The Salamander Resort and Spa

Middleburg, Virginia

Final Report

Paul Roberts
Construction Management
Advisor: Jim Faust
April 2010

The Salamander Resort & Spa

General Building Data

Location: Middleburg, Virginia
Occupancy: Mixed use, Hotel, Spa
Size: 230,000 sf
Height: 4 plus mechanical penthouse
Construction Cost: $93 million
Construction Dates: Spring 2008 - Spring 2011

Structural

- Basement 5" slab on grade with typical18x18 and 24x24 concrete columns
- Converts from concrete to steel columns on 1st floor main building
- Guest house 9" or 10" 3500psi post tensioned concrete slab
- Lightgage steel roof trusses at 48" on center
- Spread footings minimum 36" below grade

PAUL ROBERTS CONSTRUCTION MANAGEMENT

Project Team

General Contractor: Turner Construction Company
Owner: Salamander Hospitality
Architect: Architecture Inc.
Design Architect: Winberly Allison Tong and Goo
Structural Engineer: Rathgeber/Goss Associates
MEP Engineer: RG Vanderweil Engineers

Mechanical

- 1950 gpm cooling tower on main roof serves chillers 1-3
- 15 AHU's. (9) Variable Frequency Drive. (6) Constant Volume
- (6) additional heat recovery AHU's

Lighting / Electrical

- 3200A 480/277V 3 phase, 4W main switchboard
- Uninterrupted Power Supply (UPS) for 4th floor lodge
- Indoor emergency diesel generator, 650kW 480/277V
- Secondary 120/208V 3 phase
- Dimmable neon 2400K "incandescent" tubing used in spa coves

http://www.engr.psu.edu/ae/thesis/portfolios/2010/pcr115/index.html

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Acknowledgements

Turner Construction

- Mark Miller, Project Manager
- Andy Yohe, MEP Manager

FTI Consulting

- Nick Giambra, Senior Consultant

Penn State Architectural Engineering Faculty

- Jim Faust, Spring Advisor
- Chris Magent, Fall Advisor

Executive Summary

The purpose of this senior thesis is to study The Salamander Resort and Spa, which is located in Middleburg, Va. This report contains a project overview and three analyses focusing on schedule deceleration, guest lodge lighting redesign, and water management. The analyses are focused on reducing the upfront and running costs of the resort through the use of lower energy use and alternate scheduling.

The first analysis deals with the voluntary schedule deceleration per owner's request. The initial design and schedule called for completion in March 2011, but was delayed 12 months to March 2012. In the revised schedule, most activities were not delayed, rather their durations were extended over a longer period of time. The main exception to this schedule was the interior work. From January 2009 to November 2009, all interior work in the lodge was stopped. I analyzed a halt in construction activities for a period of ten months. This will alleviate the general conditions costs for that time period while still allowing the project to finish by March 2012. The general conditions savings totaled $252,345. The main component of the savings came from the project team salaries and temporary power, lighting, and heating.

The second analysis deals with the redesign of the guest lodge lighting system. A large amount of energy is wasted every year when occupants leave lights on when they are not in the room. The resort has 168 rooms and this leads to a significant energy waste. I analyzed a system that will replace all halogen lamps with LED's and install a control system that will turn off the guest room's lights when no one is present. The total energy cost per year with the LED's is $5,151 versus $60,584 with halogens. Taking initial investment, replacement cost, and yearly energy cost into consideration, the payback period for the proposed system is 2.37 years. Approximately $100,000 will be saved in energy and maintenance costs annually for the following 15 years.

The final analysis investigates the buildings water management, more specifically, the irrigation system. A wide range of plants are used in the surrounding landscaping, many of which are not native to Virginia. Native plants are accustomed to the climate and conditions of the location and are hardier and more likely to survive harsh conditions than that of non-native and exotic plants. By replacing the current pond pump irrigation water source with rain water collection tanks, the system improves sustainability. The additional cost of the proposed system is $18,350.

Project Overview

Introduction

Building Name: Salamander Resort and Spa
Location and Site: Middleburg, Virginia. 340 acres
Building Occupant Name: Salamander Hospitality
Occupancy: Mixed use. Hotel, spa, equestrian center
Size (total square feet): 230,000 ft^2
Building Cost: $93 million
Dates of Construction: March 2007 – March 2011

Building Enclosure:
Building Facades: There are two major exterior wall facades on the Salamander Resort and Spa. Stone and stone veneer is used on the main entrance building, front and rear. The stone is used on the lower portion of the wall and the stone veneer is used on the middle and upper portion to reduce overall weight. The remainder of the main building and guest wing is stucco.

Roofing:
The roof consists of three different types. Composite slate shingle roofing is used on all slanted roofs. EPDM single ply - fully adhered (TPO) or Modified Bituminous Irma Roofing Systems are used for all flat roofs, usually found in the mechanical spaces.

Client Information

Salamander Hospitality is a company formed in 2005 in part by the current CEO Sheila Johnson. Her goal is to grow the company by acquiring one of a kind properties and managing them to provide an unforgettable experience. Salamander Hospitality specializes in the management of luxury resorts and hotels, like the Salamander Resort and Spa. Their focus on owner and customer satisfaction is what drives this company. Salamander Hospitality also owns

and manages the Innisbrook Resort and Golf Club in Florida and the Woodlands Inn in South Carolina. Both of these properties reflect the mission that Salamander Hospitality set out to achieve.

Owner Expectations

Cost: Most of the funding for this project comes directly from Salamander Hospitality. The high-end nature of this project can lead to changes in interior and exterior finishes throughout the project and it is one of the goals of the contractor to minimize the cost impact of these.

Quality: The owner is looking for a very high quality finished product that will serve the needs of her client base. Only the finest fixtures, furniture, and wood details are used. This requires the contractor to provide special attention to the installation process in order to ensure the best looking product.

Schedule: The owner had initially set a Spring 2010 completion date but has since pushed that back to Spring 2011. This has provided the contractor with significant float time, and allows for easier trade coordination.

Safety: It is critical that the contractor provide a safe environment for all the workers on site.

Local Conditions

Figure (1)

Figure (2)

The project is located in the town of Middleburg, Virginia on route 50, about 40 miles west of Washington D.C. and 120 miles north of Richmond (Figure 1). Figure (2) shows the site boundary in blue and the resort location in red.

Preferred Methods of Construction: Much of the residential properties in old town Middleburg are masonry and brick construction. To match this look, Salamander Resort uses a stone façade on the main entrance area.

Construction Recycling: All recycling is collected on site and removed by a third party company to a local recycling plant.

Tipping Fee: In 2008, the tipping fee in Loudon County is $60/ton. (Loundon County Solid Waste Management Planning District)

Soil Type: The regional soil consists of a blend of deep, well drained, silty soils and clays. During footing excavation, the subsurface water level was not reached.

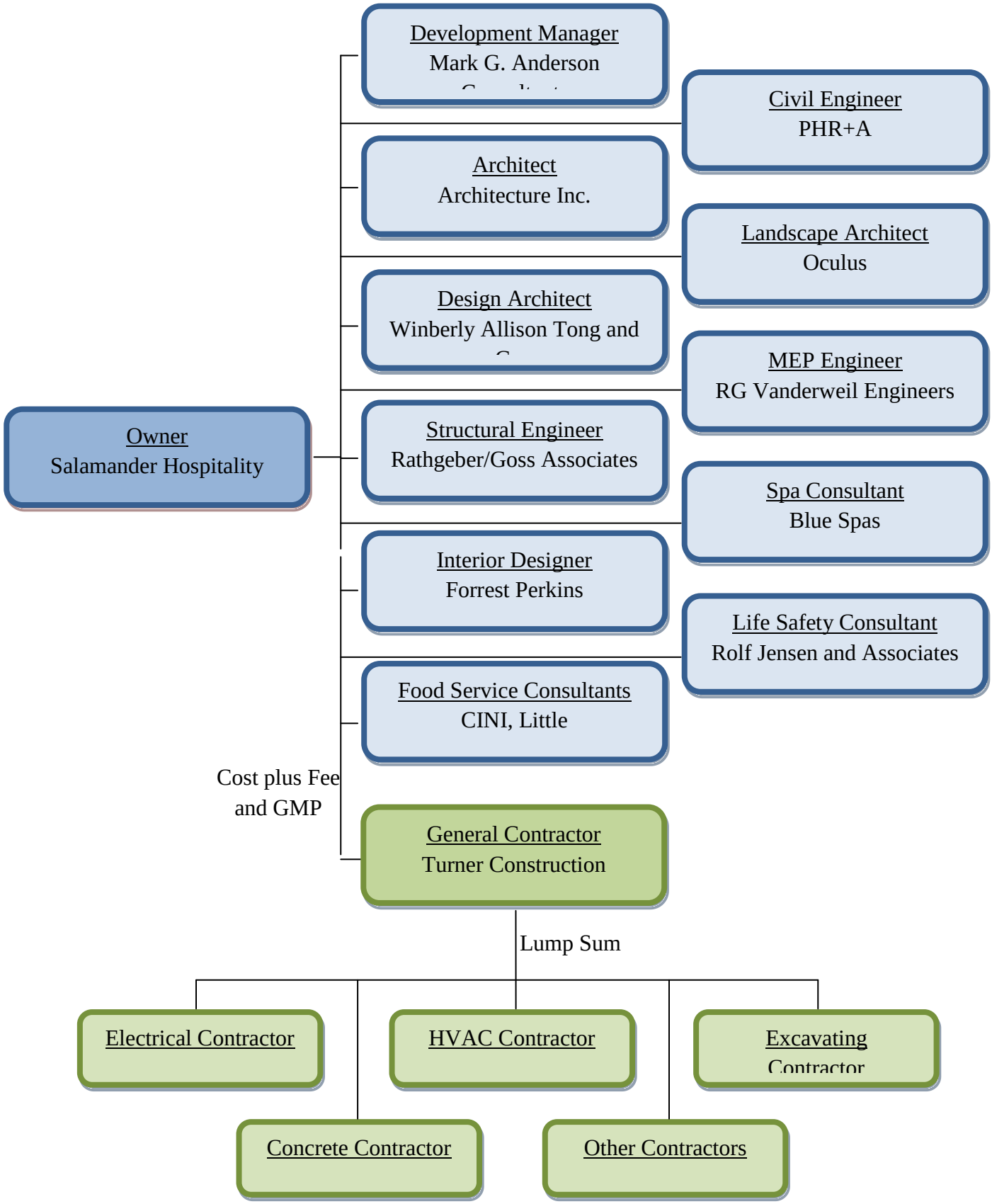
Project Delivery System

The project delivery method used is a design build. A design build method was chosen because a large portion of the lighting system and custom interior work was not designed at bid time. When Turner took over the project in 2007 it had already undergone three complete redesigns under a different general contractor. The owner initially wanted to fast-track the process to make up for lost ground but this was later altered to fit their needs more accurately.

The Owner, Salamander Hospitality, holds direct contracts with all the design architects, engineers, consultants. The contract between the Owner and Turner Construction is a Cost Plus Fee with a Guaranteed Maximum Price (GMP). Turner Construction holds lump sum contracts with all the subcontractors. The contractor was selected through a competitive process based upon qualification, fee, and a general conditions proposal.

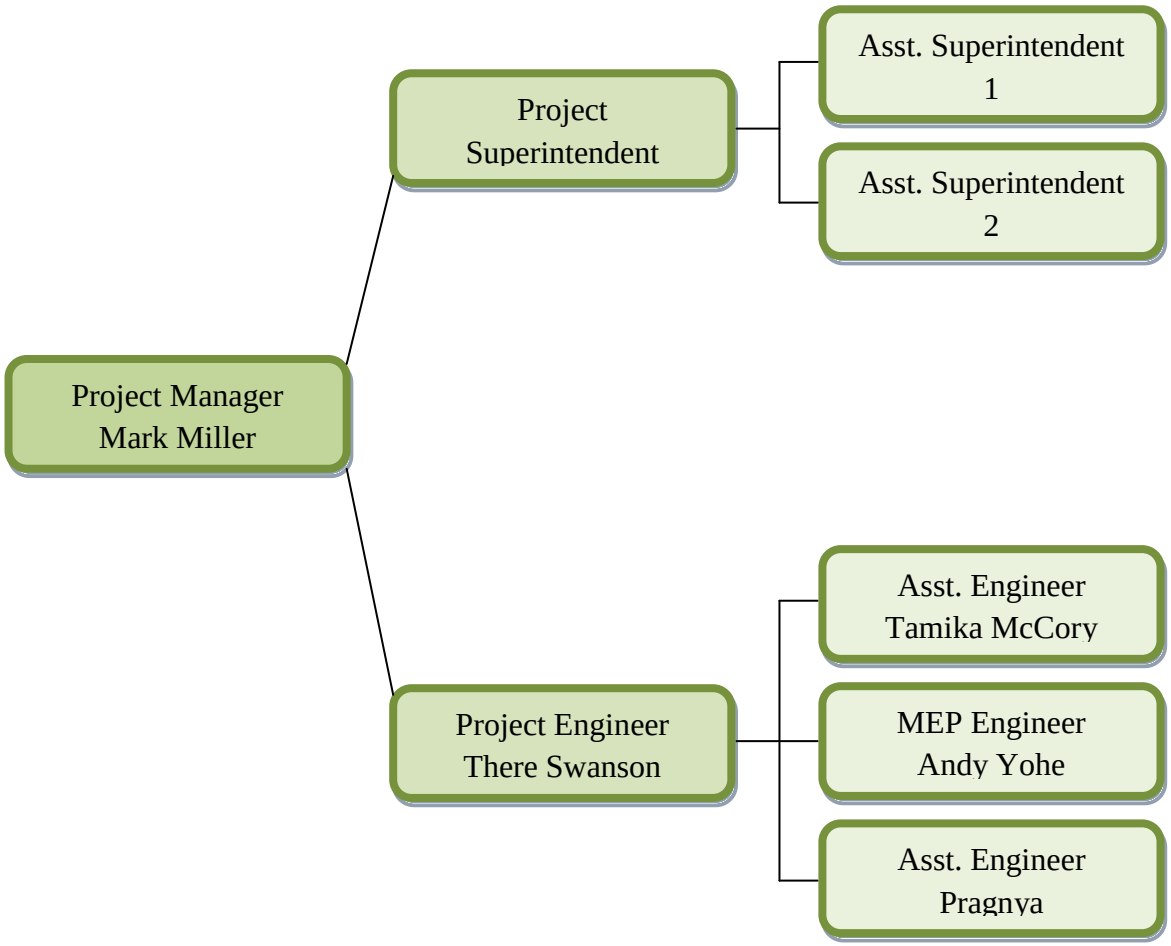
Turner Construction uses a Contractor Controlled Insurance Program (CCIP) which includes workers compensation and general liability. The Owner separately purchased Builders Risk Insurance. There is no Performance Bond on this project.

See the following page for the project delivery system organizational chart.


Development Manager
Mark G. Anderson
Civil Engineer
PHR+A
Architect
Architecture Inc.
Landscape Architect
Oculus
Design Architect
Winberly Allison Tong and
MEP Engineer
RG Vanderweil Engineers
Owner
Salamander Hospitality
Structural Engineer
Rathgeber/Goss Associates
Spa Consultant
Blue Spas
Interior Designer
Forrest Perkins
Life Safety Consultant
Rolf Jensen and Associates
Food Service Consultants
CINI, Little
Cost plus Fee
and GMP
General Contractor
Turner Construction
Lump Sum
Electrical Contractor
HVAC Contractor
Excavating
Contractor
Concrete Contractor
Other Contractors

Staffing Plan

Turner Construction has eight people working on site, one project manager, three superintendents, and four engineers. There are more people on this site than usual because of the complexity of the systems and installation. The Project Engineer and Assistant Engineer are responsible for RFI's and submittals on a daily basis. The Superintendents are responsible for work flow, schedule changes, and subcontractors. Below is the Turner Construction on-site staff.



Building Overview and Systems Summary

Building Systems Summary			
Yes	No	Work Scope	Issues
	X	Demolition required?	
X		Structural steel frame	Mobile crane for erection
X		Cast in place concrete	Crane and bucket placement. Wood formwork
	X	Precast concrete	
X		Mechanical system	Mechanical room located in basement of main building, northeast corner. Dry sprinkler system
X		Electrical system	Main 3200A 480/277 - 3 phase 4W and secondary120/208V - 3 phase 4W
X		Masonry	Stone veneer on main building at entrance
	X	Curtain wall	
	X	Support of excavation	

Excavation:

- All foundations should be a minimum of 36” below grade
- Building spread and strip footings shall bear on undisturbed natural soils or compacted fill with a bearing pressure of 3500 psf.
- Utility lines shall not be placed through of below foundations without structural engineer’s approval

Concrete:

- A 3000 psi reinforced concrete was used for 5” interior slab on grade
- The guest house utilized 9” and 10” 3500 psi post tensioned reinforced concrete on metal deck with continuous welded wire fabric.
- Typical 16x28 reinforced concrete columns utilized in guest house.

Structural Steel:

- Rolled shapes and Round HSS Shapes – ASTM A992, ASTM A500
- 2” 18 gage Lok-Floor composite metal decking used in the guest house
- 1 ½” deep, wide rib, 20 gage galvanized roof decking used for both the guest house and main building
- Lightgage steel roof trusses with 8” lightgage purlin at 48” on center

Mechanical System:

- 15 main AHU's, 9 Variable Frequency Drive (VFD) and 6 Constant Volume (CV)
- 6 heat recovery AHU's. 3 located in the main lodge, 2 in the spa, and 1 in the laundry room
- 1950 gpm cooling tower located on the main roof serves chillers 1-3
- Mechanical room located in basement in north east corner

Electrical System:

- From utility, main 3200A 480/277V - 3 phase 4W switchboard with secondary 120/208V 3 phase
- Uninterrupted Power Supply (UPS) for 4th floor guest house and 1st floor main building
- Indoor emergency diesel generator (650kW 480/277V – 3 phase 4W)
- Custom designed light fixtures and chandeliers

LEED Design Features:

- "Green" slate roofing made from recycled rubber and PVC piping
- Minimize irrigation by using native plants and species
- Maximize opportunity to use building materials made from recycled products
- Use low emitting paints, carpets, and window treatments
- Protection procedures in place to conserve 250 of the 340 acres

Site Plan of Existing Conditions

See Appendix A for Site Plan of Existing Conditions

Site Layout Planning

See Appendix B for Site Layout Planning

The most critical phase of this project is the finishing phase. Due to the large number of custom designed fixtures and materials, transportation and handling should be kept to a minimum to avoid damage. Material storage locations are placed by the guest lodge and restaurant on the northern side of the site, to minimize movement. Turner Construction does not supply any material hoists so the subcontractors should place their hoist in the center section of the guest lodge. The main building and spa is one floor so a hoist is not needed to access those areas.

The on-site trailer and temporary parking is located in the designed parking lot for guests. Dumpsters and recycling collectors are located to the east of the main building, which has relatively flat graded land for easy pick-up. Entrance and exit will on the existing 2-way paved

road. Due to the large area and remoteness of the site, no barrier fences are used except for chain link gates at the two entrance and exits.

The planning and coordination for this project benefits greatly from being located on a relatively flat piece of land in the middle of a large open field, free of trees, surrounding buildings, and vehicular/pedestrian traffic. It allows for a lot of freedom when designing a site layout.

Project Cost Evaluation

Actual Costs	
Construction Cost	$ 93,802,046.00
Construction Cost/SF	$ 409.24
Total Project Cost Estimate	$ 135,280,000.00
Total Project Cost Estimate/SF	$ 590.19

Building Systems Costs (Cost and Cost/SF)		
Building System	Cost	Cost/SF
Excavation and Fill	$ 277,443	$ 1.21
Building Concrete	$ 7,191,105	$ 31.37
Structural Steel and Metal Deck	$ 2,023,292	$ 8.83
Plumbing	$ 13,766,120	$ 60.06
Electric	$ 10,674,385	$ 46.57
Finish Carpentry & Architectural Millwork	$ 4,120,000	$ 17.98
Windows, Doors, and Glazing	$ 1,285,355	$ 5.61
Gypsum Drywall Work	$ 5,911,608	$ 25.79
General Requirements	$ 1,893,275	$ 8.26

The Total Project Cost Estimate includes land, design/consultant fees, furniture, fixtures, equipment, and development/marketing in addition to construction costs. The Turner Construction Project Manager on site estimated all these additional costs because the owner did not release the official data. As seen in the chart, the most expensive systems in the building are the plumbing and electric.

Three different project cost analysis were performed throughout the course of the fall semester. The most basic estimate was performed using the software D4Cost. The next estimate was done using R.S. Means Square Foot and the final estimate was a detailed structural systems estimate. The three estimates can be seen below.

D4Cost Estimating

See Appendix C for the detailed D4Cost Estimate

The D4Cost estimate was calculated by selecting two similar projects in the database and combining their attributes into one estimate. The closest projects that D4 had in the database were motel/hotels. I chose The Hampton Inn and Suites Hotel because it is a high end hotel located in Chicago. The Inn on Lake Superior is more similar because of the amenities offered but does not come close to the luxury that the Salamander Resort offers.

Projects Used in D4 Cost Estimate				
Use	Project Name	Size (SF)	Floors	Building Cost
Hotel/Motel	Hampton Inn and Suites Hotel	162,000	12	$ 13,797,591
Hotel/Motel	The Inn on Lake Superior	65,345	3	$ 4,073,012

Parametric D4Cost Estimate				
Division	Name	Percent	Sq. Cost	Amount
0	Bidding Requirements	7.22	$ 9.60	$ 2,200,317
1	General Requirements	3.75	$ 4.99	$ 1,144,345
2	Site Work	4.08	$ 5.42	$ 1,242,343
3	Concrete	21.00	$ 27.92	$ 6,400,073
4	Masonry	6.09	$ 8.09	$ 1,855,012
5	Metals	1.56	$ 2.07	$ 475,578
6	Wood & Plastics	4.78	$ 6.36	$ 1,457,405
7	Thermal & Moisture Protection	1.91	$ 2.54	$ 581,897
8	Doors & Windows	6.39	$ 8.50	$ 1,947,182
9	Finishes	11.38	$ 15.13	$ 3,467,559
10	Specialties	0.35	$ 0.47	$ 107,688
11	Equipment	0.09	$ 0.12	$ 26,443
12	Furnishings	0.05	$ 0.06	$ 13,973
13	Special Construction	0.68	$ 0.90	$ 206,514
14	Conveying Systems	2.49	$ 3.31	$ 758,084
15	Mechanical	19.61	$ 26.08	$ 5,978,605
16	Electrical	8.60	$ 11.43	$ 2,620,616
	Total Building Costs	100.00	$ 132.99	$ 30,483,633

The D4Cost estimate reported at $132.99/SF with a total project cost of $30,483,633. This value is approximately one third of the actual project cost. This significant difference is due in part to the use of the building. The D4 projects are mainly hotel oriented while the Salamander project is a full resort with spa, restaurant, guest rooms, and horse stables/pastures. The Hampton Inn utilizes precast concrete, whereas The Salamander Resort does not. If the three projects had more similar structural, mechanical, and electrical systems the estimate would be closer. The amount of custom interior work, lighting fixtures and woodwork, found on this project also contributes to the difference.

R.S. Means Square Foot Estimate

See Appendix D for the reference pages from R.S. Means 2009

The following R.S. Means square foot estimate is based off M.350: 4-7 Story Hotel with Face Brick and Concrete Back-Up. The costs are calculated using an area of 229,213 square feet and 2,828' perimeter. Basement addition along with height, perimeter, and location adjustments were used. A majority of the structural framing is done with reinforced concrete.

