BYU | CIVIL & ENVIRONMENTAL ENGINEERING

IRA A. FULTON COLLEGE

CAPSTONE

CEEn-2016CPST- 007

Flood Control Plan Feasibility Study

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Scope

The Ridge Lane area of Payson City, UT currently experiences flooding problems that are due to lack of infrastructure in the stormwater system. These issues cause flooding in several locations in the backyards and garages of homeowners. As a result, the main goal for this project was to determine the feasibility of a stormwater system that will eliminate flooding in the area. This system will have the capacity of handling a 25-year storm event. A detention basin will also be constructed that will have the capability of storing water for a 100-year storm event.

Analysis

This project required us to analyze a 11 acre rainfall contributing area. We used AutoCAD Civil 3D, Storm and Sanitary Analysis, and storm event data to predict rainfall intensity and duration.

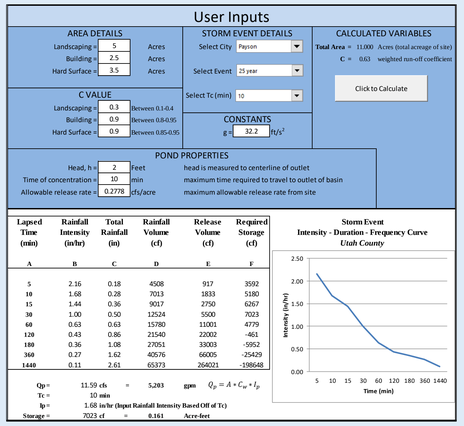
Storm CAD was used to calculate acceptable inlet sizes, pipe sizing, pipe location, and manhole sizing. We were able to calculate the maximum potential ponding potential at the inlet and judged it to be within acceptable limits.

A design for a new curb and gutter along the road was also designed in order to allow water to bypass driveways rather than inundating them.

In summary, a 15” concrete pipe with a 9800 ft^3 detention basin was designed.

The pipe was designed to handle 25-year, high intensity rainfall.

The detention basin was designed to handle 100-year low long duration rainfall.



User Inputs

AREA DETAILS

Landscaping =	5	Acres
Building =	2.5	Acres
Hard Surface =	3.5	Acres

C VALUE

Landscaping =	0.3	Between 0.1-0.4
Building =	0.9	Between 0.8-0.95
Hard Surface =	0.9	Between 0.85-0.95

STORM EVENT DETAILS

Select City: Payson

Select Event: 25 year

Select Tc (min): 10

CONSTANTS

g = 32.2 ft/s^2

CALCULATED VARIABLES

Total Area = 11.000 Acres (total acreage of site)

C = 0.63 weighted run-off coefficient

Click to Calculate

POND PROPERTIES

Head, h =	2	Feet	head is measured to centerline of outlet
Time of concentration =	10	min	maximum time required to travel to outlet of basin
Allowable release rate =	0.2778	cfs/acre	maximum allowable release rate from site

Lapsed Time (min)	Rainfall Intensity (in/hr)	Total Rainfall (in)	Rainfall Volume (cf)	Release Volume (cf)	Required Storage (cf)
A	B	C	D	E	F
5	2.16	0.18	4508	917	3592
10	1.68	0.28	7013	1833	5180
15	1.44	0.36	9017	2750	6267
30	1.00	0.50	12524	5500	7023
60	0.63	0.63	15780	11001	4779
120	0.43	0.86	21540	22002	-461
180	0.36	1.08	27051	33003	-5952
360	0.27	1.62	40576	66005	-25429
1440	0.11	2.61	65373	264021	-198648

Storm Event Intensity - Duration - Frequency Curve *Utah County*

Qp = 11.59 cfs = 5.203 gpm $Q_p = A * C_w * I_p$

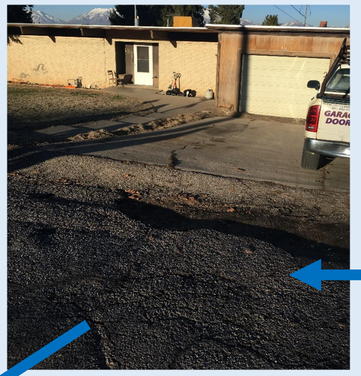
Tc = 10 min

Ip = 1.68 in/hr (Input Rainfall Intensity Based Off of Tc)

