NORTH Dakota Be Legendary.™ | Public Service Commission

2020 PROJECT SUMMARIES

March 2021

2020 Projects

Hettinger and Stark Counties AML Project

Abandoned surface mine reclamation in Hettinger and Stark Counties

Williams County Road 9 Phase 8 AML Project

Abandoned underground mine reclamation near Williston

Noonan Foamed Sand AML Project

Underground mine reclamation using foamed sand

Sinkhole Filling AML Project

Filling of hazardous sinkholes at various sites

Contents

This sign dates back to the early 1980s. Scranton was one of the first sites where the North Dakota PSC AML Division reclaimed abandoned coal mines.

North Dakota Public Service Commission and Abandoned Mine Lands

North Dakota has records for about 1,700 abandoned coal mines which are mostly in the western half of the state. The Surface Mining Control and Reclamation Act of 1977 (SMCRA) provides for the reclamation of abandoned mine lands with fees collected on actively mined coal. In 1981, the North Dakota Legislature approved an Abandoned Mine Lands (AML) Program to be administered by the Public Service Commission (PSC) on behalf of the State of North Dakota.

ND PSC AML Mission

The AML Program is charged with eliminating existing and potential public hazards resulting from abandoned surface and underground coal mines. The AML Program is a service (not regulatory) program aimed at protecting North Dakotans by reclaiming hazardous abandoned mines. Mines eligible for reclamation may be in our 1,700 plus abandoned mine inventory, found through exploratory drilling or reported to us. The PSC's selection of reclamation projects is based on prioritization of abandoned mine related hazards. It also requires federal approval. Emergency projects are conducted when AML problems are an immediate and serious danger to the public.

Program Funding

Reclamation costs are covered through a federal fee on actively mined coal. The current rate for lignite coal is 8¢ per ton. The federal government, through the Office of Surface Mining Reclamation and Enforcement (OSMRE), reallocates the money to each state or tribe with an AML program through a grant program. North Dakota's allocation is about $3 million per year. Federal fee collection is scheduled to end in 2021 unless reauthorized by the United States Congress.

Drilling and Grouting

Reclamation by drilling and grouting involves drilling through the overburden into the coal to locate areas where the coal was removed. When these openings (voids) are found, a cement-like grout mixture is pumped into the void to fill the space left when the coal was removed. The goal is to stabilize the mine and reduce the likelihood of the mine collapsing. This will reduce the chances of sinkholes forming at the surface. Drilling and grouting projects are expensive and are reserved for use around public roads or residential and commercial areas.

A Knife River truck lined up to pump grout in the Shift Services lot in Williston. Each truck holds 9 cubic yards of grout.

When mines were abandoned, the buildings were also abandoned. Although the foundation has failed, this building at the Albrecht Mine in Hettinger County has managed to hold together.

The edge of the sinkhole gave way causing the scraper to become stuck. It took an excavator and truck to tow the scraper out. Please use care when driving near sinkholes.

Subsidence

Filling sinkholes is a temporary fix that does not fix the underlying problem of abandoned underground coal mines. In high-use areas such as near homes and business or along roadways, drilling and grouting projects pump a cement-like grout mixture into the underground mine workings. However, drilling and grouting projects are expensive. On land like pastures or crop fields, sinkhole filling is more economical, efficient and quickly fixed than drilling and grouting project. All AML work conducted by the ND PSC AML Division is done at no cost to the property owner.

Glossary of Terms

Backfill— Material used to fill an opening, void or depression. Material placed in the mine void to support the mine roof.

Casing—A tubular structure installed in a drill hole to prevent the wall of the hole from caving and to provide a conduit for grout.

Core—A cylindrical sample taken from a formation for analysis. Usually a core barrel is substituted for the drilling bit and it procures a sample as it penetrates the formation.

Cribbing— Timbers laid at right angles to each other, sometimes filled with earth, as a roof support or as a support for machinery.

Drift mine— An underground coal mine that enters a coal seam horizontally usually from a coal outcrop.

Haul Tunnel— Any underground entry or passageway designed for transport of coal, other material, personnel, or equipment.

Highwall— The unexcavated face of exposed overburden and coal in a surface mine.

Mine Workings— The entire system of openings in a mine.

Overburden— Layers of soil and rock covering a coal seam.

Pillar—The part of coal left between individual rooms and entries to support the overlying strata.

Rob— To mine or remove coal pillars left for support.

Roof —The stratum of rock or other material above a coal seam; the overhead surface of a coal working place.

Roof Fall— A coal mine cave-in.

Room and Pillar Mining— A method of underground mining in which a portion of the coal is left in place to support the roof of the active mining area. Large "pillars" are left while "rooms" of coal are extracted.

Rubble— Debris encountered when drilling into mine workings that may indicate mine collapse or roof fall.

Seam— A stratum or bed of coal.

Shaft— A vertical opening from the mine to the surface that may be used for ventilation, drainage or transportation.

Slope— An inclined connection to the surface from underground workings used for transportation, drainage and ventilation.

Slump—In material testing it is a measure of consistency of concrete or grout on a scale from 0-12 inches. The higher the number the more liquid or flowable the mixture.

Void— A general term for openings in rock. In mine reclamation it is the open space remaining after coal was extracted by underground mining.

Source: OSMRE

1: Weinandy Site with mulch & erosion blanket.

2: Shawn Nixon, PSC staff, surveys a frozen pit at Regent.

3: Contractor pulling a casing of a grout-filled hole.

Photo 4: A countersunk cased hole with a header pipe.

