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Watseka Affordable Housing

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Watseka Affordable Housing Project

PROJECT 2022-07

GROUP MEMBERS - BEN SKOLEK, ALLISON WINTER, KIANA KRAHULIK, & MIKAYLA

ZAKUTANSKY

PROJECT SPONSOR - JOHN ALLHANDS

FACULTY MENTOR - JACOB CARLILE

ACKNOWLEDGEMENTS

- **Mayor John Allhands - Project Sponsor**
- **Professor Jacob Carlile - Faculty Mentor**
- **Professor Scott Ragan - Project Advisor**

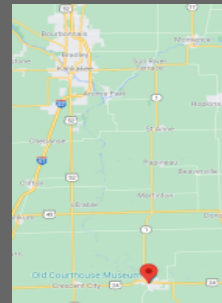
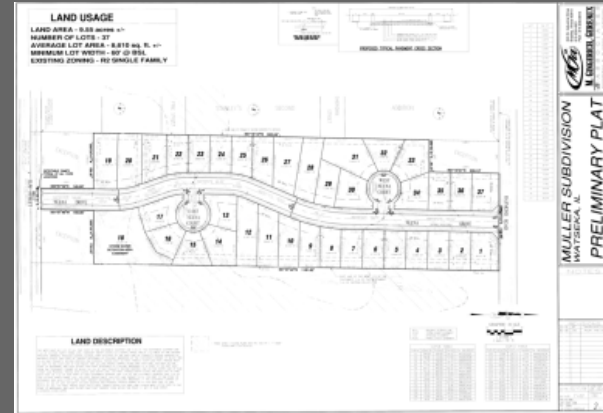
PRESENTATION OUTLINE

- Sponsor Background
 - Need Assessment
 - Site Information
- Project Breakdown
- Problem Statement & Elements
- Design Alternatives
- Final Design Solution
- Design Verification & Analysis
- Conclusion
- Questions & Answers

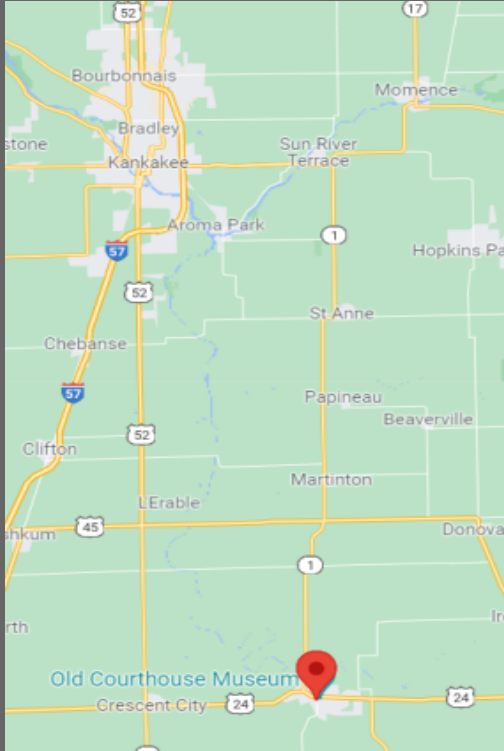


SPONSOR BACKGROUND

- The Village of Watseka
 - Mayor - John Allhands
- 2019 - Affordable Housing Project
 - Conceptual
 - Goal: Retain and attract residents



