Substantial and Widespread Adverse Social and Economic Impacts of Wisconsin's Phosphorus Regulations

A Preliminary Determination

May 12, 2015

Wisconsin Department of Administration
Wisconsin Department of Natural Resources

Introduction: Multi-Discharger Phosphorus Variance

Phosphorus Standards

- Promulgated in 2010
- Provided some flexibility
  - Extended compliance schedules
  - Trading
  - Adaptive Management
- Additional flexibility needed
  - Framework
  - Multi-discharger variance

Multi-Discharger Variance (MDV)

- Act 378 – April 2014
- DOA Determination
  - Substantial and widespread adverse impact
  - Sycamore / Arcadis / UMass
  - REMI model
  - Categories: ***municipalities*** (2); ***industry*** (Paper, Power, Cheese, Food, NCCW, Aquaculture, Other)
  - Primary and Secondary Indicators

Multi-Discharger Variance (MDV)

- Thirty-day comment period
- Informational hearing (May 12 – Wausau)
- Submit to EPA
  - Variance = change to water quality standard
  - 90 days
- Initial Findings
  - $6.0 billion
  - Over 3,300 jobs

Multi- Discharger Variance (MDV)

- What is required?
  - Major facility upgrade
  - Agree to
    - Interim limits: 0.8 mg/L; 0.6 mg/L; 0.5 mg/L;WQBEL
    - Watershed project
      - Self-managed / DNR-approved
      - Third party / DNR-approved
      - $50.00 per pound to counties in watershed
      - Target value (TMDL or 0.2 mg/L)

Determining Compliance Costs

Compliance Cost – Overview

- Scope of Cost Determination
  - Statewide, high level look
  - Technology choice that would be appropriate across all sites for a given category
  - General conformity with other published studies
  - Development of Cost Curve that can be used to estimate costs for all sites

Facility Breakdown

Type of Permittee	Number of Permitted Facilities in each Category
Municipal WWTP: Mechanical	334
Municipal WWTP: Lagoon	91
Municipal Subtotal	425
Cheese	27
Aquaculture	10
Food Processing	14
NCCW/COW	59
Paper Mills	17
Power Plants	15
Other	25
TOTAL	592

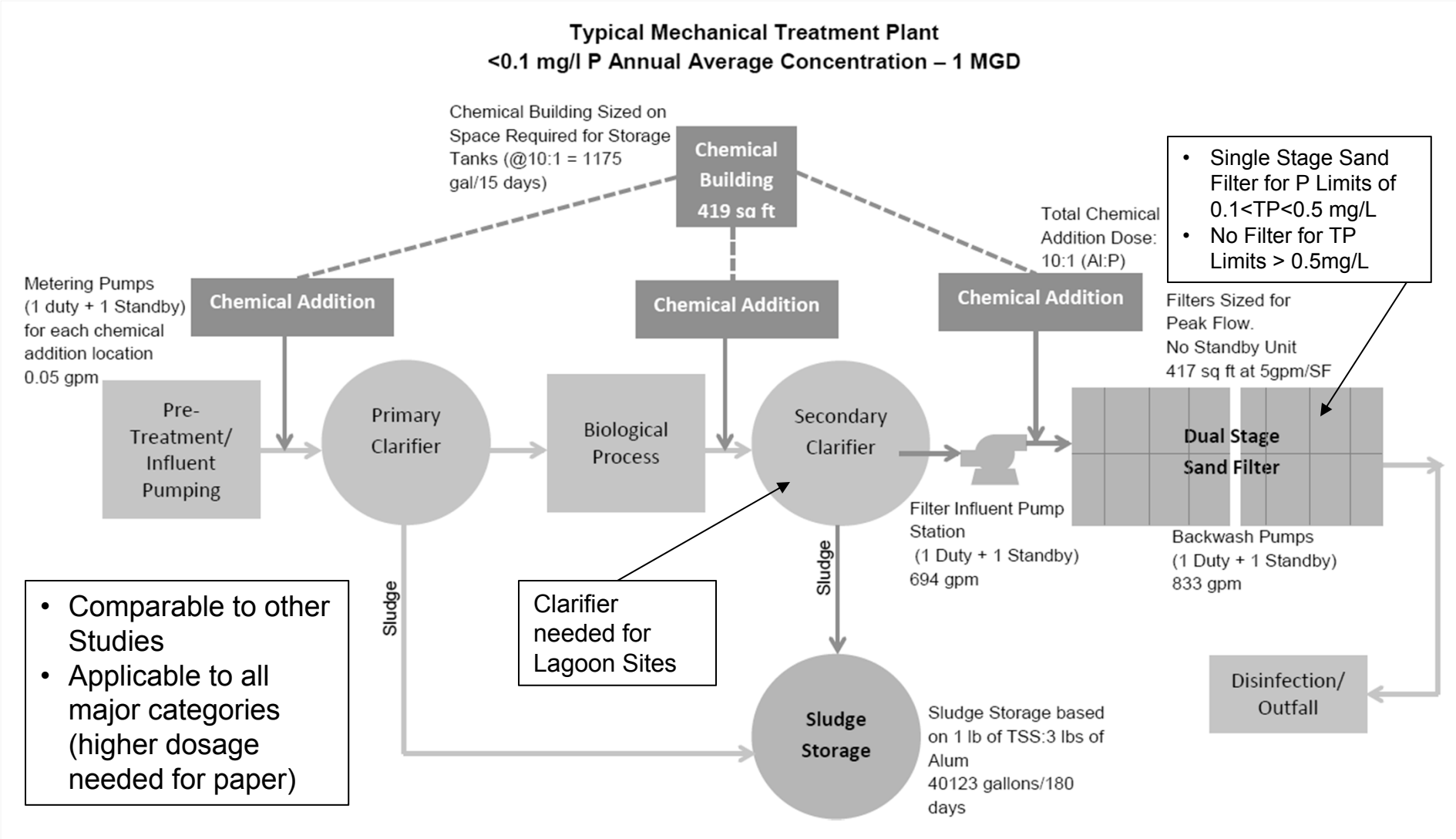
A total of 592 permittees were expected to need to add phosphorus treatment technologies to meet more stringent phosphorus discharge limits, and were further evaluated in this study.

