1000 E Storm Drain Project

Civil Engineering Capstone Spring 2025

David Demke
Team Member
10818115@uvu.edu

Joe Money
Team Member
10881225@uvu.edu

Justin Riley
Team Member
10786138@uvu.edu

Cayden Wright
Team Member
10991077@uvu.edu

Khaled Shaaban
Faculty Advisor
kshaaban@uvu.edu

Taggart Bowen
Orem City
trbowen@orem.gov

Tom Nissan
Orem City
tlnissan@orem.gov

Project Objectives

The primary objective of this project was to design a storm drain system for Orem City along 1000 East in Orem, Utah. The system aims to manage stormwater and well flush water within a 250-day well protection zone. This includes rerouting stormwater and well flush water south along 1000 East into a new drain line, abandoning existing stormwater sumps and canals, and ensuring minimal disruption to surrounding infrastructure while meeting environmental, societal, and safety standards.

Design Requirements

The storm drain system was designed to:

•Manage runoff from impervious surfaces during a 10-year, 3-hour storm event.

•Incorporate pollutant-trapping features to protect sensitive water resources.

•Integrate seamlessly with Orem City's existing stormwater infrastructure.

Alternatives

Three design alternatives were evaluated for crossing the existing canal:

1.Bored Pipeline: Installing a pipe at a constant slope deep enough to go under the canal.

2.Open-Cut Trench: Cutting through the side of the canal.

3.Siphon System: Employing a siphon design under the canal.

Each option was assessed based on cost, hydraulic efficiency, maintenance ease, pipe depth, and risk of disruption.

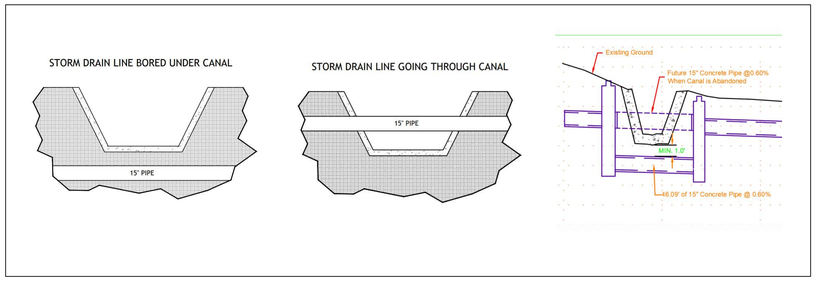


Figure 2. Design Options

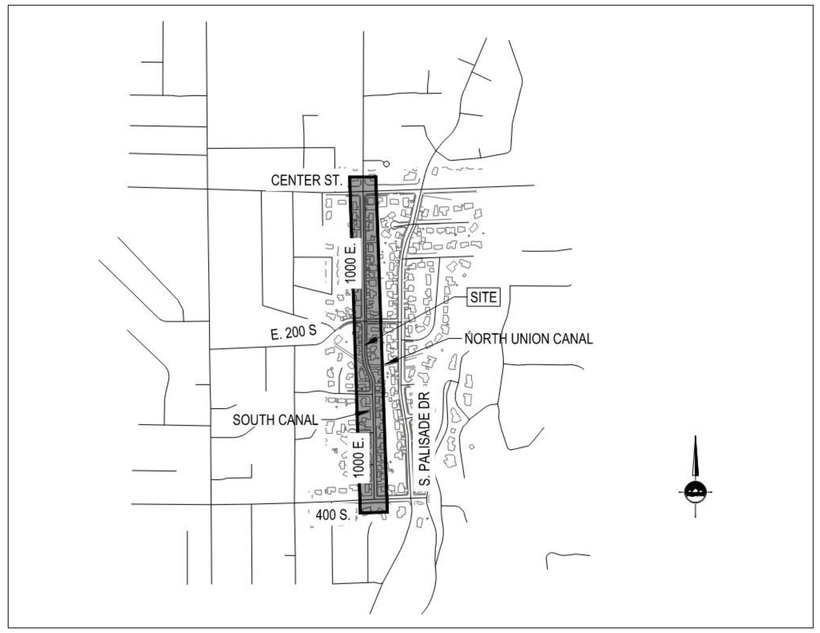


Figure 1. Vicinity Map

Comparisons

A weighted scoring matrix was used to compare the three alternatives:

•The bored pipeline scored highest due to its cost-effectiveness, minimal disruption to existing infrastructure, and ease of maintenance.

•The open-cut trench posed significant risks of disruption during construction.

