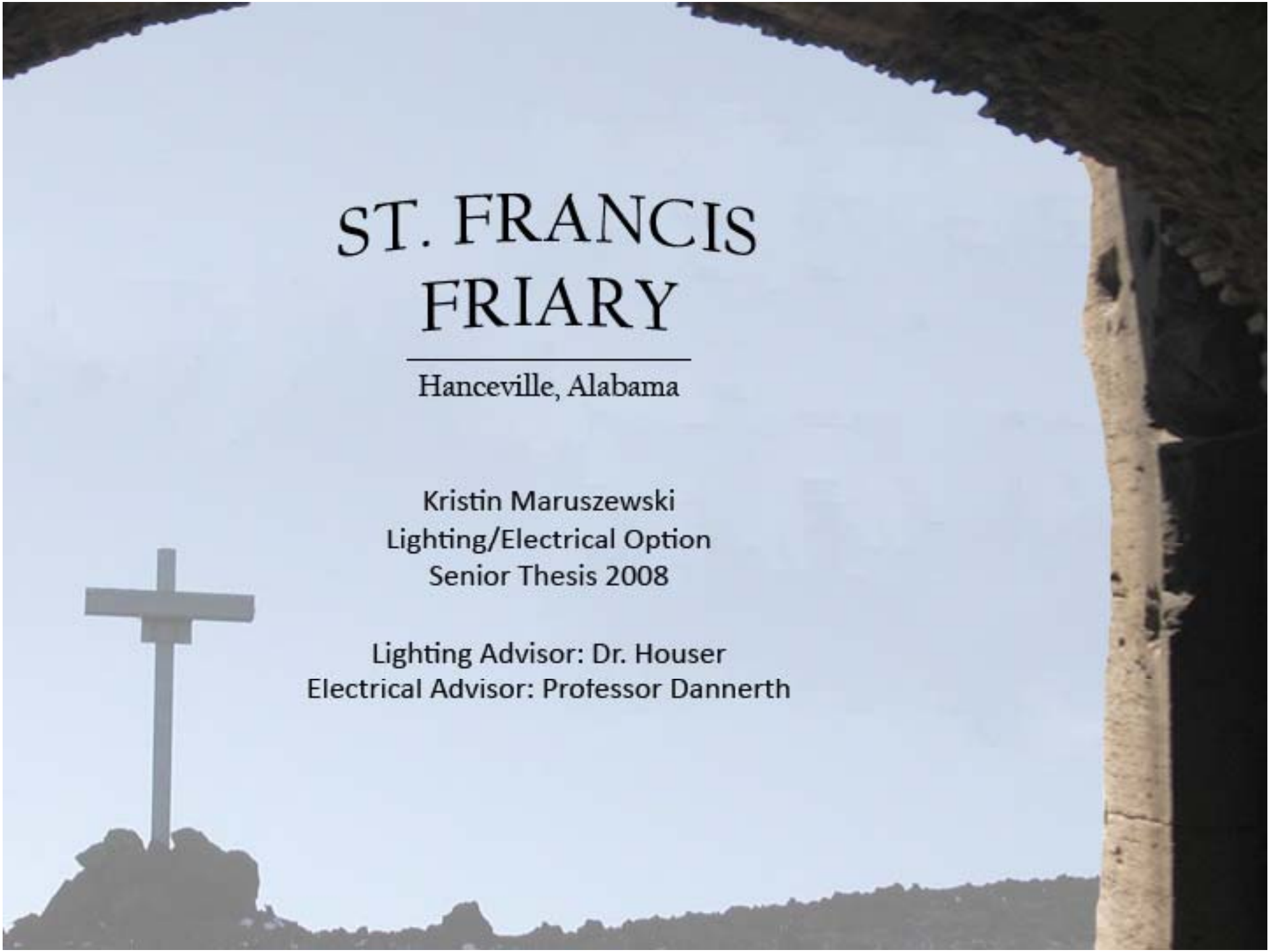


ST. FRANCIS FRIARY

Hanceville, Alabama

Kristin Maruszewski
Lighting/Electrical Option
Senior Thesis 2008

Lighting Advisor: Dr. Houser
Electrical Advisor: Professor Dannerth

BUILDING OVERVIEW

BUILDING: St. Francis Friary

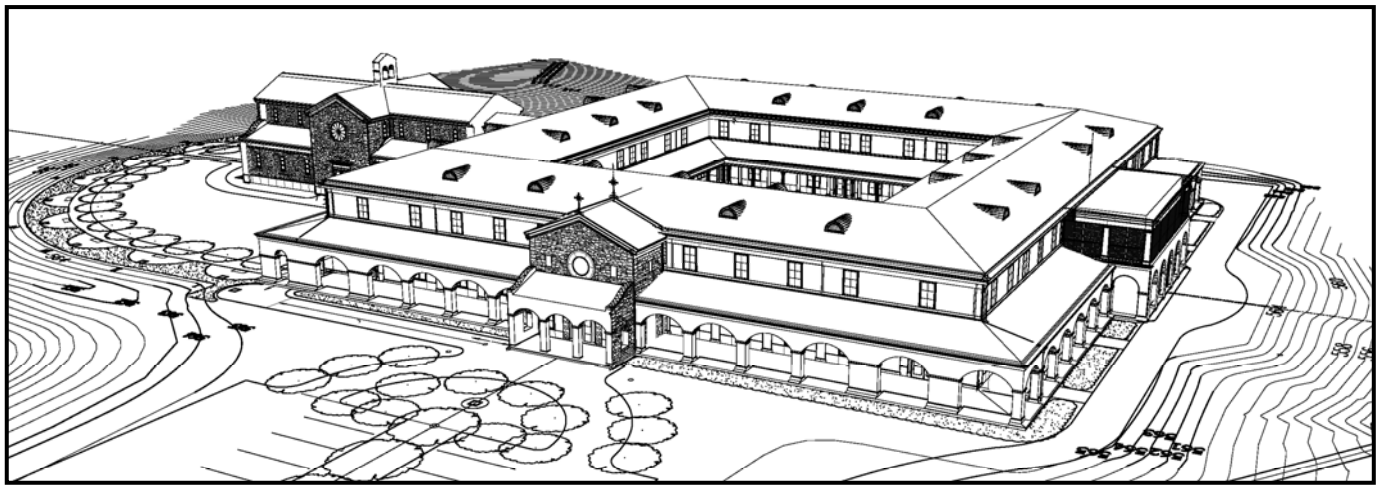
LOCATION: Hanceville, Alabama

SIZE: 59,900 square feet, 2 floors above grade

OCCUPANT: Archdiocese

ARCHITECT: Franck, Lohsen, McCrery Architects

ENGINEERS: Spiegel, Zamecnik, & Shah Inc. (S)
Meta Engineers (MEP)



Rendering courtesy of Franck, Lohsen, McCrery Architects

PRESENTATION OUTLINE

MAIN PROJECT GOAL:

To meet the desires of the client while silently honoring nature by enhancing the natural materials of the project and minimizing the project's impact on the environment.

LIGHTING DEPTH:

Chapel Lighting Design
Courtyard Lighting Design

MECHANICAL BREADTH:

Geothermal Heat Pump System

ELECTRICAL DEPTH:

Copper feeders vs. Aluminum feeders

CONCLUSIONS

QUESTIONS?

LIGHTING DEPTH

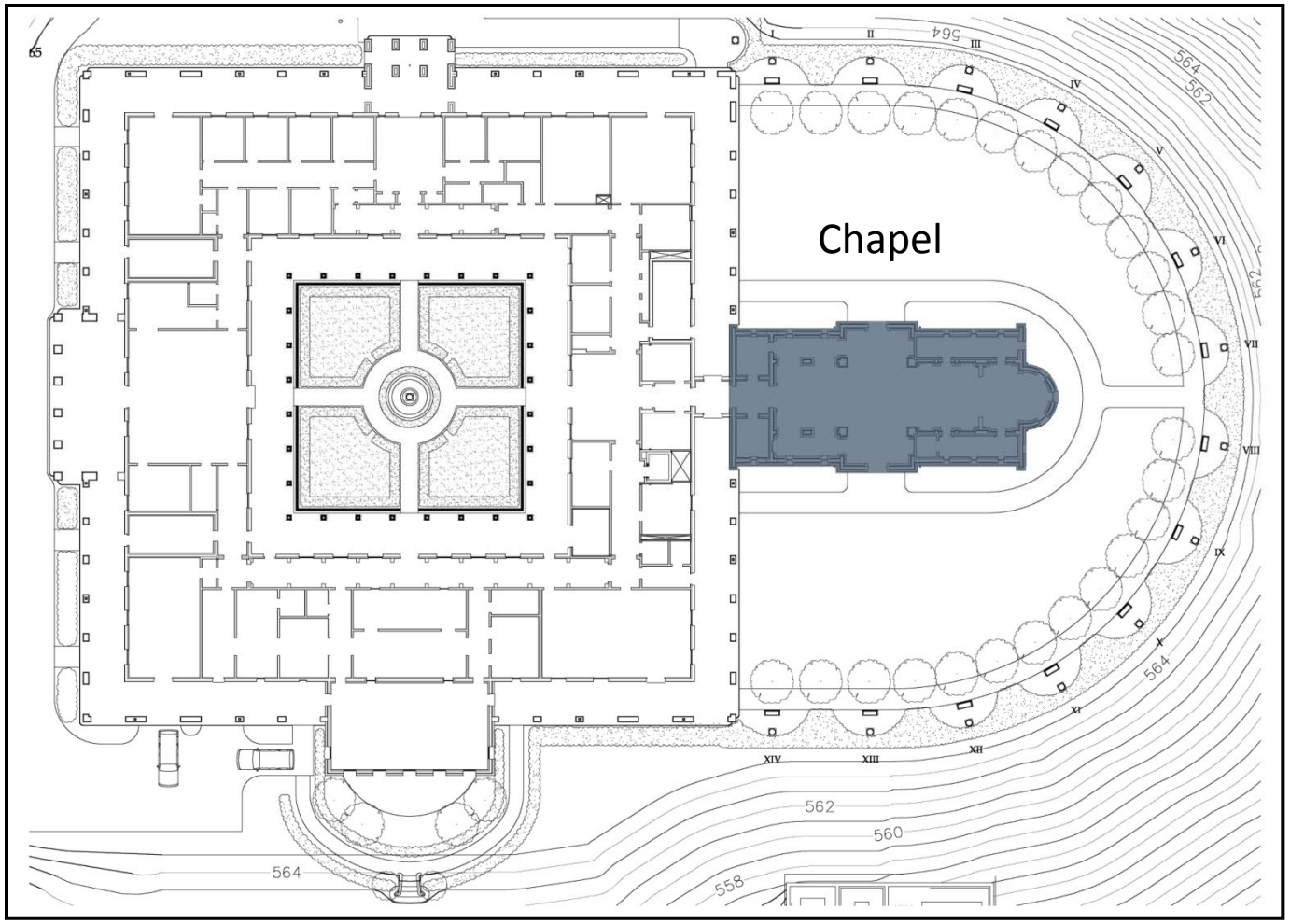
RESPONSE TO MAIN GOAL:

To silently honor nature by enhancing the natural elements of each space.

