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Residential Dwelling Design and Construction Planning

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Residential Dwelling Design and Construction Planning

University of Akron William Honors College

HONORS RESEARCH REPORT

JODI BEERY

SPRING 2021

TABLE OF CONTENTS

Abstract	2
Introduction	3
Initial Site Investigation	4
<i>General Property Information</i>	
<i>Due Diligence</i>	
Site Design	6
<i>Building Footprint</i>	
<i>Utility Connections and Design</i>	
<i>Grading Design</i>	
Building Construction Planning	16
<i>Exterior Construction</i>	
<i>Interior Construction</i>	
Cost Analysis and Schedule	26
Conclusion	26
References	27
Appendix	31

1. ABSTRACT

This report presents a step-by-step guide in building a hypothetical residential dwelling in Wayne County, Ohio.

The project begins with the initial site investigation phase, which gathers general information about the physical site of proposed construction as well as the requirements of the governing body of the area; applications for permits and inspections for example. Next, phase is the site design which includes creating plans for the building footprint, pavement areas, and utility locations. The next phase in the design will be the building plans which will include floor plans and associated material lists for the construction of the home. Lastly, the time frame and overall cost will be compiled.

Each stage of the design and construction planning listed above will be researched and discussed in detail, creating a collaborative and complete plan of constructing a residential home.

2. INTRODUCTION

Residential design and construction planning is a complex process that involves many small and separate tasks and details that must come and work together as a whole in order to be successful. A residential home in construction is under the authority of the governing jurisdiction of the area in which it is built. The home must effectively connect to several different utility lines. The home must be located properly on the site to allow proper drainage. The home must efficiently schedule several different subcontractors during construction. And lastly, a home must be constructed within a certain time frame and within a given budget.

This report explores and presents the design and construction plan of a residential dwelling that brings each of these moving parts together. The plan is broken down into phases: initial site investigation, site design, building plans, and construction. The total time frame and total cost will be accumulated during each phase for a final cost estimate at the conclusion of the project.

3. INITIAL SITE INVESTIGATION

Initial Site Investigation is a process of analyzing the area in which construction is to occur. This includes general information of the property and surrounding properties as well as gathering information on what regulations and code requirements exist in an area regarding new construction and what must be done to fulfil them.

3.1 General Property Information

The property on which the residential construction is to take place is a 79.2-acre plot of existing farmland in Rittman, Wayne County Ohio. The natural grade of the site crests at the northeast corner and slopes southwesterly into unnamed tributaries of the Chippewa Creek. **Figure 1**, taken from the Wayne County GIS map¹, shows a visual of the project site as well as 10-foot contour lines that show the topography of the land.

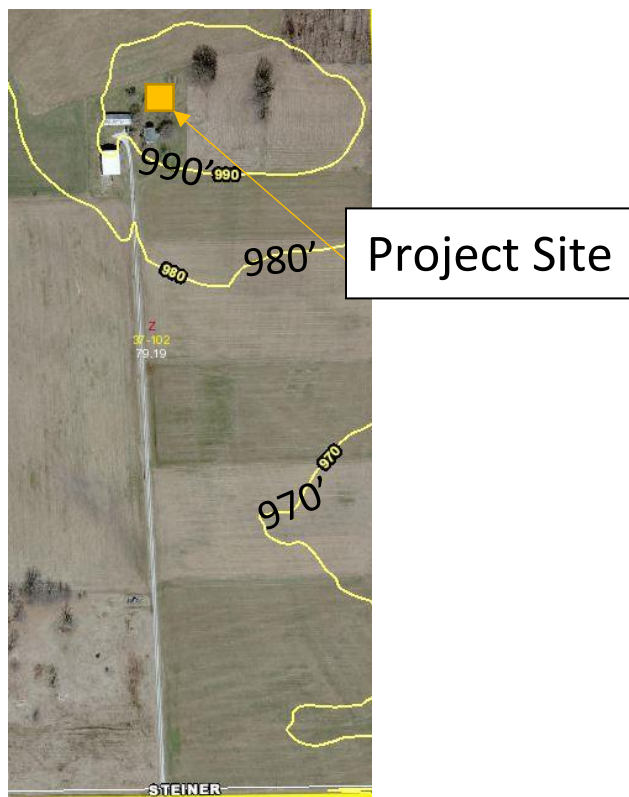


Figure 1 The Proposed Project Site for the Residential Construction.

3.2 Due Diligence

With all construction projects comes obligatory interaction with the governing jurisdiction. This comes in the form of applying for appropriate permits and seeing the required inspections are performed. The property is located in Wayne County, Ohio, and is therefore required to submit a Construction Application for Permit. Another application for Building/Electrical/HVAC Permits is also to be submitted. There is also a given list of inspections that will need to be carried out during and after construction.

Construction Application for Permit

The Construction Application for Permit must be submitted to and approved by the Wayne Soil & Water Conservation District.² The fee schedule calls for a \$75 fee for a permit for a one family residence that disturbs less than one acre.³

Application for Building/Electrical/HVAC Permits

The residential Application for Building/Electrical/HVAC Permit must be submitted and approved by the Wayne County Building Department.⁴ The permit fees for a plan review, building, electric, and HVAC are \$40.00, \$60 + 0.05SF, \$60 + 0.03SF, and \$60 + 0.03SF, respectively.⁵ These initial costs are reflected in **Figure 2** below and reflect a total of \$515.00.

Table 1 Estimated Project Costs for Permit Fees.

Estimated Project Costs				
DESCRIPTION	BULK PRICE	PRICE PER UNIT	QUANTITY	SUBTOTAL
Initial Site Investigation				
<i>Permit Fees</i>				
Construction Permit Fee	\$ 75.00	\$ -		\$ 75.00
Plan Review Fee	\$ 40.00	\$ -		\$ 40.00
Building Permit Fee	\$ 60.00	0.05/SF	2000 SF	\$ 160.00
Electrical Permit Fee	\$ 60.00	0.03/SF	2000 SF	\$ 120.00
HVAC Permit Fee	\$ 60.00	0.03/SF	2000 SF	\$ 120.00
		Permit Fees Total		\$ 515.00

The estimated time frame to apply for and receive permits is two weeks.⁷

Residential Required Inspections

To assure public safety, the county requires several inspections to be completed during and after the completion of construction. The Wayne County Building Department requires several inspections, the following are applicable to the project: footer inspection, foundation inspection, rough in electric, rough plumbing, frame inspection, insulation, service inspection, final septic and final plumbing, final electric, and final building.⁶

Time considerations around inspections are the inspection must be requested one day in advance and the specific day of inspection depends upon the completion and status of the respective construction.⁶ The various inspections will appear later on the Gantt chart once construction operations are scheduled.

4. SITE DESIGN

Site design refers to the design of all areas surrounding the house itself. The house will be shown as only a footprint as the pavement, landscape, utilities and grading only require the location of exterior walls of the building.

4.1 Building Footprint

The Building footprint is obtained from an architect's floor plans and is essentially the outline of the exterior walls of the proposed residential building. The building footprint serves as a beginning point for the site design as all other elements are based on it. The building footprint is shown in **Figure 2**.

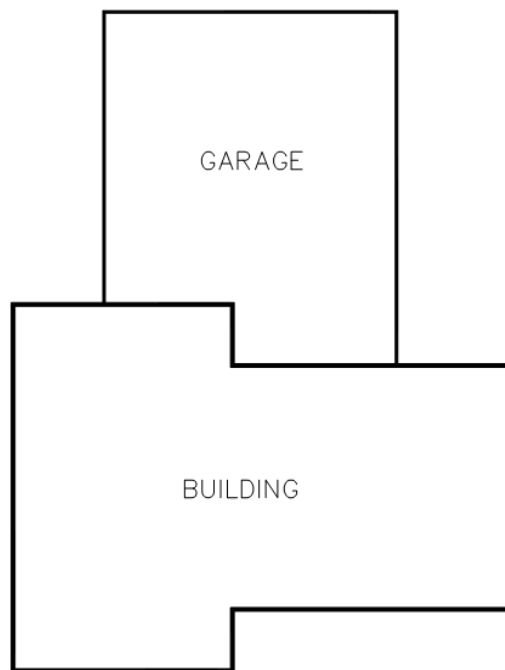


Figure 2 The Residential Building Footprint

The cost associated with the building footprint is included in the architect's fees. There are a variety of ways in which architects charge for drawings: a price per square foot, a percentage of total house cost, or an hourly rate. The average cost in Ohio for architectural drawings ranges from \$1,405-\$3,624 with the average being \$2,381.⁸ To be conservative, \$3,000 was assumed for architectural drawings and is included in **Table 2** at the end of the section.

