

Optimize Magnesium Dosage Process at Westside WWTP



Project Start: 11-19-10

Project Champion: Jimmie Johnson

Green Belt: Sheila Hudnall

Black Belt: Sherry Pettit

Team Members: Guillermo Garcia, Earl Brown, Kenneth Johnson, Homer Pruitt, Kenneth Acker, Treatment Plant Operators, Jim Yanker

Define Phase

1. Select Output Characteristics



What is The Purpose of Magnesium Hydroxide ?

pH Stabilization

Odor Control of Raw Wastewater

Sludge Reduction / Settling Solids in the Primaries

TCEQ Requirements for pH Levels in Effluent Flow

pH Levels between 6.0 – 9.0

Monitored daily at effluent flow

Magnesium hydroxide *n.*

A white powder used as an antacid and a laxative.

The American Heritage® Stedman's Medical Dictionary

Define Phase

1. Select Output Characteristics



Odor Control

Odors occur when wastewater pH allows (H_2S) hydrogen sulfide to evolve from liquid phase

Sulfate reducing bacteria operate best at pH levels 6.8 to 7.2. Above this ideal pH range, less sulfide is produced and SRB growth rate is stunted.

Since THIOGUARD® reactivity varies with wastewater chemistry, a titration is necessary to determine the optimum rate of addition. In general, it takes only 30-100 gallons of THIOGUARD® per million gallons of sewage to raise and hold the pH in a range of 8.0 to 8.5. Once determined, the feed rate is seasonally constant, despite variances in sulfide concentration.

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Titration:

an operation, used in volumetric analysis, in which a measured amount of one solution is added to a known quantity of another solution until the reaction between the two is complete. If the concentration of one solution is known, that of the other can be calculated

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Define Phase

1. Select Output Characteristics



Mag Information

Mag works as a buffer that can be used if alkalinity levels at influent are too low

Mag formula is 1 part mag for 2 parts hydrogen to raise pH

Mag raises pH levels slowly and can only obtain about a 9.0 pH level

It only takes 0.4 mg/L of caustic soda to raise a water sample to pH 9 and 4.0 mg/L to reach pH 10.

0.4 and 4.0 mg/L of Lime raises pH to 9.06 and 10.06 respectively.

It takes 100+ mg/L of **THIOGUARD®** to raise a water sample to pH 8.8.

This same 100 mg/L of **THIOGUARD®** has the same neutralizing power as 138 mg/L of caustic soda and 135 mg/L of lime and would be the equivalent of, though significantly more reactive ...

- Premier Magnesia -

Define Phase

1. Select Output Characteristics



Texas Commission of Environmental Quality (TCEQ) Requirements

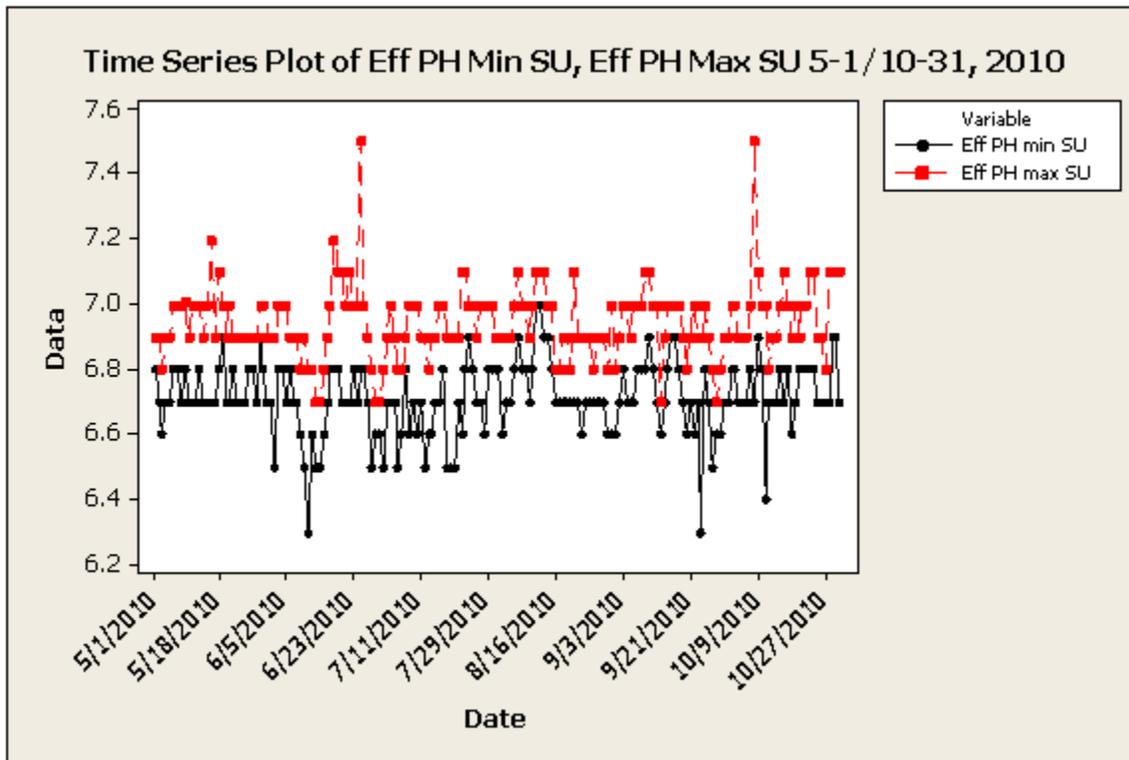
City of Tyler	TPDES Permit No. WQ0010653001
<u>INTERIM PHASE EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS (CONTINUED)</u>	<u>Outfall Number 001</u>
2. The effluent shall contain a chlorine residual of at least 1.0 mg/l after a detention time of at least 20 minutes (based on peak flow) and shall be monitored daily by grab sample. The permittee shall dechlorinate the chlorinated effluent to less than 0.1 mg/l chlorine residual and shall monitor chlorine residual daily by grab sample after the dechlorination process. An equivalent method of disinfection may be substituted only with prior approval of the Executive Director	
3. The pH shall not be less than 6.0 standard units nor greater than 9.0 standard units and shall be monitored once per day by grab sample.	
4. There shall be no discharge of floating solids or visible foam in other than trace amounts and no discharge of visible oil.	
5. Effluent monitoring samples shall be taken at the following location(s): Following the final treatment unit.	
6. The effluent shall contain a minimum dissolved oxygen of 6.0 mg/l (March-November) and 5.0 mg/l (December-February), and shall be monitored once per day by grab sample.	
7. The annual average flow and maximum 2-hour peak flow shall be reported monthly	

