Chapter 5 SETTLING PONDS, PROCESS WATER PONDS, EVAPORATION PONDS, SLIME PONDS

The purpose of these BMP's is to ensure that settling ponds used in dredge and placer mining, process water ponds, evaporation ponds, and slime ponds are designed, operated, and reclaimed so that nonpoint source water pollution is minimized and water quality protected.

Both the Idaho Department of Water Resources and the Idaho Department of Health and Welfare (Division of Environmental Quality) have rules and regulations that may apply to settling pond design and construction. See Appendix A for specific authorities and requirements.

Settling ponds are used as:

1. Impoundments for process contaminated water derived from floating or dry land dredges, washing plants, sluicing, or other forms of placer mining that can deposit significant amounts of sediment into surface water.

2. Impoundments for sediment laden water running off excavated or stripped lands.

3. Impoundments designed for percolation, infiltration or evaporation of water.

Process water ponds are used as:

1. Make-up water ponds for dredge and placer mining, surface mining, or milling operations.

2. Make-up water or holding ponds to store clean water for placer mining operations.

3. Recycle ponds for reducing the volume of fresh make-up water used in an operation.

Evaporation Ponds are used as a means of getting rid of process water either by evaporation, percolation, or infiltration without discharging it.

Slime ponds are used in the phosphate industry for the storage of phosphatic clay waste derived from the beneficiation of phosphate ore.

PRE-MINING SITE EVALUATION

Before commencing construction for mining operations that require the use of ponds, conduct a site evaluation, including adequate sampling, to determine the economic extent of the ore body as well as the best location to set up the plant and build support facilities. This information will provide guidelines for determining the amount of surface to be uncovered in the initial construction phase, as well as assist the miner in determining the size and location of settling pond(s).

Analyze the soil at the site to determine the percentage of clay, sand, and silt it contains. This information will dictate the amount of time water must be retained in the pond to allow sediments to settle out and will impact the size and number of ponds needed for the mining operation. Suspended solids and sediment from sandy soil will settle faster than those high in clay or silt. Note: Discharging water from a settling pond to a stream requires a National Pollutant Discharge Elimination System (NPDES) Permit issued by the Environmental Protection Agency.

LOCATION CRITERIA

Settling ponds may either be permanent or moved during the course of mining. The following criteria should be considered when locating ponds:

1. Ponds should be located in a geologically stable area, at least fifty (50) feet away from streams or other surface waters.

2. Ponds should be kept out of active floodplains. This will eliminate the need for diverting streams around the ponds and will reduce reclamation requirements. If a pond is in a flood plain, all the sediment must be removed and the area stabilized upon completion of the mining project.

3. Ponds should be located so all surface water may be diverted around them. This might necessitate diverting streams and other surface water away from the site. Refer to the following BMP's:

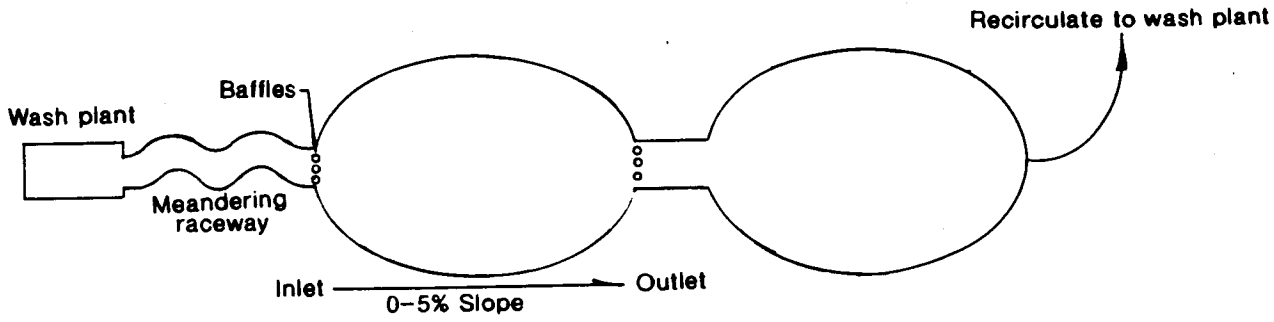
III.1 Diversion Dike/Ditch
III.2 Interceptor Trench
III.8 Stream Alteration

4. Ponds should be located so ground water seepage into the pond is kept at a minimum. This can be done by lining the pond with bentonite clay or other impermeable liners, or by installing cut-off trenches around the pond to decrease ground water infiltration. If the pond is lined, a drain field may have to be installed below the liner to reduce hydrostatic pressures against the liners caused by the ground water.

