E. coli & Tiny Township's Beaches

Environment Canada's Studies 2005 - 2007

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INSTITUT NATIONAL DE RECHERCHE SUR LES EAUX

Objectives of this Presentation

Focus on the role of groundwater in delivering *E. coli* to the shoreline and storage of *E. coli* below beaches.

specifically . . .

- What is the extent of the problem?
- What are the sources of *E. coli*?
- How long will E. coli persist?
- What is the role of the lake, creeks, and groundwater at beaches?
- How can be done to reduce *E. coli* levels?

Objectives of this Presentation

This presentation will not discuss . . .

***E. coli* in lake water** ➡ **Simcoe-Muskoka Health Unit**

***E. coli* in rivers and streams** ➡ **SSEA**

Our Study Sites:

Balm Beach . . .

Jackson Park Beach

Woodland Beach

Our Study Sites:

Balm Beach

Jackson Park Beach . . .

Woodland Beach

Our Study Sites:

Balm Beach

Jackson Park Beach

Woodland Beach . . .

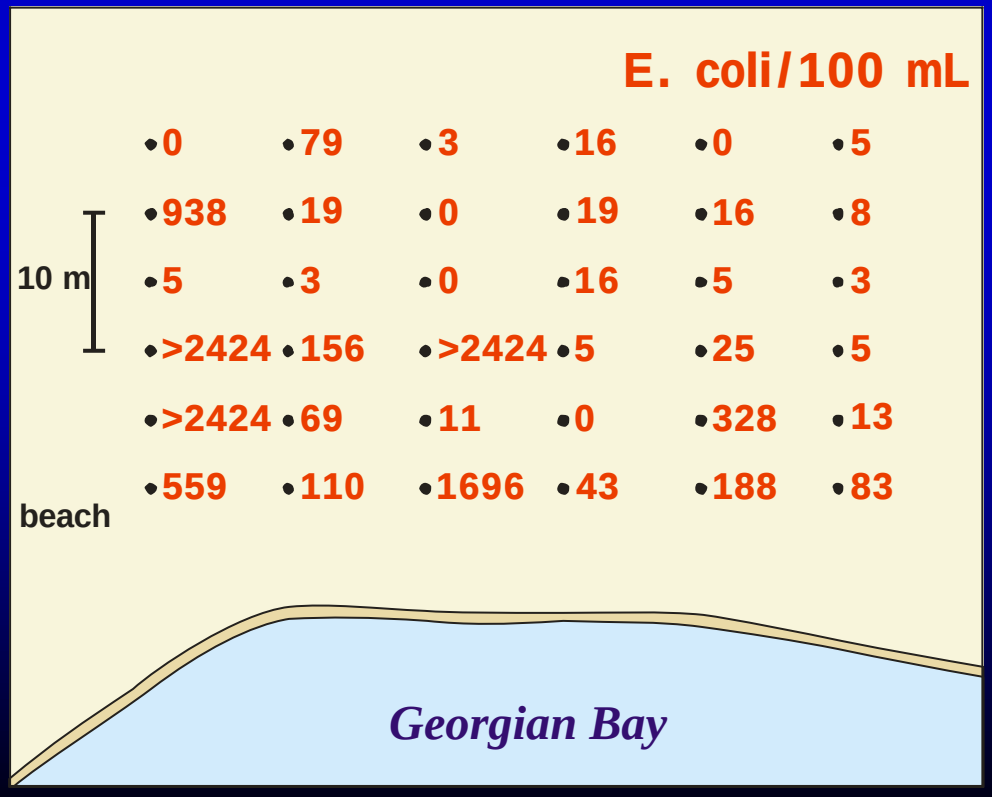
E. coli in GW below Beaches

Is *E. coli* present in groundwater below beaches of Tiny Township?

