

Phosphate Primer & Mining 101

**The Mosaic
Company**

**DeSoto County BOCC
February 18, 2020**

Witness Introductions

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NAME	BUSINESS INFORMATION
Kim Nicholson	Vice President Agriculture Technology and Innovation Mosaic Fertilizer, LLC
Kenny Miller	General Manager, Four Corners Mine Mosaic Fertilizer, LLC

Phosphate Primer



Kim Nicholson

Vice President of Agriculture Technology and Innovation
Mosaic Fertilizer, LLC

- Bachelors in Agronomy, Purdue University
- Advanced training in leadership, marketing, global supply chains and product management from Columbia University, Massachusetts Institute of Technology, and others.
- 30 years of experience in national and global business, trade, and product development with a special emphasis on agriculture sector development.

Mining 101



Kenny Miller
General Manager, Four Corners Mine
Mosaic Fertilizer, LLC

- Bachelor of Arts Natural Sciences, University of South Florida
- Nearly 40 years of experience in the Central Florida phosphate industry

Phosphate is Essential

- Required for plant growth and photosynthesis
- Naturally occurring in all living organisms; no synthetic substitute
- Provides structure to DNA and powers cell activity
- Enters the food cycle through soil, and then nourishes crops to feed animals and humans

DeSoto County has a significant reserve of a mineral that the world needs and an important role to play in the global food supply

Phosphate and Florida's Bone Valley

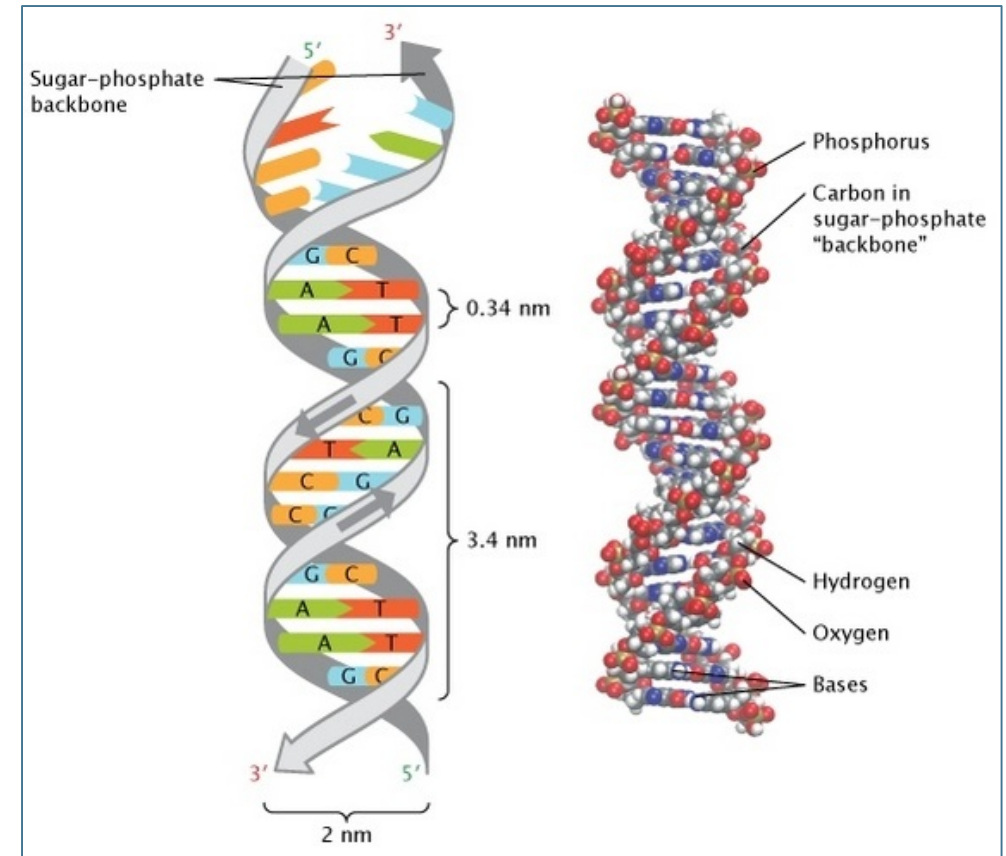
- Millions of years ago, Florida was covered by phosphorous-rich ocean water.
- Phosphate deposits formed from the remains of prehistoric marine animals, such as sharks and manatees.
- The sea level dropped and sandy sediment covered the phosphate deposits.



The Central Florida phosphate district is commonly known as the Bone Valley formation.

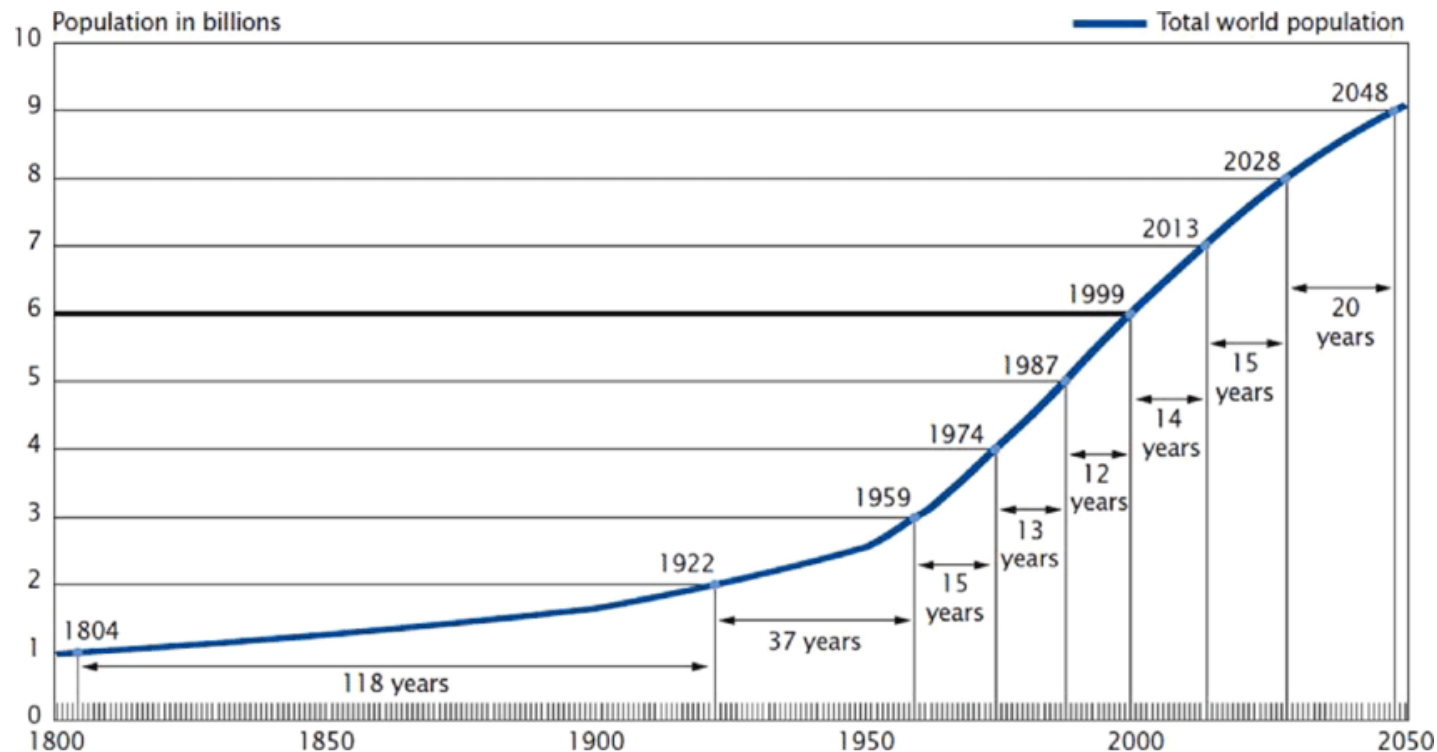
Phosphate: The Big Picture

- One of three critical nutrients for crop growth
 - ☐ Nitrogen (N)
 - ☐ Phosphorus (P)
 - ☐ Potassium (K)
- Phosphorus is necessary for all life
 - ☐ Provides structure to DNA
 - ☐ Transfers chemical energy in cells
 - ☐ Primary component of bone tissue
- We absorb phosphate through the foods we consume
- Phosphorus is the 11th most common element and cannot be substituted or synthetically created