The time consideration for the building plans is also based on the architect. For a residential site, the estimated time to obtain the drawings is four weeks.⁹ The architectural drawings will need to be completed prior to applying for a building permit as it is one of the requirements to receive a building permit.

4.2 Pavement and Landscape Areas

Pavement Areas

After the development of the building footprint, paved areas surrounding the house can be established. These include concrete sidewalks, front porch, and driveway. **Figure 3** shows the location of proposed pavement.

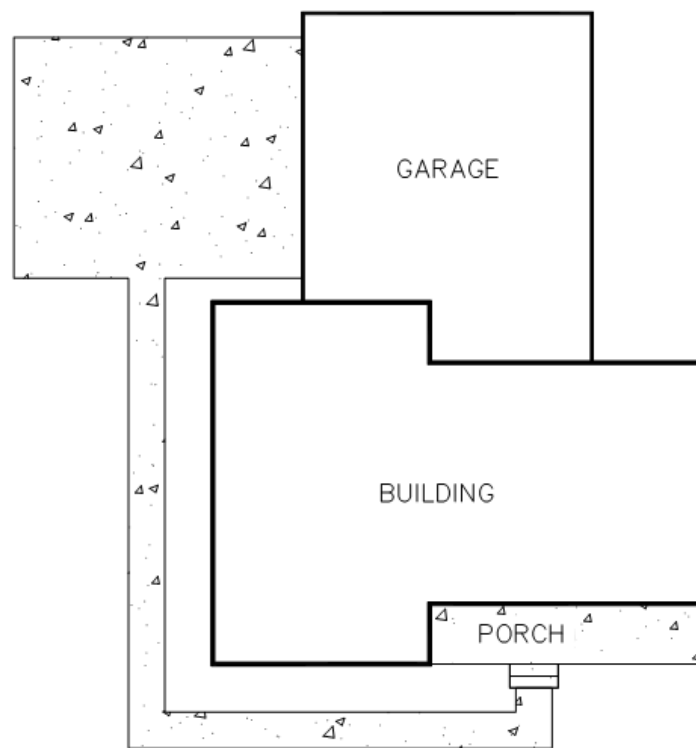


Figure 3 The Proposed Paved Areas On-Site

The average cost range per square foot of concrete is \$5.35-\$6.17. Again, to be conservative, a price of \$6.00 per square foot will be assumed. The total proposed concrete area is 815 SF, making the estimated price of concrete work \$4,890. The price is reflected in **Table 2** at the end of the section. The estimated time associated with the actual concrete installation is one day; however, since it is a weather dependent task, 3 days is assumed to account for potential rain. The concrete must be installed after the storm drainage system has been installed, which will be discussed in future sections.

Landscape Areas

The landscaped areas are placed near the foundation of the building and consist of mulched areas containing bushes and other plants. The shaded areas in **Figure 4** show the location of the proposed landscape areas.

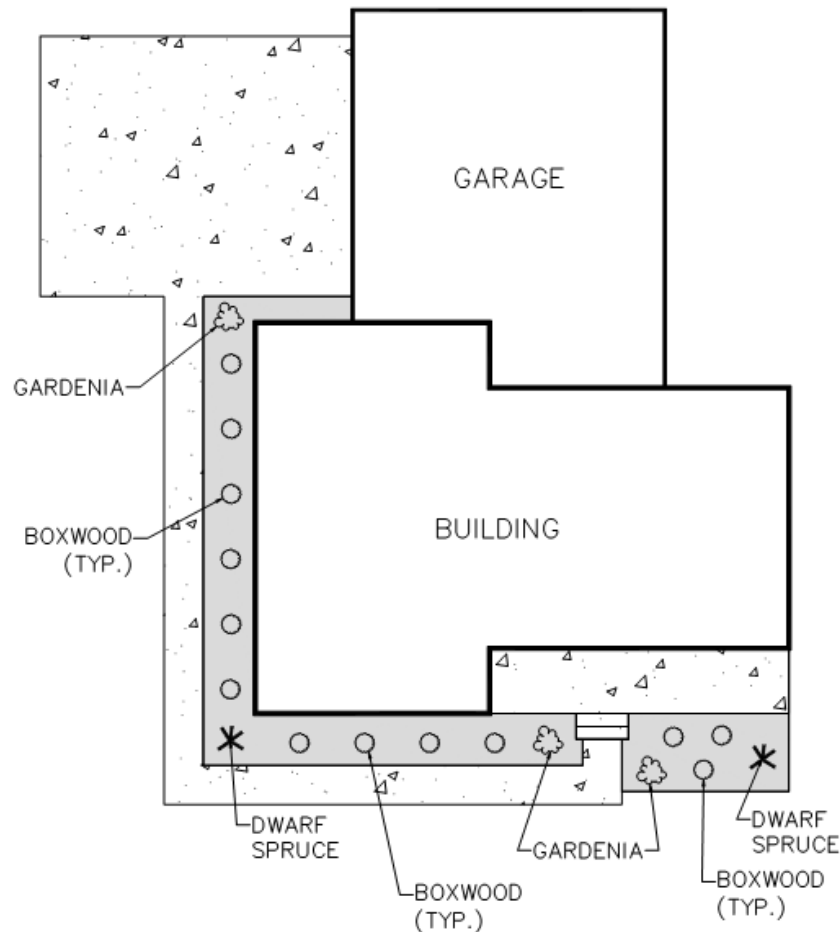


Figure 4 The Proposed Landscape Areas On-Site

The cost of installing landscape beds is simply from the mulch, and various plants. The total area to be covered with mulch is 336 SF. Since mulch is spread at an average 3-inch thickness, the mulch needed is 84 cubic feet.¹¹ Mulch is \$2.50 per cubic foot which totals \$210¹². The cost of the plants is solely based on quantity of plants. Based on local retail prices, boxwood shrubs, dwarf spruce, and gardenia shrubs cost \$20, \$30, and \$40, respectively¹². Once multiplied by their respective quantities, the price for plants is \$440 making the total cost for the landscape areas \$650, shown in **Table 2** at the end of the section. Installation of landscaping can be completed in one day and must be preceded by the concrete installation.

4.3 Utility Connections and Design

The residential home needs access to a variety of utilities: gas, electric, sanitary sewer, water, and storm sewer. Since the proposed location is not within city limits, utility options are in some categories more limited, as the site does not have access to public water, sanitary and storm sewer lines.

Gas Connection

Providing heat for a house can be provided in different ways: electric, natural gas, or propane. Natural gas was chosen as there is a gas main in the right-of-way of the local road on which the proposed property is located. The average cost to install a new gas line is \$735.00¹³ and is reflected in **Table 2**. **Figure 5** shows the location of the proposed gas line. The line connects to the gas main running along Steiner Road and connects on the east side of the building. A gas meter is to be installed on the side of the house. The estimated installation time is one day and must be preceded by the foundation and basement block construction.