Hettinger and Stark Counties AML Project

Project Type: Surface Mine Reclamation

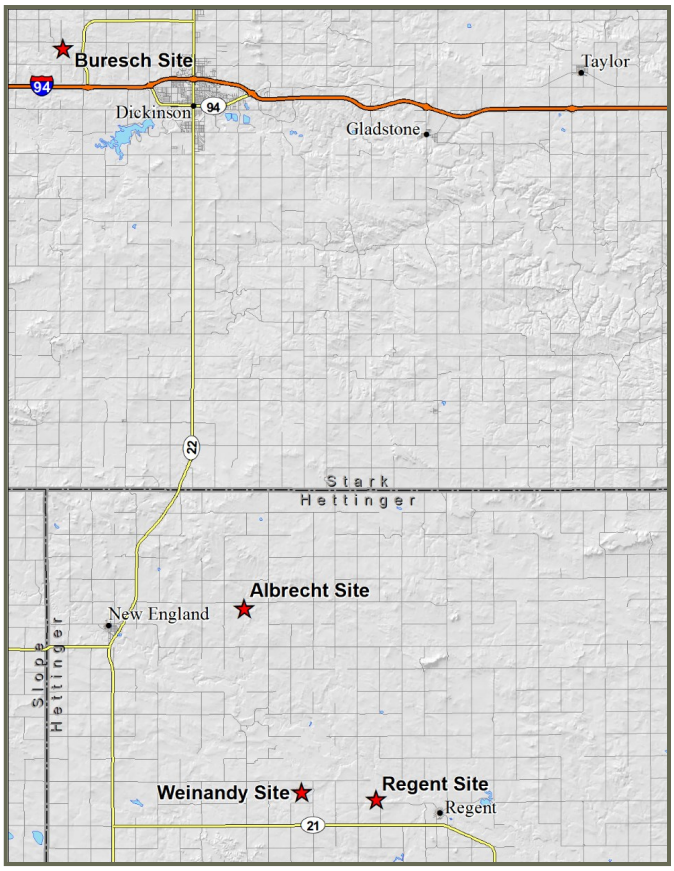
Reclamation involved backsloping about 2,550 feet of dangerous highwalls and backfilling with spoil material at four abandoned surface coal mines. The highwalls ranged between 20 and 50 feet high. One water filled mine pit was eliminated.

Contractor: Dan Hart Patrol Service, LLC of Upton, Wyoming

2020 Project Cost: $409,193.04

Locations

Site	Location	Acreage	Dirt Moved	Highwall Length	Construction Cost
Regent	Sec. 9-T134N-R95W	21.07	149,740 yd^3	1,180 feet	$224,516.41
Weinandy	Sec. 12-T134N-R96W	5.51	24,462 yd^3	360 feet	$39,540.94
Albrecht	Sec. 33-T136N-R96W	2.17	5,091 yd^3	500 feet	$18,482.94
Buresh	Sec. 27-T140N-R97W	5.55	14,519 yd^3	510 feet	$126,652.75



The Dickinson Press
TheDickinsonPress.com | TUESDAY, AUGUST 25, 2020

Kayla Henson / The Dickinson Press
Jonathan Emmer, environmental engineer with the Abandoned Mine Lands Division, demonstrates how deep the pile of trash was at the Buresh coal mine site before his team began its work.

FROM TRASH TO TREASURE:
Reclaiming ND's abandoned coal mines

By Kayla Henson
The Dickinson Press

Above is a clipping from a feature story on the Hettinger and Stark Counties AML Project published in The Dickinson Press. The map on the left shows the Hettinger and Stark Counties project locations.

Albrecht

The abandoned mine at the Albrecht site covers just over 20 acres. Much of the site is well vegetated and has naturalized over the years and needed no reclamation.

Reclamation involved backsloping about 500 feet of dangerous highwall and excavating on-site spoil material while preserving the pits. The highwall averaged 20 feet in height. The Initial design included backfilling a pit. Once reclamation began, and plans were alter to keep the pond intact. Years of erosion occurring next to a tilled field was stabilized using a rock rip-rap channel as shown in the photos below.

Reclamation began on September 3 and was completed on October 10. A total of 5,091 cubic yards of material was excavated and 524 cubic yards of topsoil was salvaged and respread. The average slope after reclamation was 12.3%. The site was tilled, fertilized, and seeded with a native grass mix. Areas of the site were deep tilled and prepared for tree planting by the Hettinger County Soil Conservation District. Tree planting is scheduled for Spring 2021.

Weinandy

The Weinandy site is located approximately 5 miles northwest of Regent. The site contained a dangerous 360 foot long highwall that averaged a height of 20 feet. The site is situated just south of a natural drainage and is surrounded by cropland. Silt fences were installed to prevent any runoff from the site into the drainage.

The reclamation design for the site involved backsloping the east highwall and filling it in with spoil material. The design also included a drainage feature trending south to north and extending to the natural drainage. This drainage will help reduce erosion at the site over time. An erosion control blanket was placed in the drainage after reclamation was complete to minimize erosion until the site could is vegetated.

Reclamation began on August 21 and was complete by September 3. A total of 24,462 cubic yards of spoil material were used as fill material. Over 1,500 cubic yards of topsoil was saved and respread. The average slope after reclamation was 9.6%. The site was tilled, fertilized, and seeded in November with a native grass mix.

Regent

The Regent site was the largest site of the four surface mine sites. The site contained a dangerous highwall that totaled 1,180 feet in length and averaged 50 feet in height and two water filled pits. The land surrounding the mine is cropland. The design consisted of backsloping the northwest highwall and filling in the southern pond. The reclamation of the Regent site began by constructing a dike between the two ponds and pumping about 1.97 million gallons of water from the southeast pond to the northwest pond.

The Regent site proved to be more challenging as reclamation progressed. As the contractor began backsloping the northwest highwall, a rock ledge was exposed. This slowed down the progress of the site because the CAT 637C scrapers were unable to continue working in the area. The contractor brought in a CAT D9 dozer to rip up the rock ledge and push the rocks into the fill area in the southeast part of the site. The southwest portion of the site was a wet area before reclamation began due to the presence of a natural spring. Once the rock ledge was removed along the northwest highwall, the area became too wet for the scrapers to effectively excavate the area. The contractor constructed a series of drainage channels in this area so the spring could drain into the northwest pond. Two Komatsu 61PXI low ground pressure dozers were utilized in the southwest portion of the site to excavate the remaining material and to spread topsoil.

