

ANALYSIS & PROGRAMMING III

ASSUMPTIONS & METHODOLOGIES

ASSUMPTIONS

The following assumptions were used as the basis for analysis in this study. These assumptions were derived through information provided by the District and through meetings and dialogue with principals and the Working Group.

- Class Size Guidelines
 - o Kindergarten through 3rd Grade = 18 to 22 Students
 - o 4th and 5th Grade = 20 to 24 Students
 - o 6th-8th "Reasonable" = 20 to 24 students for purposes of the study arithmetic
 - o District's preference is to maintain class sizes within these guidelines.

Repurposing of Space

- o In the elementary schools, calculations assume spaces currently dedicated to specials like Art, Music, STEAM, Technology, and World Languages would remain or return to those dedicated functions. The sizing of new elementary school projects would assume enough general classroom spaces across the district to allow those specials to have dedicated space. Master plan calculations, however, assume that specials that haven't had dedicated space historically would still not have dedicated space in the future.
- Spaces currently dedicated to Special Education functions may not be considered as targets to be repurposed into general classrooms. Calculations will assume appropriate and dedicated space for special education spaces in each elementary school across the district.

Master Plan Level Programming

O Programming for this study was based largely on general classroom counts at the elementary grades, overall teaching station counts at the middle grades, and capacity analyses. Individual space summaries were not prepared for each school in every master plan scenario. However, theoretical space summaries were prepared for potential projects resulting from the exploration of new grade configurations. For example, the Design Team relied on MSBA space summary templates to determine the approximate size of a project that would house grades 6th-8th in a single facility.

Redistricting

 The study did not explore alterations to the existing elementary school catchment area boundaries. However, the study took a wholistic view of the elementary schools to see if redistricting "around the edges" could be a strategy to alleviate perceived and/or emerging overcrowding in specific areas of town.

Utilization Rates at the Middle Grades

- Daily school schedules for middle school grades are often more complex than at elementary schools. They are often based on whether or not instructional spaces are "owned" by teachers, on the middle school model of being "onteam" versus "off-team", and based on offering the widest range of specials and electives possible. This often results in inefficient utilization of space.
- Observed utilization rates for the High Rock School differ from those at Pollard Middle School.
- Calculations to determine capacity and to size potential projects assume utilization rates of either 67% (Current Pollard Utilization Rate), 71% (Current High Rock Utilization Rate), 75% (Rate based on students occupying instructional spaces 6 of 8 periods per day, or 85% (Rate based on MSBA guidelines).

Enrollment Forecasts

- McKibben Demographic Research, LLC prepared three enrollment forecast scenarios: Low, Best, and High.
- Dore + Whitter analyzed all three scenarios to determine space needs but relied mostly on the Best scenario when preparing master plan scenarios.

METHODOLOGIES

In order to understand the capacity of each facility and the impact of the enrollment forecast on space, Dore + Whittier performed several calculations. With many of these calculations, the objective was to establish the boundary conditions so that the District could understand how changing one or more independent variable impacted the dependent variable. Dore + Whittier's methodology for performing those calculations is detailed below.

Elementary Building Capacity

Number of Existing Grade Level Classrooms X Minimum Allowable Class Size for Each Grade Level

4 Kindergarten x 18	4 Kindergarten x 22
+ 4 1 st Grade x 18	+ 4 1 st Grade x 22
+ 4 2 nd Grade x 18	+ 4 2 nd Grade x 22
+ 4 3 rd Grade x 18	+ 4 3 rd Grade x 22
+ 4 4 th Grade x 20	+ 4 4 th Grade x 24
<u>+ 4 5th Grade x 20</u>	<u>+ 4 5th Grade x 24</u>
448 Student Capacity	544 Student Capacity

Elementary School Theoretical Classroom Count Need

Total Forecasted Enrollment by Grade ÷ Minimum Allowable Class Size for Each Grade Level

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100 Kindergartners \div 18 Students per Classroom = 5.55 Sections = 6 Sections Needed 100 Kindergartners \div 22 Students per Classroom = 4.55 Sections = 5 Sections Needed
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Elementary School Theoretical Classroom Size

Total Forecasted Enrollment by Grade + Bounding Number of Sections per Grade

90 Kindergartners ÷ 4 Sections = 22.50 Students per Section = 22 in 2 sections, 23 in 2 sections 90 Kindergartners ÷ 5 Sections = 18.00 Students per Section

Total District-wide Elementary School Classroom Need

Sum of the Enrollment Forecast for Kindergarten through 3^{rd} Grade \div 20 Students per Classroom + Sum of the Enrollment Forecast for 4^{th} and 5^{th} Grade \div 22 Students per Classroom

Perform this calculation for each year of the enrollment forecast and identify the minimum and maximum classroom count needs.

