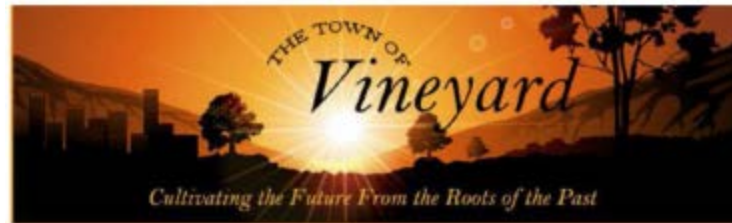


Storage Tank Evaluation and Location Study



CENTRAL UTAH WATER
CONSERVANCY DISTRICT



Origin of Study

- CUWCD, City of Orem and Town of Vineyard share joint ownership of a 20 MG Storage Tank at the Don A. Christiansen Regional Water Treatment Plant
- Ownership Distribution of 20 MG:
 - CUWCD: 10 MG
 - Orem: 9.5 MG
 - Vineyard: 0.5 MG
- Demands from Orem & Vineyard have increased such that tank utilization now exceeds your 10 MG allotment.

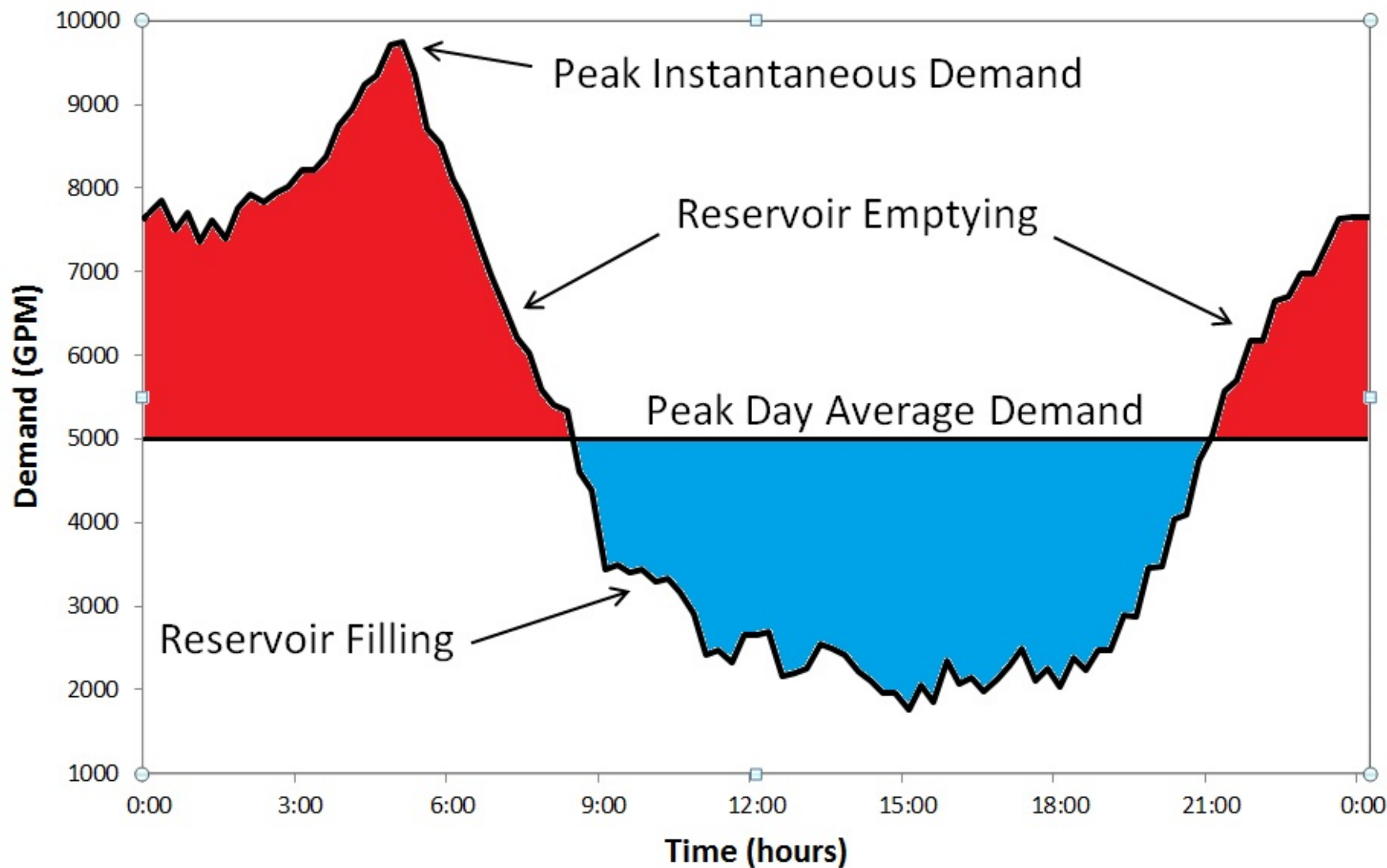
Study Objective

- Assist Orem & Vineyard in determining the optimal locations and sizes for required finished water storage for their respective drinking water systems.

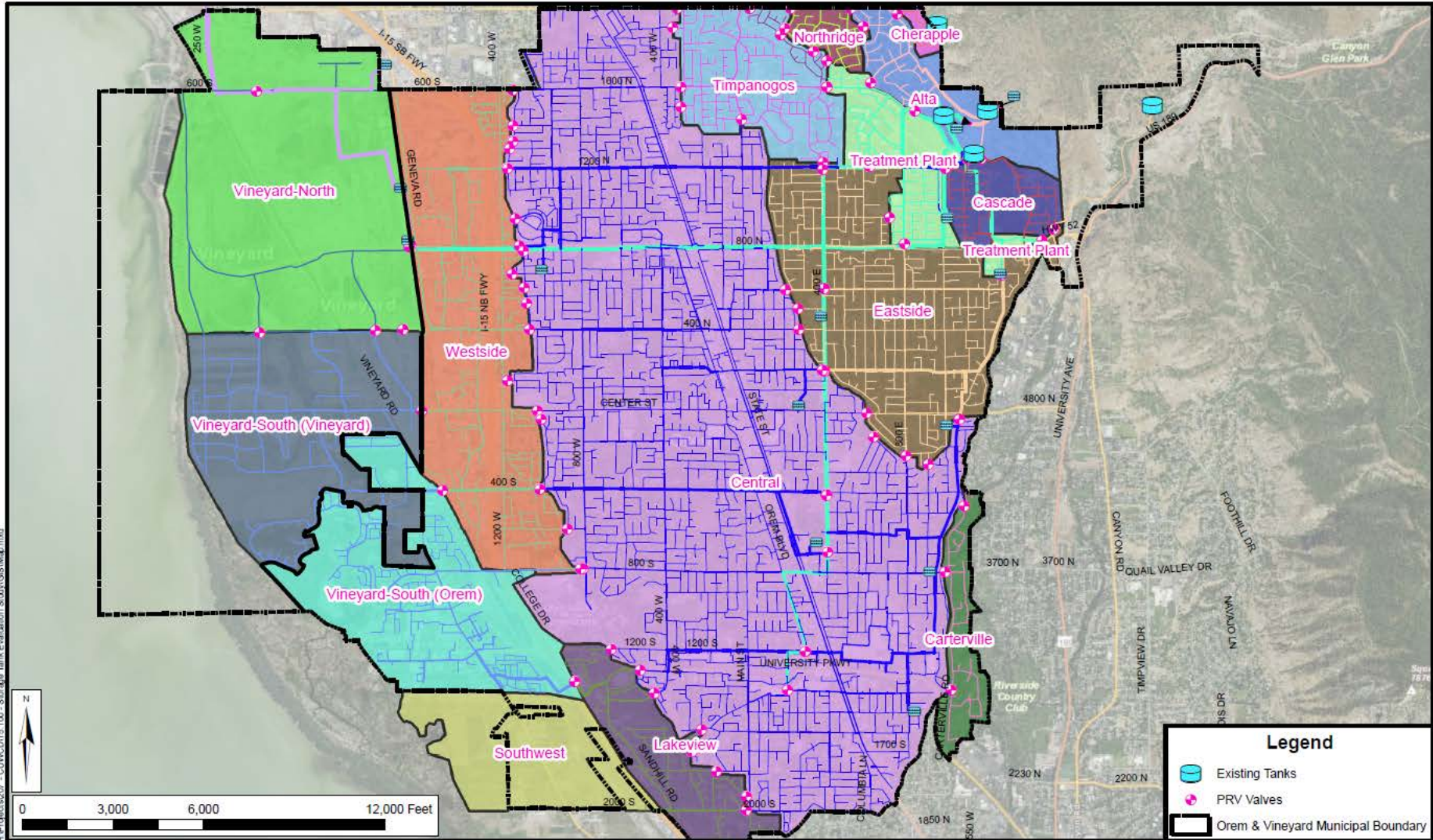
Presentation Outline

1. Essential function of water storage in a drinking water system
2. Existing water system & general storage areas
3. Storage requirements
4. Model Development
5. Storage Site Locations & Site Evaluations
6. Alternatives Development
7. Alternatives Evaluation
8. Recommendations

1. Essential Function of water storage in a drinking water system.



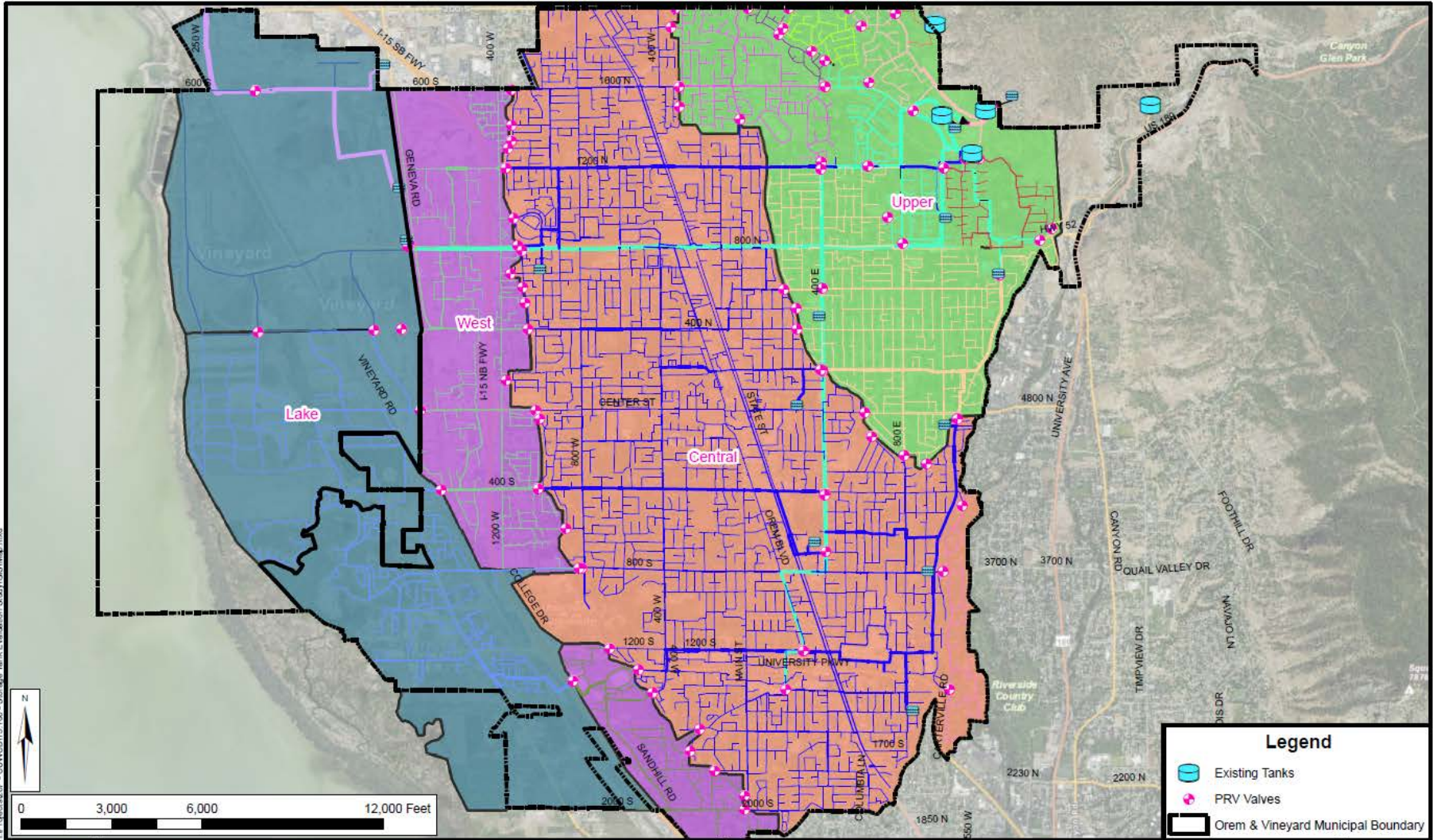
2. Existing Water System & General Storage Areas.



