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[TECHNICAL REPORT 1]

North Hall – American University
Washington, D.C.

Executive Summary

After American University's 2011 Campus Plan was approved the by District of Columbia Zoning Commission on March 8, 2012 Grunley Construction Company was awarded the construction contract on April 23, 2012 for American University's newest dormitory, North Hall. North Hall is an eight story, tracked for LEED Gold upon completion, dormitory building that is located on American University's Main Campus in downtown Washington, D.C. The 122,200 square foot building will house 358 undergraduate students in 94 suite style dorm rooms consisting of 6 bed, 4 bed and, RA units (1 bed). Grunley bid North Hall with a Guaranteed Maximum Price (GMP) of just under $ 29 Million.

Grunley Construction must deliver North Hall to American University by August 9, 2013. Sticking to the project schedule is paramount for Grunley. Any delays will become very costly for both Grunley and American University. The Grunley project team is made up of six people who are dedicated to delivering American University a great building on time as well as building a relationship between Grunley Construction and American University.

After an analysis of North Hall's project costs, it was evident that actual construction costs were much higher than the estimated costs of North Hall. North Hall's actual construction cost was $26,042,366 at $213.11 per square foot compared to an estimated construction cost of $21,430,000 at $175.37 per square foot. The large difference in the two costs per square foot can be attributed to lack of mechanical equipment in the estimate as well as the post tensioning that is located in the third through eighth floor slabs.

Technical Report 1 includes detailed analysis of North Hall's project schedule summary, project cost evaluation, existing conditions plan, site layout plans, local conditions, client information, project delivery system, and staffing plan.

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Project Schedule Summary

Please See Appendix A for Project Summary Schedule.

Overview of Schedule

Hitting the completion date is paramount for the North Hall Project. The driving force behind this consideration is that the rooms in North Hall have already been promised to current students at American University. These 358 students will need a place to live for the start of the Fall 2013 semester and American University will not have extra room in another dorm to house the students if the project were to miss the completion date of August 9, 2013.

The summary schedule is broken down into the following seven phases:

- Design
- Site Work
- Foundation
- Superstructure
- Enclosure
- Finishes
- Occupancy

North Hall's floors are typical on each of the floors that are home the suites (Floors 2-8). The summary schedule has a more detailed breakdown of the first floor finishes with floors two through eight being shown with just one line item for each floor.

Foundation

North Hall's site needed to be excavated down to the subgrade elevation to allow for the caissons to be drilled. In some parts of the footprint of the building approximately 25 to 30 feet of soil need to be removed. As the caissons were underway the grade beams followed along behind.

Structure

The structure of North Hall is made up entirely of reinforced cast in place concrete. Floors three through eight are also utilizing post tensioning in the concrete. The concrete subcontractor plans to complete each floors columns and floor slab in just less than two weeks per floor.

Enclosure

Precast panels will begin as the concrete structure is almost complete. The panels will be used to enclose a majority of the building from the second floor to the top of North Hall. A curtain wall system will be used on one of the stair towers, in the study lounges on each floor as well as the fitness center on the ground floor. The Southwestern corner of North Hall will receive a field stone veneer.

FINISHES

Each of the typical floors are planned to take less than six months to complete all the work required on each floor. This time includes all the rough in, finishes and punch list items. The work on each floor is will start two weeks after the floor below it begins. Any delay in the finishes will negatively impact the schedule.

Building Systems Summary

The checklist shown below in Table 1 provides a summary of the major building systems for North Hall. A more detailed explanation each system follows the major building systems table.

Table 1: North Hall Building Systems Checklist

Building Systems Checklist		
Work Scope	Yes	No
Demolition Required	X	
Structural Steel Frame	X	
Cast in Place Concrete	X	
Precast Concrete	X	
Mechanical System	X	
Electric System	X	
Masonry	X	
Curtin Wall	X	
Support of Excavation	X	
LEED Gold Certification	X	

Demolition

North Hall required only some minor demolition of two retaining walls and a parking lot. One of the retaining walls was only 6 feet tall at its highest point and sloping to a height of 6 inches at its lowest point. This wall was approximately 30 linear feet in length. The other retaining wall was much bigger this wall was 20 feet tall and 80 linear feet in long. This wall can be seen in Figure 1 during the demolition process. There was parking lot that needed demolished to before the site could be excavated to subgrade. There was approximately 6,100 square feet of asphalt parking lot that had to be removed.

Figure 1: Large Retaining Wall Demolition
Photo Taken By: Brandon Tezak

Structural Steel Frame

The building's structure is not a steel frame. The structure is predominately cast-in-place concrete. However, there is a small area that uses structural steel framing to support the roof in the Penthouse

area. There are only 24 pieces of structural steel used in the penthouse area. The tower crane will be used to fly these pieces in to place. See the next section for more information on the tower crane.

Cast in Place Concrete

The structure of the building is entirely made up of reinforced concrete except for the penthouse area. Sixty-six concrete caissons ranging in diameter from 30 inches to 48 inches support North Hall. These caissons are located under either a grade beam or a concrete column. The slab on grade and second floor slab are both reinforced cast in place concrete. Post tensioned reinforced concrete will be used for floors three through eight as well as the eighth floor roof slab.

The caissons were poured right out of the back of the concrete truck. The rest of the building will be poured using a concrete bucked and the tower crane. The tower crane that is being used for North Hall is a Peiner SK575. The jib height for the tower crane is 155 feet 2 inches and the reach of the crane is 196 feet 10 inches. The Peiner SK575 is sported by four 36 inch caissons and a reinforced concrete pad that is 5 feet thick. The crane was erected in early August of 2012 and will be used until approximately the end of December 2012.

Miller & Long, the concrete subcontractor, is using a metal form system to form up the concrete walls, slabs, and columns so that they will be able to reuse the forms throughout the duration of the construction of North Hall

Precast Concrete

North Hall will utilize a precast panel system for the building façade. These precast panels will sit on the second floor slab and stack on top of each other. The panels will be attached to each floor slab with imbeds in the edge of the floor slabs. The entire exterior of the building except for the lounge areas and the stair towers at the end of the central hallways of the building will have precast panels.

Gate Precast is providing the precast panels. The panels are being cast in Oxford, North Carolina. They will be shipped to from North Carolina to Washington, D.C and then will be erected with the Peiner SK575 tower crane.

Mechanical System

The main mechanical room is located on the Western side of the first floor. There are two air handing units located within the mechanical room that serve the ground floor areas. The electrical room has its own dedicated air handing unit. The mechanical system is fed by both chilled water and steam from a campus loop similar to Penn State's steam loop.

Each suite has a Fan Coil Unit (FCU) that will also be supplied with steam and chilled water. These fan coil units will provide the heating and cooling needed for each suite. The FCU's will be located in each suite's mechanical room. This will provide the residents of each suite to control their heating or cooling. Each floor has a lounge that also will have its own FCU.

The building will be protected from fires with a wet pipe sprinkler system. There will be a dry sprinkler system in the electrical room and loading dock areas. This is to protect the electrical equipment from water unless it is necessary and to avoid having a pipe burst in the loading dock area.

Electrical System

North Hall will get its electrical supply from a nearby campus electrical vault. The vault will supply the switchgear with 277/480 V, 3 phase, 4 wire, 2,000 Amp service. A backup emergency 180 KW/125 kVA diesel generator will supply the emergency power with 277/480V, 3 phase, 4 wire.

The lighting of North Hall will be primarily fluorescent lighting. LED's are going to be used for emergency exit signs.

Masonry

A field stone veneer is going to be used on the Southwestern corner of North Hall. The stone veneer will be applied to the concrete wall on the first floor. The stone will be part of the precast panels on the second floor and above. This will eliminated the need for scaffolding since the stone will be cast into the panels and then placed with the tower crane.

Curtain Wall

North Hall will have three areas that have an aluminum curtain wall system, the exterior side of the lounge areas, the Southeast stair tower, and a section of the Northeast wall that is at the end of the main hallway. The curtain wall system is supported by the floor slabs, an imbed is in the edge of the slabs and attaches to the curtain wall frame.

