No-Drill Options for Effective Heat Transfer

Stephen Hamstra, P.E.
GreyEdge Group

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No Drill Options (?) for Effective Heat Transfer

the GreyEdge group

NY-GEO New York Geothermal Energy Organization

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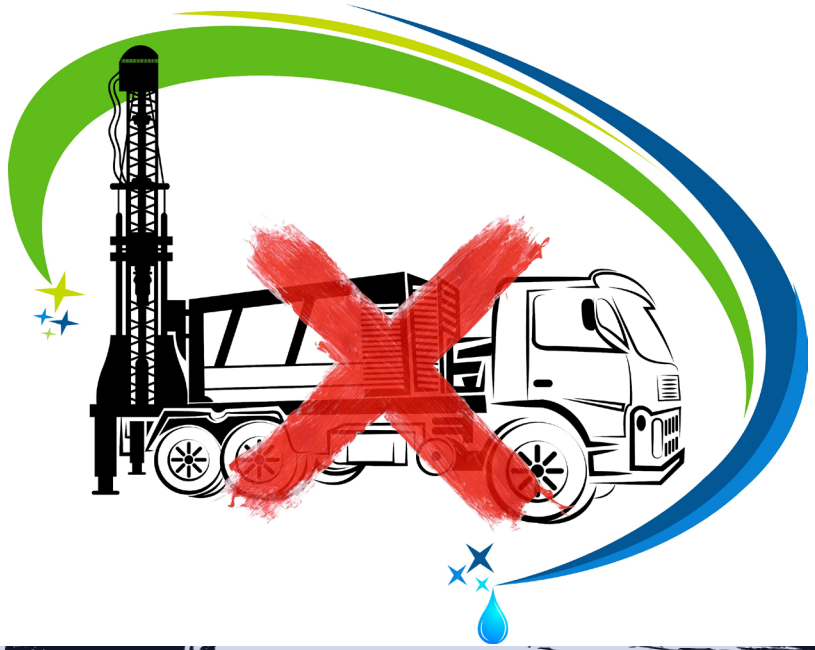


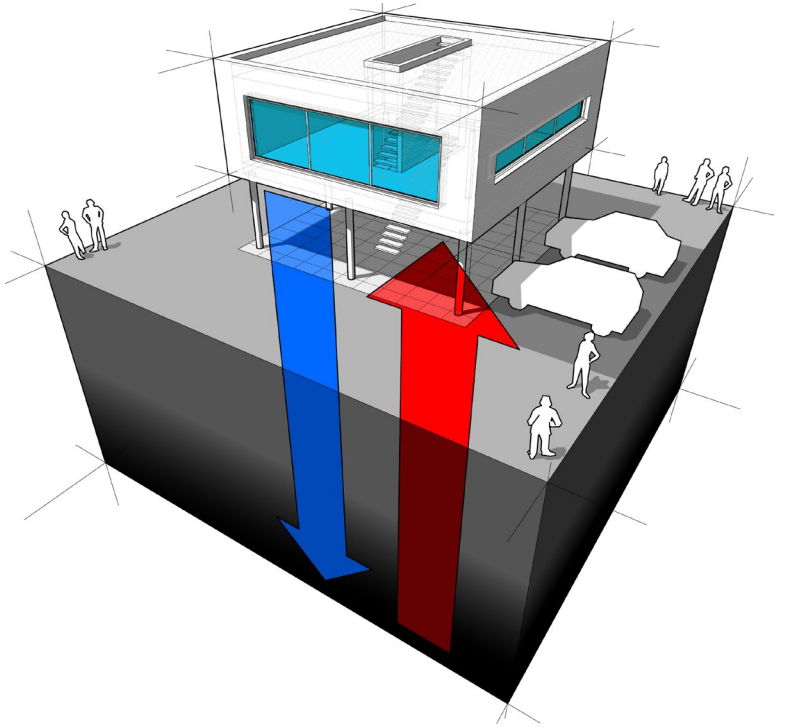
About the Presenter

Stephen Hamstra is a recognized industry thought leader with decades of experience in the design and application of ground-source heat pump systems, thermal energy storage systems, and the integration of high-performance building concepts into functional, existing spaces.

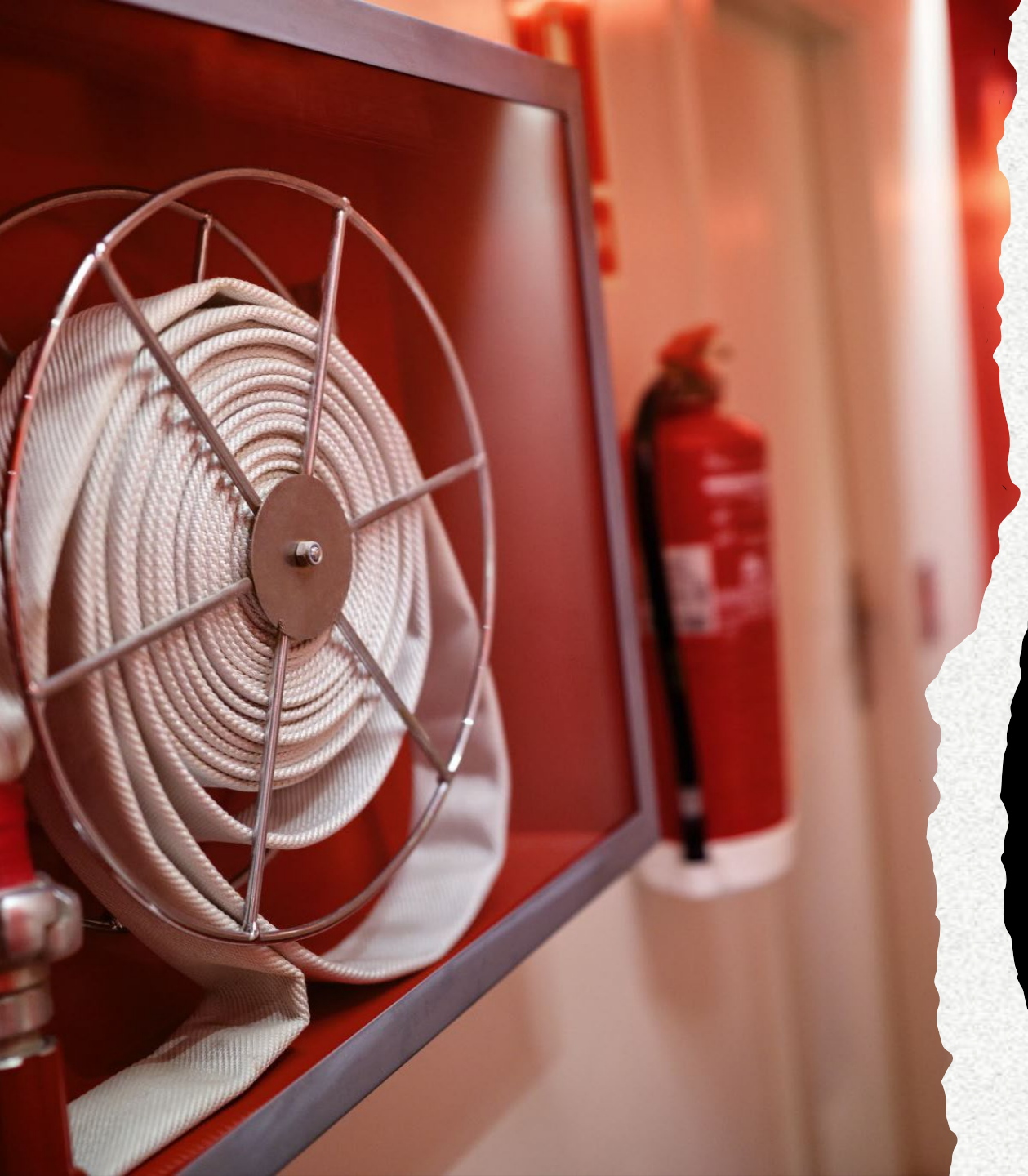
Mr. Hamstra is a registered Professional Engineer, an AEE Fellow, a Certified GeoExchange Designer, and an ASHRAE High-Performance Building Design Professional. He is the Past Chair of ASHRAE TC 6.8–Geothermal Heat Pumps and Energy Recovery Applications, and honored recipient of the 2014 ASHRAE Global Energy Efficiency Award. Mr. Hamstra is a frequent conference speaker and author of numerous published ASHRAE Journal articles.

