VT Agency of Agriculture's Groundwater Monitoring Program

A look at the impact of agriculture on the waters of Vermont

A brief history

Created in 1986, headed by Jeff Comstock

Goals

- Improve agricultural practices
- Protect groundwater
- Raise public awareness
- Provide for clean drinking water

A brief history

- Sample private drinking water sources on and around agricultural use lands
- Funded by registration fees from pesticide and fertilizer companies
- Original focus was on corn herbicides only
- Sampling was expanded to include nitrate after a couple years
- Voluntary, confidential program

The program today

- Goals, funding, and protocols remain largely unchanged
- Expanded testing capabilities and the number of samples taken annually statewide
- Legacy/monitoring sites (“works in progress”)
- Responsive sampling (complaints or concerns)
- Surface water studies (about 1/3 of samples)
- Current testing generally includes pesticides, nutrients, and bacteria

Our working partners

- **VT Agricultural and Environmental Laboratory**

  does our testing, now in Randolph

- **VT Dept of Health, Div of Environmental Health**

  coordinates with us on outreach, referrals, drinking water standards

- **VAAFM Ag Water Quality Program**

  works on farms to monitor surface water quality and to help remediate contamination

- **Natural Resources Conservation Service**

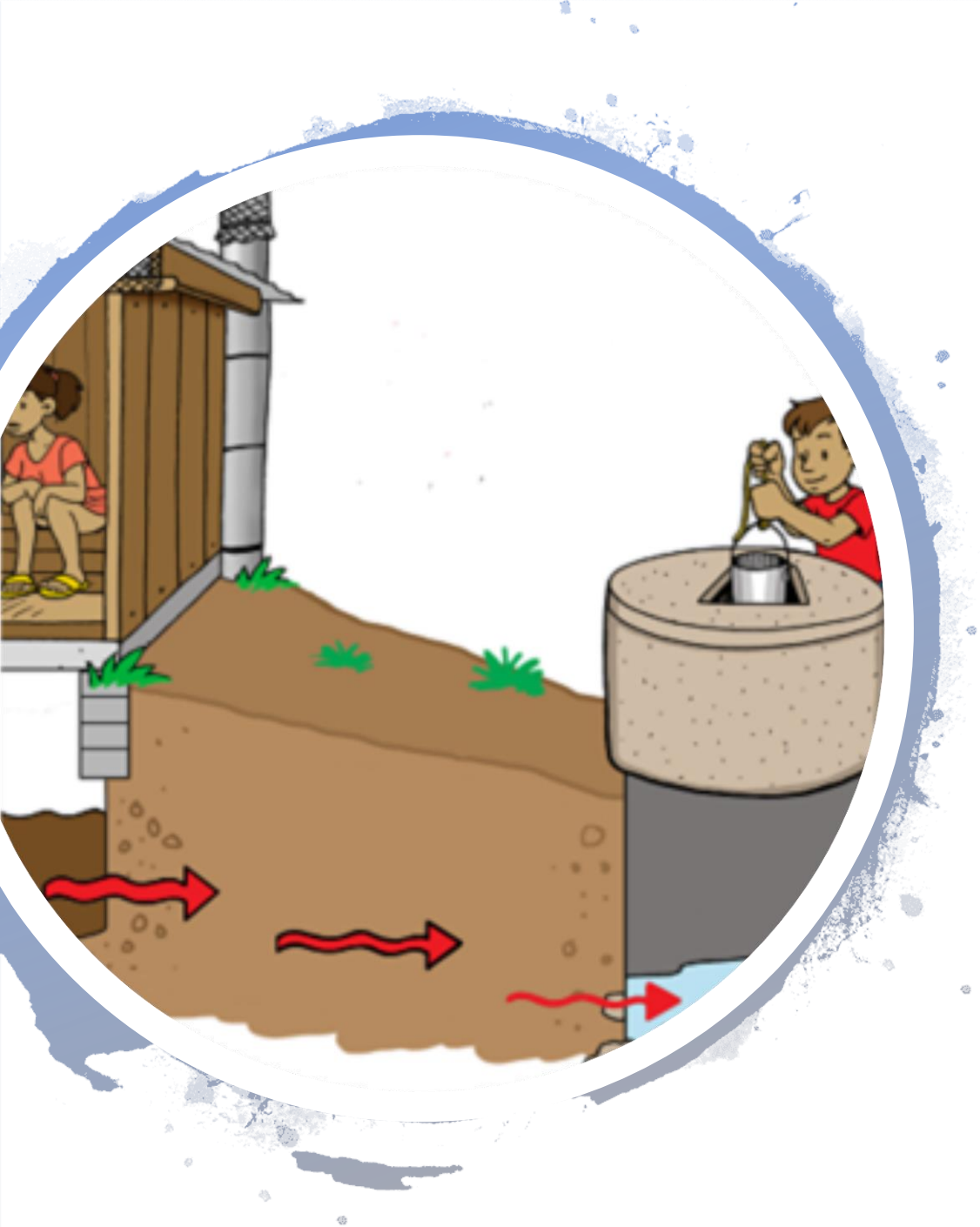
  works to upgrade on-farm facilities to improve water quality (manure pits, drainage, clean catch diversion projects, grass waterways)