CHAPEL

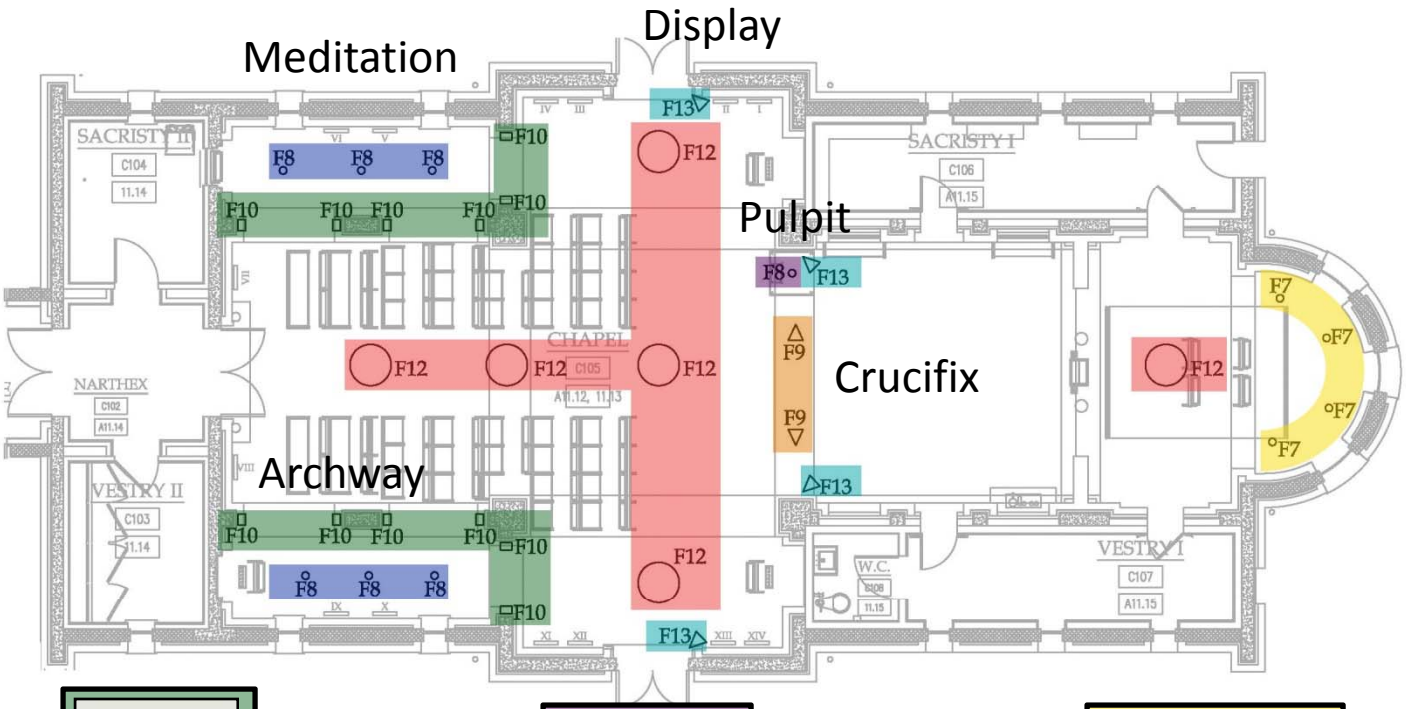
COURTYARD

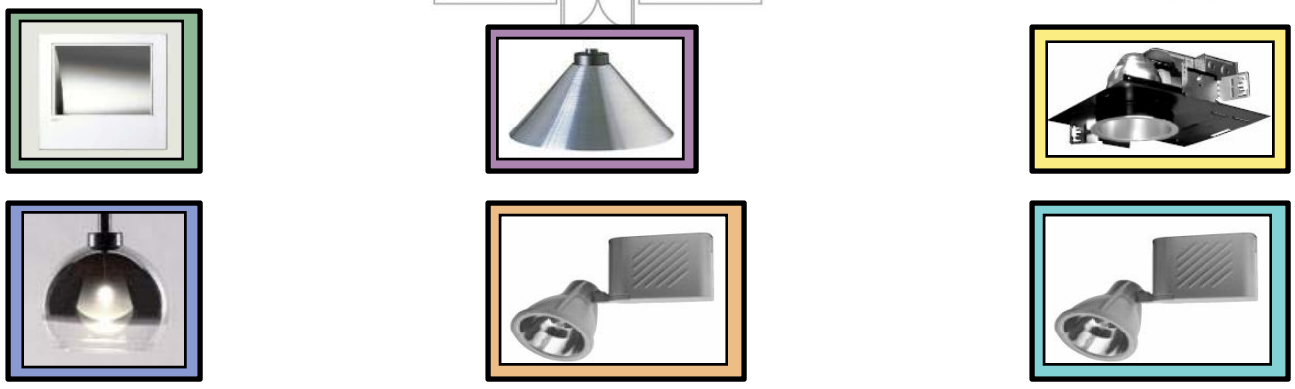
CHAPEL: LOCATION



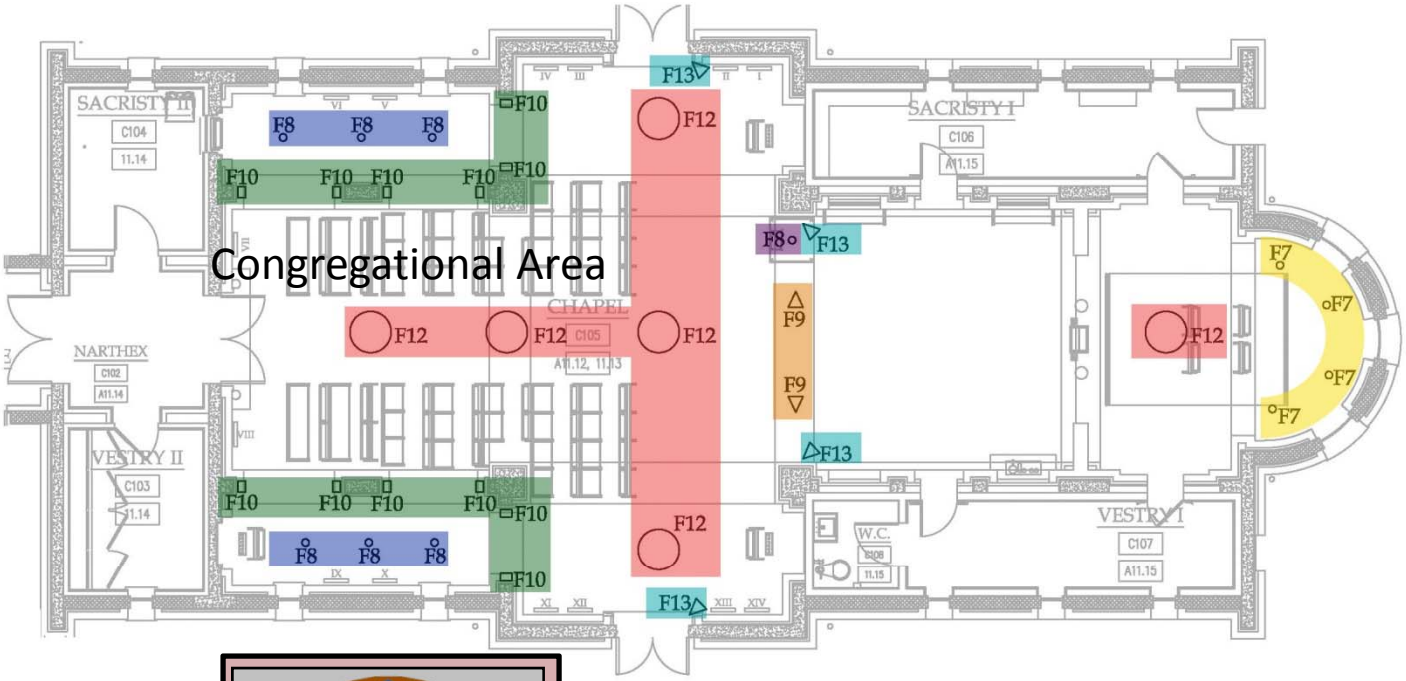
CHAPEL: LIGHTING LAYOUT

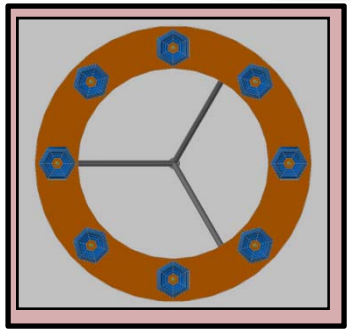
ST FRANCIS FRIARY

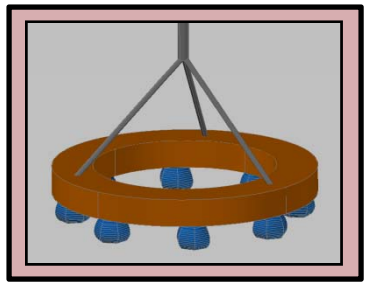




CHAPEL: LIGHTING LAYOUT





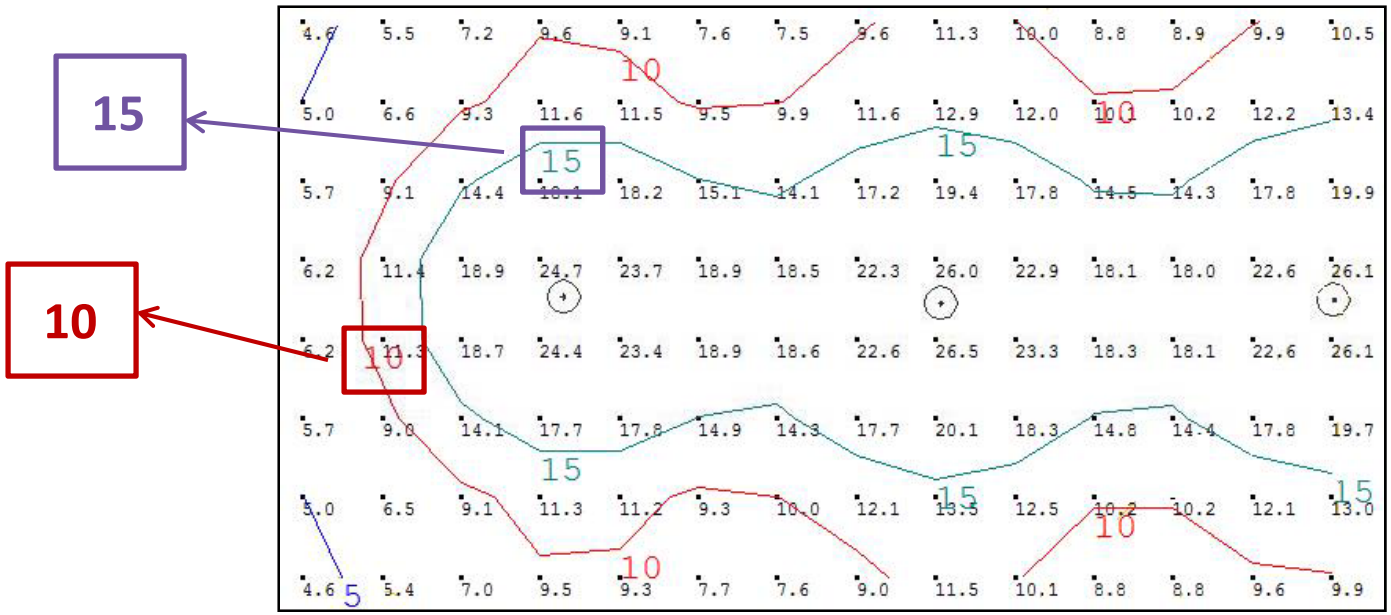


CHAPEL: CALCULATION GRIDS

ST FRANCIS FRIARY

CALC GRID	AVERAGE ILLUMINANCE	RECOMMENDED ILLUMINANCE	
