The Hazard Ranking System (HRS)

The Ground Water Migration Pathway

October 26, 2023

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The ground water migration pathway evaluates people drinking water from contaminated or potentially contaminated aquifers

Ground Water Migration Pathway

Likelihood of Release

Observed release
Potential to release

Waste Characteristics

Toxicity
Mobility
Hazardous waste quantity

Targets

Nearest well
Population
Resources
Wellhead Protection Area

TABLE 3–1—GROUND WATER MIGRATION PATHWAY SCORESHEET

Factor categories and factors	Maximum value	Value assigned
Likelihood of Release to an Aquifer:		
1. Observed Release	550	_____
2. Potential to Release:		
2a. Containment	10	_____
2b. Net Precipitation	10	_____
2c. Depth to Aquifer	5	_____
2d. Travel Time	35	_____
2e. Potential to Release [lines 2a(2b + 2c + 2d)]	500	_____
3. Likelihood of Release (higher of lines 1 and 2e)	550	_____
Waste Characteristics:		
4. Toxicity/Mobility	(a)	_____
5. Hazardous Waste Quantity	(a)	_____
6. Waste Characteristics	100	_____
Targets:		
7. Nearest Well	50	_____
8. Population:		
8a. Level I Concentrations	(b)	_____
8b. Level II Concentrations	(b)	_____
8c. Potential Contamination	(b)	_____
8d. Population (lines 8a + 8b + 8c)	(b)	_____
9. Resources	5	_____
10. Wellhead Protection Area	20	_____
11. Targets (lines 7 + 8d + 9 + 10)	(b)	_____
Ground Water Migration Score for an Aquifer:		
12. Aquifer Score [(lines 3 × 6 × 11) / 82,500][c]	100	_____
Ground Water Migration Pathway Score:		
13. Pathway Score (S_{gw}), (highest value from line 12 for all aquifers evaluated)[c]	100	_____

[a] Maximum value applies to waste characteristics category.
[b] Maximum value not applicable.
[c] Do not round to nearest integer.

Ground Water Migration Pathway

WHAT IS YOUR SITE?

What is Your Site?
Ground Water Migration Pathway - Conceptual Site Model

4 mi 3 mi 2 mi 1 mi .5 mi .25 mi
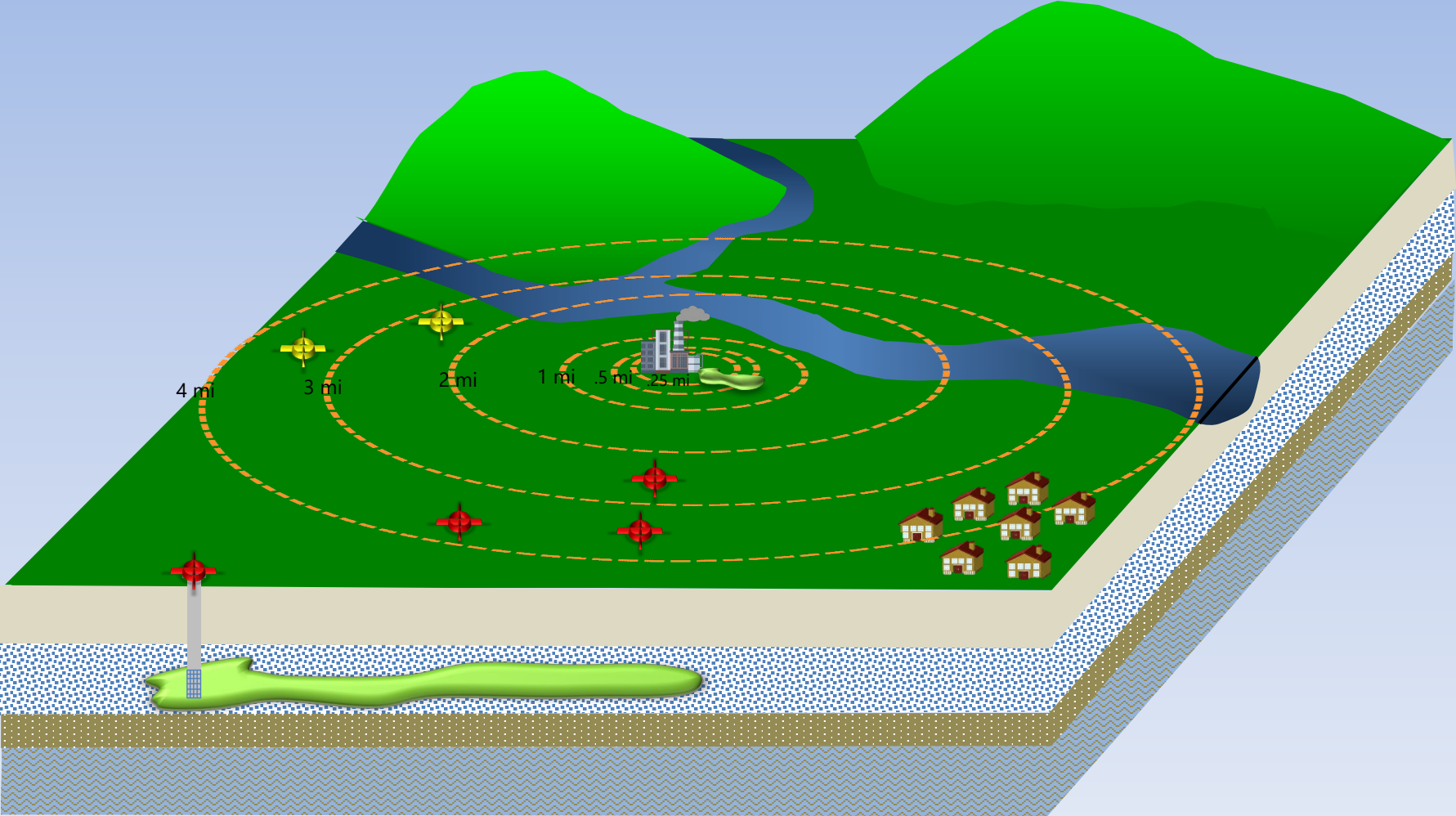
ELEMENTS OF THE GROUND WATER PATHWAY EVALUATION

Elements of the Ground Water Migration Pathway
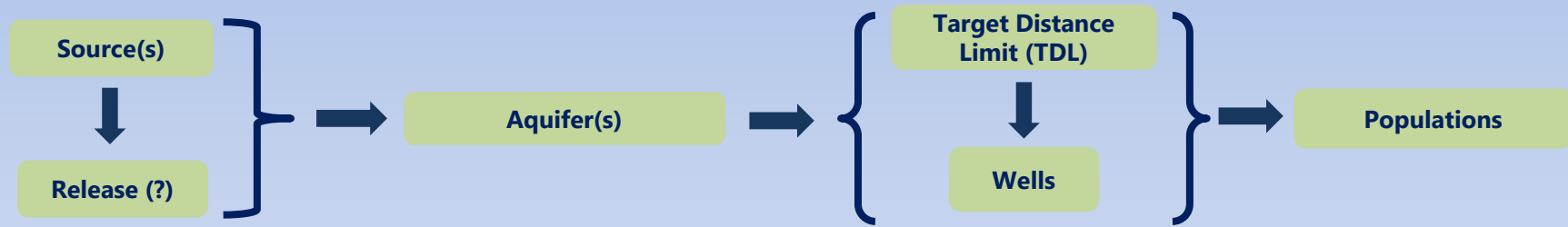
Sources

