

Sustainable Communities

Week Two

Geog 4771 – Fall 2017

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Lakehead University



Agenda for Sept. 15

◆ Potential Guest Speakers

LCRA - Lakehead U? - Dr. Todd Randall - Grassy Narrows?
- City of Thunder Bay? - Aaron Koch (Chicago Resilience Office)?

◆ Field trip

◆ Topics

◆ Erma updates and discussion

◆ Not in Canada?

◆ Netherlands example

◆ Lecture 2a: Cities – Peril and Progress

Irma in Florida

- ◆ What are some long, medium and short term preparations taken in Florida to prepare for hurricanes such as Irma?
- ◆ Do any preparations provide more than one benefit for the community (in tandem)?



Two-Day Graphical Tropical Weather Outlook

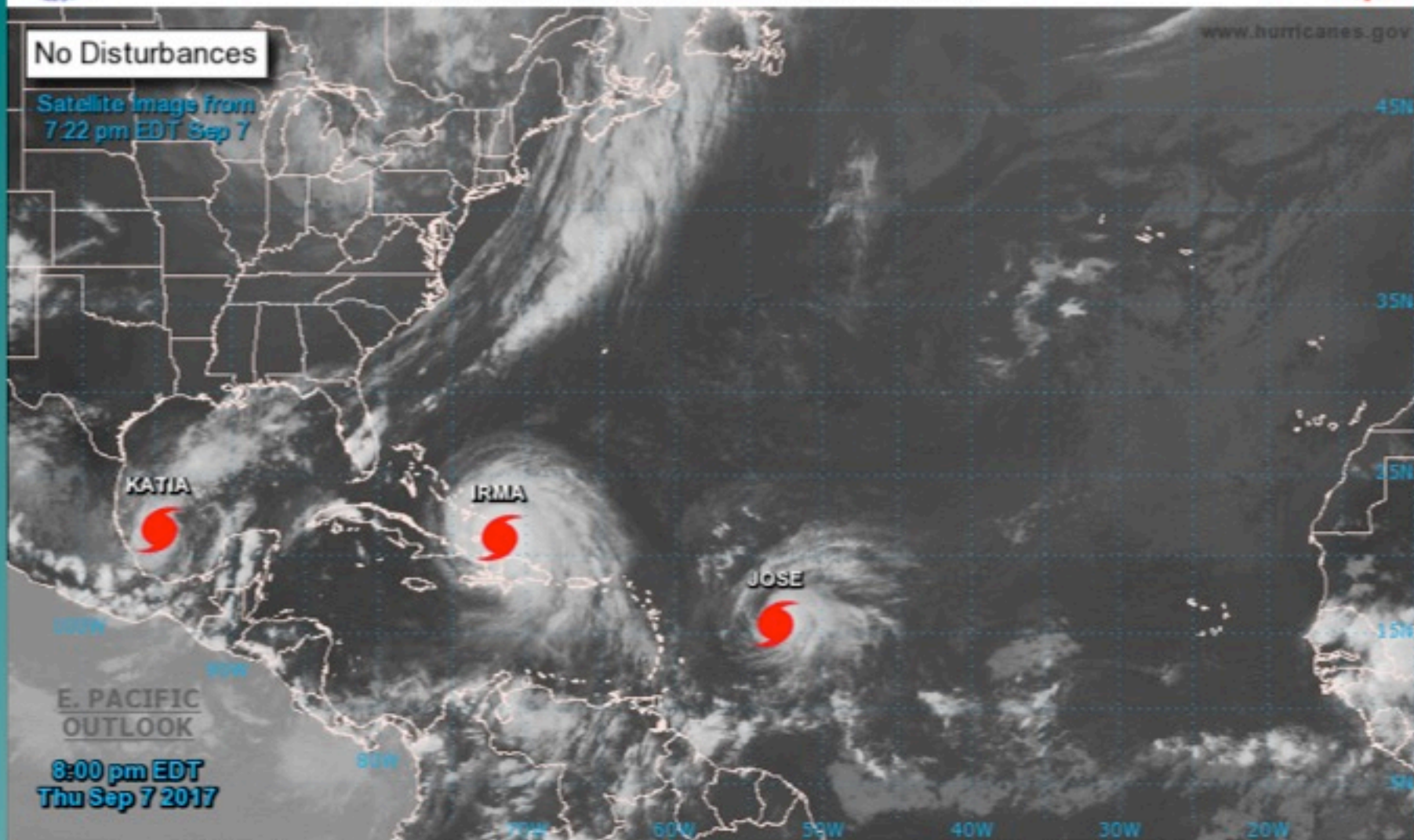
National Hurricane Center Miami, Florida