PROGRAM LOCATION

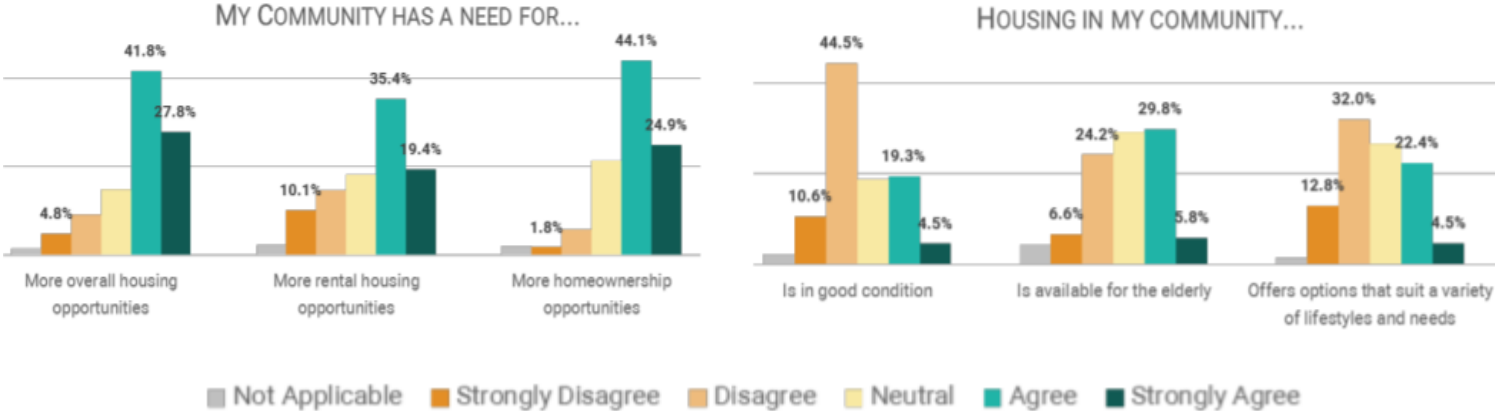


PROGRAM LOCATION (cont'd)



NEED ASSESSMENT

- Community Needs Assessment Survey
 - The Village of Watseka & Illinois Housing Development Authority (spring 2019)



PROJECT DESCRIPTION & MISSION

Students will design a small residential dwelling that will fit into the affordable housing development currently under consideration in Watseka. The design will include architectural, structural, mechanical, and electrical design.

As a team, our mission is to design and provide construction documentation for a residence that exceeds the needs of the Watseka community as a part of their affordable housing program.

DESIGN OBJECTIVES

- The residential design will ideally
 - Serve as a practical and useful housing option
 - Be functional for a variety of demographics
 - Be accessible to potential users
 - Include functional and well utilized space
 - Be durable and maintainable
 - Be conscious of material usage
 - Be safe and code compliant
 - Be aesthetic both on the exterior and the interior

FUNCTIONAL REQUIREMENTS

- **The residential design should**
 - **Keep users safe and protected from the exterior**
 - **Provide functional spaces**
 - **Provide sufficient lighting and electrical capabilities**
 - **Provides adequate thermal comfort**
 - **Adhere to ADA guidelines for user accessibility**

DESIGN CONSTRAINTS

- Budget - \$150,000 per residence (all inclusive)
- International Residential Code (IRC 2018)
- Local regulations of the Village of Watseka
- Time deadline - April 2022