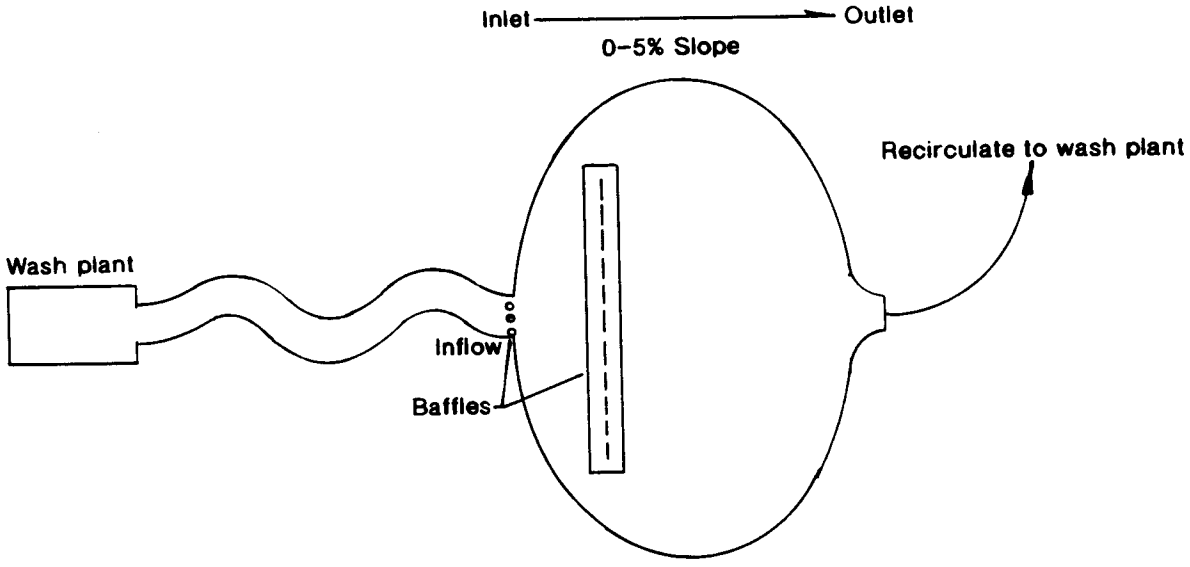
DESIGN CRITERIA

1. Settling ponds should be designed by a qualified specialist in accordance with current engineering practices.

2. Several settling ponds in series are often preferable to one large pond. (See Figure 5-1) Water can be retained for a longer period in multiple ponds, thus allowing sediments more time to settle out before water is discharged. One pond in the series might be the principle sediment trap while another could be used to hold "clarified" water that could be recirculated through a processing plant.



STANDARD SETTLING PONDS IN SERIES



SETTLING POND WITH BAFFLES

DIAGRAM OF SETTLING PONDS FOR PLACER MINING
FIGURE 5-1

3. Ponds should be designed so their length is greater than their width. A 2:1 ratio is adequate, although a 5:1 ratio is preferred. A long length to width ratio helps reduce the velocity of water flowing through the pond, which increases the stability of the embankment. Reduced velocities also enhance the settlement of solids.

4. Design the pond so that it is large enough to contain all sediment laden process water as well as seepage, surface runoff, and precipitation from the design storm event. The pond must be large enough to provide a minimum freeboard of two (2) feet at all times. It is beneficial if size constraints conform to the physical configuration of the site.

CONSTRUCTION CRITERIA

1. If the pond cannot be built below ground level, build the pond embankment on clean, stable foundation material. This will help prevent seepage between the embankment and the foundation material. Seepage could cause piping and subsequent failure of the embankment.

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

3. Settling ponds can also be excavated below ground level with a compacted embankment placed above the ground surface as an additional safety factor. This method also increases the holding capacity of the pond (See Figure 5-2). If ponds are excavated below ground level, the foundation should be constructed so water cannot seep out of the pond into adjacent streams or other surface waters.

4. Depending upon whether the ponds will be operated as an open (discharging) or closed (non-discharging) system, a spillway will need to be installed so sediment free water can be decanted. In all cases, an emergency spillway must also be installed. Spillways must be riprapped with a coarse material to prevent erosion of the toe of the dam. Anti-seep collars must be placed around spillways to prevent seepage and eventual washout of the spillway.

5. The settling pond must be completed, ready for use, and all surface flows should be diverted around the pond, before general mining activities commence.

