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November 27, 2019

Delivered Via Email and Hard Copy

RE: Pride of America Mine, Colorado Stone Quarries, M-1999-058, October 2019 Diesel Spill Incident Report and Mitigation and Remediation Plan; Minerals Program Inspection Report, October 24, 2019; Follow-up Notice Requirements

Dear Mr. Czapla:

Colorado Stone Quarries, Inc. (CSQ), through its consultant Greg Lewicki & Associates, PLLC (GLA), hereby submits this report concerning the above-referenced incident. This report is submitted pursuant to and in satisfaction of the requirements set forth in Rule 8.2.3 of the Mineral Rules and Regulations of the Colorado Mined Land Reclamation Board for Hard Rock, Metal and Designated Mining Operations and in the above-reference Inspection Report.

The report is divided into eight principal parts. First, an overview of the events that occurred regarding the recent accidental release of diesel fuel at the mine is provided. Second, a brief description of the mine, and in particular those parts of the mine that were involved in the diesel fuels, is presented. Third, information is provided in regard to each of the four items/requests presented in Rule 8.2.3 and the Inspection Report. Fourth, a timeline is presented in great detail as requested by the Division. The fifth and sixth parts of this report discuss factors that contributed to the spill. Finally, the seventh and eighth sections detail the mitigation efforts and ongoing mitigation plans and procedures. Much, if not all, of this information has been shared with the Division as a result of discussions between GLA and Division representatives, and visits to the mine sites by the Division.

Overview

On Wednesday, October 16, 2019, the Pride of America Mine (PAM) operated by CSQ reported a spill of ~5,500 gallons of dyed off-highway diesel fuel from its operating above-ground storage tanks. This release resulted in contamination of the road fill material (~169,000 CY) of CSQ's haul road within the permit boundary.

The timeline of discovery events, explanation of factors contributing to the spill, mitigation procedures, and remediation plans are provided below. As to potential impacts associated with the spill, based on currently available information:

- NO diesel appears to have left the site and the full spill appears to be contained within the road fill material and the sump at the toe of the fill material.
- NO detectable amounts of diesel entered Yule Creek and the terminal berm and booms with the sump provide adequate redundancy within the sump at the toe of the fill material.
- NO detectable discharge of contaminated water occurred at any time during the initial spill and through mitigation and the start of remediation.
- Discharge of clean water via seepage through the terminal berm occurred and this water was sampled and yielded no detectable diesel limit values.
- NO damage to persons or off-site properties occurred during any phase of the spill and resultant mitigation and remediation efforts.

Site Description

CSQ is located in Marble, Colorado between 9,100 – 9,700 feet in a sub-alpine environment. The DRMS permit boundary and mine access gate is 3.1 miles south along County Road 3c from the bridge over the Crystal River. Drone flight images of the site are included in Appendix A as a spill map and long section maps. Relevant surface mine site locations are labeled on the 2019 drone image long section map.

Quarrying operations at the site utilize mechanical cutting techniques – rock and wire saws – rather than drilling and blasting. Similar techniques are utilized both underground in the galleries and outside in the quarries. Finished blocks are hauled on flatbed trucks to the historic mill site for transloading onto highway trucks. Waste marble either is utilized as blocks for erosion protection or is broken to create stable waste rock landforms.

Marketable and waste marble blocks are transported throughout the mine site by loaders that are supported by various other heavy equipment such as excavators and smaller loaders. All heavy equipment use the same routes as the SUVs and trucks that transport CSQ staff and operators. Heavy equipment regularly moves between the underground galleries and surface quarries, while only diesel vehicles may access the underground working areas. All moving surface equipment and vehicles are fueled at the main fueling area included in the primary generator pad located at the Franklin Pad. All heavy equipment and vehicle maintenance along with lubricant storage occurs at the maintenance

shop located at Pad 2 excepting events where equipment cannot be moved until it is repaired.

Power to the mine is provided by a prime generator that is composed of two computer-controlled Caterpillar (Cat 27) motor/generators (collectively, a genset). The prime power genset operates on diesel fuel, which is stored in a 12,000 gallon above-ground storage tank. Fuel from the bulk tank is pumped to a smaller 100 gallon above-ground tank (the day tank) that provides fuel directly to the genset. Both tanks are double walled and the 100 gallon day tank is located within the generator container (Conex) that houses the genset. As described more fully below, the spill that occurred at the site was a result of accidental overfilling of the day tank.

Rule 8.2.3 and Inspection Report Responses

1. Actions taken to respond to and correct the effects of the spill.

Response: As discussed more fully below under headings 'Timeline' and 'Appendix F: HRL monitoring and remediation designs', the following actions were taken to respond to and mitigate the effects of the spill: (i) reinforcement of the pre-existing sump berm that was located at the toe and northern edge of the sump, (ii) segregation of fuel-stained soils, (iii) inspection and disconnection of the primary generators, (iv) clean water flushing and pumping of the road fill materials that were impacted by the spill, (v) introduction of Micro-Blaze®, a patented safe microbial treatment media, to capture hydrocarbons trapped within the fill, (vi) removal and disposal of contaminated water and soil, and (vii) implementation of short and long term water sampling. Each of these activities was undertaken to prevent migration of fuel from the immediate spill site and was judged reasonable and necessary to contain the spill and prevent fuel from entering Yule Creek.

2. Any known or anticipated adverse impacts to persons or property. This should include information regarding impact to Yule Creek.

Response: As noted above, there were no detectable or measured impacts to Yule Creek and, given the response actions taken and to be taken, none are expected.

3. Monitoring and analyses that are necessary to evaluate the situation and corrective action along with copies of all pertinent data.

Response: Generally speaking, the monitoring and remediation plan includes installation of the bioremediation ports, installation of monitoring wells, and continued water sampling. The bioremediation plan was prepared by HRL Compliance Solutions and is presented in 'Appendix F: HRL monitoring and remediation designs.' A long-term water sampling plan will be provided by HRL once the planned monitoring wells are installed. Mitigation activities undertaken to prevent migration of the fuel and completed as of the approximate date of this report include: (i) collection and appropriate disposal of contaminated water, (ii) collection and appropriate disposal of contaminated surface soils in the immediate vicinity of the genset Conex, and (iii) fortification of the sump that

would collect water flows from the road fill as temperatures warm in the late spring. A more detailed description of the work completed to date is provided under heading 'Mitigation and Remediation Efforts'. Soil and water sample results are included in 'Appendix G: Colorado Stone Quarries – Master Data Tracker 11.12.19.'

4. Results of the operator's investigation to assess the conditions or circumstance that led to the spill, and what protective measures will be taken to prevent a similar event from occurring in the future.

Response: The results of the investigation, to date, detailing the cause of the spill are included under heading 'Timeline.' The spill does not appear to have been the result of a single cause, but rather resulted from several potentially contributing factors which are discussed more fully under the heading 'Factors Contributing to the Spill.' Protective measures to be implemented are detailed under the heading 'Plan to Mitigate Diesel Spill Reoccurrence' and include: (i) installation of a liner under all permanent fuel tanks and transfer points (the tanks in issue were double-walled to satisfy spill containment requirements; however, the transfer points were not included within the overall containment system), (ii) increased training of appropriate CSQ staff regarding proper fuel handling and procedures associated with fuel handling, (iii) and installation and certification of all systems involving hydrocarbons will be conducted by appropriately authorized fuel services specialists.

Timeline of Events

A schematic timeline is presented in Appendix B and should be used in conjunction with the following text narrative. The timeline begins a few months before the spill occurred, with the earliest factors occurring in July 2019.

As noted above, the fuel configuration of the prime power genset relies on a relatively small 100 gallon day tank to provide fuel to the C27 engines. The 100 gallon tank is filled by a float and pump system that feeds from a 12,000 gallon above-ground bulk tank. Both tanks are double walled, and the day tank is located within the genset Conex and the 12,000 gallon bulk tank is located adjacent to the Conex.

The original installation of the prime power genset and related tanks in 2014 is depicted in Figure 1A. As initially installed, the Conex was located at an elevation slightly above or level with the bulk tank. The 100 gallon day tank was equipped with a return flow system and a vent pipe that exited the Conex through the roof. The top of the vent pipe was higher than the 'elbow' of the return pipe system. The vent pipe was capped by a pressure release cap meant to keep precipitation out of the vent pipe, but at the same time allow for the release of pressure buildup in the system. In the event of an overfill of the day tank, the fuel pump would continue to feed the day tank, but the pressure of the pump would push the overflow back into the bulk tank through the return flow system. At the same time fuel was being pushed through the return system into the bulk tank, fuel would rise in the vent pipe until it reached equilibrium with the 'elbow' height of the return pipe (depicted as the red fuel line in Figure 1A).

In April 2019, the primary power genset required a rebuild due to failure of one of the C27 engines. The other generator was also rebuilt at the same time. Permitted temporary power was brought onsite to relieve the primary power unit and allow the mine to continue to operate. The two C27s were ready for recommissioning in mid-July. Temporary power was decommissioned on July 14th and the rebuilt prime power genset was brought back online on July 17th. The rebuilt genset was installed outside Portal #4 and is depicted in Figure 1B.

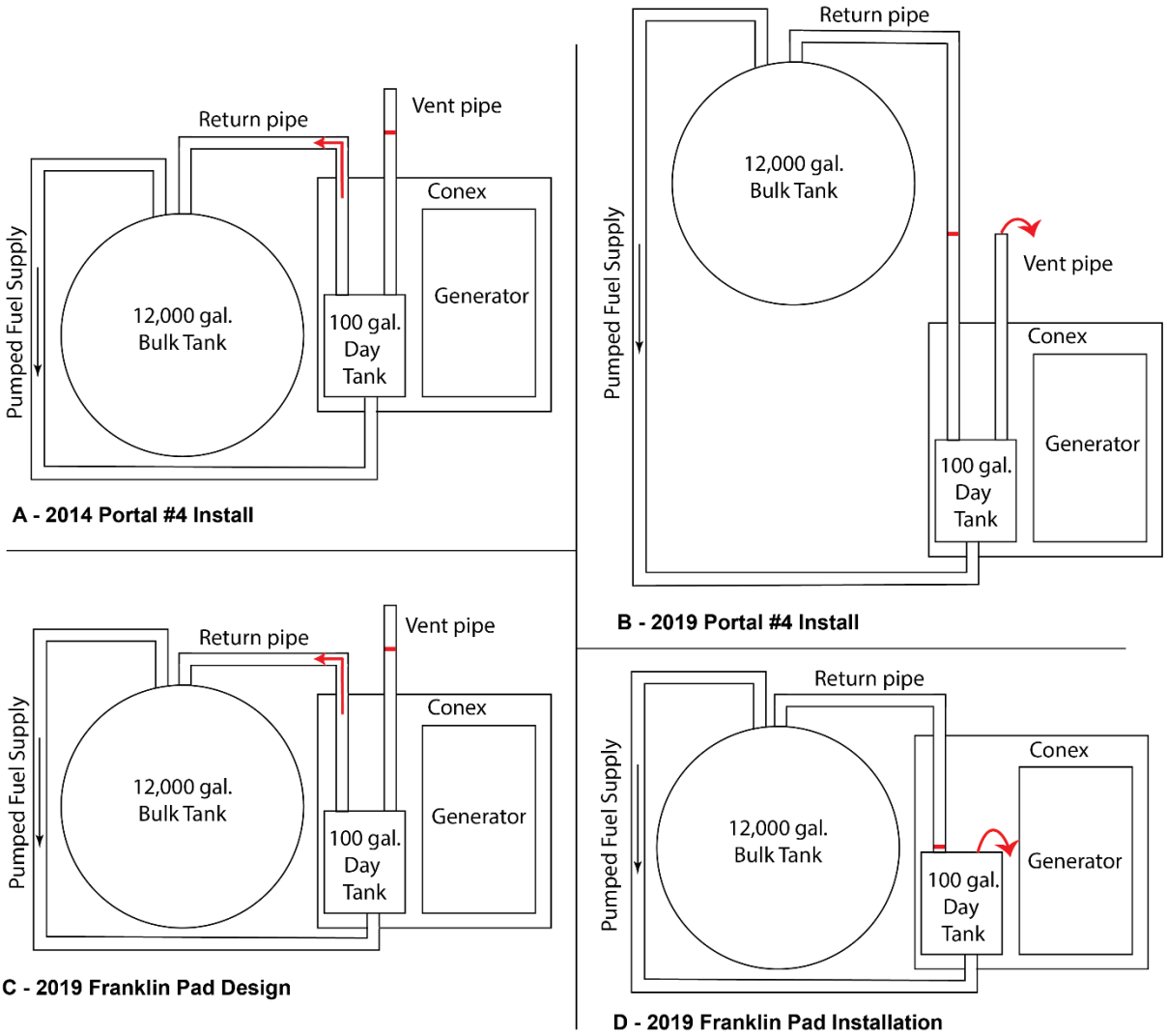

Figure 1. Schematic of the general mechanics of the CSQ genset fueling system. The red line represents fuel level. **A**. 2014 Portal #4 install. In the event that the 100 gallon day tank overfills, the pump would return fuel through the return pipe into the bulk tank. **B.** 2019 Portal #4 Reinstall following recommissioning. Notice that the genset Conex was placed beside and much lower than the bulk tank. **C.** 2019 Franklin Pad design. In the event that the 100 gallon day tank overfills, the pump would return fuel through the return pipe into the bulk tank. **D.** 2019 Franklin Pad installation at the time of the October 11, 2019 diesel spill. Note that, as more fully described below, the vent pipe inadvertently was not re-installed after testing and commissioning of the 2019 Portal #4 installation, which allowed fuel to spill out of the vent tank pressure relief cap opening in the event of an overfill of the day tank.

In July of 2019, the rebuilt genset shipping Conex was delivered to the site on a flatbed trailer (float) and parked to the east and at an elevation well below the bulk tank (at

approximately the elevation of the excavator shown in Figure 2; Figure 1B). This July 2019 installation placed the genset near its 2014 location outside Portal #4. (Although the genset was placed below the level of the bulk tank, thereby making the previous system's overflow plumbing system ineffective, no overflows occurred while the genset was at that location (Figure 1B)).

Figure 2. Original installation of the prime power genset and bulk tank. Lines running to the right serviced the previous overnight generator. Photo captured August 16, 2018; view to the south.

During start-up of the recommissioned genset, the day tank apparently ran empty within a few hours of operation due to a float and pump issue. To inspect the float system, the vent pipe on the day tank was removed by CSQ Maintenance on July 17th. The unit was then operated in a test configuration. The vent pipe, however, inadvertently had not been reinstalled at that time (see Figure 1D). Instead, a pressure relief cap was installed directly on the top of the day tank, possibly to accommodate transport of the genset Conex to the Franklin pad as described below.

On September 17, 2019, the genset Conex was moved from outside Portal #4 to the upper Franklin pad. The intended installation of the genset and associated tanks is depicted in Figure 1C. As can be seen, the intended configuration for the Franklin pad was similar to the 2014 configuration. The actual configuration, however, was different than intended as

the vent pipe had not been reinstalled at that time. Instead, as noted above, the vent pipe had been replaced with a pressure relief cap on the top of the day tank. The actual configuration of the genset and associated tanks following installation on the Franklin pad is depicted in Figure 1D. (The vent pipe was not reinstalled until October 16th, after the spill event on October 11th.)

On September 25th, Rapid Energy, CSQ's electrical contractor, installed and commissioned a new overnight genset located on the upper Franklin pad. The overnight generator is utilized to maintain heat in the main generator trailer and block heaters to allow for easier starting each morning. The overnight genset was wired into the primary power genset to provide power to the shipping container when the main generator was not operating. This configuration did not match the previous wiring arrangement at the initial 2014 installation location. The overnight genset and primary power genset operated without incident for ~15 days prior to the spill event.

On Friday, October 11, 2019, for unknown reasons, the power switch on the overnight genset was switched from the 480V position to the 240V position (Figure 3). The Eaton transfer system and the Caterpillar transfer switch on the day tank requires a single phase from a 480V supply to operate. The lower voltage (240V) may have caused or contributed to the system not functioning correctly, and as a result, the day tank filled to over capacity during the night. Due to the fact that the vent pipe had not been reinstalled and had been replaced by a pressure release cap on the top of the day tank, diesel flowed out of the pressure release cap and spilled into the generator trailer and ultimately onto the road fill beneath it (Figure 1D and Figure 4).

Figure 3. Photo captured Thursday, October 31, 2019 of the 480V to 240V switch within the overnight generator. Access to the switch was not limited.

