Attachment I.

Lyons Quarry – Catchment Basin O&M Plan (Draft)

This page intentionally left blank.

Lyons Quarry Reclamation Project Operation and Maintenance (O&M) Plan

1 Introduction and General Information

1.1 Facility Information

This plan serves to outline the procedures for operation and maintenance of the proposed rockfall and sediment catchment basins for Lyons Quarry (Boulder County Parcel # 120125000007). Aggregate Industries (now Holcim-WCR, Inc.) operated the Lyons Quarry mine located 3 miles southwest of the town of Lyons, Colorado, in the South St. Vrain canyon area. Quartz monzonite was extracted from the mine between 1977 and 2008. While the mining permit for the quarry is still under active status with the Colorado Division of Reclamation, Mining and Safety (DRMS), the quarry is currently inactive and in the process of closure and reclamation in accordance with the rules and regulations of DRMS.

Reclamation for Lyons Quarry was proposed to occur in two Phases. Phase 1 included all areas above the historic 100-year floodplain area such as the Quarry #1 pit in the center of the site, Quarry #2 in the southwest corner of the site (Figure 1 below), associated fill areas as well as the high wall and crest (top) of the quarry to the south. Phase 2 included the toe of the mining area and the floodplain north to South St. Vrain Creek with some areas across South St. Vrain to be restored. The east and west boundaries of the mine permit are the approximate extents of reclamation for the floodplain. A draft of this O&M Plan was provided as an attachment for Technical Revision 05 (TR-05) of the mining permit in 2021. This updated draft may be revised again before the completion of the Phase 1 and Phase 2 reclamation plan activities. Completed reclamation is expected to occur when the vegetation of the site has reached acceptable criteria for establishment and no erosion issues exist.

Figure 1 - Lyons Quarry Pit Configuration prior to Reclamation

1.2 Organization Responsible for O&M

Holcim-WCR will be completing reclamation of the Site in 2022 to meet requirements of the State of Colorado 112d mine permit# M-1977-141. Holcim will be responsible for the O&M of all features of the site until the mine permitted acreage is released by DRMS. At this point, Boulder County Parks and Open Space will assume responsibility for the Site O&M of the released acreage. Boulder County Parks & Open Space (located at 5201 St Vrain Rd Bldg. 1, Longmont, CO 80503 [303.678.6200]), purchased the property known as the Hall Ranch Open Space in 2011 with proceeds from an open space tax passed by voters. Holcim and Boulder County have been working together over the years to transfer the site and enhance the final configuration for the proposed future land use.

Following the release of Holcim's mine reclamation bond, BCPOS will conduct a public planning process for Hall II property. Based on that process, the site's significant natural resources values will be protected**,** and public recreation may be allowed in appropriate locations, including geological interpretation of the former mine.

Facility Overview

The site is described as having a surface elevation (El.) of 5,508 feet near the northeastern entrance of the site to above El. 6,000 feet at the south end of the site. The existing natural slopes in sedimentary rock strata are as steep as 1.75H:1V, where the sedimentary strata are capped by the Lyons Sandstone. Where the sedimentary rocks are not capped by the Lyons Sandstone, slopes ranged from 2H:1V to 4H:1V. The mining plan splits the operation up into two quarries as shown in Attachment A - Figure 5 of Technical Revision 5. Quarry 1 is at the east end and at the base of the 300-foot tall high wall. Quarry 1 is bounded on the south and west by the highwall protrusion and on the east and northeast by backfill material. A constructed swale allows access into Quarry 1 between the backfill and an access road ramp that leads to Quarry 2 to the west. The horseshoe-shaped Quarry 2 is in the southwest corner of the

operation and is bounded on the east, south and west by quarry highwalls. Quarry 2 was partially backfilled in 2017 but still had highwalls approximately one hundred feet in height prior to reclamation activities.

