



**Paul Roberts**

Senior Thesis 2010  
Construction Management

# Presentation Agenda

Project Overview

Introduction of Analyses

Analysis 1: Schedule Deceleration

Analysis 2: Lighting Redesign

Analysis 3: Water Management

Conclusions

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# Project Overview

Location: Middleburg, Virginia. 340 acres

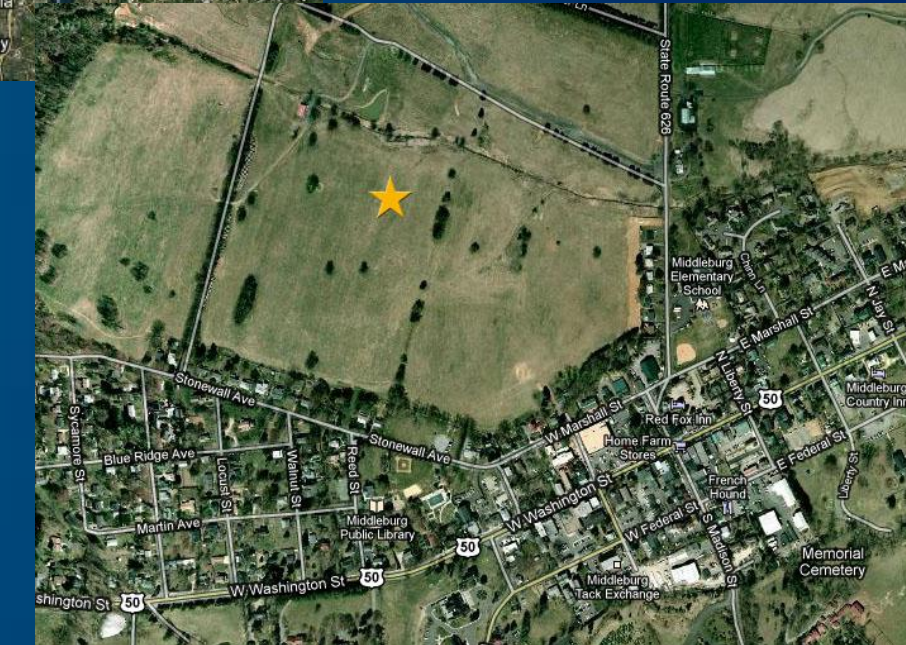
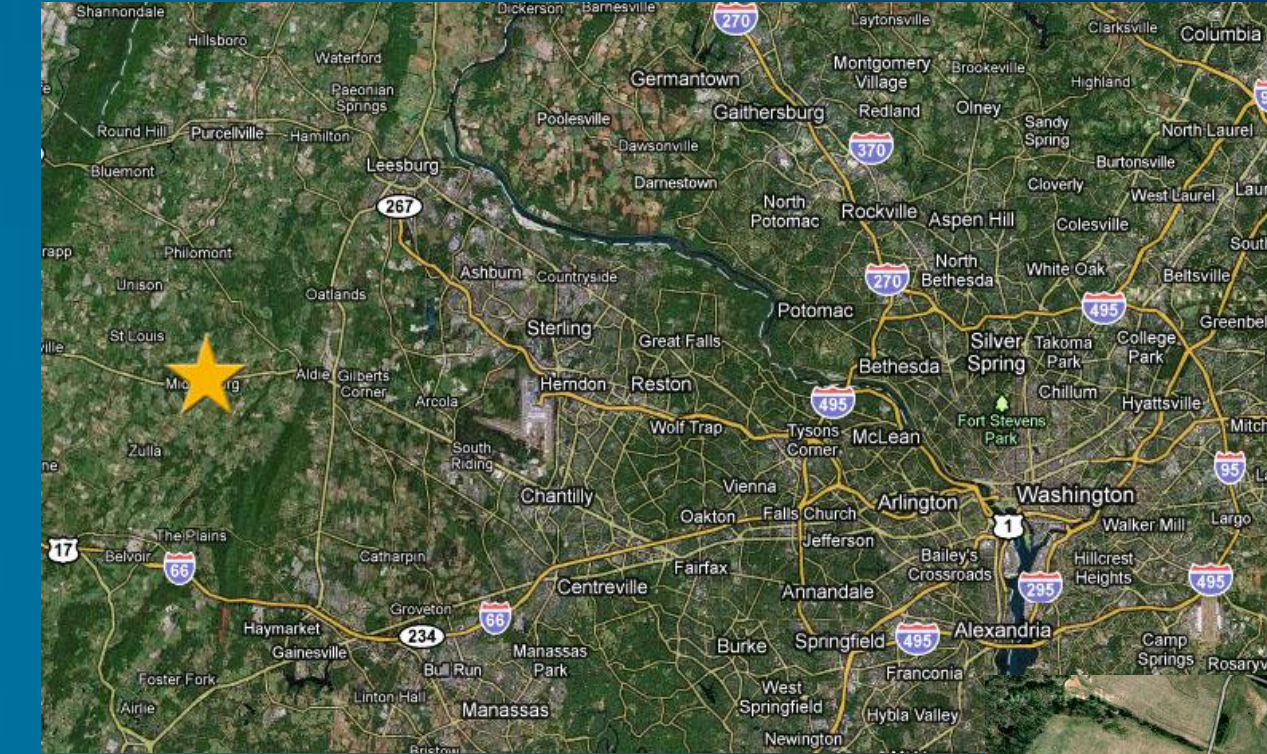
Size: 230,000 square feet