CONGREGATION	13.56 FC	10 FC	OK

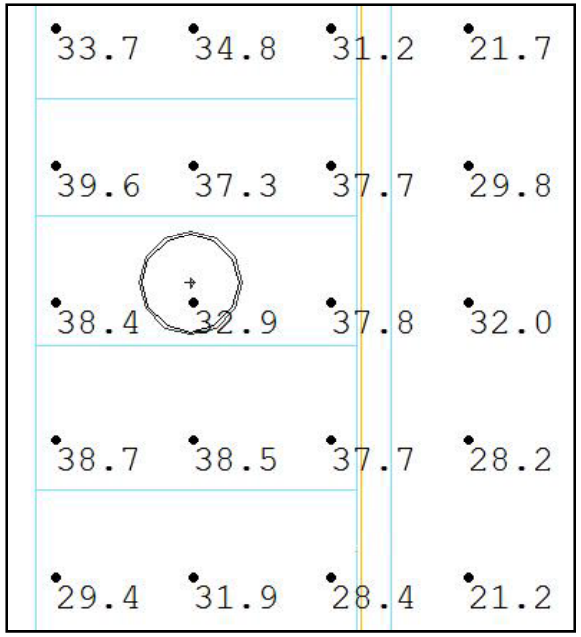
Recommended values obtained from IESNA Handbook.



CHAPEL: CALCULATION GRIDS

CALC GRID	AVERAGE ILLUMINANCE	RECOMMENDED ILLUMINANCE	
PULPIT	33.05 FC	30 FC	OK

Recommended values obtained from IESNA Handbook.



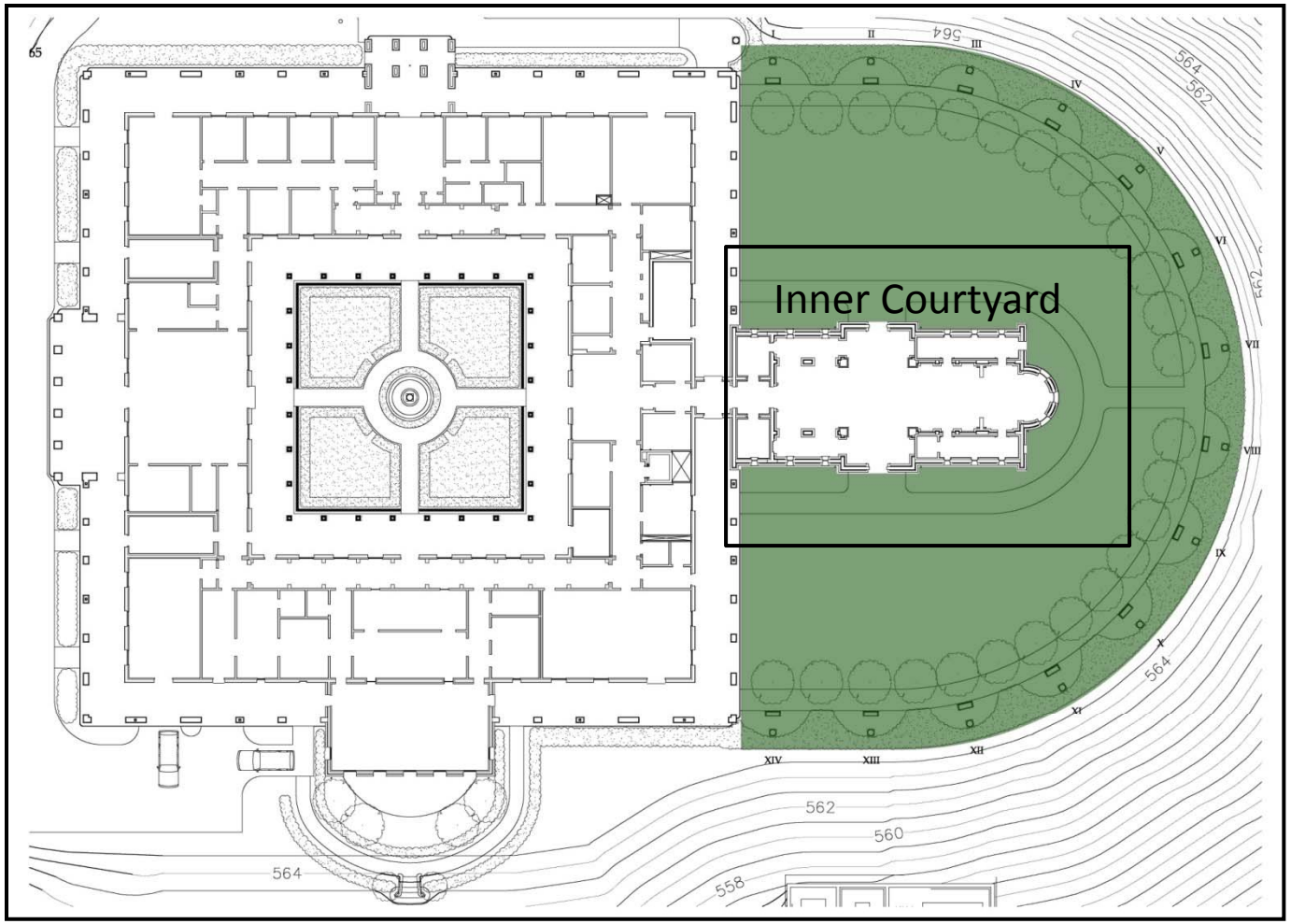
- The illuminance levels obtained at the pulpit meet IESNA's recommended values.
- The lighting condition allows for performance of visual tasks with high contrast.

