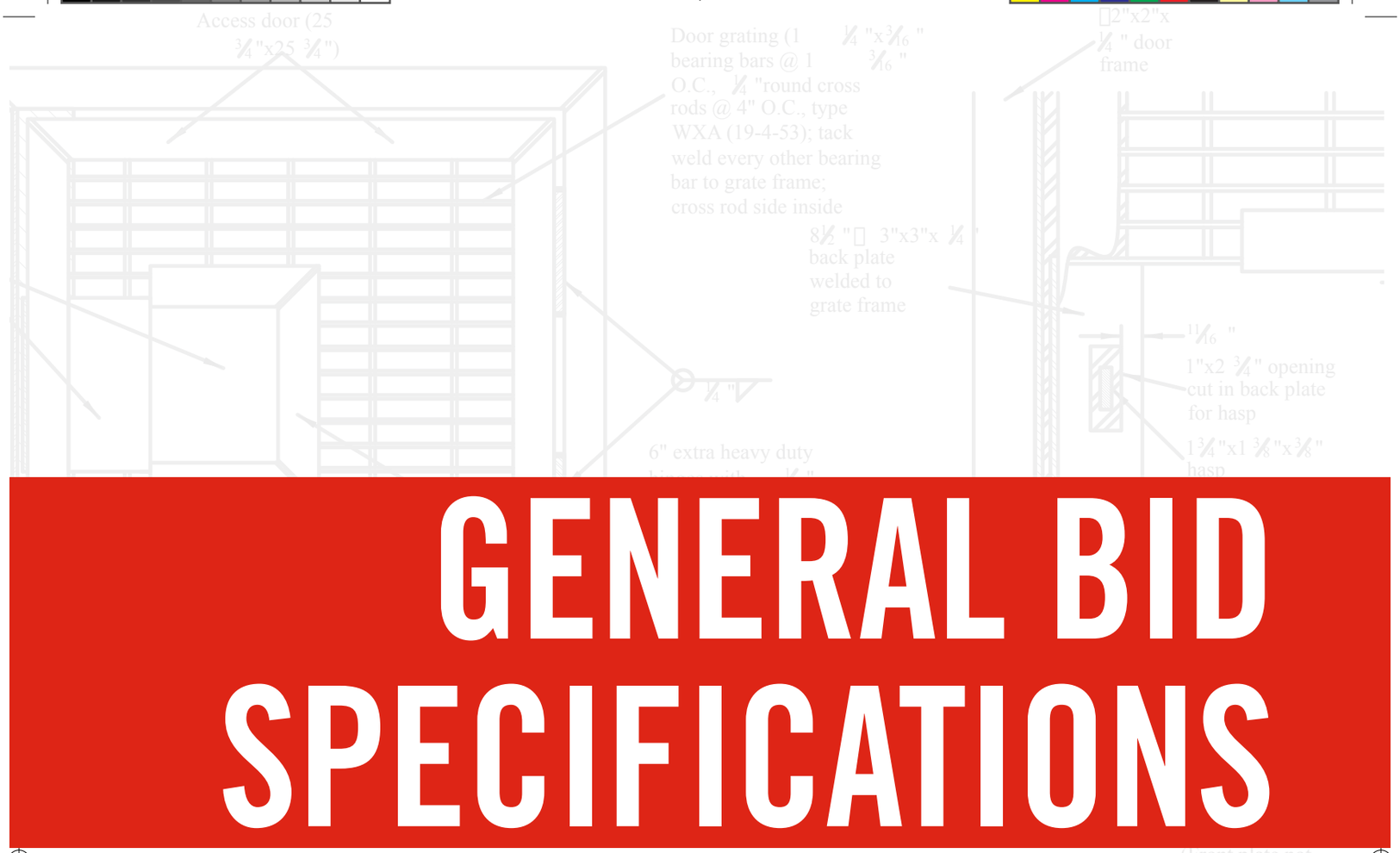

GENERAL BID SPECIFICATIONS

Colorado Inactive Mine Reclamation Program

Division of Reclamation, Mining & Safety

Department of Natural Resources

State of Colorado

March 2009

These General Bid Specifications

are intended to accompany

Special Conditions for each bid

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GENERAL BID INFORMATION

The Colorado Division of Reclamation, Mining and Safety, Inactive Mine Reclamation Program, (IMRP) mitigates the hazards and environmental problems associated with past mining operations. The program is funded with monies collected by the U.S. Department of the Interior as reclamation fees under the Surface Mining Control and Reclamation Act of 1977 as amended (SMCRA). Operating Coal mines are assessed 15 cents per ton of coal produced underground and 35 cents per ton of coal extracted using surface mining methods. Fifty percent of fees collected can be returned to the state for reclamation purposes. Lands that were mined prior to 1977 and after, per the 1990 SMCRA Amendments and for which there is no continuing reclamation responsibility, are eligible for reclamation.

The Program also undertakes a number of Non-Point Source projects, which focus on improving water quality of streams affected by past mining activities. Non-Point Source projects are funded through the Clean Water Act, and incorporate matching funds, materials and time from private companies, governmental agencies and private citizens.

Several projects to reclaim sites which were permitted under the state's Mined Land Reclamation Laws and for which the bond was forfeited are undertaken each year.

The IMRP has completed over 350 projects in 31 counties. Over 6500 hazardous features and 1400 acres have been reclaimed. Landowner consent for all project work is obtained by the IMRP before construction activities commence.

1.1 Bidding Process

Documented Quotes: Projects which are anticipated to cost over $25,000 and less than $50,000 are bid informally using the documented quotations procedures. These projects are announced in the Colorado Bidder Information Distribution System (BIDS) and a pre-bid meeting may be held. Bonds are not required, but the successful bidder must submit insurance certificates, and any other required paperwork.

Formal Bids: Projects which are anticipated to cost over $50,000 are bid through the competitive sealed bid process. All such projects are advertised in local newspapers where project work takes place. Mandatory pre-bid meetings are held at the project site. Bids are opened and read publicly by the Division of Reclamation, Mining and Safety. The successful bidder is sent a Notice of Award, must sign a contract Agreement and submit insurance, bonds and any other required information. After required paperwork is received and approved, the contract Agreement is finalized, the Notice to Proceed sent to the Contractor, and project work can commence.

1.2 Requesting Bid Documents

The Colorado Inactive Mine Reclamation Program keeps a limited active bidders list. Announcements of formal Invitations for Bids are sent to contractors who have recently bid on IMRP projects and to contractors who specifically express interest in a certain job.

All projects are posted on the BIDS website, at http://www.gssa.state.co.us/ under the link "state Purchasing Office."

1.3 Contacts

For bid documents on projects currently out to bid contact Yvonne Brannon at (303) 866-3567 ext. 8109. For information on upcoming projects or information on Colorado Procurement rules and procedures, contact Yvonne Brannon, Division of Reclamation, Mining and Safety, 1313 Sherman Street, Room 215, Denver, Colorado 80203, (303) 866-3815, or yvonne.brannon@state.co.us.

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GENERAL CONDITIONS OF THE CONTRACT

Article 1 DEFINITIONS

A. Contract Documents. The Contract Documents consist of:

(1) Agreement and Bid Schedule;

(2) Performance and Payment Bonds;

(3) Liability, Automobile and Workmen's Compensation Certificates of Insurance;

(4) Notice to Proceed; and

(5) General Conditions of the Contract.

Detailed Special Conditions, including all amendments issued prior to the opening of the bids and including any applicable Standard Work Specifications;

(1) Maps and drawings, including all amendments issued prior to the opening of the bids;

(2) Final inspection and certificate of completion;

(3) Notice of CONTRACTORS Settlement; and

(4) List of Equipment Offered.

B. Procedural Documents. The Procedural Documents consist of:

(1) Advertisement for Bids;

(2) Bid form;

(3) Bid Bond;

(4) Notice of Award;

(5) W-9/MBE/WBE Forms;

(6) AML Contractor Ownership and Control Information Package (AVS);

(7) Excluded Parties List System (EPLS);

(8) Secretary of State Registration;

(9) Standard Invoice Form; and

(10) Three-Way Agreement for Reclamation Activities, if required.

C. Correlation and Intent of the Documents

The Contract Documents are complementary; what is called for by any one document shall be as binding as if called for by all. The intention of the documents is to include all labor and materials, equipment and transportation necessary for the proper execution of the work. Materials or work described in words which have a well-known technical or trade meaning shall be held to refer to such recognized standards.

In case of a difference between the contract documents, precedence shall be given in the following respective order: Agreement, Special Conditions, Bid Schedule, Standard Work Specifications, Maps, Drawings, and General Conditions. Amendments shall take precedence in the area of the bid document

which they modify or clarify. In the case of any such difference, the matter shall be promptly brought to the attention of the PRINCIPAL REPRESENTATIVE who will make a determination in writing.

D. Words and Terms Used

AGREEMENT - The word Agreement means the written Agreement entered into by the STATE of Colorado acting by and through the PRINCIPAL REPRESENTATIVE and the CONTRACTOR for the performance of the work and payment for the work.

COLORADO LABOR - The term Colorado Labor shall be defined as provided in Title 8-17-101, et seq. CRS 1973, as amended.

CONTRACTOR - The term contractor means the sole proprietorship, partnership, or corporation entering into a Contract with the STATE of Colorado.

DRAWINGS - The word Drawings shall mean all drawings in the Special Conditions.

PRINCIPAL REPRESENTATIVE, OWNER OR STATE - The terms PRINCIPAL REPRESENTATIVE, Owner, or STATE mean the Director of the STATE of Colorado Division of Reclamation, Mining and Safety (DRMS) or his designee. The Colorado Division of Reclamation, Mining and Safety is located at 1313 Sherman Street, Room 215, Denver, Colorado, 80203, telephone (303) 866-3567.

PROJECT MANAGER - The term Project Manager means the Division of Reclamation, Mining and Safety employee or representative responsible for day to day observation of work at the project site, and general contract administration for the DRMS.

PRIVATE LANDOWNER – The term private landowner refers to the owner of the land or adjacent land upon which upon which the project is to be constructed.

SUBCONTRACTOR - A Subcontractor is a sole proprietorship, partnership or corporation which has a contract with the CONTRACTOR for the performance of labor at the site of the work regardless of whether supplying of material is part of such contract, but without contractual relationship to the PRINCIPAL REPRESENTATIVE.

WORK - The word Work means material and/or labor.

Article 2. PERFORMANCE AND PAYMENT BONDS

The CONTRACTOR shall furnish a labor and material payment bond for 100 percent of the original contract price and a performance bond for 100 percent of the original amount of the contract. The bonds are required by STATE Law, Title 24-105, 202-203, C.R.S. as amended. The bonds shall be submitted using the STATE forms. A certified or cashiers check or bank money order may be accepted in lieu of the bonds. If a surety other than a bond is used, the STATE will hold fifty percent (50%) of the surety until the final settlement date and fifty percent (50%) for six (6) months after the final settlement date.

Article 3. INSURANCE

A. The CONTRACTOR shall obtain at his own expense, and maintain at all times during the term of this contract, insurance listed below. Proof of insurance must be submitted on certificates showing the following minimum coverage:

(1) Worker's Compensation Insurance as required by STATE statute, and Employer's Liability Insurance covering all of contractor's employees acting within the course and scope of their employment.

(2) Commercial General Liability Insurance written on ISO occurrence form CG 00 01 10/93 or equivalent, covering premises operations, fire damage, independent contractors, products and completed operations, blanket contractual liability, personal injury, and advertising liability with minimum limits as follows:

(a) $1,000,000 each occurrence;

(b) $1,000,000 general aggregate;

(c) $1,000,000 products and completed operations aggregate; and

(d) $50,000.00 any one fire.

If any aggregate limit is reduced below $1,000,000 because of claims made or paid, the contractor shall immediately obtain additional insurance to restore the full aggregate limit and furnish to the STATE a certificate or other document satisfactory to the STATE showing compliance with this provision.

(3) Automobile Liability Insurance covering any auto (including owned, hire and non-owned autos) with a minimum limit as follows: $1,000,000 each accident combined single limit.

The Certificates of Insurance and insurance policies required above shall be subject to the following stipulations:

B. The STATE of Colorado shall be named as additional insured on the Commercial General Liability and Automobile Liability Insurance policies (leases and construction contracts will require the additional insured coverage for completed operations on endorsements CG 2010 11/85, CG 2037 or equivalent). Coverage required of the contract will be primary over any insurance or self-insurance program carried by the STATE of Colorado.

C. The Insurance shall include provisions preventing cancellation or non-renewal without at least 45 days prior notice to the STATE by certified mail.

D. The CONTRACTOR will require all insurance policies in any way related to the contract and secured and maintained by the contractor to include clauses stating that each carrier will waive all rights of recovery, under subrogation or otherwise, against the STATE of Colorado, its agencies, institutions, organizations, officers, agents, employees and volunteers.

E. All policies evidencing the insurance coverages required hereunder shall be issued by insurance companies satisfactory to the STATE.

F. The contractor shall provide certificates showing insurance coverage required by this contract to the STATE within ten days of the Notice of Award. No later than 15 days prior to the expiration date of any such coverage, the contractor shall deliver the STATE certificates of insurance evidencing renewals thereof. At any time during the term of this contract, the STATE may request in writing, and the contractor shall thereupon within 10 days supply to the STATE, evidence satisfactory to the STATE of compliance with the provisions of this section.

Bidders are advised to consult with their insurance carrier concerning these requirements. Submit a bid only if you are prepared to complete these requirements.

Article 4. THREE-WAY AGREEMENT

If a three-way Agreement for Reclamation Activities (see Appendix A) is required, the CONTRACTOR shall enter into a three-way agreement among the CONTRACTOR, the STATE of Colorado and the

private landowner (a sample is included in Appendix A), and maintain for the duration of the work, in addition to that specified above, additional insurance coverage of:

(a) Comprehensive General Liability Insurance, which includes operations & premises coverage, products/completed operation coverage, all on an occurrence basis, all with combined single limit of liability of $1,000,000;

(b) Statutory Worker's Compensation and Occupational Disease Disability Insurance;

(c) Employers' Liability Insurance with limits of $500,000 each occurrence; and

(d) Automobile Insurance with a combined single limit of liability of $1,000,000, and furnish evidence of the insurance coverage as prescribed the three-way agreement.

If a three-way *Agreement for Reclamation Activities* is required, the CONTRACTOR will be required to furnish lien waivers to the private landowner. See Number 5 of the sample three-way *Agreement for Reclamation Activities* (Appendix A) The landowner's address will be furnished to the CONTRACTOR with the Notice to Proceed.

Article 5. PROJECT SCHEDULE

The successful bidder shall, prior to the execution of an Agreement, furnish a plan for construction of the work showing (1) the date(s) he expects to move various pieces of equipment onto the work site, and (2) the dates and period(s) he proposes to perform each phase of the project work.

Article 6. APPLICANT VIOLATOR SYSTEM

The successful bidder will be required to submit a completed AML Contractor Ownership and Control Form and pass a check of the Applicant Violator System (AVS).

Although there are many circumstances under which a bidder might be found "not responsible", any CONTRACTOR who has had direct or indirect association with a firm that has had a permit revoked or a bond forfeited by the Division of Reclamation, Mining and Safety or the Mined Land Reclamation Board will be considered not responsible, and not eligible to be awarded any bid. Any firm listed in the Federal Office of Surface Mining's Applicant Violator System or who is not confirmed by the Office of Surface Mining will be considered not responsible

Article 7. MINORITY/WOMEN BUSINESS PARTICIPATION

The successful bidder is required to complete and return the Minority/Women Business Enterprise/W-9 Form before an Agreement will be executed

Article 8. NOTICE TO PROCEED

After the Agreement has been fully-executed, the PRINCIPAL REPRESENTATIVE will issue the Notice to Proceed consistent with the project dates in the Special Conditions. Under no circumstance shall the CONTRACTOR begin work before a Notice to Proceed is issued.

Article 9. ACCIDENT PREVENTION AND SAFETY MEASURES

The CONTRACTOR shall comply with applicable provisions of OSHA Part 1926, Construction Standards and Interpretations, in effect on the date of Bid Opening. The CONTRACTOR shall continuously maintain, at his expense, adequate protection of the work and the PRINCIPAL REPRESENTATIVE's property, and shall take all practicable precautions in the interest of safety, including: Safety Glasses (when flying debris may be encountered), steel toe boots and hard hats (except

when inside operator's cab or inside vehicle cab) are required to be worn at all times. At least two 10 pound A B C rated Dry Chemical type-portable fire extinguishers shall be on site at all times. A First Aid Station meeting MSHA requirements (CFR 75.1713-7, or 77.1707) must be kept in a sanitary condition and must be kept on site during all work operations. An emergency accident and medical evacuation/transportation plan shall be established and posted for the site.

If required by the PROJECT MANAGER, the CONTRACTOR shall prepare a Safety, Health, and Environmental Action Plan (SHEAP) for the project operations prior to beginning work.

If a SHEAP is required, the CONTRACTOR will comply with the following at a minimum:

TRAINING REQUIREMENTS: Prior to working on the site, site-specific hazard training as covered in the SHEAP will be administered to ALL persons working on the project site (both surface and underground), by the CONTRACTOR and PROJECT MANAGER, and will be acknowledged on a form attached to the SHEAP to document this training.

PROACTIVE SAFETY: The CONTRACTOR shall designate one person to be responsible for safety and health at the work site. The CONTRACTOR will conduct daily pre-work safety talks with all employees. The CONTRACTOR shall conduct daily work area safety inspections and document the results of these inspections.

Any shafts which were fenced prior to construction activities shall be protected by a temporary fence during non-working hours. Without relieving the CONTRACTOR of its legal or contractual duties to take safety precautions, other openings may be designated by the PRINCIPAL REPRESENTATIVE as requiring fencing due to proximity of houses or visitation by tourists.

Work may involve activities around unprotected hazardous mine shafts, stopes, adits and other openings which may be open to the surface or hidden from view by trash, debris, vegetation, or thin and unstable layers of surficial materials or rock. The CONTRACTOR shall be responsible for thoroughly investigating the site conditions and scheduling and directing his equipment, equipment operations, personnel and safety procedures to prevent accidents and injuries. Failure to comply will be cause for immediate suspension of the work.

All Chemicals, equipment and materials proposed and/or used in the performance of this Contract must conform to the standards required by the William-Stieger Occupational Safety and Health Act of 1970. Bidders must furnish all Material Safety Data Sheets (MSDS) for any regulated chemicals, equipment or hazardous materials at the time of delivery to the job site.

Projects involving work in or around radiological hazards will require special measures to be followed during the project as directed by the PROJECT MANAGER.

Article 10. PLANS AND WORKING DRAWINGS

The drawings if any, included with the Contract Documents are complete and adequate for construction. While every effort has been made to have the plans and drawings free of errors and ambiguities, any such errors or ambiguities must be brought to the PRINCIPAL REPRESENTATIVE's attention immediately.

Article 11. JOB PROGRESS REPORTS

The CONTRACTOR will be required to properly complete weekly or daily progress reports, forms for which will be provided by the PRINCIPAL REPRESENTATIVE. Completed reports must be submitted to the PRINCIPAL REORESENTATIVE prior to or at the time of requests for payment. Payment requests will not be processed until progress reports corresponding to the payment period are received.

Article 12. CORRESPONDENCE FROM THE CONTRACTOR

All correspondence from the CONTRACTOR to the PRINCIPAL REPRESENTATIVE shall be submitted to the PROJECT MANAGER with a copy to:

Colorado Division of Reclamation, Mining and Safety
1313 Sherman Street, Room 215
Denver, Colorado 80203
(303) 866-3567
Fax (303) 832-8106

Article 13. MATERIALS

Unless otherwise stipulated, the CONTRACTOR shall provide and pay for all materials, labor, water, tools, equipment, light, power, transportation and other facilities necessary for the execution and completion of the work.

Unless otherwise specified, all materials shall be new and both workmanship and materials shall be of good and uniform quality. The CONTRACTOR shall, if required, furnish satisfactory evidence as to the kind and quality of materials.

Article 14. PREFERENCE OF BIDDERS AND MATERIALS

The selection of materials and equipment for the work shall be in accordance with the laws of Colorado and the Buy American Act (41 U.S.C. 10) as follows:

A resident bidder shall be allowed a preference against a nonresident bidder from another STATE or a foreign country equal to the preference given or required by the STATE or foreign country in which the nonresident bidder is a resident. (Title 8-19-101 to 102, CRS, as amended).

The Buy American Act provides that the Government give preference to domestic construction material. The CONTRACTOR agrees that only domestic construction material will be used by the CONTRACTOR, subs, material men and suppliers in the performance of this agreement, except for foreign construction material, if any, listed in this agreement.

Components, as used in this clause, means those articles, materials, and supplies incorporated directly into construction materials. Construction material, as used in this clause, means an article, material or supply brought to the construction site for incorporation into the building or work. Construction material also includes an item brought to the site pre-assembled from articles, materials or supplies. However, emergency life safety systems, such as fire alarm systems, which are discrete systems incorporated into a public building or work and which are produced as a complete system, shall be evaluated as a single and distinct construction material regardless of when or how the individual parts or component of such systems are delivered to the construction site. Domestic construction material, as used in this clause means (a) an unmanufactured construction material mined or produced in the United STATEs, or (b) a construction material manufactured in the United STATEs, if the cost of its components mined produced, or manufactured in the United STATEs exceeds 50 percent of the cost of all its components. Components of foreign origin of the same class or kind as the construction materials determined by the PRINCIPAL REPRESENTATIVE or designee not to be mined, produced or manufactured in the United STATEs in sufficient and reasonably available commercial quantities of a satisfactory quality, shall be treated as domestic.

Article 15. LABOR AND WAGES

Title 8-17-101, C.R.S., as amended applies to this contract and STATEs that eighty percent of the laborers employed on each project must be Colorado labor. "Colorado labor" means any person who is a resident of the STATE of Colorado at the time of employment, without discrimination as to race, color, creed, sex, age or religion."

The rate of wages to be paid for all laborers and mechanics shall be in accordance with the laws of Colorado. The Davis-Bacon Act does not apply. The CONTRACTOR shall at all times enforce strict discipline and good order among his employees, and shall not employ on the work any unfit person or anyone not skilled in the work assigned to him.

Article 16. PROJECT MANAGER'S DECISIONS

The PROJECT MANAGER shall make decisions on all matters relating to the execution and progress of the work or the interpretation of the Contract Documents.

The PROEJCT MANAGER is, in the first instance, the judge of the performance of the Contract as it relates to compliance with drawings and specifications, quality of workmanship and material.

Article 17. WORK ACCESS AND INSPECTION

The PRINCIPAL REPRESENTATIVE shall at all times have access to the work. The CONTRACTOR shall provide proper facilities for such access and for their inspection of the work. If any work should be covered up without approval or consent of the PRINCIPAL REPRESENTATIVE, it must if required, be uncovered for examination at the CONTRACTOR'S expense.

If the Special Conditions, the PRINCIPAL REPRESENTATIVE*'s* instructions, laws, ordinances or any public authority require any work to be specifically tested or approved, the CONTRACTOR shall give the PRINCIPAL REPRESENTATIVE timely notice of its readiness for observation by the PRINCIPAL REPRESENTATIVE or inspection by another authority. If the inspection is by another authority, the CONTRACTOR shall give the PRINCIPAL REPRESENTATIVE timely notice of the date of inspection and copies of certificates of inspection being secured by the CONTRACTOR.

Article 18. PRIME CONTRACTOR

If several CONTRACTORS propose to join together to perform the work, the PRINCIPAL REPRESENTATIVE will recognize only one bonded prime CONTRACTOR, who will enter into a contract with the PRINCIPAL REPRESENTATIVE, and who will subcontract the work to such others as are required to perform the work, unless a "joint venture" arrangement between CONTRACTORS satisfactory to the PRINCIPAL REPRESENTATIVE has been executed. In this case, the "joint venture" shall be bonded in accordance with these General Conditions and shall designate a Superintendent with whom the PRINCIPAL REPRESENTATIVE can communicate and who will supervise the work and be fully responsible for the performance of the work.

Article 19. SUPERINTENDENCE OF THE WORK

The CONTRACTOR shall keep a competent and reliable superintendent on the job at all times that labor is being performed. The superintendent, in the CONTRACTOR'S absence from the site, shall stand in the stead of the CONTRACTOR and any authoritative directions given to the superintendent shall be as binding as if given to the CONTRACTOR.

The CONTRACTOR shall give efficient supervision to the work, using his best skill and attention. He shall carefully study and compare all Drawings, Specifications and other instructions and shall at once

report to the PRINCIPAL REPRESENTATIVE any error, inconsistency or omission which he may discover, but he shall not be liable to the PRINCIPAL REPRESENTATIVE for any damage resulting from any errors or deficiencies in the Contract Documents or other instructions by the PRINCIPAL REPRESENTATIVE.

The CONTRACTOR shall see that the work is carried out in accordance with the Contract Documents and in a thorough and first-class manner in every respect. The CONTRACTOR shall establish all lines, levels, grades, and marks necessary to facilitate the operations of all concerned in such CONTRACTOR'S work. He shall lay out the work in a manner satisfactory to the PRINCIPAL REPRESENTATIVE

Article 20. SUBCONTRACTORS

The CONTRACTOR shall submit to the PRINCIPAL REPRESENTATIVE, a complete list of subcontractors for the project, including the name of the proposed subcontractor and a description of the work to be subcontracted. The CONTRACTOR shall not, without prior written approval of the PRINCIPAL REPRESENTATIVE, enter into any subcontract covering any part of the work covered by this contract.

If at any time the PRINCIPAL REPRESENTATIVE determines that any subcontractor is incompetent or undesirable, he shall notify the CONTRACTOR accordingly in writing and the CONTRACTOR shall take immediate steps for cancellation of the subcontract.

Article 21. RELATIONS OF CONTRACTOR AND SUBCONTRACTOR

The CONTRACTOR agrees to bind each subcontractor to the terms of these General Conditions and to the requirements of the drawings and specifications, and any amendments or change orders, and also all the other Contract Documents, so far as applicable to the work of such subcontractor, unless specially noted to the contrary.

Nothing contained in the contract shall create any contractual relationship between any subcontractor and the PRINCIPAL REPRESENTATIVE. Approval by the PRINCIPAL REPRESENTATIVE to any subcontract or any provisions thereof shall not be construed to be a determination of the acceptability of any subcontract price, or of any amount paid under subcontract or to relieve the CONTRACTOR of any responsibility for performing all work covered by this contract.

The CONTRACTOR shall be fully responsible to the PRINCIPAL REPRESENTATIVE for the acts and omissions of his subcontractors and of persons either directly or indirectly employed by them. All instructions or orders in respect to work being done by subcontractors shall be given to the CONTRACTOR.

Subcontracting by subcontractors shall be subject to the above requirements.

Article 22. WORK BY OTHERS

The PRINCIPAL REPRESENTATIVE reserves the right to let other contracts in connection with this work.

The work site is located in a mining area and mining or other construction activities may be occurring at the same time as the work proposed under this contract. It shall be the CONTRACTOR'S responsibility to coordinate his work with those of the landowners, mining companies or other contractors on the site. The CONTRACTOR shall allow other contractors or mining companies reasonable opportunity for the introduction and storage of their materials and the execution of their work, and shall properly connect and coordinate his work with theirs.

The CONTRACTOR shall, without charge, permit the landowner, mining companies, and such other contractors to use the roads and other facilities constructed or improved by the CONTRACTOR for the contract work; provided that such usage shall in no way interfere with the contract work of the CONTRACTOR. If any part of the CONTRACTOR'S work depends, for proper execution or results, upon the work of any other contractor, the CONTRACTOR shall inspect and measure work already in place. The CONTRACTOR shall promptly report to the PRINCIPAL REPRESENTATIVE any defects in such work that render it unsuitable for proper execution and results, or any discrepancy between the executed work and the Special Conditions or Drawings. Failure of the CONTRACTOR to so inspect and report shall constitute an acceptance of the other CONTRACTOR'S work as fit and proper for the reception of his work, except as to defects which may develop in the other CONTRACTOR'S work after the execution of the CONTRACTOR'S work.

Article 23. MUTUAL RESPONSIBILITY OF CONTRACTORS

Should the CONTRACTOR cause damage to any separate CONTRACTOR on the work, the CONTRACTOR agrees, upon due notice, to settle with such CONTRACTOR by agreement if he concurs. If such separate CONTRACTOR sues the PRINCIPAL REPRESENTATIVE on account of any damage alleged to have been so sustained, the PRINCIPAL REPRESENTATIVE shall notify the CONTRACTOR, who shall defend such proceedings. If any judgment against the PRINCIPAL REPRESENTATIVE arises therefrom, the CONTRACTOR shall pay or satisfy it and pay all costs incurred by the PRINCIPAL REPRESENTATIVE.

Article 24. ACCESS AND WORKING AREA

Access to the sites or to the vicinity of sites is by public roads and private roads as shown on the drawings or as may be located in the field. Some sites may not have adequate access roads for CONTRACTOR'S methods or equipment and construction or improvement of existing roads may be required. Access roads used or constructed by the CONTRACTOR shall be maintained during use and the land reclaimed or restored to pre-existing or better conditions.

The CONTRACTOR shall keep access roads, equipment, the storage of materials and the operation of his workmen to the immediate vicinity of the work sites and shall not unreasonably encumber the premises with his materials and equipment. Caution shall be exercised at all times to avoid blocking roads or in any other way interfering with operations by others or presenting a hazard to personnel, equipment, or to the public.

The CONTRACTOR shall obtain all permits and/or permission required to use public and private roads. The CONTRACTOR shall obey all laws and regulations affecting the use of public thoroughfares.

The CONTRACTOR shall provide such temporary barricades, fences, or warning signs as may be necessary to make temporary or permanent roads safe by night as well as by day. He shall at all times have a sufficient number of watchmen, flagmen, and warning lights to protect traffic where it is interfered with by his operations, where his trucks enter or leave public roads, or where work is being done adjacent to such roads.

Article 25. PROTECTION OF WORK AND PROPERTY

The CONTRACTOR shall continuously maintain adequate protection of all his work and materials, protect the property from injury or loss arising in connection with the Contract and adequately protect adjacent property as provided by law and the Contract Documents.

The CONTRACTOR shall make good any damage, injury or loss, except such as may be:

(a) Directly due to errors in the Contract Documents;

(b) Caused by agents or employees of the PRINCIPAL REPRESENTATIVE;

(c) Due to causes beyond the CONTRACTOR'S control and not to his fault or negligence.

The CONTRACTOR shall take all necessary precautions for the safety of employees on the work site, and shall comply with all applicable provisions of Federal, STATE and Municipal safety laws and building codes to prevent accidents or injury to persons on, about or adjacent to the premises where the work is being performed. He shall erect and properly maintain at all times, as required by the conditions and progress of the work, all necessary safeguards for the protection of workmen and the public and shall post danger signs warning against the hazards created by such features of construction.

The CONTRACTOR shall take due precautions when obstructing sidewalks, streets or other public ways in any manner, and shall provide, erect and maintain barricades, temporary walkways, roadways, trench covers, colored lights or danger signals and any other devices necessary to assure the safe passage of pedestrians and automobiles.

In an emergency affecting the safety of life or posing a threat to adjoining property, the CONTRACTOR, without special instruction or authorization from the PROJECT MANAGER or PRINCIPAL REPRESENTATIVE, is hereby permitted to act, at his discretion, to prevent such threatened loss or injury; and he shall so act, without appeal, if so authorized or instructed. The PRINCIPAL REPRESENTATIVE must be notified as soon as possible in the event of any emergency. Any compensation, claimed by the CONTRACTOR on account of emergency work, shall be determined by agreement for extra compensation.

Article 26. HISTORICAL PRESERVATION

Areas adjacent to the mine sites often contain related artifacts and structures, such as buildings, tipples, ore houses, headframes and foundations, which may be historically significant. Care shall be exercised to avoid any impact to these structures and artifacts, in order to preserve their integrity. Existing structures, except shaft timbering, shall not be used as load-bearing devices

Article 27. ELECTRICAL POWER, POTABLE AND CONSTRUCTION WATER

The CONTRACTOR shall be responsible for providing electrical power and potable and construction water as needed to perform the contract work. If the CONTRACTOR desires to use power other than portable generators, the CONTRACTOR plans for providing such power will be subject to the PRINCIPAL REPRESENTATIVE's prior approval. The cost for providing power and water will not be paid for separately but shall be included in the bid prices of the various work items. The CONTRACTOR shall install and maintain all utilities in such manner as to protect the public and workmen and conform to any applicable laws and regulations. Upon completion of the work he shall remove all such temporary utilities from the site.

Article 28. PROTECTION OF EXISTING UTILITIES

Utilities, both underground and aboveground, may exist which could affect construction work covered under this contract. The CONTRACTOR is responsible for determining the nature and locations of any and all utilities which could affect construction work covered under this contract. The horizontal and vertical locations of utilities may vary. The CONTRACTOR is responsible for excavation and equipment movement without damage to utilities. The CONTRACTOR assumes all responsibility for damages to any utilities he causes under this contract.

When construction crosses highways, railroads, streets or utilities under the jurisdiction of STATE, County, City or other Public agency, Public Utility or private entity, the CONTRACTOR shall secure proper written permission before executing such construction. The CONTRACTOR will be required to furnish a proper release before final acceptance of the work.

Article 29. PERMITS, LICENSES AND REGULATIONS

Permits and licenses at a Federal, STATE, County and/or local level, required for prosecution of the work shall be procured and paid for by the CONTRACTOR.

Article 30. TAXES

STATE of Colorado as purchaser is exempt from all Federal taxes under Chapter 32 of the Internal Revenue Code (Registration No. 84-730123K) and from all STATE and Local Government Use Taxes (Ref. Colorado Revised Statutes Chapter 39-26.114(a)). (the IMRP Colorado STATE and Local Sales Exemption Number is 98-022381). The Contractor is hereby notified that when materials are purchased in certain political subdivisions (e.g.-the City of Denver), the Contractor may be required to pay sales tax even though the ultimate product or service is provided to the STATE of Colorado. This sales tax will not be reimbursed by the STATE.

Article 31. ROYALTIES AND PATENTS

The CONTRACTOR shall pay all royalties and license fees. He shall defend all suits or claims for infringement of any patent rights and shall save the STATE of Colorado harmless from loss on account thereof.

Article 32. PROJECT PUBLICITY

The PRINCIPAL REPRESENTATIVE will be sole provider of information about the project work to area residents and special districts, county, STATE, and federal agencies, and individuals from the media. Any contact with these groups by the CONTRACTOR must be cleared through the PRINCIPAL REPRESENTATIVE.

Article 33. TIME OF COMPLETION

It is hereby understood and mutually agreed, by and between the parties hereto, that the date of beginning, rate of progress and the time for completion of the work to be done hereunder are *Essential Conditions* of the Contract; and it is further understood and agreed that the work embraced in this Contract shall be commenced in the time to be specified in the Notice to Proceed.

It is further agreed that time is of the essence of each and every portion of the Contract and of the specifications wherein a definite and certain length of time is fixed for the performance of any act whatsoever; and where under the Contract an additional time is allowed for the completion of any work, the new time limit fixed by such extension shall also be of the essence of the Contract.

The CONTRACTOR agrees that work will be performed with due diligence in accordance with accepted engineering and construction practices to the end that the entire contract work shall be completed within the time specified in the Special Conditions after receipt of the Notice to Proceed. It is expressly understood and agreed, by and between the parties, that the stipulated performance time for completion of the work described is a reasonable time for completion of the work, taking into consideration all factors, including average climatic conditions and usual construction practices prevailing in the area.

Article 34. TEMPORARY SUSPENSION OF WORK

If the CONTRACTOR is responsible for a delay in progress of the work, the CONTRACTOR shall, without additional cost, work overtime and use such additional equipment and manpower as may be necessary to complete the contract work by the stipulated date. Failure to comply will be grounds for termination of this Agreement as stipulated below or assessment of liquidated damages as stipulated under Article 39, LIQUIDATED DAMAGES.

The STATE, acting by and through the PRINCIPAL REPRESENTATIVE, shall have the authority to suspend the work, either wholly or in part, for such period or periods as he or they may deem necessary due to:

(a) Unsuitable weather;

(b) Faulty workmanship;

(c) Improper superintendence

(d) CONTRACTOR failure to carry out orders or to perform any provision of the Contract Documents; and

(e) Conditions which may be considered unfavorable for the prosecution of the work.

Additional time will be added to the performance time for the contract for (a) above only.

If it should become necessary to stop work for an indefinite period, the CONTRACTOR shall store all materials in such manner that they will not become an obstruction or become damaged in any way; and he shall take every precaution to prevent damage to or deterioration of the work, provide suitable drainage and erect temporary structures where necessary.

Such Suspend Work Order shall be in writing and the CONTRACTOR shall again proceed with the work when so notified in writing.

Article 35. ESTIMATED QUANTITIES

The CONTRACTOR understands and agrees that:

(a) The quantities and measurements set forth in the Special Conditions are in no case exact and in some instances the exact quantities and measurements are impossible to determine until after conditions have become known during construction;

(b) The quantities shown in the Special Conditions are for use as a basis for comparing bids only;

(c) The PRINCIPAL REPRESENTATIVE does not expressly, or by implication, agree that the actual amount of work performed or material furnished or installed will correspond therewith;

(d) During the progress of the work the PRINCIPAL REPRESENTATIVE may find it advisable and shall have the right to make changes in locations of portions of the work, to omit portions of the work and to increase or decrease the quantities, as may be deemed necessary or desirable;

(e) Under no circumstances or conditions will the CONTRACTOR be paid anything on account of anticipated profits upon the work or any portion thereof covered by the Contract which is not actually performed;

(f) Under no circumstances or conditions will the CONTRACTOR be paid more than the unit price bid for any item of the Bid because the actual quantity is greater or less than the quantity shown in the Bid or Bid Schedule, and

(g) Measurements of any openings have been made in sufficient detail to establish general shapes and dimensions. The locations and dimensions of vertical and horizontal openings and depths of materials shown on the documents as waste material, soil and unconsolidated material and rock material are approximate measurements only and shall be verified by excavation.

Article 36. DIFFERING SITE CONDITIONS

(a) The CONTRACTOR shall promptly, and before such conditions are disturbed, notify the PRINCIPAL REPRESENTATIVE of:

(1) subsurface or latent physical conditions at the site differing materially from those indicated in the Contract, or

(2) unknown physical conditions at the site, of an unusual nature, differing materially from those ordinarily encountered and generally recognized as inherent in work of the character provided for in this Contract.

The PRINCIPAL REPRESENTATIVE shall promptly investigate the conditions, and if he finds that such conditions do materially so differ and cause an increase or decrease in the CONTRACTOR'S cost of, or the time required for, performance of any part of the work under this Contract, whether or not changed as a result or such conditions, an equitable adjustment shall be made and the Contract modified in writing accordingly.

(b) No claim of the CONTRACTOR under this clause shall be allowed unless the CONTRACTOR has given the notice required in (a) above; provided, however, the time prescribed therefore may be extended by the STATE.

Article 37. CHANGES IN THE WORK

The PRINCIPAL REPRESENTATIVE, without invalidating the Contract, may order extra work, or make any other reasonably related changes by altering, adding to, or deducting from, the work; the contract price and time for completion of the work will be adjusted accordingly by written change order.

All such work shall be executed under the conditions of the original contract except that any claim for extension of time caused by changes authorized in the change order shall be included in the written change order.

The PRINCIPAL REPRESENTATIVE shall have authority to make minor changes in the work, not involving extra cost, and not inconsistent with the purpose of the work, but otherwise, except in an emergency endangering life or property, no extra work or change in the Contract Documents shall be made unless by a change order. No claim by the CONTRACTOR for an equitable adjustment hereunder shall be allowed if asserted after final payment under this Contract, approved by the PRINCIPAL REPRESENTATIVE. No claim for any change to the Contract sum shall be valid unless so ordered.

The value of any extra work or change shall be determined in one or more the following ways:

(a) By estimate and acceptance in a lump sum;

(b) By unit prices named in the Contract;

(c) By actual cost plus a fixed fee, or percentage, the latter agreed upon prior to starting the extra or changed work.

Changed work shall be adjusted and considered separately for the work either added or omitted. The amount of adjustment for work omitted shall be estimated at the time it is authorized, and the agreed adjustment will be deducted from the subsequent monthly progress payments.

Article 38. CLAIMS FOR EXTRA COST

If the CONTRACTOR claims that any instructions, by drawings or otherwise, involve extra cost under this Contract, he shall give the PRINCIPAL REPRESENTATIVE written Notice thereof within a reasonable time after the receipt of such instructions. In any event, before proceeding to execute the work, except in emergency endangering life or property, the procedure shall be as provided for under Article 36, CHANGES IN THE WORK. No such claim shall be valid unless so made.

In all such cases, the CONTRACTOR shall keep a correct account of the extra cost, in such form as the PRINCIPAL REPRESENTATIVE may direct, and shall present such account, supported by receipts. The PRINCIPAL REPRESENTATIVE shall be entitled to reject any claim for extra cost whenever the foregoing procedure is not followed.

The payments to the CONTRACTOR in respect of such extra costs shall be limited to reimbursement for the current additional expenditure by the CONTRACTOR made necessary by the change in the work, plus a reasonable amount of overhead and profit, determined solely with reference to the additional work, if any, required by the change, at or prior to the time of making the change.

Any claim by the CONTRACTOR arising by virtue of the Contract which is not disposed of by agreement shall be submitted in writing, together with any written and oral evidence in support thereof, to the PRINCIPAL REPRESENTATIVE for decision. Before making a decision the PRINCIPAL REPRESENTATIVE may notify the CONTRACTOR that additional written and/or oral evidence in support of the claim is required. If such notice is given, CONTRACTOR shall provide additional evidence to the PRINCIPAL REPRESENTATIVE within the time specified by the PRINCIPAL REPRESENTATIVE in the notice. The PRINCIPAL REPRESENTATIVE shall make his decision in writing and mail or otherwise furnish a signed copy to the CONTRACTOR. Pending the decision of the PRINCIPAL REPRESENTATIVE, the CONTRACTOR shall proceed diligently with the performance of the Contract.

Article 39. LIQUIDATED DAMAGES

If the CONTRACTOR shall neglect, fail or refuse to complete the work within the time agreed upon in this Agreement or any extension thereof, the CONTRACTOR shall be liable to the PRINCIPAL REPRESENTATIVE in the amount specified in the Special Conditions for this project for each and every calendar day the completion of the work is delayed beyond the time provided in this Agreement, as fixed and agreed liquidated damages, and not as a penalty. If the PRINCIPAL REPRESENTATIVE terminates the CONTRACTOR'S right to proceed, the resulting damage will consist of liquidated damages until such reasonable time as may be required for final completion of the work along with any increased costs incurred by the PRINCIPAL REPRESENTATIVE in completing the work. If the PRINCIPAL REPRESENTATIVE does not terminate the CONTRACTOR'S right to proceed, the resulting damage will consist of liquidated damages until the work is completed or accepted.

The PRINCIPAL REPRESENTATIVE shall have the right to deduct from and retain out of monies which may be due or which may become due and payable to the CONTRACTOR, the amount of such liquidated damages; and if the amount so retained by the PRINCIPAL REPRESENTATIVE is insufficient to pay in full such liquidated damages, the CONTRACTOR shall pay to the PRINCIPAL REPRESENTATIVE the amount necessary to effect payment in full of such liquidated damages.

Article 40. DAMAGES

If either party to this Contract shall suffer damage in any manner because of any wrongful act or neglect of the other party or of anyone employed by him, then he shall be reimbursed by the other party for such

damage, except that the PRINCIPAL REPRESENTATIVE shall be responsible for and at his option insure against loss of use of any of his existing property, due to fire or otherwise, however caused.

Claims under this clause shall be made in writing to the party liable within a reasonable time of the first observance of such damage and not later than the time of final payment, except as expressly stipulated otherwise in the case of faulty work or materials.

Article 41. STATE'S RIGHT TO DO THE WORK

If the CONTRACTOR should neglect to prosecute the work properly or fail to perform any provision of the Contract, the PRINCIPAL REPRESENTATIVE, after seven (7) days' written notice to the CONTRACTOR and the Surety may, without prejudice to any other remedy he may have, make good such deficiencies and may deduct the cost thereof from the payment then or thereafter due the CONTRACTOR.

Article 42. STATE'S RIGHTS TO TERMINATE THE CONTRACT

A. General

If the CONTRACTOR should be adjudged as bankrupt, or if he should make a general assignment for the benefit of his creditors, or if a receiver should be appointed to take over his affairs, or if he should fail to prosecute his work with due diligence and carry the work forward in accordance with his work schedule and the time limits set forth in the Contract Documents, or if he should fail to subsequently perform one or more of the provisions of the Contract Documents to be performed by him, the PRINCIPAL REPRESENTATIVE may serve Written Notice on the CONTRACTOR and the Surety on his performance and payment bonds, stating his intention to exercise one of the remedies hereinafter set forth and the grounds upon which the PRINCIPAL REPRESENTATIVE bases his right to exercise such remedy. In such event, unless the matter complained of is satisfactorily cleared within ten (10) days after serving such Notice, the PRINCIPAL REPRESENTATIVE may, without prejudice to any other right or remedy, exercise one of such remedies, at once.

B. Conditions and Procedures

(1) The PRINCIPAL REPRESENTATIVE may terminate the services of the CONTRACTOR, which termination shall take effect immediately upon serving notice to the CONTRACTOR and his Surety, whereupon the Surety shall have the right to take over and perform the Contract. If the Surety does not commence performance of the Contract within ten (10) days after service of the notice of termination, the PRINCIPAL REPRESENTATIVE may take over the work, take possession of and use all materials, tools, equipment and appliances on the premises and prosecute the work to completion by such means as he shall deem best. In the event of such termination of his service, the CONTRACTOR shall not be entitled to any further payment under his contract until the work is completed and accepted. If the PRINCIPAL REPRESENTATIVE takes over the work and if the unpaid balance of the contract price exceeds the cost of completing the work, including compensation for any damages or expenses incurred by the PRINCIPAL REPRESENTATIVE through the default of the CONTRACTOR, such excess shall be paid to the CONTRACTOR. If, however, the cost, expenses and damages as certified by the PRINCIPAL REPRESENTATIVE exceed such unpaid balance of the contract price, the CONTRACTOR and his Surety shall pay the difference to the PRINCIPAL REPRESENTATIVE.

