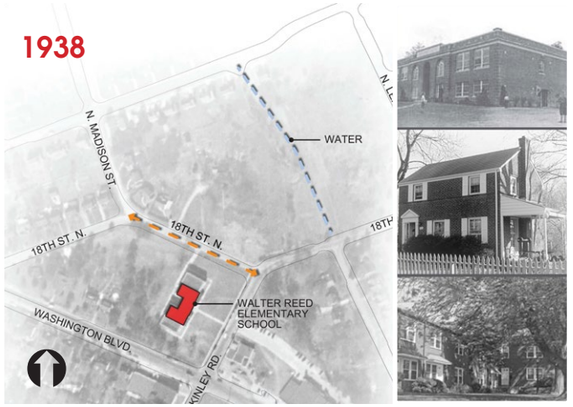
Reed School / Westover Site Analysis

December 2014

Stantec

Site Analysis

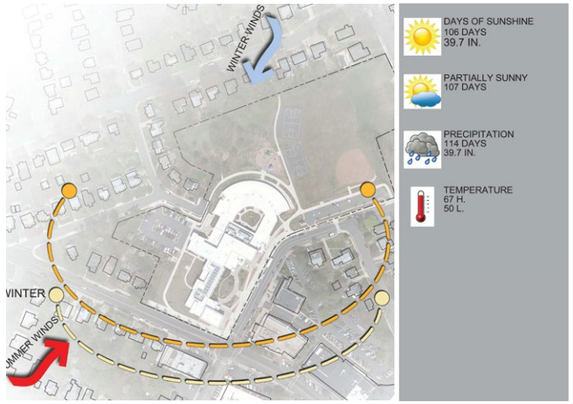


Adjacent Context

Vehicular Circulation

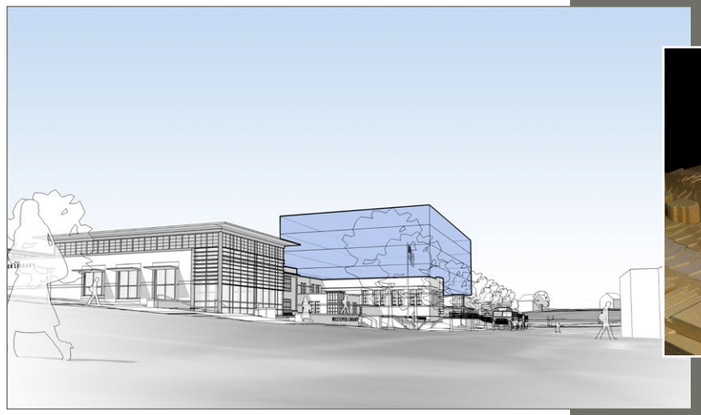
Site Circulation

Environmental/Climate



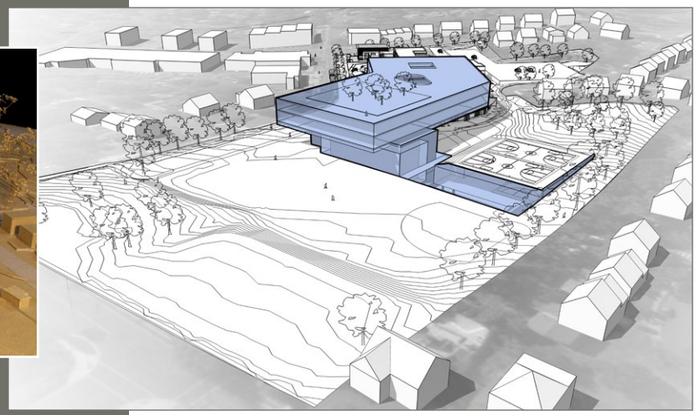
Four Concepts

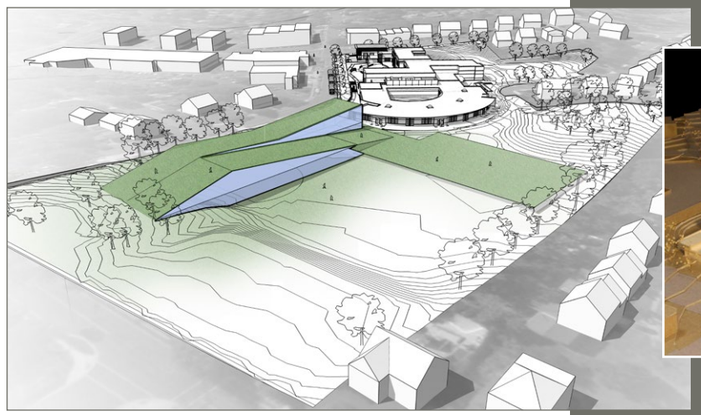
Cloud



Tower

Tree House





Hill

Community Concerns

Traffic/Parking

Minimize Vehicular Impact

- Add Parking Structure
- Separate Traffic
  - Bus Drop-Off
  - Parent Drop-Off
  - Student Drivers
  - Staff

Green Space

Preserve Green Space

- Limit Building Footprint
- Limit Parking Footprint
- Create Roof Top Green Space

Farmers Market

Maintain Farmers Market

- Expand Plaza at Street
- Create Stage for Performance
- Provide Amphitheater Seating

Local Businesses

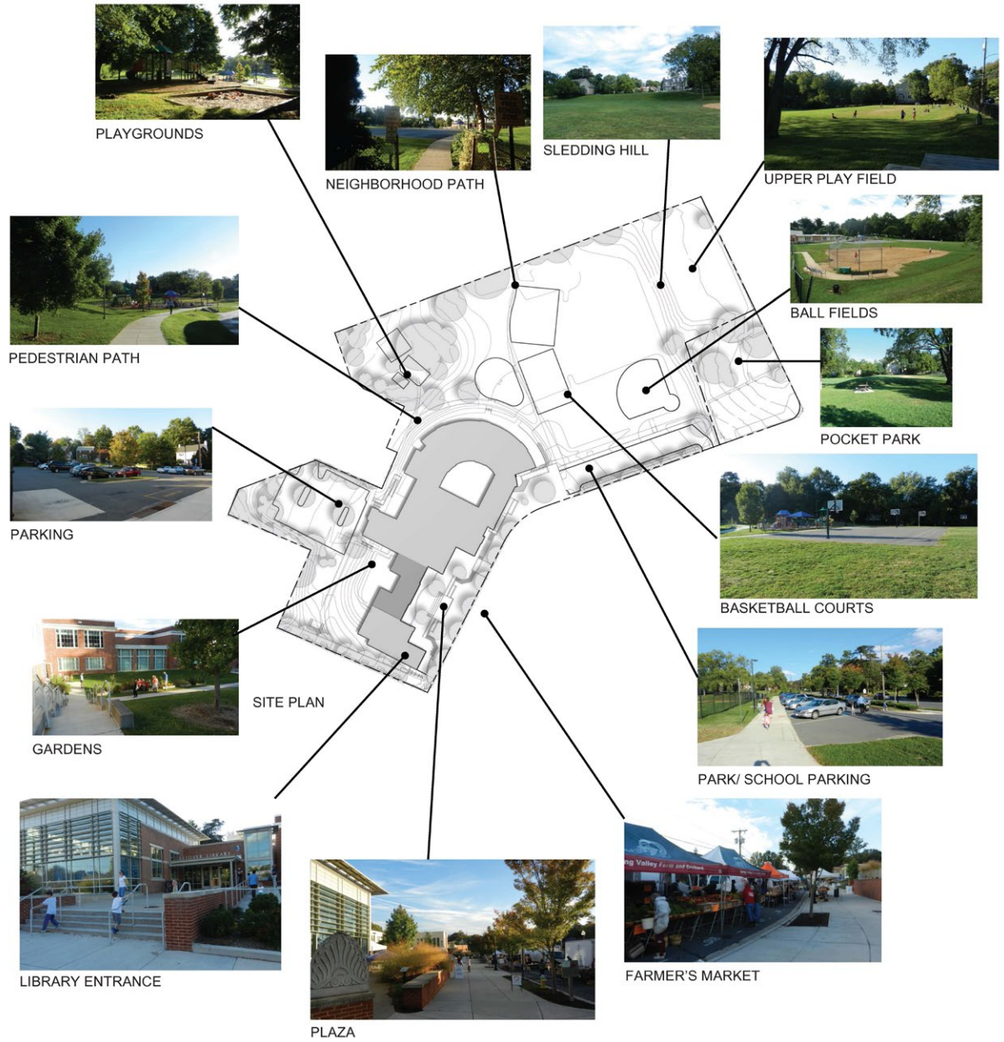
Do Not Disturb Local Businesses

- Available Public Parking — Evenings
- Include Food Service for Students

Community/Site Activities

Acknowledge and Preserve Community/Site Activities

- Plaza
- Library
- Garden
- Parking
- Playgrounds
- Neighborhood Path
- Basketball Courts
- Sledding Hill
- Ball Fields
- Upper Play Field
- Pocket Park
- Park and School Parking
- Pedestrian Pathway
- Farmers Market



Preparing H-B for the Next 40 Years

Safe and Secure
a school designed foremost to ensure the safety of its occupants

Healthy and High-Performing
a high-quality environment designed to support learning and minimize long-term operations costs

Differentiated Spaces
a variety of educational spaces responding to a wide range of learning styles and preferences

Flexible and Adaptable
spaces and places that lend themselves to change depending on the activity occurring within them

Large-Group Gathering
a place designated for town hall meetings, large-group gatherings, and performances

Active
modern facilities for physical education and extra-curricular activities

Unique, Fun, and Inspiring
a unique design response intended to enhance the unique program housed within it

Program Options

H-B Woodlawn and Stratford Program

H-B Woodlawn is a school of choice geared toward independent learners who seek more control over their education than permitted in a traditional setting. Student choice is realized in three central areas: use of time and personal behavior, educational goals, and school governance. The program outlined below is aimed at serving 800 students in grades 6–12, and is based on input received from students, teachers, and administrators at H-B Woodlawn.