Support of Excavation

A portion of North Hall's first floor will be underground. To avoid having to over excavate as well as the small site would not allow for it, soldier beams and lagging with tiebacks were used to hold back the earth. The project required 46 soldier beams with 11 tiebacks. The support of excavation can be seen in Figure 2. The support of excavation is four feet from the exterior face of the first floor wall. When the building is complete, the top four feet will be cut off and the rest will be

Figure 2: North Hall Soldier Beams, Lagging and Tiebacks
Photo Taken By: Brandon Tezak

abandoned and buried.

LEED Gold Certification

Upon completion North Hall will track to obtain LEED Gold Certification under the LEED 2009 for New Construction and Major Renovations System. Grunley is in charge of making sure certain credits' requirements are met during the construction process. These specific credits include Materials and Resources Credits such as 75% of construction waste is recycled or salvaged, 20% recycled content, and 20% of materials are regional. In addition, Grunley is responsible for Indoor Environmental Quality credit for having an indoor air quality (IAQ) management plan during construction and Innovation and Design credit for exemplary performance in either regional recycle or construction waste management.

Project Cost Evaluation

Project Parameters

Table 2: North Hall Project Parameters

Project Parameters	
Parameter	**Total**
Square Footage	122,000
Number of Floors	8 + Penthouse
Footprint (SF)	15,400

Construction Costs & Total Project Costs

All cost information was for North Hall was provided by Grunley Construction Company. The construction cost shown below in Table 3 does not include the costs of land, site work, permitting, or Grunley's Fee. The square foot cost was calculated by using the square footage listed in Table 2. The total project costs include all costs for the project including all that was not included in construction costs except for the cost of land since American University already owned the land prior to construction.

Table 3: North Hall Actual Project Costs

Actual Project Costs	
Parameter	**Total**
Construction Costs (CC)	$ 26,042,366
CC/SF	$ 213.11
Total Project Costs (TC)	$ 28,953,457
TC/CC	$ 236.94

Building System Costs

The major building systems construction costs are listed below in Table 4. These costs are the costs provided in each subcontractors bid that was submitted to Grunley Construction during the bid process.

Table 4: North Hall Major Building Systems Actual Costs

Major Building Systems Actual Costs		
System	**Construction Cost (CC)**	**CC/SF**
Electrical	$ 2,403,875	$ 19.67
Fire Protection	$ 385,500	$ 3.15
Mechanical/Plumbing	$ 6,800,000	$ 55.65
Precast Panels	$ 2,386,300	$ 19.53
Structural Concrete	$ 4,029,750	$ 32.97

Square Foot Cost Estimate

The square foot cost estimate can be found in Appendix B. Note that RS Means CostWorks was used to complete the Square Foot Estimate.

MEP Assemblies Cost Estimate

The MEP assemblies cost estimate can be found in Appendix C. Note that RS Means CostWorks was used to complete the MEP Assemblies Estimate.

Cost Comparison

RS means does not include site work contingencies, etc., therefore when comparing the RS Means value to the actual cost the construction cost not the total project cost should be used. Table 5 compares the Construction Costs to the RS Means total.

Table 5: North Hall Actual Construction Costs VS RS Means Costs

	Total Construction Cost	CC/SF
Actual Construction	$ 26,042,366	$ 213.11
RS Means	$ 21,430,000	$ 175.37

The RS Means costs are much lower than the Actual Construction Costs are for a variety of reasons. RS Means makes many assumptions about what is in the building so it is hard to get a completely accurate cost from using strictly RS Means cost data. North Hall has some features that are not found in RS Means. For example very little of the Mechanical System's components were listed in RS Means CostWorks database. In addition, RS Means only assumes one crew will be working on the particular system when in reality that might not be the case and there could be multiple crews working which would increase the labor on the job. Table 6 compares the Actual Construction Costs to the RS Means Costs for the Mechanical/Plumbing System and the Electrical System.

Table 6: North Hall MEP Actual Construction Costs VS RS Means Costs

		Total Construction Cost	CC/SF
Mechanical & Plumbing Systems	Actual Construction	$ 6,800,000	$ 55.65
	RS Means	$ 1,678,762	$ 13.74
Electrical System	Actual Construction	$ 2,403,875	$ 19.67
	RS Means	$1,554,355	$ 12.72

As can be seen in Table 6 the difference in the costs per square foot for the Mechanical and Plumbing Systems is $41.91. The large discrepancy in the two cost values is due the lack of a similar Mechanical and Plumbing system in RS Means database. The Electrical System has a much more accurate estimate when compared to the mechanical and electrical system. This is partially due to the incompleteness of the documents that were used for the takeoffs.

Site Plans

Existing Conditions

Please See Appendix D for the full Existing Conditions Site Plan.

North Hall is being built on what used to be a parking lot directly behind the President's Office Building. The parking lot was also right next to both Leonard Hall and McDowell Hall, which are both dorms. The site sits on a hill that overlooks Massachusetts Avenue NW the on the side opposite of the two dorm buildings. The Wesley Theological Seminary borders the other side of the site. The site of North Hall is the parking lot on the right side of Figure 3.

Figure 3: North Hall Site
Source: Google Maps

The campus road that runs between the site and Leonard and McDowell Halls has been closed down during the construction of North Hall. All construction traffic will enter and exit the site through the same gate. The gate is on the campus road that is closed which runs diagonally across Figure 3. The Grunley office trailers were placed right inside the gate to North Hall. This location was picked due to the fact that it the trailers were completely out of the way of construction for the duration of the project.

Phase 1: Foundation

Please See Appendix E for the full Phase 1: Foundation Site Plan

Demolition of the parking lot along with two retaining walls and excavation to the subgrade elevation was required to prepare the site for the caissons to start. Due to the small site, American University's restrictions on what campus roads could be used by construction vehicles and, the traffic of downtown Washington, D.C. made planning the excavation very important. The same road is used as the entrance and exit of the site. Unfortunately the road is too narrow for two dump trucks to be able to pass each going opposite directions at the same time, essentially turning the main entrance into a one way street. This became an issue during the excavation of North Hall when multiple dump trucks would return to the site all at once and block the roadway while waiting to be filled and not allowing the full truck out. To avoid this one of the site work subcontractor's laborers was stationed at the gate of the site to control the flow of trucks into and out of the site.

The same issue was a problem for the caisson subcontractor when their concrete trucks would arrive and leave only not on the scale of the site work subcontractor. North Hall's foot print is in the shape of the letter "L". The part of the site that was not occupied with the footprint was utilized for material storage and staging. This area shown in Figure 4 was used to store the caisson's rebar cages so that the crawler crane and the two drill rigs had full access to the site during the installation of the caissons.

Figure 4: Material Storage/ Staging Area
Photo Taken By: Brandon Tezak

PHASE 2: SUPERSTRUCTURE

Please See Appendix E for the full Phase 2: Superstructure Site Plan

Before the structure of North Hall started the tower crane was erected. The Piener SK575 tower crane can reach the entire site. A concrete bucket will be used to place the concrete for the entire building as well as for erecting the precast panel façade. A material hoist will be installed along the side of North Hall that runs along the road that services the site. This will allow trucks to be unloaded in the road and the material placed on the hoist to be delivered to the appropriate floor.

The flow of traffic in and out of the site is critical to this phase. As the building moves out of the ground the area where smaller trucks were able to turn around will disappear meaning that the trucks will need to back out of the site if the truck had pulled directly in to the site or back in to the site so that the truck will be able to pull out when the material is unloaded.

PHASE 3: FINISHES

Please See Appendix E for the full Phase 3: Finishes Site Plan

The final phase of construction at North Hall will be the finishes. The tower crane will have been disabled by this time of construction meaning that materials will be delivered to the correct floor by the material hoist or by hand delivery. As this phase moves on the material hoist will be removed to allow the Curtin Wall system to be installed in the lounges on each floor. As in the previous phases traffic control of the delivery trucks into and out of the site is still critical since there is still only one entrance and exit.

