Minnesota Water Reuse Workshop

Project Planning and Implementation of Rainwater Harvesting Projects

Presented by:
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Regional Representative for ARCSA and RMS
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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
Rainwater System Planning

End uses (Variable daily uses)

Supply

Demand

Code

Budget

Stormwater Regulations (Event Based)
Pre-tank filtration

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

Composition of gross pollutants by mass
Source: Cooperative Research Center for Catchment Hydrology in Australia
Sample pre-tank filter section and function view

- Filter
- Rainwater from all groundpipes
- Filtered water
- Rinsing water with particulate
Base Design Protects In Tank Water Quality

Water Treatment to Meet End Use Standards

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

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
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.
End Use Drives Water Treatment

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

Indoor End Use Water Quality for Non Potable Uses
<1.1 cfu/100/ml e coli
<1 NTU turbidity
Non offensive odor
Ph and Temperature Measure and Record
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
Civil and Mechanical Components Explained With a Day Tank

FROM CATCHMENT AREA

GRADE

TO OVERFLOW/STORM

WFF300 VORTEX FILTER

8" SCH-40 PVC

8" SMOOTHING INLET

FLOATING FILTER

8" SCH-40 PVC STUB OUT

8" OVERFLOW DEVICE

30" 3" PVC ACCESS RISER W/ COVER (2 TYP.)

TO PROCESS SKID

SUBMERSIBLE PUMP

RMS 200 CONTROLLER

SINGLE POINT POWER SOURCE

SELF CLEANING FILTER

BAG FILTER

CARBON FILTER

UV LIGHT

DAY TANK

FROM TANK

SOLENOID VALVE

RPZ

FROM DOMESTIC

TO END USE

DUPLEX PUMP SKID
Pump tricks

Bottom sump

VFD

Cooling jacket

Booster pump in a vault

3/4" Sealed Penetration
Power Cable
Threaded Cap Drilled for 2" Bulkhead Fitting (Socket & Thread)
2" Discharge
6" Socket x Thread End Cap
6" x 4" Tee
Submersible Pump
6" Sch 40 PVC Pump Sleeve

To 2" Floating Filter
6" Socket x Thread End Cap

1 1/4" Thick Spacers. Three at 120 degrees apart.

6" x 4" Tee
1 1/4" Thick Spacers. Three at 120 degrees apart.
Water is added to the tank from precipitation ($P_t$)

Water is taken from the tank for daily use ($D_t$)

If more water is added to the tank than it can hold, water overflows from the tank ($O_t$)

Final water level in the tank is

$$T_t = T_{t-1} - D_t + P_t - O_t$$
### Example Model Run

**Water Demand vs. Tank Size**

![Graph showing the relationship between tank size and percent of demand supplied per year.](image)

<table>
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<th>Tank size (gallons)</th>
<th>Overflow days (per year)</th>
<th>&quot;Dry&quot; days (per year)</th>
<th>Overflow volume per year (thousands of gallons)</th>
<th>Supplied volume per year (thousands of gallons)</th>
<th>% of demand met by rainwater</th>
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Rainfall data used: Duluth, Minnesota

Water use: 73 gallons per day

Roof area used: 2500
Useful Outputs from Tank Sizing Model

Figure 6-B.14. 7,000 Gallon Cistern

Figure 6-B.10. Overflow Volume and Number of Overflow Days for all Storms and All Uses
Event Modeling and Stormwater Treatment
Linking Functions

Figures by Foraste 2009
Identify Control Options

- 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
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.
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
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

Figures by Foraste 2009