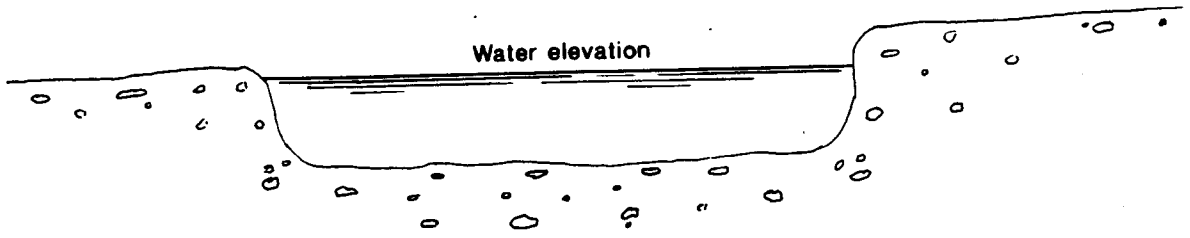
OPERATING PARAMETERS

1. While operating do not fill the pond with solid sediments exceeding 60% of the designed storage volume. If this limit is reached, some of the sediments should be removed and deposited elsewhere or used for reclamation.

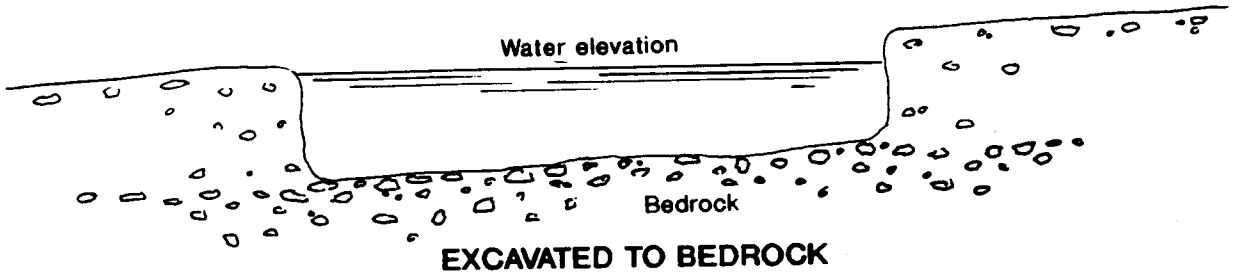
2. Always maintain at least two (2) feet of freeboard in the ponds. This is especially important during spring runoff, periods of high precipitation, and for non-discharging ponds.

3. At the close of the mining season, decant sediment free water onto vegetated ground to allow sufficient freeboard for direct precipitation during seasonal closure. This will help preserve the structural integrity of the pond embankment.

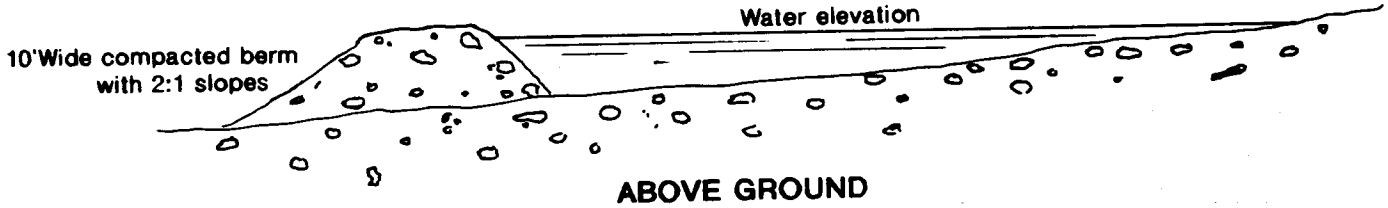
4. Chemical flocculants such as alum or lime can be added to settling ponds to reduce the length of time needed to settle out solids.



