

How Title 5 Addresses Protection of Water Supplies

# NITROGEN LOADING ISSUES

MEHA Title 5 Seminar  
March 9, 2022 – Mansfield  
Claire A. Golden, MassDEP

# TOPICS FOR DISCUSSION

Definition of Nitrogen Sensitive Areas

Areas Subject to Nitrogen Loading  
Limitations

Using I/A Technology and/or Credit Land  
to Address Nitrogen Loading Limitations

Upgrades in Areas Subject to Nitrogen  
Loading Limitations

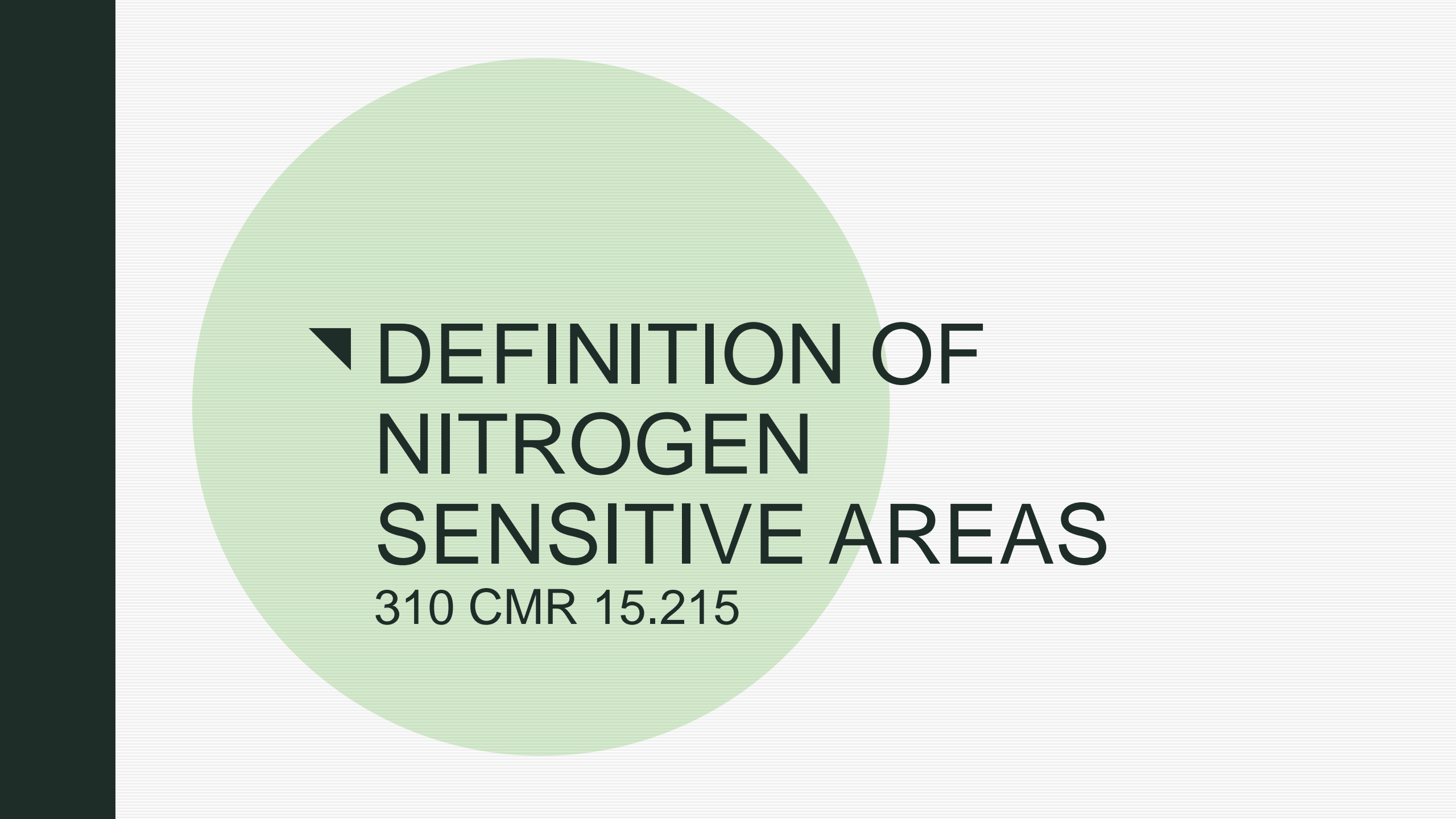
Questions



## **DISCLAIMER**

This presentation represents the requirements of 310 CMR 15.000, Title 5 of the State Environmental Code, and is for educational and informational purposes only. Please note that municipalities may have regulations that are more restrictive than Title 5.