Sources
Groundwater Plume

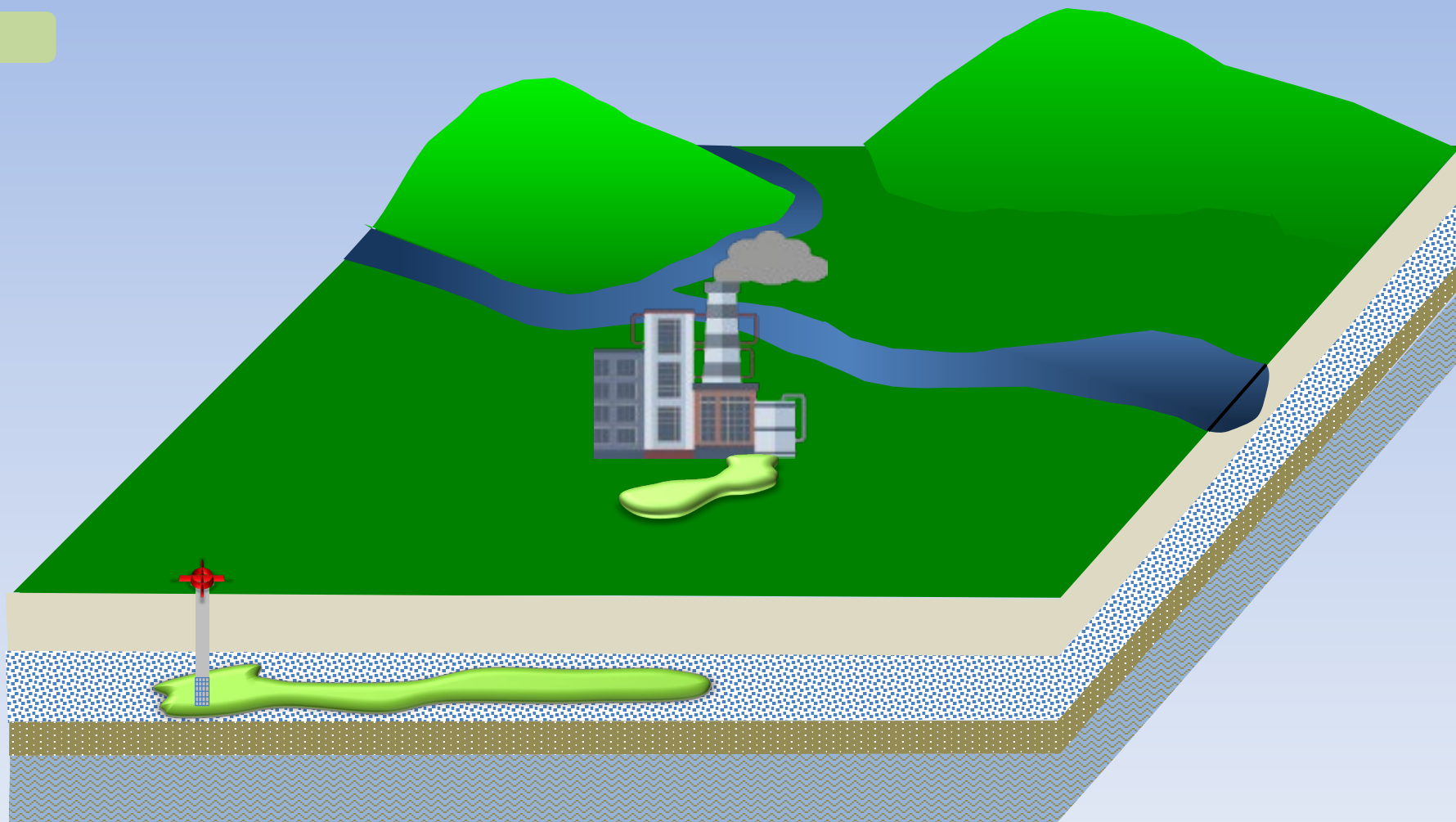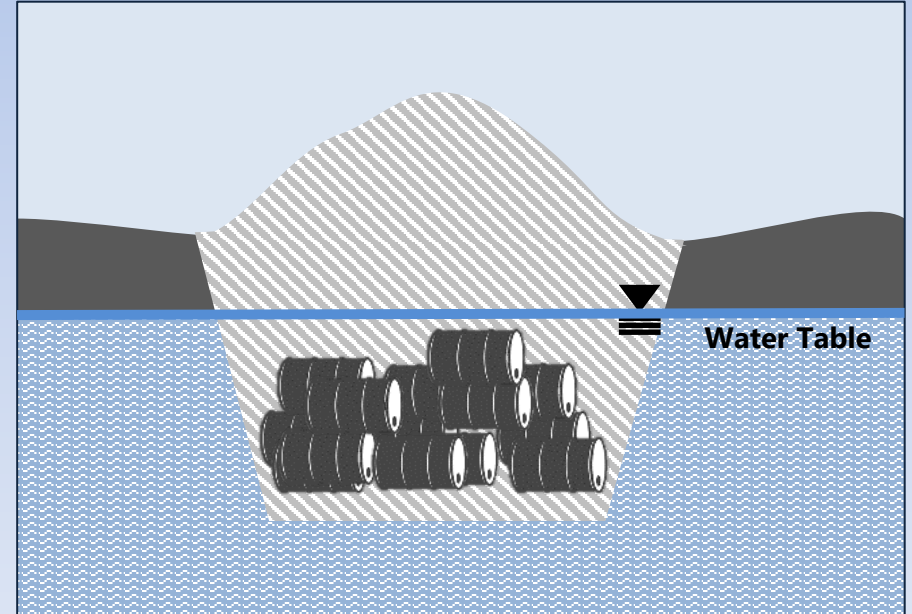# Observed Release