CUWCD - Orem & Vineyard Storage Location Study

Orem & Vineyard Pressure Zones

FIGURE 2-1



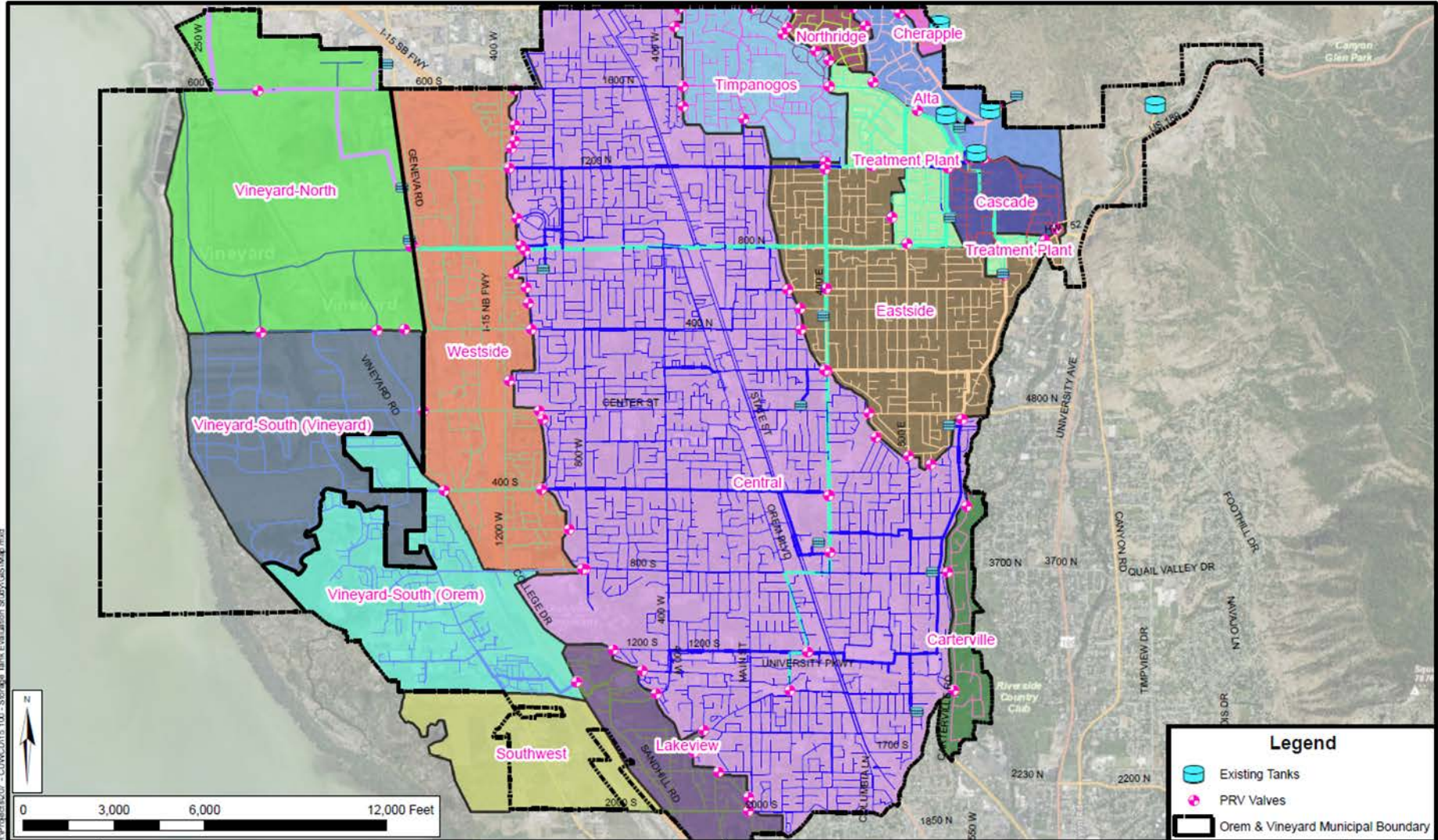
Date: 8/3/2016
 Document Path: H:\Projects\2016 - CUWCD\15-100 - Storage Tank Evaluation Study\GIS\Map.mxd

3. Storage Requirements

Table 1 - Storage Analysis By Area

AREA	ZONE	Existing Storage Capacity (MG)	Existing Required Storage (MG)	Existing Storage (deficit) (MG)	Buildout Required Storage (MG)	Buildout Storage (deficit) (MG)
Upper	Cherapple	12.9	12.9	0	12.9	0
	Alta					
	Northridge					
	Timpanogos					
	Treatment Plant					
	Cascade					
	Eastside					
Central	Central	8	14.8	(6.8)	20	(12.0)
	Carterville					
West	Lakeview	0	2.3	(2.3)	4.8	(4.8)
	Westside					
Lake	Southwest	0	0	0.0	2.4	(2.4)
	Vineyard South (Orem)	0	1.7	(1.7)	4.1	(4.1)
	Vineyard South	0.5	2.5	(2.0)	5.8	(5.3)
	Vineyard North	0	0.2	(0.2)	2.4	(2.4)
TOTAL		21.4	34.4	(13.0)	52.4	(31.0)

4. Model Development



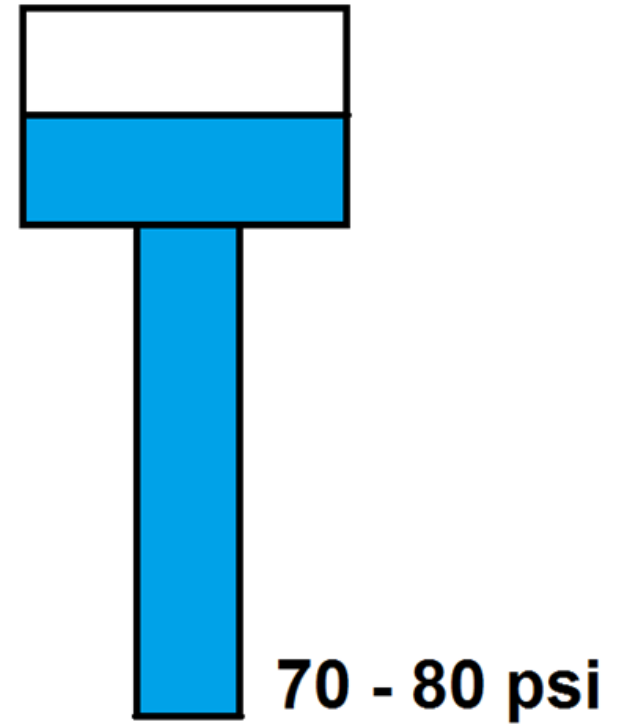
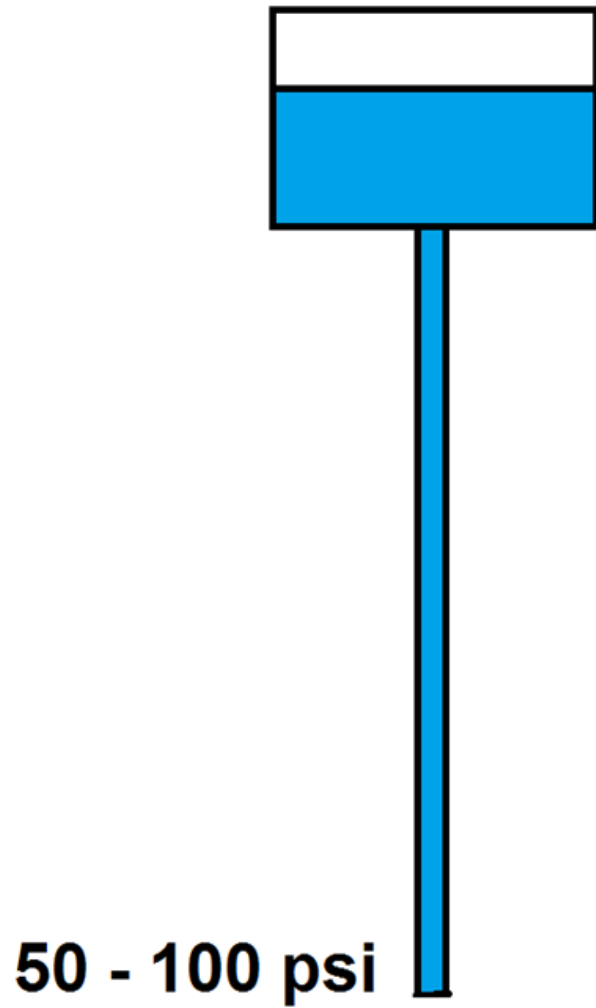
Legend

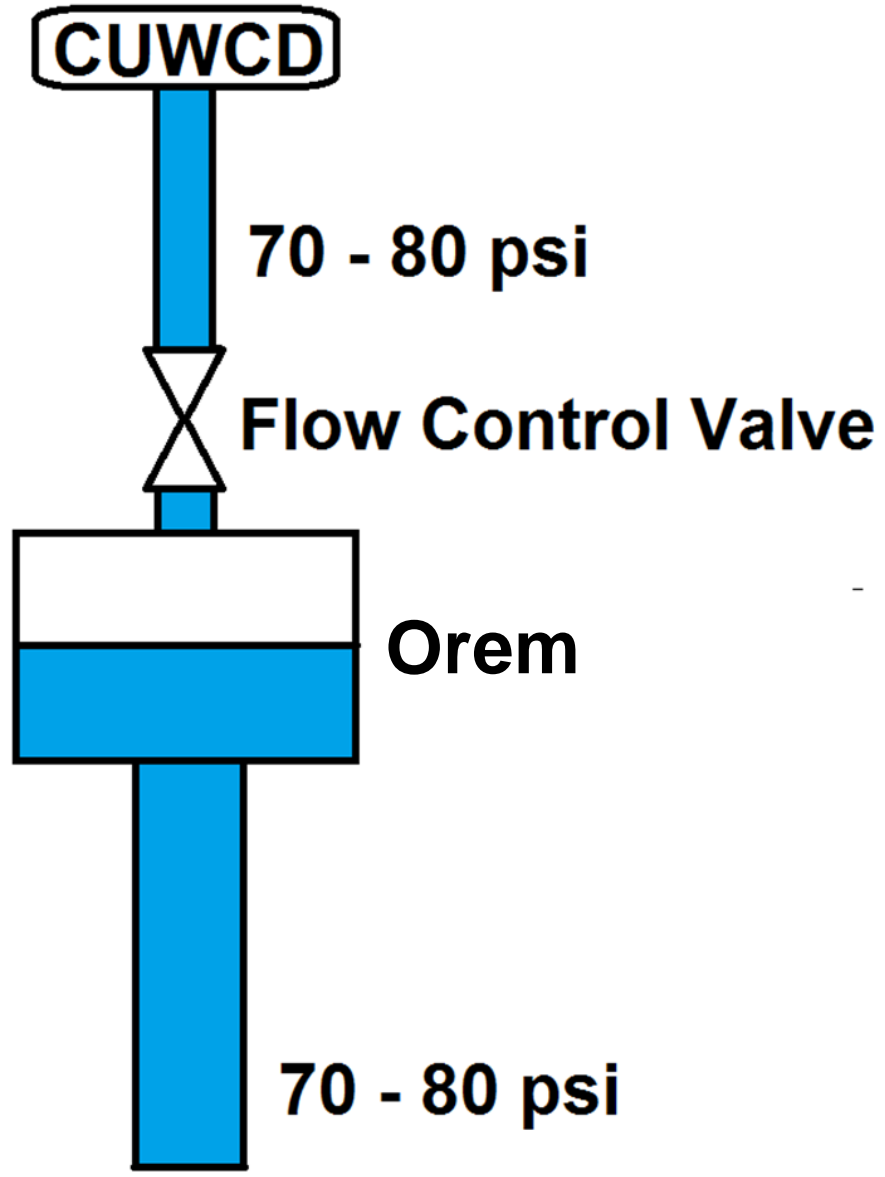
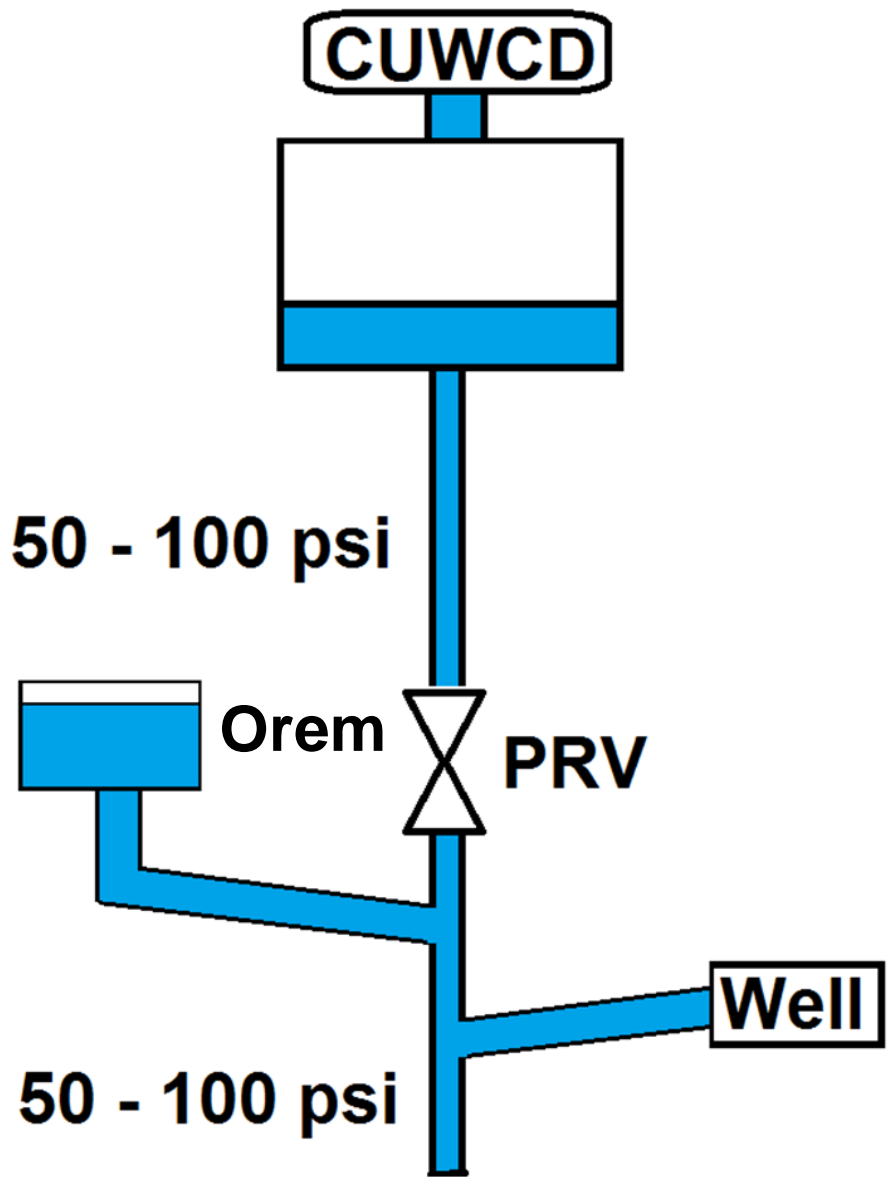
-  Existing Tanks
-  PRV Valves
-  Orem & Vineyard Municipal Boundary

