HD WOODSON HIGH SCHOOL

Construction Project Management

Rendering courtesy of cox graae + spack

TECHNICAL ASSIGNMENT 1

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Construction Option
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EXECUTIVE SUMMARY

Technical Assignment One provides background information for the HD Woodson High School. This report contains information on the project schedule, building systems, cost summaries, client information, project delivery system, and staffing organization.

HD Woodson Senior High School will be a 230,130 gross square foot new high school facility to accommodate up to 900 students in grades 9 through 12. The facility is designed around a developing trend in high schools that are focused on Science, Technology, Engineering and Mathematics (STEM). This newly developed STEM Concept allows students to learn in a very practical and hands-on manner. The STEM requirements allow for integral design of classroom and laboratory spaces. An emphasis in technology at HD Woodson High School is also very present. Classrooms will use interactive smart board technology and students will all have individual laptops.

The actual facility of HD Woodson Senior High School will be striving to achieve LEED Gold Certification upon completion under the LEED for Schools program by the US Green Building Council. Green Roof technology and highly reflective EPDM roofing membrane will assist in achieving critical LEED Points. An elaborate rain and grey water system will also be used to reduce run-off and conserve water. A Baysaver system will be used to filter all other run-off water.

In addition to the high tech classrooms, the facility construction also includes a competition gymnasium, auxiliary gymnasium, natatorium, auditorium, cafeteria, artificial turf football field, eight lane all-weather track, throwing areas, high jump and triple jump areas, softball field and press boxes.

The facility is a project of the DC Public Schools. Internal to DCPS it is the first totally new facility that the Office of Public Education Facilities Modernization (OPEFM) will be responsible for. The former facility on the location was deemed no longer fit for use by the faculty and community prior to demolition. This is DCPS's first school design focused on the STEM concept. The school is scheduled to be open for the 2011-2012 school year.

