CLIENT **: GUYANA ENVIRONMENTAL CAPACITY DEVELOPMENT PROJECT (GENCAPD)**

PROJECT**: GUIDELINES FOR ENVIRONMENTAL MINING REGULATIONS**

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DISCLAIMER

The primary purpose of this publication is to provide guidelines for environmental mining regulations in Guyana's mining industry. It expresses the professional opinion of SNC-LAVALIN INC. (SLI) regarding the matters set out herein, based on SLI's professional judgment and reasonable due diligence. It is to be read in the context of the agreement of August 4, 2003 (the Agreement) between SLI and Natural Resources Canada (the Client), and in accordance with the methodology, procedures and techniques that SLI used, the assumptions SLI made, and the circumstances and constraints under which SLI carried out its mandate. This document is meant to be read as a whole, and sections or parts thereof should therefore not be read or relied upon out of context.

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1. INTRODUCTION

1.1 Why Guidelines for Environmental Mining Regulations?

Amendments to the Guyana Mining Regulations will soon be enacted. These amendments call for an improved environmental management on the part of small and medium-scale miners.

As it occurred elsewhere, some difficulties are likely to arise as a consequence of the adoption of these amendments. The natural and inevitable reluctance to change and the very nature of small-scale mining, namely labour intensive, unmechanized and lacking operation capital, are the main reasons for these difficulties.

To overcome these obstacles, the Regulatory Body as well as the miners need a tool that will help them enforcing the new environmental provisions set forth in the regulations. The present Environmental guidelines are meant to be that enforcement tool.

These guidelines reflect sound management practices followed in other countries. Their principles and approaches are also taken from various sources. They are the result of a comprehensive literature review and collaborative efforts by the GENCAPD Mining Project stakeholders under the guidance of SNC-LAVALIN ENVIRONMENT INC.

2. GLOSSARY OF TERMS

Abandoned site	An area formerly used for mining and mineral processing, where closure is incomplete and for which a titleholder still exists.
Acid rock drainage	Drainage of acid water containing dissolved metals as a result of the natural oxidation of sulphides found in waste rock, ore and tailings exposed to air and water.
Appurtenances	Structures and equipment within a tailings facility, other than the dam itself. They include, but are not limited to, facilities such as pipelines, spillways, drains, intake towers, tunnels, canals, low-level outlets, and water treatment, control and release facilities. They may also include mechanical equipment and electrical control and power supply equipment.
Amalgamation	The process by which mercury is alloyed with some other metal (mostly gold) to produce an amalgam.
Artisanal mine	A small, medium or even large-scale, informal, legal or illegal mining operation that uses rudimentary processes to extract gold from either primary or secondary ore bodies.
Best practice	The best way of doing things. The objective of best practices is to prevent or (when that is not possible) minimize risks to human health, as well as adverse environmental, social and economic impacts.
Buffer areas	Means land on either bank of rivers or watercourses from the low watermark of the bank to 20 metres (20 m) inland, and extending from the mouth of the river or navigable watercourse to its source; or any area within 30 metres (30 m) of a public road; or 100 metres (100 m) of approved residences, commercial/industrial developments; or 1 kilometer (1 km) of an approved nature reserve or park.

Code of practice	A collection of rules and ethical principles related to a specific field of activity. A code of practice describes procedures and sets out standards considered to be best practices in the said field of activity. The code may be voluntary or mandatory.
Community	For the purpose of an emergency response plan, the sum of all affected communities plus the immediate community, whether it is affected or not.
Cut-off trench	Channel or ditch usually excavated around a mining structure in order to collect groundwater.
Effluent	A liquid, solid or gaseous product, frequently waste, discharged or emerging from a process.
End of mine life process	A process undertaken when the mining operation is about to be decommissioned.
Freeboard	The difference in elevation between the maximum operating water surface of the impoundment dam and the low point on the upstream edge of the crest.
Grouting	The injection of grout into fissured, jointed, or permeable rocks in order to reduce their permeability or increase their strength.
Guidelines	A non-binding document, usually designed to provide users with information, explanations, guidance and help with respect to a specific topic. Guidelines are a tool frequently used to enforce new regulations. Users can be either the Regulator itself or the industry.
HSE	Stands for **H**ealth, **S**afety and **E**nvironment.
Hydraulicking	The excavating of alluvial or other mineral deposits by means of high-pressure water jets.
Medium-scale mine	A mine for which a mining permit has been issued and from which a volume in excess of 200 m^3, but less than 1 000 m^3, of material, including any

	overburden, is excavated or processed as an aggregate in any continuous 24-hour period.
Mine	Includes any excavation, processing facility and/or related facilities for the recovery of metal, mineral or quarriable material and excludes any excavation, processing facility or related facilities that excavate or process less than 20 m^3 in any continuous period of twenty-four hours.
Mine closure	A whole of mine life process which typically culminates in tenement relinquishment. Closure includes decommissioning and rehabilitation. This term is often used interchangeably with Mine decommissioning.
Mine decommissioning	The process that begins near, or at, the cessation of mineral production. This term is often used interchangeably with Mine Closure.
NGO	Stands for **N**on-**G**overnment **O**rganization.
Non-point source	A source of water (surface or groundwater) pollution that is diffuse and intermittent resulting from land surface disturbing activities, such as mining, grazing, agriculture or forestry practices. A source of pollution that cannot be traced to a specific, identifiable point of entry into a waterway.
Orphan site	An abandoned mine for which a responsible party no longer exists or can be located.
Open circuit	Any process whereby the ore that has been in contact with mercury, the water used in processing or the mercury itself may enter a waterway or infiltrate into the soil. It also includes the vaporization of mercury into the atmosphere.
Overburden	Loose soil, sand, gravel, etc. that lies above the bedrock or above a deposit of useful materials, ores or coal. Also called burden, capping, cover, drift, mantle or surface.

Paydirt	An unconsolidated sediment containing a mineral deposit.
Placer mining	The removal of high-density minerals (such as native gold) from alluvial deposits by washing with water.
Progressive reclamation	Reclamation that is carried out throughout the mine life in day to day operations.
Reclamation (rehabilitation)	The return of the disturbed land to a stable, productive and self-sustaining condition, taking into account beneficial uses of the site and surrounding land.
Regulations	A type of "delegated legislation" enacted by a state or federal or local government agency given authority to do so by the appropriate legislature. Regulations are generally very specific and are also referred to as rules or simply administrative law. Regulations are official rules and must be followed.
Relinquishment	Point where the mining company has met agreed completion criteria to the satisfaction of the responsible authority. At this point, the site is no longer a danger to public health and safety, is not a source of ongoing pollution or instability and allows a productive use of the land similar to its original use. A mining company has no further obligations regarding a specific property once its relinquishment has been accepted by the regulatory authorities.
Riparian	Pertaining to or situated on the bank of a body of water, especially of a watercourse such as a river, e.g., riparian land situated along or abutting on a stream bank, or a riparian owner who lives along or has property on a riverbank.
Risk analysis	The systematic use of available information to identify hazards and to estimate quantitatively or qualitatively, the likelihood and consequences of those hazards being realized.

Risk assessment	The process of evaluating what might go wrong with a facility and its associated plans and procedures in addition to the consequences of failure. Risk assessments are the basis for developing a risk management strategy that includes communications, contingencies, mitigation measures and emergency response plans.
Settling pond	Means a basin designed to remove settlable solids.
Siltation	The deposition of sediments in a water body as fine suspended particulate matter.
Slurry	A semi-fluid, slushy, murky mass of sediment resulting from treatment of water, sewage or industrial or mining wastes; often appears as local bottom deposits in polluted bodies of water.
Small-scale mine	A mine for which a claim licence has been issued and from which a volume in excess of 20 m^3, but less than 200 m^3, of material, including any overburden, is excavated or processed as an aggregate in any continuous 24-hour period.
Stakeholders	The sum of all representative institutions of the community as well as the relevant sectoral Regulatory bodies.
Stream	Any watercourse, no matter how small or large it is. Includes creeks and rivers.
Stripping	The removal of earth or non-ore rock materials in order to gain access to desired coal, ore or mineral materials; the process of removing overburden or waste material in a surface mining operation.
Sustainable Development (SD)	Development that meets present-day needs without compromising the ability of future generations to meet their needs.

Tailings	The gangue and other refuse material resulting from the washing, concentration or treatment of ground ore. Also those portions of washed ore regarded as too poor for further treatment.
Tailings dam	An impoundment to which tailings are transported and in which solids settle to make it possible for liquid to be withdrawn.
Topsoil	Dark-colored, organic, well-decomposed soil material consisting of the residues of plant and animal materials together with synthesized cell substances of soil organisms and various inorganic elements.
Temporary closure	Phase following temporary cessation of operations when infrastructure remains intact and the site continues to be managed. Also called Care and Maintenance.
Turbidity	The state, condition or quality of opaqueness or reduced clarity of a fluid attributable to the presence of suspended matter.
UNECA	**UN**it of Gold **E**xtraction and **C**ontrolled **A**malgamation. UNECA regional processing centres provide small-scale mining operations with processing services for gold gravity concentrates. The gold is extracted by trained technicians using environmentally friendly technology (closed-circuit amalgamation, special retorts, fume hoods fitted with charcoal filters, etc). These centres can also provide miners with advice on how to improve their production as well as information on health and safety measures. They also provide a place for educational and organizational activities and other purposes. There are UNECA centres in Venezuela and Zimbabwe.
Whole of mine life process	A process that is carried out throughout the life of a mining operation.

3. SCOPE

These guidelines are provided in order to help both the Regulatory Body and the small and medium-scale miners' associations in complying with the environmental provisions of the amendments to the Mining Regulations. They emphasize practical aspects related to HOW the requirements can actually be implemented in the field when these requirements are not self-explanatory enough.

Although cyanide is one of the key issues of the amendments, it is not addressed as a topic here because the amendments deal mostly with obtaining, suspending or cancelling a cyanide permit and not much with cyanide use. In Guyana at this time, cyanide is used exclusively in large-scale mining. As cyanide is an issue in its own right, we have included in appendix E the International Code on Cyanide Management.

The guidelines are divided by topic. For each topic, the relevant articles of the regulations are indicated as well as the category of mining the guidelines apply to (small, medium and large-scale). We also linked the guidelines to the Codes of Practice, as many of the requirements that make up the guidelines were taken from the Codes and are related to them.

4. MERCURY

4.1 Storage, Handling and Transport of Mercury

4.1.1 Mercury in open systems

Article of Regulations: 127, 2) and 131 **All mining operations**

The use of mercury in open systems must be avoided at all time. Open system means any process whereby the ore that has been in contact with mercury, the water used in processing or the mercury itself may enter a waterway or infiltrate into the soil. It also includes the vaporization of mercury into the atmosphere.

Article of Code of Practice: Glossary

4.1.2 Use of safety gears

Article of Regulations: 127, 4) **All mining operations**

All persons involved in handling mercury should use appropriate safety equipment, such as approved gloves and respirators, rubber boots, safety glasses and overalls at all times while handling mercury.

Article of Code of Practice: 5.1.1

4.1.3 Mercury storage

Article of Regulations: 127, 5), 130 and 135 **All mining operations**

Mercury should be stored in bottles and containers made of unbreakable material, such as plastic or steel. The containers should be airtight to reduce vapour formation and be clearly labelled. Mercury should be covered by water.

The storage area should be properly ventilated to avoid build-up of vapour concentrations.

Mercury should be stored away from food preparation and sleeping areas.

Mercury should be kept out of children's reach. Besides, the area where mercury

is stored should be fenced in to prevent inadvertent access thereto.

Flooring should have an impervious, smooth surface with adequate slope leading to impervious drains via traps at several points and should be laid out so that any spillage is collected in a water-sealed sump for proper collection and disposal. Concrete or HDPE membrane are examples of impervious materials that may be used for flooring). (For medium-scale mines only).

In cases of mercury spillage, the material should be washed away into impervious drains and collected in water-sealed sumps. Where it is suspected that small tiny droplets of mercury may remain after adequate washing with water, they can be collected with a syringe or, if the droplets are too abundant, the spilled area ay be sprinkled with lime sulphur spray and swept after a period of time as an additional decontamination measure.

Measures explained above must be taken immediately when a mercury spill occurs in a living space, such as a house, because mercury, when exposed to air, evaporates slowly and contaminates the air in a closed environment.

Articles of Code of Practice: 6.1.1; 6.1.2; 6.1.3; 6.1.4; 6.1.5; 6.1.6; 6.1.8

4.2 Burning of amalgam

4.2.1 Vaporization of mercury

Article of Regulations: 128, 1) All mining operations

Gold amalgam should never be burned in open air because lost mercury cannot be recondensed and recovered and cause secondary exposure and contamination.

Gold and mercury separation should be carried out so that maximum mercury recovery is achieved.

All persons involved in burning mercury should use appropriate safety equipment and gears, including certified respirators.

The extraction of residual mercury from gold amalgam by burning releases mercury into the atmosphere. Proper mercury vapour abatement measures should be carried out at all times when gold is purified using this method.

a) Fume hoods fitted with a condenser and an activated carbon filter should be used when burning gold amalgam in the Gold Board or other gold-refining

facility such as goldsmiths or gold buyers in order to prevent the operator or nearby residents from being exposed to mercury poisoning.

b) As much as possible, the Gold Board or other gold-refining facility such as goldsmiths and gold buyers should be located away from inhabited areas.

c) Technicians and workers at the Gold Board and other gold-refining facility such as goldsmiths and gold buyers should always wear personal safety gear when handling or burning amalgam.

Children should not be around when amalgam is burnt.

Amalgam should not be burnt in living quarters or enclosed areas.

Promote the setting up of regional processing centres (UNECA centres) and their use by miners.

Articles of Code of Practice: 5.4.1; 5.4.5; 5.4.6; 6.4.1 a), c), d); 6.5.1

4.2.2 Use of retorts

Article of Regulations: 128, 2) All mining operations

To burn amalgam, a mercury recovery device should be used, such as the following:

- A retort, consisting of an airtight closed vessel fitted with a condensing tube to recover liquid mercury. Always use a GGMC certified-retort.
- A GGMC-approved oven for amalgam burning equipped with a cooling and mercury fume condensation system.
- Any other GGMC-approved condensation or filtering system that allows mercury recovery.

