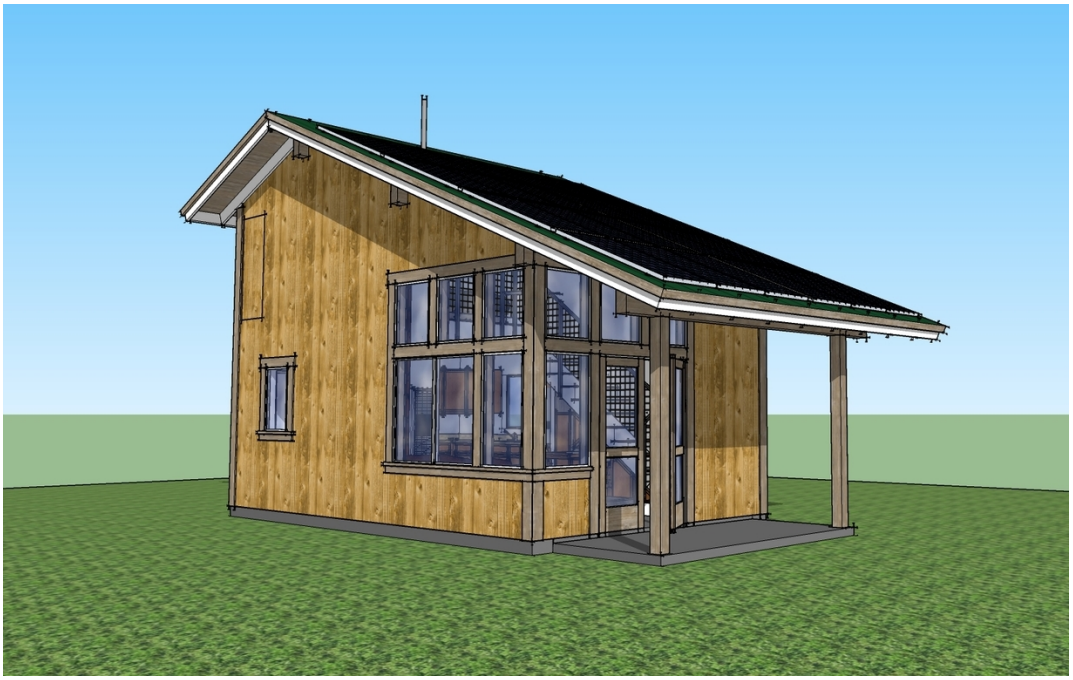
Habitat for Humanity Tiny Homes Affordable Housing Site Design Proposal for Flagstaff Unified School District in Flagstaff, Arizona



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Final Design Report

May 6th, 2019

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List of Abbreviations

ADA: Americans with Disabilities Act

AHJ: Authority Holding Jurisdiction

COF: City of Flagstaff

FUSD: Flagstaff Unified School District

SWPPP: Storm Water Pollution Prevention Plan

Acknowledgements

We would like to thank our technical adviser Stephen Irwin at Shepard-Wesnitzer, our grading instructor Dr. Dianne McDonnell, and our clients from the board of Habitat for Humanity Dr. Steve Mead and Karl Eberhard for their guidance and technical expertise.

1.0 Project Introduction

Habitat for Humanity (Habitat) is collaborating with Flagstaff Unified School District to create affordable housing to retain teachers in Flagstaff among the rising cost of living. Flagstaff schools struggle to retain their employees because the median house price in Flagstaff is $373,600 compared to the median house price of $241,500 found in Phoenix [1]. A new affordable development would create affordable housing for teachers and FUSD employees. Habitat proposes to construct a tiny home community with at least 45 units on a property adjacent to Sinagua Middle School as shown in Figure 1. Habitat had requested the development of a preliminary civil site plan including a grading and drainage plan, a road and parking design, a storm water management design, a site utility infrastructure, and a preliminary cost estimate. The project requirements were laid out by the City of Flagstaff engineering codes and ADA compliance standards. The goal of the project design was to produce a design that will ensure this development is affordable to construct and occupy. This project is limited by the constraints set out by the AHJ, the zoning of the site, and existing topography. The site parcel is currently a wooded, undeveloped area that is zoned as a Public Facility space and owned by FUSD. The site location is displayed in Figure 1 below.

