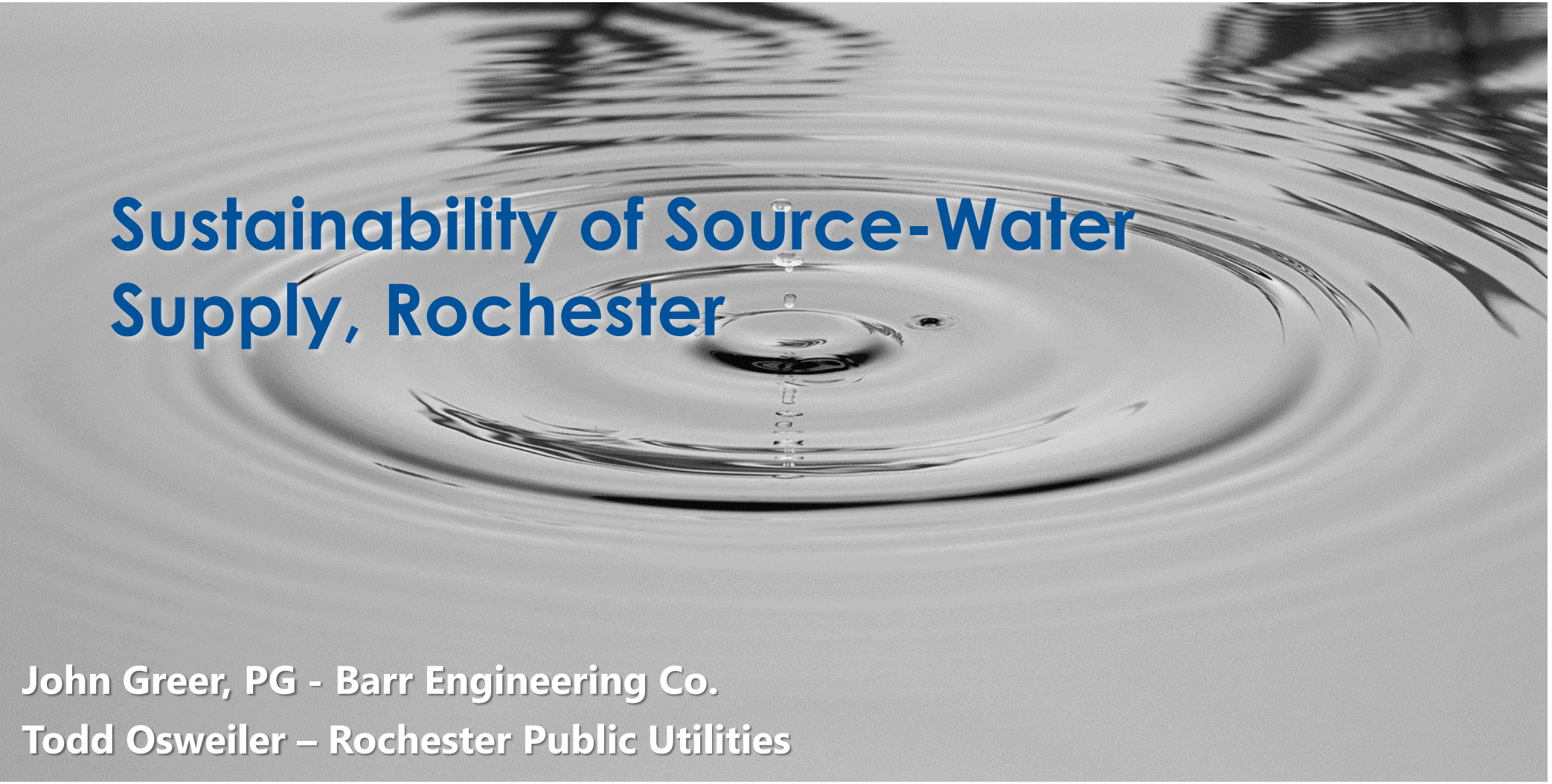

Sustainability of Source-Water Supply, Rochester

John Greer, PG - Barr Engineering Co.
Todd Osweiler – Rochester Public Utilities

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Overview

- RPU's Water System
- Future Water Demands
- Water Source Sustainability
- Groundwater Modeling
- Potential Alternative Water Sources
- Stakeholder Communication

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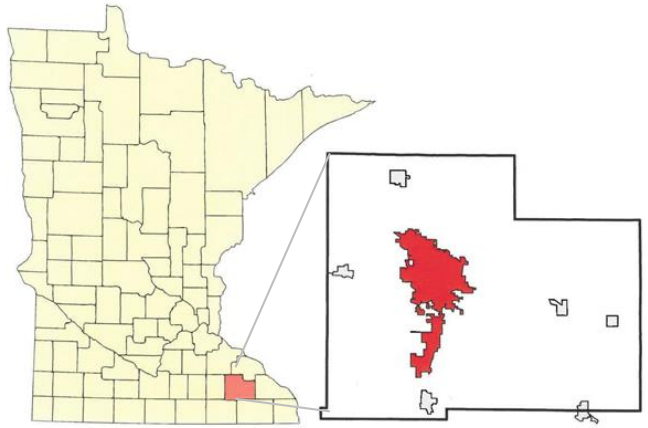
Rochester's Water System

- Rochester population~115,000
- Approximately 40,400 water customers
- Appropriation limit 5.7 billion gallons/year
- 10 pressure zones
- 20 water storage facilities
  - Storage capacity = 16.95 million gallons



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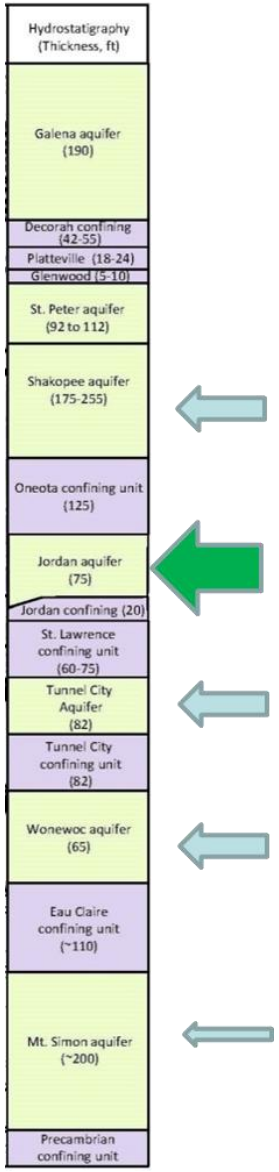
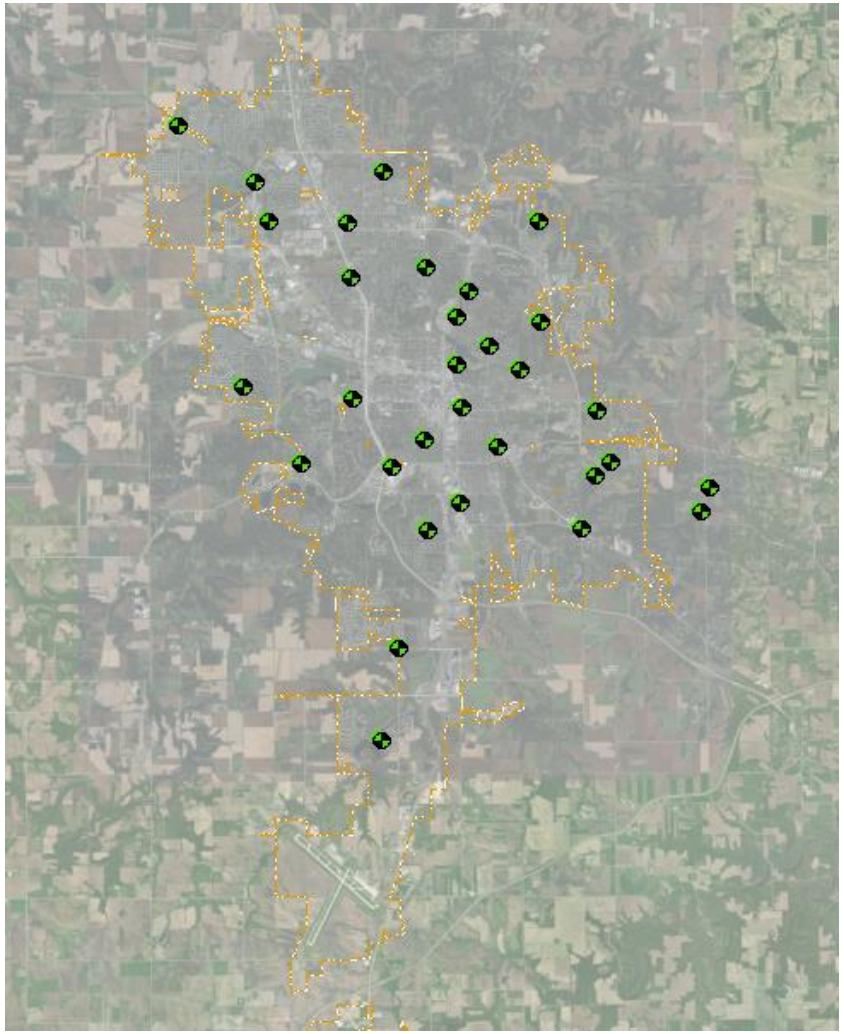
Rochester's Water System

