# Minnesota Water Reuse Workshop

# Project Planning and Implementation of Rainwater Harvesting Projects

Presented by:
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Regional Representative for ARCSA and RMS
Monday May 2, 2016

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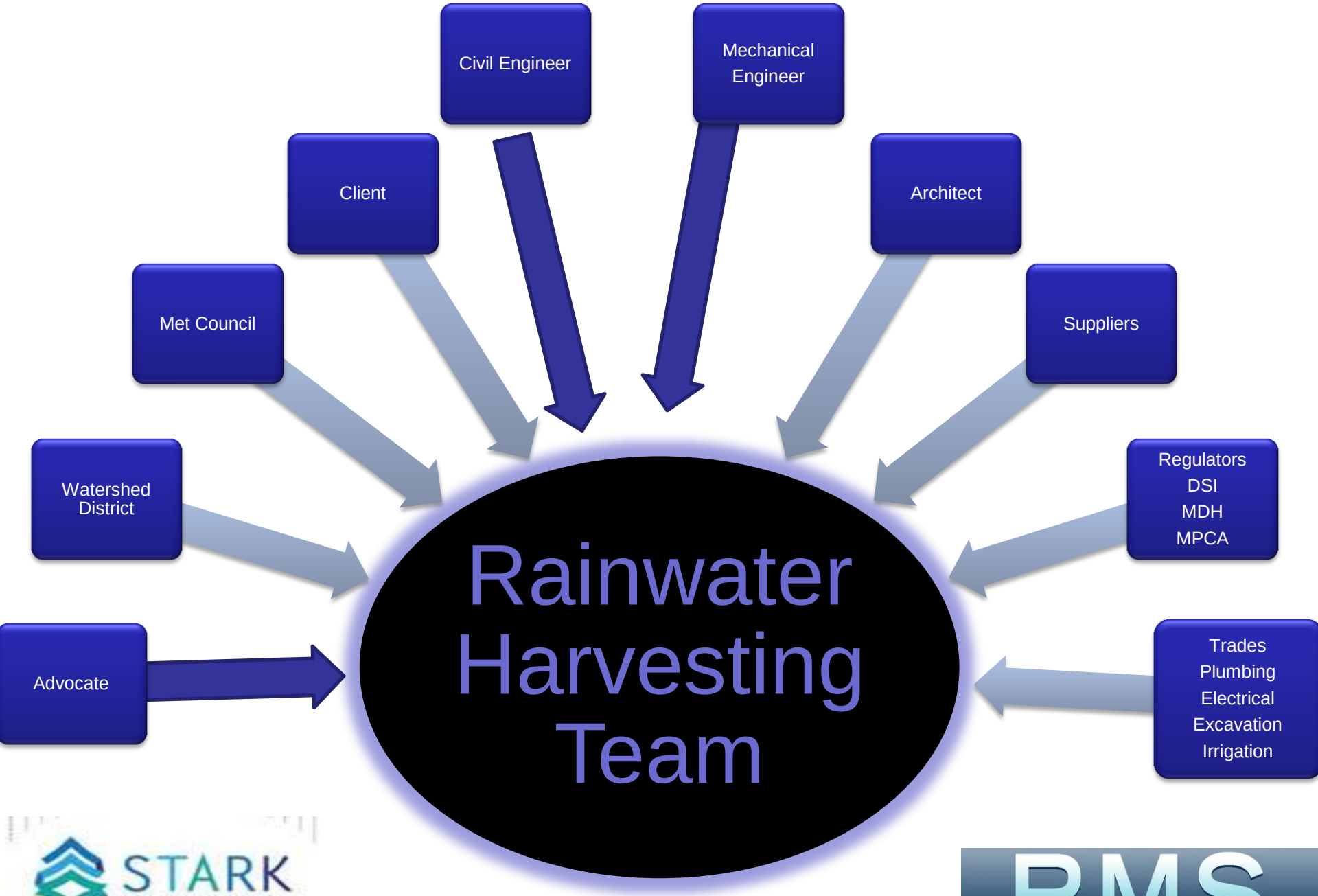


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# Key Project Planning Elements for RWH

1. Base design should protect in tank water quality
2. Roof Area Supply _____SF
3. Water Demands _____GPD
4. Determine location of use Indoor/Outdoor
5. Determine season of use Seasonal/Year Round
6. Identify codes Stormwater/Plumbing
7. Determine end uses Potable/Non-potable
8. Design pressure and rates _____PSI-GPM-TDH
9. Design water treatment Use AND Overflow _____
10. Identify control functions _____ BAS, Backup

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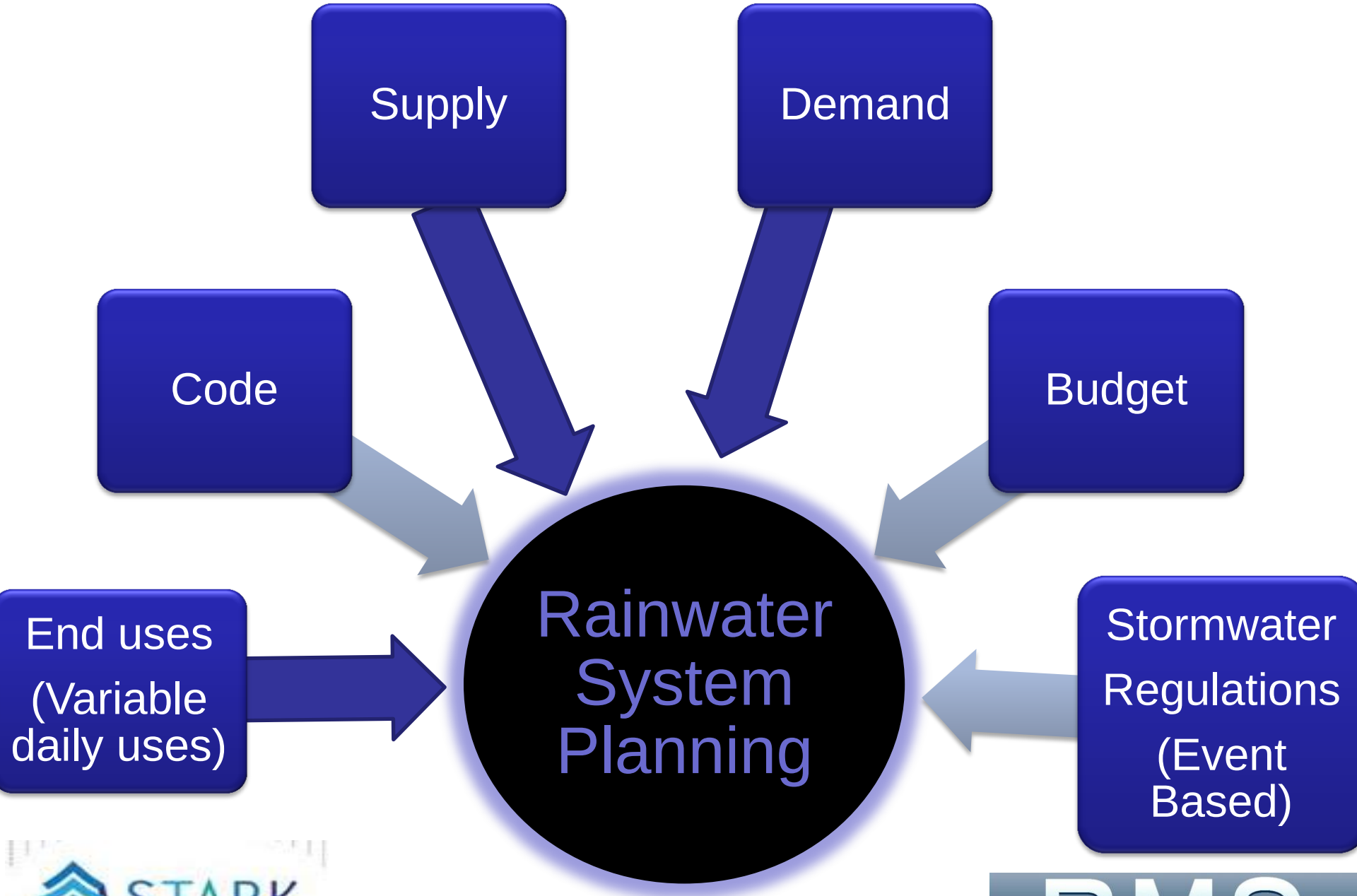