Article of Code of Practice: 6.4.1 b)

4.3 Register of mercury

4.3.1 Traceability of mercury

Article of Regulations: 132 All mining operations

A protocol for the record keeping and traceability of mercury should be developed and implemented by the mine operator. This should include a balance sheet of mercury used on site, the names of suppliers, how much was used per kg of gold produced, etc.

Article of Code of Practice: 6.6.6

4.4 Code of Practice on mercury

Article of Regulations: 224

A Code of Practice on the use of mercury has been prepared and enforced by GGMC in collaboration with GGDMA.

Article of Code of Practice: The Code itself

5. RECLAMATION AND CLOSURE PLANS

5.1 New mining operations

Article of Regulations: 227, 1) and 4) Medium and large-scale mines

Reclamation must be planned prior to the commencement of mining operations so that the process of closure occurs in an orderly, cost effective and timely manner with the allocation of adequate resources.

The Reclamation and closure plan is part of the Environmental management plan (see section 5 below).

The Regulatory body should set clear and unambiguous reclamation goals and objectives for small-scale and medium-scale mining taking into account applicable regulations and outcome of community consultations.

The Regulatory body should prepare reclamation alternatives for small-scale and medium-scale mining and assess the different reclamation alternatives' viability against a number of criteria such as: the ability to meet expected environmental conditions, cost effectiveness, available technologies and maintenance and monitoring requirements.

The mining licence or mining permit holder should select a reclamation alternative and prepare a conceptual Reclamation Plan.

Mine closure should not be an "end of mine life process" but should be integral to "whole of mine life" if it is to be successful.

A schedule should be provided to describe the implementation of progressive reclamation. Such a schedule should also be provided for each stage of reclamation during the shut-down and decommissioning procedure.

If necessary, estimating costs for decommissioning at the early stages of mine planning can be achieved using unit costs (per ha, per m, per ton, etc.) for similar work done elsewhere.

Articles of Code of Practice: 5.1; 5.1.1; 5.1.2; 5.1.3; 6.1.2; 6.1.3

5.2 Existing mining operations (holders or operators)

5.2.1 Progressive reclamation

Article of Regulations: 227, 3) **Medium and large-scale mines**

Integrate mine decommissioning and closure with day to day management. As far as possible, the site should be rehabilitated progressively in step with the rate of mining. This will permit optimizing reclamation efforts and will bring about substantial costs reduction by avoiding re-mobilizing heavy equipment or manpower to the site.

Always remove and keep the soil for subsequent rehabilitation. Ensure that erosion by wind and water is minimized during and following operations and reclamation.

Re-vegetate the area throughout mine life with plant species that will control erosion, provide diversity and enable plant succession so as to restore a stable and compatible ecosystem. The sooner re-vegetation is initiated, the faster an ecosystem will be re-established. Where possible, respread cleared vegetation on disturbed areas.

The mining licence or mining permit holder should prepare a more detailed Reclamation Plan as the mine develops to ensure the greatest efficiencies are achieved through progressive reclamation.

The mining licence or mining permit holder should integrate progressive reclamation into the conceptual Reclamation Plan.

The mining licence or mining permit holder should update the Reclamation Plan regularly to accommodate changes as a result of factors such as: future developments; changes in industry practices and available technology; rehabilitation success as determined by monitoring, increase/decrease of expected ore reserves; land use options.

Articles of Code of Practice: 5.2; 5.2.1; 5.2.2; 5.2.3; 6.2.1; 6.2.2; 6.2.3; 6.2.4; 6.2.5

5.3 Content of the reclamation and closure plan

See also Appendix B for detailed reclamation measures applicable to the different issues that make up a reclamation and closure plan.

Article of Regulations: 227 5) Medium and large-scale mines

The contents of the Reclamation Plan should include all or most of the following:

- Schedule;
- Site Security and Safety;
- The backfilling of placer mine pits, where applicable;
- The sealing or capping of shafts at closed mines;
- Revegetation of disturbed lands;
- Restoration of watercourses, where appropriate;
- Mine workings;
- Mine development Rock, Overburden and Topsoil Piles;
- Tailings Impoundment;
- Water Management and Treatment;
- Buildings, Equipment and Infrastructure;
- Landfill Waste Disposal;
- Chemical and Fuel Storage Areas;
- Hazardous Waste Storage and Disposal.

Correct any hazard to the public associated with openings to surface (shafts, raises, stopes open to the surface, adit, etc.) in underground mines.

Prevent and/or control safety hazards related to slope stability including impoundment structures such as tailings ponds and settlings ponds.

Control erosion processes that may cause sediment release.

Prevent or stabilize any surface disruption (caving, collapse of crown pillars, subsidence) that may present a hazard to the public.

In underground mining, prevent rib or barrier pillars instability in order to protect neighboring operations.

Prevent and/or correct acid mine drainage and/or leaching of contaminants.

Minimize visual impacts and ensure productivity of land once mining has ceased.

Articles of Code of Practice: 6.1.1; 5.3.1; 5.3.2; 5.3.3; 5.3.4; 5.3.5; 5.3.6; 5.3.7

5.4 Environmental Bond

Article of Regulations: 225 1) and 2) Medium and large-scale mines

The mining licence or mining permit holder should provide adequate securities to protect the community from closure liabilities. A proper decommissioning and reclamation costs estimation must be carried out before determining the amount of the Bond.

Estimating costs for decommissioning at the early stages of mine planning can be achieved using unit costs (per ha, per m, per ton, etc.) for similar work done elsewhere.

Article of Code of Practice: 5.2.5; 6.1.4

6. ENVIRONMENTAL MANAGEMENT PLAN

Article of Regulations: 226 1) and 2) Medium and large-scale mines and 250

The environmental management plan should be based on the following Codes of Practice:

- waste management and disposal;
- effluents,
- contingency and response plans,
- mine reclamation and closure plans;
- mercury.

These codes generally include a section on environmental monitoring where the operator can find information to be used in drafting an environmental effects monitoring programme.

Article of Code of Practice: Content of the above mentioned Codes.

7. SETTLING PONDS

See also Appendix C for sediment and runoff collection structures and Appendix D for permanent soil stabilization techniques.

7.1 Location, design and construction criteria for settling ponds

Article of Regulations: 243, 1) to 4) Small-scale mines and 253

Ponds should be located in a geologically stable area, at least 20 meters away from the low water mark of a riverbank except for access of dredges from the river.

Ponds should be located so that all surface water may be diverted around them. This may necessitate diverting streams and other surface water away from the site.

Ponds should be located so that groundwater seepage into the pond is kept to a minimum. Should excess seepage occur, line the pond with bentonite clay or other impermeable liners, or by installing cut-off trenches around the pond to decrease groundwater infiltration.

Several settling ponds in a series are often preferable to one large pond. Water can be retained for a longer period in multiple ponds, thus allowing sediments more time to settle out before water is discharged. One pond in the series might be the principle sediment trap, while another could be used to hold clarified water that can be recirculated through a processing plant.

Design the pond so that it is large enough to contain all sediment-laden process water as well as seepage, surface runoff and precipitation from the design storm event. The pond should be large enough to provide a minimum freeboard of 0.60 m (2 feet) at all times.

To reduce the velocity of water flowing through the pond, settling ponds should be designed so that their length is greater than their width. Reduced velocity enhances the settlement of solids and increases the stability of the embankments.

Settling ponds can also be excavated below ground level with a compacted embankment placed above the ground surface as an additional safety factor. If ponds are excavated below ground level, the foundation should be constructed so that water cannot seep out of the pond into adjacent streams or other surface

waters.

If the pond cannot be built below ground level, build the pond embankment on clean, stable foundation material. This will help prevent seepage between the embankment and the foundation material. Ponds requiring large dams should be designed and built by a qualified specialist.

Construct the containment embankment with well-compacted, competent soil free of organic debris.

A spillway may have to be installed for a discharging settling pond so that sediment-free water can be decanted. An emergency spillway must also be installed. Spillways must be riprapped with coarse material to prevent erosion of the toe of the dam.

Article of Code of Practice: 6.1.10; 6.1.11; 6.1.12; 6.1.14; 6.1.16; 6.1.15; 6.1.18; 6.1.19; 6.1.20; 6.1.21

8. CONTINGENCY AND RESPONSE PLANS

8.1 Preparation and submission of contingency and emergency response plans

Article of Regulations: 228, 1) to 4) Medium and large-scale mines

Prepare a draft integrated response plan.

Ensure that the newly developed plan is consistent with any regional disaster plans and with legislation.

Check that the plan is robust in relation to all previously identified risks and emergency scenarios and in relation to response tasks.

Include post-accident clean-up in the plan. However, details about clean-up operations should of course be prepared after the accident.

Article of Code of Practice: 6.4.2; 6.4.3; 6.4.4; 6.4.7

8.2 Communication of contingency and emergency response plans

Article of Regulations: 229 Medium and large-scale mines

Communicate final version of integrated response plan to participating groups.

Prepare procedure manuals.

Complete field exercises for hands-on training in monitoring, use of communication, traffic control, etc.

Complete workshops on key issues related to the plan, focusing on education and communication.

Establish schedules and procedures for periodic testing, review and updating the plan.

Communicate the integrated plan to the general community.

Article of Code of Practice: 5.5.1; 5.5.2; 5.5.3; 5.5.4, 5.5.6

9. TAILINGS DAM

9.1 Monitoring and inspection

Article of Regulations: 247 2) and 3) Small-scale mines

Establish and maintain a routine inspection program for assessing the ongoing environmental and safety performance of the impoundment and its appurtenances, including all critical structures such as dams, dikes, ditches, ponds, pipes, spillways and decant structures.

Establish a Dam Monitoring Plan.

In addition to the routine inspection program, arrange for an annual inspection of the tailings facility by an experienced engineer.

Performance monitoring and visual inspections shall be carried out very frequently and include the following: groundwater pressure (level), seepage, deformation (settlement and stability), weather influence, seismic events (after the fact), and special inspection programs after major events (earthquakes or floods).

The following are indicators of instability: soft zones and boils along the toe; dirty sediments in seepage; increased seepage rates; new areas of seepage; longitudinal and transverse cracking; and settlement.

The following are areas requiring special attention: spillways, decant structures, drain and pressure relief wells, concrete structures, pipes and conduits through dams, riprap areas, siphons, weirs, trees and animal holes.

Stability monitoring program plans include the following: locations of control stations; schedule; type of monitoring (visual, measurements of parameters); appropriate level of instrumentation (eg, piezometers); inspection methods; data compilation and evaluation; persons responsible for monitoring; data storage and reporting systems.

Article of Code of Practice: 5.4.12; 5.4.13; 5.4.14; 6.4.5; 6.4.6; 6.4.7; 6.4.8

10. HAZARDOUS WASTE

Article of Regulations: 244, 2) and 3) Small-scale mines

Identify materials and prepare hazardous waste inventories. The hazardous substances inventory should list all chemicals on the site, including:

- The chemical name;
- Typical quantities maintained at the site;
- Operating procedures incorporating handling precautions, storage requirements, safety equipment needed, training required and specific instructions for clean-up of spills.

Describe methods for transport, storage and handling of hazardous waste.

Identify options for disposal and long term storage of hazardous waste. All hazardous wastes storage facilities should be designed with protection of the environment as well as health and safety in mind.

If the storage or disposal area is on the site, it needs inspection to ensure sufficient protection is installed to prevent escape of the material to the environment.

Where storage or transport systems are not clearly visible, as with underground tanks or buried pipes, additional protective measures are needed. Material balances and inventory reconciliation should be used on a regular basis to detect any unaccounted loss of material.

Any disposal area should be clearly identified and labelled.

Disposal areas should be adequately monitored to permit identification of any leakage.

Provide training on hazardous waste handling and storage for workers. Training programs should include appropriate information about the environmental hazards of materials.

Article of Code of Practice: 5.3.1; 5.3.2; 5.3.3; 5.3.4; 6.3.1; 6.3.2; 6.3.4; 6.3.6; 6.3.7; 6.3.8

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http://www.northstar.k12.ak.us/schools/upk/gold/facts/dredge/dredge.html (How a gold dredge works)

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APPENDIX A

Information on Mercury and Associated Hazards

A-1 Mercury is the only metal present in a liquid state at ordinary temperatures. In its elemental form, it is used in a number of instruments and equipments, such as thermometers, barometers, manometers, blood pressure instruments, direct current meters and mercury switches. Also, because mercury readily forms alloys with many metals, it is used in alkali manufacturing, extraction metallurgy and dentistry. Mercury vapour lamps and mercury arc rectifiers are some major applications of mercury.

A-2 Mercury forms both inorganic and organic compounds. Inorganic compounds are used in various chemical reactions. Organic mercury compounds, such as fulminate, are used in explosives, while alkyl mercury halides are used in seed treatment. **Mercury and its alloys are toxic.** The most extensive use of mercury in Guyana is in the gold extraction and processing industry.

A-3 Metals with which mercury readily forms alloys include sodium, potassium, aluminium, copper, silver, gold and zinc. Mercury metal alloys are generally called amalgams.

A-4 Properties of Mercury

- Atomic number: 80
- Atomic mass: 200.61
- Melting point: -38.9°C
- Density: 13,546 g/cm^3 at 20°C
- Vapour pressure: $<$ 0.01 at 20°C
- Description: Silvery white liquid metal
- Solubility in water: Practically insoluble

A-5 Health Hazards

A-5.1 Mercury is highly toxic, particularly as a vapour or when part of organic compounds. Unless properly managed, the use of mercury can be detrimental to the health of any workers close to where mercury is being used. Alkyl mercury compounds are readily absorbed through the skin.

A-5.2 Mercury gives off vapours even at room temperature (25°C). When equilibrium with the mercury source is at room temperature, the vapour concentrates are 200 times the threshold limit value. Vapour pressure nearly doubles when the temperature increases by about 10°C.

