MINE REHABILITATION CODE OF ONTARIO

Ministry of Mines

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About the Code

O. Reg 35/24 made under the *Mining Act*, R.S.O. 1990, c. M. 14, prescribes Ontario's standards for the rehabilitation of advanced exploration and mine production projects and other mine sites, as well as prescribing the required content of closure plans.

The Mine Rehabilitation Code (the "**Code**") is incorporated by reference into O. Reg 35/24 made under the *Mining Act*. The standards, procedures, and requirements in the Code have the force of law and should be read together with O. Reg 35/24.

Document Control

Version Number	Version Date	Date In Force	Brief Description of Change
1	April 25, 2000	April 25, 2000	Prior to April 1, 2024, the Mine Rehabilitation Code was a schedule to O. Reg 240/00.
2.1	February 2, 2024	April 1, 2024	Version prepared in anticipation of the revocation and replacement of O. Reg 240/00. Updates made throughout. New Part 10 (Infrastructure, Machinery and Equipment) added.

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INTERPRETATION

Interpretation – terms defined in Code

0.1. In this Code:

"Act" means the *Mining Act,* R.S.O. 1990, c. M. 14;

"approved onsite landfill" means a waste disposal site within the meaning of the *Environmental Protection Act,* R.S.O. 1990, c. E. 19 located on the site and governed by, and to be closed under, the terms and conditions of an environmental compliance approval;

"Code" means the Mine Rehabilitation Code of Ontario;

"crown pillar" means a rock mass of variable geometry that is situated between the surface and an underground opening of a mine and that serves to ensure permanently or temporarily the stability of surface elements and underground workings;

"environmental compliance approval" means an environmental compliance approval governing the site issued under the *Environmental Protection Act*, R.S.O. 1990, c. E. 19;

"qualified professional" means a qualified person referred to in clause (a) of section 3 of the Regulation;

"Regulation" means O. Reg [35/24].

Interpretation – terms defined in Act or Regulation

0.2. Terms used in the Code that are defined in the Act or Regulation have the meaning given to them in the Act or Regulation, as applicable.

PART 1
PROTECTION OF MINE OPENINGS TO SURFACE

Objective

1. The objective of this Part is to ensure that unauthorized or inadvertent access to mine openings to the surface is prevented.

General

2. (1) Subject to sections 11 to 15.1 (steel caps), 17 (backfilling), and 17.1 (fencing) of this Part, a reinforced concrete cap designed by a qualified professional shall be used to stop shafts, raises and stopes.

(2) Before installation of a concrete cap to stop shafts, raises and stopes,

(a) a qualified professional shall examine the competency of the rock at the supports and no construction shall be undertaken unless the qualified professional approves the rock as competent;

(b) all loose rock shall be removed from the rock anchorages leaving only competent rock;

(c) all concrete work shall meet or exceed the minimum standards set out in the CAN/CSA-A23.1-M90 or latest revision; and

(d) the formwork for the concrete, shoring and temporary support shall be designed by a qualified professional.

(3) The concrete cap may be left exposed to the elements or may be buried.

(4) Where the cap is to be left exposed, consideration shall be given to providing a slope to the surface of the cap to prevent the collection of water on the surface.

Concrete Caps – Design Specifications

3. All reinforced concrete caps shall meet or exceed the following specifications:

1. The reinforced concrete cap shall be designed for the following minimum design live loads:
   i. 1.4 metres cover of saturated soil uniformly distributed with a unit weight of 19 kN/cubic metre, and
   ii. The greater effect of either,
      (A) an 18 kPa uniformly distributed load, or
      (B) an 81 kN concentrated load applied over an area 300 mm by 300 mm anywhere on the cap, and
      (C) the weight of the cap as the dead load.
2. The 28-day concrete strength shall be a minimum of 30 MPa.
3. The reinforcing bars yield strength shall be a minimum of 400 MPa.
4. The concrete cap minimum thickness shall be:
   i. 450 mm as per MNDM Drawing No. 94103-M1: “Monolithic Concrete Cap Typical Plan and Section” and Drawing No. 94103-M2: “Typical Monolithic Concrete Cap Reinforcement Schedule”, available on a website of the Government of Ontario, or
   ii. 300 mm if an alternate design with all calculations is provided.

5. All supports shall be founded on sound rock having a minimum bearing capacity of 600 kPa.
6. All concrete design shall be as per CAN3-A23.3-M84 or its most recent revision.
7. The reinforced concrete cap shall be vented with a stainless steel pipe that is at least 75 mm in diameter and extends above the cap or soil cover to permit airflow.
8. The reinforced concrete cap shall be securely attached to the bedrock or to the concrete collar if one exists.
9. Appropriate reinforcing steel bars and concrete shall be used in areas where corrosive conditions may exist.

Reinforced Concrete

4. The concrete design shall meet the following specifications:
   1. The minimum 28-day concrete strength shall not be less than 30 MPa.
   2. The maximum slump shall not be greater than 75 mm. +/– 25 mm.
   3. The maximum aggregate size shall not be greater than 20 mm.
   4. The air entrainment content shall be 6 per cent +/– 1 per cent.
   5. The maximum water/cement ratio by weight shall not be greater than 0.50.
5. The aggregates used in the concrete mix shall be non-alkali-silica reactive type.
6. The concrete cover shall be as follows:
   1. 75 mm thick on the top of reinforcing bars.
   2. 50 mm thick on the bottom of reinforcing bars.
   3. 40 mm thick on the stirrups.
7. The concrete shall be cured as per CSA-A23.1-M90 or its latest revision. Curing compounds shall be clear liquid conforming to Canadian General Standards Board (CGSB) Standard 90-GP-1a, Type 1 or its latest revision and applied as directed by the manufacturer.

Inspection and Testing

8. Before the placement of concrete, a qualified professional shall inspect and approve any reinforcing steel bars that have been installed.