Future Use: Hotel, spa, equestrian center

Dates of Construction: Spring 2007 – Spring 2012

Building Cost: \$93 million

Project Delivery Method: Design Bid Build with GMP



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# Project Overview

## Project Team

Owner - Salamander Hospitality

Architect - Architecture Inc.

Design Architect - Wimberly Allison Tong and Goo

Interior Designer - Forrest Perkins

Structural Engineer - Rathgeber/Goss Associates

MEP Engineer - RG Vangerweil Engineers



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# Project Overview

## Design

- 168 guest rooms
- Spa, restaurant, and ballrooms
- Stone and stucco façade
- Extensive landscaping

## Structural System

- Concrete and structural steel
- Composite metal decking
- Post-tensioned concrete beams

## LEED Features

- EcoSlate roofing
- Low emitting paints, carpets, and window treatments
- Conserve 250 of the 340 acres

## Electrical System

- From utility, main 3200A 480/277V – 3 phase 4W switchboard
- Uninterrupted Power Supply (UPS) for main building
- Indoor emergency diesel generator (650kW 480/277 – 3 phase 4W)

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# Project Overview

1: Schedule Deceleration

2: Guest Room Lighting Redesign

3: Water Management

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# Introduction

## Analysis 1: Schedule Deceleration

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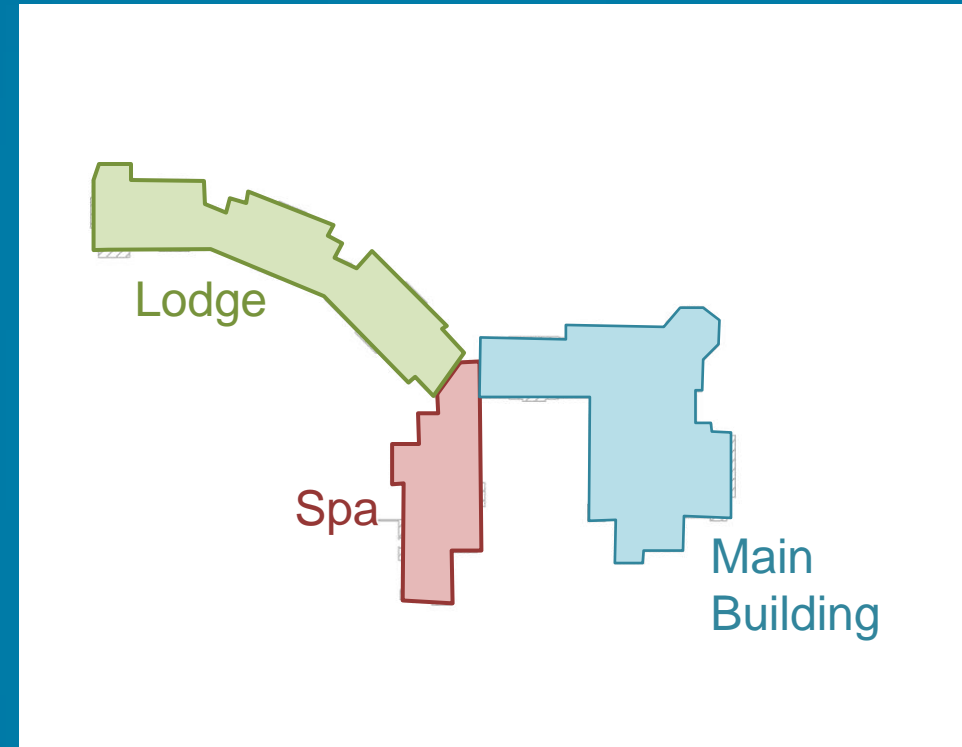
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# Schedule Deceleration