THE DESIGN TEAM



Allison Winter
STRUCTURAL



Kiana Krahulik
STRUCTURAL



Ben Skolek
MECHANICAL &
ELECTRICAL



Mikayla Zakutansky
ARCHITECTURAL

Jacob Carlile
FACULTY MENTOR

Mayor John Allhands
PROJECT SPONSOR

PROJECT TIMELINE

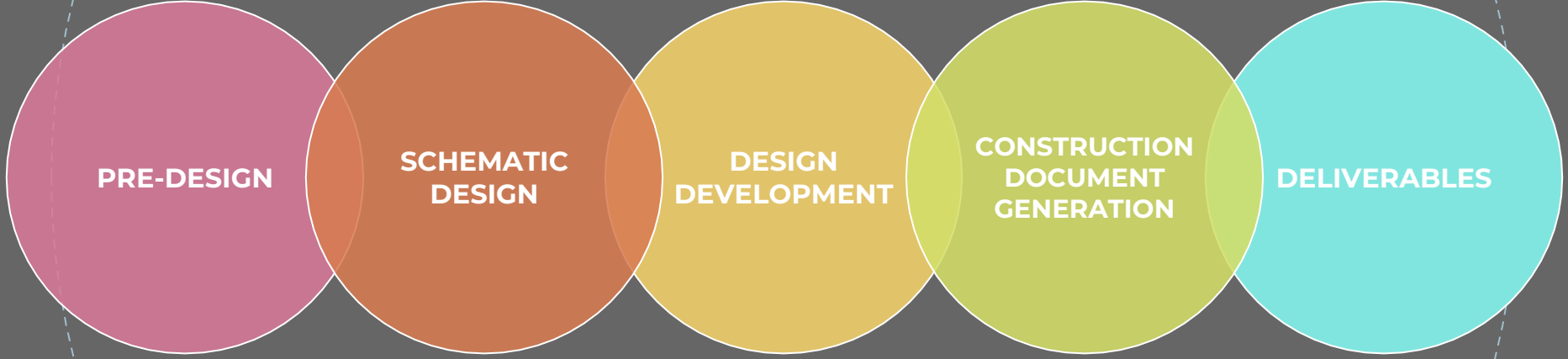
PRE-DESIGN

**SCHEMATIC
DESIGN**

**DESIGN
DEVELOPMENT**

**CONSTRUCTION
DOCUMENT
GENERATION**

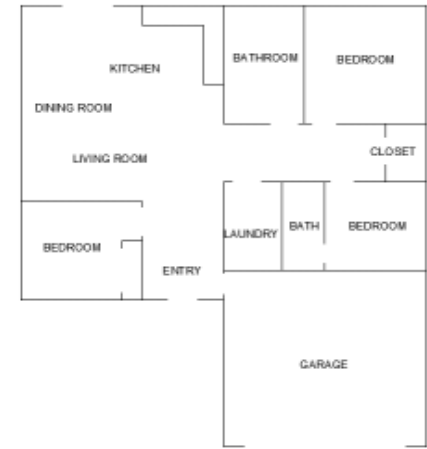
DELIVERABLES



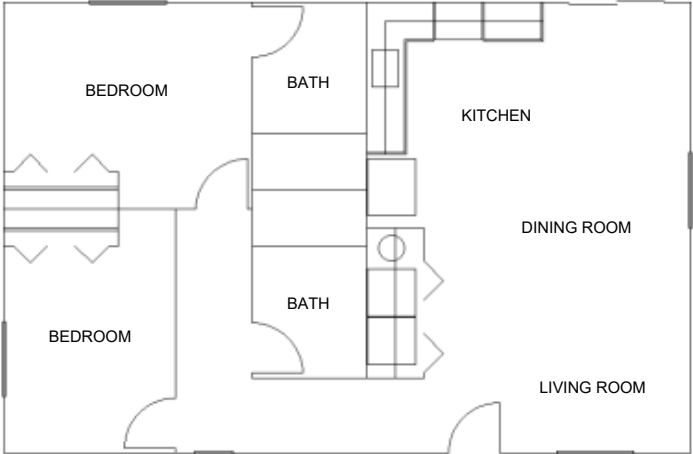
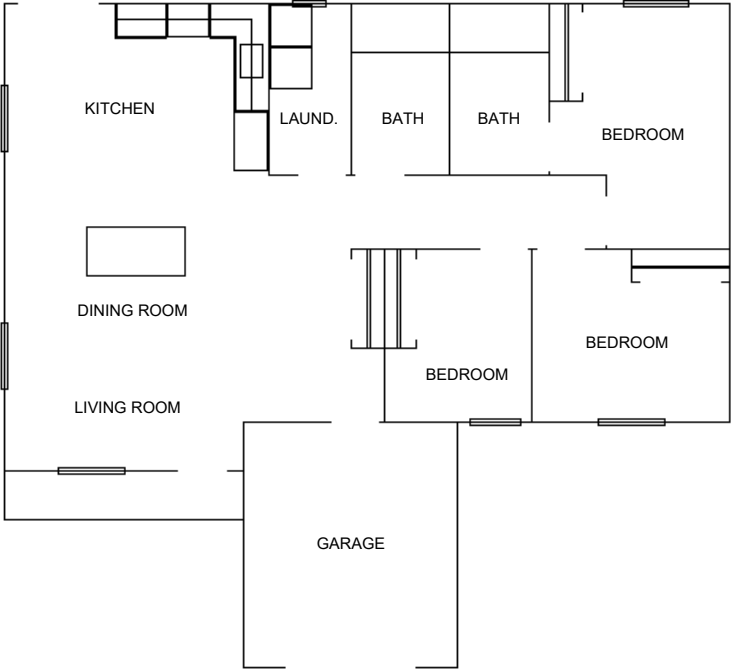
PROJECT DELIVERABLES

