



# Cleanup Criteria Rules

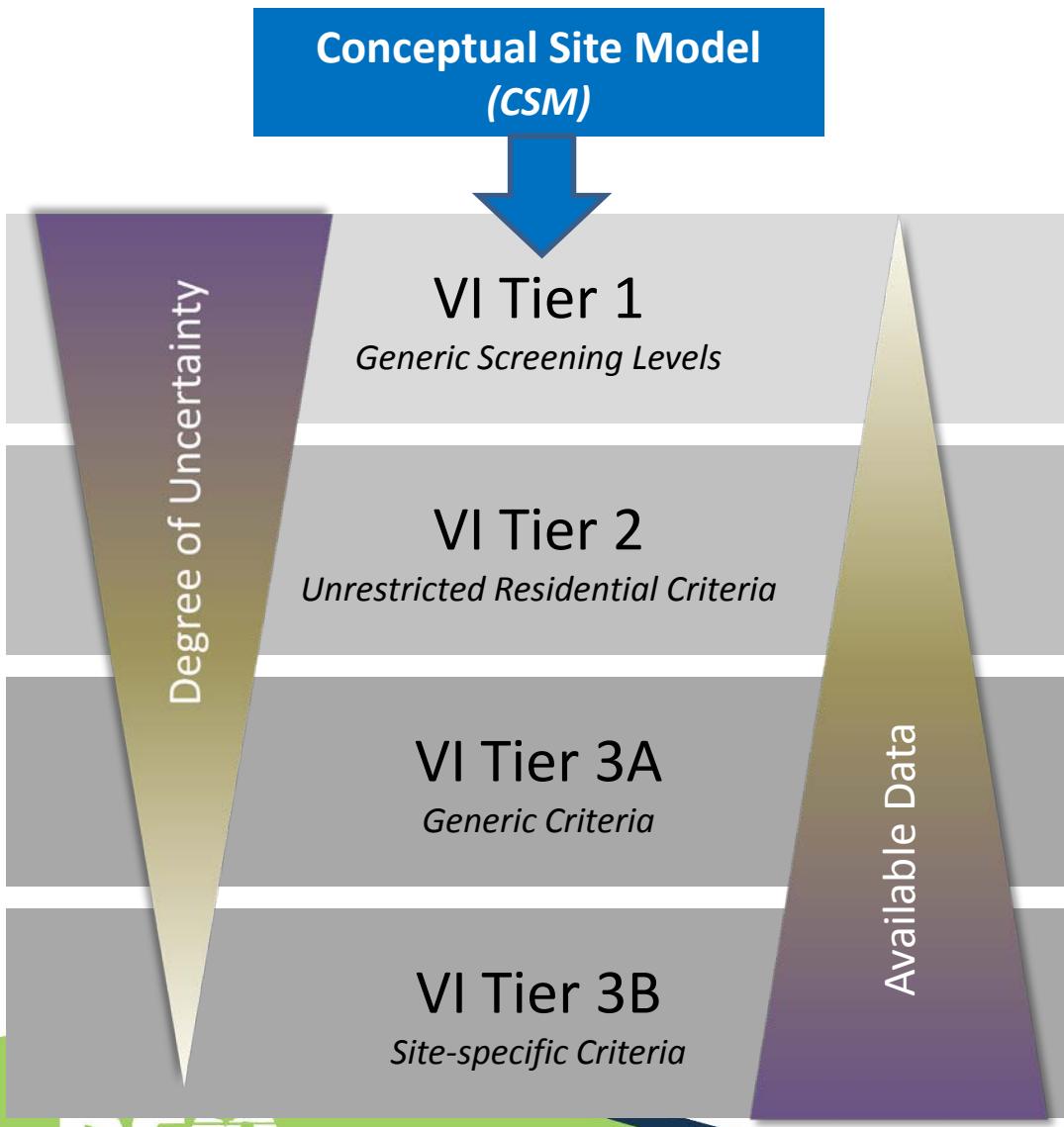
## Volatilization to the Indoor Air Pathway

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Remediation and Redevelopment Division

# Proposed Rule 27

- Volatilization to the indoor air pathway (VIAP)
  - Shallow groundwater
    - Situations where groundwater may be close or in contact with a building
    - Direct volatilization to the indoor air is likely to occur
  - Groundwater
    - Situations where groundwater is deeper than a typically constructed building
    - Vapor Intrusion (VI) is likely to occur
  - Vapor
  - Soil

# Tiered Approach For the VIAP



- Common in modern risk-based guidance
- Intended to promote:
  - Efficiency
  - Better characterization
- Other key features:
  - Ability to self implement through VI Tier 3A
  - Flexible

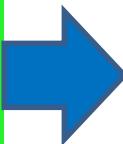
# 1<sup>st</sup> Step in the VI Tiered Approach

VI Tier 1  
*Generic Screening Levels*

VI Tier 2  
*Unrestricted Residential Criteria*

VI Tier 3A  
*Generic Criteria*

VI Tier 3B  
*Site-specific Criteria*



- Applicable to all sites with limited data and information
- If your samples meet the screening levels, you are done
- If concentrations exceed:
  - Go to VI Tier 2 or VI Tier 3A
  - Implement a response action and/or restriction(s)
  - “Site-specific” or VI Tier 3B