No Disturbances

Satellite image from
7:22 pm EDT Sep 7

www.hurricanes.gov



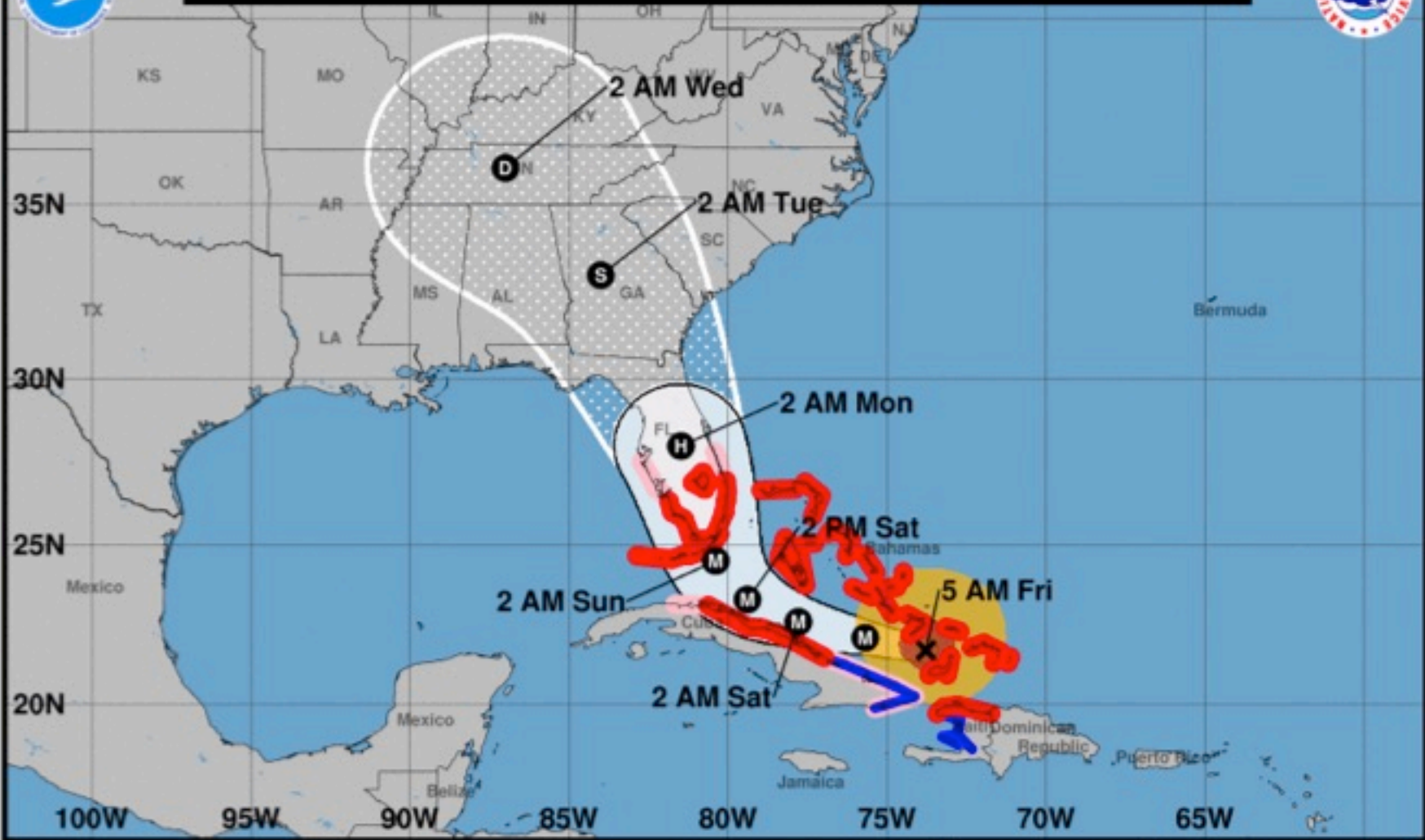
Current Disturbances and Two-Day Cyclone Formation Chance: < 40% 40-60% > 60%

Tropical or Sub-Tropical Cyclone: Depression Storm Hurricane

Post-Tropical Cyclone Remnants



Note: The cone contains the probable path of the storm center but does not show the size of the storm. Hazardous conditions can occur outside of the cone.



Hurricane Irma
 Friday September 08, 2017
 5 AM EDT Advisory 37
 NWS National Hurricane Center

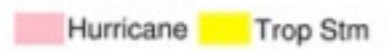
Current information: x
 Center location 21.7 N 73.8 W
 Maximum sustained wind 155 mph
 Movement WNW at 16 mph

Forecast positions:
 ● Tropical Cyclone ○ Post/Potential TC
 Sustained winds: D < 39 mph
 S 39-73 mph H 74-110 mph M > 110 mph

Potential track area:



Watches:



Warnings:



Current wind extent:

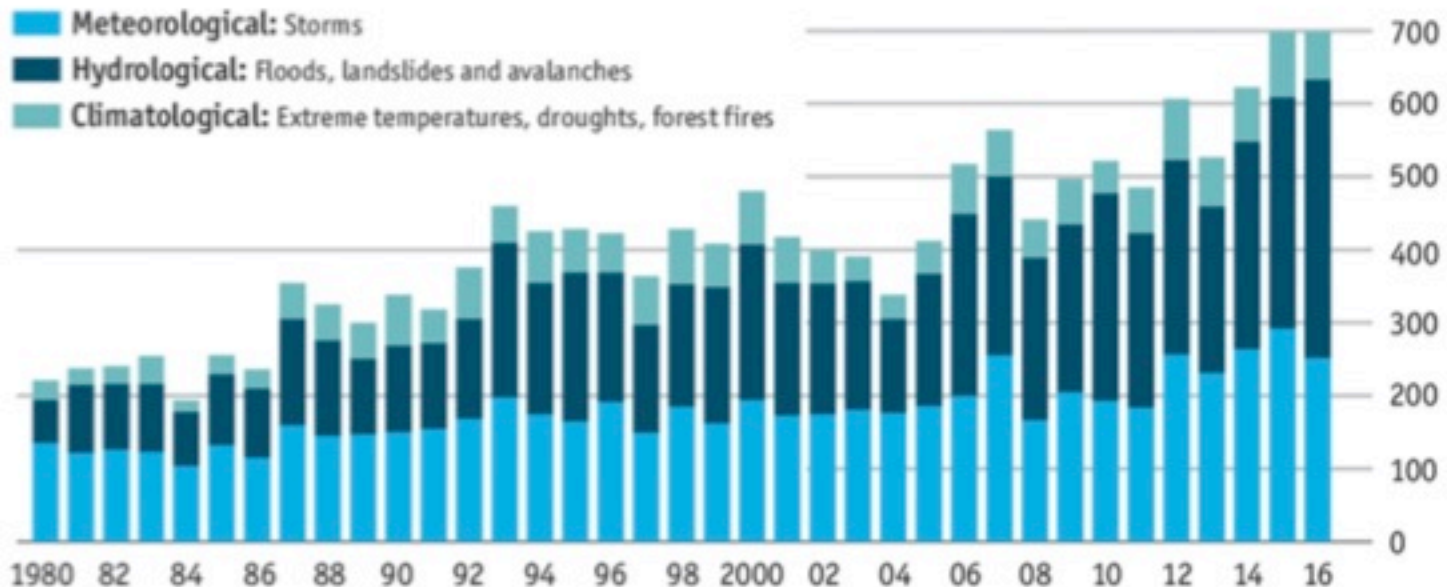


Extreme weather: *Le déluge*

The number of natural disasters worldwide has more than quadrupled since 1970 to around 400 a year. There are six times more hydrological events, such as those in Texas or South Asia, now than in 1980. Yet fewer people are dying, thanks to improved building strength, flood-prevention schemes and other measures. To reduce deaths still further, urban planners may have to plan for more such extreme events, [writes our data team](#)