Local Conditions

The construction industry in Washington, D.C. has been somewhat unaffected by the recent recession in the economy unlike the rest of the country has been. This is mainly due to the large amount of government construction that takes place. Congress has not only kept the construction industry going it also controls the height of buildings in the District of Columbia with the Height of Building Act of 1910. Buildings are limited to 130 feet in height (Craig). This limiting of the building height makes reinforced concrete buildings the preferred type of construction in Washington D.C. When reinforced concrete is used instead of the traditional steel framed building one more floor can be achieved.

American University is located in the Northwest quadrant of Washington, D.C. near Embassy Row. As the case in all of Washington, D.C. space is very valuable, thus parking is expensive. The site of North Hall has no onsite parking due to the extremely tight site. American University allotted Grunley 45 spaces in a surface lot about a block and half away from the site free of the normal $16 a day rate. These 45 spaces are shared with another Grunley project at American University, Nebraska Hall Expansion. It is first come first serve for the parking spaces and during the peak of construction activity there will not be enough spaces for every worker. There is a Metro stop about a mile away from the site so workers are encouraged to use the Metro or carpool to avoid paying for parking.

Grunley Construction has it written into each of the subcontracts that each subcontractor is responsible for hauling all of their own waste from the site. The tipping fee for the dumpsters that are being used on site is $500. The dumpsters contents are sorted by the dumpster company and the proper items are recycled and tracked for LEED credit.

Schnabel Engineering Consultants Inc. is the Geotechnical Engineer for North Hall. They found 6 to 7 inches of topsoil on the site in places there was not an existing parking lot. Between 2.5 to 5 feet below ground sandy lean clay, sandy silt, silty sand and sandy fat clay, containing gravel, silt mica, clay pockets, roots and quartz fragments where encountered. From a depth of 8.5 to 13.5 feet Schnabel found brown and light gray sandy lean clay, sandy silt, and sand fat clay with varying amounts of quartz fragments, clay seams, silt seams, roots, gravel and, mica. At a depth of 24.5 to 44 feet below the surface residual soils consisting of varying shades of brown and gray silty sand, clayey sand, sandy silt, and varying amounts of elastic silt seams, quartz fragments, mica, roots and, clay layers/pockets. Also in some of the borings, Schnabel found disintegrated rock at depths ranging from 35 to 49 feet below the surface. Schnabel used eight test borings spread throughout the building footprint. Groundwater was encountered in half of the borings at 8.5 to 9 feet below ground. The other borings did not hit any ground water. However, there was no ground water problem when the site was excavated to the required depth.

Client Information

American University is a private university that is located in the heart of Washington, D.C. There are approximately 6,000 undergraduate and 4,000 graduate students enrolled at American. American University is a liberal arts research university.

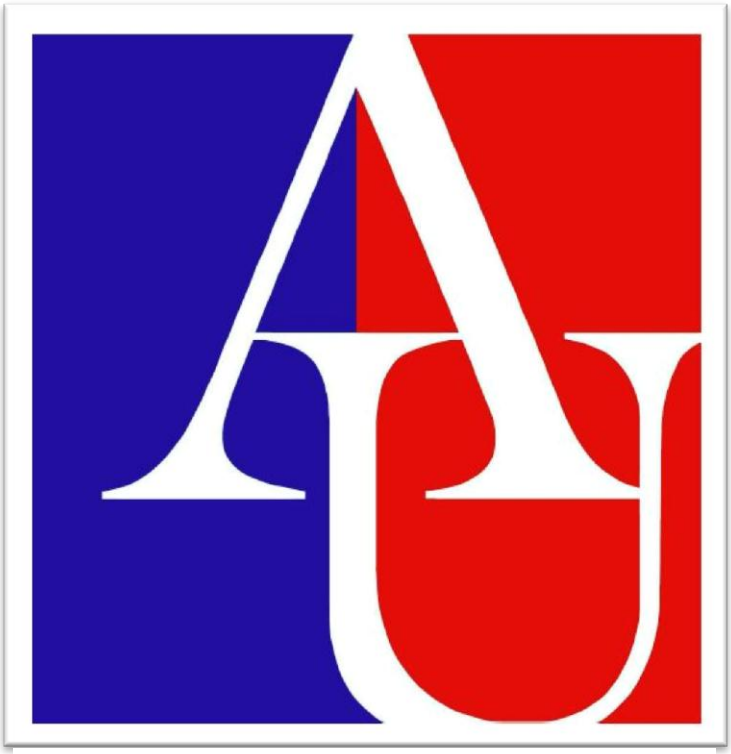


Figure 5: American University Logo
Source: www.american.edu

American University recently had their 2011 Campus Plan approved by District of Columbia Zoning Commission on March 8, 2012. This Campus Plan calls for new on-campus housing for undergraduate students, academic, athletic, recreation, dining and, activity facilities to be built by 2020 ("Campus Plan"). North Hall is the first the new on-campus housing being built as part of the 2011 Campus Plan. The president of American University, Dr. Cornelius Kerwin, was instrumental in this new plan. He wants to get as many students onto the campus as they can fit.

The cost of the building is a concern for American University since they are a private school and don't get any government funding. The school was originally funded by the United Methodist Church. American seemed to care about the cost of the building when the Guaranteed Maximum Price was negotiated with Grunley Construction as they try tried to get the lowest price with the best value. However American was quick to spend nearly $100,000 to make a place for the president of the university and his two support staff to park. The President's Office Building (POB) is located right next to North Hall, which will sit in the place of the parking lot that was used for the POB. There is a large parking garage right across Massachusetts Avenue from the POB. Why couldn't those three spots be located across the street in the parking garage? This would have saved American University approximately $100,000, making it appear that they are not completely cost focused.

American's quality expectations are simply the level of quality that is specified in the specifications for North Hall. Grunley's project team is responsible for quality control on items that do not specify a third party inspection. American University has hired their own third party inspection firm to complete the quality checks on items that are specified to need a third party.

The schedule is top priority for American University. The rooms in North Hall have already been assigned to for the Fall 2013 Semester so the completion date of August 9, 2013 must be met. These rooms are being offered to any student who lived in one of the three neighboring dorms during construction of

North Hall as a gesture of thanks for dealing with a possible inconvenience caused to the students by the ongoing construction by American. This was evident this past summer when clearing the site of trees. In Washington, D.C. a special permit is required to cut down any tree that is over 55 inches in diameter. Strittmatter, the site work subcontractor, removed two trees that American University needed a permit before they each be cut down. American did not know about the permit that was required or they choose not to get it since the job potentially could have been stopped for a few weeks while the tree permit was obtained. Within a day of the trees being cut down a neighbor called the District Department of the Environment (DDOE) to report the cutting down of the two trees. Fortunately DDOE only fined the job approximately $30,000 and did not shut the job down allowing construction to proceed uninterrupted. This was important since it had the potential to negatively impact the schedule possibly making the end date unreachable.

Safety is also very important to American University. With three dorms adjacent to the site there is a lot of student traffic around the site. The site fence was placed in a way that students could still access all of the entrances and exits to the building so they would not be wondering onto the site looking for a way into their dorm. There are numerous signs posted at every gate in the fence that states it is a construction site and authorized personnel are the only ones allowed in. The only gate that is open during construction is right in front of the office trailers which allow Grunley's project team to stop anybody who shouldn't be in the fence before they get to the area where there is lots of activity taking place. Grunley has a site safety plan that was a proved by American University before the project started.

One of American University's major concerns is the noise level during construction. There are two reasons for this. One of them is there are hundreds of students living right next to the site in the three adjacent dorm buildings. Due to this work hours are limited to 7AM to 7 PM to minimize disrupt of the students sleep and or studying in their rooms. American also required Grunley Construction to inform the American University representative a few days in advance of any loud activity that will be taking place so the nearby President's Office Building (POB) staff so that they are prepared for any loud noises during the day. This was critical during the site excavation when a large retaining wall and footing was demolished. There was a constant noise of roughly 100dB from the Hoeram and Concrete Pulverizer that were used in the demolition.

Project Delivery System

Grunley Construction is relative new to the Higher Education Construction market. Grunley's primary market for the past several years was GSA jobs throughout the Washington, D.C. area. Grunley was selected to preform preconstruction services for American University. Some of duties that Grunley preformed for American included surveying existing utilities, schematic design review, develop a BIM model, value engineering and, identify long lead-time material and equipment. Grunley was then awarded the construction services part of North Hall.