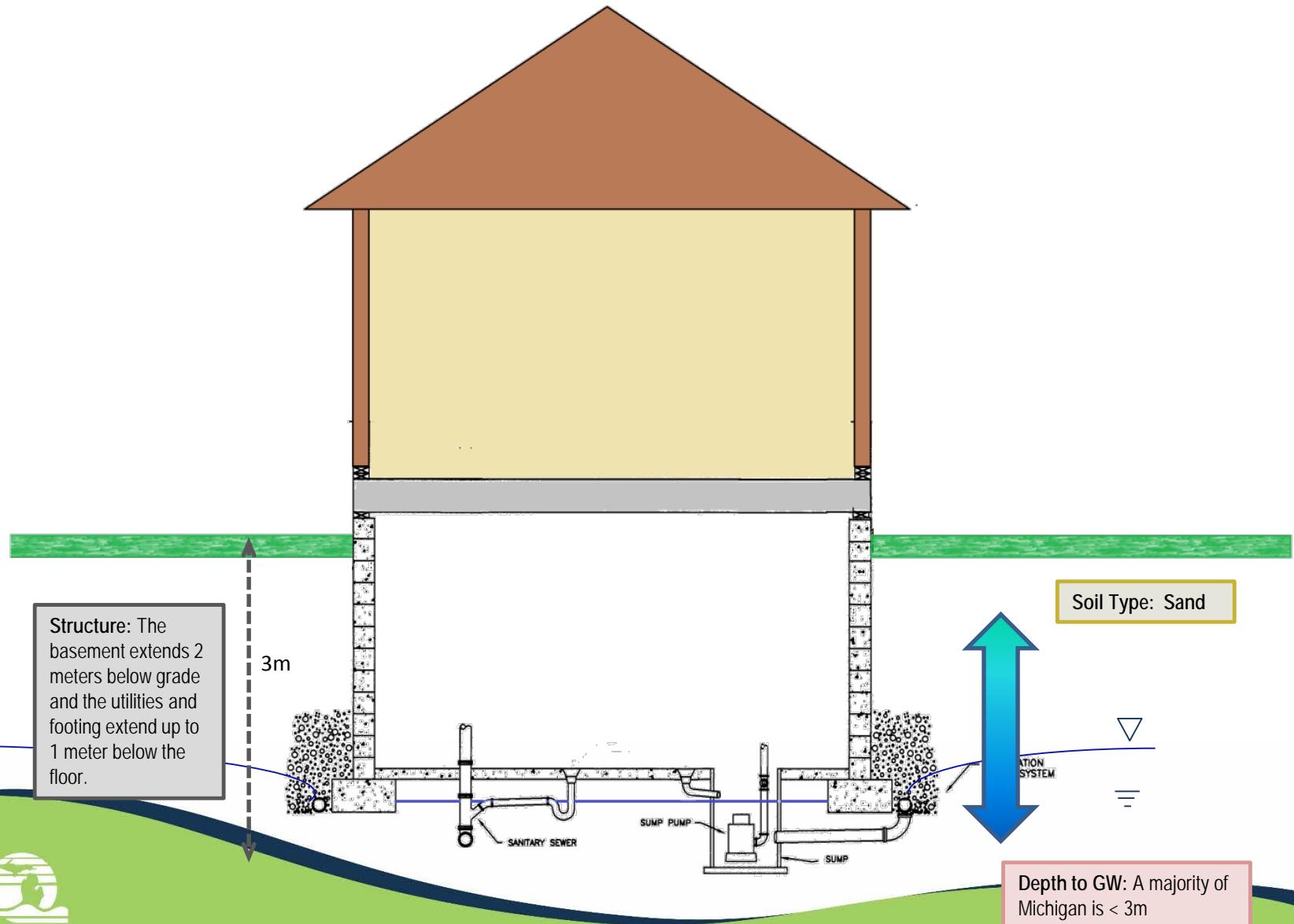
# VI Tier 1

## Generic Screening Levels

- VI Tier 1 is a screening level

**\*NOT FACILITY STATUS** – A person may use the screening level as the criterion to evaluate the pathway when limited or no information is available

