

MILE POST 7 WEST RIDGE RAILROAD RELOCATION, DAM EXTENSIONS, AND STREAM  
MITIGATION PROJECT ENVIRONMENTAL ASSESSMENT WORKSHEET (EAW)

RECORD OF DECISION – FINDING OF FACT 28.v  
1984 Reclamation Activities Report

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This document is available in alternative formats to individuals with disabilities by contacting Bill Johnson at 651-259-5126 ([bill.johnson@state.mn.us](mailto:bill.johnson@state.mn.us)) or Jill Townley at 651-259-5168 ([jill.townley@state.mn.us](mailto:jill.townley@state.mn.us)).

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## RESERVE MINING COMPANY

SILVER BAY, MINNESOTA 55614

January 30, 1985

RECEIVED

FEB - 6 1985

COMMISSIONER'S  
OFFICE

Mr. Joseph N. Alexander, Commissioner  
Department of Natural Resources  
Box 37  
500 Lafayette Road  
Saint Paul, Minnesota 55146



Dear Commissioner Alexander:

### Annual Mineland Reclamation Report

1984

Reserve Mining Company submits herein its second annual report in duplicate under 6MCAR Sec. 1.043D as requested of permittees:

#### I. FINANCIAL STATEMENTS

We are enclosing a copy of Reserve Mining Company's audited financial statements for the year ended December 31, 1983 in fulfillment of the Sec. 1.0403D.1. requirements. These are the most recent statements available since our financial statements are not completed, approved and audited until well into March following the end of our fiscal year.

We request that the information contained in these financial statements be kept as confidential as possible within the constraints of the governing statutes and rules.

#### II. RATE OF MINING

While we had projected a 1984 production of 4,200,000 tons of pellets, the continued economic depression in the steel industry forced a reduction down to an actual 3,647,194 tons of pellets dry for the calendar year 1984. Our Proposed 1985 Operational Plan is based on the production of 3,600,000 tons of pellets this year.

#### III. 1984 MINING ACTIVITIES

We mined 10,200,000 tons of blasted crude ore and stripped 488,000 tons of lean ore, no waste rock, and 133,000 cubic yards of surface material. Actual mining activities in 1984, including quantities of ore mined, material stripped and locations of mining, stripping and stockpiling are shown on the enclosed Reserve Mining Company drawing C-17-A, dated January 1, 1985.

Commissioner Joseph N. Alexander  
January 30, 1985  
Page 2

A total of 6,626,106 tons of tailings were deposited in the Mile Post 7 tailings basin near Silver Bay in 1984.

Under the Proposed 1984 Operational Plan, we did not include any stripping. However, we did do limited amounts of both lean ore and surface stripping during brief interruptions in the ore production schedule in 1984. Similarly, there is no stripping planned in 1985.

#### IV. 1984 RECLAMATION ACTIVITIES

We indicated in our last Annual Mineland Reclamation Report that we planned to develop a vegetative research area on a waste rock stockpile and to reclaim about 4.2 acres of surface area along the relocated main entrance road to the mine in Babbitt. Both of these projects have been undertaken as planned and are detailed in the attached reports labeled Attachment 1 and Attachment 2, respectively.

During 1984, we also planted approximately 200 red pine and 1,200 jackpine seedlings (2 to 3 years old) on about two acres of Surface Stockpile No. S25 in Babbitt. While this stockpile was last active in 1967 and not within the scope of the rules, we had these extra seedlings on hand and decided this was a good use for them. The location of this stockpile is shown on the enclosed C-17-A.

Additionally, we plan to develop a vegetative research area on a lean ore stockpile in 1985. The determination of its location, area, vegetative types and other details will be made later in the spring.

Progressive reclamation work continued at the Silver Bay area in 1984 as planned, both in the tailings basin area and on the old tailings delta. This work is detailed in the attached report designated Attachment 3.

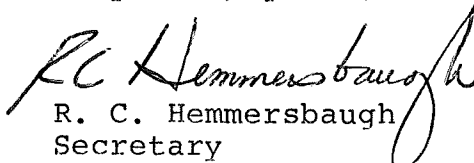
#### V. STATUS OF MINING MODIFICATIONS

The status of mining, construction, reclamation and watershed modifications is shown on the enclosed drawing C-17-A.

#### VI. PROPOSED 1985 OPERATING PLAN

As required under 6MCAR Sec. 1.0403C., we are enclosing a copy of Reserve Mining Company drawing C-17, dated January 1, 1985, Proposed 1985 Operational Plan, for your records.

Very truly yours,

  
R. C. Hemmersbaugh  
Secretary

ses  
Encs.