Original Schedule Completion Date: Spring 2011



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# Schedule Deceleration

Revised Schedule Completion Date: Spring 2012

## Negative Aspects of Deceleration

- Renegotiate subcontractors contracts
- Lost revenue
- Additional general conditions
- Public image

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# Schedule Deceleration

- Allocation of activities
- 10-month break
- December 21, 2009 to October 18, 2010

## 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

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# Schedule Deceleration

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## General Conditions

- Field personnel
- General Expenses
- Temporary Security
- Temporary Utilities
  - 10% power
  - 20% lighting
  - 10% heating

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# Schedule Deceleration

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

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

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## Analysis 2: Guest Room Lighting Redesign

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# Lighting Redesign

168 guest rooms

- 151 King/Queen rooms
- 17 Suites

## Current System

- Halogen downlights, ceiling/wall fixtures
- 2,500 hour average rated life
- 45 to 50 W per lamp
- \$5.50 to \$7.95 per lamp

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# Lighting Redesign

## Proposed System

- LED lamps
  - 50,000 hour average rated life
  - 6 to 9 Watts per lamp
  - \$70 to \$90 per lamp
- Lighting control system
  - Unoccupied 10 am – 4 pm
  - Occupied 7 hours

760 VA per room in King/Queen and Suites

kW for 151 Rooms

114.76

kW for 17 Suites

12.92

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# Lighting Redesign

## 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
Par20 Halogen	1344	50	67200	67.2	403.2	470.4	873.6	0.10	87.36	31886.40
Par16 Halogen	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
Par20 LED	1344	9	12096	12.1	0.0	84.7	84.7	0.10	8.47	3090.53
Par16 LED	1344	6	8064	8.1	0.0	56.4	56.4	0.10	5.64	2060.35



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# Lighting Redesign

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
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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
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Par16 LED	1344	6	8064	8.1	0.0	56.4	56.4	0.10	5.64	2060.35

# Energy Cost

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

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

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# Lighting Redesign

## Halogen Replacement Cost

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

**Total Cost/year**    \$ 44,513.41

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# Lighting Redesign

## LED Initial Investment

Lamp Type	Lamps /Room	Rooms	Lamps	\$/Lamp + Install	Cost (\$)
Par20 LED	8	168	1344	\$ 92.00	\$ 123,648.00
Par16 LED	8	168	1344	\$ 72.00	\$ 96,768.00
Total Lamp Cost					\$ 220,416.00

Key Card System, \$100/Room
\$ 16,800.00

Total Initial Investment
\$ 237,216.00

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# Lighting Redesign

## Operating Costs

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

\*Included in annual replacement cost

<sup>^</sup>per year for 17 years

Payback Period (yrs)

2.37

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## Analysis 3: Water Management

