KENT WALKER

WALK WITH THE
WILD THINGS

P378
.W1523

LIBRARY
Montana State University
BOZEMAN

WALK WITH THE WILD THINGS

A Zoo For Billings, Montana

thesis project submitted to the school of architecture
at montana state university, may 29, 1973, by kent walker

thesis advisor francis woods

P378
.W1523

1. Statement of Thesis

STATEMENT OF THESIS

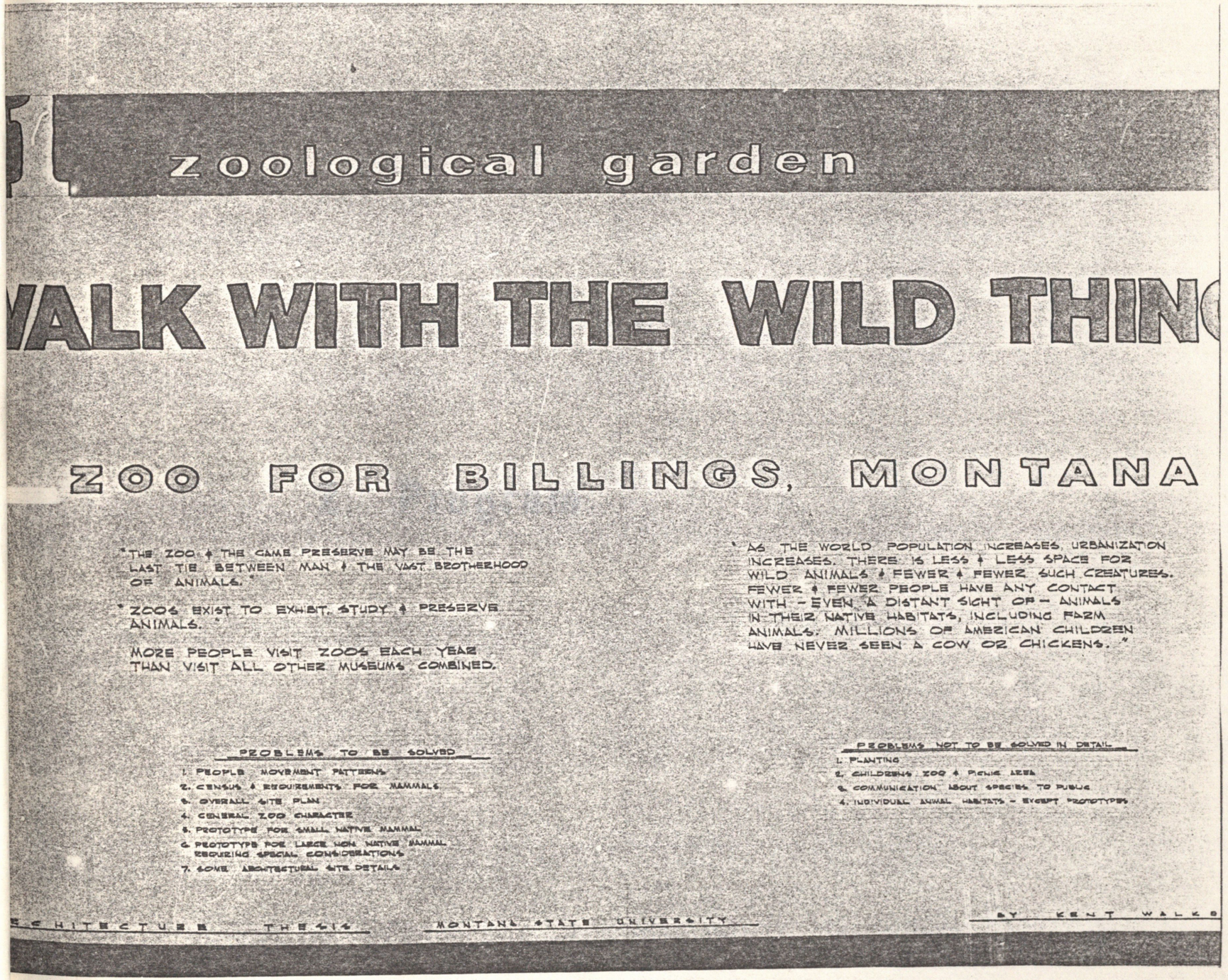
I propose for my architectural thesis project at Montana State University to undertake the design of a zoological garden for Billings, Montana. The problems to be solved are to create:

1. A place in which animals can live comfortably and where their basic needs would be met.

2. A place for the study and preservation of animals.

3. A living museum that would be an educational and recreational experience for people.

4. An open, living, breathing space in which people would become more aware and sensitive of their relationship to the environment.



Because of the vastness of the problems involved in the design of a zoological garden, I felt it would be very inportant to list the problems I would like to solve, and then list the problems that I would not solve in detail. The problems that I will try to solve for this zoo are:

1. People movement patterns.
2. Census and requirements for mammals.
3. Overall site plan.
4. General zoo character.
5. Prototype for small native mammals.
6. Prototype for large non native mammals requiring special considerations.
7. Some architectural site details.

The problems not to be solved in detail are:

1. Planting.
2. Children's zoo and picnic area.
3. Communication about species to public.
4. Individual animal habitats- except prototypes.

The problems no to be solved in detail will still be considered during the design stage but will not be solved, in the sense that no final drawings will be made of their solutions.

2. Program

animal design criteria

WAPITI - ELK

ORIGIN: NORTH AMERICA

SOCIAL GROUPING: SMALL FAMILY PARTIES

NO. DESIRED: 10 - 12



CLIMATIC ADAPT.: TOTAL ■ PARTIAL ☐ DIFFICULT ☐

HABIT: DIURNAL ☐ CREPUSCULAR ■ NOCTURNAL ☐

MOTION: WALKING ■ RUNNING ■ JUMPING ■ SWIMMING ☐ CLIMBING ☐ BURROWING ☐ FLYING ☐ SWINGING ☐

CLIMATE: TEMPERATE ■ ARCTIC ☐ DESERT ☐ TROPIC ☐

BASIC ECOLOGY: FOREST ■ FLATLAND ■ UPLAND ■ WATER ☐

PRIORITY: MUST ■ DESIRED ☐ SECONDARY ☐

RESEARCH EXAMPLES	DETROIT	CATSKILL		PROPOSED
AREA SIZE	50 000 - 5 000	50 000 10 000		80 000
BARRIER TYPE	4	1		9 4 4 6
ENCLOSURE TYPE	LAND &	LA &		&

SPECIAL REQMTS.: SQUEEZE CAGE ☐ BREEDING AREA ☒ RETREAT AREA ☐ HOLDING PEN ■

SPECIAL PROPS & SERVICE EQUIP: REQUIRES LARGE SPACE, SHADE SEPERATE HOLDING PEN FOR BULLS DURING RUT.

COMPATIBILITY WITH SPECIES ■
COMPATIBILITY OTHER SPECIES ■

NOTES & SPECIAL CONSIDERATIONS
ARE GREGARIOUS THROUGHOUT YEAR. PREFER THICKLY FORESTED MOUNTAIN DISTRICTS. HAVE LITTLE SENSE OF THIRD DIMENSION (EYES).

MOOSE

ORIGIN: N. AMERICA, N. EURASIA

SOCIAL GROUPING: SMALL GROUPS OR SOLO

NO. DESIRED: 8 - 12



CLIMATIC ADAPT.: TOTAL ■ PARTIAL ☐ DIFFICULT ☐

HABIT: DIURNAL ☐ CREPUSCULAR ■ NOCTURNAL ☐

MOTION: WALKING ■ RUNNING ■ JUMPING ■ SWIMMING ■ CLIMBING ☐ BURROWING ☐ FLYING ☐ SWINGING ☐

CLIMATE: TEMPERATE ■ ARCTIC ■ DESERT ☐ TROPIC ☐

BASIC ECOLOGY: FOREST ■ FLATLAND ■ UPLAND ■ WATER ■

PRIORITY: MUST ■ DESIRED ☐ SECONDARY ☐

RESEARCH EXAMPLES	SAN DIEGO	MILWAUKEE	DETROIT	PROPOSED
AREA SIZE	55 000 - 5 000	60 000 - 50 000	50 000 - 10 000	80 000
BARRIER TYPE	4	4	4	4 & 16
ENCLOSURE TYPE	LAND &	LAND &	LAND &	LA &

SPECIAL REQMTS.: SQUEEZE CAGE ☐ BREEDING AREA ☐ RETREAT AREA ☒ HOLDING PEN ■

SPECIAL PROPS & SERVICE EQUIP: ABUNDANT SHADE SOFT AREAS W. ROCKY AREAS FOR HOOFS. POOL REQUIRED FEEDING RACKS PLACED UP HIGH

COMPATIBILITY WITH SPECIES ■
COMPATIBILITY OTHER SPECIES ■ (DEER)

NOTES & SPECIAL CONSIDERATIONS
BROWSES FROM TREES, AQUATIC PLANTS & WATER -- ES AS TH LONG LEGS & SHORT NECK ARE NOT ADAPTED TO GRAZING.

WHITE - TAILED DEER

ORIGIN: NORTH AMERICA

SOCIAL GROUPING: SMALL GROUPS OF MOTHER & YOUNG

NO. DESIRED: 12 - 5



CLIMATIC ADAPT.: TOTAL ■ PARTIAL ☐ DIFFICULT ☐

HABIT: DIURNAL ■ CREPUSCULAR ☐ NOCTURNAL ☐

MOTION: WALKING ■ RUNNING ■ JUMPING ☐ SWIMMING ☐ CLIMBING ☐ BURROWING ☐ FLYING ☐ SWINGING ☐

CLIMATE: TEMPERATE ■ ARCTIC ☐ DESERT ☐ TROPIC ☐

BASIC ECOLOGY: FOREST ■ FLATLAND ■ UPLAND ■ WATER ☐

PRIORITY: MUST ☐ DESIRED ■ SECONDARY ☐

RESEARCH EXAMPLES	DETROIT	BOSTON ZOO		PROPOSED
AREA SIZE	50 000 - 5 000	50 000 - 25 000		80 000
BARRIER TYPE	4	4		4 & 16
ENCLOSURE TYPE	LAND &	LA &		LA &

SPECIAL REQMTS.: SQUEEZE CAGE ☐ BREEDING AREA ☐ RETREAT AREA ☐ HOLDING PEN ■

SPECIAL PROPS & SERVICE EQUIP: 7 HEIGHT ADEQUATE FENCE MECHANISM TO OPEN UNDER & ROLLING TYPE GATE

COMPATIBILITY WITH SPECIES ■
COMPATIBILITY OTHER SPECIES ■ (CRANE - TURKEY)

NOTES & SPECIAL CONSIDERATIONS
LITTLE SENSE OF THIRD DIMENSION. SHIFT FROM ONE ENCLOSURE TO ANOTHER.

CARIBOU

ORIGIN: ARCTIC REGIONS

SOCIAL GROUPING: HUGE HERDS

NO. DESIRED: 0 - 2



CLIMATIC ADAPT.: TOTAL ■ PARTIAL ☐ DIFFICULT ☐

HABIT: DIURNAL ☐ CREPUSCULAR ☐ NOCTURNAL ☐

MOTION: WALKING ■ RUNNING ■ JUMPING ■ SWIMMING ■ CLIMBING ☐ BURROWING ☐ FLYING ☐ SWINGING ☐

CLIMATE: TEMPERATE ☐ ARCTIC ■ DESERT ☐ TROPIC ☐

BASIC ECOLOGY: FOREST ☐ FLATLAND ■ UPLAND ■ WATER ■

PRIORITY: MUST ■ DESIRED ☐ SECONDARY ☐

RESEARCH EXAMPLES	SAN DIEGO	PHILADELPHIA	CATSKILL GAME FARM	PROPOSED
AREA SIZE	5 000 - 3 000	5 000 - 2 000	10 000 - 50 000	80 000
BARRIER TYPE	4	4	1	4 & 16
ENCLOSURE TYPE	LAND &	LAND &	LAND &	LA &

SPECIAL REQMTS.: SQUEEZE CAGE ☐ BREEDING AREA ☒ RETREAT AREA ☐ HOLDING PEN ☐

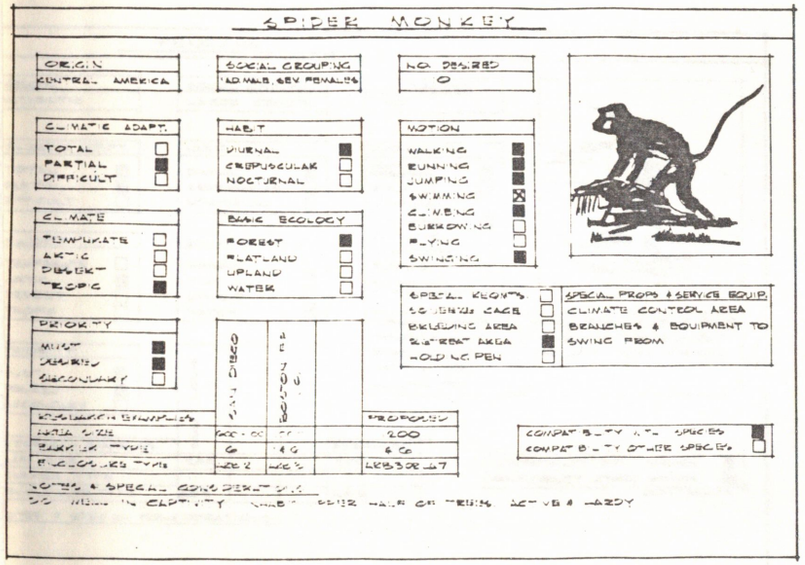
SPECIAL PROPS & SERVICE EQUIP: AREAS OF HARD PACKED WELL DRAINED EARTH. CONTENT & RELATIVELY SMALL ENCLOSURES

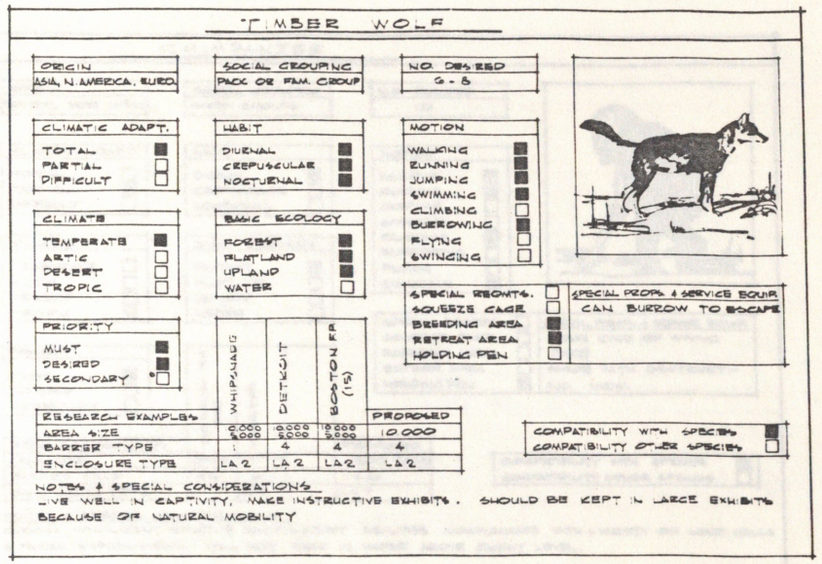
COMPATIBILITY WITH SPECIES ■
COMPATIBILITY OTHER SPECIES ■ (SOME DEER)

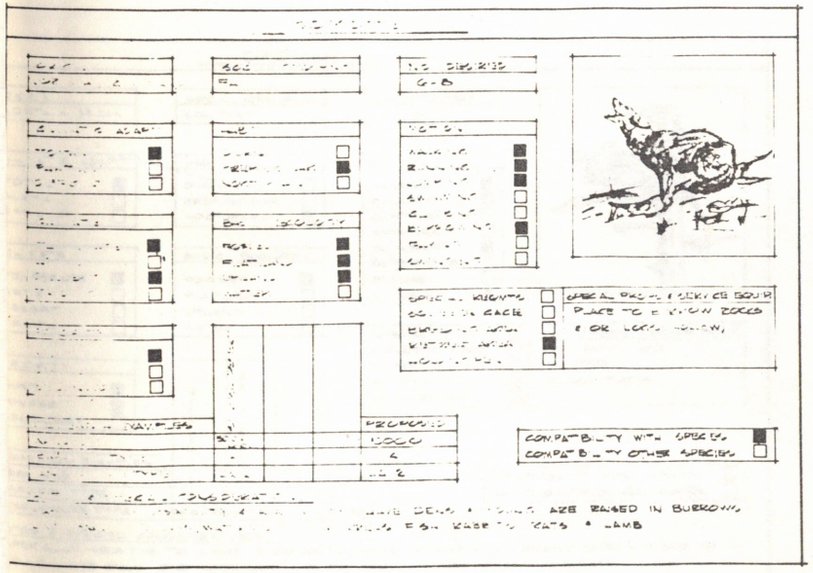
NOTES & SPECIAL CONSIDERATIONS
HOOFS HAVE SHARP EDGES TO GRIP ICE & SNOW. EXCELLENT SWIMMER. WOLVES NATURAL ENEMY.

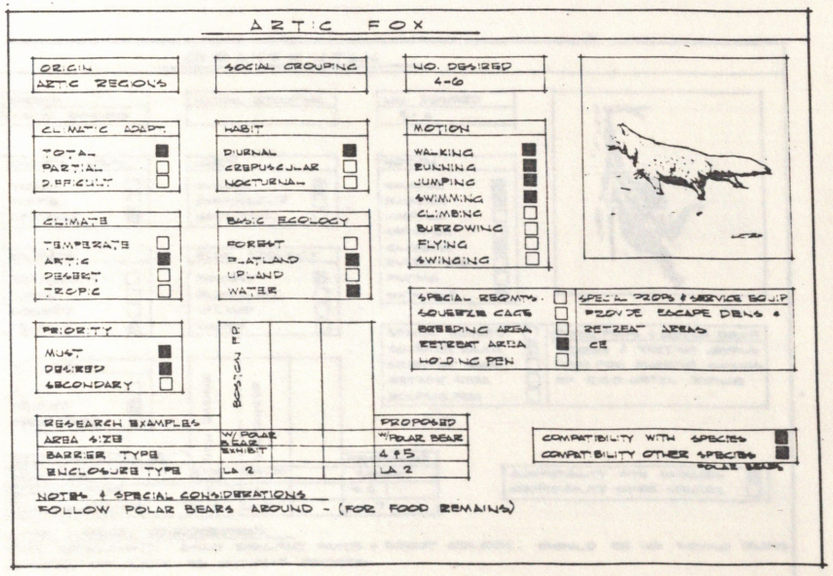
Zoos exist to exhibit, study, and preserve animals. Whatever other purposes a zoo may serve, whatever other uses a zoo may be put to, it is basically a residence for animals. Zoos are for people, but the animal and its welfare come first.

