



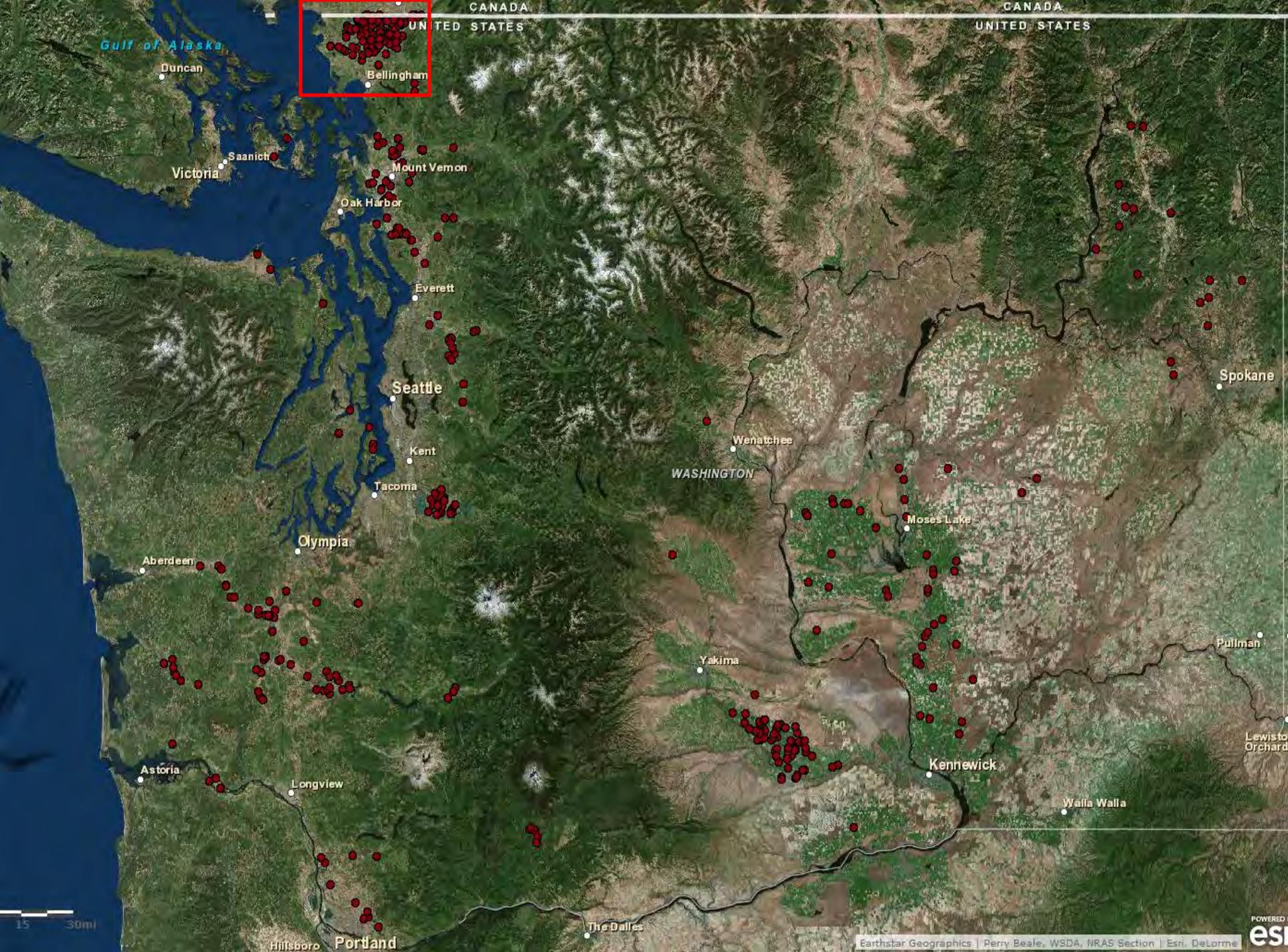
Innovative Manure Application Risk Management (ARM) System for Protecting Water Quality