(2) The PRINCIPAL REPRESENTATIVE may take control of the work and either make good the deficiencies of the CONTRACTOR or direct the activities of the CONTRACTOR in doing so, employing such additional help as the PRINCIPAL REPRESENTATIVE deems advisable. In such event the PRINCIPAL REPRESENTATIVE shall be entitled to collect from the CONTRACTOR and his Surety, or to deduct from any payment then or thereafter

due the CONTRACTOR, the costs incurred in having such deficiencies made good and any damages or expenses incurred through the default of the CONTRACTOR, provided the PRINCIPAL REPRESENTATIVE approves the amount thus charged to the CONTRACTOR.

(3) The PRINCIPAL REPRESENTATIVE may require the Surety on the CONTRACTOR'S bond to take control of the work at once and see to it that all the deficiencies of the CONTRACTOR are made good, with due diligence. As between the PRINCIPAL REPRESENTATIVE and the Surety, the cost of making good such deficiencies shall all be borne by the Surety. If the Surety takes over the work, either upon termination of the services of the CONTRACTOR or upon instructions from the PRINCIPAL REPRESENTATIVE to do so, the provisions of the Contract Documents shall govern in respect of the work done by the Surety, the Surety being substituted for the CONTRACTOR as to such provisions, including provisions as to payment for the work and provisions of this Article as to the right of the PRINCIPAL REPRESENTATIVE to do the work or take control of the work.

Article 43. TERMINATION FOR CONVENIENCE OF STATE

(a) The performance of work under this Contract may be terminated, in whole or from time to time in part, by the STATE whenever for any reason the PRINCIPAL REPRESENTATIVE shall determine that such termination is in the best interest of the STATE. Termination of work hereunder shall be effected by delivery to the CONTRACTOR of a Notice of Termination specifying the extent to which performance of work under the Contract is terminated and the date upon which such termination becomes effective.

(b) After receipt of the Notice of Termination the CONTRACTOR shall cancel his outstanding commitments hereunder covering the procurement of materials, supplies, equipment and miscellaneous items. In addition, the CONTRACTOR shall exercise all reasonable diligence to accomplish the cancellation or diversion of his outstanding commitments covering personal services and extending beyond the date of such termination to the extent that they relate to the performance of any work terminated by the Notice. With respect to such canceled commitments the CONTRACTOR agrees to:

(1) settle all outstanding liabilities and all claims arising out of such cancellation of commitments, with approval or ratification of the PRINCIPAL REPRESENTATIVE, to the extent he may require, which approval or ratification shall be final for all purposes of this clause, and

(2) assign to the STATE, in the manner, at the time, and to the extent directed by the PRINCIPAL REPRESENTATIVE, all of the right, title, and interest of the CONTRACTOR under the orders and subcontracts so terminated, in which case the STATE shall have the right, in its discretion, to settle or pay any or all claims arising out of the termination of such orders and subcontracts.

(c) The CONTRACTOR shall submit his termination claim to the PRINCIPAL REPRESENTATIVE promptly after receipt of a Notice of Termination, but in no event later than ninety (90) days from the effective date of termination, unless one or more extensions in writing are granted by the PRINCIPAL REPRESENTATIVE upon written request of the CONTRACTOR within such one year period or authorized extension thereof. Upon failure of the CONTRACTOR to submit his termination claim within the time allowed, the PRINCIPAL REPRESENTATIVE may determine, on the basis of information available to him, the amount, if any, due to the CONTRACTOR by reason of the termination and shall thereupon pay to the CONTRACTOR the amount so determined.

(d) Costs claimed, agreed to, or determined pursuant to (c) above and (e) below shall be in accordance with the provisions of ARTICLE 107 (COST PRINCIPLES) of the Colorado Procurement Code and Rules as in effect on the date of this Contract.

(e) Subject to the provisions of paragraph (c) above, the CONTRACTOR and the PRINCIPAL REPRESENTATIVE may agree upon the whole or any part of the amount or amounts to be paid to the CONTRACTOR by reason of the termination under this clause, which amount or amounts may include any reasonable cancellation charges thereby incurred by the CONTRACTOR and any reasonable loss upon outstanding commitments for personal services which he is unable to cancel; provided, however, that in connection with any outstanding commitments for personal services which the CONTRACTOR is unable to cancel, the CONTRACTOR shall have exercised reasonable diligence to divert such commitments to his other activities and operations. Any such agreement shall be embodied in an amendment to this Contract and the CONTRACTOR shall be paid the agreed amount.

(f) The STATE may from time to time, under such terms and conditions as it may prescribe, make partial payments against costs incurred by the CONTRACTOR in connection with the termination portion of this Contract, whenever, in the opinion of the PRINCIPAL REPRESENTATIVE, the aggregate of such payments is within the amount to which the CONTRACTOR will be entitled hereunder.

(g) The CONTRACTOR agrees to transfer title and deliver to the STATE, in the manner, at the time, and to the extent, if any, directed by the PRINCIPAL REPRESENTATIVE, such information and items which, if the Contract had been completed, would have been required to be furnished to the STATE, including:

(1) completed or partially completed plans, drawings and information; and

(2) materials or equipment produced or in process or acquired in connection with the performance of the work terminated by the Notice.

Other than the above, any termination inventory resulting from the termination of the Contract may, with written approval of the PRINCIPAL REPRESENTATIVE, be sold or acquired by the CONTRACTOR under the conditions prescribed by and at a price or prices approved by the PRINCIPAL REPRESENTATIVE. The proceeds of any such disposition shall be applied in reduction of any payments to be made by the STATE to the CONTRACTOR under this Contract or shall otherwise be credited to the price or cost of work covered by this Contract or paid in such other manner as the PRINCIPAL REPRESENTATIVE may direct. Pending final disposition of property arising from the termination, the CONTRACTOR agrees to take such action as may be necessary, or as the PRINCIPAL REPRESENTATIVE may direct, for the protection and preservation of the property related to this Contract which is in the possession of the CONTRACTOR and in which the STATE has or may acquire an interest.

(h) Any disputes as to questions of fact, which may arise hereunder, shall be subject to the provisions of ARTICLE 109 (REMEDIES) of the Colorado Procurement Code.

Article 44. CONTRACTOR'S RIGHT TO STOP WORK OR TERMINATE CONTRACT

If the work shall be stopped under an order of any court or other public authority for a period of three (3) months through no act or fault of the CONTRACTOR or of any one employed by him, then the CONTRACTOR may, on seven (7) days' written Notice to the PRINCIPAL REPRESENTATIVE and the PROJECT MANAGER, stop work or terminate this Contract and recover from the PRINCIPAL REPRESENTATIVE payment for all work executed, any losses sustained on any material, and a reasonable profit.

This provision shall not apply to work suspended due to conditions unsatisfactory for the prosecution of the work, including winter weather conditions.

Article 45. CLEANUP

The CONTRACTOR shall at all times keep the construction area free from accumulations of waste material or rubbish resulting from his work. Upon completion of the work, the CONTRACTOR shall

remove from the vicinity of the work and haul all rubbish, trash, garbage, and construction debris to a county-approved disposal site. Additionally, the CONTRACTOR shall remove from the vicinity all unused materials, and the like, belonging to the CONTRACTOR or used under the CONTRACTOR'S direction during construction.

Cleanup is subject to the approval of the PRINCIPAL REPRESENTATIVE.

Article 46. PERIODIC PARTIAL PAYMENTS

If the time for completion of the work is more than one month, the CONTRACTOR may requisition and receive monthly progress payments in the amount of ninety percent (90%) of the value of the work completed to date, less the total of such previous payments, if the CONTRACTOR is satisfactorily performing the contract.

On some occasions, after approval by the PRINCIPAL REPRESENTATIVE, payment may be made on account of materials not incorporated in the work but delivered and suitably stored at the site, or at some other location agreed upon in writing. Such payments shall be conditioned upon submission by the CONTRACTOR of bills of sale or such other procedure as will establish the PRINCIPAL REPRESENTATIVE*'s* title to such material or otherwise adequately protect the PRINCIPAL REPRESENTATIVE*'s* interest, including applicable insurance.

The Division of Reclamation, Mining and Safety will accept original invoices only. Change order amounts and retainage must be invoiced separately from items included in the original contract. All invoices, except the final invoice, and the payments thereunder, shall be subject to correction in the next invoice following the discovery of any error. The final payment, or the retainage bill, shall STATE “Final Bill” on the invoice.

STATE law and regulations provide that CONTRACTORS will be paid within 45 days after receipt of a correct invoice. A STATE liability not paid within 45 days is considered delinquent and, unless otherwise agreed to, interest on the unpaid balance shall be paid beginning with the forty-sixth day at the rate of one percent per month on the unpaid balance until paid in full. A liability shall not arise if a good faith dispute exists as to the agency's obligation to pay all or a portion of the liability. CONTRACTORS shall invoice separately for interest on delinquent amounts due. The billing shall reference the delinquent payment, the number of day’s interest to be paid and the applicable interest rate (24-30-202(24), C.R.S. as amended).

Article 47. PAYMENTS WITHHELD

The PROJECT MANAGER or the PRINCIPAL REPRESENTATIVE may hold, or, on account of subsequently discovered evidence, nullify the whole or any part of any invoice on account of:

(a) Defective work not remedied;

(b) Claims filed or reasonable evidence indicating probable filing of claims;

(c) Failure of the CONTRACTOR to make payment to subcontractors or for material or labor;

(d) A reasonable doubt that the Contract can be completed for the balance of the contract price then unpaid;

(e) Damage to another CONTRACTOR;

(f) Failure to obtain necessary permits or licenses or to comply with applicable laws, ordinances, codes, rules or regulations;

(g) Failure to submit weekly progress reports;

(h) Failure of the CONTRACTOR to keep his work progressing in accordance with his time schedule;

(i) Failure to keep a superintendent on the work;

(j) Unauthorized deviations by the CONTRACTOR from the Contract Documents.

When the grounds for such withholding or nullifying are removed, payment shall be made for the amounts withheld.

If the PRINCIPAL REPRESENTATIVE deems inexpedient the correction of damaged work or of work not performed in accordance with the contract, equitable reduction of contract price shall be made.

Article 48. FINAL INSPECTION

The PRINCIPAL REPRESENTATIVE shall make *final inspection* of the project to determine whether the work has been completed in accordance with the Contract Documents. A final punch list shall be made by the PRINCIPAL REPRESENTATIVE on the *Final Inspection and Certificate of Completion* form in sufficient detail to fully outline to the CONTRACTOR:

(a) Work to be completed, if any;

(b) Work not in compliance with the drawings or specifications, if any;

(c) Unsatisfactory work for any reason, if any.

If any punch-list results from the final inspection, the CONTRACTOR shall promptly rectify all items on it.

Article 49. FINAL INSPECTION AND CERTIFICATE OF COMPLETION

The *Final Inspection and Certificate of Completion* shall establish the completion date of the project.

Article 50. SETTLEMENT

The PRINCIPAL REPRESENTATIVE shall not authorize final payment until all items on the punch list have been completed, the *Final Inspection and Certificate of Completion* issued, and the Notice of CONTRACTOR'S Settlement published. Before the PRINCIPAL REPRESENTATIVE may advertise, the CONTRACTOR shall deliver the PRINCIPAL REPRESENTATIVE all guaranties and warranties, and daily or weekly Job Logs.

When the PRINCIPAL REPRESENTATIVE indicates acceptance of the work, the CONTRACTOR may requisition final payment, including retainage, on account of the contract price.

Before such final payment may be made the PRINCIPAL REPRESENTATIVE must comply with Title 38-26-107 C.R.S. as amended, which requires that publication of a notice of final settlement with the CONTRACTOR be made twice for projects over $50,000.00, in a newspaper of general circulation in the county wherein the Agreement was made (usually Denver County) and the county wherein the work was performed. The date fixed in such notice, before which final payment to the CONTRACTOR may not be made, must be no less than ten days after the publication of the notice.

Any unpaid creditor of the CONTRACTOR who supplied labor and/or material for the work has those ten days in which to file with the PRINCIPAL REPRESENTATIVE a verified STATEment of the amount due and unpaid. The PRINCIPAL REPRESENTATIVE must withhold from payment to the CONTRACTOR the total amount of such claim for a period of ninety days after the date in the notice fixed for settlement, but the PRINCIPAL REPRESENTATIVE may not directly make payment to the creditor(s). If within those ninety days a creditor does not reach settlement with the CONTRACTOR, he must file with the PRINCIPAL REPRESENTATIVE a notice that he has brought action at law, otherwise the PRINCIPAL REPRESENTATIVE, at expiration of ninety days, will pay the CONTRACTOR for the amount withheld.

Article 51. GUARANTY AND WARRANTIES

The CONTRACTOR shall furnish the PRINCIPAL REPRESENTATIVE with a written guaranty for one year covering all labor, materials and workmanship incorporated in the work. The CONTRACTOR, in instances of work performed or material or equipment furnished for which warranties are required by the specifications, shall procure such warranties and deliver them to the PRINCIPAL REPRESENTATIVE on completion of the work. Such warranties will in no way lessen the CONTRACTOR'S responsibilities under the Agreement. Whenever warranties or guarantees are required by the specifications for a period longer than one year, such longer period shall govern. Written guaranties must be received by the PRINCIPAL REPRESENTATIVE before final payment will be approved.

Article 52. ASSIGNMENT

The CONTRACTOR shall not assign the whole or any part of this Contract as any moneys due or to become due hereunder without the written consent of the PRINCIPAL REPRESENTATIVE. No assignment without said prior approval shall be valid. In case the CONTRACTOR assigns all or part of any moneys due or to become due under this Contract, the instrument of assignment shall contain a clause substantially to the effect that it is agreed that the right of the assignee in and to any moneys due or to become due to the CONTRACTOR shall be subject to all claims of all persons, firms, and corporations for services rendered or materials supplied for the performance of the work called for in this Contract, whether said service or material were supplied prior to, or after the assignment.

Article 53. LIENS

There is no right of Mechanic's Lien against publicly-owned property in the STATE of Colorado. However, as outlined in **Article 51 SETTLEMENT**, unpaid labor and/or materials suppliers for the work are by law provided certain alternate remedies.

Article 54. POST-COMPLETION INSPECTIONS

Final payment made to the CONTRACTOR on account of the work shall not operate to relieve the CONTRACTOR of responsibility for faulty material or workmanship, and unless otherwise provided the CONTRACTOR shall remedy any defect due thereto and pay for any damages resultant therefrom which shall appear within one year from the date of final acceptance of the work, which date will be that of the Final Inspection and Certificate of Completion.

If the CONTRACTOR fails promptly to correct the punch list items resulting from such inspections, the PRINCIPAL REPRESENTATIVE may correct such defects and deficiencies and backcharge the CONTRACTOR for the cost thereof.

Article 55. ACCESS TO DOCUMENTS

The CONTRACTOR shall grant access to the STATE, the Office of Surface Mining Reclamation and Enforcement, the Comptroller General of the United STATEs, or any of their duly authorized representatives to any books, documents, papers and records of the CONTRACTOR which are directly pertinent to this contract for the purpose of audit, examination, excerpts and transcriptions. All required records shall be retained for three years after final settlement and all other matters are closed.

Article 56. CORRUPT INFLUENCES

The signatories hereto aver that they are familiar with 18-8-301 et seq. (Bribery and corrupt influences) and 18-8-401, et seq. (abuse of Public Office), C.R.S., as amended and that no violation of such provisions is present.

Article 57. COLORADO SPECIAL PROVISIONS

These Special Provisions apply to all contracts except where noted in *italics*.

1. **CONTROLLER'S APPROVAL**. **CRS §24-30-202(1)**. This contract shall not be valid until it has been approved by the Colorado STATE Controller or designee.

2. **FUND AVAILABILITY**. **CRS §24-30-202(5.5)**. Financial obligations of the STATE payable after the current fiscal year are contingent upon funds for that purpose being appropriated, budgeted, and otherwise made available.

3. **GOVERNMENTAL IMMUNITY**. No term or condition of this contract shall be construed or interpreted as a waiver, express or implied, of any of the immunities, rights, benefits, protections, or other provisions, of the Colorado Governmental Immunity Act, CRS §24-10-101 et seq., or the Federal Tort Claims Act, 28 U.S.C. §§1346(b) and 2671 et seq., as applicable now or hereafter amended.

4. **INDEPENDENT CONTRACTOR**. Contractor shall perform its duties hereunder as an independent contractor and not as an employee. Neither Contractor nor any agent or employee of Contractor shall be deemed to be an agent or employee of the STATE. Contractor and its employees and agents are not entitled to unemployment insurance or workers compensation benefits through the STATE and the STATE shall not pay for or otherwise provide such coverage for Contractor or any of its agents or employees. Unemployment insurance benefits will be available to Contractor and its employees and agents only if such coverage is made available by Contractor or a third party. Contractor shall pay when due all applicable employment taxes and income taxes and local head taxes incurred pursuant to this contract. Contractor shall not have authorization, express or implied, to bind the STATE to any agreement, liability or understanding, except as expressly set forth herein. Contractor shall **(a)** provide and keep in force workers' compensation and unemployment compensation insurance in the amounts required by law, **(b)** provide proof thereof when requested by the STATE, and **(c)** be solely responsible for its acts and those of its employees and agents.

5. **COMPLIANCE WITH LAW**. Contractor shall strictly comply with all applicable federal and STATE laws, rules, and regulations in effect or hereafter established, including, without limitation, laws applicable to discrimination and unfair employment practices.

6. **CHOICE OF LAW.** Colorado law, and rules and regulations issued pursuant thereto, shall be applied in the interpretation, execution, and enforcement of this contract. Any provision included or incorporated herein by reference which conflicts with said laws, rules, and regulations shall be null and void. Any provision incorporated herein by reference which purports to negate this or any other Special Provision in whole or in part shall not be valid or enforceable or available in any action at law, whether by way of complaint, defense, or otherwise. Any provision rendered null and void by the operation of this provision shall not invalidate the remainder of this contract, to the extent capable of execution.

7. **BINDING ARBITRATION PROHIBITED.** The STATE of Colorado does not agree to binding arbitration by any extra-judicial body or person. Any provision to the contrary in this contact or incorporated herein by reference shall be null and void.

8. **SOFTWARE PIRACY PROHIBITION. Governor's Executive Order D 002 00**. STATE or other public funds payable under this contract shall not be used for the acquisition, operation, or maintenance of computer software in violation of federal copyright laws or applicable licensing restrictions. Contractor hereby certifies and warrants that, during the term of this contract and any extensions, Contractor has and shall maintain in place appropriate systems and controls to prevent such improper use of public funds. If the STATE determines that Contractor is in violation of this provision, the STATE may exercise any remedy available at law or in equity or under this contract, including, without limitation, immediate termination of this contract and any remedy consistent with federal copyright laws or applicable licensing restrictions.

9. **EMPLOYEE FINANCIAL INTEREST/CONFLICT OF INTEREST. CRS §§24-18-201 and 24-50-507**. The signatories aver that to their knowledge, no employee of the STATE has any personal or beneficial interest whatsoever in the service or property described in this contract. Contractor has no interest and shall not acquire any interest, direct or indirect, that would conflict in any manner or degree with the performance of Contractor's services and Contractor shall not employ any person having such known interests.

10. **VENDOR OFFSET**. **CRS §§24-30-202 (1) and 24-30-202.4**. [***Not Applicable to intergovernmental agreements***] Subject to CRS §24-30-202.4 (3.5), the STATE Controller may withhold payment under the STATE's vendor offset intercept system for debts owed to STATE agencies for: **(a)** unpaid child support debts or child support arrearages; **(b)** unpaid balances of tax, accrued interest, or other charges specified in CRS §39-21-101, et seq.; **(c)** unpaid loans due to the Student Loan Division of the Department of Higher Education; **(d)** amounts required to be paid to the Unemployment Compensation Fund; and **(e)** other unpaid debts owing to the STATE as a result of final agency determination or judicial action.

11. **PUBLIC CONTRACTS FOR SERVICES**. **CRS §8-17.5-101**. [***Not Applicable to agreements relating to the offer, issuance, or sale of securities, investment advisory*** services ***or fund management services, sponsored projects, intergovernmental agreements, or information technology services or products and services***] Contractor certifies, warrants, and agrees that it does not knowingly employ or contract with an illegal alien who will perform work under this contract and will confirm the employment eligibility of all employees who are newly hired for employment in the United STATEs to perform work under this contract, through participation in the E-Verify Program or the Department program established pursuant to CRS §8-17.5-102(5)(c), Contractor shall not knowingly employ or contract with an illegal alien to perform work under this contract or enter into a contract with a subcontractor that fails to certify to Contractor that the subcontractor shall not knowingly employ or contract with an illegal alien to perform work under this contract. Contractor **(a)** shall not use E-Verify Program or Department program procedures to undertake pre-employment screening of job applicants while this contract is being performed, **(b)** shall notify the subcontractor and the contracting STATE agency within three days if Contractor has actual knowledge that a subcontractor is employing or contracting with an illegal alien for work under this contract, **(c)** shall terminate the subcontract if a subcontractor does not stop employing or contracting with the illegal alien within three days of receiving the notice, and **(d)** shall comply with reasonable requests made in the course of an investigation, undertaken pursuant to CRS §8-17.5-102(5), by the Colorado Department of Labor and Employment. If Contractor participates in the Department program, Contractor shall deliver to the contracting STATE agency, Institution of Higher Education or political subdivision a written, notarized affirmation, affirming that Contractor has examined the legal work status of such employee, and shall comply with all of the other requirements of the Department program. If Contractor fails to comply with any requirement of this provision or CRS §8-17.5-101 et seq., the contracting STATE agency, institution of higher education or political subdivision may terminate this contract for breach and, if so terminated, Contractor shall be liable for damages.

12. **PUBLIC CONTRACTS WITH NATURAL PERSONS. CRS §24-76.5-101.** Contractor, if a natural person eighteen (18) years of age or older, hereby swears and affirms under penalty of perjury that he or she **(a)** is a citizen or otherwise lawfully present in the United STATEs pursuant to federal law, **(b)** shall comply with the provisions of CRS §24-76.5-101 et seq., and **(c)** has produced one form of identification required by CRS §24-76.5-103 prior to the effective date of this contract.

Revised 11-14-08
Issued by the Office of the STATE Controller Date Issued: 7/1/74 Rule 3-1 Date Revised: 1/1/09

APPENDIX A: Three-Way Agreement for Reclamation Activities

Recorded at ___ o'clock _M

Reception #_____ Recorder

AGREEMENT FOR RECLAMATION ACTIVITIES

This Agreement is made this _____ day of _____, 20___, between (owner) _____ the STATE of Colorado, acting through its Department of Natural Resources, Division of Reclamation, Mining and Safety ("Colorado"), and _____ ("Contractor").

_____ represents to Colorado and Contractor that it owns the described real property located in the County of _____and the STATE of Colorado:

Legal Description:

Colorado has included sites on tracts of land owned by _____in its Abandoned Mine Reclamation Plan ("Plan") approved by the Office of Surface Mining Reclamation and Enforcement of the United STATEs Department of the Interior on June 11, 1982 pursuant to Title IV of the Surface Mining Control and Reclamation Act of 1977. Colorado has offered to conduct, at no cost to _____, reclamation activities pursuant to the Plan on the Project site. Colorado proposes to hire Contractor to perform the reclamation activities.

_____ is willing to give its consent to such reclamation activities on the conditions described in this Agreement.

Therefore, in consideration of the consent and permission granted to Colorado and Contractor by _____ grants permission to Colorado, its agents, employees, and contractors, including _____, Colorado and Contractor agree with_____ as follows:

1. Contractor, to enter upon the project site for the length of time necessary (but not exceeding 24 months) to complete the work described in the "Project Narrative" (Exhibit A to this Agreement) which is attached to and made a part of this Agreement (the "Work"). Colorado shall give reasonable notice to _____ before its entry and its commencement of the Work.

2. Contractor shall effect, at no cost to _____, the Work described in Exhibit A in a good and workmanlike manner. The Work shall, once commenced, be diligently pursued to completion and without unreasonable delay. Contractor guarantees that the Work shall be free from defects in materials and workmanship and that all materials incorporated into the Work shall be fit for the use and purpose intended and shall not be subject to any chattel mortgage, security agreement, or other interest in a third party.

3. In effecting the Work under this Agreement, Contractor, its agents, employees, and subcontractors, shall comply with all applicable federal, STATE, and local laws, rules, and regulations. All Work required to be performed by licensed personnel shall be carried out by personnel so licensed.

4. All persons performing any Work under this Agreement, including all employees, agents, servants, and subcontractors engaged by Contractor shall be at all times the sole employees of and subject to the control and direction of Contractor and shall not be the employees or subject to the direction or control of _____ in any way.

5. Contractor shall pay all sales, occupational, gross receipts, compensating, business, excise, or other taxes of any kind levied or imposed in connection with the Work. In addition, the contractor shall furnish the landowner with valid lien waivers duly executed by the contractor and by all other persons or other entities which might otherwise acquire liens upon the lands described above pursuant to the Colorado General Mechanics' Lien Act, Section 38-22-101 to 133 C.R.S.

6. Contractor shall assume the risk of all injuries, including death resulting therefrom, to persons, (including employees and contractors of Contractor, _____or any third party) and damage to and destruction of property resulting directly or indirectly, wholly or in part, from the prosecution or omission of any work or obligation undertaken or required by this Agreement or the occupation and possession of the premises, and shall indemnify and save harmless _____ (including its officers, employees, agents, and/or affiliated companies) from and against any and all liability arising therefrom, including all expense, legal or otherwise, incurred by_____ in the investigation and defense of any claim or suit. Contractor agrees to indemnify _____ from and against any and all liability arising from activities and work conducted pursuant to this Agreement on the above-described _____property for the duration of the actual period of work. It is mutually understood and agreed that the assumption of liabilities and indemnification provided for in this Agreement shall survive any termination of this Agreement.

7. Contractor shall secure, or cause anyone entering upon the premises at its request to secure, before commencing and shall maintain or cause to be maintained during the performance of the Work (a) Comprehensive General Liability Insurance, which includes operations & premises coverage, products/completed operation coverage, contractual liability coverage, all on an occurrence basis, all with combined single limit of liability of $1,000,000.00; (b) Statutory Workmen's Compensation and Occupational Disease Disability Insurance; 8 Employers' Liability Insurance with limits of $500,000.00 each occurrence; (d) Automobile Insurance with a combined single limit of liability of $1,000,000.00. Prior to commencing work, Contractor shall also furnish to _____evidence of the foregoing insurance coverage in the form of Certificates of Insurance. All such insurance shall be underwritten by an insurance company acceptable to _____.

8. The duties and obligations of Contractor in Sections 2 through 7 above are enforceable only against Contractor and not Colorado.

9. Colorado agrees that the Work will be designed and engineered in accordance with professional standards generally prevailing in Colorado.

10. All the covenants and agreements of Contractor contained in this Agreement shall inure to the benefit of the successors and assigns of _____.

11. This Agreement shall be effective for the period of time necessary for Colorado and Contractor to effect the Work, but in no event shall the permission for entry extend beyond 24 months after the date of this Agreement unless _____ has specifically agreed to an extension in writing.

12. The performance of the said reclamation activities upon the said lands shall in no way preclude or restrict _____, its successors or assigns, from utilizing the said lands for the purpose of investigating, prospecting, exploring, developing, mining, operating for, producing, consuming, transporting and marketing all grades and types of coal or any other type of mineral situated and lying or being in, under or upon the said lands by any method of methods deemed desirable by _____, his successors or assigns, whether the same be now or hereafter known, expressly including, but not limited to, mining by strip, open pit, underground, auger, solution, and in-situ combustion methods.

The landowner has an existing responsibility to insure that any abandoned or inactive mine openings located on his/her properties are adequately safeguarded and all present and subsequent landowners are required to maintain the mine closure after the Work had been completed as outlined in C.R.S. 34-24-110(1). This responsibility is unchanged by this consent to have these reclamation activities performed.

IN WITNESS WHEREOF, _____, Colorado and Contractor have executed this Agreement effective the date first written above.

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

Date_____ By:_____

Title:_____

_____

Witnessed By

CONTRACTOR

Date_____ By:_____

Title:_____

_____

Witnessed By

LANDOWNER

Date_____ By:_____

Title:_____

_____

Witnessed By

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STANDARD WORK SPECIFICATIONS

STANDARD DRAWINGS

(Following Standard Work Specifications)

Standard Drawing No.	Title
1	Precast Concrete Panel Closure
2	Hollow Core Shaft Closure
3	Concrete Shaft Closure
4	Grated Shaft Closure
5	Corrugated Steel Adit Closure
6	Grated Adit Closure, Sheets 1 and 2
7	Adit Door Closure
8	Chain Link Fencing
9	Barbed-Wire Fencing
10	Rock Bulkhead Closure
11	Vertical Culvert Door and Cover
12	Concrete Block Wall Closure
13	Wire Rope Netting

Section 1

MOBILIZATION/DEMOBILIZATION

1.1 DESCRIPTION

This specification covers CONTRACTOR'S operations for:

a. Payment of premiums for bonds and insurance acquired specifically for the construction of this project, including premiums for performance and payment bonds;

b. Movement of personnel, equipment, operation supplies, and incidentals to the project site;

c. Establishment of office, buildings, and other necessary temporary facilities at the project site;

d. Preparatory work at the construction site;

e. All temporary barricades or fencing used to safeguard mine openings during construction; and

f. Demobilization of CONTRACTOR'S equipment and all other facilities, final project clean-up, and all other work for which payment is not otherwise provided for under the contract.

The temporary facilities may include, but not be limited to the following:

a. Workshops, offices, storage yards, and construction plant and equipment including spare parts, fuels, and oil;

b. Sanitation facilities, communication facilities, and sprinkler trucks;

c. CONTRACTOR'S electrical power system; and,

d. Other items such as water, compressed air, etc., not specifically listed but required for the functioning of construction activities.

1.2 RELATED WORK

Section 20 – Revegetation

1.3 REFERENCE DOCUMENTS

None

1.4 EXECUTION

1.4.1 Mobilization

Upon receipt of the Notice to Proceed, CONTRACTOR shall furnish, mobilize, move in, and install such temporary works and equipment as are necessary for the successful completion of the work. CONTRACTOR shall also operate and maintain such temporary works, equipment and construction plant throughout the period of construction. All applicable temporary works, such as sanitation facilities, shall fully comply with all rules and regulations.

Clearing and grubbing operations necessary for the temporary works, if any, shall also be included as mobilization.

1.4.2 Fencing

Any shafts which were fenced prior to construction, or other openings as designated by PROJECT MANAGER, shall be protected by a temporary fence during non-working hours.

1.4.3 Demobilization

Upon completion of the work under this Contract, CONTRACTOR shall remove all temporary facilities and equipment. CONTRACTOR shall remove from the work site all rubbish, unused materials, and shall fill and dress all holes and disturbances made for convenience, and leave all areas in good order and condition, subject to the approval of PROJECT MANAGER.

1.4.4 Remobilization

If remobilization becomes necessary due to seasonal conditions beyond CONTRACTOR'S control, remobilization costs will be paid based on documented actual costs. No remobilization payment will be made if delays necessitating remobilization were CONTRACTOR'S responsibility.

1.5 MEASUREMENT AND PAYMENT

No measurement for payment shall be made for mobilization and demobilization. Payment of two thirds of the lump sum price bid will be made with the first monthly progress payment after completion of the work described above for mobilization. Payment of one third of the lump sum price bid will be made with the final progress payment for the work if demobilization has been completed. If the price bid for mobilization and demobilization is greater than 15 percent (15%) of the total contract price, original invoices supporting the mobilization costs will be required before payment is approved.

Section 2

BACKFILL CLOSURE

2.1 DESCRIPTION

This work shall consist of backfilling mine openings with on-site or imported fill materials, revegetation of disturbed areas, project signage, monumentation, and erosion control as designated in the specifications or by PROJECT MANAGER. Mine openings may be shafts, adits, collapsed stopes or other features some of which may be small requiring the use of hand labor or small equipment to complete the closure.

2.2 RELATED WORK

Section 20 – Revegetation
Section 21 – Project Sign
Section 22 – Erosion Control

2.3 REFERENCE DOCUMENTS

ASTM C150 – Standard Specification for Portland Cement.
ASTM C1107 – Standard Specification for Non-Shrink Grout
ASTM D2104 – Standard Specification for Polyethylene (PE) Plastic Pipe, Schedule 40.

2.4 MATERIALS

Backfill Materials shall be on site Rockfill, Common Backfill or other materials as designated by PROJECT MANAGER. CONTRACTOR may use on-site rock backfill materials if permission is obtained from the landowner by CONTRACTOR and with the approval of PROJECT MANAGER.

Common Backfill shall consist of, hard, durable and well graded material with a median diameter of approximately 12 inches and sufficient finer particles to minimize the presence of voids when placed, as determined by PROJECT MANAGER.

Rockfill shall consist of durable rock particles having an equivalent median diameter of approximately two feet (24”), the smallest particle approximately one foot (12”), and the largest dimension no more than three feet (3’) as approved by PROJECT MANAGER.

Drain Pipe shall be six-inch (6”) nominal diameter SDR-35 or Schedule 40 perforated PVC, ABS or HDPE drain pipe.

Monument Pipe shall be new, six foot (6’) long, three inch (3”) inside diameter Schedule 40 galvanized steel pipe.

Brass Cap furnished by OWNER.

Non-Shrink Grout shall be Moly Parabond, Pour Rock, or QUIKRETE

Cement shall be Type II Portland cement, conforming to ASTM C150.

2.5 EXECUTION

2.5.1 Shaft, Stope, and Subsidence Feature Backfilling

Prior to backfilling shafts, stopes, and subsidence features CONTRACTOR shall remove all wood, garbage, cribbing, or other vegetative materials as directed by PROJECT MANAGER. All trash and debris shall be hauled to a county approved land fill, as directed by PROJECT MANAGER. Shafts, stopes and subsidence features shall be backfilled using a sequential backfill technique. First, Rockfill shall be placed in the opening to a minimum thickness of twelve feet (12') or to a depth three feet (3') below the final surface. In deep openings or water filled openings, Rockfill shall be placed in the opening until visible from the edge of the opening. The remaining fill shall be Common Backfill and may be obtained on site as directed by PROJECT MANAGER. The final one foot (1') of fill material shall be comparable to surrounding surface material and shall be suitable for plant growth. The final surface of the backfilled opening shall be mounded a minimum of three feet (3') above the surrounding ground level to allow for settlement. Backfill shall be compacted as directed by PROJECT MANAGER in lifts of one foot (1') or less using multiple passes with available heavy equipment. The final one foot (1') of fill material shall not be compacted.

A Monument Pipe shall be installed at the center of each backfilled feature. The lower two feet (2') of pipe shall be set in concrete a minimum one foot (1') diameter, and the upper one foot (1') minimum, two feet (2') maximum, of the pipe shall extend above grade. Alternatively, a minimum one foot (1') diameter 3/8-inch thick galvanized steel plate may be welded perpendicular to the bottom end of the pipe to act as an anchor, in place of the concrete. CONTRACTOR shall grout a brass cap flush to ¼" below the top of the pipe using non-shrink grout.

2.5.2 Adit Backfilling - Rockfill

Prior to backfilling adits, CONTRACTOR shall remove all wood, garbage, cribbing, or other vegetative materials as directed by PROJECT MANAGER. All trash and debris shall be hauled to a county approved land fill, as directed by PROJECT MANAGER.

Adits shall be backfilled to a minimum depth of fifteen feet (15') from the inner top of the fill to the outer top of the fill. There shall be no spaces between the top of the fill and the roof of the adit that exceed three inches (3") and there shall be no space between the top of the fill and the roof of the adit at the entrance of the adit. The innermost three feet (3') of the backfill shall consist entirely of large diameter rock as determined by PROJECT MANAGER. The remainder of the fill with the exception of the outermost one foot (1') shall consist of Rockfill and/or Common Fill as determined by PROJECT MANAGER. The outermost one foot (1') of backfill shall consist of suitable plant-growth medium. CONTRACTOR may be required to use hand labor, a tamping device or a fabricated ram to place the necessary rock.

2.5.3 Adit Backfilling – Soil Cement Backfill

Alternatively, where acceptable rock is not available, or where directed by PROJECT MANAGER, a soil cement mixture may be used. The soil cement will consist of on-site soil mixed with Portland cement in a ratio of 20:1 by volume (20 units of soil to 1 unit of cement). The on-site materials shall be well graded, with less than 5% passing the No. 200 Sieve, contain sufficient water to feel moist, and be approved by PROJECT MANAGER. The soil shall not be acidic or toxic in nature. Soil materials and Portland cement shall be thoroughly blended by mechanical means prior to placement. This may be done by machine or by hand. The entire length of the backfill except for the outermost three feet (3') feet shall be composed of soil cement. The outermost three feet (3') shall be composed of backfill material suitable for plant growth.

2.5.4 Adit Backfilling - Drainage

Where there is a water discharge from the adit to be backfilled, a six-inch (6") diameter drain pipe shall be placed at the bottom of the fill. The drain pipe shall be bedded in a minimum of six inches (6") of granular fill and covered with at least six inches (6") of compacted granular fill prior to backfilling the

adit. The granular fill shall contain no particles greater than two inches (2") in the largest dimension. The ends of the pipe shall extend at least five feet (5') beyond the inside and outside edges of the backfill.

2.5.5 Adit Backfilling - Monumentation

A Monument Pipe shall be installed at the center of each backfilled feature. The lower two feet (2') of pipe shall be set in concrete a minimum one foot (1') diameter, and the upper one foot (1') minimum, two feet (2') maximum, of the pipe shall extend above grade. Alternatively, a minimum one foot (1') diameter 3/8-inch thick galvanized steel plate may be welded perpendicular to the bottom end of the pipe to act as an anchor, in place of the concrete. CONTRACTOR shall grout an OWNER furnished brass cap flush to ¼" below the top of the pipe. using a non-shrink grout. CONTRACTOR may alternatively drill and grout a brass cap in undisturbed, competent rock immediately adjacent to each backfilled feature.

2.5.6 Revegetation, Project Sign, and Erosion Control

If required, revegetation, furnishing, placing, and maintaining Project Sign, and Erosion Control shall be completed in accordance with Section 20 – Revegetation., Section 21, Project Sign, and Section 22, Erosion Control.

2.6 MEASUREMENT AND PAYMENT

No measurement for payment shall be made for these bid items. Payment shall be for the lump sum bid price. The price bid shall include all of CONTRACTOR's cost of whatever nature to provide a complete backfill closure, and, if required, revegetation of disturbed areas, project sign, and erosion control in accordance with the specifications.

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Section 3

BLASTING

3.1 DESCRIPTION

This work shall consist of sealing openings through the use of controlled blasting techniques, revegetation of disturbed areas, project signage, monumentation, and erosion control as designated in the specifications or by PROJECT MANAGER.

3.2 RELATED WORK

Section 20 – Revegetation
Section 21 – Project Sign
Section 22 – Erosion Control

3.3 MATERIALS

A detailed blasting plan, complying with regulations of either The Colorado State Division of Labor or the Colorado Mined Land Reclamation Board for Coal Mining shall be submitted to PROJECT MANAGER a minimum of ten (10) days prior to any blasting. At a minimum, the blasting plan shall include the following:

a. The supplier and manufacturer and type of the explosives or blasting agents and detonators and method of initiation;

b. The name of the explosive expert in CONTRACTOR'S employ or the subcontractor proposed to supervise the blasting operation, the expert's experience along with evidence of a valid current permit for storage and use of explosives;

c. Proof of compliance with any County regulations and notification to the respective County Sheriff's office a minimum of 48 hours prior to the start of blasting operations;

d. Within 24 hours following blasting, provide PROJECT MANAGER with a copy of the completed Blaster's report as prepared for the Colorado State Division of Labor (Chapter VI, Use of Explosive Materials, 6.1 General Provisions, Paragraph T.): or the Colorado Mined Land Reclamation Board for Coal Mining, (Performance Standards, 4.08.5). PROJECT MANAGER may direct the use of a seismograph during the blast.

f. Provisions to be taken for employee and public safety.

All materials and procedures shall comply with the following regulations:

The Colorado State Division of Labor Section 9-7-105, CRS (1998), or the Colorado Mined Land Reclamation Board for Coal Mining Rules 34-33-120(2)(o)(III) Concurrence by OWNER with the blasting plan will not relieve CONTRACTOR of any responsibility, including safety and completion of the work as specified.

3.4 EXECUTION

PROJECT MANAGER shall be present during blasting activities. The size of broken rock left after blasting which creates the closure shall be such that it cannot be removed by hand. No opening greater than 36 square inches shall remain unless one of the two dimensions is three inches (3") or less.

Horizontal Openings: Existing entry ways shall be collapsed by means of controlled blasting such that entry is prevented for a minimum depth of fifteen feet (15') from the surface. If conditions permit, this

will require blasting inside the entry way for this distance. The construction of a permanent backstop to contain the blasted material may be permitted at the fifteen foot minimum distance but shall be approved by PROJECT MANAGER.

Vertical Openings: Vertical openings shall be collapsed by means of controlled blasting such that entry is prevented and the feature is stabilized with filled material conforming to the surrounding topography. Mounding of blasted material should be avoided.

Monument: A new, six foot (6') long, three inch (3") inside diameter galvanized steel pipe shall be installed in front of each horizontal collapsed opening (adit) and in the center of each vertical collapsed opening. The lower two feet (2') of pipe shall be set in concrete a minimum of one foot (1') diameter and the upper one foot (1') minimum, two feet (2') maximum, shall extend above grade. Alternatively, a minimum one foot (1') diameter 3/8-inch thick steel plate may be welded perpendicular to the bottom end of the pipe in lieu of the concrete anchor. A brass cap shall be grouted flush to ¼" below the pipe by CONTRACTOR using a non-shrink grout, such as, Moly Parabond, Pour Rock, or QUIKRETE. CONTRACTOR may alternatively drill and grout a brass cap in undisturbed, competent rock immediately adjacent to each blasted feature. The brass caps will be supplied by OWNER.

3.5 MEASUREMENT AND PAYMENT

No measurement for payment shall be made for these bid items. Payment shall be for the lump sum bid price. The price bid shall include all of CONTRACTOR'S cost of whatever nature to provide a complete closure in accordance with the plans and specifications.

Section 4

PRECAST CONCRETE PANEL CLOSURE

4.1 DESCRIPTION

This work shall consist of installing OWNER furnished precast concrete panels and, if required, CONTRACTOR furnished steel beams, including clearing and grubbing, excavation of panel footings and beam seats, furnishing, installation, and welding of steel beams and tie plates to tie bars, backfilling, revegetation of disturbed areas, project signage, monumentation, and erosion control in accordance with Standard Drawing No. 1 and these specifications. Precast concrete panels will be provided by OWNER.

4.2 RELATED WORK

Section 20 – Revegetation
Section 21 – Project Sign
Section 22 – Erosion Control

4.3 REFERENCE DOCUMENTS

Standard Drawing No. 1.
ACI 301 – Specifications for Structural Concrete.
ACI 305 – Recommended Practice for Hot Weather Concreting.
ACI 306 – Recommended Practice for Cold Weather Concreting.
ASTM A36 – Standard Specification for Carbon Structural Steel.
ASTM A53 – Standard Specification for Pipe, Steel, Black and Hot Dipped, Zinc Coated, Welded and Seamless.
ASTM C31 - Standard Specification for Making and Curing Concrete test Specimens in the Field.
ASTM C33 - Standard Specification for Concrete Aggregate.
ASTM C39 - Standard Test Method for Ready Mixed Concrete.
ASTM C94 - Standard Specification for Compressive Strength of Cylindrical Concrete Specimens.
ASTM C150 - Standard Specification for Portland Cement.
ASTM C172 - Standard Practice for Sampling Freshly Mixed Concrete.
ASTM C494 - Standard Specification for Chemical Admixtures for Concrete.
ASTM C1107 – Standard Specification for Non-Shrink Grout
ASTM D615 – Standard Specification for Plain and Deformed Carbon Steel bars for Concrete Reinforcement.
AASHTO M 36 – Standard Specification for Corrugated Steel Pipe, Metallic Coated
AASHTO M 294 – Standard Specification for Corrugated Polyethylene Pipe.
CDOT Standard Specifications, 2005 – Section 601 – Structural Concrete.

4.4 MATERIALS

Tie Bars shall be supplied by CONTRACTOR and shall be ASTM A-36 steel bar.

Steel Beams shall be ASTM A36 all-purpose steel and shall be supplied by CONTRACTOR.

Concrete for beam installation shall be Colorado Department of Transportation Class D concrete having a minimum compressive strength of 4,500 psi at 28 days.

Steel Beam Coating shall be bituminous asphalt or coal tar epoxy coating.

Drain Pipe shall be six-inch (6") nominal diameter SDR-35 or Schedule 40 perforated PVC, ABS or HDPE drain pipe.

Monument Pipe shall be new, six foot (6') long, three inch (3") inside diameter Schedule 40 galvanized steel pipe.

Brass Cap furnished by OWNER.

Non-Shrink Grout shall be Moly Parabond, Pour Rock, or QUIKRETE.