Zoo animals range in size from umbrella ants to elephants, from animals with a lifetime of a year to those that can live a century, from grass and leaf eaters to ant eaters to fish eaters to snake eaters to meat eaters, from animals that are most content when in contact with their keepers to animals that can never be approached closely. All the varities of size and shape and feeding and psychological need that can be envisioned are represented in the zoo. It is a place of constant surprises and regular crises.









BASIC SPACE UNITS OF A MAINSTREAM ZOO

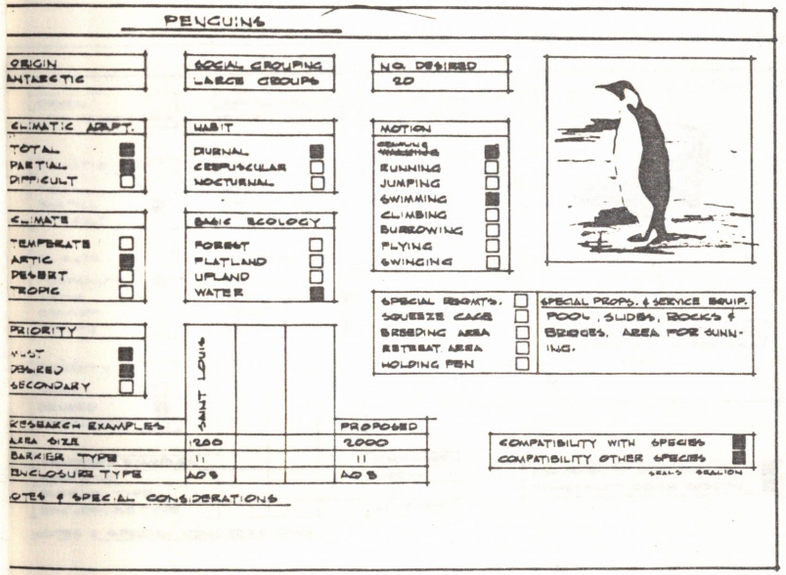
1. SMALL MAMMALS. A small-mammal house probably with satellite paddocks for kangaroos, wallabies, and wombats; and separate accommodations for larger rodents such as marmots, cypus, and porcupines.

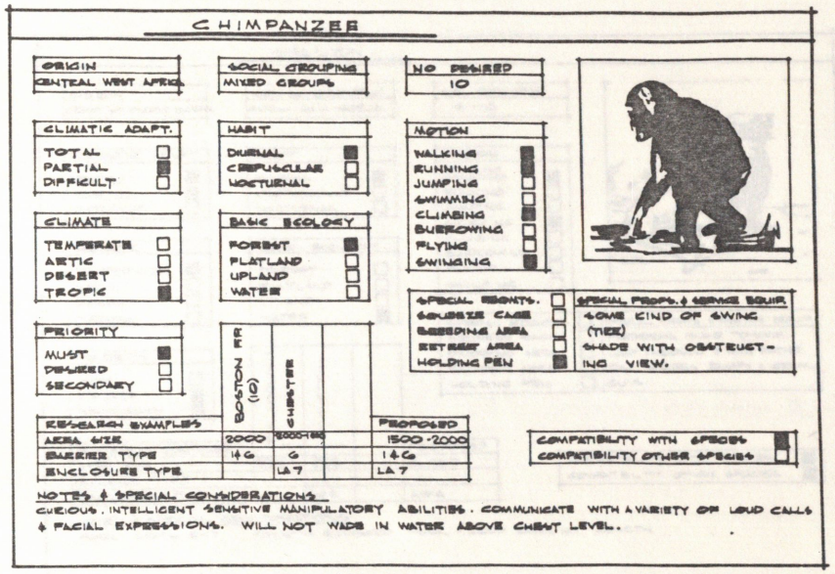
2. PRIMATES. Monkey house and ape house (often combined) with various separate enclosures, such as hills or castles for baboons and macaques; and islands in ponds or lakes for spider monkeys and gibbons.

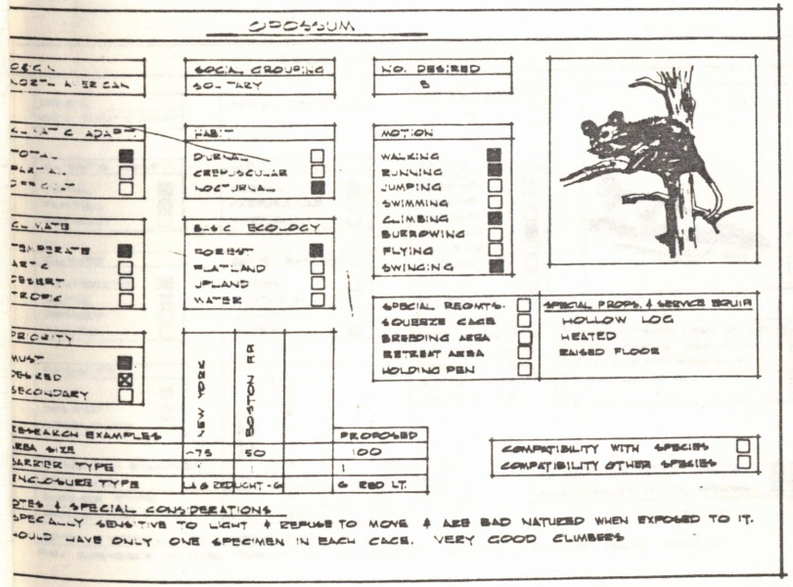
3. MAMMALS OF PREY. Usually a great-cat house, with separate enclosures for dog family, hyenas, racoons, badgers, otters and so on.

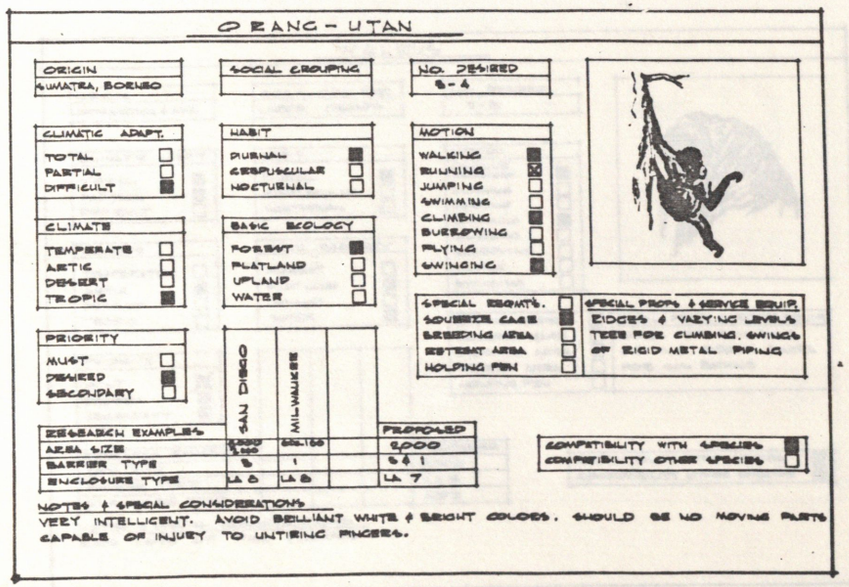
4. BEARS. Dens, pits, and enclosures, including a polar bear pool.

5. SEAL FAMILY. Large pools for seals, sea lions, elephant seals, and walruses.









6. LARGE UNGULATES. Houses and paddocks for horses and zebras; separate or variously combined accommodations for the pig family, deer giraffes, okapis, cattle and antelopes.

7. SHEEP AND GOATS. Hills and rocky paddocks.

8. PENQUINS. Pool.

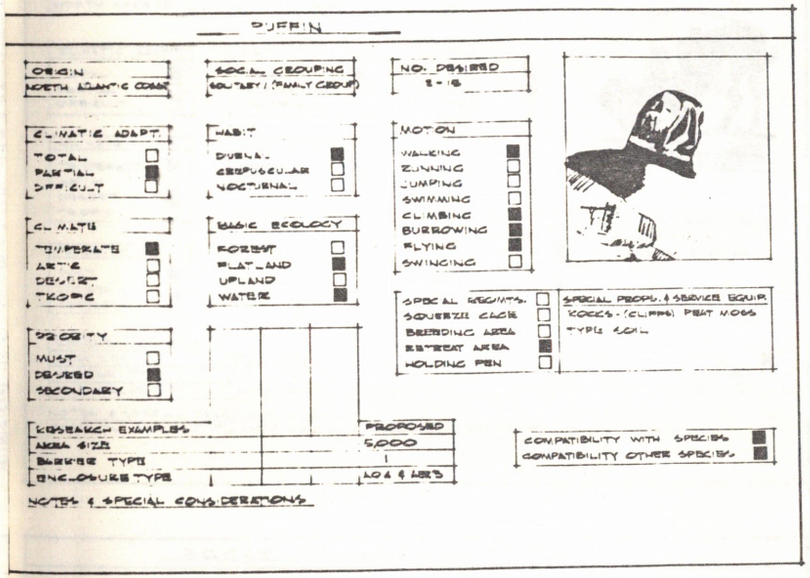
9. LARGE FLIGHTLESS BIRDS. Paddocks for ostriches, emus, cassowaries, and rheas.

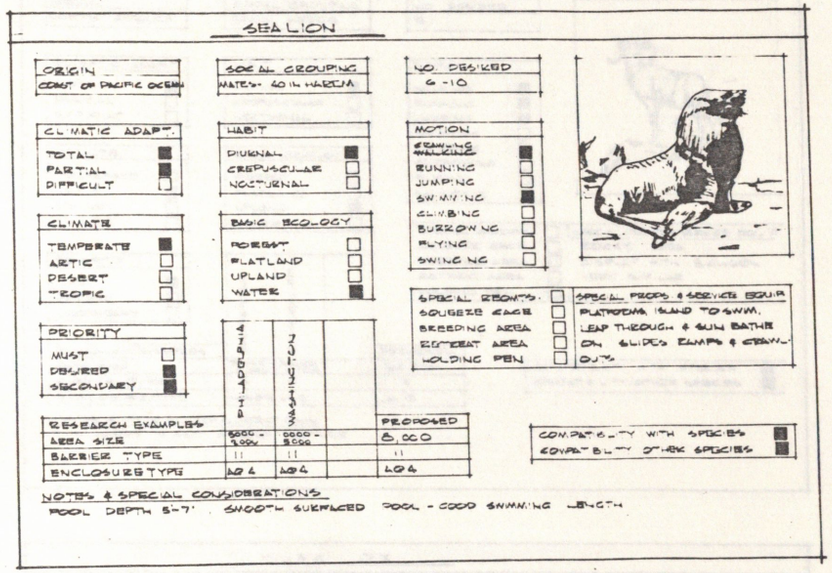
10. BIRD HOUSE. This may have indoor "walkthrough" or barless aviaries, and separate or satellite divisions for parrots, hummingbirds, pigeons, weavers, waxbills, and so on.

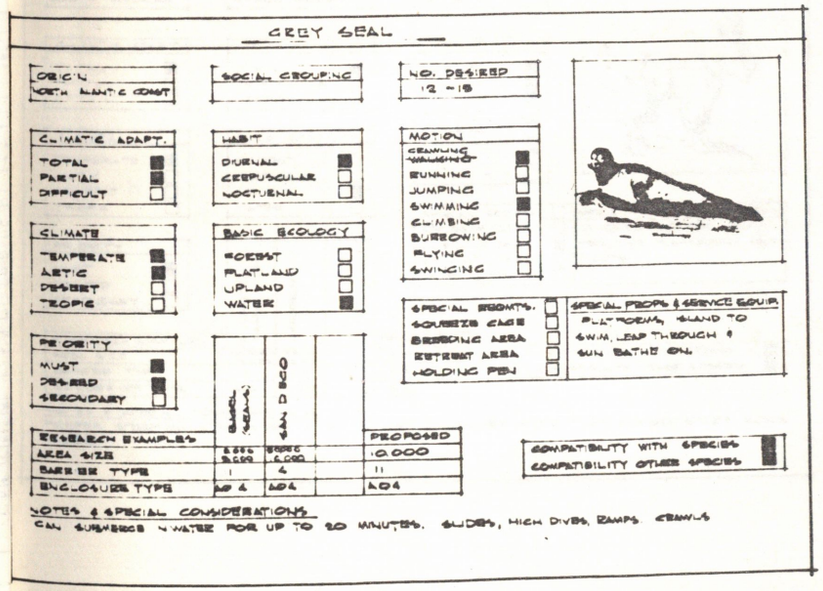
11. BIRDS OF PREY. Even today these are sometimes housed in comparatively small cages; but some modern flights for vultures, condors, and eagles are mercifully vast. Avaries for day-flying birds of prey are often combined with wol avaries.

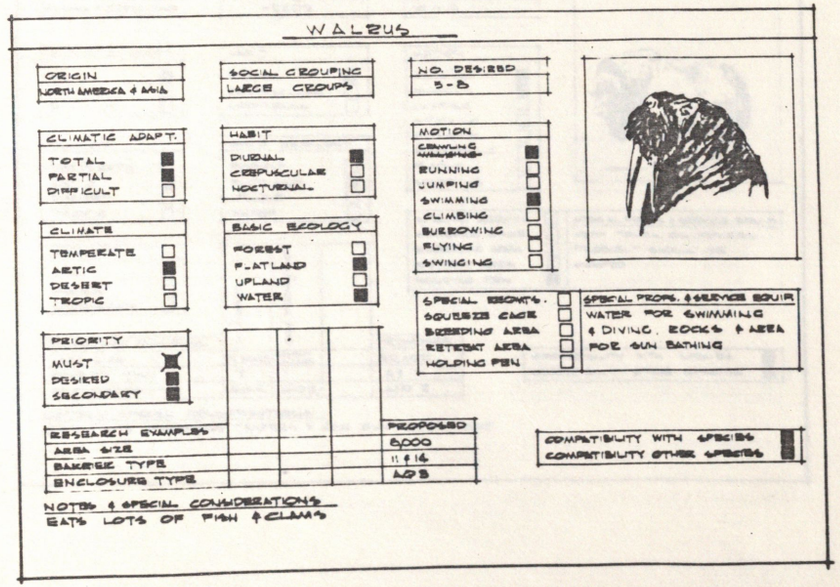
12. GAME BIRDS AND BUSTARDS. Various combinations of pheasantries, crane paddocks, bustard runs and so on.

animal design criteria









13. REPTILE HOUSE. This needs to be heated and air-conditioned. Often it has a satellite outdoor reptiliary.

14. AQUARIUM. This is often combined with, or has as satellites, accommodations for manatees, small seals and sometimes even dolphins.

15. CHILDREN'S ZOO.

16. EDUCATION BUILDING. Here there may be live and non-living zoological demonstrations, living displays of local fauna, and sometimes an animal art studio.

17. ANIMAL HOSPITAL. This is commonly combined with a research and autopsy laboratory and sometimes with an animal quarantine station, which is uaually a satellite outside the gardens.

18. ANIMAL FOOD WAREHOUSE. This is commonly combined with a central food-preparation kitchen.

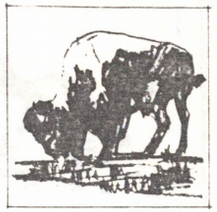
19. WORKS AND MAINTENANCE DEPARTMENTS. Transportation units, fire engines, and similar equipment are housed here.

AMERICAN BUFFALO

ORIGIN: NORTH AMERICA

SOCIAL GROUPING: LARGE HERDS

NO DESIRED: 15



CLIMATIC ADAPT: TOTAL ■ PARTIAL ☐ DIFFICULT ☐

HABIT: DIURNAL ■ CREPUSCULAR ☐ NOCTURNAL ☐

MOTION: WALKING ■ RUNNING ■ JUMPING ☐ SWIMMING ☐ CLIMBING ☐ BURROWING ☐ FLYING ☐ SWINGING ☐

CLIMATE: TEMPERATE ■ ARCTIC ☐ DESERT ☐ TROPIC ☐

BASIC ECOLOGY: FOREST ■ FLATLAND ■ UPLAND ■ WATER ☐

PRIORITY: MUST ■ DESIRED ☐ SECONDARY ☐

SPECIAL REQMTS.: SQUEEZE CAGE ☐ BREEDING AREA ☒ RETREAT AREA ☐ HOLDING PEN ☐

SPECIAL PROPS & SERVICE REQUIR: MUD & DUST BATHS; LOW UNHEATED SHELTER

RESEARCH EXAMPLES	SAN DIEGO	MILWAUKEE		PROPOSED
AREA SIZE	5000-10,000	10,000-50,000		40,000
BARRIER TYPE	4	4		4
ENCLOSURE TYPE	LAND 2	LAND 4		LA 4

COMPATIBILITY WITH SPECIES ■
COMPATIBILITY OTHER SPECIES ☐

NOTES & SPECIAL CONSIDERATIONS
FEED ON GRASSES TEMPERAMENTAL & UNPREDICTABLE BEHAVIOR

DALL SHEEP

ORIGIN: NORTH AMERICA

SOCIAL GROUPING: SMALL HERDS

NO DESIRED: 5



CLIMATIC ADAPT: TOTAL ■ PARTIAL ☐ DIFFICULT ☐

HABIT: DIURNAL ■ CREPUSCULAR ☐ NOCTURNAL ☐

MOTION: WALKING ■ RUNNING ■ JUMPING ■ SWIMMING ☐ CLIMBING ☐ BURROWING ☐ FLYING ☐ SWINGING ☐

CLIMATE: TEMPERATE ☐ ARCTIC ■ DESERT ☐ TROPIC ☐

BASIC ECOLOGY: FOREST ☐ FLATLAND ☐ UPLAND ■ WATER ☐

PRIORITY: MUST ■ DESIRED ☐ SECONDARY ☐

SPECIAL REQMTS.: SQUEEZE CAGE ☐ BREEDING AREA ☐ RETREAT AREA ☐ HOLDING PEN ☐

SPECIAL PROPS & SERVICE REQUIR: ROCKY AREA; DISPLAY WITH BIGHORN; VERY SIMILAR

RESEARCH EXAMPLES	BROOKFIELD	BOSTON PK		PROPOSED
AREA SIZE	5000-10,000	50,000-100,000		80,000
BARRIER TYPE	4	4		4
ENCLOSURE TYPE	LAND 2	LAND 2		LA 2

COMPATIBILITY WITH SPECIES ■
COMPATIBILITY OTHER SPECIES ■

NOTES & SPECIAL CONSIDERATIONS
IT'S HARDY IN HOT & COLD WEATHER

ROCKY MOUNTAIN GOAT

ORIGIN: NORTH AMERICA

SOCIAL GROUPING: SMALL HERDS

NO DESIRED: 5-8



CLIMATIC ADAPT: TOTAL ■ PARTIAL ☐ DIFFICULT ☐

HABIT: DIURNAL ■ CREPUSCULAR ☐ NOCTURNAL ☐

MOTION: WALKING ■ RUNNING ■ JUMPING ■ SWIMMING ☐ CLIMBING ☐ BURROWING ☐ FLYING ☐ SWINGING ☐

CLIMATE: TEMPERATE ■ ARCTIC ☐ DESERT ☐ TROPIC ☐

BASIC ECOLOGY: FOREST ☐ FLATLAND ☐ UPLAND ■ WATER ☐

PRIORITY: MUST ■ DESIRED ☐ SECONDARY ☐

SPECIAL REQMTS.: SQUEEZE CAGE ☐ BREEDING AREA ■ RETREAT AREA ☐ HOLDING PEN ☐

SPECIAL PROPS & SERVICE REQUIR: UNHEATED SHELTER - ROOF PROVIDES PLAYGROUND FOR GOATS

RESEARCH EXAMPLES	ALBERTA GAME FARM	LONDON		PROPOSED
AREA SIZE	50,000-100,000	5000-10,000		80,000
BARRIER TYPE	1	1		4 & 6
ENCLOSURE TYPE	LAND 1	LAND 2		LA 2

COMPATIBILITY WITH SPECIES ■
COMPATIBILITY OTHER SPECIES ■

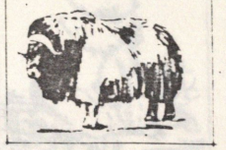
NOTES & SPECIAL CONSIDERATIONS
PREFER STEEP MOUNTAIN SIDES & CLIFFS. SPLIT HOOVES MOVE THEM ACROSS STEEP ROCK FACES.