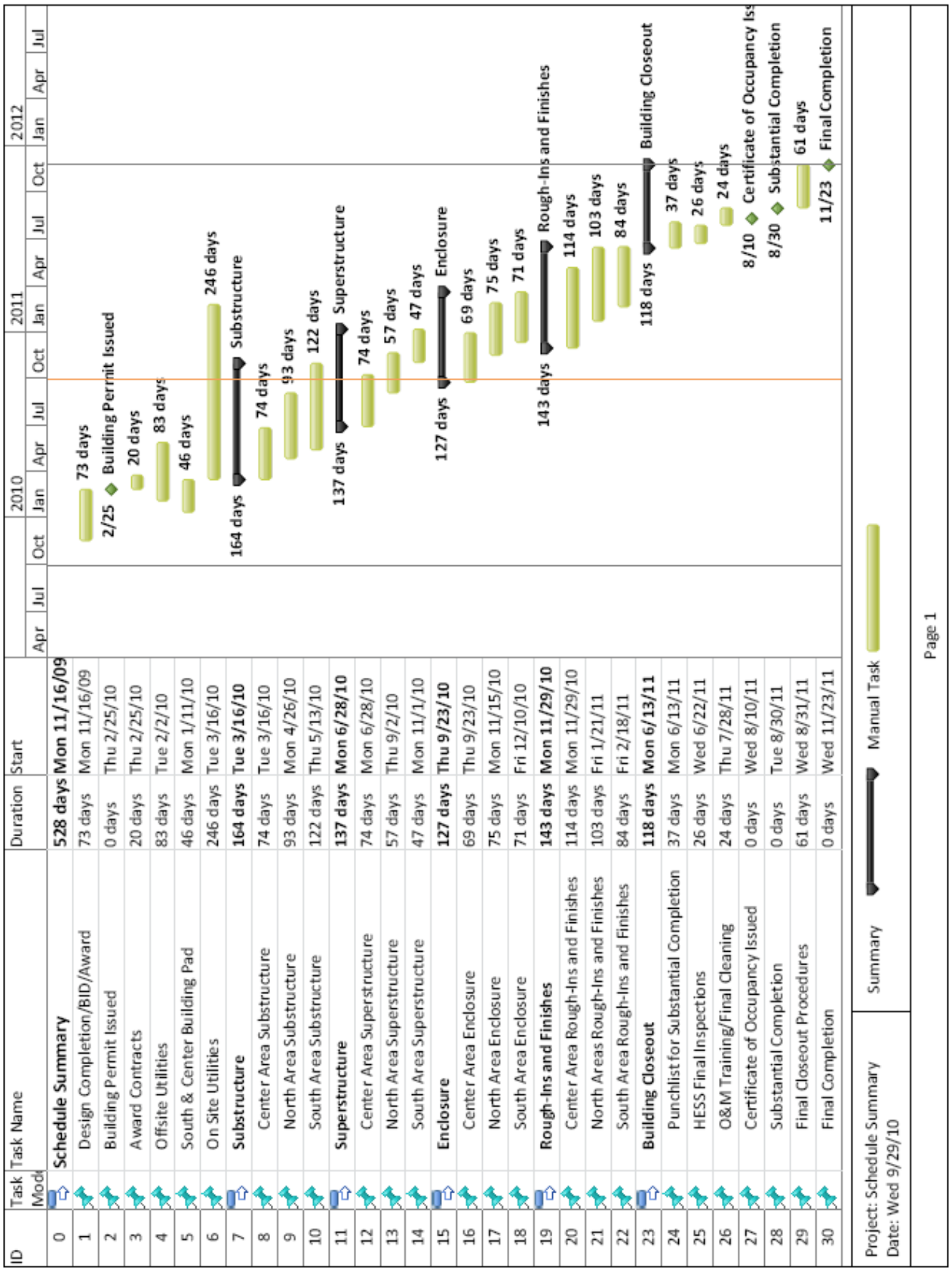
PROJECT SCHEDULE SUMMARY

Foundation, Structural and Finish Sequence Narrative

The foundations will be constructed one of two ways on the site depending on the location and loading. Higher load areas will require geopeirs to be constructed under the footings to create a high load bearing capacity. The rest of the site and outbuildings will use spread footings. The one exception will be the pool location; this area will involve the installation of sheeting and shoring, a mud mat, and special water-proofing of the Pool Structure inside and out.

Structurally the building will be erected in three segmented sections separated by fire rated barriers. The Substructure and Superstructure will both follow similar sequence paths. The Center Section and core of the building will always lead followed by the North Section and then the South. By segmenting the schedule throughout the process crews will be able to be of smaller sizes and more productive, if other trades have already moved out of a particular area prior to the next starting its work. There are however a number of trades that will require tight collaboration to achieve success on this project. The primary example being, the Electrical Contractor and Masonry Contractor as many block walls will need to be roughed in while being constructed. The Rough-in and finish schedule will follow a similar sequence by starting in the Center, progressing to the North and then finishing in the South Building.

In summary, the total project is scheduled to take 528 Days. This does not include pre-design demolition. Substructure is projected to last 164 days, superstructure will take 127 days and the rough-in and finish timeline is 143 days. Building closeout includes testing for LEED point verification and other testing and balances, as well as final punch list work. Final completion is expected to be November 23, 2011. See Gantt Chart Summary Schedule on Next Page.