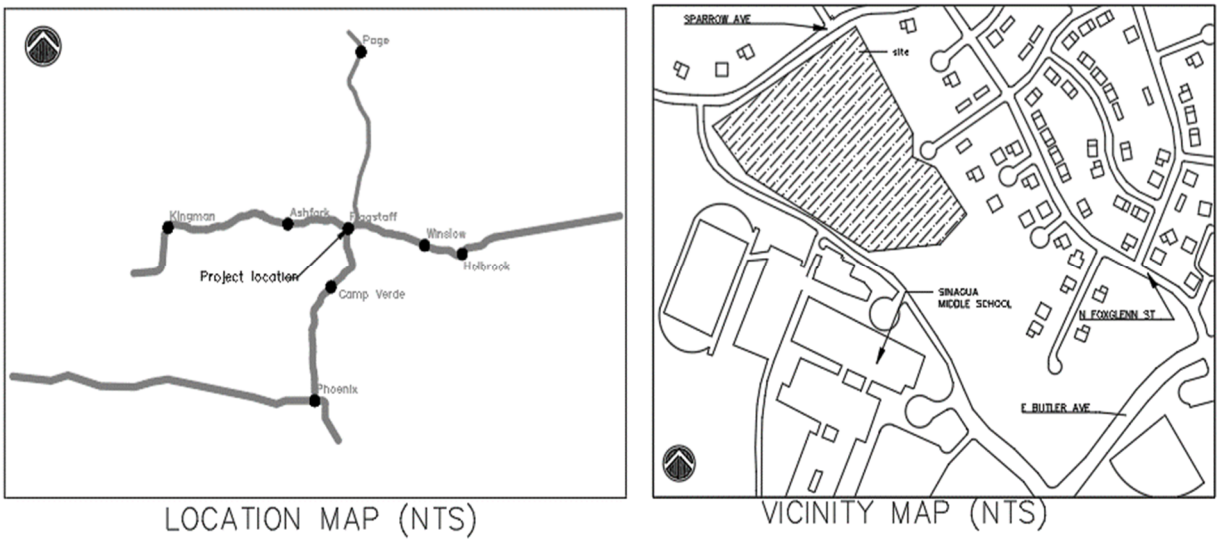


Figure 1: Habitat for Humanity Tiny Home Project Site in Flagstaff, Arizona [2]

2.0 Project Impacts

The design and implementation of the project will impact the Flagstaff community economically and socially in addition to the direct environmental impacts. Economically, FUSD hopes to impact the community by providing a cost-efficient affordable housing option in an area where housing and living expenses are continuously rising. FUSD wants to impact the community by increasing the retention of the local educators within the Flagstaff community due to decreased living expenses for teachers. It is possible that FUSD could pursue other options such as grants to subsidize the cost in order to lower the overall price of the project. The project will impact the environment directly due to the need to cut down, remove, and thin trees in the area to provide space for the housing units and road to be built. Due to the steep grade of

the site, the project required large amounts of earthwork to excavate and grade the finished floor elevations for the building pads. Due to the exclusion of a geotechnical report, the team operated under the assumption that there are large amounts of rock underground which will likely need to be hammered or blasted out for the implementation of the design. The large anticipated amounts of cut and fill will need to be transported as import and export to and from the project site which will also have an impact on the environment in the area. The project will impact children of the neighborhood and nearby Sinagua Middle School because the empty lot is currently used as a recess and recreational play area.

3.0 Road Design

3.1 Site Access

Access to the site will be by a road connecting Mustang Way and Sparrow Avenue. Tie in points to the road will be at the north corner of the site at the intersection of Sparrow Avenue and Falcon Road. The southeast entrance will tie in at an existing stop sign intersection on Mustang Way near Sinagua Middle School. Sidewalk access will correlate directly with the road as the sidewalk will run parallel to the road.

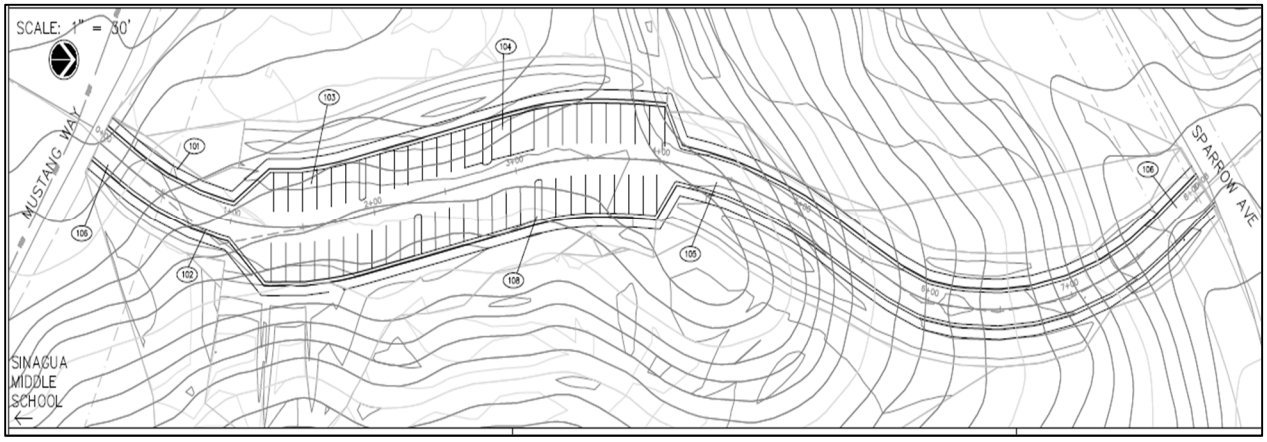


Figure 2: Road Layout and Design for Habitat for Humanity Preliminary Site Design (NTS)

3.2 Road Layouts

Three design alternatives were considered for the site and road layout. A concept plan developed by architect Karl Eberhard was used for guidance and considered as one alternative [3]. Two additional road layouts were developed following the City of Flagstaff codes for road layouts to compare and analyze. The road design was strategically laid out to avoid excessive amounts of cut and fill. When possible, the option to fill was favored as it was determined to be the most cost-effective option. The proposed street for the site was presumed to be a residential local street for design criteria.

The proposed residential street follows City of Flagstaff codes and maintain a 2% grade for 20 feet at site access points is followed [4]. Vertical curvature was determined using City of Flagstaff code 13-10-008-0002 with a design speed of 20 MPH, crest value of 7, and sag value of 17 [4]. Horizontal curvature was determined using City of Flagstaff code 13-10-011-0001, requiring a minimum curve radius of 100 feet and maximum grade of 10% [4]. The cumulative cut and fill amounts were analyzed to determine the most cost effective and efficient option. Table 1 below provides a summary of amounts for all three design

alternatives. Using the values for cut and fill for the design options, design option #3 was chosen for the road layout.