The flattest measured slopes were in areas mapped as landslides. Existing natural slopes in the dacite are nearly vertical where the dacite is exposed along the north side of South St. Vrain Creek. Where the dacite outcrops in the drainage along the west side of the site, the existing natural slopes range from 0.3H:1V to 2.2H:1V. This large range in the natural slope was measured along west-facing slopes over a span of approximately 300 feet. Surface water is present along the north perimeter of the site, in South St. Vrain Creek. Groundwater is present, ponded in low areas of the floodplain. Groundwater is also anticipated perched above siltstone and shale layers in the Fountain Formation.

Rockfall and Sediment Catchment Basins

The plan for construction of the rockfall catchment basins along the northeast and northwest-facing high walls of the quarry can be found in the Lyons Quarry Mine Permit M-1977-141 Technical Revision #6 – Section 3. With the proposed changes to the site grading plan, corresponding revisions to the 2021 approved reclamation plan for channeling stormwater runoff and controlling erosion will be necessary. As with the original plan, slopes equal to or more gradual than 1.5H:1V have been stabilized with appropriate Best Management Practices (BMP's) including biodegradable waddles, stabilizing mulch, and hydromulch with tackifier. Slopes steeper than 1.5H:1V may not be feasible to install BMPs but have been channeled to the rockfall catchment basin located within the main pit of the quarry, and a secondary earthen berm around the scour berm at the toe of the quarry to capture potentially suspended sediments.

The runoff control channel that ran along the west perimeter of the quarry has been realigned to convey drainage through the reconstructed swale of Quarry 2 into the catchment basin of Quarry 1 (shown in Attachment A of this O&M Plan). Channelizing and capturing surface runoff within the quarry area will further reduce impacts to areas outside of the already impacted mining activity. Flow is now directed through the swale and scour berm in Quarry 1 via a 24-inch reinforced concrete pipe (RCP) culvert. This culvert was sized to convey the peak discharge from a 10-year, 24-hour storm event. The culvert outlet ties into the drainage channel at the toe of the scour berm and directs flow to the east. The culvert is necessary to prevent the retention of water within the catchment basin.

As Section 3.2.4 of Technical Revision #6 notes, due to grading discrepancy between the survey files used for developing the TR-05 grading plan, a small depression below the elevation of the floodplain remains in Quarry 1. This area is at the toe of the rockfall above the highest portion of highwall and is not feasible for equipment to safely enter and perform earthwork. Monitoring over three years of construction, the basin has not shown any evidence of retaining stormwater as the fractured bedrock of the quarry likely allows for high hydraulic conductivity to shallow groundwater adjacent to South St. Vrain Creek. In discussion with BCPOS, the county supports leaving the 50-foot by 30-foot basin as-is since it does not appear to be impounding water, provides additional area to capture sediment coming down the channel from the Quarry 2 slope and rock off the Quarry 1 high wall, as well as providing potential habitat for wildlife.

The runoff control channel on the east perimeter of the quarry remains as previously designed in Technical Revision #2 though with some improvements to limit erosion. The ditch runs along the existing

access road grade and ties in with the scour berm toe drainage channel before discharging through a 24-inch RCP culvert running under the site access road to South St. Vrain Creek. During reclamation, BCPOS proposed installation of water bars, or sloped mounds in the access roads to channelize flow towards the ditch. The water bars were installed in 2023 and have performed well during restoration work and storm events in 2024. Some minor improvements to the channel were necessary to prevent shortcutting of flow across the road in the lower one-third of the hill. The 24-inch culvert at the ditch outlet represents a new discharge point for the site but is needed to convey stormwater and groundwater seepage under the site access road.

Highwall Stabilization

As discussed in Section 3 of Technical Revision #6, the north-facing dacite highwalls in Quarry 1 and Quarry 2 have been partially to fully backfilled providing stabilization using the unconsolidated Fountain Formation material as a buttress for the majority of the exposed highwalls. This material began accumulating in Quarry 1 in 2022 and final blasting was complete in Summer 2023. The material in Quarry 1 has been stable for over two years with this configuration with no noticeable sloughing.

In Quarry 2, material was placed and compacted by tracking of heavy equipment as the higher Fountain Formation sections of the highwall in Quarry 1 were sloped back to 2H:1V. The fill was placed to re-create the swale that existed in this area prior to mining. As noted above, a riprap drainage channel was constructed through the center of this swale to channel stormwater flow to the Quarry 1 sedimentation basin. More information on this revised grading plan can be found in Section 3.1, Attachment E, and Attachment F of Technical Revision #6.

