ITEM # 2

Staff Report

NUTRIENT REDUCTION EVALUATION

November 20, 2018

At the workshop on November 20, 2018, City staff and its consulting engineers with HDR Engineering, Inc. will provide a brief review of the evaluation that has been performed to identify the strategy for complying with the Iowa Nutrient Reduction Strategy. The final recommendation from the evaluation is that the City should pursue a two-track approach to meet the goals of the Nutrient Reduction Strategy.

The first track is to modify the Water Pollution Control Facility to achieve the targeted 67% reduction in Total Nitrogen and 75% reduction in Total Phosphorus, with the implementation being phased in over a period of 20 years. The phased approach allows existing infrastructure with remaining useful life to be fully utilized before being replaced. It also allows for the facility's capacity to be expanded over time to accommodate growth in the Ames community.

The second track is to pursue watershed-based Best Management Practices (such as wetlands, buffer strips, cover crops, stream bank stabilization, and similar land practices). These practices will not reduce the size or scope of the mechanical upgrades at the Water Pollution Control Facility. However, staff believes that the nutrient reduction from these sorts of projects will ultimately be able to be "banked" in the newly created Nutrient Reduction Exchange, and be available as an offset for any further reductions in the nutrient standards in the future.

Projects that would be pursued under this track would be those that would offer additional ancillary benefits in addition to nutrient reduction. Potential ancillary benefits would vary by project, but could include things like: flood mitigation; drinking water source protection; new or improved recreational opportunities; improved or restored wildlife habitat; and water quality benefits beyond nutrient reduction.

BACKGROUND:

The Ames Water Pollution Control Facility (WPCF) is an advanced secondary treatment facility using a trickling filter/solids contact treatment scheme. The facility has a rated maximum wet-weather capacity of 20.4 million gallons per day and had an annual average flow of 6.0 million gallons per day in calendar year 2017. The facility has maintained a 100% compliance record with the numeric limitations of its permit since becoming fully operational; a streak that, according to the National Association of Clean Water Agencies, is the second-longest active compliance record in the nation.

In May 2016, the City received a draft NPDES permit from the Iowa Department of Natural Resources. Included in that draft was a requirement to perform an evaluation of the feasibility and reasonableness of reducing nitrogen and phosphorus discharged into the receiving stream. The City raised a number of concerns with new requirements contained in the draft permit, including the nutrient reduction requirements. The City was notified in August 2016 that the permit was being withdrawn. As of the date of this staff report, no replacement permit has been provided by the State, and the Facility continues to operate under the terms of its expired permit.

Even though no new permit has been issued and the obligation to perform a nutrient reduction feasibility study has not formally been imposed, the City chose to perform that evaluation now. The reason was a concern about the remaining life of the trickling filter media. The four filters are packed with corrugated plastic sheeting that provides a surface for the waste-consuming bacteria to attach to and grow. The plastic modular media is original to the plant construction, and has been in service for 29 years. The media has an assumed life of 20-30 years, and staff estimate a cost in excess of $10 million to replace the media in the filters. While trickling filters are very good at removing conventional pollutants like biochemical oxygen demand (BOD) and Total Suspended Solids (TSS), they perform poorly at removing nutrients. As such, staff felt this was a significant financial reason for determining a long-term strategy to comply with the Nutrient Reduction Strategy.

In April of 2018, City Council executed a contract with HDR Engineering to perform the nutrient reduction evaluation. A workshop-based process has been utilized that maximized participation by multiple City departments (Water & Pollution Control, Public Works, Parks & Recreation), as well as important external stakeholders like Prairie Rivers of Iowa, Iowa State University, and the Iowa Department of Natural Resources. That process culminates in the City Council workshop on November 20, 2018.

WATERSHED-BASED ALTERNATIVES:

Nutrient offset is a form of water quality trading whereby nutrient reduction requirements for point sources under the Clean Water Act may be achieved from offsite reductions. As

commonly conceived, agricultural practices play an integral role in providing such offsets. The motivations for point-nonpoint source trading can be numerous including reduced costs and other ancillary benefits such as mitigating the impacts of flooding. Implementation practices designed to reduce agricultural nutrient loadings can also help improve agricultural productivity by improving soil quality, moisture retention, and the timing of nutrient availability.

Recognizing the potential benefits of water quality trading, the Iowa Nutrient Reduction Strategy states that the Water Resources Coordinating Council (WRCC) and its member organizations will cooperate with and assist non-governmental organizations interested in developing a voluntary nutrient credit trading program in Iowa. Furthermore, the NRS states that where available and allowable by law, incentives may be provided to encourage and facilitate nutrient credit trading as a means to reduce nutrient loadings to rivers and streams.

After evaluating a wide range of watershed-based Best Management Practices, it was concluded that watershed-based nutrient reduction is not a practical means to completely eliminate the need for nutrient reduction improvements at the Ames WPC Facility. Land requirements for achieving those nutrient reductions are surprisingly large. Approximately 176,500 acres suitable for constructed wetlands and 235,100 acres suitable for riparian buffers have been identified in the upstream watershed. **To fully offset the required WPCF phosphorus reductions, approximately 115,700 acres suitable for constructed wetlands (i.e., 66 percent of suitable acreage), 372,700 acres suitable for riparian buffers (i.e., over 100 percent of suitable acreage), or some combination of the two would be required. The consultants noted that there is no precedent with the Iowa Department of Natural Resources to offset point source nutrient reduction requirements by using watershed BMP projects. As such, money invested in watershed reductions demonstrates commitment and progress towards the objectives of the Iowa NRS, but provides no direct short-term benefit in terms of mitigating WPCF nutrient reduction requirements.**

Even though the study determined that offsite nutrient reduction was not a viable route towards offsetting the City's obligations at the WPC Facility, the study nevertheless recommends that the City make a commitment to pursue watershed-based BMP projects for the following reasons.

- It demonstrates commitment to the goals and objectives of the Iowa Nutrient Reduction Strategy.

- When performed on City property, it demonstrates leadership and good stewardship on behalf of the City.

- When properly selected, BMP's can provide additional ancillary benefits like flood mitigation, erosion control, source water protection, habitat restoration, and recreational opportunities.

- While there is not currently a regulatory benefit for implementing watershed practices, the Iowa Department of Natural Resources is working with the Iowa League of Cities to establish the Iowa Nutrient Reduction Exchange. The Iowa DNR's stated intent is to allow projects registered with the Exchange to offset any more stringent requirements in the future.

The study recommends that watershed-based projects be prioritized in the following order.

- Projects on City-owned land. This should be the first priority as both a demonstration of responsible land ownership and a show of support for the ultimate goals of the Iowa Nutrient Reduction Strategy.

- Projects within the City limits that provide additional ancillary benefits. Staff believes that projects that provide additional benefits would provide a greater return on the investment of sewer rate payer's monies. And having those benefits inside the City limits provides the greatest access to any ancillary amenities for Ames rate payers.

- Projects upstream of Ames that provide additional ancillary benefits. Performing these improvements upstream means that any water quality or quantity benefits will be realized by Ames rate payers.

WATER POLLUTION CONTROL FACILITY IMPROVEMENTS:

The study revealed that 20 percent of the phosphorus and 5 percent of the nitrogen loadings on the Skunk River immediately downstream of the Ames WPC Facility are from the WPC Facility itself. Iowa's Nutrient Reduction Strategy targets 75 percent reduction in phosphorus and 67 percent reduction in nitrogen loadings from wastewater treatment facilities. These reductions are to be achieved through implementation of biological nutrient removal through improvements on a timeline to be established by each City, but ultimately approved by the Iowa Department of Natural Resources.

The study reached the following conclusions about the existing infrastructure at the WPC Facility.

- The existing trickling filters have performed extremely well for BOD and TSS removal, but they provide limited capability to achieve the required nutrient reduction and have a limited capacity for future growth. Coupled with uncertainty regarding the remaining useful life of the media, the existing trickling filters should not be a significant part of the long-term solution and may not be worth continued investment short-term. The remaining useful life of the trickling filters is difficult to predict but generally believed to be as few as 5 years and as many as 10 years.

- Money could be better spent moving forward with an alternative technology to replace the trickling filters to provide both nutrient reduction and capacity for growth.

- The existing Solids Contact Basin and existing clarifiers have considerable remaining useful life and should be integrated with the alternative technology to the extent possible.

- Optimization of the existing trickling filter system makes sense in concept, but only as an initial, interim step and only to the extent that such optimization does not require any additional significant investment in the existing trickling filters.

Multiple treatment technologies were evaluated, with consideration given for both the up-front capital costs as well as the on-going operations and maintenance costs. Additionally, a series of non-monetary criteria were also considered, including things like: the response of the treatment scheme to wet-weather flows; impacts to the solids handling portion of the treatment process; the safety of the technology; and consideration for the degree of operator and maintenance "friendliness" of the technology.

Ultimately, three technologies emerged as potential candidates.

