

McKinleyville Community Services District

Water Distribution System Model Results



P.O. Box 2247
McKinleyville CA 95519

Prepared and Presented by:
Brian Anspach
North Coast Mapping Solutions
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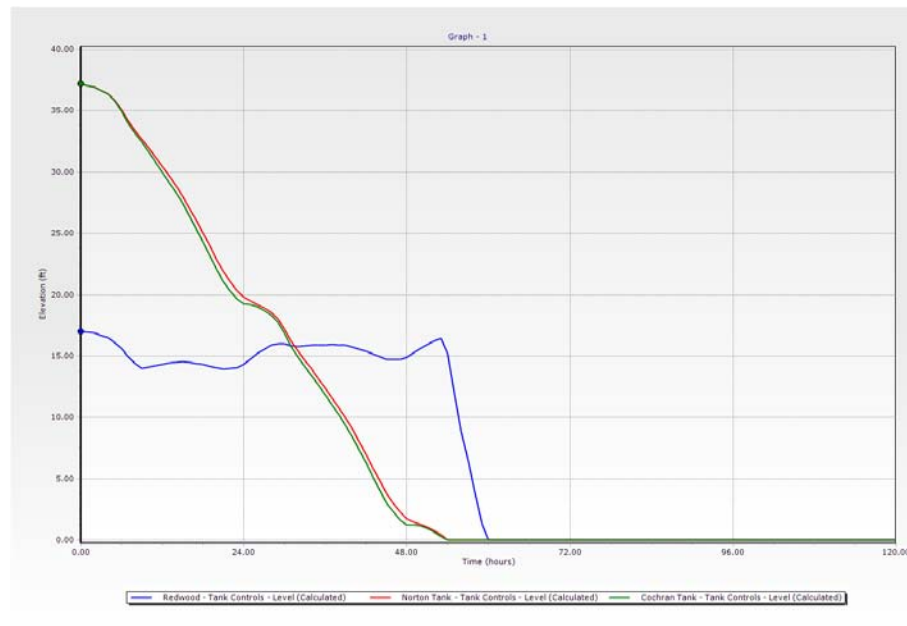
Background

- **Graduated From Humboldt State University Dec. 2010**
 - B.S. in Natural Resource Planning: GIS and Remote Sensing, minor in Computer Science
- **Humboldt State Institute for Spatial Analysis**
- **Worked with CCRP (California Center for Rural Policy)**
- **Started North Coast Mapping Solutions**
- **Worked With MCSD since January 2011**

Introduction

The vulnerability of the MCSD's sole source of water from storage only there is approximately 2 days of water available for the entire distribution system.

Tank Levels
In Feet



Hours

Introduction

Brian Anspach of North Coast Mapping Solutions worked in cooperation with McKinleyville Community Services District and SHN consulting and Engineers to analyze the water distribution system for storage capacity, fire flow availability, pressures, and flow rates.

ESRI ArcView GIS



WaterCAD v8i (Select3)



Definitions

Average Daily Demand (ADD)

1.51MG per day

Max Daily Demand (MDD)

2.5x's ADD = 3.78MG per day

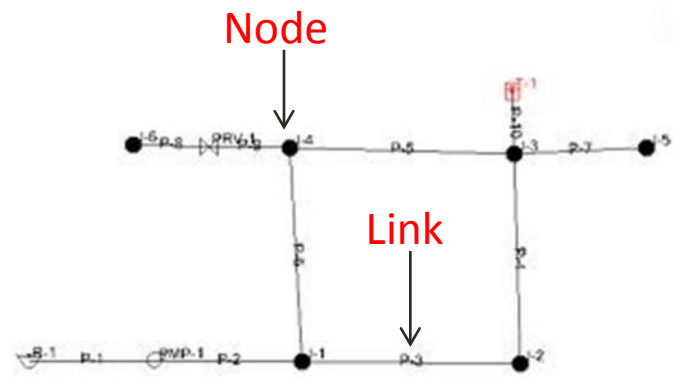
Peak Hour Demand (PHD)