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## Goals

Increase use of native plants

Utilize rainwater collection for irrigation

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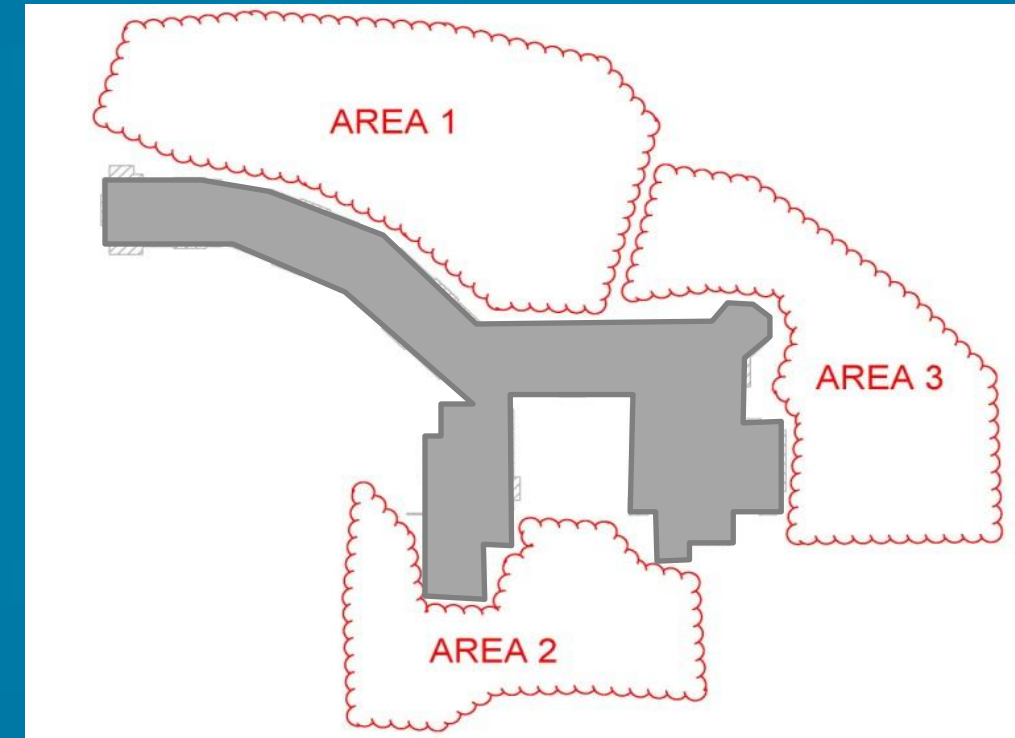
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# Water Management



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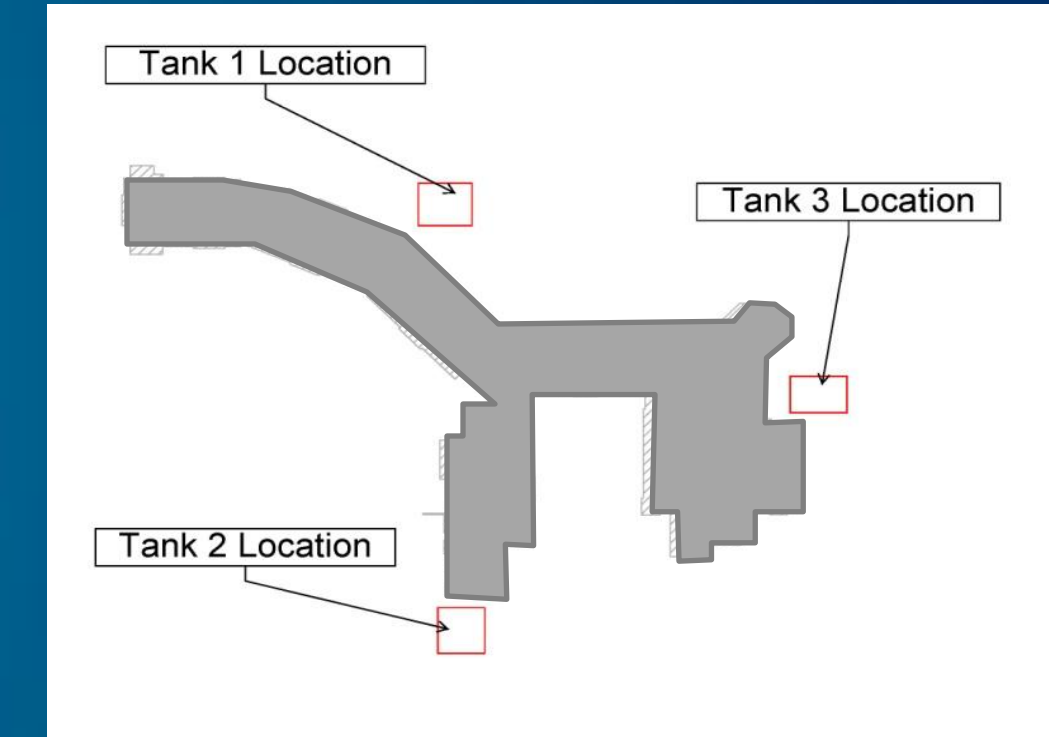
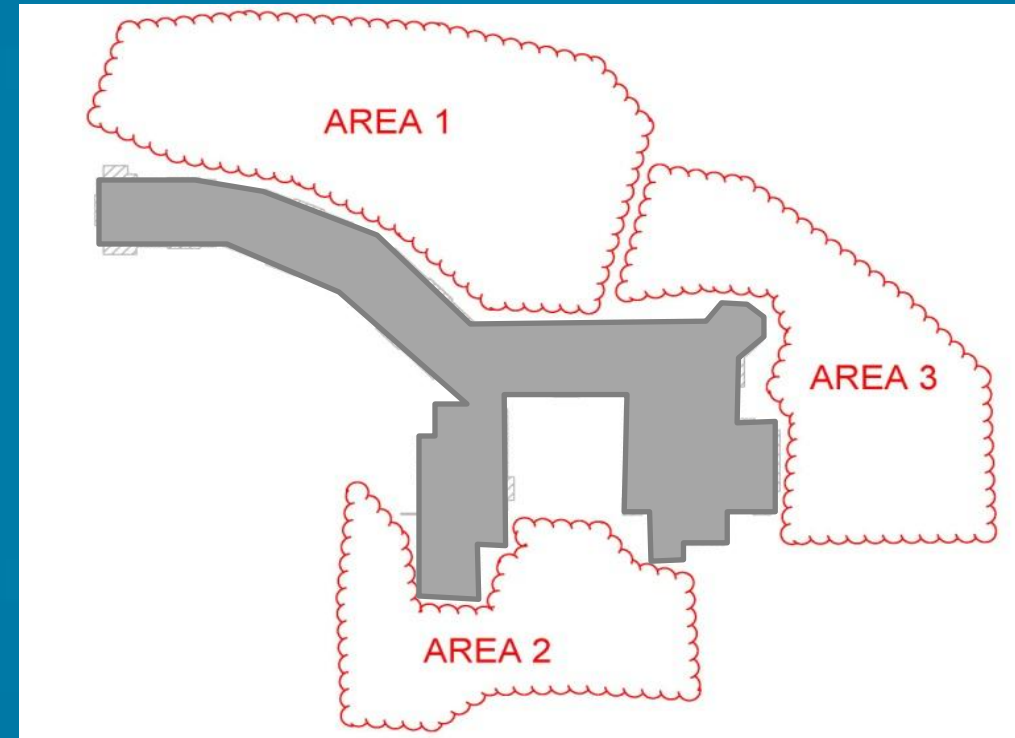
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# Water Management