Objectives

1. Identify alternative heat source/sink options when vertical or horizontal closed loops may not be the best option.
2. Discuss the advantages and disadvantages of the various heat transfer options.
3. Discuss the different types of equipment or systems needed to access alternative heat sources and sinks.
4. Stimulate “alternative” thoughts on providing solutions:



“If all you have is a hammer, everything looks like a nail.”

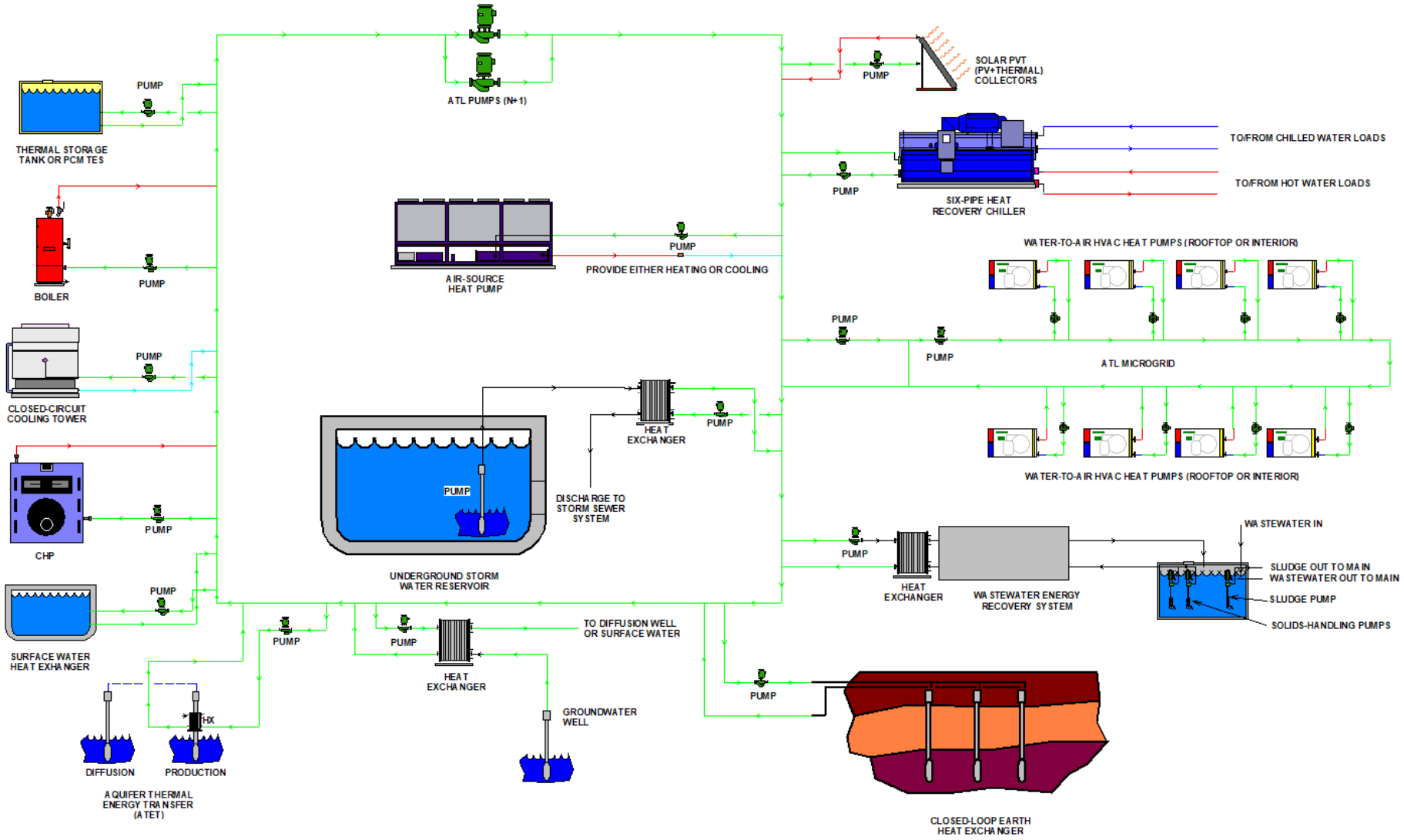


No-Drill Options?

- Air-Source Heat Pumps
- Wastewater Energy Transfer (WET)
  - Central Plant
  - Building Level
  - Collection Network
  - Appliance Level
- Storm Water
- Surface Water
  - Convection & Current-driven
  - Advection Driven
- Potable water
- Irrigation water
- Thermal Energy Storage