.21MG per hour = .84MG per four hour period

Model Components

Links: pipes, valves, pumps

Nodes: junctions, tanks,
reservoirs



Criteria Requirements and Standards

- **Operational Storage vs. Total Storage Criterion**
 - Minimum tank level of 20ft must be maintained to account for fire flows and/or minimum pressure
- **Minimum Storage Criterion**
 - Distribution system must have enough storage to sustain 5 days of ADD and fire flows

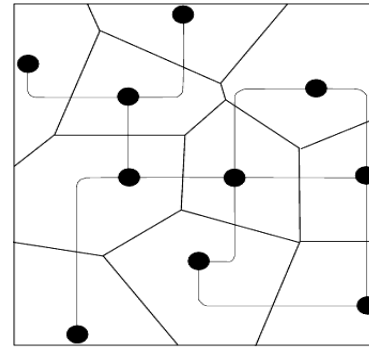
Criteria Requirements and Standards

- **California Department of Public Health Requirements**
 - The system as a whole is required to meet four hours of Peak Hour Demand (PHD) and Max Daily Demand (MDD) at all times
- **California Waterworks Standards**
 - The distribution system must maintain 20 psi at all times at customer connection

Model Methodology

Demand Allocation

- Actual billing records
- By land use



Rule Based Controls

IF Cochran Tank Hydraulic Grade \leq 310.00 ft Or Norton Tank Hydraulic Grade \leq 310.00 ft

THEN Ramey Pump Pump Status = On

Model Calibration

- Hydrant testing



Scenarios

- **Current State**

- Analyzes the MCSD water system under it's current conditions.
 - Compliance with regulations and standards
 - Pressures, flows and fire flow analysis
 - Storage, pumping and capacity
 - Ability to handle high density development

- **New 4.5MG Water Tank Scenario**

- Analyzes the water system with addition of a 4.5MG water tank at the Cochran tank site. (Map)

Scenarios

- **Additional 2.5MG Water Tank Scenario**
 - Analyzes the water system with a 2.5MG water tank at the end of Mather Rd in addition to the 4.5MG water tank at the Cochran tank site.
- **20 Year Growth Scenario**
 - This scenario will analyze the ability of the MCSD water system to handle population growth over the next 20 years.

Results

Current State

Pressures/Flows

Under peak hour demand with a fire event the current system can provide adequate pressure to all service connections.

Fire Flow Availability under Max Daily Demand

Failed to supply required flow.

High Elevation Areas

Table 9				
<u>MDD Fire Flow Analysis Failed Junctions</u>				
Junction #	Flow Available	Residual Pressure	Satisfies Fire Flow	Location
44	825.86	53.9	False	Central / Kjer Rd.
334	808.94	20.0	False	Terra Vist Ct.
382	699.05	58.3	False	End of Huntz Rd.
142	699.05	32.7	False	Clay Rd / Leona Dr.
35	570.31	24.3	False	Dows Prairie / Woody Rd.
43	570.30	32.2	False	Dows Prairie / Clam Beach Rd.
30	563.58	21.8	False	Dows Prairie / Baird
31	522.75	20.0	False	Baird Rd. / Chaffin Rd.
387	500.21	13.2	False	End of Mather Rd. (High Elev.)

