



A watershed-based NPDES approach  
to AMD treatment in  
Muddy Creek, Cheat River,  
West Virginia, USA.

Greg Phillips Jr.  
Environmental Resource Program  
Manager II  
WV DEP Office of Special Reclamation  
Philippi, WV

# NPDES approach to AMD treatment in Muddy Creek, Cheat River

Location

Difference between “Title 4” and “Title 5” mines as it pertains reclamation of orphaned, abandoned, forfeited and to the SMCRA

Costs of treating Title 5 AMD discharges in a “Point Source” approach

Legal and policy changes that had to be made to implement this approach

Components specific to the Muddy Creek watershed

Water quality results

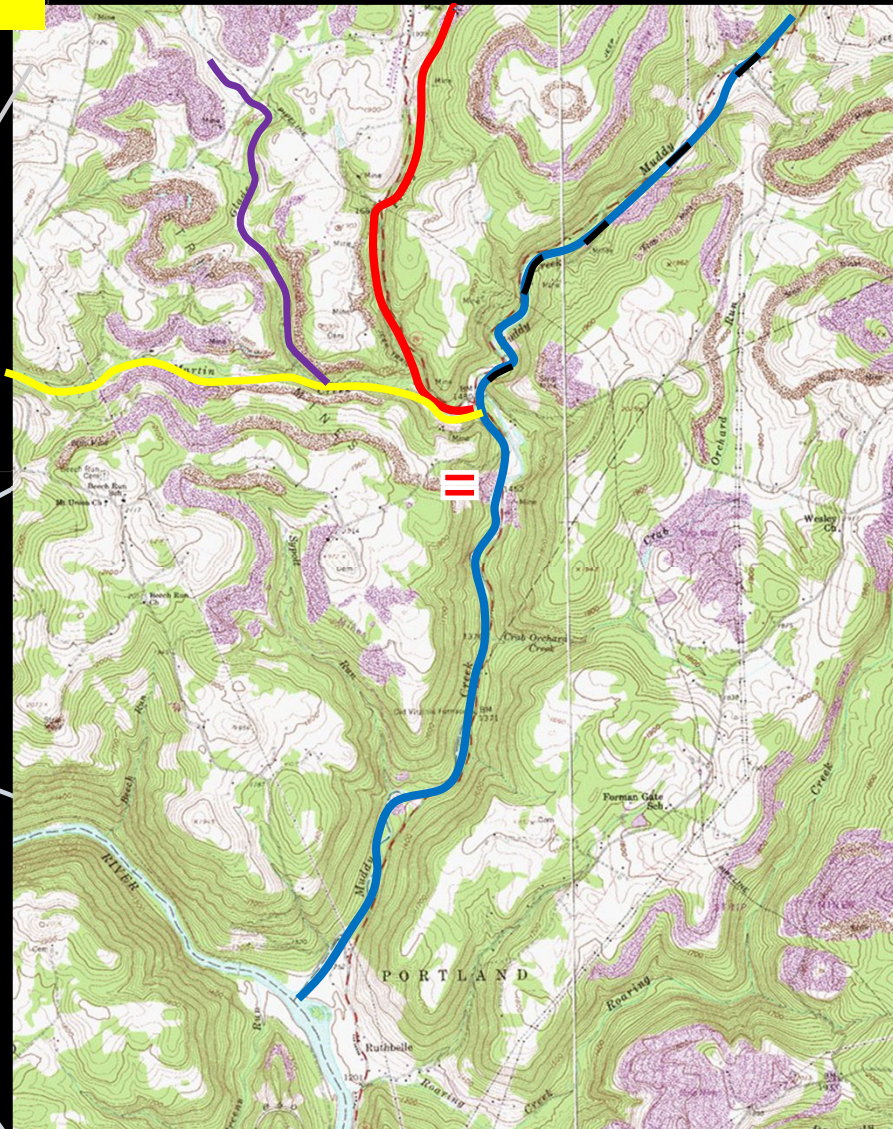
What we have learned



# Muddy Creek Watershed

Muddy Creek Watershed

Morgantown



Muddy Creek in 2016  
Impaired

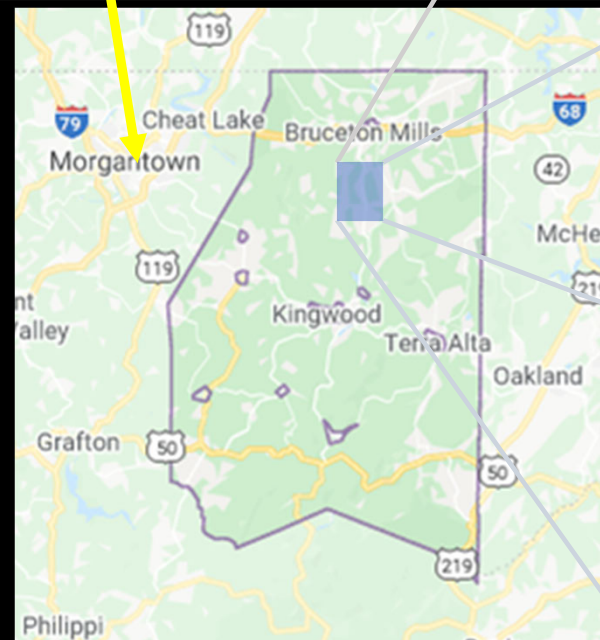
Trout Stream

Fickey Run  
*Impaired*

Glade Run  
*Impaired*

Martin Creek  
*Impaired*

T & T Mine Portals





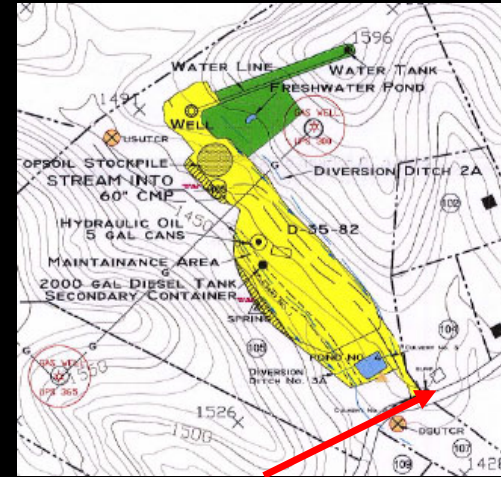
# Title 5 vs. Title 4 Abandoned/Forfeited Mine Sites

Surface Mine Control and Reclamation Act Passed (SMCRA) August 3, 1977.

Establishing Title 4 (Pre-law) Mine sites and Title 5 (Post-law) Mine sites.

SMCRA required States to establish a Mine permit program including NPDES permit. Requiring permittee to monitoring discharges and reclaiming the mine site.

What happens when operator walks away and does not reclaim site?



Typical NPDES Sample Location Title 5 Minesite

## Title 5 Forfeited Mine Permits (Post-Law)

In West Virginia, that is the WVDEP Office of Special Reclamation (OSR) Program.

## Title 4 Abandoned & Orphaned Mines (Pre-Law)

In West Virginia that is managed by the WVDEP Office of Abandoned Mine Land and Reclamation (AMLR) Program.





# OSR “Point Source” NPDES Approach Costs Treating Title 5 Discharges

## T&T EM-113 MINE

1994 (time of forfeiture) to 2016 OSR had spent over \$9 million in operational costs. Outdated and inefficient facility.

New facility was needed to meet NPDES limits at a cost of \$8 Million.



## ADDITIONAL MINE STIES IN MUDDY CREEK WATERSHED

In 2016 OSR had 6 active water treatment sties . Capital costs for those sites were \$8 Million.

OSR had spent over \$3.5 Million in operations cost for those sites. *(Average of \$50,000/site/year.)*

At that time OSR also had 3 additional sites that required initial capital costs of nearly \$4 Million. It was estimated that these sites would have a yearly total operational costs of \$120,000/year.

Treating all Title 5 AMD Discharges "Point Source" approach		
Capital Costs	\$	12,500,000
Operational Costs/Year	\$	1,000,000



