BCWD Watershed Board Meeting April 9, 2025

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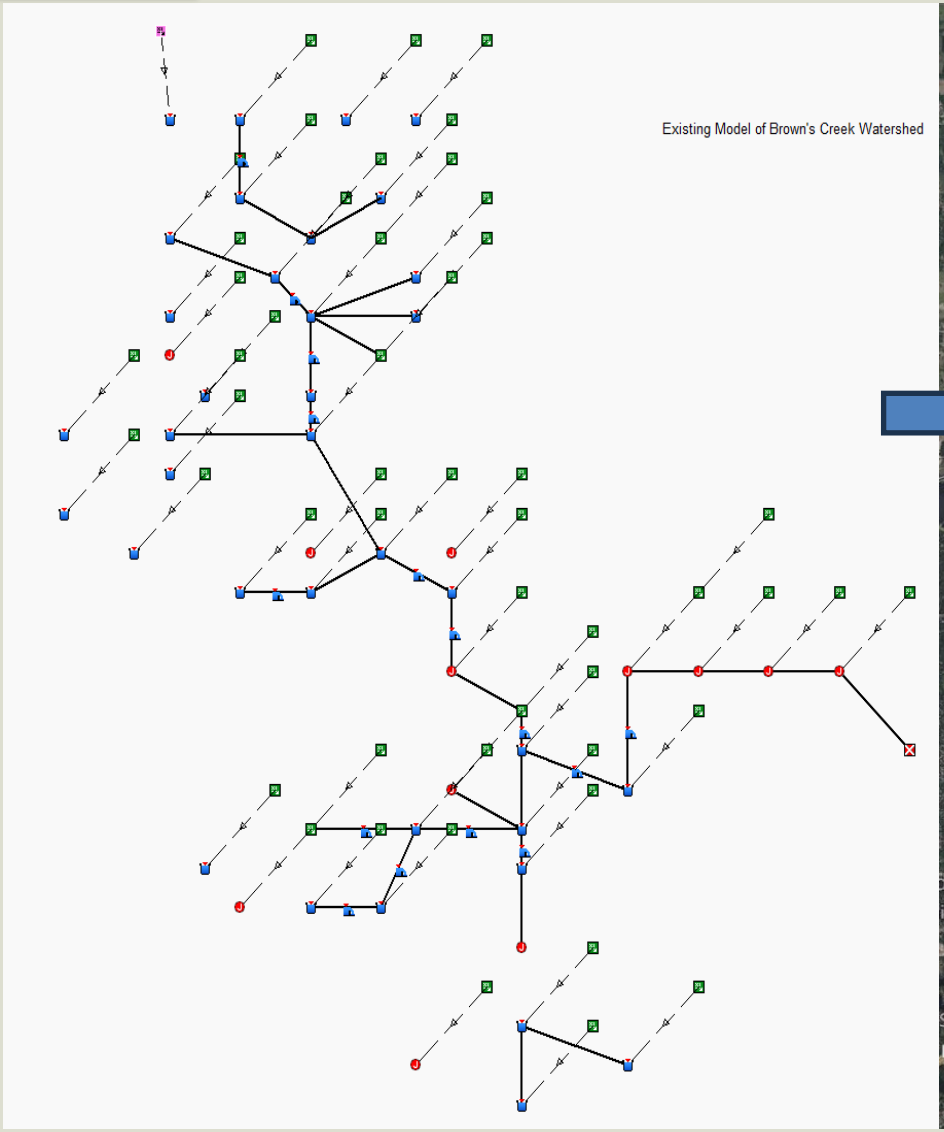
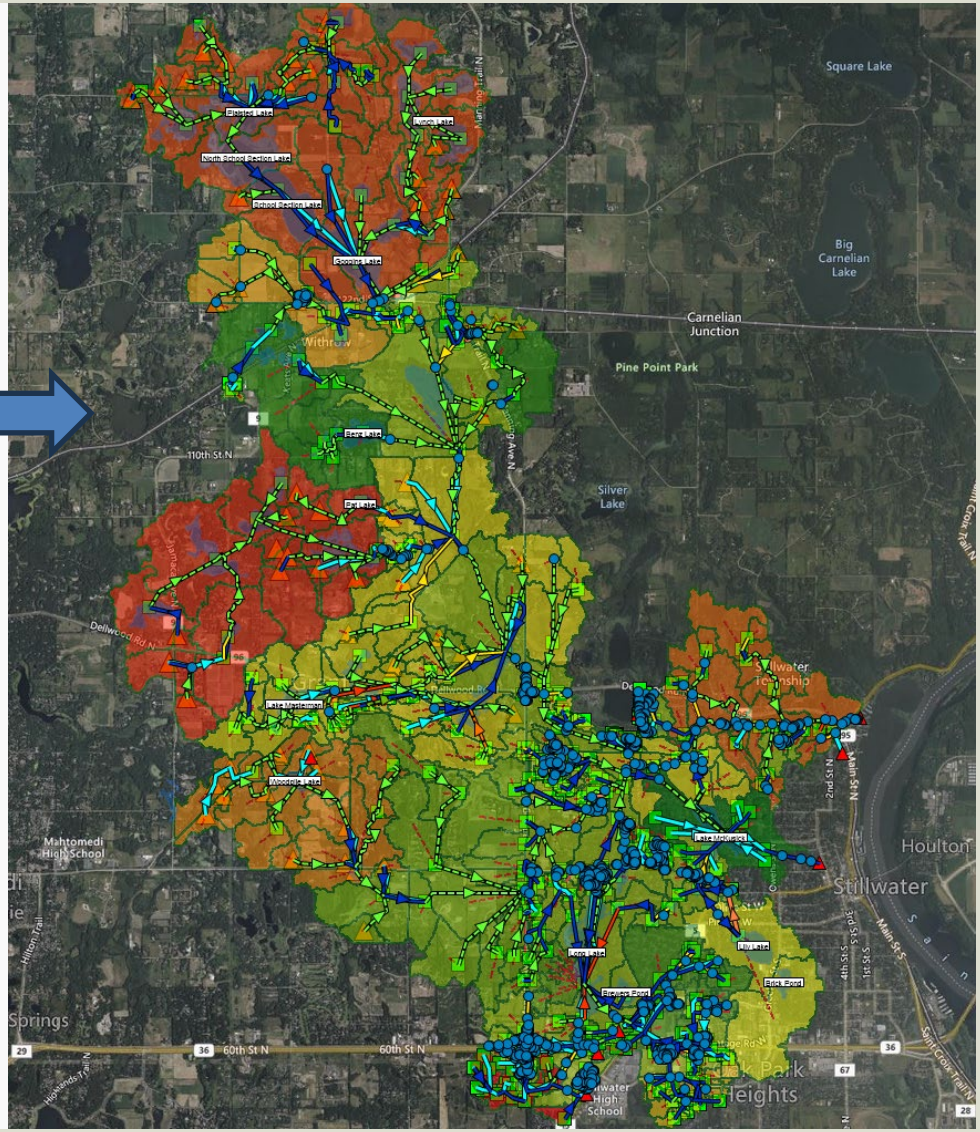
BCWD H&H Model Update

1. Model Update History
2. Project Scope/Update Overview
3. Model Update Benefits
4. Calibration and Validation Process & Results
5. BCWD Rainfall History and Future Climate Forecast
6. Floodplain Footprints
7. Recommendations & Next Steps

- 1999 H&H (46 subcatchments)
  - paper maps, 10’ topo, limited culvert information
- 2004 H&H Update (345 subcatchments)
  - 2’ topography & Minn. Landcover Classification System
  - Calibration of seventeen DNR waterbodies (BCWD “Lakes”)
  - 100-Year Event = 5.9” -Basis for 2010 FEMA Flood Insurance Studies
  - Landlocked basin policy
- 2015 H&H Update (380 subcatchments)
  - 2011 LiDAR topography & GIS “trained” impervious areas
  - Calibration of DNR waterbodies & Brown’s Creek
  - “Atlas 14” 100-Year Event = 7.2” with greater rainfall intensity
  - Average of +0.5-foot 100-year water level increase





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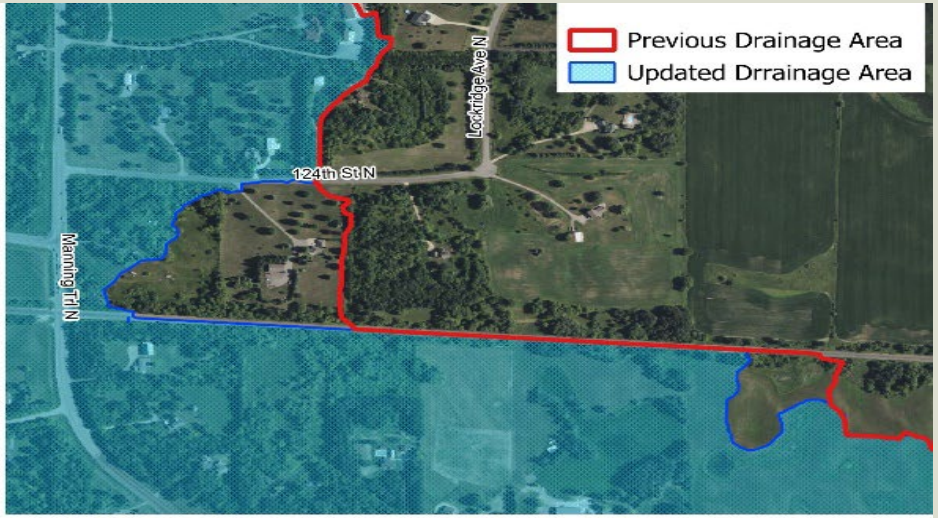
2025 H&H Update - Phased approach based on data availability:

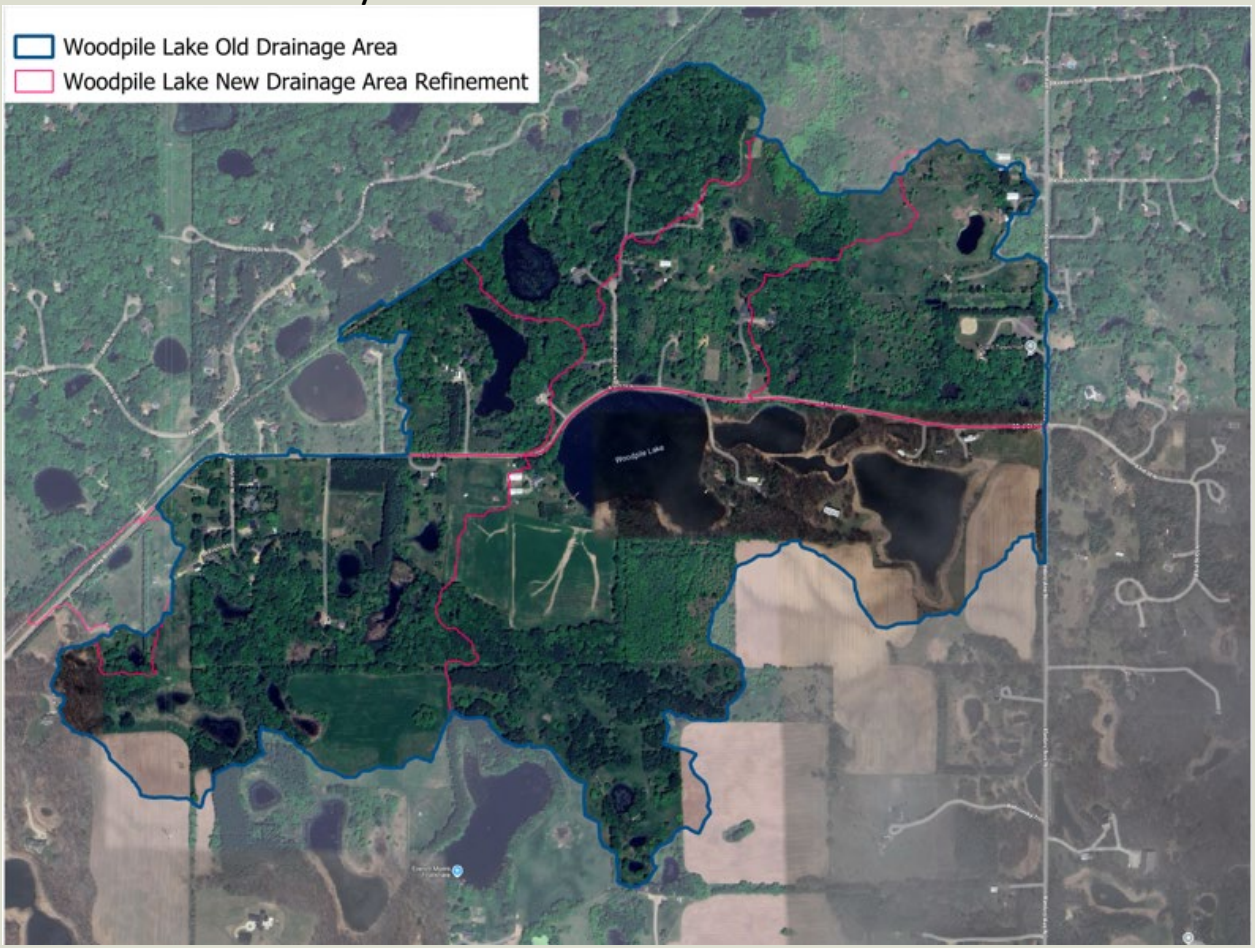
- Updated climatology & precipitation data (NEXRAD Radar)
- Model hydraulics updated from 34 permits
- Topography Update (2022 LiDAR):
  - 621 subcatchment boundaries refined
  - 568 pond/depression/wetland storage
  - Overflow location/elevation, flow paths
  - More accurate accounting of flood storage in the landscape
- Updated land cover (2016 U of M 1-meter resolution)
- Calibration & validation for lakes and Brown's Creek
- Model design storm event simulations (2-year, 10-year, 100-year)
- 100-year flood mapping:
  - 7.2" Rainfall
  - 9.5" Rainfall - Upper bound 90% confidence interval

1. Refine Watershed Hydrologic Boundaries



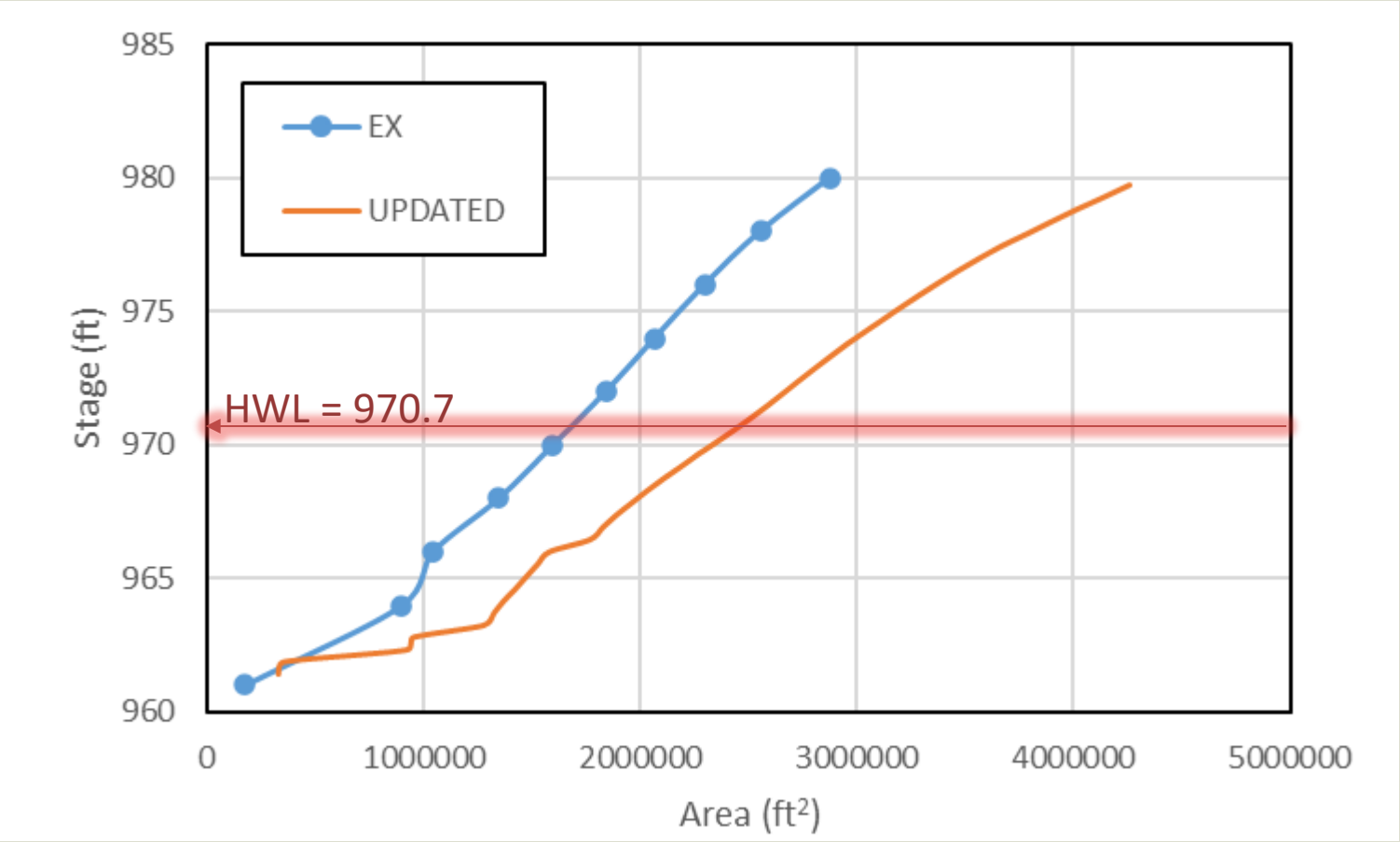
2. Refined Subcatchments

- Accounts for natural depressional storage in the landscape
- Informs of areas that normally hold water back from lakes



2. More Accurate Basin Storage

- Woodpile Lake (Landlocked)
- Improves lake calibration for more accurate high water level predictions