Technology Selection

Less restrictive WQBEL (>0.5-1 mg/L)	• Treatment Technology: Multi-point metal salt additions
Intermediate WQBELs (>0.1-0.5 mg/L)	• Treatment Technology: Multi-point metal salt additions with single stage sand filtration
Restrictive WQBELs (<0.1 mg/L)	• Treatment Technology: Multi-point chemical precipitation with clarification and dual-stage sand filtration

Effluent TP for the current facilities was assumed to be at 1 mg/L. The additional treatment equipment was sized based on removing 1 mg/L of TP for all sites regardless of their new limit. The development of cost curves that can be applied to all sites did not allow for the incorporation of site specific TP discharge information.

Technology Selection



Technology Selection

- Biological phosphorus removal (BPR) was not reviewed as part of this study as it cannot consistently reduce phosphorus to low levels at all of the facilities.
  - Chemical Addition was chosen as a technology that will work at the sites and effluent limits included in the study.
  - Incorporating BPR can reduce chemical requirements for TP removal and sludge production
  - Applicability of BPR is often a site specific decision due to wastewater characteristics
- Use of ‘package plants’ for phosphorus treatment was not reviewed as this relies on site specific information
- Chemical addition will increase the amount of solids that must be managed and disposed of. Therefore, there are additional costs for solids management units and for disposal.

Cost Curve Development

Main Process Components	Parameters
Chemical Storage Tank	15 days @ design capacity
Chemical Feed System	Required feed rate with one pump out of service
Chemical Added	Alum ($Al_2(SO_4)_3 \cdot 14H_2O$)
Chemical Solution Strength	49%
Chemical Dosage (Target Alum: Phosphate Molar Ratio)	
Primary Clarifiers	1:1
Secondary Clarifiers	2:1
Upstream of Filters	10:1
Paper Mills	300 or 1,000 mg/L (low and middle range discussed in Section 2.4)
Maximum Day Flow Peaking Factor	2:1 (facilities >1.0 MGD)
	3:1 (facilities < 1.0 MGD)
System Sizing Basis	Maximum day flow with one unit out of service
Clarifier*	900 GPD/ft^2 surface overflow rate (at design flow)
Sand Filter*	2.5 GPM/ft^2 filtration rate (at design flow)
Dual-Stage Sand Filter	2.5 GPM/ft^2 filtration rate (at design flow)
Filter Feed Pumps	Required feed rate with one pump out of service
Filter Backwash Pumps	Required feed rate with one pump out of service
Sludge Production Rate	1 lb. TSS/3 lbs. of alum added
Additional Sludge Storage	180 days
Sludge Dewatering Facility	
Polymer for Dewatering	15 lbs. polymer/ton solids
Belt Filter Press	1,000 gpd/meter of belt width

Capital Cost Parameter	Percentage Multiplied by Value in Subtotal Column	Subtotal
Site Work	5%	Equipment Subtotal
Yard Piping	15%	Equipment Subtotal
Electrical and Instrumentation & Controls	25%	Equipment Subtotal
HVAC and Plumbing	15%	Building Cost
Site Foundation	2%	Equipment Subtotal
Maintenance of plant operations (MOPO)	5%	Equipment Subtotal
Mobilization, Bonds and Insurance	5%	Equipment Subtotal
Demobilization	2%	Equipment Subtotal
Contractor Overhead & Profit	15%	Construction Cost Subtotal
Construction Contingency	35%	Construction Cost Subtotal
Engineering and Administration	18%	Bid Cost Subtotal

Site specific costs were not included in this cost estimate but would affect the cost of implementation for individual facilities.

- Land Acquisition
- Combining Multiple Outfall Locations

Cost Curve Development

- Capital Costs are consistent with the Association for the Advancement of Cost Engineering's (AACE) Class 4 estimate, where project definition is between 1% to 15% and engineering design is 1% to 5% complete
- The typical purpose for this level of estimate is for conceptual studies or feasibility evaluations
- No site specific information other than discharge flowrate and new permit limit was used for the estimate which would put the project definition and design level near 1%
- Class 4 estimates are generally prepared based on limited information without a site specific process description and thus they have a wide accuracy range

O&M Cost Parameter	Unit Value
Additional labor	$45/hr.
Alum cost	$0.25/lb.
Power	$0.08/kWh
Additional solids hauling and disposal cost	$225/dry ton @20% TS for mechanical WWTPs >1 MGD
	$0.05/wet ton @2% TS for lagoons and mechanical WWTPs < 1 MGD
Annual equipment maintenance	2% capital cost applied to the equipment subtotal