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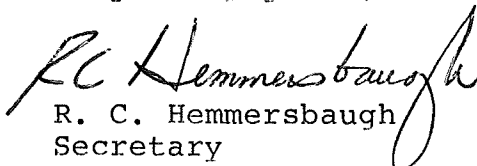
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Progress Report  
for  
Vegetation Research on Waste Rock Stockpile, N78W  
1984

In 1984 a research project was initiated on one of Reserve's waste rock stockpiles to determine if the waste rock stockpiles as they are presently built will support a vegetative cover or if a two foot surface overburden capping is necessary to meet requirements pursuant to MDNR "Rules Relating to Mineland Reclamation (6 MCAR §1.0402 D.1. and D.2.e.). The regulations allow alternate methods if it can be demonstrated that reclamation requirements will be met through acceptable research. This demonstration project was approved by the Division of Minerals Section of the MDNR pursuant to 6MCAR §1.0401 B.1.

Figure 1 shows the test site location designated North 78 West waste rock stockpile. The research project includes tests using grass and legume mixtures and woody species plantings. Figure 2 shows the plot layout for the tests initiated in 1984.

The tests compare the establishment and development of a vegetative cover on the waste rock stockpile with and without a two foot surface overburden capping. The stockpiles as built, have up to twelve inches of a loamy sand and gravel mixture on the top surface. In this report areas that have the loamy sand-gravel surface of the original waste rock stockpile will be referred to as "as built". The area covered with the two foot overburden will be referred to as "capped".

#### CONCLUSIONS

Results from the first year's growth on waste rock stockpile, N78W, show that:

- o Vegetation can be established on waste rock stockpiles "as built", provided the proper planting techniques, fertilizer rates, frequency of application and plant varieties are used;
- o Ground cover was the same on the unmulched "as built" plots and the "capped" plots;
- o Hay mulch improved ground cover on the "as built" plots;
- o Organic matter production was greater on the "as built" plots with or without mulch than on the "capped" plots;
- o Two willow species cuttings and the pine species appear suitable for growth on the "as built" stockpiles and, in particular, jack pine planted from seeds give encouraging results.

## TEST RESULTS

Experimental designs are presented with the following test results.

### Grass-legume mixtures:

Figure 3 shows the varietal mixture plot design. The test is designed to evaluate the growth characteristics of eight mixture combinations planted with the same planting techniques in three different growing environments: a "capped" area; an "as built" area without mulch; and an "as built" area mulched after seeding.

The seeding rate was 30 pounds pure live seed per acre and consisted of a mixture of three parts of a grass species to one part redtop and two parts of a legume species. Legume seeds were inoculated with appropriate nitrogen fixing bacteria prior to sowing.

The surface overburden came from Blocks 1 and 2 South and was placed on the western one half of the test site. A ten foot wide buffer zone provided a gradual slope from the "capped" area to the edge of the "as built" plots. The overburden capping contained some large rock aggregate that was covered as much as possible with the finer material present in the overburden. This provided a flat top to allow planting equipment to operate efficiently on the site.

Planting was performed June 7 and 8 and consisted of broadcasting fertilizer with a hand held cyclone spreader, incorporating the fertilizer 2-3 inches below the surface by backblading with a dozer, broadcasting the seeds with a hand held cyclone spreader, and compacting the ground with cleated tracks of a dozer. Aged redtop hay at the rate of two tons per acre was spread over the southern half of the "as built" area using a mechanical mulch blower.

Table 1 presents the fertilizer rates applied and the results of the analyses from soil samples collected from the research site. Fertilizer applications were made four times during the growing season on the test site. The rate and grade of fertilizer applied to each test condition was based on the vegetation appearance and development, climatic conditions, and soil test results.

All fertilizer rates and grades were the same for each test except that on July 6 vegetation on the unmulched "as built" plots received a heavier application than the mulched plot or the "capped" plots. The grasses growing on the "as built" plots without mulch appeared to have a nutrient deficiency, particularly for nitrogen. Soil analysis results verified that nutrient levels were below their counterparts in the other test conditions. The vegetation responded favorably to the extra fertilizer.

Table 2 presents the mean percent ground cover and Table 3 presents the mean organic matter production at the end of the first growing season from each test plot. The cover was estimated on September 14, 18 and 19 while the organic matter was harvested on September 18 and 19.

For percent cover, sampling points within each test plot were randomly selected from random numbers tables prior to sampling. A circular ring 4.75 square feet in area centered at the random sampling points enclosed the areas in which ground cover was estimated. Ground cover is estimated by looking down from directly overhead. The estimate includes the aerial parts of living and dead plants and their litter. Hay mulch was excluded from the vegetation cover estimates. Additional information was recorded in the field and is on file at Reserve's Environmental Control Department. This information includes a breakdown of the components making up the total ground cover and total bare ground; for vegetative cover it is the percentage of grass cover, legume cover and endemics; for bare ground it is the percentage of sand, gravel and rock.

After the percent cover was estimated, a one foot square frame was randomly tossed from one half the number of sampling points used for ground cover estimates. The plant parts were removed by clipping down to one inch above ground within the one square foot area. The samples were placed in individual paper bags, dried in an oven at 65°C for 48 hours, and weighed.

#### Woody Species Trial Plantings:

Tests initiated in 1984 include conifer and deciduous plantings on "as built" areas including jack pine seeds in rocky terrain with little or no loamy sand cover in order to screen woody species for future plantings on the waste rock stockpile. Woody species will enhance reclamation progress.