Phosphate is Critical to Global Food Supply

- Population continues to grow
 - ❑ 80 million people added to global population each year
 - ❑ Developing nations are experiencing population booms
- Amount of arable land is not increasing
 - ❑ Only solution to food problem is increased yields on existing lands
 - ❑ It cannot be accomplished without phosphate





Crop Nutrition Vital for Yield



Long-Term Studies Summarized:

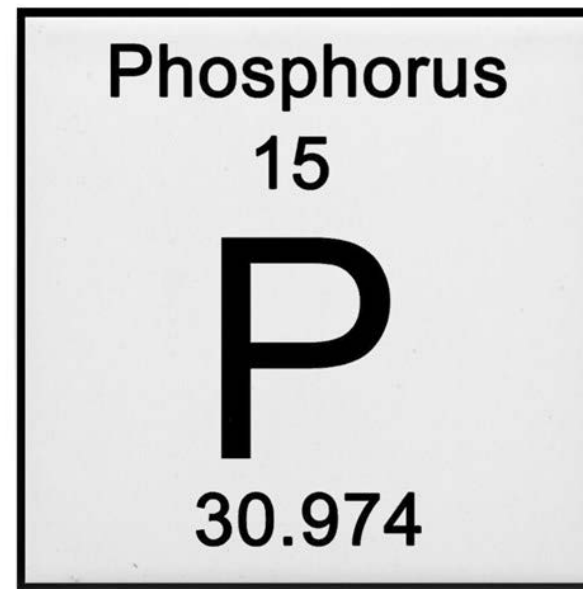
Study	Yield %
Wheat yield attributable to fertilizer input	
• US Studies (182 years)	54%
• England Studies (96 years)	64%
• Combined (277 years)	57%
Corn yield attributable to fertilizer input	
• US Studies (95 years)	60%
Multiple crops in tropics	
• Brazil and Peru (50 crops, after 1 year)	>90%

Precision is Modern Way to Farm

Technology Touches All Aspects of Agriculture

- Use of technology continues to refine how producers use nutrients and all inputs on the farm
- Yields are steadily increasing
- Technology is driving better nutrient utilization
- Mosaic's agronomy team is actively working to accelerate this evolution through our 4R Nutrient Stewardship Program
 - ❑ Right Rate, Right Product at the Right Time with the Right Placement- 4Rs
- Phosphate along with all critical plant nutrients will always play important role



[illegible]

We Should All Just Go Organic!

Organic does not magically break the principles of simple mathematics

1 acre = @ 170 bushels of corn

170 bushels of corn = @ 60 pounds of P

170 bushels of corn = @ 1.6 tons of manure

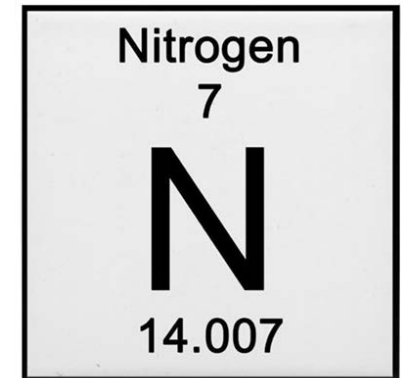
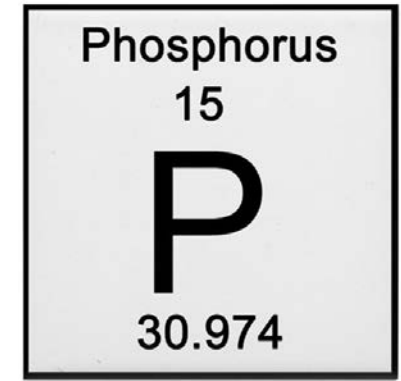
60 pounds of P = @ 3.5 tons of manure

You are 1.9 tons of manure short of replacing the P you took off the field.



Just Switch to Regenerative Agriculture!

- Use of no fertilizer - Advocates for building of the soil microbiome
- Mosaic fully supports a healthy soil biome and continues to look for solutions to support this practice
- Major issue:
 - ☐ While microbes can release available Phosphorus in the soil; they cannot generate Phosphorus; and eventually the soil balance must be restored with additions of Phosphorus
- Where does the new P come from? It leaves the field with crops
- There are microbial organisms that can convert Nitrogen from the air into ammonia
- When these crops (primarily legumes) are grown they can serve as a natural source of Nitrogen



No Such Process Exists for Phosphorus

Finished Phosphate Product Distribution



60% of Product
Stays in North America

Export

40% of Product

Major Export Customers

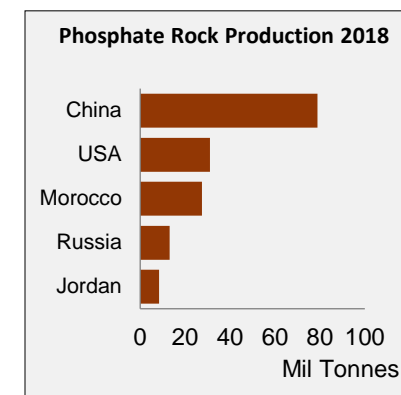
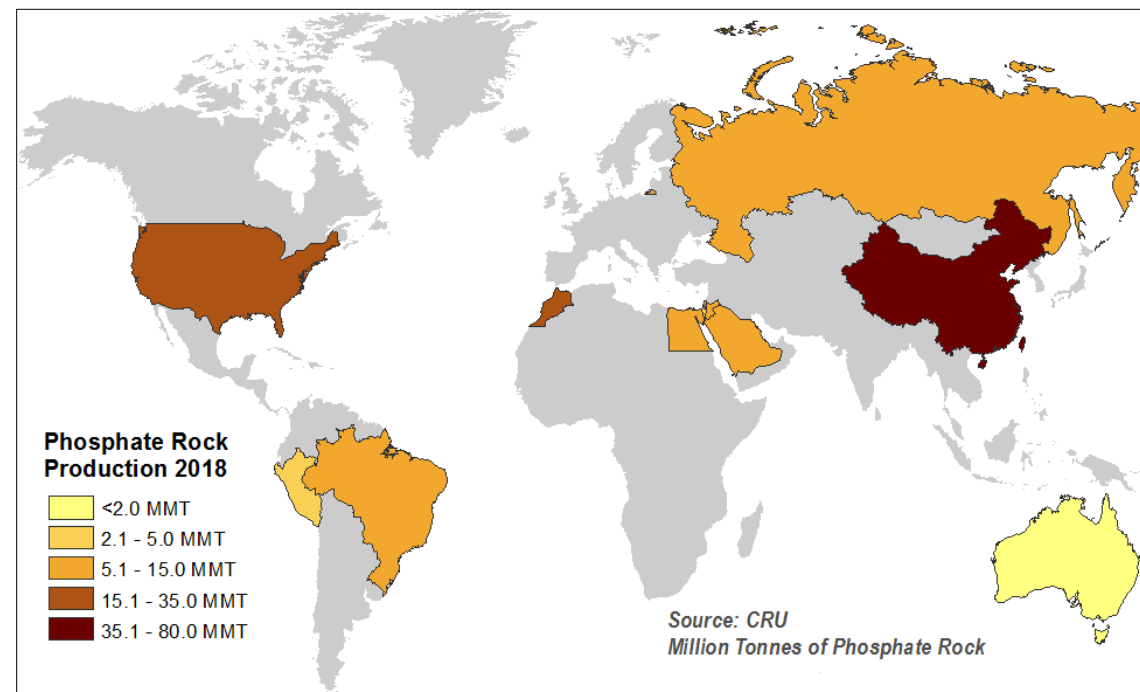
Brazil, India, Argentina,
Japan, Australia,
Colombia, Mexico



- Capacity to produce 11.7MM tons/year of phosphate fertilizer and animal feed ingredients
- Transport product via rail, ships and trucks

Phosphate Exports – Bad or Good?