- **VT Geological Survey**

  helps us identify bedrock and surficial geology that impacts groundwater transport

- **Farmers and neighbors**

  trust us with access on their property for sampling



Speaking of trust…

Private wells have always been unregulated in Vermont (get your water tested!)

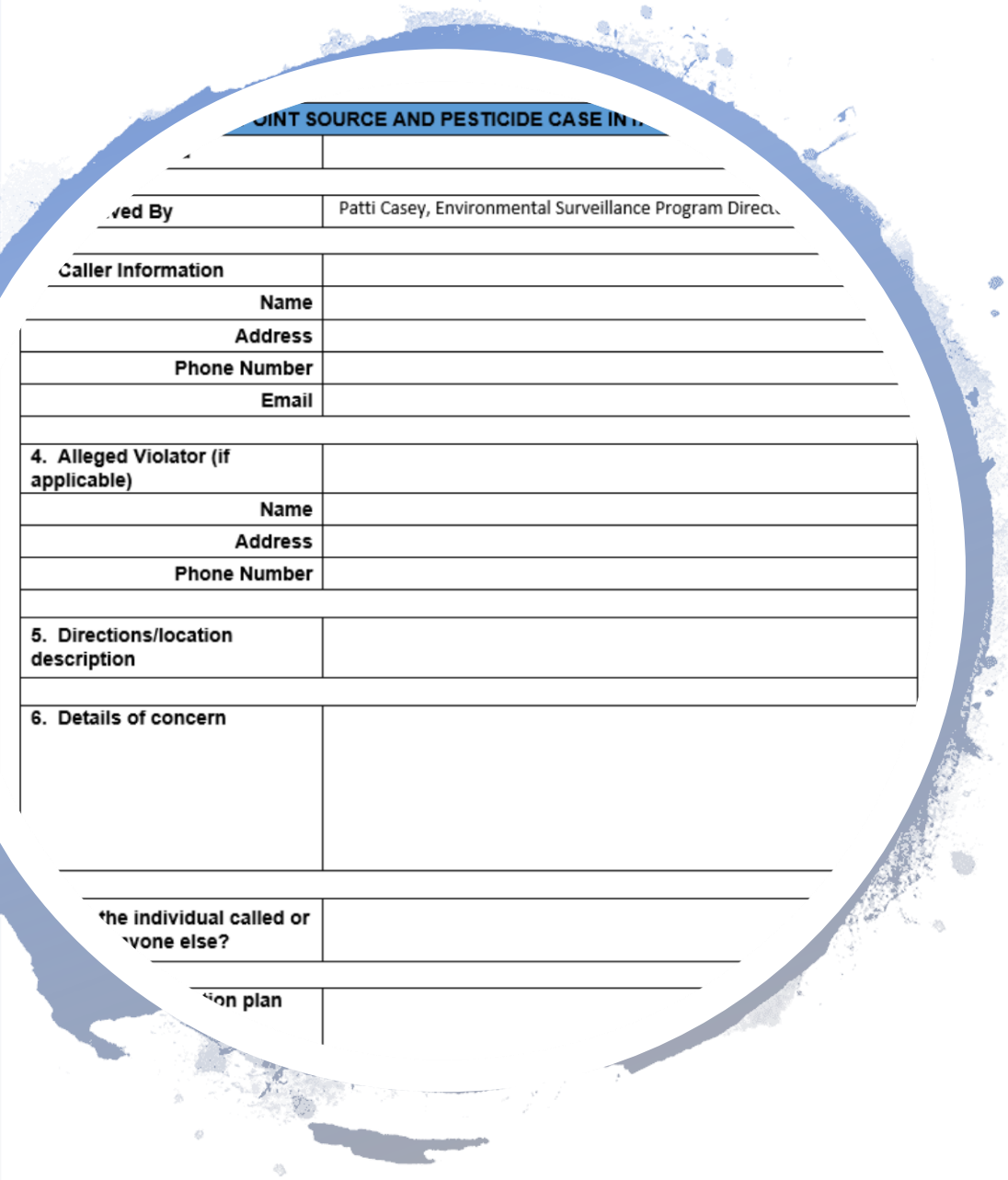
Changes coming: Act 161

- July 1, 2019
- Requires sampling of new water supplies at single-family homes
- Homeowner responsibility to test (~ $125)
- VDH will maintain a database
- No enforcement provision

A typical scenario

A Vermonter calls with concerns over a nearby farm spreading manure on fields, as they have a private well located in the vicinity…

…or they have concerns over herbicide applications on nearby corn fields



ved By	Patti Casey, Environmental Surveillance Program Direc
Caller Information	
Name	
Address	
Phone Number	
Email	
4. Alleged Violator (if applicable)	
Name	
Address	
Phone Number	
5. Directions/location description	
6. Details of concern	
the individual called or vone else?	
ion plan	

- Our program takes the info, gets best-guess measurements on setbacks, well depth and construction, and type of soil
- Tools include Google Earth, VT Well Drillers' Report, Nitrate Leaching Index, VGS maps

- Measure setbacks
- Scout for possible sources of contamination
- Sample untreated water for nitrate and corn herbicides
- Err on the side of caution and almost always sample, even if ag use may not be immediately nearby

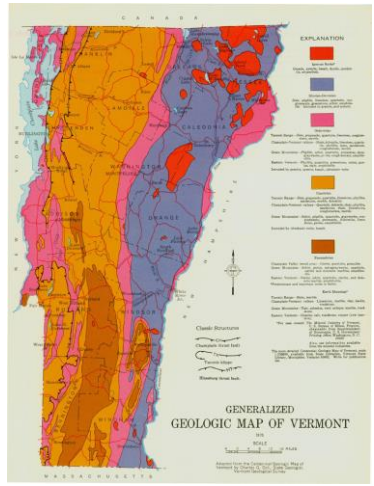
- Sample results guide action, from none to possible remediation with the farmer or applicator
- A letter with test results, fact sheets, and a call are used to educate the well owner

A bit about geology

Geology

Bedrock – Waits River Formation on the eastern side of the state and into central VT – limestone and phyllite