Technology	Total Capital Costs*	Annual O&M Costs	Present Worth**
Simultaneous Nitrification Denitrification	$28.0 million	$1.69 million	$53.1 million
Conventional Activated Sludge configured for Biological Nutrient Removal	$26.3 million	$1.20 million	$44.3 million
Granular Activated Sludge	$32.1 million	$1.15 million	$49.3 million

* - includes engineering costs

** - 3% interest, 20 years

The ultimate recommendation from the study was to tentatively adopt the conventional activated sludge-biological nutrient removal scheme for the purposes of establishing budgets and rates. Given the very high level cost estimates developed as a part of this study, all three projects could be considered to have essentially the same capital costs. Technology for nutrient removal is evolving at a very quick pace, and it seems reasonable to anticipate that costs may lower over time for some of the technologies.

PHASING OF MODIFICATIONS AT THE WPC FACILITY:

As was described above, one of the goals of the study was to identify ways to maximize the use of the existing infrastructure. The biggest hurdle in doing so was the trickling filters. The filters do not have a meaningful role in the future for nutrient reduction, but are believed to have another five to ten years of useful life remaining.

With that thought in mind, the consulting team devised a phased implementation scheme that will allow the trickling filters to operate for another ten years, while progressively moving the facility towards fully achieving the goals of the Nutrient Reduction Strategy over a period of 20 years. Implementation would progress in three phases.

- **Phase One** would include the construction of additional capacity downstream of the 1st stage trickling filters and upstream of the existing Solids Contact Basin. This capacity could provide redundant capacity should the trickling filters fail, thus allowing the trickling filters to "run to failure" without a significant risk of violating the discharge permit requirements.

- **Phase Two** would remove the 1st stage trickling filters, and convert the basins constructed in Phase One to the conventional activated sludge-biological nutrient removal treatment process. It would also include the construction of a new return/waste sludge pump station, sludge fermentation, sludge thickening, and additional blower capacity.

- **Phase Three** would remove the 2nd stage trickling filters, add additional conventional activated sludge-biological nutrient removal treatment trains, and add additional blower capacity.

STAKEHOLDER ENGAGEMENT:

Gathering input and feedback from stakeholders is an important goal for all major initiatives at the City of Ames. This study took a unique approach by actually inviting several key stakeholder groups to be active participants in the process, allowing staff and its consultants to gain their perspectives immediately. The participating stakeholder groups included: Prairie Rivers of Iowa, faculty and research staff from Iowa State University, and representatives from the Iowa Department of Natural Resources. One of the outcomes of this form of stakeholder engagement was that City staff were able to partner with ISU researchers to submit a grant that evaluates the interrelationship between water, energy, and food production systems.

Additionally, two public open house-style meetings were held in October to offer an opportunity for other interested individuals and organizations to learn more about the study, and to offer their thoughts on the direction the City should take. The feedback from the October open houses was revealing, even when considering that the survey responders were predisposed to have an interest in the topic.

- Every response (18 out of 18) answered "yes" to the question "Based on your knowledge, do you believe the Ames Sewer Utility should invest rate payer dollars in addressing nutrients?"

- 85% responded that they would support the City spending rate payer dollars to invest in upstream watershed projects.

- 89% responded that they would support the City spending rate payer dollars to invest in treatment plant upgrades.

- Below are responses to the following question: "The current median residential sewer bill in Ames is $27.15 per month. How much additional do you think is reasonable to ask rate payers to pay to address nutrients in and around Ames?"

    - 6% chose "An additional 50% (an additional $13.58 per month)
    - 44% chose "An additional 25% (an additional $4.79 per month)
    - 44% chose "An additional 10% (an additional $2.72 per month)
    - 6% chose "No additional increase in sewers bills would be appropriate).
    - Comments on this question are shown below.
        - Why should rate payers pay for the problem? Find the source and have them pay for it.
        - $35 per month
        - Not enough info to make informed choice; additional 35% might be reasonable. It's a big problem.
        - $5.00 per month

- Other comments provided are shown below.
    - I would understand paying for practices outside city limits and rate increases to meet treatment levels. Ames should be a state leader in demonstrating and promoting.
    - Make a better awareness to the public about the concerns of excess nutrients so that they would be more willing and understanding to support rate payer dollars to go towards environmental causes.
    - Cities are going to be forced to act. The hope is that the agro community will also eventually be required to act.
    - I think that there is too much fertilization and treatment with pesticides and herbicides to lawns and grassy areas such as golf courses and parks. I also think building infrastructure in floodplain is insane.

IMPLEMENTATION:

Based on the conclusions and recommendations of this study, staff has prepared two Capital Improvement Plan projects that will be presented to Council in January.

The first CIP project will be an updated version of the "Nutrient Reduction Modifications" project that was included in last year's CIP. This new page will include the capital cost information provided by HDR, *with the costs inflated forward to the year each phase would be implemented*. That project will earmark the following dollar amounts. **It should be noted that the total project cost is slightly less than is shown in the current version of the CIP, but the costs are now spread out over 20 years, instead of all being incurred within the first six years.**

2022/23 – 2024/25	Phase One	$10,200,000
2027/28 – 2028/29	Phase Two	$14,260,000
2037/38 – 2038/39	Phase Three	$15,170,000
	Total	$39,630,000

The second CIP project will be a new project shown for the first time, titled "Watershed-Based Nutrient Reduction." This project will set aside $100,000 per year to undertake the implementation of Best Management Practices in the watershed. The money can be considered as a "placeholder," until specific projects are identified. It is possible that the funds could be allowed to accumulate for a few years to allow for larger scale projects to be undertaken. It would also allow the flexibility to suspend the project for a year or two if the funds are needed for other higher-priority purposes.

Working draft copies of the planned Capital Improvements Plan (CIP) projects are shown on the following pages.

DRAFT

NUTRIENT REDUCTION MODIFICATIONS **PROJECT STATUS:** Scope Change Cost Change 11-14-18

City of Ames, Iowa
Capital Improvements Plan

DESCRIPTION/JUSTIFICATION

In early 2013, the Iowa Department of Natural Resources (IDNR) released the Iowa Nutrient Reduction Strategy. This strategy will require the State's 102 largest municipal wastewater facilities to install "technically and economically feasible process changes for nutrient removal." A feasibility study was completed in early 2019 that identified the City's desired approach to meet the nutrient standards. The cost estimates shown below are built around the "Conventional Activated Sludge – Biological Nutrient Removal" treatment scheme, implemented over a 20 year period. The actual treatment scheme will need to be confirmed closer to construction so that advances in technology and the state of the art can be incorporated.

COMMENTS

The Iowa Nutrient Reduction Strategy lays out a schedule for point source discharges based on the National Pollutant Discharge Elimination System (NPDES) permit renewal cycle for each facility. When the next permit is issued, the City will be required to submit a plan to the Iowa Department of Natural Resources that evaluates the cost and feasibility of installing nutrient reduction at the facility. The facility will then receive a compliance schedule requiring the construction of nutrient reduction facilities during subsequent NPDES permits.

2017/18	$ 285,000	Preliminary Engineering Report
2022/23 – 2024/25	10,200,000	Phase 1 Engineering and Construction
2027/28 – 2028/29	14,260,000	Phase 2 Engineering and Construction
2037/38 – 2038/39	15,170,000	Phase 3 Engineering and Construction
Total	$ 39.915.000	

The above schedule would construct back-up capacity for the trickling filters in Phase 1, with engineering beginning in FY 22/23 and construction occurring over the following two years. The second phase would begin in approximately FY 27/28 and would remove the trickling filters and construct additional nutrient removal capacity. The third and final phase would begin in approximately FY 37/38, bringing on-line the full nutrient reduction capacity. This work will replace other major investments that would otherwise be needed, including: an "integrated fixed-film activated sludge" modification to meet the anticipated lower ammonia discharge limits ($3.16 million); and a trickling filter media replacement ($8.13 million).

LOCATION

WPC Facility; four miles south of Highway 30, east of I-35

	TOTAL	2019/20	2020/21	2021/22	2022/23	2023/24
COST:						
Engineering	1,260,000				1,260,000	
Construction	4,390,000					4,390,000
TOTAL	**5,650,000**				**1,260,000**	**4,390,000**
FINANCING:						
Clean Water State Revolving Fund	5,650,000				1,260,000	4,390,000
TOTAL	**5,650,000**				**1,260,000**	**4,390,000**

PROGRAM - ACTIVITY: Utilities - WPC Plant

DEPARTMENT: Water and Pollution Control

ACCOUNT NO.

WATERSHED-BASED NUTRIENT REDUCTION **PROJECT STATUS:** New

DRAFT
10-26-18

City of Ames, Iowa
Capital Improvements Plan

DESCRIPTION/JUSTIFICATION

The Water Pollution Control Facility is being converted to a nutrient removal treatment technology over a period of 20 years. Separate from the work that will occur inside the treatment plant, watershed-based improvements performed by the City can be included in the Iowa Nutrient Reduction Exchange. Staff is currently working with the Iowa League of Cities and other large utilities to encourage the Iowa Department of Natural Resources to allow these off-site nutrient reductions to be "banked" as credit towards any future, more stringent nutrient reduction requirements imposed on the WPC Facility. This project sets aside $100,000 per year that can be put towards urban watershed improvements that have a nutrient reduction component.