Results

Current State

Minimum Storage Requirement

- 5 Days ADD from storage only

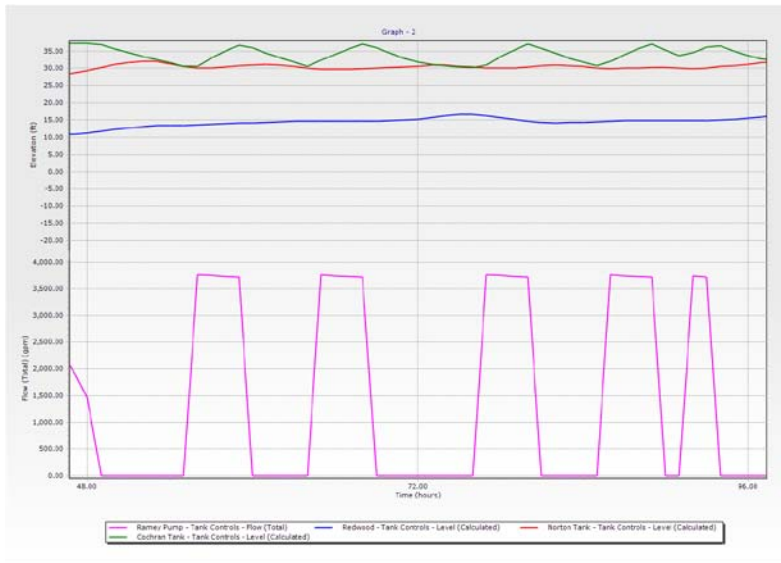
From storage only there is approximately 2 days of water available for the entire distribution system.



Results

Current State

High Density Build-Out Potential



Pumps work harder

1.5 days water from storage



Results

Current State

Summary

- The current water system does not provide the required 1000gpm fire flow to all hydrants.
- The current system does not have five days of average daily demand available from storage only. It has less than three.
- The current system cannot handle the proposed high density build-out.

Results

4.5MG Tank at Cochran

Pressures/Flows

Under peak hour demand with a fire event system can provide adequate pressure to all service connections.

Fire Flow Availability under Max Daily Demand

Improves fire flow but still Failed to supply required flow.

High Elevation Areas

- Dows Prairie

Junction #	Flow Available	Residual Pressure	Satisfies Fire Flow	Location
44	957.31	53.9	False	Central / Kjer Rd.
382	924.54	45.1	False	End of Huntz Rd.
142	924.54	31.0	False	Clay Rd / Leona Dr.
35	659.63	24.1	False	Dows Prairie / Woody Rd.
43	659.63	32.2	False	Dows Prairie / Clam Beach Rd.
30	651.44	21.8	False	Dows Prairie / Baird
31	604.32	20.0	False	Baird Rd. / Chaffin Rd.

Results

4.5MG Tank at Cochran

Minimum Storage Requirement

- 5 Days ADD from storage only

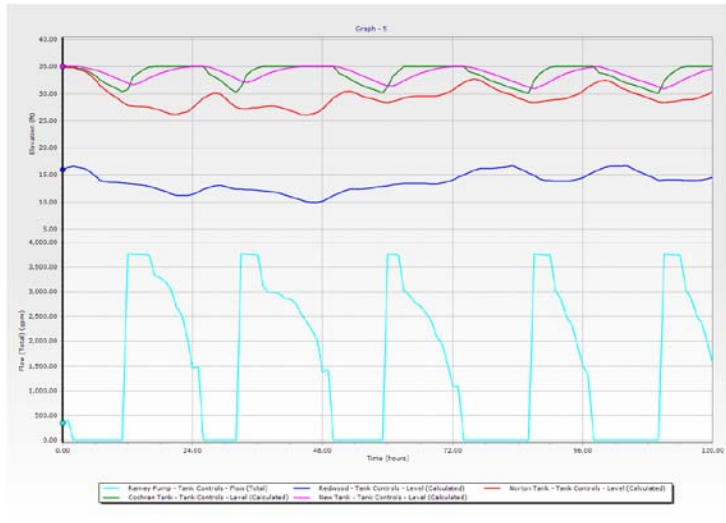
From storage only there would be approximately 4 days of water available for the entire distribution system.



Results

4.5MG Tank at Cochran

High Density Build-Out Potential



Pumps work harder

2.5 days of water from storage



Results

4.5MG Tank at Cochran

Summary

- The addition of 4.5MG does not provide the required 1000gpm fire flow to all hydrants.
- The addition of 4.5M does not provide five days of average daily demand available from storage. It has approximately 4 days.
- The addition of 4.5MG of storage cannot handle the proposed high density build-out.