- General Instruction
  - general instruction (35 rooms)
  - science laboratories (7 rooms)
  - science lab prep/storage
  - individual study
  - small-group instruction/breakout
- Fine/Performing Arts Instruction
  - visual arts
    - » fine arts studios
    - » photography studio
    - » A/V production/editing studio
  - performing arts
    - » choir studio
    - » band/orchestra studio
    - » drama instruction
    - » auditorium and stage
- Food Service and Dining
- Physical Education and Athletics
  - competition gymnasium
  - locker rooms
  - fitness room
  - athletic fields
  - outdoor basketball courts
- Library/Media
  - library stacks
  - media studios
- Administration and Clinic
  - reception
  - accounting/records
  - principal
  - assistant principal
  - clinic
- Guidance
- Miscellaneous Facility Infrastructure

Designed to be flexible to evolve along with the H-B Woodlawn curriculum, this facility could likewise accommodate a 6–8 middle school for 800 students.

The Stratford Program serves a unique population of 100 special needs students. Aside from conventional instructional needs these students also require accessible aids, additional storage for apparatus, and spaces designed to accommodate the special programs being delivered. The addition constructed onto the Reed School in 2008 was designed to serve a special needs population, and the intent would be for Stratford Program to occupy this space.

- General Instruction
  - special needs classrooms (10 rooms)
  - accessible bathrooms (5 rooms)
  - life skills studios
- Physical Education and Motor Skills
  - multipurpose room
  - motor skills studio
  - special needs equipment storage
- Library
- Administration
  - reception
  - accounting/records
  - principal
- Miscellaneous Facility Infrastructure

The total square footage of the combined programs would be approximately165,000 SF: 45,000 SF existing plus 120,000 SF of new construction as follows:

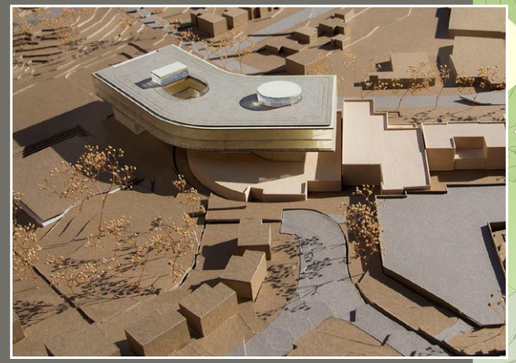
- 36,000 SF — gymnasium and levels 1 and 2 new construction
- 42,000 SF — level 3 new construction
- 42,000 SF — level 4 new construction

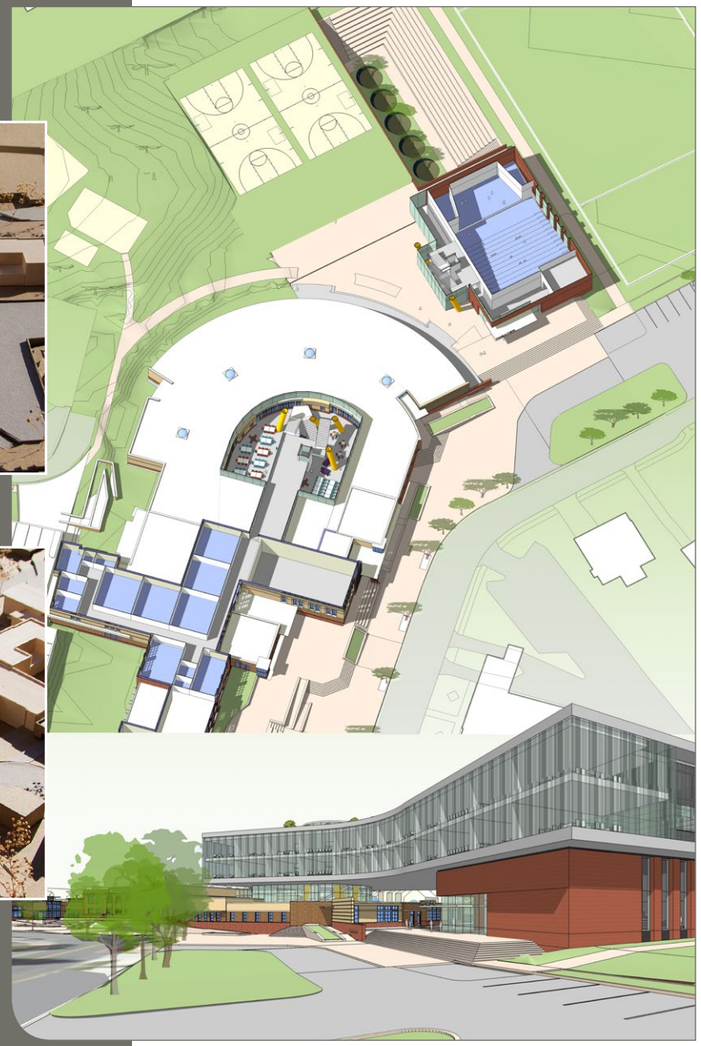
Site Plan

Gymnasium Level

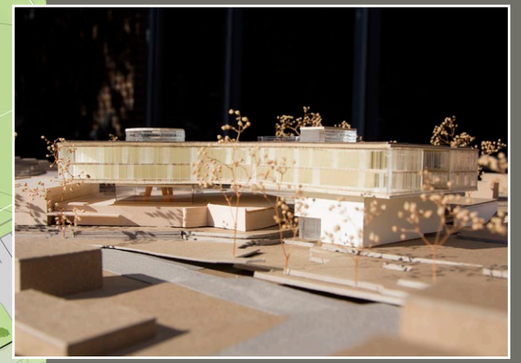
Level 1

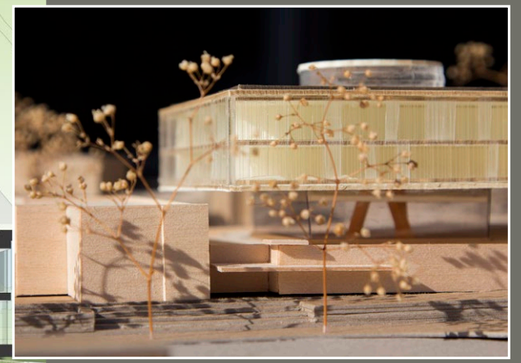
Level 2





Level 3





Level 4

Roof Level

Reed Site Detailed Cost Estimates

800 Seats *(Grades 6–12)*	**Low**	**High**
Addition (120,000 SF)	$ 47,030,704	$ 47,030,704
Renovation	$ 1,731,880	$ 1,731,880
Site	$ 5,542,855	$ 5,542,855
Parking (137 Spaces)*	$ 5,498,204	$ 5,498,204
PV System		$ 2,000,000
Green Roof		$ 2,699,252
Subtotal	$ 59,803,643	$ 64,502,895
Escalation (5.8%)	$ 3,468,611	$ 3,741,168
Total Hard Cost	**$ 63,272,254**	**$ 68,244,063**
Soft Cost (22.5%)	$ 14,236,257	$ 15,354,914
Total Project Cost	**$ 77,508,512**	**$ 83,598,977**

** 110 spaces in the parking structure and 27 existing on site spaces*

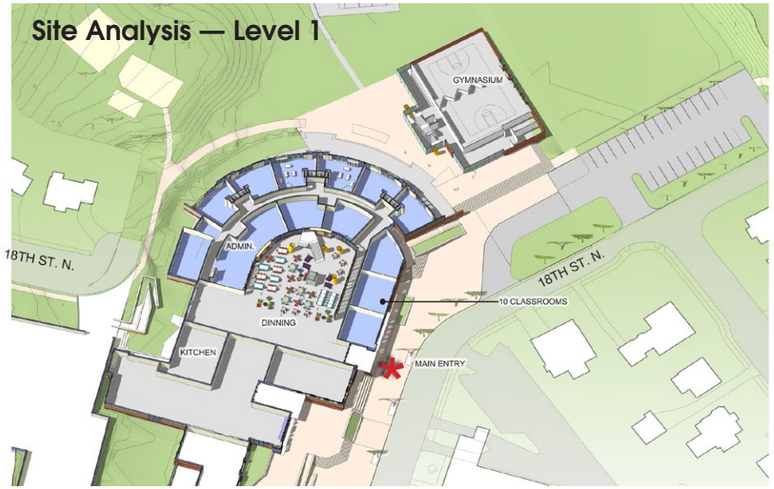
Elementary School Alternative

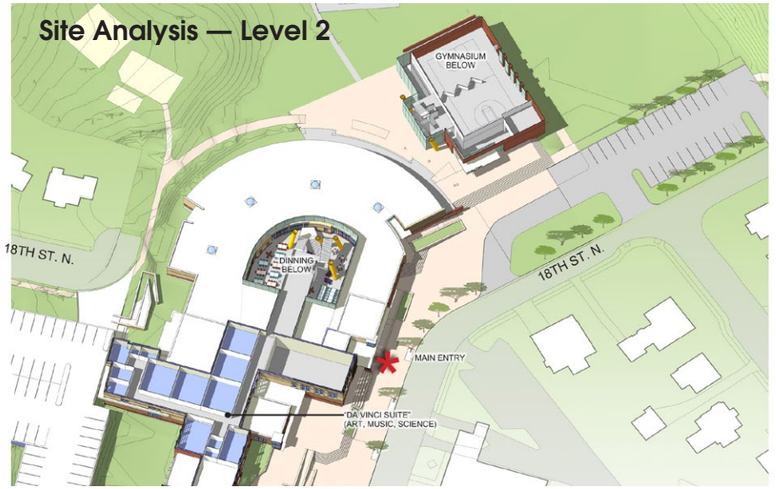
Based on the Reed Community's request to look at an optional elementary school program for the Reed site, we have looked at the capacity generated if the "Treehouse" scheme was simplified to one upper level, with Pre-K and K on the Ground Level for a total capacity of 725 students.