Table 1: Cut/Fill Volumes for Road Designs Alternatives 2 and 3

Cut/Fill Amounts for Selection	Design Alternative #1	Design Alternative #2	Design Alternative #3
Cumulative Fill Amount (Cubic Yards)	3215.26	3315.33	828.82
Cumulative Cut Amount (Cubic Yards)	3685.67	3806.89	3412.73

Layout of the site was optimized for best uses of the topography and tree locations in the area, including consideration of resource protection and minimizing tree removal, solar access, and avoiding ice build-up on roads. COF detail 10-40.60.280 states that planned residential developments must designate a minimum of 15 percent of the gross site area included within any areas with natural resources such as slopes or forests that may be required to be protected as stipulated in Division 10-50.90, Resource Protection Standards [4]. The resource protection requirements were met by use of tree banks with large, undisturbed areas. Only 3.7 acres of the 18.8 acres were developed upon, leaving nearly 80% of the site undeveloped and with preservation of natural resources.

The tiny homes are 28’ by 14’ for Studio Apartments, with lots for 1-bedroom units to be included with an addition 11’ by 15’ [2]. The property will need to be rezoned, and this project assumed the new zoning to be residential with homes following ‘Bungalow Court’ requirements [4]. Setbacks for the lots will be determined once the new zoning category is selected, but current design will be compliant with residential zones R1, R2, and R3 [4].

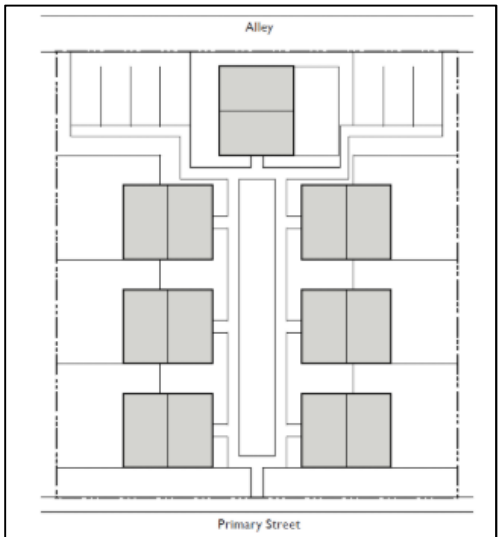


Figure 3: Basis of Design for Bungalow Court Building Types, Following City of Flagstaff Zoning Code 10-50.110.080

The site layout was designed with the following criteria:

- Maximize the number of units that have solar panel access to south-side sun

- Reduce number of trees to be removed by arranging homes in existing open/flat areas
- Reduce amount of cut/fill required by utilizing existing topography
- Provide a park area space on the property available by walking access

The final site design provided includes 50 total tiny home units with 51 parking spaces. ADA accessibility is compliant as 6 units are ADA accessible with 3 ADA parking stalls. Concrete sidewalks with conforming slopes are used on walkways at this location instead of decomposed granite as specified. Parking stalls follow City of Flagstaff standard 10-50.80.080 with perpendicular stalls that are 20 feet long by 10 feet wide. ADA stalls are provided as 20' long and 12' wide, meeting minimum COF standard of 18' by 11' [4].

4.0 Grading

The grading plan provides optimal finished floor elevations and earthwork volumes required for the development. Due to the scope and exclusions of this project, a geotechnical report of the site is not available. The assumption was made that the property is rock and would need to be fully excavated with no economic option for onsite reuse. The design favored imported fill rather than balancing the amounts of cut and fill as it was determined to be the most economically feasible design.

Civil 3D was utilized to overlay the road, building pads, and walkways on the existing contours surface. Finished floor elevations were determined by balancing the pad elevation to the existing grade. Once elevations for the roads, buildings, and parking were determined, a new surface for proposed grade was developed. A grid surface volume method with cut and fill factors of 1 were used. Grading functions in Civil 3D were used to compare the existing contour surface to the proposed contour surface to determine required volumes for cut and fill. To determine the quantities of required earthwork, the volumes for the road asphalt and AB sections had to be removed from the calculated volume, which accounted for 1,200 cubic yards of cut material and 314 cubic yards of fill. The final volumes for earthwork are available in Table 2 below.

Table 2: Grading Volume Summary

Grading Volume Summary		
Cut Volumes	4,562	Cubic Yards
Fill Volumes	6,073	Cubic Yards

Due to the topography and challenges of the site, the only ADA compliant walkways are the concrete paths up to the identified ADA unites. The hatched pathways are 8' wide decomposed granite walkways. The properties on the East side of the road will need to have stair access to some of the homes due to steep grade changes. The recommendation is made that the homes on the east side have larger stem wall and may require retaining walls. Figure 4 below for the grading plan.

Figure 4: Grading Plan for Tiny Home Affordable Housing Site Development

5.0 Drainage

The drainage design used the rational method to account for maximum rate of runoff, precipitation factors, runoff coefficients, rainfall intensity, and the drainage area tributary to the design location (in acres) [5]. The design follows the C.O.F. requirements for storm water drainage because the development will tie in to existing storm water system at the northeast corner of Sparrow Avenue.