9. (1) The concrete shall be tested for air content and slump in the field.

(2) A minimum of one set of four cylinders shall be cast and tested for compressive strength.

(3) The cylinders shall be cured under the same field conditions as the shaft cap and seat support (if applicable).

(4) The testing shall be done in accordance with CAN/CSA-A23.2-M90 or its latest revision.

Concrete Caps – Reporting Requirements

10. A report certified by a qualified professional shall be submitted to the Minister no later than 90 days after the testing under section 9 is conducted, stating,

(a) that each concrete cap described in the report meets the applicable design standards set out in this Part;

(b) that all reinforcing steel bars installed have been inspected and approved as required under section 8; and

(c) the results of the testing under section 9.

Steel Caps – General

11. With the Minister's prior authorization, a steel cap designed by a qualified professional may be used, instead of a reinforced concrete cap, to stop shafts, raises and stopes, if the project is temporarily suspended or placed in a state of inactivity.

12. (1) A steel cap shall only be used in an area where there is no vehicular traffic.

(2) A steel cap shall not be covered with earth.

Steel Caps – Design Specifications

13. Before the installation of a steel cap,

(a) a qualified professional shall examine the competency of the rock at the supports and no construction shall be undertaken unless the qualified professional approves the rock as competent;

(b) all loose rock shall be removed from the rock anchorages leaving only competent rock;

(c) all steel used in making the cap shall comply with Ontario Provincial Standard Specification 906 or its latest revision;

(d) all structural steel and its erection shall conform to CSA-CAN3-S16.1-M78 or its latest revision;

(e) the cap shall be protected against corrosion in accordance with CSA-G189-1980 or its latest revision;

(f) temporary support and shoring shall be designed by a qualified professional;

(g) warning signs and barriers shall be set up around the cap location; and

(h) a qualified professional shall inspect all steel members.

14. The cap shall meet or exceed the following design and steel specifications:

1. The cap shall be designed for the following minimum design loads:
    i. The greater effect of,
        (A) a uniformly distributed load of 18 kPa, or
        (B) a concentrated load of 81 kN over a 300 mm square area anywhere on the cap, and
    ii. The weight of the cap as a dead load.
2. The cap design shall be based on CSA-CAN3-S16.1-M84 or its latest revision.
3. All structural steel shall be Grade 300W conforming to CSA-CAN3-G40.21-M78 or its latest revision.
4. All welding shall conform to CSA W59-1989 or its latest revision and electrodes shall be type E480xx to CSA W48.1-M1980 or its latest revision.
5. The individual or the corporation that employs the individual who performs the welding shall be certified in accordance with W47.1-1992 or its latest revision.
6. The cap shall have no opening greater than 75 mm.
7. All bolts shall conform to ASTM A325 (A325M) or its latest revision.
8. All galvanized coating shall conform to CSA G164 or its latest revision.
9. All supports shall be founded on sound rock based on the minimum bearing value of good quality sedimentary rock of 600 kPa.

10. All oil and grease shall be removed in accordance with SSPC Standard SP-1 or its latest revision.
11. The steel shall be cleaned and painted in accordance with the following rules:
    i. The prime coat shall be applied at a dry film thickness of 2.5 mils.
    ii. The two intermediate coats shall be applied at a dry film thickness of not less than 3.5 mils per coat.
    iii. The final high gloss, anti-fouling coat shall be applied at a dry film thickness of not less than 2 mils.
    iv. The coating material shall be applied by brushing or spraying or a combination of these methods.
    v. Each coat shall be inspected for coverage and dry film thickness prior to the application of the following coat.
    vi. All painted surfaces that have been damaged during transit or installation shall be touched up with two intermediate coats and a final coat.
    vii. Primer shall conform to CGSB-85-GP-10M or its latest revision for plain steel surface.
    viii. Paint materials shall conform to CGSB standards.

Steel Caps – Reporting and Inspection Requirements

14.1. Following a steel cap having been installed, a report certified by a qualified professional shall be submitted to the Minister stating that the steel cap meets or exceeds the applicable design standards set out in this Part.

15. An inspection of the steel cap shall be carried out at least once every five years to ensure that it continues to meet the specifications and requirements of this Part.

Adits

16. The measures to secure adits, ramps, declines, or portals shall be designed in a fashion that will permanently prevent access to such mine features.

16.1. Following the measures described in section 16 having been carried out, a report certified by a qualified professional shall be submitted to the Minister, stating that the measure will permanently prevent access to the applicable mine feature.

Backfilling

17. If a shaft, raise or stope is to be backfilled rather than capped, the shaft, raise, or stope shall be designed in a manner to allow for long term stability once backfilled.

17.1. Following the measures described in section 17 having been carried out, a report certified by a qualified professional shall be submitted to the Minister, stating the long-term stability of the backfilled opening.

Fencing

17.2. Where the backfilling or capping of a stope that is open to the surface is impracticable, fencing may be used if justified in the closure plan, provided that such fencing,

(a) conforms to the standards set out in subsections 26(a), (a.1), (b), and (d); and

(b) is located beyond any area of potential instability, as determined in a geotechnical study that has been certified by a qualified professional and included in the closure plan.

PART 2
OPEN PITS

Objective

18. The objective of this Part is to ensure that potential hazards are limited and public safety is maintained.

General

19. When planning the rehabilitation of open pits, including quarries, open cuts and trenches, safety shall be the prime objective although land use and aesthetics are also important.

20. Open pits shall be rehabilitated through measures that have been decided upon after consideration of,

(a) the dimensions of the open pit;

(b) the characteristics of the pit walls and benches;

(c) access to the crest of the open pit;

(d) the nature of the rock;

(e) faulting;

(f) rock stability;

(g) the surrounding topography;

(h) the surrounding land use;

(i) proximity to residential or recreational areas;

(j) the disposition of waste rock extracted from the open pit; and

(k) water elevations and groundwater characteristics.