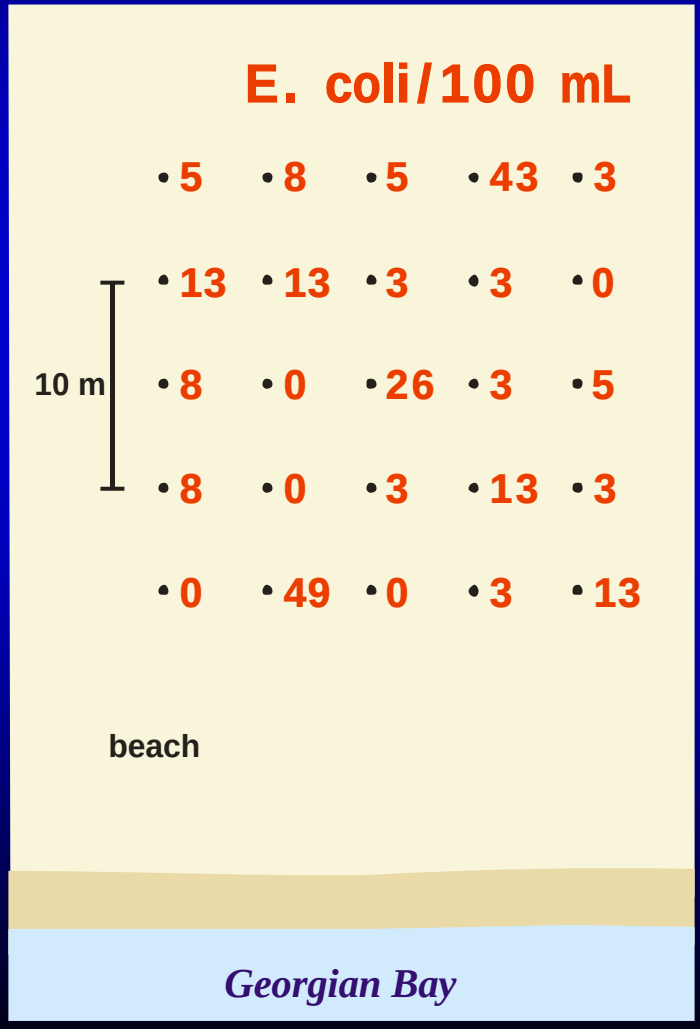
E. coli in GW below Beaches

E. coli at some beaches

Jackson Park Beach

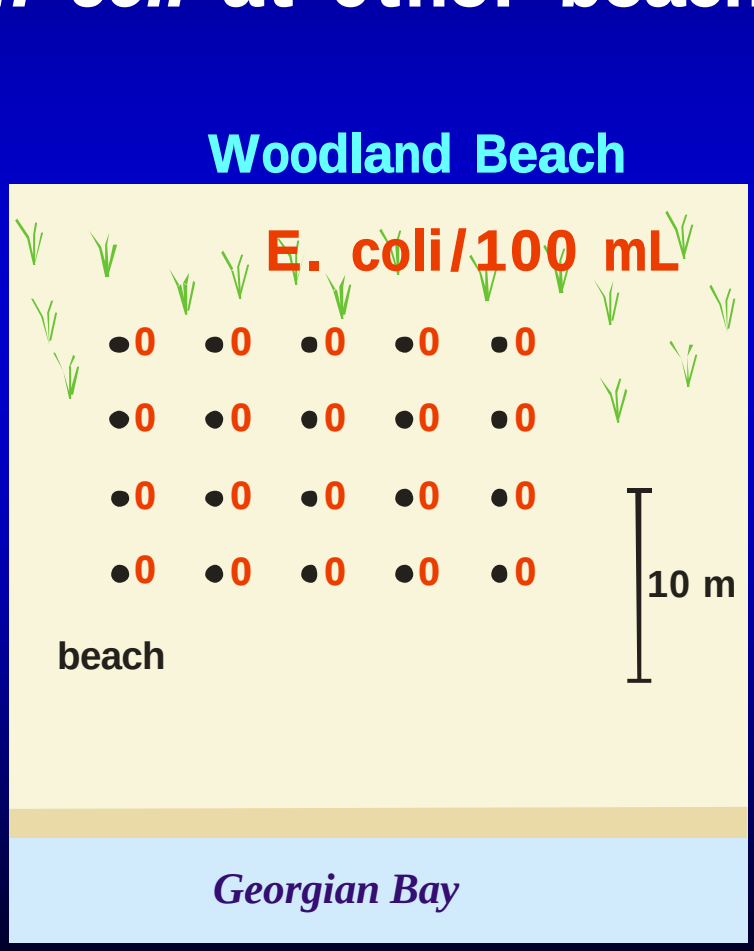


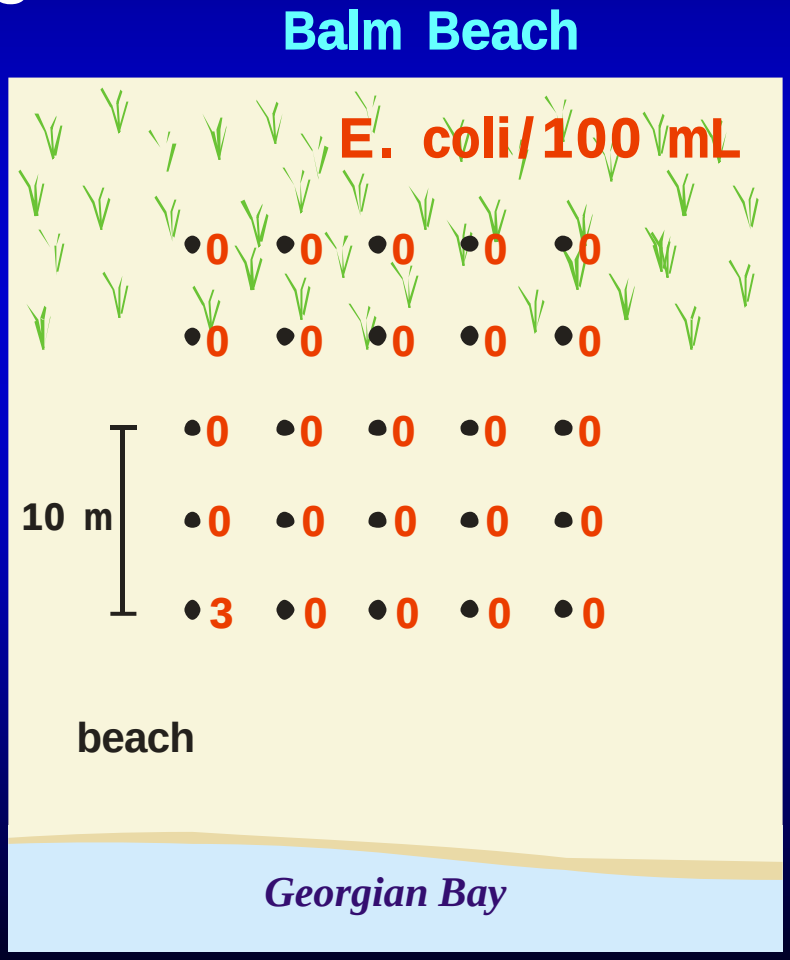
Woodland Beach



E. coli in GW below Beaches

no *E. coli* at other beaches



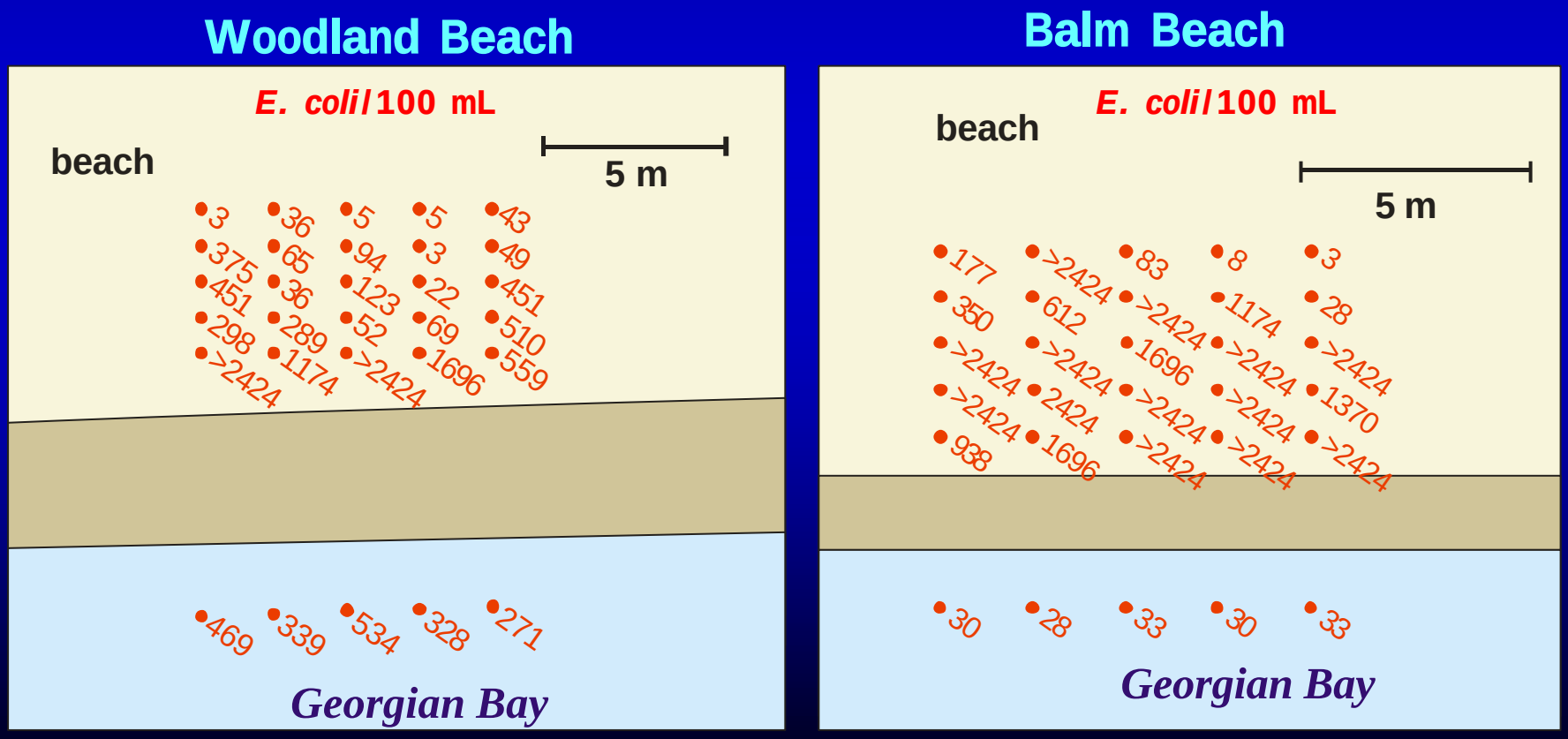


E. coli in GW below Beaches

Is *E. coli* present in groundwater adjacent to the shoreline?

E. coli Adjacent to Lake

E. coli always present at the shoreline



E. coli Adjacent to Lake

E. coli persists in groundwater during winter

below frozen sand and ice

E. coli Below Beaches

What we see at the Beaches of Tiny Twp is no different from what we see at beaches at Lake Huron, Lake Ontario, Lake Erie.

This also seen by U.S. researchers

Your beaches are no better or no worse than others beaches!

E. coli in GW below Beaches

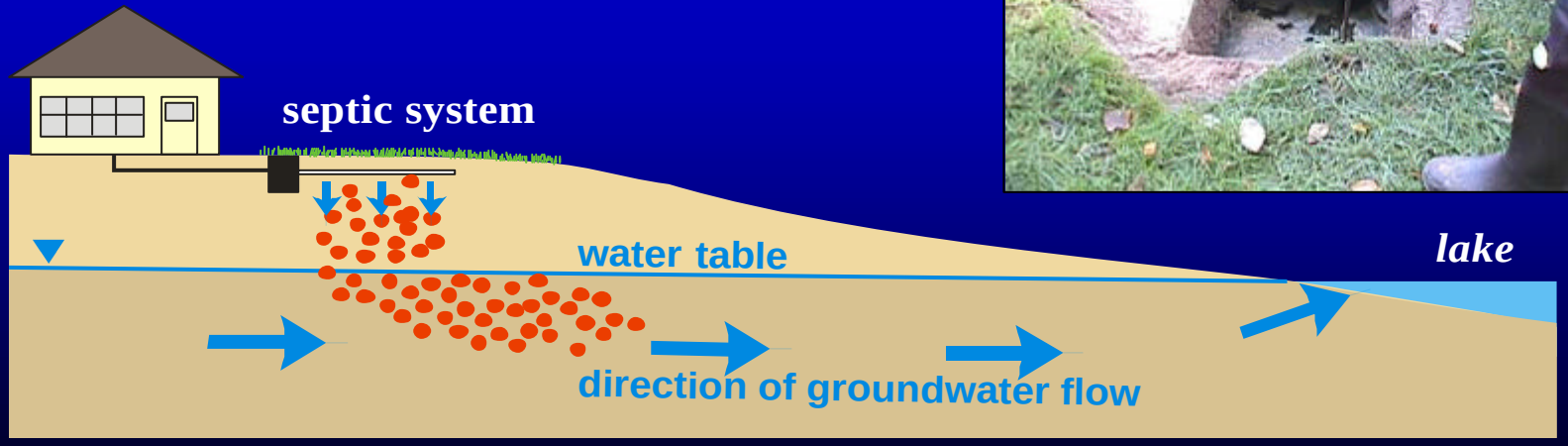
What are the sources of *E. coli* found in groundwater below the beaches?