2 Operations and Maintenance

2.1 Operating Procedures

Normal operating procedures for facility function, including any seasonal modifications or adjustments.

The catchment basins (shown in Figure 2 below) were designed to provide the necessary runout area to capture 100% of potential rockfall from the sandstone and dacite slopes that would remain exposed along the northwest and northeast-facing slopes of Lyons Quarry. Refer to Sections 3.1, 3.2, and Attachment F of the Technical Revision #6 for the geotechnical modeling that was performed on both of these areas following blasting and the drone photogrammetric survey. The constructed berm across the opening at the base of the northeast Quarry 1 highwall along with the natural topography creates a catchment basin that will have an adequate factor of safety to capture dacite and sandstone rockfall from even the highest sections of the northeast-facing highwall. The evaluation of the northwest-facing highwall in Quarry 2 has been almost completely backfilled by blast material such that only the upper most portion is still exposed. This section was left in place to provide valuable nesting habitat or avian species per BCPOS request. No seasonal modifications or adjustments are anticipated outside of monitoring for erosion or buildup of rockfall material or sedimentation within the catchment basins at the base of both highwalls. Once vegetation has been established on the restored slopes, monitoring and maintenance of weed species will be needed.

Figure 2 – Lyons Quarry Catchment Basin and O&M Stockpile Area

2.2 Regular Maintenance

The proposed catchment basins rock reinforcements are designed to require as minimal maintenance as possible. The large basin that is proposed at the base of Quarry 1 is oversized to allow for additional rockfall material. Based on the minimal amount of rockfall that has occurred since mining ceased in 2008 and since the final reclamation blasting occurred in 2023, along with the fact that the overlying sandstone slopes have been graded back or used to buttress the base of the highwall, it is estimated that this catchment basin will not reach capacity for many years, possibly decades

The 12-foot high catchment berm along the Quarry 2 northwest facing slope creates a much smaller basin than the Quarry 1 berm; however, the remaining vertical wall of 10-15 feet is much shorter as the highwall has already been mostly backfilled to angle of repose by blast material. The dacite in this area is also much more stable than the northeast-facing dacite. Overall, this area should receive minimal rockfall.

The following measures are recommended in the Federal Highway Administration (FHWA) – Context Sensitive Rock Slope Design Solutions 2011 report. All cut slopes and their attendant stabilization and protection systems must be monitored for damage, weathering, stability, and rock accumulation. Periodic maintenance may be needed to uphold safety (Andrew, et. al. 2011).

Table 2-1 – Maintenance Procedures for Highwall Stabilization and Mitigation Measures

MAINTAINED ITEM	MAINTENANCE PROCEDURE
PROTECTION MEASURES	
Earthen Berms	Clear accumulated material periodically. Repair any damaged section(s) of berm.
Ditches	Clear accumulated material periodically.

2.3 Inspections

Required inspection frequency to verify facilities are being maintained and functioning as designed.

All components of the remedy shall be inspected at least once per year during the Annual Inspection. Additional inspections may be performed as necessary to respond to reports from observers, or to inspect maintenance activities. The following paragraphs describe required inspections. Table 2-2 summarizes the inspections relevant to the catchment basins.

Annual Inspections

Annual Inspections will be conducted by the landowner, Boulder County Parks and Open Space. Table 2-2 summarizes the annual inspections that are required. Inspectors shall provide adequate noting and reporting of changes in hazardous conditions since the last inspection or maintenance was performed including photographic logs to show the progression of the hazard since the last inspection.