A rising tide

Natural disasters by cause



Source: Munich Re

Irma in Florida

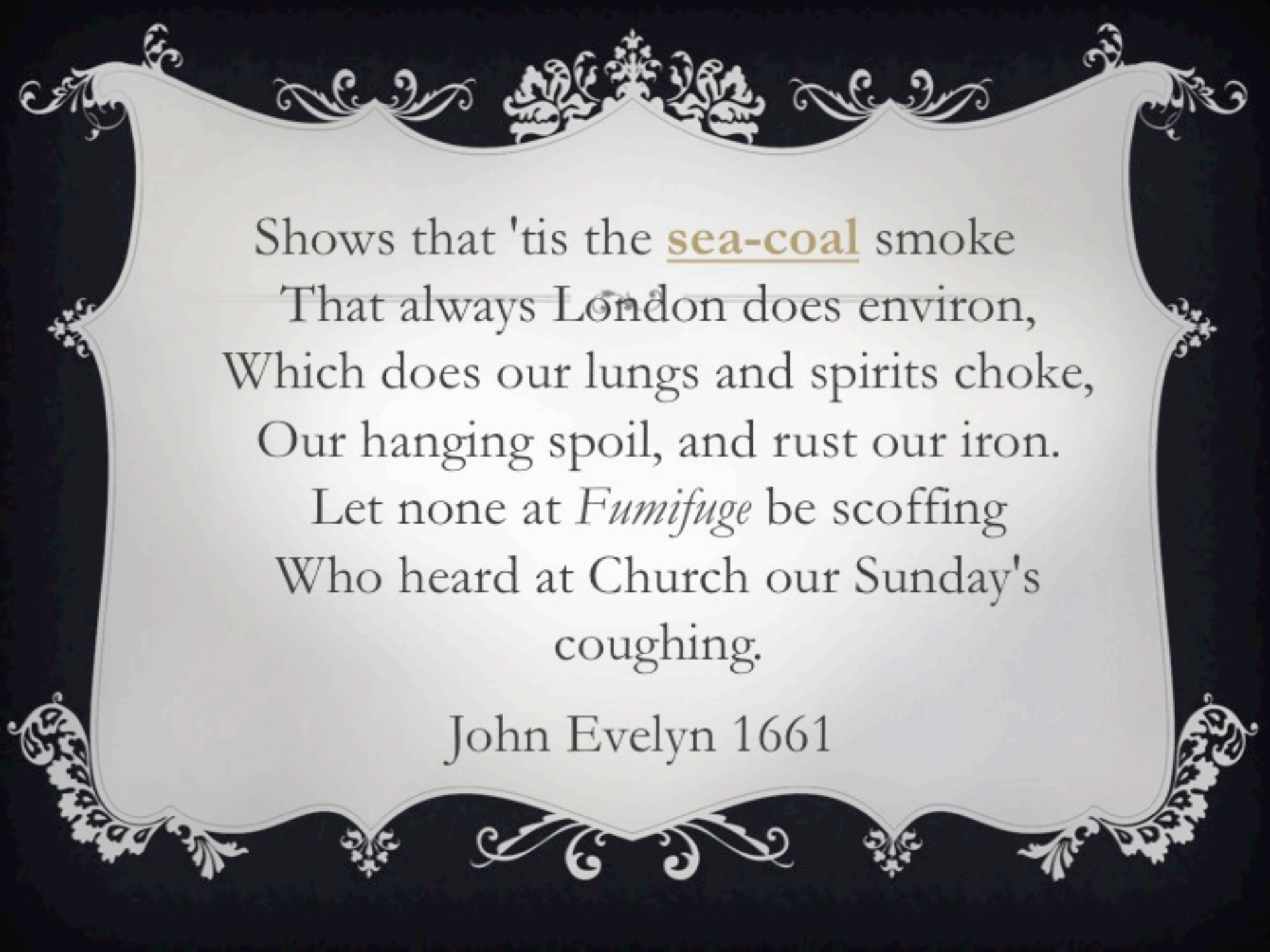
- ◆ What are some long, medium and short term preparations taken in Florida to prepare for hurricanes such as Irma?
- ◆ Do any preparations provide more than one benefit for the community (in tandem)?

In the 1600s....

The Inconveniencie of the AER,
and SMOAK of LONDON

With some REMEDIES humbly
PROPOSED

To His Sacred MAJESTIE



Shows that 'tis the sea-coal smoke
That always London does environ,
Which does our lungs and spirits choke,
Our hanging spoil, and rust our iron.
Let none at *Fumifuge* be scoffing
Who heard at Church our Sunday's
coughing.

John Evelyn 1661

Scales for Sustainable Community Design



- ◆ Orientation of buildings
 - ◆ Construction materials
 - ◆ “Green Building”
- ◆ Alignment and Style of Streets
 - ◆ Traffic Calming
 - ◆ Stormwater Treatment
- ◆ Transit and Land Use Planning

Green Building (definition)

- ◆ The practice of **increasing the efficiency** with which buildings and their sites use energy, water, and materials, and **reducing building impacts** on human health and the environment (from Wikipedia 2007)
- ◆ **Principles applied throughout the complete building life cycle** (i.e., siting, design, construction, operation, maintenance and removal)

Green Building as defined by Alex Wilson (2006) Your Green Home

- ◆ Used to describe buildings with some or all of the following characteristics:
 - Buildings with **minimal adverse impacts** of local, regional and even global ecosystems;
 - Buildings that **reduce reliance on automobiles**;
 - Buildings that are **energy-efficient** in their operation;
 - Buildings and grounds that **conserve water**;
 - Buildings that built in an environmentally responsible manner from **low-environmental impact materials**;
 - Buildings that are **durable** and can be maintained with minimal environmental impact;
 - Buildings that **help their occupants practice environmentalism**;
 - Buildings that are **comfortable, safe, and healthy** for their occupants.

ECOFRIENDLY CONSTRUCTION

With 32 "green" buildings, Seattle has become a leader in environmentally sensitive building and design. Green construction aims to reduce pollution and reduce dependence on power plants and logging.