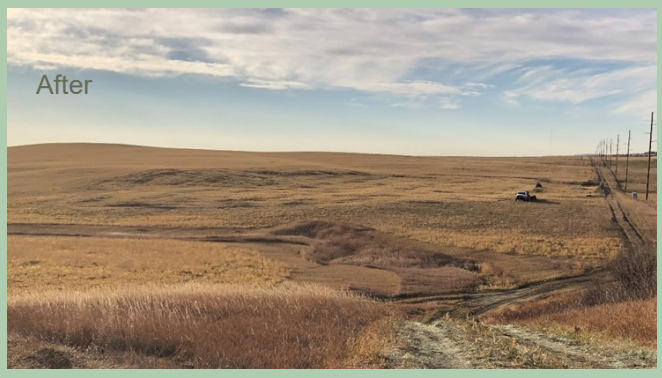
The landowner requested the northwest pond and spoil piles remain untouched and left as a wildlife area. The reclamation of the site involved moving 149,740 yd^3 of material. The average slope after reclamation was 5.6%. The site was tilled, fertilized, and seeded in November and December with a native grass mix. Areas for tree planting were prepped and deep tilled. Trees will be planted in 2021 by the Hettinger County Soil Conservation District.

Buresh

In 2019 the landowner of the 4 acre abandoned mine at the Buresh site contacted the PSC AML Division regarding reclamation. Hidden neatly behind a hilltop and near Dickinson city limits, the site had been used as an illegal dumpsite for many years. Discarded liquor bottles and bullet holes suggest that it was also used as a hang out. The mine site also had a 500-foot dangerous highwall greater than 20 feet high.

All sorts of wood, household waste, appliances, furniture and tires made up the bulk of the garbage as shown in the composite photo below. Before addressing the hazardous highwall, the waste needed to be sorted and hauled to a local landfill. The contractor utilized a John Deere 250G excavator to sort and two side dump semi-trucks to haul the waste. The waste was sorted into piles onsite by type. The type of piles included were tires, recyclable metal, wood, and waste for the landfill. The contractor began sorting and hauling the waste July 1 and finished on July 30. Even as the contractor was hauling trash, newly dumped trash would appear overnight. Forty-six loads of waste were hauled which included 26 loads of metal, 12 loads of trash, and 8 loads of tired. The total amount of waste removed was over 900 tons.

Once the waste was hauled offsite, the remaining wood and trees were burned onsite and the ash hauled away. Due to the dry conditions of the area, several partially buried trees continued to burn underground for approximately a month. The smoldering trees were excavated and transferred to an existing pit and buried. Spoil material onsite was used to bury any existing residual inert waste that was left at the surface.



Reclamation of the site was complete on October 8. A total of 14,519 cubic yards of spoil material were excavated onsite and 1,055 cubic yards of topsoil were salvaged and respread. The average slope after reclamation was 6.5%. The site was tilled, fertilized, and seeded in November with a native grass mix. It is hoped this reclamation will prevent further illegal dumping at the site.

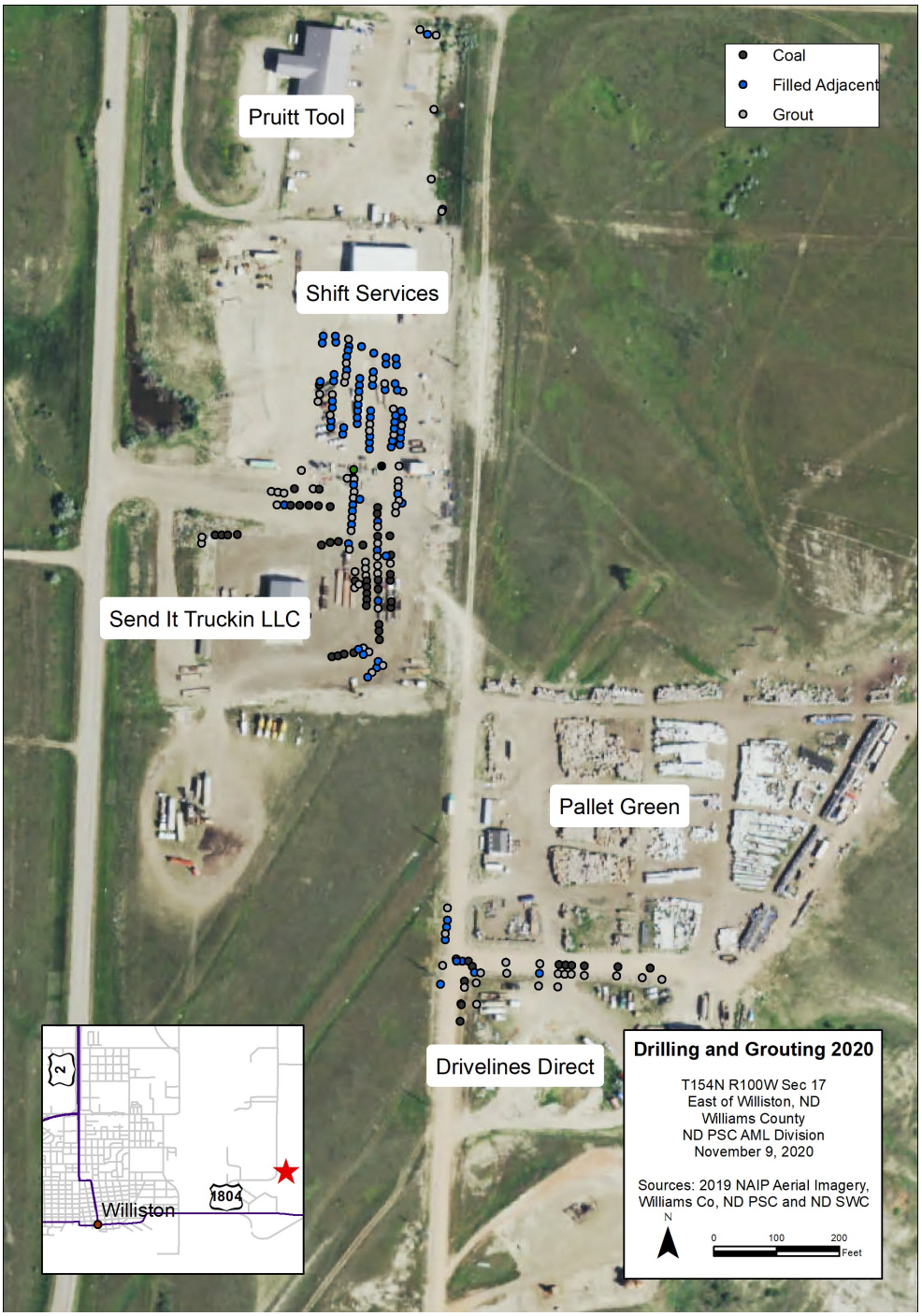
Williams County Road 9 Phase 8 AML Project

Project Type: Underground Mine Reclamation

Reclamation involved drilling to locate mine workings and pressurized remote backfilling with cementitious grout to stabilize the underground mine workings.