CUWCD - Orem & Vineyard Storage Location Study

Orem & Vineyard Pressure Zones

FIGURE 2-1

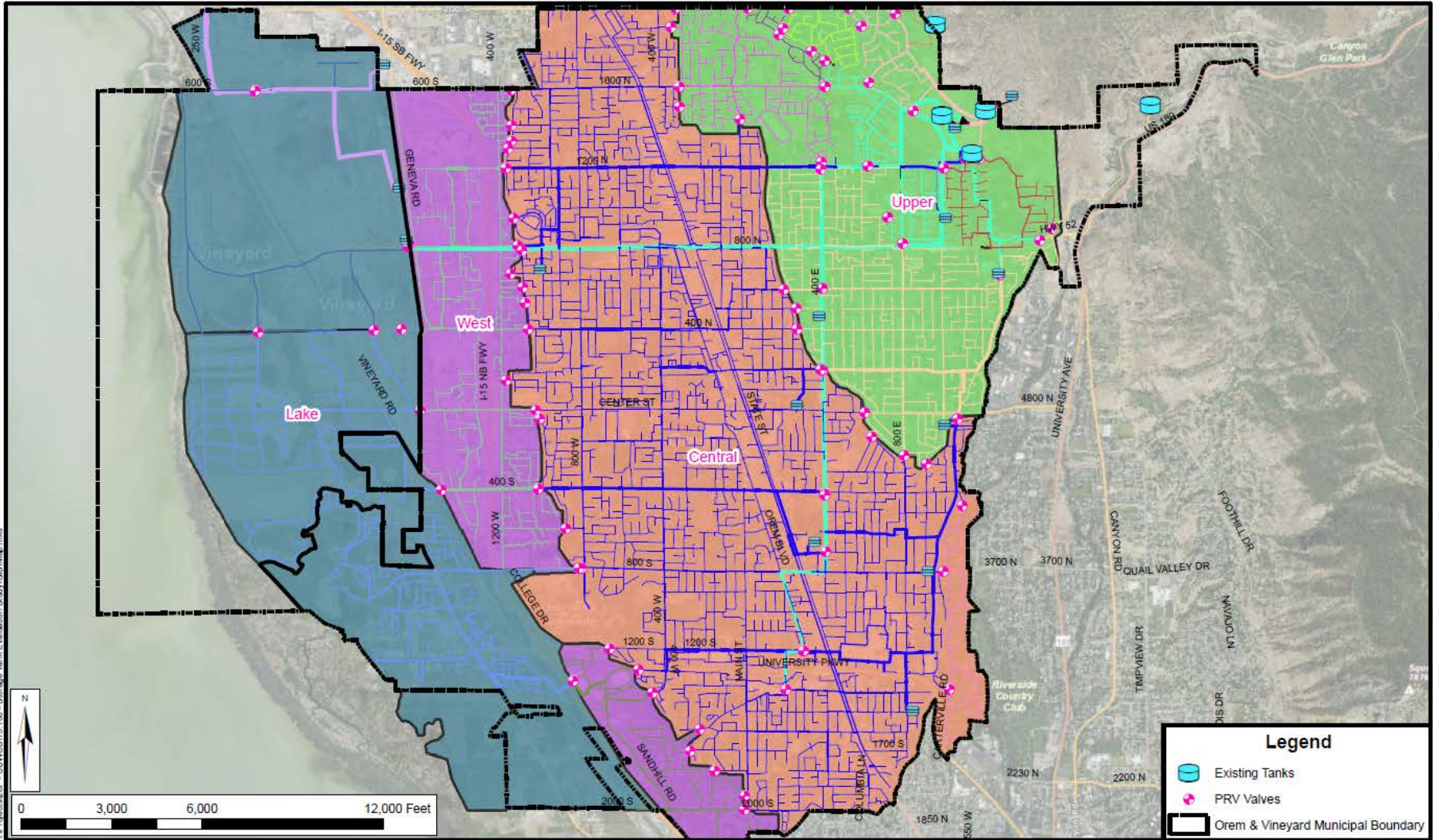




Consequences of Not Building Transmission and Storage

- Increased pressure fluctuations
- Lower pressures
- CUWCD charging for use of storage
- Poor utilization of wells
- Poor utilization of existing storage
- Fire flow capacity issues
- Failure to meet State minimum storage and pressure requirements

5. Storage Site Locations & Site Evaluations



Date: 8/3/2016
 Document Path: H:\Projects\2016 - CUWCD\15-100 - Storage Tank Evaluation Study\GIS\Map.mxd

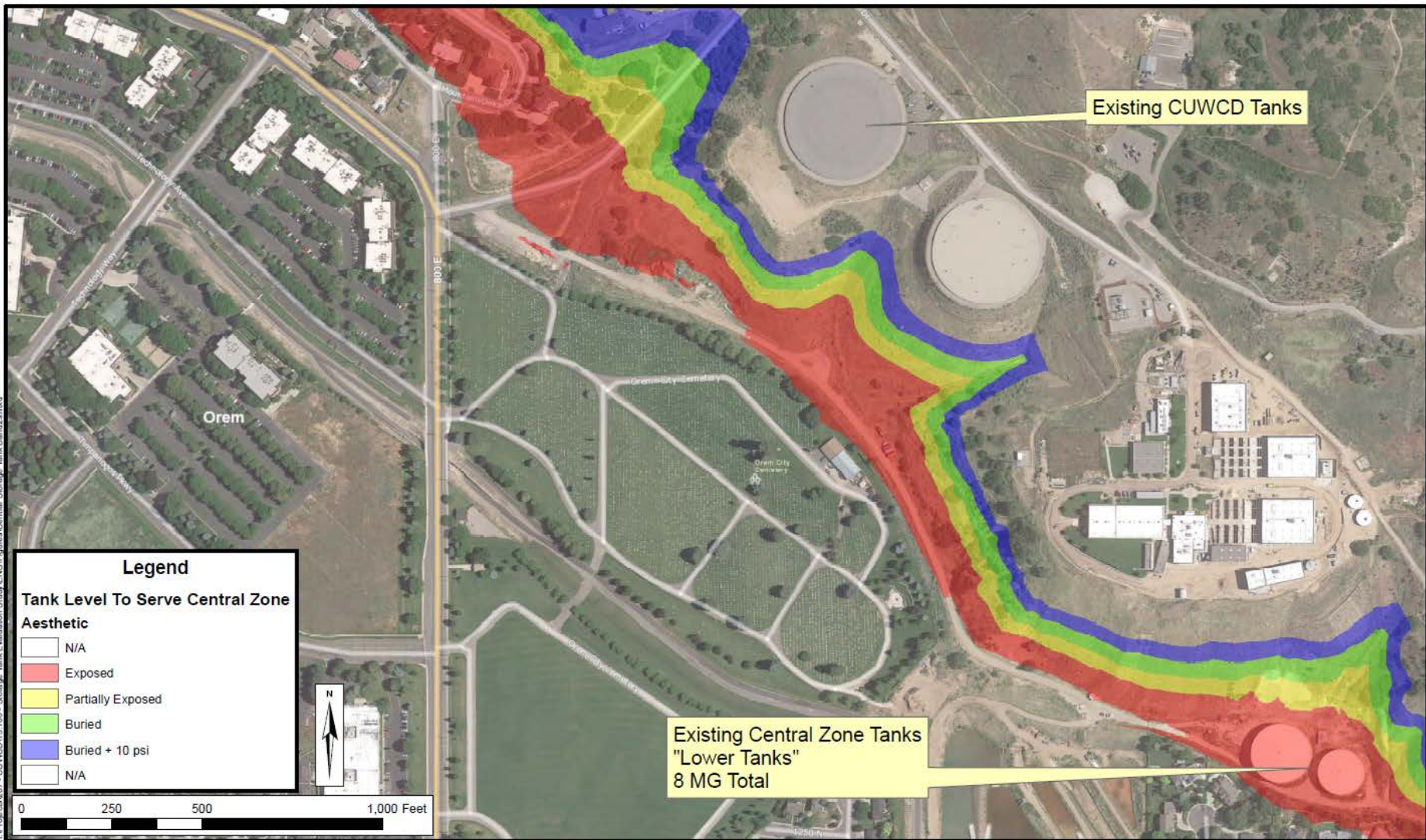


CUWCD - Orem & Vineyard Storage Location Study

Orem & Vineyard General Storage Areas

FIGURE 2-2

Date: 4/1/2016
Document Path: H:\Projects\2017 - CUWCD\15.100 - Storage Tank Evaluation Study\ENG\Figures\Central Storage Tank Band2.mxd



Legend

Tank Level To Serve Central Zone

Aesthetic

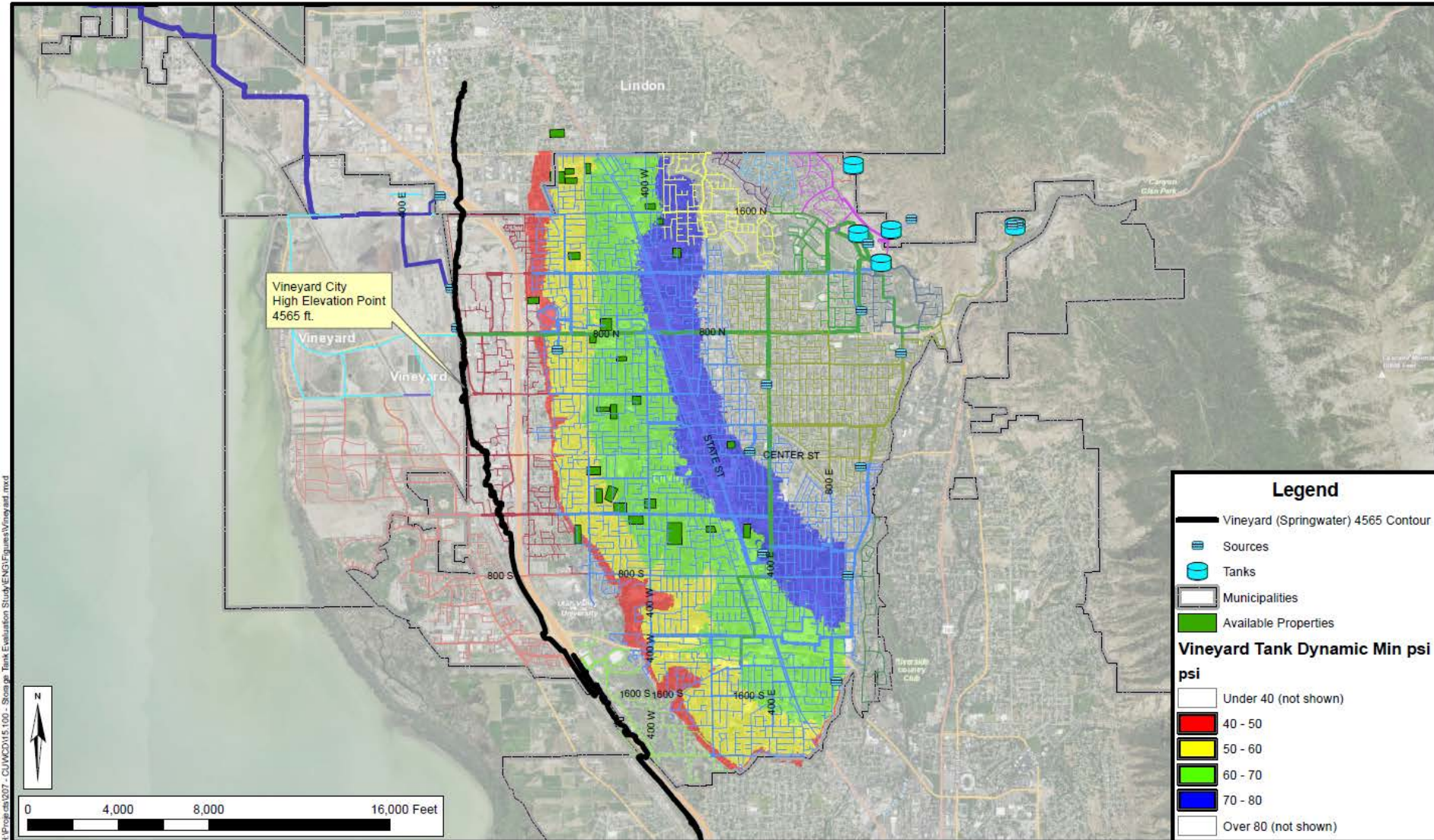
- N/A
- Exposed
- Partially Exposed
- Buried
- Buried + 10 psi
- N/A