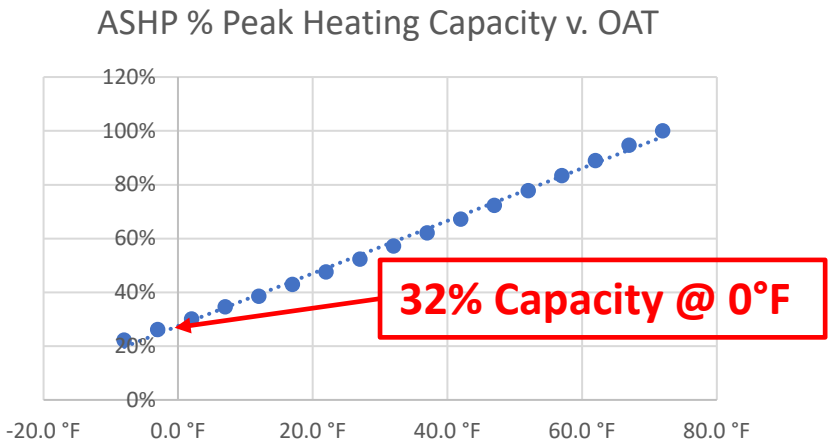
AMBIENT TEMPERATURE LOOPS
THERMAL SOURCES/SINKS

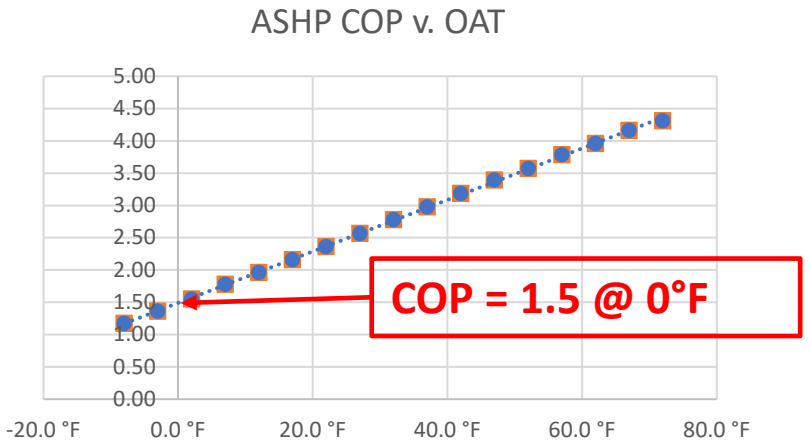
AMBIENT TEMPERATURE LOOPS THERMAL SOURCES/SINKS

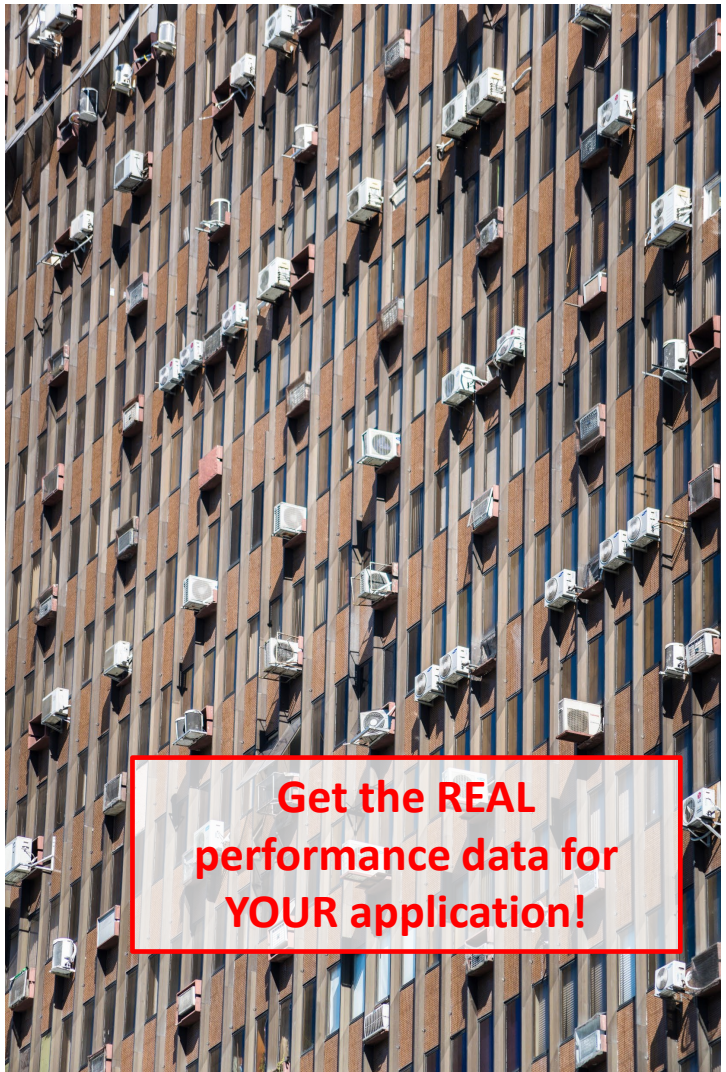


AIR-SOURCE HEAT PUMPS

AIR-SOURCE HEAT PUMPS
BE SMART!







AIR-SOURCE HEAT PUMPS
BE SMART!

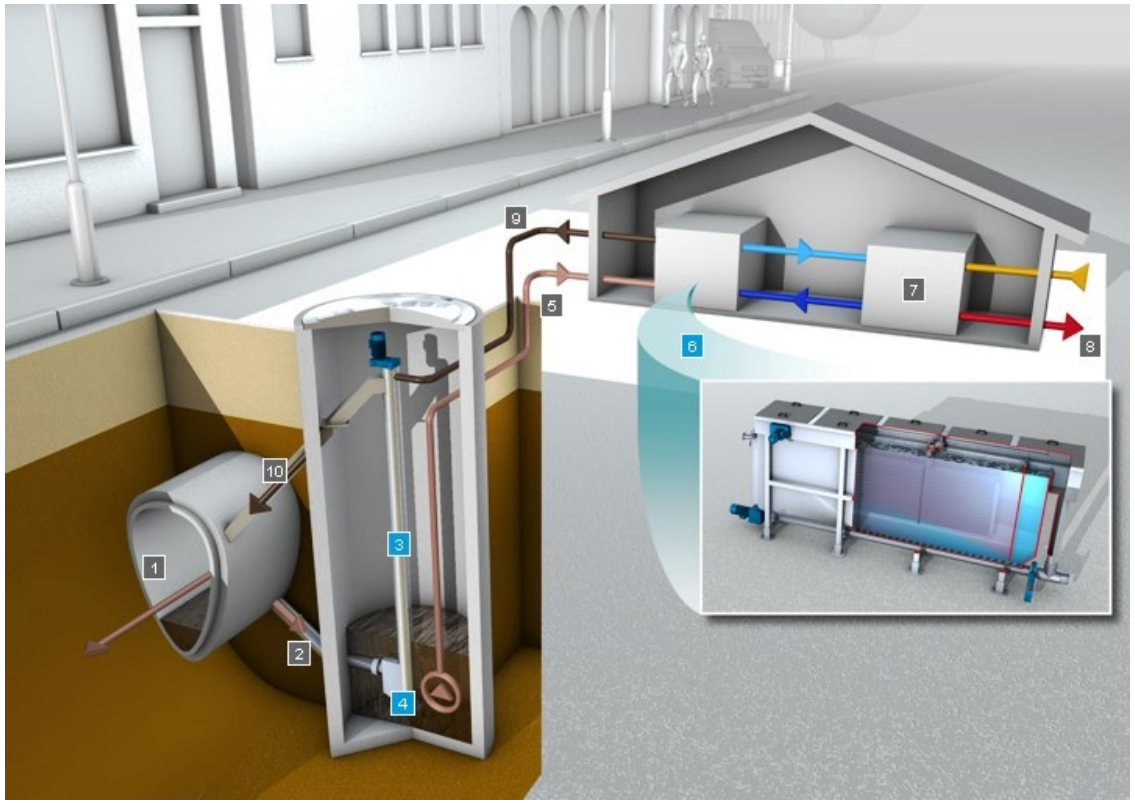
If we are using Air Source Heat Pumps:

1. Consider your heating capacity at low outside air temperatures – do you 3x the size?
2. At low temperatures, the electrical consumption is high – can your electric service (and the grid) handle it?
3. What about snow drifts and defrost cycles?
4. What about a shorter anticipated life?
    - ASHRAE: 15 years ASHP v 24+ years WSHP or GSHP

Image courtesy of Steven Winter Associates, Inc.