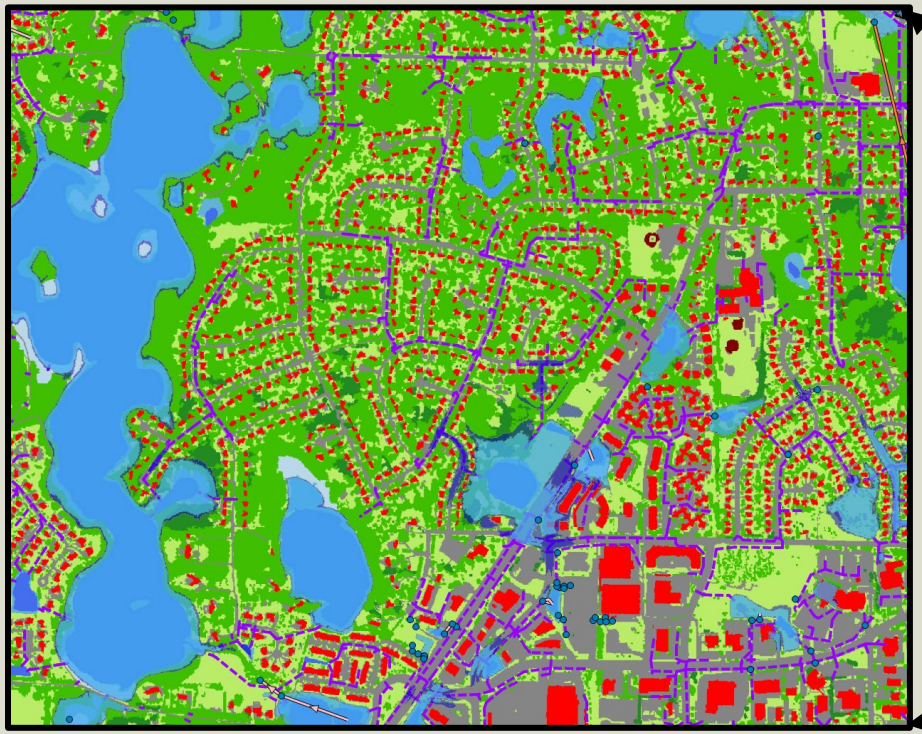


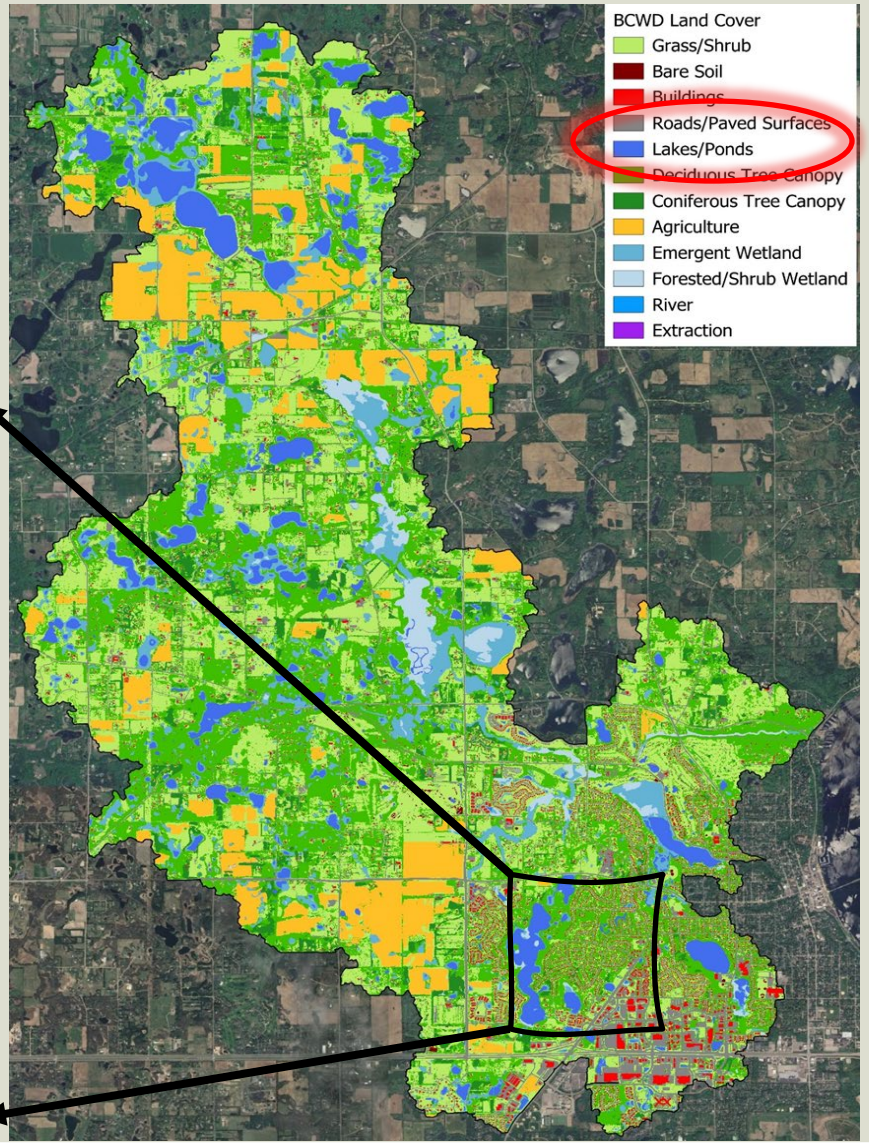
3. Utilization of Updated Land Cover Data

- More accurate, imperviousness and hydrologic parameter estimates

4. Enhanced Model Resolution

- Ability to assess proposed land cover changes within subcatchments





17 Lakes – Volume (Elevation)

Lake Name	Node Name	DNR ID
Masterman	CBC-2a	82012600
South School Section	GSL-12a	82015100
Lynch Lake	GSL-14a	82004200
Goggins	GSL-20a	82007700
Plaisted	GSL-7a	82014800
Unnamed	KPL-1	82012800
Bass	KPL-2	82012300
Unnamed (Bass)	KPL-5	82012400
Kismet	KPL-6a	82033400
Pat	KPL-7	82012500
Long	LL-20	82002100
Jackson	LL-22	82030500
McKusick	McK-18	82002000
Unnamed (July Ave)	UBC-1	82031800
Benz	UBC-5f	82012000
Wood Pile	WKL-3	82013200
Kimbro	WKL-4	82034900

3 Locations of Brown's Creek - Flow

1. Manning Avenue
2. Stonebridge Trail
3. Highway 96 (WOMP)

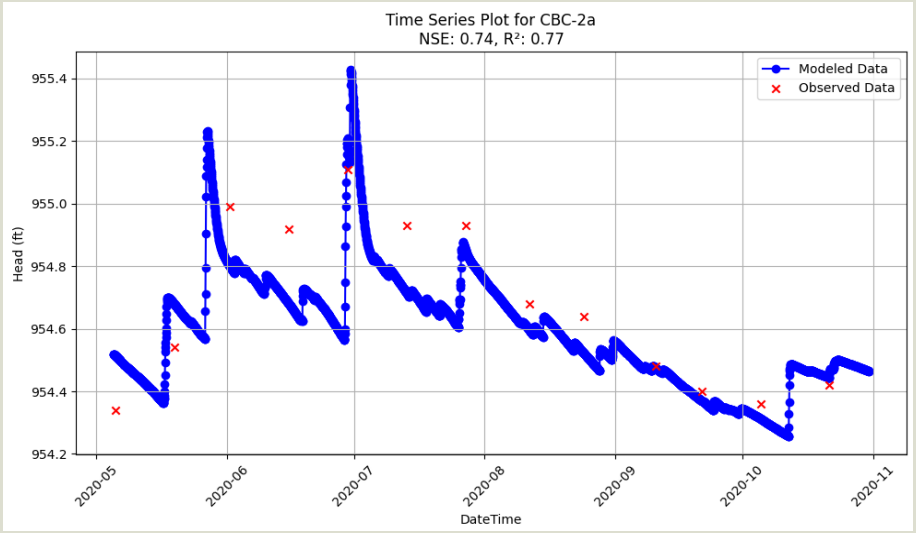
Time Period

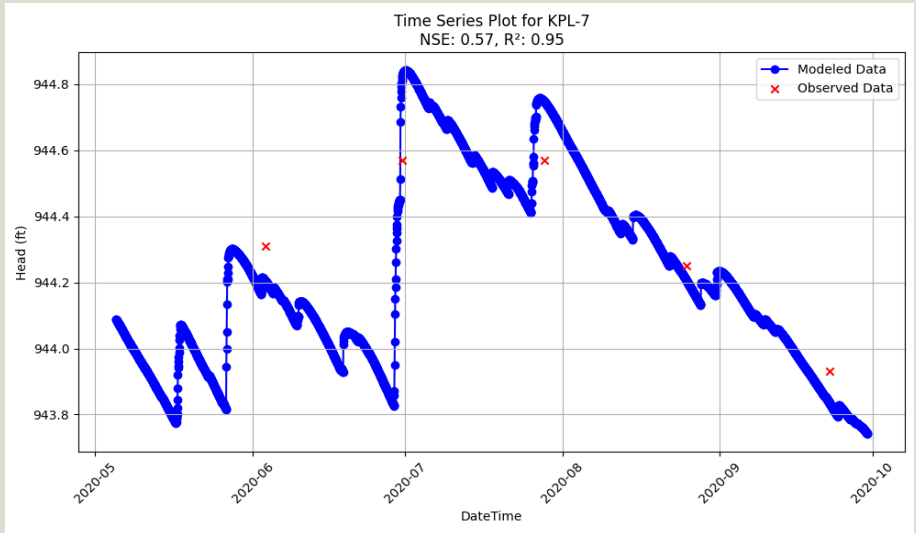
1. Calibration: 2020 data
2. Validation: 2022 data