Exterior Wall	S.F. Area	195,000
	L.F. Area	850
Face Brick with Concrete Block Back-up	Steel Frame	$ 159.60
	R/Conc. Frame	$ 157.60

Story Height Adjustment:

12' – 10'3" = 1.75'

-$1.25/ft * (1.75) = -$2.19/sq. ft.

Perimeter Adjustment:

2828' – 850' = 1978'

+$1.75/100 ft * (1978') = +$34.62

Basement Addition:

+$32.20/sq ft

Sub-Total Per Square Foot Estimate:

157.60 + 2.19 + 34.62 + 32.20 = $226.61/sq ft.

Project Location Adjustment

Arlington, Virginia is the closest location listed in RS Means.

$226.61 * 0.93 = $210.75/sq ft.

Sub-Total Construction Cost

$210.75/sq ft. * (229,213 sq ft.) = $48,306,640

Common Additives:

(5) 5000 lb. capacity elevators @ $170,700 each → +$853,500

(1) Security camera and monitor @ $1850 and
(37) additional cameras @ $1000 each → +$38,850
(4) 125 lb. washers @ $32,800 each → +$131,200
(1) 50 lb. washer @ $12,200 each → +$12,200
(2) Laundry folders @ $66,500 each → +$133,000
(1) Laundry ironer @ $35,500 each → +$35,500

Common Additives Total = +$1,204,250

Total Construction Cost:

$48,306,640 + $1,204,250 = **$49,510,890**

$216.00/SF

The R.S. Means square foot estimate is about $45 million less than the actual project cost. Part of this difference can be attributed to using a hotel as the basis for the estimate, as R.S. Means does not have a category for resorts. Another reason for the difference comes in the façade, R.S. Means uses Face Brick with Concrete Clock Back-Up while The Salamander Resort uses a stone veneer and stucco. Other discrepancies were discussed in the analysis of the D4Cost estimate.

The R.S. Means estimate for this project is more accurate than the D4Cost estimate partly because the Means estimate is more tailored to this project, while the D4 Cost is based off other buildings. While neither estimate had a good basis for comparison, the R.S. Means estimate is would be fairly accurate if it included more of the specialty items and finishes found in The Salamander Resort.

Detailed Structural Systems Estimate

See Appendix E for detailed structural systems estimate

Total Structural Costs			
System	SF	$/SF	Cost
Concrete	230000	$ 1.96	$ 449,821.00
Structural Steel	230000	$ 2.93	$ 672,769.00
Reinforcing	230000	$ 1.04	$ 238,934.00
Sub-Total	230000	$ 5.92	$ 1,361,524.00
		Location Factor	0.982
		Total	$ 1,337,016.57

Assumptions:

- Location Factor, Arlington = .982
- 2 use plywood was used for forming
- No waste factors were used
- Footings used 6 #6 for reinforcing
- Slab on grade used #4 @ 12" O.C. for reinforcing
- Concrete Beams used 6 #7 for reinforcing
- Concrete Column used 8 #10 for reinforcing
- Elevated slab used #4 @ 24" O.C. for reinforcing
- Concrete CY totals do not exclude volume of rebar

The detailed structural estimate was performed using R.S. Means 2009. Due to the irregularity of my project I was unable to do a simple estimate of a typical bay and extrapolate. The guest lodge is the only area that has a repeatable structural system. In order to simplify the take-off of concrete beams, concrete columns, and steel members, I used a length range method. I grouped all the different sized beams and columns into length ranges. For example, I counted up all 24"x24" concrete beams and categorized them as either 10'-15', 15'-20', 20'-25', etc. I then took the average length, in this case 12.5', 17.5', 22.5', and multiplied it by the quantity and size to get cubic yards of concrete. I used a similar method for the concrete columns, footings, and steel members. As seen in the above assumptions, I used uniform reinforcing for slabs, beams, and columns to simplify to the take-off. The total structural cost for the project is $1,337,016.57.

The actual cost of building concrete from the GMP estimate by Turner Construction is $7,191,105. This number is significantly larger than the value that I obtained for structural concrete. The main reason for this difference is that this work was performed by a subcontractor

who also had to excavate and backfill the footings. The actual estimate also includes concrete used for paving, sidewalks, and retaining walls. I also did not take into account the additional material and labor costs of post tensioned concrete in the guest lodge.

General Conditions Estimate

See Appendix F for General Conditions Estimate

Assumptions:

- Location factor, Arlington = .982
- Turner Construction employees are on site for entire duration of project
- Project duration: 5 years = 60 months

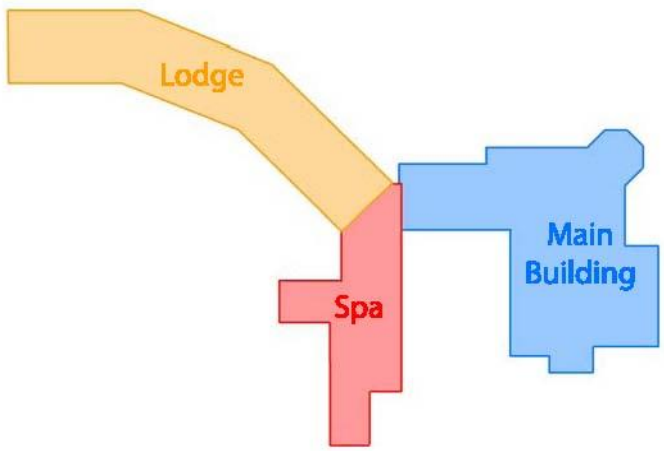
General Conditions Summary		
Item	Cost	% of GC
Field Personnel	$ 2,419,402.50	50.8%
General Expenses	$ 876,418.50	18.4%
Temporary Utilities	$ 209,274.81	4.4%
Insurance	$ 1,260,298.80	26.4%
Total	$ 4,765,394.61	100.0%

The General Conditions estimate was performed using R.S. Means 2009. The estimate was broken up into four categories, field personnel, general expenses, temporary utilities, and insurance. The estimate came to $4,765,394.61 which is 5.1% of the total construction cost. The largest portion of the cost estimate, roughly 50%, is from field personnel because Turner Construction has seven employees on-site.

Detailed Project Schedule

See Appendix G for a detailed Project Schedule

The Salamander Resort and Spa schedule is broken up into the construction of three buildings, the guest lodge, the spa, and the main building.



The three buildings each begin and finish construction at about the same time. The important dates are shown below.

Building	Start	Finish	Duration (days)
Lodge	1/23/2008	12/19/2011	976
Spa	2/19/2008	9/8/2011	928
Main Building	2/27/2008	11/30/2011	980

Construction of the spa and main building are very similar except for the inclusion of more structural steel in the main building. Project Substantial Completion occurs less than a week after the finish of the main building. Closeout takes roughly two months, and the building is handed over to the owner in March 2012. In 2008 the schedule was modified and delayed by a year to accommodate the owner's wishes. This change can be seen very clearly in the delay between the structure of the buildings and the finishes. Between January and November 2009, all interior work was put on hold. After the schedule adjustment, the total duration of the project is exactly five years, March 1, 2007 to March 2, 2012

Foundation

The total duration of the foundation work was approximately 6 months. The foundation consisted of reinforced concrete spread footings excavated down to a minimum of 36 inches below the slab on grade. No formwork was needed because the excavation holes were dug to the correct footing size.

Structural

Superstructure for The Salamander Resort and Spa took about 6 months to complete. It consisted of both concrete and steel framing. The basement and guest wing have concrete

framing throughout and the main building has steel framing on the first floor. This created challenges in the schedule when both concrete and steel were being installed simultaneously.

Finishes

Turner has allocated a large amount of time to the finishes due to the complexities of the project. A majority of the fixtures are custom designed for this project and are more likely to require additional time to install. Like many of the activities, finishes would be able to finish in less time than the allotted if the schedule was optimized for time.

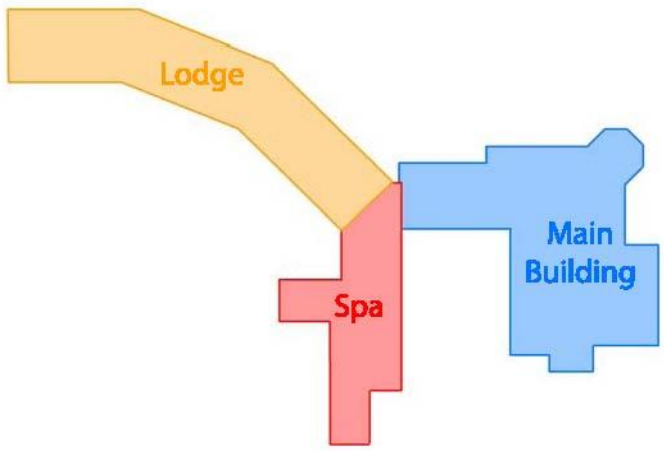
Analysis I: Schedule Deceleration

Introduction

The initial design and schedule for The Salamander Resort and Spa called for completion in March 2011. Per owner's request, the project was delayed 12 months to March 2012. This was done for a variety of reasons that will be discussed later. This intentional deceleration of the schedule creates more work for the contractor. The cost impact is significant, mainly due to the additional year of general conditions. For this analysis, I am proposing a halt in construction activities for a period of ten months. This will alleviate the general conditions costs for that time period while still allowing the project to finish by March 2012.

Original Schedule: Completion date March 2011

The Salamander Resort and Spa schedule involves the construction of three interconnected areas, the guest lodge, the spa, and the main building. The breakdown of areas is seen in the schematic below.



The Main Building and Spa are smaller in square footage than the lodge because they are one floor compared to four. Due to the repetitive nature of the guest lodge, the three building areas all finish in roughly the same amount of time, from exteriors to interiors.

The critical path for The Salamander Resort and Spa followed that of a typical commercial construction project. It includes the following activities; concrete frame, steel frame, core/shell, enclosure, and interiors. A delay to any of these activities would cause a delay in the overall project completion date. The roof dry-in milestone was the most critical point in the schedule as it occurred between the enclosure and the interiors. This was an important point to reach

because it then allowed the extensive interior work to begin. The importance of this milestone was later negated due to the one year delay the owner placed on the entire project.

Revised Schedule: Completion date March 2012

See Appendix G for Revised Schedule

The revised schedule in Appendix G is the schedule created immediately following the decision to extend the project by 12 months. Therefore, it shows a gap in activities similar to that of my proposed schedule in Appendix H. What differs between this revised schedule and the actual work is that the activities preceding the break were not on schedule and ran into the extension period.

The revised schedule has a project completion date of March 2012. The owners of The Salamander Resort and Spa decided it was in their best interest to delay the project by one full year. One of the main reasons for this decision was the current economic climate. They felt that if the resort opened up in March 2011, and the economy had not recovered, they could not rent out all the rooms to capacity. The owner of Salamander Hospitality, Sheila Johnson, is a prominent figure in the Middleburg community, and she felt that this would be bad for her image. The name of her company, Salamander Hospitality, is part of the name of the resort and this would be a direct negative tie to any future properties or communities the company would build.

Deceleration of a construction project is a very rare occurrence and is usually only done in extreme cases. There are numerous negatives aspects to the deceleration of a project schedule. When it comes to timeline and substantial completion dates, owners almost always want them to be earlier. They want to begin collecting rent from tenants or use the building themselves sooner rather than later. When a project is unintentionally delayed, it can cost the owner thousands of dollars a day. Clauses are sometimes built into the contract to make the contractor pay for lost profit if they don't finish on schedule. On this project, because the owner requested the delay, a different set of problems arose.

One of the problems that resulted from the deceleration of this project was the renegotiation of contracts between contractor and subcontractors. The two parties had to agree to when the required work will be completed and more importantly to the subcontractor, when they would be paid. The largest expense of the deceleration to the owner came from cost of the salaries of the Turner Construction project team for the additional 12 months. Temporary lighting, heating, and power are required for all the additional months and can be a large expense during the winter months.

For the revised schedule, most activities were not delayed rather their durations were extended over a longer period of time. The main exception to this schedule was the interior work. From January 2009 to November 2009, all interior work in the lodge was stopped. By the end of December 2008, a portion of the metal framing had been completed, and on January 1, 2009 the interior work was put on hold for 11 months. When it was stopped, some of the interior work had been completed, requiring heating and cooling during the shutdown period.

Proposed Schedule

See Appendix H for Proposed Schedule

I am proposing that instead of the revised schedule, where select activities were lengthened and interior work was put on hold, all activities be stopped for a period of approximately 10 months. Ten months instead of the full twelve months is chosen because certain activities should be completed prior to shutting down the site.

The shutdown of the site will occur between the shell and core completion dates for all the building areas and the start of the interior work. Interior metal framework will be included in the shell and core completion. The project shutdown will be for 43 weeks and occur between December 21, 2009 and October 18, 2010. The important dates of the proposed schedule can be seen below.

Important Dates			
	Complete Shell and Core	Start Finish Work	Complete Finish Work
Lodge	9/24/2009	10/29/2010	11/16/2011
Spa	9/1/2009	12/27/2010	11/10/2011
Main Building	12/18/2009	10/19/2010	11/30/2011

The main building core and shell is completed last because it has the most complicated façade and requires additional installation time. Due to the extensive interior work, the finish work for all three areas take approximately 12 months to complete.

The interior finishing start and finish dates were modified to allow for the overlap of same trades across building areas. This was done so a subcontractor could work straight through and not have week breaks between the main building work and the spa work. An example of this overlapping is shown below with the Hanging/Taping/Finish of the drywall.

Hang/Tape/Finish Drywall Dates		
	Start Date	Finish Date
Main Building	12/21/2010	3/15/2011
Spa	2/1/2011	2/21/2011
Lodge	2/14/2011	6/7/2011

This analysis was done for all the finish work from Layout to MEP Trimout.

The main difference between my proposed schedule and the revised schedule is that the revised schedule still maintains the full Turner Construction project team on site. By removing the project team, the salaries and the office general conditions are eliminated. The temporary power can be reduced by 90%, while the temporary lighting can be reduced by 80%. As for the temporary heating, 30% is needed for the months December to March to keep the interior temperature at 40 degrees, and 0% is needed for April to November. In a finished space, humidity and temperature are a huge factor. Mold can grow on drywall, carpets, and curtains if the humidity is not correct. I eliminate this problem by placing the break in the schedule before any of these sensitive materials are installed. This was one of the contributing factors to choosing the dates of the 10-month halt.

I consolidated related activities that were broken up across the revised schedule. The Ecostar Slate roof installation was originally scheduled for installation from August 30, 2010 to October 7, 2010 for the spa and from September 13, 2010 to November 5, 2010 for the main building. I moved it to immediately following the roof installation of spa and main building. This allows the roofing subcontractor to finish all his work instead of postponing approximately 30 work days.

Below is a summary of the general conditions saved during the 43 week break. See Appendix I for a detailed breakdown of the general conditions with the proposed schedule.

General Conditions Savings		
Description		Cost
Field Personnel		$ 423,765.00
General Expenses		$ 24,700.00
Temporary Utilities		$ 47,155.12
	Sub-Total	$ 495,620.12
	Location Factor	0.982
	Total	$ 486,698.96

Offsetting some of the savings are additional security expenditures. Security is needed on a full time basis to protect against theft and vandalism. A single security guard on two 12-hour shifts will be required. The total cost of security for 43 weeks is $234,354.30. See Appendix J for a detailed breakdown of security. This offsets approximately 48% of the overall general conditions savings.

Recommendation

The following chart summarizes the overall general conditions savings and additional cost.

Overall Savings		
General Conditions Savings		$ 486,698.96
Temporary Security Cost		$ 234,354.30
	Total Savings	$ 252,344.66

The overall savings from my proposal are approximately a quarter of a million dollars. On a project that was heavily value engineered before and during construction, this amount is significant and this timeline should be considered as an alternative to the revised schedule. The 10-month break allows the owner to consider any other value engineering topics without the time restrictions. Turner Construction also benefits from this because it allows them to rearrange manpower and place the current staff on other projects.

Analysis II: Guest Room Lighting Redesign

Introduction

As with most hotels and resorts, a large amount of energy is wasted because occupants leave the lights on when they are out of the room. The Salamander Resort and Spa has 168 guest rooms and the likelihood of everyone turning off unneeded lights is very low. When in the room, occupants also tend to use more light than is necessary, having multiple light fixtures on at once. With the introduction of compact fluorescent and LED lights in recent years, the ability to significantly reduce energy bills has increased. Specialized lighting control systems also increase efficiency and reduce cost.

The resort has 168 guest rooms in seven different layout types, king, ADA king, double queen, ADA double queen, junior suite, executive suite, and presidential suite. The breakdown of the room types is shown below.

	Number of Rooms				
Room Type	Ground Floor	1st Floor	2nd Floor	3rd Floor	Total
King	22	24	29	27	102
ADA King	1	1	1	1	4
Double Queen	12	13	8	8	41
ADA Double Queen	2	1	1	0	4
Junior Suite	3	3	3	3	12
Executive Suite	1	1	1	1	4
Presidential Suite	0	0	0	1	1
				Total	168

For this analysis, the room types are broken into two layouts, king/queen (151 rooms) and suites (17 rooms). The lighting layout of the junior suites is used for all the suites.

Current System

The current lighting system for The Salamander Resort and Spa is highly customized. Halogen lamps were chosen for their increased life expectancy and high output over normal incandescent lamps. The guest rooms are predominantly halogen downlights that utilize Par20 lamps. The ceiling and wall fixtures for the space are not specified but designed wattage is given. I will assume these fixtures use Par16 halogen lamps. The number of lamps needed is determined by the designed wattage. The lamp specifications for the Par20 and Par16 lamps can be seen below:

Par20 Halogen	
Approx. Lumens	570
Average Rated Life (hr)	2500
Beam Type	Flood
Beam Angle	25 deg.
Diameter (in)	2.5
Diameter (mm)	63.5
Filament	CC-8
Maximum Overall Length (in)	3.125
Maximum Overall Length (mm)	79.3
Nominal Voltage (V)	120
Nominal Wattage (W)	50
Price	$5.50

Par16 Halogen	
Approx. Lumens	450
Average Rated Life (hr)	2500
Beam Type	Flood
Beam Angle	
Diameter (in)	
Diameter (mm)	
Filament	
Maximum Overall Length (in)	
Maximum Overall Length (mm)	
Nominal Voltage (V)	120
Nominal Wattage (W)	45
Price	$7.95

It is important to note the lumens, average rated life, nominal wattage, and price for both lamps. The Par20 lamps produce 570 lumens while the Par16 puts out slightly less, 450 lumens. The average rated life is 2,500 hours which is typical of most halogen lamps. The dimensions of the Par16 lamp will be determined when the fixture is designed. The Par20 costs $5.50/lamp and the Par16 is $7.95/lamp. The price is for the lamp alone and does not include installation costs. The wattage for both lamps is around 50 watts. This value is similar to that of a comparable incandescent lamp.

The current fixture schedule is shown below for both the typical king/queen room and junior suite:

Typical Double Queen/King Guestroom (151 Rooms)							
Type	Description	Quantity of Fixtures	Per Lamp			Quantity of Lamps	Volt-Amps
			Voltage	Watts	Amps		
AM	Adj. Downlight	2	120	50	0.42	2	100
AN	Downlight	2	120	50	0.42	2	100
AP	Shower Rated Downlight	2	120	50	0.42	2	100
AR	Downlight	2	120	50	0.42	2	100
GD1	Decorative Wall Fixture	1	120	45	0.38	1	45
GD2	Decorative Ceiling Fixture	1	120	45	0.38	3	135
GD3	Decorative Wall Fixture	2	120	45	0.38	2	90
GD4	Decorative Ceiling Fixture	1	120	45	0.38	2	90
						Total/Room	760

There are a total of 8 downlight fixtures with one lamp in each. There are also 5 decorative ceiling and wall fixtures that combine for a total of 8 lamps. GD2 and GD4 have multiple lamps because the designed wattage is greater than the wattage of one lamp. Three lamps are put in the GD2 ceiling fixture and 2 in the GD4 ceiling fixture. The number of volt-amps was calculated for each fixture and then summed for the whole room. The total number of volt-amps for one king/queen room is 760 VA.

Typical Junior Suite (17 Rooms)							
Type	Description	Quantity of Fixtures	Per Lamp			Quantity of Lamps	Volt-Amps
			Voltage	Watts	Amps		
AM	Adj. Downlight	2	120	50	0.42	2	100
AN	Downlight	2	120	50	0.42	2	100
AP	Shower Rated Downlight	2	120	50	0.42	2	100
AR	Downlight	2	120	50	0.42	2	100
GD1	Decorative Wall Fixture	1	120	45	0.38	1	45
GD2	Decorative Ceiling Fixture	1	120	45	0.38	3	135
GD3	Decorative Wall Fixture	0	120	45	0.38	0	0
GD4	Decorative Ceiling Fixture	2	120	45	0.38	4	180
						Total/Room	760

The junior suite fixture schedule is similar to the king/queen rooms. The only difference is the number of decorative wall and ceiling fixtures. Despite this difference, the number of lamps is unchanged. When the volt-amps are summed across all lamps in the junior suite the room total is 760 VA.

For each room type the volt-amps are the same, 760 VA. This was applied to all the rooms in the lodge and converted to kW to get the total energy use.

kW for 151 Rooms
114.76

kW for 17 Suites
12.92

For all the king/queen rooms in the lodge the total energy use is 114.76kW, while the suites consume 12.92 kW. I will compare costs below.

Proposed System

The proposed system will replace all halogen lamps with LED's and install a control system that will turn off the guest room's lights when no one is present. The two manufacturers used are EarthLED for the lamps and Messerschmitt for the control.

LED lamps are chosen over compact fluorescent because CFL's contain mercury and must be treated as hazardous waste upon disposal. Modern LED lamps are able to replicate the light emitted by incandescent and halogen bulbs at a significantly lower wattage. This increased efficiency leads to direct energy cost savings. Other benefits of LED lamps include instant full brightness upon startup, no output of ultraviolet light, reduced maintenance cost due to long life, and less heat production. The main disadvantage of LED lamps is the relatively high bulb cost. This can deter many of potential buyers who are unfamiliar with the substantial energy savings.

Two different types of LED bulbs will be installed, both of which are manufactured by EarthLED. The lamps are direct replacement retrofits that do not require any addition equipment for installation. The lamp to be installed in the downlights is "EarthLED Lumiselect Par20/R20 Dimmable LED". The "EarthLED Lumiselect Par16/R16 Dimmable LED" will be installed in the decorative wall and ceiling fixtures. Lamp specifications can be seen below.

EarthLED LumiSelect PAR20/R20 Dimmable LED	
Approx. Lumens	450
Average Rated Life (hr)	50,000
Beam Type	Flood
Beam Angle	90
Diameter (in)	2.91
Diameter (mm)	74
Filament	
Maximum Overall Length (in)	4.01
Maximum Overall Length (mm)	102
Nominal Voltage (V)	120
Nominal Wattage (W)	9
Comparable Wattage (Incandescent)	50-60
Price	$90

EarthLED LumiSelect Par16/R16 Dimmable LED	
Approx. Lumens	300
Average Rated Life (hr)	50,000
Beam Type	
Beam Angle	90
Diameter (in)	2.36
Diameter (mm)	60
Filament	
Maximum Overall Length (in)	4.25
Maximum Overall Length (mm)	108
Nominal Voltage (V)	120
Nominal Wattage (W)	6
Comparable Wattage (Incandescent)	50
Price	$70

The three most important differences between the halogen and LED lamps are average rated life, nominal wattage, and price. The average LED lamp is rated for 50,000 hours, 20 times longer than the specified halogen lamp while using less than a fifth of the energy. The lumen output is slightly less than the halogen counterpart but EarthLED claims the usable light output is similar

to that of a 50 watt incandescent lamp. The LED's cost significantly more than the halogen lamps and the payback period will be analyzed later in this section. A factor that determines which lamp is chosen is the ability of dimming, as the original halogen lamps are dimmable.