# VI Tier 1



# VI Tier 2 – Facility-specific Information

## VI Tier 1

*Generic Screening Levels*

## VI Tier 2

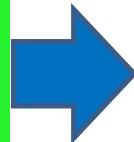
*Unrestricted Residential Criteria*

## VI Tier 3A

*Generic Criteria*

## VI Tier 3B

*Site-specific Criteria*



- Exceed the VI Tier 1
- Want to apply facility-specific inputs

**AND**

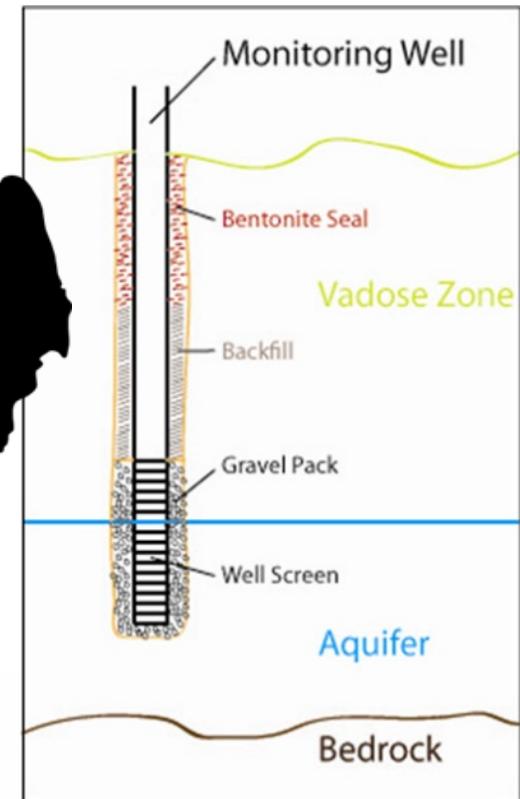
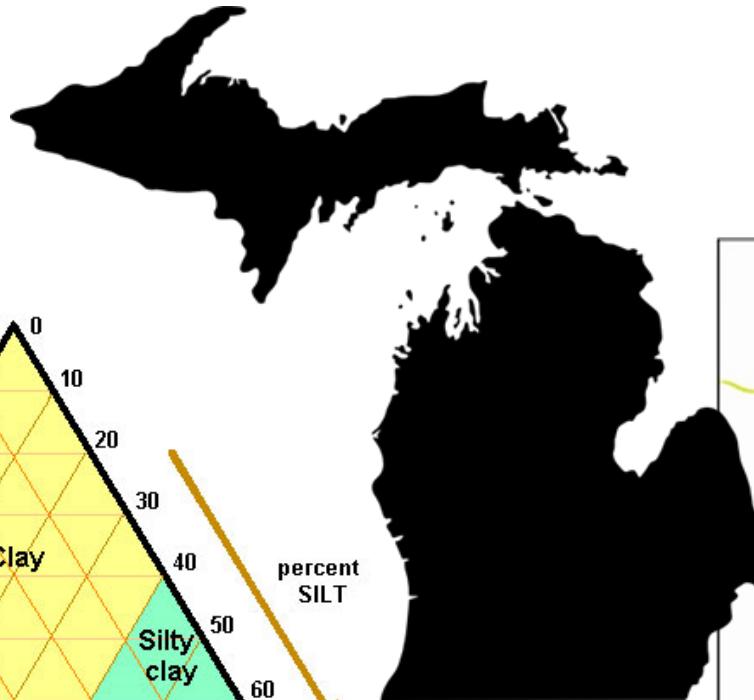
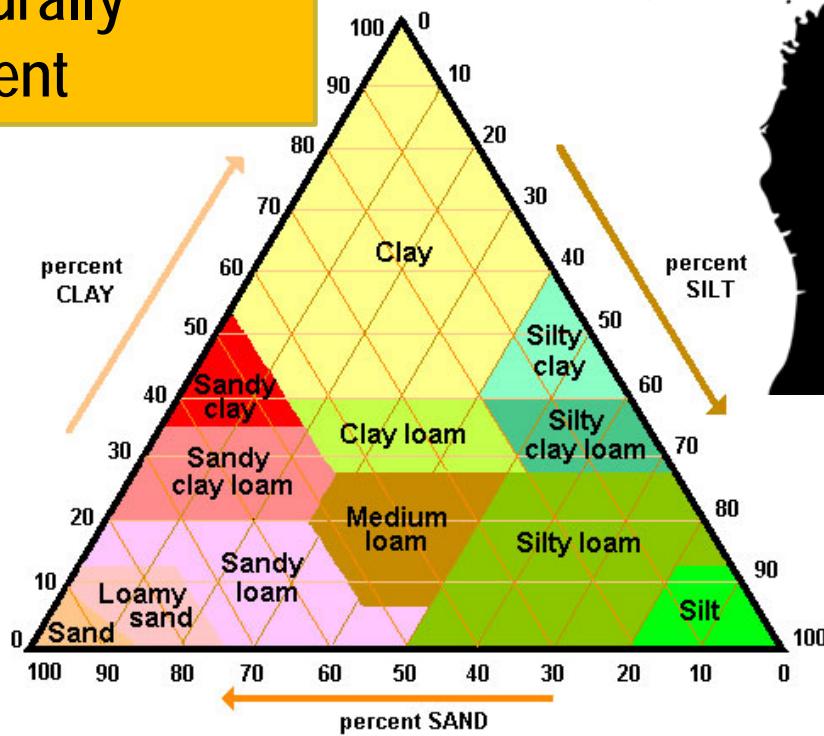
- The soil type is different

**OR**

- The depth to groundwater is greater than 3m

# What is Facility-specific Information for VI Tier 2?

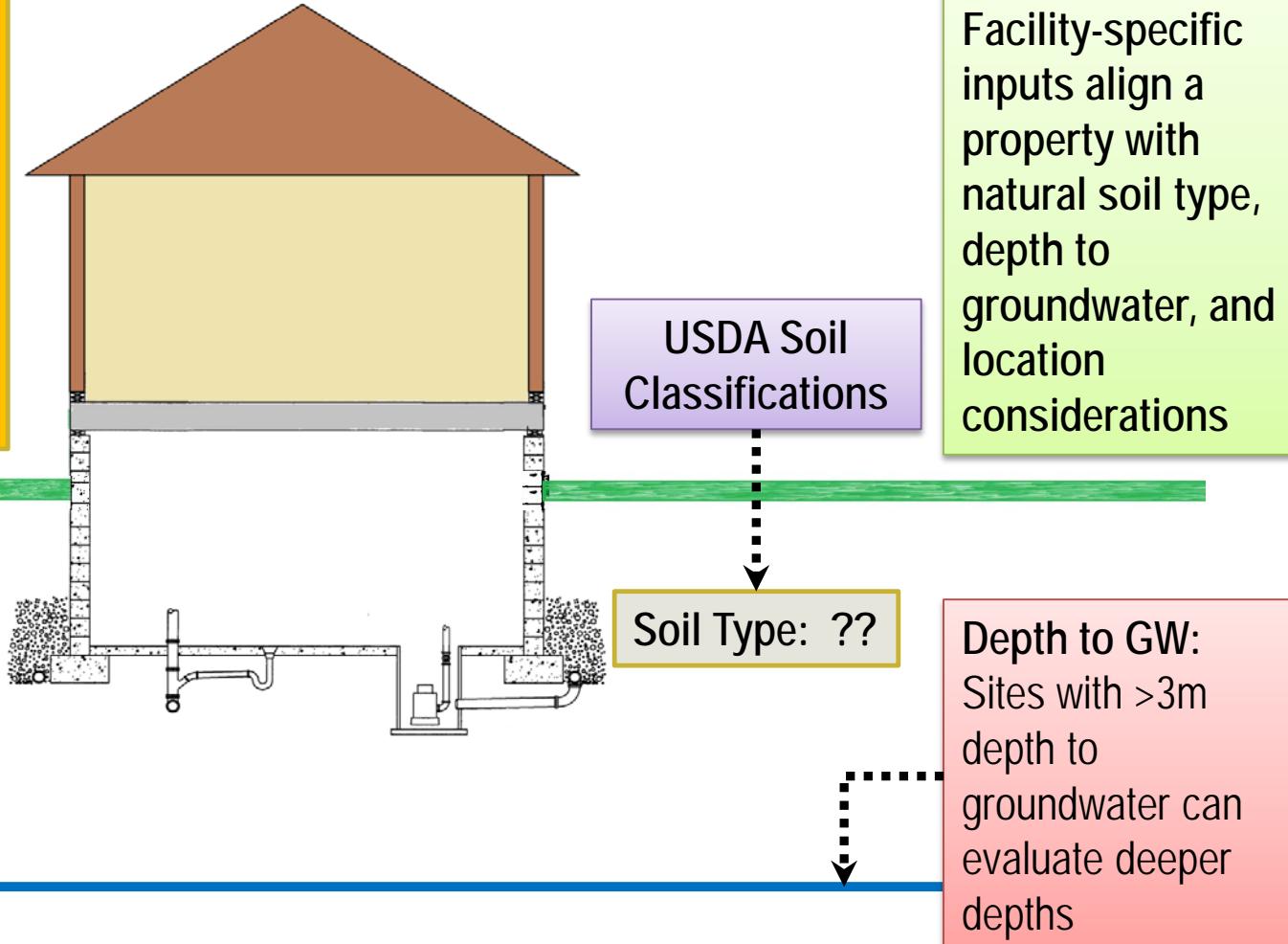
Modifications so that the site matches what is “naturally” present



