STATE OF COLORADO

Eschberger - DNR, Amy <amy.eschberger@state.co.us>

Corrective action deadline tomorrow / Lyons Quarry / M-1977-141

Jeremy DEUTO <jeremy.deuto@lafargeholcim.com> Fri, Oct 2, 2020 at 9:53 AM
To: "Eschberger - DNR, Amy" <amy.eschberger@state.co.us>, Kimberly DENNIS <kimberly.dennis@lafargeholcim.com>

Amy,

please find TR-04 attached. This TR addresses the corrective action requirements for Area 2 Reclamation. This TR also includes an engineers opinion of costs (EOC) for the reclamation. Please note, that the EOC assumes that this reclamation will occur concurrently or immediately following Area 1 reclamation, thus the lower than typical mobilization costs.

Once the TR and associated budget are approved, AI will provide the appropriate bond rider to the DRMS.

Jeremy Deuto, P.E., P.G.
Regional Land and Environment Manager | Colorado, Arizona, Nevada
LafargeHolcim|Aggregate Industries
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DRAFT TR4 Package.pdf
4641K

October 2, 2020

Amy Eschberger
Colorado Division of Reclamation, Mining and Safety
1313 Sherman Street, Room 215
Denver, CO 80203

RE: Lyons Quarry; DRMS File No. M-1 977-141; Technical Revision No. 4

Dear Ms. Eschberger,

Please find enclosed the Request for Technical Revision (TR) from Aggregate Industries-WCR, Inc. for an update to the Reclamation Plan for the Lyons Quarry site. Enclosed are supporting documents that include the following:

1. Updated Site Grading Plan
2. Updated Reclamation Plan Map
3. Updated Reclamation Cost
4. Geotechnical Stability Exhibit

We understand that Aggregate Industries-WCR, Inc. will also obtain concurrence from the current property owner, Boulder County Parks and Open Space, that the updated Reclamation Plan meets their applicable regulations or zoning requirements.

Technical Revision No. 4 documents response to the Division's comments provided in their adequacy review regarding Lyons Quarry, Technical Revision No. 2, submitted by Aggregate Industries-WCR, Inc. on July 1, 2016. The following DRMS comment and response from Adequacy Review #1, dated August 10, 2016, are provided below:

DRMS Comment #10:
The Technical Revision application does not propose any changes to the Reclamation Plan as it pertains to the level area below the highwall where processing activities previously occurred. This portion of the mine site was heavily impacted by flooding in 2013 and currently is covered with sediment and cobble. The current Reclamation Plan calls for reclaiming this area to rangeland. The area was previously affected by mining operations and must be reclaimed. Please describe how the Operator intends to reclaim this portion of the quarry.

Response:
Following the September 2013 flooding in South St. Vrain Creek, Boulder County [in collaboration with the SSV Restoration group] *contracted Matrix Design Group to develop*

restoration plans for the 3.2 mile stretch of South St Vrain Creek, from the forest service boundary in the canyon to the Old Saint Vrain Bridge off Highway 7. These restoration plans include the flat "meadow" area located between South St. Vrain Creek and the mined high walls at Lyons Quarry. Matrix requested that we coordinate ideas and work to develop one holistic project or at least develop plans that do not preclude the others plans. Based on Matrix's 30 percent design plans, the restoration in the "meadow" is much more extensive than addressing the mine processing, stockpiling, and access areas. The Matrix 30 percent design plans include realignment of the main channel to mimic the historical pre-mining and pre-flood alignments, additional flow paths for overflow channels (activated at approximately 1.5- and 5-yr flows), wood structures to aid in bank stability and initiate pool formation, extensive floodplain grading, extensive revegetation, and potentially offset buried riprap and reestablishment of the Otto diversion at the base of the vertical andesite wall.

Our approach will be to collaborate with Boulder County on the reclamation of the "meadow" area. However, Boulder County's planned restoration construction in the immediate future is limited to the areas downstream of the old Andesite Bridge and does not include the quarry area. Because the Matrix plan for restoration of the Lyons Quarry "meadow" area will not be implemented until sometime in the future, our approach will be to submit a future Technical Revision based on a collaborative plan for such future reclamation. The scope of Technical Revision No. 2 is limited to reclamation of the quarry area above the meadow, including the pit and highwall areas and down to the toe of the riprap scour berm.

Downstream South Saint Vrain Creek restoration activities were completed in January 2019 and have since restored access to the Lyons Quarry site for reclamation efforts to continue. Aggregate Industries assisted with these reclamation efforts by facilitating over 25,000 cubic yards of downstream cobble and gravel material to be placed within the quarry as backfill, saving the restoration project both time and money in transportation and dump fees.

Although the SSV Restoration group has not updated their 2016 30% Design for the floodplain area (Area 2) of Lyons Quarry, Aggregate Industries has collaborated with Boulder County in developing the following Technical Revision No. 4. This revision specifically addresses mining impacted locations within the floodplain area while also taking into consideration areas that are proposed to be disturbed for SSV Restoration efforts. Aggregate Industries is proposing to focus on four separate locations where mining material either remains stockpiled or was deposited during flooding of the site in 2013.

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We hope that this Technical Revision will satisfactorily address the concerns identified in the Division's adequacy review. If there are still any questions or unresolved issues regarding the Technical Revision, please let us know at your earliest convenience.

Sincerely,
HDR

Travis Snyder
Project Manager

Cc: Jeremy Deuto – Aggregate Industries-WCR, Inc.

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Aggregate Industries - WCR, Inc.

Lyons Quarry

112d Reclamation Permit Operations Technical Revision

Boulder County, Colorado

October 2020

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Contents

Attachments

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1 Introduction

1.1 Purpose and Objectives

The purpose of this document is to support the request to the Colorado Division of Reclamation Mining and Safety (DRMS) for a Technical Revision (TR) to the 112d Reclamation Permit Operations for Lyons Quarry (File number M-1977-141). The objectives of this document are to provide a narrative and updated Exhibits that explain the requested revisions to the approved Reclamation Plan based on changes in the mining operations at Lyons Quarry. Revised Exhibits include the following:

Exhibit E – Reclamation Plan

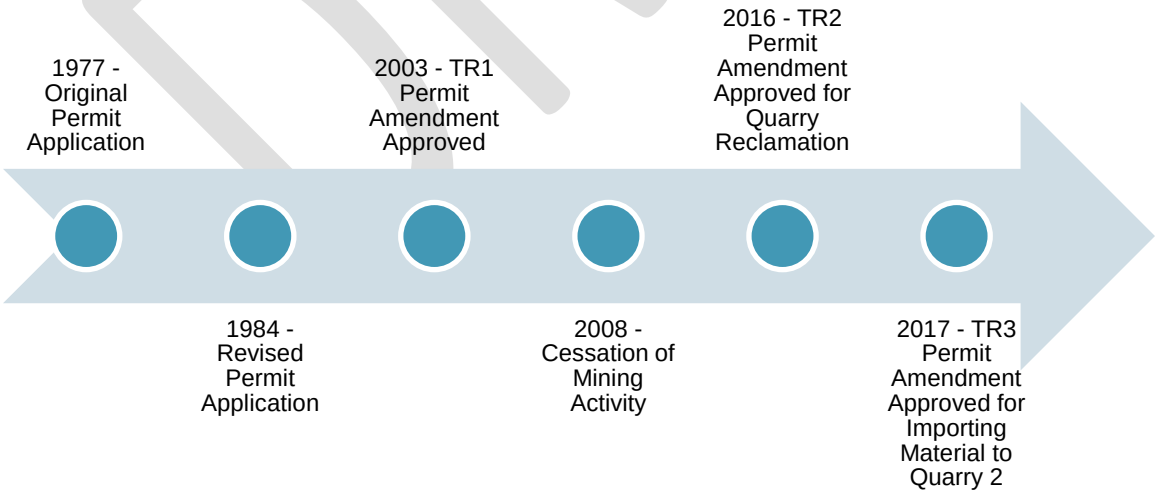
Exhibit F – Reclamation Plan Map

Exhibit L – Reclamation Costs

Rule 6.5 – Geotechnical Stability Exhibit

1.2 Background

Aggregate Industries 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. A timeline of the approved Mining Plan and Reclamation Plan for the project, as described in the Lyons Quarry Colorado DMG File M-1977-141 (2004), is provided below (Technical Revisions to the permit are noted as TR).