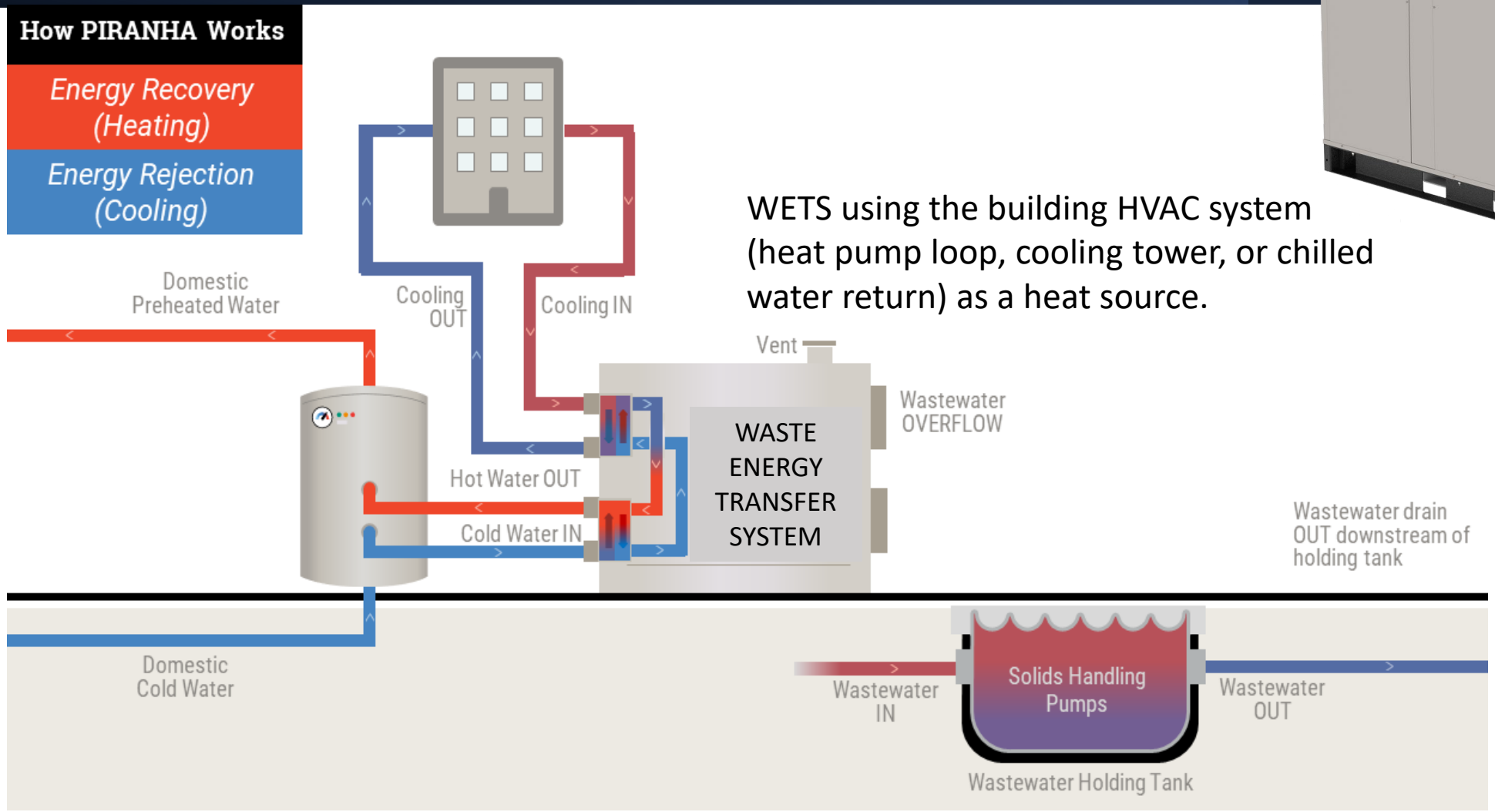

WASTEWATER ENERGY TRANSFER

WASTEWATER ENERGY TRANSFER (WET): CENTRAL PLANT



Images courtesy of SHARC Energy and Huber

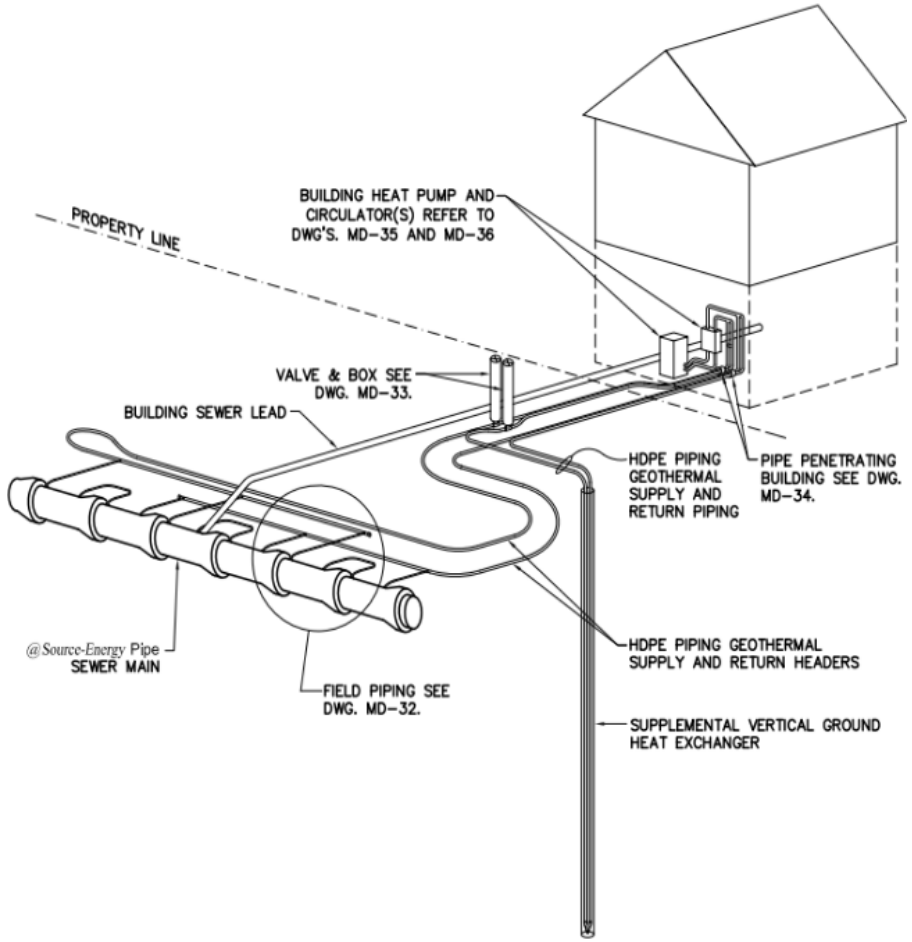
WASTEWATER ENERGY TRANSFER (WET): BUILDING LEVEL

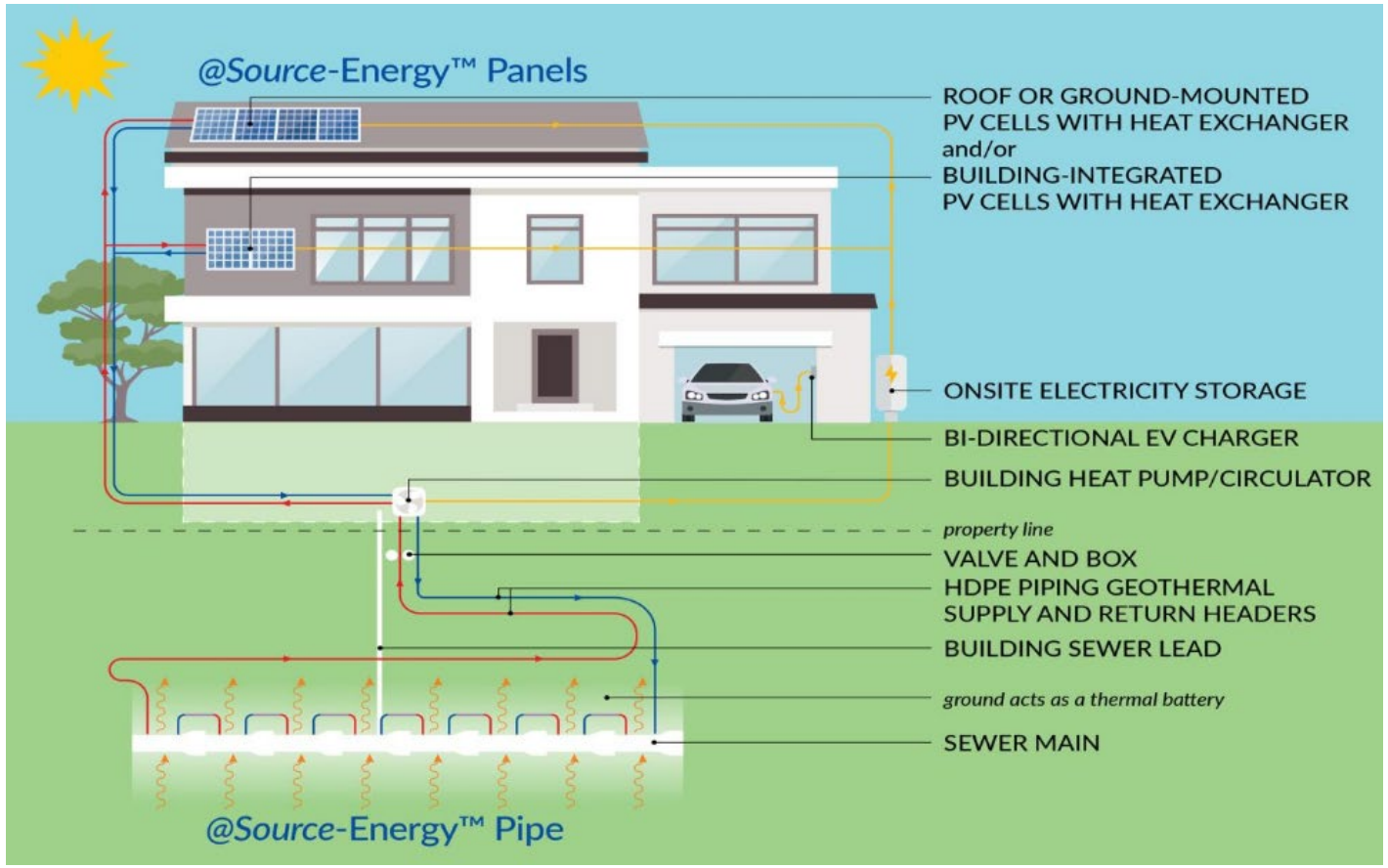


WETS using the building HVAC system (heat pump loop, cooling tower, or chilled water return) as a heat source.