HANSEN ALLEN & LUCE inc
ENGINEERS

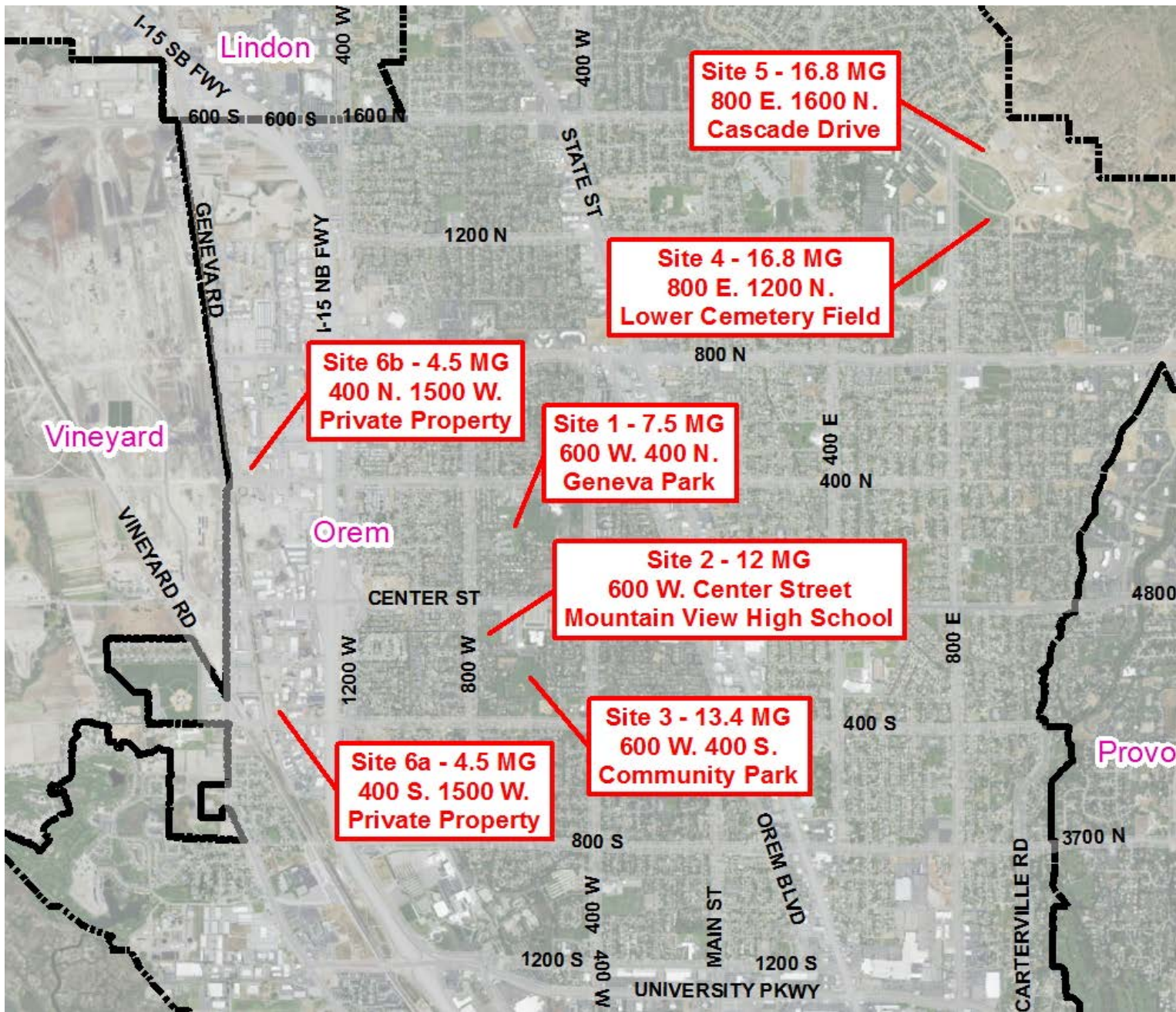
CUWCD - Orem & Vineyard Storage Location Study

Potential Central Zone Storage Locations

FIGURE C-2



Document Path: H:\Projects\2027 - CUWCD\115.100 - Storage Tank Evaluation Study\ENGI\Figures\Vineyard.mxd



Evaluation Sites

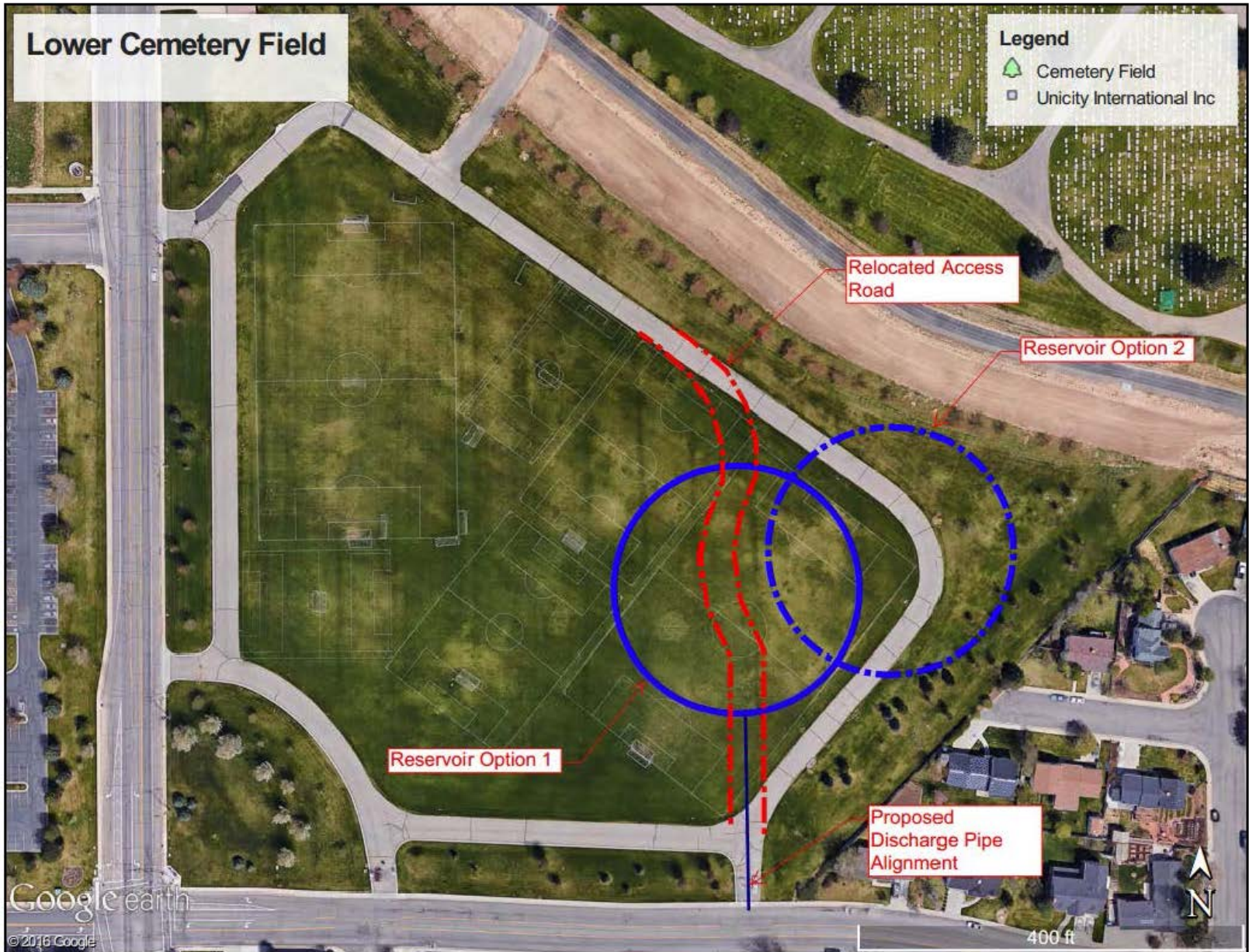
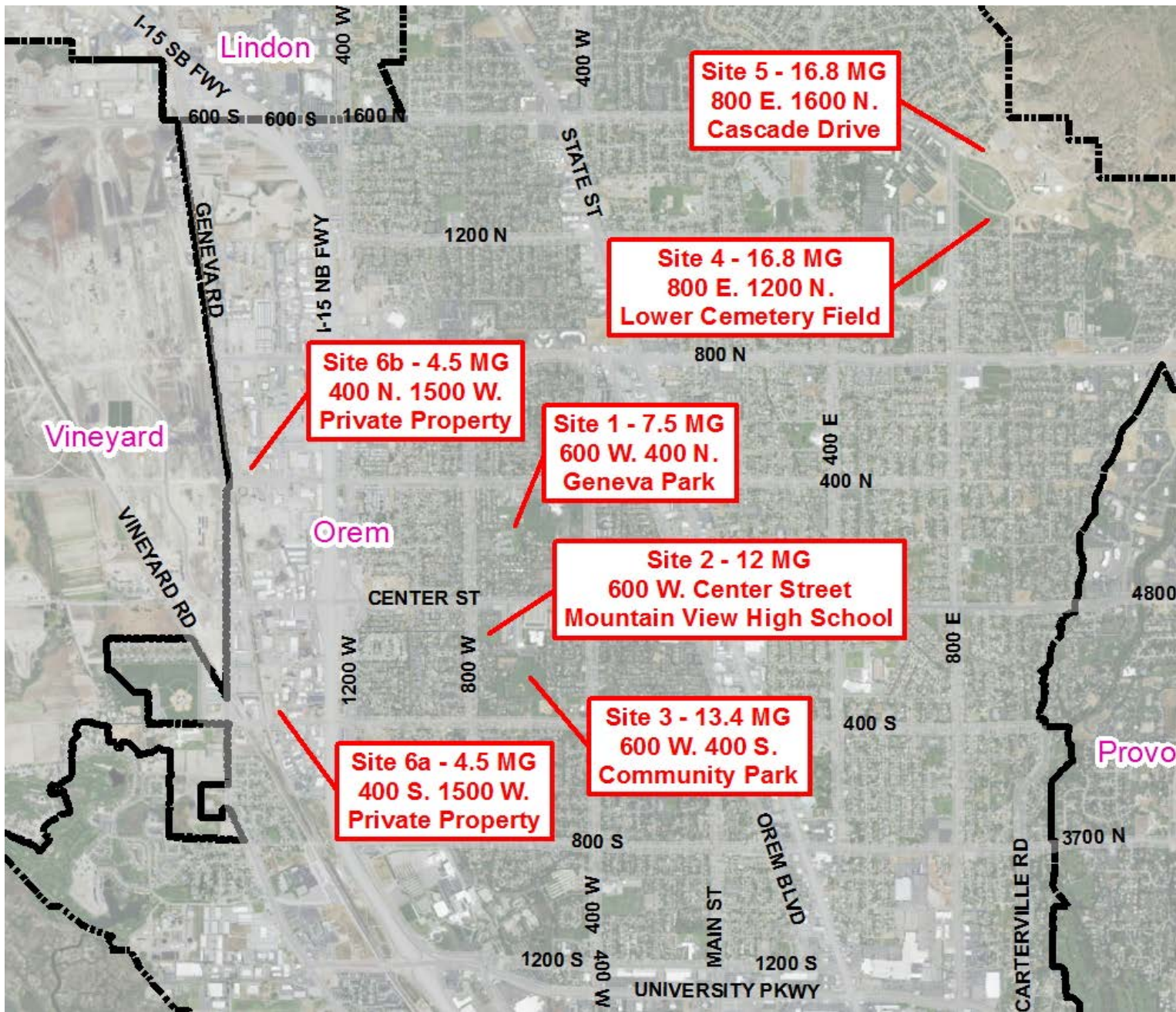


Figure 4-14: Site 4 – 800 East 1200 North (Lower Cemetery Field)

Site 4

The Lower Cemetery Field site (Site 4) has been excluded from further consideration in the analysis because of operational issues.

- Located at an elevation lower than the existing 8 MG Lower Tank
- A tank located at this site would require a booster pumping station to match the elevation provided by the Lower Tanks.
- It will be difficult to make the two tanks function efficiently in parallel.



Evaluation Sites

Site 6

Site 6 has been excluded from further consideration in the analysis due to construction and operation related issues:

- High groundwater potential
- Low soil bearing pressure
- High to moderate potential for liquefaction
- Above ground construction
- Continuous pumping required



Figure 4-16: Site 6a – 400 S. 1500 W.