Table 2-2 – Summary of Inspection Requirements

#	Component to be Inspected	Minimum Frequency	Maintenance Issues to be Identified
1	General Site Inspection	Annual	Evidence of vandalism, trespassing around gates, storm/flood damage.
2	Site Vegetation	Annual	Erosion where vegetation is absent or where vegetation is restricting flow through stormwater conveyances. Noxious weed monitoring and spraying.
3	Northeast Quarry 1 Catchment Basin and Berm	Annual	Erosion along berm side slopes. Catchment basin is nearing capacity as material has accumulated within 25 feet of catchment berm toe.
4	Northwest Wall Catchment Basin and Berm	Annual	Erosion along berm side slopes. Catchment basin has accumulated significant rockfall material to within 6 feet of the top of the berm (half the height of the 12-foot berm).
5	Quarry Highwall, Benches, and Crest Areas	Annual	Noting major signs of loose ground, cracking, spalling, large and potentially hazardous rocks, or sloughing. Signs of stormwater accumulating at top of slopes.
6	Drainage Channels and Stormwater Conveyance Through Northeast Catchment Berm	Annual	Clearing of sediment and other debris riprap drainage channels, culverts, water bars, etc.

The Colorado DRMS office will review and approve long-term monitoring/management plans for this permitted site during the reclamation planning process. Once the site has been reclaimed in accordance with the approved reclamation plan and the permit is released by DRMS, no further reporting to the DRMS office is required. Following transfer of the site to Boulder County Parks and Open Space, it is up to the landowner to maintain the site and ensure compliance with all state and local requirements.

2.4 Maintenance Standards.

Minimum standards that are required for the sediment and rock catchment basins to produce desired results and maintenance actions when the minimum standards are not met.

For the catchment basins to retain their effectiveness, periodic cleanout may be required if the basins capture enough rockfall or sediment to impact their operation. Basins should also be cleaned out if their drainage channels or the culvert inlet through the Quarry 1 catchment berm become impacted by sedimentation.

As Table 2-3 notes, the Quarry 1 basin should be cleaned out to the extent practicable once sedimentation or rockfall has accumulated to within 25 feet of the culvert at the toe of the catchment berm slope. The Quarry 2 catch

Table 2-3 – Quarry Catchment Basin Capacities and Maintenance Schedule

Catchment	Total Basin Area (sf)	Average Depth (ft)	Total Capacity (CY)	Basis for Initiating Maintenance
Quarry 1	126,105	15	70,058	Rockfall or sedimentation accumulation within 25 feet of the toe of the catchment berm slope and culvert inlet.
Quarry 2	19,577	6	4,350	Rockfall accumulation to within six feet of the top of the catchment berm (one-half the height of the catchment berm)

Equipment access ramps have been constructed on the northeast and northwest corners of the Quarry 1 catchment basin to allow equipment access. Access gates at the top of the quarry highwalls allow equipment to access the majority of Quarry 2. The Quarry 2 Northwest catchment basin can be accessed from these gates or though Quarry 1 for work further to the north. For repairs to the Quarry 2 Northwest catchment basin, equipment should operate from the top of the catchment berm to the extent possible. This will require temporary removal of the fencing that runs along the top of the catchment berm to allow access.

Material removed from the catchment basins shall be transported to the designated stockpile area (Figure 2) located where remnant materials (logs, rock, gravels) from the reclamation work are currently stockpiled. This area is outside of the historic 100-year floodplain and is proposed to have 20,000-40,000 CY capacity before the lower section of the basin area is filled. Fill could continue above the basin area at a 3H:1V grade to the south and east, providing additional capacity as needed.

To reduce maintenance of vegetation that could decrease the capacity of the basin or potentially constrict drainage through the swale berm, these areas were not revegetated at the end of reclamation. If vegetation does become established to the point that these components are affected, the vegetation shall be removed.

2.5 Lifespan

Expected lifespan of the facility components.

Due to the catchment basins being constructed of natural, durable soils and rock, the expected lifespan of the rockfall and sediment catchment basin structures is at least 50 years. The life expectancy of the concrete pipe culverts is also assumed to be 50 to 75 years.

3 HEALTH AND SAFETY CONSIDERATIONS

This section lists and describes safety and health hazards that may be present while performing O&M activities at the Site.

This section does not constitute a site-specific health and safety plan, nor is it intended to relieve any entity performing services or work pursuant to this O&M Plan from following applicable Occupational Safety and Health Administration (OSHA) requirements. The entity performing operation and maintenance activities is required to meet current OSHA requirements, with the exception of State and local government workers, who are exempt from OSHA regulations.