Graphic and image from SHARC Energy

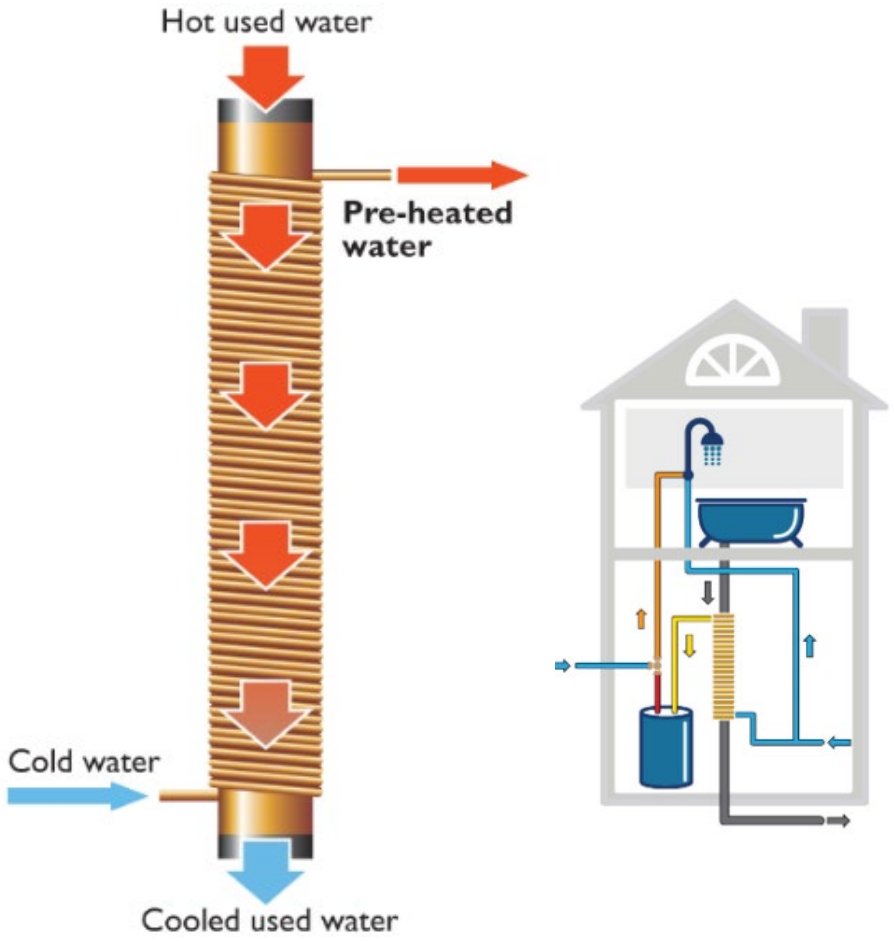
WASTEWATER ENERGY TRANSFER (WET): COLLECTION NETWORK

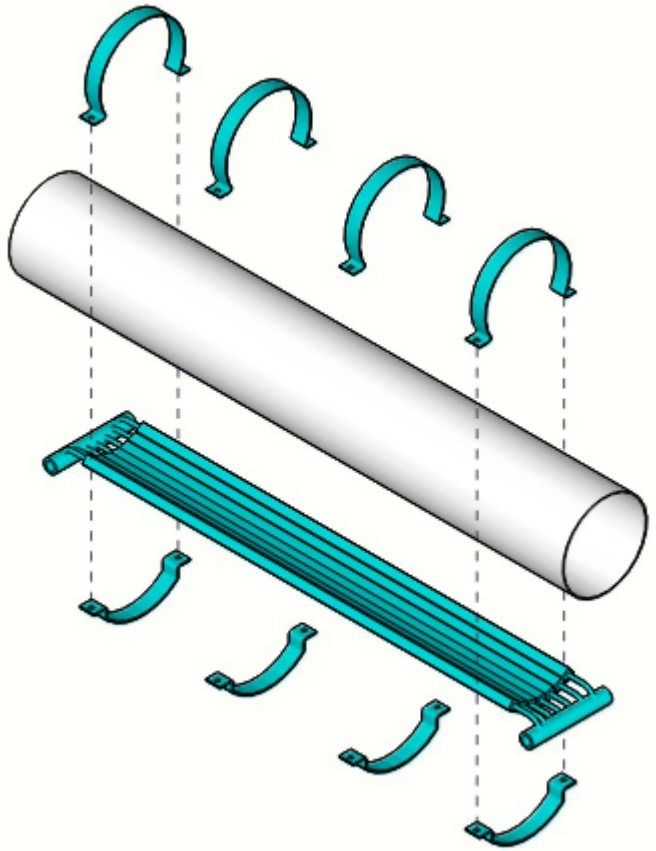




Images provided by @Source-Energy.

WASTEWATER ENERGY TRANSFER (WET): APPLIANCE LEVEL





This horizontal HX can clamp onto pipe 3” to 12” in diameter.

Maybe incorporate a second HX into a heat pump loop?

1st HX – preheat DHW

2nd HX – provide additional heat to the heat pump loop

Images provided by EcoInnovation Technologies and Ecodrain.

STORMWATER ENERGY TRANSFER

STORM WATER

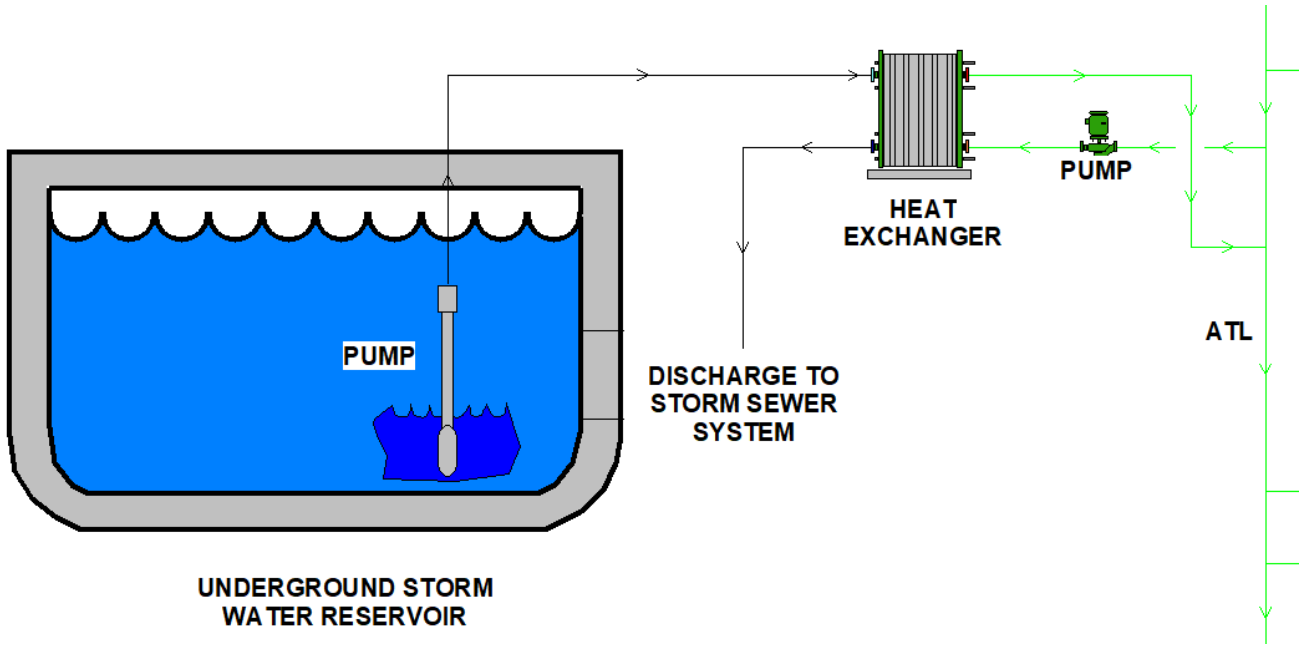


Image on left was provided by Uponor.


