White Bear Lake Area Comprehensive Plan Study 9A

Impacts and Risks Evaluation from Raising White Bear Lake Outlet Elevation

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METROPOLITAN COUNCIL

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Purpose

The purpose of Study 9A is to evaluate the potential flooding impacts and risks from raising the existing White Bear Lake outlet elevation to collect and store additional precipitation and runoff to provide additional lake storage after wet weather events.

The work group can then decide whether to scope out Study 9B to evaluate the infrastructure requirements and estimated costs or discontinue with it.

Scope of Study

1. Summarize available datasets on water levels, lidar data, flood mapping, historical flood events, and prior studies (convert all datasets to NAVD 1988).
2. Conduct screening-level GIS assessment of potential flooding impacts and identify potentially impacted properties and key infrastructure.
3. Review existing bathymetric surveys.
4. Compile flood history, FEMA data, and historical flood claims around White Bear Lake.

Data Collection and Review

Data – Vertical Datum

Datums

- Ramsey County vertical datum (MSL 1912 or MSL)
- National Geodetic Vertical Datum of 1929 (NGVD 29)
- North American Vertical Datum of 1988 (NAVD 88)

Conversions

- MSL 1912 + 0.27’ = NGVD 29
- MSL 1912 + 0.46’ = NAVD 88
- NGVD 29 + 0.19’ = NAVD 88

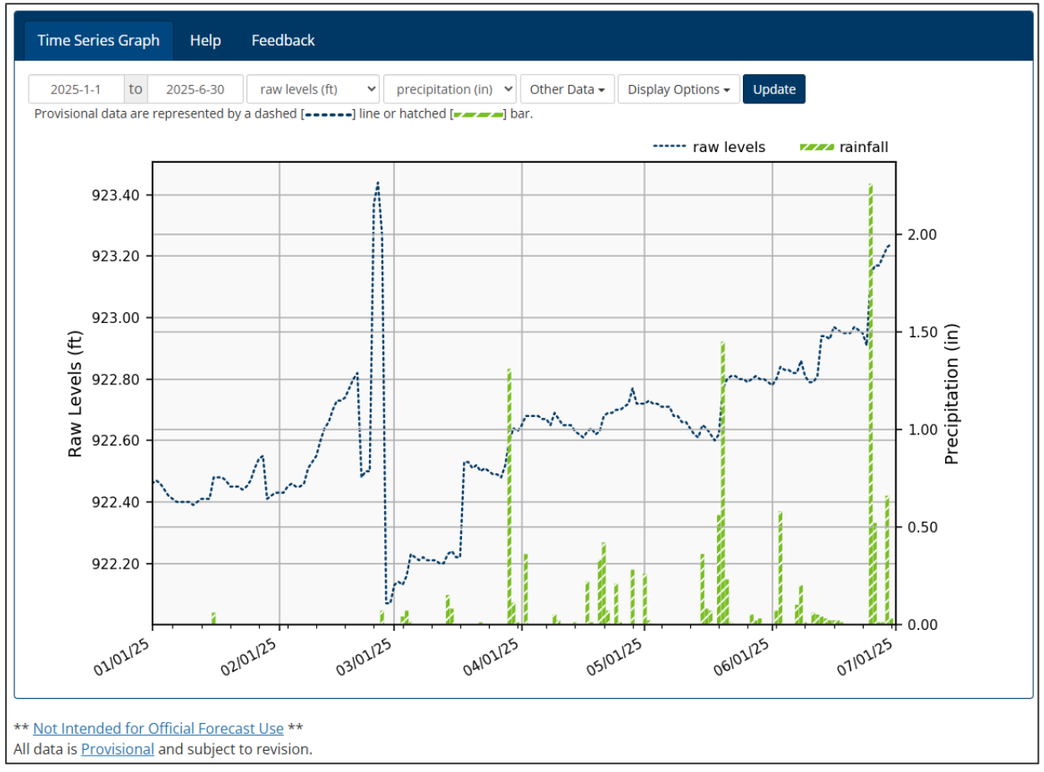
Data – Water Levels

MnDNR - MSL 1912 (ft)