CHAPEL: RENDERINGS

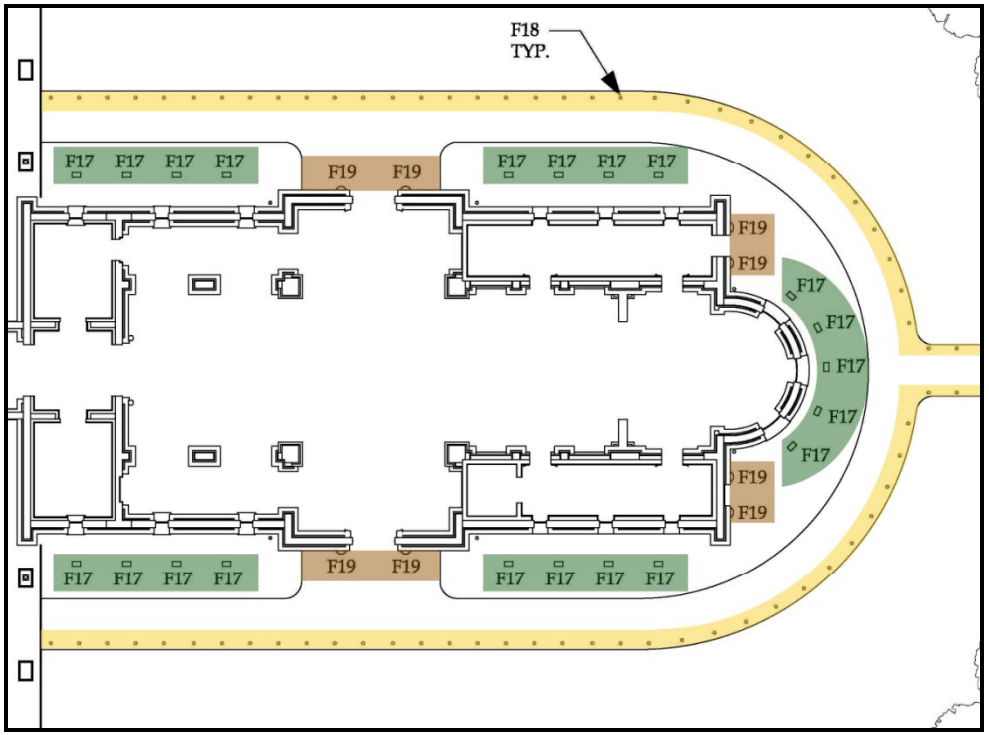
CHAPEL: RENDERINGS

CHAPEL: RENDERINGS

COURTYARD: LOCATION

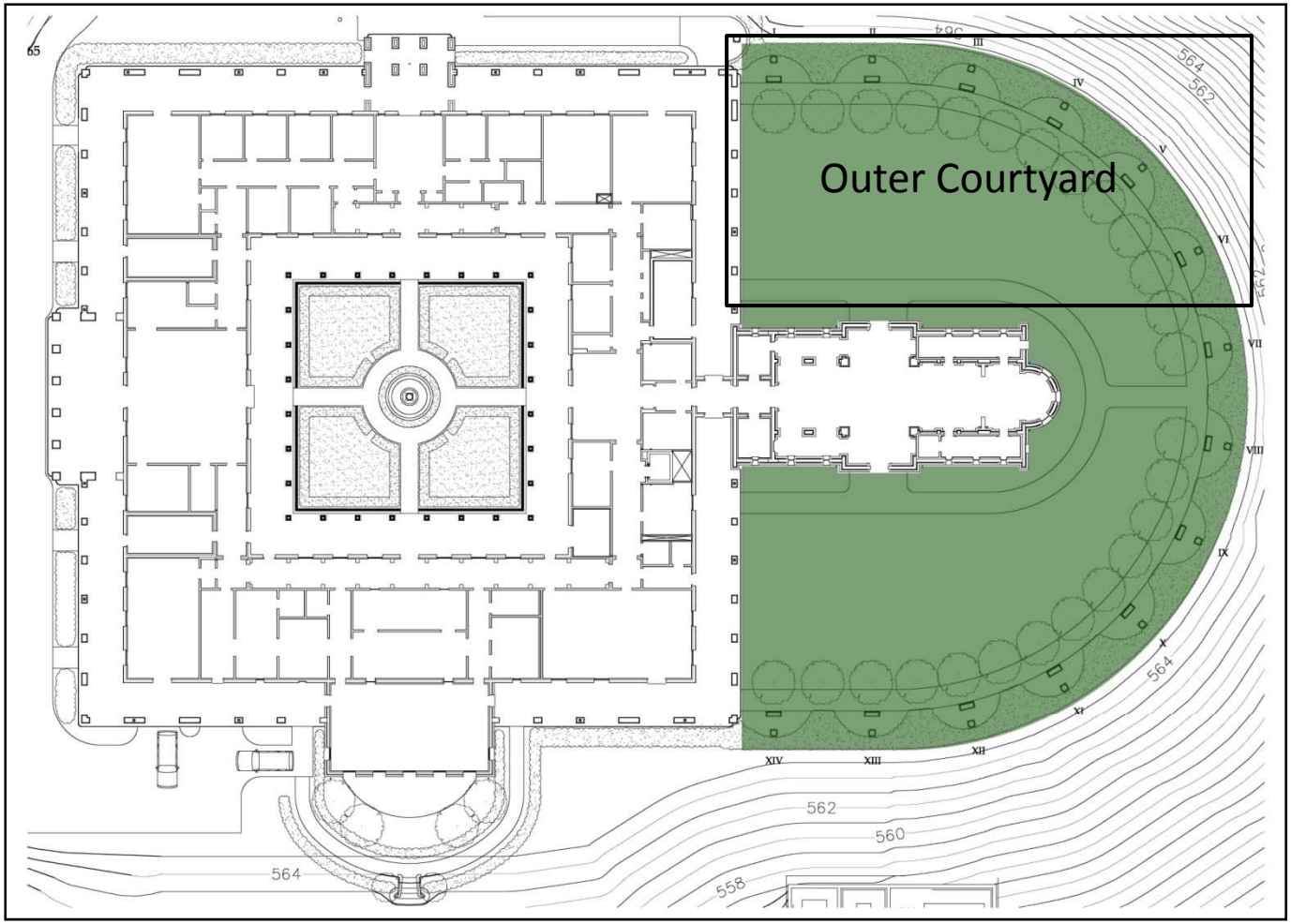


COURTYARD: LIGHTING LAYOUT

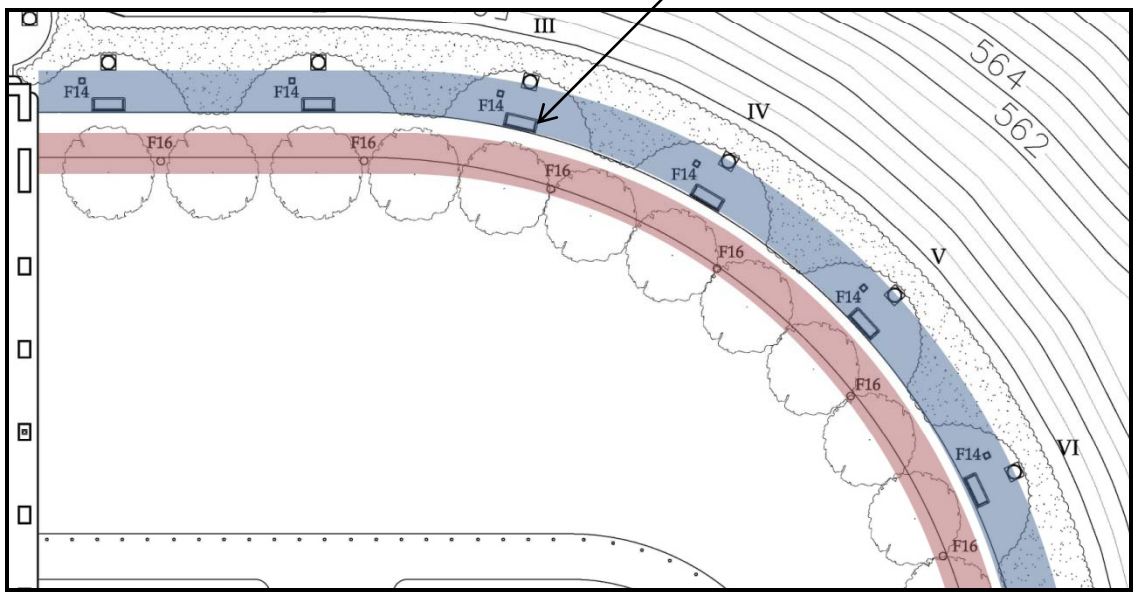


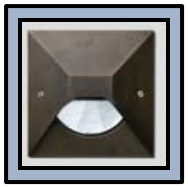
- Flood Light to wash 1st story facade
- In-ground LEDs line path to mimic candles
- Wall sconce to mark key entryways

COURTYARD: LOCATION



COURTYARD: LIGHTING LAYOUT





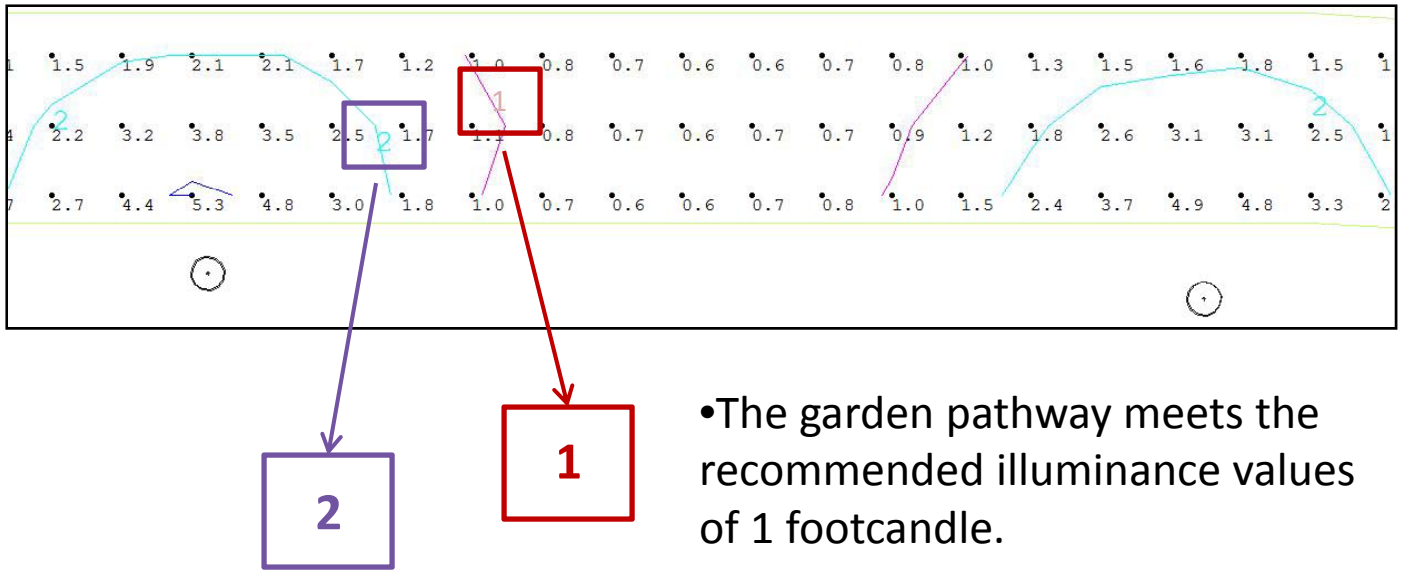
In-ground fixture to spot light statues of stations of the cross

