IOWA NUTRIENT REDUCTION STRATEGY

A science and technology-based framework to assess and reduce nutrients to Iowa waters and the Gulf of America

Prepared by:

Iowa Department of Agriculture and Land Stewardship
Iowa Department of Natural Resources
Iowa State University College of Agriculture and Life Sciences

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IOWA NUTRIENT REDUCTION STRATEGY UPDATES

In February 2025, the Iowa Department of Agriculture and Land Stewardship, Iowa State University College of Agriculture and Life Sciences, and the Iowa Department of Natural Resources identified needed updates to the Iowa Nutrient Reduction Strategy. Updates were necessary to keep the text of the strategy up-to-date based on current information and status of efforts related to the strategy. As such, this is a historic document with updates of items noted below. Detailed activities and measurement tracking associated with the INRS can be found on the INRS dashboard. Original and previous updates to the NRS can be found at this link.

Below is a summary of the updates that have been made to the February 2025 strategy document:

Section 1. Policy Considerations and Strategy

- Clarified the establishment of the 1980-1996 baseline period to be consistent with the Gulf Hypoxia Action Plan.
- Clarified the process and establishment of the NRS priority watersheds and included a map.
- Replaced Section 3.3 List of Affected Facilities with a reference and link to the NRS website where the list will be located. This allows for the list to be updated and posted more frequently.
- Updated the estimated number of farmers in Iowa to be consistent with other references.
- Clarified roles of the Water Resources Coordinating Council (WRCC) and NRS principal entities (DNR, IDALS, and ISU).
- Updated and added several links to condense and provide more reliable reference information.
- Removed references to costs to accomplish the goals of the NRS. Scenarios were based on the benchmark period of 2006-2010. Goals are based on the baseline period of 1980-1996. More information can be found here under Supplemental Documents-NRS Baseline Period. Removed obsolete cost estimates that aren't reflective of costs to address NRS goals comparing the baseline period and don't factor in changes in costs for practice implementation (inputs, land, construction, etc.).
- Updated the tracking and accountability sections to acknowledge the development and implementation of the interactive INRS Dashboard for public display of NRS progress.
- Updated reference to the Watershed Planning Advisory Council (WPAC). The group was dissolved during the 2024 Iowa Legislative session. Removed additional references to WPAC.
- Added link to IDNR's Iowa Nonpoint Source Management Plan required by EPA for the Section 319 Program.
- Added reference to the Iowa BMP Mapping Project (p. 18).
- Provided clarification how Animal Feeding Operations are considered in the INRS.
- Section 1.1 Add reference to the EPA's Hypoxia Task Force Report to Congress.
- Updated references to private sector engagement and ag retail in conservation delivery to reflect advances in those areas since the original NRS was released.
- Clarified and added emphasis of edge-of-field practices and the importance to NRS goals.
- Added emerging barriers to implementation section to illustrate key barriers to implementation of priority practices that didn't exist during the development of the NRS.
- Clarified and updated state and federal program changes.
- Clarified new research regarding the contribution of P from in-stream/bed and bank sources.
- Clarified role of agronomists/Certified Crop Advisors (CCAs) have in NRS practices.

- Updated Nutrient Credit Trading section to reflect the development and establishment of the Iowa Nutrient Reduction Exchange (NRE).
- Clarified the annual farmer recognition program is the Iowa Farm Environmental Leader Award (IFELA).
- Removed reference to the establishment of an Iowa Natural Resource Inventory. This is section is related to the NRS Dashboard.
- Updated reference to subsequent EPA memos related to NRSs since the release of the INRS.
- Updated HTF section to include updates and establishment of the Gulf Hypoxia Program (GHP).
- Updated references in accordance with "Restoring Names that Honor American Greatness" Executive Order from January 20, 2025.

Section 2. Nonpoint Source Nutrient Reduction – Science Assessment Updates

- Incorporated the addition of 3-year extended rotations as a practice that reduces nitrogen loss
- Updated Science Assessment to incorporated new research for existing N practices. A similar effort is underway for P-based practices.

Section 3. Point Source Nutrient Reduction Technology Assessment Updates

- Section 3.3 - Removed the outdated list of affected facilities and added a link to the current list.

Preparation and Presentation of the IOWA NUTRIENT REDUCTION STRATEGY

Background

On November 19, 2012, Iowa Gov. Terry Branstad, Iowa Secretary of Agriculture Bill Northey, Director Chuck Gipp from the Iowa Department of Natural Resources and John Lawrence of Iowa State University announced the release of the Iowa Nutrient Reduction Strategy for public comment.

A two-month public comment period and several informational meetings allowed the public to provide feedback on the draft strategy. Updates and improvements were made to the draft based on the public comments. The final version of the strategy was released May 29, 2013.

The Iowa Nutrient Reduction Strategy was developed as a science and technology-based approach to assess and reduce nutrients delivered to Iowa waterways and the Gulf of America. The strategy outlines voluntary efforts needed to reduce nutrients in surface water from both point sources, such as wastewater treatment plants and industrial facilities, and nonpoint sources, including farm fields and urban areas, in a scientific, reasonable and cost-effective manner.

The development of the strategy reflected more than two years of work led by the Iowa Department of Agriculture and Land Stewardship (IDALS), Iowa Department of Natural Resources (DNR) and Iowa State University (ISU). The scientific assessment to evaluate and model the effects of practices was developed through the efforts of 23 individuals representing five agencies or organizations, including scientists from ISU, IDALS, IDNR, USDA Agricultural Research Service (ARS) and USDA Natural Resources Conservation Service (NRCS).

The strategy was developed in response to the 2008 Gulf Hypoxia Action Plan that called for the 12 states along the Mississippi River to develop strategies to reduce nutrient loading to the Gulf of America. The Iowa strategy followed the recommended framework provided by EPA in 2011. Iowa was the second state to complete a statewide nutrient reduction strategy.

This strategy was the beginning. It is a dynamic document that is evolving over time, and it has been a key step towards improving Iowa's water quality. Work to implement the strategy continues, as reflected in this document.

IOWA NUTRIENT REDUCTION STRATEGY

A science and technology-based framework to assess and reduce nutrients to Iowa waters and the Gulf of America

EXECUTIVE SUMMARY

The Iowa Nutrient Reduction Strategy (INRS) is a science and technology-based framework to assess and reduce nutrients to Iowa waters and the Gulf of America. It is designed to direct efforts to reduce nutrients in surface water from both point and nonpoint sources in a scientific, reasonable and cost-effective manner.

Its development was prompted by the 2008 Gulf Hypoxia Action Plan that called for Iowa and states along the Mississippi River to develop strategies to reduce nutrient loadings to the Gulf of America. The Gulf Hypoxia Action Plan set a goal of at least a 45% reduction in total nitrogen and total phosphorus loads compared to the 1980-1996 baseline period. The INRS, released in 2013, also intensified efforts to address nutrient related water quality problems in Iowa's waters that negatively impact beneficial water uses enjoyed and required by all Iowans.

The Environmental Protection Agency (EPA) embraced a practical approach to meet these goals in the March 16, 2011, memorandum titled, "Recommended Elements of a State Framework for Managing Nitrogen and Phosphorus Pollution" (Stoner 2011).

The memo outlines eight strategy elements that emphasize state implementation of new and existing nutrient reduction practices and technologies for point and nonpoint nutrient sources. The Iowa strategy, which was developed over a two-year period in response to the Gulf Hypoxia Action Plan, followed the recommended framework provided by the EPA in the 2011 memo.

The Iowa strategy proposed a pragmatic, strategic and coordinated approach for reducing nutrient loads discharged from the state's largest wastewater treatment plants, in combination with targeted practices designed to reduce loads from nonpoint sources now while evaluating the need for nutrient water quality standards long-term.

Steps were outlined to prioritize watersheds and limited resources, improve the effectiveness of state programs and increase voluntary efforts to reduce nutrient loading.

Iowa's many successes can be duplicated using the tools known to work, such as targeted, voluntary conservation measures, in conjunction with research, development and demonstration of new approaches.

This updated strategy recognizes the continued need to work with farmers, industry and cities to optimize nutrient management and lessen impacts to streams and lakes. It also recognizes success is highly dependent on many complicated factors, and new technologies will also need to be developed, tested and implemented.

All Iowans have an impact on nutrients in surface water and can play a role in reducing those impacts over time. This strategy emphasizes Iowans working together in small watersheds, using existing and new frameworks, to make an impact.

INRS Basics

- The initial release of the Iowa Nutrient Reduction Strategy reflected a new beginning in the state's efforts to assess and reduce nutrient loading to Iowa waters. Iowa leaders representing nonpoint sources (agriculture) and point sources (municipalities and industries) started working together through the Water Resources Coordinating Council (WRCC) to develop and implement an integrated strategy to enhance Iowa's and downstream waters, including the Gulf of America.
- An Iowa Science Assessment of Nonpoint Source Practices to Reduce Nitrogen and Phosphorus Transport to the Mississippi River Basin was completed to enhance the implementation of conservation practices to improve Iowa's waters.
- An Iowa Point Source Nutrient Reduction Technology Assessment was completed, to guide the

implementation of wastewater treatment technologies to reduce nutrient discharges to Iowa waters. The strategy continues to harness the collective initiative and capacity of Iowa agricultural organizations, ag businesses and farmers towards implementation of nonpoint source management practices to improve Iowa water and soil quality.

- Iowa's major municipalities and industries continue to evaluate and implement process changes and biological nutrient removal wastewater treatment processes to reduce nutrient discharge to Iowa's and downstream waters.
- Coordination, oversight and implementation of this strategy initially included identification of high priority watersheds within one year through the Iowa Water Resources Coordinating Council, which consists of 19 state and federal agencies, in consultation with the nongovernmental organizational membership of a Watershed Planning Advisory Council.

Point Source and Nonpoint Source Collaboration

Point source pollution is characterized by relatively constant discharges from stationary locations or fixed facilities from which discrete discharges originate, such as municipal wastewater treatment plants and major industries.