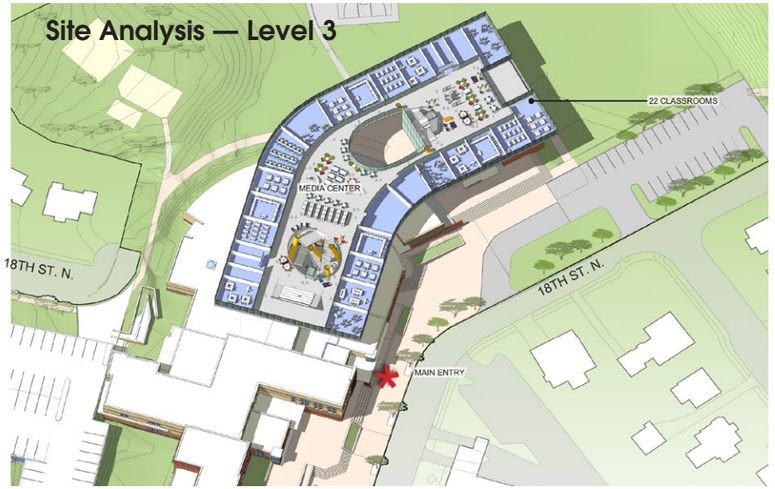
- General Instruction
  - 10–12 classrooms on the ground level
  - art, music and science (discovery) on the existing second floor
  - 22 classrooms on the upper level
- Physical Education and Athletics
  - gymnasium
  - athletic fields
  - outdoor basketball courts
- Library/Media
- Food Service and Dining
- Administration and Clinic
  - reception
  - principal
  - assistant principal
  - clinic

Reed Elementary School Cost Estimate

725 Elementary Seats *(Grades Pre-K – 5)*	**Low**	**High**
Addition (56,000 GSF)	$ 21,840,000	$ 21,840,000
Renovation	$ 1,731,880	$ 1,731,880
Site	$ 4,042,855	$ 4,042,855
PV System		$ 2,000,000
Green Roof		$ 2,699,252
Subtotal	$ 27,614,735	$ 32,313,987
Escalation (5.8%)	$ 1,601,654	$ 1,874,211
Total Hard Cost	**$ 29,216,389**	**$ 34,188,198**
Soft Cost (22.5%)	$ 6,573,687	$ 7,692,344
Total Project Cost	**$ 35,790,076**	**$ 41,880,542**







Stantec

Reed School / Westover Program	Woodlawn Program (800 Students)			Stratford Program (100 Students)			Combined Program	
	NO. Spaces	SF Each	Total SF	NO. Spaces	SF Each	Total SF	NO. Spaces	Total SF
General Instruction			**49,150**			**11,100**		**60,250**
○ general instruction	37	750	27,750	0	-	-	37	27,750
○ science laboratories	7	900	6,300	0	-	-	7	6,300
○ science lab prep/storage	7	500	3,500	0	-	-	7	3,500
○ individual study	10	100	1,000	0	-	-	10	1,000
○ small-group instruction/breal	10	300	3,000	0	-	-	10	3,000
○ Special Needs Classrooms	0	-	-	10	1,000	10,000	10	10,000
○ Accessible Bathrooms	8	350	2,800	10	100	1,000	18	3,800
○ Life Skills Studios	2	900	1,800	1	100	100	3	1,900
○ Learning Stair	1	1,500	1,500	0	-	-	1	1,500
○ Terrace	1	1,500	1,500	0	-	-	1	1,500
Fine/Performing Arts Instruction			**21,600**			**-**		**21,600**
○ visual arts								
▪ fine arts stud	5	700	3,500			-	5	3,500
▪ photography	1	800	800			-	1	800
▪ A/V productio	1	800	800			-	1	800
▪ offices	4	150	600			-	4	600
○ performing arts								
▪ choir studio	1	1,500	1,500			-	1	1,500
▪ band/orchest	1	2,400	2,400			-	1	2,400
▪ drama instruc	1	1,000	1,000			-	1	1,000
▪ Black Box	1	4,000	4,000			-	1	4,000
▪ auditorium ar	1	7,000	7,000			-	1	7,000
Physical Education and Athletics			**18,100**			**-**		**18,100**
○ competition gymnasium	1	9,500	9,500			-	1	9,500
○ locker rooms	2	2,300	4,600			-	2	4,600
○ fitness room	1	4,000	4,000			-	1	4,000
○ athletic fields (Ultimate Frisbe	1		-			-	1	-
○ outdoor tennis court	1		-			-	1	-
○ outdoor basketball courts	2		-			-	2	-
○ outdoor running track	1		-			-	1	-
○ outdoor classroom	1		-			-	1	-
Physical Education and Motor Skills (Stratford Only)			**-**			**4,100**		**4,100**
○ Multipurpose Room			-	1	2,400	2,400	1	2,400
○ Motor Skills Studio			-	1	1,000	1,000	1	1,000
○ Special Needs Equipment Storage			-	1	700	700	1	700
Library/Media			**5,000**			**-**		**5,000**
○ library stacks	1	2,500	2,500			-	1	2,500
○ media studios	5	500	2,500			-	5	2,500
Food Service and Dining			**-**			**16,000**	**0**	**16,000**
○ Serving			-	1	1,500	1,500	1	1,500
○ BOH			-	1	3,500	3,500	1	3,500
○ Dining Commons			-	1	10,000	10,000	1	10,000
○ Storage			-	1	1,000	1,000	1	1,000
Administration and Clinic			**2,850**			**2,750**	**0**	**5,600**
○ reception	1	800	800	1	700	700	2	1,500
○ accounting/records	1	800	800	1	800	800	2	1,600
○ principal	1	300	300	1	300	300	2	600
○ assistant principal	1	150	150	1	150	150	2	300
○ clinic	1	800	800	1	800	800	2	1,600
Guidance			**1,000**			**-**	**0**	**1,000**
○ Guidance	1	1,000	1,000	0	-	-	1	1,000
Miscellaneous Facility Infrastructure			**-**			**-**	**0**	**-**
Total Net Square Footage			**97,700**			**33,950**		**131,650**
Total Gross Area (1.4 X)			**136,780**			**47,530**		**184,310**

Memorandum

To: Bill Bradley, Stantec Architectture

From: Steve Gleason

Date October 24, 2104

Re: REED School – Site Conditions Review to support Planned School Expansion

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Based on a limited review of the most recent site/civil plan to determine existing conditions and reviews of the evolving Stantec concept sketches, we offer the following civil narratives and accompanying "**Preliminary Utility Exhibit**" for cost estimating purposes. The plan exhibit reflects both the existing site conditions that include the existing utility locations and line sizes, and the proposed concept plan. The plan is drawn to a scale of 1"=30' and includes a bar scale to measure dimensions.

PROPOSED SITE IMPROVEMENTS

Demolition

- The proposed "tree house" building expansion, new structured parking deck and modified surface parking will result in the demolition of several facilities. Specifically, demolition will be required for the following areas:
  - existing rear parking area along with associated sanitary sewer and storm sewer drainage that carry off-site flows
  - Walkways, pedestrian lighting, etc.;
  - Playground and ball field;
  - Entrance driveways
  - Miscellaneous utilities (mostly private) .

Erosion Sediment Control

- Assume typical Virginia Erosion Sediment Control requirements including temporary detention during construction and two construction entrances.

Grading and Earthwork

- Based on the proposed plan there will be excavation for the gymnasium portion of the new building and a portion of building under the "overhang building". Additionally, we anticipate some excavation for the parking structure in the rear and for the utility and storm water management installations. It does not appear the project will be a balanced earthwork site unless we are permitted to fill and

re-grade the adjacent park site to dispose of excess material. Therefore, for cost purposes we should assume the excavated material will required to be hauled off site.

- Gordon does not have any information regarding soils suitability; location of underlying rock or underground geology (i.e. presence of water, etc.) However, it appears this site may have once contained a stream/swale, therefore, there could be a presence of ground water encountered during excavation.

Wet Utilities

- **Water** – assume the existing water services remain to the existing building. Add additional domestic service; fire line and assume additional fire hydrants and fire department connections. Assume new water tap to the existing 8 inch Main. Assume approximately 90 feet of new 8 inch DIP Fire Line; Assume approx. 60 feet 6 inch DIP domestic line; Assume one new meter vault with 2- 2-1/2 inch meters. Assume approximately 3 new fire hydrants with approximately 100 feet of new six inch DIP water main.

- **Sanitary Laterals–** assume existing sanitary services remain to the existing building. Add two (2) additional 6 inch sanitary sewer laterals to the new building at a distance of 50 feet each with two clean-outs.

- **12 inch Off-Site Sanitary Sewer Relocation**-(east side of expansion)- Assume the relocation of approximately 600 feet of 12 inch sanitary sewer and add 4 new sanitary manholes.

- **8 inch Off-Site Sanitary Sewer** (west side of expansion)-Assume the line will remain in place and proposed underground basement at the southwest corner can be adjusted, if needed to avoid impact to the line. The will require the 10 foot easement to be maintained with service access the existing manholes.

- **84 inch Off-site Storm Sewer Relocation** (east side of expansion)– The proposed building expansion and gymnasium will require the relocation of approximately 550 feet of an existing 84 inch RCP Storm Pipe. Additionally, this re-routing of the existing storm pipe will require approx. 4 storm junction boxes. Assume for these to be approx. 12 ft. x 12 ft. due to the size of pipe and angle of approach. Assume vertical clearance to allow the relocated sanitary line to cross the proposed amphitheater (or steps to gymnasium), in the event this is not the case one additional junction box would be needed.