Define Phase

1. Select Output Characteristics



Time Series Plot of Effluent PH Minimum & Maximum SU Sample Test Results



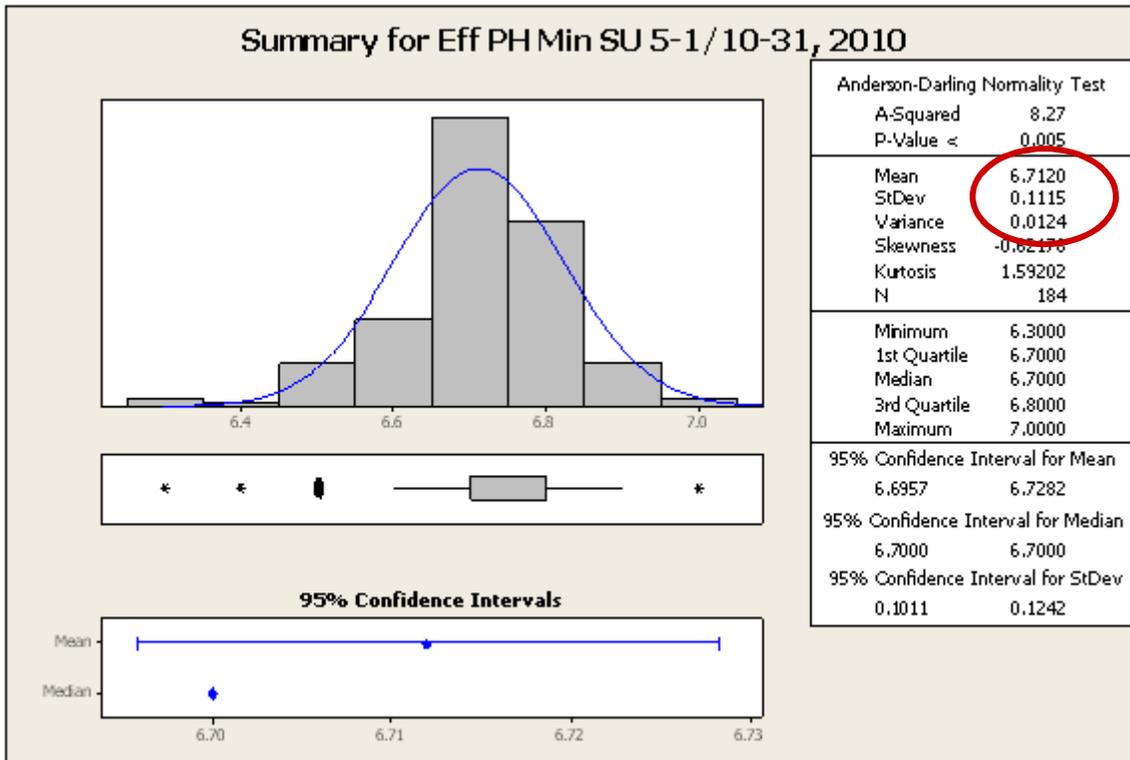
The Time Series Chart indicates the variation between the pH minimum and the pH maximum sample test results.

Define Phase

1. Select Output Characteristics



Summary for Effluent PH Minimum SU Sample Test Results



Mean = 6.712

StDev = 0.1115

Define Phase

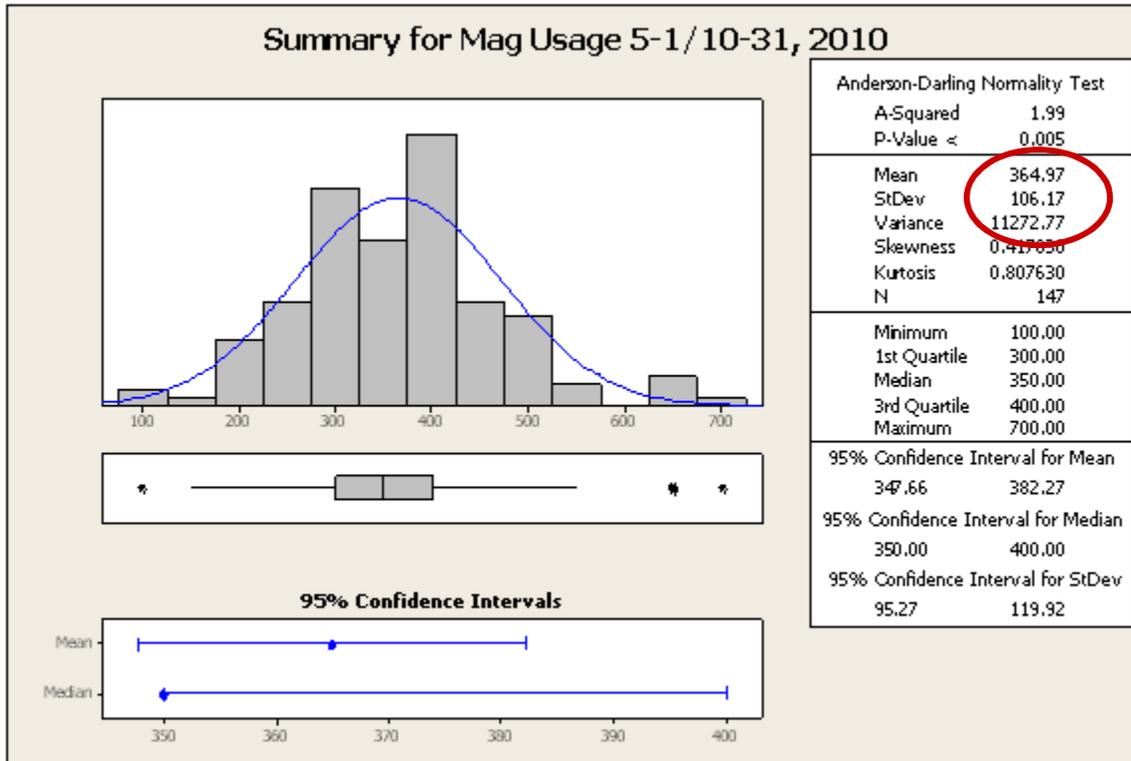
1. Select Output Characteristics



Summary for Mag Usage 5-1/10-31, 2010 - Gallons per Day

Mean =364.97

StDev =106.17



Define Phase

2. Define Performance Standards



Project Charter

Project Charter			
Project Authorization			
Organization:	Champion:	Process Owner:	
Tyler Water Utilities	Jimmie Johnson	Kenneth Johnson	
Project:	Project #:		
Optimize Magnesium Dosage Process (Effluent) at Westside WWTP	4		
Problem Statement:			
As of May 1, 2010 through October 31, 2010 the average Magnesium Hydroxide dosage usage has been sporadic. On average the dosage has been 364.97 gallons per day with standard deviation of 106.17. The Magnesium Hydroxide added to the wastewater ranged from 100 to 700 gallons per day.			
Project Objective:			
Identify standard dosage of Magnesium Hydroxide to obtain and maintain PH levels conforming to the Texas Commission of Environmental Quality (TCEQ). The standard minimum being 6.0 with a maximum being 9.0.			
Estimated Defect Level:	Initial Goal:	Estimated Benefits:	
364.97	200		
Approval Date:	Champion Signature:	Process Owner Signature:	
Estimated Completion Date:	Project Leader:	Financial Analyst:	
	Sherry Pettit	Jim Yanker	
Project Team			
Name	Role	Comments	Phone
Earl Brown	Factory/Facility Mana		903-592-5391
Sheila Hudnall			903-531-1232
Jimmie Johnson	Champion		903-939-1538
Kenneth Johnson	Process Owner		903-592-5391
Guillermo Garcia	Master Black Belt		903-595-7174
Jim Yanker	Financial Analyst		903-531-1141
Homer Pruitt	Lab Analyst		903-592-5391
Kenneth Acker	Consultant		903-592-5391
Sherry Pettit	Project Leader		903-531-1288
Project Definition and Scoping			
Metrics (unit of measure):			
Dosage (Gallons) PH Levels			

Problem Statement:

As of May 1, 2010 through October 31, 2010 the average Magnesium Hydroxide dosage usage has been sporadic. On average the dosage has been 364.97 gallon per day with a standard deviation of 106.17. The Magnesium Hydroxide added to the wastewater ranged from 100 to 700 gallons per day.

Project Objective:

Identify a standard dosage of Magnesium Hydroxide to obtain and maintain the levels conforming to the Texas Commission of Environmental Quality (TCEQ). The standard minimum being 6.0 with a maximum being 9.0.

Define Phase

2. Define Performance Standards



Summary of Cost for Magnesium Hydroxide

Financial Data

Cost of Magnesium Hydroxide per gallon

$45,340 \times .5387 / 2000 = 12.2123$ TN

Truck load 45,340 lbs / Density 11.99 lb/gal = 3781gal

12.2123 TN \times \$545.00 = \$6655.70 / 3781 = \$1.76 gal.

Density, lb/gal varies due to wt % solids

The cost per gallon changes with each truck load received due to the % of the product.

The average per gallon is \$1.85.

Average cost of Magnesium Hydroxide per gallon is \$1.85.

Define Phase

2. Define Performance Standards



City Council Communication for Annual Price Agreement for Magnesium Hydroxide



CITY OF TYLER
CITY COUNCIL COMMUNICATION

Agenda Number: C-A-11

Date: September 22, 2010

Subject: Request that the City Council consider awarding bids opened August 10, 2010, for the purchase of various annual chemical price agreements for chemicals, from October 1, 2010 thru September 30, 2011, to the listed vendors.

Page: 1 of 2

Item Reference: City Council Agenda Items:

On August 10, 2010, sealed bids for Bid No. 10-048 were received for furnishing Liquid Oxygen for use in water treatment. Four bids were received. Praxair of Burr Ridge, Illinois submitted the lowest responsible bid.