The area analyzed for drainage of the site is 9.9 acres. The total area of the property is 18 acres, but the southwest, undeveloped area was not analyzed as part of this scope as it drains to the southeast corner and does not affect the development. The runoff coefficient (C) was determined by calculating a weighted C value used for the existing area of woods (Gravelly Clay Steep). A C value of .17 was used for the design. The property was analyzed in sub-basins for the 5-minute storm in various flood events. To be conservative in design and adhere to code, the storm water management system was designed to handle the 100-year storm event. Information on the existing infrastructure along Sparrow Avenue was obtained from the 2018 Capital Improvements project by City of Flagstaff [6]. Flows for the new development were analyzed in comparison to the existing infrastructure.

The existing impervious area on the vacant site was determined to be zero square feet. The proposed design includes a total of 77,115 square feet of impervious surface and was analyzed to determine post-development flow values and detention requirements. The rational method was utilized via Civil 3D to determine required detention volume for each basin. Results are displayed

in Appendix A. The calculated required volume of detention was determined to be less than the ROCV volume due to the size of the site and relatively small amount of impervious area that is being added. The provided detention volume meets COF low-impact-development standards, as reflected in Table 3.

Table 3: Impervious Area and LID Analysis By Basin for Tiny Home Development

IMPERVIOUS AREA AND LID ANALYSIS BY BASIN					
BASIN ID	TOTAL BASIN AREA(SF)	TOTAL IMPERVIOUS AREA (SF)	REQ 1" LID VOLUME BASED ON IMPERV. AREA (CF)	CALCULATED REQ DETENTION VOLUME (CF)	PROVIDED DETENTION VOLUME (CF)
WEST BASIN	240388	39,406	3026.0000	1,689	3,300
EAST BASIN	192315	37,709	3,213	1,621	3,600

The existing maximum rate of runoff is 14.39 cfs. The calculated maximum rate of runoff post-development is 24.66 cfs. This 41.65% increase will be accounted for in infrastructure design of LID basins onsite. Following City of Flagstaff Stormwater Management Codes, the required LID volume for 1" of rainfall on impervious surfaces was 6,426 cubic feet. This is broken into the West and East basin and detention ponds. The volume and properties of these ponds can be found in the tables 4 below.

Table 4: LID Detention Basin Properties for Onsite West and East Detention Ponds

WEST DETENTION BASIN PROPERTIES	EAST DETENTION BASIN PROPERTIES
PONDING DEPTH = 3 FT	PONDING DEPTH = 3 FT
AREA = 1500 SQ FT	AREA = 1500 SQ FT
LENGTH = 100 FT	LENGTH = 75 FT
TOP WIDTH = 15T	TOP WIDTH = 20 FT
BOTTOM WIDTH = 7 FT	BOTTOM WIDTH = 12 FT
EMBANKMENT WIDTH = 4 FT	EMBANKMENT WIDTH = 4 FT
SLOPE = 0.75	SLOPE = 0.75
DETENTION VOLUME = 3300 CUB. FT	DETENTION VOLUME = 3600 CUB. FT

6.0 Utilities

Utilities were connected to existing hookups already found on access locations off-site. Water access was connected at two points to existing pressurized water main access points located on both sides of the project site at Mustang Way and Sparrow Avenue. Utility trenches were designed according to Engineering Detail 9-01-010 from the COF Standard Drawings [7]. The standard states that neither the combination of water and electric lines nor the combination of gas and sewer are permitted in the same trench. Water and gas lines will be placed in the same trench. Minimum spacing of 12" is required between the gas and water lines in both the vertical and horizontal directions. Water and sewer lines have minimum separation of 6 feet horizontally and 2 feet vertically to avoid cross contamination. Mains were separated from the edge of the curb by a minimum of 4ft. The sanitary sewer line has been designed in the paved roadway section at least 7 feet from the water line where it uses gravity to carry waste to the connection downhill located on Sparrow Avenue. The Arizona Revised Statutes and Arizona Department of

Environmental Quality states that fire flow demand for single-family residential dwellings is 1,000 gpm. Number of fire hydrants required on the site will be determine by the length of the roadway and the spacing required between each fire hydrant. Due to the elevation of the housing units on the east side of the project, the sewer lines had to be rerouted from the back end to the street downhill to following downward slope.

Figure 5: Utility Layout for Tiny Home Site Design Showing Sewer Line Connections Back to Proposed Road

7.0 Final Design Recommendations

The final design for the proposed Habitat for Humanity affordable housing development was influenced by affordability. Three road design alternatives were presented with different curvatures and earthwork amounts. The final decision on the road design was made to ensure the road layout met all of COF codes stated in Section 2. The final road design configuration was altered slightly to reduce construction cost. The COF code typical configuration includes six-foot parkways on each side of the road. The road design used for the site will remove these parkways as there is a parking lot along the road. The removal of a total 12 feet to the road width will reduce the amount of earthwork and asphaltic concrete needed. These reductions will lower the overall cost of construction.

The placement and layout of the building pads for the tiny homes were placed to follow the contours lines of the existing site to minimize earthwork, as well as to orient the solar panels for optimal access. Due to the topography of the site, there are only six ADA accessible pads for the layout. This decision was made to only have six ADA building pads as the construction cost would increase as other building pads would require more earthwork to be placed at proper ADA elevations. Table 2 in Section 3 shows the earthwork

values for the final site layout of the building pads and sidewalks. Figure 4 in Section 5 shows the ADA building pads placed on the west side of the road on the most level part of the site.