Figure 4. 100 gallon dyed diesel day tank within the generator Conex. The large diameter black pipe in the foreground is the vent pipe that, if installed properly with the top of the pipe at a height higher than the 'elbow' of the return flow line, would ensure return overflow was directed to the 12,000 gallon diesel tank via the return piping. The vent pipe had not been reinstalled at the time of the spill. Photo captured Monday, October 21, 2019.

On the morning of Saturday, October 12, 2019, diesel sheen was first smelled and discovered immediately west of the generator trailer within the road alignment (Figure 5). Recent rains and typical morning dew wet the area and did not allow for full characterization of the surface spill stain. Furthermore, the fuel area footprint is dark in color and soil staining was unobservable. At the time, the spill was assumed to be minor.

Figure 5. View of diesel spill near the generator Conex and Clean Pak totes filled with contaminated soils. Photo captured Wednesday, October 16, 2019; view to the east-southeast.

Midday on Saturday, October 12, 2019, the CSQ General Manager was operating an excavator to repair some erosion along the creek diversion when he was alerted to diesel sheen on the sediment sump below the toe of the road fill (Figure 6). The General Manager immediately proceeded to the toe of the fill material and refortified the already in place sump. This action to armor the sump is the start of emergency mitigation actions for the October 2019 diesel spill incident.

Figure 6. Image of sheen on the sump. Photo captured Wednesday, October 16, 2019; view to the northeast.

CSQ personnel immediately sought to determine the potential source of the spill. As a first step, the fuel level in the 12,000 gallon dyed off-highway diesel bulk storage tank was checked. Due to an inadvertent error, the fuel level gauge unit was read as indicating the tank had 7 feet of fuel, rather than 7 inches of fuel, the actual amount. Based on that inaccurate interpretation, CSQ personnel concluded that minimal fuel had been released to the road fill surface and, accordingly, limited surface cleanup around the generator Conex was conducted. No further seepage of diesel was witnessed in the expanded sump at the toe of the road fill. While the spill volume was not accurately defined on Saturday, October 12th, effective containment measures were put in place by fortifying the sump.

On Sunday, October 13th, CSQ personnel checked the northern sump at 6 am and no sheen change was observed. The sump was checked again at 2 pm and no change was observed.

On Monday, October 14th, CSQ staff re-measured the fuel level in the bulk tank and realized that the Saturday reading of the fuel level gauge was incorrect and that 7 inches, not 7 feet, of fuel had been present in the tank. Calculations were completed and resulted in the determination that ~5,500 gallons of diesel was missing from the 12,000 gallon tank. Figure 7 details the daily fuel volume in the bulk fuel tank from October 7 through

October 15 in graphic form. Values of 500 gallons are used as the average amount consumed on a full production day, while an average of 250 gallons are consumed on low production day, such as weekends.

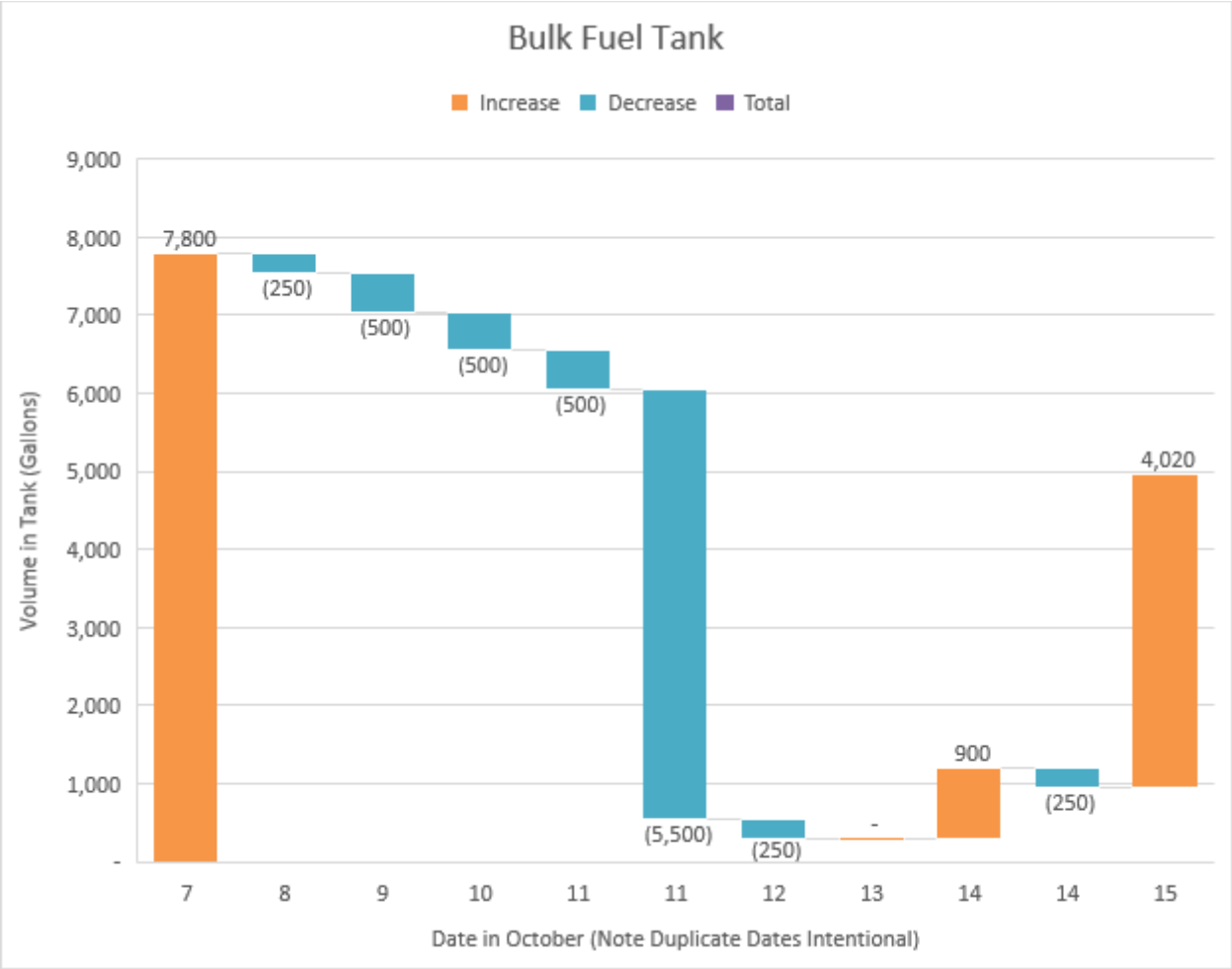

Figure 7. Waterfall chart of the fuel status within the 12,000 gallon dyed diesel generator tank from October 8 through October 15, 2019.

Following confirmation of the amount of fuel suspected to have been released and the follow-up internal discussions, all production activities at CSQ were halted on Wednesday, October 16, and all operators, supervisory and management staff were diverted to mitigation efforts surrounding the generator unit. GLA was contacted and consulted on procedures to be followed in the case of a large spill event.

Mitigation actions on Wednesday, October 16th included hand shoveling fill from the generator and fuel storage footprint to determine the depth of soil contamination. During or prior to the 'all personnel' mitigation effort, an anonymous hazard complaint was filed with the Mine Safety and Health Administration (MSHA). During the Wednesday mitigation effort, a CSQ representative contacted Mr. Michael Cunningham of the

Colorado Division of Reclamation, Mining, and Safety (DRMS) to alert him of the incident. Mr. Cunningham advised that he would alert Messrs. Travis Marshall and Dustin Czapla of the DRMS of the incident. Mr. Cunningham also provided the phone number to use to report the spill to the Colorado Department of Public Health and Environment (CDPHE). Following conversations with the DRMS, a call was placed to CDPHE, but CSQ personnel were unable to reach a person of authority or a mailbox that was not full. (As described in more detail below, CDPHE personnel were contacted by the DRMS and were again later contacted by HRL Compliance Solutions, Inc. on Wednesday, October 30, 2019.)

On Thursday, October 17th, Mr. Mark P. Brewer of MSHA arrived at CSQ and assessed the nature of the previously mentioned hazard complaint. The resultant Mine Citation/Order #9028906 is included in Appendix C.

Also on Thursday, October 17th, Clean Harbors, Inc. responded to the emergency spill call to assess the situation as the first emergency spill incident responder. A plan was developed between CSQ, GLA, and Clean Harbors representatives. This plan is detailed in the mitigation and remediation section of this report. CSQ returned all non-mitigation personnel to limited production activities on Thursday, October 17th. These limited production activities were to clear work in progress and to reach a safe shut-down state of the quarry.

On Thursday, October 17th, an inspection hole was dug near the Franklin quarry surface opening along the marble outcrop (Figure 8). The hole was dug to the maximum depth the excavator could reach and was along the sloped marble bedrock surface. Placement was determined to visualize if dyed diesel was flowing along the fill to bedrock contact on the east side of the fill material. Excavation to the bedrock contact on the west side would have been near impossible due to constraints from blasted material and due to the dip of bedding. No stained soils or other evidence of diesel was observed during this digging exercise. CSQ operators began preparing clean-up activities at the sump.

Figure 8. View of excavation along the west side of the Franklin ridge to characterize spill depth and contamination. Photo captured October 17, 2019; view to the north-northwest.

On Monday, October 21st, Mr. Ben Miller and Ms. Katie Todt of GLA arrived on site to oversee the mitigation operation. Clean Harbors sent two representatives. Representatives from GLA, CSQ, and Clean Harbors discussed the previously developed mitigation plan.

Additionally, on Monday, October 21st, Mr. Dustin Czapla of the DRMS conducted a site visit in response to CSQ's spill report received by the Division on October 16, 2019. He also addressed a separate unrelated and subsequently resolved complaint which is detailed in his inspection report included as an attachment to this report in Appendix D. DRMS required CSQ to "respond to and correct the effects of the spill", and established a corrective action date of November 22, 2019. After conferral at the site, Mr. Czapla verbally agreed that the plan developed by Clean Harbors, CSQ, and GLA on Thursday, October 17, 2019 would meet Division standards.

On Tuesday, October 22, 2019, CSQ operators and Clean Harbors prepared the sump area for pumping activities. This included building up a pad south of the sump to serve as the pump location and walking the pumps, hoses, and associated equipment down to the pump pad via heavy equipment. Extra water tanks, totaling 24,000 gallon capacity plus a 4,000

gallon water truck, were placed at the road level above the sump area to accommodate a heavy return of pumped water in the event that flushing resulted in a large push of water through the fill into the sump (Figure 9 and Figure 10). The Clean Harbors water tanker was also placed in the same location to receive the first load of pumped water.

Figure 9. Water tank placement to receive pumped sump water. Photo captured Wednesday, October 23, 2019; view to the north.

Figure 10. Water tank placement to receive pumped sump water. Photo captured Thursday, November 14, 2019; view to the south-southeast.

On Wednesday, October 23, GLA and CSQ personnel prepared a Job Safety Agreement (JSA) to be understood and signed by every party participating in the clean-up activity. Following the adoption of the JSA, the initial pump supplied by United was unable to pump at the required pressure over the required elevation change. Arrangements were made for replacement pumps to be delivered by Rain for Rent based out of Rifle, Colorado. Also on Wednesday, CSQ and GLA concluded that Clean Harbors would not be able to manage and complete the mitigation operation as planned. Therefore, additional consultants were contacted and HRL Compliance Solutions, Inc. (HRL) conducted a site visit to assess its ability to complete the job. Following this initial site visit, HRL was chosen to assist with mitigation activities and to take over the long term sampling and remediation plan required by the state.

Two holes were dug near the generator Conex to determine potential pathways for diesel to enter and potentially saturate the fill near the generators (Figure 11). One hole was located at the center of the northern face and a second adjacent to the western Conex face. Both holes were within 10 feet of the generator Conex. The western hole yielded diesel soaked soil to a depth of 2.5-3 feet and was observed via smell and mild staining. The northern hole yielded diesel soaked soil to a depth of 2.5-3 feet with less distinct, but still detectable, diesel odor at a depth of approximately 12 feet below the pad surface. It was determined due to the mild presence of diesel odor at depth that the northern hole would serve as the input location for water flushing, simple green injection, and final seasonal fill remediation of a Micro-Blaze application.

Figure 11. Northern hole prepared for clean water flushing input directly adjacent to the generator Conex (out of frame to the right). Photo captured October 23, 2019; view to the east; man in yellow for scale.

On Thursday, October 24th, two pumps of roughly equal size were delivered by Rain for Rent. The first pump was tested and worked (Figure 12). The second pump did not work as it was rated for high flow and low pressure – the opposite required in this environment. Rain for Rent replaced that pump on the same day. The third Rain for Rent pump was the largest pump available in the Rain for Rent fleet.

Figure 12. View of the Rain for Rent pumped that was checked and worked on October 24, 2019. Notice the hose running up the colluvium slope shown in the background to the tank located along the northern extent of the haul road. Photo captured October 23, 2019; view to the west-southwest.

Friday, October 25th was planned to begin by testing the extra-large pump; however, it experienced faulty starting. Rain for Rent sent two repair mechanics to CSQ Marble to service the extra-large pump. An HRL representative conducted a site visit to determine sampling points. He was escorted by GLA and CSQ personnel to determine the most appropriate, accessible, and repeatable locations for sampling. These locations and a brief narrative describing the criteria used for their selection are detailed later in this report. The work week ended with one confirmed pump in place, no confirmed back-up pump in place, the diesel spill contained to the road fill, and no diesel in the creek.

No changes and no mitigation work was completed on Saturday, October 26th or Sunday, October 27th. The sump was checked for sheen on both weekend days by CSQ personnel and no observable change in sheen was discovered.

On Monday, October 28, 2019, CSQ, Rain for Rent and Clean Harbors personnel attempted to get the large primary pump online. There were some delays as a result of site conditions, including deicing activities and heating. Upon reevaluation, the extra-large

pump did not have a faulty starter as previously believed, but had a problem with the relay. Once the relay was fixed, the extra-large pump was tested, but still did not work. Rain for Rent mechanics were again called to the site from Rifle, arrived near the close of business for the day, but were unable to resolve the pump problem.

HRL conducted baseline sampling for diesel in 8 locations, including one off-site location at the confluence of Yule Creek and the Crystal River (Figure 13). These sample locations are shown on the map in Appendix E. Diesel odor was only detected in one location – the sump. No other visual cues of diesel were observed at any other sampling locations. HRL was also consulted regarding changes to the flushing and pumping plan.

Figure 13. HRL personnel baseline sampling the sump. Photo captured October 28, 2019; view to the west-southwest.

CSQ, GLA, and HRL personnel agreed that flushing needed to begin in earnest on Tuesday, October 29th, with or without an online secondary pump at the sump. Given the fact that over 6 inches of cumulative snowfall (1.4 snow-water equivalent inches from SNOTEL site North Lost Trail ~9,200 foot elevation, <2 miles east of Marble) had occurred across the fill area since the spill and that warm surface temperatures on Sunday, October 27th did not result in a discernable level change of the sump, it was determined that, even with flushing, a significant influx of water would not enter the sump.

On Tuesday, October 29th, a Caterpillar representative arrived on site to inspect the transfer switch of the generator day tank to verify it was installed correctly. The results of this inspection were unknown at the time this report was written. At 10:18 am, pumping from Yule Creek was initiated by CSQ and GLA representatives. By 10:55 am, 5,015 gallons of water were flushed into the hole prepared near the generators (Figure 14). By 11:16 am, the sump had already risen to the 1'8" level from the starting 1' level (Figure 15). All sump levels are relative to the 2x4 with markings placed every foot that was propped up in the sump leaning against the western bedrock surface of the sump. The sump has a non-uniform bottom that is shallower on the sides and ~1-3 feet deeper in the center. Therefore, all subsequent sump level measurements and values are relative to the 2x4 and do not reflect an actual known depth of the sump.

Figure 14. Flush of 5,015 gallons of clean water into the hole featured in Figure 10; notice the totalizing flow meter at the hose end. Photo captured October 29, 2019.

Figure 15. Sump with visual level rise post flushing; notice the 2x4 in the right of the frame. Photo captured October 29, 2019; view to the west-southwest.

Once it was determined that the sump had risen almost a foot within the hour following initiation of flushing, it became immediately apparent that pumping needed to begin promptly. (This realization nullified the previous hypothesis that no flow would result from pumping water through the road fill.) Constant pumping efforts were initiated and ceased only when the hoses were transferred between tanks as they were filled. After two hours of pumping, it was determined that flow into the sump was occurring at a rate of 5,000 gallons an hour based on the amount of water collected in the tanks located on the haul road.