Results

Additional 2.5MG (Dows Prairie)

Pressures/Flows

Under peak hour demand with a fire event system can provide adequate pressure to all service connections.

Fire Flow Availability under Max Daily Demand

System passes fire flow analysis.

Table 15				
<u>MDD Fire Flow Analysis Failed Junctions Cochran Tank Location</u>				
Junction #	Flow Available	Residual Pressure	Satisfies Fire Flow	Location
334	961.92	20.0	True	Terra Vista Ct.
142	924.44	31.0	True	Clay Rd / Leona Dr.
382	924.44	45.1	True	End of Huntz Rd.

Results

Additional 2.5MG (Dows Prairie)

Minimum Storage Requirement

- 5 Days ADD from storage only

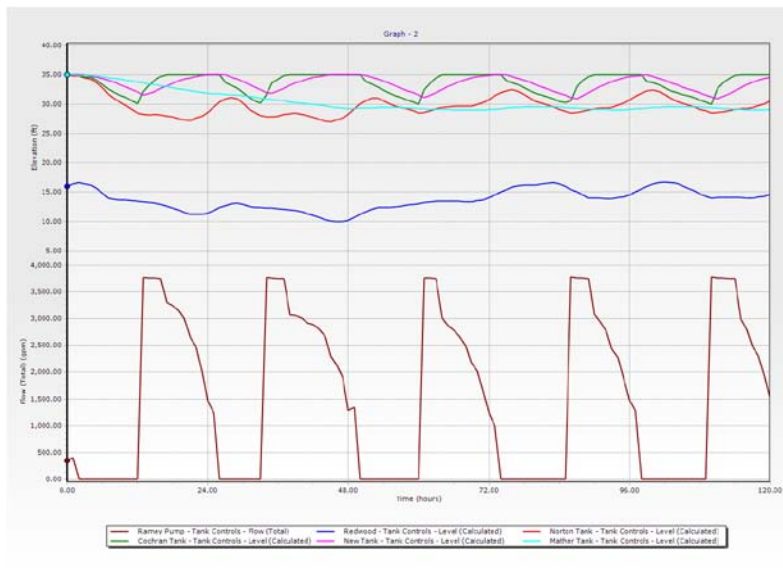
From storage only there would be approximately 5 days of water available for the entire distribution system.



Results

Additional 2.5MG (Dows Prairie)

High Density Build-Out Potential



Pumps run once a day

3.5 days of water from storage only



Results

Additional 2.5MG (Dows Prairie)

Summary

- The addition of 2.5MG in the Dows Prairie area provides the required 1000gpm fire flow to all hydrants.
- The addition of 2.5M in the Dows Prairie area provides five days of average daily demand available from storage.
- The addition of 2.5MG in the Dows Prairie area cannot handle the proposed high density build-out (Minimum storage requirement).

Results

2020/2030 Projections

According to the MCSD 20 Year Facilities Plan and Urban Water Management Plan the annual growth rate of McKinleyville since 1994 is 1.8%.

Date	% Increase	ADD	MDD
2010	0%	1.51MGD	3.40MGD
2020	18%	1.78MGD	4.01MGD
2030	18%	2.04MGD	4.59MGD