Changes in the mining operations at Lyons Quarry resulted in much less mining (removal of quartz monzonite) than was originally planned. The reduction in mining activities resulted in less removal and stockpiling of overburden materials than were originally planned to support reclamation.

In 2013, flooding of South St. Vrain Creek destroyed several structures on the site and displaced stockpiled materials within the floodplain area. Access to the site was restored via construction of a new bridge and road improvements in 2017. In 2018, the remains of the structures, equipment and miscellaneous surface debris were removed from the floodplain area by Aggregate Industries; however, several areas impacted by the displacement of stockpiled site materials remain.

2 Project Location and Description

2.1 Location

Lyons Quarry is located southwest of Lyons, Colorado in Boulder County. **Figure 1.1,** Attachment A, shows the Lyons Quarry site just south of South St. Vrain Creek, along Colorado State Highway 7 in Sections 25 and 26 of Township 3 North, Range 71 West of the 6th Principle Meridian.

2.2 Recent Flooding

The floods in September 2013 changed the low-lying areas of the Lyons Quarry as up to 17 inches of rain fell over a three-day span raising the levels of the South St. Vrain Creek to 100 and 500-year floodplains (Boulder County's annual precipitation is 18 inches). The flooding washed away the access bridge that crossed the South St. Vrain from Highway 7. **Figure 1.2 and Figure 1.3,** Attachment A, display the pre- and post-flood conditions of the site as satellite images from October 7, 2012 and October 6, 2013, respectively. The extent of the flood destruction and change in creek alignment especially at the east end of the site is shown on these images.

Boulder County Parks and Open Space, the current property owner, contracted Matrix Design Group to develop restoration plans for the 3.2 mile stretch of South St. Vrain Creek, from the Forest Service boundary in the canyon to the Old Saint Vrain Bridge off Highway 7. These restoration plans include the floodplain area located between South St. Vrain Creek and the mined high walls at Lyons Quarry. Restoration of South St. Vrain Creek downstream of the site were completed in 2017. During this work, approximately 25,000 cubic yards (CY) of cobble material from impacted reaches of the South St. Vrain Creek downstream of the site were allowed to be disposed of within Quarry #2 of the Lyons Quarry. This saved the restoration project both time and transportation costs. The preliminary designs for the floodplain area adjacent to the Quarry call for realignment of the creek and will be taken in to consideration for how the reclamation of these areas is considered.

2.3 Lyons Quarry

Lyons Quarry is currently inactive and is being prepared for closure and reclamation in cooperation with the current landowner, Boulder County Parks and Open Space. The Quarry consists of mined and leveled ground along the north end of the site, adjacent to South St. Vrain Creek, with mined high walls and overburden waste piles extending less than 1,500 feet to the south of the creek. **Figure 1.4,** Attachment A, shows the mining operations at the site in September 2002. As of

September 2013, several one story buildings and processing equipment were present near the entrance of the site but most were destroyed or lost during the 2013 flooding. Most of these structures were cleaned up, stockpiled away from the drainageway or removed from the site during the initial flood recovery operations in 2013-2014. The remaining equipment and large debris was removed in 2017.

The surface elevation across the site ranges from elevation (El.) 5,508 feet near the entrance of the site to above El. 6,000 feet at the south end of the site. Existing natural slopes in sedimentary rock strata are as steep as 1.75 horizontal to 1.0 vertical (1.75H:1.0V), where the sedimentary strata are capped by the Lyons Sandstone. Where the sedimentary rocks are not capped by the Lyons Sandstone, these slopes ranged from 2.0H:1.0V to 4.0H:1.0V.

The area within the floodplain is relatively uniform with the exception of the incised channel which the South St. Vrain currently flows with grades of 0.5% to 2.5%. The channel is bounded on the north by Highway 7 and on the south by a vegetated berm. Additional site features within the floodplain area include an orphan stockpile of crusher fines in the northwest corner of the site, a deposit of crusher fines located across South St. Vrain Creek in the northeast corner of the site and a deposit of crusher fines at the entrance to the site. These four areas are currently slated as alternate tasks for removal and relocation in to the quarry pit during the reclamation work of the quarry itself.

Vegetation over most of the site is described by Boulder County ecologists as grasses, forbs, and shrubs/brush with various cottonwoods, willows, Virginia creeper and golden current found along the drainages. Several outcroppings of cottonwoods can be found at the transition between the quarry and the floodplain area as well as the vegetated berm area mentioned above.

Surface water is present along the north edge of the site, in South St. Vrain Creek as well as an existing pond located at the eastern end of the site. Groundwater is present, ponded in low areas and observed as wet areas along the transition zone between the quarry and floodplain areas. Groundwater is also anticipated to be perched above siltstone and shale layers in the Fountain Formation.

3 Exhibit E – Reclamation Plan

The post mining use remains unchanged with the land being reclaimed to cattle range and pasture land in the production, stockpile, and pit floor areas. A Reclamation Plan developed in the 2016 Technical Revision #2 addressed the areas within the quarry, known as Lyons Quarry Reclamation Area 1 (LQRA1), including re-grading the high walls, backfilling the pit areas, installation of runoff erosion control structures around the site perimeter and revegetation of approximately 81% of the LQRA1 total 37 acre area. The remaining 19% of the area includes steep slopes that will either be covered by talus riprap or remain open for nesting birds

This Technical Revision #4 addresses impacted locations within the floodplain area. This area is designated in the original Mining Permit as “Permitted Non-Mining Disturbance Area” is bounded on the north by the pre-2013 flood South St. Vrain Creek channel and on the south by the toe of the

quarry depicted on the design drawings as the “Scour Berm”. The east and west boundaries correspond to the mining permit site perimeter.

The following paragraphs provide a summary of the proposed reclamation for Lyons Quarry Reclamation Areas 2 through 5 (LQRA2-LQRA5**)** identified in **Table 1**, which will address the following four discreet areas containing stockpiled materials from mining operations or deposits of crusher fines within the floodplain.

Table 1 - Lyons Quarry Reclamation Areas 2-5

LQRA #	Description	Area Acreage	Avg. Depth (FT)	Volume (CY)
2	Orphan pile located in northwest corner	0.16	10	2,600
3	Vegetated Berm along South St. Vrain Creek	0.70	5	5,700
4	Crusher fines deposit within Staging Area	1.01	3	4,900
5	Crusher fines deposit across channel	0.91	2	3,000
	Total	**2.78**		**16,200**

The Site Grading Plan, Attachment B, shows the proposed cut and fill slopes and final grading. Exhibit F – Reclamation Plan Map, Attachment C, shows the planned reclamation areas and the types of reclamation proposed in Reclamation Areas 2 through 5, based on a slope analysis of the final grading and the proximity within the floodplain. Section 5.1 provides more detail of the proposed Reclamation Plan and Scope of Work developed for estimating the costs for Exhibit L – Reclamation Cost, Attachment D. Rule 6.5-Geotechnical Stability Exhibit, Attachment E, provides the basis for the Site Grading Plan. The Geotechnical Stability Exhibit limitations include a 3 year limit on the use of the report due to possible changes over time in land use, site conditions, regulations, or other factors. This reclamation plan is based on the premise that the conditions described in the geotechnical report for the analyses performed and the conclusions and recommendations presented still exist at the sit and should remain valid for the duration of the planned reclamation. A Grading Plan Verification Letter, signed and sealed by a registered professional engineer, Attachment F, is a letter verifying that the slopes and configurations shown on the Grading Plan meet the specifications of the Geotechnical Stability Exhibit.

Table 2 shows the proposed reclamation schedule with planned reclamation phases, sequence, and estimated durations for each phase.

