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THE PARK

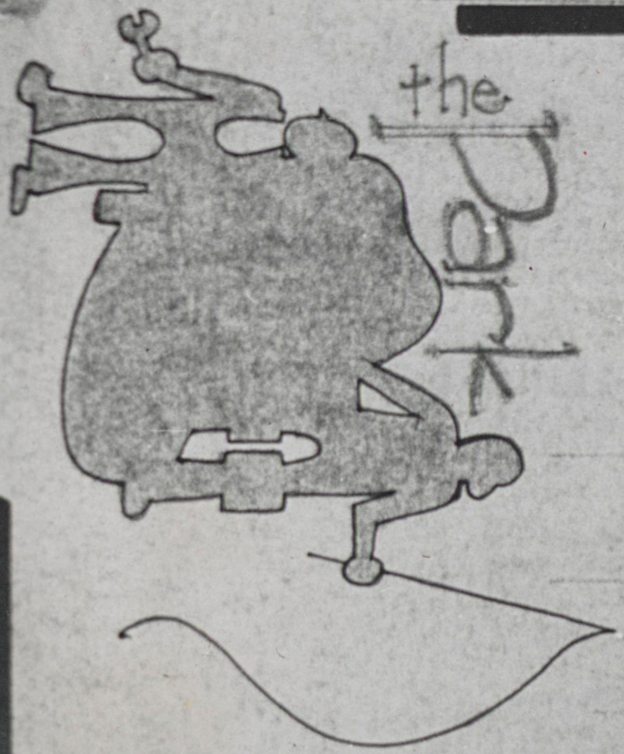
An Industrial Co-operative
for Bozeman, Montana

by

Steven R. Harrison

A thesis submitted to the Architecture Faculty
in partial fulfillment of the requirements for the
degree of
Bachelor of Architecture

Montana State University
Bozeman, Montana
June, 1975


the
THESIS

"When the content (architectural) is so trivial (candle shops, boutiques, technical gadgetry for the World's Fair) the brilliant form just drives the point in with further gusto. Hence we have reached the ironic position of having what may well be the most inventive and excitingly formal architecture ever produced, with surely the most ridiculous content."

Charles Jencks, Modern Movements In Architecture, Doubleday, 1973, p. 371.

Arch

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THESIS

Architecture for industry, like any other architecture, is obligated to reflect the desirable qualities of our modern culture.

In the design of industrial buildings, particularly several industries in close physical proximity (hereafter referred to as "Industrial Park") the very nature of the existing systems and processes indicates the logical possibilities (and obligations) for inter-relationships between those systems into a larger more effective, more homogeneous whole. Development of this idea is possible in many ways, from visual unity to economic and systematic functionalism. Buckminster Fullers favorite word "synergism" expresses my objectives in its definition: that the total effect is greater than the sum of the effects taken independently.

Cultural qualities which I feel are positive and which require attention in the solution of any architectural problem are economy, efficiency, technology, environmental consciousness, change, rationalism, communication, mobility and precision.

HISTORY

In researching the historical role of factories--their economic and social roles, imagery involved, etc.--beginning primarily around the time of the Industrial Revolution, I concluded several points which I consider worthy of note when assuming the design of a contemporary factory facility:

1. At the beginning of the Industrial Revolution, aims of manufacturing, society and factory owners were similar. Emphasis rapidly went from the quality of the product to just making money thus breaking the link with the community and conditions began to deteriorate.
2. Factory design lost its direction at the end of the 19th century and hit a low in the 1940's and 50's. Lack of a philosophy to order and integrate manufacturing, society, and the environment as a whole caused this disorientation.
3. At this time, there was somewhat of a divorce of technology by society.
4. Owners originally built housing and facilities for their workers.
5. Factories historically have been sited for raw materials, natural water power, work force, and transportation links.
6. Often time spent in factories was considered a necessary evil and factories were designed in that respect.
7. Factories have historically symbolized technology, employment, progress and patriotism.

The industrial architects that have influenced me are numerous, and study of their work was essential in obtaining a feel for a historical "factory aesthetic." Albert Kahn, Saarinen, Gropius, Stirling and many others stand out, and although the projects most frequently published were at a much larger scale than I planned on working, one can always learn from the study of great men and their work.

Recent trends in the field of industrial architecture are also important, and from this portion of my research I obtained several more points worth noting:

1. There seems to be an increasing sophistication of larger clients concerning industrial architecture.
2. There are more precise controls at internal environments due to rising power of organized labor and severity of employee compensation laws.
3. Increasing use of phased construction.
4. Clients are striving for obtaining a building in the shortest time at the lowest cost.
5. A growing concern with community impact--socially, economically, visually, environmentally.
6. There seems to be an increasing use of color, graphics and landscaping, both interior and exterior.
7. An increasing sensitivity to the working environment.
8. More expensive equipment being used, greater need for security.
9. Controls being more clearly defined by the Occupational Safety and Health Act of 1970.

10. Trends towards energy conservation.

11. Greater need for flexibility and adaptability.

12. Move towards "cell" production rather than "line" production.

13. Movement further from CBD's.

14. There fortunately seems to be a trend away from "in-house" architecture.

Also trends in the design of industrial park developments are towards the traditional separate building theory, related only by location and possibly access roads.

SITE

I chose to take the approach of being hired to design an industrial park in an area already deemed as economically feasible for such a development. Therefore, I made an effort to find a site already zoned and planned by the owners to be an industrial park. I came up with three major possibilities: (see map)

1. Gardener-Simmental Plaza, located north-west of town on I-70.
2. Small lot owned by Bozeman Sand and Gravel north of town, south off Griffin Drive.
3. Large site with proposed lake north of town and north of Griffin Drive (also owned by Bozeman Sand and Gravel).

After extensive study of the three sites, their sizes, sitings, utilities, etc., I settled on the large site owned by Bozeman Sand and Gravel. I obtained much information from Glen Hash, Bozeman Sand and Gravel representative, who was happy to consult as a client.

In a detailed analysis of this site, I realized numerous exterior influences to be considered during design:

1. Bridger Mountains
2. Storey Hills
3. Tank Farm
4. Northern Pacific Railroad
5. Griffin Drive
6. County Road
7. Future City Park

8. Drive-in Movie Screen

9. Gallatin River

10. Sun, Wind, and Climate

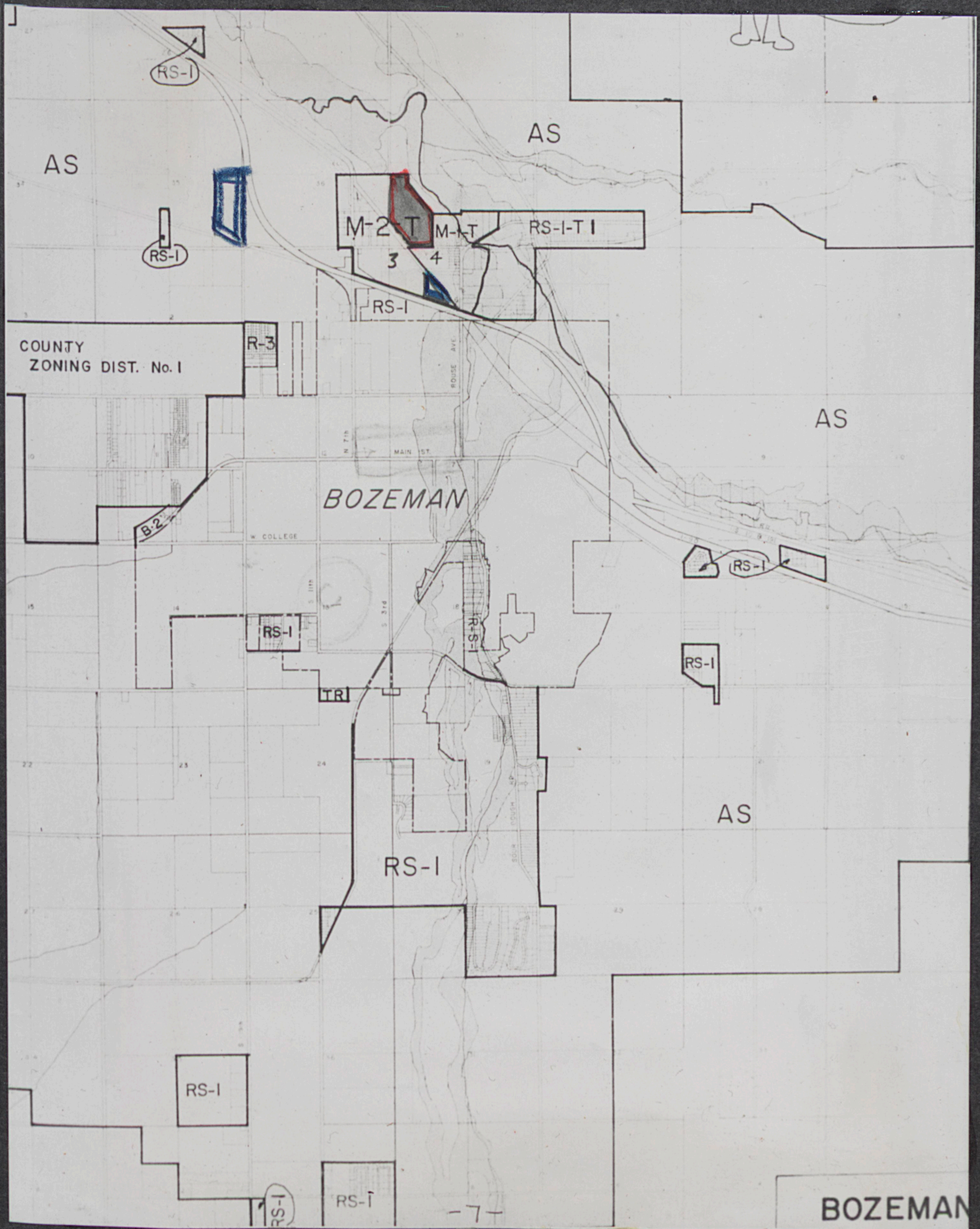
On site factors involve:

1. Existing sewer, gas, power, and ground water

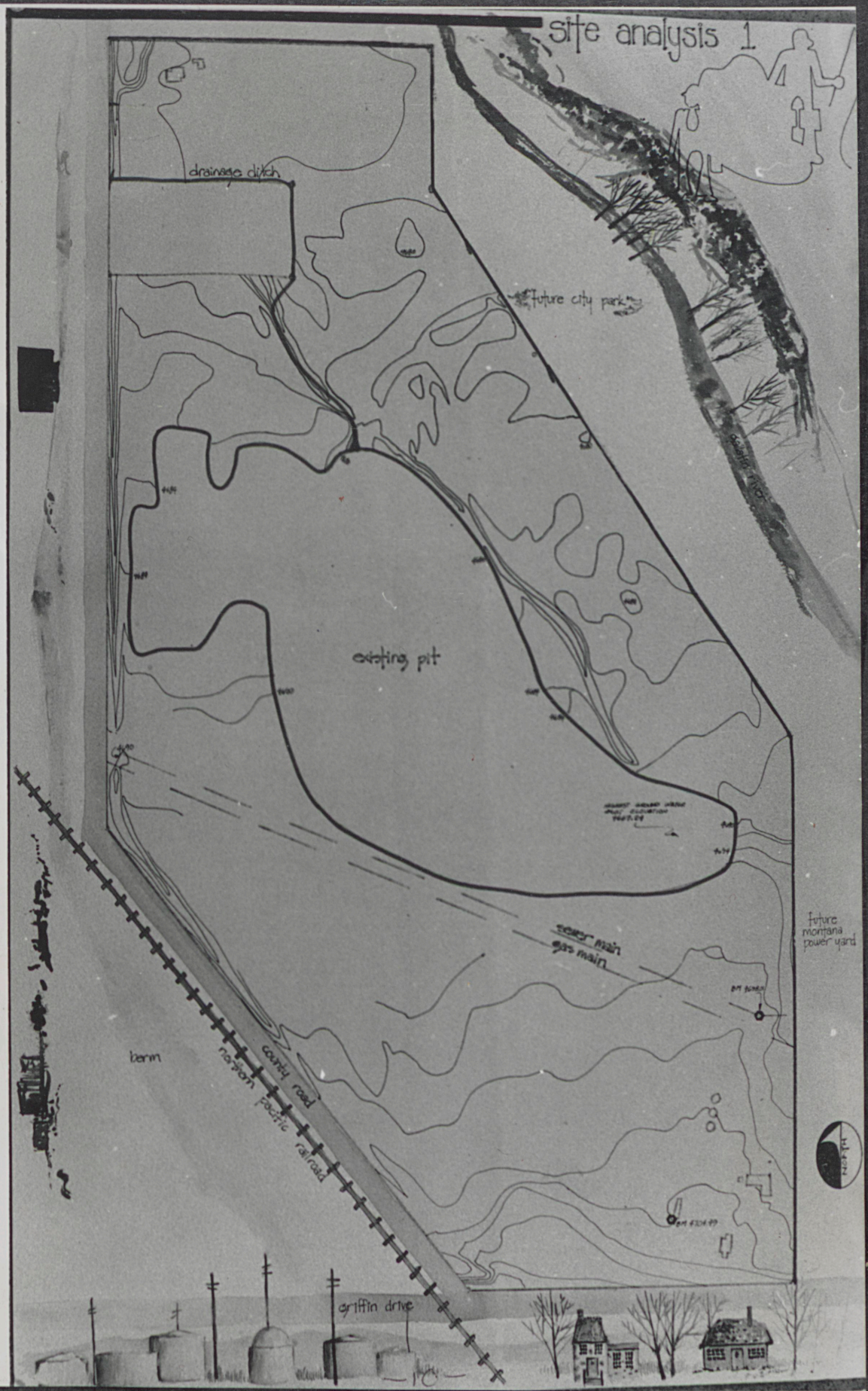
2. 42 foot natural elevation change rising north to south

3. 20 acre proposed lake in empty gravel pit

4. Some sparse deciduous vegetation


RS-1
AS
AS
M-2 T
M-1-T
RS-1-T 1
3
4
RS-1
COUNTY
ZONING DIST. No. 1
R-3
AS
BOZEMAN
B-2
RS-1
RS-1
RS-1
TR
RS-1
AS
RS-1
RS-1
RS-1
BOZEMAN


BOZEMAN SAND & GRAVEL
TOPOGRAPHIC MAP
SURVEYED & PLATTED by C. BLANKENSHIP, D. SULLIVAN


site analysis 1
drainage ditch
future city park
existing pit
future montana power yard
water main
gas main
barn
county road
northern pacific railroad
griffin drive

Assuming industrial facilities of approximately 25,000 square feet in size, I came up with an economic and physical site capacity analysis. These two analyses were done under the assumption that the available land would be subdivided into 3-acre lots, one to be alloted to commercial/craft development, and as many of the remaining lots as necessary to make it feasible going to industry. My analysis showed six such industries were necessary for the clients desired return (one being commercial) making it possible to allot the northeastern 18-20 acres to use as recreation area in conjunction with city plans for a park. This served two purposes, leaving the view in that direction unobstructed, and giving the city lake frontage for recreation.

These findings indicated to me that the primary emphasis of the programming phase of my project was required in site planning. At the point of designing my site, I was still assuming the traditional approach of separate buildings, and designed the site under this premise. As you will see, this premise changed requiring the re-design of the site, although many of the same ideas remained.

SITE CAPACITY

Economic

all financing assumed 30 yr payments

land - $280,000
× 2 (financing)
30 | 560,000
$18,700/yr

tax - $3,000/yr

construction 25,000 sq ft bldgs
× 6 sites
150,000
× $25/sq ft (metal)
$3,750,000
× 2 (financing)
30 | $7,500,000
250,000/yr

roads 25,778 sq. yds
× $6/sq. yd
$154,668
× 2 (financing)
30 | 309,336
$10,300/yr
+ 20,000/yr parking
$30,300/yr

18,700/yr
3,000/yr
250,000/yr
39,300/yr
$302,000/yr
+ 10%
$330,000/yr

110,000 sq ft
3 | $330,000

110,000 sq ft needed

ECONOMIC SITE CAPACITY

SITE CAPACITY

Physical -

site size - 64 acres

unbuildable land

lake -	20 acres
buffer easement access	10 acres
mechanical	2 acres
	32 acres

64
-32
32 buildable acres

2½ - 3 acre sites
= 11 sites
- 5 sites for recreational
6 sites (5 res, 1 commercial)

PROGRAMS

In considering how many and what programs would be required for my project, I realized that simce my major emphasis was to be on the park as a whole, I could not allow myself the time to analyze any number of processes in detail and develop my own programs. Therefore, I made two decisions: 1) That three industrial programs would be sufficient to develop a model for the concept I had in mind and 2) I would use pre-determined programs, adjusted to my concepts needs.

The Industrial Engineering department (specifically Mr. Eldon Olson) supplied me with two very detailed industrial programs, senior theses in fact from Industrial Engineering students. These were Yellowstone Plastics, a PVC pipe forming plant, and Swanda, a factory for making small kitchen utensils (e.g. can opener). My third program came from the files of architectural programs, and is that of a soft drink bottling plant.

The process and storage requirements of these facilities were used almost exactly as stated in the information. However, the administration programs were somewhat altered and added to in anticipation of centralizing these facilities. I also developed my own program for facilities for the employees themselves.

In analysis of these three programs (averaging approximately 25,000 square feet each) I realized that there were several departments that had distinct similarities. These included the administration area, shipping and receiving departments, and storage areas.