- 31 active water supply wells
- Pumping from 5 aquifers:
  - Shakopee (6)
  - Jordan (31)
  - Tunnel City (9)
  - Wonewoc (9)
  - Mt. Simon (1)





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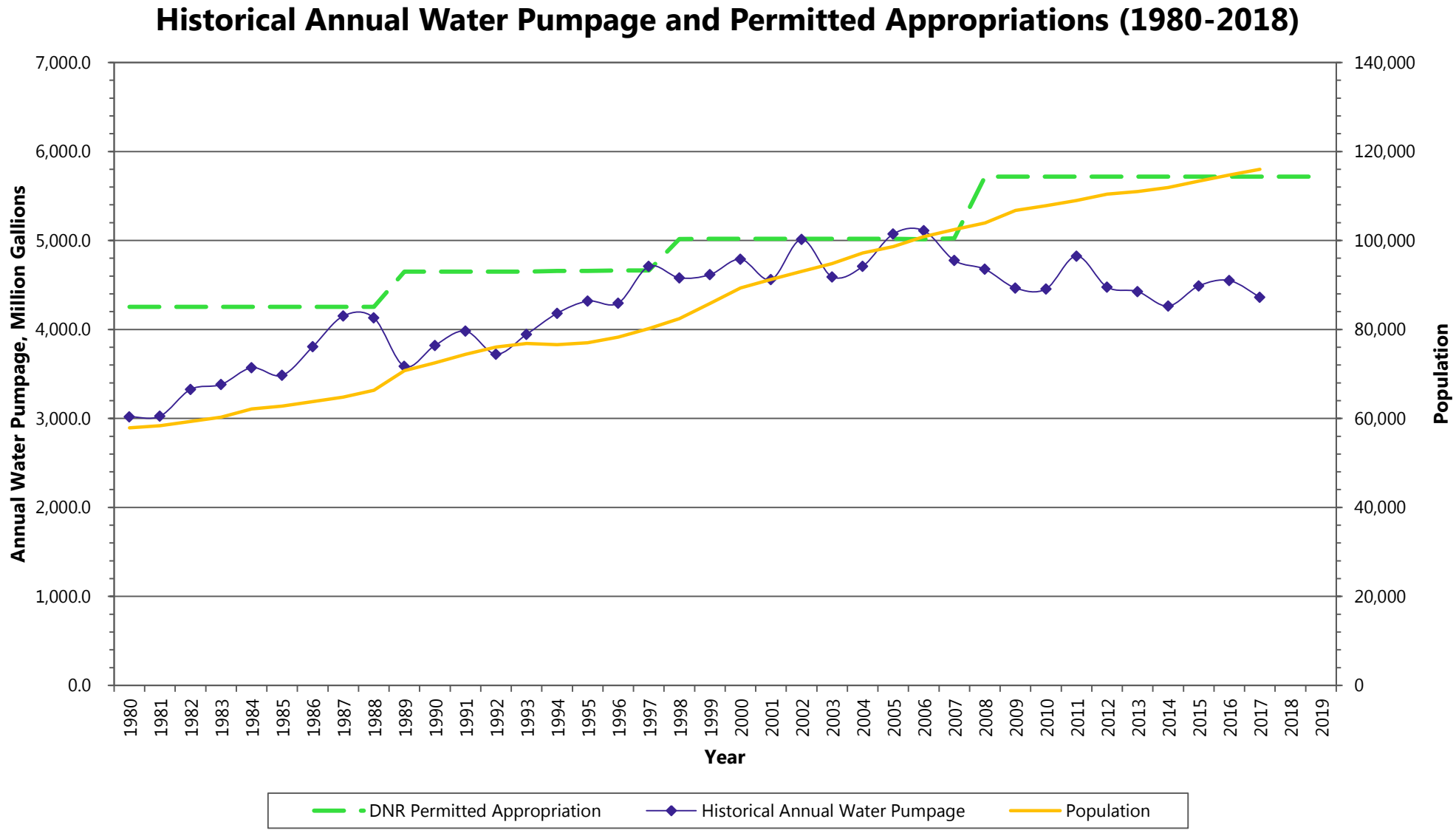
Rochester's Water System



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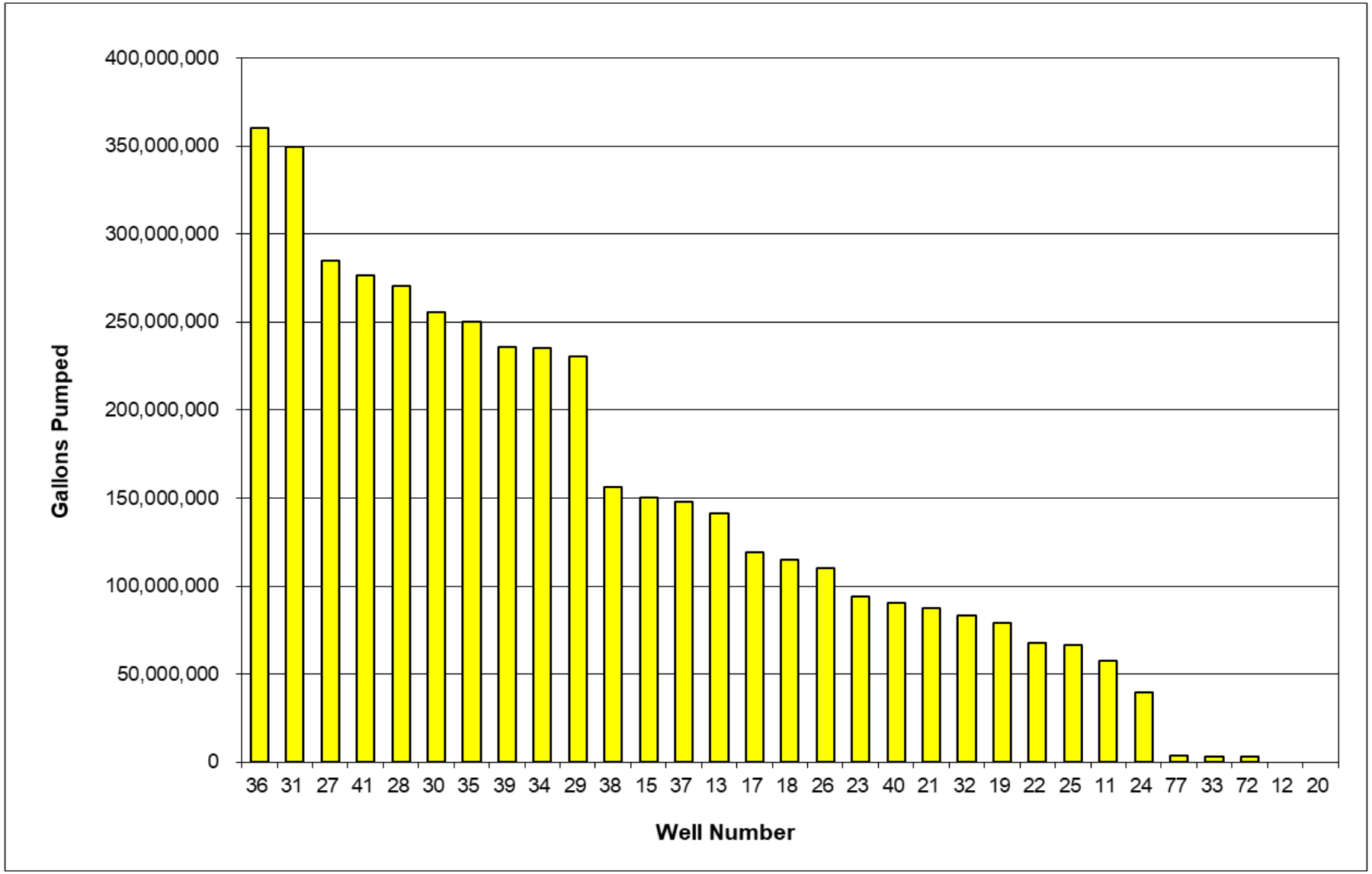
Rochester's Water System



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Mayo Destination Medical Center (DMC)

- Largest economic development initiative in Minnesota's history
- $5 billion in private development
- $585 million in public infrastructure (State, County, City)
- Projected growth by 2040 as a result of DMC
  - Population increase ~40% (115,000 to 165,000)
  - 50,000 new jobs
- Larger population = greater water demand