- Period of Record: 01/01/1924 to 05/31/2025
  Highest recorded: 926.7 ft (06/20/1943)
  Lowest recorded: 918.84 ft (01/10/2013)
  Recorded range: 7.86 ft
  OHW elevation: 924.89 ft

MnDNR Cooperative Stream Gaging (CSG) data

- Raw water level and rainfall

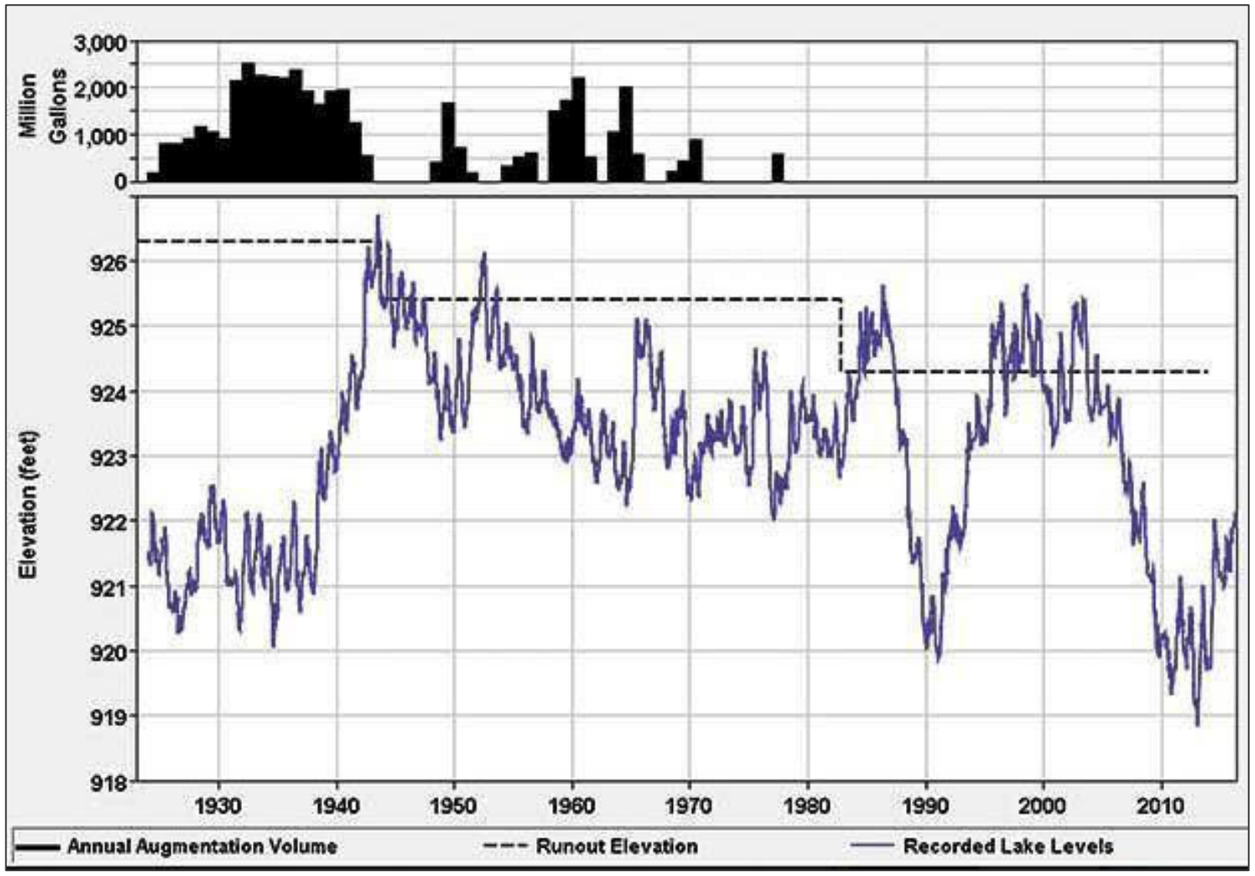


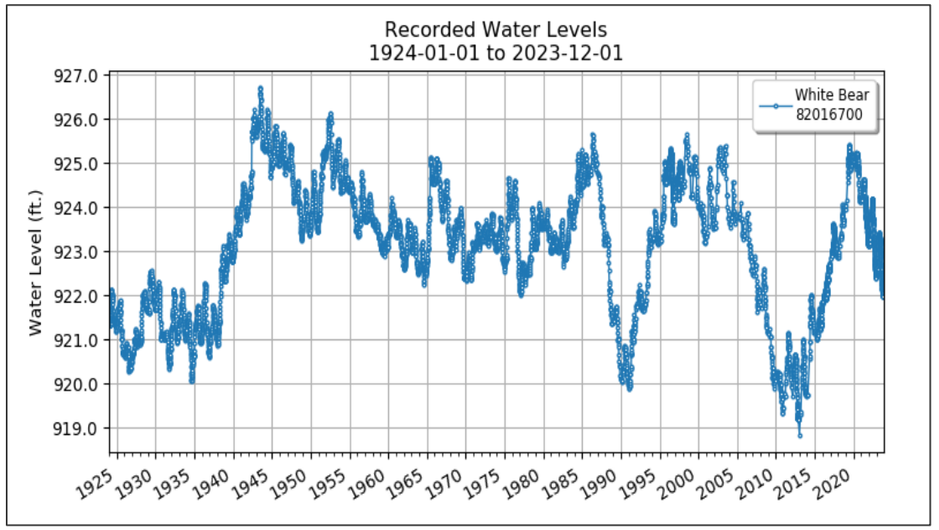
DNR Protective Elevation

- 922.0 (MSL) / 922.46 (NAVD 88)

