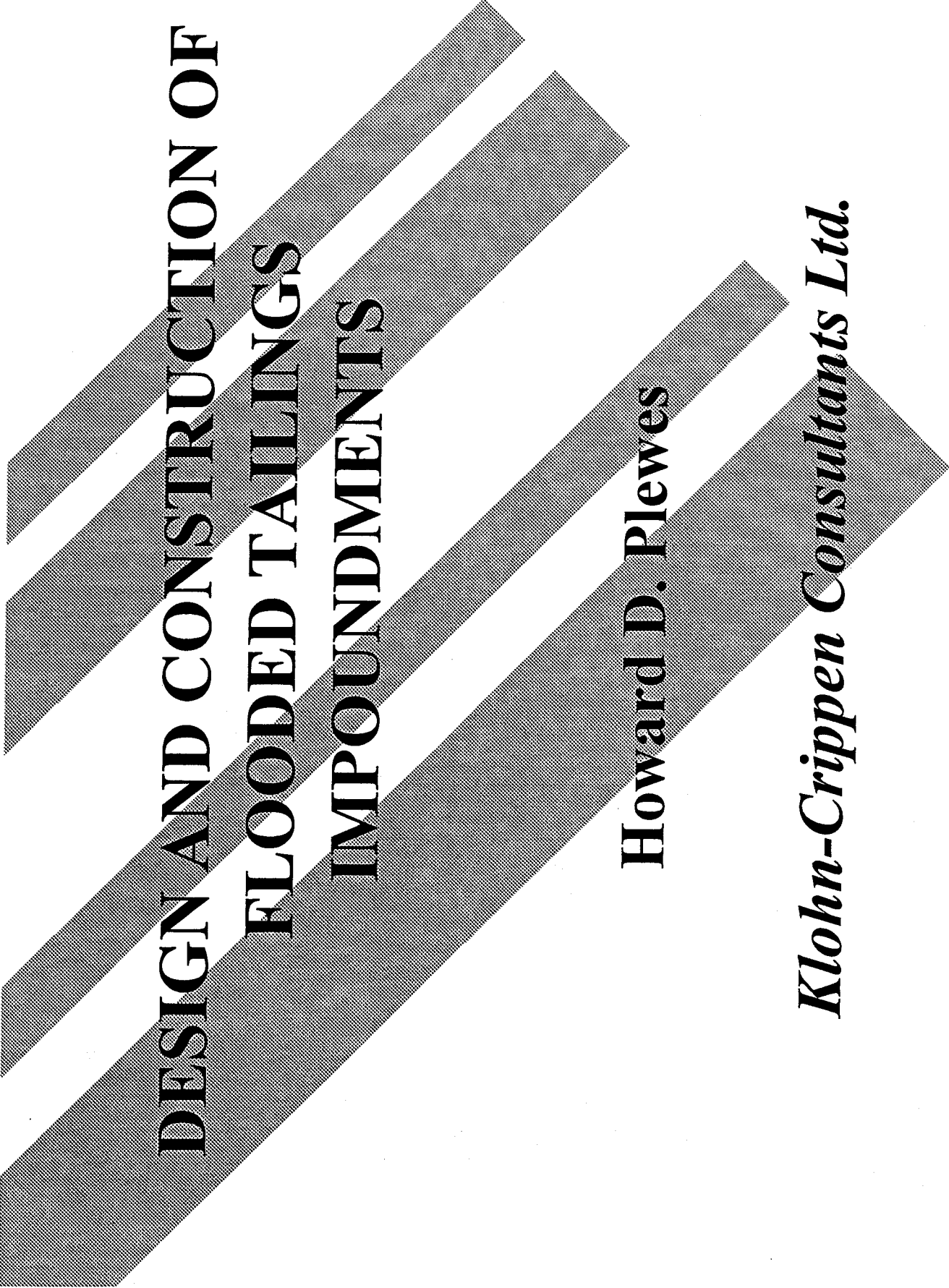


4.3. DESIGN AND CONSTRUCTION OF FLOODED TAILINGS IMPOUNDMENTS

**Howard Plewes
Klohn-Crippen Consultants Ltd.**





DESIGN AND CONSTRUCTION OF FLOODED TAILINGS IMPOUNDMENTS

Howard D. Plewes

Klohn-Crippen Consultants Ltd.



