APPENDIX A
OVERVIEW OF PROPOSED MINING AND RECLAMATION METHODS

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APPENDIX A OVERVIEW OF PROPOSED MINING AND RECLAMATION METHODS

This appendix discusses the proposed mining areas, the proposed mining plan and the proposed reclamation plan. It is intended to provide the reader with a thorough understanding of ECG's mining practices, application of best management practices (BMPs), and reclamation procedures. Additional details and information are contained in the Plan of Operations (ECG 2002).

1.0 Proposed Mining Areas

There are six proposed mining areas comprising 327.5 acres of property adjacent to and near the St. Maries River between Emerald and Carpenter creeks in Benewah and Shoshone counties, Idaho (Figure A-1). Mining Areas C, D, and F are located in an existing floodplain immediately adjacent to the St. Maries River. These floodplains contain non-wetland areas and a labyrinth of seasonally saturated to permanently inundated depressions, swales, and oxbows. Mining Areas A, B and E, are located in non-floodplain areas and in the historic floodplain of the St. Maries River. These areas have been truncated from the active floodplain by the construction of Highway 3 and the St. Maries River railroad line. These areas contain non-wetlands on sideslopes and topographic highs and seasonally saturated/inundated wetlands on relatively flat bottomlands. All proposed mining areas have been grazed by cattle for more than 50 years. Table A-1 summarizes the proposed mining area acreage.

Table A-1. Proposed Mining Acreage

Mining Area	*Wetland Acreage*	*Total Acreage*
A	3.5	7.5
B	1.0	10.5
C	33.1	85.7
D	14.5	52.5
E	21.0	34.1
F	59.9	137.2
TOTAL	**133.0**	**327.5**

Source: ECG 1999

The proposed mining areas are located in the St. Maries River basin, approximately between river-miles 35 and 38. The St. Maries River joins with the St. Joe River, which, subsequently, drains into Lake Coeur d'Alene. The Spokane River outlets the lake and joins with the Columbia River. The St. Maries River is a low gradient system with a wide floodplain in this mid-portion of its basin. The riparian corridor has been significantly impacted by man's activities. Extensive logging occurred between 1880 and 1935, including salvage logging after the 1912 fires. Salvage logging activities included building railways through the floodplain and building splash dams to hold water to float large volumes of logs downstream. Cattle grazing during the summer and fall months has occurred annually for more than 50 years. Open range laws have encouraged cattle grazing of riparian corridors. Range and/or farming improvement practices converted large portions of the floodplain from native vegetation to seeded fields, as evidenced by aerial photographs from 1955. Cropping the floodplain for hay was common 40 years ago. Today, cropping is limited mostly to cattle grazing. Today's riparian system is a product of historic and on-going anthropogenic processes including fires, fire suppression, clearing, grazing and other agricultural activities, and logging activities. Most of these processes are long-standing and influential so that they are integral components of the local ecosystem.

A wetland delineation, revised in 2002, identified 133.0 acres of jurisdictional wetland within the proposed mining areas (Selkirk Environmental 2002a). The wetland study identified a mosaic of emergent, scrub-shrub, and forested wetlands. Wetland hydrology in these systems varies from seasonal saturation to permanent inundation. Identified wetlands are highlighted in blue in Figure A-1. In the same figure, oxbow complexes are shown in green.

2.0 Proposed Mining Plan

The proposed mining plan provides flexibility, allowing ECG to respond on an annual basis to changes in market structure and changes in product demand. This flexibility would also allow ECG to phase its mining operations into a comprehensive mining plan comprised of annual mining plans in other permitted areas in Emerald and Carpenter basins. The Plan of Operations (ECG 2002) contains further details on the proposed mine plan.

The proposed mine plan is based on ECG's current and historic annual production goal of 30,000 tons of finished product. This goal is based on the number of minable days per year, the present equipment inventory, and on reclamation time requirements. ECG reports that they require a minimum 18,000 tons per year to meet fixed costs of operation. At 30,000 tons per year, operable equipment and facilities are at full, or near-full production and mining is most efficient. Above 30,000 tons per year, additional equipment inventory must be acquired, increasing the costs of operation and reducing profitability. Within the framework of a 30,000-ton production year, daily production rates vary directly with the number of minable days and the garnet reserves. The current inventory of equipment can mine and process up to 145 tons per day in a full mining year with the average reserves proven in the proposed permit areas.

2.1 Mining Techniques

The combination of wet and dry panel mining is proposed for the mining areas along the St. Maries River. Because dredge mining of riparian areas and floodplains encounters numerous environmental variables, different types of mining techniques are needed to accommodate space limitations, seasonal conditions, and proximity to existing streams and rivers. These techniques are wet panel, dry panel and a combination of wet and dry panel mining. Each technique allows operation under unique conditions with a minimum of impacts. These techniques are standard practices in the dredge mining industry and are being used in ECG's current permit areas in Emerald and Carpenter basins.

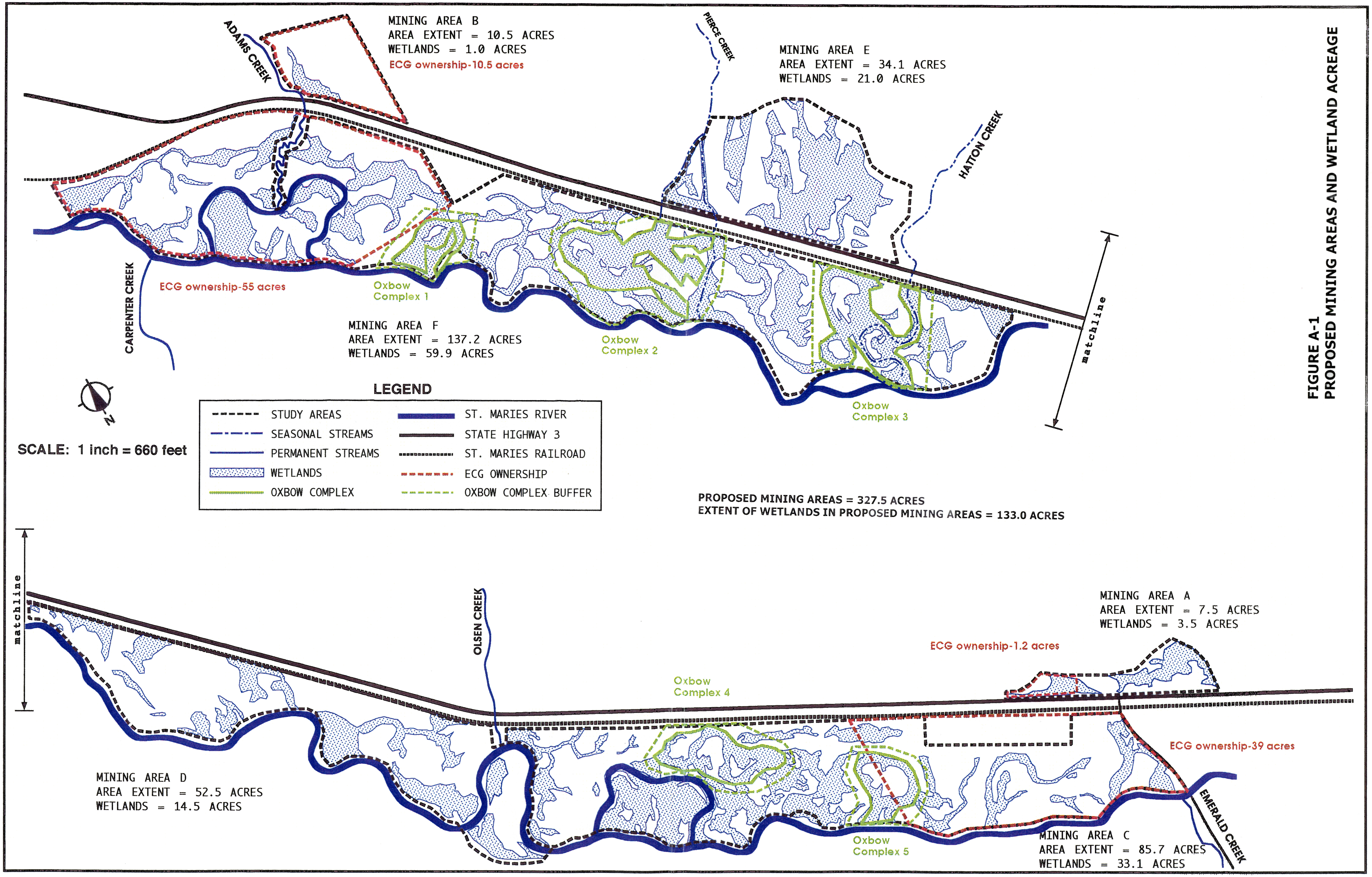


FIGURE A-1
PROPOSED MINING AREAS AND WETLAND ACREAGE

2.1.1 Wet Panel Mining

Topsoil would be stripped from an annual mining unit, stockpiled, and used for berm construction to control surface runoff (see discussion of BMPs, section 3.4). Overburden is then stripped off one panel at a time using a trackhoe and bulldozer. A "panel" is defined as a long, narrow area that is mined in one continuous pass. Wet panels generally run perpendicular to the length of the valley, and are typically 300 feet long and 80 feet wide, occupying more than 0.5 acre.

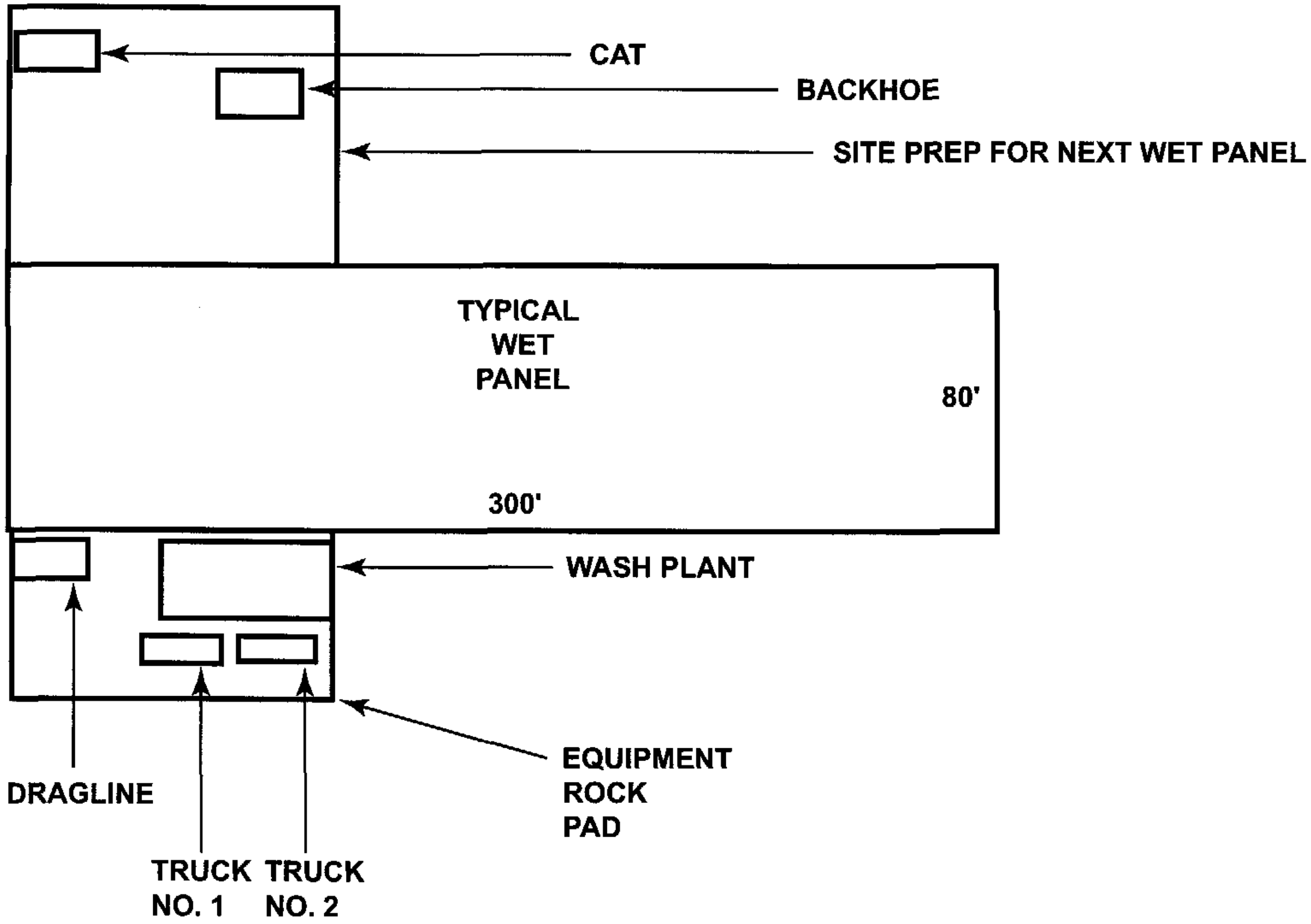
The garnet would be excavated in one of several ways. One method would excavate using a dragline and feed the garnet directly into the wash plant. A second method would mine with a trackhoe and deposit the garnet on the work area. The material would then be loaded into the wash plant with a dragline. A third method is a suction dredge, where garnet would be removed directly to the wash plant via a suction device attached to a boom. The wash plant would have a water containment/recycle system beneath it that would collect water from the wash plant and direct it back into the wet panel. This method is proposed because the substrate in most of the proposed permit areas is unconsolidated alluvium and may allow the sides of a wet panel to slough. For safety reasons, the wash plant and excavator cannot be situated immediately adjacent to the wet panel. In this case, a suction dredge is the most efficient way of mining and maintaining safety.

