systems over many years. If proper infrastructure is provided, additional capabilities and equipment can be added later as technology progresses.

Equipment refers to the devices that can be connected through the infrastructure. Equipment includes microphones, loudspeakers, mixers, signal processing gear, video projectors, flat panel displays, cameras, AV control systems, equipment racks, and many other devices that comprise an AV system. One thing is certain – equipment will change over the life of the room as user needs and technology change. For this reason, infrastructure is the key to the long-term success of a thoughtfully conceived AV design project because it governs what can and cannot be easily installed in the future.

EQUIPMENT NOTES AND DEFINITIONS

This program is not a technical specification and is insufficient to bid or build an AV system. Except where useful to illustrate a standard of performance or a specific user requirement, equipment manufacturers and model numbers are not used.

- Permanently installed refers to equipment that is part of the room systems and cannot easily be removed for use elsewhere.
- Portable refers to equipment that is available for connection at one or more locations, but is not hard-wired to the system. Portable equipment can be disconnected by the user or technical personnel and stored or used with systems elsewhere in the facility.
- Future Provisions refers to equipment that may be purchased and used or installed at a future date.
- Options refer to equipment or systems that are not at this point considered to be central to the needs of the Owner but may be chosen if desired. Optional equipment is not included in the budget estimate totals.
- OFE (Owner Furnished Equipment) refers to equipment that is either already owned by the Owner, or may be purchased in the future as needs arise. FBO (Furnished by Others), or “by others” refers to any service or equipment (e.g. lighting) required but not a part of the AV system design or installation.

SYSTEM CLASSIFICATIONS:

Presentation Systems

Presentation systems are the source, routing, and display devices that provide highly intelligible communication of speech, music, information, and graphics to groups of people. This includes equipment such as microphones, loudspeakers, video projectors, plasma displays, computers, and the interfacing, mixing, routing, and control equipment that connects these devices together and allows the user to select the appropriate sources and operate the system.

Assistive Listening Systems

Permanently installed Assistive Listening Systems (ALS) are required by the ADA (Americans with Disabilities Act), a 1990 federal law that forbids discrimination against persons who are handicapped. A 2010 revision states, “In each assembly area where audible communication is integral to the use of the space, an assistive listening system shall be provided” in the following quantities and versions:

Receivers for Assistive Listening Systems		
Capacity of Seating in Assembly Area	**Minimum Number of Required Receivers**	**Minimum Number of Required Receivers Required to be Hearing-aid Compatible**
50 or less	2	2
51 to 200	2, plus 1 per 25 seats over 50 seats[1]	2
201 to 500	2, plus 1 per 25 seats over 50 seats[1]	1 per 4 receivers*
501 to 1000	20, plus 1 per 33 seats over 500 seats[1]	1 per 4 receivers*
1001 to 2000	35, plus 1 per 50 seats over 1000 seats[1]	1 per 4 receivers*
2001 and over1	55 plus 1 per 100 seats over 2000 seats[1]	1 per 4 receivers*
		1 "Or Fraction thereof"

The term "assembly area" includes facilities used for entertainment, educational, or civic gatherings. Additionally, courtrooms are required to support Assistive Listening systems regardless of whether or not an installed sound system exists.

Audiovisual Control System

Audiovisual (AV) control systems are required to centralize the operation of the various functions of the AV system. This includes environmental controls such as lighting presets and shade and drape controls, as well as audiovisual functions such as system and projector power, source device selection and media transport controls, audio volume controls, and many other operational functions identified by the design team before the equipment is installed.

Advanced functions of the AV control system may include multi-level password protection for system operation to prevent unauthorized use, control of automatic system shut-down sequences (to reduce unnecessary wear and tear), and a help system interface for user experiencing technical problems (see below).

Remote Management

Permanently-installed AV control systems can be connected to the Owner LAN to enable remote control and diagnostics of the AV systems. An asset management hardware / software suite allows monitoring and operation of AV systems via the Owner's LAN. These products allow technical personnel to operate audiovisual systems in remote locations from any computer with a web browser. The features of remote management systems include:

- Real-time monitoring of system status, including notification of imminent problems in certain devices before they fail.
- Mobile management.
- A method of asset management by tracking equipment usage in real time.
- Will integrate with other control system hardware/software.