Contractor: Terracon Consultants, LLC of Fargo, ND

2020 Project Cost: $989,128.55



Williston

The 2020 drilling and grouting project is shown on the map on the right. It includes the remaining void holes from 2018 and 2019 that were grouted in 2020 as well as all the holes that were both drilled and grouted in 2020. The black dots represent holes that encountered coal . The grey dots represent holes that were pumped directly, while blue represents a hole that was filled by pumping grout into an adjacent hole.

Cased holes from the 2018 and 2019 Williams County Road 9 projects were buried in 1 to 3 feet of packed gravel that were located and dug up by PSC staff. Pumping began on June 2nd in the Shift Services parking lot. Every cased hole was pumped unless filled adjacent by pumping a nearby hole. On June 16th pumping was completed in the Shift Services lot and then moved to Pruitt tool. Meanwhile, the east side of the Send-It Truckin parking lot was drilled. Mostly rubble and coal were encountered. Rubble holes were pumped at a slower rate to allow grout to penetrate the rubble.

(Continued on page 9)

(Continued from page 8)

Drilling in the access road between Pallet Green and Drivelines encountered large voids.

The borehole camera showed a haul tunnel under the road. A prep day was required to let the batch plant get enough materials and drivers for the big day ahead. The holes were pumped at about 50 yards per hour and a daily total of 575 yards was amassed. A total of 1,050 cu. yds. was pumped into the haul tunnel. After that, no cased holes remained, and pumping was completed.

Core samples of the pumped grout are taken at least 14 days after grouting. Six different core samples were taken from various areas of the project site. Coring in specific areas showed that grout filled large open voids and rubble. Coring was completed on August 5th. Site clean-up and final inspection occurred on August 19. Our goal is to return the project site to its original condition or better. This involved hauling in material, and grading the lots.

Williams County Road 9 Project Statistics

Project Dates	**June 3 — August 19, 2020** 77 calendar days
Total Feet Drilled	6,019
Total Feet Cased	1,590
Days of Drilling	15
Number of Holes Drilled	90
Number of Holes Cased	28
Total Grout Pumped (cubic yards)	3,931
Days of Grout Pumping	24
Average Grout Take Per Hole Pumped	45 cubic yards
Average Grout Take Per Hole Filled	24 cubic yards
Daily Averages	Grout — 164 cubic yards Drilling — 401 feet
Highest Daily Totals	Grout — 575 cubic yards Drilling — 632 feet

Material Testing: Keeping an Eye on Quality

The Public Service Commission contracts with a material testing firm on each drilling and grouting project . This creates an objective third party for testing of grout materials. The material testing firm conducts several tests to assure the quality of grout used in our underground mine reclamation projects.

All aggregate used in the grout mix must come from an approved NDDOT pit. Once the aggregate source is identified, a gradation test is done to assess the particle size distribution. A sample from the aggregate pile is run through a series of sieves with progressively smaller mesh sizes. The material caught on each sieve is weighed and compared to the total weight of the sample. The percentage of material passing each sieve is the gradation.

This core was a really good indicator that the void was filled in this area. The grout looks solid and strong.

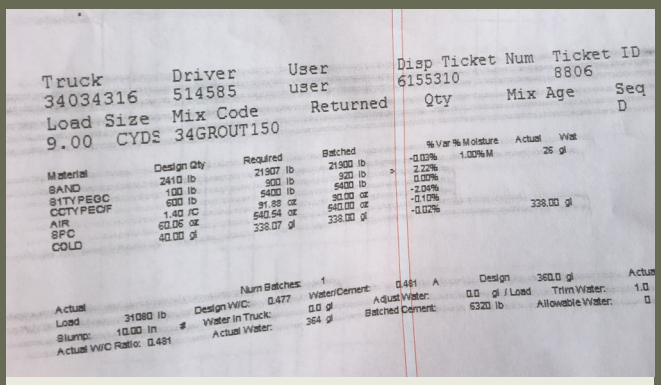
Other quality assurance tests are done in the field. For every 50 cubic yards of grout pumped a sample is taken. Flowability is checked with a slump or spread test.

(Continued on page 10)

Above:Eric Wagner, owner of Agassiz Concrete Pumping, detaching the pump from a cased hole at Williston.

(Continued from page 9)

The strength of the grout is tested by making 3 cylinders of the grout and breaking them at 14 days, 28 days, and 56 days. Our specification for grout strength is for the cylinders to break at 150 pound per square inch (psi) or more at 28 days. The 150 psi is selected to emulate the strength of lignite coal. Every strength test for the 2020 project passed the 150 psi threshold.