Recycled water, originally pumped from an adjacent body of water under permit, would be used to fill the wet panel after it is opened (appropriation of this water is discussed in the Plan of Operations [ECG 2002] and section 2.4.4 of the EIS). Upon completion of one panel, the process would be repeated for each subsequent panel. Overburden from the next panel would be cast into the previous panel before the next panel is mined. The procedure would result in the remaining process waters being transferred to the new panels with fine sands, silts, clays, and washed rock left in the old panels. This sequence would continue until mining in the area is completed. In this fashion, a wet panel would be open throughout the mining period. All wet panels would be backfilled and rough graded at the end of the current mining year.

Water, essential to the wash plant operation, would be provided by ponding water in the wet panel. Water control would be necessary to insure that process water would be kept in close proximity to the wash plant and that a zero discharge condition would be maintained during mining. Wash plant water would be discharged directly into the open panel. When mining ends, remaining process waters would be pumped out and used as irrigation water on reclaimed sites. Dewatered panels would be backfilled with remaining overburden, making the site ready for reclamation. Typical equipment layout and positioning for wet panel is shown in Figure A-2.

2.1.2 Dry Panel Mining

Initially, topsoil would be stripped and stockpiled, then the overburden would be removed with a trackhoe from an area approximately 40 feet wide by 40 feet long and stockpiled in a corner of the mining unit. Garnet laden ore would be excavated from the open panel, loaded into dump trucks, and hauled to a wash plant for initial washing. When this panel is completely mined, a second, adjacent panel would be opened. The overburden from the second panel would be backfilled with returned washed rock into the first panel, compacted, and rough-leveled. This process would be repeated sequentially throughout the mining period. The trackhoe would move laterally and repeat the process throughout the mining area. This process would not require appropriated water in the



SCALE
1" = 50 ft.

FIGURE A-2
TYPICAL EQUIPMENT LAYOUT

open panels. The garnet ore would be hauled to washers at open wet mining panels located elsewhere. Dry panels would then be backfilled and regraded within an average of 30 days.

Although this method is called dry panel mining, dry panels often contain water. During the wet season and in areas where the water table may be close to the surface, dry panels may contain ground water. This makes the visual difference between wet and dry mining imperceptible. The difference between the two techniques lies in their operation, rates of reclamation, and required degree of water management.

Sloughing due to unconsolidated alluvium, as described under wet panel mining, may also be an issue in dry panel mining. It is not expected to be an issue on the side of a dry panel that abuts a non-mining setback. The setback area is fully vegetated with a sufficient root mass to provide stability. If sloughing becomes a safety issue on dry panels where vegetation, topsoil, and overburden have been removed, ECG would need to slope or terrace the area of access to the dry panel to provide a safe platform of operation.

2.1.3 Wet and Dry Panel Mining

Wet and dry panels would be mined concurrently within most mining units in the St. Maries River floodplain. In this case the wet panel has two functions. First, it is a mining panel where garnet is extracted. Second, it is a concentration panel where garnet from a dry panel is puddled to increase the concentration. The number of dry panels per wet panel would vary depending upon the ore concentration and extent of dry mining required. Typically, 6 to 8 dry panels would be opened for each wet panel. Dry panels would be used exclusively within 70 feet of the St. Maries River and of all unmined tributaries. Garnet laden ore would be hauled from the dry panel to a nearby wet panel for concentration. Washed rock would be hauled back to the dry panel immediately.

2.2 Mining Equipment

Specialized equipment would be utilized during the extraction, preliminary processing, transport, and final processing of the garnet ore. This equipment would be necessary because of the site conditions encountered at each mining site and the volume of material handled to extract the garnet-laden ore from the soil and rock.

ECG currently has a working inventory of 35 pieces of operable equipment and 12 pieces of reserve equipment. Operable equipment is on-line daily; reserve equipment is held for use when daily equipment breaks and for use during peak mining and reclamation periods. Reserve equipment must be available regardless of daily production rates and equipment demand. Dozers and excavators are often diverted from mining activities during the dry summer and fall months for required reclamation activities. This typically reduces on-line mining and reserve equipment by 8 pieces for an 8 to 10 week period. The following equipment would be routinely used in daily operations in existing permit areas and the new proposed permit areas.

Track-Mounted Excavators - would be used for road construction, diversion ditch installation, and garnet extraction in both wet and dry panel mining. The size of equipment utilized would include Caterpillar 235 and 245 excavators. Other common names for this equipment are trackhoe, hydraulic excavator, and hoe.

Track-Mounted Draglines - would be primarily used in garnet extraction from wet panel mining sites. The size of equipment utilized would be Bucyrus Erie 30 B's. Draglines may be utilized with a large bucket for garnet extraction, or may have a suction tube attached for extraction. A suction dredge may also be used in dry panels.

Suction Dredge - would be primarily used in wet panels where soils may be unconsolidated and panels tend to slough or cave. The suction tube would be attached to a boom that reaches into the panel, extracts garnet, and transports it directly to pre-concentration machinery, or to a washer.

Dozers - would be used for topsoil stripping, overburden removal, and site regrading after mining. Some of the dozers would be equipped with Low Ground Pressure (LGP) pads, which would enable them to work in soft areas or on wet ground. The size of equipment utilized would be Caterpillar D-6 and D-8 dozers. LGP pads would not be advantageous for D-8 dozers. Other common names for this equipment are cat and swamp cat.

Pre-concentration Machinery - is a scaled down version of a jig plant. It would be used in the field at a multi-year location. It may also accompany, or be attached to, a wash plant.

Wash Plant - would be used during the preliminary processing of the garnet ore to separate gravel and rock from sand and garnet less than 5/16 of an inch in diameter. The plant would be track-mounted allowing it to be moved with the dragline as mining proceeds through the site. Other common names for this equipment are trommel and concentration plant. The wash plants would process approximately 6,000 tons of 5/16 minus material per year.

Twin Axle Dump Trucks - would be used to haul materials during all phases of the mining and processing operation. These trucks would typically have 10 to 12 cubic yard dump boxes.

Jig Plant - would be used for final separation of the garnet from the fine sand. Segregation of the garnet and sand would be completed using specific gravity separation. An internal recycling system would recycle all water used in the separation process. Two jig plants would be used during mining operations, one in Emerald Creek basin, and one in Carpenter Creek basin.

The jig plants that would be used in this mining operation are existing facilities that have a closed system of recycling water. Water is pumped from a recycle pond and used internally in the jig plant. The used water is gravity-fed downslope through an outwash plain and back into the recycle pond. The outwash plain allows the outflow to drop its sediment load before entering the recycle pond. This keeps the recycled water cleaner for later use and provides an area to periodically reclaim fine sediments. These sediments would be returned to active mining areas for reclamation. The recycle pond is designed to retain a 25-year, 24-hour storm event. Should discharge exceed this event, it would flow through a series of detention ponds before sheet flowing onto upland areas. A typical equipment layout for mining a wet panel is shown in Figure A-2.

2.2.1 Mining Components and Design Criteria

Mining Unit - Mining activities within each mining area would be completed in increments called mining units. Mining units are discrete locations defining where pre-mining and mining activities would be completed. Post-mining (reclamation and mitigation) activities would be completed in one unit at the same time pre-mining activities are being started in the next sequential mining unit.

Pre-Mining Activities - Preparations within each mining unit prior to mining are called pre-mining activities. Prior to mining, the permit area boundaries would be field surveyed, staked, and flagged for easy identification. Pre-mining activities within the mining units would include construction of siltation berms, installation of interceptor or diversion channels, construction of temporary haul roads, installation of culverts, removal of timber, and removal of topsoil. When these activities are completed, removal of garnet ore would begin.

Reclamation Activities - After the mining activities have been completed, reclamation activities to restore the topography, vegetation, and hydrology would be initiated. These activities are called reclamation or post-mining activities. Upon completion of these activities, the general topography, amount of wetlands, and biologic habitat would be reclaimed to similar to the pre-mining conditions. These activities would be based on replacement and compensatory mitigation guidelines and designs discussed in detail in section 3.2 and 3.3 of this appendix.

Existing Roads - These roads are part of the existing road system in and adjacent to the St. Maries River floodplain. Current use includes vehicle and truck traffic for recreation, logging, and mining activities. Construction and maintenance of these roads is the responsibility of the counties, Potlatch Corporation, USFS, ECG, and other private landowners. These roads are permanent roads, serving multiple uses, and would remain open after mining is completed. These roads include Highway 3, Emerald Creek Road, and Carpenter Creek Road.

Temporary Roads - These roads currently do not exist or are old, abandoned roadbeds. They would be constructed or improved as part of the mining activities. Use of these roads would be for mining use only. They would be constructed to provide access into specific mining units when short roads to the existing road system are not feasible because of stream crossings, site distances, and safety criteria. Construction of the roads would be part of the pre-mining activities. Roads would be sloped from the cutslope to the fill slope with a roadside ditch along the fill slope to capture and convey storm waters into and through catch basins. All design criteria would be implemented to meet or exceed the minimum requirements of BMP III.11 in *Best Management Practices for Mining in Idaho* (Idaho Department of Lands [IDL] 1992). Roads would be removed when the mining has been completed within the mining area accessed by the road. These roads would be mined as the area they access is completed. They would then be recontoured and planted per reclamation designs and would no longer provide access into the mined areas.

Haul Roads - These roads currently do not exist and would be constructed as part of the mining activities. Use of these roads would be for mining use only and would be constructed to provide access from specific mining units to the existing road system or to a temporary road. Construction of the road would be part of the pre-mining activities. The road would be removed when mining within the mining unit accessed by the haul road has been completed. These roads would be mined as the mining unit they access is completed. Stormwater from haul roads would be handled by mining unit BMPs, including siltation berms and interceptor/diversion channels.

Culverts - These structures would be installed to convey water under all types of roads for all types of channels. Culvert size would depend on the type of channel being crossed, duration of installation, and the drainage area upstream of the culvert. Table A-2 shows culvert sizes that would be used with interceptor and diversion channels. In addition, 12-inch to 24-inch diameter culverts would be used where necessary to convey temporary road waters beneath the road.

Table A-2. Culvert Sizing for Interceptor and Diversion Channels

Drainage Area (square miles)	*Design Flow (cubic feet per second [cfs])*	*Culvert Diameter (inches)*	*Culvert Slope (Percent)*
1.0	38	48 circular	0.5
2.0	77	60 circular	0.5
4.0	154	66 circular	1.0
6.0	230	78 circular	1.0
8.0	307	90 circular	1.0
10.0	384	90 circular	1.5
12.0	460	102 circular	1.5

Note: Design flows for Diversion and Interceptor Channels will be calculated using average daily flow with a 25-year recurrence interval as the design criteria.

Source: ECG 1999

Circular culverts up to 144-inches in diameter would be 1 piece with 3 x 1-inch corrugations. Multiple smaller pipe installations would be acceptable as long as total flow area of multiple pipe equals 110 percent of single pipe flow area. ECG may employ single or multiple pipe installations at their discretion, depending upon initial cost and available stock on hand.

Culverts would be installed using BMPs described in section 2.4 to avoid stream sedimentation from scouring around roads, culverts, and streambanks. All design criteria would be implemented to meet or exceed the minimum requirements of BMP III.6 in *Best Management Practices for Mining in Idaho* (IDL 1992).

2.3 Best Management Practices and Other Avoidance Mitigation Incorporated into Proposed Mining Plan

Three types of mitigation have been incorporated into the proposed mining plan: 1) Mining BMPs, 2) BMP Implementation and Surface Water Management, and 3) Pre-flood Shutdown Criteria and Procedures.

2.3.1 Mining BMPs

Successful implementation of a mining plan for each of the specified mining areas would require the construction of specific structures, or utilization of specific construction techniques to meet erosion and non-point discharge criteria. These structures and construction techniques have specific uses and when installed correctly would satisfy State of Idaho BMPs for both dredge mining permits and water quality certification as established in *Best Management Practices for Mining in Idaho* (IDL 1992). Where applicable, design criteria as specified by IDL and installation specifications are provided. Schematics of BMPs can be found in Appendix 10.1 of the Plan of Operations (ECG 2002). Figure A-3 shows a schematic of BMP's described and discussed in this section.