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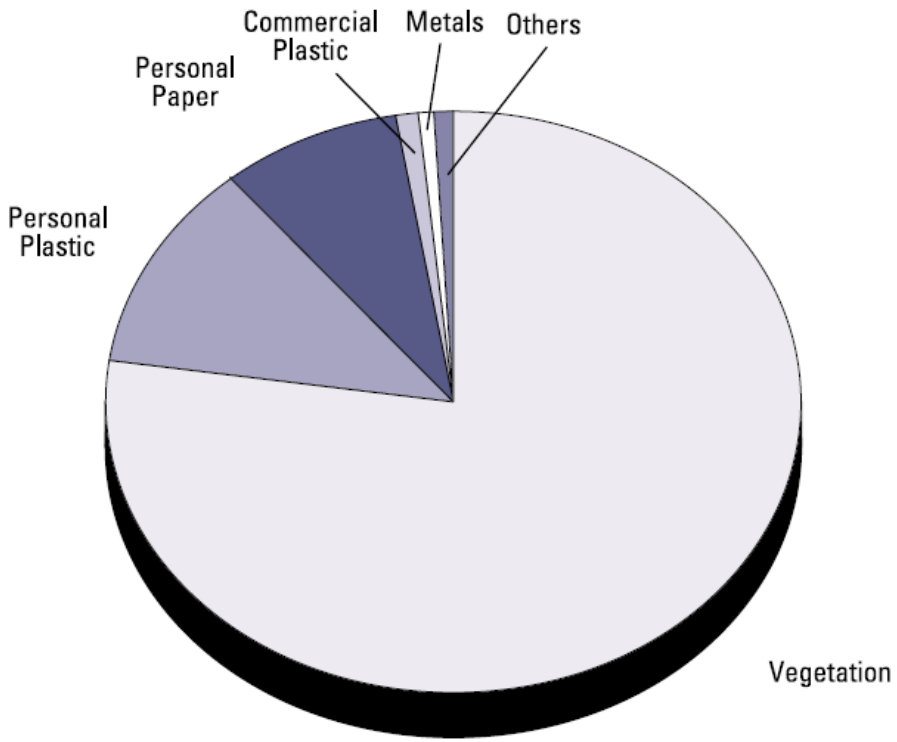
# Pre-tank filtration




*Composition of gross pollutants by mass*
Source: Cooperative Research Center for Catchment Hydrology in Australia

Why?

1. Improve in tank water quality.
2. End use water quality.
3. Less tank maintenance.
4. Good for irrigation and indoor use systems.

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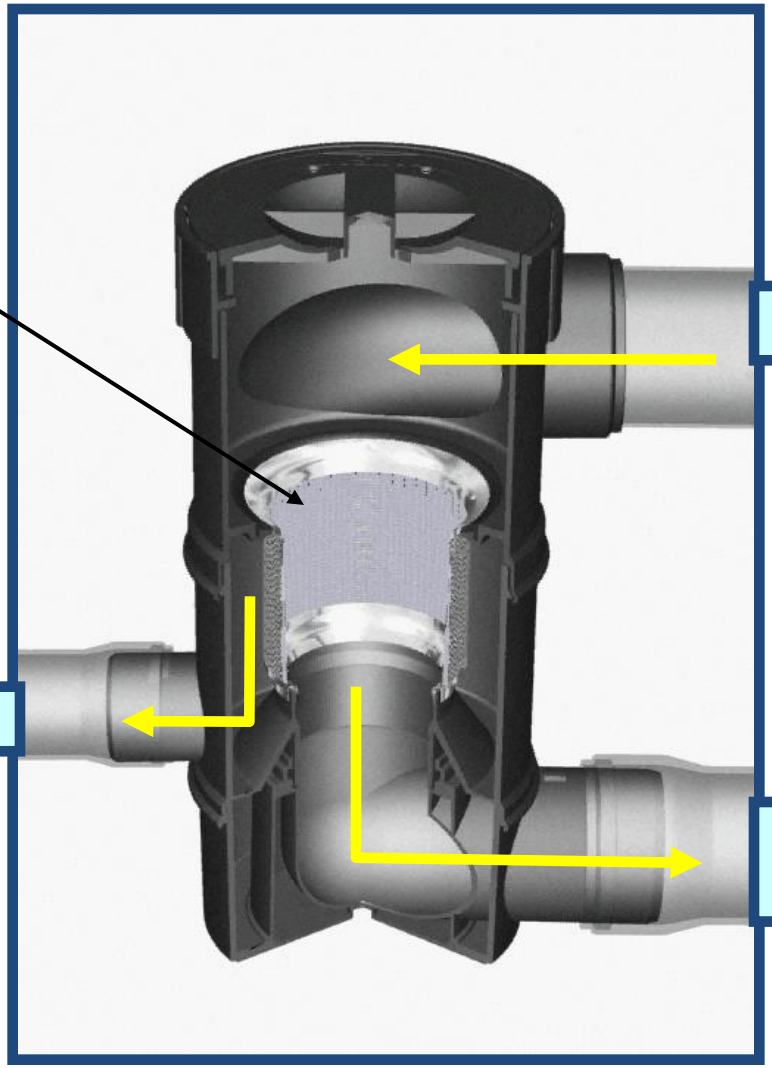
# *Sample pre-tank filter*
## section and function view



Filter

Rainwater from all groundpipes

Filtered water

Rinsing water with particulate

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# Base Design Protects In Tank Water Quality
# Water Treatment to Meet End Use Standards