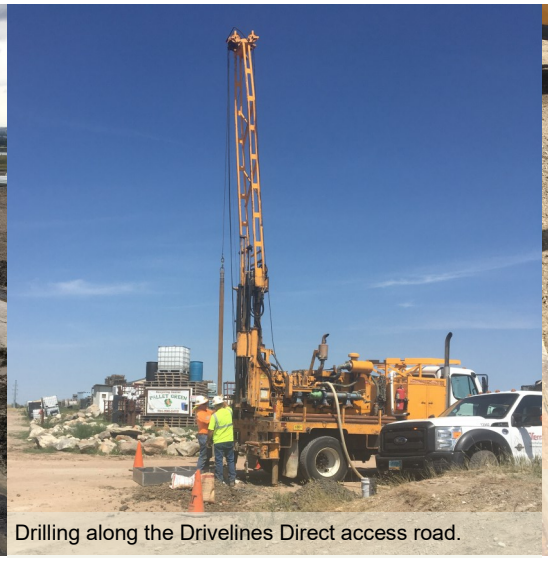

Truck 34034316 Driver 514585 User user
Load Size 9.00 CYDS Mix Code 34GROUT150 Returned
Disp Ticket Num 6155310 Ticket ID 8806
Qty Mix Age Seq D

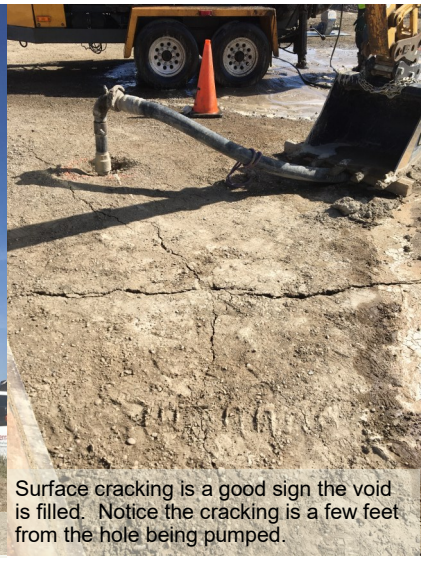
A grout ticket from Knife River's fully computerized batch plant just down the road on County Road 9.

The material tester calculates yield based on quantities from the grout tickets. The tickets tell us the amount of fly ash, sand, water, cement, and superplasticizer. Yield is the comparison of the weight of the materials in the batch actually make the specified volume. We require the batch plant to print off accurate grout tickets for each load.

The material testing firm is also responsible for conducting a pre and post-construction structural surveys. In 2020 this was conducted by Material Testing Services, LLC. The structural survey was conducted and the findings were compiled into a report and approved by a professional geotechnical engineer. These surveys ensure that the work we did had no effect on the existing structures.


The contractor used a vac truck to clean up drilling fluid at Williston.


Drilling along the Drivelines Direct access road.


Surface cracking is a good sign the void is filled. Notice the cracking is a few feet from the hole being pumped.

The Borehole Camera: A View into the Void

Even when drilling encounters a void, we don't truly know the size or condition of the void. The borehole camera is one tool that allows us to "see" into the voids.

Our borehole camera fits in the 3" PVC casing we use to case void holes. The rotating head with lights allows a 360 horizontal view. The camera head also tilts vertically up and down. With the camera we can confirm what the voids look like. While the borehole camera doesn't give exact dimensions of the void, it does give a clearer picture of the void size and conditions. With experience, the operator can roughly estimate dimensions. All of this helps us decide which holes to pump on and provides a general idea of the amount of grout that will be needed to fill the hole. Borehole camera pictures are featured on page 11.

Left: A view from the monitor of the borehole camera: The camera is suspended above the void and recording the foamed sand as it flows into a void.

The Borehole Camera: A View into the Void

This void hole was on the access road between Drivelines Direct and Pallet Green in Williston. After seeing the large open tunnel, we knew a large amount of grout would be needed. This hole took 1,595 cubic yards.

By looking at the muck at the bottom of the casing it seems this hole would not take much grout. However, this hole took 43 cubic yards of grout. You can never sure until it is pumped!

A large void with collapsed rocks and rubble shows another hole that could potentially take a large amount of grout to fill.

The camera is about to leave the drill hole and enter a void.

Foam for the sand looks like shaving cream.

Foamed sand in the pump hopper.

Foamed Sand spread test.

Noonan Foamed Sand AML Project

Project Type: Underground Mine Reclamation

Reclamation involved pressurized remote backfilling with foamed sand and cementitious grout.

Contractor: Agassiz Concrete Pumping, LLC of Bismarck, North Dakota

2020 Project Cost: $478,515.25

Locations: Harris M. Baukol WMA and Divide County Highway 21 near Noonan

Noonan

In recent years the demand for cement and flyash has inflated the cost of grout in abandoned underground reclamation. The Harris H. Baukol WMA near Noonan was an ideal site for trying a foamed sand alternative to fill underground mine voids. The mine was dry and the underground voids varied from open to heavily rubblized. The mine site was also away from highways or buildings. If the method didn't work, people would not be endangered.

Foamed sand is a flowable fill with the potential of reducing or replacing the cementitious grout mix we currently use. It is composed of finely graded sand similar to the sand used in our grout, water and a foaming agent with the consistency of shaving cream. It eliminates the use of cement and flyash. The environmentally friendly foam is designed to dissipate under pressure and over time leaving the sand. With the availability of a less expensive alternative, we may be able to extend our underground reclamation projects to areas that would otherwise not be considered.

The contractor spent a week perfecting the batching of the foamed sand to get the right amount of foam and water to create the optimal flowable fill. The photo at bottom left shows a line test with foamed sand being pumped through about 100 feet of hose. The test showed the foamed sand retains its properties even when pumped through a restricted hose as evidenced by the skid steer wheel on the hose.

The foamed sand performed very well in the field. Foamed sand was pumped into 63 cased holes on an abandoned road on the Harris M. Baukol WMA that were drilled in 2019.

We captured borehole camera video of foamed sand flowing in open voids. We conducted split spoon coring (photo top right) to verify that the foamed sand penetrates rubble. Other core samples were sent for compaction testing that reveal over 80% and as high as 95% compaction of the foamed sand. We observed surface lifting and surface cracking (bottom right). Both indicate of filling of the void space. We considered this a successful first attempt in using foamed sand.

The site will be monitored over the next few years for any signs of subsidence. At this point we don't know if foamed sand can replace cementitious grout completely, but it is a possible tool in our belt to help stretch our dollars and accomplish more. Going forward we hope that foamed sand will be a third to a half the cost of cementitious grout.