- **Complete set of construction drawings**
 - **Architectural**
 - **Structural**
 - **Mechanical**
 - **Electrical**
- **3D renderings**
 - **Indoor**
 - **Outdoor**
- **Final cost estimate**

CONCEPTUAL DESIGN



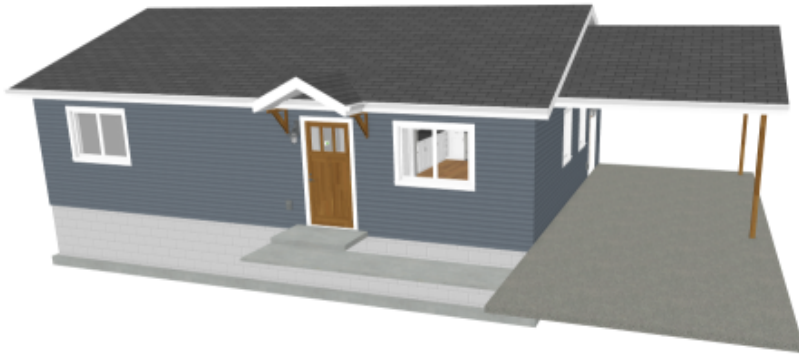
DESIGN ALTERNATIVES



DESIGN SELECTION

<u>Design Criteria</u>	<u>Weight</u>	<u>FP1</u>	<u>FP1</u> <u>(weighted)</u>	<u>FP2</u>	<u>FP2 (weighted)</u>
Cost	8	1	8	2	16
Spaciousness	1	2	2	1	1
Effective Space Utilization	5	2	10	1	5
Material Efficiency	6	1	6	2	12
Accessibility	7	2	14	2	14
Durability	4	2	8	2	8
Maintainability	2	1	2	2	4
Safety	9	2	18	2	18
Aesthetic/Visually Appealing	3	2	6	2	6
Total		15	74	16	84

DESIGN SOLUTION



- 900 square feet
- 2 bedrooms, 2 bathrooms
- Open floor plan
- General appliances & utilities
- Vehicle protection

ARCHITECTURAL DESIGN

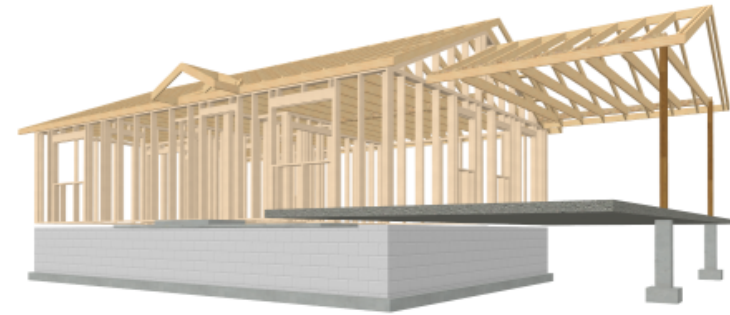
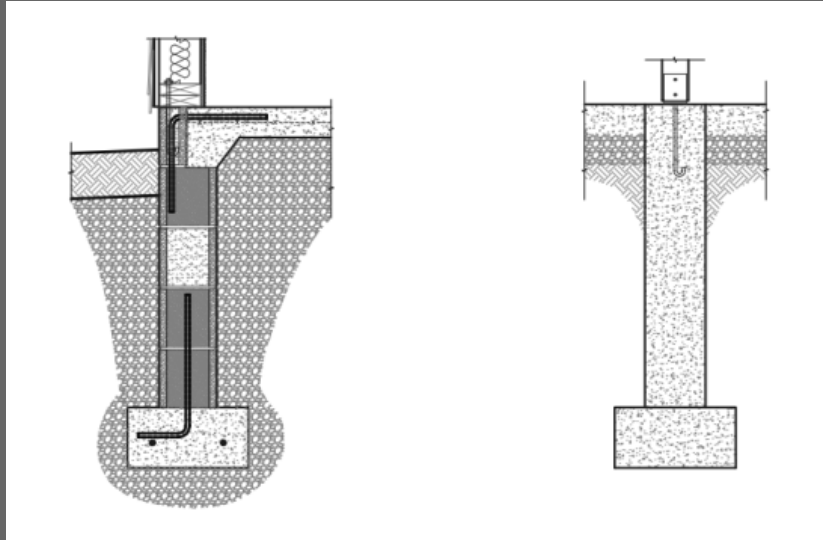