Any reference to a proprietary technology in the presentation is solely for illustration and does not constitute an endorsement of or comment upon said technology by the presenter or MassDEP. The same applies to any questions about particular technologies posed to the presenter and the accompanying answers.



▼ DEFINITION OF  
NITROGEN  
SENSITIVE AREAS

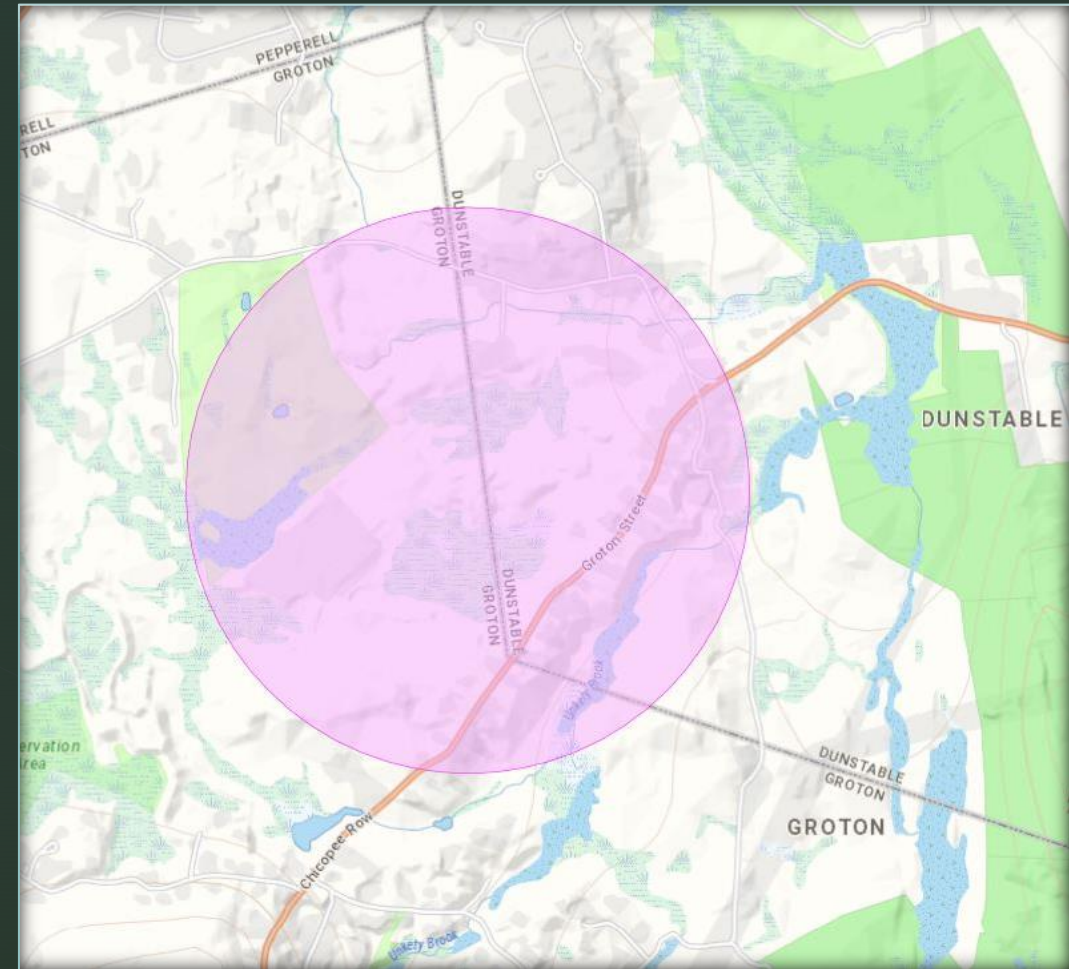
310 CMR 15.215

# Nitrogen Sensitive Area Designation

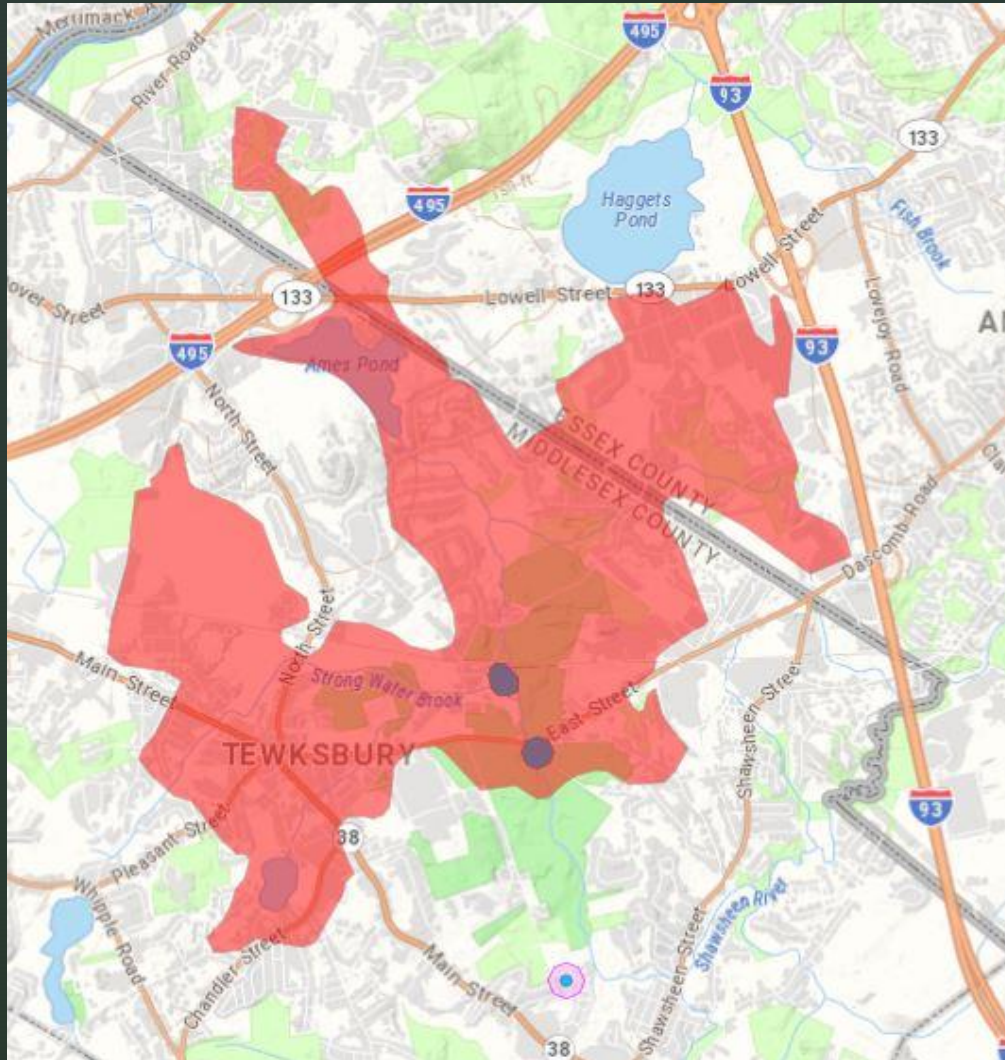
- Interim Wellhead Protection Areas (IWPAs) of Public Water Supply (PWS) Wells
- Zone IIs of PWS Wells
- Nitrogen sensitive embayments or other areas which are designated as nitrogen sensitive for purposes of 310 CMR 15.000 shall be mapped based on scientific evaluations of the affected water body and adopted through parallel public processes pursuant to both 310 CMR 15.000 and 314 CMR 4.00: Massachusetts Surface Water Quality Standards.