Rehabilitation

21. (1) Subject to subsections (2) to (6), open pits shall be rehabilitated by backfilling.

(2) Flooding may be used to rehabilitate an open pit if fully justified in the closure plan.

(3) Sloping may be used to rehabilitate an open pit if fully justified in the closure plan as being more appropriate than backfilling or flooding.

(4) If backfilling, flooding or sloping are impracticable, boulder fencing or berming may be used if fully justified in the closure plan.

(5) If all of the measures set out in subsections (1) to (4) are impracticable, fencing and signs may be used if fully justified in the closure plan.

(6) A combination of measures set out in subsections (1) to (5) may be used at different stages of closure if fully justified in the closure plan.

22. Where an open pit has, or is planned to have, a single vertical or near vertical drop of greater than 3 metres and a bench width of less than 3 metres and is not to be rehabilitated by the measure referred to in subsection 21 (1), a geotechnical study shall be undertaken to support the selection and justification of the selected rehabilitation measures, and a copy of the study and report certified by a qualified professional shall be included in the closure plan.

23. If an open pit is flooded,

(a) additional rehabilitation is required only with respect to workings above the final water elevation;

(b) interim protection shall be provided until the final water elevation is reached;

(c) at least one sloped entrance shall be left or created to allow a reasonable exit point should inadvertent access occur; and

(d) a qualified professional shall predict the water elevation within the pit to provide an assurance of the continuing effectiveness of flooding as a protective measure.

24. If boulder fencing is used, the boulders,

(a) shall be a minimum of 2.0 metres in height;

(b) shall be no further than 0.60 metres apart; and

(c) where no geotechnical study exists, shall be set back from the toe of the pit at least a distance equivalent to the pit depth so as to locate the boulder fence beyond any area of potential pit instability.

25. If berming is used, the berm,

(a) shall be at least 2.0 metres in height;

(b) where no geotechnical study exists, shall be set back from the toe of the pit at least a distance equivalent to the pit depth so as to locate the berm beyond any area of potential pit instability; and

(c) may be combined with a shallow trench or boulders to increase its effectiveness.

26. If fencing is used, fences,

(a) shall be constructed of at least #6 gauge chain-link galvanized material;

(a.1) shall be constructed in accordance with,

(i) the drawing entitled “Fence, Chain-Link: Component — Barbed Wire” and identified as OPSD-972.101,

(ii) the drawing entitled “Fence, Chain-Link: Component — Gate” and identified as OPSD-972.102,

(iii) the drawing entitled “Fence, Chain-Link: Installation — Roadway” and identified as OPSD-972.130, and

(iv) the drawing entitled “Fence, Chain-Link: Details and Table” and identified as OPSD-972.132,

in Volume 3 of the *Ontario Provincial Standards for Roads and Public Works*, published by the Ministry of Transportation;

(b) shall be secured against access at the bottom;

(c) where no geotechnical study exists, shall be set back from the toe of the pit at least a distance equivalent to the pit depth so as to locate the fence beyond any area of potential pit instability; and

(d) shall be used in conjunction with signs.

27. If signs are used in conjunction with another measure, the signs,

(a) shall be at least 30 cm by 30 cm in size;

(b) shall be placed no further than 20 metres apart; and

(c) shall have at least the words “Danger — Open Hole”, in both English and French, in letters that are at least 3.5 cm in size.

PART 3
STABILITY OF CROWN PILLAR AND ROOM AND PILLAR OPERATIONS

Objective

28. The objective of this Part is to ensure that potential hazards are limited and public safety is maintained.

General

29. In this Part,

"NGI-Q" means the Norwegian Geotechnical Institute Q value as given by E. Hoek, P.K. Kaiser and W.F. Bawden in "Support of Underground Excavations in Hard Rock", A.A. Balkema, Rotterdam, 1995;

"RMR" means the Council for Scientific and Industrial Research (CSIR) Rock Mass Rating as given by E. Hoek, P.K. Kaiser and W.F. Bawden in "Support of Underground Excavations in Hard Rock", A.A. Balkema, Rotterdam, 1995.

30. (1) Where a crown pillar or pillars will remain on a site after the site is closed out, a geotechnical study shall be undertaken to support the selection and justification of the appropriate rehabilitation measures, and a copy of the study and report certified by a qualified professional shall be included in the closure plan.

(2) The study required under subsection (1) shall include at least information with respect to,

(a) the history, if any, of instability of the rockmass in the stope walls or crown pillar;

(b) whether backfilling of the stopes should be considered and, if so, the type of backfill that would be suitable;

(c) the location of backfilled stopes and the backfill material used;

(d) the proximity of people or infrastructure to the site;

(e) the population density in the surrounding area;

(f) the likelihood that the public will access the site;

(g) the infrastructure at risk including roads, power lines, pipelines, gas lines, buildings;

(h) the potential for mining or alternative uses in the future;

(i) the possible environmental impacts caused by a failure; and

(j) the current land use designation and post-closure state.

(3) Based on the results of the study required under subsection (1), an assessment of the risk and consequences of crown pillar failure shall be provided by a qualified professional and included in the closure plan.

31. For sites assessed to be of low risk and consequence, the following is the minimum information that shall be evaluated:

1. General surface topography, including lakes, rivers, roads, buildings, benchmarks and survey details.
2. Sections showing the overburden profile.

3. Sections showing plans of all mine levels to a depth specified by a qualified professional that is not less than 200 metres below the base of the crown pillar.
4. The basic crown pillar/abutment and stope configuration, including length, span, thickness, basic geology and structural features.
5. The nature and composition of the backfill, where applicable.
6. The RMR and NGI-Q values for each of the controlling rock mass zones.
7. Historical information on rock mass instability, where available.