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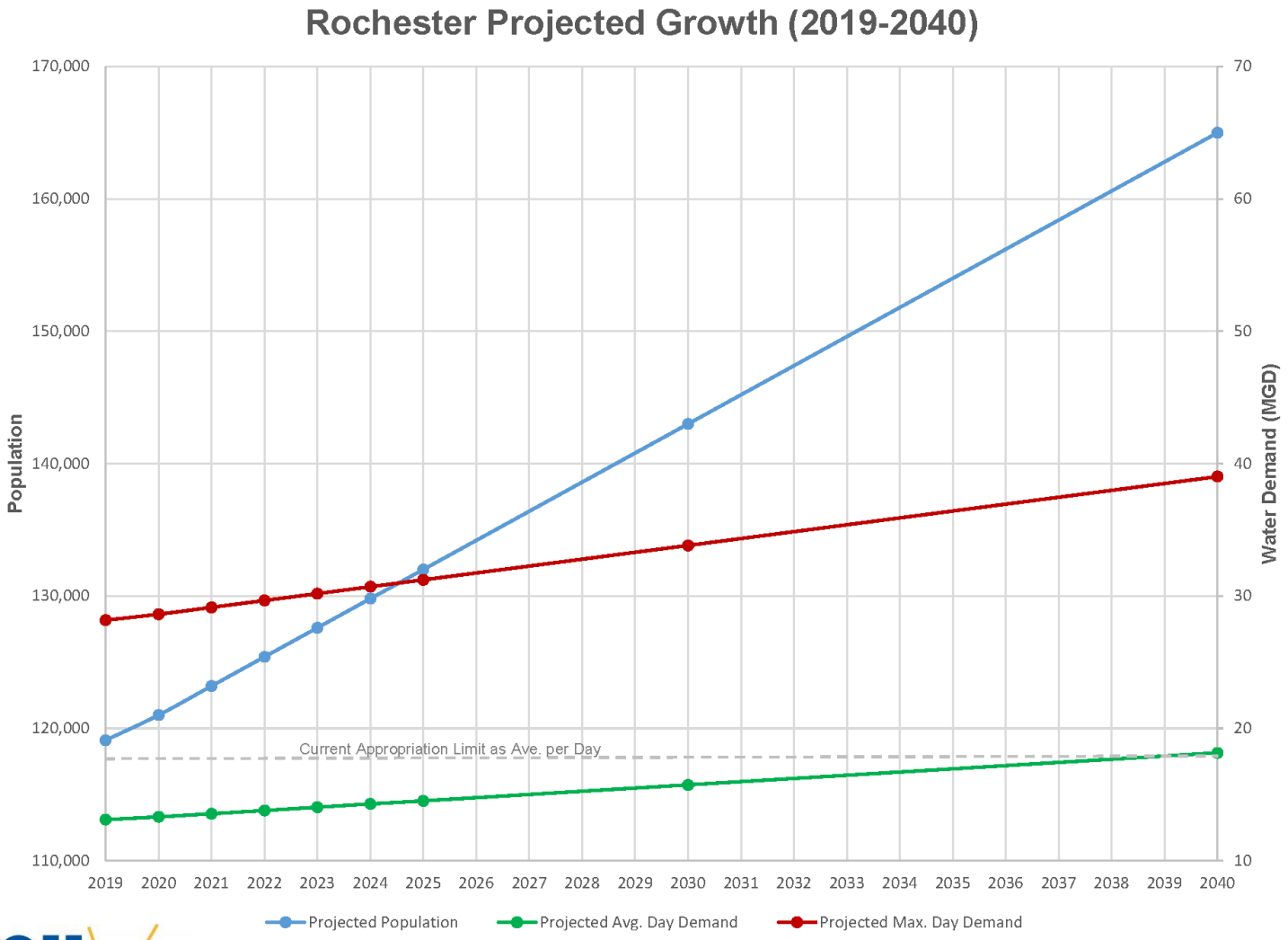
Water Demand Projections



Year	Population	Average Daily Demand (MGD)	Maximum Daily Demand (MGD)
2019	119,100	13.1	28.17
2020	121,000	13.31	28.62
2021	123,200	13.55	29.14
2022	125,400	13.79	29.66
2023	127,600	14.04	30.18
2024	129,800	14.29	30.7
2025	132,000	14.52	31.22
2030	143,000	15.73	33.82
2040	165,000	18.15	39.02

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Water Source Sustainability

- RPU has a robust water conservation program
- RPU has been investigating their groundwater source for 30 years
  - Partnering with MGS/USGS/DNR/MDH
  - Total expenditures to day >$1.5 million
- Still, the question remains:

Can the aquifers sustainably meet future water demand?

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Water Source Sustainability

- Water source sustainability study started in late 2013 and is ongoing
  - Groundwater modeling
  - Identification and closing of data gaps
  - Calcareous fen evaluations
  - Preliminary evaluation of alternative sources
  - Periodic coordination meetings with DNR staff
- Future work
  - Assessment of deeper aquifers
  - Evaluation of potential water re-use options
  - Optimization of pumping

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Water Source Sustainability: Groundwater Use

- Proposed use:
  - No adverse effect on the aquifer's ability to supply the needs of future generations
  - No harm to ecosystems
  - No degradation of water quality
  - No reduction of water levels such that existing wells can no longer access water
- Potential for ecosystem impacts

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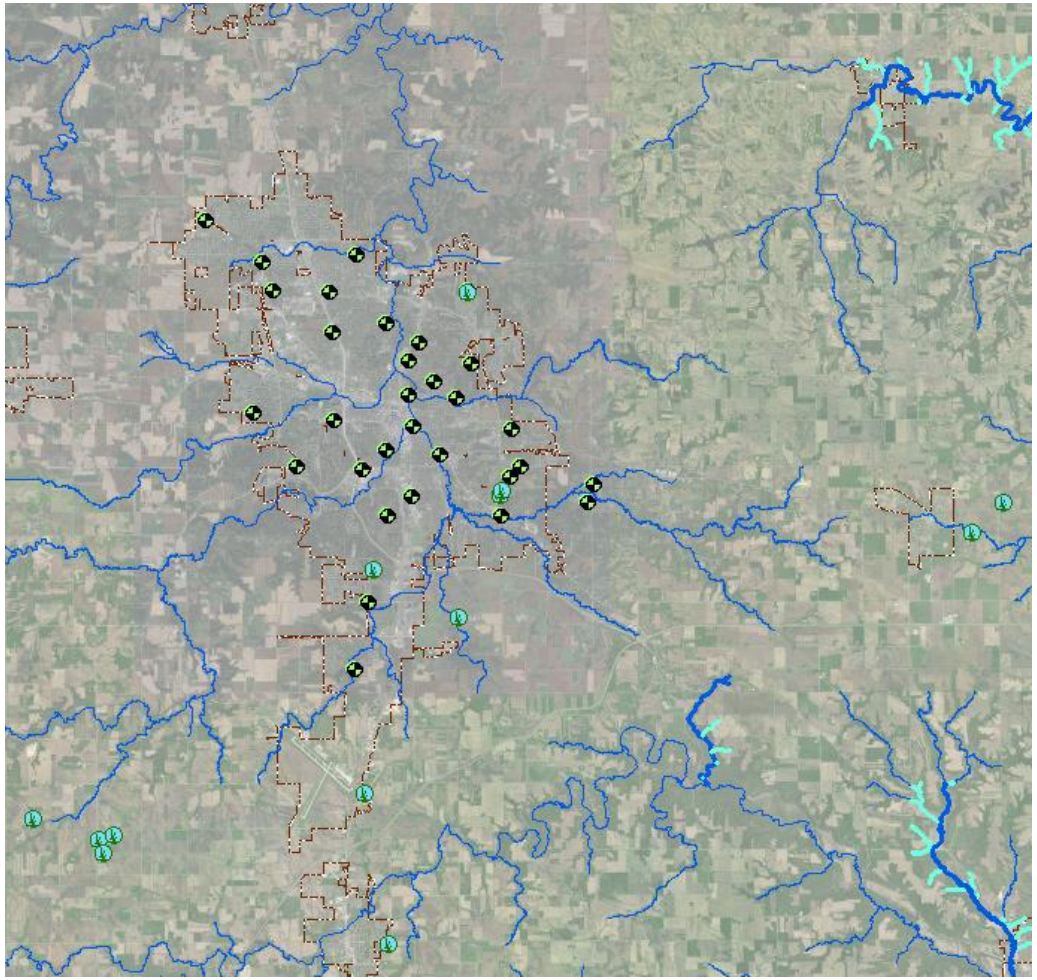
Water Source Sustainability: Groundwater Use

- Ecosystem includes:
  - Rivers and streams
  - Calcareous fens (13)
  - Trout streams
- Groundwater modeling being used to evaluate potential impacts of future pumping on the ecosystem
- RPU has regular meetings with DNR staff to discuss the evaluation



