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Water Supply Evaluation

City of Bloomington Utilities Department Public Meeting

Black & Veatch

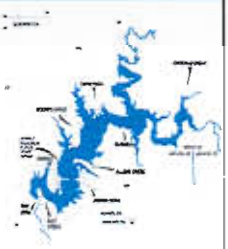
April 14, 2008

Agenda

- Water System Fundamentals
- Water Demands
- Storage Facilities
- Water System Alternatives
- Conclusions
- Discussion and Questions

Background

- 2003 Long Range Water Capital Plan
- 2007 Water Supply Evaluation
- Monroe WTP capacity summary
  - 24 mgd capacity with all 4 filters in service
  - 18 mgd capacity with 1 filter out of service



Water System Fundamentals

Water System Fundamentals

- Most significant demands in design and operation of water system
  - Average Day (AD)
  - Maximum Day (MD)
  - Maximum Hour (MH)

Water System Fundamentals

- Average Day Demand = total annual quantity of water pumped divided by days in a year
- Average Day Demand is used for estimating
  - Water supply requirements
  - Chemical usage
  - Revenue

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Water System Fundamentals

- Maximum Day Demand = largest quantity pumped on any one day
- Water treatment plants and pumping facilities are sized for Maximum Day Demands

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Water System Fundamentals

- Maximum Hour Demand = largest quantity pumped, adjusted for inflow/outflow from storage, in any one hour
- Water storage tanks are sized to handle Maximum Hour Demand

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Ten States Standards

- A guide to the design and preparation of plans and specifications for public water supply systems
- Intended to establish, as far as practical, uniformity of practice among several states
- Prepared by the Great Lakes-Upper Mississippi River Board of State and Provincial Public Health and Environmental Managers
  - Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, New York, Ohio, Ontario, Pennsylvania, Wisconsin

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Ten State Standards

- The system including the water source and treatment facilities shall be designed for maximum day demand at the design year (Part 2.1)
- The quantity of water at the source shall be adequate to meet the maximum projected water demand of the service area shown by calculations based on a one in fifty year drought or the extreme drought of record, and should include consideration of multiple year droughts (Part 3.1.1.a)

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Ten State Standards

- Filters shall be capable of meeting the plant design capacity [projected maximum daily demand] at the approved filtration rate with one filter removed from service (Part 4.2.1.3)
  - With one filter out of service, Monroe WTP capacity = 18 mgd

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Distribution Storage Standards

- Ten States Standards
  - Excessive storage capacity should be avoided to prevent potential water quality deterioration problems (Part 7.0.1.c)
- IDEM
  - Minimum total storage capacity of 1 day under average conditions
    - 14 to 15 MG for Bloomington
  - Total storage shall be less than 1.5 times average day conditions
    - 21 to 23 MG for Bloomington

Water Quality – EPA Regulations

- Two disinfection byproducts (DBPs) are regulated
  - TTHMs
  - HAAs
- Required to maintain DBP levels below the maximum contaminant levels (MCLs)
- DBPs are formed by reaction between chlorine used for disinfection and natural occurring organics in the water
- Required to maintain a free chlorine residual within the distribution system (0.2 mg/l to 4.0 mg/l)

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Water Demands

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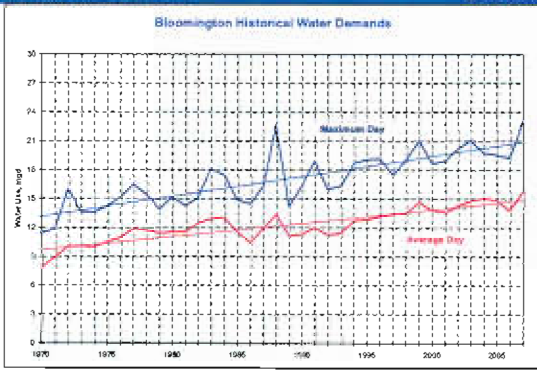

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Historical Water Demands and Weather Factors