Cost Curve Development

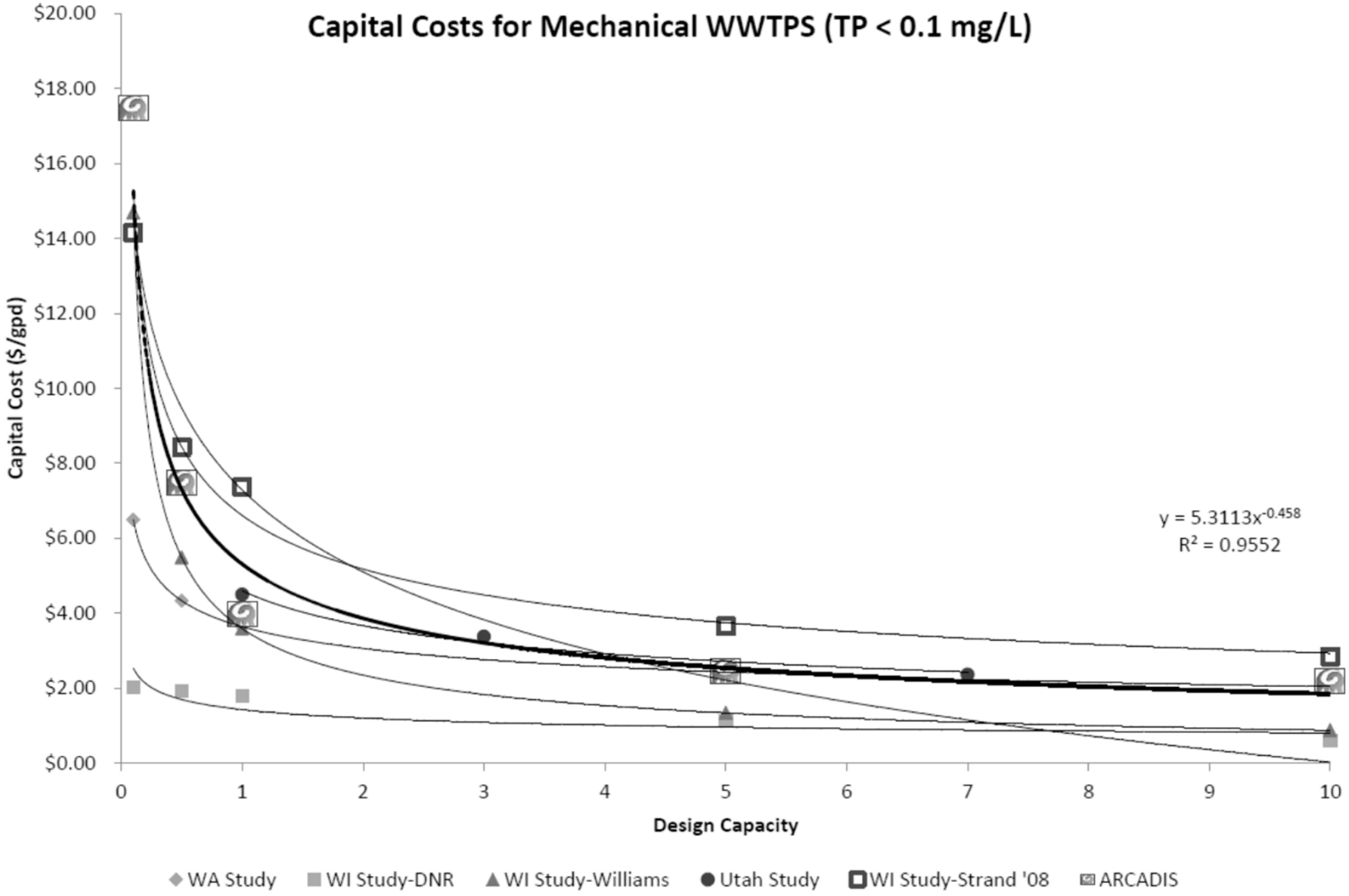
Mechanical WWTP (< 0.1 mg/L TP)
Concept-Level Estimate of Capital Costs

		Design Flow:						
Item	**Unit Cost**	**0.1 MGD**	**0.5 MGD**	**1 MGD**	**5 MGD**	**10 MGD**	**20 MGD**	**50 MGD**
Chemical Feed System								
Chemical Storage and Feed Building	$150/sq ft	$14,000	$40,000	$63,000	$192,000	$260,000	$356,000	$713,000
Chemical Storage Tanks	LS	$200	$1,000	$2,000	$7,000	$15,000	$29,000	$74,000
Metering Pumps	LS	$17,000	$19,000	$24,000	$34,000	$58,000	$92,000	$94,000
Miscellaneous piping, valves, and appurtenances	$66/lin ft	$6,600	$7,000	$10,000	$13,000	$17,000	$23,000	$30,000
Dual-Stage Sand Filters								
Dual Stage Sand Filter Building	$200/sq ft	$25,000	$125,000	$250,000	$833,333	$1,416,667	$2,833,333	$7,083,333
Filter Feed pumps	LS	$100,000	$150,000	$200,000	$310,000	$380,000	$475,000	$600,000
Backwash pumps	LS	$120,000	$180,000	$240,000	$124,000	$152,000	$190,000	$240,000
Dual Stage Filters	LS	$268,500	$450,000	$498,000	$2,376,000	$4,564,500	$9,010,500	$21,220,500
Piping, valves, and appurtenances	$150 to $450/lin ft	$7,500	$15,000	$15,000	$50,000	$105,000	$157,500	$220,000
Filter Clearwell	LS	$6,305	$16,897	$26,862	$64,312	$110,725	$196,139	$434,197
Additional Sludge Storage								
Sludge Storage Tank	LS	$52,200	$260,797	$52,159	$260,797	$521,594	$1,062,198	$1,553,926
Equipment Cost Subtotal		**$ 618,000**	**$ 1,265,000**	**$ 1,382,000**	**$ 4,265,000**	**$ 7,601,000**	**$ 14,425,000**	**$ 32,263,000**
Sitework (5%)		$ 30,900	$ 63,250	$ 69,100	$ 213,250	$ 380,050	$ 721,250	$ 1,613,150
Yard Piping (15%)		$ 92,700	$ 189,750	$ 207,300	$ 639,750	$ 1,140,150	$ 2,163,750	$ 4,839,450
Electrical and Instrumentation (25%)		$ 154,500	$ 316,250	$ 345,500	$ 1,066,250	$ 1,900,250	$ 3,606,250	$ 8,065,750
HVAC and Plumbing (15% of Building Cost)		$ 5,850	$ 24,750	$ 46,950	$ 153,800	$ 251,500	$ 478,400	$ 1,169,450
Site Foundation (2%)		$ 12,360	$ 25,300	$ 27,640	$ 85,300	$ 152,020	$ 288,500	$ 645,260
Maintenance of plant operations (5%)		$ 30,900	$ 63,250	$ 69,100	$ 213,250	$ 380,050	$ 721,250	$ 1,613,150
Mobilization, bonds and insurance (5%)		$ 30,900	$ 63,250	$ 69,100	$ 213,250	$ 380,050	$ 721,250	$ 1,613,150
Demobilization (2%)		$ 12,360	$ 25,300	$ 27,640	$ 85,300	$ 152,020	$ 288,500	$ 645,260
Construction Cost Subtotal		**$ 989,000**	**$ 2,037,000**	**$ 2,245,000**	**$ 6,936,000**	**$ 12,338,000**	**$ 23,415,000**	**$ 52,468,000**
Contractor OH&P (15%)		$ 149,000	$ 306,000	$ 337,000	$ 1,041,000	$ 1,851,000	$ 3,513,000	$ 7,871,000
Contingencies (35%)		$ 347,000	$ 713,000	$ 786,000	$ 2,428,000	$ 4,319,000	$ 8,196,000	$ 18,364,000
Bid Cost Subtotal		**$ 1,490,000**	**$ 3,060,000**	**$ 3,370,000**	**$ 10,410,000**	**$ 18,510,000**	**$ 35,120,000**	**$ 78,700,000**
Engineering and Administration (@18%)		$ 269,000	$ 551,000	$ 607,000	$ 1,874,000	$ 3,332,000	$ 6,322,000	$ 14,166,000
CAPITAL COST TOTAL (ROUNDED)		**$ 1,760,000**	**$ 3,610,000**	**$ 3,980,000**	**$ 12,280,000**	**$ 21,840,000**	**$ 41,440,000**	**$ 92,870,000**