MUSK OX

ORIGIN: CANADA & GREENLAND

SOCIAL GROUPING: HERDS

NO DESIRED: 0-5



CLIMATIC ADAPT: TOTAL ■ PARTIAL ☐ DIFFICULT ☐

HABIT: DIURNAL ■ CREPUSCULAR ☐ NOCTURNAL ☐

MOTION: WALKING ■ RUNNING ☐ JUMPING ☐ SWIMMING ☐ CLIMBING ☐ BURROWING ☐ FLYING ☐ SWINGING ☐

CLIMATE: TEMPERATE ☐ ARCTIC ■ DESERT ☐ TROPIC ☐

BASIC ECOLOGY: FOREST ☐ FLATLAND ■ UPLAND ☐ WATER ☐

PRIORITY: MUST ■ DESIRED ☐ SECONDARY ☐

SPECIAL REQMTS.: SQUEEZE CAGE ☐ BREEDING AREA ☐ RETREAT AREA ☐ HOLDING PEN ■

SPECIAL PROPS & SERVICE REQUIR: VERY TOUCH OF FENCES; PROBABLY SHOULD BE MOATED

RESEARCH EXAMPLES	ALBERTA	SAN FRANCISCO		PROPOSED
AREA SIZE	25 ACRES	5000-10,000		80,000
BARRIER TYPE	7	1		4 & 6
ENCLOSURE TYPE	LAND 2	LAND 2		LAND 2

COMPATIBILITY WITH SPECIES ■
COMPATIBILITY OTHER SPECIES ■

NOTES & SPECIAL CONSIDERATIONS
OFTEN HAVE DANGEROUS TEMPERS & CAN RUN QUITE FAST

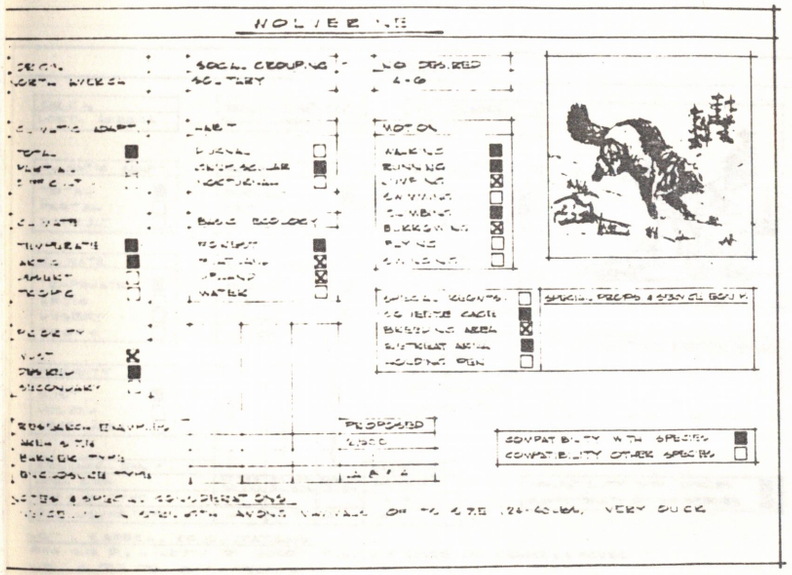
20. FIRST-AID POST. This often includes a lostchildren depot.

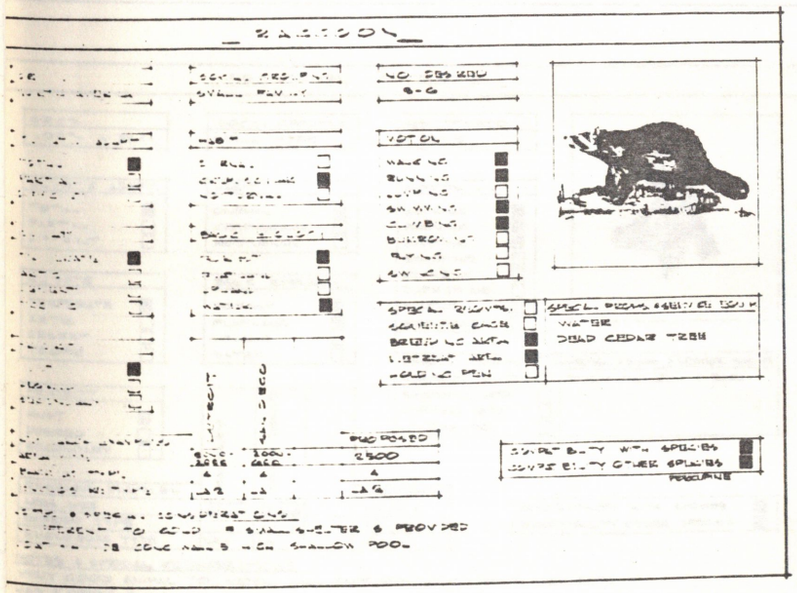
21. ZOO SHOP.

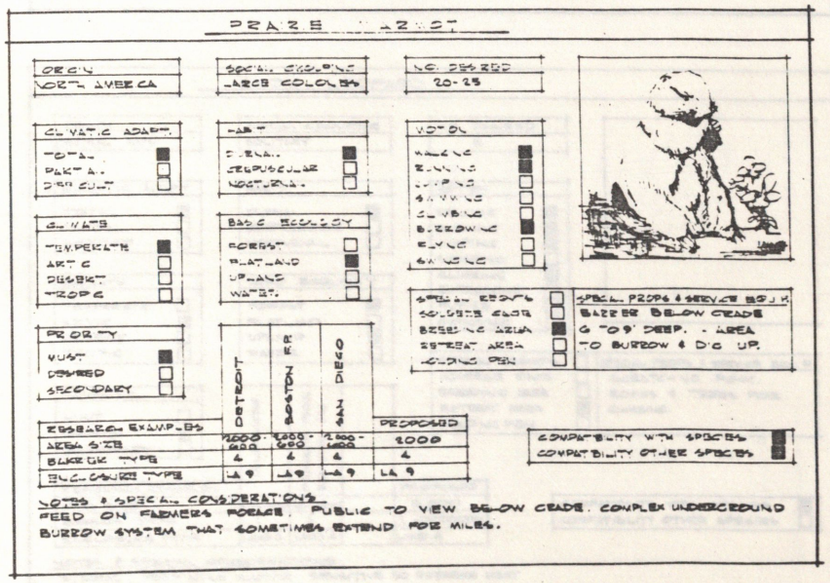
22. ADMINISTRATIVE OFFICE BUILDING. This includes, or has as satellites, library, archives, lecture halls, meeting-rooms, accommondation for various societies, and research laboratories.

23. PARKING LOT. There is sometimes also a railroad station or boat wharf.

24. FLOWER GARDERN. Interlacing all other space units are flower beds, arboreta, bowers, glades, shrubberies, and lawns with plenty of seats and public resting places.



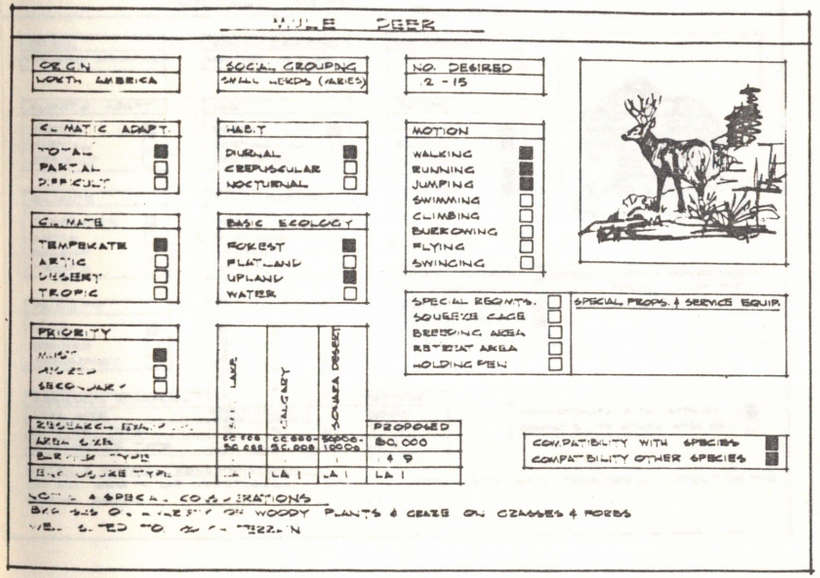


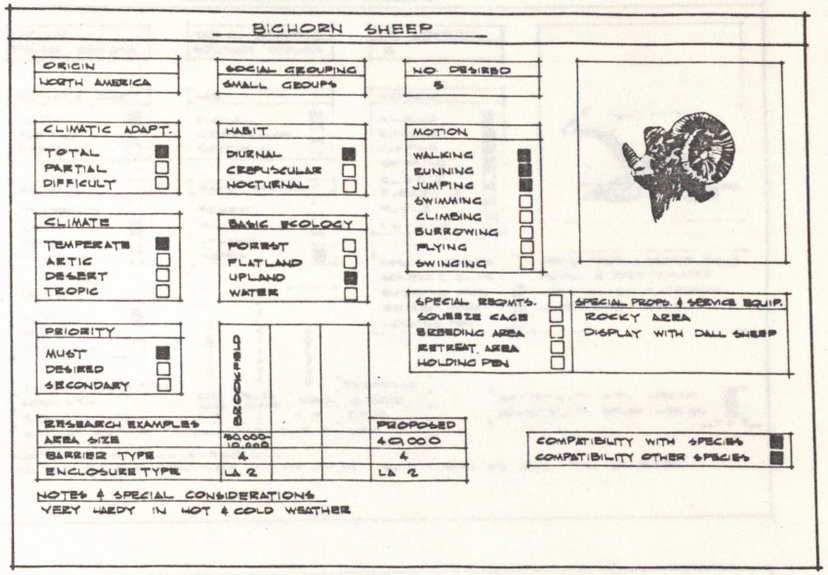


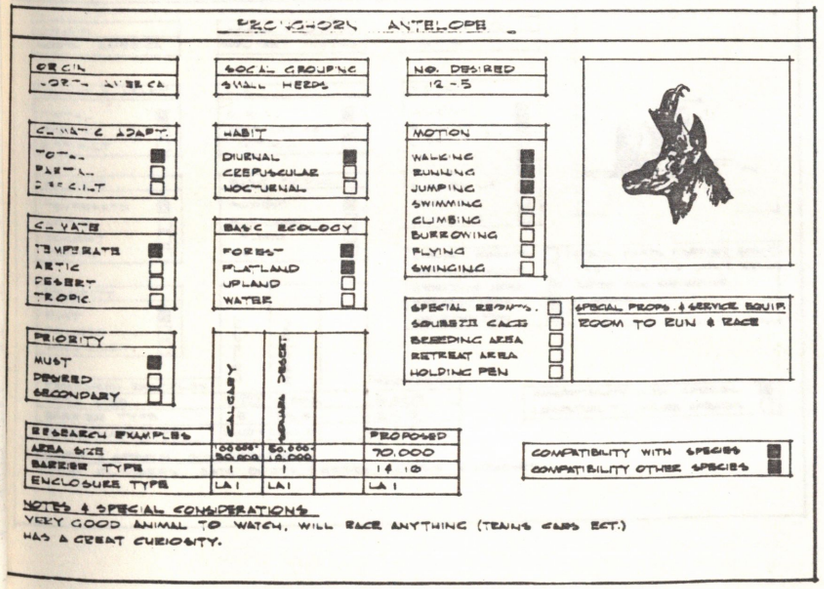
Before the animal census could be selected it had to be decided what kind of a zoo the Billings zoo should be. Rather than a zoo with lots of different and unusual species of animals on exhibit I chose to make it a zoo with emphasis on animals that tend to be native to the northwestern United States, or animals that used to be native and abundant in this area. These "native" animals would be on display in larger numbers than is usually seen in zoos. The reason for this is not only cost, but I feel the public would relate to this situation better as well as the animals. Rather than see one or two moose, deer and buffalo on display I would prefer to have 10 or 15 of each species in a natural setting. The public could relate this to a situation in nature a lot better. Also this would be a better research situation for zoologists and help with the problems within different family groups for breeding.

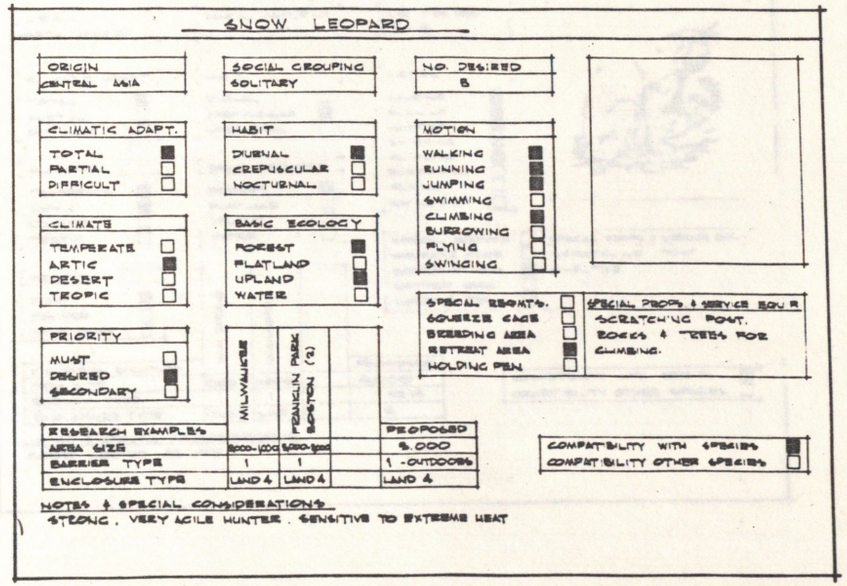
While doing an animal census I found there were certain animals which are not native tothe area which I classified as "fun animals". Thses are animals on the 10 most popular lists and

animal design criteria







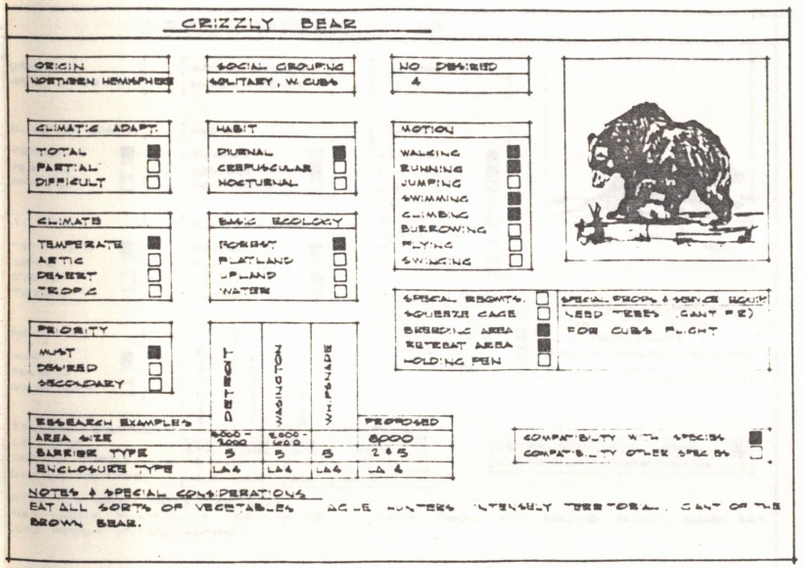


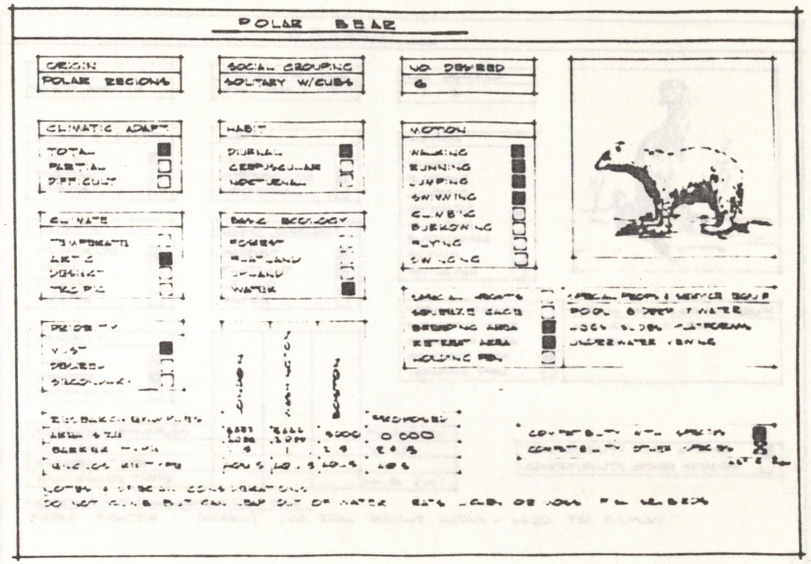
are those animals which the public go to the zoos to be entertained by. Thses "fun animals" would include such things as monkeys, penquins, seals, and giraffes.