1. MGD = Million Gallons per Day
2. ADD = Average Daily Demand
3. MDD = Max Daily Demand

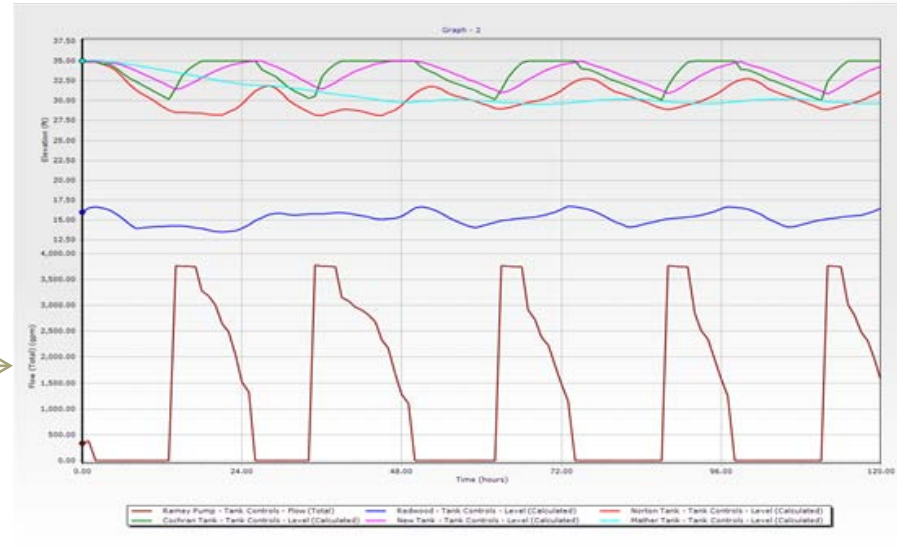
Results

2020 Projections

**2020
Average Daily Demand**

Tank Levels →

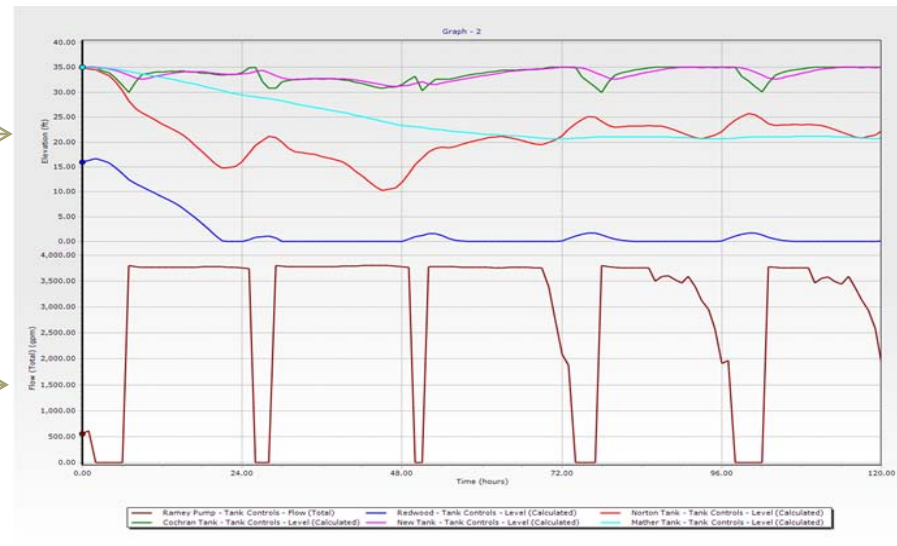
Pump Flow →



**2020
Max Daily Demand**

Tank Levels →

Pump Flow →



Results

2020 Projections

Minimum Storage



4.5MG plus 2.5MG (7MG)



6.0MG plus 4.5MG (10.5MG)