By mid-afternoon, the immediately available tank space provided by CSQ was exhausted and plans began to collect and repair other water tanks located throughout the site; final tank arrangements are shown in Figure 10. A total of ~70,000 gallons of tank space was made available, not including mobile water trucks and tankers. Immediate calls were made to HRL requesting that more water tankers and water trucks be deployed to the site to collect additional water. One 20,000 gallon frac tank was ordered by HRL and delivered to the site at loadout. Over the course of the evening, the site's water truck transported multiple 4,000 gallon loads of contaminated water from the pump, and also from the filled tanks on the haul road, to the frac tank. Also, around mid-afternoon, snowfall and wind speeds began to rise while temperatures continued to drop. The resultant ~10-25˚F temperatures with wind chills into the negative Fahrenheit values created an extremely difficult outside working environment. The rate of inflow to the sump did not slow at any time during the first days pumping efforts and, near the close of business on October 29th, it became apparent that more tank space would be needed to accommodate the rate of pumped water from the sump throughout the night.

Also, near the close of business on October 29th, it was determined that the quarry did not have the necessary tank volumes on hand, nor would it be possible to get the necessary tank volumes delivered prior to the start of business on Wednesday to accommodate the much higher than anticipated flow into the sump throughout the night. Therefore, emergency excavation began to build up the berm along the northern edge of the sump (Figure 16). This berm was refortified with colluvium, marble block, and soil from the adjacent slope to the south. The berm was compacted with an excavator with the intention that diesel laden surface water would be trapped, while potentially clean water would seep through the berm.

Figure 16. Emergency night work to fortify and build up the berm along the northern edge of the sump. Photo captured from the pump pad on October 29, 2019; view to the northeast.

All CSQ personnel assigned to the pumping effort worked a 25-hour shift that began at 7 am on Tuesday, October 29th and ended at 8 am on Wednesday, October 30th. Those personnel included supervisors, pump operators and technicians, truck and heavy equipment operators, and office support. Clean Harbors provided one overnight pump operator who arrived on site around 3 pm on Tuesday, October 29th. Other CSQ and GLA representatives were also on site until ~9:30 pm on Tuesday.

Throughout the night, two tankers were filled from the sump and were sent offsite to a disposal site, Greenleaf Environmental Services in De Beque, and were temporarily stored there through the night. At around 11:30 pm, calls were made from the CSQ supervisor in charge of running the night pumping operation to GLA. They discussed options and the reality that tank space and storage areas were not adequate to accommodate the volume of flow continuing to enter the sump from the road fill. The decision was made to slow the then-current pumping rate that was keeping the sump below the 2 foot mark and instead allow the sump to fill to a new equilibrium level. All parties were aware that infiltration from the sump would occur through the berm, but anticipated that clean uncontaminated water would be able to pass through the berm while surface diesel-laden water would be

captured and retained in the sump by the numerous booms in the sump and the nature of the earthen surface of the berm. Following this determination, the pump was run for a few minutes on a 30-minute interval to ensure the pump and hoses did not freeze throughout the night. Approximately 10,000 gallons of tank space were kept open for this activity.

Also, on Tuesday, the liner for full secondary containment of the primary generators, associated fuel tanks, and all included transfer points was ordered. The liner company, Raven CLI Construction, Inc., confirmed that the liner would be prepared and available for install the week of November 18, 2019. The liner was installed by Raven CLI Construction, Inc. on November 20 and 21, 2019, and is detailed in later sections of this report. CSQ only provided heavy equipment necessary to move and arrange the marble blocks used to anchor and support the liner. At the time this report was written, the generators were being reassembled by Rapid Energy, Wagner (Caterpillar), and Eaton exclusively. CSQ personnel did not participate in installation or assemblage activities associated with the liner and did not participate in placing the generators back online. Finally, HRL will to be utilized to review the liner installation as an additional third party knowledgeable in secondary containment implementation.

On Wednesday, October 30th, GLA and CSQ representatives went to the quarry directly upon arrival at CSQ Marble. All CSQ personnel were reallocated to mitigation and pumping efforts to relieve the night shift crew. An immediate inspection was made by GLA to determine if diesel was discharged into Yule Creek. A strong diesel odor was present in the area along with a visible flow of water through the berm; however, visual cues did not exclusively indicate diesel had entered the creek (Figure 17). Agitated foam was observed on the surface of the two closest pools just north and downstream of the sump berm; however, the foam was likely the product of organics such as diesel and/or pine trees. The GLA representative first notified her offices of potential impact of diesel-laden waters into Yule Creek based on the strong diesel odor detectable north of the berm and also so advised HRL. While proper noticing occurred due to the concern for a potential impact to Yule Creek, all subsequent water sampling yielded results of non-detect in Yule Creek and thus verified that diesel impact to Yule Creek did not occur.

Figure 17. Location of strong diesel odor and visible sheen within ponds that outlet into Yule Creek. Photo captured October 30, 2019; view to the north.

HRL promptly notified the appropriate authorities which included the CDPHE. CDPHE then sent out its standard round of noticing and issued the release spill tracking #2019-0587. As of November 21, 2019, only Colorado Parks & Wildlife (CPW) are known to have responded to this notice. The DRMS was notified promptly by GLA. Mr. Czapla requested daily phone calls with updates during the immediate mitigation and start of remediation activities. In addition, on or about this date, CSQ elected to replace Clean Harbors with HRL to take responsibility for mitigation activities.

During the night, the sump rose to a height of 6 feet and allowed for clean water to infiltrate the taller berm while trapping the surface diesel sheen within the sump (Figure 18). As a result, work began the following morning, Thursday, October 31st, to further fortify and compact the berm at the northern edge of the sump (Figure 19). Marble blocks were installed along the northern edge of the sump to strength the berm and in preparation of much stronger spring melt flows that Yule Creek experiences annually. Soil and crushed marble fines were mixed and compacted along the south face of the berm to further concentrate any diesel particulates in the sump while allowing clean water to flow through. Additional booms were deployed down gradient in Yule Creek to further capture any potential diesel in Yule Creek (Figure 20).

Figure 18. View of the sump at its elevated height of 6 feet following the termination of full-time pumping. Diesel laden surface water was captured within the berm while clean water was allowed to infiltrate through the lower levels of the berm. Photo captured October 30, 2019; view to the north.

Figure 19. Berm rebuilding following emergency berm refortification the night before. Left image view to the south from beside Yule Creek; right image view to the north-northeast from the pump pad. Photos captured October 30, 2019.

Figure 20. Additional boom deployment in Yule Creek. Photo from October 30, 2019; view to the north.

Also, on Wednesday, an HRL sampling technician collected water samples from the sump, directly north of the berm at the location that diesel was smelled and organics were observed, and at two locations further north and down gradient of the sump within Yule Creek (see HRL sampling map, point DG4 and DG5, Appendix E). The HRL representative noted that that potential diesel impact may have occurred based on the smell and the sheen seen on pooling water downstream of the sump, but that confirmation would be based on the final sample results. All water samples collected within Yule Creek, however, yielded non-detect diesel range organic (DRO) values; therefore, no diesel impact occurred to Yule Creek.

Mitigation efforts on Wednesday were centered on transporting water from the storage tanks along the haul road down to the loadout. A total of 4 frac tanks were in place by midday on Wednesday and were capable of holding a total of 80,000 gallons of water. Two tanker trucks were transported up to the tanks by the regular CSQ contracted truck operators – Girardi's Towing, Inc. – and were filled with water direct from the sump. This was an attempt to draw down the sump level which was at ~6 feet and totaling <6,000 gallons. Throughout the day, two water trucks ran laps from the onsite tanks down to the

frac tanks located at loadout with 4,000 gallon loads per trip.

At 2 pm, a GLA representative arrived onsite to further support the mitigation and remediation effort. At around 3 pm on Wednesday, October 30th the night crew arrived to take over 24 hour operations. However, the CSQ, GLA and HRL representatives agreed to terminate night operations. GLA did mass balance calculations determining potential concentrations and impact to Yule Creek and it was determined that the risk of maintaining pumping with regard to operator safety and current site conditions overweighed the logistics and potential for continued pumping operations. The generators and pumps were turned off at 10 pm.

On Thursday, October 31st, activity began at the normal start time of 6:45 am; however, activity was slow to start as the generators needed to be warmed and prep to start following their full shut-down at 10 pm the night before. The two large generators were temporarily turned on to drain all water lines within the Lincoln galleries in preparation of weeks of limited power and thus limited heat in the underground. Limited quarrying activities were to continue to take place underground operating under the use of temporary generators at localized working areas.

All available operators were tasked to mitigation efforts which included removal of the pumps at the sump, continued emptying of tanks onsite, and continued shuttling of diesel-laden water from the onsite tanks to the frac tanks at load out. Tanker trucks made two trips per day from the frac tanks at load out to the Greenleaf facility in De Beque. Rapid Energy personnel were onsite to disconnect and move the generator system. CSQ operators were only used to operate heavy equipment or were directly under the supervision of Rapid Energy personnel during the generator moving process.

At the close of day Thursday, CSQ representatives decided to change operating hours to 8 am - 4 pm, effectively running 8 hour shifts over a 5-day work week. Also, at the close of the day, the sump was at the 6 foot level with over half of the sump covered with >1 inch thick ice. The location of inflow was obscured by the water surface and wood debris that was frozen in place.

On Friday, November 1, 2019, Rapid Energy was again onsite facilitating the disconnection of the generators. Once the generator trailer was removed from its current location – the location of the spill – the upper 6-10 feet of soil was excavated and stockpiled in preparation of soil removal from the site (Figure 21). Stockpiling occurred as HRL was awaiting approval from South Canyon Landfill in Glenwood Springs for import of contaminated soils. The stockpile was located approximately northwest of the previous generator location and allowed enough room for trucks and heavy equipment to use the haul road to the west. Waste marble blocks were moved in preparation of the new generator and fuel area liner installation.

Figure 21. Contaminated soil stockpile to be removed pending approval from South Canyon landfill. Photo taken November 1, 2019; panoramic view to the west and south-southwest.

Transport of diesel laden water continued to occur from the tanks onsite along the haul road down to the loadout frac tanks. Frac tanks were continually pumped from the tanker trucks that continued to transport waste water to the Greenleaf facility in De Beque.

HRL collected another round of water samples from the sump and three downstream locations in Yule Creek. At the time of sampling the sump, the water level had dropped to 3 feet (<2,500 gallons) and the previous location of inflow was observed as dry (Figure 22). The previous flow of clean water through the berm into Yule Creek had ceased. Comparison to the current sump level showed that the sump had established a new equilibrium level at around 3 feet and was below the level needed for clean water to infiltrate the berm and enter Yule Creek. HRL also took soil samples from the segregated soil pile northwest of the spill location to further characterize the contaminated soil to be imported at the South Canyon Landfill.

Figure 22. Water sampling the sump at post pumping levels of around 3 feet; notice the cracked ice at the height of the sump at its previous 6 foot level. Photo captured November 1, 2019; view to the west-southwest.

Following confirmation with HRL regarding future water sampling of the sump, on Friday, November 1st, the sump was partially filled with marble blocks and soil to facilitate the transport of the excavator used to buildup and fortify the sump berm (Figure 23). Prior to filling with marble blocks and loose soils, the ice, debris and soil along the eastern edge of the sump was removed and stockpiled above the sump area for removal once soil import was approved. Fresh soil was placed in the sump and will be segregated for removal during installation of HRL's long-term water sampling and remediation plan for the sump. The final HRL designed long-term sampling plan will be provided once it is completed by HRL and confirmed by CSQ and GLA. Rough estimates of long-term sampling includes bi-monthly (2x) sampling of the to-be-installed monitoring wells, sump and surface waters through spring and summer 2020 during peak runoff. Sampling will occur across all areas on a monthly basis during the winter months as dictated by safe access. Two totes of Micro-Blaze were delivered to the site. Implementation of Micro-Blaze treatment will be conducted by HRL. HRL committed to completing an application plan, facilitating the application, and monitoring the immediate and long-term results of the Micro-Blaze application. The installation of bioremediation ports and the initial surface sprayed application of Micro-Blaze occurred on Thursday, November 14th and Friday, November 15th. The HRL Bioremediation Treatment Plan is included in Appendix F.

Figure 23. Temporary fill and marble blocks within the sump. Photo captured November 1, 2019; view to the east.

No changes and no mitigation work was completed on Saturday, November 2nd or Sunday, November 3rd.

On Monday, November 4, 2019, HRL, CSQ and CLA representatives met. The goal was to reach a consensus on continued short-term and future long-term sampling of the site. Monitoring wells and sample stations will be installed as detailed in the attached HRL sampling designs in Appendix F. The sampling interval and procedure will be provided once they are finalized by HRL and approved by CSQ and GLA.

Designs were discussed to ensure the sump sampling location could be accessed year-round, including winter months when snowfall accumulates to >20 foot depth in the sump area. Sampling points along the haul road were planned such that sampling can occur without impacting truck and heavy equipment use along the road (Appendix F). HRL further confirmed that the emergency mitigation operation was transitioning to the remediation phase, following the removal of contaminated soils. Once the HRL team left the site, CSQ and GLA representatives discussed the details of this report and GLA officially left the site. GLA representatives were onsite from Wednesday, October 16 to Monday, November 4, 2019, the full duration of the spill, excepting weekends when no mitigation work was occurring.

On November 11, 2019 authorization was granted from the South Canyon Landfill to accept contaminated soil from CSQ. Removal and transport of contaminated soils promptly began once authorization was relayed to HRL.

Factors Contributing to the Spill

Like most incidents, the nature of this spill is complex and includes more than one factor contributing to the event. Initial focus of an investigation explores the physical factors of the incident. Two physical factors evident from this investigation are:

- The switch from 480V to 240V power on the overnight generator
- Missed assembly of the day tank vent following generator relocation

The switch from 480V to 240V caused a condition where the float control, valves, and pump malfunctioned. The malfunction allowed the day tank to overfill and continue overfilling. As required by a root-cause analysis, a number of questions are raised by this failure point:

- Why is there a switch?
- Who flipped the switch?
- Why is the switch accessible?
- Why is the pump enabled when the prime power genset is not operating?

The overnight generator is equipped to deliver various combinations of single-phase and multi-phase power in 110V, 240V, and 480V configurations. Depending on the usage case, generator settings will be selected to deliver the proper required power. The overnight generator was setup by Rapid Energy to provide power to the prime power generator as required by the specifications of the prime power generator. The switch is located on the back of the generator inside a lockable enclosure; however, this enclosure was not locked (Figure 3). The overnight generator was installed on September 25, 2019, was tested, and ran for approximately two weeks without issue.

As previously noted, access to the switch was not restricted. Additional protection could be provided by limiting access to the 240V to 480V switch panel (Figure 3). On cursory inspection, the panel did not provide access to typical maintenance points of the machinery. Upon restart of the primary power generation, consideration should be given to locking the voltage panel.

The second physical factor contributing to the spill was that the vent pipe was not reinstalled on the day tank following the relocation of the generators on July 17th, 2019 (Figure 3). Instead, a vent pressure cap was installed directly on top of the day tank in the previous location for the vent pipe. The fuel system was then operated in a test mode to trouble shoot and solve any fuel transfer issues. As a result, the vent cap was more than 10 feet lower than what was required to mitigate an overfill condition event (Figure 1). The vent pipe was reinstalled and extended to provide spill protection on October 16th.

A second round of who, what, and whys should also occur for this factor. The investigation and interviews resulted in the following questions:

- Who designed and installed the initial system?
- Was the initial system adequate to be reinstalled when the generator and fuel system were reconfigured?
- Who reinstalled the fuel system?
- Was the reinstallation checked by the original manufacturer(s)?

Eaton has provided fuel systems to the quarry for a number of years. It provided and installed the fuel system utilized in the 2014 primary power generator installation and continues to provide equipment and services to CSQ.

The initial system was adequate to protect the generator from spilling during transfer operations. Due to the capacity of the tanks onsite, the site must provide secondary containment for fuel tanks and transfers. The tanks onsite were and continue to be either double walled or are kept within containment structures. Fuel transfer areas should also have secondary containment protection against spills. The system provided by Eaton addressed the most common spill condition of overfilling by providing a pumped return system. If the day tank of the prime power generator is overfilled, overfill will be pumped to flow back into the bulk tank. This requires control of the elevations of the tanks, lines, and vents.

