# KENNECOTT GREENS CREEK MINING COMPANY

# GENERAL PLAN OF OPERATIONS

# APPENDIX 14

# RECLAMATION PLAN

Date:
October 2000

# TABLE OF CONTENTS

# LIST OF TABLES



# LIST OF FIGURES

# 1. Introduction

## 1.1. Purpose and Scope of Reclamation Plan

The Kennecott Greens Creek Mining Company (KGCMC) reclamation plan is designed to return the mine to a near-natural condition as contemplated in the Final Environmental Impact Statement (FEIS). Additionally, the goal of this plan is to implement concurrent reclamation, as appropriate, to minimize the effects of disturbance while mining within Admiralty National Monument (Monument). Also, the reclamation plan is designed to meet the Forest Service Manual's definition of reclamation: "Those actions performed during or after mineral activities to shape, stabilize, revegetate, or otherwise treat the affected lands in order to achieve a safe and ecologically stable condition and land use that is consistent with long-term forest land and resource management plans and local environmental conditions." Additionally, the reclamation plan is designed to fulfill the requirements of the State of Alaska for facilities over which they have jurisdiction through the Alaska Department of Environmental Conservation (ADEC) including the Solid Waste Management Program and other regulatory initiatives, and the Reclamation Act administered by the Alaska Department of Natural Resources (ADNR). Finally, the plan addresses the requirements of the US Army Corps of Engineers (COE) and the City and Borough of Juneau (CBJ).

This reclamation plan sets performance goals applicable to interim, concurrent and final reclamation, and addresses post-closure monitoring requirements. It also sets scheduling and other standards for reclamation and for final closure planning requirements, and it explains how detailed, regularly-updated reclamation task planning will be used for purposes of calculating a reclamation bond.

## 1.2. Site History

Kennecott Greens Creek Mining Company (KGCMC) began operating a mine/mill complex in the upper Greens Creek drainage of northern Admiralty Island in February 1989. The production startup was the culmination of approximately two years of intense development and construction following a 10-year permitting effort. In 1993 the mine suspended operations primarily because of low metal prices. Operations restarted in 1996 following extensive feasibility studies, recovered metal prices, and site-wide reconstruction efforts. The facility design as it is currently permitted and operated is shown in Figure 1.

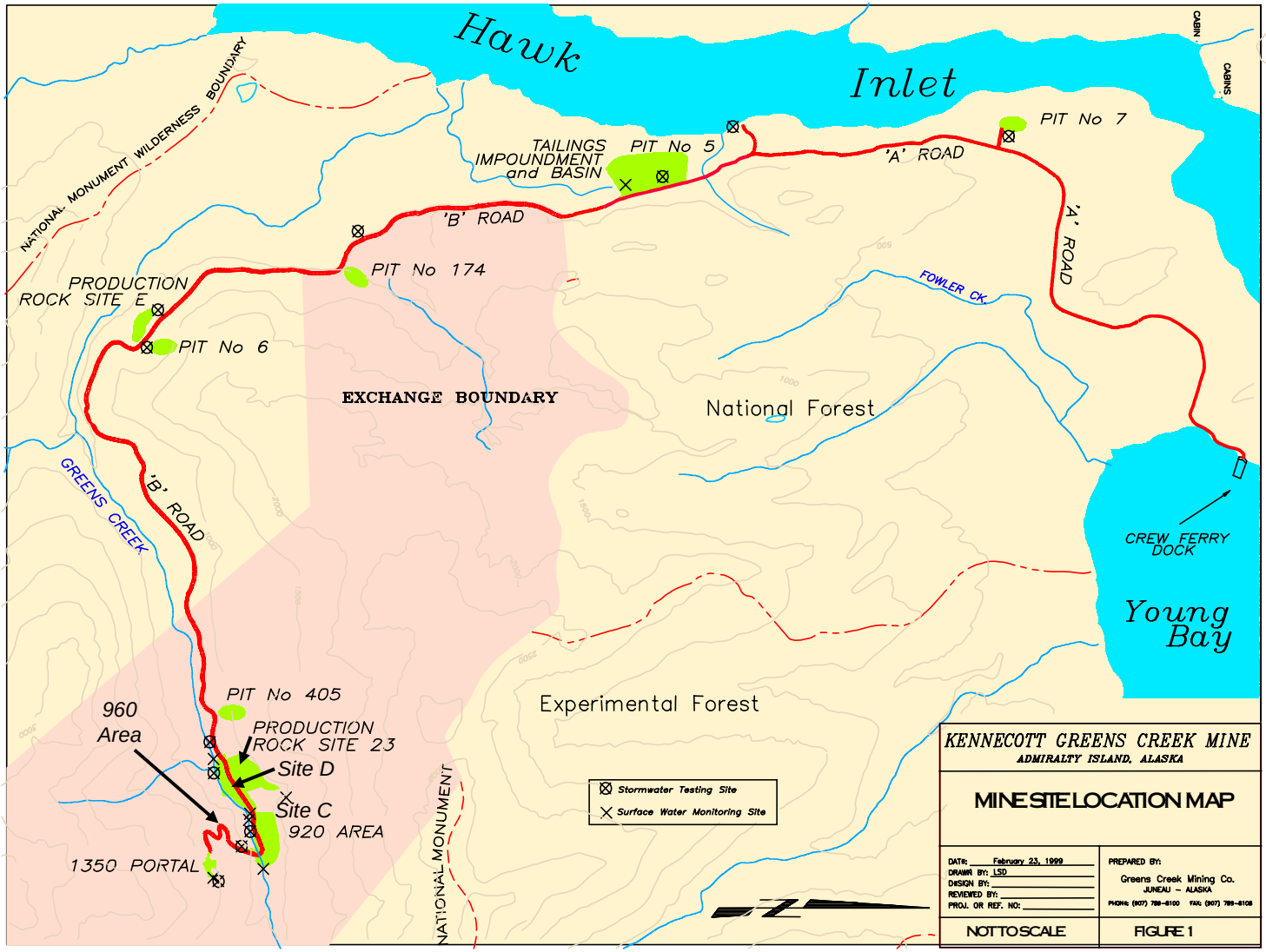


**Figure 1. Layout of the Greens Creek Mine.**

## 1.3. Post-Mining Land Use and Ownership

The land comprising the Greens Creek mine, inclusive of all Admiralty Island facilities, consists of both publicly and privately owned uplands and tidelands. Greens Creek leases parcels from the United States on both the Monument and non-monument lands. It uses other public lands pursuant to special use permits issued by the Forest Service and leases issued by the State of Alaska. It owns land on Admiralty Island both as a result of patenting mining and millsite claims and through transfer of private lands in the historic cannery area from its predecessor. Additionally, Greens Creek holds subsurface and restricted surface use rights to approximately 7,300 acres of public lands as a result of a land exchange made pursuant to the Greens Creek Land Exchange Act of 1995 (Pub. L. 104-123 April 1, 1996).

Under the land exchange agreement, certain of the private lands (e.g. patented claims) owned by Greens Creek ultimately will be transferred to the United States and the 7,300 acres of subsurface and restricted-use surface lands patented to Greens Creek in 1999 will revert to the United States. The land exchange agreement does not impose special reclamation requirements on these lands. It requires simply that they must be reclaimed in accordance with applicable laws and the approved reclamation plan.

Final reclamation of the mine facilities will take into account anticipated post-mining land uses. Since such uses likely will be limited primarily to monument-related activities, returning the surface to a near-natural condition should satisfy post-mining land use needs as to most of the lands. Private lands that will retain their private status, if any, after mining were developed for non-monument uses prior to creation of the Admiralty Island National Monument. After closure, Greens Creek will consult with the ultimate landowner, as well as any agencies having regulatory authority over reclamation of such lands, to determine the final disposition of structures and facilities then having remaining useful life.

## 1.4. Agency Requirements

### **1.4.1.** United States Forest Service

The Forest Service has numerous reclamation requirements for the Greens Creek mine. These requirements can be categorized as general Forest Service mining rules, Forest and Monument specific rules, and decisions reached through the NEPA process. These are discussed in Table 1.1 through 1.4, respectively.

## Table 1-1. General Forest Service reclamation requirements.

### General Forest Service Mine Reclamation Requirements

**CODE OF FEDERAL REGULATIONS**
**TITLE 36--PARKS, FORESTS, AND PUBLIC PROPERTY**
**PART 228--MINERALS**

**Subpart A--Locatable Minerals**

Sec. 228.8 …All operations shall be conducted so as, where feasible, to minimize adverse environmental impacts on National Forest surface resources, including the following requirements:

(f) Roads. Operator shall construct and maintain all roads so as to assure adequate drainage and to minimize or, where practicable, eliminate damage to soil, water, and other resource values. Unless otherwise approved by the authorized officer, roads no longer needed for operations:

(1) Shall be closed to normal vehicular traffic,

(2) Bridges and culverts shall be removed,

(3) Cross drains, dips, or water bars shall be constructed, and

(4) The road surface shall be shaped to as near a natural contour as practicable and be stabilized.