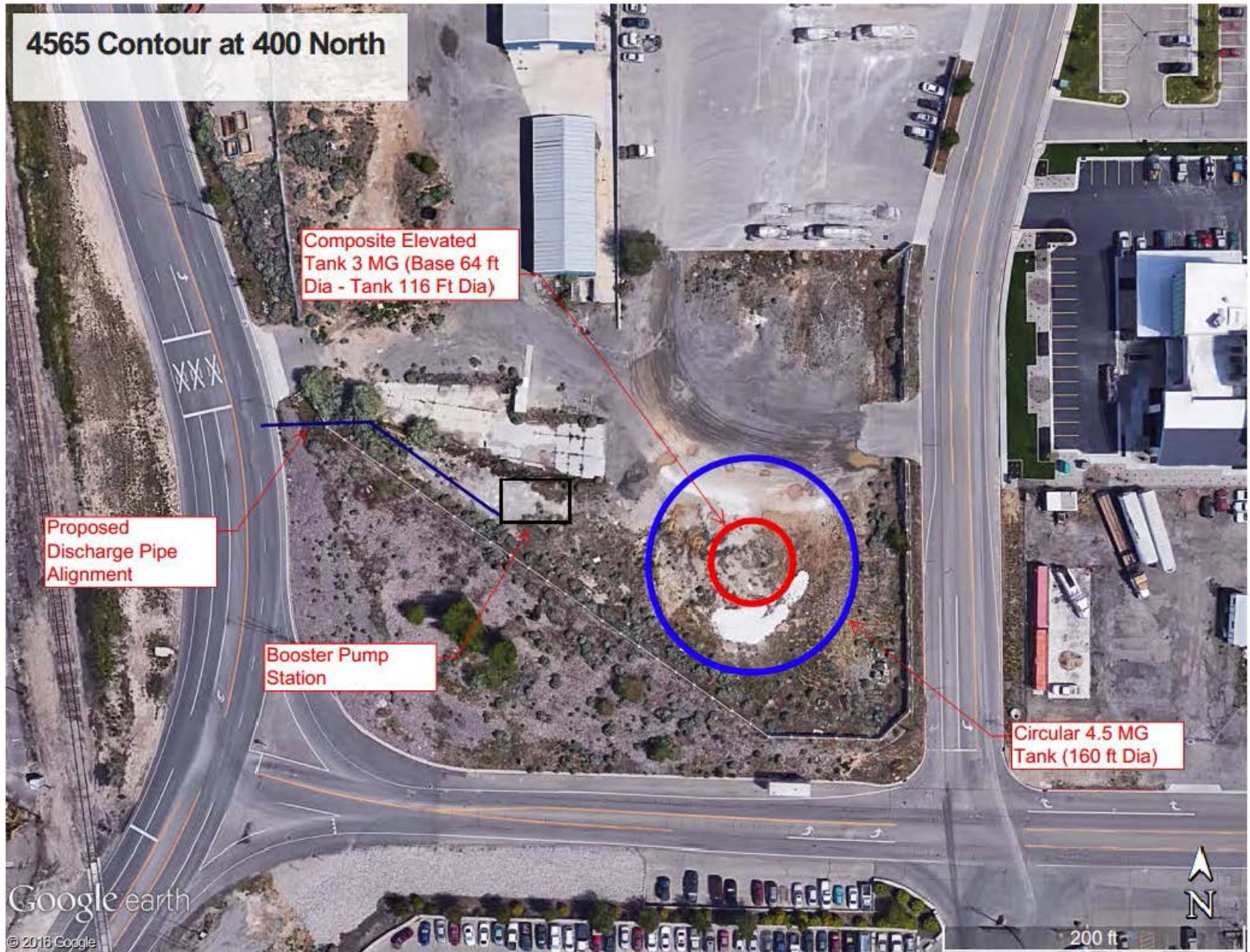
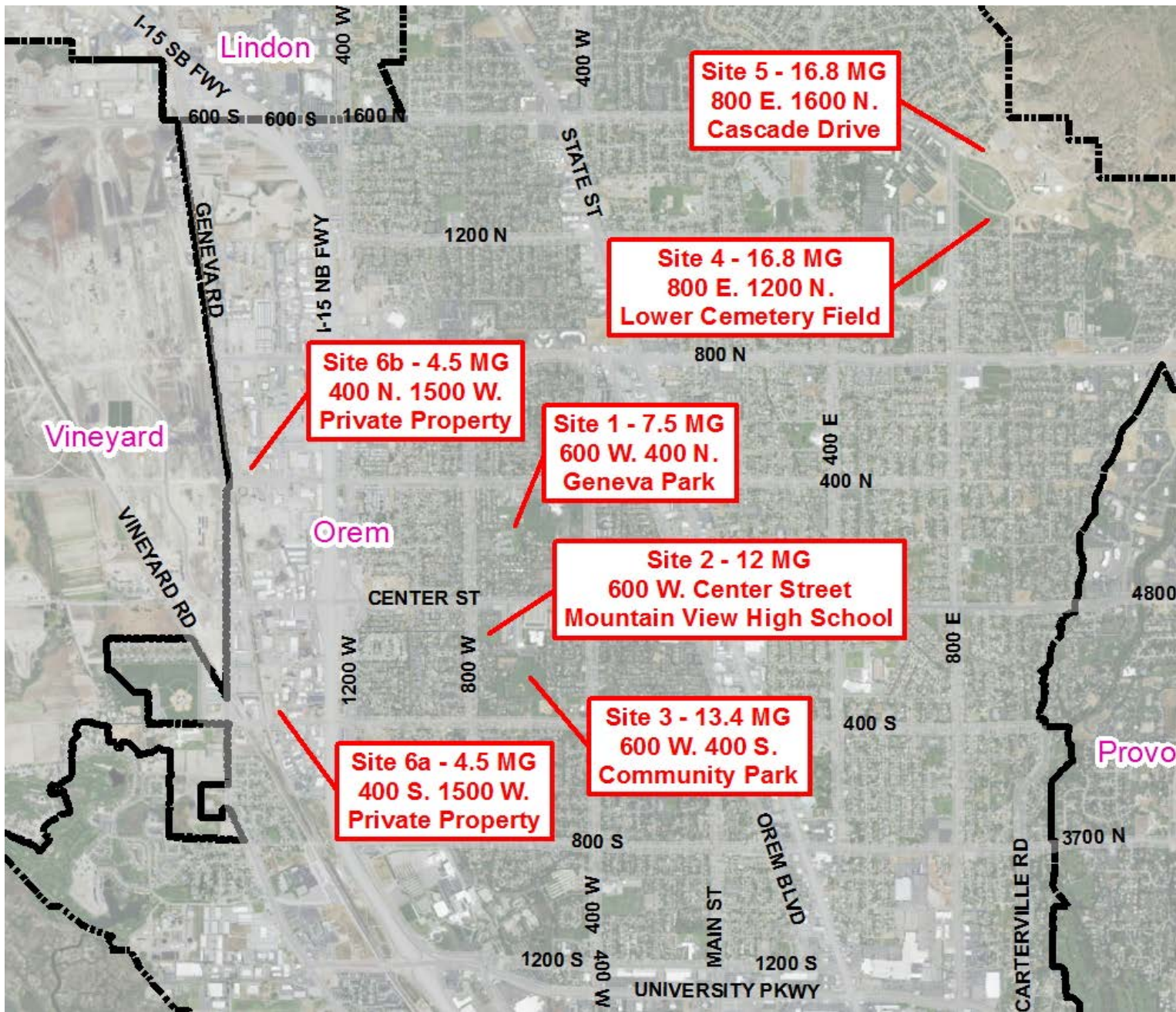


Figure 17: Site 6b – 400 N. 1500 W.



Evaluation Sites

6. Alternatives Development

ALTERNATIVE 1

- All gravity
- No pumping out of tanks

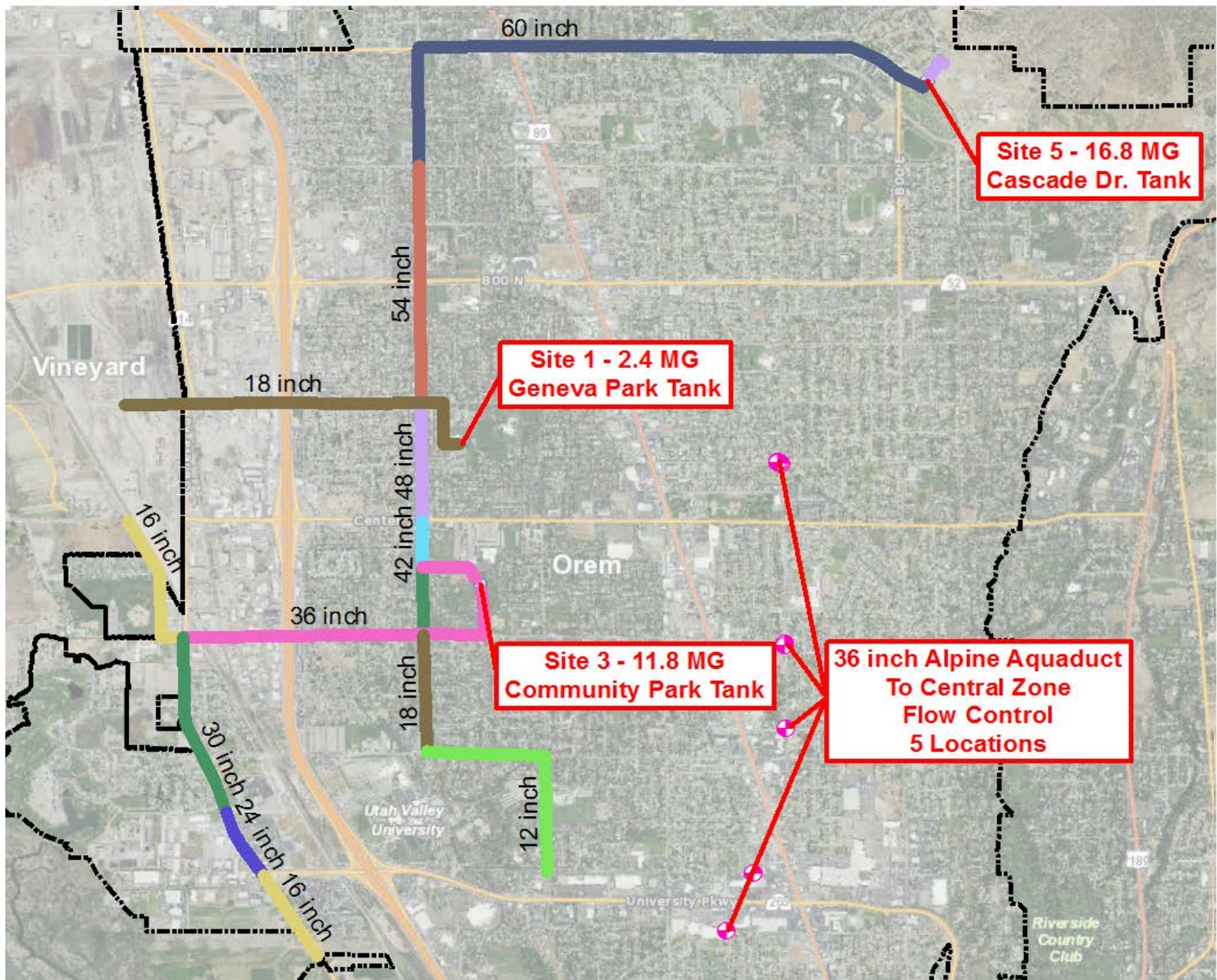
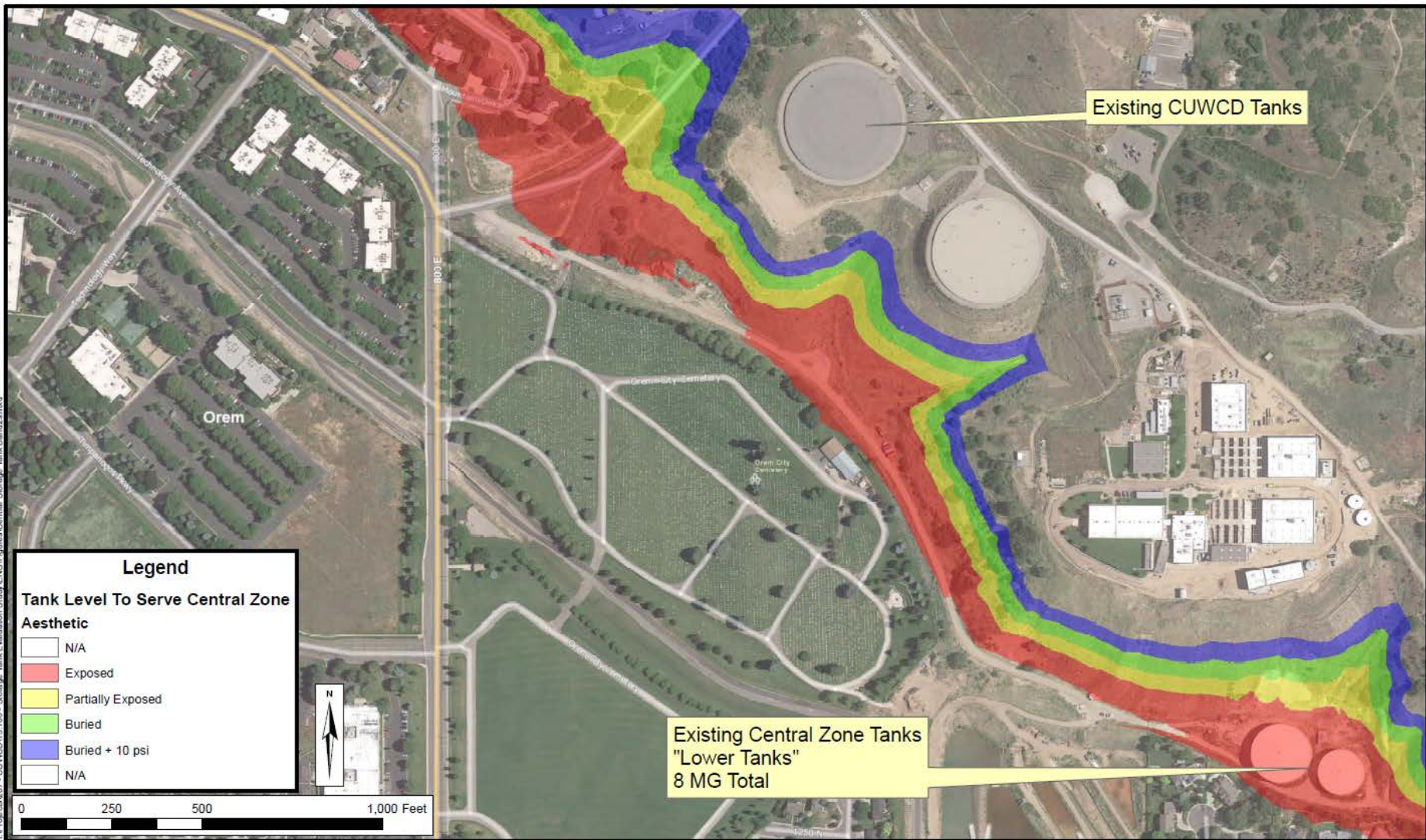


Figure 5-1: Alternative 1 Facilities

Date: 4/1/2016
Document Path: H:\Projects\2017 - CUWCD\15.100 - Storage Tank Evaluation Study\ENG\Figures\Central Storage Tank Band2.mxd

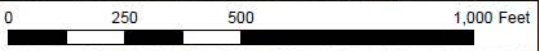


Legend

Tank Level To Serve Central Zone

Aesthetic

- N/A
- Exposed
- Partially Exposed
- Buried
- Buried + 10 psi
- N/A



Existing Central Zone Tanks
"Lower Tanks"
8 MG Total

Existing CUWCD Tanks



CUWCD - Orem & Vineyard Storage Location Study

Potential Central Zone Storage Locations

FIGURE
C-2



Figure 4-15: Site 5 – 800 East 1600 North (Cascade Drive)