<u>Siltation Berm</u> - These structures would be installed around the annual mining unit to capture and contain all surface runoff within the mining unit. They would not be designed to keep river floodflows from entering the annual mining unit. The berms would be impermeable, preventing water from leaving the mining unit. All berms would remain in place through the first winter after

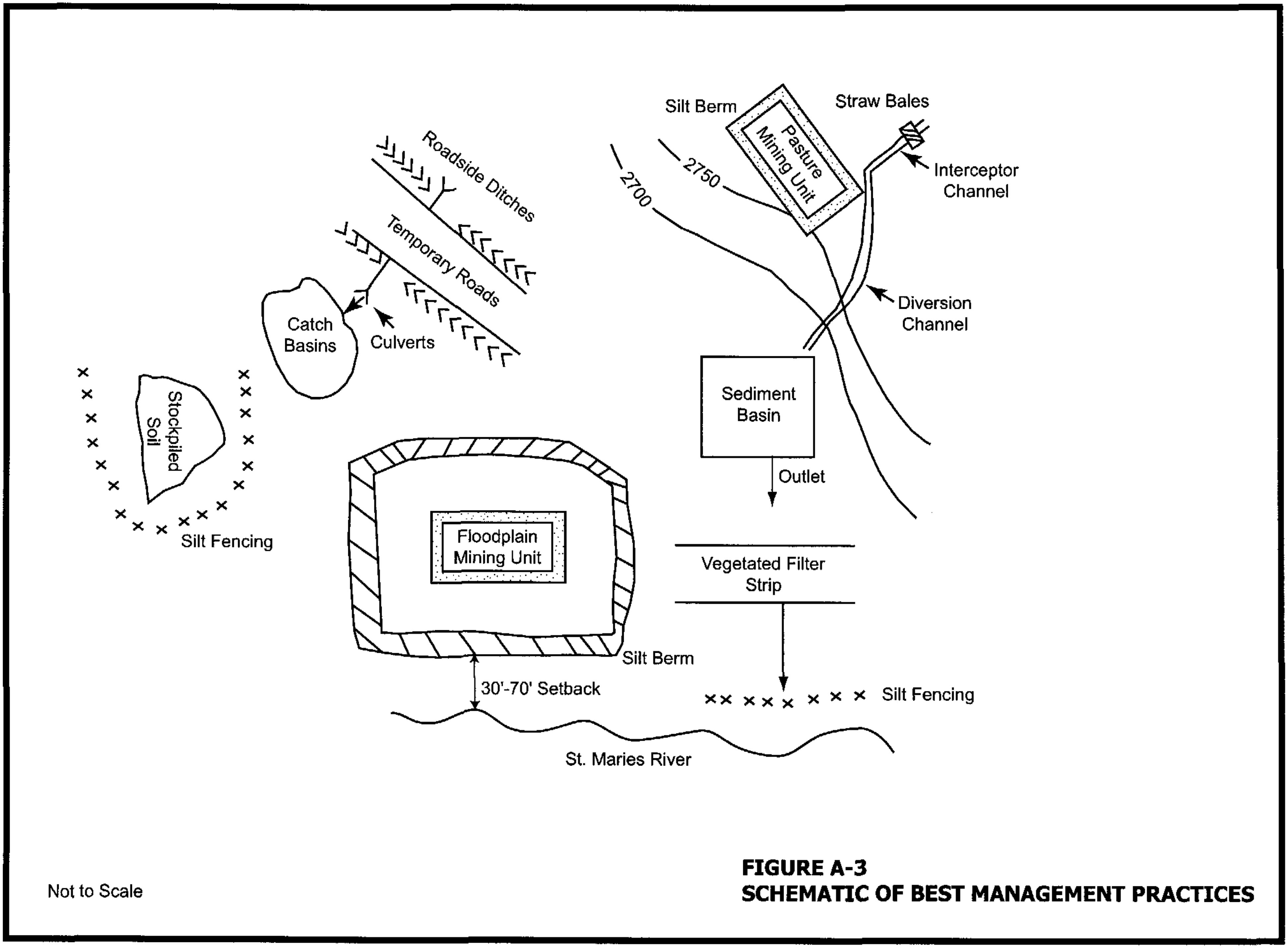


FIGURE A-3
SCHEMATIC OF BEST MANAGEMENT PRACTICES

all mining activities and rough grading have been completed. The berms would be removed the second spring as topsoil is being replaced, and prior to seeding. A typical installation would include berms installed along the river top-of-bank and the upstream and downstream boundaries of the mining unit. A typical siltation berm is shown in Figure A-4. All design criteria would be implemented to meet or exceed the minimum requirements of BMP III.4 in *Best Management Practices for Mining in Idaho* (IDL 1992). At a minimum, design criteria and construction specification for siltation berms would include:

Height	18 inches
Core Material	Compacted topsoil/subsoil
Surface Material	Topsoil/subsoil
Top Width	18 inches minimum
Sideslope	1V:2H
Berm Base Width	7.5 feet
Stabilization	Topsoil seeded with erosion control seed mix
Cover	Plastic sheeting for short-term installations that do not overwinter
Distance to river/creek	20 feet minimum

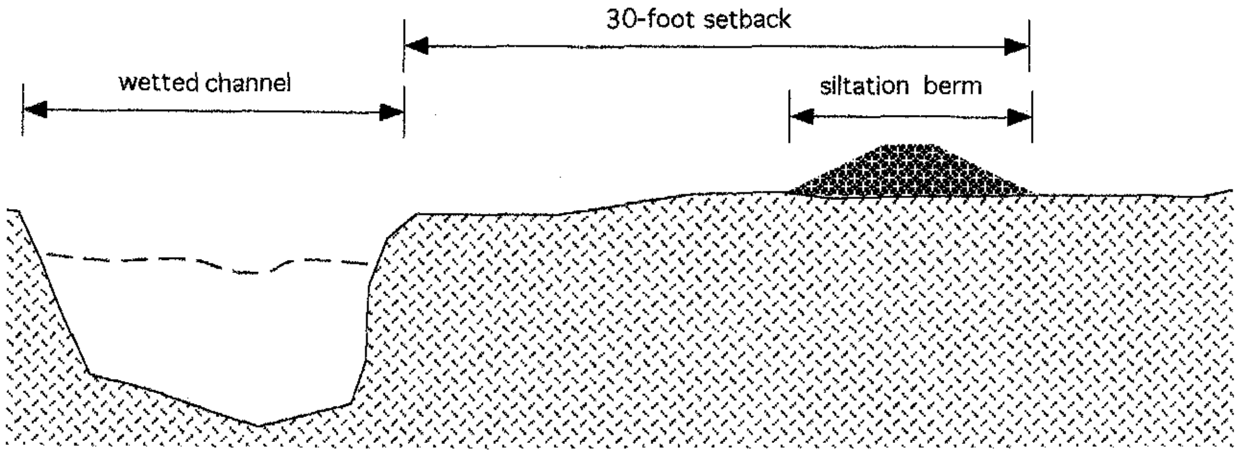
Stabilization Seed Mix - A seed mix would be used for siltation berm stabilization, interceptor and diversion channel stabilization, and upland revegetation. Other seed mixes would be used for wetland reclamation (refer to Selkirk Environmental 2000). Application of the seed mix would be completed when a siltation berm has been completed, interceptor or diversion channel excavated and bermed, or an upland regraded and topsoil respread. The seed mixture would be spread using a hand-held spreader, a trailer mounted hydroseeder, or grass drill at the rates shown in Table A-3. Application rates are based on desired percent composition and number of seeds per pound for each species. All design criteria would be implemented to meet or exceed the minimum requirements of BMPs II.3, II.4, II.5, and II.9 in *Best Management Practices for Mining in Idaho* (IDL 1992).

Table A-3. Stabilization Seed Mix

Scientific Name	*Common Name*	*Percent of Mix (by seed number)*	*Application Rate*
Dactylis glomerata	orchard grass	25	3.5 lb/ac
Festuca elatior	meadow fescue	20	6 lb/ac
Trifolium hybridum	Alsike clover	15	2 lb/ac
Trifolium repens	white clover	5	0.5 lb/ac
Phleum pratense	Timothy	15	1 lb/ac
Elymus glaucus	blue wildrye	5	3 lb/ac
Lolium sp.	annual ryegrass	15	10 lb/ac
		Total Application Rate	26 lb/ac

lb/ac = pounds per acre
Source: ECG 1999

Siltation Berm: This berm would be constructed 22.5 feet back from the creek, and along the perimeter of the mining unit. These berms would have a core of gravel and cobble, a topsoil surface, a 1.5-foot minimum height, a 1.5-foot minimum top width, and a 1V:2H sideslope. Single season berms would be covered with plastic as shown below. Longer term berms would be stabilized with erosion control vegetation.



Typical Siltation Berm Cross Section

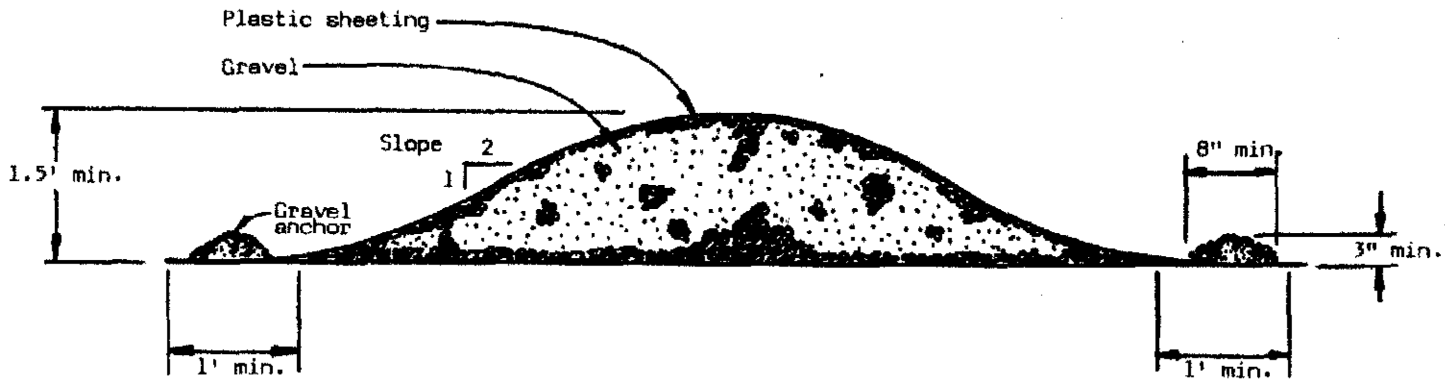


FIGURE A-4
TYPICAL SILTATION BERM

Catch Basins - These temporary structures would be used along temporary roads at the outfall of culverts and/or collection points of roadside ditches. These structures would be designed to detain stormwater, and capture the sediment load, preventing degradation of stream and river water quality. All design criteria would be implemented to meet or exceed the minimum requirements of BMP V.2 in *Best Management Practices for Mining in Idaho* (IDL 1992). At a minimum, design criteria and construction specification for catch basins would include:

Depth	12 inches
Bottom Width	12 inches
Bottom Length	24 inches
Gradient	0 to 0.5 percent maximum
Sideslope	2:1
Excavation Spoil	Removed from site
Stabilization	Erosion control seed mix

Silt Fencing and Straw Bales - These structures would be installed to prevent sediment from entering a specific area or body of water. The structure would be constructed to create a physical barrier that allows sediment to deposit, and water to flow through or over the structure. Use of silt fencing and/or straw bales would be on an as-needed basis for the following typical situations:

- Perimeter of stockpiled topsoil.
- Along stream banks during culvert placement/removal.
- During temporary road construction/improvement when activities would be within 30 feet of a channel.
- During interceptor/diversion channel and sediment basin construction/reclamation when equipment and/or bare ground would be within 30 feet of a channel.
- During storm/flood events if process waters leak beneath an established silt berm.
- During storm/flood events if surface water overtops an interceptor/diversion channel, or sediment basin.

All design criteria would be implemented to meet or exceed the minimum requirements of BMP V.4, (silt fencing) and BMP V.1 (straw bales) in *Best Management Practices for Mining in Idaho* (IDL 1992).

At a minimum, design criteria and construction specification for silt fencing would include:

Height	24 inches minimum
Anchors	steel or wooden posts at least 12 inches deep, 24 inches high
Trench	6 inches deep at uphill side of fence location
Silt Fence	Geotextile fabric placed in trench and covered with rock

At a minimum, design criteria and construction specification for straw bales would include:

Height	18 inches minimum
Anchors	2-1/2" x 48" rebar or wooden stake per bale
Embedding depth	6 inches
Core Material	Standard straw or hay bales

Interceptor Channels - These structures would be constructed upslope of the mining unit to collect overland runoff and convey it around the mining unit. The channel would be constructed using an excavator or dozer with the spoil material placed along the downslope edge of the channel. In some locations, a biofiltration system would be installed near the end of the channel for sediment removal. This system would consist of a low gradient section of channel seeded with a mixture of hydrophytic plants. A typical installation would include the interceptor channel with the downslope berm, a sediment basin at the downstream end of the channel, and a 30-foot vegetated biofilter strip with undisturbed existing vegetation between the basin and stream or river. All design criteria would be implemented to meet or exceed the minimum requirements of BMP III.2 in *Best Management Practices for Mining in Idaho* (IDL 1992). All interceptor channels would be constructed to the following design criteria and construction specifications and would be designed to receive water from areas of 0.5 square miles:

Depth	24 inch minimum
Bottom Width	24 inch minimum
Sideslope	1V:2H or less
Channel Slope	1.5 to 2.0 percent maximum
Stabilization	stabilization seed mix
Design Flow	25-year, 24-hour storm event from a 0.5 square mile watershed

Diversion Channels - These structures would be constructed upslope of the mining unit to collect overland and tributary flow and convey it around the mining unit. The channel would be constructed using an excavator or front-end loader with the spoil material placed along the downslope edge. Channel gradient must be minimized to prevent erosion within the diversion channel. In some locations, an interceptor channel would be merged into a diversion channel to prevent construction of multiple channels along the edge of the mining unit. Also a biofiltration system may be installed near the end of the channel for sediment removal. This system would consist of a low gradient section of channel seeded with a mixture of hydrophytic plants. A typical installation would include the diversion channel with the downslope berm, a sediment basin at the downstream end of the channel, and a 30-foot vegetated biofilter strip with undisturbed existing vegetation between the basin and stream. All design criteria would be implemented to meet or exceed the minimum requirements of BMP III.1 in *Best Management Practices for Mining in Idaho* (IDL 1992). Diversion channels would not receive water from an area exceeding 0.5 square miles. All diversion channels would be constructed to the following design criteria and construction specifications:

Depth	24 inches minimum
Top Width	24 inches minimum but dependent on flow
Sideslope	1V:2H or less
Channel Gradient	1.5 to 2.0 percent maximum
Design Flow	25-year, 24-hour storm event from a 0.5 square mile watershed

Sediment Basins - Sediment basins would be constructed at the downstream end of all interceptor and diversion channels. The basins would be designed to detain runoff from 25-year, 24-hour storm events for a 0.5 square mile area. The basins would be designed to allow settling of suspended sediments and to allow trapping of organic debris. All design criteria would be implemented to meet or exceed the minimum requirements specified by the State of Idaho (IDL 1992) for design of these structures. If the design capacity for a basin is exceeded during a storm event, water would discharge over a long crest with a uniform elevation on the downslope edge. Water would be discharged onto a minimum 30-foot vegetated biofilter strip of undisturbed, native vegetation on the existing floodplain where further settling of sediments would occur. All design criteria would be implemented to meet or exceed the minimum requirements of BMP V.6 in *Best Management Practices for Mining in Idaho* (IDL 1992). At a minimum, design criteria and construction specification for sediment basins would include:

Depth	24 to 36 inches
Top Width	48 to 72 inches
Gradient	0 to 0.5 percent maximum
Excavation Spoil	removed from site
Distance From River	30 feet minimum of vegetated buffer strip

Vegetated Biofilter Strip - Vegetated biofilter strips would be used at the outflow of all sediment basins and adjacent to temporary roads. The vegetated biofilter strips would be located to slow storm waters, trap sediments, and biofilter any surface flow before it enters a stream or river. All design criteria would be implemented to meet or exceed the minimum requirements of BMP V.2 in *Best Management Practices for Mining in Idaho* (IDL 1992). At a minimum, design criteria and construction specification for vegetated biofilter strips would include:

Minimum Width	30 feet
Vegetation	emergent groundcover/native shrubs
Gradient	0 to 0.5 percent maximum

2.3.2 Mining BMP Implementation and Surface Water Management

BMPs would be implemented for both mining and reclamation activities. Certain BMPs implemented during mining would continue to be used during reclamation.