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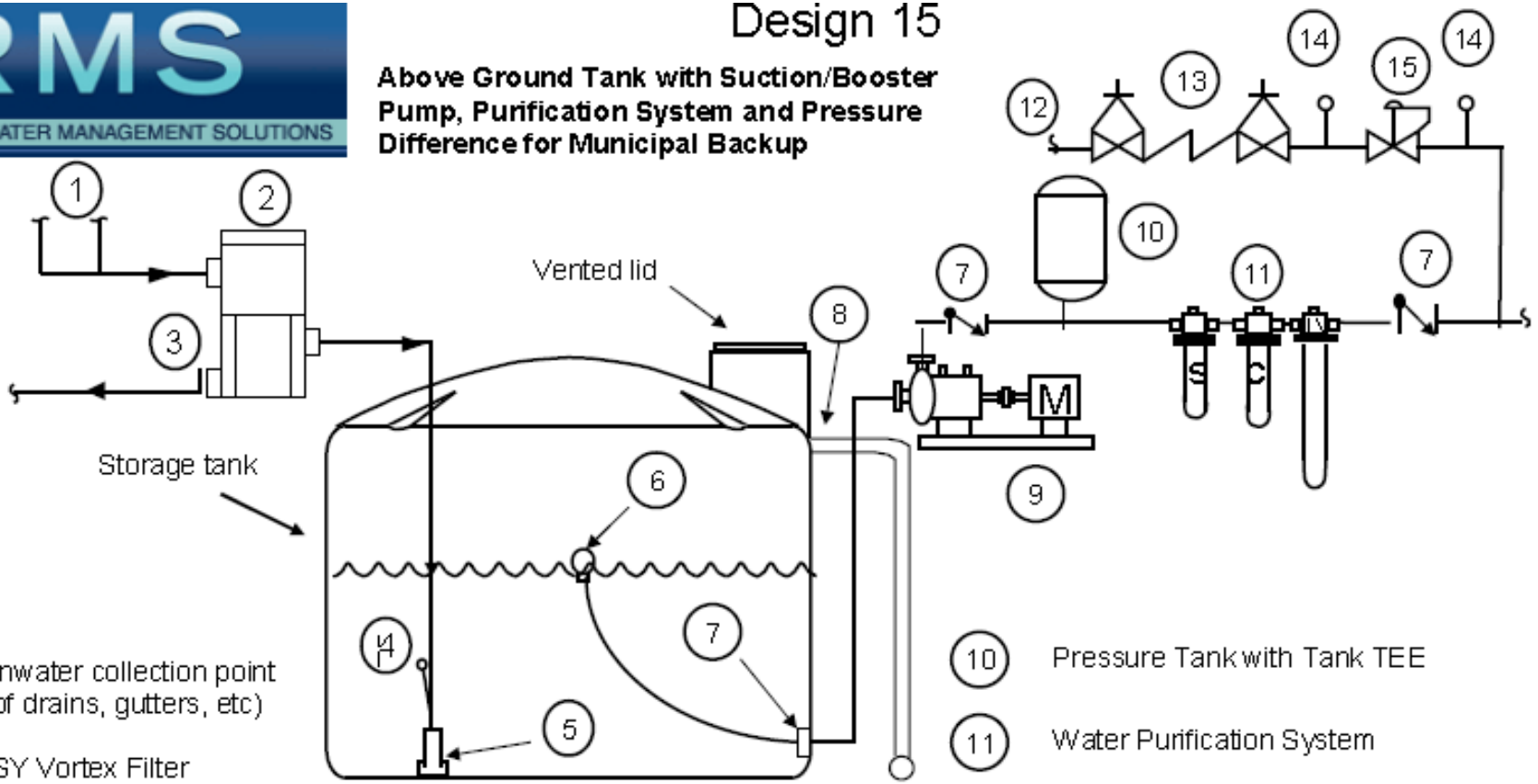
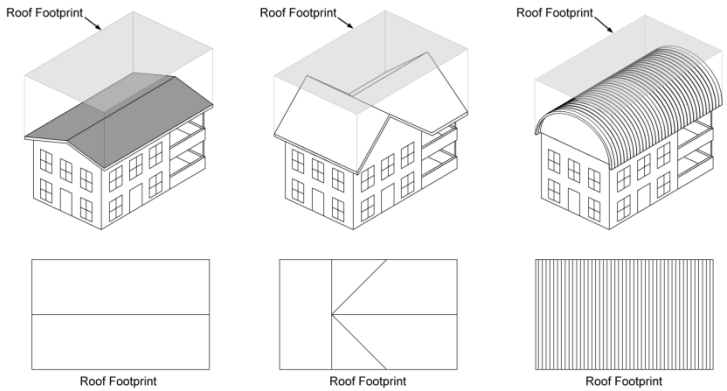
## Design 15

**Above Ground Tank with Suction/Booster Pump, Purification System and Pressure Difference for Municipal Backup**




1. Rainwater collection point (roof drains, gutters, etc)
2. WISY Vortex Filter
3. First Flush and Excess Water Outlet
4. Low water cut off float switch for pump protection (N/O)
5. Stainless Steel Smoothing inlet
6. Floating stainless steel suction filter
7. Check valve
8. Overflow
9. Suction/Booster Pump
10. Pressure Tank with Tank TEE
11. Water Purification System
12. Domestic water supply
13. Backflow prevention device
14. Pressure gauge
15. Pressure Regulator Valve Set

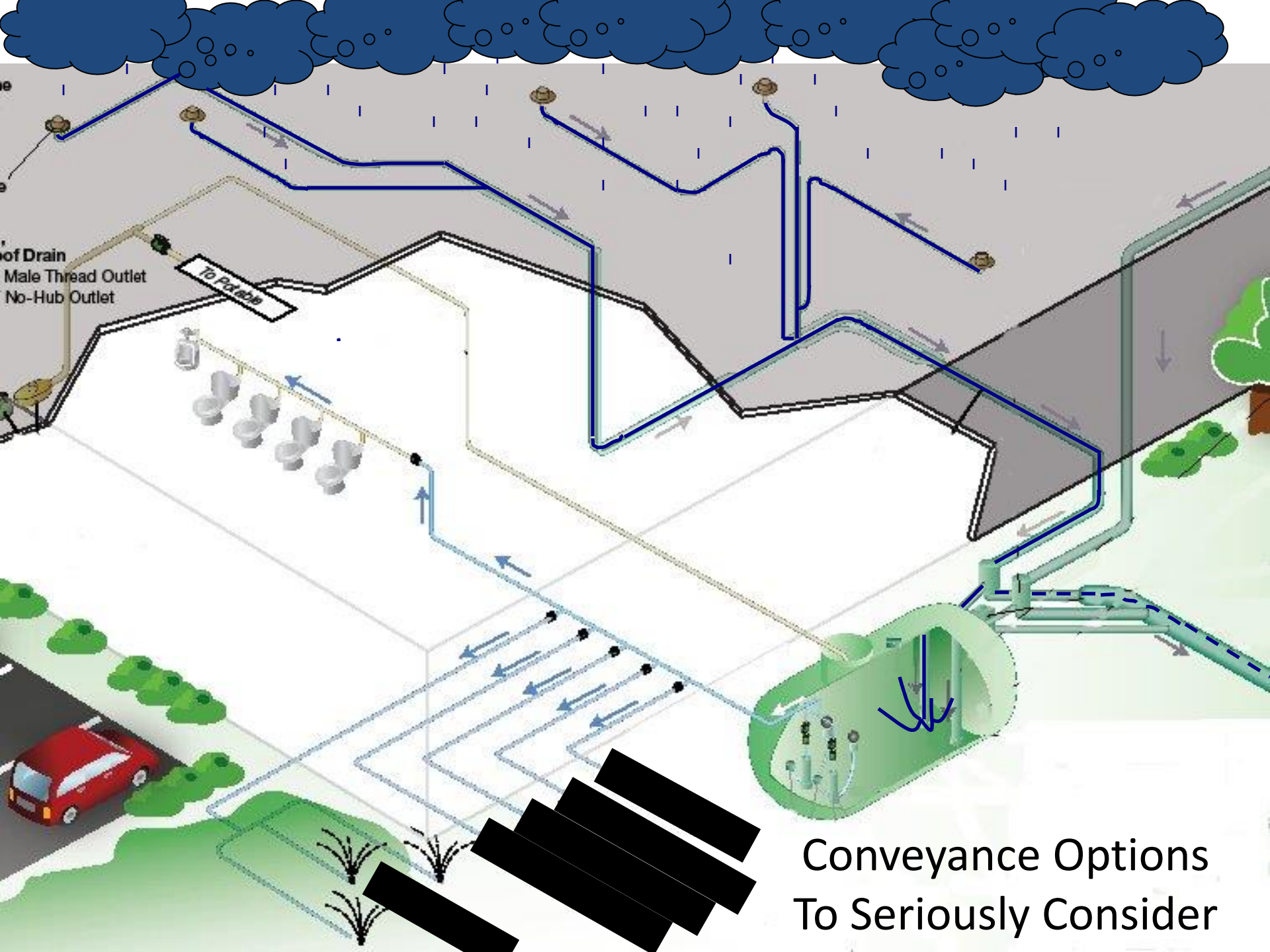
# Water Supply
# Match Roof Area to Pre filtration Device