(g) Reclamation. Upon exhaustion of the mineral deposit or at the earliest practicable time during operations, or within 1 year of the conclusion of operations, unless a longer time is allowed by the authorized officer, operator shall, where practicable, reclaim the surface disturbed in operations by taking such measures as will prevent or control onsite and off-site damage to the environment and forest surface resources including:

(1) Control of erosion and landslides;

(2) Control of water runoff;

(3) Isolation, removal or control of toxic materials;

(4) Reshaping and revegetation of disturbed areas, where reasonably practicable; and

(5) Rehabilitation of fisheries and wildlife habitat.

(h) Certification or other approval issued by State agencies or other Federal agencies of compliance with laws and regulations relating to mining operations will be accepted as compliance with similar or parallel requirements of these regulations.

Sec. 228.10 …Unless otherwise agreed to by the authorized officer, operator shall remove within a reasonable time following cessation of operations all structures, equipment and other facilities and clean up the site of operations...

Sec. 228.13

(a) Any operator required to file a plan of operations shall, when required by the authorized officer, furnish a bond conditioned upon compliance with Sec. 228.8(g), prior to approval of such plan of operations. In lieu of a bond, the operator may deposit into a Federal depository, as directed by the Forest Service, and maintain therein, cash in an amount equal to the required dollar amount of the bond or negotiable securities of the United States having market value at the time of deposit of not less than the required dollar amount of the bond. A blanket bond covering nationwide or statewide operations may be furnished if the terms and conditions thereof are sufficient to comply with the regulations in this part.

(b) In determining the amount of the bond, consideration will be given to the estimated cost of stabilizing, rehabilitating, and reclaiming the area of operations.

(c) In the event that an approved plan of operations is modified in accordance with Sec. 228.4 (d) and (e), the authorized officer will review the initial bond for adequacy and, if necessary, will adjust the bond to conform to the operations plan as modified.

(d) When reclamation has been completed in accordance with Sec. 228.8(g), the authorized officer will notify the operator that performance under the bond has been completed: Provided, however, That when the Forest Service

## Table 1-1. General Forest Service reclamation requirements.

### General Forest Service Mine Reclamation Requirements

has accepted as completed any portion of the reclamation, the authorized officer shall notify the operator of such acceptance and reduce proportionally the amount of bond thereafter to be required with respect to the remaining reclamation.

**FOREST SERVICE MANUAL 2800 (FSM 2800) – MINERALS AND GEOLOGY (Selected Provisions)**

2840.2 - Objectives. The Forest Service manages the reclamation of lands disturbed by mineral and associated activities in order to:

1. Minimize the environmental impacts resulting from such activities.

2. Ensure that disturbed lands are returned to a use that is consistent with long-term forest land and resource management plans.

2840.3 - Policy

1. Reclamation shall be an integral part of Plans of Operation that propose surface disturbance.

2. All lands disturbed by mineral activities shall be reclaimed to a condition that is consistent with forest land and resource management plans, including applicable State air and water quality requirements.

3. All reclamation requirements included in a Plan of Operations shall include measurable performance standards. Reclamation requirements shall be those reasonable, practicable, and necessary to attain standards.

4. Reclamation shall be undertaken in a timely fashion and occur sequentially with on-going mineral activities.

5. Reclamation bonds, sureties, or other financial guarantees shall ordinarily be required for all mineral activities that require a Plan of Operations; dollar amounts of such guarantees shall be sufficient enough to cover the full cost of reclamation.

6. To the extent practicable, reclaimed National Forest System land shall be free of long-term maintenance requirements.

2840.5 - Definitions

1. Mineral Activities. Any aspect of mineral exploration, development, or production.

2. Reclamation. Those actions performed during or after mineral activities to shape, stabilize, revegetate, or otherwise treat the affected lands in order to achieve a safe and ecologically stable condition and land use that is consistent with long-term forest land and resource management plans and local environmental conditions.

3. Plan of Operations. A written description of planned, on-the-ground mineral activities, including reclamation, to be conducted by the mineral operator for either locatable, leasable, or common variety minerals.

4. Topsoil. Those soil materials useful for the establishment, growth, and perpetuation of vegetal cover on disturbed areas. Such soil materials provide mechanical support for plant root systems and plant nutrients for establishment and growth; useful soil materials may include selected subsoils.

5. Performance Standard. The expected site conditions to be achieved upon completion of reclamation activities.

6. Multiple Bonding. Having more than one bond, surety or other financial guarantee for reclamation on any one

## Table 1-1. General Forest Service reclamation requirements.

### General Forest Service Mine Reclamation Requirements

mineral operation.

7. Excess Bonding. Where the total amount of bonds, sureties or other financial guarantees exceeds the cost of reclamation.

8. Interim Shutdown. The cessation of mineral activities by the operator prior to the expected time described in the Plan of Operations.

9. Disturbed Area. The surface lands disturbed by mineral or associated activities.

2841 - RECLAMATION COMPONENTS FOR PLANS OF OPERATIONS. Forest Supervisors shall ensure the following administrative and environmental components are adequately addressed in each Plan of Operations when applicable:

1. Administrative Components.

a. Timing, kind, and amount of reclamation to be accomplished concurrently with mineral activities.

b. Reclamation requirements for interim shutdown, including seasonal shutdown.

c. The maximum allowable time in the event of interim shutdown before final reclamation measures will be required.

d. Concurrent and final reclamation of transportation facilities, such as roads, railways, tramways, power line corridors, and pipelines.

e. Removal of facilities and reclamation of the site.

f. Timeframes for periodic review and updating of the Plan of Operations, including reclamation performance requirements and financial guarantees.

g. Procedures for ensuring interim and final stability of waste embankments, including dumps, tailings dams, or impoundments.

2. Environmental Components.

a. Final configuration of the disturbed areas, including such items as roads, pits, waste embankments, ponds, leach pads, drill holes, and facility sites.

b. Revegetation of disturbed areas, including timing, kind, and amount.

c. Topsoil management, including soil salvage and reapplication (FSM 2550 and FSH 2509.15).

d. Air quality management during and after operations (FSM 2580 and FSH 2509.19).

e. Watershed management, including runoff and erosion control, and riparian and wetland protection (FSM 2520 and FSH 2509.15).

f. Water quality management, including physical and chemical characteristics of surface and subsurface water during and after operations (FSM 2530 and FSH 2509.15).

## Table 1-1. General Forest Service reclamation requirements.

| General Forest Service Mine Reclamation Requirements |
|---|
| g. Visual resource management during and after operations (FSM 2380 and FSH 2309.22). |
| h. Potential for the occurrence and control of hazardous or toxic substances, including acid mine drainage, that may contaminate air, water or soil. |
| i. Fish and wildlife habitat reclamation or mitigation (FSM 2630 and FSH 2609.11). |
| j. Tailings and associated tailings facilities. |
| k. Stream diversions, reservoirs, ditches, or canals. |
| 2842 - RECLAMATION PERFORMANCE STANDARDS. In addition to a consideration of appropriate reclamation components (FSM 2841), a Plan of Operation shall include measurable performance standards for all reclamation requirements in the plan. Develop performance standards for at least the following. |
| 1. Revegetation. |
| 2. Soil and water conservation measures. |
| 3. Mass stability of overburden or other waste embankments. |
| 4. Concurrent reclamation. |
| 5. Post-mining land configuration. |
| Regions or Forests should develop Region-wide or Forest-wide reclamation performance standards for common reclamation practices. Use performance standards in determining the amount of the reclamation bond, surety, or other financial guarantee and as criteria for release of these instruments. |
| 2843 - RECLAMATION BONDING. Tie dollar amounts of bonds or other financial guarantees to specific reclamation activities or standards to facilitate full or partial release of the instruments. Release bonds or other guarantees as satisfactory reclamation is performed and completed, and the area stabilized. Avoid multiple or excessive bonding. See FSM 2846 for direction on bonding when other agencies with bonding authority are involved in the administration of mineral activities on National Forest System lands. |
| 2844 - RECLAMATION MONITORING. Regional Foresters and Forest Supervisors shall determine those sites that need monitoring to assess the condition and environmental quality of reclaimed sites following release of bonds or other financial guarantees. Base monitoring priorities on the degree of risk to human health and safety or on long-term environmental effects. Reclaimed sites or structures that might require monitoring include, but are not limited to, revegetated areas, large waste embankments, tailing dams and impoundments, french-drains, stream diversions, dam structures on permanent water impoundments, and water treatment facilities. |
| 2846 - COOPERATIVE AGREEMENTS. Where more than one agency, Federal and/or State, has jurisdiction over a mineral operation, the role of each agency should be defined in a cooperative agreement. The cooperative agreement becomes a primary basis for avoiding multiple and excessive bonding and eliminating conflicting reclamation requirements. |

## Table 1-2. Monument-specific Forest Service reclamation requirements.

## Admiralty Island Reclamation Requirements

**Subpart D--Miscellaneous Minerals Provisions**

Sec. 228.80 Operations within Misty Fjords and Admiralty Island National Monuments, Alaska.