Management of surface water runoff within each permit area would be completed by focusing activities within the active mining units. BMPs in previously mined areas would be minimized to allow these areas to re-establish pre-mining surface drainage patterns and groundwater regimes as quickly as possible.

Surface water runoff within each of the proposed mining areas would be managed using the mining unit as the boundary as specified in the annual mining plan (see Figure A-5 for the first year mining plan and section 9.0 of the Plan of Operations, ECG 2002). For each mining unit, an annual stormwater management plan would be implemented beginning with the pre-mining activities. A siltation berm would be constructed along all sides of each floodplain mining unit prior to mining to prevent any surface water from leaving the mining unit or entering the stream. A siltation berm would be constructed along each side, and along the down-slope end of each pasture mining unit, prior to mining.

Interceptor and/or diversion channels would not be used in conjunction with floodplain mining units since there is no water from an upper watershed to capture. An interceptor channel would be constructed along the upslope boundary of each pasture mining unit to prevent natural surface runoff from the surrounding sideslopes from entering the mining unit. A diversion channel would be constructed where water from a seasonal drainage is intercepted. Water collected by the interceptor or diversion channel would flow into a sediment basin and then onto the undisturbed existing vegetation adjacent to the mining unit.

The silt berms and interceptor or diversion channels would be kept in place through the first winter and subsequent high flow period to prevent storm waters and seasonal run-off from leaving the mining unit. They would be removed the first summer after mining when topsoil is re-spread and the mining unit is seeded.

Temporary or haul roads would provide access into and out of the mining unit. Culverts would be installed to convey all water under the road and prevent blockage of the channel, as necessary. Straw bales, silt fencing, and erosion control seed mixes would be used to prevent water quality degradation during culvert placement, and to stabilize all areas of disturbed soil. Haul roads would not be constructed over the siltation berms to prevent a weak or low area in the berm from being created.

Overland runoff within the active mining unit would occur as a result of rainfall or snowmelt within the boundary of the unit. Interceptor or diversion channels and silt berms would prevent overland flow from outside the mining unit reaching the interior portions of the mining unit. Due to the construction of the impermeable siltation berm, any overland runoff generated within the mining unit would accumulate in the mining panels or the lowest corner of the mining unit, and would be contained within the mining unit. If a large amount of water begins to accumulate along the berms, a 5,000-gallon water tank would be brought on-site to pump the water out of the mining unit and released to an upland area in a manner that would prevent entry into surface waters.

A Surface Water Management Team would be established to insure proper BMP construction, to inspect BMP integrity, and to specify BMP maintenance requirements. This team would be composed of the Operations Manager, the Field Foreman, and the Company (ECG) Environmental Specialist. They would be responsible for correct implementation of BMPs and long-term maintenance and monitoring of BMPs, as described in section 8.1, Plan of Operations (ECG 2002).

2.3.3 Pre-flood Shutdown Criteria and Procedures

The mining plan incorporates the following avoidance mitigation and mining operation safeguards which are intended to minimize potential flood-related impacts:

- Mining operations would not occur within the ordinary high water line (OHWL) of the St. Maries River. OHWL is defined as the edge of the wetted river channel during the annual high flow period. The annual high flow has been determined to be 724 cfs (see Appendix G of the EIS, Hydrology/Water Resources). The OHWL would be visually determined in the field by identification of the topographic position where the unvegetated channel meets the vegetated top-of-bank.

- Mining would not occur within 30 feet of OHWL.

- Wet mining panels would not be constructed within 70 feet of OHWL.

- Permanent stream channels crossing the floodplain would not be mined.

- Mining operations would not occur when BMPs proper function is limited by excessive surface runoff.

The proposed mining timeframe is year round, as long as designed BMPs are functioning properly. Short-term hydrologic conditions and other climatic factors including snow, rain, extreme freezing conditions, and access factors including road closure and road stability may necessitate a temporary suspension of mining. The determination to temporarily suspend mining would be based on proper functioning of BMPs, and on real time storm and flood forecasting.

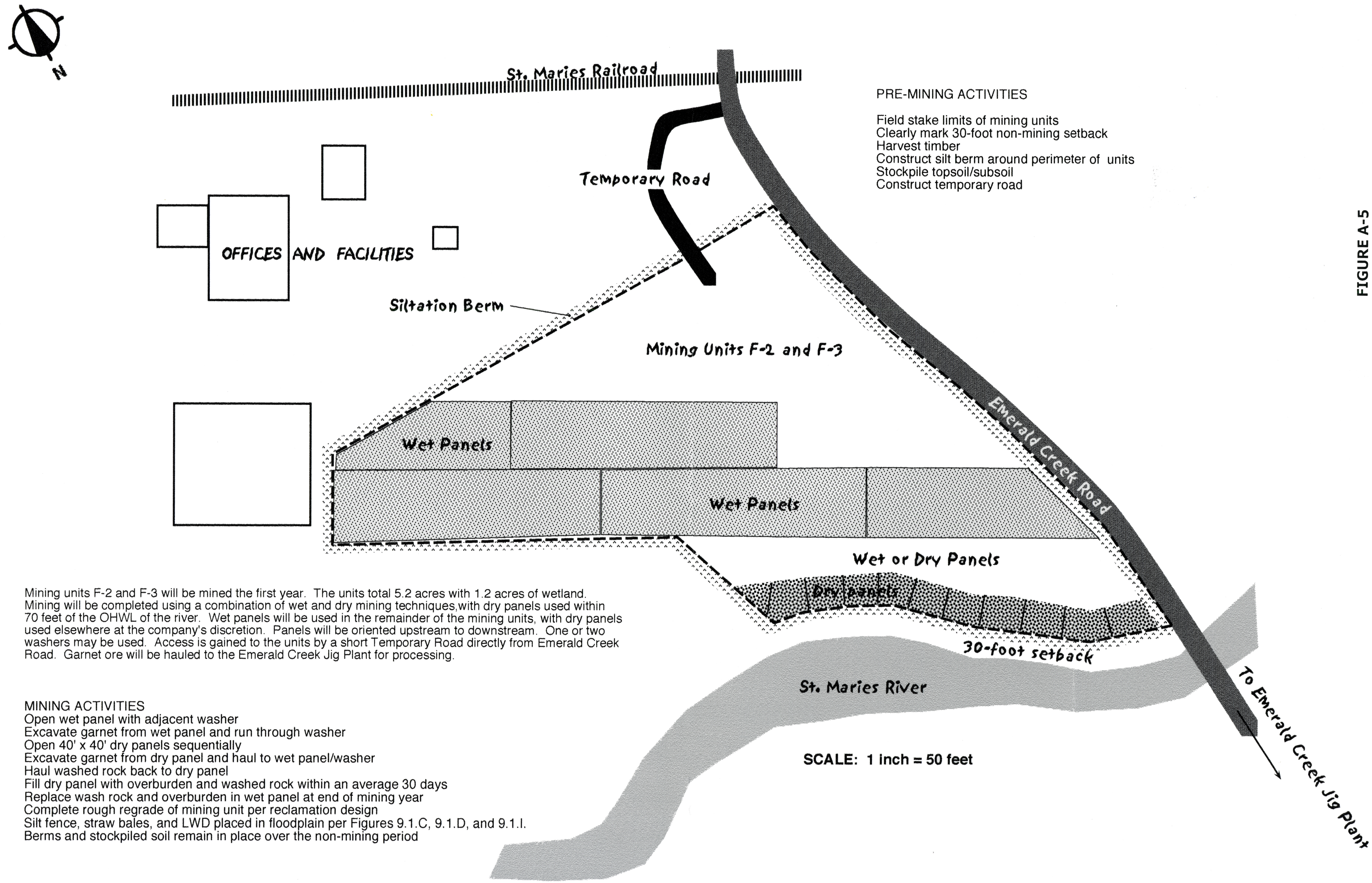
In order to anticipate the need for implementation of shutdown procedures, specific duties would be assigned to a Mining Management Team. This team consists of the Operations Manager, the Field Supervisor, and the Company (ECG) Environmental Specialist. The Operations Manager is responsible for monitoring real-time storm and flood forecasting. The Field Supervisor and Environmental Specialist are responsible for monitoring the effective operation of BMPs, maintaining those BMPs, alerting the Operations Manager when BMPs are near or at capacity, and implementing shutdown protocol when directed. The Operations Manager is responsible for ordering discretionary implementation of shutdown protocol when BMP conditions or forecasting information provide sufficient evidence that shutdown is necessary.

BMPs may approach capacity during adverse weather conditions before a flood is forecast, or before a flood event affects the proposed permit areas. In this case, if <u>any</u> of the following criteria are met, mining activities would be suspended until conditions change and criteria can be met.

- Interceptor and/or diversion channels are not carrying all flow around the mining unit.

- Culverts in interceptor and/or diversion channels are not passing all flow through the structures.

- Settling and dispersion basins are not collecting bedload, suspended sediment, and organic debris.



PRE-MINING ACTIVITIES

Field stake limits of mining units
Clearly mark 30-foot non-mining setback
Harvest timber
Construct silt berm around perimeter of units
Stockpile topsoil/subsoil
Construct temporary road

Mining units F-2 and F-3 will be mined the first year. The units total 5.2 acres with 1.2 acres of wetland. Mining will be completed using a combination of wet and dry mining techniques,with dry panels used within 70 feet of the OHWL of the river. Wet panels will be used in the remainder of the mining units, with dry panels used elsewhere at the company's discretion. Panels will be oriented upstream to downstream. One or two washers may be used. Access is gained to the units by a short Temporary Road directly from Emerald Creek Road. Garnet ore will be hauled to the Emerald Creek Jig Plant for processing.

MINING ACTIVITIES
Open wet panel with adjacent washer
Excavate garnet from wet panel and run through washer
Open 40' x 40' dry panels sequentially
Excavate garnet from dry panel and haul to wet panel/washer
Haul washed rock back to dry panel
Fill dry panel with overburden and washed rock within an average 30 days
Replace wash rock and overburden in wet panel at end of mining year
Complete rough regrade of mining unit per reclamation design
Silt fence, straw bales, and LWD placed in floodplain per Figures 9.1.C, 9.1.D, and 9.1.I.
Berms and stockpiled soil remain in place over the non-mining period

FIGURE A-5
FIRST YEAR MINING PLAN

- Discharge from sediment basins is not spreading over the floodplain.

- Runoff originating from within the active mining unit is not contained within the mining unit.

In addition to temporary suspension of mining when BMPs are near or at capacity, mining would also be suspended when real-time storm and flood forecasting predicts a flood event. During December, January, February, and March, the Operations Manager would retrieve storm and flood forecasts at the beginning, middle, and end of each day, including weekends. Specifically, the Idaho Bureau of Disaster Services and National Oceanic and Atmospheric Administration weather forecasts and flood warning system would be accessed and monitored. If a flood forecast of any flood size is received, the Operations Manager would order a suspension of all mining activities in flood-prone areas. ECG can shut down field operations, mobilize all equipment, and relocate all equipment outside the flood-prone area in a 4-hour timeframe. As a safety margin, ECG would react in time to suspend all mining at least 8 hours before a flood is expected. As an example, if a flood is forecast for 1800 hours on Tuesday, ECG would implement shutdown, mobilization, and relocation of all equipment at 0600 hours Tuesday, and have all procedures completed by 1000 hours Tuesday. If a flood is forecast for 1200 hours on Monday, ECG would implement shutdown, mobilization, and relocation of all equipment at 1600 hours Sunday, and have all procedures completed by 2000 hours Sunday.

Mining would remain suspended until surface runoff and stream flow return to manageable conditions, and all BMPs are functioning within their capacities. A National Pollutant Discharge Elimination System (NPDES) permit would be in place that would address an accidental release of sediment-laden water during an extreme flood event.

Under this plan, shutdown or suspension of mining means no equipment is operating in a flood-prone area, and no equipment is stored in a flood-prone area. Shutdown or suspension of mining does not mean that wet panels would be closed as part of the shutdown process. Wet panels are, at a minimum, 80 feet x 100 feet (normally 80 feet x 300 feet) in size and may take several months to close, even during the best reclamation time in the summer months. Water must be pumped out of the wet panels and the accumulated silt must be allowed to dry, before the area is firm enough to use grading equipment to close the panel. This cannot be accomplished in a short timeframe and still maintain a degree of effectiveness.

2.4 Description of Mining Activities

ECG would mine annual mining units using various dredge mining techniques and equipment as described earlier. Areas of topsoil and overburden would be stripped and stockpiled, the garnet bearing gravels would be extracted with different types of dredge equipment, and the extracted material would be taken to an on-site concentration facility. Washed rock from the concentration facility would be used as backfill, overburden would be replaced, and the site would be final graded with topsoil and seeded.