As defined by EPA, nonpoint source pollution generally results from land runoff, precipitation, atmospheric deposition, drainage, seepage or hydrologic modification. Unlike pollution from industrial and sewage treatment plants, nonpoint source pollution comes from many diffuse sources. Nonpoint source pollution is caused by rainfall or snowmelt moving over and through the ground. As the runoff moves, it picks up and carries away natural and human-made pollutants, finally depositing them into lakes, rivers, wetlands, coastal waters and ground waters.

With an integrated strategy to address both point source and nonpoint source nutrient loads, it is important to understand the different roles that each part plays on an annual and seasonal basis in achieving nutrient load reductions that will enhance water resources within Iowa as well as receiving waters beyond our state.

While it is true the largest percentage of nutrient loads in Iowa comes from nonpoint sources on an annual basis, this should not be interpreted to mean that point source contributions are insignificant. In fact, point sources can be the primary source of nutrient contributions during the most critical conditions for protecting stream aquatic life when stream flows are low and/or when a point source comprises the majority of flow to a stream. These types of low flow conditions commonly develop during summer months as well as during drought conditions. Both nonpoint source and point source loads play critical roles in Iowa and Gulf of America waters.

A concerted, cooperative and sustained effort by both point and nonpoint sources will be needed to meet the ambitious goals defined in this strategy, since neither source can meet the goals on its own. We must continue to recognize that both sources play a critical role in nutrient loading on a seasonal and annual basis.

The approach of addressing the diverse and weather-driven nutrient transport from Iowa nonpoint sources involving Iowa's more than 90,000 farmers will be different from the approach to address the controlled and relatively constant nutrient discharge from Iowa's major point sources. However, both approaches share a common goal of reducing nutrient loads to the water resources of our state and receiving waterbodies beyond our border.

Point Source Policy

The nutrient strategy outlines steps to achieve significant reductions in the amounts of nitrogen and phosphorus discharged to Iowa's rivers and streams by point sources. The portions of this strategy related to point sources are built on a technology assessment of practices that offer the most "bang for the buck"

at reducing loading of nitrogen (N) and phosphorus (P) to Iowa surface waters from Iowa's major wastewater treatment plants and industrial facilities that discharge N and P to Iowa waters. The assessment also takes into account related costs of these practices.

A total of 102 major municipal facilities serve the wastewater treatment needs of 55-60% of Iowa's population and treat more than 80% of the volume of all wastewater handled by Iowa cities. Among permitted industrial facilities, 28 discharge significant amounts of nitrogen and phosphorus to Iowa waters.

For the first time, discharge permits issued to these 130 facilities require implementation of technically and economically feasible process changes for nutrient removal. These changes are designed to achieve targeted reductions of at least two-thirds in the amount of nitrogen and a three-fourths reduction in the amount of phosphorus from levels discharged by these facilities.

Nonpoint Source Policy

The approach to addressing the diverse and weather-driven nutrient transport from Iowa nonpoint sources involving Iowa's 90,000 farmers, landowners, and other land managers must be different from the approach to address the controlled and relatively constant nutrient discharge from Iowa's 130 major cities and industries.

Accounting for the potential reduction from point sources, the target load reductions for nonpoint sources is 41% of the statewide total nitrogen and 29% of the total phosphorus compared to the 1980-1996 baseline period to meet Gulf Hypoxia Action Plan goals. Iowa has nutrient-rich landscapes and significant progress towards these large nutrient reduction targets takes considerable time, effort and funding sources.

Iowa is a national and global leader in the production of food and renewable fuels, so the goal of this strategy is to make Iowa equally a national and global leader in addressing the environmental and conservation needs associated with food and renewable fuels production.

The policy of this strategy related to nonpoint sources is built on a scientific assessment of practices and associated costs to reduce loading of N and P to Iowa surface waters.

Nonpoint Source Policy Actions

The strategy identifies multiple action items within five categories. Highlights of the action items (detailed in Section 1.4(4)) include:

Setting Priorities

- Focus on conservation programs
- Combine in-field and edge-of-field practices
- Deploy small watershed pilot projects
- Develop nutrient trading and other innovative approaches

Documenting Progress

- Create new and expanded frameworks to document farm best management practices
- Continue to collaborate with the science assessment team to measure success

Research and Technology

- Explore new technologies and creative solutions
- Utilize private and public funding for science and technology

- Learn from Gulf Hypoxia Zone research

Strengthen Outreach, Education, Collaboration

- Seek new, enhanced private and public sector roles
- Assist local watershed groups with coordination of nutrient reduction projects
- Expand agribusiness consulting and advisory services to farmers
- Broaden awareness and provide relevant information to farmers
- Achieve market-driven solutions
- Collaborate and share information with other states
- Increase public awareness and recognition
- Farmer recognition program
- Statewide marketing and education campaign

Funding

- Make most effective use of funding resources including maximizing benefits per amount expended

Nonpoint Source Science Assessment

To develop the strategy, the Iowa Department of Agriculture and Land Stewardship and the College of Agriculture and Life Sciences at Iowa State University partnered in October 2010 to conduct a scientific assessment. The team consisted of 23 individuals representing five agencies or organizations.

The objective of the Iowa Nonpoint Source Nutrient Reduction Science Assessment was to identify and model the effectiveness of specific practices at reducing N and P from reaching the Gulf of America, plus estimating the total cost and per unit cost of nutrient removed when implementing each practice.

The assessment involved establishing baseline conditions, reviewing scientific literature to assess potential performance of practices, estimating potential load reductions from implementing various scenarios involving nutrient reduction practices, and estimating implementation costs.

Possible nutrient reduction practices identified fall into three categories — nitrogen and phosphorus management, erosion control and land use, and edge-of-field. Management practices involve such things as application rate, timing and method, plus the use of cover crops and living mulches.

Land use practices include such things as perennial energy crops, extended rotations, tillage methods, grazed pastures and land retirement. Edge-of-field practices involve drainage water management, wetlands, bioreactors, multi-purpose oxbows, buffers, terraces and sediment control structures.

The scientific assessment demonstrated that a combination of practices would be needed to reach desired load reductions. To that end, the science team developed scenarios of practice combinations that could potentially achieve the goals. The practice combinations provided examples, not recommendations.

To carry these action items forward, coordinated efforts have been happening since 2013 and are still underway. Where appropriate, the science assessment and outcomes of the science assessment are now integrated into the operational plans of agencies and organizations

Moving Forward

While the positive effects of any individual nutrient control practice may not be noticed immediately, the cumulative impact of these actions will result in long-term water quality improvements in Iowa, plus downstream waters from Iowa to the Gulf of America.

This strategy signaled the beginning of a new science-based approach for reduction of nutrients lost to waters of Iowa. This work is built from past priorities and initiatives but adapts to the unique needs of taking on this challenge in Iowa. Periodic updates reflect that this is a dynamic strategy document that continues to evolve as new information, data and science are discovered, adopted and adapted.

There still is a need for development of additional practices, testing of new practices, further testing of existing practices and verifying practice performance at implementation scales. This strategy encourages the development of new science, new technologies, new opportunities and the further engagement and collaboration of both the public and private sectors.

The path forward to reducing nutrient impacts is not quick or easy, but this strategy remains a key step towards improving Iowa's water quality while ensuring the state's continued, reasonable economic growth and prosperity.

Section 1 — Policy Considerations and Strategy

1.1 Introduction

The 2008 Gulf Hypoxia Action Plan calls for states along the Mississippi River to develop strategies to reduce nutrient loadings to the Gulf of America. The plan establishes targets of at least a 45% reduction in riverine total nitrogen (N) load and in riverine total phosphorus (P) load compared to the 1980-1996 baseline period.

Iowa has been working for decades to protect and improve water quality, with positive small watershed results, mostly focused on reducing soil erosion and P losses. Progress measured at the Gulf of America towards these larger reduction targets, however, has been challenging, and many complex nutrient-related impacts in Iowa's lakes, reservoirs and streams remain to be addressed.

The Iowa Nutrient Reduction Strategy, released May 2013, outlines efforts to reduce nutrients in surface water from both point and nonpoint sources in a scientific, reasonable and cost-effective manner.

The Environmental Protection Agency (EPA) embraced a practical approach in the March 16, 2011, memorandum titled, *"Recommended Elements of a State Framework for Managing Nitrogen and Phosphorus Pollution"* (Stoner 2011). The framework includes eight strategy elements that emphasize implementation of existing nutrient reduction practices and technologies for point and nonpoint nutrient sources.

Consistent with EPA's framework and subsequently issued memos and policies, the Iowa strategy implements a pragmatic approach for reducing nutrient loads discharged from the state's largest wastewater treatment plants in combination with targeted practices designed to reduce loads from nonpoint sources.

Iowa's many successes in protecting the state's water quality can be duplicated using the tools known to work, such as targeted, voluntary conservation measures, in conjunction with research, development and demonstration of new approaches.

Current investments will continue to pay dividends, and the policies proposed within this strategy have accelerated progress towards reducing nutrient loads to local and Gulf waters. EPA's biennial Report to Congress describes recent advances toward addressing the Gulf Hypoxia Action Plan.

This is a dynamic strategy and science/technology assessment document that will change over time as new information, data and science are discovered and adopted. The IDNR, IDALS, and Iowa State shall, in coordination with the Water Resources Coordinating Council, annually evaluate whether the Iowa Nutrient Reduction Strategy needs to be reviewed and updated. This evaluation shall be included in reporting of implementation activities and progress.

1.2 Background

Nutrients are chemical elements that are necessary to sustain all life forms. Nitrogen and phosphorus are two nutrients that are naturally found in the environment and allow for healthy aquatic ecosystems. However, at excessive levels these nutrients can lead to water quality problems and interfere with beneficial water uses.

Iowa is not alone in facing nutrient-related water quality problems. To some degree, every state faces problems associated with nutrient over-enrichment caused primarily by too much N and P in waters. Nutrient enrichment can originate from many types of sources including from the landscape or within the stream itself. Complex biological systems demand an adaptive management approach to address the variability and uncertainties of addressing the related water quality problems.

The Gulf Hypoxia Task Force Report attributes the hypoxic zone – an area containing little or no oxygen – in part to excessive algae growth stimulated by nutrients. Targets of 45% total N and 45% total P riverine load reductions have been called for in order to achieve the goal for hypoxic zone size and to facilitate water quality improvements in the basin (Gulf Hypoxia Action Plan 2008).