# IWPA Example

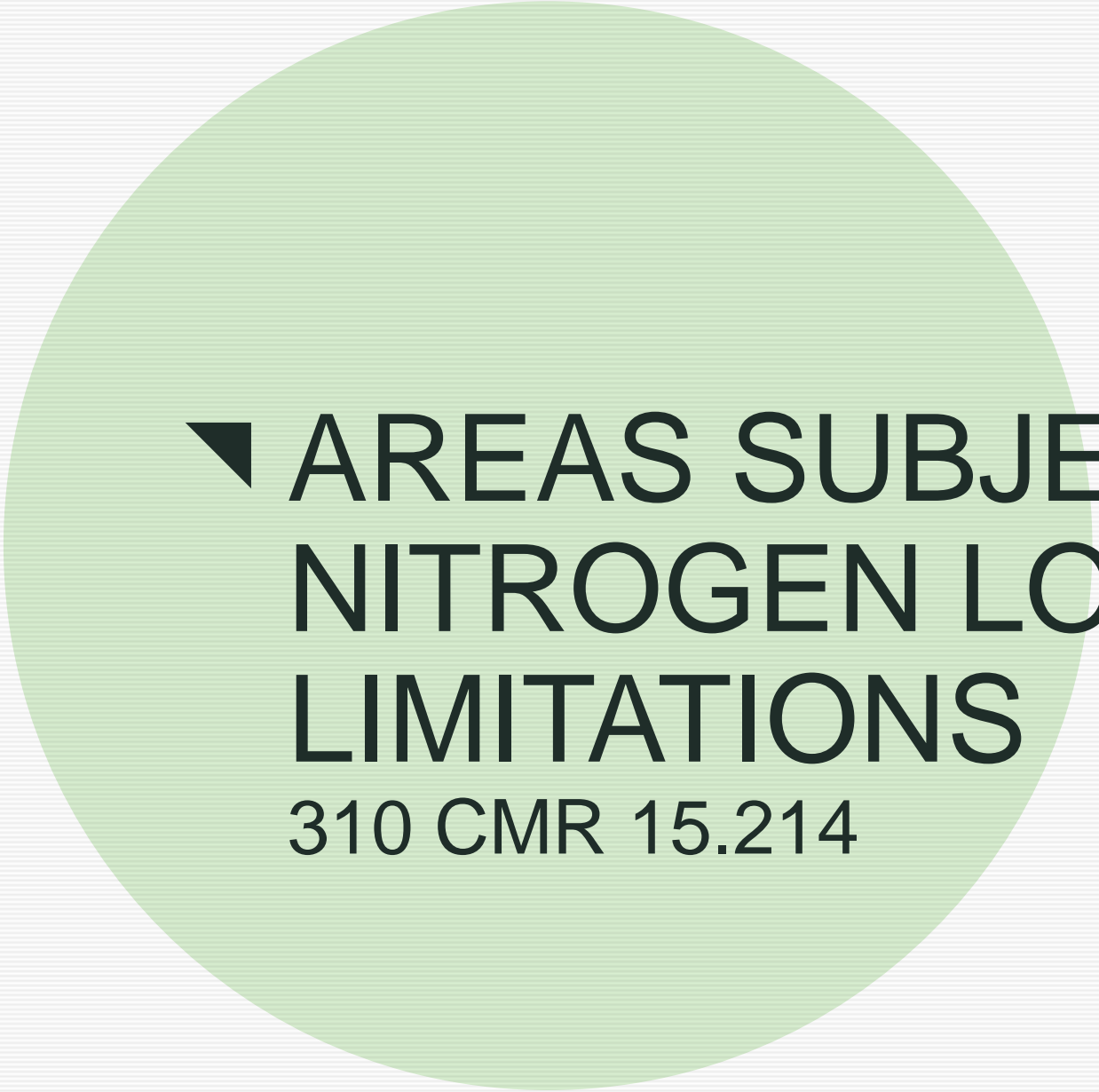
Circle around PWS with a radius calculated by the approved pumping rate of the well.



# Zone II Example



The area of an aquifer which contributes water to a well under the most severe pumping and recharge conditions that can realistically be anticipated.



