




# **COMPARATIVE WATER QUALITY ISSUES IN ROOFTOP RAIN COLLECTION AND URBAN STORM DRAINAGE COLLECTION**

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# WHY THESE SOURCES

- AS IN ENERGY PRODUCTION, UNTIL WE REACH A STAR TREK MOMENT, WE MUST CONSIDER “ALL OF THE ABOVE” FOR WATER SOURCES
    - PERHAPS CENTURIES OF NATURAL WATER SOURCE MISMANAGEMENT, ABUSE, AND WASTE IN USAGE?
  - ALL TYPES OF SOURCES IN “ALL OF THE ABOVE” HAVE SIGNIFICANT DRAWBACKS
    - ISSUES SUCH AS CONSISTENT VOLUME, ENERGY CONSUMPTION, TREATMENT BY-PRODUCTS, PUBLIC PERCEPTION
  - WE HAVE REALIZED WE DO NOT HAVE THE LUXURY OF TIME
    - MANY CURRENT CONFLICTS AND REFUGEE SITUATIONS HAVE SOME OR TOTAL CONNECTION TO WATER RELATED SHORTAGES
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# TROUBLED WATERS

- MANY INDUSTRIES AND POPULATION CENTERS ARE FACING SEVERE WATER SHORTAGES
  - CURRENTLY ALL POTABLE AND COMMERCIAL WATER IS TAKEN FROM NATURAL SOURCES
    - MANY AQUIFERS WILL BE DEPLETED IN 5-25 YEARS
  - PRECIPITATION PATTERNS IN MUCH OF THE WORLD WILL BE LESS FREQUENT BUT CONTAIN MORE ENERGY AND DELIVER MORE WATER
    - CALIFORNIA'S DROUGHT AND FLOOD CYCLE IS AN IDEAL EXAMPLE
      - MOST OF THIS YEAR'S PRECIP IS LOST TO RUNOFF
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# TWO METHODS OF COLLECTING STORM WATER



- THE TEXAS WATER DEVELOPMENT BOARD FUNDED A STUDY OF ROOFTOP RAIN WATER HARVESTING (RWH) AS A WATER SUPPLY FOR ENTIRE DEVELOPMENTS (2013)
    - THE STUDY FOCUSED ON POTENTIAL CAPABILITIES IN THE AUSTIN, TX METRO AREA AS THE TEXAS HILL COUNTRY AQUIFERS ARE NEARING DEPLETION
    - STANDARDIZED HOUSE SIZES AND BASEMENT/CISTERN SIZES WERE APPLIED
    - THE OVERALL THEME MAY BE THAT EACH BUILDING SUPPLIES SOME OR ALL OF ITS WATER SUPPLY
  - RAIN CATCH BASIN FEASIBILITY STUDY FOR MOLSON COORS (2013)
    - MOLSON COORS INTENDED TO CONSTRUCT RAIN CATCHMENT BASINS IN THE UK AND CANADA
      - 5-10 YEAR ESTIMATE UNTIL AQUIFERS HAVE REDUCED CAPACITY
    - AN ALTERNATIVE DESIGN WAS PROPOSED
      - CAPTURE URBAN STORM DRAINAGE FROM NEARBY CITIES AND TREAT ONSITE
      - 1/10 OF THE COST OF CONSTRUCTING BASINS
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# INITIAL RAIN WATER QUALITY PROBLEMS

- ATMOSPHERIC ACIDIFICATION OF RAIN WATER
    - CONTRIBUTORS ARE INDUSTRY OR URBAN SMOG
    - LOCALIZED EFFECTS, OFTEN IN THE SAME LOCATION AS THE SOURCE OR DOWNWIND
  - CREATES A SNOWBALL EFFECT SIMILAR TO ACID MINE DRAINAGE
    - SLIGHT ACIDIFICATION DISSOLVES SUBSTANCES ON ROOF TOPS, SOIL AND ROADS
    - CONCENTRATION AND VARIETY OF CONTAMINANTS IS INCREASED
      - MOST TYPICAL: HEAVY METALS, ANIMAL WASTE, FERTILIZERS, ORGANIC COMPOUNDS
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# ROOFTOP RAIN WATER HARVESTING

- FUNDED BY THE TEXAS WATER DEVELOPMENT BOARD, SEE HANDOUT
  - COVERS HILL COUNTRY IN AND AROUND AUSTIN, TEXAS
  - OBJECTIVE OF STUDY:
    - COST ANALYSIS OF FITTING HOMES WITH CISTERN STORAGE SYSTEM AND WATER TREATMENT
    - IN ESSENCE, EACH RESIDENCE AND BUILDING BECOMES ITS OWN WATER SOURCE (AND RESPONSIBLE FOR ITS OWN WATER VOLUME AND QUALITY)
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# URBAN STORM DRAINAGE COLLECTION