- Rapid conveyance downward to aquifers due to fractures and bedding/foliation creating a “criss-cross” pattern in the bedrock
- Can be difficult to trace source of contamination because of deep fractures originating far away



Geology

Much of western Vermont, Champlain Valley

- Very thick overburden of clay
- Can be quite impermeable
- Can be several aquifers with aquitards between them at different depths
- Deep drilled wells tend to be safer from contamination due to layers of relative impermeability
- Surface waters are vulnerable to contamination from runoff

Geology

- Some groundwater moves extremely slowly (VGS has age-dated water to 70 years)
- This can frustrate well owners and make it difficult to gauge efficacy of remediation efforts
- Can take many years or even decades to see change
- Highlights importance of preventing contamination!

Private Drinking Water Sources in Vermont

- Springs and shallow dug or drilled wells are more vulnerable to contamination, as they mix ground and surface water
- Drilled wells terminating in sand/gravel are also more vulnerable than those grouted into bedrock
- Drilled wells and springs are often found in fields and might not be marked
- We've seen pesticides and manure sprayed over well heads
- Always observe label restrictions regarding buffers around wells
- Minimum 50-ft buffer around private drinking water supplies when spraying

Surface Water Studies

Ambient Surface Water Study (28 sites)

- Lake Champlain and tributaries near ag use
- Sampling for neonicotinoids, corn herbicides and degradates, glyphosate, and nitrate
- Third year of the study
- Post-rain event sampling is done by DEC
- All detections to date have been below aquatic invertebrate benchmarks

Miner Institute, Chazy NY

- Tile drain and field (paired study on 4 fields)
- Sampling for corn herbicides and nitrate

