



## Water Quality Simulation for Scale and Corrosion Control

WATER TREATMENT GROUP

Leeds Water Treatment Facility

Date: 1/7/2026

Submitted By: Chad Hardt

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### Treatment Recommendation

A post filter sample was submitted for our WatSim analysis. Based on previous reports and water treatment recommendations from December of 2012, the city should be feeding LPC – 4 at approximately 6.5 ppm. When I looked at the two WatSim's side by side, the Fe and Mn jumped out to me.

In 2012, Fe (0.02) and Mn (0.027) were reported. The most recent analysis shows Fe at (0.249) and Mn at (0.237). We also see an ammonia presence of 0.237 as NH<sub>3</sub>. My understanding is you are only chlorinating on the pre side of the filter. With this ammonia presence I am assuming a chloramine is forming and with that you are unable to oxidize iron and manganese properly because chloramines are weaker and are less reactive oxidant than common oxidants. This is then preventing the formation of particles large enough for effective filtration.

Our recommendation is to start feeding Sodium or Potassium Permanganate to properly oxidize the Fe and Mn.

After the Fe and Mn levels are back to appropriate levels, we can have a new WatSim sample analyzed for the proper corrosion inhibitor feed rate.

If you have any questions, please feel to reach out at any time.

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# WatSim

## WATER CHEMISTRY INPUT

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Leeds, ND  
Washburn Branch

Filter Discharge

Report Date: 12-19-2012  
Sample #: 0

Sampled: 12-19-2012  
at 1210

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### CATIONS

Calcium (as Ca)	88.50
Magnesium (as Mg)	19.00
Sodium (as Na)	47.86
Potassium (as K)	0.00
Ammonia (as NH <sub>3</sub> )	0.00
Iron (as Fe)	0.0200
Manganese (as Mn)	0.0270
Aluminum (as Al)	0.00
Zinc (as Zn)	0.00
Boron (as B)	0.00

### ANIONS

Chloride (as Cl)	15.00
Sulfate (as SO <sub>4</sub> )	60.00
"M" Alkalinity (as CaCO <sub>3</sub> )	320.00
"P" Alkalinity (as CaCO <sub>3</sub> )	0.00
Oxalic acid (as C <sub>2</sub> O <sub>4</sub> )	0.00
Cyanide (as HCN)	0.00
Phosphate (as PO <sub>4</sub> )	0.00
Pyrophosphate (as PO <sub>4</sub> )	0.00
Silica (as SiO <sub>2</sub> )	0.00
Nitrate (as NO <sub>3</sub> )	0.00
Fluoride (as F)	0.00

### PARAMETERS

pH	6.91
Temperature (°F)	55.00
Calculated T.D.S.	713.71
Calculated Cond.	710.92
98% Sulfuric Acid	0.00

### COMMENTS

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Hawkins Water Chemicals Group  
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## WATSIM

DATE TESTED: 14-Dec-12  
SAMPLE ID Leeds, ND - Bottom of filter  
WTG BRANCH: Washburn  
TECHNICIAN: SN

Test	Result	Methodology
pH	6.91	Other
Calcium, mg/L	88.50	Flame AA
Magnesium, mg/L	19.00	Flame AA
Manganese, mg/L	0.027	Flame AA
Iron, mg/L	0.02	HACH
P Alkalinity, mg/L	0.00	HACH
Total Alkalinity, mg/L	320.00	HACH
Sulfate, mg/L	60.00	HACH
Chloride, mg/L	15.00	HACH
Orthophosphate, mg/L		HACH
Total Phosphate, mg/L		HACH
Copper, ppb		HACH
Nitrates, mg/L		HACH

**Notes:**

2026



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## Water Quality Simulation for Scale and Corrosion Control

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### Leeds, ND Post Filtration Sample

#### Treatment Recommendation

A sample was analyzed and it indicates moderate Hardness (297 as  $\text{CaCO}_3$ ), low levels of Iron (0.02 ppm) and Manganese (0.027 ppm). Langelier, Ryznar, and Puckorius indexes show a potential for corrosion to occur in the distribution system.

With the higher potential for corrosion and the need to also sequester the Hardness along with any Iron and Manganese that is currently deposited in the distribution system, it is recommended that LPC-4 be used in this application. LPC-4 is a blended Ortho/Polyphosphate designed to sequester Iron, Manganese, and Hardness as well as provide corrosion protection for potable drinking water systems. The use of LPC-4 at the dosage listed below will give you about 1.00 ppm as Ortho to protect from corrosion while still providing the necessary sequestering from any iron or manganese that breaks through the filters or is cleaned up within the distribution piping.

#### Recommended Dosage

		Maximum Use Level
LPC-4 Dosage	<b>6.529744</b> ppm as product	<b>33 ppm as product</b>
	<b>54.45806496</b> lbs per million gallons treated water	
	<b>4.777023242</b> gallons of LPC-4 per million gallons treated water	

Disclaimer: WatSim Simulation is an initial treatment recommendation based on the chemistry information supplied. Additional testing and adjustments may be required to optimize chemical treatment performance. Hawkins Water Treatment Group, and/or Hawkins, Inc. is not responsible for treatment errors due to inaccurate calculations received as a result of the WatSim program.