One of the largest energy drains in the hospitality industry is hotel guests leaving lights and electronics on in the room when they are not present. In most hotel settings, guests are absent from their room for extended periods of time during the day. To combat this problem, this analysis is proposing the use of a stand-alone guest occupancy key card system. Upon entering the room, the guest places the hotel room key in a card reader. When the card is in the reader, electricity flows to all connected lights and electronics. When the guest leaves, they take the key card and all connected lights are turned off to save energy. This is similar to many hotel lighting control systems found in Asia. For this analysis, it is assumed that the guests are absent from their rooms between the hours of 10 am and 4 pm.

Cost Analysis – Electrical Breadth Analysis

Energy Cost

On initial inspection, it might seem that the initial cost of the LED lamps far outweighs the long term energy cost savings, but one has to remember that it is not only the energy savings from the lamp but also the lighting control system that keeps them on for about half the time of the halogens. The chart below shows the energy cost per year broken down by lamp type. The quantity of lamps, 1344, is the total number lamps of each type in the guest lodge at any one point. Calculating the energy use of the halogen lamps per kWh assumes that the lights will not be turned off during the unoccupied or occupied time frame. The proposed system with LED lamps will shut off during the unoccupied time frame, 10 am to 4 pm. The cost per kWh in Middleburg, Va is $0.10.

Current Energy Use (Halogen)										
Lamp	Quantity of Lamps	Watts /Lamp	Total Watts	Total kW	Unoccupied 10AM - 4PM	Occupied 7 hrs.	kWh /day	$ /kWh	$ /day	$/year
50PAR20H/FL25	1344	50	67200	67.2	403.2	470.4	873.6	0.10	87.36	31886.40
45PAR16/FL	1344	45	60480	60.5	362.9	423.4	786.2	0.10	78.62	28697.76

Proposed Energy Use (LED)										
Lamp	Quantity of Lamps	Watts /Lamp	Total Watts	Total kW	Unoccupied 10AM - 4PM	Occupied 7 hrs.	kWh /day	$ /kWh	$ /day	$/year
EarthLED LumiSelect PAR20/R20 Dimmable LED	1344	9	12096	12.1	0.0	84.7	84.7	0.10	8.47	3090.53
EarthLED LumiSelect Par16/R16 Dimmable LED	1344	6	8064	8.1	0.0	56.4	56.4	0.10	5.64	2060.35

Existing kWh/day	Existing $/year
1659.84	$ 60,584.16

Proposed kWh/day	Proposed $/year
141.12	$ 5,150.88

The annual savings on energy alone by installing the lighting control system and alternate lamps is over 55 thousand dollars. Before the recommendation can be made to implement this system, one has to look to factor in the bulb and maintenance costs.

Halogen Replacement Cost

With a 2,500 hour lamp life and 13 hours of use per day, one halogen lamp will last approximately 6.5 months. This comes out to 1.9 halogen lamps per year, per fixture. Maintenance costs come into play when replacing the bulbs. Assume 10 lamps can be replaced every hour and at $20/hr, the cost per lamp is an additional $2. The table below shows the cost per year to replace halogen lamps.

Halogen Replacement Cost				
Room Type	Lamp Type	Lifetime Lamp Hours	Hrs. in use/year (Fixture)	Lamps/year
Typ. King/Queen	50PAR20H/FL25	2500	4745	1.90
Typ. King/Queen	45PAR16/FL	2500	4745	1.90
Typ. Suite	50PAR20H/FL25	2500	4745	1.90
Typ. Suite	45PAR16/FL	2500	4745	1.90

Halogen Replacement Cost					
Room Type	$/Lamp + Install*	$/Year/Lamp	Lamps/Room	Rooms	$/Year Total
Typ. King/Queen	$ 7.50	$ 14.24	8	151	$ 17,195.88
Typ. King/Queen	$ 9.95	$ 18.89	8	151	$ 22,813.20
Typ. Suite	$ 7.50	$ 14.24	8	17	$ 1,935.96
Typ. Suite	$ 9.95	$ 18.89	8	17	$ 2,568.37

*Install Cost: 10 per hour at $20/hr = $2/lamp

Total Cost/year	$ 44,513.41

The total cost per year to replace the halogen bulbs comes out to slightly over 44 thousand dollars. This value includes the initial investment of purchased lamps.

Initial Investment

The next thing to consider is the initial investment of the proposed system. With a 50,000 hour lamp life and 7 hours of use per day, one LED lamp will last approximately 17 years. The following chart shows the cost to buy and install the LED lamps in all the guest rooms. Unlike the halogen replacement chart, this is a one-time initial cost calculation as the next time the lamps will need to be replaced is after 17 years.

Lamp Type	Lamps /Room	Rooms	Lamps	$/Lamp + Install	Cost ($)
EarthLED LumiSelect PAR20/R20 Dimmable LED	8	168	1344	$ 92.00	$ 123,648.00
EarthLED LumiSelect Par16/R16 Dimmable LED	8	168	1344	$ 72.00	$ 96,768.00

The key card system plus installation will be $100 per room, which totals to $16,800 for all the guest rooms.

Total Initial Proposed Cost
$ 237,216.00

Operating Cost

The total proposed lighting system including lamps, install, and control system cost comes out to a little over a quarter of a million dollars. The proposed initial and energy cost is more than the halogen annual replacement and energy cost. The final piece of information to look at is the payback period for the existing versus the proposed.

		Operating Costs/year	
	Initial Investment	Replacement Cost^	Energy cost
Existing	0*	$44,513.41	$60,584.16
Proposed	$237,216.00	0	$5,150.88

*included in annual replacement cost

^per year for 17 years

To calculate the payback period to recoup the initial investment of the new system one must add the replacement and energy cost of the existing system, subtract from that the energy cost of the proposed system and then divide that number into the proposed initial investment. The final payback period comes out to 2.37 years.

Recommendation

The initial investment of the proposed system is significantly higher than the current system, but with $55,000 annual savings in energy and $44,000 less per year in replacement costs, the system has a payback period of 2.37 years. Following the payback period, the annual savings is approximately $100,000 for the following 15 years, or until the LED lamps burn out. Replacing all the LED lamps costs $220,416.00, this is more than made up for in the 15 previous years of energy and replacement savings.

Analysis III: Water Management

Native Plants

The Salamander Resort and Spa employs an immense number of different trees, shrubs, vines, perennials and annuals. This is done to create a diverse and unique look around the building. One objective of this analysis is to create a similar look to the originally designed plants but replace them with native plant species. Using native plants has many benefits, the largest being that they are able to survive on natural rainfall and don't need an irrigation system to prosper. Native species are plants that are present in the region in which they have evolved. They are accustomed to the climate, rainfall, soil, frost, and interactions with other species. Native plants have developed a special set of characteristics that allow them to prosper in the current region without the use of fertilizers or pesticides. They also have the ability to match the quality and aesthetics of invasive and exotic plants while surpassing them in durability, resistance to insects, and disease.

One of the most important characteristics of native species in relation to this analysis is the ability to survive and prosper on the natural rainfall. I have chosen to just focus on replacing shrubs because they draw the most water in the areas where irrigation is placed. The vast majority of trees lie outside of the reach of the irrigation system because they are more tolerant of drought conditions. The perennials and annuals placed around the site provide the Resort with a very unique look that is hard to replicate. They also require the least amount of water on a per plant basis. One issue with performing a water savings analysis is that it is nearly impossible to quantify the actual savings.

According to the Virginia Department of Conservation and Recreation there are close to sixty different species of native shrubs in the state of Virginia. Below is a list of the proposed shrubs along with the native alternative.

Quantity	Proposed	Native Replacement
277	Fothergilla	Buttonbush
71	Cherry Laurel	Virginia Sweetspire
74	Otto Luyken Cherry Laurel	Henry Garnet's Sweetspire
64	San Jose Holly	Red Chokeberry
19	Korean Spice Viburnum	Arrowwood Viburnum
5	Shasta Doublefile Viburnum	Possumbaw Viburnum
91	Nandina	Inkberry
27	Vernal Witchhazel	Common Witchhazel

See Appendix K for a detailed Shrub Replacement Plan

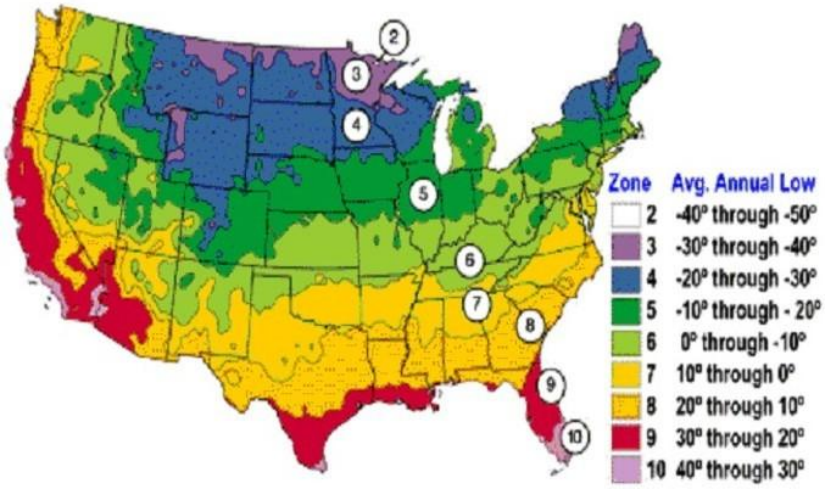
I focused the replacement process on the shrubs which appear at least 25 times as they provide the greatest water savings impact. Virginia and Henry Garnet's Sweetspire already appeared on site so I split the two species of Cherry Laurel between them. There is very little difference between the four species of Viburnums, so I replaced the least frequently occurring plants, Korean Spice and Shasta Doublefile, with the Arrowwood and Possumbaw.

Climate

Virginia has a humid and sub-tropical climate. Very hot and humid summers yet cool winters that often produce frost. There are four distinct seasons each year. During the summer months, short rain squalls are common, while the month of May receives the most precipitation. Annual average temperatures fall between 45 and 50 degrees Fahrenheit. The chart below shows the average monthly rainfall in Northern Virginia.

Average Rainfall in Northern Virginia (inches)												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Year
3.2	2.8	3.7	3.3	4.3	4.0	4.4	3.5	3.7	3.3	3.3	2.9	40.6

One of the factors in determining what kind of plant species will survive in a given area is the USDA Frost Zone map. This map classifies each zone, number 1-10, of the US based on minimum temperature and earliest and latest dates of possible frosting. This is called plant hardiness, and the plant hardiness for Middleburg, Virginia is Zone 6. Zone 6 plants have the ability to withstand temperature as low as -10 degrees F. The average date of the first frost is September 1 – September 30, while the average day of the last frost is between May 1 and May 30.



The lower the zone number, the higher the hardiness of the plant species. It is important to consider the optimal zone of each plant because it determines whether it will survive cold winters or hot summers. This is another reason why native plants should be considered in plantings because they are in the given zone and are able to survive the climate.

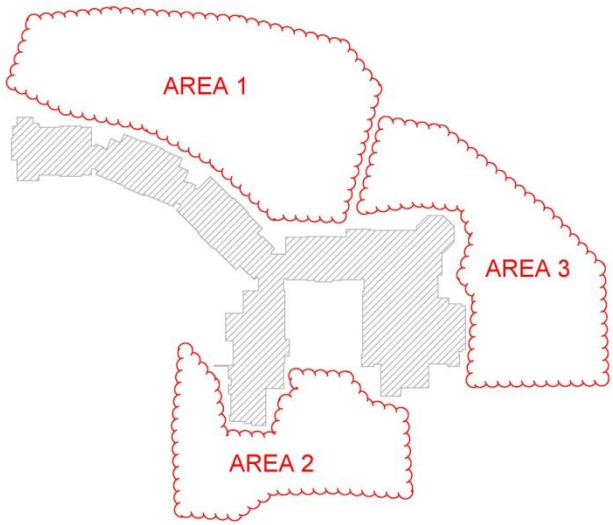
Current Irrigation System

The main supply for the currently proposed irrigation system comes from a pump located at an existing pond to the northwest of the building. The supply runs from that point, in a 3" PVC mainline, to several remote valves in each of the three areas. 1.5" to 3" PVC piping is used to distribute the water from the mainline to the irrigation fixtures. Immediately around the building, drip tubing is used for watering while the remaining portions have 4", 6" of 12" sprayhead fixtures. Quick couplers are attached to the main line that surrounds the culinary garden to allow for specialized hookups. A PVC sleeve is installed around the piping that goes underneath concrete walkways or driveways to prevent structural failure. A wireless rain sensor is located on the southeast side of the building to shut off the irrigation system if there has been enough rainfall.

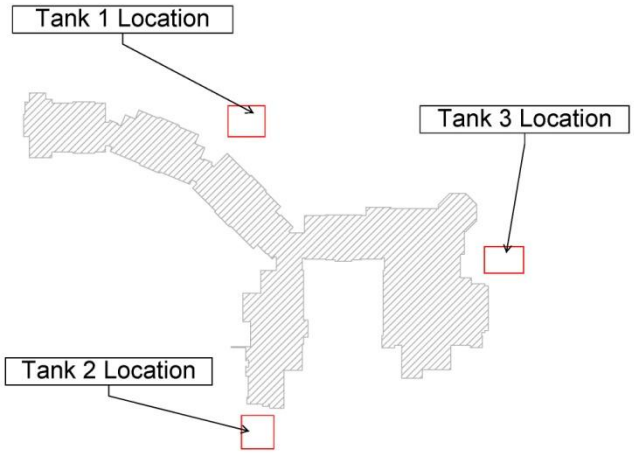
Proposed Irrigation System

See Appendix L for full specifications

The proposed rainwater collection system is manufactured by Snyder Industries. This project will utilize a series of below ground cistern tanks in either the 1200 or 1700 gallon size. The tanks will be placed in series with one another to obtain the capacity required in each of the three irrigation areas seen below.



They will be placed in non traffic areas to reduce the possibility to structural failure. This system will tap into the current piping and fixtures and replace the pond pumping station. The location of tanks can be seen here:



The tanks have a pump inside that will be used to bring the rainwater to the surface. From there, the tanks are positioned such that the irrigation can mainly be gravity-fed.

Rainwater Collection Potential

The use of rainwater is an economical alternative to public water and is ideal for irrigation systems. This system will also reduce the water extraction from the onsite pond that is currently being tapped for the irrigation. The preservation of this pond during the hot summer months will enhance the appeal of the surrounding area. Rainwater is very low in minerals so it is an excellent source of irrigation for sensitive plants and flowers. It is not regulated by the municipality so in a time of drought, when water restrictions are in place, the rainwater collected from earlier months can protect your investments in landscaping. By utilizing rainwater collections tanks, storm water runoff is reduced, thus eliminating the danger of soil erosion, water drain overflow, and water pollution.

Rainwater can be collected from almost any surface, but bare rooftops provide the easiest collection and the water usually contains the least amount of contaminants and chemicals. Not all the water that strikes a rooftop can be collected because a portion is lost to evaporation, blowing wind, leaks, and overflowing gutters. The collectable water that can be obtained after the loss factors can be summarized in the following equation:

Collectable rainwater (gallons) = .5 x rainfall (inches) x area (square feet)

The Salamander Resort and Spa has approximately 28,600 square feet of roof area, which when calculated along with an average of 42.4 inches of rain annually comes out to 606,320 gallons/year of potential rainwater collection. As shown in the later analysis, not all of the potential collection is necessary.

Along the east coast of the US, the rainfall is relatively evenly distributed throughout the year which makes for easy rainwater collection and distribution. This also helps in simplifying the sizing of the water tanks as there is no need to worry about over sizing to account for drier months.

Water Requirements – MEP Breadth Analysis

Determining water use for an irrigation system depends heavily on the proportion of native plants present. According to Snyder Industries, temperate-climate plants, like the ones found in Northern Virginia, need about 1-inch of rainfall per week to survive. The plants in the local region obtain between 3.0 and 3.5 inches of rainfall a month, which translates to between .75 and

.88 inches a week. For my calculations, I will assume .75 inches per week. The factor of .6 is used in the following equation to represent water use of temperate-climate plants.

Gallons/week needed = .6 x (square feet)

Irrigation area 1, located to the north of the lodge is the largest of the three irrigation zones. The total area is 28,000 ft^2. The proposed irrigation system will be designed as a supplement to natural rainfall.
The above equation is used to determine the overall water requirement for this area.

.6 x 28,000 ft^2 = 16,800 gal/wk needed

In order to accurately size the rainwater collection tanks, the amount of natural rainfall in the irrigation area has to be determined. This calculation is done using the .75 inches per week assumption.

.75 in/week = 108 in^3/ft^2 = .47 gal/ft^2
.47 x 28,000 ft^2 = 13,160 gal/wk natural rainfall

The difference between the needed and natural rainfall, gallons per week is the determining factor for sizing the collection tank.

16,800 – 13,160 = 3,640 gal/wk

These same calculations are repeated for the two other irrigation areas and the findings are summarized in the following table:

Area	Square Footage	Needed (gal/wk)	Natural (gal/wk)	Difference (gal/wk)
1	28,000	16,800	13,160	3,640
2	12,825	7,700	6,030	1,670
3	17,100	10,260	8,040	2,223

The gallons/week difference that is needed for the proposed irrigation system must be matched up with a roof area that will adequately supply the cistern tanks. See Appendix M for the assigned roof collection area. The following table summarizes the cistern sizing:

Area	Rainwater Needed	Roof Area (ft^2)	Rainwater Collected (gal/wk)	Tanks
1	3,640	9540	4220	(4) 1200 gal
2	1,670	4831	2130	(2) 1200 gal
3	2,223	8190	3620	(2)1700 gal

I conservatively sized the tanks to err on the high side in order to account for droughts and dry spells. Area 3, on the east side of the building, is sized extra large because the garden will need additional manual watering.

Constructability and Schedule Impact

With the introduction of more native plant species on the project, it lessens the impact of the schedule. Native species are more readily found at local nurseries than the more exotic types. There are dozens of nurseries within 50 miles of Middleburg, Virginia that would be able to supply all the necessary native plants for the project. The larger and more exotic plants that the project requires, the longer the lead time is needed to get them to the site. Care should be taken to find a nearby nursery that can accommodate the size and scope of The Salamander Resort and Spa. It will probably be necessary to find numerous suppliers to fill the large and diverse order.

The Virginia Department of Conservation and Recreation gives information about the purchasing and selection of native plants. Due to the seasonal availability of many plants, ordering all the required plants at once can be quite difficult. Contact with the nurseries will be necessary to adequately gauge the amount of lead time required. Because of this problem, it is difficult to determine the impact on the project schedule. If the correct research is done, the project schedule has the potential to decrease in length because of the decrease in shipping distance.

A total of 8 cistern tanks will be placed in three different locations on site. Each set of tanks will require a concrete pad for the base. This can be performed when the foundations for the building are being placed, and will add one day to the schedule. In order to prevent the tank from floating in the soil, they must be strapped down with hooks cast into the concrete pad. It can only be backfilled once the tanks have been strapped down. The tanks are to be installed per Snyder Industries instructions.

In order to accommodate the additional rainwater, the gutters around the roof collection area will be increased by 2 inches. The main downspout leading to the tanks will be upgraded to a 6-inch pipe. The gutters and downspouts outside of the roof collection area will not change in size.

The fixtures and piping will not be changed so there is not a schedule impact. In place of the pond pump station and piping there will be three hook-ups to the cistern rainwater collection tanks. These activities have off setting durations so the schedule is not impacted.

Cost Analysis

The most significant additional cost is the price of the Snyder collection tanks. A summary of these costs is seen below:

Tank Size	Quantity	Price/each	Cost
1200 Gallons	6	$2,900	$17,400
1700 Gallons	2	$3,600	$7,200
		Total	$24,600

The savings achieved from this proposal comes from the loss of the pond pump station, concrete pad, and subsequent piping to the irrigation system. The cost breakdown of the pump station is as follows:

Equipment	Price ($)
Pump, Goulds 3656/Motor 3600 RPM	$2,400
1 kVa Transformer	$320
Variable Frequency Drive, ACS550	$2,000
Exhasut Fan, 1320 CFM	$80
Pressure Transducer	$150
GB6 Electronic Controller, Tekleen	$1,000
Backwash Filter	$300
Total	$6,250

The additional cost of this proposal, relative to the existing plan is $18,350. This ignores some cost components in each system. For this rough estimate I am assuming the existing concrete pad, piping from the pump station to the system hookup cancel out the proposed cost of the cistern hookups, and concrete pads for the tanks. These costs would more or less cancel each other out and be relatively small in comparison to $18,350.

The on-site pond is located quite a distance away from the building and is significantly lower in elevation. This poses two problems, first is the distance that the water needs to be pumped and second, the amount of electricity the pump uses to get it up the hill to the irrigation system. With the water collection system in place, the water tanks will be located directly underneath the irrigation areas. This will reduce the overall distance the water needs to travel from the source to

the irrigation system. Each tank will have a small pump that will distribute the rainwater. These motors only need to pump the water 3 vertical feet which will cut down on the energy use.

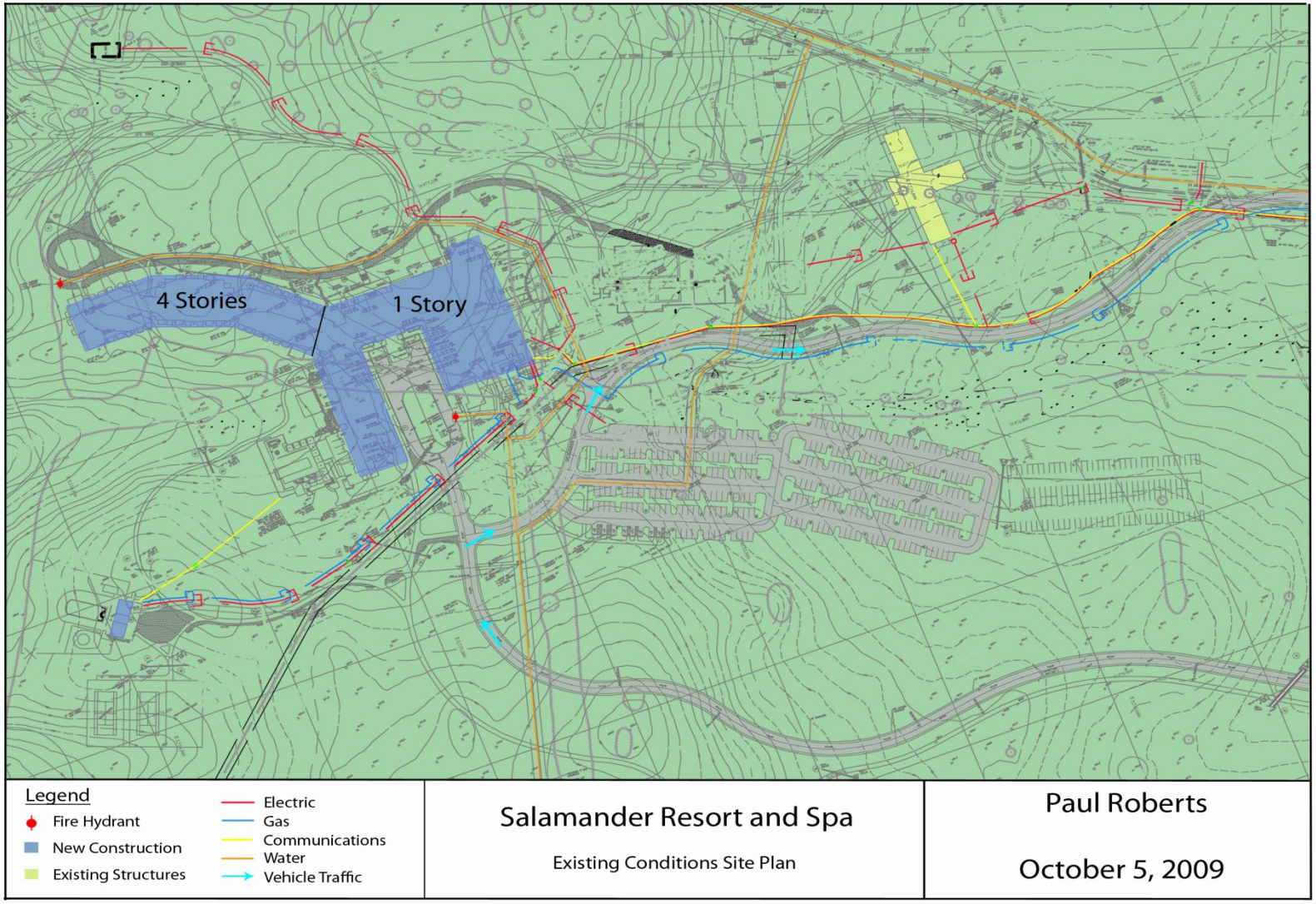
Conclusion and Recommendation

The use of native plants in landscaping can have a significant positive impact on water use without drastically changing the aesthetics. Native plants are accustomed to the climate and conditions of the location and are hardier and more likely to survive harsh conditions than that of non-native and exotic plants. It is important to note both the aesthetic characteristics and hardiness of a plant when replacing it with an alternative.