North Hall is being delivered with a Guaranteed Maximum Price (GMP) contract. This type of contract required an open book style of accounting for Grunley. They must submit back up for the requisition that they submit each month to be paid. This gives American University the schedule of values for the project so they know exactly what they are paying for each month.

The contract was negotiated to a price of $28,729,368. This price includes a 2% contingency, general liability insurance, builder's risk insurance, preconstruction services and the CM Fee. The CM Fee includes the cost of all the general conditions. With all these removed the direct cost of the construction is $27,046,788.

The subcontractors are required to get bonding as well. Grunley holds or will hold lump sum contracts with each of the subcontractors. Grunley also has a working relationship with the architect, Little Diversified Architectural Consulting but there is no contract between Grunley and Little.

The project organizational chart can be seen on the following page in Figure 5. Contracts are shown with solid lines and a working relationship is shown with a dashed line. The structural engineer is a joint venture between ReStl Designers, Inc. and Tadjer Cohen Edelson Associates, Inc.

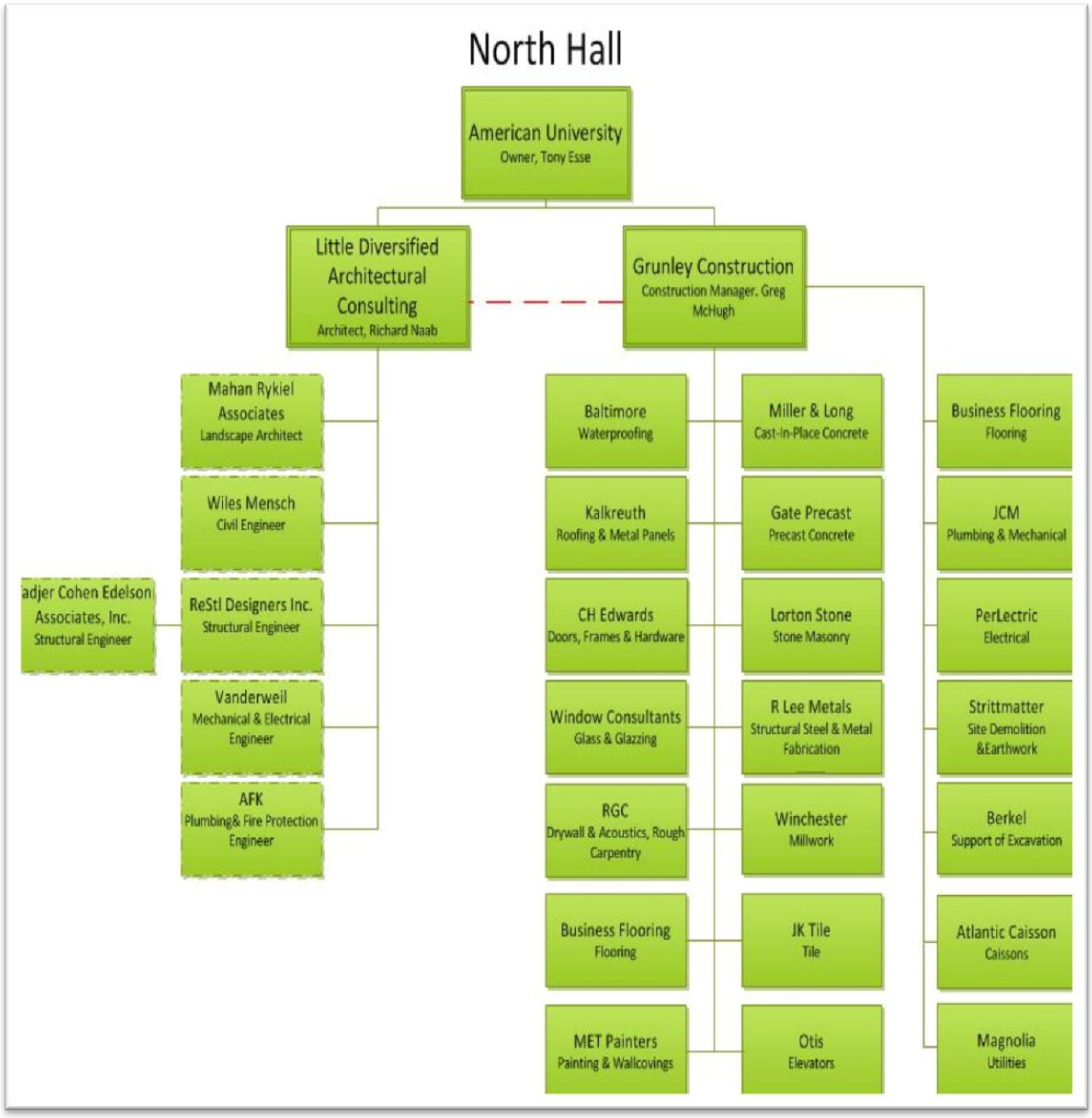


Figure 6: North Hall Organizational Chart
Chart Developed By: Brandon Tezak

The project delivery and contract type are appropriate for this project. The open book systems of accounting that the GMP requires of Grunley will benefit both Grunley and American University. Grunley will have the opportunity to make a good impression with American and possible gain an inside track to securing a long term relationship with American University as they continue the building of the 2011 Campus Plan.

Staffing Plan

Grunley Construction has project team consisting of a Project Executive, a Project Manager, an Assistant Project Manager/Project Engineer, a Jr. Project Engineer (Intern), a Senior Superintendent and, a Superintendent. All but the Project Executive are located on site with the Project Executive being located at the main office and overseeing multiple projects. Refer to Figure 6 for the Staffing Chart for North Hall.