Table 2 – Reclamation Schedule for LQRA1-5

Phase	Duration
Final Design and Construction Documents – Completed June 2019	6 months
Procurement of Construction Contractor – Completed August 2019	2 months
Mobilization, Site Prep. and Earthwork Construction	12 months
Revegetation Test Plot Monitoring	12 months
Revegetation	6 months

As a first step toward final reclamation, and prior to mobilization, an updated topographical survey of the site will be conducted to establish the 100 and 500-year floodplains as well as site perimeters and slope staking. An inventory will be taken of existing structures, utilities, and remaining equipment, if any, to be demobilized and/or disposed of. A project safety plan will be developed to be consistent with applicable MSHA and OSHA requirements prior to initiation of field activities. Utility locates will be conducted prior to any earthwork.

A number of permits and notices are required for construction within the floodplain area. The following permits have either been retained by Aggregate Industries since mining activities ceased or will be applied for prior to commencement of reclamation activities within the floodplain:

- Boulder County Floodplain Permit
  A Boulder County Floodplain Development Permit (FDP) is required for any work within the floodplain. FDP are acquired through the Boulder County Transportation Department. All development and proposed improvements are required to conform to the Article 4-400, Floodplain Overlay District of the Boulder County Land Use Code. A detailed hydraulic report was generated that meets the Hydraulic Modeling Report Guide provided by Boulder County.
- Boulder County Grading Permit
  A Boulder Count Grading Permit is required for grading, excavation or placement of fill in excess of 50 cubic yards. Grading permits must be reviewed by the Planning and Zoning Division, the Transportation and Engineering Department, and Building Safety and Inspection Services through the Land Use Department.
- Boulder County Land Use Permit
- CDPHE Dewatering Permit
- CDPHE Stormwater Discharge Permit
- USACE Pre-Construction Notice

Erosion control Best Management Practices (BMPs) and dust control measures will be established prior to any site grading to restrict sediment transport from the site and control dust generation during construction activities. BMPs will be established in accordance with Boulder County Storm Drainage Criteria Manual that requires the design of BMPs be consistent with the guidance in the

Colorado Department of Transportation (CDOT) Erosion Control and Stormwater Quality Guide (CDOT, 2006) or the Mile High Flood District (MHFD), Urban Storm Drainage Criteria Manual Volume 3 (UDFCD, 2016).

Appropriate measures will be taken to ensure areas outside of the affected land are protected and any refuse associated with the flood-impacted area, or any identified hazardous materials, are disposed of properly. At this time there are no known hazardous materials on site and the construction documents will include specifications that require the contractor to stop work immediately and notify Aggregate Industries and the State if any hazardous materials are encountered.

Once the site controls are installed, the grading plan will be implemented. All reclamation slopes in the designated areas will be blended to match surrounding topography. In areas where crusher fines are removed below the grade of the floodplain, clean fill will be brought in either from the vegetated berm (LQRA3) or from areas within the quarry that provide suitable backfill material characteristics. This fill material will be combined with riprap to create a soil riprap mixture as described in Section 5.1. Reclamation adjacent to South Saint Vrain Creek will be protected with Type M riprap. There is no planned reclamation within the creek channel and the proposed grading will not change the existing elevations or flow path of South St. Vrain Creek.

The reclaimed areas will have slopes of at least 3H:1V with the exception of areas adjacent to South St. Vrain Creek which will be 1.5H:1V. All soil riprap backfill will be moisture conditioned, placed, and compacted to achieve adequate density for stability. The revised Site Grading Plan is shown in Attachment B. The slopes shown on the Site Grading Plan are verified as meeting the geotechnical specifications of the Geotechnical Stability Report in a letter signed and sealed by a qualified Colorado registered Professional Engineer, Attachment F.

Soil riprap backfill within the floodplain reclamation areas will be placed in horizontal lifts not exceeding 12 inches in thickness, depending on the fill materials. Compaction requirements will depend on the lift thickness and the equipment used, but adequate compaction should be achievable with the routing of construction equipment traffic, provided material characteristics, moisture content and lift thickness are appropriate. Final grading of all fill slopes, benches, crest areas, and toe areas should ensure that water is not allowed to pond on or adjacent to the fill slopes.

All of the floodplain areas will be reclaimed using types of revegetation appropriate for the final grades and soil conditions present. The subgrade of the reclamation areas will be prepared and then covered with a layer of growth medium material comprised of a blend of available onsite topsoil, the soil materials developed from excavation and breakdown of the weathered fine-grained sedimentary overburden rock, and from imported topsoil, biosolids, or compost. Growth medium will only be imported as necessary and the appropriate blend of onsite and imported topsoil/growth medium for revegetation will be determined based on a Test Plot using the soil types and slopes planned for reclamation.

The focus of revegetation will be native plant species, adapted to area climate, that require no irrigation. The floodplain area seed mix is expected to differ from the upland seed mix that is specified for the quarry reclamation and will include more riparian species. If irrigation is required, an estimated maximum 0.1 total acre feet is projected to establish vegetation with the goal of no watering once plants are established. The water would be pumped from an existing sedimentation

pond at a rate of 40 to 80 gallons per minute, depending upon the irrigation system setup, season, and weather conditions. Areas of revegetation will be maintained for up to one growing season to control weed infestation.

The existing sedimentation pond on site will be utilized for dust control, fill moisture conditioning, and watering vegetation as needed. The pond will then be backfilled at the end of construction to blend with the surrounding topography, unless post-mining use dictates otherwise. The final contours will be graded toward South St. Vrain Creek.

4 Exhibit F – Reclamation Plan Map

The Reclamation Plan Map is provided as Attachment C.

5 Exhibit L – Reclamation Costs

Estimated reclamation costs for each of the major work items described below are summarized and presented in Exhibit L – Reclamation Costs, Attachment D.

5.1 Planned Reclamation Scope of Work

The following tasks are specific to the reclamation work to be performed in the LQRA2-5 locations and do not include tasks to be performed within the reclamation of the quarry (LQRA1) itself which are covered in Technical Revision #2. The item numbers below correspond to the line item tasks for the contractor to perform as specified in the reclamation project manual. Several tasks are not included as they are specific to reclamation of the quarry.

Item 1.0 – Mobilization/Demobilization

This item includes all costs necessary and incidental to move equipment and supplies onto the project area, perform minimal road improvements, if required, move equipment within the project area during the course of the project, and any other requirements necessary for the successful completion of this project. The contractor will also operate and maintain such temporary works and equipment throughout the period of construction. This item also includes all labor, equipment, and costs associated with demobilization and clean-up of the project site following the completion of the project.

Item 2.0 – Project Safety Plan and Implementation

The project will involve working around inactive quarry slopes and associated hazards, and the contractor must comply with all OSHA regulations. This task includes all the contractor's expenses for employee time, labor, materials, and safety equipment and safety training necessary for preparing and executing a job safety plan. The contractor will be required to prepare the Project Safety Plan implement the plan in conjunction with project implementation.

Item 3.0 – Erosion, Sedimentation, and Dust Control Plan

This item covers the design, installation, maintenance, and removal of temporary erosion, sedimentation, and dust control features. The contractor will be required to install these sediment control features prior to any ground disturbing activities and maintain them throughout the duration of the project. The work to reclaim areas within the floodplain is anticipated to be performed during low flow conditions on South St. Vrain Creek to minimize the impacts of snowmelt runoff within the work areas. The installed temporary erosion and sediment control features assume BMP's in accordance with Boulder County Storm Drainage Criteria Manual, including but not limited to Temporary Embankment Protectors, Silt Barriers and Sediment Control Logs.

Dust generated from the project area during work and off-work periods will be controlled and kept to a minimum. The contractor will be required to develop and implement a Dust Control Plan, including Wind Erosion/Dust Control BMP's and application of water to working areas during working and non-working periods, including weekends, throughout the duration of the project.

Item 4.0 – Site Survey

This task consists of performing all surveys, measurements, and computations required by the specifications to accurately track that the materials are imported and exported according to the design drawings.

Item 5.0 – Disposal of Excavated Materials

This item covers off-site disposal of debris materials that may be encountered during excavation of the floodplain areas. While most of the mining infrastructure has been accounted for, the potential for deposition of debris from upstream sources following the 2013 flood remains.