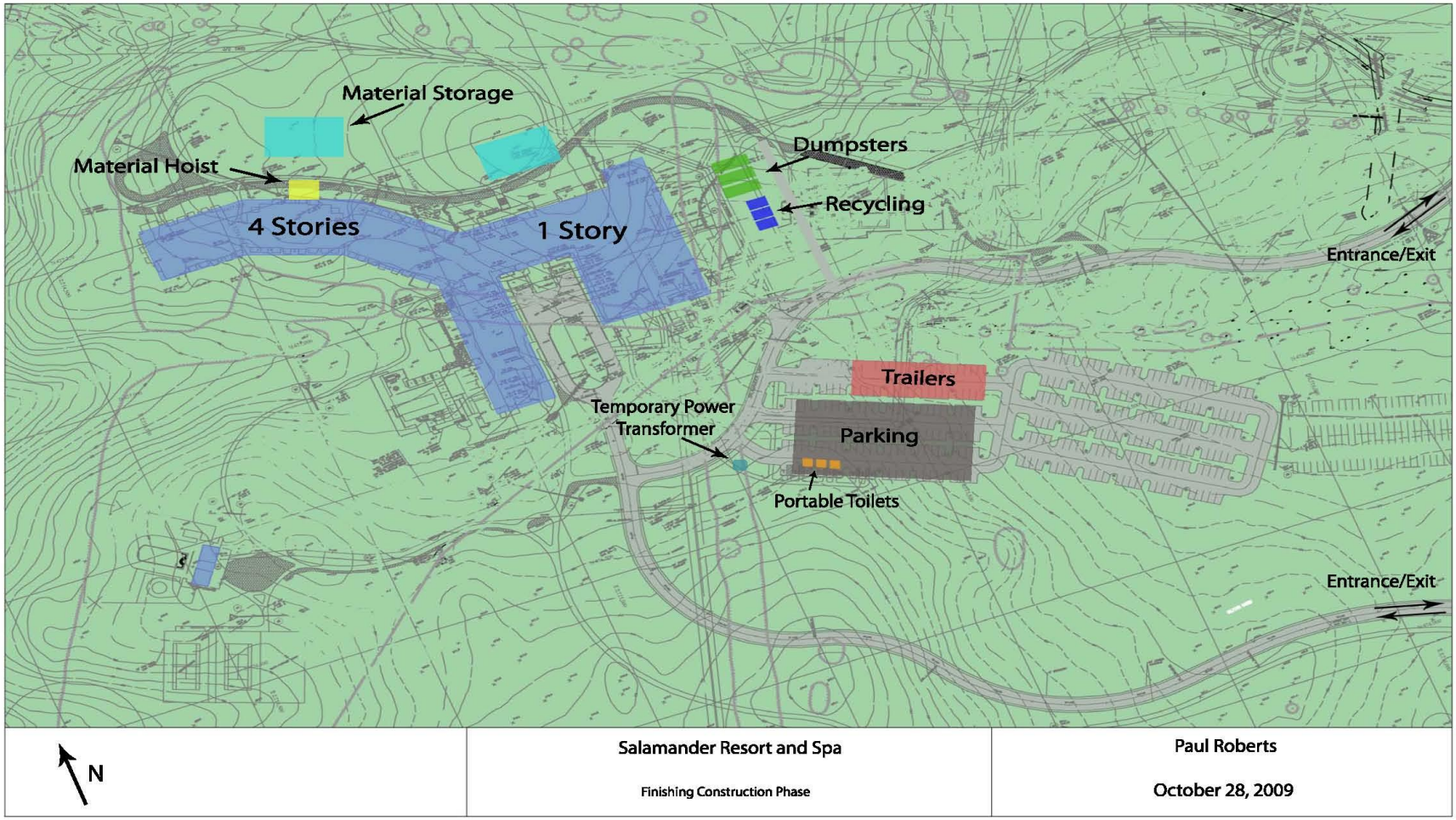
Some of the non-native species in the existing plan have close relatives that are native to the region. This made changing the plant species a trivial task and was confusing as to why the native plant was not specified in the first place. For the remaining non-native plants, focus was placed on the species that are used over 25 times.

The estimated additional cost of $18,350 is a relatively small cost for increased efficiency and sustainability. It is recommended that The Salamander Resort and Spa implement the proposed rainwater collection system and native plant redesign.

Appendix A: Site Plan of Existing Conditions



Appendix B: Site Layout Planning



Appendix C: D4 Cost Estimate

Tuesday, September 29, 2009

Statement of Probable Cost

Salamander Resort and Spa - Mar 2009 - VA - Arlington

Prepared By:	**Paul Roberts**	Prepared For:	**Paul Roberts**
,		,	
Fax:		Fax:	
Building Sq. Size:	**229213**	Site Sq. Size:	**66135**
Bid Date:		Building use:	**Hotel/Motel**
No. of floors:	**4**	Foundation:	**CON**
No. of buildings:	**1**	Exterior Walls:	**STU**
Project Height:		Interior Walls:	**GYP**
1st Floor Height:	**10.25**	Roof Type:	**SLA**
1st Floor Size:		Floor Type:	**WOD**
		Project Type:	**NEW**

Division		Percent	Sq. Cost	Amount
00	**Bidding Requirements**	**7.22**	**9.60**	**2,200,317**
	Bidding Requirements	7.22	9.60	2,200,317
01	**General Requirements**	**3.75**	**4.99**	**1,144,345**
	General Requirements	3.75	4.99	1,144,345
02	**Site Work**	**4.08**	**5.42**	**1,242,343**
	Site Work	4.08	5.42	1,242,343
03	**Concrete**	**21.00**	**27.92**	**6,400,073**
	Concrete	21.00	27.92	6,400,073
04	**Masonry**	**6.09**	**8.09**	**1,855,012**
	Masonry	6.09	8.09	1,855,012
05	**Metals**	**1.56**	**2.07**	**475,578**
	Metals	1.56	2.07	475,578
06	**Wood & Plastics**	**4.78**	**6.36**	**1,457,405**
	Wood & Plastics	4.78	6.36	1,457,405
07	**Thermal & Moisture Protection**	**1.91**	**2.54**	**581,897**
	Thermal & Moisture Protection	1.91	2.54	581,897
08	**Doors & Windows**	**6.39**	**8.50**	**1,947,182**
	Doors & Windows	6.39	8.50	1,947,182
09	**Finishes**	**11.38**	**15.13**	**3,467,559**
	Finishes	11.38	15.13	3,467,559
10	**Specialties**	**0.35**	**0.47**	**107,688**
	Specialties	0.35	0.47	107,688
11	**Equipment**	**0.09**	**0.12**	**26,443**
	Equipment	0.09	0.12	26,443
12	**Furnishings**	**0.05**	**0.06**	**13,973**
	Furnishings	0.05	0.06	13,973
13	**Special Construction**	**0.68**	**0.90**	**206,514**
	Special Construction	0.68	0.90	206,514
14	**Conveying Systems**	**2.49**	**3.31**	**758,084**
	Conveying Systems	2.49	3.31	758,084
15	**Mechanical**	**19.61**	**26.08**	**5,978,605**
	Mechanical	19.61	26.08	5,978,605
16	**Electrical**	**8.60**	**11.43**	**2,620,616**
	Electrical	8.60	11.43	2,620,616
Total Building Costs		**100.00**	**132.99**	**30,483,633**

Total Non-Building Costs	100.00	0.00	0
Total Project Costs	--	--	30.483.633

Appendix D: RS Means Reference Pages

COMMERCIAL/INDUSTRIAL/INSTITUTIONAL | **M.350** | **Hotel, 4-7 Story**

Costs per square foot of floor area

Exterior Wall	S.F. Area	35000	55000	75000	95000	115000	135000	155000	175000	195000
	L.F. Perimeter	314	401	497	555	639	722	754	783	850
Face Brick with Concrete Block Back-up	Steel Frame	182.95	173.80	169.95	166.40	164.80	163.70	161.70	160.15	159.60
	R/Conc. Frame	180.95	171.85	167.95	164.40	162.85	161.75	159.75	158.20	157.60
Glass and Metal Curtain Walls	Steel Frame	177.25	168.95	165.40	162.35	160.90	159.90	158.20	156.85	156.35
	R/Conc. Frame	175.50	167.25	163.70	160.60	159.15	158.10	156.50	155.15	154.60
Precast Concrete Panels	Steel Frame	189.05	178.55	174.15	170.00	168.15	166.90	164.55	162.80	162.10
	R/Conc. Frame	188.20	177.55	173.10	168.85	167.00	165.70	163.35	161.50	160.85
Perimeter Adj., Add or Deduct	Per 100 L.F.	9.50	6.05	4.40	3.50	2.85	2.45	2.15	1.95	1.75
Story Hgt. Adj., Add or Deduct	Per 1 Ft.	2.65	2.15	1.95	1.70	1.60	1.60	1.45	1.30	1.25
For Basement, add $32.30 per square foot of basement area										

The above costs were calculated using the basic specifications shown on the facing page. These costs should be adjusted where necessary for design alternatives and owner's requirements. Reported completed project costs, for this type of structure, range from $108.75 to $208.75 per S.F.

Common additives

Description	Unit	$ Cost
Bar, Front bar	L.F.	360
Back bar	L.F.	289
Booth, Upholstered, custom, straight	L.F.	202 - 375
"L" or "U" shaped	L.F.	210 - 355
Closed Circuit Surveillance, One station	Each	1850
Camera and monitor	Each	1000
For additional camera stations, add		
Directory Boards, Plastic, glass covered	Each	595
30" x 20"	Each	1450
36" x 48"	Each	600
Aluminum, 24" x 18"	Each	980
48" x 32"	Each	2025
48" x 60"		
Elevators, Electric passenger, 5 stops	Each	167,200
3500# capacity	Each	170,700
5000# capacity	Each	13,600
Additional stop, add		
Emergency Lighting, 25 watt, battery operated	Each	282
Lead battery	Each	805
Nickel cadmium		

Description	Unit	$ Cost
Laundry Equipment		
Folders, blankets & sheets, king size	Each	66,500
Ironers, 110" single roll	Each	35,500
Combination washer extractor 50#	Each	12,200
125#	Each	32,800
Sauna, Prefabricated, complete		
6' x 4'	Each	5850
6' x 6'	Each	6950
6' x 9'	Each	8525
8' x 8'	Each	10,100
10' x 12'	Each	14,000
Smoke Detectors		
Ceiling type	Each	187
Duct type	Each	480
Sound System		
Amplifier, 250 watts	Each	2350
Speaker, ceiling or wall	Each	191
Trumpet	Each	365
TV Antenna, Master system, 12 outlet	Outlet	315
30 outlet	Outlet	203
100 outlet	Outlet	194

Important: See the Reference Section for Location Factors

Location Factors

STATE/ZIP	CITY	Residential	Commercial
UTAH (CONT'd)			
845	Price	.70	.78
846-847	Provo	.80	.87
VERMONT			
050	White River Jct.	.76	.80
051	Bellows Falls	.78	.82
052	Bennington	.80	.83
053	Brattleboro	.80	.84
054	Burlington	.81	.86
056	Montpelier	.82	.84
057	Rutland	.81	.85
058	St. Johnsbury	.78	.80
059	Guildhall	.77	.79
VIRGINIA			
220-221	Fairfax	1.02	.93
222	Arlington	1.03	.93
223	Alexandria	1.07	.95
224-225	Fredericksburg	.94	.88
226	Winchester	.91	.86
227	Culpeper	.99	.88
228	Harrisonburg	.89	.86
229	Charlottesville	.90	.86
230-232	Richmond	.98	.88
233-235	Norfolk	1.00	.89
236	Newport News	.99	.88
237	Portsmouth	.92	.86
238	Petersburg	.96	.87
239	Farmville	.88	.81
240-241	Roanoke	.97	.85
242	Bristol	.85	.81
243	Pulaski	.83	.80
244	Staunton	.90	.84
245	Lynchburg	.95	.86
246	Grundy	.83	.80
WASHINGTON			
980-981,987	Seattle	1.02	1.04
982	Everett	1.04	1.02
983-984	Tacoma	1.02	1.03
985	Olympia	1.01	1.02
986	Vancouver	.97	1.01
988	Wenatchee	.92	.95
989	Yakima	.96	.98
990-992	Spokane	.99	.95
993	Richland	.97	.96
994	Clarkston	.96	.94
WEST VIRGINIA			
247-248	Bluefield	.88	.89
249	Lewisburg	.90	.92
250-253	Charleston	.95	.95
254	Martinsburg	.86	.90
255-257	Huntington	.96	.96
258-259	Beckley	.90	.93
260	Wheeling	.92	.96
261	Parkersburg	.91	.95
262	Buckhannon	.91	.95
263-264	Clarksburg	.91	.95
265	Morgantown	.92	.95
266	Gassaway	.91	.95
267	Romney	.89	.92
268	Petersburg	.91	.93
WISCONSIN			
530,532	Milwaukee	1.07	1.03
531	Kenosha	1.03	1.00
534	Racine	1.02	1.00
535	Beloit	.98	.97
537	Madison	.98	.98
538	Lancaster	.97	.94
539	Portage	.96	.95
540	New Richmond	.99	.95
541-543	Green Bay	1.00	.96
544	Wausau	.94	.92
545	Rhinelander	.94	.94
546	La Crosse	.94	.94
547	Eau Claire	.97	.95
548	Superior	.98	.96
549	Oshkosh	.94	.93
WYOMING			
820	Cheyenne	.82	.86
821	Yellowstone Nat. Pk.	.74	.81
822	Wheatland	.74	.82
823	Rawlins	.75	.83
824	Worland	.74	.81
825	Riverton	.73	.81
826	Casper	.76	.83
827	Newcastle	.74	.81
828	Sheridan	.79	.84
829-831	Rock Springs	.78	.83

STATE/ZIP	CITY	Residential	Commercial
CANADIAN FACTORS (reflect Canadian currency)			
ALBERTA			
	Calgary	1.14	1.14
	Edmonton	1.13	1.14
	Fort McMurray	1.14	1.13
	Lethbridge	1.11	1.09
	Lloydminster	1.06	1.05
	Medicine Hat	1.07	1.05
	Red Deer	1.07	1.05
BRITISH COLUMBIA			
	Kamloops	1.05	1.06
	Prince George	1.05	1.07
	Vancouver	1.06	1.11
	Victoria	.99	1.02
MANITOBA			
	Brandon	1.02	1.00
	Portage la Prairie	1.02	.99
	Winnipeg	1.02	1.04
NEW BRUNSWICK			
	Bathurst	.94	.95
	Dalhousie	.94	.95
	Fredericton	1.01	.98
	Moncton	.95	.96
	Newcastle	.94	.95
	St. John	1.01	.98
NEWFOUNDLAND			
	Corner Brook	.96	.98
	St. Johns	.98	.99
NORTHWEST TERRITORIES			
	Yellowknife	1.07	1.06
NOVA SCOTIA			
	Bridgewater	.97	.99
	Dartmouth	.98	1.00
	Halifax	1.00	1.02
	New Glasgow	.97	.99
	Sydney	.96	.97
	Truro	.97	.99
	Yarmouth	.97	.99
ONTARIO			
	Barrie	1.13	1.08
	Brantford	1.14	1.09
	Cornwall	1.14	1.08
	Hamilton	1.16	1.12
	Kingston	1.14	1.09
	Kitchener	1.09	1.05
	London	1.14	1.10
	North Bay	1.11	1.07
	Oshawa	1.13	1.08
	Ottawa	1.16	1.11
	Owen Sound	1.11	1.08
	Peterborough	1.12	1.08
	Sarnia	1.14	1.09
	Sault Ste Marie	1.07	1.04
	St. Catharines	1.10	1.05
	Sudbury	1.07	1.04
	Thunder Bay	1.12	1.05
	Timmins	1.11	1.07
	Toronto	1.17	1.14
	Windsor	1.11	1.05
PRINCE EDWARD ISLAND			
	Charlottetown	.92	.95
	Summerside	.92	.95
QUEBEC			
	Cap-de-la-Madeleine	1.13	1.04
	Charlesbourg	1.13	1.04
	Chicoutimi	1.16	1.05
	Gatineau	1.12	1.03

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Appendix E: Detailed Structural Systems Estimate

Concrete Columns:

Normal Weight Concrete, 3000 psi						
Location	Size	Quantity	Total CY	Unit Mat'l Cost	Material Cost	Total Cost
Area 1	18 x 18	9	7.50	$ 101.00	$ 757.48	$ 757.48
	24 x 24	40	59.26	$ 101.00	$ 5,985.02	$ 5,985.02
Area 2	18 x 18	22	18.33	$ 101.00	$ 1,851.61	$ 1,851.61
	24 x 24	31	45.92	$ 101.00	$ 4,638.39	$ 4,638.39
	24 x 72	2	8.89	$ 101.00	$ 897.75	$ 897.75
Area 3	12 x 12	6	2.22	$ 101.00	$ 224.44	$ 224.44
	12 x 16	2	0.99	$ 101.00	$ 99.75	$ 99.75
	18 x 18	21	17.50	$ 101.00	$ 1,767.45	$ 1,767.45
	18 x 36	5	8.33	$ 101.00	$ 841.64	$ 841.64
	24 x 24	7	10.37	$ 101.00	$ 1,047.38	$ 1,047.38
	26 x 26	5	8.69	$ 101.00	$ 878.01	$ 878.01
Area 4	10 x 30	4	3.09	$ 101.00	$ 311.72	$ 311.72
	12 x 12	11	4.07	$ 101.00	$ 411.47	$ 411.47
	12 x 24	8	5.93	$ 101.00	$ 598.50	$ 598.50
	16 x 24	2	1.98	$ 101.00	$ 199.50	$ 199.50
	16 x 28	73	84.11	$ 101.00	$ 8,495.40	$ 8,495.40
					Total	$29,005.51

Placing Concrete, pumped								
Location	Size	Quantity	Total CY	Unit Labor Cost	Labor Cost	Unit Equipment	Equipment Cost	Total Cost
Area 1	18 x 18	9	7.50	$ 24.00	$ 179.99	$ 8.80	$ 66.00	$ 245.99
	24 x 24	40	59.26	$ 23.50	$ 1,392.55	$ 8.60	$ 509.62	$ 1,902.17
Area 2	18 x 18	22	18.33	$ 24.00	$ 439.99	$ 8.80	$ 161.33	$ 601.32
	24 x 24	31	45.92	$ 23.50	$ 1,079.23	$ 8.60	$ 394.95	$ 1,474.18
	24 x 72	2	8.89	$ 15.50	$ 137.77	$ 5.65	$ 50.22	$ 187.99
Area 3	12 x 12	6	2.22	$ 36.00	$ 80.00	$ 13.15	$ 29.22	$ 109.22
	12 x 16	2	0.99	$ 24.00	$ 23.70	$ 8.80	$ 8.69	$ 32.39
	18 x 18	21	17.50	$ 24.00	$ 419.99	$ 8.80	$ 154.00	$ 573.98
	18 x 36	5	8.33	$ 15.50	$ 129.16	$ 5.65	$ 47.08	$ 176.25
	24 x 24	7	10.37	$ 23.50	$ 243.70	$ 8.60	$ 89.18	$ 332.88
	26 x 26	5	8.69	$ 15.50	$ 134.74	$ 5.65	$ 49.12	$ 183.86
Area 4	10 x 30	4	3.09	$ 23.50	$ 72.53	$ 8.60	$ 26.54	$ 99.07
	12 x 12	11	4.07	$ 36.00	$ 146.66	$ 13.15	$ 53.57	$ 200.24
	12 x 24	8	5.93	$ 23.50	$ 139.26	$ 8.60	$ 50.96	$ 190.22
	16 x 24	2	1.98	$ 23.50	$ 46.42	$ 8.60	$ 16.99	$ 63.41
	16 x 28	73	84.11	$ 15.50	$ 1,303.75	$ 5.65	$ 475.24	$ 1,778.99
							Total	$8,152.15

Forms in Place, plywood 2 use								
Location	Size	Quantity	SFCA	Unit Mat'l Cost	Material Cost	Unit Labor Cost	Labor Cost	Total Cost
Area 1	18 x 18	9	26.00	$ 1.37	$ 35.62	$ 5.60	$ 145.60	$ 181.22
	24 x 24	40	28.00	$ 1.37	$ 38.36	$ 5.60	$ 156.80	$ 195.16
Area 2	18 x 18	22	26.00	$ 1.37	$ 35.62	$ 5.60	$ 145.60	$ 181.22
	24 x 24	31	28.00	$ 1.37	$ 38.36	$ 5.60	$ 156.80	$ 195.16
	24 x 72	2	36.00	$ 1.03	$ 37.08	$ 6.28	$ 226.08	$ 263.16
Area 3	12 x 12	6	24.00	$ 1.25	$ 30.00	$ 5.75	$ 138.00	$ 168.00
	12 x 16	2	24.67	$ 1.19	$ 29.35	$ 5.65	$ 139.37	$ 168.72
	18 x 18	21	26.00	$ 1.37	$ 35.62	$ 5.60	$ 145.60	$ 181.22
	18 x 36	5	29.00	$ 1.03	$ 29.87	$ 6.28	$ 182.12	$ 211.99
	24 x 24	7	28.00	$ 1.37	$ 38.36	$ 5.60	$ 156.80	$ 195.16
	26 x 26	5	28.67	$ 1.03	$ 29.53	$ 6.28	$ 180.03	$ 209.55
Area 4	10 x 30	4	26.67	$ 1.03	$ 27.47	$ 6.28	$ 167.47	$ 194.93
	12 x 12	11	24.00	$ 1.25	$ 30.00	$ 5.75	$ 138.00	$ 168.00
	12 x 24	8	26.00	$ 1.37	$ 35.62	$ 5.60	$ 145.60	$ 181.22
	16 x 24	2	26.67	$ 1.37	$ 36.53	$ 5.60	$ 149.33	$ 185.87
	16 x 28	73	27.33	$ 1.03	$ 28.15	$ 6.28	$ 171.65	$ 199.81
							Total	$ 3,080.39

Concrete Slabs:

Normal Weight Concrete								
Location	Type of Slab	Area (SF)	Depth (in)	PSI	Total CY	Unit Mat'l Cost	Material Cost	Total Cost
Area 1	SOG	20500	5	3000	43.94	$ 101.00	$ 4,437.80	$ 4,437.80
Area 2	SOG	20400	5	3000	43.72	$ 101.00	$ 4,416.15	$ 4,416.15
Area 3	SOG	17100	5	3000	36.65	$ 101.00	$ 3,701.77	$ 3,701.77
Area 4.B	SOG	30000	5	3000	64.30	$ 104.00	$ 6,687.24	$ 6,687.24
Area 4.1	Elevated	30000	9	3500	208.33	$ 104.00	$ 21,666.64	$ 21,666.64
Area 4.2	Elevated	30000	9	3500	208.33	$ 104.00	$ 21,666.64	$ 21,666.64
Area 4.3	Elevated	30000	9	3500	208.33	$ 104.00	$ 21,666.64	$ 21,666.64
Area 4.P	Elevated	30000	10	3500	257.20	$ 104.00	$ 26,748.94	$ 26,748.94
							Total	$ 110,991.83

Placing, pumped								
Location	Type of Slab	Depth (in)	Total CY	Unit Labor Cost	Labor Cost	Unit Equipment	Equipment Cost	Total Cost
Area 1	SOG	5	43.94	16.7	733.77	$ 6.10	$ 268.03	$ 1,001.80
Area 2	SOG	5	43.72	16.7	730.19	$ 6.10	$ 266.72	$ 996.91
Area 3	SOG	5	36.65	16.7	612.08	$ 6.10	$ 223.57	$ 835.65
Area 4.B	SOG	5	64.30	16.7	1073.82	$ 6.10	$ 392.23	$ 1,466.05
Area 4.1	Elevated	9	208.33	13.55	2822.91	$ 4.94	$ 1,029.17	$ 3,852.08
Area 4.2	Elevated	9	208.33	13.55	2822.91	$ 4.94	$ 1,029.17	$ 3,852.08
Area 4.3	Elevated	9	208.33	13.55	2822.91	$ 4.94	$ 1,029.17	$ 3,852.08
Area 4.P	Elevated	10	257.20	13.55	3485.08	$ 4.94	$ 1,270.57	$ 4,755.65
							Total	$ 20,612.30

Forming									
Location	Type of Slab	SFCA	Depth (in)	L.F.	Unit Mat'l Cost	Material Cost	Unit Labor Cost	Labor Cost	Total Cost
Area 1	SOG	295.83	5	710.00	$ 0.46	$ 326.60	$ 3.03	$ 2,151.30	$ 2,477.90
Area 2	SOG	254.17	5	610.00	$ 0.46	$ 280.60	$ 3.03	$ 1,848.30	$ 2,128.90
Area 3	SOG	291.67	5	700.00	$ 0.46	$ 322.00	$ 3.03	$ 2,121.00	$ 2,443.00
Area 4.B	SOG	500.00	5	1200.00	$ 0.46	$ 552.00	$ 3.03	$ 3,636.00	$ 4,188.00
Area 4.1	Elevated	900.00	9	1200.00	$ 0.70	$ 840.00	$ 5.90	$ 7,080.00	$ 7,920.00
Area 4.2	Elevated	900.00	9	1200.00	$ 0.70	$ 840.00	$ 5.90	$ 7,080.00	$ 7,920.00
Area 4.3	Elevated	900.00	9	1200.00	$ 0.70	$ 840.00	$ 5.90	$ 7,080.00	$ 7,920.00
Area 4.P	Elevated	1000.00	10	1200.00	$ 0.70	$ 840.00	$ 5.90	$ 7,080.00	$ 7,920.00
								Total	$42,917.80

Footings

Normal Weight Concrete, 3000 psi							
Width (ft.)	Length (ft.)	Depth (in.)	Quantity	Total CY	Unit Mat'l Cost	Material Cost	Total Cost
4	4	12	4	2.37	$ 101.00	$ 239.41	$ 239.41
4.5	4.5	12	9	6.75	$ 101.00	$ 681.75	$ 681.75
5	5	12	8	7.41	$ 101.00	$ 748.15	$ 748.15
5.5	5.5	13	17	20.63	$ 101.00	$ 2,083.98	$ 2,083.98
6	6	14	42	65.33	$ 101.00	$ 6,598.66	$ 6,598.66
6.5	6.5	16	17	35.47	$ 101.00	$ 3,582.38	$ 3,582.38
7	7	17	24	61.70	$ 101.00	$ 6,232.07	$ 6,232.07
7.5	7.5	18	31	96.87	$ 101.00	$ 9,784.37	$ 9,784.37
8	8	19	10	37.53	$ 101.00	$ 3,790.61	$ 3,790.61
8.5	8.5	20	11	49.06	$ 101.00	$ 4,954.92	$ 4,954.92
9	9	21	2	10.50	$ 101.00	$ 1,060.50	$ 1,060.50
9.5	9.5	22	10	61.28	$ 101.00	$ 6,189.36	$ 6,189.36
10.5	10.5	25	12	102.08	$ 101.00	$10,310.41	$ 10,310.41
12	12	28	1	12.44	$ 101.00	$ 1,256.89	$ 1,256.89
12.5	12.6	28	12	163.33	$ 101.00	$16,496.65	$ 16,496.65
13	13	30	12	187.78	$ 101.00	$18,965.54	$ 18,965.54
14	14	31	10	187.53	$ 101.00	$18,940.60	$ 18,940.60
15	15	34	1	23.61	$ 101.00	$ 2,384.72	$ 2,384.72
9	12	19	2	12.67	$ 101.00	$ 1,279.33	$ 1,279.33
10	14	26	1	11.23	$ 101.00	$ 1,134.69	$ 1,134.69
10	15	24	3	33.33	$ 101.00	$ 3,366.66	$ 3,366.66
18.5	28	24	1	38.37	$ 101.00	$ 3,875.40	$ 3,875.40
5	8	16	1	1.98	$ 101.00	$ 199.51	$ 199.51
						Total	$124,156.54

Placing Concrete Footings, Pumped									
Width (ft.)	Length (ft.)	Depth (in.)	Quantity	Total CY	Unit Labor Cost	Labor Cost	Unit Equipment	Equipment Cost	Total Cost
4	4	12	4	2.37	$ 14.45	$ 34.25	$ 5.25	$ 12.44	$ 46.70
4.5	4.5	12	9	6.75	$ 14.45	$ 97.54	$ 5.25	$ 35.44	$ 132.97
5	5	12	8	7.41	$ 14.45	$ 107.04	$ 5.25	$ 38.89	$ 145.93
5.5	5.5	13	17	20.63	$ 14.45	$ 298.15	$ 5.25	$ 108.33	$ 406.48
6	6	14	42	65.33	$ 14.45	$ 944.07	$ 5.25	$ 343.00	$ 1,287.07
6.5	6.5	16	17	35.47	$ 14.45	$ 512.53	$ 5.25	$ 186.21	$ 698.74
7	7	17	24	61.70	$ 14.45	$ 891.62	$ 5.25	$ 323.94	$ 1,215.56
7.5	7.5	18	31	96.87	$ 14.45	$ 1,399.84	$ 5.25	$ 508.59	$ 1,908.44
8	8	19	10	37.53	$ 14.45	$ 542.32	$ 5.25	$ 197.04	$ 739.36
8.5	8.5	20	11	49.06	$ 14.45	$ 708.90	$ 5.25	$ 257.56	$ 966.45
9	9	21	2	10.50	$ 14.45	$ 151.72	$ 5.25	$ 55.12	$ 206.85
9.5	9.5	22	10	61.28	$ 14.45	$ 885.51	$ 5.25	$ 321.72	$ 1,207.23
10.5	10.5	25	12	102.08	$ 14.45	$ 1,475.10	$ 5.25	$ 535.94	$ 2,011.04
12	12	28	1	12.44	$ 14.45	$ 179.82	$ 5.25	$ 65.33	$ 245.16
12.5	12.6	28	12	163.33	$ 14.45	$ 2,360.16	$ 5.25	$ 857.50	$ 3,217.66
13	13	30	12	187.78	$ 14.45	$ 2,713.39	$ 5.25	$ 985.83	$ 3,699.22
14	14	31	10	187.53	$ 14.45	$ 2,709.82	$ 5.25	$ 984.54	$ 3,694.35
15	15	34	1	23.61	$ 14.45	$ 341.18	$ 5.25	$ 123.96	$ 465.14
9	12	19	2	12.67	$ 14.45	$ 183.03	$ 5.25	$ 66.50	$ 249.53
10	14	26	1	11.23	$ 14.45	$ 162.34	$ 5.25	$ 58.98	$ 221.32
10	15	24	3	33.33	$ 14.45	$ 481.67	$ 5.25	$ 175.00	$ 656.67
18.5	28	24	1	38.37	$ 14.45	$ 554.45	$ 5.25	$ 201.44	$ 755.90
5	8	16	1	1.98	$ 14.45	$ 28.54	$ 5.25	$ 10.37	$ 38.91
								Total	$24,216.67

Forms in Place, Plywood, 2 use									
Width (ft.)	Length (ft.)	Depth (in.)	Quantity	SFCA	Unit Mat'l Cost	Material Cost	Unit Labor Cost	Labor Cost	Total Cost
4	4	12	4	72.00	$ 4.10	$ 295.20	$ 2.75	$ 198.00	$ 493.20
4.5	4.5	12	9	180.00	$ 4.10	$ 738.00	$ 2.75	$ 495.00	$ 1,233.00
5	5	12	8	176.00	$ 4.10	$ 721.60	$ 2.75	$ 484.00	$ 1,205.60
5.5	5.5	13	17	410.83	$ 4.10	$ 1,684.42	$ 2.75	$1,129.79	$ 2,814.21
6	6	14	42	1106.00	$ 4.10	$ 4,534.60	$ 2.75	$3,041.50	$ 7,576.10
6.5	6.5	16	17	487.33	$ 4.10	$ 1,998.07	$ 2.75	$1,340.17	$ 3,338.23
7	7	17	24	740.00	$ 4.10	$ 3,034.00	$ 2.75	$2,035.00	$ 5,069.00
7.5	7.5	18	31	1023.00	$ 4.10	$ 4,194.30	$ 2.75	$2,813.25	$ 7,007.55
8	8	19	10	351.67	$ 4.10	$ 1,441.83	$ 2.75	$ 967.08	$ 2,408.92
8.5	8.5	20	11	410.67	$ 4.10	$ 1,683.73	$ 2.75	$1,129.33	$ 2,813.07
9	9	21	2	79.00	$ 4.10	$ 323.90	$ 2.75	$ 217.25	$ 541.15
9.5	9.5	22	10	416.67	$ 4.10	$ 1,708.33	$ 2.75	$1,145.83	$ 2,854.17
10.5	10.5	25	12	554.00	$ 4.10	$ 2,271.40	$ 2.75	$1,523.50	$ 3,794.90
12	12	28	1	52.67	$ 4.10	$ 215.93	$ 2.75	$ 144.83	$ 360.77
12.5	12.6	28	12	658.40	$ 4.10	$ 2,699.44	$ 2.75	$1,810.60	$ 4,510.04
13	13	30	12	684.00	$ 4.10	$ 2,804.40	$ 2.75	$1,881.00	$ 4,685.40
14	14	31	10	611.67	$ 4.10	$ 2,507.83	$ 2.75	$1,682.08	$ 4,189.92
15	15	34	1	65.67	$ 4.10	$ 269.23	$ 2.75	$ 180.58	$ 449.82
9	12	19	2	90.33	$ 4.10	$ 370.37	$ 2.75	$ 248.42	$ 618.78
10	14	26	1	52.33	$ 4.10	$ 214.57	$ 2.75	$ 143.92	$ 358.48
10	15	24	3	162.00	$ 4.10	$ 664.20	$ 2.75	$ 445.50	$ 1,109.70
18.5	28	24	1	97.00	$ 4.10	$ 397.70	$ 2.75	$ 266.75	$ 664.45
5	8	16	1	28.67	$ 4.10	$ 117.53	$ 2.75	$ 78.83	$ 196.37
								Total	$58,292.82

Concrete Beams:

Normal Weight Concrete 3000 psi							
Size	Length Range (ft.)	Avg. Length (ft.)	Quantity	Total CY	Unit Mat'l Cost	Material Cost	Total Cost
12 x 24							
	10 . 15	12.5	1	0.93	$ 101.00	$ 93.52	$ 93.52
16 x 24							
	5 . 10	7.5	1	0.74	$ 101.00	$ 74.81	$ 74.81
	10 . 15	12.5	2	2.47	$ 101.00	$ 249.38	$ 249.38
18 x 22							
	0 . 5	7.5	1	0.76	$ 101.00	$ 77.15	$ 77.15
18 x 32							
	10 . 15	12.5	1	1.85	$ 101.00	$ 187.04	$ 187.04
22 x 24							
	5 . 10	7.5	1	1.02	$ 101.00	$ 102.87	$ 102.87
24 x 24							
	0 . 5	7.5	2	2.22	$ 101.00	$ 224.44	$ 224.44
	5 . 10	7.5	2	2.22	$ 101.00	$ 224.44	$ 224.44
	10 . 15	12.5	2	3.70	$ 101.00	$ 374.07	$ 374.07
	15 . 20	17.5	3	7.78	$ 101.00	$ 785.55	$ 785.55
	20 . 25	22.5	10	33.33	$ 101.00	$3,366.66	$ 3,366.66
	25 . 30	27.5	5	20.37	$ 101.00	$2,057.41	$ 2,057.41
24 x 30							
	10 . 15	12.5	1	2.31	$ 101.00	$ 233.80	$ 233.80
	15 . 20	17.5	1	3.24	$ 101.00	$ 327.31	$ 327.31
	20 . 25	22.5	4	16.67	$ 101.00	$1,683.33	$ 1,683.33
	25 . 30	27.5	2	10.19	$ 101.00	$1,028.70	$ 1,028.70
24 x 32							
	10 . 15	12.5	1	2.47	$ 101.00	$ 249.38	$ 249.38
24 x 57							
	20 . 25	22.5	1	7.92	$ 101.00	$ 799.58	$ 799.58
	25 . 30	27.5	1	9.68	$ 101.00	$ 977.27	$ 977.27
12 x 18							
	5 . 10	7.5	4	1.67	$ 101.00	$ 168.33	$ 168.33
12 x 24							
	10 . 15	12.5	13	12.04	$ 101.00	$1,215.74	$ 1,215.74
	15 . 20	17.5	6	7.78	$ 101.00	$ 785.55	$ 785.55
	20 . 25	22.5	6	10.00	$ 101.00	$1,010.00	$ 1,010.00
12 x 36							
	10 . 15	12.5	4	5.56	$ 101.00	$ 561.11	$ 561.11
	15 . 20	17.5	2	3.89	$ 101.00	$ 392.78	$ 392.78
	15 . 20	17.5	2	3.89	$ 101.00	$ 392.78	$ 392.78
12 x 38							
	10 . 15	12.5	1	1.47	$ 101.00	$ 148.07	$ 148.07
Post-Tensioning Beams							
18 x 22							
		19	8	15.48	$ 101.00	$1,563.63	$ 1,563.63
		30	2	6.11	$ 101.00	$ 617.22	$ 617.22
		40	8	32.59	$ 101.00	$3,291.85	$ 3,291.85
		50	9	45.83	$ 101.00	$4,629.16	$ 4,629.16
18 x 25							
		50	1	5.79	$ 101.00	$ 584.49	$ 584.49
22 x 24							
		30	1	4.07	$ 101.00	$ 411.48	$ 411.48
		40	1	5.43	$ 101.00	$ 548.64	$ 548.64
22 x 32							
		19	2	6.88	$ 101.00	$ 694.95	$ 694.95
		40	2	14.49	$ 101.00	$1,463.04	$ 1,463.04
		50	1	9.05	$ 101.00	$ 914.40	$ 914.40
22 x 36							
		19	1	3.87	$ 101.00	$ 390.91	$ 390.91
		40	1	8.15	$ 101.00	$ 822.96	$ 822.96
		50	1	10.19	$ 101.00	$1,028.70	$ 1,028.70
24 x 36							
	10 . 15	12.5	1	2.78	$ 101.00	$ 280.56	$ 280.56
	20 . 25	22.5	2	10.00	$ 101.00	$1,010.00	$ 1,010.00
	25 . 30	27.5	2	12.22	$ 101.00	$1,234.44	$ 1,234.44
						Total	$36,043.09

Placing Concrete, Pumped									
Size	Length Range (ft.)	Avg. Length (ft.)	Quantity	Total CY	Unit Labor Cost	Labor Cost	Unit Equipment Cost	Equipment Cost	Total Cost
12 x 24									
	10 . 15	12.5	1	0.93	$36.00	$ 33.33	$ 13.15	$ 12.18	$ 45.51
16 x 24									
	5 . 10	7.5	1	0.74	$36.00	$ 26.67	$ 13.15	$ 9.74	$ 36.41
	10 . 15	12.5	2	2.47	$36.00	$ 88.89	$ 13.15	$ 32.47	$ 121.36
18 x 22									
	0 . 5	7.5	1	0.76	$36.00	$ 27.50	$ 13.15	$ 10.05	$ 37.55
18 x 32									
	10 . 15	12.5	1	1.85	$36.00	$ 66.67	$ 13.15	$ 24.35	$ 91.02
22 x 24									
	5 . 10	7.5	1	1.02	$36.00	$ 36.67	$ 13.15	$ 13.39	$ 50.06
24 x 24									
	0 . 5	7.5	2	2.22	$36.00	$ 80.00	$ 13.15	$ 29.22	$ 109.22
	5 . 10	7.5	2	2.22	$36.00	$ 80.00	$ 13.15	$ 29.22	$ 109.22
	10 . 15	12.5	2	3.70	$36.00	$ 133.33	$ 13.15	$ 48.70	$ 182.04
	15 . 20	17.5	3	7.78	$36.00	$ 280.00	$ 13.15	$ 102.28	$ 382.28
	20 . 25	22.5	10	33.33	$36.00	$1,200.00	$ 13.15	$ 438.33	$ 1,638.33
	25 . 30	27.5	5	20.37	$36.00	$ 733.33	$ 13.15	$ 267.87	$ 1,001.20
24 x 30									
	10 . 15	12.5	1	2.31	$36.00	$ 83.33	$ 13.15	$ 30.44	$ 113.77
	15 . 20	17.5	1	3.24	$36.00	$ 116.67	$ 13.15	$ 42.62	$ 159.28
	20 . 25	22.5	4	16.67	$36.00	$ 600.00	$ 13.15	$ 219.17	$ 819.17
	25 . 30	27.5	2	10.19	$36.00	$ 366.67	$ 13.15	$ 133.94	$ 500.60
24 x 32									
	10 . 15	12.5	1	2.47	$36.00	$ 88.89	$ 13.15	$ 32.47	$ 121.36
24 x 57									
	20 . 25	22.5	1	7.92	$36.00	$ 285.00	$ 13.15	$ 104.10	$ 389.10
	25 . 30	27.5	1	9.68	$36.00	$ 348.33	$ 13.15	$ 127.24	$ 475.57
12 x 18									
	5 . 10	7.5	4	1.67	$36.00	$ 60.00	$ 13.15	$ 21.92	$ 81.92
12 x 24									
	10 . 15	12.5	13	12.04	$36.00	$ 433.33	$ 13.15	$ 158.29	$ 591.62
	15 . 20	17.5	6	7.78	$36.00	$ 280.00	$ 13.15	$ 102.28	$ 382.28
	20 . 25	22.5	6	10.00	$36.00	$ 360.00	$ 13.15	$ 131.50	$ 491.50
12 x 36									
	10 . 15	12.5	4	5.56	$36.00	$ 200.00	$ 13.15	$ 73.06	$ 273.06
	15 . 20	17.5	2	3.89	$36.00	$ 140.00	$ 13.15	$ 51.14	$ 191.14
	15 . 20	17.5	2	3.89	$36.00	$ 140.00	$ 13.15	$ 51.14	$ 191.14
12 x 38									
	10 . 15	12.5	1	1.47	$36.00	$ 52.78	$ 13.15	$ 19.28	$ 72.06
Post-Tensioning Beams									
18 x 22									
		19	8	15.48	$36.00	$ 557.33	$ 13.15	$ 203.58	$ 760.91
		30	2	6.11	$36.00	$ 220.00	$ 13.15	$ 80.36	$ 300.36
		40	8	32.59	$36.00	$1,173.33	$ 13.15	$ 428.59	$ 1,601.92
		50	9	45.83	$36.00	$1,650.00	$ 13.15	$ 602.71	$ 2,252.71
18 x 25									
		50	1	5.79	$36.00	$ 208.33	$ 13.15	$ 76.10	$ 284.43
22 x 24									
		30	1	4.07	$36.00	$ 146.67	$ 13.15	$ 53.57	$ 200.24
		40	1	5.43	$36.00	$ 195.56	$ 13.15	$ 71.43	$ 266.99
22 x 32									
		19	2	6.88	$36.00	$ 247.70	$ 13.15	$ 90.48	$ 338.18
		40	2	14.49	$36.00	$ 521.48	$ 13.15	$ 190.49	$ 711.97
		50	1	9.05	$36.00	$ 325.93	$ 13.15	$ 119.05	$ 444.98
22 x 36									
		19	1	3.87	$36.00	$ 139.33	$ 13.15	$ 50.90	$ 190.23
		40	1	8.15	$36.00	$ 293.33	$ 13.15	$ 107.15	$ 400.48
		50	1	10.19	$36.00	$ 366.67	$ 13.15	$ 133.94	$ 500.60
24 x 36									
	10 . 15	12.5	1	2.78	$36.00	$ 100.00	$ 13.15	$ 36.53	$ 136.53
	20 . 25	22.5	2	10.00	$36.00	$ 360.00	$ 13.15	$ 131.50	$ 491.50
	25 . 30	27.5	2	12.22	$36.00	$ 440.00	$ 13.15	$ 160.72	$ 600.72
								Total	$ 18,140.50