1,000 sq ft

5,500 sq ft

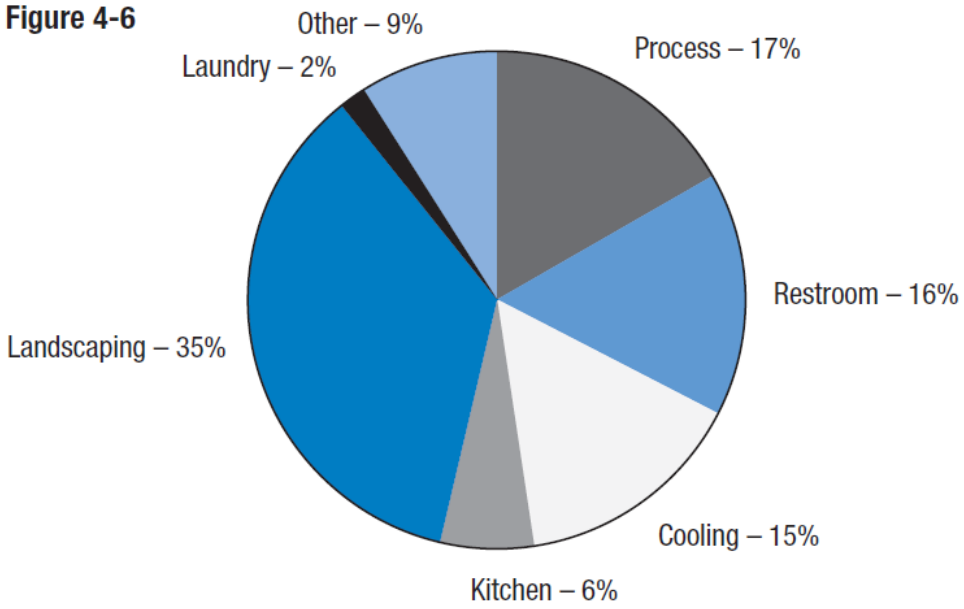
32,292 sq ft




# Conveyance Options To Seriously Consider

# Water Demand
# Conservation First and Then Use
# Commercial Settings

**Figure 4-6**




Recommendations:

1. Smart controls on irrigation
2. Water sense fixtures
3. Control options to draw down tank (simple to complex).
4. Smaller tanks reduce cost.

http://www.pacinst.org/reports/urban_usage/waste_not_want_not_full_report.pdf

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# Location of Use Drives Jurisdiction & Code

Indoor Use and Combined Systems

- Plumbing /Health/Stormwater Code Apply

Outdoor use Systems

- Currently only Stormwater Code Apply

National Standards

- ARCSA-ASPE 63 – Rainwater
- ARCSA-ANSI-ASPE 78 – Stormwater


National Codes

- Universal Plumbing Code
- International Plumbing Code

Minnesota Plumbing Code


**Minnesota Adopts Uniform Plumbing Code (UPC).** The state of Minnesota has formally adopted the 2012 edition of IAPMO's flagship document and American National Standard designated plumbing code, the UPC, with state- specific amendments.

# Seasonality of Use Drives Tank Choice

Above Ground Poly

500 – 10,000 Gallons

- Den Hartog
- Norwesco


Below Ground Poly

500 – 2,500 Gallons

- Fralo
- Den Hartog

Metal

700-622,000 Gallons

- Corgal

Fiberglass

600-50,000 Gallons

- Containment Solutions

Pipe

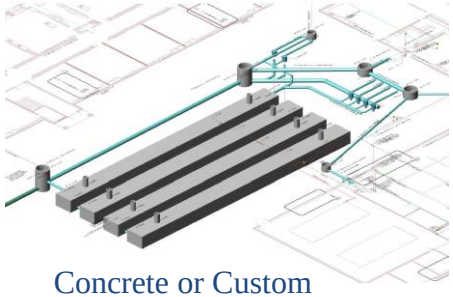
Unlimited

- ADS Pipe

Modular

250 – Unlimited

- FTC Corporation
- Atlantis



Concrete or Custom

Don't see your preferred tank? Ask. Building relationships with tank/infiltration manufacturers around the world.

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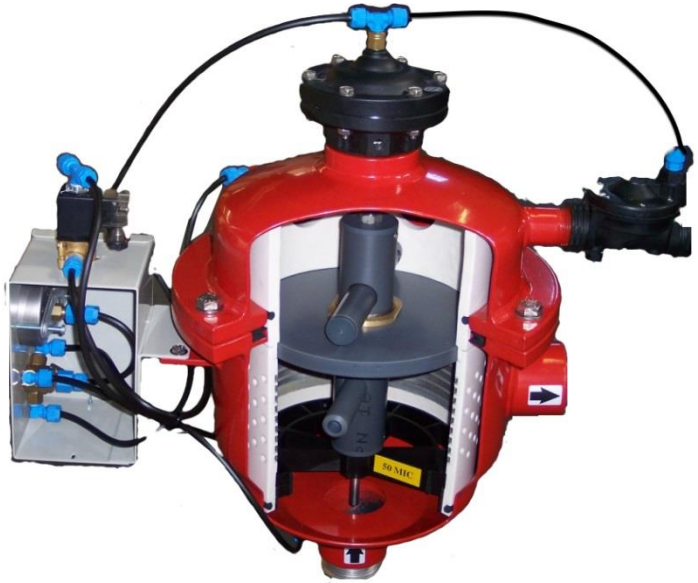
# End Use Drives Water Treatment

## Sediment filtration



**Indoor End Use Water Quality**
**<u>for Non Potable Uses</u>**
<1.1 cfu/100/ml e coli
<1 NTU turbidity
Non offensive odor
Ph and Temperature Measure and Record

- Sediment filtration can prevent damage to fixtures and irrigation equipment.
- Sediment filtration can increase the efficacy of disinfection.