Year	Maximum Day Water Demand, mgd	No. Days Temp≥90	[illegible] May 1-Oct 1	Precipitation (in) May 1 - Oct 1
1985	14.67	11	[illegible]	[illegible]
[illegible]	14.50	[illegible]	[illegible]	22.41
[illegible]	[illegible]	[illegible]	[illegible]	15.90
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1989	14.20	7	[illegible]	27.93
1990	[illegible]	[illegible]	[illegible]	[illegible]
1991	[illegible]	[illegible]	23	[illegible]
[illegible]	[illegible]	2	33	17.45
[illegible]	[illegible]	17	35	34.14
[illegible]	[illegible]	18	[illegible]	15.65
[illegible]	19.12	[illegible]	[illegible]	[illegible]
[illegible]	19.19	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	22	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	19.60	1	40	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

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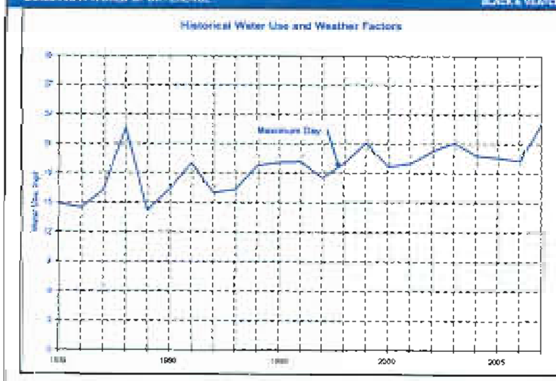

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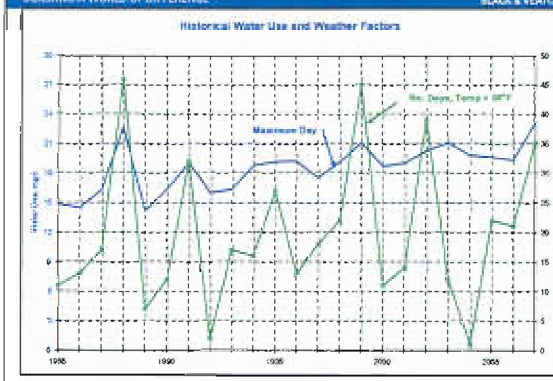