▼ AREAS SUBJECT TO  
NITROGEN LOADING  
LIMITATIONS

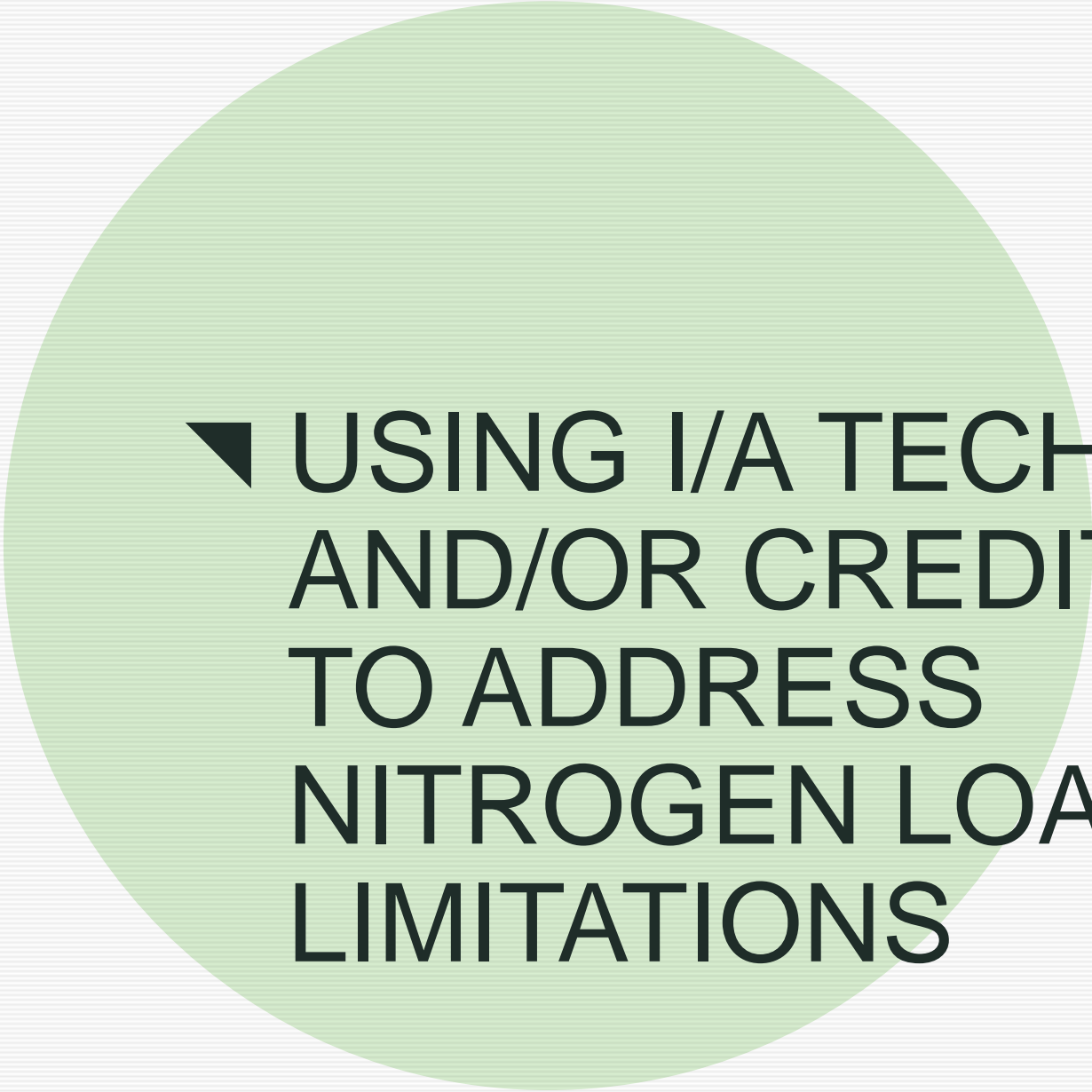
310 CMR 15.214



# Areas Subject to Nitrogen Loading 310 CMR 15.214

- No system serving new construction in a NSA shall be designed to receive or shall receive more than 440 gallons of design flow per day per acre\* except as set forth at 310 CMR 15.216 (aggregate flows) or 15.217 (enhanced nitrogen removal).
- No system serving new construction in areas where the use of both on-site systems and drinking water supply wells is proposed to serve the facility shall be designed to receive or shall receive more than 440 gallons of design flow per day per acre from residential uses except as set forth at 310 CMR 15.216 (aggregate flows) or 15.217 (enhanced nitrogen removal).

\* 310 CMR 15.002 defines acre as 40,000 sf, not 43,560 sf.



▼ USING I/A TECHNOLOGY  
AND/OR CREDIT LAND  
TO ADDRESS  
NITROGEN LOADING  
LIMITATIONS



Nitrogen-  
Reducing I/A  
Technologies  
310 CMR 15.217



## Nitrogen-Reducing I/A Technologies

- Must be MassDEP-approved
- May be approved under
  - Piloting Use Approval
  - Provisional Use Approval
  - General Use Approval
- Must meet all requirements of the appropriate approval
  - Facility type limitation (residential)
  - Design flow limitation

# Nitrogen-Reducing I/A Technologies

## PILOTING USE APPROVAL

- AnuaPura Sys
- Bio Barrier MBR
- ECOPod
- Hydrokinetic
- Jet JC-1500 CF
- RUCK CFT

## PROVISIONAL USE APPROVAL

- Advantex
- Amphidrome
- Bioclere
- FAST
- Fuji Clean
- Modular FAST
- Nitrex
- NitRoe
- SeptiTech
- Singulair
- Waterloo Biofilter

## GENERAL USE APPROVAL

- Advantex
- Bioclere
- MicroFAST
- Recirculating Sand Filter
- Ruck
- SeptiTech
- Singulair

## Nitrogen Loading Allowed with Use of Approved I/A Technologies

Depending on the technology, the type of facility and the design flow, permissible loading may be either:

- 550 gpd/acre
- 660 gpd/acre



# Use of Credit Land

310 CMR 15.216



# Nitrogen Aggregation Credit Land for Facilities in NSAs

- Must be in the same NSA
- Must be owned or controlled by facility needing it
- Cannot be subject to any man-made nitrogen loading
- Cannot be used for raising/breeding/keeping animals
- Be pervious
- Be outside Zone As, V-Zones and Regulatory Floodways
- Cannot be land under water
- Cannot be already designated as nitrogen credit land
- Meet criteria set forth in *Guidelines for Title 5 Aggregation of Flows and Nitrogen Loading*