32. (1) For all other sites, the following minimum information shall be evaluated:

1. Surface conditions, including:
    i. Surface topography in the vicinity of the crown pillar.
    ii. The presence or absence of a water body.
    iii. A surface projection of the underground working to a depth specified by a qualified professional that is not less than 200 metres below the base of the crown pillar.
    iv. General surface topography, including lakes, rivers, roads, buildings, benchmarks and survey details.
    v. All rights-of-way, utility corridors and easements.
    vi. The surface area that would be affected by a crown pillar failure.
2. Overburden characterization, including:
    i. Soil types and thicknesses, unless a qualified professional considers this information unnecessary.
    ii. The bedrock-overburden interface topography.
    iii. The groundwater regime.
    iv. If soil investigation is undertaken, the following information shall be collected as a minimum requirement:
        A. Bulk density.
        B. *In situ* bulk density.
        C. Grain size distribution.
        D. Friction angle.
        E. Cohesion.
        F. Moisture content.
        G. Groundwater levels.
3. A rock mass characterization including:
    i. The geology.
    ii. The strike and dip of the ore body and host rocks.
    iii. The presence of structural features such a joints, faulting or cleavage.
    iv. The geotechnical classification of the hanging wall, footwall and crown pillar using both the RMR and NGI-Q classification systems, utilizing,
        (A) underground mapping or drill core data evaluation,

(B) laboratory strength determination or published ranges, where available, with justification for using the data specified and its origin, and

(C) discontinuity characterization.

4. The mine workings geometry, including the geometry and location of the crown pillar, upper mine openings and stopes including:
   i. The mining width and depth, if mine unfilled.
   ii. The crown pillar thickness.
   iii. The stope span.
   iv. The nature and composition of backfill.
   v. The support method used.
   vi. All drifts, shafts and raises.
   vii. Historical information on rock mass instability, where available.
5. Other factors including the presence of,
   i. elevated horizontal stress fields,
   ii. multiple openings, and
   iii. complex geometries.

(2) Numerical modelling of the crown pillar and stope geometry shall be conducted using an industry-recognized model to assist in assessing potential failure mechanism and the likelihood of crown pillar failure.

(3) All rock and soil properties testing shall conform to American Society for Testing and Materials (ASTM) Standards.

33. (1) The study and assessment required under section 30, and the results of the evaluation required under section 31 or 32 as applicable, shall be used to determine appropriate rehabilitation measures for the crown pillars.

(2) The measures determined under subsection (1) shall be detailed and justified in the closure plan.

(3) If it is determined that the appropriate rehabilitation measures include the use of fencing, the fences shall conform to the standards set out in subsections 26(a), (a.1), (b), and (d), and be located beyond any area of potential instability, as determined through the study required under section 30.

34. (1) For room and pillar operations, geotechnical studies, assessments and evaluations similar to those referred to in sections 30, 31 and 32 shall be undertaken in the manner specified by a qualified professional.

(2) The results of the assessments and evaluations referred to in subsection (1) shall be used to determine appropriate rehabilitation measures.

(3) The measures determined under subsection (2) shall be detailed and justified in the closure plan.

(4) If it is determined that the appropriate rehabilitation measures include the use of fencing, the fences shall conform to the standards set out in subsections 26(a), (a.1), (b), and (d), and be beyond any area of potential instability, as determined through the study or studies required under subsection (1).

PART 4
TAILINGS DAMS AND OTHER CONTAINMENT STRUCTURES

Objective

35. The objective of this Part is to ensure the long-term physical stability of tailings dams and other containment structures.

General

36. (1) All persons engaged in the design, construction, maintenance and decommissioning of tailings dams and other containment structures shall give due regard to the procedures and requirements set out in the following documents published by the Canadian Dam Association, as they are amended from time to time:

1. Dam Safety Guidelines 2007 (2013 Edition).
2. CDA Technical Bulletin: Application of Dam Safety Guidelines to Mining Dams, 2019.
3. CDA Dam Safety Guidelines Technical Bulletin: Inundation, Consequences and Classification for Dam Safety, 2007.
4. CDA Dam Safety Guidelines Technical Bulletin: Surveillance of Dam Facilities, 2007.
5. CDA Dam Safety Guidelines Technical Bulletin: Flow Control Equipment for Dam Safety, 2007.
6. CDA Dam Safety Guidelines Technical Bulletin: Dam Safety Analysis and Assessment, 2007.
7. CDA Dam Safety Guidelines Technical Bulletin: Hydrotechnical Considerations for Dam Safety, 2007.
8. CDA Dam Safety Guidelines Technical Bulletin: Seismic Hazard Considerations for Dam Safety, 2007.
9. CDA Dam Safety Guidelines Technical Bulletin: Geotechnical Considerations for Dam Safety, 2007.
10. CDA Dam Safety Technical Bulletin: Structural Considerations for Dam Safety, 2007.
11. CDA Technical Bulletin: Dam Safety Reviews, 2016.
12. CDA Technical Bulletin: Tailings Dam Breach Analysis, 2021.
13. CDA Technical Bulletin: Emergency Management for Dam Safety, 2021.

(2) Details of the consideration given under subsection (1) shall be provided in the closure plan.

PART 5
SURFACE WATER MONITORING

Objective

37. The objective of this Part is to ensure that surface water monitoring programs demonstrate that the receiving environment will not be impaired by mine impacted waters, rendering it satisfactory for aquatic life and other beneficial uses.

General

38. (1) In this Part,

"mixing zone" means the smallest possible area of surface water that does not meet the Provincial Water Quality Objectives (PWQO) established by the Ministry of the Environment, Conservation and Parks as a result of discharge, drainage or seepage from a project, or the background levels for water quality referred to in subsection (2).

(2) Subject to subsection (3), the surface water quality of a closed out site shall meet the PWQO referred to in subsection (1) or, where the proponent establishes that it is not practicable to meet the objectives set out therein, shall,

(a) meet the background levels for water quality if the proponent establishes scientifically what those levels were, or

(b) in respect of one or more parameters, meet an ambient water quality standard other than PWQO established by a public body in Canada in respect of those parameters, if the proponent establishes that the use of that standard in relation to the closed out site is acceptable to the Ministry of the Environment, Conservation and Parks.