ID
Task Mode
Task Name
Duration
Start
2010
2011
2012
Apr
Jul
Oct
Jan
Apr
Jul
Oct
Jan
Apr
Jul
0 Schedule Summary 528 days Mon 11/16/09
1 Design Completion/BID/Award 73 days Mon 11/16/09
2 Building Permit Issued 0 days Thu 2/25/10
3 Award Contracts 20 days Thu 2/25/10
4 Offsite Utilities 83 days Tue 2/2/10
5 South & Center Building Pad 46 days Mon 1/11/10
6 On Site Utilities 246 days Tue 3/16/10
7 Substructure 164 days Tue 3/16/10
8 Center Area Substructure 74 days Tue 3/16/10
9 North Area Substructure 93 days Mon 4/26/10
10 South Area Substructure 122 days Thu 5/13/10
11 Superstructure 137 days Mon 6/28/10
12 Center Area Superstructure 74 days Mon 6/28/10
13 North Area Superstructure 57 days Thu 9/2/10
14 South Area Superstructure 47 days Mon 11/1/10
15 Enclosure 127 days Thu 9/23/10
16 Center Area Enclosure 69 days Thu 9/23/10
17 North Area Enclosure 75 days Mon 11/15/10
18 South Area Enclosure 71 days Fri 12/10/10
19 Rough-Ins and Finishes 143 days Mon 11/29/10
20 Center Area Rough-Ins and Finishes 114 days Mon 11/29/10
21 North Areas Rough-Ins and Finishes 103 days Fri 1/21/11
22 South Area Rough-Ins and Finishes 84 days Fri 2/18/11
23 Building Closeout 118 days Mon 6/13/11
24 Punchlist for Substantial Completion 37 days Mon 6/13/11
25 HESS Final Inspections 26 days Wed 6/22/11
26 O&M Training/Final Cleaning 24 days Thu 7/28/11
27 Certificate of Occupancy Issued 0 days Wed 8/10/11
28 Substantial Completion 0 days Tue 8/30/11
29 Final Closeout Procedures 61 days Wed 8/31/11
30 Final Completion 0 days Wed 11/23/11
73 days
2/25 Building Permit Issued
20 days
83 days
46 days
246 days
164 days Substructure
74 days
93 days
122 days
137 days Superstructure
74 days
57 days
47 days
127 days Enclosure
69 days
75 days
71 days
143 days Rough-Ins and Finishes
114 days
103 days
84 days
118 days Building Closeout
37 days
26 days
24 days
8/10 Certificate of Occupancy Iss
8/30 Substantial Completion
61 days
11/23 Final Completion
Project: Schedule Summary
Date: Wed 9/29/10
Summary
Manual Task
Page 1

BUILDING SYSTEMS SUMMARY

Yes	No	Work Scope
	X	Demolition Required
X		Structural Steel Frame
X		Cast in Place Concrete
X		Precast Concrete
X		Mechanical System
X		Electrical System
X		Masonry
X		Curtain Wall
X		Support of Excavation
X		LEED Rating

Demolition Required

Existing facilities on site were demolished prior to Design-Build Phase commencing. A 300 square foot hole ranging from 6 to 14 feet deep must be filled with structural fill after dewatering and stabilization.

Structural Steel Frame

Floor system will use structural steel beams and columns as part of a composite system. The roof framing will be open web steel joists and 1 ½" metal decking. Concentrically braced frames are used to carry additional lateral loads not accounted for by structural masonry walls. Typical columns range from W10x33 to W10x88 and W12x79 to W12x152. Typical beams are W8x10, W16x26 and W16x31.

Cast in Place Concrete

Foundations and footing will be cast in place and formwork will typically be job-built wood forms. Placement will be done with use of a concrete pumping truck. Main structure of pool will be cast in place concrete as well.

Precast Concrete

Precast concrete or cut stone will be used as an architectural feature on the exterior of the building. Creating shadow lines, banding and enhance the exterior of the Building.

Mechanical System

The main Mechanical room will be located on the Ground Floor of the building. In this space there will be two dual centrifugal chillers that will be connect to an outdoor cooling tower and the main Dedicated Outdoor Air Systems Unit and two Air Handling Units. The lower level will also have a separate mechanical room dedicated to the pool and its dedicated dehumidification unit. Other areas of the building are feed by AHU's and DOAS Units on all floors and multiple Roof Top Units. As a whole the system is water to air system in conjunction with a Dedicated Outdoor Air System. These main units located in dedicated Mechanical/Electrical Rooms thought the building supply hot water from five parallel boilers and chilled water to multiple VAV boxes, typically located in the ceiling plenum.

Electrical System

Two switchboards will be used to supply power to the building at 3000A 480/277V 3PH 4W. Multiple step-down transformers are located on all floors to meet 208/120V loads.

Masonry

Masonry bearing walls are used at stair towers and elevators. These will provide resistance to lateral loads and required fire rating. Bearing walls will also be used at gymnasiums, auditorium, natatorium, and fire walls. Masonry is also primary exterior surface, both ground face CMU's and Utility Bricks on Metal Studs make up the majority of the exterior.

Curtain Wall

Key locations that high visibility in and out of the building are wanted, a hollow core aluminum curtain wall is used. Gale Associates, Inc. (GALE) is assisting CGS Architects in the Building Envelope/ Waterproofing plans.

Support of Excavation

Dewatering will be required as multiple areas of the building will be excavated to below ground Water Table levels for construction, most importantly, the pool and both gymnasiums will use sheeting and shoring method.