- REQUESTED BY MOLSON COORS OF THE PRESENTER
  - FEASIBILITY STUDY OF A PLAN TO CONSTRUCT RAIN/SNOW CATCH BASINS
    - TARGETING PLANTS IN THE UK AND CANADA
    - AQUIFERS HAVE REDUCED RELIABILITY AND OUTPUT – 2023?
  - THE PRESENTER PROPOSED AN ALTERNATIVE SOLUTION
    - CONNECT URBAN STORM DRAIN DISCHARGE PIPES TO MOLSON COORS FACILITY
    - TREAT THE WATER AT THE POINT OF USE
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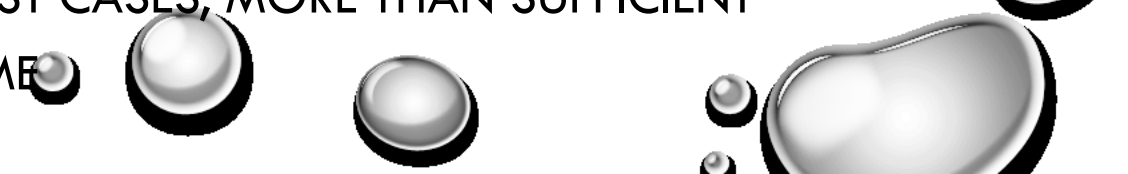
# CISTERN VS STORM DRAINAGE



## ROOFTOP TO CISTERN STORAGE

- HEAVY METALS
- MICROORGANISMS
- O&M OF CISTERNS AND GUTTERS
  - REGULAR CLEANING DEPENDENT ON RESIDENT OR OWNER
  - REQUIRES CISTERN IS EMPTY
  - CONFINED SPACE OPERATION
  - HOW WELL DO MOST KEEP UP THEIR CARS, LAWNS, CLEANING?
- STANDING WATER IN THE CISTERN
  - GROWTH OF ORGANISM
- INSUFFICIENT VOLUME