## Treating all Title 5 AMD Discharges "Point Source" approach

Capitol Costs \$ 12,500,000

Operational Costs/Year \$ 1,000,000

## 2016 The Problem

Title 5 Discharges

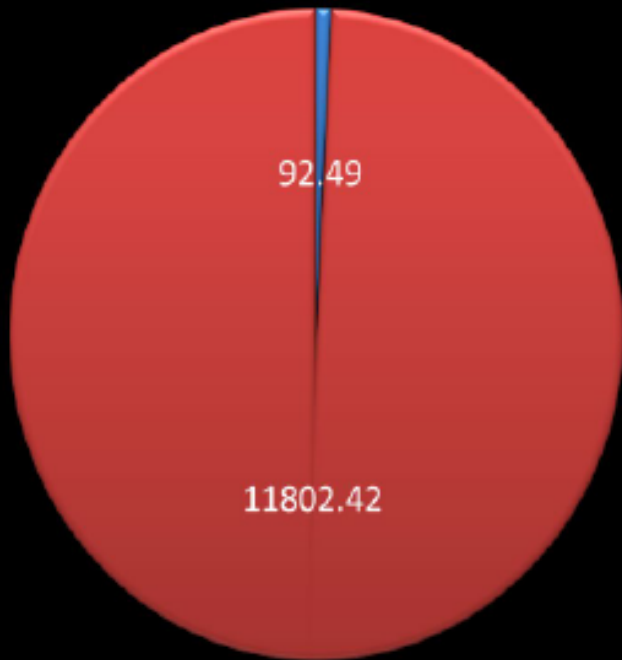


Title 4 Discharges

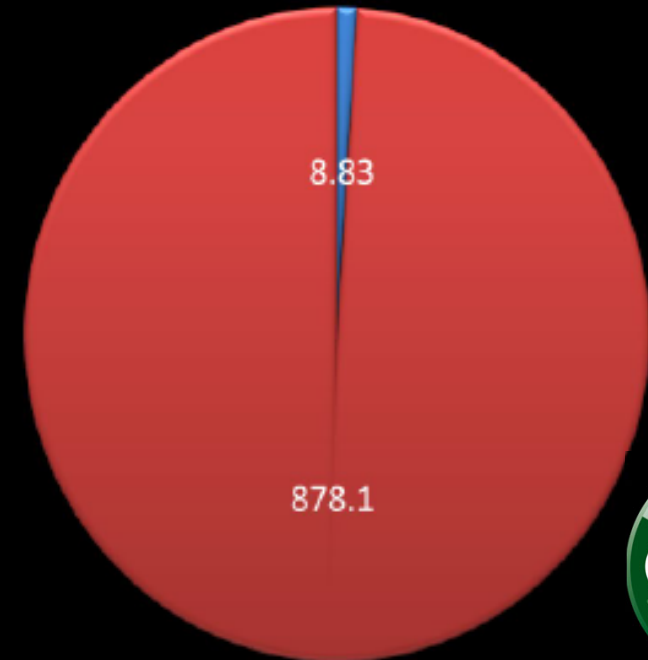


**Muddy Creek 50% Acid Load  
To Cheat River Watershed**

### Acid Load (lbs/day)

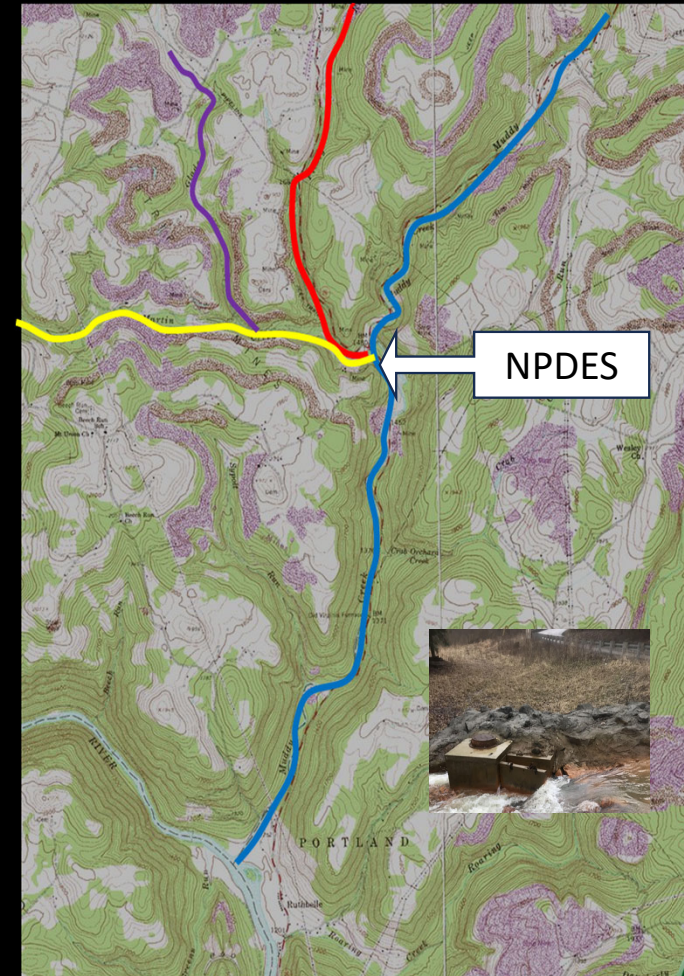
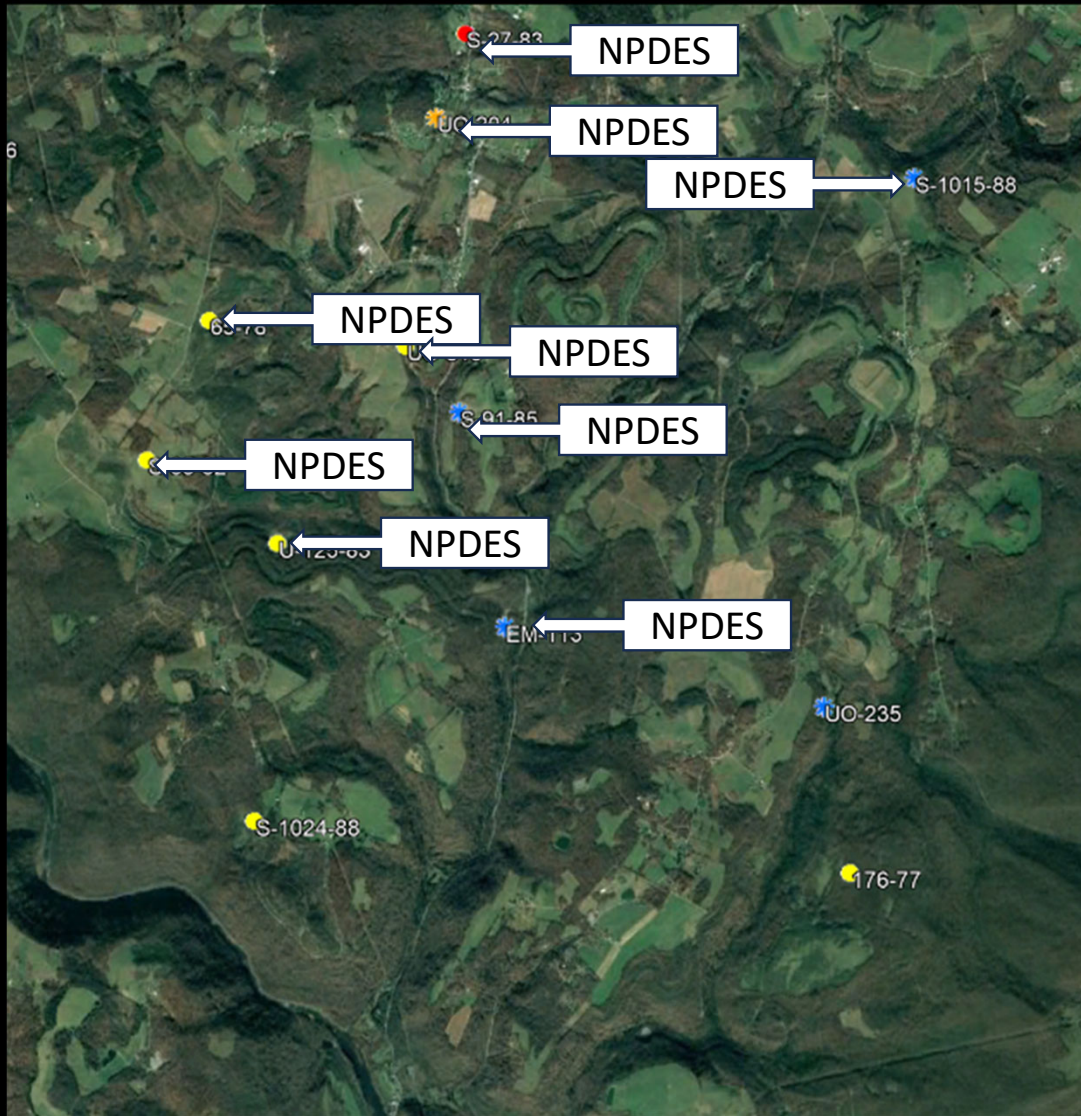


### Total Iron Load (lbs/day)





# Title 5 Point Source Approach vs. NPDES Watershed Based Approach





# Cost Comparison “Point Source” vs. “Watershed Approach”

Treating all Title 5 AMD Discharges "Point Source" approach		
Capital Costs	\$	12,500,000
Operational Costs/Year	\$	1,000,000

Spending \$12M in CapX and \$1M in O & M

*Muddy Creek Still a Dead Stream*

Treating all Title 5 & Title 4 AMD Discharges "Watershed" approach		
Capital Costs	\$	15,920,000
Operational Costs/Year	\$	\$530,000

**Note** Operational Costs Less in Watershed Approach  
Because you Have Less Sites to Maintain.



“Freshwater Neutral” Company Policy

Contribute \$2.5 Million for Capital Costs

Annual Contribution of \$350,000 for  
Operational Costs

Treating all Title 5 & Title 4 AMD Discharges "Watershed" approach		
Capital Costs	\$	13,420,000
Operational Costs/Year	\$	180,000