ARCHITECTURAL DESIGN





STRUCTURAL DESIGN FOUNDATION



STRUCTURAL DESIGN - FRAMING

International Residential Code (IRC):

- Snow and Dead Loads
- Attic and Roof Loads
- Rafter Size and Spacing

American Society of Civil Engineers (ASCE) Calculations:

- Wind Load
- Snow Load

STRUCTURAL DESIGN - FRAMING

Snow & Dead Loads

IRC Figure R301.2(6)

Roof Design Loads:

Snow Load: 20 Psf

Dead Load: 10 Psf

Total Loads: 30 psf

Tributary Area: 870 Sf

Load: 26,100 lbs = 26.1 kips

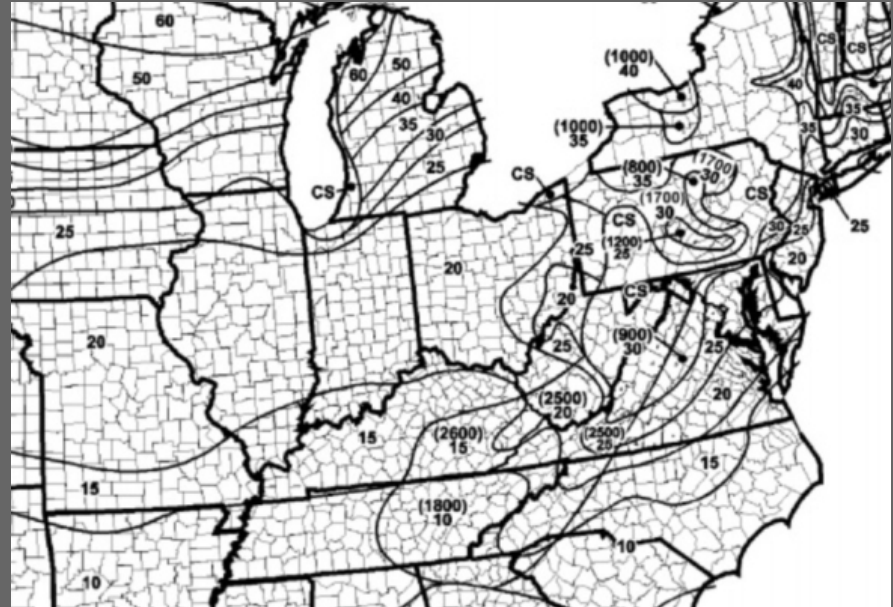


TABLE R802.4.1(4)

RAFTER SPANS FOR COMMON LUMBER SPECIES (Ground snow load = 30 psf, ceiling attached to rafters, L/Δ = 240)