Concrete Panels will be furnished by OWNER with grating for access openings when required. The dimensions and approximate weights of the precast concrete panels are as follows:

A-1 panels, 5' x 10' (with and without grates)	4,500 pounds
B-1 panels, 6' x 12' (with and without grates)	6,500 pounds
A-1 half panels, 5' x 5'	2,250 pounds
B-1 half panels, 3' x 12'	3,250 pounds
C-1 panels, 3' x 18'	6,400 pounds
D-1 panels, 7' x 10'	6,300 pounds
E-1 panels, 5' x 14'	6,300 pounds
E-1 half panels, 2.5' x 14'	3,100 pounds

The concrete panels will be transported and delivered by OWNER to storage areas near the project site. CONTRACTOR shall transport precast panels from storage areas to the job sites. CONTRACTOR is responsible for determining the location of the storage area and including the cost of loading and transporting the concrete panels to the job site in his bid. CONTRACTOR shall inspect panels prior to transport to the project site. Damage found on panels shall be reported to OWNER prior to transport. Panels found to be damaged during transportation to the job sites or installation will be replaced at CONTRACTOR'S expense.

4.5 EXECUTION

4.5.1 Clearing and Grubbing

The work site shall be cleared and grubbed of vegetation, debris, loose rocks and other items which interfere with construction, except those items shown on the plans or designated by PROJECT MANAGER as to remain. All trash and debris shall be disposed of at a county approved disposal site, as directed by PROJECT MANAGER.

4.5.2 Excavation

Mine openings to be closed with precast concrete panels or panels and beams were originally excavated in competent rock. Many are now surrounded by weathered rock and/or by loose waste rock and soils. The depth of the loose material varies. If upon excavation the depths of these materials at any site are found to be over eight feet (8'), unless otherwise noted in the Special Conditions, such condition shall be reported to PROJECT MANAGER immediately. CONTRACTOR shall inspect the opening and lay out his excavation such that his equipment will provide an excavation for panel footings and beam seats in general conformance with Standard Drawing No. 1.

Excavation may reveal conditions which, as determined by PROJECT MANAGER, necessitate a revised layout of panels and beams. CONTRACTOR shall complete the excavation, panel footings and beam seats for the revised layout as required by PROJECT MANAGER.

Panel footings and/or beam seats shall be excavated through surficial materials and weathered rock to competent rock. Competent rock is defined as rock which cannot be readily removed by a medium sized

excavator weighing in the 45,000 pound to 55,000 pound range, or otherwise as determined by PROJECT MANAGER. The excavation shall be located such that the panels overlap a minimum of two feet (2') on competent rock and overlap equally on each side of the opening. Trimming by use of hand or pneumatic tools may be required in conjunction with leveling as shown on Standard Drawing No. 1 to obtain an adequate panel or beam footing. Panel footings shall be trimmed and leveled in accordance with the details shown on Standard Drawing No. 1, such that each panel has more than 2/3 of the length of each side resting on a planar rock or concrete surface and so there are no gaps more than one foot (1') long and six inches (6") deep. Fine grained fill may be used as a leveling course as long as the average depth does not exceed two (2) inches. The final footing and/or beam seat excavation and leveling shall be approved by PROJECT MANAGER prior to installation of precast panels.

CONTRACTOR shall be responsible for site inspections, testing or exploration necessary to insure that his bid adequately reflects excavation conditions, including hand trimming and leveling required. All excavation of whatever nature shall be done in accordance with the plans. In all cases CONTRACTOR is responsible for complete excavation, including situations requiring revised layout of panels. Where additional panels are required, the bid price for additional panel installation shall include the cost for excavating the panel footing.

4.5.3 Beam Installation

Steel beams shall be placed on a concrete leveling course a minimum of three inches (3") thick. Steel beams shall be coated with a bituminous tar or epoxy resin tar prior to installation. Steel beams shall be set such that the vertical axis is perpendicular to the plane of the panel footings and the top of the beam is in the plane of the panel footings. The beams shall extend a minimum of one foot (1') beyond the edge of the panel. Steel beams shall be totally encased in concrete for the entire length of the beam which rests on the footing surface, except for the top portion where panels will be placed. Concrete shall be poured a minimum of three inches (3") thick over ends, sides and top of the beam. Panels may be set on steel beams immediately following the enclosure of beam ends in concrete.

4.5.4 Panel Installation

Panels shall be placed on prepared panel footings and/or beams leaving a maximum one-inch (1") space between panels. Panels shall be placed such that they rest uniformly on a planar panel footing and beam surface with no discernible rocking motion. Inadequate footing leveling, as determined by PROJECT MANAGER, shall be repaired by shimming or additional concrete as directed by PROJECT MANAGER. The edge of the panels shall be located within two inches (2") of the beam center line. There shall be a maximum six degrees (6o) deviation from a planar surface between adjacent panels and a maximum three inch (3") vertical offset. If panels are placed more than fifteen degrees (15º) from horizontal, CONTRACTOR is required to key-in and anchor the panels to competent rock as directed by PROJECT MANAGER. Anchors shall be #8 rebar or rock bolts grouted with non-shrink grout in 18-inch deep drill holes on 24-inch centers. The anchors shall be welded to the panel tie plates. After approval by PROJECT MANAGER, panels shall be welded together using a tie bar in accordance with Standard Drawing No. 1. CONTRACTOR shall remove the lifting hooks from the panels, as directed by PROJECT MANAGER.

4.5.5 Monumentation

After the panels have been installed, CONTRACTOR shall install a brass cap near the center of the closure. The brass caps will be supplied by OWNER. If the closure includes a grate, a brass cap may be already attached to the grate and no additional brass cap is required. If a brass cap is required, install abrass cap by drilling a hole in one panel large enough to accommodate the shank of the brass cap, then grout the cap in place with non-shrink grout.

4.5.6 Revegetation, Project Sign, and Erosion Control

If required, revegetation, furnishing, placing, and maintaining Project Sign, and Erosion Control shall be completed in accordance with Section 20 – Revegetation., Section 21, Project Sign, and Section 22, Erosion Control.

4.5.5 Backfill and Drainage Berms

The side slopes of the excavation shall be backfilled with uncompacted excavated material or waste rock at a slope of 1 ½ H:1 V and maximum panel encroachment of two and a half feet [2 1/2'] as shown on Standard Drawing No. 1. Drainage berms shall be constructed of uncompacted waste rock or excavated material to direct surface runoff away from the opening. All areas including access routes and work areas that are disturbed by CONTRACTOR shall be revegetated according to the specifications in this document, unless otherwise noted.

4.6 MEASUREMENT AND PAYMENT

No measurement for payment shall be made for these bid items. Payment shall be for the lump sum bid price based upon the total number of panels and beams estimated for the entire project. Panels installed in excess of the estimated number will be paid according to the unit price bid for installation of additional panels. The price bid for additional panels shall include the cost of excavating for additional panels. The price bid shall include all of CONTRACTOR'S cost of whatever nature to provide a complete closure installation in accordance with the plans and specifications, including storage and handling of precast concrete units, clearing and grubbing, surveying, excavation, hand trimming, leveling, including concrete work, installation and welding, backfill and final grading, berm construction, spoil handling, and revegetation of disturbed areas.

Section 5

HOLLOW CORE SHAFT CLOSURE

5.1 DESCRIPTION

This specification covers all work and materials required to construct a Hollow Core Shaft Closure including a vertical grated access culvert, if specified. The work will consist of building forms, placing reinforcing steel, installing the culvert, pouring concrete, backfilling, revegetation of disturbed areas, project signage, monumentation, and erosion control as designated in the specifications and as shown on Standard Drawing No. 2 or designated by PROJECT MANAGER.

5.2 RELATED WORK

Section 20 – Revegetation
Section 21 – Project Sign
Section 22 – Erosion Control

5.3 REFERENCE DOCUMENTS

Standard Drawing No. 2.
Standard Drawing No. 11.
ACI 301 – Specifications for Structural Concrete.
ACI 305 – Recommended Practice for Hot Weather Concreting.
ACI 306 – Recommended Practice for Cold Weather Concreting.
ASTM A53 – Standard Specification for Pipe, Steel, Black and Hot Dipped, Zinc Coated, Welded and Seamless.
ASTM C31 - Standard Specification for Making and Curing Concrete test Specimens in the Field.
ASTM C33 - Standard Specification for Concrete Aggregate.
ASTM C39 - Standard Test Method for Ready Mixed Concrete.
ASTM C94 - Standard Specification for Compressive Strength of Cylindrical Concrete Specimens.
ASTM C150 - Standard Specification for Portland Cement.
ASTM C172 - Standard Practice for Sampling Freshly Mixed Concrete.
ASTM C494 - Standard Specification for Chemical Admixtures for Concrete.
ASTM C1107 – Standard Specification for Non-Shrink Grout
ASTM D615 – Standard Specification for Plain and Deformed Carbon Steel bars for Concrete Reinforcement.
AASHTO M 36 – Standard Specification for Corrugated Steel Pipe, Metallic Coated
AASHTO M 294 – Standard Specification for Corrugated Polyethylene Pipe.
CDOT Standard Specifications, 2005 – Section 601 – Structural Concrete.

5.4 MATERIALS

Cement shall be Type II Portland cement, conforming to ASTM C 150, unless otherwise approved by PROJECT MANAGER.

Fine and Coarse Aggregate shall conform to ASTM C 33.

Water shall be potable.

Admixtures shall conform to ASTM C 494. Calcium chloride will not be permitted.

Concrete shall conform to CDOT Section 601, Structural Concrete, Class D.

Formwork shall be constructed as outlined in ACI 301, Structural Concrete for Buildings, Chapter 4. The exterior grain of the plywood shall be parallel to the span and perpendicular to the supports on all vertical forms.

Reinforcing Steel shall be made of deformed new billet stock and shall conform to ASTM A 615, Grade 60. All reinforcing steel shall be free from heavy rust, scale or other coatings that will destroy or reduce the bond.

Corrugated Steel Pipe Access Culvert shall be of 12 gauge galvanized steel pipe with helical or annular corrugations. The pipe shall be free of rust, gaps in seams, holes and deformations which reduce the inside diameter of the pipe at any location by more than two inches (2").

Corrugated Polyethylene Pipe Access Culvert shall be fabricated in accordance with AASHTO M294 Type S.

5.5 EXECUTION

5.5.1 Formwork

The formwork shall be constructed as specified on Standard Drawing No. 2. The formwork shall have a minimum height of four feet (4') and shall be at a height such that the top of the formwork shall be at least two feet (2') horizontally from the side walls of the shaft. In the case that any side of the formwork shall exceed eight feet (8'), interior cross supports shall be installed in the formwork on a minimum of four foot (4') centers. A minimum of four (4), two by fours (2" x 4") shall be used for each four feet (4') of height for each cross-support member. The formwork shall be constructed outside the shaft either as a five sided structure with a top or a four sided structure with the top open. Hangers shall be attached to the formwork to hold the reinforcing steel required for the footings as specified on Standard Drawing No. 2. The formwork shall be placed so as to be centered directly over the shaft opening. Rocks shall be placed around the formwork to keep it from moving. The rocks shall not extend to more than two feet (2') from the bottom of the formwork. Special care shall be taken while placing the rocks so as not to disturb the footing reinforcing steel hanging from the sides of the formwork. Formwork removal is not required.

5.5.2 Mixing

The concrete may be mixed at the work site or delivered as "ready mix", at CONTRACTOR's option. If the concrete is mixed on site, equipment and mixing procedures shall conform to ACI 301, Chapter 7. If "ready mix" is used, it shall be mixed and transported in accordance with ASTM C94. The concrete mix shall be designed to produce a minimum 40,500 psi concrete at the 28 day test. If hot weather concreting is done, it shall conform to the requirements of ACI 305. If cold weather concreting is done, it shall conform to the requirements of ACI 306.

5.5.3 Footing

Concrete shall be poured around the outside of the formwork to the top of the formwork. The concrete shall be poured in maximum 15 to 20-inch lifts and systematically consolidated using mechanical vibrators, taking care to insure the joints between lifts are adequately vibrated.

5.5.4 Slab

If a poured in place slab is required, the slab may be poured at the same time as the footing. The reinforcing steel shall be laid over the formwork using plastic chairs or equivalent to support the steel the proper distance above the formwork. In the event a vertical culvert is to be installed in the shaft, the vertical culvert shall be installed prior to pouring the concrete. A short section of culvert may be used and cast in place. The remainder of the culvert shall be attached with a coupler band. The concrete shall be poured the thickness as specified on the Hollow Core Drawing. In the case of a rectangular shaft, the smaller dimension shall be used to determine the concrete thickness and the size and spacing of rebar from the tables on Standard Drawing No. 2. Consolidation shall be done with the systematic use of a

mechanical vibrator. If a vertical culvert is not specified, a monument anchor plate as described in Section 5.5.9 shall be embedded ½ the slab thickness at approximately the center of the opening.

5.5.5 Field Quality Control

CONTRACTOR shall take sample specimens of the concrete in cylindrical containers in accordance with ASTM C 31 at the point of deposit as follows:

- One sampling, consisting of a minimum of four cylinders, shall be taken and paid for by CONTRACTOR.
- The samples shall be taken in accordance with ASTM C 172.
- All four sample cylinders will be taken at the same time: one cylinder to be used for a seven (7) day test and two for a twenty eight (28) day test, and the fourth for a fifty six (56) day test if required by PROJECT MANAGER. The average of the twenty eight (28) day test result will be used for determining acceptance, the fifty-six (56) day test may be used as a referee sample. These tests shall be performed at CONTRACTOR'S expense in accordance with ASTM C 39 by a materials testing laboratory of CONTRACTOR'S choice with the concurrence of PROJECT MANAGER.
- PROJECT MANAGER may require additional random samples. Testing of any additional samples will be at OWNER'S expense.

5.5.6 Curing

The Hollow Core Plug concrete shall reach a minimum compressive strength of 3000 psi in seven (7) days before backfilling can occur. However, it will be CONTRACTOR'S responsibility to correct any closures if the concrete does not reach a minimum compressive strength of 4,500 psi at 28 days.

5.5.7 Vertical Access Culvert and Grated Door

If required, a Corrugated Steel Pipe or a Corrugated HDPE vertical access culvert shall be installed extending from the opening in the slab to the surface. The access culvert diameter shall be 30 inches or 36 inches as specified. The bottom of the culvert shall rest on the formwork. The bottom of the culvert shall be open to the shaft by cutting out or removal of the form. Backfill material shall be placed in the opening in two foot (2') lifts. The material shall be compacted as much as practicable. The culvert shall extend a minimum of one foot (1') above the final graded surface. The backfill shall be mounded to provide positive drainage away from the backfilled area.

A grated door, fabricated according to Standard Drawing No 11, shall be welded to the top of the vertical culvert. The weld shall be continuous around the entire culvert, and shall be in accordance with the requirements of the American Welding Society AWS D1.1. A brass cap, supplied by OWNER, shall be attached to the door, using a four inch (4”) long three-inch (3") I.D. (inside diameter) galvanized pipe welded to the grate. The brass cap shall be grouted flush to ¼” below the top of the pipe with a non-shrink grout such as Moly Parabond, QUIKRETE, or Pour Rock.

On mine sites with acid-producing materials, and where specified by PROJECT MANAGER, a 30-inch diameter corrugated HDPE pipe shall be used instead of a corrugated steel pipe. The HDPE pipe shall extend from the form to two feet (2') above ground level. To place a steel locking grate over the top, a 42-inch diameter corrugated steel pipe three feet (3') in length shall be placed over the top of the HDPE pipe and the annular space shall be filled with concrete. The concrete shall be carefully rodded into place so as to completely fill the annular space and the pipe corrugations. The locking grate shall be attached to the steel pipe in accordance with Standard Drawing No. 11 prior to placement over the HDPE pipe. The grate frame dimensions shall be adjusted to fit the 42 inch diameter corrugated steel pipe.

5.5.8 Backfill

Backfill material shall be placed in the opening in two foot (2') lifts. The material shall be compacted as much as is practicable. The final graded surface shall be mounded to provide positive drainage away from the backfilled area.

5.5.9 Monumentation

In locations with no Access Culvert, a new, three inch (3") I.D. (inside diameter) galvanized steel pipe shall be embedded in the hollow core slab. The pipe shall be sufficient length to extend a minimum of three inches (3") into the concrete and two feet (2') above the final graded surface. A minimum one foot (1') diameter 3/8-inch thick galvanized steel plate shall be welded perpendicular to the bottom end of the pipe to act as an anchor, in the concrete. CONTRACTOR shall grout an OWNER furnished brass cap flush to ¼" below the top of the pipe using a non-shrink grout such as Moly Parabond, QUIKRETE, or Pour Rock.

5.6 MEASUREMENT AND PAYMENT

No measurement for payment shall be made for these bid items. Payment shall be for the lump sum bid price. The price bid shall include all of CONTRACTOR's cost of whatever nature to provide a complete closure installation and revegetation of disturbed areas in accordance with the plans and specifications.

Section 6

CAST IN PLACE CONCRETE SHAFT CLOSURE

6.1 DESCRIPTION

This work shall consist of construction of cast-in-place concrete slabs over vertical or near vertical mine openings in accordance with Standard Drawing Nos. 3 and 11. This work includes clearing and grubbing, excavation of slab footings, furnishing and installing of forms, reinforcing steel, and concrete, project signage, monumentation, erosion control and revegetation of disturbed areas.

6.2 RELATED WORK

Section 20 – Revegetation
Section 21 – Project Sign
Section 22 – Erosion Control

6.3 REFERENCE DOCUMENTS

Standard Drawing No. 3.
Standard Drawing No. 11.
ACI 301 – Specifications for Structural Concrete.
ACI 305 – Recommended Practice for Hot Weather Concreting.
ACI 306 – Recommended Practice for Cold Weather Concreting.
ASTM A53 – Standard Specification for Pipe, Steel, Black and Hot Dipped, Zinc Coated, Welded and Seamless.
ASTM C31 - Standard Specification for Making and Curing Concrete test Specimens in the Field.
ASTM C33 - Standard Specification for Concrete Aggregate.
ASTM C39 - Standard Test Method for Ready Mixed Concrete.
ASTM C94 - Standard Specification for Compressive Strength of Cylindrical Concrete Specimens.
ASTM C150 - Standard Specification for Portland Cement.
ASTM C172 - Standard Practice for Sampling Freshly Mixed Concrete.
ASTM C494 - Standard Specification for Chemical Admixtures for Concrete.
ASTM C1107 – Standard Specification for Non-Shrink Grout
ASTM D615 – Standard Specification for Plain and Deformed Carbon Steel bars for Concrete Reinforcement.
AASHTO M 36 – Standard Specification for Corrugated Steel Pipe, Metallic Coated
AASHTO M 294 – Standard Specification for Corrugated Polyethylene Pipe.
CDOT Standard Specifications, 2005 – Section 601 – Structural Concrete.

6.4 MATERIALS

Cement shall be Type II Portland cement, conforming to ASTM C 150, unless otherwise approved by PROJECT MANAGER.

Fine and Coarse Aggregate shall conform to ASTM C 33.

Water shall be potable.

Admixtures shall conform to ASTM C 494; Calcium chloride will not be permitted.

Reinforcing Steel shall be made of deformed new billet stock and shall conform to ASTM A 615, Grade 60. All reinforcing steel shall be free from heavy rust, scale or other coatings that will destroy or reduce the bond.

Corrugated Steel Pipe (culvert) shall consist of a 36-inch, 12-gauge galvanized steel pipe with helical or annular corrugations. The pipe shall be free of rust, gaps in seams, holes and deformations which reduce the inside diameter of the pipe by more than two inches(2").

Corrugated Metal Stay-In-Place Forms shall be made of high-strength, full-hard steel conforming to ASTM A-496, Grade E, with a galvanized coating conforming to ASTM A-515, class G60.

Drain Pipe shall be two-inch (2") schedule 40 PVC drain pipe.

6.5 EXECUTION

6.5.1 Clearing and Grubbing

The work site shall be cleared and grubbed of vegetation, debris, loose rocks and other items which interfere with construction, except those items shown on the plans or designated by PROJECT MANAGER. All trash and debris shall be disposed of at a county-approved disposal site, as approved by PROJECT MANAGER.

6.5.2 Excavation

Mine openings to be closed with a cast-in-place cap shall be excavated to competent bedrock. CONTRACTOR is responsible for site inspections, testing or exploration necessary to insure that the bid adequately reflects excavation conditions including hand trimming and leveling required. The perimeter of the mine opening shall be excavated to a minimum ledge width of two feet (2') on competent bedrock.

6.5.3 Forming

Forms for cast-in-place concrete caps shall be constructed in accordance with Standard Drawing No. 3, using corrugated metal stay-in-place forms (bridge decking) and steel or wood beams. Alternative materials may be used for forming if CONTRACTOR demonstrates to PROJECT MANAGER that the alternative forms are capable of withstanding the loads applied by the concrete. CONTRACTOR shall be responsible for reinstalling the cap should alternative materials fail to adequately support the concrete.

Forms shall be mortar tight and sufficiently rigid to prevent distortion due to the pressure of the concrete and other loads incidental to the concrete operations, including vibration.

If a vertical culvert is specified, an opening shall be cut in the formwork, where the culvert is to be set. The inside diameter of the opening shall be a minimum of 32 inches in diameter for a 36 inch corrugated steel pipe.

6.5.4 Reinforcing Steel Installation

The reinforcing steel shall be laid over the formwork using plastic chairs or equivalent to support the steel three inches (3") above the formwork. If a vertical culvert is installed in the shaft, the vertical culvert shall be installed prior to pouring the concrete. Reinforcing steel shall be tied together. Welding of reinforcing steel is not allowed.

6.5.5 Concrete Pouring

The concrete shall be poured a thickness as specified in Standard Drawing No. 3. The concrete may be mixed at the work site or delivered as "ready mix", at CONTRACTOR'S option. If the concrete is mixed on site, equipment and mixing procedures shall conform to ACI 301, Chapter 7. If "ready mix" is used, it shall be mixed and transported in accordance with ASTM C 94. The concrete mix shall be designed to produce a minimum 4000 psi concrete at the 28 day test. If hot weather concreting is done, it shall conform to the requirements of ACI 305. If cold weather concreting is done, it shall conform to the requirements of ACI 306.

The rate of depositing concrete in forms shall be controlled to prevent deflection of the formpanels. The concrete shall be thoroughly compacted by means of a suitable mechanical vibrator. Vibrating shall be supplemented with hand spading the concrete around the reinforcing steel. If the cap is specified to be backfilled, a pipe flange shall be embedded in the concrete immediately after vibration.

6.5.6 Field Quality Control

CONTRACTOR shall take sample specimens of the concrete in cylindrical containers in accordance with ASTM C31 at the point of deposit as follows:

- One sampling, consisting of a minimum of four cylinders, shall be taken and paid for by CONTRACTOR.
- The samples shall be taken in accordance with ASTM C172.
- All four sample cylinders will be taken at the same time: one cylinder to be used for a seven day test and two for a 28 day test, the fourth for a fifty six (56) day test if required by PROJECT MANAGER. The average of the twenty eight (28) day test result will be used for determining acceptance, the fifty six (56) day test may be used as a referee sample. These tests shall be performed at CONTRACTOR's expense in accordance with ASTM C39 by a materials testing laboratory of CONTRACTOR's choice with the concurrence of PROJECT MANAGER.
- PROJECT MANAGER may require additional random samples. Testing of any additional samples will be done at OWNER's expense.

6.5.7 Vertical Culvert

If a vertical culvert is specified, the culvert shall be secured from the opening in the slab to the surface. The bottom of the culvert will be resting on the horizontal member of the formwork. Backfill material shall be placed in two foot (2') lifts. The material shall be compacted as much as practicable.

The culvert shall extend a minimum of one foot (1') above the backfilled surface. The final backfilled surface shall be as shown in Standard Drawing No. 3. A grated access door fabricated according to Standard Drawing No. 11, shall be welded to the top of the culvert. The weld shall be continuous around the culvert.

On mine sites with acid-producing materials, and where specified by PROJECT MANAGER, a 30-inch diameter corrugated HDPE pipe shall be used instead of a corrugated steel pipe. The HDPE pipe shall extend from the form to two feet (2') above ground level. To place a steel locking grate over the top, a 42-inch diameter corrugated steel pipe three feet (3') in length shall be placed over the top of the HDPE pipe and the annular space shall be filled with concrete. The concrete shall be carefully rodded into place so as to completely fill the annular space and the pipe corrugations. The locking grate shall be attached to the steel pipe in accordance with Standard Drawing No. 11 prior to placement over the HDPE pipe. The grate frame dimensions shall be adjusted to fit the 42 inch diameter corrugated steel pipe.

6.5.8 Backfill and Drainage Berms

If the cast-in-place cap is greater than eight feet (8') below ground surface, the cap shall be backfilled. The cast in place cap shall reach a minimum compressive strength of 3,000 psi within seven (7) days before backfilling can occur. However, it will be CONTRACTOR’s responsibility to correct any closures when the concrete does not reach a minimum compressive strength of 4,500 psi at 28 days. Backfill material shall be placed in the opening in two foot (2') lifts. The material shall be compacted as much as is practicable. Prior to backfilling, a three-inch (3") galvanized steel pipe shall be welded to the pipe flange installed in the concrete. The galvanized pipe shall be of sufficient length to extend a minimum of one foot (1') above the final backfilled surface. The final backfilled surface shall be as shown for the openings with culverts on Standard Drawing No. 11.

If the cap is less than eight feet (8') below the ground surface, the edges of the excavation shall be graded to a maximum 1.5H: 1 V with maximum encroachment onto the concrete cap of three feet (3'), unless otherwise specified. Drainage berms shall be constructed to divert runoff from the mine opening.

6.5.9 Monument

A brass cap supplied by OWNER shall be set in the cast-in-place cap, the grate on the vertical culvert, or the steel pipe monument.

- If the cast-in-place cap is exposed upon backfilling, the brass cap shall be grouted into the cap with a non-shrink grout, cast in the cap or placed in concrete immediately following pouring.
- If a vertical culvert is used, the brass cap shall be installed in a three-inch (3") I.D. (inside diameter), four-inch (4") long galvanized pipe that is welded to the grate frame, then a brass cap grouted flush to ¼" below the top of the pipe using a non-shrink grout or adhesive.
- If a pipe monument is used, the brass cap shall be grouted flush to ¼" below the top of the pipe using a non-shrink grout such as Moly Parabond, QUIKRETE, or Pour Rock.

6.6 MEASUREMENT AND PAYMENT

No measurement for payment shall be made for this bid item. Payment shall be for the lump sum bid price. The price bid shall include all of CONTRACTOR'S cost of whatever nature to provide a complete closure installation and revegetation of disturbed areas in accordance with the plans and specifications.

Section 7

MONOLITHIC PLUG CLOSURE

7.1 DESCRIPTION

This work shall consist of pouring a four feet (4') thick concrete cap over mine shafts that have collapsed at the collar and have no apparent opening. This work includes clearing and grubbing, excavation, furnishing and installing rockfill, furnishing and placing concrete, project signage, monumentation, erosion control, backfilling, and revegetating disturbed areas, according to these specifications.

7.2 RELATED WORK

Section 20 – Revegetation
Section 21 – Project Sign
Section 22 – Erosion Control

7.3 REFERENCE DOCUMENTS

ACI 301 – Specifications for Structural Concrete.
ACI 305 – Recommended Practice for Hot Weather Concreting.
ACI 306 – Recommended Practice for Cold Weather Concreting.
ASTM A53 – Standard Specification for Pipe, Steel, Black and Hot Dipped, Zinc Coated, Welded and Seamless.
ASTM C31 - Standard Specification for Making and Curing Concrete test Specimens in the Field.
ASTM C33 - Standard Specification for Concrete Aggregate.
ASTM C39 - Standard Test Method for Ready Mixed Concrete.
ASTM C94 - Standard Specification for Compressive Strength of Cylindrical Concrete Specimens.
ASTM C150 - Standard Specification for Portland Cement.
ASTM C172 - Standard Practice for Sampling Freshly Mixed Concrete.
ASTM C494 - Standard Specification for Chemical Admixtures for Concrete.
ASTM C1107 – Standard Specification for Non-Shrink Grout
CDOT Standard Specifications, 2005 – Section 601 – Structural Concrete.

7.4 MATERIALS

Cement shall be Type II Portland cement, conforming to ASTM C 150, unless otherwise approved by PROJECT MANAGER.

Fine and Coarse Aggregate shall conform to ASTM C 33.

Water shall be potable.

Admixtures shall conform to ASTM C 494; Calcium chloride will not be permitted.

Rockfill shall be hard and durable with a minimum diameter of twelve inches (12").

Monument Pipe shall be new, six foot (6’) long, three inch (3”) inside diameter Schedule 40 galvanized steel pipe.

Brass Cap will be furnished by OWNER.

Non-Shrink Grout shall be Moly Parabond, Pour Rock, or QUIKRETE.

7.5 EXECUTION

7.5.1 Clearing and Grubbing

The work site shall be cleared and grubbed of vegetation, debris, loose rocks and other items which interfere with construction, except those items designated by PROJECT MANAGER to remain. All trash and debris shall be disposed of at a county approved disposal site, as approved by PROJECT MANAGER.

7.5.2 Excavation

In some cases, no excavation may be necessary since the shafts to be closed using this method have collapsed to dimensions larger than eight feet by twelve feet (8' x 12'). If the dimensions are smaller, the shaft shall be excavated to a cone shape so that the top dimensions of the plug are eight feet by twelve feet (8' X 12') or larger at the top of the plug. In all cases, unless otherwise directed by PROJECT MANAGER, the collapsed mine opening shall be excavated to expose bedrock on all sides.

7.5.3 Rockfill Installation

Prior to pouring concrete, two feet (2') of rockfill shall be placed in the bottom of the shaft depression. The rockfill shall be placed with a generally flat top such that no individual rock extends beyond two feet (2') above the lowermost portion of the rockfill.

7.5.4 Concrete Placement

The concrete shall be placed to a thickness of four feet (4'). The concrete may be mixed at the work site or delivered as "ready mix", at CONTRACTOR's option. If the concrete is mixed on site, equipment and mixing procedures shall conform to ACI 301, Chapter 7. If "ready mix" is used, it shall be mixed and transported in accordance with ASTM C 94. The concrete mix shall be designed to produce a minimum compressive strength of 4,500 psi at the 28 day test. If hot weather concreting is done, it shall conform to the requirements of ACI 305. If cold weather concreting is done, it shall conform to the requirements of ACI 306.

The concrete shall be thoroughly compacted by means of a suitable mechanical vibrator. Vibrating shall be supplemented with hand spading to work the concrete into the rockfill.

7.5.5 Field Quality Control

CONTRACTOR shall take sample specimens of the concrete in cylindrical containers in accordance with ASTM C 31 at the point of deposit as follows:

- One sampling, consisting of a minimum of four cylinders, shall be taken and paid for by CONTRACTOR.
- The samples shall be taken in accordance with ASTM C172.
- All three sample cylinders will be taken at the same time, one cylinder to be used for a seven day test and two for a 28 day test, the fourth for a fifty-six (56) day test if required by PROJECT MANAGER. The average of the twenty eight (28) day test result will be used for determining acceptance, the fifty six (56) day test may be used as a referee sample. These tests shall be performed at CONTRACTOR's expense in accordance with ASTM C39 by a materials testing laboratory of CONTRACTOR's choice which meets the approval of PROJECT MANAGER.
- PROJECT MANAGER may require additional random samples. Testing of any additional samples will be done at OWNER's expense.

7.5.6 Monument

A new, three inch (3") I.D. (inside diameter) galvanized steel pipe shall be embedded in the concrete. The pipe shall be sufficient length to extend a minimum of one foot (1') into the concrete and two feet (2') above the final graded surface. A minimum one foot (1') diameter 3/8-inch thick galvanized steel plate shall be welded perpendicular to the bottom end of the pipe to act as an anchor in the concrete. CONTRACTOR shall grout an OWNER furnished brass cap flush to ¼" below the top of the pipe, using a non-shrink grout such as Moly Parabond, QUIKRETE, or Pour Rock.

7.5.7 Backfill

The monolithic plug shall reach a minimum compressive strength of 3000 psi within seven (7) days before backfilling can occur. However, it will be CONTRACTOR'S responsibility to correct any closures when the concrete does not reach a minimum compressive strength of 4,500 psi at 28 days. The initial backfill may be composed of any adjacent material such as mine waste. The final backfill shall be comparable to adjacent surficial material. The backfill shall be mounded a minimum of one foot (1') above the surrounding area to insure positive drainage from the closure.

7.6 MEASUREMENT AND PAYMENT

CONTRACTOR shall supply PROJECT MANAGER with copies of receipts from concrete trucks or, if mixed on-site, shall supply copies of receipts to verify the quantities of concrete poured at each monolithic plug site. Payment will be based on the total number of cubic yards of concrete poured at all monolithic plug closure sites. The total of the lump sum bid prices for the monolithic plugs will be adjusted based upon the bid price for additional concrete. Payment shall constitute full compensation for all CONTRACTOR'S costs of whatever nature to provide a complete closure and to revegetate disturbed areas.

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Section 8

STEEL GRATED SHAFT CLOSURE

8.1 DESCRIPTION

This work shall consist of installing steel grating over a shaft according to Standard Drawing No. 4, including clearing and grubbing, excavation of loose material, trimming of shaft, and furnishing, securing, and welding of steel grating, project signage, monumentation, erosion control and revegetation of disturbed areas in accordance with these specifications.

8.2 RELATED WORK

Section 20 – Revegetation
Section 21 – Project Sign
Section 22 – Erosion Control

8.3 REFERENCE DOCUMENTS

Standard Drawing No. 4.
ACI 301 – Specifications for Structural Concrete.
ACI 305 – Recommended Practice for Hot Weather Concreting.
ACI 306 – Recommended Practice for Cold Weather Concreting.
ASTM A36 – Standard Specification for Carbon Structural Steel.
ASTM A53 – Standard Specification for Pipe, Steel, Black and Hot Dipped, Zinc Coated, Welded and Seamless.
ASTM C31 - Standard Specification for Making and Curing Concrete test Specimens in the Field.
ASTM C33 - Standard Specification for Concrete Aggregate.
ASTM C39 - Standard Test Method for Ready Mixed Concrete.
ASTM C94 - Standard Specification for Compressive Strength of Cylindrical Concrete Specimens.
ASTM C150 - Standard Specification for Portland Cement.
ASTM C172 - Standard Practice for Sampling Freshly Mixed Concrete.
ASTM C494 - Standard Specification for Chemical Admixtures for Concrete.
ASTM C1107 – Standard Specification for Non-Shrink Grout
ASTM D615 – Standard Specification for Plain and Deformed Carbon Steel bars for Concrete Reinforcement.
AASHTO M 36 – Standard Specification for Corrugated Steel Pipe, Metallic Coated
AASHTO M 294 – Standard Specification for Corrugated Polyethylene Pipe.
CDOT Standard Specifications, 2005 – Section 601 – Structural Concrete.

8.4 MATERIALS

Steel Grating shall conform to grating sizes specified in Table 8.1. Cross bars shall be resistance welded at right angles to the bearing bars and spaced as specified in Table 8.1, (type WXA bar as manufactured by AMICO type 19-W-4-53, or equivalent).

Structural Steel shall conform to the requirements of ASTM A36, all-purpose steel.

Rock Bolts shall be expansion type with a minimum pullout strength of 2,000 pounds at an embedded depth of 4.5 inches. The rock bolts shall be Hilti Heavy Duty Expansion Anchor, Kwik Bolt or equivalent.

Anchor Bars shall be Number 6 (3/4") rebar in accordance with ASTM A615, Grade 60, anchored a minimum depth of 8 inches (8") into competent rock with Moly Parabond epoxy capsule or equivalent, or with an interference fit in drilled holes in solid rock.

Concrete shall have a minimum compressive strength of 3500 psi at 28 days.

Cement shall be Type II Portland cement, conforming to ASTM C150, unless otherwise approved by PROJECT MANAGER.

Fine and Coarse Aggregate shall conform to ASTM C33.

Water shall be potable.

Admixtures shall conform to ASTM C494. Calcium chloride will not be permitted.

Reinforcing Steel (rebar) shall be made of deformed new billet stock and shall conform to ASTM A615, Grade 60. All reinforcing steel shall be free from heavy rust, scale or other coatings that will destroy or reduce the bond.

8.5 EXECUTION

8.5.1 Grating Spanning Shaft Openings

8.5.1.1 Fabrication

The grating shall be welded to a 2” x 2” x ¼” angle iron framework which will be securely anchored to the perimeter of the opening. On sites where bedrock is near the ground surface the framework will be anchored using six inch (6”) minimum rock bolts or anchor bars inserted into a hole drilled eight inch (8") deep minimum, to accommodate the bolt or bar with a non shrink grout, such as Moly Parabond, Pour Rock or QUIKRETE. Rock bolts or anchor bars will be twelve inches (12") center to center with a minimum two feet (2') setback from the edge of the opening. The bolts or bars shall then be welded to the framework. All welds shall be in accordance with the American Welding Society AWS D1-1.

8.5.1.2 Installation

Unless otherwise noted in the special conditions, all Steel Grated Shaft Closures shall span the mine opening. Grating shall be placed on competent bedrock, unless otherwise noted in the Special Conditions. The shaft opening to be grated shall be excavated to bedrock, cleaned of loose rock and trimmed to provide a uniform contact with the framework. The angle iron framework shall be securely anchored as described above. Rock bolts or anchor bars shall be welded to the framework. The grating shall be welded to the framework; welds will be on every other bearing bar. All edges of grate sections will be welded to each other. All voids below the edges of the grating larger than one inch (1") shall be filled with concrete mix or pieces of welded grating or angle iron to fill the void. The concreted area shall be a minimum of twelve (12") inches in width. Where gaps between the grating and bedrock exceed six inches (6"), a grouted durable rock wall with a minimum width of eighteen inches (18") shall be constructed.

Spread Footings shall be used on sites where the surficial material is incompetent as determined by PROJECT MANAGER. The framework will extend a minimum of three feet (3') beyond the opening on all sides and be anchored to spread footings. Footings will be constructed around the entire perimeter of the grating per Standard Drawing No. 4.

In circumstances where vein material is to be spanned and the vein material appears weak, the angle iron framework over the vein shall be replaced with an appropriately sized beam to span the anticipated weak zone.

If a hinging and locking mechanism is required, the hatch will be welded into the center of the grate in accordance with Standard Drawing No. 6. Following installation of the grating, CONTRACTOR shall install the brass cap in a three-inch (3") I.D. (inside diameter), four-inch (4") long galvanized pipe that is welded to the grate frame. The brass cap shall be grouted flush to ¼" below the top of the pipe using a non-shrink grout or adhesive. The brass cap will be supplied by OWNER.

8.5.2 Grating Placed Inside Shaft Opening

8.5.2.1 Fabrication

The grating and an angle iron grate frame (L 2" x 2" x 1/4") will be cut and welded on-site to fit the irregularities of the opening. The frame will be anchored to the shaft walls using imbedded anchor bolts protruding through holes drilled in the frame, or rebar anchor rods welded to the bottom of the iron grate frame. All field welds shall be in accordance with the requirements of the American Welding Society AWS D1.1. If there is an access requirement, the grating shall be designed with a hinging and locking mechanism in accordance with Standard Drawing No. 6.

8 5.2.2 Installation

In competent rock, the shaft opening to be grated shall be cleaned of loose rock and trimmed to provide a uniform contact with the framework. The grate shall be positioned over or slightly inside the shaft walls at a stable location as directed by PROJECT MANAGER. All loose or weathered rock and other materials shall be scaled from the shaft walls and the opening trimmed to provide the most competent, clean, and uniform contact with the grating frame as possible.

The angle iron frame shall be cut, formed, and fitted continuously around the perimeter of the opening. Spacing between the shaft perimeter and the angle-iron frame shall not exceed 2". Rock bolts or 3/4" diameter anchor bars shall be installed on twelve inch (12") centers around the entire perimeter of the shaft opening. The rock bolts or anchor bars shall be anchored an eight inch (8") minimum embedded depth into horizontally drilled holes in competent rock. Holes receiving bars may be drilled at a slight downwards angle not more than 20 degrees from horizontal, so that the bars when inserted angle upwards from the shaft walls. In no case will bars be installed so that they angle downwards towards the grate. Rock bolts shall be installed in horizontal holes. Anchoring shall be by bolt expansion, Moly Parabond epoxy capsules (or equivalent epoxy capsules), or by swaging anchor bars into the drilled holes such that an interference fit is obtained. If rock is soft or excessively fractured, 3/4-inch anchor bars shall be used, and a minimum anchoring depth of eighteen inches (18") is required with epoxy capsule anchoring.

The grate frame shall be positioned onto anchor bars from above with a minimum two inch (2") weld length (overlap) on each anchor bar. Both sides of each anchor bar will be welded to the frame. Rock bolts shall protrude through holes drilled in the grate frame. Torch-cut holes will not be accepted. Rock bolts will be tightened securely and the nuts tack welded. The grate material will then be positioned onto the secured frame and welded at every other bearing bar, one side, around the entire perimeter of the grate. Painting is not required.

If a hinging and locking mechanism is required, the hatch and hatch frame will be welded into the center area of the grate. The locking door shall be constructed as shown on Standard Drawing No. 6. The grating material shall be the same as the surrounding grating.

All voids along the edges of the grating larger than one inch (1") shall be filled with bolt protection plates where anchor bars or bolts are exposed from above, or pieces of welded grating or angle to fill the void.

Following installation of the grating, CONTRACTOR shall weld a 3" inside diameter 4" long steel pipe to the grating, the brass cap, provided by OWNER, shall be grouted flush to ¼" below the top of the pipe using non-shrink grout such as Pour Rock, QUIKRETE, Epoxy Bond, or Moly Parabond.

8.5.3 Beams

Steel beams will be used to reduce all grating spans to a maximum as shown below. For shaft spans of twelve feet (12'), or less, W4 x 13 steel beams will be used. For shaft spans between twelve feet (12') and twenty feet (20'), W6X20 steel beams shall be used.

Table 8.1

Maximum Grating Span

Bearing Bar Size	Bearing Bar Spacing	Cross Bar Spacing	Maximum Grating Span (feet)
1-1/4" x 1/8"	1-3/16"	4"	3.5
1-1/4" x 1/8"	15/16"	2"	4.0
1-1/4" x 3/16"	1-3/16"	4"	4.0
1-1/4" x 3/16"	15/16"	2"	4.5
1-1/2" x 1/8"	1-3/16"	4"	4.5
1-1/2" x 1/8"	15/16"	2"	5.0
1-1/2" x 3/16"	1-3/16"	4"	5.0
1-12/" x 3/16"	15/16"	2"	5.5
1-3/4" x 3/16"	1-3/16"	4"	5.5
1-3/4" x 3/16"	15/16"	2"	6.0
2" x 3/16"	1-3/16"	4"	6.0
2" x 3/16"	15/16"	2"	6.5
2 1/4" x 3/16"	1-3/16"	4"	6.5
2 1/4" x 3/16'	15/16"	2"	6.5
2 1/2" x 3/16"	1-3/16"	4"	6.5
2 1/2" x 3/16"	15/16"	2"	7.0

Steel beams will be embedded and covered in concrete for the entire length of the beam that rests on the footing surface, except for the top portion where grating will be placed. The steel beams shall extend to the edges of the grating. Grating may be set on steel beams immediately following the embedment of beam ends in concrete. Where grating crosses a support beam, every other bearing bar shall be welded for a length of one inch to the support beam. Paint, if any, will be wire brushed or ground off beams prior to welding.

8.5.4 Installation within Historical Structures

Gratings constructed within wooden headframe structures will require modifications to conform to the existing support columns. Custom fitting and welding operations while the grate is in the structure will be allowed if the adjacent wood is adequately protected from sparks or flames, and only when an approved fire extinguisher is at the site. Additional connector plates, stiffeners or other steel reinforcing elements may be required to satisfactorily support and reinforce the historic structure. Wood flooring may be required to be removed and replaced for beam and grating installation.

The structures are often in poor condition and CONTRACTOR shall exercise extreme caution in his operation to insure that the structure is not damaged or destroyed. CONTRACTOR assumes all responsibility for damages to structures during the actual period of work and will replace and reconstruct at CONTRACTOR's own expense any damages with like materials. Any material that needs replacing will be prepared (stained, painted, etc.) in a way which will blend in with the surrounding material.

8.5.5 Drainage Berms

Drainage berms shall be constructed of uncompacted waste rock or excavation material to direct surface runoff away from the opening. All areas including access routes and work areas that are disturbed by CONTRACTOR are required to be revegetated according to the specifications in this document, unless otherwise noted.

8.6 MEASUREMENT AND PAYMENT

No measurement for payment shall be made for these bid items. Payment shall be for the lump sum bid price. The price bid shall include all of CONTRACTOR'S cost of whatever nature to provide a complete closure installation in accordance with the plans and specifications including materials, fabrication of the grated closure, excavation, welding, final grading, and revegetation of disturbed areas.

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Section 9

POLYURETHANE FOAM CLOSURE

9.1 DESCRIPTION

The polyurethane foam (PUF) closure consists of installing a bottom form, installing PUF to specifications and backfilling over the PUF to the specified level with common fill. One drainage pipe is required. Additional drainage pipes, accessways and locking grated access doors may be required, as specified in the Special Conditions. Project signage, monumentation, erosion control, and revegetation of disturbed areas will be required.

9.2 RELATED WORK

Section 20 – Revegetation
Section 21 – Project Sign
Section 22 – Erosion Control

9.3 REFERENCE DOCUMENTS

ASTM C150 – Standard Specification for Portland Cement.
ASTM C387 – Standard Specification for Packaged, Dry, Combined Materials for Mortar and Concrete.
ASTM D1621 – Compressive strength
ASTM D1692 – Fire Resistance
ASTM D2127 - Water absorption
ASTM D2856 - Closed cell content
ASTM D2104 – Standard Specification for Polyethylene (PE) Plastic Pipe, Schedule 40.
AASHTO M 36 – Standard Specification for Corrugated Steel Pipe, Metallic Coated
AASHTO M 294 – Standard Specification for Corrugated Polyethylene Pipe.