A-5.3 The principal routes of entry of mercury are: (a) vapour into the respiratory tract through inhalation, and (b) ingestion of plant and animal material, including fish, that contain mercury. Mercury bioaccumulates and predatory fish are known to have some of the highest concentrations of the material if the aquatic system contains mercury. Mercury and many of its organic compounds may be absorbed through the skin on direct contact. If mercury-bearing compounds are ingested, mercury may be absorbed through the alimentary tract. Serious exposure may occur if mercury-containing material is heated in an open or inadequately sealed vessel.

A-5.4 Acute local effects may include irritation, blistering and corrosion of the skin, resulting in dermatitis or eczematic rash.

A-5.5 *Chronic toxicity.* Inorganic mercury poisoning affects the liver and kidneys, while organic mercury (or methylmercury) settles chiefly in the brain. Chronic exposure to organic mercury causes damage to the nervous system. Methylmercury poisoning, or "Minamata disease," has the following five classic symptoms:

- Visual constriction;
- Numbness of the extremities;
- Hearing impairment;
- Speech impairment;
- Walking impairment.

With severe exposure, paralysis and death may result. The onset of symptoms of chronic mercury poisoning is insidious. The recovery is usually very slow.

A-5.6 *Acute toxicity.* Acute toxicity may be attributable to ingestion of inorganic mercury compounds, short-term exposure to organic mercury compounds, use of mercury-containing foods, or inhalation of mercury vapour. Acute systemic effects may include kidney damage. Possible symptoms of exposure may include metallic taste, burning sensations, swelling, abdominal pain, diarrhoea, ulceration, intestinal hemorrhaging, weakness, chills, nausea, coughing and vomiting. If acute exposure is suspected, immediate medical attention is recommended.

A-5.7 *Threshold exposure levels in air*: The recommended time-weighted average (TWA) for mercury is 0.01–0.05 mg/m^3 of air for continuous exposure over an 8-hour workday and a 40-hour work week. The short-term exposure limit (STEL) for this material is 0.03–0.1 mg/m^3 for 10 minutes. The provisional tolerable weekly intake is 1-5 μ/kg body weight.

APPENDIX B

Mine Reclamation Measures

Reclamation Measures- Surface Workings

(modified after UNEP/WHO 1999)

Issue	Reclamation Objectives	Control Technologies
PHYSICAL STABILITY ISSUES		
• Safety • Hazardous cliffs • Water hazard • Failing slopes	• Restrict access to hazardous areas • Emergency access to drinkable water in case of groundwater disruption	• Ditch and berm • Fence, & sign post, if necessary • Slope stabilisation where practicable • Provide emergency access to water
• Slope Failure • Deep seated or overall slope failure • Erosion	• Prevent deep seated failure, if practicable • Restrict access to unstable areas • Control sediment release, if necessary	• For potentially unstable slopes, either stabilise by flattening slopes or constructing toe berm, or restrict access with ditch/berm &, if necessary, fence & sign post • Establish vegetation or place riprap • Provide stable spillway & overflow channel, rehabilitate for fish, waterfowl, wildlife habitat.
CHEMICAL STABILITY ISSUES		
• Acid drainage and/or leaching of metals • Turbidity	• Meet water quality objectives by; 1. Control reactions 2. Control migration 3. Collect and treat 4. Settlement	• Flood to control reaction • Cover to control reactions and/or migration • Collect and treat, active treatment to be avoided where possible • Settlement to control turbidity
LAND USE ISSUES		
• Productivity of land • Visual impacts • Visual impact of river diamond mining tailings piles	• Return to approved alternative use	• Backfill pit where practicable & beneficial • Flatten slopes • Contour - blend with natural topography • Establish vegetation • Return tailings to riverbed

Reclamation Measures- Mine Rock and Overburden Piles

(modified after UNEP/WHO 1999)

Issue	Reclamation Objectives	Control Technologies
PHYSICAL STABILITY ISSUES		
• Slope failure - deep seated or overall slope failure - erosion • Drainage disruption	• Avoid deep seated failure • Avoid large surface slumps and sediment release • Avoid blockage of drainage	• Site selection to avoid low strength foundations (P) • Internal drains to prevent water table rise • Construct in lifts to achieve flatter slopes • Covers to control infiltration of water • Ditches for water management • Bulldoze crest, if required, to flatten slope • Construct toe berm to stabilise slope and to flatten inclination • Collect sediment in ponds • Establish vegetation or riprap, where required • Monitor
CHEMICAL STABILITY ISSUES		
• Acid drainage and/or leaching of metals or contaminants • Turbidity	• Meet water quality objectives by: 1. Control reactions 2. Control migration 3. Collect and treat 4. Settlement	• Underwater disposal to control reactions • Pre-treatment-blending of alkaline material to mitigate acid drainage (P) • Cover to control reactions and/or migration and/or turbidity • Settle to control turbidity • Segregation of deleterious materials for controlled disposal or cellular pile construction • Collect and treat, active treatment to be avoided where possible • Monitor • Complete detoxification of all cyanide dumps, as required
CHEMICAL STABILITY FOR SPENT ORE PILES		
• Flushing of mill reagents - cyanide	• Meet water quality objectives by: 1. Control reactions 2. Control migration 3. Collect and treat	• Detoxify by flushing with water or other solution to degrade cyanide to pH<7 • Regulate seepage to meet water quality objectives with covers and/or retention pond prior to release
• Flushing of acid		• Detoxify by flushing with lime solution to achieve effluent water quality which meets mine effluent objectives, if possible • Regulate seepage to meet water quality objectives with cover • Collect and treat - active treatment to be avoided where possible
LAND USE ISSUES		
• Productivity of land • Visual impacts	• Returned to acceptable alternative use	• Contour-blend with natural topography • Establish vegetation where practical

(P) - Option to be implemented at approved pre-mine stage.

Reclamation Measures- Tailings Impoundment

(modified after UNEP/WHO 1999)

Issue	Reclamation Objectives	Control Technologies
PHYSICAL STABILITY ISSUES		
• Tailings - dust - water erosion	• Control dust migration • Control tailings erosion	• Establish erosion resistant covers of vegetation soil, riprap or water • Monitor
• Dams - deep seated or overall slope failure - surface slump - erosion	• Factor of safety >1.5 for static conditions • Erosion resistant overtopping protection • Restrict access	• Appropriate site selection and dam design (P) • Where necessary, stabilise embankments by constructing toe berm to flatten overall slope • Riprap or vegetation cover to control erosion • Increase freeboard and/or upgrade spillway to prevent overtopping • Ditch/berm/fence to prevent erosion by motorised vehicles • Monitor • Internal + toe drains
• Weathering • Destruction of permanent - structures - spillways - decant towers & pipes • Drainage disruption	• Remove or establish long-term stability • Integrate with local drainage	• Remove or plug/backfill structures • Diversions and spillways designed for long-term stability • Plug/seal decant lines through embankments • Define and provide for long-term monitoring and maintenance • Avoid ongoing operation where possible
CHEMICAL STABILITY ISSUES		
• Tailings and pore water - acid drainage - leaching - mill reagents (including mercury) - Water quality	• Meet water quality objectives by: 1. Control reactions 2. Control migration 3. Collect and treat	• Implement permanent control measures • Flood to control reactions • Pre-treatment-removal of deleterious material for controlled disposal elsewhere or blending with alkali material to mitigate acid drainage (P) • Cover to control acid reactions and/or migration using inert material or bog (biological filter) • Ditch to divert runoff • Collect and treat - active treatment to be avoided where possible (requires continued maintenance)
• Dams, structures	• Meet water quality objectives by: 1. Control reactions 2. Control migration 3. Collect and treat	• Do not construct with materials which are potential acid producers or are leachable • Decontaminate and/or remove acid generating or leaching materials
LAND USE ISSUES		
• Productivity of land • Visual impacts	• Return to acceptable land use	• Rehabilitate by one or more of the following means: - flood, contour, cover, establish vegetation, wetland

(P) - Option to be implemented at approved pre-mine stage.

Reclamation Measures- Water Management

(modified after UNEP/WHO 1999)

Issue	Reclamation Objectives	Control Technologies
PHYSICAL STABILITY ISSUES		
• Water dams - stability - erosion - overtopping - intakes/ decant towers	• Ensure long-term stability • Protect erodible slopes • Ensure no overtopping • Seal pipes	• Maintain embankment indefinitely • Breach dam • Maintain operating spillway in durable Rock • Plug intakes with concrete, plug decants and remove towers • Monitor
• Ditches - overtopping - erosion	• Adequate flood capacity • Prevent blockage • Prevent erosion	• Design for extreme events • Construct from materials suitable for long-term stability • Riprap protection • Provide for long-term maintenance • Monitor
• Storage Tanks - stability	• Remove	• Drain, remove or knock down, fill, & cover • Monitor
• Pipelines - collapse - obstruction	• Remove surface and large shallow pipes	• Remove all surface and large shallow pipes • Plug those pipes at depth • Monitor
• Culverts - blockage - collapse	• Ensure maintenance free passage of water under design flood conditions	• Remove and breach if not required • Upgrade to pass design flood • Provide for long-term maintenance • Monitor
CHEMICAL STABILITY ISSUES		
• Contaminated reservoirs	• Meet water quality objectives by: 1. Control reactions 2. Control migration 3. Collect and treat	• Drain, treat and discharge • Strip and dispose of contaminated soils in tailings dam or approved location • Breach dam • Establish vegetation • Treat indefinitely, if necessary • Monitor
LAND USE ISSUES		
• Dams - interruption of drainage	• Restore drainage patterns • Determine if alternative use exists	• Breach and restore to erosion resistant drainage • Stabilise to maintain dam
• Reservoirs - productivity of land - potential water supply	• Return to acceptable alternative use	• Maintain dam • Drain and establish vegetation
• Ditches	• Restore drainage patterns	• Grade to restore natural drainage • Establish vegetation

Reclamation Measure – Buildings and Equipment

(modified after UNEP/WHO 1999)

Issue	Rehabilitation Objectives	Control Technologies
PHYSICAL STABILITY ISSUES		
• Safety and access • Maintenance and stability - building - hoist & shaft facility - power plant - conveyors - mobile equipment	• Control access	• Decontaminate if necessary • Disassemble & remove all equipment and buildings • Backfill excavations • Remove buried tanks • Restore natural drainage
CHEMICAL STABILITY ISSUES		
• Buildings - insulation • Chemical storage areas • Mill reagents • Petroleum products • PCBs • Explosives	• Make secure • Monitor stored supplies • Meet water quality criteria • Dispose of surplus chemicals off-site	• Chemicals of all types to be recycled, returned to vendor, sold, or disposed of in an approved site
LAND USE ISSUES		
• Alternative uses • Productivity • Visual	• Original or acceptable alternative use	• Contour • Vegetate • Break and bury concrete • Restore natural drainage

Reclamation Measures- Underground Workings

(modified after UNEP/WHO 1999)

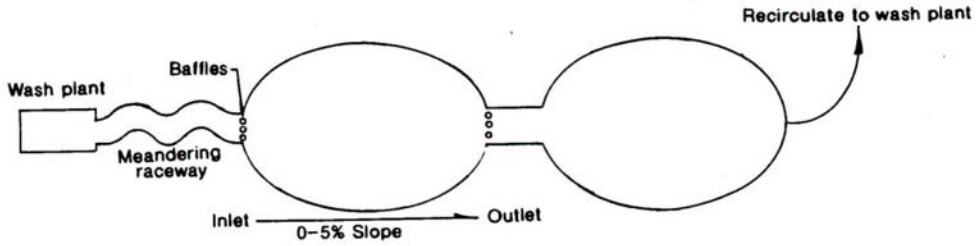
Issues	Reclamation Objectives	Control Technologies
PHYSICAL STABILITY ISSUES		
• Openings to surface which are hazardous to public (shafts, raises & stopes open to the surface, and portals to adits & declines)	• Prevent inadvertent access • Permanently seal openings	• Minimise number of openings (P) • Permanently plug or seal all access openings to surface • Backfill shafts & stopes, if practical • Fence areas • Place warning signs around • Vent water & gas pressures
• Surface disruption which are hazardous to public (caving, collapse of crown pillars)	• Prevent inadvertent access • Surface stabilisation • Underground stabilisation	• Use mining method resulting in stable surface (P) • Stabilise surface, if feasible • Ditch/berm &, if necessary, fence & sign post unsafe areas until natural stabilisation occurs • Backfill surface openings, if practical
• Surface disturbance (subsidence)	• Surface re-contouring where beneficial	• Use mining method resulting in stable surface (P) • Re-contouring or diversion to establish drainage patterns
• Barrier pillars stability which are hazardous to neighbouring operations	• Prevent collapse and flooding of adjacent mine • Prevent collapse and stress transfer to adjacent mine	• Permanently support boundary pillar, if practical and necessary • Ensure access to neighbouring mine and continued pumping, if required
CHEMICAL STABILITY ISSUES		
• Acid drainage and/or leaching of minerals or contaminants • Seepage of mill reagents from backfill	• Meet water quality objectives by: 1. Control reactions 2. Control migration 3. Collect and treat	• Flood workings to control reactions • Permanently plug workings & drill-holes to control migration • Collect & treat passively; active treatment to be avoided where possible • Drain all oil containing equipment, motors, transformers, etc.
LAND USE ISSUES		
• Productivity & aesthetics • Drainage interrupted • Groundwater lost	• Return to original or accepted alternative use • Establish surface and groundwater drainage patterns	• Backfill disrupted portions & openings where practicable • Contour surface • Flood workings • Establish vegetation