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
			2 x 4	2 x 6	2 x 8	2 x 10	2 x 12	2 x 4	2 x 6	2 x 8	2 x 10	2 x 12
			Maximum rafter spans ^a									
		(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)
19.2	Douglas fir-larch	SS	7-9	12-3	16-1	20-7	25-0	7-9	12-3	16-1	19-9	22-10
	Douglas fir-larch	#1	7-6	11-8	14-9	18-0	20-11	7-1	10-5	13-2	16-1	18-8
	Douglas fir-larch	#2	7-4	11-0	14-0	17-1	19-10	6-9	9-1	12-6	15-3	17-9
	Douglas fir-larch	#3	5-9	8-5	10-8	13-1	15-2	5-2	7-7	9-7	11-8	13-6
	Hem-fir	SS	7-4	11-7	15-3	19-5	23-7	7-4	11-7	15-3	19-1	22-1
	Hem-fir	#1	7-2	11-4	14-7	17-9	20-7	7-0	16-3	13-0	15-11	18-5
	Hem-fir	#2	6-10	10-9	13-7	16-7	19-3	6-7	9-7	12-2	14-10	17-3
	Hem-fir	#3	5-7	8-3	10-5	12-9	14-9	5-0	7-4	9-4	11-5	13-2
	Southern pine	SS	7-8	12-0	15-10	20-2	24-7	7-8	12-0	15-10	20-0	23-7
	Southern pine	#1	7-4	11-7	15-1	17-7	20-11	7-1	10-7	13-5	15-9	18-8
	Southern pine	#2	6-10	10-2	12-11	15-4	18-1	6-1	9-2	11-7	13-9	16-2
	Southern pine	#3	5-3	7-9	9-9	11-10	14-0	4-8	6-11	8-9	10-7	12-6
	Spruce-pine-fir	SS	7-2	11-4	14-11	19-0	23-1	7-2	11-4	14-9	18-0	20-11
	Spruce-pine-fir	#1	7-0	10-11	13-9	16-10	19-6	6-8	9-9	12-4	15-1	17-9
	Spruce-pine-fir	#2	7-0	10-11	13-9	16-10	19-6	6-8	9-9	12-4	15-1	17-6

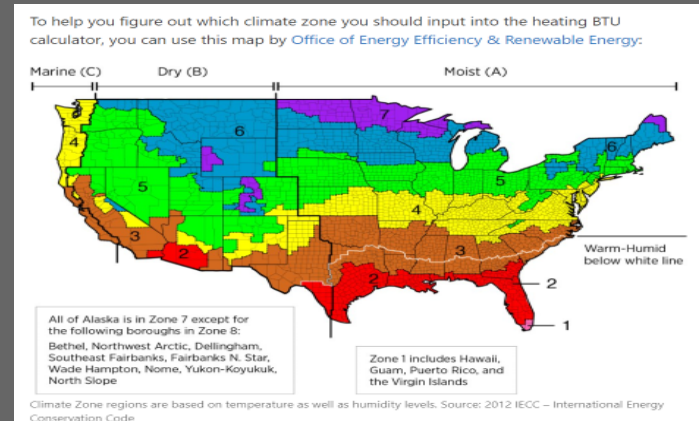
Size & Spacing

Table R802.4.1(4)

- Ceiling Joist
- Rafters

MECHANICAL DESIGN

- Elements
 - Cooling
 - Mini-split system
 - Heating
 - Mini-split system
 - Baseboard heater - supplementary heating
- Loading
 - Area of structure
 - Cooling Regions



ELECTRICAL DESIGN

- **Elements**
 - Outlets
 - Panel Board
 - Junction Boxes
 - Lighting
 - Wiring
 - Meter
- **Code**
 - Outlet Spacing
 - Appropriate Voltages
 - Class of outlets