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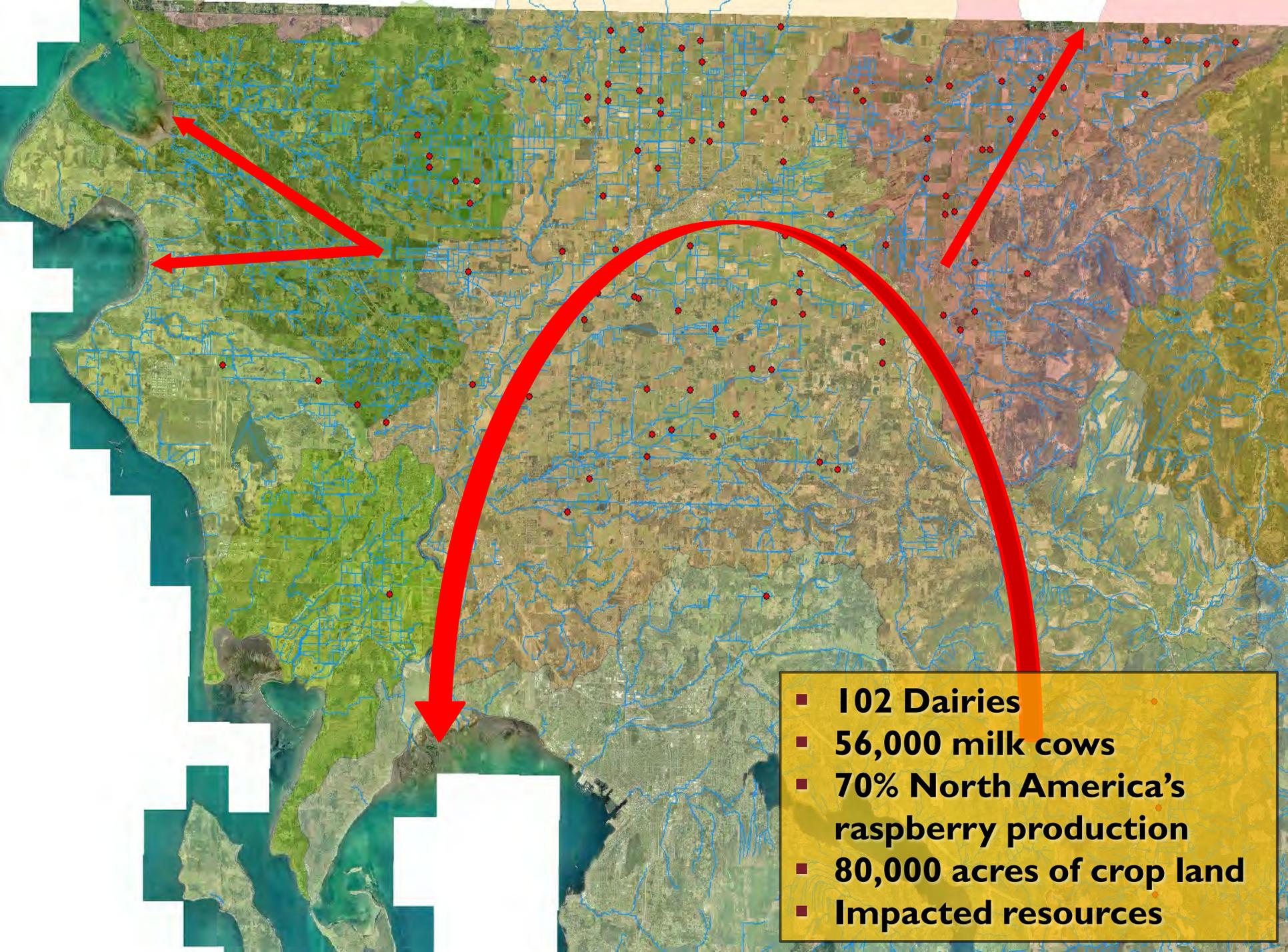
Nutrient Management and Air Quality Specialist

Whatcom Conservation District

September 18, 2014



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- **102 Dairies**
- **56,000 milk cows**
- **70% North America's raspberry production**
- **80,000 acres of crop land**