Middle Grades Building Capacity

Number of Existing Teaching Stations X Midpoint of Allowable Class Size (22) x Current Utilization Rate (71%)

Number of Existing Teaching Stations X Midpoint of Allowable Class Size (22) x Proposed Utilization Rate (75%)

ENROLLMENT PROJECTIONS AND ANALYSIS

MCKIBBEN ASSOCIATES: DISTRICT-WIDE POPULATION AND ENROLLMENT FORECASTS, DECEMBER 2019

In the summer of 2019, Needham Public Schools hired McKibben Demographic Research, LLC to prepare a population and enrollment forecast for the district. The study documents the demographic characteristics of the Town of Needham and presents three enrollment forecast scenarios based on different predictions for changes to the median age of the population and the expected impact of both housing stock turnover and development of new rental units in town. A copy of the complete report is provided in the appendices. In the executive summary, McKibben writes:

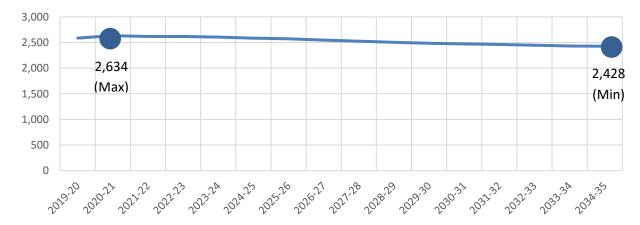
- The resident total fertility rate for Needham Public Schools over the 15-year life of the forecasts is below replacement level. (1.82vs. The theoretical replacement level of 2.1).
- 2. Most in-migration to the district continues to occur in the 0-to-9 and 30-to-44 year old age groups.
- 3. The local 18-to-24 year old population continues to leave the district, going to college or moving to other urbanized areas.

 This population group accounts for the largest segment of the district's out migration flow. The second largest out flow is the 70+ age group, which are downsizing their homes and leaving the district
- 4. The primary factors causing the district's enrollment to rise and then stabilize over the next 15 years is the number of empty nest households (home owners age 70+) "turning over" compared to the number of homes (homeowners age 50-59) that become empty nest each year.
- 5. Changes in year-to-year enrollment over the next five years will primarily be due to the size of the grade cohorts entering and moving through the school system in conjunction with the size of the cohorts leaving the system.
- 6. The elementary enrollment will begin a slight decline after the 2025-26 school year in all three scenarios. This will be due primarily to the fact that the rising 5th grade cohorts will be greater the 440 in size while the incoming grade cohorts will decline slightly.
- 7. In the Low scenario, the median age of the population will increase from 42.9 in 2010 to 43.4in 2035. In the Best scenario, the median age of the population will increase from 42.9 in 2010

- to 43.5in 2035. In the High scenario, the median age of the population will decrease from 42.0 in 2010 to 42.8in 2035.
- 8. Even if the district continues to have some of annual new home construction (particularly if that construction is rental units), the rate, magnitude and price of existing home sales will become the increasingly dominant factor affecting the amount of population and enrollment change.
- 9. In the **Low scenario**, total district enrollment is forecasted to increase by 178 students, or 3.1%, between 2019-20 and 2024-25. Total enrollment is forecasted to decrease by 124 students, or-2.1%, from 2024-25 to 2029-30.The total enrollment is forecasted to decline by 66 students, or-1.1%, from 2029-30 to 2034-35.
- 10. In the **Best scenario**, total district enrollment is forecasted to increase by 182students, or 3.2%, between 2019-20 and 2024-25. Total enrollment is forecasted to decrease by 116 students, or2.0%, from 2024-25 to 2029-30.The total enrollment is forecasted to decline by 77 students, or-1.3%, from 2029-30 to 2034-35.
- 11. In the **High scenario**, total district enrollment is forecasted to increase by 182 students, or 3.2%, between 2019-20 and 2024-25. Total enrollment is forecasted to decrease by 59students, or-1.0%, from 2024-25 to 2029-30.The total enrollment is forecasted to decline by 57students, or-1.0%, from 2029-30 to 2034-35.