■ NEW TAILINGS IMPOUNDMENTS

■ RETROFIT OF EXISTING TAILINGS
IMPOUNDMENTS

OPERATING WATER BALANCE

- **ADEQUATE POND WATER VOLUME FOR:**
 - SUBMERGENCE OF TAILINGS
 - RECLAIM WATER SOURCE
- **CATCHMENT DIVERSIONS MAY BE REQUIRED TO MINIMIZE SURPLUS**
 - ESPECIALLY FOR ZERO DISCHARGE FACILITY

SCHEMATIC WATER BALANCE

INFLOWS

- PRECIPITATION
- SURFACE WATER RUNOFF
- TAILINGS PROCESS WATER

OUTFLOWS

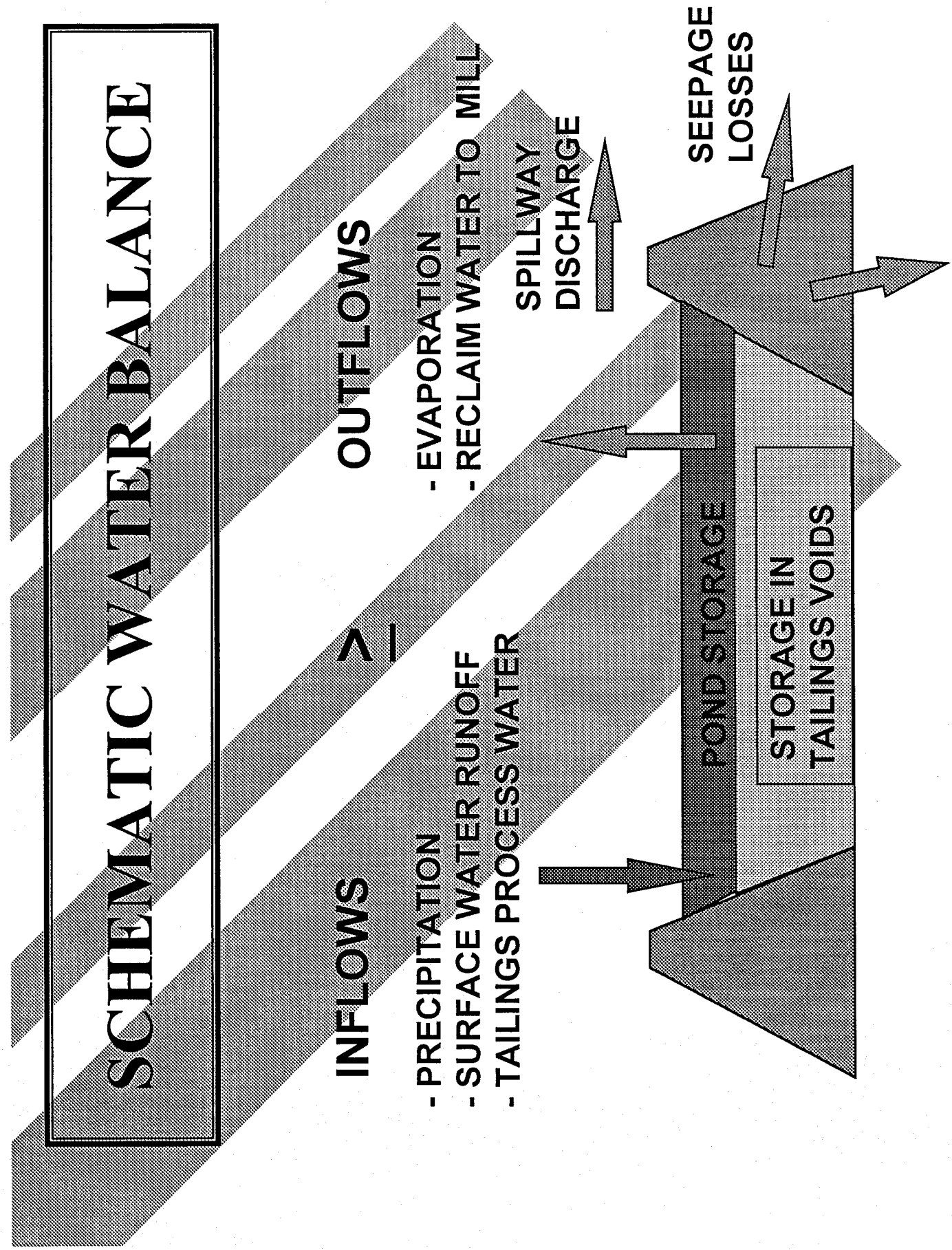
- EVAPORATION
- RECLAIM WATER TO MILL

SPILLWAY
DISCHARGE

SEEPAGE
LOSSES

POND STORAGE

STORAGE IN
TAILINGS VOIDS



FREEBOARD

- **SAME AS WATER STORAGE DAM**
- **100-YEAR PEAK FLOOD OR LARGER**
 - **SIZE OF CATCHMENT**
 - **ZERO DISCHARGE REQUIREMENT**
 - **TYPE OF DAM**
 - **CONSEQUENCE OF OVERTOPPING**
- **MAKE GENEROUS ALLOWANCE**

TAILINGS DEPOSITION

- **CONTINUOUSLY SUBMERGE TO PREVENT OXIDATION**
 - **LOW RATE OF OXYGEN DIFFUSION THROUGH WATER**
- **PERIOD OF EXPOSURE ALLOWED:**
 - **TYPICALLY LESS THAN 12 MONTHS**
 - **“HOT” TAILINGS < 3 MONTHS**

DAM DESIGN

- **NEED STABLE LONG-TERM STRUCTURE**
- **SEEPAGE LOSSES TO BE LOW**
- **EROSION RESISTANCE TO:**
 - **INTERNAL SEEPAGE**
 - **EXTERNAL EROSION**