- **Impacted resources**



How is WCD Addressing Needs?

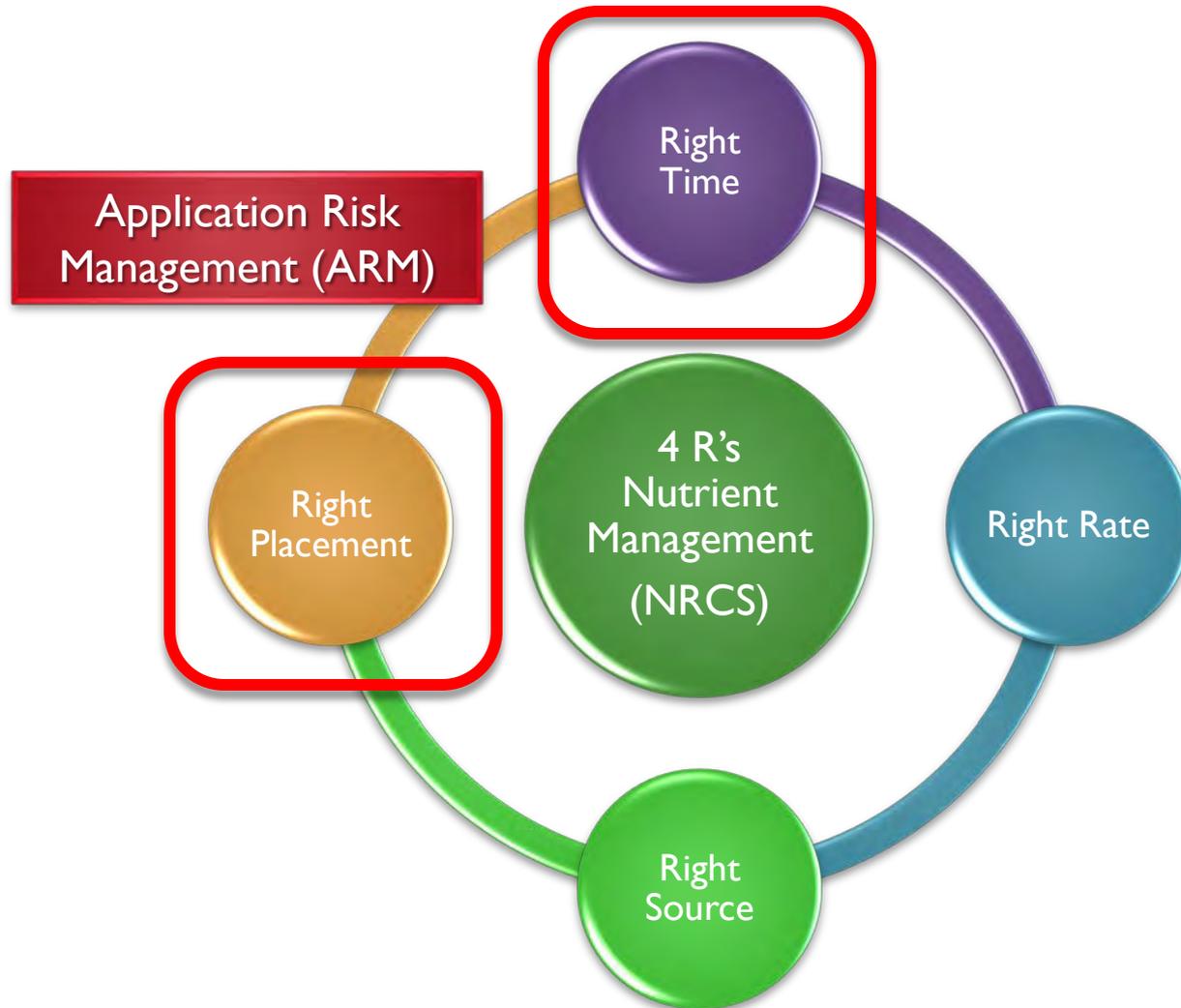
- Helping install new technologies
- Improving technical capacity in programs and technicians
- Reinventing delivery of the Dairy Nutrient Management Plan
- Research to discover better practices and management strategies
 - Application Risk Management (ARM)
 - Edge of Field Monitoring (NRCS)