# VI Tier 2

## Unrestricted Residential Criteria

Once the site matches what is “naturally” present, facility determination is made.



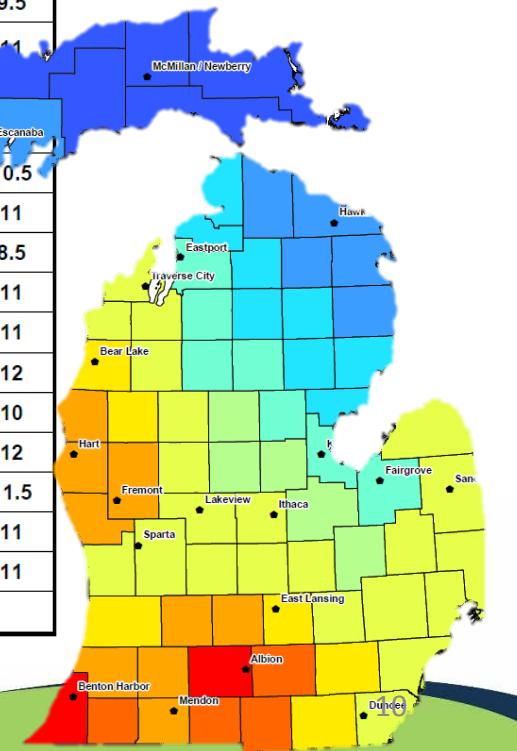
**Site Location:**  
Further north impacts  
the soil temp  
Colder = Higher values

Facility-specific inputs align a property with natural soil type, depth to groundwater, and location considerations