9.4 MATERIALS AND EQUIPMENT

9.4.1 Formwork

The bottom form and cross members may consist of any commonly available building materials capable of sustaining the initial lift of two to four feet of PUF. Examples of acceptable bottom forms and cross members include, but are not limited to, the following:

Table 9-1
Bottom Form and Cross Members

Cross Member	Bottom Form
Rebar	Plywood
2 X 4's	Cardboard
Dowels	Paneling
Cardboard Tubes	Carpeting

Any combination of the above materials will be acceptable. Alternate bottom forms will be acceptable upon approval by PROJECT MANAGER.

9.4.2 Polyurethane Foam (PUF)

PUF is required to have a minimum installed density of 1.85 pounds per cubic foot (pcf). PUF characteristics shall conform to the following standards:

Table 9-2

PUF Specifications

PUF Characteristic	Standard	Specified In
Density	1.85 pcf, nominal	
Closed cell content	90%	ASTM D-2856
Compressive strength	25 psi	ASTM D-1621
Water absorption	1% by volume	ASTM D-2127
Exothermic Reaction Rate	Low	
Fire Resistance		ASTM D-1692

Quantities. The table below is for estimating purposes only. Use the short width dimension of the shaft and depth to bottom form, to arrive at a thickness of PUF required. Multiply shaft length X shaft width X required foam thickness to arrive at cubic footage. Divide by 27 to get cubic yards. Additions and subtractions may be made for shaft irregularities, for materials in the shaft, the volume of any pipes, or required culvert.

Table 9-3
Polyurethane Foam Thickness Requirements (feet)

Depth to Bottom Form	Shaft Dimension (in feet) -- Short Width							
	3	4	5	6	7	8	9	10
8	3.4	N/A	N/A	N/A	N/A	N/A	N/A	N/A
9	3.7	5.0	N/A	N/A	N/A	N/A	N/A	N/A
10	4.0	5.4	N/A	N/A	N/A	N/A	N/A	N/A
11	4.2	5.7	7.0	N/A	N/A	N/A	N/A	N/A
12	4.4	6.1	7.4	N/A	N/A	N/A	N/A	N/A
13	4.7	6.4	7.9	N/A	N/A	N/A	N/A	N/A
14	4.9	6.7	8.3	9.6	N/A	N/A	N/A	N/A
15	5.1	7.0	8.7	10.1	N/A	N/A	N/A	N/A
16	5.3	7.3	9.1	10.6	11.8	N/A	N/A	N/A
17	5.5	7.6	9.5	11.1	12.4	N/A	N/A	N/A
18	5.7	7.9	9.9	11.6	12.9	14.0	N/A	N/A
19	5.9	8.2	10.3	12.0	13.5	14.7	N/A	N/A
20	6.0	8.4	10.6	12.5	14.0	15.3	N/A	N/A
21	6.2	8.7	11.0	13.0	14.6	15.9	16.9	N/A
22	6.4	9.0	11.3	13.4	15.1	16.5	17.6	N/A
23	6.5	9.2	11.7	13.8	15.6	17.1	18.3	N/A
24	6.7	9.5	12.0	14.3	16.1	17.7	18.9	19.9
25	6.9	9.7	12.4	14.7	16.6	18.3	19.6	20.6
26	7.0	10.0	12.7	15.1	17.1	18.8	20.2	21.3
27	7.2	10.2	13.0	15.5	17.6	19.4	20.8	22.0
28	7.3	10.4	13.3	15.9	18.1	19.9	21.5	22.7
29	7.5	10.6	13.6	16.3	18.6	20.5	22.1	23.4
30	7.6	10.9	13.9	16.7	19.0	21.0	22.7	24.0
31	7.8	11.1	14.2	17.1	19.5	21.6	23.3	24.7

Depth to Bottom Form	Shaft Dimension (in feet) -- Short Width							
	3	4	5	6	7	8	9	10
32	7.9	11.3	14.5	17.4	20.0	22.1	23.9	25.3
33	8.1	11.5	14.8	17.8	20.4	22.6	24.5	26.0
34	8.2	11.7	15.1	18.2	20.9	23.2	25.1	26.6
35	8.3	11.9	15.4	18.5	21.3	23.7	25.7	27.3
36	8.5	12.1	15.7	18.9	21.7	24.2	26.2	27.9
37	8.6	12.3	15.9	19.2	22.2	24.7	26.8	28.6
38	8.7	12.5	16.2	19.6	22.6	25.2	27.4	29.2
39	8.9	12.7	16.5	19.9	23.0	25.7	27.9	29.8
40	9.0	12.9	16.7	20.3	23.4	26.2	28.5	30.4
41	9.1	13.1	17.0	20.6	23.8	26.6	29.0	31.0
42	9.2	13.3	17.3	20.9	24.2	27.1	29.6	31.6

9.4.3 Hand Mixing

At the discretion of PROJECT MANAGER, polyurethane foam may be mixed by hand methods or prepackaged polyurethane foam may be used. Hand mixed and prepackaged polyurethane foam shall meet the same standards as discussed above in this section.

9.4.4 Proportioning Unit

The proportioning unit shall be capable of attaining a minimum temperature of 125O F. The proportioning unit shall be Gusmer Model H-11 or equivalent. For remote project areas, or with approval of PROJECT MANAGER, smaller capacity proportioners will be acceptable. In this event the proportioner shall be the Gusmer FF, or equivalent. Minimum heated hose length from proportioner to gun shall be 80 feet. The hose shall maintain or increase component temperature from the proportioner. Longer heated hose lengths may be required depending upon distance from the proportioning unit to the reclamation site. Approval of PROJECT MANAGER is required for the use of any length of unheated hose on a PUF closure.

9.4.5 Application Gun

The gun shall be capable of mixing plural components in the proper ratio at the minimum acceptable output of four pounds per minute. The gun shall be a Gusmer AR mechanically self-cleaning design, or equivalent.

Application guns constructed by individuals or manufacturers not typically in the PUF industry may be used if warranted by the PUF supplier or manufacturer.

9.4.6 Corrugated Pipe for Accessway

Corrugated steel pipe for the accessway shall consist of 30-inch diameter 16 gauge galvanized steel with helical or annular corrugations. The pipe shall be free of rust, gaps in seams, holes, and deformations which reduce the inside diameter by greater than two inches (2").

9.4.7 Grated Access Door

The grated access door for the access way shall be fabricated in accordance with Standard Drawing No. 11. The grated access door hasp shall be constructed so as to accommodate a Number 5 Masterlock with a 3/4 inch long hasp. The field weld of the CSP to the grated access door shall be in accordance with the requirements of the American Welding Society AWS D1.1. Sufficient space shall be provided for the door to open smoothly to provide full access to the access pipe.

CONTRACTOR shall weld a three-inch (3") inside diameter, four-inch (4") long galvanized pipe to the grate frame or vent pipe cover, then a brass cap shall be grouted flush to ¼" below the top of the pipe using a non-shrink grout or adhesive, such as Moly Parabond, Pour Rock or QUIKRETE.

9.4.8 Drainage Pipe

The drainage pipe shall consist of six-inch (6") diameter SDR-35 or schedule 40 PVC or similar gauge HDPE pipe.

9.4.9 Common Fill

Common fill shall consist of unclassified material free of debris or trash and not containing materials classified as toxic or hazardous.

9.5 MATERIAL SAFETY, HANDLING AND TRANSPORT

9.5.1 General

Materials shall be stored per the manufacturer's specifications. All safety precautions outlined by the Polyurethane Division of the Society of Plastics Industries, NFPA, OSHA, EPA and the manufacturer's Material Safety Data Sheets (MSDS) shall be observed. MSDS and technical Data Sheets shall be on-site and available at all times.

There shall be no welding, smoking or open flames within 25 feet of PUF application. A minimum 15 pound, class ABC, fire extinguisher shall be on site during foam application.

PUF shall be applied by workers wearing organic respirator masks and safety glasses or goggles. State or Federal regulations requiring additional equipment shall supersede these specifications.

CONTRACTOR shall follow all applicable State and Local regulations for transport and use of PUF and chemicals required for cleanup. CONTRACTOR shall also obtain any necessary permits for transportation. CONTRACTOR shall be aware of agencies and jurisdictions requiring notification in the event of a component leak or spill. In the event of a leak or spill CONTRACTOR shall notify the appropriate parties.

9.5.2 Oxygen Content of Working Area

An oxygen meter shall be used to test air before and during installation of the bottom forms. The oxygen meter will be supplied by CONTRACTOR.

Oxygen Meter. The oxygen meter shall continuously monitor oxygen levels and have an audible warning. If the oxygen content falls below 19.5% then all personnel shall withdraw from the working area in the mine until the oxygen content increases to safe levels.

Any remedy for increasing oxygen content of the working area and/or providing ventilation from the surface shall be determined in consultation with PROJECT MANAGER.

9.6 EXECUTION

9.6.1 Clearing Debris

Clear debris from the shaft before PUF is installed. Historic debris may be placed neatly to the side of the completed opening. Trash shall be taken to a county approved landfill. No mine equipment such as skips or carts may be embedded in PUF.

9.6.2 Formwork

The formwork shall be installed three feet (3') below the level of competent rock or at that level specified in the Special Conditions. Cross members may be placed at an angle less than 20 degrees from horizontal as long as both ends are seated in competent rock. The bottom form shall be set over the cross members.

All bottom forms shall be completed prior to application of any polyurethane foam. Any breach in the bottom form caused by vandals or rock fall shall be repaired prior to arrival of PUF applicators at that site. CONTRACTOR is responsible for the integrity of the bottom form, and the loss of any polyurethane should it fail.

If the inspection of an individual mine opening reveals that bedrock is closer to or further from the surface than stated in the Special Conditions, PROJECT MANAGER may order an adjustment in the depth of the bottom form. If this adjustment results in a change in the amount of PUF installed, an adjustment will be made to the bid price for that opening based on the unit price bid for additional PUF on the Bid Schedule.

9.6.3 Access Way

Corrugated pipe for access, as specified in the Special Conditions, shall be placed over a portion of the bottom form unobstructed by cross members. In shafts with more than one compartment, the access pipe shall be placed in one of the outside compartments, or as directed by PROJECT MANAGER. The access pipes shall be open to the shaft after installation of the foam. The accessway pipe shall be supported by a tripod or other load bearing device such that the load is not placed on the bottom form. Grated doors shall be welded to the corrugated steel pipe prior to placement in the shaft or after installation of the backfill according to Standard Drawing No. 11. Under no circumstances shall welding take place over exposed PUF.

Steel accessway pipe shall have PUF covering the outside of the pipe to a minimum thickness of 0.5 inch in the common fill section of the PUF plug. Polyurethane foam may be draped or splashed against the culvert during foam installation to achieve this coverage.

On mine sites with acid-producing materials and where specified by PROJECT MANAGER, a 30-inch diameter corrugated HDPE pipe shall be used instead of a corrugated steel pipe. The HDPE pipe shall extend from the bottom form to two feet (2') above ground level. To place a steel locking grate over the top, a 36-inch diameter corrugated steel pipe three feet (3') in length shall be placed over the top of the HDPE pipe the space between the outside of the HDPE pipe and the inside of the steel pipe shall then be filled with either a sand and cement mix, coarse common fill, or polyurethane foam. If common fill is used, it shall contain over 50% gravel or larger particles. The locking grate shall be attached to the steel pipe prior to placement over the HDPE pipe.

9.6.4 Drainage Pipe

The drainage pipe shall be cut with a hacksaw across the circumference creating a slit no longer than three inches (3") and less than 1/4 inch wide at two foot increments. Only the portion of the pipe exposed to common fill shall be slit.

The slits made for drainage in the drainage pipe shall be covered with visqueen or polyethylene tape during foam application. After application of PUF the visqueen or polyethylene tape shall be removed exposing the slit. Any foam covering the slits shall be removed to allow the unobstructed flow of water into the pipe.

Drainage pipes as specified in the Special Conditions, shall be placed over a portion of the bottom form unobstructed by cross-members. The drainage pipes shall be open to the shaft after installation of the foam. The drainage pipes shall be supported by a tripod or other load-bearing device such that the load is not placed on the bottom form.

Only four to twelve inches (4" - 12") of the drainage pipe may extend above the specified grade line. The six inch (6") PVC or HDPE pipe shall be encased in an eight inch (8") steel sleeve in the portion exposed above grade and for two feet (2') below grade. The annular area shall be filled with concrete.

Steel strap or rebar with a width greater than 1/2 inch shall be welded across the opening of the steel ventilation/drainage pipe(s) in such a manner as to prevent rocks with a dimension of greater than two inches (2") from being dropped down the pipe. As an acceptable substitute, grating, such as specified in Steel Grated Shaft Closures, may be cut to fit the opening across the vent pipe and welded in place.

9.6.5 Monument

A three-inch (3") I.D. (inside diameter) four-inch (4") long galvanized pipe shall be welded to the outside grate or to the drainage pipe sleeve. A brass cap shall be grouted flush to ¼" below the top of the pipe, using a non-shrink grout or adhesive, such as Moly Parabond, Pour Rock or QUIKRETE.

9.6.6 Polyurethane Foam (PUF)

PUF shall be applied in lifts with a maximum rise of 1.5 feet. Installed PUF lifts shall pass through the tack free stage before the next lift is applied. At no time shall sprayed or poured PUF cut into rising foam. The PUF shall be applied in such a manner that the entire void is filled and that shadow zones or voids are not created during PUF application. The PUF shall be applied so that the temperature does not reach unsafe levels. At the discretion of PROJECT MANAGER, thermocouples may be used to monitor exothermic generation. PUF application shall cease if heating or off-ratio foam is observed. The PUF CONTRACTOR shall remedy off-ratio foam and demonstrate proper quality PUF to PROJECT MANAGER before application resumes.

The surface of the void to be filled shall be as free as possible of grease and standing water. PUF shall not be applied to surfaces with running water. Remedial action for such situations shall be specified by PROJECT MANAGER. Polyurethane foam shall not be applied directly to a debris plug, but shall be applied to a bottom form of known physical and chemical properties. PUF shall not be applied during rain unless the foam is protected from interaction with water by a physical barrier.

If off ratio PUF is observed, the applicator shall stop, correct the imbalance and continue application with the proper ratio PUF. Correction and determination of the foam ratio shall be done on a plastic sheet away from the work area. Any lift of off-ratio PUF comprising over two percent (2%) of the intended PUF column heights shall be removed. An amount of off ratio PUF less than two percent (2%) of the specified volume may remain if allowed to cool, and if the outer perimeter of off-ratio foam is removed.

CONTRACTOR shall be responsible for any lost or damaged equipment. In addition, damages or claims arising from PUF overspray shall be the responsibility of CONTRACTOR. Under no circumstances shall foreign material be placed in the PUF unless specifically authorized by PROJECT MANAGER. If authorized, foreign materials shall be non toxic, non hazardous, and shall not compromise the strength or water saturation characteristics of the PUF.

9.6.7 Field Quality Control

Periodic checks of the quality of PUF applied shall be made by PROJECT MANAGER. The main check on quality will be visual. Acceptable PUF shall be tan white to buff in color with no vesicles and a smooth to coarse orange peel surface. Any one of the following conditions shall cause PUF application to cease, and efforts to correct the off-ratio condition begin.

Table 9-4

Unacceptable PUF Conditions

Condition	Possible Cause
Dark PUF Color Smooth and Glassy Friable or Brittle PUF Improper Density	**Excess A Component**
Light in Color to White Bad Cell Structure Mottled Appearance Blowholes or Pinholes	**Excess B Component**
Slow rise Poor Cell Structure Frequent Equipment Clogging Slow Curing Poor Physical Properties	**Bad Material**

At any time during PUF application PROJECT MANAGER may call for a density test. The applicator shall fill a container provided by OWNER for this purpose, and the sample will be tested for density. The density of the sample shall be within eight percent (8%) of the nominal two (2) pound per cubic foot density, with a minimum installed density of 1.85 pounds per cubic foot. Density tests indicating PUF installed is not within the minimum specified shall cause corrective action resulting in PUF within the acceptable nominal range, less deviation due to barometric pressure changes from STP (Standard Temperature and Pressure).

Density tests of PUF shall be conducted at no additional cost to OWNER. At the discretion of PROJECT MANAGER, density tests may be taken in the center of the cavity to which PUF is being applied. A sampling box may be lowered into the cavity to take a representative sample of PUF just above the level of installed polyurethane.

9.6.8 PUF Quality Tests

At the option of PROJECT MANAGER, up to three one cubic foot samples of PUF may be taken from the job site for analysis at OWNER'S expense. PUF shall be provided at no additional cost to OWNER.

9.6.9 PUF Tensile Strength Tests

At the option of PROJECT MANAGER, up to three samples of up to 100 cubic inches in volume may be taken for on-site tensile strength testing. PUF shall be provided at no additional cost to OWNER. If tests indicate that PUF density is less than 1.85 pounds per cubic foot, PROJECT MANAGER may require CONTRACTOR to remove and replace the PUF or add additional PUF at CONTRACTOR'S expense.

9.6.10 Backfilling

Immediately after the last lift of PUF has solidified, CONTRACTOR shall shovel a minimum one inch (1") uniform layer of fill over the PUF. This backfill is to protect the PUF from vandalism if the site is left unattended. No earlier than four (4) days after PUF application, the remaining shaft void shall be backfilled. The first two foot (2') lift of common fill shall be placed by hand, bucket or chute to lower the velocity of impact against the PUF. With approval of PROJECT MANAGER fill may be placed by streaming from heavy equipment such as a loader bucket. Pipe shall not be damaged by placement of backfill material. PUF damaged by vandalism due to the lack of protective fill shall be repaired or replaced by CONTRACTOR.

9.6.11 Maintenance

Formwork which fails for any reason during construction, any materials such as PUF lost due to failure of the bottom form, pipe lost due to failure of supporting equipment and pipe damage by backfill shall be replaced and/or repaired at no cost to OWNER.

9.6.12 Cleanup

CONTRACTOR shall clean the site of all PUF fragments and overspray. PUF overspray greater than one eighth inch (1/8") thick on timbers or historic materials shall be removed to less than one eighth inch (1/8") to permit ultraviolet degradation of oversprayed polyurethane. Tools and equipment shall be cleaned so as not to injure vegetation or wildlife. Handling of chemicals used in cleanup shall comply with all applicable local, state and federal regulations.

Ruts, damage to vegetation, and other surface disturbances shall be regraded and revegetated, if required by PROJECT MANAGER.

9.7 MEASUREMENT AND PAYMENT

Payment for polyurethane foam closures shall be based on the quantity of PUF applied. The proportioner shall have a direct reading device to monitor output of components, and the PUF applicators shall inform PROJECT MANAGER of the constant to be used to estimate PUF quantities actually installed. Barrels of material may be examined with a dipstick by PROJECT MANAGER with assistance of the PUF applicators in order to provide a second measure of quantities installed. Measurement for payment is based on attaining the specified thickness of foam to create a beam within the hazardous opening. Payment shall be for the lump sum bid prices adjusted for the actual quantity of PUF applied, based on the bid price for additional PUF.

If PUF is hand mixed, the net weight of the filled measuring containers shall be established prior to completion. The volume of PUF will be estimated by dividing the total weight of product mixed by two (2 # per cubic foot) to determine the cubic feet of PUF applied.

The price bid shall include all of CONTRACTOR'S costs of whatever nature to provide a complete closure installation in accordance with the plans and specifications, including materials, installation of PUF, fabrication of grated access door for the CSP (if required), drainage pipes, backfill, cleanup and revegetation. No payment will be made for off-ratio PUF.

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Section 10

CORRUGATED STEEL PIPE ADIT CLOSURE

10.1 DESCRIPTION

This work shall consist of installing a corrugated steel pipe (CSP) adit closure including clearing and grubbing, excavation of loose material and trimming of the adit, furnishing all necessary materials including CSP, drainage pipe and grated access doors, welding of tie plates, project signage, monumentation, erosion control revegetation, and backfilling in accordance with Standard Drawing No. 5 and these specifications.

10.2 RELATED WORK

Section 20 – Revegetation
Section 21 – Project Sign
Section 22 – Erosion Control

10.3 REFERENCE DOCUMENTS

Standard Drawing No. 5.
ACI 301 – Specifications for Structural Concrete.
ACI 305 – Recommended Practice for Hot Weather Concreting.
ACI 306 – Recommended Practice for Cold Weather Concreting.
ASTM A53 – Standard Specification for Pipe, Steel, Black and Hot Dipped, Zinc Coated, Welded and Seamless.
ASTM C31 - Standard Specification for Making and Curing Concrete test Specimens in the Field.
ASTM C33 - Standard Specification for Concrete Aggregate.
ASTM C39 - Standard Test Method for Ready Mixed Concrete.
ASTM C94 - Standard Specification for Compressive Strength of Cylindrical Concrete Specimens.
ASTM C150 - Standard Specification for Portland Cement.
ASTM C172 - Standard Practice for Sampling Freshly Mixed Concrete.
ASTM C494 - Standard Specification for Chemical Admixtures for Concrete.
ASTM C1107 – Standard Specification for Non-Shrink Grout
ASTM D615 – Standard Specification for Plain and Deformed Carbon Steel bars for Concrete Reinforcement.
AASHTO M 36 – Standard Specification for Corrugated Steel Pipe, Metallic Coated
AASHTO M 294 – Standard Specification for Corrugated Polyethylene Pipe.
CDOT Standard Specifications, 2005 – Section 601 – Structural Concrete.

10.4 MATERIALS

Corrugated Steel Pipe shall consist of 12-gauge galvanized steel pipe with helical or annular corrugations. The pipe shall be free of rust, gaps in seams, holes, and deformations that reduce the inside diameter by more than two inches (2").

Concrete shall have a minimum rated compressive strength of 3,500 psi at 28 days.

Structural Steel shall conform to the requirements of ASTM A-36, all purpose steel.

Drain pipe shall be six inch (6") SDR-35, schedule 40 perforated ABS, or HDPE drain pipe.

Durable rock shall consist of rock which gives off a ringing sound when struck with a hammer.

10.5 EXECUTION

10.5.1 Fabrication

The corrugated steel pipe adit closure shall be fabricated in accordance with Standard Drawing No. 5. The grated access door hasp shall be constructed so as to accommodate a Number 5 Masterlock with a 3/4-inch long hasp. The field weld of the CSP to the grated access door shall be in accordance with the requirements of the American Welding Society AWS D1. Free play between the hasp and grated door shall not exceed one-quarter inch (1/4") when locked.

10.5.2 Clearing and Grubbing

The work site shall be cleared and grubbed of debris, loose rocks and other items which interfere with construction, as approved by PROJECT MANAGER. All garbage and debris shall be disposed of at a county approved disposal site as directed by PROJECT MANAGER.

10.5.3 Excavation and Installation

The adit opening shall be cleared of loose rock and debris to create a planar bedding surface for the pipe. Any material placed in the floor of the adit to bed the pipe shall consist of material less than four inches (4") in diameter and shall be compacted to the extent practicable. If the adit is draining water, a six-inch (6") drain pipe shall be installed according to the specifications noted on Standard Drawing No. 5. The drain pipe shall extend a minimum of five feet (5') beyond each end of the CSP. After installation of the CSP, the space between the pipe and the adit walls shall be backfilled with unclassified material the entire length of the CSP except the front three feet (3') of backfill which shall consist of concreted durable rock. The rock to be concreted shall be a minimum of four inches (4") in diameter.

10.5.4 Grated Access Door Installation

After placement of the CSP, the grated access door shall be welded to the CSP. The weld shall be continuous around the CSP. Sufficient space shall be provided for the door to open smoothly to provide full access to the CSP. Following installation of the grated access door, CONTRACTOR shall weld a three-inch (3") I.D. (inside diameter) four inch (4") long galvanized pipe to the outside grate and grout a brass cap flush to ¼" below the top of the pipe, using a non-shrink grout or adhesive, such as Moly Parabond, Pour Rock or QUIKRETE.

10.5.5 Final Grading

All work areas, including borrow areas shall be regraded and left in a smooth condition with no steep slopes or material piles. The section of pipe outside the adit should be backfilled and graded to conform to surrounding topography. All areas disturbed by CONTRACTOR are required to be revegetated according to the specifications in this document, unless otherwise specified by PROJECT MANAGER in writing.

10.4 MEASUREMENT AND PAYMENT

No measurement for payment shall be made for these bid items. Payment shall be for the lump sum bid price. The price bid shall include all of CONTRACTOR'S cost of whatever nature to proved a complete closure installation in accordance with the plans and specifications, including materials, fabrication, grated access door, excavation, backfill including durable large rock, welding, coating final grading and revegetation of disturbed area.

Section 11

GRATED ADIT CLOSURE

11.1 DESCRIPTION

This work shall consist of installing steel grating in the existing lining within an adit including clearing and grubbing, excavation of loose material, trimming the adit, and furnishing, securing and welding of steel grate work, project signage, monumentation, revegetation, and erosion control according to these specifications and Standard Drawing No. 6, sheets 1 and 2.

11.2 RELATED WORK

Section 20 – Revegetation
Section 21 – Project Sign
Section 22 – Erosion Control

11.3 REFERENCE DOCUMENTS

Standard Drawing No. 6 Sheet 1.
ACI 301 – Specifications for Structural Concrete.
ACI 305 – Recommended Practice for Hot Weather Concreting.
ACI 306 – Recommended Practice for Cold Weather Concreting.
ASTM A36 – Standard Specification for Carbon Structural Steel.
ASTM A53 – Standard Specification for Pipe, Steel, Black and Hot Dipped, Zinc Coated, Welded and Seamless.
ASTM C31 - Standard Specification for Making and Curing Concrete test Specimens in the Field.
ASTM C33 - Standard Specification for Concrete Aggregate.
ASTM C39 - Standard Test Method for Ready Mixed Concrete.
ASTM C94 - Standard Specification for Compressive Strength of Cylindrical Concrete Specimens.
ASTM C150 - Standard Specification for Portland Cement.
ASTM C172 - Standard Practice for Sampling Freshly Mixed Concrete.
ASTM C494 - Standard Specification for Chemical Admixtures for Concrete.
ASTM C1107 – Standard Specification for Non-Shrink Grout
ASTM D615 – Standard Specification for Plain and Deformed Carbon Steel bars for Concrete Reinforcement.
AASHTO M 36 – Standard Specification for Corrugated Steel Pipe, Metallic Coated
AASHTO M 294 – Standard Specification for Corrugated Polyethylene Pipe.
CDOT Standard Specifications, 2005 – Section 601 – Structural Concrete.

11.4 MATERIALS

Steel Grating shall be a minimum of 1-1/4" by 3/16" bearing bars on 1 3/16" centers. Cross bars shall be resistance welded at right angles to the bearing bars and spaced 4 inches center to center, (bar as manufactured by AMICO type 19-W-4-53, or equivalent).

Structural Steel shall conform to the requirements of ASTM A 36, all purpose steel.

Plastic pipe shall be six-inch (6") SDR-35 or schedule 40 perforated ABS, or HDPE drain pipe, conforming to ASTM D 2104.

Cement shall be Type II Portland cement, conforming to ASTM C 150, unless otherwise approved by PROJECT MANAGER.

Concrete - shall have a minimum compressive strength of 3500 psi at 28 days.

Fine and Coarse Aggregate shall conform to ASTM C 33.

Water shall be potable.

Rock bolts shall be expansion type with a minimum pullout strength of 2000 pounds at an embedment depth of 4.5 inches. The rock bolts shall be Hilti Heavy Duty Expansion Anchor, Kwik Bolt, or equivalent.

Anchor Bars shall be Number 6 (3/4") rebar in accordance with ASTM A 615, grade 60, anchored a minimum depth of 8 inches (8") into competent rock with Moly Parabond capsule or equivalent, or as interference fit in drilled holes in solid rock.

11.5 EXECUTION

11.5.1 Fabrication

The grating and an angle iron grate frame (L 2" x 2" x 1/4") will be cut and welded on site to fit the irregularities of the opening. The frame will be anchored to the adit walls using imbedded anchor bolts or rebar anchor rods welded to the grate frame. All field welds shall be in accordance with the requirements of the American Welding Society AWS D1.1. If there is an access requirement, the grating shall be designed with a hinging and locking mechanism in accordance with Standard Drawing No. 6.

11.5.2 Clearing and Grubbing

The work site shall be cleared and grubbed of debris, loose rocks and other items which interfere with construction, as approved by PROJECT MANAGER. All trash and debris shall be disposed of at a county approved disposal site, as directed by PROJECT MANAGER.

11.5.3 Excavation and Installation

The grate shall be set into the adit entry at a stable location no more than ten feet (10') from the opening or as directed by PROJECT MANAGER. All rubble and other materials shall be removed to the original excavated level of the adit. The grating shall be sized to extend from the roof of the opening to the floor. If the floor of the entry is competent rock, the grate may be anchored directly to that rock, or the base of the grating is to be anchored to a twelve inch (12") wide, poured concrete footing, twelve inches (12") deep, across the entire width of the adit which shall incorporate Number 6 rebar anchors on two foot (2') centers. If competent rock is greater than three feet (3') below grade, the bottom of the footing shall be placed a minimum of three feet (3') below grade.

The adit opening shall be cleaned of loose rock and trimmed to provide a uniform contact with the grating frame. The angle iron frame shall be cut, formed, and fitted continuously around the perimeter of the opening. Spacing between the grating and adit perimeter will not exceed one inch (1”). Rock bolts or anchor bars shall be installed on twelve inch (12") centers around the entire perimeter of the adit opening. For openings having irregular contours, the grate may be installed without the perimeter angle iron frame, but with a two inch by three eights inch (2" x 3/8") steel reinforcing strap welded to the rock bolts or anchor bars. For openings over six feet (6') wide, stiffeners shall be used. All grated adit closures shall have L 2 ½” x 2 ½” x ¼” angle irons welded to the inside of the grating on two foot (2') centers. The angle iron stiffeners shall be welded to the bearing bars on six-inch centers. The rock bolts or anchor bars shall be anchored eight inch (8") minimum embedment depth into drilled holes in competent rock. Anchoring shall be by bolt expansion, Moly Parabond epoxy capsules (or equivalent epoxy capsules), or by swaging bars into the drilled holes such that an interference fit is obtained.

If rock is soft, excessively fractured, or generally incompetent, 3/4-inch anchor bars shall be used, and a minimum anchoring depth of eighteen inches (18") shall be required with epoxy capsule anchoring. The

grate frame shall be positioned onto the rock bolts or anchor bars with a minimum two-inch (2") weld length (overlap) on each anchor bar, or such that rock bolts go through holes drilled in the grate frame. Torch-cut holes for rock bolts will not be accepted. Both sides of each anchor bar will be welded to the frame. Rock bolts will be tightened securely and the nuts tack welded. The grate will then be welded into the secured frame at every other bearing bar, on one side, around the entire perimeter of the grate. The grating will be positioned with the cross rod surface facing inside the adit. Bolt protection plates, as shown on Standard Drawing No. 6, are required at the edges of the perimeter grate frame. Painting is not required.

If a hinging and locking mechanism is required, the hatch and hatch frame will be welded into the bottom center area of the grate. The locking door shall be constructed as shown on Standard Drawing No. 6. The grating material shall be the same as the surrounding grating.

A brass cap shall be affixed to the outside of the grating by CONTRACTOR by welding a 4” long section of 3” inside diameter steel pipe to the grating. The brass cap shall be grouted flush to ¼” below the top of the pipe using a non-shrink grout or adhesive such as Moly Parbond, Pour Rock, or Kwick Crete or alternatively, grouted into competent rock at the portal. The brass caps will be supplied by OWNER.

11.6 MEASUREMENT AND PAYMENT

No measurement for payment shall be made for these bid items. Payment shall be for the lump sum bid price. The price bid shall include all of CONTRACTOR’S cost of whatever nature to provide a complete closure installation in accordance with the plans and specifications, including materials, fabrication, grated access door, excavation, backfill including durable large rock, welding, coating, final grading, and revegetation of disturbed areas.

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Section 12

ADIT DOOR CLOSURE

12.1 DESCRIPTION

This work shall consist of installing a grated steel door within an adit including clearing and grubbing, excavation of loose material, trimming of adit, and furnishing, securing and welding of steel grate work, project signage, monumentation, revegetation, and erosion control in accordance with Standard Drawing No. 7 and these specifications.

12.2 RELATED WORK

Section 20 – Revegetation
Section 21 – Project Sign
Section 22 – Erosion Control

12.3 REFERENCE DOCUMENTS

Standard Drawing No. 7.
ACI 301 – Specifications for Structural Concrete.
ACI 305 – Recommended Practice for Hot Weather Concreting.
ACI 306 – Recommended Practice for Cold Weather Concreting.
ASTM A36 – Standard Specification for Carbon Structural Steel.
ASTM A53 – Standard Specification for Pipe, Steel, Black and Hot Dipped, Zinc Coated, Welded and Seamless.
ASTM C31 - Standard Specification for Making and Curing Concrete test Specimens in the Field.
ASTM C33 - Standard Specification for Concrete Aggregate.
ASTM C39 - Standard Test Method for Ready Mixed Concrete.
ASTM C94 - Standard Specification for Compressive Strength of Cylindrical Concrete Specimens.
ASTM C150 - Standard Specification for Portland Cement.
ASTM C172 - Standard Practice for Sampling Freshly Mixed Concrete.
ASTM C494 - Standard Specification for Chemical Admixtures for Concrete.
ASTM C1107 – Standard Specification for Non-Shrink Grout
ASTM D2104 – Standard Specification for Polyethylene (PE) Plastic Pipe, Schedule 40.
ASTM D615 – Standard Specification for Plain and Deformed Carbon Steel bars for Concrete Reinforcement.
CDOT Standard Specifications, 2005 – Section 601 – Structural Concrete.

12.4 MATERIALS

Steel Grating shall be a minimum of 1-1/4" by 3/16" bearing bars on 1 3/16" centers. Cross bars shall be resistance welded at right angles to the bearing bars and spaced 4 inches center to center, (bar as manufactured by AMICO type 19-W-4-53, or equivalent).

Cement grout shall consist of commercially available sand and cement mix with a minimum rated compressive strength of 3,500 psi at 28 days.

Structural Steel shall conform to the requirements of ASTM A36, all purpose steel.

Drain pipe shall be six-inch (6") SDR-35 or schedule 40 ABS, or HDPE pipe.

Rock bolts shall be expansion type with a minimum pullout strength of 2,000 pounds at an embedment depth of 4.5 inches. The rock bolts shall be Hilti Heavy Duty Expansion Anchor, Kwik Bolt or equivalent.

Anchor Bars shall be Number 6 (3/4") rebar in accordance with ASTM A 615, grade 60, anchored to a minimum depth of eight inches (8") into competent rock with Moly Parabond epoxy capsule or equivalent, or with an interference fit in drilled holes in solid rock.

Durable Rock shall consist of locally available durable rock, which gives a ringing sound when struck with a hammer.

12.5 EXECUTION

12.5.1 Fabrication

The door grating shall be welded to a L 2" x 2" by ¼" angle iron framework. The grate framework is to be attached with six-inch (6") extra heavy hinges to a L 2" x 2" x ¼" angle iron door frame which will be securely anchored to the perimeter of the opening with rock bolts or anchor bars in the roof and floor, and a steel grating. All field welds shall be in accordance with the requirements of the American Welding Society AWS D1.1.

12.5.2 Clearing and Grubbing

The work site shall be cleared and grubbed of debris, loose rocks and other items which interfere with construction, as approved by PROJECT MANAGER. All trash and debris shall be disposed of at a county approved disposal site, as approved by PROJECT MANAGER.

12.5.3 Excavation and Installation

The door shall be set into the adit at a stable location a minimum of five feet (5') and a maximum of ten feet (10') from the opening or as directed by PROJECT MANAGER. The foundation shall be excavated to bedrock. The adit opening shall be cleaned of loose rock and trimmed as needed to accommodate the door framework.

The door frame shall be secured to the internal adit surface on the sides by rock bolts or anchor bars on twelve-inch (12") centers. The rock bolts or anchor bars shall be anchored eight-inch (8") minimum embedment depth into the drilled holes such that an interference fit is obtained. Swaged bar embedments will be allowed only in competent rock. No rock bolts or anchor bars are required on the top or bottom unless the space between the door frame and the adit exceeds eighteen (18") inches.

If the rock is soft, excessively fractured, or generally incompetent, a minimum anchoring depth of eighteen inches (18") shall be required, and anchoring shall be by Moly Parabond epoxy capsules (or equivalent epoxy capsules).

The ends of the anchors at the door frame will be welded to the door frame. Welding shall be made on both sides of the anchors.

The spaces between the adit and the angle-iron doorframe be covered with grating identical to that of the door. This alternative requires that anchor bars shall be placed around the entire perimeter of the door frame. The grating shall be trimmed, framed, attached, and installed around the perimeter of the adit in accordance with the specifications for the grated adit closure, (11.0), as shown in Standard Drawing No. 7.

L 2" x 2" x ¼" stiffeners installed from roof to floor shall be used to support the L 2" x 2" x ¼" angle iron door frame as shown on Standard Drawing No. 7. Bolt protection plates, as shown on Standard Drawing No. 6, are required at the edges of the perimeter grate frame.

If there is any mine drainage, a twelve inch (12") thick, twelve inch (12") tall concrete footer shall be poured. A six inch (6") diameter SDR or schedule 40 ABS pipe shall be placed near the bottom of the footer. The concrete footer shall be anchored into the floor with rock bolts or anchor bars on twelve inch (12") centers. The steel grating or door frame shall extend into the concrete a minimum of two inches (2"). If the door frame is cast into the concrete footer, the top of the angle iron shall be flush with the top of the concrete footer.

A brass cap shall be grouted flush to ¼" below the top of a 3" inside diameter pipe 4" long welded to the outside of the grating or the brass cap may be set into the mortared rock by CONTRACTOR. The brass caps will be supplied by OWNER.

12.5 MEASUREMENT AND PAYMENT

No measurement for payment shall be made for this bid item. Payment shall be for the lump sum bid price. The price bid shall include all of CONTRACTOR'S cost of whatever nature to provide a complete closure installation in accordance with the plans and specifications, including all necessary materials, fabrication of the door, excavation and welding.

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Section 13

BAT GRATE ALTERNATIVE

13.1 DESCRIPTION

This work will consist of fabricating and installing a special grate within a Grated Adit Closure (Section 11) or an Adit Door Closure (Section 12). The grate shall consist of steel bars with an inset series of spaces to allow for bat ingress and egress, according to these specifications, and Standard Drawing No. 6 Sheet 2.

13.2 RELATED WORK

Section 20 – Revegetation
Section 21 – Project Sign
Section 22 – Erosion Control

13.3 REFERENCE DOCUMENTS

Standard Drawing No. 6 Sheet 2.
ASTM A36 – Standard Specification for Carbon Structural Steel.

13.4 MATERIALS

Structural Steel shall conform to the requirements of ASTM A-36, all purpose steel.

13.5 EXECUTION

13.5.1 Fabrication

The bat grate alternative will consist of a sequence of 6" high X 24" wide inside dimension spaces installed from ceiling to floor of the adit opening. These spaces will be constructed out of any of three alternate cross bar forms, as specified and shown in Standard Drawing No. 6. Cross bar alternates shall be called out in the special conditions, and shall consist of either 3/4" X 3" steel bars, L4" X 4" X 5/16" angle iron, or 2 1/2" inside diameter pipe with a free rolling 2" inside diameter pipe inside. All three alternative cross bar designs shall be welded to vertical 3" X 3" X 1/4" angle iron uprights. The bat grate will be inset into the adit-grating material, as specified for the conventional Grated Adit Closure (Section 11), or Adit Door Closure (Section 12).

13.5.2 Installation

The bat grating will be cut to fit and welded into the grating of the Grated Adit Closure (Section 11) or the Adit Door Closure (Section 12). All field welds shall be in accordance with the requirements of the American Welding Society AWS D1.1.

If there is an access requirement in a Grated Adit (Section 11), the inset bat grate will be designed with an integral access hatch in the bat grate section, as shown on Standard Drawing No. 6. If the bat grate is called for in the Adit Door Closure (Section 12), the bat grate shall extend the full height of the door opposite the lock box side.

Upon completion of the bat grating installation, the exact grade of sloughed or blocking earth materials will be replicated to pre-construction conditions in front of the adit

A brass cap shall be grouted flush to ¼” below the top of a 3” inside diameter pipe 4” long welded to the outside of the grating or the brass cap may be set into the mortared rock by CONTRACTOR. The brass cap will be supplied by OWNER.

13.6 MEASUREMENT AND PAYMENT

No measurement for payment will be made for this bid item. Payment will be for the lump sum bid price. The price bid will include all of CONTRACTOR'S cost of whatever nature to provide a complete bat grate installation within a Grated Adit Closure or an Adit Door Closure, in accordance with the plans and specification, including all necessary materials, fabrication of the grate, welding and installation.

Section 14

ROCK BULKHEAD CLOSURE

14.1 DESCRIPTION

This specification covers all work required for construction of a rock bulkhead closure in an adit or inclined shaft, project signage, monumentation, revegetation, and erosion control according to Standard Drawing No. 10, with or without a grated access opening.

14.2 RELATED WORK

Section 20 – Revegetation
Section 21 – Project Sign
Section 22 – Erosion Control

14.3 REFERENCE DOCUMENTS

Standard Drawing No. 10.
ASTM A36 – Standard Specification for Carbon Structural Steel.
ASTM A53 - Standard Specification for Pipe, Steel, Black and Hot Dipped, Zinc Coated, Welded and Seamless.
ASTM C1107 – Standard Specification for Non-Shrink Grout.
ASTM D2104 – Standard Specification for Polyethylene (PE) Plastic Pipe, Schedule 40.
AASHTO M 36 – Standard Specification for Corrugated Steel Pipe, Metallic Coated

14.4 MATERIALS

Corrugated steel pipe shall consist of 12-gauge galvanized steel pipe with helical or annual corrugations. The pipe shall be free of rust, gaps in seams, holes, and deformations that reduce the inside diameter by more than two inches (2").

Cement grout shall consist of commercially available sand and cement mix with a minimum rated compressive strength of 3,500 psi at 28 days.

Structural steel shall conform to the requirements of ASTM A36, all purpose steel.

Drain pipe shall be six-inch (6") SDR-35, Schedule 40, perforated ABS, or HDPE pipe.

Durable rock shall consist of rock which gives off a ringing sound when struck with a hammer.

14.5 EXECUTION

14.5.1 Clearing and Grubbing

The foundation for the rock bulkhead seal shall be bedrock. The foundation shall be cleared of all unconsolidated material prior to construction of the seal. If unconsolidated material is in excess of thirty six (36") inches below the original excavated level of the adit, the rock bulkhead seal shall be constructed from thirty six inches (36") below the original excavated level to the adit roof.

14.5.2 Installation

The bulkhead seal shall be constructed of grouted durable native rock, a minimum of thirty inches (30") in thickness. There shall be no spaces between the rock bulkhead seal and the adit walls. Dry stacking of rock is not permitted.

Grated access opening. If a grated access opening is specified, a 36-inch long, 36-inch diameter, corrugated steel pipe (CSP) shall be installed in the rock bulkhead seal. A grated access opening shall be constructed according to Standard Drawing No. 10.

After placement of the CSP, the grated access door shall be welded to the CSP. The weld shall be continuous around the CSP. Sufficient space shall be provided for the door to open smoothly to provide full access to the CSP.

Ventilation openings. If a ventilation opening is specified, a solid grate shall be constructed and attached in accordance with Standard Drawing No, 11. Every other bearing bar shall be welded to the frame. The frame shall be sized to fit a 36-inch diameter CSP unless otherwise specified.

Drain pipe. Where there is a discharge from the adit, drain pipe shall be placed at the bottom of the seal. The ends of the pipe shall extend at least five feet (5') beyond the edges of the bulkhead.

14.5.3 Monumentation

A brass cap shall be installed in the masonry work by CONTRACTOR using a non-shrink grout such as Pour-rock, QUIKRETE, or Moly Parabond. The brass cap will be supplied by OWNER.

14.6 MEASUREMENT AND PAYMENT

No measurement for payment shall be made for this bid item. Payment shall be for the lump sum bid price. The price bid shall include all of CONTRACTOR's cost of whatever nature to provide a complete closure installation in accordance with the plans and specifications, including all necessary materials, fabrication of the door, excavation, welding and coating.

Section 15

CONCRETE MASONRY UNIT BULKHEAD SEAL CLOSURE

15. 1 DESCRIPTION

This specification covers all work required for construction of a bulkhead seal with or without a grated access opening project signage, monumentation, revegetation, and erosion control according to Standard Drawing No. 12.

15.2 RELATED WORK

Section 20 – Revegetation
Section 21 – Project Sign
Section 22 – Erosion Control

15.3 REFERENCE DOCUMENTS

Standard Drawing No. 12.
ACI 301 – Specifications for Structural Concrete.
ACI 305 – Recommended Practice for Hot Weather Concreting.
ACI 306 – Recommended Practice for Cold Weather Concreting.
ASTM A36 – Standard Specification for Carbon Structural Steel.
ASTM C31 - Standard Specification for Making and Curing Concrete test Specimens in the Field.
ASTM C33 - Standard Specification for Concrete Aggregate.
ASTM C39 - Standard Test Method for Ready Mixed Concrete.
ASTM C90 – Standard Specification for Loadbearing Concrete Masonry Units
ASTM C94 - Standard Specification for Compressive Strength of Cylindrical Concrete Specimens.
ASTM C150 - Standard Specification for Portland Cement.
ASTM C172 - Standard Practice for Sampling Freshly Mixed Concrete.
ASTM C270 – Standard Specification for Mortar for Unit Masonry.
ASTM C404 – Standard Specification for Aggregate fir Masonry Grout.
ASTM C494 - Standard Specification for Chemical Admixtures for Concrete.
ASTM C1107 – Standard Specification for Non-Shrink Grout.
ASTM D2104 – Standard Specification for Polyethylene (PE) Plastic Pipe, Schedule 40.
ASTM D615 – Standard Specification for Plain and Deformed Carbon Steel bars for Concrete Reinforcement.
CDOT Standard Specifications, 2005 – Section 601 – Structural Concrete.