In the initial 2019 installation outside Portal #4, the elevation of the top of the day tank vent was at approximately the middle of the bulk tank and was also within the Conex. The intended plumbing design requires that the top of the vent pipe be higher than the 'elbow' of the return piping into the bulk tank, i.e. above the top of the bulk tank elevation (Figure 1.A.). Figure 24 shows the original 2014 installation of the primary power generators outside Portal #4. The vent pipe of the day tank can been seen in the middle of the photo exiting the roof of the Conex. The vent pipe would partially fill until the overflow begins to flow into the bulk tank via the return flow piping (Figure 1.A.). Both the day tank and the bulk tank would need to overflow for any of the tank vents to overflow. The design of the 2014 and 2019 installation does not provide secondary containment for fuel transfers if the elevations of the tanks, transfer lines, or tank vents are changed.

Figure 24. Image of the 2014 primary generator Conex set up. Photo captured August 5, 2014; view to the northeast.

When the primary power generator was relocated to the Franklin pad, its configuration was similar to the initial installation. The elevation of the tanks, lines, and vent pipes (if installed) was close, but not exactly the same relative elevation. The generator elevation was about 1 vertical foot higher than in the 2014 installation. If the vent pipe was reinstalled when the primary power generators were moved to the Franklin pad it would have likely leaked in an overfill condition due to this change in relative elevation of the Conex to the bulk tank. (The reinstallation of the vent pipe on October 16, 2019 included a 1 foot extension on the vent pipe.)

Again, a second round of who, what, why should occur in this analysis. Reinstalling the fuel line was conducted by CSQ personnel. While a small mine site can expect operators to function across many roles, the change from a typical day to day role into a special project should include additional training, procedures, and communication. Highly skilled tasks such as plumbing the fuel system should be accomplished only by fully trained professionals, whether in-house or through third-party contractors.

Mitigation/Remediation Efforts

The initial mitigation plan was developed and implemented by CSQ personnel on Saturday, October 12, 2019 to prevent any migration of the fuel and confine its impact. Mitigation efforts are detailed in the above timeline of events. Two subsequent mitigation

plans were created: one under the direction of Clean Harbors, Inc. and a second plan that was created by CSQ, GLA and HRL.

On Thursday, October 17th, a plan was suggested by Clean Harbors and was developed among CSQ, GLA, and Clean Harbors representatives. The primary goal of mitigation efforts was to prevent diesel laden waters from entering and impacting Yule Creek. The general plan commonly used by Clean Harbors to clean-up diesel spills within large volumes of fill is to flush the fill with clean water followed by insertion of Simple Green. Simple Green is a biodegradable, non-toxic EPA-approved (2013) surface washing agent. Following Simple Green application, more clean water is flushed into the system. Once flushing is complete, Micro-Blaze would be introduced to the flush input site as well as across the surface of the spill area.

Clean Harbors suggested flushing clean water in at a volume 3x the spill volume with a 1x volume of diluted Simple Green. Therefore, the plan for this spill event included introduction of 5,000 gallons of clean water, followed by 5,000 gallons of diluted Simple Green, followed by 10,000 gallons of clean water. Micro-Blaze was to be applied at the diluted rate suggested by the manufacturer to appropriately accommodate a 5,000 gallon diesel spill. This plan was approved by the DRMS and corroborated by HRL as the appropriate initial response.

On Tuesday, October 29, 5,000 gallons of clean water was pumped from Yule Creek up gradient of the spill location and was flushed into the hole pre-dug at the spill location near the generator Conex. As detailed above, the return of water into the sump was much greater than anticipated; therefore, the plan to introduce Simple Green and 10,000 additional gallons of water was abandoned. This change in plan was determined by:

- >90,000 gallons water that flowed through the fill into the sump effectively diluted the diesel spill beyond the need for Simple Green.
- Following consultation with HRL, it was learned that Simple Green had the strong potential to behave effervescently and potentially flood Yule Creek with bubbles.
- 5,000 gallons of diesel in the road fill was flushed with >90,000 gallons of water resulting in an at least 18x dilution of the spilled diesel.
- The source of the additional water was due to the precipitation that occurred during the mitigation process.

Furthermore, the high return of water into the sump switched the plan from a mitigation plan to another emergency response plan centered on maintaining an appropriate sump level to not allow for surface flow of diesel-laden water into Yule Creek.

Following the order to stop pumping very late in the evening on October 29, 2019. CSQ, GLA, and HRL representatives began developing a short term plan as well as a long-term sampling and remediation plans. The post-pumping short term plan involved removal of pumps, fortifying the northern edge of the sump, temporary filling of the sump, planned sample locations for monitoring wells, and removal of diesel-laden soils around the generator and the sump. The intent of the plan was to further prevent migration of diesel,

particularly into Yule Creek. Long-term sampling will include sample collection throughout the road fill alignment, down by the sump area, and at the confluence of Yule Creek and the Crystal River.

HRL completed three rounds of water and soil sampling: a baseline pre-flushing sample on Monday, October 28th; a second round on Wednesday, October 30th; and a follow-up round of sampling on Friday, November 1, 2019. The only samples with detectable concentrations (>0.5 ppm) of diesel range organics (DRO) and gasoline range organics (GRO) were from the locations within the sump – the sump basin and the seep into the sump. These samples only showed detectable GRO and DRO during pre-flushing baseline sampling (October 28th) and immediate post-flushing (October 30th) while the final post-pumping samples (November 1st) did not have detectable concentrations. The HRL sampling results spreadsheet is included in Appendix G. No detectable DRO or GRO concentrations were reported for samples collected in the up gradient (UG), cross gradient (CG), confluence, bedrock seep, or any of the five down gradient (DG) locations. Following the flushing, the sump basin yielded non-detect values. Therefore, the potential DRO and GRO impact to Yule Creek and downstream tributaries (as noted earlier in this report) was determined to be null as all samples collected from Yule Creek were non-detect.

Plan to Mitigate Diesel Spill Reoccurrence

While all the tanks in issue are either double walled or within a metal secondary containment structure, certain transfer points were not (Figure 25). Also, as noted above, the primary vent pipe had not been reinstalled at the time of the spill. Although the top of the now reinstalled vent pipe is at an elevation higher than the 'elbow' of the return piping, the transfer points – the return piping system – still needed secondary containment. CSQ, based on advice from of GLA and later direction from DRMS, installed a liner beneath the entire fueling and generator area.

Figure 25. Panoramic photo of the fuel tanks adjacent to the generator Conex. The red tank is used to fuel heavy equipment while the white 12,000 gallon tank feeds the 100 gallon day tank within the generator Conex. While both tanks are double walled, none of the transfer points for either tank or the equipment in the generator Conex are in secondary containment. Photo captured October 23, 2019; view to the north and northeast.

The liner was fully prepared and provided by Raven CLI Construction, Inc. Raven designed, managed and facilitated the installation of the liner (Figure 26 and 27). The fuel tanks are installed at an elevation ~2 feet lower in elevation than the footprint of the genset Conex and are thus effectively ~5 feet lower in elevation than the 100 gallon day tank within the Conex. Rapid Energy, Eaton, and Wagner (Caterpillar) will work together to successfully reinstall the generators and get them back on line. The liner installation will also be critically inspected by HRL to provide third party quality control on secondary containment.

Figure 26. Photo of the liner installation with marble blocks as the perimeter anchor of the liner. Photo captured Thursday, November 21, 2019; view to the west-southwest.

Figure 27. Photo of the fuel tanks, genset Conex, and all transfer points now in full lined secondary containment. Photo captured Thursday, November 21, 2019; view to the west.

CSQ, with the assistance of GLA, is currently evaluation CSQ's training and record keeping programs to ensure against and to eliminate or minimize to the extent possible, potential future fuel releases. Additional long-term remediation will include continued water sampling; maintenance of site berms around the generator, sump area, and generally throughout the site; regular updates to the CSQ SPCC plan and SWMP; and maintenance of the sump, including after the monitoring wells are installed and following the close of long-term sampling. At the request of the Army Corps of Engineers, the temporary diversion of Yule Creek may be converted to a permanent diversion. If the Corps decides this is the most appropriate route, the proper permits will be secured with Corps.

Lastly, plates are included in Appendix A that show drone flights from September 20, 2018 to be compared to the drone flight from October 6, 2019. Changes include the diversion of Yule Creek to its historic eastern alignment, blasting of the western ridges, and the resultant road fill and new haul road. The cross section details topography from the 2019 post-diversion and road fill drone flight. The Spill Map highlights key features of the spill.

Please do not hesitate to contact me with questions of concerns.

Regards,

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Appendix A

PAM 191106-Spill Map (Drone Image 2019)

PAM 190501-Long Section (Drone Image 2018)

PAM 191117-Long Section (Drone Image 2019)

PAM 191106-Cross Sections

Appendix B

Colorado Stone Quarries – October 11, 2019 Diesel Fuel Spill Timeline

Appendix C

MSHA Diesel Spill Citation 191017

Appendix D

DRMS INSP-REPORTMWP_M1999058_DMC_10222019013215

Appendix E

Yule Quarry Sample Location Map (drone imagery)

Appendix F

HRL Bioremediation Treatment Plan

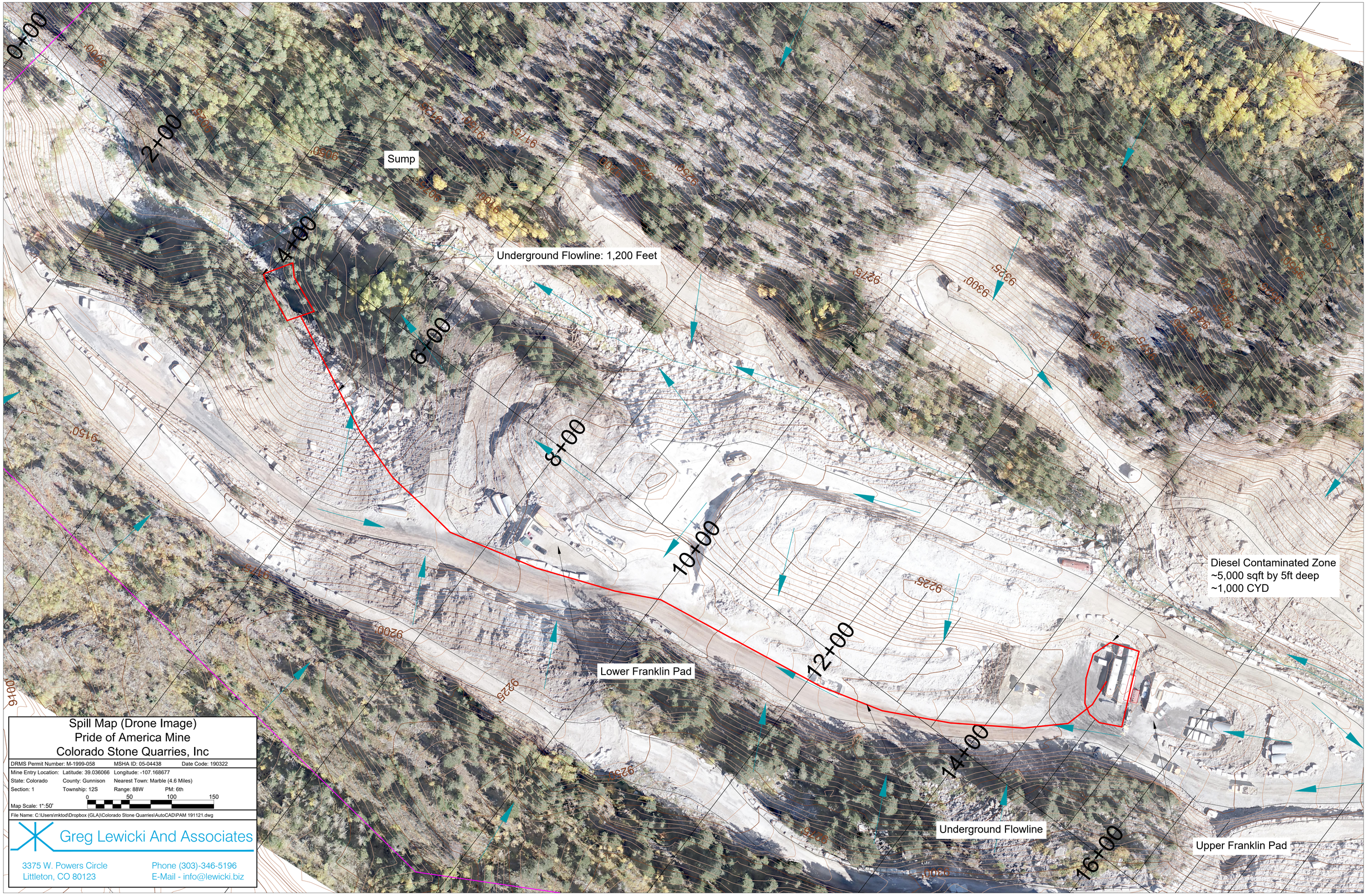
HRL monitoring well designs

Appendix G

Colorado Stone Quarries – Master Data Tracker 11.12.19 – water

Colorado Stone Quarries – Master Data Tracker 11.12.19 – soil

Colorado Stone Quarries – Master Data Tracker 11.12.19 – stockpile



Spill Map (Drone Image)
Pride of America Mine
Colorado Stone Quarries, Inc

DRMS Permit Number: M-1999-058 MSHA ID: 05-04438 Date Code: 190322

Mine Entry Location: Latitude: 39.036066 Longitude: -107.168677

State: Colorado County: Gunnison Nearest Town: Marble (4.6 Miles)

Section: 1 Township: 12S Range: 88W PM: 6th

Map Scale: 1":50' 0 50 100 150

File Name: C:\Users\mktod\Dropbox (GLA)\Colorado Stone Quarries\AutoCAD\PAM 191121.dwg

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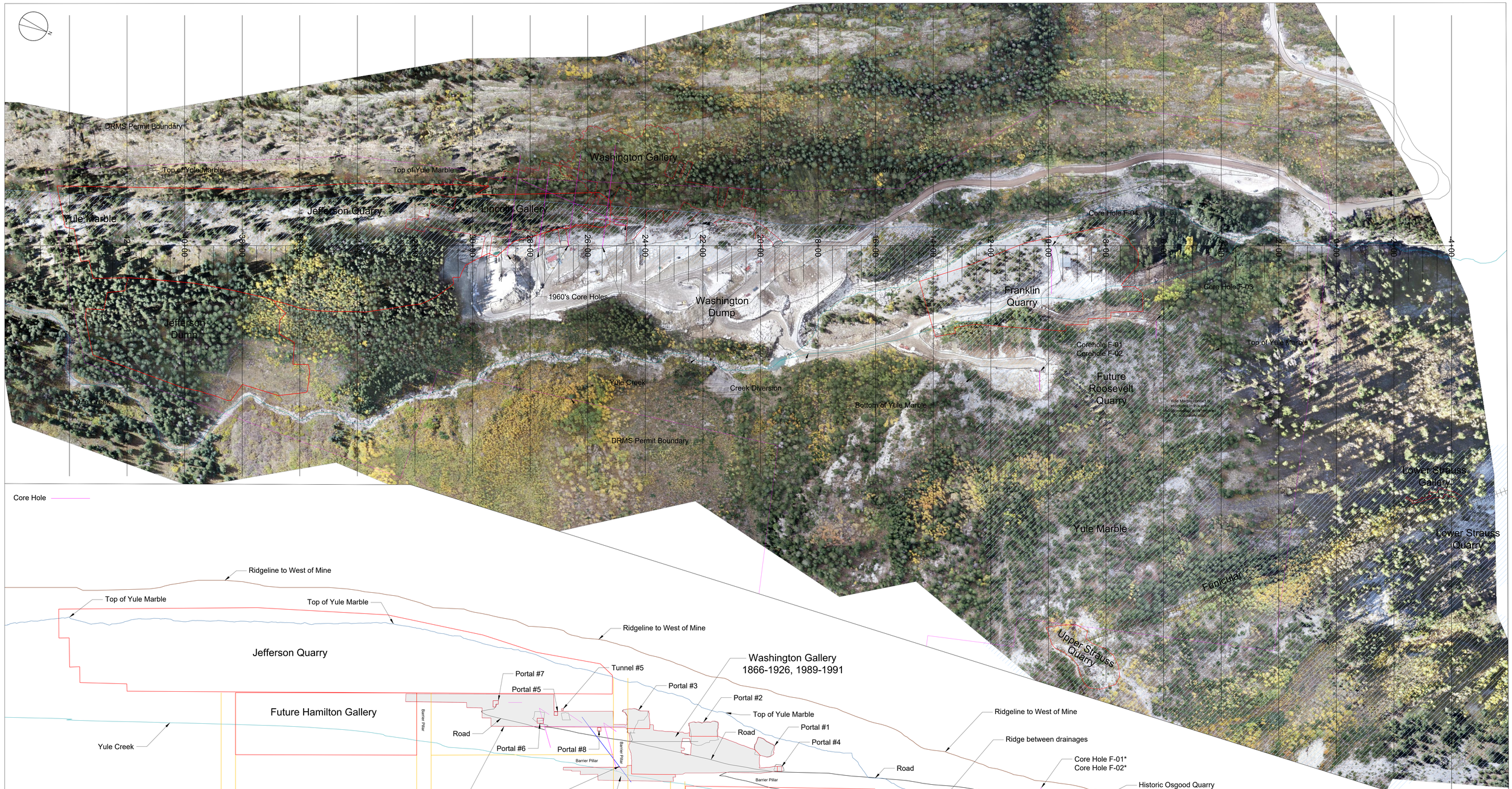

Core Hole

Long Section (Drone Image)
Pride of America Mine
Colorado Stone Quarries, Inc

DRMS Permit Number: M-1999-059 MSHA ID: 05-04438
Mine Entry Location: Latitude: 39.036066 Longitude: -107.168677
State: Colorado County: Gunnison Nearest Town: Marble (4.6 Miles)
Section: 1 Township: 12S Range: 86W PM: 6th
Map Scale: 1"=100' 0 100 200 300
File Name: E:\Dropbox (GLA)\Colorado Stone Quarries\AutoCAD\PAM 190501.dwg

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*Core Hole F-01 and F-02 are located across the valley from this projection.

