Technical Report 1

State College, PA

320 W. Beaver Ave.

Student Apartments

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Executive Summary

320 W. Beaver Avenue is a multi-use building created on the edge of the downtown area in State College, Pennsylvania, only 2 blocks away from Pennsylvania State University (Penn State). This area is also a good location for the commercial side of the building due to the amount of stores in the area and will hopefully bring in an acceptable amount of revenue.

320 W. Beaver Ave. is a $15,000,000.00, 7 story building containing: 3 levels of parking, 2 of which are below grade, a small commercial space for rent that can accommodate 2-3 small stores, and the rest of the building, floors 2-7, are student apartments, 10 one bedroom and 55 two bedroom apartments. The project is constructed with cast in place concrete for the parking garage and the first floor then switches to CMU walls. All the floors are constructed of pre-manufactured planks, which allows for a shorter construction process. This is a very simple building except for the excavation process due to a certain issues, which are discussed in the local conditions and the building systems sections.

Included in Technical Report #1 is a preliminary investigation of the 320 W Beaver Ave. It consists of simple project schedule, summaries of the different systems within the building, a comparison between the preliminary cost estimate and actual costs, a description of the local conditions, information about the client, the project delivery system, a staffing plan and an existing conditions site plan.

This project has a tight schedule with numerous repetitive processes during construction. If a part of one sequence was added to the project, it could severely alter the flow of trades though the building thus extending the time of the construction process. These sequences will be something to consider when exploring different ideas to improve the building.

At $113.00 per square foot this building is relatively inexpensive, which could mean that any additional systems or ideas added could increase the cost of the building dramatically. This may never be accepted by the owner unless a detailed economic analysis was completed to verify that these ideas and improvements add value or save money over time.

Project Schedule Summary

There are two main items in this schedule that caused delays. The first occurred during the design process. This plot of land was originally designed for another building, Nicholas Tower, which was moved to another site; therefore the design had to essentially start over. Many of the same aspects of Nicholas Tower carried over to 320 W. Beaver Ave, which allowed HAAS Building Solutions to base the design off of something. During this period the lead Architect on the project left HAAS Building Solutions, which extended the design process even further. The other main item that delayed the project was the excavation phase. This was due to the amount of drilling and blasting to create a large hole, two floors below grade. During this process contaminated soils were found, which required special removal, delaying the project further. For further information about the soil conditions refer to local conditions on page 8. Besides these two main factors, the schedule flows smoothly. After the foundation and parking garage are constructed, the rest of the building is a flow of trades one after another. The hollow core planks are placed, the block walls are erected, and then the different trades can move up through the building following one floor behind the structural erection.

Refer to Appendix A: Project Schedule on page 11.

Building Systems Summary

Demolition

There were two existing buildings on the property. One, the olds 320 W. West Beaver Ave., was located on the west end of the site and 310 -314 W. Beaver Ave., which was located at the east end of the site. Both of these buildings were demolished. There was also a small structure taken down behind the church to the north east of the building. All three building are shown clearly on the site plan In Appendix B on page 12.

Excavation

320 W. Beaver Ave. was excavated mostly two levels below grade, except for the northeastern part which went 3 levels below, due to the sloping of the parking garage and the slight slop of site. There were two major issues on this project dealing with the excavation; the first was the amount of rock. A great deal of drilling and blasting were required. The second, was contaminated soil, see Local Conditions on page 8 for more information.

In the process of excavation, shoring pipes were placed 8' o.c., down one level below grade. Next, pre split holes are drilled every 6" o.c., between the shoring pipes, to allow for the soil and rock to split along those holes when excavated. After these were drilled, explosives were used to blast the rock and soil to the inside of site, for it to be removed. Once the excavation was down one story below grade, lagging was used to hold back the soil and rock. This process

was repeated until the required depth was met, which was typically 19'. Dewatering was not needed during the entire process of excavation and construction, the water drained naturally.

Structure

There are two levels below grade for a parking garage. This parking garage contains cast in place concrete walls for the exterior walls, structural interior walls and columns. The formwork used was made by Ulma. There were two types used, one was Mega Forms, which are large metal wall forms put in place with a crane, the other is called Mega Light, which are much smaller that can be put in place by hand. The floors for the parking garage are slopped as ramps for the cars to get up and down the different levels. The bottom floor level is a slab on grade, at least 5" thick with welded wire mesh. The parking floors above consist of solid precast panels that are tied together with welding plates. All precast panels for the building were poured and manufactured by Wm S Long Inc, in Callery, PA.