This section affirms that subpart A of the regulations (§§228.1 to 228.15) applies to mining conducted within the Monument. Additional provisions of this section apply to mine operations but do not specifically address facility reclamation.

## Table 1-3. Tongass Forest specific Forest Service reclamation requirements.

## Tongass National Forest Reclamation Requirements

**TONGASS NATIONAL FOREST LAND AND RESOURCE MANAGEMENT PLAN (TLRMP) (1997)**

Note: The majority of Greens Creek's facilities (everything south of the north end of the tailings pile) lie within Admiralty Island National Monument in an area with a Land Use Designation of "Nonwilderness National Monument". The road north of the tailings pile to Young Bay lies outside of the National Monument in an area with a Land Use Designation of "Semi Remote Recreation". As such, the two areas are treated slightly different within the Forest Plan in regards to minerals development and reclamation.

The TLRMP being implemented at the time the reclamation plan was prepared contemplates that (a) disturbed areas will be reclaimed in accordance with an approved plan of operations; (b) reclamation will leave a natural-appearing condition; (c) affected areas will be rehabilitated to minimize the evidence of past mining and to return the area to generally natural conditions, to the maximum extent feasible; and that this is consistent with the project specific reclamation goals as described in the NEPA documents.

***General TLRMP reclamation requirements:***

"…Reclaim disturbed areas in accordance with an approved plan of operations…."

***Semi-Remote Recreation land use designation requirements:***

" Approve reclamation plans in which minerals activities leave a natural-appearing condition.

Ensure that landform modifications simulate naturally-occurring forms.

Ensure that disturbed areas are revegetated in accordance with project plans.""

***Nonwilderness National Monument land use designation requirements:***

" Develop rehabilitation plans following project completion. Include, as needed, rehabilitation of fish and wildlife habitats, soil resources, and the scenery…"

"…After the completion of mining, rehabilitation of the affected areas is done to minimize the evidence of past mining and to the maximum extent feasible, seek to return the area to generally natural conditions. Ultimately, the entire Nonwilderness National Monument provides the same natural settings and recreation experience as the adjacent wilderness National Monument areas…"

## Table 1-4. NEPA reclamation requirements.

## NEPA Reclamation Requirements

Although the EIS and EA's conducted for the project do not contain enforceable standards, they contain general language about the goals and scope of reclamation activities contemplated during review and approval of the project.

**GREENS CREEK FINAL ENVIRONMENTAL IMPACT STATEMENT (1983)**

Relevant sections of the Final EIS state:

"…The reclamation plan will include all areas on National Forest land disturbed by the project…"

"Reclamation

1. Reclamation within the monument will be to as near a natural condition as practicable. This will include sealing mine openings, restoring original surface drainage, removal of all structures, recontouring where possible and revegetating all disturbed areas.

2. Reclamation requirements on the non-monument portion of the project area will be determined by the most current TLMP revision at the time of the mine closure. …"

Also see pages 2-57 through 2-60 for general reclamation guidance.

**ENVIRONMENTAL ASSESSMENT FOR PROPOSED CHANGES TO THE GENERAL PLAN OF OPERATION FOR THE DEVELOPMENT AND OPERATION OF THE GREENS CREEK MINE ADMIRALTY ISLAND NATIONAL MONUMENT, ALASKA (March 1988)**

Reclamation provisions described on page 2-11. Also see pages 4-15 to 4-16 and 4-23, for discussion of reclamation in the context of the then-proposed alternative.

**ENVIRONMENTAL ASSESSMENT FOR ADDITIONAL WASTE ROCK DISPOSAL CAPACITY AT GREENS CREEK MINE ADMIRALTY ISLAND NATIONAL MONUMENT, ALASKA (November 1992)**

See the reclamation section on pages 30 through 31 and Table 26 on page 96.

Note that alternative 3 was the selected alternative.

The FEIS Record of Decision (ROD) states that reclamation performed within the Monument will intend to return as near a natural condition as practicable. This includes sealing mine openings, restoring original surface drainage, removing structures, re-establishing natural contours where possible, and stabilizing the soils. Stabilizing the soils includes revegetating all disturbed areas, where necessary, and ensuring and maintaining healthy growth.

The ROD states that detailed mitigation, monitoring, and reclamation plans will be included in the Final Operating Plan. The reclamation plan includes all areas on National Forest land disturbed by the project. The plan includes both lands administered by the Admiralty National Monument and Juneau Ranger District (JRD). The reclamation of the Hawk Inlet facility is also covered in this reclamation plan. The privately-owned surface facility is under the jurisdiction of the CBJ and ADNR.

### **1.4.2.** Alaska Department of Environmental Conservation

Mining wastes, except for certain kinds of tailings are categorically exempt from regulation under the Alaska solid waste program 18 Alaska Administrative Code (AAC)

section 60.005(b)(8), unless they pose a potential "welfare threat or environmental problem associated with the management of the waste". Recently, ADEC and KGCMC agreed to include production rock Site 23 in the waste disposal permit for which KGCMC had previously applied. Site 23 was included not because it poses an immediate environmental problem, but so that the waste disposal permit would cover its management, even if an environmental problem does not develop. Mining waste is regulated under the monofill standards 18 AAC section 60.455 which allows the department the discretion to incorporate applicable provisions of 18 AAC 60 into a waste disposal permit. A waste that is not specifically addressed in Article 4, such as waste rock, will be classified by the ADEC and assigned the most applicable waste category. The disposal of these wastes is also subject to the requirements of Article 1,2,4,6 and 7 of 18 AAC 60 as necessary to prevent a violation of the air quality standards found in 18 AAC 50 or the water quality standards found in 18 AAC 70.

The waste disposal permit will contain conditions based on applicable provisions of Article 1 and 2 (60.010 to 60.265) that have to do with general standards, limitations, prohibitions and administrative procedures to be followed by every disposal facility regulated under the chapter. Additionally, the waste disposal permit will apply relevant locational, operational, and design related requirements from the monofill standards in Article 4 (18 AAC 60.400 to 60.495) in which the industrial waste standards most closely match the Greens Creek facilities. The monofill requirements also include closure and post-closure care, deed notations, notifications, monitoring and reporting.

According to regulation, financial assurance will be required for closure and post-closure care. The post-closure maintenance and monitoring period that begins after completion of all reclamation activities will extend to a minimum of thirty years, and possibly beyond, as determined at the end of the 30-year period. The permit for the facility will have additional requirements for temporary closure during times when the mine temporarily shuts down and stops the disposal process. Article 7 specifies certain visual, surface water and groundwater monitoring requirements, some of which apply to the post-closure period. Within the detection monitoring subsection, if a significant statistical difference exists between upgradient and downgradient stations or if the water quality standards are exceeded in detection monitoring, then assessment monitoring will be triggered. Assessment monitoring will require that the plume be identified and that the owner/operator identify and implement remedial corrective measures according to 40 Code of Federal Regulations (CFR) 258.55 to 258.58. Lastly, the facilities at Greens Creek are open to waivers to any provision of the chapter under 18 AAC 60.900 upon adequate demonstration and ADEC discretion.

### **1.4.3.** Alaska Department of Natural Resources

Alaska Statute AS 27.19, the Reclamation Act, applies to state, federal, municipal and private land and water subject to mining operations and is administered by the commissioner of the Department of Natural Resources. The Reclamation Act states

that "a mining operation shall be conducted in a manner that prevents unnecessary and undue degradation of land and water resources, and the mining operation shall be reclaimed as contemporaneously as practicable with the mining operation to leave the site in a stable condition". An approved reclamation plan and a performance bond are required prior to approval of a mining operation with the exception of certain small operations. The bond amount shall be set at a level not more than an amount reasonably necessary to ensure the faithful performance of the requirements of the reclamation plan. The ADNR cannot require the bond to exceed $750 for each acre of mined land, though 11 AAC 97.420 (c) allows a miner to provide a bond for more than the $750 statutory limit. The commissioner, on a determination that an agreement is in the best interest of the state, may enter into a cooperative management agreement with the federal government or a state agency to implement a requirement of the Reclamation Act or a regulation adopted under it.

Alaska Administrative Code (11 AAC 97 Mining Reclamation) applies to the approval of reclamation plans, reclamation bonding, and enforcement of reclamation requirements under AS 27.19 for locatable mineral, leasable mineral, and material mining operations on state, federal, municipal, and private land. Nothing in the Reclamation Act precludes a federal or state agency (including the Department of Natural Resources), acting under its own regulatory or proprietary authority, from establishing and enforcing additional requirements or higher standards for reclamation. The Reclamation Performance Standards are defined in 11 AAC 97.200 and are summarized in Table 1-5.