Protecting Puget Sound Watersheds from Agricultural Pollution Using a Progressive Manure Application Risk Management (ARM) System

- EPA Watershed Grant: 2010-2015
 - A method of assessing and mitigating the runoff and leaching risk associated with manure application on a temporal (timing) and spatial (location) scale year-round.

4 R's of Nutrient Management

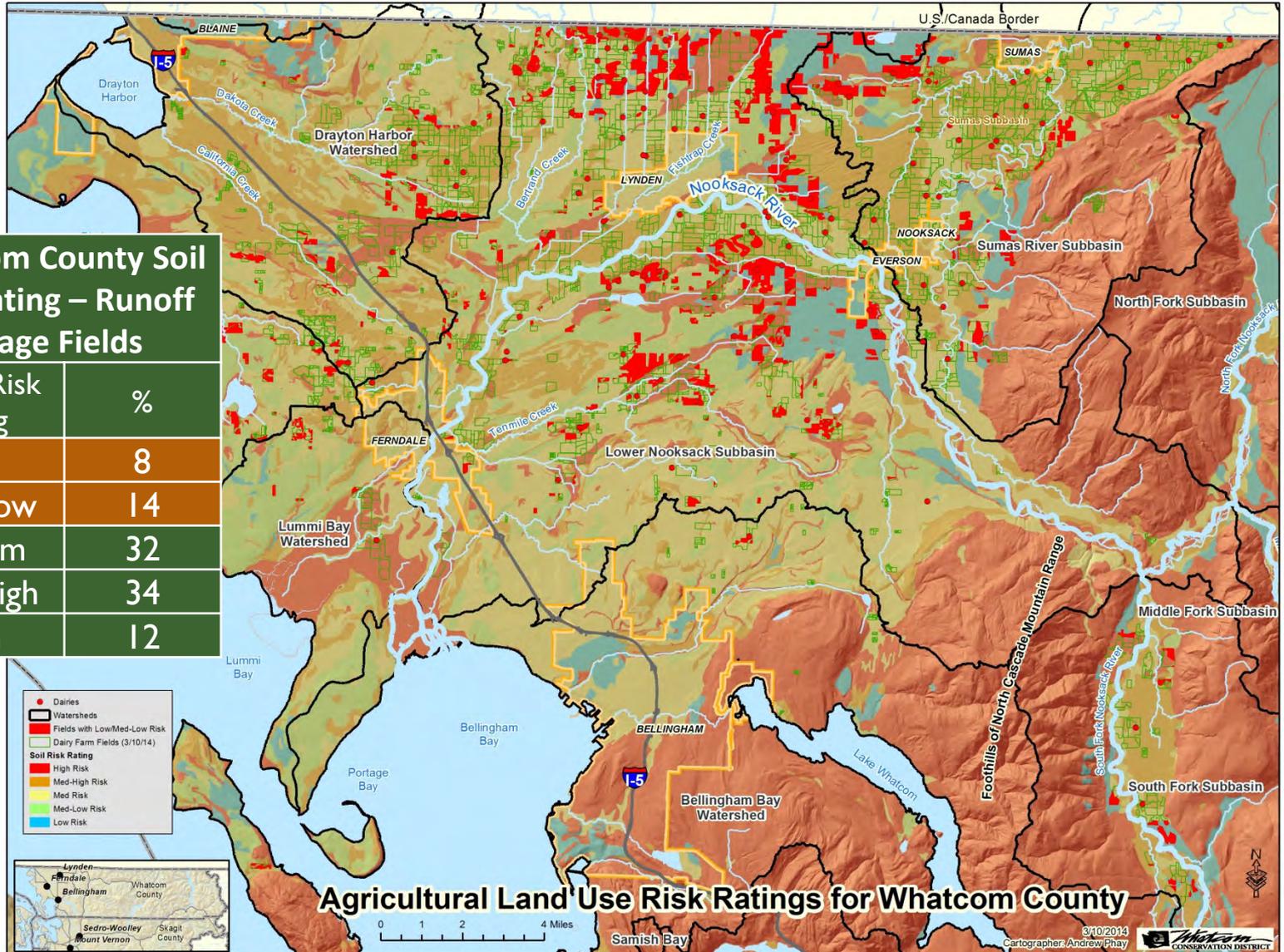




Application Risk Management

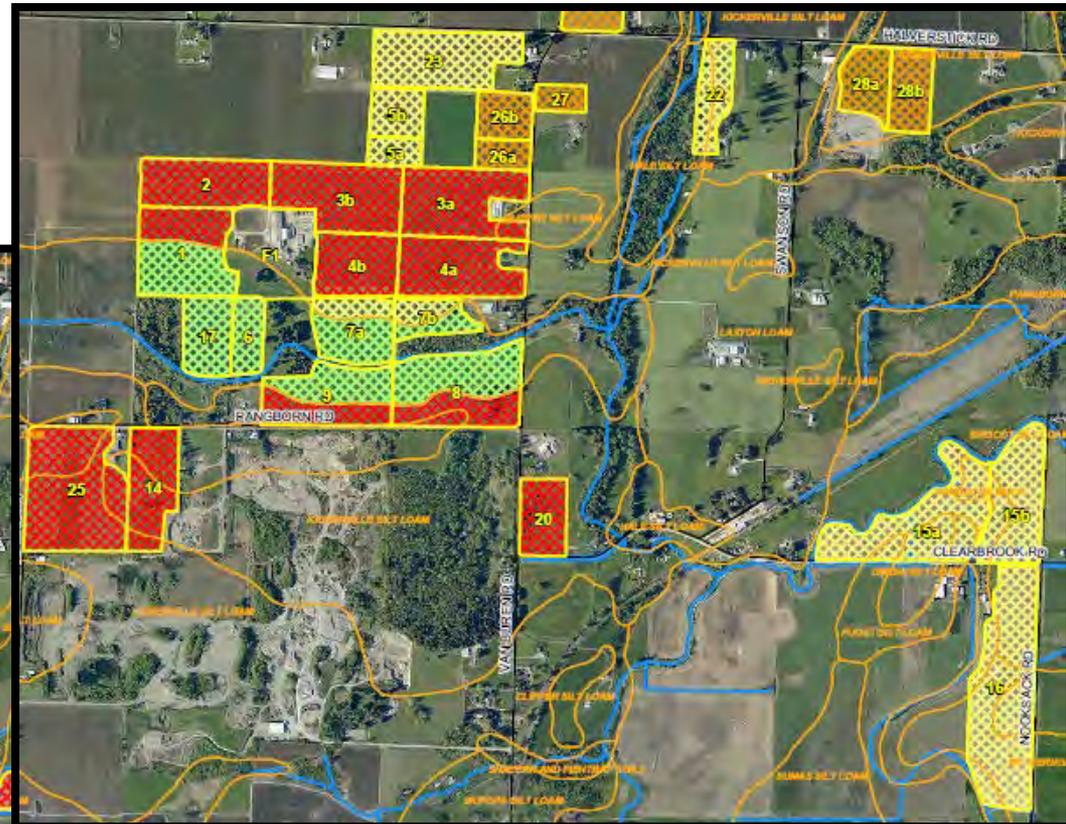
- Producer wants to apply, so what should they do?
 1. Determine agronomic rate
 2. Identify optimal fields via field risk map
 3. Look at Manure Spreading Advisory (MSA) and seasonal Manure Setbacks
 4. Assess field and fill out ARM Worksheet
 5. Apply and monitor fields
- **Do this assessment year round**

