

User Guide

Version: 2.0

Updated: 14 July 2021

Domain: <https://erams.com/>

CLEAN Nutrient Decision Support System



One Water Solutions Institute

Colorado State University

CONTENTS

Executive Message	2
Who Should Use This guide	2
Need Help?	2
Introduction	3
Purpose	3
Description	3
DATA	4
RESULTS.....	4
Software Availability.....	4
Authorized Use Permission.....	5
Getting Started.....	6
Quick Start.....	6
System Requirements.....	6
Using the Tool	7
Access the tool.....	7
Define Watershed	9
Future Changes	11
Nutrient Sources	12
Contextual Data Layers	15
Run Analysis.....	15

EXECUTIVE MESSAGE

Catena Analytics offers powerful platforms for building accessible and scalable analytical tools and simulation models that can be accessed via desktop or mobile devices. Our team has spent the last decade developing the Environmental Resource Assessment and Management System (eRAMS). eRAMS is an open-source technology that provides cloud-based geospatially-enabled software solutions as an online service and a platform for collaboration and development, and deployment of online tools. Our services assist with strategic and tactical decision-making for sustainable management of land, water, and energy resources. Thank you for choosing Catena Analytics and the eRAMS platform to meet your data, modeling, analysis, and geospatial needs.

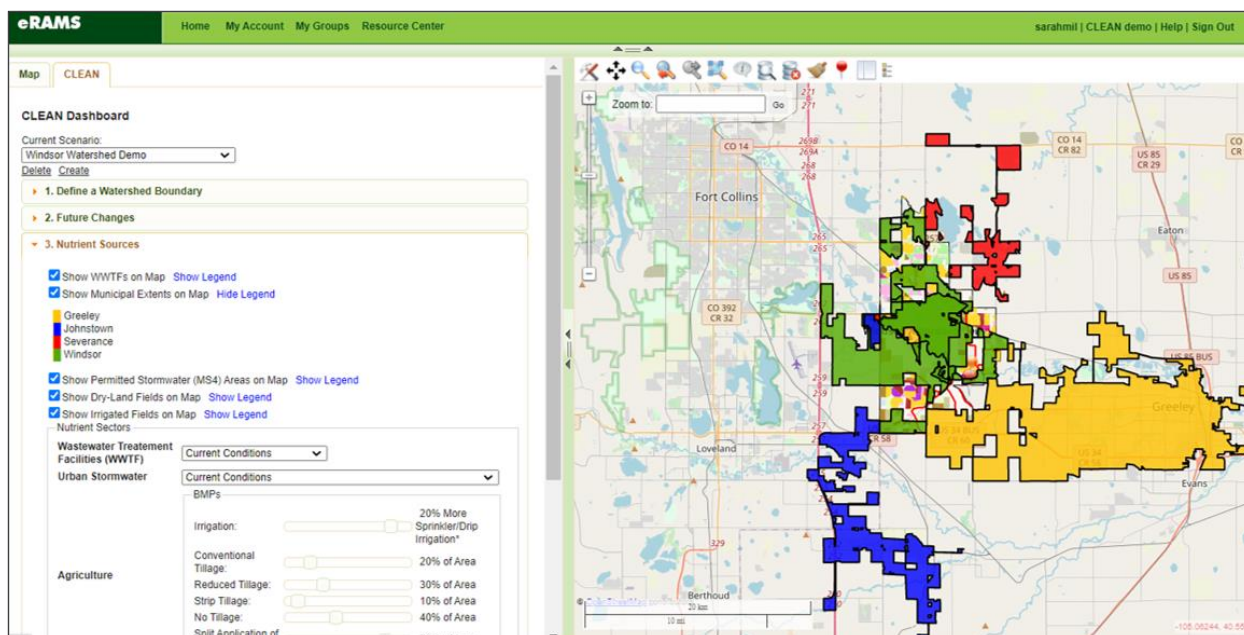
WHO SHOULD USE THIS GUIDE

This guide is a tutorial to get you started using eRAMS and [CLEAN Nutrient Decision Support System](#). This tool is intended for use by urban planners and water managers, academic groups, regulatory officials, consultants, state, local, and federal agencies planning for the future of water resources. The guide provides instructions for commonly performed tasks and uses of the tool.

NEED HELP?

After reviewing the guide, if you need additional assistance, we are here to help! This guide is designed to provide instruction on commonly performed operations and answers to many frequently asked questions. If you find any aspect of the tool challenging or missing information from this guide, please engage an eRAMS expert to guide you through any hurdles. Contact us at: eramsinfo@gmail.com

INTRODUCTION



PURPOSE

The eRAMS nutrient management portfolio was created to assist watershed managers in determining the most effective ways to reduce harmful nutrient loadings from a watershed. Currently, the portfolio evaluates management options for wastewater, stormwater and agricultural operations in Colorado.

DESCRIPTION

The CLEAN Nutrient Decision Support System (NDSS) was developed by the One Water Solutions Institute's [CLEAN Water Pollution Control Center](#) in partnership with the [U.S. EPA](#) and [Colorado Department of Public Health and Environment \(CDPHE\)](#) to help watershed managers analyze scenarios to implement nutrient abatement requirements from Colorado Nutrients Management Control Regulation 85.

The CLEAN NDSS web-tool enables the assessment of nutrient contributions from various sources, identifying optimal nutrient control strategies and potential effects of incentives, trading, and policy alternatives.

A user can analyze nutrient management scenarios in a specified area ranging in size from a HUC-12 watershed up to a regional-scale analysis. Users can also input their own data and upload various land-use configurations to analyze future growth scenarios.