**Table 1-5. Reclamation requirements of the Alaska Mine Reclamation Act.**

| **Alaska Mine Reclamation Act** |
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| ***LAND RECLAMATION PERFORMANCE STANDARDS (11 AAC 97.200)*** |
| (a) A miner shall reclaim areas disturbed by a mining operation so that any surface that will not have a stream flowing over it is left in a stable condition. |
| (1) For the purposes of AS 27.19.100 (6) and this section, a stable condition that "allows for the reestablishment of renewable resources on the site within a reasonable period of time by natural processes" means a condition that can reasonably be expected to return waterborne soil erosion to pre-mining levels within one year after the reclamation is completed, and that can reasonably be expected to achieve revegetation, where feasible, within five years after the reclamation is completed, without the need for fertilization or reseeding. If rehabilitation of a mined site to this standard is not feasible because the surface materials on the mined site have low natural fertility or the site lacks a natural seed source, the department recommends that the miner fertilize and reseed or replant the site with native vegetation to protect against soil erosion; however, AS 27.19 does not require the miner to do so. Rehabilitation to allow for the reestablishment of renewable resources is not required if that reestablishment would be inconsistent with an alternate post-mining land use approved under AS 27.19.030 (b) on state, federal, or municipal land, or with the post-mining land use intended by the landowner on private land. |
| (2) If topsoil from an area disturbed by a mining operation is not promptly redistributed to an area being reclaimed, a miner shall segregate it, protect it from erosion and from contamination by acidic or toxic materials, and |

**Table 1-5. Reclamation requirements of the Alaska Mine Reclamation Act.**

| Alaska Mine Reclamation Act |
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| preserve it in a condition suitable for later use.<br><br>(3) If the natural composition, texture, or porosity of the surface materials is not conducive to natural revegetation, a miner shall take measures to promote natural revegetation, including redistribution of topsoil, where available. If no topsoil is available, a miner shall apply fines or other suitable growing medium, if available. However, a miner may not redistribute topsoil and fines over surfaces likely to be exposed to annual flooding, unless the action is authorized in an approved reclamation plan and will not result in an unlawful point- or non-point-source discharge of pollutants.<br><br>(b) A miner shall reclaim an area disturbed by a mining operation so that the surface contours after reclamation is complete are conducive to natural revegetation or are consistent with an alternate post-mining land use approved under AS 27.19.030 (b) on state, federal, or municipal land, or with the post-mining land use intended by the landowner on private land. Measures taken to accomplish this result may include backfilling, contouring, and grading, but a miner need not restore the site's approximate original contours. A miner shall stabilize the reclaimed site to a condition that will retain sufficient moisture for natural revegetation or for an alternate post-mining land use approved under AS 27.19.030 (b) on state, federal, or municipal land, or for the post-mining land use intended by the landowner on private land.<br><br>(c) A pit wall, subsidence feature, or quarry wall is exempt from the requirements of (a) and (b) of this section if the steepness of the wall makes them impracticable or impossible to accomplish. However, a miner shall leave the wall in a condition such that it will not collapse nor allow loose rock that presents a safety hazard to fall from it.<br><br>(d) If a mining operation diverts a stream channel or modifies a flood plain to the extent that the stream channel is no longer stable, a miner shall reestablish the stream channel in a stable location. A miner may not place a settling basin in the way of the reestablished channel location unless the fines will be properly removed or protected from erosion.<br><br>11 AAC 97.240 requires that additional performance standards require that a miner reclaim a mined area that has potential to generate acid rock drainage in a manner that prevents the generation of acid rock drainage or prevents the offsite discharge of acid rock drainage. |

## 1.5. Plan Objectives

The objectives of this plan are to:

- Reclaim mine facilities as soon as practical after disturbance,
- Satisfy all regulatory requirements,
- Protect water quality, and public health,
- Return the site to a near-natural condition to the extent practical,
- Support land uses consistent with the TLRMP especially maintaining fish and wildlife habitat,

- Minimize or eliminate long-term management requirements,
- Ensure long-term stability, and
- Provide a basis for estimating the cost for reclaiming the mine.

A myriad of specific reclamation techniques may be used to accomplish the goals outlined above. Additionally, the technologies available for reclamation are constantly changing as the industry gains collective experience with mine operation and closure. Consequently, the reclamation plan must provide a framework that encourages changes in reclamation technologies, while providing clear guidance on the performance requirements that the plan must achieve. Accordingly, the format of this plan has been developed to define performance goals by describing specific post-closure monitoring requirements, including duration and frequency of inspection or sampling, compliance points, and compliance levels. Specific technologies that will be employed to satisfy these performance goals are the responsibility of KGCMC. A detailed reclamation plan will be submitted and periodically updated by KGCMC as required in Section 1.7.

## 1.6. Reclamation Schedule

The ultimate reclamation of a mine is often considered during the earliest stages of mine design to ensure that facilities are sited, designed and operated in a manner that is conducive to timely and cost-effective final reclamation. Reclamation activities may occur throughout the life of a mine operation. Five stages of reclamation have been defined for the purposes of this plan as described below.

### **1.6.1.** Interim Reclamation

Interim reclamation includes all actions taken to stabilize disturbed areas during operation of the mine. Generally, the focus of interim reclamation is to reduce erosion and sedimentation of waterways, and to protect water quality.

Techniques used to protect slopes from erosion and to reduce sediment delivery into water courses include various Best Management Practices (BMP's) that are described in more detail in the GPO Appendix 10. Management actions used to protect water quality include surface water diversion, groundwater diversion, and collection and treatment of contact water. These management actions are also described in more detail in GPO Appendix 10.

KGCMC has striven to maintain habitat in its natural condition and improve the habitat in areas where it is feasible. Wildlife has quickly taken advantage of newly created

habitats at inactive production rock sites and along the roads that are maintained and improved through interim stabilization seeding. The installation of a fish pass in Greens Creek is an example of an improvement in habitat. The fish pass was originally proposed as mitigation for lost salmon rearing areas because the location and method of surface tailings disposal would have interfered with these areas. Then KGCMC changed how surface tailings disposal has been handled which minimized disturbance to the salmon rearing areas. However, KGCMC still installed the previously proposed fish pass structures to allow salmon access to additional spawning habitat in middle Greens Creek.

KGCMC has routinely performed interim reclamation at inactive sites until final reclamation can be completed, as required by the Forest Service leases and BMP's. Interim reclamation has included hydroseeding and fertilization of disturbed sites to minimize erosion and reduce sediment production in these areas. Maintenance of these areas has achieved the requirements of the leases and BMP's and has resulted in healthy grass and clover growth.

Berms, slope drains, straw bales, silt fences, catch basins, polymers, and hydroseeding have been utilized for temporary erosion control since inception of the mine. When construction is in progress but cannot be completed until the following year, KGCMC removes all temporary culverts and constructs temporary cross drains, drainage ditches, dips, berms, culverts, or other facilities needed to control erosion.

KGCMC strives to implement soil stabilization and erosion control measures in all disturbed and unprotected areas prior to the end of a normal operating season. Work on any additional disturbed areas commences when weather permits or when practical.

### **1.6.2.** Concurrent Reclamation

Reclamation activities should be completed as soon as practical after portions of mine facilities achieve their final grade. Reclamation that is completed while the mine is still in production is termed concurrent reclamation. Concurrent reclamation differs from interim reclamation in that concurrent reclamation is designed to provide permanent, low maintenance achievement of reclamation goals.

Concurrent reclamation is encouraged for many reasons. First, it allows the mine and agencies to measure the performance of specific reclamation technologies before mine closure and to refine the techniques for site-specific conditions. Next, concurrent reclamation reduces bonding requirements. Also, concurrent reclamation for areas of the mine project which are constructed in phases (e.g., tailings pile) can have beneficial effects such as minimizing water infiltration. Additionally, concurrent reclamation facilitates the determination of closure costs. Finally, evaluation of the performance of

concurrently reclaimed areas allows for a more accurate assessment of the likelihood that specific reclamation technologies will achieve performance goals.

Generally, for areas in which ARD risk may exist, KGCMC will initiate concurrent reclamation within 6 months of the time that both of the following conditions occur; 1) the performance of reclamation techniques such as the oxygen-excluding cover has been verified by field evaluations and has been found to be effective, and 2) a contiguous area within a facility greater than 2 acres in extent has been brought to its final grade. Five consecutive years of monitoring will be required to verify the effectiveness of the cover. For other areas without a risk of ARD, concurrent reclamation shall be initiated within 6 months of the time that a contiguous area within a facility greater than 2 acres in extent has been brought to its final grade. Before areas may be reclaimed concurrently with mine operation, a detailed reclamation plan must be submitted for Agency review and approval. Plan requirements are described in more detail in Section 1.7.

### **1.6.3.** Temporary Cessation

In the event of temporary cessation of mining activities, KGCMC shall notify the appropriate Agencies in writing at least thirty days prior to any planned suspension or cessation of operations of ninety days or longer. KGCMC shall notify the Agencies of any unanticipated suspension or cessation of operations expected to last more than ninety days or more within ten days of the first day of the temporary closure. The notice shall state the nature and reason for the temporary closure, the anticipated duration of the temporary closure and any event that would reasonably be anticipated to result in either the resumption or abandonment of operations. Project operations must resume for not less than ninety consecutive days in order to terminate the temporary closure status. If a temporary closure extends beyond ten years, the Agencies may deem project operations to be permanently abandoned or ceased, and whereupon final reclamation must commence unless otherwise agreed to by the Agencies. KGCMC shall ensure that the project area is maintained in a safe and secure condition during a temporary closure and KGCMC shall not allow the project area to be degraded or eroded during or as a result of the temporary closure. KGCMC shall continue, in full force, all water collection and treatment, monitoring and reporting required by the reclamation plan unless otherwise agreed to by the agencies.