Sampling

What we sample for

- Nitrate
- Corn herbicides
- Glyphosate/AMPA
- Neonics

Other analytes

- Tracers: bacteria, chloride
- Phosphorus (Ag Water Quality Program’s on-farm inspectors)

Nitrate

Nitrate

- Nitrogen is a necessary plant nutrient added to crops
- Nitrate is water-soluble and very mobile
- EPA drinking water standard is 10 ppm
- Sources of nitrate contamination include
  - Manure spread on fields and in storage (leaking pits)
  - Inorganic fertilizers
  - Silage leachate from bunks
  - Lawn fertilizers
  - Failed septic systems
  - Explosives from hydrofracking
  - Large piles of composting vegetative material

Agrichemicals

Agrichemicals we sample for

Corn Herbicides

- Acetochlor*
- Alachlor*
- Atrazine*
- Dimethenamid*
- Mesotrione
- Metolachlor*
- Simazine
- Glyphosate*
- Bicyclopyrone

**Plus degradates (breakdown products) for these*

Neonics (insecticides)

- Clothianidin
- Imidacloprid
- Thiamethoxam

These are seed treatments for corn (~120,000 acres in VT) and soy (~3,000 acres in VT)

Agrichemicals in Vermont

What we find

Corn herbicides and their breakdown products (degradates)

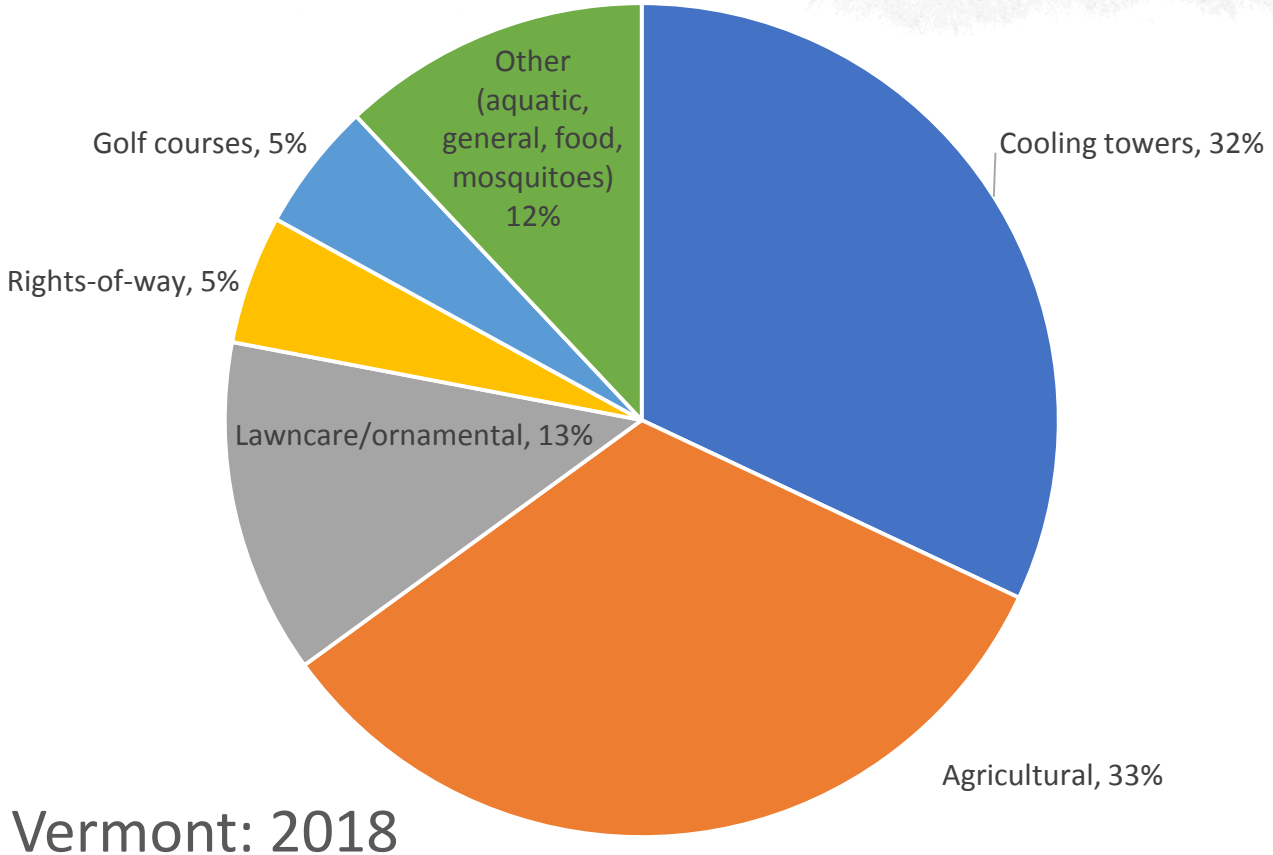
- Atrazine, atrazine DEA
- Metolachlor, metolachlor ESA
- Acetochlor, acetochlor ESA
- Alachlor hasn't been used in Vermont since the early 1990s, but we occasionally still find traces of it