LEED Rating

The High School is currently projected to meet LEED Gold under LEED for Schools Program. This rating will be achieved by focusing on Indoor Air Quality and Optimizing Energy Performance. A large portion of the roof (over 40%) will be extensive green roof gardens, while the remaining areas will be a highly reflective material. The current scorecard for LEED rating is picking up 45 yes points, 19 maybe's and 15 no's. The following is an excerpt from the cox graae + spack project narrative explaining outlining what points the project will be pursuing.

"Certification will be achieved through the following steps:

1. Reduce ozone depletion and global warming by specifying refrigeration equipment that does not contain CFC's or HCFC's, The refrigerant specified will be R-410a or equivalent. (EA Prerequisite 3, Fundamental Refrigerant Management EA Credit 4, Enhanced Refrigerant Management)
2. Reduce energy usage by specifying high efficiency equipment. All motors on the project must be 'PREMIUM' efficiency (92%+) motors. (EA Credit 1, Optimize Energy Performance – 6 points expected)
3. Reduce HVAC equipment capacity by:
   a) Reducing heat losses and gains associated with the envelope, especially through windows (EA Credit 1, Optimize Energy Performance)
   b) Reducing heat gain from the roof by specifying a highly reflective roof surface (EA Credit 1, Optimize Energy Performance; SS Credit 7.2, Heat Island Effect: Roof)
4. Include in the specifications the requirements for Enhanced Commissioning. (EA Credit 3, Enhanced Commissioning).
5. Include in the specifications the requirements for Enhanced Refrigerant Monitoring. (EA Credit 4, Enhanced Refrigerant Management).
6. Carbon dioxide (CO2) sensors to monitor CO2 concentrations throughout the building. (EQ Credit 1, Outdoor Air Delivery Monitoring)
7. Include in the specifications the requirements for the Construction IAQ Management Plan. (EQ Credits 3.1 & 3.2, Construction IAQ Management Plan).
8. Improve indoor air quality by specifying filters with a MERV of 13 or higher.
9. Exhaust spaces that contain indoor chemical pollutants such as the Janitor's Closet where the storage and mixing of chemicals occurs to prevent the recirculation of air throughout the building. Make up air will be transferred from an adjacent space to maintain a negative pressure within the Janitor's Closet. Coordination with the Architect will be necessary to ensure deck-to-deck partitions are specified. (EQ Credit 5, Indoor Chemical and Pollutant Source Control).
10. All regularly occupied spaces will have individual lighting control and temperature control. (EQ Credits 6.1 & 6.2, Controllability of Systems).

11. Individual space temperature control along with displacement ventilation allows for easy demonstration that indoor thermal comfort by design has been achieved. (EQ Credit 7.1, Thermal Comfort).
12. Do not install a permanent irrigation system. Provide hose bibs connected to the various rainwater harvesting tanks if irrigation required. (WE Credits 1.1 and 1.2, Water Efficient Landscaping)
13. Reduce the use of potable water by specifying efficient toilets and urinals, installing sensor operated lavatory fixtures as well as water conserving shower heads. (WE Credits 3.1, Water Use Reduction)
14. Public bus transportation is available at site and bicycle storage will be provided. (SS 4.1, 4.2. Alternative transportation
15. Parking capacity will be requested to be reduced by 25%. (SS 4.4, Parking Capacity)
16. Baysaver" structures will provide for filtering rainwater run-off before leaving site. (SS 6.2, Quality Control)
17. Over 75% of the roof area will be covered by extensive green roof vegetation. White EPDM roofing will cover all non-vegetated roofing. (SS 7.2, Roof)
18. Full cutoff exterior light fixtures will be specified to reduce light trespass and increase night sky visibility. (SS Credit 8, Light Pollution Reduction)
19. Campus will provide gymnasium, auditorium and natatorium facilities for community access. (SS10, Joint Use Facilities)
20. Interior light fixtures will be specified and placed such that the maximum light output reaches an opaque surface within the space rather than a window. (SS Credit 8, Light Pollution Reduction)
21. Lighting controls will automatically turn off lights after a specified period time of un-occupancy or according to a predefined schedule to conserve electricity. (SS Credit 8, Light Pollution Reduction)
22. Provide individual lighting controls for instructional and office spaces, and lighting controls in multi-occupancy spaces such as the multi-purpose room, science classroom and kitchen to allow for occupants to adjust the lighting to meet the needs of various functions. Coordinate with the owner and architect to determine the specific functions intended for each space. (EQ Credit 6.1, Controllability of Systems-Lighting)."