Field Risk Assessment - Runoff

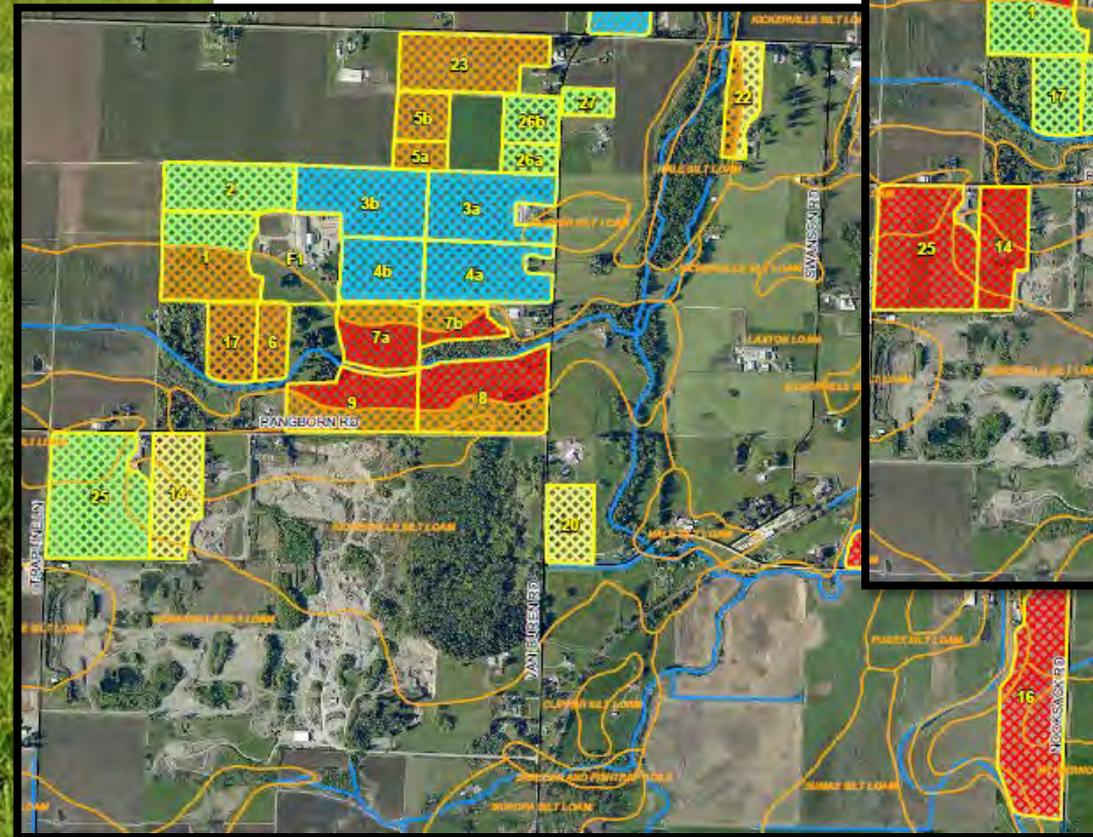


Farm Field Risk Assessment Map

Runoff Risk Rating
(October-June)

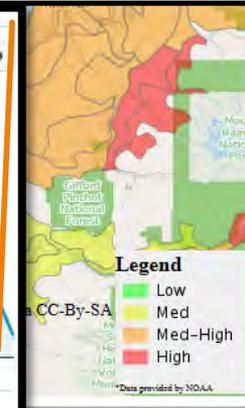
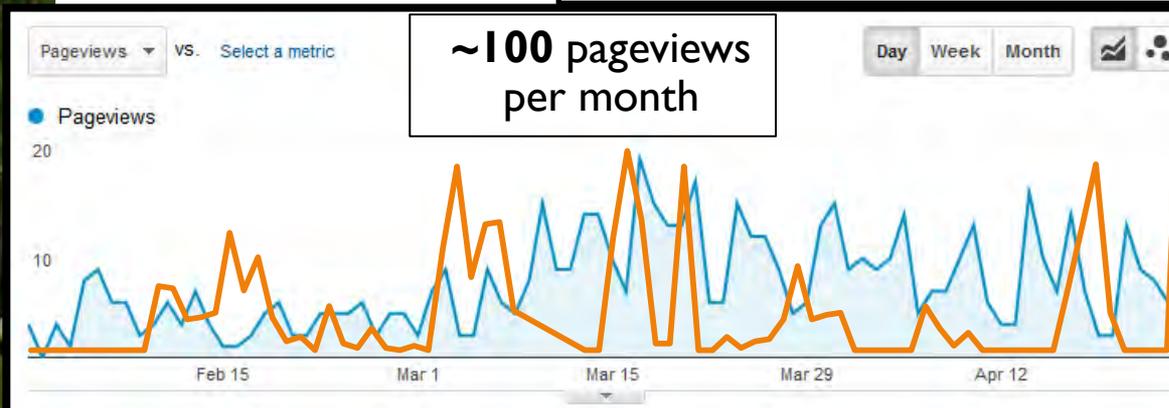
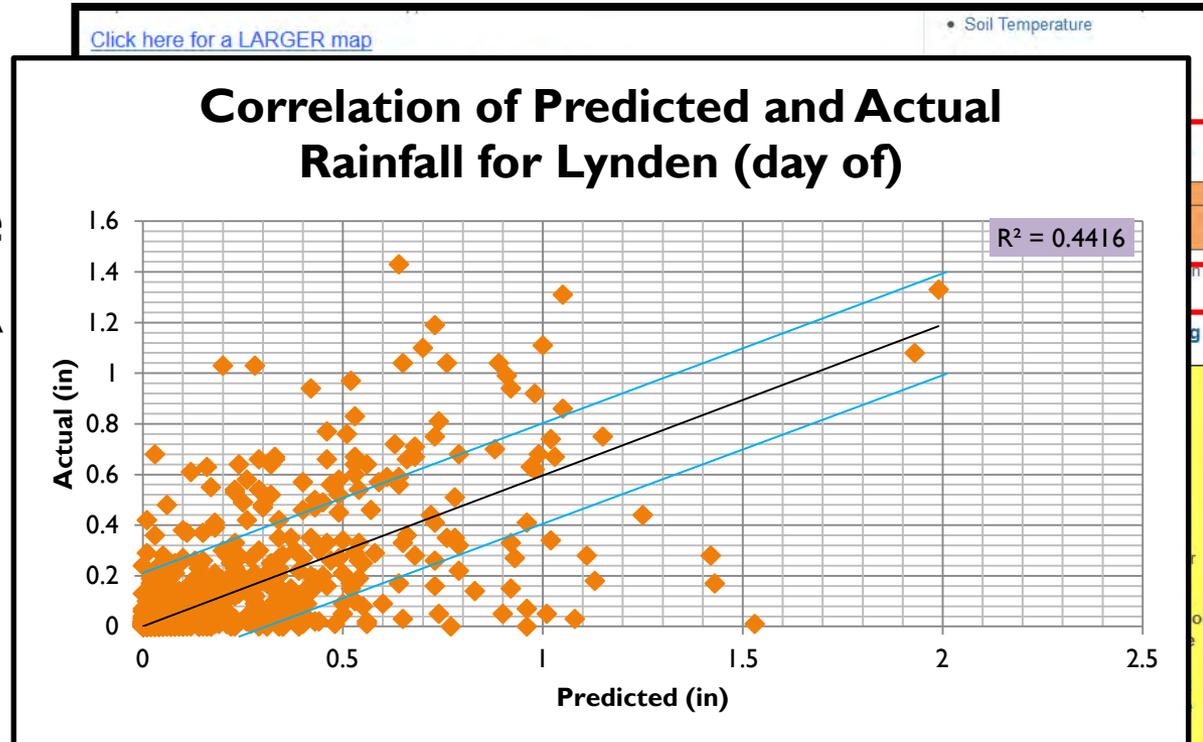


Leaching Risk Rating
(June-October)



Manure Spreading Advisory

- Real-time
- Auto-update from NOAA
- Runoff risk
- Soil leaching risk layer



today to request a field evaluation.

