Rain Barrel
Build and Installation Workshop

How to Create a Simple Rainwater Harvesting System for Stormwater Management

PARKWAY PARTNERS GREEN KEEPERS PROGRAM

SEPTEMBER 20, 2014 @ REFRESH FARMS

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Giving Thanks...

PARKWAY PARTNERS
Susannah Bridges Burley, Programs Director, and the Whole PPP Krewe

SPROUT NOLA FARM
Emily Mickley-Doyle and Matt Glassman

BROAD COMMUNITY CONNECTIONS
Jeffrey Schwartz

NEW ORLEANS SEWERAGE & WATER BOARD
Green Infrastructure Initiative

AUDUBON/TOYOTA TOGETHERGREEN
for funding the Gentilly Rainwater Harvesting program
and supporting many innovative and important conservation projects across the US

LONGUE VUE HOUSE AND GARDENS
for supporting the Gentilly Rainwater Harvesting Program from 2010 to 2013

PONTILLY NEIGHBORHOOD ASSOCIATION
for overall support and enthusiasm in leading NOLA green infrastructure projects

MICHAEL WARD, NOLA BAMBOO, AP ARCSA
for technical advice and mentoring

Connections to Place

Culture is intimately interwoven with the environment. We cannot separate the two. We are where we live.

INTRODUCTIONS

Green Infrastructure

“Green Infrastructure” generally refers to systems and practices that use or mimic natural processes to infiltrate, evapotranspirate (the return of water to the atmosphere through evaporation by plants), or reuse stormwater or runoff on the site where it is generated.

In terms of stormwater management, green infrastructure allows rainwater to be absorbed and cleansed by soil and vegetation and either re-used or allowed to flow back into groundwater or surface water resources.

http://water.epa.gov/infrastructure/greeninfrastructure/index.cfm
(from S&WB GI Plan)

A Few of the Many Benefits of Rainwater Harvesting

- Free water supply
- Chlorine free; salt free
- Soft water -- no calcium carbonate
- High-quality water for plants, soil -- the plants and microbes love it
- A source of water for wildlife
- Can be used for watering the landscape, washing tools, your car or your pets
- Reduces energy-intensive demand from water treatment plants
- Reduces water demand from the Mississippi River
- Reduces your water bill
- Your own water source in times of drought or when the municipal system shuts down

Benefits of Rainwater Harvesting Specifically Related to Stormwater Management

- Help recharge the soil -- help mitigate subsidence
- Help reduce stormwater runoff
- Reduce runoff pollutants that enter Lake Pontchartrain

*** CAPTURE THE RAIN BEFORE THE DRAIN. ***

NOLA S&WB
Drainage System Overview

- 90 miles of covered canals
- 82 miles of open, lined/unlined canals
- 37 pumping stations
- Total pumping capacity ~53,500 cfs (cubic feet per second)
- Responsible for the maintenance and repair of subsurface drain pipes >/= 36” diameter

NOLA Rain Drain Dynamics

- With an average annual rainfall of 64 inches and an average of 56 rainy days a year, New Orleans ranked third among U.S. locations. (Mark Schleifstein, nola.com/weatherbill.com)