On August 10, 2010, sealed bids for Bid No. 10-049 were received for furnishing Pulverized Quicklime for use in water treatment. Three bids were received. Texas Lime Company, Dallas, Texas, submitted the lowest responsible bid.

On August 10, 2010, sealed bids for Bid No. 10-050 were received for furnishing Fluorosilicic Acid (Fluoride) for use in water treatment. Two bids were received. LCI, Ltd. of Jacksonville Beach, Florida, submitted the lowest responsible bid.

On August 10, 2010, sealed bids for Bid No. 10-051 were received for furnishing Anhydrous Ammonia for use in water treatment. Three bids were received. DPC Industries of Lindale, Texas, submitted the lowest responsible bid.

On August 10, 2010, sealed bids for Bid No. 10-052 were received for furnishing 150 lb. Cylinders of Chlorine for use in water treatment. Three bids were received. Brenntag Southwest Inc. of Longview, Texas submitted the lowest responsible bid.

Agenda Number: C-A-11

Page: 2 of 2

On August 10, 2010, sealed bids for Bid No. 10-053 were received for furnishing One-Ton Cylinders of Chlorine for use in water and wastewater treatment. Three bids were received. Altivia Corporation of Houston, Texas, submitted the lowest responsible bid.

On August 10, 2010, sealed bids for Bid No. 10-055 were received for furnishing Magnesium Hydroxide for wastewater treatment. Two bids were received. Premier Chemicals of Austin, Texas, submitted the only responsible bid.

On August 10, 2010, sealed bids for Bid No. 10-056 were received for furnishing Sludge Dewatering Polymer for wastewater treatment. Three bids were received. Polydyne, Inc. of Riceboro, Georgia, submitted the lowest responsible bid.

On August 10, 2010, sealed bids for Bid No. 10-057 were received for furnishing Sulfur Dioxide for wastewater treatment. Three bids were received. Brenntag Southwest Inc. of Longview, Texas submitted the lowest responsible bid.

On August 10, 2010, sealed bids for Bid No. 10-058 were received for furnishing Filter Polymer for water treatment. Four bids were received. Ashland Hercules, of Wilmington, Delaware, submitted the lowest responsible bid.

These annual price agreements will establish unit prices to be used for periodic purchases throughout the year.

The tabulation sheets are attached for review.

RECOMMENDATION:

It is recommended that the City Council consider awarding bids opened August 10, 2010 for the purchase of various annual price agreements for chemicals, from October 1, 2010 thru September 30, 2011, to the listed vendors.

Drafted/Recommended By:
Department Leader


Jimmie Johnson, Manager Production & Water Quality

Edited/Submitted By:
City Manager



Define Phase

2. Define Performance Standards



Annual Price Agreement Tabulation Document

Tyler Water Utilities FY 2010/2011 Annual Chemical Bids Bid Tabulations				
Product	Bidder	Quantity	Unit Price	Estimated Totals
Liquid Oxygen (lbs)	Praxair	1,400,000	\$ 0.0337	\$ 47,180.00
	Air Liquide		\$ 0.0470	\$ 65,800.00
	ETOX		\$ 0.0362	\$ 50,718.20
	Apcl		\$ 0.0373	\$ 52,220.00
Pulverized Quicklime (1 Ton)	Austin White Lime	550	\$ 153.00	\$ 84,150.00
	US Lime Company		\$ 175.00	\$ 96,250.00
	Texas Lime Company		\$ 151.00	\$ 83,050.00
Fluorosilicic Acid (lbs)	LCI, Ltd.	179,000	\$ 0.300	\$ 53,700.00
	Penco		\$ 0.348	\$ 62,282.00
Anhydrous Ammonia (lbs)	LCI, Ltd.	68,000	No Bid	No Bid
	DPC, Inc.		\$ 0.550	\$ 37,400.00
	Penco		No Bid	No Bid
Chlorine (150 lbs)	DPC, Inc.	115	\$ 94.00	\$ 10,810.00
	ALTMA		No Bid	No Bid
	Brenttagg Southwest Inc.		\$ 54.00	\$ 6,210.00
Chlorine (1 Ton)	DPC, Inc.	260	\$ 554.00	\$ 144,040.00
	ALTMA		\$ 549.00	\$ 142,740.00
	Brenttagg Southwest Inc.		\$ 590.00	\$ 153,400.00
Magnesium Hydroxide (1 Ton)	Premier Chemicals	1,000	\$ 545.00	\$ 545,000.00
	ALTMA		No Bid	No Bid
Sludge Dewatering Polymer (lbs)	Ashland Hercules	30,000	\$ 0.940	\$ 28,200.00
	Polydyma		\$ 0.890	\$ 26,700.00
	ALTMA		No Bid	No Bid
Sulfur Dioxide (1 Ton)	DPC, Inc.	116	\$ 698.00	\$ 80,968.00
	ALTMA		No Bid	No Bid
	Brenttagg Southwest Inc.		\$ 640.00	\$ 74,240.00
Filter Polymer (lbs)	Ashland Hercules	30,000	\$ 0.640	\$ 19,200.00
	Polydyma		No Bid	No Bid
	ALTMA		No Bid	No Bid
	Chameleon, Ind.		\$ 1.080	\$ 32,400.00

Measure Phase

3. Validate Measurement System



Measurement System Confirmation vs TCEQ standard

**CWA - Non-Potable Water
Performance Evaluation Report
NSI Laboratory Proficiency Testing Program
Study DMRQA-30 - Shipped: 03/15/2010 - Closed: 07/02/2010 - Reports Printed On: 07/20/2010
Participant USEPA Labcode: TX01293**

Study Designed and Coordinated by:
NSI Solutions, Inc.
7212 ACC Street, Houston, TX 27817
AZLA Certificate# 2432.01
1-800-234-7837

This evaluation report is being submitted to:
City of Tyler - Westside WWTP
Attention: Earl Brown
PO Box 2039
Tyler, TX, 75710-2039

LabCode and Accreditation Information:

Send Results to: State and EPA
EPA Lab Code: TX01293
State Lab Code:
Primary Agency: TX - Texas CEQ
N.D. Kaku
Add'l Agencies below
12100 Park 35 Circle, Bldg. APO Box 13087
Austin, TX 78753

Reports to: TX
EPA Region VI

Participant Information

NSI Lab Code: N35228B
Permittee Code: TX0047996

This report was submitted by Earl Brown, Wastewater Superintendent.

City of Tyler - Westside WWTP
PO Box 2039
Tyler, TX, 75710-2039
903-531-1235

Please contact Mark Hammersla at NSI if you have any questions about this report.
(800) 234-7837 - Mark.Hammersla@NSI-ES.com

This PT report may contain data not covered under AZLA Accreditation. Such data is noted by an asterisk.

MIC-003 Total and Fecal Coliform - City of Tyler - Westside WWTP - NSI Solutions/DMRQA-30

Analyte	NELAC Method Code	Method Description	Reported Value	Assigned Value	Units	EPA Code ¹	Acceptance Limits	Evaluation	Analysis Date
E.coli, MF	n/a	9222 B.	87.0	97.0	cfu/100mL	TX01293	8.00-693	ACCEPT.	6/2/10
Total Coliform, MF	- Not Reported -								
Total Coliform, MPN	- Not Reported -								
Fecal Coliform, MF	- Not Reported -								

Fecal Coliform, MPN - Not Reported -
E.coli, MPN - Not Reported -

PEI-026 Demand - City of Tyler - Westside WWTP - NSI Solutions/DMRQA-30

Analyte	NELAC Method Code	Method Description	Reported Value	Assigned Value	Units	EPA Code ¹	Acceptance Limits	Evaluation	Analysis Date
CBOD	n/a	SM 5210 B.	27.5	32.3	mg/L	TX01293	14.5 to 30.1	ACCEPT.	6/12/10
COD	- Not Reported -								
TOC	- Not Reported -								
BOD	- Not Reported -								

PEI-033 Total Residual Chlorine - City of Tyler - Westside WWTP - NSI Solutions/DMRQA-30