In compliance with *Best Management Practices for Mining in Idaho* (IDL 1992), ECG would employ a 30-foot mining setback (i.e., mining would not occur within 30 feet of the St. Maries River). A siltation berm would be constructed in the inner 7.5 feet of the setback. This provides a 22.5-foot greenbelt that would ensure a 30-foot setback from excavation activities.

These mining activities are applicable to all mining alternatives. Wet and dry panel mining would be employed in all mining units. Wet panels allow the concentration of garnet before it is transported out of the mining unit. This is an essential cost-saving step in the mining process. Dry panels would be used within close proximity to the river (i.e., within 30 to 70 feet), in narrow areas, and elsewhere as appropriate. Wet panels would not be used within 70 feet of the river, but would be used elsewhere as appropriate.

Wet and dry panels would be no deeper than the garnet-laden alluvial gravel, approximately 8 to 20 feet. The underlying Clarkia clays would not be penetrated. Wet panels are deliberately filled with water during the mining process. Dry panels are only wet when groundwater is encountered. Groundwater is expected to be roughly 30 inches to more than 60 inches deep during the mining period. Therefore, dry panels can be expected to hold groundwater, but to have at least 30 inches of dead storage, and possibly more than 5 feet of dead storage.

Within each mining unit, pre-mining and mining activities would occur in one year, and reclamation (post-mining) activities would occur over a one to two year period. Pre-mining activities would take place once site conditions are favorable for mining. As described in the Plan of Operations (ECG 2002), pre-mining activities include

- marking extent of mining unit in field,
- establishing 30-foot mining setback,
- harvesting of commercial timber, harvesting and storage of non-commercial timber for reclamation BMPs and special habitat features,
- construction of siltation berms,
- construction of interceptor and/or diversion channels,
- construction of sediment basin,
- stockpiling of topsoil,
- construction of temporary and haul roads, and
- placement of culverts.

Mining would start once all pre-mining activities have been completed. Mining activities include

- opening a wet panel by stockpiling overburden and locating a washer adjacent to the wet panel,
- withdrawing water from the river to fill the initial wet panel,
- excavating garnet layer from wet panel and run through washer,
- opening 40 foot x 40 foot dry panels sequentially and stockpile overburden,
- excavating garnet layer from dry panel and haul to wet panel/washer,

- hauling washed rock back to dry panel,
- replacing overburden in dry panel when done, within an average of 14 days,
- replacing wash rock and overburden in wet panel and close at end of mining year, and
- completing rough regrade of mining unit to meet reclamation specifications.

These pre-mining and mining activities would all be completed in one year and would be discontinued for the year if criteria and safeguards described in section 3.4 cannot be met. Siltation berms, interceptor or diversion channels, sediment basins, and stockpiled topsoil would remain in place through the first winter and subsequent high flow period. Reclamation activities would take place for one to two years following mining as described in section 3.0, Proposed Reclamation Plan.

2.5 Typical Mining Sequences

Mining Areas C and E are described in this section as a conceptual example of sequencing annual mining units. The sequence is shown graphically in Figure A-6, Conceptual Mining Sequence. Mining in two or more units per year reduces costs by "coupling" a higher concentration mining unit with a lower concentration mining unit, allows flexibility in the size of garnet mined, and provides a consistent and predictable annual revenue flow to ECG and other landowners. The mining sequence is based on the following mining parameters:

- One to three mining units may be mined each year.
- One or two washers would be used per mining unit, depending on mining unit size and garnet concentration.
- An average of 10,000 to 20,000 tons per year would be mined.

Figure A-6 shows 14 annual mining units in the river floodplain, labeled F-1 to F-14, and shows 4 annual mining units in a pasture, labeled P-1 to P-4. Table A-4 shows a sequence of annual units that demonstrates the conceptual approach to mining these two mining areas.

Table A-4. Yearly Mining Sequence for Mining Areas C and E

Year	*Annual Units*	*Total Acreage*	*Wetland Acreage*
1	F-2, F-3	5.2	1.2
2	F-4, P-1	9.5	2.7
3	F-5, F-7, P-2	15.2	10.7
4	F-6, F-11, P-3	20.2	10.7
5	F-8, F-9	8.3	4.1
6	F-13, F-14, P-4	29.8	13.8
Final	F-1, F-10	11.3	2.5

Source: ECG 2002

This sequence may be altered on an annual basis to provide needed flexibility to satisfy market conditions, weather conditions, and landowner requirements. The orientation and sequencing of the annual mining units is designed to maintain at least 50 percent of the existing floodplain width in most cases. The orientation and sequencing is also designed to allow for rapid reclamation immediately following mining.

2.6 Phasing of Existing and Proposed Mining Activities

Proposed mining activities would be phased into existing mining activities in the Emerald and Carpenter Basins. The production and reclamation phasing is discussed below.

2.6.1 Production Phase

The goal of ECG is to mine enough garnet from the proposed mining areas (St. Maries River floodplain) to mix with the production from currently permitted areas (upper Emerald and Carpenter Creek Basins). This would allow ECG to provide the grade of garnet products required to meet current market demand. This means that ECG would be able to mine coarser material in the upper drainages while mining fine materials from the river floodplain areas. The demand for coarse or fine garnet in any given year would, to large degree, determine how much mining is scheduled in the upper drainages rather than the river floodplain area. This would also allow ECG to provide natural fine garnet to its higher end market, and reduce the need to crush larger garnet to meet fine garnet demand.

2.6.2 Reclamation Phase

The integration of existing and proposed mining areas would allow proper scheduling and efficiency in reclamation activities. The Emerald and Carpenter drainages may require additional reclamation time for construction and stabilization of temporary and permanent stream channels. This time element constrains mining opportunities in these basins. When such a time constraint occurs, mining would be concentrated on the proposed mining areas. This would allow reclamation to proceed quickly without sacrificing production goals.

The opposite of this may also occur since oxbow construction would precede oxbow mining in the proposed mining areas. The necessity of oxbow construction may limit the number of mining units available in the proposed mining areas. If this occurs, mining can be focused in the Emerald and Carpenter basins without a loss in production.

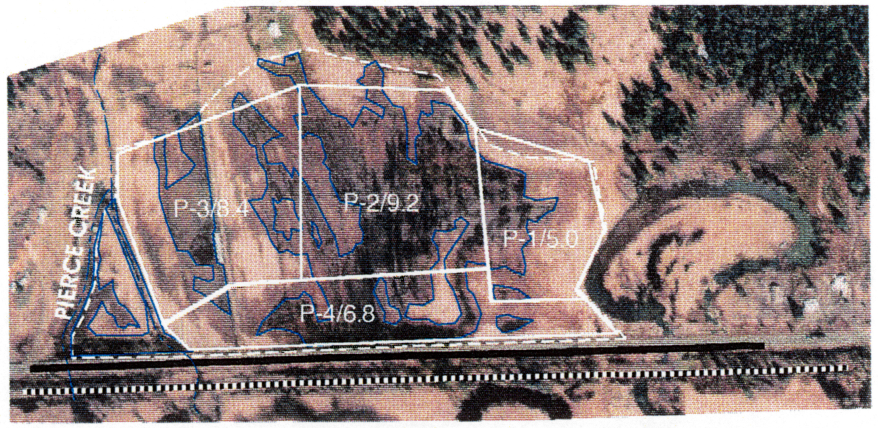
The following is a probable sequence for the merging of existing mining areas and proposed mining areas within a five-year timeframe:

<u>Year 1</u> - Concentrated mining in proposed areas to allow existing areas to stabilize and to construct permanent and temporary stream channels.

<u>Year 2</u> - Concentrated mining in proposed areas to provide enough acreage to construct oxbows and special features, before mining existing oxbows.

<u>Year 3</u> - Concentrated mining in existing areas to allow construction of oxbows and reclamation in proposed areas.

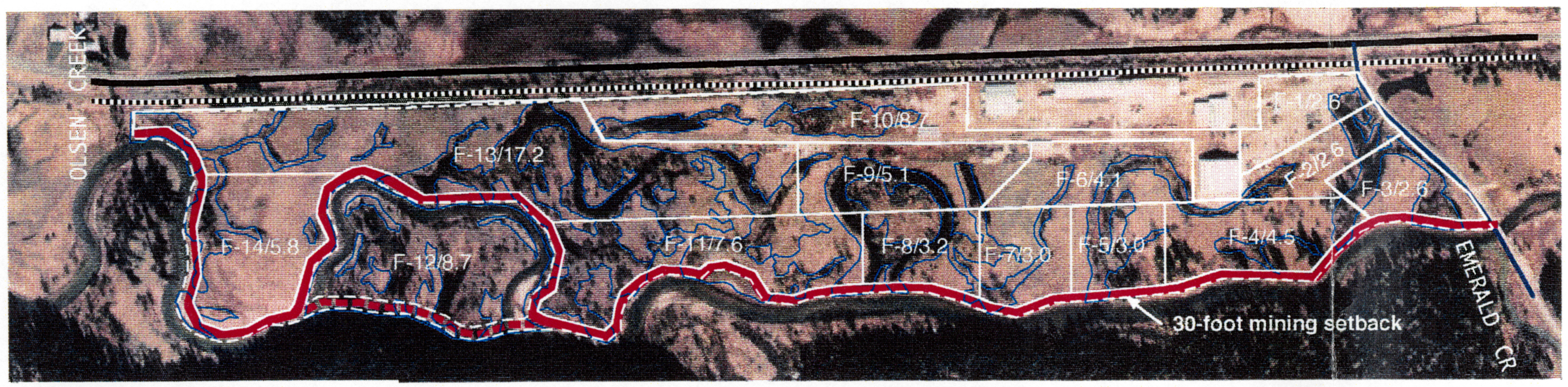
SCALE: 1 inch = 660 feet



LEGEND

- MINING AREAS
- STREAMS
- WETLANDS
- STATE HIGHWAY 3
- ST. MARIES RAILROAD
- ACTIVE MINING UNITS

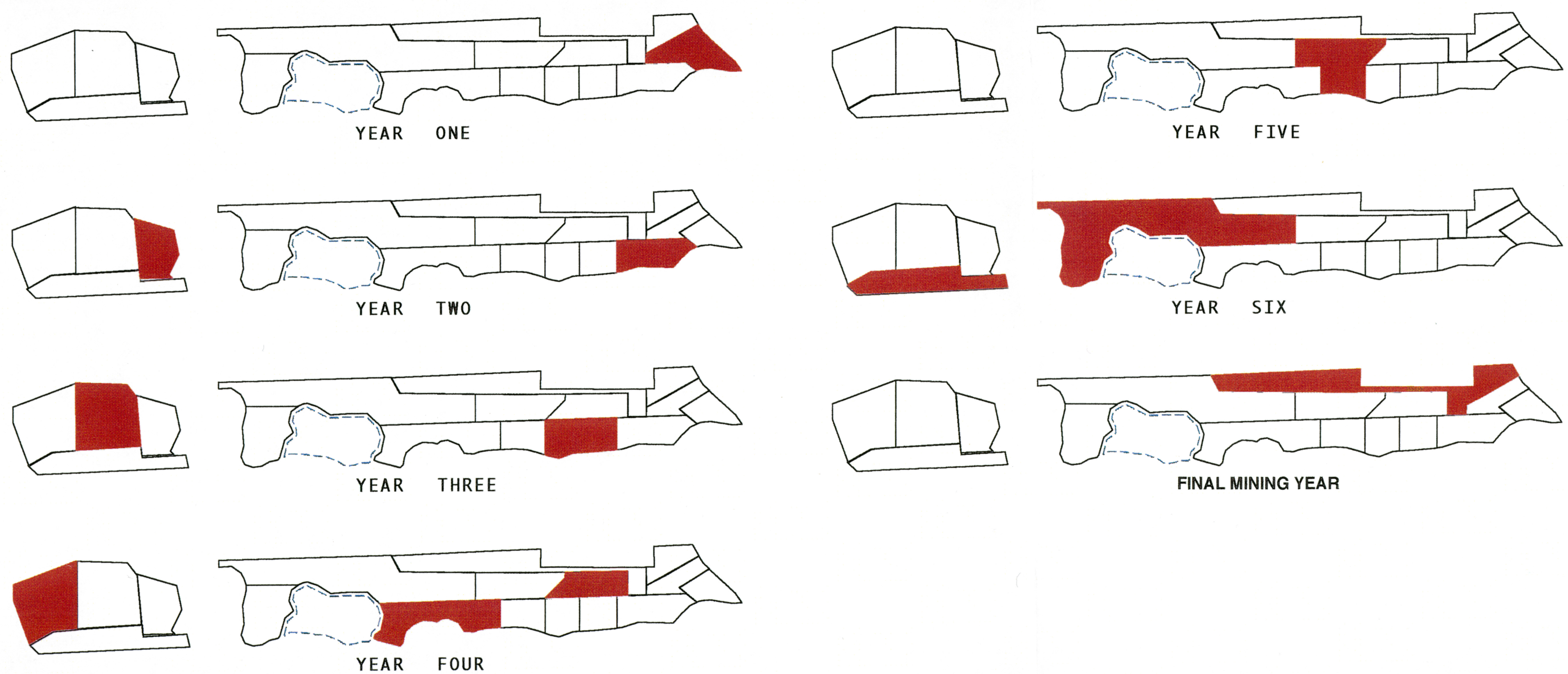
FIGURE A-6 CONCEPTUAL MINING SEQUENCE



CONCEPTUAL MINING SEQUENCE**

Year	Units
1	F-2 F-3
2	F-4 P-1
3	F-5 F-7 P-2
4	F-6 F-11 P-3
5	F-8 F-9
6	F-13 F-14 P-4
Final	F-1 F-10

** F-12 will not be mined unless access can be developed across the river, or unless the main channel becomes an oxbow while mining is on-going.