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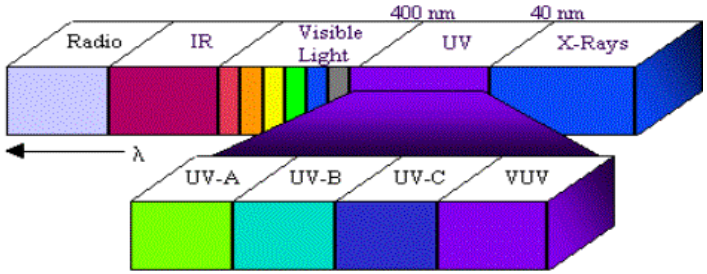
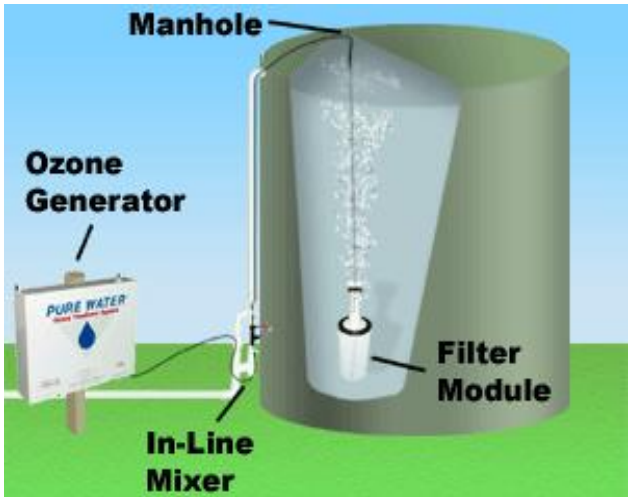
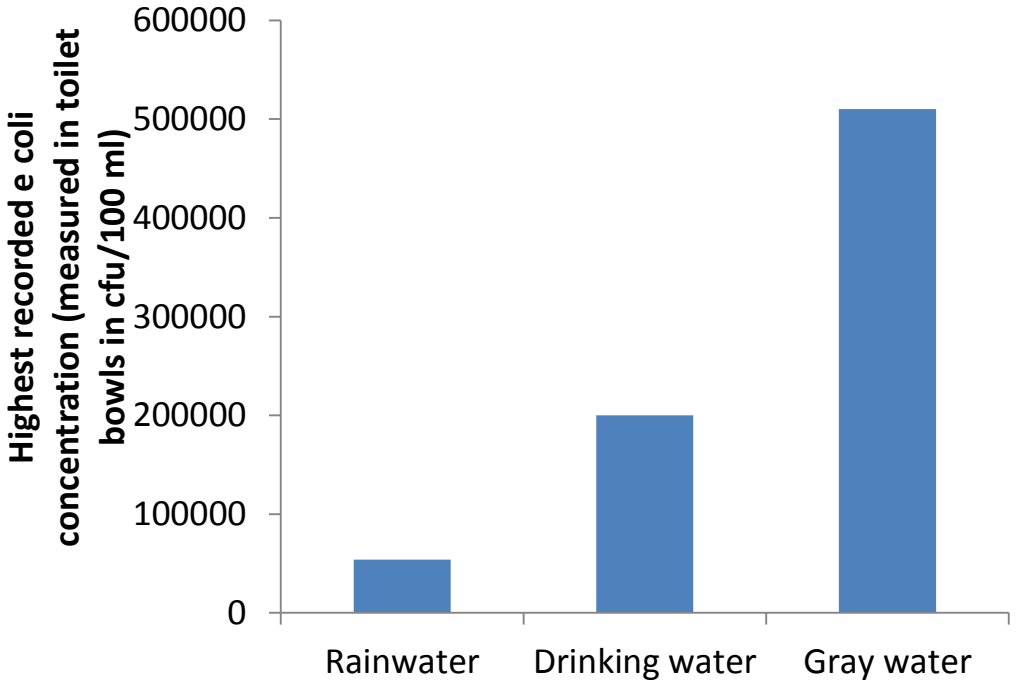
# Disinfection

- The effectiveness of disinfection depends on the quality of the water before disinfection
- Disinfection is required if water is brought indoors
- Typical disinfection options include ozone, chlorine, and ultraviolet