(P) - **Option to be implemented at approved pre-mine stage.**

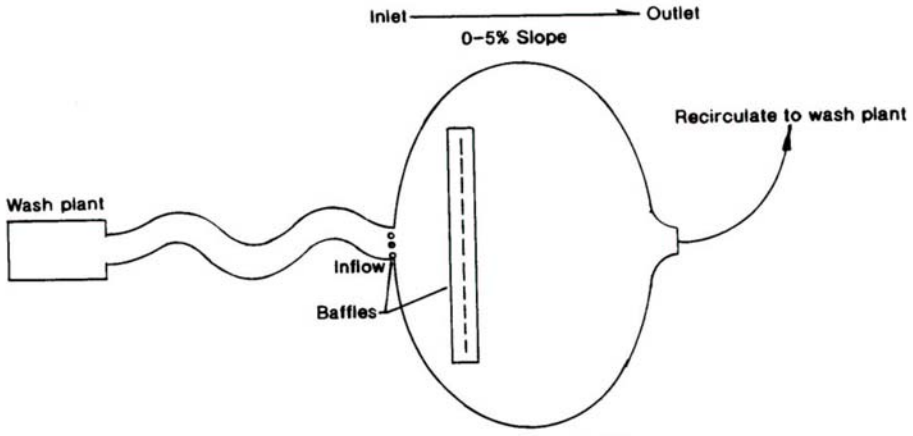
APPENDIX C

Sediment and Runoff Collection Structures

Diagram of Settling Ponds for Placer Mining



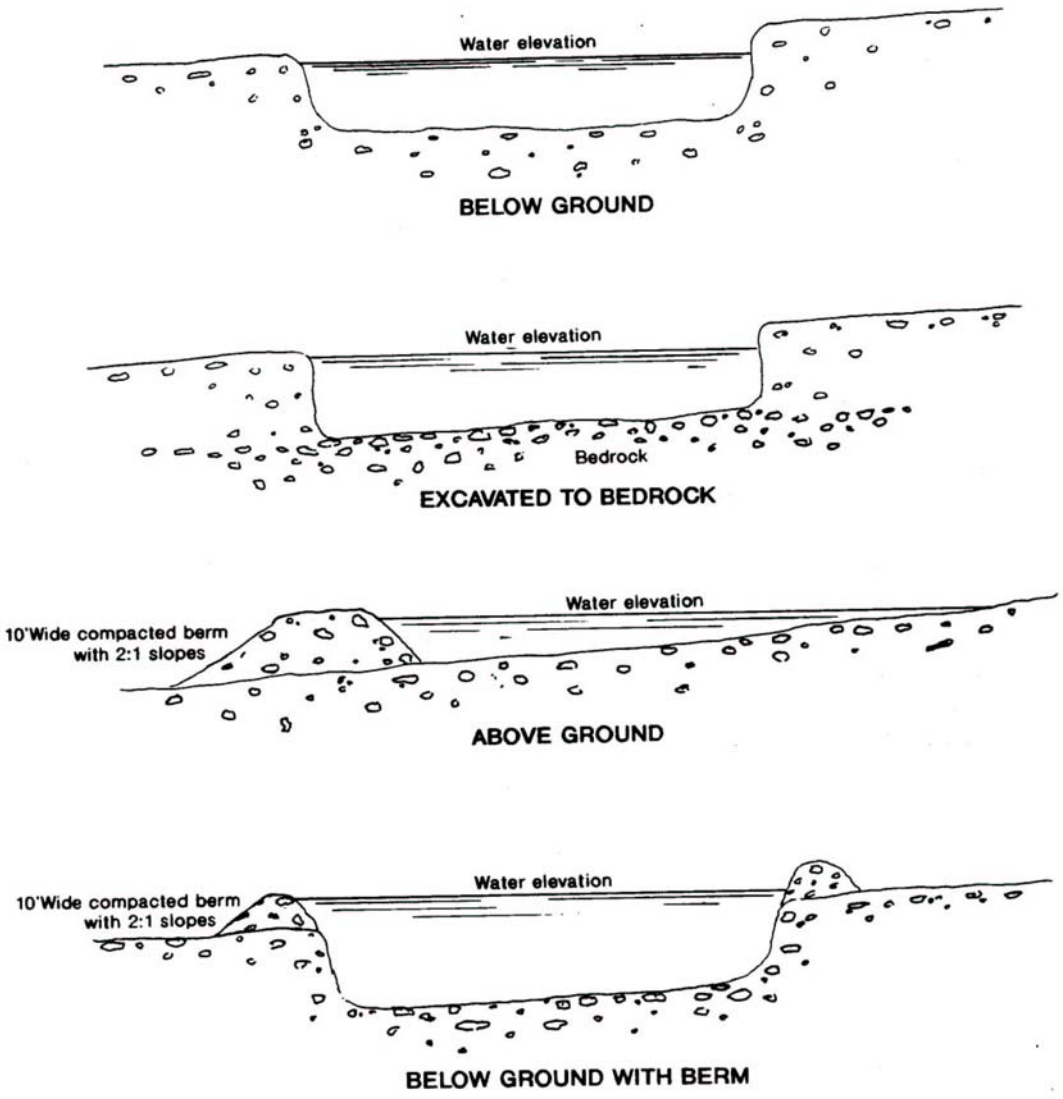
STANDARD SETTLING PONDS IN SERIES



SETTLING POND WITH BAFFLES

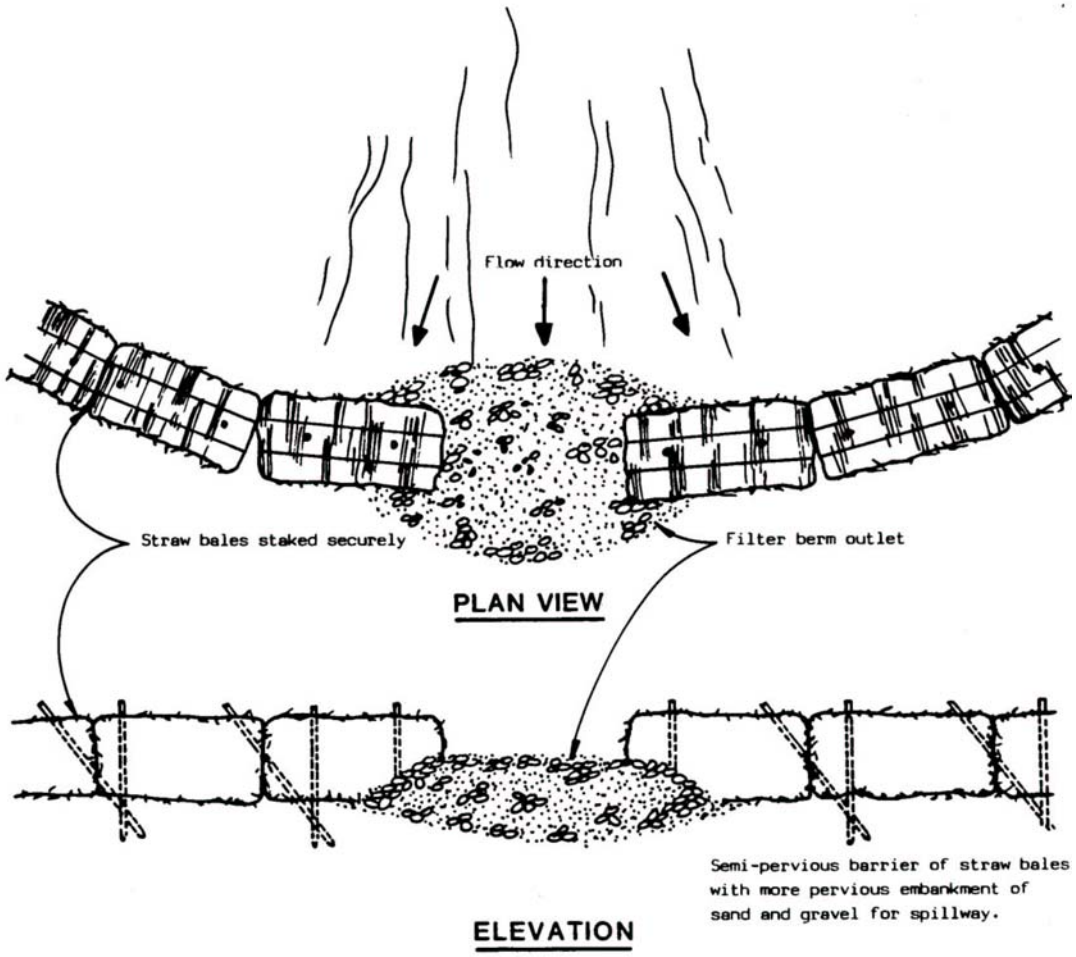
After Idaho Department of Lands, 1992

Settling Pond Construction Options



After Idaho Department of Lands, 1992

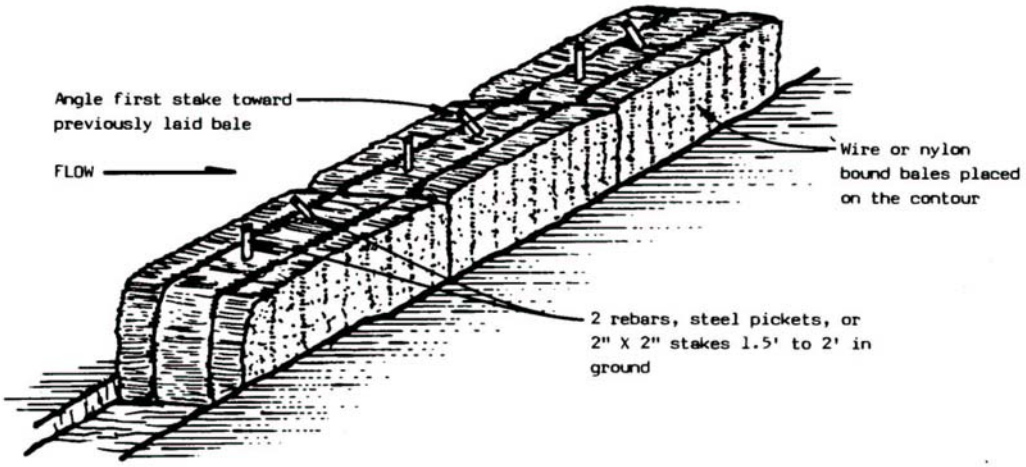
Straw Bale Sediment Barrier



After Idaho Department of Lands, 1992

Straw Bale Sediment Barrier *(cont'd)*

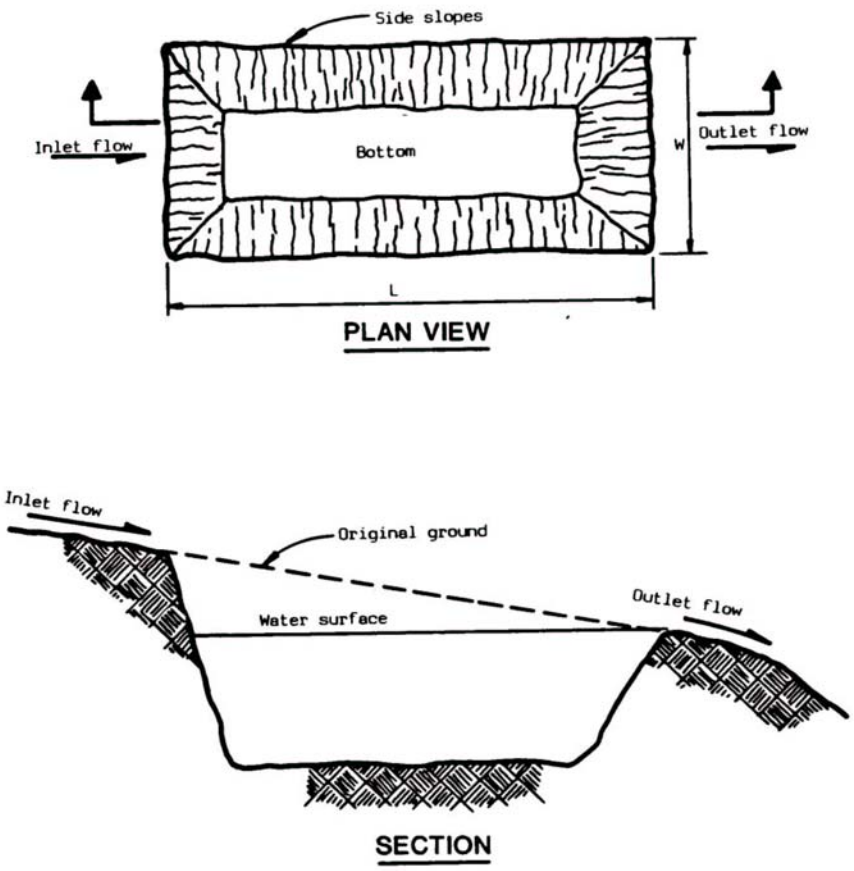
EMBEDDING DETAIL



ANCHORING DETAIL

After Idaho Department of Lands, 1992

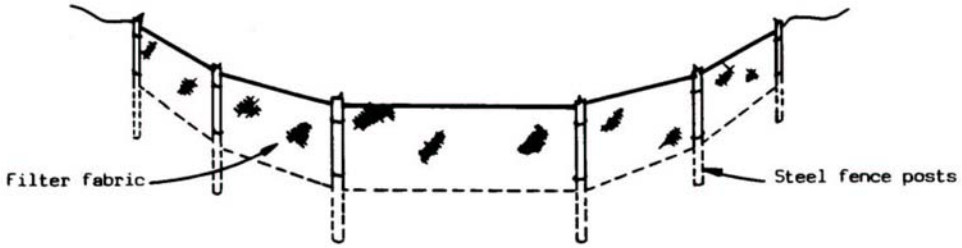
Sediment Traps or Catch Basins