TYPICAL PRE-MINING ACTIVITIES

Construct silt berm(s)
Construct interceptor and/or diversion channel(s)
Construct sediment basin(s)
Stockpile topsoil/subsoil
Construct temporary and haul road(s)
Place culvert(s)

TYPICAL MINING ACTIVITIES

Open wet panel with adjacent washer
Excavate garnet from wet panel and run through washer
Open 40' x 40' dry panels sequentially
Excavate garnet from dry panel and haul to wet panel/washer
Haul washed rock back to dry panel
Fill dry panel with overburden and washed rock within an average 30 days
Replace wash rock and overburden in wet panel at end of mining year
Complete rough regrade of mining unit per reclamation design
BMP's remain in place; topsoil/subsoil remains stockpiled through non-mining period

Year 4 - Mining in both existing and proposed areas.

Year 5 - Mining in both existing and proposed areas with reclamation continuing in existing areas with the establishment of stream channels, and in proposed areas with the establishment of oxbows.

In summary, by merging or phasing mining activities in both existing and proposed mining areas it would be possible to sequence production to meet customer requirements and demand, and sequence reclamation activities to achieve reclamation goals and standards more efficiently.

3.0 Proposed Reclamation Plan

ECG has developed a detailed Reclamation Plan as part of the Plan of Operations that outlines reclamation timeframes, reclamation sequencing, detailed reclamation design concepts as well as reclamation monitoring and performance standards necessary to successfully complete reclamation of the proposed mining units and permit areas. This reclamation plan is the same for all mining alternatives, however it would require modification if any options of the Oxbow Avoidance Alternative are selected. The modification would reduce the reclaimed acreage in proportion to the mitigation ratio and the land ownership as described in section 4.6. Section 5.0 of the Plan of Operations (ECG 2002) and sections 4.0 and 5.0 of the Reclamation and Mitigation Concepts Report (Selkirk Environmental 2000) contain detailed discussions and figures and tables that relate to the following summary of proposed reclamation. The reclamation plan has the following key elements:

- Mining BMPs would remain in place through the first high flow season after mining has been completed. Siltation berms, interceptor or diversion channels, and sediment basins would be functional at this time, no panels are open, and no mining process water is present in the mining unit.
- Mining BMPs would be removed after the first high flow season during final grading to allow the normal hydrologic cycle to resume.
- Reclamation BMPs would be placed on the regraded mining unit after mining BMPs are removed, and would be maintained through two high flow seasons to abate flood flows, minimize local scour, and trap sediments.
- Topsoil would be spread to final grade and the mining unit seeded the first summer season after mining is completed.
- Irrigation would occur as necessary to assure seed and plant establishment.
- Wetland areas regraded and seeded the first summer season would be planted with woody species the second summer season.
- Oxbow complexes would be recreated before they are mined.
- Oxbow complexes would be constructed, seeded, and planted with woody species the second reclamation season.

3.1 Reclamation Timeframe

Reclamation activities would be undertaken during the drier summer and fall months, when surface water is not present and groundwater levels are at their deepest. This is the optimum timeframe for reclamation as it follows closely behind the completion of mining and provides dry conditions for spreading topsoil and excavating deeper aquatic systems, including oxbows.

Reclamation activities are undertaken in one season in areas being reclaimed to pasture lands, and in two seasons in active floodplain areas. Pasture reclamation is completed the first summer season after mining by removing mining BMPs, respreading topsoil, seeding a pasture seed mix, and irrigating as needed. Floodplain reclamation would take two seasons to complete. During the first season, the recently mined area would be rough graded to provide upland habitats, seasonally saturated wetland habitats, and shallowly inundated wetland habitats. This would be accomplished by following annual reclamation designs and undulating the floodplain as it is rough graded. Topsoil would be spread, the area seeded, reclamation BMPs installed, and fencing installed, prior to the start of winter.

During the second season, oxbows and other deeply inundated wetland areas would be excavated. Once these areas are excavated, they would be seeded (including mucky substrate from existing oxbows that would be mined) and all of the reclaimed unit would be planted with woody material. Any reclamation BMPs moved during excavation would be relocated for the second winter. During the third season, silt fencing would be removed. Woody materials and straw bales used as reclamation BMPs would be left in place to decompose.

The reclamation timeframes have been established to minimize soil loss and potential water quality degradation. This is achieved in two ways. The first is reclaiming only during the drier summer and fall months when surface water is not present within the reclaimed units. The second is the reliance on two seasons to complete reclamation. In this manner, the regraded overburden and stockpiled topsoil is protected during high flows by mining and reclamation BMPs, regraded topsoil has an established groundcover before becoming vulnerable to the first unprotected high flow period, and oxbow construction occurs in stabilized areas that have been graded and have an established groundcover.

3.2 Reclamation Guidelines

The following reclamation guidelines would be used as a framework for reclamation design development. These include replacement and mitigation guidelines outlined in the Temporary Wetland Impacts and Reclamation and Mitigation Concepts Report (Selkirk Environmental 2002b) and in Plan of Operations (ECG 2002).

Replacement guidelines are designed to offset temporary impacts to wetlands such as the temporary placement of fill associated with temporary and haul roads, topsoil and overburden stockpiles, and pads for excavators and wash plants. Mitigation guidelines are designed to offset temporal losses of wetland functions that return over time, and to provide wetland protection.

Guideline 1 (Replacement)

Reclamation of impacted wetlands would be accomplished at a 1:1 ratio on non-ECG properties (based on acreage of proposed temporary impacts). Wetland functions would be restored as quickly as possible. The pre-mined acreage of open water, emergent, scrub-shrub, and forested habitats would be incrementally replaced as reclamation follows mining. Riverine habitat would not be reclaimed because it would not be mined.

Guideline 2 (Mitigation)

Reclamation of impacted wetlands would be accomplished at a 1.7:1 ratio on ECG's property (based on acreage of proposed temporary impacts). Wetland functions would be restored as quickly as possible. The pre-mined acreage of open water, emergent, scrub-shrub, and forested habitats would be incrementally increased as reclamation follows mining.

Wetland habitats and functions would be reclaimed by replacing the pre-mining plant structure and hydrologic regime. Wetland functions would be replaced at their pre-mining values, some nearly immediately, others over time. Hydrologic support and groundwater exchange functions would be replaced once wetland reconstruction has been completed. Storm/flood water storage and abatement would be nearly replaced once wetland construction has been completed. Abatement would be maximized over time with woody plant growth. The goal is water quality improvement functions would be replaced once emergent and groundcover vegetation has been re-established. This takes approximately 3 growing seasons from ECG's past experience. Natural biologic functions for aquatic organisms is replaced once wetland reconstruction has been completed and hydrologic stratification is present. The same functions for terrestrial organisms would be replaced over time as woody vegetation matures and stratifies. The woody component would be functional within 5 years of wetland re-establishment.

Guideline 3 (Replacement and mitigation)

Reclamation would proceed at a rate that would minimize surface water quality degradation. Farmed wetlands (pasture and hay fields) would be reclaimed the first season following mining while native growth, floodplain wetlands would be reclaimed over a two year period following mining.

Farmed wetlands are separated from the active floodplain by Highway 3 and the adjacent railroad line. These areas would have the siltation berms and interceptor/diversion channels from mining in place, as well as all topsoil/subsoil stockpiled during the first high flow season after mining. These mining BMPs would be removed the first summer season after mining, topsoil/subsoil would be replaced to final grade, and all bare ground seeded with a pasture seed mix. Since flood protection is not imperative in these areas, activities guided by this goal may be accelerated into the mining year if seeding can occur prior to September 1, allowing time for seedling establishment.

Floodplain wetlands are immediately adjacent to the St. Maries River and receive annual high flows and frequent flood flows. These areas would have siltation berms from mining remain in place, and all topsoil/subsoil remain stockpiled the first high flow season after mining. These mining BMPs would assist in trapping sediments during high flows and flood flows, but they are not designed to impede flood flows. Reclamation BMPs, including silt fencing, straw bales, and/or large woody material, would be staggered across the regraded floodplain perpendicular to the river channel.

Reclamation BMPs would slow flood velocities, protect regraded overburden and stockpiled topsoil, and trap sediments. Siltation berms would be removed the first summer season after mining, topsoil and overburden would be replaced to final grade, and all bare ground seeded with various wetland and upland seed mixes. In this fashion, the replaced topsoil would have an established groundcover to protect it during typical winter and spring hydrologic patterns. Woody vegetation would be planted and oxbows would be constructed the second summer season after mining. Reclamation BMPs would be removed after the second high flow season, except for large wood that would remain as special habitat features (see Guideline 5).

Guideline 4 (Mitigation)

Six oxbow complexes were identified in Wetland Delineation Report (Selkirk Environmental 2002a) as having scrub-shrub and forested components, and having semi-permanent or longer duration inundation. Five of these wetland complexes occur in the proposed permit areas. They would be reconstructed in nearby, completed mining units before they are mined. These systems would be constructed after topsoil has been placed and groundcover established for one year. The oxbows would be excavated to pre-mining depths and configurations determined by cross sections and pre-mining aerial photography. These complexes would be inoculated with substrate from existing oxbows and planted with woody species endemic to the St. Maries basin. This process would reduce the overall recovery time and would minimize temporal losses of the most diverse wetland complexes.

Guideline 5 (Mitigation)

Reclamation designs would provide additional special habitat features to augment the natural biologic functions of the reclaimed wetlands. These special features include downed logs, snags, and forested upland pockets and corridors. Downed logs provide habitat for insects, small mammals, amphibians, and gallinaceous birds. Snags provide habitat for insects, passerines, woodpeckers, and predatory birds, including raptors. Forested upland pockets and corridors provide cover opportunities, primarily for ungulates. These features would be incorporated into annual site-specific reclamation designs for forested, scrub-shrub, and deeply inundated emergent areas.

Guideline 6 (Mitigation)

Mature trees would be replaced as mining proceeds so that a 230+ percent gain (4140/1754=2.36) in tree population is realized over the lifetime of the mining activities. Section 1.2 of the Plan of Operations (ECG 2002) describes the tree survey, as well as the number of trees retained versus the number of trees lost to mining. Tree re-establishment at this rate would be realized by

- providing a net increase in forested wetlands (at least 20 percent tree canopy) at a 1.40:1 ratio.
- providing a 5 percent tree canopy in all re-established scrub-shrub wetlands (replaced at a 1.15:1).
- providing 16.9 acres of upland forest.

Guideline 7 (Mitigation)

Riparian enhancement plantings would be incorporated into the reclamation designs on ECG's property. The mining plan proposes a 30-foot wide buffer along the St. Maries River. ECG has traditionally left a 30-foot setback between active mining and the stream channel based upon the State of Idaho dredge/placer mining permit (Permit Item 4). At times it has been necessary for ECG to ask IDL to reduce the setback to 15 feet in areas that are restricted for space and/or had poor reserves. Twenty-two and a half feet (22 ½ feet) of the buffer adjacent to the river would not be altered. A silt berm would occupy the remaining 7.5 feet of the buffer for a two-year period. This 30-foot wide area would be planted with native shrubs, and deciduous and coniferous trees where existing woody vegetation is lacking. This would occur after mining has been completed, when woody material is being planted in active reclamation areas.

These riparian plantings would provide additional cover for small mammals, passerines, and ungulates, detritus for the river system, and bank stabilization with deep root structures. At maturity, the trees would decay and topple, providing downed logs at top-of-bank and large woody debris (LWD) for the river system.

Guideline 8 (Mitigation)

Protection of the reclaimed wetlands from grazing would be provided by short- and long-term fencing.

Short-term fencing would be placed around the perimeter of each reclaimed mining unit until monitoring has been completed and the reclamation has been determined to be successful.

Two long-term fencing options would be employed. The first is placement of fencing around all clusters of planted trees in annually reclaimed units. The fencing would remain in place for different lengths of time, depending on stock size and growth rate. This option would be used on other, private ownership, and would be maintained by ECG.

Long-term perimeter fencing would be accomplished by extending short-term fencing as recently mined annual units are seeded and planted. This option would be used on ECG ownership, and would be maintained on an annual basis as long as ECG owns the property or until a new land use is proposed.

3.3 Reclamation Design Criteria

Design criteria for replacement of impacted wetlands and uplands is discussed in the following sections. Design criteria include conceptual grading plans, reclaimed wetland hydrologic support, and vegetation design concepts and planting plans.

3.3.1 Conceptual Grading Plans

Successful wetland reclamation is key to providing adequate wetland hydrology. In the post-mining landscape, this is readily accomplished by proper regrading and excavation. In the pasture environment of Mining Areas A and E (see Figure A-1), grading would be focused on creating a generally level landscape with limited seasonal inundation and saturation. In the active floodplain environments of Mining Areas C, D, and F (see Figure A-1), grading would seek to re-create a varied relief landscape featuring areas of saturation, seasonal inundation, semi-permanent inundation, and permanent inundation. Mining Area B would be regraded to create seasonal inundation and semi-permanent inundation. Grading variations of 6 inches to more than 48 inches would provide the topographic variability needed for hydrologic diversity.

Site-specific annual grading plans would be prepared for each mining unit. Annual grading plans would be based on existing topographic features of the various wetland habitats. The Plan of Operations (ECG 2000) contains surveyed cross sections of the various wetland habitats. All annual reclamation plans would be implemented during the end of the mining year, when overburden is being regraded. Grading stakes would be established with cut or fill requirements. An undisturbed wetland edge point in the buffer, or at OHWL, would become a benchmark to identify the cut or fill required at each grading stake. The result of this approach would be the re-creation of the pre-mining landscape with the goal of increasing the amount of semi-permanently and permanently flooded conditions.

Regrading during the end-of-mining each year would provide the necessary elevations for seasonally flooded/saturated and farmed wetland habitats. Excavation during the first season of reclamation would provide the necessary elevations for semi-permanently flooded and permanently flooded wetland habitats.