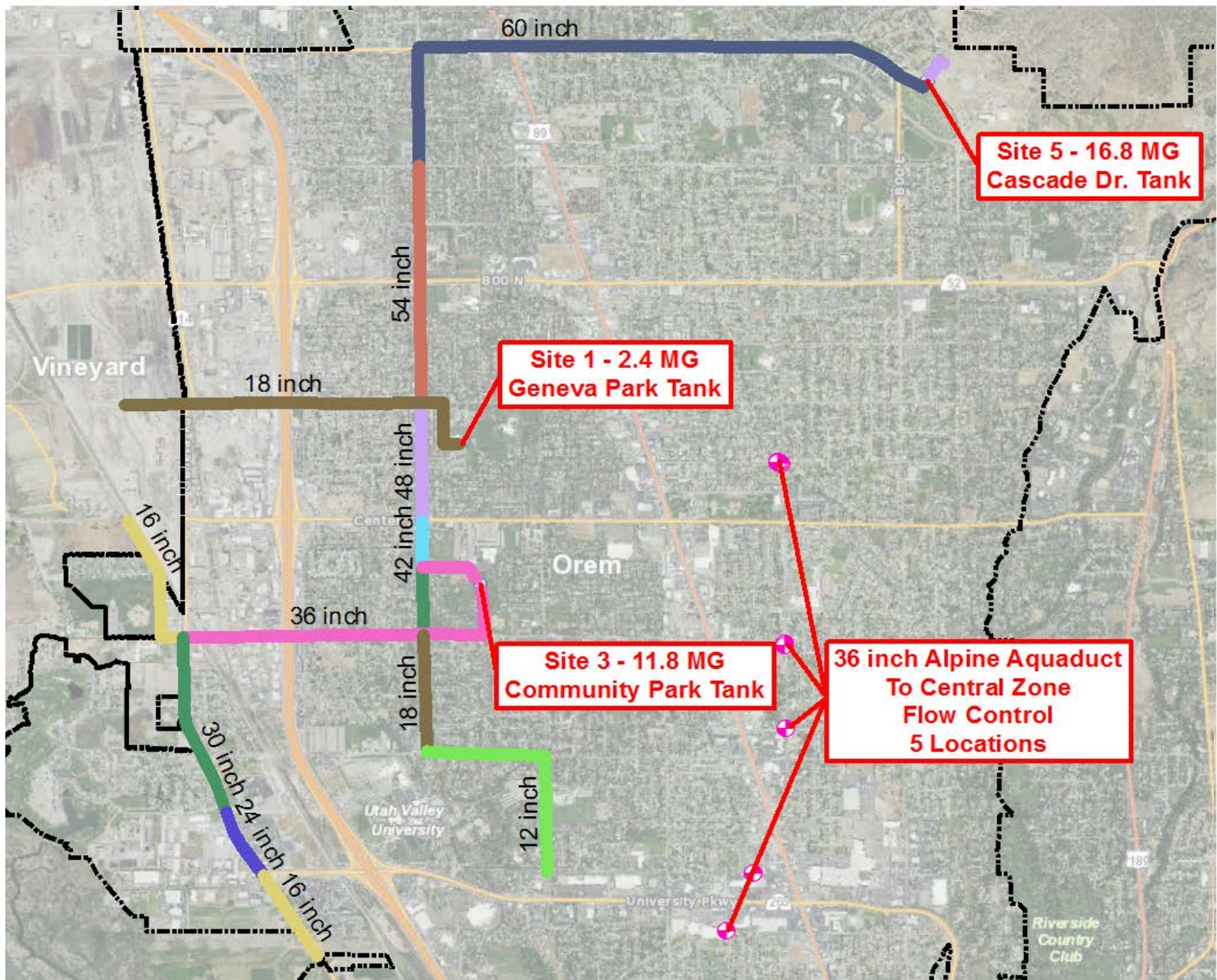


Figure 5-1: Alternative 1 Facilities



Figure 4-11: Site 1 – 600 West 400 North (Geneva Park)

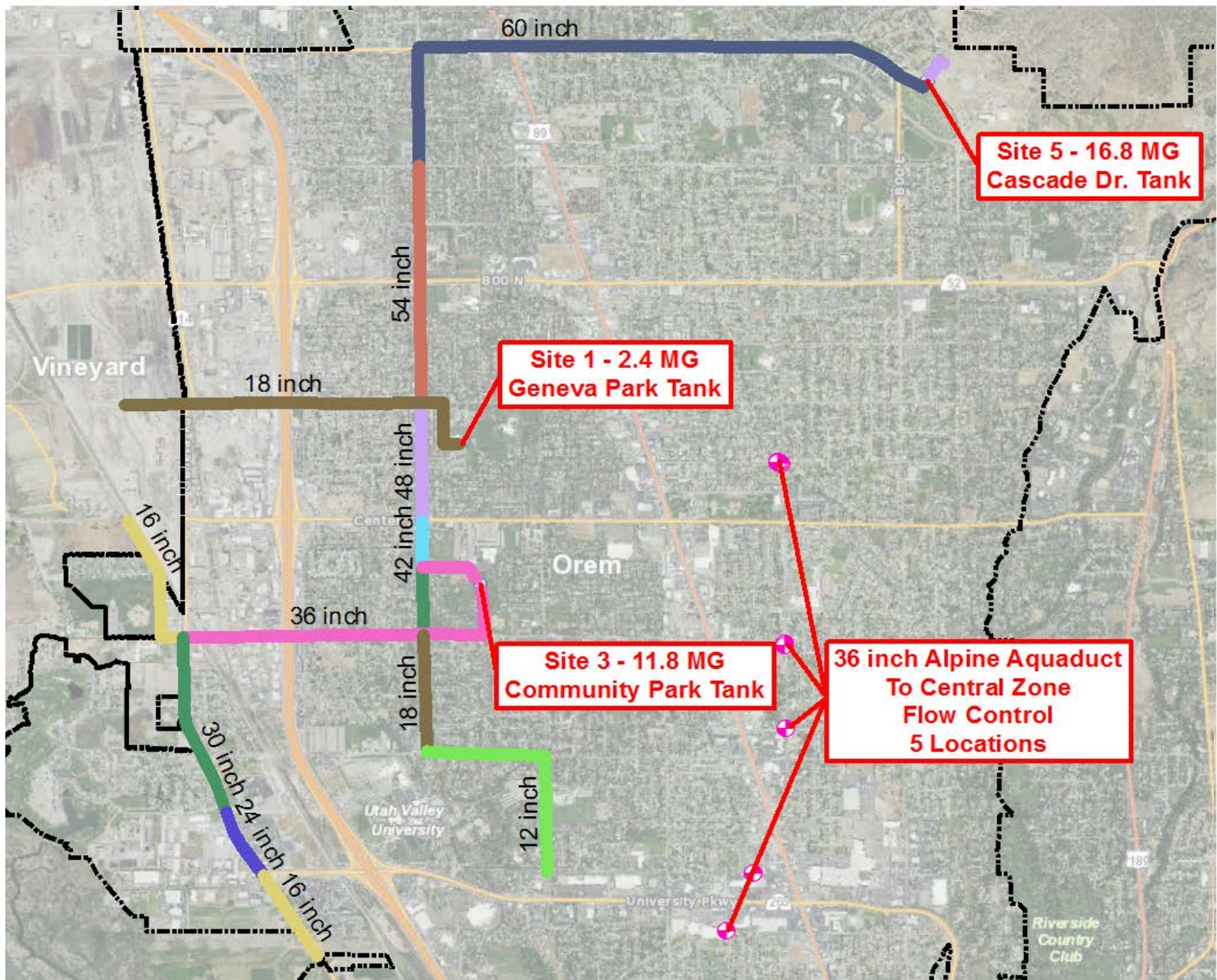


Figure 5-1: Alternative 1 Facilities



Site 3 – 600 W. 400 S. (Community Park)

Alternative 1 Proposed Tanks Water Levels

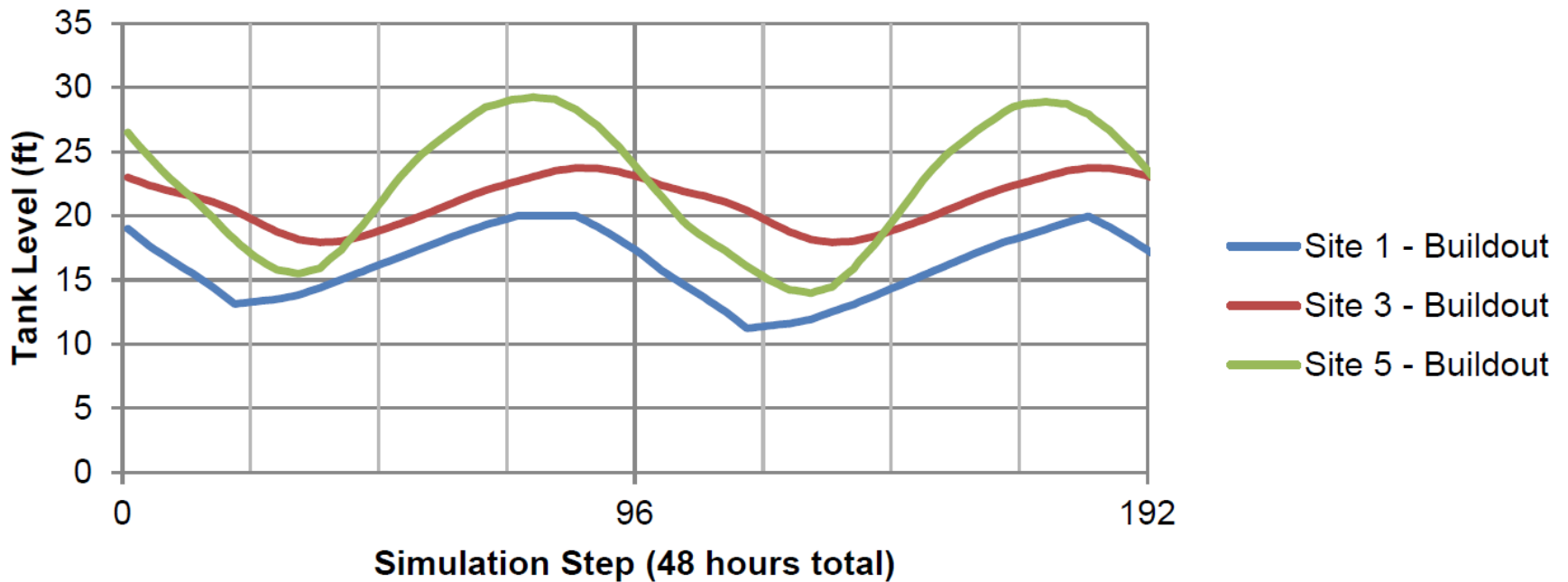


Figure 5-2: Alternative 1 Tanks Utilization Performance

ALTERNATIVE 2

- Gravity to Vineyard and Lower Orem Zone (Lake Zone)
- Pumping to Central Zone

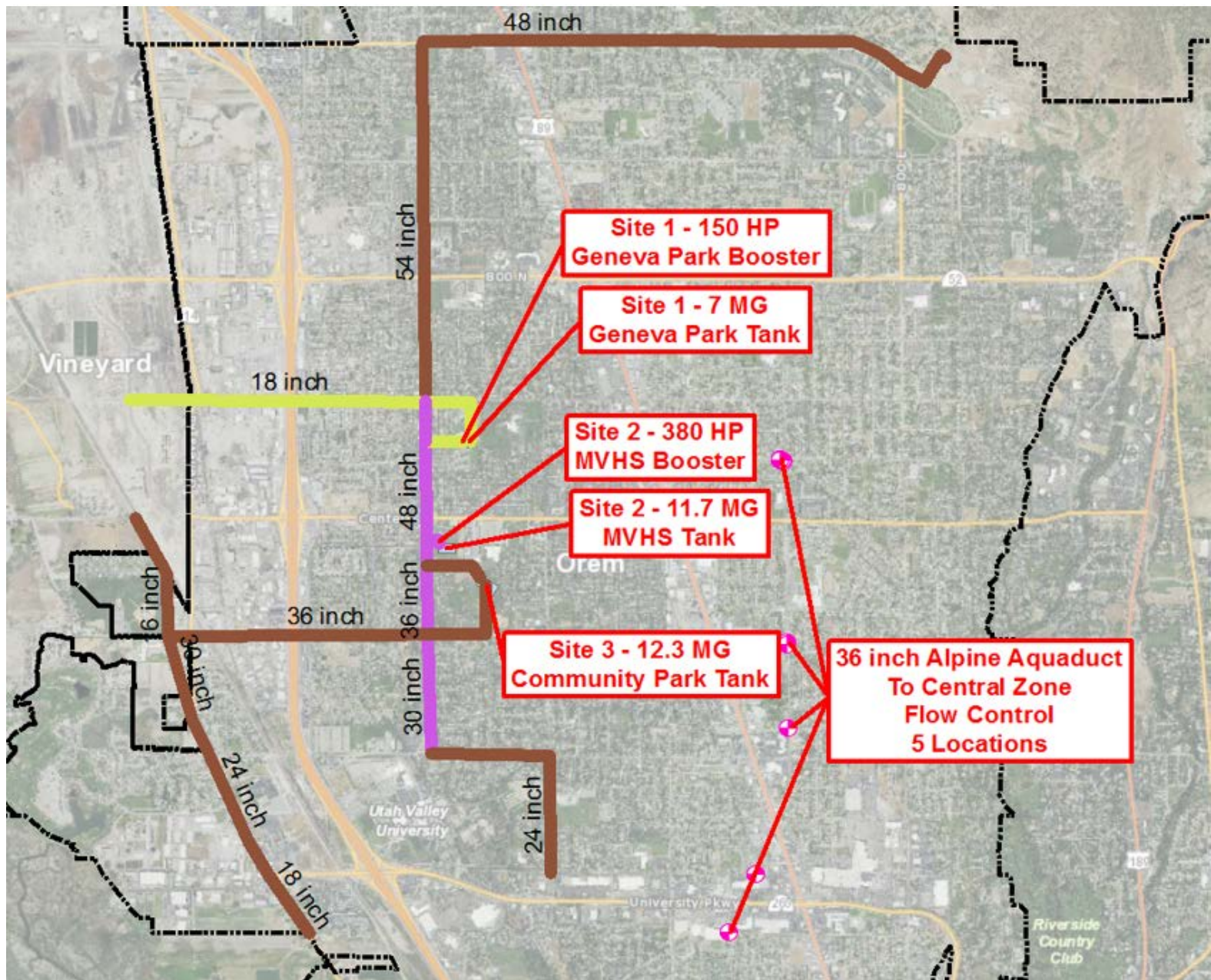


Figure 5-3: Alternative 2 Facilities



Figure 4-11: Site 1 – 600 West 400 North (Geneva Park)