## The NPDES Variance

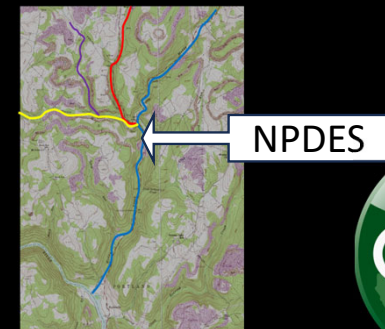
EPA Participated in the development of the variance

The variance states:

40 CFR 125.3(f)

7.2.d.8.2. A variance pursuant to 46 CSR 6, Section 5.1, based on human-caused conditions which prohibit the full attainment of any designated use and cannot be immediately remedied, shall apply to WVDEP Division of Land Restoration's Office of Special Reclamation's discharges into Martin Creek of Preston County and its tributaries, including Glade Run, Fickey Run, and their unnamed tributaries. The following existing conditions will serve as instream interim criteria while this variance is in place: pH range of 3.2-9.0, 10 mg/L total iron, and 15 mg/L dissolved aluminum. Alternative restoration measures, as described in the variance application submitted by WV DEP Division of Land Restoration's Office of Special Reclamation, shall be used to achieve significant improvements to existing conditions in these waters during the variance period. Conditions will be evaluated during each **triennial review** throughout the variance period. This variance shall remain in effect until action by the Secretary to revise the variance or until July 1, 2025, whichever comes first.

Approved WV's in-stream permit in August 2017



To address the AMD entering  
Martin Creek & Glade Run



Glade Run and Martin Creek In  
Stream Dosing Unit.



Title 5 Viking  
Deep Mine  
Wet Seal



Title 4 Listen  
Deep Mine  
Wet Seal

# The Components

This approach will remove approximately 86% of the acid and metal loads from Fickey Run. Removing the "bad actors" main contributors in the watershed taking them to a central point to be treated.



Title 4 Lagoon  
Drop Inlet



Title 5  
Seep Collector

68% of the load reductions would come from Title 4 mine discharges



1200 GPM Lift  
Station to Plant



2.5 Miles of  
Pipeline



T & T AMD Treatment Plant





# The Plant



(5) Sludge Pumps  
to Mine or Geotubes



(4) Two 80' Diameter Clarifiers



(3) Mix tank  
*pH monitoring and polymer injection*



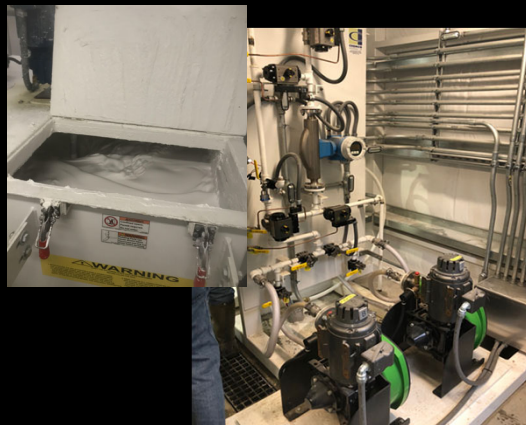
(2) Polymer Injection  
*Aid Flocculation*