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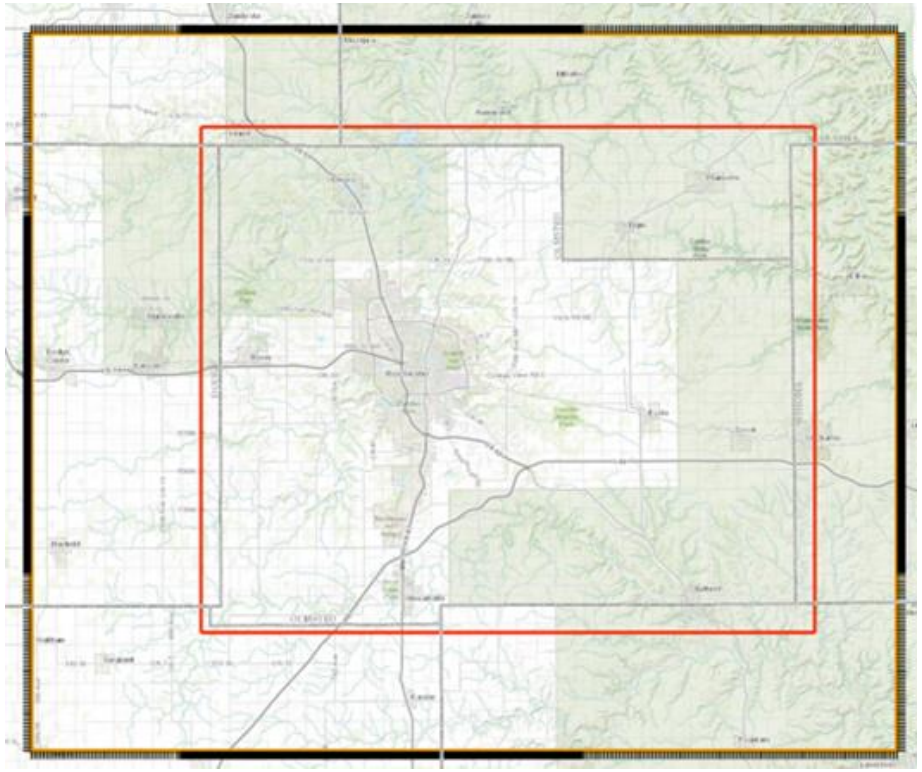
Groundwater Modeling

- Preliminary model available 2014
- Two rounds of model improvement have been completed
  - Model domain and BCs
  - Addition of model layers
  - Decorah edge enhanced recharge
  - Improved capability to evaluate land use changes
  - Steady state & transient calibration



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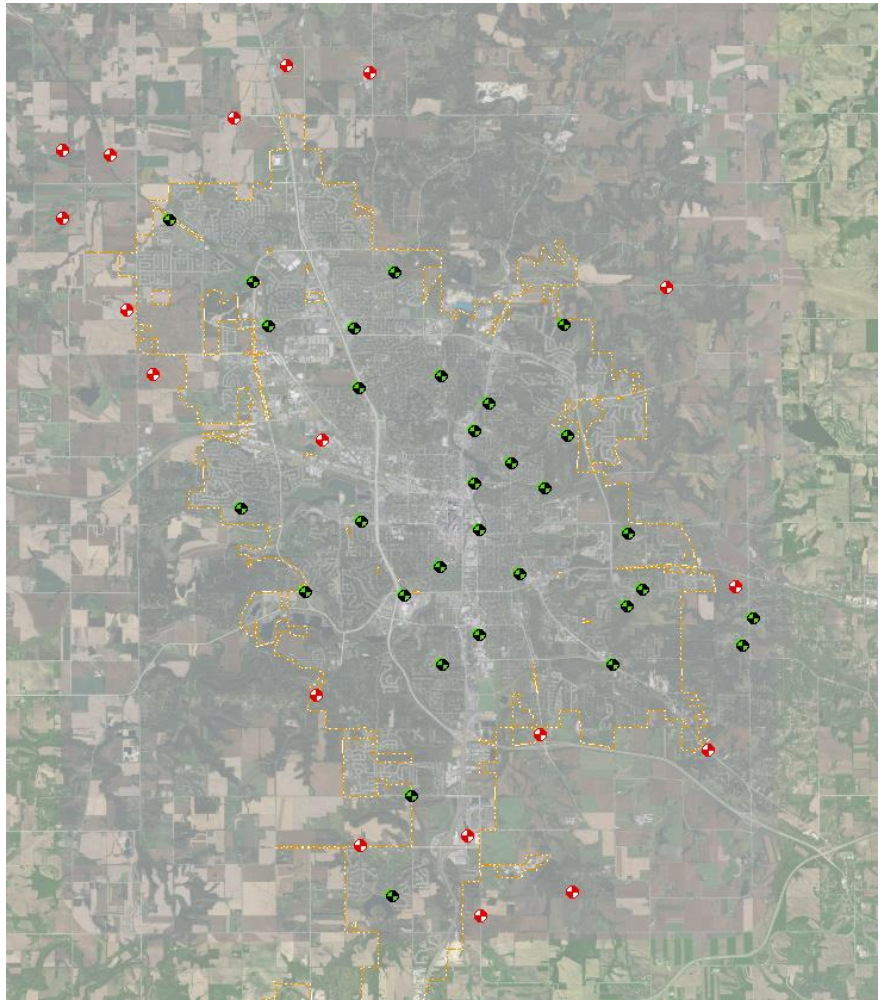
Groundwater Modeling

- Future demand modeled in steady state scenarios (w/ uncertainty analysis)
- 2007 – 2013 averages used as the baseline
- Up to 18 additional wells
  - New wells assumed to be in Jordan
  - Modeled pumping rates based on ultimate demand projection of 28.2 MGD (developed in 2010)
  - Average day demand of 12.1 MGD for 2014 – 2018



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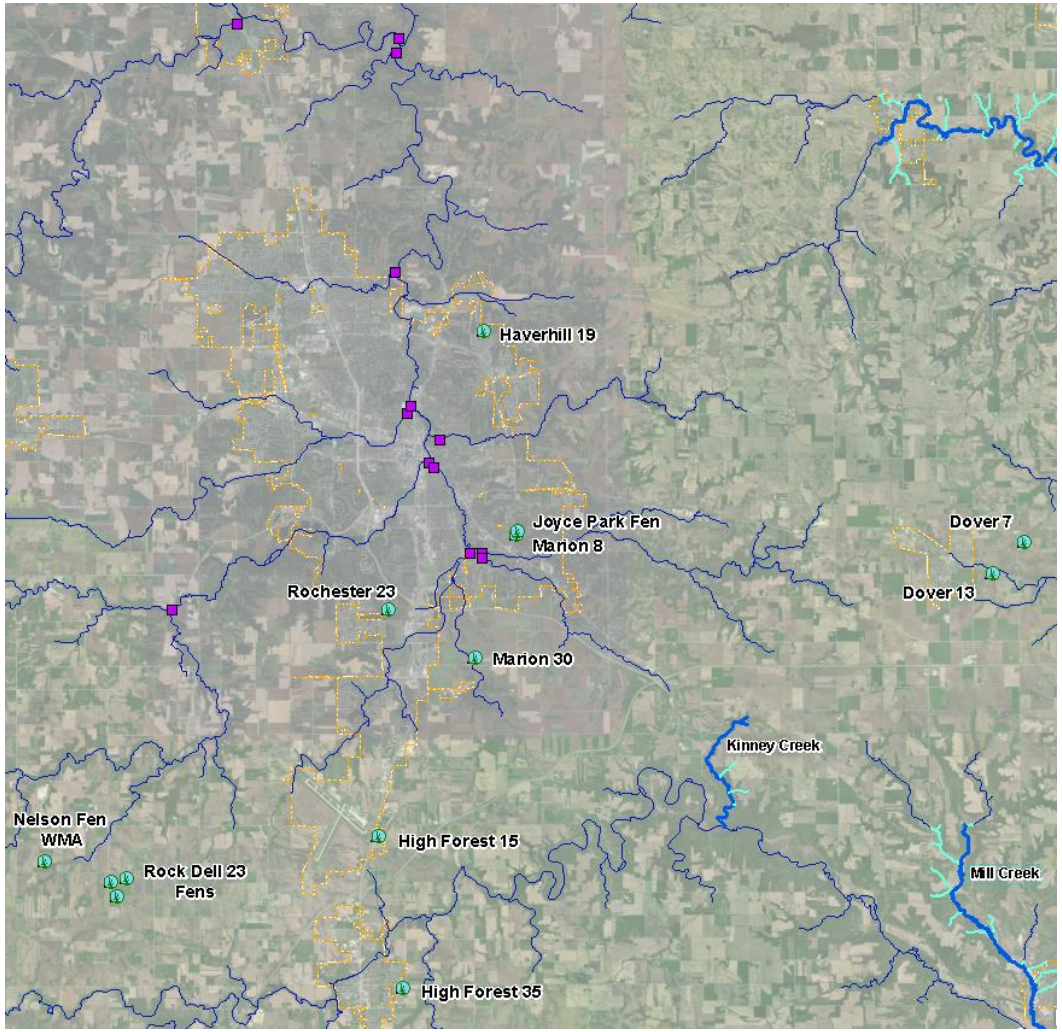
Groundwater Modeling

- Model used to evaluate potential impact of future pumping:
  - Water table drawdown at calcareous fens
  - Baseflow reduction in streams
  - Drawdown in pumped aquifers