Methodologies

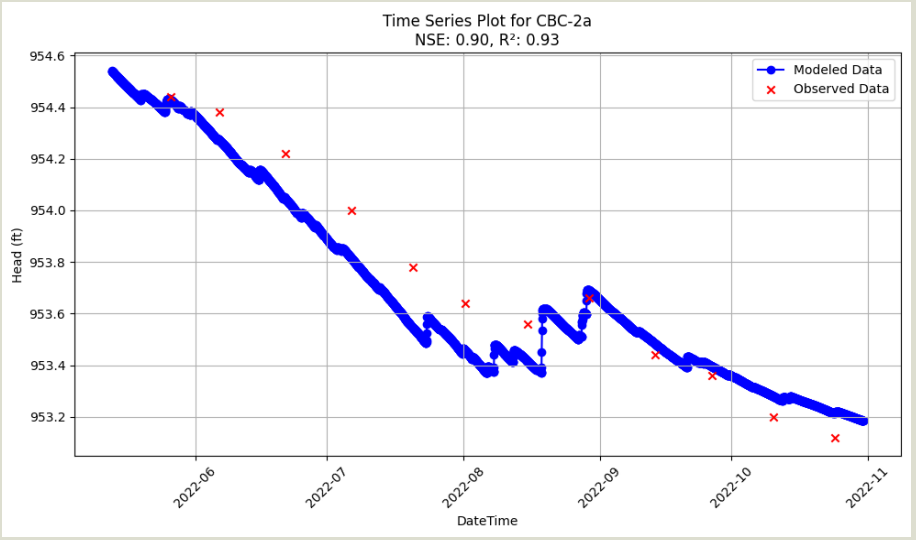
1. Used a hotstart tool to simulate early spring precip. as a "warm up" period for realistic soil conditions/moisture
2. Set initial lake levels, aligning with recorded data
3. Developed scripts to automate parts of the calibration and validation process, improving efficiency