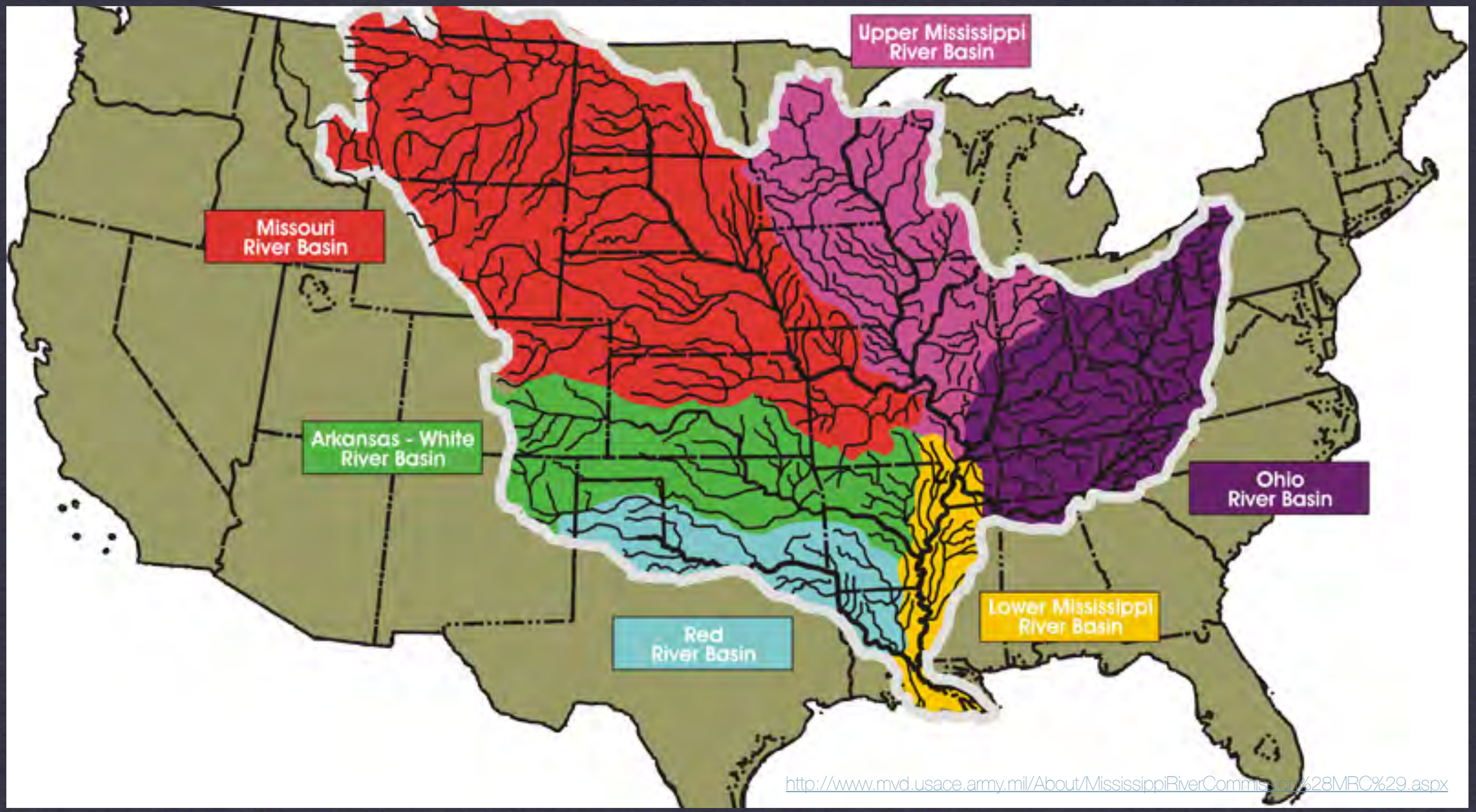
- When all 24 pump stations are 100 percent operational, the drainage system can handle one inch of rainfall in the first hour of a continuous storm, then a half-inch each hour thereafter. (Mayor Mitch Landrieu, nola.com)

- Though the S&WB's huge pumps can suck about 50,000 cubic feet of water per second off the city's streets, the system generally operates at no more than 90 percent of capacity. That's because a handful of the system's 115 major pumps typically are out of service at any one time for routine repairs or to keep power in reserve for emergency backup. (Michelle Krupa, nola.com)

- The removal of water of New Orleans' soils over time is a principal reason why the city has experienced such a severe rate of subsidence.