COMMENTS

Projects undertaken will not only have a nutrient reduction element, but will also be projects that provide additional, ancillary benefits such as: flood risk reduction, increased recreational opportunities; improved wildlife habitat; urban storm water management; and drinking water source protection. It is possible that a project may not be undertaken every year. Funds may be allowed to accumulate to enable a larger-scale project to be undertaken.

LOCATION

Throughout the community; specific locations will vary by year

	TOTAL	2019/20	2020/21	2021/22	2022/23	2023/24
COST:						
Engineering	100,000	20,000	20,000	20,000	20,000	20,000
Construction	400,000	80,000	80,000	80,000	80,000	80,000
TOTAL	**500,000**	**100,000**	**100,000**	**100,000**	**100,000**	**100,000**
FINANCING:						
Sewer Utility Fund	500,000	100,000	100,000	100,000	100,000	100,000
TOTAL	**500,000**	**100,000**	**100,000**	**100,000**	**100,000**	**100,000**

PROGRAM - ACTIVITY: Utilities - WPC Plant

DEPARTMENT: Water and Pollution Control

ACCOUNT NO.

City of Ames

Nutrient Feasibility Study

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Today's Objective

Council Work Session

1. Provide overview of work completed to date.
2. Identify recommended path forward (unless directed otherwise).

Today's Agenda

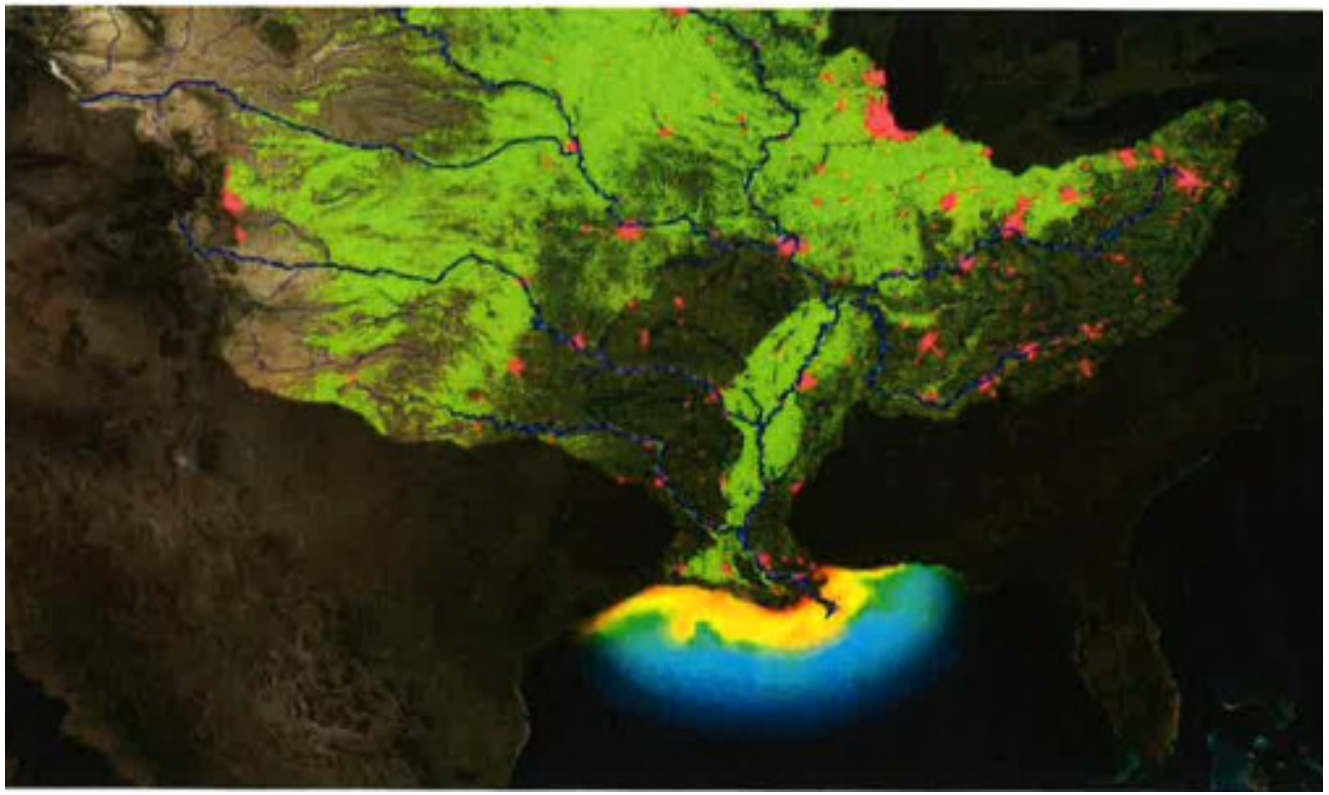
Council Work Session

1. Drivers
2. Approach
3. Watershed Analysis and Findings
4. Water Pollution Control Facility (WPCF) Analysis and Findings
5. Watershed Alternatives
6. WPCF Alternatives
7. Summary Strategy
8. Questions and Directions

Drivers

Iowa Nutrient Reduction Strategy

45% Reduction in Nutrients (Nitrogen and Phosphorus) Leaving the State



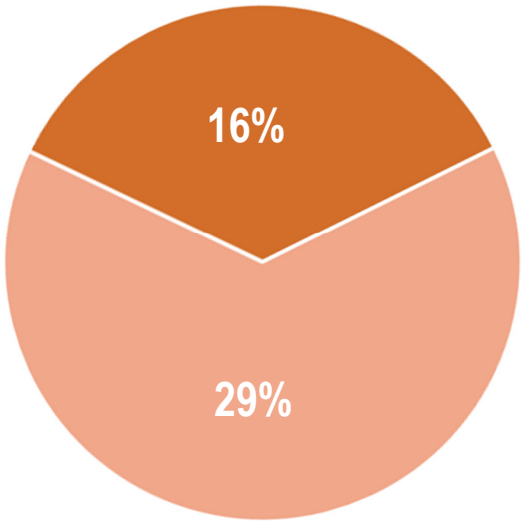
Iowa Nutrient Reduction Strategy

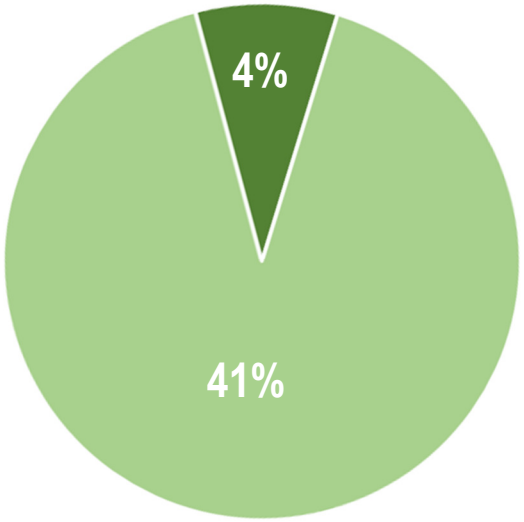
45% Reduction in Nutrients (Nitrogen and Phosphorus) Leaving the State