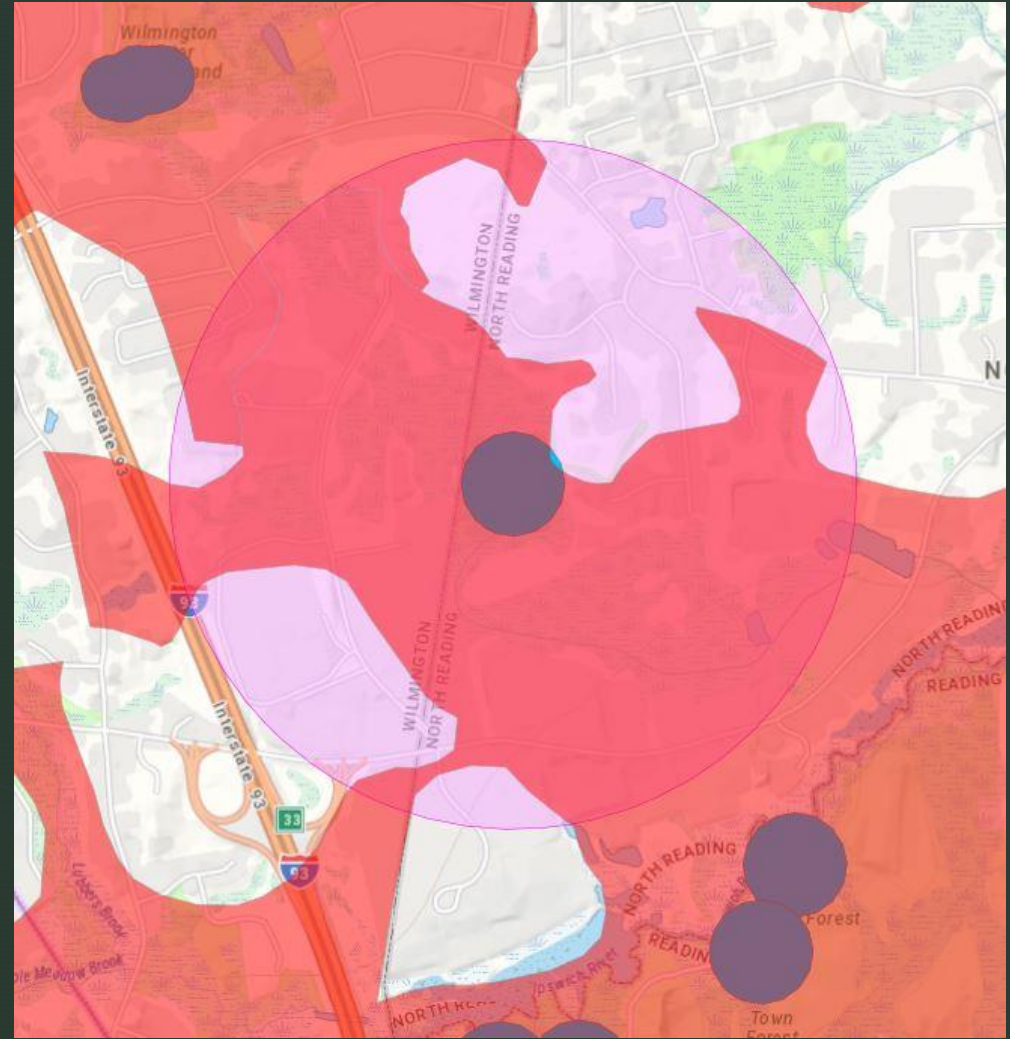
# Nitrogen Aggregation Credit Land for Facilities in Private Well/Septic System Areas