What we don't find

GLYPHOSATE (Roundup™)/AMPA

- ~320 samples taken since 2006
- Surface and groundwater samples
- Targeted at high-risk areas
- **Zero detections at 0.05 ppb DL**
- Highly immobile (binds tightly)
- Short half-life (~28 days in VT)

Industrial pesticide use in Vermont



Industrial pesticide use in Vermont: 2018

A look at our findings

Terminology

- ***Locations*** are farm facilities or residences that have one or more *sites*
- ***Sites*** are individual water sources (drilled, dug, or driven point well, spring) – for simplicity we'll use the term "wells"
- ***Samples*** are waters collected from any site for testing

2018 Stats

2018 Sampling

- 15 employees sampling statewide
- All 14 counties sampled
- 585 water samples taken over all programs

2018 Number of Pesticide Detections

Number of wells* sampled = 170	**# (%)**
Wells with any pesticide detection	27 (16%)
Legacy wells with pesticide detection	25 (15%)
New wells with pesticide detection	2 (0.01%)

**Includes drilled, driven point, dug wells, and springs*

Indicates that we have identified sites of concern around the state and we're monitoring them.

2018 Pesticides Detected

Parent Compound	# Positive Samples	Range, ppb	Drinking water standard, ppb	# of Wells Impacted	# of Legacy Wells	# of New Wells
Acetochlor	0	-	20	0	0	0
Alachlor	0	-	2	0	0	0
Atrazine	**7**	**0.05 - 0.09**	**3**	**6**	**5**	**1**
Cyanazine	0	-	1	0	0	0
Dimethenamid	0	-	2	0	0	0
Metolachlor	**1**	**0.05**	**70**	**1**	**1**	**0**
Simazine	0	-	4	0	0	0
Degradate						
Acetochlor ESA	**6**	**0.05 - 0.09**	**Not established***	**6**	**5**	**1**
Alachlor ESA	**11**	**0.05 - 0.53**	**Not established**	**8**	**6**	**2**
Atrazine DEA	**26**	**0.11 - 0.61**	**Not established**	**22**	**20**	**2**
Dimethenamid ESA	0	-	Not established	0	0	0
Metolachlor ESA	**29**	**0.07 - 7.78**	**Not established**	**25**	**23**	**2**
Detection limit = 0.05 ppb						

* Drinking water standards are not established for degradates; we use parent standards, although degradates are generally less toxic.