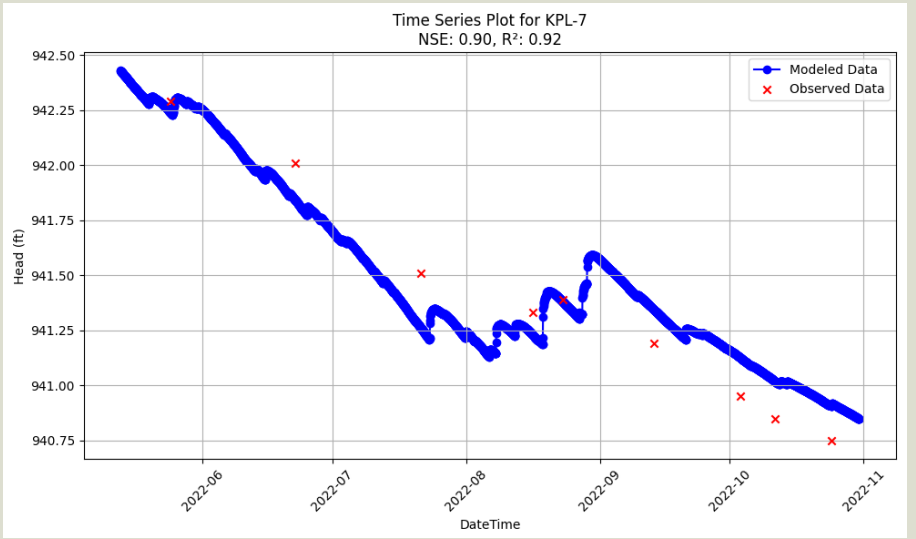
2020 Lake Levels - Calibration



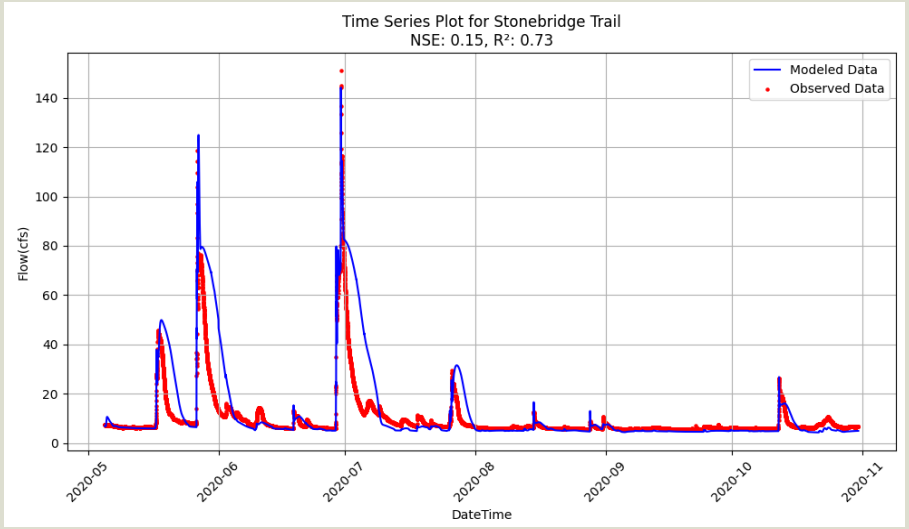


2022 Lake Levels - Validation

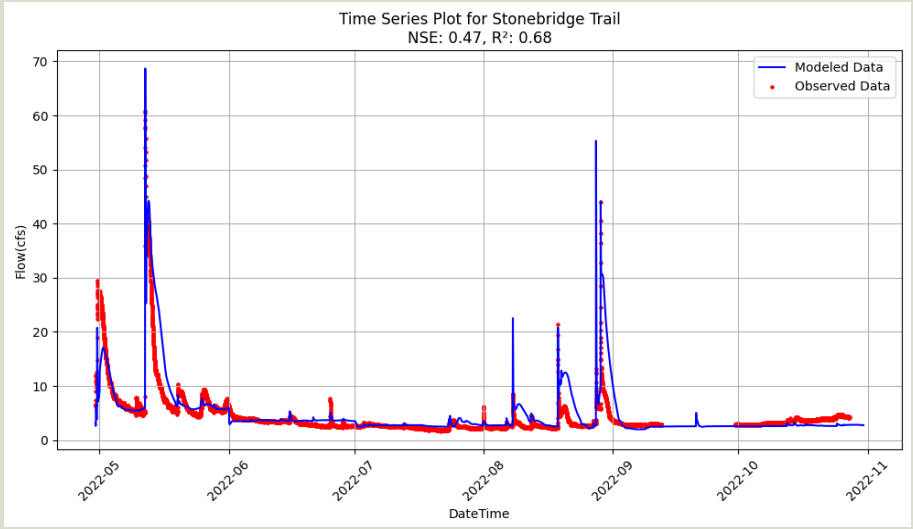


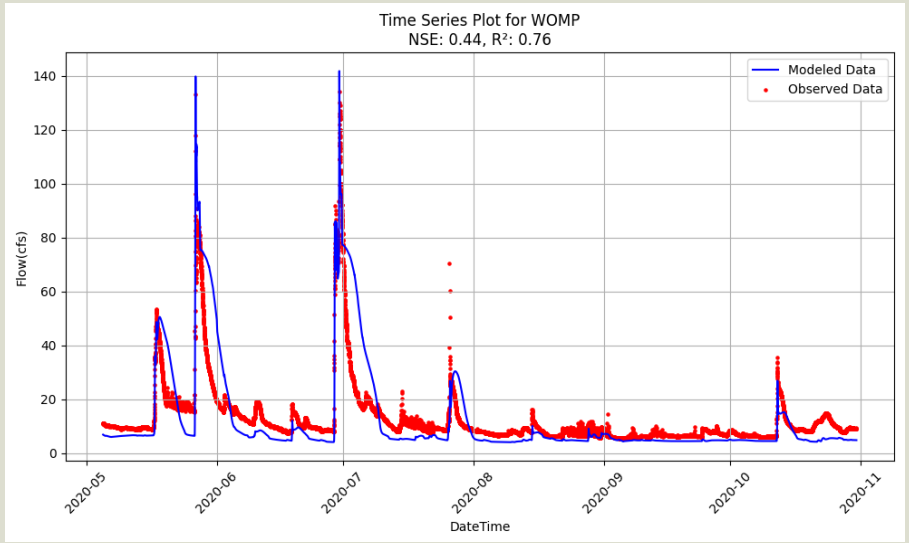


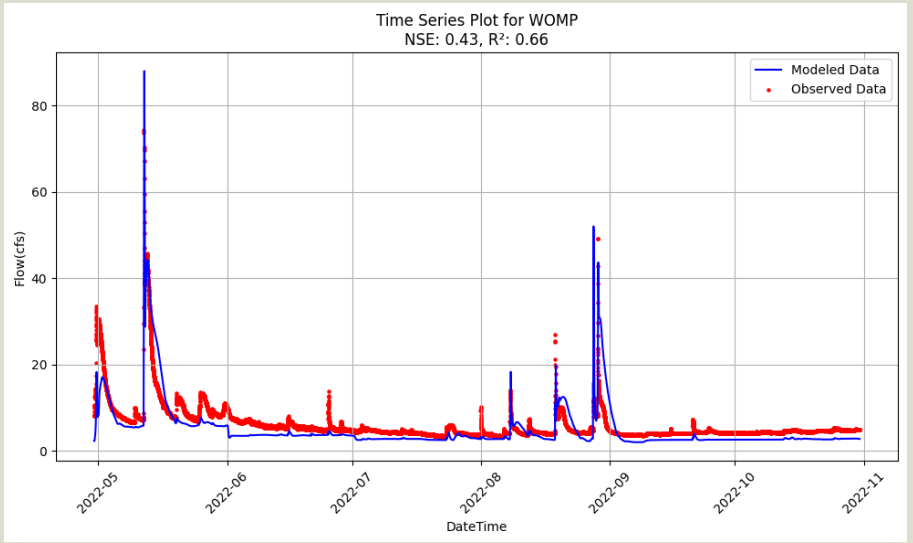
2020 Creek Flow - Calibration



2022 Creek Flow - Validation

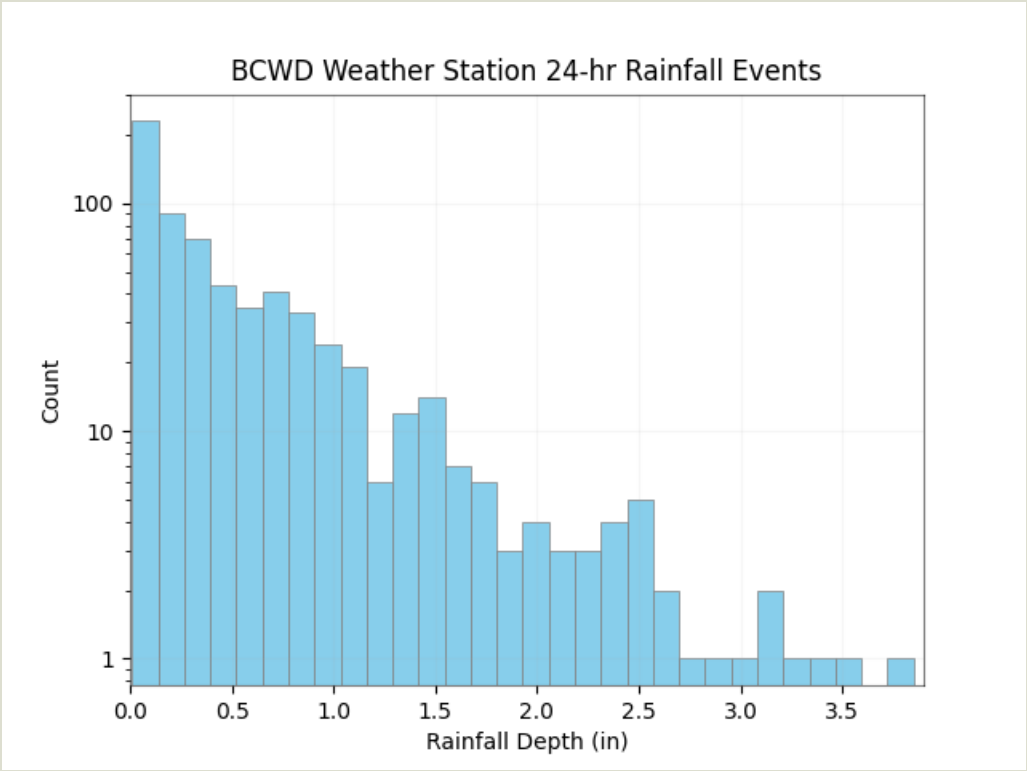






BCWD Weather Station (Record starting 07-2011)

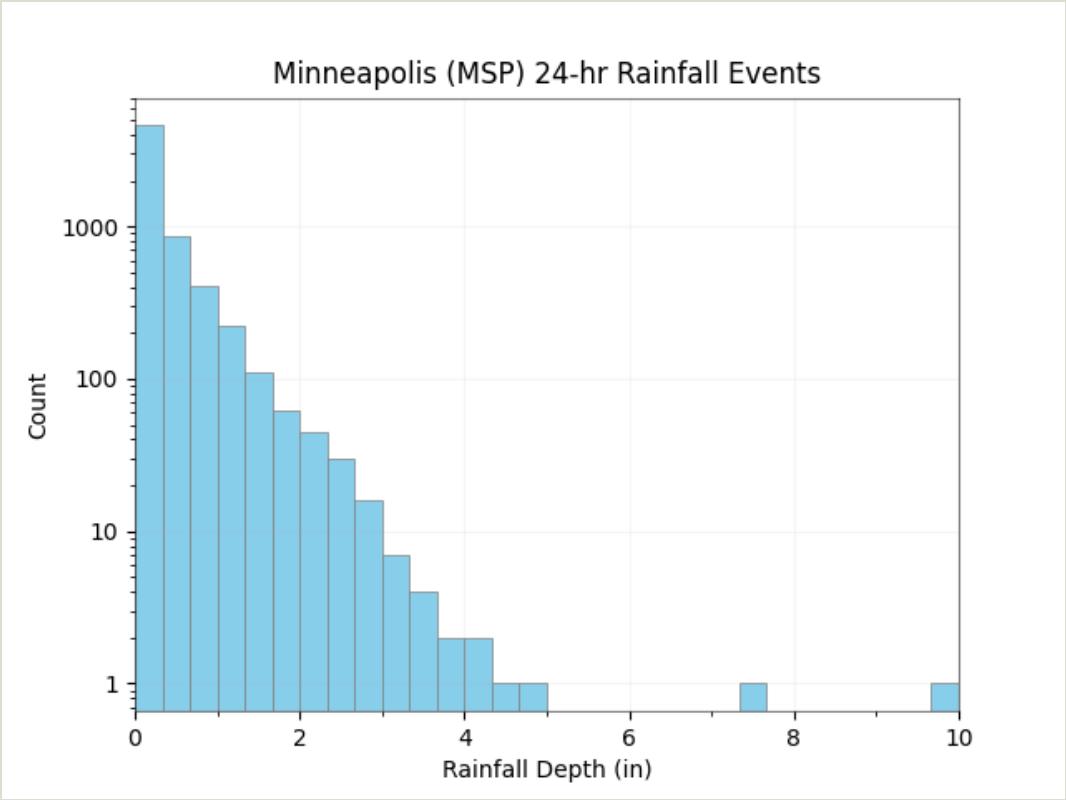
Rainfall Event	Event Depth (in.)	Event Count
24-hr, 1-yr	2.44	12
24-hr, 2-yr	2.81	4
24-hr, 5-yr	3.49	3
24-hr, 10-yr	4.17	0
24-hr, 25-yr	5.23	0
24-hr, 50-yr	6.16	0
24-hr, 100-yr	7.23	0



Two largest 24-hr storm events:
**3.85-inch event occurred on 7/5/2015*
**3.49-inch event occurred on 6/28/2020*

Minneapolis Station (Record starting 01-1947)

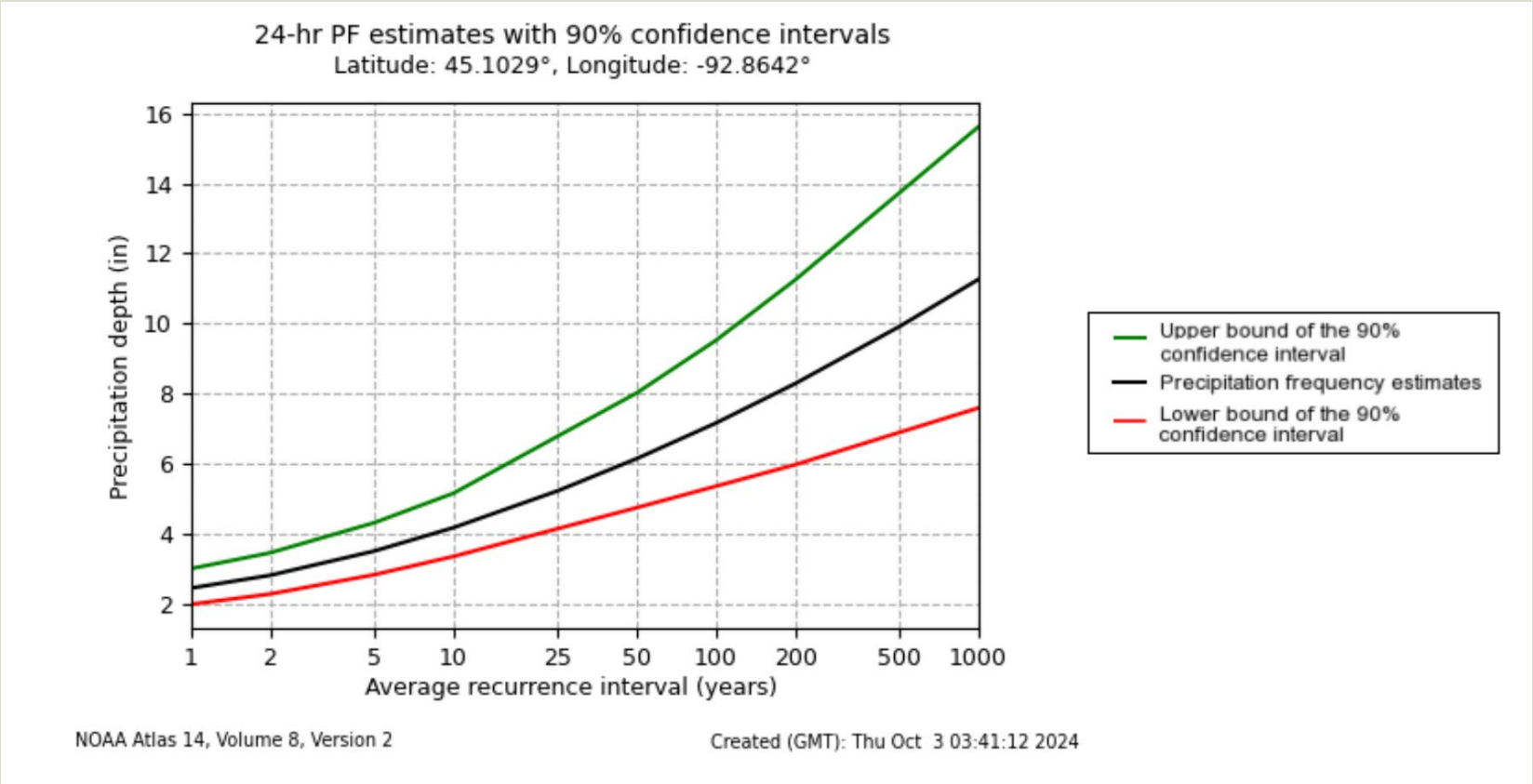
Rainfall Event	Event Depth (in.)	Event Count
24-hr, 1-yr	2.44	39
24-hr, 2-yr	2.81	24
24-hr, 5-yr	3.49	6
24-hr, 10-yr	4.17	2
24-hr, 25-yr	5.23	0
24-hr, 50-yr	6.16	0
24-hr, 100-yr	7.23	1
24-hr, 200-yr	8.32	0
24-hr, 500-yr	9.98	1