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# Water Management

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

Assume .75 in/week natural rainfall

$$\text{Gallons/week} = .6 \times \text{area (sq. ft.)}$$

$$\text{Collectable rainwater (gal)} = .5 \times \text{rainfall (in)} \times \text{area (sq. ft.)}$$

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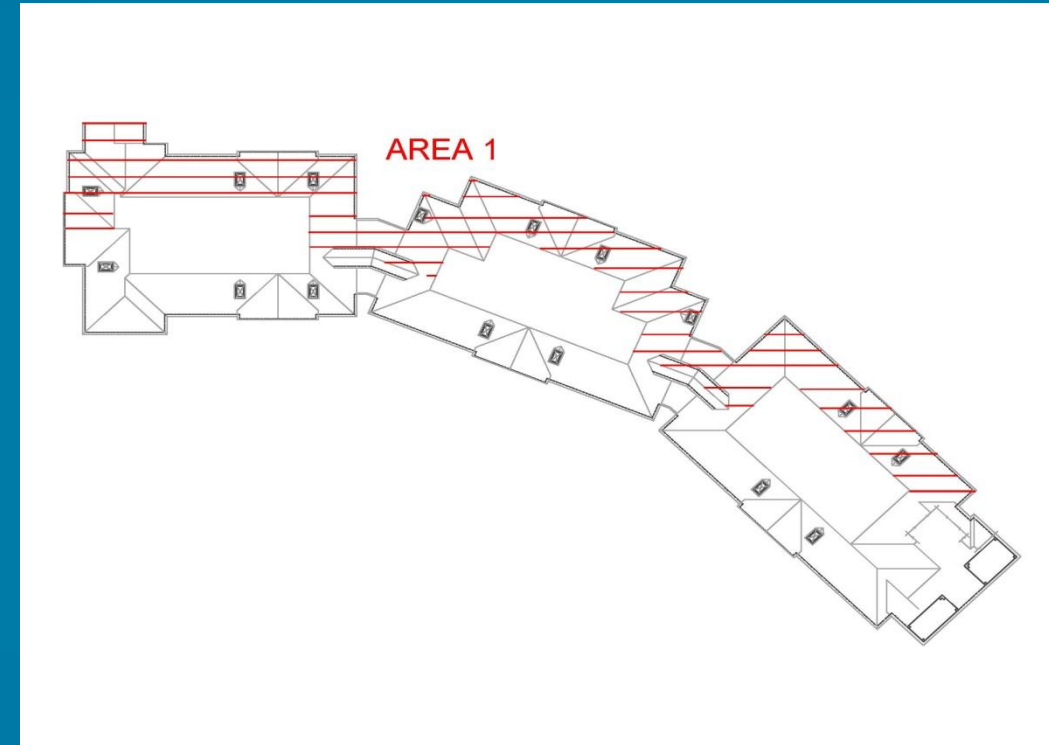
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# Water Management