Item 6.0 – Earthwork Excavation, Fill, and Compaction

Once the site controls are installed, the grading plan will be implemented. All areas will be cleared and grubbed prior to excavation and backfilling. Trees with diameters greater than 12 inches will be removed with the root ball intact. Root wad materials will be available for use as stream bank protection for future restoration of South St. Vrain Creek.

All areas that require excavation down to surrounding grade will be over-excavated by 18 inches and backfilled with soil riprap. Excavated materials from the floodplain reclamation areas LQRA 2, 4 and 5 will be transported to Quarry Pit #2 for backfill material. If the material from the vegetated berm (LQRA3) is suitable, it will be used as backfill material for the floodplain areas that require soil riprap backfill.

Soil riprap fill materials will consist of overburden materials that are uniformly graded continuously from 9 inch D_{50} Type L riprap size to silt size, with a maximum particle size equal to one-half to two-thirds of the lift thickness and maximum 45 percent fines in the minus 3-inch fraction. Soil riprap backfill will be placed as follows:

- Placed in horizontal lifts not to exceed 12 inches thick, based on the maximum particle size of the fill materials
- The soil material shall be native or topsoil and mixed with sixty-five percent (65%) riprap and thirty five percent (35%) soil by volume

- Soil riprap shall consist of a uniform mixture of soil and riprap without voids.
- Compacted to achieve greater than 90% of the maximum dry density in accordance with ASTM D698
- Placed in a manner that allows for a moisture content within 3% of optimum based on ASTM D698
- Final Grading of all fill slopes, benches, crest areas, and toe areas will ensure that water is not allowed to pond on or adjacent to the fill slopes.

Item 8.0 – Restoration - Test Plots, Soil Conditioning and Revegetation

Reclamation areas will be restored depending on their proximity to the current channel alignment and whether backfill material is required as shown on Exhibit F- Reclamation Plan Map, Attachment C.

8.1 – Test Plots

The final reclamation topsoil/growth medium, seeding, fertilization, and revegetation will be determined based on the results of Test Plots developed during the Quarry reclamation work using the soil types and slopes planned for reclamation to assist in determining the appropriate types and methods for reclamation.

The actual location of the restoration test plots will be determined by the Quarry reclamation contractor and based on their earthwork schedule and re-grading plan. However, the specifications will require that the contractor develops test plots with similar elevations and aspects as the planned reclamation. The test plots will have 30'x30' dimensions with two variables per plot, or two 15'x30' subplots. There would be a total of 4 test plots, or 8 total subplots. For the purposes of the floodplain reclamation, an additional test plot will be dedicated to the restoration of the LQRA2-LQRA5 areas. The test plots will be seeded in the spring once the ground surface is exposed and there is sufficient moisture to obtain germination.

The test plots will be monitored periodically throughout the reclamation of the Quarry. The plots and plants would be photographed and a vegetative survey conducted to include plant type, plant height, plant density, overall, vegetation density, and presence of weeds. Monitoring would also include general observations such as evidence of erosion and pest issues. Soil samples would be collected in the fall for routine soil nutrient assessment, including major plant nutrients and micronutrients. Aggregate Industries may also conduct a bench top study to be conducted that could allow the start of reclamation activities sooner than the proposed 12 month schedule. The bench study would supplement the field plot information. By growing indoors, faster germination and vegetative growth can be achieved.

8.2 – Soil Conditioning

All reclamation areas within the floodplain will be reclaimed in a manner that allows for livestock grazing. These areas will be backfilled as described above then covered with a layer of growth medium material. The growth medium material will be developed from a blend of any available topsoil stockpiled on site and material available from the excavation and breakdown of the fine grained sedimentary overburden rock, supplemented as needed by imported topsoil, biosolids, or compost, then blended, scarified, seeded and mulched. This material will then be uniformly mixed

with conventional earthmoving equipment, such as dozer rippers or the teeth of an excavator bucket, in to the top 6 to 12 inches of the subsoil. Adjusting for over-excavation, it is anticipated that the area to receive amendments covers approximately 3.5 acres.

8.3 – Revegetation

Seeding of the affected lands assumes a native seed mix comprised of the species and mixtures recommended by Boulder County Parks and Open Space with updates provided in December 2019 by Senior Plant Ecologist, David Hirt. This seed mix incorporates species that have performed well **Table 3** shows the native seed mix recommended for 5,500 to 7,000 feet elevation (reclaimed areas at the site range in elevation from 5,500 to 5,820 feet). The listed quantities and application rates are shown in pounds of pure live seed per acre (#PLS/Acre), assuming broadcast seeding. The seeding is anticipated to be completed from March - April 15, 2021. If any areas must be prepared in the summer, fall, or winter, then the topsoil will be mulched at that time and seeded the following spring.

Table 3 – Native Seed Mixes 5,500 Feet to 7,000 Feet Elevation

Common Name	Species Name	Variety	%of Mix	#PLS/ Acre
Canada Wildrye	*Elymus canadensis*	Mandan	12	3.64
Blue Grama	*Bouteloua gracilis*	Native, Alma, or Hachita	14	0.59
Slender Wheatgrass	*Elymus trachycaulus*	San Luis or First Strike	10	2.19
Squirrel Tail	*Elymus elymoides*	Pueblo	12	2.18
Thickspike Wheatgrass	*Elymus trachycaulus*	Critana	10	2.26
Sandberg Bluegrass	*Poa secunda*	Colorado Plateau	5	0.38
Switchgrass	*Panicum virgatum*	Blackwell or Nebraska 28 or BOCO	9	0.81
Green Needlegrass	*Stipa viridula*	Lodorm or Native	8	1.54
Fringed Sage	*Artemesia frigida*	VNS	4	0.03
Hairy Golden Aster	*Heterotheca viliosa*	VNS	5	0.20
Rocky Mtn. Bee Plant	*Cleome serrulata*	VNS	4	2.12
Rabbitbrush	*Ericameria nuaseousus*	VNS	7	0.61
		Totals:	**100**	**16.55**

Fertilization assumes a minimum of 300 pounds (lbs.) of available nitrogen and 50 lbs. of available phosphorous per acre will be supplied after seeding and not included with the seeding. A soil analysis will be performed as part of the Test Plots to determine the fertilizer needs. Immediately following the seeding and fertilizing, the area will be lightly scarified and mulched using various application processes, based on the final grade, soil conditions, and equipment access. These may include:

a. Excelsior and coir mats properly staked down

b. Long-stemmed native prairie hay (4000 lbs/acre) tied down with properly anchored jute netting. This will apply to areas where mechanical crimping is not feasible due to access limitations or slope configuration. We estimate this area to be less than 0.5 acre primarily along the stream banks.

c. Long-stemmed native prairie hay (4000 lbs/acre) mechanically crimped in to the soil a minimum of 2". It is assumed mulching and crimping will be applied to slopes flatter than 3H:1V or unless prohibited by access or topography (See Exhibit F – Reclamation Plan). The slope analysis indicates approximately 18.3 acres are in this slope range.