Two largest 24-hr storm events:
**10.0-inch event occurred on 7/23/1987*
**7.36-inch event occurred on 8/30/1977*

FUTURE CONDITIONS SCENARIO

- NOAA Atlas 14 upper bound of 90th percentile for the 100-year event (9.5” rainfall)
- Resulted in an average of + 0.5’ water level increase over current conditions (MAX of 1.4’ on Long Lake)



Methodology:

1. Exported 100-year water level results from model storage nodes into GIS
2. Integrated LiDAR data (topography) to generate floodplain maps

Limitations:

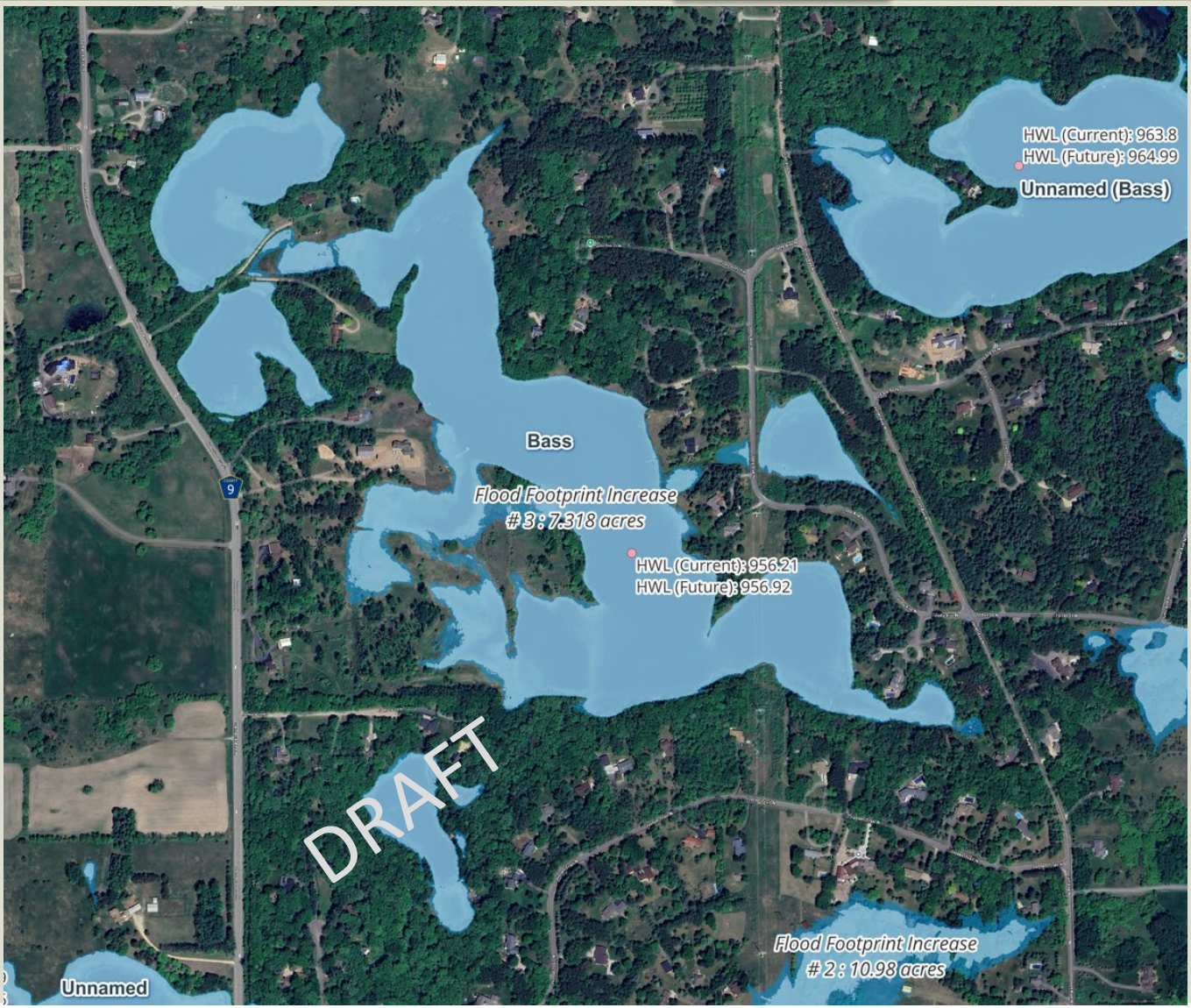
1. In urban areas, the entire storm sewer system is not modeled, only pond outlet pipes
2. Floodplain footprints are generated from the high water level of one pond in a subcatchment area, but not necessarily every depression in an urban area.
    - Therefore, depression areas surrounding the modeled ponds are assumed to be connected and reach the same water elevation - Example is backyard swales connecting to downstream ponds.
3. Pipes, inlets, and outlet capacity limitations and clogging could worsen flood footprints

- Top 10 flood footprint increases for 9.5” Upper Bound 100-Year Event:

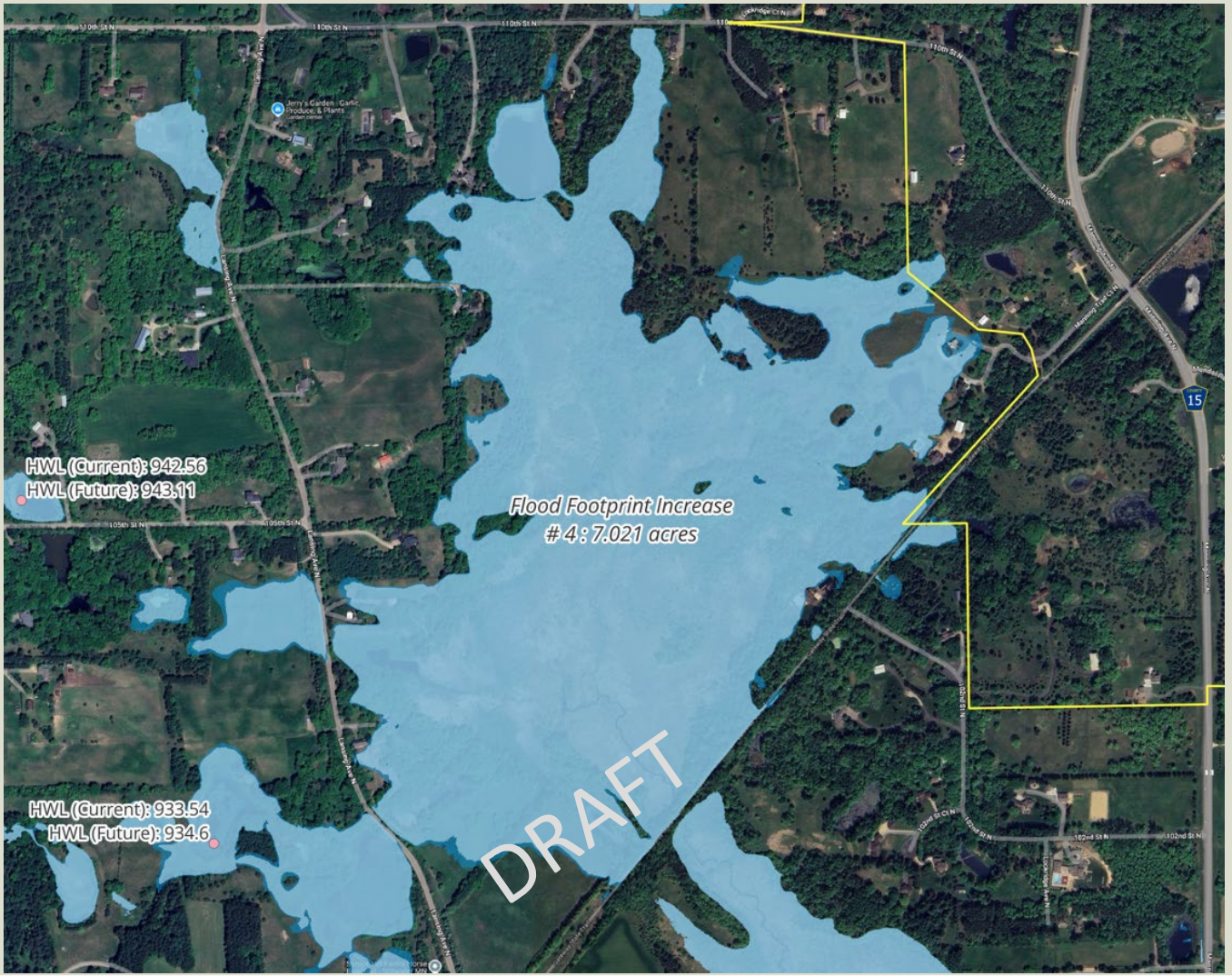
Location	Area Increase	% Increase
Dellwood Rd Wetland	+11 acres	+22%
Bass Lake West	+7 acres	+9%
BOND Conservation Area	+7 acres	+4%
Stillwater Blvd & Orleans St	+6.8 acres	+54%
Long Lake	+6.5 acres	+5%
Manning & 115th St	+5.7 acres	+18%
July Avenue Pond	+5.4 acres	+15%
Goggins Lake	+5.2 acres	+4%
Plaisted Lake	+5.0 acres	+5%
Mendel Wetland	+41 acres	+130%