DRMS Permit Boundary
Top of Yule Marble
Top of Yule Marble
Yule Marble
Jefferson Quarry
Lincoln Gallery
Washington Gallery
2014 Generator Conex Location
Portal #4
Top of Yule Marble
Future Public Trail
Lower Franklin Pad
Haul Route
Mine Gate
Water Tank Location
Sump
Core Hole F-04
Core Hole F-03
2019 Primary Generator Conex
Franklin Quarry
Upper Franklin Pad
Fuel Tanks
Corehole F-01
Corehole F-02
Top of Yule Marble
Future Roosevelt Quarry
Yule Marble pinches out below this level
Jefferson Dump
1960's Core Holes
Washington Dump
Yule Creek
Pad 2 - Maintenance Shop
Yuld Creek
Creek Diversion
Roadfill Excavation
DRMS Permit Boundary
DRMS Affected Area
Bottom of Yule Marble
Lower Strauss Gallery
Lower Strauss Quarry
Yule Marble
Funicular
Upper Strauss Quarry
Core Hole
Ridgeline to West of Mine
Top of Yule Marble
Top of Yule Marble
Jefferson Quarry
Hamilton Gallery
Yule Creek
Ridgeline to West of Mine
Tunnel #5
Portal #7
Portal #5
Portal #3
Portal #2
Top of Yule Marble
Portal #1
Portal #4
Road
Road
Portal #6
Portal #8
Barrier Pillar
Barrier Pillar
Barrier Pillar
Barrier Pillar
Barrier Pillar
Freshwater Bore
Lincoln Gallery
2012 - Present
Washington Gallery
1866-1926, 1989-1991
Future Adams Gallery
Little Italy Gallery
2004-2014
Yule Creek
Ridgeline to West of Mine
Ridge between drainages
Core Hole F-01*
Core Hole F-02*
Road
Historic Osgood Quarry
Corehole F-03
Core Hole F-04
Road
Creek Diversion
Yule Creek
Franklin Quarry
Opening 2019
Yule Marble is Open At Depth
*Core Hole F-01 and F-02 are located across the valley from this projection.

Long Section (Drone Image)
Pride of America Mine
Colorado Stone Quarries, Inc

DRMS Permit Number: M-1999-058 MSHA ID: 05-04438 Date Code: 190322
Mine Entry Location: Latitude: 39.036066 Longitude: -107.168677
State: Colorado County: Gunnison Nearest Town: Marble (4.6 Miles)
Section: 1 Township: 12S Range: 86W PM: 6th
Map Scale: 1": 100' 0 100 200 300
File Name: C:\Users\mtodd\Dropbox (GLA)\Colorado Stone Quarries\Auto\CAD\PAM 191121.dwg

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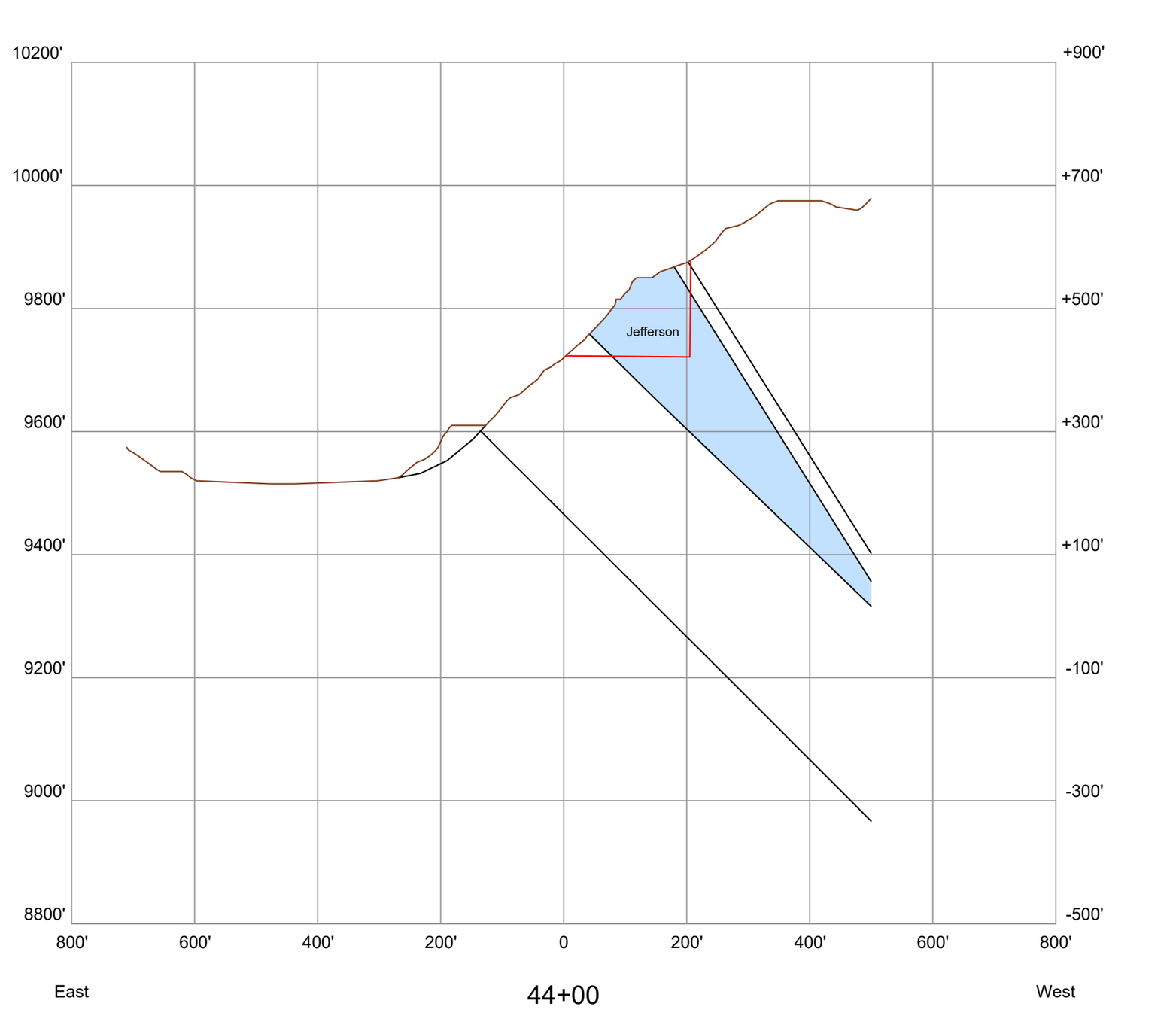
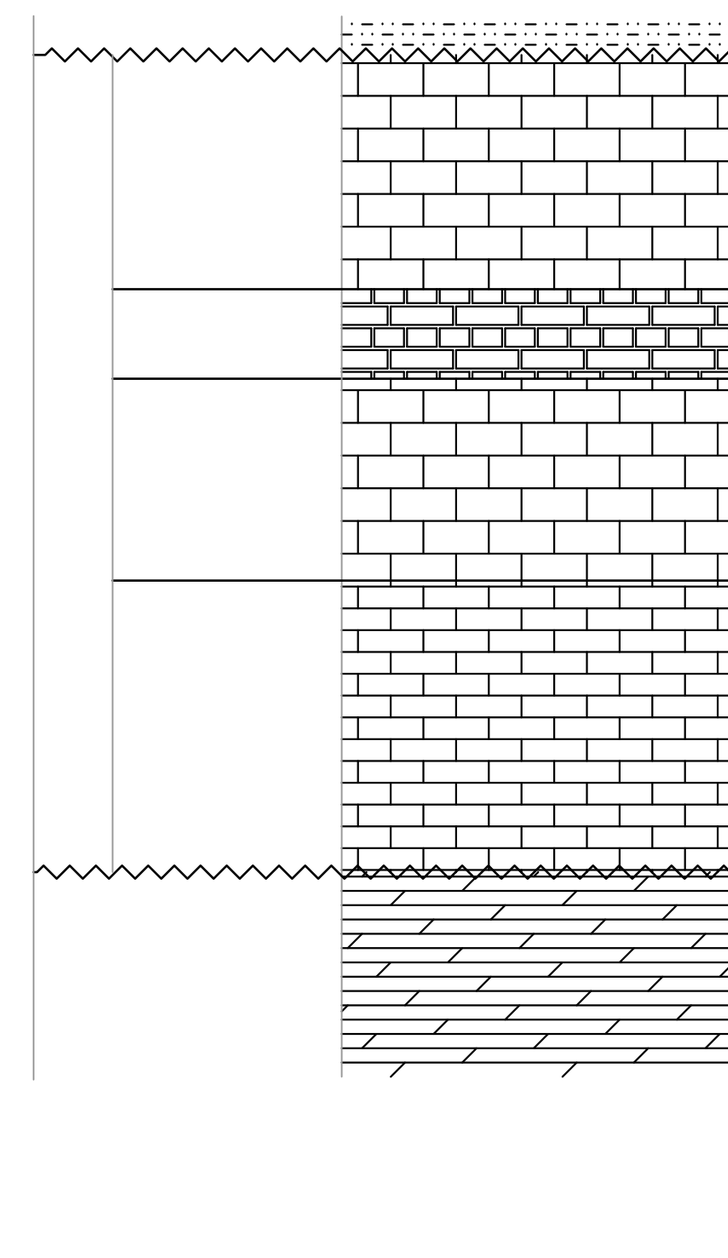


	Jurassic Morrison Formation (320-380 ft) greenish- to dark-gray and varicolored siltstone, shale, and marlstone; a few beds of white to gray quartzite and light- to dark-gray limestone and dolomitic limestone. Locally metamorphosed to varicolored hornfels, slate, and white marble; contains specularite, epidote, and tremolite.
	Jurassic Entrada Sandstone (20-45 ft) greenish- to olive-gray to white cross-bedded sandstone. Some beds are well sorted; others have medium to coarse sand grains scattered in fine-grained sandstone. Some shale partings. Locally conglomeratic at base. Metamorphosed to quartzite on Treasure Mountain Dome.
	Pennsylvanian Belden Formatoin (0-350 ft) light- to dark-gray sandy cherty limestone, dolomitic limestone, and dolomite; gray to greenish-gray calcareous sandy siltstone and sandstone. Formation is sandier in upper part and contains fossiliferous sandy sandy detrital limestone near top. Locally metamorphosed to white marble and gray hornfels.
	Mississippian Leadville Limestone/Yule Marble (about 220 ft) upper 90 to 100 feet, white fine to very coarse crystalline (calcite) marble. Lenses of dolomite and pods of stringers of chert locally. Lower 120 to 130 feet, white to medium dark-gray, buff- to gray-weathering very fine- to coarse grained dolomite marble and dolomitic limestone. Thin beds of sandy limestone, limy quartzite, or hornfels at base. Lime- and magnesium-silicate minerals widespread.
	Devonian Chaffee Formation (0-160 ft) Light-gray to white, generally buff weathering fine-grained thin- to very thin-bedded locally sandy dolomite and limestone. Locally cherty. Metamorphosed to lime-silicate marble and occasional serpentine marble. Parting member white to medium-gray limestone and dolomite with partings and thin beds of greenish-gray shale and siltstone. Includes a thick gray quartzite at top and locally a dolomite pebble conglomerate at base. Metamorphosed to fine-grained marble, hornfels, and argillite.
	Devonian Undivided (unkown) Undivided rocks older and under the Devonian Chaffee Formation.
	Quaternary Glacial Moraine - Large angular clast within a sandy to clayey matrix. Locally stable at 0.5H to 1.0V. Landslide Deposit - Large angular clast without a matrix infill. Locally stable at 1.0H to 1.0V



Cross Sections
Pride of America Mine
Colorado Stone Quarries, Inc

DRMS Permit Number: M-1999-058 MSHA ID: 05-04438 Date Code: 190322

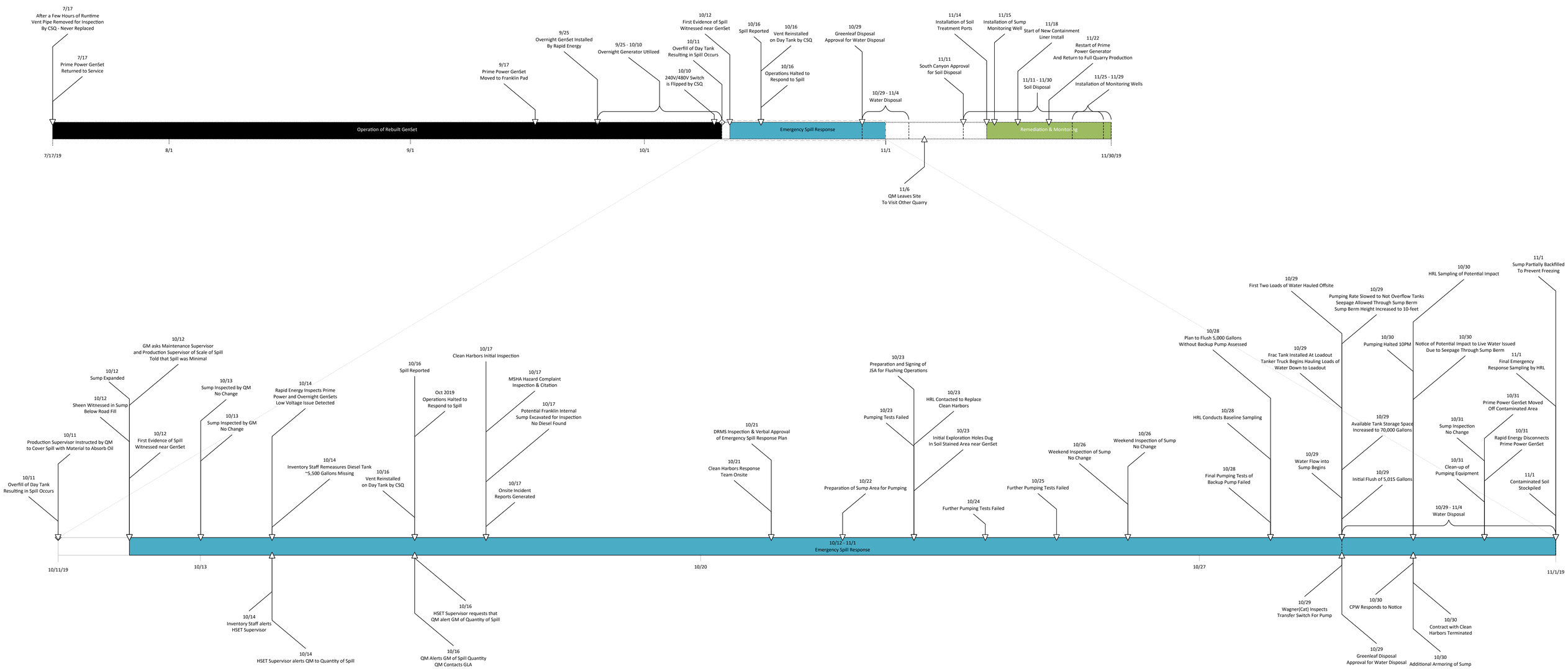
Mine Entry Location: Latitude: 39.036066 Longitude: -107.168677
State: Colorado County: Gunnison Nearest Town: Marble (4.6 Miles)
Section: 1 Township: 12S Range: 88W PM: 6th

Map Scale: 1":200' (scale bar: 0, 200, 400, 600)

File Name: E:\Dropbox (GLA)\Colorado Stone Quarries\AutoCAD\PAM 191106(2013).dwg

Greg Lewicki And Associates
3375 W. Powers Circle
Littleton, CO 80123
Phone (303)-346-5196
E-Mail - info@lewicki.biz

Colorado Stone Quarries – October 11, 2019 Diesel Fuel Spill
Timeline (July 17th – November 30th)



Greg Lewicki And Associates

Mine Citation/Order

U.S. Department of Labor
Mine Safety and Health Administration

Section I--Violation Data

1. Date (Mo Da Yr)	2. Time (24 Hr. Clock)		3. Citation/ Order Number
10/17/2019	1130		9028906

4. Served To	5. Operator
Dan Penfield	COLORADO STONE QUARRIES, INC.

6. Mine	7. Mine ID (Contractor)
PRIDE OF AMERICA MINE	05-04438

8. Condition or Practice — 8a. Written Notice (103g) ☐

The diesel fuel day tank located in the generator trailer on the generator pad was not being maintained in a manner to prevent leakage. Over the weekend the diesel fuel tank leaked approximately 5500 gallon. The electric float system for the day tank was faulty and stuck open allowing the diesel fuel to keep flowing into the tank. The diesel fuel was allowed to leak out of the relief valve for approximately 20 hours.