(6) Geotube Deep Mine  
Sludge Storage



(7) Discharge



(1) Lime Slurry Injection  
*for pH Adjustment*





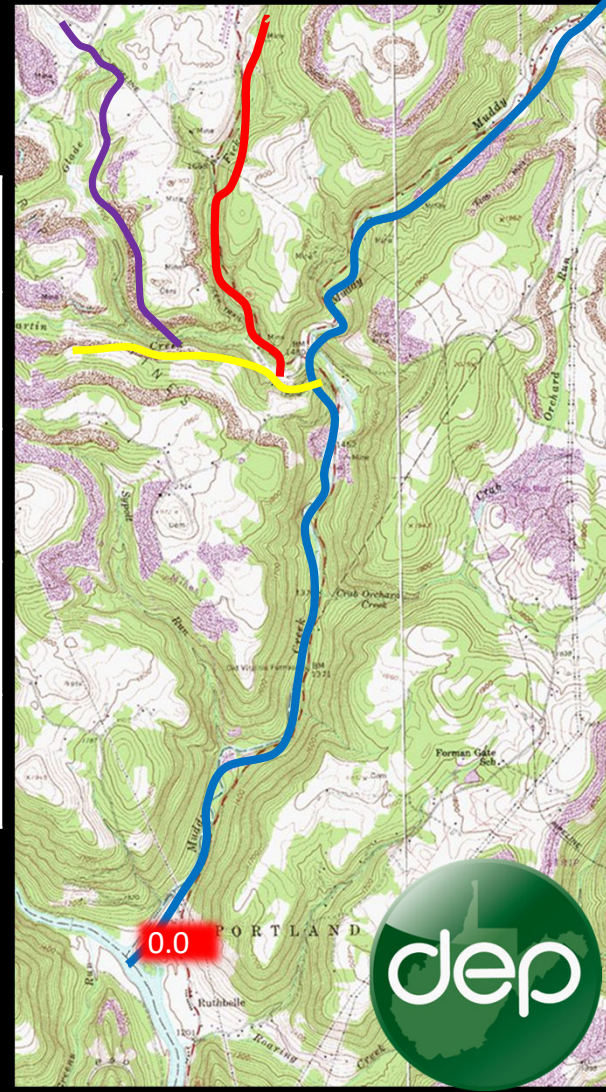
# Fish Community Results

Credit WVDEP Watershed Assessment Branch 2023

T & T Plant  Glade Run  Fickey Run   
 Muddy Creek  Martin Creek 



## Mouth of Muddy Fish Community Comparison

	<u>2015</u>	<u>2019</u>	<u>2021</u>	<u>2023</u>
<b>Total Species</b>	0	9	10	8
<b>Total Collected</b>	0	143	150	134
<b>Fish/Meter</b>	0	0.48	0.5	0.45