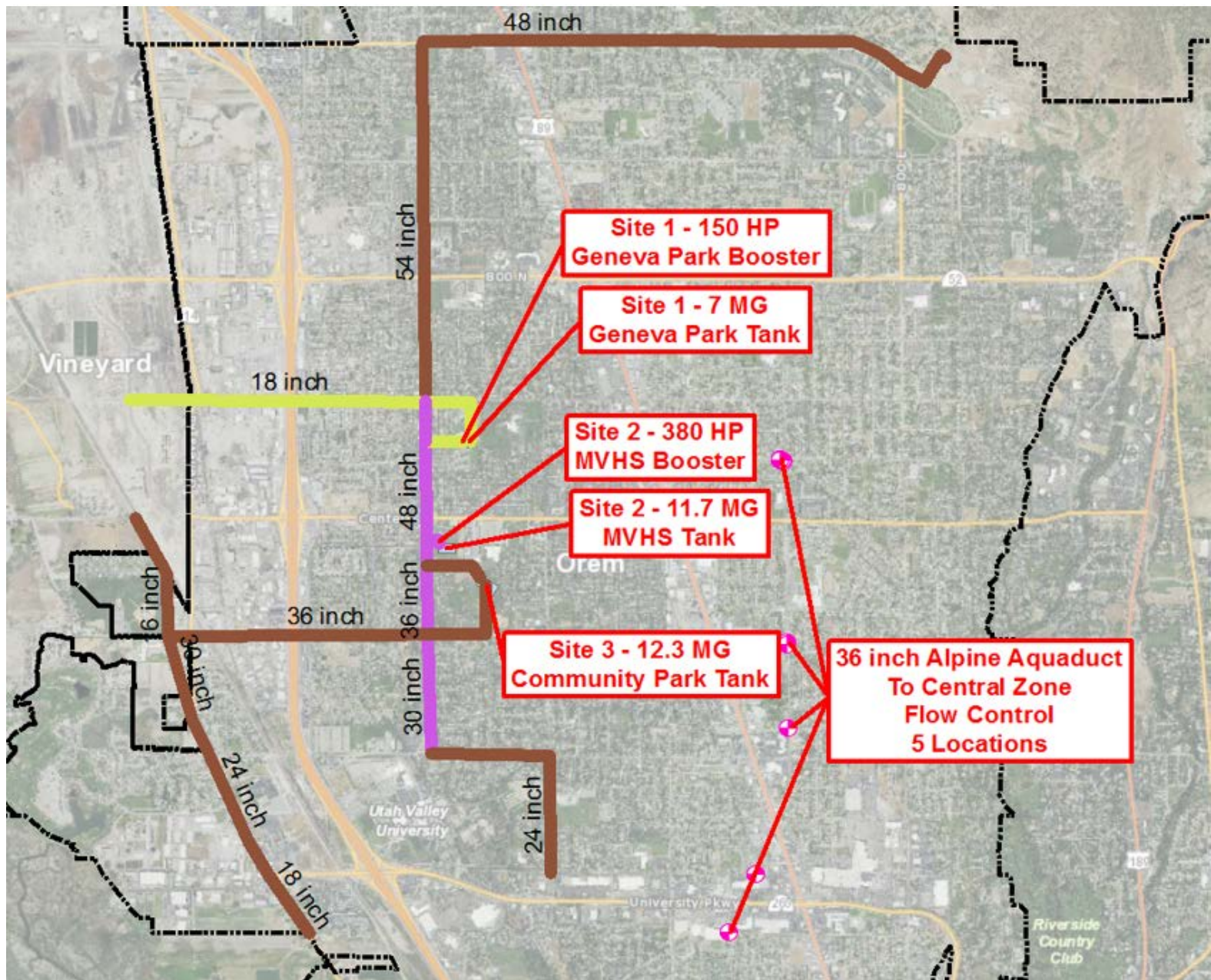


Figure 5-3: Alternative 2 Facilities



Figure 4-12: Site 2 – 600 W. Center St. (Mountain View High School)

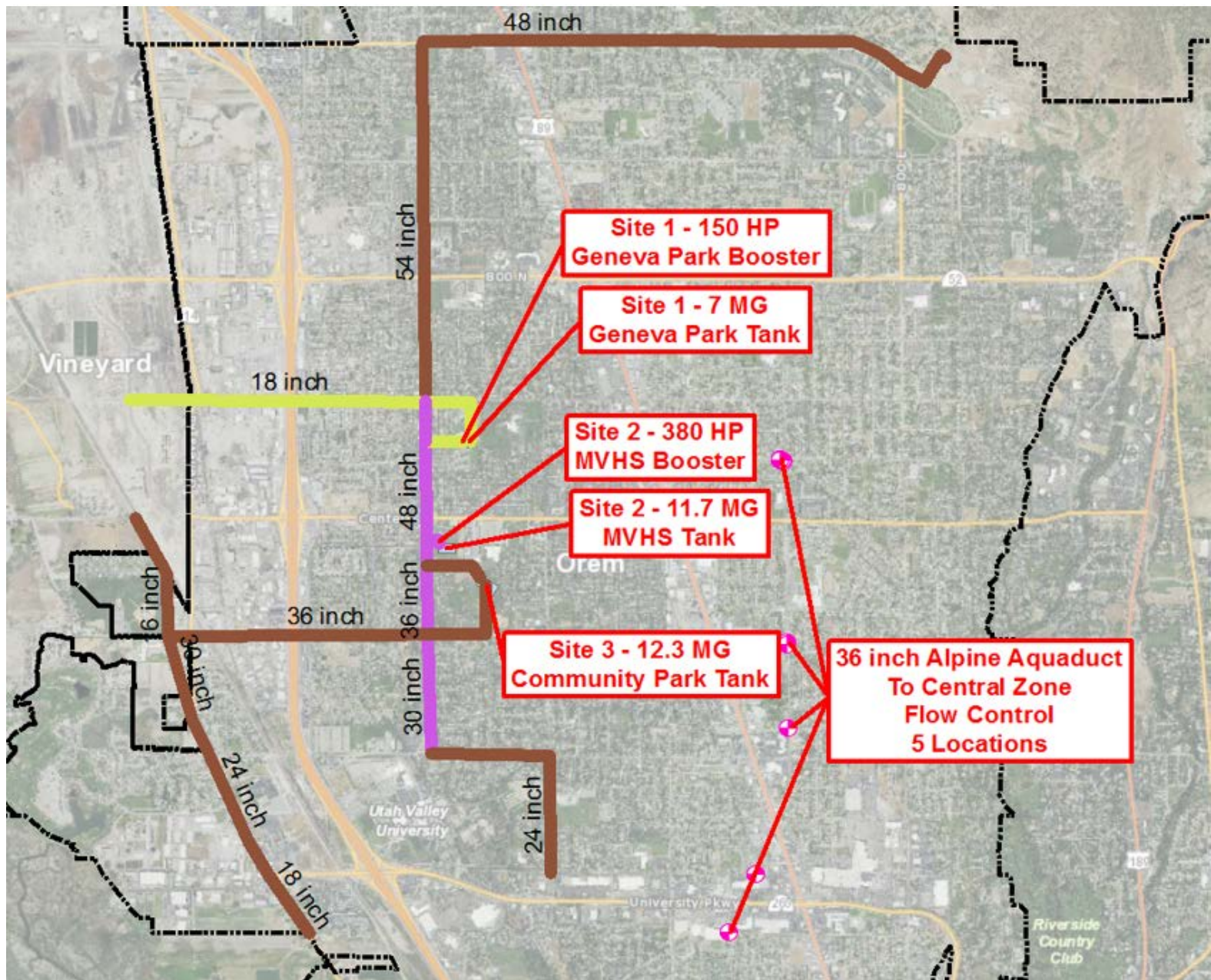


Figure 5-3: Alternative 2 Facilities



Site 3 – 600 W. 400 S. (Community Park)

Alternative 2 Proposed Tanks Water Levels

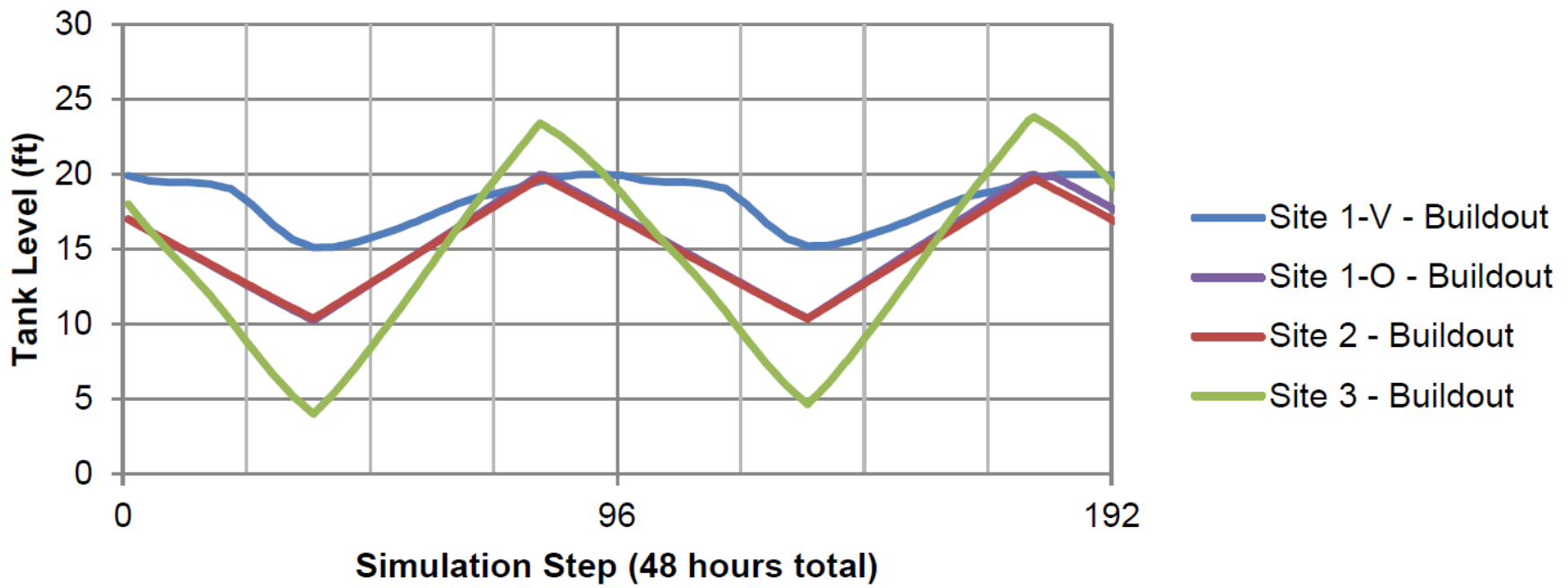


Figure 5-4: Alternative 2 Tanks Utilization Performance

ALTERNATIVE 3

- Pumping out of Central Zone initially to delay construction of transmission.
- Eventually all gravity storage and transmission of Alternative 1

