Fecal Contamination of Water & Determination of Pollution Sources

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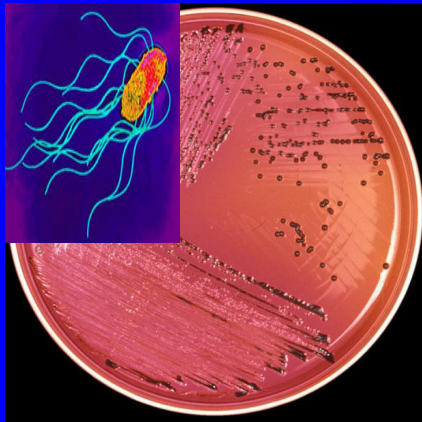**The Impending Water Crisis of Tampa Bay**
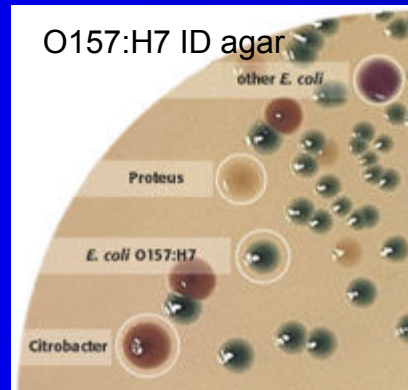
Water Can Be Contaminated by Many Different Fecal Sources

Water Quality Standards Must Protect Against Many Types of Pathogens
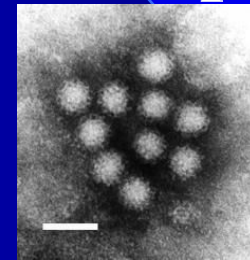
Bacterial pathogens

Salmonella

O157:H7 ID agar

other *E. coli*

Proteus

E. coli O157:H7

Citrobacter

E. coli O157:H7

Viral pathogens

Norovirus

Protozoan pathogens

Cryptosporidium *Giardia*

How Do We Test Water Quality?

ADVISORY
HIGH BACTERIAL LEVELS
HEALTH RISK AT THIS TIME
SWIMMING NOT RECOMMENDED

Temporary Health Warning
14th DECEMBER 2006

As water testing shows high bacterial levels in this part of the Maitai River we recommend that you:-
Do not swim or bathe in the river from the Riverside Pool to the Maitai River mouth including the Collingwood Street Bridge

Maitai River swimming holes upstream of the Riverside Pool are within acceptable levels for swimming and bathing.

The signs will be removed when bathing water quality in this part of the river has improved.

For more information contact the NCC on 03 546 0200.

Public Health Service
NELSON CITY COUNCIL   Nelson Marlborough District Health Board
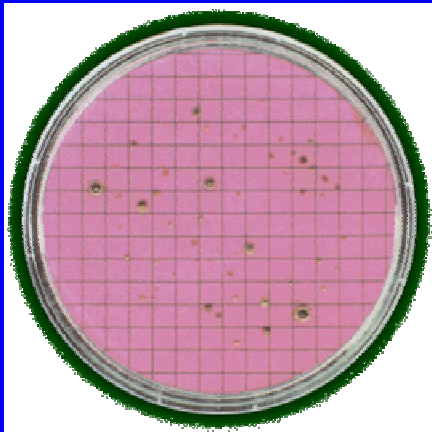
Boil Water Advisory
February 5, 2008

Office of Emergency Management is that any water used for drinking and/ or ed, prior to use.

Fecal Indicator Bacteria Surrogates for Pathogens

- **Meant to act as a warning signal of fecal pollution and increased risk of associated pathogens in water**

Total Coliform (drinking water)

Fecal Coliform (wastewater & recreational water)

Enterococci (recreational water)

Are Fecal Indicator Bacteria Always Good Surrogates?

- Sometimes absent when pathogens are present

- **Consequence** : No warning; more people may get sick

- Frequently present when pathogens are absent (false-positive)

- **Consequence** of false-positive: "crying wolf"; hurts tourism, public confidence in water quality

- Many possible sources!

Fecal Coliforms Are Relatively Wimpy!
Results from Reclaimed Water Across the U.S.