Are Septic Systems a Source of *E. coli* in Groundwater at Beaches?

settling tanks have > 40,000 *E. coli*/100 mL

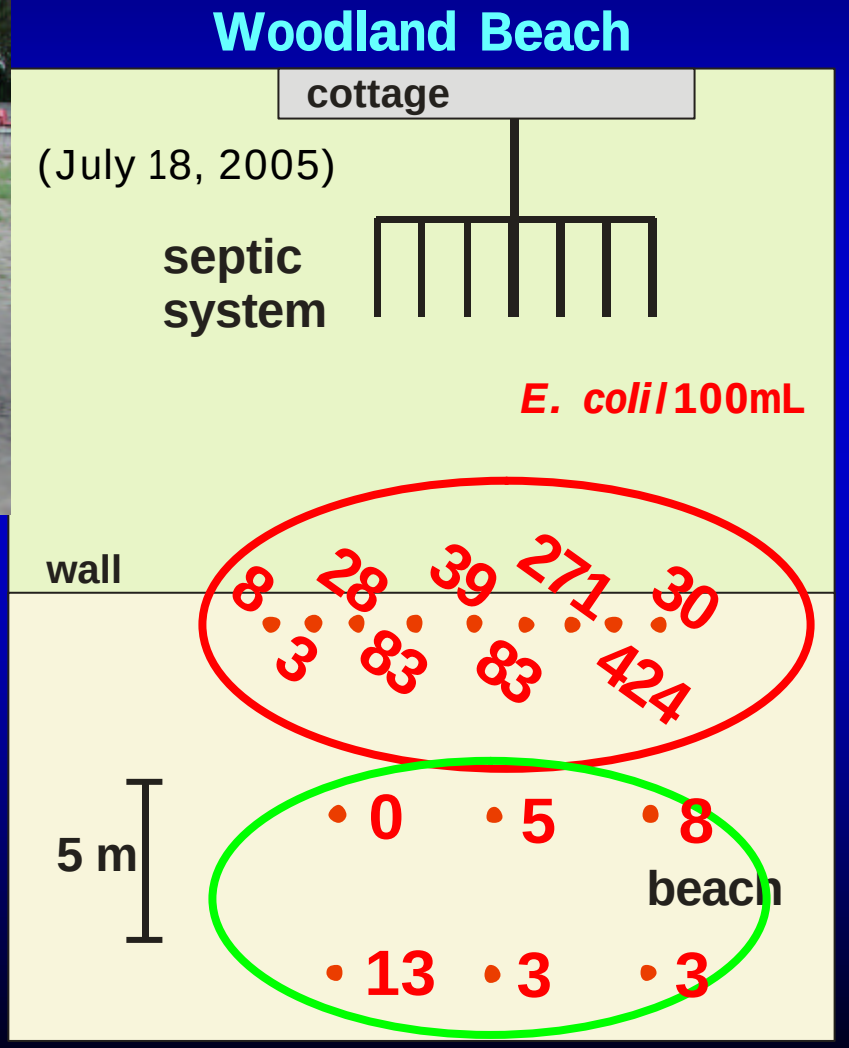
they discharge to subsurface

gw flows towards the lake



Impact of Septic Systems

MST confirms human source (septic system)

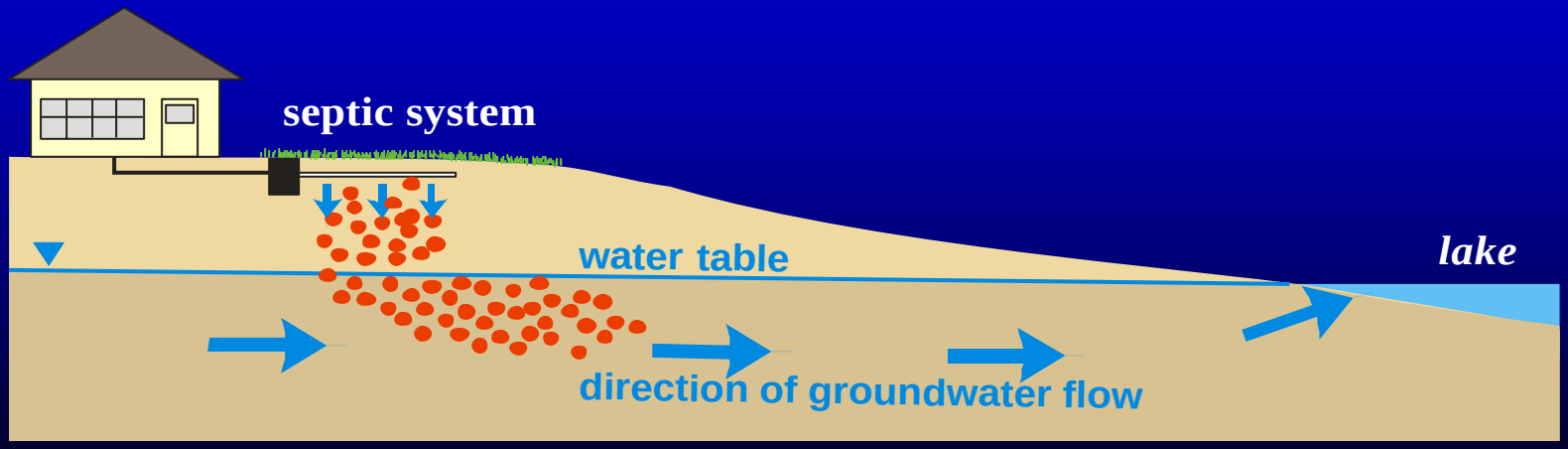


Impact of Septic Systems

little transport via groundwater because

E. coli tend to attach to sand grains

thus, subsurface movement ~10 – 20 m



Impact of Septic Systems

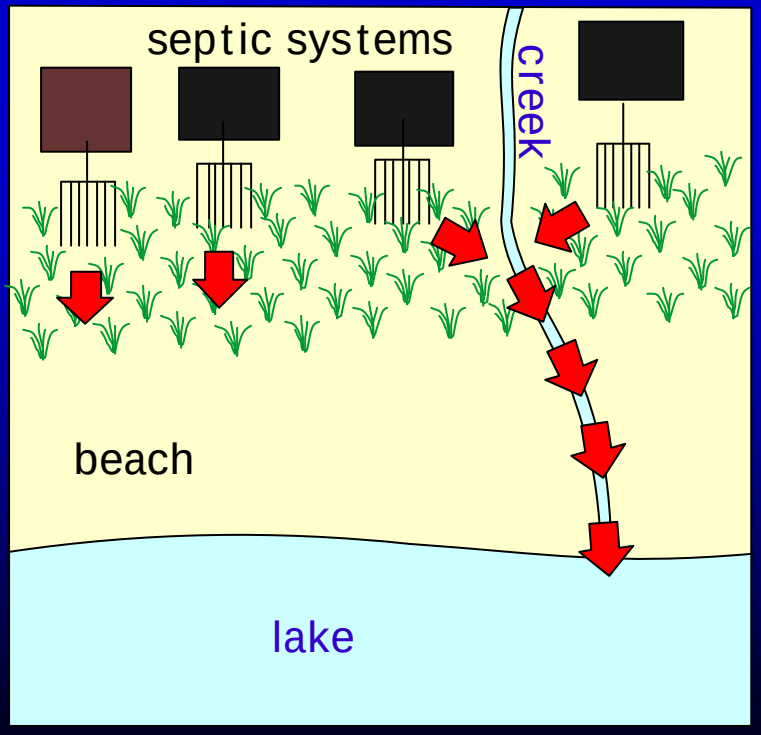
No evidence of *E. coli* migration via gw below the dunes and beach to the shoreline from septic systems at beach-front residences.

(other contaminants (NO_3, PO_4) can reach shoreline)

But . . .