- **18’ to 24 Inch Off-site Storm Sewer Re-Alignment** (west side of expansion)- The storm sewer line that runs through the proposed plaza area between the existing and proposed building can remain largely in place with exception of approximately 150 feet of new 24 inch RCP storm pipe and (2) additional manholes that are required to avoid conflicts with the proposed basement.

- **On-Site Storm sewer** (west side of expansion**)-** Assume the existing storm sewer line that carries the roof drainage for existing building will remain in place. Potentially some of these manholes could be changed to yard drains to pick up surface drainage from the proposed plaza.

- **Washington Boulevard** Storm Sewer (drains parking deck) Assume approximately 385 feet of RCP pipe and two storm DI type drains/inlets drain and 2 manholes.

- Additionally, assume 100 approximately feet of additional storm pipe (RCP 15-24 inches) and approx. six (6) additional storm DI type drains/inlets will be required throughout the site for drainage. These additional storm drains will most likely be needed to replaces storm lines impacted by the new driveway entrances

  Additionally, the storm water runoff near the gymnasium will likely have to be pumped from the amphitheater to the existing relocated 84" storm sewer. Pumps are allowed by Arlington County.

Existing Utility Relocation

- Relocation of existing 84 inch storm sewer (See description above)
- Relocation of the existing 12 inch sanitary sewer (See description above)

Service Utilities

- **Electric** - There is existing electric service along Washington Blvd and along McKinley. At this time there is no information regarding the required electric loads. Therefore, we would assume that a new transformer could be installed along McKinley and/or Washington Blvd from the electric lines to serve the new buildings. .

- **Communications** – unknown at this time but assume new connections will be required to the new building. If not already provided by the previous renovation, Arlington County requires 4-2" PVC conduits be provided along the frontage of Washington Blvd, and McKinley Road as part of the "Arlington Connects" requirement.

Natural Gas – unknown at this time but assume new connections will be required to the new building. **The existing gas main is located in Washington Blvd.**

Storm Water Management

GORDON has not had the opportunity to prepare a preliminary storm water analysis, however both storm water detention and storm water quality will be required to comply with the new storm water management regulations which require both quantity control and quality control for redevelopment projects such as this. The following would be required to support the expansion:

- ***Water Quantity Facilities (Detention)*** consisting of a two (2) underground vault or series of storm pipes. Approximate volume is estimated at 10,000 cubic feet of storage and there would be a manhole or junction box with a control structure associated with detention each facility (2). Along the front of the building, adjacent to N. McKinley Road, there is an existing underground detention system

consisting of approximately 540 linear feet of 60" HDPE pipe. There may be an opportunity, with further review of the structure and the approved

engineering designs to determine available excess capacity, to modify this existing system to accommodate the detention needs for these improvements.

The accompanying exhibit shows no connections or potential use of this existing system.

- **Water Quality** is likely to require an average treatment efficiency of 71%. The new treatment standard is assumed to apply to a new impervious area of approximately 49, 500 square feet, while the 20% reduction standard is assumed to apply to an existing impervious area of 10,000 square feet. Water Quality facilities consist of several practices including:

  1.) 15,000 square feet (or 25%) of Green Roof (Media Depth 4 to 8 inches; 2-inch stone drainage layer)

  2.) Bioretention with a surface area of approximately 3,000 square feet treating approximately 1 acre of impervious area (Media Depth 36"; Gravel 12"; and 6" underdrain)

New Entrance along Washington Blvd (to upper level parking structure)

- Assume the design will include new driveway entrance and new curbed islands to transition from entrance to parallel parking. Additionally, a storm inlet (DI-#C) and some 15 inch RCP storm pipe will be required to drain the low spot created by the island on the uphill end. It should be noted that the sight distance at the proposed entrance is limited due to the crest of the hill.

Relocated Entrance on 18th Street (to upper level parking structure)

- Assume the design will include new driveway entrance with concrete apron with connecting 5 foot wide sidewalks similar to the current entrance on 18th Street. The entry driveway would include new curb and gutter that would transition from the street entrance to the entry travel lane with a new storm drain inlet (DI-#C) and some 15 inch RCP storm pipe will be required to collect water from the high side of 18th Street.

New Entrance Madison Street (to lower level parking structure)

- Assume the design will include new driveway entrance with concrete apron connecting 5 foot wide sidewalks similar to the current entrance on 18th Street. . Additionally, a storm inlet (DI-#C) and some 15 inch RCP storm pipe will be required to drain the low side of Madison Street.
-

Existing Parking Area revisions (Front)

- The existing parking lot along McKinley is planned to be redesigned and expanded. Assume the parking lot will be lined with new curb and gutter and will have a heavy duty (3-layer) asphalt section due to the potential for bus traffic. Approx. parking area is 60 ft. x 250 ft.

Proposed Parking Garage (Rear)

-

- The proposed plan is to replace the existing rear surface parking lot with a two level parking structure. From a civil site perspective there will be demolition of the existing parking area and excavation both areas already covered in other sections of this narrative.

Landscape

On-site recreation facilities

- Assume the existing playground that measure 5,000 SF in size will be replaced with new equipment to support a middle school. Currently, the playground supports the Community Center and Elementary School and has two age appropriate areas (estimated at 2-5 and 6-10) that are separated by a low (3-4 ft. high fence). The new playground equipment replacement would consist of similar metal/plastic materials that support multiple play apparatus, a new perimeter metal fence totaling approximately 300 linear feet. The ground surface material would consist of engineered wood fiber or a poured in place rubber surface.
- The existing playground is fairly new and maybe able to be re-used
- The 2 existing basketball courts will be demolished and replaced
- Demolish and replace 320 LF of concrete sidewalk that connects the existing playground and basketball courts to the school parking lot area on McKinley Road
- Remove and replace 5 pedestrian lights along new sidewalk
- Relocate the existing baseball diamond and outfield to maintain a minimum 200 foot outfield, this will require the removal and replacement of the fenced backstop, benches, and walkways.
- Based on review of the existing contours the ball field would require clearing and grading into the adjacent land area along North Lexington Street..
- Street trees: most of the required trees are in place, but a few will need to be removed to accommodate new entry drives, assume 16 new street trees (4 at each of the 3 new drive locations and for the reconfigured parking lot entry on McKinley.

Lastly, absent of a proposed grading plan to determine potential clearing limits it appears that the construction would all occur on-site, however temporary clearing and grading easements to construct, for example, the proposed 2 level parking structure that is shown abutting three residential lots and possibly for the new driveway entrances maybe required.

ELECTRICAL DESIGN NARRATIVE

Reed School Site Analysis –

Arlington Public Schools

Interior Lighting

Interior artificial lighting will be largely accomplished with recessed high performance LED non-planer troffers throughout the facility with specialized lighting in selected spaces such as Media Center, Entry Lobby, etc. Lighting in the Gymnasium will be 6-lamp T5HO fluorescent high bays with wire guards. Lighting throughout will meet the latest Illuminating Engineering Society of North America (IESNA) Handbook, IESNA Recommended Practices, etc. LED Task Lighting will be provided at each Teacher desk and at office workstations/desks.

100% occupancy sensor coverage will be provided. Common area lighting will be controlled through the web-based DDC control system through relay control panels. Enclosed classrooms, offices, storage rooms, etc. will have stand alone occupancy sensors.

Exterior Lighting

Dark sky compliant LED exterior lighting will be provided around the exit doors and to light the perimeter of the building**.** Separate egress lights powered from emergency battery back-up for 90 minutes will be provided by each exit door**.** Parking lot lighting will be LED fixtures on straight round aluminum poles and in accordance with the site guidelines for color to match the existing landscape architectural theme.

Daylighting

Natural daylighting will be integrated into each classroom to provide a higher quality learning environment. The natural daylighting will be accomplished through a combination of top lighting via Tubular Daylighting Devices (i.e. Solatubes) and/or daylighting windows.

HVAC DESIGN NARRATIVE

Reed School Site Analysis –

Arlington Public Schools

Codes and Standards

The **Reed School Site** shall incorporate an HVAC system designed to meet the requirements of the following:

- Virginia Uniform Statewide Building Code (USBC)
- International Mechanical Code (2009)
- Americans with Disability Act Accessibility Guidelines (ADAAG)
- LEED for Schools (2009)
- ASHRAE Guidelines
- Arlington Public Schools Elementary Design Guidelines

Heating and Air Conditioning Systems

The HVAC system for this project consists of unitary geothermal heat pumps for zone control and outside air handling units with energy recovery. In general, the schools is zoned with two similar function classrooms on one heat pump. The ventilation (outside) air is de-coupled from the HVAC heating and cooling with each space (or zone) receiving outside air separately.

Each heat pump will be a high efficiency, heat pump unit with an ECM fan motor. All units will be floor mounted and installed in distributed mechanical room spaces located throughout the facility. Each heat pump unit will utilize refrigerant R-410A and will have an ozone depleting potential (ODP) of 0.05 or less.

Each zone will have a heat pump with a thermostat, BAS interface and occupancy sensor interlock. Averaging sensors will be used in many areas. Also, the main electrical service room will be conditioned with a geothermal heat pump unit. All heat pump units shall have fully ducted supply and return sheet metal ductwork. All supply and un-conditioned outside air ductwork shall be insulated with 1.5" thick, ¾ pcf duct wrap with vapor barrier. Return air ductwork will not be insulated. Each heat pump unit will include a duct-mounted pre-filter rack. The pre-filters shall be 24"x24" Flanders/FFI PrePleat 40. Each heat pump shall include integral disconnect. Condensate for each unit will be disposed of through and floor drain or open receptacle into the sanitary system.