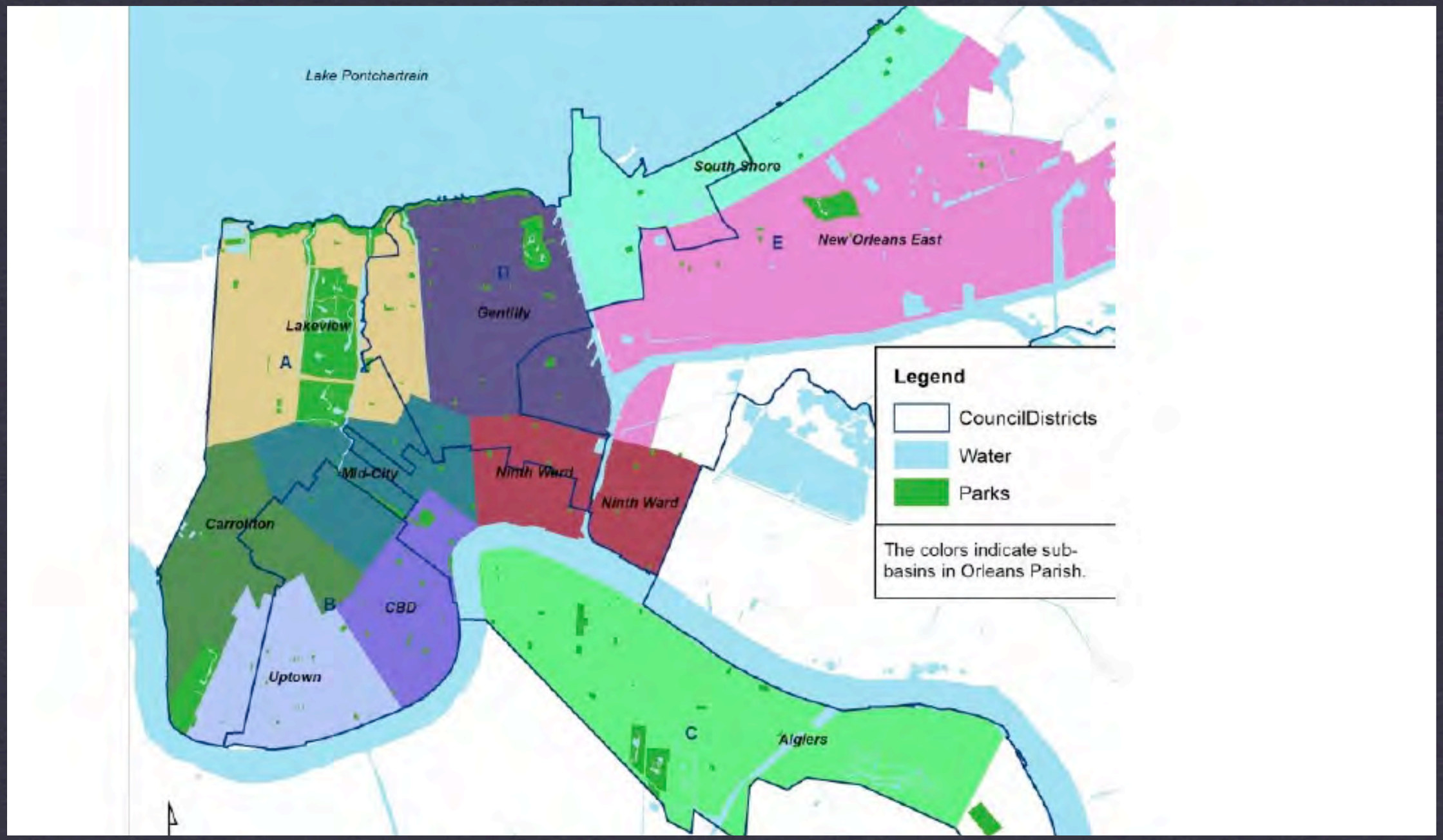
The Watershed
at a Range of Scales

A watershed is the land area that drains to a common body of water, such as a stream, lake, estuary, wetland, or even the ocean. (EPA)