Reducing excess nutrients in Iowa's surface waters can a) improve water clarity and minimize objectionable algal growths affecting water-based recreation; b) reduce dissolved oxygen deficiencies which can lead to fish kills and reduced aquatic biological diversity; and c) minimize occurrence of taste and odor chemical compounds that impact potable drinking water supplies. Reducing nitrogen in groundwater aquifers and surface water withdrawals also protects private and public drinking water sources.

Numeric Nutrient Criteria

Based on its 1998 Nutrient Strategy, EPA (1998) developed a plan to adopt numeric nutrient criteria to protect surface waters against the negative effects of nutrient enrichment. However, for most states, including Iowa, the adoption of numeric nutrient criteria has proven to be difficult for a variety of reasons. In 2000, EPA issued nutrient criteria recommendations derived from statistical distributions of nutrient data from the nation's lakes and rivers (EPA 2000). These recommendations were developed with the available water quality data for each of the 14 "nutrient ecoregions" nationwide. Ecoregions are defined as areas of relative homogeneity in ecological systems and their components. The recommendations have been characterized as a starting point for the development of more refined, local and waterbody-specific nutrient criteria.

Concerns with EPA's initial statistical approach have been raised by the U.S. Geological Survey (USGS) and several states. For example, the USGS estimated natural background concentrations for total P can vary by an order of magnitude within an ecoregion and would exceed EPA recommended numeric criteria in 52% of stream reaches nationwide (Smith et al., 2003). In other words, more than half of all streams in the country might not be able to meet the EPA recommended numeric criteria for P due to naturally occurring background conditions.

Iowa and many other states have been evaluating alternative approaches for establishing numeric water quality standards or strategies in order to reduce nutrients in surface water. EPA has recommended regional criteria or averages and ranges for nutrients in lakes and reservoirs and streams and rivers for states to consider when setting standards. State nutrient criteria based on the EPA recommendations would establish the maximum acceptable concentrations of nutrients in surface waters that would allow those waters to support designated uses, such as drinking water supplies, fishing and swimming.

There is debate on how to establish the appropriate nutrient criteria for protecting these designated stream and lake uses. Unlike most pollutants that currently have criteria established, no single criterion value appears to be appropriate for every water body. Therefore, numeric criteria may not be the best approach for achieving reductions in nutrient loads.

Because of the difficulties involved in deriving and implementing numeric nutrient criteria for streams, as well as the complexity and widespread occurrence of nutrient pollution, states that have made only small strides in reducing nutrient pollution have focused their efforts to reduce nutrient losses on activities other than establishing numeric criteria. Concern over states uneven progress in establishing and implementing numeric nutrient criteria according to the timeframe set by EPA was raised in a 2007 memorandum from Benjamin Grumbles, Assistant Administrator, U.S. EPA, Office of Water. Grumbles called upon EPA and its partners to take steps to accelerate the pace. In its response letter (July 18, 2007), the Association of State and Interstate Water Pollution Control Administrators (ASIWPCA) pointed to a number of factors confounding the nutrient criteria development process, including variability of nutrient responses in aquatic ecosystems, and the lack of strong linkages and clear

thresholds between nutrient causal and response variables.

The primary impact of numeric nutrient criteria would be felt almost exclusively by point source wastewater dischargers, primarily municipal wastewater treatment plants. Federal regulations require wastewater treatment plant permits to contain limitations for pollutants that "contribute to an excursion above any State water quality standard." If a state adopts numeric water quality standards for nutrients, wastewater treatment plants would be required to remove nutrients to the degree their discharge to surface waters would not cause the water quality standard to be exceeded. Nonpoint sources do not have this requirement, but rather use voluntary state and federal conservation programs.

Discharges from wastewater treatment plants contribute approximately 8% of the total nitrogen (TN) and 20% of the total phosphorus (TP) entering Iowa's streams and rivers annually. Wastewater treatment facilities contribute relatively minor percentages of the total annual nutrient loads to Iowa streams as compared with nonpoint sources. However, the impacts of nutrient discharges by wastewater treatment facilities on water quality in small streams during low streamflow conditions can be significant.

Nonpoint sources account for 92% of the TN and 80% of the TP entering Iowa streams annually. However, only about 5% of overall N inputs and 4% of all P inputs in watersheds are lost to Iowa streams. The rest are removed by harvest, grazing, volatilization, denitrification or are immobilized in soil (Libra et al., 2004).

For Iowa streams, EPA's recommended criteria range from 0.712 to 3.26 mg/L for TN and from 0.070 to 0.118 mg/L for TP. The best performance expected for municipal wastewater treatment facilities utilizing biological, physical and chemical treatment methods is around 3.0 mg/L TN and 0.1 mg/L TP. Wastewater discharges that comprise a large portion of the flow in a receiving stream could be required to treat to levels that are impossible to achieve even with today's state-of-the-art treatment technologies.

In addition to the issues with treatment efficacy for nutrient removal, the treatment technology is typically beyond the financial and technical capabilities of the many small towns in Iowa. Based on cost data developed by Foess et al. (1998), the cost per household for new treatment facilities, including biological nutrient removal (BNR), ranges from approximately $60/month for a population of 1,000 to more than $200/month for a population of 100. These rates are approximately three to 10 times higher than the typical Iowa sewer rate.

An economy of scale is also apparent in IDNR's estimation of costs[11] associated with BNR improvements for Iowa's current 102 major municipal wastewater treatment facilities. User rates resulting from construction of nutrient removal facilities will depend on a number of factors such as the existing treatment facility type and configuration, ease of BNR modifications in specific plant configurations and available funding sources. In general, the larger the population served, the lower the cost per user.

If the EPA nutrient criteria recommendations were adopted as Iowa water quality standards, cities would be required to pay for expensive wastewater treatment plant upgrades that would address only a fraction of the overall amount of nutrients discharged to Iowa's streams while leaving wastewater treatment facilities unable to comply with permit limits. A summary of estimated treatment costs is included in Section 3.2.

If compliance with stringent numeric effluent limits on point source discharges did not eliminate an existing

[1 1] Cost estimates were developed by categorizing each facility by treatment type and design average wet weather flow. Capital and operational costs on a treatment type/unit design flow basis for target effluent nitrogen and phosphorus concentrations of 10 mg/L and 1 mg/L, respectively, were derived from the Utah POTW Nutrient Removal Cost Impact Study (CH2MHILL). These unit costs then were applied to the Iowa facilities based on treatment type and design flow.

impairment, the receiving stream would continue to exceed the water quality standard and would require development of a total maximum daily load (TMDL). At that point, any further reduction required by a TMDL would need to be accomplished through voluntary controls placed only on nonpoint sources. Nonpoint sources face another set of equally challenging technological and financial limitations.

Recently EPA has been exploring water quality standards and permitting implementation flexibility for states that have stringent numeric criteria in place to help resolve implementation issues. These flexibilities include site-specific criteria, revisions to designated uses, permit compliance schedules, water quality standards variances and trading. While the increased interest from EPA on these possible flexibilities is encouraging, each one has pros and cons and may or may not be possible depending on case-specific circumstances.

Because of the lack of confidence in EPA's (2000) statistically derived criteria recommendations and the substantial financial costs associated with implementing nutrient removal technologies, legitimate concerns about the value of numeric nutrient criteria have been raised. Other criteria derivation approaches such as nutrient stressor-response analysis and reference condition modeling are better alternatives that Iowa will continue assessing as a basis for appropriate nutrient standards for implementation within an adaptive watershed management framework.

Challenges of Best Management Practice Adoption to Address Nonpoint Sources

As noted by Danalatos et al. (2022), within the U.S. Corn Belt annual croplands are the primary source of nitrate loading to waterways. The primary factor in this loss is that there are long fallow periods within the year which increase the risk of nitrate loss. In addition, weather is a strong driver in the interannual variability of nitrate loading. As such, largest losses can occur with sustained flows that occur in the spring or fall, times with little evapotranspiration and nutrient uptake.

In "rolling" or more hilly landscapes with good surface drainage, the phosphorus losses can be greater. Surface runoff water and sediment are the predominant carriers. The largest losses can occur with "flashy" rainfall-runoff events, such as in spring when there is less vegetative cover. In addition, recent work has documented that stream bed and bank erosion can be a major source of P in measured stream loads. Schilling et al. (2022) estimated that over an 18-yr period streambanks contributed at least 31% of riverine total phosphorus export from Iowa.

Meeting nutrient reduction goals from nonpoint sources will require a massive effort and no one single practice will meet the goals. While following recommended nutrient management practices would aid in reducing downstream nutrient delivery, science indicates these practices alone would not achieve load reduction goals, and they need to be combined with land cover and edge-of-field practices (Feyereisen et al., 2022).

Edge-of-field practices are necessary to achieve the goals of the INRS. In recent years, the ability to implement some of these priority practices has become increasingly difficult to navigate due to myriads of federal bureaucratic requirements that include standards and procedures that add barriers to practice adoption and ultimately limit the ability to scale up practices. These barriers discourage the adoption of conservation practices through increased time required to install practices, increasing costs, adding burden to landowners/staff, and limiting the locations to install these practices.

Ongoing research at Iowa State University and other institutions also indicates in-channel scouring and streambank erosion contributes a previously unrecognized, higher contribution to the phosphorus loading of streams. While this strategy calls for continued in-field erosion reduction and soil sustainability, thereby reducing sediment and phosphorus loading to streams, it is unlikely that in-stream phosphorus mass loading water quality goals will be achieved from only in-field phosphorus loading reductions to streams, given in-channel bed and bank sediment, and legacy phosphorus loads. This should not discourage

continuing efforts to reduce sediment and phosphorus loads from fields to streams, but should be recognized as an area of critical research need to better evaluate, understand and address in-channel bed and bank sources of sediment and P.

Mississippi River/Gulf of America Watershed Nutrient Task Force

The EPA co-chairs the Mississippi River/Gulf of America Watershed Nutrient Task Force. The task force has set a goal of establishing state nutrient strategies by 2013 that will coordinate basin efforts to reduce nitrogen and phosphorus delivery to the Gulf by 45 percent. The task force consists of five federal agencies, 12 state agencies (including Iowa) and the tribes within the Mississippi/Atchafalaya River Basin.