▶ GREEN ROOFS:

A thin layer of plants and soil on rooftops provides insulation, reduces stormwater runoff, absorbs carbon dioxide and creates oxygen.

▶ WATER EFFICIENCY

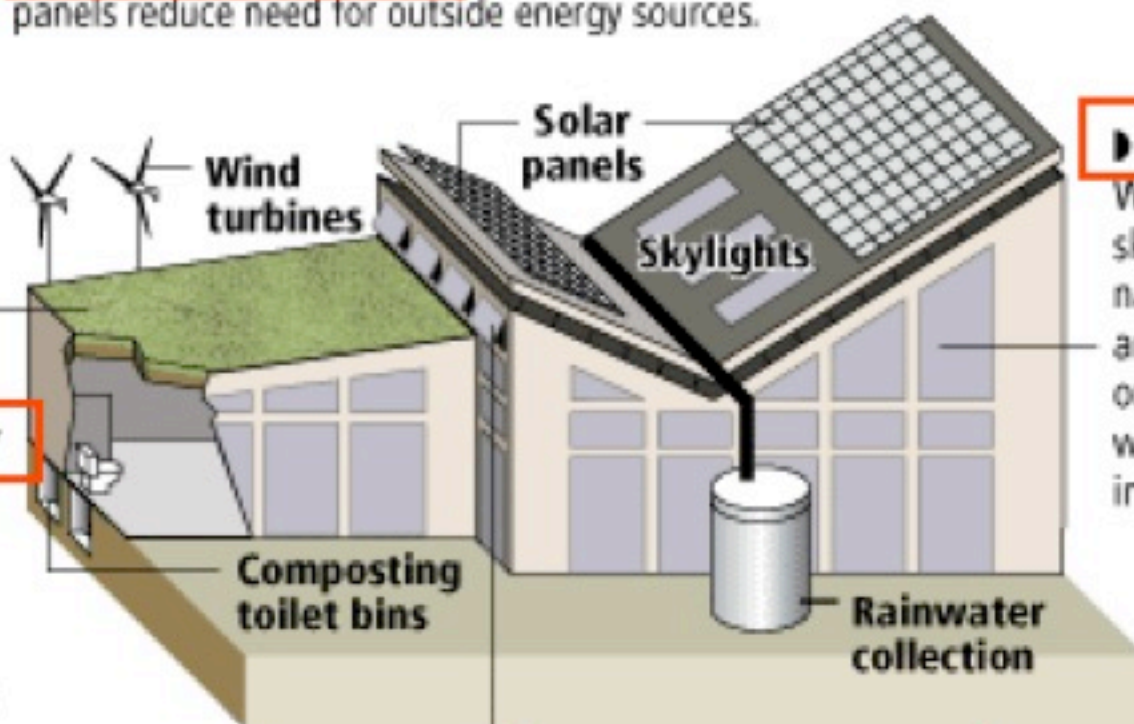
Cisterns collect rainwater to use for landscaping irrigation. Low-flow, waterless or composting toilets help reduce water use.

▶ VENTILATION

Vents and operable windows assist in heating and cooling by circulating air better.

▶ ALTERNATIVE ENERGY:

Roof-mounted wind turbines and solar panels reduce need for outside energy sources.



▶ WINDOWS

Windows and skylights provide natural lighting and heat. Glazed or double-paned windows provide insulation.

▶ BUILDING MATERIALS:

Recycled building materials reduce waste. Building with certified lumber helps protect forests and using non-toxic paints and carpets creates a healthier interior space.

Source: P-I reporting

SEATTLE POST-INTELLIGENCER

Benefits of Green Building

- ◆ **Reduced Operating Costs** by increasing productivity and using less energy and water,
- ◆ **Improved Public and Occupant Health** due to improved indoor air quality, and
- ◆ **Reduced Environmental Impacts**
 - (e.g., lessening stormwater runoff and the heat island effect).

Green Building Materials (1)

◆ Natural Materials

- Less off-gassing of solvents, etc leading to improved indoor air quality



Example: Straw-bale construction

Straw Bale Houses

- ◆ Walls of compressed straw bales (laid like bricks) that are approximately 18 inches (45 cm) thick.
- ◆ Straw bales provide **better insulation than conventional** fibreglass or cellulose fibres.
- ◆ **Energy efficient** (25 - 40% less heating and cooling energy required).
- ◆ **Inexpensive to build** (up to 50% savings from conventional wall structures).

<http://www.kellybradford.com/7thportfolio2.html>

<http://www.strawbalebuilding.ca/strawbales.shtml>

<http://www.cmhc-schl.gc.ca/publications/en/rh-pr/tech/02-115e.pdf>



Location: Kanata, ON
of Bedrooms: 4
Square Footage: 1890
Built: 2002



<http://www.strawbalebuilding.ca/houses/37.shtml>

<http://www.strawbalebuilding.ca/houses/44.shtml>



Location: Bancroft, ON
of Bedrooms: 2
Square Footage: 1400
Built: 2004

Built Examples



2003 5 29

Green Building Materials (2)

◆ **Certified Sustainable**

- E.g., "Certified Wood" from sustainable forests rather than old growth destruction



Green Building Materials (3)

◆ Local Materials

- i.e., short haul distances

◆ Recycled Materials

- Consider the example of Construction and Demolition Debris



Construction & Demolition Debris (C&DD)

- ◆ C&DD consists of {concrete, asphalt, wood, gypsum wallboard, asphalt roofing materials, metal, bricks, glass, plastics, building components, trees, soil, rocks}
- ◆ C&DD in the USA in 2003: **≈ 164 million tonnes**
 - 9% construction waste
 - 38% renovation waste
 - 53% demolition waste
- ◆ Reuse strategies can include on-site reuse, donations to other projects, or off-site recycling

Existing and Emerging Green Technologies

◆ **Energy Generation**

- E.g., solar panels (on- and off-grid systems)

◆ **Greywater Recycling**

- Filtering and reuse of bathing and washing water for non-potable household uses