SURFACE WATER ENERGY TRANSFER

SURFACE WATER ENERGY TRANSFER (Convection and Current)

Images provided by Aweb Supply and Major Geothermal.

SURFACE WATER ENERGY TRANSFER (Advection or forced flow)

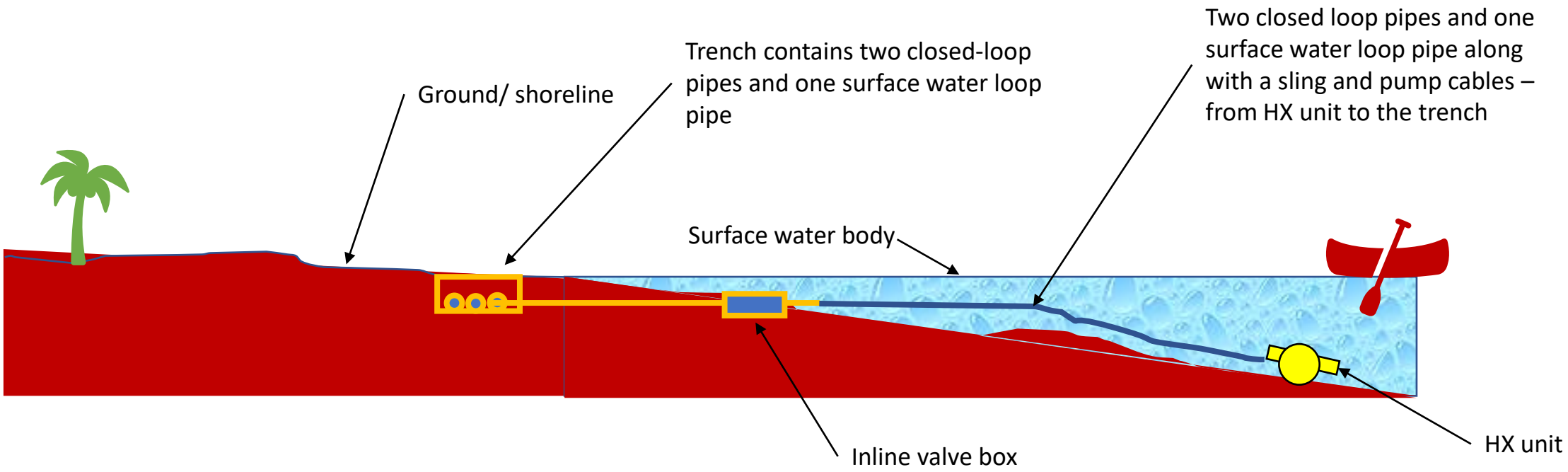
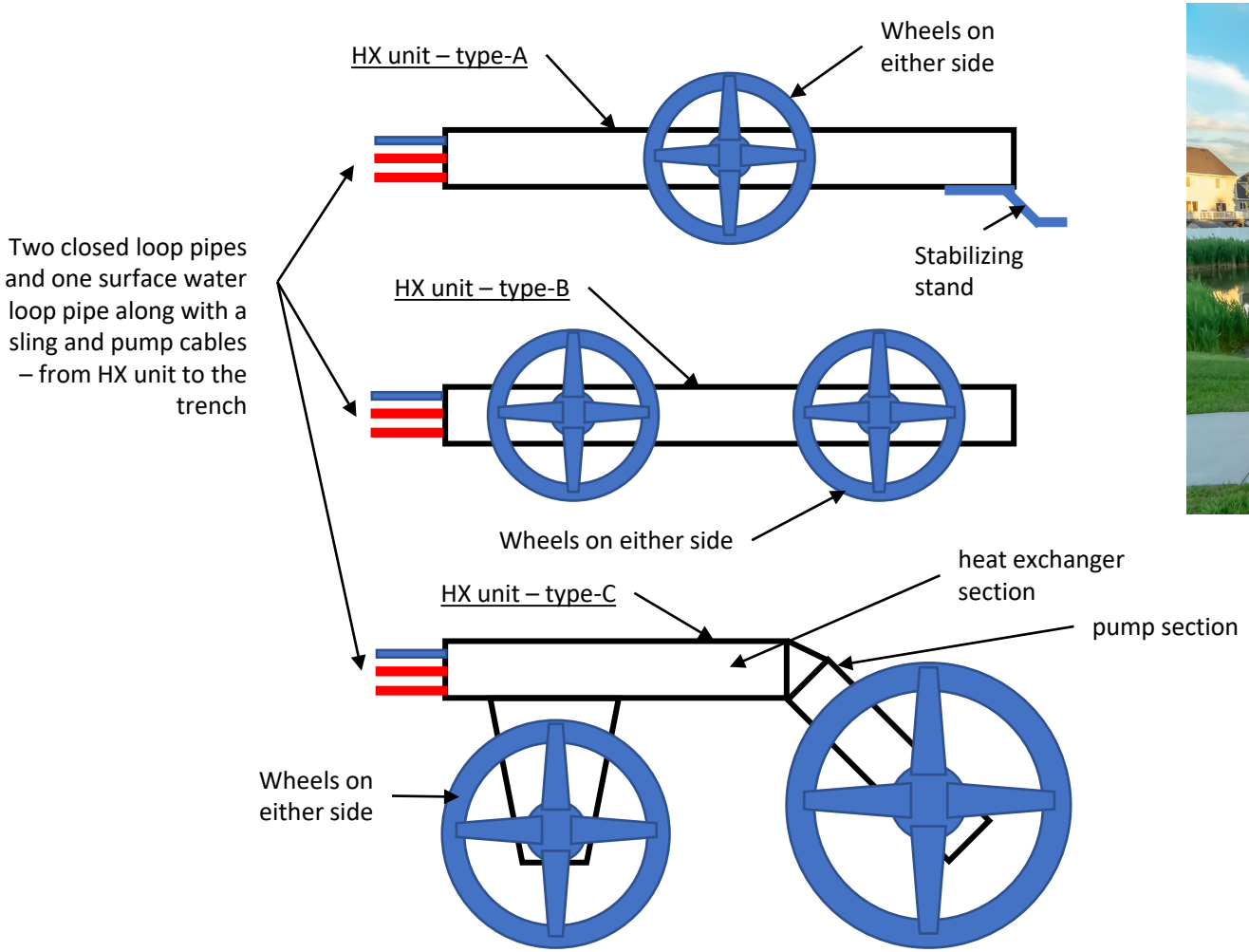


Image provided by Genesys NZE.

SURFACE WATER ENERGY TRANSFER (Advection or forced flow)



HX images provided by Genesys NZE.