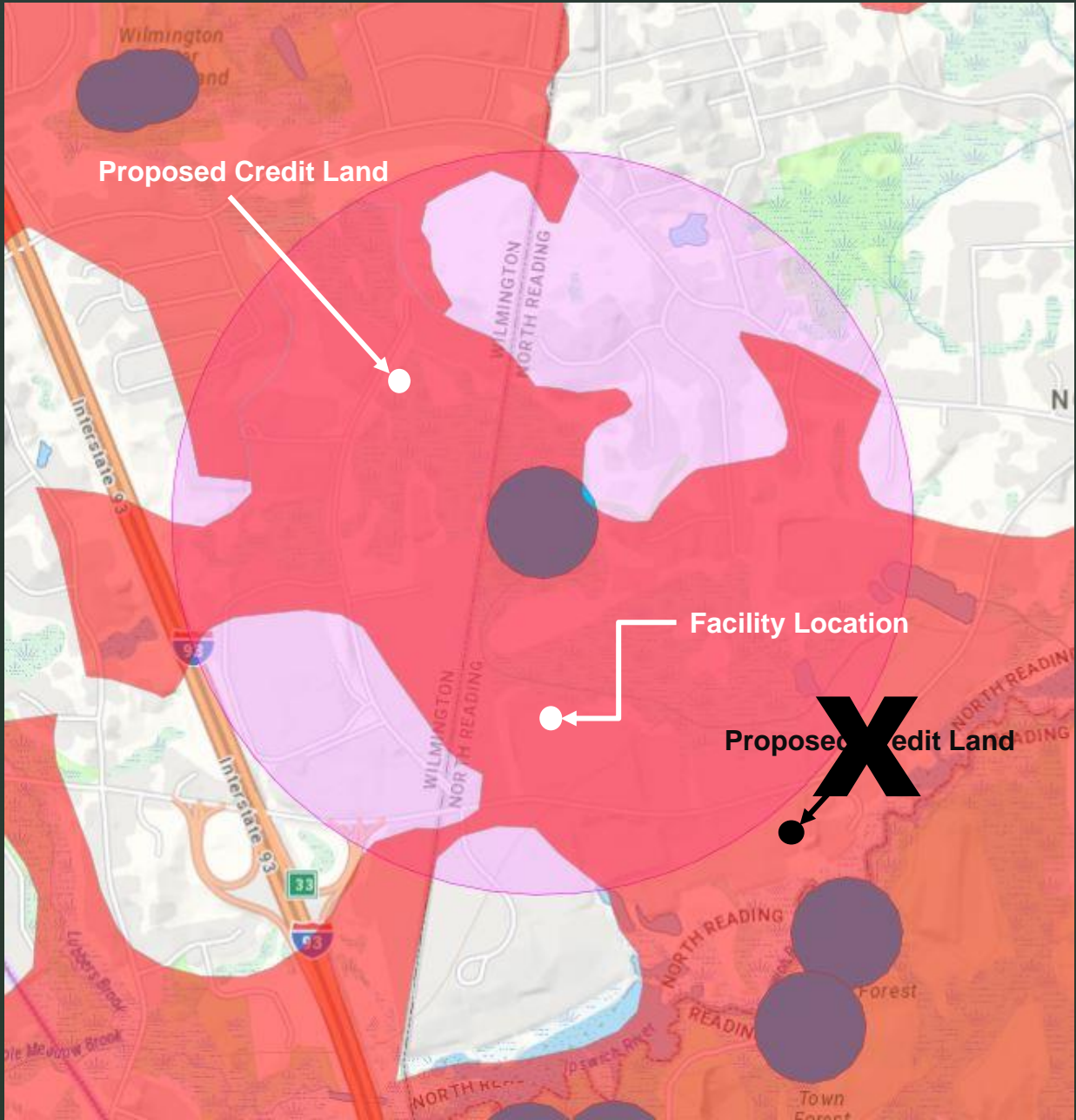
- Must be located within the subdivision if applicable
- If < 2,000 gpd, must be adjacent to the facility land
- $\geq$  2,000 gpd, must be adjacent and downgradient
- Must be owned or controlled by facility needing it
- Cannot be subject to any man-made nitrogen loading
- Cannot be used for raising/breeding/keeping animals
- Be pervious
- Be outside Zone As, V-Zones and Regulatory Floodways
- Cannot be land under water
- Cannot be already designated as nitrogen credit land
- Meet criteria set forth in *Guidelines for Title 5 Aggregation of Flows and Nitrogen Loading*



## What to do in this case?

Facility needing credit land is located in multiple NSAs.

The NSAs also straddle two towns.







# Equations for Nitrogen Loading and Credit Land

$$\text{Loading Rate} = \frac{\text{Design Flow}}{\text{Area}}$$

*Where*

*Design flow of the facility (gpd)*

*Area = Area of the facility land and any credit land (acre\*)*

\* 1 acre = 40,000 sf (not 43,560 sf)

$$LR = \frac{Q_F}{(A_F + A_{CL})/40,000}$$

*Where*

- $Q_F$  *Design flow of the facility (gpd)*
- $A_F$  *Area of the facility land (sq feet)*
- $A_{CL}$  *Area of the credit land (sq feet)*
- $LR$  *Loading rate (gpd/acre)*

*and by rearranging these terms.....*

$$LR = \frac{40,000 \cdot Q_F}{A_F + A_{CL}}$$

$$LR = \frac{40,000 \cdot Q_F}{A_F + A_{CL}}$$



$$A_{CL} = \frac{40,000 \cdot Q_F}{LR} - A_F$$

$$Q_F = \frac{A_F + A_{CL}}{40,000} \cdot LR$$

Where

- $Q_F$  Design flow of the facility (gpd)
- $A_F$  Area of the facility land (sq feet)
- $A_{CL}$  Area of the credit land (sq feet)
- $LR$  Loading rate (gpd/acre)

## Example No. 1

Vacant lot in Zone II

23,000 sf

4-bedroom home proposed

I/A with LR of 550 gpd/acre

How much credit land is needed?

$$\begin{aligned}A_{CL} &= \frac{40,000 \cdot Q_F}{LR} - A_F \\ &= \frac{40,000 \cdot 440}{550} - 23,000 \\ &= 9,000 \text{ sf}\end{aligned}$$



## Example No. 2 – Iteration 1

Existing lot in Zone II

36,000 sf lot

Existing 4 bedroom home

2 additional bedrooms are proposed

This is new construction!