Impact of Septic Systems

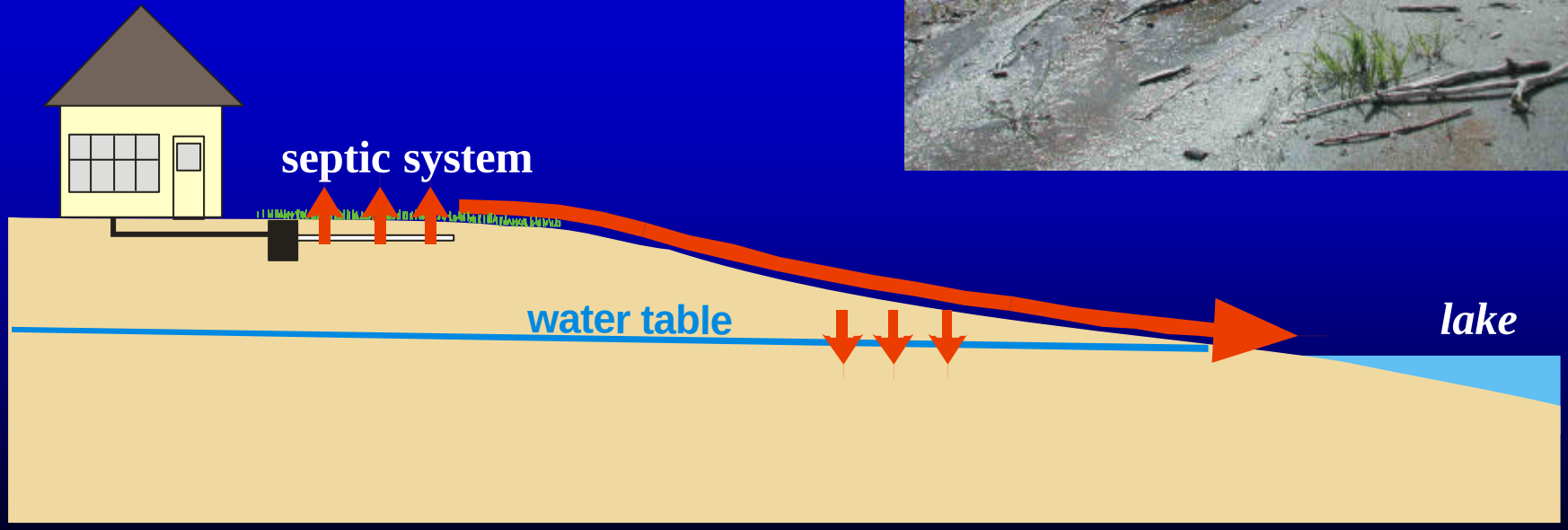
groundwater and *E. coli* can take a short-cut to shoreline via adjacent creeks



Impact of Septic Systems

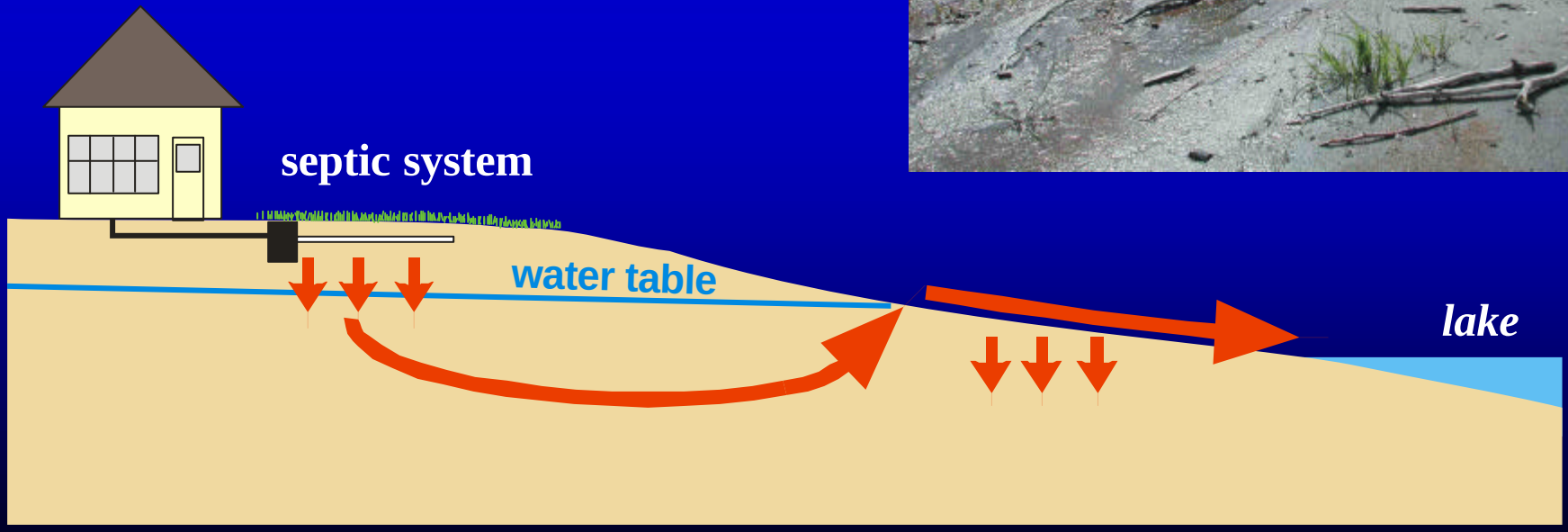
E. coli **and contaminants can reach shoreline & gw below beach via:**

runoff (failed septic system)

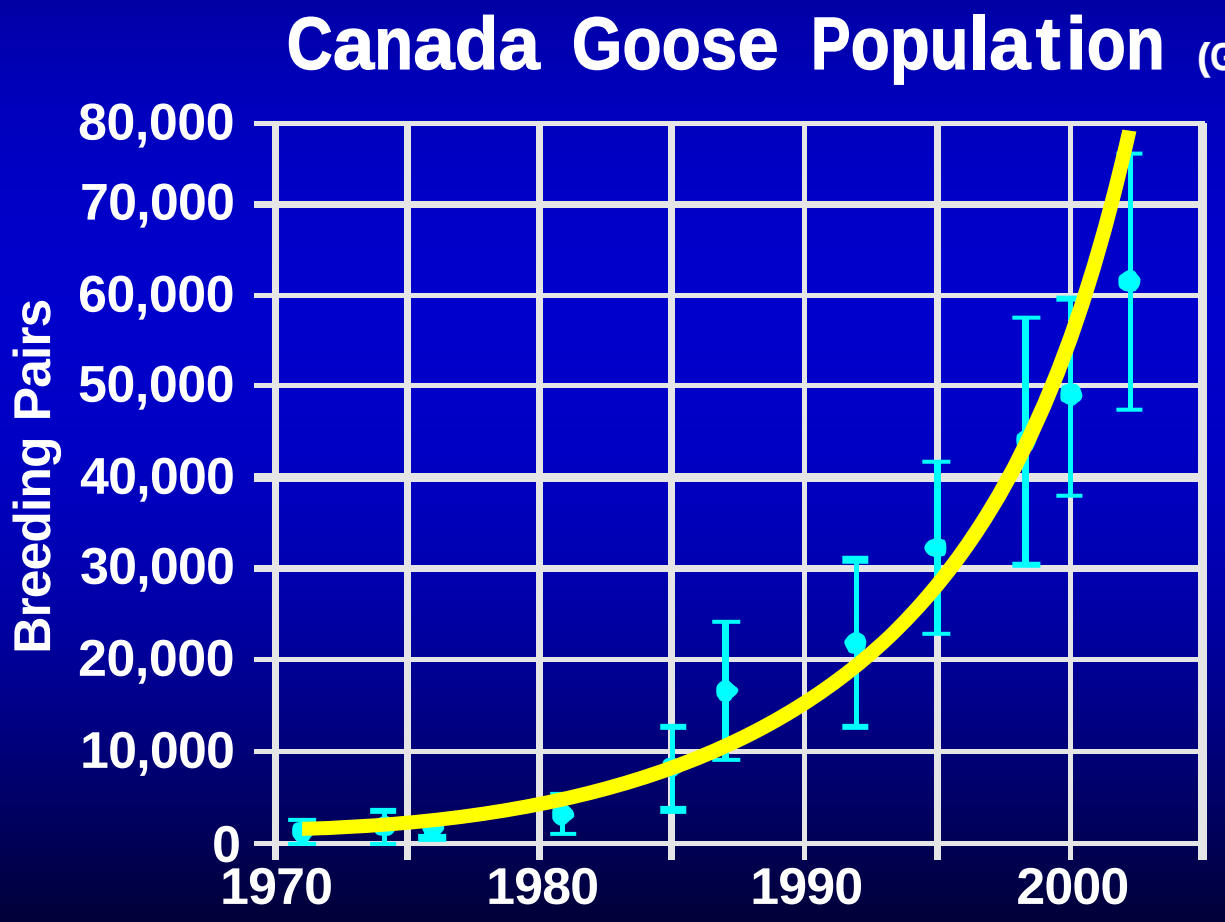


Impact of Septic Systems

E. coli **and contaminants can reach shoreline & gw below beach via:**
spring discharge onto beach



Are Birds a Source of *E. coli*?



source: Canadian Wildlife Service

Are Birds a Source of *E. coli*?