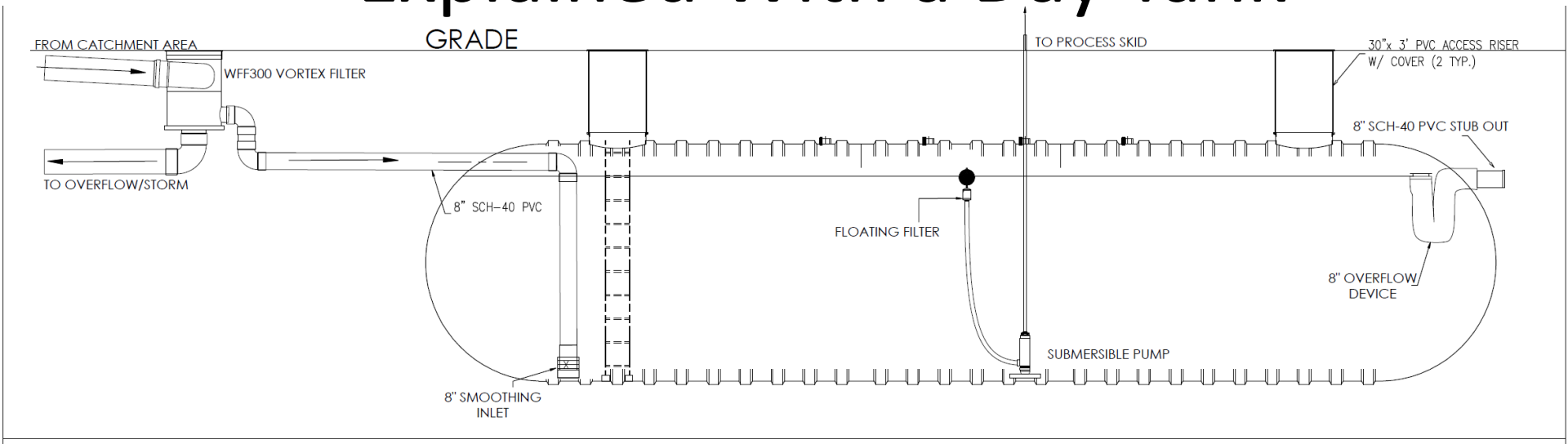


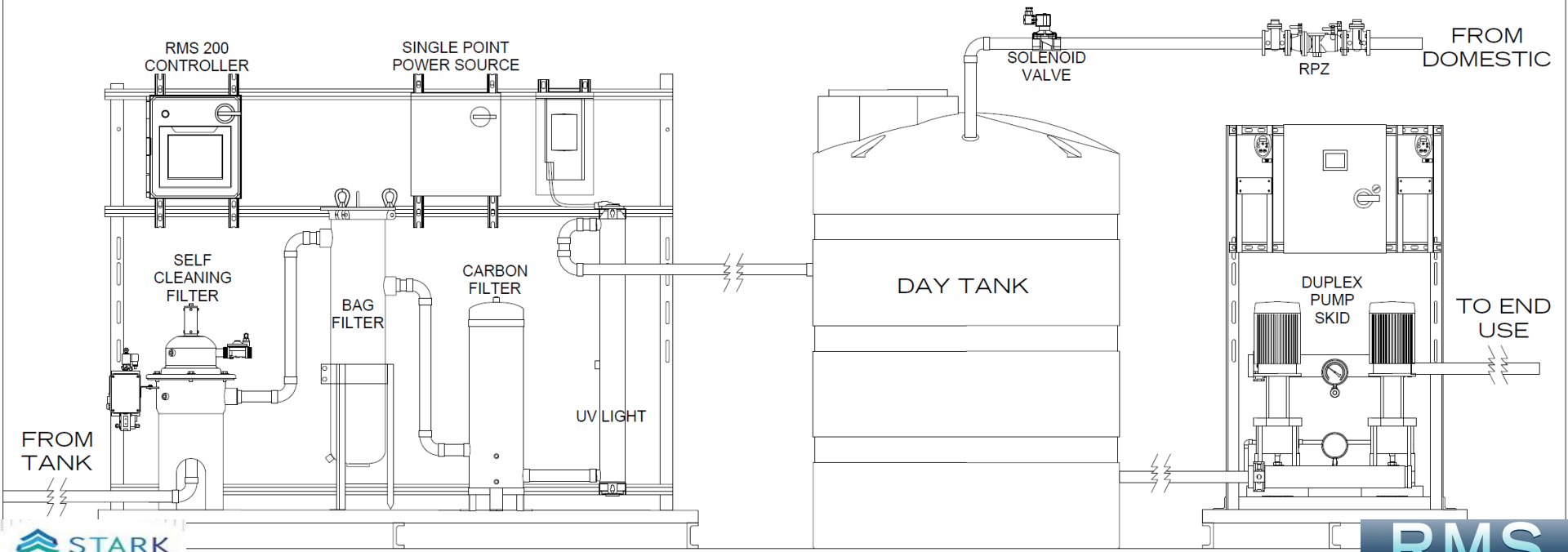




Albrechtsen 2002

# Civil and Mechanical Components Explained With a Day Tank

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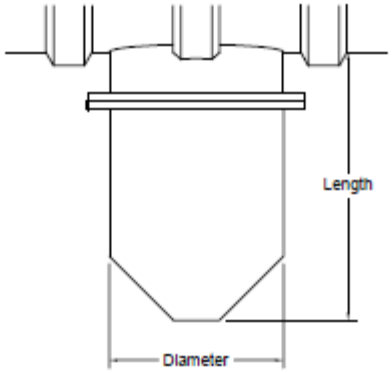
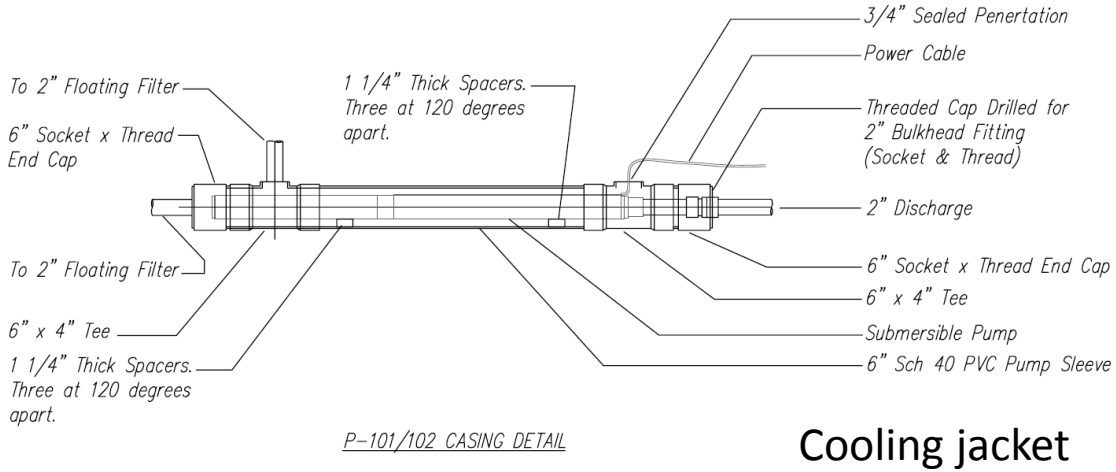
# Pump tricks




Bottom sump


VFD




Cooling jacket

Booster pump in a vault

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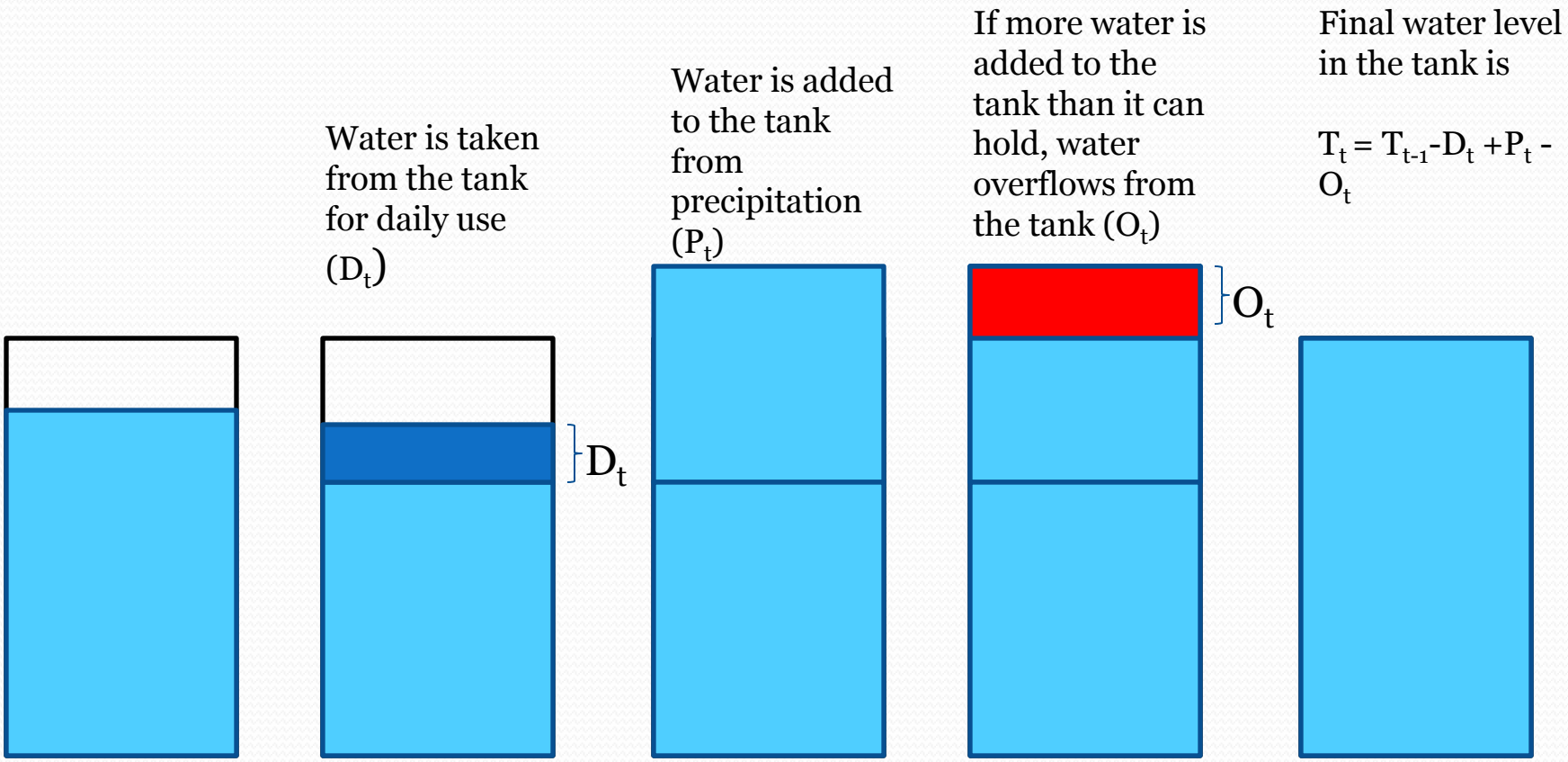
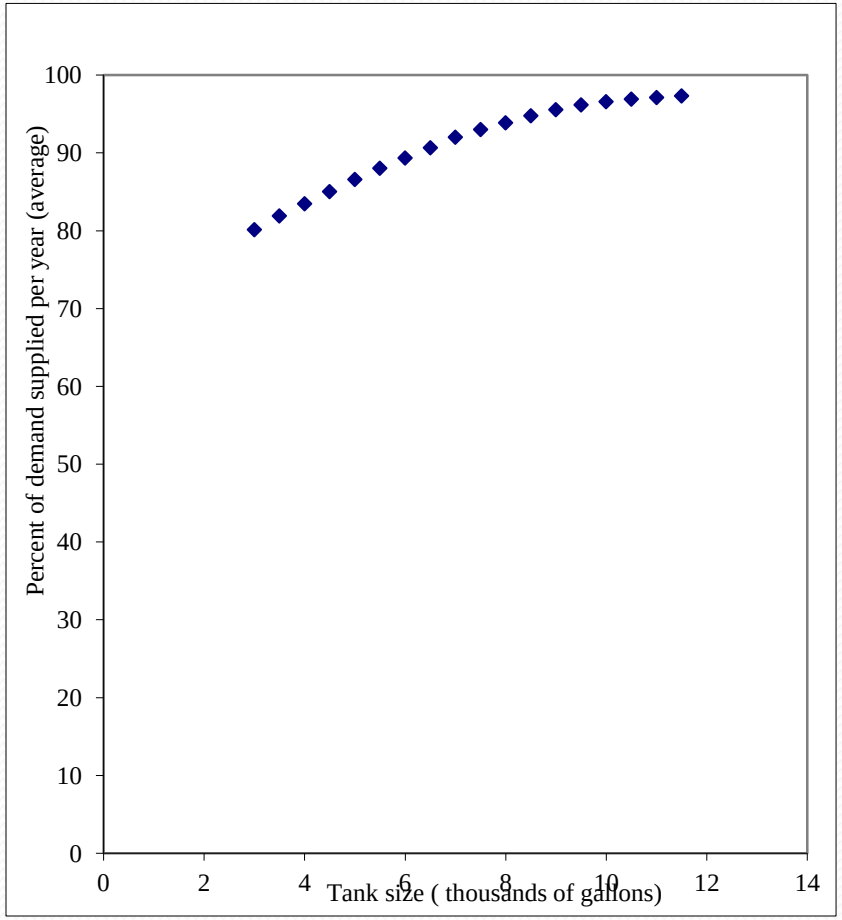
# Modeling For Water Uses And Stormwater Management Continuous Simulation Recommended