PROJECT COST EVALUATION

Construction Cost	Source	Construction Cost per SF
$ 39,564,992	D4 Cost Estimating	$ 171.92
$ 49,120,500	R.S. Means	$ 213.44
$ 89,000,000	Actual	$ 386.74

Table 1

The total project has a budget of $103 million and building cost of $89 million. The actual building cost per square foot was calculated to be $387. In Table 1 a comparison to the parametric estimate created using D4 Cost Estimating, can be seen, the estimates created in my research appear to be low. I feel that the reason for this difference in cost is justified. The actual building cost considers the many amenities and sport facilities created for HD Woodson High School. In D4 it is strictly looking at square foot and a comparable size building. HD Woodson is a revolutionary design for a High School focusing on the use of technology and striving for LEED Gold Certification. Also HD Woodson HS involves the construction of an auditorium, competition gymnasium, auxiliary gymnasium, natatorium and multiple outdoor sports facilities.

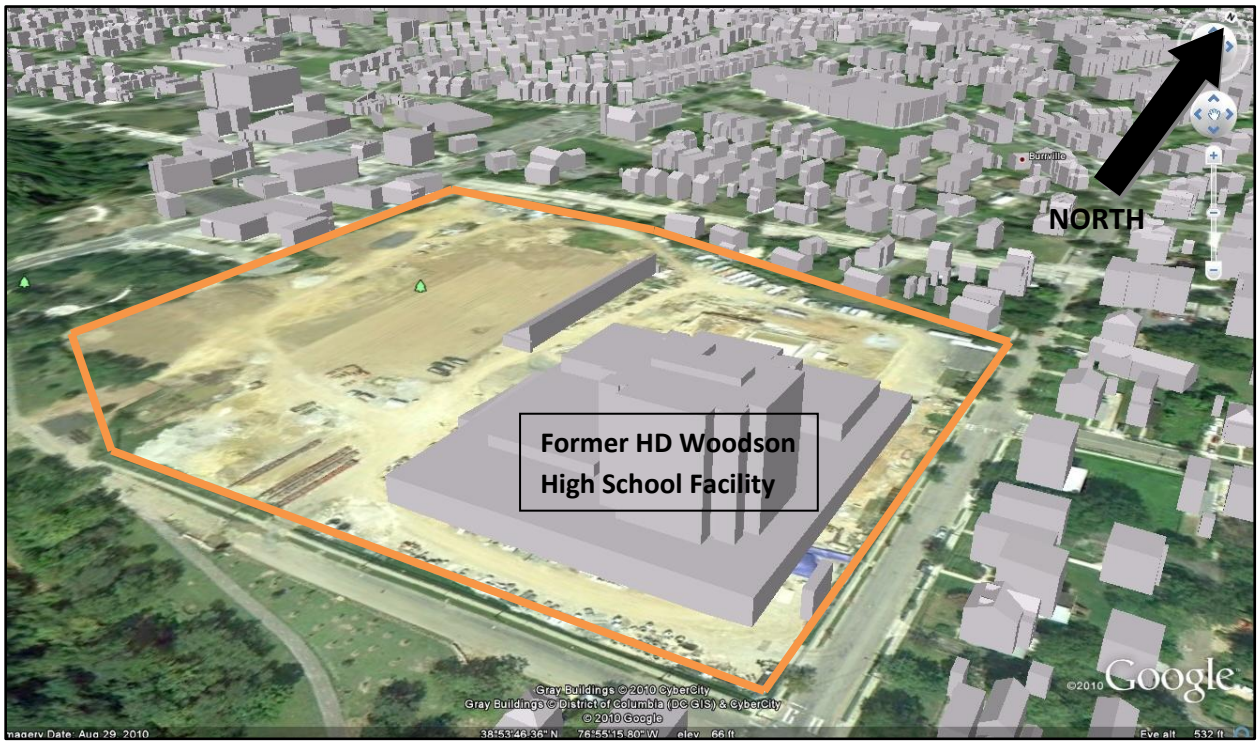
My estimate using Cost works (RS Means) has resulted in an estimate of $49.1 million. The revisions made to the base square foot price include: adjusting to appropriate story height and perimeter as well as some additional amenities. The large differences can be accounted for in the differences in the design of the project compared to other high school facilities. RS Means square foot cost data cannot account for the many amenities included in the actual construction costs of HD Woodson High School.