15.4 MATERIALS

Mortar shall be masonry cement mortar designed to reach 2500 psi at 28 days and proportioned in accordance ASTM C 270.

Grout shall consist of Type II Portland Cement conforming to ASTM C 150 mixed with fine aggregate conforming to ASTM C404 size number 2 that attains a minimum compressive strength of 3,500 psi at 28 days.

Steel Grating shall consist of main bearing bars 1 1/4" X 3/16" spaced 1 3/16 inches center to center. Cross bars shall be resistance welded at right angles to the bearing bars and spaced four (4") inches center to center, (AMICO 19-W-4-53, or equivalent).

Structural Steel shall conform to the requirements of ASTM A36 grade all-purpose steel.

Drain Pipe shall be six-inch (6") SDR-35, schedule 40 perforated ABS, or HDPE pipe, conforming to ASTM D 2104.

Concrete Block (Concrete Masonry Units) shall conform to ASTM C 90 Grade N-1.

Durable rock shall consist of rock which gives off a ringing sound when struck with a hammer.

Reinforcing Steel (rebar) shall be made of deformed new billet stock and shall conform to ASTM A 615, Grade 60. All reinforcing steel shall be free from heavy rust, scale, or other coating that will destroy or reduce the bond with the concrete.

15.5 EXECUTION

15.5.1 Foundation

The foundation for the bulkhead seal shall be bedrock. The foundation shall be cleared of all unconsolidated material prior to construction of the seal. If bedrock is in excess of thirty six inches (36") below the original excavated level of the adit, a footer shall be installed. Number 5 rebar shall be set on eight inch (8") centers to a thirty six inch (36") depth. The footing shall be keyed twelve inches (12") minimum into competent rock. If rock is greater than three feet (3') below grade, the bottom of the footing shall be placed three feet (3') minimum below grade. The concrete footing shall be twelve inches (12") minimum thickness. Footing width shall be thirty inches (30") minimum.

15.5.2 Installation

Adit walls shall be trimmed with whole or partial blocks laid as close as possible to the adit wall. Any spaces between the blocks and the adit wall shall be grouted. Number 5 rebar shall be installed and grouted in each block opening from the floor to the roof of the mine openings. Walls shall include 4 x 4 W2.0 x W2.0 steel mesh placed horizontally between every course (every 8”) for the full height of the wall. Spacing within blocks and between block courses shall be grouted. Top blocks shall be capped and any openings between the top of the wall and the adit shall be grouted.

Ventilation Opening. If a ventilation opening is specified, a steel grating shall be welded to an L 2” x 2” x ¼” frame. The frame shall be sized with three-foot by three foot (3' x 3') inside dimension. If access is required, this opening shall be constructed with a locking and hinging mechanism in accordance with Standard Drawings No. 12. The grated door shall be centered within the bulkhead seal.

Drain Pipe. Where there is discharge from the adit to be sealed, a six-inch (6") drain pipe shall be placed at the bottom of the seal. The ends of the pipe shall extend at least five feet (5') beyond the edges of the bulkhead.

15.5.3 Monumentation

A brass cap shall be installed in the masonry work by CONTRACTOR using a non-shrink grout such as Pour Rock, QUIKRETE, Epoxy Bond, or Moly Parabond. The brass cap will be supplied by OWNER.

15.6 MEASUREMENT AND PAYMENT

No measurement for payment shall be made for these bid items. Payment shall be for the lump sum bid price. The price bid shall include all of CONTRACTOR’s cost of whatever nature to provide a complete closure installation in accordance with the plans and specifications, including materials, fabrication of CSP and grated access door or ventilation grate, excavation, and revegetation of disturbed areas.

Section 16

WIRE ROPE NETTING CLOSURE

16.1 DESCRIPTION

This work shall consist of installing a wire rope netting closure within an adit or over a shaft or stope, including clearing and grubbing, excavation of loose material, trimming of the adit or shaft, furnishing and securing the cable netting, project signage, monumentation, erosion control and revegetation of disturbed areas in accordance with these specifications and Standard Drawing Nos 6 and 13.

16.2 RELATED WORK

Section 20 – Revegetation
Section 21 – Project Sign
Section 22 – Erosion Control

16.3 REFERENCE DOCUMENTS

Standard Drawing No. 6 Sheet 1.
Standard Drawing No. 13.
ASTM C150 – Standard Specification for Portland Cement.
ASTM C387 – Standard Specification for Packaged, Dry, Combined Materials for Mortar and Concrete.
ASTM D2104 – Standard Specification for Polyethylene (PE) Plastic Pipe, Schedule 40.

16.4 MATERIALS

Aircraft cable shall consist of single length of 1/4", 7 x 7-14 preformed galvanized aircraft cable, 7,000 pounds tensile strength.

Swaged cable clamps shall be brass, stainless or non-corrosive metal, and swaged to the cable in the net "weaving" process. Brass oval sleeve clamps or galvanized/plated steel wire rope clamps will be used in creating the cable end loops.

Rock bolts shall be expansion-type with a minimum pullout strength of 2,000 pound at an embedment depth of 4.5 inches. The anchor bolts shall be Hilti Heavy Duty Expansion Anchor, Kwik bolt or equivalent eye-type anchor bolt.

Anchor Bars shall be Number 6 (3/4") rebar in accordance with ASTM A 615, grade 60, anchored a minimum depth of 8 inches (8") into competent rock with Moly Parabond capsule or equivalent, or as interference fit in drilled holes in solid rock.

Cement shall be Type II Portland cement, conforming to ASTM C-150, unless otherwise approved by PROJECT MANAGER.

Water shall be potable.

16.5 EXECUTION

16.5.1 Fabrication

The 1/4" aircraft cable shall be woven in a grid with six inch (6") openings, unless a bat accessible opening is specified, in which case, 6" x 24" metal framed openings will be required to allow bats to pass through the net. At all points of steel cable intersections, swaged cross cable clamps shall be placed to hold the steel cables in position. After threading through the eyes of the anchor pins, these clamps will be

swaged to the cable to provide a permanent connection. Every other cable along the exterior edge of the net shall be looped over and clamped to itself using brass, or stainless steel oval sleeve clamps, or galvanized/plated wire rope clips to form a loop for attachment to an anchor. If wire rope clips are used, the nuts shall be tack welded after tightening.

16.5.2 Installation

The wire rope netting shall be attached to anchor bars or rock bolts installed according to the specifications contained in Grated Adit Closure (Section 11) and Standard Drawing No. 6, Sheet 1. The ends of the anchors shall have continuous rings welded on, or be formed to provide a continuous solid eye for cable attachment. A minimum three feet (3') of setback will be provided from the edge of the opening.

On sites where the surface material is incompetent, caissons shall be used for anchor points. Caissons will be excavated a minimum three feet (3') deep and will have a minimum six-inch diameter column. Caissons will be placed on three foot centers, yet will conform to irregular dimensions. A three-foot (3') long, three-quarter inch (3/4") diameter eye bolt will be centered in the caisson, leaving the top three inches (3") exposed. The eyelet shall be welded closed to prevent cable detachment. Welding of eyes shall be done prior to stringing cable, as welding near cables can seriously reduce cable strengths.

16.5.3 Drainage Berms

Drainage berms shall be constructed of uncompacted waste rock or excavated material to direct runoff away from the opening. All areas including access routes and work areas that are disturbed by CONTRACTOR shall be revegetated according to the Revegetation specifications.

16.5.4 Monument

A brass cap shall be anchored into competent rock within the perimeter of the closure. A hole shall be drilled into competent rock, then a brass cap (supplied by OWNER) shall be grouted using a non-shrink grout such as Moly Parabond, QUIKRETE, or Pour Rock.

16.5 MEASUREMENT AND PAYMENT

No measurement for payment shall be made for these bid items. Payment shall be for the lump-sum bid price. The price bid shall include all of CONTRACTOR's cost of whatever nature to provide a complete closure installation in accordance with the plans and specifications including materials, fabrication of the cable netting closure, excavation, installation, and revegetation of disturbed areas.

Section 17

CHAIN LINK FENCING

17.1 DESCRIPTION

This specification covers all work involved in construction of a chain link fence around hazardous mine openings and revegetated areas, project signage, monumentation, revegetation, and erosion control according to Standard Drawing No. 8.

17.2 RELATED WORK

Section 20 – Revegetation
Section 21 – Project Sign
Section 22 – Erosion Control

17.3 REFERENCE DOCUMENTS

Standard Drawing No. 8.
AASHTO M 181
ASTM A53 – Standard Specification for Pipe, Steel, Black and Hot Dipped, Zinc Coated, Welded and Seamless.
ASTM C150 – Standard Specification for Portland Cement.
ASTM C387 – Standard Specification for Packaged, Dry, Combined Materials for Mortar and Concrete.
ASTM D2104 – Standard Specification for Polyethylene (PE) Plastic Pipe, Schedule 40.
CDOT Standard Specifications, 2005 – Section 601 – Structural Concrete.
Concrete shall be Class B

17.3 MATERIALS

Chain link fencing shall consist of 72-inch high, two-inch (2") mesh, 9-gauge galvanized wire.

End, Corner and Line Brace Posts shall be 2.5 inch I.D. (inside diameter) round galvanized pipe or 3.5 inch X 3.5 inch roll formed galvanized steel.

Line posts shall be 2.0 inch I.D. round galvanized pipe or 1.875 inch X 1.875 inch H-beam steel.

Top rail and brace rails shall consist of 1.25 inch I.D. round galvanized pipe or 1.625 inch X 1.625 inch roll formed galvanized steel.

Tension wire shall be 7 gauge galvanized coil spring steel.

Barbed wire shall be composed of two strands of galvanized 12.5 gauge steel wire, with 14 gauge galvanized steel 2-point barbs. Spacing of barbs shall be on approximately 4- to 5-inch centers.

Concrete shall be Class B or mixed one part cement to two part sand and 1 1/2 parts gravel, with not more than six gallons of water per 94-pound sack of cement.

17.5 EXECUTION

The chain-link fence shall consist of a fence with a railed top that conforms to the requirements of AASHTO M81 unless otherwise designated. Spacing of vertical posts shall not exceed ten feet (10'). Each post shall be set in a concrete base that is thirty-six inches (36") deep and twelve inches (12") in diameter. Concrete shall be Class B. Where competent rock is present the pipes may be set in holes drilled two inches (2") larger than the pipe and filled with concrete.

A 7-gauge galvanized coil spring steel tension wire shall be placed four inches above ground level. The tension wire shall be continuous between end or corner posts and line-brace posts. A turnbuckle of other approved tightening device shall be used for each continuous span of tension wire. Line brace posts are required at locations where the ground level changes abruptly.

The chain link fabric shall be securely fastened to tension wires, lineposts, rails, braces and stretcher bars at twelve inch (12") intervals vertically and twenty inch (20") intervals horizontally using eleven (11) gauge galvanized steel wire, seven (7) gauge aluminum wire, or nine (9) gauge hogrings. Tension bands, stretcher bars, brace rails, and 3/8" truss rods with turnbuckles are required at all corner, end and line brace posts. All open pipe tops shall be capped. All bolt nuts shall be welded to the bolt or the threads damaged to prevent removal. Brace rails shall be installed exactly mid-way between the top rail and tension wire. The fabric will be twisted and barbed on the top and bottom selvage. The fabric shall be placed as close to the ground surface as practicable. In no case shall there be a gap exceeding three inches (3") between the ground surface and the bottom of the fabric. Durable rock shall be placed at the base of the completed fence in places where gaps between the fabric and ground level exceed two inches (2"). Durable rock is defined as rock which gives off a ringing sound when struck with a hammer.

The barbed wire top shall slope out at forty-five degrees (45°). The three (3) strands of barbed wire shall be spaced at four inch (4") intervals. Each arm shall support a 200 pound test load and consist of one fourth inch (1/4") bar or twelve gauge folded galvanized steel.

17.5.1 Monument

A three inch (3”) inside diameter galvanized steel pipe, a minimum of four (4”) inches in length shall be welded to one of the corner posts, then a brass cap, supplied by OWNER, shall be grouted flush to ¼” below the top of the pipe with a non-shrink grout such as Moly Parabond, QUIKCRETE, or Pour Rock.

17.6 MEASUREMENT AND PAYMENT

Chain link fencing shall be measured to the nearest linear foot. Payment shall be made at the unit price per linear foot. Such payment will constitute full compensation for all labor materials, equipment and all other items necessary and incidental to the complete installation of a chain link fence around a hazardous mine opening and revegetation of disturbed areas.

Section 18

BARBED WIRE FENCING

18.1 DESCRIPTION

This specification covers all work involved in construction of barbed wire fences around hazardous mine openings and reclaimed areas in accordance with Standard Drawing No. 9 as directed by the Bid Documents and PROJECT MANAGER, project signage, monumentation, revegetation, and erosion control. .

18.2 RELATED WORK

Section 20 – Revegetation
Section 21 – Project Sign
Section 22 – Erosion Control

18.3 REFERENCE DOCUMENTS

Standard Drawing No. 9.
ASTM A53 – Standard Specification for Pipe, Steel, Black and Hot Dipped, Zinc Coated, Welded and Seamless.
ASTM C150 – Standard Specification for Portland Cement.
ASTM C387 – Standard Specification for Packaged, Dry, Combined Materials for Mortar and Concrete.
ASTM D2104 – Standard Specification for Polyethylene (PE) Plastic Pipe, Schedule 40.

18.4 MATERIALS

Barbed wire shall be composed of two strands of galvanized Number 12-1/2 steel wire, with 14 gauge galvanized steel 2-point barbs. Spacing of barbs shall be on approximately 4 to 5 inch centers.

Steel corner posts, end posts, gate posts for wire gates, and brace posts shall be 2-1/2 inches x 2-1/2 inches x 1/4 inch standard steel angle fence posts, 4.10 pounds per foot, with a minimum length of 7 feet for 4-feet high fences and 8 feet for 5-feet high fences. Braces for these posts shall be 2 inches x 2 inches x 1/4 inch structural steel angles of proper length to provide adequate bracing.

Steel line posts shall be 1-3/8 inches x 1-3/8 inches T-shaped, or 2 inches x 1-1/4 inches U- or Y-shaped, standard steel fence posts, with a minimum length of 5-1/2 feet for 4-feet high fences and 6-1/2 feet for 5-feet high fences. All steel line posts shall have an anchor plate. Steel line posts shall be painted with green enamel.

Wooden line posts shall be straight, sound and seasoned with ends sawed off square. All knots shall be trimmed flush with the surface. Posts shall be treated with either Pentachlorophenol, creosote oil or creosote petroleum solution, meeting the requirements of AASHTO M 133. Posts shall be treated by the empty cell method in accordance with American Wood Preservers' Association standards, except that the net retention shall be at least five pounds of preservative per cubic foot of wood. All wooden line posts shall have a minimum diameter of four inches (4"). All wooden line posts shall be a minimum of six feet (6') in length.

Concrete shall be mixed one part Portland II cement to two parts sand and 3 1/2 parts gravel, with not more than six gallons of water per 94 pound sack of cement.

Gate Bars shall be mixed 2 inches x 4 inches standard dimension lumber, 4 feet long. Gate spacers shall be 2 inches by 2 inches standard dimension lumber, 3 feet 6 inches long.

Manufactured gates shall be 18 feet long x 51 1/2 inches high, constructed of 15 gage, 1-1/2 inch square tubing similar in quality to the "Heavy Duty Cattle Gate" as manufactured by Linn Enterprises, Linn, Kansas 66953, except that a 1-1/2 inch x 1-1/2 inch x 2 feet 2 inches long solid steel bar shall be continuously welded onto the gate for a gate latch as shown on Standard Drawing No. 9. (These gates shall be furnished with all necessary hinges and appurtenances.) The gate shall have at least one finish coat of green enamel so as to match standard steel fence posts.

Steel pipe used for framing the lock chambers, for manufactured gates, shall be standard weight (Schedule 40) seamless steel pipe.

18.5 EXECUTION

18.5.1 Line Posts

Steel line posts shall be driven 1 1/2 feet into the ground or to the top of the anchor plate. All posts shall be set to the minimum depths specified above unless bedrock or other restrictive layer prohibits it. In such cases, line jacks or other suitable type of anchoring shall be acceptable, or posts may be set in pre-drilled holes at least twelve inches (12") deep and backfilled with concrete. Line posts shall be spaced uniformly, as shown on Standard Drawing No. 9.

Wooden line posts shall be inserted into a hole dug a minimum of 28 inches deep. The backfill material shall be thoroughly compacted by tamping so that the installed post has minimal play. Maximum wooden post spacing is twenty feet (20') for a 4-wire fence, and eighteen feet (18') for a 5 wire fence.

Fence shall be straight between corners. Some tree branch or brush cutting may be required to maintain alignment. Reasonable deviation in alignment will be permitted where rocky ground or steep slopes make it necessary.

18.5.2 Corner Post

Unless otherwise specified, corner post installations in conformance with Standard Drawing No. 9 shall be installed at all corners and at all points where the fence alignment changes horizontally fifteen degrees (15°) or more.

18.5.3 End Post With Brace

End posts with braces shall be built as shown in on Standard Drawing No. 9 at both sides of all wire gates, at all fence ends, and where fences cross large water courses or below rock structures as shown on Standard Drawing No. 9. A twelve-inch by twelve-inch by twenty four-inch (12" x 12" x 24") concrete block or durable rock of equal size may be used as a deadman anchor in lieu of braces to fit site conditions.

18.5.4 Line Braces

Line braces shall be installed in conformance with Standard Drawing No. 9 at the following locations:

a. In straight fence sections, at intervals of no more than 800 feet.

b. At any point where the vertical angle between two adjacent reaches of wire is upward and exceeds 15 degrees (15^{o}).

c. At the beginning and end of each curve.

18.5.5 Attaching Fencing to Posts

The fence shall be 4-wire, barbed, or 5-wire, barbed as shown on the drawings.

Four-Wire Fence - Wires shall be equally spaced as shown in Standard Drawing No. 9, with the bottom wire not more than twelve inches (12") above ground at the post and the top wire not less than forty two inches (42") above the ground at the post. One metal stay shall be placed at the midpoint between posts.

Five-Wire Fence - Wires shall be spaced as shown in Standard Drawing No. 9, with the bottom wire not more than nine inches (9") above ground at the post and the top wire not less than 54 inches above the ground at the post. Two equally spaced metal stays shall be placed between posts.

The fencing shall be mechanically stretched taut and attached to posts as follows:

a. The fencing shall be placed on the side of the post opposite the area being protected, except on curves.

b. The fencing shall be placed on the outside of curves.

c. The fencing shall be fastened to each end post, corner post and pull post by wrapping each horizontal strand around the post and tying it back on itself with not less than three tightly wound wraps.

d. Each strand of barbed wire shall be attached to each post as shown on Standard Drawing No. 9.

e. The fencing shall be fastened to steel line posts with either two turns of 14-gauge galvanized steel wire or the post manufacturer's special wire fasteners.

f. The fencing shall be fastened to wooden line posts using one inch (1") staples.

g. Wire shall be spliced by means of a Western Union splice or by suitable splice sleeves applied with a tool designed for the purpose. The Western Union splice shall have less than eight (8) wraps of each end about the other. All wraps shall be tightly wound and closely spaced. Splices made with splice sleeves shall have a tensile strength no less than eighty percent (80%) of the strength of the wire.

h. Stays shall be attached to the fencing in a manner to ensure maintenance of the proper spacing of the fence wire strands.

18.5.6 Crossings at Depressions and Watercourses

Where the fence crosses a draw, drainage or water course less than thirty feet (30') wide, or where the bottom of the draw will be more than twenty inches (20") below the bottom wire, seven feet (7') long steel fence posts shall be driven on each side of the water course and a deadman anchor shall be fastened to the fence as shown on Standard Drawing No. 9 to maintain the required wire spacing interval. An acceptable alternate to the deadman anchor is a five and one half feet (5 1/2') long standard fence post driven into the slope at a 30o to 45o angle as shown on Standard Drawing No. 9. Additional wires shall be added for short distances, as necessary.

Where the fence crosses water courses wider than thirty feet (30'), and/or below rock structures, a 2-1/2-inch x 2-1/2-inch x 1/4-inch x 7 feet long structural steel angle post shall be set 2-1/2 feet into a concrete base, either twelve inches (12") circular or square, on both sides of the water course. The posts shall be anchored with either a structural steel brace or deadman anchor, as shown on Standard Drawing No. 9. Line fence shall be tied off at the post and the fence across the water course shall be tied to each post. Twisted wire stays shall be spaced on 8 feet centers. Additional wire or one quarter-inch (1/4") cable may be used as necessary. Floating deadmen shall be two-inch by eight inch (2" x 8") timbers tied to all wires so as to equalize the stress.

18.5.7 Gates

Wire gates to allow for passage of vehicles or livestock shall be installed at location shown on the drawings and/or as directed by PROJECT MANAGER. The materials shall conform with the kinds, grades and sizes of the new fence, and shall include the necessary fittings, stays and Number 9 smooth wire closures. Gate posts for wire gates shall be included in the length of fence for measurement and payment.

Gate posts, for all gates other than wire gates, shall be 6-inch diameter seamless steel pipe, standard weight (Schedule 40), nine feet (9') long in a three feet by three feet by three feet-six inches (3' x 3' x 3' 6") concrete base. After installation, the entire pipe shall be filled with concrete. The exposed metal surfaces shall be thoroughly cleaned of all rust, grease and other foreign substances and painted with one coat of metal primer and two coats of green enamel so as to match standard steel fence posts.

Manufactured gates shall be installed at locations marked on the drawings and/or as directed by PROJECT MANAGER. Gates shall be fastened to six- inch (6") diameter steel pipe gate posts with one and one fourth inch (1-1/4") pipe and one inch (1") pins similar to those furnished with the "Heavy Duty Cattle Gate" manufactured by Linn Enterprises, Inc., Linn, Kansas. The latch bar and lock chamber shall be as detailed on Standard Drawing No. 9. Gaps in fence for manufactured gates will not be measured for payment of the fence.

18.5.8 Monument

If the fence is constructed around a hazardous mine opening, a brass cap, supplied by OWNER shall be installed in the concrete at one of the corner posts.

18.6 MEASUREMENT AND PAYMENT

Fencing, including wire gates, shall be measured to the nearest linear foot.

Payment for each type of fence construction will be made at the unit price for that type of work. Such payment will constitute full compensation for all labor, materials, equipment and all other items necessary and incidental to the performance of the work including concrete, fasteners, making all special crossings of narrow and wide water courses, and fabricating and installing all wire gates, and revegetation of disturbed areas.

Payment for furnishing and installing each type and size of manufactured gate will be made at the unit price for that type and size of gate. Such payment will constitute full compensation for all labor, materials, equipment and all other items necessary and incidental to the complete installation, including all gate posts with concrete bases, hinges, latches and lock chambers, and all other appurtenances, and painting all exposed metal surfaces as specified.

Section 19

EQUIPMENT RENTAL

19.1 DESCRIPTION

This specification covers the furnishing and operation of equipment for other supplemental earthwork as directed by PROJECT MANAGER.

19.2 RELATED WORK

None

19.3 REFERENCE DOCUMENTS

None

19.4 EQUIPMENT

All equipment shall be of the type and equipped as specified in the Special Conditions and on the Invitation and Bid. Mounted or attached equipment shall be that customarily manufactured for the respective size of equipment being offered. Size will be determined by maximum flywheel horsepower ratings at sea level and are the minimum size that shall be furnished and operated.

Equipment shall be in good operating condition and shall be maintained in good operating condition by CONTRACTOR throughout the life of the contract. PROJECT MANAGER shall be the sole judge of whether equipment is or is not in "good operating condition".

The number of hours indicated in the Special Conditions and on the Invitation and Bid Sheet are estimated. It is impossible to determine in advance the actual number of hours that the equipment will be required to be used, or to guarantee that any equipment rental will be necessary.

19.4.1 Calculations for Flywheel Horsepower (FHP) Adjustments

Equipment of any size above the minimum FHP may be furnished subject to the approval of PROJECT MANAGER. In order to evaluate the bids for various sizes of equipment proposed to be furnished by the bidders, the unit price inserted in the bid shall be adjusted. The bidder may figure the unit price to insert in the Invitation and Bid by doing the following computation for the applicable bid item:

(Rate you want per hour) X (Requested FHP) = Price on Bid Schedule

(The FHP of your machine)

EXAMPLE: If the desired unit rate to be received is $70.00/hour for a 215 FHP bulldozer and the minimum FHP requested is 140, then multiply $70.00 x 140/215 = $45.50 per hour.

Use that calculated amount ($45.50 in the example) as the unit price on the Invitation and Bid. If CONTRACTOR plans to furnish a machine other than the minimum FHP listed on the Invitation and Bid, he shall write the FHP of the machine, in ink, under the bid item on the Invitation and Bid, or include it on the *List of Equipment Offered* form.

After the successful bidder has furnished evidence of the FHP capacity of the equipment to be used, the amount bid for Equipment Rental will be modified by reversing the above procedure to reflect the unit price desired by CONTRACTOR with a corresponding reduction in the quantity of hours required. This modified hourly rate and number of hours will appear on the Purchase Order.

19.5 EXECUTION

19.5.1 Operators

The equipment shall be furnished complete with competent operating personnel. Operators shall be qualified to perform all work under this specification in a skillful and professional manner. OWNER may, in writing, require CONTRACTOR to remove from the work any employee OWNER deems incompetent or careless. OWNER will be the sole judge of the acceptability of any employee.

19.5.2 Supervision

CONTRACTOR shall be responsible for the supervision of all mechanical operations of the equipment including proper maintenance.
Equipment maintenance, fueling and repairs shall be done so that spilling of lubricants and fuel is minimized.

19.5.3 Performance of Work

Supplemental work shall be performed after the general construction work in that particular area and shall consist of general earthmoving or other finishing work as may be directed by PROJECT MANAGER.
All operations under this section will be under the direct supervision of PROJECT MANAGER and work under this section shall be performed only as ordered and directed by PROJECT MANAGER. PROJECT MANAGER will designate the work to be performed and the order in which it is to be done, and WILL inspect all work. PROJECT MANAGER will maintain documentation of the work.

19.5.4 Equipment Rental Documentation

At the close of each day's operations during which equipment rental work has been conducted under this specification, PROJECT MANAGER shall prepare a form entitled "Equipment Rental Record" listing the date, times and total hours (computed to the nearest one-half hour), each piece of equipment was operated in accordance with this specification. PROJECT MANAGER will obtain the signature of CONTRACTOR on the form.
"Operation" means that time spent in performing work as well as time necessary for moving equipment around the work site when directed by PROJECT MANAGER. However, "operation" does not include that time spent in transporting the equipment to the initial work site, removing the equipment when all work had been completed, transporting the equipment away from and returning it to the work site in the event of a temporary or seasonal suspension of operation, maintenance of the equipment, any time during which the equipment is "bogged down" or otherwise not working, nor for any periods when operations are suspended by the Principal Representative.

19.6 MEASUREMENT AND PAYMENT

The number of hours each piece and type of equipment used as directed by PROJECT MANAGER under this specification will be counted to the nearest one half hour. Payment will be made at the unit price established by the Invitation and Bid Sheet and in the purchase order contract for supplemental earthwork for each piece and type of equipment. Such payment shall include the cost of all materials, accessories, labor, maintenance, operating supplies, salaries of operators, and any other expenses incidental to the operation of the equipment in the performance of work in accordance with this specification and bid item(s). No extra payment will be made for the use of the same equipment while performing work on other bid items on the Invitation and Bid Sheet, Bid Schedules or Purchase Order Contract. No additional payment will be made for hauling equipment to or away from the work site except as may be proper under Mobilization/Demobilization.

Section 20

REVEGETATION

20.1 DESCRIPTION

This specification covers revegetation of all areas disturbed by CONTRACTOR during project work and areas designated in the Special Conditions to be revegetated. CONTRACTOR is responsible for revegetating all areas disturbed during installation of closure elements, or during backfilling of a mine opening or other reclamation work. Revegetation includes preparing the areas for seeding, furnishing seed (if required), placing seed, and furnishing and placing fertilizers, mulch and/or mulch stabilizers. Revegetation shall be factored into CONTRACTOR's bid for closure of each opening/area, unless a specific bid item for revegetation is included in the bid.

20.2 RELATED WORK

Section 22 – Erosion Control

20.3 REFERENCE DOCUMENTS

None

20.4 MATERIALS

20.4.1 Seed

Seed provided by CONTRACTOR. All seed shall conform to the current rules and regulations of the State of Colorado and the U.S. Department of Agriculture. Unless exception is granted by PROJECT MANAGER, seed shall be thoroughly pre-mixed (except for legumes) in the required proportions and delivered to the work site in bags or containers clearly tagged showing the name and address of the supplier, the net weight of each species of seed in the mix, the percent of weed seed content, and the guaranteed percentage of purity and germination for each species furnished. CONTRACTOR shall give the tags to PROJECT MANAGER. CONTRACTOR shall furnish a signed statement certifying that the seed furnished is from a lot that has been tested by a recognized laboratory for seed testing within nine months prior to the date of delivery to the job site.

Legume seed shall be inoculated with the correct viable inoculant for the species. Outdated inoculant will not be accepted. Inoculating shall be done within 48 hours before seeding.

Seed provided by OWNER. CONTRACTOR shall give PROJECT MANAGER at least five (5) working days notice of the acreage to be seeded, so PROJECT MANAGER can deliver the proper amount of seed.

If CONTRACTOR is required to supply the seed, the seed mixture to be used shall be one of the seed mixtures in the tables , as specified in the Special Conditions. Seed mixtures for various zones are listed in the tables following Section 20:

Table 20-1	Ponderosa Pine/Spruce/Fir Vegetation Area (6,000 – 9,000 feet)
Table 20-2	Western Pinon/Juniper Vegetation Area (5,000 – 7,000 feet)
Table 20-3	Eastern Pinon/Juniper Vegetation Area (5,000 – 7,500 feet)
Table 20-4	Grassland/Eastern Colorado Vegetation Area (4,500 feet +)
Table 20-5	Subalpine Vegetation Area (9,000 feet to treeline)
Table 20-6	Alpine Vegetation Area (above treeline)

20.4.2 Fertilizers

Commercial Fertilizer. Fertilizers shall be commercial grade diammonium phosphate (18-46-0) and free flowing, suitable for application with hydraulic- or pneumatic-type equipment or fertilizer spreaders and conforming to applicable Colorado State Fertilizer laws. Caked or lumpy fertilizer will not be accepted. CONTRACTOR shall furnish a supplier's certificate of analysis and weight. All fertilizer shall be in a form readily available to plants. Commercial fertilizer shall be applied at the rate of 300 pounds per acre.

Manure. Fertilizer shall be dry cow, horse or sheep manure that has been stockpiled a minimum of one (1) year. Manure shall not be so caked or lumpy that it cannot be spread uniformly. CONTRACTOR shall furnish weight tickets from a certified scale. Manure shall be applied at the rate of 30 tons per acre.

20.4.3 Mulches

Mulch shall consist of hay or straw mulch, pest-free or weed-free to the extent possible. Approximately 30 percent by weight of the mulch material shall be ten inches (10") in length or longer. Rotted, caked, decayed or moldy material will not be accepted. Hay or straw mulch shall be applied uniformly at the rate of two (2) tons per acre. Hydromulch shall be applied at the rate of one and a half (1 1/2) tons per acre.

20.5 EXECUTION

CONTRACTOR shall give PROJECT MANAGER at least two (2) days notice of the time and place of starting his revegetation operations and shall continue to advise as to the schedule of operations. Revegetation may take place at the completion of work at an individual opening if CONTRACTOR so desires.

20.5.1 Fertilizers

Immediately prior to seedbed preparation, fertilizer shall be uniformly applied over the areas designated for seeding and immediately incorporated into the soil by tilling methods as discussed below. Commercial fertilizer shall be applied at the rate of 300 pounds per acre. Manure shall be applied at the rate of 30 tons per acre.

20.5.2 Seedbed Preparation

The seedbed shall be firm. Trash, weeds and other debris that will interfere with seeding operations shall be removed or disposed of as approved by PROJECT MANAGER.

On sites where equipment can operate, the seedbed shall be adequately loosened (four to six inches (4" to 6") deep) and smoothed. Chiseling, discing, harrowing or cultipacking may be required. Work shall be done on the contour where practicable.

On sites where equipment cannot operate, the seedbed shall be hand raked or otherwise prepared by hand by scarifying to a minimum depth of one inch (1") to provide a roughened surface so that seed will stay in place.

Seedbed preparation shall be suspended when soil moisture conditions are not suitable for the preparation of a satisfactory seedbed as determined by PROJECT MANAGER.

20.5.3 Seeding

The designated seed mixture shall be sown uniformly on the prepared areas. Seeding shall not be done if the ground is frozen. Some areas, such as rock outcrops, etc., within the work limits may not be designated to be seeded.

Drill Seeding. In all areas where practicable and where the area to be seeded exceeds one (1) acre, seeding shall be performed with a grassland drill with depth bands and seedbox agitator and equipped with either packing wheels or a cultipacker. The drill shall be capable of properly handling the seed on all slopes designated for this method. Seed shall be drilled across the slope, where practicable. The distance

between drilled furrows shall not be more than twelve (12) inches. Seed shall be planted one quarter inch (1/4") to one half inch (1/2") deep.

Broadcast Seeding. Seeding shall be performed using hand operated or machine seeders whereby dry seed shall be applied in prescribed quantities uniformly on specified areas. Broadcast seeding shall be used where drill seeding is not practicable, or where the area to be seeded is less than one acre, or may be used at CONTRACTOR'S option. Broadcast seed shall be covered about one quarter (1/4) to one half (1/2) inch deep by flexible-tine harrowing or a similar method acceptable to PROJECT MANAGER. One to two operations may be required to obtain adequate coverage as specified by PROJECT MANAGER.

20.5.4 Seed Mixtures

If CONTRACTOR is required to supply the seed, the seed mixture to be used shall be one of the mixtures listed in the table following Section 20 as specified in the Special Conditions. The seeding rates shown in the tables are for drilled seeding. The rates for broadcast seeding are double those for drilled seeding.

20.5.5 Mulching

Hay or straw mulch shall be applied uniformly at the rate of two (2) tons per acre over seeded areas. Hydromulch shall be applied at the rate of one and a half (1 1/2) tons per acre. Mulch shall be applied to the designated areas immediately after seeding and not later than 24 hours after seeding has been performed. Mulching shall not be done when the wind velocity exceeds fifteen (15) miles per hour.

20.5.6 Stabilizing Mulch

On areas larger than one (1) acre a mulch crimper shall be used to stabilize or anchor the mulch into the soil after hay or straw mulch has been spread. The crimper shall be equipped with scrapers to keep the blades clean. Spacing of crimper blades shall not exceed nine inches (9"). On areas less than one acre crimping shall be achieved by hand with a suitable tool, such as a spade, on 18" centers.

20.5.7 Maintenance

CONTRACTOR shall maintain the areas until all work on the entire contract has been completed and accepted. Maintenance will consist of the repair of area damaged by erosion, wind, fire or other causes. Such areas shall be repaired to reestablish the condition and grade of seedbed and shall be refertilized, reseeded, remulched and/or reestablished as directed by PROJECT MANAGER.

20.6 MEASUREMENT AND PAYMENT

If revegetation is not included as a separate bid item, there will be no measurement for payment made for this bid item. The cost for revegetating disturbed areas shall be included in the bid for closure of each mine opening/area. CONTRACTOR shall estimate how much area will be disturbed during reclamation activities. The price bid shall include all costs for labor, materials, equipment and all other items necessary for revegetation as described in these specifications.

If revegetation is included as a separate bid item, revegetated areas will be measured to the nearest 0.1 acre and paid at the unit price bid for revegetation on the Bid Schedule. The price bid shall include all costs for labor, materials, equipment and all other items necessary for revegetation as described in these specifications.

Table 20-1

Ponderosa Pine/Spruce/Fir Vegetation Areas (6,000 - 9,000 feet)

The below rates are for drilled seeding. The rates for broadcast seeding are double the drilled rate.

Species	Scientific Name	Variety	lbs/Acre
Yarrow *	Achillea lanulosa		0.1
Rocky Mt. Penstemon*	Penstemon strictus	Bandera	0.3
Western wheatgrass	Pascopyrum smithii	Arriba	1.5
Slender wheatgrass	Elymus trachycaulus	San Luis	1.0
Mtn. Brome	Bromus marginatus	Bromar	2.0
Arizona fescue	Festuca arizonica	Redondo	0.5
Hard fescue	Festuca ovina	Durar	0.5
Indian ricegrass	Oryzopsis hymenoides	Nezpar	1.0
Big bluegrass	Poa ampla	Sherman	0.5
Canby bluegrass	Poa canbyi	Canbar	0.25
Green needlegrass	Stipa viridula	Lodorm	1.0
TOTAL pls lbs./acre (drilled)			**8.65**

Areas greater than 5 acres add:

Species	Scientific Name	Variety	lbs/Acre
Wood's rose	Rosa woodsii		1.0
Mtn. mahogany	Cercocarpus montanus		1.0

* To be bagged separately from mix. Bag to be attached outside of primary seed bag.

Table 20-2

Western Pinon - Juniper Vegetation Areas (5,000 - 7,500 feet)

The below rates are for drilled seeding. The rates for broadcast seeding are double the drilled rate.

Species	Scientific Name	Variety	lbs/Acre
Louisiana sage *	Artemisia ludoviciana		0.1
Palmer Penstemon *	Penstemon palmeri	Cedar	0.2
Globemallow *	Sphaeralcea coccinea		0.2
Western wheatgrass	Pascopyrum smithii	Arriba	1.5
Slender wheatgrass	Elymus trachycaulus	San Luis	1.5
Sideoats grama	Bouteloua curtipendula	Vaughn	1.0
Blue grama	Bouteloua gracilis	Lovington	0.5
Basin wildrye	Leymus cinereus	Trailhead	1.0
Indian ricegrass	Oryzopsis hymenoides	Paloma	0.75
Green needlegrass	Stipa viridula	Lodorm	1.0
Sand dropseed *	Sporobolus cryptandrus		0.1
TOTAL pls lbs./acre (drilled)			**7.85**

Areas greater than 5 acres add:

Species	Scientific Name	Variety	lbs/Acre
Fourwing saltbush	Atriplex canescens		0.3
Winterfat	Krascheninnikovia lanata	Hatch	0.2

* To be bagged separately from mix. Bag to be attached outside of primary seed bag.

Table 20-3

Eastern Pinon - Juniper/Foothills Vegetation Areas (5,000 - 7,500 feet) -

Add to West Pinyon-Juniper mix:

Species	Scientific Name	Variety	lbs/Acre
Little bluestem	Schizachyrium scoparius	Pastura	1.0
Big bluestem	Andropogon gerardii	native	1.0

Table 20-4

Grassland - Eastern Colorado Vegetation Areas (4,500 +)

The below rates are for drilled seeding. The rates for broadcast seeding are double the drilled rate.

Species	Scientific Name	Variety	lbs/Acre
Rocky Mtn. Penstemon *	Penstemon strictus	Bandera	0.2
Globemallow *	Sphaeralcea coccinea		0.2
Western wheatgrass	Pascopyrum smithii	Arriba	1.0
Slender wheatgrass	Elymus trachycaulus	San Luis	0.75
Big bluegrass	Poa ampla	Sherman	0.1
Blue grama	Bouteloua gracilis	1 Alma or Lovington	0.5
Indian ricegrass	Oryzopsis hymenoides	Paloma	0.5
Green needlegrass	Stipa viridula	Lodorm	0.75
Little bluestem	Schizachyrium scoparius	Pastura	0.5
Switchgrass	Panicum virgatum	Grenville	0.3
Alkaligrass *	Puccinella airoides		0.1
Alkali sacaton *	Sporobolus airoides	Salado	0.1
TOTAL pls lbs./acre (drilled)			**5**

*To be bagged separately from mix. Bag to be attached outside of primary seed bag.

Table 20-5

Subalpine Vegetation Areas (9,000 - treeline)

The below rates are for drilled seeding. The rates for broadcast seeding are double the drilled rate.

Species	Scientific Name	Variety	lbs/Acre
Yarrow *	Achillea lanulosa		0.1
Groundsel	Senecio atratus		0.1
Lupine	Lupinus alpestris		1.0
Slender wheatgrass	Elymus trachycaulus	San Luis	1.4
Nodding brome	Bromus anomalus		2.5
Sheep fescue	Festuca ovina	Covar	0.5
Hard fescue	Festuca ovina duriuscula	Durar	0.5
Red fescue	Festuca rubra	Pennlawn	0.5
Tufted hairgrass	Deschampsia caespitosa		0.5
Redtop	Agrostis alba		0.1
Blue wildrye	Elymus glaucus		1.75
Muttongrass	Poa fendleriana		0.5
TOTAL pls lbs./acre (drilled)			**9.45**

* To be bagged separately from mix. Bag to be attached outside of primary seed bag.

Table 20-6

Alpine Vegetation Areas (above treeline)

The below rates are for drilled seeding. The rates for broadcast seeding are double the drilled rate.

Species	Scientific Name	Variety	lbs/Acre
Slender wheatgrass	Elymus trachycaulus	San Luis	3.2
Alpine bluegrass	Poa alpina		0.5
Sheep fescue	Festuca ovina	Covar	0.75
Hard fescue	Festuca ovina duriuscula	Durar	0.75
Red fescue	Festuca rubra	Pennlawn	0.75
Alpine timothy	Phleum alpinum		0.5
Tufted hairgrass	Deschampsia caespitosa		0.3
TOTAL pls lbs./acre (drilled)			**6.75**

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Section 21

PROJECT SIGN

21.1 DESCRIPTION

CONTRACTOR shall furnish all materials and install the project sign to identify the project. The project sign shall be installed at a prominent location designated in the field by PROJECT MANAGER.

21.2 RELATED WORK

None

21.3 REFERENCE DOCUMENTS

ASTM C150 – Standard Specification for Portland Cement.
ASTM C387 – Standard Specification for Packaged, Dry, Combined Materials for Mortar and Concrete.

21.4 MATERIALS

Sheet Steel or Aluminum The sign shall be painted with a good quality primer, followed by two coats of white exterior oil based paint.

Letters and Numbers Letters and numbers making up the sign may be computer generated, but shall be on all weather quality vinyl and applied to the sign in accordance with the manufacturer's specifications.

Lumber The sign shall be constructed of 3/4 inch thickness plywood, CDX grade, with outside dimensions of 4'-0" vertical by 8'-0" horizontal.

Support posts for the sign shall be two (2) 4" x 4" (S4S) standard dimension commercially available kiln dried lumber, ten (10) feet long.

Hardware The sign shall be fastened to each support post with three (3) galvanized 3/4-inch diameter steel bolts 7 inches long with two (2) washers and nut. The bolts shall be spaced 12 inches center-to-center.

Concrete for anchoring the posts for the project sign shall be mixed with one (1) part Type I, II or II-A portland cement to two (2) parts sand and three and a half (3 1/2) parts gravel with not more than six (6) gallons of water per sack of cement. The maximum aggregate size shall be one half (1/2) inch. The concrete may be mixed by stationary mixer on-site or may be imported as ready-mixed concrete.

Paint All sides of the support posts and both sides and all edges of the sign shall be painted with one (1) coat of exterior priming paint, and two (2) brush coats of white exterior oil paint.

21.5 EXECUTION

21.5.1 Application of Paint

Paint shall not be applied when the temperature of the wood surface or the surrounding air is less than 45^{o}F.

Surfaces shall be clean and dry when paint is applied. Paints shall be thoroughly mixed at the time of application. Each coat shall be applied in such a manner as to produce a paint film of uniform thickness with a finished surface free from runs, drops, ridges, laps, or excessive brush marks. The drying time between coats shall be as prescribed by the manufacturer of the paint, but not less than that required for the paint to dry thoroughly. The surface of each coat shall be cleaned as necessary before application of the next coat.

21.5.2 Lettering

After the top coat of white paint has thoroughly dried, all letters shall be painted with a green exterior oil paint.

Each line of lettering shall be centered on the sign. Lettering shall appear on the sign as specified in the special conditions.

21.5.3 Installation

Prior to the start of other construction work, the sign shall be installed at the designated location in the field. The support posts shall be embedded vertically in a concrete base.

Support post holes may be excavated manually or with a power auger. Holes shall be a minimum of two (2) feet deep and shall be at least nine (9) inches in diameter. The walls of the holes shall be stable to ensure a strong foundation for the sign.

The posts shall be set plumb and centered in the hole to a depth of two (2) feet. The bottom of the sign shall be level and at a point about four (4) feet above the ground line.

Concrete shall be placed so as to completely fill the hole around the posts, and thoroughly consolidated by rodding to eliminate air pockets and voids.

21.6 MAINTENANCE

After installation, CONTRACTOR shall maintain the sign in good condition until completion of the project.

21.7 MEASUREMENT AND PAYMENT

No measurement for payment will be made for sign installation. Payment shall be for the lump sum bid price. The price bid shall include all of CONTRACTOR's costs of whatever nature to install a complete sign in accordance with these specifications. In some instances, sign installation may be included as a part of another bid item, such as Mobilization. Please see the Special Conditions for each project.

Section 22

EROSION CONTROL

22.1 DESCRIPTION

CONTRACTOR shall furnish all materials and install Erosion Control measures as specified in the bid documents or as directed by PROJECT MANAGER. Erosion Control measures shall consist of one or more of the following items: Erosion Bales, Erosion Logs, and Silt Fence. The specifications described below are adapted from the Colorado Division of Transportation (CDOT) Sediment Control measures. Additional information may be found at:

http://www.dot.state.co.us/environmental/envwaterqual/docs/StormWaterQ/swqChapter5.pdf)

22.2 EROSION BALE

An erosion bale is a temporary sediment barrier consisting of a row of entrenched and anchored straw, or hay bales used as temporary sediment barriers and filters along the toe of fills or around inlets.