Foamed sand has a couple of advantages over grout. Foamed sand can be held in the *(continued on page 12)*

Noonan Project Statistics

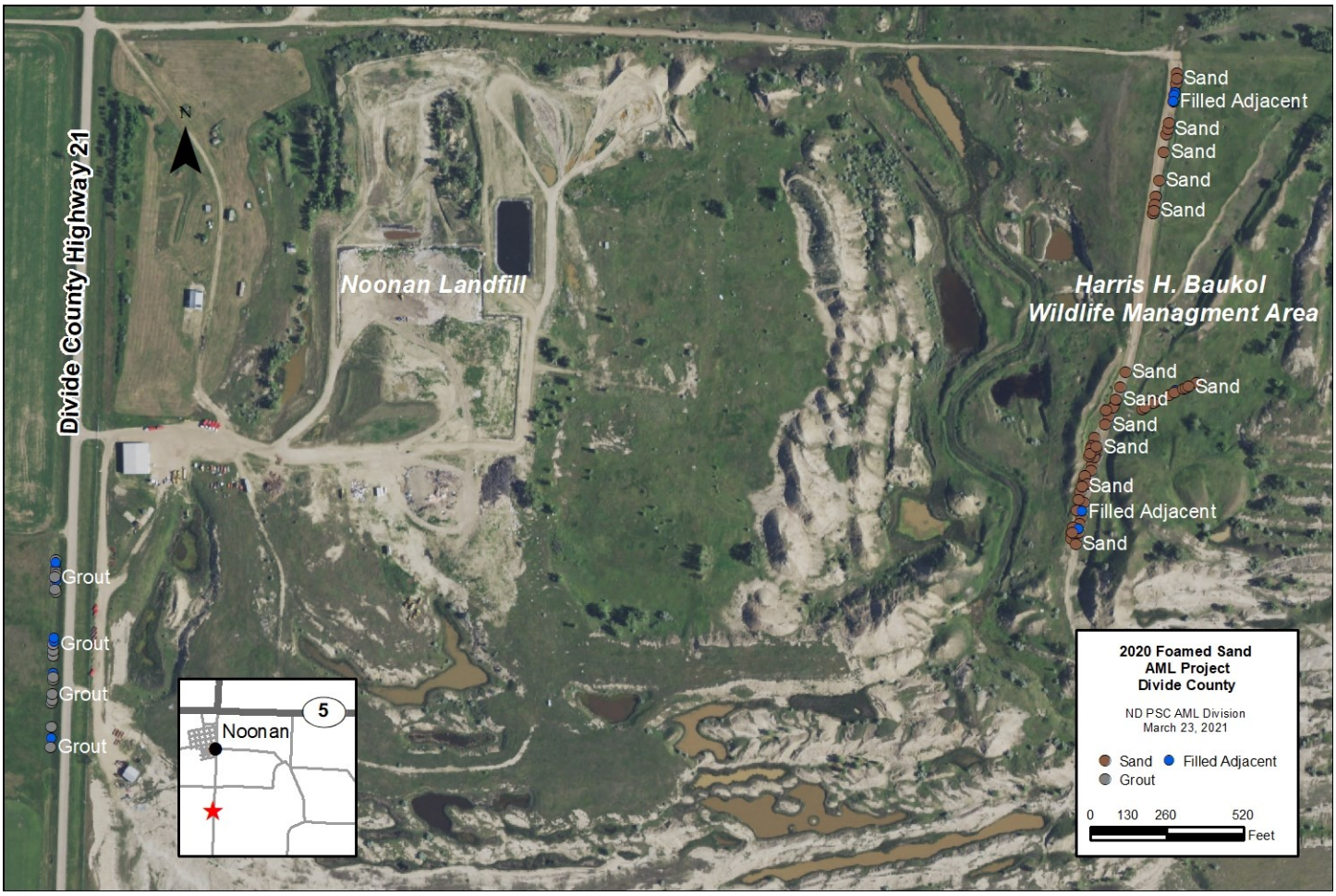
Project Dates	July 21-September 17, 2020 59 calendar days	
Holes Drilled		17
Holes Cased		11
Feet Drilled		646
Feet Cased		185
	Foamed Sand	**Grout**
Material Pumped	1189 tons	678 cubic yards
Holes Pumped	60	21
Holes Filled by Pumping Adjacent Holes	7	9
Average Take per Pumped Hole	20 tons	32 cubic yards
Average Take per Filled Hole	18 tons	23 cubic yards

(continued from page 12)

drum of a mixer truck indefinitely unlike grout. It can be re-foamed as needed, making for little waste. Clean-up is much easier as well. Sand can be shoveled, swept or raked leaving little evidence behind.

This project included pumping grout on Divide County Highway 21. About 678 cubic yards of cementitious grout were pumped into holes drilled and cased in 2017 in the ditch on the west side of Highway 21 across from the land fill. While pumping, we observed ground cracking up the roadside of the ditch indicating that the voids potentially extended under the road.

Grout pumping along Divide County Highway 21.



Sinkhole Filling AML Project

Project Type: Sinkhole Filling
Surface backfilling of dangerous sinkholes caused by collapse of underground mines.