Mechanical WWTP (< 0.1 mg/L TP)
Concept-Level Estimate of O&M Costs

		Design Flow:						
Annual O&M Cost Items	**Unit Cost**	**0.1 MGD**	**0.5 MGD**	**1 MGD**	**5 MGD**	**10 MGD**	**20 MGD**	**50 MGD**
Annual Power Cost	$0.08/kW-hr	$834	$3,351	$5,375	$24,471	$50,270	$111,847	$338,555
Alum Usage	$0.25/lb	$7,916	$39,582	$79,165	$395,824	$791,648	$1,583,297	$3,958,242
Biosolids Hauling and Disposal	$0.05/2% solids ton $225/$20% solids ton	$4,068	$20,340	$15,267	$76,336	$152,671	$305,343	$763,357
Equipment Maintenance (2% of equipment capital cost)	LS	$12,341	$26,241	$27,599	$85,302	$151,991	$288,515	$645,235
Additional Labor Cost	$45/hr	$18,720	$65,520	$93,600	$140,400	$187,200	$205,920	$234,000
Subtotal Annual Additional Operations and Maintenance Costs ($/year)		**$ 44,000**	**$ 155,000**	**$ 221,000**	**$ 722,000**	**$ 1,334,000**	**$ 2,495,000**	**$ 5,939,000**