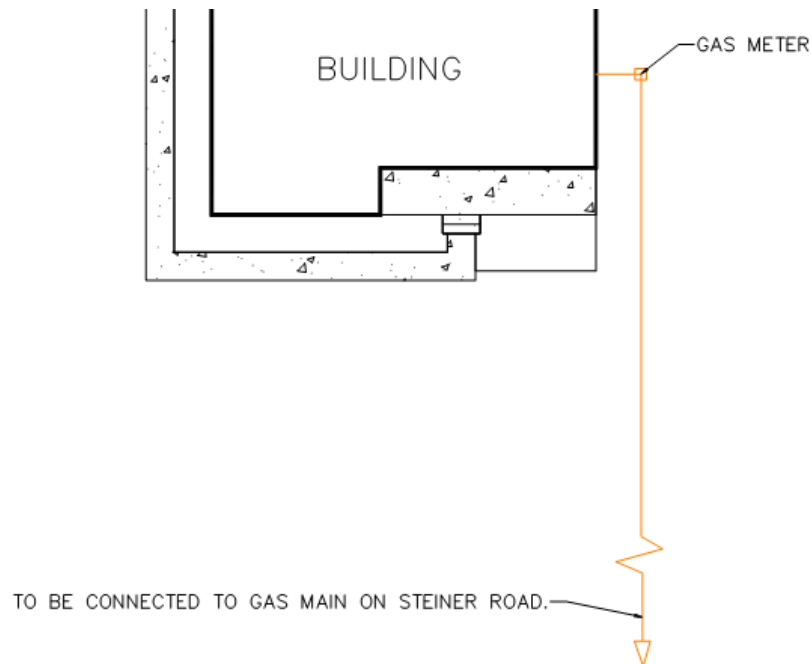


Figure 5 The Proposed Gas Connection

Electric Connection

Similar to the gas connection, there is an existing electric line in the right-of-way on Steiner Road. An underground electric line is to connect the existing line to the east side of the building as shown in **Figure 6**. The electrical line will be a direct bury line. An electric meter is to also be installed. The cost associated with installing the electric line from the right-of-way to the house will be accounted for in electrical cost in future sections. The estimated installation time is two days, one to bury the line and one to install a

transformer, if needed. The electrical connection must be preceded by the foundation and basement block construction.

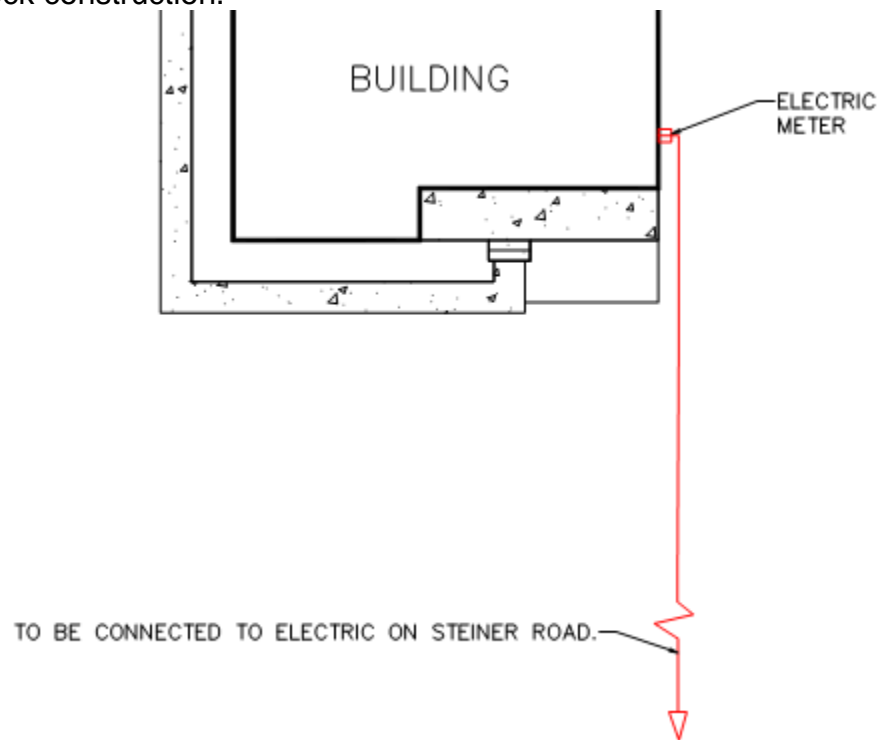


Figure 6 The Proposed Electric Connection

Sanitary Sewer Design

As previously noted, the proposed site is outside city limits and therefore does not have access to public sanitary sewer main. The alternative is to install a septic system. The type of septic system will depend on the existing soil conditions of the site. A USDA web soil survey was conducted for the project site and yielded that the soil on-site is Rittman Silt Loam, RsB²¹. The soil map and full soil description can be found in Appendix A. In general, loamy soil is desired for septic systems¹⁹. A soil scientist will be hired to conduct a more detailed test on the soil and make recommendations for the appropriate septic system. The cost of the soil consultant is estimated to be \$300. The average cost to install a septic system in Ohio typically ranges from \$4,080-\$7,590¹⁴. Since the specific soil conditions will be determined only after the soil investigation is complete, \$7,590 will be assumed. The costs are reflected in **Table 2** at the end of the section. **Figure 7** shows the proposed location of the septic system. The Soil investigation is estimated to take 10 days²⁰. Installation of the septic tank is estimated to take two to five days¹⁵. Five days was assumed for scheduling purposes. The installation of the septic must be preceded by the foundation and basement block construction.

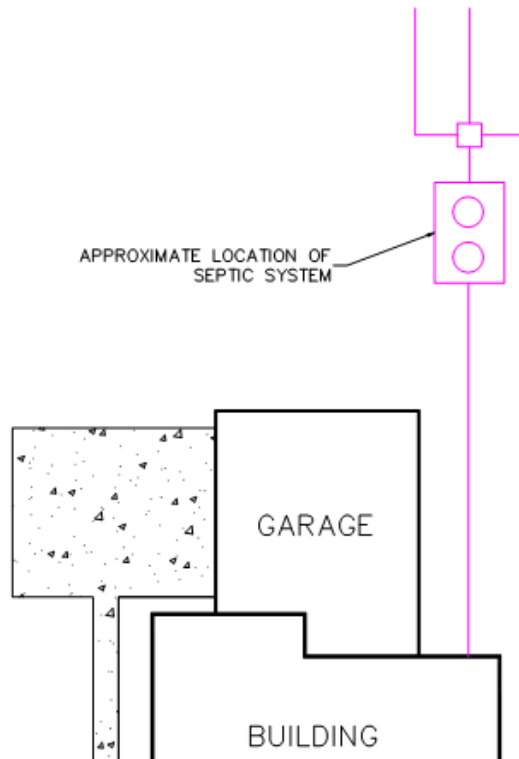


Figure 7 The Proposed Location of the Septic System

Storm Sewer Design

The proposed storm sewer connects the multiple downspouts on the building. The line should be buried and maintain a 1% slope to maintain water flow. Inspection of the project site confirms that the site contains adequate fall for the storm pipe to maintain the 1% slope and discharge at the approximate location shown in **Figure 8**. The storm pipe is to be 6-inch ADS corrugated pipe and approximately 200 linear feet are needed along with 5 Tee-Fittings. Cleanouts will be installed at two locations on pipe. Material cost for the pipe is about \$170.00 per 100 linear feet and about \$18.00 per Tee fitting, based on local retail price¹⁶. The cost for the cleanouts will be about \$22.00 per wye fitting and \$7.00 for each cap^{22,23}. The total cost for the storm installation is \$488.00, shown in **Table 2**. Installation of the storm line is three days and must be installed after the construction of the roof and downspouts.