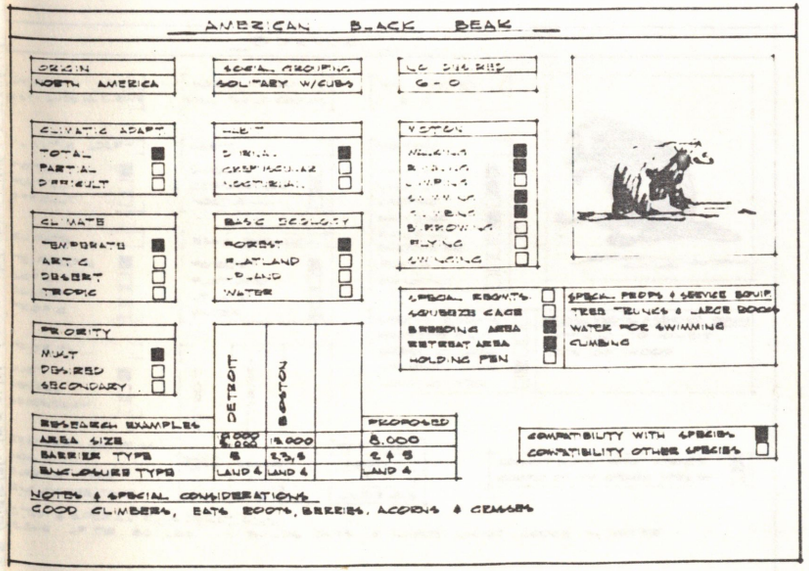
The next step was to list the different groups of animals and they are:

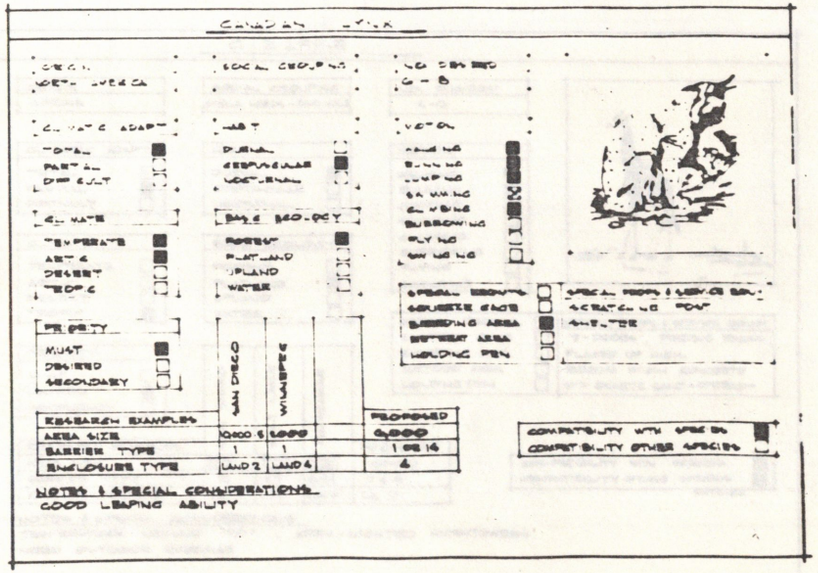
1. Small Mammals
2. Birds
3. Reptiles
4. Primates
5. Mammals of Prey
6. Seal Family
7. Bears
8. Large Ungulates
9. Sheep and Goats
10. Penquins
11. Native Fish

A list of certain species that would definately be included in this zoo had to be constructed, especially those animals which use up large spaces as far as square footages is concerned. Because it would take to much time and space to list each species individually, I just listed them in their respective groups in most cases. (An example of this would be birds; instead of listing each species of bird I just listed a certain area for birds.)



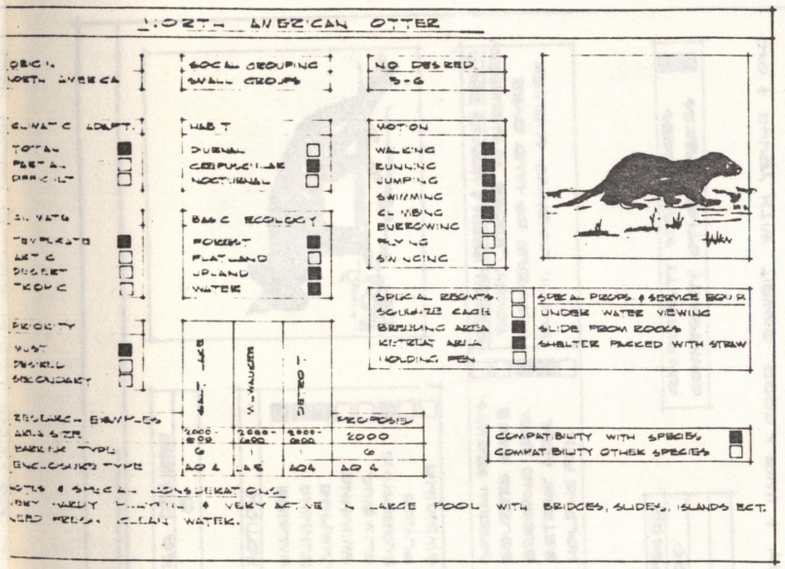


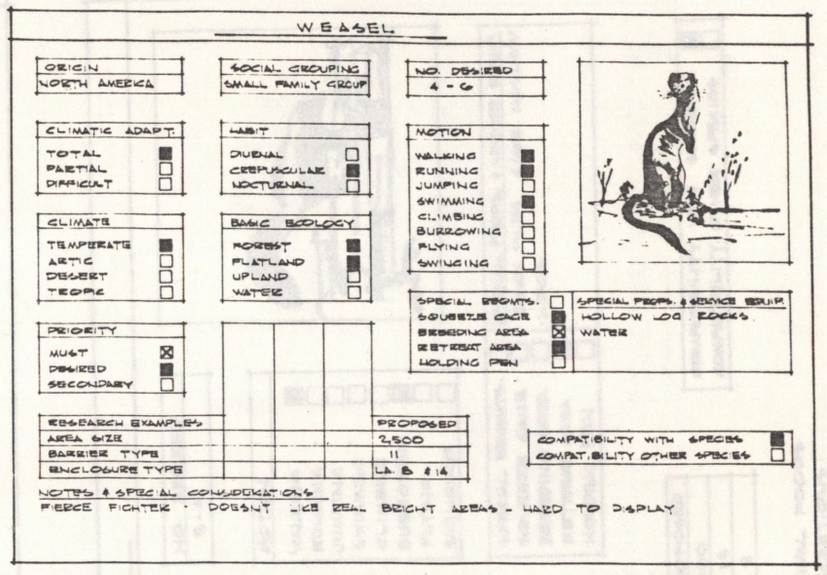


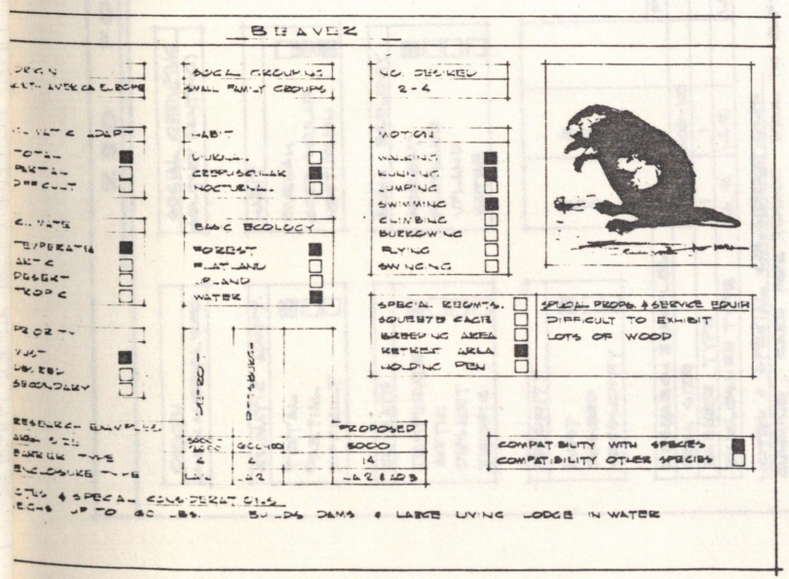


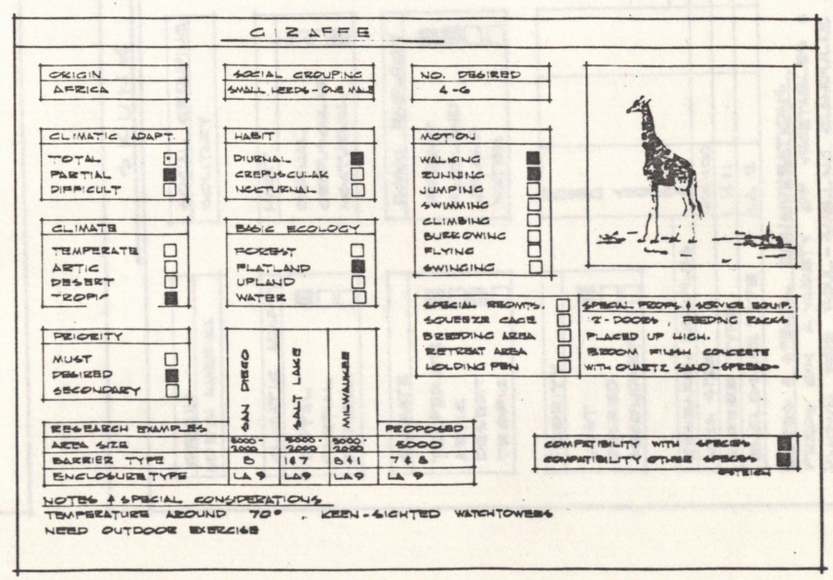
Animals to be included in this zoo are:

White Tailed Deer
Caribou
Moose
American Buffalo
Rocky Mountain Goat
Dahl Sheep
Musk Ox
Elk
Mule Deer
Pronghorn Antelope
Polar Bears
Penquins
Opossum
Spider Monkey
Orang-Utan
Chimpanzee
North American Porcupine
Beaver
Prairie Dog
Squirrel
Timber Wolf
Artic Fox
Red Fox
Grizzly Bear
Black Bear
Raccon
North American Otter
Northern Lynx
Puma (Mountain Lion)
Bobcat
Bighorn Sheep
Skunk
Badger
Weasel
Mink









Coyotes
Wolverine
Walruses
Giraffe
Sea Lion
Grey Seal
Siberian Tiger
Snow Leopard
Reptiles
Fish
Birds--including Puffins and bats.

With the animals chosen I decided to categorize certain species as to nature of animal and its needs. With the help of the Spokane and Franklin Park Zoo Programs I used a similar chart to categorize these animals. These charts are to the left and are broken down in the following manner:

1. Origin of Animal: The area or areas which the animal is most likely to reside in nature.

2. Social Grouping: The size of groups the animals is used to in its native habitat.

3. Number Desired: The number of the particular animal mentioned that would be desired by this zoo.

4. Climatic Adaption: This indicates whether the animal can adapt to the Billing's climate and how well.

5. Habit: To indicate whether the animal is most active in the daytime (diurnal) or nighttime (nocturnal).

6. Motion: This categorizes the animal as to its motions that it naturally has i.e. walking, running, swimming, and ect.

7. Climate: This tells whether the animal is from a temperate, artic, desert or tropic climate.

8. Basic Ecology: This gives the nature of the land, or water, the animal is best adapted to.

9. Priority: Helps to indicate what priority will be put on having this animal in the Billing's zoo.

10. Special Requirements: Indicates any special requirements this animal will need.

NORTH AMERICAN PORCUPINE

ORIGIN: NORTH AMERICA

SOCIAL GROUPING: SOLITARY

NO. DESIRED: 3 - 5



CLIMATIC ADAPT.: TOTAL ■ PARTIAL □ DIFFICULT □

HABIT: DIURNAL □ CREPUSCULAR ■ NOCTURNAL □

MOTION: WALKING ■ RUNNING ■ JUMPING □ SWIMMING □ CLIMBING ■ BURROWING □ FLYING □ SWINGING □

CLIMATE: TEMPERATE ■ ARTIC □ DESERT □ TROPIC □

BASIC ECOLOGY: FOREST ■ FLATLAND □ UPLAND □ WATER □

SPECIAL REQMTS.		SPECIAL PROPS. & SERVICE EQUIP.
SQUEEZE CAGE	□	CLIMBING PERCHES
BREEDING AREA	☒	TOOTH RESTRAINING
RETREAT AREA	■	MATERIALS REQUIRED FOR
HOLDING PEN	□	ENCLOSURE

PRIORITY: MUST ■ DESIRED □ SECONDARY □

RESEARCH EXAMPLES	DETROIT	BOSTON RP		PROPOSED
AREA SIZE	2000 - 600	600-200		1200
BARRIER TYPE	4	4		4
ENCLOSURE TYPE	LA 2	LA 2		LA 2

COMPATIBILITY WITH SPECIES ■
COMPATIBILITY OTHER SPECIES RACCOON

NOTES & SPECIAL CONSIDERATIONS
CLIMBS WELL. BUT PREFERS ROCKY CAVITY TO REST IN.
EXHIBIT CAN BE SMALL WITH TREES TO CLIMB.
LIKE BARK STRIPPED FROM EVERGREENS.

BADGER

ORIGIN: NORTH AMERICA

SOCIAL GROUPING: FAMILY GROUPS

NO. DESIRED: 8-10



CLIMATIC ADAPT.: TOTAL ■ PARTIAL □ DIFFICULT □

HABIT: DIURNAL □ CREPUSCULAR ■ NOCTURNAL ■

MOTION: WALKING ■ RUNNING □ JUMPING □ SWIMMING □ CLIMBING ■ BURROWING □ FLYING □ SWINGING □

CLIMATE: TEMPERATE ■ ARTIC □ DESERT □ TROPIC □

BASIC ECOLOGY: FOREST □ FLATLAND ■ UPLAND ☒ WATER □

SPECIAL REQMTS.		SPECIAL PROPS & SERVICE EQUIP
SQUEEZE CAGE	□	TREES, LOGS & PLACE
BREEDING AREA	□	TO BURROW
RETREAT AREA	■	
HOLDING PEN	□	

PRIORITY: MUST ■ DESIRED □ SECONDARY □

RESEARCH EXAMPLES				PROPOSED
AREA SIZE				2,500
BARRIER TYPE				3
ENCLOSURE TYPE				LA 4

COMPATIBILITY WITH SPECIES ■
COMPATIBILITY OTHER SPECIES ☒

NOTES & SPECIAL CONSIDERATIONS
ADAPT WELL TO ZOOS

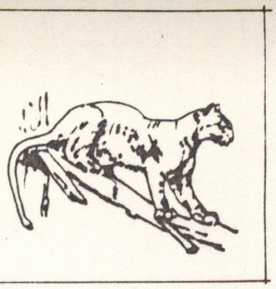
11. Compability: This indicates a compatibility with other species or within its own species.

12. Research Examples: This is probably one of the most important areas of the chart in that it tells how other zoos treat it as far as size, barrier and enclosure type. The barrier and enclosure type refer to charts in the section on Primary Design Considerations, Section III.

13. Notes and Special Considerations: This indicates special considerations and unusual facts about the animal that should be taken into consideration during design.

MOUNTAIN LION (PUMA) (COUGAR)

ORIGIN	SOCIAL GROUPING	NO. DESIRED
N. & S. AMERICA	SOLITARY	2 - 6



CLIMATIC ADAPT.		HABIT		MOTION	
TOTAL	■	DIURNAL	☐	WALKING	■
PARTIAL	☐	CREPUSCULAR	■	RUNNING	■
DIFFICULT	☐	NOCTURNAL	☐	JUMPING	■
				SWIMMING	☐
				CLIMBING	■
				BURROWING	☐
				FLYING	☐
				SWINGING	☐

CLIMATE		BASIC ECOLOGY	
TEMPERATE	■	FOREST	■
ARTIC	■	FLATLAND	☐
DESERT	■	UPLAND	■
TROPIC	■	WATER	☐

SPECIAL REQMTS.		SPECIAL PROPS & SERVICE EQUIP
SQUEEZE CAGE	☐	ROCKS & TREES FOR
BREEDING AREA	■	CLIMBING. SECLUDED
RETREAT AREA	☐	SLEEPING QUARTERS
HOLDING PEN	☐	MUST BE CAGED

PRIORITY	
MUST	■
DESIRED	☐
SECONDARY	☐

RESEARCH EXAMPLES	BOSTON Z.P.			PROPOSED
AREA SIZE	10000 3000			8,000
BARRIER TYPE	1			1
ENCLOSURE TYPE	LA 4			LA 4

COMPATIBILITY WITH SPECIES	☐
COMPATIBILITY OTHER SPECIES	☐

NOTES & SPECIAL CONSIDERATIONS

SIBERIAN TIGER

ORIGIN	SOCIAL GROUPING	NO. DESIRED
ASIA, JAVA,	SOLITARY	2

CLIMATIC ADAPT.		HABIT		MOTION	
TOTAL	☒	DIURNAL	☐	WALKING	■
PARTIAL	☒	CREPUSCULAR	■	RUNNING	■
DIFFICULT	☐	NOCTURNAL	☐	JUMPING	■
				SWIMMING	■
				CLIMBING	☐
				BURROWING	☐
				FLYING	☐
				SWINGING	☐

CLIMATE		BASIC ECOLOGY	
TEMPERATE	■	FOREST	■
ARTIC	☐	FLATLAND	☐
DESERT	☐	UPLAND	■
TROPIC	☐	WATER	☐

SPECIAL REQMTS.		SPECIAL PROPS & SERVICE EQUIP.
SQUEEZE CAGE	■	SCRATCHING POSTS
BREEDING AREA	☒	CAN BE MOATED
RETREAT AREA	☐	
HOLDING PEN	☐	

PRIORITY	
MUST	☐
DESIRED	■
SECONDARY	☐

RESEARCH EXAMPLES	DETROIT	BOSTON		PROPOSED
AREA SIZE	20,000 10,000	20,000 10,000		20,000
BARRIER TYPE	5, 3	5		5 & 4
ENCLOSURE TYPE	LAND 2	LAND 4		LA 4

COMPATIBILITY WITH SPECIES	■
COMPATIBILITY OTHER SPECIES	☐

NOTES & SPECIAL CONSIDERATIONS

3. Primary Design Considerations

"Man can see in nature the qualities of perfection, even of joy, of which he himself is capable if he lives true to his natural origin. Further more, since other living things share his structure to survive in a wilderness of inanimate matter, he can make their companionship a sorce of strength and satisfaction if he allows himself to be aware of them or he can condemn himself to eternal loneliness if he ignores them." From the Arizona-Sonora Desert Museum pamphlet.