Biological Nutrient Removal (BNR) for Point Sources

Required ~75% Phosphorus Reduction & ~67% Nitrogen Reduction

Current ~19% Phosphorus & ~36% Nitrogen



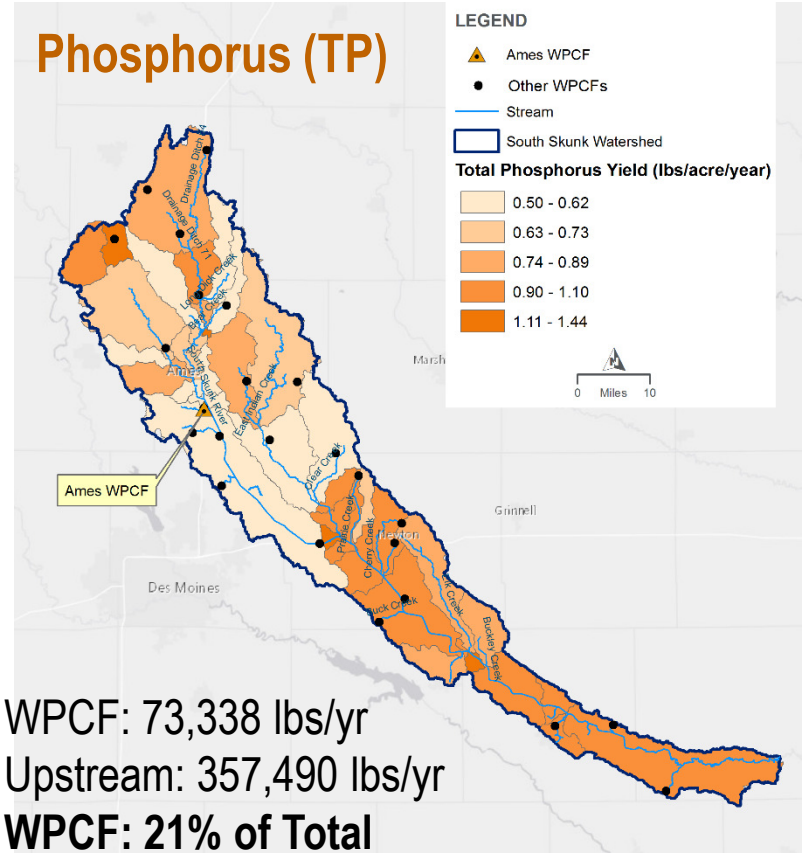


Voluntary Reductions from Nonpoint Sources

Nutrient Baseline

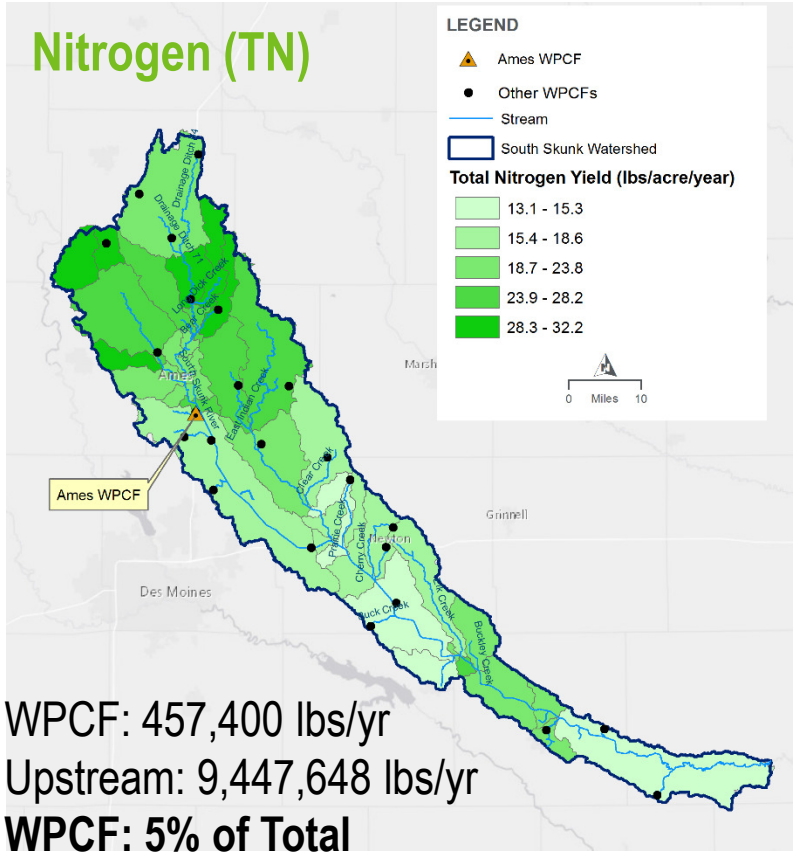
SPARROW Model Upstream of WPCF

Phosphorus (TP)



WPCF: 73,338 lbs/yr
Upstream: 357,490 lbs/yr
WPCF: 21% of Total

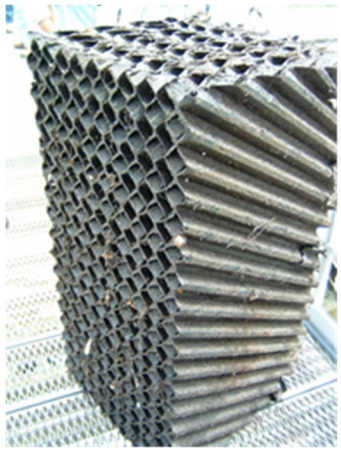
Nitrogen (TN)



WPCF: 457,400 lbs/yr
Upstream: 9,447,648 lbs/yr
WPCF: 5% of Total

Age and Condition of Trickling Filters

Initial Operation in 1989



Media Inside

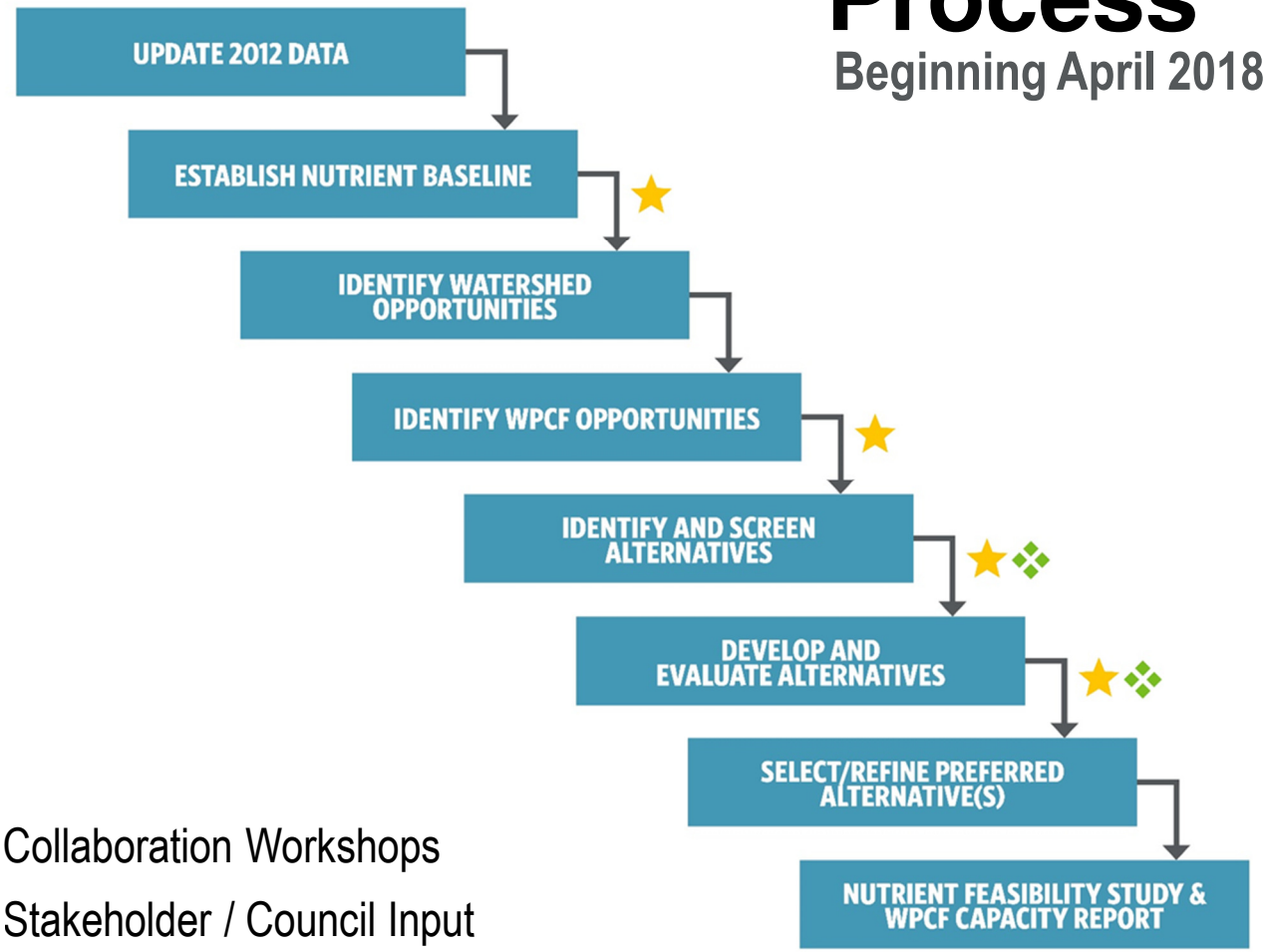
Exterior Structure

- 5 - 10 Years Remaining?
- $8.8 million to Replace
- Great for Organics
- Limited Value for BNR