Forms in Place, Plywood, 2 use									
Size	Length Range (ft.)	Avg. Length (ft.)	Quantity	SFCA	Unit Mat'l Cost	Material Cost	Unit Labor Cost	Labor Cost	Total Cost
12 x 24									
	10 . 15	12.5	1	31.00	$ 1.57	$ 48.67	$ 5.10	$158.10	$ 206.77
16 x 24									
	5 . 10	7.5	1	21.67	$ 1.57	$ 34.02	$ 5.10	$110.50	$ 144.52
	10 . 15	12.5	2	31.67	$ 1.57	$ 49.72	$ 5.10	$161.50	$ 211.22
18 x 22									
	0 . 5	7.5	1	21.67	$ 1.57	$ 34.02	$ 5.10	$110.50	$ 144.52
18 x 32									
	10 . 15	12.5	1	33.33	$ 1.57	$ 52.33	$ 5.10	$170.00	$ 222.33
22 x 24									
	5 . 10	7.5	1	22.67	$ 1.57	$ 35.59	$ 5.10	$115.60	$ 151.19
24 x 24									
	0 . 5	7.5	2	23.00	$ 1.57	$ 36.11	$ 5.10	$117.30	$ 153.41
	5 . 10	7.5	2	23.00	$ 1.57	$ 36.11	$ 5.10	$117.30	$ 153.41
	10 . 15	12.5	2	33.00	$ 1.57	$ 51.81	$ 5.10	$168.30	$ 220.11
	15 . 20	17.5	3	43.00	$ 1.57	$ 67.51	$ 5.10	$219.30	$ 286.81
	20 . 25	22.5	10	53.00	$ 1.57	$ 83.21	$ 5.10	$270.30	$ 353.51
	25 . 30	27.5	5	63.00	$ 1.57	$ 98.91	$ 5.10	$321.30	$ 420.21
24 x 30									
	10 . 15	12.5	1	34.00	$ 1.57	$ 53.38	$ 5.10	$173.40	$ 226.78
	15 . 20	17.5	1	44.00	$ 1.57	$ 69.08	$ 5.10	$224.40	$ 293.48
	20 . 25	22.5	4	54.00	$ 1.57	$ 84.78	$ 5.10	$275.40	$ 360.18
	25 . 30	27.5	2	64.00	$ 1.57	$ 100.48	$ 5.10	$326.40	$ 426.88
24 x 32									
	10 . 15	12.5	1	34.33	$ 1.57	$ 53.90	$ 5.10	$175.10	$ 229.00
24 x 57									
	20 . 25	22.5	1	58.50	$ 1.57	$ 91.85	$ 5.10	$298.35	$ 390.20
	25 . 30	27.5	1	68.50	$ 1.57	$ 107.55	$ 5.10	$349.35	$ 456.90
12 x 18									
	5 . 10	7.5	4	20.00	$ 1.57	$ 31.40	$ 5.10	$102.00	$ 133.40
12 x 24									
	10 . 15	12.5	13	31.00	$ 1.57	$ 48.67	$ 5.10	$158.10	$ 206.77
	15 . 20	17.5	6	41.00	$ 1.57	$ 64.37	$ 5.10	$209.10	$ 273.47
	20 . 25	22.5	6	51.00	$ 1.57	$ 80.07	$ 5.10	$260.10	$ 340.17
12 x 36									
	10 . 15	12.5	4	33.00	$ 1.57	$ 51.81	$ 5.10	$168.30	$ 220.11
	15 . 20	17.5	2	43.00	$ 1.57	$ 67.51	$ 5.10	$219.30	$ 286.81
	15 . 20	17.5	2	43.00	$ 1.57	$ 67.51	$ 5.10	$219.30	$ 286.81
12 x 38									
	10 . 15	12.5	1	33.33	$ 1.57	$ 52.33	$ 5.10	$170.00	$ 222.33
Post-Tensioning Beams									
18 x 22									
		19	8	44.67	$ 1.57	$ 70.13	$ 5.10	$227.80	$ 297.93
		30	2	66.67	$ 1.57	$ 104.67	$ 5.10	$340.00	$ 444.67
		40	8	86.67	$ 1.57	$ 136.07	$ 5.10	$442.00	$ 578.07
		50	9	106.67	$ 1.57	$ 167.47	$ 5.10	$544.00	$ 711.47
18 x 25									
		50	1	6.67	$ 1.57	$ 10.47	$ 5.10	$ 34.00	$ 44.47
22 x 24									
		30	1	67.67	$ 1.57	$ 106.24	$ 5.10	$345.10	$ 451.34
		40	1	87.67	$ 1.57	$ 137.64	$ 5.10	$447.10	$ 584.74
22 x 32									
		19	2	47.00	$ 1.57	$ 73.79	$ 5.10	$239.70	$ 313.49
		40	2	89.00	$ 1.57	$ 139.73	$ 5.10	$453.90	$ 593.63
		50	1	109.00	$ 1.57	$ 171.13	$ 5.10	$555.90	$ 727.03
22 x 36									
		19	1	47.67	$ 1.57	$ 74.84	$ 5.10	$243.10	$ 317.94
		40	1	89.67	$ 1.57	$ 140.78	$ 5.10	$457.30	$ 598.08
		50	1	109.67	$ 1.57	$ 172.18	$ 5.10	$559.30	$ 731.48
24 x 36									
	10 . 15	12.5	1	35.00	$ 1.57	$ 54.95	$ 5.10	$178.50	$ 233.45
	20 . 25	22.5	2	55.00	$ 1.57	$ 86.35	$ 5.10	$280.50	$ 366.85
	25 . 30	27.5	2	65.00	$ 1.57	$ 102.05	$ 5.10	$331.50	$ 433.55
								Total	$ 14,449.44

Structural Steel:

Size	Length Range	Avg. Length	Quantity	L.F.	Unit Mat'l Cost	Material Cost	Unit Labor Cost	Labor Cost	Unit Equipment Cost	Equipment Cost	Total Cost
C 8 x 12											
	10 . 15	12.5	173	2163	$ 10.35	$ 22,381.88	$ 30.50	$ 65,956.25	$ 3.73	$ 8,066.13	$ 96,404.25
	15 . 20	17.5	12	210	$ 10.35	$ 2,173.50	$ 30.50	$ 6,405.00	$ 3.73	$ 783.30	$ 9,361.80
W 8 x 10											
	10 . 15	12.5	75	937.5	$ 16.50	$ 15,468.75	$ 4.06	$ 3,806.25	$ 2.90	$ 2,718.75	$ 21,993.75
	15 . 20	17.5	48	840	$ 16.50	$ 13,860.00	$ 4.06	$ 3,410.40	$ 2.90	$ 2,436.00	$ 19,706.40
W 8 x 21											
	15 . 20	17.5	10	175	$ 34.50	$ 6,037.50	$ 4.06	$ 710.50	$ 2.90	$ 507.50	$ 7,255.50
W 10 x 12											
	5 . 10	7.5	25	187.5	$ 19.80	$ 3,712.50	$ 4.06	$ 761.25	$ 2.90	$ 543.75	$ 5,017.50
	10 . 15	12.5	14	175	$ 19.80	$ 3,465.00	$ 4.06	$ 710.50	$ 2.90	$ 507.50	$ 4,683.00
	20 . 25	22.5	31	697.5	$ 19.80	$ 13,810.50	$ 4.06	$ 2,831.85	$ 2.90	$ 2,022.75	$ 18,665.10
W 10 x 15											
	15 . 20	17.5	4	70	$ 25.00	$ 1,750.00	$ 4.06	$ 284.20	$ 2.90	$ 203.00	$ 2,237.20
W 10 x 19											
	15 . 20	17.5	4	70	$ 36.50	$ 2,555.00	$ 4.06	$ 284.20	$ 2.90	$ 203.00	$ 3,042.20
W 12 x 16											
	10 . 15	12.5	23	287.5	$ 26.50	$ 7,618.75	$ 2.77	$ 796.38	$ 1.98	$ 569.25	$ 8,984.38
	15 . 20	17.5	14	245	$ 26.50	$ 6,492.50	$ 2.77	$ 678.65	$ 1.98	$ 485.10	$ 7,656.25
	25 . 30	27.5	4	110	$ 26.50	$ 2,915.00	$ 2.77	$ 304.70	$ 1.98	$ 217.80	$ 3,437.50
W 12 x 19											
	5 . 10	7.5	17	127.5	$ 36.50	$ 4,653.75	$ 2.77	$ 353.18	$ 1.98	$ 252.45	$ 5,259.38
	15 . 20	17.5	11	192.5	$ 36.50	$ 7,026.25	$ 2.77	$ 533.23	$ 1.98	$ 381.15	$ 7,940.63
	20 . 25	22.5	24	540	$ 36.50	$ 19,710.00	$ 2.77	$ 1,495.80	$ 1.98	$ 1,069.20	$ 22,275.00
W 14 x 22											
	15 . 20	17.5	24	420	$ 43.00	$ 18,060.00	$ 2.46	$ 1,033.20	$ 1.76	$ 739.20	$ 19,832.40
	20 . 25	22.5	30	675	$ 43.00	$ 29,025.00	$ 2.46	$ 1,660.50	$ 1.76	$ 1,188.00	$ 31,873.50
W 14 x 26											
	10 . 15	12.5	24	300	$ 43.00	$ 12,900.00	$ 2.46	$ 738.00	$ 1.76	$ 528.00	$ 14,166.00
	25 . 30	27.5	10	275	$ 43.00	$ 11,825.00	$ 2.46	$ 676.50	$ 1.76	$ 484.00	$ 12,985.50
W 14 x 35											
	10 . 15	12.5	5	62.5	$ 56.00	$ 3,500.00	$ 3.01	$ 188.13	$ 2.15	$ 134.38	$ 3,822.50
	30 . 35	32.5	4	130	$ 56.00	$ 7,280.00	$ 3.01	$ 391.30	$ 2.15	$ 279.50	$ 7,950.80
W 16 x 26											
	20 . 25	22.5	17	382.5	$ 43.00	$ 16,447.50	$ 2.44	$ 933.30	$ 1.74	$ 665.55	$ 18,046.35
	25 . 30	27.5	6	165	$ 43.00	$ 7,095.00	$ 2.44	$ 402.60	$ 1.74	$ 287.10	$ 7,784.70
W 16 x 31											
	20 . 25	22.5	26	585	$ 51.00	$ 29,835.00	$ 2.71	$ 1,585.35	$ 1.93	$ 1,129.05	$ 32,549.40
	30 . 35	32.5	14	455	$ 51.00	$ 23,205.00	$ 2.71	$ 1,233.05	$ 1.93	$ 878.15	$ 25,316.20
W 16 x 40											
	25 . 30	27.5	2	55	$ 66.00	$ 3,630.00	$ 3.05	$ 167.75	$ 2.18	$ 119.90	$ 3,917.65
W 16 x 57											
	10 . 15	12.5	7	87.5	$ 82.50	$ 7,218.75	$ 3.05	$ 266.88	$ 2.18	$ 190.75	$ 7,676.38
	30 . 35	32.5	5	162.5	$ 82.50	$ 13,406.25	$ 3.05	$ 495.63	$ 2.18	$ 354.25	$ 14,256.13
W 18 x 13											
	10 . 15	12.5	3	37.5	$ 58.00	$ 2,175.00	$ 3.67	$ 137.63	$ 1.95	$ 73.13	$ 2,385.75
	25 . 30	27.5	1	27.5	$ 58.00	$ 1,595.00	$ 3.67	$ 100.93	$ 1.95	$ 53.63	$ 1,749.55
W 18 x 35											
	25 . 30	27.5	12	330	$ 58.00	$ 19,140.00	$ 3.67	$ 1,211.10	$ 1.95	$ 643.50	$ 20,994.60
	30 . 35	32.5	6	195	$ 58.00	$ 11,310.00	$ 3.67	$ 715.65	$ 1.95	$ 380.25	$ 12,405.90
W 18 x 55											
	20 . 25	22.5	3	67.5	$ 91.00	$ 6,142.50	$ 3.87	$ 261.23	$ 2.06	$ 139.05	$ 6,542.78
	25 . 30	27.5	4	110	$ 91.00	$ 10,010.00	$ 3.87	$ 425.70	$ 2.06	$ 226.60	$ 10,662.30
	30 . 35	32.5	5	162.5	$ 91.00	$ 14,787.50	$ 3.87	$ 628.88	$ 2.06	$ 334.75	$ 15,751.13
W 20 x 26											
	25 . 30	27.5	6	165	$ 72.50	$ 11,962.50	$ 3.32	$ 547.80	$ 1.76	$ 290.40	$ 12,800.70
W 21 x 50											
	20 . 25	22.5	4	90	$ 82.50	$ 7,425.00	$ 3.32	$ 298.80	$ 1.76	$ 158.40	$ 7,882.20
	30 . 35	32.5	2	65	$ 82.50	$ 5,362.50	$ 3.32	$ 215.80	$ 1.76	$ 114.40	$ 5,692.70
W 21 x 68											
	30 . 35	32.5	1	32.5	$ 112.00	$ 3,640.00	$ 3.41	$ 110.83	$ 1.81	$ 58.83	$ 3,809.65
W 24 x 55											
	20 . 25	22.5	5	112.5	$ 91.00	$ 10,237.50	$ 3.18	$ 357.75	$ 1.69	$ 190.13	$ 10,785.38
	25 . 30	27.5	2	55	$ 91.00	$ 5,005.00	$ 3.18	$ 174.90	$ 1.69	$ 92.95	$ 5,272.85
W 24 x 84											
	15 . 20	17.5	1	17.5	$ 139.00	$ 2,432.50	$ 3.27	$ 57.23	$ 1.74	$ 30.45	$ 2,520.18
W 27 x 84											
	20 . 25	22.5	10	225	$ 139.00	$ 31,275.00	$ 2.96	$ 666.00	$ 1.58	$ 355.50	$ 32,296.50
										Total	$ 595,649.48

Size	Length (ft.)	Quantity	L.F.	Unit Mat'l Cost	Material Cost	Unit Labor Cost	Labor Cost	Unit Equipment	Equipment Cost	Total Cost
HSS 6 x 6 x 3/8										
	23	16	368	$ 880.00	$14,080.00	$ 49.00	$ 784.00	$ 35.00	$ 560.00	$15,424.00
	15	40	600	$ 880.00	$35,200.00	$ 49.00	$1,960.00	$ 35.00	$1,400.00	$38,560.00
	13	24	312	$ 880.00	$21,120.00	$ 49.00	$1,176.00	$ 35.00	$ 840.00	$23,136.00
									Total	$77,120.00

Reinforcing:

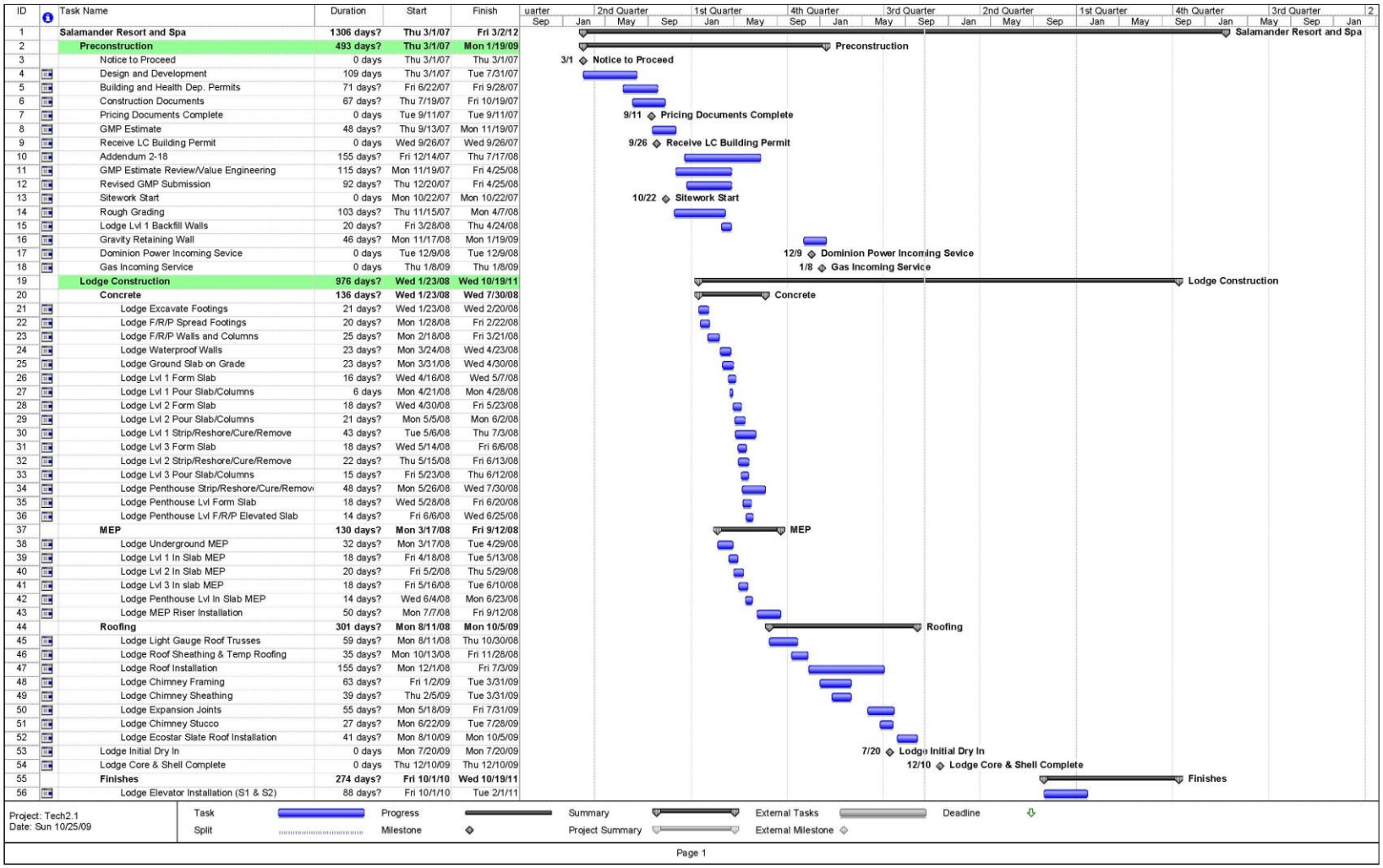
Rebar in Concrete					
Location	Rebar	L.F.	Unit Mat'l Cost	Material Cost	Total
Footing	6 #6	8670	$ 1.35	$11,704.50	$ 11,704.50
Slab on Grade	#4 @ 12" O.C.	140400	$ 0.70	$98,280.00	$ 98,280.00
Elevated Slab	#4 @ 24" O.C.	69000	$ 0.70	$48,300.00	$ 48,300.00
Concrete Column	8 #10	15000	$ 3.45	$51,750.00	$ 51,750.00
Concrete Beam	6 #7	17000	$ 1.70	$28,900.00	$ 28,900.00
				Total	$238,934.50

Appendix F: General Conditions

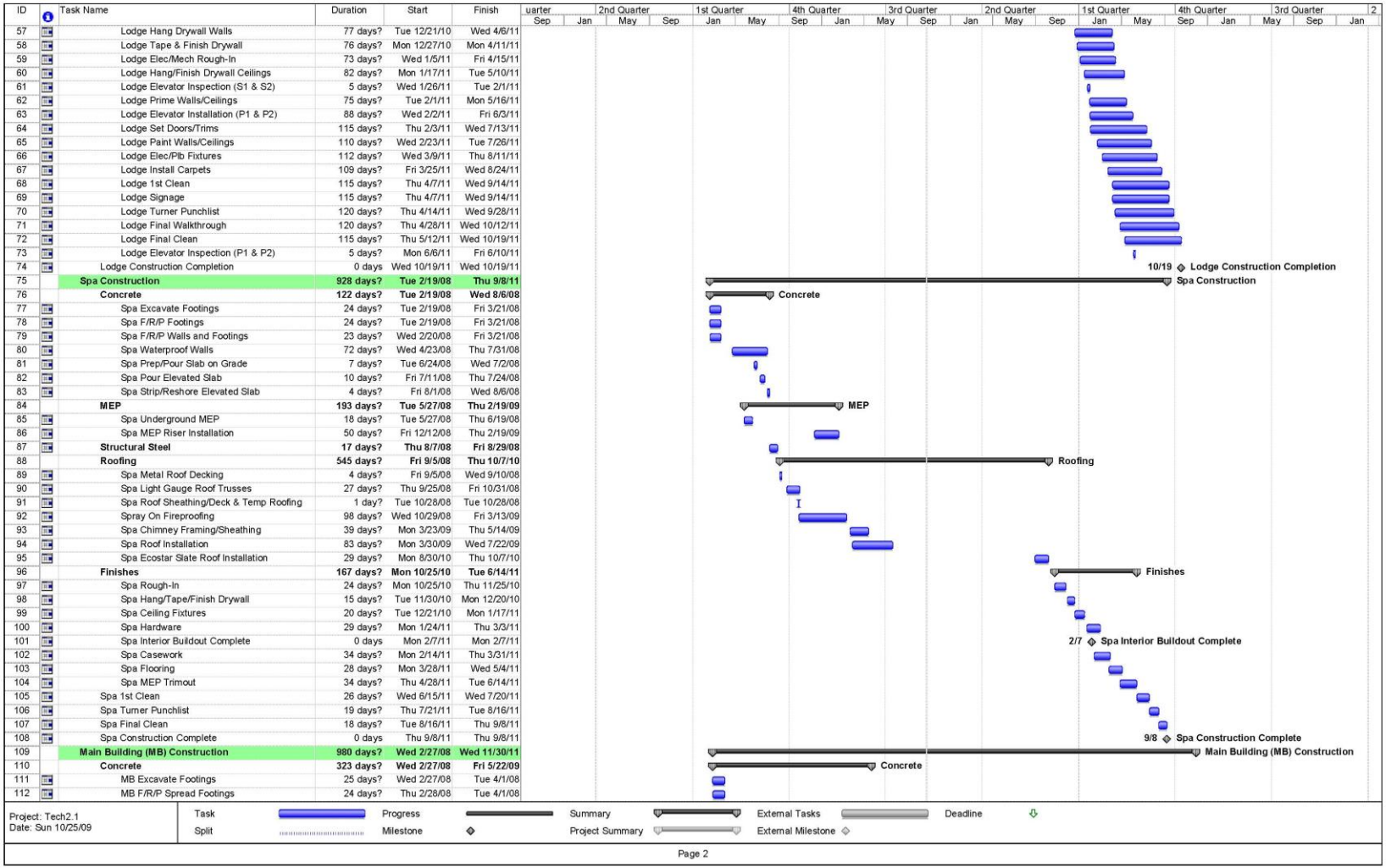
General Conditions Estimate				
Description	Unit	Quantity	Cost/Unit	Total
Field Personnel				
Project Manager	Week	250	$ 1,925.00	$ 481,250.00
Superintendent	Week	250	$ 1,775.00	$ 443,750.00
Asst. Superintendent	Week	250	$ 1,600.00	$ 400,000.00
Asst. Superintendent	Week	250	$ 1,600.00	$ 400,000.00
Field Engineer	Week	250	$ 1,165.00	$ 291,250.00
Asst. Field Engineer	Week	250	$ 895.00	$ 223,750.00
Asst. Field Engineer	Week	250	$ 895.00	$ 223,750.00
General Expenses				
Field Trailer 32'x8'	Mo	60	$ 200.00	$ 12,000.00
Office Equipment	Mo	60	$ 155.00	$ 9,300.00
Office Supplies	Mo	60	$ 85.00	$ 5,100.00
Office Telephone	Mo	60	$ 80.00	$ 4,800.00
Office Lights and HVAC	Mo	60	$ 150.00	$ 9,000.00
Temporary Fencing, 6' high	L.F.	30	$ 9.44	$ 283.20
Toilet 1, portable	Mo	60	$ 150.00	$ 36,000.00
Toilet 2, portable	Mo	60	$ 150.00	$ 36,000.00
Toilet 3, portable	Mo	60	$ 150.00	$ 36,000.00
Permits	Job	1	0.50%	$ 465,000.00
Final Clean Up	Job	1	0.30%	$ 279,000.00

Temporary Utilities				
Temporary Lighting, 4 floors	CSF/Flr.	581	$ 13.68	$ 31,792.32
Temporary Heating, 4 floors	CSF/Flr	581	$ 30.27	$ 70,347.48
Temporary Power, 4 floors	CSF/Flr.	581	$ 47.75	$ 110,971.00
Insurance				
Insurance, All-risk type	Job	1	0.25%	$ 232,500.00
Performance Bond	Job	1	0.60%	$ 558,000.00
Scheduling, Large job	Job	1	0.03%	$ 27,900.00
Permits, Rule of thumb	Job	1	0.50%	$ 465,000.00
			Sub-Total	$ 4,852,744.00
			Location Factor	0.982
			Total	$ 4,765,394.61