# Example Model Run
# Water Demand vs. Tank Size




| Tank size (gallons) | Overflow days (per year) | "Dry" days (per year) | Overflow volume per year (thousands of gallons) | Supplied volume per year (thousands of gallons) | % of demand met by rainwater |
|---|---|---|---|---|---|
| 3000 | 23 | 77 | 13 | 21 | 80 |
| 3500 | 22 | 71 | 12 | 22 | 82 |
| 4000 | 21 | 65 | 12 | 22 | 83 |
| 4500 | 19 | 58 | 11 | 23 | 85 |
| 5000 | 19 | 52 | 11 | 23 | 87 |
| 5500 | 19 | 47 | 10 | 24 | 88 |
| 6000 | 18 | 42 | 10 | 24 | 89 |
| 6500 | 17 | 37 | 10 | 24 | 91 |
| 7000 | 16 | 31 | 9 | 25 | 92 |
| 7500 | 16 | 27 | 9 | 25 | 93 |
| 8000 | 15 | 24 | 9 | 25 | 94 |
| 8500 | 15 | 20 | 8 | 25 | 95 |
| 9000 | 14 | 17 | 8 | 26 | 96 |
| 9500 | 14 | 15 | 8 | 26 | 96 |
| 10000 | 13 | 13 | 8 | 26 | 97 |
| 10500 | 13 | 12 | 7 | 26 | 97 |
| 11000 | 13 | 11 | 7 | 26 | 97 |
| 11500 | 13 | 10 | 7 | 26 | 97 |

Rainfall data used :Duluth, Minnesota

Water use: 73 gallons per day

Roof area used: 2500

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# Useful Outputs from Tank Sizing Model

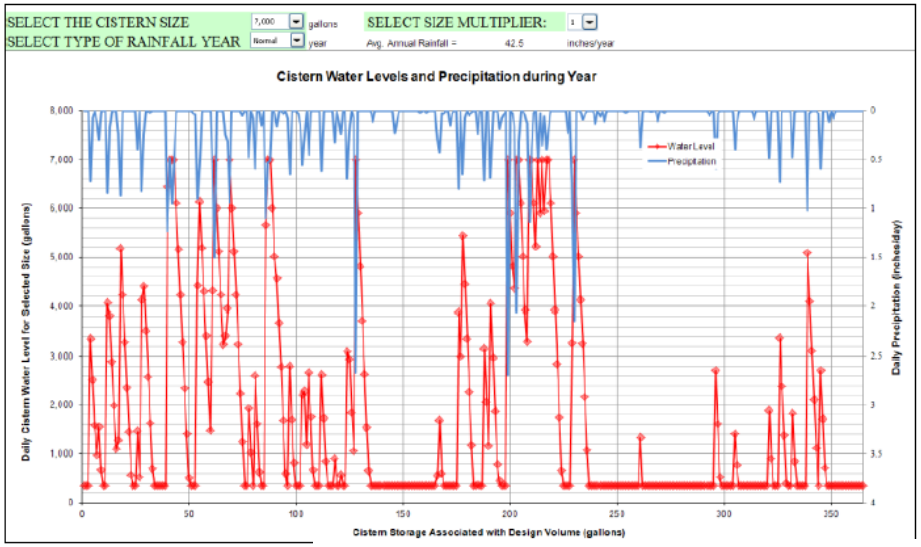
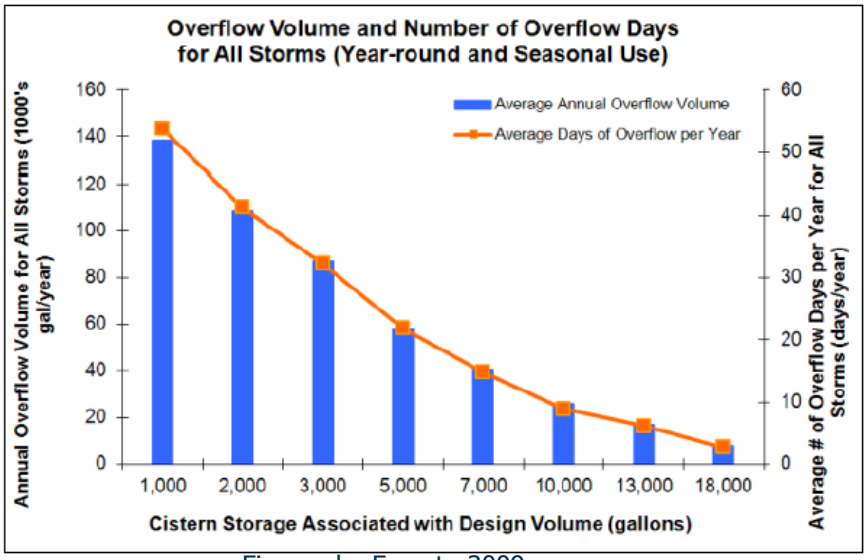



*Figure 6-B.14. 7,000 Gallon Ciste*




Figures by Foraste 2009

*Figure 6-B.10. Overflow Volume and Number of Overflow Days for all Storms and All Uses*