- Export rates much higher in past
 - ❑ Reserves in other parts of world were slower to develop
 - ❑ More than 60% of product produced by Florida is used by North American farmers
 - ❑ More than 90% is used in the Americas
- Food supply is global issue
 - ❑ Gray areas of map show no phosphate resources, but contain high concentrations of the global population
 - ❑ Nations with phosphate reserves must play a crucial role in helping to feed the world

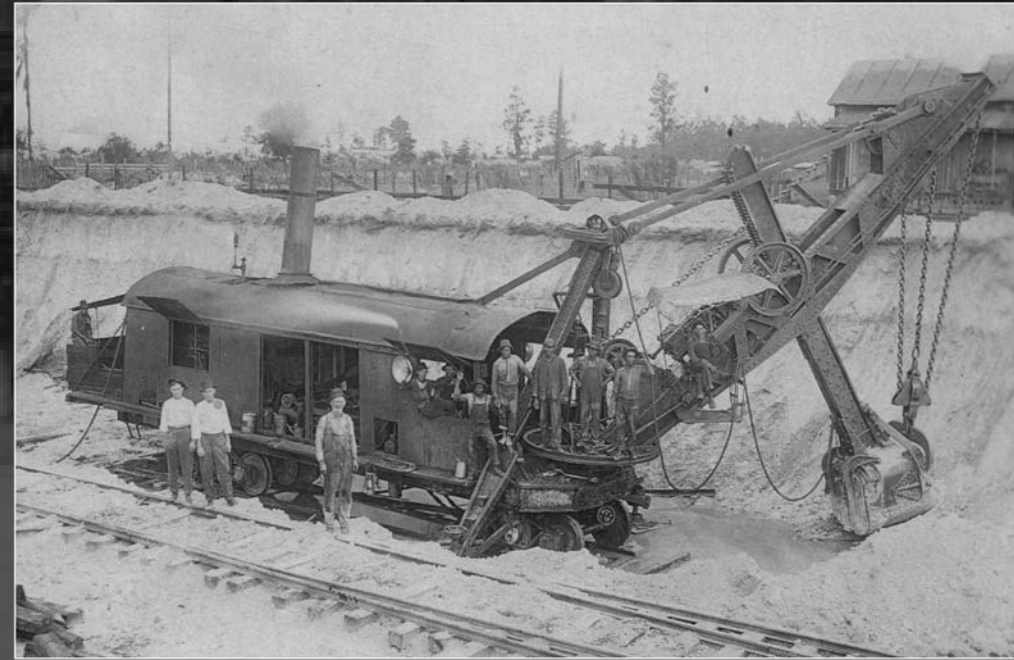


Mosaic 101: Phosphates



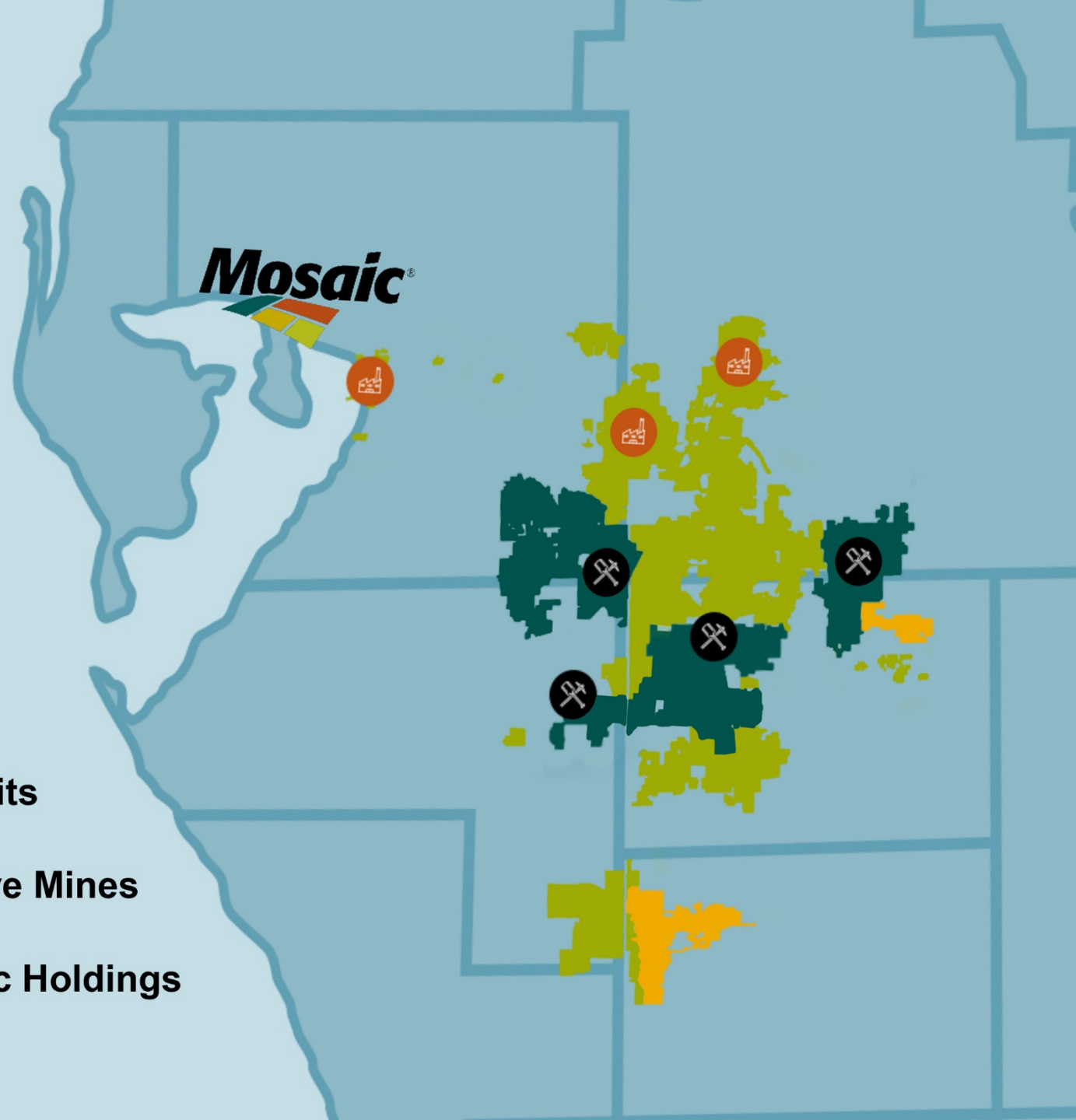
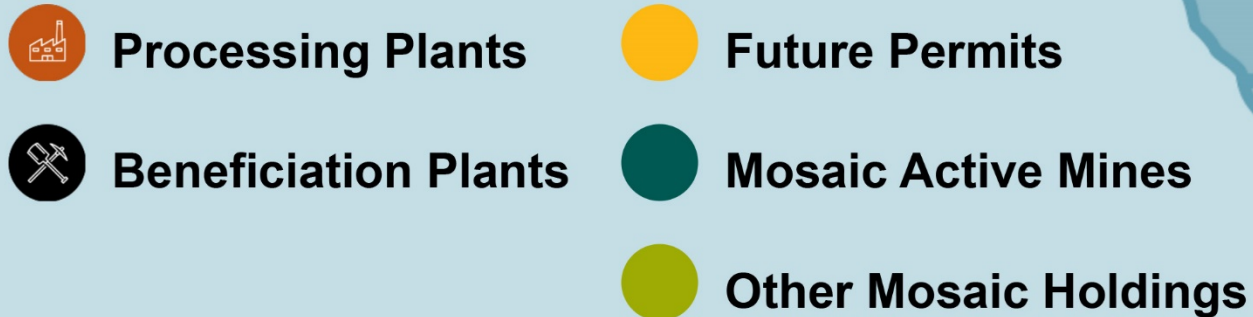
Florida Phosphate's Historical Roots

- **1881:** Pebble discovered by Captain J. Francis LeBaron in the Peace River
- **1889:** Arcadia Phosphate Co. mined the first commercial phosphate in Florida
- **1890:** Polk County's phosphate boom began, along with mining towns like Pierce, Brewster and Bradley



Mosaic in Florida

- Tampa Executive Office Headquarters
- FishHawk Office
- 4 Phosphate Mines
(one temporarily idled)
- 3 Manufacturing Plants
- 2 Ammonia Terminals
- 2 Marine Terminals
- Several other support offices