FORECASTS AND ANALYSIS FOR GRADES K-5TH

K-5 Total Forecast, Best



The following table summarizes the projected classroom need for grades K-5th over the course of the 'best' scenario enrollment forecast. There are currently four modular classroom spaces at Mitchell that are excluded in the existing classroom count and three classroom spaces, (one at Eliot, one at Broadmeadow, and one at Newman) that have been repurposed into classrooms from other functions that are also excluded from the existing classroom count.

District-Wide Classroom Need - 'Best' Enrollment Forecast Scenario

	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35
Total Classroom Need @ Minimum Students/ Classroom	139	141	141	140	140	139	138	137	135	134	133	133	132	132	130	130
Total Classroom Need @ Midpoint Students/ Classroom	125	127	127	127	126	125	124	124	122	121	121	120	119	119	117	117
Total Classroom Need @ Maximum Students/ Classroom	114	116	115	115	115	115	114	112	111	111	109	109	108	108	107	107
Total Available Classrooms*	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116
Surplus Classrooms @ Maximum Students/ Classroom	2	0	1	1	1	1	2	4	5	5	7	7	8	8	9	9

^{*} Does not include four modular classrooms at Mitchell or three classrooms that have been repurposed into general classrooms (one at Broadmeadow, one at Eliot, and one at Newman).

This high level analysis suggests that even if the three spaces that have been repurposed into classrooms were converted back to their specialized function, the District could accommodate the entirety of the K-5th 'best' scenario enrollment forecast within the existing classrooms AND stay within the district's class size guidelines by redistricting around the edges.

District Wide Classroom No.	ad 'Uiah	Envallment	Foreget Ce	anaria
District-Wide Classroom Ne	eu – nigii	Enronnent	rorecast sc	enario

	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35
Total Classroom Need @ Minimum Students/ Classroom	139	141	141	140	140	139	138	138	137	137	135	136	135	133	132	132
Total Classroom Need @ Midpoint Students/ Classroom	125	127	127	127	126	125	125	124	124	123	122	123	122	120	119	119
Total Classroom Need @ Maximum Students/ Classroom	114	116	115	115	115	115	114	113	113	112	112	111	111	110	109	108
Total Available Classrooms*	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116
Surplus Classrooms @ Maximum Students/ Classroom	2	0	1	1	1	1	2	3	3	4	4	5	5	6	7	8

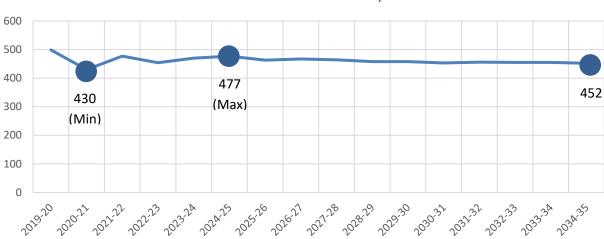
^{*} Does not include four modular classrooms at Mitchell or three classrooms that have been repurposed into general classrooms (one at Broadmeadow, one at Eliot, and one at Newman).

This high level analysis suggests that even in the 'high' enrollment forecast scenario, the District would only need to continue the current repurposing of three spaces into classrooms to accommodate the enrollment forecast to stay within the District's class size guidelines.

While these analyses suggest it is possible to accommodate the entirety of the enrollment projection within the existing classroom count and remain within the District's class size guidelines, this analysis also suggests that doing so will require all classrooms across the District to be at the maximum end of the class size guidelines leaving little to no room for flexibility to accommodate deviations in the enrollment forecast. It may be in the District's best interest to plan for a total of 126 general classrooms across the District to allow all classes to be at the approximate mid-point of the class size guideline to provide this level of flexibility.

FORECASTS AND ANALYSIS FOR GRADES 6TH-8TH

McKibben projected 6th grade independent of grades 7th and 8th based on the current grade configuration. However, since some of the master plan scenarios explore the possibility of grades 6th,7th, and 8th in a single facility, Dore + Whittier has also combined those forecasts into one grade grouping.