See Continuation Form (MSHA Form 7000-3a) ☐

9. Violation	A. Health ☐ Safety ☐ Other ☐	B. Section of Act	C. Part/Section of Title 30 CFR
			57.4430(a)(2)

Section II--Inspector's Evaluation

10. Gravity:

A. Injury or Illness (has) (is): No Likelihood ☐ Unlikely ☑ Reasonably Likely ☐ Highly LIkely ☐ Occurred ☐

B. Injury or illness could reasonably be expected to be: No Lost Workdays ☐ Lost Workdays Or Restricted Duty ☑ Permanently Disabling ☐ Fatal ☐

C. Significant and Substantial: Yes ☐ No ☑

D. Number of Persons Affected: 001

11. Negligence (check one) A. None ☑ B. Low ☐ C. Moderate ☐ D. High ☐ E. Reckless Disregard ☐

12. Type of Action: 104(a)

13. Type of Issuance (check one) Citation ☑ Order ☐ Safeguard ☐ Written Notice ☐

14. Initial Action A. Citation ☐ B. Order ☐ C. Safeguard ☐ D. Written Notice ☐

E. Citation/ Order Number

F. Dated (Mo Da Yr)

15. Area or Equipment

16. Termination Due	A. Date (Mo Da Yr)	B. Time (24 Hr. Clock)	
	10/17/2019	1200	

Section III--Termination Action

17. Action to Terminate

The mine operator repaired the electric float system by adjusting the voltage. Also the relief valve was replaced and fittings resealed. When tested the diesel day tank did not leak diesel fuel.

18. Terminated	A. Date (Mo Da Yr)	B. Time (24 Hr. Clock)	
	10/17/2019	1145	

Section IV--Automated System Data

19. Type of Inspection (activity code)	20. Event Number	21. Primary or Mill	
E04	4480690	P	

22. AR Name	23. AR Number
Mark P. Brewer	25356

COLORADO
Division of Reclamation, Mining and Safety
Department of Natural Resources

MINERALS PROGRAM INSPECTION REPORT
PHONE: (303) 866-3567

The Division of Reclamation, Mining and Safety has conducted an inspection of the mining operation noted below. This report documents observations concerning compliance with the terms of the permit and applicable rules and regulations of the Mined Land Reclamation Board.

MINE NAME: The Pride of America Mine	**MINE/PROSPECTING ID#:** M-1999-058	**MINERAL:** Marble	**COUNTY:** Gunnison
INSPECTION TYPE: Monitoring	**INSPECTOR(S):** Dustin Czapla	**INSP. DATE:** October 22, 2019	**INSP. TIME:** 12:00
OPERATOR: Colorado Stone Quarries, Inc.	**OPERATOR REPRESENTATIVE:** Daniele Treves	**TYPE OF OPERATION:** 112c - Construction Regular Operation	

REASON FOR INSPECTION: High Priority	**BOND CALCULATION TYPE:** None	**BOND AMOUNT:** $404,857.00
DATE OF COMPLAINT: NA	**POST INSP. CONTACTS:** None	**JOINT INSP. AGENCY:** None
WEATHER: Snowing	**INSPECTOR'S SIGNATURE:** 	**SIGNATURE DATE:** October 24, 2019

The following inspection topics were identified as having Problems or Possible Violations. OPERATORS SHOULD READ THE FOLLOWING PAGES CAREFULLY IN ORDER TO ASSURE COMPLIANCE WITH THE TERMS OF THE PERMIT AND APPLICABLE RULES AND REGULATIONS. If a Possible Violation is indicated, you will be notified under separate cover as to when the Mined Land Reclamation Board will consider possible enforcement action.

1. **INSPECTION TOPIC:** Acid And Toxic Materials, Hydrologic Balance

   POSSIBLE VIOLATION: Fuel storage associated with the generator unit was not placed in adequate secondary containment structures, resulting in a fuel spill which has impacted soils, and potentially surface and groundwater.

   CORRECTIVE ACTIONS: The operator shall immediately remediate the spill and submit a final report to the Division containing at least the following information:

   a) Actions taken to respond to and correct the effects of the spill.

   b) Any known or anticipated adverse impacts to persons or property. This should include information regarding impact to Yule Creek.

   c) Monitoring and analyses that are necessary to evaluate the situation and corrective actions along with copies of all pertinent data.

   d) Results of the operator's investigation to assess the conditions or circumstances that led to the spill, and what protective measures will be taken to prevent a similar event from occurring in the future.

e) Evidence in the form of a receipt that the contaminated soil was disposed of by an approved method (such as sent to an approved landfill, land farming, recycling center, etc.).

All storage tanks, petroleum and any hazardous materials on site for any period of time shall have appropriate secondary containment. The site will also have to comply with all applicable SPCC requirements. Note that secondary containment structures shall consist of an impermeable containment which could contain all contents of the tanks and various containers (when full) plus 10% of the total capacity.

CORRECTIVE ACTION DUE DATE: Friday, November 22, 2019

OBSERVATIONS

This inspection was conducted in response to a spill report that was received by the Division on October 16, 2019. Present during the inspection were Daniele Treves and Daniel Penfield (Colorado Stone Quarries, Inc.), and Ben Miller and Katie Todt (Lewicki and Associates). The Division also received a separate, unrelated complaint regarding work occurring within Yule Creek from Crystal Valley Environmental Protection Association on October 21, 2019. Issues presented in the complaint form were also inspected.

The Pride of America Mine is located approximately 2.5 miles south of Marble and accessed from CR3c. The site is a 112c operation that includes a total of 124.1 permitted acres. The Division currently holds a financial warranty amount of $404,857.00 for this site.

A 112c conversion application (CN-1) was approved by the Division in 2016. Additional acreage was added to the permit area in order to include the Franklin and Jefferson Quarries. In 2018, relocation of the access road and temporary diversion of Yule Creek was approved by the Division through technical revision (TR-5).

A generator and associated diesel fuel storage tanks were recently moved from their previous location within the 110c permit area near the Lincoln Gallery, to a location on Franklin Ridge. The new location was not proposed in CN-1, and therefore has not been approved by the Division. Currently, two double-wall fuel tanks feed a fuel tank located within the generator unit. During the relocation, a vent pipe was installed incorrectly on the generator tank, which led to the fuel pump running continuously and overflowing through the vent. This situation went undiscovered for several days resulting in a diesel spill estimated at 5,500 gallons. Fuel was spilled onto unlined ground and seeped into the unconsolidated material beneath the generator. Although the diesel storage tanks are double walled, which is generally appropriate secondary containment, their connection to each other and the generator create potential for spills. Therefore, the fuel tanks and generator need to be contained within a single secondary containment structure of adequate capacity. The containment structure and fuel storage location shall be addressed through a technical revision to the permit.

Due to the temporary diversion of Yule Creek, Franklin Ridge lies between the spill location and the creek. The ridge is composed of marble and is for the most part impermeable, creating a barrier between the spill and creek. There is potential, however, that diesel can move downhill through unconsolidated material following the abandoned channel of Yule Creek, joining the diverted Yule Creek at the north end of Franklin Ridge. The operator has placed absorbent booms in a sump located at the end of the channel. At the time of this inspection water in the sump appeared clear and did not appear to have the oily sheen typically associated with diesel spills. It is unknown though whether or not diesel has reached the creek. Water samples are to be collected by a third party group, Terracon, and lab analyzed for hydrocarbons. The operator has initiated cleanup efforts to be conducted by Clean Harbors Environmental Services.

Pursuant to Rule 8.2.3, as soon as practicable the operator shall provide a written report to the Division, that includes the following:

1. Actions taken to respond to and correct the effects of the spill.
2. Any known or anticipated adverse impacts to persons or property. This should include information regarding impact to Yule Creek.

3. Monitoring and analyses that are necessary to evaluate the situation and corrective actions along with copies of all pertinent data.
4. Results of the operator's investigation to assess the conditions or circumstances that led to the spill, and what protective measures will be taken to prevent a similar event from occurring in the future.

The letter of complaint from Crystal Valley Environmental Protection Association states concerns regarding work conducted in the Yule Creek drainage. Yule Creek has been diverted into its historic drainage on the east side of Franklin Ridge. This diversion was necessary in order to develop the Franklin Quarry and new access road. The diversion is temporary as approved through TR-5. The operator is currently in the process of armoring the banks and channel of the diverted creek. The work observed during this inspection appeared to be in compliance with plans approved through TR-5 and CN-1. Yule Creek water appeared clear above and below the Franklin Quarry area.

No other problems or violations were noted during this inspection.

Responses to this inspection report should be directed to Dustin Czapla at the Division of Reclamation, Mining and Safety, 1313 Sherman Street Room 215, Denver, Colorado, 80203, phone number (303) 866-3567, ext. 8188.

Figure 1: Generator unit and two associated fuel tanks

Figure 2: Fuel tanks for generator

Figure 3: Generator unit in which leak occurred

Figure 4: Fuel tank with pump located inside generator unit. Vent was initially installed without the extension pipe causing the system to fail

Figure 5: Fuel storage near trailers. Tank on right has been decommissioned due to inadequate secondary containment.

Figure 6: Current cut into Franklin Ridge mining area. Franklin Ridge lies between spill location and diverted Yule Creek

Figure 7: Looking upstream from Yule Creek diversion point

Figure 8: Looking downstream from Yule Creek diversion point

Figure 9: Yule Creek diversion channel

Figure 10: Yule Creek diversion channel

Figure 11: Yule Creek diversion channel

Figure 12: Yule Creek diversion channel

GENERAL INSPECTION TOPICS

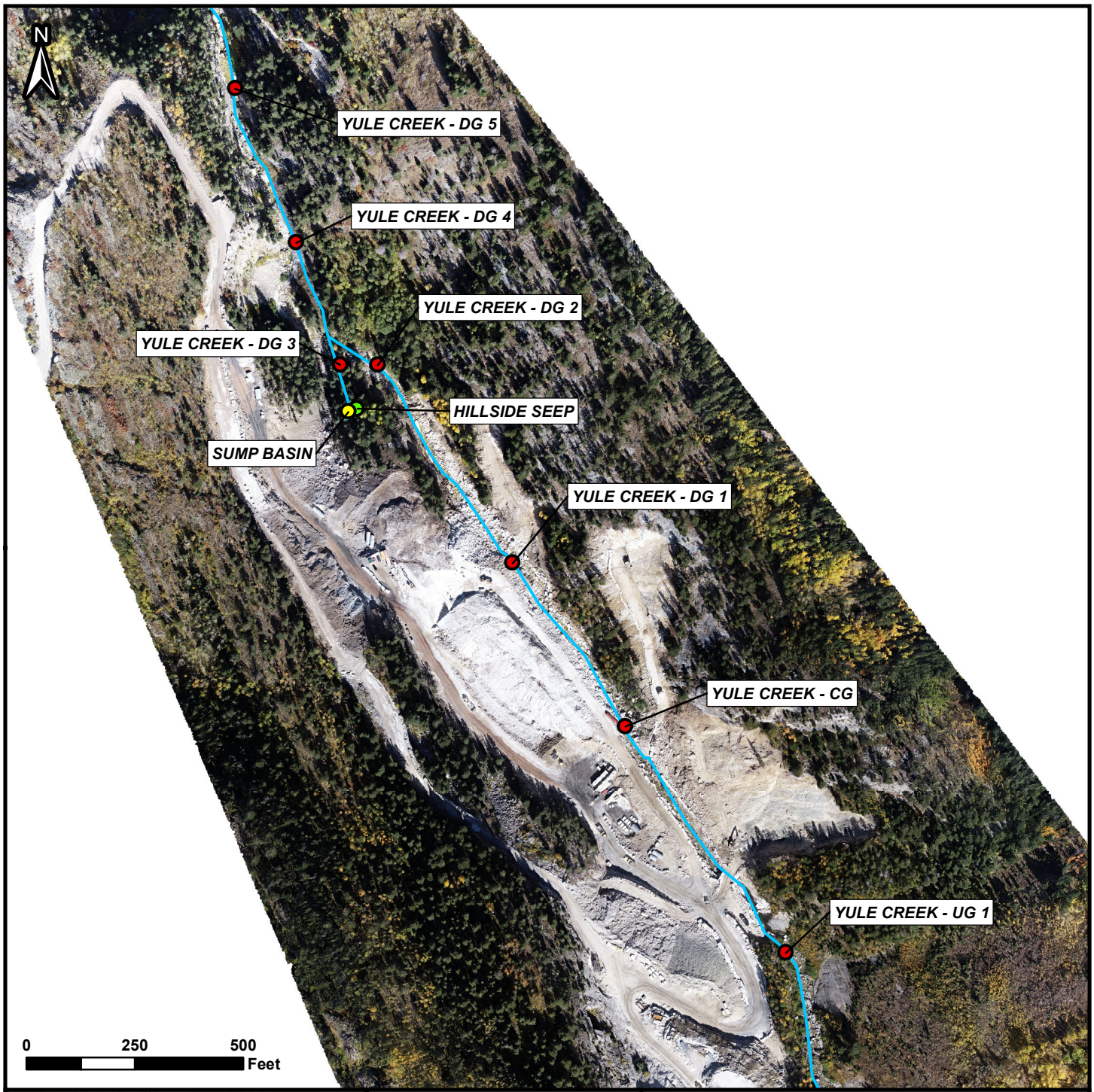
The following list identifies the environmental and permit parameters inspected and gives a categorical evaluation of each

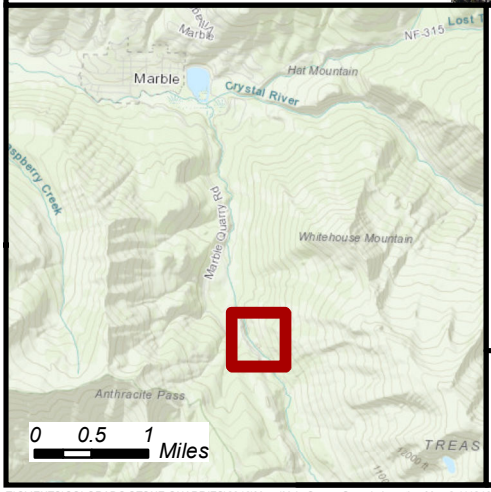
(AR) RECORDS---------- Y	**(FN) FINANCIAL WARRANTY-------- Y**	**(RD) ROADS---------- N**
(HB) HYDROLOGIC BALANCE---------- PB	**(BG) BACKFILL & GRADING---------- N**	**(EX) EXPLOSIVES--------- N**
(PW) PROCESSING WASTE/TAILING---- N	**(SF) PROCESSING FACILITIES------- N**	**(TS) TOPSOIL---------- N**
(MP) GENL MINE PLAN COMPLIANCE- Y	**(FW) FISH & WILDLIFE---------- N**	**(RV) REVEGETATION---- N**
(SM) SIGNS AND MARKERS---------- Y	**(SP) STORM WATER MGT PLAN---- N**	**(RS) RECL PLAN/COMP-- N**
(ES) OVERBURDEN/DEV. WASTE--------- N	**(SC) EROSION/SEDIMENTATION--- N**	**(ST) STIPULATIONS------- N**
(AT) ACID OR TOXIC MATERIALS------- PB	**(OD) OFF-SITE DAMAGE---------- N**	

Y = Inspected and found in compliance / N = Not inspected / NA = Not applicable to this operation / PB = Problem cited / PV = Possible violation cited

Inspection Contact Address

Daniele Treves
Colorado Stone Quarries, Inc.
1 Marble Quarry Road
Marble, CO 81623





Mapped Features

- Sample Locations
- Sump Basin
- Hillside Seep
- Creek Channel

DISCLAIMER: This representation and the Geographic Information System (GIS) used to create it are designed as a source of reference and not intended to replace official records and/or legal surveys. HRL assumes no responsibility for any risks, dangers, or liabilities that may result from its use and makes no guarantees as to the quality or accuracy of the underlying data.