The [web-tool](#) summarizes contributions from urban stormwater, wastewater treatment facilities, irrigated agriculture, and background and compares them against instream nutrient

loads for available stream monitoring stations. The dashboard is used by the Colorado Department of Public Health and Environment and other stakeholders for nutrient control in watersheds across the State.

DATA

The CLEAN Nutrient Decision Support System fetches live data from several publicly available datasets and regulatory data provided by the CDPHE through Regulations 85 and 31. Data sets utilized in the analysis include:

- [EPA's Water Quality Exchange \(WOX\)](#)
- [Parameter-elevation Regressions on Independent Slopes Model \(PRISM\)](#)
- [USGS National Land Cover Dataset \(NLCD\)](#)
- [Land-use and Agricultural Management Practices web-Service \(LAMPS\)](#)
- [USGS National Water Information System \(NWIS\)](#)
- [Colorado Decision Support System](#)
- Colorado Dept. of Public Health and Environment – Regulatory Data (user supplied)

RESULTS

The web-tool estimates total nitrogen and phosphorus (nutrient load) by source on an average annual basis. The following sources are included in the analysis:

- Urban stormwater
- Wastewater treatment facilities
- Agriculture
- Background

Graphical plots can be customized to examine and visualize:

- Management strategy scenario comparison
- Nutrient load sources

SOFTWARE AVAILABILITY

Domain

<http://www.erams.com/>

Documentation URL

<https://erams.com/catena/tools/nutrient-control/>

AUTHORIZED USE PERMISSION

The information contained in the CLEAN Nutrient Decision Support System (the "Service") is for general information purposes only. Colorado State University's One Water Solutions Institute ("CSU-OWSI") assumes no responsibility for errors or omissions in the contents of the Service. In the Service, you agree to hold neither the creators of the software platform nor CSU-OWSI or its affiliates liable for any action resulting from the use or misuse of the Service. In no event shall CSU-OWSI nor its affiliates be liable for any special, direct, indirect, consequential, or incidental damages or any damages whatsoever, whether in an action of contract, negligence, or other sorts, arising out of or in connection with the use of the Service or the contents of the Service. CSU-OWSI reserves the right to make additions, deletions, or modifications to the Service contents at any time without prior notice.

GETTING STARTED

QUICK START

The NDSS is intended to assist watershed managers in determining the most effective ways to reduce harmful nutrient loadings from a watershed.

Follow the simple workflow below to get started:

1. [Define Watershed](#)
2. [Future Changes](#)
3. [Nutrient Sources](#)
4. [Run Analysis](#)

SYSTEM REQUIREMENTS

A modern web-browser is required to connect and run the WRAP. Browser options include: Google Chrome v.69, Mozilla Firefox v.62, Safari v.11.1, and Microsoft Edge v.17.

USING THE TOOL

ACCESS THE TOOL

The CLEAN NDSS requires a registered user account to create a project and begin using the tool. Follow the instructions below to create your free account or visit our website to get started: <https://erams.com/account/>

Create an eRAMS Account

1. From the [eRAMS Registration page](#), enter a username, password, your first and last name, and your email address. Click on the "Create Account"
 - eRAMS will display a popup box alerting you that an email confirmation has been sent to the provided email address
2. Open the email account provided in the registration form from a new browser window or your local email application.
 - Search for an email from eRAMS with the subject line "eRAMS Email Check."
3. Open this email and click on the provided link to confirm your email address.
 - **Note:** *If you do not see the confirmation email appear in your email inbox immediately, check your spam or junk email folder to ensure that the confirmation message wasn't automatically discarded. You may also need to wait a few moments to ensure the email is delivered successfully.*
4. Once you click on the provided email link, you should be redirected to eRAMS, where you'll be automatically logged in

Registered User Access

1. Login to your eRAMS account here: <https://erams.com/account/>
2. Select the "Projects" tab from the left panel (Figure 1)
 - **Hint:** *You must be logged into your eRAMS account*
3. Select "Create Project" from the top toolbar
4. Enter a Project Name
 - Alternatively, select a project from the list to access previous projects
5. Select "CLEAN Nutrient Dashboard" from the Project Type drop-down
 - Optional: Select layers from previously saved projects under the "Include Layers from Project" drop-down
6. Click "OK"
7. Locate the name of the project you have created in the project list, click the link
 - The link will redirect you to the CLEAN interface, where you can conduct analysis and save work to your account