TABLE 2. Percentage of samples with detectable indicator organisms and pathogens

Indicator or pathogen	% of samples positive in each stage[a]			
	Influent	Biological treatment	Filter effluent	Disinfected effluent
Indicators				
Total coliforms	100	100	94	63
Fecal coliforms	100	97	65	27
Enterococci	100	94	84	27
Clostridium perfringens	93	86	79	61
Coliphages on 15597	100	97	83	38
Coliphages on 700891	100	93	80	45
Pathogens				
Enteric viruses	100	73	58	31
Giardia	100	94	88	80
Cryptosporidium				
Total oocysts	74	84	71	70
Infectious oocysts	32	19	19	20

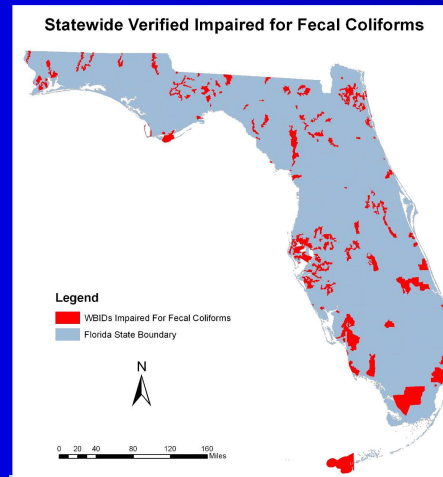[a] Data from all sampling events at the six facilities were pooled for each treatment step.

Why Do We Need to Know the Source?
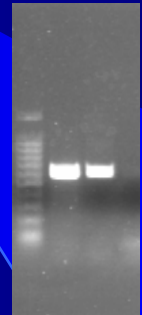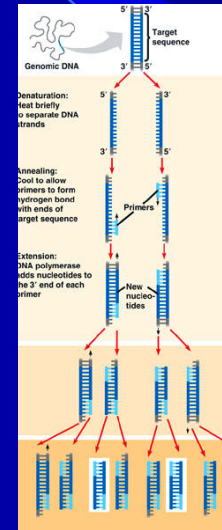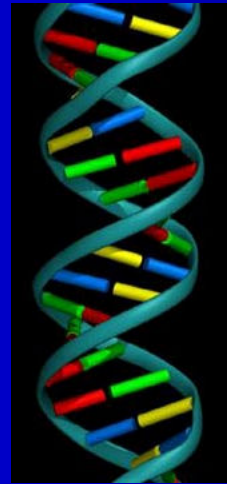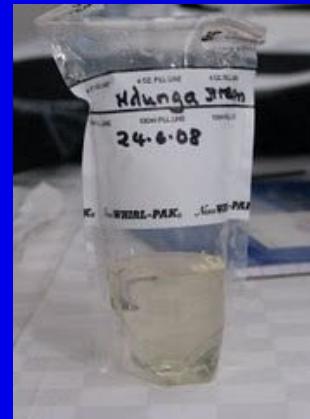
- Sources vary from **highest risk** (human sewage)…
- …to **definite risk** (cattle, poultry)
- …to **unknown risk** (wildlife, pets, sediments, soils, stormwater)
- Can't remediate or implement w/o knowledge of dominant source(s)
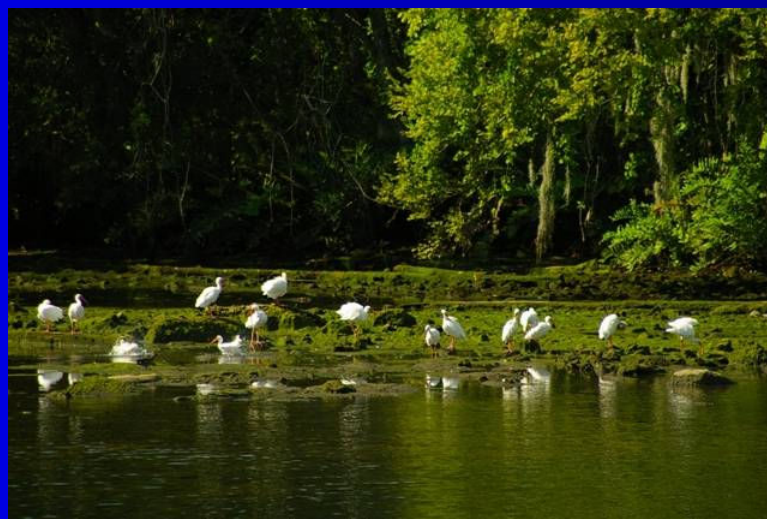
Microbial Source Tracking Based on DNA "Markers"

- Polymerase chain reaction targets a specific gene & copies it
- Forensic-type evidence for contamination source

Summary

- **Many pathogens have the potential to contaminate surface water**

- **These pathogens can come from many sources**

- **Detection of contamination is "one size fits all"**

- **We may not be using the best indicator(s)**

- **Clean-up and prevention of water contamination require knowledge of source**

Questions?

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