On-Farm Water
How much and from where?

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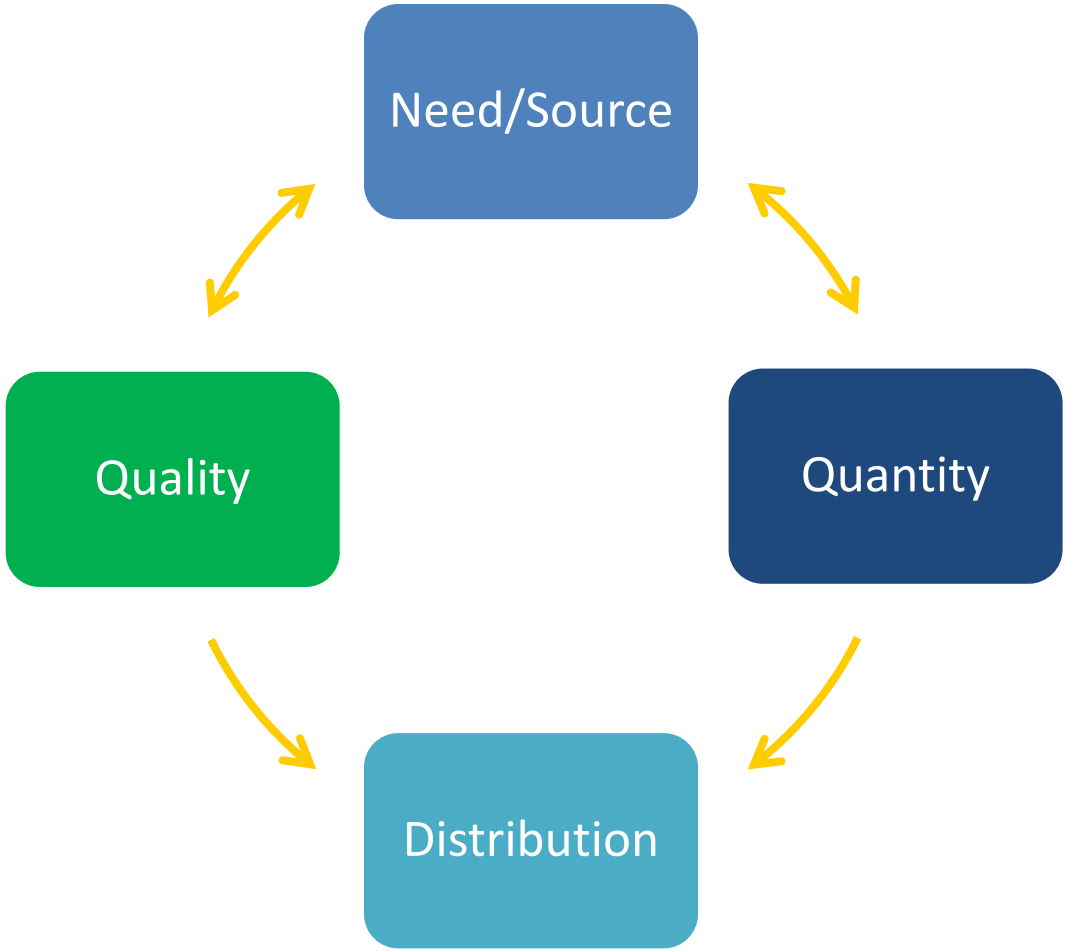
Total Water System Overview



No direct path from need/source to distribution.

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Total Water System Overview

Water Need and Source

What is the quantity and quality of water by use and where are possible sources?

Water Quantity

- Supply sizing
- Daily use requirement
- Peak demand determination

Water Quality

Does water quality from the available source meet the need? If not, water treatment?

Water Distribution

- Pipe and pump system design
- Intermediate water storage
- Water treatment incorporation

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Water Need

- Daily water need for dairy herd, equipment cleaning and cooling
- Estimate peak water demand and simultaneous use
  - Water flow rate for drinking water
  - Water flow rate for washing equipment, parlor, etc.
  - Water flow rate for sprinkler cooling
- Water desired for pasture irrigation

Primary Water Uses and Quantities for Dairy Operations

	Drinking Water (gallons/head/day)	Supplemental Cooling Water (gallons/head/day)	Parlor Wash Water (gallons/cow/day)
Calves	6 to 10		
Heifers	10 to 15		
Dry Cows	20 to 30	8 to 12	
Milk Cows	35 to 50	10 to 15	10 to 50

Irrigation Water – about 27,154 gallons per acre-inch of water {acre-inch = 1 inch of water applied on 1 acre of pasture}

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Table 1. Estimated daily water consumption for a 1,500-pound lactating cow producing 40 to 100 pounds of milk daily[a].