Total 6th Grade Forecast, Best

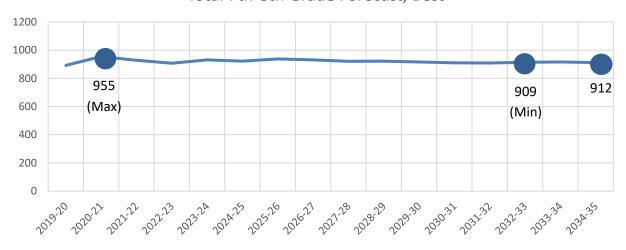
The following table summarizes the projected classroom need for grade 6th over the course of the 'best' scenario enrollment forecast assuming the existing utilization rate of 71% (spaces occupied by students 5 of 7 periods per day).

6th Grade Teaching Station Need (71% Utilization)
'Best' Enrollment Forecast Scenario

	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35
Total Teaching Stations Needed @ 20 Students / Classrooms & 71% Utilization	35	30	34	32	33	34	33	33	33	32	32	32	32	32	32	32
Total Teaching Stations Needed @ 22 Students / Classrooms & 71% utilization	32	28	31	29	30	31	30	30	30	29	29	29	29	29	29	29
Total Teaching Stations Needed @ 24 Students / Classrooms & 71% utilization	29	25	28	27	28	28	27	27	27	27	27	27	27	27	27	27
Total Available Teaching Stations	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
Surplus Teaching Stations @ 22 Students/ Classroom	-7	-3	-6	-4	-5	-6	-5	-5	-5	-4	-4	-4	-4	-4	-4	-4

This high level analysis suggests that as many as six more teaching stations are required to accommodate the enrollment forecast. Additional spaces for dedicated special education classrooms or specialty spaces to serve more elective programs may also be needed over and above these teaching station needs.

Total 7th-8th Grade Forecast, Best



The following table summarizes the projected teaching station need for grades $7^{th} - 8^{th}$ over the course of the 'best' scenario enrollment forecast assuming the existing 67% utilization rate (spaces occupied by students 4 of 6 periods per day). The total existing teaching station count does not include the 10 modular classrooms present.

7th – 8th Grade Teaching Station Need (67% Utilization) 'Best' Enrollment Forecast Scenario

	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35
Total Teaching Stations Needed @ 20 Students / Classrooms & 67% Utilization	67	72	70	68	70	69	70	70	69	69	69	68	68	69	69	68
Total Teaching Stations Needed @ 22 Students / Classrooms & 67% utilization	61	65	63	62	63	63	64	63	63	63	62	62	62	62	62	62
Total Teaching Stations Needed @ 24 Students / Classrooms & 67% utilization	56	60	58	57	58	58	59	58	58	58	57	57	57	57	57	57
Total Available Teaching Stations	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61
Surplus Teaching Stations @ 22 Students/ Classroom	0	-4	-2	-1	-2	-2	-3	-2	-2	-2	-1	-1	-1	-1	-1	-1

This high level analysis suggests that as many as four additional teaching stations are needed to serve the enrollment forecast. Or stated slightly differently, four of the ten modular classrooms would need to be replaced to serve the enrollment forecast using the existing daily schedule.

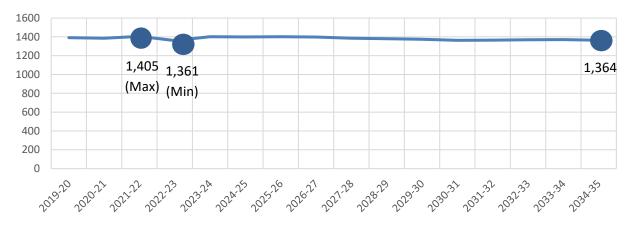
While a 67% utilization rate for middle school facilities is not uncommon, it falls well short of the MSBA guidelines of 85% utilization. The table below summarizes the projected teaching station need for grades $7^{th} - 8^{th}$ over the course of the 'best' scenario enrollment forecast assuming the same 71% utilization rate as the High Rock School. The total teaching station count excludes the 10 modular classrooms present.