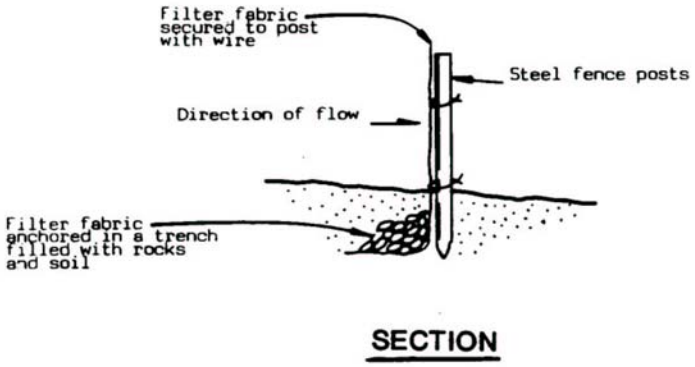


After Idaho Department of Lands, 1992

Silt Fence/Filter Fence

Wood may replace steel for fence posts

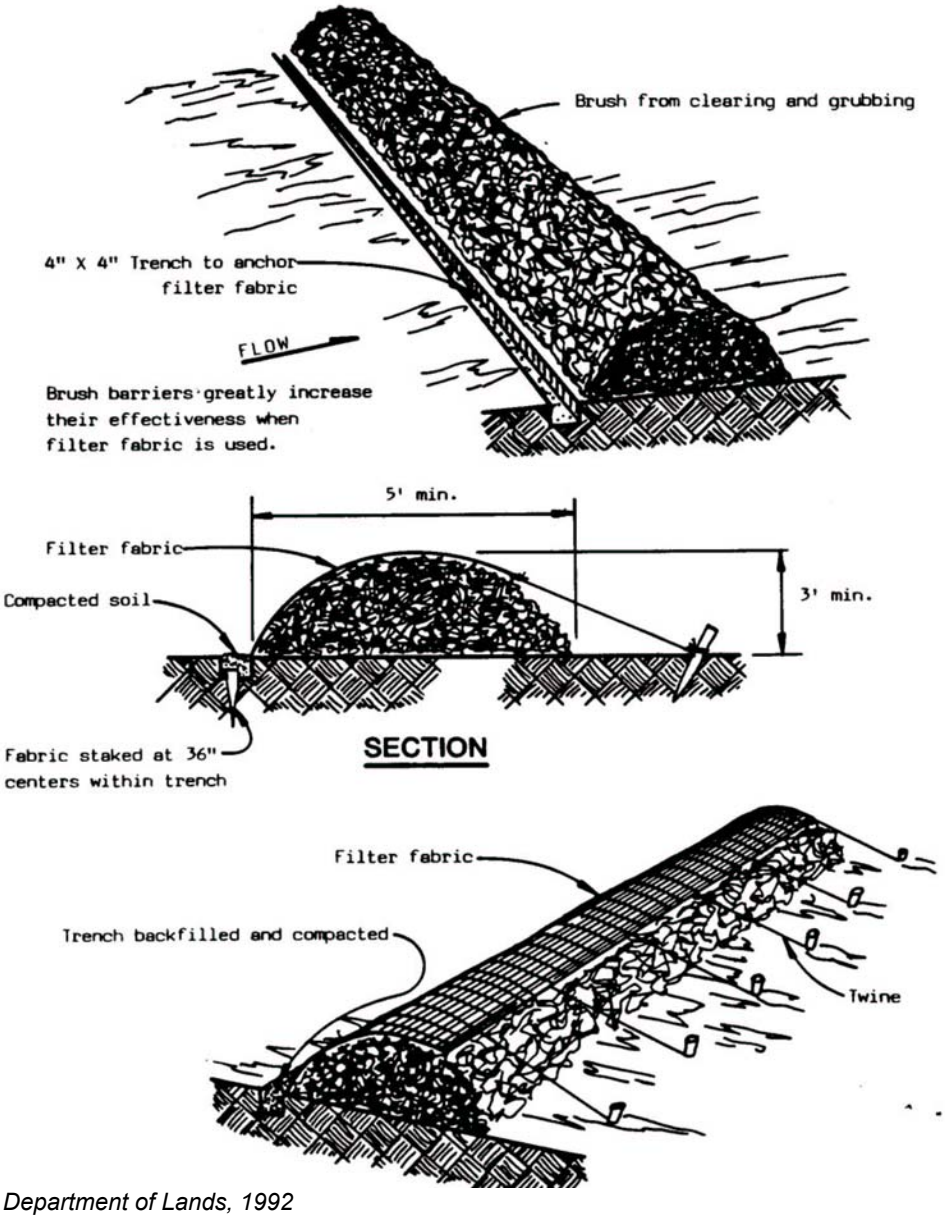




SECTION

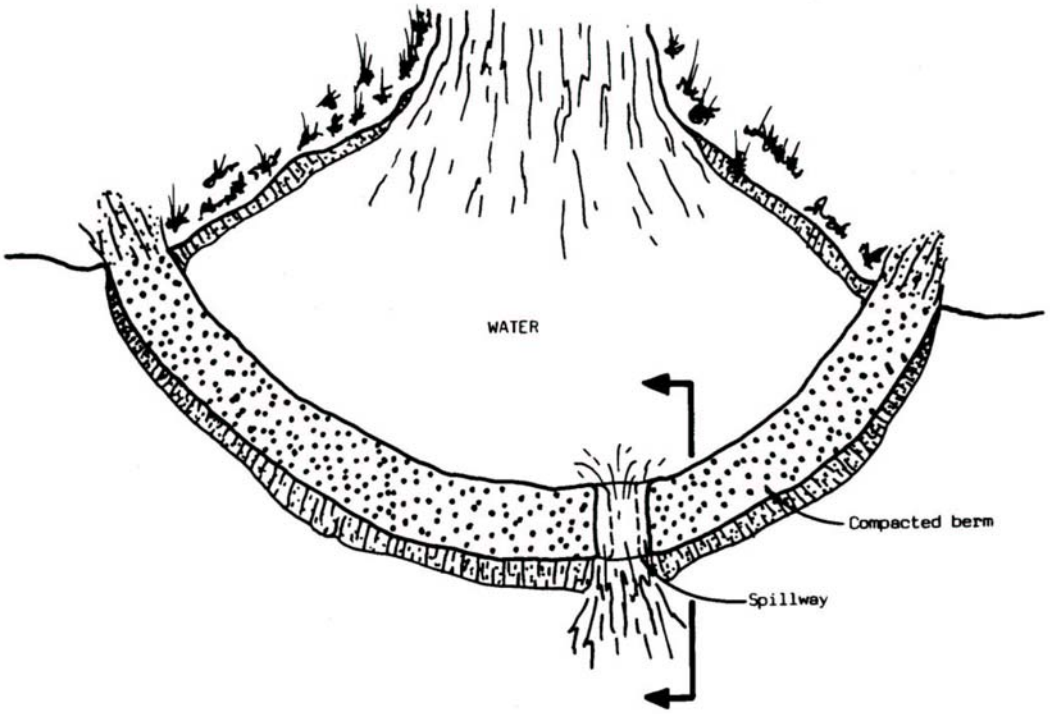
After Idaho Department of Lands, 1992

Brush Sediment Barrier

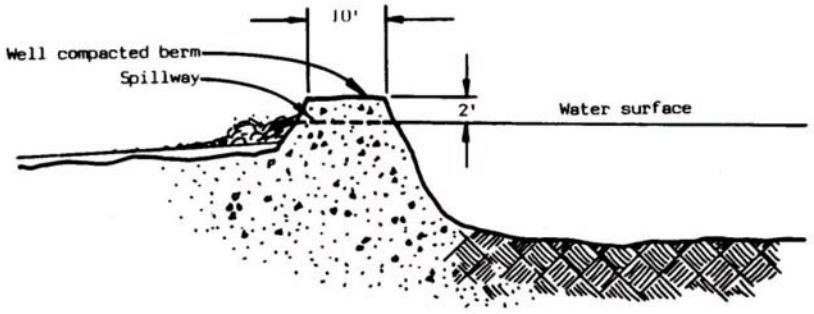


After Idaho Department of Lands, 1992

Sediment/Settling Pond



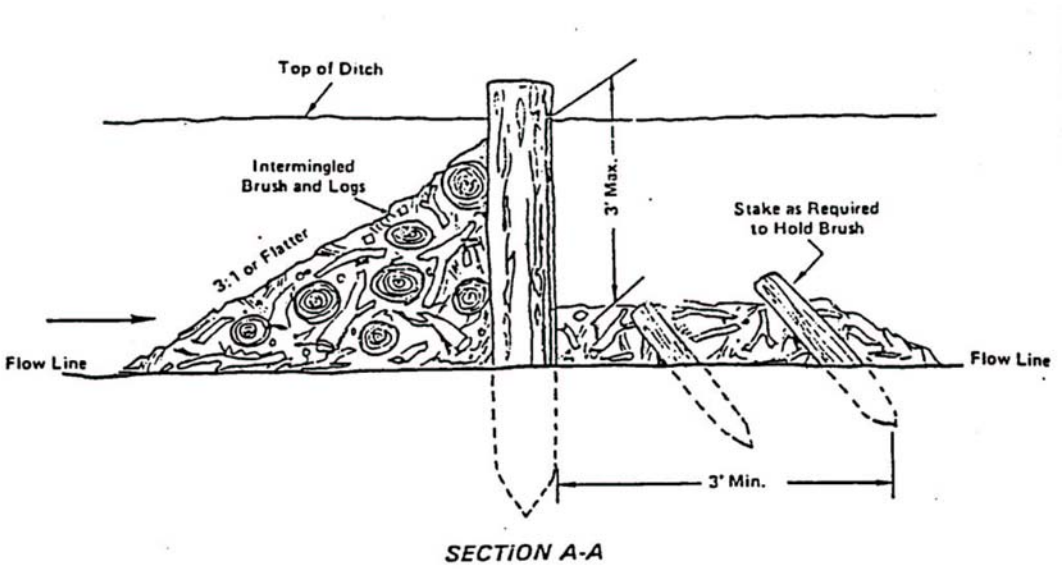
PLAN VIEW



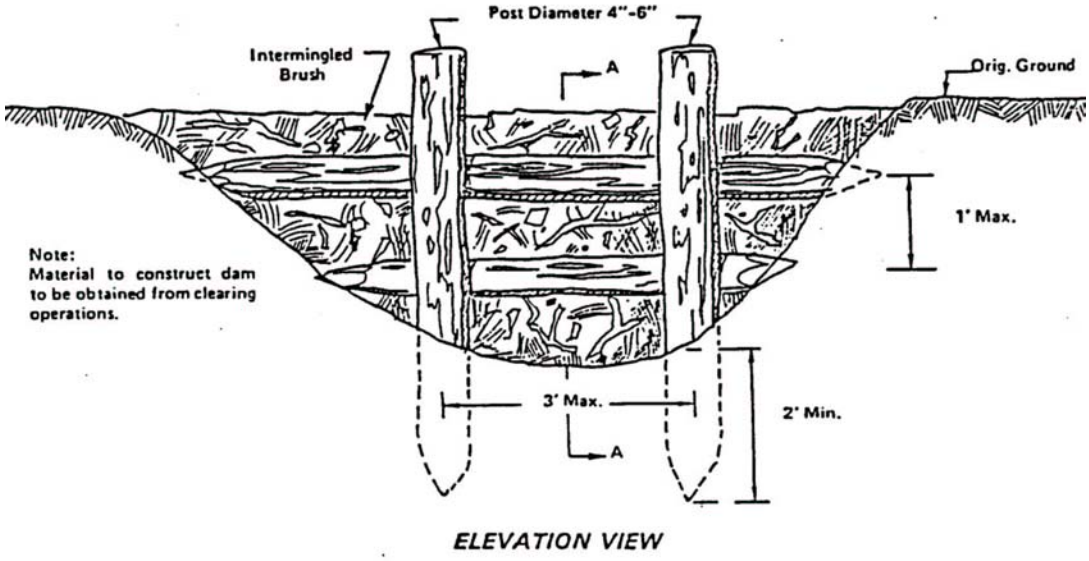
CROSS SECTION

After Idaho Department of Lands, 1992

Log and Brush Check Dam



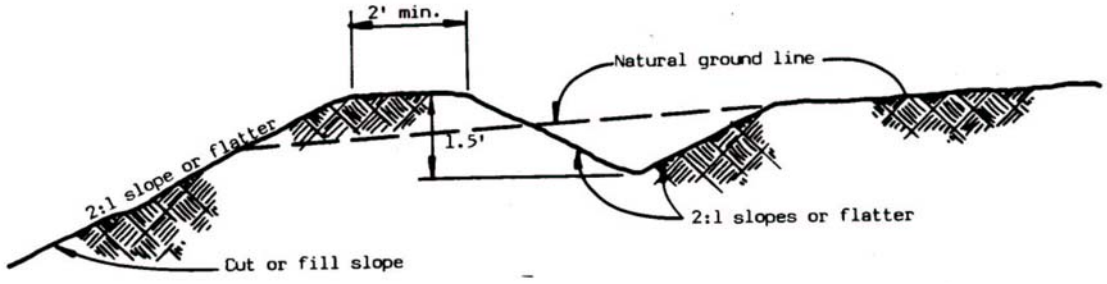
SECTION A-A



ELEVATION VIEW

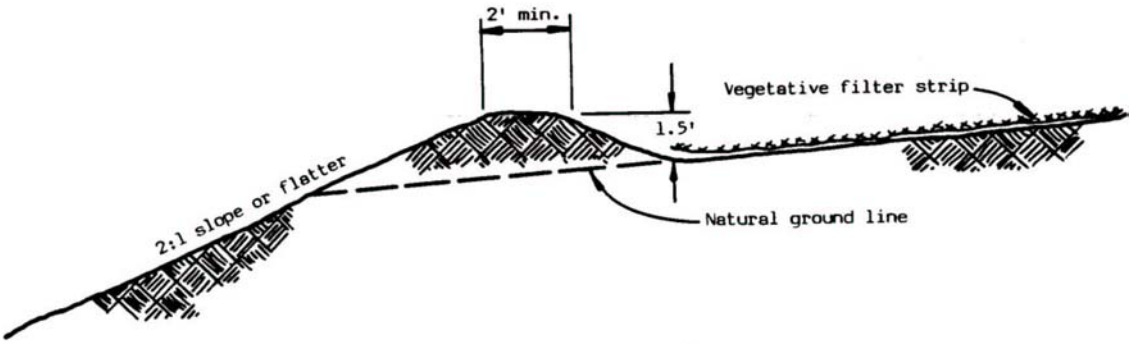
After Idaho Department of Lands, 1992

Diversion Dike/Ditch



NOTE: Bed of dike to be riprapped.