Cost Curve Example



Financing Costs

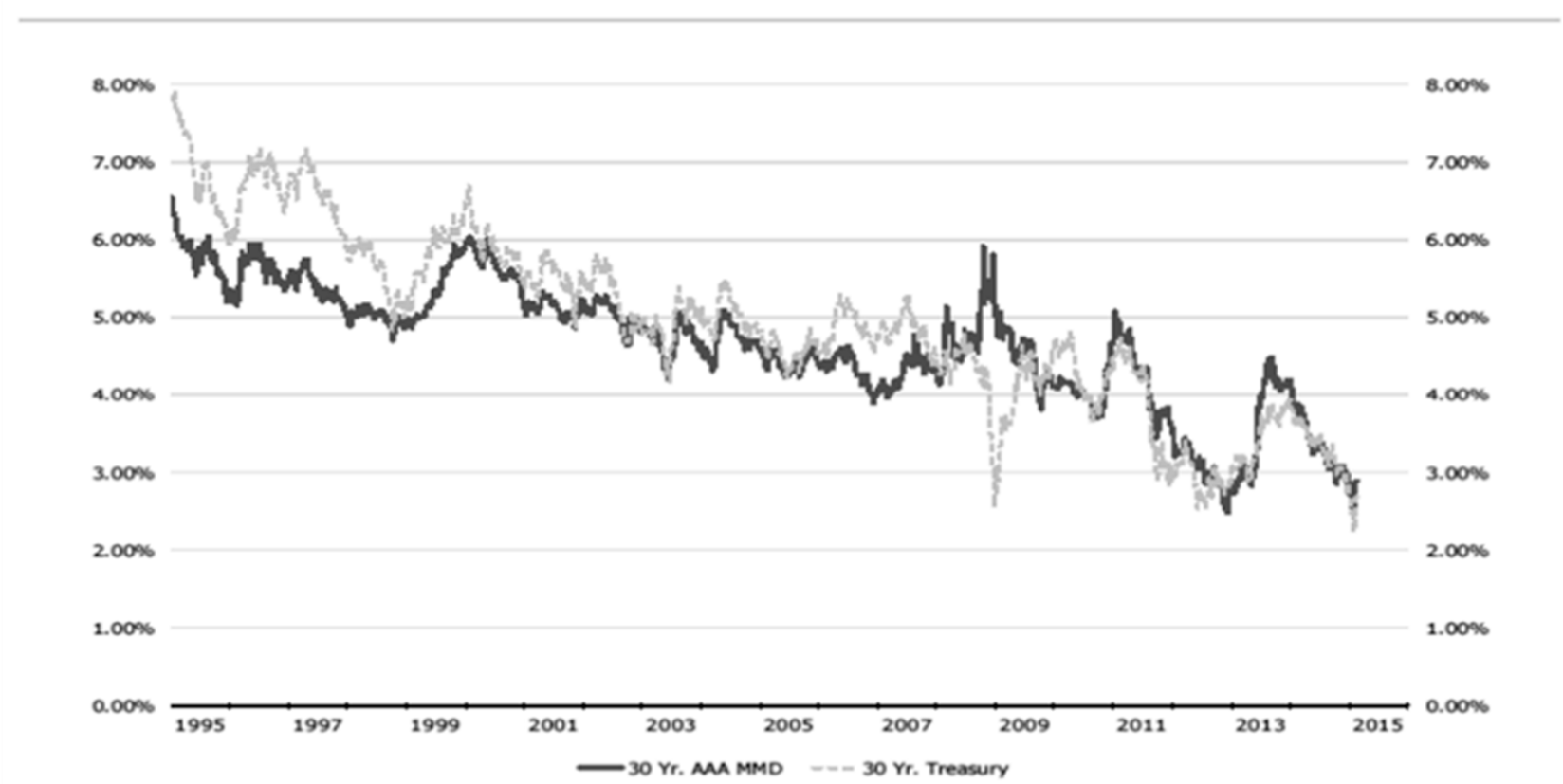
Capital Financing Costs – Assumptions

- The capital costs of construction to comply with the new phosphorus regulations were estimated at $3.45 Billion statewide
- Project construction is expected to take two years.
- The analysis assumed:
  - Most of the costs of construction would need to be financed
    - Industry/corporate borrowing – 100% financed
    - Municipal – 90% municipal bonds; 10% cash (operations or rate hike)
  - 20 year debt with level debt service

Capital Financing Costs

- The analysis developed estimates of borrowing costs for four categories of borrowers utilizing historic corporate borrowing data over a 20-year period from the Federal Reserve Board's database
  - Municipal
  - Power plants
  - Paper companies
  - Corporate (including Fisheries, Cheese, and Food Processing)
- The analysis also reviewed historic borrowing costs over several different interest rate cycles for both WI municipal borrowers and the respective industries to determine what an historic "average" borrowing rate has been

Historical 30 Year Treasury vs. 30 Year MMD Rates



Clean Water Program Loan Capacity

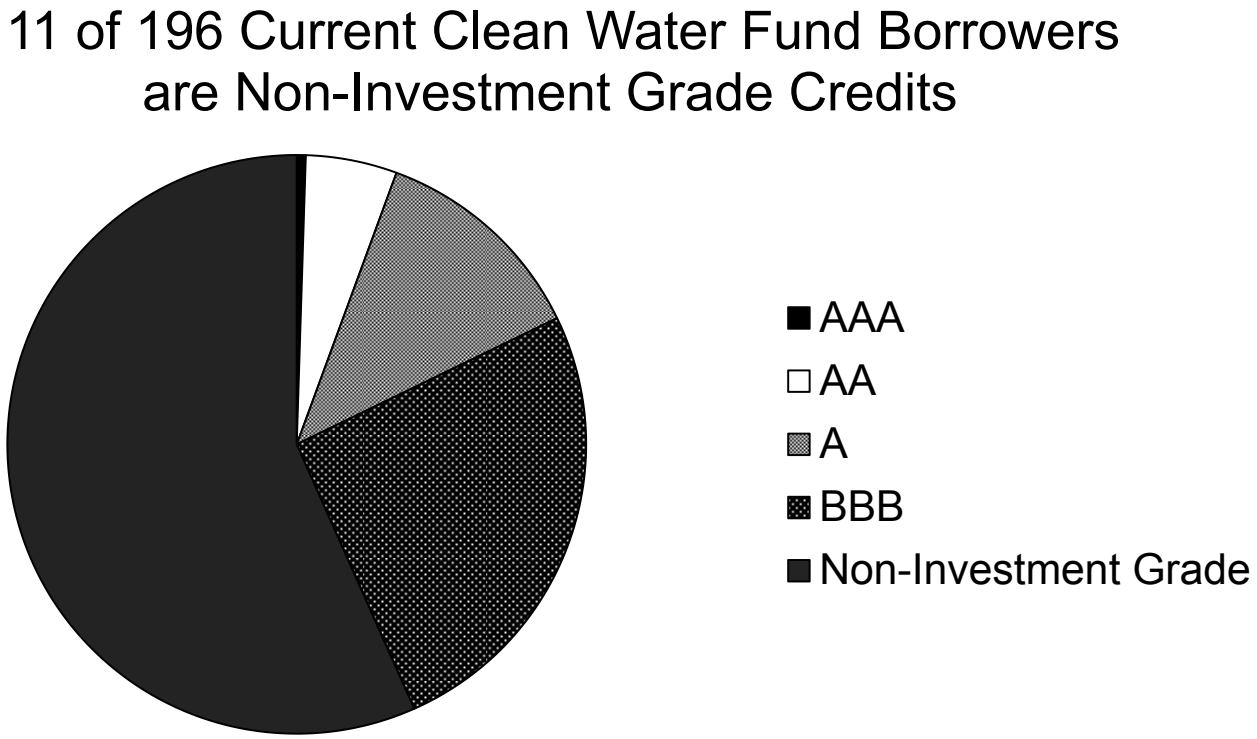
- Based on the 2016-2017 biennial state budget request, the analysis assumed the Environmental Improvement Fund (WI's SRF) could loan up to $80 million of its $186 million capacity to projects for phosphorus compliance.
- The remainder would need to come from open market financing.