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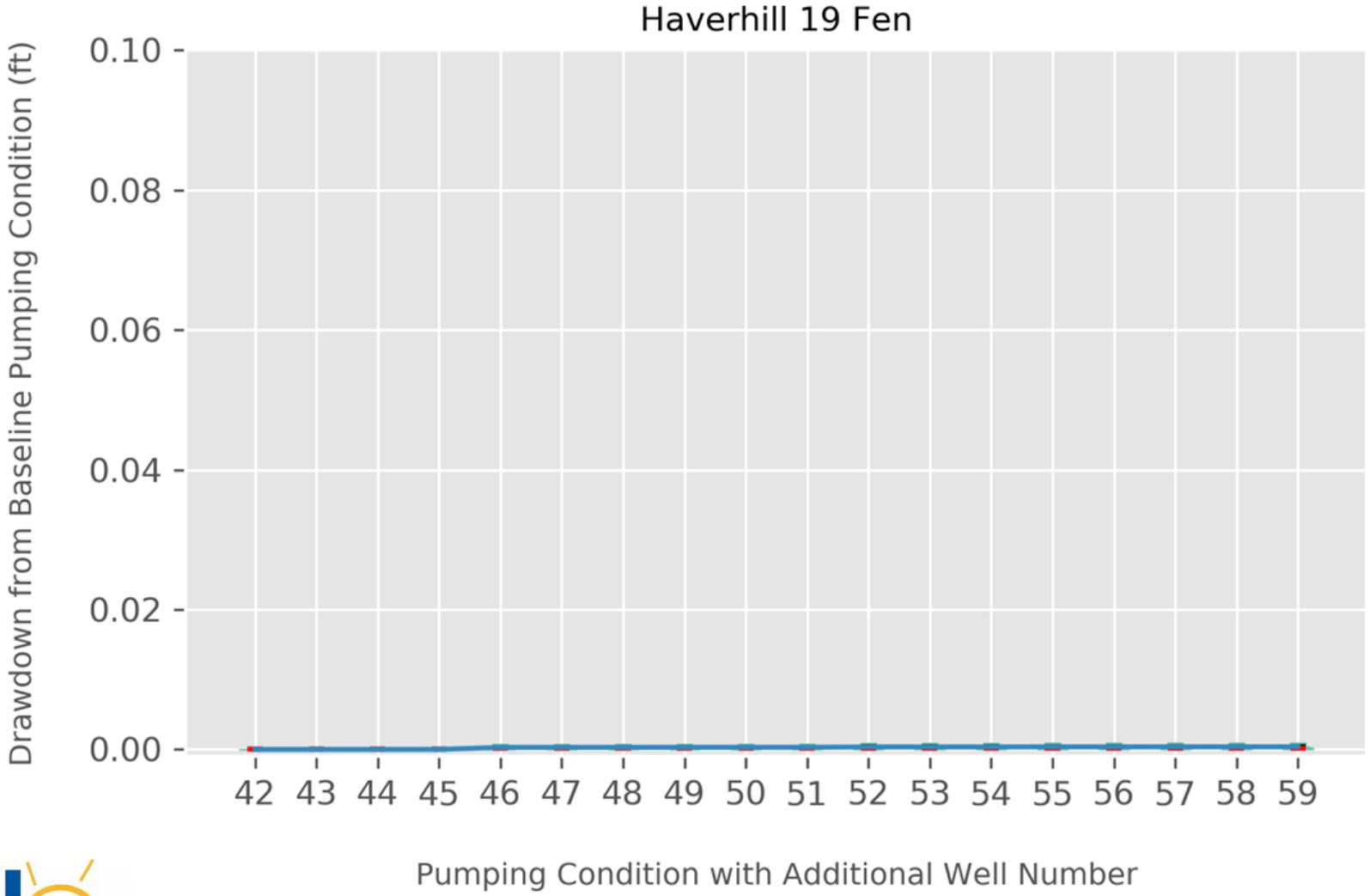
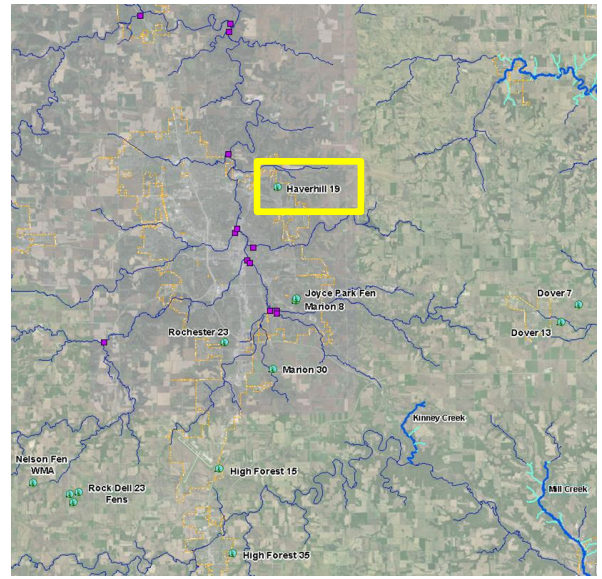
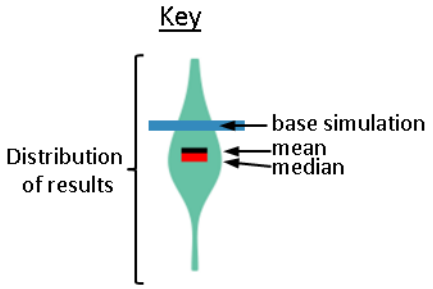
Groundwater Modeling







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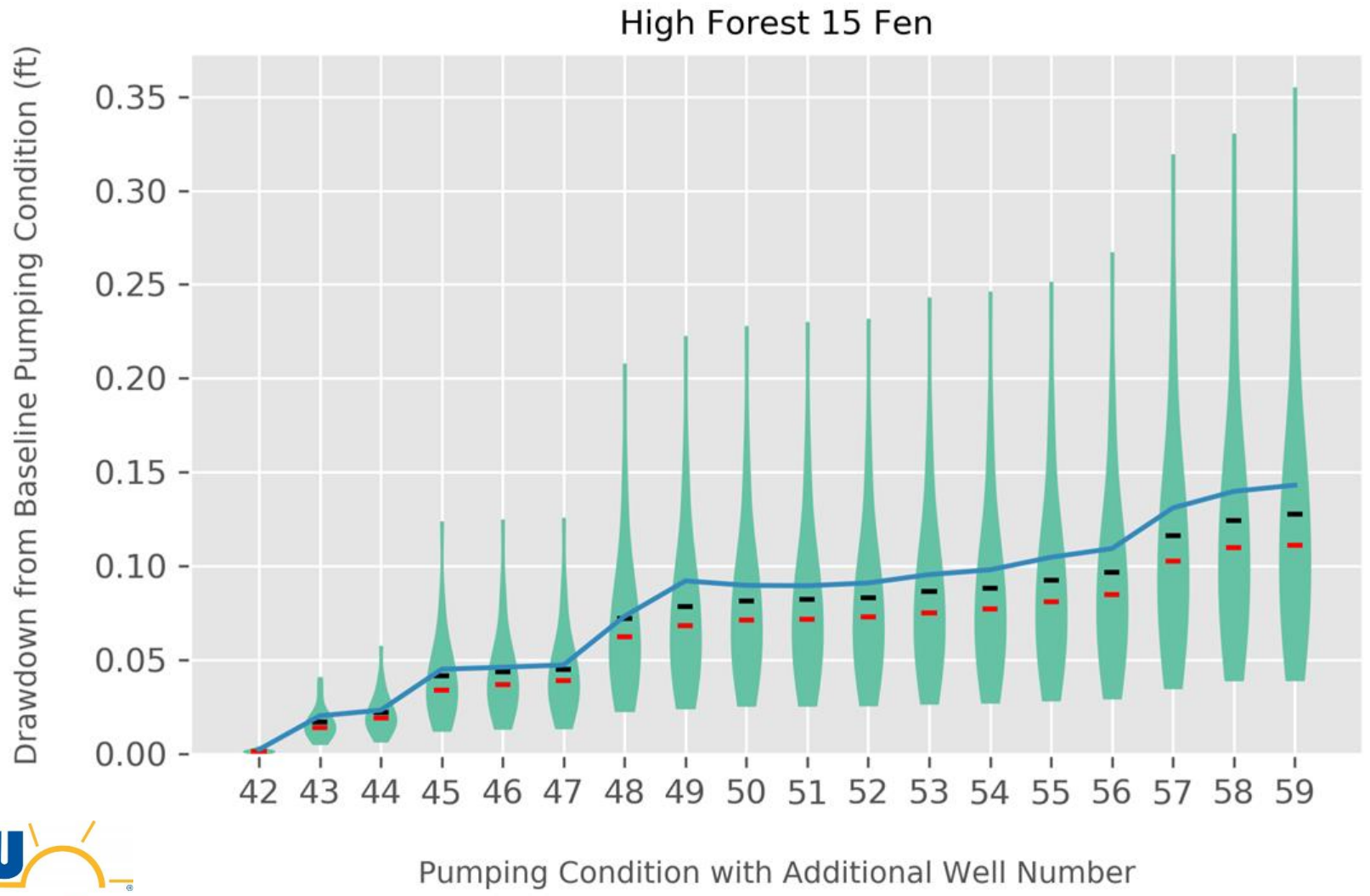
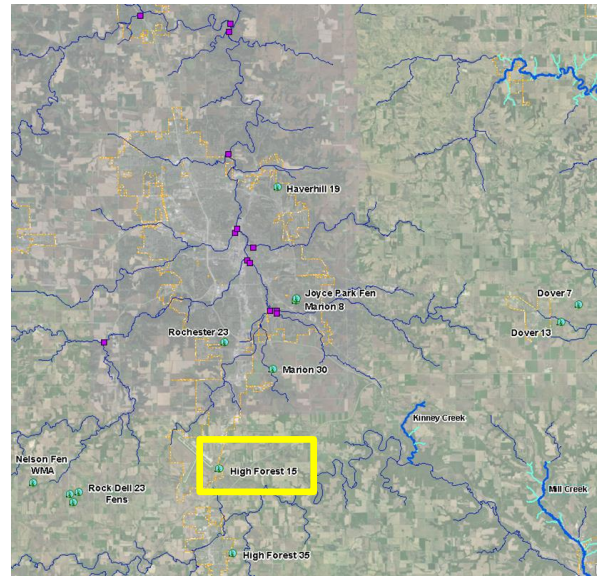
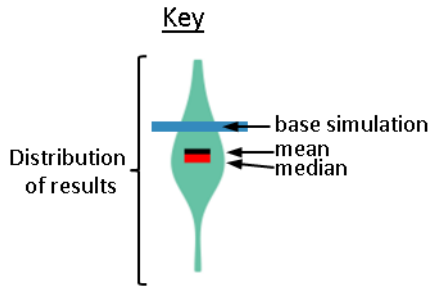
Groundwater Modeling