Keep an eye on the weather forecast for both rain events and flooding (<http://www.nwrfc.noaa.gov/rfc>).

Assessment of field conditions should be conducted prior to every application to ensure that field conditions are suitable and you won't cause a runoff issue.

Manure application should follow the ARM guidance including having a field risk evaluation, filling out the ARM Worksheet, and sending it in.

Manure Application Setback Distances

- **Runoff** reduction
- Dynamic distance/date
- Based on scientific principle and local considerations
- Apply to both liquid and solid manure
- *Demonstrating effectiveness via EoF*

Whatcom Conservation District

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Manure Application Setback

View Edit Revisions Track

Manure application setback guidelines for Whatcom are based on scientific studies which recommend specific distances for sediment and nutrient removal based on seasonal precipitation and soil saturation conditions.

Manure Application Setback Distances

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
80'	80'	40'	40'/10'	10'†	10'†	10'†	10'†	40'	80'	80'	80'

*This is a floating date and should be evaluated based on current weather and forecast information.
†A big gun applicator should NEVER be closer than 40 feet at any time of the year due to drift.
[Click here for the current seasonal recommend setback distance.](#)

These guidelines apply equally to both liquid and solid manures.

A distance of 40 feet has been shown to be most effectual under our spring and fall rain events at preventing runoff of surface nutrients and sediment, while we allow that distance to be reduced to 10 feet in the dry summer months when the chance of runoff is slight. The setback distance is increased to 80 feet in the late fall through the winter to be protective against periods of heavy, prolonged rain events, and/or saturated soils which require greater distances for nutrients and pathogens to be treated prior to reaching a waterway. Application during this risky time can readily move surface applied manure from your field if you're not careful.

If you have any discharge due to poor management, you may be put under the penalty of an EPA CAFO permit with a mandatory setback of 100 feet year-round.

When applying manure, remember to follow the [manure application setback guidance](#) posted on the

ARM Worksheet

- Fill out Worksheet
 - Forecast
 - Field Conditions
 - Protective Measures
- Runoff Risk by field and day
- Recordkeeping & accountability
- Incorporates NRCS 590 & TN14 elements

APPLICATION RISK MANAGEMENT (ARM) WORKSHEET			
This worksheet is a pilot version. Use it ONLY with the proper guidance from WCD. It does NOT give you the license nor okay to apply manure, it only helps you evaluate field conditions.			
Please fill out this worksheet for each applicable field prior to EVERY application of manure, particularly those conducted between October and the end of February to determine if manure application is appropriate and at what rate. Fill in all BLUE boxes.			
Date: 1/25/2013		Date you would like to apply: 1/25/2013	
Dairy Name: Example		Field Number(s) or Name(s)*: 1	
Dominant Soil Type (required): Silt Loam			
*You may group fields as long as they have the same soil type, risk rating, and crop. Otherwise, do a separate analysis for each			
Notes: Simply click on indicated cells within the worksheet to go to highlighted links. If you are unable to open the links, your security setting on your computer may be too high. Simply go to WCD's webpage (www.whatcomcd.org) to access them directly. Cells with a small red triangle in the top right hand corner indicate that a comment or explanation is available. Simply move your mouse over the cell and the comment will pop up.			
Criteria	Answers	Risk Warning	Risk Rating
WEATHER FORECAST (click HERE for helpful weather links)			
Rain in last two days? (Yes or No) <i>Click HERE for historical weather info</i>	Yes	Caution: Be sure to check soil moisture and water holding capacity	Low-Med
Amount (total cumulative inches)	0.05	Criteria Acceptable: Continue Analysis	Low
Rain predicted on day of application? (Yes or No) <i>Click HERE for predicted precip amounts</i>	No	Criteria Acceptable: Continue Analysis	Low
Amount (total inches)	0	Criteria Acceptable: A small amount of rain can actually help to incorporate manure into the top layer of soil in the 72 hours following application.	Low
Rain predicted in the 72 hours following application? (Yes or No) <i>Click HERE for predicted precip amounts</i>	Yes	Caution: Be sure to only apply at recommended rates based on soil water holding capacity	Medium
Amount (total cumulative inches)	0.12	Criteria Acceptable: A small amount of rain can actually help to incorporate manure into the top layer of soil in the 72 hours following application.	Low-Med
WATER TABLE (click HERE for info on determining your water table depth)			
Depth to water table (inches)	36	Criteria Acceptable: Continue Analysis	Medium
SOIL MOISTURE / AWC (click HERE for info on determining soil moisture)			
Soil Moisture (%)	85	Caution: You may be at risk for runoff. Check field conditions and the forecast, and apply only at or below recommended rates.	Med-High
FIELD SURFACE CONDITION			
Vegetation height within setback area (inch)	4	Criteria Acceptable: Continue Analysis	Medium
Density of vegetation in setback area (%)	85	Criteria Acceptable: Continue Analysis	Low-Med
Application Risk Analysis for Surface Runoff: <i>(If "N/A" appears in this field, go back and make sure ALL parameters are filled out including Soil Type at top of sheet)</i>	MEDIUM RISK	Apply manure with caution. Follow all guidelines and recommendations in your Plan for proper application	
Maximum Recommended Application Rate:	7,000	gal/acre	