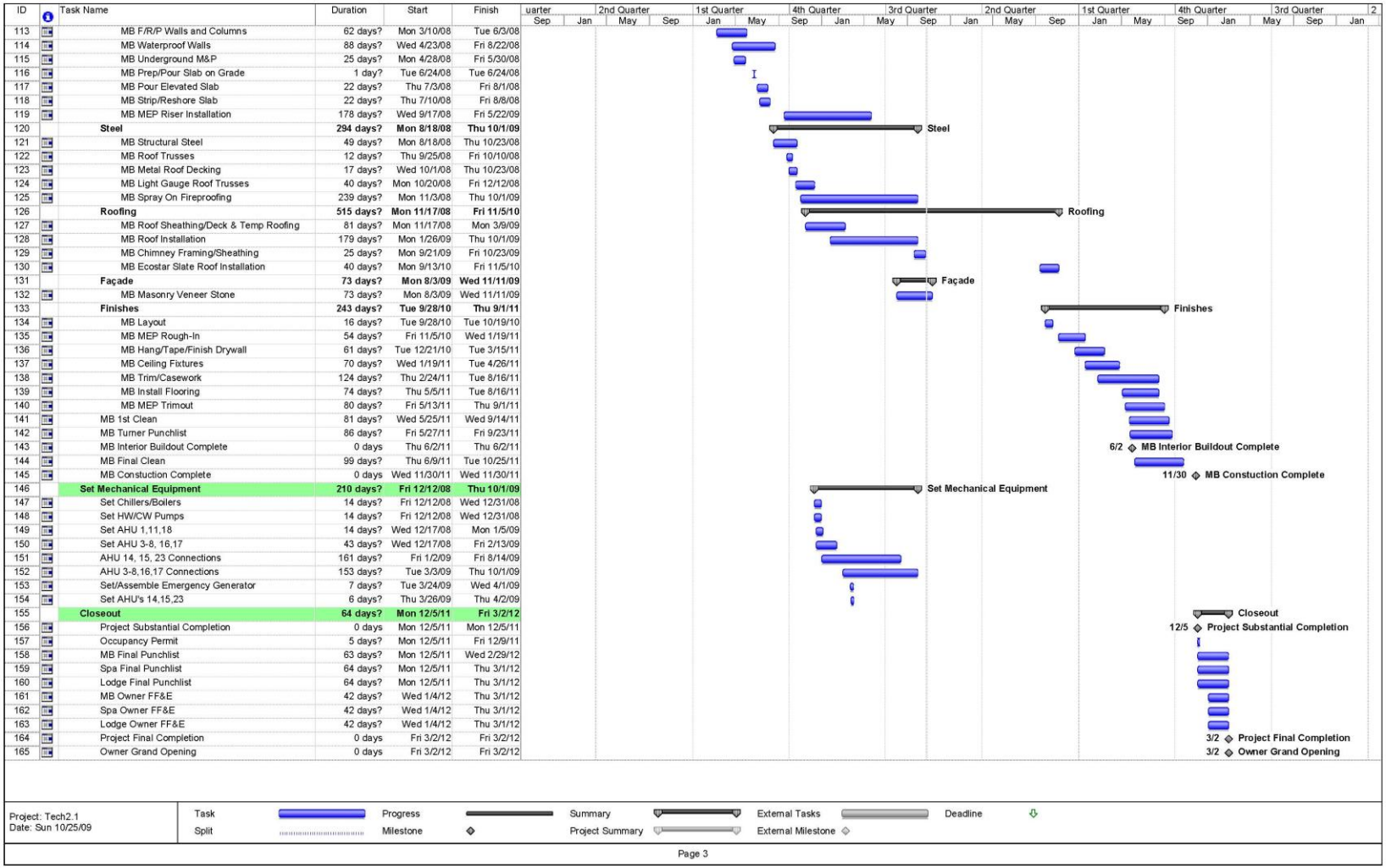
Appendix G: Detailed Project Schedule



ID	Task Name	Duration	Start	Finish
1	**Salamander Resort and Spa**	**1306 days?**	**Thu 3/1/07**	**Fri 3/2/12**
2	**Preconstruction**	**493 days?**	**Thu 3/1/07**	**Mon 1/19/09**
3	Notice to Proceed	0 days	Thu 3/1/07	Thu 3/1/07
4	Design and Development	109 days	Thu 3/1/07	Tue 7/31/07
5	Building and Health Dep. Permits	71 days?	Fri 6/22/07	Fri 9/28/07
6	Construction Documents	67 days?	Thu 7/19/07	Fri 10/19/07
7	Pricing Documents Complete	0 days	Tue 9/11/07	Tue 9/11/07
8	GMP Estimate	48 days?	Thu 9/13/07	Mon 11/19/07
9	Receive LC Building Permit	0 days	Wed 9/26/07	Wed 9/26/07
10	Addendum 2-18	155 days?	Fri 12/14/07	Thu 7/17/08
11	GMP Estimate Review/Value Engineering	115 days?	Mon 11/19/07	Fri 4/25/08
12	Revised GMP Submission	92 days?	Thu 12/20/07	Fri 4/25/08
13	Sitework Start	0 days	Mon 10/22/07	Mon 10/22/07
14	Rough Grading	103 days?	Thu 11/15/07	Mon 4/7/08
15	Lodge Lvl 1 Backfill Walls	20 days?	Fri 3/28/08	Thu 4/24/08
16	Gravity Retaining Wall	46 days?	Mon 11/17/08	Mon 1/19/09
17	Dominion Power Incoming Sevice	0 days	Tue 12/9/08	Tue 12/9/08
18	Gas Incoming Service	0 days	Thu 1/8/09	Thu 1/8/09
19	**Lodge Construction**	**976 days?**	**Wed 1/23/08**	**Wed 10/19/11**
20	**Concrete**	**136 days?**	**Wed 1/23/08**	**Wed 7/30/08**
21	Lodge Excavate Footings	21 days?	Wed 1/23/08	Wed 2/20/08
22	Lodge F/R/P Spread Footings	20 days?	Mon 1/28/08	Fri 2/22/08
23	Lodge F/R/P Walls and Columns	25 days?	Mon 2/18/08	Fri 3/21/08
24	Lodge Waterproof Walls	23 days?	Mon 3/24/08	Wed 4/23/08
25	Lodge Ground Slab on Grade	23 days?	Mon 3/31/08	Wed 4/30/08
26	Lodge Lvl 1 Form Slab	16 days?	Wed 4/16/08	Wed 5/7/08
27	Lodge Lvl 1 Pour Slab/Columns	6 days	Mon 4/21/08	Mon 4/28/08
28	Lodge Lvl 2 Form Slab	18 days?	Wed 4/30/08	Fri 5/23/08
29	Lodge Lvl 2 Pour Slab/Columns	21 days?	Mon 5/5/08	Mon 6/2/08
30	Lodge Lvl 1 Strip/Reshore/Cure/Remove	43 days?	Tue 5/6/08	Thu 7/3/08
31	Lodge Lvl 3 Form Slab	18 days?	Wed 5/14/08	Fri 6/6/08
32	Lodge Lvl 2 Strip/Reshore/Cure/Remove	22 days?	Thu 5/15/08	Fri 6/13/08
33	Lodge Lvl 3 Pour Slab/Columns	15 days?	Fri 5/23/08	Thu 6/12/08
34	Lodge Penthouse Strip/Reshore/Cure/Remov	48 days?	Mon 5/26/08	Wed 7/30/08
35	Lodge Penthouse Lvl Form Slab	18 days?	Wed 5/28/08	Fri 6/20/08
36	Lodge Penthouse Lvl F/R/P Elevated Slab	14 days?	Fri 6/6/08	Wed 6/25/08
37	**MEP**	**130 days?**	**Mon 3/17/08**	**Fri 9/12/08**
38	Lodge Underground MEP	32 days?	Mon 3/17/08	Tue 4/29/08
39	Lodge Lvl 1 In Slab MEP	18 days?	Fri 4/18/08	Tue 5/13/08
40	Lodge Lvl 2 In Slab MEP	20 days?	Fri 5/2/08	Thu 5/29/08
41	Lodge Lvl 3 In slab MEP	18 days?	Fri 5/16/08	Tue 6/10/08
42	Lodge Penthouse Lvl In Slab MEP	14 days?	Wed 6/4/08	Mon 6/23/08
43	Lodge MEP Riser Installation	50 days?	Mon 7/7/08	Fri 9/12/08
44	**Roofing**	**301 days?**	**Mon 8/11/08**	**Mon 10/5/09**
45	Lodge Light Gauge Roof Trusses	59 days?	Mon 8/11/08	Thu 10/30/08
46	Lodge Roof Sheathing & Temp Roofing	35 days?	Mon 10/13/08	Fri 11/28/08
47	Lodge Roof Installation	155 days?	Mon 12/1/08	Fri 7/3/09
48	Lodge Chimney Framing	63 days?	Fri 1/2/09	Tue 3/31/09
49	Lodge Chimney Sheathing	39 days?	Thu 2/5/09	Tue 3/31/09
50	Lodge Expansion Joints	55 days?	Mon 5/18/09	Fri 7/31/09
51	Lodge Chimney Stucco	27 days?	Mon 6/22/09	Tue 7/28/09
52	Lodge Ecostar Slate Roof Installation	41 days?	Mon 8/10/09	Mon 10/5/09
53	Lodge Initial Dry In	0 days	Mon 7/20/09	Mon 7/20/09
54	Lodge Core & Shell Complete	0 days	Thu 12/10/09	Thu 12/10/09
55	**Finishes**	**274 days?**	**Fri 10/1/10**	**Wed 10/19/11**
56	Lodge Elevator Installation (S1 & S2)	88 days?	Fri 10/1/10	Tue 2/1/11

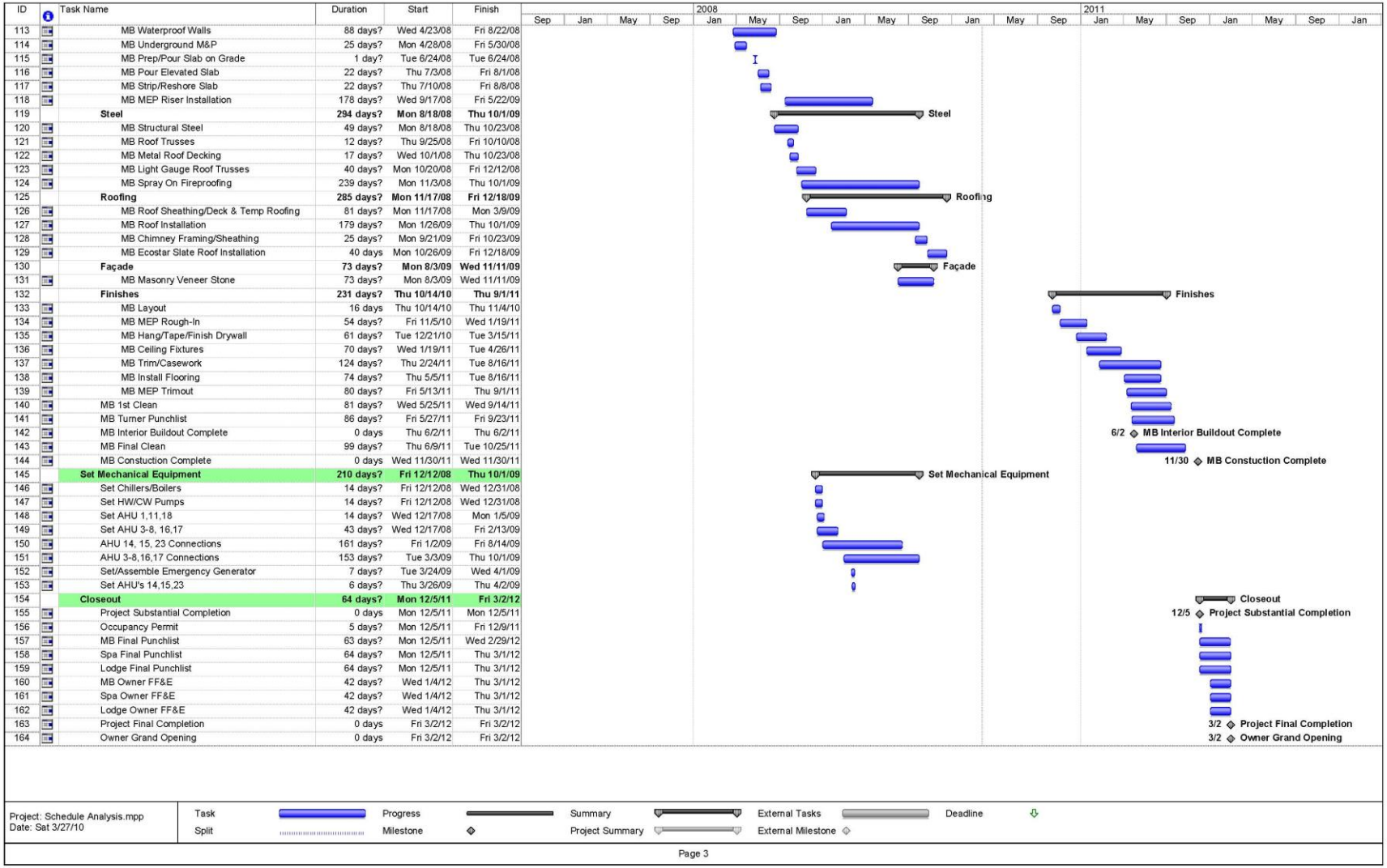


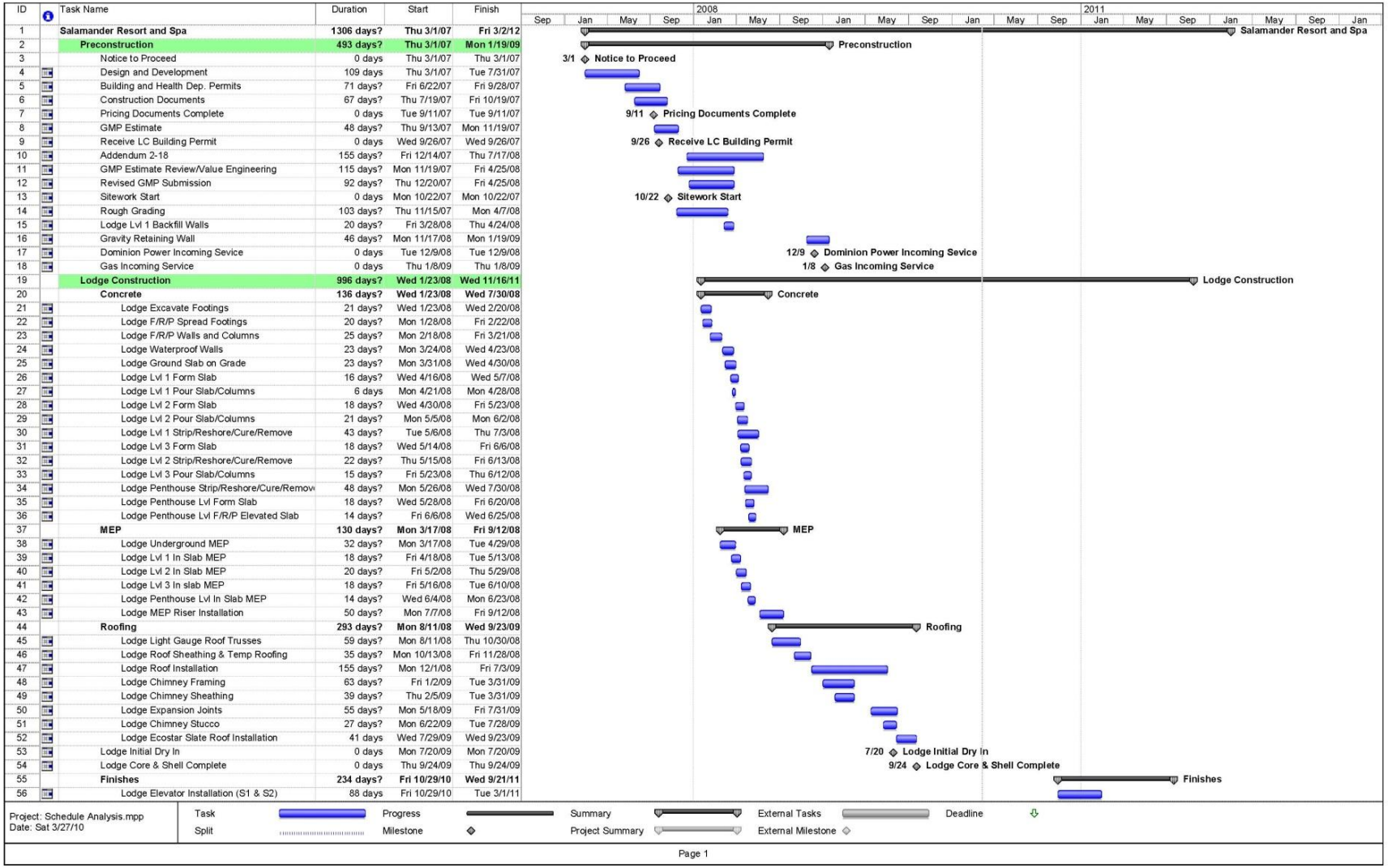
ID	Task Name	Duration	Start	Finish
57	Lodge Hang Drywall Walls	77 days?	Tue 12/21/10	Wed 4/6/11
58	Lodge Tape & Finish Drywall	76 days?	Mon 12/27/10	Mon 4/11/11
59	Lodge Elec/Mech Rough-In	73 days?	Wed 1/5/11	Fri 4/15/11
60	Lodge Hang/Finish Drywall Ceilings	82 days?	Mon 1/17/11	Tue 5/10/11
61	Lodge Elevator Inspection (S1 & S2)	5 days?	Wed 1/26/11	Tue 2/1/11
62	Lodge Prime Walls/Ceilings	75 days?	Tue 2/1/11	Mon 5/16/11
63	Lodge Elevator Installation (P1 & P2)	88 days?	Wed 2/2/11	Fri 6/3/11
64	Lodge Set Doors/Trims	115 days?	Thu 2/3/11	Wed 7/13/11
65	Lodge Paint Walls/Ceilings	110 days?	Wed 2/23/11	Tue 7/26/11
66	Lodge Elec/Plb Fixtures	112 days?	Wed 3/9/11	Thu 8/11/11
67	Lodge Install Carpets	109 days?	Fri 3/25/11	Wed 8/24/11
68	Lodge 1st Clean	115 days?	Thu 4/7/11	Wed 9/14/11
69	Lodge Signage	115 days?	Thu 4/7/11	Wed 9/14/11
70	Lodge Turner Punchlist	120 days?	Thu 4/14/11	Wed 9/28/11
71	Lodge Final Walkthrough	120 days?	Thu 4/28/11	Wed 10/12/11
72	Lodge Final Clean	115 days?	Thu 5/12/11	Wed 10/19/11
73	Lodge Elevator Inspection (P1 & P2)	5 days?	Mon 6/6/11	Fri 6/10/11
74	Lodge Construction Completion	0 days	Wed 10/19/11	Wed 10/19/11
75	**Spa Construction**	**928 days?**	**Tue 2/19/08**	**Thu 9/8/11**
76	**Concrete**	**122 days?**	**Tue 2/19/08**	**Wed 8/6/08**
77	Spa Excavate Footings	24 days?	Tue 2/19/08	Fri 3/21/08
78	Spa F/R/P Footings	24 days?	Tue 2/19/08	Fri 3/21/08
79	Spa F/R/P Walls and Footings	23 days?	Wed 2/20/08	Fri 3/21/08
80	Spa Waterproof Walls	72 days?	Wed 4/23/08	Thu 7/31/08
81	Spa Prep/Pour Slab on Grade	7 days?	Tue 6/24/08	Wed 7/2/08
82	Spa Pour Elevated Slab	10 days?	Fri 7/11/08	Thu 7/24/08
83	Spa Strip/Reshore Elevated Slab	4 days?	Fri 8/1/08	Wed 8/6/08
84	**MEP**	**193 days?**	**Tue 5/27/08**	**Thu 2/19/09**
85	Spa Underground MEP	18 days?	Tue 5/27/08	Thu 6/19/08
86	Spa MEP Riser Installation	50 days?	Fri 12/12/08	Thu 2/19/09
87	**Structural Steel**	**17 days?**	**Thu 8/7/08**	**Fri 8/29/08**
88	**Roofing**	**545 days?**	**Fri 9/5/08**	**Thu 10/7/10**
89	Spa Metal Roof Decking	4 days?	Fri 9/5/08	Wed 9/10/08
90	Spa Light Gauge Roof Trusses	27 days?	Thu 9/25/08	Fri 10/31/08
91	Spa Roof Sheathing/Deck & Temp Roofing	1 day?	Tue 10/28/08	Tue 10/28/08
92	Spray On Fireproofing	98 days?	Wed 10/29/08	Fri 3/13/09
93	Spa Chimney Framing/Sheathing	39 days?	Mon 3/23/09	Thu 5/14/09
94	Spa Roof Installation	83 days?	Mon 3/30/09	Wed 7/22/09
95	Spa Ecostar Slate Roof Installation	29 days?	Mon 8/30/10	Thu 10/7/10
96	**Finishes**	**167 days?**	**Mon 10/25/10**	**Tue 6/14/11**
97	Spa Rough-In	24 days?	Mon 10/25/10	Thu 11/25/10
98	Spa Hang/Tape/Finish Drywall	15 days?	Tue 11/30/10	Mon 12/20/10
99	Spa Ceiling Fixtures	20 days?	Tue 12/21/10	Mon 1/17/11
100	Spa Hardware	29 days?	Mon 1/24/11	Thu 3/3/11
101	Spa Interior Buildout Complete	0 days	Mon 2/7/11	Mon 2/7/11
102	Spa Casework	34 days?	Mon 2/14/11	Thu 3/31/11
103	Spa Flooring	28 days?	Mon 3/28/11	Wed 5/4/11
104	Spa MEP Trimout	34 days?	Thu 4/28/11	Tue 6/14/11
105	Spa 1st Clean	26 days?	Wed 6/15/11	Wed 7/20/11
106	Spa Turner Punchlist	19 days?	Thu 7/21/11	Tue 8/16/11
107	Spa Final Clean	18 days?	Tue 8/16/11	Thu 9/8/11
108	Spa Construction Complete	0 days	Thu 9/8/11	Thu 9/8/11
109	**Main Building (MB) Construction**	**980 days?**	**Wed 2/27/08**	**Wed 11/30/11**
110	**Concrete**	**323 days?**	**Wed 2/27/08**	**Fri 5/22/09**
111	MB Excavate Footings	25 days?	Wed 2/27/08	Tue 4/1/08
112	MB F/R/P Spread Footings	24 days?	Thu 2/28/08	Tue 4/1/08