Observed Release
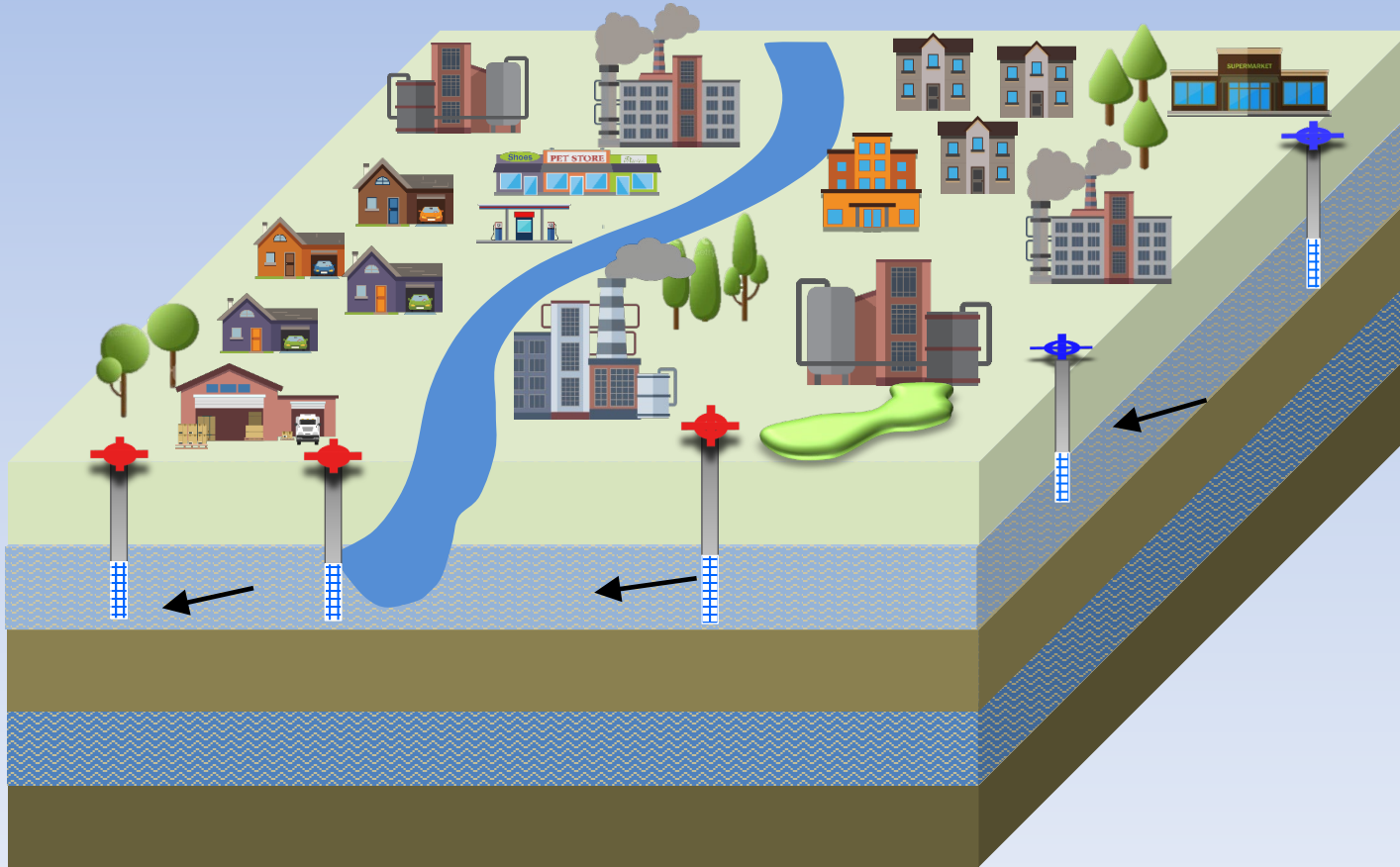*Direct Observation*

Source(s)

Release (?)

Water Table

Observed Release
Chemical Analysis

Source(s)

Release (?)

Observed Release
Chemical Analysis – Sample Similarity

Source(s)

↓

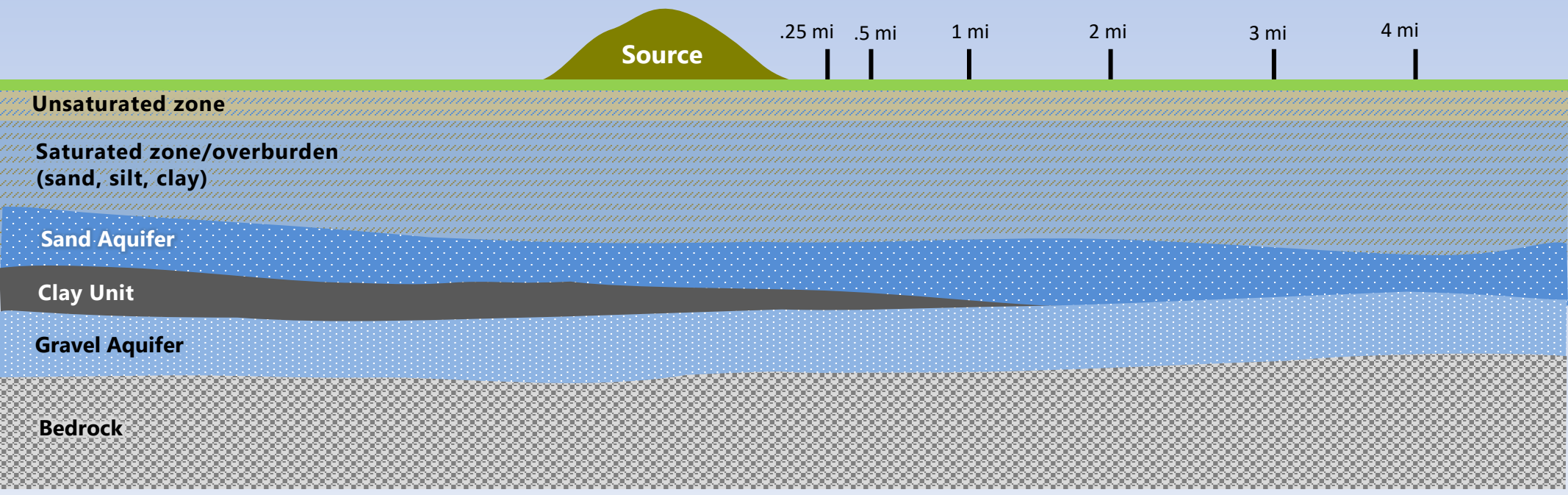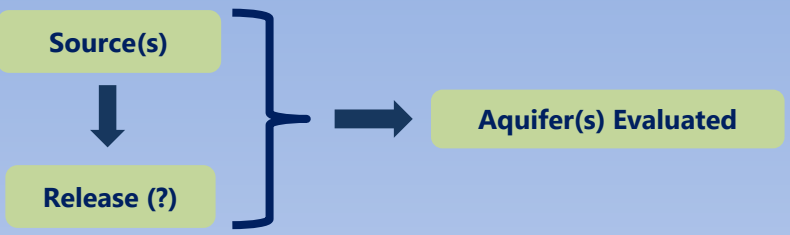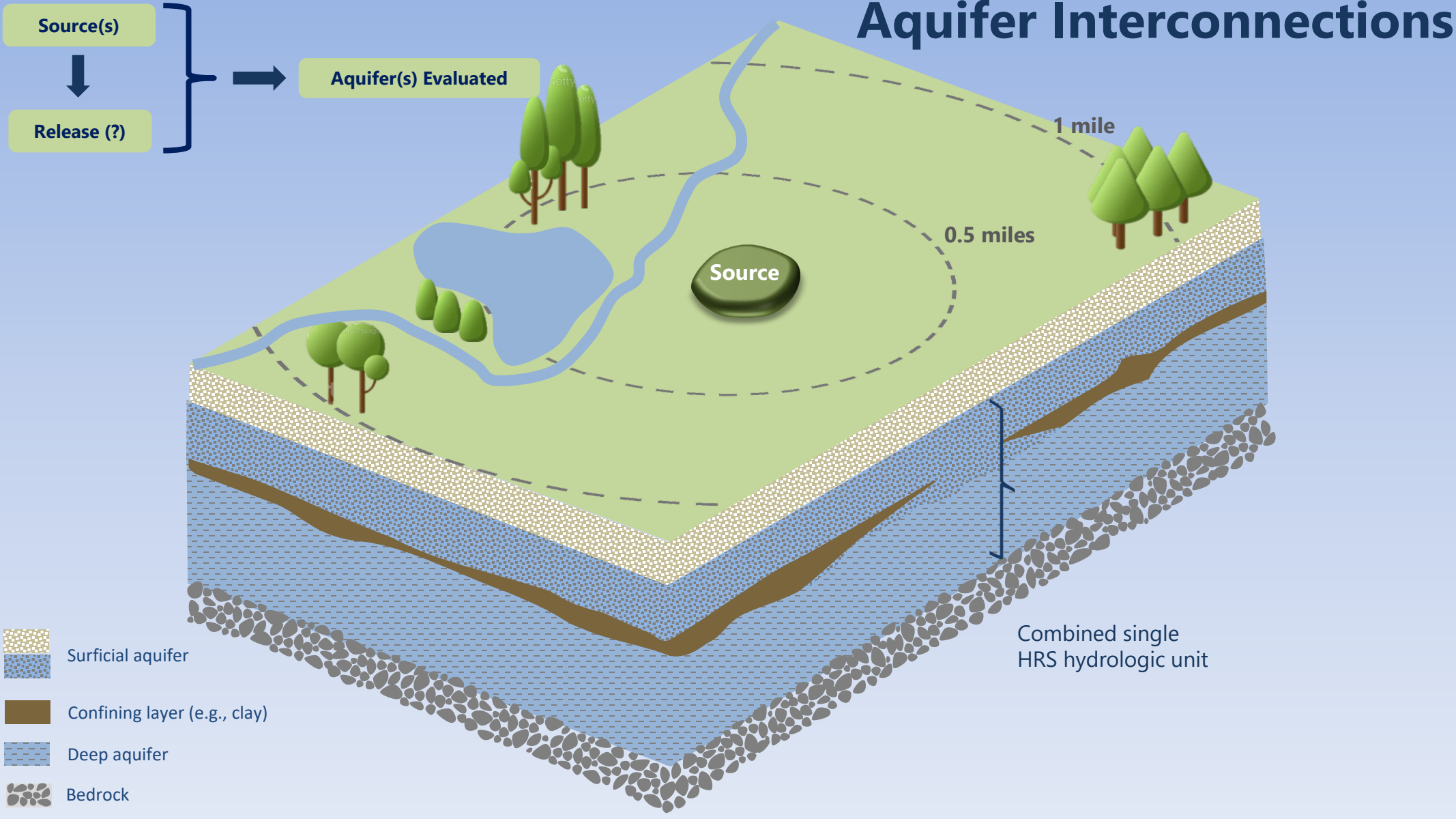Release (?)