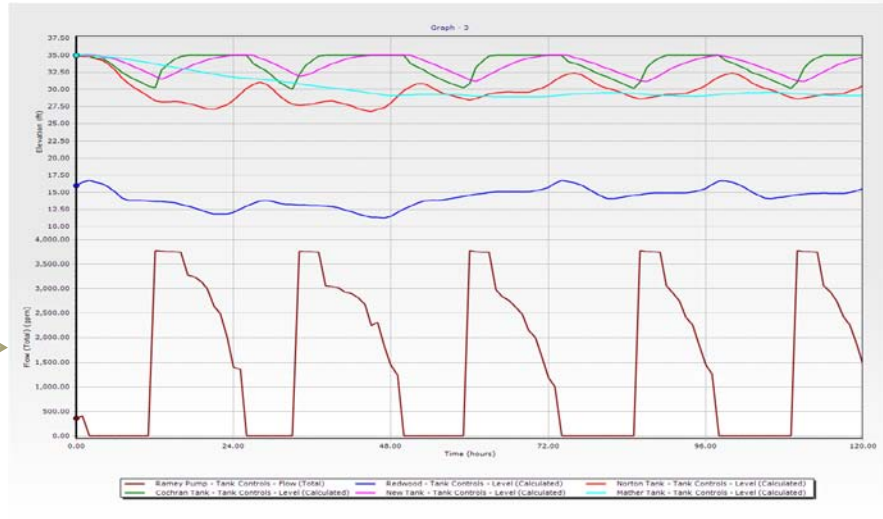
Year	Tank Location	Tank Size (MG)	# Days of Water Available from Storage
2020	Mather Rd.	2.5	4 Days Water from Storage Only
	Cochran Rd.	4.5	
2020	Mather Rd.	4.5	4.5 Days Water from Storage Only
	Cochran Rd.	4.5	
2020	Mather Rd.	4.5	5 Days Water from Storage Only
	Cochran Rd.	6.0	