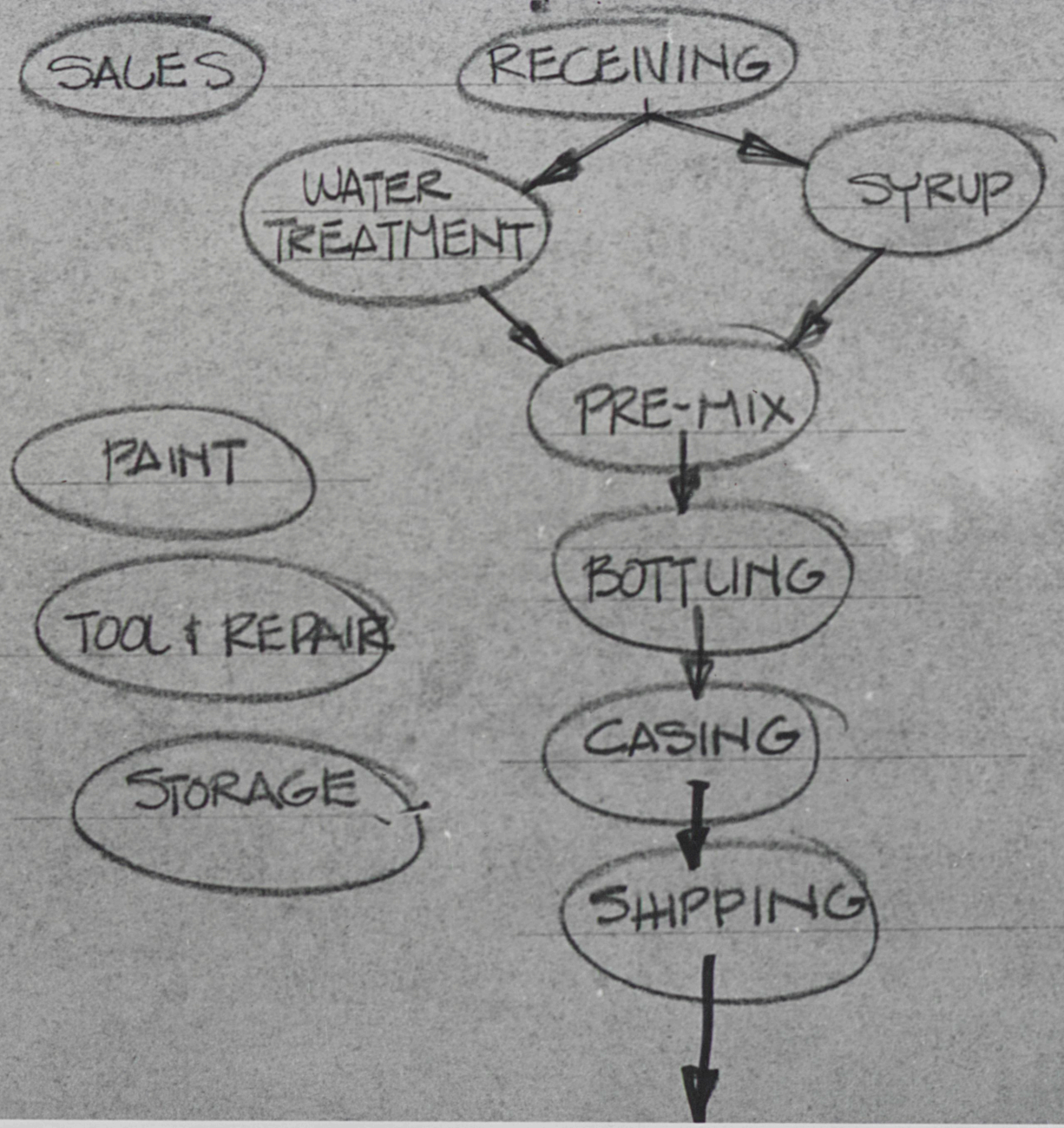
PROGRAM

Cola

Sales		
	lobby	300 sq. ft.
	owners office	250
	sales office	150
	salesmens offices	200
	sales room	700
	business offices	400
	vault	150
Production Process		
	pre-mix	350
	water treatment	900
	syrup room	750
	bottling room	1200
	offices	250
Casing Area		1000
Warehouse		12000
Truck Loading and Parking		8500
Machine Servicing		
	paint room	100
	tool and repair room	500
	machine storage	800

25 employees

SCHEMATIC


SALES
RECEIVING
WATER TREATMENT
SYRUP
PRE-MIX
PAINT
BOTTLING
TOOL & REPAIR
CASING
STORAGE
SHIPPING

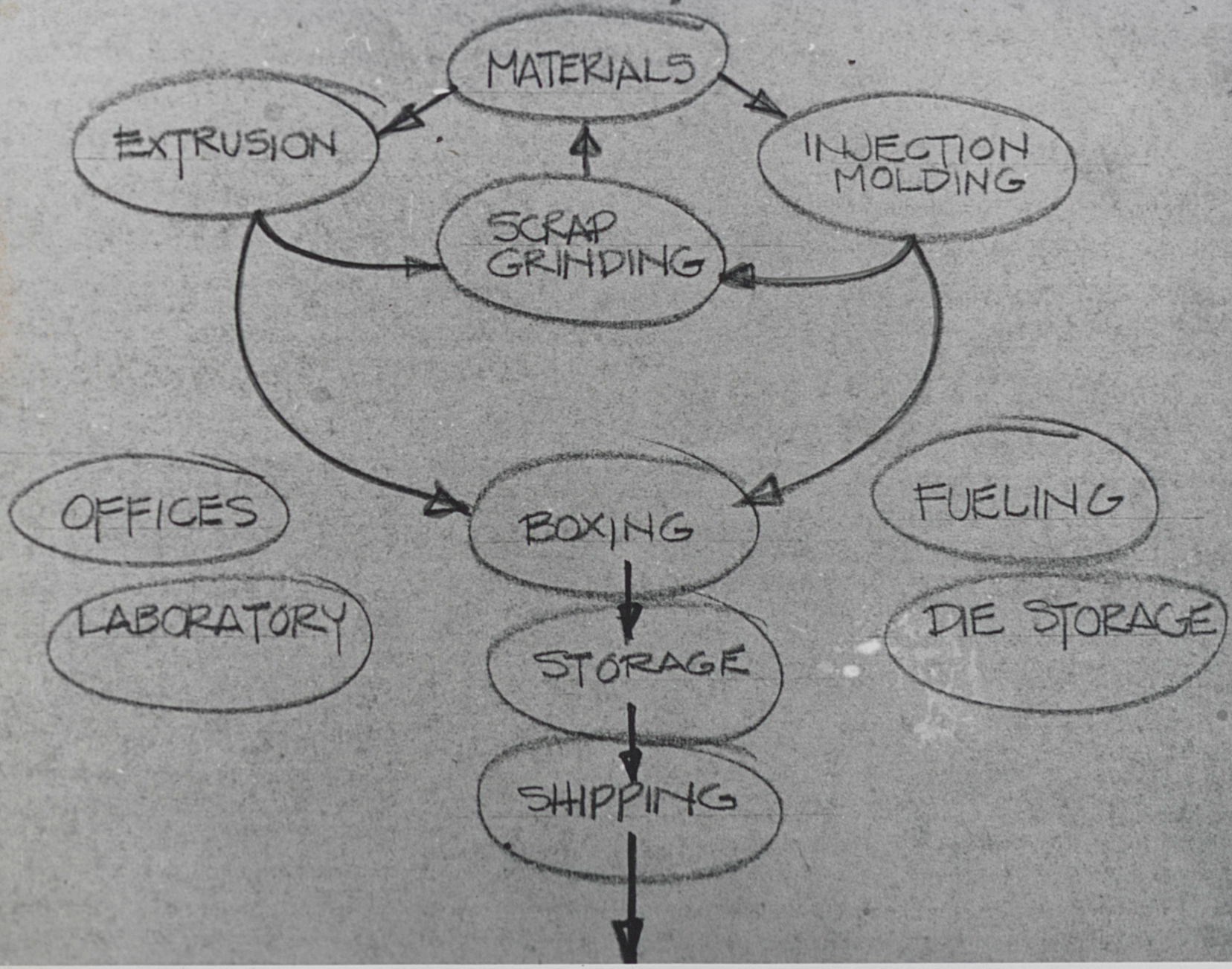
PROGRAM

Yellowstone Plastics

Extrusion	5188 sq. ft.
Injection Molding	2688
Scrap Grinding	1400
Dye Storage	108
Shipping and Receiving Office	91
Foreman's Office	77
Fueling Station	117
Lab and Engineering Office	770
Maintenance and Janitorial	625
Box Storage and Receiving	1920
Warehouse and Shipping	11570
Toilets (3)	400