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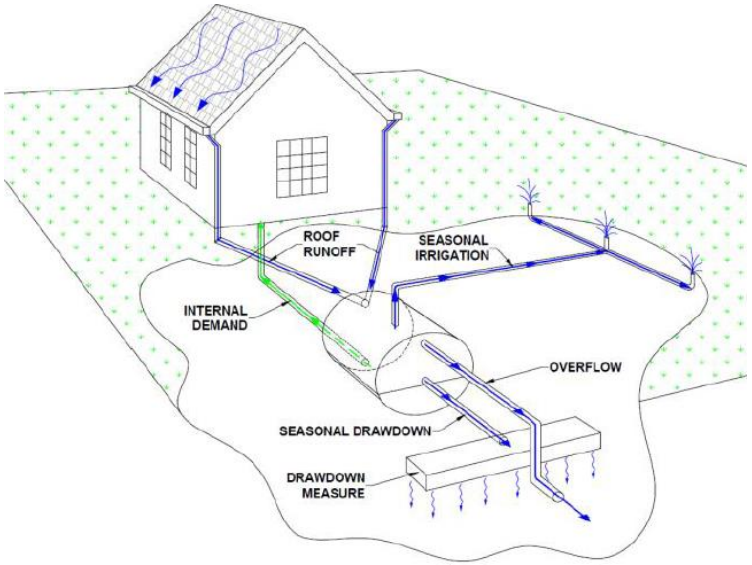
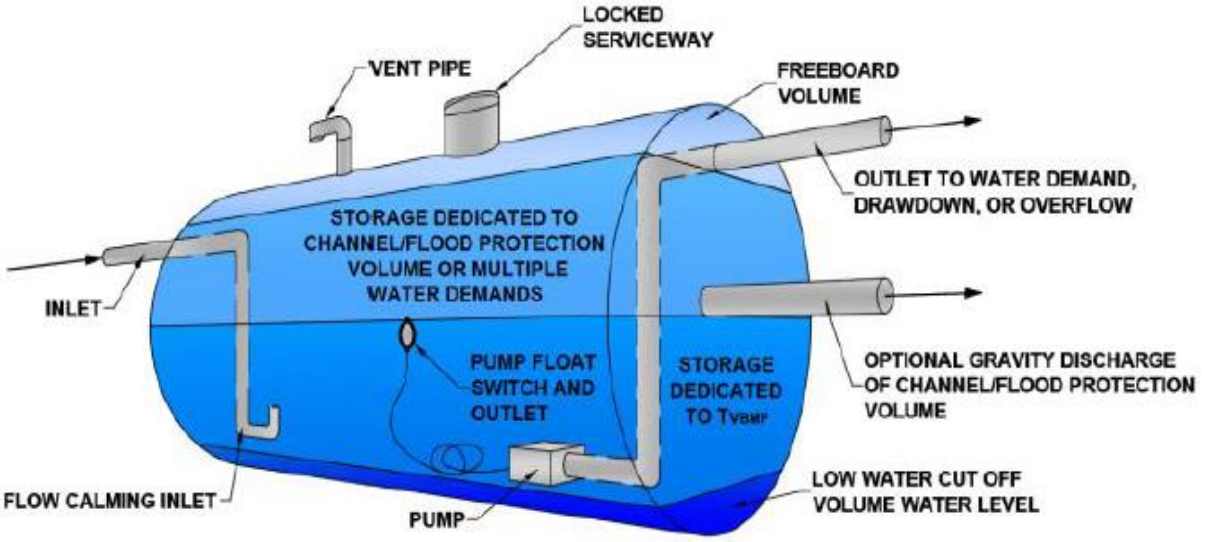
# Event Modeling and Stormwater Treatment Linking Functions




Figures by Foraste 2009

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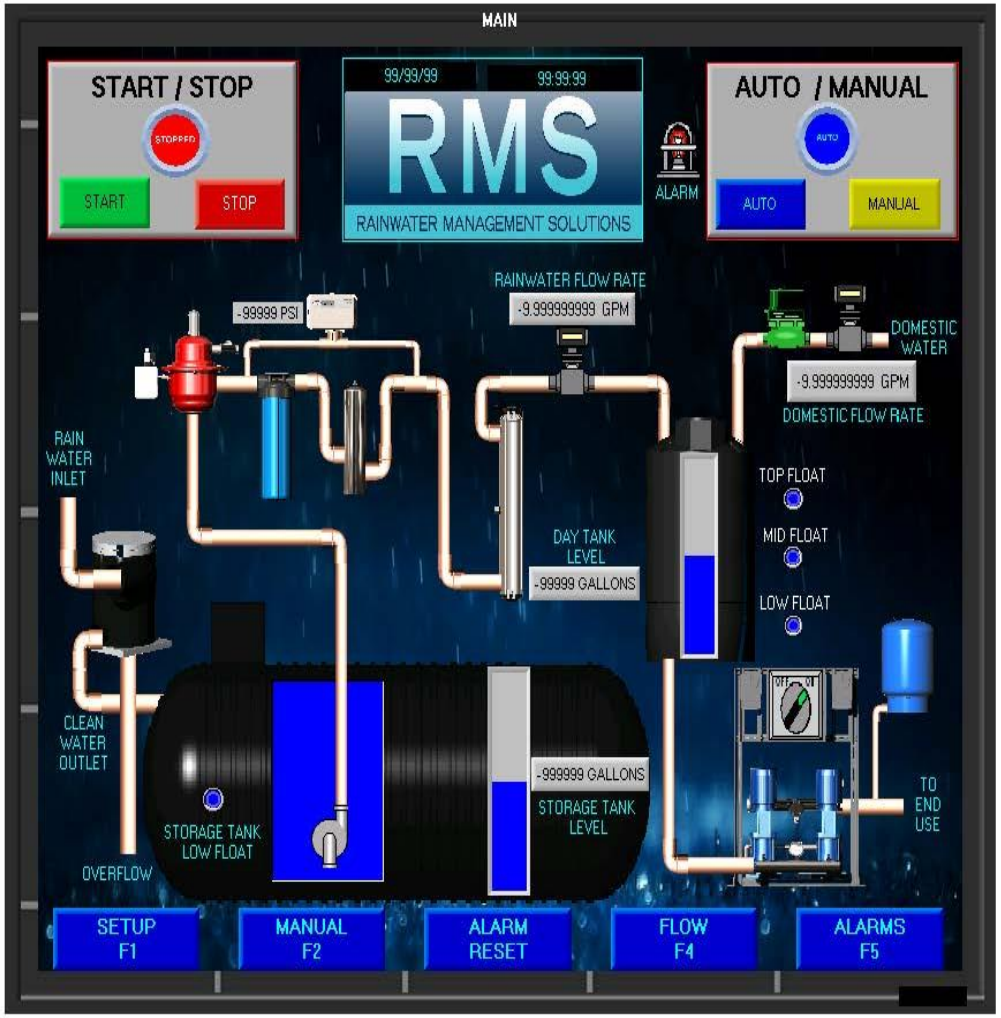
# Identify Control Options




**Typical**

- Building Automation System
- Control of Backup Supplies
- Flow and Pressure
- Domestic vs. Rainwater Use
- Alarms – Treatment Pumps
- Internet Connections
- Educational Messages
- Programmed Draw Down for Stormwater Management

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# Project Implementation Recommendations

- Use a  base system that protects in tank water quality
- Water demand must be calculated in order to accurately  optimize system size and pumping and treatment systems
- Define roles and system in a written specification
- Follow plumbing code for indoor use  (protect municipal, supplies, sizing, materials, venting etc.)
- Implement RWH as the first BMP in the stormwater treatment train
- Bring all disciplines together early in your planning process
- Include commissioning, monitoring and maintenance plans
- Normal maintenance includes filter changes, backflow/cross connection testing and water quality testing.

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# Thank You!!

## Q&A after Deborah's presentation

## And

## During the Tours of the Stadium System

**System Supplier for St. Paul Saints Baseball Stadium**
**Stark Rainwater Harvesting**
**218-428-4413**
**dave@starkllc.com**
**www.rainwatermanagement.com**

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# Recommendations to Advance Alternative Source Use and Re-Use in Minnesota

- Education For All – Suppliers, plumbers, engineers, landscape architects, architects
- Workshops - U of M, ARCSA, ASSE
- Collaboration - Design charrettes, LBC teams, Stormwater
- Partner – Suppliers, mechanical/civil engineers, plumbers, landscape architects, irrigation professionals
- Modeling -Continue work on MN Specific Sizing Models
- Task Force – Include ARCSA and Industry Partners
- Database – Build databases of water quality
- Adopt standards for greywater and other alternative source approaches

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Figures by Foraste 2009

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