Area 1: (4) 1200 gallon tanks

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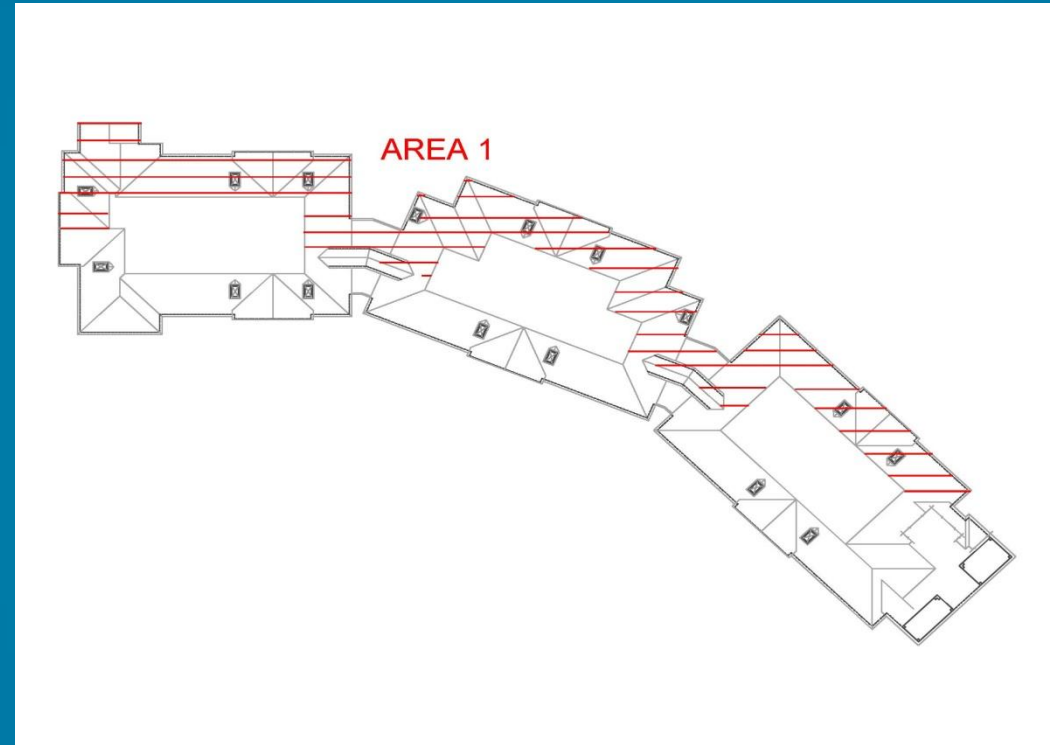
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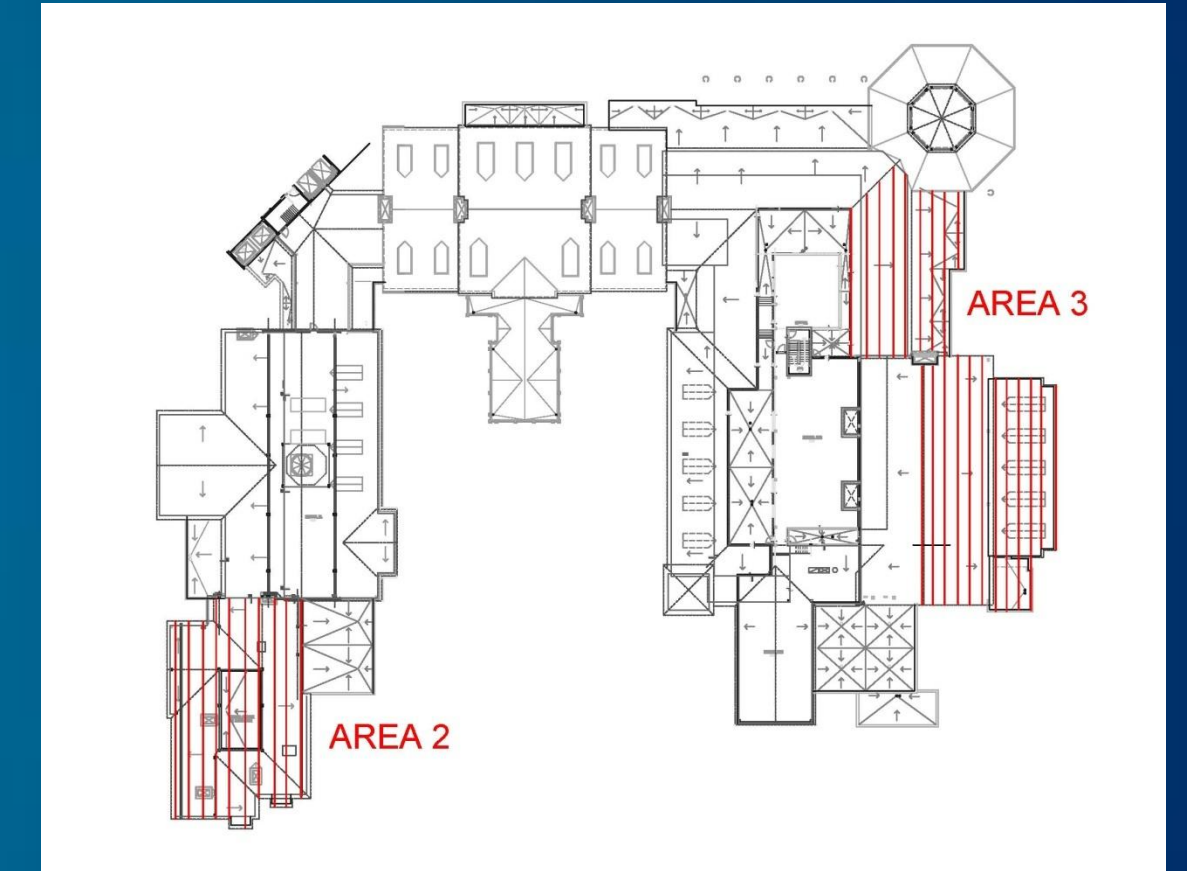