◆ **Passive Solar Design**

- E.g.s., solar orientation of streets, window placement, building massing

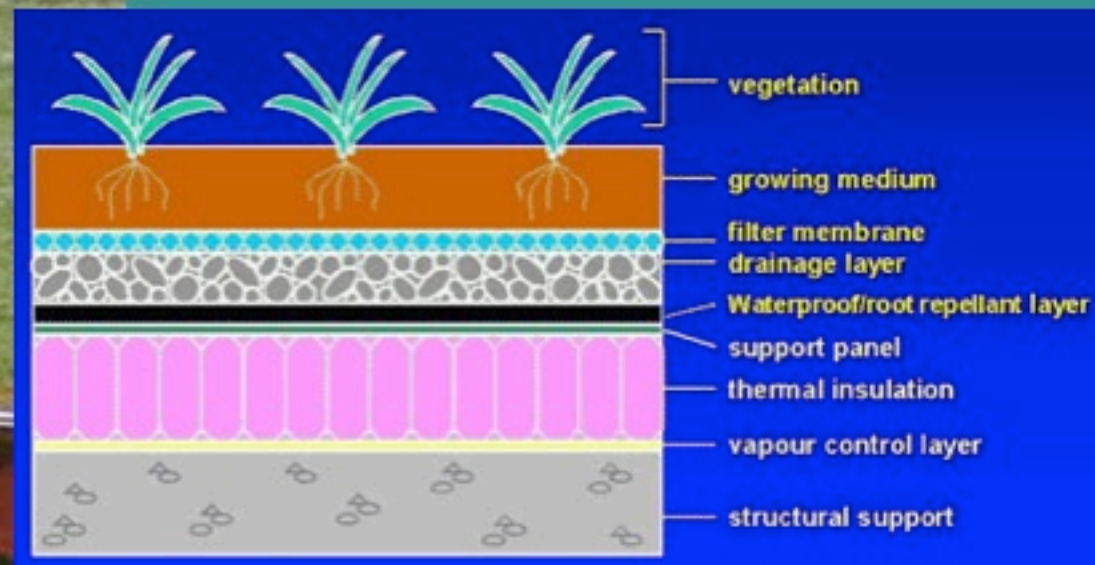
◆ ...

Green Roofs



Green Roofs (1)

- ◆ (def'n) part or all of the roof area is covered with vegetation, planted in a layer of soil that sits on a membrane directly on the roof surface;



Source: NRC 2004

Green Roofs (2) – examples from Toronto

- ◆ “concept ...to replace the vegetated footprint lost when the building was constructed” (Schneider 2006)



New

York University
Computer Science Building



401 Richmond

Retrofit

Retrofit

New

Benefits of Green Roofs

- ◆ Stormwater retention
- ◆ Insulation
- ◆ Cooling
- ◆ Air quality improvements
- ◆ Energy conservation
- ◆ Sound absorption
- ◆ Food production
- ◆ Bird/insect habitat



Herb garden on top of the Fairmont Hotel in Vancouver.

Toronto's Healthy House

The image features a solid teal background. In the bottom right corner, there is a stylized, dark teal silhouette of a mountain range with jagged peaks. The text "Toronto's Healthy House" is centered in the upper half of the image.

Canada Mortgage and Housing Corporation (CMHC)

Healthy House Competition (1996)



Healthy House in Toronto's
Riverdale Neighbourhood

Photo Credits: Breathe Architects
(2007)

Key Facts

- **1700 ft²**, semi-detached, 3 bedroom home operated by CMHC
- **100% "OFF GRID"** with an annual operating cost below \$300.
- All **concrete is 78% recycled natural materials**
- **Greywater recycling system** typically recycles water 5 times in a system that duplicates soil filtration
- **Solar heating and electricity generation** through photo voltaic panels and south facing windows.
- Healthy House **uses one-tenth the amount of energy** as a conventional home.