In order to reduce cost, decomposed granite walkways were used as a replacement for concrete on most site sidewalks. Concrete sidewalks were used for ADA access paths. The choice of sidewalk was made as decomposed granite is the more cost-effective option in both the short term and long-term time periods. Figure 4 in Section 2.1.4 shows the where the different sidewalk materials will be used for the site.

The option of lift stations were considered for this site, but the recommended utility layout is to trench a sewer line from the east homes to the north end of the road to avoid extended maintenance and operation costs. Unconventional systems, such as incinerator toilets and compost, were not considered in this design. Value engineering recommendations include the use of master meter systems on the development instead of individually metering each dwelling.

The proposed site plan avoids excessive amounts of tree removal to keep an aesthetic appeal of nature that Flagstaff presents. The final plan for the affordable housing development was designed using cost efficient methods while keeping the environment and community in consideration. It is our recommendation that further analysis and development of construction drawings are completed for this use of the site.

8.0 Cost of Implementing the Design

The total cost estimation for the conceptual design was found to be $979,176. The values for each major category of infrastructure construction is shown in Table 5. This cost currently excludes utility connection points, the cost for building of the homes, and building permits and fees. There is also a 20% contingency added into the cost of construction as the design is a conceptual level design. The contingency is added, as there may be issues that can occur later in the design process that can cause the construction cost to rise. A detailed breakdown of the cost estimate is located in Appendix B. The total bid cost results in a cost of $19,584 for each of the 50 tiny homes. With a monthly payment of $600, each tiny home can be paid off in less than 3 years. Grants may be a source that can lead to a lower price per tiny home.

Table 5: Cost Estimation for Conceptual Design

Item	Total
Removal/Replacement Stormwater Drain Sparrow Lane	$ 1,822
Earthwork/Concrete/Paving	$ 379,829
Drainage	$ 58,026
Water	$ 154,020
Sewer	$ 92,000
Miscellaneous	$ 130,282
Contingency	$ 163,196
Total Base Bid	$ 979,176

9.0 Summary of Engineering Work

Modifications were made from the preliminary schedule to complete the road design prior to the grading and drainage plan. This was done due to a recommendation made by the technical advisor due to the difficulty of matching the site topography to road grade requirements. Deliverables were moved up in

the Spring 2019 semester based on comments received from the client and grading instructors during final presentation. The 30% deliverable was accurate with the initial proposed schedule, but the 60% did not include the full drainage plans. Further calculations and confirmation with the technical advisor had to be considered before finalizing the plan. The scope has not differed than what was provided in the proposal and the critical path has not been effected.