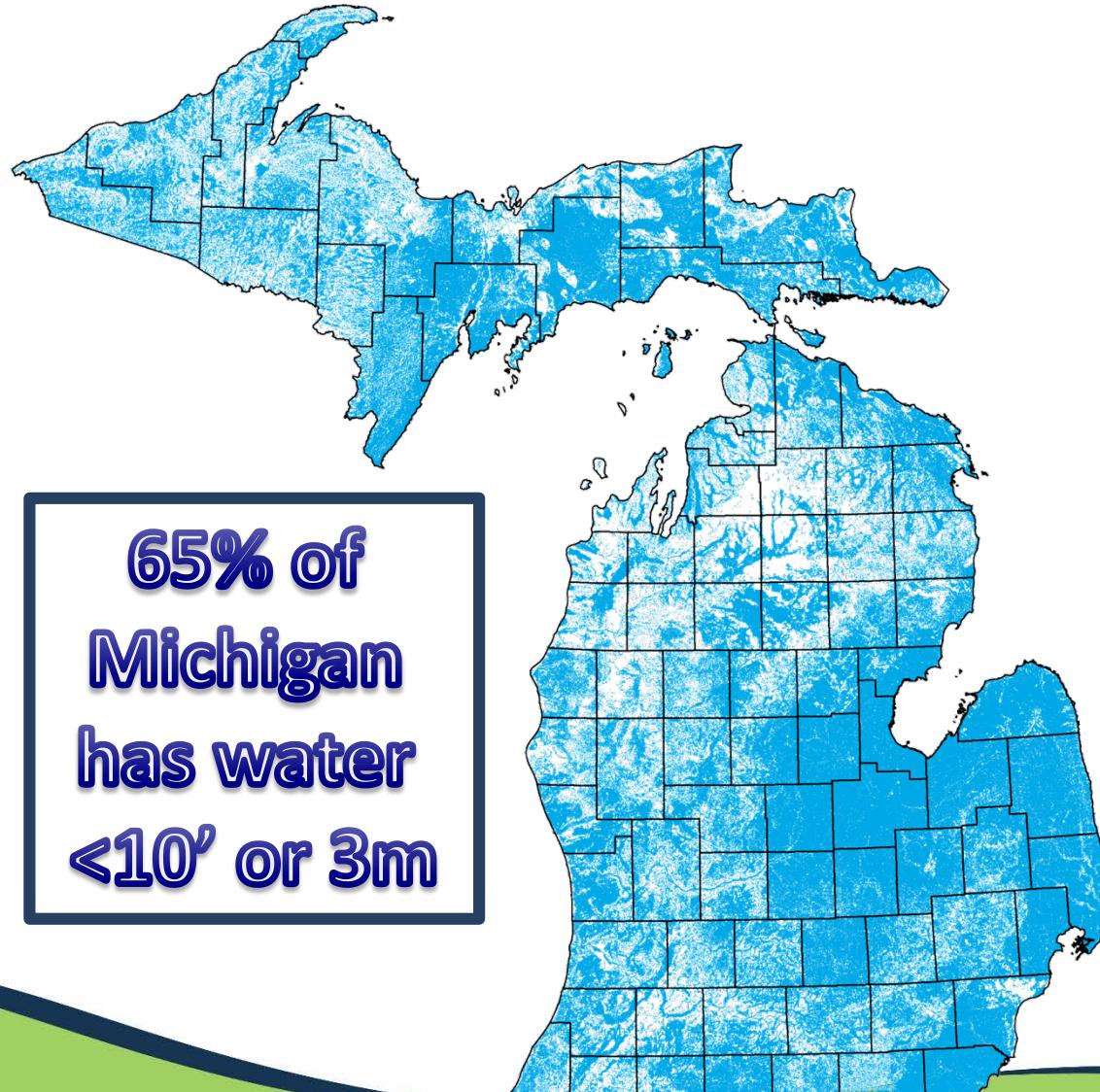
# County Specific Temperature

**Table 3**  
**Facility Specific Temperatures by County (degrees Celsius)**

County	Temp	County	Temp	County	Temp	County	Temp
ALCONA	9	DICKINSON	9	LAKE	11.5	OCEANA	12
ALGER	8.5	EATON	12	LAPEER	11	OSEMIAW	9.5
ALLEGAN	11.5	EMMET	9.5	LEELANAU	11	ONTONAGON	8
ALPENA	9	GENESEE	10.5	LENAWEE	11.5	OSCEO	11
ANTRIM	10	GLADWIN	10	LIVINGSTON	11	OSCEOLA	9.5
ARENAC	9.5	GOGEBIC	8	LUCE	11	OSCEOLA	9.5
BARAGA	8.5	GRAND TRAVERSE	11	MACKINAC	11	OSCEOLA	11
BARRY	12	GRATIOT	11	MACOMB	11	OSCEOLA	11
BAY	10	HILLSDALE	12.5	MANISTEE	11.5	ROSCOMM	10.5
BENZIE	11	HOUGHTON	8	MARQUETTE	8.5	SAGINAW	10.5
BERRIEN	13	HURON	11	MASON	12	SANILAC	11
BRANCH	12.5	INGHAM	11.5	MECOSTA	11	SCHOOLCRAFT	8.5
CALHOUN	13	IONIA	11	MENOMINEE	9.5	SHIAWASSEE	11
CASS	12.5	IOSCO	9.5	MIDLAND	10.5	ST. CLAIR	11
CHARLEVOIX	9.5	IRON	8.5	MISSAUKEE	10	ST. JOSEPH	12
CHEBOYGAN	9	ISABELLA	10.5	MONROE	11	TUSCOLA	10
CHIPPEWA	8.5	JACKSON	12.5	MONTCALM	11	VAN BUREN	12
CLARE	10.5	KALAMAZOO	12	MONTMORENCY	9	WASHTENAW	11.5
CLINTON	11	KALKASKA	10	MUSKEGON	12	WAYNE	11
CRAWFORD	9.5	KENT	11	NEWAYGO	12	WEXFORD	11
DELTA	9	KEWEENAW	8	OAKLAND	11		