In lieu of a central pumping system, each heat pump will have a dedicated circulating pump (B&G PL-55 or equal) that shall cycle on when the compressor cycles on, the circulating pump shall be powered through the heat pump unit. Flexible stainless steel braided hoses shall be used at the connection of each unit. The hose kits shall include shut-off valves on each the supply and return and a strainer on the supply hose.

Remote electrical rooms will be conditioned with cabinet exhaust fans connected into the central exhaust system.

Ventilation Systems

The outside air systems for the facility shall be de-coupled. In general, outside air shall be provided directly to the occupied space. The dedicated outside air handling units will be indoor type and have double wall construction. The units shall be variable volume energy recovery type units utilizing building exhaust and general exhaust air to precondition the outside air through a total energy recovery wheel. All conditioned outside air ductwork and building exhaust air ductwork will not be insulated – this applies to positive pressure outside air ductwork and negative pressure exhaust air ductwork. All un-conditioned air ducts shall be insulated with 1.5" thick, ¾ pcf duct wrap with vapor barrier – this applies to negative pressure outside air ductwork and positive pressure exhaust air ductwork.

The outside air units will consist of the following sections/components: stacked on top and in the direction of air flow will be a pre-filter, energy recovery wheel, and plenum type direct-drive exhaust air plenum fan, on the bottom will be a pre-filter, energy recovery wheel, access, hot / chilled water coil (2-pipe), access, plenum type direct drive supply air fan. Each fan will be controlled by a VFD. The exhaust fan shall be sized at 20% reduction in capacity. The supply air distribution system will supply outside air to VAV terminal units for distribution of outside air to each zone.

To control outside air, a central CO2 monitoring system will be provided to take advantage of building diversity. Each occupied area will contain a CO2 measuring port with a high quality central CO2 sensor. The VAV terminal will modulate in accordance with the CO2 measurements. The VAV terminal will also be interlocked with room occupancy sensor.

The outside air conditioning system will be provided with water to water, reverse cycle chiller units (2-pipe system) located in the mechanical room. The units will provide hot or chilled water as required to condition the outside air. The 2-pipe system will changeover from heating to cooling and vice versa based on outside air temperature. A separate primary constant volume hydronic pumping system will circulate water to the dedicated outside air handling units. This system will have a primary and backup pump with lead/lag operation. The 2-pipe loop will consist of steel and copper piping and also contain approximately 30% propylene glycol with chemical treatment and rust inhibitors. The 2-pipe loop will be insulated with 1" thick glass fiber insulation for 1.5" and smaller piping. Larger piping will be insulated with 2" thick glass fiber insulation.

Each classroom includes a natural ventilation indicator to allow the occupants to know the temperature and humidity conditions outdoors are acceptable to allow them to open the windows in their area. This device will be connected to DDC system and illuminate when outdoor conditions are appropriate.

Geothermal Well Field and Piping System

The geothermal well field will consist of 400 feet deep wells depending on test well results. The wellfield size will be established during the design phases utilizing on-site test data and computerized simulation software.

The bores will be 6" in diameter and will include a factory made DR-9, 1-1/4" U-tube, fully grouted well. Manufactured geothermal vault structures will be utilized and shall include isolatable circuits per vault. The wells shall be installed on a 20' by 20' staggered grid system. One circuit shall be considered spare/redundant. All horizontal mains shall be a minimum of three feet below grade and the trenches shall be 100% back filled with rock or other suitable materials.

All geothermal piping exterior of the building shall be HDPE butt-fused joints and fittings. All geothermal piping mains interior of the building shall also be HDPE butt-fused joints and fittings so as to eliminate steel piping in this Hydronic loop. Heat pump runouts shall be copper. The geothermal loop will contain approximately 20% antifreeze fluid. The heat transfer fluid shall be an ethanol based solution non-toxic antifreeze heat transfer fluid formulated specifically for use in geothermal heat pump systems. The wellfield piping and building piping will be purged to remove dirt, debris and air.

All concealed geothermal piping interior of the building shall be insulated with 1" thick fiberglass insulation with an all service jacket. Valve tags and charts shall be provided for every valve 1" and larger within the facility.

Temperature Control

A web-based BAC-Net or Lon-Works DDC controls system shall be provided for the entire building and associated systems. The controls system will also include a JACE panel to communicate (wired/wireless) over the web-based area network to the Niagara based FMCS. The BAS shall also interface with the building lighting controls, and switch gear / electric metering. BTUH metering shall be provided for the central geothermal system, kitchen systems, etc. The system shall be ASHRAE 135 BACnet compliant.

Narrative Descriptions

ELECTRICAL SYSTEMS

CODES AND STANDARDS

- Building / Dwelling Code: 2012 Virginia USBC (based on IBC 2012)
- Energy Code: 2012 Virginia USBC (based on IECC 2012)
- National Electrical Code: 2011 NFPA 70
- National Fire Alarm Code: NFPA 72
- Fire/Life Safety Code: 2012 International Fuel Gas code and NFPA requirements
- Illuminating Engineering Society of North America (IESNA)
- LEED 2009 for Schools – New Construction
- Arlington Public Schools Elementary Design Guidelines

SUSTAINABILITY AND ENERGY CONSERVATION:

- The project is anticipated to be designed to LEED 2009 for Schools - gold level certification.

POWER

- Incoming Electrical Service and Main Switchboard
    - A new dedicated 2000A, 480/277V incoming electrical service will be provided. An exterior utility pad mounted transformer will be provided on the site with underground concrete encased primary and secondary conduits. Secondary voltage serving the building will be 480/277V. Size of the electrical service is preliminary based on anticipated building size. Final size to be verified during design.
    - No interconnection to the existing building electrical service is anticipated.
    - The new incoming electrical service will feed a main switchboard with Dominion Virginia Power (DVP) required CT cabinet and meter, main service disconnect, and distribution sections with circuit breakers. Main switchboard will be located at the ground level in a 2 hour rated main electrical room.
    - Main switchboard shall be GFI protected as required by the National Electrical Code (NEC) as well as an integral surge protection device.
- Electrical Distribution
    - 480/277V distribution panels will be provided in select electrical rooms.
    - 480-208/120V local transformers will be provided at select electrical rooms for local distribution panels.
    - Local 480/277V and 208/120V panel boards will be provided to receptacles, lighting, and miscellaneous loads. These panel boards will be provided with surge protection devices.
    - Mechanical and plumbing equipment loads will be kept separate from all other loads.
    - Provide local metering as required to meet the requirements of LEED 2009 for Schools – New Construction.
- General Power
    - A receptacle will be provided on each wall in each classroom. A receptacle will be provided at the smart board. A receptacle will also be provided at the teacher work station. Four receptacles will be provided at the computer work stations.
    - A GFCI receptacle will be provided in each toilet room.
    - Resource rooms and the teachers work rooms will have a receptacle on each wall.
    - A GFCI receptacle shall be mounted above counter at each sink of science rooms.
    - Offices will be provided with a receptacle at desk and convenience receptacles at each wall.

- All loads over ½ HP will be fed at 480V or 277V. All electric heat will be served at 480V or 277V.
- Metal-clad cables, Type MC, will be permitted for drops in walls and circuiting of lighting fixtures above accessible ceilings. All feeder circuits and circuits over 30A shall be ran in EMT.
- All wiring shall be based on copper conductors.

EMERGENCY POWER

- A 200kW, 480/277V emergency generator shall be provided for the following loads. Separate transfer switches are required for life safety and miscellaneous equipment loads. Size of the generator is preliminary based on anticipated building size. Final size to be verified during design.
    - Life safety loads including egress lighting, fire alarm system, mass evacuation system, elevator power, elevator cab lighting and power, fire pump (if required).
    - Miscellaneous equipment loads including IT equipment, security equipment including cameras, and other code required equipment which require emergency generator backup.

FIRE ALARM

- A new standalone, fully addressable fire alarm will be provided with all code required initiation (smoke detectors, manual pull stations, etc.) and notification devices (speakers, strobes, etc.).
- Monitor kitchen ansul system, emergency generator, fire pump (if required) will be provided.

AUXILIARY SYSTEMS

- All data outlets shall consist of ¾" conduit and a 4 "square box with cover.

LIGHTING

- Lighting fixtures will be specified with multi-voltage 277/120V ballasts and drivers.
- All fluorescent ballasts shall be electronic instant start.
- Emergency egress lighting will be provided in the corridors and other areas as required by the Life Safety Code and connected to the emergency generator.
- Exit signs shall be cast aluminum housing (brushed aluminum face and red letters) with a LED source and circuited to the life safety panel board.
- Each classroom will have approximately one light per 100 sf. The lighting fixtures shall be 2' X 4' with an LED lighting source.
- The corridors will have 2' X 4' recessed lighting fixtures with an LED lighting source.
- Each toilet room space shall have one light fixture per 80 sf. The light fixtures shall have an LED lighting source.
- All lamps and LEDs shall be 3500K and minimum 85 CRI.

Narrative Descriptions

PLUMBING AND FIRE PROTECTION SYSTEMS

CODES AND STANDARDS

- Building / Dwelling Code: 2012 Virginia USBC (based on IBC 2012)
- Plumbing Code: 2012 Virginia USBC (based on IPC 2012)
- Mechanical Code: 2012 Virginia USBC (based on IMC 2012)
- Fire/Life Safety Code: 2012 International Fuel Gas code and NFPA requirements
- Gas Code: 2012 Virginia USBC (based on 2012 International Fuel Gas code and NFPA requirements)
- Energy Code: 2012 Virginia USBC (based on IECC 2012)
- LEED 2009 for Schools – New Construction
- Arlington Public Schools Elementary Design Guidelines

SUSTAINABILITY AND ENERGY CONSERVATION:

- The project is anticipated to be designed to LEED 2009 for Schools - gold level certification.