Table 4 summarizes the survival and growth rate of three willow species and two pine species planted in the Spring and evaluated September 19. All willow cuttings and pine seedlings were planted in "as built" loamy sand - gravel soil.

The results indicate that crack and slender willow survived better than narrow leaf willow. There was no indication that fertilizer or mulch improved survival rates or height based on the limited number of replicates used in the test. Any future testing should evaluate crack and slender willow cuttings on established vegetation stands with and without fertilizer and mulch additions.

Jack pine seedlings survived better and attained greater height than red pine seedlings during the first year on N78W although both species appear suitable for growing on the waste rock stockpile. The results indicate that fertilizer is not needed for the seedlings during the first year. Jack pine in particular showed a drop in survival after the second fertilizer application. Mulch did not enhance pine seedlings growth during the first year.

Table 5 shows the first year results using jack pine seeds on the "as built" loamy sand and rock terrain. Seedling density was good overall. The test results indicate that terrain, fertilizer and ground scarification had no effect on the survival rate of the seeded jack pine seedlings except for one test condition, the fertilized and scarified loamy sand plot in which no survivors were observed within the randomly selected subplots. An explanation is not evident from the data.



On November 6, 1984, a 40' x 20' test plot was marked off on N78W loamy sand capping to evaluate the establishment of paper birch from direct seeding. One-half the plot was seeded with birch seeds while the other one-half was not seeded. The test is designed to determine if the birch can be successfully propagated through direct seeding. The seeding rate was 0.11 pound pure live seed per acre. The seeds were collected in late September and early October from surrounding trees. This planting will be evaluated in 1985.

#### Precipitation Records:

Table 6 summarizes the precipitation data from climatological records taken at Babbitt since 1956. Precipitation was very low during the 1984 growing season. The precipitation was below normal for each month except June.

#### Photographs:

Pictures of the test plots were taken during the 1984 growing season to document results of the research and are on file in the Environmental Control Department.

#### Plans for 1985

The research projects initiated in 1984 on N78W waste rock stockpile will continue through 1985 to evaluate the effect of winter on the established vegetation and to develop the vegetation cover to meet mineland reclamation rules governing the 90% minimum vegetative cover (6MCAR § 1.0402E.2.d.). Subsequent progress reports will include evaluations to determine the best suitable grass-legume variety mixture(s) that will meet the minimum requirements.

Soil samples will be collected in the spring to determine the need for additional fertilization on the test plots during the growing season.

Since jack pine appear to be easily established through direct seeding on the waste rock stockpile, further tests are planned to determine if jack pine can be established when the seeds are blended with a grass and legume reclamation seed mixture.