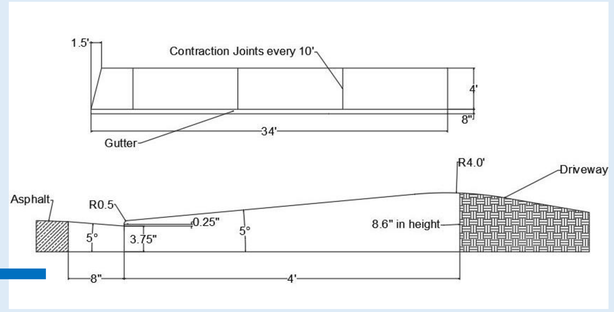
Storage = 7023 cf = 0.161 Acre-feet

25-Year Storm Analysis

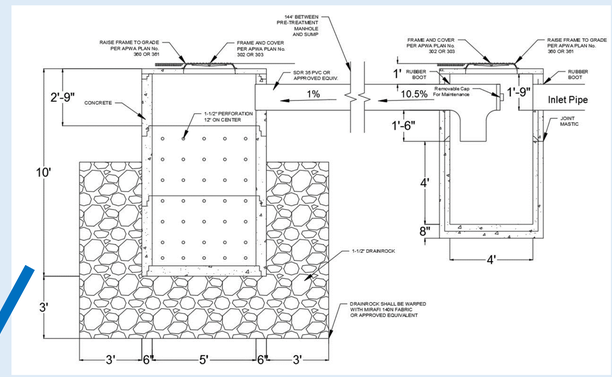
Extent View of Ridge Lane



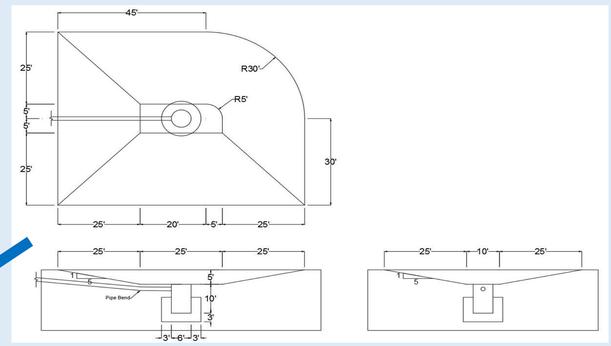
This driveway sag point will be fixed.



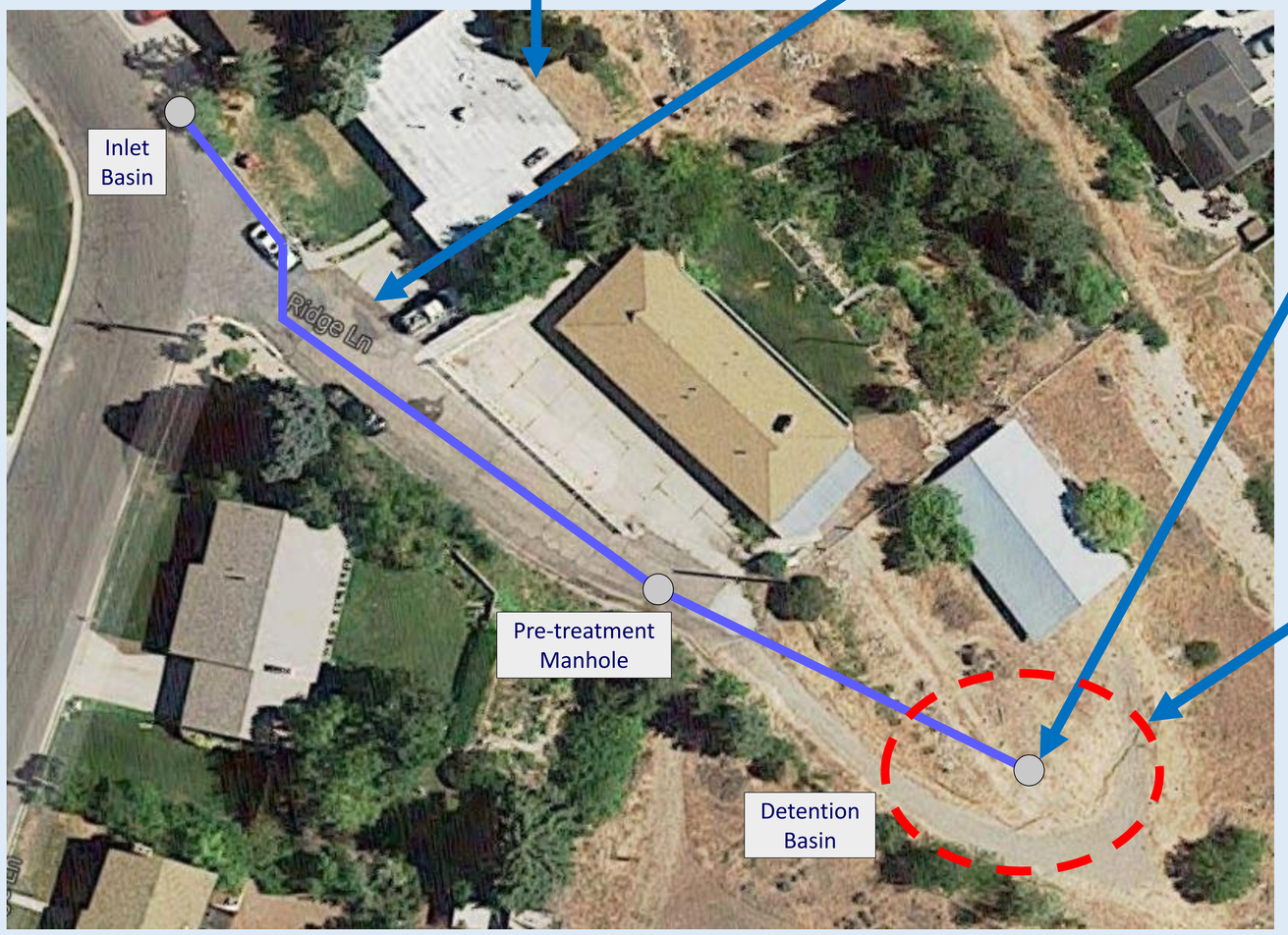
Curb and gutter to fix driveway sag point.



Pre-treatment manhole that leads stormwater to a sump in the detention basin.



Detention basin design



Conclusion

This stormwater design is feasible for the Ridge Lane area. However, we recommend having a slope stability analysis be done on the hill with the detention basin. Diverting the stormwater and draining it in the hill could increase the risk of slope instability and/or water seepage.