Two Distinct Operations

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Minerals



Phosphate Ore



Reclaimed Land

Fertilizer Manufacturing



Biofos



DAP

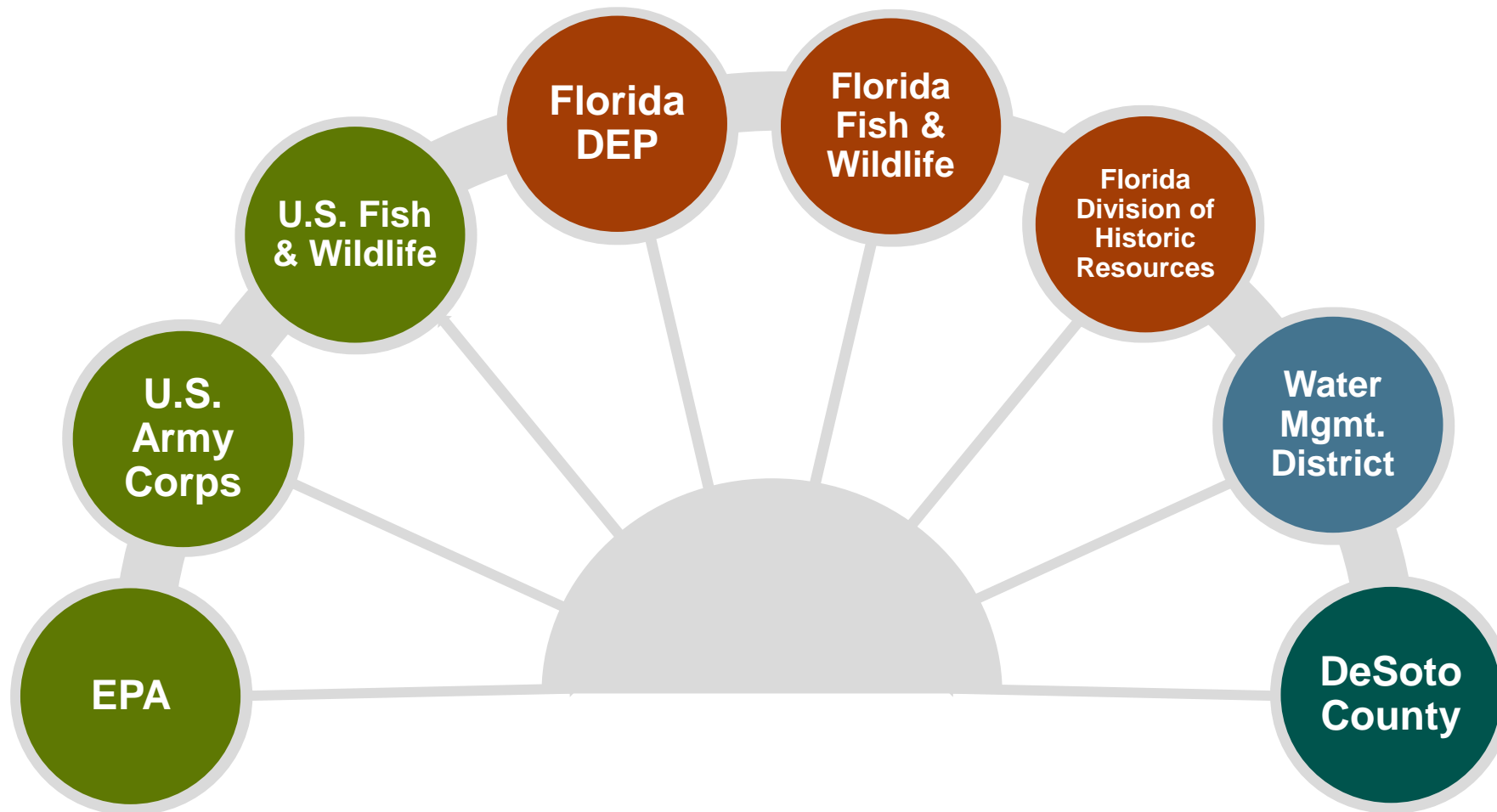


MAP



MicroEssentials®

Florida Phosphate Mine Permitting



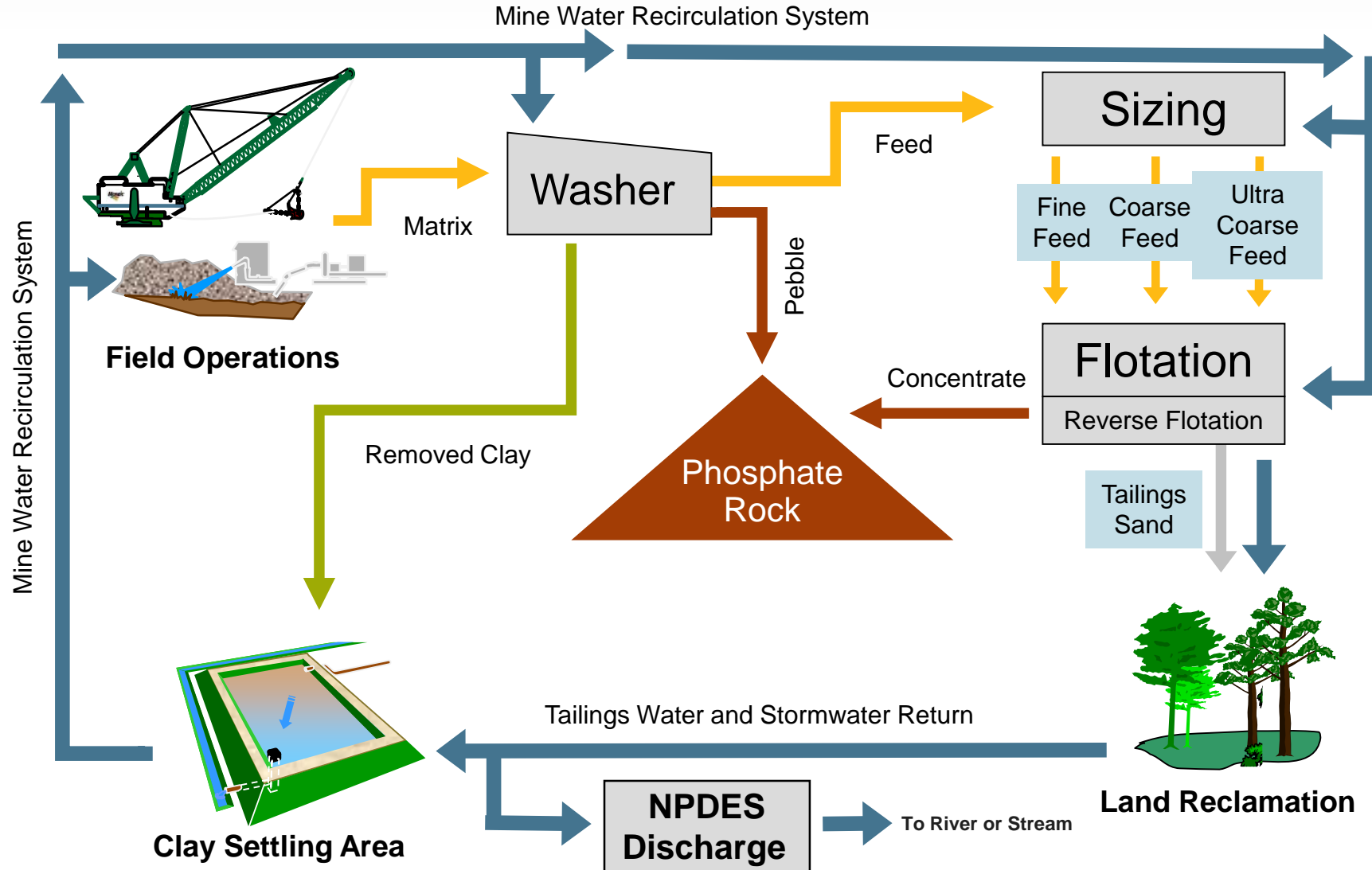
Minerals Operations

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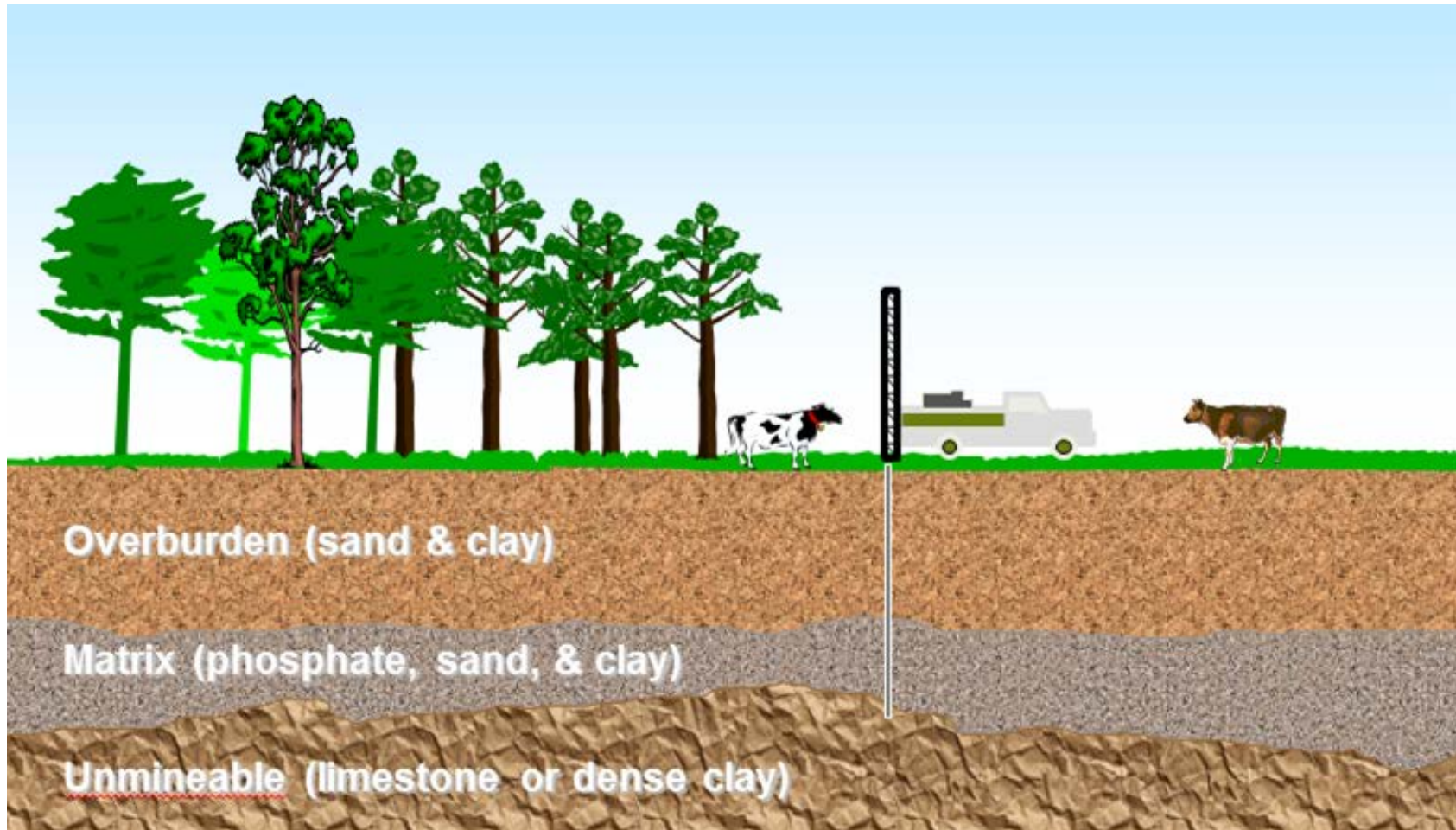
- 4 Mines / Beneficiation Plants
- 14 Draglines / 2 Dredges