Quiz #1: Sample Similarity

Background samples were collected on 8/12/2021. Release samples were collected on 8/14/2023. Is it appropriate to compare these two sets of samples?

A. Yes

B. No

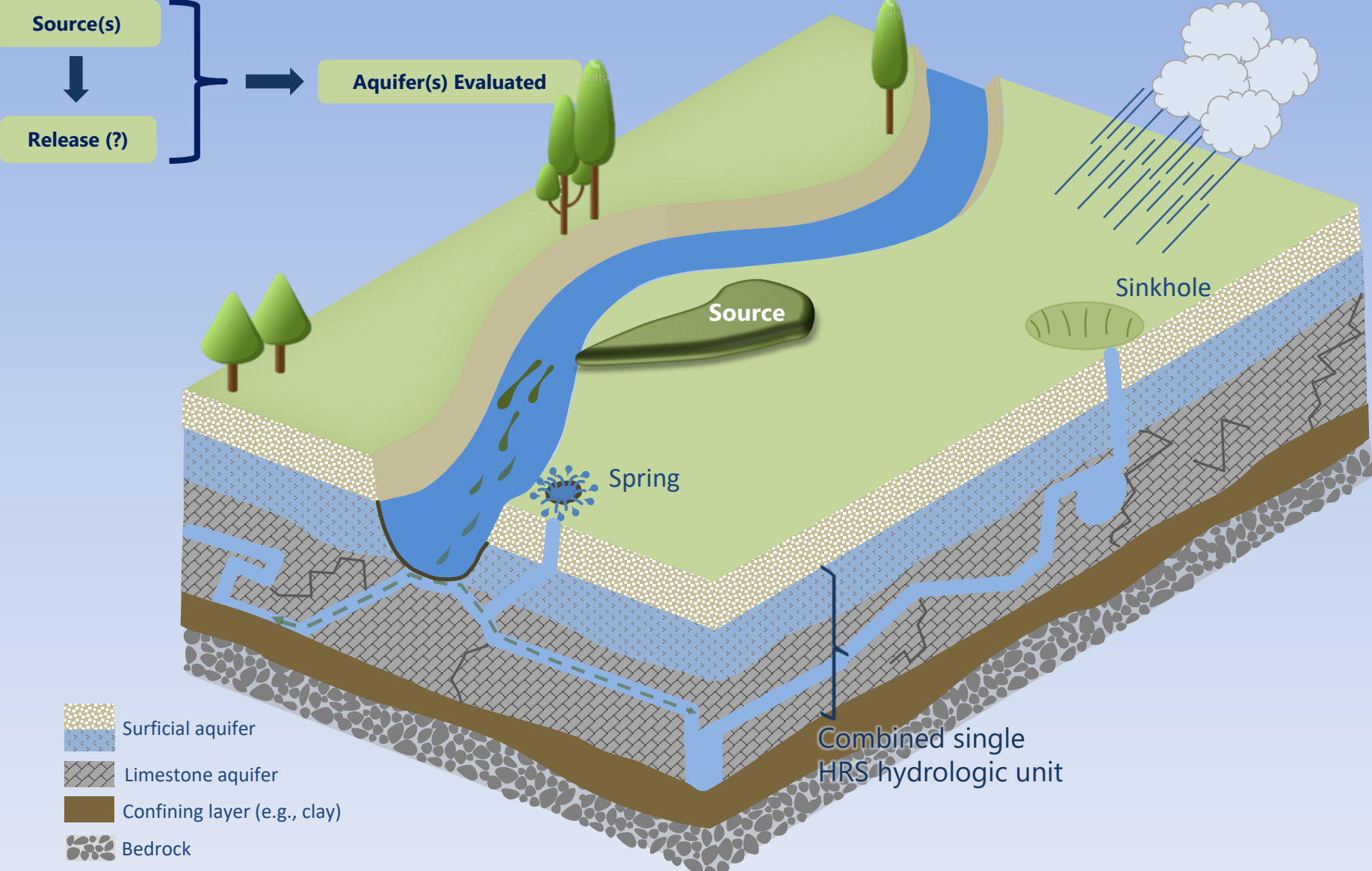C. Not enough info to decide

Source(s) → Release (?) → Aquifer(s) Evaluated

Source

.25 mi   .5 mi   1 mi   2 mi   3 mi   4 mi

Unsaturated zone

Saturated zone/overburden
(sand, silt, clay)

Sand Aquifer

Clay Unit

Gravel Aquifer

Bedrock

Aquifer Interconnections

Source(s)

↓

Release (?)

Aquifer(s) Evaluated

1 mile

0.5 miles

Source

Combined single
HRS hydrologic unit

Surficial aquifer

Confining layer (e.g., clay)

Deep aquifer

Bedrock

Karst

Source(s)

Release (?)

Aquifer(s) Evaluated

Source

Sinkhole

Spring

Combined single
HRS hydrologic unit

Surficial aquifer

Limestone aquifer

Confining layer (e.g., clay)

Bedrock

Aquifer Discontinuities
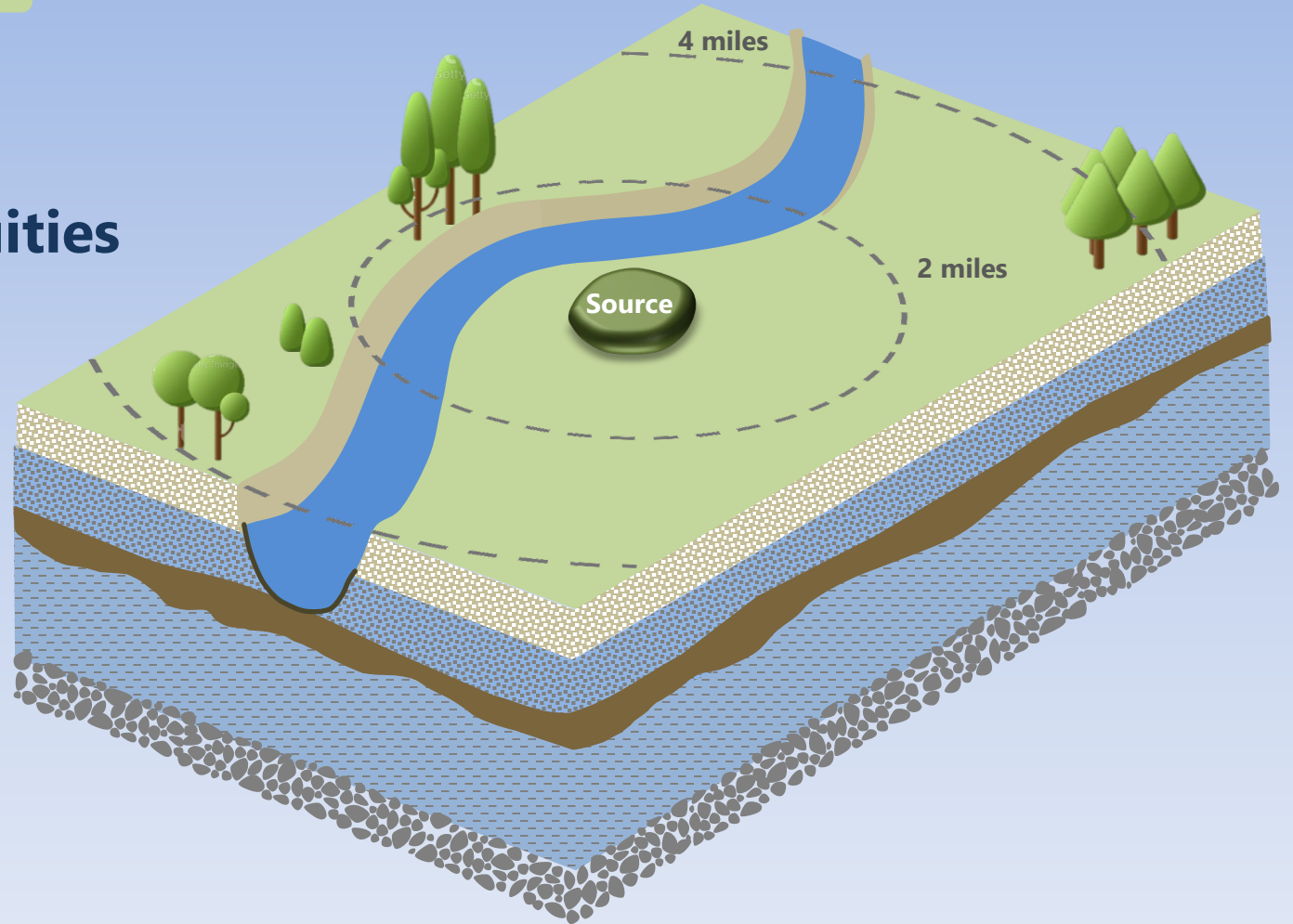
Quiz #2: Interconnections/Discontinuities