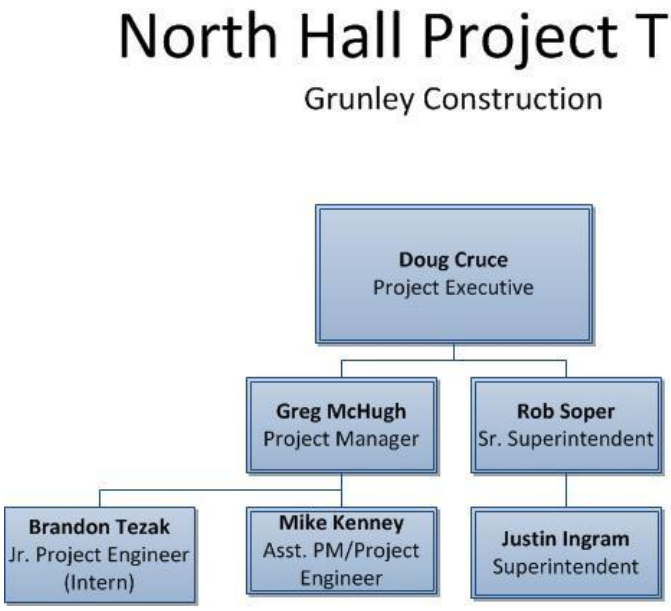


Figure 7: Grunley Construction Project Team
Chart Developed By: Brandon Tezak

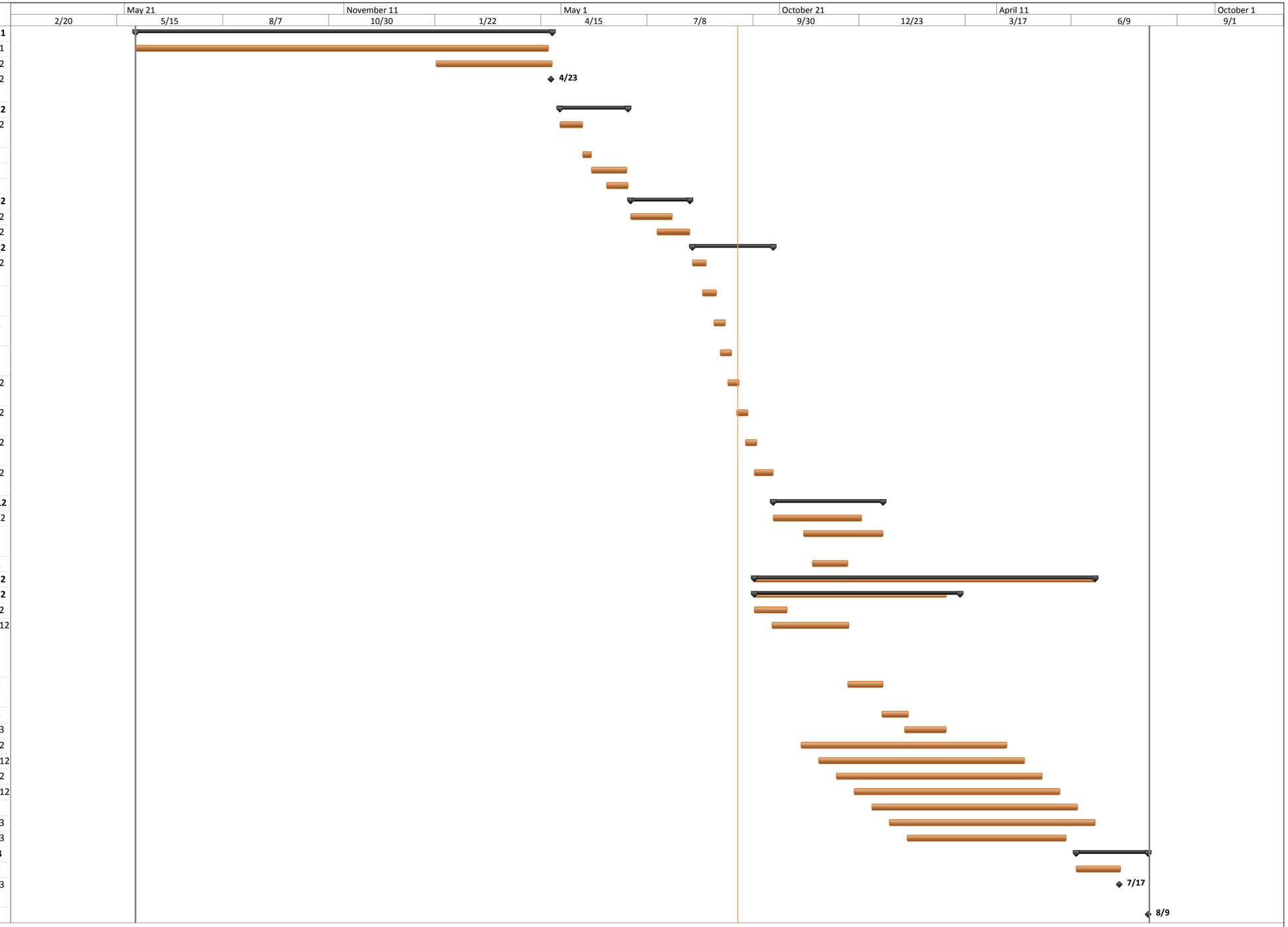
Resources

Campus Plan. (2012, March). Retrieved from http://www.american.edu/finance/fas/Campus-Plan.cfm

Craig, T. (2012, April 11). Gray, Issa Consider Relaxing D.C. Building Height Limits. *The Washington Post*. Retrieved from http://www.washingtonpost.com/local/dc-politics/gray-issa-consider-relaxing-dc-building-height-limits/2012/04/11/gIQAiXJeBT_story.html

Appendix A: Project Summary Schedule

ID	Task Mode	Task Name	Duration	Start
1		**Design Phase**	**236 days**	**Mon 5/30/11**
2		Design	235 days	Mon 5/30/11
3		Preconstruction	66 days	Mon 1/23/12
4		Award Construction Services	0 days	Mon 4/23/12
5		**Site Work**	**40 days**	**Mon 4/30/12**
6		Temporary Fence/ Erosion Control	14 days	Mon 4/30/12
7		Clear and Grub	5 days	Fri 5/18/12
8		Support of Excavation	20 days	Fri 5/25/12
9		Excavate To Subgrade	13 days	Wed 6/6/12
10		**Foundation**	**35 days**	**Mon 6/25/12**
11		Caissons	25 days	Mon 6/25/12
12		Grade Beams FRP	20 days	Mon 7/16/12
13		**Superstructure**	**46 days**	**Mon 8/13/12**
14		Slab On Grade & 1st Floor Columns FRP	9 days	Mon 8/13/12
15		2nd Floor Slab & Columns	9 days	Tue 8/21/12
16		3rd Floor Slab & Columns	7 days	Thu 8/30/12
17		4th Floor Slab & Columns	7 days	Tue 9/4/12
18		5th Floor Slab & Columns	7 days	Mon 9/10/12
19		6th Floor Slab & Columns	7 days	Mon 9/17/12
20		7th Floor Slab & Columns	7 days	Mon 9/24/12
21		8th Floor Slab, Columns & Roof	11 days	Mon 10/1/12
22		**Enclosure**	**63 days**	**Tue 10/16/12**
23		Erect Precast Panels	50 days	Tue 10/16/12
24		Glass, Glazing & Curtain Wall	45 days	Fri 11/9/12
25		Roofing	20 days	Fri 11/16/12
26		**Finishes**	**194 days**	**Mon 10/1/12**
27		**1st Floor**	**117 days**	**Mon 10/1/12**
28		Wall Framing	20 days	Mon 10/1/12
29		Rough-In (Plumbing, Electrical, Fire Protection & Alarms. & Lighting)	45 days	Mon 10/15/12
30		Drywall - Hang & Finish	20 days	Fri 12/14/12
31		Paint Walls & Ceiling	15 days	Thu 1/10/13
32		Tile & Floor Coving	25 days	Mon 1/28/13
33		2nd Floor Summary	117 days	Wed 11/7/12
34		3rd Floor Summary	117 days	Wed 11/21/12
35		4th Floor Summary	117 days	Wed 12/5/12
36		5th Floor Summary	117 days	Wed 12/19/12
37		6th Floor Summary	117 days	Wed 1/2/13
38		7th Floor Summary	117 days	Wed 1/16/13
39		8th Floor Summary	90 days	Wed 1/30/13
40		**Occupancy**	**41 days**	**Thu 6/13/13**
41		Final Inspections	25 days	Thu 6/13/13
42		Substantial Completion	0 days	Wed 7/17/13
43		Final Completion	0 days	Fri 8/9/13



Project: Summary Schedule.mpp
Date: Tue 9/18/12

Task	Summary	External Milestone	Inactive Summary	Manual Summary Rollup	Finish-only
Split	Project Summary	Inactive Task	Manual Task	Manual Summary	Deadline
Milestone	External Tasks	Inactive Milestone	Duration-only	Start-only	Progress

Appendix B: Square Foot Estimate

Estimate Name:	North Hall - American University
Building Type:	College, Dormitory, 4-8 Story with Precast Concrete Panels With Exposed Aggregate / R/Conc. Frame
Location:	WASHINGTON, DC
Story Count:	8
Story Height (L.F.):	9.33
Floor Area (S.F.):	122200
Labor Type:	Open Shop
Basement Included:	No
Data Release:	Year 2012
Cost Per Square Foot:	$175.37
Building Cost:	$21,430,000

Costs are derived from a building model with basic components.

Scope differences and market conditions can cause costs to vary significantly.

Parameters are not within the ranges recommended by RSMeans.