DESIGN VALIDATION

**ADA
GUIDELINES**

**COST
ESTIMATES**

IRC 2018 CODE

CALCULATIONS

DESIGN VALIDATION - COST ESTIMATE

Watseka Affordable Housing - Cost Estimation - FP2

ITEM	CSI CODE	UNIT	TOTAL QUANTITY	TOTAL UNITS	TIME DURATION (hrs)	UNIT LABOR COST	TOTAL LABOR COST	MATERIAL UNIT COST	TOTAL MATERIAL COST	TOTAL COST
DIVISION 03										
Formwork	031000	S.F.	100	1	3.4	\$2.48	\$368.50	\$0.34	\$49.50	\$418.00
Reinforcing Steel	032000	L.F.	427		-		\$0.00	\$0.75	\$320.25	\$320.25
Poured Concrete	033105	C.Y.	10	10	-	\$55.00	\$550.00	\$65.00	\$650.00	\$1,200.00
									DIVISION TOTAL	\$1,938.25
DIVISION 04										
CMU Blocks (4"x8"x16")	042200	Ea.	90	90	-	\$5.00	\$450.00	\$1.78	\$160.20	\$610.20
CMU Blocks (8"x8"x16")	042200	Ea.	360	360	-	\$5.00	\$1,800.00	\$1.17	\$421.20	\$2,221.20
									DIVISION TOTAL	\$2,831.40
DIVISION 06										
Framing - 2 x 4	061100	L.F.	2700	338	24	\$20.00	\$480.00	\$6.16	\$2,082.08	\$2,562.08
Framing - 2 x 6	061101	L.F.	800	55	24	\$20.00	\$480.00	\$17.50	\$962.50	\$1,442.50
Framing - 2 x 8	061102	L.F.	850	60	30	\$20.00	\$600.00	\$33.64	\$2,018.40	\$2,618.40
Framing - 2 x 12	061103	L.F.	72	6	4	\$20.00	\$80.00	\$64.00	\$384.00	\$464.00
4 x 4 Post	061300	L.F.	16	2	1	\$20.00	\$20.00	\$12.95	\$25.90	\$45.90
5/8" Sheathing	061633	S.F.	976	35	36	\$20.00	\$56.00	\$49.67	\$1,738.45	\$1,794.45
LVL Beam - Double-Ply 9 1/4" (13')	061713	Ea.	3	3	9	\$20.00	\$180.00	\$93.98	\$281.94	\$461.94
Decorative Wood Gable Pieces	064000	Ea.	3	3	6	\$20.00	\$120.00	\$155.00	\$465.00	\$585.00
Upper Cabinets - Kitchen										
15" x 30" x 12" Upper Cabinet	064100	Ea.	4	4	4	\$20.00	\$80.00	\$150.00	\$600.00	\$680.00
18" x 30" x 12" Upper Cabinet	064100	Ea.	2	2	2	\$20.00	\$30.00	\$114.00	\$228.00	\$258.00
36" x 24" x 12" Upper Cabinet	064100	Ea.	1	1	2	\$20.00	\$40.00	\$183.00	\$183.00	\$223.00
30" x 24" x 12" Upper Cabinet	064100	Ea.	1	1	2	\$20.00	\$40.00	\$149.00	\$149.00	\$189.00
23.6" x 30" x 23.6"	064100	Ea.	1	1	2	\$20.00	\$40.00	\$133.00	\$133.00	\$173.00

DESIGN VALIDATION - DESIGN OBJECTIVES

REQUIREMENT	METRIC	NOTES
Remain in budget	Pass/Fail	Pass; see evaluation of design constraints
Functional for variety of users	Architectural perspective inspection	Provides desired spaces/spaces necessary for residence
Accessible to a variety of users	ADA guideline compliance	See evaluation of design constraints
Durable and maintainable	Code compliance	-
Material conscious	Plan dimensions	-
Aesthetic on exterior and interior	Group, mentor, & sponsor feedback	-