Approach

Process

Beginning April 2018



★ Collaboration Workshops

❖ Stakeholder / Council Input

Objective

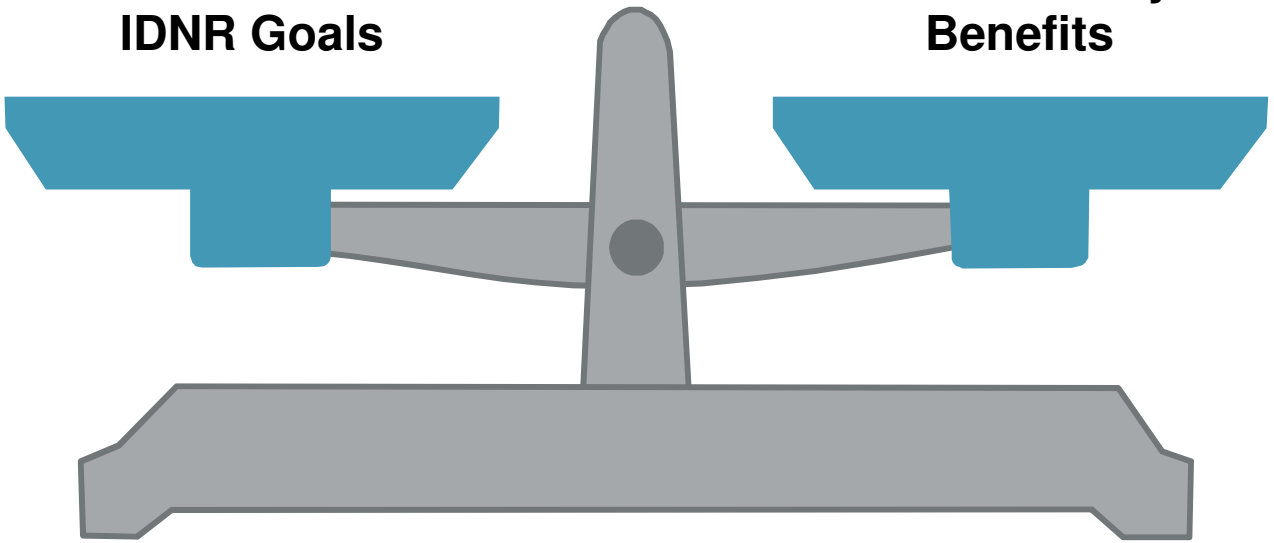
Find the Appropriate Balance

Cost of and timing of Nutrient Removal

IDNR Goals

Rate Impacts

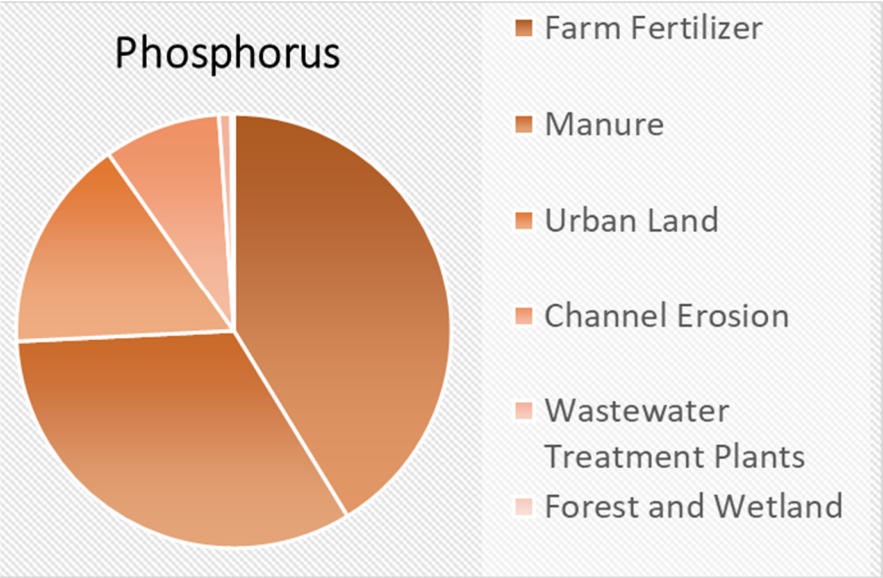
Water Quality Benefits

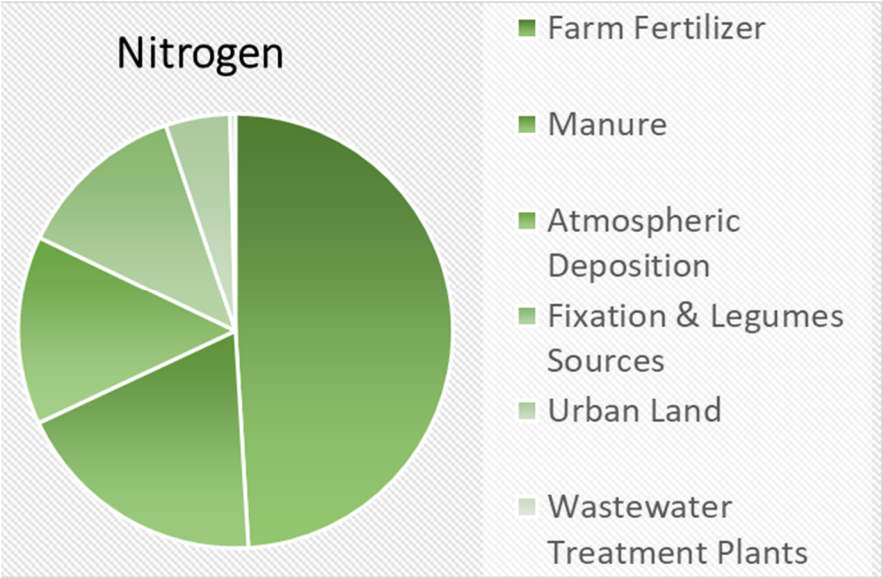


Watershed Analysis and Findings

Watershed Sources

SPARROW Model Upstream of Ames WPCF





Farm Fertilizer and Manure are 74% of Phosphorus and 68% of Nitrogen Loadings

Watershed Reduction Options

Potential Offsets for WPCF Reductions

Practice
Cover crops
Water & Sediment Control Basins
Constructed wetlands
Denitrification bioreactors
Riparian buffers
Grassed waterways

Water & Sediment Control Basin

Riparian Buffer

Constructed Wetland

Grassed Waterway

Woodchip Bioreactor

Watershed Reduction Options

Reductions & Costs

Practice	% Reduction		Cost of TN Reduction, $/lb	Cost of TP Reduction, $/lb
	TN	TP		
Cover crops	31%	29%	$6.00	$210
Water and sediment control basins	0%	80%	--	$29
Constructed wetlands	52%	58%	$1.20	$35
Denitrification bioreactors	43%	0%	$1.50	--
Riparian buffers	7%	18%	$5.50	$70
Grassed waterways	7%	18%	$33	$410

Constructed Wetlands are Best Value for Nitrogen and Phosphorus

Bioreactors for Nitrogen & WASCBs for Phosphorus also offer Value

Watershed Reduction Options

Potential Applicability

Practice	Treatment Area, ac	Potential Credits (lbs/yr)	
		TN	TP
Cover crops	304,133	2,262,768	65,280
Water & Sediment Control Basins	7,768	0	4,896
Constructed wetlands	**176,507**	**2,202,792**	**75,752**
Denitrification bioreactors	57,870	597,176	0
Riparian buffers	**235,100**	**394,944**	**31,280**
Grassed waterways	65,663	110,296	8,704

Cover Crops are focus of ISU Research

WPCF Required Reductions

- 49,640 lbs/yr TP
  - 67% Available Wetland Acres
- 213,890 lbs/yr TN
  - 10% Available Wetland Acres
  - 54% Available Riparian Acres

Limited potential for TP Offsets
Some potential for TN Offsets

Watershed Reduction Options

Ongoing ISU Efforts

Perennial Ground Cover

Riparian Energy Crop

Affordable nonpoint source reductions relieve pressure on future point source reductions

Urban BMPs

With Ancillary Nutrient Reduction Benefits

- City Hall Parking Lot Reconstruction
- Stormwater Erosion Control Project - South Skunk River from Carr Park to Homewood Golf Course
- Bioretention Cells on 24th Street with Street Rehabilitation Project
- Riffle Pools and Streambank Stabilization with Squaw Creek Water Main Stabilization at Lincoln Way
- Phosphorus Free Fertilizer on Parks
- Water Quality Treatment of Stormwater Runoff through City's Current Post-Construction Ordinance