(3) A proponent may use a mixing zone if,

(a) it is able to demonstrate scientifically that,

(i) it is not practicable to meet any of the standards referred to in subsection (2),

(ii) contaminant levels in the mixing zone will meet the requirements of sections 44 and 45, and

(iii) the mixing zone is of minimal area, and

(b) the proponent has consulted with the Ministry of the Environment, Conservation, and Parks regarding the proposed mixing zone.

39. (1) A monitoring program shall demonstrate that, during closure of the site or portion of the site, in respect of any sewage works within the meaning of the *Ontario Water Resources Act,* R.S.O. 1990, c. O.40 in operation at the site, contaminant concentrations in the effluent discharge from the works will not exceed,

(a) concentration limits determined from existing environmental compliance approvals; or

(b) where clause (a) does not apply to the site, the following concentration limits:

Item	Parameter	Daily concentration limit (mg/L)	Monthly average concentration limit (mg/L)
1.	Total Cyanide	2	1
2.	Total Suspended Solids	30	15
3.	Copper	0.6	0.3
4.	Lead	0.4	0.2
5.	Nickel	1	0.5
6.	Zinc	1	0.5
7.	Arsenic	1	0.5

(2) Despite subsection (1), if the limits referred to in subsection (1) are exceeded in the effluent discharge from the sewage works, or if material discharging from the site from sources that are not sewage works may impair the quality of any water or watercourse within the meaning of the *Ontario Water Resources Act,* the closure plan shall be amended to specify the procedures that will be implemented to ensure, in the case of discharge from a sewage works, that the limits in subsection (1) are not exceeded, or, in the case of discharge from other sources, that the quality of waters are not impaired.

(3) For the purposes of subsection (2), if the limits specified in subsection (1) cannot practicably be achieved, it must be demonstrated to the satisfaction of the Minister that contaminant loading will not be significant.

40. If aquatic life in the receiving water body has been adversely affected during the operating phase or the closure of the site, the closure plan shall be amended to specify the steps that will be taken to re-establish a diverse and viable aquatic community.

Components of a Monitoring Program

41. (1) Details of a monitoring program shall be established on a site-specific basis.

(2) In determining specific details under subsection (1), the following shall be considered:

1. The size of the operation.
2. The characteristics of the ore.
3. The nature of the receiving watercourse.
4. Any other characteristics specific to the site that would influence monitoring requirements.

Mixing Zone

42. A mixing zone shall not be used as an alternative to reasonable and practical treatment.

43. Mixing zones shall be assessed on a site-specific basis, including the consideration of,

(a) water quality;

(b) seasonal stream-flow and current patterns;

(c) physical factors;

(d) biotic communities and habitat in and adjacent to the mixing zone;

(e) nearby water uses such as bathing beaches and drinking water intakes; and

(f) other waste-water discharges.

44. (1) Conditions within a mixing zone must not result in irreversible environmental damage, risk to ecosystem integrity or risk to human health.

(2) Mixing zones shall not interfere with other water uses such as existing drinking water supply or recreation.

45. In order to protect important aquatic communities in the vicinity of mixing zones, no conditions shall be created within the mixing zone which,

(a) are lethal to aquatic life in the mixing zone, in accordance with accepted testing procedures;

(b) cause irreversible responses which could result in detrimental post-exposure effects;

(c) result in bioconcentration of toxic materials which are harmful to the organism or its consumer; or

(d) create a barrier to the migration of fish or other aquatic life.

46. To ensure the protection of acceptable aesthetic conditions, mixing zones should not contain,

(a) materials which form objectionable deposits including scums, oil or floating debris;

(b) substances producing objectionable colour, odour, taste or turbidity;

(c) substances which produce or contribute to the production of objectionable growths of nuisance plants and animals; or

(d) substances that render the mixing zone aesthetically unacceptable.

Chemical Monitoring

47. (1) Surface water chemical monitoring shall be conducted for the following:

1. Discharge or seepage exiting on-site sources.
2. Discharge or seepage exiting the property boundary.
3. On-site water bodies and water bodies downstream from the site.
4. Background reference sites.

(2) Concentrations at the sites referred to in subsection (1) shall be monitored for at least the following:

1. pH.
2. Conductivity.
3. Total suspended solids.
4. Total dissolved solids.
5. Alkalinity.
6. Acidity.
7. Hardness.
8. Cyanide, unless cyanide has never been used or will never be used as a process reagent at the site.
9. Ammonia.

10. Sulphate.
11. Aluminum (Al).
12. Arsenic (As).
13. Cadmium (Cd).
14. Calcium (Ca).
15. Copper (Cu).
16. Iron (Fe).
17. Lead (Pb).
18. Mercury (Hg).
19. Molybdenum (Mo).
20. Nickel (Ni).
21. Zinc (Zn).

(3) The monitoring requirements under subsection (2) may be reduced if it can be demonstrated scientifically that any of the tests are not applicable.

48. Additional physical or chemical tests must be considered where site specific characteristics warrant.

Frequency of Monitoring

49. The frequency of monitoring must be adequate to establish water chemical conditions on a site specific basis and must be sufficient to demonstrate the site's chemical stability.

PART 6
GROUNDWATER MONITORING

Objective

50. The objective of this Part is to ensure that monitoring programs identify and characterize any potential impediments to beneficial use of groundwater as a result of the presence of migration of contaminants.

General

51. (1) The hydrogeology of all mine sites shall be addressed in sufficient detail in a site groundwater characterization study, and a copy of the study and report certified by a qualified professional shall be included in the closure plan.