30 employees

SCHEMATIC


MATERIALS
EXTRUSION
INJECTION MOLDING
SCRAP GRINDING
OFFICES
LABORATORY
BOXING
FUELING
DIE STORAGE
STORAGE
SHIPPING

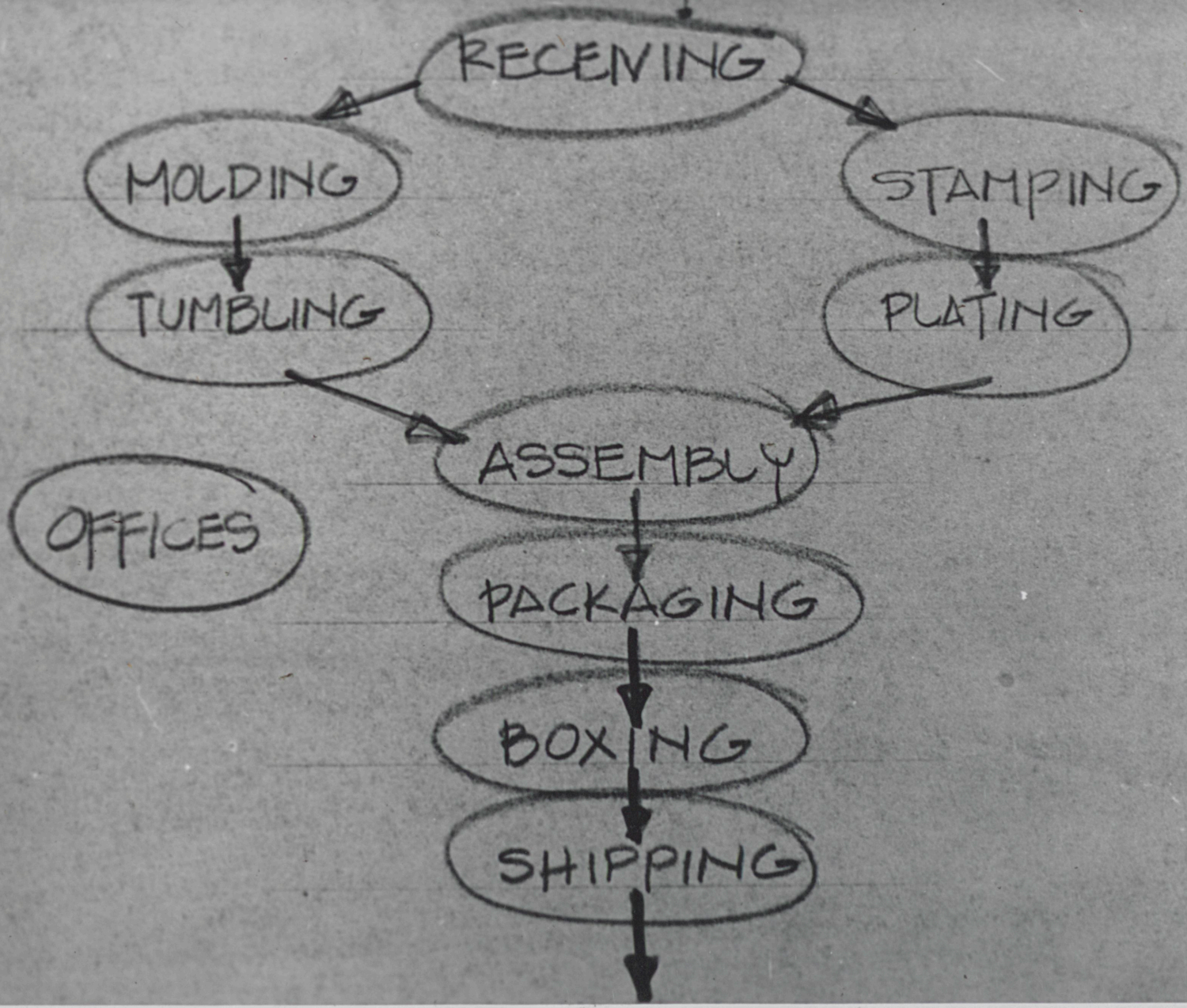
PROGRAM

Swanda

Receiving	3360 sq. ft.
Molding	2040
Tumbling	480
Stamping	1530
Plating	1320
Assembly	1250
Packaging	295
Boxing	260
Shipping	3360
Production Foreman's Office	90
Offices	2450

25 employees

SCHEMATIC


RECEIVING
MOLDING
STAMPING
TUMBLING
PLATING
ASSEMBLY
OFFICES
PACKAGING
BOXING
SHIPPING

PROGRAM

Park

Minimal Vehicular Traffic

Density (see site analysis)

Centralized Services

Unity

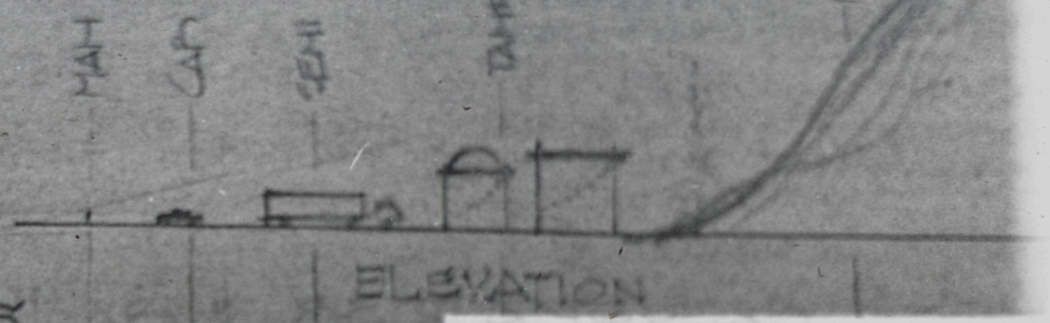
Employee Facilities for 80+ People

1.	Medical Service	
	Resident Doctor's Office	150 sq. ft.
	Two Nurses Offices	200
	Examination Rooms (2)	200
2.	Lockers	300
3.	Toilets	200
4.	Food Service w/ Kitchen	2000
5.	Recreation Facilities Room	750
	Pool Table	
	Ping Pong	

The scale of anything put on this site is of extreme importance, as you are dealing with the Bridger range to the northeast and the tank farm to the southwest--one a natural organic geometry, the other a strict man-made cylindrical geometry. Scale and texture are two important considerations on this site.

•IMAGERY:

■SCALE



■VIEWPOINTS

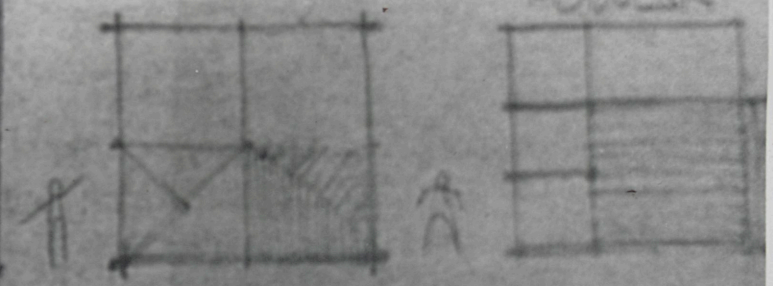
① DISTANT
(across Lake, N. 7th, Bridger Dr.)

② NEAR
(street, pkng lot, approaching bldg.)

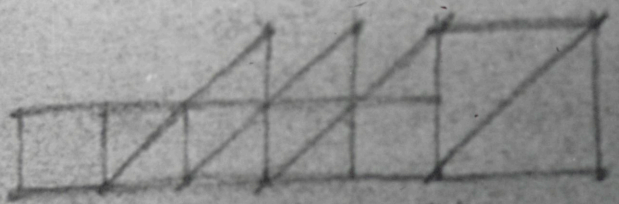
■VIEWERS

① STANDING
② WALKING
③ PASSING IN CAR

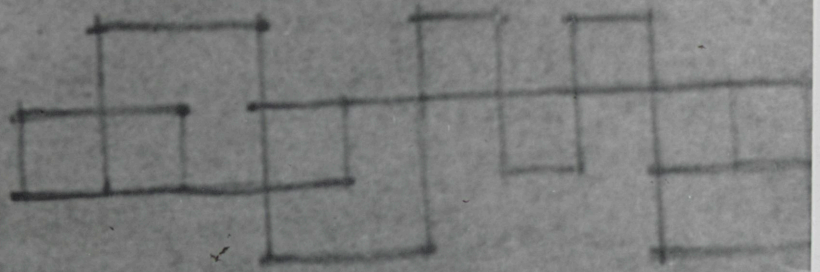




•CHANGE: GROWTH: FLEXIBILITY



RIGHT ANGLE



APPLICABLE IN PLAN
ELEVATION & SECTION

IMAGERY

Imagery and appropriateness are important aspects of design today--not that a building ought to be designed from the outside in, but that starting from the inside and the outside it is possible to meet harmoniously in the middle. The basic existing images affecting my site, as previously mentioned, are the Bridger Mountains and the Conoco tank farm. A site condition which was deduced, and will prove important in the development of my design, is the fact that there is a definite progression of degree of order and regimentation across the site. To the south and west, a definite grid type order exists, while diagonally across the site, the geometry breaks into natural free-form shapes. My site, then, effectively becomes the transition from one to the other, and any design developed on that site needs to reflect and respond to this fact.

My decision for an appropriate and efficient transitional industrial image on my site is this--the use of rectangular (primarily square) building forms and geometry in an attempt to develop the necessary transition between strict cylindrical shapes and organic free-form. Rectangular geometry is, of course, most appropriately suited to the functional efficiency of my processes and facilities.

The basic concept behind my choice of rectangular vocabulary is 'image reinforcement thru contrast', that is contrasting the rectangular geometries with organic and cylindrical, while at the same time creating an order on the site and creating the necessary transition.

DESIGN: CONSIDERATIONS AND OBJECTIVES

I developed, from my research and study, several considerations which I tried to keep upper most in my mind during the design of my project. Considerations for the buildings themselves were:

1. Service for buildings, processes and machines
2. Reduction of production costs
3. Pleasant working environment
4. Efficient transportation of workers, materials and products
5. Flexibility for growth or change
6. OSHA of 1970
7. Building as an advertisement for the character of the company and quality of the product.
8. Developed employee facilities
9. Use of energy conservation methods

My major considerations for the park as a whole were:

1. Visual, graphic order
2. Overall, landscaping philosophy
3. Centralized services such as utilities, solar heat, parking, use of lake, etc.
4. Effects on park and community
5. Industrial-recreational dualism

My park objectives have generally been mentioned or implied previously, but to reiterate and summarize, they basically are:

1. To introduce a system of interrelationships between individual processes for purposes of convenience, economy and order.