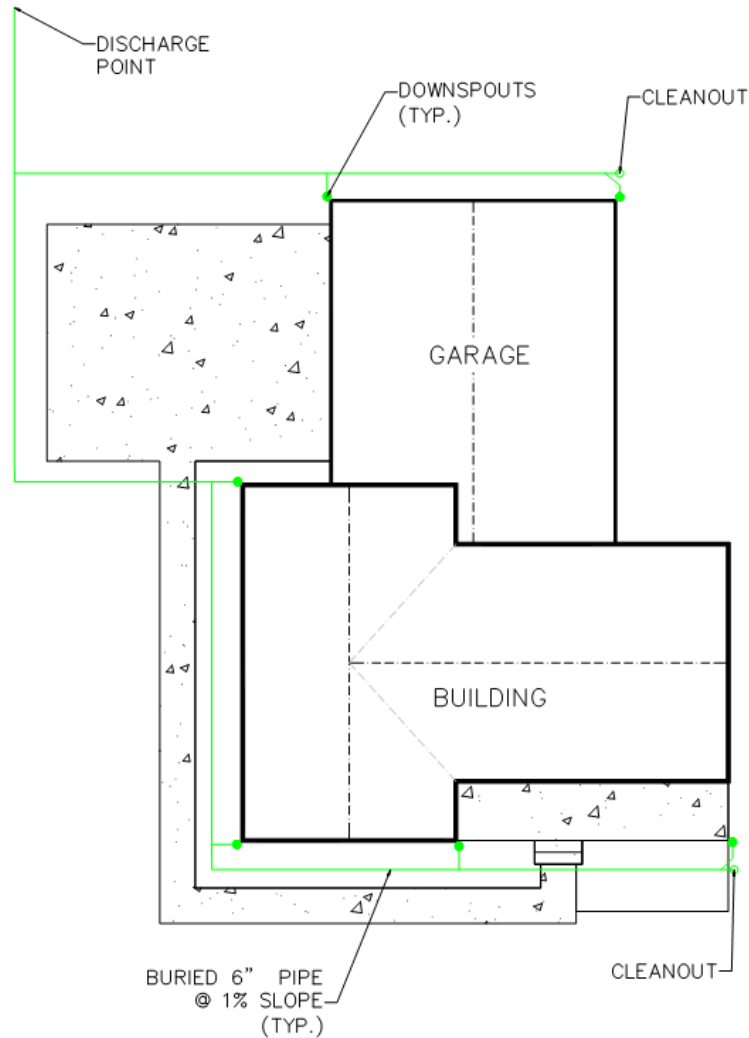


Figure 8 The Proposed Location of the Storm Sewer

Water Connection

Similar to the sanitary sewer, a public water line is not available for connection. A groundwater well will need to be installed to provide the residence with water. The average cost to install a groundwater well ranges from is \$1,500 to \$12,000. Since a hydrological study has not been conducted to confirm the depth of an adequate water supply, \$12,000 will be assumed to account for the possibility of needing to drill a deeper well. The cost is reflected in **Table 2**. Estimated installation time is two weeks and must be preceded by the completion of the basement and foundation¹⁷. The proposed location of the well is shown in **Figure 9**.

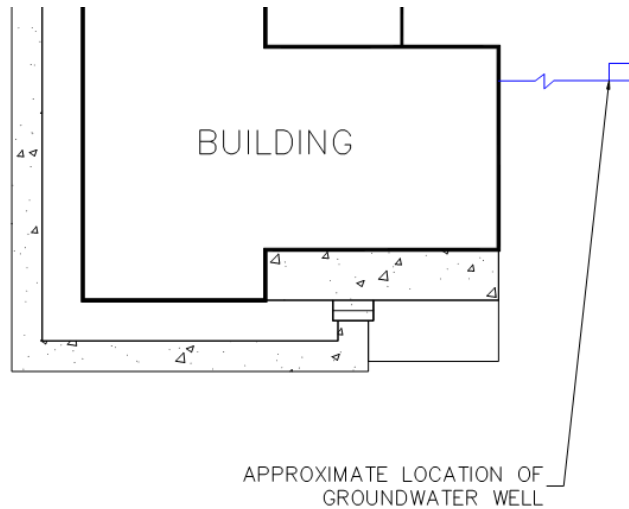


Figure 9 Proposed Location of the Groundwater Well

Utilities must be looked at as a whole to prevent unnecessary crossings or conflicts. **Figure 10** shows all the proposed utilities described and shown in previous sections.

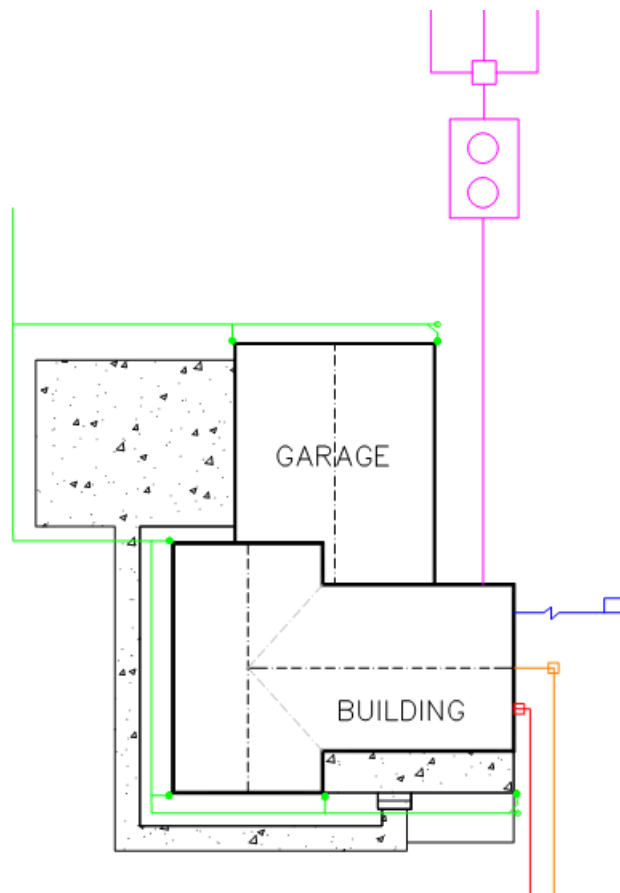


Figure 10 Proposed Utility Locations

4.4 Grading Design

The main objective in grading design for a site is to ensure proper drainage. Water is to be directed away from foundations to prevent flooding in the basement and structural damage that could occur from water freezing and thawing. Water is also to be directed off paved areas as pooling water during storm events is undesirable. For these reasons, **Figure 11** shows the grading design for the proposed site. The design includes the finished floor elevation of the building, which is to be the highest elevation on site, estimated to be 995-feet. The design also includes slope arrows in pavement and landscaped areas to accommodate water flow. The monetary and time cost of grading will be reflected in the excavation costs in future sections.

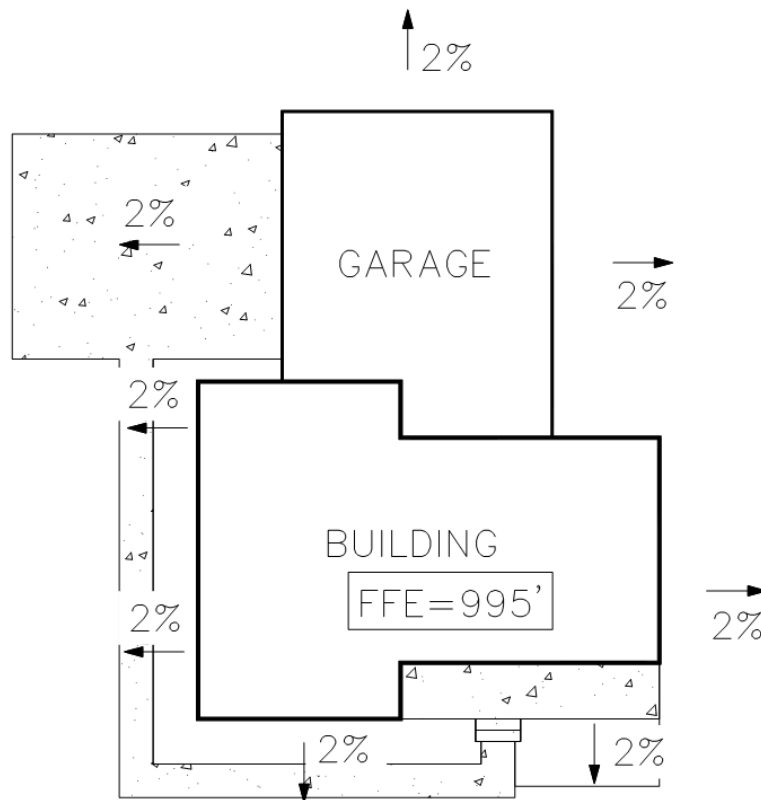


Figure 11 Proposed Grading Plan

The total estimated cost for the site design including architectural drawings, concrete and landscape work, and utilities is \$29,653. **Table 2** shows the itemized costs.