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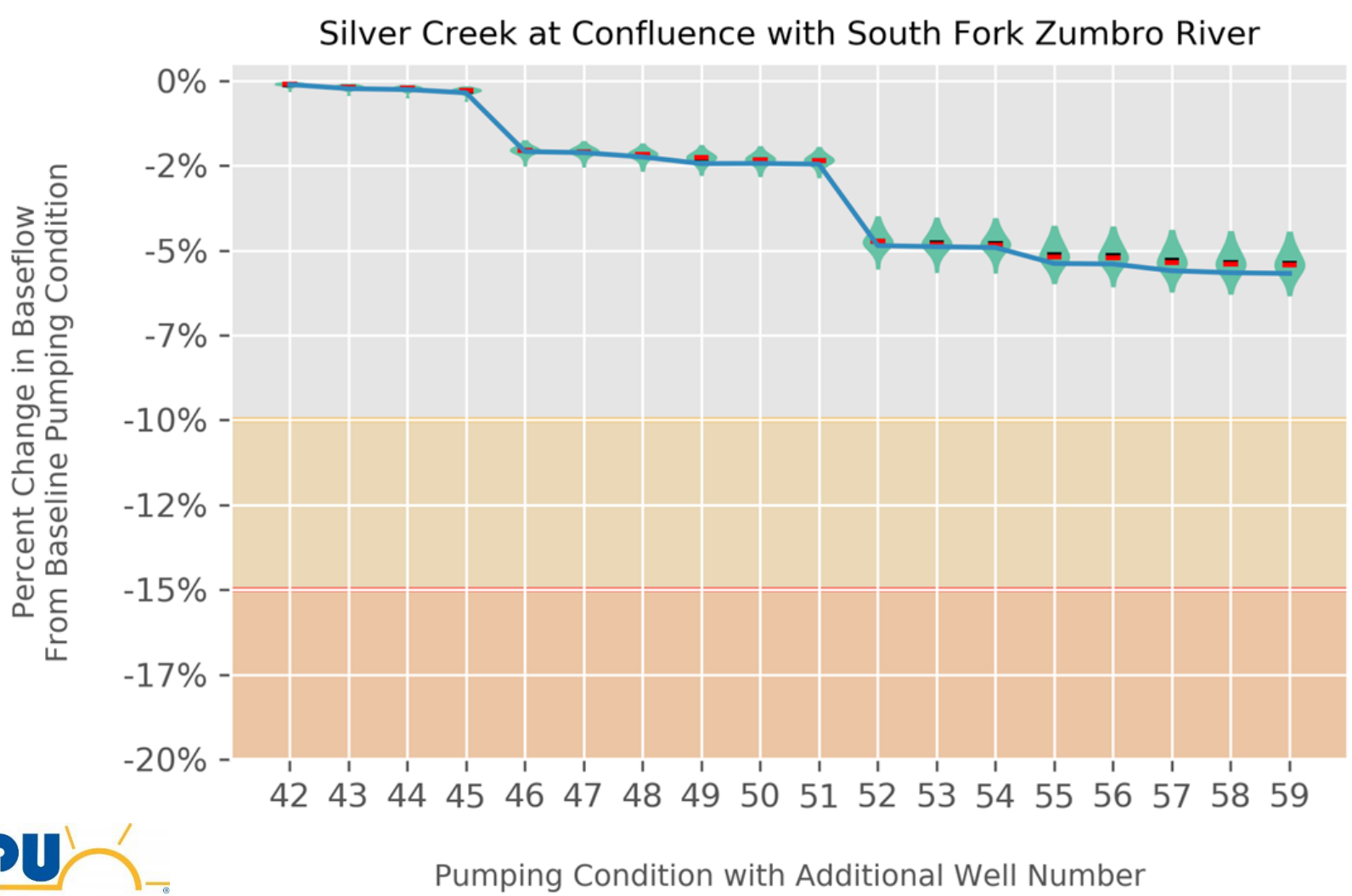
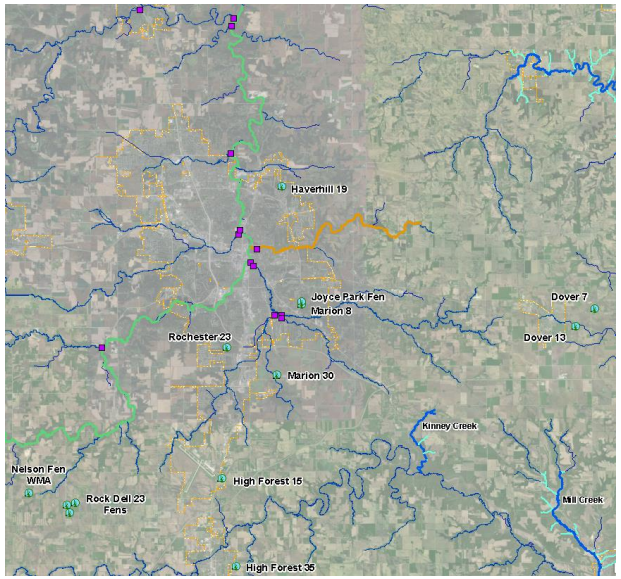
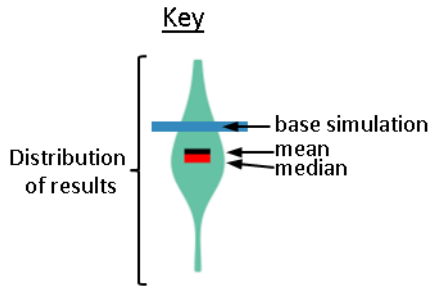
Groundwater Modeling