New sites

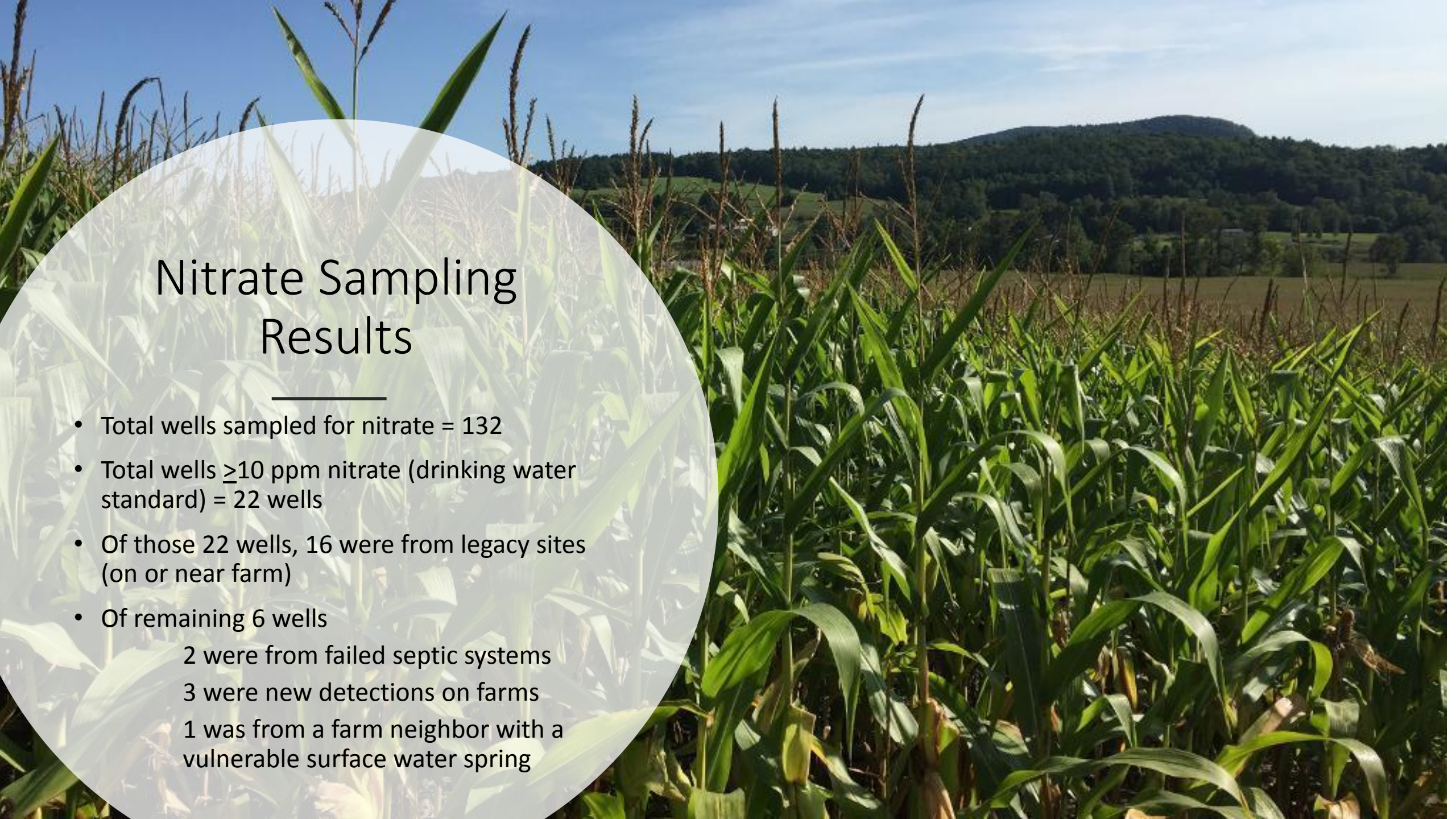
SITE 1

- 80’ drilled well terminating in a thick overburden of sand/gravel in Addison County
- ½ mile down-gradient from several large farm fields (~86 acres) in continuous corn since at least 2011
- Samples contain atrazine, atrazine DEA, alachlor ESA, metolachlor ESA, and high nitrates
- May result in a large-scale investigation, as it’s in a rural/suburban area

New sites

SITE 2

- Surface spring located in a wooded area
- Adjacent to a longstanding cornfield in Franklin County
- Samples contain acetochlor ESA, alachlor ESA, atrazine DEA, metolachlor ESA, bacteria, and high nitrates
- Very rural area, homeowners are saving up to drill a well



Nitrate Sampling Results

- Total wells sampled for nitrate = 132
- Total wells ≥10 ppm nitrate (drinking water standard) = 22 wells
- Of those 22 wells, 16 were from legacy sites (on or near farm)
- Of remaining 6 wells
  - 2 were from failed septic systems
  - 3 were new detections on farms
  - 1 was from a farm neighbor with a vulnerable surface water spring

The Bottom Line

- 93% of 2018 pesticide detections came from sites already being monitored
- Degradates are detected more commonly
- Metolachlor ESA is found most frequently
- Nitrate contamination is also concentrated around a few large farms and is not widespread in the state
- Pesticide detections have all been below drinking water standards
- Attributable to improving ag practices and closer oversight by VT Agency of Ag
- Bedrock geology can make contamination source and groundwater flow direction difficult to identify

Questions?

If I don’t know the answer,

I’ll find it and get back to you!

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