- All Rock Transported via Rail & Truck

Mining Process Overview



Prospecting for Phosphate

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Primary Mining Method: Draglines

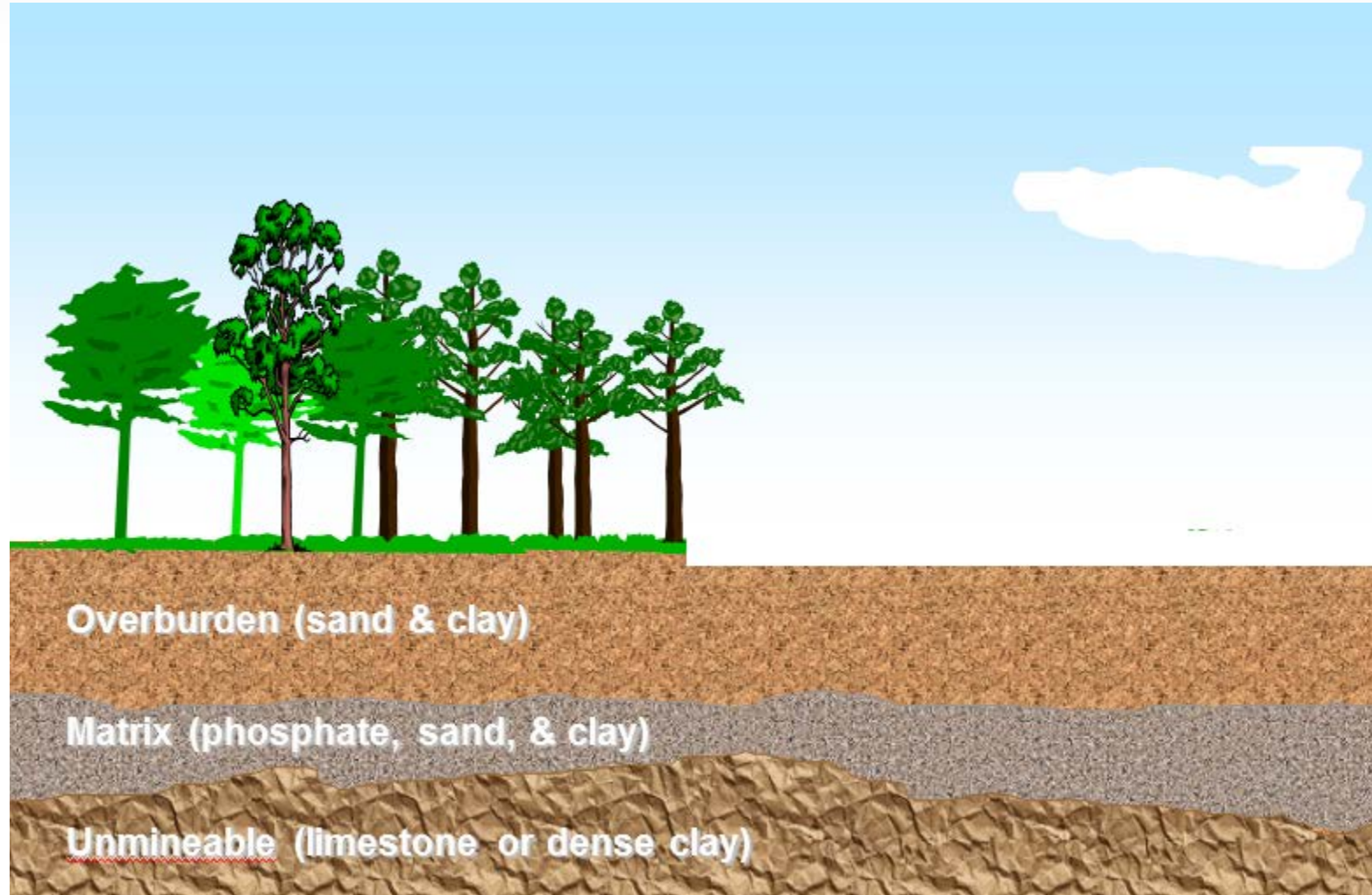
- Weigh up to 7 million lbs.
- Boom length up to 325 ft. – longer than a football field
- Empty bucket weighs ~100,000 lbs. and holds up to 65 cubic yards
- Electrically powered by 7,200 Volts Alternating Current
- Operated by two employees



325 ft.