A

Attachment A. Figures

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Figure 1.1 – Site Map and Location

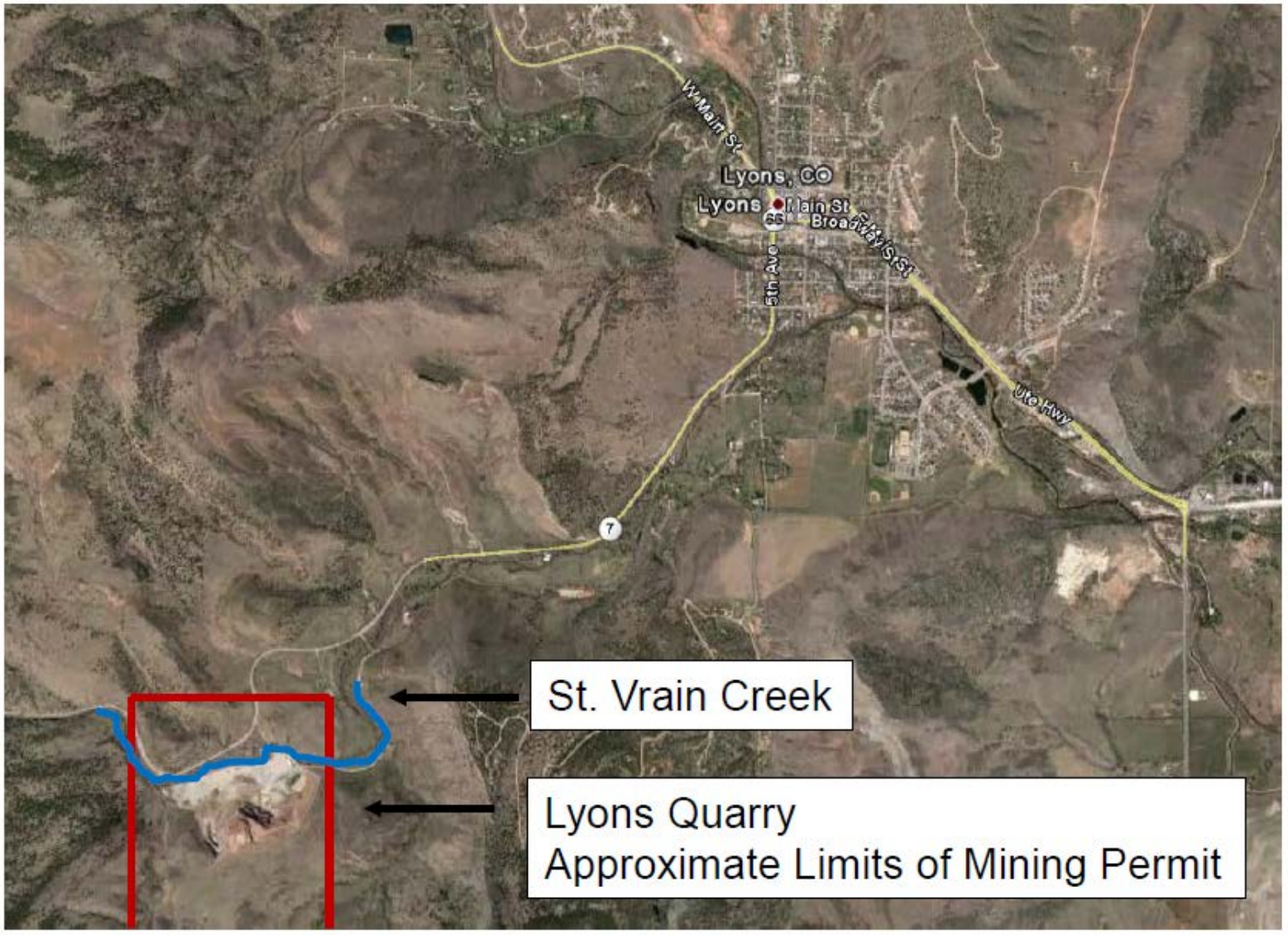

Figure 1.2 – Pre-Flood Satellite Image
October 6, 2012

Figure 1.3 – Post-Flood Satellite Image
October 7, 2013

Figure 1.4 – Andesite Quarry Mining Map

B

Attachment B.
Site Grading Plan

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Figure B-1 – Grading Plan

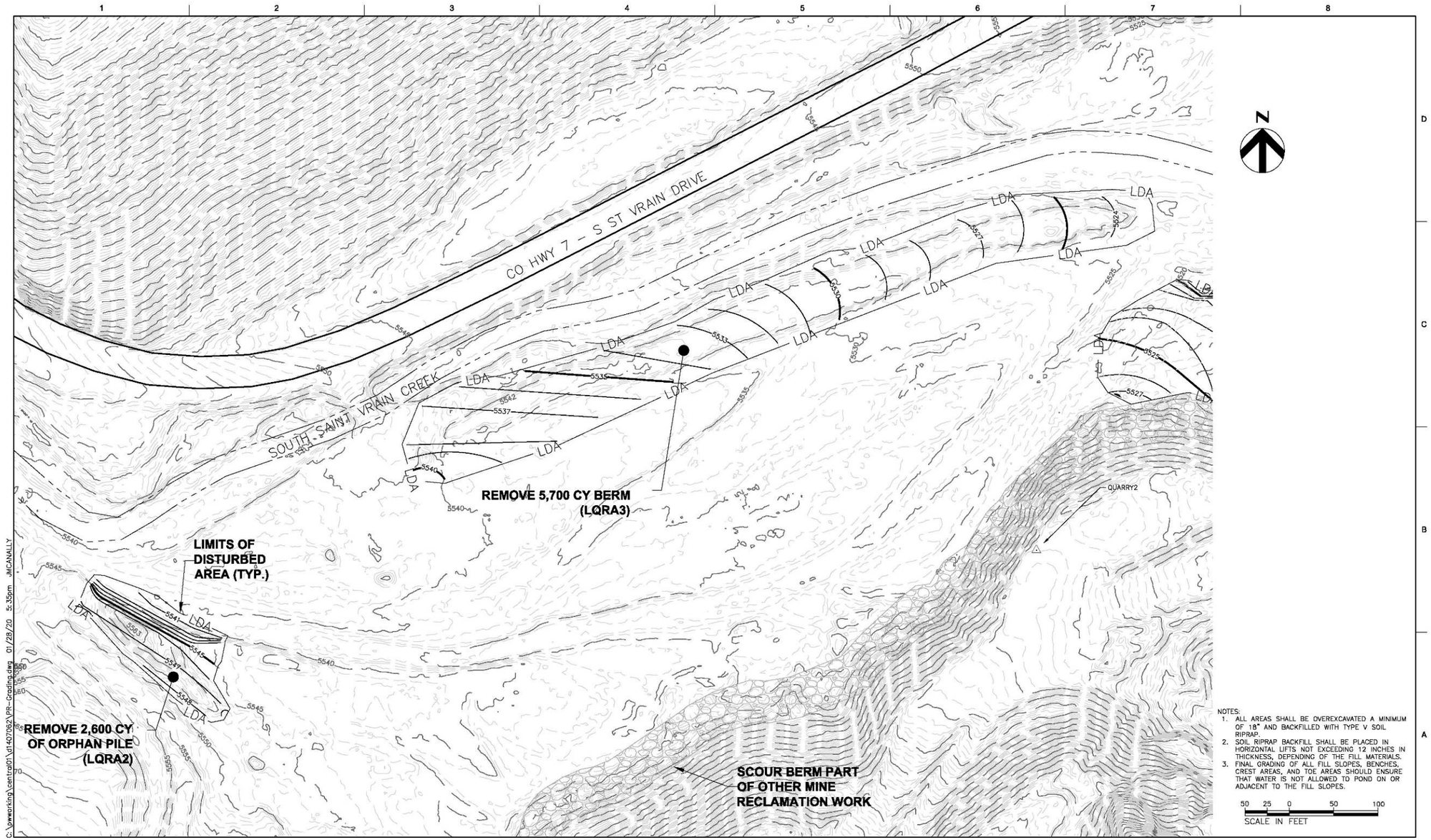
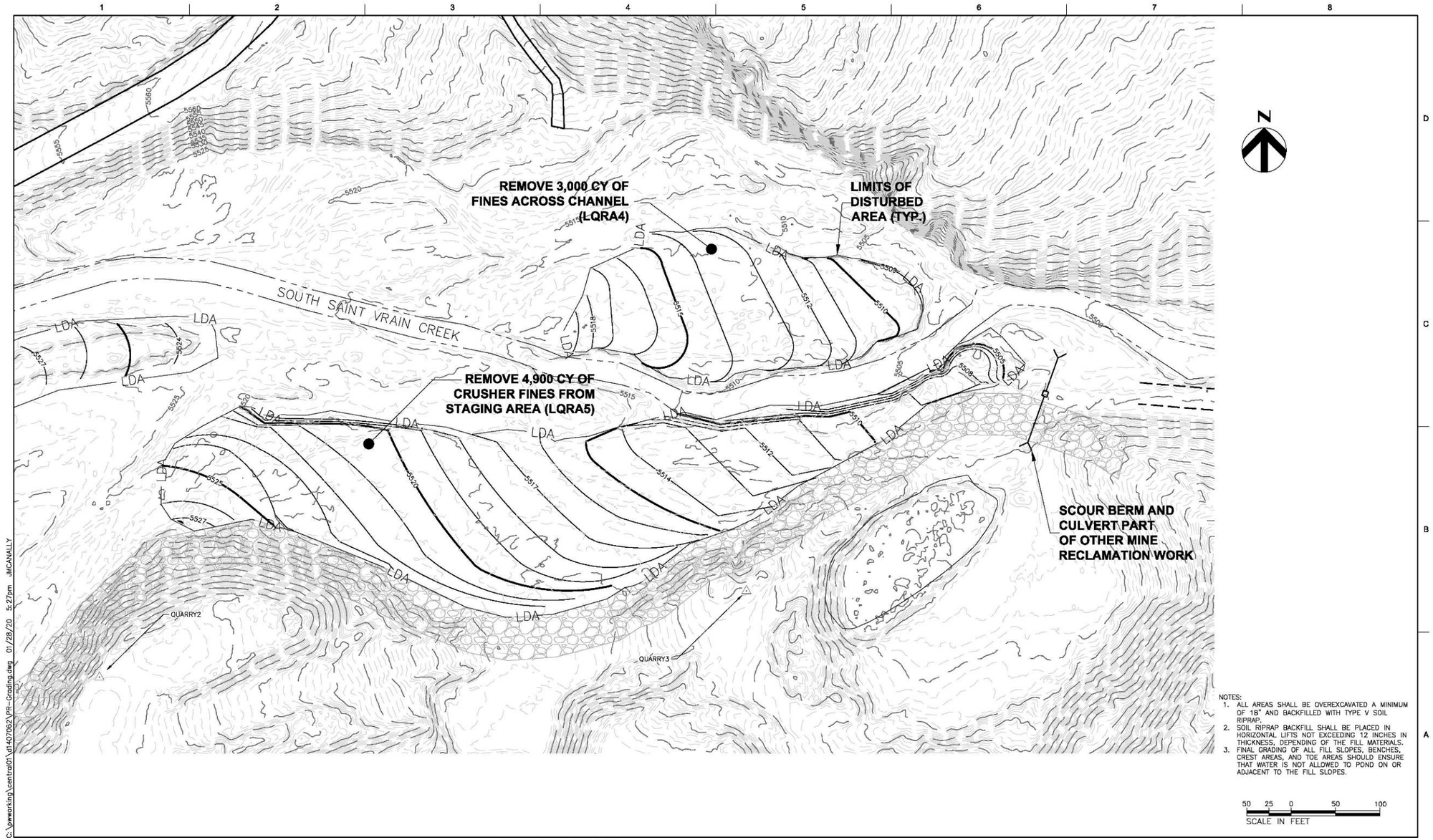