While the mine operation is inactive, environmental monitoring programs, including the internal monitoring programs described in Appendices 3 and 11 will remain in effect. The need for implementation of interim reclamation activities or final reclamation on components of the mine will be addressed on the basis of environmental monitoring results and consultation with the appropriate agencies.

### **1.6.4.** Final Reclamation

After KGCMC has completed operations at Greens Creek, or at any individual facility or mine unit, then final reclamation can be initiated. When a facility is no longer needed for mine operation or when it has reached its design capacity, then reclamation shall be initiated as soon as practical. It is assumed that at the final reclamation stage, a significant amount of site-specific reclamation experience and performance data will be available. This information will be used to guide development of a site-wide closure plan. Before areas may undergo final reclamation, a detailed plan must be submitted for Agency review and approval. Plan requirements are described in more detail in Section 1.7.

### **1.6.5.** Post-Closure Care and Maintenance

Achievement of many reclamation goals can be expected over a number of years. During the period immediately after final reclamation, the site will be inspected, monitored and managed in a fashion that helps achieve the long-term goals set out in Section 2. Specific management actions that will be employed may depend in part, on the results of post-closure monitoring. The sequence of response actions taken by KGCMC triggered by adverse monitoring results will be described in a detailed contingency plan that will be submitted as part of the final reclamation plan for the mine or if temporary cessation lasts more than 3 years unless otherwise approved by the appropriate agencies.

## 1.7. Detailed Plan Submission and Approval

A detailed reclamation plan will be submitted periodically by KGCMC. The plan will contain sufficient detail to allow calculation of closure cost including post-closure maintenance and monitoring and to demonstrate that the reclaimed facilities will conform to performance standards, and will describe monitoring to be conducted during the post-closure period.

The first detailed reclamation plan shall be submitted on or before July 1, 2001, unless later submission is authorized in writing by the appropriate agencies. Subsequent updates to the detailed reclamation plan will be submitted at least every five years. The timing of the five-year updates shall be coordinated with the five-year audits that KGCMC and the agencies anticipate having conducted by a third-party auditor, so that information developed during the audits can be taken into account in updating the detailed reclamation plan. More frequent plan revision may be required by the agencies if substantial increases in the disturbed area have occurred since the last reclamation plan revision, or if specific portions of the plan are shown to be incapable of meeting performance goals.

The detailed reclamation plan shall contain preliminary engineering drawings and calculations and a tabulation of material quantities required to complete the reclamation. Additionally, the plan will have a map of the mine area (with detailed maps

of Site 23/D, the mill area, the Tailings facility, and other facilities to be reclaimed with an engineered cover) showing final grades, location of channels and diversions, a site access plan, and vegetation type/land use designations. The reclamation plan should also contain a detailed schedule that designates all areas that have been (or will be) concurrently reclaimed by year.

Additionally, a detailed monitoring plan should be developed that identifies how monitoring will be conducted for FWMP sites, internal contact water, and for vegetation establishment. The monitoring plan should describe the sites monitored, the data collected, and the monitoring frequency and duration.

Finally, the reclamation plan shall contain an evaluation of the predicted environmental performance of the facilities that demonstrates that performance goals will be met. The demonstration should consist of previously collected performance data from KGCMC facilities (or from similar sites) that are used as inputs to appropriate models that predict site-specific behavior.

## 1.8. Final Reclamation Plan and Monitoring/Contingency Plan

Prior to commencement of final reclamation of any facility at the site, KGCMC will submit a final reclamation plan that will be used as the basis for remaining reclamation activities at the site. The final reclamation plan will follow the same format as prior updates of the detailed reclamation plan. The final plan will also include a Monitoring and Contingency Plan that describes in detail what actions KGCMC would follow if the site fails to meet performance goals during the post-closure monitoring period, including long-term contact water management, should that prove necessary. The actions described in the Contingency Plan may be used to determine potential costs that may be associated with the post-closure care and maintenance period. These costs can be used to calculate the amount of bond that needs to be retained after incremental bond release (Section 1.9).

## 1.9. Bond Cost Calculation and Bond Release

Federal, State and municipal agencies have authority to require financial assurance for performance of reclamation or facility closure and post-closure monitoring activities at Greens Creek. Agencies will coordinate their bonding authority through a memorandum of agreement or other mutually agreeable means. Proof of financial assurance, which may take any form mutually agreed upon by the agencies and KGCMC, is referred to as a “bond” in this section. Unless otherwise agreed between the agencies and KGCMC, the bond amount will be calculated on the basis of detailed reclamation plans submitted by KGCMC pursuant to this appendix.

### **1.9.1.** Incremental Bond Release

A site or area will be eligible for release or partial release of the bond amount directly attributable to that site or area when all pertinent aspects of final reclamation activities are complete, including: removing any facility and necessary materials, grading the surface, applying cover-soils as necessary, and applying the final seed mix. Bond release can be sought for areas reclaimed concurrently (during operation) or after final reclamation.

For a site or area subject to overlapping jurisdiction of the agencies, concurrence from all agencies having jurisdiction over the site or area will be sought as to the completeness of the reclamation. KGCMC will apply for incremental bond release by submitting a letter to the appropriate agencies requesting release of the specific site or area(s). Also, the letter will summarize the conducted reclamation activities, the reclamation activity schedule, and the final revegetation completion date.

The agencies will approve incremental bond release through a process upon which they have agreed. The agencies may require a joint agency/KGCMC site visit to confirm that KGCMC has completed pertinent reclamation activities at the site or area(s). These reclamation requirements will be described in the detailed and final reclamation plans, in the waste disposal permit, and in other applicable permits. If required under the post-reclamation/closure requirements of an applicable permit or approval, KGCMC will continue monitoring the site or area(s) in compliance with applicable permits or approval until the agencies release the entire bond.

### **1.9.2.** Bonding and Management During Post-Closure Care Period

After mining activities are completed in a particular area, KGCMC will return the area to a natural appearing condition using the pertinent procedures described in this Reclamation Plan. After closure, a portion of the site's total bond will be retained for a period to be determined in consultation with the agencies, in light of the applicable post-closure care requirements, to provide for personnel, materials, equipment, and repairs necessary for monitoring, maintenance, and post-closure water management should reclamation maintenance and contingencies become necessary.

If monitoring shows that a site or area is not satisfactorily progressing toward meeting performance goals, KGCMC, will within 60 days of problem identification propose for the agencies' concurrence a written corrective action plan which may require either or both:

- Continued monitoring, with continued retention of the remaining bond amount, over an extended period until progress is made toward satisfaction of the performance goals;

- Implemention of remedial measures to correct the situation delaying or preventing attainment of those goals.

If remedial measures are implemented, KGCMC will, at the discretion of appropriate agencies, restart the monitoring period, which will delay final bond release. The agency holding the bond, in accordance with the agreement among the agencies, may proceed with final bond release if the problems being addressed through remedial measures represent an insignificant proportion of the unreclaimed area compared to the overall success of the reclamation closure.

### **1.9.3.** Final Bond Release

Final release of the remaining bond will occur when monitoring demonstrates that performance goals described in Section 2.0 have been met and any post-closure monitoring required by an applicable permit or approval has been satisfactorily completed. Application for and final bond release will follow the same protocol as described above for incremental bond release. Removal of monitoring equipment will follow the joint agency/KGCMC site visit for confirmation of final bond release.

## 1.10. Reporting

Starting in 2001, KGCMC shall include in each annual report a tabulation of disturbed acreage and concurrently reclaimed areas (including date), and a description of reclamation activities planned for the following year (provided in the report or in an attached annual workplan for the upcoming year). The report shall also contain a narrative and as-built drawings (in hard copy and in electronic form, if available) that describe the reclamation. Annual reports are submitted to the Forest Service, ADEC and ADNR. Additionally, performance monitoring of concurrently reclaimed areas, and post-closure monitoring results will also be described in annual reports. Additional reporting requirements are described in Section 2.0.

# 2. Performance Goals

## 2.1 Water Quality

### **2.1.1.** Monitoring Requirements

The KGCMC Fresh Water Monitoring Program (FWMP) in Appendix 1 of the GPO documents the necessary methods, procedures, analysis, data management, and information to fulfill the water quality monitoring requirements. After closure KGCMC will continue to:

- Sample and analyze groundwater monitoring wells per the latest FWMP schedule.
- Sample and analyze surface water monitoring sites per the latest FWMP schedule.
- Sample and analyze sediment and marine organisms, marine receiving waters and effluent bioassay as long as wastewater discharges continue under the National Pollutant Discharge Elimination System (NPDES) permit.

If practical, remaining monitoring sites that were used in internal monitoring programs at Production Rock Pile 23 and D, the Tailings facility, and at remaining inactive Production Rock piles will also continue to be monitored during the post-closure monitoring period.