System	System Cost	% of Total	Cost per SF
Mechanical	$14,000,000*	16	$ 60.83
Electrical	$10,960,000	12	$ 47.62
Structural	$ 3,900,000*	4	$ 16.95

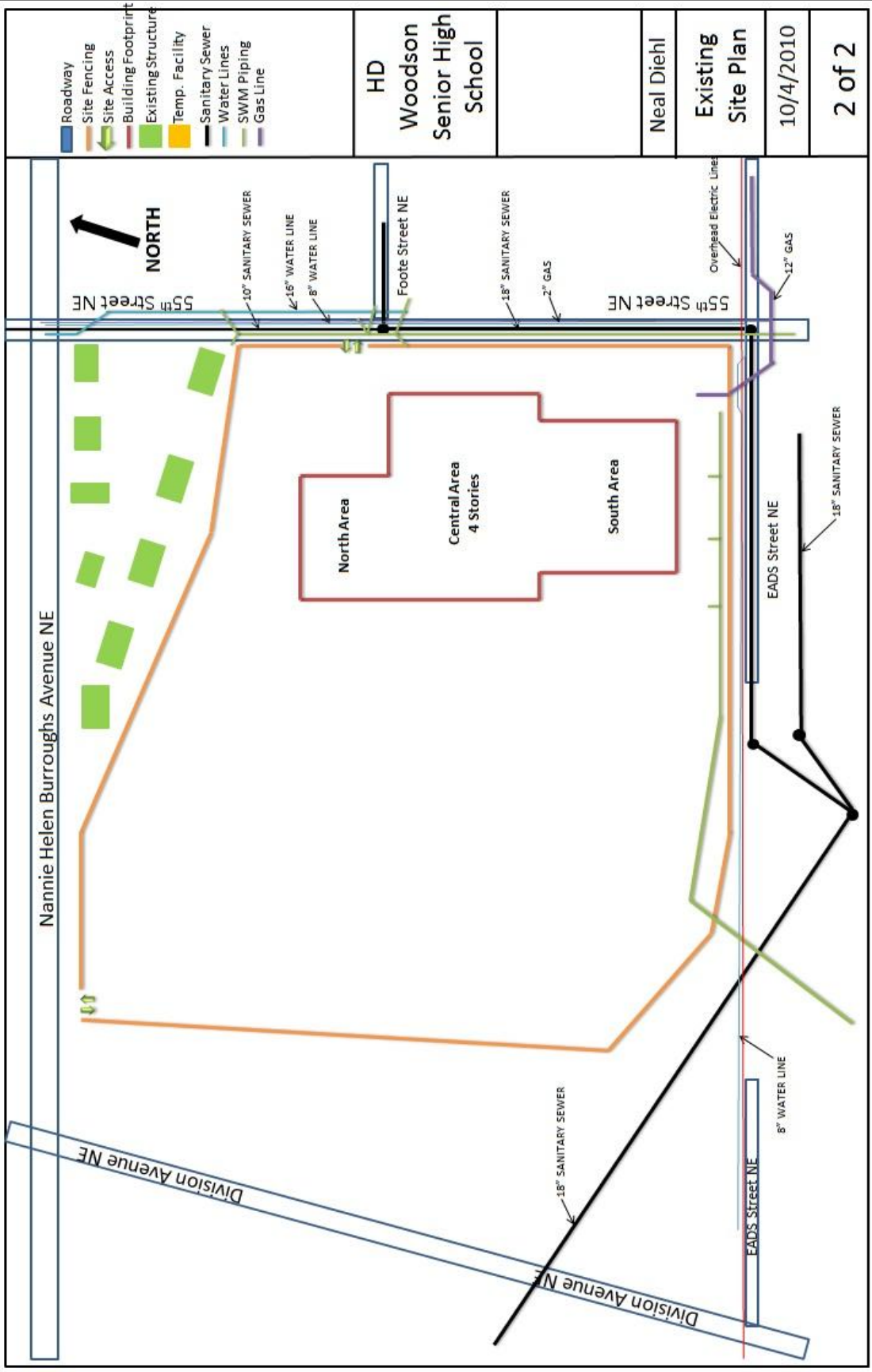
*Estimated Values

SITE PLAN OF EXISTING CONDITIONS

The image below shows the existing site and surrounding building structures prior to demolition. The following to pages are further detailed drawings of the existing site conditions. The first shows roads, vehicular and pedestrian pathways around the site. The second shows more details on the existing utility locations.