2. To provide a positive addition to the social and economic fabric of the existing community.

3. To create a concrete identity, a definite sense of place.

4. To reinforce and enhance the industrial-recreational dualism of the site.

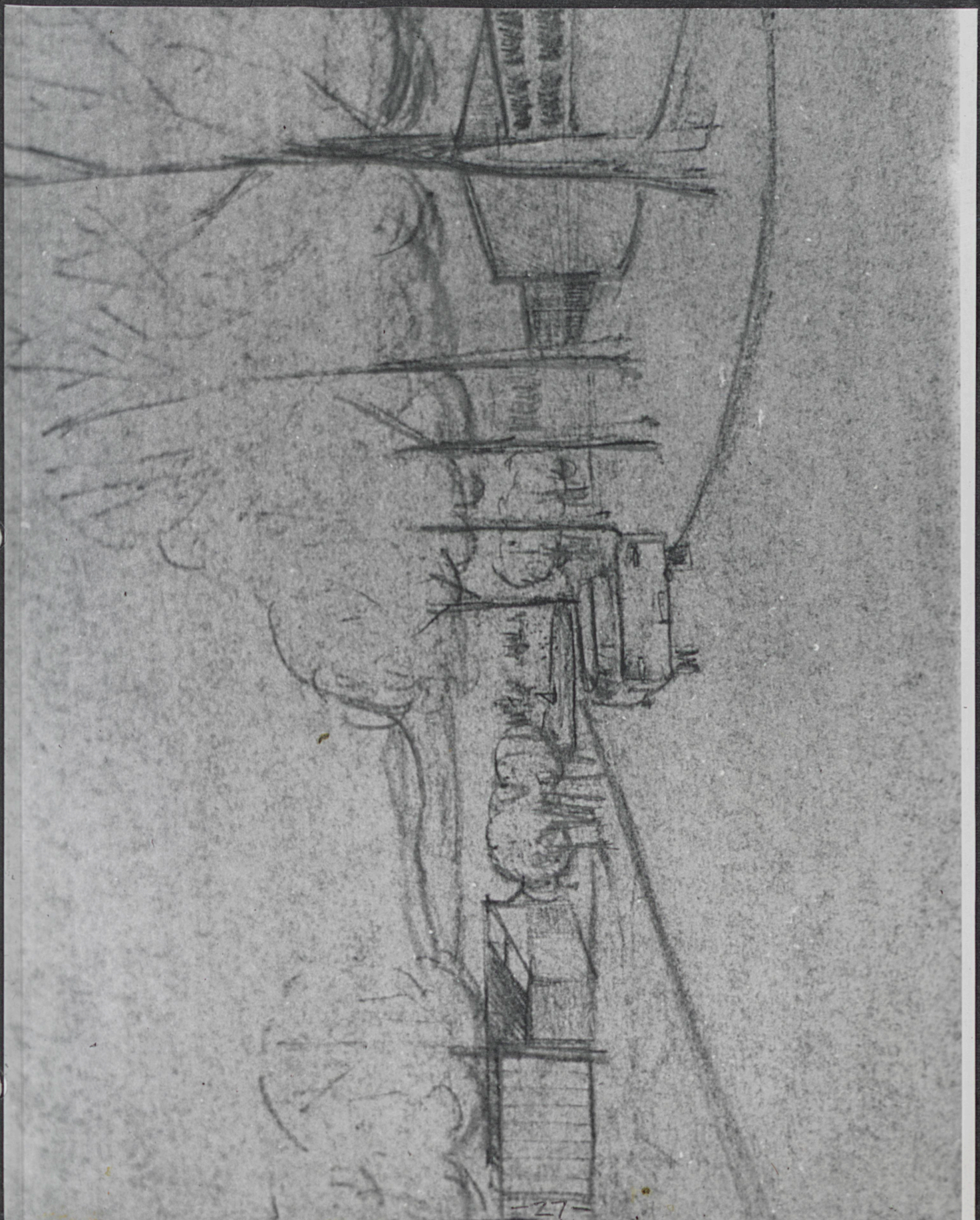
5. To develop a graphic visual order for the site.

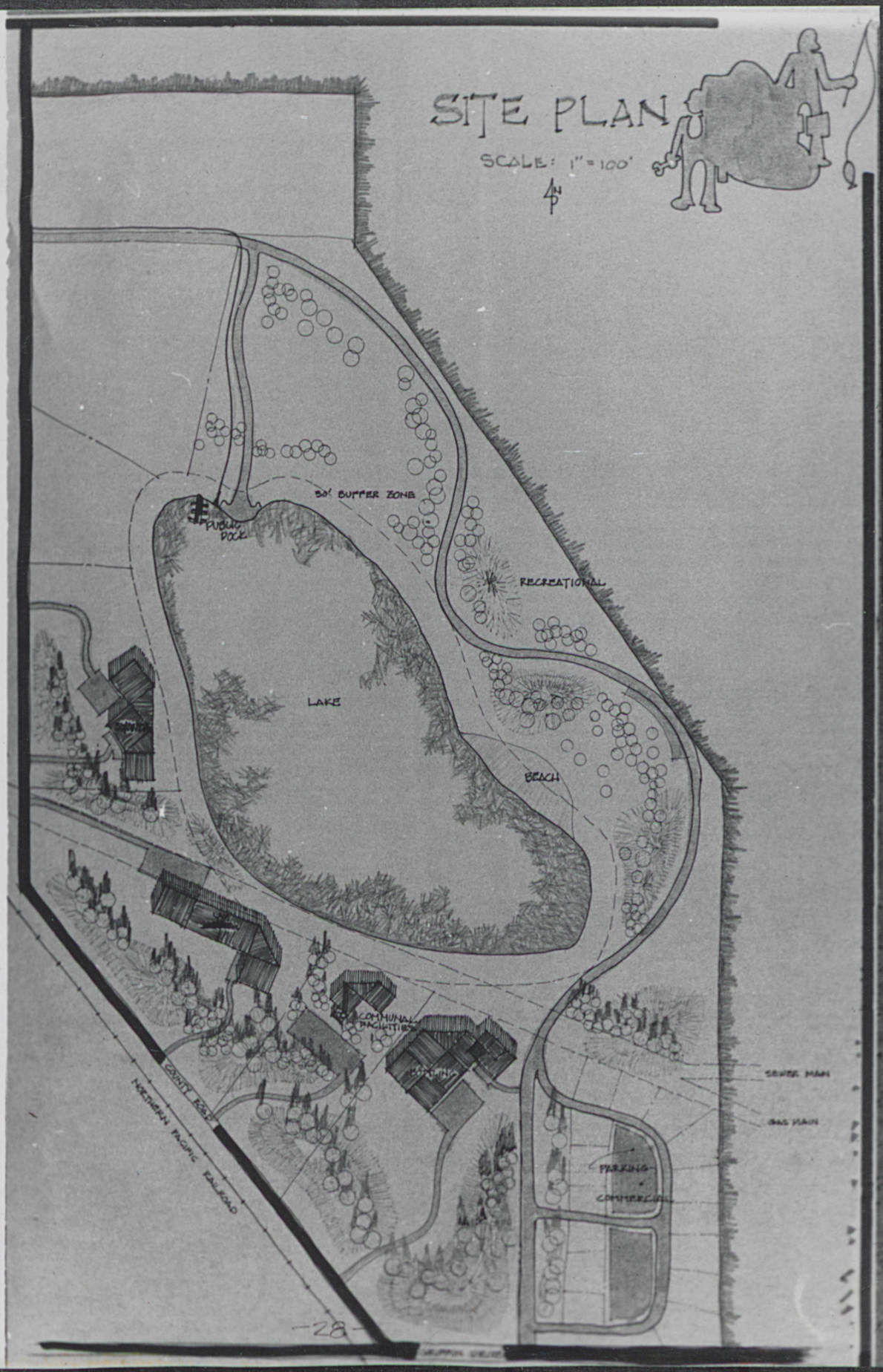
CONCEPT

My concepts on the design of a park are multivalent and will hopefully create an interesting complexity for the site and surrounding area. Working with the ideas that scale and texture occur on different levels depending on location and condition of perceiver, I worked with the manipulation of this fact and the control of different vistas and positions of the perceiver. With the use primarily of landscaping, I created a mat effect from a distance, a softening in the foreground and background of my buildings, while setting up a screening device with trees when approaching the building from a closer point. The landscaping is also used to give directional quality at several levels--visual, vehicular and pedestrian and help control movement across the site.

My concepts concerning the use of solar energy are, basically, that it cannot be ignored, especially in a case like this, where large expanses of roof area are available, and temperatures inside a warehouse ordinarily need not be as high as with many structures. An interesting note here is the fact of traditional historical use of natural power is finally being returned to.

At this point, I felt that the buildings, rather than taking on the traditional separate building image, would probably lean towards consolidation into one structure for convenience and economic stability.




SITE PLAN
SCALE: 1" = 100'
50' BUFFER ZONE
PUBLIC DOCK
RECREATIONAL
LAKE
BEACH
COMMUNAL FACILITIES
SEWER MAIN
GAS MAIN
PARKING - COMMERCIAL
COUNTY ROAD
NORTHERN PACIFIC RAILROAD

"When one has the fortune to be in some way protagonist of the enlightening of a civility, the virtues which matter are coherence, constancy, and the conscious active participation in the labors of one's own time."

Kevin Lynch, Image of the City,
MIT Press, 1960.

DESIGN PHILOSOPHY/APPROACH

My primary philosophy in the design of these industries was the development of a co-operative image on all levels--visual, functional, and economic--as well as an economy and realism of building systems. However, I also worked with several other subordinate philosophies within the major one.