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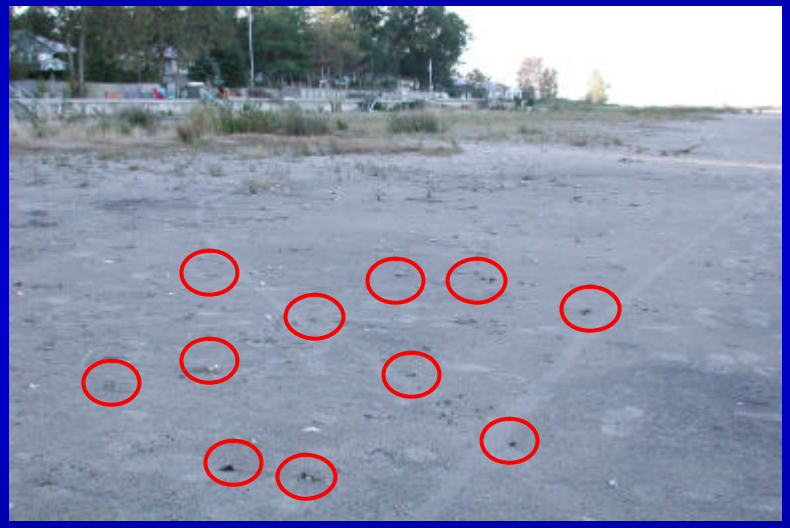
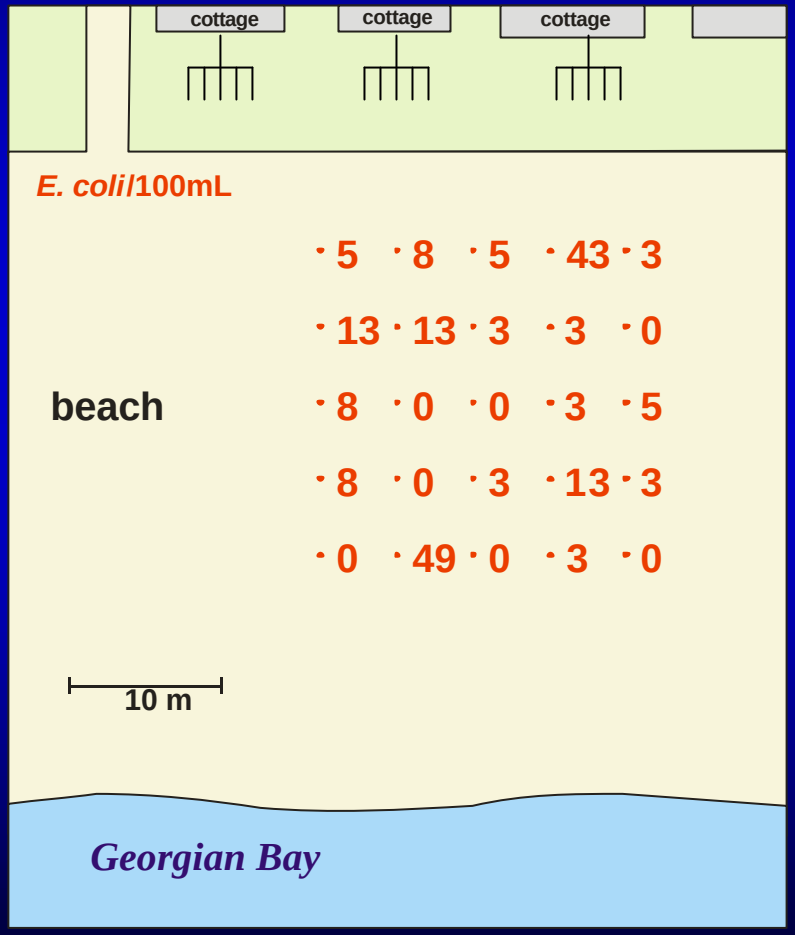


geese & gulls leave lots of sources of *E. coli*

Source of *E. coli* Below Beaches?

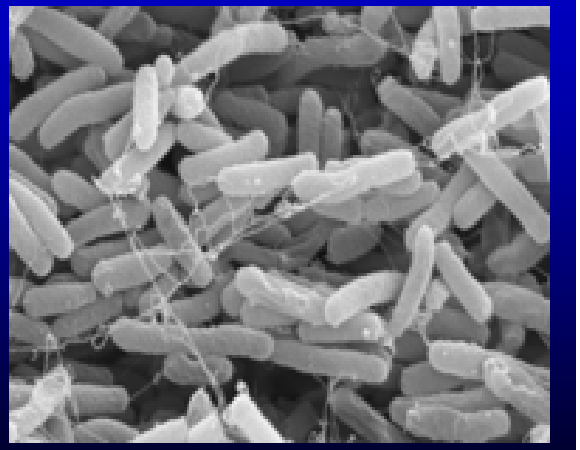
MST confirms source is gulls and geese

But, why is *E. coli* below some beaches but not other beaches?



Dry vs. Wet Beaches

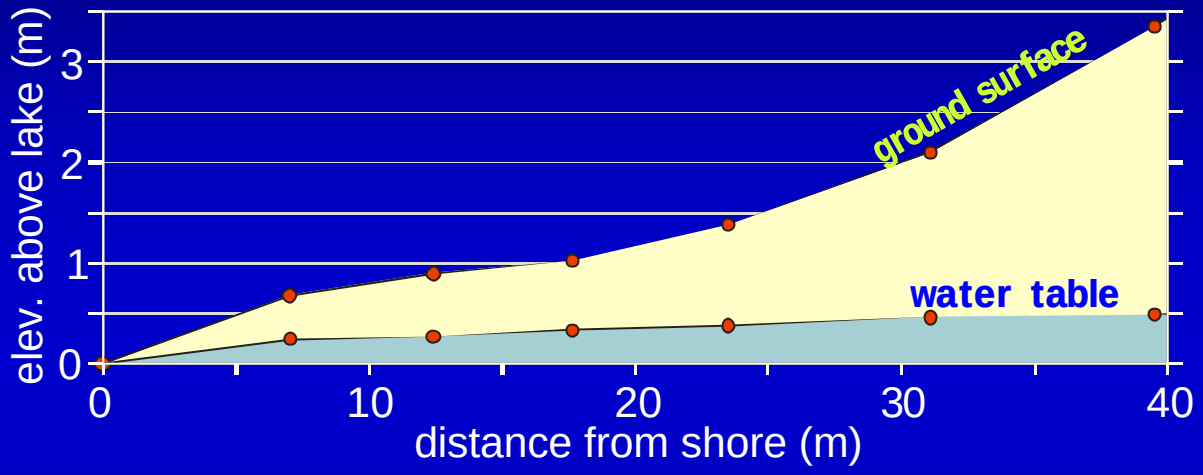
E. coli



Depth to W.T. & Beach Physiography

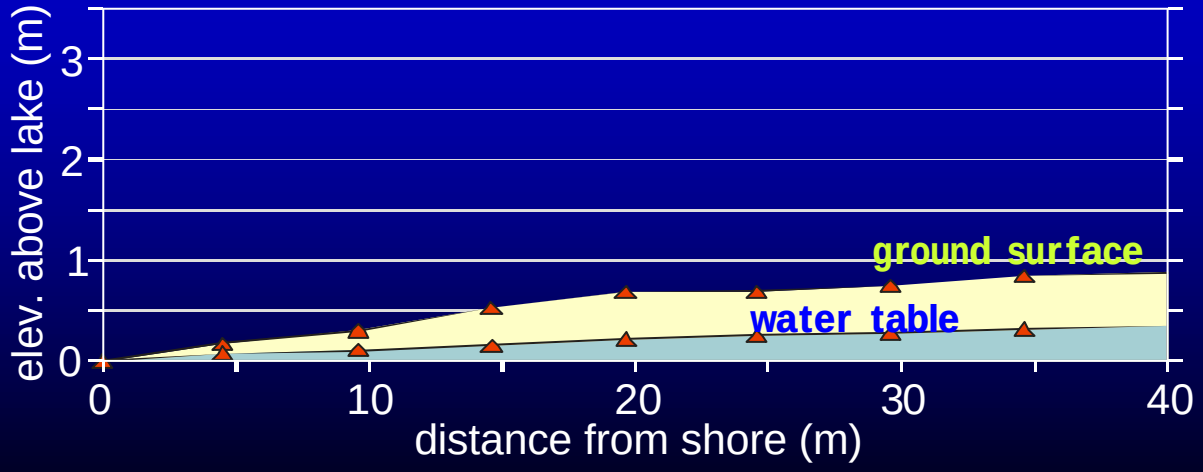
Dry Beach:

water table depth:
0.5 m to 3.0 m



Wet Beach:

water table depth:
0.2 m to 0.3 m



Source of *E. coli* at Degraded Beach

removal of dunes & beach grass, causes . . .