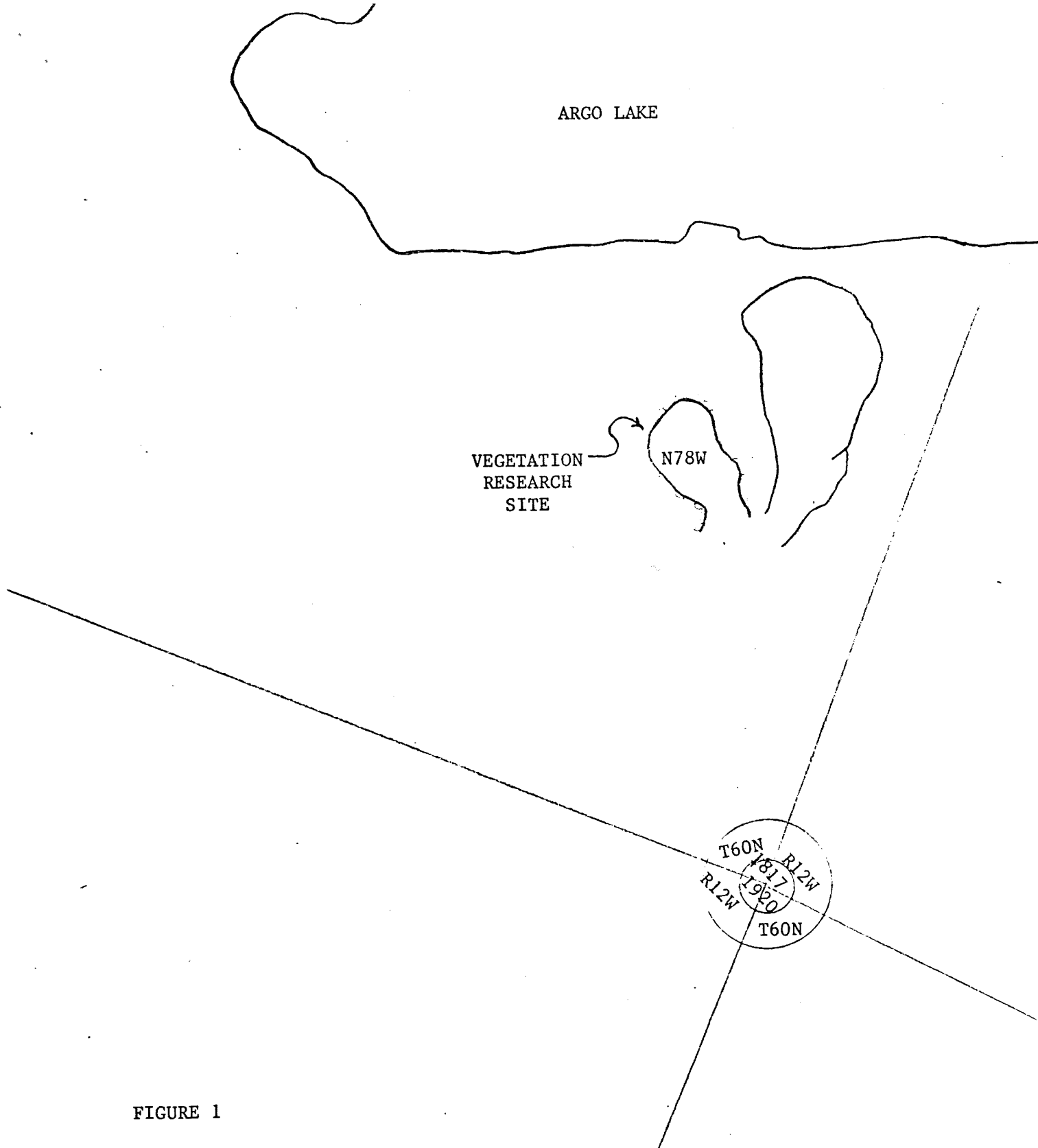
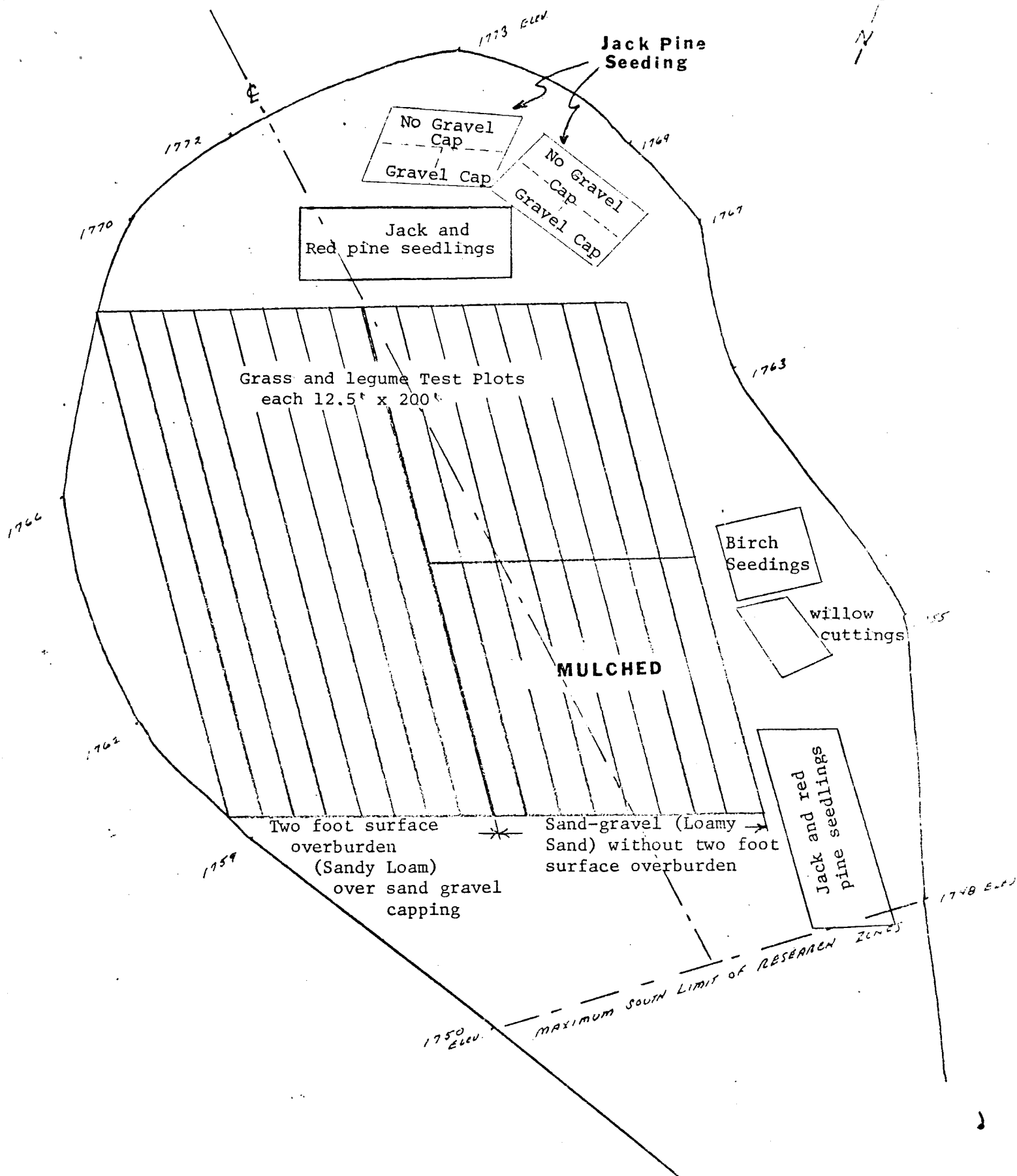