Results

2030 Projections

**2030
Average Daily Demand**

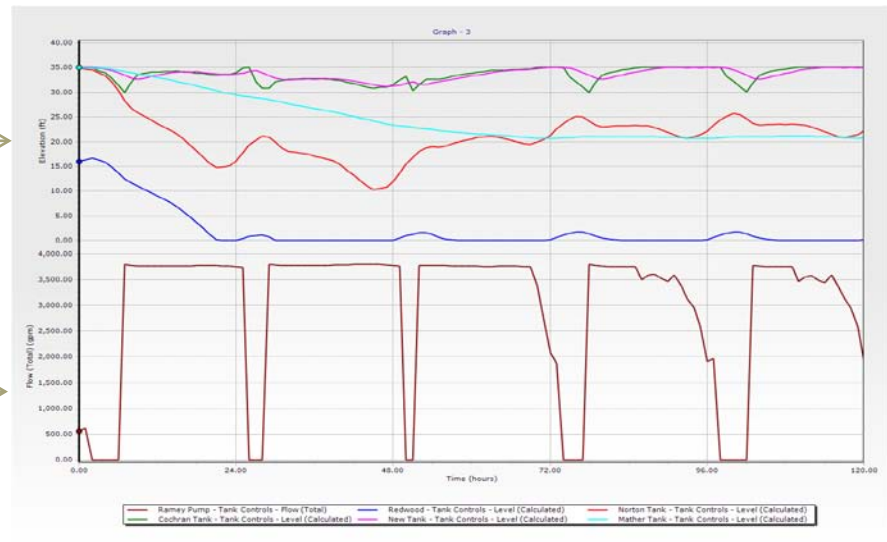
Tank Levels →



Pump Flow →

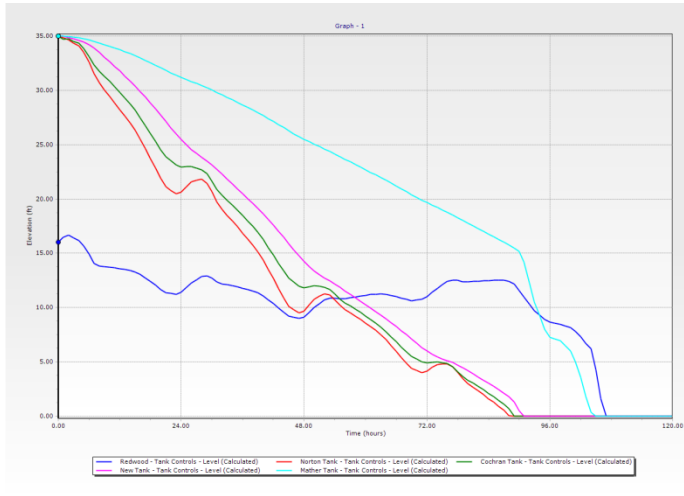
**2030
Max Daily Demand**

Tank Levels →

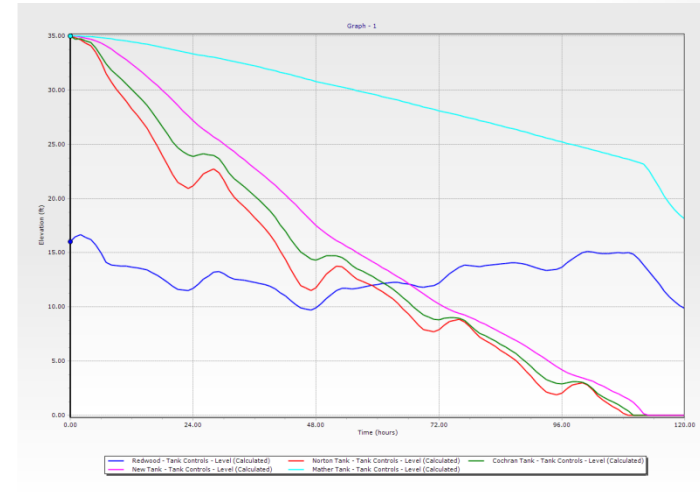


Pump Flow →

Results



4.5MG plus 2.5MG (7MG)



6.0MG plus 6.0MG (12MG)

Table 18			
2030 Tank Size and Available Storage			
Year	Tank Location	Tank Size (MG)	# Days of Water Available from Storage
2030	Mather Rd.	2.5	3 Days Water from Storage Only
	Cochran Rd.	4.5	
2030	Mather Rd.	4.5	3.5 Days Water from Storage Only
	Cochran Rd.	4.5	
2030	Mather Rd.	4.5	4 Days Water from Storage Only
	Cochran Rd.	6.0	
2030	Mather Rd.	6.0	4.5 Days Water from Storage Only
	Cochran Rd.	6.0	

Results

2020/2030 Projections

Summary

- By the year 2020 10.5MG of additional storage will be needed to satisfy the 5 day minimum storage requirement.
- By the year 2030 12MG of additional storage will be needed to satisfy the 5 day minimum storage requirement.

Conclusion

Current State

- The current water system does not provide the required 1000gpm fire flow to all hydrants.
- The current system does not have five days of average daily demand available from storage only. It has less than 3.
- The current system cannot handle the proposed high density build-out (Minimum Storage).

Conclusion

4.5MG Tank at the Cochran Road Tank Site

- The addition of 4.5MG does not provide the required 1000gpm fire flow to all hydrants.
- The addition of 4.5M does not provide five days of average daily demand available from storage. It has approximately 4 days.
- The addition of 4.5MG of storage cannot handle the proposed high density build-out (Minimum storage/ 2.5 days).

Conclusion

Additional 2.5MG Tank at the end of Mather Road

- The addition of 2.5MG in the Dows Prairie area provides the required 1000gpm fire flow to all hydrants.
- The addition of 2.5M in the Dows Prairie area provides five days of average daily demand available from storage.
- The addition of 2.5MG in the Dows Prairie area cannot handle the proposed high density build-out (Minimum storage/ 3.5 days).

Results

2020 / 2030 Growth Projections

- By the year 2020 10.5MG of additional storage will be needed to satisfy the 5 day minimum storage requirement.
- By the year 2030 12MG of additional storage will be needed to satisfy the 5 day minimum storage requirement.

References

- *“Advanced Water Distribution Modeling and Management”* Haestad Methods Water Solutions. 2007 Bentley Institute Press.
- MCSD Operations Department Staff 2011-2012.
- SHN Preliminary Technical Memorandum *“MCSD Water Distribution System–Preliminary Assessment”* August 18, 2011.

Thank You

Any Questions?