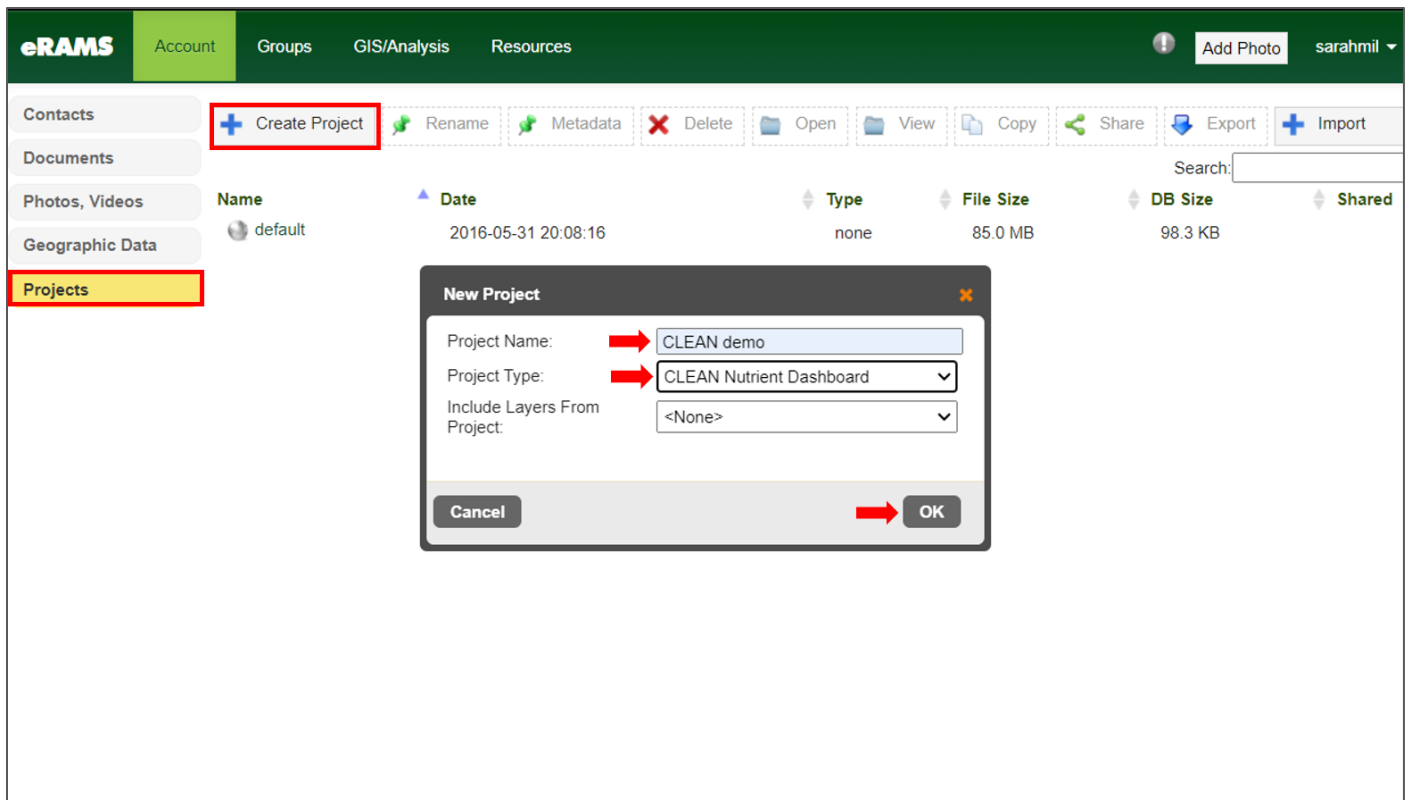


Figure 1: Registered user process for creating a NDSS (CLEAN) project in eRAMS

DEFINE WATERSHED

Select Desired Map Layer(s)

Users can specify desired base, public, user, or project layers for analysis. To do so, with the CLEAN interface open, click the “Map” tab on the left dashboard

1. Select the desired drop-down menu to modify the map:
 - Base layers: None, Google, Bing, or USGS National Map
 - Public layers: U.S. Census, U.S. Geo Data, U.S. Hydro Data, U.S. EPA Water, Land Use Land Cover
 - User layers: spatial layers, tables (see below)
 - Project layers: option to import from previous analysis when you set up a new CLEAN project

Upload Layers

Users can upload files (Fig. 2) and add their own information under the “Map” tab:

- (i) Project Layers – Registered user access, these files correspond to the current project and will be available to any project members (i.e., used within a project). Check out the [eRAMS Grouping capabilities](#) for more information about sharing projects.
- (ii) User Layers – Registered user access, these files are associated with your user account and can be accessed from any project (i.e., used across projects)