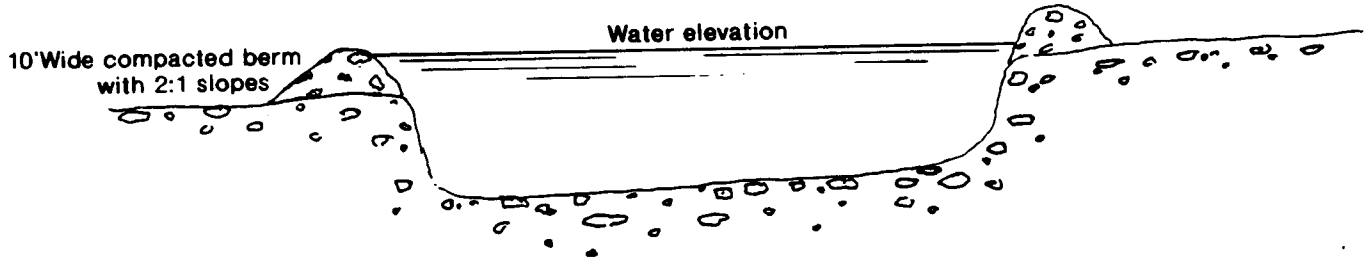
BELOW GROUND



EXCAVATED TO BEDROCK



ABOVE GROUND



BELOW GROUND WITH BERM

SETTLING POND CONSTRUCTION OPTIONS

FIGURE 5-2

RECLAMATION ALTERNATIVES FOR SETTLING PONDS

If ponds are located in an active flood plain:

1. Dewater the pond onto vegetated ground before commencing additional rehabilitation work. Unless an NPDES permit has been issued, there can be no discharge to surface waters.

2. Remove all sediments away from the floodplain. This can be done with a dragline, front end loader, or trackhoe.

3. Recontour the sides and floor of the pond to blend with the surrounding topography.

4. Seed and fertilize the recontoured area.

5. Another alternative is to complete reasonable stabilization work on the sides of the pond and then leave it intact for fish rearing or wildlife habitat. Seeding and revegetation of the embankment around the pond must be completed to stabilize the area.

If ponds have not been located in an active flood plain:

1. Dewater the pond.

2. Remove some or all of the sediments and stabilize them in an approved area. Recontour the entire site and make the perimeter of the pond irregular by adding fill to some sections while removing it from other areas. Seed, fertilize and mulch the recontoured area.

3. Another alternative is to stabilize the sediments in place by putting a cap of coarse material over the fines to a depth of three (3) feet or more. Then recontour the pond to conform as much as possible to the surrounding topography. Replace topsoil and seed.

Refer to the following BMP's when reclaiming settling ponds:

I.3	Mulch-Straw	II.4	Broadcast Seeding
I.4	Mulch-Wood Chip	II.5	Drill Seeding
		II.6	Vegetative Planting
II.1	Topsoiling	II.8	Fertilizer Use
II.2	Seedbed Preparation	II.9	Maintenance of Revegetated Areas
II.3	General Planting and Seeding		

PROCESS WATER PONDS

Ponds constructed to hold process water, other than that containing cyanide, should be designed by a qualified specialist using current engineering practices and should take into account the criteria outlined under settling ponds. Ponds built to hold process water containing cyanide must be designed in accordance with the guidelines and requirements set forth in **Rules and Regulations for Ore Processing by Cyanidation** administered by the Idaho Department of Health and Welfare - Division of Environmental Quality.

Process water ponds must be designed as a closed system, meaning there is no discharge. The water is recycled for process water after being circulated through the tailings/settling ponds. Process water systems usually contain the following elements:

1. A collection and conveyance system that stores and transports water from the mine/mill to a holding pond.

2. A pump and conveyance system to transport water from the holding pond back to the mine or mill.

3. A conveyance system to transport process contaminated water from the mine or mill to the tailings/settling pond.

4. A pump and conveyance system to carry water from the tailings pond to the holding pond.

Closed circuit process water systems help protect water quality, and make mining/milling possible over a longer season in areas with minimum precipitation. One drawback to these systems is that process water quality can be affected by suspended solids or chemicals that were not removed while the water was held in the tailings/settling pond. Another disadvantage is that where other water supplies are limited, there must be a large, non-mineralized area for pond construction.

EVAPORATION PONDS

Large holding ponds may be used to evaporate water which will alleviate the need to discharge it. Discharge from mines and mills must be collected and conveyed to a large evaporation pond or series of ponds. The system should be large enough so all water can be evaporated, with no discharge occurring. The bottom of the pond should be lined with an impermeable material to prevent seepage into and out of the impoundment. (See Figure 5-2)

SLIME PONDS

Slime ponds are used exclusively in phosphate mining to store phosphatic clay waste. The ponds are created by pumping slime containing 90-98% water and 2-10% suspended solids into an impoundment area behind an earthen dam.

Slime ponds must be designed by a qualified specialist using current engineering practices and should take into account the criteria set forth in this chapter and Chapter 4 - Mill Tailings Impoundments.

RECLAMATION OF SLIME PONDS

Slime ponds are difficult to reclaim because of the high volume of water in the pond, and because a percentage of the suspended solids are so fine (colloidal) they will not settle out. One viable reclamation alternative is to plant deep rooted woody vegetation (varieties of saltbush, quailbush, catclaw acacia, cattails, and leadplant) adjacent to the pond to increase transpiration rates.