The first floor, at grade level, is mostly cast in place concrete walls; however, it contains a structural steel front for the commercial space. The commercial store front had a glass curtain wall system supported by a steel frame. The rest of the façade at the first floor is non load bearing brick requiring minimal scaffolding. At Floor 2, the structure is a combination of cast in place concrete and CMU walls. In floors 2-7, the structure consisted of CMU walls. All of the floors were hollow core planks with a 2" topping. These are attached with welded plates up to the 3rd Floor, and then switch to bent rebar, which is grouted into the CMU walls. Exterior and interior non load bearing walls consisted of metal stud framing.

The crane used on this project was a Peiner SK 315, which is located in the elevator shaft on the western side of the building that has an 8-16 ton capacity and an HUH of 237'.

Mechanical

The Sprinkler system utilizes a dry pipe system for the parking garage, while for the rest of the building a wet pipe system was implemented. The fire pump is located in the basement.

The mechanical system is split into a couple areas. There is a main mechanical room in the basement that contains two combustion water heaters connected to a hot water storage tank, which will be used for the domestic hot water. The commercial floor does not have a mechanical system implemented at the moment, but the system will be electric and decided upon tenant fit out. The parking garage has continuously running fans that pull in fresh air. The corridors of the building are heated through two gas fired 3000 CFM air handling units that are housed on the roof. The roof also contains a 27.9 kW condensing unit that cools the corridors. Each apartment has its own 5.4 kW heat pump, in the exterior porch closet, used to heat and cool the apartment. This is controlled from a thermostat and distributed via forced

air. Each apartment's bathroom has its own 0.75 kW wall heater and is directly vented to the outside.

Electrical

The power enters into the building into the main switchboard with a 2000 A main breaker, located in the basement and is then distributed up through the building via a 1600 A copper busway. There is a 125 kW backup diesel generator located in the basement. Each floor has a 400 A panel coming off of the busway that distributes the power to a 125 A panel for each apartment. There are 3 other panels that run off of the busway. The first Panel E1 is 400 A and distributes the power for the fire suppression system and safety systems, such as exit signs. Panel MSB is another 400 A panel that distributes power for the heating systems for the corridors and the basement. Panel LSB is a 225 A panel for the lighting and receptacles in the parking garage as well as the first floor, containing the mail room and the commercial spaces.

CATV cable and phone lines are distributed throughout the building. Each apartment has a cable jack and telephone jack located in the living room and each bedroom, there is also an additional telephone jack in the kitchen.

Project Cost Evaluation

Square Foot Cost Analysis — Table 1

Exterior wall contruction		Concrete Block and Precast Panels						
Ground Floor								
Area	13,427 SF							
Gross Floor Area	80,102 SF							
Number of Stories	7					RS Means 2002		
Story Height	9'							
Perimeter	640 LF							
Basement Area	56,533 SF							
Specify Source	Page	104	Model #	140	Area	85,000 SF		
	Frame	Steel Frame With Concrete Block						
Size Adjustmnet	65000	80102	85000					$111.97
	$114.05	$111.97	$111.30					
Height Adjustment	65000	80102	85000		$0.99	per foot		$2.96
	$1.25	$0.99	$0.90		3	foot difference		
Perimeter	65000	80102	85000		$2.97	per 100 LF		$4.48
	$3.65	$2.97	$2.75		150.69	LF Difference		
Total Adjustment				Cost per SF				**$113.49**
Building Cost	$113.49		80102	SF				**$9,090,971.50**
Basement Cost	$21.40		56533	SF				**$1,209,806.20**

Additives

Type	#	Cost					
Elevator	1	$105,400.00	Adjustment	5	$5,675.00	$28,375.00	$133,775.00
Cocktop	65	$400.00	Assumed 400 because of range of 340-1475				$26,000.00
Fridge	65	$600.00	Assumed 600 because of range of 555-950				$39,000.00
Total							**$198,775.00**

Total Building Cost						**$10,499,552.70**
Location Modifier	City	State College PA	Date	May-07	0.96	**$10,079,570.59**
Final Cost	Time Factor	2002	2007	1.32		**$13,267,406.14**