22.2.1 Limitations

- Do not use along toe of fills where the size of the drainage area is greater than one-quarter acre per 100 feet of barrier length; maximum slope length and gradient behind the barrier is 100 feet and 50 percent (2:1), respectively.
- Do not use where effectiveness is required for more than 3 months.
- Useful life of erosion bale is approximately 1 year; the bales may have to be replaced one or more times during construction.
- Under no circumstances should erosion bale be constructed in flowing streams or in swales where flows are likely to exceed 1 cfs, and where the contributing drainage area is greater than 1 acre.
- Not to be used where the control of sediment is critical; in high-risk areas; in areas where they cannot be entrenched as required and firmly anchored; and areas where ponded water could flow onto the roadway.

22.2.2 Installation

The erosion bale must be entrenched and backfilled. A trench should be excavated the width of a bale and the length of the proposed barrier to a minimum depth of 4 inches. After the bales are staked, the excavated soil must be backfilled against the barrier. Backfill soil should conform to the ground level on the downhill side and should be built up to 4 inches against the uphill side of the barrier.

Each bale must be securely anchored by at least two wooden stakes driven toward the previously laid bale to force the bales together. Stakes should be driven into the ground a minimum of 1 foot to securely anchor the bales. Stakes should have a minimum diameter or cross section of 2 inches. Reinforcing bars shall not be used in place of the wooden stake.

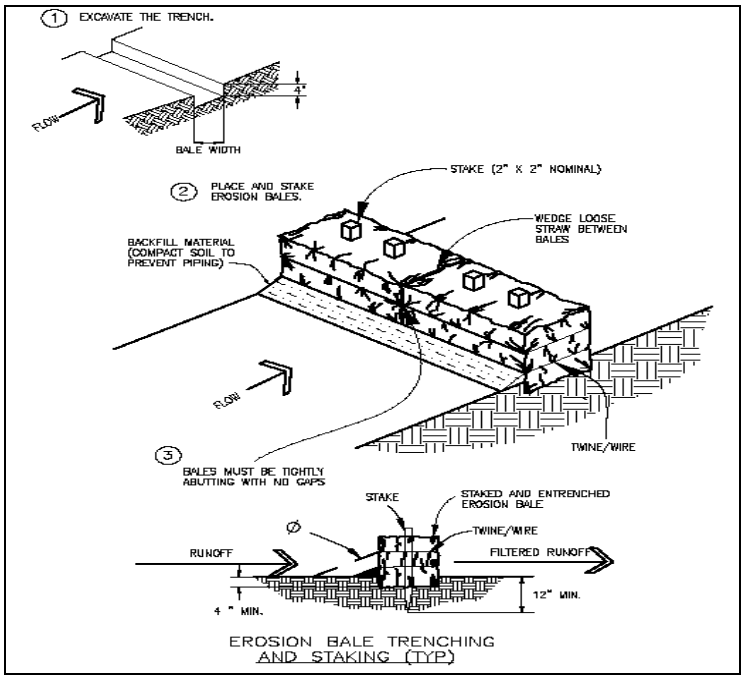

FIGURE 22-1

Erosion Bale Installation (CDOT18)

All bales must be either wire-bound or string-tied, and they should be installed so that bindings are oriented around the sides rather than along the tops and bottoms of the bales (in order to prevent deterioration of bindings).

The gaps between bales should be filled by wedging with straw to prevent water from escaping between the bales. The main consideration is to obtain tight joints. Erosion bales will not filter sediment or pond water if the water is allowed to flow between, around, or under the bales. Loose straw or hay scattered over the area immediately uphill from an erosion bale barrier tends to increase barrier efficiency.

Along toe of fills, install the erosion bales along a level contour and leave enough area behind the barrier for runoff to pond and sediment to settle. A minimum distance of 5 feet from toe of the fill is recommended.

22.2.3 Maintenance and Inspection

- Erosion bales deteriorate quickly and, therefore, inspections during construction should be frequent. Repair or replacement should be made promptly as needed.
- Erosion bales must be removed when they have served their usefulness.
- Trenches where erosion bales were located should be graded and stabilized.
- Sediment accumulation against the erosion bale barrier shall be removed when it reaches half the exposed bale height. Sediments removed must be properly disposed.
- Replace erosion bales as necessary but at a minimum of once each year.

22.3 EROSION LOGS

Erosion logs filled with rock or other filter material used for erosion and sediment control. Used upstream of curb inlets to filter sediment-laden runoff.

Logs of various lengths can be accommodated with multiple logs installed in series. Typical placement of a log is upstream of an inlet, in the gutter flow line, and also at the entrance of an inlet.

Used as check dams in ditches and swales for erosion control until vegetative cover is established.

Used as a temporary feature.

22.3.1 Limitations

Logs are manufactured Best Management Practices (BMPs). Refer to the manufacturer for guidelines on limitations.

Do not use in ditches and swales with continuous flow.

22.3.2 Material

Several types of logs exist. A "gravel" log is typically a cylindrical shaped filter with ¼ inch mesh or burlap filter cover filled with ¾ inch gravel. Refer to the manufacturer for specific material specifications.

22.3.3 Installation

General installation guidelines are provided, however, refer to the manufacturer for specific installation requirements.

- **Installation for Check Dam Applications:**

  When using as a check dam, it should be placed in straight sections to minimize the potential for erosion in the channel bend.

- **Installation for Curb Inlet Protection (Upstream of inlet):**

  Logs will be used upgradient of inlet perpendicular to and flush with the curb.

  The maximum height of the curb log should be less than the top of the curb opening. This is to allow overflows to occur during large rainfall events even though sediment-laden runoff will enter the storm drainage system.

  No less than two 10-inch diameter logs must be used in sequence, spaced no more than five feet apart, upgradient of inlet. No less than six logs shall be used if the 4–inch log is chosen.

  Incline at 30 degrees from perpendicular, opposite the direction of flow.

- **Installation for Curb Inlet Protection (Entrance of inlet):**

  Identify curb opening dimensions to determine how many logs are required.

  Place the log(s) end-to-end along the curb inlet opening.

  Angle the ends of the log(s) towards the curb inlet opening.

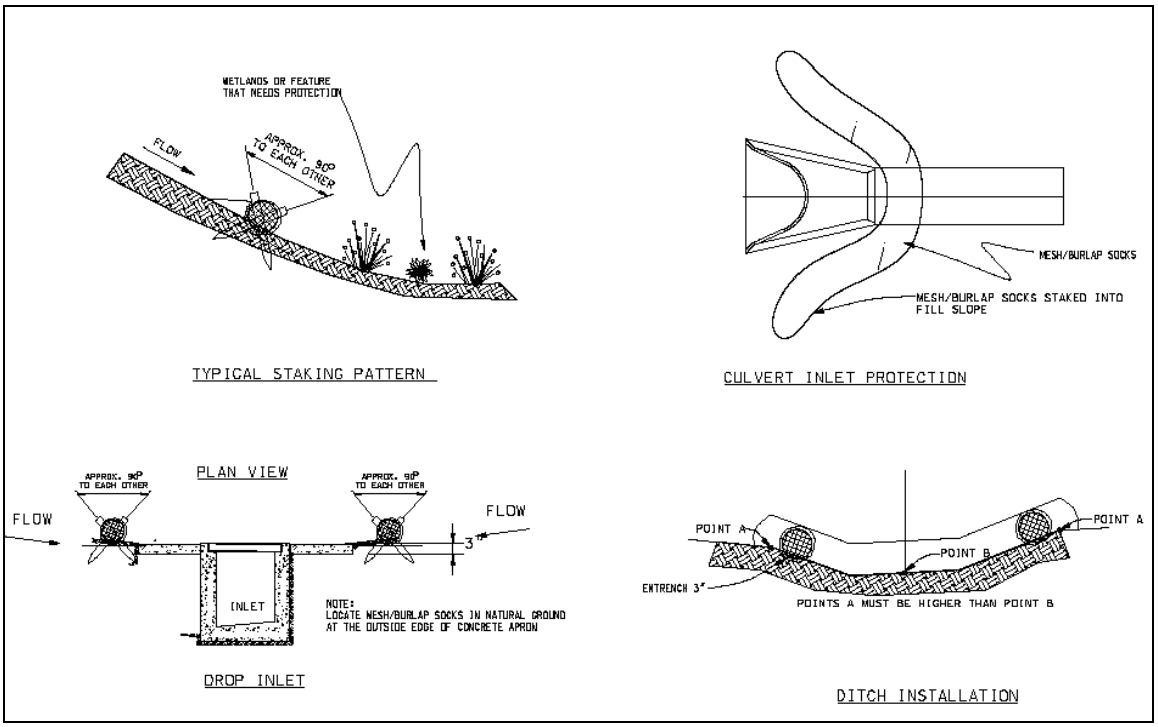

FIGURE 22-2

Applications for Erosion Logs (CDOT18)

22.3.4 MAINTENANCE AND INSPECTION

Inspect logs daily for cuts, abrasions, and proper installation, replace or reposition daily. Remove sediment and dispose in a proper manner. Discontinue use if logs create a traffic hazard.

22.4 SILT FENCE

A temporary vertical barrier of filter fabric attached to and supported by posts and entrenched into the ground. Used to intercept sediment from disturbed areas during construction operations. Used to filter sheet flow.

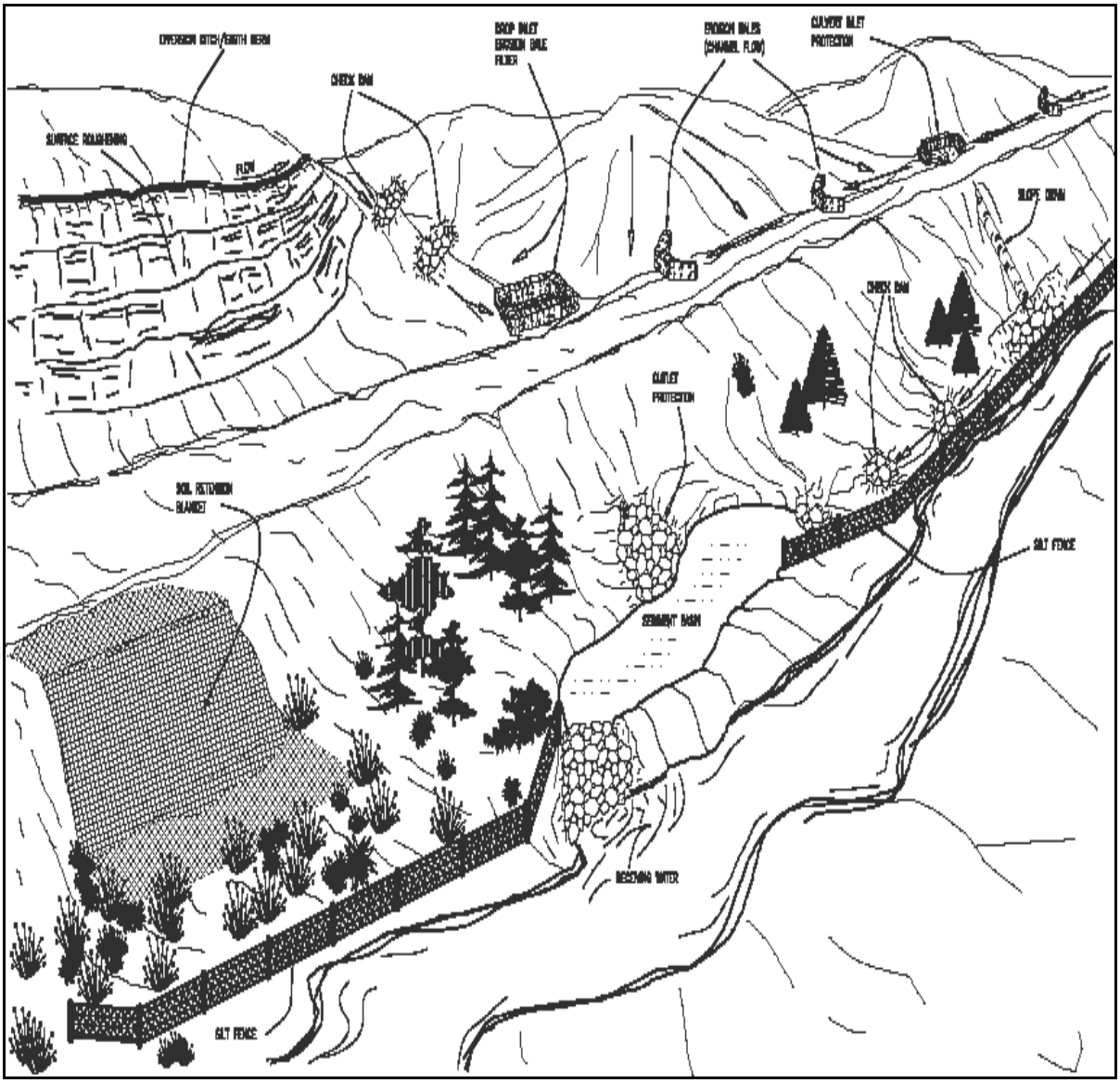

FIGURE 22-3

Silt Fence Applications (CDOT18)

Typically used along the toe of fills, in transition areas between cut and fills, and adjacent to streams. Also used around drop inlets as applicable. Used as a temporary feature.

22.4.1 Limitations

Maximum drainage area is one-quarter acre per 100 feet of silt fence length; the maximum slope length behind the barrier is 100 feet; and the maximum gradient behind the barrier is 50 percent (2:1).

Under no circumstances should silt fences be constructed in live streams, swales, or ditches.

On steep slopes, care should be given to placing the fence perpendicular to the general direction of the flow.

Silt fences should not be used in areas where rocky soils will prevent keying in the filter fabric.

22.4.2 Materials

The filter fabric shall conform to the requirements described in Section 420 of CDOT's Standard Specifications for Road and Bridge Construction. Minimum height of the filter fabric shall be 36 inches.

The use of joints should be minimized to improve the strength and efficiency of the barrier.

Posts for silt fences shall be metal or hard wood with a minimum length of 42 inches. Wooden posts shall have a minimum diameter or cross section of 1-¼ inches. Metal posts shall be "studded tee" or "U" type with a minimum weight of 1.33 lbs/ft, and they shall be protected against corrosion. Metal posts shall have projections for fastening wire.

When used, wire fence reinforcement for the filter fabric should be a minimum of 36 inches in height and a minimum of 14-gauge, with a maximum mesh spacing of 6 inches.

22.4.3 Installation

Drive posts vertically into the ground to a minimum depth of 18 inches, and excavate a trench approximately 6 inches wide and 6 inches deep along the line of posts and upslope from the barrier (see Figure SC 3.2). Not less than the bottom 1 foot of the filter fabric shall be buried into this trench. The trench shall be backfilled and the soil compacted.

When joints are necessary, filter cloth shall be spliced together only at a support post and securely sealed (see Figure SC 3.3).

The filter materials shall be fastened securely to metal or wooden posts using wire ties, or to the wood posts with ¾-inch long #9 heavy-duty staples. The filter fabric shall not be stapled to existing trees.

Posts shall be spaced a maximum of 10 feet apart. For channel flow applications, the posts shall be spaced a maximum of 3 feet apart.

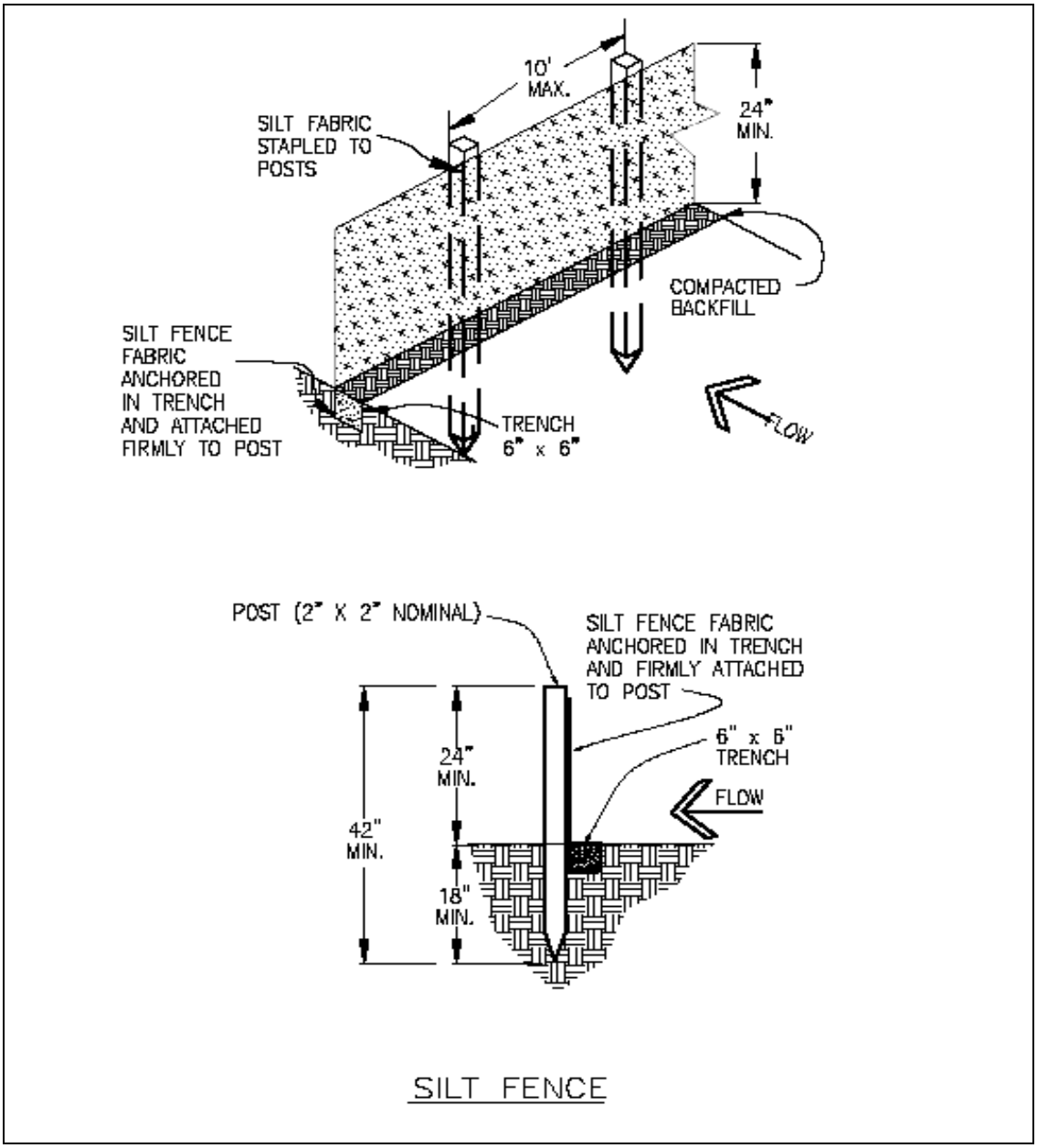

FIGURE 22-4

Silt Fence Installation (CDOT18)

When used, the wire mesh support fence shall be fastened securely to the upslope side of the posts using heavy-duty wire staples at least 3/4 inches long, tie wires, or hog rings. The wire shall extend into the trench a minimum of 2 inches and shall not extend more than 36 inches above the original ground surface.

Along the toe of fills, install the silt fence along a level contour and provide an area behind the fence for runoff to pond and sediment to settle. A minimum distance of 5 feet from the toe of the fill is recommended.

The height of the silt fence from the ground surface shall be a minimum of 24 inches and shall not exceed 36 inches; higher fences may impound volumes of water sufficient to cause failure of the structure.

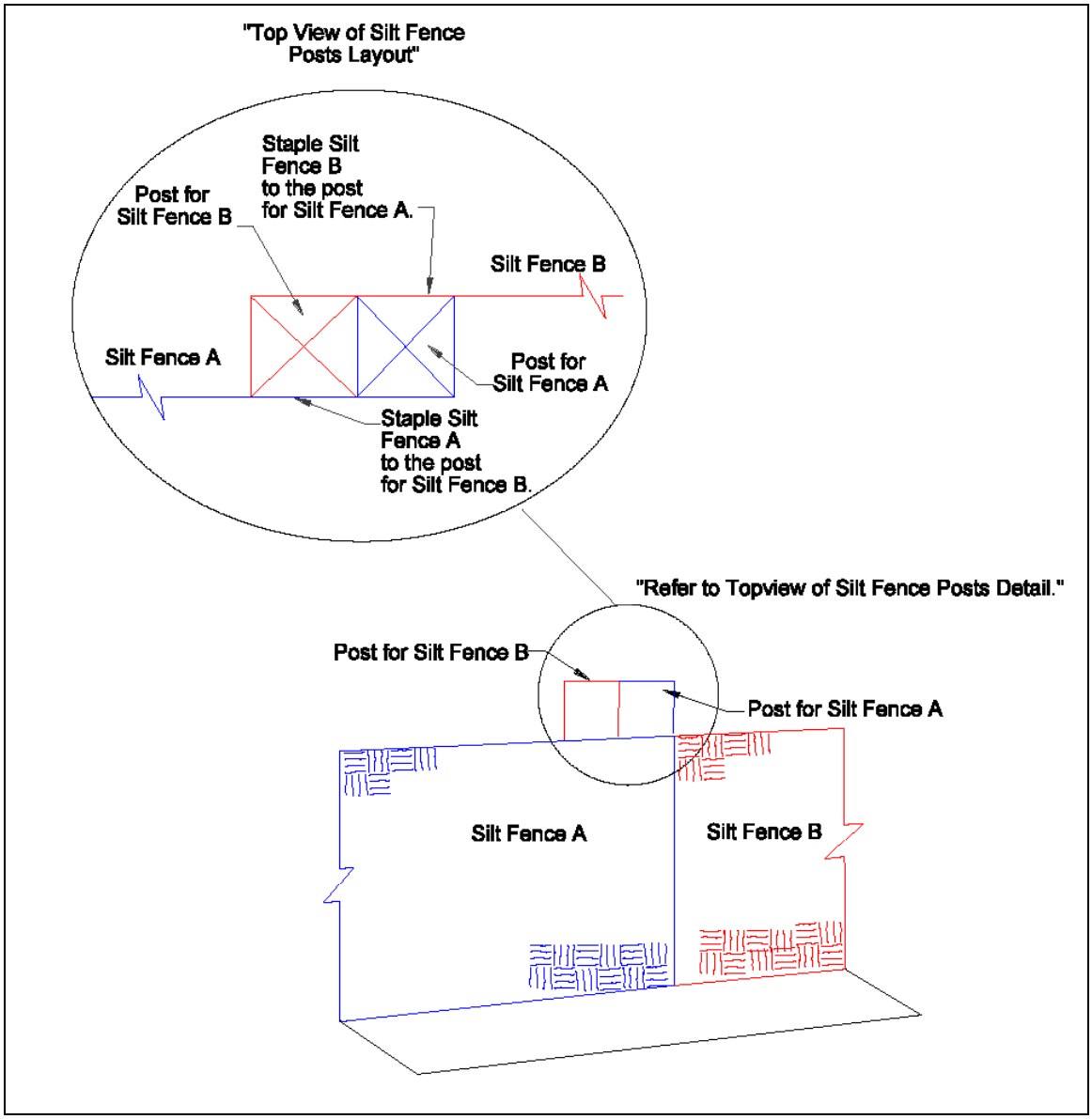

FIGURE 22-5

Silt Fence Joints (CDOT18)

22.4.4 Maintenance and Inspection:

Silt fences shall be periodically maintained to prevent sediment from passing over or under the fence. Sediment shall be removed from behind the silt fence when it accumulates to one-half the exposed fabric height. Sediments removed must be properly disposed.

Silt fence damaged by wind or other factors should be promptly repaired.

Silt fences shall be removed when they have served their useful purpose. The area with the silt fences shall be stabilized after removal of the fence.

22.5 MEASUREMENT AND PAYMENT

Erosion Control measures may be included as a part of another bid item or as a separate bid item. Please see the Special Conditions for each project.

If Erosion Control <u>is not included</u> as a separate bid item, there will be no measurement for payment made for this bid item. The cost for furnishing, installing, and maintaining Erosion Control measures shall be included in the bid price for closure of each mine opening/area. CONTRACTOR shall estimate the number and type of Erosion Control measures required during construction and reclamation activities. The price bid shall include all costs for labor, materials, equipment and all other items necessary for Erosion Control measures as described in these specifications.

If Erosion Control <u>is included</u> as a separate bid item, there will be no measurement for payment made for this bid item. Payment shall be for the lump sum bid price. The price bid shall include all of CONTRACTOR's costs of whatever nature to furnish and install complete Erosion Control measures in accordance with these specifications. The price bid shall include all costs for labor, materials, equipment and all other items necessary for Erosion Control as described in these specifications.

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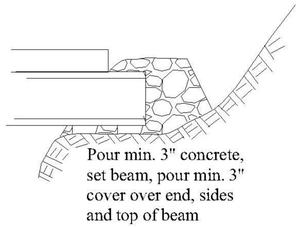
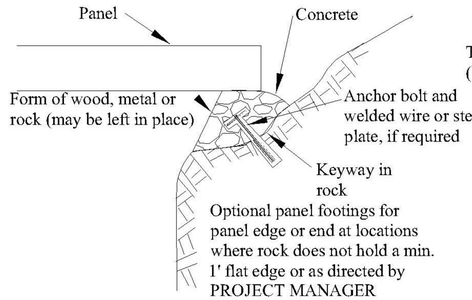
Beam span (ft)	Min. section modulus(in^3)	Beam sections having 12"min. flange width and min. section modulus	Built up sections Cont. welds
10	67.5	HP 12 x 63 HP 12 x 74 HP 12 x 84 All HP 13 & HP14 W 12 x 65 on up W 14 x 90 on up	C 15 x 33.9 on up MC 12 x 37 on up W 8 x 40 on up W 10 x 33 on up W 12 x 26 on up
11	79.2	HP 12 x 63 HP 12 x 74 HP 12 x 84 All HP 13 & HP14 W 12 x 65 on up W 14 x 90 on up	C 15 x 33.9 on up MC 12 x 40 on up W 8 x 48 on up W 10 x 39 on up W 12 x 35 on up
12	91.9	HP 12 x 74 HP 12 x 84 HP 13 x 73 HP 13 x 87 HP 13 x 100 All HP 14 W 12 x 72 on up W 14 x 90 on up	C 15 x 40 on up MC 12 x 50 MC 13 x 50 on up W 8 x 58 on up W 10 x 45 on up W 12 x 35 on up
13	106	HP 12 x 84 HP 13 x 87 HP 13 x 100 All HP 14 W 12 x 72 on up W 14 x 90 on up	C 15 x 50 MC 18 x 42.7 on up W 10 x 49 on up W 12 x 45 on up
14	120	HP 13 x 100 HP 14 x 89 HP 14 x 102 HP 14 x 117 W 12 x 96 on up W 14 x 90 on up	MC 18 x 42.7 on up W 10 x 54 on up W 12 x 50 on up
16	136	HP 13 x 100 HP 14 x 102 HP 14 x 117 W 12 x 106 on up W 14 x 90 on up	MC 18 x 51.9 on up W 10 x 66 on up W 12 x 53 on up
18	164	HP 14 x 102 HP 14 x 117 W 12 x 120 on up W 14 x 103 on up	S 18 x 54.7 on up W 10 x 77 on up W 14 x 61 on up W 16 x 58 on up W 18 x 50 on up W 21 x 49 on up
20	188	W 12 x 161 on up W 14 x 119 on up W 21 x 112 on up W 24 x 100 on up	S 18 x 70 S 20 x 65.4 on up W 10 x 89 on up W 12 x 72 on up W 14 x 61 on up W 16 x 58 on up W 18 x 55 on up W 21 x 55 on up
22	212	W 12 x 161 on up W 14 x 136 on up W 24 x 100 on up W 24 x 100 on up	S 20 x 65.4 on up S 24 x 79.9 on up W 10 x 100 on up W 12 x 79 on up W 14 x 74 on up W 16 x 71 on up W 18 x 60 on up W 21 x 55 on up W 24 x 55 on up
24	236	W 12 x 190 W 14 x 150 on up W 24 x 100 on up W 24 x 100 on up	S 20 x 65.4 on up W 10 x 112 on up W 12 x 92 on up W 14 x 78 on up W 16 x 78 on up W 18 x 64 on up W 21 x 62 on up W 24 x 61 on up

Structural steel beam supports for precast concrete panels.
(Section modulus and shapes taken from AISC Manual of Steel Construction, 8th edition.) Beams shall be ASTM A36 all purpose steel.

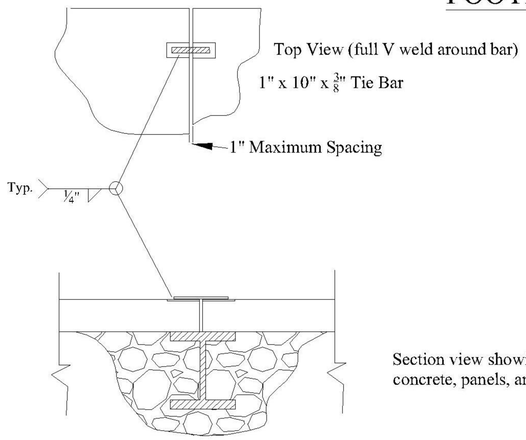
BEAM DESIGN TABLE



DETAIL A BEAM SEAT



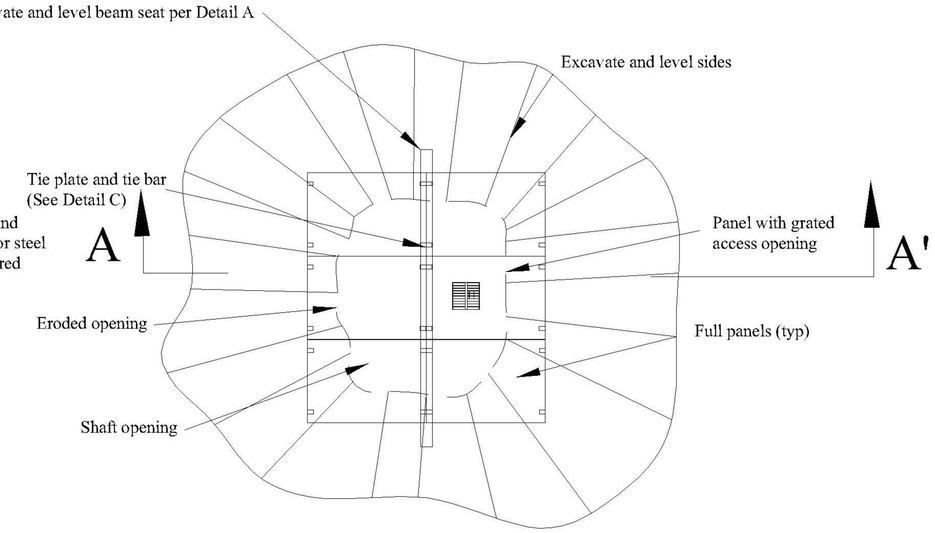
DETAIL B OPTIONAL PANEL FOOTINGS



Section view showing I beam set in concrete, panels, and tie bar

DETAIL C SECTION AND TIE PLATE DETAIL

CAUTION: This project requires construction work around and over hazardous and unprotected mine shafts, stope, adits, and other openings which may be open to the surface or hidden from view by trash, debris or thin and unstable layers of surficial materials or rock. The CONTRACTOR shall be responsible for thoroughly investigating the site conditions and scheduling his equipment, equipment operations, personnel and safety procedures to prevent accidents and injuries.



PRECAST CONCRETE PANEL CLOSURE

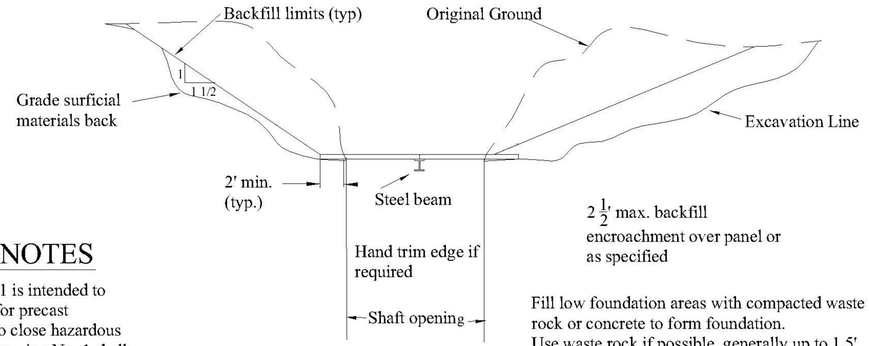
GENERAL NOTES

1. Standard Drawing No. 1 is intended to provide installation details for precast reinforced concrete panels to close hazardous mine openings. Standard Drawing No. 1 shall be used in conjunction with site specific information in the bid documents.

2 During excavation, the nature of the bearing surface for precast concrete panels may vary and show a different configuration than that shown on the drawings. The contractor shall notify the Project Manager of this situation and various panel footing options or layout modifications will be authorized if required.

3. Concrete for panel footings, shims and miscellaneous uses shall have a minimum compressive strength of 3,000 psi at 28 days.

4. Steel beam and built up steel section supports for precast concrete panels are shown in Table A for the maximum allowable fill height of four feet for precast concrete panels. The opening to be covered may vary up to 24 feet in span and any length. Only those HP, W, and built up shapes meeting the section modulus requirements for various spans, and having minimum of a 12 inch wide flange, are shown.



Fill low foundation areas with compacted waste rock or concrete to form foundation.
Use waste rock if possible, generally up to 1.5' max. Use lean mix concrete over 1.5' or as directed by Project Manager. (See Detail B)

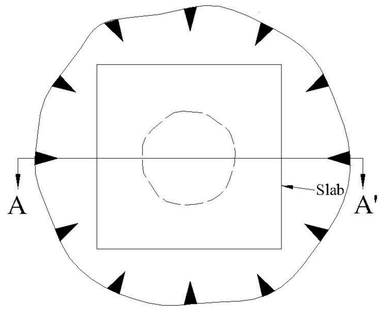
PRECAST CONCRETE PANEL CLOSURE SECTION A - A'

COLORADO DIVISION OF MINERALS & GEOLOGY
RECLAMATION MINING SAFETY SCIENCE

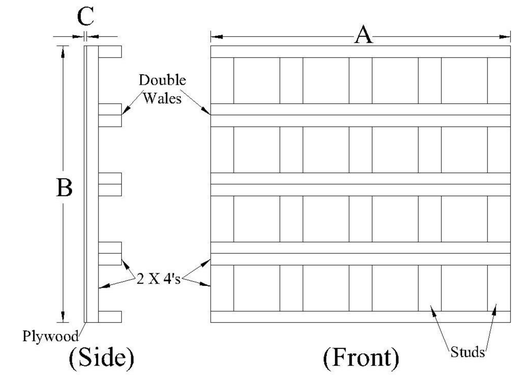
INACTIVE MINE RECLAMATION PROGRAM

STANDARD DRAWING No. 1
PRECAST CONCRETE PANEL CLOSURE

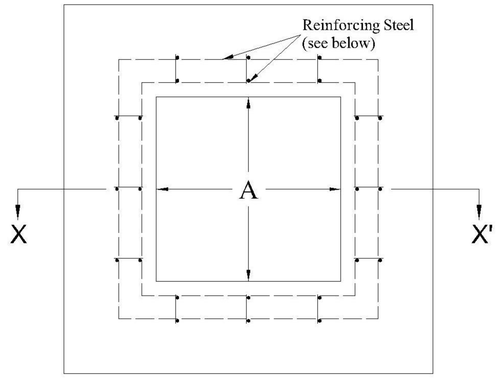
Scale Varies	December 2003	Sheet No. 1 of 1
Drawn by: ALA	Reviewed by JTH and JTG	



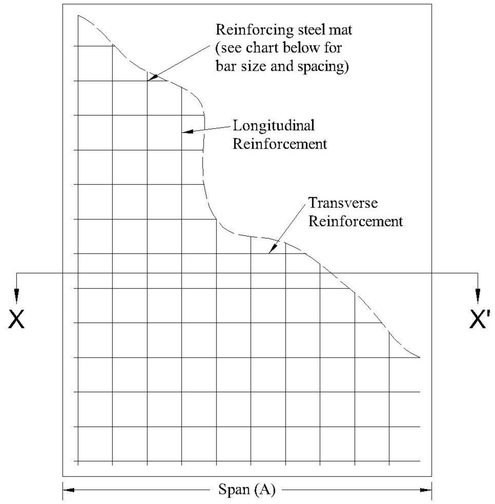
HOLLOW CORE SHAFT CLOSURE



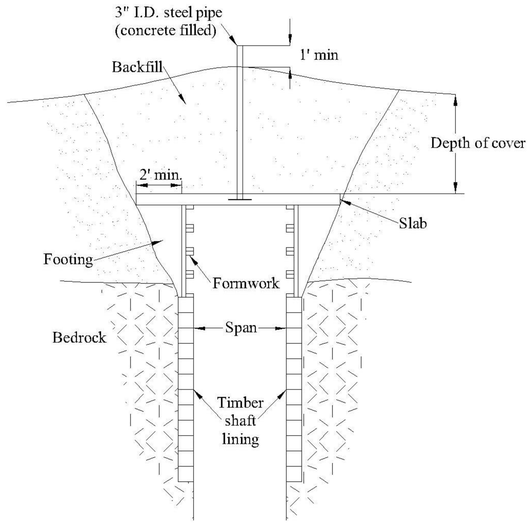
HOLLOW CORE SHAFT CLOSURE FORMWORK DESIGN



HOLLOW CORE SHAFT CLOSURE FOOTING DESIGN



HOLLOW CORE SHAFT CLOSURE SLAB DESIGN



HOLLOW CORE SHAFT CLOSURE (SECTION A-A')

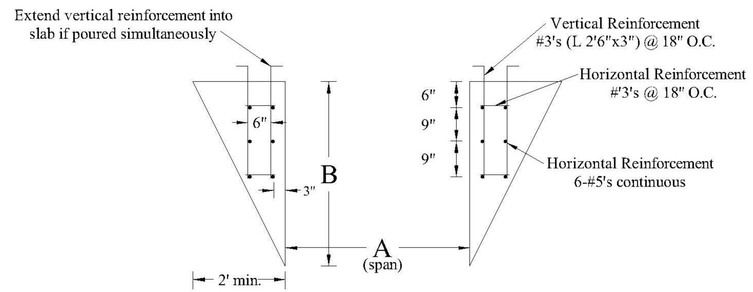
FORM DESIGN CHART

Form height (ft)	Plywood thickness (in)	Stud spacing (in)	Wale spacing (in)
4	½	12	12
6	⅝	12	12
8	¾	12	12

A: Determined by the size of the shaft opening. (if greater than 8', cross supports must be used.)

B: Minimum 4', at a height which will put top of the formwork at least 2' from side of shaft.

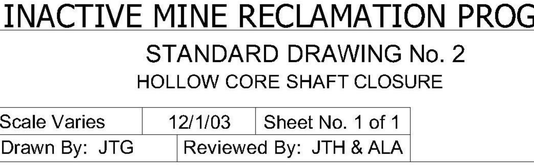
C: Determined from FORM DESIGN chart



A: Determined by the size of the shaft opening (span).

B: See B under Formwork.

FOOTING SECTION (X-X')



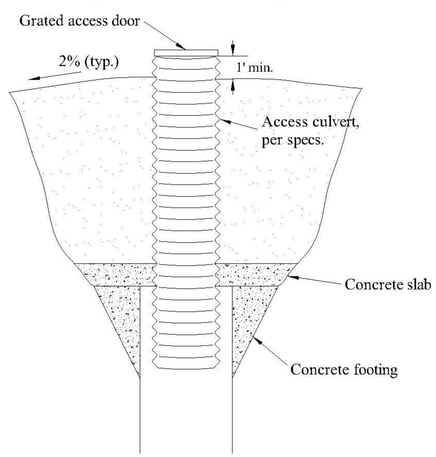
SLAB SECTION (X-X')

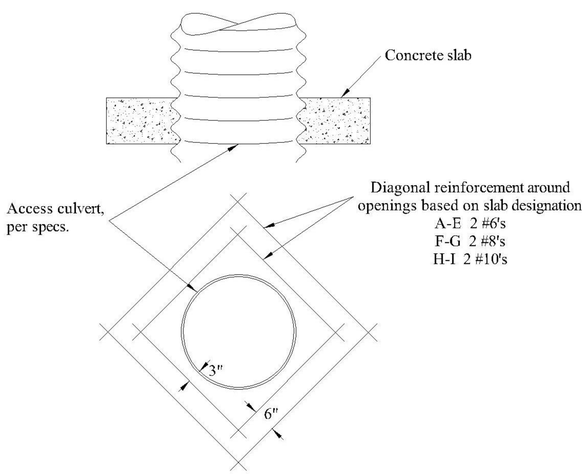
SLAB DESIGN CHARTS

Competent Rock Opening Span (ft)	Potential Future Fill Height Range (Depth of Cover) (ft)				
	0-4	4-8	8-12	12-16	16-20
4	D-panels/A	D-panels/A	D-panels/A	D-panels/B	E-panels/B
5	D-panels/A	D-panels/A	E-panels/B	E-panels/C	E-panels/C
6	D-panels/A	E-panels/B	E-panels/C	E-panels/C	D
7	D-panels/B	E-panels/B	E-panels/C	D	E
8	D-panels/B	E-panels/C	D	E	E
10	E-panels/C	D	E	F	F
12	E-panels/C	E	F	F	G
14	D	E	F	G	H
16	E	F	G	H	I
20	F	G	H	I	
24	G	H	I		

Slab Designation	Slab Thickness (in)	Transverse Rebar (across span)	Longitudinal Rebar
A	7	#6 @ 6"	#4 @ 12"
B	8	#6 @ 6"	#4 @ 12"
C	9	#7 @ 6"	#4 @ 12"
D	10	#8 @ 7"	#4 @ 11"
E	12	#8 @ 6"	#4 @ 9"
F	14	#9 @ 6"	#5 @ 12"
G	16	#10 @ 6"	#5 @ 10"
H	18	#10 @ 6"	#5 @ 9"
I	20	#11 @ 7"	#6 @ 12"

*4000 PSI Concrete Required





CULVERT REINFORCEMENT

CAUTION: This project requires construction work around and over hazardous and unprotected mine shafts, stope, adits, and other openings which may be open to the surface or hidden from view by trash, debris or thin and unstable layers of surficial materials or rock. The contractor shall be responsible for thoroughly investigating the site conditions and scheduling his equipment, equipment operations, personnel and safety proceedures to prevent accidents and injuries.