(2) The study specified under subsection (1) shall identify,

(a) the expected uses of area groundwater;

(b) the existence or potential for development of groundwater contamination;

(c) the nature of the contamination;

(d) the potential of contaminants to migrate; and

(e) the degree of attenuation expected.

(3) Where an existing or potential threat to the use of groundwater exists, the magnitude of that threat shall be assessed and remediation methods shall be proposed.

Components of the Study

52. (1) The site groundwater study required under subsection 51 (1) shall contain the following, where applicable:

1. A topographic map showing:
   i. Drainage patterns.
   ii. Major watersheds.
   iii. Tailings areas.
   iv. Waste rock dumps.
   v. Waste disposal sites.
   vi. Fuel storage areas.
   vii. Chemical storage areas.
   viii. Any other contaminant sources.
2. A topographic map identifying:
   i. The regional groundwater flow regime.
   ii. All relevant groundwater users.
   iii. Sensitive receivers.
   iv. All monitoring locations.

(2) Contaminant migration, where applicable, shall be identified detailing,

(a) migration direction;

(b) rate of migration;

(c) potential impact on receivers; and

(d) calculated arrival times.

(3) Monitoring wells, where required, shall be located to provide a baseline assessment of the local groundwater regime and shall be used to assess the contaminant sources by monitoring groundwater quality both up-gradient and down-gradient of the contaminant sources.

Chemical Monitoring

53. (1) Chemical monitoring of groundwater shall be undertaken in sufficient detail to characterize contamination sources and to identify contaminants of concern and associated indicator tests.

(2) The monitoring shall be carried out for at least the following:

1. pH.
2. Conductivity.
3. Total suspended solids.
4. Alkalinity.
5. Acidity.
6. Hardness.
7. Cyanide, unless cyanide has never been used or will never be used as a process reagent at the site.
8. Ammonia.
9. Sulphate.
10. Aluminum (Al).
11. Arsenic (As).
12. Cadmium (Cd.;
13. Calcium (Ca).
14. Copper (Cu).
15. Iron (Fe).
16. Lead (Pb).
17. Mercury (Hg).
18. Molybdenum (Mo).
19. Nickel (Ni).
20. Zinc (Zn).

(3) The monitoring requirements under subsection (2) may be reduced if it can be demonstrated scientifically that any of the tests are not applicable.

54**.** Additional physical or chemical tests must be considered where site specific characteristics warrant.

Frequency of Monitoring

55. The frequency of monitoring must be adequate to establish groundwater chemical conditions on a site specific basis with due regard to seasonal variability and must be sufficient to demonstrate the site's chemical stability.

PART 7
METAL LEACHING AND ACID ROCK DRAINAGE REQUIREMENTS

Objective

56. The objective of this Part is to ensure that the potential for significant metal leaching (ML) or acid rock drainage (ARD) is determined and, where such potential exists, that effective prevention, mitigation and monitoring strategies are developed and implemented.

Sampling

57. (1) A program shall be undertaken to sample all materials remaining on the site that have been excavated, exposed or otherwise disturbed by mining activities, including but not limited to,

(a) drill core;

(b) metallurgical samples;

(c) pit walls;

(d) existing waste rock, ore, concentrate and overburden piles;

(e) construction rock; and

(f) tailings.

(2) The sampling program referred to in subsection (1) shall be developed and conducted by a qualified professional in accordance with a report prepared by William A. Price on behalf of the Mine Environment Neutral Drainage (MEND) program, entitled “Prediction Manual for Drainage Chemistry from Sulphidic Geologic Materials”, MEND Report 1.20.1, dated December, 2009, as that report may be amended from time to time, and,

(a) available on a website maintained by the MEND program; or

(b) available from the Ministry upon request.

Testing and Interpretation

58. Testing of the materials sampled pursuant to subsection 57 (1) and the interpretation of the data shall be conducted in accordance with the MEND report referred to in subsection 57 (2) and shall be certified by a qualified professional.

59. (1) Where the interpretation indicates that the materials have the potential for ML or ARD, a management plan shall be developed to ensure that these materials do not adversely affect the quality of the environment.

(2) In order to ensure the chemical and physical stability of the ML or ARD generating materials and that the quality of the environment is protected, the management plan shall be prepared with consideration, where appropriate, given to,

(a) the design and construction of covers and diversion works; and

(b) the use of passive and active treatment systems.

(3) Wet and dry covers for materials that have ML or ARD potential shall be designed in accordance with good engineering practice.

(3.1) After a cover described in subsection (3) has been constructed, a report certified by a qualified professional shall be submitted to the Minister, stating that the cover was designed and constructed in accordance with good engineering practice.

(4) Analytical models shall be used to predict the performance of wet and dry covers for the materials mentioned in subsection (3) and a monitoring program shall be put in place to test the results predicted by the analytical models used.

PART 8
PHYSICAL STABILITY MONITORING

Objective

60. The objective of this Part is to ensure monitoring programs demonstrate that all lands, water management structures and other mine-related structures and workings have been left in a stable condition prior to the site being closed out.

General

61. (1) All mine-related structures and workings shall be monitored for physical stability during all stages of closure until the site is closed out, including:

1. Crown pillars.
2. Open pits, including slope stability.
3. Waste rock, ore stockpiles, concentrate stockpiles, overburden and other stockpiles.
4. Tailings dams and other impoundment structures.
5. Water management structures.
6. Surface structures.
7. Surface openings.

(2) Any mine-related structure or working that is determined not to be physically stable shall be promptly protected and remediated.

Specific Monitoring Issues

62. The physical stability of all underground mine workings, such as crown pillars, glory holes, shafts, adits and plugs shall be monitored,

(a) for tension cracks, scarps and changes in drainage patterns;

(b) for any enlargement or other changes in existing tension cracks or scarps;

(c) where mine features or overlying structures may be affected by rising water levels, for the water filling rate by measuring and recording water levels; and

(d) for subsidence or other instability by conducting accurate ground surveys involving the installation of appropriate instrumentation or the use of geophysical techniques.