Data – Water Levels

WBL Conservation District

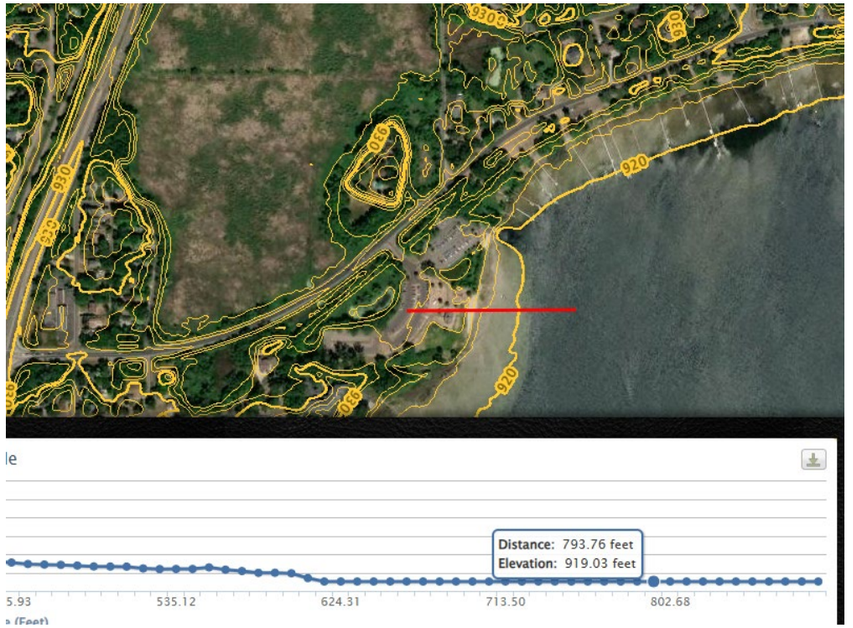




Data – LIDAR

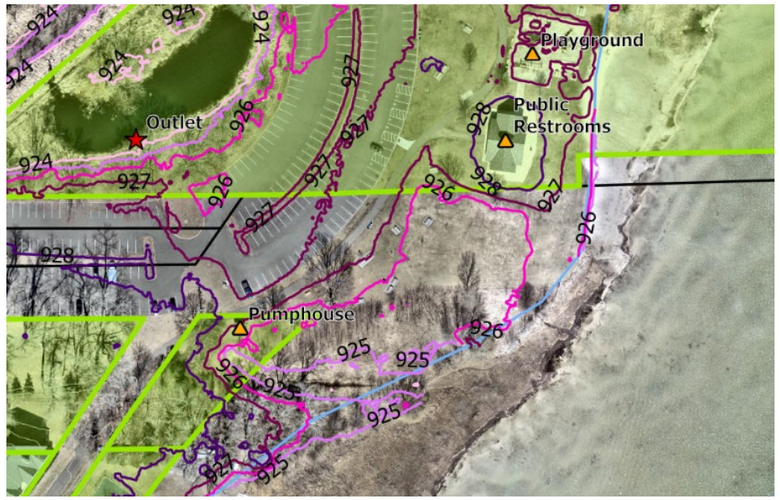
2011 Data

- Lidar set currently available in MnTOPO online tool
- Low contour at lake surface consistent with water levels recorded in 2011



2024 Data

- Consistent with levels in 2024



Data – Flood Mapping

Official FEMA Documents

- FIS, Ramsey County, Minnesota – September 16, 2015
- FIS, Washington County, Minnesota – February 3, 2010.
- White Bear Lake as a Zone A Special Flood Hazard Area

Elevation References