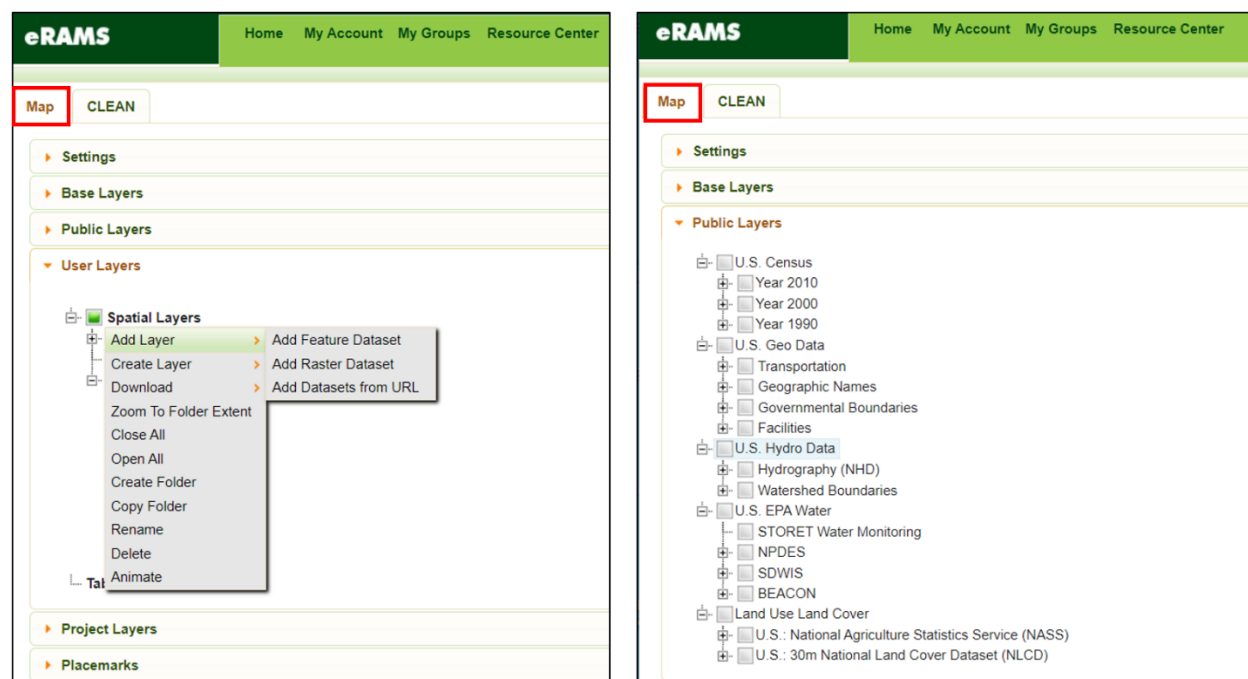


Figure 2: Public and user layer options available in eRAMS

Define Watershed Boundary

With the tool interface open, click the “CLEAN” tab on the left dashboard. Define your watershed boundary by performing one of the following operations:

Draw Boundary

The options for manual selection of the geographic region of interest include the area within the desired radius of a point (point buffer), area within a buffer of a line, area within a rectangle, or area within a free-hand polygon.

1. Select boundary type
 - Enter desired buffer radius (point or line)
2. Place point(s) on desired map location
3. Name the watershed

Upload Boundary Layer

Users can upload a layer (shapefile) by performing the following operations:

1. Select “Upload a Boundary”
2. Select a shapefile for upload from your device
 - All files associated with a shapefile can be zipped into a ZIP archive (*.zip) then uploaded, or multiple files can be uploaded at the same time outside of a ZIP archive
 - Depending on the size of your file(s), it may take a few minutes to process

Select Known Boundary

Users can select a region from known boundaries such as states, counties, or hydrological unit codes (HUCs).

1. Select “Known Boundary”
2. Select predefined boundary from drop down list(s)

AUID/WBID

Users can select their region based on the stream segment in the area. Stream segments in Colorado are tracked by segment (waterbody ID, WBID) or portion (smaller than a segment, AUID). If the ID is known to a user, they can simply look it up and the corresponding boundary region of that segment will be selected by the tool.

1. Select “AUID/WBID”
2. Enter a known stream segment WBID or AUID

FUTURE CHANGES

Current Conditions/No Change

This feature allows users to assess current conditions and develop a baseline for the desired location. Data are used from the following sources to create the baseline scenario:

- Climate: **PRISM (1981-2010)**
 - ***Parameter-elevation Regressions on Independent Slopes Model (PRISM)** is a set of gridded data products for average, minimum, and maximum temperature and average precipitation. For more information, please see the [PRISM Climate group's data page](#). **Coverage:** Conterminous United States (Lower 48 States).*
- Population: **U.S. Census (2010)**
 - ***U.S. 2010 Census** population for blocks or block groups (depending on the size of the area of interest) extracted and analyzed. **Coverage:** United States.*
- Land Use: **NLCD (2016)**
 - ***The National Land Cover Database (NLCD)** is a land-use summary by the U.S. Geological Survey (USGS). These assessments began in 1992 nationwide. For more information, please see the [USGS NLCD home page](#). **Coverage:** Conterminous United States (Lower 48 States).*

Future Development

This feature allows users to define areas in the desired location experiencing population change, new growth, and development or merging nearby communities (e.g., new subdivisions, consolidation of utility areas, etc.).

1. First, the define the subunit
 - a. Draw on the map the subunit that is to be developed (part of a city, a new sub-division, consolidation of a nearby urban area into this urban area, etc.)
2. Next, modify desired attributes:
 - Precipitation (annual average)
 - Population – **note:** default projections are drawn from the Colorado State Demographers office
 - Headcount – the number of people in a single family equivalent (used with SFE to automatically calculate total future population)
 - SFE (Single Family Equivalent) – the number of households in a given area (used with Headcount to automatically calculate total future population)
 - Land-use type – **note:** this will result in changes to nutrient sources from agriculture, stormwater, wastewater
 - Percent impervious – **note:** this will result in changes to nutrient sources from agriculture, stormwater, wastewater

- Development date – when the new area will be developed/changes. Until this date, no changes are made to nutrient loadings from the development
 - Population (future) – total future population (used with Headcount to automatically calculate SFE)
 - Growth rate (%) – the annual percent growth for the subunit (used with current population to automatically calculate total future population)
3. PRISM (1981-2010) data are prepopulated for the climate.

NUTRIENT SOURCES

Once desired dataset(s) and attributes are selected, the user can then manipulate various nutrient sources for the analysis. The various sources and the legends can be toggled on or off by selecting the corresponding blue text/box next to the title. Users can also click on the interactive map to review a popup summary of the selected area (Figure 3).