D4 Cost Estimate					
Table 2					
Code	Division Name		%	SF Cost	Projected
1	General Requirements		4.53	$7.90	$632,805.80
3	Concrete		10.82	$18.88	$1,512,325.76
4	Masonry		17.31	$30.21	$2,419,881.42
5	Metal		2.49	$4.35	$348,443.70
6	Wood & Plastics		1.82	$3.18	$254,724.36
7	Thermal & Moisture Protection		3.06	$5.35	$428,545.70
8	Doors & Windows		7.06	$12.31	$986,055.62
9	Finishes		10.22	$17.84	$1,429,019.68
10	Specialties		0.8	$1.40	$112,142.80
11	Equipment	Appliances	0.05	$0.08	$6,408.16
12	Furnishings	Window Treatments	0.08	$0.13	$10,413.26
14	Conveying Systems	Elevators	2.6	$4.53	$362,862.06
15	Mechanical		24.8	$43.28	$3,466,814.56
16	Electrical		14.36	$25.05	$2,006,555.10
	Total		100	$174.49	**$13,976,997.98**

Actual Cost			
Table 3			
	Type of Cost	SF Cost	Projected
	Construction Cost	$83.00	$11,000,000.00
	Excavation Cost	$30.00	$4,000,000.00
	Mechanical Cost	$8.00	$1,000,000.00
	Electrical Cost	$6.00	$800,000.00
	Structural Cost	$34.00	$4,500,000.00
	Total Cost	$113.00	**$15,000,000.00**

There is some variation in the costs due to several factors. The RS Means estimate shown in Table 1 and the D4 estimate shown in Table 2, are low because there were not any multiuse facilities to compare to 320 W. Beaver in the references used. These estimates assume that there is a three story basement not a parking garage and does not have a commercial space on the front of the first floor. When looking at two estimates using a parking garage and a building then combining them, the cost was extremely high giving a false representation of the project. The other reason the actual cost is higher is due to the excavation.

Local Conditions

In State College there are two distinct types of buildings. One is a steel frame building with a curtain wall. These are primarily on Penn State's campus. Downtown state college tends to be a different type of building. They are for the most part made of precast concrete elements and cast in place concrete, which is what 320 W Beaver is. This building is built just like many buildings have been built before it in this area. One major difference is the underground parking garage. Not too many projects have gone two to three stories below grade for a parking garage.

The site is somewhat congested, leaving little room for laydown. The crane pulls items right of the delivery truck which requires shutting down one lane of traffic. The parking space for workers is also limited, maybe enough to park 15 cars, however many of the workers drive large trucks in order carry supplies. Many of the workers squeeze their cars and trucks on W Highland Alley on the south side of the site.

There was not much of a consideration for construction waste management on the project. Despite recycling programs for on campus construction projects, apparently there was no opportunity to recycle on this job. Luckily for this job most of the structure is precast so there is smaller amount of waste. There are a lot of metal studs used in the project, whose waste could easily be recycled. The main waste will come about during finishes, with drywall, carpet, and tile.

Subsurface conditions were one of the more interesting aspects of this project. A contaminant known as PCE, seeped into the soil of the site. This chemical originates from an outdated dry cleaning process, which Balfurd Cleaners, located next door, used in the past. Before Balfurd Cleaners moved in, in the 1960's, there was another cleaning business that most likely used the same toxic chemical in their cleaning process. The chemical was required to be completely removed before the site could be used.

Through the entire construction process no dewatering system was needed, the water drained on its own.

Client Information

Blue Mountain Harmony, LLC, wishes not to reveal any information.

Purely speculating, Blue Mountain Harmony is making a multi-use facility in order to delve into two different markets, student apartments as well as the commercial sector for some small shops or maybe a café. Due to the area this project should succeed with flying colors.

Project Delivery System

320 W. Beaver Ave. is a design-bid-build project, which was selected by the owner. The owner would prefer that most of the contracts to be kept confidential. What can be said is that some of the contracts were GMP contracts and others were Cost plus a fee. As seen in the diagram below all the subcontractors work directly below Poole Anderson Construction, except for R&R Steel who are working under Altoona Pipe & Steel who is working under Poole Anderson Construction.