63. The physical stability of all open pits, including quarries, open cuts and trenches, shall be monitored for at least the following:

1. Slope stability, by,
    i. inspecting for and identifying tension cracks at the crest of slopes and signs of new or ongoing failure and gully erosion, and
    ii. surveying or instrumenting if critical rates of slope movement are reached.
2. The water filling rate, by measuring water levels.

64. The physical stability of all rock piles and stockpiles of ore, concentrate, overburden and other materials shall be monitored for at least the following:

1. Slope stability, by,
    i. inspecting for tension cracks at the crest of any slopes,
    ii. inspecting for signs of new or ongoing failure, and

iii. inspecting for rill or gully erosion.

2. Cover stability, by inspecting for,
   i. erosion, and
   ii. the stability of vegetation.

65. The physical stability of all tailings impoundment areas, dams and underdrains shall be monitored for at least the following:

1. Surface erosion, including gully or wind erosion.
2. Vegetation cover growth.
3. Tension cracks at the crest of any slopes.
4. Signs of new or ongoing failure.
5. Seepage stains.
6. Piping failure.
7. Bulging of slopes.
8. Sloughing of crests.
9. Drainage for suspended solids.
10. Settlement, seepage increases or internal deformation which may require surveying or instrumentation.
11. Water discharge, by measuring discharge rates and comparing to design flows.

66. The physical stability of all water management structures, including ditches and spillways, shall be monitored,

(a) for erosion;

(b) for blockage or potential blockage caused by sediment, ice, debris accumulation or animal activity; and

(c) for deterioration of materials.

67. (1) For temporarily suspended or inactive sites, the physical stability of all surface structures shall be monitored for structural integrity.

(2) The frequency of monitoring must be adequate to identify stability problems and must be sufficient to demonstrate a safe environment if inadvertent or unauthorized access occurs.

Stability Assessments

67.1. In addition to and not in substitution for the monitoring program required under this Part, at the outset of any state of inactivity, and again before a site may be closed out, all surface and subsurface mine workings shall be assessed by a qualified professional to confirm their stability, including an assessment of whether any surface areas are disturbed or are likely to be disturbed by such mine workings.

67.2. In addition to and not in substitution for the monitoring program required under this Part or the assessment referred to in subsection 67.1, prior to the completion of the monitoring programs required under this Part and before a site may be closed out,

(a) all tailings dams and other impoundment structures shall be assessed by a qualified professional to confirm their stability against static and dynamic loadings to which the structures are likely to be subjected; and

(b) a report, certified by a qualified professional, shall be provided to the Minister respecting the assessment referred to in subparagraph (a), stating that the stability of each structure is sufficient to maintain the post-closure state.

67.3. For greater certainty, where an assessment under sections 67.1 or 67.2 determines that a mine structure or working is not physically stable, subsection 61(2) applies.

PART 9
REVEGETATION

Objectives

68. (1) The objective of this Part is to ensure that sufficient vegetative growth occurs to,

(a) stabilize surface materials and provide protection from wind and water erosion;

(b) enhance natural vegetation growth and establish a self-sustaining vegetation cover; and

(c) support the post-closure state.

(2) A site shall not be considered to be closed out until sufficient vegetative growth, where specified in the closure plan, has been achieved to meet the objectives stated in subsection (1).

General

69. When determining the appropriate revegetation measures for a site, the following shall be considered:

1. The post-closure state.
2. Climatic conditions including mean daily temperature, frost free period, growing season, amount and timing of precipitation and the prevailing wind.
3. The size of the area requiring revegetation in order to assess materials requirements.
4. Presence of waterbodies, sensitive ecosystems or other special considerations.
5. Availability of stockpiled materials for revegetation.
6. Likelihood of success of natural revegetation given species present.
7. Need for contouring or engineering works to ensure proper drainage or re-establish previous drainage.
8. Presence of erosion prone areas, and necessity for erosion control work.
9. Soil characteristics including texture, pH, moisture regime, and content of nutrients and organic matter.
10. Use of native species.

70. Wherever practicable, soils on the site that are displaced due to mining activities shall be stored appropriately for use in revegetating the site.

Site Preparation

71. When determining measures for revegetating waste rock storage areas, tailings dams or other steeply sloped features, the following specific site preparation measures shall be considered, where appropriate:

1. Contouring to mimic local topography and blend into surrounding landscape.
2. The application of soil to a depth sufficient to maintain root growth and nutrient requirements.
3. The incorporation of organic materials, mulches and fertilizers based upon soil assessment.

4. The scarification or ripping of flat surfaces which may have been compacted by heavy equipment.
5. Improving site drainage to prevent water erosion on rehabilitated areas.
6. Establishing windbreaks to prevent wind erosion on rehabilitated areas.
7. The integration of contouring and sloping into the engineering design of impoundment areas.

72. When determining measures for revegetating tailings surfaces, the following site preparation measures shall be considered, where appropriate:

1. Contouring to provide accessibility and good surface drainage while controlling surface erosion.
2. Removing any crests prone to wind erosion or creating/planting live wind breaks.
3. The scarification or ripping of crusted surfaces.
4. The incorporation of organic materials and mulches.
5. Correcting the pH and adding fertilizer based upon soil assessment and vegetation requirements.
6. Applying soils or a gravel barrier.

73. When determining measures for revegetating mill or building sites or other concrete structures, the following site preparation measures shall be considered for implementation after any applicable decontamination and removal of the buildings or structures:

1. Applying topsoil on the fill material to provide an appropriate growth medium to a depth sufficient to maintain root growth and nutrient requirements.
2. Scarifying any areas of the site that have been heavily compacted by large equipment.
3. Adding soil amendments based upon soil assessment and vegetation requirements.