Pole fixture to provide ambient light for pathway

COURTYARD: RENDERINGS

CALC GRID	AVERAGE ILLUMINANCE	RECOMMENDED ILLUMINANCE	
WALKWAY	1.63 FC	1.0 FC	OK

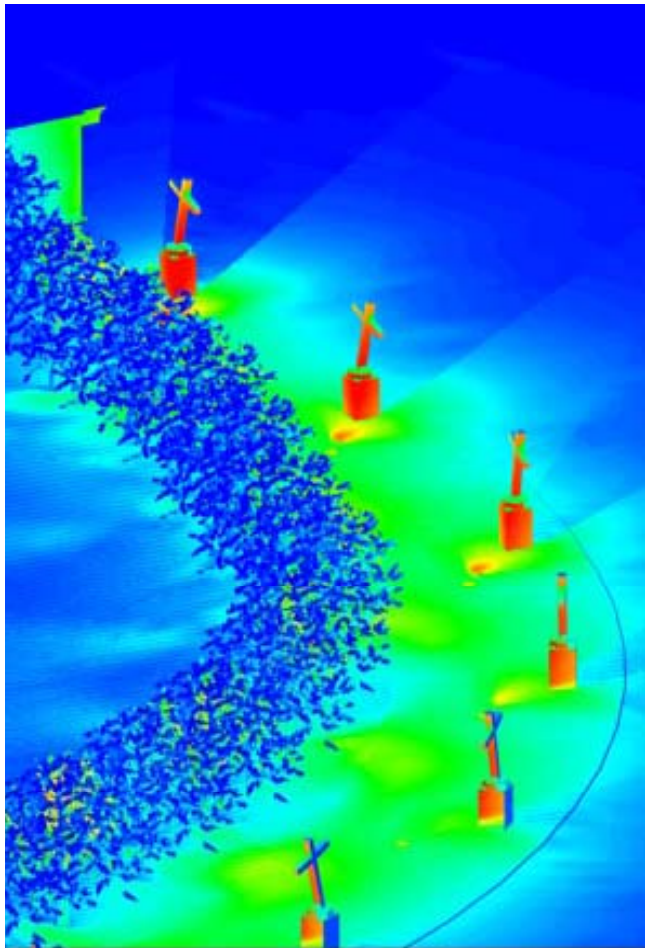
Recommended values obtained from IESNA Handbook.



- The garden pathway meets the recommended illuminance values of 1 footcandle.

COURTYARD: FACADE

COURTYARD: PATHWAY



COURTYARD: RENDERINGS

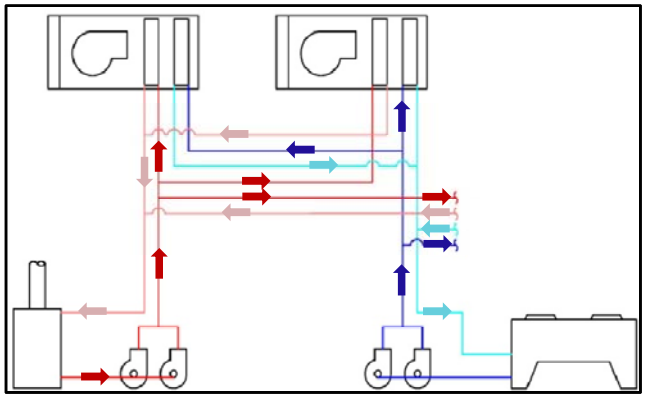
ST FRANCIS FRIARY

MECHANICAL BREADTH

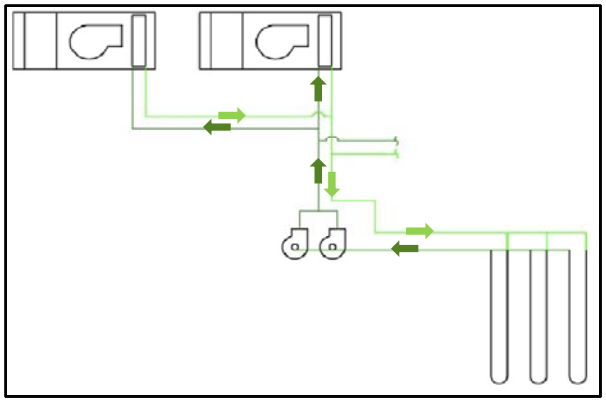
RESPONSE TO MAIN GOAL:

To silently honor nature by minimizing impact on the environment

FCU/AIR HANDLING UNITS

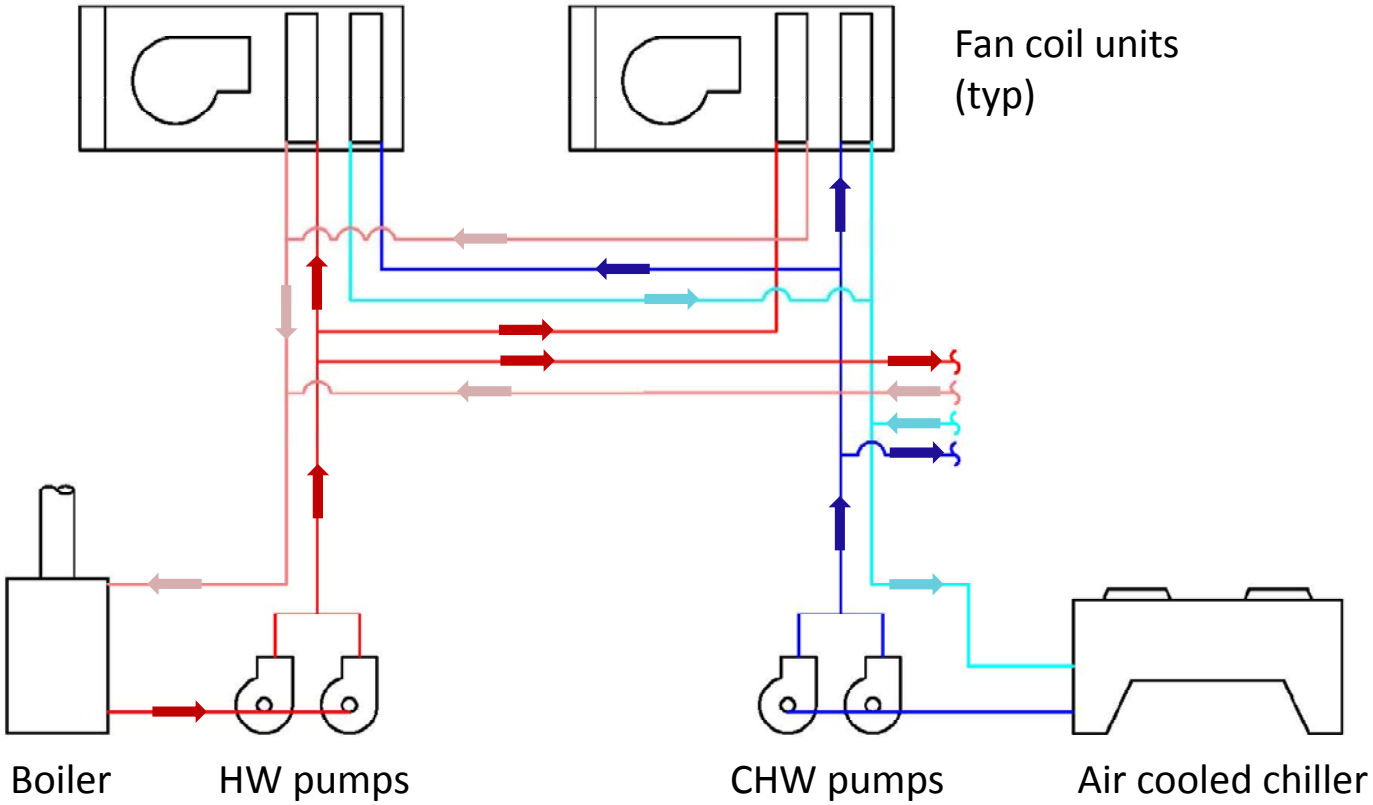


GEOTHERMAL HEAT PUMPS



EXISTING SYSTEM

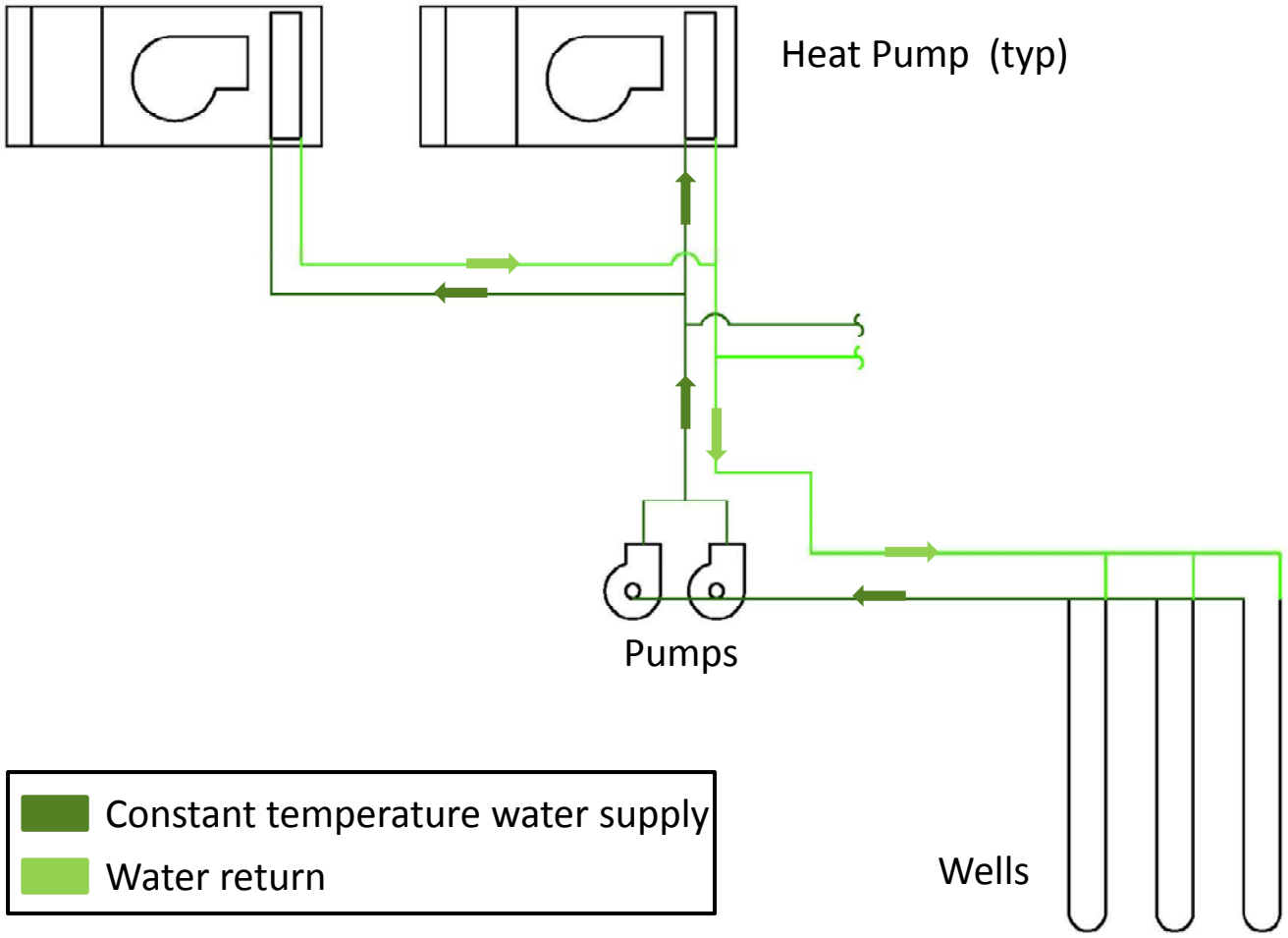
Four Pipe Fan Coil/Air Handling System



ST FRANCIS FRIARY

PROPOSED SYSTEM

Water to Water Geothermal Heat Pump System



ENERGY SAVINGS, EMISSIONS REDUCTIONS

ST FRANCIS FRIARY

	COOLING	HEATING	AUXILIARY	TOTAL
ORIGINAL	247,252.2 KWH/YR	3,880 KWH/YR	39,208.3 KWH/YR	290,340.5 KWH/YR
REDESIGN	164,843.7 KWH/YR	960.5 KWH/YR	0 KWH/YR	174,449.4 KWH/YR
			ENERGY SAVINGS	**40%**