Video Conferencing/Distance Learning

Videoconferencing equipment (HD CODECs, software codecs, cameras, echo cancellers, telephone interfaces and related devices) is equipment specifically designed to transmit and receive audio and video signals over local and wide area networks. This capability is not currently planned for this project.

Broadcast Systems
Broadcast quality equipment and systems generally refer to audio and video devices (cameras, recorders, and editing equipment) of the highest quality, specifically designed for the recording, editing, and production at the commercial level, such as in network television studios. Broadcast equipment is an order of magnitude more expensive than “professional” quality equipment, and is not planned for this project.

PROPOSED AUDIOVISUAL SYSTEM DESCRIPTIONS

AUDITORIUM
The auditorium will be used for live music and theater performances, multimedia presentations with audio and video, lectures, and panel discussion. It is anticipated that the following will be required:

Sound System
- Microphones:
    - Wired Microphones: The system will include a stereo microphone that is hung in the room and used for audio recordings. Another microphone will be permanently installed over the stage/performance area and used for backstage monitoring. A gooseneck microphone will be provided for connection to a lectern (lectern, by others). Connections for wired microphones will be available at the sides of the stage, above the stage performance area, and along the side walls of the seating area.
    - Wireless Microphones: The system will include 4 wireless microphone systems. Each will include an interchangeable handheld and lavalier (clip-on) microphone transmitter.
- Audio Mixers: The system will operate in one of two microphone mixing modes; automatic or manual. These modes will be selectable from a control panel.
    - Automatic Microphone Mixing Mode: This mode will allow an end-user to simply connect a microphone to the system at one of multiple designated microphone receptacle locations. Master volume control will be accessible from the control panels. This will be the system's default setting and will be used for presentations, movies, and lectures.
    - Manual Microphone Mixing Mode: For events when more complex operation of the sound system is required, the automatic microphone-mixing can be bypassed and the system can be run by a trained operator. Volume levels of microphones and other audio playback sources will be controlled from a 32-channel digital mixing console; providing a flexible variety of audio outputs that can be used for special effects, recording, and speech reinforcement. The mixing console will be permanently located at a "tech position" within the house. The mixing location will require ample space for operation of the console and other items such as scripts required for rehearsals or performances. The mixing console will connect to the IT network and will have the capability of being controlled from an Owner-furnished tablet computer (such as an Apple iPad) that is connected via Wi-Fi to the same IT network.
- Audio Recorder: An audio recorder will used for recording events from the stereo microphone. The recorder will be capable of connecting to the IT network and can upload recorded audio tracks to another computer or server. The USB connection will allow recordings to be transferred to a thumb drive.
- Audio Signal Processing: A digital audio signal processor will be used for automatic microphone mixing, and equalizing the loudspeakers. The signal processor will be expandable so that, if required, additional input and output capacity can be added to the system in the future.
- Production Communications: A two-channel intercom system will be used for communication between production crew members at control locations, and the backstage spaces. AV connection panels within the performance space will include receptacles for the connection of intercom belt-packs. Wall-mounted speaker stations will be located in the music classrooms and other backstage spaces. The system will be provided with eight dual-channel belt-packs, headsets, and cables.
- Loudspeakers:

  - Installed Auditorium System: The loudspeaker system will provide uniform audio coverage through the audience area allowing the system to provide high levels of speech intelligibility and musical clarity.
  - The loudspeaker configuration will consist of a central loudspeaker cluster above and in-line with the primary stage area. It will be used for speech reinforcement and playback of audio. Supplementary "delay" loudspeakers will be provided to cover the rear seating areas. Front-fill loudspeakers will be used in the stage apron. Subwoofers will also be provided. Left and right loudspeakers will be used for stereo audio playback, and for sound effects; which can be panned across the left, center, and right loudspeakers. Amplifiers will be provided to power the loudspeakers.
  - Control Room: A pair of wall-mounted loudspeakers will be installed in the Control Booth and will be used by technicians in the booth to monitoring audio from the stage performance/event. Amplifiers will be provided to power the loudspeakers.
  - Portable: Four portable self-powered loudspeakers will be provided for use on stage as "wedge" monitor loudspeakers. These loudspeakers can also be used in the house or on stage as sound effects speakers. Additionally, the loudspeakers will slant for use as a "wedge" or fold back monitor loudspeaker for use on stage.
  - Backstage and Front of House: In addition to the Auditorium's loudspeakers, ceiling-mounted loudspeakers will be provided in backstage areas, dressing rooms, etc. for audio monitoring (for cues, etc.). Amplifiers will be provided to power the loudspeakers.
- Assistive Listening System: An FM-based wireless assistive listening system will be included to meet the requirements of the Americans with Disabilities Act. Portable receivers (i.e., headphones) will be stored centrally and issued to participants as required. These receivers are intended to be used by patrons with hearing impairments.