Iowa is well-positioned to work with the federal task force to document past success and make additional progress on nutrient reductions in surface water. The task force was established in the fall of 1997 to understand the causes and effects of eutrophication in the Gulf of America; coordinate activities to reduce the size, severity, and duration; and reduce the effects of hypoxia.

In 2001, the task force released the 2001 Action Plan, a national strategy to reduce Gulf hypoxia. While there was an initial federal commitment to funding state actions under the plan, no federal funding was ever received. Iowa has developed a variety of creative state actions (e.g., the Iowa Conservation Reserve Enhancement Program, the Iowa Wetland Landscape Systems Initiative and various Iowa watershed protection projects) and continues to work to make progress with available resources.

Since the release of the 2001 Action Plan, the task force embarked on a four-year reassessment of the science surrounding Gulf hypoxia. A 2008 Action Plan currently is being advanced by member states and agencies, including Iowa. The revised action plan includes five annual operating plans, one for each year through the next reassessment, that provide short-term roadmaps to maintain forward progress towards the goals of the Action Plan.

In 2015, the HTF established the New Goal Framework that reiterated the overall target of the 2008 Action Plan. Federal agencies, states, tribes and other partners are working collaboratively to plan and implement specific, practical and cost-effective actions to achieve both the Interim Target and the updated Coastal Goal.

In 2022, Congress established a new Gulf Hypoxia Program (GHP) within EPA through the Bipartisan Infrastructure Law (BIL). The GHP designates funds directly to 12 states of the HTF for advancing their respective Nutrient Reduction Strategies. The BIL appropriated $60M in funding distributed to states, tribes and regional basin subcommittees. The GHP signifies the first significant financial investment from EPA to states for the purpose of advancing the goals of the NRSs and HTF.

Iowa Secretary of Agriculture Mike Naig currently serves as the state co-chair of the Mississippi River/Gulf of America Watershed Nutrient Task Force (EPA is the federal co-chair with states). The Iowa Department of Agriculture and Land Stewardship (IDALS) is the designated lead Iowa agency for hypoxia issues and participation in the hypoxia task force, its subcommittees and related working groups.

Iowa Nutrient Reduction Strategy Development

The Iowa Department of Agriculture and Land Stewardship (IDALS) and the Iowa Department of Natural Resources (IDNR) worked cooperatively to develop the state nutrient reduction strategy, with the support of EPA Region 7. IDALS is leading work with the affected nonpoint source industries, while IDNR is working with permitted facilities and industries to focus on point source impacts.

The initial step to develop a statewide strategy to reduce nutrients to streams and the Gulf of America was a scientific assessment of the practices with potential to achieve the desired environmental goals. Iowa has voluntarily moved forward to complete the science assessment and strategy development using existing state funds, much of which comes from fertilizer fees paid by Iowa farm families.

IDALS and the Iowa State University College of Agriculture and Life Sciences (CALS) led the nonpoint source science assessment. The Iowa Nonpoint Source Nutrient Reduction Science Assessment is based on the peer-reviewed science studies of in-field, edge-of-field and watershed scale practices and treatments to determine the potential reductions in total nitrogen and total phosphorus leaving agricultural landscapes. A team of 23 research and extension faculty from ISU CALS, IDALS, USDA-ARS, NRCS, EPA and IDNR, as well as scientists from nearby states, worked on the science assessment.

The coefficient of potential nutrient reductions for each practice and treatment is based on peer-reviewed literature and best professional judgment of the team. The initial level of use of each practice is based on values estimated by the team using published literature and information publicly available from the USDA. Scenarios of combinations of the practices and treatments were developed to estimate the expected reduction in nutrients and the resulting cost.

For each scenario, the coefficient of potential nutrient reduction was multiplied by adoption rate and potential acreage to determine the potential nutrient reduction for the practice. Next, the reductions from the practices were aggregated to a total potential reduction for the scenario over the state. The cost in investment, operating expenses and lost production also were taken into consideration, as were potential trade-offs with other environmental concerns. For instance, a practice that reduces nitrates in groundwater may increase phosphorus in surface water. The cost and supply impacts of each scenario were used to estimate the local economic impact.

The science assessment is particularly useful in demonstrating the relative effectiveness of various practices in achieving N and P reductions. For example, ranking the 15 nitrate-N reduction practices suggests that cover crops (28% reduction), wetlands (22%), bioreactors (18%) and perennial crops (18%) offer the greatest potential for N reductions. In contrast, a commonly highlighted practice such as moving fall fertilizer applications to spring only resulted in a nitrate-N reduction of 0.1%. However, the science assessment goes beyond simply listing practice effectiveness by including the number of acres that a practice can impact and estimating the cost of N reduction per pound. So, while perennial crops are associated with higher N reductions, the practice is also the most expensive practice ($21.46 per pound of N reduced). Hence, the science assessment can be used by the NPS community to identify appropriate N and P practices that align with specific watershed goals in terms of nutrient reductions, area impacted by a practice and potential practice cost. Details provided in the science assessment can form the basis for developing specific nutrient reduction plans in watersheds.

The science assessment demonstrates that a combination of in-field and edge-of-field practices will be needed to reach desired load reductions from nonpoint sources. To that end, the science team developed scenarios of practice combinations that could potentially achieve the goals. **The practice combinations are examples, not specific recommendations.**

Nitrogen reduction practices considered in the assessment included in-field N management practices such as timing, source, application rate, nitrification inhibitor, cover crops and living mulches; land use changes such as the addition of perennials, extended rotations and grazed pastures; and edge-of-field practices such as drainage water management, shallow drainage, wetlands, bioreactors and buffers.

Phosphorus reduction practices studied included in-field P management practices such as application, source and placement; erosion control and land use change practices such as tillage, crop choice, perennials and terraces; and edge-of-field practices such as wetlands, buffers and sediment control.

After considering all possible practices, three example scenarios were developed that met both the N- and P-reduction objectives. While significant research has been conducted on the potential performance of various nutrient reduction practices, there is a need for development of additional practices, testing of new practices, further testing of existing practices and verification of practice performance at implementation scales. Additional research also would improve the predictability of practice performance

and the understanding of practice uncertainty.

1.3 Regulatory and Administrative Framework

Federal Framework

EPA, in its March 16, 2011, memo, outlined a new path for local-state-federal partnerships to address nutrients. In the memo, Working in Partnership with States to Address Phosphorus and Nitrogen Pollution through Use of a Framework for State Nutrient Reductions, the agency said that states, EPA and stakeholders must make greater progress in accelerating the reduction of nitrogen and phosphorus loadings to the nation's waters. While EPA has a number of regulatory tools at its disposal, its resources can best be employed by catalyzing and supporting action by states to protect their waters.

Since the 2011 memo, succeeding EPA administrations have provided renewed and expanded efforts on reducing the loss of nutrients. These previously issued policy and supporting documents can be found at this link. The most recent EPA Nutrient Reduction Memorandum was released in 2022 and can be found at this link. Subsequent memos provide opportunities, prioritization, and other points of emphasis from EPA for advancing state nutrient reduction strategies. The 2011 memo serves as the outline and overall structure for the Iowa Nutrient Reduction Strategy.

State Framework

In 2011, the Iowa Secretary of Agriculture was given the responsibility by the Iowa Legislature to chair the Iowa Water Resources Coordinating Council (WRCC), which was created in 2008 to coordinate state and federal efforts to address water quality and flooding issues. The WRCC is comprised of 19 state and federal agencies and is responsible for engaging in regular coordination of water resource related functions, including protection strategies, planning, assessment, prioritization, review, concurrence, advocacy and education. The purpose of the council is to preserve and protect Iowa's water resources and to coordinate the management of those resources in a sustainable and fiscally responsible manner.

The Iowa Watershed Planning Advisory Council, a diverse group of private, non-governmental organizations and stakeholders, was to cooperate with the WRCC, make recommendations and report annually to the Iowa Legislature. This council was dissolved by the legislature in 2024.

Iowa's 100 Soil and Water Conservation Districts (SWCD) provide on-farm technical and financial assistance for implementation of conservation and environmental practices. SWCDs are co-located with NRCS, IDALS and sometimes other NGO staff and provide the authority to execute maintenance agreements and conservation agreements for state and local programs that assure long-term protection and maintenance requirements based on practices installed on private lands with financial assistance. They also provide local leadership for small watershed implementation projects.

Conservation and Water Quality Funding

Funding support is a top priority for addressing the Iowa Nutrient Reduction Strategy. Funding to advance the Iowa NRS comes from a variety of sources that are often combined and/or leveraged together to serve as the foundation of cooperative partnerships for conservation delivery. Sources can be categorized in several ways from the public sector (federal, state and/or local) and the private sector (NGOs, farmer/landowner investments, etc.).

Funding for conservation and water quality from many funding sources since 2012 can be found in INRS annual reports and are available on the INRS Inputs dashboard here.

State of Iowa Programs:

Iowa Department of Agriculture and Land Stewardship (IDALS)

IDALS administers several conservation programs to address NPS water quality and conservation in the state.

Many of these programs provide support to the Iowa NRS. More information can be found here. These programs regularly report and are accounted for on the Iowa NRS Dashboard reporting system.

Iowa Water Quality Initiative

The Iowa Water Quality Initiative (WQI), established in 2013, is a program dedicated solely to developing actionable steps to advance the INRS. The WQI supports collaborative, partnership-based water quality implementation projects, based on research-based practices in the most recent version of the NRS-Science Assessment that are evaluated and reported by a team of independent researchers from multiple institutions, led by Iowa State University. This comprehensive approach allows farmers and cities alike to adopt conservation practices that fit their unique needs, lands and budgets.

Water Quality Infrastructure Fund (WQIF)

In 2018, Governor Reynolds signed the Water Quality Infrastructure Fund, the first long-term, dedicated funding (as opposed to annual appropriations) bill to establish several water quality programs that advance conservation efforts in the state through 2029. During the 2021 Legislative Session, the program was extended to another 10 years providing an additional $15M in funding for WQI annually through 2039.