### **2.1.2.** Waiver or Modification

Water quality monitoring shall be conducted for not less than 5 years after completion of reclamation activities and not less than 3 years after cessation of collection and treatment of contact water (see Section 2.1.4). KGCMC may, however, request modification of the water quality monitoring requirements at any or all monitoring sites. Modifications may include removal of water quality monitoring stations, reduction in monitoring frequency, or changes in constituents monitored. Request for changes in the monitoring requirements at a facility will be contained in a report that demonstrates that all downgradient monitoring stations have been in compliance with Alaska Water Quality Standards (AWQS) for at least 3 consecutive years. Additionally, results of monitoring at internal sites must corroborate the finding that water quality downgradient of the facility will not change in the foreseeable future. The report will be submitted by KGCMC to the appropriate agencies for their review and approval prior to changing water quality monitoring practices.

This waiver section should be interpreted jointly with waiver provisions contained in the FWMP. Where the waiver provisions contained in this document conflict with the FWMP, these provisions supercede the FWMP.

If a point source discharge permit remains in effect for the components of the mine affected by the request for modification, then KGCMC will also obtain approval for any modifications of the point source discharge permit from the agency or agencies having permit authority for the discharge.

### **2.1.3.** Performance Standards and Point of Compliance

The facilities will be in compliance if 1) all relevant AWQS are met at the downgradient monitoring points specified in Table 2-1, or 2) if accepted detection monitoring statistical analysis, as set out in Section 10 of Appendix 1 (FWMP), applied to the upgradient and downgradient stations fail to show a statistically significant increase in the constituents. These provisions supercede the compliance provisions of the FWMP.

Table 2-1. Proposed compliance monitoring locations for KGCMC facilities.

| **Facility** | **Compliance Points** |
|---|---|
| Mill Area/920 Portal/1350 Adit | Upgradient - Site 48 (upper Greens Creek)<br><br>Downgradient - Site 6 (middle Greens Creek), |
| Production Rock Pile 23/D | Upgradient - Site 6 (middle Greens Creek)<br><br>Downgradient - Site 54 (Greens Creek below D Pond) |
| Tailings | Upgradient - Site 58 monitor well MW-T001C (peat), and Site 59 monitor well MW-T001A (till)<br><br>Downgradient - Tributary creek headwaters / Site 27 monitor well MW-2/shallow (peat), and Site 28 monitor well MW-2/deep (till)<br><br>Downgradient - West side / Site 29 monitor well MW-3/shallow (peat), and Site 30 monitor well MW-3/deep (till) |
| All other areas | No specific compliance point identified. |

### **2.1.4.** Contact Water Management

During operation of the Greens Creek mine, seepage collected beneath Site 23 and the Tailings facility, and waters that run off of Site 23, Site D, the mill area, and the Tailings facility are collected and treated. Collectively, these waters, known as "contact water", are collected and treated prior to discharge under an NPDES permit. In order to return the site to a near-natural condition and minimize or eliminate long-term management requirements, KGCMC plans to phase out collection and conventional treatment of contact water. In order to ensure that water quality will be protected after KGCMC ceases to collect and treat contact water, the following requirements shall be satisfied.

- Before KGCMC will be allowed to cease collection and conventional treatment of contact water, a report will be developed by KGCMC for submission to the appropriate agencies. The report will utilize a water quality predictive model of the Production Rock and Tailings facilities to determine whether AWQS will be met at downgradient stations, and will include identification of effective treatment methods. Achievement of AWQS at the compliance point can be by any of the following processes alone or in combination: reduction in ARD or metals loads due to reclamation practices, deployment of demonstrated biological or other non-conventional treatment techniques, or reliance on natural attenuation mechanisms.

- A monitoring plan must be submitted with the report that identifies "early warning" stations that will detect increases in metal loading that represent a precursor to violation of AWQS at the facility compliance point. The monitoring plan shall describe the indicator parameters to be monitored, the monitoring frequency, and duration. Additionally, "trigger levels" shall be proposed at each early warning station that represents levels of constituents that may cause subsequent violation of AWQS at the compliance point.

- The findings of the report, and the monitoring plan are subject to review and approval by the appropriate agencies.

Early warning stations and the downgradient point of compliance shall be monitored for a minimum of 3 years after cessation of collection and treatment of contact water. If violation of the AWQS occurs at the compliance points, or if trigger levels are exceeded at the early warning stations, then KGCMC shall notify the agencies as required by the FWMP. Additionally, a report shall be prepared which describes the potential or observed water quality violation, and will identify probable causes. This report shall be submitted by KGCMC to the appropriate agencies within 30 days of problem identification. A corrective action plan shall be submitted by KGCMC to the appropriate agencies for review and approval within 75 days of the date of problem identification. Following approval of the plan, KGCMC shall implement the plan in a timely manner. The corrective actions to be taken may include, but need not be limited to, changes in

the passive treatment system, modification of the water management system, re-establishment of conventional treatment, or improvements to the facility reclamation.

## 2.2. Demolition

### **2.2.1.** Solid Waste

Structures that have been constructed on Forest Service administered lands will be demolished. All material and equipment will be salvaged and recycled when economically feasible. All hazardous materials will be removed as described in Section 2.2.2 below. Materials that cannot be salvaged will be removed from the site for disposal or disposed on-site in an appropriate manner. If applicable, a solid waste permit will be obtained for on-site disposal of demolition debris.

KGCMC will recover and remove all salvageable equipment, instrumentation, furniture, unused chemicals and fuels, and other salvageable or waste material following permanent closure of the operation. All mobile equipment and other equipment not needed for future potential uses of the site will be salvaged and removed from the site. Removal will consist of loading at the site, transporting to the KGCMC Hawk Inlet facility and offloading to a barge. These materials will either be shipped to buyers, recyclers, or to an approved waste disposal area.

### **2.2.2.** Hazardous Materials

Hazardous materials that remain on-site at the time of final reclamation, whether in the form of unused process reagents, fuels or lubricants, or as residue from demolition of the site (contaminated soil, etc.) shall be removed from Admiralty Island and will be properly recycled or disposed under applicable State and Federal law.

## 2.3. Land Use/Vegetation

### **2.3.1.** Roads and Site Access

As a part of periodic updates of the detailed reclamation plan and the final reclamation plan that will be submitted by KGCMC to the appropriate agencies, a site access plan will show the roads and trails that are retained after facility closure. Additionally, an approximate time frame for road removal will be developed. Road access will be retained to the Tailings facility, production rock piles, mill area and portal for at least the first five years after closure. Roads will be maintained for longer if necessitated because of continued collection and treatment of contact water (Section 2.1.4). The site access plan shall be developed in a manner that balances the need for economic post-closure care and maintenance and for achieving the goal of returning the site to a near-natural condition.

### **2.3.2.** Aesthetics

The final reclamation plan shall be reviewed by a qualified professional to assess the degree to which the reclamation plan meets the aesthetic goals of the plan. Examples of aesthetic considerations in a reclamation plan may include but are not limited to:

- reduction in the extent of long uninterrupted slope crests with the same elevation,
- design of contours on reclaimed facilities that have crenulations in plan view (e.g. having an irregularly wavy or serrate outline) that approximate those found in surrounding landforms,
- creation of slopes that have a similar profile to those found in surrounding landforms (e.g. concave or convex profiles), and
- integration of natural drainage networks into reclaimed slopes.

Aesthetic considerations may conflict with other performance goals such as stability or environmental performance of engineered covers. Where such conflicts exist, environmental protection shall take precedence over aesthetics.

### **2.3.3.** Revegetation

Disturbed areas at Greens Creek will be reclaimed to one of three vegetation types including upland meadows, upland forest, or wetlands. Specific seed mixtures, woody seedling density, and maps showing each vegetation type will be submitted within the detailed reclamation plan.

Revegetation success will be monitored for three years following seedbed preparation, fertilization, seeding, mulching, and temporary erosion control measures. Fall revegetation surveys will be conducted the first year and a fall survey will be conducted the second and third year. Growth, ground cover, and species survival will be measured and reported on an annual basis. Specific goals for different plant communities are specified in Section 2.3.3.4.

#### **2.3.3.1.** Upland Meadow Areas

In all reclaimed areas with slope greater than 25%, the soils will first be stabilized using a hydromulch mixture. A seed mixture containing predominantly native species, to be approved by the Forest Service prior to use, will be broadcast at a rate of 30 lbs pure live seed per acre or other approved rate. Additional native species may be added to the mix to provide cover and variety based upon seed availability and their suitability for hydroseeding. These species may consist of forbs, grass species, blueberries and other food sources that would benefit the wildlife.

Areas reclaimed with grass and forbs on Admiralty Island have shown significant use by a wide range of wildlife species; deer, bear, rodents, raptors, and songbirds. KGCMC will generally limit open meadow areas to 10 contiguous acres to enhance edge-effect, benefit wildlife, improve aesthetics, and advance the rate of succession to the next seral stage.