The wild places of the world are shrinking and the number of animals with them. Zoos are the repositories of some irreplaceable living treasures. As time goes on, we can expect that more and more species will have to be tided over in zoos during periods of change in their homelands. There will be no other way of preserving them to enrich the lives of future generations.

Mans biological background is mirrored in the creatures that shape the world with him and it is the zoo's job to make this plain: to help man to understand man by presenting the lower creatures to him in an orderly way.

There are six main reasons for the existence of modern zoos:

1. Recreation
2. Nature appreciation
3. Education
4. Research
5. Conservation
6. Sociological

The recreational aspects of a zoo are evident in the 100 million people that visit zoos each year, more than visit all other museums combined. Since zoos are generally in park settings, a visit to the zoo offers a walk in a natural setting and mild exercise, both spiced with close up views of the living wonders of nature. The zoo is a sorce of entertainment. Zoo people may tend to emphasize the more serious purposes of education, research, and conservation. For the endless streams of people who come to the zoo, entertainment is the primary function. No other recreational, entertaining, or educational facility appeals to so many different kinds of people and is used by so many people. The attraction over the age span is unique, children can begin to enjoy the zoo at the age of one and there is no upper age limit. The zoo is as attractive to the illiterate as to the Ph. D. For boys and girls, men and women, the zoo has equal appeal. As a family entertainment and recreation, it is unsurpassed.

Visitors are also the greatest danger to the zoo's inhabitants. The barriers between animals and people, originally constructed to keep the visitor's safe from the animals, are equally inportant in keeping the animals safe from people. One of the saddest comments on people is that zoos now use quard dogs at night to protect the animals from man. A domesticated animal must be trained to attack humans in order to protect wild animals.

Nature appreciation is closely akin to the recreational function of the zoo but goes well beyond. Properly designed exhibits must lead to a sense of wonder at the infinite variety of life and appreciation of its mystery. Close watching should temper the idea of the "slimy slithering" snake to wonder at its geometric beauty and obvious cleanliness.

The sight of a leading male baboon slapping at the adolescents, but enduring every indignity from the young, is a lesson in parenthood.

One of the great advantages of the zoo as an educational institution is that almost no one minds learning this way. Even the most rebelious child will absorb information on a zoo trip.

An increasing number of zoos have formal arrangements with local school systems for teaching visits. (It has been suggested that the most stubborn non-reader might learn to read in the zoo.)

Zoos should constantly up grade the presentation and educational level of their exhibits. As long as zoos present natural history in layman's terms instead of scientific jargon, they cannot go wrong. The animals will see to it that the education is well mixed with recreation.

In the long range, conservation may be the zoos most important function. There are a thousand species of animals considered "endangered" today. These are animals whose survival is in doubt in their natural habitat. Unless they are preserved in someway, future generations will not see their like.

Many humans enjoy camping in the woods. They enjoy giving up the trappings of civilization-flush toilets, stoves, floors, roofs, soft chairs-for the relative rigors of outdoor living. They feel renewed by this close contact with nature, and they assume that animals have the same need. Animals act more rationally. Given a secure, confortable (for them) home, access to food and water, they have little desire to rough it.

In gereral, most animals move about as little as possible. They search for food; they look for a mate; they patrol their territory to make sure it is not invaded. Beyond taking care of these needs, most animals would rather sit and rest or snooze. The young play and rough-house, but the mature adult takes it easy whenever it can.

Of course, it is a shock to a wild animal to be taken from its own territory and put into a zoo where most of its instincts are not needed. The animal in the zoo doesn't have to fight off predators or competitors; it doesn't have to search for food; it doesn't have to flee from its enemies. This displacement of the animal's "natural" pattern has to be adjusted to; but once adjustments are made, the animal appears content. Dr. Heinz Hediger, the world's leading animal psychologist, compares wild animals in a zoo with estate owners. In a properly designed enclosure in a modern zoo, the animal does not seek escape. Its enclosure is its turf. It wants to conquer its living space, defend it, keep it safe from intrusion. It doesn't want to leave it.

Among the important factors determining the size of an animal's territory are: an area able to provide enough food for the animal (and family); an area that can be defined by whatever marking methods are used by the particular animal.

The space available to the zoo animal is obviously much smaller than its usual natural territory. It might be 100 times, or 10,000 times, smaller. To the non-expert, this relative restriction on movement would seem to be traumatic to the animal. In general, this is not so. Free-roaming animals

need large territories because they must forage for themselves. The zoo or domestic animal has no need to look for its own food, and so has much less need for space.

Within the zoo, the adjusted animal seems to have decided that whatever space is given it is its proper territory. If the zoo space has the proper attributes-some shade, a place for privacy, water, food-the animal will not only defend this space, it will not leave without complusion.

In their wild state, animals often withdraw into hadden places for periods of privacy, and when privacy is not provided in an enclosure because visitors want to see the animals every moment of visiting hours, the animal is being deprived for the convenience of the visiting public.

There is a great deal of zoo experience with animals that voluntarily return to their cages when they have been accidentally or deliberately freed.

Very different from territory is flight distance. Almost all animals have a sort of circle around them within which they cannot comfortably allow other beings or moving things to intrude. The flight distance varies from animal to animal, from intruder to intruder, with the nature of cover, and even with mood.

The flight reaction isn't an automatic response to all animal intruders. An elephant doesn't flee because a monkey passes close by, nor does a monkey flee because a bird intrudes. Animals tend to know their enemies, and man is the universal enemy. His presence triggers almost every animal's escape reaction. In the zoo, the reaction normal in the wild, flight from man, cannot operate. The animal must adapt, and in most cases, it does. Man, the enemy, becomes transposed into man, the friend. In mathematical terms, the minus sign in front of man becomes a plus sign. A wild animal that has become tamed, that has lost its need to escape from man, has had its flight distance reduced to zero, and so needs much less space in the zoo than it did in the wild.

The fact that the public is the major reason for the existence of zoos determines in good part how the animals are kept. When there is a choice between the needs of the animal and the needs of the visitors, compromises are often made. The architecture that marks many zoos, particularly older institutions, is for the delight of the visitors, not the animals. This does not bother the animals, although the money could have been better spent on animal needs rather than human.

Zoos pride themselves in being zoological gardens and not menageries. One of the most pleasant and outstanding features of most zoos is the plant collection which is often more valuable than the entire animal collection. However, the botanical aspects of zoos have been, for the most part, ignored. Occasionally a shrub or tree is labelled with the common name, scientific name and country of origin. But these simple labels are not satisfactory for the animal exhibits and there is no reason why the botanical labels could not be expanded. Not only could the natural history of the plant be given on the label but hints on its culture in the local area could be given for visitors with an interest in gardening. The room for expansion in the botanical field is enormous.

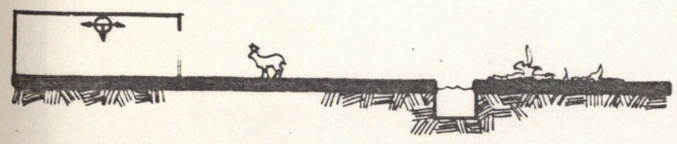
land animal enclosures



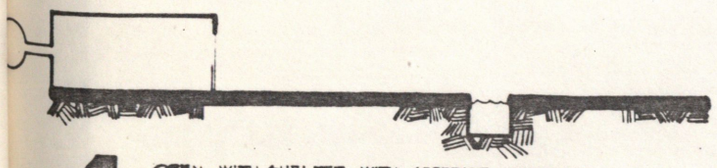
1 OPEN PADDOCK



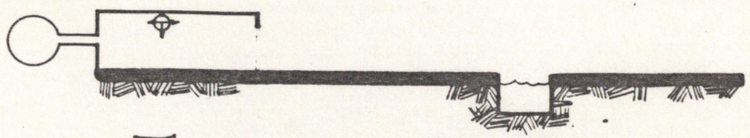
2 OPEN WITH SHELTER



3 OPEN WITH SHELTER & HEATER



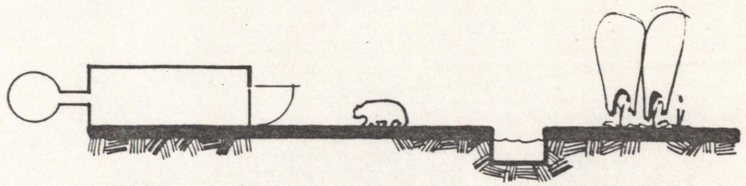
4 OPEN WITH SHELTER WITH SEPERATE BREEDING OR ISOLATION AREAS



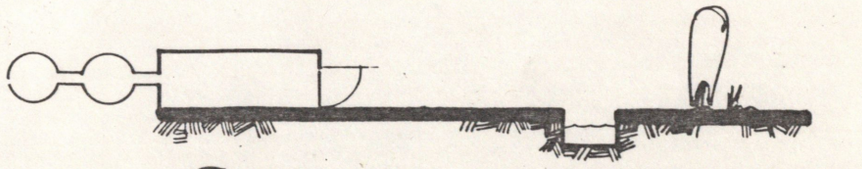
5 OPEN WITH SHELTER & HEATER WITH SEPERATE BREEDING OR ISOLATION AREAS.



6 ENCLOSED CLIMATIC CONTROLLED AREA



7 ENCLOSED CLIMATIC CONTROLLED AREA WITH SEPERATE BREEDING OR ISOLATION AREA



8 ENCLOSED CLIMATIC CONTROLLED AREA WITH SEPERATE BREEDING OR ISOLATION AREA. WITH SHIFT CAGE !

ENCLOSURE TYPES

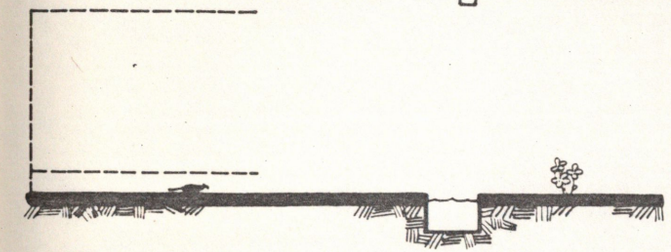
The charts on this page and the next two pages indicates various enclosure types that animals may require. The first type are for land animals; the second type are for water animals; and the last type are for aerial animals.

These enclosure types are refered to under research examples of the animal design criteria in Section II.

The enclosure types when categorized with specific animals become very important during the design stage. This enables the designer of an enclosure to better meet the needs of the particular animal.

From the zoo keeper's viewpoint of an enclosure, tilted areas may be best; they are easiest to clean and keep up. Dirty enclosures not only upset some visitors, they may upset the animals as well. The visitors are also upset when animal enclosures are allowed to become to comfortable for the animals. Visitors ascribe to

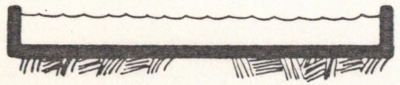
aquatic animal enclosures



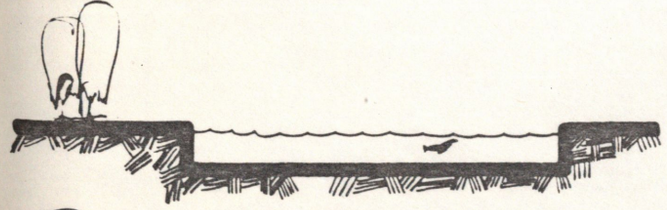
9 SPECIAL SIZE & EXHIBIT REQUIREMENTS (SMALL OR LARGE MAMMALS)



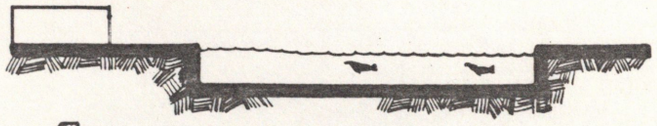
1 NATURAL WATER POND



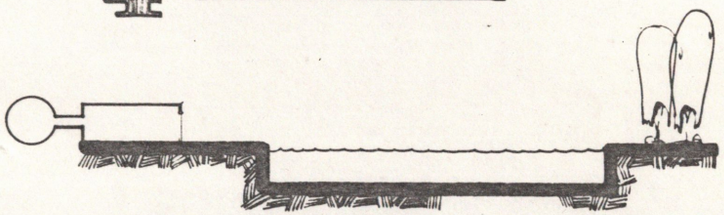
2 SPECIAL POOL SURFACE



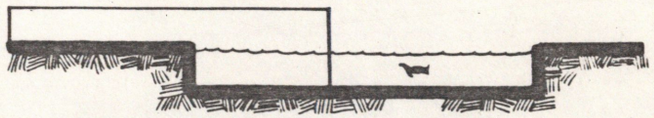
3 OVER 50% POOL WITH ACCESS TO LAND



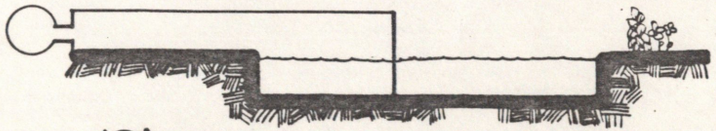
4 ACCESS TO LAND WITH SHELTER



5 ACCESS TO LAND WITH SHELTER & BREEDING AREA



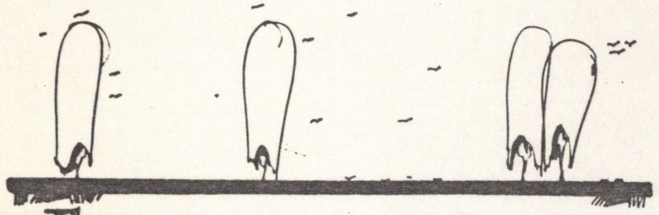
6 CLIMATE CONTROL : COOLED OR HEATED



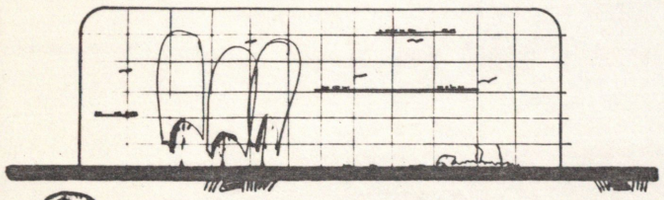
7 CLIMATE CONTROL: COOLED OR HEATED WITH BREEDING AREA

the animals their own desire for clean living space. They hold their noses in the lion house crying, "It stinks." Well, it dosen't stink to the big cats. Most animals are uncomfortable in a place that doesn't smell. The animal knows this is its place because it has its own smell. For this reason a cage may need some sticks, dry grass, roots, even a stone curb will do, one on which the animal can deposit his smellmarks.

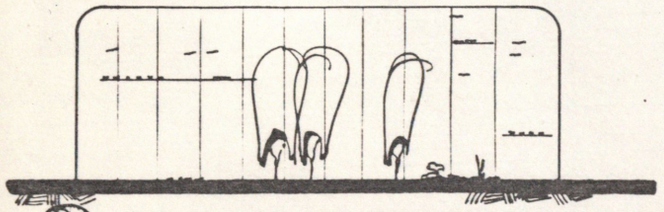
aerial enclosures



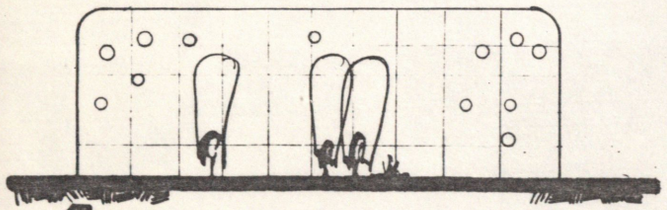
1 IN OPEN AIR ABOUT ZOO



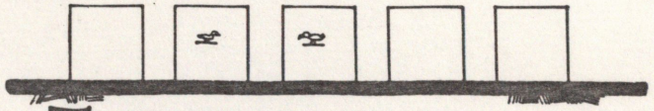
2 OPEN AIR WIRE FLIGHT CAGE WITH PERCHES



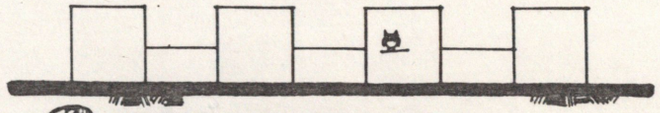
3 GLASS CLIMATE-CONTROL FLIGHT CAGE WITH PERCHES & SPRAY.



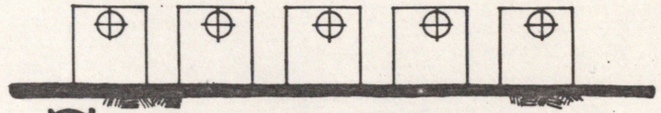
4 FLIGHT CAGE WITH RESTING AREAS



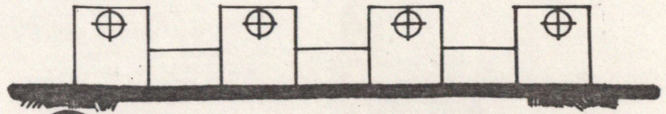
5 INDIVIDUAL EXHIBITS



6 INDIVIDUAL EXHIBITS WITH ISOLATION & BREEDING AREAS.

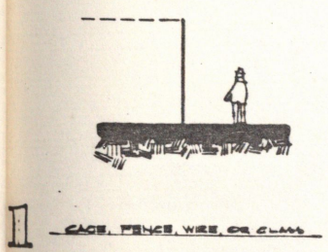


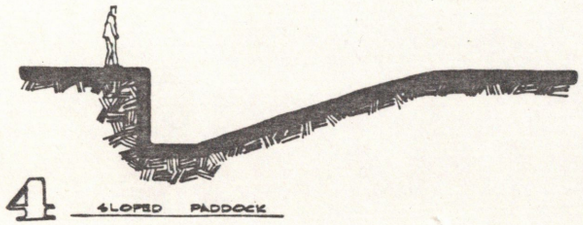
7 INDIVIDUAL EXHIBITS WITH CLIMATE CONTROL

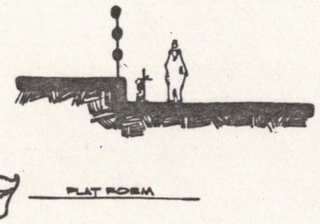


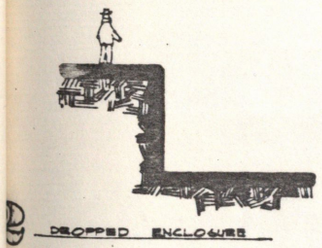
8 INDIVIDUAL EXHIBITS WITH CLIMATE CONTROL & ISOLATION & BREEDING AREAS.