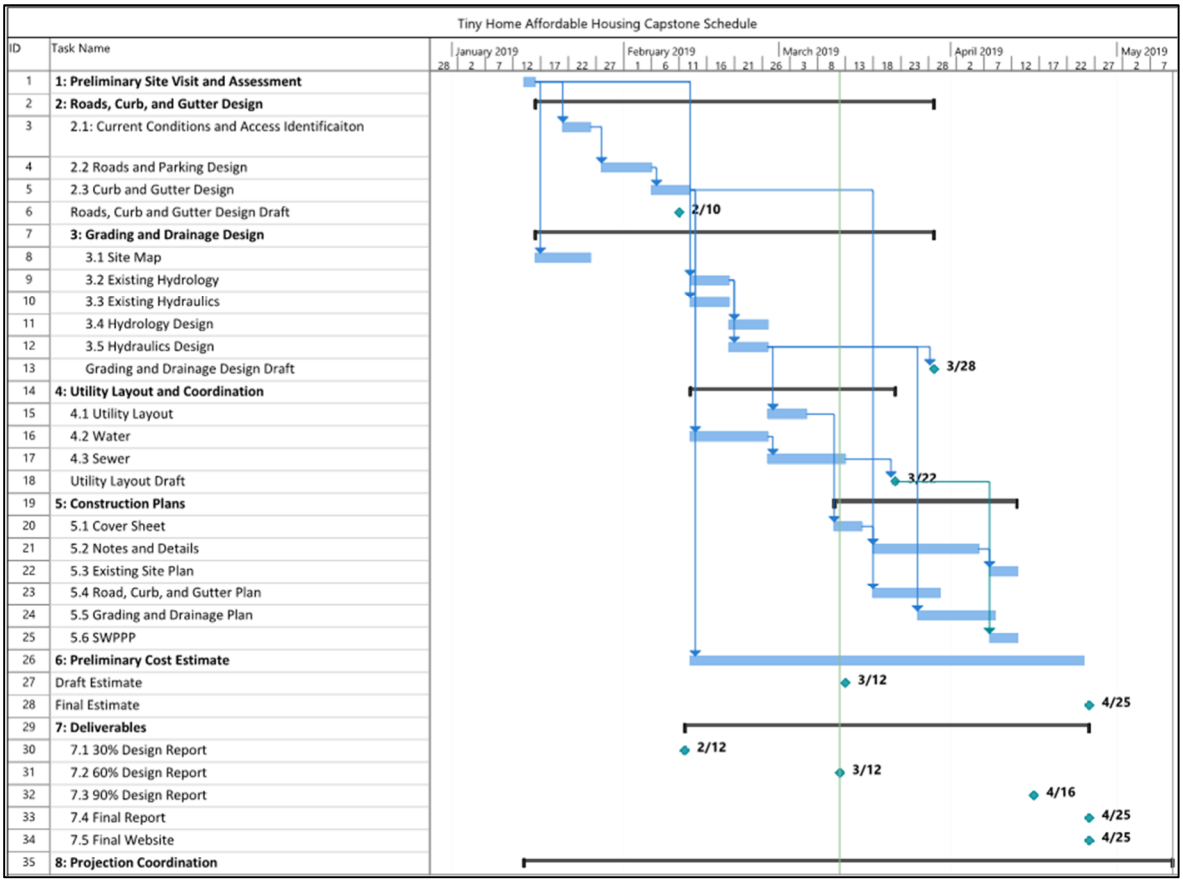


Figure 6: Updated Spring 2019 Schedule for Tiny Home Capstone Project

10.0 Summary of Engineering Cost

The staffing for this project has changed slightly due to a decrease in team size from 5 members to 4. Previously the five team members divided the team into the 4 possible positions, which resulted in some positions receiving twice as many hours at times. With only 4 team members, the total number of hours has decreased as each member is assigned their own position. Table 6 below provides the original allocation of hours for each team member, and Table 7 provides the updated working hours of each team member.

Table 6: Original Working Hours of each Team Member by Task

Task	SENG Hours	ENG Hours	EIT Hours	INT Hours
1.0 Preliminary Site Visit and Assessment		8	4	4
2.0 Grading and Drainage Design	20	60	55	55
3.0 Roads, Curb and Gutter Design	16	60	55	55

4.0 Utility Layout and Coordination	8	40	40	10
5.0 Construction Plans	40	80	60	60
6.0 Cost Analysis	16	10		
7.0 Deliverables	35	10		
8.0 Project Coordination	80			
Subtotal	215	268	214	184
Total (hours)	881			

Table 7: Updated Working Hours of each Team Member by Task

Task	S ENG Hours	ENG Hours	EIT Hours	INT Hours
1.0 Preliminary Site Visit and Assessment	0	8	4	4
2.0 Roads Curb and Gutter Design	15	45	35	35
3.0 Grading and Drainage Design	15	48	37	39
4.0 Utility Layout and Coordination	15	32	23	21
5.0 Construction Plans	40	50	15	15
6.0 Cost Analysis	20	38		
7.0 Deliverables	40	8		
8.0 Project Coordination	80			
Subtotal	225	229	114	114
Total (hours)	682			

Table 8 provides the original projection for cost of engineering services. The EIT and Intern will work closely underneath the supervision of the engineer to complete the grading and drainage designs as well as the layout of utilities. The Engineer was responsible for the design of the road, curb, and gutter so they have completed the most hours thus far.

Table 8: Original Cost of Engineering Services

Personnel	Classification	Hours[1]	Rate, $/hr	Cost
	SENG	215	150	$32,250
	ENG	268	91	$24,388
	EIT	214	65	$13,910
	INT	184	23	$4,232
TOTAL				$74,780
[1] Number of hours/day × number of days, for each classification				

Table 9: Updated Cost of Engineering Services

Personnel	Classification	Hours	Rate, $/hr	Cost
	SENG	225	$ 150.00	$ 33,750.00
	ENG	229	$ 91.00	$ 20,839.00
	EIT	114	$ 65.00	$ 7,410.00
	INT	114	$ 23.00	$ 2,622.00
Total				$ 64,621.00

11.0 Conclusion

The project was designed to meet the original objectives as assigned by the client. The constraints of tying into existing roads and utility connection points were met and unconventional options for utility and building systems were not explored in this analysis as requested by the client. This project has met the assigned objectives by providing a preliminary project layout that follows all requirements of the AHJ and is within constraints of the site. The cost estimate provides a rough order of magnitude for development of the site and infrastructure that will provide the client with the opportunity to determine feasibility.

12.0 References

[1] Zillow, Inc, “Flagstaff AZ Home Prices & Home Values,” Zillow. [Online]. Available: https://www.zillow.com/flagstaff-az/home-values/. [Accessed: 08-Mar-2019].

[2] Habitat for Humanity Tiny Homes Affordable Housing Site Design Proposal for Flagstaff Unified School District in Flagstaff, Arizona. ABK : Anna Kurn, David Borja, Michael Bulriss, Abdulrahim Abdullah, Mobarak Alsulaiman. CENE 476 Capstone : https://onedrive.live.com/view.aspx?resid=565C70869A7714A1!116&ithint=file%2cdocx&app=Word&authkey=!AmFru8ZQYdBNQkQ

[3] Karl Eberhard, Tiny Home Designs. https://karleberhard.com/multifamily/#/habitat-soliere/

[4] City of Flagstaff, "Title 10: Flagstaff Zoning Code," 24 January 2019. [Online]. Available:

https://www.codepublishing.com/AZ/Flagstaff/.

[5] City of Flagstaff, “Stormwater Management Design Manual – City of Flagstaff” Created March 2009. [Online]. Accessed March 2019. Available: https://www.flagstaff.az.gov/DocumentCenter/View/58133/SWMgmtDesignManual-3-09?bidId=

[6] City of Flagstaff, “Sparrow Ave Record Drawings FINAL”. September 18th, 2018. Print.

[7] “Engineering Detail 9-01-010: Underground Utilities in Streets Typical Location and Trench Detail,” City of Flagstaff Engineering Standards. [Online]. Available: https://www.flagstaff.az.gov/DocumentCenter/View/14939/Title-23-APPENDIX-A---STANDARD-DRAWINGS?bidId=. [Accessed: 05-Mar-2019].