- Several Letter of Map Amendment (LOMA) documents relate to White Bear Lake:
  - Some LOMAs list a 1% Chance Flood Elevation of 926.9 (NAVD 88)
  - Some provide no elevation

Data – Bathymetric Surveys

MnDNR – two available documents

- May 1978
- One map with no date provided

Data Assessment

- Bathymetry data value would relate more to Study 9B, if advanced, for quantifying storage above historic low water elevation at about 919 (NAVD 88).
- Recall we have LIDAR data for 2011 and 2024

Data – Other

- Outlets - Twin 18 x 28 RCP Arch (NAVD 88)

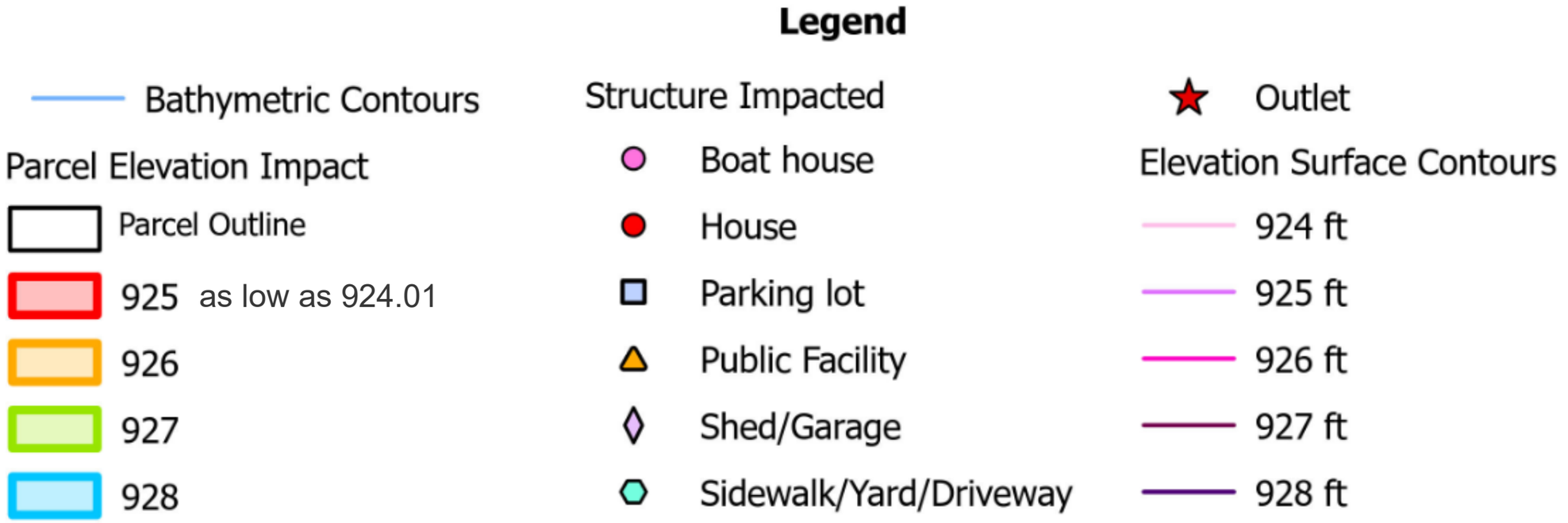
RCWD	MnDNR Survey
924.77 / 924.78	924.16 / 924.30