COLORADO STONE QUARRIES

Sample Location Map

Yule Quarry Diesel Spill

39.038417302 -107.170610792
Section 1, Township 12 South, Range 88 West
Section 25, Township 11 South, Range 88 West

Imagery courtesy of Greg Lewicki and Associates, PLLC

Sample ID	Latitude	Longitude
CONF POINT	39.066561	-107.177660
YULE CREEK - DG 5	39.039976	-107.170845
YULE CREEK - DG 4	39.039680	-107.170706
YULE CREEK - DG 3	39.039443	-107.170557
SUMP BASIN	39.039244	-107.170623
YULE CREEK - DG 2	39.039433	-107.170387
HILLSIDE SEEP	39.039267	-107.170436
YULE CREEK - DG 1	39.037879	-107.169000
YULE CREEK - CG	39.037129	-107.168262
YULE CREEK - UG 1	39.035900	-107.167123

HRL COMPLIANCE SOLUTIONS

Author: A. Asay
Revision: 0
Date: 11/12/2019

T:\CLIENTS\COLORADO STONE QUARRIES\2019\Maps\Yule Quarry Sample Location Map 2 111219.mxd

COLORADO STONE QUARRIES

MARBLE QUARRY DIESEL SPILL

BIOREMEDIATION TREATMENT PLAN

Gunnison County, CO

November 2019

HRL COMPLIANCE SOLUTIONS

Prepared by:
HRL Compliance Solutions, Inc.
2385 F ½ Road
Grand Junction, CO 81505

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VI. Closure 3

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FIGURES

Figure 1: Treatment System Design

Figure 2: Treatment System Injection Port Design

I. Purpose and Scope

This plan outlines the bioremediation treatment details associated with the diesel fuel spill that resulted in ~5,500 gallons of diesel being released to the underlying soils as the result of a diesel pump supplying fuel to a generator mishap.

Colorado Stone Quarries (CSQ) reported on October 16, 2019 to the Department of Reclamation and Mining Safety (DRMS) and Colorado Department of Public Health and Environment (CDPHE) that a diesel fuel release occurred on October 12, 2019 from an above ground storage tank, impacting the underlying soils below the tank and generator. CSQ personnel discovered diesel fuel daylighting within a downgradient sump, ~1,200 feet downgradient. The CDPHE issued the release spill tracking # 2019-0587 and noted that DRMS will be the lead agency on monitoring the remediation.

HRL Compliance Solutions Inc. (HRL) was contracted on October 23, 2019 to perform an initial onsite and evaluate the impacted area to provide support for initial clean-up in conjunction with remediation, sampling, waste management and monitoring support.

The following information is to provide details of the treatment process, frequency, contingency plans and ultimately closure of the diesel impacted material. It should be noted that changes in the project scope may directly affect the specifics of this treatment plan.

II. Plan Applicability

This plan is applicable to the in-situ bioremediation of the diesel impacted soil in the underlying fill material and area designated as the "sump basin". This plan is not intended to be used as a ground/surface water remediation plan and is limited to soil/solid media.

A. Bioremediation Background

Enhanced and augmented aerobic bioremediation technologies are used to accelerate naturally occurring in-situ remediation of petroleum hydrocarbons by indigenous microorganisms and supplement with additional hydrocarbon-degrading microbes in the subsurface. Enhanced aerobic bioremediation technologies to be utilized at this site include the addition of a specifically formulated and engineered Micro-blaze product targeting diesel range organics (C12-C15) through the addition of hydrocarbon-degrading bacteria such as pseudomonas, bacillus, brevebacterium, and others. In addition to the bacteria, there are other non-toxic trade secrete compounds that increase the production of biosurfactants to facilitate the reduction of surface tension and formation of micelles enabling the release of hydrocarbons from soil chemical bonds allowing for microbe utilization. In addition to utilizing enhanced augmented methodologies, the use of oxygen releasing compounds such H2O2 to chemically enhance the treatment water will be employed to maintain optimal aerobic activity. These technologies work by providing a supplemental supply of oxygen to the subsurface, which becomes available to aerobic, hydrocarbon-degrading bacteria. The stoichiometric ratio of oxygen per hydrocarbon is 3 M O2 per 1 mole of hydrocarbons. Oxygen is considered by many to be the primary growth-limiting factor for hydrocarbon degrading bacteria, and it is normally depleted in zones that have been contaminated with hydrocarbons. By using these technologies, rates of biodegradation of petroleum

hydrocarbons can be increased at least one, and sometimes several, orders of magnitude over naturally-occurring, non-stimulated rates.

Of all the limiting factors associated with active aerobic bioremediation, the primary limiting factor will be temperature. Typically, optimal temperature for average microbe replication is 75°F to 90°F. Activity will be reduced as temperatures vary from the optimal range. Expected site conditions will be between 55°F and 60°F and slower than optimal activity is expected. Since treatment is planned through the addition of water, microbes, oxygen and nutrients utilizing treatment ports, temperature will be manipulated to maintain more optimal conditions when possible as described below.

During the treatment process, if it is identified that ground/surface water is impacted, an amendment or revision to the bioremediation plan will be conducted outlining the specifics of groundwater and surface water monitoring and remediation.

III. Bioremediation Treatment Port Design

For soils that cannot be excavated and transported offsite to disposal at South Canyon Landfill, HRL proposes to treat the impacted soils in-situ via infiltration of bioremediation treatment through a PVC infiltration piping gallery and gravity feed percolation.
Three (3) 10-slot 2” PVC laterals will be installed horizontally in the bottom of the excavation at the release point of origin. The treatment system will be installed approximately 10 feet below ground surface (bgs), with each lateral extending approximately 25-30ft. The slotted PVC piping system will be placed on the southeastern and southwestern side of the excavation, and one lateral extending through the middle of the impacted area (See Figure 1). The horizontal laterals will come together at one focal point located on the southeast corner of the excavation but contain separate ports for flow control and isolation of the treatment lateral.
The 2” PVC riser ports extending above ground will contain a butterfly valve and a threaded plug to prevent precipitation from entering the ports, as well as aid in preventing freezing of the bioremediation product.

During construction of the treatment ports, modifications to the center lateral may consist of solid stem PVC with slotted 2” PVC pipe extending off the main line to increase the effective treatment area and additional underlying pathways throughout the impacted area.
The treatment system will be backfilled with 3/4-inch washed gravel providing protection and preventing a compacted oxygen depleted environment (See Figure 2).
Once the gravel is placed around the infiltration laterals, backfilling of the excavated area will occur with clean fill material from the surrounding area. Large marble blocks will be placed within the excavation adjacent to the PVC pipe for added support. Upon backfilling of the excavated area, CSQ will install a poly liner to serve as spill containment for the generator and fuel tanks.

IV. Infiltration Trench

Groundwater monitoring wells will be installed downgradient of the in-situ treatment system to monitor the effectiveness of the treatment process. If it is determined that the treatment application is not adequately treating areas downgradient or missing target areas, infiltration trenches can be installed to allow additional application of bioremediation product.

Due to the location of this release and winter weather, as well as limited information currently available regarding the area of influence from the initial treatment, infiltration trenches would not be recommended until the spring/summer of 2020 when the soils and outside temperatures are more favorable to bioremediation.

V. Product Application

The initial application of bioremediation product will be applied at a 10% concentration to the soils within the open excavation via aspiration nozzle and pump. A total of 500-550 gallons will be utilized during the initial application from fresh water pumped from the adjacent Yule Creek. Fresh water from Yule Creek is ideal due to the water already containing the natural elements typical for this area, as well as a great source of dechlorinated water, preventing mortality of the bioremediation enzymes.
Water and Microblaze product will be mixed together at the appropriate ratios and sprayed into the excavation during the initial treatment to provide a thorough application prior to backfilling. For subsequent treatment applications, micro-blaze, nutrients and oxygenating compounds will be gravity fed through the treatment system.

B. Winter Treatment

Follow-up applications via the infiltration ports will occur monthly throughout the winter months when conditions allow. Product will be applied at an 8-10% concentration, utilizing water from Yule Creek and mixed onsite as needed. The amount of bioremediation product applied will vary on timing of the year but will typically consist of 550-1000 gallons of water to bioremediation product and amendments.

C. Summer Treatment

During the spring/summer months, when temperatures are optimal for bioremediation activity and snow runoff is occurring, a second treatment will be applied to continue the bioremediation process. Additionally, based on runoff volumes, a higher quantity may be applied using the runoff water flowing above the previous creek channel to provide the necessary ratio to activate the microbes and transport the product downgradient. Summer treatments are going to vary based on hydrocarbon concentrations within the downgradient monitoring wells and hydrocarbon concentrations within the soil. The amount of treatment product will likely remain the same, 550-1000 gallons, although concentrations and frequency are going to be dependent on conditions and contaminant concentrations.

D. Treatment Conditioners

As with all microbial activity, bioremediation products require a food source and oxygen. It will be necessary to include a periodic treatment of oxygenated water and liquid fertilizers to enhance and keep the microbial activity optimal

VI. Closure

Closure of the project will be based on the conditions set forth by the regulatory agencies providing oversight. Upon completion of the bioremediation process, PVC infiltration ports can be filled with sand and/or cut at or below ground surface and capped.

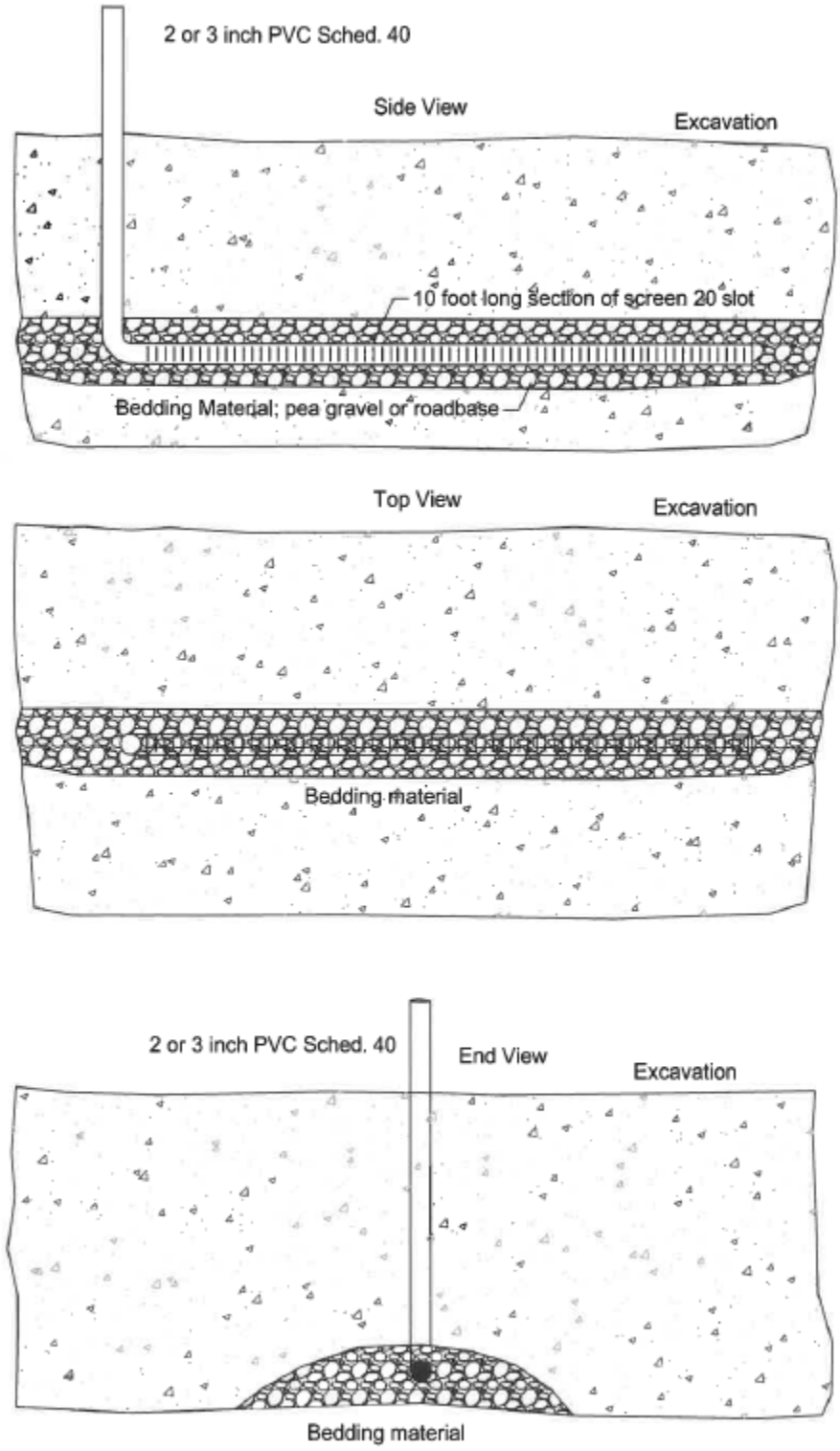
VII. Conclusion

The information outlined above is designed and intended the enhance the bioremediation of diesel impacted soils. Please note that changing conditions, site activity, geochemistry and other unforeseen circumstances may affect the treatment process which will require modifications to the treatment process. All changes or modifications to the bioremediation process will be communicated and provided in a written revision/amendment to this plan.

As underlying soil conditions have not been evaluated HRL cannot provide a timeline of when the proposed in-situ remediation will be completed, however due to the location of the release and composition of the fill material, HRL feels that in-situ is the most effective course of remediation at this time.