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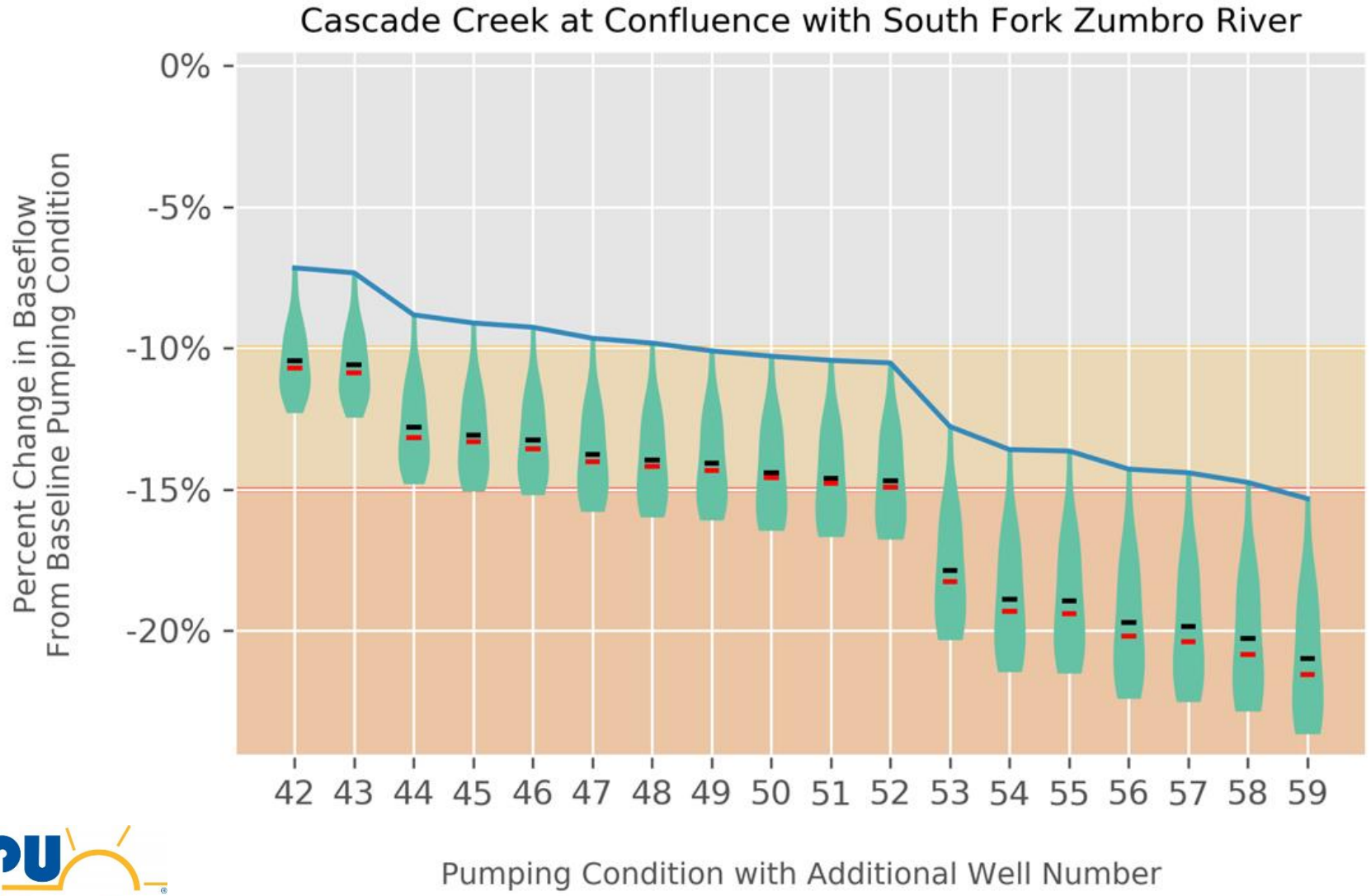
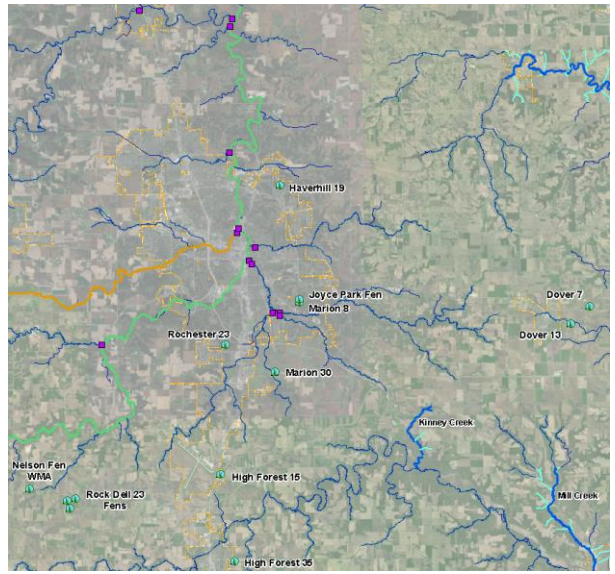
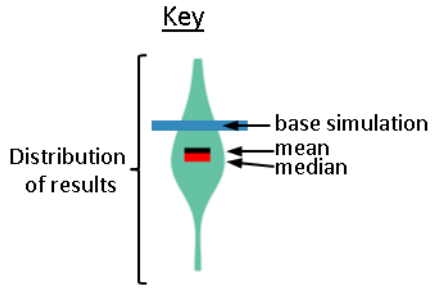
Groundwater Modeling







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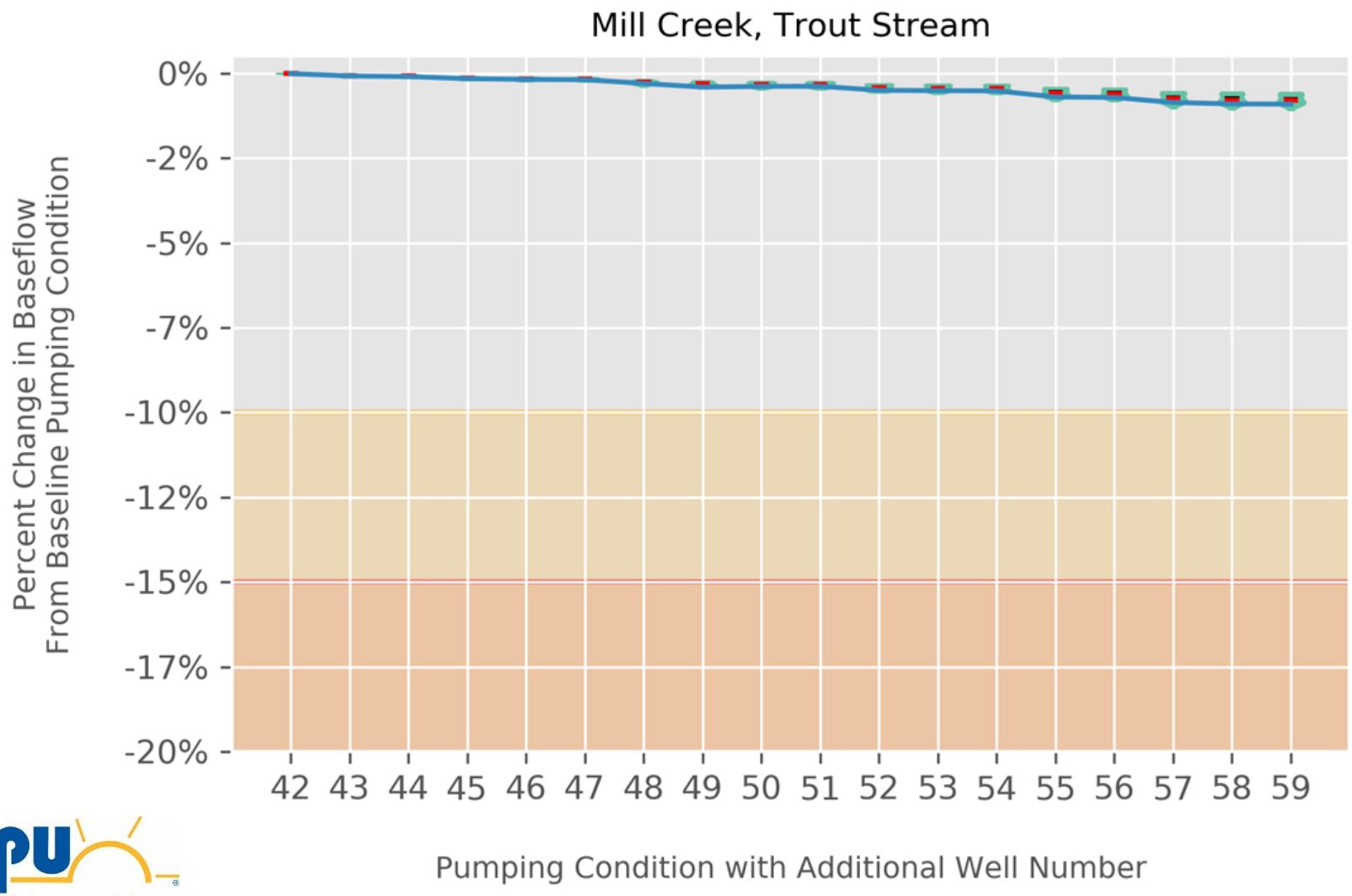
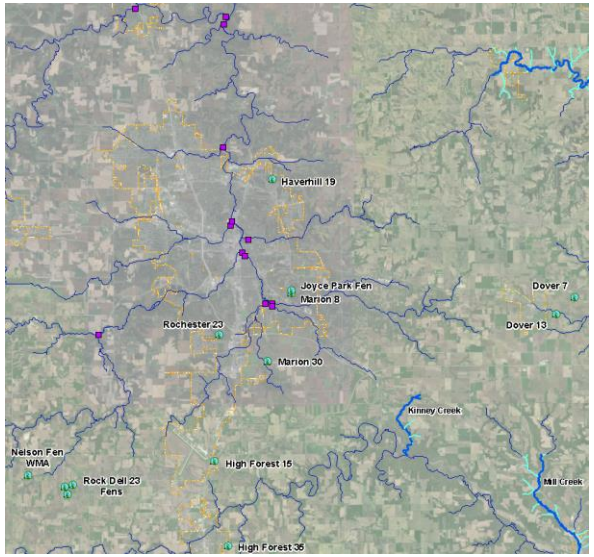
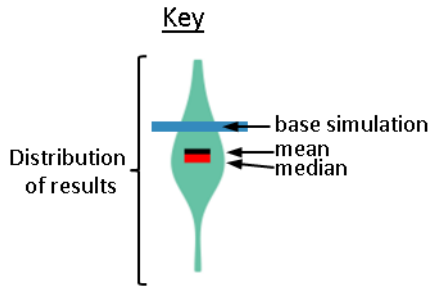
Groundwater Modeling