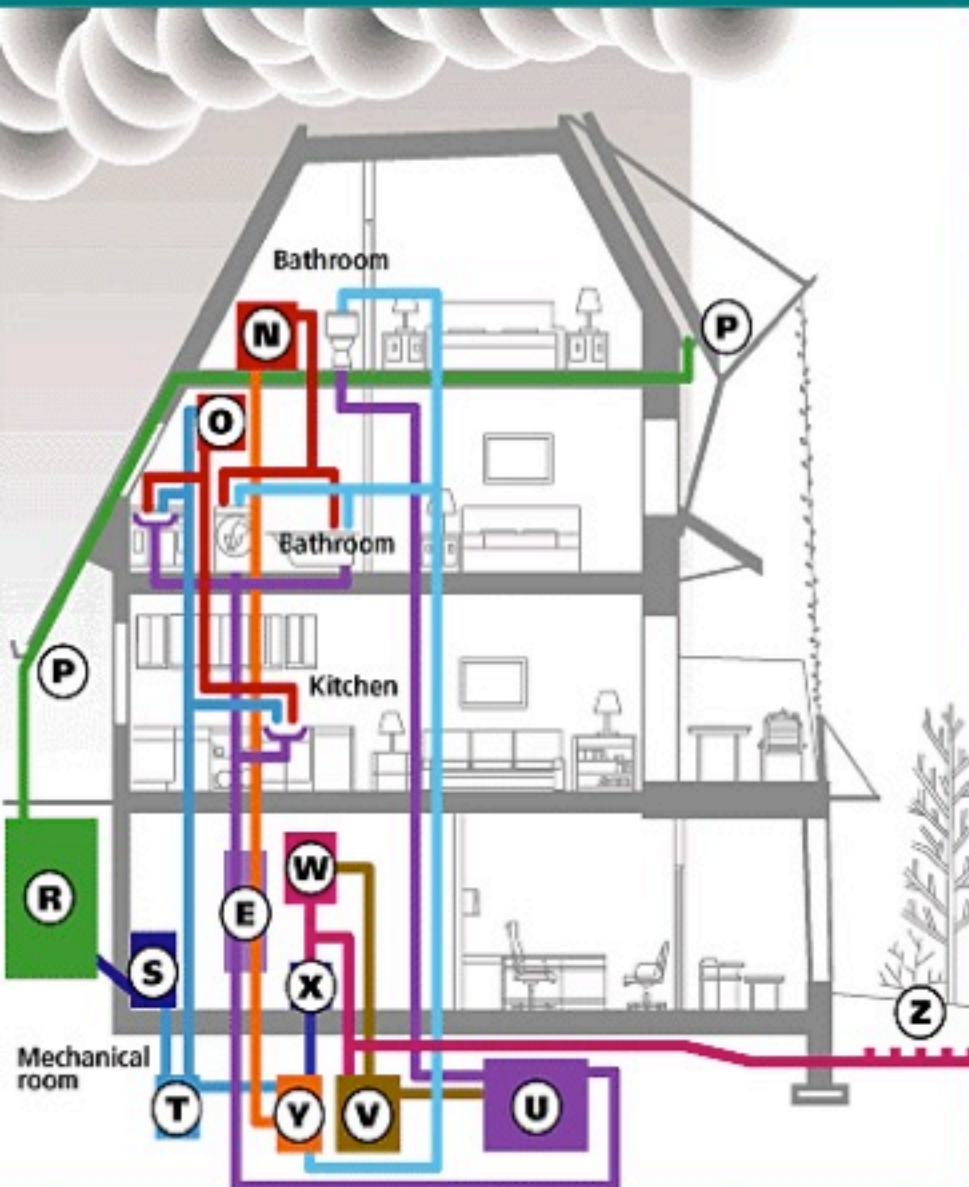
Toronto Healthy House



<http://www.cmhc-schl.gc.ca/popup/hhtoronto/frame.html>

<http://healthyhousesystem.com/toronto.html>

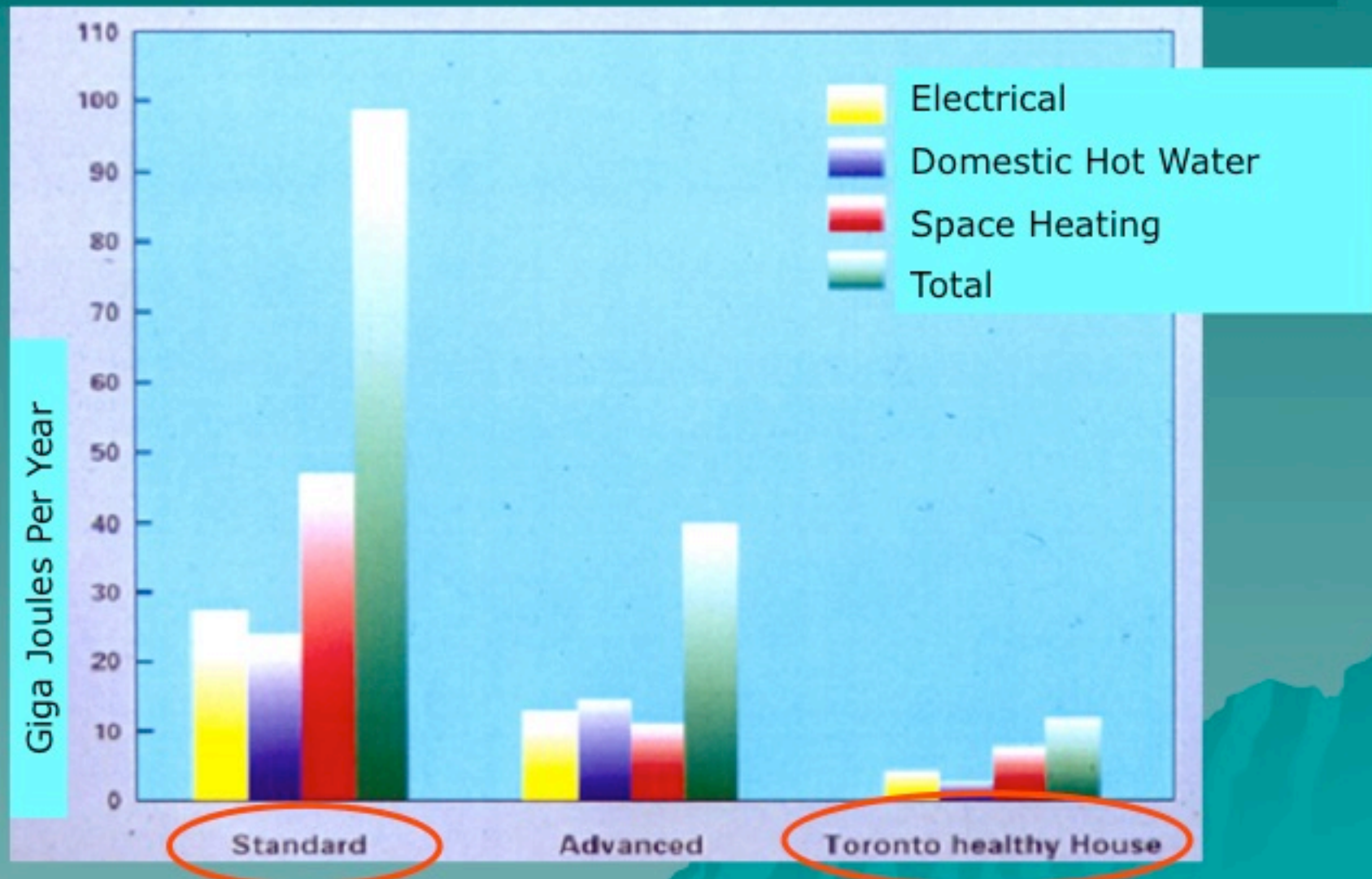
Waste(grey-)water Recycling System



- ◆ **P** - EAVESTROUGHS
- ◆ **R** - RAINWATER CISTERN
- ◆ **S** - COMBINATION FILTER
- ◆ **T** - DRINKABLE-COLD-WATER TANK
- ◆ **O** - DRINKABLE-HOT-WATER TANK
- ◆ **E** - GREY WATER HEAT EXCHANGER
- ◆ **N** - RECLAIMED-HOT-WATER TANK
- ◆ **U** - SEPTIC TANK
- ◆ **V** - RECIRCULATION TANK
- ◆ **W** - WATERLOO BIOFILTERTM
- ◆ **X** - TWIN COMBINATION FILTERS
- ◆ **Y** - RECLAIMED-COLD-WATER TANK
- ◆ **Z** - GARDEN IRRIGATION

Annual Energy Consumption

(source: Breathe Architects)



Benefits of the Toronto Healthy House

- ◆ Annual Thermal Energy Cost:
 - \$80 versus \$800 (1996 dollars)