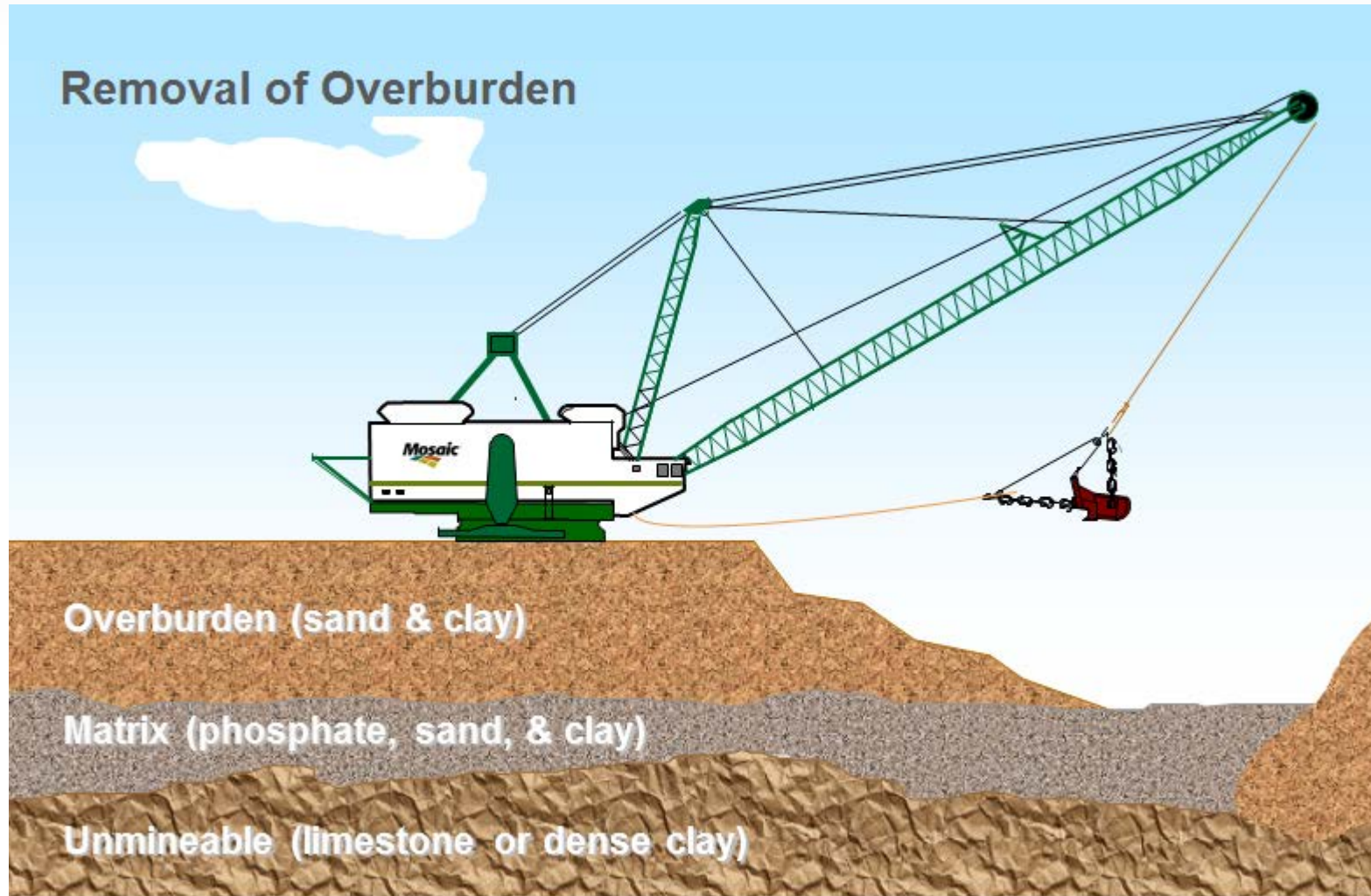
The length of the
Dragline's boom.
Longer than a
football field!