Display System

- Video Projector: The system will display computer and motion video using a high brightness video projector with appropriate lens. The projector will be installed at the rear of the Auditorium in the control booth.
- Projection Screen: A motorized video projection screen with a high-contrast screen material will hang from above the stage.
- AV Sources: AV sources will include an Owner-furnished computer. Inputs for portable AV devices, such as a laptop computer or portable audio player, will be available at three locations (one on one side of the stage, one at the in-house audio mix location, and one in the Control Booth).
- Video Cameras: A high-definition video camera with integral pan/tilt head will be installed in the Theater. In addition, a night vision camera will also be provided for viewing of dark scenes. The cameras will be used to feed images of events in the space to backstage and front-of-house areas with video displays. Control of the cameras will be via presets on the touchscreen control panel.
- Video Routing and Processing: A matrix type switcher will be used to route video and audio sources to the displays and sound system. This will include video signal transmitters and receivers that are needed to send digital video signals longer distances. It will support playback and distribution of digital and analog video formats and the transport system will be compatible with newer generation 4K sources. Fiber optic transmitter outputs will be provided to send signals to the backstage areas with video displays, such as the Music Classrooms.

System Control

The control system will be used to simplify the operation of the audiovisual system by unifying the operation under one platform and user interface. The user interface will consist of three 10" LCD touch screens (one at the side of the stage, one at the in-house audio mix location, and one in the Control Booth). The control panels will be able to control all functions of the audiovisual system; including source selection and media transport controls, volume control, and can interface with other operational functions including lighting and HVAC.

Miscellaneous

Miscellaneous equipment will include a floor-standing and lockable equipment rack(s), AC power distribution, and sequencers in the racks, custom connection panels at the stage/performance area and

house mix position, audio press feed connections to locations within the room, and all cable, connectors, and additional hardware and labeling required to install the system.

MUSIC CLASSROOMS

The Music Classrooms will include the Band Room and Chorus Room. These spaces will be used for musical instruction and rehearsal for choir, jazz band, orchestra, and band groups. Each audiovisual system will comprise the following sub-systems:

Sound System

- Microphones: A stereo microphone will be provided and will hang from the ceiling. This microphone will tie into the AV system and can be used for recording performances.
- Audio Signal Processing: A digital audio signal processor will be used for signal routing and equalizing the loudspeakers.
- Audio Recording: A network USB/SD audio recorder will be provided.
- Loudspeakers: Wall-mounted loudspeakers will be wall-mounted at the front of the room for program audio playback. Amplifiers will be provided to power the loudspeakers.
- Assistive Listening System: An FM-based wireless assistive listening system will be included to meet the requirements of the Americans with Disabilities Act. Portable receivers (i.e., headphones) will be stored centrally and issued to participants as required. These receivers are intended to be used by patrons with hearing impairments.

Display System

- Video Projector: The system will display computer and motion video using short-throw, 3,300 ANSI lumen video projectors (1280 x 800 WXGA resolution). The projectors will be installed on the wall above the whiteboard/projection screens in each room (whiteboard material to be provided by Others). Note that the whiteboard material should be of a projection quality and should not create reflections or hot spots from the projector.
- AV Sources: AV sources will include connectivity for an Owner-furnished computer. Inputs for portable AV devices, such as a laptop computer or portable audio player, will be available at locations at the front of the room. An overflow audio and video feed from the Auditorium will also be provided.
- Video Routing and Processing: A matrix type switcher will be used to route video and audio sources to the display and sound system. This will include video signal transmitters and receivers that are needed to send digital video signals longer distances. It will support playback and distribution of digital and analog video formats and the transport system will be compatible with newer generation 4K sources.

System Control

The control system will be used to simplify the operation of the audiovisual system by unifying the operation under one platform and user interface. The user interface will consist of a 7”LCD touch screen at the presentation area. The control panel will be able to control all functions of the audiovisual system; including source selection and media transport controls, and volume control. Control system processing will be embedded in the video matrix switch.