3.3.2 Reclaimed Wetland Hydrologic Support

Successful wetland reclamation is largely dependent upon restoration of sustainable hydrologic regimes. The grading plans would re-establish the pre-mining elevation changes between uplands, seasonally saturated areas, semi-permanently inundated areas, and permanently inundated areas. Hydrologic support in regraded areas would come from four sources: 1) seasonal flooding of the St. Maries River; 2) seasonally shallow groundwater associated with periods of groundwater recharge; 3) high in-channel flow; and 4) precipitation.

3.3.3 Vegetation Design Concepts

The principal goal of vegetation designs would be to replace the existing plant communities by seeding, planting, and transplanting most of the species present in the pre-mining state. The designs would serve as a 'blueprint,' establishing a source of plant material that would allow the post-mining landscape to be re-established as quickly as possible. Each wetland habitat, described in the wetland study (Selkirk Environmental 1999), has different vegetation types.

Wetland habitats would be reclaimed with one of two seed palettes - a wetland mix or a wetland pasture mix. Woody habitats would also be planted with shrubs and trees, including cottonwood, aspen, alder, willow, dogwood, hawthorne, and rose. Woody stock may be locally transplanted or commercially purchased. The established shrub habitat would have a forested component with a 5 percent aerial cover. The established forest habitat would have a forested component with a 20+ percent aerial cover.

The riparian corridor would be enhanced with the woody material described above plus additional species on topographic highs. These additional species include lodgepole pine, Engelmann spruce, grand fir, subalpine fir, snowberry, and serviceberry.

3.4 Reclamation Best Management Practices

The following are primary BMPs that would be employed during reclamation to control sedimentation, water volume, and release of storm waters in and around recently reclaimed areas.

Silt fencing, straw bales, and LWD would be installed to trap sediments, abate flood flows, and minimize scour on recently regraded landscapes. They would be staggered across the floodplain perpendicular to the direction of flood flow.

Design criteria for silt fences would be implemented to meet or exceed the minimum requirements of BMP V.4 in *Best Management Practices for Mining in Idaho* (IDL 1992). At a minimum, design criteria and construction specification for silt fencing would include:

Height	24 inches minimum
Anchors	steel fence posts at least 12 inches deep, 24 inches high
Trench	6 inches deep at uphill side of fence location
Silt Fence	Geotextile fabric placed in trench and covered with rock
Distance apart	20 to 25 percent of floodplain width
Location	Perpendicular rows
Row separation	40 to 50 percent of floodplain width

Design criteria for straw bales would be implemented to meet or exceed the minimum requirements of BMP V.1 in Best Management Practices for Mining Idaho (IDL 1992). At a minimum, design criteria and construction specifications for straw bales would include:

Height	18 inches minimum
Anchors	2-1/2" x 48" rebar per bale
Embedding depth	6 inches
Core Material	Standard straw or hay bales
Distance apart	20 to 25 percent of floodplain width
Location	Perpendicular rows
Row separation	40 to 50 percent of floodplain width

Design criteria and construction specifications for LWD would include:

Diameter	24 inches minimum
Length	20 feet to 40 feet
Embedding depth	6 inches minimum
Material	Sound green or dead wood
Distance apart	20 to 25 percent of floodplain width
Location	Rows perpendicular to direction of floodflow
Row separation	40 to 50 percent of floodplain width

Management of surface water runoff following active mining would be focused on trapping sediments and abating floodwater velocities on reclaimed ground during spring high flows and flood flows.

3.5 Reclamation Sequence

Figure A-7 shows a reclamation sequence for annual mining units F-1 to F-14 in the river floodplain and annual mining units P-1 to P-4 in the pasture. Table A-5 shows the conceptual sequence for reclaiming the mining units in these two mining areas.

Table A-5. Conceptual Reclamation Sequence for Completed Mining Unit

Year	*Reclamation Activities*
2	F-2 and F-3 topsoil respread to final grade and seeded, BMPs removed
3	F-2 and F-3 permanently inundated forested, shrub, and emergent oxbow constructed and planted
	F-4 and P-1 topsoil respread to final grade and seeded, BMPs removed
4	F-4 wetland shrubs and trees planted
	F-5, F-7, and P-2 topsoil respread to final grade and seeded, BMPs removed
5	F-5 and F-7 permanently inundated forested, shrub, and emergent oxbow constructed and planted
	F-6, F-11, and P-3 topsoil respread to final grade and seeded, BMPs removed
6	F-6 and F-11 wetland shrubs and trees planted
	F-8 and F-9 topsoil respread to final grade and seeded, BMPs removed
7	F-8 and F-9 wetland shrubs and trees planted
	F-13, F-14, and P-4 topsoil respread to final grade and seeded, BMPs removed
8	F-13 and F-14 wetland shrubs and trees planted
Final	F-1 and F-10 topsoil respread to final grade and seeded; wetland shrubs and trees planted

Source: Selkirk Environmental 2002b

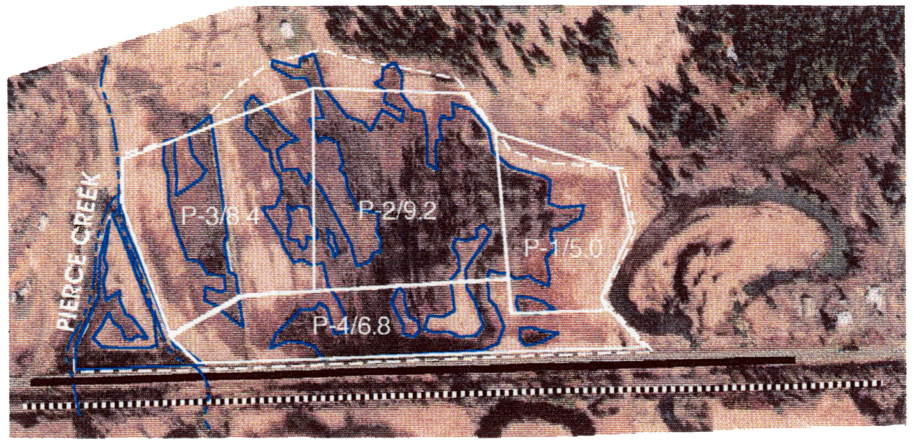
F-1 and F-10 would be mined when reserves in all other mining areas have been mined. These two mining units would be reclaimed immediately after mining.

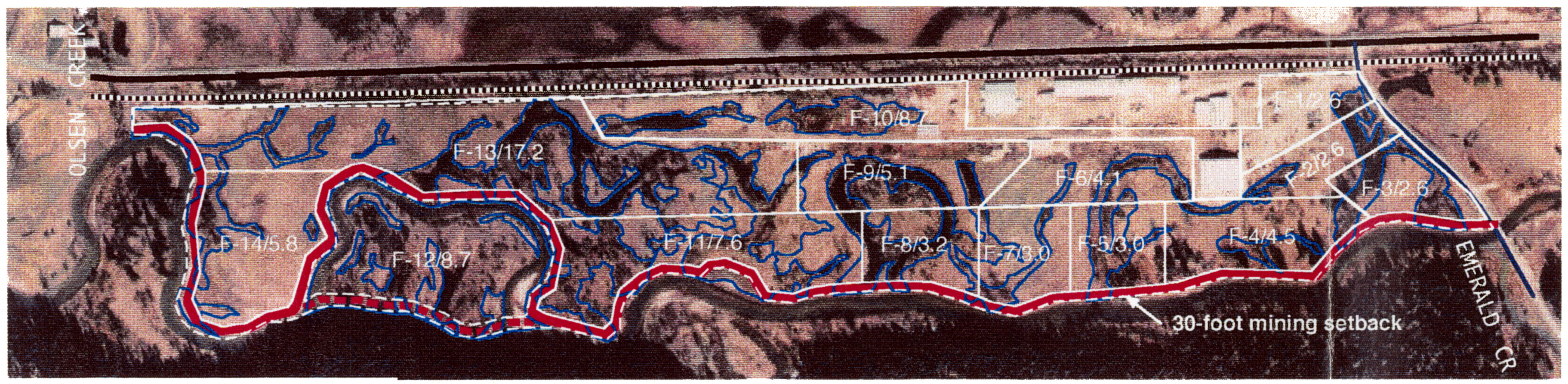
This sequence is conceptually presented to show how reclamation would proceed. This sequence may be modified if future annual mine plans change the conceptual mining sequence described in section 3.6.

The reclamation plan would be implemented in annual increments, based on annual plans submitted to USACE and IDL. These annual plans would take up to two calendar years to implement, depending upon the type of wetland habitat that is being reclaimed. Figures A-8 and A-9 show the reclamation plans for the Year 1 mining unit. The following is a typical 2-year reclamation

FIGURE A-7 CONCEPTUAL RECLAMATION SEQUENCE

SCALE: 1 inch = 660 feet





LEGEND

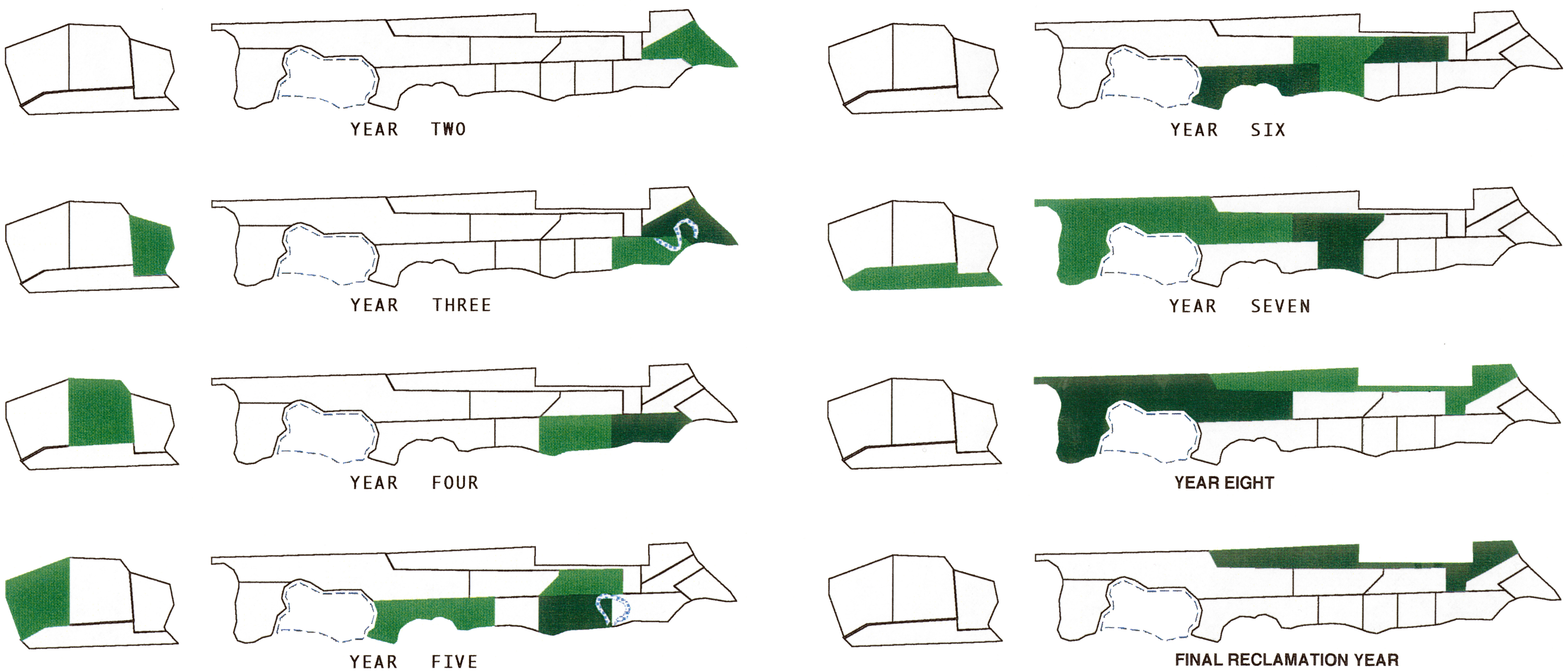
MINING AREAS	
STREAMS	
WETLANDS	
STATE HIGHWAY 3	
ST. MARIES RAILROAD	
FIRST SEASON REC	
SECOND SEASON REC	

TYPICAL RECLAMATION ACTIVITIES

Mining Units P-1 through P-6
First season; BMP's removed, topsoil/subsoil replaced to final grade. Wetland and Upland pasture seed mixes applied and irrigated.

Mining Units F-1 through F-14
First season; BMP's removed, topsoil/subsoil replaced to final grade. Wetland and Upland seed mixes applied and irrigated.

Second season; Oxbows excavated in Units F-3, F-4, F-5, and F-6. Oxbows 'inoculated' with substrate from existing oxbows. All woody plant species planted per reclamation designs. Irrigation continued through dry portion of growing season.