Table 2 Site Design Estimated Costs

Estimated Project Costs				
DESCRIPTION	BULK PRICE	PRICE PER UNIT	QUANTITY	SUBTOTAL
Site Design Costs				
Architectural Drawings	\$ 3,000.00			\$ 3,000.00
Concrete Work		\$6.00/SF	815 SF	\$ 4,890.00
Landscape				
Mulch		\$2.5/CF	84 CF	\$ 210.00
Boxwood Shrub		\$20/EA	13	\$ 260.00
Dwarf Spruce		\$30/EA	2	\$ 60.00
Gardenia		\$40/EA	3	\$ 120.00
Utilities				
Gas Connection	\$ 735.00			\$ 735.00
Soil Consultant	\$ 300.00			\$ 300.00
Septic System	\$ 7,590.00			\$ 7,590.00
Storm - 6" Pipe		\$170/100LF	200 LF	\$ 340.00
Storm - Pipe Cap		\$7/EA	2	\$ 14.00
Storm - Wye Fittings		\$22/EA	2	\$ 44.00
Storm - Tee Fittings		\$18/EA	5	\$ 90.00
Water - Groundwater Well	\$ 12,000.00			\$ 12,000.00
		Site Design Total		\$ 29,653.00

5. BUILDING CONSTRUCTION PLANNING

Building construction planning is the coordination of construction events that result in the construction of the house. The construction phase is split into two main categories: exterior and interior construction. **Figure 12** shows a more detailed plan view of the proposed 2,000 square foot building. Elevation views denoted as A-A through D-D in **Figure 12** are shown in **Figure 13** through **Figure 16**.

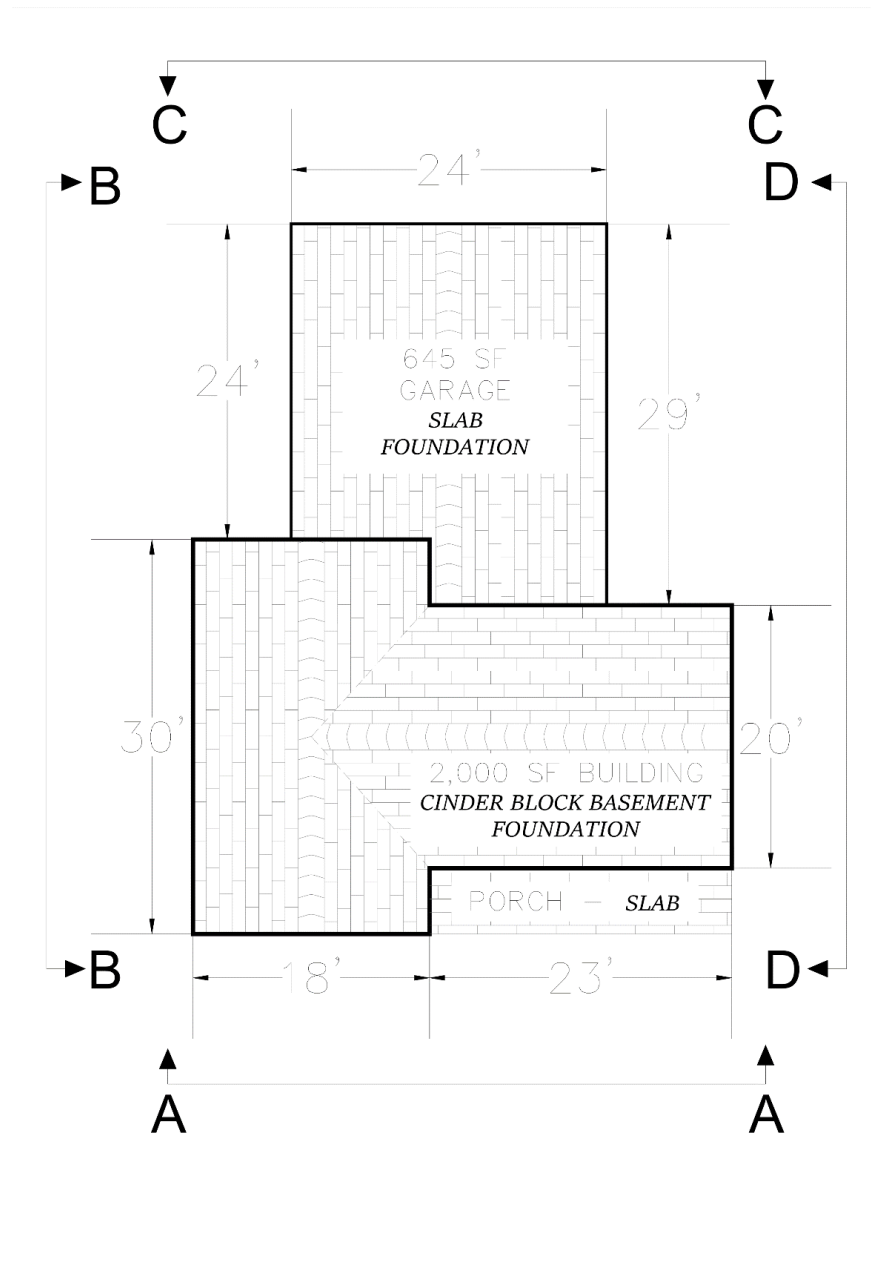


Figure 12 Plan View of the Proposed Home



Figure 13 Elevation View of Proposed Building A-A



Figure 14 Elevation View of Proposed Building B-B



Figure 15 Elevation View of Proposed Building C-C



Figure 16 Elevation View of Proposed Building D-D

5.1 Exterior Construction

Exterior construction is the process of building and enclosing the home. It begins with the excavation and foundation of the site, then includes installation of the basement, framing, roofing, and siding. Exterior fixtures like installing doors, windows, gutters, and downspouts are also included in this phase.

Excavation

Excavation of the site includes digging out the basement and moving dirt such that it directs water flow away from the building as discussed previously in Section 4.4. The average cost of excavation work for a residential home in Ohio ranges from \$2,104 to \$6,434. A cost of \$5,000 was estimated for excavation costs, which is reflected in **Table 3**²⁴. The estimated time for excavation work is three days. Excavation cannot begin until the required permits are received. The excavated material is to be retained on site.

Foundation and Basement

After excavation events, the foundation of the home is to be constructed. The foundation type under the main section of the house is a basement with concrete masonry units. The garage floor will consist of only a concrete slab on grade. The cost of construction of the basement is dependent upon the square footage²⁵. The average price to construct an unfinished basement ranges from \$10 to \$25 per square foot. With the proposed basement square area being 1,000 square feet, the estimated foundation and basement construction would range from \$10,000 to \$25,000. A cost of \$20,000 was assumed for the cost for the foundation and basement on the main section of the home. The garage floor is a slab on grade, which is also calculated based on the square footage. The average cost for a slab foundation ranges from \$3 to \$5 per square foot. With the proposed garage being 645 square feet, the cost would range from \$1,935 to \$3,325. A cost of \$3,000 was assumed for the cost of the garage foundation. The time associated with foundation and basement construction is estimated to be two to four weeks²⁶. Four weeks was assumed for scheduling purposes and must be proceeded by excavation work. The four-week time frame includes time for the concrete to be placed and cured.

Framing

The next phase in the construction is framing. The home will be framed in using lumber. The average price to frame a 2,000 square foot, two-story home ranges from \$12 to \$27 per square foot or \$24,000 to \$54,000 total for a 2,000 square foot home²⁷. The lumber package includes floor beams, floor joists, and sub-flooring. A cost of \$50,000 was assumed for total framing cost. The price also includes sheathing and wrap. The cost associated with framing the garage is \$5 per square foot which totals \$3,225 for the proposed 645 square foot garage. The total cost for framing is \$53,225. Individual values are shown in **Table 3**. Framing a home takes two-weeks and must be proceeded by the foundation and basement installation²⁸.

Roof

Roof installation is calculated per square foot. Installing the roof includes setting wood trusses, installing plywood sheathing, and installing asphalt shingles. The total square footage of the proposed home with a 6/12 pitch roof, including the garage is 1,845 square feet. The cost of the trusses is included in the framing package. The average cost of the plywood sheathing and asphalt three-tab shingles is \$4.50 per square foot, which produces a projected total roofing cost of \$8,302²⁹. The cost is reflected in **Table 3**. The estimated time to set the trusses and install the roof is 5 days and must be preceded by framing.