Miscellaneous

Miscellaneous equipment will include a floor-standing and lockable equipment rack, AC power distribution and sequencers in the racks, custom connection panels, and all cable, connectors, and additional hardware and labeling required to install the system.

CAFETERIA

The Cafeteria will include seating for a large number of students. An audiovisual system will be provided for lectures and will serve as an area to view and hear overflow AV feeds from the Auditorium. The audiovisual system will comprise the following sub-systems:

Sound System

- Microphones:

  - Wired Microphones: Connections for wired microphones will be available.
  - Wireless Microphones: The system will include a wireless microphone system. This will include lavalier (clip-on) microphone transmitter.
- Audio Signal Processing: A digital audio signal processor will be used for automatic microphone mixing and equalizing the loudspeakers.
- Loudspeakers: The loudspeaker configuration will consist of distributed ceiling-mounted loudspeakers and will be used for program audio and speech reinforcement. Amplifiers will be provided to power the loudspeakers.
- Assistive Listening System: An FM-based wireless assistive listening system will be included to meet the requirements of the Americans with Disabilities Act. Portable receivers (i.e., headphones) will be stored centrally and issued to participants as required. These receivers are intended to be used by patrons with hearing impairments.

Video System

- Video Displays: Two wall-mounted video display panels will be provided to display computer and motion video. These can be used for digital signage with owner provided PC, local AV presentations, or overflow video feeds from the auditorium.
- AV Sources: Inputs for portable AV devices, such as a laptop computer or portable audio player, will be available at one location in the Cafeteria area.
- Video Routing and Processing: A matrix type switcher will be used to route video and audio sources to the display and sound system. This will include video signal transmitters and receivers that are needed to send digital video signals longer distances. It will support playback and distribution of digital and analog video formats and the transport system will be compatible with newer generation 4K sources.

System Control

The control system will be used to simplify the operation of the audiovisual system by unifying the operation under one platform and user interface. The user interface will consist of a 7” LCD touch screen. The control panel will be able to control all functions of the audiovisual system; including source selection and media transport controls, and volume control.

Miscellaneous

Miscellaneous equipment will include a floor-standing and lockable equipment rack, AC power distribution and sequencers in the racks, custom connection panels, and all cable, connectors, and additional hardware and labeling required to install the system.

ENTRY HALL

The Entry Hall is a public area where large murals are hung. A digital video wall will be used to display electronic artwork, and can also be used to display other images and announcements. The audiovisual system will comprise of the following sub-systems:

Display System:

- Video Display: The system will display computer and motion video using a wall-mounted video wall consisting of nine (9) x 55" video display panels arranged in a 3 x 3 grid. The overall image size will be approximately 81" high x 143.5" wide.
- AV Sources: Inputs for portable AV devices, such as a laptop computer, will be available at a wall-mounted receptacle panel in the main office area of the school. An Owner-furnished computer will connect to the system.
- Video Routing: A switcher will be used to route video and audio sources to the display and sound system. This will include video signal transmitters and receivers that are needed to send digital video signals longer distances. The video routing equipment will be compliant with newer generation digital video sources (4K).

System Control:

The control system will be used to simplify the operation of the audiovisual system by unifying the operation under one platform and user interface. The user interface will consist of a wall-mounted 7” LCD

touch screen. It will be able to control all functions of the audiovisual system; including source selection and media transport controls.

Miscellaneous:
Miscellaneous equipment will include an equipment rack, AC power distribution and sequencing, custom connection panels, and all cable, connectors, and additional hardware and labeling that are required to install the system.

CLASSROOMS
The classrooms (including the art classrooms) will be used for lectures and presentations. The audiovisual systems will each comprise of the following sub-systems:

Sound System
- Loudspeakers: A pair of wall-mounted loudspeakers will be used for program audio playback. Amplifiers will be provided to power the loudspeakers.
- Assistive Listening System: An infrared-based wireless assistive listening system will be included to meet the requirements of the Americans with Disabilities Act. Portable receivers (i.e., headphones) will be stored centrally and issued to participants as required. These receivers are intended to be used by patrons with hearing impairments.

Display System
- Video Projector: The system will display computer and motion video using a wall-mounted short-throw video projector (1920 x 1200 WUXGA minimum resolution). The projector will display content on a wall-mounted white board suitable for projection (white board, by Others).
- AV Sources: AV sources will include inputs for portable AV devices, such as a laptop computer or portable audio player. It will be available at the front of the room on a wall-mounted receptacle panel.