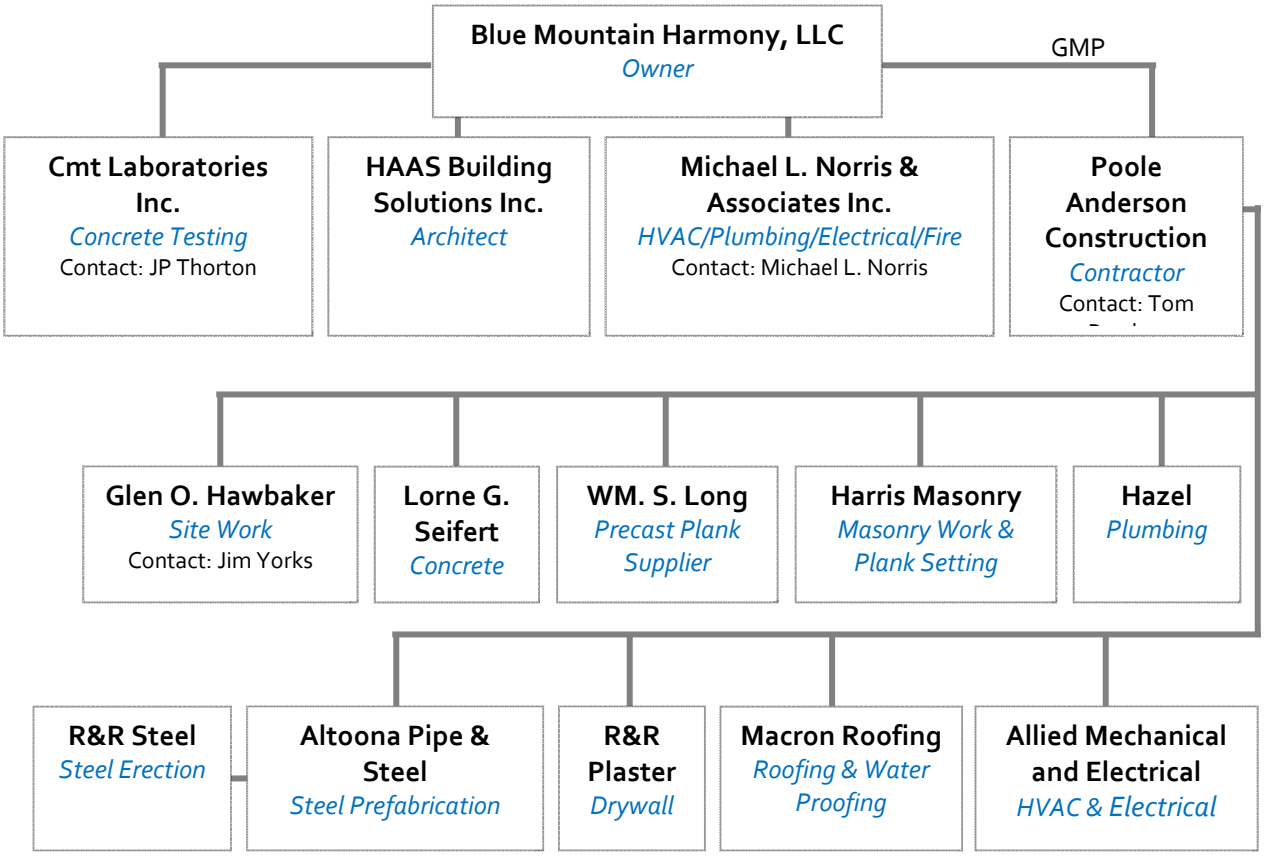


Figure 1

Staffing Plan

320 W. Beaver Ave has 3 staff from Poole Anderson assigned to the project. Ben Shuff is the Project Manager and Tom Brasher, the Project Engineer both work underneath Dan Long, the Vice President of Operations, at Poole Anderson Construction. Ben Shuff and Tom Brasher coordinate the project mostly from the onsite office, located in the basement of the church next door and communicate the project with the outside world, through deliveries, other engineers, the architect, and the owner. Terry Getz, the Superintendent, organizes the construction on the site and works directly with the subcontractors on the site. He is the main communication between the subcontractors and Ben and Tom. This is all shown in Figure 2