Field Operations: Preparing for Dragline

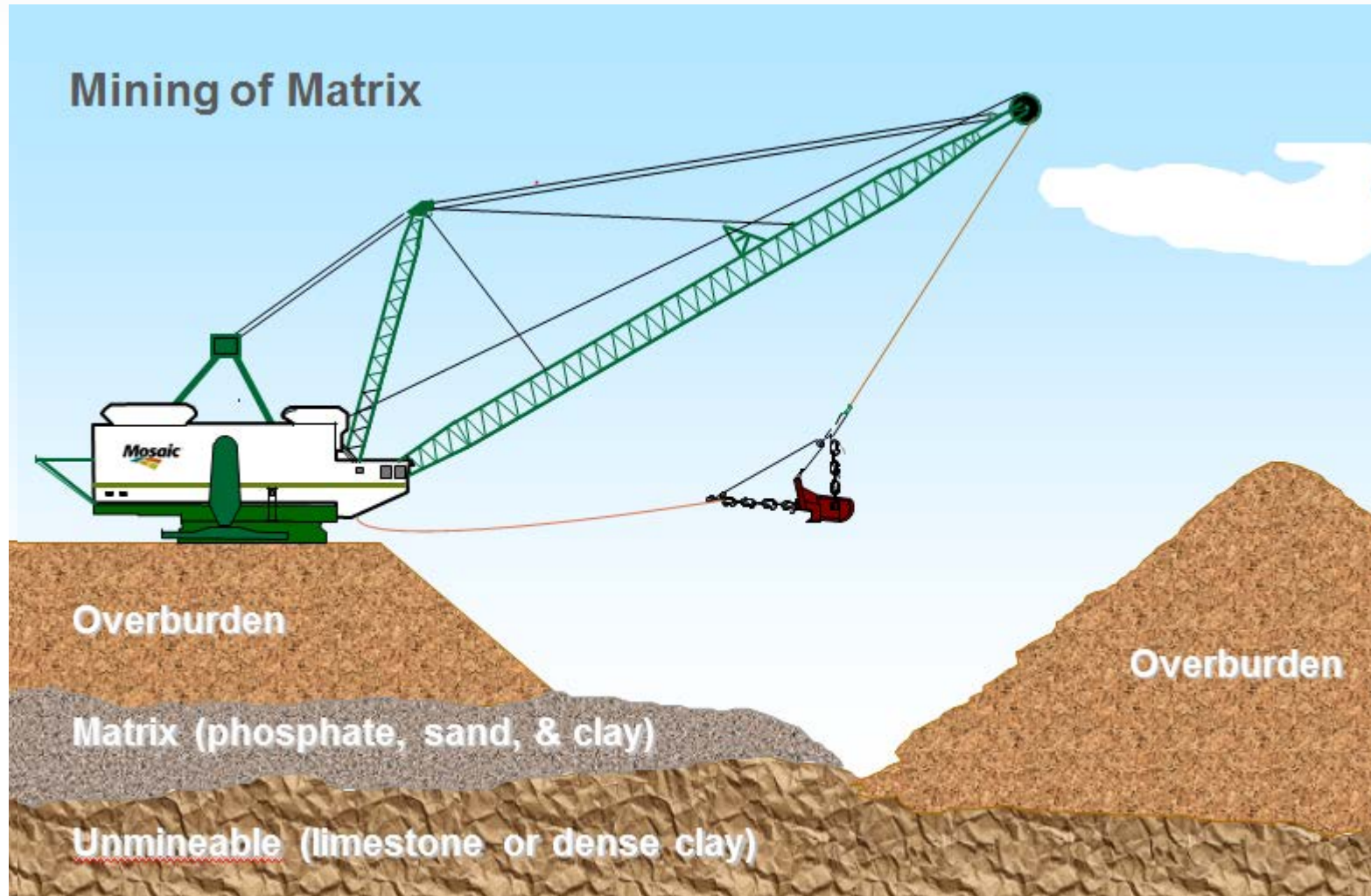


Field Operations: Mining Process

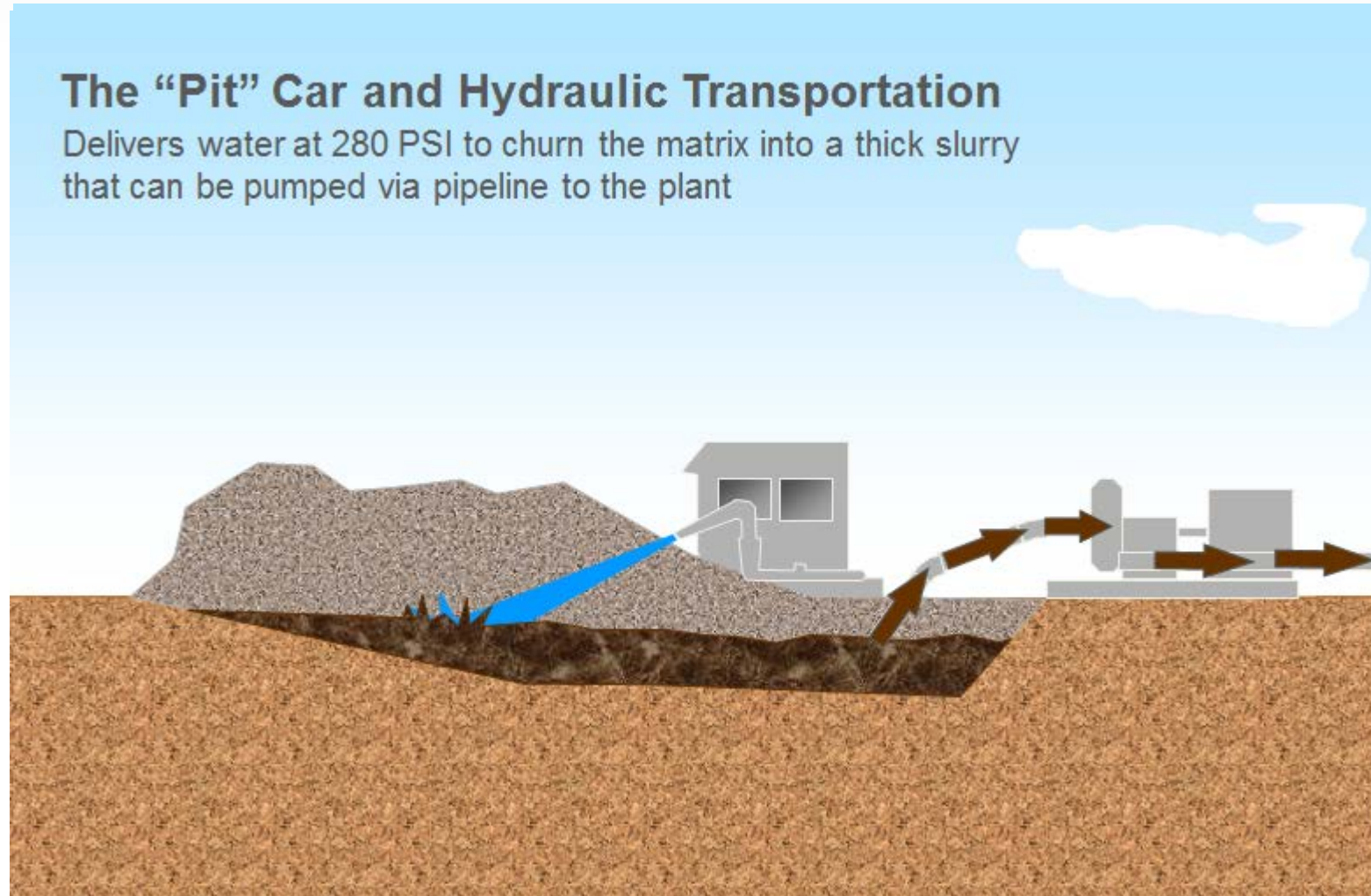
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Field Operations: Mining Process



Field Operations: Matrix Unloaded into the Pit Pit



Field Operations: Pumps

Hydraulic Transport

- Matrix pipelines range from 18-24" in diameter
- Systems can be miles long
- Pumps 2,000-3,200 tons per hour
- Typically require one pump every mile
- Pump impellers can be up to 62" in diameter



Beneficiation Plant Operations

- Removes oversize material
- Produces “pebble” phosphate
- Removes clay by scrubbing and rinsing
- Feeds all undersized phosphate and sand to the sizer
- Same-sized sand and phosphate is pumped to the flotation plant for separation



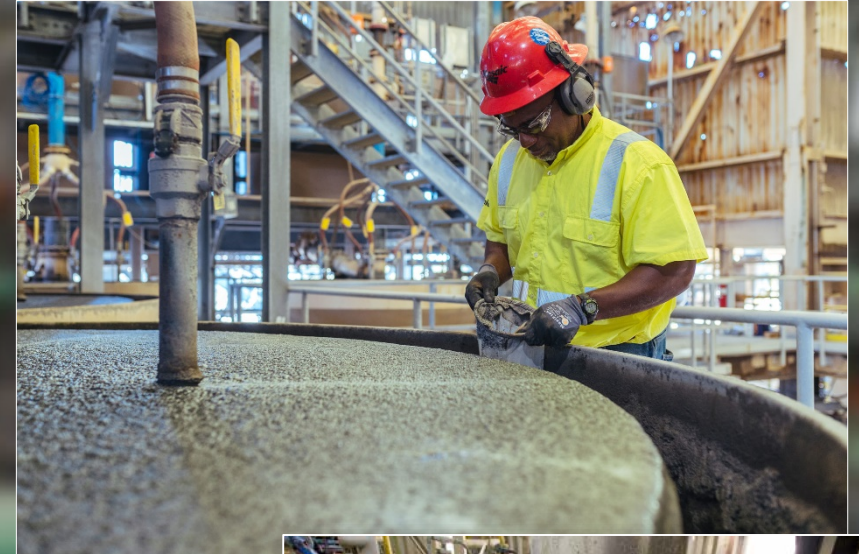
Beneficiation Plant Operations: Washer

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Beneficiation Plant Operations: Flotation Plant

- Produces fine-sized “concentrate” phosphate
- Uses special additives (mostly biodegradable oils from the pulp and paper industry) to coat the phosphate
- Phosphate separates from the sand, floats to the top and is skimmed off
- Pumps sand back to the field for reclamation



Beneficiation Plant Operations: Flotation Plant

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Plant Operations: Product Transport



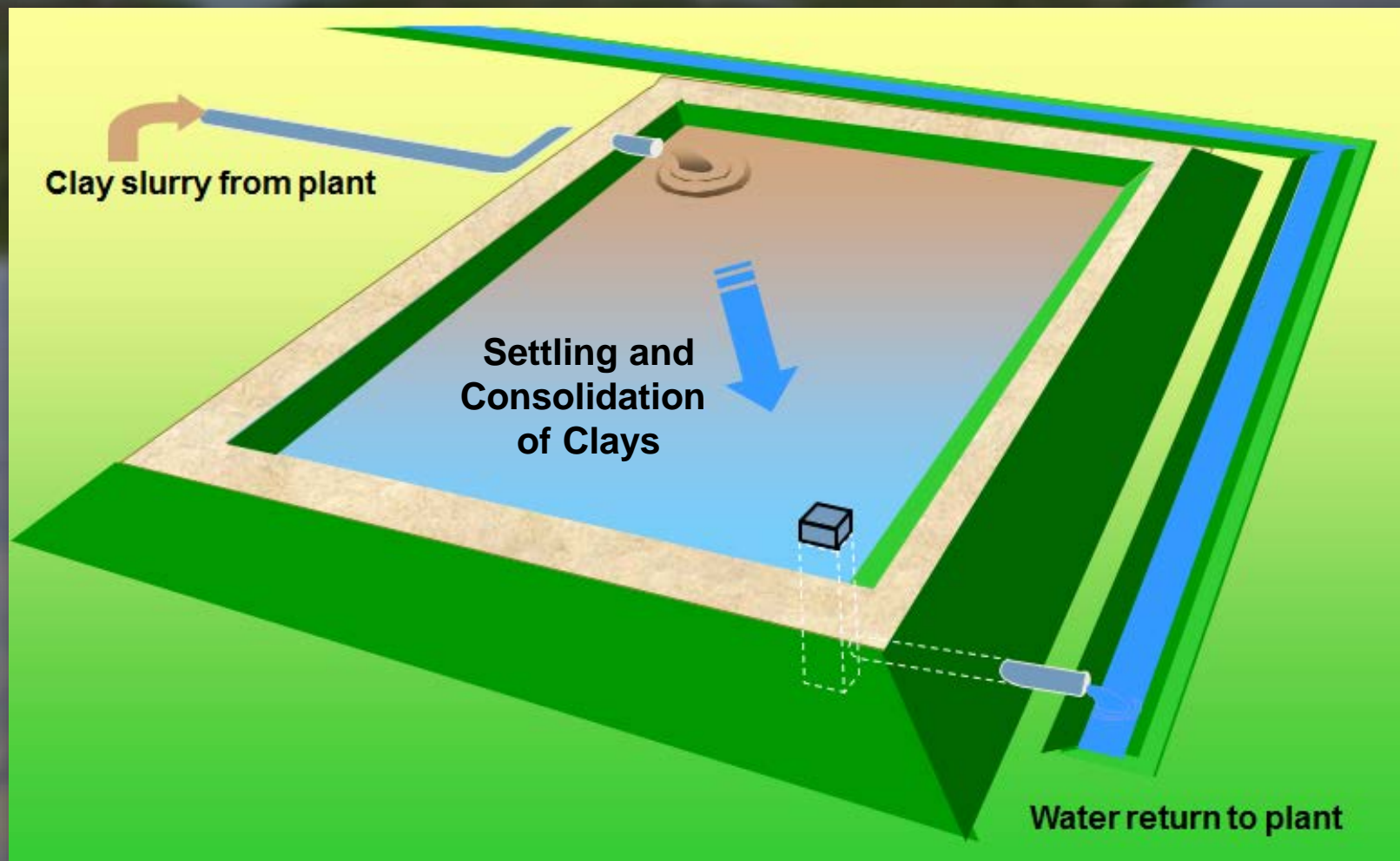
45 sec.