MISSISSIPPI RIVER WATERSHED

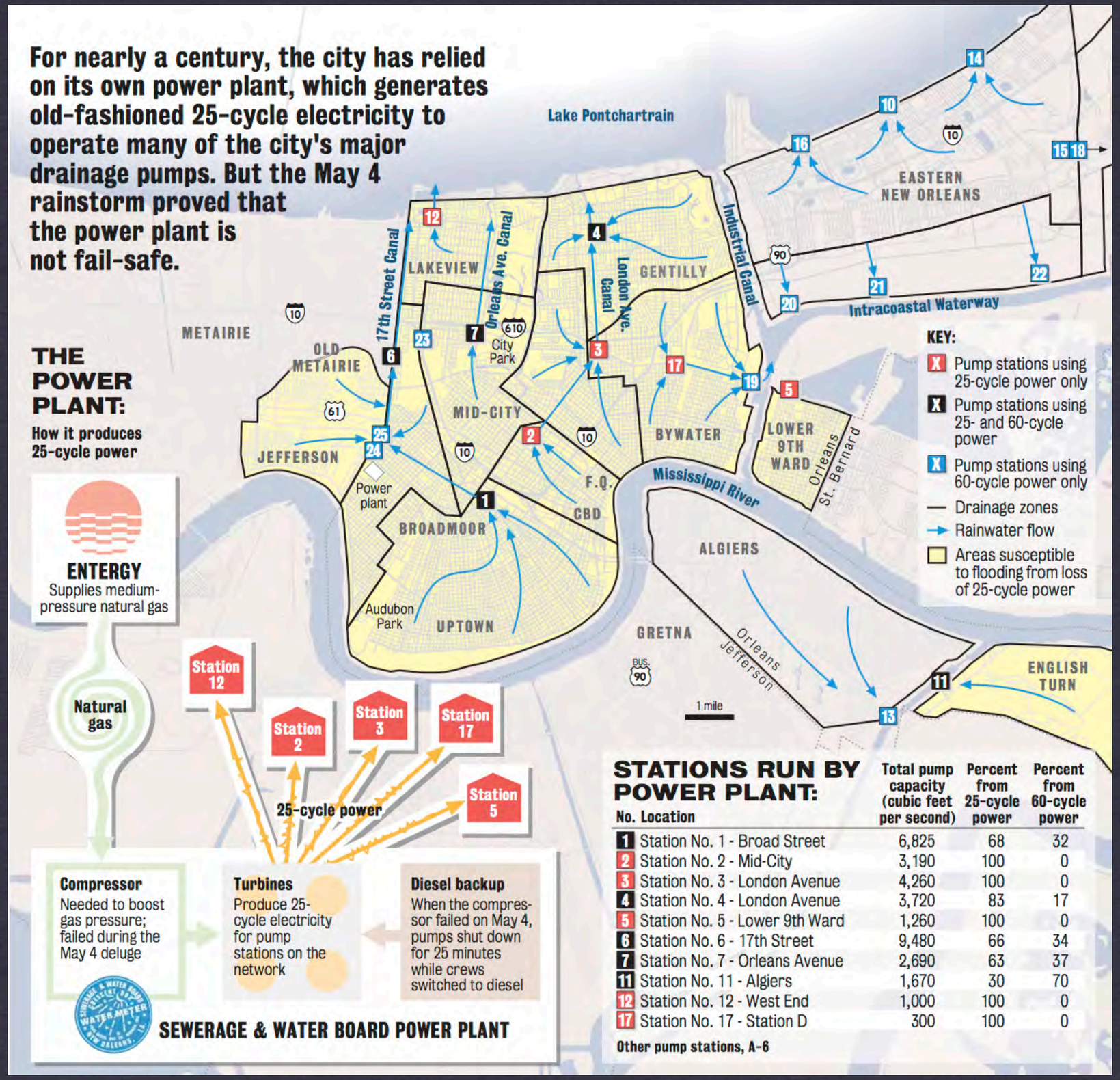
The Mississippi River has the third largest drainage basin in the world, exceeded in size only by the watersheds of the Amazon and Congo Rivers. It drains 41 percent of the 48 contiguous states of the United States. The basin covers more than 1,245,000 square miles, includes all or parts of 31 states and two Canadian provinces, and roughly resembles a funnel which has its spout at the Gulf of Mexico. Waters from as far east as New York and as far west as Montana contribute to flows in the lower river.



NOLA DRAINAGE BASIN SYSTEM

A basin is defined as a sewer service area in which all wastewater flows by gravity to a sewer pump station, and from there pumped via a force main to the East Bank Wastewater Treatment Plant. There are nine Basins (Carrollton, Central Business District, Gentilly, Lakeview, Mid-City, New Orleans East, Ninth Ward, South Shore, and Uptown) on the East Bank of Orleans Parish.

For nearly a century, the city has relied on its own power plant, which generates old-fashioned 25-cycle electricity to operate many of the city's major drainage pumps. But the May 4 rainstorm proved that the power plant is not fail-safe.