Roadway
Site Fencing
Site Access
Building Footprint
Existing Structure
Temp. Facility
Pedestrian Access
Traffic Pattern
HD Woodson Senior High School
Neal Diehl
Existing Site Plan
10/4/2010
1 of 2
NORTH
Foote Street NE
55th Street NE
55th Street NE
Existing 1 or 2 Story Structures
North Area
Central Area 4 Stories
South Area
EADS Street NE
Nannie Helen Burroughs Avenue NE
Division Avenue NE
Division Avenue NE
EADS Street NE


Roadway
Site Fencing
Site Access
Building Footprint
Existing Structure
Temp. Facility
Sanitary Sewer
Water Lines
SWM Piping
Gas Line
HD Woodson Senior High School
Neal Diehl
Existing Site Plan
10/4/2010
2 of 2
NORTH
55th Street NE
10" SANITARY SEWER
16" WATER LINE
8" WATER LINE
Foote Street NE
18" SANITARY SEWER
2" GAS
Overhead Electric Lines
12" GAS
North Area
Central Area 4 Stories
South Area
EADS Street NE
18" SANITARY SEWER
Nannie Helen Burroughs Avenue NE
Division Avenue NE
8" WATER LINE

LOCAL CONDITIONS

Typically in the Washington DC region the preferred method of construction is cast in place concrete. It is interesting that the structural system is mainly ordinary steel construction. With building height not being a design limitation, in respect to maximizing number of floors this may have factored into the method chosen.

The site allows limited on-site parking and street parking is available for overflow parking. The surrounding area is mostly residential and street parking will provide sufficient parking spaces during construction.

Many construction recycling companies are available to the DC area, from Aggregate on site recycling to sorting and hauling services. The concrete from the existing facility was recycled during demolition, before the Design-Build Process started.

Subsurface and site conditions from the demolition posed a hazard to the surrounding area due to the groundwater level and large holes on the site. Certain areas ranged from 6 to 14 feet below grade and contained up to 10 feet of water. The soil bearing capacity does not require anything more than the use of geopeirs in certain locations. Spread footings are sufficient in certain areas and for detached structures around sports facilities.

CLIENT INFORMATION

District of Columbia Public Schools (DCPS) is the client for Howard D. Woodson High School. This school is the first totally new facility that is being handled by the Office of Public Education Facilities Modernization (OPEFM) within DCPS. Howard D. Woodson High School opened originally in 1972. Prior to demolition, a nine story white tower was located on the site. The tower was surrounded by a tennis court, long and triple jump track, pole vault track, football field and parking area. After 30 years of operation the faculty, students and community decided it was no longer feasible to be in use.