ENERGY--Since energy is in over-demand now and is likely to get worse, I felt that energy conservation need be addressed in all aspects of the design. Less exterior walls, more efficient insulation, natural ventilation, recycling of existing heat, as well as the use of solar collectors as a subordinate heating system were all considerations important to making my design realistic and economically feasible.

LIGHT--Natural and artificial light was an important criteria in my factory design, and obviously, the more natural light utilized, the less energy need be expended for artificial. This then was another important consideration--to allow maximum feasible amount of natural light to enter the building.

PSYCHOLOGY--The psychology of factory work--of visual relief from tasks constantly performed, and of the manner in which the site is entered--was also important in my design. The sequence of events encountered by a worker or visitor as he approaches and enters the building is an important feature that affects the attitudes and impressions of companies involved and products produced.

SOLUTION

RESTATEMENT OF THESIS:

Architecture for industry, like any other architecture, is obligated to reflect the desirable qualities of our modern culture.

My design was successful as a whole on several levels. First, it successfully provides the transition needed on the site orderly and geometrically. It literally addresses and deals with site factors, such as the mountains, lake, utility easement, agricultural fields and access roads. My design optimizes efficiency of process while remaining within the restrictions, of flexibility and adjustability. It also centralizes all facilities within reason and in this way increases the efficiency and economic stability of the design.

SPECIFICS

Systems. Through analyzing several systems of structure and walls, I came up with basically two best suited to my needs. The use of a concrete folded Z plate for solar collectors and skylights, supported by poured in place concrete columns and beams is the system used on the warehouse area. Infill here is with concrete block supplemented with translucent metal panels. The second system is pre-designed metal building components with combinations of metal opaque and translucent panels as wall infill. This system is used in the processing area and modified in the administration. All floors are slab on grade. These choices were made primarily on the grounds of economy and suitability to my functions.

Orientation. The warehouse area of my project is oriented exactly north-south for the optimization of the efficiency of my solar collectors. Orientation of the remaining parts addresses the access road, the easement for utilities and the views. Truck docks are oriented south for better sun utilization.

Shipping/Receiving. In an effort to centralize as much of the trucking on the site as possible, I located all of the shipping at the same point, controlled primarily by one office. The nature of the processes necessitated the dispersal of receiving points along the back side of the plant.

Processes. Natural light is introduced through the process areas by means of skylights and the processes are set up as efficiently as possible in a universal adaptable space of this kind. Intense lighting occurs only at manned stations.

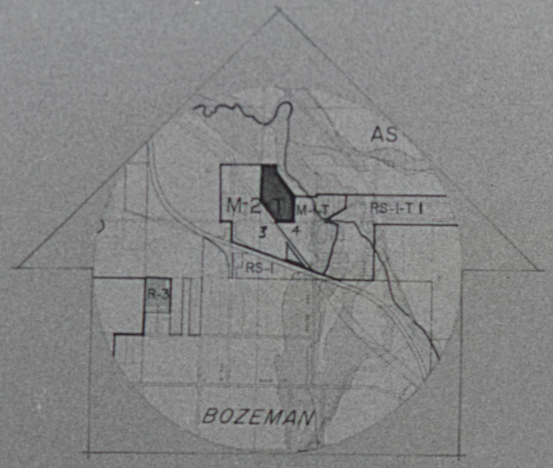
Mechanical. My mechanical system is centered around hot water which is supplemented by solar collectors. Unit heaters in the warehouse and process areas provide heat while operable skylight windows and spot roof ventilators provide ventilation. Isolated roof top units on the administration (also hot water) control heating, cooling and ventilation in that area.

Administration. The effort on the administration was to make all members of the staff, office workers and plant personnel, feel relatively equal, and not to reinforce, through building design, "boss--peasant" attitudes. The building forms also provide a visual transition from one site axis to another, and this continues visually through the lake on to the organic vocabulary northeast.

Graphics. Light yellow translucent panels with dark yellow finely textured panels work with the standard profile slate blue panels to empathize with both the process occurring within and the landscape occurring without. The colors chosen were in sympathy with indigenous colors as close as possible within the context of standard metal building colors.

Landscaping. Trees were used to develop a mat-like image from a distance, to soften foreground and background around the building. They also help with the transition from a regimented vocabulary to organic geometry and help make a smooth axis change in conjunction with building forms and terracing. They also give a directional quality to both vehicular and pedestrian movement while helping control cars by creating the illusion of speed near the parking area.

The building does reflect economy, efficiency, technology, environment, adaptability to change, rationality and a general humanistic feeling that could have been another Bridger Center.

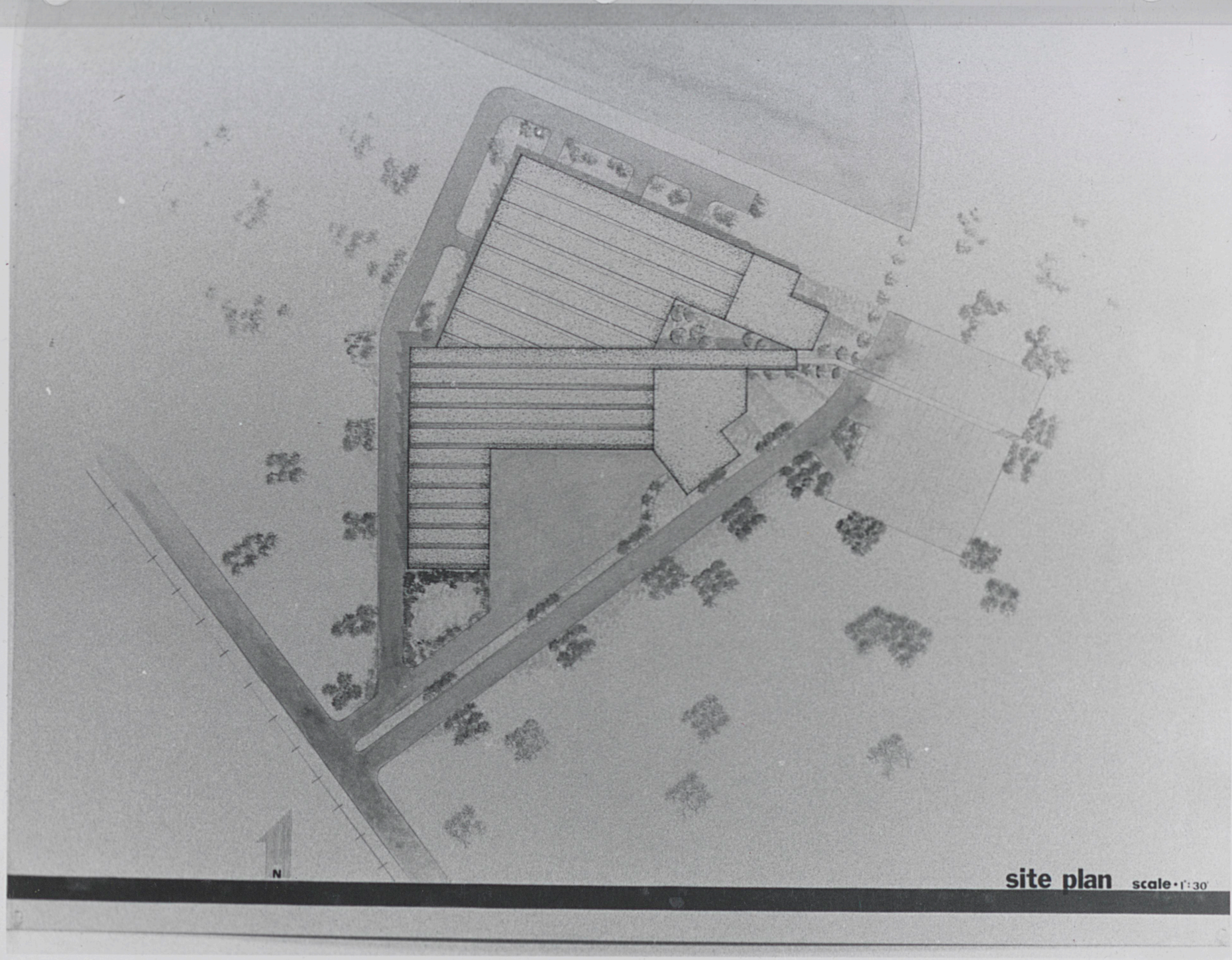


"the PARK"
an industrial cooperative
for bozeman, montana

·thesis by steven r. harrison



site plan scale · 1 : 100'



site plan scale • 1':30'