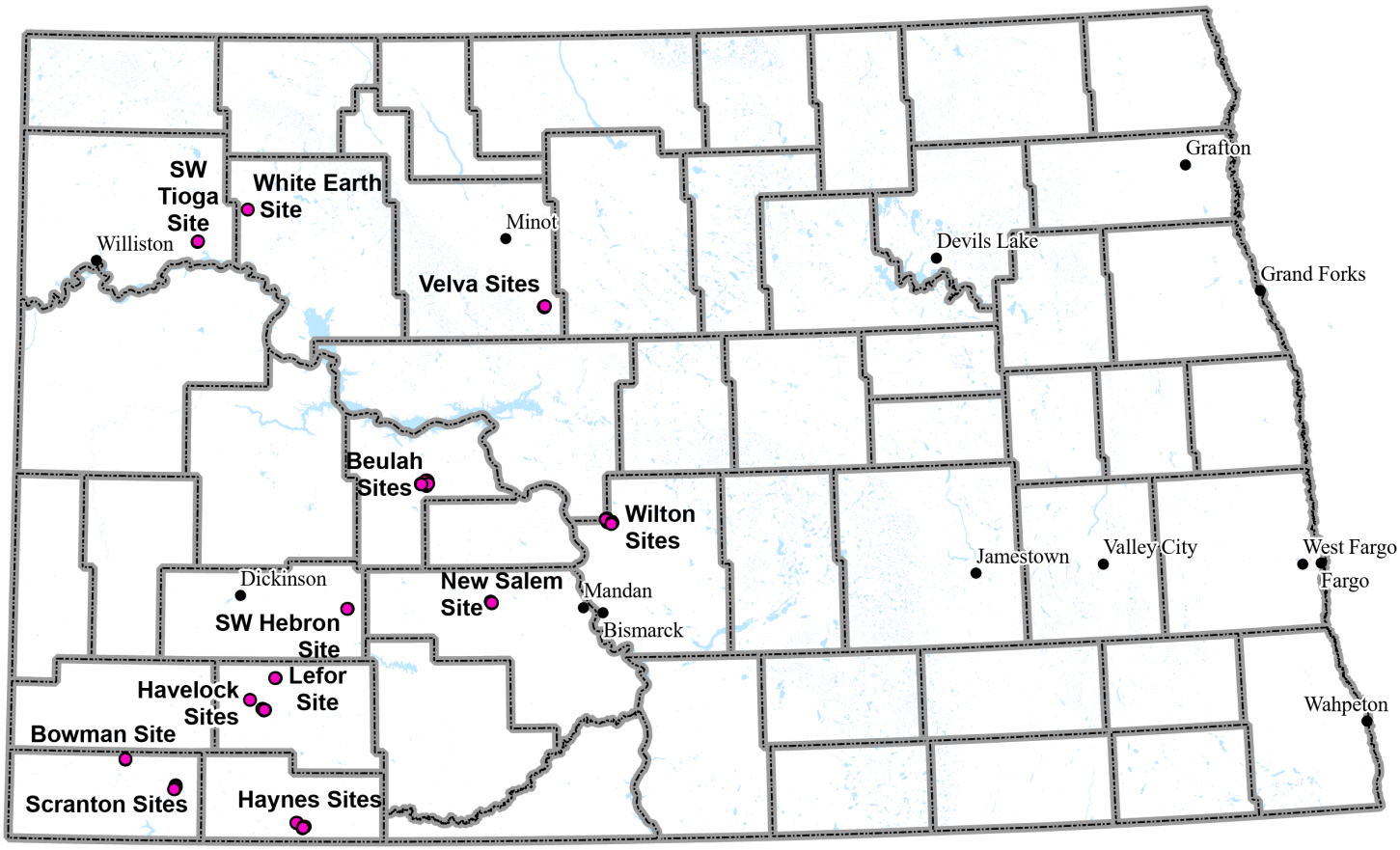
Contractor: Earthworm Excavating of Tolna, ND

2020 Project Cost: $116,210

This was the second year of a two year project.

Locations

- Bowman
- Beulah
- Haynes
- Lefor
- New Salem
- Havelock
- Scranton
- SW Hebron
- SW Tioga
- Velva
- White Earth
- Wilton



2020 Sinkhole Filling Statistics

Project Dates		July 1—November 11, 2020
Total Work Days		33
Sinkhole locations:	Number of sinkholes	Cost per site
Bowman	3	$7,768.95
Scranton	5+	$5,358.14
Haynes	24	$13,537.96
Havelock	10	$4,428.00
Lefor	7	$2,600.79
SW Hebron	10	$3,373.68
New Salem	3	$1,717.00
Wilton	13	$2,580.89
White Earth	1*	$1,745.00
SW Tioga	10	$1,787.00
Beulah	76	$68,665.17
Velva	6	$2,647.48

*White Earth: complete closure of a partially collapsed mine entry.

2019 Sinkhole Filling Statistics

Project Dates		May 13-15; October 7-November 16
Total Work Days		33
Sinkhole location:	Number of Sinkholes	Cost per site
Wilton	28	$9,081.79
Beulah	74	$62,529.55
Williston	2	$469.82

2020 Sinkhole Filling

The 2020 Sinkhole Filling Project was the second year of a two year contract. A brief statistical summary of the 2019 sinkhole filling project can be found on the left. In 2020, the NDPSC AML Division filled sinkholes in 12 different locations covering the western half of the state. Three additional sinkholes were filled as part of the 2020 Williams County Road 9 Phase 8 AML Project. Three more were filled as part of the 2020 Noonan Foamed Sand AML Project. We continue to advise against the development of any land containing underground mines. The surface is inherently unstable and could collapse without warning. Anyone with questions about historic mines in North Dakota may contact the Public Service Commission AML Division for further information. The AML Division maintains an inventory of abandoned coal mines in North Dakota.

Beulah

The PSC AML Division was notified in June that a sinkhole in the north road ditch of US Highway 200 near the Beulah Cenex fertilizer plant had appeared. This is the third sinkhole in four years to occur in this area. A drilling, grouting and foamed sand project is planned for the area in summer 2021.

Another 75 holes were filled at Beulah both on privately owned land and North Dakota Game and Fish properties. For safety reasons access to some of the North Dakota Game and Fish property is closed to public. The sinkholes there can be large and deep and occur without warning like the one in the photo below. As the contractor removed topsoil in preparation of filling the hole, it became evident that the hole was much larger than it initially appeared. Although 76 holes were filled at Beulah, hundreds of sinkholes remain. New sinkholes will likely appear as the ground thaws in the spring.

How Sinkholes are filled in North Dakota

The North Dakota Public Service Commission Abandoned Mine Lands (AML) Division requirements for sinkhole filling are as follows:

- Remove and stockpile topsoil or other suitable plant growth material from around/within sinkhole and borrow areas.
- Excavate the sinkhole (as directed) with a backhoe or excavator.
- Backfill sinkhole with approved fill material; if trucks are used, compaction with backhoe bucket and wheels is required between dumps. If a scraper is used, holes shall be ramped into and filled in such a way to get maximum compaction.
- Grade area to blend with adjacent topography and re-establish drainage.
- Respread topsoil evenly over disturbed areas and finish-grade.
- Seed disturbed areas with the required mixture.
- Till all areas with a Harley Box Rake (or equivalent equipment) sufficiently to break up all clods, prepare the seedbed and cover all seed.