■ **SEISMIC STABILITY A FACTOR FOR
HIGHER WATER TABLE IN DAM**

– **LIQUEFACTION OF HYDRAULIC FILLS**

– **EFFECTS OF DEFORMATIONS ON
SERVICEABILITY**

– **DESIGN FOR MAXIMUM CREDIBLE
EARTHQUAKE**

CLOSURE WATER BALANCE

■ MAINTAIN MINIMUM WATER COVER

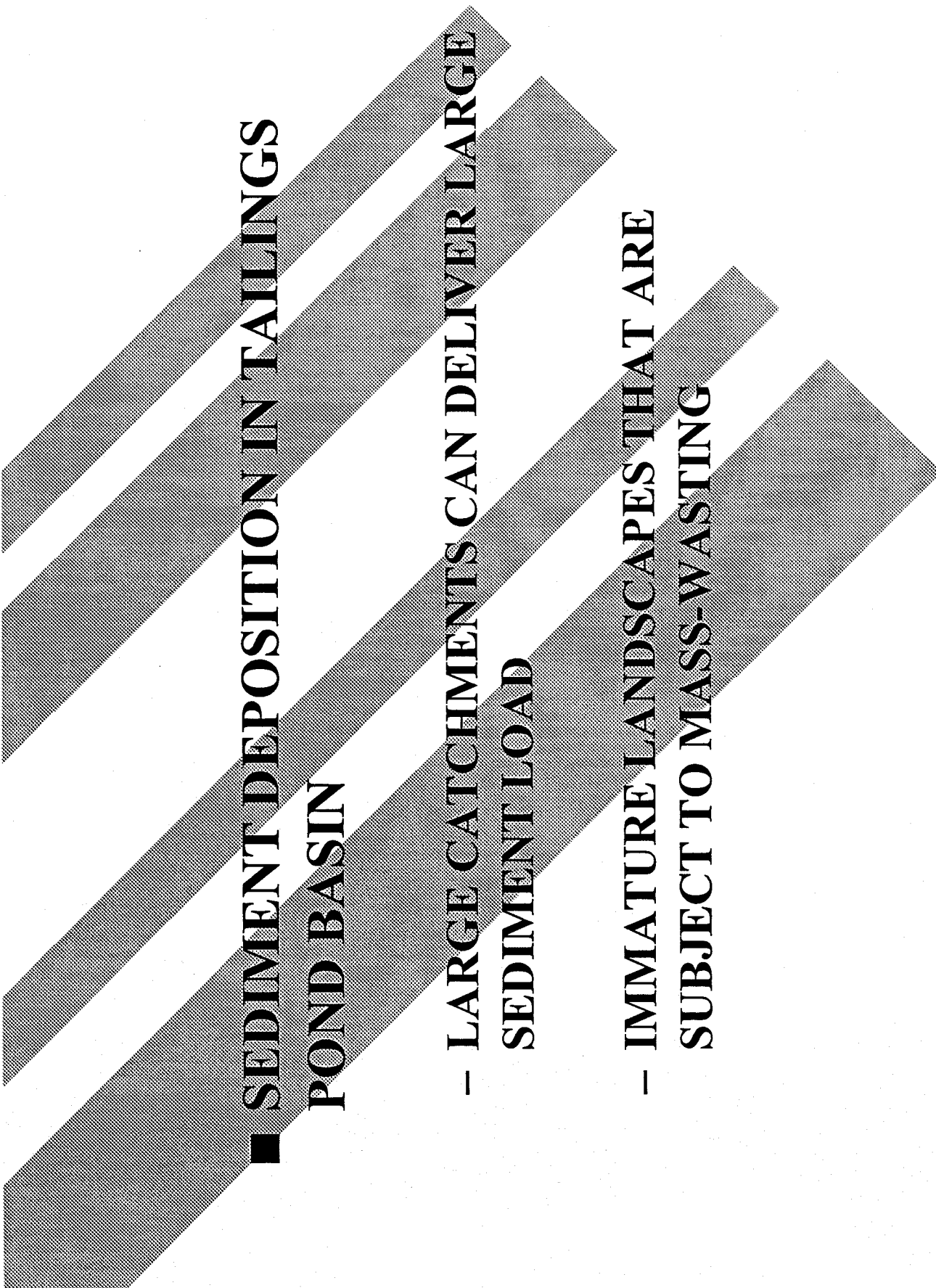
– 0.8 m MINIMUM

■ EFFECT OF 100-YEAR DRY YEAR

■ CATCHMENT DIVERSIONS

– REMOVED

– MAINTAINED AT ANNUAL COST

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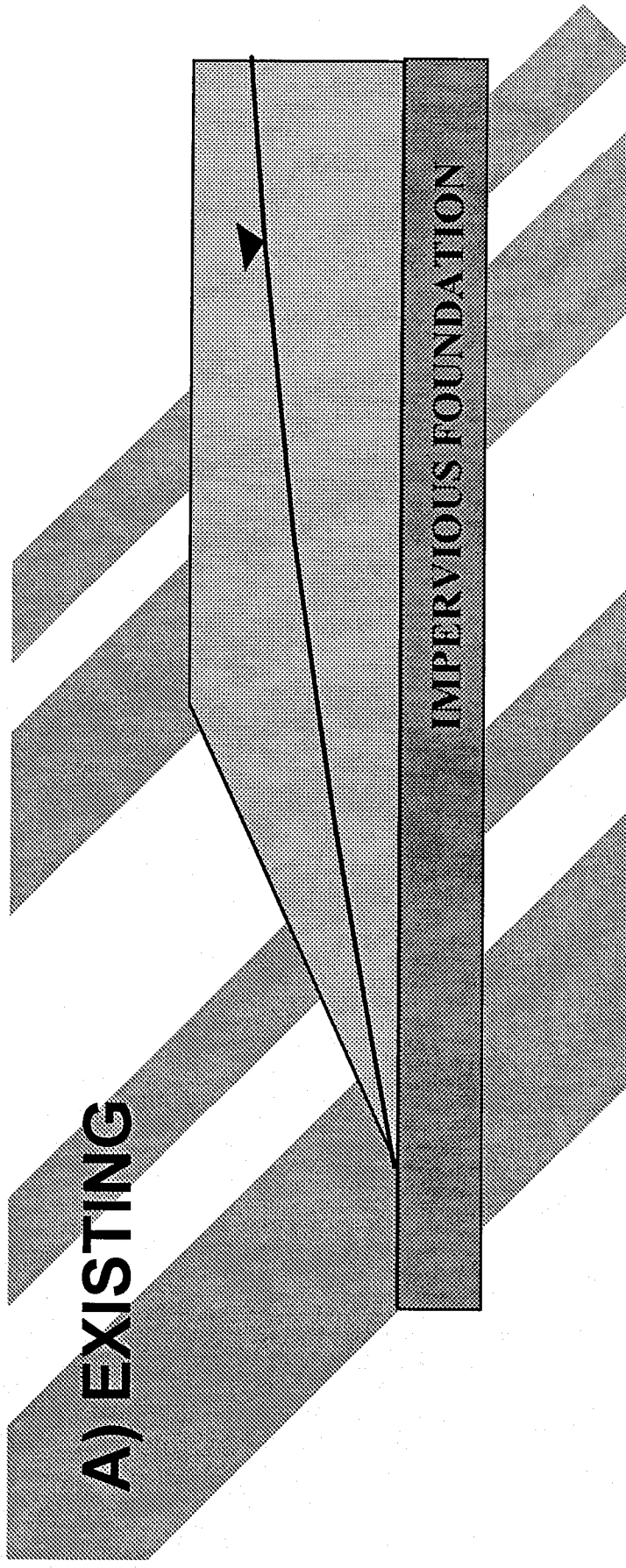
■ SEDIMENT DEPOSITION IN TAILINGS POND BASIN