74. When determining measures for revegetating transportation or utility corridors or other disturbed areas, the following site preparation measures shall be considered for implementation:

1. Scarifying or ripping corridors, after any applicable decontamination and removal of infrastructure.
2. Grading and contouring to fit the surrounding landscape.
3. Applying topsoil and other amendments at some locations to improve initial growth and the establishment of a sustainable community.

75. When determining measures for revegetating sites containing reactive materials,

(a) all dust and erosion shall be controlled; and

(b) where the upward movement of acidic pore water and heavy metals could inhibit plant growth, an appropriate measure to allow for plant growth shall be applied, such as a capillary break consisting of coarse rock or an impermeable layer, covered with an appropriate growth medium and revegetated.

76. *Revoked*.

Inspection and Maintenance

77. (1) Inspection of the revegetated area shall be conducted semi-annually following initial planting until vegetation is successfully established.

(2) Soil analysis for nutrients and pH shall be conducted annually in the spring until vegetation is successfully established.

(3) Areas showing evidence of erosion, sedimentation or slope failure shall be restored.

78. Once vegetation has been established, annual inspection shall be conducted to determine any necessary repairs, and to review the progress toward development of a self-sustaining vegetation cover.

78.1. If an inspection conducted pursuant to subsections 77(1) or 78 reveals evidence of excessive vegetation stress or poorly established areas, the revegetation program shall be reassessed and additional measures shall be implemented.

79. Once a self-sustaining vegetation cover has been established and subsection 68(2) has been complied with, the monitoring and inspection program may be discontinued.

PART 10
INFRASTRUCTURE, MACHINERY AND EQUIPMENT

Objective

80. The objective of this Part is to ensure that buildings, supporting utilities, and other mine infrastructure, as well as machinery and equipment at a site, are removed or treated to the extent necessary to,

(a) maintain public safety;

(b) minimize potential for contamination; and

(c) support the post-closure state.

Application of Part where Post-Closure State Determination Exists

81. A requirement under this Part to demolish, remove, or otherwise decommission an item of mine infrastructure is not applicable if the item is consistent with a post-closure state for which a post-closure state determination has been obtained.

Access Control

82. If necessary to prevent unauthorized or inadvertent access to a site on which mine hazards exist during closure, or if necessary to maintain public safety after the site is closed out, appropriate access control measures shall be implemented.

Transportation Infrastructure – Maintenance and Decommissioning

83. At least one means of exterior road access for the site (or airstrip in case of fly-in sites), as well as every other internal transportation corridor and other access way necessary to undertake the rehabilitation measures set out in the closure plan or otherwise monitor the site, shall be maintained in good condition until such corridor or access way is no longer necessary for rehabilitation or monitoring activities.

84. Once no longer necessary for rehabilitation or monitoring, transportation corridors shall be,

(a) closed off to the extent necessary to maintain public safety; and

(b) treated with site preparation measures for revegetation determined under section 74, or, if natural revegetation of a transportation corridor without such treatment has been determined appropriate under section 69, treated only to the extent necessary to achieve the objectives of this Part.

85. All airstrips shall be decommissioned to the extent, and in a manner, permitted under other applicable legal requirements.

86. All railway lines shall be decommissioned.

87. All water crossings and overpasses shall be removed.

Surface Structures

88. All buildings and other surface structures shall be razed to the ground and removed from the site or disposed of in an approved onsite landfill.

89. All concrete structures, foundations and slabs shall be removed from the site, disposed of in an approved onsite landfill, or covered by overburden and revegetated.

Utilities

90. (1) Subject to subsections (2) and (3), all utility poles and utility lines shall be removed from the site.

(2) Provided that a utility pole is removed to ground level, the remainder of the utility pole may remain in place.

(3) Underground utility lines, including electrical power lines, communication lines, and compressed air lines, may remain in place if disconnected at the surface and de-energized.

Pipelines

91. (1) Subject to subsections (2) and (3), prior to the site being closed out, all pipelines shall be removed from the site or disposed of in an approved onsite landfill.

(2) A pipeline located below grade may remain in place if fully decontaminated and permanently sealed off.

(3) When determining whether to leave a pipeline in place under subsection (2), the following shall be considered:

1. Its dimensions, type, material, and condition.
2. Its depth of burial, if buried.
3. Its location, including proximity to waterbodies, sensitive ecosystems, tailings impoundment areas, and other waste disposal sites.
4. Any physical stability risks to surface or subsurface mine workings that may result from it remaining in place.

(4) For the purpose of this section and section 93, the term “pipeline” includes waterlines.

Storage Tanks

92. (1) Subject to subsection (2), prior to the site being closed out, all storage tanks shall be removed from the site or disposed of in an approved onsite landfill.

(2) A storage tank located below grade may remain in place where the storage tank has been fully decontaminated and permanently sealed off and, if the storage tank is buried, filled with inert material to prevent collapse.

Infrastructure Governed by TSSA

93. Despite any other provision in this Part, where the *Technical Standards and Safety Act, 2000,* S.O. 2000, c. 16, and its regulations apply to a storage tank, including requiring any authorizations, approvals, or other instruments to be obtained thereunder, the pipeline or storage tank shall be treated in accordance with such requirements.

Machinery and Equipment

94. All machinery and equipment located at surface level or within an open pit shall be removed from the site.

95. (1) Subject to subsection (2), all underground machinery and equipment shall be removed from the site.

(2) Underground machinery and equipment may remain in place if each item is fully decontaminated, including the draining of fluid and stripping of hazardous substances.

Other Items

96. Where an item of mine infrastructure is not expressly referenced in this Part, the item shall be rehabilitated through measures that are sufficient to achieve the objectives of this Part.

Reporting Requirements – End-of-Life Report for Buried or Underground Features

97. Prior to the project being closed out, a report certified by a qualified professional shall be submitted to the Minister detailing the location of each mine feature or other item referred to in this Part that will remain buried or underground, and stating that each such item has met all applicable safety and decontamination requirements under this Part.