Wisconsin SRF Borrowers

Clean Water Program Ratings

EIF Rating Category	Number of Borrowers	Loan Amount	% of Portfolio
AAA	1	$ 83,350,277	8.0%
AA	10	510,055,905	49.1%
A	24	226,249,790	21.8%
BBB	50	100,918,437	9.7%
Non-Investment Grade	111	117,930,030	11.4%
Total	**196**	**$1,038,504,439**	**100%**

Clean Water Ratings as a Percentage of Future Borrowers



Interest Rate Assumptions

Municipal Rates		
Current 20 YR AAA MMD		2.85%
1 Yr Forward Delivery		0.72%
Incremental Credit Spread for AAA		0.25%
	Market Rate for AAA credits	3.82%
Credit Spread for AA		0.50%
	Rate for AA credits	4.07%
Credit Spread for A		0.75%
	Rate for A credits	4.32%
Credit Spread for Baa		1.15%
	Rate for BBB credits	4.72%
Credit Spread for UnRated Credits		1.75%
	Rate for UnRated credits	5.32%
	Potential Loan Rate for EIF Subsidized Loans	2.87%
	Blended Open Market Rate for Municipal Credits	5.02%
	Blended EIF and Open Market Borrowing Rate for POTWs	4.80%

Corporate Rates	
Utilities	5.50%
General Corporates	6.80%
Paper	7.50%

Sensitivity Analysis

- While financing costs are significant and add about $2.4B to the total cost of compliance, sensitivity analyses testing for 1% increases or decreases in interest rates for different categories of borrowers had limited impact
- For municipalities, a 1% change in interest rates reduced or increased costs by about $200M, or about 7-8% of the projected financing costs
- For all corporate borrowers, costs increased or decreased by approximately $100M
- Changing interest rates did not result in a determinative change in costs to communities

Sensitivity Analysis

Updated Customer Analysis

Base Analysis, 2.87% EIF, 5.02% OMB, Average MHI

	Total Capital & Debt	Counties above 2.0%	Total Counties	% of Counties	Change in Total Cost	% Change	Cost per Year
5% Cash Funded	$ 2,704,747,555.34	39	72	54.2%	$ 54,718,553.29	2.023%	$ 2,735,927.66
10% Cash Funded	$ 2,650,029,002.05	42	72	58.3%	$ -	0.000%	$ -
15% Cash Funded	$ 2,595,310,448.76	43	72	59.7%	$ (54,718,553.29)	-2.108%	$ (2,735,927.66)
20% Cash Funded	$ 2,540,591,895.47	47	72	65.3%	$ (109,437,106.58)	-4.308%	$ (5,471,855.33)
25% Cash Funded	$ 2,485,873,342.17	53	72	73.6%	$ (164,155,659.88)	-6.604%	$ (8,207,782.99)
	Total Capital & Debt	Counties above 2.0%	Total Counties	% of Counties	Change in Total Cost	% Change	Cost per Year
1% Increase in Borrowing Rate[1]	$ 2,442,759,198.48	42	72	58.3%	$ (207,269,803.57)	-8.485%	$ (10,363,490.18)
1% Decrease in Borrowing Rate[1]	$ 2,866,210,076.78	42	72	58.3%	$ 216,181,074.73	7.542%	$ 10,809,053.74
	Total Capital & Debt	Counties above 2.0%	Total Counties	% of Counties	Change in Total Cost	% Change	Cost per Year
+25% Construction Cost[1]	$ 4,109,692,302.44	47	72	65.3%	$ 1,459,663,300.39	35.518%	$ 72,983,165.02
-25% Construction Cost[1]	$ 1,504,975,431.03	35	72	48.6%	$ (1,145,053,571.02)	-76.085%	$ (57,252,678.55)

1 - Scenario ran at base scenario, 10% cash funded

Substantial Impact Analysis

Substantial Impact Analysis

- The analysis identifies communities and dischargers that would be impacted substantially by immediate implementation of phosphorus standards

- Impact is measured by:
  1) Primary indicators
  2) Secondary indicators

Substantial Impact Analysis

Primary Indicators

1) Primary Indicator for ***Municipal WWTFs***

   a) Per-customer cost < 1% MHI of the affected communities, not eligible for MDV (may still apply for individual variance).

   b) Per-customer cost ≥1% of MHI < 2% of MHI, need to meet at least two secondary indicators.

   c) Per-customer cost ≥2% of MHI, need to meet one secondary indicator.

Substantial Impact Analysis

Primary Indicators

2) Dual Primary Indicators for ***Industrial Dischargers***. Either

a) The discharger's estimated costs are in the top 75% of estimated costs for dischargers in the category

or

b) The discharger's county is in the top 75% of counties with positive estimated costs and the discharger has positive estimated costs.

Substantial Impact Analysis

Secondary Indicators

1) Median Household Income below U.S. MHI of $53,046 (does not apply to municipal WWTFs)
2) Personal Current Transfer Receipts as a Share of Total Personal Income above U.S. rate of 17.1%
3) Jobs per Square Mile below Wisconsin rate of 50 Jobs Per Square Mile
4) Population Change 2004-2014 less than ½ U.S. Rate
5) Net Earnings by Place of Residence Change 2003-2013 slower than national rate (39.9%)
6) Job Growth 2003-2013 slower than U.S. rate of 9.8%
7) County dischargers' capital costs ≥ 1.5% of total county wages