Because requirements change over time and hazards are specific to activities, this information should only be used as a guide. Each time an entity performs work or services at this Site, a site-specific project health and safety plan should be developed.

3.1 Potential Hazards

- **Remote Site Safety:** This project will require work activities in a remote location. The primary hazards associated with working in remote locations are (1) isolation from public rescue services; (2) limited means of communication; (3) exposure to adverse severe weather; and (4) exposure to violence or crime. The potential hazards associated with each remote site visit must be evaluated and mitigated prior to the team departing for the field.
- **Mining Safety:**

Ground instabilities can cause falling rock. Using heavy equipment can crumble highwalls and/or send falling rock onto work areas. Failure to control rockfall with rock-fall fences or barriers may result in injuries and highwall disintegration. If rock debris is not contained or removed, the workplace may become unsafe.

Safe mine operations need to be in place and followed. To ensure the integrity of highwalls, early detection of failing highwalls is key. The design for the Lyons Quarry highwall was developed with preventative measures against potential destruction of expensive equipment or loss of life, but the contractors performing the necessary maintenance should follow the best management practices listed below before and during their work.

These best management practices include:

- Training employees to recognize and report highwall hazards.
- Conducting thorough examinations before beginning work around highwalls
- Noting changing weather conditions and inspecting highwall for major signs of loose ground, cracking, spalling, large potentially hazardous rocks, or sloughing.
- Noting and reporting changes in hazardous conditions since the last maintenance was performed.
- Positioning equipment so it swings away from the highwall.
- Making sure slope spotting occurs regularly while maintenance within the respective basin is ongoing.

In general, if a single bench or rock ledge is fifty feet high, mining employees are advised to stay fifty feet from the wall. There are no exceptions to this rule. In the case of a double ledge or bench of a hundred feet, it is advised that no one goes nearer than a hundred feet from those benches. For repairs to the northwest catchment basin, equipment should operate from the top of the catchment berm to the extent possible.

If a maintenance employee notices movement or spots a discontinuity, they are to report their observation to a superior immediately. There is to be no maintenance directly below the highwall.

- **Slip, Trip, & Fall Prevention:** Each year, physical injuries due to common slips, trips, and falls while walking account for a significant percentage of all reportable accidents nationwide. Most of these accidents are preventable through proper housekeeping, correct walking surfaces/footwear and simple precautions.
- **Biological Hazards:** Virtually every project site affords the possibility of harboring some form of biological hazard. Biological hazards include wild, domesticated or feral mammals, snakes, spiders, mites, insects, arachnids, noxious plants or harmful bacteria, viruses, fungi – any living organism that can cause injury or illness. These hazards can cause a variety of health effects, including bite trauma, envenomation, skin irritation, allergies, infections or illness, paralysis and death. Due to the nature and location of the project assignments, exposure to biological hazards may be unavoidable.
- **Heat Stress:** Fieldwork conducted during periods of high temperatures and/or humidity can result in heat-related disorders. While there is no specific OSHA standard addressing heat stress, guidelines are available in the publication, *Threshold Limit Values for Chemical Substances and Physical Agents*, published by the American Conference of Governmental Industrial Hygienists.
- **Cold Stress**: It is much more likely that Site workers incur a cold-induced illness than a heat disorder, as cold stress can occur very rapidly at higher elevations. Preventative steps should be followed during periods of cold weather, especially when combined with high winds and/or precipitation.

4 Attachments

A - Lyons Quarry Reclamation Project – 100% Final Design Site Drawings

B - Lyons Quarry Reclamation Project - Final Site Drawings – As-Builts

5 References

Andrew, R.D., Bartingale, R. and Hume, H. (2011) Context Sensitive Rock Slope Design Solutions (Report No. FHWA-CFL/TD-11-002). Federal Highway Administration.
https://www.fhwa.dot.gov/clas/ctip/context_sensitive_rock_slope_design/

Attachment A –

Lyons Quarry Reclamation Project – 100% Final Design Site Drawings

Attachment B –

Lyons Quarry Reclamation Project –

Final Site Drawings – As-Builts