SECTION

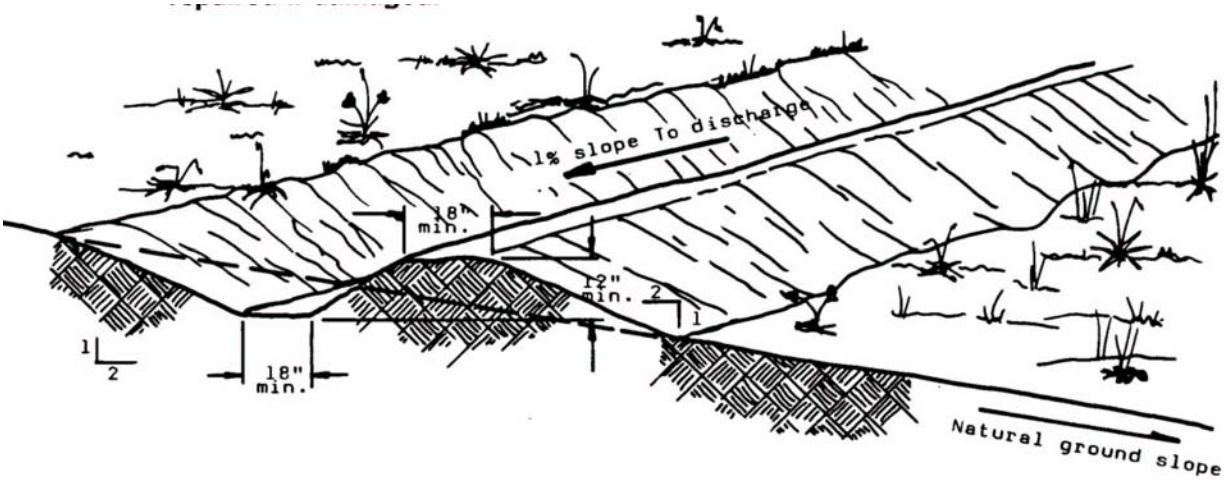


NOTES: 1) Dike constructed by dozer moving soil upslope and dumping at top of slope.
2) Outlet to stabilized vegetated soil.

SECTION

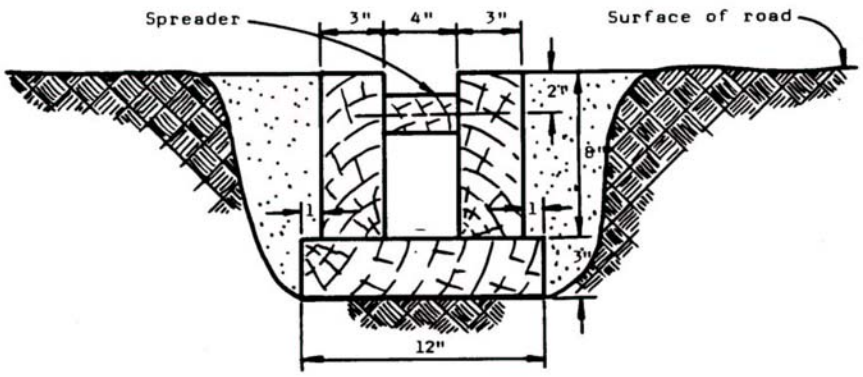
After Idaho Department of Lands, 1992

Interceptor Trench

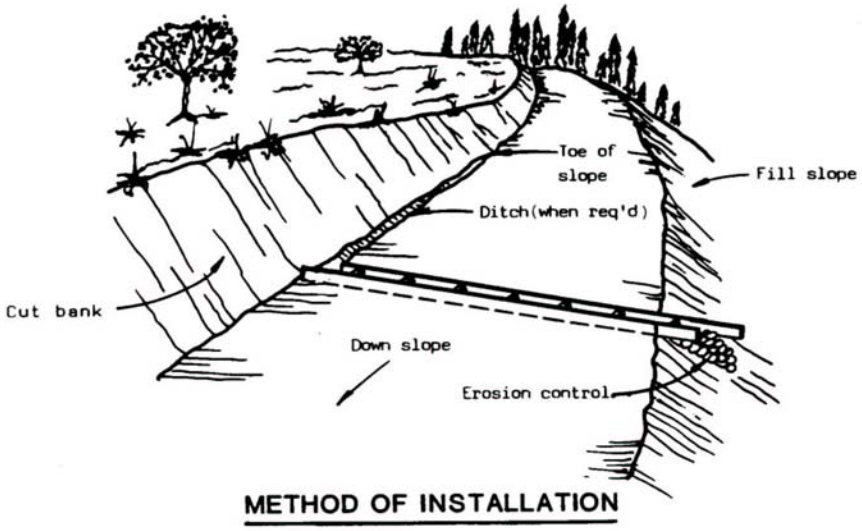


After Idaho Department of Lands, 1992

Open Top Box Culvert



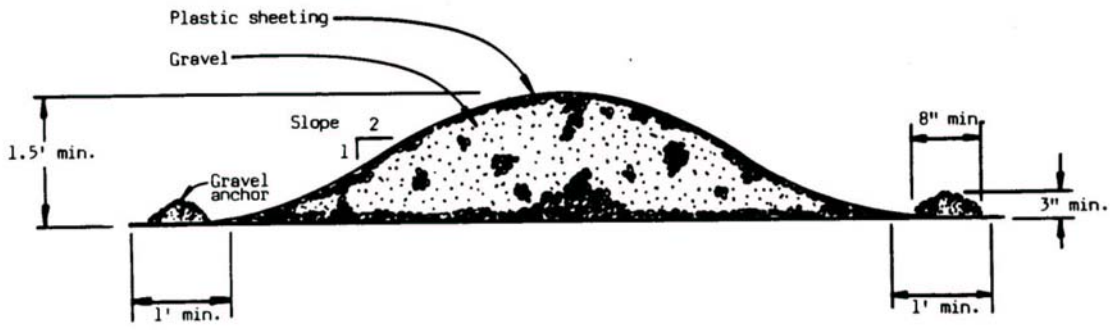
END VIEW



METHOD OF INSTALLATION

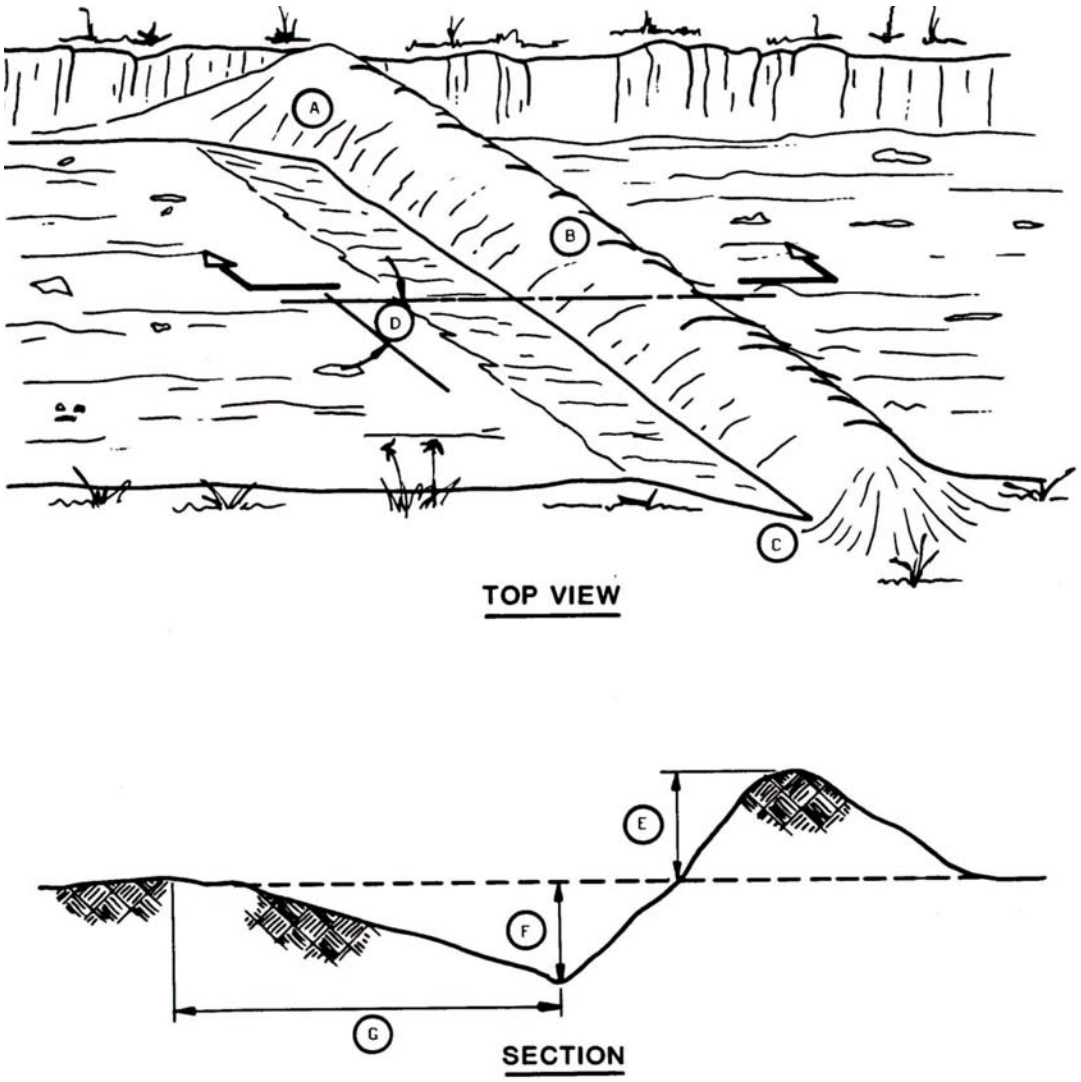
After Idaho Department of Lands, 1992

Siltation Berm



After Idaho Department of Lands, 1992

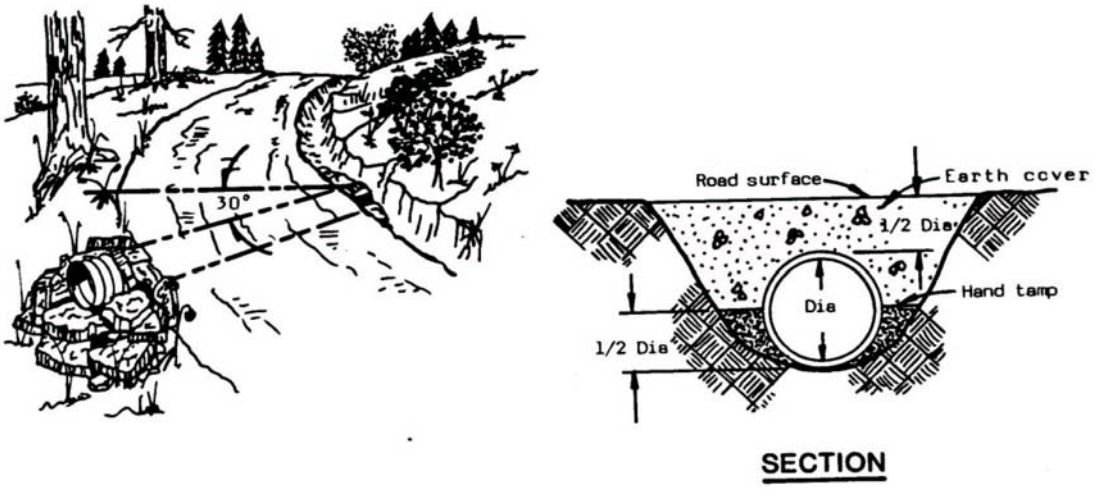
Waterbars



WATERBAR (CROSSDITCH). Construction for unpaved forest roads with limited or restricted traffic. Specifications are average and may be adjusted to gradient and other conditions. A, bank tie-in point cut 6 to 12 in. into roadbed; B, cross drain berm height 12 to 24 in. above roadbed; C, drain outlet cut 8 to 16 in. into roadbed; D, angle drain 30 to 40 degrees downward with road centerline; E, height up to 24 in; F, depth to 18 in; G, 36-48 in.

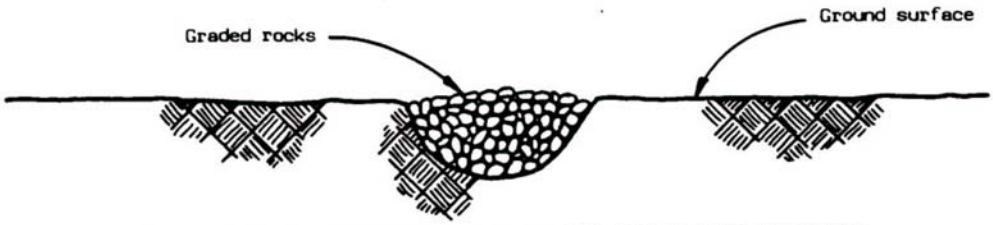
After Idaho Department of Lands, 1992

Culvert Installation

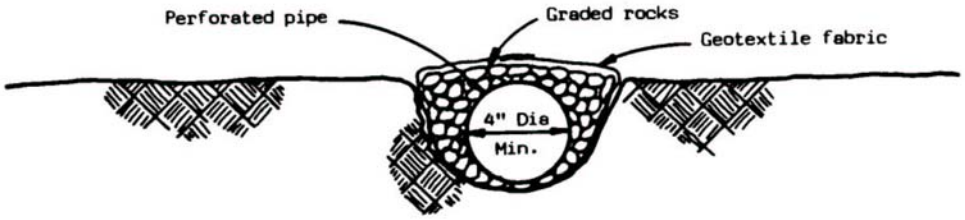


After Idaho Department of Lands, 1992

Drain Fields

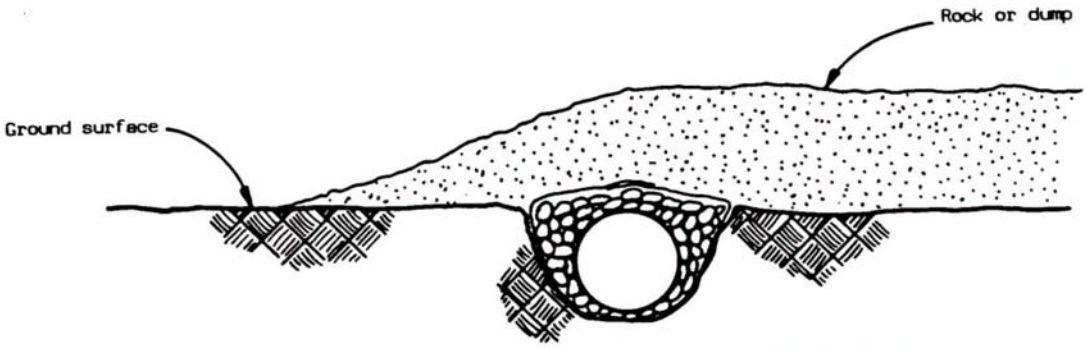


DRAIN FIELD TRENCH LINED WITH GRADED ROCKS



NOTE: Diameter of pipe to be based on the amount of water to be drained.