Iowa Finance Authority (IFA)

In the same legislation that established the WQIF, two additional programs were established to support NPS and PS infrastructure improvements through the Iowa Finance Authority: the Wastewater & Drinking Water Treatment Financial Assistance Program and Water Quality Financing Program. More information on these programs can be found at this link.

Iowa Department of Natural Resources (IDNR)

The IDNR administers several programs in support of NPS management. These programs can be found here. The Iowa Nonpoint Source Management Plan is a requirement of IDNR to remain eligible for EPA's Clean Water Act Section 319 grants. The 319 program supports nutrient-related and broader NPS efforts.

Iowa State Revolving Loan Fund

The IFA and the IDNR jointly administer the State Revolving Fund (SRF). More than 600 Iowa communities and municipalities have utilized the SRF to finance the design and construction of quality drinking water and wastewater infrastructure. Thousands of Iowa landowners, livestock producers and homeowners have also benefited from the SRF's unique affordable financing programs. Detailed information is available at this link.

Federal Farm Bill Contributions:

Most of the direct federal funding for conservation practice financial assistance for working lands in Iowa to help protect water soil and water quality comes through the federal farm bill and USDA's Farm Service Agency (FSA) or Natural Resources Conservation Service (NRCS). The FSA and NRCS work to help USDA implement water quality goals in partnership with Iowa SWCDs. A complete list of NRCS's Iowa programs can be found at this link. NRCS also reports annually through "At-a-Glance" publications that summarize annual program accomplishments. FSA's conservation programs can be found at this link. Available NRCS and FSA data is tracked through the INRS Dashboard and found at this link.

NRCS-Regional Conservation Partnership Program (RCPP)

The RCPP was authorized in the 2014 Farm Bill to leverage partner-led (non-USDA) conservation investments with USDA-NRCS funding to increase the scale and adoption levels their projects can support alone. NRCS placed an added emphasis on partner-led projects that can demonstrate innovative delivery methods to address resource concerns on a regional or watershed basis.

NRCS regularly solicits proposals from partners to request RCPP funding to support projects. The RCPP has provided an additional opportunity to leverage state and stakeholder support for the Iowa NRS and other priorities.

More information on Iowa RCPP projects can be found at this link.

NRCS-Mississippi River Basin Healthy Watersheds Initiative (MRBI)/National Water Quality Initiative (NWQI):

The Mississippi River Basin Healthy Watersheds Initiative (MRBI), sponsored by NRCS and its partners, supports producers in selected watersheds in the Mississippi River Basin who voluntarily implement conservation practices that avoid, control and trap nutrient runoff; improve wildlife habitat; and maintain agricultural productivity. These improvements will be accomplished through a conservation systems approach to manage and optimize N and P within fields to minimize runoff and reduce downstream nutrient loading. The NWQI builds on the past efforts of producers, NRCS, partners and other state and federal agencies in the 12-state Initiative area to address nutrient loading in the Mississippi River Basin. More details here.

FSA-Conservation Programs

The FSA also manages federal farm bill conservation programs. One of the key FSA programs for nutrient reduction in Iowa is the Conservation Reserve Program, a temporary land retirement program. Total CRP enrollment and expenditures are tracked through the INRS Dashboard and found at this link.

USDA-Partnerships for Climate-Smart Commodities

First announced in 2022, the Partnerships for Climate-Smart Commodities is an opportunity through USDA to finance partnerships that support multi-year projects to assist in advancing climate-smart agricultural products and methods. USDA publishes a project dashboard with more information on funded projects at this link.

EPA – Gulf Hypoxia Program

The Bipartisan Infrastructure Law (BIL) established the Gulf Hypoxia Program in 2022. This program represents the first time EPA has invested significant financial resources in strategies to improve water quality in the Mississippi River/Atchafalaya River Basin and Gulf of America aimed at reducing the hypoxia zone in the northern Gulf.

Private Sector:

While state, federal and local programs provide support for conservation implementation, private/non-publicly funded programs are critical to meeting the goals of the NRS. Many NGOs and private sector groups/businesses are supporting conservation implementation. One group, established in 2014 to help bridge the gap between the public and private sector was the Iowa Agriculture Water Alliance (IAWA).

The Iowa Nutrient Research and Education Council (INREC) was established in 2015 to support, monitor and report on progress towards the NRS through science-based solutions and collaboration across Iowa's agricultural production system.

INREC and IAWA are 2 groups established solely to advance the NRS and are one of several other private sector groups that are working to advance efforts that complement the NRS.

Expanded Agribusiness Consulting and Advisory Services to Farmers

In addition to state and federal publicly cost-shared conservation programs, private sector organizations, non-governmental organizations, agribusinesses and Certified Crop Advisors (CCA) are contributing to Iowa conservation progress. These entities serve important roles in environmental advocacy for advancing better management of natural resources and are making significant investments in the development and implementation of new technologies to address nutrient concerns related to agricultural production.

As envisioned in the original NRS, a network of Conservation Agronomists has been established and is growing to advance conservation progress through trusted ag advisors. This network supports expanded and enhanced public-sector roles to assist farmers and landowners in reducing nutrient transport to local and Gulf waters. It also represents a new and enhanced way for the private sector to provide leadership, new technologies and services to reduce nutrient transport.

As conservation efforts are expanded and increased, opportunities need to be identified, and actions supported to achieve the rapid adoption of nutrient reduction actions that occur through market-driven solutions. Private and public sector support of market-driven initiatives needs to be aligned to maximize progress through market forces.

The level of future efforts needed to achieve the nutrient reductions called for in this strategy will extend beyond what can be achieved through publicly funded government-centric programs and actions alone and will also depend on private sector actions and solutions.

Iowa farmers and landowners represent the largest constituent of the private sector. Traditionally, public sector programs have operated on incentive rates or cost-share that do not cover the full cost of implementation, requiring farmers and landowners to provide the remaining costs for those practices or the full costs of implementation absent public or private sector incentives. Iowa landowner and farmers' requests for combined federal and state cost-share dollars to match with their own money to protect Iowa's soil and water has historically exceeded funds available.

Iowa Conservation Progress

State and federal cost share programs have contributed significantly to helping Iowa farmers make progress in protecting Iowa's soil and water resources. At the same time, significant changes have happened on the landscape absent public sector programs. Here are some examples of resources that regularly assess and estimate conservation adoption within the state, region and/or nation:

- Progress and assessments related to measured changes in nutrient losses in the state will be done through periodic assessments based on baseline/benchmark processes and also presented on the dashboard annually. The benchmark assessment was completed during the original INRS-Science Assessment. In 2018, an assessment was completed and posted on the INRS website to estimate nutrient loading during the baseline period of 1982-1996. This report can be found here.

- Since 1982 and annually since 2000 (every five years 1982-1997), USDA's Natural Resources Inventory published and assessment on the status, condition and trends of land, soil, water and related natural resources on non-federal lands. National Resources Inventory reports assess Iowa's estimated land use, erosion rates and wetland acreage, among other categories.

- Since 1840, the USDA-National Agricultural Statistics Service (NASS) has developed and released its Census of Agriculture. The census reports a wide count of agricultural data with several categories that can be used to support tracking progress of the INRS, and these are assessed for inclusion in the dashboard.

- USDA-NRCS's Conservation Effects Assessment Project (CEAP) provides assessments and associated conservation outcome insights for various conservation programs and land uses.

- The Iowa BMP Mapping Project provides a complete baseline set of best management practices dating from the 2007-2010 timeframe for use in watershed modeling, historic occurrence and future practice tracking. The BMPs mapped are terraces, water and sediment control basins (WASCOB), grassed waterways, pond dams, contour strip cropping and contour buffer strips. BMPs are being collected by 12-digit hydrologic unit code (HUC) and data collected can be downloaded from the website.

- Since 2017, the Iowa Nutrient Research and Education Council (INREC) has conducted an annual survey of Iowa ag retail locations to assess in-field crop production and conservation practice methods. Responses are aggregated and provided to ISU Center for Survey Statistics & Methodology to build a statistically valid estimate of these methods statewide. Reports can be found at the following link and are also summarized on the Iowa NRS dashboard.

1.4 Nutrient Reduction Strategy

The original Iowa Nutrient Reduction Strategy, including the science and technology assessments for both nonpoint and point sources, was developed over a two-year period prior to its release in May 2013. It is built on a scientific assessment of actions considered to be effective and cost efficient to reduce loading of nitrogen and phosphorus to Iowa surface waters.

This strategy follows the framework provided by the EPA in its March 16, 2011 memo, Working in Partnership with States to Address Phosphorus and Nitrogen Pollution through Use of a Framework for State Nutrient Reductions.

Since 2013, the Iowa Nutrient Reduction Strategy has been reviewed and updated as needed. Any updates are presented to the Water Resources Coordinating Council for approval.

1. Prioritization of Watersheds

To better coordinate various ongoing activities and promote new watershed initiatives, the Water Resources Coordinating Council (WRCC) will prioritize watersheds on a statewide basis for nitrogen and phosphorus loading reductions.

The watershed management planning framework also addressed other resource needs, such as sediment delivery and flooding. The WRCC uses a variety of data available and in development to prioritize Iowa eight-digit HUC watersheds relative to their contribution to nutrient loading.[2] This prioritization is periodically reviewed and adjusted as needed.