- Rice Creek Watershed District - 100-YR HWL
  - Polynomial equation fit to data from 1924 to 2021
  - One occurrence reaching 927.0 (NGVD 29) in 1943
    - Prior to lowering culvert two times
  - 100-YR (*used by RCWD for implementation of their floodplain rule*)
    - 927.00 NGVD 29
    - 927.20 NAVD 88

GIS Mapping Assessment

GIS – Infrastructure Risk Assessment

Exhibit 1 – 21 Page Map Panel Set (2024 LiDAR)



GIS – Infrastructure Risk Assessment

Exhibit 1 – 21 Page Map Panel Set (2024 LiDAR)

Metropolitan Council

GIS – Infrastructure Risk Assessment

- Difficult to accurately identify which of these structures are actually at risk without a closer inspection and potential survey
- Could be a couple dozen structures at or below the 100-year HWL

Elevation Range (NAVD 88)	Parcels	Structures	Types of Structures
924.01 – 925.00	2	2	Garage and attached boat house on Map page 10. Shed/boat house on Map page 14.
925.01 – 926.00	3	3	Shed/boat house on Map page 2. Boat house on Map page 3. Boat house on Map page 21.
926.01 – 927.00	20	22	Multiple features including potential houses, a parking lot, playground and several boat houses and/or sheds. See map set for details.
927.01 – 928.00	33	42	Multiple features including potential houses, a parking lot, picnic shelter and several boat houses and/or sheds. See map set for details.

GIS – Infrastructure Risk Assessment

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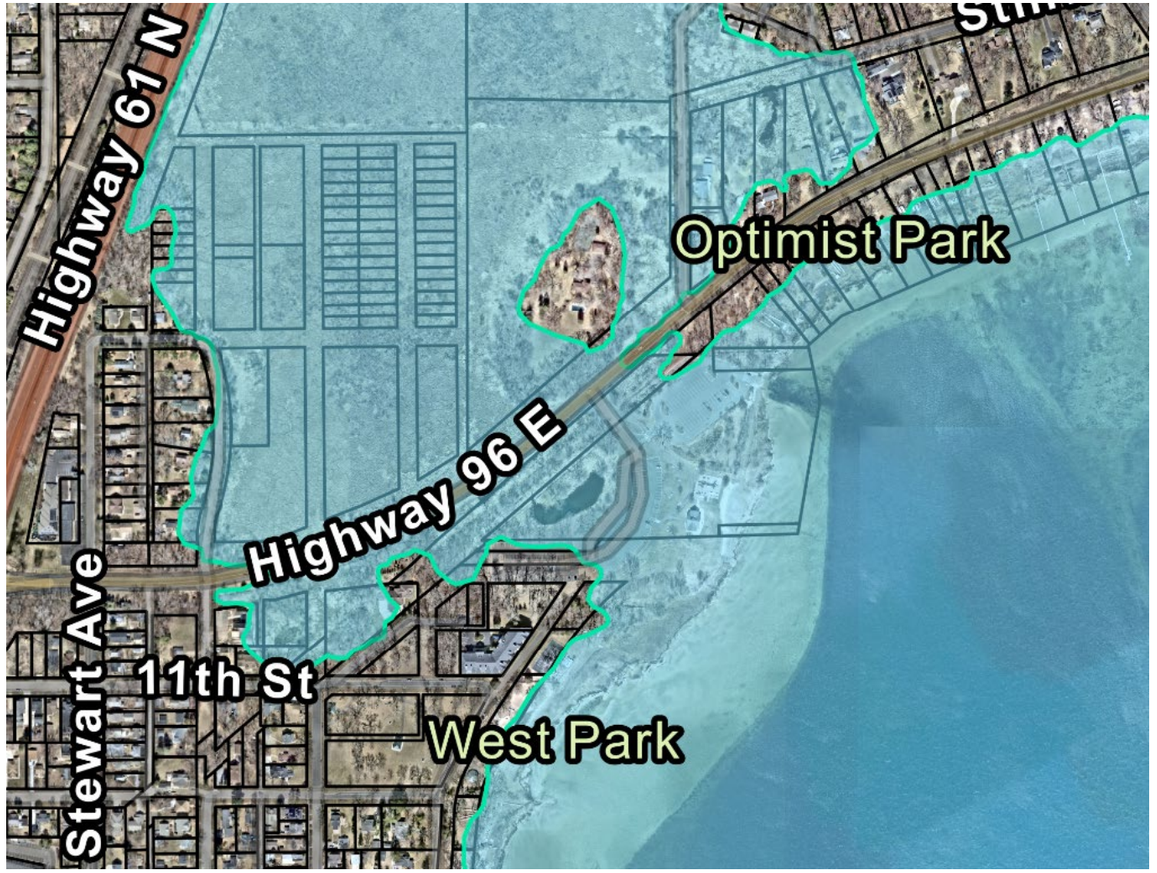
GIS – Flood Mapping