ID	Task Name	Duration	Start	Finish
113	MB F/R/P Walls and Columns	62 days?	Mon 3/10/08	Tue 6/3/08
114	MB Waterproof Walls	88 days?	Wed 4/23/08	Fri 8/22/08
115	MB Underground M&P	25 days?	Mon 4/28/08	Fri 5/30/08
116	MB Prep/Pour Slab on Grade	1 day?	Tue 6/24/08	Tue 6/24/08
117	MB Pour Elevated Slab	22 days?	Thu 7/3/08	Fri 8/1/08
118	MB Strip/Reshore Slab	22 days?	Thu 7/10/08	Fri 8/8/08
119	MB MEP Riser Installation	178 days?	Wed 9/17/08	Fri 5/22/09
120	**Steel**	**294 days?**	**Mon 8/18/08**	**Thu 10/1/09**
121	MB Structural Steel	49 days?	Mon 8/18/08	Thu 10/23/08
122	MB Roof Trusses	12 days?	Thu 9/25/08	Fri 10/10/08
123	MB Metal Roof Decking	17 days?	Wed 10/1/08	Thu 10/23/08
124	MB Light Gauge Roof Trusses	40 days?	Mon 10/20/08	Fri 12/12/08
125	MB Spray On Fireproofing	239 days?	Mon 11/3/08	Thu 10/1/09
126	**Roofing**	**515 days?**	**Mon 11/17/08**	**Fri 11/5/10**
127	MB Roof Sheathing/Deck & Temp Roofing	81 days?	Mon 11/17/08	Mon 3/9/09
128	MB Roof Installation	179 days?	Mon 1/26/09	Thu 10/1/09
129	MB Chimney Framing/Sheathing	25 days?	Mon 9/21/09	Fri 10/23/09
130	MB Ecostar Slate Roof Installation	40 days?	Mon 9/13/10	Fri 11/5/10
131	**Façade**	**73 days?**	**Mon 8/3/09**	**Wed 11/11/09**
132	MB Masonry Veneer Stone	73 days?	Mon 8/3/09	Wed 11/11/09
133	**Finishes**	**243 days?**	**Tue 9/28/10**	**Thu 9/1/11**
134	MB Layout	16 days?	Tue 9/28/10	Tue 10/19/10
135	MB MEP Rough-In	54 days?	Fri 11/5/10	Wed 1/19/11
136	MB Hang/Tape/Finish Drywall	61 days?	Tue 12/21/10	Tue 3/15/11
137	MB Ceiling Fixtures	70 days?	Wed 1/19/11	Tue 4/26/11
138	MB Trim/Casework	124 days?	Thu 2/24/11	Tue 8/16/11
139	MB Install Flooring	74 days?	Thu 5/5/11	Tue 8/16/11
140	MB MEP Trimout	80 days?	Fri 5/13/11	Thu 9/1/11
141	MB 1st Clean	81 days?	Wed 5/25/11	Wed 9/14/11
142	MB Turner Punchlist	86 days?	Fri 5/27/11	Fri 9/23/11
143	MB Interior Buildout Complete	0 days	Thu 6/2/11	Thu 6/2/11
144	MB Final Clean	99 days?	Thu 6/9/11	Tue 10/25/11
145	MB Constuction Complete	0 days	Wed 11/30/11	Wed 11/30/11
146	**Set Mechanical Equipment**	**210 days?**	**Fri 12/12/08**	**Thu 10/1/09**
147	Set Chillers/Boilers	14 days?	Fri 12/12/08	Wed 12/31/08
148	Set HW/CW Pumps	14 days?	Fri 12/12/08	Wed 12/31/08
149	Set AHU 1,11,18	14 days?	Wed 12/17/08	Mon 1/5/09
150	Set AHU 3-8, 16,17	43 days?	Wed 12/17/08	Fri 2/13/09
151	AHU 14, 15, 23 Connections	161 days?	Fri 1/2/09	Fri 8/14/09
152	AHU 3-8,16,17 Connections	153 days?	Tue 3/3/09	Thu 10/1/09
153	Set/Assemble Emergency Generator	7 days?	Tue 3/24/09	Wed 4/1/09
154	Set AHU's 14,15,23	6 days?	Thu 3/26/09	Thu 4/2/09
155	**Closeout**	**64 days?**	**Mon 12/5/11**	**Fri 3/2/12**
156	Project Substantial Completion	0 days	Mon 12/5/11	Mon 12/5/11
157	Occupancy Permit	5 days?	Mon 12/5/11	Fri 12/9/11
158	MB Final Punchlist	63 days?	Mon 12/5/11	Wed 2/29/12
159	Spa Final Punchlist	64 days?	Mon 12/5/11	Thu 3/1/12
160	Lodge Final Punchlist	64 days?	Mon 12/5/11	Thu 3/1/12
161	MB Owner FF&E	42 days?	Wed 1/4/12	Thu 3/1/12
162	Spa Owner FF&E	42 days?	Wed 1/4/12	Thu 3/1/12
163	Lodge Owner FF&E	42 days?	Wed 1/4/12	Thu 3/1/12
164	Project Final Completion	0 days	Fri 3/2/12	Fri 3/2/12
165	Owner Grand Opening	0 days	Fri 3/2/12	Fri 3/2/12

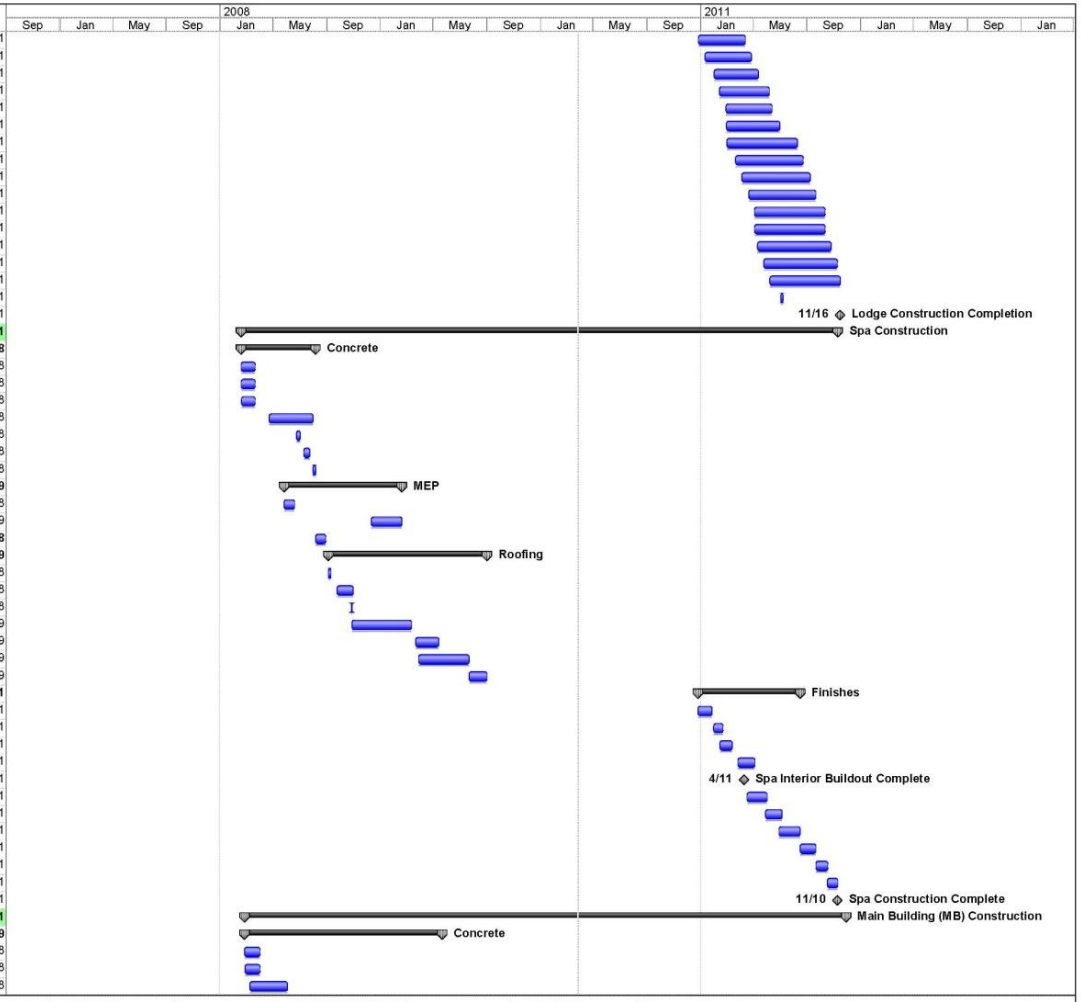
Appendix H: Proposed Schedule





ID	Task Name	Duration	Start	Finish
1	**Salamander Resort and Spa**	**1306 days?**	**Thu 3/1/07**	**Fri 3/2/12**
2	**Preconstruction**	**493 days?**	**Thu 3/1/07**	**Mon 1/19/09**
3	Notice to Proceed	0 days	Thu 3/1/07	Thu 3/1/07
4	Design and Development	109 days	Thu 3/1/07	Tue 7/31/07
5	Building and Health Dep. Permits	71 days?	Fri 6/22/07	Fri 9/28/07
6	Construction Documents	67 days?	Thu 7/19/07	Fri 10/19/07
7	Pricing Documents Complete	0 days	Tue 9/11/07	Tue 9/11/07
8	GMP Estimate	48 days?	Thu 9/13/07	Mon 11/19/07
9	Receive LC Building Permit	0 days	Wed 9/26/07	Wed 9/26/07
10	Addendum 2-18	155 days?	Fri 12/14/07	Thu 7/17/08
11	GMP Estimate Review/Value Engineering	115 days?	Mon 11/19/07	Fri 4/25/08
12	Revised GMP Submission	92 days?	Thu 12/20/07	Fri 4/25/08
13	Sitework Start	0 days	Mon 10/22/07	Mon 10/22/07
14	Rough Grading	103 days?	Thu 11/15/07	Mon 4/7/08
15	Lodge Lvl 1 Backfill Walls	20 days?	Fri 3/28/08	Thu 4/24/08
16	Gravity Retaining Wall	46 days?	Mon 11/17/08	Mon 1/19/09
17	Dominion Power Incoming Sevice	0 days	Tue 12/9/08	Tue 12/9/08
18	Gas Incoming Service	0 days	Thu 1/8/09	Thu 1/8/09
19	**Lodge Construction**	**996 days?**	**Wed 1/23/08**	**Wed 11/16/11**
20	**Concrete**	**136 days?**	**Wed 1/23/08**	**Wed 7/30/08**
21	Lodge Excavate Footings	21 days?	Wed 1/23/08	Wed 2/20/08
22	Lodge F/R/P Spread Footings	20 days?	Mon 1/28/08	Fri 2/22/08
23	Lodge F/R/P Walls and Columns	25 days?	Mon 2/18/08	Fri 3/21/08
24	Lodge Waterproof Walls	23 days?	Mon 3/24/08	Wed 4/23/08
25	Lodge Ground Slab on Grade	23 days?	Mon 3/31/08	Wed 4/30/08
26	Lodge Lvl 1 Form Slab	16 days?	Wed 4/16/08	Wed 5/7/08
27	Lodge Lvl 1 Pour Slab/Columns	6 days	Mon 4/21/08	Mon 4/28/08
28	Lodge Lvl 2 Form Slab	18 days?	Wed 4/30/08	Fri 5/23/08
29	Lodge Lvl 2 Pour Slab/Columns	21 days?	Mon 5/5/08	Mon 6/2/08
30	Lodge Lvl 1 Strip/Reshore/Cure/Remove	43 days?	Tue 5/6/08	Thu 7/3/08
31	Lodge Lvl 3 Form Slab	18 days?	Wed 5/14/08	Fri 6/6/08
32	Lodge Lvl 2 Strip/Reshore/Cure/Remove	22 days?	Thu 5/15/08	Fri 6/13/08
33	Lodge Lvl 3 Pour Slab/Columns	15 days?	Fri 5/23/08	Thu 6/12/08
34	Lodge Penthouse Strip/Reshore/Cure/Remov	48 days?	Mon 5/26/08	Wed 7/30/08
35	Lodge Penthouse Lvl Form Slab	18 days?	Wed 5/28/08	Fri 6/20/08
36	Lodge Penthouse Lvl F/R/P Elevated Slab	14 days?	Fri 6/6/08	Wed 6/25/08
37	**MEP**	**130 days?**	**Mon 3/17/08**	**Fri 9/12/08**
38	Lodge Underground MEP	32 days?	Mon 3/17/08	Tue 4/29/08
39	Lodge Lvl 1 In Slab MEP	18 days?	Fri 4/18/08	Tue 5/13/08
40	Lodge Lvl 2 In Slab MEP	20 days?	Fri 5/2/08	Thu 5/29/08
41	Lodge Lvl 3 In slab MEP	18 days?	Fri 5/16/08	Tue 6/10/08
42	Lodge Penthouse Lvl In Slab MEP	14 days?	Wed 6/4/08	Mon 6/23/08
43	Lodge MEP Riser Installation	50 days?	Mon 7/7/08	Fri 9/12/08
44	**Roofing**	**293 days?**	**Mon 8/11/08**	**Wed 9/23/09**
45	Lodge Light Gauge Roof Trusses	59 days?	Mon 8/11/08	Thu 10/30/08
46	Lodge Roof Sheathing & Temp Roofing	35 days?	Mon 10/13/08	Fri 11/28/08
47	Lodge Roof Installation	155 days?	Mon 12/1/08	Fri 7/3/09
48	Lodge Chimney Framing	63 days?	Fri 1/2/09	Tue 3/31/09
49	Lodge Chimney Sheathing	39 days?	Thu 2/5/09	Tue 3/31/09
50	Lodge Expansion Joints	55 days?	Mon 5/18/09	Fri 7/31/09
51	Lodge Chimney Stucco	27 days?	Mon 6/22/09	Tue 7/28/09
52	Lodge Ecostar Slate Roof Installation	41 days	Wed 7/29/09	Wed 9/23/09
53	Lodge Initial Dry In	0 days	Mon 7/20/09	Mon 7/20/09
54	Lodge Core & Shell Complete	0 days	Thu 9/24/09	Thu 9/24/09
55	**Finishes**	**234 days?**	**Fri 10/29/10**	**Wed 9/21/11**
56	Lodge Elevator Installation (S1 & S2)	88 days	Fri 10/29/10	Tue 3/1/11

ID	Task Name	Duration	Start	Finish
57	Lodge Hang Drywall Walls	77 days?	Tue 12/28/10	Wed 4/13/11
58	Lodge Tape & Finish Drywall	76 days?	Wed 1/12/11	Wed 4/27/11
59	Lodge Elec/Mech Rough-In	73 days?	Wed 2/2/11	Fri 5/13/11
60	Lodge Hang/Finish Drywall Ceilings	82 days?	Mon 2/14/11	Tue 6/7/11
61	Lodge Prime Walls/Ceilings	75 days?	Tue 3/1/11	Mon 6/13/11
62	Lodge Elevator Installation (P1 & P2)	88 days?	Wed 3/2/11	Fri 7/1/11
63	Lodge Set Doors/Trims	115 days?	Thu 3/3/11	Wed 8/10/11
64	Lodge Paint Walls/Ceilings	110 days?	Wed 3/23/11	Tue 8/23/11
65	Lodge Elec/Plb Fixtures	112 days?	Wed 4/6/11	Thu 9/8/11
66	Lodge Install Carpets	109 days?	Fri 4/22/11	Wed 9/21/11
67	Lodge 1st Clean	115 days?	Thu 5/5/11	Wed 10/12/11
68	Lodge Signage	115 days?	Thu 5/5/11	Wed 10/12/11
69	Lodge Turner Punchlist	120 days?	Thu 5/12/11	Wed 10/26/11
70	Lodge Final Walkthrough	120 days?	Thu 5/26/11	Wed 11/9/11
71	Lodge Final Clean	115 days?	Thu 6/9/11	Wed 11/16/11
72	Lodge Elevator Inspection (P1 & P2)	5 days?	Mon 7/4/11	Fri 7/8/11
73	Lodge Construction Completion	0 days	Wed 11/16/11	Wed 11/16/11
74	**Spa Construction**	**973 days?**	**Tue 2/19/08**	**Thu 11/10/11**
75	**Concrete**	**122 days?**	**Tue 2/19/08**	**Wed 8/6/08**
76	Spa Excavate Footings	24 days?	Tue 2/19/08	Fri 3/21/08
77	Spa F/R/P Footings	24 days?	Tue 2/19/08	Fri 3/21/08
78	Spa F/R/P Walls and Footings	23 days?	Wed 2/20/08	Fri 3/21/08
79	Spa Waterproof Walls	72 days?	Wed 4/23/08	Thu 7/31/08
80	Spa Prep/Pour Slab on Grade	7 days?	Tue 6/24/08	Wed 7/2/08
81	Spa Pour Elevated Slab	10 days?	Fri 7/11/08	Thu 7/24/08
82	Spa Strip/Reshore Elevated Slab	4 days?	Fri 8/1/08	Wed 8/6/08
83	**MEP**	**193 days?**	**Tue 5/27/08**	**Thu 2/19/09**
84	Spa Underground MEP	18 days?	Tue 5/27/08	Thu 6/19/08
85	Spa MEP Riser Installation	50 days?	Fri 12/12/08	Thu 2/19/09
86	**Structural Steel**	**17 days?**	**Thu 8/7/08**	**Fri 8/29/08**
87	**Roofing**	**258 days?**	**Fri 9/5/08**	**Tue 9/1/09**
88	Spa Metal Roof Decking	4 days?	Fri 9/5/08	Wed 9/10/08
89	Spa Light Gauge Roof Trusses	27 days?	Thu 9/25/08	Fri 10/31/08
90	Spa Roof Sheathing/Deck & Temp Roofing	1 day?	Tue 10/28/08	Tue 10/28/08
91	Spray On Fireproofing	98 days?	Wed 10/29/08	Fri 3/13/09
92	Spa Chimney Framing/Sheathing	39 days?	Mon 3/23/09	Thu 5/14/09
93	Spa Roof Installation	83 days?	Mon 3/30/09	Wed 7/22/09
94	Spa Ecostar Slate Roof Installation	29 days	Thu 7/23/09	Tue 9/1/09
95	**Finishes**	**167 days?**	**Mon 12/27/10**	**Tue 8/16/11**
96	Spa Rough-In	24 days	Mon 12/27/10	Thu 1/27/11
97	Spa Hang/Tape/Finish Drywall	15 days?	Tue 2/1/11	Mon 2/21/11
98	Spa Ceiling Fixtures	20 days	Tue 2/15/11	Mon 3/14/11
99	Spa Hardware	29 days	Mon 3/28/11	Thu 5/5/11
100	Spa Interior Buildout Complete	0 days	Mon 4/11/11	Mon 4/11/11
101	Spa Casework	34 days	Mon 4/18/11	Thu 6/2/11
102	Spa Flooring	28 days	Mon 5/30/11	Wed 7/6/11
103	Spa MEP Trimout	34 days	Thu 6/30/11	Tue 8/16/11
104	Spa 1st Clean	26 days	Wed 8/17/11	Wed 9/21/11
105	Spa Turner Punchlist	19 days?	Thu 9/22/11	Tue 10/18/11
106	Spa Final Clean	18 days?	Tue 10/18/11	Thu 11/10/11
107	Spa Construction Complete	0 days	Thu 11/10/11	Thu 11/10/11
108	**Main Building (MB) Construction**	**980 days?**	**Wed 2/27/08**	**Wed 11/30/11**
109	**Concrete**	**323 days?**	**Wed 2/27/08**	**Fri 5/22/09**
110	MB Excavate Footings	25 days?	Wed 2/27/08	Tue 4/1/08
111	MB F/R/P Spread Footings	24 days?	Thu 2/28/08	Tue 4/1/08
112	MB F/R/P Walls and Columns	62 days?	Mon 3/10/08	Tue 6/3/08



Appendix I: Proposed General Conditions

General Conditions Savings				
Description	Unit	Quantity	Cost/Unit	Total
Field Personnel				
Project Manager	Week	43	$ 1,925.00	$ 82,775.00
Superintendent	Week	43	$ 1,775.00	$ 76,325.00
Asst. Superintendent	Week	43	$ 1,600.00	$ 68,800.00
Asst. Superintendent	Week	43	$ 1,600.00	$ 68,800.00
Field Engineer	Week	43	$ 1,165.00	$ 50,095.00
Asst. Field Engineer	Week	43	$ 895.00	$ 38,485.00
Asst. Field Engineer	Week	43	$ 895.00	$ 38,485.00
General Expenses				
Field Trailer 32'x8'	Mo	10	$ 200.00	$ 2,000.00
Office Equipment	Mo	10	$ 155.00	$ 1,550.00
Office Supplies	Mo	10	$ 85.00	$ 850.00
Office Telephone	Mo	10	$ 80.00	$ 800.00
Office Lights and HVAC	Mo	10	$ 150.00	$ 1,500.00
Temporary Fencing, 6' high	L.F.	30	$ 9.44	$ 283.20
Toilet 1, portable	Mo	10	$ 150.00	$ 6,000.00
Toilet 2, portable	Mo	10	$ 150.00	$ 6,000.00
Toilet 3, portable	Mo	10	$ 150.00	$ 6,000.00
Permits	Job	1	0.50%	$ 465,000.00
Final Clean Up	Job	1	0.30%	$ 279,000.00
Temporary Utilities				
Temporary Lighting	CSF/Flr.	581	$ 13.68	$ 6,358.46
Temporary Heating	CSF/Flr	581	$ 30.27	$ 15,828.18
Temporary Power	CSF/Flr.	581	$ 47.75	$ 24,968.48
Insurance				
Insurance, All-risk type	Job	1	0.25%	$ 232,500.00
Performance Bond	Job	1	0.60%	$ 558,000.00
Scheduling, Large job	Job	1	0.03%	$ 27,900.00
Permits, Rule of thumb	Job	1	0.50%	$ 465,000.00
			Sub-Total	$ 495,620.12
			Location Factor	0.982
			Total Savings	$ 486,698.96

Appendix J: Proposed Security Cost

General Conditions Estimate				
Description	Unit	Quantity	Cost/Unit	Total
Temporary Security				
Watchman	Hr	2580	$ 25.00	$ 64,500.00
Watchman, Overtime	Hr	4644	$ 37.50	$ 174,150.00
			Sub-Total	$ 238,650.00
			Location Factor	0.982
			Total Cost	$ 234,354.30

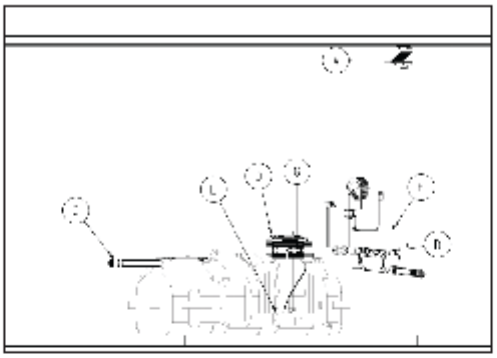
Appendix K: Shrub Replacement Plan

Proposed		Native Replacement	
Fothergilla		Button Bush	
Cherry Laurel		Virginia Sweetspire	
Otto Luyken Cherry Laurel		Henry Garnet's Sweetspire	
San Jose Holly		Red Chokeberry	

Korean Spice Viburnum		Arrowwood Viburnum	
Shasta Doublefile Viburnum		Possumhaw Viburnum	
Nandina		Winterberry	
Vernal Witchhazel		Common Witchhazel	

Appendix L: Irrigation System Specifications

Below Ground Cistern Tank Collection System



(Note how overflow is directed away from and downhill from the tank excavation and housing structure and must drain at the surface).
(Follow underground cistern installation instructions carefully which are included with each tank.)

The Complete System package detailing a 1200 gallon underground cistern (PN10010--).

A. Leaf Eater (RCLE3).

B. First Flush In-Ground Diverter (RCID12).

C. 4" Overflow (RCOF4).

D. 12" Riser.

E. Submersible Pump (RCSUBPUMP) with controls (RCCONTROL).

F. Filter Pit (optional) (RCFP).

G. 3 Cord Seal (RC3CS).

Snyder Industries has the solution for your rain harvesting needs. Snyder is a leading manufacturer of exceptionally performing polyethylene water tanks and offers a full line of rain harvesting systems and components.

Potential Annual Rainwater Collection

Rainfall in Inches	Square Feet of Roof Surface					
	1,000	2,000	3,000	4,000	5,000	10,000
	Gallons of Water					
1	625	1,250	1,875	2,500	3,125	6,250
2	1,250	2,500	3,750	5,000	6,250	12,500
5	3,125	6,250	9,375	12,500	15,625	31,500
10	6,250	12,500	18,750	25,000	31,250	62,500
30	18,750	37,500	56,250	75,000	93,750	187,500
40	25,000	50,000	75,000	100,000	125,000	250,000
50	31,250	62,500	93,750	125,000	156,250	312,500
60	37,500	75,000	112,500	150,000	187,500	375,000
	Gallons of Water Captured					

Calculation: annual rainfall per inch x 625 gallons per 1,000 square feet roof surface.

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Appendix M: Rainwater Collection Areas