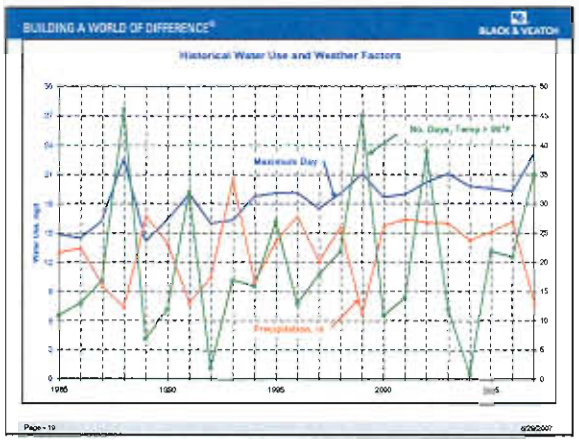
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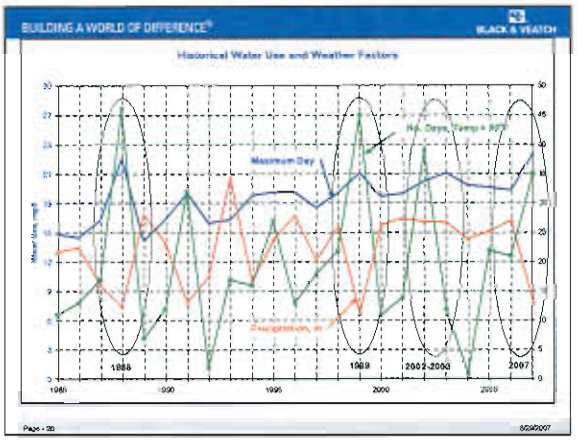
Historical Water Use and Weather Factors
Maximum Day
No. Days, Temp > 95°F
Precipitation, in
Water Use, mgd
1985
1990
1995
2000
Page - 19
8/29/2007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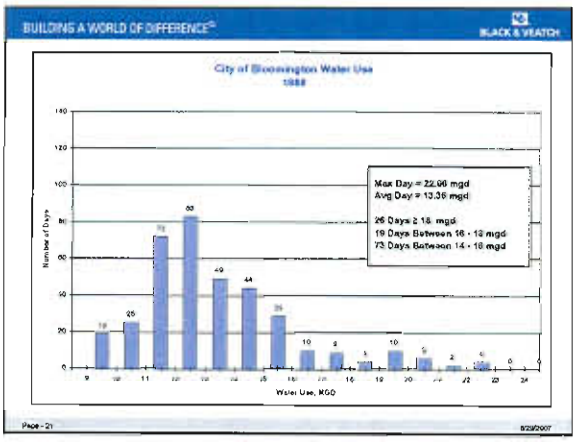
Historical Water Use and Weather Factors
Maximum Day
Precipitation, in
1988
1989
2002-2003
2007
1985
1990
1995
2000
Page - 20
8/29/2007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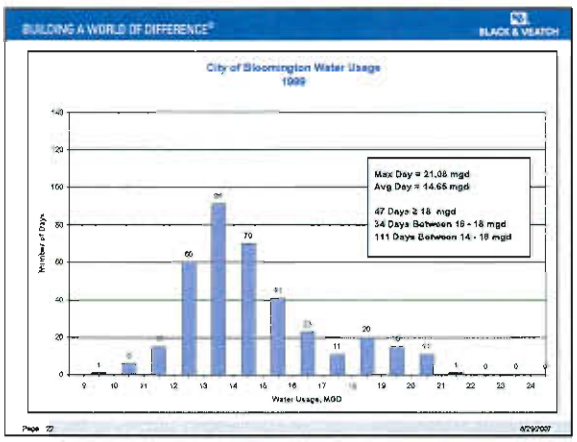
City of Bloomington Water Use
1988
Max Day = 22.90 mgd
Avg Day = 13.36 mgd
26 Days ≥ 18 mgd
19 Days Between 18 - 18 mgd
73 Days Between 14 - 18 mgd
Number of Days
Water Use, MGD
Page - 21
8/29/2007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City of Bloomington Water Usage
1999
Max Day = 21.08 mgd
Avg Day = 14.66 mgd
47 Days ≥ 18 mgd
34 Days Between 18 - 18 mgd
111 Days Between 14 - 18 mgd
Number of Days
Water Usage, MGD
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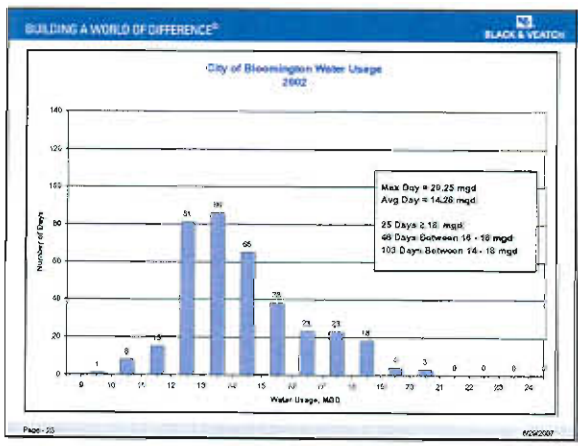
8/29/2007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City of Bloomington Water Usage
2002
Max Day = 29.25 mgd
Avg Day = 14.28 mgd
25 Days ≥ 18 mgd
48 Days Between 18 - 18 mgd
103 Days Between 14 - 18 mgd
Number of Days
Water Usage, MGD
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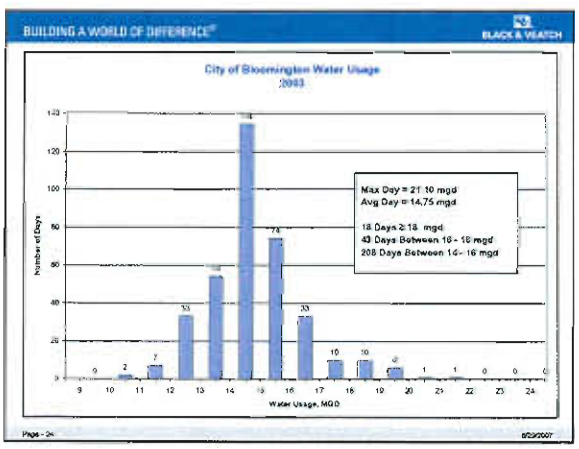
8/29/2007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City of Bloomington Water Usage
2003
Max Day = 21.10 mgd
Avg Day = 14.75 mgd
18 Days ≥ 18 mgd
43 Days Between 18 - 18 mgd
208 Days Between 14 - 18 mgd
Number of Days
Water Usage, MGD
Page - 24
8/29/2007