Watershed Findings

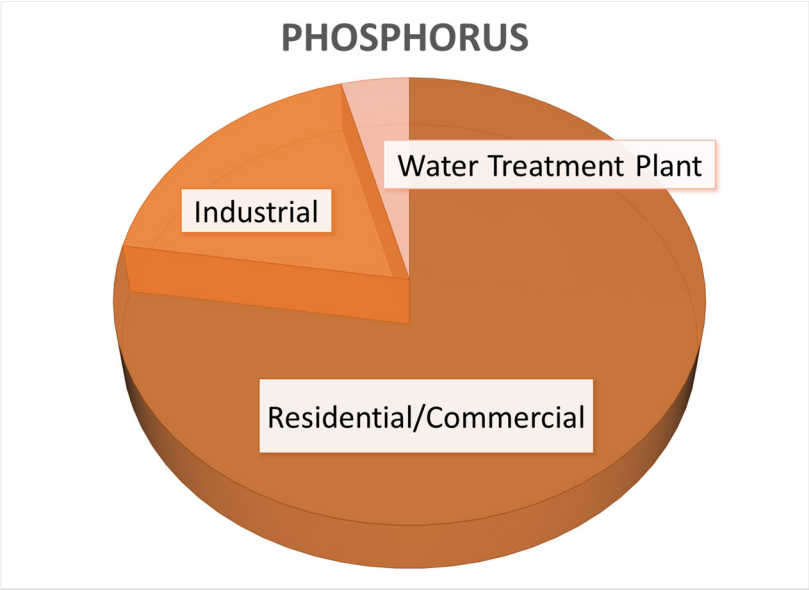
Nutrient Reduction

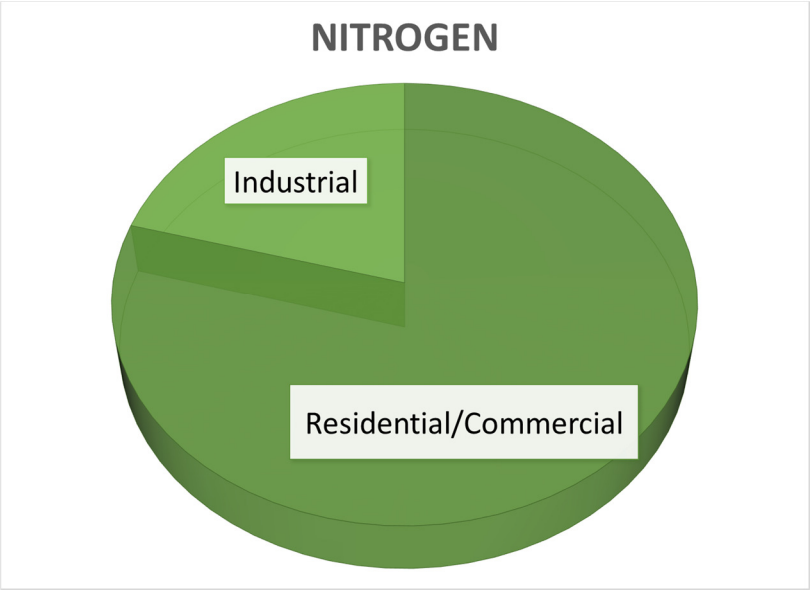
- ***Not practical to entirely offset the need for WPCF reductions.***
- Land requirements are surprisingly large.
- There is no guarantee off offsets short term but an exchange program is under development for offsets longer term .
- The City has and should continue to include urban BMPs that have achieved nutrient reductions as ancillary benefits.
- Watershed reductions may still be useful to demonstrate leadership, make progress, and offset future requirements.

WPCF Analysis and Findings

WPCF Sources

WPCF Influent Data





Greatest contribution is from Residential / Commercial Sources

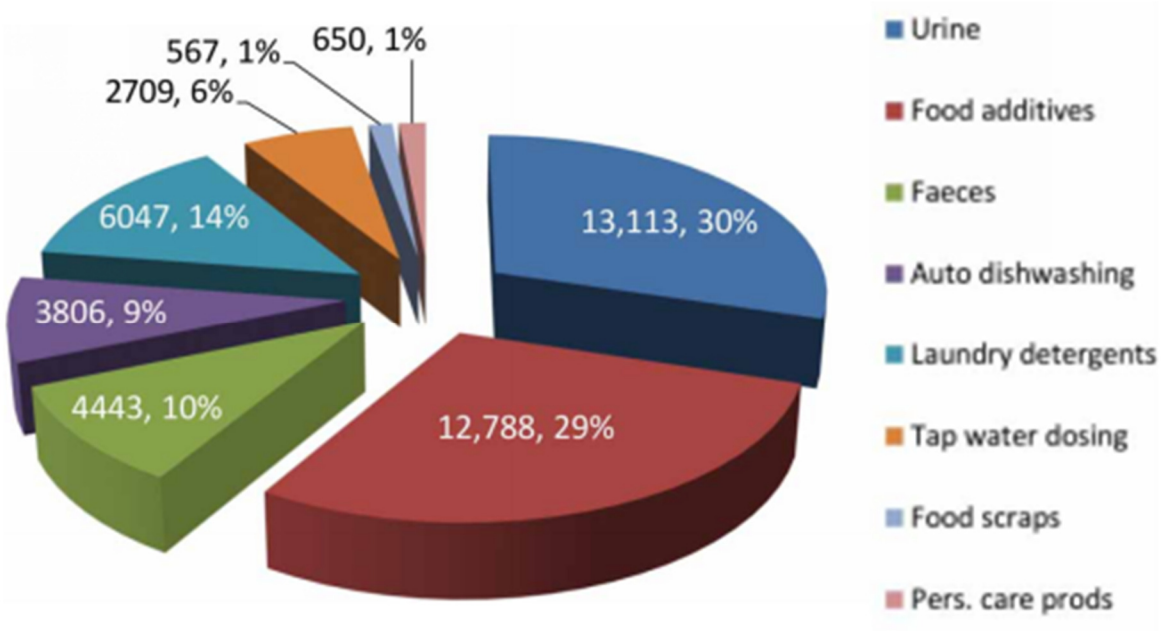
No single large industrial contributor

(ISU Central Campus, Hach South, NCAH North, Mary Greeley, Danfoss)

Water Treatment Plant is insignificant.

Residential / Commercial Sources

Phosphorus Data from Sean Comber, etal 2012



Detergent Contributions have been reduced Significantly in last 10 years

Additional Residential / Commercial Source Reductions are Challenging

WPCF Optimization Potential

Existing WPCF Modifications for Nutrient Removal

- 6 options – flow routing, repurposing of facilities, separate solids thickening, and/or modified operation
- Some achieved the required phosphorus reduction but with limited nitrogen reduction
- Capital Costs from $4.9 to $10.6 million
- Continued dependency on trickling filter technology

Cost effective if implemented in conjunction with alternative technology

WPCF Findings

Nutrient Reduction

- ***Facilities incorporating alternative treatment technology will be required to achieve required reductions.***
- Source reductions alone can not achieve required reductions.
- Facility optimization alone can not achieve required reductions.
- Existing trickling filters are not part of long term solution due to process limitations and condition
- Existing trickling filters should be used as long as condition allows to minimize customer rate impacts.