FIGURE 1  
VEGETATION RESEARCH SITE  
ON WASTE ROCK STOCKPILE



**FIGURE 2**  
N 78 WEST ROCK STOCKPILE

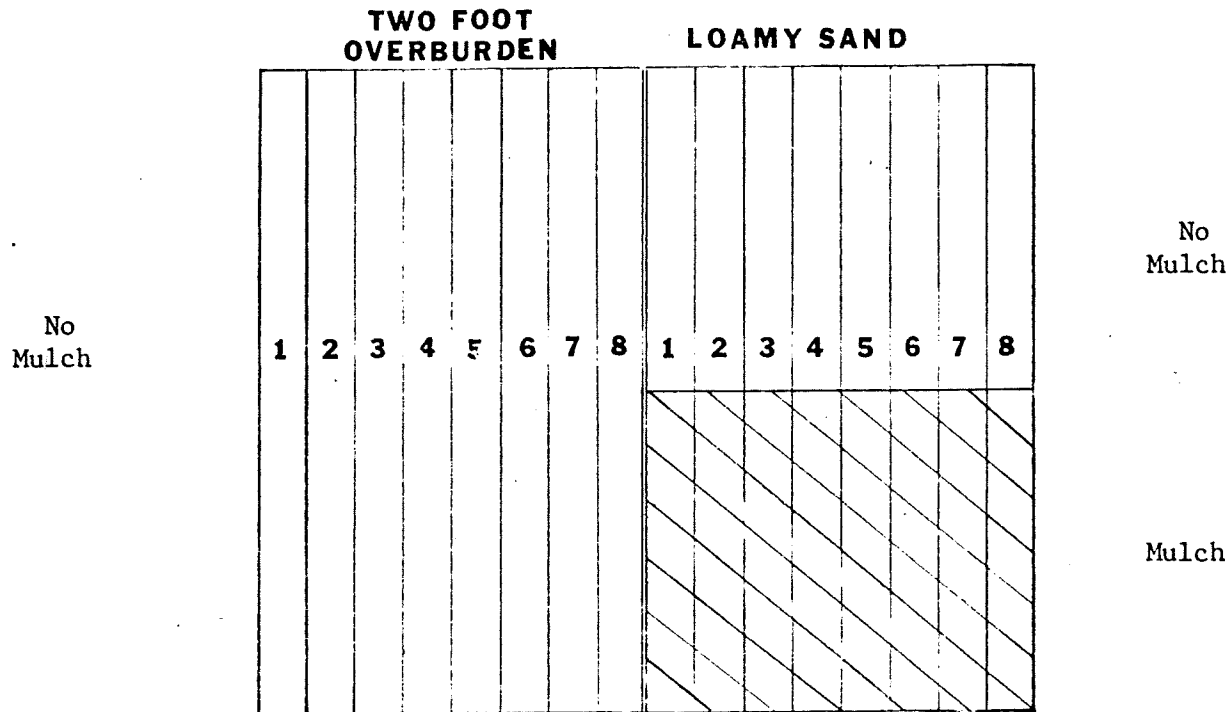
VEGETATIVE RESEARCH AREA

SCALE 1" = 50'

Figure 3

Test Plot Diagram of Grass-Legume Mixture for

Waste Rock Stockpile N78W



1. Tall fescue and redtop and vernal alfalfa.
2. Tall fescue and redtop and birdsfoot trefoil.
3. Intermediate wheatgrass and redtop and vernal alfalfa.
4. Intermediate wheatgrass and redtop and birdsfoot trefoil.
5. Smooth brome grass and redtop and vernal alfalfa.
6. Smooth brome grass and redtop and birdsfoot trefoil.
7. Crested wheatgrass and redtop and vernal alfalfa.
8. Crested wheatgrass and redtop and birdsfoot trefoil.

Test Plot Size: 12.5 feet x 200 feet (2500 square feet)

Table 1

Nutrient Availability for Each Test Condition on N78W Stockpile  
(Values expressed in elemental pounds per acre. From composite samples)

Fertilization Date	Pounds Per Acre Equivalent Rate Applied in $\text{NO}_3\text{N} + \text{P} + \text{K}$	Soil Sample Date	Soil Sample Depth	Loamy Sand (Not Mulched)*			Loamy Sand (Mulched)*			Sandy Loam (2' Surface Overburden)*		
				$\text{NO}_3\text{N}$	P	K	$\text{NO}_3\text{N}$	P	K	$\text{NO}_3\text{N}$	P	K
Prior to Fertilization	None	April & May	Surface to 6 inches	<10	25	100	<10	25	100	10	35	80
June 7, 1984	80+35+66 on all Plots	6/29	Surface to 5 inches	<10	36	134	10	45	180	15	68	165
July 6, 1984	37+16+31 on "as built" mulched and two foot "capped" plots	7/24	Surface to 5 inches	10	66	200	10	58	317	30	75	309
August 7, 1984	65+28+54 on unmulched "as built" plots	8/21	Surface to 5 inches	10	99	383	10	84	388	40	90	394
August 31, 1984	18.5 + 8 + 15 on all plots	Not Sampled										