Analyte	NELAC Method Code	Method Description	Reported Value	Assigned Value	Units	EPA Code ¹	Acceptance Limits	Evaluation	Analysis Date
Total Residual Chlorine	n/a	SM 4500-Cl. D.	0.750	0.781	mg/L	TX01293	0.565 to 0.979	ACCEPT.	6/15/10

PEI-035 pH - City of Tyler - Westside WWTP - NSI Solutions/DMRQA-30

Analyte	NELAC Method Code	Method Description	Reported Value	Assigned Value	Units	EPA Code ¹	Acceptance Limits	Evaluation	Analysis Date
pH	n/a	SM 4500-H+ B.	7.46	7.50	units	TX01293	7.30 to 7.70	ACCEPT.	6/14/10

PEI-079 Residue - City of Tyler - Westside WWTP - NSI Solutions/DMRQA-30

Analyte	NELAC Method Code	Method Description	Reported Value	Assigned Value	Units	EPA Code ¹	Acceptance Limits	Evaluation	Analysis Date
Non-Filtrable Residue (TSS)	n/a	SM2540 D.	42.5	44.0	mg/L	TX01293	33.5 to 50.9	ACCEPT.	6/14/10
Total Solids	- Not Reported -								

PEI-138 Simple Nutrients - City of Tyler - Westside WWTP - NSI Solutions/DMRQA-30

Analyte	NELAC Method Code	Method Description	Reported Value	Assigned Value	Units	EPA Code ¹	Acceptance Limits	Evaluation	Analysis Date
Ammonia as N	n/a	SM 4500-NH3 D.	3.14	3.35	mg/L	TX01293	2.39 to 4.39	ACCEPT.	6/20/10
Nitrate as N	- Not Reported -								
Orthophosphate as P	- Not Reported -								
Nitrate-nitrite as N	- Not Reported -								

Scoring: Assigned values and acceptance limits for analytes included under the AZLA Scope of Accreditation are determined according to the USEPA National Standards for Water Proficiency Testing Studies.
¹ If present, the EPA Code of the lab that actually performed the analysis for this analyte.

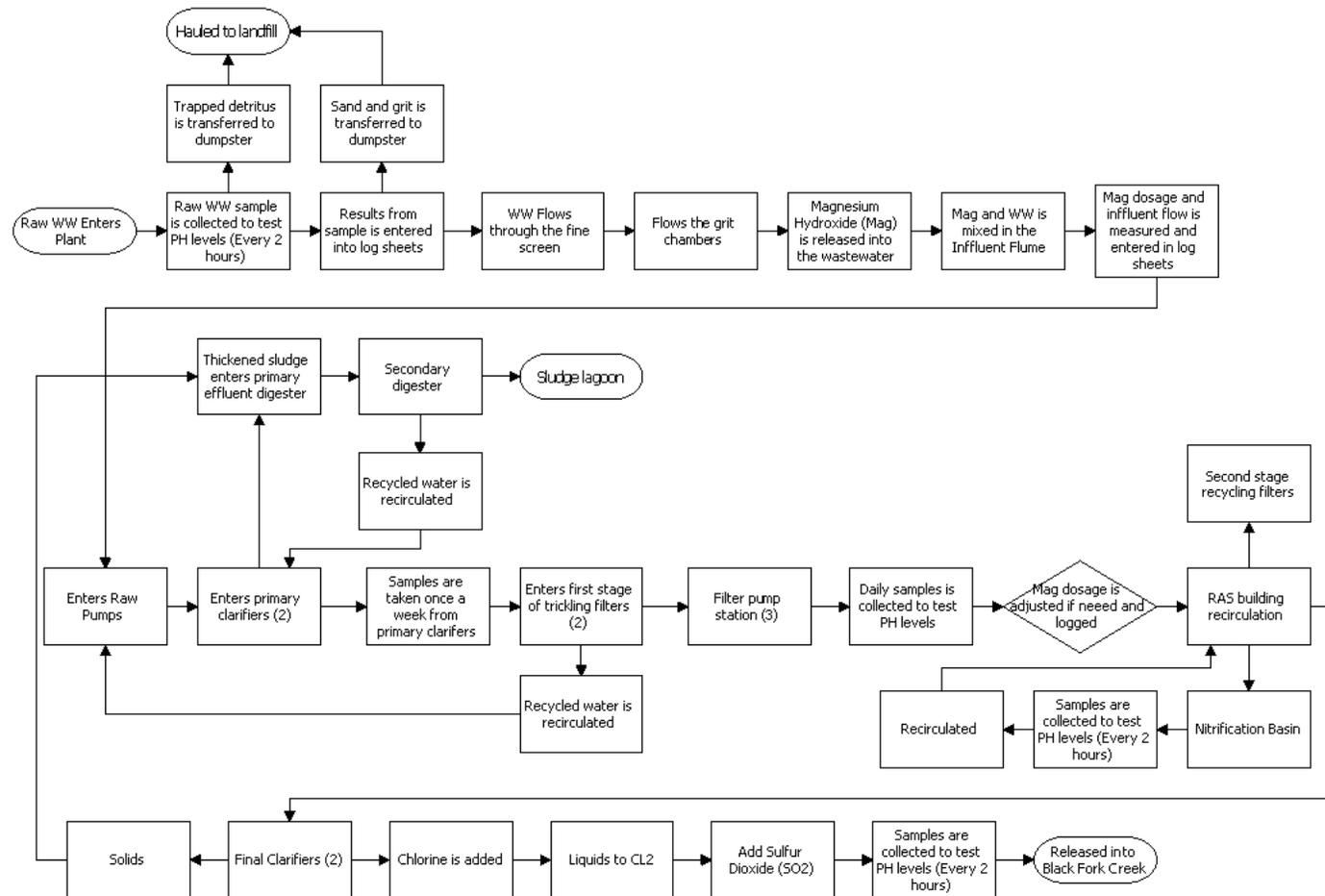


Measure Phase

6. Identify Variation Sources



Process Map of the Westside WWTP



Measure Phase

6. Identify Variation Sources



Premier Chemicals Analysis

PREMIER CHEMICALS, LLC

Currently

Based on current usage numbers, it is estimated that the Westside WWTP uses one truckload 1 of 50% Caustic Soda (NaOH) every ten days. This equates to 456.25 tons annually or 1.25 dry tons per day. Based on 8.0 mgd treated per day, this equates to 37.6 mg/L NaOH or 47.1 mg/L alkalinity on a CaCO₃ basis. These numbers exceed the 220 tons per year, estimated in the budget for the Westside WWTP. At the budgeted amount, Tyler would be supplying 18.1 mg/L NaOH or 22.7 mg/L alkalinity on a CaCO₃ basis.

Influent Ammonia: 17 mg/L

Influent Alkalinity: 145 mg/L

Nitrification Alkalinity Demand: 17 mg/L NH₃ x 8.64 mg/L Alk/NH₃ = 146.9 mg/L Alkalinity

Alkalinity Shortfall: 75-150 mg/L

Current Supplement: 18-38 mg/L 23-47 mg/L Alkalinity

Thioguard

Premier proposes the addition of Thioguard into the Parshall Flume, in order to facilitate optimal treatment through all phases of biological treatment process and reduce odors from the Primary Clarifiers and Trickling Filters. Proposed feed rate would be 100-200 gallons per day, to match current caustic soda alkalinity supplements. The equipment is as described below.

On August 13, 2008, C-A-6, the City Council approval the purchase of a Mag feed system for \$34,895 from Premier Chemicals, which is now Premier Magnesia. Premier Chemicals proposed the feed rate to be 100-200 gallons per day. (Caustic Soda was used previously.)

Measure Phase

6. Identify Variation Sources



Mag dosages are measured by reading the amount in the tank daily, the flow is measured by a percentage. It is a 5000 gallon tank.

Analyze Phase

7. Screen Potential Causes



Mag is added to the influent wastewater at an average rate of 365 gallons a day.

Measure Phase

6. Identify Variation Sources



Mag and wastewater is mixed in the influent flume.