Widespread Impact Analysis

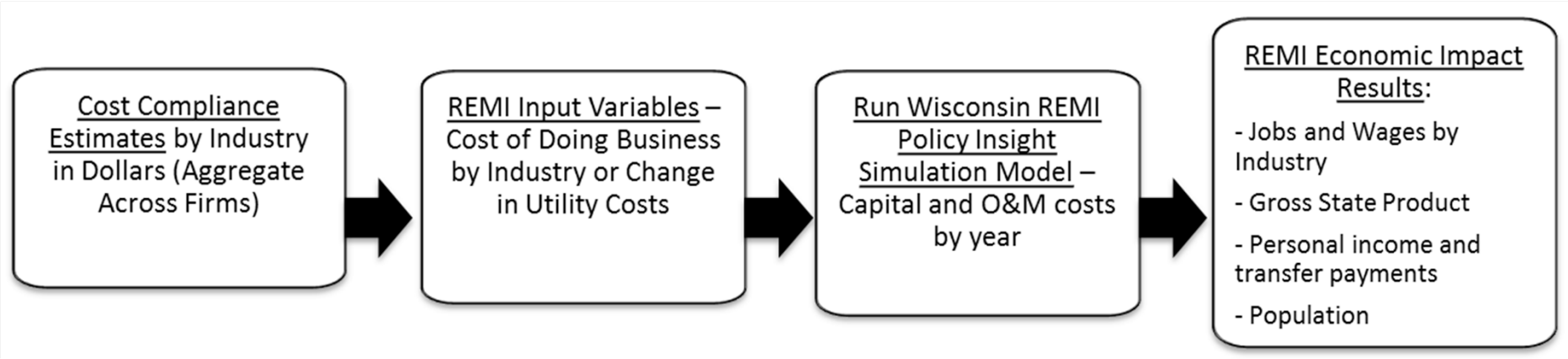
“Widespread” Test

- Information in the “EIA Report” as well as the “EIA Addendum” were used to make a **widespread impact determination**
- Analysis focused on quantifying the economic impacts of phosphorus compliance to Wisconsin’s economy and key industries
- Utilized the Regional Economic Models, Inc. (REMI) model to demonstrate the economic impacts of phosphorus compliance costs

REMI Model Methodology

- A dynamic economic forecasting software application long-used by WI state agencies
- The key data input for the REMI model was the phosphorus compliance costs by facility
  - Municipal utilities, industries (paper, cheese, food, electric power, aquaculture), NCCW, and other
- The model was run over a 20-year period to determine the long-term impacts of costs on the Wisconsin economy
- Sensitivity testing and assessment of potential “upstream” offsetting impacts also considered to test various uncertainties

Flowchart of REMI Inputs and Results

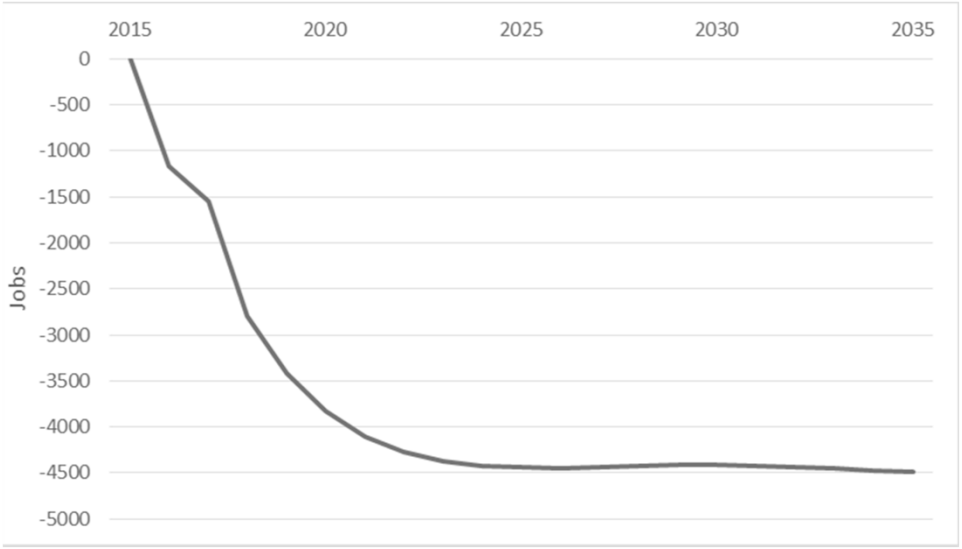


Total Direct Costs and REMI Statewide Impacts

Cost	Amount
Capital Cost (Millions)	$3,449.8
Capital Cost after Interest (Millions)	$5831.1
Annual Capital Cost with Financing	$291.6
Annual O&M Costs (Millions)	$405.4
Total Annual Cost	$696.9

Economic Impacts	2017	2025
Total Employment (Jobs)	-1,548	-4,442
Gross State Product (Millions of 2014 Dollars)	-$169.4	-$604.2
Total Wages (Millions of 2014 Dollars)	-$65.7	-$234.8
Population (Individuals)	-1,954	-10,711