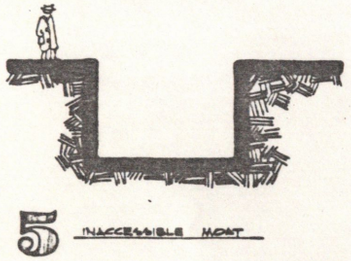
animal barrier types

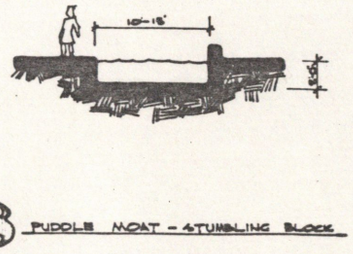


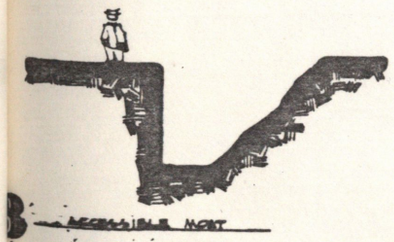


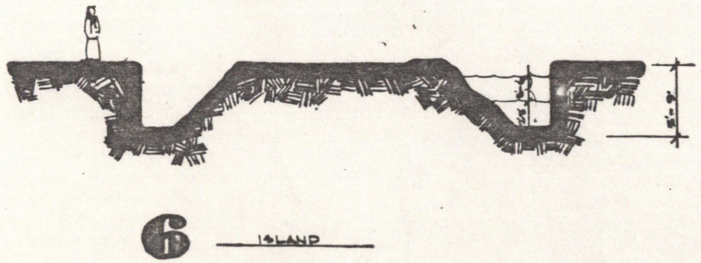












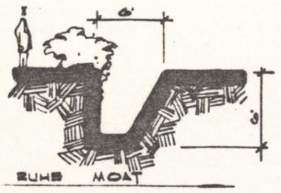
BARRIER TYPES

The barrier types to the left and on the following page may be referenced to research examples on the Animal Design Criteria charts in Section II. This enables the designer to better meet the needs of an animal and the barrier between that animal and the public or another animal.

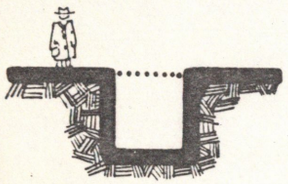
Barriers separating animals from visitors are of many types, depending on the animal and on the money available. The most common barriers are wire mesh for small animals and bars for larger ones. From the point of view of the visitor, these are physically and phychologically the least desirable. They spoil the view and give the zoo the look of a prison.

Moats are the most natural looking and probably the most pleasing to visitors.

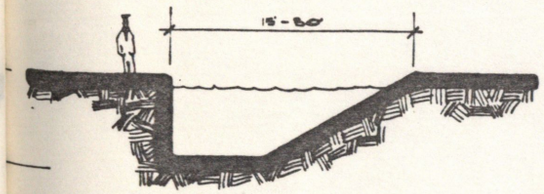
Glass is used as a barrier either to protect the visitor from the animal, as with snakes, or to protect the animal from the visitor, as with gorillas and orangs which are very susceptible to human disease.



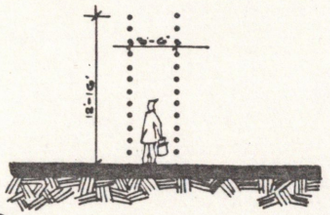
9 RUHR MOAT



10 CATTLE GUARD



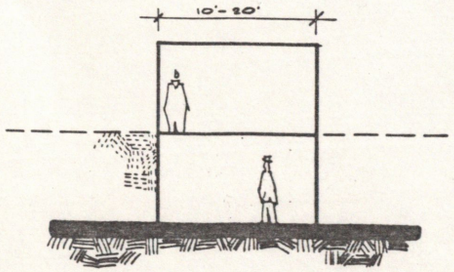
11 POOL



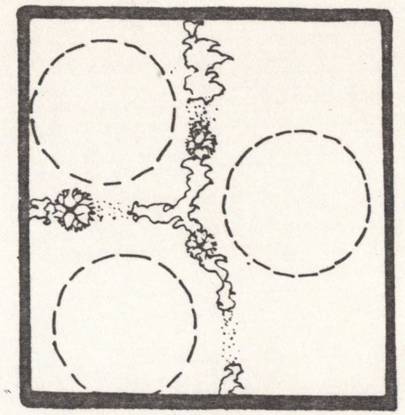
12 KEEPER'S WALK



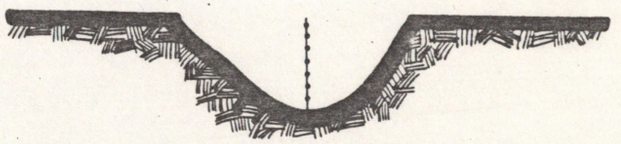
13 PSYCHOLOGICAL BARRIER



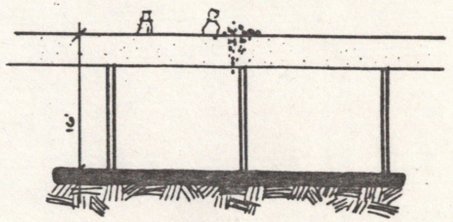
14 ENCLOSED WALKWAY



15 TERRITORIAL DIVIDER



16 INVISIBLE FENCE



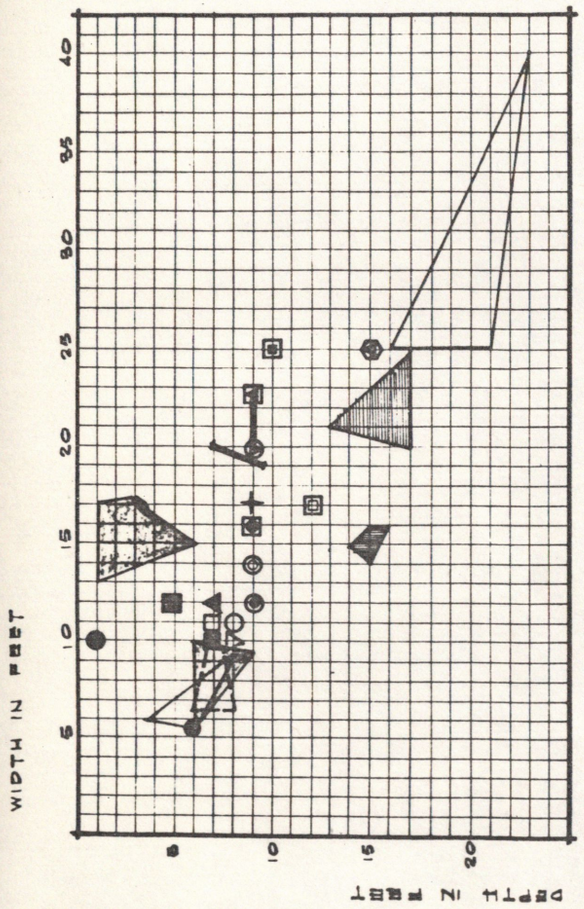
17 OVERHEAD BRIDGE

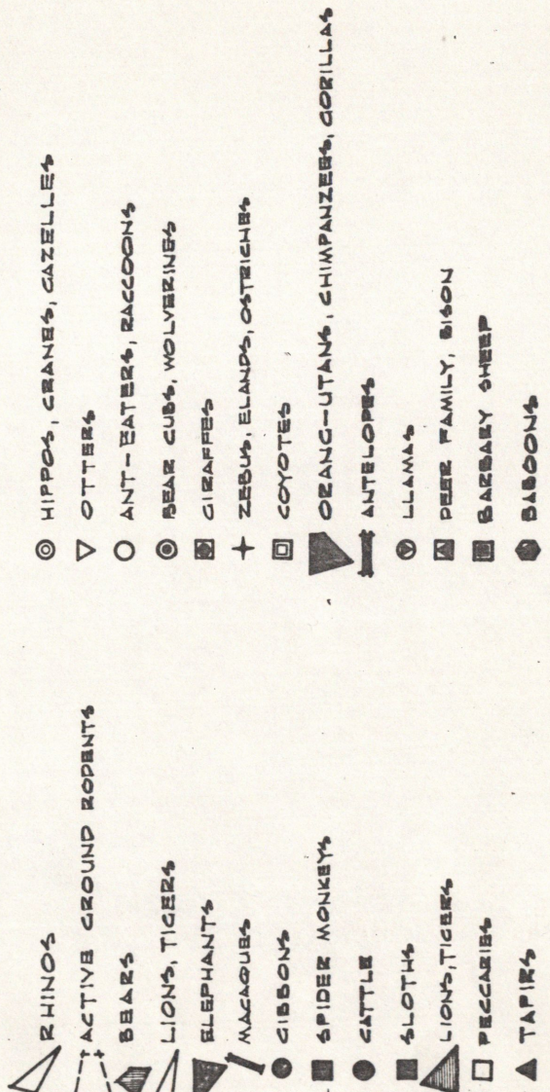
Grazing animals can be kept behind electrically charged wires. They learn to keep away from the wire, which can be turned off after the lesson has sunk in.

There are also psychological barrier, especially for birds. If the birds space is well-lighted, and the visitors' space is dark, the birds will not fly into the darkness.

Some animals, can be kept from leaving their space by thermal barriers, refrigerated coils or hot water pipes. They are crawling type and will not cross the uncomfortable temperatures.

There are also cages that work in reverse: the people are caged while the animals are free. An enclosed walkway through an aviary that allows visitors to get close to the birds would be an example.

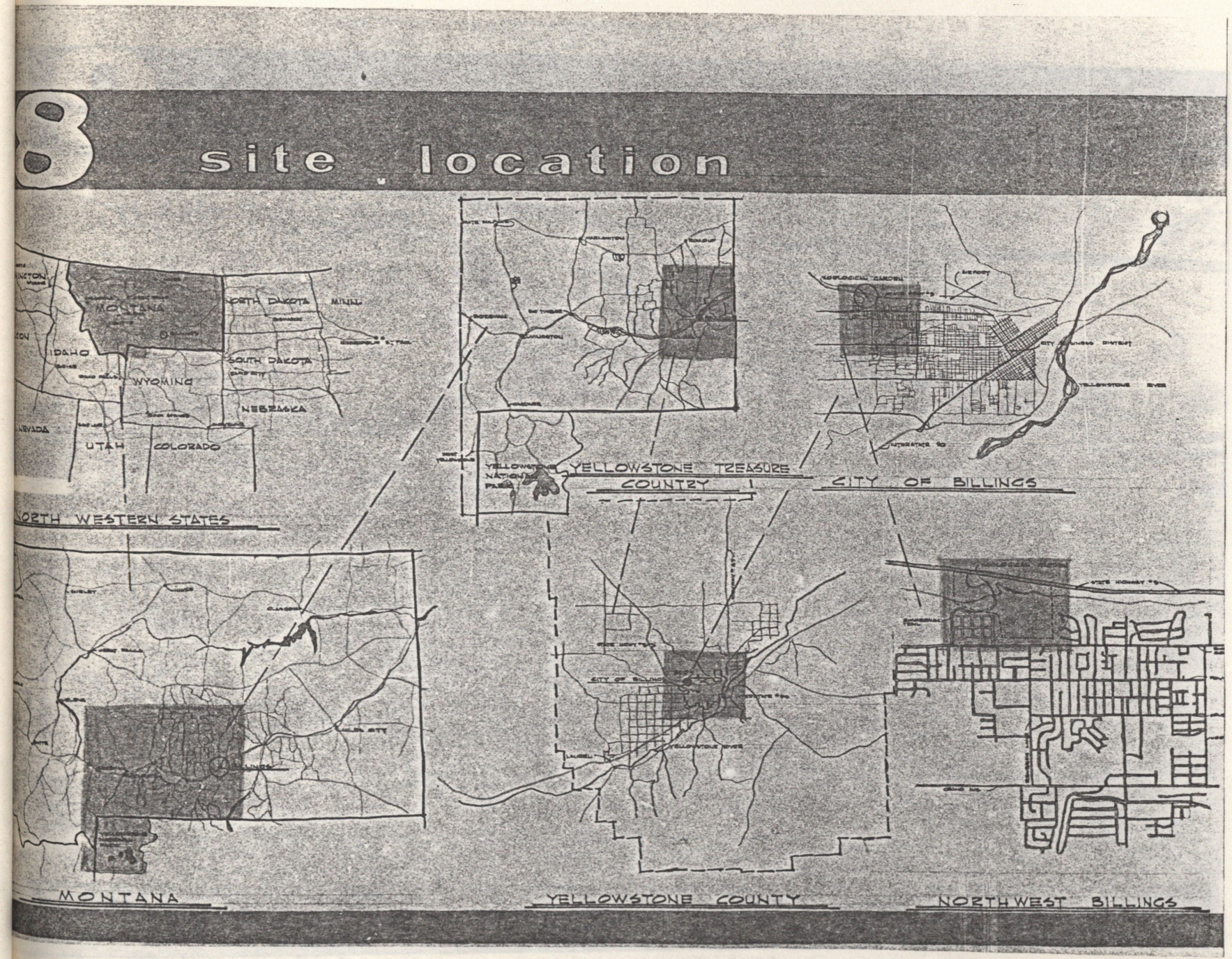




MOAT SIZES

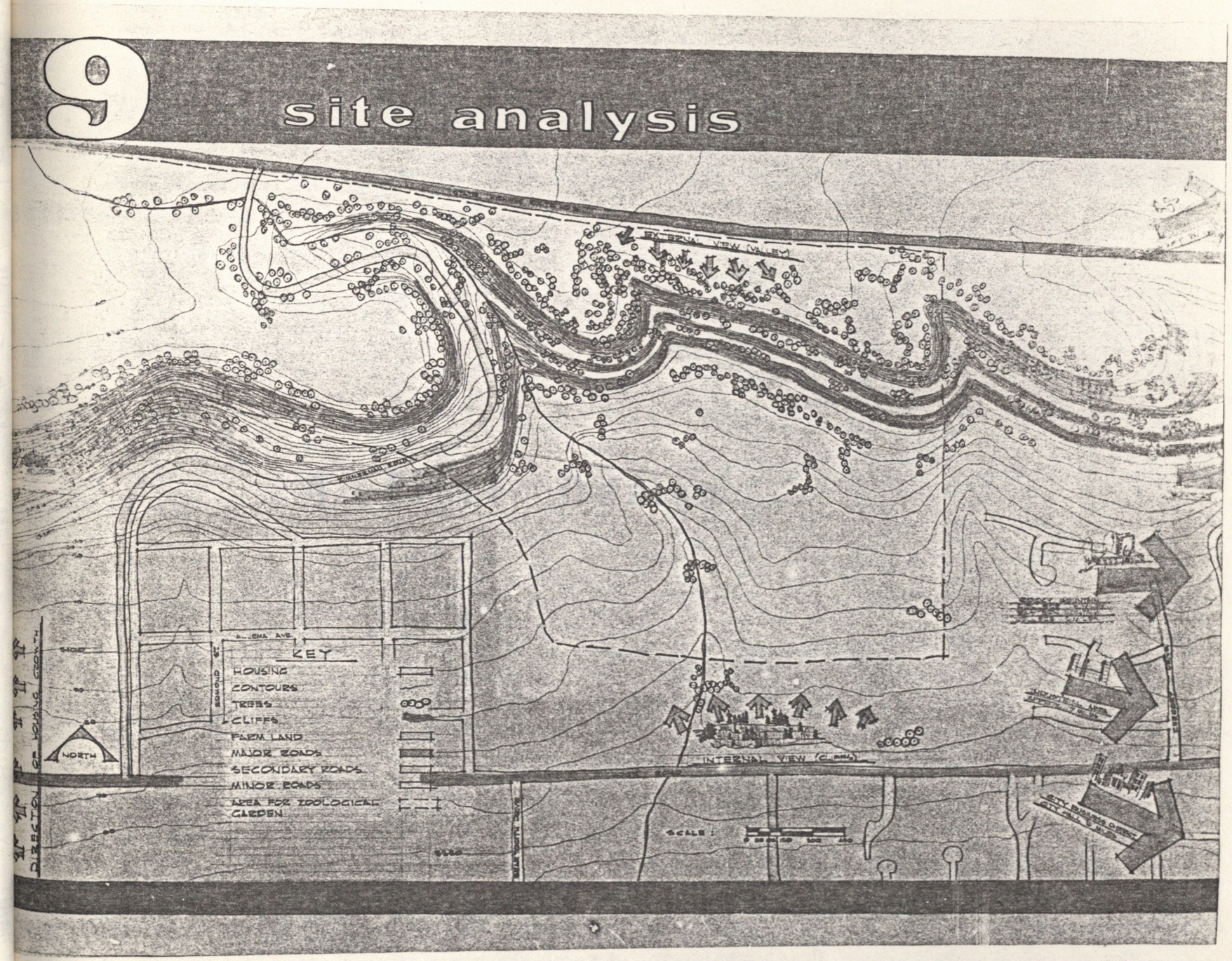
The chart to the left is taken from the book MANAGEMENT OF WILD MAMMALS IN CAPTIVITY. It lists the different moat sizes required for the mammals indicated.

Moats can be dry, sloped, or water-filled. Almost all non-flying animals can be kept behind moats. Small animals are as a rule not put in moated enclosures because they would become less visible to the public. Also a moat wide enough to keep a leopard is not actually feasible, as can been seen from the chart.