west



northeast



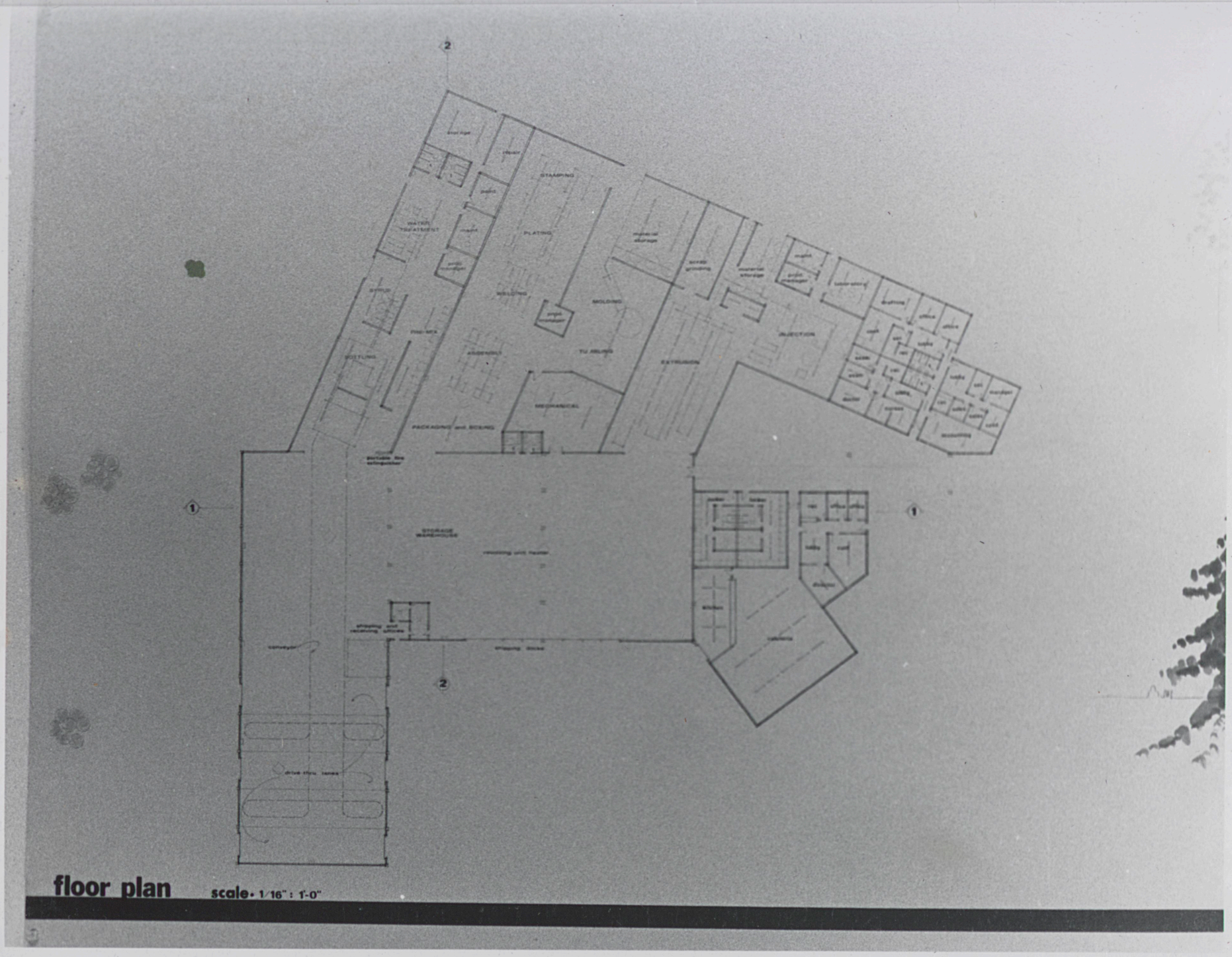
east



south

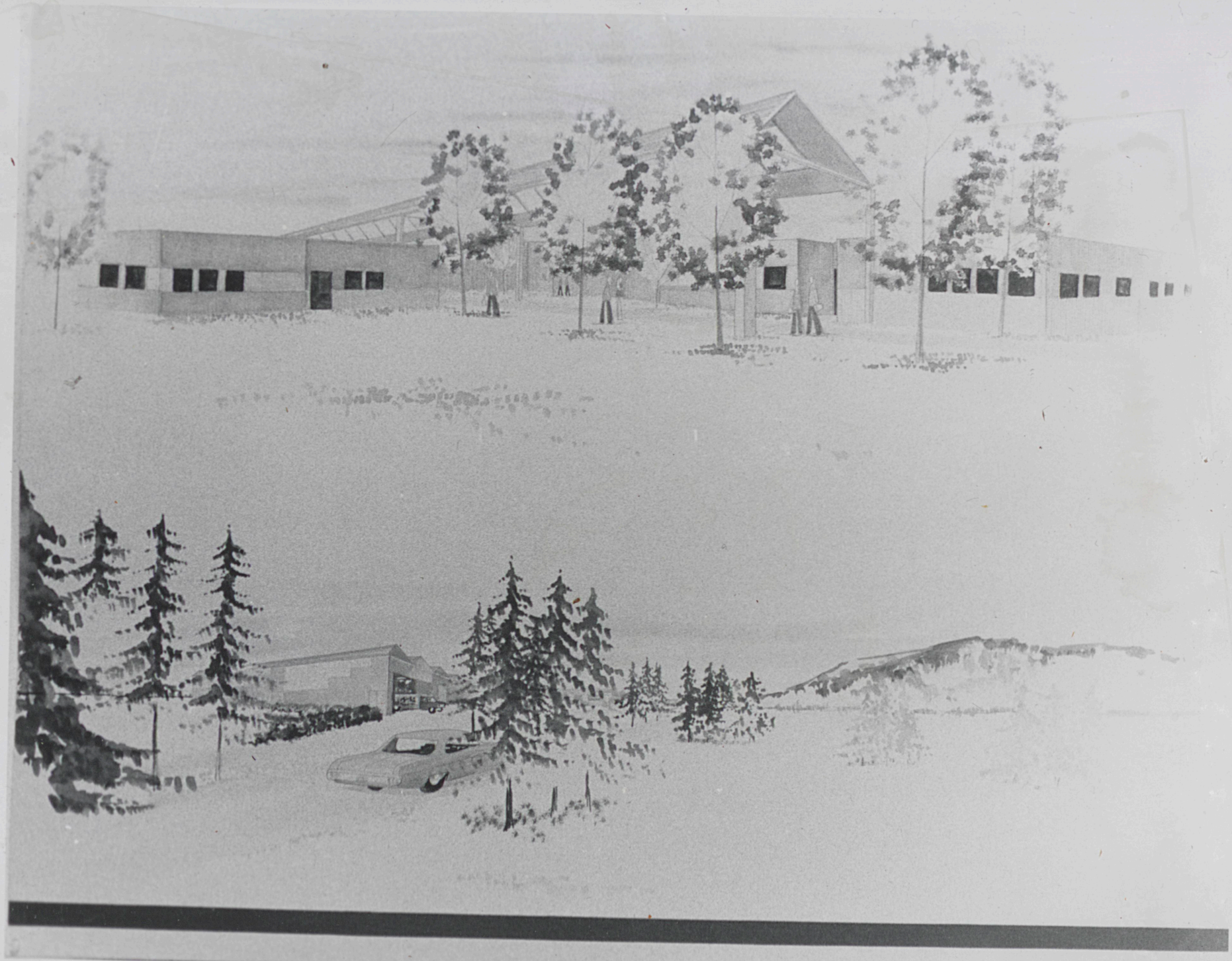
elevations

scale • 3/32" : 1'-0"

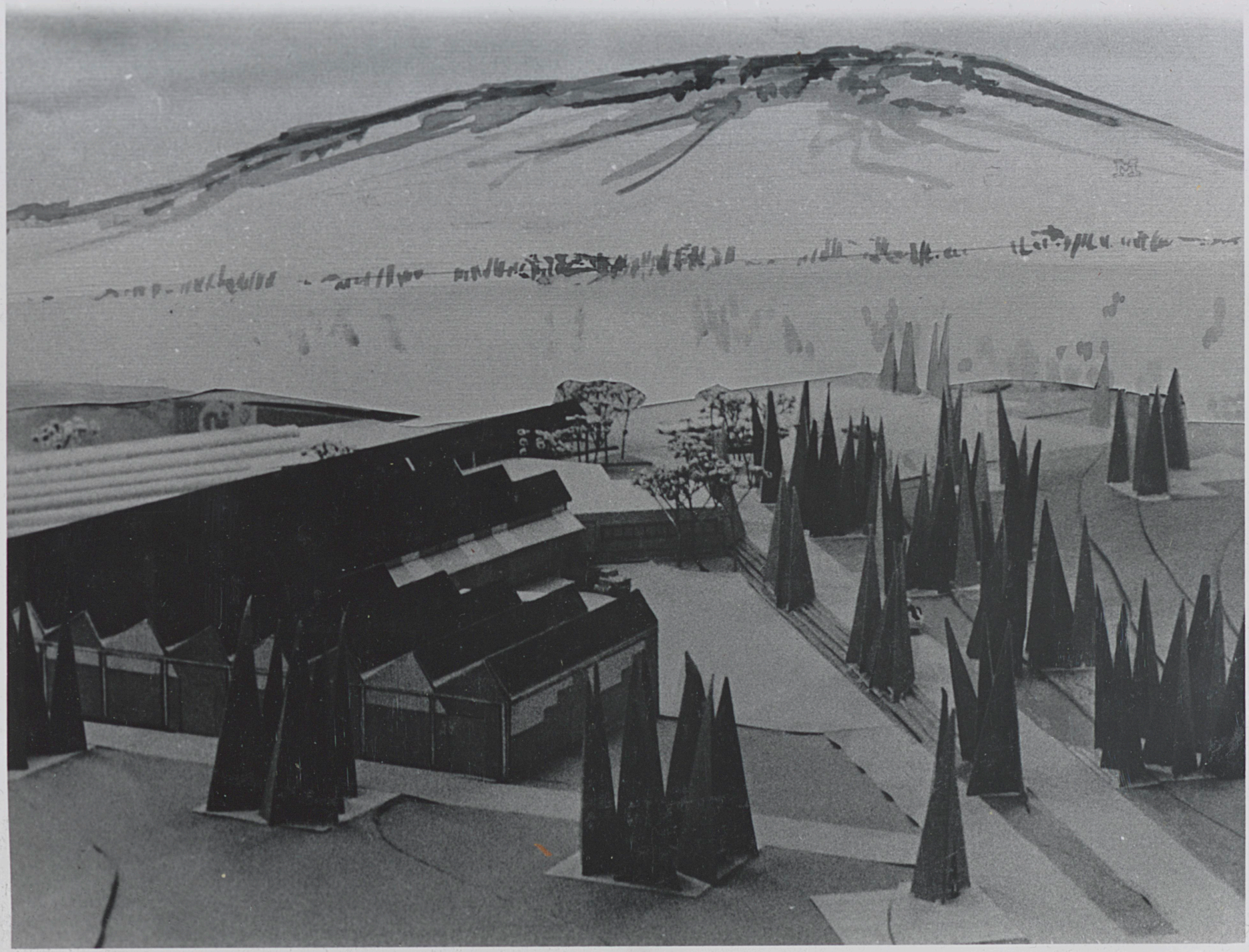


floor plan scale- 1/16" : 1'-0"