PIPE SIZING CRITERIA

- Domestic water piping 4" size and smaller:

  Maximum velocity: 6 fps

  Maximum water pressure drop: 3.0 ft.hd./100 ft. equivalent length

UTILITIES:

- The following new utilities will serve the building (all listed sizes are preliminary estimates based on anticipated building size, final sizes to be verified during design):

Domestic Water – 4" meter and service pipe, 4" distribution main

Fire Protection – 6"

Sanitary – 8"

Storm – to be determined

Natural Gas – 3"

FIRE PROTECTION SYSTEMS:

- The buildings will be hydraulically designed with an automatic sprinkler system in accordance with NFPA 13 and NFPA 14.

- The sprinkler occupancy hazard classifications shall meet the more stringent of the NFPA 13 requirements for the different rooms. Science rooms, mechanical rooms, electrical equipment rooms, and general storage rooms shall be Ordinary Hazard Group 1 classification. Classrooms, offices and public spaces shall be Light Hazard classification.

- Standpipes are not anticipated being required at this time. The highest occupiable floor is less than 30 feet above the fire fighters entry and the building does not consist primarily of chemical using laboratory spaces. Building entry point to be verified as design progresses.

- A sprinkler riser will be located in the central stairwell. The riser will be provided with a zone control valve with tamper switch, check valve, and flow switch at each floor.

- An electric fire pump is not anticipated at this time, but will be further explored as the design progresses. A flow test will be performed to confirm available pressures.

- A dry type sprinkler system will be provided to serve any areas subject to freezing. The dry type system will consist of an air compressor, dry pipe valve, schedule 40 galvanized steel piping and associated trim. Wherever possible, piping will route within conditioned spaces and dry type sprinkler heads will serve the unconditioned spaces. Antifreeze systems will not be permitted. Requirements will be determined as design progresses.

- Sprinkler heads shall be concealed type with white finish to match ceiling in areas with suspended ceilings. All other locations shall have upright or pendant type sprinkler heads as required with brass (unfinished areas) or chrome finish (finished areas). Flexible drop sprinkler heads will not be permitted. Sprinkler heads shall have a 165 degree F rating unless otherwise indicated. Sprinkler heads located within mechanical room, boiler room, electrical rooms, storage rooms, elevator machine rooms, and communication rooms shall be rated for 286 deg. F. Sprinklers shall not include O-ring seals. Sprinkler heads will be centered in two directions in ceiling tiles. Sprinkler head guards will be provided for sprinklers located less than eight feet above finished floor or where damage to sprinkler heads may occur,

such as stairways, corridors, etc. Wet pipe fire protection sprinklers will be provided at bottom of elevator pits. Valves to isolate elevator pit and elevator equipment room sprinklers will be provided per elevator code/inspection requirements.

- Fire department connection (Siamese or Storz) shall be provided. Location and type to be coordinated with Fire Marshal.

- Fire Command Center location to be coordinated with Fire Marshal.

PLUMBING SYSTEMS:

- Domestic Water: A new domestic water service shall be provided. A backflow preventer and wye-strainer will be provided along with the meter in the mechanical room.

  No lawn irrigation is anticipated at this time. A separate meter will be provided for lawn irrigation if necessary.

  HVAC makeup water is not anticipated at this time. A deduct meter will be provided to serve HVAC makeup water if necessary.

  The water meter will be connected to the building energy management system for monitoring.

  A domestic water booster pump is not anticipated. A flow test will be performed to confirm available pressure.

  The building domestic hot water will be generated by natural gas-fired, storage type domestic water heater(s) complete with primary recirculation pump and master thermostatic mixing valve located in the mechanical room. The hot water will be generated at 140°F. The water will then go through a master mixing valve and be distributed at to the building at 130°F. An ASSE 1070 individual-fixture thermostatic mixing valve will be provided at each hand washing fixture.

  All domestic piping will be Type L copper with soldered joints. PEX and ProPress are not permitted. Piping will be valved at each floor for isolation of the floor. Piping will also be valved at each room serving fixture in an accessible location either at entrance to the room or adjacent corridor to allow maintenance to be performed within the room without affecting others.

  Each floor will be provided with isolation and drain valves on the distribution piping.

- Plumbing Fixtures: Plumbing fixtures will be high-efficiency. All fixtures types to be verified with Architect and Owner.

  - Water closets shall be floor mounted vitreous china bowls with electronic, 1.28 gallon per flush, dual-flush, sensor operated flush valves. Sensor shall be electric.

- Urinals, if utilized, shall be wall mounted vitreous china with electronic, 0.50 gallon per flush, sensor operated flush valves. Sensor shall be electric.
- Lavatories shall be vitreous china or one piece solid surface countertops with integral sinks. Lavatory faucets will be electronic, 0.5 gallon per minute. Sensor shall be electric.
- Water coolers shall be non-CFC refrigerant, self-contained air cooled electric water coolers with bottle fillers.
- Mop sink in janitor's closets shall be floor or wall mounted enameled cast iron or precast terrazzo, with wall mount service sink faucet.
- Lockable hose bibs will be provided in the toilet rooms.
- Freeze proof wall hydrants will be provided at various locations around the exterior of the building.

- Natural Gas: A new natural gas service shall be provided. The system will serve the mechanical equipment, domestic water heater, as well as point of use outlets. Rooms containing more than two point of use outlets will be provided with an emergency shut off valve (solenoid or manual, to be determined) located outside of the area of use within five feet of the door. A service station for the teacher will be provided, which includes a room natural gas shutoff valve for all stations.

- Sanitary: A new sanitary and vent system will be installed. Automatic trap primers complying with ASSE 1018 or ASSE 1044 will be provided on each floor drain where required by code.

  Sanitary, waste, and vent piping will be cast iron above ground and PVC piping underground.

  Solid interceptors shall be provided on sinks where required by code.

  Oil and grease interceptors shall be provided where required by code.

  A sewage ejection pump or backwater valve is not anticipated at this time. The finished floor elevation will be evaluated for requirements during design.

- Storm: A new storm drainage system will be installed. Storm piping will drain by gravity to grade or to a storm water main.

  A separate overflow roof drainage system will be provided for the building, piped down, and will spill on grade.

  Rain conductor piping will be cast iron above ground and PVC piping underground.

  Rainwater harvesting system is not anticipated at this time, but is being investigated for feasibility of storm water requirements by Civil Engineer.

- Specialty Systems:

- Chemical/acid waste piping will be provided to serve laboratory spaces utilizing chemicals and fume hoods (where required). The chemical waste piping will be routed to a neutralization tank. The tank will serve multiple rooms where space permits. If space is not available, point of use neutralization shall be provided. Chemical waste piping will be PVDF.

- A sump pump shall be provided in the elevator pit (if required).

- The elevator is not anticipated to be hydraulic and therefore no oil interceptor is anticipated.

- Specialty gases (compressed air, vacuum, and bottled gases) are not anticipated.

- <u>Emergency Fixtures:</u>

  Emergency eyewash/shower combination units shall be provided in all science rooms (to verify with owner).

  Emergency eye wash station shall be provided in all janitors closets (to verify with owner).

Silman

BASIS OF DESIGN
DRAFT STRUCTURAL DESIGN NARRATIVE
REED SCHOOL
SILMAN PROJECT NO. W3188

Structural Engineers

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SECTION 1 – CODES AND STANDARDS

Applicable Governing Codes and Design Guidelines

A. Local Code
   1. 2012 Virginia State Building Code

B. Model Building Code:
   1. International Building Code 2012 (IBC 2012)

Applicable Reference Standards

The following structural design standards will be followed as specified by the governing codes:

A. Load/Analysis:
   1. ASCE 7-10, Minimum Design Loads for Buildings and Other Structures

B. Concrete:
   1. ACI 318-11, Building Code Requirements for Structural Concrete (ACI), as modified by IBC

C. Structural Steel:
   1. AISC 360-10 Specification for Structural Steel Buildings –AISC Load and Resistance Factor Design for Structural Steel Buildings (AISC-LRFD), and the seismic provisions for Structural Steel Buildings – load and resistance factor design as modified by IBC

D. Floor Vibration The following industry guideline is used to communicate the issues related to floor vibration due to human activities and the related planning issues:
   1. AISC Design Guide #11 “Floor Vibration Due To Human Activity”

SECTION 2 - STRUCTURAL CODE ANALYSIS/ DESIGN CRITERIA

Design Criteria

1. Structural Loading: According to the building code the Risk Category for the building according to IBC Table 1604.5 is III.

Uniformly Distributed Live Loading

Occupancy or Use	Live Loadings	
	Uniform (psf)	Concentrated (pounds)
Lobbies / Assembly	100[1]	2000 lbs / 2.5 ft^2
First Floor Corridors	100[1]	2000 lbs / 2.5 ft^2
Floors above First Floor	60[1][3]	
Mechanical Rooms	150[1][2]	
Roof	100	
Light Storage	125	
Library (Reading Room)	60	
Library (Stack Room)	150	
[1] SDL 20 psf partitions also applied		
[2] Used in absence of actual weight of mechanical equipment		
[3] Additional 20 psf SDL for partitions		

1. Snow Loading:
   a. Exposure Factor Ce 0.9
   b. Thermal Factor Ct 1.0
   c. Snow Importance Factor (I) 1.1

2. Wind Loading :
   a. Basic Wind Speed: 90 mph
   b. Exposure: B
   c. Wall elements shall be designed for components and cladding wind pressure.