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Placeholder for 2007

Max Day = 23.06 mgd
Avg Day = 15.76 mgd

XX Days ≥ 16 mgd
XX Days Between 16 - 15 mgd
XX Days Between 14 - 16 mgd

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Maximum Day Demand Rate of Increase

- From 1970 to 2007
  - MD demands have increased 102.3%
  - Average annual increase of 2.76%
- From 1985 to 2007
  - MD demands have increased 55.08%
  - Average annual increase of 2.50%
- LRWCP projected increase
  - Average annual increase 2.17%

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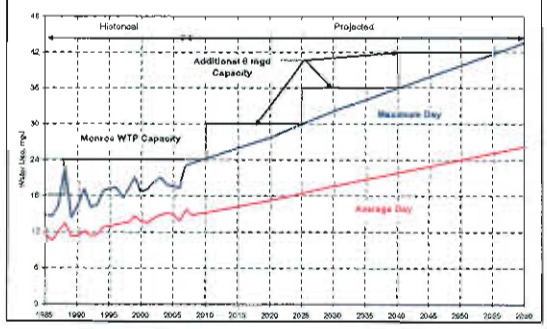
Historical and Projection Water Use Requirements



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Storage Facilities

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Storage Facilities

- Purposes
  - Flow Equalization
  - Fire Reserve
  - Emergency Storage
- Total Storage Capacity – 21.7 MG (~ 1.5 times average day use)
- Usable Capacity – 6.4 MG

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Storage vs. Treatment Capacity

- Two major issues with building storage instead of treatment capacity to meet maximum day demands
  - It is not sustainable
  - Water quality considerations

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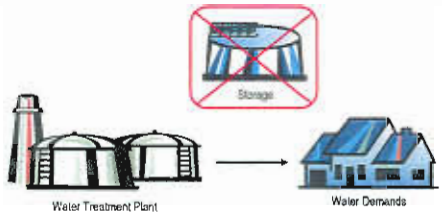
Treatment Capacity = Water Demands



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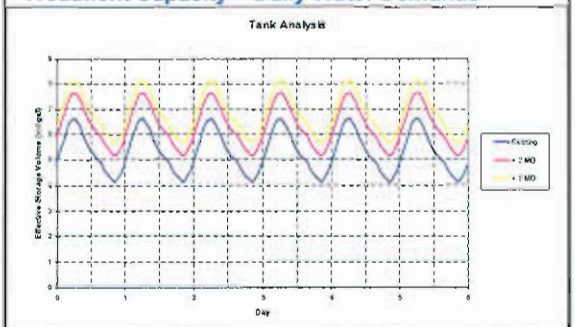
Treatment Capacity = Daily Water Demands



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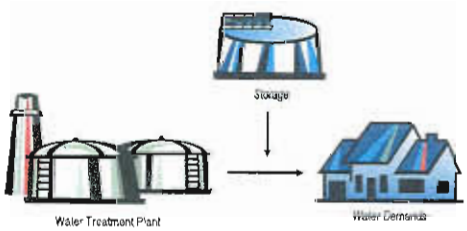
Treatment Capacity < Water Demands



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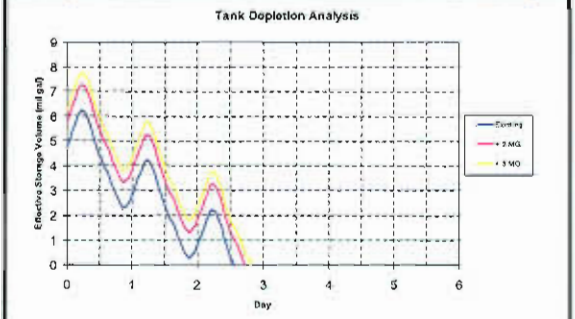
Daily Water Demand Exceeds Treatment Capacity