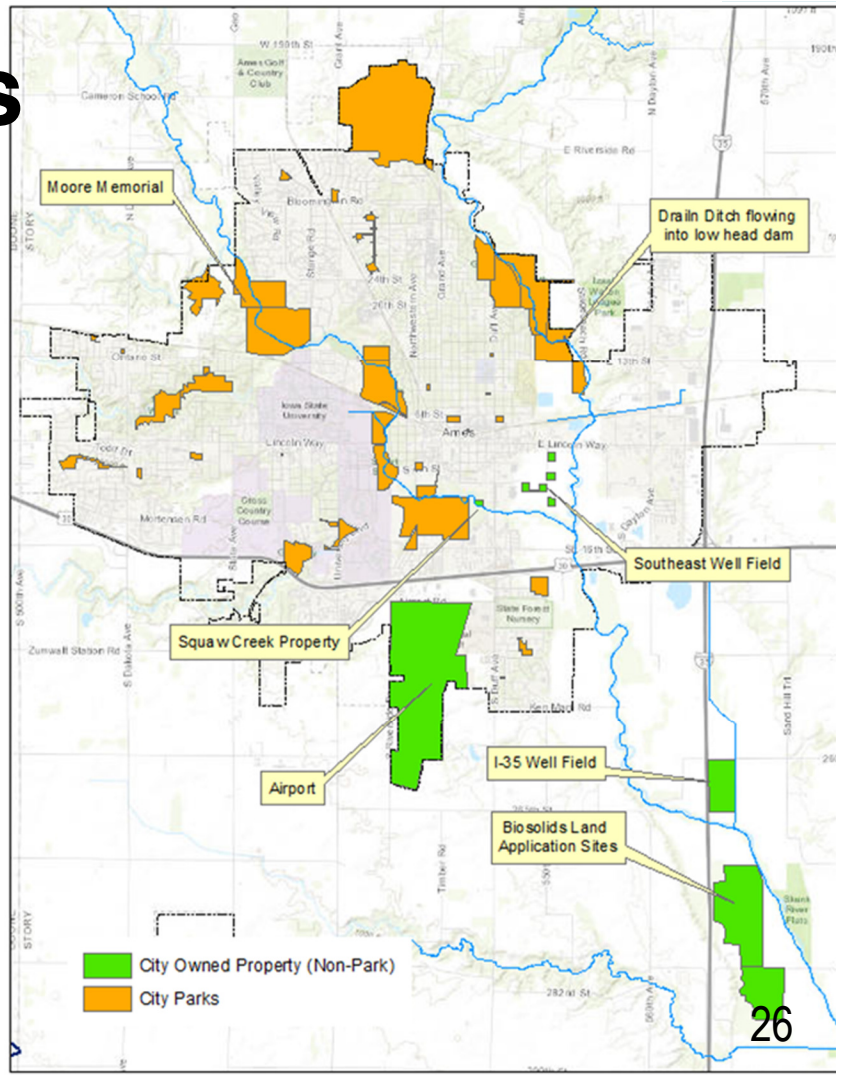
Watershed Alternatives

Watershed Alternatives

Potential Sites/Projects on City Property

- **Simply Examples to Convey Concepts**

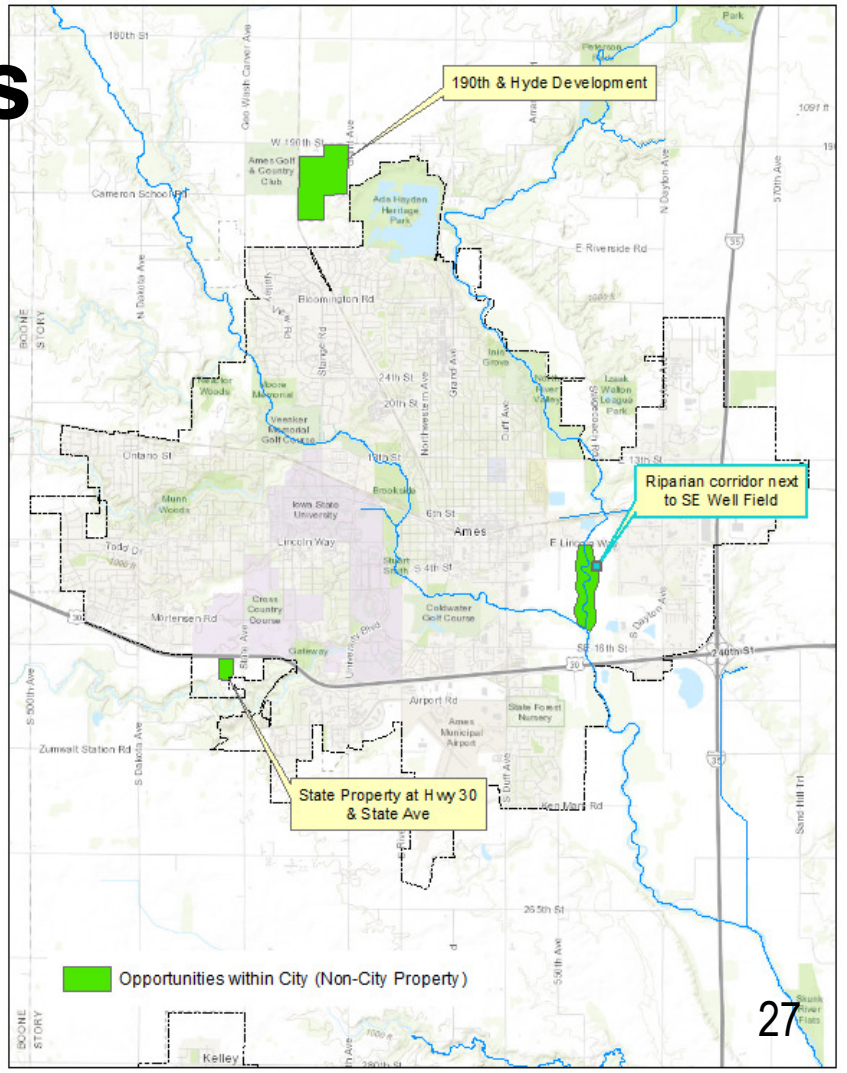
- Biosolids Land Application Sites
- Airport
- I-35 Well Field/ISU Research Facility
- City Parks
- Squaw Creek Property
- Moore Memorial Park
- Gunder Nutty Woods/Drain Ditch flowing into low head dam



Watershed Alternatives

Potential Sites/Projects Within City

- **Simply Examples to Convey Concepts**
- 190th and Hyde Development
- Riparian Corridor next to SE Well Field
- State Property at Hwy 30 & State Avenue

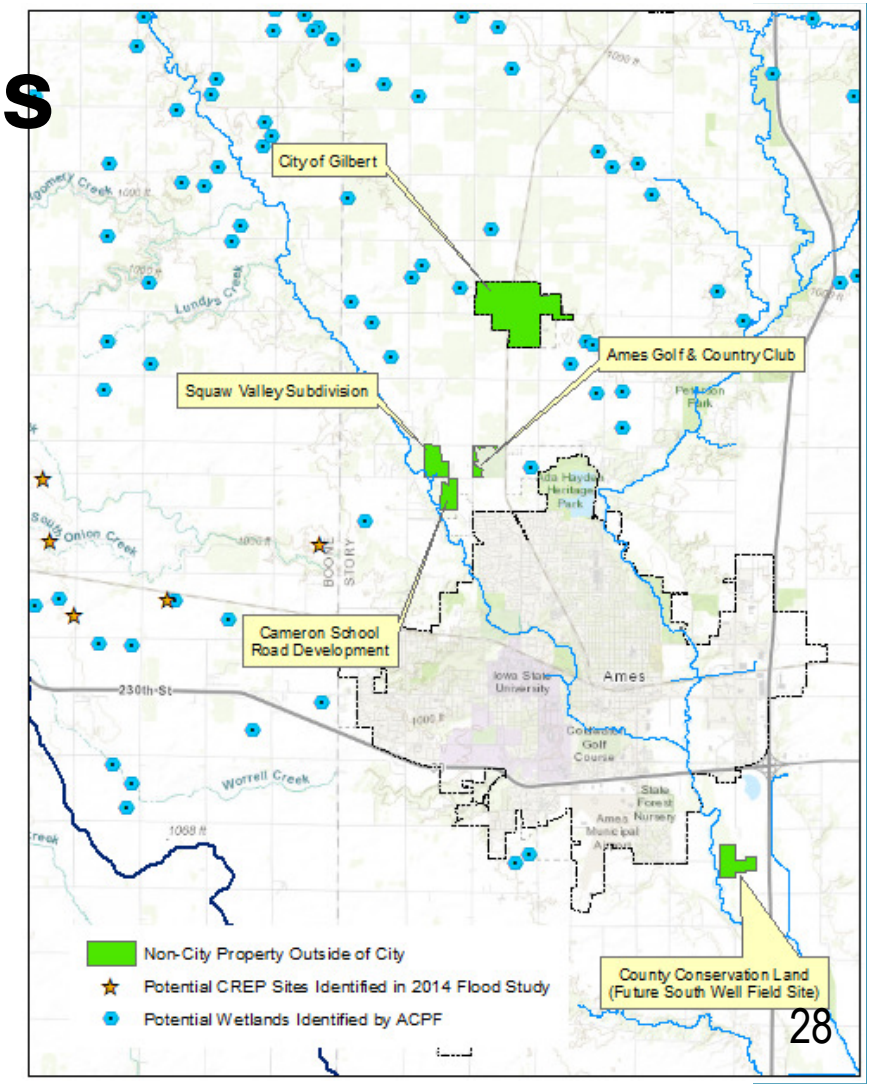


Watershed Alternatives

Potential Sites/Projects Upstream

- **Simply Examples to Convey Concepts**

- Ames Golf & Country Club
- Cameron School Road Development
- Squaw Valley Subdivision
- County Conservation Land (Future South Well Field)
- City of Gilbert
- CREP Sites (2014 Flood Study)
- Potential Wetlands (ACPF)



Ancillary Benefits

		Potential Project	Nutrient Reduction	Flood Mitigation	Erosion Control	Habitat Restoration	Water Quality	Recreation
City Property	Biosolids Land Application Sites	Bioreactor, Constructed wetlands	X	X	X	X		
	Airport	Bioreactor	X					
	I-35 Well Field	CRP/Potential ISU Research	X		X	X	X	
	City Parks	Native grasses. Reduced fertilizer. Green SW infrastructure	X	X	X	X		X
	Squaw Creek Property	Storm sewer interceptor/constructed wetland	X	X	X	X		
	Moore Memorial Park	Bioreactor, Constructed wetlands	X	X	X	X		X
	Gunder Nutty Woods/Drain Ditch	Bioreactor, Constructed wetlands	X	X	X	X		X
Within City	190th & Hyde Development	Regional SW facility	X	X	X	X		X
	Riparian Corridor next to SE Well Field	Bike trail/riparian restoration	X		X	X	X	X
	State Property at Hwy 30 & State Ave	Bioreactor, Constructed wetlands	X	X	X	X		X
Upstream	Ames Golf & Country Club	Stormwater detention basins	X	X	X	X		X
	Cameron School Road Development	Regional SW facility	X	X	X	X		X
	Squaw Valley Subdivision	Interceptor/hook up with City sewer	X					
	County Conservation Land (Future South Well Field)	CRP	X		X	X		
	City of Gilbert	Interceptor/hook up with City sewer	X					
	Potential CREP/Wetland Sites	Constructed wetlands	X	X	X	X		X

Select/Implement Based on Priorities

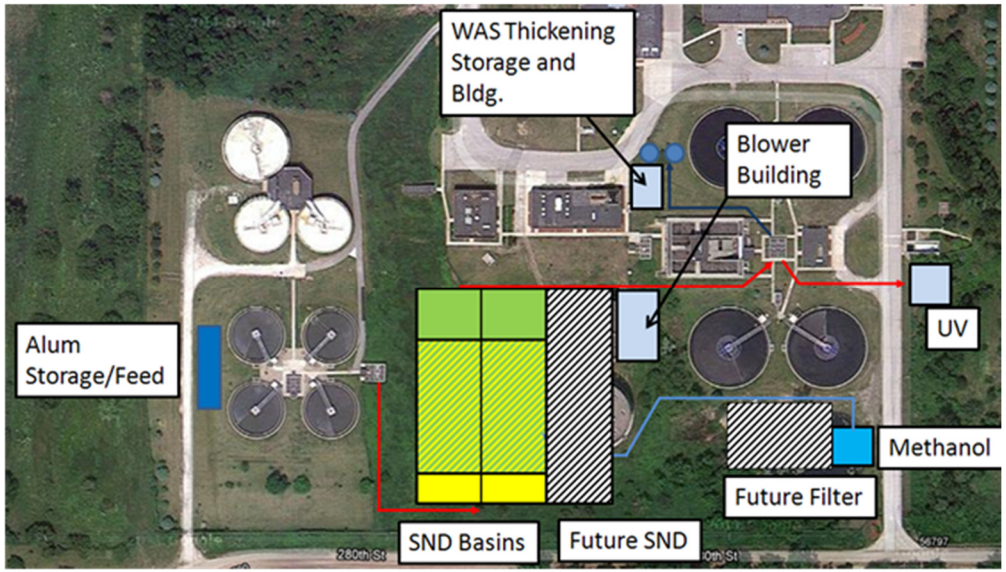
Demonstrate Leadership, Make Progress, and Offset Future Requirements