Appendix A: Civil3D Hydrology Reports

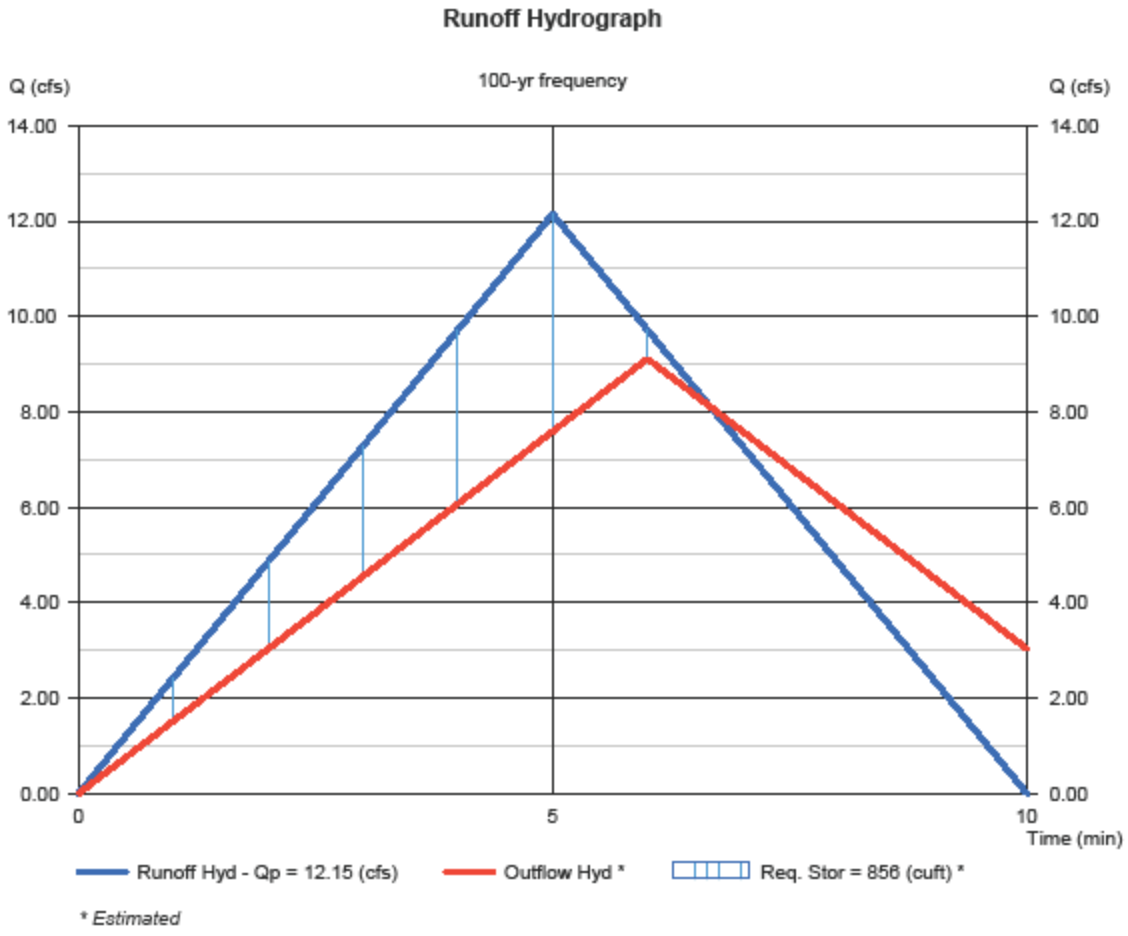
Hydrology Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Tuesday, May 7 2019

East Sub Basin

Hydrograph type	= Rational	Peak discharge (cfs)	= 12.15
Storm frequency (yrs)	= 100	Time interval (min)	= 1
Drainage area (ac)	= 4.420	Runoff coeff. (C)	= 0.28
Rainfall Inten (in/hr)	= 9.814	Tc by User (min)	= 5
IDF Curve	= SampleExpress.IDF	Rec limb factor	= 1.00

Hydrograph Volume = 3,644 (cuft); 0.084 (acft)