CONCEPTUAL RECLAMATION SEQUENCE**

Year	Units
2	F-2 F-3
3	F-2 F-3 F-4 P-1
4	F-4 F-5 F-7 P-2
5	F-5 F-7 F-6 F-11 P-3
6	F-6 F-11 F-8 F-9
7	F-8 F-9 F-13 F-14 P-4
8	F-13 F-14
Final	F-1 F-10

**F-12 to be reclaimed if it is mined.

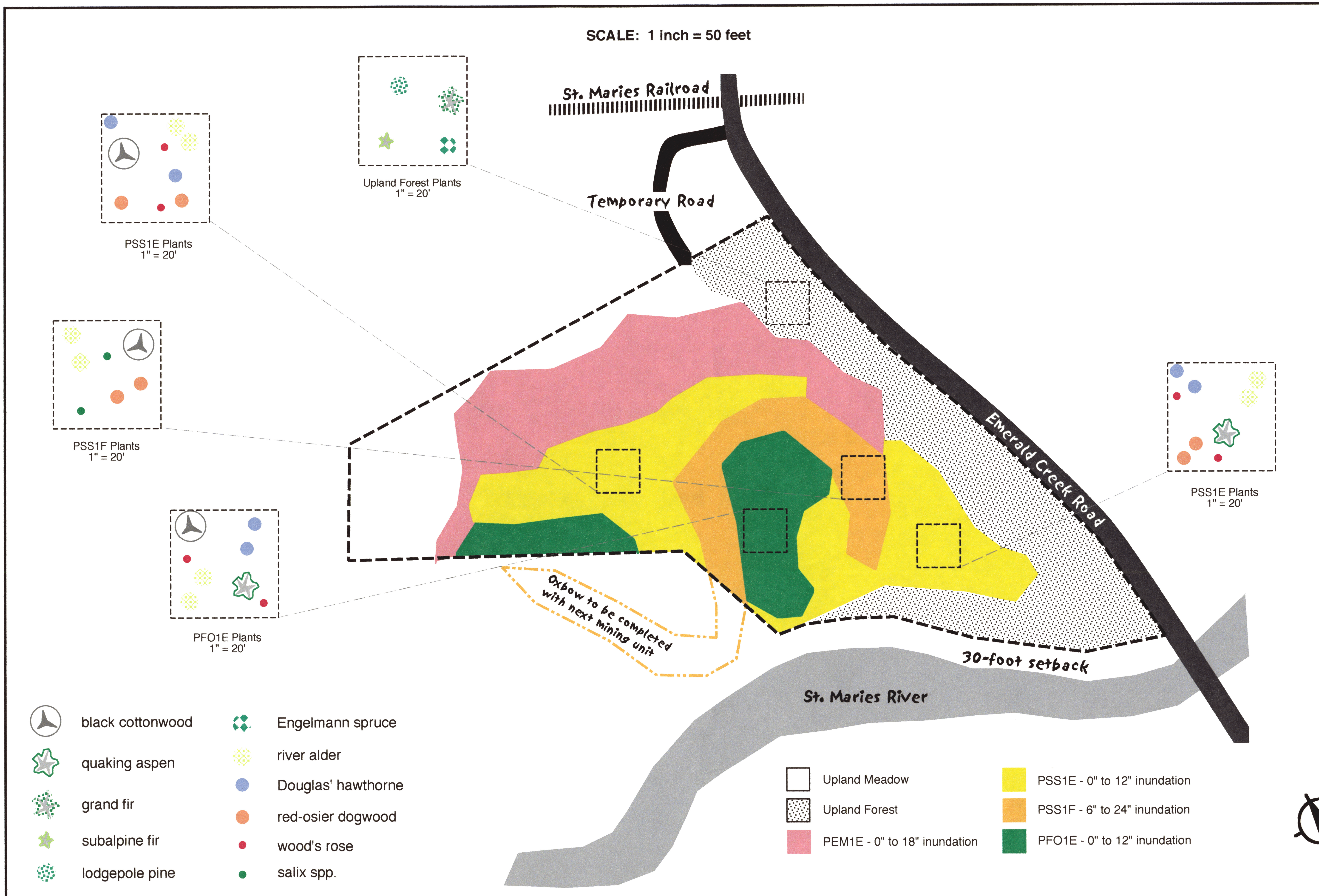


FIGURE A-8
FIRST YEAR RECLAMATION PLAN-VEGETATION

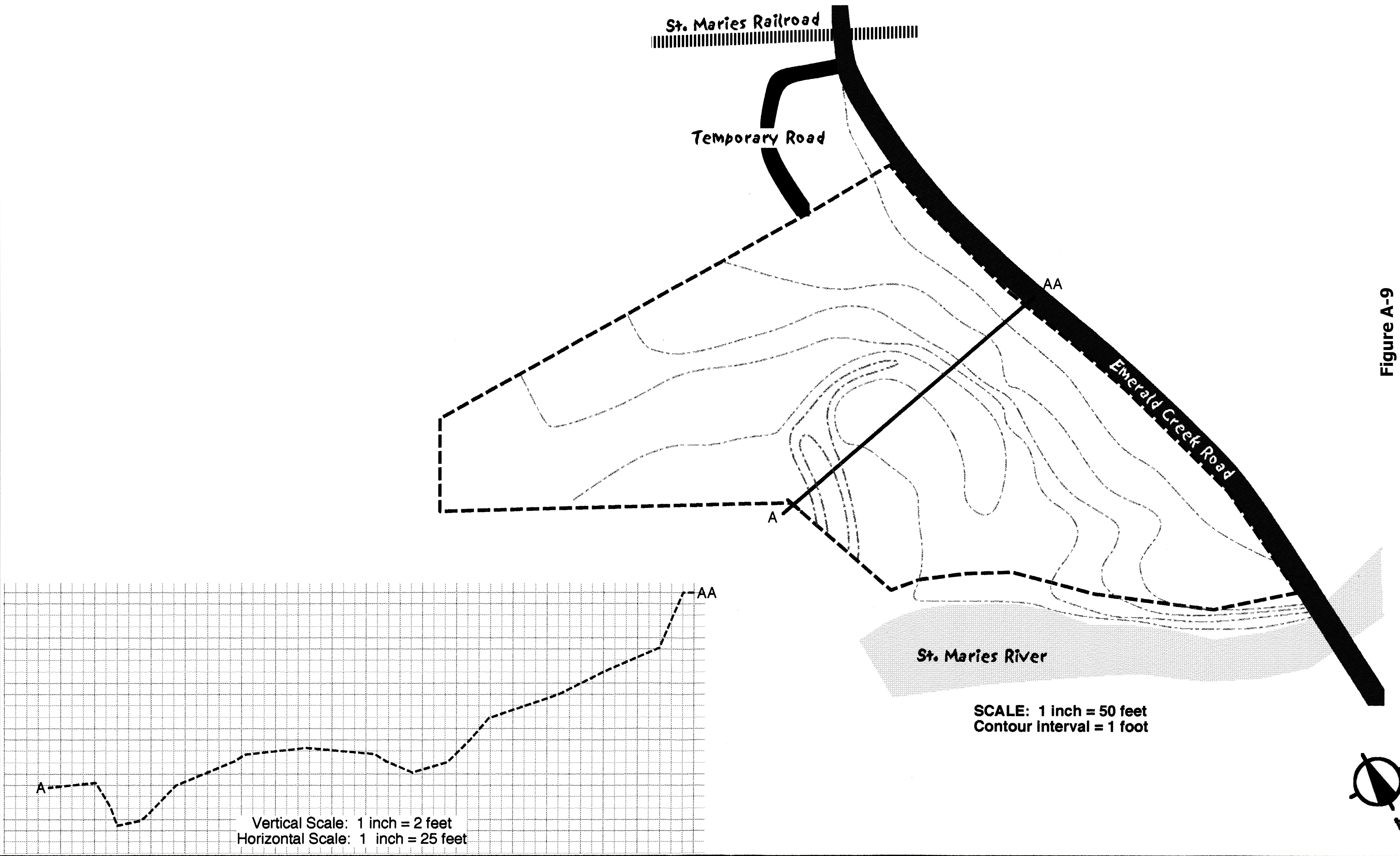


Figure A-9
First Year Reclamation Plan-Grading

sequence. It should be noted that proposed reclamation activities would be phased into existing mining activities in the Emerald and Carpenter Creek basins.

Reclamation Year 1

- Topsoil respread to final floodplain grade
- Reclamation BMPs installed
- Appropriate seed mix for wetland habitats applied
- Revegetated areas irrigated
- Reclaimed mining unit fenced until performance standards are realized, except for ECG ownership that would have long-term fencing

Reclamation Year 2

- Oxbow and deeper wetland habitats excavated
- Appropriate seed mix for excavated wetland habitats applied
- Downed logs and snags placed
- Upland forested corridors and pockets planted
- Riparian corridor enhanced
- Revegetated areas irrigated

3.6 Reclaimed Landscape

Wetland hydrology would be restored and functional at the end of Reclamation Year 1 in non-floodplain wetlands and at the end of Reclamation Year 2 in other wetlands. Restoration of the vegetative component would take longer to occur. Historically, ECG has had emergent vegetation re-establish with 80 percent groundcover in 3 years. Woody vegetation would increase in functional value as it matures. At maturity, the reclaimed landscape would provide the same functions and values as the pre-mined landscape, and would provide the following increased wetland functions:

- Hydrologic support by increasing the permanently saturated/inundated component.
- Storm and flood water abatement by increasing the percent and density of woody vegetation.
- Groundwater exchange to a limited degree by increasing the permanently flooded component.
- Water quality improvement by increasing the retention of overland flow.
- Biologic support by diversifying the woody vegetation and by adding special habitat features.

Table A-6 summarizes the acreage of reclaimed wetlands for ECG and other private ownership. This table is based on mining all oxbows and 133.0 acres of wetland in the proposed mining areas. If oxbow avoidance is selected, the post-mining wetlands would be decreased. If oxbow avoidance reduces the mined wetlands by 10 acres on ECG ownership, the reclamation plan would reclaim and mitigate 17 less acres (10 acres x 1.7 mitigation ratio). If oxbow avoidance reduces the mined wetlands by 10 acres on other private ownership, the reclamation plan would reclaim and mitigate 10 less acres (10 acres x 1.0 mitigation ratio). The overall reclamation ratio would remain the same. If all oxbows are avoided, no oxbows would be constructed.

Table A-6. Acreage of Reclaimed Wetlands by Ownership

Ownership	*Existing Wetlands*	*Post-mining Wetlands*	*Net Change*	*Ratio*
ECG Lands	35.0	59.5	24.5	1.7:1
Other Private Lands	98.0	102.9	4.9	1.05:1
Total	**133.0**	**162.4**	**29.4**	**1.22:1**

Figure 6.4 located in the Temporary Wetland Impacts and Reclamation Mitigation Concepts Report (Selkirk Environmental 2000) provides an overview of the reclaimed landscape for all proposed mining areas. The reclaimed landscape would have the following attributes:

- 1:1 in-kind wetland replacement on other private ownership, with ECG ownership having 1.7:1 in-kind replacement (the overall project replacement ratio is 1.22:1).
- Oxbow complexes reclaimed before they are impacted.
- Net increase of 70 percent in semi-permanently and permanently flooded wetlands.
- Improved riparian streambank condition on approximately 6000 feet of bank (4.1 acres).
- Net increase of 140 percent in forested wetlands.
- Net increase in riparian trees from approximately 1800 to 4140 initially (230%), or 3105 (170%), with mortality allowance.
- Addition of snags, downed logs, and wildlife corridors.

3.7 Reclamation Protection and Success

Protection of the reclaimed wetlands from grazing is provided by short- and long-term fencing.

3.7.1 Short-term Fencing

Short-term perimeter fencing would be placed around each reclaimed mining unit during the first year of reclamation. This fencing would remain in place and be maintained during a 5-year monitoring period. Fencing would be removed on other private ownership once the monitoring period has ended and all performance standards have been realized (see section 6.2 Plan of Operations, ECG 2000). Short-term perimeter fencing would become long-term perimeter fencing on ECG ownership once performance standards have been realized.

3.7.2 Long-term Fencing

Two types of long-term fencing would be employed, depending on land ownership. On ECG ownership, long-term fencing would be accomplished by extending short-term fencing as recently mined annual units are seeded and planted. Fencing would be maintained on an annual basis as long as ECG owns the property, or until a change in land use activity occurs. This would provide long-term protection to approximately 106 acres of wetlands and non-wetland riparian corridor. This would protect 32 percent of the total project area once mining and reclamation have been completed. It would also protect 59.5 acres of the 162.4 acres of wetland that would be reclaimed (37 percent).

Long-term cluster fencing would also be employed by placing fencing around all clusters of trees in annually reclaimed units. This fencing would remain in place for different lengths of time, depending upon stock size and growth rate. Cluster fencing duration would be based on the following stock size:

- 1 gallon cottonwood or aspen, 4' - 6' height (5-10 additional years)
- 5 gallon cottonwood or aspen, 6' - 8' height (3-7 additional years)
- Cottonwood poles, 3" caliper, 5' above ground (3-5 additional years)

Long-term fencing is not intended to protect planted trees until they reach maturity. Long-term fencing is intended to protect planted trees until they are well established with healthy root systems and crown development. Over 3,100 planted specimens (25 percent mortality of 4,140 planted stock) are warranted to survive with this plan. New planted specimens would be protected for 8 to 15 years and would be producing seed as well as root suckering providing additional trees annually. This is adequate mitigation even if mortality from cattle or other factors occurs after the period of long-term fencing. Some mortality after the period of long-term fencing is beneficial in terms of creating specialized habitat features for primary and secondary decomposers as well as other members of the food chain.

REFERENCES

Emerald Creek Garnet Ltd (ECG). 1999. Emerald Creek Garnet Ltd. Plan of Operation, St. Maries River Permit Areas (2nd Final Draft). November 1999.

______. 2000. Plan of Operations for 12-Month Wet and Dry Panel Mining of St. Maries River Mining Areas. Prepared by Emerald Creek Garnet Ltd. June 2000.

______. 2002. Plan of Operations for 12-Month Wet and Dry Panel Mining of Sr. Maries River Mining Areas. Prepared by Emerald Creek Garnet Ltd. February 2002.

Idaho Department of Lands (IDL). 1992. Best Management Practices for Mining in Idaho.

Selkirk Environmental. 1999. Wetland Delineation for St. Maries River Study Areas. September 7, 1999. Prepared for Emerald Creek Garnet, LTD. Fernwood, Idaho. .

______. 2000. Temporary Wetland Impacts and Reclamation and Mitigation Concepts for St. Maries River Permit Areas. June 20, 2002.

______. 2002a. Wetland Delineation for St. Maries River Study Areas. February 2002. Prepared for Emerald Creek Garnet, Ltd. Fernwood, Idaho. (Provided as Appendix D).

______. 2002b. Temporary Wetlands Impacts and Reclamation and Mitigation Concepts for St. Maries River Permit Areas. February 2002. (Provided as Appendix F).