- lower ground surface elevation
- shallow depth to water table
- damp/wet sand
- loss of beach grass

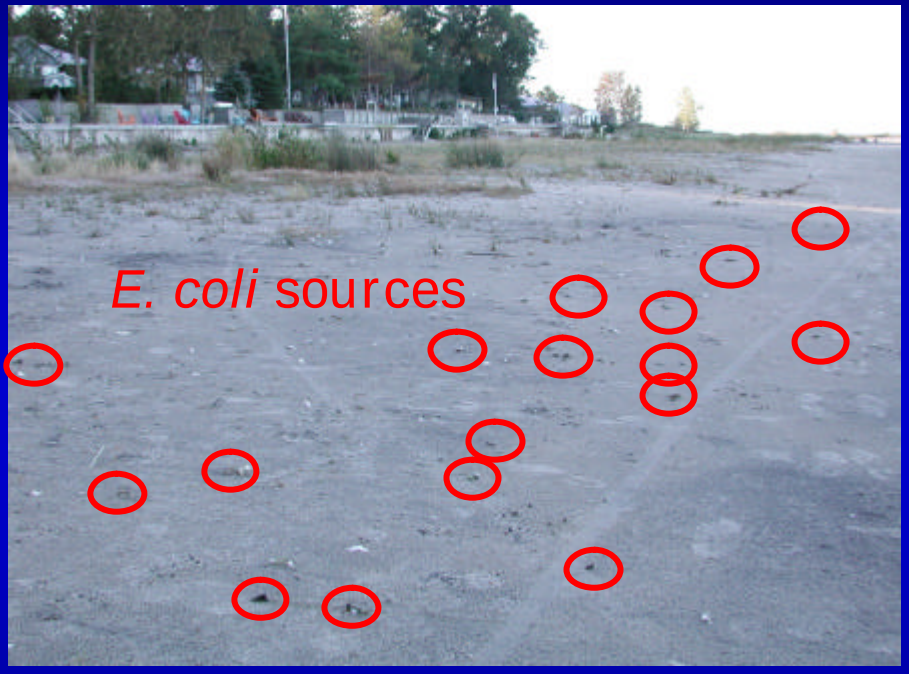
Source of *E. coli* at Degraded Beach

lawns planted with turf grass at beach front residences

grass migrates to, or be pushed onto, beach

becomes established because of damp sand and shallow water table

Source of *E. coli* at Degraded Beach

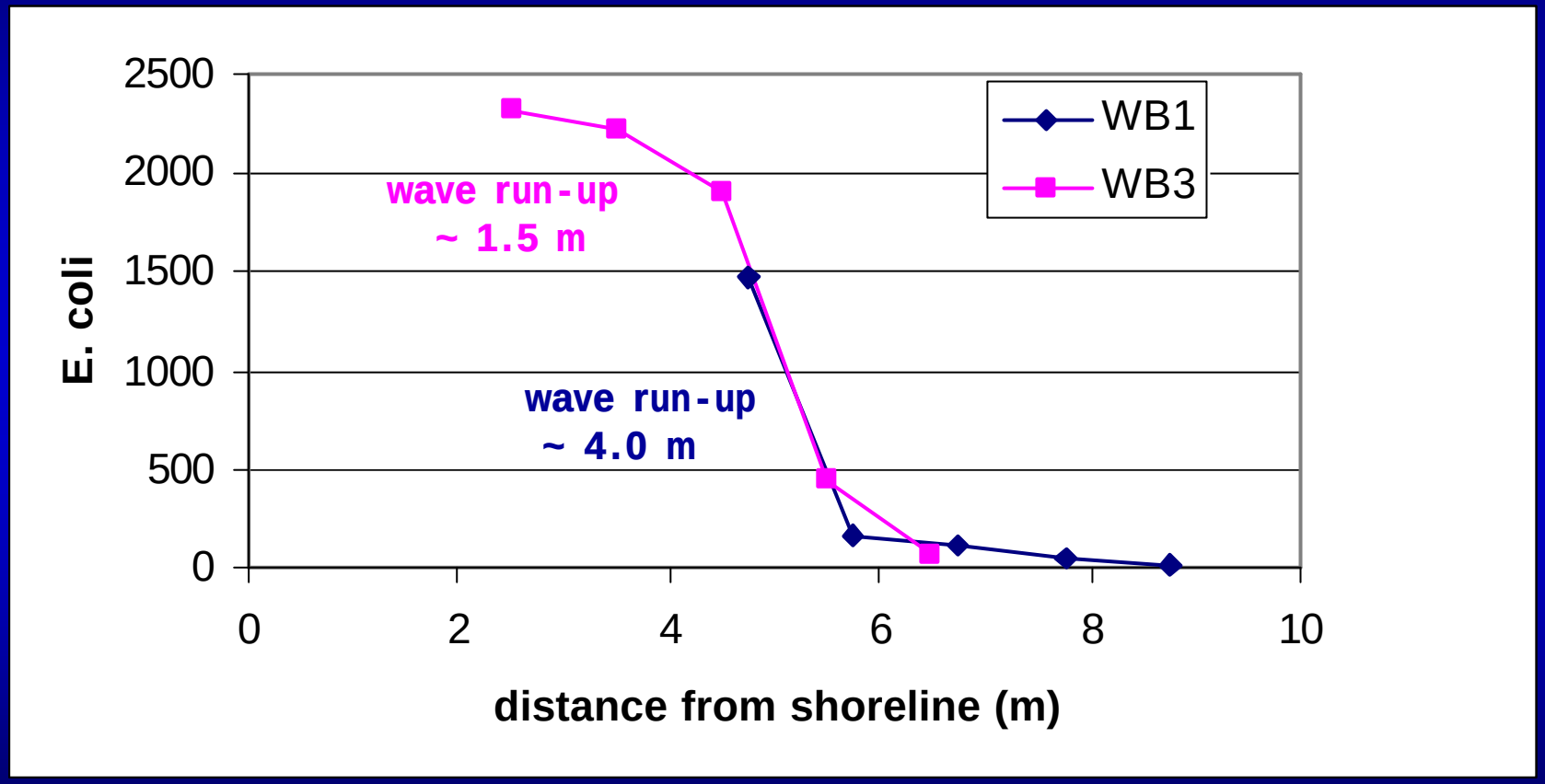


turf grass next to shoreline will attract geese

geese leave lots of sources of *E. coli*

wet sand & shallow w.t. permits *E. coli* infiltration to gw

Is the Lake a Source of *E. coli*?

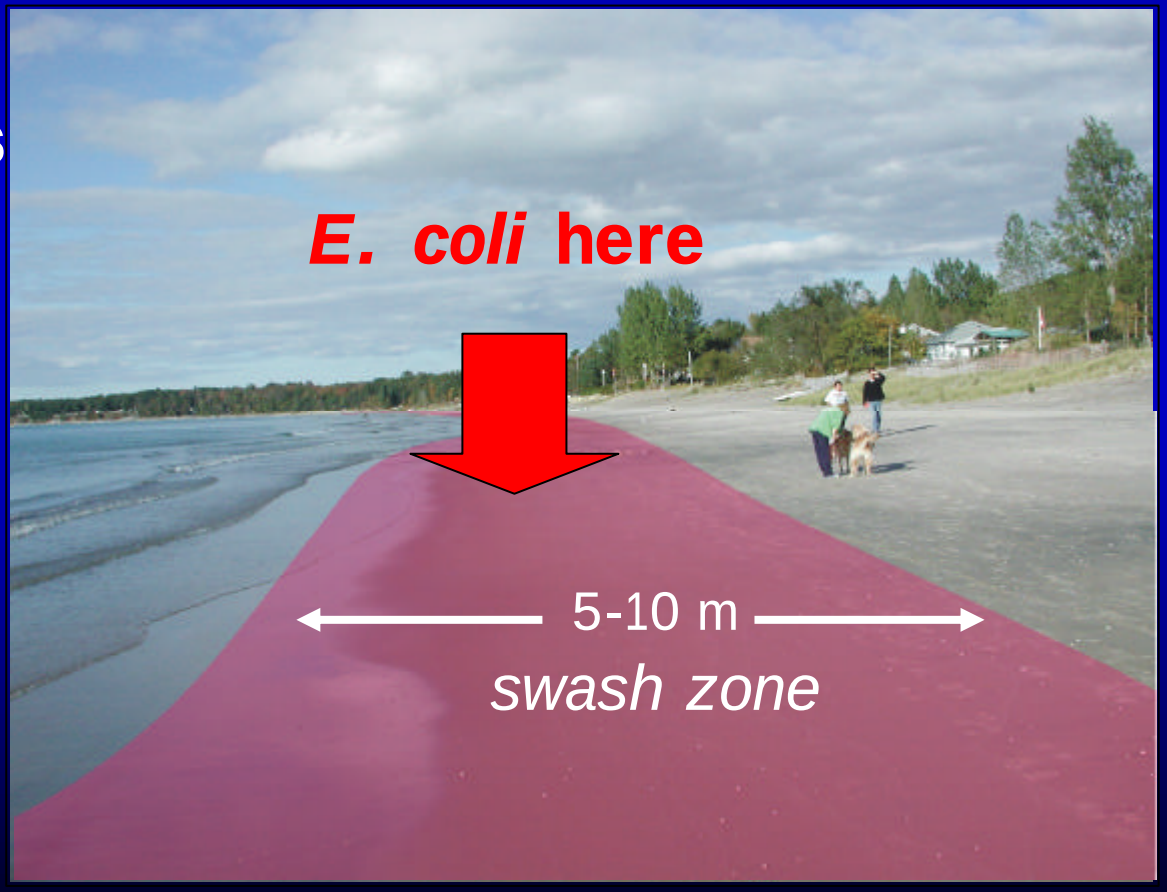


rapid decline in *E. coli* past wave run-up zone

Is the Lake a Source of *E. coli*?