- ◆ Annual Water Use:
 - 120 L versus 1050 L

- ◆ Total Operating Cost:
 - Under \$300 annually
 - TR's House (Thunder Bay)

 - ◆ Heat via natural gas (\$1500)

 - ◆ City Water (\$500)

 - ◆ Electricity (\$1000)

**At least \$3000
annually**



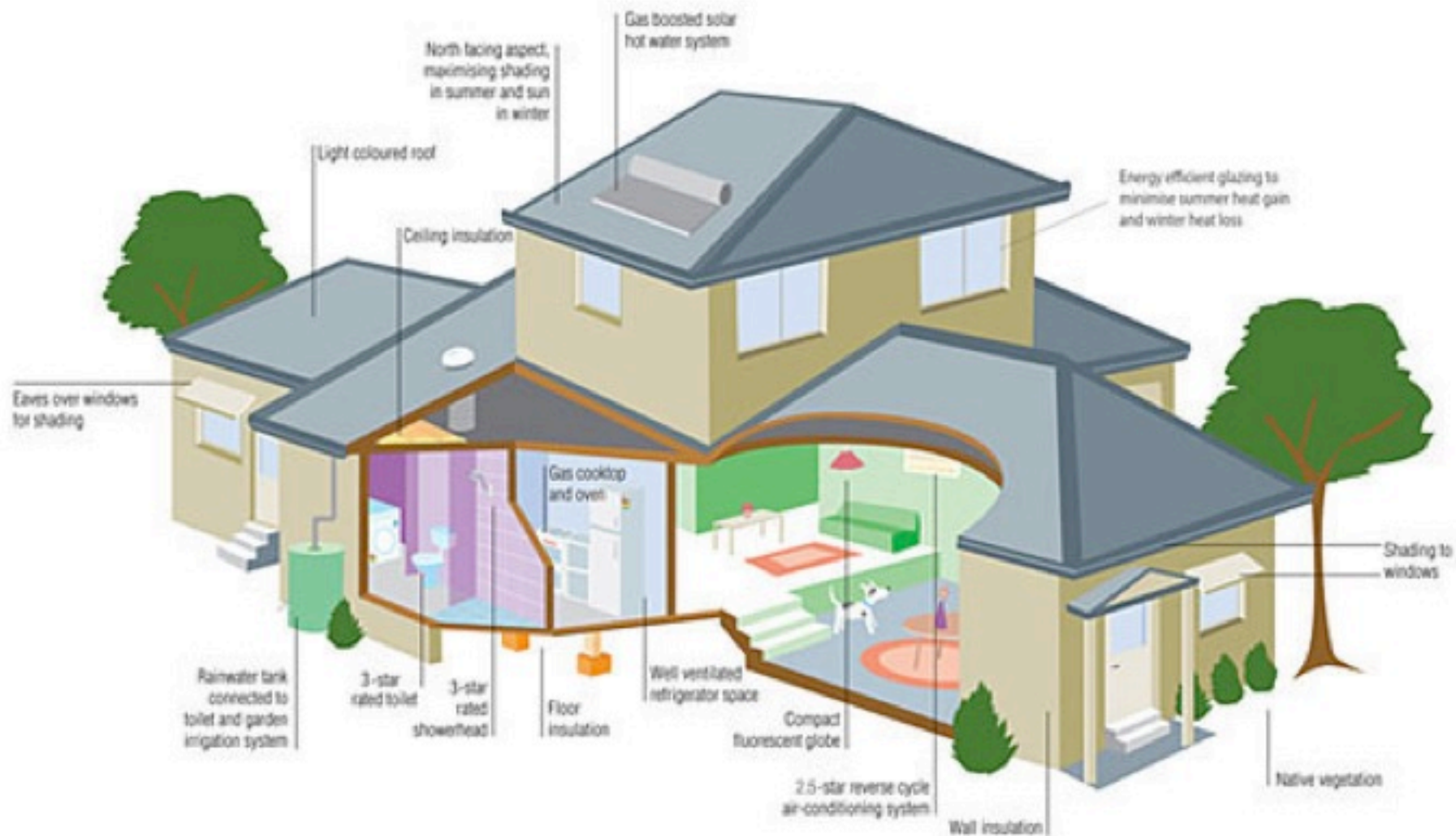
All new homes in Sydney must be designed to use 40 per cent less water and 25 per cent less energy (Baseline 1990) to get building approval.