In 2013, the WRCC selected nine HUC8 watersheds as the initial priority areas in Iowa. These watersheds serve as areas to focus targeted conservation and water quality efforts through demonstration projects and implementation activities of the INRS. The priority watersheds selected are provided in Figure 1:

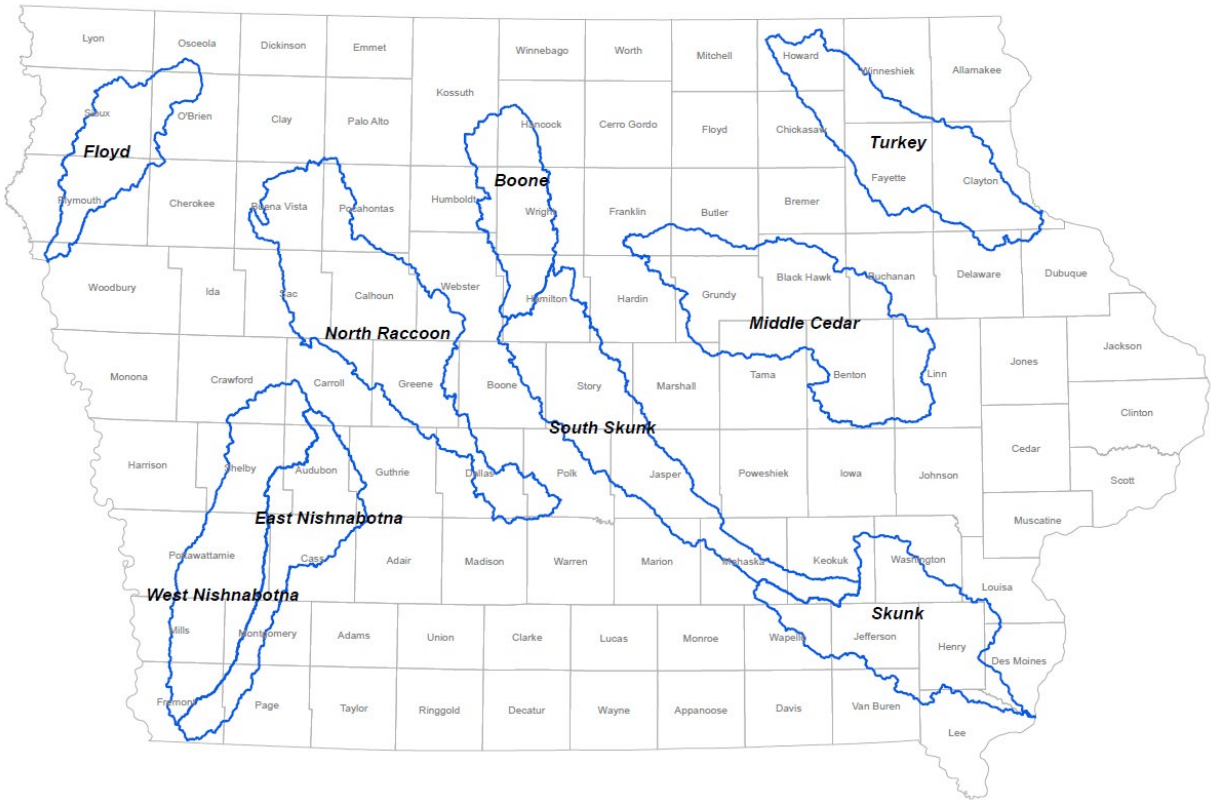

Figure 1. Map of current INRS Priority (HUC 8) Watersheds: Boone, East Nishnabotna, Floyd, Middle

Cedar, North Raccoon, Skunk, South Skunk, Turkey, and West Nishnabotna

1 Hydrologic Unit Codes (HUCs) are part of a U.S. Geologic Survey watershed classification system based on size. Under this system, the United States is divided into major watersheds and subwatersheds. Each watershed is represented by a unique 8, 10 or 12- digit code commonly known as a HUC, with 8-digit HUCs the largest and 12-digit HUCs the smallest.

In addition, within each major watershed that has been identified and prioritized as accounting for the substantial portion of the load, targeted/priority sub-watersheds on a HUC 12 scale have been implemented, and potential future watersheds to implement targeted N and P load reduction activities.

2. Determine Watershed Goals

The WRCC will coordinate development of measures of success and relate these to watershed improvement based upon a set of mutually agreed-to indicators.

The WRCC through a subcommittee coordinated the development of multipurpose indicators that provide Iowa watershed stakeholders information to establish baselines and report water nutrient reduction goal progress. These indicators can be aggregated at a watershed and/or state scale, depending on data sources and collection methodology. They can be integrated across major land resource areas (MLRAs) and watersheds to evaluate cumulative impacts and trends. The INRS Logic Model for Progress Measurement identifies state-wide indicators that are being tracked and reported on the dashboard.

3. Ensure Effectiveness of Point Source Permits

Reduction in nitrogen and phosphorus discharges from wastewater treatment facilities will be accomplished via the National Pollutant Discharge Elimination System (NPDES) permit process.

Although continuously evolving, many nutrient removal technologies in wastewater treatment are already proven and well established. Thus, nutrient removal for Iowa's wastewater treatment facilities is technologically feasible. The primary mechanism IDNR will use in assessing the "reasonableness" of nutrient removal for individual facilities is the estimated costs for improvements and the ability of end users to afford those costs.

The goal is to have the major point source dischargers construct or modify treatment facilities or, in the case of some industries, modify plant operations, to achieve significant reductions in the amounts of N and P discharged into Iowa's rivers and streams.

Iowa has 106 designated major municipal dischargers (Publicly-Owned Treatment Works – POTWs) defined as facilities designed to treat 1.0 million gallons of wastewater or more per day (Average Wet Weather – AWW – Design Flow). There are 34 industries in Iowa designated by the EPA as major industrial dischargers. See Section 3.3 for a link to the list of affected facilities.

NPDES permit renewals for municipal and industrial NPDES permits with existing biological treatment systems include a requirement for evaluating the feasibility for biological nutrient removal and to develop a schedule for BNR installation. See Section 3.1 for the point source technology assessment and implementation details.

Nutrient reduction costs are generally affordable for most of Iowa's major municipal facilities based on the ratio of estimated project cost to median household income (MHI). These same facilities also have the largest design flows and, in general, the greatest point source nutrient contributions. If the communities served by major municipal facilities can afford a project cost/MHI ratio of 0.5%, the design flow treated by those facilities for which nutrient reduction is affordable is over 550 MGD, or roughly 86% of the total designed flow for all major municipal facilities.

The modifications to these wastewater treatment facilities have the potential to reduce the plants'

nitrogen discharge by 66% and phosphorus discharge by 75%.

If successful, this strategy will reduce by at least 11,000 tons per year the amount of N and 2,170 tons per year the amount of P discharged annually by these facilities. These figures represent a 4% N reduction and a 16% P reduction in the estimated statewide nutrient loads to Iowa's streams and rivers.

This technology-based approach also provides benefits to point sources by providing 1) flexibility for implementation considering cost and permit structure, 2) a level of regulatory certainty, and 3) permit limitations that can be met by known wastewater treatment technologies.

Minor POTWs

There are many more minor POTWs in Iowa than those designated as majors, but most of the wastewater is discharged by major POTWs, both in terms of volume and amounts of nutrients. Cost estimates developed for this strategy and elsewhere indicate nutrient removal would likely be unaffordable for smaller communities. Due to the high cost in relation to the amount of nutrient reduction that could be achieved by minor POTWs, this strategy focuses only on major facilities. However, minor POTWs will be required to evaluate total N and P as "Pollutants of Concern" within Iowa's Antidegradation Implementation Procedure and implement the least degrading reasonable treatment alternative when designing new or expanded treatment facilities.

Animal Feeding Operations

Animal feeding operations were considered in the strategy development. First, all Animal Feeding Operations are regulated by the IDNR for environmental performance and manure management. The amount of regulation varies by the type and size of farm and addresses potential to discharge, construction of manure storage and manure application rates. Second, manure application to farmland is accounted for in the strategy as part of in-field management practices. Overall manure application is estimated to supply over 30% of the state's N and P needs (Andersen, 2024).

Confinement Operations:
Farms 1,000 animal units or larger are required to have construction permits to ensure that construction of manure storage facilities will properly contain the manure produced and stored. Stormwater permits also are likely to be required before construction. Farms larger than 500 animal units are required to comply with an IDNR approved manure management plan (MMP), which is updated annually. These plans help ensure that manure is applied at an agronomic rate, thus minimizing the likelihood of over-application. These farms also must have certified applicators land-apply the manure from the farm.

All farms have water quality setback requirements. Setbacks are required from streams, lakes, designated wetlands, drinking water wells, ag drainage wells and sinkholes. Livestock barns or manure storage structures cannot be located in a 100-year flood plain. These operations must retain all manure between periods of land application. Farms with dry or bedded manure also have regulations governing the stockpiling of dry manure.

Open Feedlot Operations:
Farms that are concentrated animal feeding operations under federal law and that discharge to waters of the United States must have NPDES permits. These farms must comply with nutrient management plans and are also required to obtain permits before constructing effluent basins or alternative technology systems. Setback requirements to water wells and limitations on the stockpiling of manure must be followed.

Nutrient Credit Trading

Water quality credit trading involves collaboration between two or more entities, commonly a point source

and one or more nonpoint sources, to reduce the amounts of pollutants, in this case nitrogen and phosphorus, entering a water body. It can provide a means to improve water quality, especially in cases where the technology does not exist or is not affordable to allow a point source discharger to comply with permit requirements -- or where the same or greater pollutant reductions can be achieved more quickly or at lower cost through controls on nonpoint sources. Trading can benefit not only the parties involved in a trade but everyone who lives, works and recreates within the watershed where pollutant reductions occur.

Given the potential for nutrient credit trading to further the goals of this strategy, the WRCC and its member organizations have cooperated with and assisted non-governmental organizations interested in developing a voluntary nutrient credit trading program in Iowa. Where available and allowed by law, incentives may be provided to encourage and facilitate nutrient credit trading as a means to reduce nutrient loadings to rivers and streams.

In 2019, the Iowa Nutrient Reduction Exchange (NRE) was established that formalized a framework for a voluntary nutrient credit trading program in Iowa, which is now utilized by Iowa communities.

4. Agricultural Areas

As Iowa is a national and global leader in the production of food and renewable fuels, a goal of this strategy is to make Iowa an equal national and global leader in addressing the environmental and conservation needs associated with food and renewable fuels production.

Accounting for potential load reduction from point sources, nonpoint sources need to achieve a 41% load reduction in nitrogen and a 29% load reduction in phosphorus to meet the overall INRS 45% reduction goal. Iowa has nutrient-rich landscapes, and significant progress towards these large nutrient reduction targets will take considerable time, effort and funding.

The approach to addressing the diverse and weather-driven nutrient transport from Iowa nonpoint sources involving Iowa's 90,000 farmers must be different from the approach to address the controlled and relatively constant nutrient discharge from Iowa's 130 major cities and industries.