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Potential Alternative Water Sources

- Potential alternative sources:
  - Surface water
  - Stormwater reuse
  - Wastewater reuse
  - Aquifer storage and recovery
  - Move more pumping to deeper aquifers

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Potential Alternative Water Sources

- Preliminary evaluation criteria:
  - Water quantity
  - Drought resistance
  - Water Quality/Treatment
  - Reliability
  - Regulatory burden
  - Overall cost

- Potential uses
  - Total replacement of GW
  - Total replacement of Shakopee/Jordan
  - Partial replacement of supply from existing wells
  - Mitigation of ecosystem impacts
  - Reduction of summer irrigation peak impacts
  - ASR

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Potential Alternative Water Sources

Table 9 Total replacement of potable groundwater supply

Source	Water Quantity	Drought Resistance	Water Quality/Treatment	Reliability	Regulatory Burden	Overall Cost	Total Score
TCW aquifer	Not applicable						
Mt Simon Aquifer	Not applicable						
Wastewater Reuse	1	1	3	3	3	3	14
Surface Water	2	2	2	2	1	2-3	11-12
Stormwater Reuse	1-3	3	2	3	2	2	13-15

Table 10 Total replacement of potable Shakopee/Jordan supply

Source	Water Quantity	Drought Resistance	Water Quality/Treatment	Reliability	Regulatory Burden	Overall Cost	Total Score
TCW aquifer	2	1	1-2	1	1	1-2	7-9
Mt Simon Aquifer	2	1	1-2	1	1	2	8-9
Wastewater Reuse	1	1	3	3	3	3	14
Surface Water	3	3	2	2	2	3	15
Stormwater Reuse	1-3	3	2	3	2	3	14-16

Potential Alternative Water Sources

Table 11 Partial replacement of potable supply

Source	Water Quantity	Drought Resistance	Water Quality/Treatment	Reliability	Regulatory Burden	Overall Cost	Total Score
TCW aquifer	1-2	1	1-2	1	1	1-2	6-9
Mt Simon Aquifer	1-2	1	1-2	1	1	2	7-9
Wastewater Reuse	1	1	3	3	3	3	14
Surface Water	1	2	2	2	1	3	11
Stormwater Reuse	1-3	3	3	3	1	3	14-16

Table 12 Mitigation of impacts to natural resources

Source	Water Quantity	Drought Resistance	Water Quality/Treatment	Reliability	Regulatory Burden	Overall Cost	Total Score
TCW aquifer	1	1	1	1	3	1	8
Mt Simon Aquifer	1	1	1	1	3	2	9
Wastewater Reuse	1	1	1-3	1	1	2-3	7-10
Surface Water	1	2	2	2	1	2	10
Stormwater Reuse	2	3	2-3	3	1	1	11-12

Potential Alternative Water Sources

Table 13 Reduction of the impact of summer irrigation peak

Source	Water Quantity	Drought Resistance	Water Quality/Treatment	Reliability	Regulatory Burden	Overall Cost	Total Score
TCW aquifer	1	1	1	1	1-2	2	7-8
Mt Simon Aquifer	1	1	2	1	1-2	3	9-10
Wastewater Reuse	1	1	2-3	1	3	2	10-11
Surface Water	2	2	1	2	1	1	9
Stormwater Reuse	1-2	2-3	1	2	1	1	8-10

Table 14 Aquifer storage and recovery

Source	Water Quantity	Drought Resistance	Water Quality/Treatment	Reliability	Regulatory Burden	Overall Cost	Total Score
TCW aquifer	1	1	1-2	1	2	1	7-8
Mt Simon Aquifer	1	1	1-2	1	2	2	8-9
Wastewater Reuse	1	1	3	2	3	3	13
Surface Water	1-2	2	3	2	2	2	12-13
Stormwater Reuse	1-3	3	3	3	2	2	14-16

Upcoming Work

- 2019 – Applying for a LCCMR grant to expand MW network
  - Currently 10 MW's (DNR Contract) expanding to 17 MW's
- 2019 – Completing RPU's wellhead protection plan amendment
- 2019 – Continuing Evaluation of Alternative Sources
  - Water re-use options w/water reclamation plant
  - Assessment of deeper aquifers
- 2019 – Continue Coordination w/DNR Staff
- 2020 – Update water master plan
  - Future wells needed to meet demands
  - Optimization of pumping

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Community Outreach and Stakeholder Engagement

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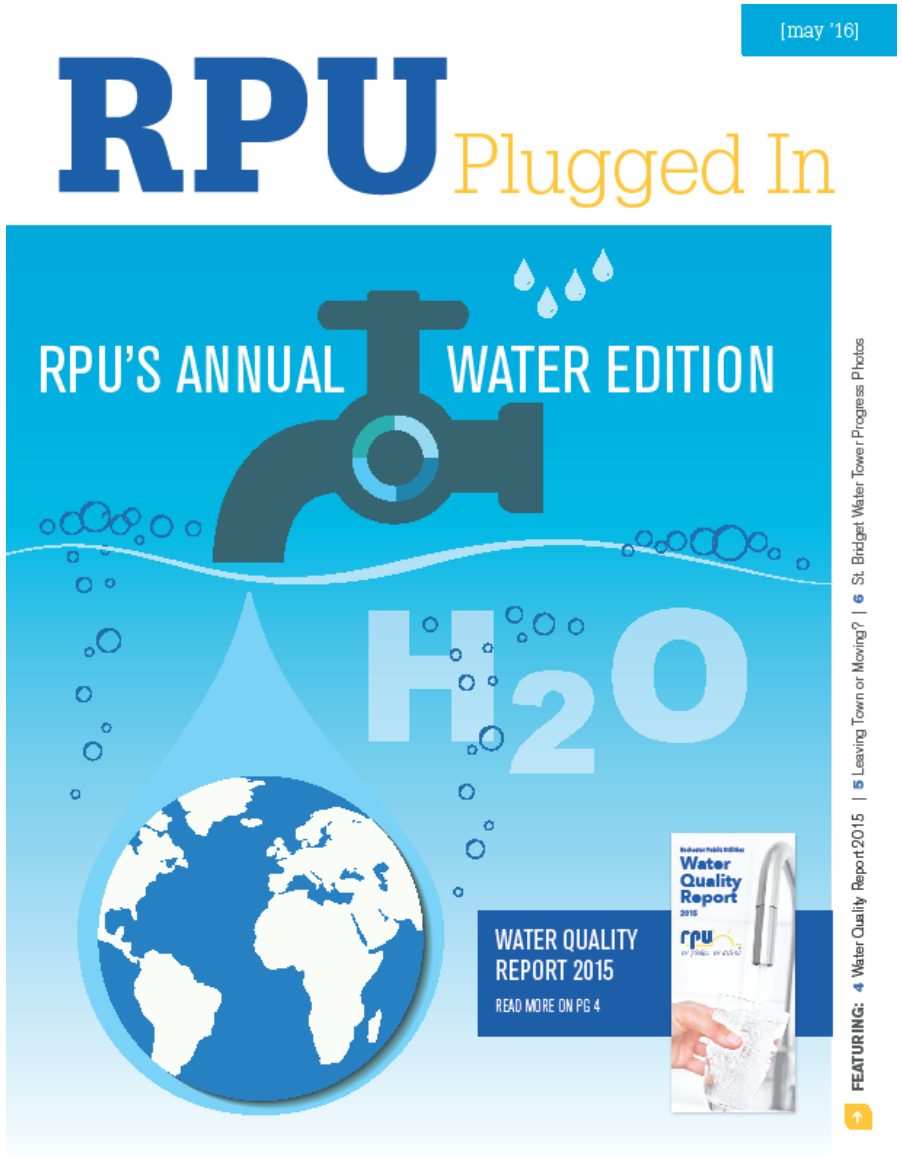
RPU Plugged In – Monthly Newsletter



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School Tours

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Drinking Water Week

- Public Tours of Water Tower & Well
- Promotional Giveaways
  - Rain Barrels & Water Bottles
- Water Bottle Display in Lobby

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RPU Partnering with local businesses

RPU Partnered with Graham Arena & Children's Museum

- Installed Bottle Filler Drinking Fountains
- Reduced Waste, Save Money & Conserve Water

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TV Commercials – "Tips from Tony"

Tips from Tony - Water Bottles

Tips from Tony - Water Conservation & Backflow Testing

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Summary

- Communication with Stakeholders:
  - Customer Communication
    - Presentations, social media, website, brochures
  - DNR Meetings
    - GW model, water sustainability activities, field monitoring
  - State & Local Agencies
    - MDH, MPCA, DNR, Olmsted County, SWCD

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Questions

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