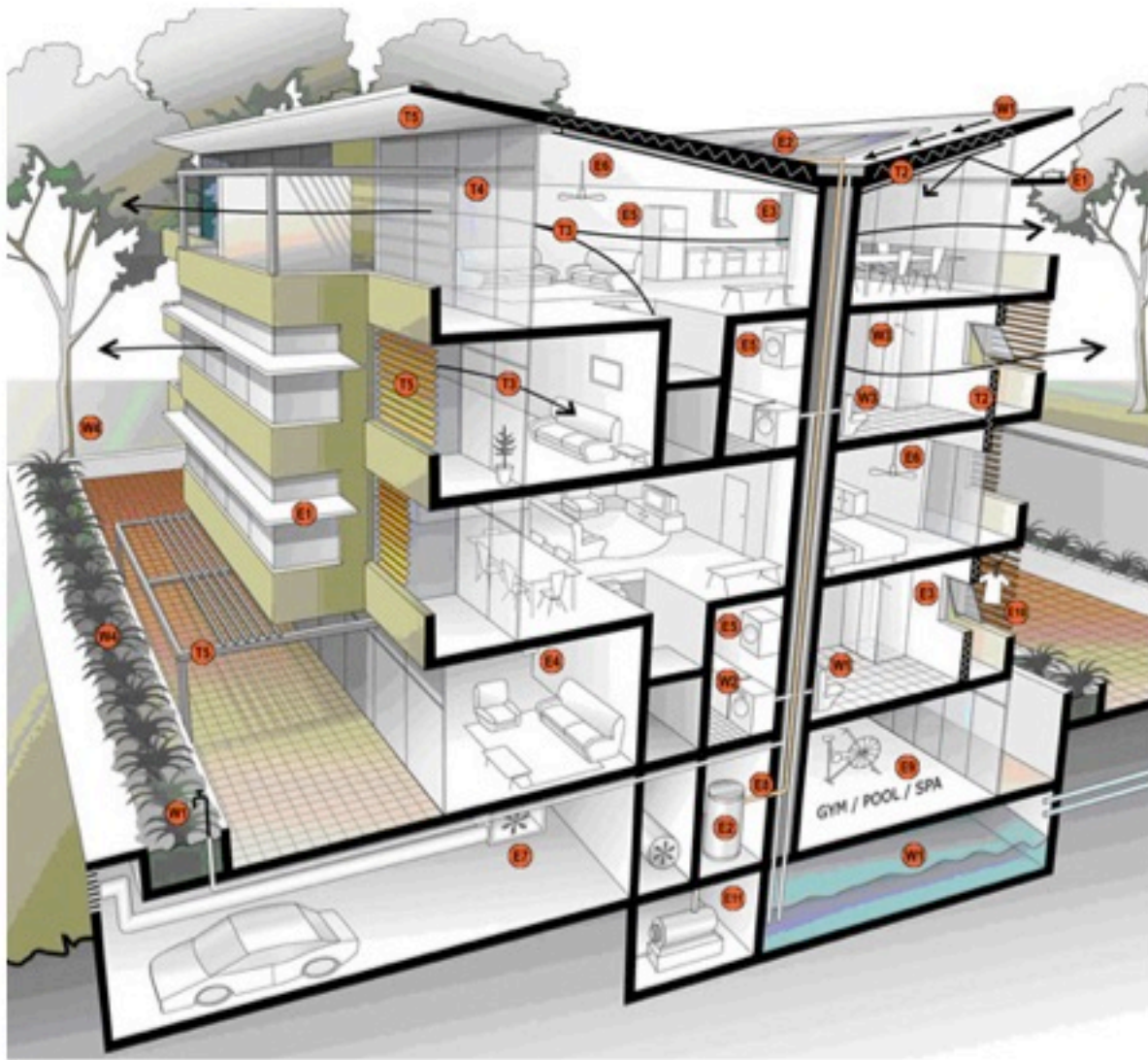
BASIX July 1, 2004

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These reductions can be achieved by:

- Using native plants in the garden to cut water use;
- Installing a rain water tank for gardening and flushing the toilet;
- Fitting water-saving showerheads, taps and dual-flush toilets;
- Ensuring walls and ceilings are well insulated;
- Choosing a light-coloured roof to reduce cooling costs;
- Installing an outdoor cloths line and
- Using skylights to bring in natural lights.





Energy

Light shelves for improved natural lighting

Solar hot water system

Natural light in kitchen and bathroom areas

Compact fluorescent lights with timers in common area lighting

Energy efficient appliances such as refrigerators

Ceiling fans for cooling

Carbon monoxide monitoring to regulate carpark ventilation

Insulated hot water pipe

Energy efficient pool and spa heating

Clothes line on louvred balcony to reduce need for electric drying

On-site electricity and heat generation (cogeneration system)

Water

Storm/rainwater collection for toilet and garden use

4 STAR rated appliances such as washing machines and dishwashers

3 STAR rated water fixtures - dual flush toilets, shower heads and taps

Native, low water use landscaping

Thermal Comfort

Passive solar orientation

Insulation in ceiling and walls

Cross ventilation allowing air to flow through units, reducing the need for air conditioning

Performance glass

Roof overhang, window eaves, pergolas and louvres to reduce sun's heat

Duluth, Minnesota

- SUSTAINABLE CITY RESOLUTION ADOPTED BY DULUTH, MINNESOTA
Following an initiative by its mayor, the Duluth City Council approved a resolution :

- “endorses the guidelines for sustainable community development and agrees to apply those guidelines whenever possible in its planning, policy making and municipal practices. ... This resolution announces policies to be used in running the city in a manner that is sustainable and consistent with being an eco-municipality.”

Duluth joins other cities working under the Swedish-based eco-municipality framework: Cities for Climate Protection campaign as well as through the Mayor's Eco-Industrial Development working group. As objectives, resolutions include goals to: Reduce dependence upon fossil fuels, synthetic chemicals, encroachment upon nature; and to better meet human needs fairly and efficiently.



Duluth, Minnesota

- These are four Natural Steps for a sustainable economy:
 - Reduce wasteful dependence upon fossil fuels, scarce metals, and minerals that accumulate in nature.
 - Reduce wasteful dependence upon chemicals and synthetic substances that accumulate in nature.
 - Reduce encroachment upon nature.
 - Meet human needs fairly and efficiently.

Source: "The Natural Step for Communities" by Sarah James & Torbjörn Lahti. The book depicts examples of how cities and towns can change to sustainable practices.

Melbourne Principles

- **ENERGY CONSERVATION**
- **ENVIRONMENTAL LEGISLATION**
- **INNOVATION & TECHNOLOGY**
- **RESOURCE CONSERVATION**
- **COMMUNICATIONS & CONSULTATION**

- **ENVIRONMENTAL EDUCATION**
- **COMMUNITY INVOLVEMENT**
- **ENVIRONMENTAL ACTION PLAN**



EarthWise Thunder Bay



Environmental Innovation

Brownfield Development



Bethlehem Steel Warehouse

Photo Credit: Sean M.L. Galbraith Photography

Brownfield Development (1)

- ◆ Recycling of old, abandoned land and/or buildings
- ◆ Refurbishing as both commercial and residential properties



Example: Granville Is. Public Market, Vancouver

Source: <http://www.seegravilleisland.com/views/views.htm>

Brownfield Development (2)

Example: Loft Conversions, Former Tip Top Tailor Factory, Toronto Waterfront



Issues with Brownfields

- ◆ Soil Contamination
- ◆ High Costs
- ◆ Asbestos Contamination
- ◆ Land Acquisition
- ◆ Public Distrust



Lister Block, Hamilton, Ontario

Photo Credit:

Sean M.L. Galbraith Photography

Summary Remarks



- ◆ Opportunities to **re-evaluate the use of existing land and buildings** with alternatives that result in less environmental impact while still allowing for economic and societal well-being.
- ◆ **More sustainable development** uses less material, resources, land and energy than conventional development approaches.