THE SITE

The site location is a factor which affects the design of a zoo considerably. Billings is a city in Southern Montana. It is in Yellowstone County and is about 150 miles from Yellowstone National Park. Billings at the present time is the most populated city in Montana and I am designing the zoo for a date when the population of Billings will be about 150,000. The zoo is to be located on the edge of a residential area in northwest Billings; it's along what is commonly known as the Rimrocks. The Rimrocks face south which is ideal for the location of a zoo: Southern exposure is excellent because it is very important that a lot of animals receive sun exposure, especially during the winter months. The zoo will be located five miles from the city business district, seven miles from the industrial area, two and one-half miles from two colleges, and two and one-half miles from the airport. There exists lots of trees along the cliffs, an abundance of big rocks at the base of the cliffs, and natural short grass in the flat areas of the site. To the north of the site is farmland.



The main access to the site for out of town people, and at least half of the local people, will be along State Highway No. 3, from the east. The rest of the people will have access to the zoo from Rimrock Road and Zimmerman Road.

4. Final Design



SITE LAYOUT

In the final design of the site I tried to accomplish seven main things.

1. Grouping of the animals according to family groups.

2. Putting the larger plains animals in the larger flat areas.

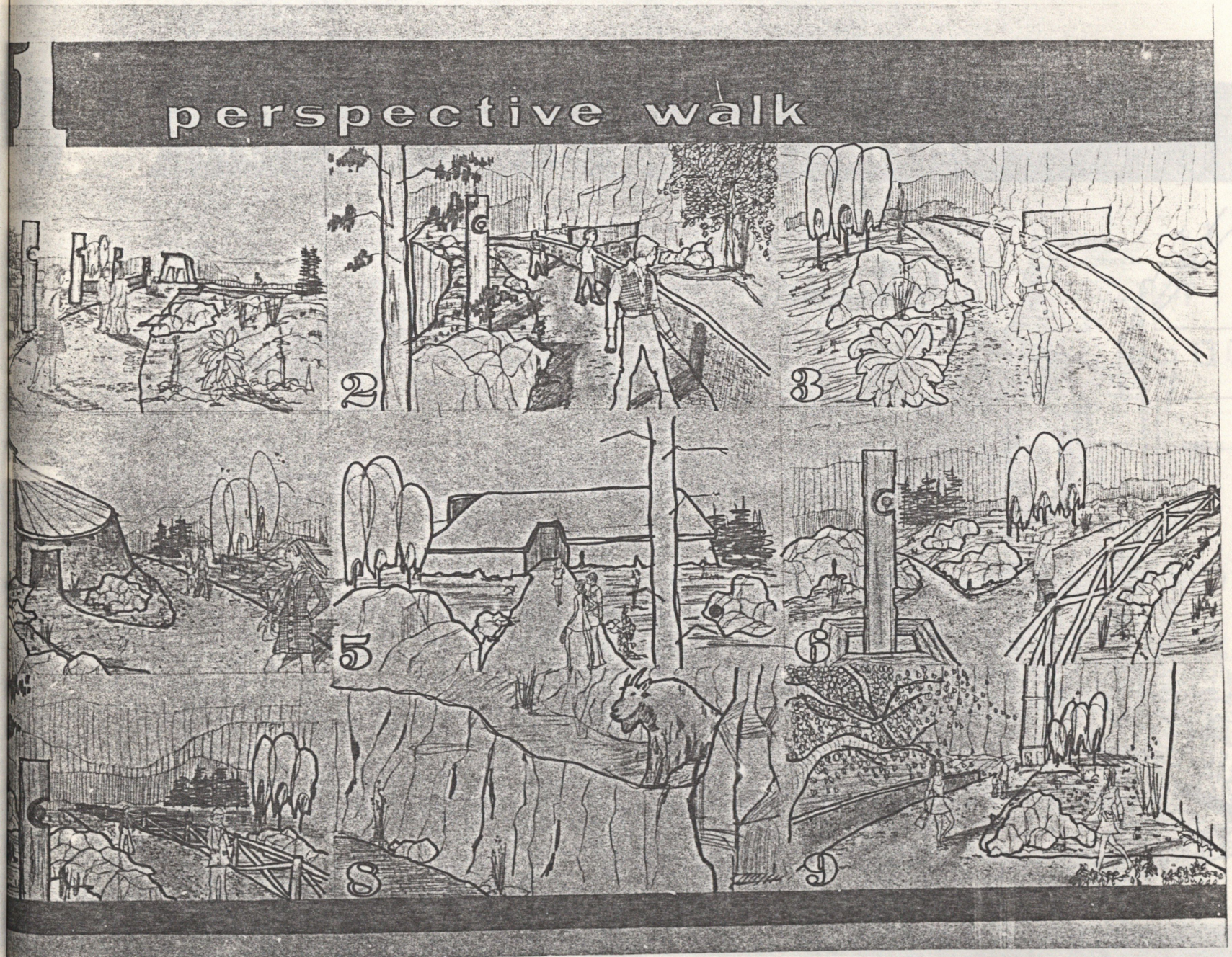
3. The animals which naturally roam in cliffy areas are placed against the cliffs.

4. A path by which a person could see all the zoo animals without having to do any backtracking.

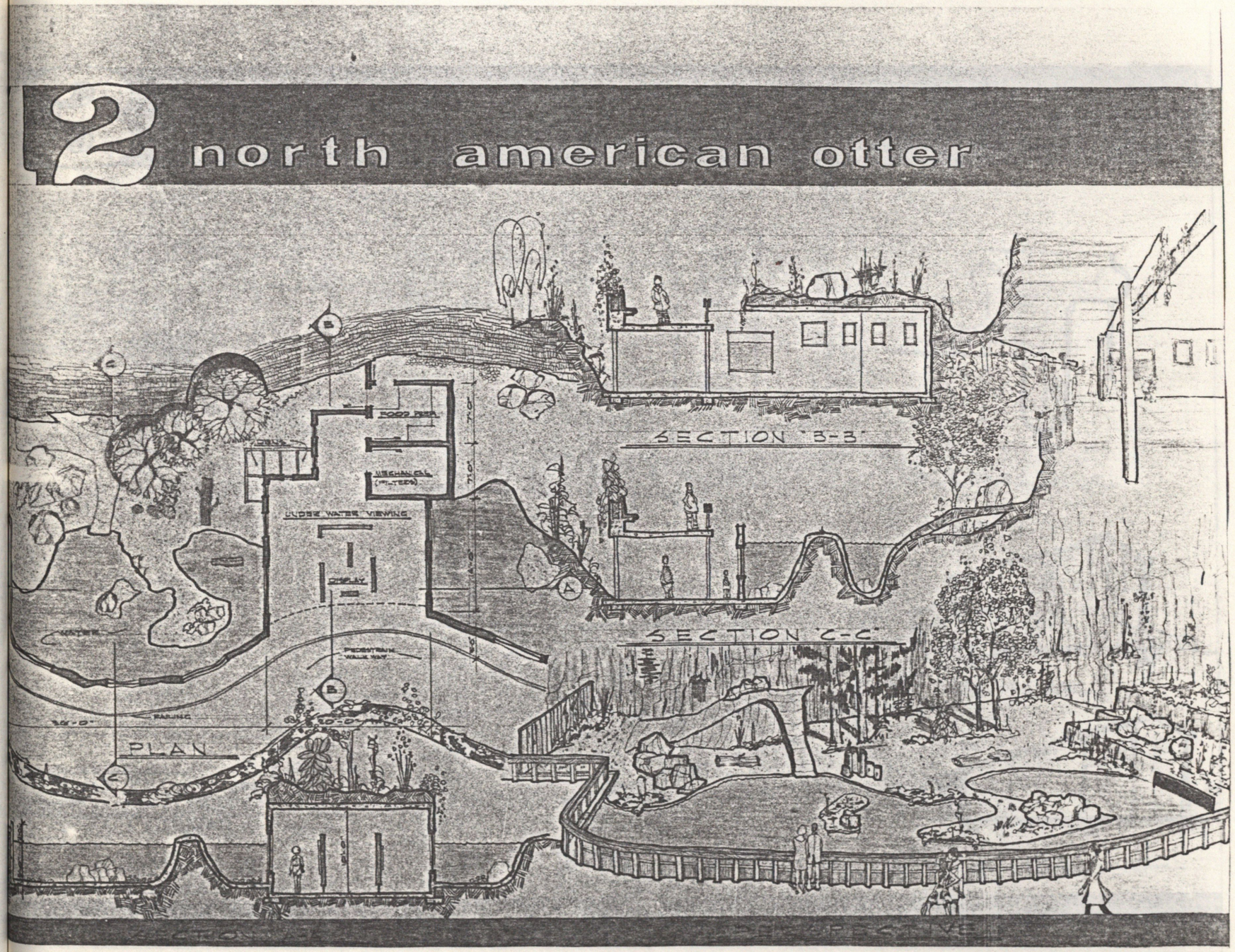
5. All the main man structures are grouped into a central area.

6. Once the zoo visitor has left his car he in no longer aware of his car but just of the zoo and its world.

7. One way viewing with only natural backdrops and not that of people in the background.

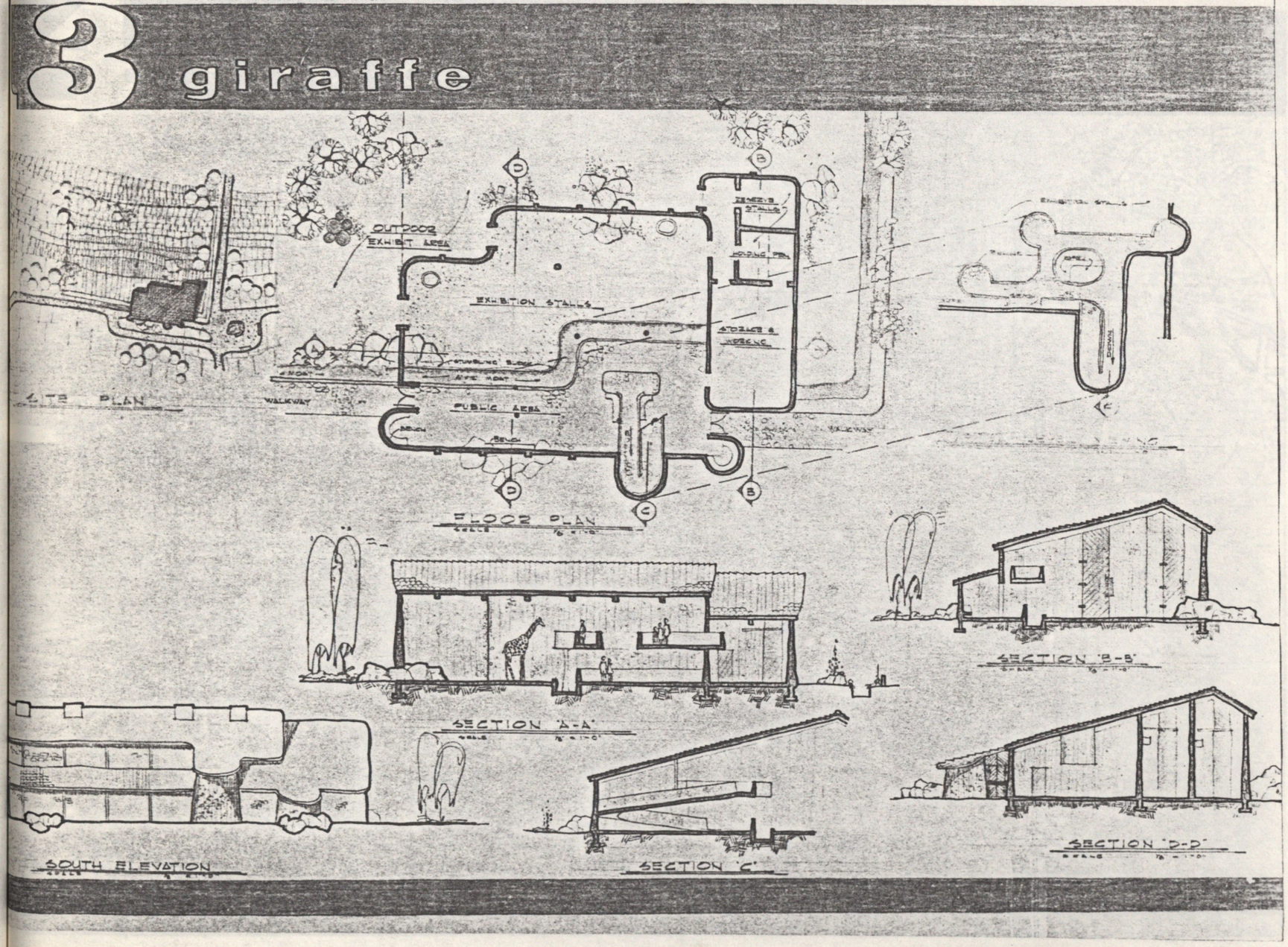


From a site layout I thought it would be very important to develope a zoo character and this I have tried to accomplish by what I call a perspective sequential order that a person would take in a typical walk through the zoo. The two buildings indicated are the primate cages and the visitors center. The main focal point and node of the whole zoo, the elevator, is depicted in the first drawing and the last drawing.



For my first prototype I chose to design an area for a native small mammal, the North American Otter. The otter is basically a land mammal and spends about 30% of its time in the water. It loves to play in the water and is known for its ability to entertain and please the public. The otters' enclosure contains rocks, a pool, hollow logs, a sliding area which enters the water, shade, a place where it can escape from the public when it wants to and underwater viewing. The mechanical area contains water filters to keep the water very fresh which is a must for good healthy otters. The enclosure is designed to adequately house five otters with provisions for breeding and expansion.

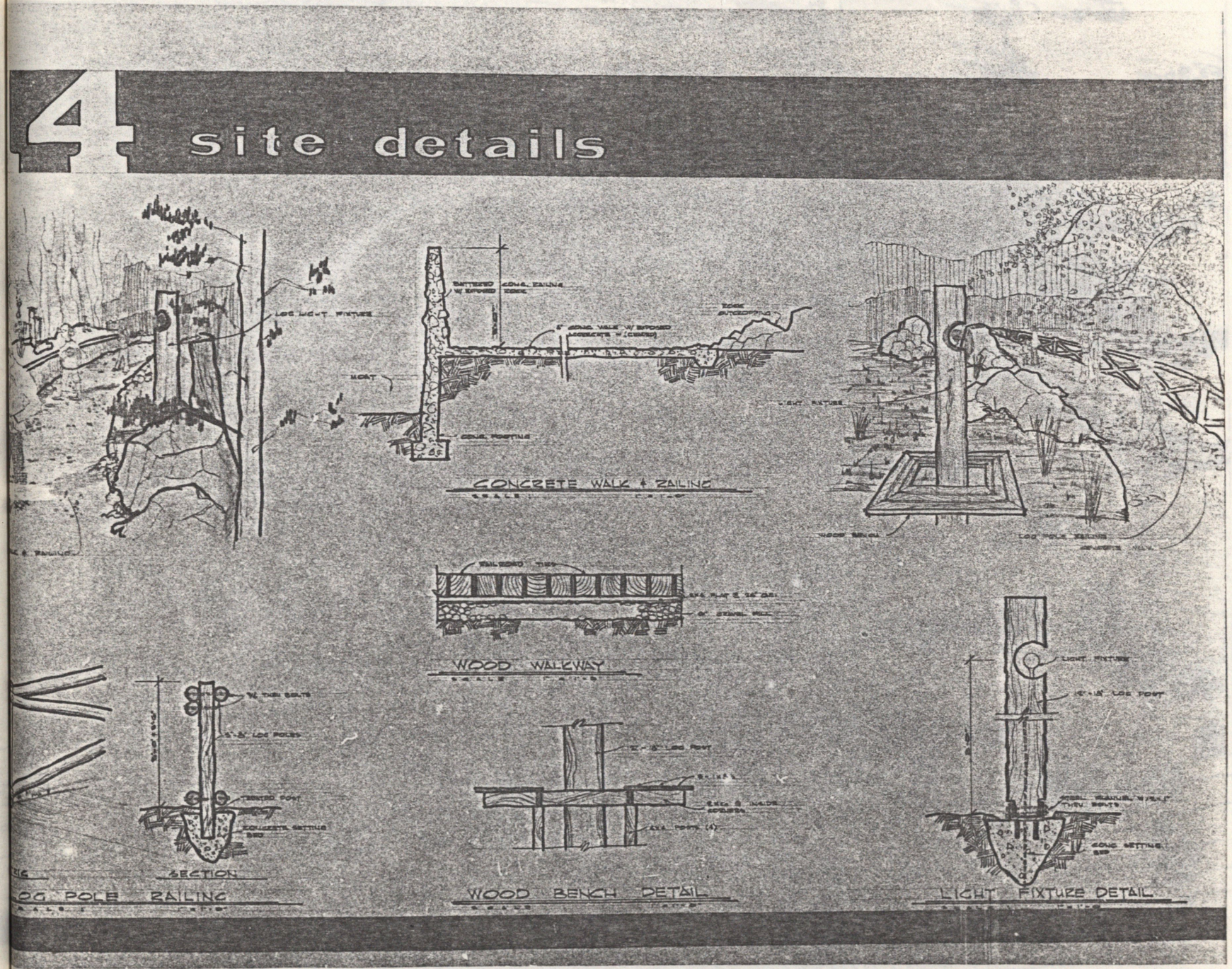
3 giraffe



For my second prototype I chose to design an area for a non-native large mammal, the giraffe which requires an enclosed area part of the time. The building is divided into two main areas; an area for the giraffes and an area for the public. The giraffe's area not only contains the display areas but also reserve stalls, holding pens, and a place for storage and feeding.

The building is made from concrete with aggregate and large rocks from the site. The concrete acts as a mortor for the large rocks. The walls are battered and the roof structure is concrete with clay tile on the roof. The circular edges are to acknowledge the circular movement of a giraffe as well as eliminate sharp corners where the legs of a giraffe could be damaged.