3. Seismic Loading:
   a. The design base shear is found using the static force procedure with the following factors:
   b. Mapped Response Acceleration (S_s): 0.119g
   c. Mapped Response Acceleration (S_1): 0.051g
   d. Site Class Definition: D*
   e. Occupancy Category: III
   f. Seismic Design Category: B
   g. Seismic Design Importance Factor (Ie) 1.25

   *Site Class D is typically assumed in the absence of a geotechnical report

4. Superimposed Dead Loads (Assumed):
   a. MEP & Ceiling 10 psf

b. Partitions 20 psf

5. Design Considerations:
   a. Stability:
      i. Dead Load (+ anchorage) = 1.5 x overturning
      ii. Dead Load = 1.5 x sliding

   b. Lateral Deflection
      i. Allowable story drift due to seismic shall not exceed 0.015 x story height.
      ii. The lateral deflection of vertical elements supporting masonry shall not exceed 1/600 of the span length or 3/8".

   c. Deflections:
      i. The live load deflection of floors shall not exceed 1/360 of span lengths.
      ii. Roof deflection under live snow or wind shall not exceed 1/360 of the span length.
      iii. The post-masonry-installation deflection of beams and floors supporting masonry shall not exceed 1/600 of the span length or 3/8".

   d. Vibrations
      i. Where human comfort is the criteria for limiting pedestrian induced motion, floor framing vibration due to footfall vibrations will be controlled. Where vibrations are caused by running machinery, they shall be isolated by damping devices on frame structure (each specified by the MEP consultant) to satisfy all building vibration requirements.

   e. Non-Structural Components
      i. M/E/P systems are to be provided with appropriate joints to allow for movements/settlements at existing expansion joints.

   f. Sustainability- Below list several structural opportunities for promoting sustainability and assisting in meeting LEED™ Certification
      i. Fly ash can be used in the concrete mix to replace a portion of the Portland cement needed. Fly ash is considered a post-consumer recycled material, one of the residues generated in the combustion of coal, generally captured from the chimneys of power generation facilities. Its use provides an additional benefit in that it reduces the embodied energy of the cement mixture as the production of Portland cement requires very large amounts of energy.
      ii. Structural steel qualifies as a post-consumer recycled material.
      iii. Regional materials can be used; specifically concrete that is regionally batched.
      iv. Certified wood can be used for any structural wood framing and non-structural elements.
      v. Reusable forms can be specified instead of plywood in order to decrease construction waste.
      vi. Areas of concrete construction or paving that need to be demolished for new construction could be crushed for use as a sub-base below the foundations, both decreasing construction waste and providing a recycled material.
      vii. Low-emitting materials can be specified for materials such as low-VOC adhesives and concrete sealants.

SECTION 3 - STRUCTURAL MATERIAL SPECIFICATIONS

Existing Foundations

1. Soil Bearing Capacity
   a. Spread Footings 3,000 psf (Estimate)

New Foundations

1. Soil Bearing Capacity
   a. Spread Footings 3,000 psf (Estimate)
2. Micropile Capacity
   a. 200 k per micropile (Estimated)

Existing Concrete

1. Existing
   a. f'c=4000psi for all concrete work (Estimated)
2. Existing Reinforcing
   a. For WWR: Grade 75 (Estimated)
   b. For all other reinforcement: Grade 60 (Estimated)

New Concrete

1. Foundations, slabs on grade and walls
   a. f'_c = 4,000 psi
   b. Normal weight = 150 lb/ft^3
2. Reinforcing
   a. Mild: ASTM A-615 Grade 60
   b. WWR: Grade 75

Existing Structural Steel

1. Existing Structural Steel
   a. ASTM A992 (Estimated)
   b. ASTM A36 (Estimated)

New Structural Steel

1. Rolled W Shapes — ASTM A992
2. Miscellaneous Steel Sections — ASTM A572 Gr. 50
3. Tubes — ASTM A500 – Grade B
4. High Strength Bolts — ASTM A325
5. Steel Plate — ASTM A36
6. Welding Electrodes — E70XX
7. Elements supporting exterior masonry walls and elements exposed to weather shall be galvanized.
8. Fire protected steel shall be unpainted.

New Steel Deck

1. Floor: 3" 18 Ga
2. Roof: 1.5" 20 GA Type B

SECTION 4 - NEW STRUCTURAL SYSTEMS

Below grade gymnasium

The new below grade gymnasium is estimated to require a 40' excavation which can be permanently supported in one of two ways:

1. The first option is to permanently support the excavation using a 2' thick (+/-) concrete retaining wall. The wall would span from slab on grade to the bottom of the beams. This option will require temporary support of excavation (SOE)
2. The second option is to utilize a permanent earth retention system. The simplest option would be to use the temporary SOE, assumed to be a soldier pile wall with tiebacks, as a permanent retention system. The interior wall can then be a thinner concrete wall.

In both options the ground floor level will be a slab on grade, estimated to be 5" thick. The foundation for the walls and columns will be spread foundations. Spread foundations are estimated to be 15'x15'.

The new Gym roof is expected to span approximately 70' between columns located next to the locker room and columns located on the perimeter of the gym. The roof can be framed using deep rolled shapes such as W40-W44 beams with a spacing of approximately 5'-0". In consideration of the columns and beams the weight of the new steel will be about 20 psf. The perimeter walls will be used to support the new beams where possible. The roof surface is expected to be a 3" deep, 18 gage composite metal deck with 3" concrete fill. The exterior seating area will be built-up using concrete cast on grade.

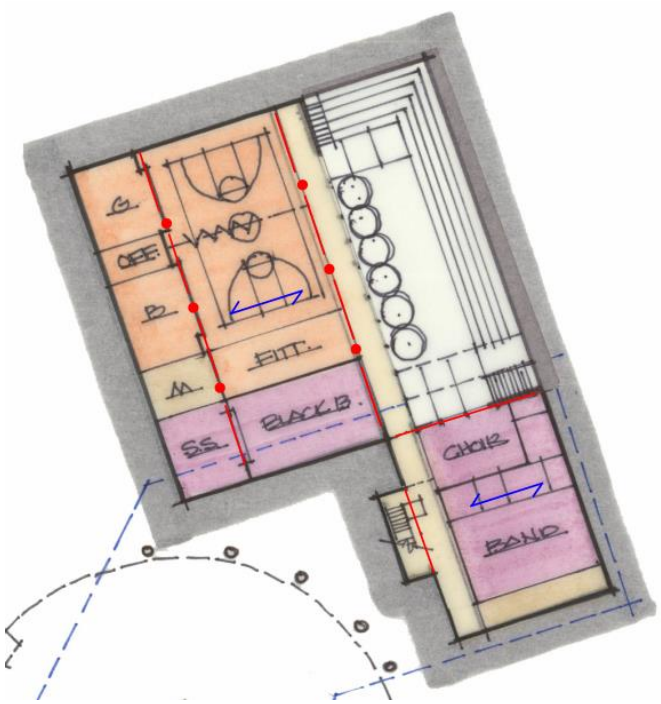

Figure 1 - Below Grade Gymnasium

At the entrance to the new gymnasium area, a curtainwall system will be installed. This system will be braced by the roof structure, and the structure will be cantilevered to the building face to support the proposed masonry.

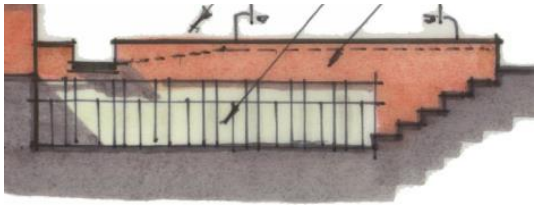

Figure 2 - Curtainwall System at below grade gym

New Auditorium Building

Since the new auditorium building is attached to the new gymnasium, the below grade retention system will be the same with the same depth of excavation. Similarly, the ground floor slab and foundation system will also be the same.

We anticipate that the floor systems for this area will be fairly heavy rolled shapes designed to accommodate vibration requirements and spanning approximately 70' from wall to wall (See Figure 1). It is estimated that the weight of the steel structure will be approximately 18 psf. The floor system will utilize the same composite deck as the gym roof.

We anticipate that the above grade structure for the auditorium will be 12" +/- concrete walls around the perimeter. Interior structures, such as the proposed retractable seating system, may require additional support or framing.

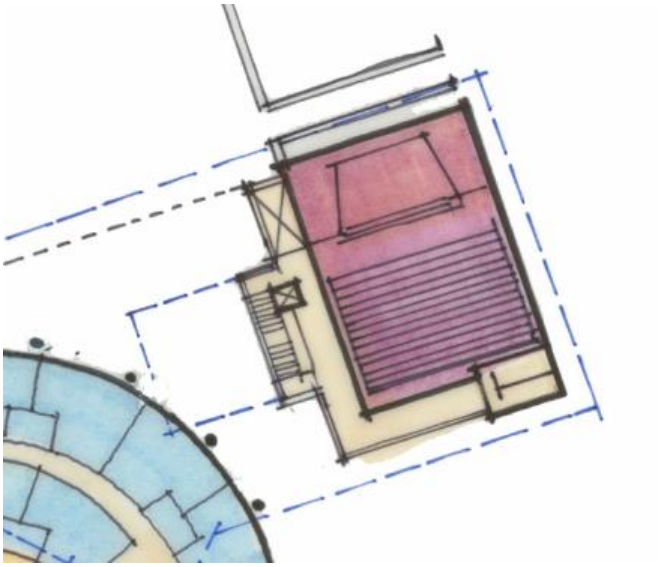

Figure 3 - Auditorium Area above grade

Treehouse Addition

The treehouse addition will be supported on 'super' columns which are threaded through the existing building courtyard on one side. The treehouse will be supported on the other side by the new auditorium structure.