- **Dellwood Road Wetland**
  - **+11 acres;**
  - **+1.4 feet**

- **Bass Lake West**
  - **+7.0 acres;**
  - **+0.7 feet**

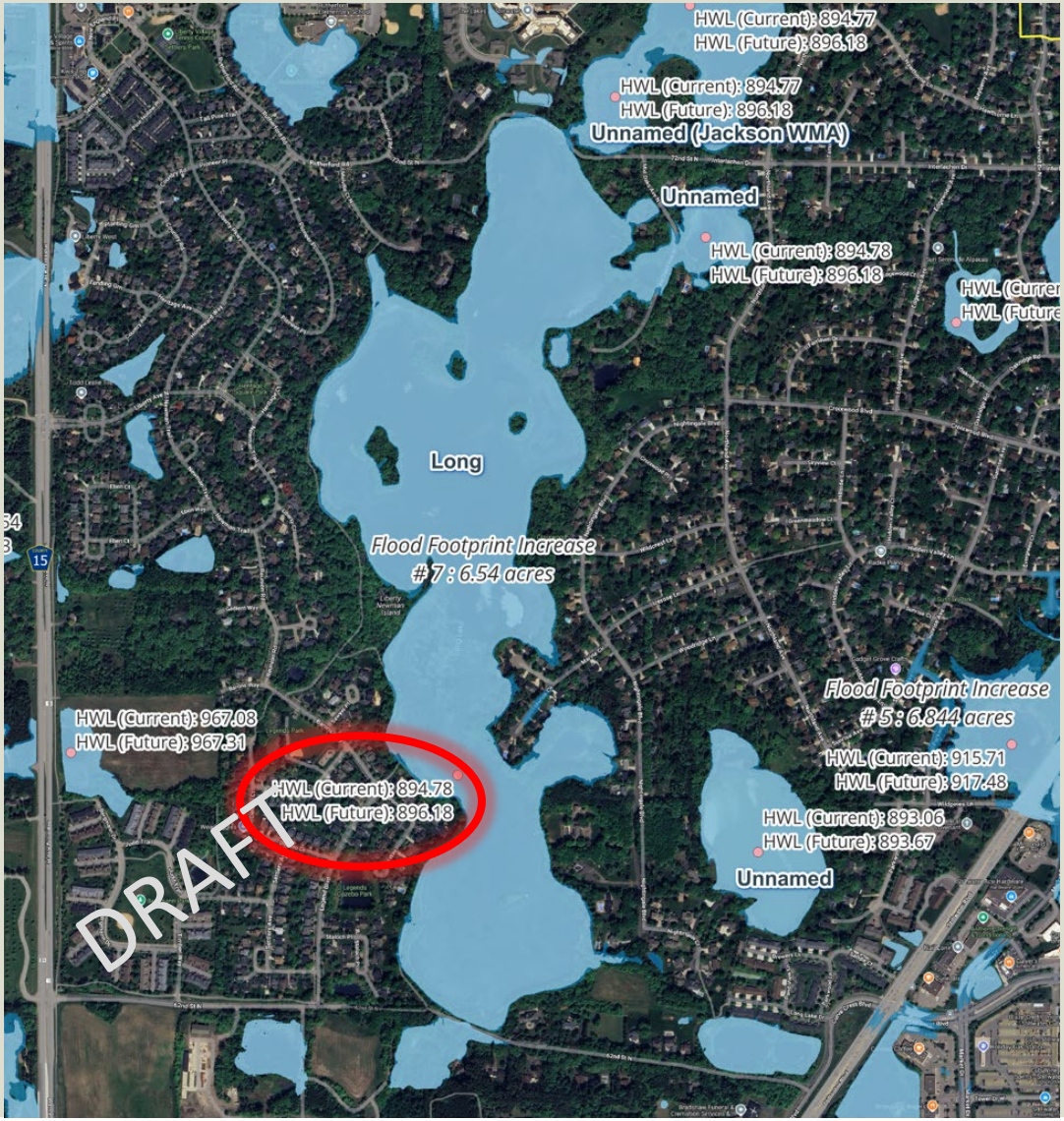


- **BCWD Conservation Area**
  - **+7.0 acres;**
  - **+0.9 feet**



- **Stillwater Blvd & Orleans Street**
  - **+6.8 acres;**
  - **+1.8 feet**

- **Long Lake**
  - **+6.5 acres;**
  - **+1.4 feet**



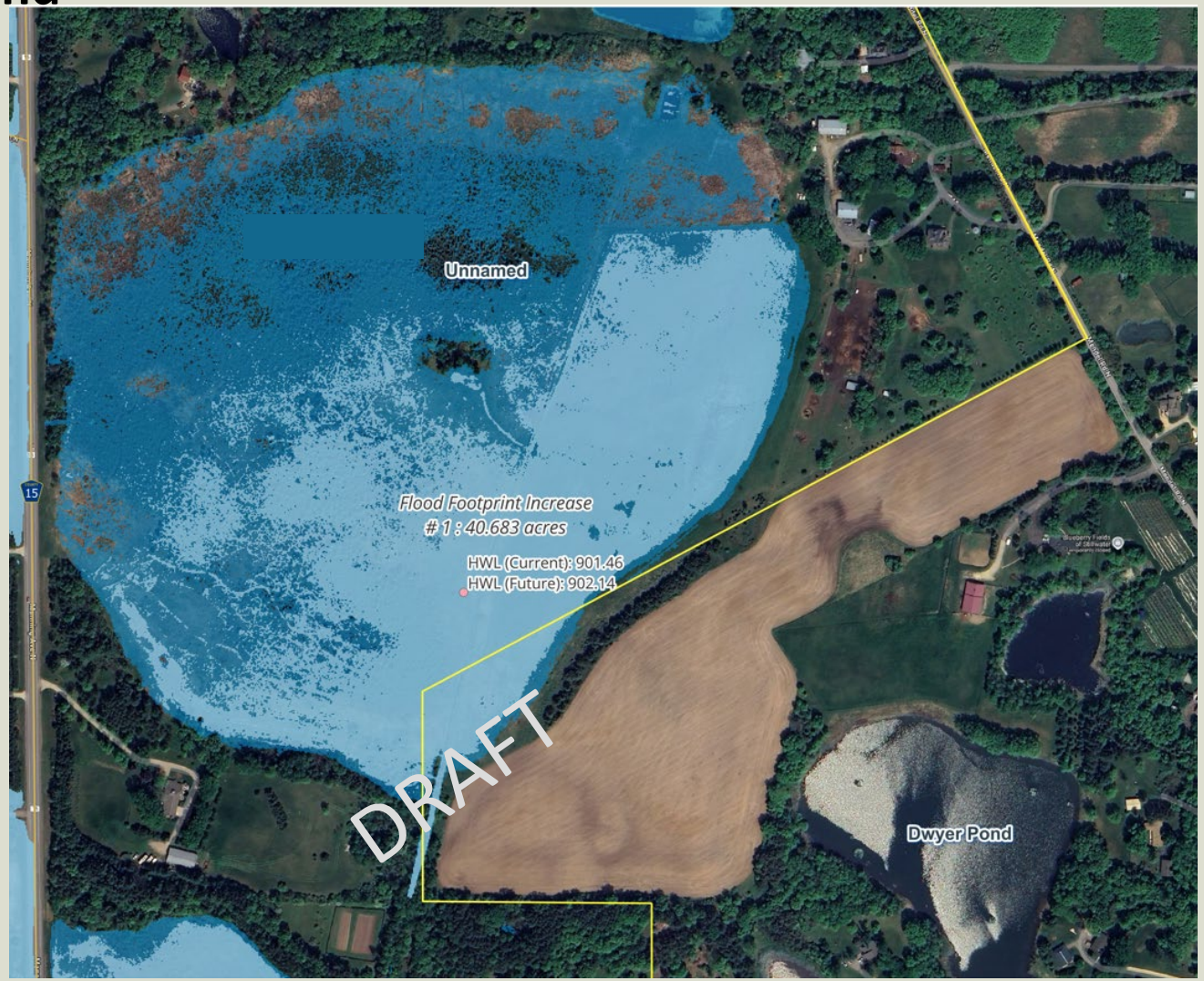
- **Manning & 115th**
  - **+5.7 acres;**
  - **+1.2 feet**