Gutter and Downspouts

The next phase of construction is installing gutter and downspouts. Aluminum gutters are to be installed and cost about \$3 to \$5 per linear foot³⁰. The proposed building requires 139 linear feet of gutter which would cost \$417 to \$695. A cost of \$600 was assumed for the estimate value. Similarly, aluminum downspouts are estimated to cost \$5 to \$8 per linear foot. 100 linear feet of downspout is estimated for the proposed building, costing \$500 to \$800. A cost of \$700 was assumed. Both costs are reflected in **Table 3**. The time estimated for gutter and downspout installation is two days and must be preceded by installation of the siding.

Exterior Fixtures

Exterior fixtures include the exterior doors, windows, and the garage door. The proposed design requires four exterior doors (three doors directly leading outside and one leading into the garage from the home) costing \$210 each and will require doorknobs and deadbolts at \$36 each^{31,32}. The proposed design also requires 14 – 36" x 60" windows and one 81" x 50" window which cost about \$160 and \$950 each, respectively^{33,34}. The garage door is to be eight feet in height and 16 feet wide which costs \$900³⁵. The quantities and individual costs are reflected in **Table 3** and show a total cost of \$5,394. All exterior fixture cost estimates are based on local retail prices. The installation of the fixtures is three days and must be preceded by the framing.

Siding

The final exterior construction item is siding. The average cost to side a typical single-family home is \$11,025 for vinyl siding³⁶. The cost is reflected in **Table 3**. Siding must be preceded by the installation of the roof and the exterior fixtures. Siding is estimated to take 5 days.

Exterior Construction Total Cost

Exterior construction includes excavation, foundation, framing, roofing, gutters, downspouts, doors, windows, and siding. Each construction event is shown in the following **Table 3** along with their associated costs. The total cost for the exterior

construction of the 2,000 square foot proposed home is \$107,246.00. Visual depiction of all exterior elements is shown in **Figure 12** through **Figure 16** shown at the beginning of Section 5.

Table 3 Estimated Construction Costs for Exterior Construction

Estimated Project Costs				
DESCRIPTION	BULK PRICE	PRICE PER UNIT	QUANTITY	SUBTOTAL
Exterior Construction				
Excavation	\$ 5,000.00			\$ 5,000.00
Foundation				
Basement		\$20/SF	1,000 SF	\$ 20,000.00
Garage		\$4.65/SF	645 SF	\$ 3,000.00
Framing				
Main Building		\$25/SF	2000 SF	\$ 50,000.00
Garage		\$5/SF	645 SF	\$ 3,225.00
Roofing				
Main Building + Garage		\$4.5/SF	1845 SF	\$ 8,302.00
Gutter + Downspout				
Gutter		\$4.32/LF	139 LF	\$ 600.00
Downspout		\$7/LF	100 LF	\$ 700.00
Exterior Fixtures				
Exterior Doors		\$210/EA	4	\$ 840.00
Exterior Doorknobs		\$36/EA	4	\$ 144.00
36" Window		\$160/EA	16	\$ 2,560.00
81" Window		\$950/EA	1	\$ 950.00
8' X 16' Garage Door		\$900	1	\$ 900.00
Siding				
Vinyl Siding	\$ 11,025.00			\$ 11,025.00
		Exterior Construction Total		\$ 107,246.00

5.2 Interior Construction

Interior construction takes the home from a structural shell to a completed dwelling. The events included are plumbing, HVAC, electrical, insulation, drywall, paint, miscellaneous interior fixtures, flooring and trim. The calculations for the interior construction events are based on the proposed floor plan which is shown in **Figure 17** and **Figure 18**.