		% of Total	Cost Per S.F.	Cost
A Substructure		**1.60%**	**$2.13**	**$260,500**
A1010	Standard Foundations		$1.06	$130,000
	x 24" wide			
A1030	Slab on Grade		$0.60	$73,500
	Slab on grade, 4" thick, non industrial, reinforced			
A2010	Basement Excavation		$0.03	$3,500
	Excavate and fill, 100,000 SF, 4' deep, sand, gravel, or common earth, on site storage			
A2020	Basement Walls		$0.44	$53,500
	Foundation wall, CIP, 4' wall height, direct chute, .099 CY/LF, 4.8 PLF, 8" thick			
B Shell		**20.50%**	**$26.82**	**$3,277,000**
B1010	Floor Construction		$13.53	$1,653,000
	Cast-in-place concrete column, 28" X 14" Rectangleular, tied, 500K load, 12' story height, 394 lbs/LF, 4000PSI			
B1020	Roof Construction		$1.41	$172,500
	beam, 7" slab, 127 PSF total load			
B2010	Exterior Walls		$8.90	$1,087,000
	gray, high rise			
B2020	Exterior Windows		$2.17	$265,000
	Windows, aluminum, sliding, standard glass, 5' x 3'			
B2030	Exterior Doors		$0.30	$36,500
	x 7'-0" opening			
B3010	Roof Coverings		$0.52	$63,000
	Roofing, single ply membrane, EPDM, 60 mils, loosely laid, stone ballast			
	Insulation, rigid, roof deck, composite with 2" EPS, 1" perlite			
	Flashing, aluminum, no backing sides, .019"			
C Interiors		**27.00%**	**$35.34**	**$4,318,500**
C1010	Partitions		$9.25	$1,130,000
	GWB on Metal Stud			
C1020	Interior Doors		$6.13	$748,500
	Door, single leaf, wood frame, 3'-0" x 7'-0" x 1-3/8", birch, solid core			
C1030	Fittings		$1.51	$185,000
	Bathroom accessories, stainless steel, mirror, framed, with shelf, 72" x 24"			
C2010	Stair Construction		$3.46	$422,500
	Stairs, steel, cement filled metal pan & picket rail, 20 risers, with landing			
C3010	Wall Finishes		$4.23	$517,500
	Painting, masonry or concrete, latex, brushwork, primer & 2 coats			

	Ceramic tile, thin set, 4-1/4" x 4-1/4"			
C3020	**Floor Finishes**		$9.93	$1,213,500
	Carpet, tufted, nylon, roll goods, 12' wide, 36 oz			
	Tile, ceramic natural clay			
C3030	**Ceiling Finishes**		$0.83	$101,500
	Paint on plaster or drywall, roller work, primer + 1 coat			
D Services		**48.60%**	**$63.71**	**$7,785,500**
D1010	**Elevators and Lifts**		$10.99	$1,343,000
	Traction, geared passenger, 4000 lb, 6 floors, 12' story height, 2 car group, 200 FPM			
D2010	**Plumbing Fixtures**		$19.18	$2,343,500
	Water closet, vitreous china, bowl only with flush valve, wall hung			
	Lavatory w/trim, wall hung, vitreous china, 18" x 15"			
	Kitchen sink w/trim, countertop, stainless steel, 19" x 18" single bowl			
	Laundry sink w/trim, stainless steel, countertop, 22" x 17" single compartment			
	Service sink w/trim, vitreous china, wall hung 22" x 20"			
	Shower, stall, fiberglass 1 piece, three walls, 36" square			
	Water cooler, electric, wall hung, wheelchair type, 7.5 GPH			
D2020	**Domestic Water Distribution**		$1.67	$204,000
	Electric water heater, commercial, 100< F rise, 300 gal, 180 KW 738 GPH			
D2040	**Rain Water Drainage**		$0.20	$24,000
	Roof drain, DWV PVC, 4" diam, diam, 10' high			
	Roof drain, DWV PVC, 4" diam, for each additional foot add			
D3010	**Energy Supply**		$3.93	$480,500
	FCU's			
D3030	**Cooling Generating Systems**		$8.49	$1,037,500
	FCU's			
D4010	**Sprinklers**		$2.62	$320,500
	Wet pipe sprinkler systems, steel, light hazard, 1 floor, 10,000 SF			
	Wet pipe sprinkler systems, steel, light hazard, each additional floor, 10,000 SF			
	Standard High Rise Accessory Package 8 story			
D4020	**Standpipes**		$0.57	$69,500
	Wet standpipe risers, class III, steel, black, sch 40, 6" diam pipe, 1 floor			
	Fire pump, electric, with controller, 4" pump, 30 HP, 500 GPM			
D5010	**Electrical Service/Distribution**		$0.82	$100,500
	Service installation, includes breakers, metering,			
	20' conduit & wire, 3 phase, 4 wire, 277/480 V, 2000 A			
D5020	**Lighting and Branch Wiring**		$9.10	$1,111,500
	Wall switches, 5.0 per 1000 SF			
	Miscellaneous power, to .5 watts			
	Fluorescent fixtures recess mounted in ceiling, 0.8 watt per SF, 20 FC, 5 fixtures @32 watt per 1000 SF			
D5030	**Communications and Security**		$5.92	$723,500
	Telephone wiring for offices & laboratories, 8 jacks/MSF			
	includes outlets, boxes, conduit and wire			
	Fire alarm command center, addressable with voice, excl. wire & conduit			
D5090	**Other Electrical Systems**		$0.23	$27,500
	operated, 3 phase, 4 wire, 277/480 V, 30 kW			
	fuel tank, 30 kW			

E Equipment & Furnishings		**2.40%**	**$3.12**	**$381,000**
E2020	Moveable Furnishings		$3.12	$381,000
	Furnishings, dormitory furniture, dressing unit, built-in, deluxe			
F Special Construction		**0.00%**	**$0.00**	**$0**
G Building Sitework		**0.00%**	**$0.00**	**$0**
SubTotal		100%	$131.12	$16,022,500
Contractor Fees (General Conditions,Overhead,Profit)		25.00%	$32.78	$4,005,500
Architectural Fees		7.00%	$11.47	$1,402,000
User Fees		0.00%	$0.00	$0
Total Building Cost			**$175.37**	**$21,430,000**