TRENCH LINED WITH GEOTEXTILE FABRIC, GRADED ROCK AND PERFORATED PIPE



SURFACE WASTE OR DUMP TO BE PLACED OVER UNDERDRAIN AFTER CONSTRUCTION

After Idaho Department of Lands, 1992

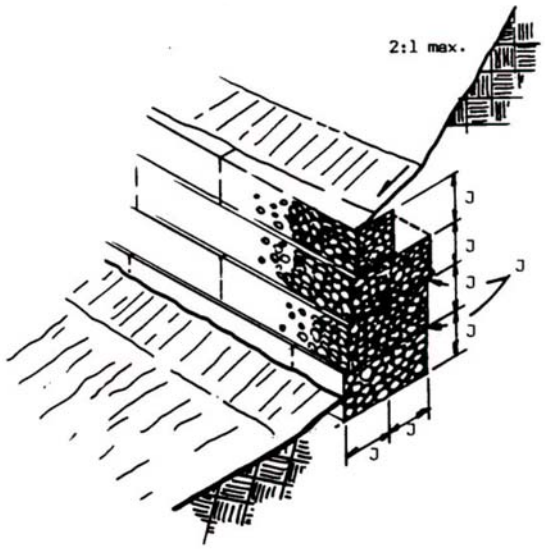
Road Sloping

After Idaho Department of Lands, 1992

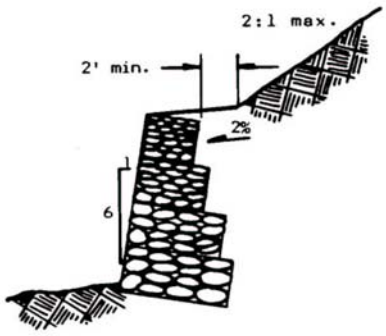
APPENDIX D

Permanent Soil Stabilization Techniques

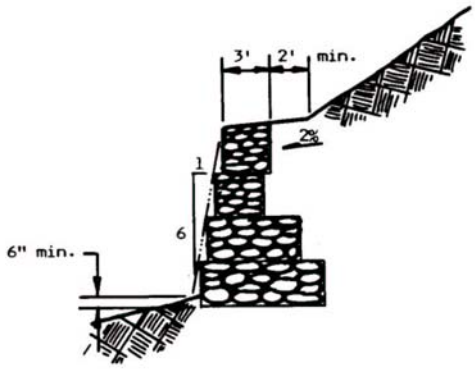
Gabions



3-DIMENSIONAL



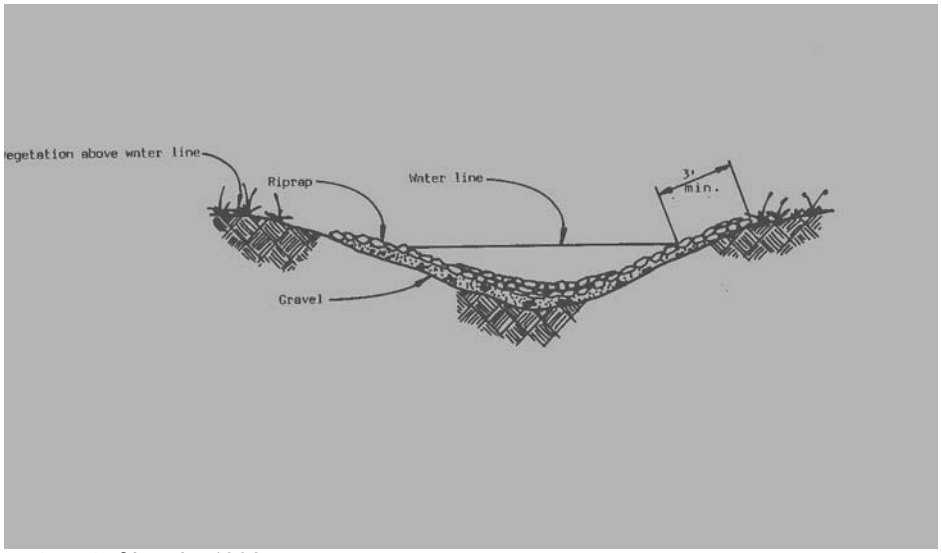
SECTION



SECTION

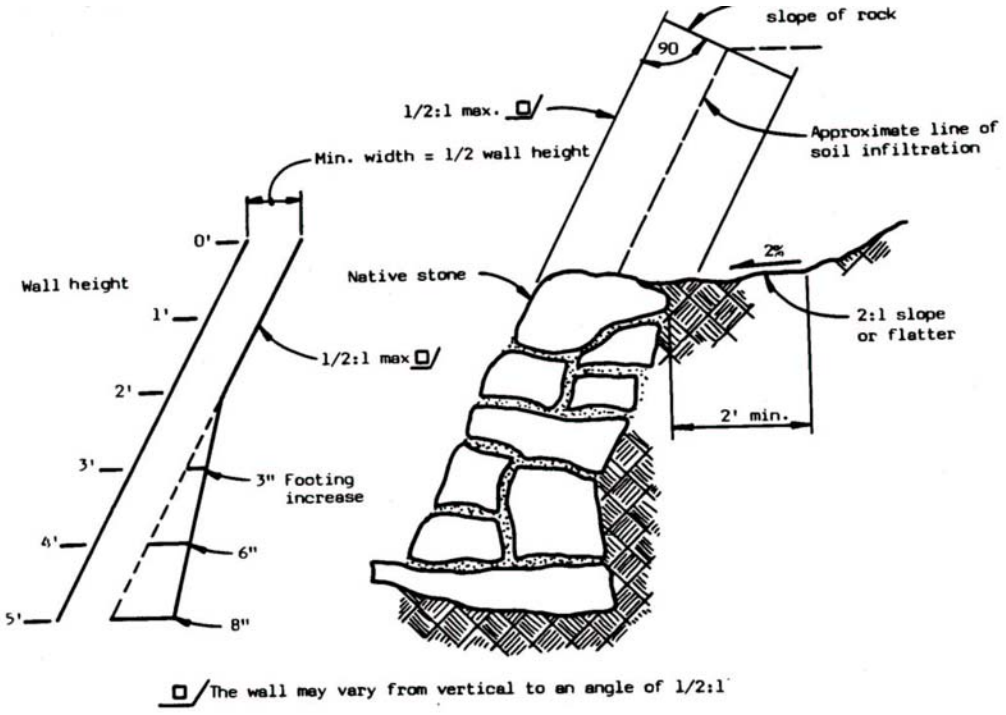
After Idaho Department of Lands, 1992

Riprap



After Idaho Department of Lands, 1992

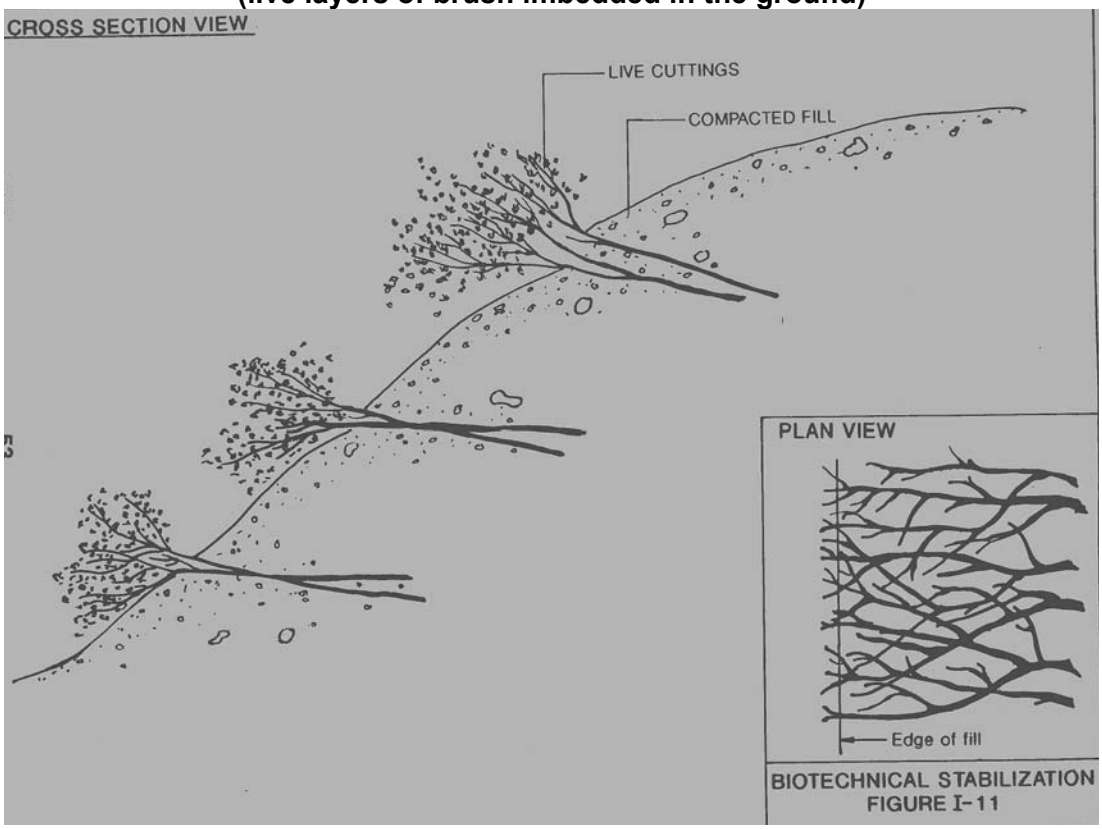
Native rock retaining wall



After Idaho Department of Lands, 1992

Biotechnical Stabilization

(live layers of brush imbedded in the ground)



After Idaho Department of Lands, 1992

APPENDIX E

International Cyanide Management Code

INTERNATIONAL CYANIDE MANAGEMENT INSTITUTE

www.cyanidecode.org

International Cyanide Management Code

For The Manufacture, Transport and Use Of Cyanide in the Production of Gold

May 2002

BACKGROUND

For over a century, cyanide has been the primary reagent used by the mining industry for the production of gold. It is a hazardous chemical that requires careful management. Since no other commercially viable and environmentally sound alternatives currently exist, gold mines will continue to use cyanide.

In January 2000, the accidental release of large amounts of cyanide solutions and tailings from the Aurul mine in Romania resulted in significant pollution of the receiving river system. This incident dramatically increased the consciousness of governments, international organizations, industry and the public of the environmental hazards associated with the use of cyanide in the gold mining industry.

To address concerns about cyanide use and management, a two-day multi-stakeholder workshop was held in May 2000 to consider development of a voluntary industry code of practice for the use of cyanide in mining. Workshop participants determined that a voluntary code, implemented industry-wide, could improve the management of cyanide.

The International Cyanide Management Code For The Manufacture, Transport and Use of Cyanide in the Production of Gold ("the Code") were developed as this voluntary industry code. The Code was prepared under the direction of a multi-stakeholder Steering Committee, whose members were chosen by the United Nations Environment Programme and the International Council on Metals and the Environment. The Committee, consisting of participants from the gold mining industry, governments, non-governmental organizations, labor, cyanide producers and financial institutions, worked cooperatively toward the common goal articulated in the Code's Mission Statement:

To assist the global gold mining industry in improving cyanide management, thereby minimizing risks to workers, communities and the environment from the use of cyanide in gold mining, and reducing community concerns about its use.

The objectives of the Code as identified by the Committee are:

- ***To protect workers, communities and the environment from adverse effects of cyanide.***
- ***To improve cyanide management.***
- ***To be used by large and small gold mining companies, cyanide manufacturers and transporters.***
- ***To serve as a form of assurance for interested parties including regulators, financiers, communities and non-governmental organizations.***
- ***To be applied internationally, in both developed and developing countries.***
- ***To be credible and verifiable.***
- ***To be dynamic over time.***

The Code encourages improvement on an industry-wide basis by aggressively promoting participation in the Code, and by requiring signatories to the Code to take appropriate action to manage cyanide responsibly. The public, workers, industry and the environment will derive their

greatest benefits if operations using cyanide to extract gold adopt the Code and upgrade their practices as required to meet the Code.

SCOPE

The Code is a gold mining industry voluntary code, intended to complement an operation's existing regulatory requirements. Compliance with the rules, regulations and laws of the applicable political jurisdiction is necessary; this Code is not intended to contravene such laws.

The Code focuses exclusively on the safe management of cyanide and cyanidation mill tailings and leach solutions. It addresses production, transport, storage, and use of cyanide and the decommissioning of cyanide facilities. It includes requirements related to financial assurance, accident prevention, emergency response, training, public reporting, stakeholder involvement and verification procedures.

It does not address all safety or environmental activities that may be present at gold mining operations such as the design and construction of tailings impoundments or long-term closure and rehabilitation of mining operations.

The term "cyanide" used throughout the Code generically refers to the cyanide ion, hydrogen cyanide, as well as salts and complexes of cyanide with a variety of metals in solids and solutions. It must be noted that the risks posed by the various forms of cyanide are dependent on the specific species and concentration. Information regarding the different chemical forms of cyanide is found at *www.cyanidecode.org/library/cyanide facts/cyanide chemistry*.

CODE IMPLEMENTATION

The Code is comprised of two major elements. The Principles broadly state commitments that signatories make to manage cyanide in a responsible manner. Standards of Practice follow each Principle, identifying the performance goals and objectives that must be met to comply with the Principle. Operations are certified as being in compliance with the Code upon an independent third-party audit verifying that they meet the Standards of Practice.

For implementation guidance, visit *www.cyanidecode.org/thecode/implementationresources*

The programs and procedures identified by the Code's Principles and Standards of Practice for the management of cyanide can be developed separately from other programs, or they can be integrated into a site's overall safety, health and environmental management programs. Since operations typically do not have direct control over all phases of cyanide production, transport or handling, gold mines will need to require that other entities involved in these activities commit to and demonstrate that they adhere to the Code's Principles and meet its Standards of Practice for these activities.