THE POWER PLANT:

How it produces 25-cycle power

ENTERGY
Supplies medium-pressure natural gas

Natural gas

Station 12
Station 2
Station 3
Station 17
Station 5

25-cycle power

Compressor
Needed to boost gas pressure; failed during the May 4 deluge

Turbines
Produce 25-cycle electricity for pump stations on the network

Diesel backup
When the compressor failed on May 4, pumps shut down for 25 minutes while crews switched to diesel

SEWERAGE & WATER BOARD POWER PLANT

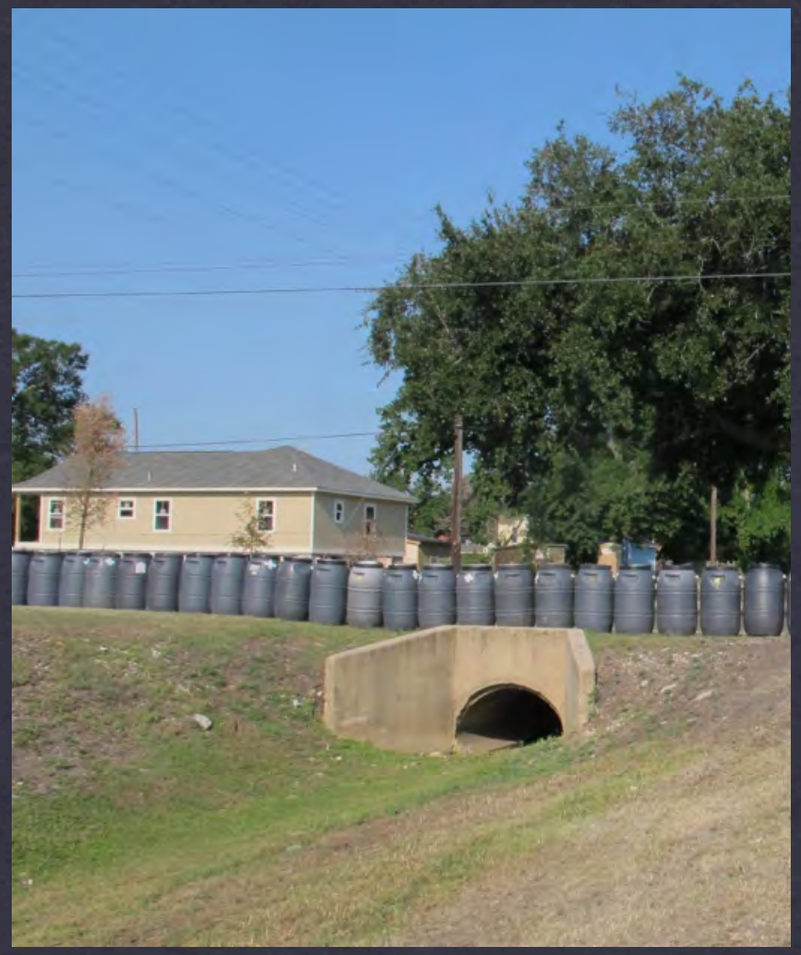
STATIONS RUN BY POWER PLANT:

No.	Location	Total pump capacity (cubic feet per second)	Percent from 25-cycle power	Percent from 60-cycle power
1	Station No. 1 - Broad Street	6,825	68	32
2	Station No. 2 - Mid-City	3,190	100	0
3	Station No. 3 - London Avenue	4,260	100	0
4	Station No. 4 - London Avenue	3,720	83	17
5	Station No. 5 - Lower 9th Ward	1,260	100	0
6	Station No. 6 - 17th Street	9,480	66	34
7	Station No. 7 - Orleans Avenue	2,690	63	37
11	Station No. 11 - Algiers	1,670	30	70
12	Station No. 12 - West End	1,000	100	0
17	Station No. 17 - Station D	300	100	0

Other pump stations, A-6

DRAINS TO LAKE :: BACKS UP TO DWYER CANAL

Keep in mind that the underground pipe system has a cross-over design that allows water to flow through storm drains toward another basin if it's primary basin is overloaded.



RAIN BARRELS AS ONE LINE OF DEFENSE

CASE STUDY: GENTILLY RAINWATER HARVESTING PROGRAM TO PREVENT FLOODING AT THE DWYER CANAL

The Power of Collective Action

“There is a power that can be created out of pent-up indignation, courage, and the inspiration of a common cause, and that if enough people put their minds and bodies into that cause, they can win. It is a phenomenon recorded again and against in the history of popular movements against injustice all over the world.”