- **Location**
  - City-owned land
  - Within City limits
  - Land in Upstream Watersheds
- **Ancillary Benefits**
  - Flood mitigation
  - Drinking Source Water Protection
  - Increased Wildlife Habitat
  - Improved Water Quality
  - Increased Recreational Opportunities
  - Increased hunting opportunities
  - Other benefits
- **Nutrient Reduction Cost/Benefit**
  - Lower $/pound Removed than WPCF
  - Lowest $/pound Removed
  - Highest Pounds Removed
- **Life Cycle**
  - Number of Years Provided
  - Lowest Annual Maintenance Costs
  - Lowest Life Cycle Cost

WPCF Alternatives

WPCF Alternative Technologies

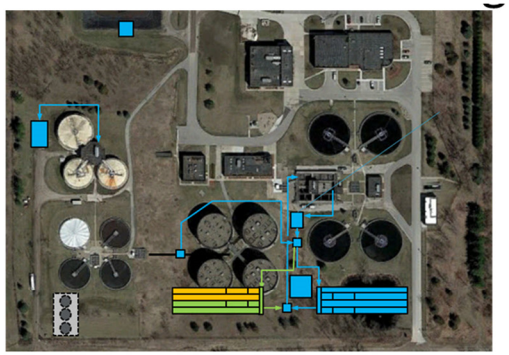
Prior 2012 Long Range Facility Plan Recommendation



- Prior to Iowa Nutrient Reduction Strategy
- Replace Trickling Filters
- Incorporate Simultaneous Nitrification Denitrification (SNDN)
- In 2012 Estimated at $25 million

WPCF Alternative Technologies

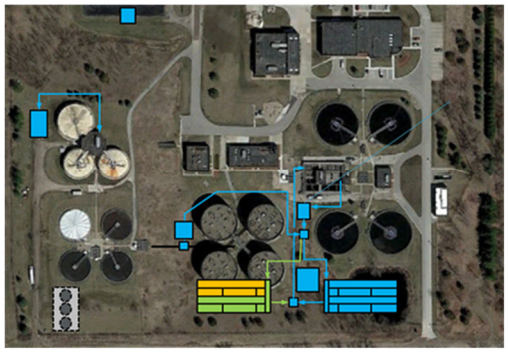
Current Study Identified Other Potential Options



Conventional Activated Sludge (CAS)

Granular Activated Sludge (GRAS)

Integrated Fixed Film Activated Sludge (IFAS)



Membrane Aerated Bioreactor (MBAR)

- Reflect Iowa Nutrient Reduction Strategy
- Replace Trickling Filters
- Incorporate Alternative Technology

WPCF Alternative Technologies

Shortlisted to Three Based on Monetary and Nonmonetary Considerations

- Capital & O&M Costs

- Performance Criteria
  - Reliability & Effectiveness
  - Amenable to Wet Weather Flows
  - Solids Handling Impacts
  - Energy Requirements
  - Adaptability to More Stringent Standards
  - Constructability and Phasing Potential

- Acceptance Criteria
  - Consistency with Current Operations
  - Safety
  - Positive Public Opinion
  - Operational Requirements
  - Maintenance Requirements
  - Operations During Construction

WPCF Alternative Technologies

Phasing Plan

Phase 1
1st 5 years

- Keep Trickling Filters in Service
- Incorporate 1st Phase of Alternative Technology
- Provides Redundant and some Growth Capacity (Current Permit Limits)
- Provides Limited, if Any, Nutrient Reduction

Phase 2
2nd 5 years

- Take Trickling Filters Out of Service as they Fail
- Incorporate 2nd Phase of Alternative Technology
- Provides Additional / Redundant Capacity
- Provides Seasonal Biological Nutrient Reduction

Phases 3
Last 10 years

- Takes Remaining Trickling Filters Out of Service
- Incorporate 3rd Phase of Alternative Technology
- Provides Forecast 2040 Treatment Capacity
- Provides Full Biological Nutrient Reduction

WPCF Alternative Technologies

Costs & Key Assumptions

- Costs are in 2018
- Phasing Reflects Flexibility Provided in Iowa Nutrient Reduction Strategy
- Supported by a Commitment to Watershed Nutrient Reductions to Demonstrate Leadership & Progress
- Could be Accomplished in One or Two Phases Instead

Strategy Summary

Potential Integrated Strategy

Watershed and WPCF – Will be Submitted to IDNR

Convert from trickling filters to alternative technology that provides additional capacity for growth and nutrient removal that achieves the goals of the Iowa Nutrient Reduction Strategy
Minimize WPCF costs and associated customer rate impacts through phased implementation of alternative technology that continues to use existing trickling filter capacity as long as condition allows
Incorporate existing WPCF optimization to the extent affordable and consistent with alternative WPCF technology.
Demonstrate commitment through continued implementation of urban best management practices with added emphasis on associated watershed nutrient reductions
Identify, prioritize, and fund watershed nutrient reduction projects consistent with location, ancillary benefits, cost/benefit, and life cycle cost criteria.
Register and bank watershed credits with the Nutrient Reduction Exchange to offset potentially more stringent future requirements
Support Iowa State University efforts to develop innovative and alternative watershed based nutrient reduction.

Stakeholder Input

Online Survey and Open House

- 20 respondents
- 90% Ames rate payers
- 70% with moderate or considerable knowledge on nutrients
- 75% consider nutrients an exceptional issue statewide
- 75% identified nonpoint sources as primary source
- 100% believe that the Utility should invest rate payer dollars to address nutrients
- 95% support Utility investment in upstream watershed projects outside City limits (35% w/out condition, 50% if ancillary benefits, 10% if less expensive than at WPCF)
- 95% support Utility investment in WPCF upgrade to address nutrients (58% immediately, 32% w/ expansion or other upgrade, 11% w/ other major environmental issue)
- 85% support rate increase (6% support 50% increase, 44% support 25% increase, 44% support 10% increase)

Path Forward

Path Forward

WPCF Nutrient Feasibility Study

Anticipated CIP

- $39.63 million over 20 years at WPCF
- $100,000 / year for Watershed BMPs
- $0 for Trickling Filters at WPCF

Objective

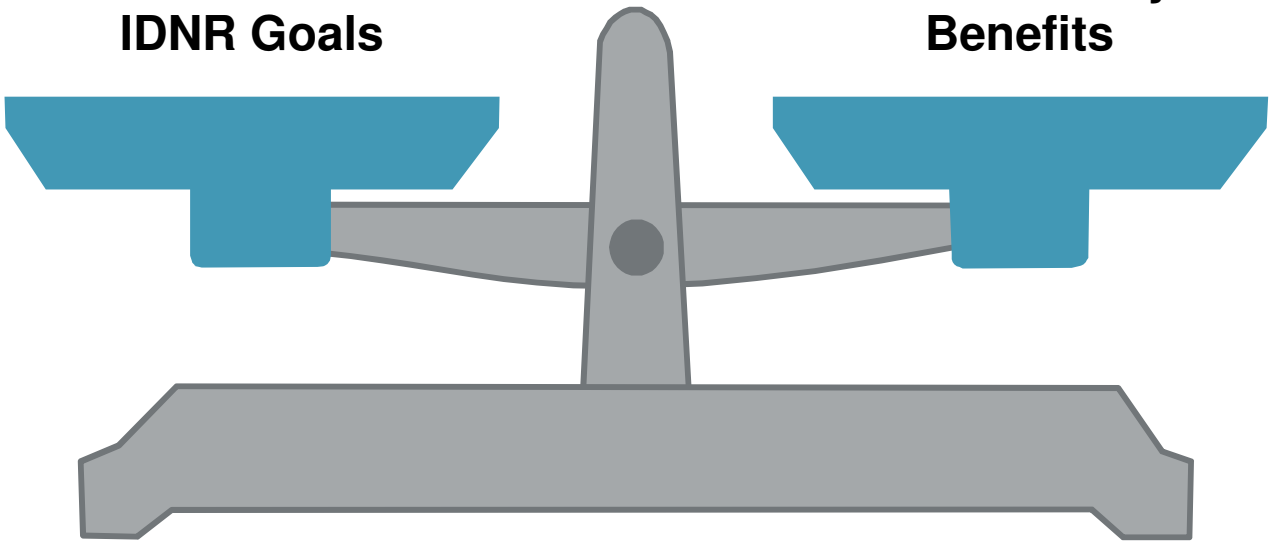
Appropriate Balance?

Cost of and timing of Nutrient Removal

IDNR Goals

Rate Impacts

Water Quality Benefits



Questions & Guidance