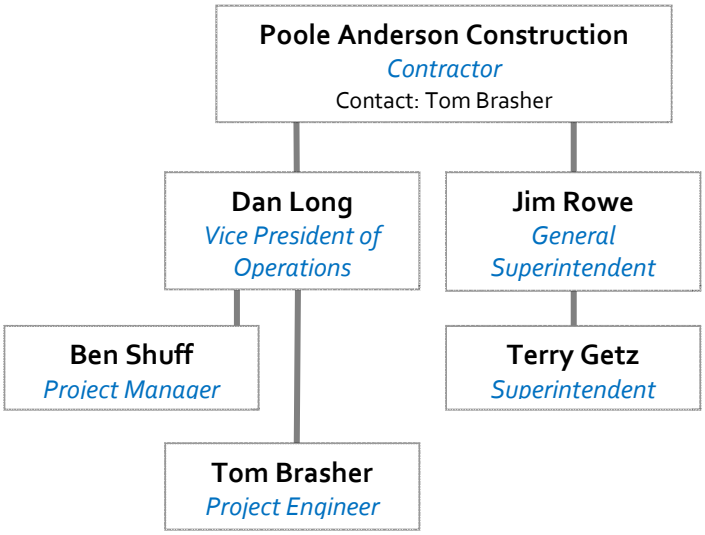
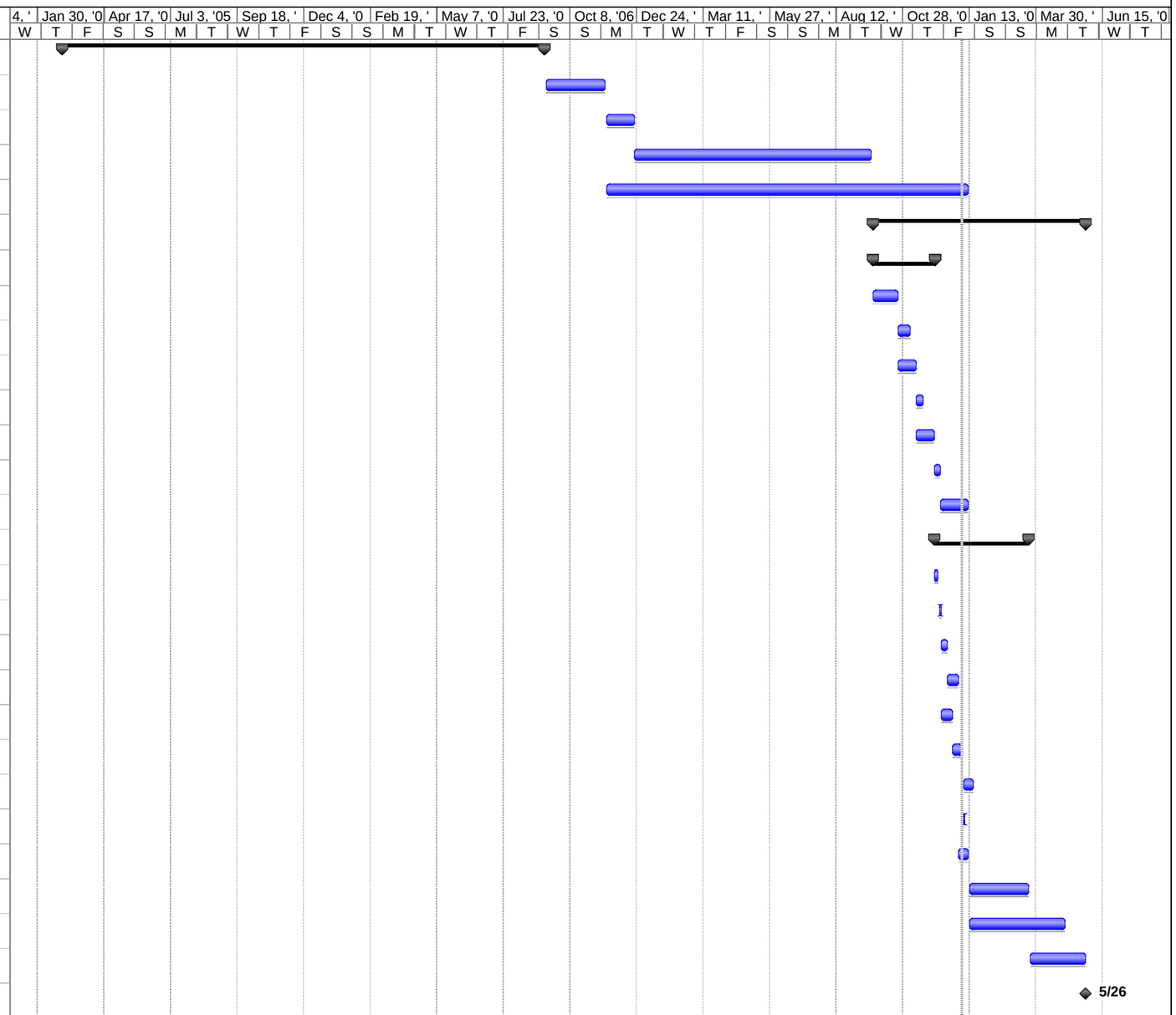