7th – 8th Grade Teaching Station Need (71% Utilization) 'Best' Enrollment Forecast Scenario

	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35
Total Teaching Stations Needed @ 20 Students / Classrooms & 71% Utilization	63	67	65	64	66	65	66	66	65	65	65	64	64	64	65	64
Total Teaching Stations Needed @ 22 Students / Classrooms & 71% utilization	57	61	59	58	60	59	60	60	59	59	59	58	58	59	59	58
Total Teaching Stations Needed @ 24 Students / Classrooms & 71% utilization	52	56	54	53	55	54	55	55	54	54	54	53	53	54	54	54
Total Available Teaching Stations	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61
Surplus Teaching Stations @ 22 Students/ Classroom	4	0	2	3	1	2	1	1	2	2	2	3	3	2	2	3

This high level analysis suggests that altering the daily schedule to be more efficient with space (71% utilization, rather than the existing 67% utilization) would allow the district to accommodate the enrollment forecast in the existing teaching stations without the need for the modular classrooms and still have as many as three additional teaching stations to function as the school desired.

Total 6th-8th Grade Forecast



The following table below summarizes the projected teaching station need for grades $6^{th} - 8^{th}$ over the course of the 'best' scenario enrollment forecast assuming the same 71% utilization rate as the High Rock School. The total teaching station count excludes the 10 modular classrooms present.

6th – 8th Grade Teaching Station Need (71% Utilization) 'Best' Enrollment Forecast Scenario

	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35
Total Teaching Stations Needed @ 20 Students / Classrooms & 71% Utilization	98	98	99	96	99	99	99	98	98	97	97	96	96	96	97	96
Total Teaching Stations Needed @ 22 Students / Classrooms & 71% utilization	89	89	90	87	90	90	90	90	89	88	88	87	87	88	88	87
Total Teaching Stations Needed @ 24 Students / Classrooms & 71% utilization	82	81	82	80	82	82	82	82	81	81	81	80	80	80	80	80
Total Available Teaching Stations	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61
Surplus Teaching Stations @ 22 Students/ Classroom	-28	-28	-29	-26	-29	-29	-29	-29	-28	-27	-27	-26	-26	-27	-27	-26

This high level analysis suggests that as many as 29 teaching stations must be added to the Pollard facility to accommodate the enrollment forecast assuming the High Rock utilization rate of 71%.

CAPACITY & NEEDS ANALYSIS

OVERVIEW

Building Capacities for elementary schools are based on the assumptions and methodologies identified below:

Minimum Capacity = Number of general classrooms (grades K-3rd) x 18 students per classrooms + number of general classrooms (grades 4^{th} & 5^{th}) x 20

Maximum Capacity = Number of general classrooms (grades $K-3^{rd}$) x 22 students per classroom + number of general classrooms (grades $4^{th} \& 5^{th}$) x 24

This technique generates a range for each school's capacity based on the boundaries of the District's current class size policies.

Building Capacities for middle schools are based on the assumptions and methodologies identified below:

Minimum Capacity =

Number of total teaching stations x 20 students per teaching station X 71% utilization rate

Maximum Capacity =

Number of total teaching stations x 24 students per teaching station X 71% utilization rate

This technique generates a range for each school's capacity based on the boundaries of the District's current class size policies.

ELEMENTARY SCHOOL BUILDING CAPACITIES

The following table communicates the calculated capacities for each elementary school and compares them to the individual school forecast from the McKibben demographic study.

		Capacity	Need
G	General Classrooms	Students	Enrollment Forecast
Broadmeadow Current = 548	24	448 to 544	504 to 560
Eliot Current = 412	18	336 to 408	413 to 443
Mitchell* Current = 484	20	376 to 456	423 to 481
Newman Current = 624	30	560 to 680	586 to 648
Williams Current = 518	24	448 to 544	502 to 533
	116	2,168 to 2,632	2,428 to 2,634

^{*} Does not include modular classrooms for Kindergarten. Including those modular classrooms would increase capacity to 448 to 544.

This high level capacity analysis suggests that the maximum capacity of the existing buildings (without the modular classroom facilities at Mitchell Elementary School) is nearly identical to the maximum enrollment forecast for grades K-5th. This suggests that the District can accommodate the entire enrollment forecast within the existing classrooms and remain within its class size policy by redistricting students around the edges of existing catchment area boundaries. While accommodating the entire enrollment forecast within the existing number of classrooms appears possible, this analysis suggests that all classrooms would be at the maximum of the District's class size guidelines, leaving little room for deviations from the enrollment forecast without either increasing class sizes or repurposing specialized spaces into general classrooms. It may be in the District's best interest to pursue master plan scenarios that increase the total number of general classrooms to create this flexibility.