— Howard Zinn, *You Can't Be Neutral on a Moving Train: A Personal History of Our Times*

5,000 55-GALLON BARRELS IN THE GENTILLY DRAINAGE BASIN TO PREVENT FLOODING AT THE DWYER CANAL

Case Study:
The Gentilly Rainwater Harvesting Program

Open-Top 55-Gallon Barrel Rainwater Harvesting System

- BASIC COMPONENTS:

- Rainfall
- Water collection / catchment
- Distribution / gutters and downspouts
- Barrel
    - Inlet -- the entrance point for rainwater
    - Spigot -- a way to access the collected rainwater
    - Overflow -- an escape route for excess rainwater
    - Mosquito prevention -- design, screen and Bti
- Other considerations: solid, level base for barrels
- You / the user -- maintain functionality -- daily, weekly and annually

100 (SQ FT) X 1” RAINFALL X 0.623 (CONVERSION FACTOR) =
62.3 HARVESTED WATER (GALLONS)

Case Study:
ReFresh Farms Rooftop Demonstration

Closed-Top Two 55-Gallon Barrel Rain Catchment System

- BASIC COMPONENTS:

- Rainfall
- **Diverter -- intercepts rain at downspout and directs water to one barrel. It also serves as an overflow -- once the barrels are filled, redirects the rainwater back to the downspout.**
- Inlet -- the entrance point for rainwater **-- at side of barrel**
- Spigot -- a way to access the collected rainwater
- Overflow -- an escape route for excess rainwater -- **The diverter acts as an overflow in that once the barrels are filled, the water continues to flow down the downspout.**
- Vent -- an escape valve for pressure to escape -- must be higher than intake valve/inlet
- Mosquito prevention -- small holes drilled in tops to allow for drainage from barrel caps; screen covers vent hole
- You / the user -- maintain functionality and empty barrel -- daily, weekly and annually
- Also consider base for barrels

Components of ReFresh Farms Rain Barrels

- Two 55-gallon food grade barrels
- Prepare bases for two barrels -- 8 cinder blocks and 4 top caps
- Inlet via a diverter -- connected to heavy-flow side of downspout
- Barrels are connected at bases via connector hose -- 2 bulkhead fittings, 3/4” close nipples, plastic tubing, hose clamps
- Overflow -- diverter serves as overflow
- Spigot -- bulkhead fitting, 3/4” close nipple coupling, ball valve, pipe/hose adapter

ReFresh Farms
System Considerations

- Catchment Area -- Approx. 6,868 sq. ft (32’ x 192’, plus 16’ x 48’)
  - Roof material -- Slick, clean (undetermined)
  - Slope of roof -- Flat roof (undetermined)

- Conveyance -- gutters + downspouts -- consider sizing, proper installation and aesthetics
  - Slope of gutters -- (undetermined) how quickly rainwater will run off
  - Gutters -- sized to carry runoff from 100-year storm event (1% chance of happening every year). Heavy storm events require wider gutters. The rule is that gutters should be 5” wide.
  - Downspouts – **Provide one square inch of downspout area for every 100 square feet of roof area.** For example, ReFresh Farms’ 6″ x 6″ downspout (36 square inches) can accommodate runoff from a 3,600 square foot roof. **What are the implications of this calculation?**

- Treatment -- Treatment of rainwater ensures that the water will be safe to use. -- Is it safe to use unfiltered rainwater for edibles? Will algae effect plant growth and development?

- Distribution -- Will the water from the cistern reach the plant beds via gravity flow, or will a pump be necessary.

Q: What size cistern will ReFresh need for it's rooftop garden?

A: How many square feet is their garden?

A: What is the evapotranspiration rate in New Orleans?

A: When are their critical waterings needs?

Also consider if the distribution will rely on gravity. Consider friction loss.

Q: How much rainfall can be collected from the roof?

A: What is the catchment area in square feet? 32' x 192', plus another 16'x48' section

A: What is the annual rainfall for New Orleans?

A: What is the monthly rainfall for New Orleans?

A: What is the least amount of monthly rainfall for New Orleans?