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# WatSim

## WATER CHEMISTRY INPUT

City of Leeds  
Raw

Chad Hardt  
Washburn

Report Date: 01-07-2026    Sampled: 01-07-2026  
Sample #: 7737                      at 0827

### CATIONS

Calcium (as Ca)	104.04
Magnesium (as Mg)	27.22
Sodium (as Na)	42.18
Potassium (as K)	8.23
Ammonia (as NH <sub>3</sub> )	0.287
Iron (as Fe)	0.249
Manganese (as Mn)	0.237
Aluminum (as Al)	0.0200
Zinc (as Zn)	0.00100
Boron (as B)	0.180

### ANIONS

Chloride (as Cl)	9.61
Sulfate (as SO <sub>4</sub> )	133.51
"M" Alkalinity (as CaCO <sub>3</sub> )	322.00
"P" Alkalinity (as CaCO <sub>3</sub> )	< 0.001
Phosphate (as PO <sub>4</sub> )	0.00
Pyrophosphate (as PO <sub>4</sub> )	0.00
Silica (as SiO <sub>2</sub> )	29.80
Nitrate (as NO <sub>3</sub> )	0.540
Fluoride (as F)	0.155

### PARAMETERS

pH	7.33
Temperature (°F)	55.00
Calculated T.D.S.	806.95
Calculated Cond.	818.59
F.A.C.	0.00

### COMMENTS

ADDITIONAL RESULTS:  
Total Hardness, mg/L (as CaCO<sub>3</sub>) 372  
Copper, µg/L 7  
Lead, µg/L <1  
Nitrite (as NO<sub>2</sub>-N), mg/L <0.001  
Nitrate (as NO<sub>3</sub>-N), mg/L 0.1220  
UV-254 Absorbance 0.034  
Orthophosphate, mg/L <0.01

**Hawkins, Inc.**  
**3100 East Hennepin Avenue, Minneapolis, MN 55413**



# WatSim

## RAW WATER DEPOSITION POTENTIAL INDICATORS

City of Leeds  
Raw

Chad Hardt  
Washburn

Report Date: 01-07-2026  
Sample #: 7737

Sampled: 01-07-2026  
at 0827

### SATURATION LEVEL

Calcite (CaCO <sub>3</sub> )	1.16
Aragonite (CaCO <sub>3</sub> )	1.03
Anhydrite (CaSO <sub>4</sub> )	0.0230
Gypsum (CaSO <sub>4</sub> *2H <sub>2</sub> O)	0.0412
Calcium phosphate	0.00
Hydroxyapatite	0.00
Fluorite (CaF <sub>2</sub> )	< 0.001
Silica (SiO <sub>2</sub> )	0.350
Brucite (Mg(OH) <sub>2</sub> )	< 0.001
Magnesium silicate	< 0.001
Iron hydroxide (Fe(OH) <sub>3</sub> )	24.54
Siderite (FeCO <sub>3</sub> )	4.15
Strengite (FePO <sub>4</sub> *2H <sub>2</sub> O)	0.00
Calcium oxalate (CaC <sub>2</sub> O <sub>4</sub> )	0.00
Ca pyrophosphate (CaP <sub>2</sub> O <sub>7</sub> )	0.00
Zinc phosphate (Zn <sub>3</sub> (PO <sub>4</sub> ) <sub>2</sub> )	0.00

### FREE ION MOMENTARY EXCESS (ppm)

Calcite (CaCO <sub>3</sub> )	0.0928
Aragonite (CaCO <sub>3</sub> )	0.0195
Anhydrite (CaSO <sub>4</sub> )	-1215.1
Gypsum (CaSO <sub>4</sub> *2H <sub>2</sub> O)	-963.44
Calcium phosphate	>-0.001
Hydroxyapatite	-388.30
Fluorite (CaF <sub>2</sub> )	-29.62
Silica (SiO <sub>2</sub> )	-56.79
Brucite (Mg(OH) <sub>2</sub> )	-3.01
Magnesium silicate	-178.10
Iron hydroxide (Fe(OH) <sub>3</sub> )	< 0.001
Siderite (FeCO <sub>3</sub> )	0.287
Strengite (FePO <sub>4</sub> *2H <sub>2</sub> O)	>-0.001
Calcium oxalate (CaC <sub>2</sub> O <sub>4</sub> )	-0.230
Ca pyrophosphate (CaP <sub>2</sub> O <sub>7</sub> )	-0.00197
Zinc phosphate (Zn <sub>3</sub> (PO <sub>4</sub> ) <sub>2</sub> )	-0.0162

### SIMPLE INDICES

Langelier	0.132
Ryznar	7.07
Puckorius	6.18
Larson-Skold Index	0.475
C.C.P.P.	24.31

### BOUND IONS

Calcium	104.04	91.74
Carbonate	1.30	0.396
Phosphate	0.00	0.00

### TOTAL

### FREE

### CHEMICAL PROPERTIES

D.I.C. (mg/L C)	84.84
Pb solubility(ug/L)	2.54
Cu solubility(mg/L)	4.81
Zn solubility(mg/L)	9.61
PPO <sub>4</sub> solubility(mg/L)	2.71
PO <sub>4</sub> solubility(mg/L)	12.85

### OPERATING CONDITIONS

Temperature (°F)	55.00
Time(mins)	3.00

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