Figure B-2 – Grading Plan



ISSUE	DATE	DESCRIPTION

PROJECT MANAGER	TRAVIS SNYDER
DRAWN BY	J. MCANALLY
PROJECT NUMBER	10191853

AGGREGATE INDUSTRIES
LYONS QUARRY
RECLAMATION PROJECT

FLOODPLAIN SOIL REMOVAL AREAS
SITE GRADING PLAN

FILENAME	PR-Grading.dwg
SCALE	AS NOTED
SHEET	C0-02

C

Attachment C.
Exhibit F –

Reclamation Plan Map

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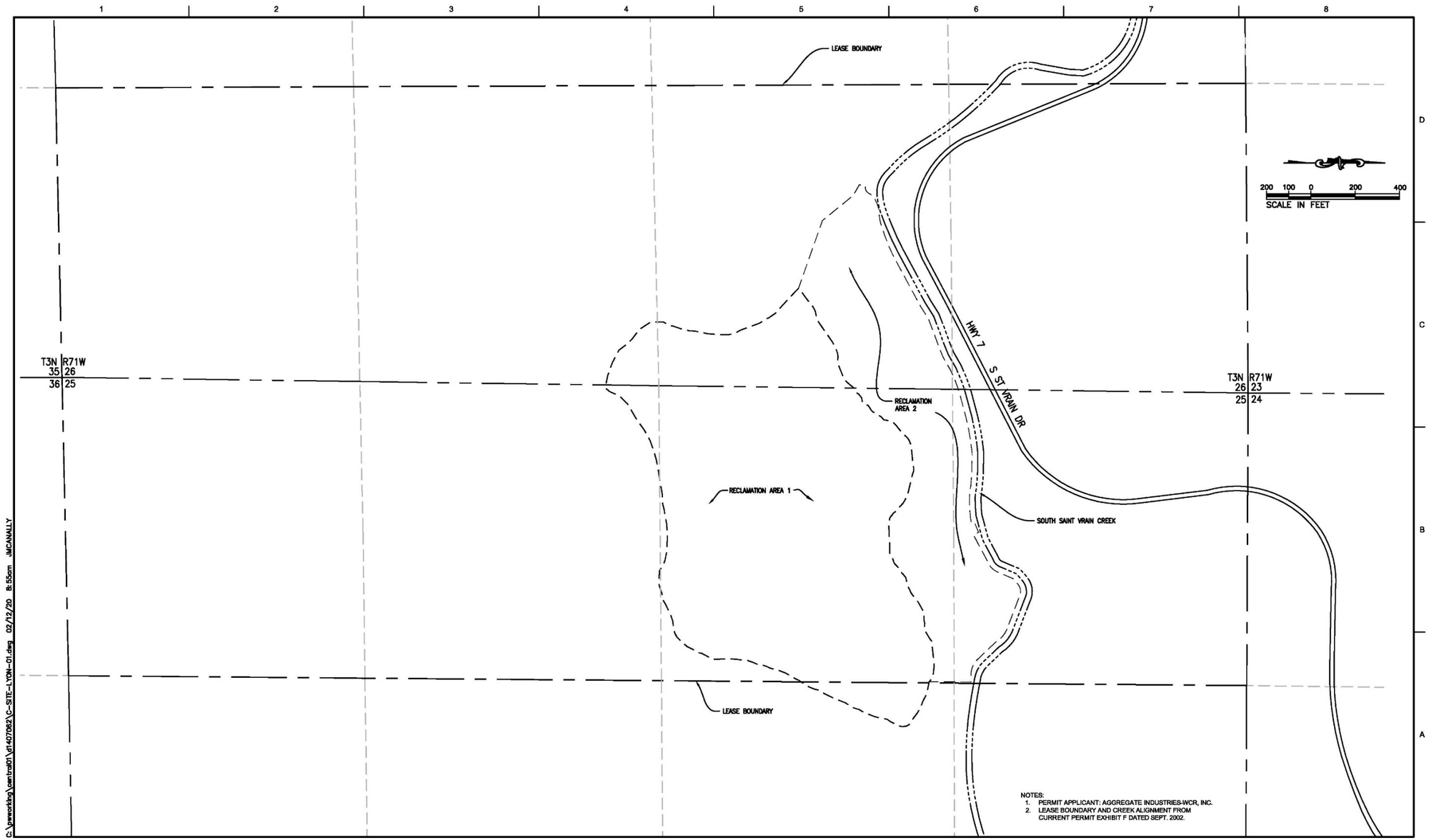
Figure C-1 – Reclamation Plan Map – Exhibit F