40% decrease in yearly energy consumption

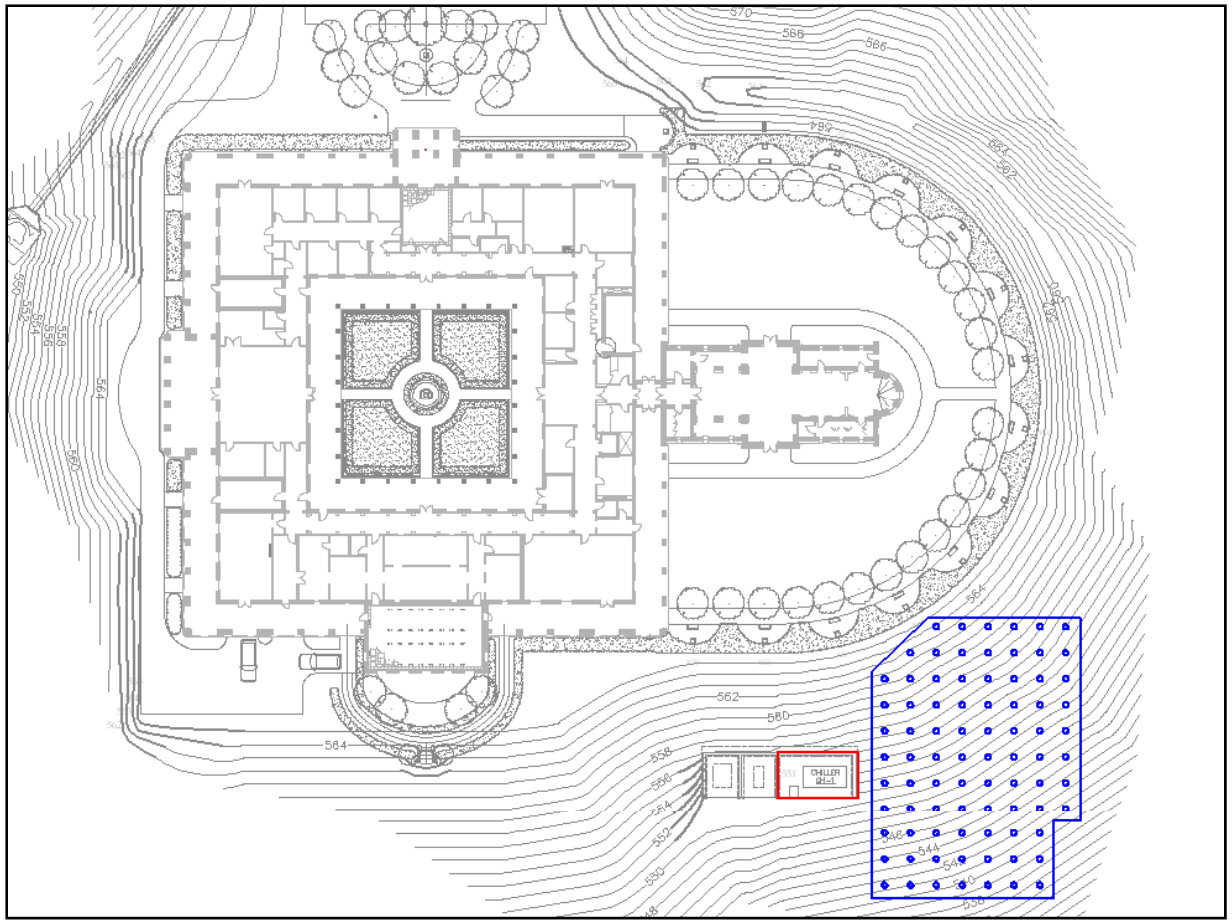
	ENERGY CONSUMPTION	UTILITY RATE	TOTAL COST/YR
ORIGINAL	290,340.5 KWH/YR	$0.8921/KWH	$25,901.27
REDESIGN	174,449.4 KWH/YR	$0.8921/KWH	$15,562.63
		COST SAVINGS	**$10,338.64**

$10,300 yearly savings on electricity

	ELECTRICITY DELIVERED		FUEL COMBUSTION		TOTAL		CHANGE
	ORIGINAL	REDESIGN	ORIGINAL	REDESIGN	ORIGINAL	REDESIGN	%
CO_{2e}	505,192.47	303,541.96	17.3799	0	505,209.85	303,541.95	**-60.08**
CO_2	476,158.42	286,097.02	3.2499	0	476,161.66	286,097.01	**-60.08**

60% decrease in CO_2 emissions

GEOTHERMAL WELL LOCATION



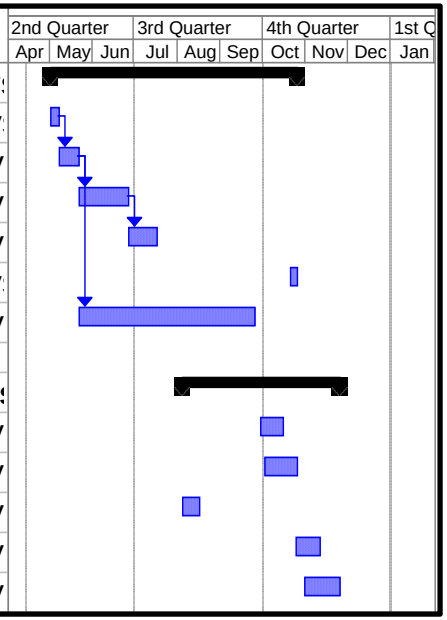
Chiller used for current mechanical system

(84)Wells for proposed geothermal system

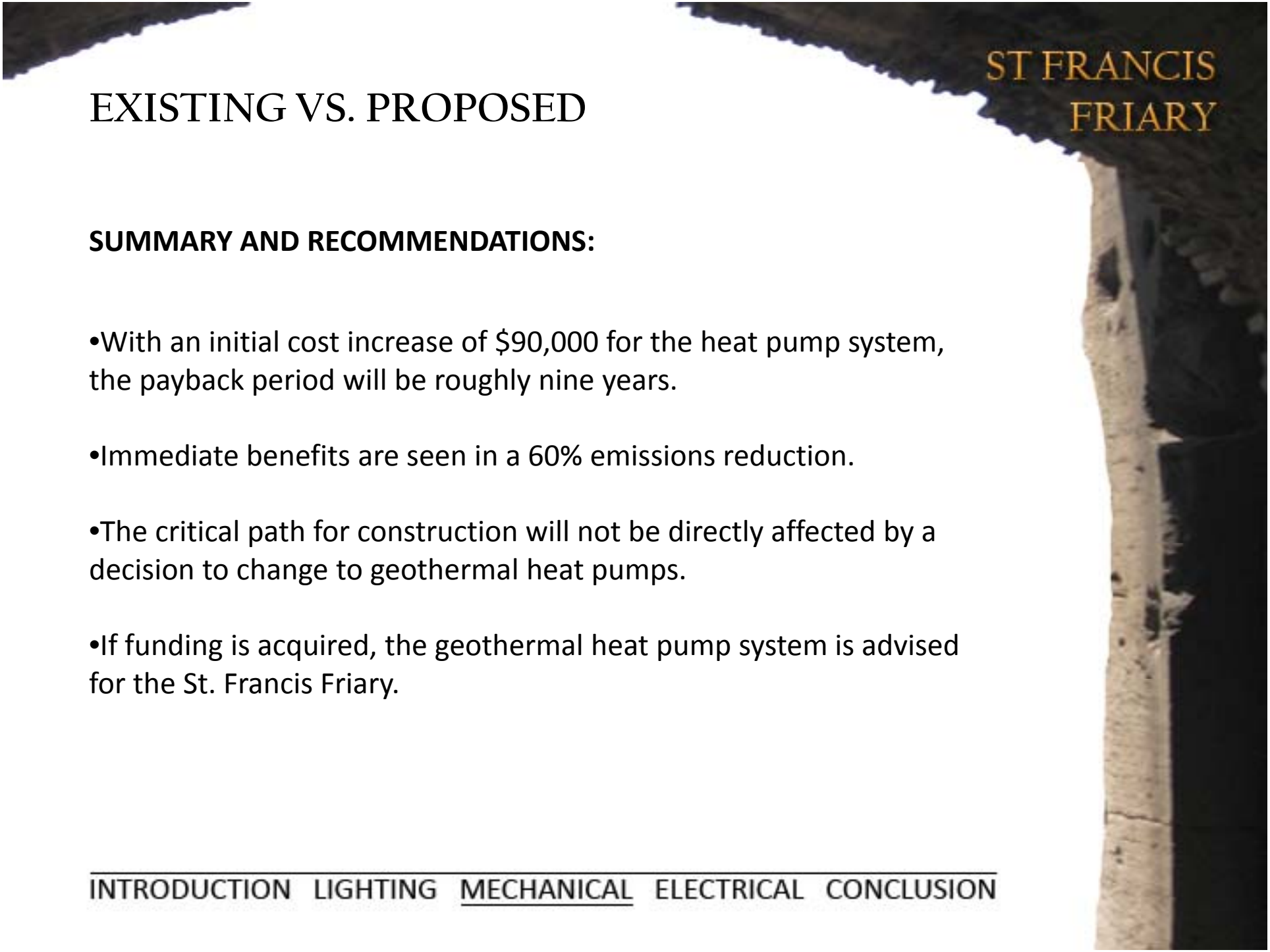
PARTIAL CONSTRUCTION SCHEDULE

ST FRANCIS FRIARY

ID	Task Name	Duration
1	**Sitework Operations**	**127 days**
2	Erosion Control	5 days
3	Bring Pad to Subgrade	10 days
4	Storm Drainage	25 days
5	Sanitary Sewer	15 days
6	Asphalt	5 days
7	**Drill Geothermal Wells**	90 days
8		
9	**Mechanical**	**81 days**
10	Lower level ductwork	12 days
11	Lower level overhead piping	17 days
12	First floor underslab ducts	10 days
13	First floor overhead ductwork	12 days
14	First Floor overhead piping	17 days



•The partial schedule above demonstrates that the addition of the geothermal wells does not adversely impact the overall construction schedule.