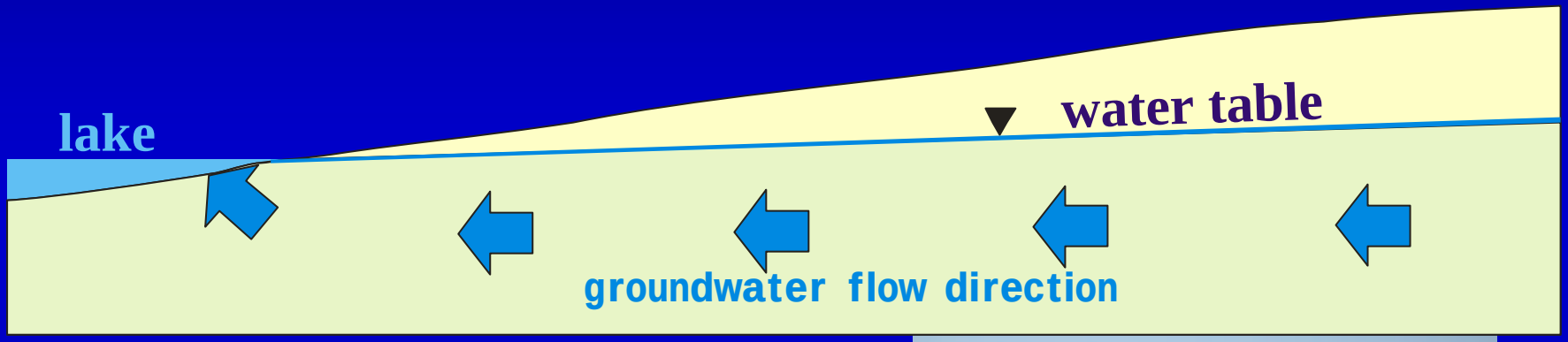
area of high levels of *E. coli* are near the shore

corresponds to area where waves runup beach



Groundwater - Lake Interaction

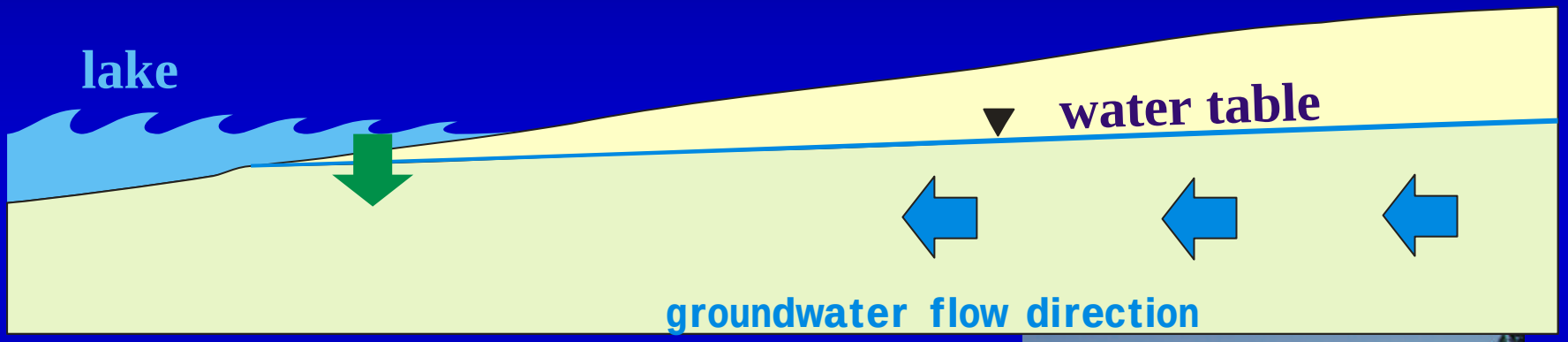
impact of the lake . . . before a storm . . .



groundwater flows towards the lake

Groundwater-Lake Interaction

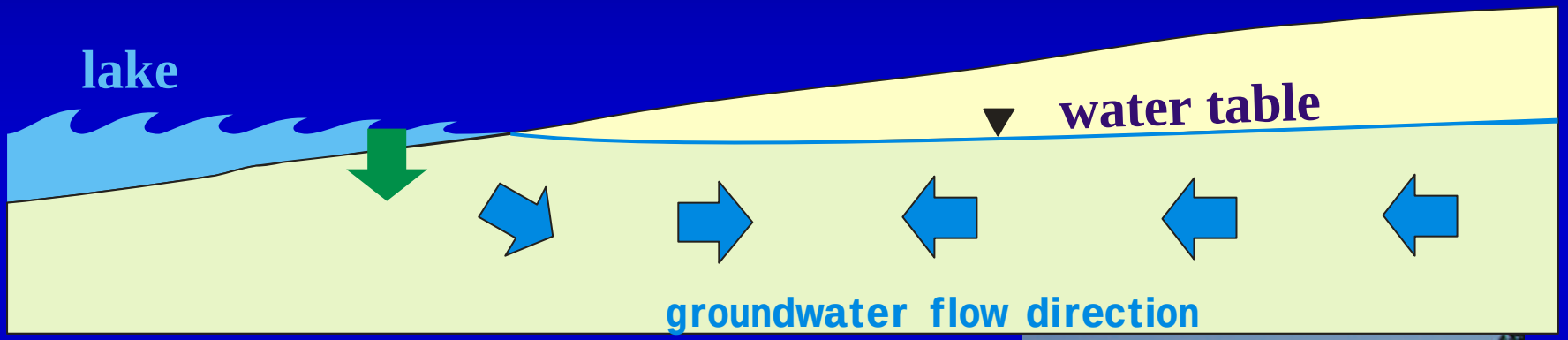
impact of the lake . . . during a storm . . .



infiltration of lake water during wave run-up

Groundwater - Lake Interaction

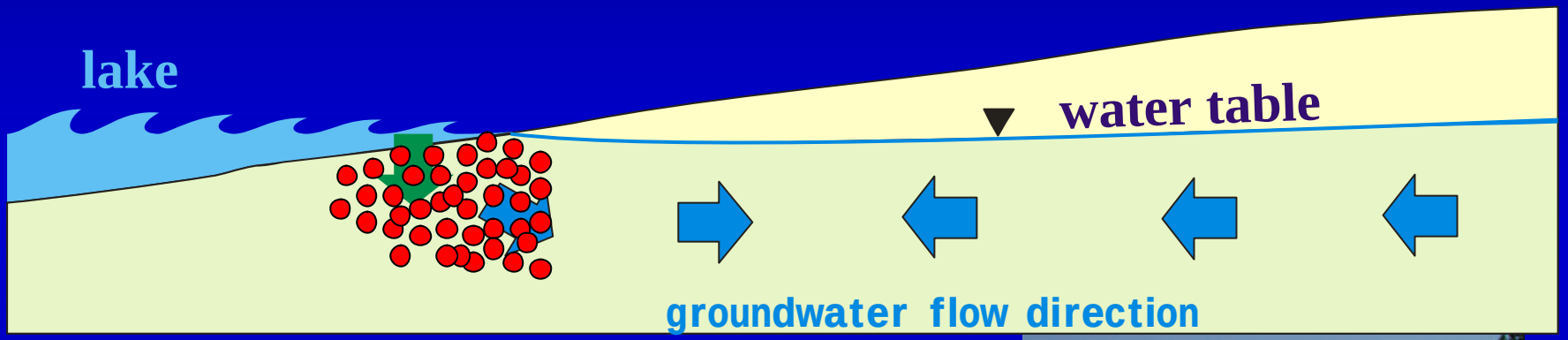
impact of the lake . . . during a storm . . .



infiltration causes water table to rise and gw backflow within a few metres of the shore

Groundwater - Lake Interaction

impact of the lake . . . during a storm . . .