Supply = inches of rainfall x .623 x catchment area x runoff coefficient

Rainwater Harvesting Around Town

DUBLIN STREET :: FLOOD UNDER HOUSE NO MORE :: NOLA BAMBOO

TWO 55-GALLON BARRELS WITH DIVERTER, CATCH BASIN AND EXTENDED DOWNSPOUT

MR. DELECROIX'S RAIN HARVESTING HERITAGE

1 5-GALLON CERAMIC HEIRLOOM CARAFE :: OPEN-TOP, DUNK

MID-CITY GARDENER'S ROUGHNECK RAIN BARREL

1 40-GALLON BRUTE TRASH CAN :: OPEN-TOP SYSTEM

MILNE COMMUNITY GARDEN

4 55-GALLON CLOSED SYSTEM

BAYOU REBIRTH INSTALLATION @ PROPELLER

12 55-GALLON SYSTEM :: DESIGNED AND INSTALLED BY RENE MCGEE

J.W. JOHNSON ELEMENTARY SCHOOL / CARROLLTON

FOUR 55-GALLON BARREL X 6 SYSTEM FOR GARDEN IRRIGATION

Appendices

Calculating Potential Rain Harvest

CATCHMENT AREA (SQ FT) X RAINFALL DEPTH (INCHES) X 0.623 (CONVERSION FACTOR) = HARVESTED WATER (GALLONS)

A few common spaces to consider in terms of rainwater displacement and potential harvest...

The dimensions of an average vehicle is about 13.5’ x 6.7’ = 90.45 sq. ft.
A one-inch rainfall will produce about 56.4 gallons of rainwater.

The dimensions of an average garden shed is 10’ x 12’ = 120 sq. ft.
A one-inch rainfall will produce about 137 gallons of rainwater.

The dimensions of an average 2-car garage is 20’ x 20’ = 400 sq. ft.
A one-inch rainfall will produce about 249 gallons of rainwater.

100 (SQ FT) X 1” RAINFALL X 0.623 (CONVERSION FACTOR) = 62.3 HARVESTED WATER (GALLONS)

FOR EVERY 1,000 SQ FT (10 X 10) OF ROOF AREA, 1 INCH OF RAIN WILL PRODUCE OVER 600 GALLONS OF RAINWATER!

Rain Barrel Maintenance Plan

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
30-yr avg. (inches)	5.9	5.5	5.2	5.0	4.6	6.8	6.2	6.2	5.6	3.1	5.1	5.1	64.2 annual rainfall
Hurricane Season								PEAK HURRICANE SEASON					
	light rains					thunderstorms					light rains		
Leaf drop (approx.)			SPRING CLEANING / ANNUAL CHECK						CHECK FOR LEAF DEBRIS IN GUTTERS				

ANTICIPATE RAINFALL.

Your rain barrel will only help with stormwater management if it is emptied (or space is made) for the next downpour.
June is typically the wettest month. October is typically the driest month.

CLEAN YOUR BARREL BEFORE HEAVY SUMMER RAINS (MAY 24-SEPT 26).

Clean out barrel, be sure cinder block base is level, make improvements if necessary, and make sure downspout is operating properly.

CLEAN YOUR GUTTERS TWICE A YEAR OR MORE.

Take note: Live Oak trees drop their leaves as they grow new ones in early spring.
Bald Cypress and Pine trees drop their leaves in the late fall and early winter.

PREPARE FOR HURRICANE SEASON.

If hurricane-force winds are expected, empty your barrel and bring it inside. If a less-intense storm is predicted, it should be okay to fill your barrel with water. When filled, your barrel will weigh close to 400 pounds. Gutters may also have to be cleaned after an intense tropical storm or hurricane.

Weekly Routine Maintenance and Preventing Mosquitos

Remember: Your rain barrel will only help with stormwater management if it is emptied and available for the next downpour. A barrel drained every three days should not allow mosquitos to breed.

- Keep you rain barrel spigot closed when you are not using the water.
- Remove debris from your colander.
- Every couple of days, splash any rainwater that may be standing on the lid to speed up evaporation. Mosquitos love standing water.
- Keep your barrel free of organic material.
- Make sure overflow screen is not clogged from inside the barrel.
- Check for mosquitos. If there are mosquitos, add a mosquito dunk (Bti), or empty barrel. Check your gutters. Check for entry points.
- If your mosquito screen is intact and there are no leaks where mosquitoes can enter the barrel, your rain barrel should be mosquito-free.