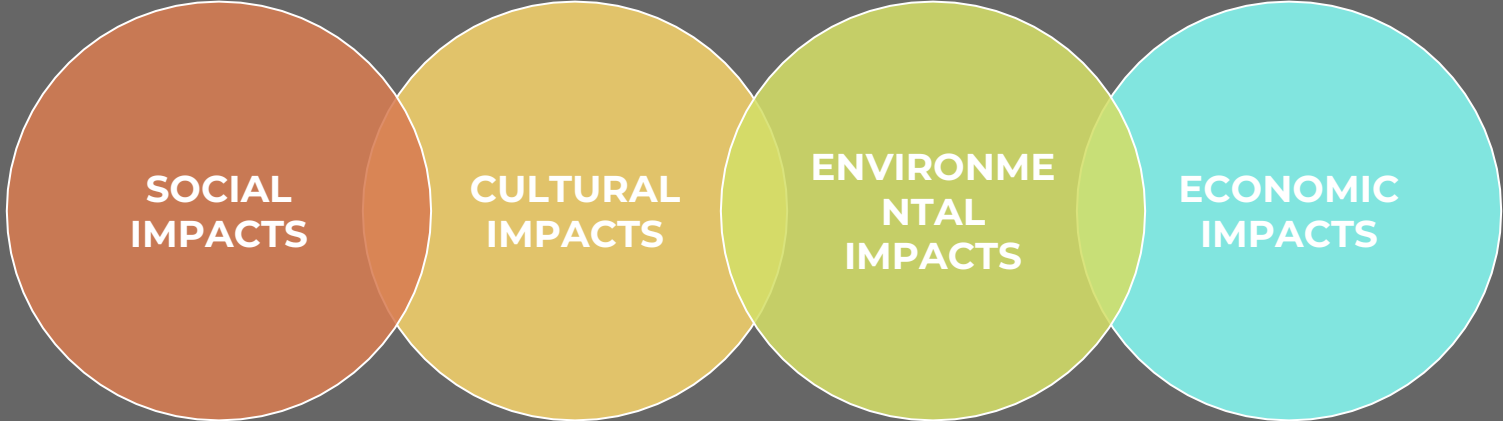
DESIGN VALIDATION - FUNCTIONAL REQS.

REQUIREMENT	CRITERIA	NOTES
Keep user safe and protected from exterior	Pass/Fail	structural code compliance (CSI Divisions 03, 04, 06, 07, 08, 09, and other applicable sections) & structural calculations
Provide functional spaces	Inclusion of required spaces	-
Provide sufficient lighting	Pass/Fail	Lighting code compliance (CSI Division 26; IRC Chapters 34-41)
Provide sufficient electrical capabilities	Pass/Fail	Electrical code compliance (CSI Division 26; IRC Chapters 34-41)
Provide adequate thermal comfort	Pass/Fail	Mechanical code compliance (CSI Division 23; IRC Chapters 12-16)
Provide sufficient plumbing components (within scope)	Pass/Fail	Plumbing code compliance; plumbing design not in project scope, fixtures are provided (CSI Division 22; IRC Chapters 26-33)

DESIGN VALIDATION - CONSTRAINTS

REQUIREMENT	INSPECTION	TEST	ANALYSIS	PASS/FAIL	NOTES
Budget: \$150,000 all inclusive	-	-	X	PASS	Cost estimation analysis
Adherence to IRC 2018	X	-	X	PASS	Code verification chart
Adherence to local regulations of Watseka	X	-	-	PASS	Code verification chart/ drawings
Adherence to ADA guidelines	X	-	-	PASS	ADA verification chart
April 2022 completion	X	-	-	PASS	-

IMPACTS OF DESIGN



**SOCIAL
IMPACTS**

**CULTURAL
IMPACTS**

**ENVIRONMENTAL
IMPACTS**

**ECONOMIC
IMPACTS**

FEASIBILITY & RISK

RISK	RISK LEVEL
Electrical Fire	Low
Structural Failure	Low
Aids or implements economic stigma	Medium
Life of systems estimated more confidently than what actually lasts	Low
Not being used /not aiding in population retainage	Low
Construction Costs	High
Failure to attract developers/contractors	Medium

RECOMMENDATIONS & CHALLENGES

- **Recommendations**
 - Funding
 - Land Acquisition
 - Site Design
- **Challenges**
 - Communication
 - Scheduling
 - Software accessibility & file sharing

CONCLUSION

- Deliverables
- Satisfying client
- Viable, safe, attractive housing





QUESTIONS & ANSWERS