#### **2.3.3.2.** Upland Forest Areas

Forest stands will be developed using a combination of natural regeneration and reseeding or transplanting. Natural regeneration is preferred over planting as a means of establishing a coniferous overstory in small areas where seed sources are available. Natural regeneration will ensure re-establishment of Admiralty Island genotype species, follow natural successional stages, and provide unique wildlife habitat during stand development. Naturally-regenerated plants are well adapted to growing on site. The seeds either migrate from surrounding native plants or, in many instances, are already in the soil. Natural regeneration benefits the environment by ensuring the succession of naturally occurring, site adapted genotype species.

According to an Alaska Forest Management Education Alliance (AFMEA) pamphlet on Forest Regeneration, Alaska has some unique regeneration opportunities that relate to the type of trees and cold soils in Southeast Alaska. The coastal forests of Southeast Alaska regenerate very quickly and profusely. Approximately 95% of disturbed areas seed-in naturally from surrounding stands. Western hemlock and Sitka spruce grow rapidly in this area. Natural regeneration of these climax species is evident throughout areas previously disturbed by KGCMC activities and in areas without any reclamation preparation.

KGCMC will utilize natural regeneration as the primary method of woody plant restoration in areas seeded as upland meadows and in disturbed areas less than 200 feet in their shortest dimension. Accelerated regeneration through seeding will be implemented in more expansive reclaimed areas. Accelerated regeneration would consist of planting more of the climax species to minimize large open areas and accelerate succession.

In areas where the trees propagate either from natural regeneration or from planted seedlings, KGCMC may thin the subsequent growth to allow the remaining trees to grow more quickly and achieve climax forest conditions.

#### **2.3.3.3.** Wetland Areas

Wetlands provide food, protection from predators, and other vital habitat factors for many fish and wildlife species. Wetland systems have economic value associated with recreational, commercial, and subsistence use of fish and wildlife resources. In addition, wetlands remove sediment from overland flows before they reach lakes, rivers and bays. Wetlands intercept storm runoff and release floodwaters gradually to

downstream surface and groundwater systems. A significant portion of the Greens Creek temperate rain forest setting supports wetlands. Riparian, muskeg, and forested wetland communities all occur in the area.

Final reclamation will provide additional wetland habitats. KGCMC has an agreement with the U.S. Army Corps of Engineers to compensate for wetlands lost during construction by re-establishing and creating additional wetlands. These wetlands will mitigate disturbances and protect the biological productivity for a unique wildlife habitat. KGCMC currently intends to create several wetland sites if the opportunity and conditions are ideal for wetlands. Others will be constructed to maintain adequate hydrology in existing, adjacent, and restored wetlands.

Constructed wetlands will be monitored annually for three years. Permanent vegetation sampling points will monitor plant establishment, growth, and relative abundance.

### **2.3.3.4.** Specific Plant Community Goals

Vegetation on reclaimed areas at Greens Creek shall be subject to the monitoring requirements and performance standards described below. Roads used for permanent access and other areas where buildings are maintained for post-mining use, shall not be subject to vegetation standards.

Vegetation success will be monitored through annual inspections, as well as by surveys of the reclaimed areas in years 1, 2 and 3 following completion of reclamation activities. KGCMC shall submit reports to the Forest Service, ADEC, ADNR and the U.S. Army Corps of Engineers describing the results of these revegetation surveys by the first quarter of the calendar year following completion of annual data collection and monitoring activities. The reports shall include an assessment of vegetation success. Climatic variation and its effects on vegetative growth rates will be considered in this assessment.

Vegetation establishment and success on each reclaimed facility shall be monitored through the establishment of transect lines. Transect locations for all reclaimed areas shall be selected by KGCMC in consultation with the appropriate agencies. Vegetation inspections of all reclaimed areas shall follow the following guidelines:

- Visual inspections of vegetation cover by life-form will be conducted (including annual grass, perennial grass, forbs, shrubs, trees, litter and standing dead.) Evidence of dieback, subsidence, slope failures or erosion will be noted.

- Inspections will be conducted on permanent transects.

- Pedestrian traffic will be restricted to the downhill side of the transect line and people will not be allowed to walk on the plots.

- Vegetation monitoring will be conducted once each year during peak standing biomass.

Revegetation efforts shall be considered successful when the following conditions are met:

- The total vegetative cover (including live biomass of perennial species, litter, and standing dead) in each revegetated area is equal to or exceeds 80 percent aerial cover, with a 90 percent statistical confidence limit;

- The density of actively growing trees is within 80 percent of target levels contained in the approved reclamation plan with a 90 percent statistical confidence;

- The reclaimed wetland and plant meadow areas have at least three graminoids present each with relative herbaceous cover value equal to or greater than 5 percent, with no one graminoid comprising more than 70 percent relative cover;

- The reclaimed upland forest areas have at least two species of trees and one species of shrubs present, with each species comprising no less than 5 percent or no greater than 95 percent of the relative density value.

If vegetation monitoring indicates that, due to natural or other causes, a reclaimed area does not exhibit the potential to achieve the revegetation standards described above, a report shall be prepared which describes the area in question, the situation as identified, probable causes, and a corrective action plan. This report shall be submitted by KGCMC to the appropriate agencies within 60 days of problem identification. Following approval of the plan by the appropriate agencies, KGCMC shall implement the plan in a timely manner. The corrective actions to be taken may include, but need not be limited to, re-establishment of topsoil thickness, reseeding, and replanting of trees and shrubs.

### **2.3.4.** Wildlife Use

KGCMC will conduct qualitative wildlife species counts to monitor wildlife habitat utilization and wildlife habitat potential of the reclaimed areas. These counts will be conducted and reported on an annual basis.

## 2.4. Stability

### **2.4.1.** Mass Instability

Semi-annual inspections of all reclaimed areas for evidence of slope instability shall be made in year 1. Annual inspections will be made in years 2, 3 and 5 following completion of reclamation activities. Additionally, Site 23/D, the Tailings Facility, and other facilities reclaimed with engineered covers will be monitored every five years for the duration of the post-closure mandatory period specified in the waste disposal permit. KGCMC shall submit a slope-stability report to the appropriate agencies, summarizing the findings of the periodic inspections.

- Development Rock Piles: The slopes and benches of the waste rock pile shall remain in a stable condition.

- Underground Mine: The portal area and stopes within 50 feet of land surface shall be monitored for signs of geotechnical instability.

- Tailings Pile: The slopes and benches of the tailings pile shall remain in a stable condition.

- Other Reclaimed Areas: The slopes of other areas throughout the permit area, including the mill area, borrow areas, reclaimed exploration roads, access roads, and other support facilities shall remain in a stable condition.

Mass instability, including slope failure and subsidence in the above areas, shall be subject to the contingency requirements described below.

***Production Rock Pile:*** If slope movement, subsidence, erosion or other mass instability which threatens the performance of the reclaimed soil cover occurs, KGCMC shall notify the appropriate agencies within two business days of problem discovery, and shall take timely action to prevent excessive entry of surface water into the pile. Additionally, a geotechnical investigation shall be conducted, and a report describing the cause of the failure and appropriate remedies for completing necessary repairs and for preventing future slope movement shall be submitted by KGCMC to the appropriate agencies for review. After review and approval of the plan by the appropriate agencies, KGCMC shall implement the corrective measures described in the plan in a timely manner.

***Underground Mine***: If crown pillar failure occurs over any stopes, or if development headings collapse near the portal, KGCMC shall notify the appropriate agencies within two business days of problem discovery, shall conduct a geotechnical investigation to determine the cause of such failure and shall propose a corrective action plan for review. After review and approval of the plan by the appropriate agencies, KGCMC shall implement the approved plan in a timely manner.

***Tailings Pile:*** If slope movement, subsidence, erosion or other mass instability is observed in the tailings pile, KGCMC shall notify the appropriate agencies within two business days of problem discovery. A geotechnical investigation shall be conducted to ascertain the extent of the problem, and a report describing the situation as identified, including estimates of the volume affected by the instability and potential consequences of the instability with respect to its affect on the integrity of the cover system and drainage features, shall be developed by KGCMC and submitted to the appropriate agencies within 30 days of the date of problem identification. A corrective action plan shall be submitted by KGCMC to the agencies for review and approval within 75 days of the date of problem identification. Any remedial measures undertaken in conjunction with the corrective action plan shall be completed in a timely manner, which minimizes disturbance to reclaimed areas and meets all original design criteria for the tailings pile.

***Other Reclaimed Areas***: If slope movement, subsidence or other failure which threatens the integrity of any other reclaimed area occurs, KGCMC shall notify the appropriate agencies within 30 days of problem discovery and shall repair any damage that could affect other reclaimed facilities in a timely manner.

### **2.4.2.** Permanent Channels and Channel Inspection

Surface water flows will be managed in most cases by establishing vegetative cover and constructing moderate slopes. Most slopes will be constructed with a 3H:1V slope. Constructing slopes at 3:1 reduces the erosive effects of water. In areas with minor flow concentrations, straw bales, silt fences, and swales will be used to reduce the velocity of the water and reduce erosion while vegetation becomes established. Also, hydroseeding of these areas will stabilize the soils.