Statewide Economic Impacts 2015-2035

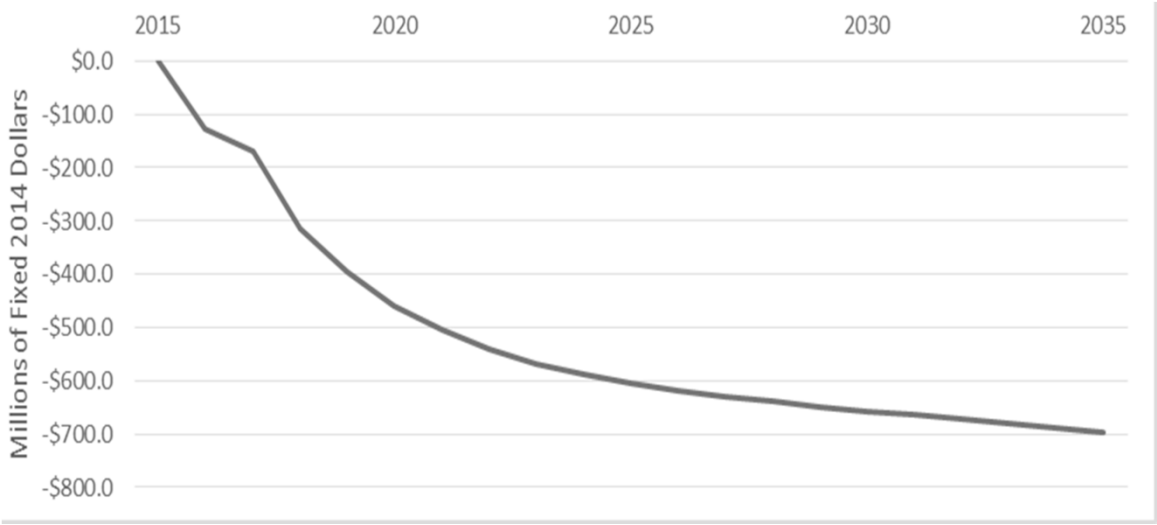


Job Impacts 2016 to 2035

Approximately 4,500 fewer jobs per year

GSP Impacts 2016 to 2035

Reaches loss of $700 million per year by 2035



Upstream Offset Analysis Integrated with Impact Analysis

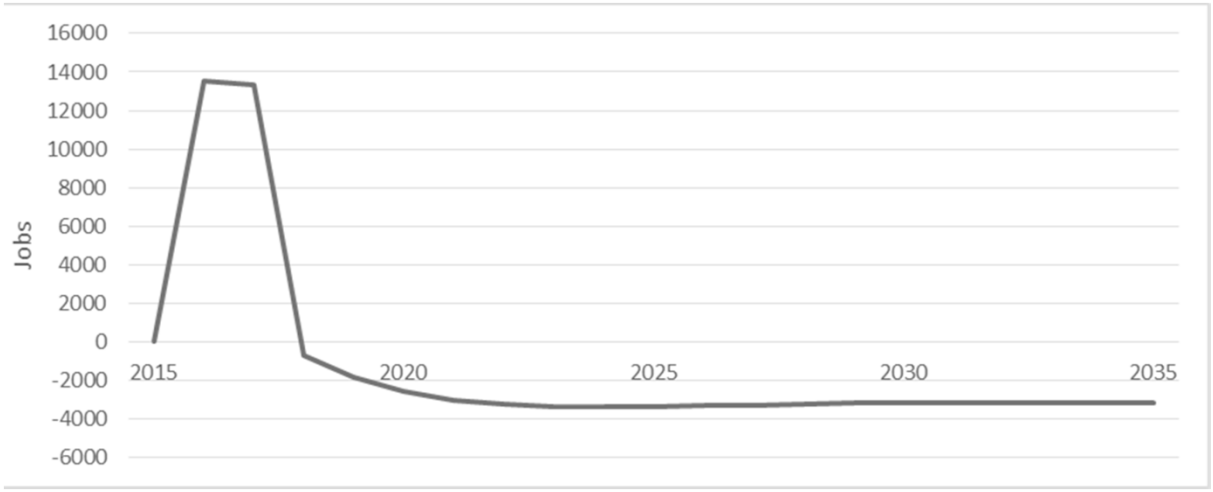
- Considers the potential positive economic impact to Wisconsin as construction and O&M expenditures may benefit some Wisconsin businesses (primarily in the short run)

Component	Cost to Industry and Municipalities	Regional Purchase Coefficient	Wisconsin Expenditure
Equipment	$1,207.4	17.5%	$211.3
Construction	$1,724.9	93.7%	$1,616.2
Engineering	$517.5	66.6%	$344.6
Polymer	$75.7	6.3%	$4.8
Power	$7.8	89.9%	$7.0
Alum	$228.3	17.5%	$39.9
Hauling and Disposal	$33.9	54.3%	$18.4
Maintenance	$23.0	63.3%	$14.6
Additional Labor	$36.7	100%	$36.7

Upstream Offset Analysis Integrated with Impact Analysis

Economic Impacts	2017	2025
Total Employment (Jobs)	13,315	-3,361
Gross State Product (Millions of Fixed 2014 Dollars)	$1,011.2	-$478.9
Total Wages (Millions of Fixed 2014 Dollars)	$597.3	-$184.1
Population (Individuals)	4,085	-7,545

Job Impacts 2016-2035



Sensitivity Analysis – Without and With Upstream Offsets

Scenario	Jobs		Gross State Product (millions)	
	2017	2025	2017	2025
Low (-25%)	-1,163	-3,341	-$127.3	-$454.6
Original	-1,548	-4,442	-$169.4	-$604.2
High (+25%)	-1,935	-5,536	-$211.6	-$752.8

Scenario	Jobs		Gross State Product (millions)	
	2017	2025	2017	2025
Low (-25%)	9,986	-2,529	$758.4	-$360.5
Original	13,315	-3,361	$1,011.2	-$478.9
High (+25%)	16,645	-4,185	$1,264.3	-$596.2

Summary of Findings

- Total statewide economic impacts are likely to be significant and sustained
  - 3,000 to 5,000 jobs lost annually; at least 7,500 fewer residents
- Impacts largest for municipal utilities, paper, and electric power
  - Driven by number of permit holders and per permit costs
- Survey indicated that businesses most likely to decrease investment, shift production to another state, or postpone expansion due to higher costs
- Inclusion of upstream offsets demonstrates short-term economic gains for some WI industries to install equipment but negative impacts are larger over time

Conclusions

Conclusions

- The Department of Administration finds that implementation of the Wisconsin water quality standards for phosphorus will cause **substantial and widespread adverse social and economic impacts to the state**.

Conclusions

- The overall cost to Wisconsin communities will be a minimum of $3.4 billion in capital expenditures which will rise to over $6 billion when accounting for interest paid on borrowing needed to meet increased capital costs. In addition, an O&M cost of $405 million annually combined with debt service will equate to almost $700 million annually.

Conclusions

- Individual costs are a factor in the decision, but of greater concern is how those costs will be borne out by residents and industries who employee them. In turn, businesses may potentially take one of four avenues if denied a variance:
  - decrease investment
  - postpone expansion in Wisconsin
  - shift production to another state
  - cease operations all together

Conclusions

- Without the multi-discharger variance, affected businesses will realize the full impact of the regulatory costs in 2025, when total statewide economic impacts result in
  - at least 3,000 fewer jobs
  - $184.1 million in wages forgone
  - $478.9 million reduction in gross state product
  - 7,500 fewer Wisconsin residents

Conclusions

- Of the 72 counties in Wisconsin, 42 have an Affordability Indicator in excess of 2.0% while another 28 counties measured a “mid-range” burden of between 1.0% and 2.0%

Conclusions

- Based on the information presented in this report, especially the combination of primary and secondary indicators affecting communities throughout Wisconsin, it is the recommendation of the Wisconsin Department of Administration that the Wisconsin Department of Natural Resources seek additional regulatory flexibility in implementing the phosphorus rule.

Thank You

Public Comments

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