ARM & NM Plan Guidance



Washington Dairy Plan

Home Dairy Nutrient Management Plan (DNMP) Application Risk Management (ARM) Manure Spreading Advisory (MSA)
Manure Application Setback Distances Weather Learning Resources

Search this site

Navigation

- Home
- Application Risk Management (ARM)
 - Application Parameters
 - ARM Worksheet
 - Forage Density Determination
 - Pre Application Steps
 - Soil Moisture Determination
 - Water Table Depth Determination
- Dairy Nutrient Management Plan (DNMP)
- Learning Resources
 - Manure Application Setback Distances
 - Manure Spreading Advisory (MSA)
 - Resource Sampling
 - Weather
 - Sitemap

[Application Risk Management \(ARM\)](#) >

Application Parameters

Prior to application of manure, the following parameters need to be assessed in order to determine if nutrient application is appropriate. The pre-application field assessment will walk you through applying these steps to the application process. An ARM Field Assessment Worksheet should be filled out for each field you are considering applying manure to prior to application. Failure to assess any of the following parameters could result in application under unfavorable conditions, which could lead to a pollution event.

- Forecast
- Water Table
- Available Water Holding Capacity (Soil Moisture)
- Field Characteristics
- Field Cover
- Application Method
- Current field Conditions
- Application Setback Distances
- Vegetative Buffers

Each of these parameters will determine the ability to apply or not to apply to your individual fields. The [Manure Spreading Advisory](#) and Application Risk Management Worksheet will guide you through the process of evaluating if ambient and field conditions are appropriate for manure application and at what rate

Forecast

<https://sites.google.com/site/wadairyplan/home>



ARM Field Measurements

- Provide field data to:
 - Better understand nutrient cycling
 - Determine risk level of fields
 - Tune risk values in Worksheet
- Samples: surface water, soil water, groundwater, soil, forage, manure, meteorological
- *Data collection to be completed: April 2015*



What the data shows so far

- Manure N conversion/availability varies throughout the year –
 - Soil temperature and dilution
- Early (Jan) application on low risk fields increases forage yield
 - 25% increase in density
 - 10-40% increase in yield
- Soil type has *big* influence on runoff and leaching potential/magnitude
 - Need to account for soil type in manure application timing



What the data shows so far

- Nitrate leaching in the fall/winter is determined by nitrogen application in the fall (Sept-Oct)
- **Focus on fall for leaching**
- Runoff is a factor for rain events on limiting (saturated) soils
- **Focus on winter/spring for runoff**
- Irrigation can push N/nitrate in soil profile
- **Focus on summer for leaching**



ARM Outcomes

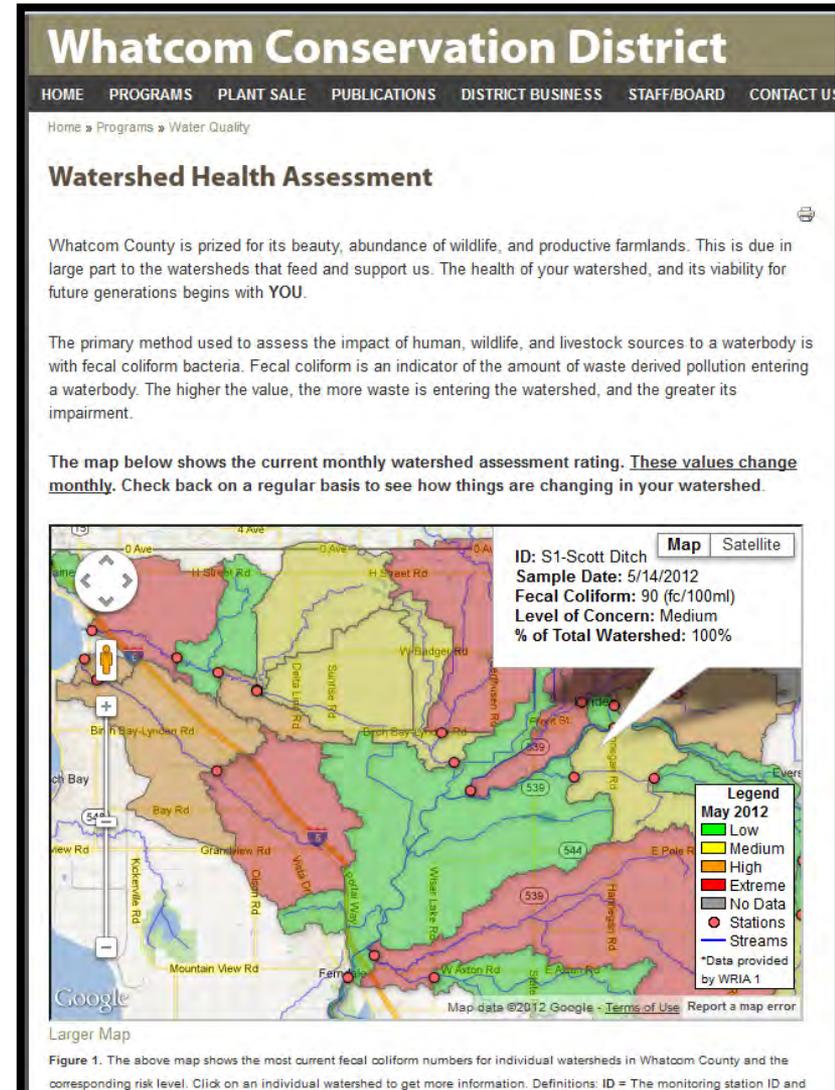
- Develop customized manure application strategies for farms
- Optimize manure application timing by soil type to minimize losses
- Create real-time management tools to help make decisions