# Depth to GW

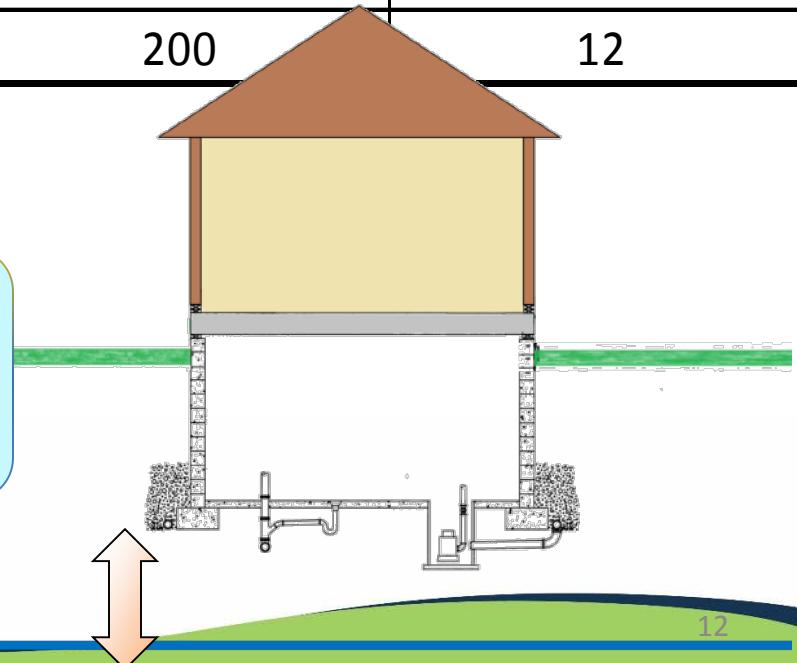


# Depth to Groundwater

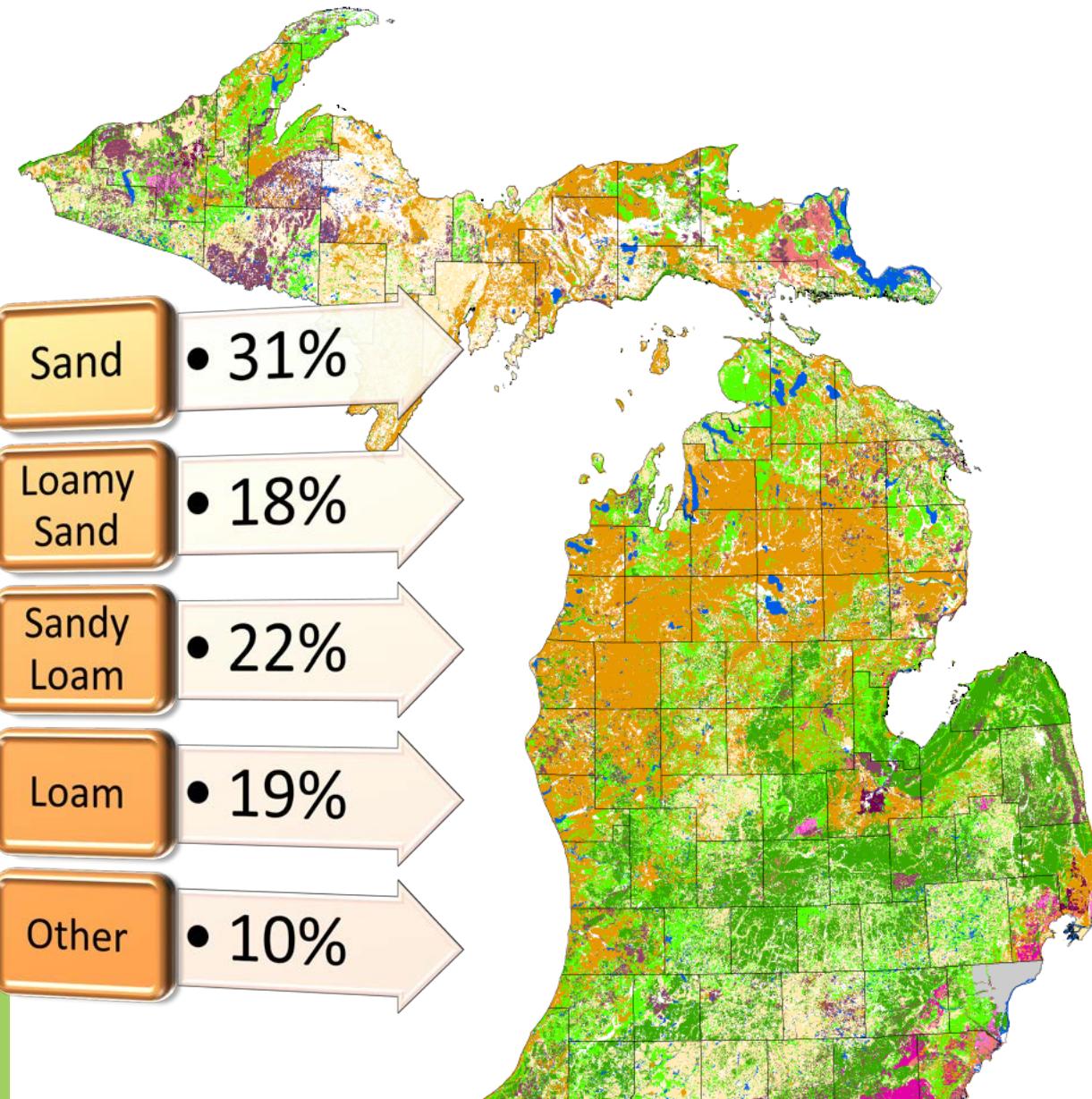
## Single Parameter Sensitivity Analysis

Hazardous Substance	Benzene	Tetrachloroethylene	Trichloroethylene
CAS #	71432	127184	79016
Depth to GW	µg/L	µg/L	µg/L
<3m	1	1.5	0.073
Just >3.0m	14	96	6.1
5m	18	130	7.8
10m	27	200	12

Deeper the groundwater is,  
the more a hazardous  
substance is likely to diffuse  
before entering a structure



# USDA Soil Classifications



# Soil Type

## Single Parameter Sensitivity Analysis

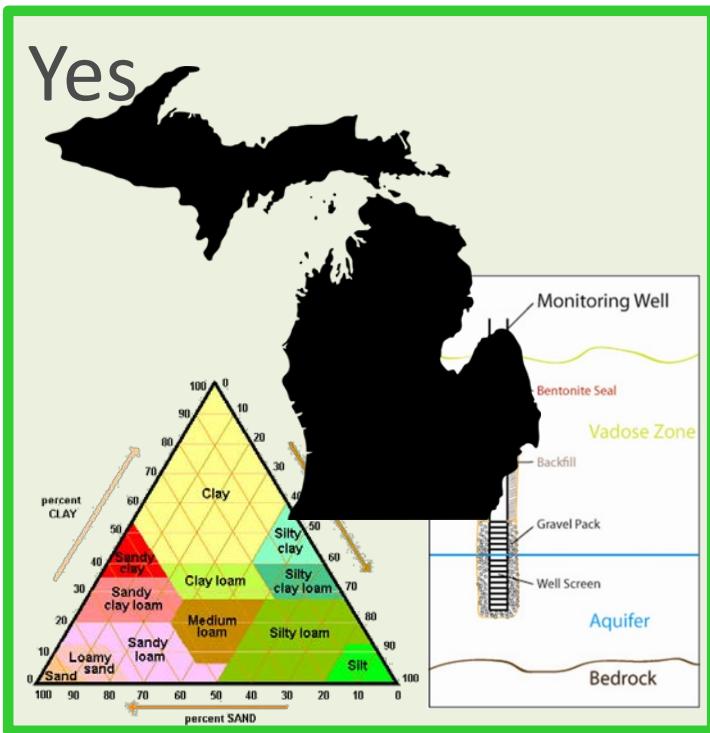
Hazardous Substance	Benzene	Tetrachloroethylene	Trichloroethylene
CAS #	71432	127184	79016
UNITS	µg/kg	µg/kg	µg/kg
Sand	1.7	6.2	0.33
Loamy Sand	11	41	2.3
Sandy Loam	33	120	7.0
Loam	120	450	27

Larger particles (e.g., sand) means more pore space and easier migration of soil vapors