FEMA - Zone A Special Flood Hazard Area

ZONE A
Areas subject to inundation by the 1-percent-annual-chance flood event generally determined using approximate methodologies. Because detailed hydraulic analyses have not been performed, no Base Flood Elevations (BFEs) or flood depths are shown.

LOMAs list 926.9 (NAVD 88)



Outlet Assessment - Preliminary

- Model Inputs
  - Primary outlets - twin 18” x 28” RCP Arch at 924.30 NAVD 88 (DNR Survey)
  - Secondary outlets – overflow from LiDAR
  - Culverts under Highway 96 - estimated
  - Lake and pond storage areas from LiDAR
  - Events: 100-yr (7.36”), 100-yr B2B, 12-Inch
- Results
  - Difficult to replicate 100-year event at 927.2 (NAVD 88) from RCWD Study
  - Would likely take much more extreme conditions to reach 927.2
  - HWL more sensitive to water level starting elevation than to elevation of culverts
  - 100-yr HWL is above surface overflow from parking lot area (est. 925.3) and Highway 96 (est. 926.0)

Conclusions

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- The primary benefit of raising the outlet elevation would be to capture and store more rainfall precipitation in the lake to help maintain lake elevations for longer periods of time during extended dry periods. Raising the lake elevation by 6-12-inches could provide an approximately 400-800 million gallons of additional storage capacity in the lake during these times.
- Primary risk relates to the potential for increasing the flood risk of properties and infrastructure around the lake.
- Based on a simple model assessment, the primary outlet culvert elevations appear to be less a factor than the water level starting elevation on extreme event high water levels. Rasing the culverts would have more days with water level starting elevations at or above 924.3.
- The existing surface overflow paths are at elevations below the 100-year flood elevation. A more detailed 1D-2D model analysis could better define the changes resulting from increasing the culvert elevations.

Questions

Questions: Model Results

Table 2. Potential High-Water Levels for Varied Lake Starting Elevations

Rainfall Event	Depth (inches)	Storms	HWL - For Each Starting Elevation		
			924.3	924.8	925.3
100-yr	7.36	1	925.67	926.12	926.54
100-yr B2B	7.36	2	927.22	927.54	927.82
12-Inch	12.00	1	926.69	927.07	927.41

Table 3. Potential High-Water Levels for Varied Culvert Inverts

Rainfall Event	Depth (inches)	Storms	HWL - For Culvert and Start Elevation		
			924.3	924.8	925.3
100-yr	7.36	1	925.67	926.15	926.58
100-yr B2B	7.36	2	927.22	927.54	927.84
12-Inch	12.00	1	926.69	927.08	927.43