Measure Phase

6. Identify Variation Sources



Primary Clarifier & Digesters



Trickling Filter, Nite Basin & Filter Pumps

Measure Phase

6. Identify Variation Sources



1st Stage Trickling Filter

Measure Phase

6. Identify Variation Sources



Final Sample Area

Measure Phase

6. Identify Variation Sources



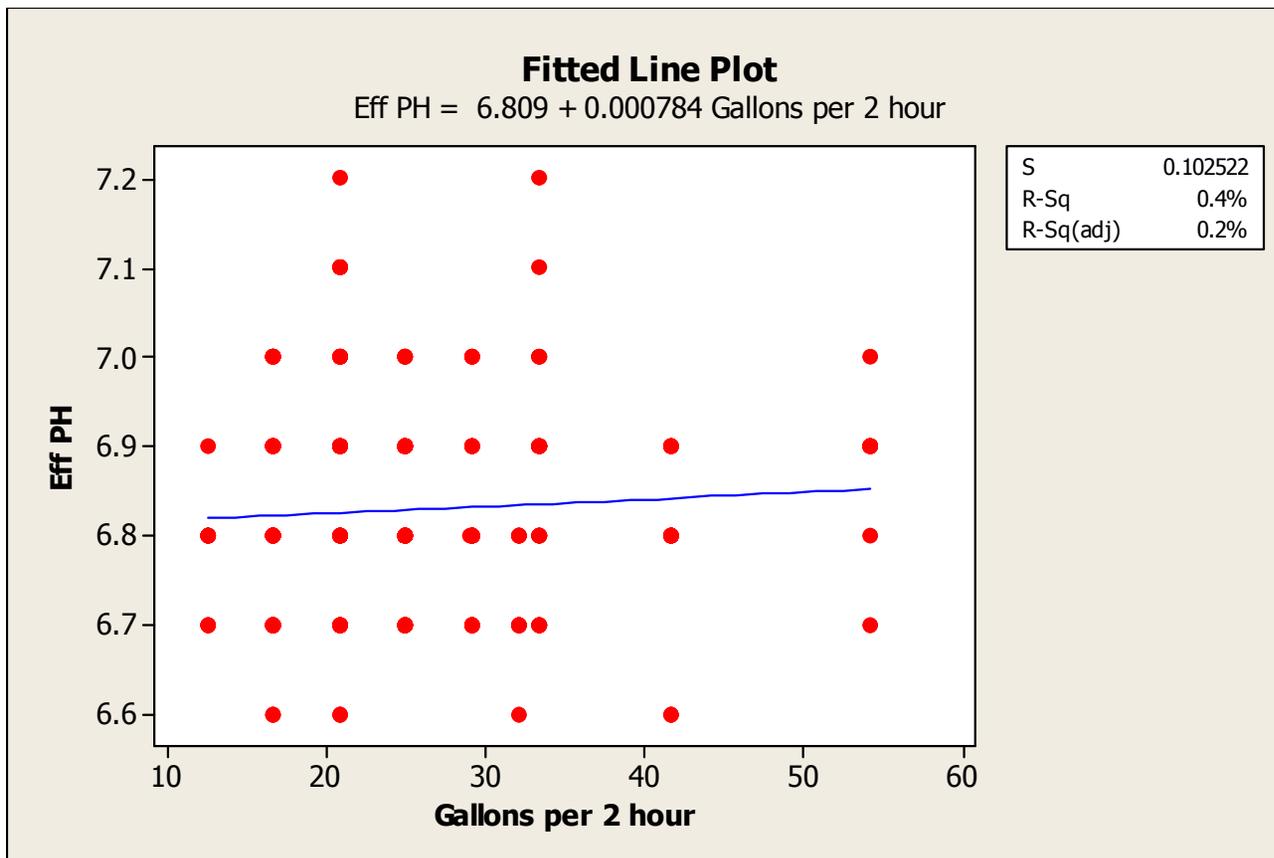
Average effluent flow into Black Fork Creek is 8million gallons per day. It takes approximately 6 hours for the process to cycle completely.

Analyze Phase

7. Screen Potential Causes



Fitted Line Plot Mag Dosage-Effluent pH



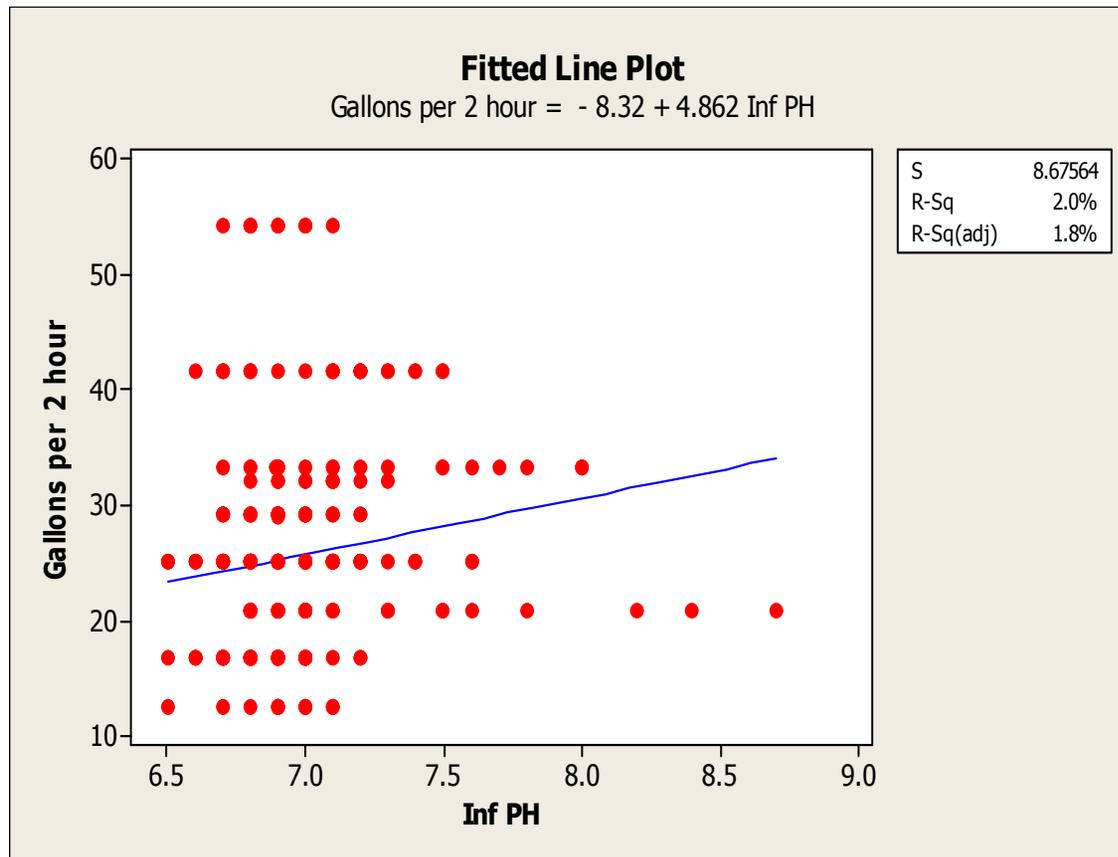
Mag dosage and Effluent pH levels were tracked for 31 days. The graph reveals the Effluent pH level changes very little whether the dosage is 12 gallons or 55 gallons per 2 hour intervals.