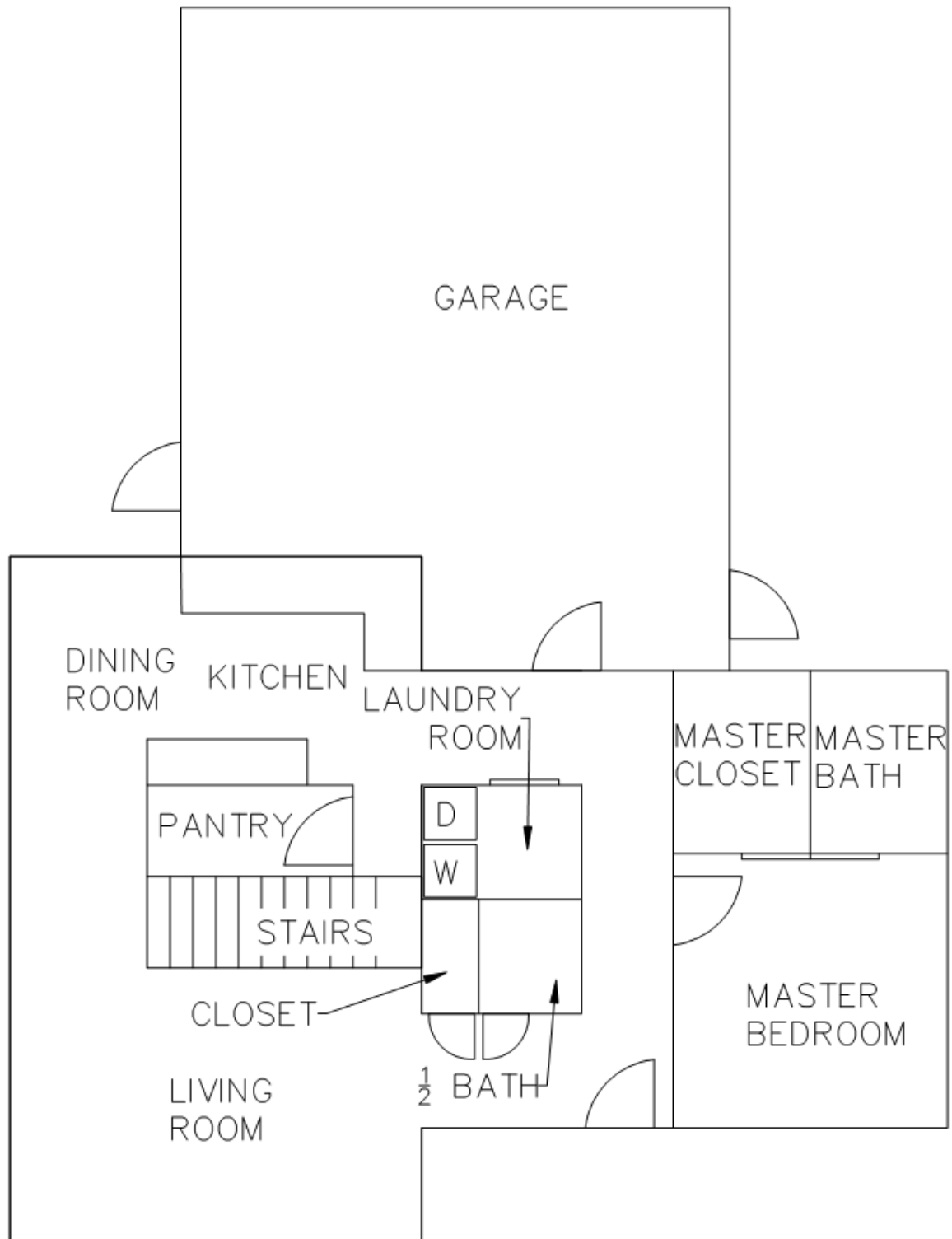


Figure 17 First Floor Proposed Floor Plan

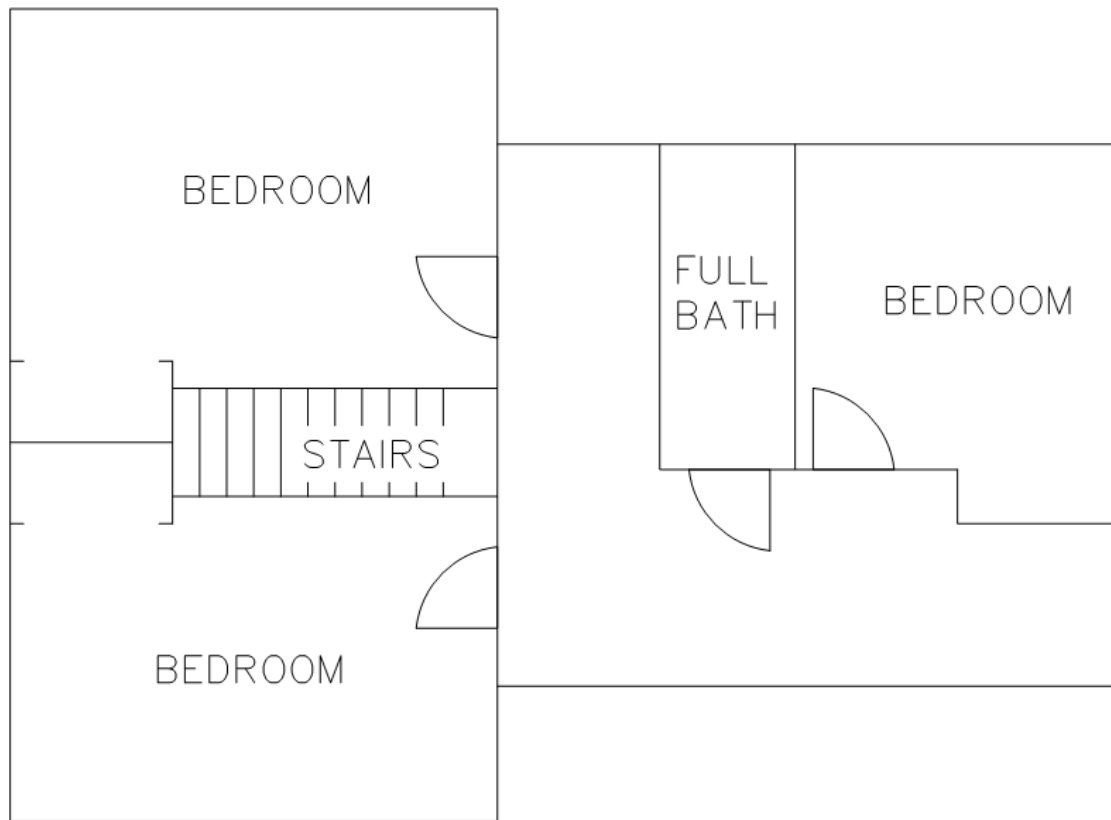


Figure 18 First Floor Proposed Floor Plan

Plumbing

The average cost to plumb a new home is based on the square footage of the home. The approximate cost to install plumbing is \$4.50 per square foot. For the 2,000 square foot house, the estimated cost to install plumbing is \$9,000. Plumbing includes running service lines and drains and installing fixtures like showers, sinks, faucets, toilets, washers, driers and dishwashers³⁷. Plumbing installation will also include installation of the sump pump, sanitary stack and the interior gas line. The cost is included in **Table 4**. Plumbing installation is separated into two events, rough plumbing and finish plumbing. Rough plumbing includes running pipes throughout the house and installing tubs, sinks, toilets and showers. Essentially, rough plumbing finishes to the point that drywall can be installed. Rough plumbing is expected to take 5 days and must be preceded by roofing³⁸. Finish plumbing is when fixtures on the outside of the drywall are installed such as faucets and toilets. Appliances such as washers and dishwashers are hooked up during finish plumbing. Finish plumbing is expected to take 3 days and must be preceded by drywall installation.

HVAC System

The HVAC system includes the installation of the heating and air conditioning systems throughout the house. This includes the furnace and air conditioning units as well as all the duct work throughout the building. The average cost for the installation for a 2,000 square foot home is \$7,000. The cost is shown in **Table 4**³⁹. Like plumbing, HVAC installation is roughed in before walls are finished and completed after the drywall is complete. The expected time of installation for rough-in and finish work is 3 and 2 days, respectively⁴⁰. Rough installation must be preceded by roofing and finish installation must be preceded by drywall.

Electrical

Electrical installation includes installing wires, panels, outlets, switches and light fixtures⁴¹. The average cost to install electric components in a 2,000 SF home is \$10,000 which is included in **Table 4**. Again, the installation is split between rough-in and finish electrical work. The process is expected to take 5 days, 3 days for rough-in and 2 days for finish work. The rough in installation is to be preceded by roofing and finish installation is to be preceded by drywall.

Insulation

Fiberglass batts will be installed in the attic and in the walls for insulation. The material cost for the insulation is approximately \$1 per square foot. For exterior walls and attic, the total square footage to cover is calculated to be 4,850 SF. Installation of the insulation is a separate, additional price of approximately \$500⁴². The total cost for the insulation installation is \$5,350. The price is reflected in **Table 4**. The installation is expected to take 2 days and must be preceded by rough in plumbing, HVAC, and electrical⁴³.

Drywall

Drywall installation includes materials and labor. The average cost to drywall a 2000 square foot home is \$20,000⁴⁴. The cost is reflected in **Table 4**. The time associated with drywall installation is four weeks and must be preceded by rough in plumbing, HVAC, and electrical.

Cabinetry

Cabinetry for the home including the kitchen, bathrooms, and laundry room is an expenditure that can vary drastically with the quality of cabinets. For an average custom cabinet installation, the average price is \$20,000⁵¹, shown in **Table 4**. The average time to install the cabinets is five days and must be preceded by drywall.

Paint

Paint for a 2000 square foot home costs approximately \$2 per square foot. This would cost a total of \$4,000, shown in **Table 4**⁴⁵. The estimated time is 5 days and should be preceded by drywall⁴⁶.

Flooring

The two main flooring materials proposed for the construction are mid-grade carpet and vinyl tile. Bedrooms and living room will receive carpet and all other floorspace will have vinyl tile flooring. The cost to install carpet and vinyl tile is approximately \$5 per square foot. For the 2,000 square foot house the total cost would be \$10,000^{47,48} shown in **Table 4**. The installation time for flooring is 5 days and must be preceded by drywall.

Trim

Trimming a home includes baseboard trim, trim around windows and doors, handrails, and interior door installation. The average cost to trim a home is \$1,300, shown in **Table 4**⁴⁹. The expected installation time is 5 days and must be preceded by flooring⁵⁰.

Interior Construction Total Cost

Interior construction included the plumbing, HVAC, electrical, insulation, drywall, cabinetry, paint, flooring, and trim. These construction events conclude the residential home construction. **Table 4** shows all the associated costs for the interior construction and yield a total cost of \$86,650.00.

Table 4 Interior Construction Costs

Estimated Project Costs				
DESCRIPTION	BULK PRICE	PRICE PER UNIT	QUANTITY	SUBTOTAL
Interior Construction				
<i>Plumbing</i>		\$4.50/SF	2000 SF	\$ 9,000.00
<i>HVAC</i>	\$ 7,000.00			\$ 7,000.00
<i>Electrical</i>	\$10,000.00			\$ 10,000.00
<i>Insulation</i>	\$ 500.00	\$1/SF	4850 SF	\$ 5,350.00
<i>Drywall</i>	\$20,000.00			\$ 20,000.00
<i>Cabinets</i>	\$20,000.00			\$ 20,000.00
<i>Paint</i>	\$ 4,000.00			\$ 4,000.00
<i>Flooring</i>		\$5/SF	2000 SF	\$ 10,000.00
<i>Trim</i>	\$ 1,300.00			\$ 1,300.00
		Interior Construction Total		\$ 86,650.00

6. COST ANALYSIS AND SCHEDULE

6.1 Construction Cost

The costs associated with due diligence, permitting, site design, external and internal construction were individually tabulated in previous sections. **Table 5** shows the complete list of itemized materials and fees anticipated to completely construct the proposed 2000 square foot residence. The total cost of the project is \$224,064.00.

Table 5 All Associated Construction Costs

TOTAL PROJECT COST	
Permit Fees Total	\$ 515.00
Site Design Total	\$ 29,653.00
Exterior Construction Total	\$ 107,246.00
Interior Construction Total	\$ 86,650.00
TOTAL ESTIMATED COST	\$ 224,064.00

6.1 Construction Schedule

The previously mentioned construction events, corresponding durations, and preceding events are modeled in a Gantt Chart shown in **Appendix B**. The total duration of the project is predicted to be five months. If construction began on April 1st, 2022, it is anticipated to be completed by August 31st, 2022. The scheduling assumes construction events to take place Monday through Saturday and includes holidays.