System Control
The control system will be used to simplify the operation of the audiovisual system by unifying the operation under one platform and user interface. The user interface will consist of a wall-mounted button panel. It will be able to control all functions of the audiovisual system; including source selection, volume control, and power.

Miscellaneous
Miscellaneous equipment will include custom connection panels, and all cable, connectors, and additional hardware and labeling required to install the system.

LECTURE HALL (AKA LITTLE THEATER)
The Lecture Hall will be used for multimedia presentations with audio and video, lectures, panel discussions, and community events.

Sound System
- Microphones:
  - Wired Microphones: A gooseneck and handheld microphone will be provided for connection to a lectern (lectern, by others). Connections for additional wired microphones will be available.
  - Wireless Microphones: The system will include a wireless microphone system. The system will include handheld and lavalier (clip-on) microphone transmitters.
- Audio Signal Processing: A digital audio signal processor will be used for automatic microphone mixing and equalizing the loudspeakers.
- Loudspeakers: Loudspeakers will be provided for speech reinforcement and audio playback. Amplifiers will be provided to power the loudspeakers.
- Assistive Listening System: An FM-based wireless assistive listening system will be included to meet the requirements of the Americans with Disabilities Act. Portable receivers (i.e., headphones) will be

stored centrally and issued to participants as required. These receivers are intended to be used by patrons with hearing impairments.

Display System:

- Video Projector: The system will display computer and motion video using a high-brightness video projector (1920 x 1200 WUXGA minimum resolution).
- Projection Screen: A motorized video projection screen with a high-contrast screen material will hang from the presentation wall.
- AV Sources: AV sources will an Owner-furnished computer. Inputs for portable AV devices, such as a laptop computer or portable audio player, will be available at two locations at the front of the room.
- Video Cameras: One high-definition video camera with integral pan/tilt head will be installed in the Lecture Hall on the rear wall. Control of the camera will be via presets on the touchscreen control panel.
- Video Routing and Processing: A matrix type switcher will be used to route video and audio sources to the display and sound system. This will include video signal transmitters and receivers that are needed to send digital video signals longer distances. It will support playback and distribution of digital and analog video formats and the transport system will be compatible with newer generation 4K sources.

System Control

The control system will be used to simplify the operation of the audiovisual system by unifying the operation under one platform and user interface. The user interface will consist of a 10" LCD touch screen at the presentation area. The control panel will be able to control all functions of the audiovisual system; including source selection and media transport controls, volume control, and can interface with other operational functions including lighting and HVAC. Control system processing will be embedded in the video matrix switch.

Miscellaneous

Miscellaneous equipment will include a floor-standing and lockable equipment rack, AC power distribution and sequencers in the racks, custom connection panels, and all cable, connectors, and additional hardware and labeling required to install the system.

Book Rooms

The Book Rooms will be used for workgroups and tutorial sessions. The audiovisual systems will each comprise of the following sub-systems:

Sound System

- Loudspeakers: A pair of wall-mounted loudspeakers will be used for program audio playback. Amplifiers will be provided to power the loudspeakers.
- Assistive Listening System: An infrared-based wireless assistive listening system will be included to meet the requirements of the Americans with Disabilities Act. Portable receivers (i.e., headphones) will be stored centrally and issued to participants as required. These receivers are intended to be used by patrons with hearing impairments.

Display System

- Video Display Panel: The system will display computer and motion video using a wall-mounted video display panel.
- AV Sources: AV sources will include inputs for portable AV devices, such as a laptop computer or portable audio player. It will be available at the front of the room on a wall-mounted receptacle panel.

System Control

The control system will be used to simplify the operation of the audiovisual system by unifying the operation under one platform and user interface. The user interface will consist of a wall-mounted button panel. It will be able to control all functions of the audiovisual system; including source selection, volume control, and power.

Miscellaneous
Miscellaneous equipment will include custom connection panels, and all cable, connectors, and additional hardware and labeling required to install the system.