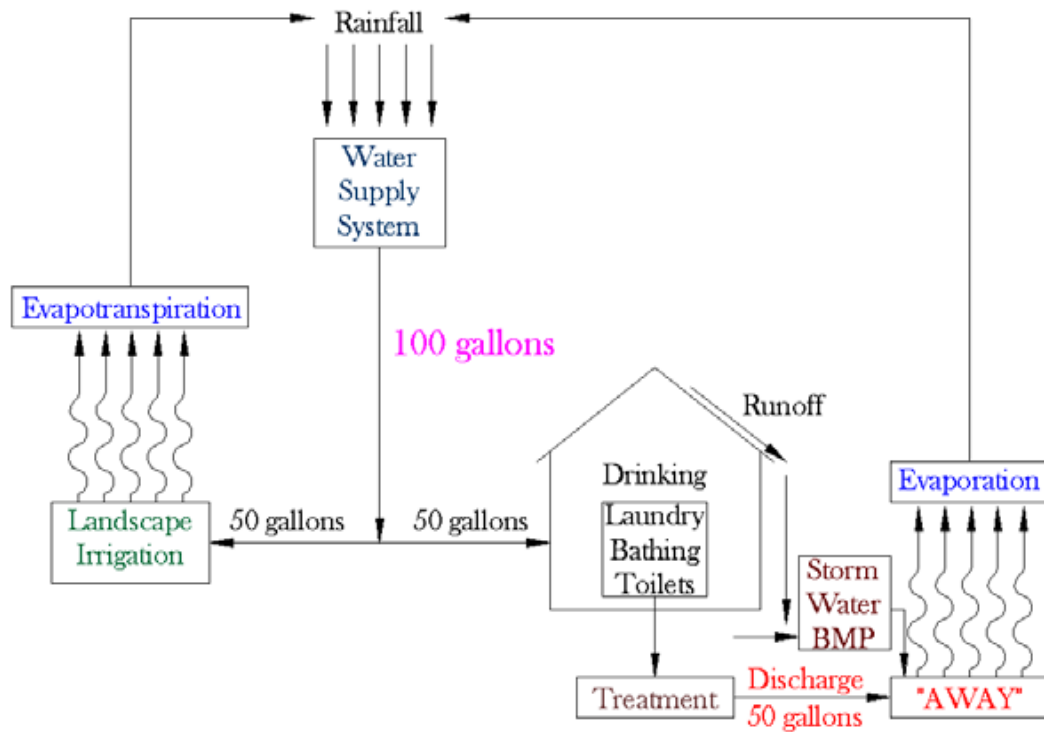
## URBAN STORM DRAINAGE PROCESS

- HEAVY METALS
  - MICROORGANISMS
  - PHOSPHATES
  - AUTOMOBILE FLUIDS
  - ROAD SALT
  - WASTE DISPOSAL FROM TEMP STORAGE TANKS
  - O&M DEPENDENT UPON COMMERCIAL OPERATIONS
  - IN MOST CASES, MORE THAN SUFFICIENT VOLUME
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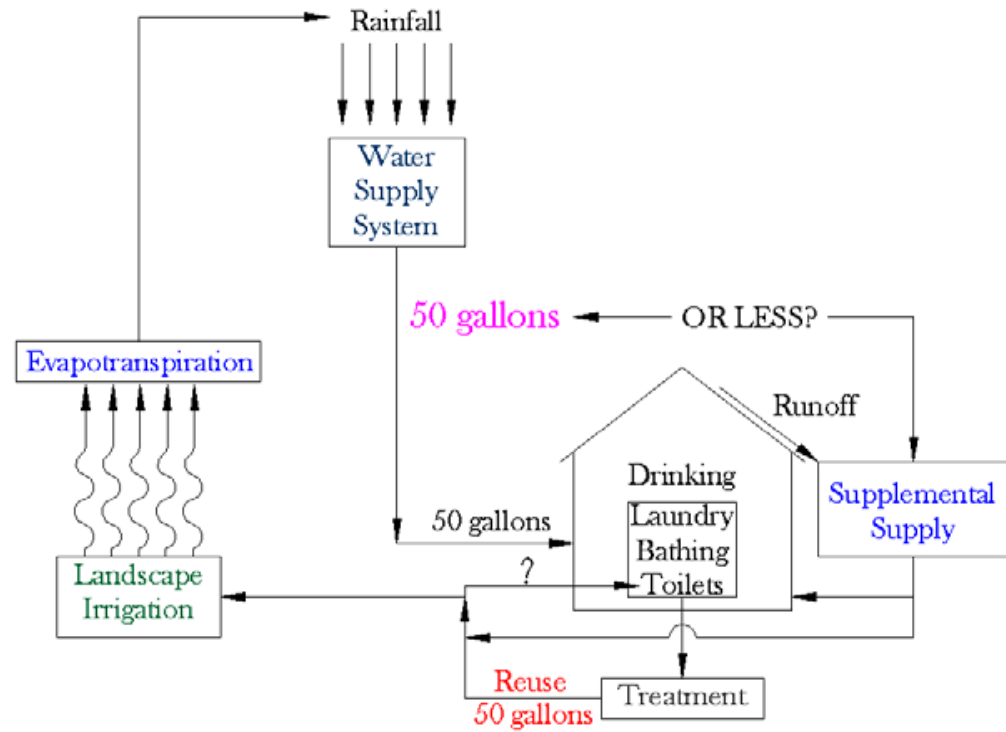


# ROOFTOP RWH PROCESS

## NON-INTEGRATED WATER SUPPLY SYSTEM



## INTEGRATED WATER SUPPLY SYSTEM





# URBAN STORM DRAINAGE UTILIZATION PROCESS




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## WHY THESE SOURCES?

- URBAN AREAS – EXISTING IMPERMEABLE SYSTEMS THAT COLLECT AND CARRY WATER AWAY FROM URBAN AREA
  - THESE SOURCES ARE POLLUTED WATER
  - YET THESE SOURCES ARE FREE WATER
  - THIS PRACTICE ALSO KEEPS POLLUTED WATER OUT OF NATURAL WATER BODIES
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# IT IS TIME TO TRULY THINK BIG

- “ALL OF THE ABOVE” IS OUR CURRENT ENERGY SOLUTION
- SO MUST IT BE WITH WATER SOURCES
  - WATER TREATMENT TECH IS NO GOOD WITHOUT WATER
  - WOULD LARGE SCALE VAPOR COLLECTION DISRUPT THERMAL BALANCE IN THE ATMOSPHERE?



# EXAMPLES

- AUSTIN TX TOTAL URBAN RWH VOLUME IS 100X GREATER THAN ROOFTOP RWH
- FT MCMURRAY, CANADA ANNUAL PRECIPITATION:
  - 27 MILLION CUBIC METERS
  - IN 2011, SUNCOR WITHDREW 143.6 MIL CU. M., PRIMARILY FROM THE ATHABASCA RIVER
  - FT. MCMURRAY'S PRECIP IS 20% OF SUNCOR'S NEEDS
- MUMBAI, INDIA REQUIRED  $1.18 \times 10^{12}$  LITERS OF WATER IN 2009
  - MUMBAI RECEIVED  $1.31 \times 10^{12}$  LITERS OF PRECIPITATION IN 2009, GREATER THAN THE CITY'S ENTIRE WATER NEEDS



# CONCLUSION

- WE ARE NOT THINKING BIG ENOUGH WHEN IT COMES TO SOLVING WATER PROBLEMS
  - WE CAN'T WAIT AND HOPE FOR GROUNDBREAKING TECHNOLOGY
  - IMPLEMENTATION OF BOTH SOLUTIONS WILL CREATE HUNDREDS OF MILLIONS OF JOBS WORLDWIDE
  - REDESIGN OUT CITIES FOR THE NEXT 10,000 YEAR
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