Does a clay lens represent a discontinuity?

A. Yes
B. No
C. Maybe

Quiz #3: Interconnections/Discontinuities

Does a fault line represent a discontinuity or an interconnection?

A. Discontinuity
B. Interconnection
C. Both
D. Could be Either
E. Neither

Quiz #4: Interconnections/Discontinuities

In order for two or more aquifers to be considered hydrogeologically connected for an HRS site, what is the maximum distance the interconnection can be located from a source?

A. 1 mile
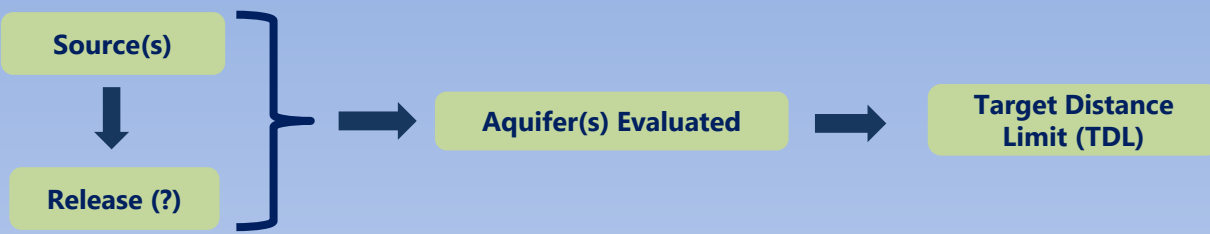
B. 1.5 miles

C. 2 miles

D. 4 miles

Target Distance Limit (TDL) - What is it?

- The maximum distance over which potential targets for the site are evaluated.

- For the ground water migration pathway, the TDL is generally a 4-mile radius from sources at the site.

What it means for evaluation:

- The TDL will dictate what targets can be counted based on:

  - Potential contamination
  - Aquifer interconnections
  - Aquifer discontinuities

4 mi

3 mi

2 mi

1 mi

.5 mi

.25 mi

Source

Source(s) → Release

Aquifer(s) Evaluated

{ Target Distance Limit (TDL) → Wells }

4 mi   3 mi   2 mi   1 mi   .5 mi   .25 mi
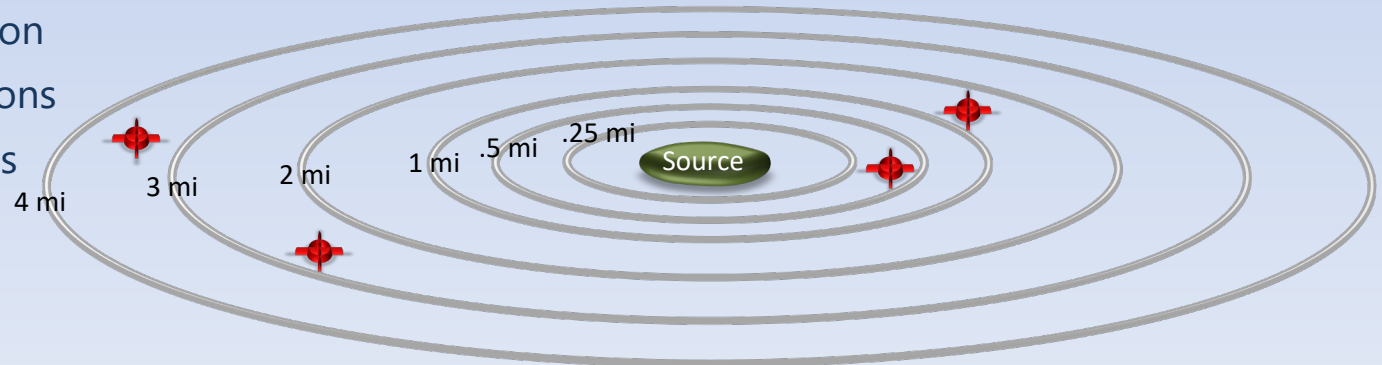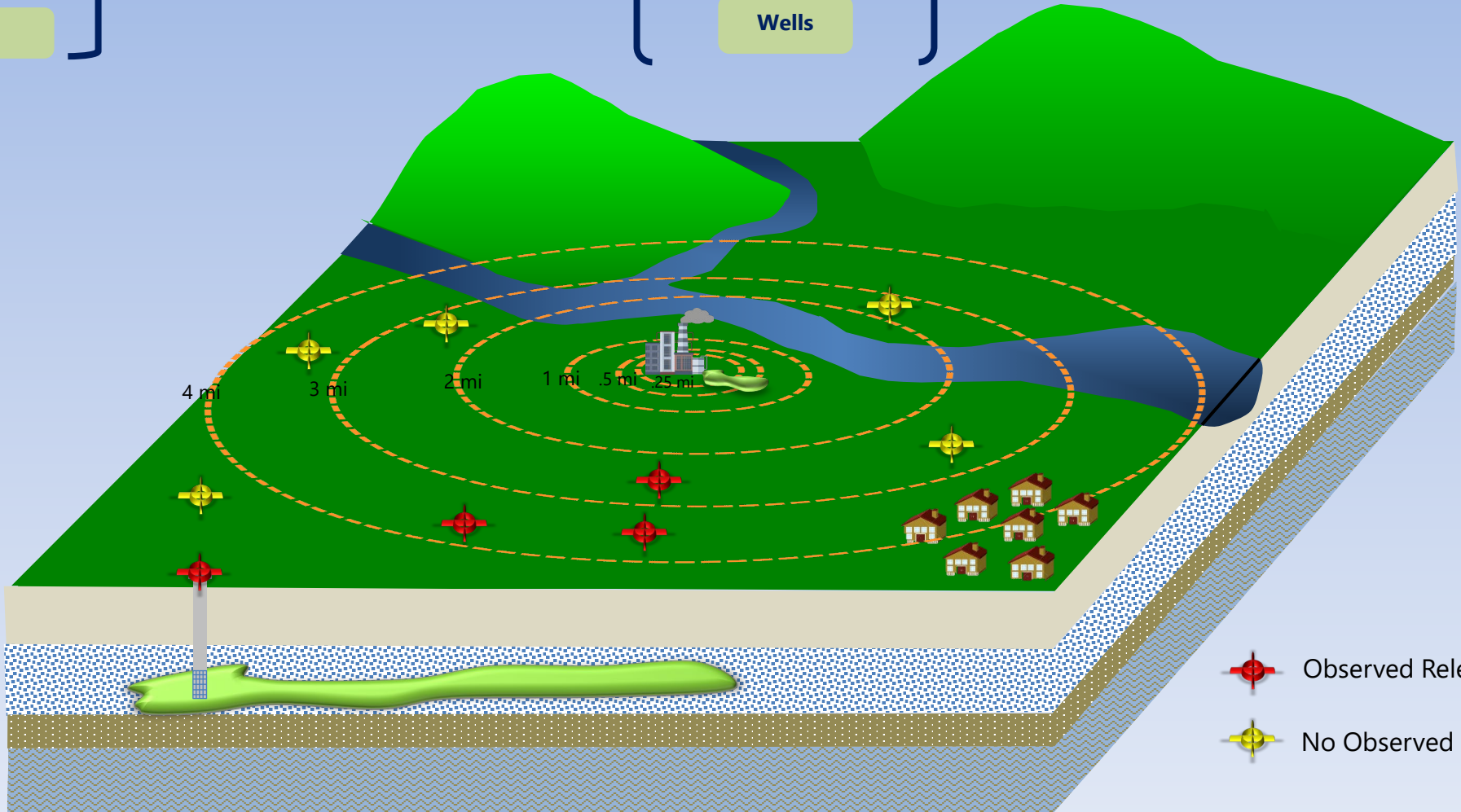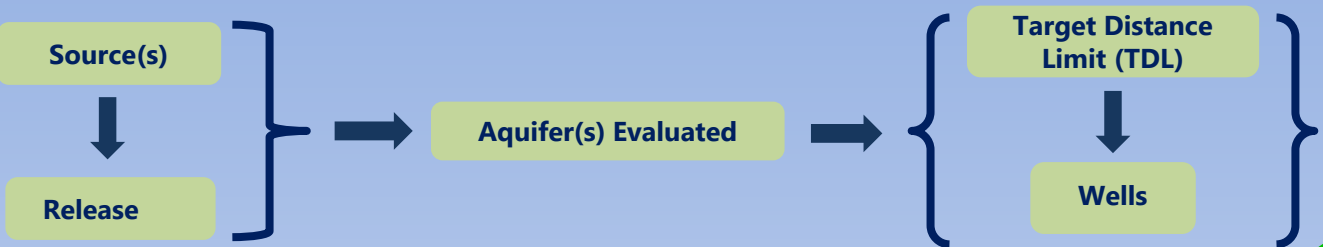
Observed Release