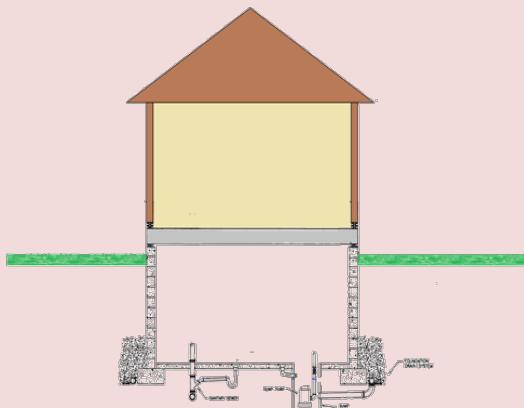


# VI Tier 2 in Review

- Unrestricted Residential Generic Criteria



No



# VI Tier 3A

## VI Tier 1

*Generic Screening Levels*

## VI Tier 2

*Unrestricted Residential Criteria*

## VI Tier 3A

*Generic Criteria*

## VI Tier 3B

*Site-specific Criteria*

- Exceed VI Tier 1 or VI Tier 2  
**AND**
- Structure is not a residential house with a basement
  - Different foundation
    - Slab-on-grade
    - Uninhabitable basement
  - Different building
    - High-rise apartment (residential)
    - Former residential, now nonresidential
    - <50,000 square feet
    - >50,000 square feet
  - Both
- Ability to self implement

# VI Tier 3A



Former Residential



\*Google image of Lansing Business

High Rise Apartment



>50,000 ft<sup>2</sup>



\*Pictures from Wikimedia

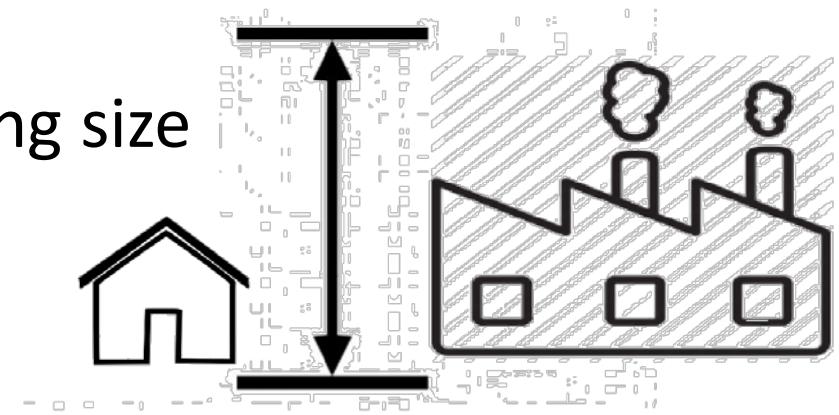
# Changes in VI Tier 3A

Air exchange rate

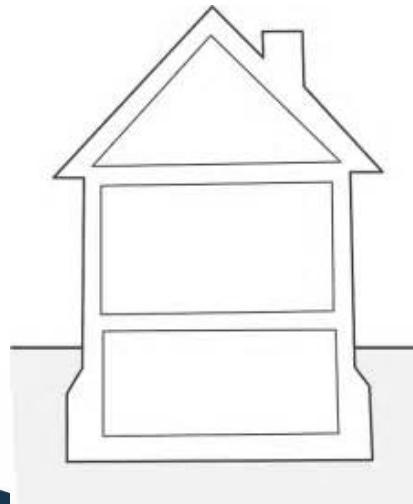


\*Wikimedia, 2017

Building size

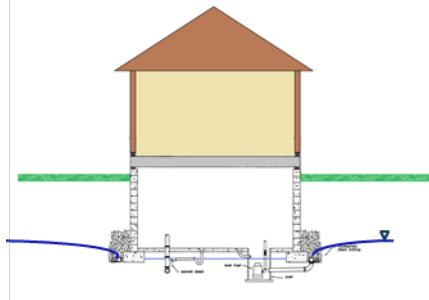


Building foundation



# VI Tiered Process

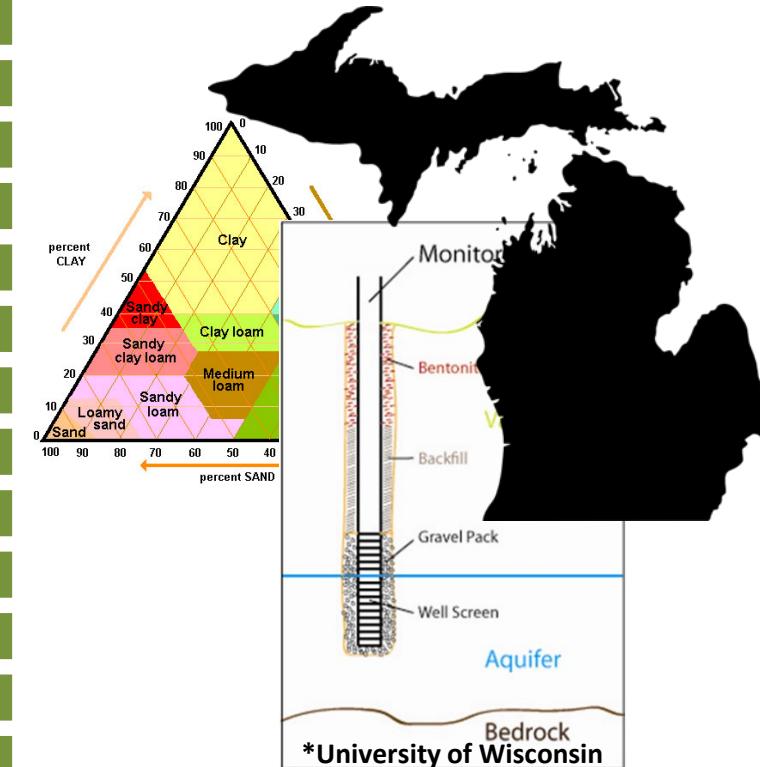
## VI Tier 1



Generic Screening  
Level



## VI Tier 2



Facility-specific inputs  
to establish  
Generic Unrestricted  
Residential Criteria