•The siphon system was less efficient hydraulically and more complex to maintain compared to the bored pipeline.

Matrix and Design Alternative Evaluation

Score Matrix		Design 1 Under Canal		Design 2 Open-Cut		Design 3 Siphon Design	
Criteria	Weight	Rating	Score	Rating	Score	Rating	Score
Cost	30%	4	1.2	2	0.6	4	1.2
Pipe Depth	15%	3	0.45	4	0.6	4	0.6
Ease of Maintenance	20%	4	0.8	3	0.6	1	0.2
Hydraulic Efficiency	25%	4	1	3	0.75	2	0.5
Risk of Disruption	10%	4	0.4	1	0.1	4	0.4
Total	100%		3.85		2.65		2.9

Figure 3. Design Matrix

References or Software and Resources

1.AutoCAD Civil 3D

2.EPA SWMM (Storm Water Management Model)

Recommendations or Lessons

The bored pipeline alternative was recommended as the most viable solution. It balances cost, efficiency, and minimal disruption while ensuring long-term reliability. Key lessons include:

•Comprehensive hydrological analysis is critical for accurate system sizing.

•Early integration of environmental considerations minimizes regulatory hurdles.

•Advanced modeling tools significantly enhance design precision.

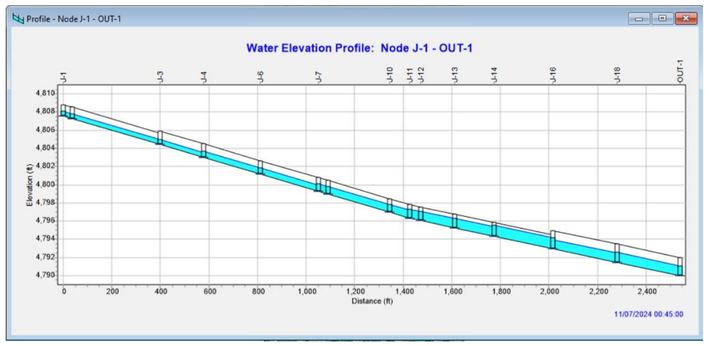


Figure 4. EPA SWMM Model Results and Corresponding Pipe Sizes

Item No.	Work Activity	Quantity	Unit	Unit Price		Total
2230	SITE PREPARATION					
	Mobilization, Bonding, Insurace (5%)	1	LS	$6,500.00	$/EA	$6,500.00
	SUBTOTAL					$6,500.00
2270	EROSION CONTROL					
	Inlet Protection	11	EA	$200.00	$/EA	$2,200.00
	Bi-Weekly Inspections & Maintenace	1	LS	$19,000.00	LS	$19,000.00
	SUBTOTAL					$21,200.00
2300	EARTHWORK					
	Cut Onsite	951.95	CY	$4.00	$/CY	$3,807.80
	SUBTOTAL					$3,807.80
2740	ASPHALT PAVING					
	3" Asphalt Paving	5,087	SF	$2.50	$/SF	$12,717.70
	8" Untreated Base Course	5,087	SF	$0.90	$/SF	$4,578.37
	Sawcut existing asphalt	2570	EA	$5.50	$/LF	$14,135.00
	SUBTOTAL					$31,431.07
2751	SITE CONCRETE					
	30" Curb & Gutter	2,570	LF	$23.50	$/LF	$60,395.00
	3' Waterway	35	LF	$27.50	$/LF	$962.50
	Concrete Drive Approach	28	EA	$3,250.00	$/EA	$91,000.00
	Handicap Ramps	3	EA	$1,500.00	$/EA	$4,500.00
	SUBTOTAL					$156,857.50
2630	STORM DRAINAGE					
Note: insert pipe type (i.e. PVC, RCP, HDPE) for all pipe types.						
	15" CL III RCP Pipe	398	LF	$40.00	$/LF	$15,920.00
	18" CL III RCP Pipe	1882	LF	$43.00	$/LF	$80,908.80
	24" CL III RCP Pipe	260	LF	$50.00	$/LF	$12,997.00
	Catch Basin	17	EA	$2,200.00	$/EA	$37,400.00
	Cleanout Box	3	EA	$3,500.00	$/EA	$10,500.00
	Pipe Bedding	2540	LF	$22.00	$/LF	$55,869.88
	SUBTOTAL					$213,595.68
	Project Summation					$433,392.05
	Contingency	10%				$43,339.20
	Project Total					$476,731.25

Figure 5. Initial Engineers Estimate