Will an I/A work or is credit land needed too?

$$\begin{aligned} LR &= \frac{40,000 \cdot Q_F}{A_F + A_{CL}} \\ &= \frac{40,000 \cdot 660}{36,000 + 0} \\ &= 733 \text{ gpd/acre} \end{aligned}$$

Use of an I/A approved for nitrogen reduction will not work alone!

## Example No. 2 – Iteration 2

Existing lot in Zone II

36,000 sf lot

Existing 4 bedroom home

2 additional bedrooms are  
proposed

Plan on an I/A approved for  
**550** gpd/acre

Is this sufficient?

$$\begin{aligned}A_{CL} &= \frac{40,000 \cdot Q_F}{LR} - A_F \\ &= \frac{40,000 \cdot 660}{550} - 36,000 \\ &= 12,000 \text{ sf}\end{aligned}$$

**No.**

**Credit land is required.**

**What if a 660 gpd/acre I/A is used?**

## Example No. 2 – Iteration 3

Existing lot in Zone II

36,000 sf lot

Existing 4 bedroom home

2 additional bedrooms are  
proposed

Plan on an I/A approved for  
660 gpd/acre

Is this sufficient?

$$\begin{aligned}A_{CL} &= \frac{40,000 \cdot Q_F}{LR} - A_F \\ &= \frac{40,000 \cdot 660}{660} - 36,000 \\ &= 4,000 \text{ sf}\end{aligned}$$

**No.**

**Credit land is still required but it is  
substantially less.**

## Example No. 3

Vacant lot in IWPA

21,000 sf lot

Proposed 3 bedroom house

Will an I/A work or is credit  
land needed too?

$$\begin{aligned} LR &= \frac{40,000 \cdot Q_F}{A_F + A_{CL}} \\ &= \frac{40,000 \cdot 330}{21,000 + 0} \\ &= 628 \text{ gpd/acre} \end{aligned}$$

Use of an I/A approved for  
660 gpd/acre would be  
sufficient to permit this  
loading without credit land.

## Special Case

310 CMR 15.217 (1)

- The nitrogen loading limitations established in 310 CMR 15.214 shall not apply to discharge of an effluent meeting the federal Safe Drinking Water Act nitrate standard of 10 ppm\* though either an approved alternative system

or a treatment works with a groundwater discharge permit issued pursuant to 314 CMR 5.00: *Groundwater Discharge Permit Program*.

\* 10 ppm = 10 mg/l

**Currently there is one I/A technology with Provisional Use approval for treating down to 10 mg/l TN, therefore meeting this regulatory requirement.**



▼ UPGRADES IN AREAS  
SUBJECT TO  
NITROGEN LOADING  
LIMITATIONS

## Upgrades and Nitrogen

- If an existing septic system is found to be in failure and is located in an area subject to nitrogen loading, the loading across the property should be calculated.
- If the loading exceeds 440 gpd/acre, reference should be made to MassDEP's policy in the matter *Title 5 Program's Guidance on System Upgrades in Areas Subject to Nitrogen Loading Limitations*.
- Title 5, under Maximum Feasible Compliance (310 CMR 15.404) references the goal of Title 5 always being full compliance
- MFC may include use of a nitrogen-reducing I/A technology.
- If use of a I/A technology for remedial use was also need because of site constraints, a technology approved for both remedial use and nitrogen removal could be used.





# MassDEP Title 5 Regional Contacts

<b>CERO</b>	David Boyer	<a href="mailto:david.boyer@mass.gov">david.boyer@mass.gov</a>
<b>NERO</b>	Claire Golden Wastewater Info Line	<a href="mailto:claire.golden@mass.gov">claire.golden@mass.gov</a> 978-694-3215
<b>SERO</b>	Drew Osei (Cape/Islands) Brett Rowe (SE MA)	<a href="mailto:andrew.osei@mass.gov">andrew.osei@mass.gov</a> <a href="mailto:brett.rowe@mass.gov">brett.rowe@mass.gov</a>
<b>WERO</b>	Matt Sokop John Bourcier Dan Kurpaska	<a href="mailto:matthew.sokop@mass.gov">matthew.sokop@mass.gov</a> <a href="mailto:john.bourcier@mass.gov">john.bourcier@mass.gov</a> <a href="mailto:daniel.kurpaska@mass.gov">daniel.kurpaska@mass.gov</a>

# MassDEP Title 5 I/A Contacts

## **Boston**

Marybeth Chubb [marybeth.chubb@mass.gov](mailto:marybeth.chubb@mass.gov)

Harshraj Thakor [harshraj.thakor@mass.gov](mailto:harshraj.thakor@mass.gov)