Analyze Phase

7. Screen Potential Causes



Fitted Line Plot Mag Dosage-Influent pH



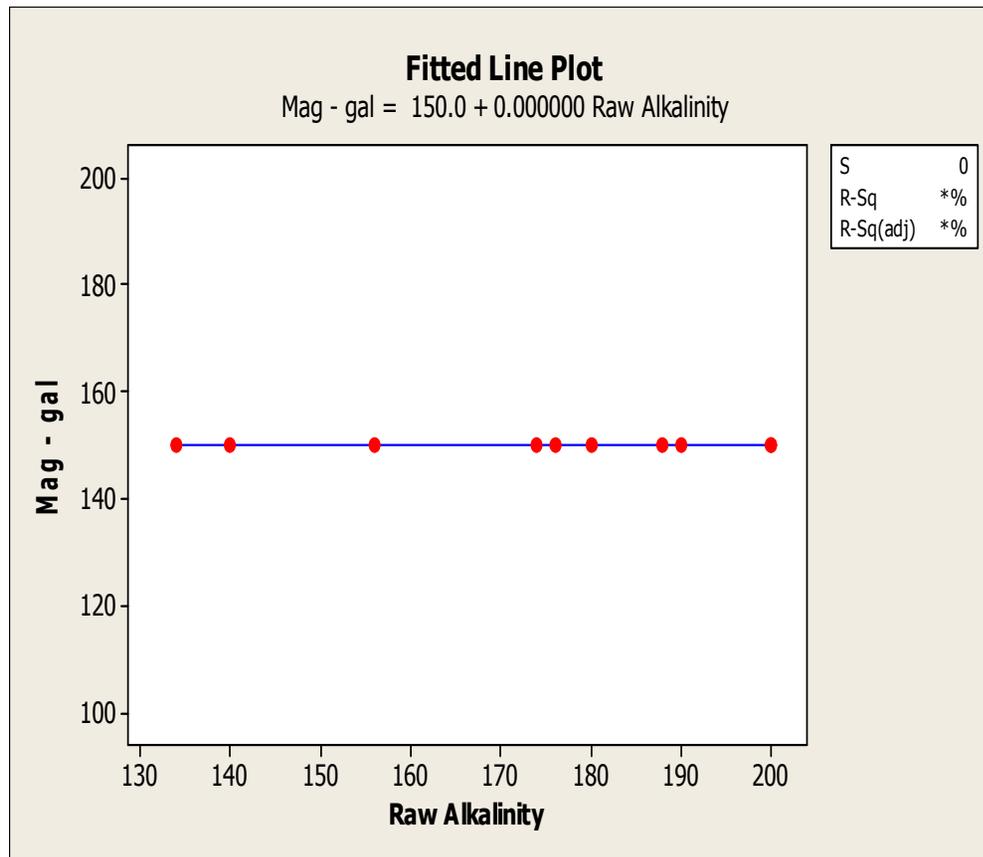
Mag dosage and Influent pH levels were tracked for the 31 days as well. The graph reveals that there is no statistical significance in the amount of Influent pH and the amount of mag put into the process.

Analyze Phase

7. Screen Potential Causes



Fitted Line Plot Mag Dosage-Raw Alkalinity



Additional analysis was conducted to verify if the mag dosage amount was added to the process based on the results of the Raw Alkalinity sample test results. A 5 day snapshot of mag and alkalinity data was gathered. The Regression Analysis indicates that there is statistical significance in the amount of raw alkalinity and the amount of mag put into the process.

Determined: Alkalinity sample test results were the driving factor for the mag dosage.

Analyze Phase

7. Screen Potential Causes



5 Day Snapshot of Mag Dosage-Alkalinity

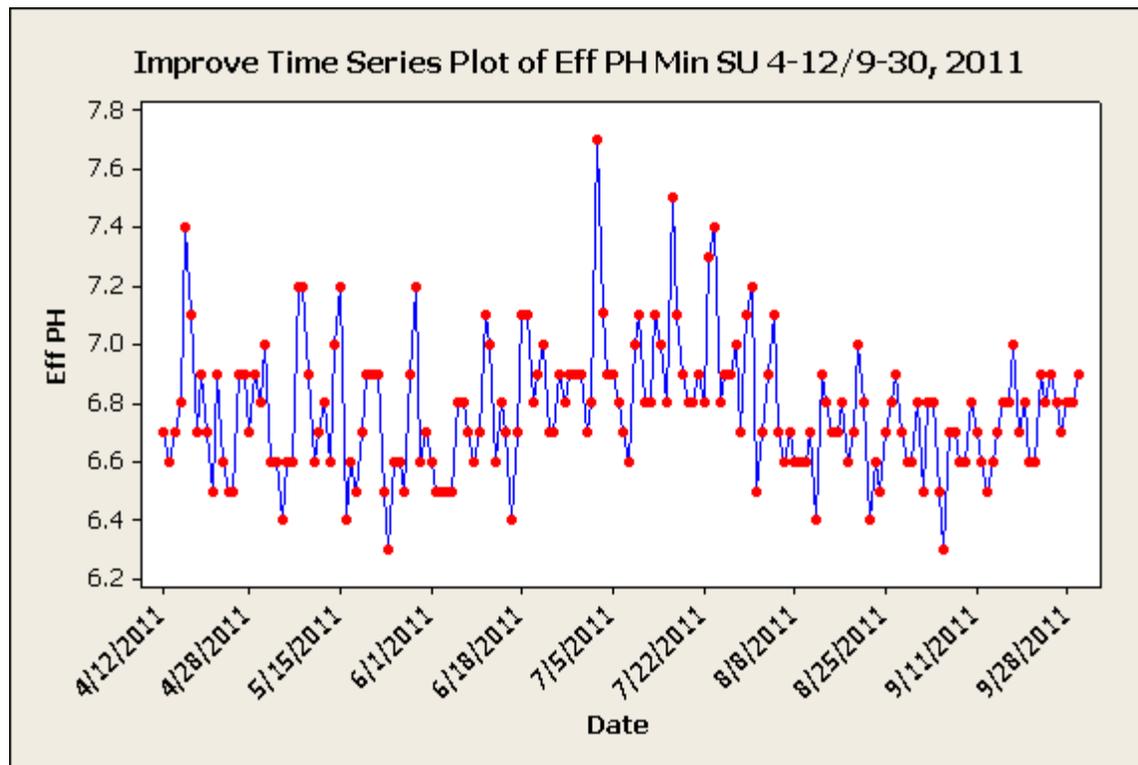
Westside Treatment Plant Analysis									
Date	Time	Raw Ammonia	Final Ammonia	Raw Alkalinity	Final Alkalinity	Raw Ph	Final Ph	Mag - gal	
2/28/2011	10:am	10	0.1	140	58	6.8	6.6	150	
	2:pm	12	0.1	176	72	6.7	6.4	150	
3/1/2011	10:am	12	0.1	200	80	6.82	6.53	150	
	2:pm	12	0.1	190	86	6.7	6.7	150	
3/2/2011	10:am	8	1.5	134	100	6.7	6.7	150	
	2:pm	14	1	200	106	6.9	6.7	150	
3/3/2011	10:am	10	2	174	116	6.8	6.9	150	
	2:pm	12	1	188	108	7	7	150	
3/4/2011	10:am	10	0.1	156	100	6.7	6.9	150	
	2:pm	12	0.1	180	100	6.8	6.7	150	

Improve Phase

11. Improved State Process Performance



Improved Time Series Plot of Effluent PH Min SU Sample Test Results 4-12/9-30, 2011



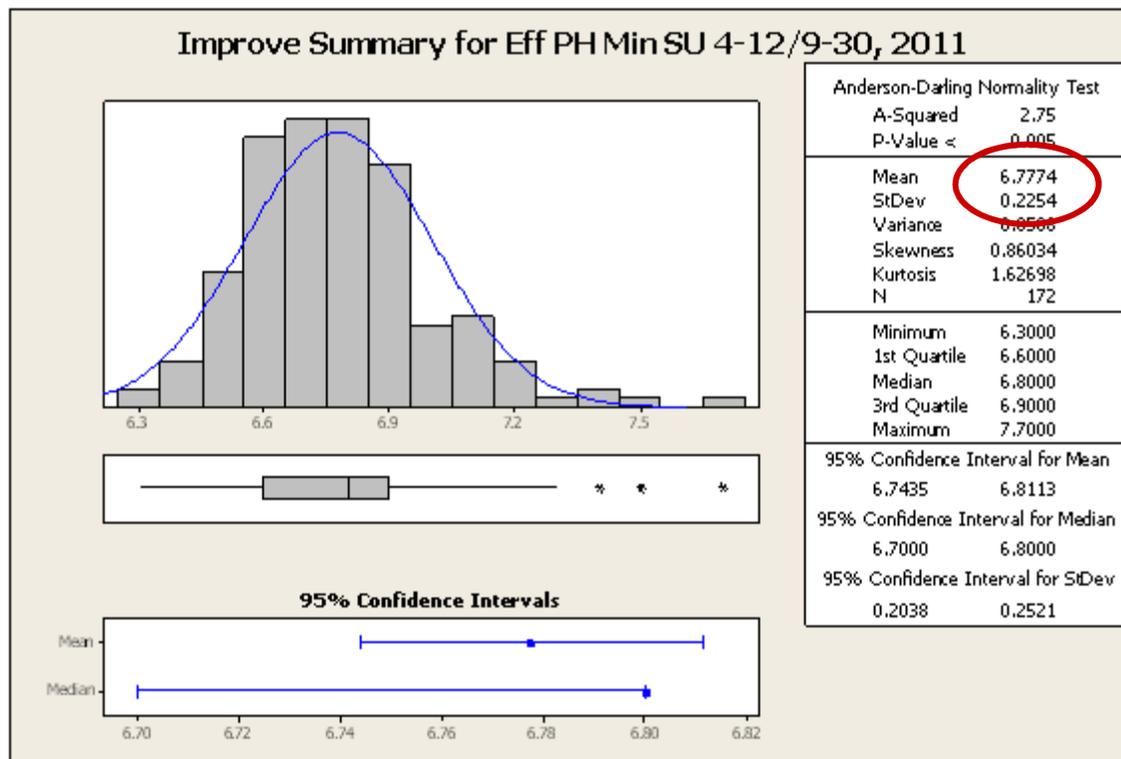
The Time Series Chart indicates the variation of the pH minimum sample test results.

