

Storm Water Solutions

1800 North 600 West Regional Detention Basin

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Introduction

Storm Water Solutions was tasked by Logan City to design a storm water detention and treatment system that addressed the following tasks:

- Model storm events in drainage basin to determine storm water runoff volumes, especially the 90th Percentile Storm.
- Remove storm water from irrigation conveyance system through design of storm diversion structure to eliminate crop flooding and system maintenance costs.
- Determine methods to reduce phosphorous entering Cutler Reservoir through a low maintenance, sustainable process.
- Retrofit existing storm water system to meet current Logan City design standards and budgetary constraints.

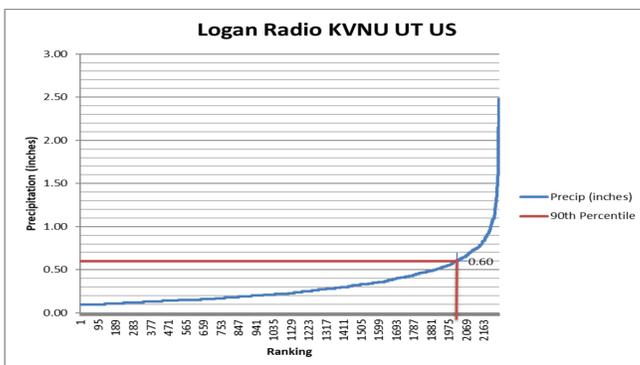


Figure 1 - KVNU Radio Station Rain Gauge This graph represents 59 years worth of storm rainfall totals ranked from the storms with the smallest precipitation to the storms with the largest precipitation. The 90th percentile storm event is shown as 0.60 inches in a single storm event.

Categories	Cost	Nutrient Removal	Logan City Preference	Impacts to Canal	Aesthetics	TOTAL
Category Weights	5	3	4	1	1	
Alternatives	Scores					
Do Nothing	5	0	1	5	3	37
Bio-Swells	1	4	1	5	2	28
Infiltration	3	3	3	5	0	41
600 West Parcel	3	4	5	4	4	55
800 West Parcel	2	4	2	4	4	38
Piping to WWTP	0	5	0	5	5	25

■ High Favorability = 5 Points
■ Medium Favorability = 3 Points
■ Low Favorability = 1 Points
■ No Favorability = 0 Points

Figure 2 – This table shows the favorability scores for each of the design alternatives. Red colors denote a low score and green a high score.

Alternative Designs

Six alternatives were developed to address the tasks outlined by Logan City. These alternatives were ranked scored against five criteria as shown in Figure 2.

- Do Nothing - Continue to allow the stormwater to enter into canal. This would not meet any design criteria.
- Bio – Swells – The park strips in the drainage basins were analyzed to determine if the runoff could be managed closer to where the runoff is generated. Having enough storage volume was the main concern.
- Infiltration Basin – This alternative had the potential for phosphorus removal. However, the volume of water to store would be of concern.
- 600 West Parcel Detention Basin – By allowing water to leave the basin, the storage decreased. The size of the parcel is only .5 acres, increasing the required runoff. Detention basins have decreased phosphorus removal.
- 800 West Parcel Detention Basin – Parcel is closer to 2 acres, but would decrease future development for the city.
- Piping to Waste Water Treatment Plant – While hydraulically feasible, any storm greater than the 90th percentile would create serious flooding or extremely large pipe size (approx. 6 ft in diameter).

Proposed Alternative

The final design alternative was selected based on scores from the Pugh Matrix found in Figure 2. The alternative that scored the highest overall was the detention basin located at the intersection of 1800 North 600 West.

Storm water for an approximately 80-acre section in the Northwest section of Logan City is captured and conveyed by ditches of the Northwest Fields canal until flowing to the corner of 1800 North 600 West. At this parcel a diversion structure would be installed allowing regular irrigation flows to pass through while storm water flows would be diverted into a detention pond built on site.

The detention pond will allow for contact time between the storm water and the Field Sedge growing in the detention pond. This contact time will allow for phosphorous uptake from the storm water. When large storm events occur the outlet of the detention pond would be sized and placed to allow for treated water to enter a new separate storm water system to be conveyed to the Cutler Reservoir now as treated storm water.

Design Results

Common Field Sedge



Common Field Sedge is more effective at phosphorus removal compared to other commonly used plants.

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Acknowledgments

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Design Parameters

Hydrology

The 90th percentile storm was modeled to calculate the runoff generated from the 90+ acres of land. By using appropriate flow equations, weir/orifice junction boxes were designed.

A combo box diverts the storm water from the irrigation canal. Outflow from the detention basin is controlled with a combo box as well.

To verify the entire design, the system was modeled using AutoCAD's Storm and Sanitary Analysis extension.

Environmental

Logan City has been identified as a source of phosphorus contributing to Cutler Reservoir. Our design focused on reducing the phosphorus concentration of the runoff leaving the basin via bioretention.

Calculations, based on the design of a free water surface constructed wetland, were then made to determine how effective phosphorus removal would be in the basin. Common Field Sedge was selected to be planted to facilitate phosphorus removal.

Conclusions

Through this design project Storm Water Solutions:

- Designed system for diversion of runoff from storm events into detention basin without affecting irrigation flows.
- Engineered detention basin for proper management of 90 acres of runoff using a .5 acre plot of land.
- Determined the efficacy of phosphorus removal from storm water via bioretention was not significantly high.
- Calculated final implementation cost of \$336,000