EXISTING VS. PROPOSED

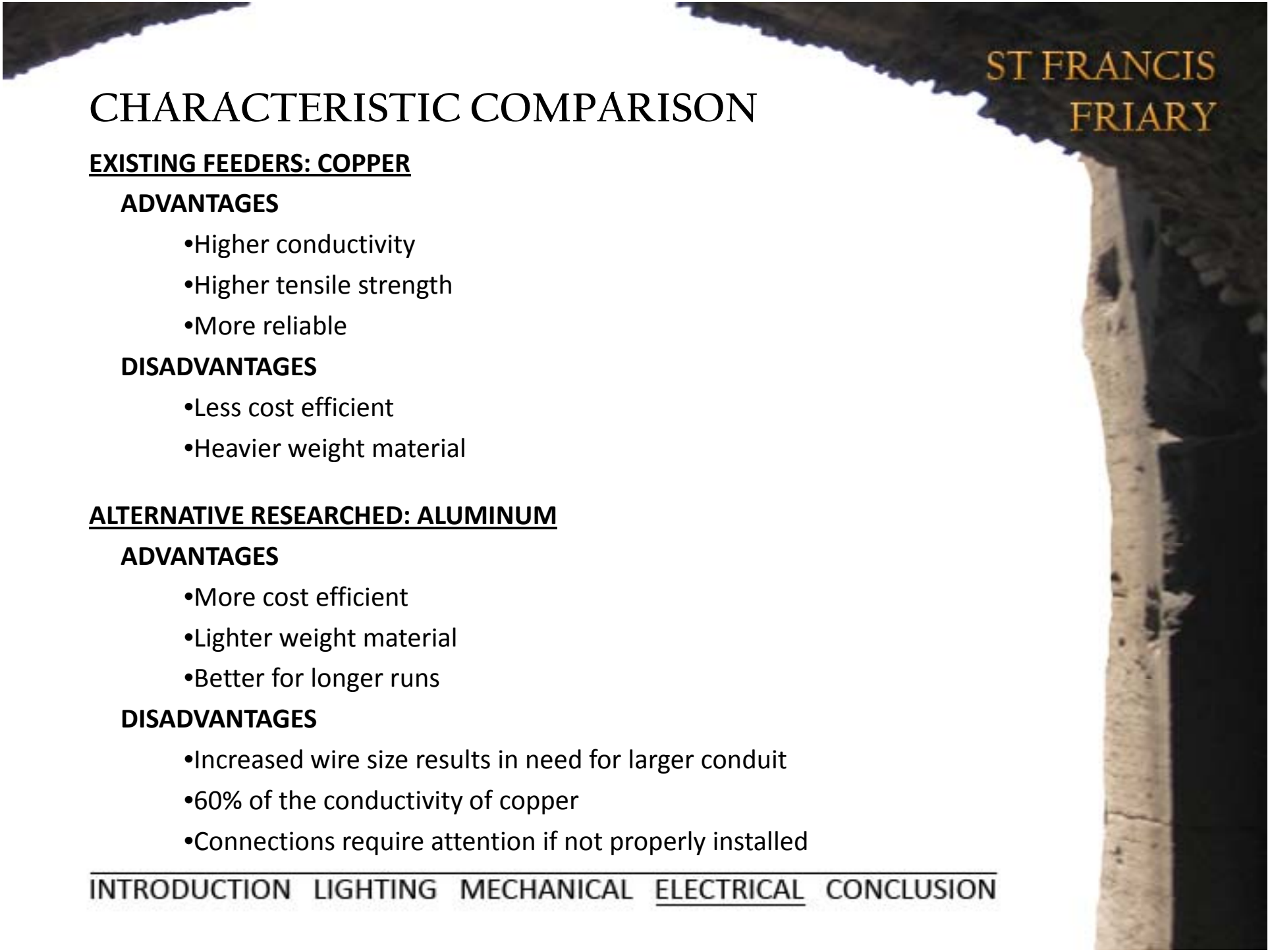
SUMMARY AND RECOMMENDATIONS:

•With an initial cost increase of $90,000 for the heat pump system, the payback period will be roughly nine years.

•Immediate benefits are seen in a 60% emissions reduction.

•The critical path for construction will not be directly affected by a decision to change to geothermal heat pumps.

•If funding is acquired, the geothermal heat pump system is advised for the St. Francis Friary.



CHARACTERISTIC COMPARISON

EXISTING FEEDERS: COPPER

ADVANTAGES

- Higher conductivity
- Higher tensile strength
- More reliable

DISADVANTAGES

- Less cost efficient
- Heavier weight material

ALTERNATIVE RESEARCHED: ALUMINUM

ADVANTAGES

- More cost efficient
- Lighter weight material
- Better for longer runs

DISADVANTAGES

- Increased wire size results in need for larger conduit
- 60% of the conductivity of copper
- Connections require attention if not properly installed

FEEDER SIZING COMPARISON

ST FRANCIS FRIARY

			COPPER				ALUMINUM			
TO	OCPD	LENGTH (FT)	NO OF SETS	PHASE/ NEUTRAL	GROUND	CONDUIT	NO OF SETS	PHASE/ NEUTRAL	GROUND	CONDUIT
MDP	2000	85	6	400 kcmil	#3	3"	7	500 kcmil	#2	3"
ELEV	350	60	1	500 kcmil	#3	3"	2	4/O	#4	2"
TROUGH	400	10	2	3/O	#6	2"	2	250 kcmil	#4	2 1/2"
L1NE	200	125	1	3/O	#6	2"	1	250 kcmil	#4	2 1/2"
LB1	225	15	1	4/O	#4	2"	1	300 kcmil	#2	2 1/2"
LB2	400	126	2	3/O	#6	2"	2	250 kcmil	#4	2 1/2"
L2NE	150	160	1	3/O	#6	2"	1	4/O	#4	2"
EDP	600	20	2	350 kcmil	#4	3"	2	500 kcmil	#2	3"
EDP	600	85	2	350 kcmil	#4	3"	2	500 kcmil	#2	3"
L1SW	225	130	1	4/O	#4	2"	1	300 kcmil	#2	2 1/2"
KL-1	225	130	1	4/O	#4	2"	1	300 kcmil	#2	2 1/2"
L2W	100	90	1	#2	#8	1 1/4"	1	2/O	#6	2"
ELNE	100	160	1	#1	#8	1 1/2"	1	2/O	#6	2"
LCHAP	200	100	1	3/O	#6	2"	1	250 kcmil	#4	2 1/2"
ELSW	200	130	1	3/O	#6	2"	1	250 kcmil	#4	2 1/2"

- Feeder size increases for all aluminum phase, neutral, and ground wires.
- Conduit sizes increase.

COST COMPARISON

	COPPER	ALUMINUM
TOTAL COST	$94,684.42	$78,447.09

Cost based upon RSMeans Version 2007.