POTABLE WATER ENERGY TRANSFER

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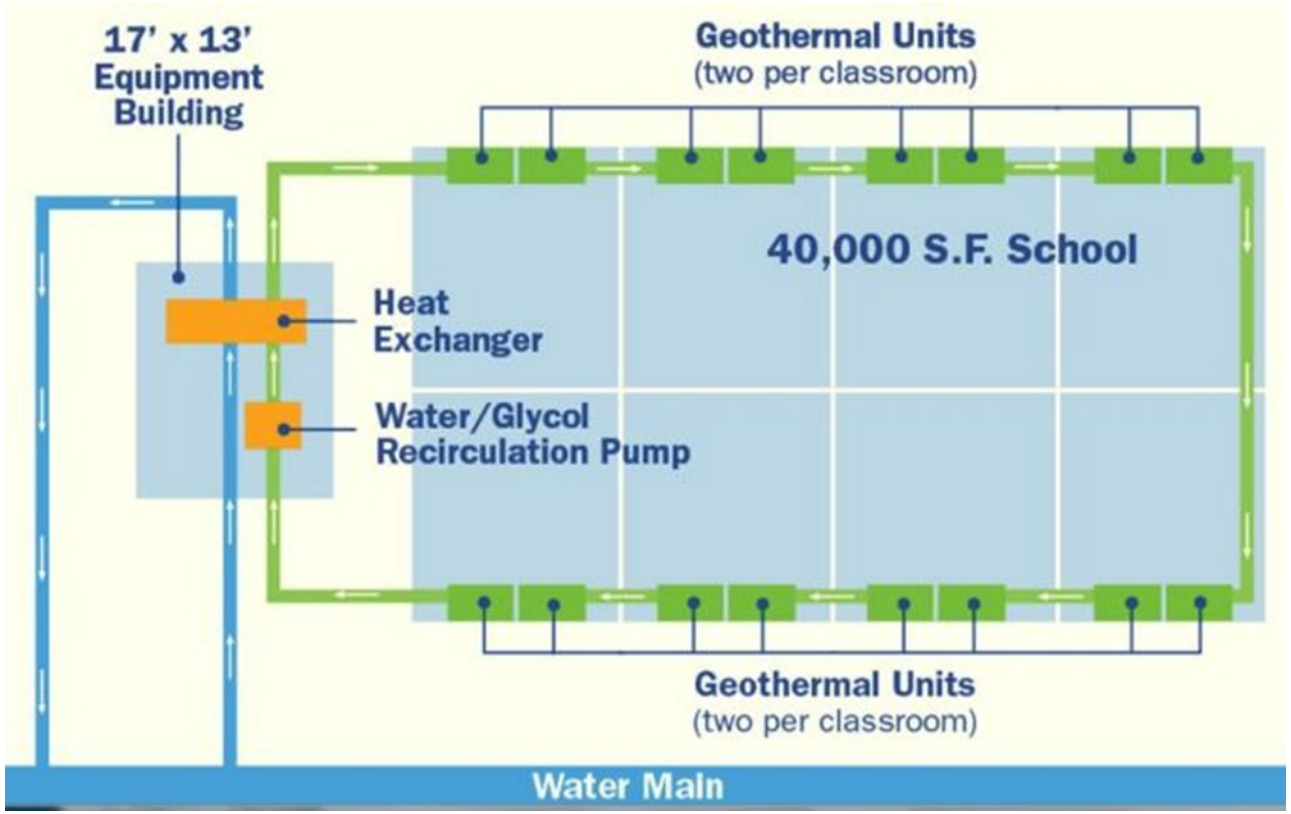


William L. Buck Elementary School

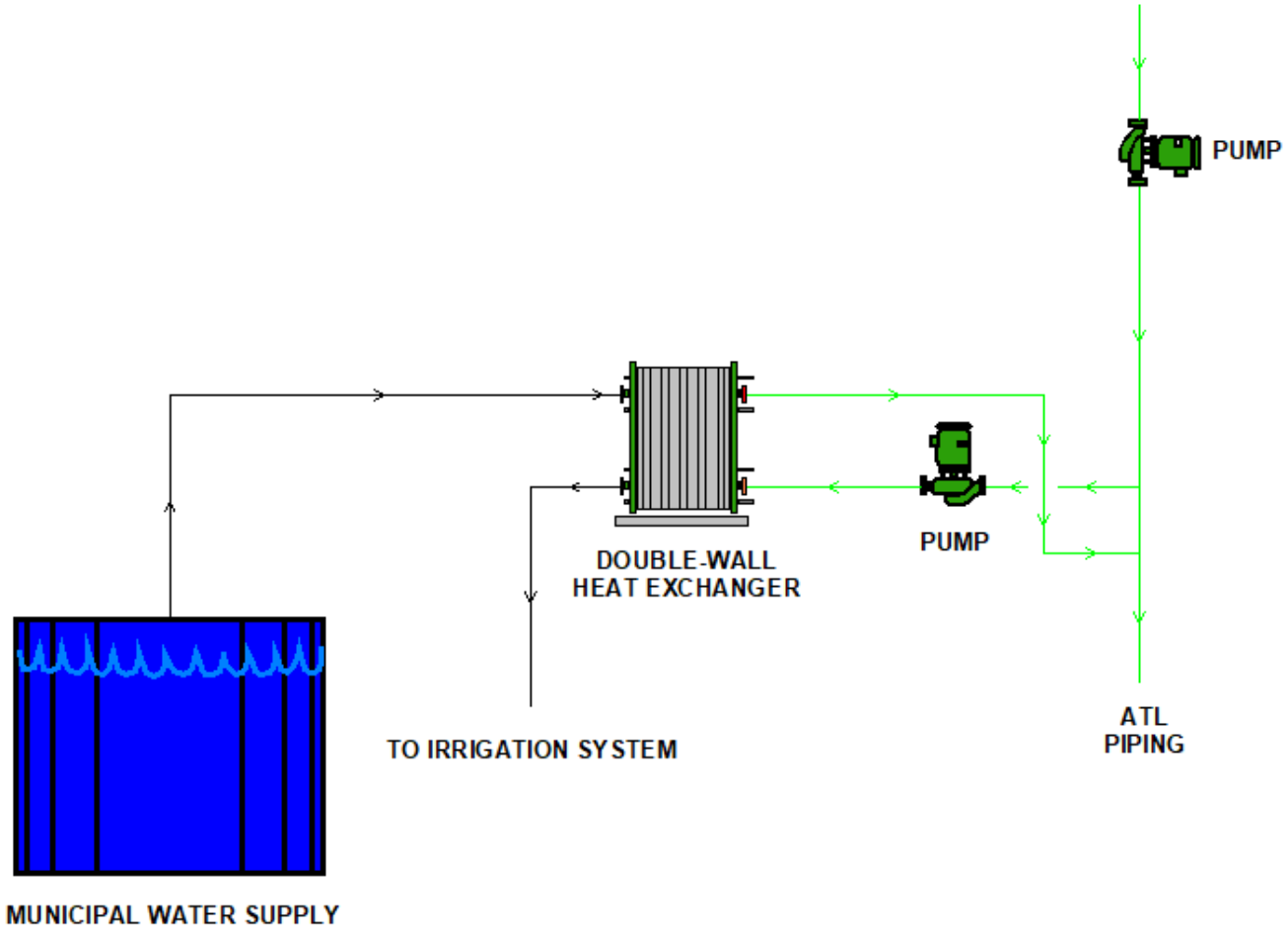
Valley Stream, NY

- 133 tons peak capacity
- 250 GPM maximum through DW HX
- Water/glycol Fluid in heat pump loop
- $40,000/year in energy savings (2015)
- Minimal temperature impact on CW

Image was provided by American Water Works.