GYMNASIUM
The Gymnasium will be used for practice, large games, presentations, and events. The audiovisual system will comprise of a number of sub-systems that include the following:

Sound System
- Microphones: The system will include one wireless handheld microphone transmitter. Connections for wired microphones will be available at wall-mounted receptacle panels and on a portable equipment rack.
- Audio Processing and Mixing: A digital audio signal processor will be used for automatic microphone mixing, and equalizing the loudspeakers. An 8-channel audio mixer in the portable equipment rack will be used to mix microphones and other audio sources.
- Loudspeakers: Distributed ceiling-mounted loudspeakers will be provided for speech reinforcement and program audio playback. Loudspeakers will be zoned so that they can be used over the entire Gymnasium floor, or over the individual courts (please note that we not anticipate sufficient acoustical isolation between the courts, and it is not recommended to use the two courts simultaneously for different audio playback or reinforcement). For larger events and games, additional loudspeakers will be used to provide coverage to the bleacher seating area. Amplifiers will be used to power the loudspeakers.
- Assistive Listening System: An FM or infrared based wireless assistive listening system will be included to meet the requirements of the Americans with Disabilities Act. Portable receivers, intended for use by patrons with hearing impairments, will be stored centrally and issued to participants as required. Inductive neck loop adapters will be provided along with the receivers for compatibility with telecoil-enabled hearing aids.

System Control
The control system will be used to simplify the operation of the audiovisual system by unifying the operation under one platform and user interface. The user interface will consist of one wall-mounted 5” LCD touch screen, and an additional 5” LCD touch screen in the portable equipment rack. The control panel will be able to control all functions of the audiovisual system; including source selection and media transport controls, and volume control.

Miscellaneous:
Miscellaneous equipment will include a floor-standing and lockable equipment rack, a portable equipment rack for use during events and games, AC power distribution and sequencers in the rack(s), custom connection panels, and all cable, connectors, and additional hardware and labeling required to install the system.

ARCHITECTURAL, MECHANICAL, AND ELECTRICAL CONSIDERATIONS

1. Architectural: The following items should be considered for proper coordination between audiovisual system components and other trades:
   a. Loudspeaker coverage must not be obstructed.
   b. Structure will be necessary to ensure that loudspeakers and the projection screen can be ceiling-mounted at recommended locations.
   c. Antennas for the assistive listening system and wireless microphones will be mounted on the wall.
   d. Wall-mounted connection panel locations will require coordination.
   e. Ceiling-mounted video projectors must be free from vibration.
2. AV Equipment Racks:
   a. Equipment racks will require coordination for space and cooling/airflow requirements. This will include floor-standing equipment racks, and any small equipment racks that may be installed within millwork.

i. Floor-standing AV equipment racks shall be fixed in position and will require front access for day-to-day operational needs. They will also require rear access for service. Clearances must be maintained around the AV equipment racks (36") to comply with the requirements of the Americans with Disabilities Act.
ii. AV equipment rack rooms may require oversized doors.

3. Auditorium Mixing Console:
   a. The Control Booth's mixing position will require ample space for operation of the console and other items such as scripts required for rehearsals or performances. The audio console is 48" wide by 36" deep.
   b. Control Booth:
      i. Please note the following guidelines:
         1. Coordination will be required with the acoustical consultant to maintain proper acoustical isolation between the Auditorium and the Control Booth.
         2. The glass in front of the video projector should be low iron. It should also be tilted between 2 and 5 degrees. Coordinate direction of tilt with the acoustical consultant.
4. Video Projection:
   a. In order to optimize the viewing experience and achieve the minimum recommended video display contrast ratio, ambient lighting within the spaces with projection will need to be reviewed. Additionally, overhead lighting should be zoned so that lighting areas directly above the projection screen surfaces can be switched off during presentations.
   b. Whiteboards & marker boards that are used as a projection surfaces shall be of projection quality so that they minimize reflections and projection hotspots.
5. Blocking will be required at all wall-mounted video display panel and loudspeaker locations.
6. Mechanical/Electrical: The following items should be considered for proper coordination between the audiovisual system components and other trades:
   a. The AC power system will be designed and specified by the electrical engineer and will include a dedicated power panel, transient voltage surge suppression, and AC outlets.
   b. Electrical outlets will be required at the equipment racks, mix location floor-box, and wall-mounted receptacle panels.
   c. IT data drops are strongly recommended at the equipment racks and all AV receptacle panels.
   d. If lighting control is desired from the audiovisual system control touch panel, the lighting system will require an interface for communication with the control system.
   e. Equipment Rack Locations:
      i. AC power requirements and heat loads will need to be considered at each equipment rack and video projector location.

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End of Feasibility Study