7. CONCLUSION

The design and construction of a 2,000 square foot two story residential home is proposed. The report starts with initial investigation of the proposed construction site and researches the permits and inspections required for construction. The project then designs the site which includes utilities, pavement, and landscaping. Lastly, exterior and interior construction events are planned and chronologically ordered. The entire project is anticipated to take five months from April 1st to August 31st and cost \$224,064.00.

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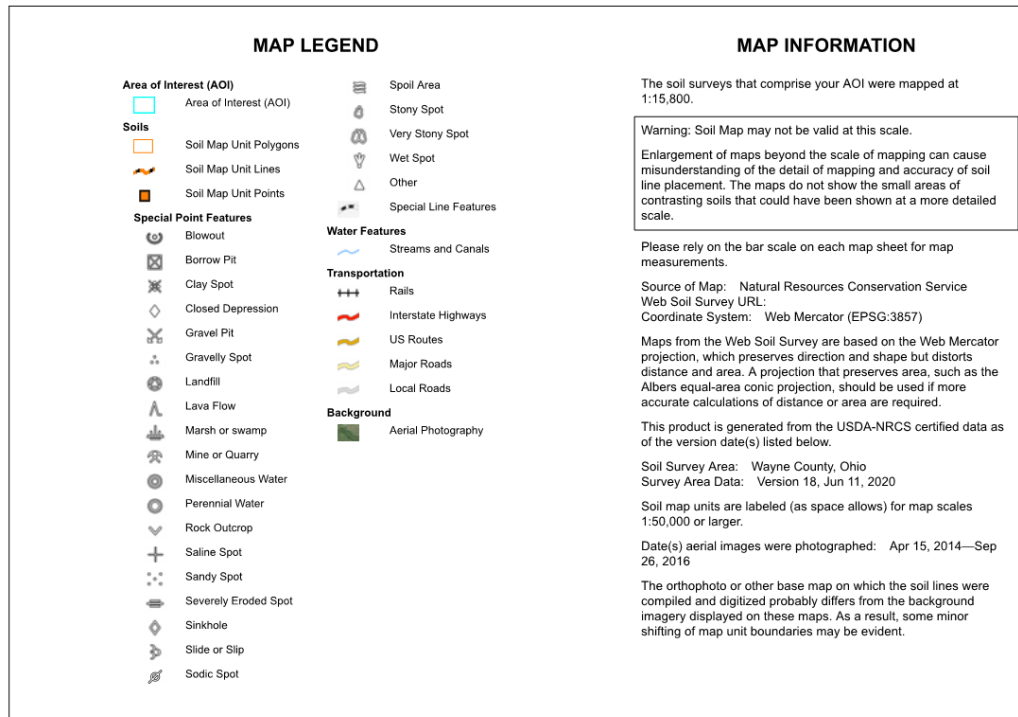
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APPENDIX

A. USDA soil map and soil description





Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
RsB	Rittman silt loam, 2 to 6 percent slopes	0.6	100.0%
Totals for Area of Interest		0.6	100.0%

Wayne County, Ohio

RsB—Rittman silt loam, 2 to 6 percent slopes

Map Unit Setting

National map unit symbol: 2vwwd
Elevation: 590 to 1,970 feet
Mean annual precipitation: 33 to 52 inches
Mean annual air temperature: 43 to 52 degrees F
Frost-free period: 135 to 215 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Rittman and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Rittman

Setting

Landform: Till plains
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Till

Typical profile

Ap - 0 to 8 inches: silt loam
BE - 8 to 11 inches: silt loam
Bt - 11 to 23 inches: clay loam
Btx - 23 to 42 inches: clay loam
BC - 42 to 49 inches: clay loam
C - 49 to 70 inches: clay loam

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: 18 to 36 inches to fragipan
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low (0.01 to 0.14 in/hr)
Depth to water table: About 10 to 27 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 10 percent
Available water capacity: Low (about 4.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: D

Ecological site: F139XY004OH - Moist Acidic Slopes
Hydric soil rating: No

Minor Components

Wadsworth

Percent of map unit: 10 percent
Landform: Till plains
Landform position (two-dimensional): Summit, footslope
Landform position (three-dimensional): Interfluvial, base slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Data Source Information

Soil Survey Area: Wayne County, Ohio
Survey Area Data: Version 18, Jun 11, 2020

APPENDIX
B. Gantt Chart

			1-Apr-22							8-Apr-22							15-Apr-22							22-Apr-22						
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
TASK	START	END	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T
Architectural Drawings	1-Apr	28-Apr																												
Permits	28-Apr	12-May																												
Excavation	13-May	16-May																												
Basement and Foundation	17-May	13-Jun																												
Basement and Foundation Inspection	14-Jun	15-Jun																												
Groundwater Well Installation	16-Jun	29-Jun																												
Septic System Installation	16-Jun	21-Jun																												
Septic System Inspection	22-Jun	23-Jun																												
Framing	16-Jun	29-Jun																												
Framing Inspection	30-Jun	1-Jul																												
Exterior Fixtures	2-Jul	5-Jul																												
Roof	2-Jul	7-Jul																												
Siding	8-Jul	13-Jul																												
Rough HVAC Installation	8-Jul	11-Jul																												
Rough Electrical	8-Jul	13-Jul																												
Rough Electrical Inspection	14-Jul	15-Jul																												
Rough Plumbing	8-Jul	13-Jul																												
Gas Connection	14-Jul	14-Jul																												
Rough Plumbing Inspection	15-Jul	15-Jul																												
Gutter and Downspouts	14-Jul	15-Jul																												
Insulation	16-Jul	18-Jul																												
Insulation Inspection	19-Jul	20-Jul																												
Storm Sewer Installation	16-Jul	19-Jul																												
Exterior Paving	20-Jul	22-Jul																												
Landscaping	23-Jul	23-Jul																												
Drywall	21-Jul	17-Aug																												
Flooring	18-Aug	23-Aug																												
Paint	18-Aug	23-Aug																												
Finish Plumbing	18-Aug	20-Aug																												
Finish Plumbing Inspection	22-Aug	23-Aug																												
Finish HVAC	18-Aug	19-Aug																												
Finish Electrical	18-Aug	19-Aug																												
Finish Electrical Inspection	22-Aug	22-Aug																												
Cabinetry	18-Aug	23-Aug																												
Trim	24-Aug	29-Aug																												
Final Building Inspection	30-Aug	31-Aug																												

[illegible]

[illegible]

TASK	START	END	26-Aug-22						
			26	27	28	29	30	31	
			F	S	S	M	T	W	
Architectural Drawings	1-Apr	28-Apr							
Permits	28-Apr	12-May							
Excavation	13-May	16-May							
Basement and Foundation	17-May	13-Jun							
Basement and Foundation Inspection	14-Jun	15-Jun							
Groundwater Well Installation	16-Jun	29-Jun							
Septic System Installation	16-Jun	21-Jun							
Septic System Inspection	22-Jun	23-Jun							
Framing	16-Jun	29-Jun							
Framing Inspection	30-Jun	1-Jul							
Exterior Fixtures	2-Jul	5-Jul							
Roof	2-Jul	7-Jul							
Siding	8-Jul	13-Jul							
Rough HVAC Installation	8-Jul	11-Jul							
Rough Electrical	8-Jul	13-Jul							
Rough Electrical Inspection	14-Jul	15-Jul							
Rough Plumbing	8-Jul	13-Jul							
Gas Connection	14-Jul	14-Jul							
Rough Plumbing Inspection	15-Jul	15-Jul							
Gutter and Downspouts	14-Jul	15-Jul							
Insulation	16-Jul	18-Jul							
Insulation Inspection	19-Jul	20-Jul							
Storm Sewer Installation	16-Jul	19-Jul							
Exterior Paving	20-Jul	22-Jul							
Landscaping	23-Jul	23-Jul							
Drywall	21-Jul	17-Aug							
Flooring	18-Aug	23-Aug							
Paint	18-Aug	23-Aug							
Finish Plumbing	18-Aug	20-Aug							
Finish Plumbing Inspection	22-Aug	23-Aug							
Finish HVAC	18-Aug	19-Aug							
Finish Electrical	18-Aug	19-Aug							
Finish Electrical Inspection	22-Aug	22-Aug							
Cabinetry	18-Aug	23-Aug							
Trim	24-Aug	29-Aug							
Final Building Inspection	30-Aug	31-Aug							