Improve Phase

11. Improved State Process Performance



Improved Summary for Effluent PH Min SU Sample Test Results 4-12/9-30, 2011



Mean = 6.7774

StDev = 0.2254

Previous:

Mean = 6.712

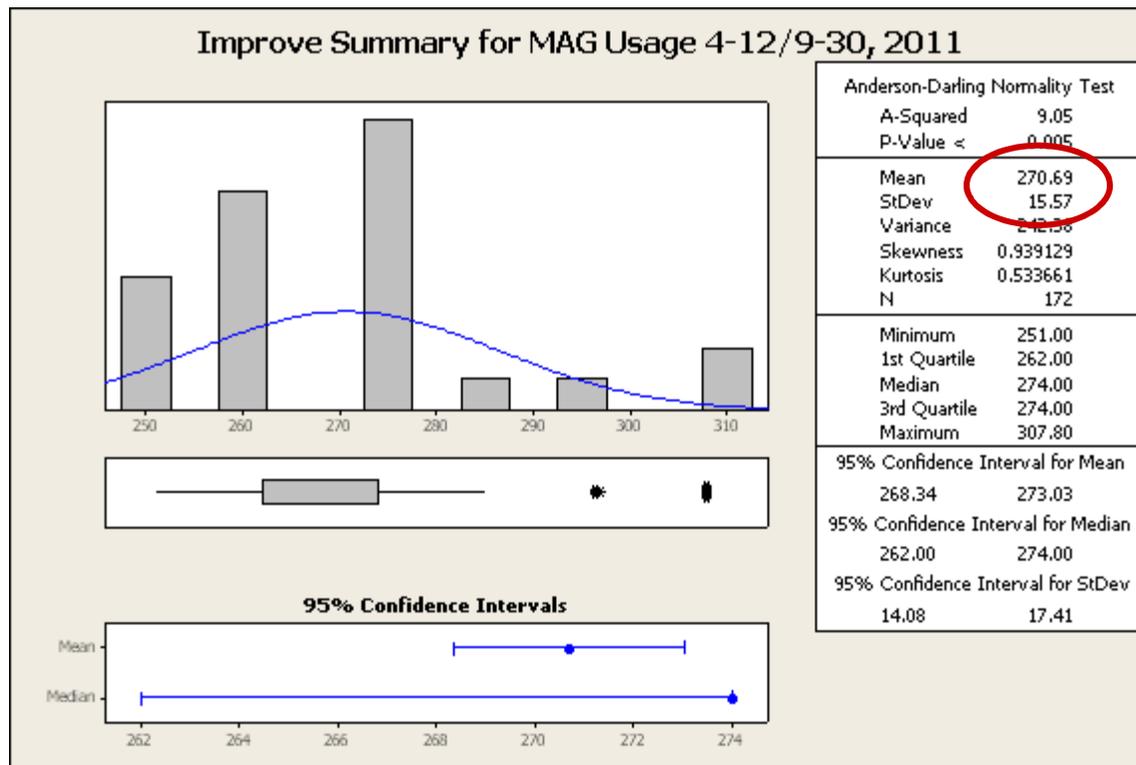
StDev = 0.1115

Improve Phase

11. Improved State Process Performance



Improved Summary for Mag Usage 4-12/9-30, 2011 - Gallons per Day



Mean =270.69

StDev =15.57

Previous:

Mean =364.97

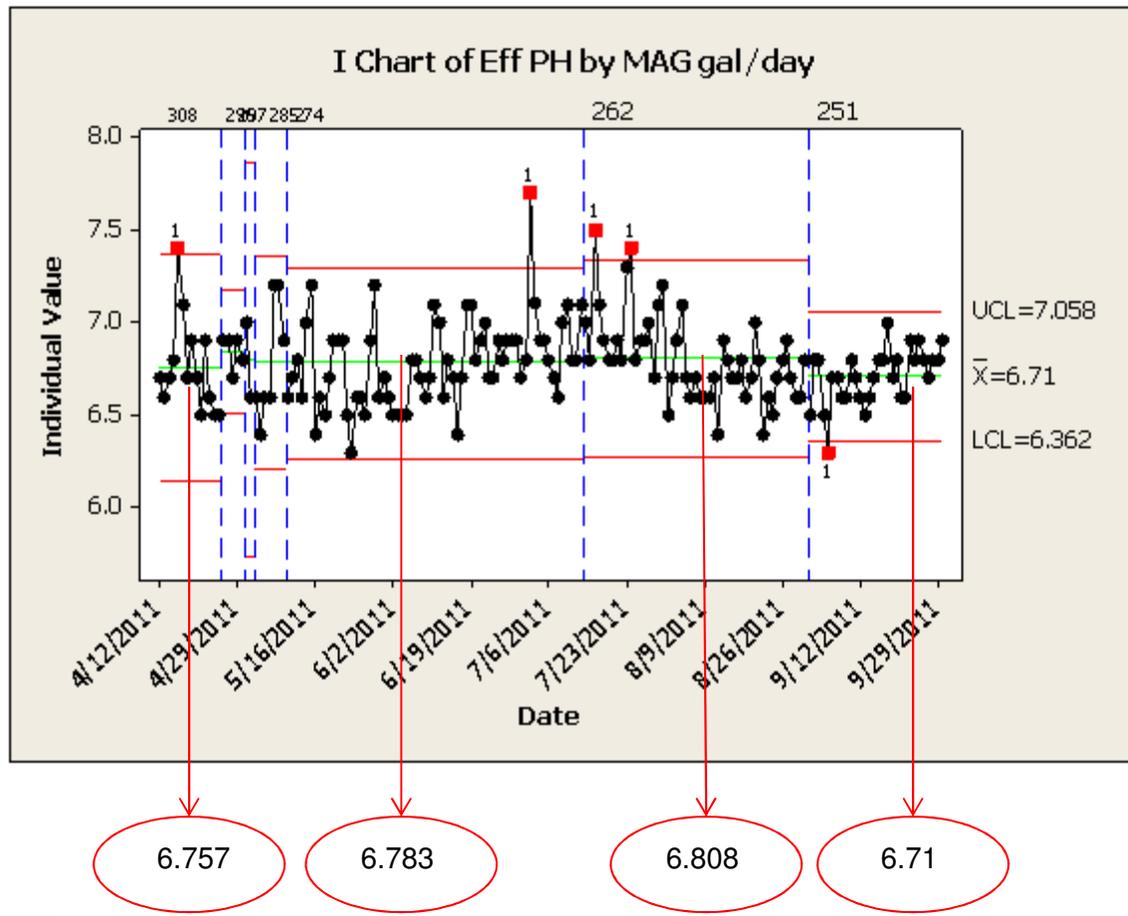
StDev =106.17

Improve Phase

11. Improved State Process Performance



Improve I Chart of Eff Ph by Mag 4-12/9-30, 2011 – Gallons per Day



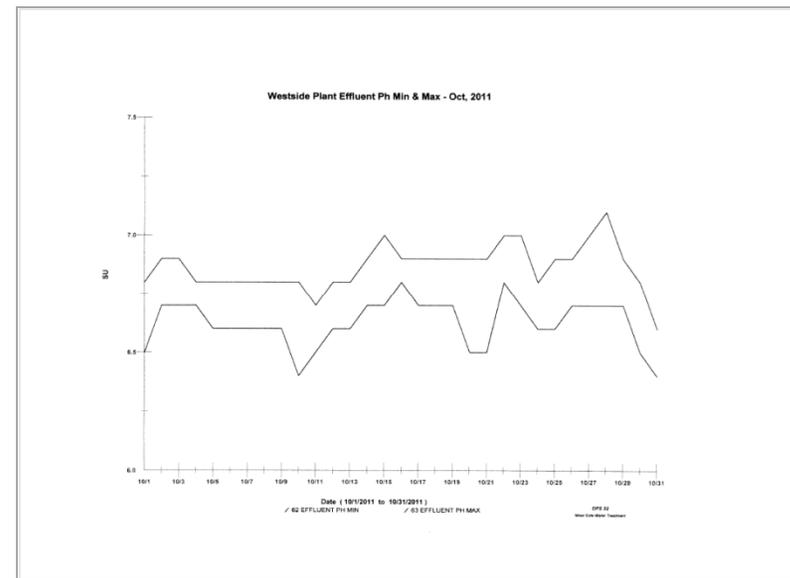
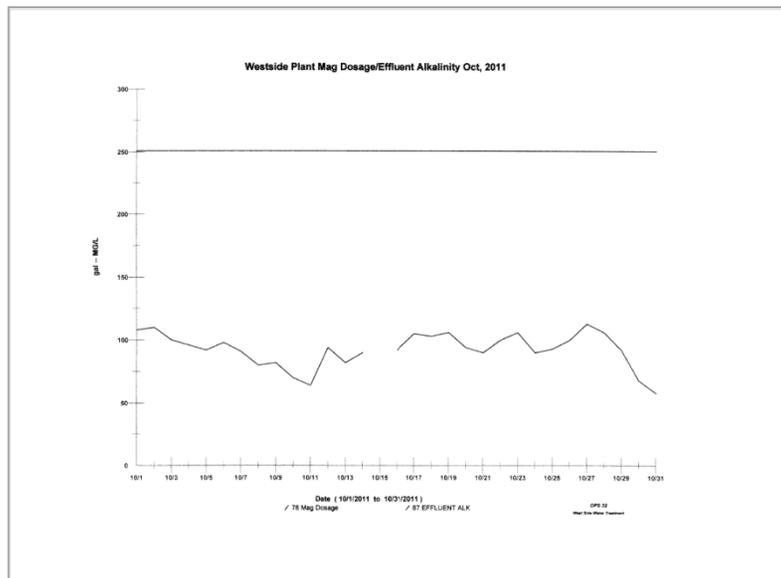
I-Chart illustrates the improvement of the overall process during the course of the project. The chart clearly shows a reduction in Mag dosage with very little change to the Ph sample test results.

Control Phase

12. Implement Process Controls



OPS Charts for Mag Dosage, Eff Alkalinity and Eff Ph Min/Max SU Measurements



OPS Charts were processed in order to view the status of the Mag usage, effluent alkalinity measurements and Ph measurements on a daily basis or as needed. Management communicates with employees concerning data which exceeds OPS Chart control limits.

Control Phase

12. Implement Process Controls



Standard Operating Procedures

Standard Operating Procedures
Westside Treatment Plant
Magnesium Hydroxide

Operators will monitor alkalinity daily, to insure that alkalinity does not fall below 40mg/L.

Operators would notify Chief operator and monitor the situation for the next 48 hours, and if there is no change in the low alkalinity. The Chief Operator will direct the operators in increasing mag dosage.

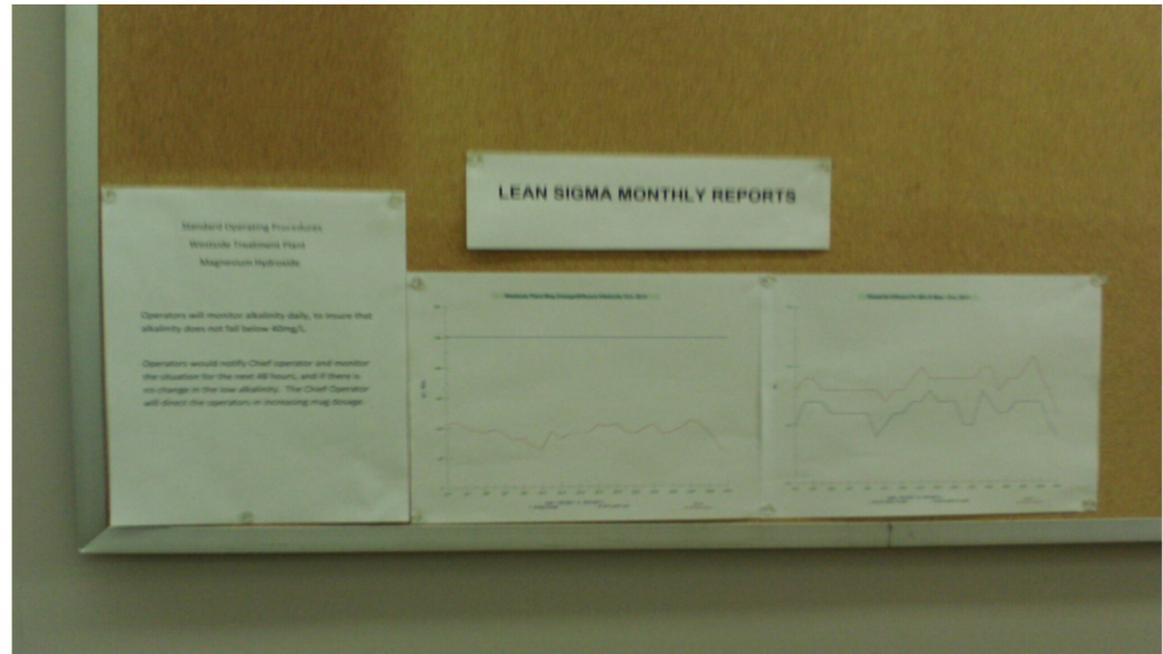
Standard Operating Procedures were established for the Westside Treatment Plant Magnesium Hydroxide dosage process.

Control Phase

12. Implement Process Controls



Visual Board



A Visual Management Board has been created. Lean Sigma project information will be displayed for viewing.

Control Phase

12. Implement Process Controls



Visual Board



Control Phase

12. Implement Process Controls



Data and Cost Calculation

Initial Cost	\$	246,466							
Hard Dollar Savings	\$	79,332							
Total Savings	\$	79,332							
			Optimize Magnesium Dosage Process at Westside WWTP						
			Data and Cost Calculation October 2011/October 2012						
Data			Hard Dollar Calculations						
Month	Average Mag Usage Per Day (Gallons)	Average Mag Usage For The Month (Gallons)	Initial Average Mag Usage Per Day (Gallons)	Mag Savings Per Day (Gallons)	Mag Cost Savings Per Day (1.85 Per Gallon)	Savings			
May	278	8,618	365	87	160.89	\$ 4,988			
June	274	8,220	365	91	168.29	\$ 5,049			
July	267	8,277	365	98	181.24	\$ 5,619			
August	262	8,122	365	103	190.49	\$ 5,905			
September	251	7,530	365	114	210.84	\$ 6,325			
October	251	7,781	365	114	210.84	\$ 6,536			
November	251	7,530	365	114	210.84	\$ 6,325			
December	251	7,781	365	114	210.84	\$ 6,536			
January	251	7,781	365	114	210.84	\$ 6,536			
February	251	7,279	365	114	210.84	\$ 6,114			
March	251	7,781	365	114	210.84	\$ 6,536			
April	251	7,530	365	114	210.84	\$ 6,325			
May	251	7,781	365	114	210.84	\$ 6,536			
June			365						
July			365						
August			365						
September			365						
October			365						

The Data and Cost Calculation captures the hard dollar savings as a result of the completed project.

The initial estimate for hard dollar savings for this project was \$77,653.

The actual savings to date is 79,332.