- **July Avenue Pond = +5.4 acres; +0.9 feet**

- **Goggins Lake**
  - **+5.2 acres;**
  - **+0.7 feet**

- **Plaisted Lake = +5.0 acres; +0.6 feet**

- **Mendel Wetland**
  - **+41 acres;**
  - **+0.7 feet**

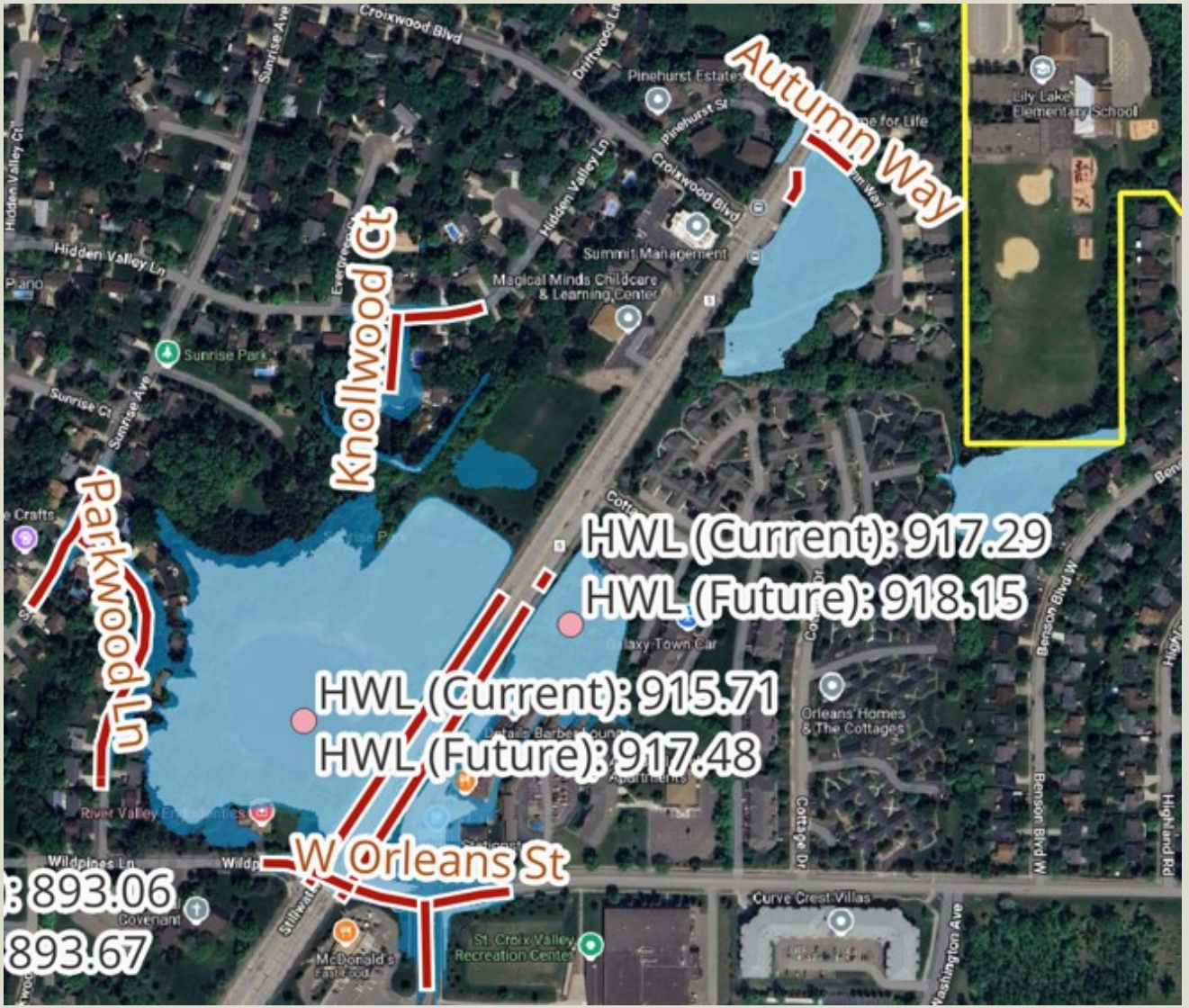


- Urban Flooded Areas:
  1. 62nd Street (x2)
  2. Curve Crest Blvd
  3. MN TH 36

- Urban Flooded Areas:
  1. W. Orleans
  2. Curve Crest Blvd
  3. Stillwater Blvd
  4. Washington Ave
  5. 60th Street
  6. MN TH 36

Urban Flooded Areas:

1. Parkwood Ln
2. W Orleans St
3. Stillwater Blvd
4. Knollwood Ct
5. Autumn Way



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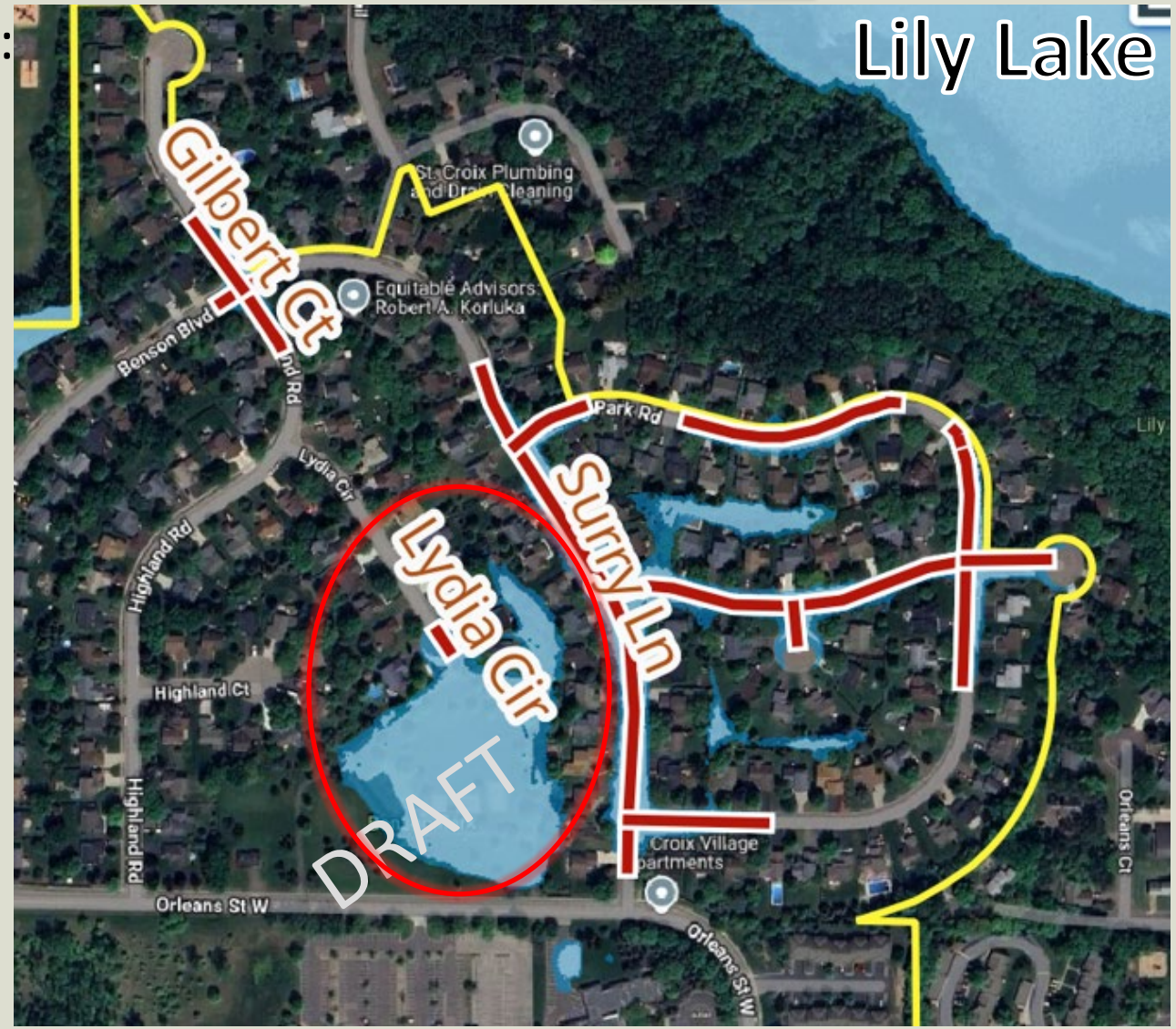
- Urban Flooded Areas:
  1. Gilbert Ct
  2. Lydia Cir
  3. Benson Blvd
  4. Surry Ln
  5. Park Rd



Urban Flooded Areas:

1. 58th St N
2. 60th St N
3. Krueger Ln
4. Norell Ave N

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Urban Flooded Areas:

1. 56th Street N
2. Memorial Ave
3. Stillwater Blvd

- **Further GIS Analysis:**
  1. Incorporate all storm sewer information to better define flooding footprints in key urban locations

- **Consider 2D modeling for urban areas (e.g., Marketplace) to:**
  1. Better understand flood dynamics
  2. Assess sewer system performance and pipe capacity limitations
  3. Demonstrate overland flow patterns, flooding duration, and roadway overtopping depths

Flood Vulnerability Assessment – ***use the updated model to:***

- Critical Event Analysis
- Evaluate Social, Environmental, and Infrastructural impacts
- Share results with member communities
- Flood Reduction Evaluation
- Review opportunities with member communities and local partners

Thank You