- LARGE CATCHMENTS CAN DELIVER LARGE
SEDIMENT LOAD
- IMMATURE LANDSCAPES THAT ARE
SUBJECT TO MASS-WASTING

CLOSURE SPILLWAY

- **MUST BE DESIGNED TO PASS PEAK
MAXIMUM FLOOD AND SPRING RUNOFF**
- **MAINTENANCE TO KEEP CLEAR**
 - BEAVER DAMS, DEBRIS
- **SPILLWAY INVERT IN ROCK PREFERRED**
 - PREVENT EROSION
 - LOSS OF WATER COVER DEPTH

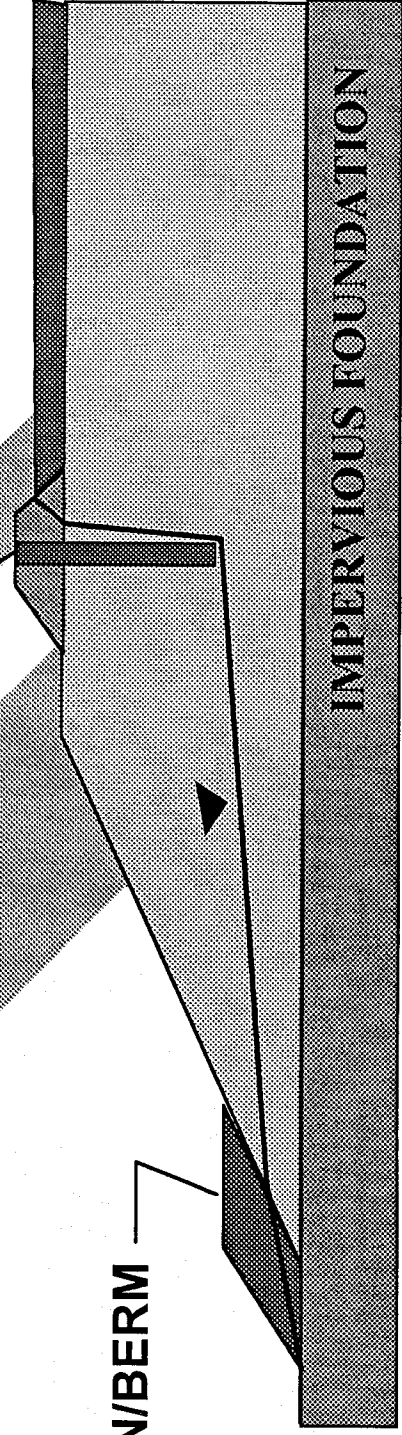
A) EXISTING



B) MODIFIED

SEEPAGE CUTOFF WALL

TOE DRAIN/BERM



**■ RELOCATION OF TAILINGS ABOVE
FINAL POND LEVEL**

- DREDGING COST-EFFECTIVE METHOD**
- SILT CURTAINS TO CONTROL SUSPENDED
SOLIDS IN OUTFLOW**

■ **MOBILIZATION OF METALS DURING
FIRST FLOODING**

- **CONTROL BY LIME ADDITION IN POND**
- **WATER TREATMENT OF OVERFLOW**

■ **LONG-TERM AND SEEPAGE FROM DAMS**

– **COLLECTION AND TREATMENT**

– **ANOXIC DRAIN SYSTEM**

» **TO SEPARATE SEEPAGE FROM SURFACE
RUNOFF**

» **MINIMIZE TREATMENT VOLUMES**

SUMMARY

■ FLOODED TAILINGS IMPOUNDMENTS

- NOT SIMPLE TO JUST “FLOOD”**
- VARIETY OF ISSUES TO ADDRESS**
- DESIGN TOOLS EXIST**
- MAY REQUIRE SPECIAL CONSTRUCTION PROCEDURES**
- NEED FOR LONG-TERM CARE AND MAINTENANCE**