Milk Production (lbs/day)	*Estimated DM Intake (lbs/day)*	*Weekly Mean Minimum Temperature[b]*				
		40°F	*50°F*	*60°F*	*70°F*	*80°F*
		gallons per day[c]				
40	42	18.4	20.2	22.0	23.7	25.5
60	48	21.8	23.5	25.3	27.1	28.9
80	54	25.1	26.9	28.7	30.4	32.2
100	60	28.5	30.3	32.1	33.8	35.6

[a] Sodium intake = 0.18% of DM intake.
[b] Mean minimum temperature is typically 10 to 15∝F lower than the mean daytime temperature
[c] 1 gallon of water weighs 8.32 pounds.

From: “Water for Dairy Cattle” Oklahoma Cooperative Extension Service, ANSI-4275

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Water Conservation Opportunities

- Appropriate management of sprinkler cooling system or evaporative pad system
- Reuse water in milking center
  - Capture and store equipment wash water for parlor cow platform washing
  - Plate cooler water can be used for drinking water or parlor cow platform wash water

Water Quality

- What is the quality of water required for the use?
- What is the water quality available from the water source?
- Does the quality of the source exceed the quality of the need?
- If not, can a different source with higher quality be located or is water treatment required?

Water Quantity - General

- Estimate daily water need based on use values
- Estimate peak water need based on use values and behavior of animals
  - Single animal water drinking rate – 5 to 6 gpm per cow
  - Number of animals drinking at one time
  - Additional water uses when animals are drinking
  - Irrigation water demand

Potential Water Sources

- Ground water accessed by using well
- Surface water impoundment
- Streams and rivers
- Public water

- Water Use Law at Farm Location
  - Riparian Law (Water on site can be used)
  - Use Law (Must obtain ‘permission’ to use water)

Water Source - Wells

- Determine if well can deliver daily demand
- If daily demand not met, additional wells or water sources must be located or size of operation downsized.
- Can well supply peak water use demand?
- If peak demand not met, intermediate water storage and booster pump is required.