No Observed Release

Quiz: Targets

4 mi 3 mi 2 mi 1 mi .5 mi .25 mi

A
B
C
D

Shallow aquifer

Deep aquifer
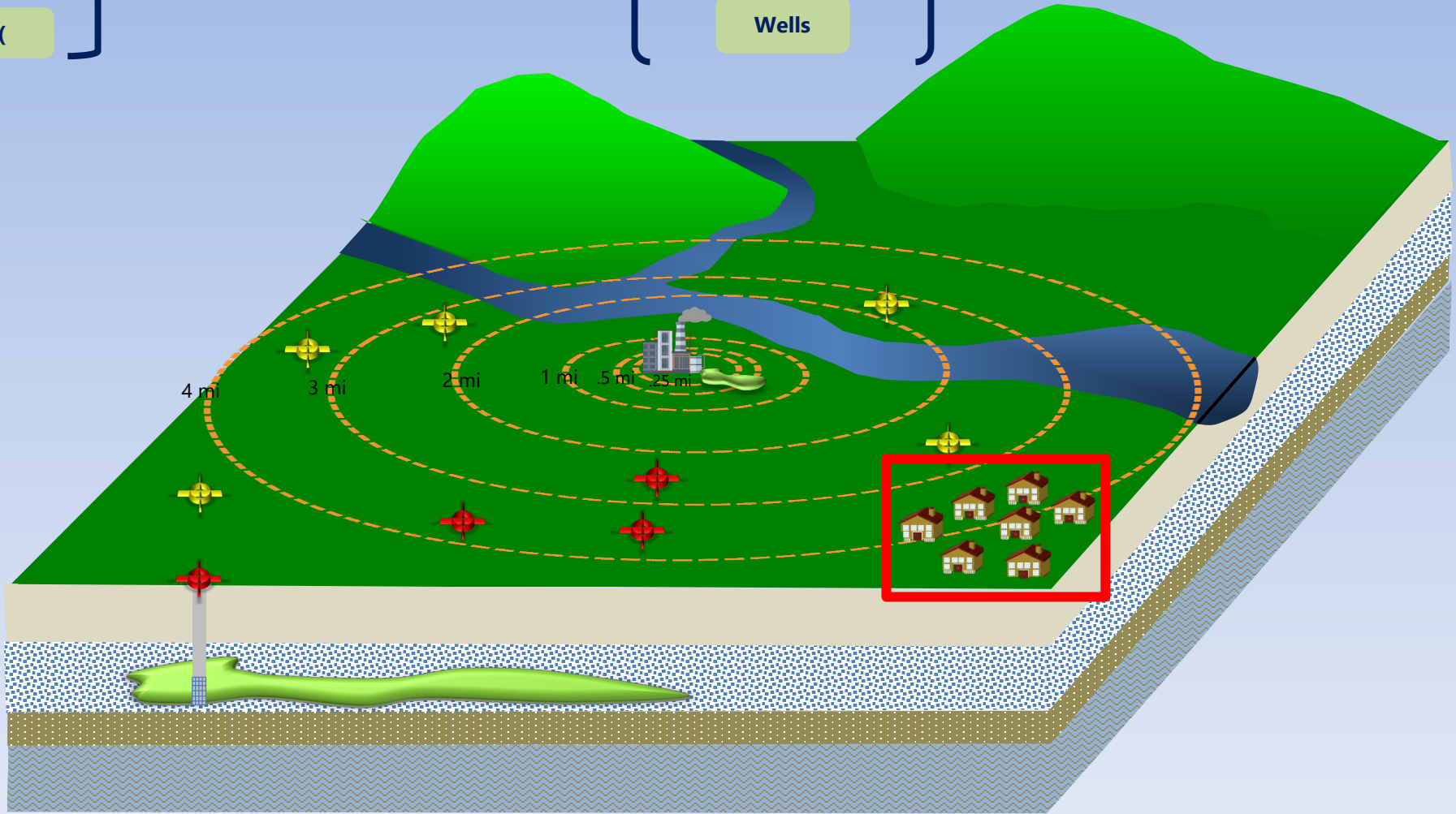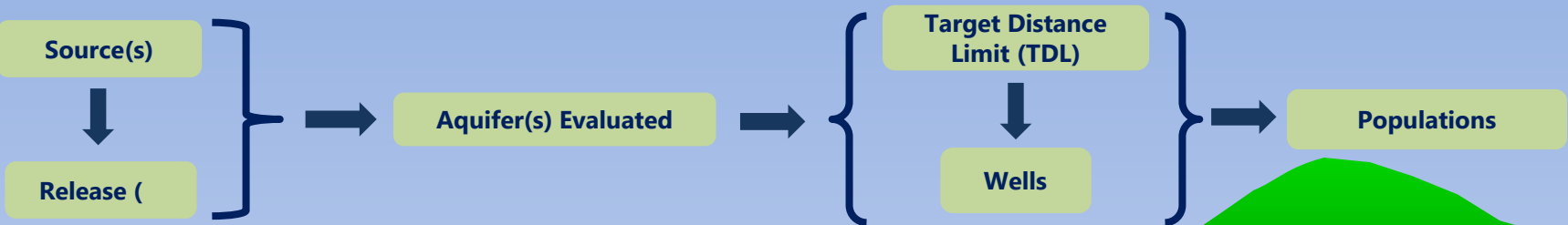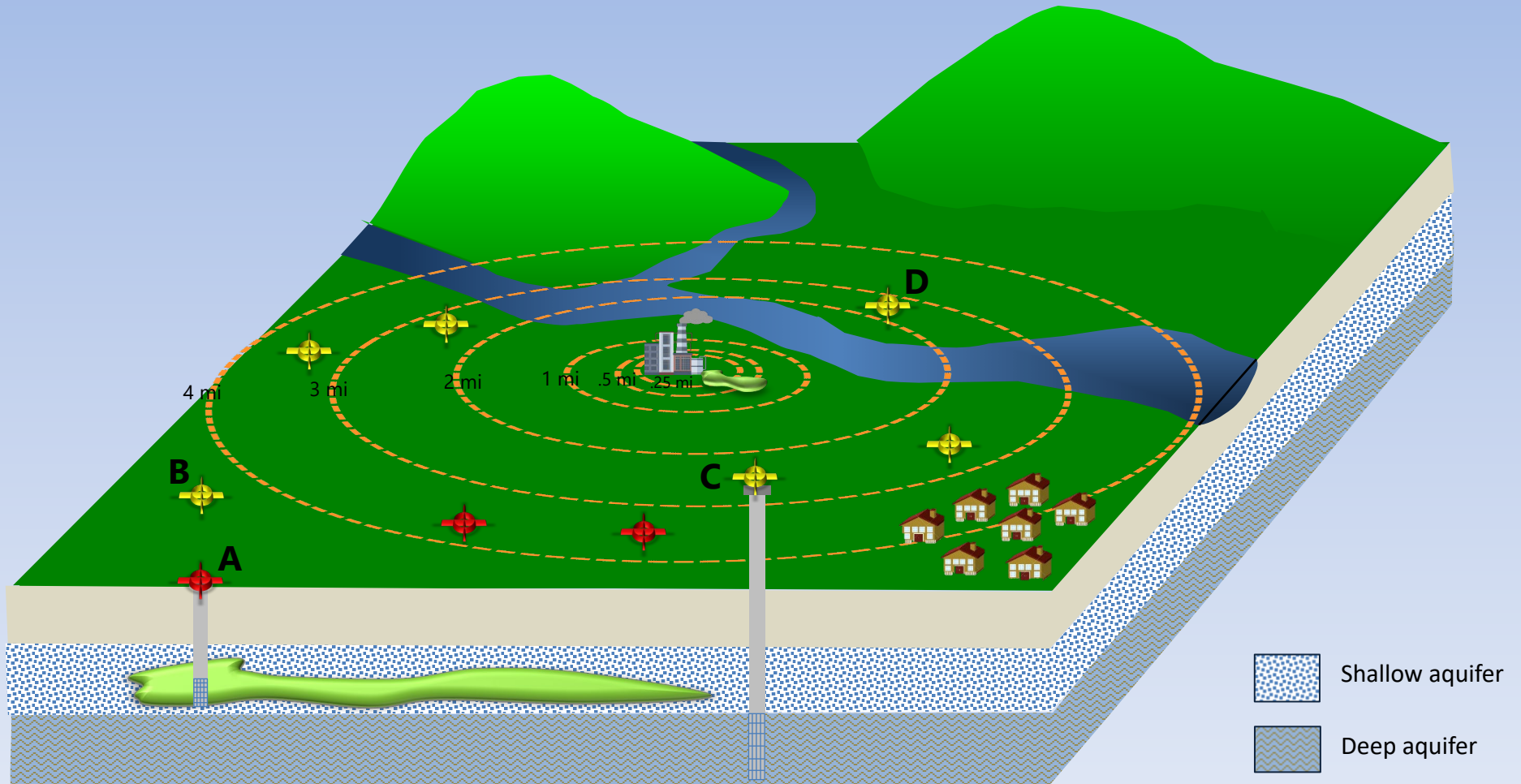
Targets and Aquifer Discontinuities