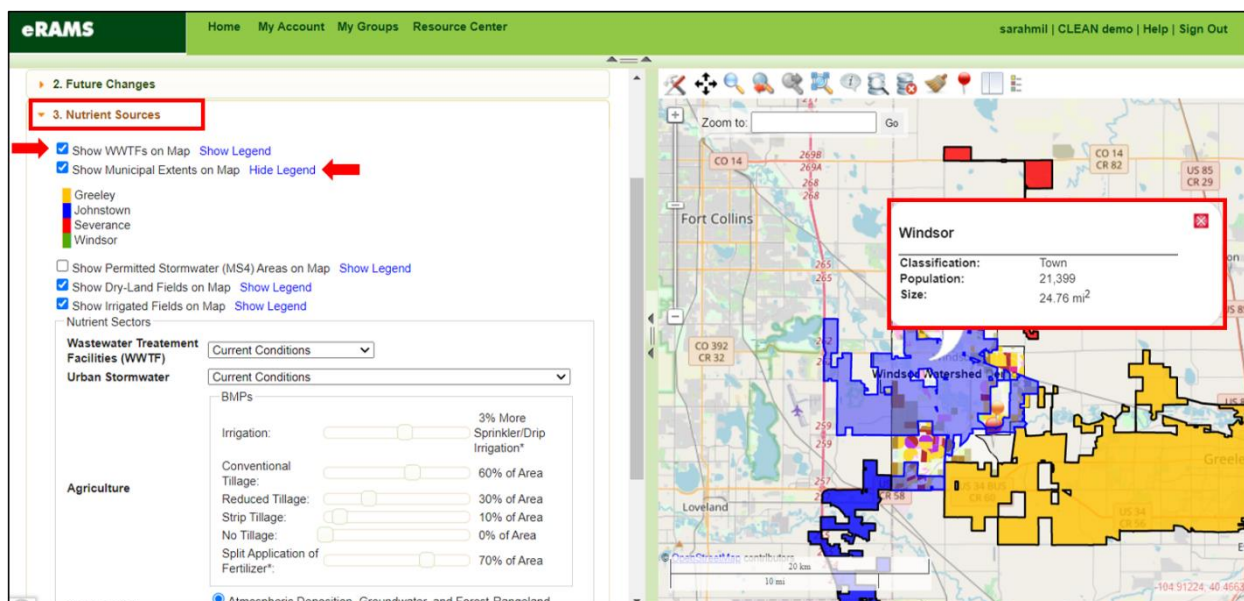


Figure 4: Nutrient sources map display and legends

Wastewater Treatment Facilities

- **Current Conditions:** observed concentration (i.e., current discharge)
- **Max. Allowable Nutrient Concentration:** Colorado Reg. 31 Max Nutrient Concentration (i.e., current discharge)
- **Max. Effluent Discharge:** Colorado Reg. 31 Max Nutrient Concentration (i.e., max permitted discharge)
- **User Specified Reduction:** current conditions multiplied by a user-specified reduction factor (0-1) for each facility
- **Treatment Technology Changes:** additional treatment technology Load Reductions

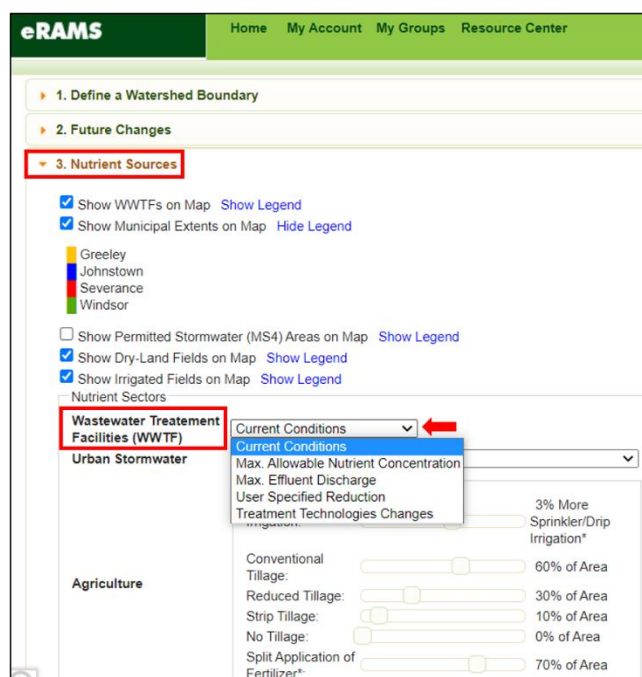
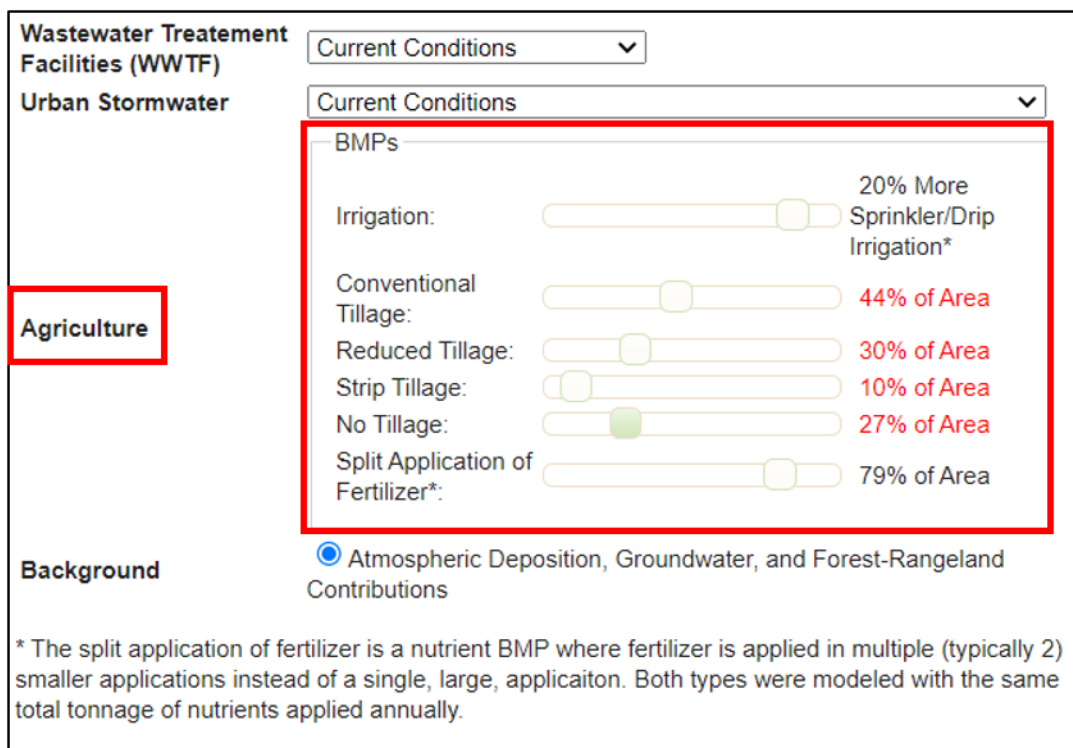