Fill material may be taken only from approved borrow areas determined in consultation with the property owner. Borrow areas are located as near as possible to the sinkholes, but haul distances may vary from 100 feet to a half-mile or more. Below is our standard native grass seed mix with seeding rate.

Species	Rate/Acres — Lbs. (PLS)
Thickspike Wheatgrass	4
Streambank Wheatgrass	4
Western Wheatgrass	4
Slender Wheatgrass	2
Green Needle Grass	2
Sideoats Grama Grass	2
Switchgrass	4

AML Sinkhole Filling Projects reduced the likelihood of death or injuries to property owners and the public. However, new hazardous sinkholes are reported each year. Sinkhole filling projects such as these have been conducted annually in North Dakota and will likely continue into the foreseeable future.

Bowman

Sinkholes continue to form at the location of the historic Halleck Mine. A 2015 drilling and grouting project pumped over 2,000 cubic yards of grout into the mine to protect the roads, but not the field. Mining removed over 20 feet of the 30 foot thick coal seam in some places. Below the contractor is seeding the filled sinkhole using a Harley rake on his skid steer.

Haynes

The Haynes sites are approximately 9 miles east of Hettinger. The property owners here included 2 private landowners as well as State Trust Land. The most dangerous sinkholes were found on the State Trust Land where sinkholes are can be deep with steep sides. This is particularly dangerous for livestock. A calf died after falling into a sinkhole at this location in 2020. On the right is an example of a very dangerous sinkhole at the Haynes site.

SW Hebron and Lefor

This was the first time the PSC AML Division filled sinkholes in these locations. Ten sinkholes were filled at SW Hebron and seven at Lefor. Both sites are on private land. The SW Hebron is pasture. The Lefor site is used as hayland and for storing semi-trailers. The photo below shows stock piled topsoil at Lefor. Visible in the background are a semi-tractor/ trailer and the contractor's excavator near the borrow site.

Scranton

Scranton was aptly named for the coal mining region of Scranton, PA. Sinkholes occur almost annually here. In the above photo the contractor is shaping the borrow area. The borrow area provides material to fill the sinkholes. We use spoil piles, knolls, bumps or places where removing material will reduce the size of the disturbed area. The landowner requested we use material from a berm left when his lot was leveled. As with sinkholes, topsoil is stripped and respread after sinkholes are filled. The area is then reseeded.

New Salem

A sinkhole does not need to be large to cause damage to farm equipment or cause an injury. The New Salem sinkhole pictured on the right is in a farmer's field and presents a hazard to farmer and his equipment. Farmers will farm around sinkholes, but they have also been known to accidentally drive equipment into hard to see sinkholes.

Havelock

The PSC AML Division refers to the area between Regent and New England as Havelock. This area is home to many abandoned surface and underground mines. While the town of Havelock no longer exists, abandoned mines in the area still cause sinkholes. A landowner on his UTV veered just in time to miss the sinkhole shown below. The same sinkhole is shown in both photos. This sinkhole was well outside where sinkholes normally appear in his field.

SW Tioga

Several sinkholes were located in two separate areas at a farmstead. Three abandoned underground mines and one surface mine is within 1,000 feet of the home.

Below the contractor is using a Harley box rake to finish tilling and seeding the filled sinkhole. About 10 sinkholes were filled at this site. This work was completed on October 1st.

White Earth

The work done at White Earth was to address a collapsed entry tunnel and a resulting sinkhole. The sinkhole was about 40 feet long, 9 feet wide and 6 feet deep. The entry tunnel was about 100 feet long. This abandoned mine is located on ND Game and Fish property and open to the public. The sinkhole was located on a plateau and difficult to see. Someone on a ATV could easily fall into the hole.

Wilton

Wilton is the site of one of the largest abandoned underground lignite coal mines in the world. Several drilling and grouting projects have been conducted in the area to protect roads and farmstead, but sinkholes will continue to be a perennial problem. The sinkhole shown on the left was reported by the landowner in March of 2020. This sinkhole was about 20 feet from 26th Street NE. The sinkhole was about 7 feet in diameter at the surface and 13 feet deep. This sinkhole could cause significate damage to vehicles going into the ditch as well as ATVs, and mowers. Additional sinkholes were filled in nearby pastures.

Velva

A bull moose surprised AML staff when it was seen running through the field near sinkhole filling activities. The picture below shows the moose trotting over a just filled sinkhole. Sinkholes can be dangerous to wildlife as well as humans and livestock.

The sinkholes in Velva were in a cultivated field. As noted at New Salem, even small sinkholes can pose significant hazards to farmers and equipment when they occur in cultivated fields.

We fill sinkholes based on their perceived hazards. The Beulah area has many large non-hazardous sinkholes like those above. Between these non-hazardous holes was one very dangerous sinkhole.

Bowman: When the sinkhole above was reported to the AML Division, it was less than 6 feet in diameter, but over 30 feet deep. Below is the same hole. The contractor is stripping the topsoil around the hole to save for spreading on the top of the filled hole. The hole was enlarged to create a ramp into the hole to allow equipment to compact fill in the bottom of the hole.

Beulah: This sinkhole opened up after being driven over by heavy equipment. Vibrations along with the high weight of equipment often result in additional sinkholes forming. This hole was then filled along with the other sinkholes.

The driver for the sinkhole filling contractor pauses during sinkhole filling near Beulah.

Havelock: Below the bushes and lumber was a very dangerous open shaft that we filled. The sinkhole filling project can address more than just hazardous sinkholes associated with abandoned underground mines.

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North Dakota Public Service Commission
Abandoned Mine Lands Division
600 East Boulevard Avenue, Department 408
Bismarck, ND 58505-0480

Dangerous Sinkholes

Underground coal mining was common in Western North Dakota in the early part of the twentieth century. After WWII, surface mining became more economical, and many underground mines ceased operation and became abandoned. Continuing surface collapse is the legacy left by abandoned underground mining.

If you live or work near an abandoned underground coal mine, please use caution. The ground can give way without warning.

This sinkhole was in the ditch of U.S. Highway 200 near Beulah. A fiber optic line can be seen running across the hole. The PSC AML Division responds quickly to reports of sinkholes in ditches.

Contact Us

To report a sinkhole or request more information about our program

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