IRRIGATION WATER ENERGY
TRANSFER

IRRIGATION WATER ENERGY TRANSFER



THERMAL ENERGY STORAGE

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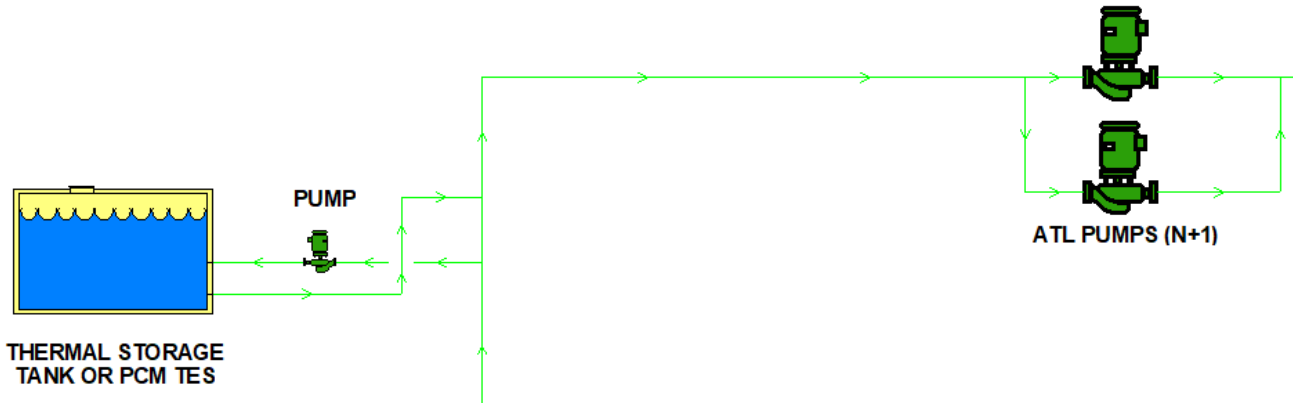
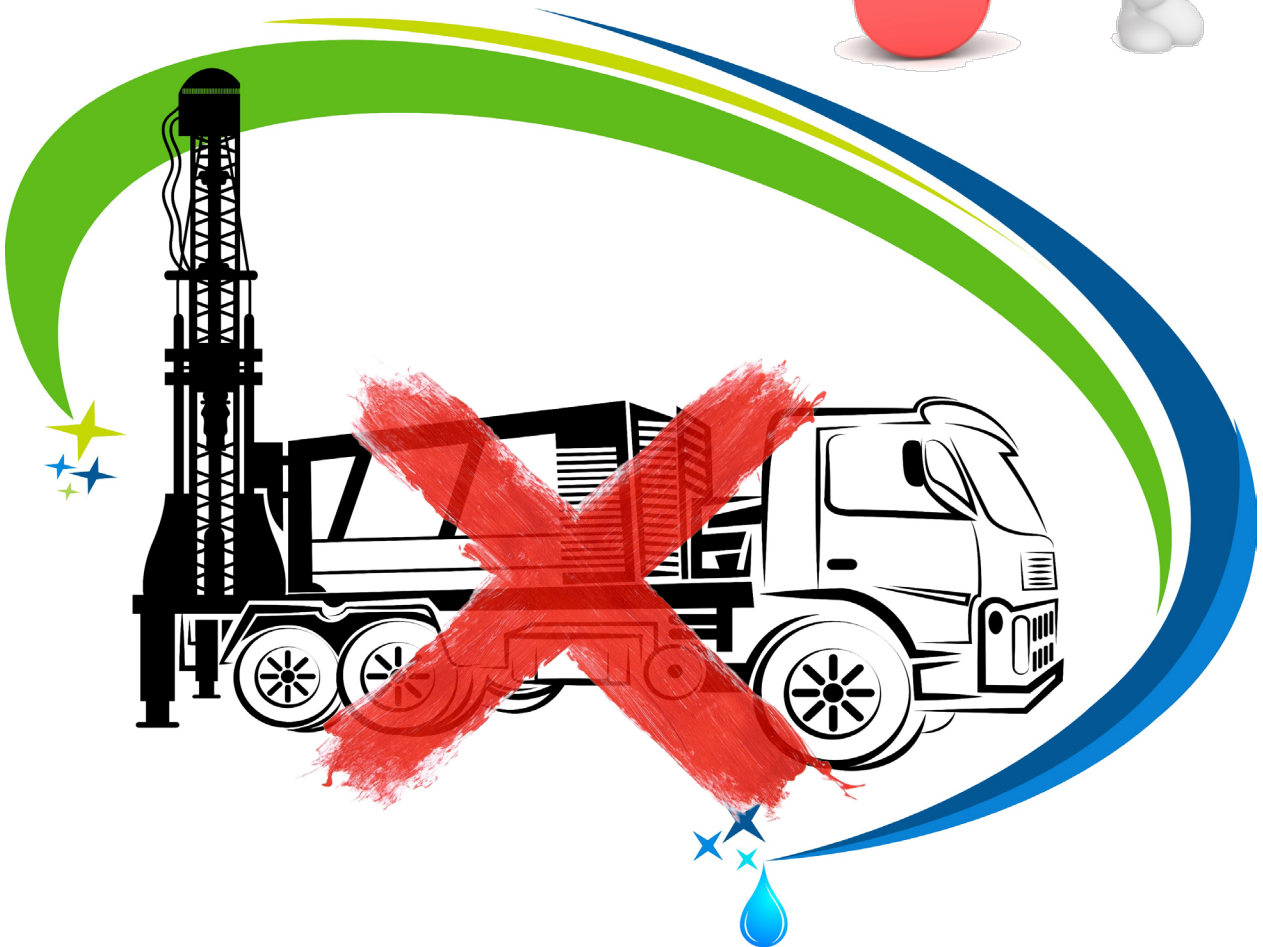


No-Drill Options?



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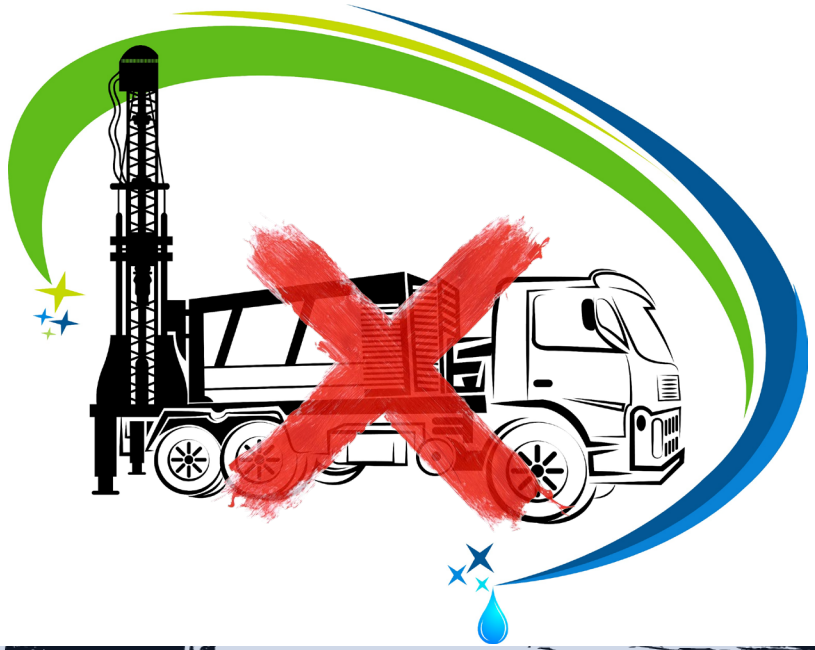
THANK YOU!



Q & A

1. Q: Wastewater energy transfer systems are only available for large, central energy plants? A: False
2. Q: Air-source heat pumps decrease in heating capacity and in efficiency as the outside air gets colder? A: True
3. Q: Storm water management structures can be used to hold storm water for both flood control and beneficial thermal energy transfer? A: True
4. Q: When using Potable Water as a heat source/sink, double-wall heat exchangers should always be used. A: True
5. Q: Irrigation water can be used as a heat source/sink? A: True