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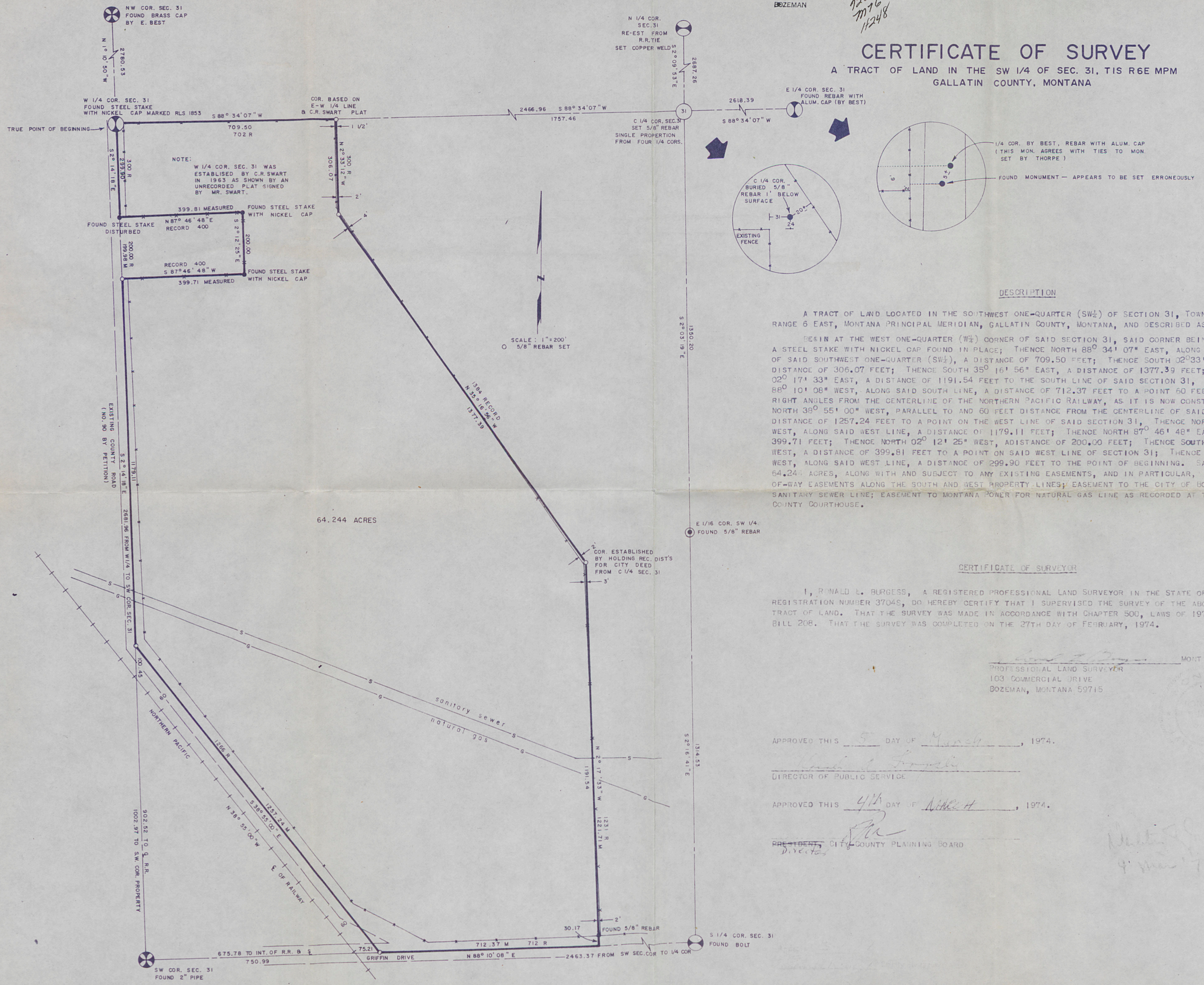
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CERTIFICATE OF SURVEY

A TRACT OF LAND IN THE SW 1/4 OF SEC. 31, T1S R6E MPM GALLATIN COUNTY, MONTANA



DESCRIPTION

A TRACT OF LAND LOCATED IN THE SOUTHWEST ONE-QUARTER (SW¼) OF SECTION 31, TOWNSHIP 1 SOUTH, RANGE 6 EAST, MONTANA PRINCIPAL MERIDIAN, GALLATIN COUNTY, MONTANA, AND DESCRIBED AS FOLLOWS:

BEGIN AT THE WEST ONE-QUARTER (W¼) CORNER OF SAID SECTION 31, SAID CORNER BEING WITNESSED BY A STEEL STAKE WITH NICKEL CAP FOUND IN PLACE; THENCE NORTH 88° 34' 07" EAST, ALONG THE NORTH LINE OF SAID SOUTHWEST ONE-QUARTER (SW¼), A DISTANCE OF 709.50 FEET; THENCE SOUTH 02°33' 12" EAST, A DISTANCE OF 306.07 FEET; THENCE SOUTH 35° 16' 56" EAST, A DISTANCE OF 1377.39 FEET; THENCE SOUTH 02° 17' 33" EAST, A DISTANCE OF 1191.54 FEET TO THE SOUTH LINE OF SAID SECTION 31, THENCE SOUTH 88° 10' 08" WEST, ALONG SAID SOUTH LINE, A DISTANCE OF 712.37 FEET TO A POINT 60 FEET DISTANT AT RIGHT ANGLES FROM THE CENTERLINE OF THE NORTHERN PACIFIC RAILWAY, AS IT IS NOW CONSTRUCTED. THENCE NORTH 38° 55' 00" WEST, PARALLEL TO AND 60 FEET DISTANCE FROM THE CENTERLINE OF SAID RAILWAY, A DISTANCE OF 1257.24 FEET TO A POINT ON THE WEST LINE OF SAID SECTION 31, THENCE NORTH 02° 14' 18" WEST, ALONG SAID WEST LINE, A DISTANCE OF 1179.11 FEET; THENCE NORTH 87° 46' 48" EAST, A DISTANCE OF 399.71 FEET; THENCE NORTH 02° 12' 25" WEST, A DISTANCE OF 200.00 FEET; THENCE SOUTH 87° 46' 48" WEST, A DISTANCE OF 399.81 FEET TO A POINT ON SAID WEST LINE OF SECTION 31; THENCE NORTH 02° 14' 18" WEST, ALONG SAID WEST LINE, A DISTANCE OF 299.90 FEET TO THE POINT OF BEGINNING. SAID TRACT BEING 64.244 ACRES, ALONG WITH AND SUBJECT TO ANY EXISTING EASEMENTS, AND IN PARTICULAR, 30 FOOT ROADRIGHT-OF-WAY EASEMENTS ALONG THE SOUTH AND WEST PROPERTY LINES; EASEMENT TO THE CITY OF BOZEMAN FOR A SANITARY SEWER LINE; EASEMENT TO MONTANA POWER FOR NATURAL GAS LINE AS RECORDED AT THE GALLATIN COUNTY COURTHOUSE.

CERTIFICATE OF SURVEYOR

I, RONALD L. BURGESS, A REGISTERED PROFESSIONAL LAND SURVEYOR IN THE STATE OF MONTANA, REGISTRATION NUMBER 3704S, DO HEREBY CERTIFY THAT I SUPERVISED THE SURVEY OF THE ABOVE DESCRIBED TRACT OF LAND. THAT THE SURVEY WAS MADE IN ACCORDANCE WITH CHAPTER 500, LAWS OF 1973, SENATE BILL 208. THAT THE SURVEY WAS COMPLETED ON THE 27TH DAY OF FEBRUARY, 1974.

_____ MONT REG #3704S
PROFESSIONAL LAND SURVEYOR
103 COMMERCIAL DRIVE
BOZEMAN, MONTANA 59715

APPROVED THIS 5 DAY OF March, 1974.

_____
DIRECTOR OF PUBLIC SERVICE

APPROVED THIS 4th DAY OF March, 1974.

_____
~~PRESIDENT~~ Director CITY-COUNTY PLANNING BOARD

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