Figure 3: Wastewater treatment facilities

Urban Stormwater

Users can select from the current conditions or no stormwater Best Management Practices (BMPs).

Agriculture



Wastewater Treatment Facilities (WWTF) Current Conditions

Urban Stormwater Current Conditions

Agriculture

BMPs

Irrigation: 20% More Sprinkler/Drip Irrigation*

Conventional Tillage: 44% of Area

Reduced Tillage: 30% of Area

Strip Tillage: 10% of Area

No Tillage: 27% of Area

Split Application of Fertilizer*: 79% of Area

Background ☒ Atmospheric Deposition, Groundwater, and Forest-Rangeland Contributions

* The split application of fertilizer is a nutrient BMP where fertilizer is applied in multiple (typically 2) smaller applications instead of a single, large, application. Both types were modeled with the same total tonnage of nutrients applied annually.

Figure 5: Agriculture best management practices

- Specify Irrigation per crop rotation: flood irrigation, sprinkler/drip irrigation (% more or less)
- Specify Tillage per crop rotation: conventional, reduced, strip, none (% of the area)
 - **Note:** tillage area must total to 100%, *red text indicates this issue requires attention (Figure 5)*
- Specify split application of fertilizer (% of the area)
 - **Note:** The split application of fertilizer is a nutrient BMP where fertilizer is applied in multiple (typically 2) smaller applications instead of a single, large application. Both types were modeled with the same total tonnage of nutrients applied annually.

Background

Users can selectively include atmospheric deposition, groundwater, and forest-rangeland contributions for the analysis.

CONTEXTUAL DATA LAYERS

Users can modify the map display of stream monitoring sites and water bodies by toggling between the corresponding blue text/box next to the title. Users can also click on the interactive map to review a popup summary of the selected site or water body (Figure 6).

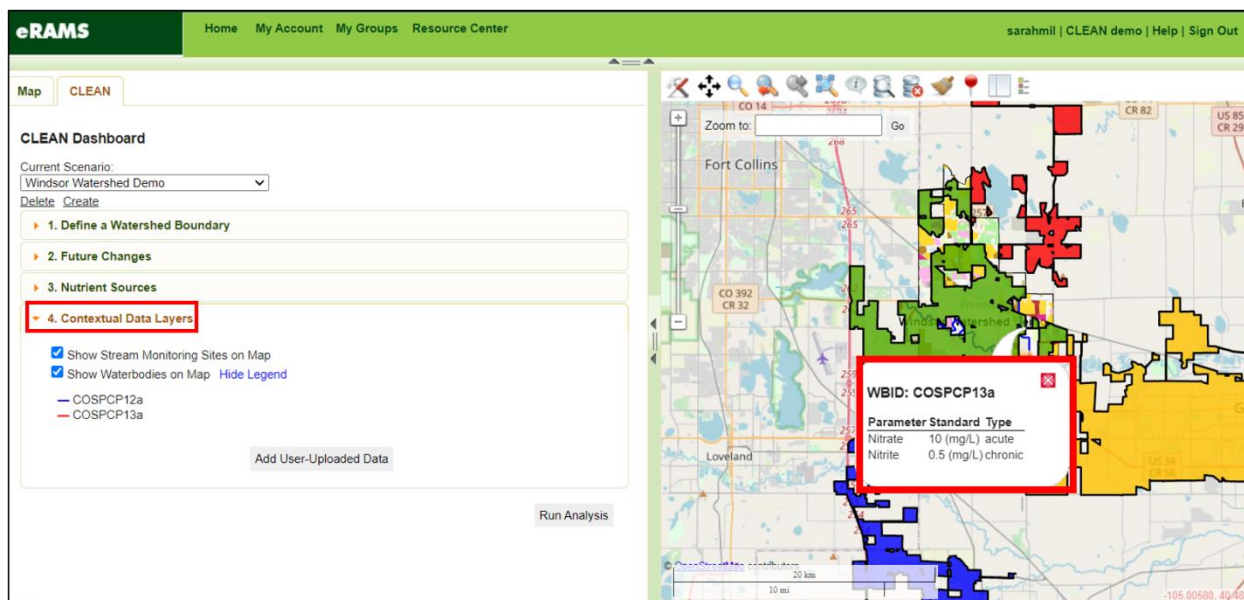


Figure 6: Contextual data layers and map features

RUN ANALYSIS

Once the desired scenario has been specified, select “Run Analysis” from the bottom of the left dashboard. Once processed, the dashboard will summarize nutrient sources (total nitrogen, total phosphorus) into an interactive bar chart that compares the selected scenarios. All images (png, jpeg, svg) and data can be downloaded (pdf, csv, xls) by clicking the stacked lines in the upper corner of the plotted area (Figure 7).