Implementation to date:

- Number of dairies in Whatcom with *full* ARM plan : 35% (~12,200 acres)
- 10% use in Skagit, Snohomish, and King

Watershed Health Assessment

- Monthly fecal coliform sampling
- Sampling: WRIA I, WSDA, DOE, WC, others
- Gives current water quality
- Opens door for self assessment and education



Tools and Outreach

- Google Forms
 - In-Field Manure Equipment Calibrator
 - Agronomic Rate Calc.
- Web-based Recordkeeping
- NM Apps
- NM Plan Website
- Whatcom Dairy Speaker Series
- ***Giving people the knowledge to make better decisions on their own***

Application Rate Calculator

* Required

Location

Number of Pans *

Total Volume of Manure Collected (ml) *

Pan Area (ft²) *
 0.51
 0.65
 1.53
 Other:

Manure N Value (lb N/1000 gal)

Applicator Speed (mph)

Applicator Hose Length (ft) or BG Pull Time (min)

Applicator Type

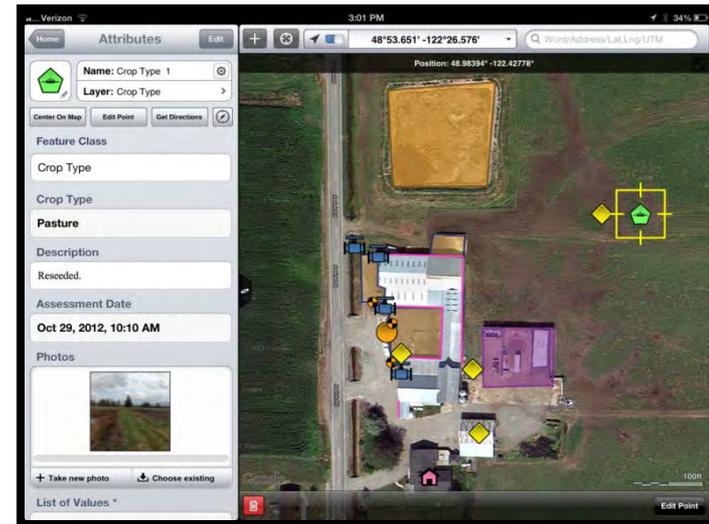
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Responses (1 of 200)					
	G	H	I	J	K
			Applicator Hose Length (ft) or BG Pull Time (min)	Calculation: Applied Rate (gal/ac)	Calculation: Total N Applied (lbs/ac)
Applicator Speed (mph)	2.1	Splash Plate	2000	6,767.42	135.35
	2	Aerator	500	6,767.42	135.35
	5	Aerator		9,023.23	135.35
	2.2	Splash Plate		7,519.36	90.23

Partnerships in Planning

- Partner with Puget Sound CD's on livestock planning efficiency
- iPads to conduct field inventory
- Update planning tools and templates
- Share expertise
- Unified planning
- Certification
- Strengthen our impact





Technical Capacity Workgroup

- Proficiencies and Training
- Tools and Communications
- Certification
- Mentoring and Job Shadowing
- Technical Expertise in Statewide Policy and Programs
- Quality Assurance
- Research, Implementation, Effectiveness Monitoring



New Research & Programs

- Implementation of a nutrient management training program for dairy operators and technicians in WA (WSDA)
- Development of outreach materials for dairy NMP (WSDA partner with KCD)
- Water quality improvement practice demonstration 4Rs (NRCS & WSCC)
- Edge of Field Monitoring (NRCS)
- **Opportunity:** Implementation of a **Discovery Farms** program across WA)



Edge of Field Monitoring

- Whatcom is only watershed in WA
- *1 site (4 dropped due to NRCS contracting)*
- Proposed monitoring plans:
 - Advanced Nutrient Management using ARM
 - Seasonal dynamic Manure Application
Setback Distances (10', 40', 80') vs CAFO
100' (control)
- **Challenges = Opportunities**



Discovery Farms

- The Discovery Farms program develops **on-farm and related research** to determine the **economic and environmental effects** of agricultural practices on a diverse group of farms; and **educates and improves communications** among the agricultural community, consumers, researchers and policy-makers to better identify and **implement effective environmental management practices** that are compatible with profitable agriculture.



Discovery Farms

- Originated in Wisconsin
- Current: WI, MN, ND, AR, IL (pending)
- Focused on surface water runoff
- Farmer lead process
- Extension and Conservation District
- Very successful with good leadership
- Scoping Meeting: Sept 8-11, 2014
- Opportunity to bring DF to WA

Discovery Farms in WA

- Objective
- Structure
- **Management**
- Research
- Funding
- Results
- Benefits



Questions?

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