$16,237 in dollar savings

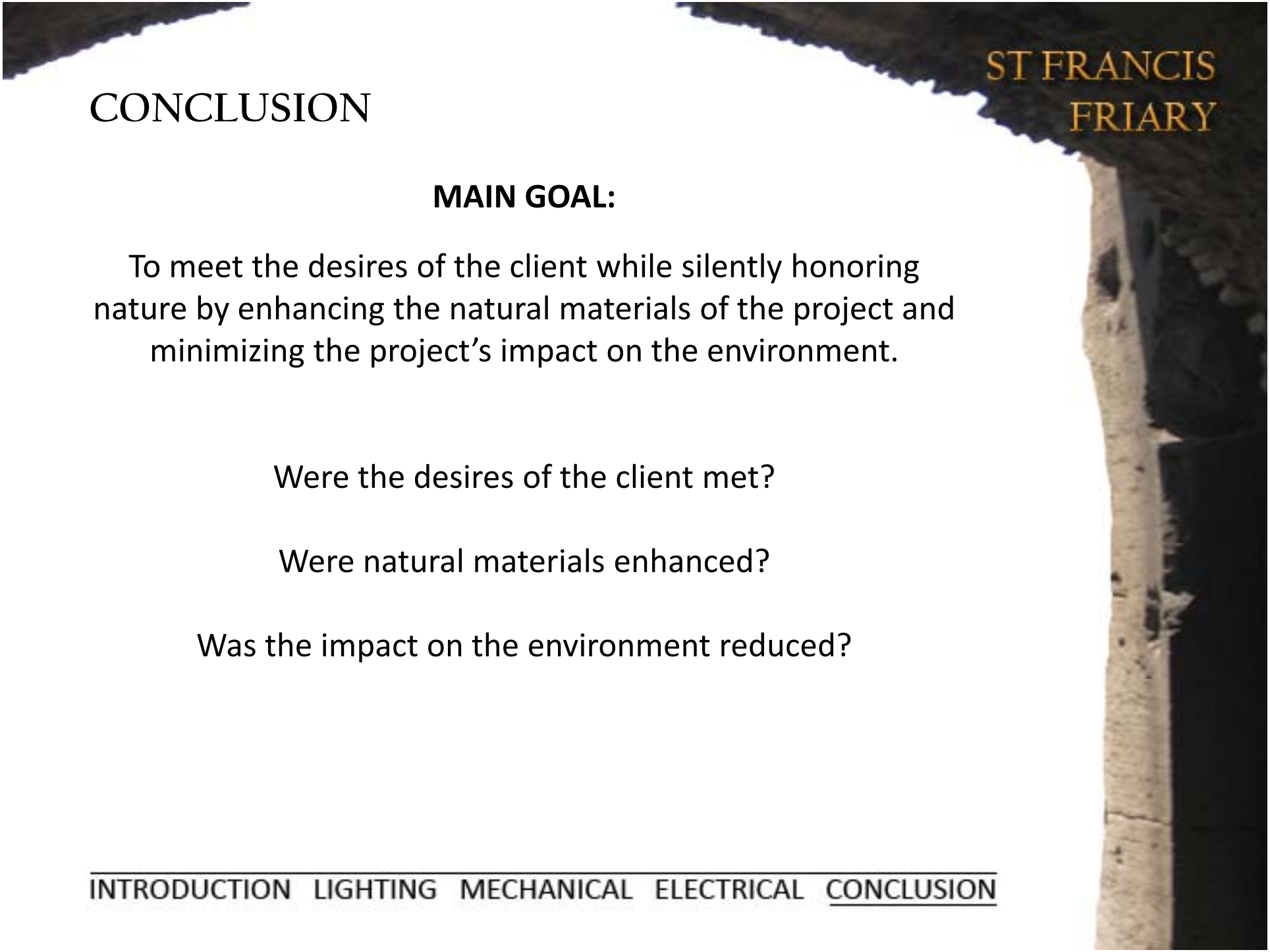
17% decrease in cost

SUMMARY AND RECOMMENDATION:

•With a 17% decrease in cost, this system will be advised for the St. Francis Friary.

•This cost will help to offset the additional costs for the geothermal system.

•To minimize maintenance issues, proper care should be taken during installation, especially at connections.



CONCLUSION

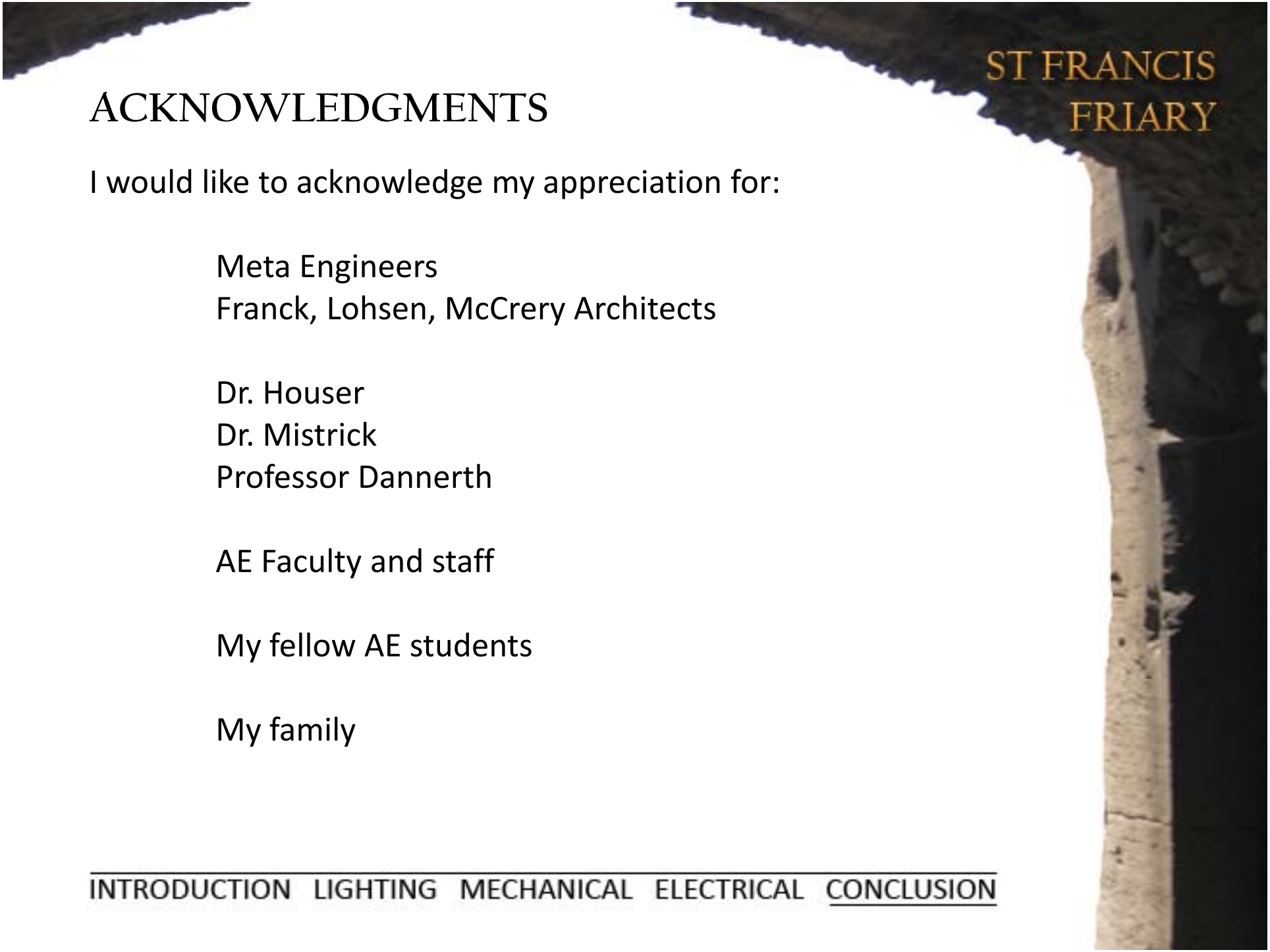
MAIN GOAL:

To meet the desires of the client while silently honoring nature by enhancing the natural materials of the project and minimizing the project's impact on the environment.

Were the desires of the client met?

Were natural materials enhanced?

Was the impact on the environment reduced?



ACKNOWLEDGMENTS

I would like to acknowledge my appreciation for:

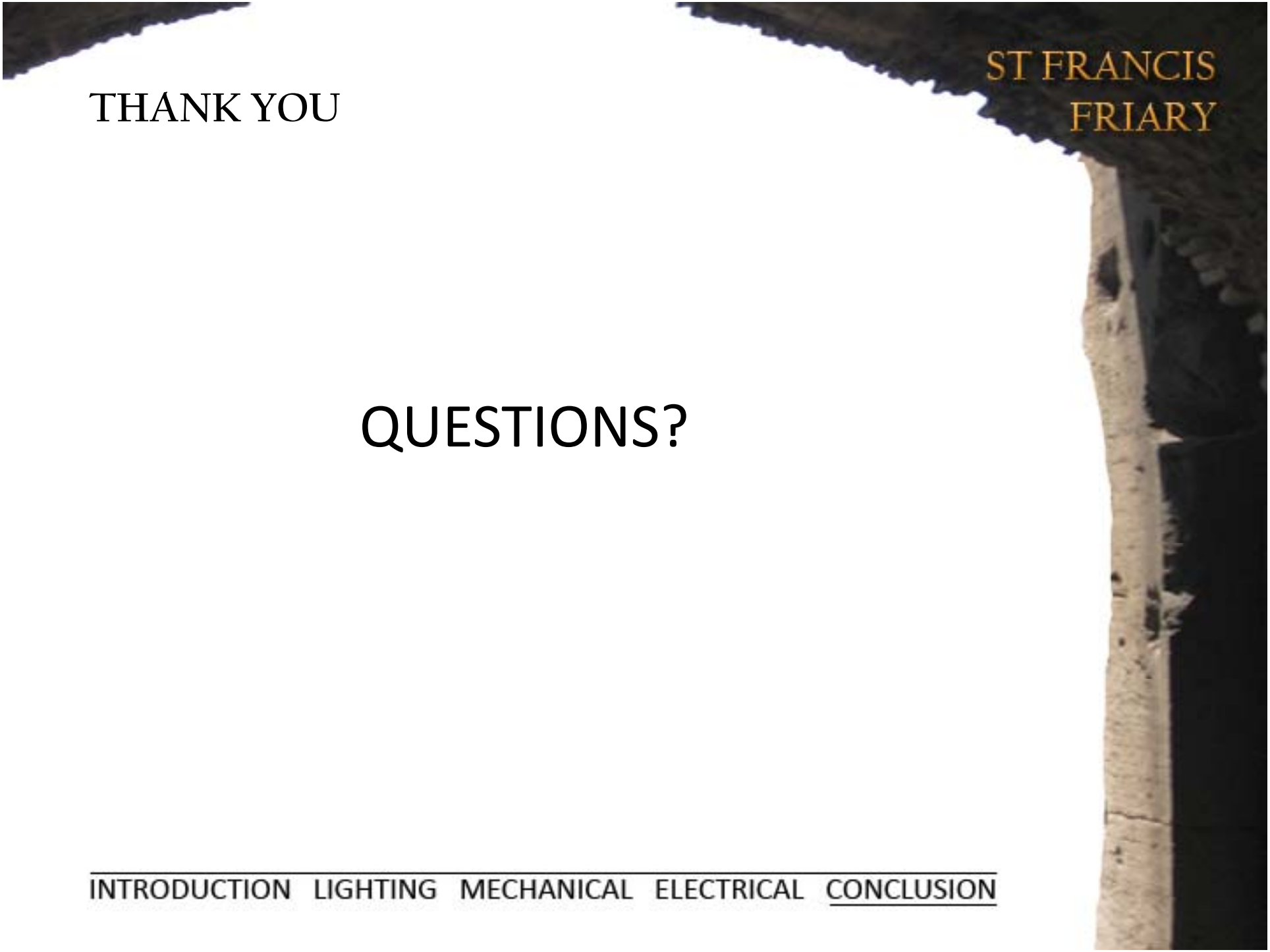
Meta Engineers
Franck, Lohsen, McCrery Architects

Dr. Houser
Dr. Mistrick
Professor Dannerth

AE Faculty and staff

My fellow AE students

My family



THANK YOU

QUESTIONS?