Figure 1: Treatment System Design

Figure 2: Treatment System Injection Port Design



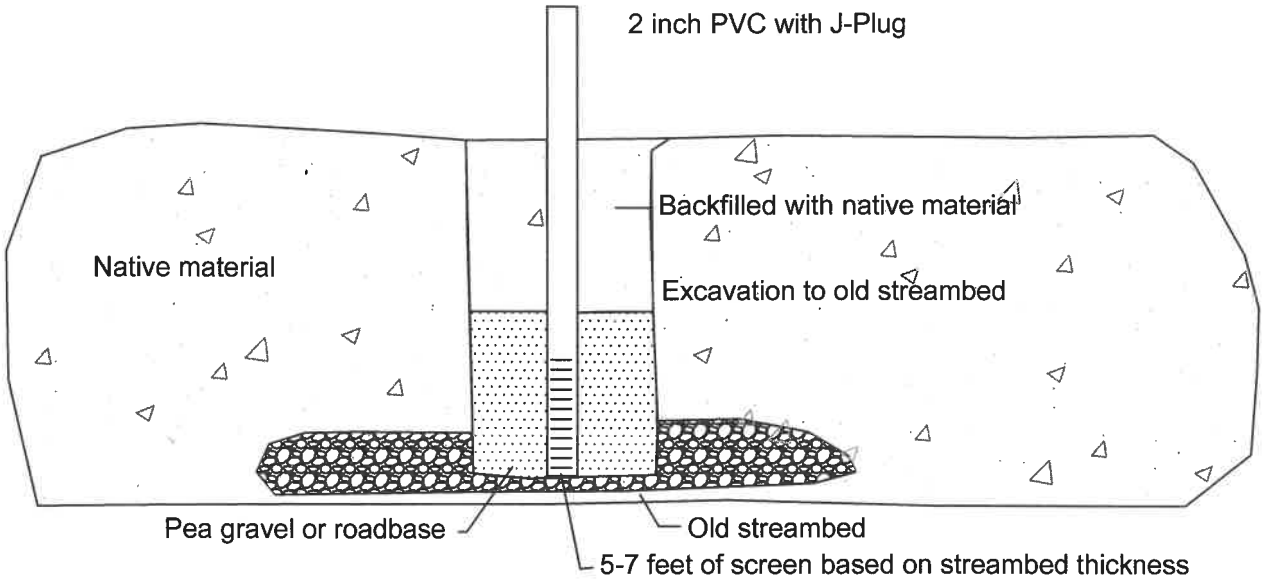
Monitoring Well Installation

Install three (3) 2” monitoring wells, extending to the depth of the previous stream bed channel in the areas outlined above

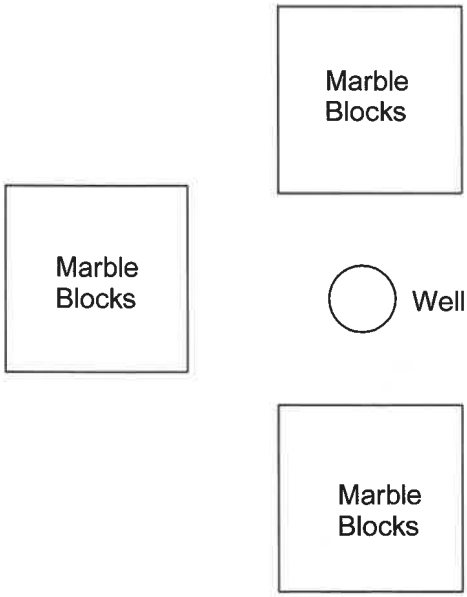
Wells will have 5’ of slotted PVC with solid riser to the surface (depth/vertical length of riser is unknown)

Risers extending out of the ground can be barricaded by marble blocks to ensure integrity

Upgradient and Downgraident wells



Top View



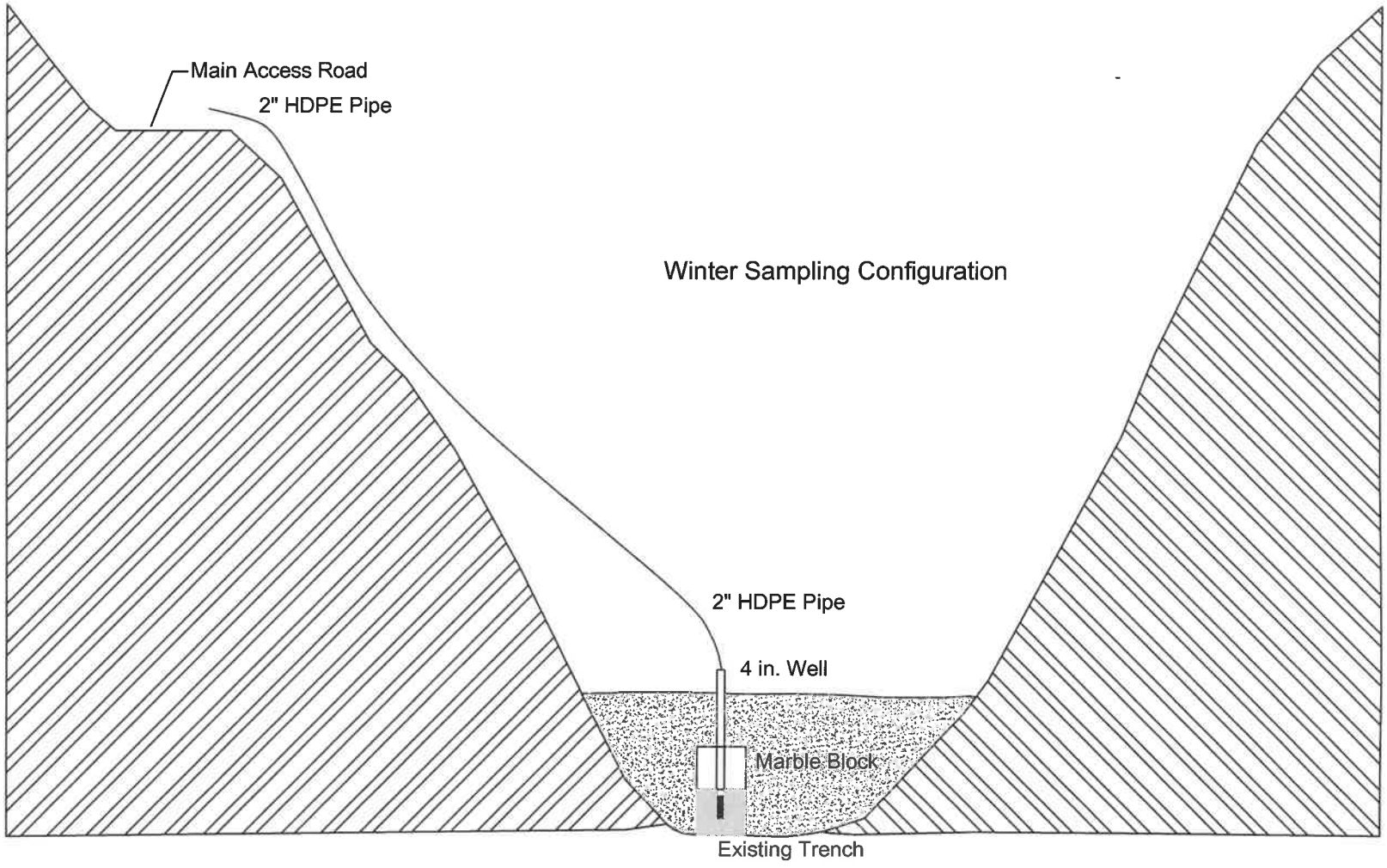
Sump Monitoring well

Excavate the fill material (2-3ft) that was placed in the sump area as outlined above.

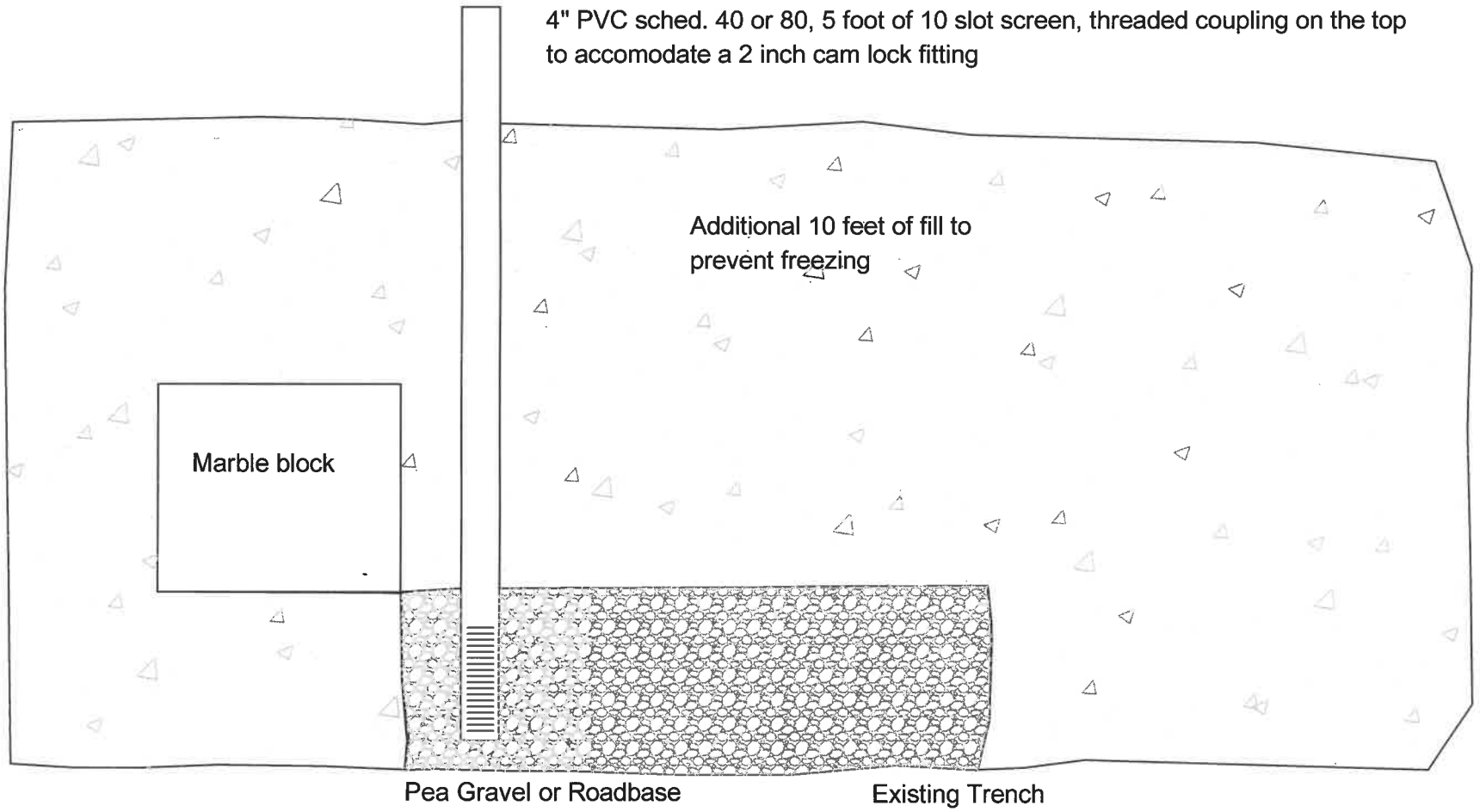
Install 4” PVC with 5ft of screening, backfilling the screened interval with Pea-gravel.

Attached 10ft of riser casing and surround with marble blocks to provide support. Backfill with clean material around riser.

Add 5ft sections of riser PVC as needed to accommodate depth


Main Access Road
2" HDPE Pipe
Winter Sampling Configuration
2" HDPE Pipe
4 in. Well
Marble Block
Existing Trench

4" PVC Well


4" PVC sched. 40 or 80, 5 foot of 10 slot screen, threaded coupling on the top to accomodate a 2 inch cam lock fitting
Additional 10 feet of fill to prevent freezing
Marble block
Pea Gravel or Roadbase
Existing Trench

Colorado Stone Quarries - Diesel Spill

Surface Water Data Tracking

							Analytical Analysis																	
						Analyte	TVPH (GRO)	TEPH (DRO)	Benzene	Toluene	Ethylbenzene	Xylenes (total)	Acenaphthene	Anthracene	Benzo (A) anthracene	Benzo (B) flouranthene	Benzo (K) fluoranthene	Benzo (A) pyrene	Chrysene	Dibenzo (A,H) anthracene	Fluoranthene	Fluorene	Indeno (1,2,3-C,D) pyrene	Naphthalene	Pyrene
				Indicates the lowest standard for the respective analyte		**CSEV Water Standard (mg/L)**	NA	NA	0.005	0.56	0.70	1.40	0.42	2.10	4.8 E-06	4.8 E-06	4.8 E-06	4.8 E-06	4.8 E-06	4.8 E-06	0.28	0.28	4.8 E-06	0.14	0.21
Location	**Sample Location**	**Sample ID**	**Sampler**	**Date**	**Time**	**Laboratory**	**CDPHE Thresholds reference EPA Regional Screening Levels (RSLs)**	-	(0.5)	0.005	1.0	0.7	10.0	5.3 E+02	1.8 E+03	3.0 E-02	2.4 E-01	2.5 E+00	2.5 E-02	2.5 E-01	2.5 E-02	8.0 E+02	2.9 E+02	2.5 E-01	1.7 E-01	1.2 E-+02
Yule Creek	UG	Baseline	Rowe	10/28/19	11:25	ALS		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	CG	Baseline	Rowe	10/28/19	11:50	ALS		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	DG 1	Baseline	Rowe	10/28/19	12:15	ALS		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	DG 2	Baseline	Rowe	10/28/19	12:25	ALS		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	DG 3	Baseline	Rowe	10/28/19	12:40	ALS		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
		Post Breach	Smith	10/30/19	13:00	ALS		ND	ND	ND	0.014	0.012	0.068	0.043	ND	ND	ND	ND	ND	ND	ND	ND	0.053	ND	0.0061	ND
		Post Stop Pump	Rowe	11/01/19	9:45	ALS		ND	ND	-	-	-	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	DG 4	Post Breach	Smith	10/30/19	13:20	ALS		ND	ND	ND	ND	ND	0.0035	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.033	ND
		Post Stop Pump	Rowe	11/01/19	9:55	ALS		ND	ND	-	-	-	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	DG 5	DG -5	Smith	10/30/19	13:50	ALS		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.032	ND
Yule Creek & Crystal River	Confluence	Baseline	Rowe	10/28/19	13:00	ALS		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Seeps	Seep	Baseline	Rowe	10/28/19	12:55	ALS		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Sump	Basin	@0-8" (total depth 2ft)	Rowe	10/28/19	13:10	ALS		1.1	0.79	0.0017	0.03	0.023	0.14	0.071	ND	ND	ND	ND	ND	ND	ND	ND	0.0011	ND	0.011	ND
	Inflow	South Inflow	Smith	10/30/19	12:45	ALS		0.57	1.1	0.0015	0.027	0.021	1.2	0.00082	ND	ND	ND	ND	ND	ND	ND	ND	0.0011	ND	0.0087	0.0024
	Basin	Post Pump Stop	Rowe	11/01/19	10:07	ALS		ND	ND	-	-	-	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0055	ND

(-) indicates data is still in process by the lab

- Indicates analytical that is no longer being monitored

Exceedances are highlighted in yellow. Results below the standard or reporting limit are reported as ND

All results are presented in mg/L, unless otherwise noted

Colorado Stone Quarries - Diesel Spill Soil Data Tracking							Analytical Analysis																		
							Analyte	TVPH (GRO)	TEPH (DRO)	Benzene	Toluene	Ethylbenzene	Xylenes (total)	Acenaphthene	Anthracene	Benzo (A) anthracene	Benzo (B) flouranthene	Benzo (K) fluoranthene	Benzo (A) pyrene	Chrysene	Dibenzo (A,H) anthracene	Fluoranthene	Fluorene	Indeno (1,2,3-C,D) pyrene	Naphthalene	Pyrene
Location	**Sample Location**	**Sample ID**	**Sampler**	**Date**	**Time**	**Laboratory**	**CDPHE Thresholds reference EPA Regional Screening Levels (RSLs)**	520	96	1.2	4,900	5.8	580	3,600	18,000	1.1	1.1	11	0.11	110	0.11	2,400	2,400	1.1	3.8	1,800
Point of Release	South Excavation Pothole	Side Wall @ 2ft	Rowe	10/28/19	14:10	ALS		32	24	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0052	ND	ND	0.0045
Spill Impacted Area	Excavation	SE Wall @3ft		11/01/19	11:00			1,900	17,000					1.1	0.71	ND	ND	ND	ND	ND	ND	0.16	2.6	ND	4.5	1.9
		North Wall @ 2ft		11/01/19	11:10			6.5	35					ND	ND	ND	ND	ND	ND	ND	ND	ND	0.006	ND	ND	0.004
		NE Wall @ 2ft			11:20			ND	18					ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
		Exc Bottom @10ft			11:30			320	1,800					0.14	ND	ND	ND	ND	ND	ND	ND	ND	0.32	ND	0.76	0.26

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Colorado Stone Quarries Diesel Spill Stockpile Data Tracking							Analytical Analysis																		
							Analyte	TVPH (GRO)	TEPH (DRO)	Benzene	Toluene	Ethylbenzene	Xylenes (total)	Acenaphthene	Anthracene	Benzo (A) anthracene	Benzo (B) flouranthene	Benzo (K) fluoranthene	Benzo (A) pyrene	Chrysene	Dibenzo (A,H) anthracene	Fluoranthene	Fluorene	Indeno (1,2,3-C,D) pyrene	Naphthalene	Pyrene
Location	**Sample Location**	**Sample ID**	**Sampler**	**Date**	**Time**	**Laboratory**	**CDPHE Thresholds reference EPA Regional Screening Levels (RSLs)**	520	96	1.2	4,900	5.8	580	3600	18,000	1.1	1.1	11	0.11	110	0.11	2,400	2,400	1.1	3.8	1,800
Point of Release	Stockpile	Comp #1	Rowe	10/28/19	14:45	ALS		200	1,200	ND	0.16	0.24	1.6	0.11	0.063	ND	ND	ND	ND	ND	ND	ND	0.29	ND	0.42	0.18
		Comp #2		11/01/19	11:45			470	3,300	ND	0.49	0.41	2.5	0.15	ND	ND	ND	ND	ND	ND	ND	ND	0.55	ND	1.2	0.61

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