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Water Quality Considerations

- Additional distribution storage under low demand conditions may
  - Increase water age
    - Increase in DBP formation
      - Affect compliance with EPA's Maximum Contaminant Levels (MCL) regulations
  - Decrease disinfectant residual in distribution system

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Storage Conclusion

- Storage is not sustainable and not a solution to meet future maximum day water demands
- Additional storage may cause water quality and regulatory issues
- Additional treatment is the appropriate solution to meet future maximum day water demands

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Conclusions

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Conclusions

- Water projections indicate need for additional capacity in near future
- Weather conditions impact water demands
- Monroe WTP currently does not meet plant capacity rating as defined by Ten States Standards
  - Filter capacity with 1 filter out of service is 18 mgd
- Storage is not a feasible option to meet maximum day demands

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Water System Alternatives

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Water System Alternatives

- Alternative A – Expand Monroe WTP from 24 to 36 mgd
  - Option to Alternative A – Expand Monroe WTP from 24 to 30 mgd
- Alternative B – New 12 mgd WTP using Monroe Lake
- Alternative C – New 12 mgd North WTP using Groundwater Supply with membrane filtration
  - Option to Alternative C – New 12 mgd North WTP using Groundwater Supply with Gravity Media Filtration

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CUD Water System

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Alternative A – Expand Monroe WTP

- Expand the Monroe WTP from 24 to 36 mgd
- Filter Rehabilitation
- New 2 MG Southeast Tank
- New 12 mgd Southeast Pump Station (Expandable to 24 mgd)
- New Raw Water Mains between the Intake and WTP
- New Finished Water Mains Between Monroe WTP and City
  - Approximately 12 miles of Mains
  - "West Leg" is required, CUD to construct
    - Not included in Opinion of Probable Cost

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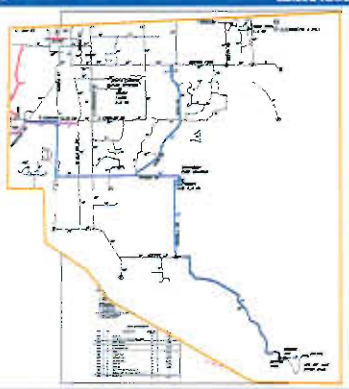
Alternative A



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Alternative A

- Advantages
  - Redundancy
  - 36 mgd total capacity
  - 24 mgd with one main out of service
  - Monroe Lake water source
  - Economical
- Disadvantages
  - No independent water source
  - Expandability beyond 36 mgd

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Option to Alternative A – Expand Monroe WTP

- Same as Alternative A except expand Monroe WTP from 24 to 30 mgd initially
  - Add capacity when additional capacity needed in the future
- Initial capital reduction of approximately 15 %

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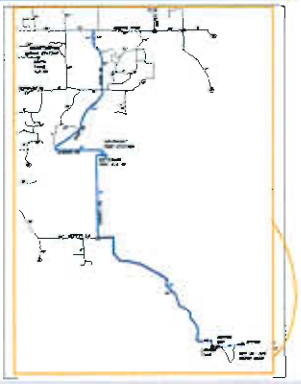
Option to Alternative A



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Option to Alternative A

- Advantages
  - Redundancy
  - 30 mgd total capacity
  - 24 mgd with one main out of service
  - Monroe Lake water source
  - Economical
  - Lower initial construction cost
- Disadvantages
  - No independent water source
  - Phased plant expansion in 6 mgd increments is more costly than a single phase

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Alternative B – New Dillman WTP

- New 12 mgd WTP Expandable to 24 mgd (or beyond)
- Membrane Filtration
- Lake Monroe Water Supply
- New Intake Facility
- Approximately 12 miles of New Water Mains
- Retrofit filters at Monroe WTP

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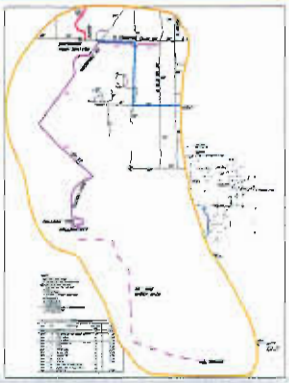
Alternative B