Note: If a user specifies ‘custom future projections’ during the [Future Changes step](#), an additional tab for ‘future changes’ will be populated to describe the changes to nutrients from the population/land-use changes specified to the subunit(s).

Interactive Charts and Figures

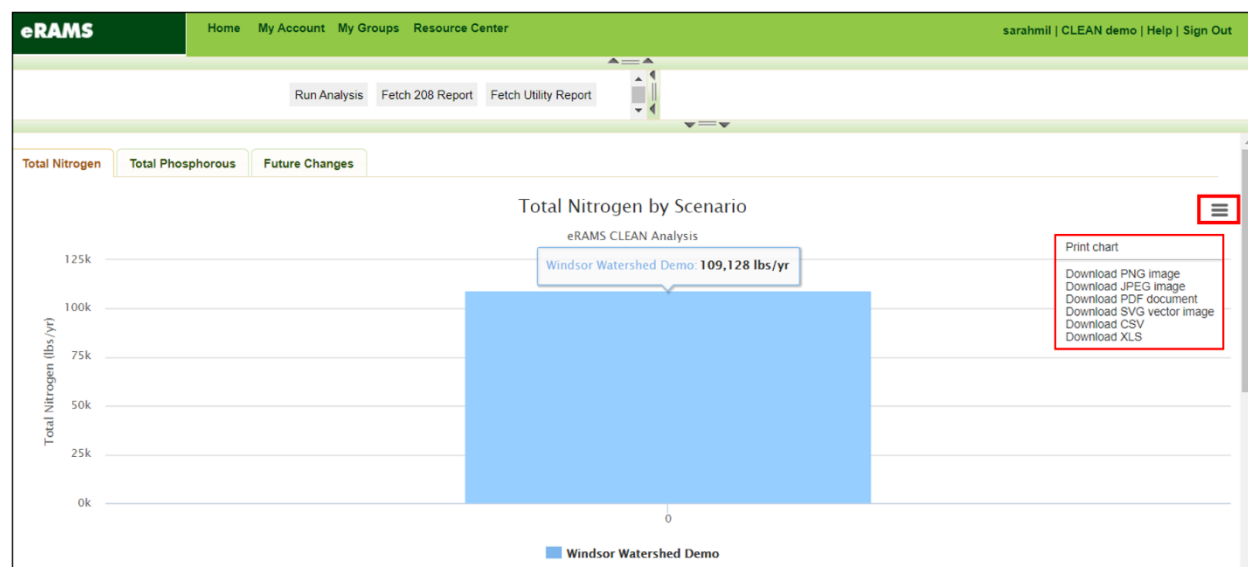


Figure 7: Analysis results dashboard and download features

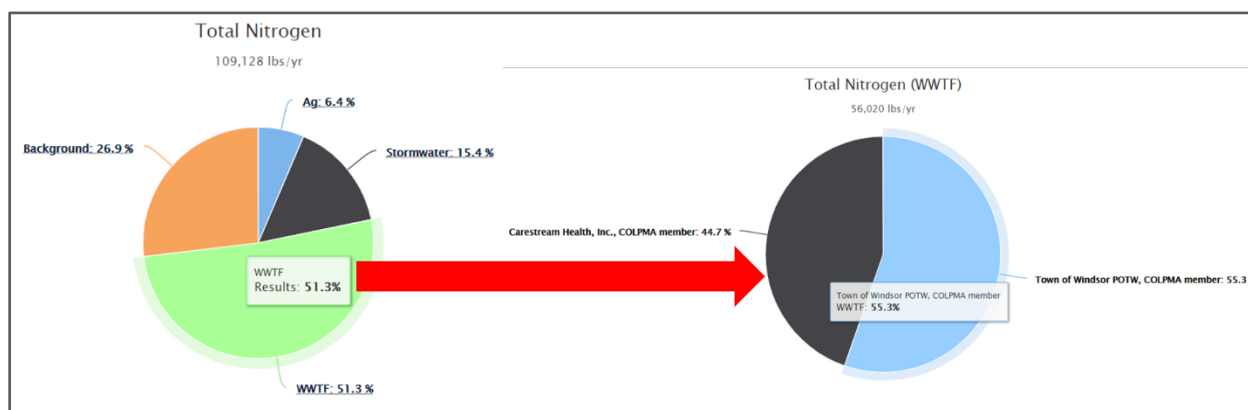


Figure 8: Pie chart summary and interactive features

The tool will also produce an interactive pie chart that displays the nutrient breakdown by source type. Clicking any section of the pie chart will provide additional details within that source 'type' (Figure 8).

Fetch Utility Plan (201 Facility Plans) Report

Here users can download a data summary report in the format expected by a 208 planning agency (e.g., NFRWQPA). Under the Clean Water Act sections 208 and 201, Utility Plans address control measures for total maximum daily loads (TMDLs), including Management and Operating Agency responsibilities for managing water quality impacts due to urban development based on population projections. Utility Plans replace the previous requirement under the Clean Water Act Section 201, known as 201 facility plans. Sections 205(j), 208, and 303 of the Act specify water quality planning requirements, which are requirements of Utility Plans and are used as

supporting information to construct and update 208 Areawide Water Quality Management Plans (208 AWQMP) periodically. 208 AWQMPs draw on water quality assessments, and Utility Plans to identify priority point and nonpoint water quality problems in a watershed or river basin regionally.