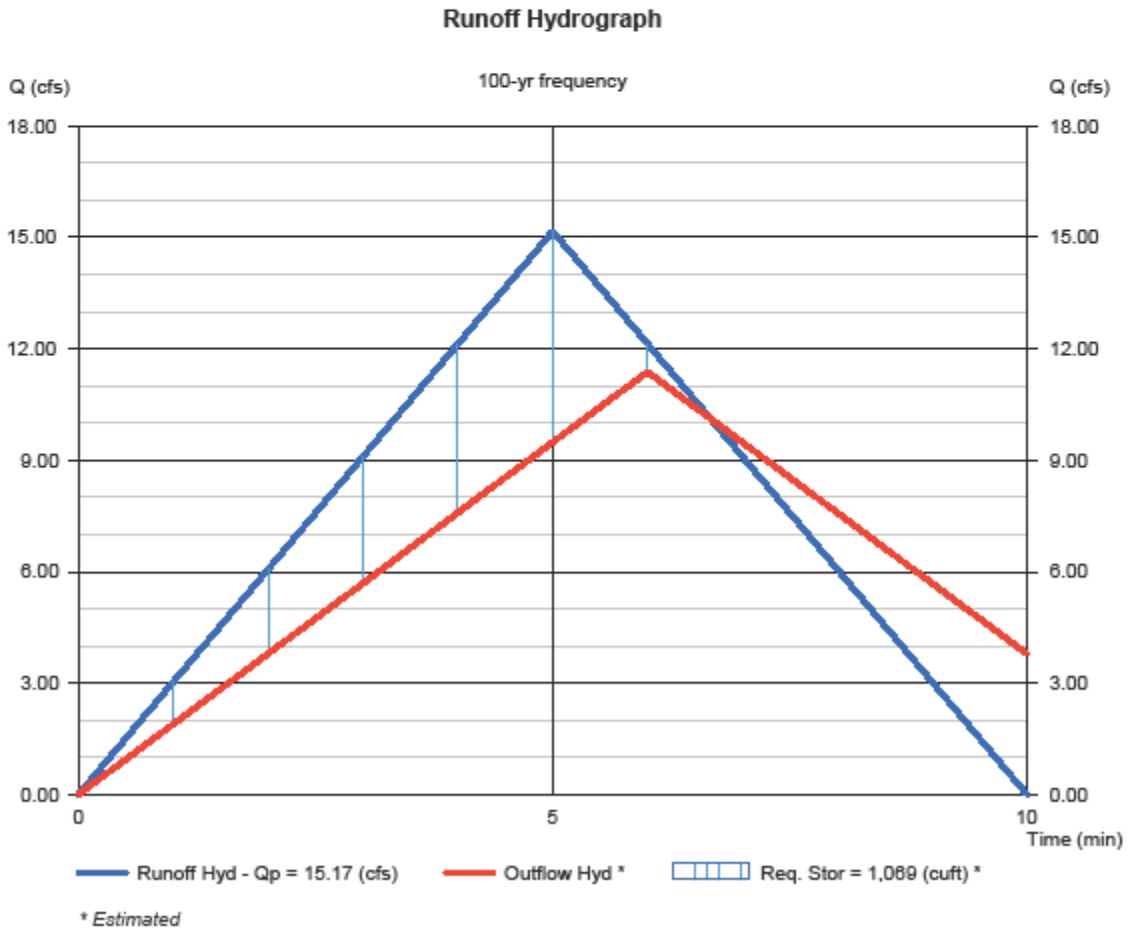
Hydrology Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Tuesday, May 7 2019

West Sub Basin

Hydrograph type	= Rational	Peak discharge (cfs)	= 15.17
Storm frequency (yrs)	= 100	Time interval (min)	= 1
Drainage area (ac)	= 5.520	Runoff coeff. (C)	= 0.28
Rainfall Inten (in/hr)	= 9.814	Tc by User (min)	= 5
IDF Curve	= SampleExpress.IDF	Rec limb factor	= 1.00

Hydrograph Volume = 4,551 (cuft); 0.104 (acft)



Appendix B: Project Cost Estimate

Item	Qty	Unit	Unit Price	Total
Removal/Replacement Stormwater Drain Sparrow Lane				
Remove Sidewalk	128	SF	$ 4.00	$ 512.00
Remove Stormdrain	40	LF	$ 20.00	$ 800.00
Remove Curb and Gutter	85	LF	$ 6.00	$ 510.00
Earthwork/Concrete/Paving				
Clear & Grub Roadway and Sidewalk	2000	SY	$ 2.00	$ 4,000.00
Clear & Grub Building Pads	20900	SY	$ 2.00	$ 41,800.00
Earthwork Cut	8251	CY	$ 12.00	$ 99,012.48
Earthwork Fill	9044	CY	$ 9.00	$ 81,398.88
Subgrade Preparation	2784	SY	$ 2.00	$ 5,568.00
Curb and Gutter	808	LF	$ 20.00	$ 16,160.00
3" A.C. Pavement/6" A.B.C.	2784	SY	$ 40.00	$ 111,360.00
Decomposed Granite Sidwalks	1102	SY	$ 15.00	$ 16,530.00
Striping and Signage	1	LS	$ 4,000.00	$ 4,000.00
Drainage				
LID Retention Basin	1	LS	$ 10,000.00	$ 10,000.00
Rip-rap	214	CY	$ 34.00	$ 7,276.00
Grouted Rip-rap	485	CY	$ 50.00	$ 24,250.00
48" Storm Drain Manhole	3	EA	$ 5,500.00	$ 16,500.00
Water				
8" PVC Waterline	770	LF	$ 60.00	$ 46,200.00
8" Gate Valve	10	EA	$ 1,605.00	$ 16,050.00
Water Meter Assembly	8	EA	$ 10,000.00	$ 80,000.00
Fire Hydrant W/ Valve	2	EA	$ 4,815.00	$ 9,630.00
Waterline Connect to Existing	2	EA	$ 1,070.00	$ 2,140.00
Sewer				
8" PVC Sewerline	600	LF	$ 45.00	$ 27,000.00
48" MH	13	EA	$ 5,000.00	$ 65,000.00
Miscellaneous				
Mobilization	1	LS	$ 13,713.95	$ 13,713.95
Erosion Control	1	LS	$ 6,856.97	$ 6,856.97
Traffic Control	1	LS	$ 13,713.95	$ 13,713.95
Testing/Quality Control	1	LS	$ 20,570.92	$ 20,570.92
Inspections	1	LS	$ 34,284.87	$ 34,284.87
Construction Staking	1	LS	$ 13,713.95	$ 13,713.95
Construction Management	1	LS	$ 27,427.89	$ 27,427.89
Contingency				
Unforseen Issues	1	LS	$ 163,196.00	$ 163,196.00
			Total Base Bid	$ 979,175.86