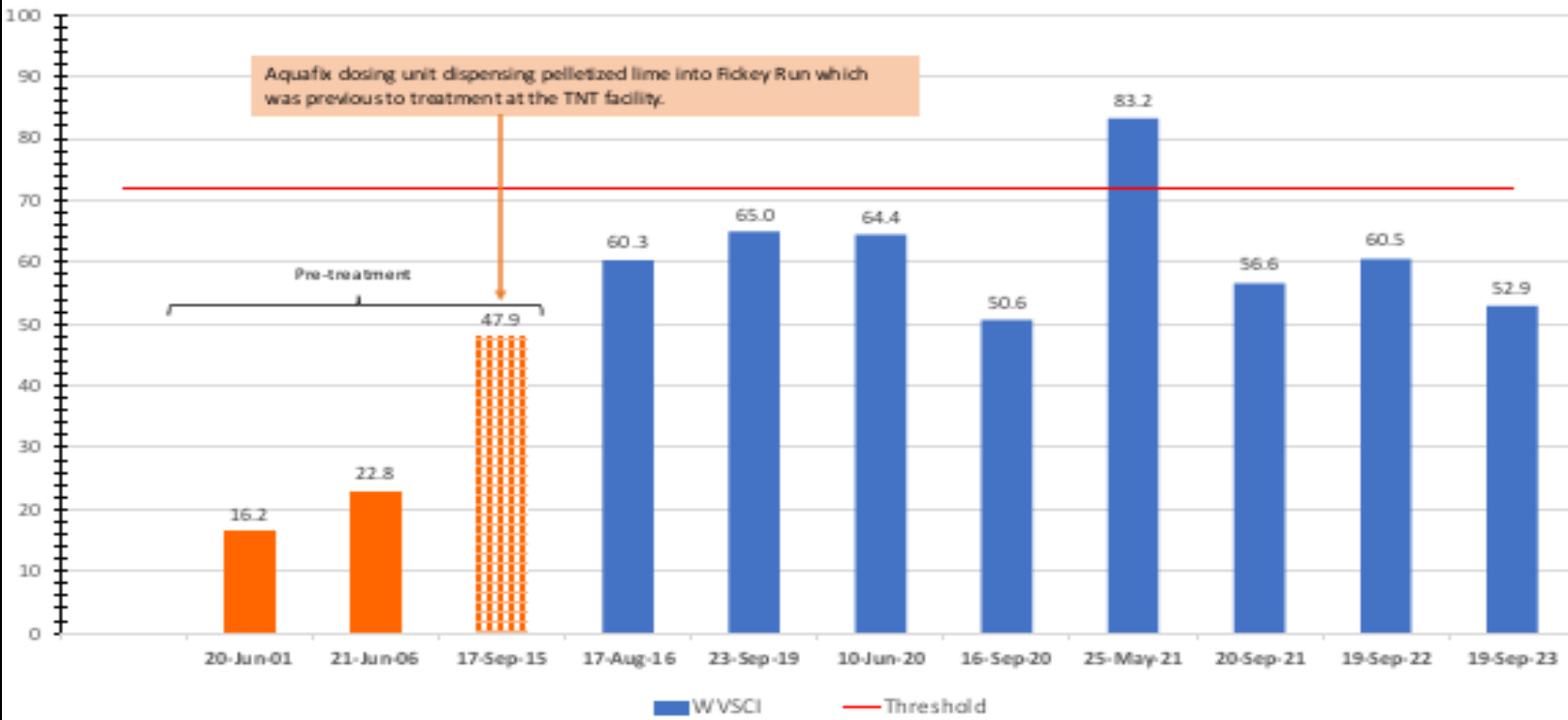
# Biological Results

WVDEP Water Quality Standards and Assessment Watering Unit

T & T Plant  Glade Run  Fickey Run   
Muddy Creek  Martin Creek 

## West Virginia Stream Condition Index (WVSCI)





WVSCI - Muddy Creek MP 0.0 – Near Mouth  
Approx 2.8 Miles Downstream of Treatment Facility  
WVDEP WQSA5 Data





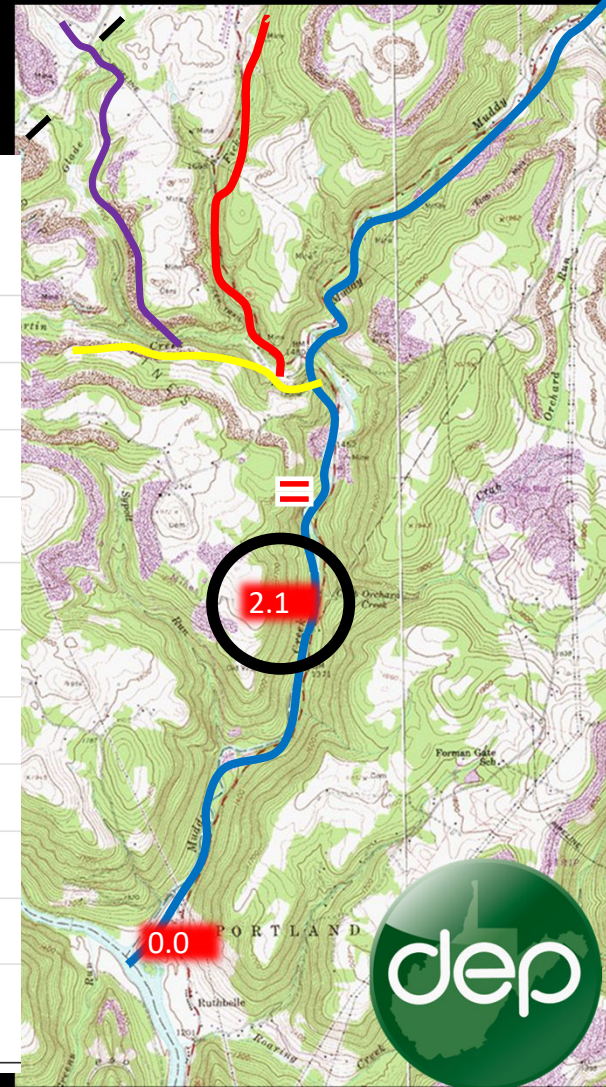
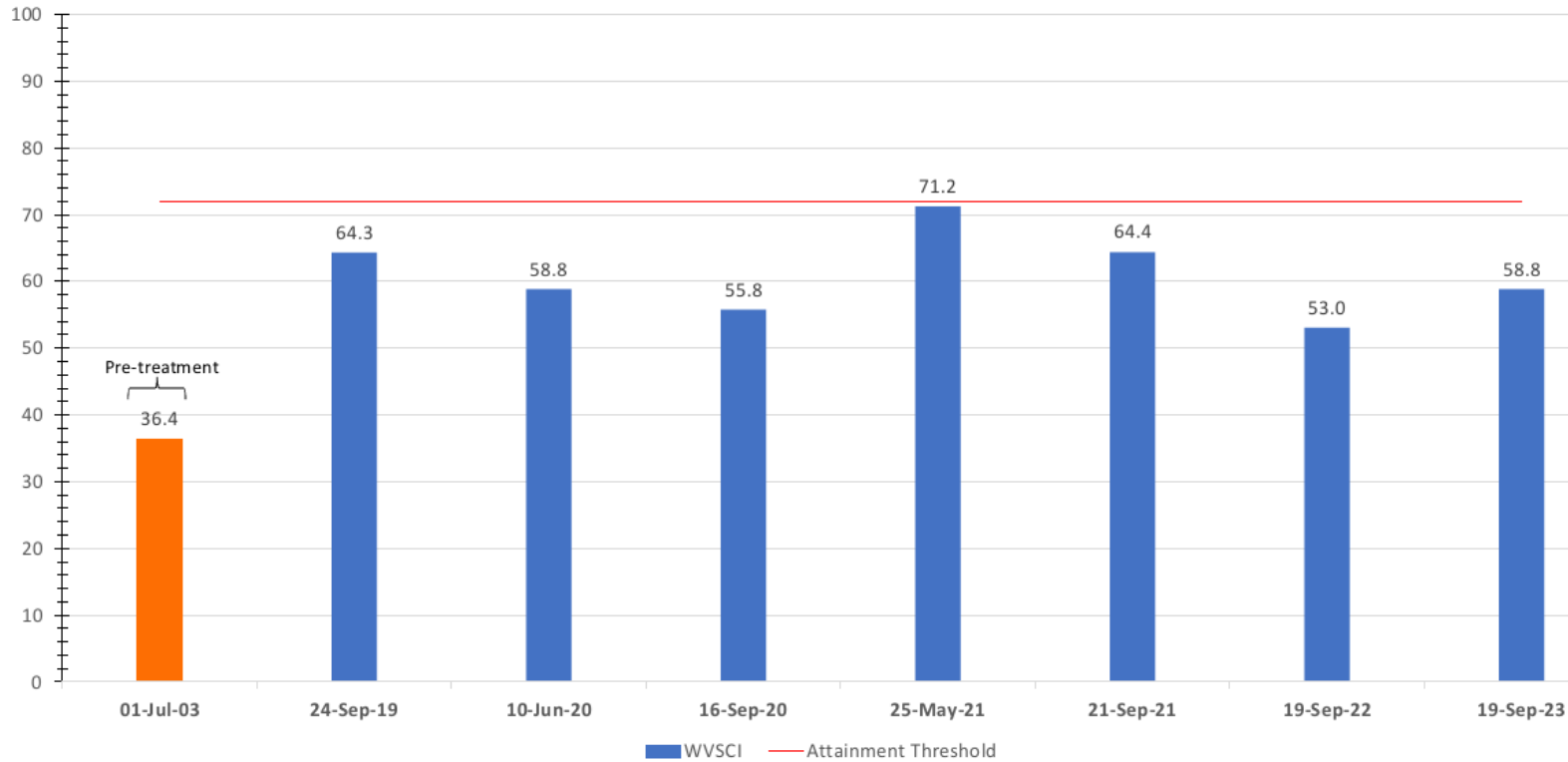
# Biological Results