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Alternative B

- Advantages
  - 36 mgd total capacity
  - Easy Expansion
  - Dispose of residuals to Dillman WWTP
  - Two separate withdraw locations on Lake Monroe
  - Monroe Lake water source
- Disadvantages
  - Increased O&M costs
  - Higher capital cost

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Alternative C – New North WTP

- New 12 mgd North WTP Expandable to 24 mgd (or beyond)
- Ground Water Supply
- Membrane Filtration
- Reverse Osmosis Membranes for Water Softening
- 12 mgd Collector Well
- Approximately 16 miles of New Water Mains
- Retrofit Filters at Monroe WTP

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Alternative C

- Advantages
  - 36 mgd total capacity
  - Independent water source
  - Good hydraulics conveying water from the north
  - Dispose of residuals to Blucher Poole WWTP
- Disadvantages
  - Increased O&M costs
  - Higher capital cost
  - Water quality compatibility concerns

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Alternative C – New North WTP

- Option to Alternative C
- Same as Alternative C Except Conventional Media Filtration Instead of Membrane Filtration

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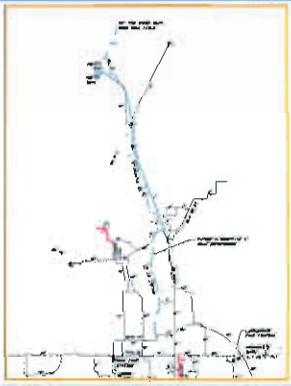
Alternative C and Option to Alternative C



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Option to Alternative C

- Advantages
  - 36 mgd total capacity
  - Independent water source
  - Good hydraulics conveying water from the north
  - Dispose of residuals to Blucher Poole WWTP
  - Lower capital cost than Alternative C
- Disadvantages
  - Increased O&M costs
  - Higher capital cost
  - Water quality compatibility concerns

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Alternative Cost Comparison

Alternatives Cost Comparison

Alternative	Total Probable Construction Cost	Total Probable Project Cost Plus Debt Issuance Cost	Projected 2008 Additional Rate Increase
Alternative A Expand the existing Monroe WTP from 24 to 36 mgd using gravity media filtration	$36,600,000	$40,395,000	53%
Option to Alternative A Expand the existing Monroe WTP from 24 to 30 mgd using gravity media filtration	$32,400,000	$42,120,000	46%
Alternative B New 12 mgd Dillman WTP with Lake Monroe supply using membrane filtration	$81,100,000	$82,270,000	91%
Alternative C New 12 mgd North WTP with groundwater supply using membrane filtration and reverse osmosis for softening	$75,700,000	$102,315,000	113%
Option to Alternative C New 12 mgd North WTP with groundwater supply using gravity media filtration and reverse osmosis for softening	$70,000,000	$95,175,000	105%

Notes
1. Probable Construction Costs are based on January 2007 price levels.
2. Debt Issuance Costs and Projected Rate Increases were provided by Crowe Chizek and Company LLC.
3. Total Annual Project Cost Plus Debt Issuance Costs includes Construction, Engineering, Land and Easement Acquisition, Debt Issuance Cost, and 6% Annual Inflation Factor.
4. Water Treatment Licensing Costs are not included in the above costs.
5. Assumes one 20-year Competitive Bond Issue for all Alternatives.
6. Annual Extensions and Replacements have been set at a minimum of 30% coverage in each Alternative.

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Recommended Alternative

- Option to Alternative A – Expand Monroe WTP from 24 to 30 mgd
  - 44,000 LF of 24", 30" and 36" water main
  - 12 mgd pump station (expandable to 24 mgd)
  - 2 MG tank
  - Expand Monroe WTP and Intake from 24 mgd to 30 mgd
- Rate increase will be implemented in a phased approach

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Benefits of Recommended Alternative

- Meets CUD's water needs through about 2025
- Most economical
- Adds reliability
- Easy expansion to 36 mgd in the future
- Includes Filter-To-Waste System
  - Improve finished water quality to system following a filter backwash
- Includes addition of air to filter washing
  - Decreases water requirements for filter washing
  - More effective cleaning of filters
- Includes filter capacity to meet 10 States Standards plant rating with 1 filter out of service

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Discussion and Questions