The time it takes to
load a 200,000 lb.
rail car.

Blended phosphate rock is
loaded onsite and transported
to manufacturing facilities via
rail, truck and vessel.



Clay Settling Areas



- Acts as a reservoir and allows mining operations to recycle and reuse water at a high rate
- Provides water treatment to clarify stormwater for discharge through permitted outfalls
- Maximizes amount of land reclaimed with sand tailings and minimizes the amount of land reclaimed with clays

Clay Settling Areas and Wildlife



Sand Tailings



Sand tailings are used to backfill the mined or disturbed areas to the design elevations to facilitate the creation of wetlands in reclamation

Water Recycling and Monitoring at Mine Sites

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About 90% of water is reused and recycled at our Florida facilities



Permitted Discharge Structure
(Upstream Side)

Permitted Discharge Structure
(Downstream Side)



- Any water releases must meet state (NPDES) and federal regulatory standards
- NPDES permits are reviewed and renewed every 5 years
- Permit limits are based on water quality standards for water body receiving discharges

Preserved Areas Are Protected

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- Sensitive areas are separated from mining activities through the installation of ditch and berm systems
- Ditch and berm systems capture surface water and keep it from leaving the disturbed mine site
- Recharge ditch and berm systems can also be a part of the mine recirculation system
- Protects the hydrology of wetlands near or adjacent to mining operations



Since 1975 All Mined Lands Are Reclaimed

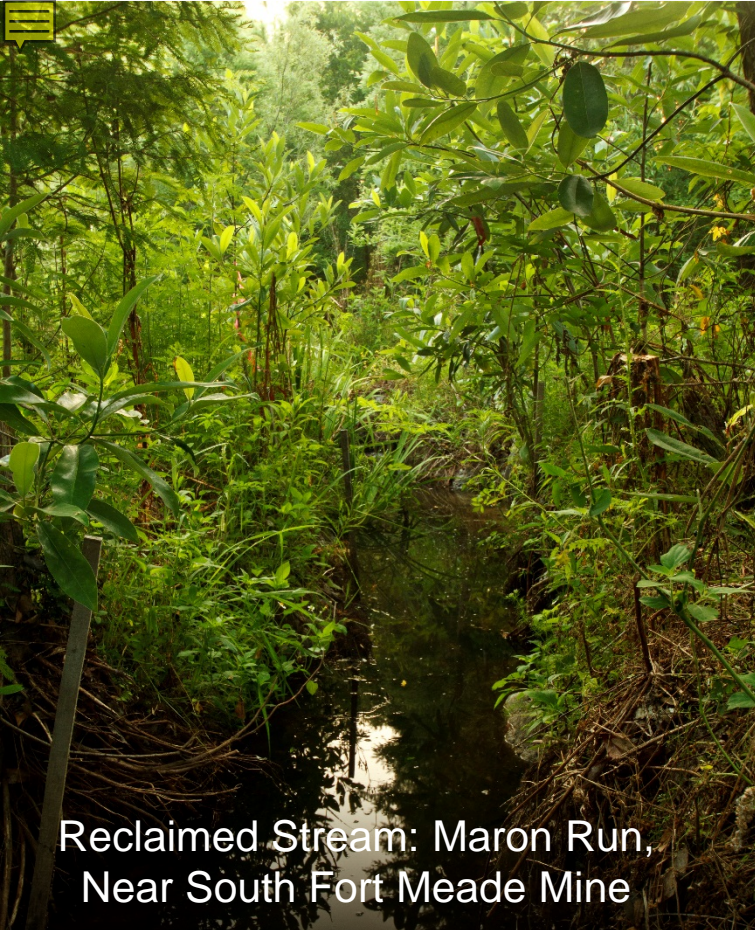
- Every acre mined and disturbed is reclaimed
- Mining and reclamation is a “Rolling” process
- Comprehensive reclamation plans safeguard the environment, natural resources and wildlife; returns land to productive uses
- Design team comprised of dozens of managers, biologists, ecologists, engineers and other professionals
- Restoring integrated habitats and connections on previously fragmented landscapes
- Reclamation plans must be approved by local, state and federal mining permits

Mosaic's Florida Land & Reclamation Facts

- Own or control more than 350,000 acres
- Planted more than 900,000 trees in 2018
- 198,500 acres have been mined or disturbed since FDEP 1975 Reclamation Rule
 - Reclaimed approximately 152,222 acres of the mined and disturbed acres (77%)
 - Released approximately 101,400 of the reclaimed acres (67%)
- Approximately 46,000 acres in Florida are preserved and/or placed under permanent protection
 - Ensures long-term protection of sensitive lands and waters



Reclamation



Reclaimed Stream: Maron Run,
Near South Fort Meade Mine



Freshwater Marsh: Near Four Corners Mine



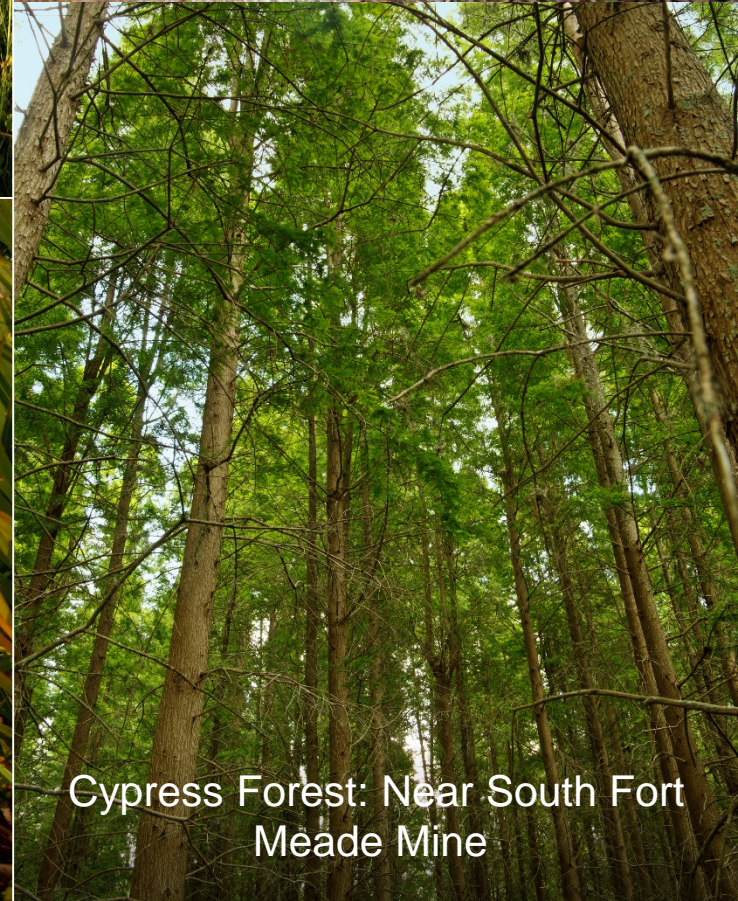
Xeric Habitat: Ft. Green



Wetlands, Mixed Hardwoods &
Coniferous: Near Former Ft. Green
Mine



Palmetto Prairie: Near Former Big Four Mine



Cypress Forest: Near South Fort
Meade Mine

Agriculture Operations on Reclaimed Land



Sod: Bowling Green, Hardee County



Cauliflower: Polk County



Pasture: Hillsborough County



Citrus: Near Former Fort Meade Mine, Polk County