Figure 2

Apendix A: Project Schedule

ID	Task Name	Duration	Start	Finish	Predecessors
1	**Design Phase**	400 days	Mon 2/28/05	Fri 9/8/06	
2	Bidding	50 days	Mon 9/11/06	Fri 11/17/06	1
3	Demolition	24 days	Mon 11/20/06	Thu 12/21/06	2
4	Excavation	196 days	Fri 12/22/06	Fri 9/21/07	3
5	Procurement of construction services	300 days	Mon 11/20/06	Fri 1/11/08	2
6	**Construction Phase**	176 days	Mon 9/24/07	Mon 5/26/08	4
7	**Parking Garage Structure**	52 days	Mon 9/24/07	Tue 12/4/07	4
8	Foundations	21 days	Mon 9/24/07	Mon 10/22/07	4
9	Exterior Wall	10 days	Tue 10/23/07	Mon 11/5/07	8
10	Interior Walls and Columns	15 days	Tue 10/23/07	Mon 11/12/07	8
11	Basement Slab	6 days	Tue 11/13/07	Tue 11/20/07	10
12	Precast Floors	15 days	Tue 11/13/07	Mon 12/3/07	10
13	Commercial Space Structure	5 days	Tue 12/4/07	Mon 12/10/07	12
14	Brick first floor only	24 days	Tue 12/11/07	Fri 1/11/08	13
15	**Apartments**	79 days	Tue 12/4/07	Fri 3/21/08	12
16	CMU Walls	4 days	Tue 12/4/07	Fri 12/7/07	12
17	Concrete Topping	2 days	Mon 12/10/07	Tue 12/11/07	16
18	Interior Framing	5 days	Wed 12/12/07	Tue 12/18/07	17
19	MEP Rough-in	9 days	Wed 12/19/07	Mon 12/31/07	18
20	Exterior Framing	9 days	Wed 12/12/07	Mon 12/24/07	17
21	Exterior Sheathing	9 days	Tue 12/25/07	Fri 1/4/08	20
22	EIFS	9 days	Mon 1/7/08	Thu 1/17/08	21
23	Windows	1 day	Mon 1/7/08	Mon 1/7/08	21
24	Drywall	9 days	Tue 1/1/08	Fri 1/11/08	19
25	Repeat 9-22 for all 7 floors	50 days	Mon 1/14/08	Fri 3/21/08	24
26	Finishes	80 days	Mon 1/14/08	Fri 5/2/08	24
27	Landscape	46 days	Mon 3/24/08	Mon 5/26/08	25
28	Occupancy	0 days	Mon 5/26/08	Mon 5/26/08	27,26



W Highland Alley

South Burrowes Street

South Atherton Street

Beaver Ave.

Temporary Parking

Existing Garage

Site Office
Church Basement

Bethune United Methodist Church &
St. John's United Methodist Church

Balfurd
Cleaners

320 W Beaver Ave. OLD

310 - 314 W Beaver Ave.

112' to Fire Hydrant

176' to Fire Hydrant

0' 5' 10' 20' 40'

Reference Nothrth

True Nothrth

- Property Line
- Existing Buildings
- Existing Buildings Demolished
- Building Perimeter
- Buildlng At Ground Level
- Buildlng Below Ground Level
- Exlsting Trees
- Existing Communlcatlon Llne
- Existing Gas Line
- Existing Sewer Line
- New Sewer Line
- Existiong Sanitary Line
- New Sanitary Line
- Exlsting Water Llne
- Existing Water Valve
- Existing Electrical
- Street Light
- Temporary Services
- Traffic Flow

Site Plan Existing Cosditions

320 W. Beaver Ave.

State College, PA

Technical Assignment 1

Scale: 1/32" = 1'-0"

Drawn By: Kyle Macht
Date: 12/10/2007

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