Appendix C: MEP Assemblies Cost Estimate

Cost Estimate Report
CostWorks
RSMeans

Assembly Detail Report

Year 2012

Date: 19-Sep-12

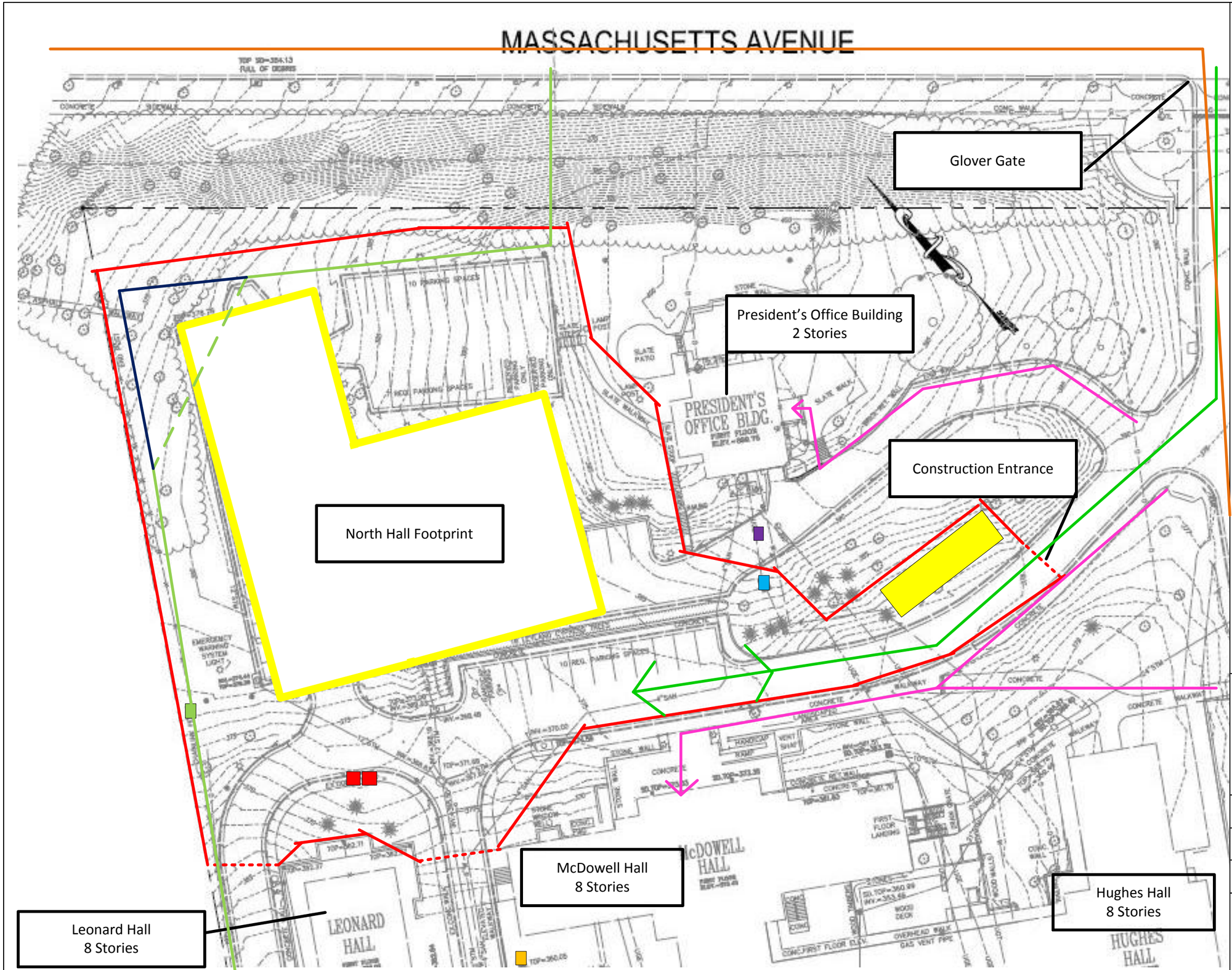
North Hall

Prepared By:
Brandon Tezak
Penn State

Assembly Number			Description	Quantity	Unit	Total Incl. O&P	Ext. Total Incl. O&P
D Services							
D20101101960			Water closet, vitreous china, tank type, 1 piece low profile	94.00	Ea.	$1,366.80	$128,479.20
D20103101600			Lavatory w/trim, vanity top, PE on CI, 19" x 16" oval	176.00	Ea.	$1,178.52	$207,419.52
D20107101840			Shower, stall, fiberglass 1 piece, three walls, 36" square	94.00	Ea.	$1,705.08	$160,277.52
D20202502260			Gas fired water heater, commercial, 100< F rise, 600 MBH input, 576 GPH	2.00	Ea.	$22,812.90	$45,625.80
D20402101960			Roof drain, DWV PVC, 3" diam, 10' high	2.00	Ea.	$934.44	$1,868.88
D20402102040			Roof drain, DWV PVC, 4" diam, diam, 10' high	12.00	Ea.	$1,085.25	$13,023.00
D20402102200			Roof drain, DWV PVC, 6" diam, 10' high	6.00	Ea.	$2,011.02	$12,066.12
D30105101760			Apartment building heating system, fin tube radiation, forced hot water, 1,000 SF area, 10,000 CF vol	5,400.00	S.F.	$11.52	$62,208.00
D30201060820			Boiler, electric, steel, steam, 6 KW, 20.5 MBH	96.00	Ea.	$5,209.05	$500,068.80
D30301103840			Packaged chiller, air cooled, with fan coil unit, schools and colleges,, 3,000 SF,11.50 ton	3,000.00	S.F.	$20.79	$62,370.00
D40104101080			Wet pipe sprinkler systems, steel, ordinary hazard, 1 floor, 10,000 SF	19,400.00	S.F.	$4.13	$80,122.00
D40104101220			Wet pipe sprinkler systems, steel, ordinary hazard, each additional floor, 10,000 SF	102,800.00	S.F.	$3.36	$345,408.00
D40203100560			Wet standpipe risers, class I, steel, black, sch 40, 4" diam pipe, 1 floor	2.00	Floor	$7,130.55	$14,261.10
D40203100580			Wet standpipe risers, class I, steel, black, sch 40, 4" diam pipe, additional floors	13.00	Floor	$1,974.84	$25,672.92
D40203100600			Wet standpipe risers, class I, steel, black, sch 40, 6" diam pipe, 1 floor	1.00	Floor	$11,886.70	$11,886.70
D40203100620			Wet standpipe risers, class I, steel, black, sch 40, 6" diam pipe, additional floors	7.00	Floor	$3,172.65	$22,208.55
D50101200220			Service installation, includes breakers, metering, 20' conduit & wire, 3 phase, 4 wire, 120/208 V, 60 A	29.00	Ea.	$1,843.10	$53,449.90
D50101200240			Service installation, includes breakers, metering, 20' conduit & wire, 3 phase, 4 wire, 120/208 V, 100 A	32.00	Ea.	$2,245.60	$71,859.20
D50101200280			Service installation, includes breakers, metering, 20' conduit & wire, 3 phase, 4 wire, 120/208 V, 200 A	7.00	Ea.	$3,544.90	$24,814.30
D50101200320			Service installation, includes breakers, metering, 20' conduit & wire, 3 phase, 4 wire, 120/208 V, 400 A	10.00	Ea.	$7,440.50	$74,405.00
D50101200360			Service installation, includes breakers, metering, 20' conduit & wire, 3 phase, 4 wire, 120/208 V, 600 A	1.00	Ea.	$12,501.90	$12,501.90

Assembly Number			Description	Quantity	Unit	Total Incl. O&P	Ext. Total Incl. O&P
D50101200400			Service installation, includes breakers, metering, 20' conduit & wire, 3 phase, 4 wire, 120/208 V, 800 A	2.00	Ea.	$15,348.80	$30,697.60
D50102400400			Switchgear installation, incl switchboard, panels & circuit breaker, 2000 A	1.20	Ea.	$54,238.40	$65,086.08
D50102400410			Switchgear inst, add 20% for 277/480 volt	1.00			$0.00
D50201100520			Receptacles incl plate, box, conduit, wire, 10 per 1000 SF, 1.2 watts per SF	122,200.00	S.F.	$2.74	$334,828.00
D50202080720			Fluorescent fixtures, type A, 41 fixtures per 3000 SF	122,200.00	S.F.	$7.14	$872,508.00
D Services Subtotal							**$3,233,116.09**

Appendix D: Existing Conditions Site Plan



Legend

- Site Fence
- Fence Gate
- Temporary Electric Tie In
- Natural Gas Tie In
- Sanitary Sewer Tie In
- Telephone Tie In
- Pedestrian Traffic
- Construction Vehicle Traffic
- Vehicle Traffic
- Existing Gas Line
- Abandoned Gas Line
- Relocated Gas Line
- Office Trailer
- Toilet

North Hall
American University
4400 Mass. Ave., NW
Washington, D.C.