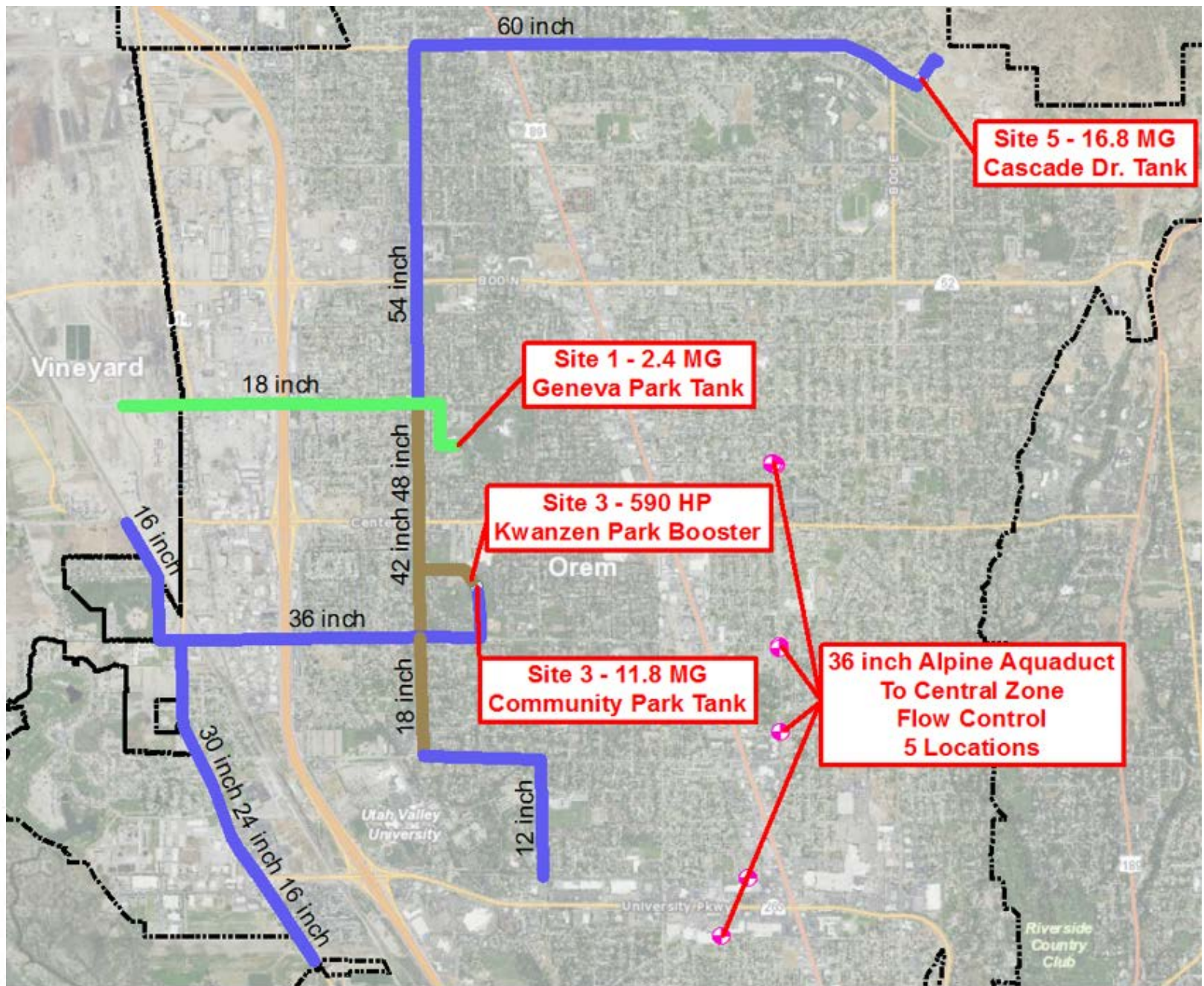


Figure 5-5: Alternative 3 Facilities

Alternative 3 Proposed Tanks Water Levels

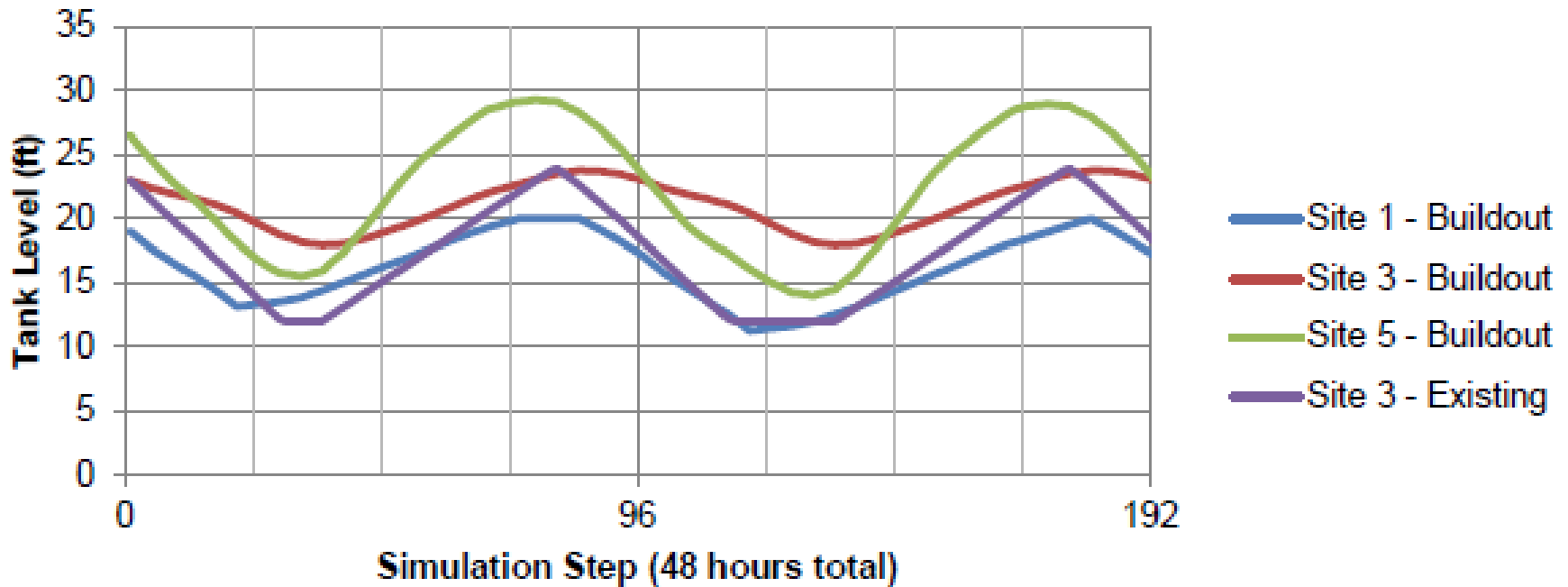


Figure 5-6: Alternative 3 Tanks Utilization Performance

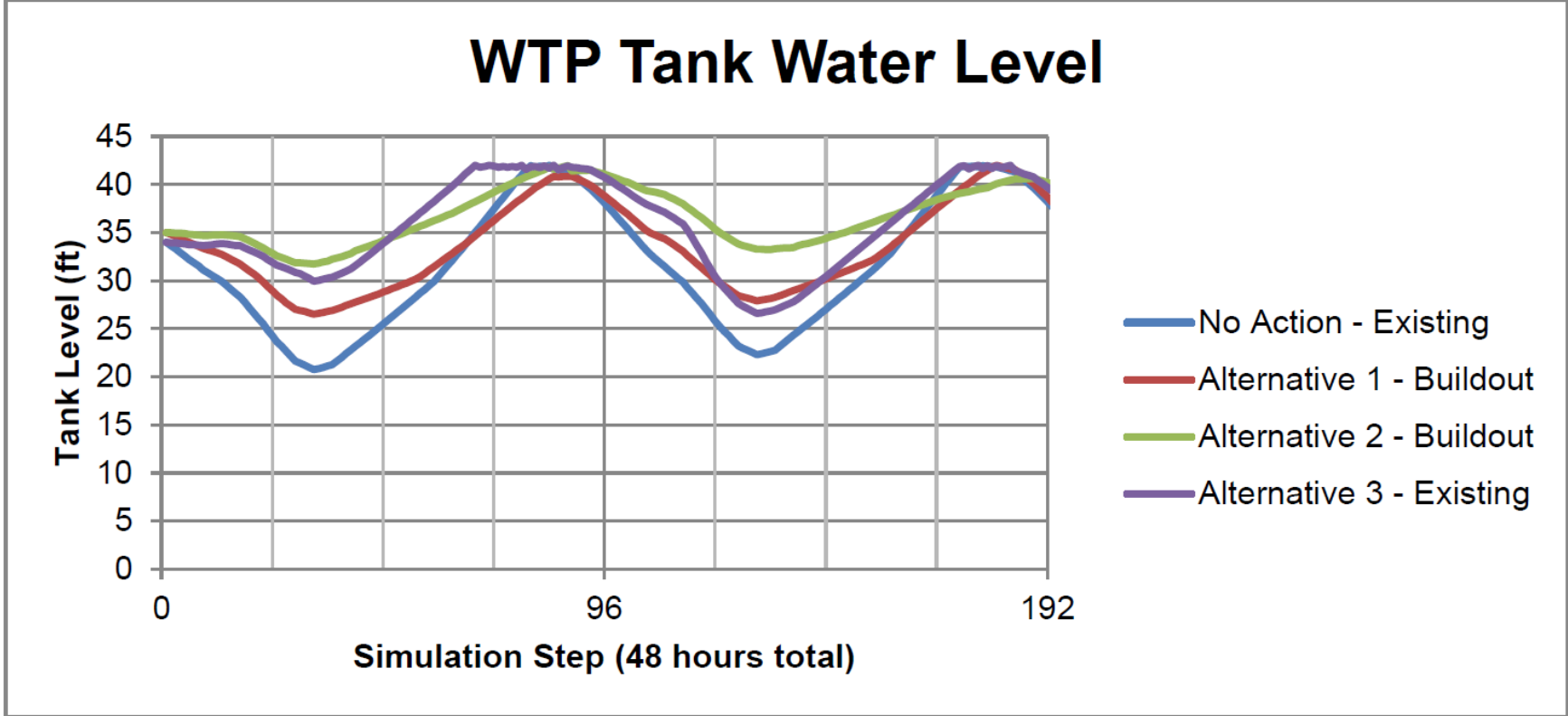


Figure 5-7: Alternatives Effect On WTP Tank Performance

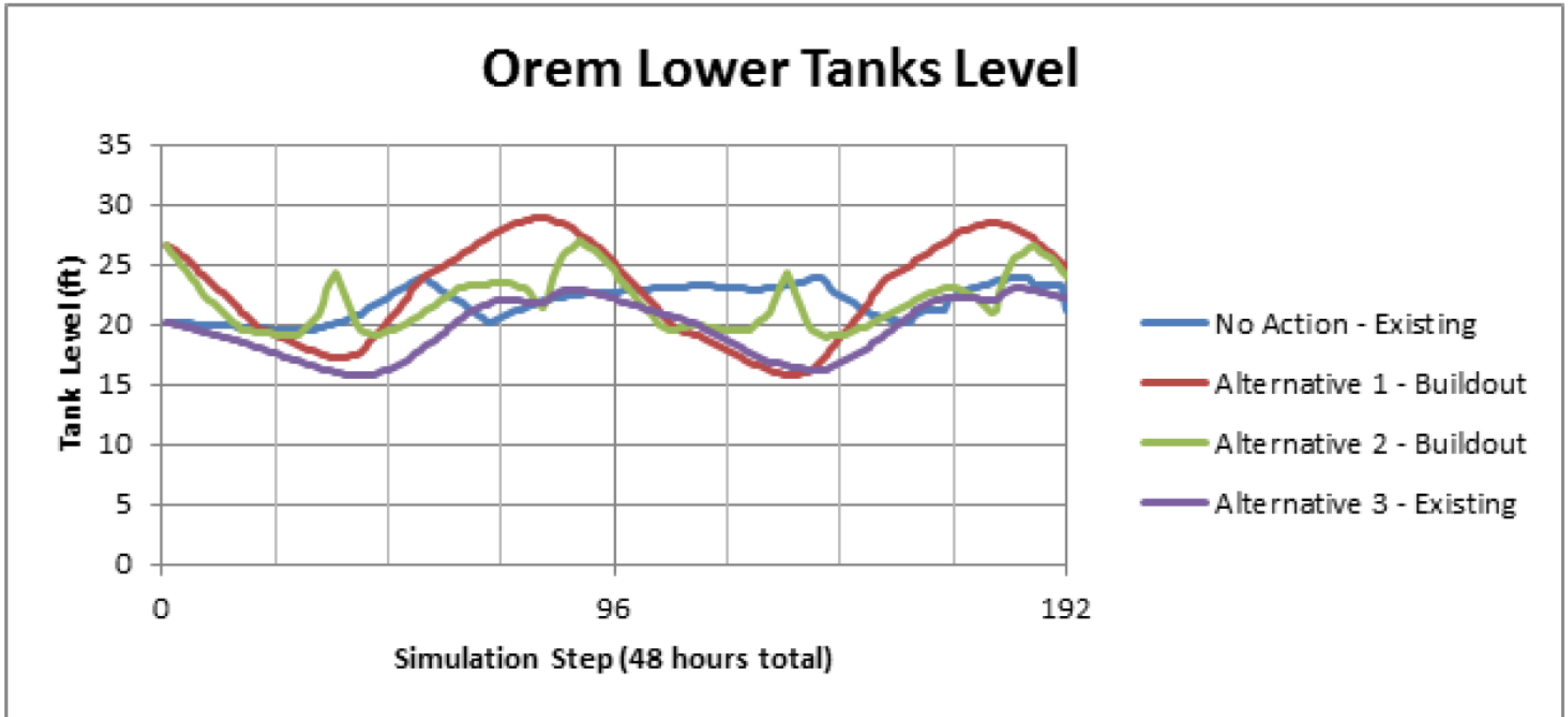


Figure 5-8: Alternatives Effect On Orem Lower Tanks Performance

7. Alternatives Evaluation

Table 6-4: Construction Phasing Plan for Alternatives

	Year		
	2017	2021	2024
Alternative 1	Site 5 – 16.8 MG	Site 1 – 2.4 MG	Site 3 – 11.8 MG
Alternative 2	Site 2 – 11.7 MG	Site 1 – 7 MG	Site 3 – 12.3 MG
Alternative 3	Site 3 – 11.8 MG	Site 1 – 2.4 MG	Site 5 – 16.8 MG

Table 6-6: Economic Comparison of Alternatives

	Tank Capital Cost	Transmission Pipeline Capital Cost	Total Capital Cost	Initial Capital Outlay (2017)	PV of Energy Cost	PV of Total Cost	FV of Total Cost
Alternative 1	\$41,194,000	\$33,442,000	\$74,636,000	\$47,157,000	\$0	\$74,636,000	\$82,765,000
Alternative 2	\$42,782,000	\$33,455,000	\$76,237,000	\$21,761,000	\$3,656,000	\$79,892,000	\$99,355,000
Alternative 3	\$43,433,000	\$33,493,000	\$76,926,000	\$23,234,000	\$609,000	\$77,535,000	\$92,176,000

Recommendations

1. While it is recognized that Alternative 1 has the highest initial capital outlay, it is recommended that Alternative 1 be selected as the proposed plan since it has the lowest total cost and no insurmountable pitfalls have been identified. Alternative 1 has lower maintenance and operating costs and no electricity pumping costs.
2. Due to deficiencies in transmission capacity in the Orem water system, it is recommended that the City address the transmission system upgrades identified in the three alternatives along with tank construction.