Preventing Mosquitoes: Learn the Life Cycle

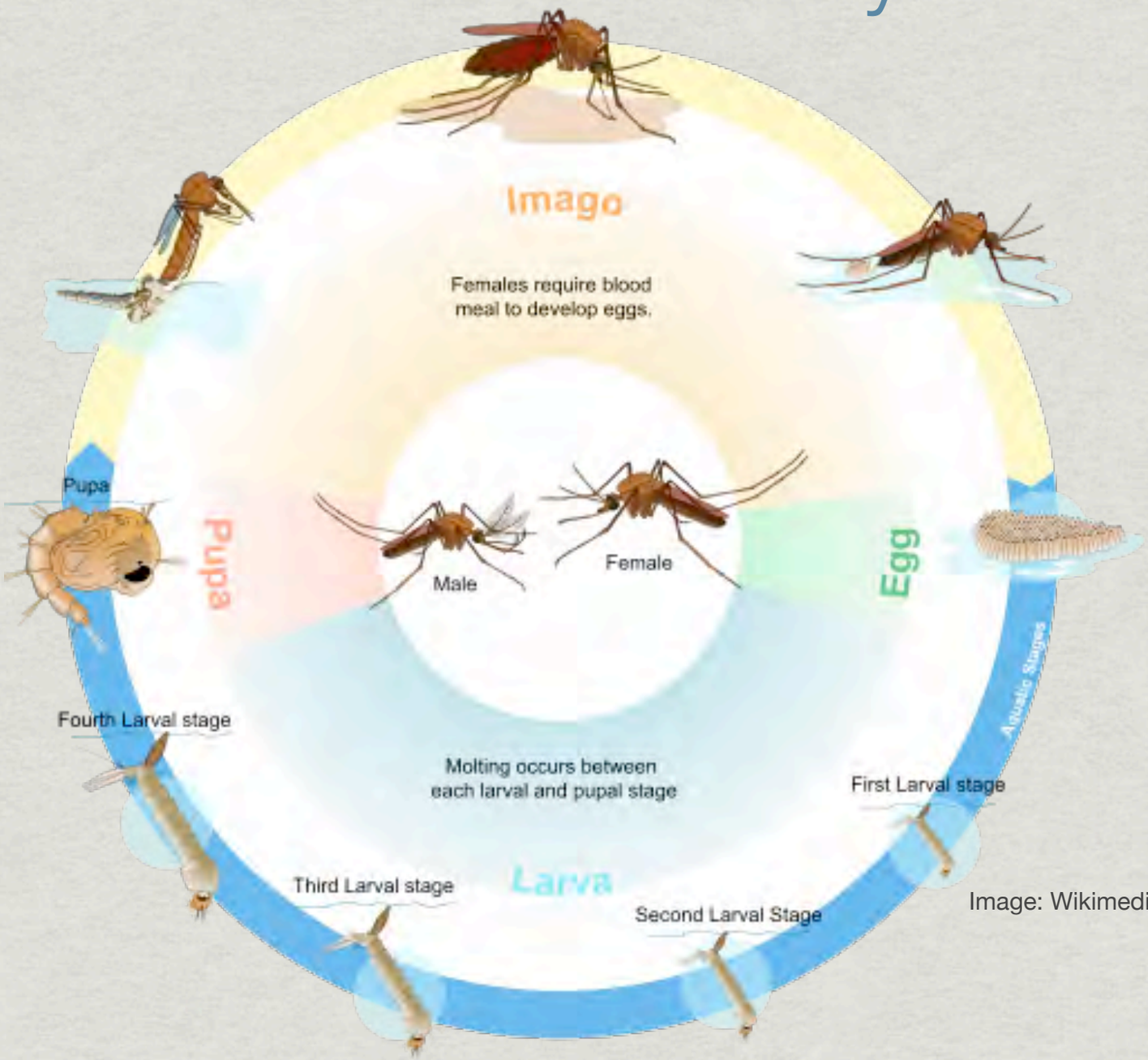


Image: Wikimedia Commons

Mosquitoes are laid as eggs which hatch into larvae (wigglers), develop into pupae (tumblers) and emerge as adults. Mosquito life cycles are swift, and can complete within 7 days. Their rapid life cycle makes it important to evaluate outdoor areas on a weekly basis, in order to reduce places where new cycles of mosquitos can breed.

(http://www.nola.gov/mosquito/mosquitoes/)