This strategy for agricultural areas includes multiple action items within several categories. Programs and initiatives were developed, and action items carried forward. Where appropriate, the science assessment and outcomes of the science assessment have been integrated into programs, initiatives, and public reporting of the INRS.

Setting Priorities

- Focus Conservation Programs - Coordinate the focus of conservation programs with the goal of reducing nutrient transport to local and Gulf waters. Develop a conservation program infrastructure that fully supports adoption of needed practices to target the reduction of nutrients to water. Increase the delivery of conservation and nonpoint source programs in a straightforward, flexible manner.
- Utilize a systems approach to combine In-Field and Edge-of-field (EOF) Practices - Nutrient transport from cropped lands cannot be solved by in-field practices alone, but must include a combined and balanced approach utilizing edge-of-field nutrient and sediment trapping and removal practices with in-field erosion and nutrient reduction practices. Watershed planning is a tool that can support implementation of BMP siting and outreach.
- Develop Small Watershed Pilot Projects - In partnership with federal and state agricultural and natural resource partners, non-governmental organizations, private sector partners, landowners and other stakeholders, local stakeholders will develop and implement small watershed-scale plans that target the most effective practices in prioritized HUC 8 watersheds.
- Encourage Nutrient Trading and Innovative Approaches - These groups will look for opportunities to include existing state and federal targeted stewardship programs with nutrient

trading and innovative new approaches to accelerate adoption of agricultural conservation practices.

Research and Technology

- New Technologies and Creative Solutions - Retain and enhance the policy framework that facilitates and encourages development and rapid adoption of new technologies for reducing nutrient transport to local and Gulf waters.
- Utilize Private and Public Funding for Science and Technology - Enhanced and consistent funding is needed to advance the science to develop and verify new technologies for reducing nutrient transport from agricultural lands to local and Gulf waters. Entrepreneurial opportunity within the private sector needs to be enhanced for development and marketing new technologies that reduce nutrient transport to water. Sustained and consistent public funding of public research activities needs to be enhanced significantly. In 2013, the Iowa Nutrient Research Center (INRC) was established by the Iowa Legislature to aid in continued research and development in nutrient reduction practices.
- Learn From Gulf Hypoxia Zone Research - There are many unanswered science issues concerning the hypoxic zone in the Gulf of America, which becomes increasingly important as Iowa moves forward addressing its role in Gulf hypoxia. Support of this type of research is critical to this strategy.
- Investigate Levels of In-stream P Contributions. The 2013 Iowa Nutrient Reduction Strategy identified an area of need for additional research related to the phosphorus contributions from streambed and streambanks. There has been substantial research in this area over the last 10 years. From this, it is estimated at least 31% of Total Phosphorus at the river scale may be coming from bed and bank sources (Schilling et al., 2023). Future research will continue to examine underlying causes for these contributions and methods for reducing these contributions.

Strengthen Outreach, Education, Collaboration

- Seek New, Enhanced Private and Public Sector Roles - This strategy calls for an expanded and enhanced public-sector role to assist farmers and landowners in reducing nutrient transport to local and Gulf waters. It also calls for identifying new and enhanced ways for the private sector to provide leadership, new technologies and services to reduce nutrient transport.
- Expand Agribusiness Consulting and Advisory Services to Farmers - This strategy seeks to harness the collective power of agronomists and Certified Crop Advisors (CCAs) working through retailers. Develop new roles for agronomists/CCAs to advise farmers and landowners and assist in accountability and certification of achieving water quality and soil sustainability goals.
- Broaden Awareness and Provide Relevant Information - Current and relevant information to farmers and landowners continues to be needed concerning the available technologies, best management practices and actions that can be taken to reduce nutrient transport. Associated costs and risks of the technologies and practices also is a critical need for optimized decision-making and to achieve sustained adoption.
- Expand Technical Assistance Capacity. Expand the availability and expertise of technical available to support landowners, especially for edge-of-field site evaluation and implementation. Train and support public and private technical advisors and contractors on Iowa NRS approved practices to assist farmers with site selection, decision making and practice management.
- Achieve Market-Driven Solutions - Opportunities need to be identified and actions supported to achieve the rapid adoption of nutrient reduction practices and actions that occur through market-driven solutions. Private and public sector support of market-driven initiatives needs to be aligned to maximize progress through market forces.
- Collaborate and Share Information with Other States - This strategy involves increased

collaboration among the states within the Mississippi River Basin and networking/sharing information on the efforts and successes within the states for achieving reductions of nutrients to water resources.

Increased Public Awareness and Recognition

- Farmer Recognition Program - To increase public recognition of farmers and landowners who are leaders in achieving reduction of nutrients leaving their farms and entering Iowa's and Gulf waters the Iowa Farm Environmental Leader Award program is presented annually at the Iowa State Fair.
- Statewide Education and Marketing Campaign - Many partners are providing tailored outreach in support of various aspects of the INRS. These efforts have integrated various priorities identified in the INRS that align with their individual organizational missions. These efforts are ongoing and evolving to advance this recommendation.

Funding

- Effective Use of Funding Resources - IDALS and IDNR are working to maximize opportunities to leverage available federal, state and local resources, prioritizing and tailoring resources and programs to INRS practices maximizing benefits per amount expended. It is recognized in this strategy and as a matter of state policy that funds are often limited and over-subscribed by citizens who desire to make further progress in addressing their soil and water resource needs. The pace of the strategy's implementation is subject to available financial and human resources.

5. Storm Water, Septic Systems, Minor POTWs and Source Water Protection

Nutrient loading in Iowa from storm water, septic systems and minor POTWs sources is considered minor on a statewide basis. However, their importance on a regional/localized base can be significant. Emphasis here is on monitoring, inspections, education/outreach and upgrades as needed.

Stormwater

Due to the intermittent nature of such discharges and their relatively small contribution to the statewide nutrient load this document does not address specific storm water reduction targets. While statewide the contribution is small, it can be significant at smaller watershed scales and should factor into any storm water permits and watershed planning efforts.

An emphasis will continue to be placed on encouraging low impact development and utilization of green infrastructure for new growth and redevelopment projects throughout Iowa. Reducing runoff volumes can significantly reduce loading of nutrients and other pollutants common in storm water flows (sediment, hydrocarbons, heavy metals, bacteria, floatable litter, thermal pollution, etc). Flashiness of flows in urban streams would also be significantly reduced, which would reduce stream corridor erosion and address the largest contributor to sediment loading. Efforts to increase education and outreach opportunities for urban storm water issues include promoting BMPs for urban lawn care and golf course management.

Private Sewage Disposal Systems

Iowa currently has more than 300,000 private sewage disposal systems, and their associated impact on nutrient loadings in Iowa is considered marginal statewide. Therefore, no specific nutrient reductions have been targeted for private sewage disposal systems. Evaluation of nutrient contributions from private sewage disposal systems is recommended in targeted watersheds as the impacts may vary from watershed to watershed. Much of Iowa's efforts with private sewage disposal systems consist of upgrading failing systems through routine inspections by counties and through Iowa's "time of transfer" septic system inspection law that took effect in 2009.

Source Water Protection

Source water protection efforts in Iowa utilize many of the same practices outlined in the strategy for reducing nutrient impacts on groundwater. These efforts also provide nutrient reductions to surface waters in Iowa.

Most Iowans rely on groundwater for potable water uses including drinking water, bathing and other household uses. In addition, many Iowa industries use groundwater in their manufacturing and processing operations. Protecting groundwater from nonpoint source and point source contamination is important to the health and well-being of all Iowans as well as the states' economy.

Nitrate is the most common contaminant in Iowa's groundwater. Once nitrate enters the groundwater it is expensive to remove, and for some communities, treatment of source water for drinking water becomes an economic hardship. Iowa's Source Water Protection Program seeks to educate the public, and especially local officials, on the benefits of preventing contamination of groundwater, especially groundwater that is or may be used as a drinking water source. The framework described in this strategy can provide a major impetus for implementing practices that will aid in reducing current nitrate contamination while protecting susceptible water supplies from future nitrate contamination.

Iowa's Clean Water State Revolving Fund (CWSRF) offers loan funding to assist in financing design for these facilities' improvements. The CWSRF program is jointly administered by IDNR and the Iowa Finance Authority. IDNR oversees the specific aspects of the CWSRF program.

6. Accountability and Verification Measures

The NRS Logic Model for Progress Measurement identifies state-wide indicators that are being tracked and reported on the Dashboard for documenting progress.

The IDNR led a technical work group to define the process for providing an annual nutrient load estimate (i.e., nutrient budget) based on the ambient water quality data network. This includes specifying the most appropriate mathematical model, the acceptability of the data and a process for making future adjustments based on the latest information and advancements in science and technology.

Regarding point sources, the IDNR provides a regular nutrient load estimate for point sources. The IDNR will track progress for implementing the point source nutrient reduction strategy using several measures:

1) Number of permits issued that require nutrient reduction feasibility studies
2) Number of nutrient reduction feasibility studies submitted
3) Number of permits amended with nutrient removal/reduction construction schedules
4) Number of nutrient removal/reduction facilities in place/in design/under construction
5) Number of facilities monitoring nutrient in their effluent
6) Total N and P loads discharged from point sources
7) Results from comprehensive annual ambient stream monitoring and analysis utilizing existing permanent monitoring locations and focused study areas

Regarding nonpoint sources, the INRS Logic Model provides a framework to track progress, beyond the traditional ambient water quality monitoring networks. Among other leading indicators it uses annual statistical surveys with private sector retailers that characterize on-farm adoption of in-field nutrient-reduction practices, a suite of practices installed through private/public sector programs, outreach events and funding levels over time.

The WRCC collaborates with the Iowa State University CALS nutrient science assessment team to support

science and technical assessments of success measurement for the strategy.

The WRCC member agencies voluntarily apply their data, programs and resources to help implement this strategy within targeted/priority sub-watersheds to report edge-of-field practice adoption to estimate nutrition reduction within a watershed.

Establishment and refinement of a public-private reporting system that documents nutrient management and conservation system application statewide is coordinated through ISU CALS.