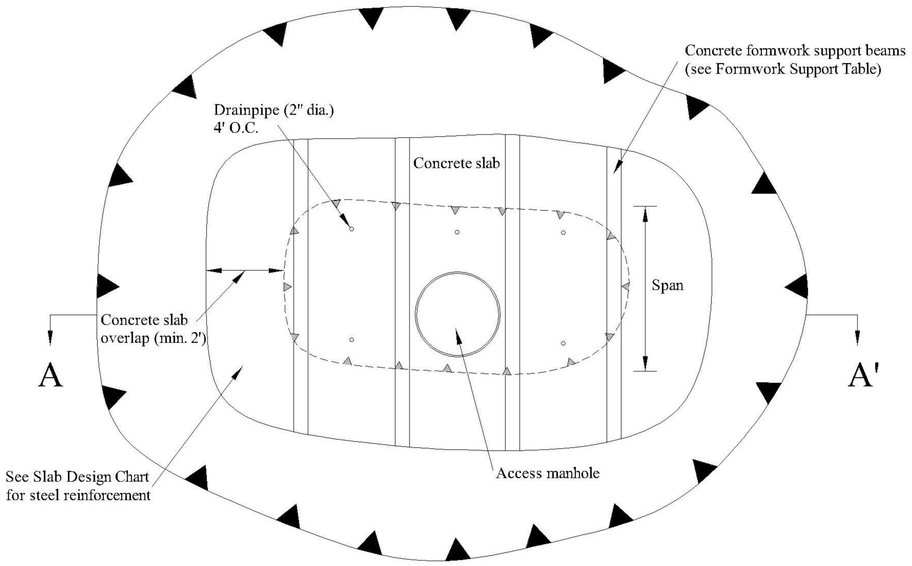
COLORADO DIVISION OF MINERALS & GEOLOGY
RECLAMATION·MINING
SAFETY·SCIENCE

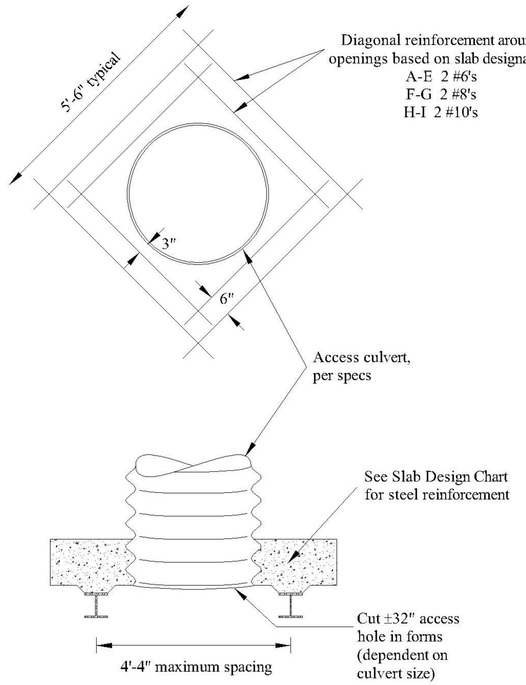
INACTIVE MINE RECLAMATION PROGRAM

STANDARD DRAWING No. 2

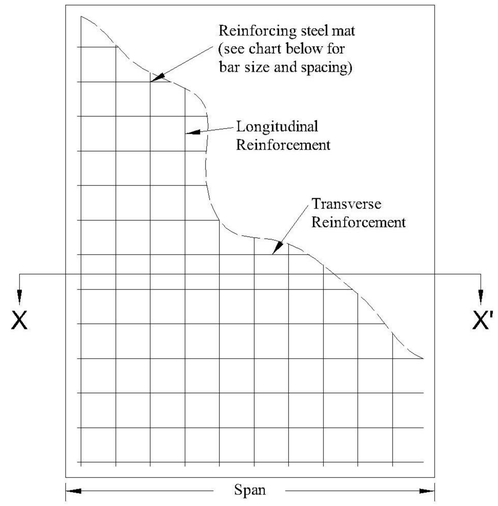
HOLLOW CORE SHAFT CLOSURE

Scale Varies	12/1/03	Sheet No. 1 of 1
Drawn By: JTG	Reviewed By: JTH & ALA	

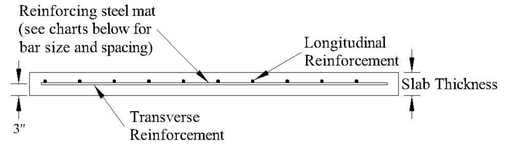




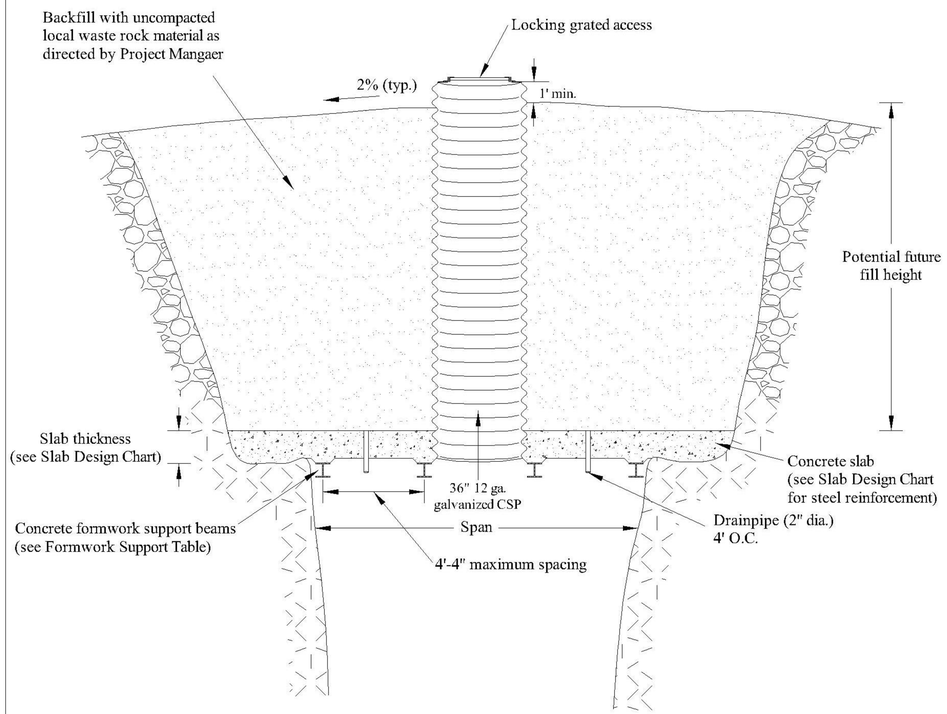
ACCESS MANHOLE DETAILS



CONCRETE SHAFT CLOSURE SLAB DESIGN



SLAB SECTION (X-X')



CAST IN PLACE SECTION (A-A')

FORMWORK SUPPORT CHART

Slab Designation	Formwork support (based on 4'-4" spacing)	
	Wood	Steel
A	8 x 10	W6x20(10.0)
B	8 x 10	W6x20(10.0)
C	8 x 12	W6x20(10.0)
D	8 x 12	W6x20(10.0)
E	8 x 16	W6x25(16.7)
F	8 x 18	W8x24(19.3)
G	-	W8x28(21.9)
H	-	W8x31(24.5)
I	-	W8x31(27.2)

*All form decking shall be corrugated stay in place forms (bridge decking), unless approved by Project Manager.

SLAB DESIGN CHARTS

Competent Rock Opening Span (ft)	Potential Future Fill Height Range (Depth of Cover) (ft)				
	0-4	4-8	8-12	12-16	16-20
4	D-panels/A	D-panels/A	D-panels/A	D-panels/B	E-panels/B
5	D-panels/A	D-panels/A	E-panels/B	E-panels/C	E-panels/C
6	D-panels/A	E-panels/B	E-panels/C	E-panels/C	D
7	D-panels/B	E-panels/B	E-panels/C	D	E
8	D-panels/B	E-panels/C	D	E	E
10	E-panels/C	D	E	F	F
12	E-panels/C	E	F	F	G
14	D	E	F	G	H
16	E	F	G	H	I
20	F	G	H	I	
24	G	H	I		

Slab Designation	Slab Thickness (in)	Transverse Rebar (across span)	Longitudinal Rebar
A	7	#6 @ 6"	#4 @ 12"
B	8	#6 @ 6"	#4 @ 12"
C	9	#7 @ 6"	#4 @ 12"
D	10	#8 @ 7"	#4 @ 11"
E	12	#8 @ 6"	#4 @ 9"
F	14	#9 @ 6"	#5 @ 12"
G	16	#10 @ 6"	#5 @ 10"
H	18	#10 @ 6"	#5 @ 9"
I	20	#11 @ 7"	#6 @ 12"

*4000 PSI Concrete Required

CAUTION: This project requires construction work around and over hazardous and unprotected mine shafts, stope, adits, and other openings which may be open to the surface or hidden from view by trash, debris or thin and unstable layers of surficial materials or rock. The contractor shall be responsible for thoroughly investigating the site conditions and scheduling his equipment, equipment operations, personnel and safety procedures to prevent accidents and injuries.

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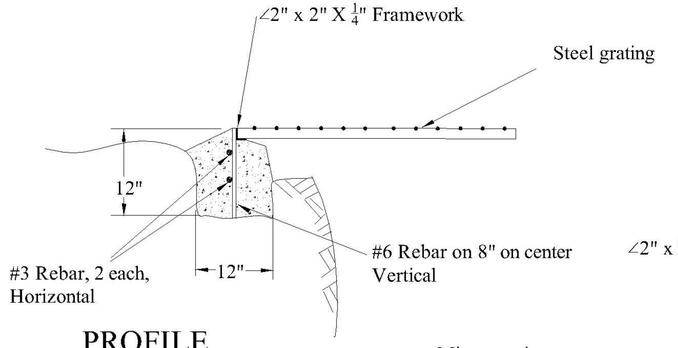
INACTIVE MINE RECLAMATION PROGRAM

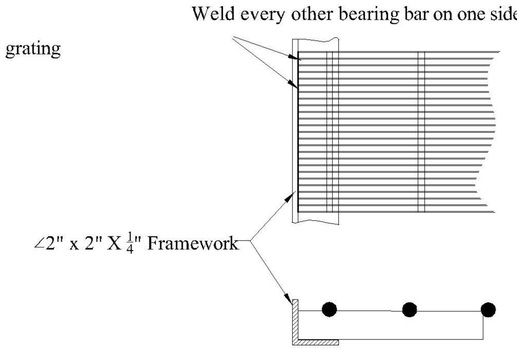
STANDARD DRAWING No. 3

CONCRETE SHAFT CLOSURE

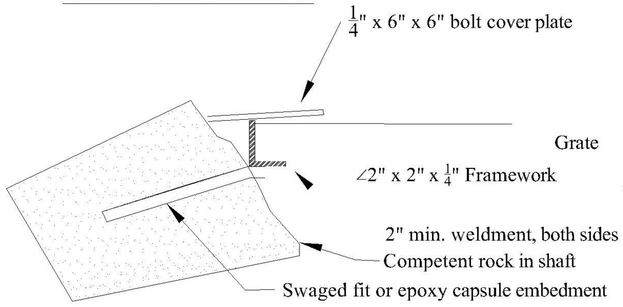
Scale Varies	2/24/04	Sheet No. 1 of 1
Drawn By: JTG	Reviewed By: JTH & ALA	



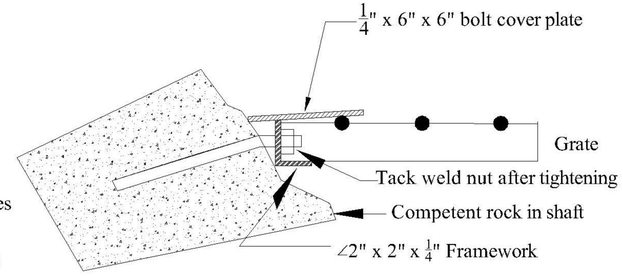
PROFILE
GRATE FOOTING



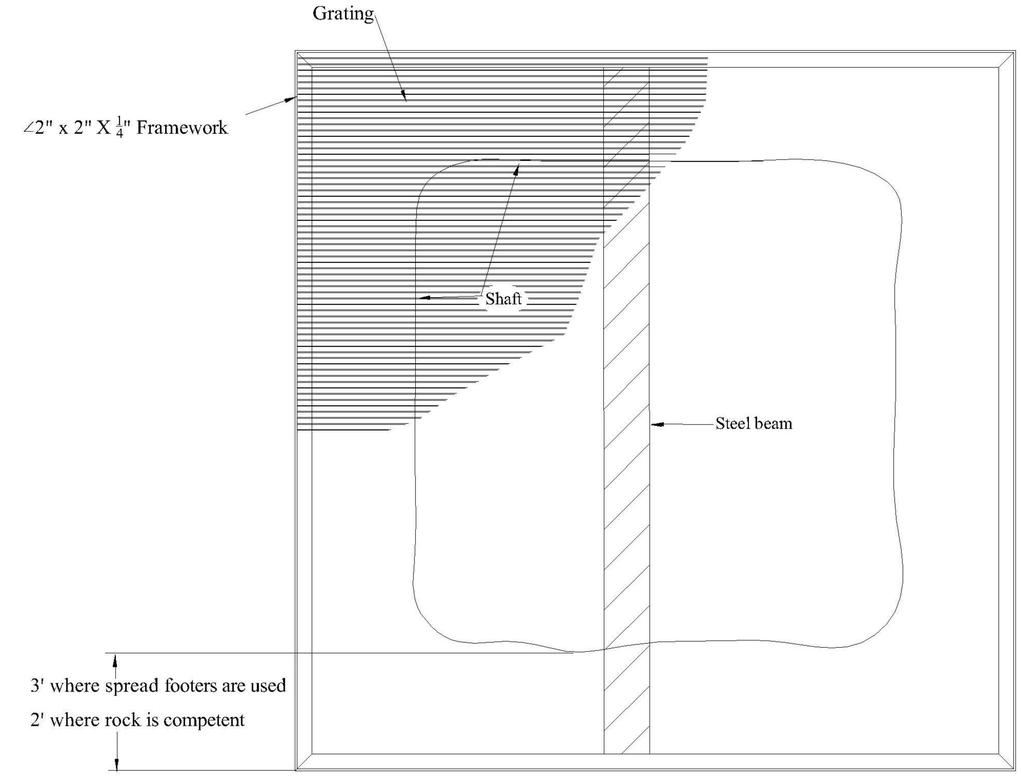
EDGE DETAIL



PROFILE
3/4" RE BAR
EMBEDMENT



PROFILE
ANCHOR BOLT
EMBEDMENT

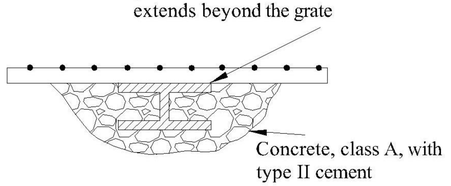


PLAN VIEW OF
SHAFT GRATING

BEARING BAR SIZE	BEARING BAR SPACING	CROSS BAR SPACING	MAX. GRATING SPAN ft.
1-1/4" x 1/8"	1-3/16"	4"	3.5
1-1/4" x 1/8"	15/16"	2"	4.0
1-1/4" x 3/16"	1-3/16"	4"	4.0
1-1/4" x 3/16"	15/16"	2"	4.5
1-1/2" x 1/8"	1-3/16"	4"	4.5
1-1/2" x 1/8"	15/16"	2"	5.0
1-1/2" x 3/16"	1-3/16"	4"	5.0
1-1/2" x 3/16"	15/16"	2"	5.5
1-3/4" x 3/16"	1-3/16"	4"	5.5
1-3/4" x 3/16"	5/16"	2"	6.0
2" x 3/16"	1-3/16"	4"	6.0
2" x 3/16"	15/16"	2"	6.5
2-1/4" x 3/16"	1-3/16"	4"	6.5
2-1/4" x 3/16"	15/16"	2"	6.5
2-1/2" x 3/16"	1-3/16"	4"	6.5
2-1/2" x 3/16"	15/16"	2"	7.0

Steel beams will be used to reduce all grating spans to a maximum as shown above. For shaft spans of twelve feet (12'), or less, W4 x 13 steel beams will be used. For shaft spans between twelve feet (12') and twenty feet (20'), W6 x 20 steel beams shall be used.

TABLE OF
GRATING
SPANS



BEAM END
DETAIL

CAUTION: This project requires construction work around and over hazardous and unprotected mine shafts, stope, adits, and other openings which may be open to the surface or hidden from view by trash, debris or thin and unstable layers of surficial materials or rock. The CONTRACTOR shall be responsible for thoroughly investigating the site conditions and scheduling his equipment, equipment operations, personnel and safety procedures to prevent accidents and injuries.

GENERAL NOTES

1. This drawing is intended to provide fabrication and installation details for safeguarding a vertical or near vertical mine opening with a steel grating.

2. A spread footer, if required, shall be installed around the entire perimiter of the steel grate.

3. Structural steel shall conform to the requirements of ASTM A 36 grade All Purpose Carbon Steel.

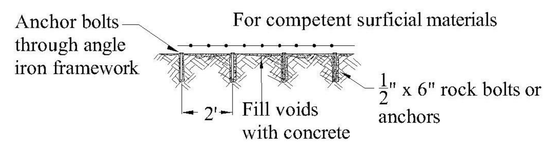
4. Concrete shall e mixed to attain a minimum compressive strength of 3,500 psi at 28 days.

5. Angle iron grate frames must be sized to entend from the bottom of the bearing bars to the top of the bearing bars. The angle iron must have equal legs. Angle iron with a leg size up to 1 3/4" must be ∠2" x 2" x 1/4", and greater than 2", the frame must be ∠3" x 3" x 3/8"

6. Anchor bolts must be expansion type with a minimum pullout strentgh of 2,000 pounds. The drilled holes must be filled with a non-shrink grout immediately prior to insertion of the anchor bolts.

7. Reinforcing steel shall conform to the requirements of A615, grade 60.

8. See Standard Drawing No. 6 for access opening, hasp, hinge and lock enclosure details.



As an alternative, 3/4" round stock may be grouted in the holes and welded to the angle iron framework also on 1' centers

ANCHORING DETAILS

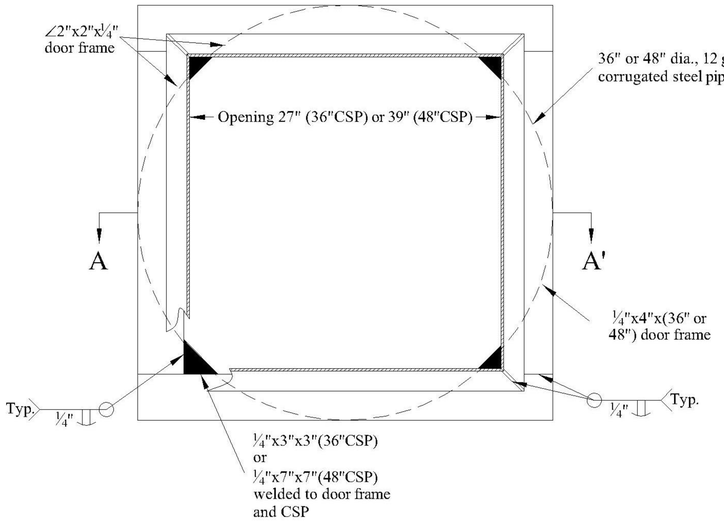
COLORADO DIVISION OF MINERALS & GEOLOGY
RECLAMATION MINING SAFETY

INACTIVE MINE RECLAMATION PROGRAM

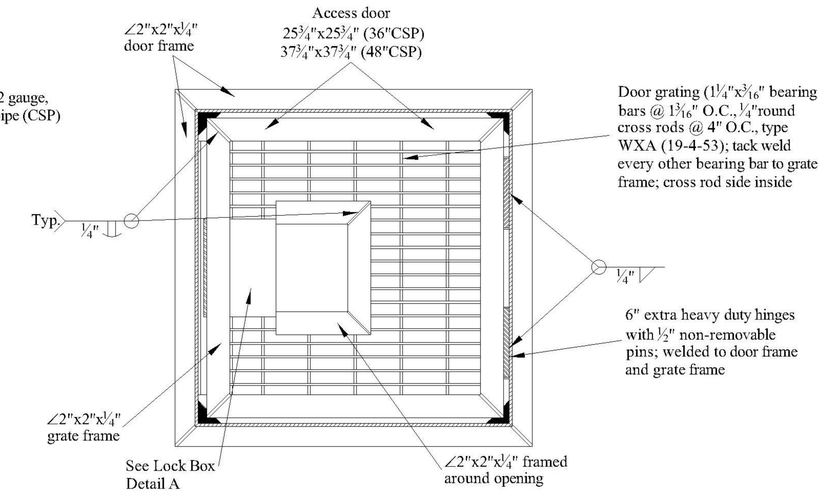
STANDARD DRAWING NO. 4

STEEL GRATING SHAFT CLOSURE

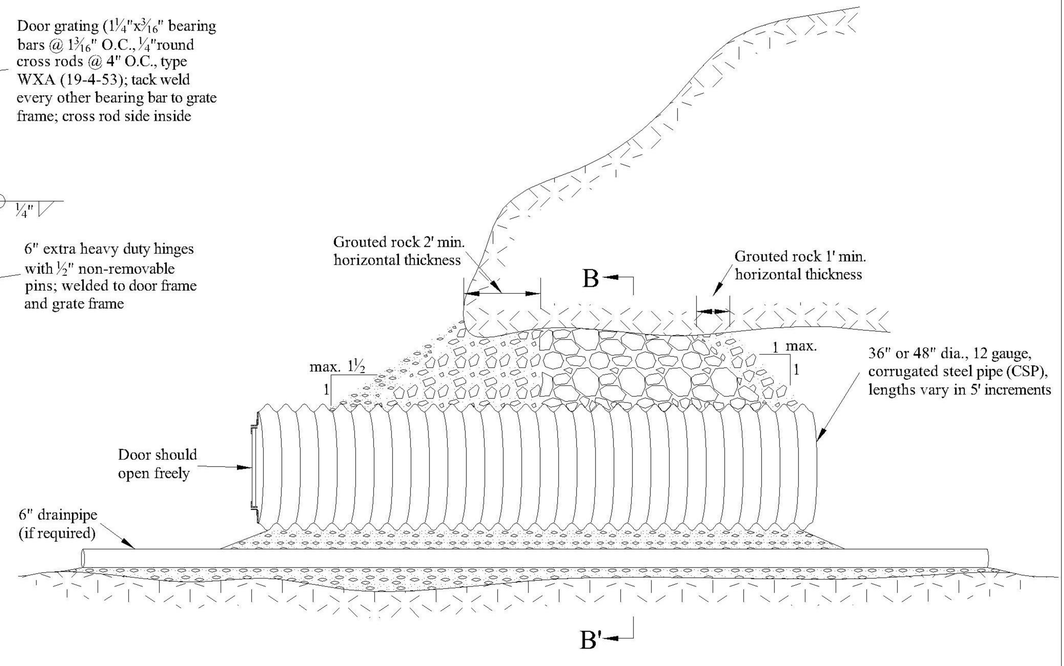
Scale Varies	January 2004	Sheet No. 1 of 1
Drawn by: ALA	Reviewed by JTH and JTG	



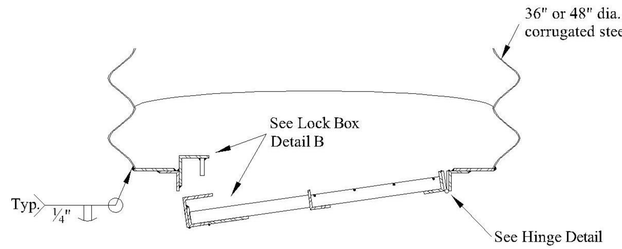
ACCESS DOOR FRAME



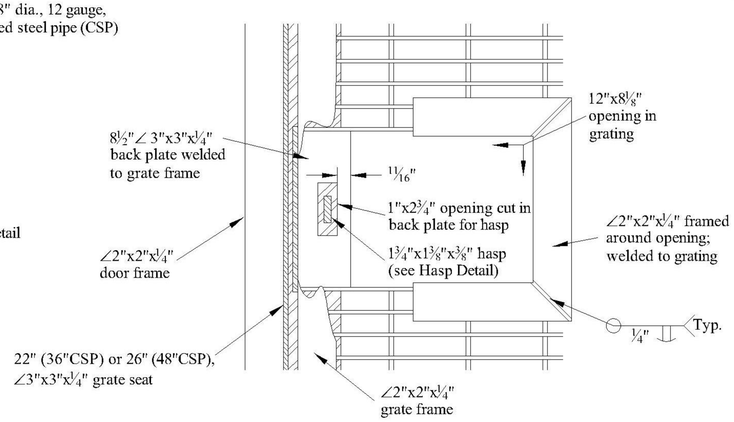
GRATED ACCESS DOOR



CORRUGATED STEEL ADIT CLOSURE

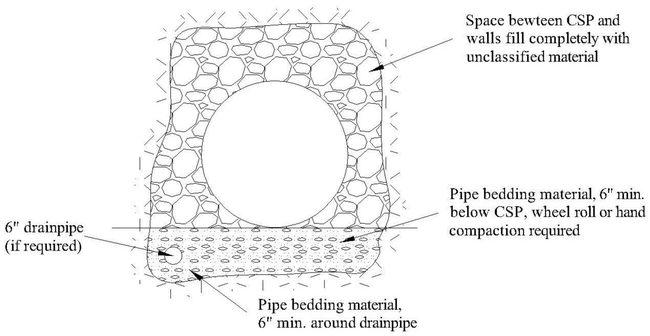


ACCESS DOOR FRAME SECTION A-A'

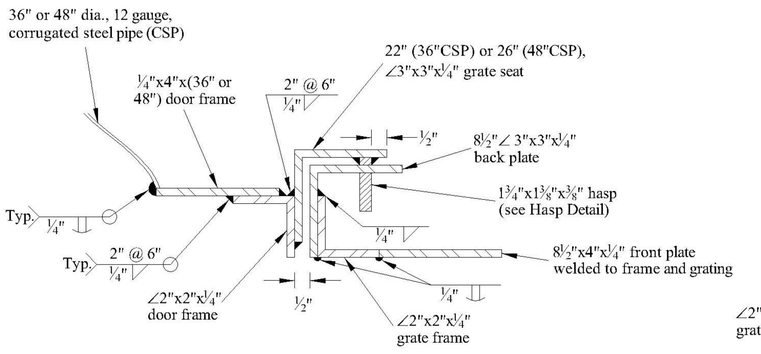


LOCK BOX DETAIL A

(Front plate not shown)

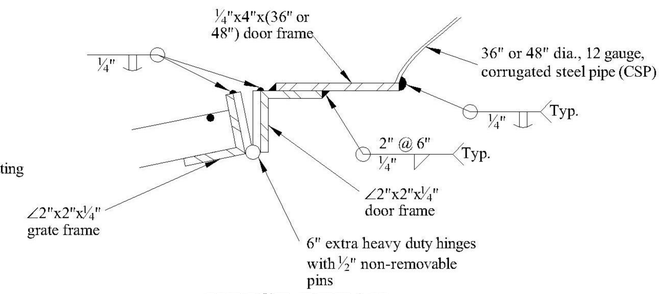


SECTION B-B'

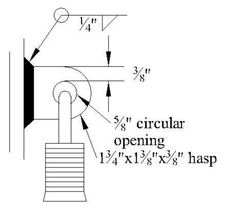


LOCK BOX DETAIL B

*Maximum ¼" free-play in door.



HINGE DETAIL



HASP DETAIL

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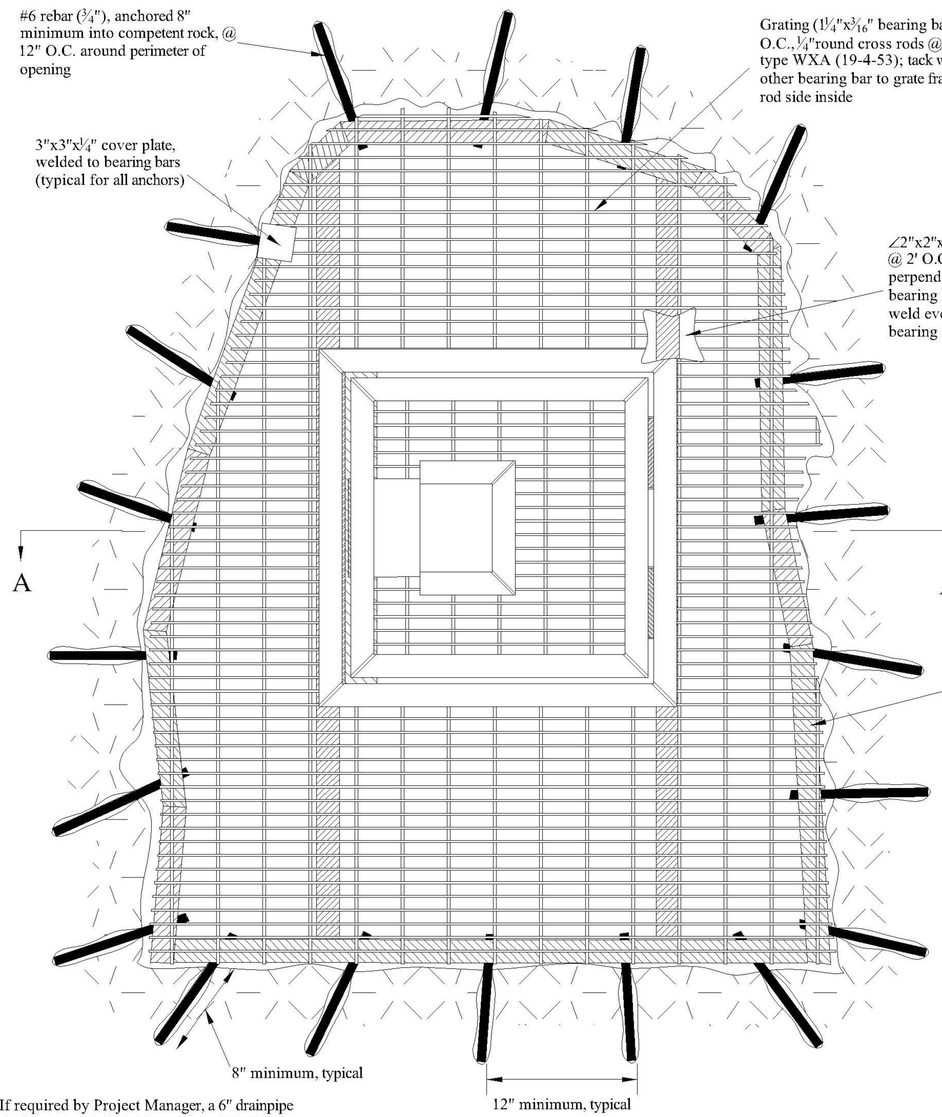
COLORADO DIVISION OF MINERALS & GEOLOGY
RECLAMATION·MINING·SAFETY·SCIENCE

INACTIVE MINE RECLAMATION PROGRAM

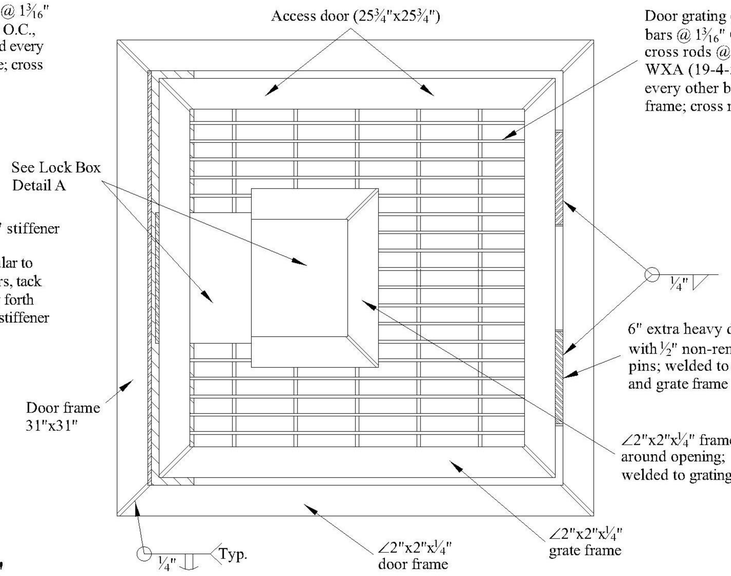
STANDARD DRAWING No. 5
CORRUGATED STEEL ADIT CLOSURE

Scale Varies	1/26/04	Sheet No. 1 of 1
Drawn by: JTG	Reviewed by: JTH & ALA	

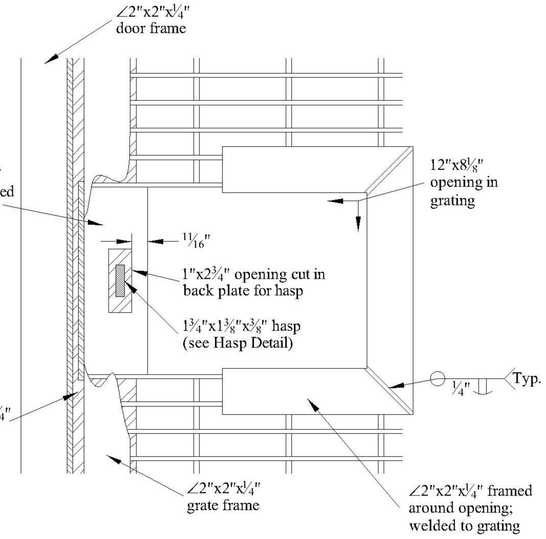


*If required by Project Manager, a 6" drainpipe shall be installed. Additionally, a 12"x12" concrete footing encasing the drainpipe and anchoring the grating will be necessary.

GRATED ADIT CLOSURE

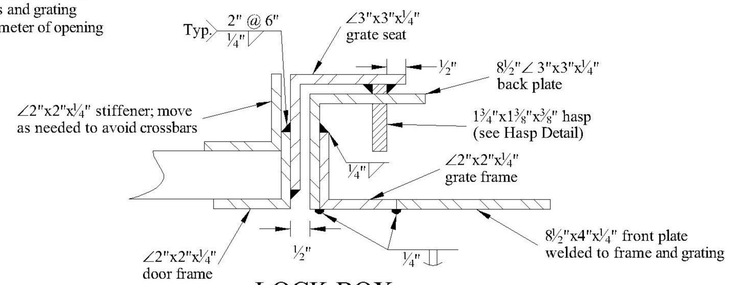


GRATED ACCESS DOOR



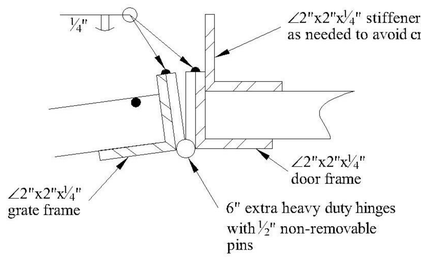
LOCK BOX DETAIL A

(Front plate not shown)

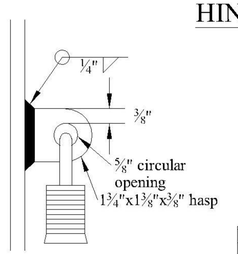


LOCK BOX DETAIL B

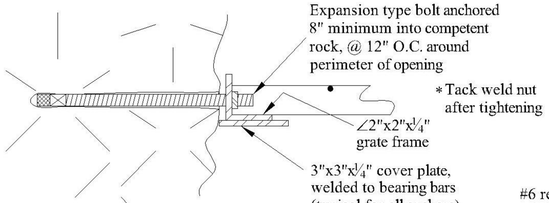
*Maximum ¼" free-play in door.



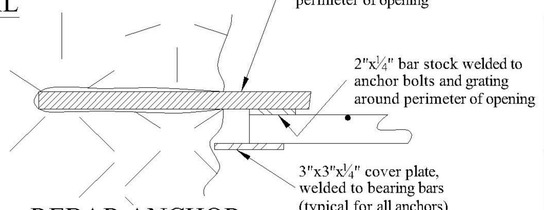
HINGE DETAIL



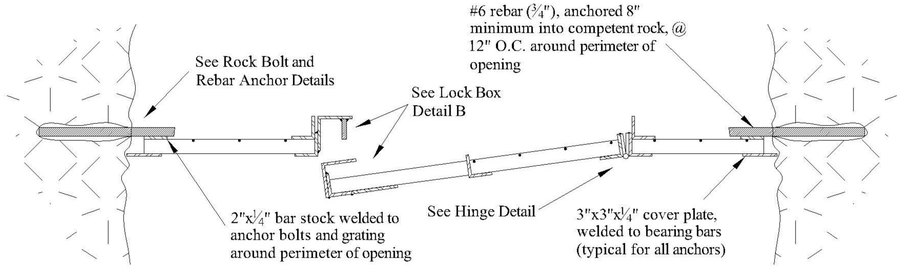
HASP DETAIL



ROCK BOLT ANCHOR DETAIL



REBAR ANCHOR DETAIL



ACCESS DOOR SECTION A-A'

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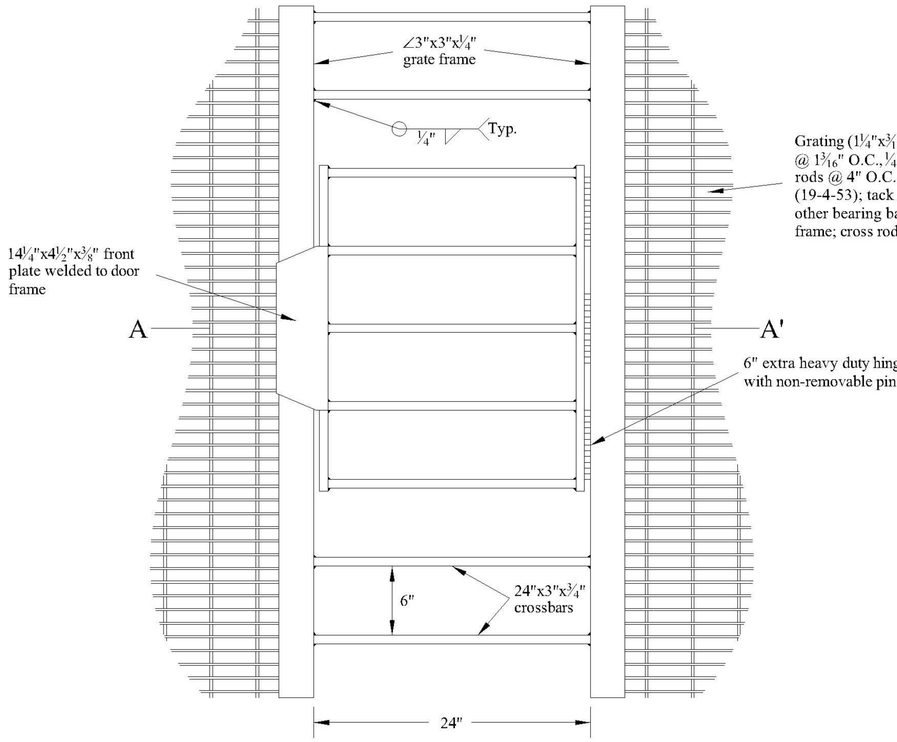
COLORADO DIVISION OF MINERALS & GEOLOGY
RECLAMATION·MINING SAFETY·SCIENCE

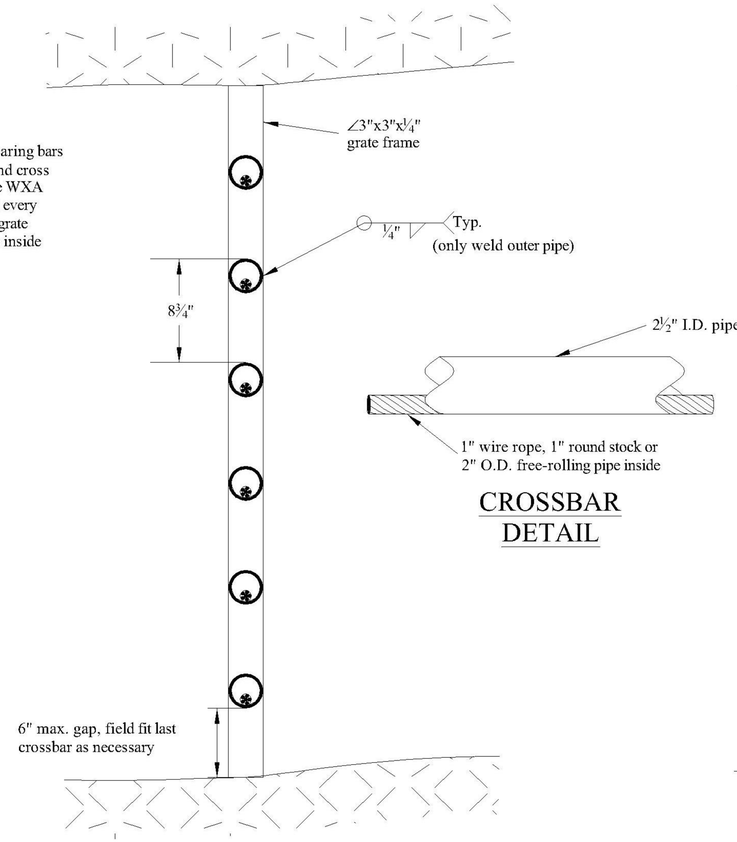
INACTIVE MINE RECLAMATION PROGRAM

STANDARD DRAWING No. 6
GRATED ADIT CLOSURE

Scale Varies	2/9/04	Sheet No. 1 of 2
Drawn by: JTG	Reviewed by: JTH & ALA	



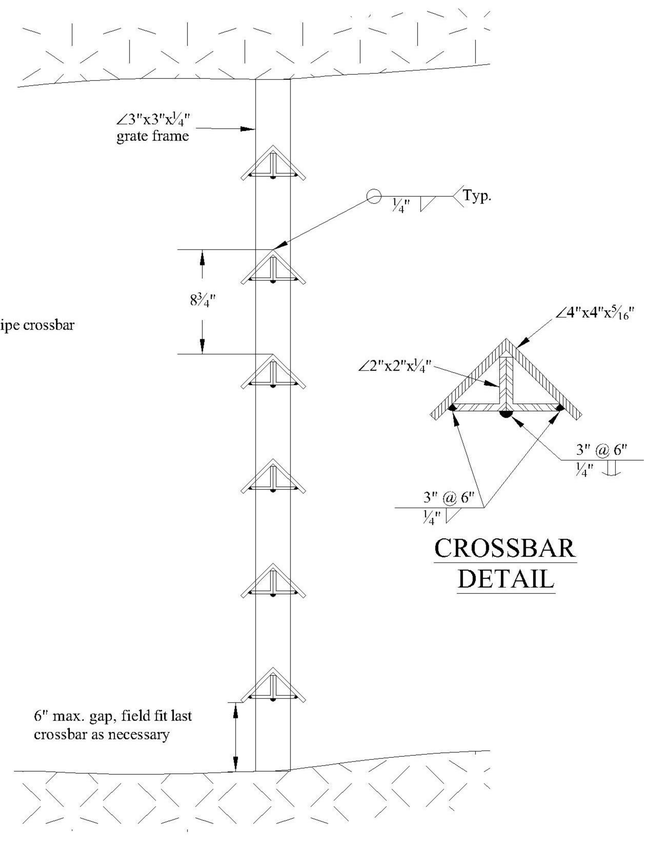
BAT CLOSURE
BAR STOCK CROSSBAR ALTERNATIVE



CROSSBAR DETAIL

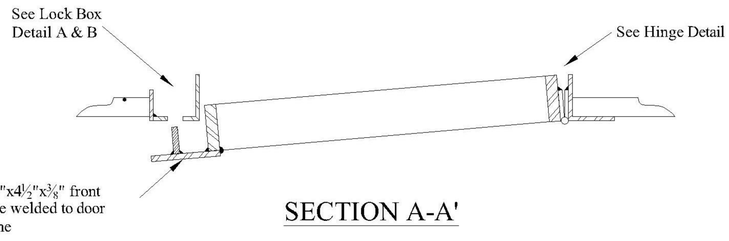
BAT CLOSURE
PIPE CROSSBAR ALTERNATIVE

(Adapted from Utah Dept. of Oil, Gas, and Mining)

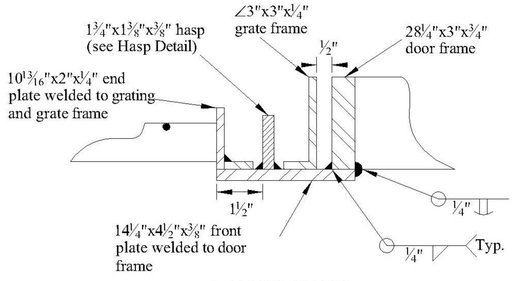


CROSSBAR DETAIL

BAT CLOSURE
ANGLE IRON CROSSBAR ALTERNATIVE

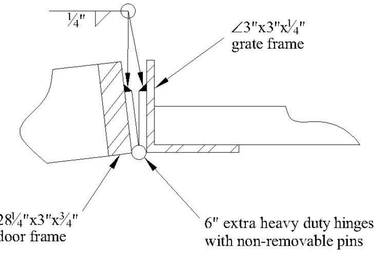


SECTION A-A'

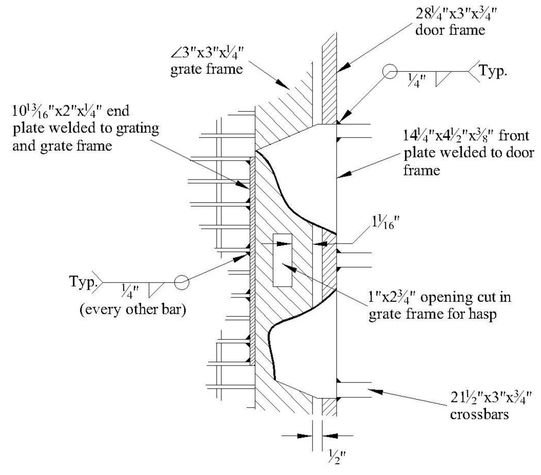


LOCK BOX DETAIL B

*Maximum ¼" free-play in door.