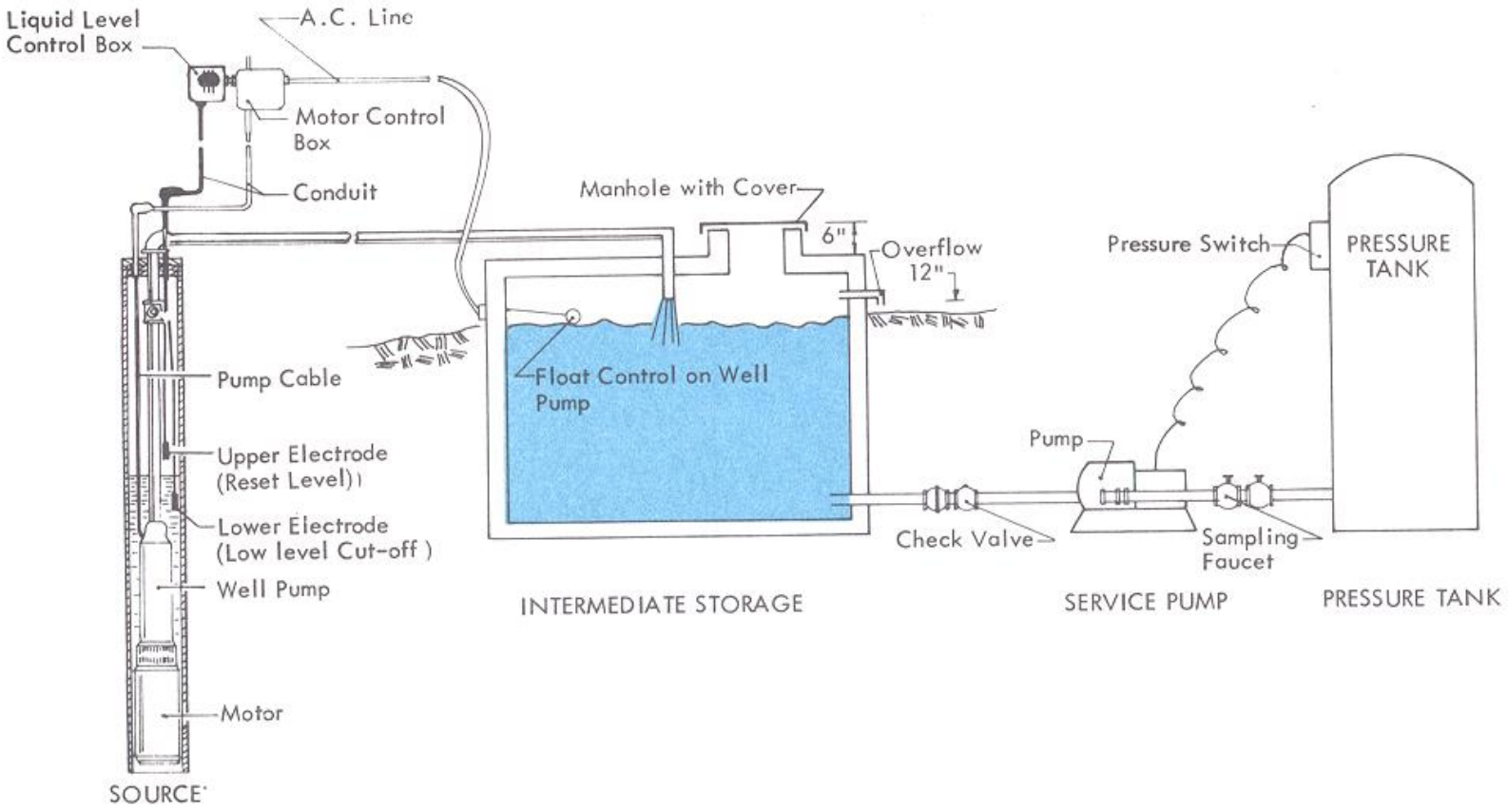
Well System Capacity

- Well system capacity needs to be large enough to supply daily water need in 10 to 12 hours. Some designers assume 5 to 8 hours to supply daily need.
- Maximum pump size needs to be slightly smaller than maximum well yield capability.
- Can a well system be constructed to meet water need for location?

Well Water Delivery

- If well can supply peak water need, pump in well supplies water to operation.
- If well can deliver daily need but not meet peak demand, then an intermediate water storage system needs to be designed and installed.
- If well system can not provide daily need, re-evaluate operation's goals or find additional water supply capability.

Intermediate Storage



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Water Source - Impoundments

- Size pump and pipe system to supply peak demand.
- Water impoundment should be large enough to store at least one year and better - two year water supply.
- Ensure enough watershed area draining runoff is large enough to refill impoundment within a normal year.
- Are other surface water sources needed to refill impoundment?

Estimating Surface Water Storage Requirements in Missouri

1. Estimate daily water usage in gallons per day
2. Annual estimated water usage = Step 1 * 365
3. Annual acre-feet usage = Step 2 divided by 325,828.8
4. For two year supply – multiply step 3 by 4 (2 year supply and 50% loss)
5. Estimate watershed area – multiply step 4 by 2.4 to get watershed area to refill pond in one average year

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Water Source – Rivers & Streams In Missouri or Riparian Water Locations

- Ensure that you have ownership of land connected to the water source where pump to be located
- Estimate volume of water to be pumped each year
- Consider pumping to an intermediate storage impoundment – especially for low flow sources
- Best to use a floating intake (minimize stream bank and channel impacts)
- Do not adversely impact a downstream owner or downstream fish habitat

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Water Source – Public Supplies

- Do not assume water for dairy operation can come from public water system. Experience has indicated any one of the following responses can be given to a prospective dairy operation
  1. Connect and use as much as desired (not typical)
  2. Connect and use a limited amount or for emergency purposes only (typical response)
  3. Do not connect. (a more common response for systems having trouble meeting current demand for water).

Water Distribution System

- Know water supply capability and location
- Know water flow rate – both daily and peak
- Know if water treatment required

- Once all above are known, a water distribution system can be designed

QUESTIONS?

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