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ISSUE	DATE	DESCRIPTION

PROJECT MANAGER	TRAVIS SNYDER
DRAWN BY	J. MCANALLY
PROJECT NUMBER	10191853

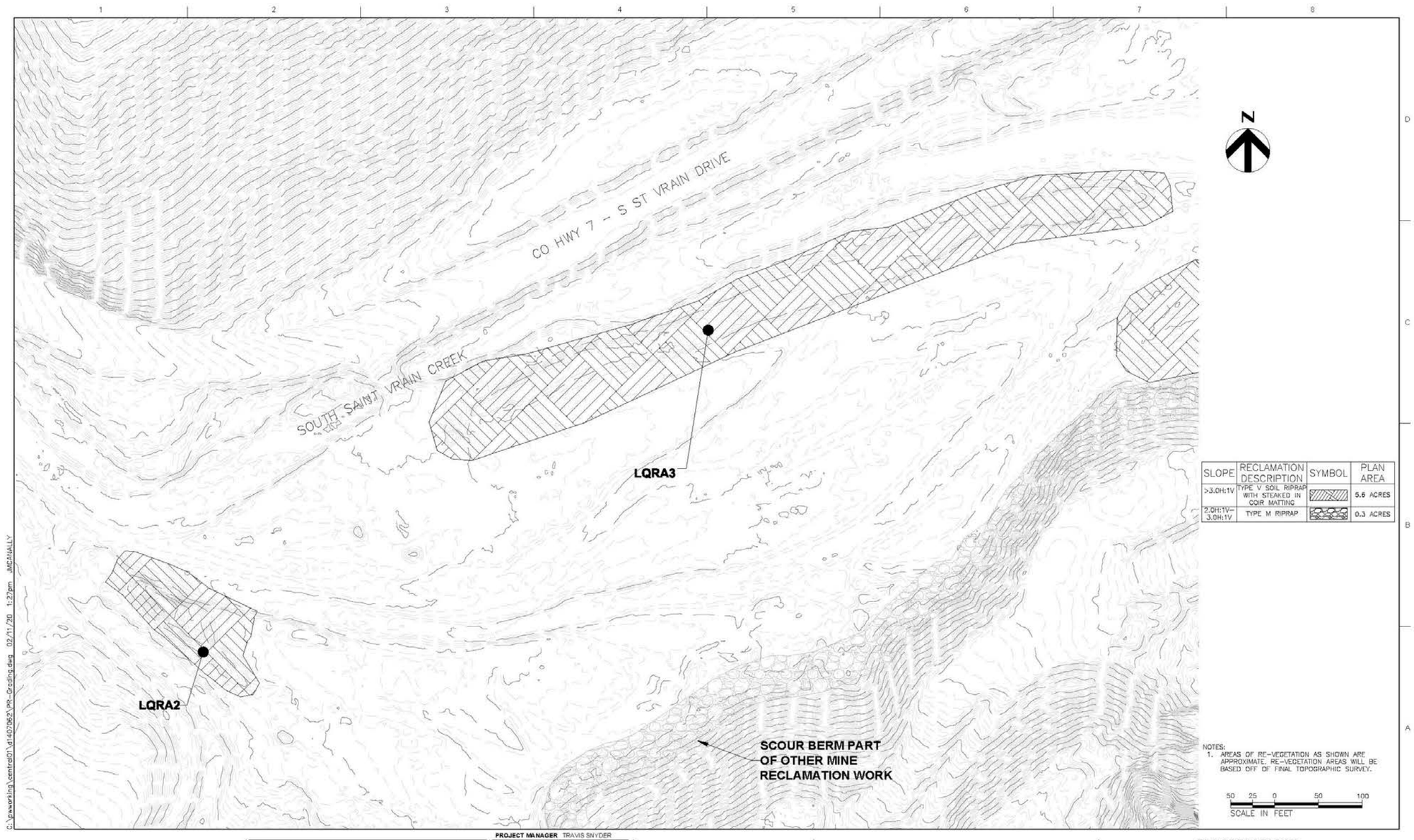
AGGREGATE INDUSTRIES
LYONS QUARRY
RECLAMATION PROJECT

EXHIBIT F
RECLAMATION PLAN

FILENAME	EXH-F-SHEET-01.dwg
SCALE	AS NOTED

SHEET **C0-03**

Figure C-2 – Reclamation Plan Map – Exhibit F



PROJECT MANAGER TRAVIS SNYDER

ISSUE DATE DESCRIPTION

DRAWN BY J. MCANALLY

PROJECT NUMBER 10191853

AGGREGATE INDUSTRIES
LYONS QUARRY
RECLAMATION PROJECT

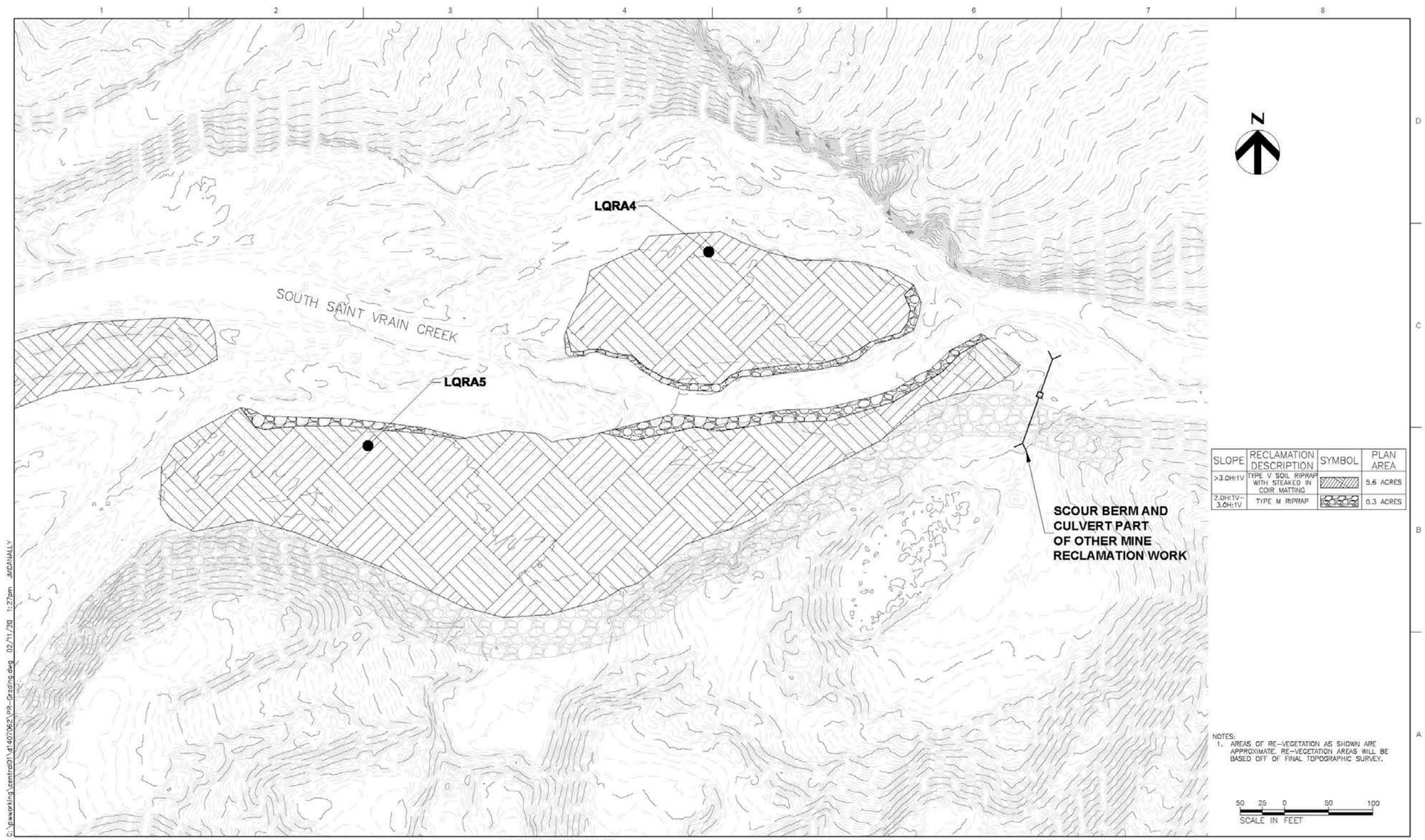
FLOODPLAIN SOIL REMOVAL AREAS RECLAMATION PLAN MAP

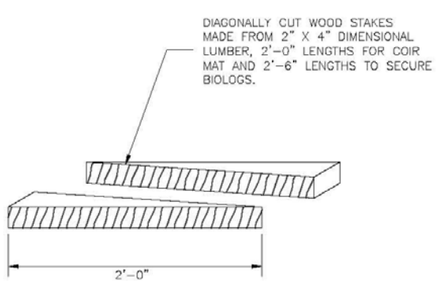
FILENAME PR-Grading.dwg

SCALE AS NOTED

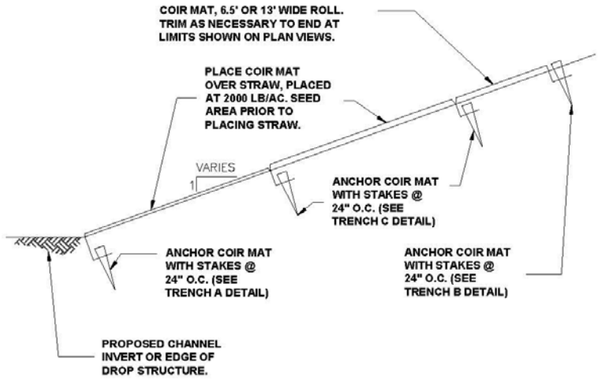
SHEET C0-04

Figure C-3 – Reclamation Plan Map – Exhibit F

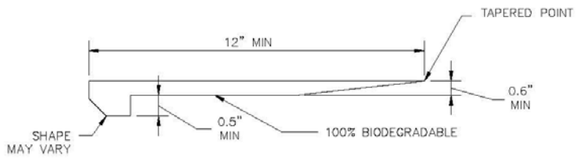




CUT WOOD



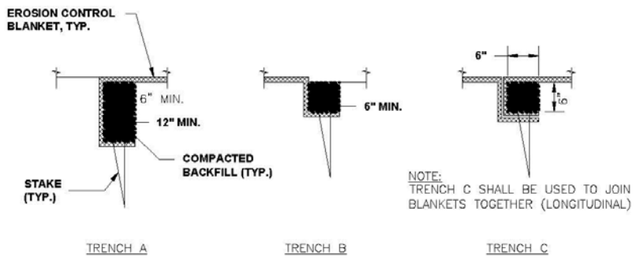
COIR MAT PLACEMENT DETAIL



PROPRIETARY

NOTES
1. PLACE STAKES 1'-6" O.C. TO 3' ABOVE WATER, THEN 2' O.C. TO UPPER LIMIT OF FABRIC.

STAKES



TRENCH A TRENCH B TRENCH C

ANCHOR TRENCH DETAILS FOR EROSION CONTROL BLANKETS

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ISSUE	DATE	DESCRIPTION

PROJECT MANAGER TRAVIS SNYDER
DRAWN BY J. MCANALLY
PROJECT NUMBER 10191653

AGGREGATE INDUSTRIES
LYONS QUARRY
RECLAMATION PROJECT

FLOODPLAIN SOIL REMOVAL AREAS RECLAMATION DETAILS

FILENAME PR-Grading.dwg
SCALE AS NOTED
SHEET **C0-06**

D

Attachment D.
Exhibit L –

Reclamation Costs

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Exhibit L – Reclamation Costs

Floodplain Reclamation Cost Estimate					
Item No.	**Description**	**Unit**	**Estimated Quantity**	**Unit Price**	**Total Cost**
1.0	Mobilization/Demobilization	Job	15% of Items 5-8	N/A	$38,445.00
2.0	Project Safety Plan	Job	2% of Items 5-8	N/A	$5,126.00
3.0	Erosion Control	Job	10% of Items 5-8	N/A	$25,630.00
4.0	Survey	Job	3% of Items 5-8	N/A	$7,689.00
5.0	Debris Removal (10 ton/load)	Load	5	$1,600.00	$8,000.00
6.0	Earthwork				
6.1	Excavation	CY	16,200	$4.00	$64,800.00
6.2	Backfill & Compaction	CY	7,900	$10.00	$79,000.00
8.0	Restoration				
8.1	Soil Test Plots	Each	1	$50,600.00	$50,600.00
8.2	Soil Conditioning	Acre	3.5	$11,000.00	$38,500.00
8.3	Re-vegetation	Acre	3.5	$4,400.00	$15,400.00
	Total of Items 1.0-8.0				**$333,190.00**

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E

Attachment E.
Rule 6.5 –

Geotechnical Stability Exhibit

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GEOTECHNICAL STABILITY EXHIBIT

Technical Revision #3 addresses impacted locations within the floodplain area and includes the removal of:

- A ten-foot high orphan pile in the northwest corner of the site (LQRA 2)
- A five-foot high vegetated berm along South St. Vrain Creek (LQRA 3)
- Crusher fines extending below existing grade deposited within the mine staging area (LQRA 4)
- Crusher fines extending below existing grade deposited across the channel from the staging area (LQRA 5)

All areas that require excavation down to surrounding grade will be over-excavated by 18 inches and backfilled with buried soil riprap. Soil riprap shall consist of a mixture of 35% native soil and 65% Type L (D50 = 9in) riprap to eliminate voids.

In areas where crusher fines are removed below the grade of the floodplain, clean fill from either the vegetated berm (LQRA3) or from areas within the quarry will be used as the soil component.