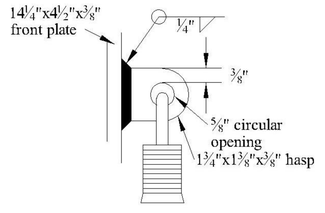


HINGE DETAIL



LOCK BOX DETAIL A

(Front plate cut away)



HASP DETAIL

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COLORADO DIVISION OF MINERALS & GEOLOGY
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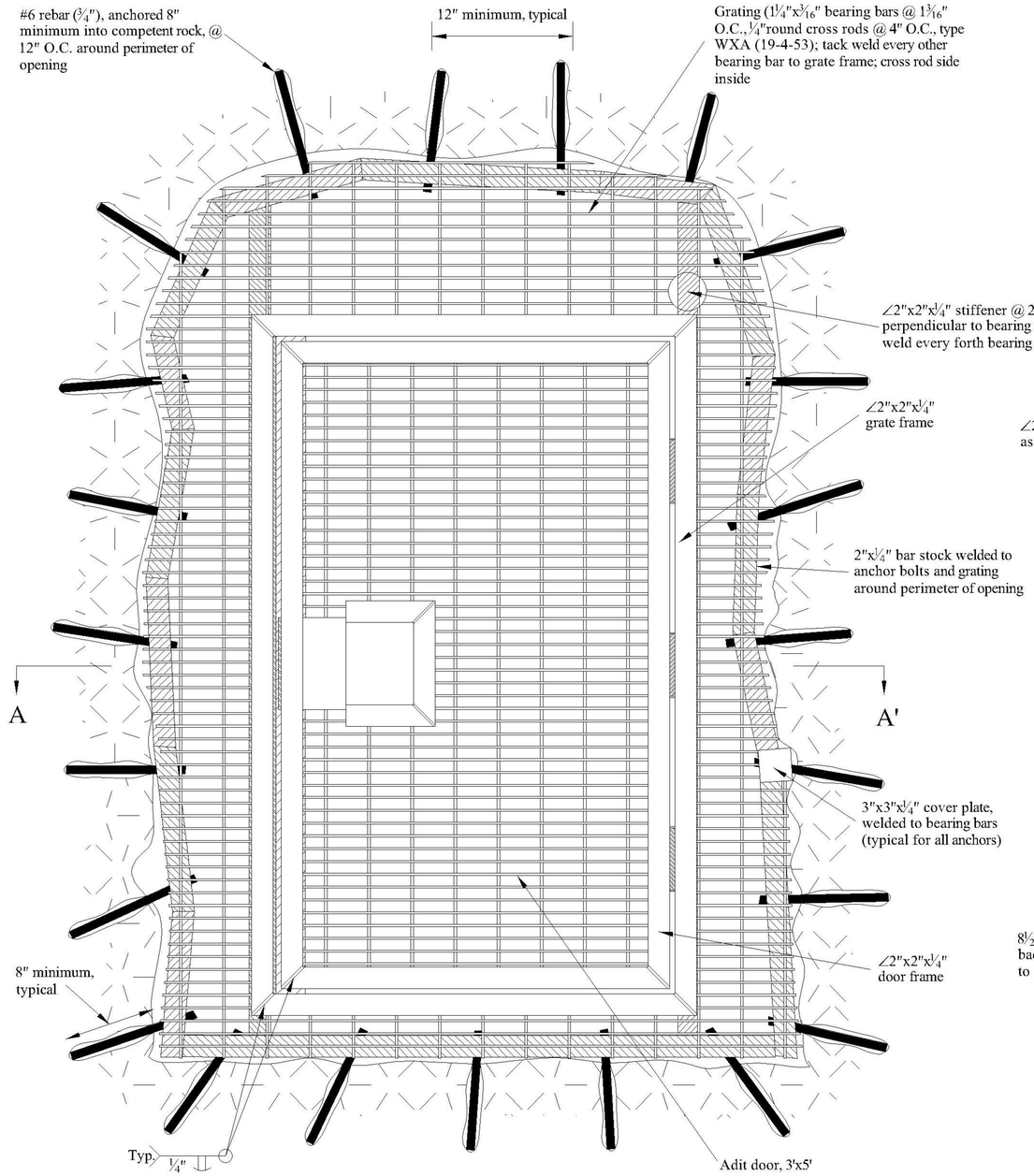
INACTIVE MINE RECLAMATION PROGRAM

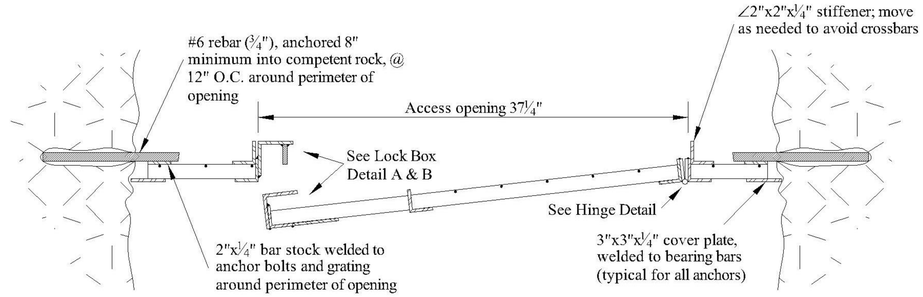
STANDARD DRAWING No. 6
BAT GRATE ALTERNATIVES

Scale Varies	1/30/04	Sheet No. 2 of 2
Drawn by: JTG	Reviewed by: JTH & ALA	

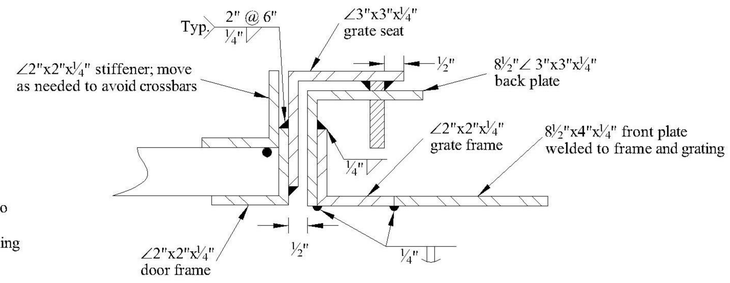


ADIT DOOR CLOSURE

*If required by Project Manager, a 6" drainpipe shall be installed. Additionally, a 12"x12" concrete footing encasing the drainpipe and anchoring the grating will be necessary.

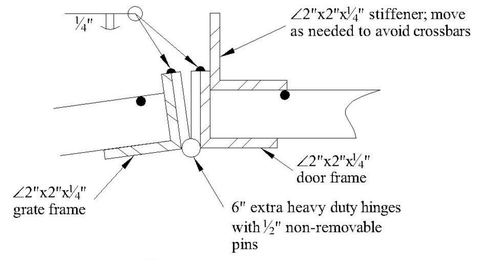


ADIT DOOR SECTION A-A'

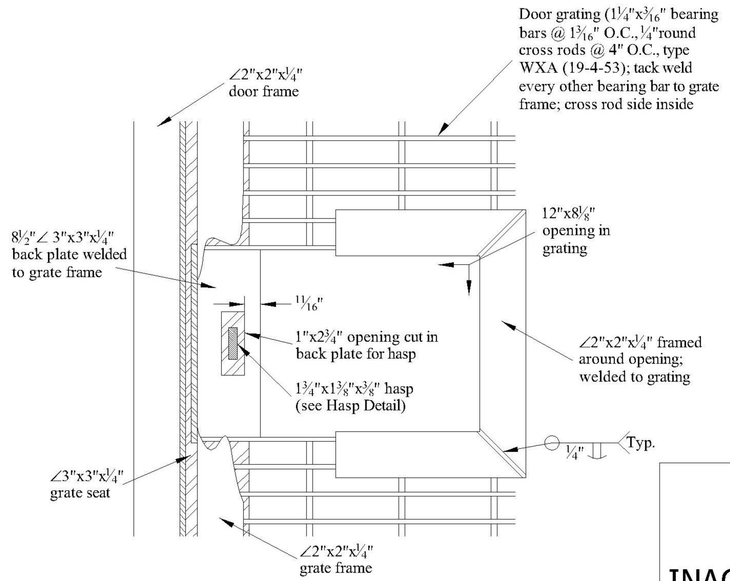


LOCK BOX DETAIL B

*Maximum ¼" free-play in door.

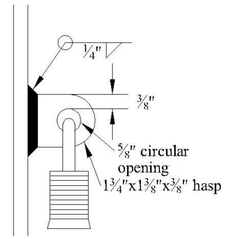


HINGE DETAIL



LOCK BOX DETAIL A

(Front plate not shown)



HASP DETAIL

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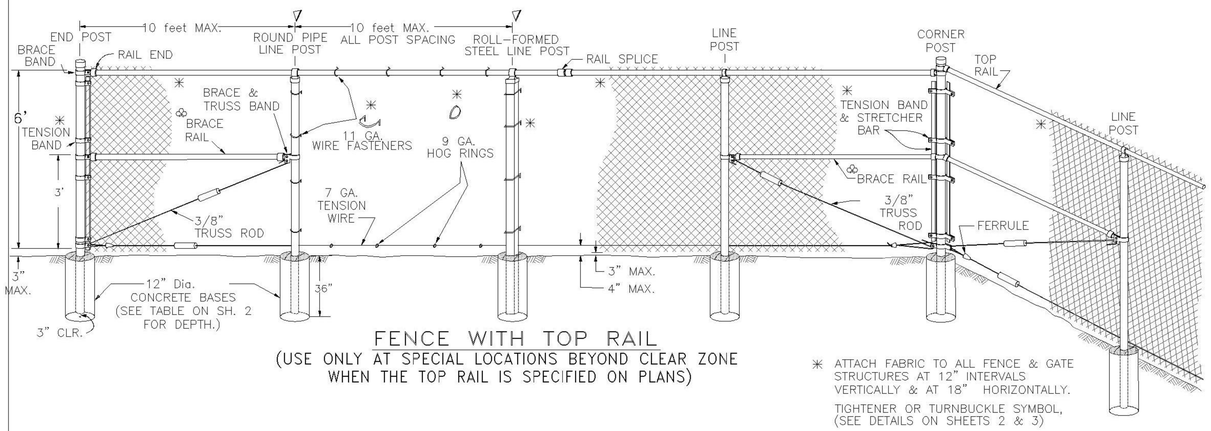
COLORADO DIVISION OF MINERALS & GEOLOGY
RECLAMATION•MINING SAFETY•SCIENCE

INACTIVE MINE RECLAMATION PROGRAM

STANDARD DRAWING No. 7
ADIT DOOR CLOSURE

Scale Varies	2/13/04	Sheet No. 1 of 1
Drawn by: JTG	Reviewed by: JTH & ALA	

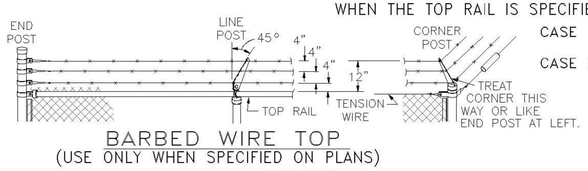


FENCE WITH TOP RAIL

(USE ONLY AT SPECIAL LOCATIONS BEYOND CLEAR ZONE WHEN THE TOP RAIL IS SPECIFIED ON PLANS)

✳ ATTACH FABRIC TO ALL FENCE & GATE STRUCTURES AT 12" INTERVALS VERTICALLY & AT 18" HORIZONTALLY.

TIGHTENER OR TURNBUCKLE SYMBOL, (SEE DETAILS ON SHEETS 2 & 3)



WHEN THE TOP RAIL IS SPECIFIED ON PLANS)

CASE 1. TO KEEP INSIDERS IN, SLOPE TOP IN 45°.

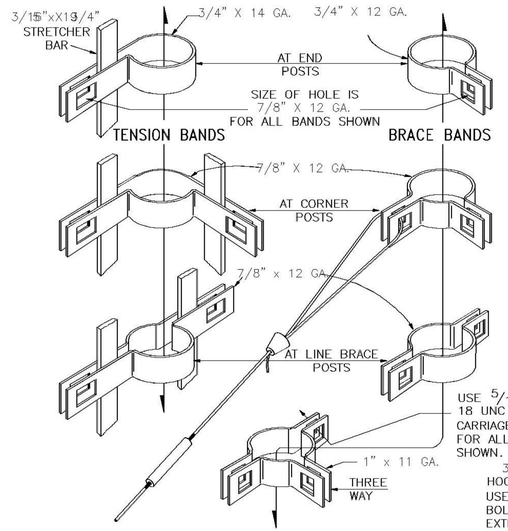
CASE 2. TO KEEP OUTSIDERS OUT, SLOPE TOP OUT 45°.

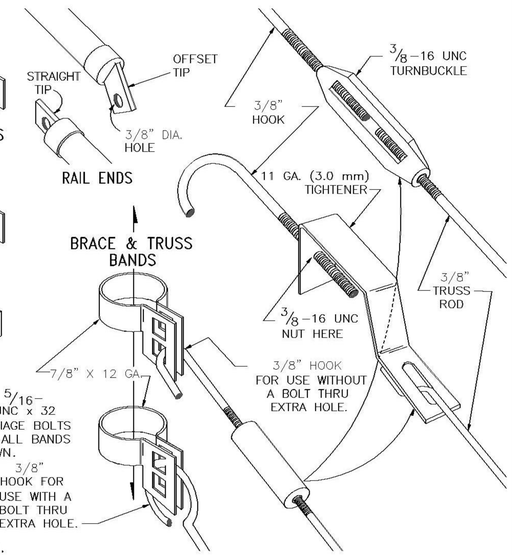
BARBED WIRE OVER GATES SHALL NOT BE SLOPED.

BARBED WIRE TOP

(USE ONLY WHEN SPECIFIED ON PLANS)

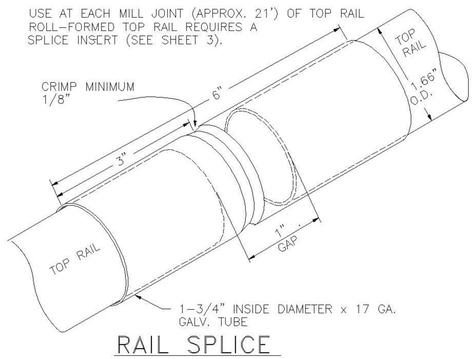
LINE POST



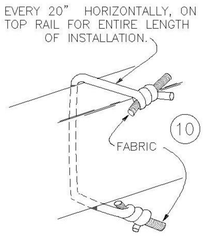


(BANDS TO BE RECTANGULAR FOR ROLL-FORMED STEEL POSTS).

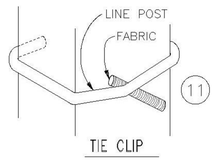
BANDS, RAIL ENDS & TIGHTENERS (DIMENSIONS SHOWN ARE MINIMUMS)



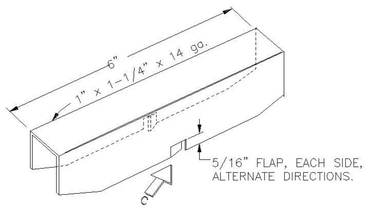
RAIL SPLICE



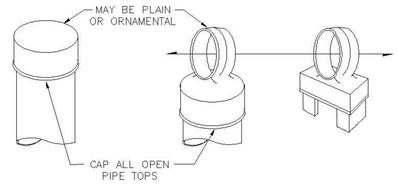
WIRE FASTENER

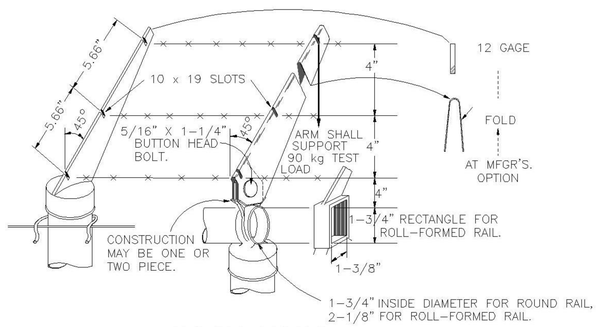


TIE CLIP



RAIL SPLICE INSERT





POST TOPS

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General Notes

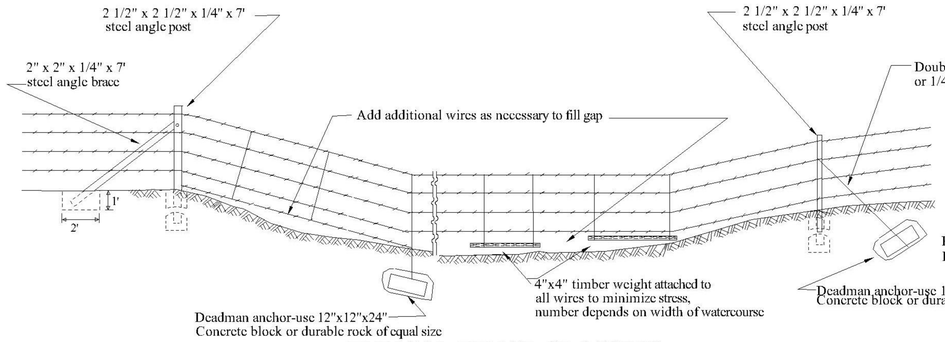
1. This drawing is intended to provide installation details for fencing hazardous mine openings with chain link.
2. Chain link fence shall conform to the requirements of AASHTO M 181 unless otherwise designated on the plans.
3. Chain link fabric shall be 2" mesh No. 9 gage galvanized wire securely fastened to tension wire, line posts, rails, braces and stretcher bars spaced as shown hereon. Wire fasteners and tie clips shall be No. 11 gage (W and M) galvanized steeel wire or No. 7 gage (B and S) aluminum wire. Hog rings shall be No. 9 gage.
4. Ordinary pipe shall be galvanized and conform to ASTM A 120, schedule 40. Roll formed steel posts and rail and H beam steel posts shall conform to Federal Specification RR-F-191/3 (latest revision).
5. Tension wire shall be continuous between end or corner post and line brace post. A turnbuckle or other approved tightening device shall be used for each continuous span of tension wire.
6. Tension wire shall be No. 7 gage galvanized coil spring steel or approved equal.
7. Concrete footings shall have tops crowned at ground level and shall be Class A or B.
8. Fence may be constructed with either round pipe or roll formed steel components. Line posts may be either round pipe or H beam. The Contractor shall state the type of construction and type of line posts to be used, at the Preconstruction Conference.

COLORADO DIVISION OF MINERALS & GEOLOGY
RECLAMATION/MINING SUPPLY COUPLE

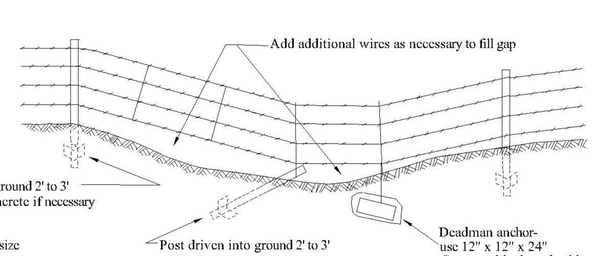
INACTIVE MINE RECLAMATION PROGRAM

STANDARD DRAWING No. 8
CHAIN LINK FENCING

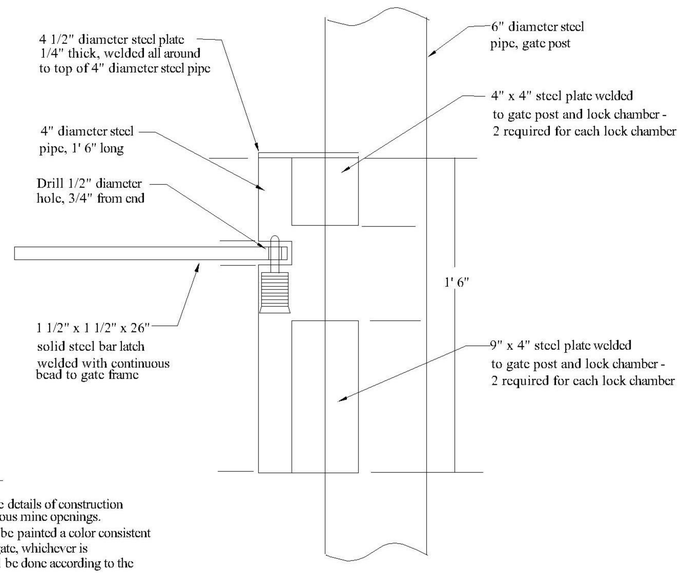
Scale Varies	January 2004	Sheet No. 1 of 1
Drawn by: ALA	Reviewed by JTH and JTG	

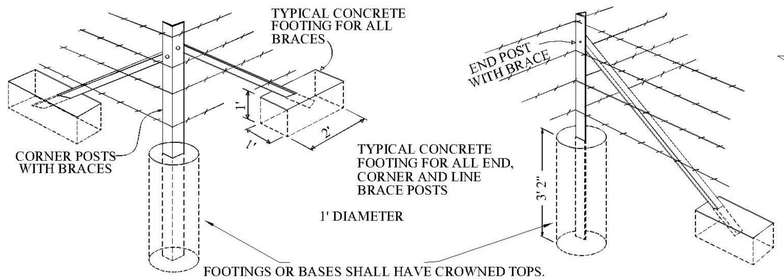


TYPICAL FENCE CROSSING FOR LARGE WATERCOURSE



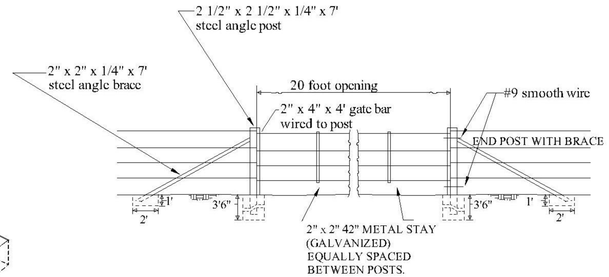
TYPICAL FENCE CROSSING FOR SMALL WATERCOURSE





TYPICAL CORNER POST INSTALLATION

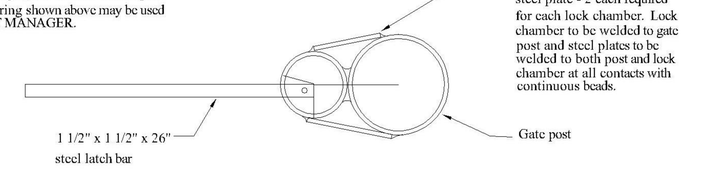
TYPICAL INSTALLATION AT FENCE INTERSECTIONS



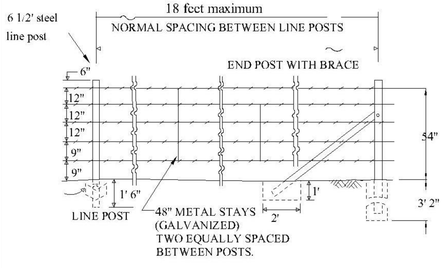
METAL END POSTS BARBED WIRE GATE

GENERAL NOTES

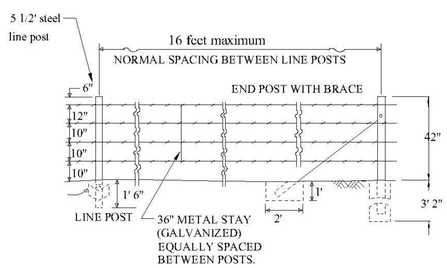
1. This drawing is intended to provide details of construction barbed wire fencing around hazardous mine openings.
2. All unpainted metal surfaces must be painted a color consistent with the color of the line posts or gate, whichever is closer in proximity. Painting shall be done according to the paint manufacturer's specifications.
3. If posts are set in rock, drill a hole and drive post without anchor plate, into hole. If not tight, use concrete to hold post.
4. Alternative methods for anchoring shown above may be used with approval of the PROJECT MANAGER.



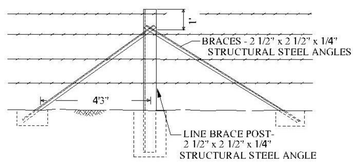
LOCK CHAMBER AND LATCH FOR STEEL GATES



5-WIRE FENCE WITH METAL POSTS



4-WIRE FENCE WITH METAL POSTS



LINE BRACES

CAUTION: This project requires construction work around and over hazardous and unprotected mine shafts, stope, adits, and other openings which may be open to the surface or hidden from view by trash, debris or thin and unstable layers of surficial materials or rock. The CONTRACTOR shall be responsible for thoroughly investigating the site conditions and scheduling his equipment, equipment operations, personnel and safety procedures to prevent accidents and injuries.

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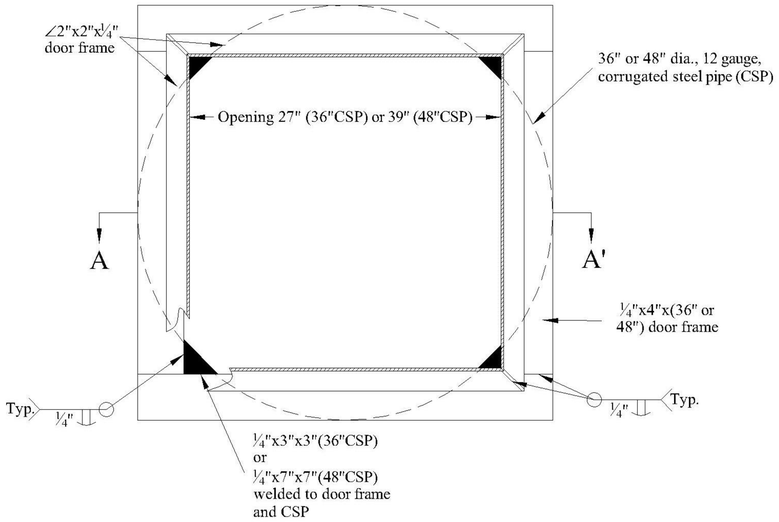
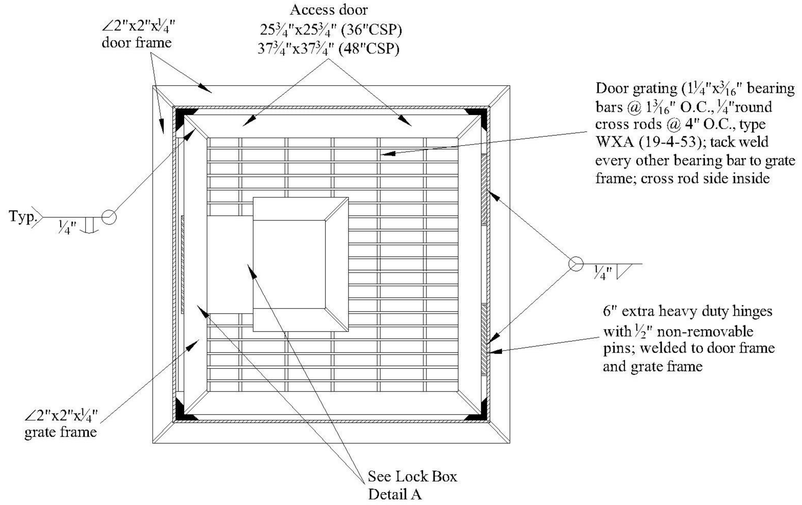
STANDARD DRAWING No. 9
BARBED WIRE FENCING

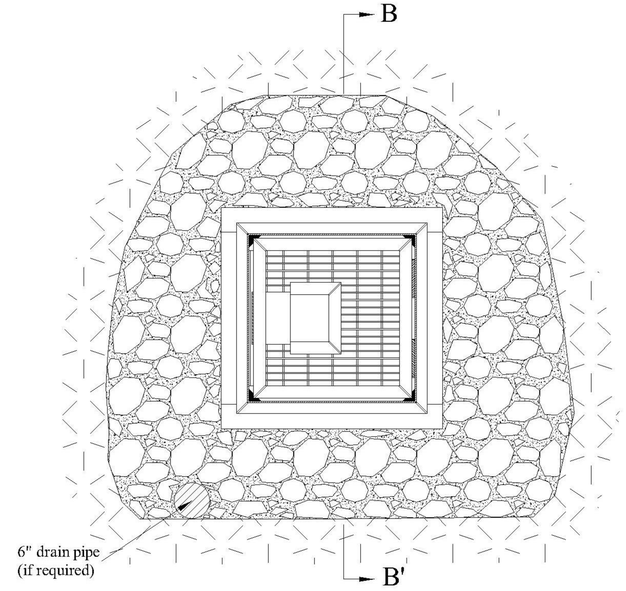
Scale Varies	January 2004	Sheet No. 1 of 1
Drawn by: ALA	Reviewed by JTH and JTG	



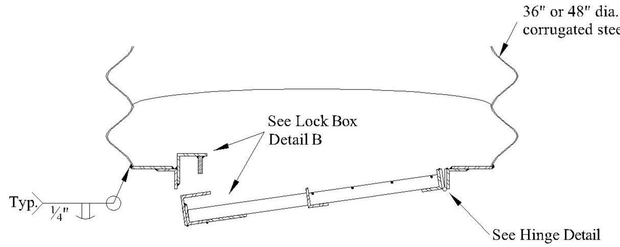
ACCESS DOOR FRAME



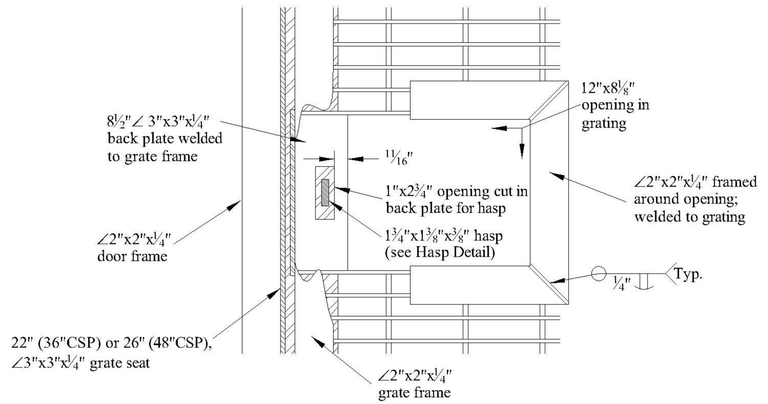
GRATED ACCESS DOOR



ROCK BULKHEAD CLOSURE

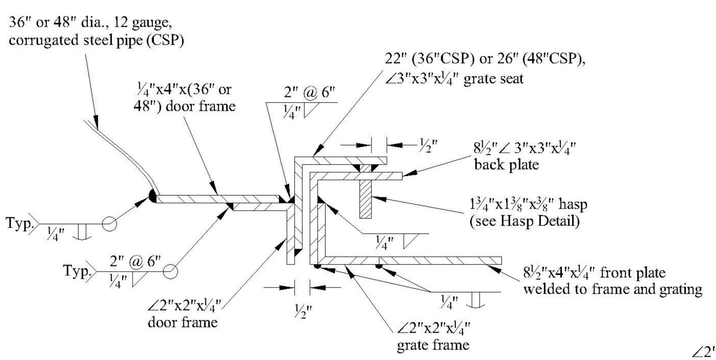


ACCESS DOOR FRAME SECTION A-A'

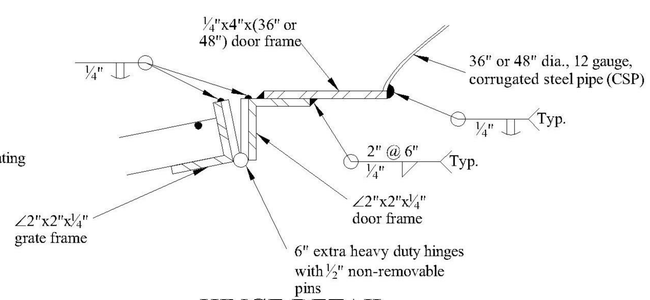


LOCK BOX DETAIL A

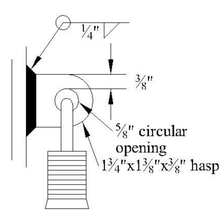
(Front plate not shown)



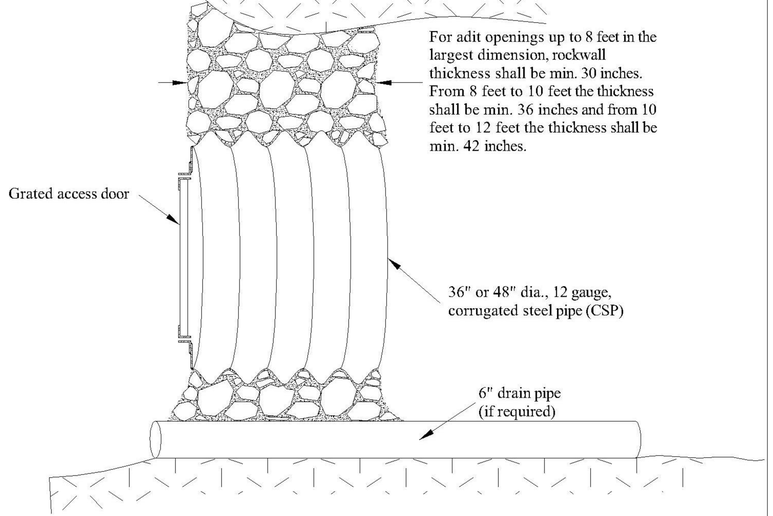
LOCK BOX DETAIL B



HINGE DETAIL



HASP DETAIL



ROCK BULKHEAD CLOSURE SECTION B-B'

CAUTION: This project requires construction work around and over hazardous and unprotected mine shafts, stope, adits, and other openings which may be open to the surface or hidden from view by trash, debris or thin and unstable layers of surficial materials or rock. The contractor shall be responsible for thoroughly investigating the site conditions and scheduling his equipment, equipment operations, personnel and safety procedures to prevent accidents and injuries.

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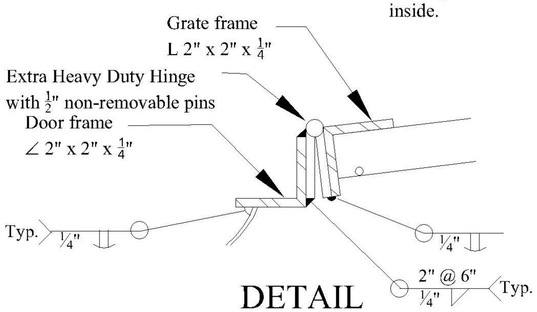
INACTIVE MINE RECLAMATION PROGRAM

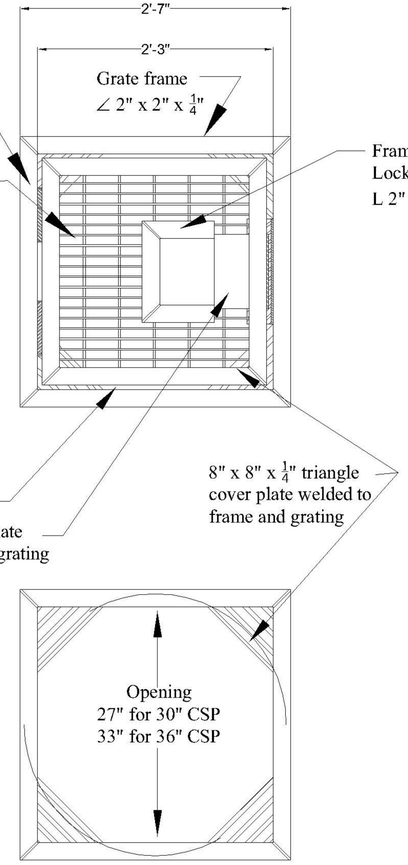
STANDARD DRAWING No. 10

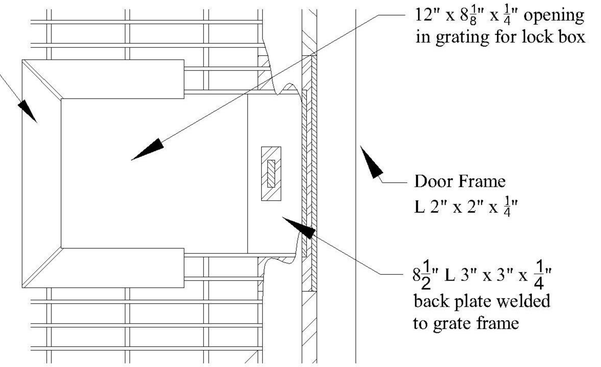
ROCK BULKHEAD CLOSURE

Scale Varies	2/10/04	Sheet No. 1 of 1
Drawn by: JTG	Reviewed by: JTH & ALA	



DETAIL DOOR HINGE





DETAIL LOCK BOX

FRONT PLATE NOT SHOWN

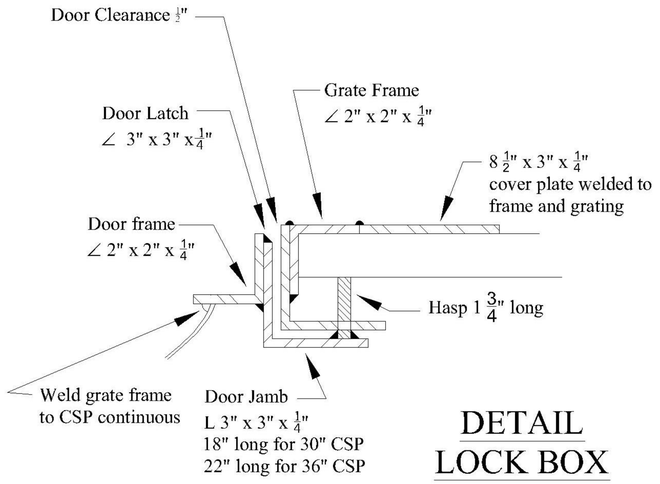
GENERAL NOTES

1. Standard Drawing No. 11 is intended to provide fabrication and installation details for locking steel doors and grated covers for 30" and 36" vertical corrugated steel pipes. Vertical steel pipes are commonly used with polyurethane foam closures, cast-in-place concrete closures, and hollow core plug closures.

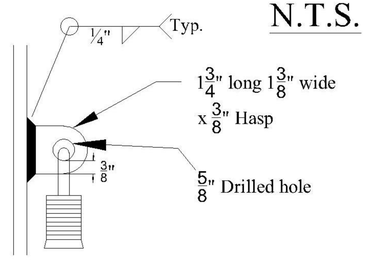
2. Grating, grate frame and frame plates are to be fabricated with ASTM A-36 carbon grade steel.

3. The contractor shall be responsible for fabricating the lock box to accomodate a No. 5 Master Lock with a 3/4" shackle.

4. Free play between hasp and grated door must not exceed 1/4" when locked.

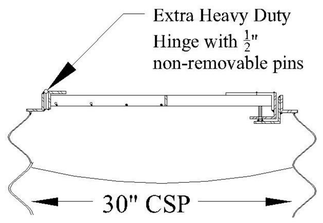


DETAIL LOCK BOX N.T.S.

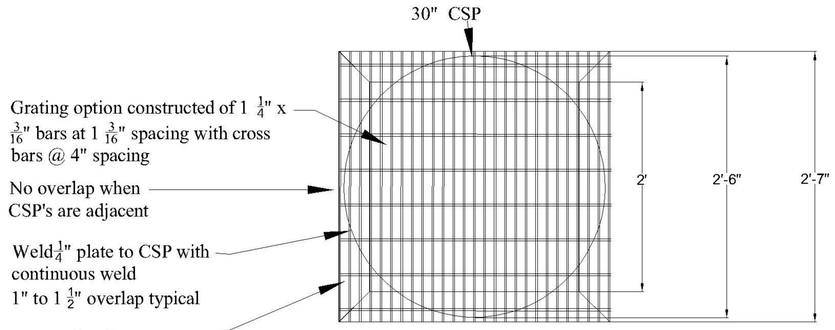


DETAIL HASP AND LOCK

PLAN GRATED ACCESS DOOR



PROFILE LOCKING STEEL ACCESS GRATE



DETAIL 1/4" STEEL PLATE COVER OR 1 1/4" X 3/16" BAR GRATE COVER

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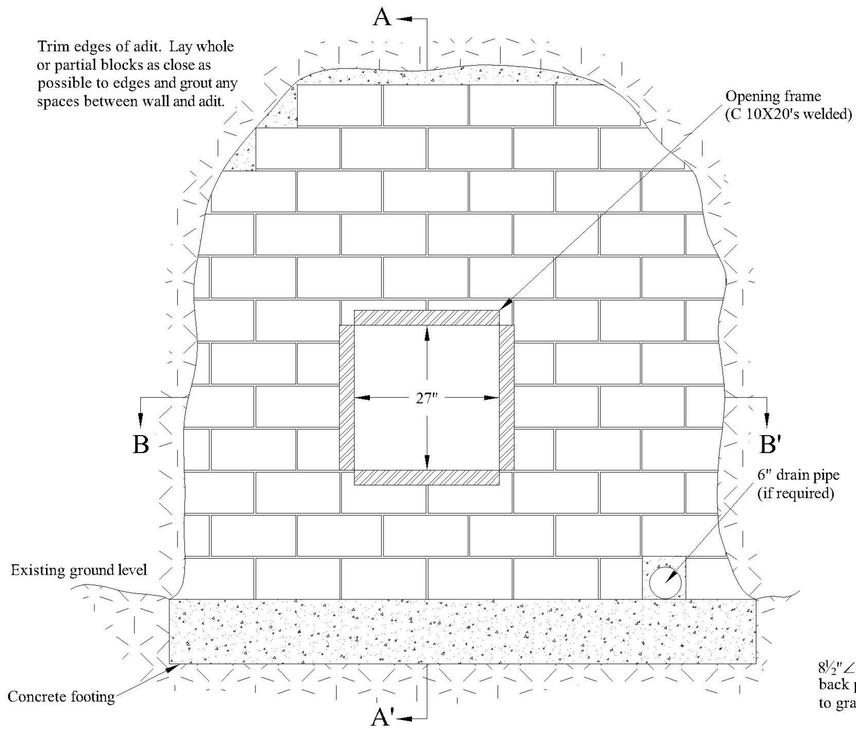
INACTIVE MINE RECLAMATION PROGRAM

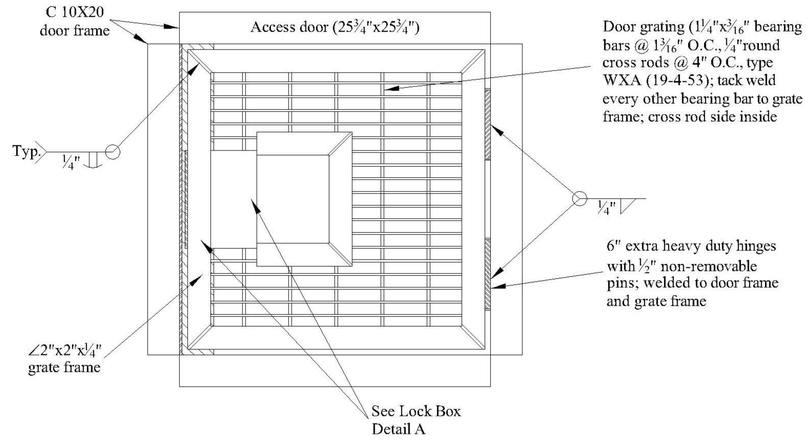
STANDARD DRAWING No. 11

VERTICAL CULVERT DOOR AND COVER

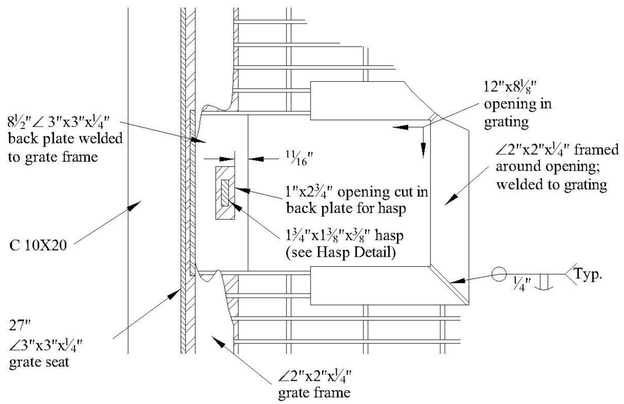
Scale Varies	January 2004	Sheet No. 1 of 1
Drawn by: ALA	Reviewed by JTH and JTG	



CONCRETE BLOCK WALL CLOSURE

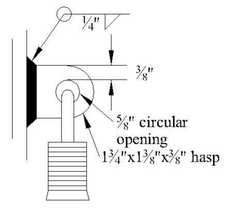


GRATED ACCESS DOOR

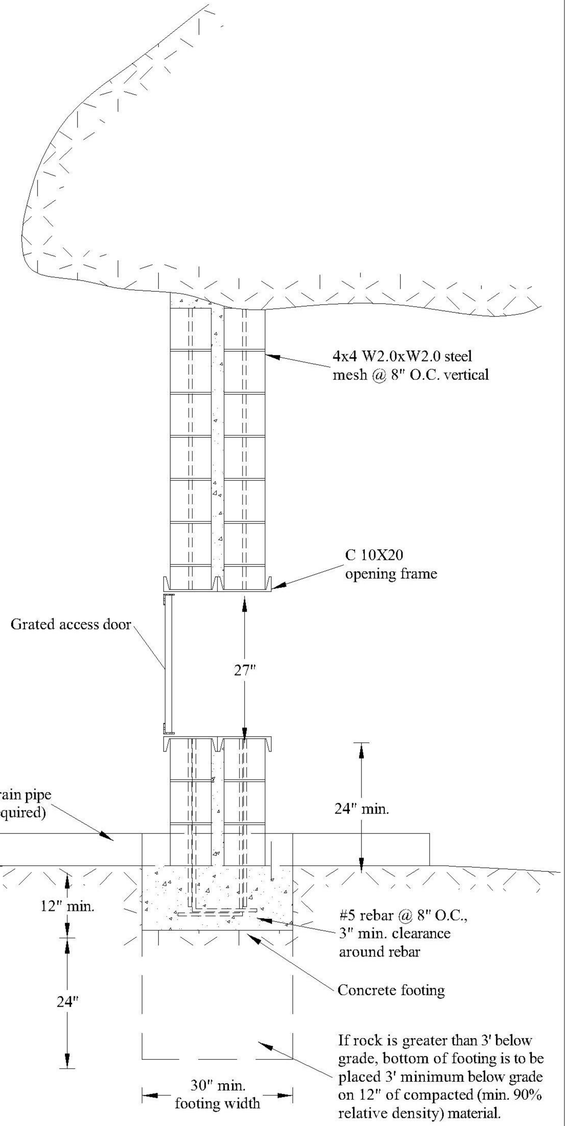


LOCK BOX DETAIL A

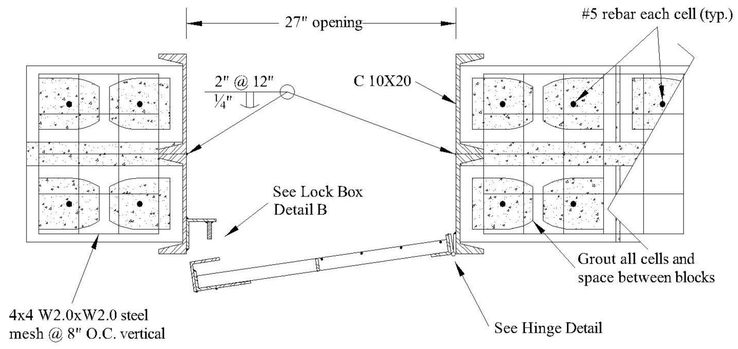
(Front plate not shown)



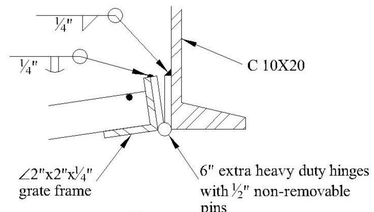
HASP DETAIL



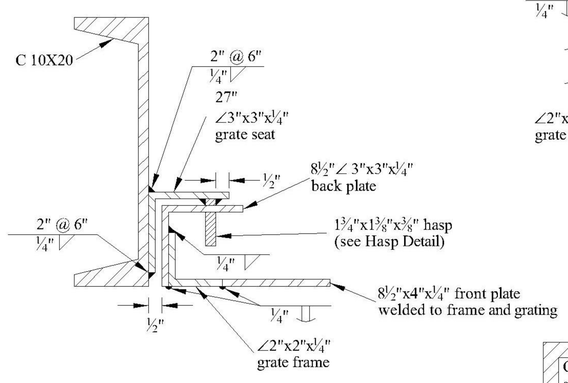
CONCRETE BLOCK WALL CLOSURE SECTION A-A'



CONCRETE BLOCK WALL CLOSURE SECTION B-B'



HINGE DETAIL



LOCK BOX DETAIL B

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STANDARD DRAWING No. 12

CONCRETE BLOCK BULKHEAD SEAL CLOSURE

Scale Varies	12/15/03	Sheet No. 1 of 1
Drawn by: JTG	Reviewed by: JTH & ALA	