Fault Line
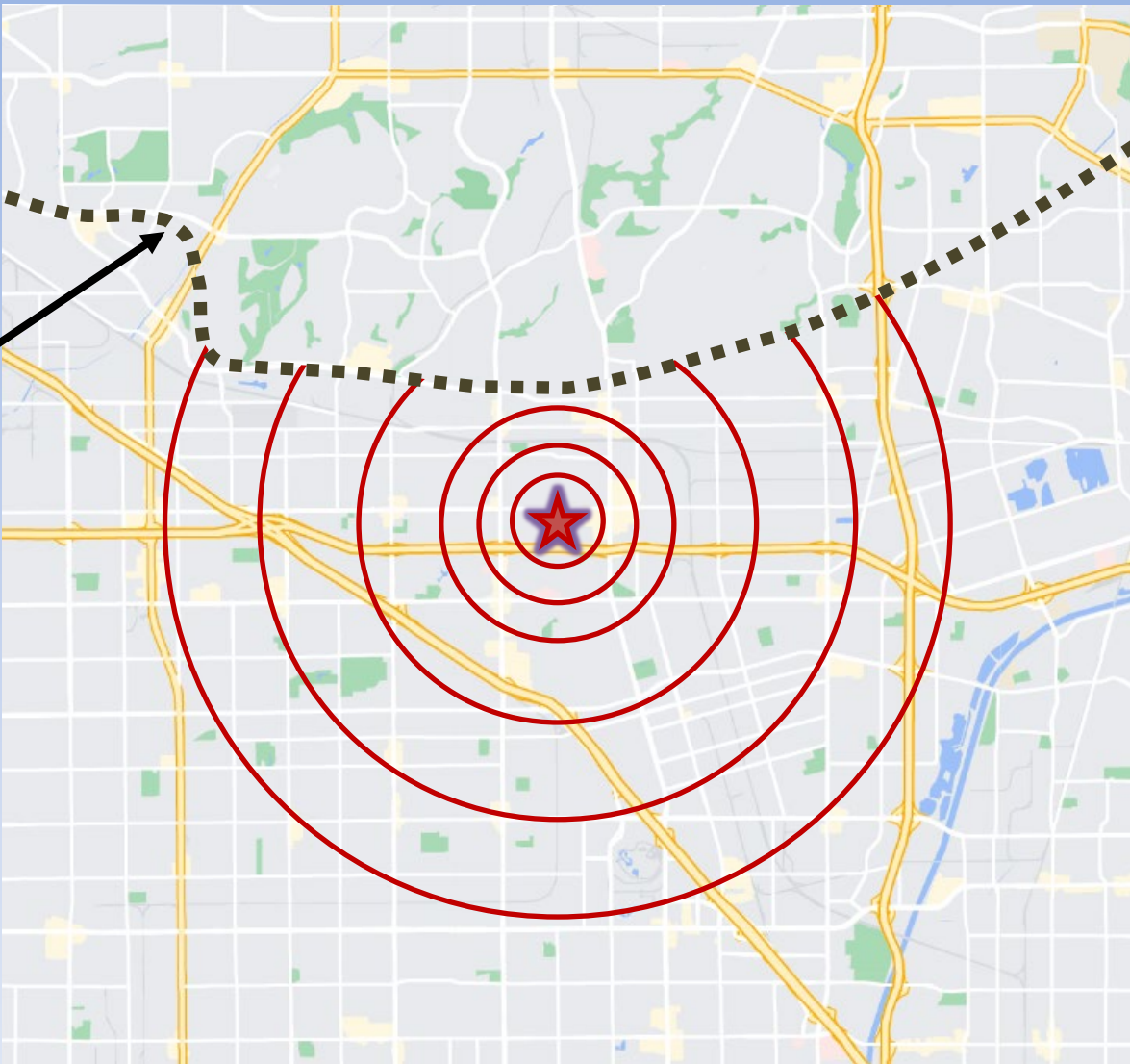
Ground Water Migration Pathway

WASTE CHARACTERISTICS

Waste Characteristics

Toxicity

Mobility

Hazardous waste quantity

Ground Water Migration Pathway

FITTING THE PIECES TOGETHER FOR THE HRS EVALUATION

Ground Water Migration Pathway

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Population
Resources
Wellhead Protection Area