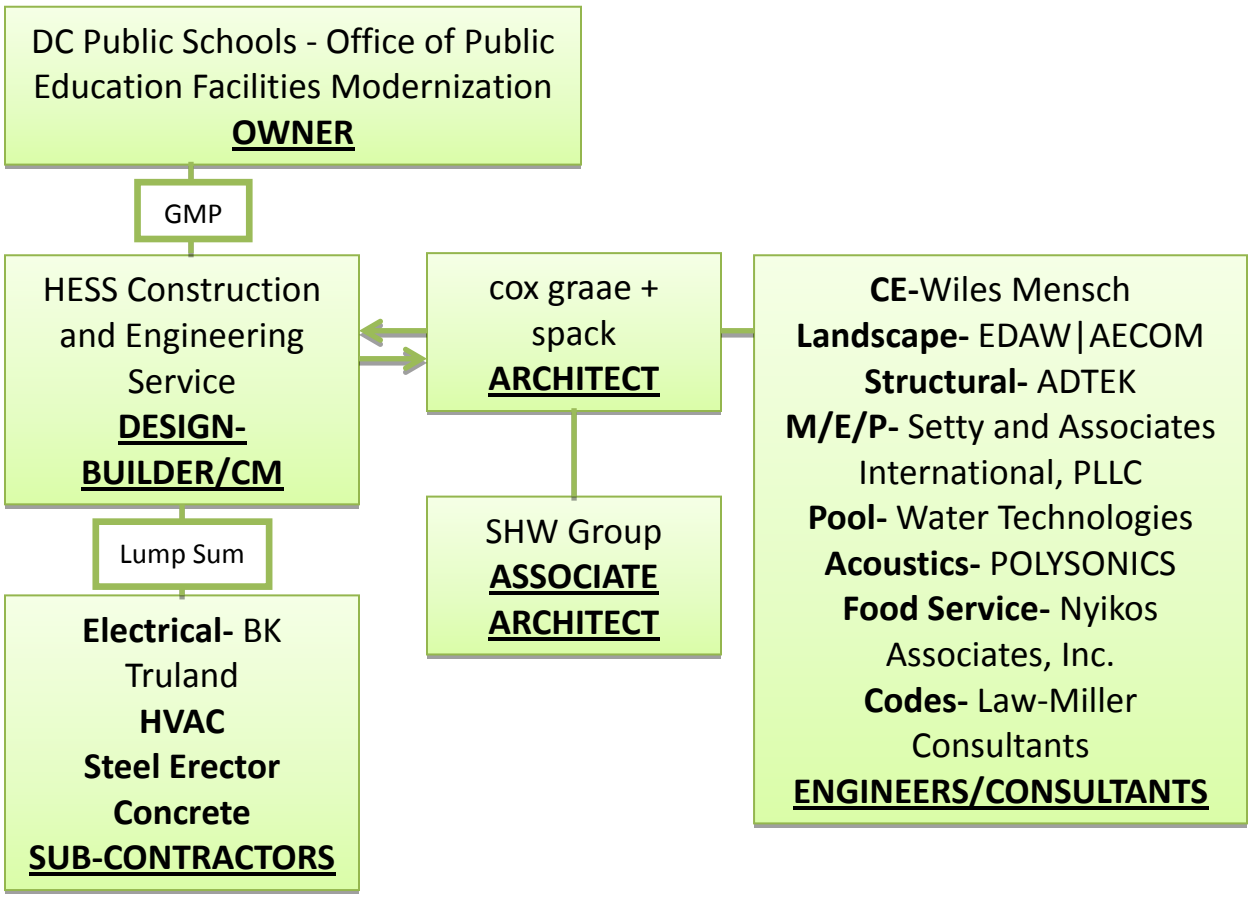
The school has been carefully designed to meet a new concept created to focus on Science, Technology, Engineering and Math (STEM). The building is also designed to achieve LEED Gold under USGBC LEED for Schools. The owner is set on having the school open for the 2011-2012 school year. They are being progressive and ambitious by implementing rain water harvesting and grey water capturing for re-use in certain plumbing fixtures. The big concept that DCPS is really excited about on this project is that it will be their first STEM School, and built to restore the community pride surrounding the site. By opening up portions of the school to the public after hours and for special events (i.e. gymnasium, natatorium, outdoor facilities) DCPS assists in achieving LEED rating and community outreach. (Considered Mixed facility use for LEED)

The owner will be satisfied with the completion of HD Woodson High School if it meets their $103 million budget, opens for the 2011-2012 school year, is LEED Gold Certified and meets STEM requirements. They have already included the mayor of DC and the director of DCPS in ceremonies on the site.

DISTRICT OF COLUMBIA
PUBLIC SCHOOLS

PROJECT DELIVERY SYSTEM

The original project was arranged to be a Design-Build with CM at Risk. Through conversations with involved parties the project has morphed into a more traditional Design-Bid-Build delivery. The original delivery method was chosen to allow the project to begin development prior to completion of all Construction Documents. Time is a large factor and the amount of wants from the owner in the time desired created a scenario that would be best fit by the Design-Build with CM at Risk Delivery Method.



STAFFING PLAN

In order to staff the project a projection of ten people are assigned to the project, two of which will be assigned solely to the office.