## Percent Range of Particle Size Distribution

*Soil Classification	Coarse			Medium		Clay to		pH	Organic Matter
	Sand	Silt	Clay	Silt	Clay	Fine Silt	Clay		
"As Built" Loamy Sand	75-80%	9-13%	2-3%	9%				6.2	Nil
"Capped" Sandy Loam	65-75%	8-10%	3-5%	12-22%				4.8-6.1	Low to Medium

TABLE 2  
MEAN PERCENT COVER AND STANDARD DEVIATION OF  
GRASS-LEGUME MIXTURE PLANTINGS  
ON N78W WASTE ROCK STOCKPILE  
(See Figure 3 for Plot Number Descriptions)

<u>Plot No.</u>	<u>"As Built"</u> <u>Unmulched Loamy</u> <u>Sand (Test)*</u>	<u>"As Built"</u> <u>Mulched Loamy</u> <u>Sand (Test)*</u>	<u>"Capped"</u> <u>Sandy Loam</u> <u>Two Foot Overburden**</u>
1	47.0 ±7.9	58.0 ±10.3	43.0 ±12.2
2	45.5 ±13.6	60.0 ±6.7	45.8 ±10.5
3	47.5 ±10.9	50.0 ±5.8	35.0 ±7.9
4	46.5 ±15.1	63.0 ±8.2	48.0 ±14.2
5	36.5 ±11.1	51.0 ±10.2	41.0 ±15.4
6	42.5 ±15.0	52.0 ±16.4	36.5 ±12.2
7	37.5 ±17.5	49.5 ±14.6	31.8 ±14.1
8	<u>36.5 ±11.3</u>	<u>63.0 ±10.9</u>	<u>36.2 ±13.9</u>
Mean of Each Condition(%)	42.4 ±13.3	55.8 ±11.8	39.7 ±13.6

An analysis of variance using the F-Test was made to test the three condition means:

- o Unmulched "As Built" vs. Mulched "As Built"; Significantly different at 1% level of probability.
- o Unmulched "As Built" vs. "Capped" (2' Overburden); Not significantly different.
- o Mulched "As Built" vs. "Capped" (2' Overburden); Significantly different at the 1% level of probability.

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\* Mean percent cover based on 10 sampling points on each test plot (See Text).

\*\* Mean percent cover based on 20 sampling points on each test plot (See Text).



TABLE 3  
MEAN ORGANIC MATTER PRODUCTION (LBS. PER ACRE) AND  
STANDARD DEVIATION OF GRASS-LEGUME MIXTURE PLANTINGS  
ON N78W WASTE ROCK STOCKPILE  
(See Figure 3 for Plot Number Descriptions)

<u>Plot No.</u>	<u>"As Built" Unmulched Loamy Sand (Test)*</u>	<u>"As Built" Mulched Loamy Sand (Test)*</u>	<u>"Capped" Sandy Loam Two Foot Overburden**</u>
1	979 ±422	825 ±259	720 ±154
2	541 ±336	864 ±585	547 ±182
3	720 ±240	585 ±163	556 ±192
4	624 ±192	883 ±288	672 ±317
5	894 ±384	854 ±221	403 ±154
6	1,007 ±614	624 ±336	576 ±326
7	1,094 ±921	652 ±288	413 ±249
8	<u>633 ±288</u>	<u>1,497 ±787</u>	<u>508 ±249</u>
Mean of Each Condition(lb/acre)	812 ±478	842 ±462	549 ±248

An analysis of variance using the F-Test was made to test the three condition means:

- o Unmulched "As Built" vs. Mulched "As Built"; Not significantly difference.
- o Unmulched "As Built" vs. "Capped" (2' Overburden); Significantly different at the 1% level of probability.
- o Mulched "As Built" vs. "Capped" (2' Overburden); Significantly different at the 1% level of probability.

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\* Mean production based on five samples collected from each plot (See Text).

\*\* Mean production based on ten samples collected from each plot (See Text).