WVDEP Water Quality Standards and Assessment Watering Unit

T & T Plant  Glade Run  Fickey Run   
Muddy Creek  Martin Creek 

## West Virginia Stream Condition Index (WVSCI)

WVSCI - Muddy Creek MP 2.1 – Near Crab Orchard Run  
Approx. 0.7 Downstream of Treatment Facility  
WVDEP WQSAS Data





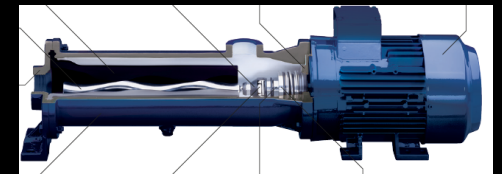
# Iron Scale



Iron Scale In Pressurized Line



Non-Calcareous Stone Bed Captures  
30% of Ferric Iron



Progressive Cavity Pumps  
Rotor and Stator Damage



Cleaned by Regular Scheduled  
High-Pressure Jetting



Grit Accumulation from  
Jetting & Settling



Grit Chamber to  
Settle Out Iron



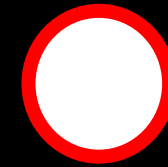


# What have we learned

# Lime

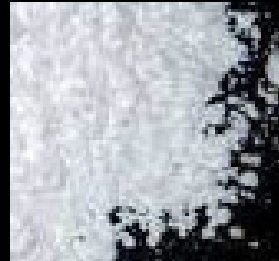
## Pelletized Lime

Drops through dosing unit silos well  
98% CaO  
Outer microns of particle react  
unreacted lime



## Hydrated Lime

Drops through dosing units with vibrator  
Mixes well with water  
71.63% CaO



## Tech Grade

Droops through silo with aid of vibrator  
Too fine particle size to use other than in a slurry  
Due to small mesh size mixes very well with water  
95% CaO  
Consistent pH for REE



95% CaO      1.05 X \$225/Ton= \$236  
71.63% CaO    1.28 X \$225/Ton= \$288





Questions?