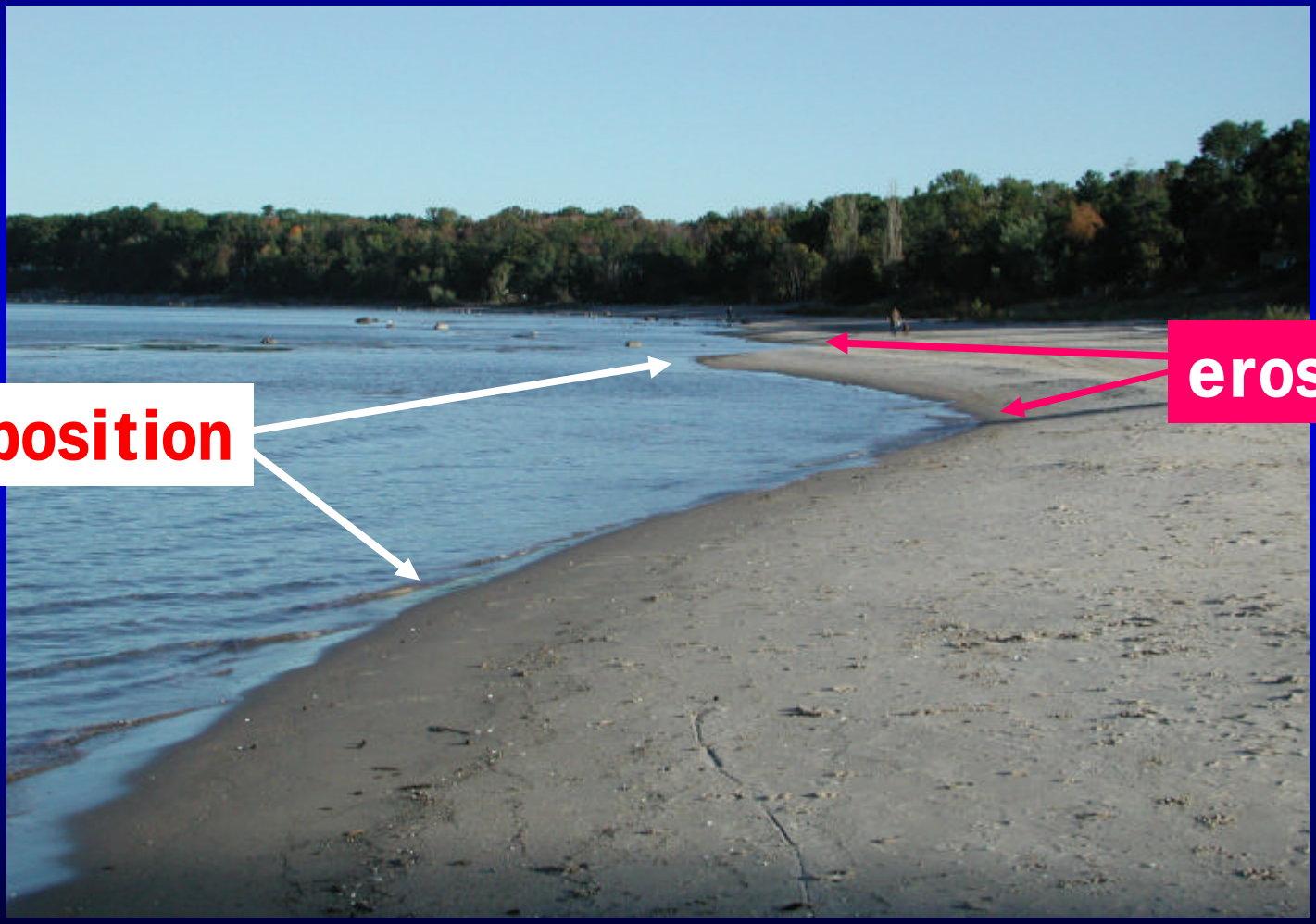


E. coli **in infiltrating lake water will move into beach below swash zone**

Is the Beach a Source of *E. coli*?

waves and currents erode sand at shore

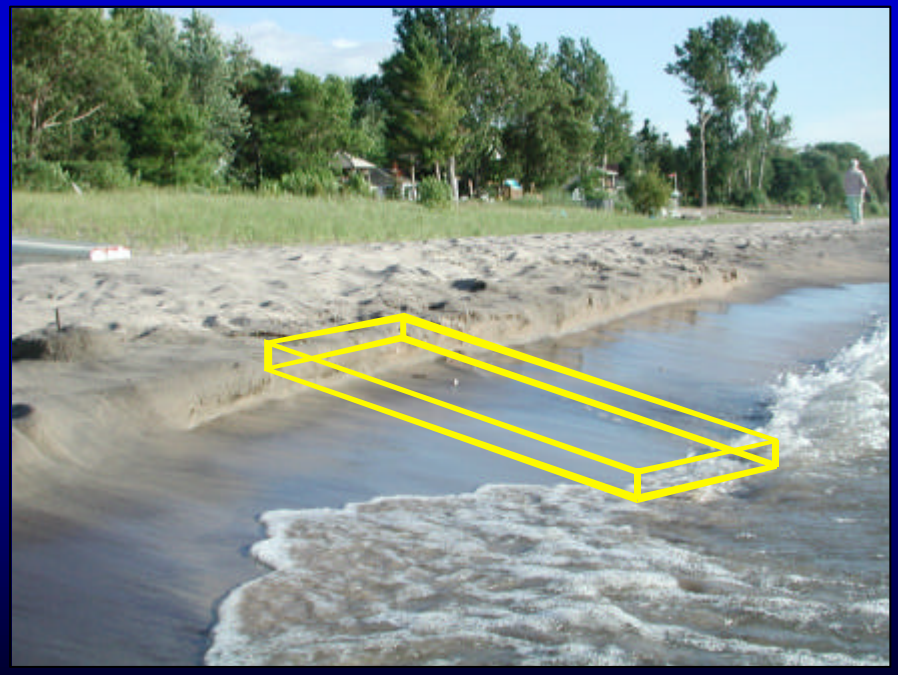
Is the Beach a Source of *E. coli*?



Is the Beach a Source of *E. coli*?

E. coli **levels: 500 *E. coli*/g dry sand**

E. coli **levels: 2,000 *E. coli*/100 mL groundwater**



shoreline erosion at swash zone may send 422,000,000 *E. coli* per m of shoreline into lake water

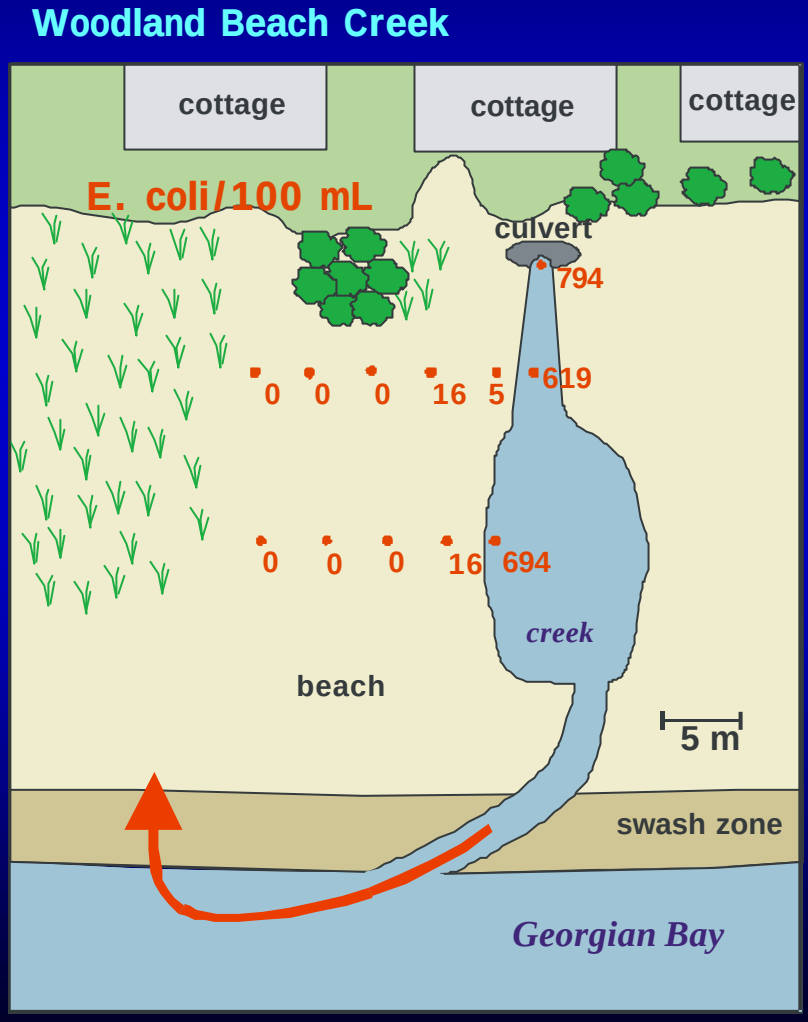
(volume = 1m x 3m x 20cm)

Are the Creeks a source of *E. coli*?

groundwater flows from beach to creek

no *E. coli* movement from creek to beach

E. coli moves onto beach & into groundwater via waves



What can you do?

1. Discourage geese and gulls.
2. Maintain natural dunes and beach grass.
3. Prohibit lawn adjacent to beach.
4. Ensure properly functioning septic systems
5. Improve drainage for some creeks.