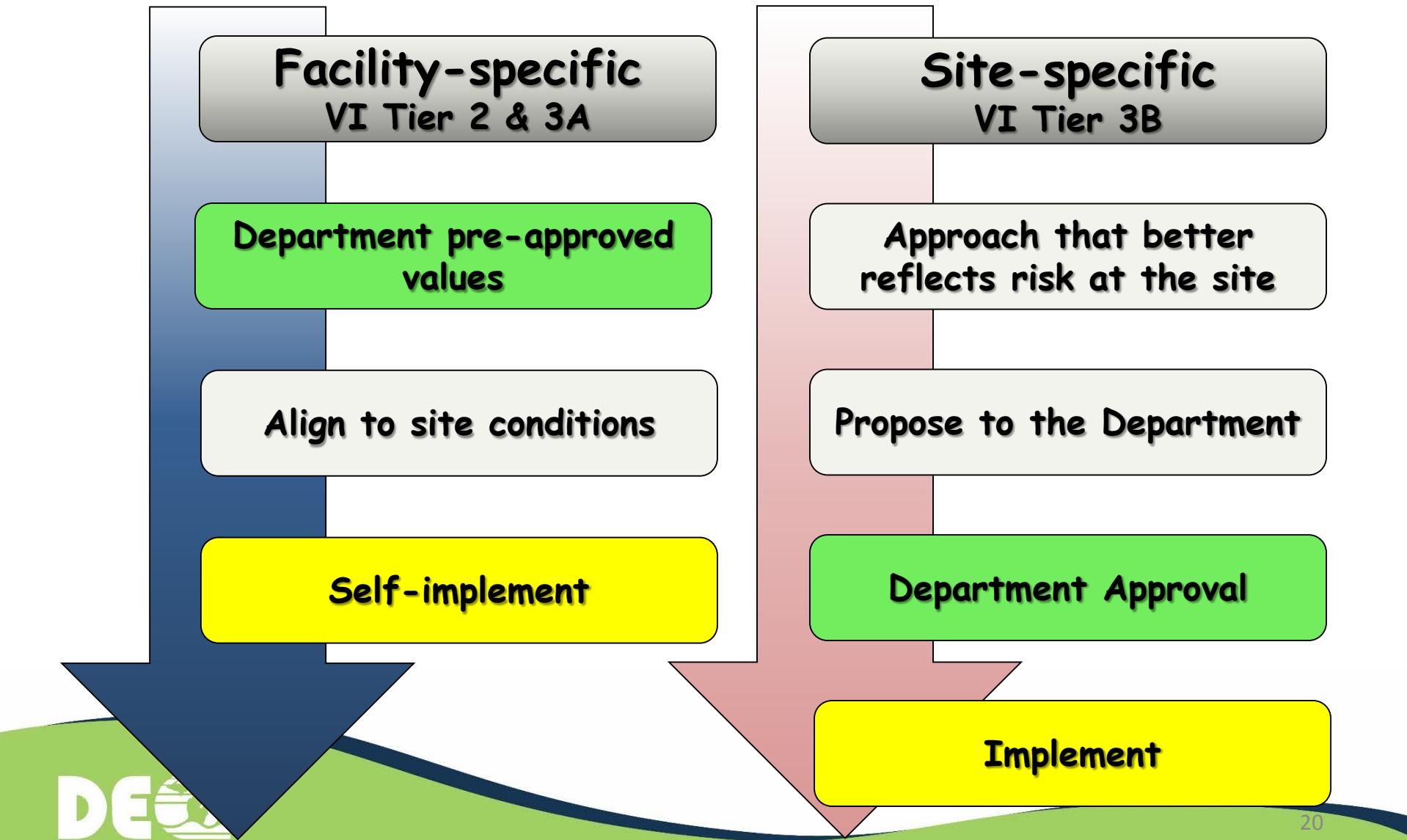
## VI Tier 3A



\*images from  
vastree.com

Facility-specific inputs  
to establish  
Generic Restricted  
Criteria

# Facility-specific vs Site-specific



# VI Tier 3B - Site-Specific

## VI Tier 1

*Generic Screening Levels*

## VI Tier 2

*Unrestricted Residential Criteria*

## VI Tier 3A

*Generic Criteria*

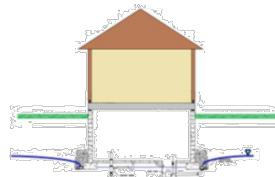
## VI Tier 3B

*Site-specific Criteria*

- Optional – NOT a requirement
- Want to capture or consider:
  - Multiple soil types present
  - Different soil parameters
  - **Greater air exchange**
  - Alternate approach
    - Evaluating petroleum
    - Evaluating NAPL
    - New method or model
- Requires DEQ approval

# Tiered Process Demonstration

VI Tier 1

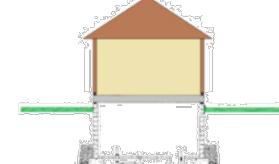


*Additional information:*

No additional data is warranted

VI Tier 2

Complete the conceptual site model (CSM) for the unrestricted residential criteria



*Additional information:*

County: \_\_\_\_\_

Depth to Groundwater: \_\_\_\_\_

Select one soil type:

Sand	S
Sandy loam	SL
Loam	L
Loamy sand	LS
Silty loam	SIL
Silty clay loam	SICL
Clay loam	CL
Clay	C
Silty clay	SIC
Sandy clay loam	SCL
Silt	SI
Sandy clay	SC

VI Tier 3A

Complete the conceptual site model (CSM) for the restricted criteria

Select one (A-E) and one subgroup (A-B) or (C-E)

	Pick one (A-E)	Pick one from either (A-B) or (C-E)
A	House	A-B Basement
B	High Rise	A-B Basement (uninhabitable) A-B Slab-on-grade
C	Former Residential	C-E Basement (NR)
D	< 50,000	C-E Slab-on-grade (NR)
E	> 50,000	C-E Basement (NR unoccupied)

# Remediation and Redevelopment Division

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