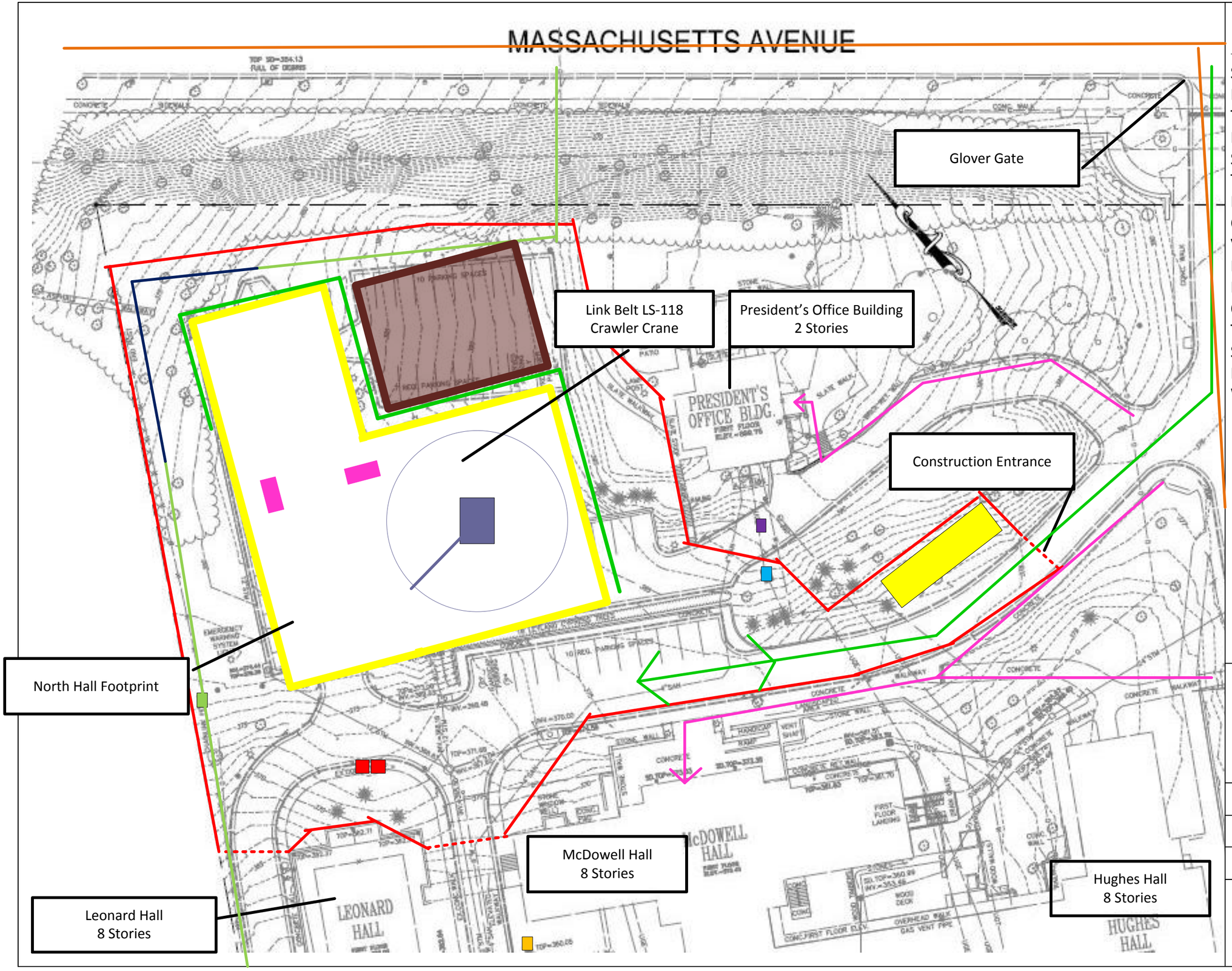
Scale: NTS

Date: 9.21.2012

Brandon Tezak

Existing Conditions
Site Plan

Appendix E: Phased Construction Site Plans



Legend

- Site Fence
- Fence Gate
- Temporary Electric Tie In
- Natural Gas Tie In
- Sanitary Sewer Tie In
- Telephone Tie In
- Pedestrian Traffic
- Construction Vehicle Traffic
- Vehicle Traffic
- Existing Gas Line
- Relocated Gas Line
- Office Trailer
- Toilet
- Support of Excavation
- Material Storage
- Watson Drill Rig

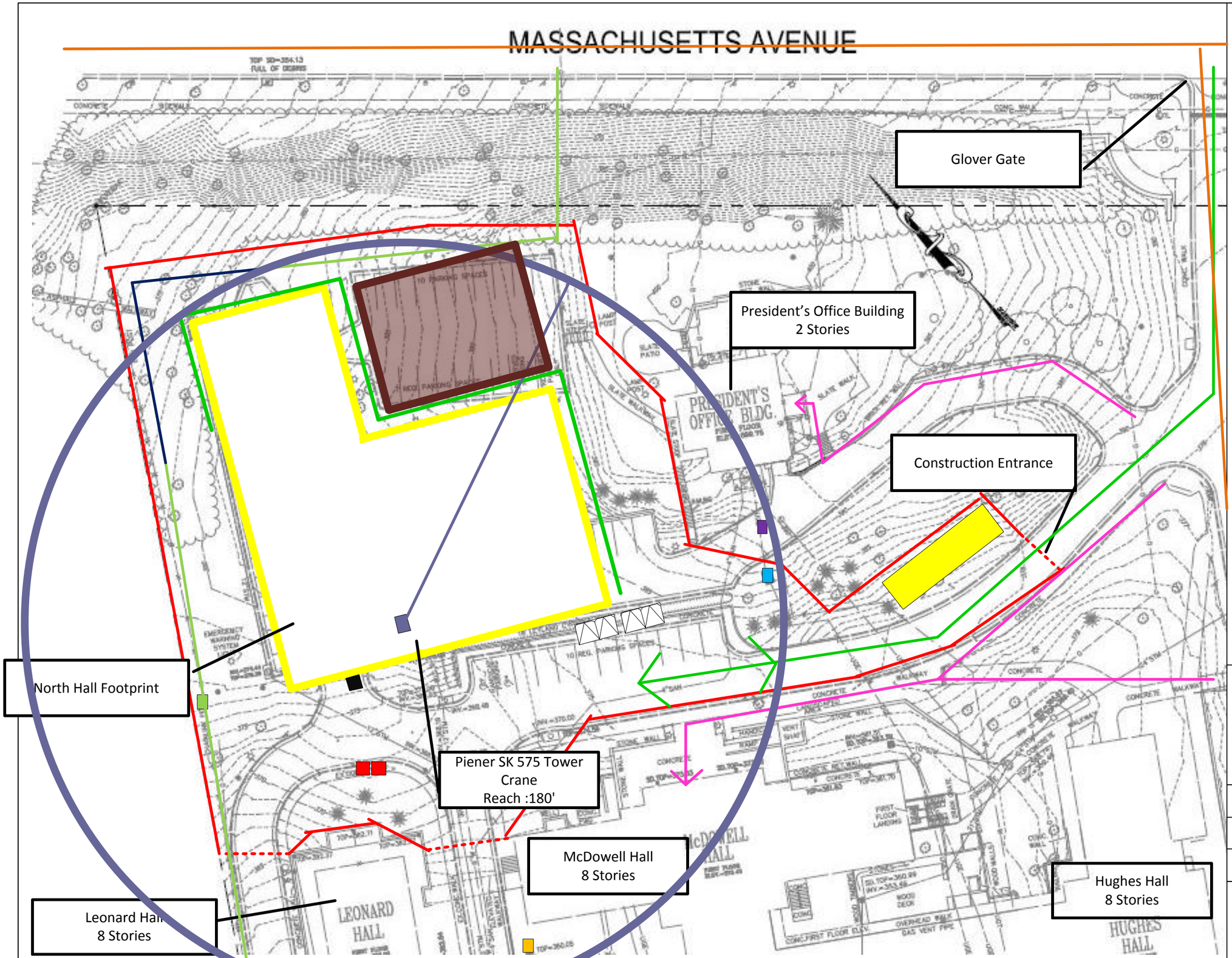
North Hall
American University
4400 Mass. Ave., NW
Washington, D.C.

Scale: NTS

Date: 9.21.2012

Brandon Tezak

Phase 1 : Foundation
Site Plan



Legend

- Site Fence
- Fence Gate
- Temporary Electric Tie In
- Natural Gas Tie In
- Sanitary Sewer Tie In
- Telephone Tie In
- Pedestrian Traffic
- Construction Vehicle Traffic
- Vehicle Traffic
- Existing Gas Line
- Relocated Gas Line
- Office Trailer
- Toilet
- Support of Excavation
- Material Storage
- Hoist

North Hall
American University
4400 Mass. Ave., NW
Washington, D.C.

Scale: NTS

Date: 9.21.2012

Brandon Tezak

Phase 2 : Superstructure
Site Plan

MASSACHUSETTS AVENUE

Glover Gate

President's Office Building
2 Stories

Construction Entrance

North Hall Footprint
8 Stories
Height: 82 Feet

McDowell Hall
8 Stories

Leonard Hall
8 Stories

Hughes Hall
8 Stories

Legend

- Site Fence
- Fence Gate
- Temporary Electric Tie In
- Natural Gas Tie In
- Sanitary Sewer Tie In
- Telephone Tie In
- Pedestrian Traffic
- Construction Vehicle Traffic
- Vehicle Traffic
- Existing Gas Line
- Relocated Gas Line
- Office Trailer
- Toilet
- Hoist

North Hall
American University
4400 Mass. Ave., NW
Washington, D.C.

Scale: NTS

Date: 9.21.2012

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Phase 3 : Finishes
Site Plan