Once a User chooses the Run Analysis button and the data processing completes, then the Fetch Utility Plan Report button will appear and is available to be selected.

Fetch 208 Areawide Water Quality Management Plan (208 AWQMP) Report

Here users can download the planning report for a 208 Planning agency (e.g., NFRWQPA). The Clean Water Act (CWA), first passed in 1972, and later amended in 1977 and 1987, is the primary federal law that regulates the quality of surface waters in the United States. This Act establishes the need for water quality planning, including regional water quality planning, as outlined in section 208. The CWA allows states to administer many programs under the Act as long as the state laws and regulations governing these programs are at least as stringent as the federal Act.

The Colorado Water Quality Control Act was established for the State to assume the lead role in many of these program areas, including water quality management. This Act authorizes the governor to designate planning agencies for the federal Clean Water Act. A designated planning agency has the responsibility of developing and updating the 208 AWQMP to keep it current. Once approved, the 208 AWQMP serves as the overriding planning document used to coordinate water quality planning in the region. As stated in the CWA, the plan shall include “the identification of treatment works necessary to meet the anticipated municipal and industrial waste treatment needs of the area” and “the identification of the measures necessary to carry out the plan.”

EPA’s 40 CFR 130.6 establishes policies and program requirements for water quality planning, management, and implementation under several sections of the CWA, including section 208. Included in these program requirements is the need for states to establish a continuing planning process that, among other things, creates the mechanism for updating and maintaining Water Quality Management Plans.

The Water Quality Control Division (WQCD) prepared “*A Guide to Colorado Programs for Water Quality Management and Safe Drinking Water*” (Commission Policy #98-2, updated in December of 2019). The Water Quality Control Commission’s Website (<https://www.colorado.gov/pacific/cdphe/wqcc-policies>) provides stakeholders access to all policies and regulations, such as Policy 98-2. This document is the latest version of guidelines for the continuous planning process for the State. It also discusses additional details regarding the roles and required elements of 208 plans. It provides a list of factors that “need to be kept current through the update and amendment process” for the 208 plans to remain useful decision-making documents.

This CLEAN 208 Report is an attempt to fulfill the state and federal requirements of a 208 AWQMP report. While Section 208 defines expected content for 208 plans, the WQCD works with designated planning agencies to ensure regional water quality priorities are highlighted in 208 AWQMPs while still demonstrating consistency with Section 208. Plans consistent with Section 208 include the following:

- The identification of treatment works necessary to meet the anticipated municipal and industrial waste treatment needs of the area over a twenty-year period, necessary wastewater collection and urban stormwater runoff systems, necessary financial arrangements, land acquisition needs, and recreational use considerations associated with these treatment works;
- The establishment of construction priorities for such treatment works and time schedules for the initiation and completion of all treatment works;
- The identification of regulatory programs to manage waste treatment, including applicable pretreatment requirements and the location, modification, and construction of any facilities that may result in any discharge in an area;
- The identification of those agencies necessary to construct, operate, and maintain all facilities required by the plan and otherwise to carry out the plan;
- The identification of the measures those agencies deem necessary to carry out the plan, the period of time necessary to carry out the plan, and the costs of carrying out the plan within such time;
- Processes to identify nonpoint source pollution (including from agricultural, silvicultural and unregulated mining activities), control the disposition of all residual waste generated in an area which could affect water quality and control the disposal of pollutants on land or in subsurface excavations within an area to protect ground and surface water quality.

Once a User chooses the Run Analysis button, the Fetch 208 AWQMP Report button appears and is available to be selected. The user must choose within Layer Extent then use the "Colorado_All208.shp" shapefile option to select the correlating Colorado 208 Planning defined region under the "Colorado_All208.shp" selection as the subunit 208 Planning area of interest. Colorado has 14 defined 208 Planning regions (Figure 9). Currently, there are only four active 208 Planning regions in Colorado.

- North Front Range Water Quality Planning Association (Larimer and Weld Counties)
- Northwest Colorado Council of Governments (Pitkin, Eagle, Summit, Grand and Jackson Counties)
- Pikes Peak Area Council of Governments (El Paso, Teller and Park Counties)
- Pueblo Area Council of Governments (Pueblo County).

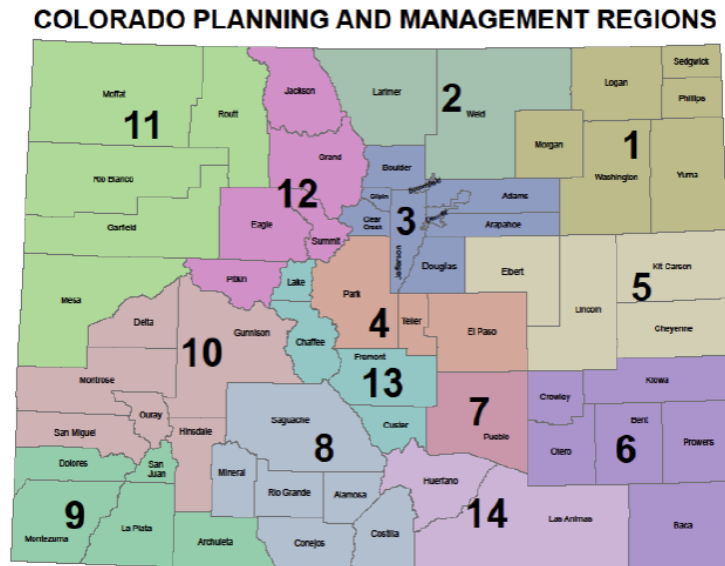


Figure 9: Colorado Planning & Management Regions