If natural stream channels enter reclaimed areas the water will be diverted, diffused, or channeled through the reclaimed area using designed and constructed non-erosive channels. Stream channels will be stabilized with degradable fiber mat to establish vegetation. Riprap will be used to stabilize the constructed channels in areas that are subject to highly erosive stream flows.

All drainage channels and diversion structures installed during reclamation of the Greens Creek Mine shall be designed to handle flows from a 24 hour/25 year storm event, at a minimum, and shall be subject to the routine inspection and maintenance requirements described below.

In order to ensure that the drainage channels and diversion structures are functioning properly, they shall be inspected semi-annually for signs of excessive erosion for five years following completion of reclamation activities. After the first two years of monitoring, KGCMC may propose to the appropriate agencies that inspection be conducted less frequently if appropriate. During the five year period, drainage channels and diversion structures shall be inspected within 24 hours following storm events in

excess of 2 inches of rainfall for signs of deterioration and erosional damage as well as sedimentation.

During the remainder of the post-closure monitoring period required under the waste disposal permit, drainage channels and diversion structures shall be inspected after each storm event that exceeds the largest prior storm that has occurred since completion of reclamation. The appropriate agencies may require more frequent inspection by KGCMC during the post-closure monitoring period if the drainage channels and diversion structures are shown to require frequent maintenance or repair.

Routine inspections and inspections completed after major storm events shall be subject to the following requirements:

- Physical damage, trash build-up and sedimentation shall be recorded on field inspection sheets.
- Diversion intake and outflow areas shall be inspected for evidence of scouring or bypass.
- Any areas needing maintenance or repair shall be reported on the field inspection sheets.

If damage is noted, appropriate repairs shall be completed by KGCMC in a timely manner. A summary of all observed damage requiring repair shall be submitted annually to the appropriate agency, including as-built reports verifying the completion of the required repair.

If significant damage or overflow is caused by storms that are smaller than the structure's design storm, KGCMC shall conduct an investigation to identify the cause of significant damage or overflow of diversions. A report shall be prepared by KGCMC identifying the extent of the problem and the probable causes. The report shall be submitted to the appropriate agencies within 30 days of the date of problem identification. A corrective action plan shall also be submitted to the appropriate agencies for review and approval within 75 days of the date of problem identification. The corrective actions to be taken may include, but need not be limited to, regrading, armoring of drainage features, re-design and re-construction of channel cross-section and alignment, replacement of topsoil, reseeding, and replanting of trees and shrubs. After approval by the appropriate agencies, KGCMC shall implement the plan in a timely manner.

### **2.4.3.** Drainage

The surface of the reclaimed facilities shall be maintained in a free-draining condition, which allows water to egress the facility without ponding or causing erosion, to the extent practical.

If significant ponding of water occurs on the surface of any non-wetland reclaimed facility, KGCMC shall notify agencies within two business days of the date of problem identification. In addition, the extent of such ponding will be ascertained and a report describing the situation as identified, including probable causes, shall be developed by KGCMC and submitted to the agencies within 30 days of the date of problem identification. A corrective action plan shall be submitted by KGCMC to the agencies for review and approval within 75 days of the date of problem identification. Following approval of the corrective action plan by the agencies, KGCMC shall implement the plan in a timely manner. The corrective actions to be taken may include, but need not be limited to, the following steps:

- placement of additional fill that meets original design criteria.
- regrading of placed fill to original design criteria.
- placement of growth medium to original design thickness.
- reseeding/planting as per original design specifications.

Any such remedial measures shall be undertaken in a manner that minimizes disturbance to adjacent reclaimed areas.

### **2.4.4.** Cover Performance and Inspection

#### **2.4.4.1.** Cover Performance

Field instrumentation will be installed to monitor performance of engineered covers used at KGCMC. The installation includes the following components:

- A weather station for measuring precipitation, net radiation, relative humidity, temperature, and wind speed.
- Thermal conductivity sensors to measure soil suction and temperature.
- Lysimeters to measure infiltration rates.
- Neutron Probe access tubes for monitoring water content profiles at selected locations on the site.

Construction details for the installation of the instrumentation is shown in the USEL Waste Rock Cover Design Final Report (1998). KGCMC proposes to monitor cover performance for 5 years beginning with installation of the Site 23 cover. KGCMC will determine from these monitoring results whether to propose additional cover performance test monitoring in which instrumentation will be installed at other selected

cover sites. The monitoring approach is subject to review and approval by the appropriate agencies.

### **2.4.4.2.** Cover Inspection

In order to ensure that the cover systems are functioning properly, they will be inspected semi-annually for five years following completion of reclamation activities for signs of excessive erosion, damage due to blow-down of trees or damage by animals. Excessive erosion is defined to be erosion that has exposed or threatens to expose any low permeability layer or oxygen excluding layer due to removal of soil. After the first two years of inspection, KGCMC may propose to the appropriate agencies that inspection be conducted less frequently, if appropriate. During the five year period, the cover system, diversion structures and drainage channels shall also be inspected by KGCMC within 24 hours following storm events in excess of 2 inches of rainfall for signs of deterioration and erosional damage as well as sedimentation. Any necessary repairs shall be completed by KGCMC in a timely manner.

If levels of erosion which are potentially destructive to the low permeability or oxygen excluding layer are identified, KGCMC shall notify the appropriate agencies within two business days of the date of problem identification. In addition, the extent of the problem will be ascertained and a report describing the situation as identified, including probable causes, shall be developed by KGCMC and submitted to the agencies within 30 days. A corrective action plan shall be submitted to the agencies for review and approval within 75 days of the date of problem identification. Following approval of the corrective action plan, KGCMC shall implement the corrective action plan in a timely manner. This work may include, but need not be limited to, regrading, armoring of drainage features, re-establishment of topsoil thickness, reseeding, and replanting of trees and shrubs.

If the cover system is breached by rodents and/or other digging wildlife, the extent of the problem will be ascertained and a report describing the situation as identified, including probable causes shall be developed by KGCMC and submitted to the appropriate agencies within 30 days of the date of problem identification. A corrective action plan shall be submitted to the agencies for review and approval within 75 days of the date of problem identification. Following approval of the corrective action plan, KGCMC shall implement the plan in a timely manner. If removal and/or relocation of animals is required, State of Alaska and Forest Service biologists shall be consulted regarding the removal/relocation process. In the event of an emergency need to remove or relocate animals when no biologist is available for consultation, KGCMC shall consult with qualified wildlife biologists and submit a summary report of the actions taken to the agencies.

Repair of the low permeability layer shall include, but need not be limited to, the following steps:

- removal of growth medium from the affected and immediately adjacent area and stockpiling.

- removal of the damaged areas of the low permeability layer or oxygen-excluding layer.

- re-installation of the cover components in affected areas to the design performance criteria under the same QA/QC procedures as the original installation. The edges of the re-installed layers will overlap with the adjacent undisturbed layers to assure adequate joining of the layers.

- replacement of overlying cover layers to their original design thickness.

- reseeding/planting as per original design specifications.

All such repairs shall be undertaken in a manner that minimizes the disturbance to the surrounding reclaimed area. KGCMC shall submit an as-built report of the work performed under the corrective action plan to the agencies.

### **2.4.5.** Erosion

All reclaimed areas shall be inspected semi-annually for five years following completion of reclamation activities for signs of excessive erosion. After the first two years of monitoring, KGCMC may propose to the appropriate agencies that inspection be conducted less frequently if appropriate. Routine monitoring shall include a visual assessment of rills and gullies.

Erosion of applied cover-soil from the production rock piles or tailings pile shall not expose significant contiguous areas of low permeability or oxygen excluding layers or otherwise be allowed to significantly decrease the performance of the reclaimed soil cover in minimizing infiltration into the pile.

Erosion of applied cover-soil from reclaimed roads, borrow areas, the mill area, and other reclaimed areas shall not be permitted to significantly decrease the performance of the reclaimed soil cover in supporting vegetation.

If erosion features deeper than 8 inches develop, KGCMC shall repair the damaged areas in a timely manner. If large numbers of significant erosion features are evident during an inspection period (more than 25 rills per acre over an area of 1 acre or more), then a mitigation plan to prevent recurrence of the erosion shall be developed, submitted for agency review and approval, and implemented by KGCMC. Elements of such a mitigation plan may include, but need not be limited to, regrading or otherwise re-directing surface runoff away from the affected areas.

If potentially destructive levels of erosion are identified, KGCMC shall notify the appropriate agencies within two business days. In addition, KGCMC shall determine the extent of erosion and shall submit a report describing the situation identified and probable causes to the appropriate agencies within 30 days of the date of problem identification. A corrective action plan shall be submitted by KGCMC to the appropriate agencies for review and approval within 75 days of the date of problem identification. Following approval of the corrective action plan, KGCMC shall implement the plan in a timely manner. This work may include, but need not be limited to, regrading, armoring of drainage features, re-establishment of topsoil thickness, reseeding, and replanting of trees and shrubs.

# 3. Attachment A: Reclamation Plan

- ***This section to be developed and submitted by KGCMC by 7/1/2001***