TABLE 4

SURVIVAL AND GROWTH RATE OF WOODY SPECIES  
PLANTED IN 1984 ON N78W WASTE ROCK STOCKPILE

Date Planted	Species Planted & Life Stage/Part	Days of Growth	Total No. Planted	Overall Survival Rate	MEAN GROWTH IN HEIGHT (cm) & PERCENT SURVIVAL					
					"As Built" Mulched			"As Built" Unmulched		
					No Fertilizer	Fertilized 4/4/84	(b) Fertilized 4/4 & 7/10/84	No Fertilizer	Fertilized 4/4/84	(b) Fertilized 4/4 & 7/10/84
April 4	Crack Willow Stem Cuttings	168	17	100%	15.2 (100%)	14.4 (100%)	25.7 (100%)	11.4 (100%)	(a)	23.4 (100%)
April 4	Slender Willow Stem Cuttings	168	18	94%	26.6 (100%)	17.4 (75%)	34.4 (75%)	21.6 (100%)	23.4 (100%)	23.4 (100%)
April 4	Narrow Leaf Willow Stem Cuttings	168	19	53%	4.4 (40%)	37.4 (67%)	32.4 (67%)	28.9 (50%)	12.4 (50%)	38.9 (67%)
May 10	Jack Pine, 2-3 Yr. Old Seedlings	132	60	92%	12.4 (100%)	9.9 (100%)	14.1 (78%)	10.9 (100%)	16.2 (100%)	13.9 (67%)
May 10	Red Pine, 2-3 Yr. Old Seedlings	132	60	80%	5.1 (93%)	5.3 (50%)	6.8 (78%)	5.9 (100%)	5.0 (67%)	7.5 (56%)

(a) Not Tested

(b)

Prior to planting, fertilizer was broadcasted at the rate of 50 lbs. nitrate-nitrogen, 22 lbs. phosphorus, and 42 lbs. potassium per acre equivalent. The second fertilizer application made on July 10 and evenly distributed at the base at the rate of 17 lbs. nitrate-nitrogen, 7.6 lbs. phosphorus, and 14.3 lbs. potassium per acre equivalent.

TABLE 5  
JACK PINE SEEDING\* ON N78W  
FOR 1984

<u>Test Condition</u>	<u>Number of Subplots Examined</u>	<u>Total Number of Seedlings Counted</u>	<u>Total Seedlings Per Square Meter</u>	<u>Comments</u>
Rough/Rock Terrain				
1. Fertilized	6	4	0.67	Gravel-Rubble Rock; Sparse Vegetation cover, seedlings 2 cm high & appear in excellent condition.
2. Not Fertilized	6	3	0.50	
Loamy Sand Terrain				
1. Fertilized & Scarified	3	0***		Sand-gravel capping and some exposed rubble; vegetation more prevalent than rocky terrain, seedlings 2 cm high and appear in excellent condition.
2. Fertilized & Not Scarified	3	2	0.67	
3. Not Fertilized & Scarified	3	2	0.67	
4. Not Fertilized & Not Scarified	3	2	0.67	

\* Seed rate of 7.2 pure live seeds per square meter on each test condition.

\*\* Each subplot is 1.0 square meter in area which were randomly selected by measuring distance along the boundary lines from values obtained from random numbers tables. The total area examined for seedling development was 17.22% of the total area of each test condition.

\*\*\* Earlier in the summer, one seedling was observed which did not survive through the summer.

TABLE 6  
SUMMARY OF PRECIPITATION AT BABBITT  
FROM 1956 TO 1984 FOR THE MONTHS  
JUNE THROUGH SEPTEMBER  
(inches of water)

Month	Loss/Gain in 1984 from Average Since 1956		For 1984		Since 1956		Highest for One Period Since 1956*		Lowest for One Period Since 1956**	
	By Month	Accumulated	Month	Accumulated	Monthly Average	Accumulated Average	Month	Accumulated Average	Month	Accumulated Average
June	1.31	1.31	5.28	-	3.97	-	6.15	-	2.64	-
July	-2.05	-0.74	1.41	6.69	3.46	7.43	3.49	9.64	2.04	4.68
August	-0.90	-1.64	3.05	9.74	3.95	11.38	6.72	16.36	0.99	5.67
September	-2.20	-3.84	1.34	11.08	3.54	14.92	5.74	22.10	2.21	7.88

\* Occurred in 1977

\*\* Occurred in 1970

1984 RECLAMATION  
BABBITT ACTIVITIES

During 1984, planting and fertilizer applications were made on 4.2 acres of side hills and flats adjacent to the new main entrance road into the mine. The surface was graded, contoured and large rocks covered with soil so that vegetation equipment could safely operate on this area. Banks were cut to a slope of 2:1 or less.

Plantings were carried out from May 23 to May 25. This included broadcasting dry commercial fertilizer at the rate of 500 pounds of 10-10-10 per acre and incorporating it three to four inches below the surface by back blading, using a dozer. Seeds were sown by broadcasting a pure live seed mixture of five pounds of redbud per acre, 12½ pounds of smooth bromegrass, 12½ pounds of intermediate wheatgrass, 7½ pounds of vernal alfalfa and 7½ pounds of birdsfoot trefoil. Legumes were inoculated with an appropriate nitrogen fixing bacteria prior to planting.

The seeded ground was then compacted by driving a cleated track dozer over the entire seed bed. A mechanical mulch blower was used to apply aged redbud hay on approximately two acres of banks having slopes greater than 4:1. The rate was two tons per acre. Flats and gentle slopes were not mulched.

On July 10, 300 pounds of 17-17-17 per acre of dry commercial fertilizer were applied as a top dressing over the four acres of side hills and flats along the main entrance. Vegetation growth responded favorably and by the end of the growing season ground cover and vegetation appearance was good. The varieties and procedures used for this site will insure a permanent vegetative cover.