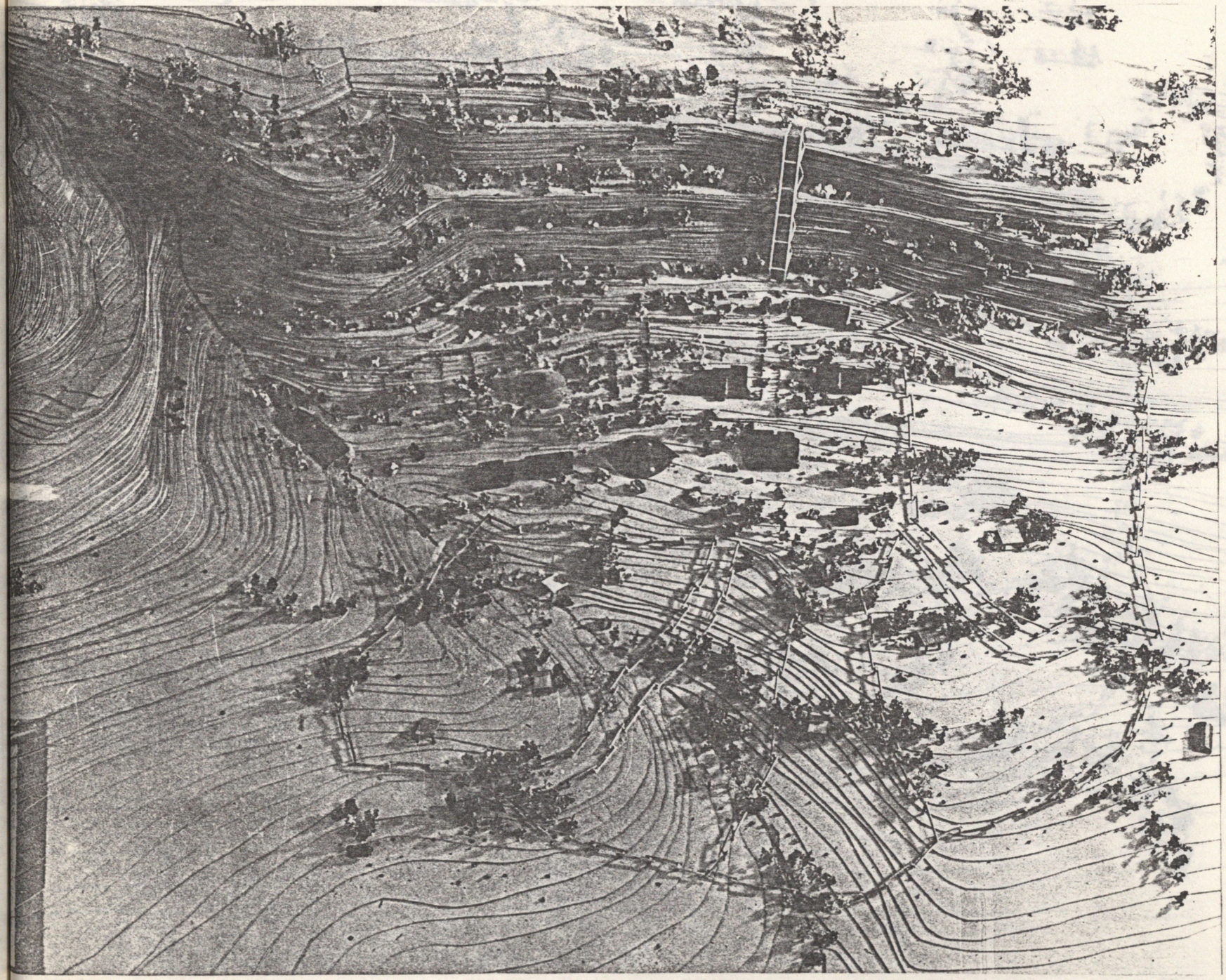
The viewing of a giraffe for the public takes place on two levels, one is eye to eye the other is leg to leg level. The ramp enables a person to view a giraffe as the visitor is going from one level to the other. The area that the giraffe is in has natural light introduced through the roof onto the north wall so that the giraffe is viewed with the light on him and not at the publics back.



Some site details which I chose to do in detail are 1) a concrete walk and railing 2) a wood walkway 3) a log pole railing 4) a wood bench and 5) a light fixture.

The walkways would contain a texture that would be controlled by the speed that people walk in certain areas. The concrete walk would contain exposed aggregate from the site. The aggregate would be placed into the concrete so that the smaller fine aggregate would be in the area where people are to walk at a faster pace and the larger aggregate would be in the areas where people would walk slower, i.e. in the viewing areas and on the outer edge of the sidewalk facing the particular enclosure.

A wood walkway being the most personal would be in the slowest areas of all which would be walks that were not direct main paths.

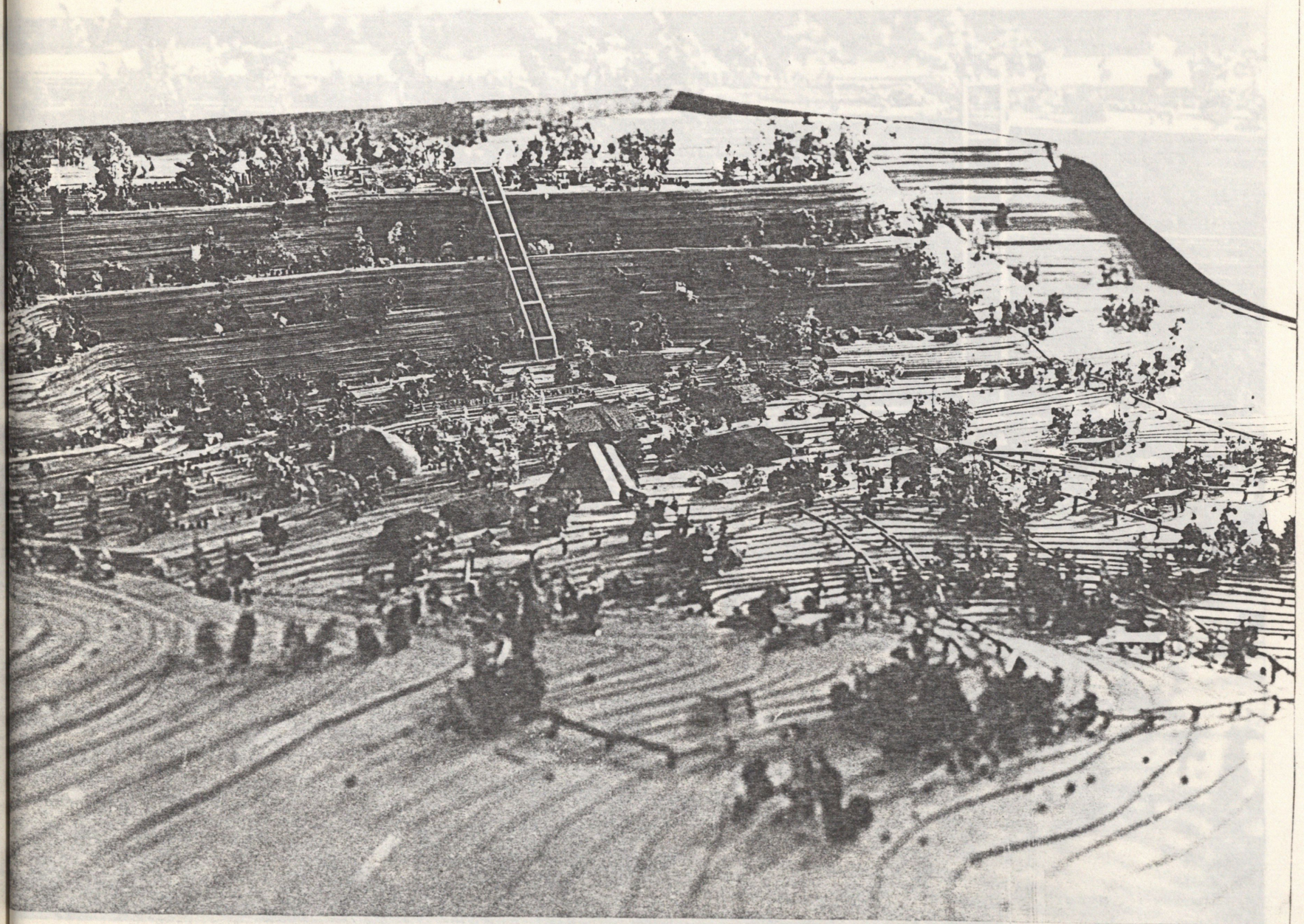


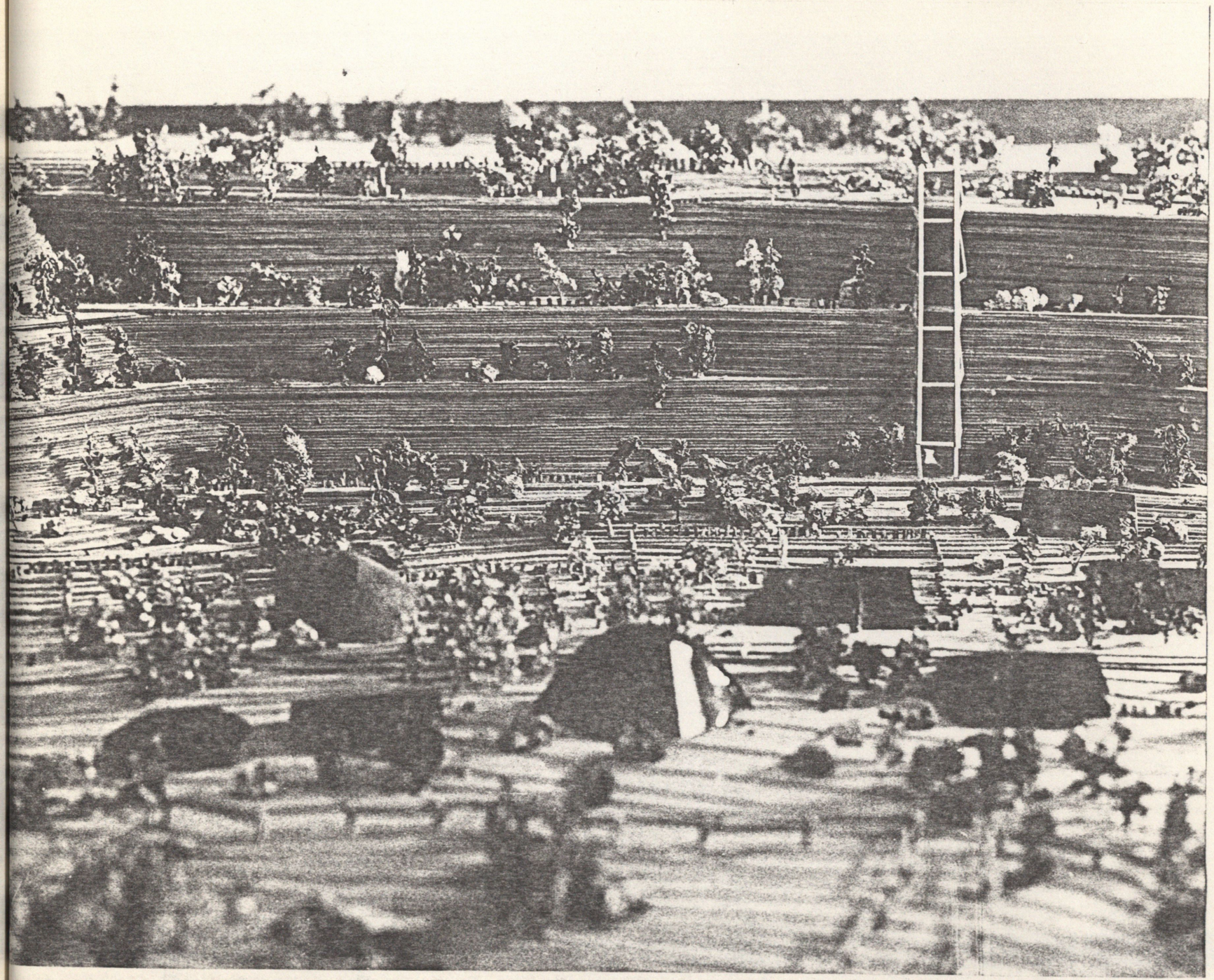
The model played a very important role in my final design decisions. The first thing it did was to give the site more three dimensional quality than I had previously been aware of. It also gives a good overall picture of the site. The model helps to relate the scale of the buildings and the enclosures to the site, trees, cliffs, and to the people. The model emphasises the elevator and its importance as a means of vertical transportation, a focal point, and a node. The total rise from the bottom to the top is 300 feet.

The slopes on the roofs of the buildings were made to face south to acknowledge the slope of the cliffs as well as to take advantage of the southernly sun for dispalys.

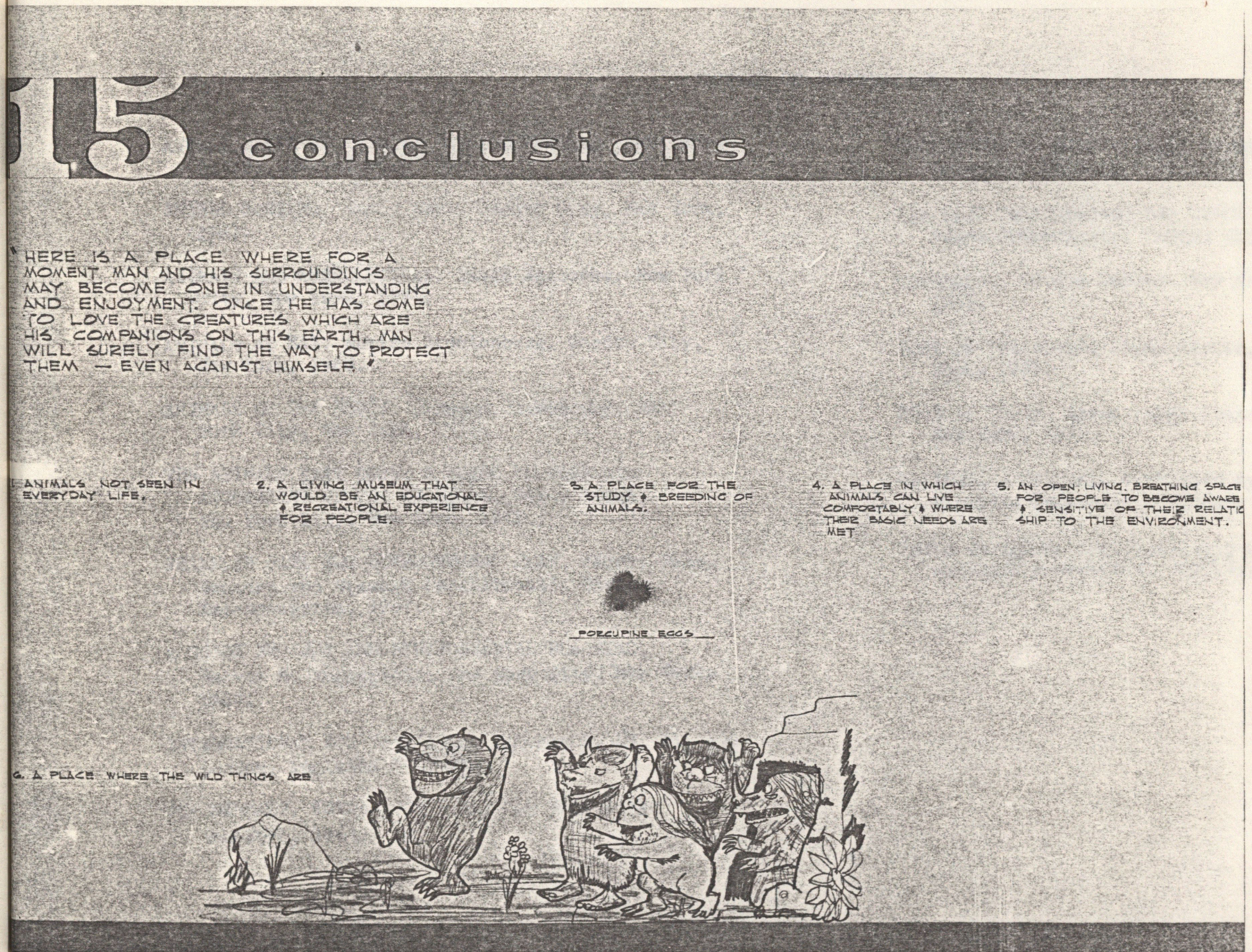
Enclosures and displays were made to follow and acknowledge the natural contour of the land as much as possible.







5. Conclusions



CONCLUSION SHEET

A zoo has in many places been referred to as a healing place or healing island. The zoo is a healing island of naturalness and reality in vast cities of artificiality and unreality. An island that can give the people glimpses of beauty and mystery and even unexpected familiarity.

The thing that I have tried to accomplish in this project is to create, "A place where for a moment man and his surroundings may become one in understanding and enjoyment. Once he has come to love the creatures which are his companions on this earth, man will surely find the way to protect them-even against himself." (From the Arizona-Sonora Desert Musuem pamphlet.)

A WALK WITH THE WILD THINGS consists of:

1. Animals not seen in everyday life.
2. A living musuem that would be an educational and recreational experience for people.
3. A place for the s tudy and breeding of animals.
4. A place in which animals can live comfortably and where their basic needs are met.
5. An open living breathing space for people to become aware and sensitive of their relationship to the environment.
6. A place where the wild things are.

SOURCES OF INFORMATION

ANIMAL BEHAVIOR. Vincent Gaston Dethier. Englewood Cliffs, New Jersey, 1961.

ANIMAL GARDENS. Emily Hahn. Garden City, New York, 1967.

ANIMALS AND ARCHITECTURE. David Hancocks. New York City, New York, 1971.

ANIMALS AT BAY. Adrien Stoutenburg. Garden City, New York, 1968.

ANIMALS OF THE ARTIC. Bernard Stonehouse. New York City, New York, 1971.

THE ANIMALS NEXT DOOR; A GUIDE TO ZOOS AND ACQUARIUMS OF THE AMERICAS. Harry Gersh. New York City, New York, 1971.

FRANKLIN PARK ZOO DEVELOPEMENT PLAN. Perry, Dean, Hepburn and Stewart (architects). Boston, Massachusetts, 1967.

A GUIDE TO SITE AND ENVIRONMENTAL PLANNING. Harvey M. Rubenstein. New York City, New York, 1969.

INTERNATIONAL ZOO YEARKBOOD, Volumes 9, 10, 11, 12. London, England, 1968-71.

THE MAMMALS. Editors of LIFE. New York City, New York, 1963.

MANAGEMENT OF WILD MAMMALS IN CAPTIVITY. Lee S. Crandall. Chicago, Illinois, 1964.

THE LAST PARADISES-ON THE TRACK OF RARE ANIMALS. Eugen Schummacher. Carden City, New York, 1967.

TOWNSCAPE. Gordon Cullen. New York City, New York, 1961.

ZOOS OF THE WORLD. James Fisher. Garden City, New York, 1967.

ZOOS OF TODAY. James Ralph Johnson. New York City, New York, 1971.

NATIONAL WILDELIFE. Published by The National Wildlife Federation. January 1968-March 1973.

PARKS AN RECREATION. Published by The National Wildlife Federation. 1971-1972.

MONTANA STATE UNIVERSITY LIBRARIES
stks 720.6.M76W152 CA
Walk with the wild things ; a zoo for Bi
3 1762 00159185 6

LIB. USE ONLY