This system has these elements:

1. Private sector tracking system of conservation practices, structures, fertilizer sales and other farm inputs and outputs by MLRA. Privacy rights of individual farms shall be maintained.
2. Conduct a regular, periodic surveys and reporting to establish MLRA baselines, monitor progress and verify effectiveness.
3. Enhance the state's water monitoring to support watershed implementation strategies and to be useful in verifying performance.
4. Use appropriate modeling to project expected performance of implementation strategies.

7. Public Reporting

NRS related activities are reported and posted on the NRS Dashboards.

Activities reported will include the use of survey data, an annual survey of management practices and physical landscape structures aggregated at the HUC 8 scale. Reports will also document calculated or modeled load reductions from quantified best management practices and will document point source implementation efforts. The following shall be incorporated into the dashboards and future reports:

a. Watershed management plans shall include strategies to assess/demonstrate progress in implementing and maintaining management activities and achieving load reductions goals. These strategies shall include baselines of existing N and P loads and current BMPs, including in-field and edge-of-field technologies, and shall be implemented in each targeted/priority watershed. An evaluation of BMP effectiveness will be used in making future plan adjustments.
b. Progress in reducing TN and TP. Narrative updates on efforts detailed in the strategy for both point source and nonpoint source elements.
c. INRS activities are reported publicly on the state's website with a continuously open portal for comment and feedback. This allows for an adaptive management approach to improve implementation, strengthen collaborative local, county, state and federal partnerships, and to identify additional opportunities for accelerating cost-effective N and P load reductions.
d. The Iowa Nutrient Reduction Strategy will be reviewed and updated as needed. Any updates will be presented to the Water Resources Coordinating Council.

8. Nutrient Criteria Development

This strategy emphasizes implementation of technology-based nutrient reductions in the near-term, with continued assessment and development of suitable nutrient criteria as a long-term goal.

The IDNR is the designated agency with responsibility to establish and periodically update Iowa's water quality standards. Under the Federal Clean Water Act (CWA), the U.S. EPA also has the authority to promulgate water quality standards for Iowa when it is necessary.

Nutrient criteria approaches continue to evolve as many states explore the best alternatives for establishing appropriate nutrient standards. For the reasons described in Section 1.2, IDNR is continuing to evaluate other methods including analysis of stream nutrient stressor-response relationships for the determination of site-specific nutrient criteria and updated EPA 304(a) criteria approaches. These

approaches would involve the application of nutrient response indicator criteria (e.g., dissolved oxygen, chlorophyll A) as a means to establish appropriate site-specific nutrient targets, which together would form the basis for identifying nutrient-related impairments of beneficial water uses.

Section 3.4 shows a conceptual flow chart outlining potential steps for determining site-specific nutrient status and management actions within a watershed context. Similar to how the IDNR currently addresses nutrient-related impairments of lakes and streams, the model allows point source nutrient limits to be established as part of an adaptive watershed management plan that is solution-driven and provides flexibility in setting load reduction targets for point and nonpoint sources. Ambient water monitoring and effluent monitoring are key components of the assessment framework, allowing tracking of point source nutrient load reductions. Best management practice data collection and modeling are key components of nonpoint source nutrient load reduction programs. Both elements support the evaluation and application of site-specific nutrient targets.

The site-specific nutrient criteria approach is one of several alternatives that will be further evaluated as part of the IDNR's triennial water quality standards review process.

1.5 References

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Links in Document

1. Iowa Nutrient Reductions Strategy https://www.nutrientstrategy.iastate.edu/documents
2. Reducing soil erosion and P losses. https://www.nutrientstrategy.iastate.edu/sites/default/files/documents/INRS_2018_1980to96BaselineWork_NPSAndPSSummary_U20180926_Final.pdf
3. Biennial report to congress. https://www.epa.gov/ms-htf/hypoxia-task-force-reports-congress
4. INRS – N practice updates. https://www.nutrientstrategy.iastate.edu/sites/default/files/documents/INRS_2024_PracticeEffiencies Nitrogen_U20240319.pdf
5. Numeric nutrient criteria. https://www.epa.gov/nutrientpollution/numeric-nutrient-water-quality-criteria
6. Lake and Reservoirs numeric nutrient criteria. https://www.epa.gov/nutrientpollution/ambient-water-quality-criteria-address-nutrient-pollution-lakes-and-reservoirs
7. Streams and rivers numeric nutrient criteria. https://www.epa.gov/nutrientpollution/ecoregional-nutrient-criteria-rivers-and-streams
8. Hypoxia Task Force. https://www.epa.gov/ms-htf
9. Annual operating plans. https://www.epa.gov/ms-htf#plans
10. New Goal Framework. https://www.epa.gov/ms-htf/hypoxia-task-force-new-goal-framework
11. Gulf Hypoxia Program. https://www.epa.gov/ms-htf/gulf-hypoxia-program
12. 2011 Memo. https://www.epa.gov/nutrientpollution/working-partnership-states-address-phosphorus-and-nitrogen-pollution-through-use
13. EPA Policy and Supporting Documents. https://www.epa.gov/nutrientpollution/previously-issued-epa-nutrient-reduction-policies-and-supporting-documents
14. 2022 Nutrient Reduction Memo. https://www.epa.gov/nutrientpollution/2022-epa-nutrient-reduction-memorandum
15. WRCC. https://iowaagriculture.gov/water-resources-bureau/water-resources-coordinating-council
16. WPAC. https://iowaagriculture.gov/water-resources-bureau/watershed-planning-advisory-council
17. IDALS Field Services. https://iowaagriculture.gov/field-services-bureau
18. INRS Inputs Dashboard. https://www.arcgis.com/apps/dashboards/70af52e840d842aaa3b97a9346a94471
19. Iowa Finance Authority info. https://www.iowafinance.com/resource-archive/?program=State+Revolving+Fund+Water+Quality+Programs&page-id=5060
20. DNR programs. https://www.iowadnr.gov/Environmental-Protection/Water-Quality
21. DNR Nonpoint Source Management Plan. https://www.iowadnr.gov/environmental-protection/water-quality/watershed-improvement/nonpoint-source-plan
22. State Revolving Fund. https://www.iowasrf.com/
23. NRCS Programs – Iowa. https://www.nrcs.usda.gov/conservation-basics/conservation-by-state/iowa
24. FSA Conservation Programs. https://www.fsa.usda.gov/resources/programs/conservation-reserve-program
25. INRS Tracking. https://nrstracking.cals.iastate.edu/tracking-iowa-nutrient-reduction-strategy
26. RCPP Projects – Iowa. https://www.nrcs.usda.gov/programs-initiatives/iowa/RCPP
27. Mississippi River Basin Healthy Watershed Initiative. https://www.nrcs.usda.gov/programs-initiatives/mississippi-river-basin-healthy-watersheds-initiative/iowa/mississippi-river
28. Climate Smart Commodities. https://www.usda.gov/climate-solutions/climate-smart-commodities

29. Iowa Agriculture Water Alliance. https://www.iaagwater.org/
30. INREC. https://iowanrec.org/
31. Conservation Agronomists. https://www.acwaiowa.com/conservation-agronomists-network/
32. Baseline Document. https://www.nutrientstrategy.iastate.edu/sites/default/files/documents/INRS_2018_1980to96BaselineWork_NPSAndPSSummary_U20180926_Final.pdf
33. NRI. https://www.nrcs.usda.gov/nri
34. Census of Ag. https://www.nass.usda.gov/AgCensus/index.php
35. CEAP. https://www.nrcs.usda.gov/ceap
36. Ag BMP Mapping. https://www.gis.iastate.edu/BMPs
37. INREC Measurement Progress. https://iowanrec.org/progress-measurements/
38. INRC. https://www.cals.iastate.edu/inrc/
39. Iowa Source Water Protection Program. https://www.iowadnr.gov/Environmental-Protection/Water-Quality/Source-Water-Protection

List of Iowa Nutrient Reduction Strategy Acronyms

AFO	Animal feeding operations
ARS	Agricultural Research Service
ASIWPCA	Association of State and Interstate Water Pollution Control Administrators
AWW	Average Wet Weather
BIL	Bipartisan Infrastructure Law
BMP	Best Management Practice
BNR	Biological nutrient removal
CCA	Certified Crop Advisors
CEAP	Conservation Effects Assessment Project
CREP	Conservation Reserve Enhancement Program
CRP	Conservation Reserve Program
CWA	Clean Water Act
CWSRF	Clean Water State Revolving Fund
EPA	Environmental Protection Agency
FSA	Farm Service Agency
FY	Fiscal Year
GHP	Gulf Hypoxia Program
HTF	Hypoxia Task Force
HUC	Hydrologic unit code
IAWA	Iowa Agricultural Water Alliance
IDALS	Iowa Department of Agriculture and Land Stewardship
IDNR	Iowa Department of Natural Resources
INREC	Iowa Nutrient Research and Education Council
INRS	Iowa Nutrient Reduction Strategy
ISU	Iowa State University
ISU-CALS	Iowa State University College of Agriculture and Life Sciences
L	Liter
mg	Milligrams
MGD	Million gallons per day
MHI	Median household income
MLRA	Major Land Resource Area
MMP	Manure management plan
MRBI	Mississippi River Basin Initiative
N	Nitrogen
NGO	Non-governmental Organization
NPDES	National Pollutant Discharge Elimination System
NPS	Nonpoint Source
NRCS	Natural Resources Conservation Service
NRE	Nutrient Reduction Exchange
NRI	National Resources Inventory
NRS	Nutrient Reduction Strategy
NWQI	National Water Quality Initiative
P	Phosphorus
POTW	Publicly-Owned Treatment Works

PS	Point Source
RCPP	Regional Conservation Partnership Program
REAP	Resource Enhancement and Protection Program
SRF	State Revolving Fund
SWCD	Soil and Water Conservation Districts
TMDL	Total maximum daily load
TN	Total nitrogen
TP	Total phosphorus
USDA	United States Department of Agriculture
USGS	U.S. Geological Survey
WIRB	Watershed Improvement Review Board
WPAC	Watershed Planning Advisory Council
WQI	Water Quality Initiative
WQIF	Water Quality Initiative Fund
WRCC	Water Resources Coordinating Council