# Water Management



Area 1: (4) 1200 gallon tanks

Area 2: (2) 1200 gallon tanks



Area 3: (2) 1700 gallon tanks

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# Water Management

## Cost Analysis

Tank Size	Quantity	Price/each	Cost
1200 Gallons	6	\$ 2,900.00	\$ 17,400.00
1700 Gallons	2	\$ 3,600.00	\$ 7,200.00
Total			\$ 24,600.00

Equipment	Price (\$)
Pump, Goulds 3656/Motor 3600 RPM	2400
1 kVa Transformer	320
Variable Frequency Drive, ACS550	2000
Exhasut Fan, 1320 CFM	80
Pressure Transducer	150
GB6 Electronic Controller, Tekleen	1000
Backwash Filter	300
Total	6250

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# Water Management

## Cost Analysis

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1700 Gallons	2	\$ 3,600.00	\$ 7,200.00
Total			\$ 24,600.00

Equipment	Price (\$)
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Variable Frequency Drive, ACS550	2000
Exhasut Fan, 1320 CFM	80
Pressure Transducer	150
GB6 Electronic Controller, Tekleen	1000
Backwash Filter	300
Total	6250

## Additional Cost

\$ 18,350.00

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# Conclusion

Analysis 1: Schedule Deceleration

Over \$250,000 in savings

Analysis 2: Guest Room Lighting Redesign

Payback period: 2.37 years  
Annual savings: over \$100,000

Analysis 3: Water Management

\$18,000 cost  
Increased sustainability

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# Acknowledgements

- Penn State AE Faculty
- Turner Construction
- Salamander Hospitality
- Industry members at PACE 2009
- Fellow AE students

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