Areas LQRA 4 and LQRA 5 are adjacent to South Saint Vrain Creek. Any grading impacts to the existing channel slope will be restored at a maximum slope of 2.5H: 1V with Type M (D50 = 12in) riprap.

From Table 2.5 in the SME Mining Reference Handbook, the soil riprap is best classified as a mix of granite, sand and gravel, and mixed grain size till. These materials have an internal angle of friction ranging from 30 to 50 degrees. An internal angle of friction of 45 degrees is assumed to for the riprap and 30 degrees for the buried soil riprap mixture. Any cohesion, or apparent cohesion, was conservatively neglected.

The Factor of Safety (FS) for soil riprap with a 4H: 1V (~14 degree) slope in a compacted mixed till with an assumed internal angle of friction of 30 degrees can be approximated by ignoring the cohesion component of the stability and simply evaluating the internal angle of friction as follows:

$$FS = \frac{Tangent\ of\ Internal\ Angle\ of\ Friction}{Tangent\ of\ Actual\ Angle\ of\ Failure\ Surface}$$

$$FS\ Soil\ Riprap = \frac{Tan\ 30°}{Tang\ 14°} = 2.3$$

The Factor of Safety for riprap with a 2.5H: 1V (~21.8 degree) slope with an assumed internal angle of friction of 45 degrees can be approximated by ignoring the cohesion component of the stability and simply evaluating the internal angle of friction as follows:

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$$FS\ Riprap = \frac{Tan\ 45°}{Tang\ 21.8°} = 2.5$$

Conclusion

The factor of safety is 2.5 in the permanent case along the channel banks and 2.3 everywhere else. Both are well above the minimum of 1.5 for permanent conditions.

Jonathan McAnally, P.E.
P.E. #52852

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(303) 764-1520

References

Lowrie, Raymond L. *SME Mining Reference Handbook*. Society for Mining, Metallurgy, and Exploration, 2002.

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F

Attachment F. Grading Plan Verification Letter

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February 11, 2020

Michael Cunningham
Colorado Division of Reclamation, Mining and Safety
1313 Sherman Street, Room 215
Denver, CO 80203

RE: Lyons Quarry; DRMS File No. M-1 977-141; Technical Revision No. 3; Verification of Grading Plan

Dear Mr. Cunningham,

This letter is to verify that the slopes and overall configuration shown on the grading plan presented in Technical Revision No. 3 meet the geotechnical specifications outlined in the Rule 6.5-Geotechnical Stability Exhibit. Technical Revision #3 addresses impacted locations within the floodplain area and includes the removal of:

- A ten-foot high orphan pile in the northwest corner of the site (LQRA 2)
- A five-foot high vegetated berm along South St. Vrain Creek (LQRA 3)
- Crusher fines extending below existing grade deposited within the mine staging area (LQRA 4
- Crusher fines extending below existing grade deposited across the channel from the staging area (LQRA 5)

All areas that require excavation down to surrounding grade will be over-excavated by 18 inches and backfilled with buried soil riprap with a maximum finished grade of 4H: 1V. Any grading impacts to the existing channel slope will be restored at a maximum slope of 2.5H: 1V with loose riprap armoring.

Sincerely,
HDR

Jon McAnally, PE
Project Engineer

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