The foundation for the super columns will be a concrete mat with micropiles. Assuming a capacity of 200kips per micropile, it is anticipated that a 27'x27'x5' +/- mat with an 8x8 grid of micropiles (total of 64) will be required. The loads on each super column are expected to be approximately 3,000 kips. While a large, shallow mat foundation is possible, the size required is unlikely to fit within the courtyard with the assumed bearing capacity of 3-4 ksf.

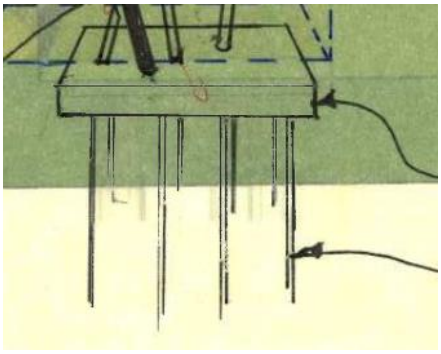

Figure 4 - Mat foundation under Super columns

Super Columns:

There are several options available that will work structurally, so we have proposed some of these options below for architectural consideration.

The first option would be to use a single, hollow, structural column, perhaps in the shape of an Andansonia tree, more commonly known as a baobab tree. The column material could be steel or ultra-high performance concrete (such as ductal).

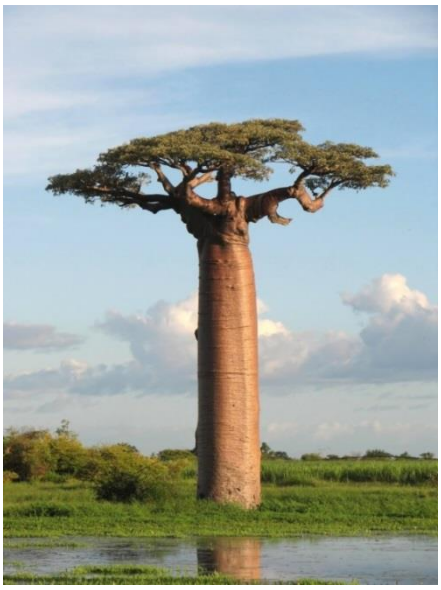

Figure 5 - Andansonia Tree

The second option would be a built up 'laced' column such as those used in three-dimensional space trusses or unique architectural situations. This type of column can more easily incorporate twisting shapes and geometry since it utilizes smaller structural shapes tied together. An example of a highly architectural structural column is below.

Figure 6 - Laced Column Example

Finally, the more conventional solution would be to use either a rolled shape for the super columns, such as a W14x600 or 24" diameter hollow steel cylinder. These columns could be vertically straight, or sloped in one or more vertical planes.

The super columns will be braced between floor levels by the proposed stair landings and stair framing. Overall, there are several 'treehouse' schemes that are structurally possible. We anticipate that the weight of the steel super columns will be approximately 100 Tons. The stairs can be open or enclosed and any enclosure used, such as a curtainwall system, can be braced by the super columns.

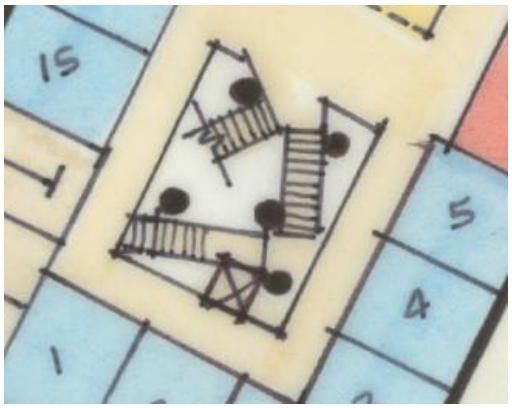

Figure 7 - Plan view of Super Columns

Treehouse Framing

The treehouse will be framed using two-story deep trusses which are supported by the super columns and the new auditorium space. The diagonals of the trusses will be located to avoid interference with programing and where necessary, a Vierendeel bay will be utilized to eliminate the bracing. These trusses will support perimeter trusses that will pick-up the edge of the building. These perimeter trusses could be expressed, or hidden, as the architectural requirements dictate.

The total steel weight for the treehouse is expected to be between 20-23 psf over the floor area including the roof for a total steel weight of approximately 1,300+/- Tons. The floors and roof garden area will be a concrete slab on metal deck similar or identical to the one proposed over the gymnasium.

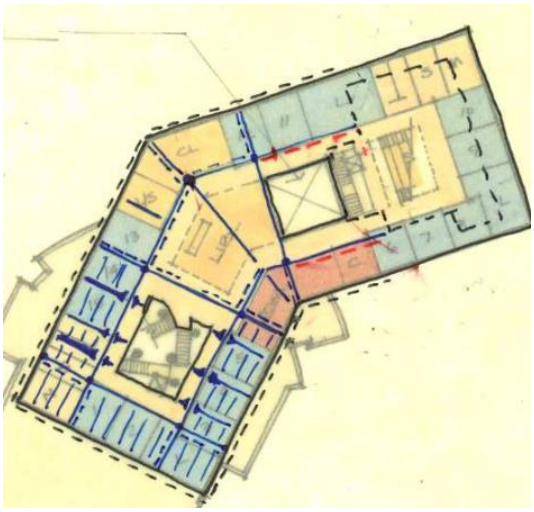

Figure 8 - Plan View of proposed Framing

There are two options for supporting the treehouse at the new auditorium building. Slanted columns weighing approximately 800 plf may be incorporated to reduce the effective span of the two-story trusses above, or the steel members in the trusses above may be increased to span to the auditorium building. If the truss member sizes are increased, the estimated floor weight will be closer to the 23 psf estimate.

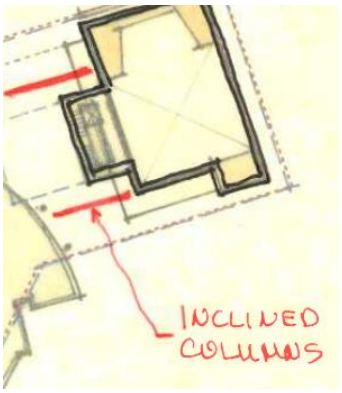

Figure 9 -Inclined columns

Hole through Building

The hole through the building is assumed to be open within the enclosed building, but above and below the floors the hole enclosure can be framed in different ways.

1. Could be framed as cable net glass structure (*note, this will require additional foundation considerations*)
2. Could be framed using typical steel sections

On the exterior, spread foundations can be utilized once the structure reaches grade

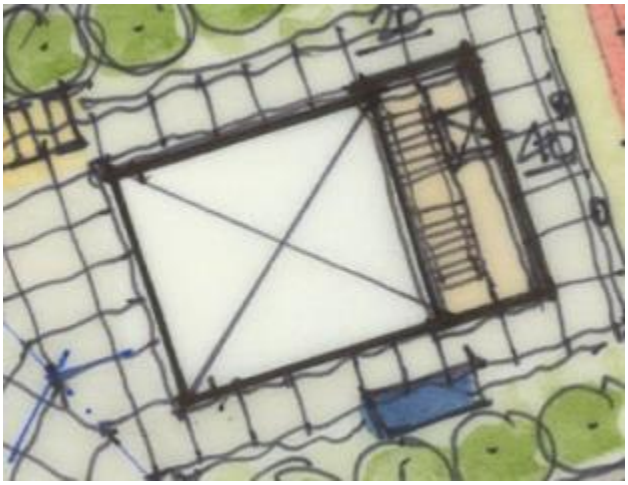

Figure 10 - Plan view of hole through building

Parking Structure

The new parking structure is anticipated to be a cast in place concrete structure. The retaining walls will be 10-12" thick. The ground floor will be a slab on grade and the second floor will be a framed slab with columns spaced 25-30' on center. The slab thickness on the ground will be 5" and the elevated slab will be 8" with 8" drop panels at the columns. The most cost effective foundation system will likely be spread foundations and it is anticipated that they will be 7-8' square.

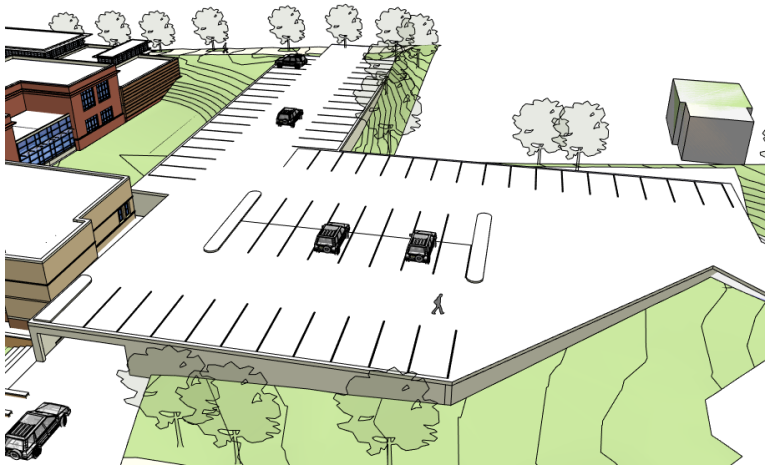

Figure 11 - View of Parking Structure

SECTION 5 – Structural Modifications

Modification of Existing Roof Structure

To reuse the existing roof structure for the new corridor, the existing structure will require reinforcement or replacement as follows:

1. Strengthen the existing columns and foundations for the additional loads
2. Add new steel beams to support floor loads
3. Relocate the existing rooftop mechanical units and reinforce the new location as needed
4. Replace existing metal deck with new deck and concrete infill
5. Tie the new enclosure to the new treehouse structure where possible and where there is no structure above; provide a new roof structure over the new enclosure using steel joists and 1.5" type B steel deck.

Alternatively, the new corridor structure could be hung from the new treehouse structure and therefore have no impact on the existing roof.

Figure 12 - New program space over Existing Structure