Elements of the Ground Water Migration Pathway
Mapped to Factor Categories
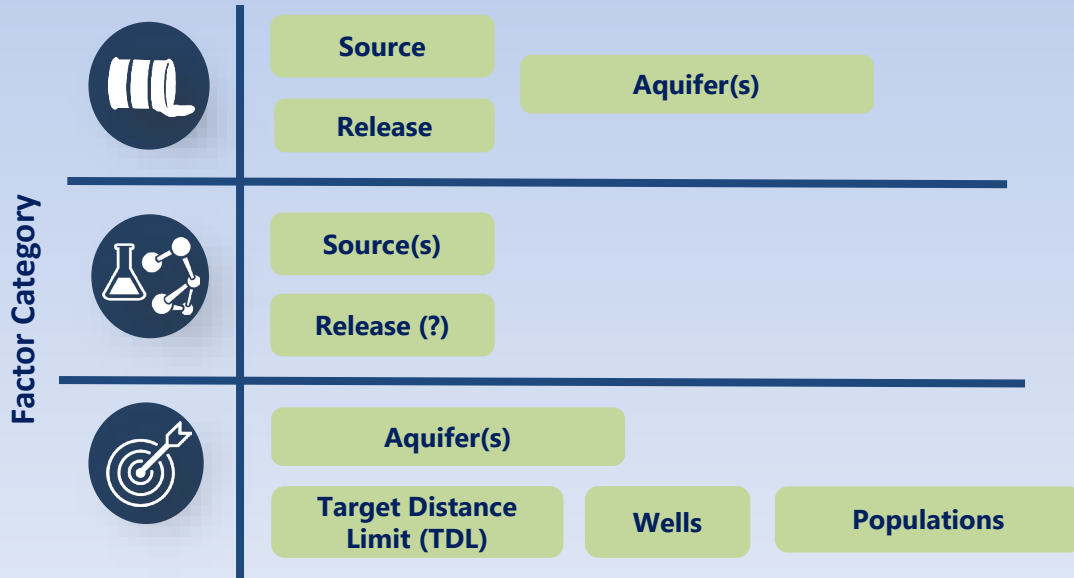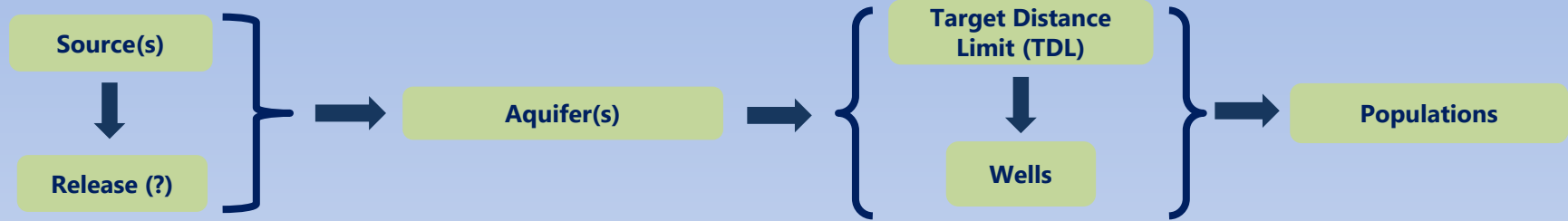
Source(s) → Release (?) → Aquifer(s) → Target Distance Limit (TDL) → Wells → Populations

Factor Category

- Source, Aquifer(s), Release
- Source(s), Release (?)
- Aquifer(s), Target Distance Limit (TDL), Wells, Populations

Ground Water Pathway Elements within the HRS Structure

- When you have a **source** with a hazardous substance that could or already has entered (released into) the ground water

- When the contamination **has impacted**, or **threatens to impact**, one or more **drinking water aquifers**

- When you have **enough contamination** that is also **toxic enough** to impact **drinking water**

- **People** are **actually ingesting** contaminated drinking water or **could potentially** drink contaminated drinking water

Likelihood of Release
Observed release
Potential to release

Waste Characteristics
Toxicity
Mobility
Hazardous waste quantity

Targets
Nearest well
Population
Resources
Wellhead Protection Area

Key Points for Information Gathering

Likelihood of Release

- Source Info
  - History
  - Manifests, permits, etc.
  - Dimensions
- Sampling Data
  - Identify source
  - Established an observed release
- Hydrogeology
  - Depth to aquifer
  - Hydraulic conductivity

Key Points for Information Gathering

Waste Characteristics

- Sampling data to identify hazardous substances
- Dimensions/capacities of sources
- Manifests, permits, other historical records
- Superfund Chemical Data Matrix (SCDM)

Key Points for Information Gathering

Targets

- Well Locations
- Usage of Standby Wells
- Populations Served by Drinking Water Wells
  - Total Population Per Municipal System
  - Total Connections per Municipal System
  - Population per private well
- Hydrogeology of the site
- Municipal water system blending
- Municipal water system buying/selling of water
- Wellhead Protection Area
- Resources

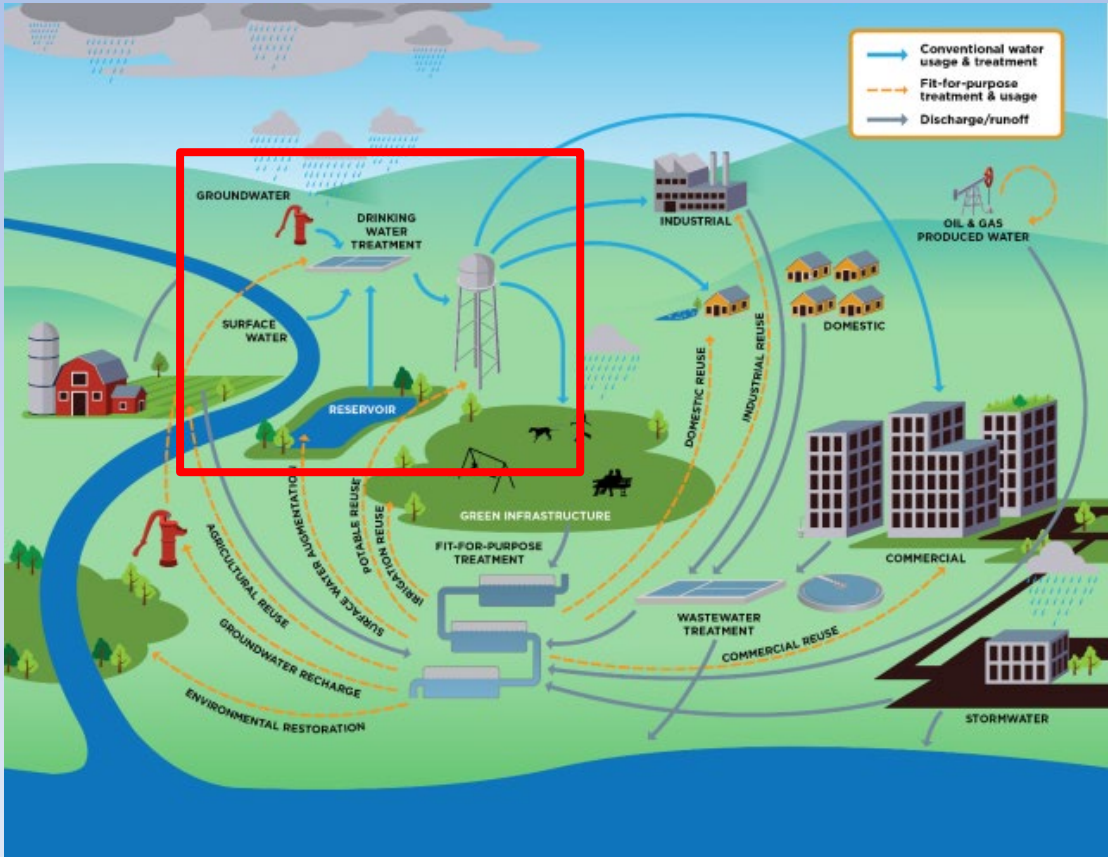# Data Collection
Targets – Blended Water Systems

Targets

Nearest well

Population

Resources

Wellhead Protection Area

Q & A