The following table compares the existing classroom counts to proposed classroom counts to demonstrate the impact on class sizes across the district.

C	Proposed*	
Broadmeadow	General Classrooms	General Classrooms
Eliot	18	18
Mitchell	20	30*
Newman	30	30
Williams @ 2,634 AVG Class * Proposed general classrooms varies by master pl		24 126 • @ 2,634 Students, AVG Class Size: 20.9 @ 2,428 Students, AVG Class Size: 19.3

At the peak K-5th enrollment of 2,634 students, the average class size across the District would be just under 23 students per classroom assuming the existing classroom count. In master plan scenarios where a potential Mitchell project assumed five sections per grade level (a total of 126 general classrooms), the average class size across the District drops to just under 21 student per classroom. Based on this analysis, it may be in the best interest of the District to pursue master plan scenarios that target 126 general classrooms across the elementary schools.

MIDDLE SCHOOL BUILDING CAPACITIES

The table below communicates the calculated capacities for Pollard Middle School and the High Rock school and compares them to the individual school forecast from the McKibben demographic study. Capacity calculations are based on the midpoint of the District's class size guidelines (20-24) and the capacity range is based on two utilization models (71% and 75%).

		Capacity	Need
High Rock (6 th Only) Current = 499	Current Teaching Stations 25	Students 391 to 412	Enrollment Forecast 430 to 477
Pollard* (7 th – 8 th) Current = 892	61	953 to 1,007 (895) Based on current utilization of 67%.	907 to 955
Pollard* (6 th – 8 th) Current = 1,391	61	953 to 1,007	1,361 to 1,405

^{*} Does not include modular classrooms. Including those modular classrooms would increase capacity to 1,109 to 1,172.

The analysis suggests there is an overcrowding challenge at High Rock currently, that will lessen over time but remain a challenge. While not appearing in this simple capacity analysis, High Rock has other spatial deficiencies including the following:

- Limited space for special education and academic support services
- A significantly undersized cafeteria
- A significantly undersized gymnasium
- Limited middle school size labs
- Limited space to offer elective specials

This analysis also suggests that the current daily schedule (under utilization) has led to an overcrowding condition when only considering the existing permanent construction. If the modular classrooms are included in the calculation, there are approximately the right number of teaching stations for the current utilization rate. It appears that if the school were to entertain a slightly more efficient use of space, the

existing building (without) the modular classrooms would be sufficient to accommodate the entirety of the enrollment forecast.

While not appearing in this simple capacity analysis, it is important to note that the existing science labs are well below MSBA guidelines in both their size and their features. Any future project should address these deficiencies in addition to the capacity challenges.

Finally, this analysis suggests that the District would need to increase the capacity of the building by approximately 400 students to accommodate the enrollment forecast for grades 6th, 7th, and 8th.

The following table compares the existing teaching stations to a proposed number in three scenarios: an intervention at High Rock to just serve 6th grade, an intervention at Pollard to just serve grades 7th-8th, and an intervention at Pollard to serve grades 6th-8th. The total proposed number of teaching stations is based on the enrollment forecast and assumes 22 students per teaching station and 71% utilization.

	Current	Proposed
High Rock (6th Only)	Teaching Stations	Teaching Stations
Pollard* (7th - 8th)	61	67
Pollard* (6th – 8th)	61	101

The 34 teaching stations at High Rock include 4 spaces to serve special education. The 67 teaching stations to serve only grade 7th-8th at Pollard Middle School contains a few more classrooms than the strict calculation would suggest to give the school the flexibility to either maintain their current utilization rate or support a slightly lower average class size (approximately 20 students per teaching station). In the scenario that explores all three grades at the Pollard site, the proposed number of teaching stations is a few more that are indicated by the strict calculation for reasons similar to those just mentioned for the other two scenarios. If 6th grade relocates to Pollard, its special education space needs will come with it. Having a few additional teaching stations allows the District the flexibility to continue its current utilization or lower the average class size.

^{*} Does not include modular classrooms.