1984 RECLAMATION ACTIVITIES  
SILVER BAY

MILE POST 7 TAILINGS BASIN

During 1984, planting and fertilizer top dressings were made on approximately nine acres of native soils. The areas were located along the temporary diversion ditch, adjacent to the main railroad tracks, along the low flow diversion channel 1 of Little Thirtynine Creek and on an abandoned road.

Temporary Diversion Ditch

Erosion control work associated with the temporary diversion ditch included applying fertilizer as a top dressing to about two acres of banks and crests along the ditch to promote vegetative cover. The rate and grade was 300 pounds of 10-10-10 per acre and applied on June 5.

Additional rock dams were placed late last winter in the lower stretch of the ditch channel to slow water velocities. On July 17, about one acre of the bank and crest next to the rock dams was repaired and replanted from the rock placement. Fertilizer was applied at 300 pounds of 10-10-10 and harrowed into the surface. Seeds were broadcasted at the rate of 15 pounds reed canary, ten pounds timothy, five pounds birdsfoot trefoil and two pounds redtop. The seed bed was compacted.

From May 15 to 17, 3.5 acres of southern hill side in lower pit 1 were planted. Fertilizer was applied at 300 pounds of 10-10-10 per acre and worked into the surface. Seeds were broadcasted at an acre rate of 15 pounds smooth brome grass, 15 pounds birdsfoot trefoil, 15 pounds timothy, 15 pounds reed canary grass and five pounds redtop. The ground was compacted and two tons per acre of straw was applied on top of the seeded area. Erosion control netting was placed on portions of the hill side. Some minor maintenance may be needed in 1985.

Adjacent to Main RR Branch

On August 14 and 16 about 1.5 acres of the hill side and ditch north of the main railroad tracks adjacent to the road crossing into the basin were planted to stabilize eroding banks. Fertilizer at the rate of 176 pounds of 17-17-17 per acre was applied. Where possible the fertilizer was worked into the surface. Seeds were broadcasted at the rate of 17 pounds birdsfoot trefoil, 22 pounds reed canary grass, 2.5 pounds redtop and 5.5 pounds timothy. One to two tons of aged hay was applied over the seeded area. Erosion control netting was placed on critical areas to protect the seed bed from heavy rains. Some minor maintenance may be needed in 1985.

Low Flow Diversion Channel 1

On April 11 and April 30 about 0.1 acre of the southern bank along the low flow diversion channel Little Thirtynine Creek was seeded with jackpine to provide future shade for fisheries improvement. During the summer jackpine seedlings were observed growing on the bank.



### Abandoned Road

About one acre of the abandoned road between bench marks 305 and 306 was fertilized with 300 pounds of 10-10-10 per acre, harrowed, seeded, compacted, and sprayed with 10% Coherex in water. The seeds and rate were reed canary grass at ten pounds per acre, smooth brome grass at ten pounds per acre, birds-foot trefoil at five pounds per acre, timothy at seven pounds per acre and red top at two pounds per acre. Some minor maintenance may be needed in 1985.

### TAILINGS DELTA

On August 22, 1½ acres of delta were fertilized to promote vegetative cover. About 1/2 acre next to clarifier 2W was planted with willow and poplar stem cuttings. Some minor touchup work may be needed in 1985.

Examination of woody species establishment on taconite tailings was the main research effort on the delta in 1984. The species which appear most suitable for growth on tailings are red pine, jackpine, crack willow and slender willow. We will continue to examine woody types for long term survival and screen new species for growth on tailings.

1984 RECLAMATION  
BABBITT ACTIVITIES

During 1984, planting and fertilizer applications were made on 4.2 acres of side hills and flats adjacent to the new main entrance road into the mine. The surface was graded, contoured and large rocks covered with soil so that vegetation equipment could safely operate on this area. Banks were cut to a slope of 2:1 or less.

Plantings were carried out from May 23 to May 25. This included broadcasting dry commercial fertilizer at the rate of 500 pounds of 10-10-10 per acre and incorporating it three to four inches below the surface by back blading, using a dozer. Seeds were sown by broadcasting a pure live seed mixture of five pounds of redbud per acre, 12½ pounds of smooth bromegrass, 12½ pounds of intermediate wheatgrass, 7½ pounds of vernal alfalfa and 7½ pounds of birdsfoot trefoil. Legumes were inoculated with an appropriate nitrogen fixing bacteria prior to planting.

The seeded ground was then compacted by driving a cleated track dozer over the entire seed bed. A mechanical mulch blower was used to apply aged redbud hay on approximately two acres of banks having slopes greater than 4:1. The rate was two tons per acre. Flats and gentle slopes were not mulched.

On July 10, 300 pounds of 17-17-17 per acre of dry commercial fertilizer were applied as a top dressing over the four acres of side hills and flats along the main entrance. Vegetation growth responded favorably and by the end of the growing season ground cover and vegetation appearance was good. The varieties and procedures used for this site will insure a permanent vegetative cover.

4.2  
2.0  
2.2  
1.2