This Code, the implementation guidance, mine operators guide, and other documents or information sources referenced at *www.cyanidecode.org* are believed to be reliable and were prepared in good faith from information reasonably available to the drafters. However, no guarantee is made as to the accuracy or completeness of any of these other documents or information sources. The implementation guidance, mine operators guide, and the additional documents and references are not intended to be part of the Code.

No guarantee is made in connection with the application of the Code, the additional documents available or the referenced materials to prevent hazards, accidents, incidents, or injury to employees and/or members of the public at any specific site where gold is extracted from ore by the cyanidation process.

Compliance with this Code is not intended to and does not replace, contravene or otherwise alter the requirements of any specific national, state or local governmental statutes, laws, regulations, ordinances, or other requirements regarding the matters included herein.

Compliance with this Code is entirely voluntary and is neither intended nor does it create, establish, or recognize any legally enforceable obligations or rights on the part of its signatories, supporters or any other parties.

PRINCIPLES AND STANDARDS OF PRACTICE

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1. PRODUCTION **Encourage responsible cyanide manufacturing by purchasing from manufacturers who operate in a safe and environmentally protective manner.**

Standard of Practice

1.1 Purchase cyanide from manufacturers employing appropriate practices and procedures to limit exposure of their workforce to cyanide and to prevent releases of cyanide to the environment.

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2. TRANSPORTATION **Protect communities and the environment during cyanide transport.**

Standards of Practice

2.1 Establish clear lines of responsibility for safety, security, release prevention, training and emergency response in written agreements with producers, distributors and transporters.

2.2 Require that cyanide transporters implement appropriate emergency response plans and capabilities, and employ adequate measures for cyanide management.

3. *HANDLING AND STORAGE* **Protect workers and the environment during cyanide handling and storage.**

Standards of Practice

3.1 Design and construct unloading, storage and mixing facilities consistent with sound, accepted engineering practices and quality control and quality assurance procedures, spill prevention and spill containment measures.

3.2 Operate unloading, storage and mixing facilities using inspections, preventive maintenance and contingency plans to prevent or contain releases and control and respond to worker exposures.

4. *OPERATIONS* **Manage cyanide process solutions and waste streams to protect human health and the environment.**

Standards of Practice

4.1 Implement management and operating systems designed to protect human health and the environment including contingency planning and inspection and preventive maintenance procedures.

4.2 Introduce management and operating systems to minimize cyanide use, thereby limiting concentrations of cyanide in mill tailings.

4.3 Implement a comprehensive water management program to protect against unintentional releases.

4.4 Implement measures to protect birds, other wildlife and livestock from adverse effects of cyanide process solutions.

4.5 Implement measures to protect fish and wildlife from direct and indirect discharges of cyanide process solutions to surface water.

4.6 Implement measures designed to manage seepage from cyanide facilities to protect the beneficial uses of ground water.

4.7 Provide spill prevention or containment measures for process tanks and pipelines.

4.8 Implement quality control/quality assurance procedures to confirm that cyanide facilities are constructed according to accepted engineering standards and specifications.

4.9 Implement monitoring programs to evaluate the effects of cyanide use on wildlife, surface and ground water quality.

5. *DECOMMISSIONING* **Protect communities and the environment from cyanide through development and implementation of decommissioning plans for cyanide facilities.**

Standards of Practice

5.1 Plan and implement procedures for effective decommissioning of cyanide facilities to protect human health, wildlife and livestock.

5.2 Establish an assurance mechanism capable of fully funding cyanide-related decommissioning activities.

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6. *WORKER SAFETY* — Protect workers' health and safety from exposure to cyanide.

Standards of Practice

6.1 Identify potential cyanide exposure scenarios and take measures as necessary to eliminate, reduce and control them.

6.2 Operate and monitor cyanide facilities to protect worker health and safety and periodically evaluate the effectiveness of health and safety measures.

6.3 Develop and implement emergency response plans and procedures to respond to worker exposure to cyanide.

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7. *EMERGENCY RESPONSE* — Protect communities and the environment through the development of emergency response strategies and capabilities.

Standards of Practice

7.1 Prepare detailed emergency response plans for potential cyanide releases.

7.2 Involve site personnel and stakeholders in the planning process.

7.3 Designate appropriate personnel and commit necessary equipment and resources for emergency response.

7.4 Develop procedures for internal and external emergency notification and reporting.

7.5 Incorporate into response plans monitoring elements and remediation measures that account for the additional hazards of using cyanide treatment chemicals.

7.6 Periodically evaluate response procedures and capabilities and revise them as needed.

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8. *TRAINING* — Train workers and emergency response personnel to manage cyanide in a safe and environmentally protective manner.

Standards of Practice

8.1 Train workers to understand the hazards associated with cyanide use.

8.2 Train appropriate personnel to operate the facility according to systems and procedures that protect human health, the community and the environment.

8.3 Train appropriate workers and personnel to respond to worker exposures and environmental releases of cyanide.

9. *DIALOGUE* **Engage in public consultation and disclosure.**

Standards of Practice

9.1 Provide stakeholders the opportunity to communicate issues of concern.

9.2 Initiate dialogue describing cyanide management procedures and responsively address identified concerns.

9.3 Make appropriate operational and environmental information regarding cyanide available to stakeholders.

CODE MANAGEMENT

Administration

The International Cyanide Management Institute ("The Institute") is a non-profit corporation established to administer the Code through a multi-stakeholder Board of Directors consisting of representatives of the gold mining industry and participants from other stakeholder groups. For additional information on the Institute, see: www.cyanidecode.org/theinstitute.

The Institute's primary responsibilities are to:

- Promote adoption of and compliance with the Code, and to monitor its effectiveness and implementation within the world gold mining industry.
- Develop funding sources and support for Institute activities.
- Work with governments, NGOs, financial interests and others to foster widespread adoption and support of the Code.
- Identify technical or administrative problems or deficiencies that may exist with Code implementation, and
- Determine when and how the Code should be revised and updated.

Code Signatories and Supporters

Companies with either single or multiple operations can become signatories to the Code; the signature of an owner or corporate officer of the operating company is required. By becoming a signatory, a company commits to follow the Code's Principles and implement its Standards of Practice. Code signatories' operations will be audited to verify their operation's compliance with the Code.

A signatory is not required to have all operations certified. When becoming a signatory, a company must specify which of its operations it intends on having certified. A company that does not have these operations audited within 3 years of signing the Code will lose its signatory status. See: www.cyanidecode.org/signatories&certifiedoperations.

Cyanide producers, transporters, and other companies or individuals not currently or directly engaged in production of gold by cyanidation can demonstrate their support of the Code's objectives by conducting audits and where appropriate becoming Code Supporters.

Code Verification and Certification

Audits are conducted every three years by independent, third-party professionals who meet the Institute's criteria for auditors. Auditors evaluate an operation to determine if its management of cyanide achieves the Code's Principles and Standards of Practice; the Code's Verification Protocol contains the criteria for all audits. Operations must make all relevant data available to the auditors, including the complete findings of their most recent independent Code Verification, in order to be considered for certification.

During an initial verification audit, an operation's compliance at the time of the audit will be evaluated. Subsequent re-verification audits will also evaluate compliance during the period between the preceding and current audits.

Upon completion of the audit, the auditor must review the findings with the operation to ensure that the audit is factually accurate and make any necessary changes. The auditor must submit a detailed "Audit Findings Report" addressing the criteria in the Verification Protocol and a "Summary Audit Report" that includes the conclusion regarding the operation's compliance with the Code to the signatory, the operation and to the Institute. The operation is certified as complying with the Code if the auditor concludes that it is in full compliance with the Code's Principles and Standards of Practice. The detailed "Audit Findings Report" is the confidential property of the operation. The "Summary Audit Report" of certified operations will be made available to the public on the Code website. The operation may submit its comments regarding the Summary Audit Report to the Institute, which will be posted along with the Summary Audit Report on the Institute's website.

Operations that are in substantial compliance with the Code are conditionally certified, subject to the successful implementation of an Action Plan. Substantial compliance means that the operation has made a good-faith effort to comply with the Code and that the deficiencies identified by the auditor can be readily corrected and do not present an immediate or substantial risk to employee or community health or the environment. Operations that are in substantial compliance with a Standard of Practice must develop and implement an Action Plan to correct the deficiencies identified by the verification audit. The operation may request that the auditor review the Action Plan or assist in its development so that there is agreement that its implementation will bring the operation into full compliance. The Action Plan must include a time period mutually agreed to with the auditor, but in no case longer than one year, to bring the operation into full compliance with the Code. The Auditor must submit the Action Plan to the Institute along with the Audit Findings Report and Summary Audit Report.

The operation must provide evidence to the auditor demonstrating that it has implemented the Action Plan as specified and in the agreed-upon time frame. In some cases, it may be necessary for the auditor to re-evaluate the operation to confirm that the Action Plan has been implemented. Upon receipt of the documentation that the Action Plan has been fully

implemented, the auditor must provide a copy of the documentation to the Institute along with a statement verifying that the operation is in full compliance with the Code.

All operations certified as in compliance with the Code will be identified on the Code website, *www.cyanidecode.org/signatories&certifiedoperations*. Each certified operation's Summary Audit Report will be posted and operations with conditional certification will have their Summary Audit Report and their Action Plan posted.

An operation cannot be certified if the auditor concludes that it is neither in full compliance nor in substantial compliance with any one of the Standards of Practice. An operation that is not certified based on its initial verification audit can be verified and certified once it has brought its management programs and procedures into compliance with the Code. Its signatory parent company remains a signatory during this process.

An operation that is not yet active but that is sufficiently advanced in its planning and design phases can request conditional certification based on an auditor's review of its site plans and proposed operating procedures. An on-site audit is required within one year of the operation's first production of gold by cyanidation to confirm that the operation has been constructed and is being operated in compliance with the Code.

An operation or an individual cyanide facility at an operation is no longer subject to certification after decommissioning of the cyanide facilities.

Certification Maintenance

In order to maintain certification, an operation must meet all of the following conditions:

- The auditor has concluded that it is either in full compliance or substantial compliance with the Code.
- An operation in substantial compliance has submitted an Action Plan to correct its deficiencies and has demonstrated that it has fully implemented the Action Plan in the agreed-upon time.
- There is no verified evidence that the operation is not in compliance with the Code.
- An operation has had a verification audit within three years.
- An operation has had a verification audit within two years of a change in ownership, defined as a change of the controlling interest of the operating company.

Auditor Criteria and Review Process

The Institute will develop specific criteria for Code Verification auditors and will implement procedures for review of auditor credentials. Criteria will include requisite levels of experience with cyanidation operations and in conducting environmental, health or safety audits, membership in a self-regulating professional auditing association and lack of conflicts of interest with operation to be audited.

Dispute Resolution

The Institute will develop and implement fair and equitable procedures for resolution of disputes regarding auditor credentials and certification and/or de-certification of operations. The procedures will provide due process to all parties that may be affected by these decisions.

Information Availability

The Code and related information and code management documentation are available via the Internet at www.cyanidecode.org. The website is intended to promote an understanding of the issues involved in cyanide management and to provide a forum for enhanced communication within and between the various stakeholder groups with interest in these issues. The site is the repository for Code certification and verification information.

ACKNOWLEDGEMENTS

This project was underwritten by a group of gold companies and cyanide producers from around the world. The Gold Institute was instrumental in organizing this financial and technical support and provided the administrative and logistical support necessary to successfully complete the project; this effort represents the first time that an industry has worked with other stakeholders to develop an international voluntary industry Code of Practice.

The individuals listed below participated in the process. Participation by these individuals does not necessarily represent an endorsement of the Code by their respective organizations.

Steering Committee

Harold Barnes (Chairman)[1]	Homestake Mining Company, United States
Stephen Bailey	International Finance Corporation, United States
Julio Bonelli	Government of Peru
Gordon Drake, Ph.D[2]	WMC Resources, Ltd., Australia
John den Dryver[3]	Normandy Mining Limited, Australia
Bill Faust	Eldorado Gold Company, Canada
Fred Fox[4]	Kennecott Minerals Company, United States
John Gammon, Ph.D.	Government of Ontario, Canada
Steven Hunt[5]	United Steelworkers of America, Canada
Juergen Loroesch, Ph.D.	Degussa, Germany
Basie Maree	Anglogold Company, South Africa
Glenn Miller, Ph.D.	University of Nevada, Reno, United States
Anthony O'Neill	WMC Resources, Ltd., Australia
Michael Rae	World Wide Fund For Nature, Australia
Stan Szymanski	International Council of Chemical Associations, United States
Stephan Theben[6]	European Commission, Spain
Federico Villasenor[5]	Minas Luismin, Mexico
Juergen Wettig	European Commission, Belgium

[1] Elected Chairman by the Steering Committee
[2] Substituted for Anthony O'Neill at Washington and Vancouver Meetings
[3] Substituted for Anthony O'Neill at Santiago Meeting
[4] Replaced Bill Faust on Committee after Napa Meeting
[5] Added to Steering Committee at Vancouver Meeting
[6] Substituted for Juergen Wettig at Washington, Vancouver and Santiago Meetings

Code Manager

Norman Greenwald	Norm Greenwald Associates, United States

Secretariat

Wanda Hoskin	United Nations Environment Programme, France
Tom Hynes, Ph.D.	International Council on Metals and the Environment, Canada
Kathryn Tayles	United Nations Environment Programme, France

Gold Institute

Paul Bateman	The Gold Institute, United States

Industry Advisory Group

Anglogold, South Africa
Ashanti Goldfields Company, Ghana
Australian Gold Council, Australia
Australian Gold Reagents, Australia
Barrick Gold Corp., Canada
Degussa, Germany
Dupont, United States
Glamis Gold, Ltd., United States
Gold Fields Limited, South Africa
The Gold Institute, United States
Homestake Mining Company, United States
Kinross Gold Corp., Canada
Lihir Management Corp., Paupa New Guinea
Mining Project Investors, Australia
Newmont Gold Company, United States
Normandy Mining, Australia
Placer Dome, Inc., Canada
South African Chamber of Mines, South Africa
Rio Tinto, United Kingdom
WMC, Australia